The Value of Colour

MATERIAL AND ECONOMIC ASPECTS IN THE ANCIENT WORLD

Shiyanthi Thavapalan
David A. Warburton
(eds.)

edition | topoi

BERLIN STUDIES OF THE ANCIENT WORLD

IN THE VALUE OF COLOUR, an interdisciplinary group of scholars come together to examine economically relevant questions concerning a narrow slice of social and cognitive history: namely, colours. Traditionally, the study of colours has been approached from a cultural or linguistic perspective. The essays collected in this volume highlight the fact that in earliest human history, colours appear in contexts of prestige (value) and commerce. Acquisition, production, labour, circulation and consumption are among the issues discussed by individual authors to show how colourful materials acquired meaning in the ancient Near Eastern and Mediterranean worlds. Spanning the Palaeolithic to the early Imperial Rome, the contributions also demonstrate the many questions asked and approaches used by historians in the growing field of Colour Studies.

70 BERLIN STUDIES OF THE ANCIENT WORLD

BERLIN STUDIES OF THE ANCIENT WORLD · 70

EDITED BY TOPOI EXCELLENCE CLUSTER

The Value of Colour

MATERIAL AND ECONOMIC ASPECTS IN THE ANCIENT WORLD

EDITED BY

Shiyanthi Thavapalan
David Alan Warburton

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliographie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Cover image: Uluburun ship, adapted from the reconstruction in the Bodrum Museum of Underwater Archaeology (Turkey). Shiyanthi Thavapalan 2019.

Design concept: Stephan Fiedler

Printed and distributed by
PRO BUSINESS digital printing Deutschland GmbH, Berlin

ISBN 978-3-9820670-1-8
ISSN (Print) 2366-6641
ISSN (Online) 2366-665X
DOI 10.17171/3-70

First published 2019

www.edition-topoi.org

CONTENTS

Preface

This publication is the result of a workshop held at the Excellence Cluster Topoi from 4 to 7 February 2016, following a chance meeting and an absorbing discussion about colours in Berlin. In recent years, the field of colour studies has gained traction across a wide range of academic disciplines, including linguistics, cognitive sciences, psychology and the fine arts. The aim of our workshop was to provide a multidisciplinary forum to promote discussion and debate about one particular theme, that of the economic value of colour in ancient times, from diverse perspectives. Fortunately, most members of that group sent in manuscripts for this volume, which we then subjected to intensive collaborative editing and re-working. Included here are papers by Egyptologists, Assyriologists, Classicists and archaeologists of the ancient Near East and the Mediterranean world. We would like to thank all of our contributors for participating so enthusiastically in this extremely productive exchange of ideas and critical feedback.

Our thanks are also due to the reviewers selected by Edition Topoi – this volume has certainly benefited from their expertise and helpful comments. For generously supporting the workshop in Berlin and the publication of this book, we extend our gratitude to the *Deutsche Forschungsgemeinschaft*, Gerd Graßhoff and Michael Meyer (the spokesmen who coordinate the Excellence Cluster Topoi in Berlin). Finally, Gisela Eberhardt and Nadine Riedl deserve special thanks for their assistance during the publication process.

Shiyanthi Thavapalan, Providence

David A. Warburton, Berlin

David A. Warburton

Value of Colour: Introduction

Summary

Bright colours and pure whites were appreciated in the ancient world, appearing in texts and artefacts. In contrast to modern colours, ancient colours were intimately tied to the real world of the palaces, temples and tombs of the elites and divinities of the Bronze Age. The origins and history of abstract ancient colours are highly material; the names of precious materials were used to designate not only some early colours, but these materials also lent their names to some of the earliest artificial products, likewise bound into the world of colours. Pigments used for dyeing and painting must be separated from the actual precious materials, which had relatively high prices as documented in the material from Egypt and Mesopotamia. The same precious materials and colours were highly esteemed across the entire ancient Near Eastern Bronze Age world, from Mesopotamia to the Aegean.

Keywords: colour terminology; hues; precious materials; prices; value; imitations

Bunte Farben und reines Weiß waren in der bronzezeitlichen Welt beliebt und treten sowohl an Objekten als auch in der Sprache auf. Im Gegensatz zur Moderne waren Farben damals eng mit der realen Welt der Paläste, Tempel und Gräber von Eliten und Gottheiten verbunden. Der Ursprung und die Geschichte abstrakter Farbbegriffe ist im Material verankert: Kostbare Materialien verliehen nicht nur einigen frühen Farben ihren Namen, sondern auch einigen der frühesten Artefakte, die damit ebenfalls in die Welt der Farben eingebunden waren. Zum Färben und Malen verwendete Pigmente müssen von den kostbaren Materialien unterschieden werden, die den Quellen aus Ägypten und Mesopotamien zufolge hohe Preise erzielten. Beides, kostbare Materialien und Farben, wurde in der gesamten vorderasiatischen bronzezeitlichen Welt, von Mesopotamien bis zur Ägäis, hoch geschätzt.

Keywords: Farbterminologie; Farbe; kostbare Materialien; Preise; Wert; Nachahmungen

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

Significantly, almost a century ago, Walter F. Otto stressed that the essence of the Greek gods was "eternal brilliance", "mighty magic glowing in gold", "intrinsic radiance"; Demeter stood forth in "shining beauty", Artemis was a "bright spirit", Dionysos was "golden haired".[1] By contrast, the less than divine Ariadne was but "blond" (like the "fostered by Zeus" Menelaos) – while ordinary warriors merely "long-haired".[2] After being welcomed by the gods, Ino became the "bright" or "white" (Λευκοθέη) goddess.[3] The links between "bright", "white", "gold" and divinity are clear.

Leo Oppenheim, Elena Cassin and recently, Rosel Pientka-Hinz have also stressed that the gods of earliest Mesopotamia were distinctly associated with the bright and luminous.[4] When Hammurabi "heaps up luxury for [the gods] Anu and Ishtar",[5] the Royal Cemetery of Ur confirms that he largely means shining gold, silver, lapis lazuli, and carnelian (cf. Figs. 1, 2 and 3).[6] Thus light and colour were attributes of the gods, with whom the kings shared precious metals and stones. Colour was nothing ordinary at the dawn of history: brilliant, shining, golden light was divinity itself.

Walter F. Otto also cites Nietzsche approvingly concerning their shared admiration for Epicurus. In the quote Otto draws from the 19th century philosopher, Nietzsche describes

> enjoying the luck of the afternoon of Antiquity: – I see his eye looking across a wide white sea, to the cliffs of the shore where the sun lies while great and small creatures play in its light, certain and calm like the light of that eye itself.[7]

An enraptured Greek taking pleasure at thought would never have expressed himself this way: involuntarily we think of the "bright" or "wine(-coloured)" sea,[8] the "golden faced" Sun,[9] and "gleaming eyed" Athena,[10] as these reflect how the Greeks treated the nature of the sublime. For the Greeks, it was not mere 'light', but rather a vague and enchanting 'brightness'.

In his form, Nietzsche was not being lax. Yet unthinkingly, through his language, he revealed our own disenchantment. In the modern world – with gas, electricity, and synthetic pigments – light and colour are all around us; light and colour have lost all mean-

1 Otto 2002, 164–165, 208, 211 (the first edition goes back to 1929).
2 Hom. *Od.* 1.408; 4.203; 4.291.
3 Hom. *Od.* 5.334.
4 Oppenheim 1943; Cassin 1968.
5 Richardson 2000, 33.
6 E.g., Aruz 2003, 93–132.
7 Nietzsche in *Fröhliche Wissenschaft*, cited by Otto in Otto 1963, 10. My translation of "das Glück des Nachmittags des Altertums zu genießen: – ich sehe sein Auge auf ein weites weißliches Meer blicken, über Uferfelsen hin, auf denen die Sonne liegt, während großes und kleines Getier in ihrem Licht spielt, sicher und ruhig wie dies Licht und jenes Auge selber".
8 Hom. *Od.* 5.349.
9 Liddell, Scott, and H. S. Jones 1958 χρυσοπρόσωπος, q.v.
10 Hom. *Od.* 5.437.

Fig. 1 Ram in the thicket. Royal Cemetery of Ur, mid-3rd millennium BC.

ing: 'red lights' and 'blues music' are just phrases, as meaningless as colourful 'white papers' and figurative 'blueprints'.

We assume that it was always this way: colour was a convenient form of classification. Yet the earliest texts indicate both (a) considerable confusion about what colour was and (b) a very sparing use of colour as a means of classification. Where once colours were treasured, laden with vague divine meaning, we have but an ephemeral phenomenon that shifts or vanishes at the touch of a keyboard.

Significantly – regardless of one's views about their methods and conclusions – the work by Berlin and Kay did demonstrate that the development of an extended colour vocabulary almost assuredly took place in the historical period: 'primitive peoples' still living in the 20th century did not have an advanced colour vocabulary; the study of ancient languages (preserved in writing) demonstrates that these also lacked an advanced colour vocabulary – as only white, black, red and grue ('green-blue') were suspected.[11]

11 As a last-minute note, I should stress that in this volume Schenkel remarks that the Egyptians had a word *dšr* for red, a word that we understand today as meaning red – but that the flamingo (which we

In this volume, Pelletier-Michaud explores precisely the ancient world of colour in the texts of the classical world, linking Greek and Roman usage revealing the different ways in which colour appeared – and demonstrating that colour was cunningly used. Schenkel covers the evidence for the earliest colour terminology in Egypt, and takes a position based on the concept that colours are abstract – confirming the paradoxical restriction on the cognitive linguistic expression of colour in the earliest linguistic evidence. By contrast, Blom-Böer presents the evidence for the range of colours actually used in ancient Egyptian art. And Moutsiou and Bar-Yosef Meyer allow a glimpse into the gradual emergence of colour as a feature of human life: indeed even in the Palaeolithic and Neolithic, even tens of thousands of years before the 'dawn of history' (associated with writing and urban architecture in the Near East), obsidian and other shining materials attracted attention.

Thus – as can be seen in the various contributions to this volume – the colours recognised, used and discussed by humans were consciously brought into the world in relatively recent times. While it is true – as we will see – that the rise of 'administered colour' does take us back hundreds of thousands of years, it is only in the last ten thousand years that major change has taken place. And in recent millennia that process of the integration of colour into society has accelerated at a rapid pace, consciously making colour a miraculous kaleidoscopic collision defying cognitive analysis to this day.

I have long argued that part of the transformation in the conceptual appreciation of colour in the historical period was rooted in the fact that some of the most important colours were themselves associated with those precious materials reserved for the gods and their elect mortals. The cognitively expressed brightness of the gods was not enhanced so much as embodied in the intensive hues of the precious materials with which the gods were associated, whether the chryselephantine (χρυσελεφάντινος, presumably meaning overlaid with ivory and gold) statue of Olympian Zeus or the precious stones with which Sumerian goddess Inanna adorned herself.

In the Palaeolithic, there were not many colours used; in the Neolithic more colours appear – and then in the Bronze Age Near East, a still wider range of colours was used in, and produced for, the arts and crafts. Indeed, significantly, more colours were used and produced than were actually designated in language.[12] On the one hand, this represents a clear case of cognitive dissonance, since we are accustomed not only to identifying colours, but also imposing meaning on them. Obviously, in the absence of an adequate

understand as being pink) seems to have been associated with this same word *dšr* red. Now, I learn that this seemingly anomaly is not alone, as it would appear that Victoria Bogushevskaya (pers. comm.) believes that the evidence can be interpreted as meaning that an ancient Chinese word *hóng* (which later meant red) was originally used to designate 'pink'. Should this turn out to be more of a pattern, it would transform our understanding or the emergence of the early terminology for the designation of colours.

12 Baines 1985.

conceptual vocabulary, this would be difficult – unless the meanings lay in the colours and materials themselves.

On the other hand, however, all of this evidence clearly demands that the naming and classifying of colours would appear to be an urban phenomenon of little more than several thousand years of age, and therefore of no great antiquity (at least in comparison to the age of our 300 000 plus year-old species). Significantly, the most ordinary colours we encounter in daily life in nature – blue skies and waters, green fields and forests – do not appear in the art of the Palaeolithic.

Blues and greens were the background of human life but did not enter into art until the emergence of the first cities – which was precisely the era when skies and foliage were gradually being obscured by the built environment forming the background against which craftsmen, poets and theologians worked. And in the second millennium BC, we find the sun "flooding the world with gold"[13], rising in a "field of turquoise"[14] – using poetic metaphors based on materials hardly known ten thousand years earlier, to describe what had been seen by humans and their ancestors for hundreds of thousands of years.

In the Bronze Age Near East blue and green stones appeared in the markets and were offered to the gods. Thus expressions from the classical era, such as chryselephantine, χρυσελεφάντινος, referring to the luxurious statues crafted by Phidias, may be useful, as they clearly bear a multi-fold meaning. Ivory and gold were themselves valuable – but also the hues of ivory and gold were intertwined with the meaning of bright and valuable.

Ivory and gold were, of course, part of the ancient Near East where lapis lazuli, carnelian, turquoise and amethyst were also appreciated. Χρυσόθριξ 'golden-haired' and Χρυσοέθειρ 'with golden hair' were mentioned at the outset.[15] And, of course, Greek χρυσός and χρύσεος 'gold coloured' were related to Akkadian *ḫurāṣu* 'gold'; just as Greek κύανος 'a dark blue substance' and κυάνεος 'dark blue' were derived from Akkadian *uqnû* 'lapis lazuli', 'lapis lazuli color'.[16] Thus, relatively early on, the linguistic expression of colour was bound up with the precious stones and metals – which had their own economic values. Both materials and words were exchanged. But the metaphorical uses in language did not necessarily emerge at the same time as the earliest usage of the materials – and only by combining archaeology and philology can we trace this.

Colourful materials are known in increasing quantities from the late Neolithic onwards, but the conscious cognitive expression of colour as a linguistic category may be

13 E.g., Assmann 1983, 11.
14 E.g., Assmann 1983, 53.
15 I cited Walter Otto above, but Liddell, Scott, and H. S. Jones 1958, χρυσ-, q.v.
16 Liddell, Scott, and H. S. Jones 1958, χρυσός, κύανος, etc. q.v.; CAD, *ḫurāṣu*, *uqnû*, q.v.

said to have begun in the lexical lists at Uruk (which are among the oldest written documents in human history, ca. 3000 BC), where various colours (black/dark, white/light, yellow, speckled, lined, multi-coloured) are used to describe the hides of animals.[17] Interestingly, an identical usage appears in Egypt a millennium later – where coloured cattle-markings figure in a lexical list; likewise white and black, but also using red,[18] as Pientka-Hinz suspects of (but cannot prove for) the earliest Mesopotamian list.[19] Significantly – with the exception of these cases in the lists – in neither Egyptian nor early Mesopotamian lists are colours used regularly or widely for other categories of classification. It may be assumed that this is neither a matter of coincidence, nor a universal, but a rather simple borrowing, betraying something about the cognitive importance of colour.

It can hardly be concealed that the linguistic expression of colour was initially quite hesitant. This is rather surprising since we perceive the world as full of colour. Long before the invention of writing, our ancestors revealed – through the artefacts they collected and/or processed – a gradual development of an appreciation for colour, which extended beyond what philologists have proposed for the earliest known languages. Thus, the linguistic expression of colour is a recent phenomenon. This also means that the conscious and deliberate denotation of colour (implying specific linguistically encoded conceptual meanings) as such cannot have been very wide-spread in Prehistoric times.[20]

In this volume, Thavapalan, Hodgkinson, and Dardeniz reveal the gradual emergence of real colours, relating these to object categories which exist and artefacts that are produced as imitations of nature. Blakolmer and Quillien take us on to completely original uses of colour, relying on – but taking leave of – nature. And I maintain (in contrast to Schenkel) that the abundance of the colourful semi-precious stones and materials played a decisive cognitive role in this development of abstract colour in language and poetry.

These object categories – gold, lapis lazuli, carnelian, silver, turquoise, amethyst, etc. – are known from just before the dawn of history, and when they appear in written records, they already enjoy high prices. And when – within millennia of the invention of writing – the technology came to be developed, these stones give their names to synthetic products produced for the market. And, as we will see presently, colour had a market price – and that price was influenced by supply and demand, along with quality and substitutability. However, the use of these precious materials also had an influence on expression and perception which would appear misleading to us, where the colours are

17 Englund 1998, 90–91. For detailed discussions, cf., e.g. Pientka-Hinz 2011.

18 Gardiner 1947, I: 23; III: pl. VA.

19 Pientka-Hinz 2011, 339.

20 In contrast to what is frequently assumed among archaeologists, as illustrated by the assumptions underlying works such as A. Jones and MacGregor 2002.

powerful but would not correspond to our concepts and expectations with the use of colour as a reflection of reality.

The origins of the present volume thus lie in a long and complicated chain of questions: among these are – at the one extreme – those related to understanding the origins and development of the modern abstract colour words, and at the other extreme, grasping the significance of the technological means and motives through which artificial colours were created in (and since) antiquity.

I have long argued that the valuable materials gave the names to the colours, and that through the exchange of goods and words, cognitive and linguistic mechanisms began the long process leading to abstraction.[21] As noted, some of the earliest synthetic materials – glass and faience in particular – bore the names of stones, and were appreciated for their red, blue, green, or green-blue, red and yellow hues. Acquiring the real stones and metals meant long chains of trade; creating the artificial products meant combining materials, technology and labour. In this sense, there were indeed economic questions at the centre of colour in antiquity.

And this is tied to one of the most important questions about the human use of colour: its origins and evolution. Fundamental to understanding the past use of colour is trying to grasp how the ancient colour terminologies relate to the hues denoted by specific words in antiquity – and how this relates to the use of colour. And then among the other subsidiary issues is the way that the words were actually used in texts – and why? For almost two decades now, I have been concerned with the potential material origins of colour terminology, stressing the high value of certain objects which played a role in the social (i.e., artistic and linguistic) expression of colour in terms of hues – while my joint editor was particularly concerned with brightness and the colours of the alleged 'imitations' of stones manufactured in glass in the ancient world, a form of colour which clearly attracted interest and led to the advance of colour as a common phenomenon.

What did it mean that materials and colour were so closely linked? What role did value play in this complex scheme? These are questions with which students of antiquity have often wrestled – but they are far from the usual questions facing students of colour as such.

1 Approaching the beginnings: philology and archaeology

The complexities of understanding the perception and expression of colour through language have generally involved intellectual disputes about epistemology, perception,

21 E.g., Warburton 2008; Warburton 2016b.

expression, hue, saturation, luminosity, loan words, universality, parallel independent evolution, categories, etc. For the ancient world, we can deal with little more than the archaeological and written evidence which can only reveal something of what colours seemed to have been appreciated – but neither the hue of the potentially degraded colours of the archaeological material nor the actual semantic meaning of the words we encounter in texts can inform us of much more about the understanding of colours. Thus, approaching colours from the traditional standpoint poses real problems for students of antiquity, while students of the contemporary world (or even the world of classical antiquity) can rarely grasp the importance of the questions with which students of early antiquity are confronted.

However, there can be little doubt that the archaeological and philological evidence from antiquity does reveal that colours were more complicated than simple hues eliciting cognitive responses. There is some doubt about the antiquity of language, but we know that the history of colour takes us deep into prehistory whereas for the linguistic history of colour, the evidence implies a restricted vocabulary in early history. Thus, the evidence from antiquity is highly relevant to the understanding of the development of abstract colour concepts.

For every era except the present (where one can interview living sources), it is only with written sources that we can link language to colour – yet the written sources from the ancient world seem to display a slight dissonance, with more colours being used in artwork and craftsmanship than are represented in ordinary language. Since this is an easily verifiable phenomenon (even more true today than in antiquity!), it seems that colour has another aspect beyond the mere name of a hue.

Did colours once have some value that was distinctly different from our terms of hues and moods? Did colours gain and lose some mysterious value – and did that mysterious value actually contribute to the development of the concept of meaning? What enabled the distribution and production of colour? For an archaeologist, it should be obvious to look into the past and see if we can resolve these and other questions. However, one must also narrow down the question in order to keep questions in focus while allowing enough leeway for the necessary breadth of input. In effect, that was the idea that led to this book.

To deal with these specific problems, we were fortunate that a number of scholars were willing to join us in discussing aspects of the questions that could be posed. Unfortunately, not all who wanted to come were able to do so – and not all who came delivered acceptable written versions. But we also had two devotees who invited themselves and added to our common experience – and also to that of our readers who likewise benefit from their presence.

Thus, in this volume we unite chapters dealing with different aspects of (a) the actual materials projecting colour; (b) the manufacture of colour; (c) the use of colour in adornment, art, architecture and language; and (d) the social significance of colour. In all of this, (e) the relations between colour, scarcity, status, prestige, and display (etc.) play a role.

Thus our argument is that material colour played a hugely important role in social life and thought in the world when the first colour terminologies were emerging. But, significantly, the use of colour and the terminologies were very closely linked at the dawn of history (when writing was invented, some 5000 years ago) – and these colours in early historical times included both natural and synthetic materials. It is also clear that these material colours involved exchange, being part of exchange networks unparalleled at any earlier point in time. As we will see, colour is at the forefront of long distance exchanges. Thus, exchange and borrowing were also important. Yet demand grew, and thus the palaces, temples and tombs of the elites in the ancient Near East occasionally contained artefacts of amethyst, carnelian, gold, lapis lazuli, silver, etc. However, the stones also stimulated the production of artificial coloured materials, in metal, glass and faience.

2 The example of lapis lazuli in context

A very useful example serving to illustrate the entire gamut of questions is that of lapis lazuli, as it concerns material, value, hue and imitations. We have some evidence for a price fluctuation in the value of real lapis lazuli from the third millennium to the second millennium BC, when measured in terms of silver. Lapis was mined virtually exclusively in north-eastern Afghanistan and traded across to the Mediterranean and Egypt before the middle of the third millennium BC, and our first prices are market prices from near the end of the long journey, at Ebla in western Syria in the mid-third millennium BC.

However, we have no way of judging what these mid third millennium prices mean – except that they confirm that the precious materials were incomparably more expensive than copper and bronze. In the middle of the third millennium BC, silver was more valuable than gold (trading at 1:2, with variations reaching a seeming common price of 1:5),[22] whereas in the second half of the third millennium and the second millennium BC the relations were reversed, and one unit of gold was worth at least 4 units of silver (with numerous variations).[23] In terms of silver, the prices for copper and bronze varied

22 Reiter 1997, 19–20. N.B:. Virtually my entire discussion is restricted to gold and silver values in Western Asia. In Egypt, the value of gold was twice that of silver in the second millennium, but may have been less in the third. Regardless of minor and major differences and fluctuations, gold and silver were far more valuable than copper and grain – and thus the most valuable stones and precious metals belong to a different category than the lower valued metals.

23 Reiter 1997, 22–35.

greatly, but copper was generally less than 100:1 for silver in the third millennium and more than 100:1 in the second millennium BC.[24]

The earliest prices for lapis lazuli are from the middle of the third millennium BC, for the trade between Mari and Ebla, with known ratios of silver to lapis lazuli of (a) 1:2; (b) 1:1.2 and (c) 1:3.5.[25] Thus in terms of weight, in western Syria in the third millennium a unit of silver could buy more than twice its weight in lapis lazuli. From the written sources of the second millennium BC – mostly from Anatolia and Mesopotamia – we know that gold and lapis lazuli had prices in silver, with both being more valuable than silver, up to 10:1 for gold; usually 2 or 3:1 for lapis lazuli. In this sense, silver was more valuable than lapis lazuli in the third millennium, and less so in the second – but the price remained close to that of silver, and was still vastly higher than, e.g., copper. These fluctuations and variations can be related to changes in the supplies of silver and gold, as well as increasing demand for lapis lazuli (or merely to the increasingly important role of market forces in the early second millennium, as I contend). Regardless, silver, gold and lapis lazuli were all valuable materials – and each had its own associations with kingship and divinity.[26]

Significantly, exactly these materials known from the texts in Egypt and Mesopotamia – lapis lazuli, amethyst, carnelian, gold and ivory – are also found in pre-palatial Crete.[27] They are mostly Early Minoan III to Middle Minoan IIA (ca. 2300–1900 BC), but some pieces did arrive already during Early Minoan II (ca. 2500? BC), seemingly following shortly after or contemporary with the appearance of the wealth in the mid-third millennium royal tombs of Ur.[28] Admittedly there are very few pieces of these precious stones – but pre-palatial Crete was still a poor place. Yet it seems that the élites were emulating their Near Eastern neighbours in seeking out highly valuable stones with special colours – and placing these in their tombs.

Of great interest is that in the Mycenaean era in Greece – i.e., after the great era of the Minoan palaces of Crete – the Mycenaeans showed little interest in lapis lazuli. There are about three dozen or so pieces in all of Mycenaean Greece: almost all of these were Near Eastern cylinder seals found at Thebes.[29] Interestingly, some of these seals from Thebes were so worn out that it would have been impossible for a Near Eastern client to have had them re-cut with a new inscription and still appear to be an impressive seal.

This issue has a multi-fold significance. Primarily, it means that Near Eastern clients would have found the bits of lapis lazuli without any real use-value. A patient craftsman

24 Reiter 1997, 133*, 135* (bar graphs).

25 Archi 2017, 37.

26 Shiyanthi Thavapalan kindly draws my attention to the fact that the prices of metal were meticulously recorded early on, but that those for precious stones were not (as the peregrinations in these footnotes confirm!). I would argue that the reason was that the metals were commonly viewed as commodities and that the precious stones played a different role in the minds of those handling them.

27 Colburn 2008.

28 For which, see Aruz 2003.

29 Cline 1994; Kopanias 2008.

could have purchased them and made beads out of segments cut from the seal, but aside from that there was not a lot of value left in the pieces. Secondarily, it means that whoever purchased them and whoever disposed of them at Thebes was probably making a decision based on the low price and the high prestige value of lapis lazuli. Most probably, a Levantine merchant purchased them for a good price somewhere, and they ended up in in the hands of the ruler at Thebes. But – aside from these – confirming the rule, a lone Egyptian scarab of lapis lazuli in Mycenae testifies to the thought that in Mycenaean Greece, where there was no real interest in lapis lazuli, someone could appreciate a nice piece.[30]

But, thirdly, it throws an interesting light on the strikingly heavy weight and large size of some of the Mesopotamian lapis lazuli cylinder seals of the third millennium BC[31] – as we can now confirm that in terms of silver they were in fact much cheaper than the later cylinder seals, which tended to be thinner. Since the price of lapis lazuli in silver rose from the second half of the third millennium onwards – as evidenced by the prices mentioned above, where the fall in the price of silver is also clear – it means that the silver value of the heavier third millennium seals was far below that of the later lighter seals. This could explain why the Mycenaeans were not interested.

And, this in turn leads to another completely different meaning, as we know that the Akkadian word for lapis lazuli, *uqnû*, entered Mycenaean Greek as *ko-wo-no*, a term for 'dark blue glass paste' (as noted above: later κυάνεος 'dark blue') – probably referring to the Greek understanding of the Egyptian glass ingots (mentioned by Hodgkinson in this volume). Thus, the actual material lapis lazuli eventually gave rise to the name of a colour in ancient Greek – but by virtue of the cheaper imitation which reproduced the hue of the precious stone, at a time when the stones themselves were seemingly disdained in Greece (but possibly because of the high price). And, as a result of these various changes, the name for the hue of the glass exported from Egypt maintained the Akkadian designation for the stone which was imitated in glass.

30 In this context, it is not without interest to refer to the treasure of Tod, dedicated by Amenemhat II to the Egyptian god Month sometime in the first quarter of the second millennium BC. One could also propose a similar explanation for a good deal of the lapis lazuli from the treasure at Tod in Egypt. Most of the small debris is neither on display nor published, but some of what is in the magazines (in the Louvre, which I have handled thanks to G. Pierrat-Bonnefois, and in Egypt of which I have heard from L. Postel) would have been pointless to rework and was probably purchased for a low price, simply because the small fragments amounted to a large weight. However, not only is there a lot of lapis lazuli in Egypt aside from this cache, but the Tod cache does include a couple of large blocks as well as cylinder seals that could have been re-cut. Thus, the contrast to the Mycenaean material is present in the overall makeup of the cache – and the otherwise generous usage of lapis lazuli in Egypt. In the Mycenaean world, lapis lazuli is virtually absent – and many of those pieces present in Thebes are worthless.

31 E.g., Aruz 2003, 216.

And at the same time, aside from the celebrated gold found by Schliemann, the Mycenaeans were extremely enthusiastic about Egyptian amethyst[32] and Baltic amber,[33] meaning that 'blue', 'purple' and 'golden' were of interest (with Akkadian *ḫurāṣu*[*m*]) 'gold' giving rise to Mycenaean *ku-ru-so*, and thus Greek χρυσός). The less than 40 objects of lapis lazuli in Mycenaean Greece must be compared to the "nearly 1650" pieces of Egyptian "amethyst from Greek sites".[34] Thus, it was not a matter of disdaining precious materials and colours, but rather of making choices about these. And seemingly these tastes were very specific: but evidently Egyptian products (originals and imitations) were preferred by the Mycenaeans.

3 Carnelian in context

Another curious example at the centre of the discussion could be carnelian in the three millennia before the beginning of our era.[35] Carnelian (cf. Fig. 2) has been called the Mesopotamian "red stone par excellence".[36] Sumerian ^{na4}GUG.ME.LUḪ.ḪA,[37] Akkadian *(abnu) sāmtu*. Carnelian was for the southern Mesopotamians intrinsically (1) a rare stone, (2) an import product from Meluḫḫa[38] (the Indus Valley civilisation), and (3) congruent with the concept of 'red', 'redness' (Akkadian *sâmu*, *sāmu*, *sāmtu*).[39] It was highly appreciated because of its colour and worked into magnificent pieces of jewellery,[40] but Moorey noted that "Throughout its long history in Mesopotamia cornelian seems not to have been used for anything other than beads, amulets and a few seals".[41] In lists and necklaces, carnelian is frequently associated with lapis lazuli and/or gold; it clearly belonged to the items found in 'treasures', and substantially because of the colour. One price from the mid-first millennium (when the ratio of silver to gold was ca. 1:10)[42] implies a ratio of silver to carnelian of 1:6,[43] meaning that it might have been more expensive than lapis lazuli – which is documented in the third millennium as being worth

32 Phillips 2015.
33 Harding, Hughes-Brock, and Beck 1974.
34 Phillips 2015, 2058.
35 This is the same as 'cornelian'. According to the *OED* (q.v. "cornelian"), "Late in the 15th" century, the etymologically correct 'cornelian' was corrupted (or transformed) into 'carnelian' under the influence of the colour 'red' (=blood) and the word 'carnal'. This occurred in an era long after the nature of colour had become an ordinary feature which could be bent in language – confirming the transformation which occurred after antiquity.
36 CAD, S: 127.
37 CAD, S: 122.
38 Moorey 1999, 97.
39 CAD, S: 121, 124, 126–131.
40 Cf. e.g., Aruz 2003, 128–132, 144.
41 Moorey 1999, 98. Moorey errs slightly as CAD, S: 123, refers to more than a kilogram being used to make beaks of birds, quite aside from offering numerous references to inlays.
42 Reiter 1997, 126*–130, 513.
43 CAD, S: 124. Another price from second millennium BC Ugarit is much lower (with 'cornelian' priced at 1/50 the weight of silver) and might refer to glass – cf. the notes about Egyptian prices below.

Fig. 2 Beads (gold, lapis lazuli, carnelian, jet). Royal Cemetery of Ur, mid-3rd millennium BC.

less than its weight in silver, and in the second as having been worth twice its weight in silver.[44]

Thus carnelian is associated with the colour 'red'. Yet, geologically, the original chalcedony or quartz was only 'red' by virtue of "minute disseminated particles of haematite" (i.e., iron oxide),[45] and thus the actual stones or pebbles ranged in natural colour from pale yellow to black (depending upon the density of the distribution of the iron oxides, and any patina). However, by excavating stones hidden from the sun (beneath the earth), and exposing them to repeated heating, craftsmen in the Indus Valley could produce a deep red colour,[46] which was adequate to earn the stone the reputation of "a rare exception to the general absence of documents from Mesopotamia indicating the role of merchants in the acquisition of foreign goods".[47] Thus, it was a 'precious stone' (by the standards of the Bronze Age, when emeralds, sapphires, rubies and diamonds were unknown), associated with a colour (produced by craftsmen), and obtained by trade.

44 The only prices of lapis lazuli I know of (Warburton 2016a, 112; Archi 2017) are from more than a millennium earlier, from the mid-third millennium and the first half of the second millennium, and imply that lapis eventually evened out at around twice or thrice as valuable as silver. It should not be neglected, however, that the Indus Civilisation had been defunct for more than a millennium and a half by the time of the Late Babylonian prices and thus real stones from the Indus would have been heirlooms.

45 Nicholson and Shaw 2000, 27.

46 Roux 1995.

47 Moorey 1999, 97.

Fig. 3 Silver earring. Royal Cemetery of Ur, mid-3rd millennium BC.

Yet carnelian was not only also found in Iran and northern Mesopotamia,[48] but even in the Egyptian eastern deserts.[49] Thus, ordinary carnelian was not necessarily rare, but it still had to be worked. While the reliable deep reds produced by the craftsmen in the Indus Valley were apparently highly esteemed in Mesopotamia, in Egypt an "end piece (of a piece of jewellery)" made of carnelian was worth less than 1/10 as much as an equivalent in gold.[50] Items of glass will have been still cheaper. Significantly, although it was a standard of value and itself prised, silver was not used as frequently in jewellery as the other precious materials. Earrings (Fig. 3) are an exception – and one wonders if the crescent moon may have lain behind this form. But – in general – despite its high value, silver was not as widely and prominently used as carnelian, which may well have had a lower value. Thus, the colour was important. Thus, there were expensive and inexpensive coloured stones and even less expensive synthetic equivalents. And all were traded and used – at least partially because of their colours.

48 Moorey 1999, 97.

49 Nicholson and Shaw 2000, 27.

50 Janssen 1975, 304–306; the other price where *ḥrs.t*, 'carnelian', appears in Egypt is likewise low, Janssen 1975, 308. All these prices from Egypt are from the late New Kingdom, after ca. 1200 BC. N.B.: As the gold to silver ratio in Egypt was ca. 1:2, as opposed to ca. 1:5 (and much steeper rates) in Mesopotamia, the price of the carnelian in silver equivalent would imply that it was worth but 5% of the value of silver (which contrasts with the price cited above). Speculating on the basis of two references is pointless, but it is clear that the price of carnelian in Egypt lay well below silver whereas the prices of carnelian and lapis lazuli seemed to lie well above silver in second millennium BC Mesopotamia. This makes perfect sense if the locally available carnelian satisfied demand in Egypt, whereas its high value in Mesopotamia was the result of it having been imported from abroad. I suspect that the concept of carnelian being prestigious originated in the rarity value of the stone in Mesopotamia, and that

This example comes from a recent era and can be readily understood in our terms, as we understand prices and colours today in a way that was not terribly different from the way they did in the relatively recent past. What was, however, the situation earlier?

What is not readily apparent is that the expansion of the use of colours seems (a) to bear no relation to the evolution of the human mind and (b) that colours play a very important part in recent human thought (and that this can be seen in the way the materials and colours are used or staged). Our origins can be traced back some seven million years or so, and there is evidence in the last couple of million years that colour actually entered into human interaction with nature in a way that we can grasp. Yet the real emergence of the use of colour in the European Upper Palaeolithic (beginning some 35 000 or so years ago) and the acceleration of the use of colour since the beginning of the Near Eastern Neolithic (some 12 000 years ago) do not reflect the genetic difference in our species which emerged some 200 000 or 300 000 years ago.

4 Jade in context

Furthermore, there is another transformation in the use of colour some 7000 years ago. Of extreme interest to us is that around 5000 BC, there is a unique conjunction which involves the virtually simultaneous appearance of axes of jadeite (Fig. 4) in Western Europe (certainly before ca. 5300 BC),[51] objects of coloured and translucent jade in China

this somehow spread to Egypt, where import substitution reduced the price but not the esteem. If, however, the Egyptian prices actually refer to glass or faience (and not the stone), this argument and the data are irrelevant. Yet, it must be appreciated that in Egypt we have semi-official records of state-sponsored mining expeditions searching for amethyst and turquoise (aside from gold), yet – aside from some rare and exceptional texts – none such activity is related to carnelian. Furthermore, lapis lazuli plays a very distinctive role in the offerings Ramesses III listed in P. Harris I, with turquoise being subsidiary and carnelian virtually absent (e.g., exceptionally P. Harris I 15a, 15). Significantly, P. Harris I also lists *ṯḥn.t* – what we translate as 'faience', but is probably a word originally used to designate both the precious Libyan desert glass, and later the manufactured faience – in large quantities meaning faience, while also separating out lapis lazuli and turquoise and throwing 'real precious stones' together (e.g., P. Harris I: 14a, 2; 15a, 1515b, 9; 55a, 12–17; 62b, 12–13; 64a, 10 – 64b, 12). This implies that the imported lapis was by far the most valuable with turquoise and jasper also singled out, with other precious stones being thrown together – and all of this separated from the articles of faience and glass which were listed in large numbers (e.g., almost 6000 faience objects, P. Harris I: 55a, 16–17), but hierarchically following the objects made of precious stones (e.g., more than 30,000!, P. Harris I: 55a, 12–13). In this sense, the abundance of real precious materials is striking – and by itself stresses that carnelian did not have a high value – but that the synthetic carnelian should probably be understood as lying among the faience objects, and the real carnelian might account for a high proportion of the 'precious stones'. Since carnelian might well have been supplied largely by the private market (as suggested by the presence of carnelian and the absence of documented expeditions), it would follow that we might be able to argue that in terms of prices in Egypt carnelian did in fact lie well below lapis lazuli, but above glass and faience.

51 Pétrequin et al. 2012.

Fig. 4 Neolithic jadeite axe head. Suffolk, England. 5th millennium BC. L: 17.4 cm. N.B. The actual deep green colour is only visible in places (e.g., to the right), as mostly obscured by the patina and incrustations today. The original piece was quite lage and beheld by the ancients as being entirely an almost pure deep green.

(from at least ca. 5000 BC),[52] copper metallurgy in the Balkans (from ca. 5000 BC),[53] and finally tin-bronze metallurgy in the Balkans (by ca. 4600 BC).[54] Significantly, in the first lexical lists from Mesopotamia – in the second half of the fourth millennium BC – metals are among the rare categories of words that are distinguished by colours.[55] Thus, the links between colours and metals were already a part of human consciousness before the real dawn of history – and at a time when metallurgy was only just beginning to assume its important role in the history of technology.

Under ordinary circumstances, one would divide the copper metallurgy from the jade, since it is more or less universally agreed that objects in jade – whether in China, Mesoamerica or Europe – are prestige objects, whereas copper objects are widely conceived of as being more utilitarian. Yet the evidence seems to imply (to the archaeologists analysing the copper and tin bronze) that the earliest copper was appreciated for a black or green colour while the earliest tin-bronze was appreciated because of its shiny brilliance (a point which is only underscored when noting that the object found is itself mere foil).[56] And this awareness of colour was conveyed from the preliterate world into

52 "Seven to eight thousand years ago the ancients cut and polished jade into ornaments and tools" Ch'in 1994, 51. This reveals the confusion challenging one's wish to offer precise dates; certainly by 5000 BC, jade was being worked – but precisely how much earlier is difficult to ascertain. The smallest well-dated archaeological find could push the Chinese use of jade to well before its documented use in Europe.

53 Radivojević, Rehren, Pernicka, et al. 2010.

54 Radivojević, Rehren, Kuzmanović-Cvetković, et al. 2013, passim, esp. 1032.

55 Englund 1998, 12, 134–141.

56 Radivojević, Rehren, Kuzmanović-Cvetković, et al. 2013; Radivojević and Rehren 2016.

the literate world. Thus, the colour – or brilliance – of the materials brings them together. Yet these earliest technological accomplishments did not take place where the first states would be found only millennia later (although it was later adopted by them).

Thus, neither genetic nor social explanations can account for the increasing use of colour; furthermore, the exploitation of advanced technology cannot contribute much, for this took place far away from and before the emergence of the first states (and it was in the first states that the significant social transformations took place). The situation becomes even more complex when it is appreciated that the earliest shiny bronze is older than the earliest known gold, and that somehow around 3000 BC, copper replaced the jade axes in Europe.[57] This latter would imply that copper was also a kind of prestige object, since the earliest jade axes were certainly not practical tools, and thus could have continued in usage, even when supplemented by copper and bronze. The former would imply that the attraction of gold was not its value alone, but also its brilliance and colour. Thus colours and materials were related and intertwined in a hierarchy of scale of values.

Significantly, the developed gold metallurgy in the Balkans (by ca. 4600 BC) comes before the first evidence of gold in Mesopotamia ("late fifth or early fourth millennium" BC),[58] or in Egypt (first half of fourth millennium?).[59] This would imply that – even if the Egyptians were mining their own gold – the idea of using it may not have originated in the brilliance of the metal encountered in Egypt, but rather in the spread of an idea which suddenly made the brilliance of gold attractive – and led to this brilliance being appreciated for its own sake.

The European axes of jade were but one part of a Neolithic development. This had begun much earlier in the Near East when items of personal adornment were made of colourful stones, among which the colour green was distinctively prominent. The use of jade ceased in Europe, and never caught on in the Near East. Significantly, there are a couple of pieces of jade in the tomb of Tutankhamun, and these might be of nephrite.[60] Obviously, by the time of Tutankhamun (ca. 1300 BC), the importance of jade had dwindled considerably in Europe – but it had persisted in China, and the tomb of Tutankhamun is contemporary with the Shang Dynasty in China, so the pieces might have come from the same mines supplying China. Significantly, the tradition of greenstone axes would eventually reach Tasmania[61] and Mesoamerica (before the European voyages of exploration).

57 Klassen 2004.
58 Moorey 1999, 221.
59 Hartung 2001, fig. 56, between pages 312 and 313.
60 Nicholson and Shaw 2000, 38–39.
61 Skinner 1936.

5 The emergence and expansion of trade

As noted, from the Neolithic onwards, various stones began to be appreciated for their colours, and this multitude of colours was greatly appreciated in the states which emerged in third millennium Mesopotamia and Egypt. There we find gold (from Anatolia and/or Egypt and Nubia), lapis lazuli (from Afghanistan), silver (probably from Anatolia), carnelian (from the Indus Valley civilisation and the Egyptian eastern deserts), turquoise (from the Sinai and elsewhere), and amethyst (from Egypt) – as well as ivory (from Africa and Western Asia), copper (from Sinai, Anatolia and Oman) and other similar goods.[62]

In the Near East, there was never much interest in amber[63] – but significantly Heltzer is persuaded that the Akkadian word *elmēšu*(*m*) (which probably entered into Hebrew through Akkadian) meant 'amber', and was actually originally a loan-word, *helmes?, of Baltic origin.[64] In this sense, we can see several different interpretations of colour, usually associating a material with a distinctive colour, and then associating that colour or that name with a different material with a similar colour, so that blue glass and lapis lazuli were both appreciated, as were amber and gold – but not awarded the same value in all of the places. Thus, gold was appreciated everywhere, but not necessarily lapis lazuli, and the same was true of amber, while amethyst might have been widely appreciated, but not everywhere. Significantly, in the ancient Near East, particular articles were frequently designated with the names used in foreign lands, i.e., loan words of unknown meaning (such as the word which gave rise to *elmēšu*[*m*]), or the names of foreign lands themselves, as in the case of carnelian, the 'red' stone from the Indus, $^{\text{na4}}$GUG.ME.LUḪ.ḪA, or Iran, $^{\text{na4}}$GUG.MAR.ḪA.ŠI$^{\text{ki}}$. In this sense, the name and the distant place of origin were attached to an article; only in the receiving land did the name then come to have a specific meaning relating to an article.

In this kind of trade over long distances, prices are one obvious issue. As noted, in the second millennium BC, gold, carnelian, and lapis lazuli traded at prices above the value of silver (which was effectively 'money'). By way of comparison, copper was worth but a fraction of the value of gold or silver.[65] Although copper came from Anatolia, Oman or Cyprus, it was traded in tons and abundant in comparison to lapis lazuli which was measured in ounces.

62 Aruz 2003; Moorey 1999; Nicholson and Shaw 2000.

63 Moorey 1999, 79–81; Lucas 1962, 387–388.

64 Heltzer 2001.

65 Reiter 1997, 126*–137*; Warburton 2016a, 111–117.

6 Glass and faience: imitations of templates?

And this brings us to the issue of the natural and artificial materials. In the fifth millennium, the metallurgists were working on copper and bronze alloys; from the fourth millennium onwards, craftsmen were on the way to manufacturing faience and glass. The production of faience took off in the third millennium, and glass in the second. Glass was probably more difficult to produce than faience, but both were distinctive crafts very different from mere pot-making or metallurgy. Both materials were used to make amulets and special objects of a not strictly utilitarian nature, frequently items of personal adornment or amulets. Obviously, glass and faience were manufactured in a fashion which literally transformed their supply from zero to whatever the market could absorb – and in this sense were very different from lapis lazuli or jade, which remained rare.

Obviously, copper will have been less expensive than jade, and faience less expensive than lapis lazuli – but are we correct in understanding these as ‘cheap imitations’? Probably not. For otherwise ‘glass’ would not be called ‘lapis lazuli’ (Sumerian ZA.GÌN.DURU$_5$), nor ‘faience’ ‘turquoise’ (Egyptian *mfk3.t*) or ‘lapis lazuli’ (Egyptian *ḫsbḏ*). And certainly, without such transfers, the conundrum about Egyptian *ṯḥn.t* probably meaning both ‘Libyan Desert Glass’ and ‘faience’ would never have come into the world, nor the Mycenaean use of the Akkadian word for lapis lazuli to designate Egyptian glass.

In one case, some forty *shabti* figurines (probably of faience) cost one *deben* (ninety-one grams of copper, equivalent to less than ten grams of silver, or a bit more than a Babylonian silver *shekel* of 8.33 grams);[66] in another transaction, a complete set of faience *shabtis* (365 plus their supervisors) is said to have been paid for with “copper, textiles, bread, cakes and fish”,[67] which does not speak for high value. We could speak of a ‘cheap imitation’. There was a difference in brittleness and price – but there was an appreciation of shiny hard surfaces.

Thus Katharina Schmidt has correctly warned us against such loose usage as describing these as ‘imitations’. My response is that it would be best to reverse the relationship, and to think of the natural materials being the ‘templates’ or ‘prototypes’, indicating that the desired features were dictated by the natural materials. These were characterised as being (a) unbreakably hard with (b) unchanging, saturated colour, occasionally (3) shimmering lustrously, aside from being (4) rare and thus charged with prestige. Thus there was some concept of value, by which the value of the original material was transferred to the synthetic object – but not at the level of price. Ultimately, the stones from the mountains remained rarer and more valuable than the glass from the kiln. Faience

66 Janssen 1975, 243.

67 Černý 1942, 109–110.

does not shine like glass – but lapis lazuli does not break like glass and faience. There were differences.

Thus, we cannot allow confusion of 'prestige value', 'exchange-value', and 'use-value'. As noted, used cylinder seals of real lapis lazuli which could no longer be re-cut ended up as cut-rate products on the market – and they could be tossed into tombs or be metamorphosed into 'offerings' for the gods. While maintaining a use value, the rarest and most exotic materials (gold, lapis lazuli) will have had the highest prices, but apparently carnelian, turquoise and amethyst will also have had a high prestige value – although not necessarily such a high market price.

By contrast, the use value of an amulet might have been ambiguous – and we have seen in the case of the *shabti* figurines that the 'price' cannot be viewed as high in economic terms. Yet, in the case of the *shabtis* referred to above as having been paid for with "fish", etc., the purchasers went so far as to prepare an oracular decree to confirm that the *shabtis* would perform their tasks in the Beyond. In this case, the material is not relevant, but rather the work that the *shabtis* must do in the Beyond. Yet this seems to have been incorporated into the price of the *shabtis* themselves.[68] In this case, the 'use-value' is the same as the 'exchange-value' (which is low), but the 'prestige value' must have been somewhere else. And thus, one can understand that faience was found not only in pre-palatial Crete,[69] but also actually manufactured in Western Europe.

7 Exchange and markets; trade and politics

This issue of the 'imitations' – glass and faience – offers us a precious glimpse into a frequently misunderstood aspect of ancient trade and markets. Archi notes that the third millennium BC palace in Ebla generally received its lapis lazuli as a gift from Ebla, and that the market transactions are exceptional;[70] in the absence of documents, we might guess that the opposite will have been true in third millennium Mari: most of the gold will have come as gifts from Ebla and elsewhere, and only smaller quantities would have been acquired on the market.

At first sight, this naturally corresponds to what we see in the Amarna letters, where enormous quantities of preciosities are listed as gifts between royal courts. And in the Late Bronze Age we can confirm that the production of glass and faience will have been related to palatial structures: even if neither Hodgkinson nor Dardeniz (in this volume) can confirm palatial control, we can certainly perceive proximity. Thus the idea that the palaces controlled the access to, and trade in, preciosities seems compelling.

68 Warburton 2007.

69 Colburn 2008.

70 Archi 2017.

However, to understand what was going on, it is useful to understand the role of the market. Here, the presence of the markets in third millennium Ebla must be related to the markets of the Ur III period, and the Old Assyrian period in southern Mesopotamia. For Ur III, Steinkeller is persuaded that "the vast majority" of the "hundreds of thousands of" textiles manufactured by the Ur III state "were produced for export"[71] – presumably to acquire silver. For the period only centuries later, we are better informed as Barjamovic notes that the state production was sold cheaply, so that the merchants made enormous profits by purchasing the state produced textiles (purchased cheaply) by selling them with substantial markups in other distant markets – and that other palaces usually had a chance to profit from the merchants.[72]

Under the circumstances, one might conclude that the palaces may have invested in production – whether of glass or textiles – and (a) passed on part of their production to friends, dependents, etc. while (b) retailing part of the production to merchants who took on the risks and hopes of profit. Their concern with textiles will have been more complicated as wool and textiles could be sold, but dyed textiles as well – yet the markets for wool, cheap textiles and dyed textiles will not have been the same, and the merchants will have understood these relations better than the institutions. Regardless, the palaces did not obviously aim at controlling trade routes so much as profiting from the activity of the merchants to dispose of the goods they produced. That the goods were produced for the markets is clear from the Ur III textile industry. That the real profits accrued to the merchants is clear from the activities of the Old Assyrian merchants.

In this sense, separating state from market is a pointless exercise – as is speculation about controlling trade or trade routes. Investigating the details is one priority, but understanding the mechanisms by which the market functioned is another. The state was an actor in the markets – but this does not mean that the Egyptian state sold all its glass, turquoise and amethyst. Nor does it mean that everything on the market was produced by some state; but ironically, it may transpire that a good deal of what was on the Bronze Age markets was produced by some institution of some kind, and that the merchants acted primarily as intermediaries. Obviously there is a distinction to be made between mechanisms and goals – one which must be examined with care (and not treated as a matter for mere speculation). The Bronze Age Near Eastern palatial and institutional interest in the production of imitations is striking – and contrasts with their inability to control the access to lapis lazuli, where the merchants were obviously decisive. Yet without the wealth of the elites, the lapis lazuli would never have been brought to market; with glass the situation was quite different.

71 Laursen and Steinkeller 2017, 5.

72 In Kristiansen, Lindqvist, and Myrdal 2018, 124.

8 The value of colour: brightness and hues, originals and imitations, materials and metaphors

And beyond the actual stones and their imitations in glass or faience, there was also the deliberate imitation of colours used in painting. In this case, some of the materials used matched the requirements easily. Yet in others, there was a clear preference for using particular materials – such as huntite for bright white and orpiment for golden yellow – which themselves will have been relatively expensive and prized by the craftsmen, but themselves intended merely to imitate the colours of the much more precious materials or more highly valued colours.

This is particularly striking in the case of white: Greek λευκός offers little distinction between 'white' and 'light', 'bright'; the same phenomenon appears in Egyptian *ḥḏ*, yet the Egyptian 'bright', 'white' is associated with the material 'silver', as in Sumerian KÙ.BABBAR, where silver is the 'shining' or 'white' metal. Sumerian AŠME, 'radiance', is associated with the sun and moon as well as with gold and silver. The abundance of words for 'bright', 'shining' is a phenomenon known from many ancient languages. And yet, when the Egyptians sought to paint white garments in a mural, they deliberately aimed at what we would understand as 'real, bright, white', and aimed at finding the best materials to achieve this. In this sense, we can see a breakthrough of colour in the real world which is not matched in the conceptual world.

And there is another problem: for Egyptian and/or Akkadian, I can propose that amethyst, carnelian, gold, jade, lapis lazuli, and silver played some kind of role in the conceptual development of colour, but there is no real consistency.[73] Furthermore, it would appear that white shell, black obsidian and red ochre played a fundamental role in the earliest – Palaeolithic – use of colours (Moutsiou, this volume), but that these materials did not leave many traces in the vocabulary, while demonstrating the importance of colour. By contrast, later, the names of the materials and linguistic exchange become more important in the advanced colours and vocabulary as testified to, e.g., by the use of gold and lapis lazuli in Greek for blue and yellow (mentioned above). But later, the materials fall into the background and the abstract colours come to dominate.

And this leads to confusion. Was it the colour or the material or some incomprehensible concept? Most outsiders would not suspect that this introduction – suitably equipped with references – is actually full of controversial assertions with which not even my co-editor is comfortable. The only way to understand how progress could be made was to offer a number of colleagues the chance to provide their interpretation of the material – while staying within the framework of a specific discussion. And for this purpose, we brought together some colleagues. The result is a tale which takes us from

73 Warburton 2008; Warburton 2016b; Warburton n.d.

the Palaeolithic to Rome, trailing obsidian, paintings, glass, stones, architecture – and leading into similes and metaphors.

At the beginning of our tale, we start with Schenkel who is at once the first and the last great theoretician to deal with Egyptian colours as abstract words referring to hues – before our world of materiality began to dominate that discourse of which this book forms a part. Schenkel's colours are among the oldest known appearing in written language – and this is usually the formal means of access to ancient colour. Thus Schenkel's work must be understood as the gateway to a new understanding of colour, and we must pass through it before we can find new ways.

However, one could argue – with Moutsiou and Bar-Yosef Mayer – that the real tale of colour begins long before the Egyptian and Sumerian colour vocabulary and goes back further than the intensified use of obsidian in the very late Palaeolithic, which was itself complemented by the polished green stones of the very early Neolithic. For us, this age is linguistically mute – yet still full of surprises linking the materials to colours and the language based sources we encounter later on.

Obviously, the circulation of stones played an important role from this time onwards. What happens is that stones are being used as ornaments – and that the later synthetic materials are generated to serve as a market alternative to the original stones. And these colours were also transformed into textiles as Quillien shows. In this sense, one wonders if Moorey had not quite missed the point when observing that the use of carnelian was restricted to items of personal adornment, as it would seem that this was one of the key roles of colour. And this point is strengthened by Blakolmer's argument that the external architectural facades of the Bronze Age Aegean may not have been quite as colourful as we might have wished. His own interpretation was that the colourful internal architectural decoration of the Bronze Age Aegean architecture belonged to the private sphere – and thus underscores a very important thought. Thus, on the one hand, one could tend to think of colour as social and personal.

On the other hand, however, Hodgkinson, Dardeniz, and Blom-Böer remind us that there was certainly representational and institutional interest in colour as well. Thavapalan takes us into the role of the glass as following the templates of the stones in a case study. Pelletier-Michaud allows us to follow this economic thread into comparatively recent times. And Brøns went to the trouble of trying to see what she could add to offer a coherent account of the richness of the workshop discussions. Admittedly, this may not help us much in understanding what colour is, and how measure it. But, it should offer food for thought about what colour means – as well as where, when and how it came into our lives. And how important it was in the ancient world, where aesthetics and prestige were linked to the production of perfect colours.

Bibliography

Archi 2017
Alfonso Archi. "Lapis Lazuli and Shells from Mari to Ebla". In *Overturning Certainties in Near Eastern Archaeology. A Festschrift in Honor of K. Aslıhan Yener*. Ed. by C. Maner, M. T. Horowitz, and A. S. Gilbert. Culture and History of the Ancient Near East 90. Leiden: Brill, 2017, 34–47.

Aruz 2003
Joan Aruz, ed. *Art of the First Cities*. New York: Metropolitan Museum of Art, 2003.

Assmann 1983
Jan Assmann. *Sonnenhymnen in Thebanischen Gräbern*. Theben Bd. 1. Mainz: Philipp von Zabern, 1983.

Baines 1985
John Baines. "Color Terminology and Color Classification. Ancient Egyptian Color Terminology and Polychromy". *American Anthropologist* 87 (1985), 282–297.

CAD
A. Leo Oppenheim, Thorkild Jacobsen, John A. Brinkman, Civil, Robert D. Briggs, Erica Reiner, Martha T. Roth, and Ignace J. Gelb, eds. *The Assyrian Dictionary of the Oriental Institute of the University of Chicago*. Chicago: Oriental Institute, 1956/2011.

Cassin 1968
Elena Cassin. *La splendeur divine. Introduction à l'étude de la mentalité mésopotamienne*. Paris: Mouton, 1968.

Černý 1942
Jaroslav Černý. "Le caractère des oushebtis d'après les idées du nouvel empire". *Bulletin de l'Institut français d'archéologie orientale* 41 (1942), 105–133.

Ch'in 1994
Hs. Ch'in, ed. *Great National Treasures of China*. Taipei: National Palace Museum, 1994.

Cline 1994
Eric H. Cline. *Sailing the Wine-Dark Sea*. British Archaeological Reports, International Series 591. Oxford: Tempus Reparatum, 1994.

Colburn 2008
Cynthia S. Colburn. "Exotica and the Early Minoan Elite. Eastern Imports in Prepalatial Crete". *American Journal of Archaeology* 112 (2008), 203–224.

Englund 1998
Robert K. Englund. "Texts from the Late Uruk Period". In *Mesopotamien: Späturuk-Zeit und Frühdynastische Zeit*. Ed. by P. Attinger and M. Wäfler. Orbis Biblicus et Orientalis 160/1 = Annäherungen 1. Freiburg and Göttingen: Universitätsverlag and Vandenhoeck & Ruprecht, 1998, 15–233.

Gardiner 1947
Alan H. Gardiner. *Ancient Egyptian Onomastica*. Oxford: Oxford University Press, 1947.

Harding, Hughes-Brock, and Beck 1974
Anthony Harding, Helen Hughes-Brock, and Curt W. Beck. "Amber in the Mycenaean World". *The Annual of the British School at Athens* 69 (1974), 145–172.

Hartung 2001
Ulrich Hartung. *Umm el-Qaab II. Importkeramik aus em Friedhof U in Abydos (Umm el-Qaab) und die Beziehungen Ägyptens zu Vorderasien im 4. Jahrtausend v. Chr.* Archäologische Veröffentlichungen des Deutschen Archäologischen Instituts Kairo 92. Mainz: Philipp von Zabern, 2001.

Heltzer 2001
Michael Heltzer. "On the Origin of the Near Eastern Archaeological Amber". In *Languages and Cultures in Contact*. Ed. by K. Van Lerberghe and G. Voet. Orientalia Lovaniensia Analecta 96. Leuven: Peeters, 2001, 169–176.

Janssen 1975
Jacobus J. Janssen. *Commoditiy Prices from the Ramesssid Period*. Leiden: Brill, 1975.

A. Jones and MacGregor 2002
Andrew Jones and Gavin MacGregor, eds. *Colouring the Past*. Oxford: Berg, 2002.

Klassen 2004
Lutz Klassen. *Jade und Kupfer*. Aarhus: Aarhus University Press, 2004.

Kopanias 2008
Konstantinos Kopanias. "The Late Bronze Age Near Eastern Cylinder Seals from Thebes (Greece) and Their Historical Implications". *Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung* 123 (2008), 39–96.

Kristiansen, Lindqvist, and Myrdal 2018
Kristian Kristiansen, Thomas Lindqvist, and Janken Myrdal. *Trade and Civilisation. Economic Networks and Cultural Ties from Prehistory to the Modern Era*. Cambridge: Cambridge University Press, 2018.

Laursen and Steinkeller 2017
Steffen Laursen and Piotr Steinkeller. *Babylonia, the Gulf Region, and the Indus*. Winona Lake: Eisenbrauns, 2017.

Liddell, Scott, and H. S. Jones 1958
Henry G. Liddell, Robert Scott, and Henry S. Jones. *A Greek English Lexicon*. Oxford: Oxford University Press, 1958.

Lucas 1962
Alfred Lucas. *Anceint Egyptian Materials and Industries*. London: Edward Arnold, 1962.

Moorey 1999
Peter R. S. Moorey. *Ancient Mesopotamian Materials and Industries*. Winona Lake, IN: Eisenbrauns, 1999.

Nicholson and Shaw 2000
Paul T. Nicholson and Ian Shaw, eds. *Ancient Egyptian Materials and Technology*. Cambridge: Cambridge University Press, 2000.

OED
James A. H. Murray, ed. *Oxford English Dictionary*. 2nd ed. Oxford: Oxford University Press, 1989.

Oppenheim 1943
A. Leo Oppenheim. "Akkadian pul(u)ḫtu and melammu". *Journal of the American Oriental Society* 63 (1943), 31–34.

Otto 1963
Walter F. Otto. *Die Wirklichkeit der Götter. Von der Unzerstörbarkeit griechischer Weltsicht*. Rowohlts Deutsche Enzyklopädie 170. Munich: Rowohlt, 1963.

Otto 2002
Walter F. Otto. *Die Götter Griechenlands*. Frankfurt a. M.: Klostermann, 2002.

Pétrequin et al. 2012
Pierre Pétrequin, S. Cassen, M. Errera, Klassen, A. Alison Sheridan, and A.-M. Pétrequin, eds. *Jade. Grandes haches alpines du Néolithique européen Ve et IVe millénaires av. J.-C.* Besançon: Presses Universitaires de Franche-Comté, 2012.

Phillips 2015
Jacke Phillips. "Egyptian Amethyst in Mycenaean Greece". In *Proceedings of the Tenth Internatinal Congress of Egyptologists*. Ed. by P. Kousoulis and N. Lazaridis. Orientalia Lovaniensia Analecta 241. Leuven: Peeters, 2015, 2057–2070.

Pientka-Hinz 2011
Rosel Pientka-Hinz. "Bunte Kühe? Zu den Farbbezeichnungen im Alten Orient". In *Die Empirische Dimension altorientalischer Forschungen*. Ed. by G. J. Selz. Berlin and Münster: LIT Verlag, 2011, 325–374.

Radivojević and Rehren 2016
Miljana Radivojević and Thilo Rehren. "Paint It Black. The Rise of Metallurgy in the Balkans". *Journal of Archaeological Method and Theory* 23 (2016). Last accessed on 04/08/2016, 200–237. DOI: 10.1007/s10816-014-9238-3.

Radivojević, Rehren, Kuzmanović-Cvetković, et al. 2013
Miljana Radivojević, Thilo Rehren, Julka Kuzmanović-Cvetković, Marija Jovanović, and Jeremy P. Northover. "Tainted Ores and the Rise of Tin Bronzes in Eurasia, C. 6500 Years Ago". *Antiquity* 87 (2013), 1030–1045.

Radivojević, Rehren, Pernicka, et al. 2010
Miljana Radivojević, Thilo Rehren, Ernst Pernicka, Dusan Šljivar, Michael Brauns, and Dusan Borić. "On the Origins of Extractive Metallurgy. New Evidence from Europe". *Journal of Archaeological Science* 37 (2010), 2775–2787. DOI: 10.1016/j.jas.2010.06.012.

Reiter 1997
Karin Reiter. *Die Metalle im Alten Orient*. Alter Orient und Altes Testament 249. Münster: Ugarit, 1997.

Richardson 2000
Mervyn E. J. Richardson. *Hammurabi's Laws*. Sheffield: Sheffield Academic Press, 2000.

Roux 1995
Valentine Roux. "Le travail des lapidaires". In *Les pierres précieuses de l'Orient ancien*. Ed. by F. Tallon. Paris, 1995, 39–44.

Skinner 1936
H. Devenish Skinner. "A Greenstone Adze or Axe from Northern Tasmania". *The Journal of the Polynesian Society* 45 (1936), 39–42.

Warburton 2007
David A. Warburton. "Work and Compensation in Ancient Egypt". *Journal of Egyptian Archaeology* 93 (2007), 175–194.

Warburton 2008
David A. Warburton. "The Theoretical Implications of Ancient Egyptian Colour Vocabulary for Anthropological and Cognitive Theory". *Lingua Aegyptia* 16 (2008), 213–259.

Warburton 2016a
David A. Warburton. *The Fundamentals of Economics. Lessons from the Bronze Age Near East*. Civilisations du Proche-Oient série IV, Histoire-Essais 3. Neuchâtel: Recherches et Publications, 2016.

Warburton 2016b
David A. Warburton. "The Origins, Development, Diffusion and Significance of Early Color Terminology". In *Essays in Global Color History: Interpreting the Ancient Spectrum*. Ed. by R. B. Goldman. Piscataway: Gorgias Press, 2016, 65–94.

Warburton n.d.
David A. Warburton. "Ancient Color Categories". In *Encyclopedia of Color Science and Technology*. Ed. by R. Shamey. 2nd ed.

Illustration credits

1–4 © Trustees of the British Museum. With permission.

DAVID A. WARBURTON

David Warburton (Dr.phil. Berne; HDR Paris I) is a professor of Egyptology at the Institute for the History of Ancient Civilizations at Northeast Normal University, Changchun, China. Research interests: Ancient economic history, economic theory, history of science, Bronze Age political history and chronology, cognition, religion, stratigraphy, etc.

Dr. David Warburton
Institute for the History of Ancient Civilizations (IHAC)
Northeast Normal University
5268 Renmin Street
130024 Changchun
Jilin Province
People's Republic of China
E-Mail: warburton@zedat.fu-berlin.de

Wolfgang Schenkel

Colours as Viewed by the Ancient Egyptians and the Explanation of this View as Seen by Academics Studying Colour

Summary

In Egyptian-Coptic there are, as in other languages, Basic Color Terms (BCTs), general colour words, as well as non-BCTs, colour words that can be used in more specific contexts. Unlike in modern languages, the number of BCTs in Egyptian-Coptic is rather limited. Differences are made with the colour words, which one can translate with 'black' and 'white', 'red' and 'green': dark and light and warm-coloured and cold-coloured. After an introduction, two aspects are considered in this paper: the projection of questions from different linguistic directions into ancient Egyptian philology and the projection of translation equivalents from Egyptological philology into Egyptological linguistics.

Keywords: Ancient Egyptian; colour; Ostwald double cone; Berlin and Kay; Basic Color Terms; non-Basic Color Terms

Im Ägyptisch-Koptischen gibt es wie in anderen Sprachen Basic Color Terms, allgemein verwendbare Farbwörter, und non-Basic Color Terms, in spezielleren Zusammenhängen verwendbare Farbwörter. Anders als in unseren eigenen Sprachen ist der Bestand an Basic Color Terms im Ägyptisch-Koptischen ziemlich beschränkt. Unterschieden werden mit den Farbwörtern, die man gern mit ‚schwarz' und ‚weiß', ‚rot' und ‚grün' übersetzt: dunkel und hell, warmfarbig und kaltfarbig. Nach einer wissenschaftsgeschichtlichen Einleitung sind zwei Aspekte zu behandeln: die Projektion von Fragestellungen aus unterschiedlichen linguistischen Richtungen in die philologische Ägyptologie und die Projektion von Übersetzungsäquivalenten aus der ägyptologischen Philologie in die ägyptologische Linguistik.

Keywords: Altägyptisch; Farbe; Ostwaldscher Doppelkegel; Berlin und Kay; Basic Color Terms; non-Basic Color Terms

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

With thanks to David Warburton for the translation of, and active support in forming, the text, and Daniel Werning for competent last-minute help with formatting the transcription font.

My task is to report on the *exploration* of Egyptian colour terminology. I begin with the current *state* of our research – as I understand it philologically and linguistically – for two reasons. First, I consider the current state of knowledge about this topic to essentially be accurate. Second, the current understanding of Egyptian colour terminology can be more suitably transposed into a more nuanced and more easily grasped representation of the colour spectrum of the ancient Egyptians, allowing for multiple approaches and criticism from philological, linguistic, and other perspectives. My efforts should not be understood as a dogma.

1 Four colour words: the core of the Egyptian colour spectrum

We approach the Egyptian language through the filter of translation into our own languages. Who reads Egyptian texts, aside from a few specialists? Additionally, who can really understand exactly what an Egyptian author meant, even if we can actually read the Egyptian text? The colour words are an excellent example of this conundrum. We are drawn to four words that are generally translated as 'black' and 'white', 'red' and 'green' and written here in a traditional Egyptological transcription. These have also been given in a phonetically more advanced form of transcription, and finally here (and on occasion where useful later) in a traditional, i.e., approximate, Egyptological pronunciation of the transcription: *km*(*m*) / kem(em) 'black'; *ḥḏ* / *ḥč̣* / ḥedj 'white'; *dšr* / *ṭšr* / desher 'red'; and *wꜣḏ* / *wꜣč̣* / wadj 'green'. From here onwards, I use the general translations for these words provided in single quotation marks.

To begin, however, I will start using some 'real' colours. First, Fig. 1 is a colour image reproduction of an actual film photograph – taken by an American astronaut in the 1960s – showing the Sinai Peninsula, the Delta, and parts of the Red and Mediterranean Seas, as well as bits of the Nile Valley and the Eastern and Western Deserts. It illustrates a simplified version of the colours of Egypt. As we translate, the Egyptians termed the cultivated land of the Nile Delta and Valley, 'Egypt', 'The Black Land'; the 'desert' was 'The Red Land'; and a body of water near Egypt was 'The Great Green'. Along with 'white', these are the basic colours used in the Egyptian language.

Fig. 1 Desert and arable land.

Fig. 2 The Bent Pyramid at Dahshur with white limestone and red sandstone blocks.

1.1 *km(m)* / kem(em) 'black' and *ḥḏ* / *ḥč* / ḥedj 'white'

For the Egyptians, *km(m)* 'black' is the cultivable soil. Thus, 'Egypt', meaning the fertile soil of Egypt is *Km.t* / Kemet 'The Black', 'The Black Land'. Of course, the soil is not black, but rather somehow dark / dark-brown. Additionally, *km(m)* 'black' is written with the crocodile skin 𓆎, which is hardly black, but rather dark or dark-grey when dry and dark green when wet. A lot of other things are 'black', such as the pupil, as in the 'black (in the eye)'; granite, flint, and even the sunburnt field worker whose forehead – to which the Egyptian text explicitly and exclusively refers – is 'black'.

For the Egyptians, *ḥḏ* / *ḥč* 'white' is limestone, *jnr ḥḏ* / *ỉnr ḥč* / iner ḥedj, literally 'white stone', used as a preferred building material in earlier ages, which can be seen in the blocks visible here in Fig. 2 in the Valley Temple of the Dyn. IV Bent Pyramid (ca. late first half of the third millennium BC). Yet sandstone, which is frequently reddish in hue with a greater tensile strength than limestone, thus, was a more suitable building material. Sandstone was popular in later periods (especially from late Dyn. XVIII, ca. 1330 BC onwards), and is also labelled as 'white', termed the *jnr ḥḏ n rwḏ.t / ỉnr ḥč̣ n(.ỉ) rwč̣.t* / iner ḥedj en/ni rudjet 'firm white stone' (David Warburton has another opinion on this matter).[1] Both limestone and sandstone are *ḥḏ / ḥč̣* 'white' in comparison to the hard stones such as granite and diorite, which are called *jnr km / ỉnr km* / iner kem 'black stone.'

I should note that in the course of the long-term linguistic development *ḥḏ / ḥč̣* 'white' was gradually replaced with *wbḫ* / webekh 'white', and that in the final stage of the ancient Egyptian language, Coptic, the linguistic descendant of this term, originally meaning 'light' or 'shining', has become the standard word for 'white.' The world of colour was, however, not touched by this. As with *km(m)* 'black', there are a lot of white things, including a variety of carnelian (chalcedony, sard), which is traditionally translated as 'white carnelian' (*ḥrś.t ḥḏ.t / ḥrś.t ḥč̣.t* / ḥerset ḥedjet), in contrast to 'red carnelian (*ḥrś.t dšr.t / ḥrś.t ṭšr.t* / ḥerset desh(e)ret); silver, onions, the 'white of the eye', 'the white royal crown', milk, honey, white bread, and teeth are all 'white.'

Thus, we come to our first generalisation: what the ancient Egyptians distinguished with *km(m)* 'black' and *ḥḏ / ḥč̣* 'white' was not what we might commonly understand as black and white, but rather two larger groups of the colour spectrum, the dark and light colours. 'Black' and 'white' were intended to distinguish luminosity or brightness, and only this.

Let us now turn to the second pair of the four colour words listed above: *dšr / ṭšr* / desher 'red' and *wꜣḏ / wꜣč̣* / wadj 'green.'

1.2 *dšr / ṭšr* / desher 'red' and *wꜣḏ / wꜣč̣* / wadj / 'green'

For the Egyptians, *dšr / ṭšr* 'red' is the colour of blood. Blood is usually called 'the Red', **dašū́r.ew / *ṭašū́r.ew* or possibly **dašū́r.u(?) / *ṭašū́r.u(?)*, as we can readily understand. Yet, an identical word (according to my knowledge – and to my amazement – down to the here reconstructed vowels) is also used for the 'flamingo', which gives us the impression of being pink or rose rather than red. Yet for the Egyptians, the colour of the flamingo was sufficiently representative to be used in the hieroglyphic writing of this colour word, and those words derived from it with the flamingo . The desert is also *dšr / ṭšr* 'red', *dšr.t / ṭšr.t* / desh(e)ret: 'the Red', 'The Red Land.' However, the Egyptian sand desert is more light brown, as shown here in Fig. 2 at the Bent Pyramid; elsewhere, with other lighting, it might be yellowish, but certainly not a typical red in the sense of the word

1 Cf. e.g. Warburton 2008.

used in translations. Thus, in the translations the actual colour word used is not really taken into account, and we translate 'desert', which bears entirely different associations.

The earliest and still really useful (and used) dictionary of Ancient Egyptian is that of Erman and Grapow (1926–1931), the five-volume Berlin *Wörterbuch der aegyptischen Sprache*.[2] In the last and final volume of 1931, we find that the basic meaning of the word 'red' (i.e., *dšr* / *ṭšr*) with a geographical meaning is 'desert', without a trace of doubt. More recent dictionaries, such as those published since the 1990s offer 'red', 'red/yellow', 'red/yellow land' without offering us any options for understanding just what 'red/yellow' actually means:[3] neither 'red' nor 'yellow' really hit the mark, nor does any colour in the red-yellow range seem to come any closer to reality. Even if in the final volume of the Berlin dictionary, where *dšr* / *ṭšr* (along with all of the derivatives) is defined as 'red', we nevertheless surprisingly encounter 'yellow', as in the first volume of 1926 where the entry for *jtj dšr* / *ỉtỉ ṭšr* / iti desher offers 'yellow barley'. The note that it is used for preparing beer does not really explain whether roasted barley is yellow or brown. Indeed, when throwing the net wider and checking again the final volume of the Berlin Dictionary from 1931, under *Km.t*, 'The Black Land' is contrasted with the 'yellow-red desert'.[4] Thus, the contributors and editors of the Berlin Dictionary clearly appreciated that *dšr* / *ṭšr* 'red' did correspond to our red, but could also be used from time to time for our yellow. Additionally, the colour of the desert was not our red, but rather a red strongly merging into our yellow.

Unfortunately, the insights of the lexicographers were expressed in obscure language that did not penetrate the German-Egyptian index volume, where there is no entry for 'yellow'. It is, thus, hardly surprising that this recognition did not become a part of general Egyptological knowledge. Nevertheless, we must understand that *dšr* / *ṭšr* only marginally covers *our* yellow and that the focus of this colour word really lies in the red range. One can see this because most of the objects that the Egyptians understood as being *dšr* / *ṭšr* really were red in *our* sense, and not yellow, as is evident with the 'Red' royal crown, which was painted with red ochre. The ancient Egyptian designation *ḏw dšr* / *č̣w ṭšr* / dju desher ('red mountain') drew on the crystallite quartzite red colour of a geological phenomenon, and was sustained in the Arabic name, Jabal al-Ahmar ('red mountain'), still used to describe a mountain on the eastern outskirts of Cairo. Carnelian (chalcedony, sard), traditionally translated as 'red carnelian' (*ḥrś.t dšr.t* / *ḥrś.t ṭšr.t* / ḥerset desh(e)ret) is in contrast to 'white carnelian' (*ḥrś.t ḥḏ.t* / *ḥrś.t ḥč̣.t* / ḥerset ḥedjet). A soda was also 'red', as was indeed the planet Mars, 'the Red (planet)', personified as *Ḥr dšr* / *Ḥr.w ṭšr* / Ḥer(u) desher, 'the Red Horus'.

2 Erman and Grapow 1926/1931.

3 Hannig 2006a; Hannig 2006b.

4 NB: 'yellow-red' and not 'red/yellow', which Hannig understands as 'red' or 'yellow'.

For the Egyptians, *wꜣḏ / wꜣč̣* 'green' are plants, including papyrus 𓇅, which they also used to write the word for 'green' in hieroglyphs. The colour *wꜣḏ / wꜣč̣* 'green' is, however, also the sea. Translated as 'the Great Green,' *wꜣḏ-wr / wꜣč̣-wr* / wadj-wer is generally understood as the term the Egyptians chose for what we call the Red Sea. For us, however, the issue is not whether that body of water is green or red (as it can be both, depending upon the season and the colour of the related algae). With the Red Sea, the Greeks (Erythrean Sea) and the Arabs (Bahr al-Ahmar) had one perspective; the Egyptians had another. Irritating in this context is only that the Red Sea is not green, but rather more blue than green, if not actually deep blue. On a spring day (18 March 1968) I experienced the Red Sea between Quseir and Hurghada as deep-blue. This raises the question of whether the Egyptian designation for the Red Sea *wꜣḏ-wr / wꜣč̣-wr* – which we Egyptologists traditionally translate as 'Great Green' – should not in fact be translated as 'Very Green' or indeed as 'Very Blue' using an alternative translation for *wr*, as 'greatly' rather than 'great.' Egyptian grammar would certainly permit this, but I will dispense with the philological reasoning – quite aside from the controversy about the identification of the Red Sea as *wꜣḏ-wr / wꜣč̣-wr 'Sea'*.[5] The terms *wꜣḏ / wꜣč̣* 'green' are thus all manner of different plants; the sea can be *wꜣḏ / wꜣč̣* 'green,' and malachite and other green stones, including malachite as eye-paint, can also be *wꜣḏ / wꜣč̣* 'green.' From the abundance of objects designated as *wꜣḏ / wꜣč̣* 'green,' it is evident that *wꜣḏ / wꜣč̣* 'green' only marginally touches *our* 'blue,' and that the focus of this word lies in the green range.

This brings us to our second generalisation. What the Egyptians distinguished using *dšr / ṭšr* and *wꜣḏ / wꜣč̣* is not somehow 'red/yellow' and 'green/blue,' but rather – as already with *km(m)* 'black' and *ḥḏ / ḥč̣* 'white' – two wider ranges in the colour spectrum: those of the warm and cold colours. Warm colours are in the red-yellow range and the cold colours in the green-blue range. While with *km(m)* 'black' and *ḥḏ / ḥč̣* 'white,' luminosity or brightness is taken into account, with *dšr / ṭšr* 'red' and *wꜣḏ / wꜣč̣* 'green' hues are distinguished.

Just how close to each other the colours lie, and how the choice of one word or the other was made can be seen in the limestone blocks in the desert by the Bent Pyramid at Dahshur (cf. Fig. 2). The Egyptians called limestone *jnr ḥḏ / ỉnr ḥč̣* / iner ḥedj 'white stone' that as far as the luminosity or brightness is concerned is not that different from the desert landscape, which was nevertheless termed the *dšr.t / ṭšr.t* / desh(e)ret 'the Red (Land).' In contrast to the stone, the desert is clearly warm coloured, not merely 'light.' If the desert is understood as having a warm colour, then the designation *dšr / ṭšr* 'red' could bear with it the contrast to an object with a 'cold' colour, namely to the *wꜣḏ / wꜣč̣* 'green' growth of the cultivated land. This interpretation can in no way be dismissed by observing that the Egyptians themselves did not designate their land as *wꜣḏ.t / wꜣč̣.t* /

5 For both, cf. Schenkel 2016, §1.2.

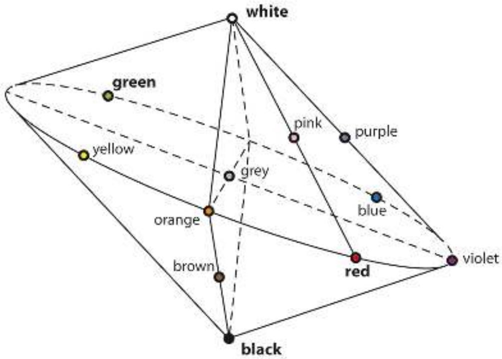

Fig. 3 Tilted Ostwald double cone.

wadjet 'the Green (Land)', but rather as *Km.t* / Kemet 'the Black (Land)'. The designations could have emerged at different times, when different aspects were stressed, just as the choice of designations for the colour of the 'sea' differed among the Egyptians, Greeks, and Arabs. The cultivated land, the soil of the fields is always 'black'; but primarily 'green' before harvest time (cf. Fig. 1, the 'green' Nile Delta beside the 'red' desert).[6]

1.3 Modified Ostwald double cone

The four Egyptian colour words can be aligned with four English (or German, or French) colour words. Here, I project the results of the observations made thus far onto Wilhelm Ostwald's biconical colour space, originally created a century ago (Fig. 3). I used this in a modified form when I first studied Egyptian colour words, adopting a tilted biconical form to situate the colours in a conceptual space in the early 1960s.[7] It is essential to grasp that I do not understand the modified biconical structure as corresponding exactly to any reality, but rather as a tool offering a comprehensible approximation of one aspect of reality. Using Ostwald's system, 'white' and 'black' are situated at the polar positions at the top and bottom, respectively, of the two cones of the biconical figure, with the bases of the two cones meeting the colour circle at the equator, where we find in English the colours 'red', 'orange', 'yellow', 'green', 'blue', and 'violet'. Our Egyptian words fit this scheme quite well, with 'red' and 'green' facing one another on the periphery of the colour circle – with 'red' relatively far down at the right (the focus of 'red' taking us into the dark end of the scale) and 'green' on the upper perimeter on the left (the focus of 'green' being in the lighter region of the scale).

6 NB: In the early era, when the designations must have emerged, there was certainly no trace of a year with multiple harvests and, thus, for most of the year, the land would have been submerged or lying 'black', barren: either harvested or fallow.

7 Ostwald 1928; modified structure: Podestà 1941.

I	II	III	IV	V	VI	VII
black & white	+ red	+ A green (or) + B yellow	+ A yellow (or) + B green	+ blue	+ brown	+ pink, purple, orange, grey

Fig. 4 Acquisition sequence (Stages I–VII) of the order in which colour words are added to languages according to Berlin and Kay, Basic Color Terms.

2 Evolutionary stages of the Egyptian colour spectrum

2.1 Basic Color Terms[8]

That four colour terms – and precisely these four: 'black' and 'white,' 'red' and 'green' – form the core of the Egyptian colour spectrum is not a mere accident (Fig. 4). Egyptian thus stands at a particular stage of the gradual expansion of the linguistic specification of colour. The anthropologists Brent Berlin and Paul Kay established in 1969 that for all of the languages they studied, the different languages of the world reveal individual, but parallel, historical sequences for the acquisition of colour words, beginning at Stage I with the distinction between black and white, and culminating in Stage VII with the multitude of colour terms familiar to *us*.[9] Egyptian stands at Stage IIIA, having terms for black and white (Stage I), red (Stage II), and green; it is the green that puts Egyptian at stage IIIA, because it did not add yellow (rather than green) after red (which would have been Stage IIIB). For the moment, I should just note that further corrections and distinctions are still being made in the structure created by Berlin and Kay: not all of the world's languages can be classified without problems. Egyptian-Coptic also suggests that further modifications are necessary, however, to understand the place of Egyptian in the general evolutionary tendency, it is certainly illuminating.

2.2 Non-Basic Color Terms

Aside from the Basic Color Terms, Egyptian also has non-Basic Color Terms, like other languages, special colour terms. Here, we can recall the English word 'blond,' which is

8 NB: The phrase Basic Color Term(s) – otherwise known as BCT(s) – is derived from the celebrated work of Berlin and Kay 1969, and taken from the title of their book which gave birth to the widely used form of reference and thus the spelling is left American.

9 Berlin and Kay 1969.

used to designate hair, complexion, beer, and tobacco, but can also be used playfully for other domains.

In Egyptian, such colour designations may be derived from substances, a noun/substantive, with the aid of an adjectival suffix, the *-j* / *-ỉ* / i (in Egyptology, a so-called *nisba*-form, taken from Arabic grammar). The *nisba* adjective *mfkꜣ.tj* / *mfkꜣ.tỉ* / mefkati 'turquoise-like', 'turquoise blue' is derived from *mfkꜣ.t* / mefkat 'turquoise', which is now generally understood as being a blue hue in English, German, and French – or a blue-green; *nb.y(.j)* / *nb·y(.ỉ)* / nebi-i 'gold-like', 'gold-coloured', 'golden', or 'yellow' from *nb.w* / *nb·w* / nebu 'gold'; or *ḏꜥm(.j)* / *č̣ꜥm(.ỉ)* / djami 'white gold-like', 'white gold coloured' from *ḏꜥm* / *č̣ꜥm* / djam 'white gold'. In hieroglyphic writings, the *nisbe*-endings of the masculine words are generally omitted, but this interpretation (that the words were in fact so formed) is supported by the hieroglyphic writings of words derived from feminine nouns/substantives where the feminine suffix *–t* is frequently followed by a nisba *ending –j* / *–ỉ*, as in the case of *mfkꜣ.tj* / *mfkꜣ.tỉ* 'turquoise-like'. The form can also be deduced from a phonetic change involving the final consonant of the noun/substantive involved, as with *nb.y.j* / *nb·y.ỉ* < *nb.w* + *j* / *nb·w* + *ỉ* 'gold-like'. A very different lexical formation has not yet been properly documented, namely that whereby *ḏꜥb* / *č̣ꜥb* / djab 'charcoal-like' is almost certainly derived from *ḏꜥb.t* / *č̣ꜥb.t* / djabet 'charcoal'; likewise *mr/lš* / mer/lesh 'light red' from *mnš.t* / men(e)shet '(a kind of ochre)'. In later stages of the Egyptian language, particularly Coptic, this latter term gives rise to a fifth Basic Color Term.[10]

For the non-Basic Color Terms, among other means, the reference is to minerals or materials related to colour: *ṯfrr* / *čfrr* / chefrer 'lapis lazuli' gives rise to *ṯfrr(.j)* / *čfrr(.ỉ)* / chefreri 'lapis lazuli-like', 'lapis lazuli blue', as with *mfkꜣ.tj* / *mfkꜣ.tỉ* 'turquoise-like', 'turquoise blue' from *mfkꜣ.t* 'turquoise', mentioned above; and *ḥrś* / ḥeres 'carnelian-like', 'carnelian red' from *ḥrś.t* / ḥerset 'carnelian'; or *ḫśbḏ(.j)* / *ḫśbč̣(.ỉ)* / khesbedji 'lapis lazuli coloured', 'azure' from *ḫśbḏ* / *ḫśbč̣* / khesbedj 'a material similar in colour to lapis lazuli'.[11] Such words allow more precision in identifying the colours than do the Basic Color Terms. Thus, 'green', 'blue' (*wꜣḏ* / *wꜣč̣*) is rendered more precisely with 'blue/green' and 'blue' (*mfkꜣ.tj* / *mfkꜣ.tỉ* 'turquoise blue / green', or with *ḫśbḏ(.j)* / *ḫśbč̣(.ỉ)* 'lapis lazuli coloured', 'azure'), or 'red', 'yellow' (*dšr* / *ṭšr*) can be limited to 'yellow' (*nb.y.j* / *nb·y.ỉ* 'golden'/ 'yellow') (in an instant, we will come to the divisions of red). *Km(m)* 'black', 'dark' can be limited to *ḏꜥb* / *č̣ꜥb* 'charcoal-black', 'deep black').

10 NB: The second consonant is uncertain: either an /l/ or an /r/.

11 Traditionally, like the infrequent *ṯfrr* / *čfrr*, the common *ḫśbḏ* / *ḫśbč̣* is translated as 'lapis lazuli'. However, lapis lazuli was virtually never used as a dye or pigment before the European Middle Ages. Therefore, in the case of *ḫśbḏ(.j)* / *ḫśbč̣(.ỉ)*, it cannot be anything except a pigment with a (blue) hue similar to that of lapis lazuli (for the pigments, cf. Fuchs 2015, 161–168). Taking account of this, in this contribution I translate the derived *ḫśbḏ(.j)* / *ḫśbč̣(.ỉ)* as 'lapis lazuli coloured', in contrast to *ṯfrr(.j)* / *čfrr(.ỉ)*, which is rendered (analogously to the other *nisba*-forms) as 'lapis lazuli-like'.

I	II	III	IV	V	VI	VII
black	+ red / dark red	+ green	+ yellow	+ blue	+ brown	+ pink, purple, orange, grey
white	+ light red					

Fig. 5 Basic colour terms with 'dark red' and 'light red'.

Finally, there are a few non-Basic Color Terms that cannot be assigned to any particular type of formation or particular reference materials; colour words which in individual cases can substitute for *dšr* / *ṭšr* 'red'. Rather than using *dšr* / *ṭšr* 'red', the medical diagnosis of an inflammation can use *ṯmś* / *č̣mś* / chemes 'red' instead, and on occasion, the 'Red Crown' (the royal crown of Lower Egypt) can also be described as *ṯmś* / *č̣mś* 'red' rather than *dšr* / *ṭšr* 'red'. It is possible that *ṯmś* / *č̣mś* 'red' is a particular red within the band covered by the Basic Color Term *dšr* / *ṭšr* 'red'. The strikingly colourful behind of a baboon can be *ṯmś* / *č̣mś* 'red', perhaps 'glaring red', while the same animal's red ears are merely described with the banal *dšr* / *ṭšr* 'red'. Another word, *ṯ(w)r/wtr* / *č̣(w)r/wtr* / che(we)r/weter 'red (or something similar)' is used to describe blood, which is normally termed *dšr* / *ṭšr* 'red', 'standard red'. Likewise for blood, we find *jnś* / *ỉnś* / ines 'red (or something similar)', which is normally used to describe linen, above all a light red textile, the inflamed raging eye, and the testicles, which can be characterised as *jnś.wy* / *ỉnś.wỉ* / ines-ui 'the two red ones' 'the two redding ones'.

2.3 Further development of the Basic Color Terms

It is striking that so many words enjoying limited usage are available precisely in the 'red'-range, but it is correspondingly less surprising that in the course of the linguistic history of Egyptian-Coptic, yet another red colour word, *mr/lš* / mer/lesh 'light red' came to the foreground, exploding the Egyptian vocabulary by becoming another, fifth, Basic Color Term (Fig. 5). Nevertheless, with the addition of a fifth Basic Color Term for a 'red', Egyptian-Coptic did not reach Berlin and Kay Stage IV because the Berlin and Kay scheme demands that additional words for other colours – in this case 'yellow' (cf. Fig. 6) would be expected – should be incorporated as Basic Color Terms, rather than additional words for already occupied hues being added. As in Stage I, there could also be an opposition between dark and light colours in Stage II. However, in the green range, different linguistic means were called upon, such as the *ad hoc wr* / wer 'very' in the case of the sea ('very green', 'deep green', and 'deep blue').

I	II	III	IV	V	VI	VII
black & white	+ red	+ green	+ yellow	+ blue	+ brown	+ pink, purple, orange, grey

Fig. 6 The Berlin and Kay acquisition sequence with 'yellow' as Stage IV.

3 The discourse among students of colour

3.1 Minerals, metals, and other materials of colour

If colour words – as is incontestably the case in the usage of non-Basic Color Terms – use designations that are derived from real world objects that have this colour, then one can legitimately enquire whether general colour words, and thus also the Basic Color Terms, can be derived from the designations of objects. David Warburton, who has repeatedly expounded such ideas at length, is clearly of the opinion that originally there were designations for a series of precious minerals and metals, and that the vernacular colour vocabulary was derived from this. Of interest to him are, e.g., the words for 'white' (*ḥḏ* / *ḥč̣*) and 'green' (*wꜣḏ* / *wꜣč̣*). In Egyptian *ḥḏ* / *ḥč̣* 'white', 'light' is the word designating silver 'belonging to silver'.[12] As far as I know, in Egyptian *wꜣḏ* / *wꜣč̣* 'green' is not a specifically identifiable precious stone, but rather a 'green stone', or the opposite: the colour 'green' is the 'green stone-like'. Without going into details, one can imagine the consequences of such an approach: not only the four (or later five) colour words , which I have presented as Basic Color Terms, but also the other terms that were presented as non-Basic Color Terms (some of which are clearly derived from object designations) would also be Basic Color Terms. At the very least, the Berlin and Kay evolutionary stage V would be reached with 'blue', i.e., with *ṯfrr(.j)* / *č̣frr(.ỉ)* 'lapis lazuli-like'/ 'lapis lazuli blue' and *ḫśbḏ(.j)* / *ḫśbč̣(.ỉ)* 'lapis lazuli coloured', 'azure'. Egyptian would, thus, have a set of Basic Color Terms that would clearly take us beyond the Berlin and Kay Stage IIIA (cf. Fig. 7).

Let us then follow Warburton in assuming that all colour words are ultimately derived from object designations, and contest that Basic Color Terms and non-Basic Color Terms have a significantly different range of uses, then the difference between Basic Color Terms and non-Basic Color Terms would be blurred to insignificance. In this sense, the Berlin and Kay system would be obsolete, at least for Egyptian. For the special case of 'blue', Warburton clearly perceived that colours in the blue range have a wider spectrum of usage than one would expect of non-Basic Color Terms. However, he did

12 E.g. Warburton 2008.

I	II	III	IV	V	VI	VII
black & white	+ red	+ A green (or) + B yellow	+ A yellow (or) + B green	+ **blue**	+ brown	+ pink purple, orange, grey

Fig. 7 The Berlin and Kay acquisition sequence with 'blue' as Stage V.

not take into consideration that the objects characterised as 'blue' were not objects of the visible world and accessible to us and the Egyptians alike, but rather objects from a non-real world point-of-view, i.e., those from a context where the discourse takes into consideration other-worldly things. Put simply: this is the view of the religious texts.

Let us take a closer look at the use of colour words in the blue range. What we find is actually this: *ḫśbḏ*(*.j*) / *ḫśbč̣(.ỉ)* 'lapis lazuli coloured', 'azure' is generally used to characterise non-real world objects such as the eyes, hair, head, horns of gods, or the complete figure or form of the gods. It is accordingly used as the characterisation or designation of real world objects from a non-real world point-of-view, such as the heavens or the greening of the fields by the sun, so that the field becomes *ḫśbḏ*(*.j*) / *ḫśbč̣(.ỉ)* 'lapis lazuli coloured', 'azure'. The term *ṯfrr*(*.j*) / *č̣frr(.ỉ)* 'lapis lazuli-like', 'blue' serves to characterise or designate real world objects from a non-real worldly standpoint, such as that of the heavens, and in exaggerated forms of expressions such as *jṯfrr*(*.j*) / *ỉ:č̣frr(.ỉ)* / ichefreri 'very lapis lazuli-like', 'very deep blue' for a designation of the heavens; but not for the characterisation or designation of the blue royal crown that was very much of this world. In the creative practice of the craftsmen, the treatment of the non-real world, the world of the gods, is not identical to the linguistic shaping of the world with the aid of the colour words. The skin of a divine being, which can be linguistically expressed as 'lapis lazuli coloured', 'azure', can be depicted as green (cf. Fig. 8). Beyond that, one suspects that the colour alone did not play the decisive role, but rather the high value of the material associated with, which, as Warburton correctly sees, was often projected onto the object that was to be characterised with that particular colour. The colour words in the blue range are, thus, devoid of significance in daily life and do not belong to the general vocabulary of colour terms, and are, therefore, not Basic Color Terms. This leads to the question of whether every colour word can be related to a corresponding precious material. Certainly, for two of the four Basic Color Terms in Egyptian, the materials that should be behind *dšr* / *ṭšr* 'red' and *km(m)* 'black' remain to be found. I, therefore, stand by the limits of the basic colour vocabulary established by Berlin and Kay Stage IIIA (cf. Fig. 4).

Fig. 8 Photograph of the tomb of King Horemhab (late 14th century BC), Valley of the Kings Egypt, with king ('red' skin, right) standing before Osiris ('green' skin, left).

In 1994, Ingrid Blom-Böer likewise found herself obliged to reject the postulated distinction of Basic Color Terms and non-Basic Color Terms.[13] Her approach aims, in principle, to derive the designations for the colours from the designations for the pigments. Unfortunately, her approach does not really accomplish this, as she was evidently familiar with neither the Berlin and Kay system of 1969, nor John Baines' 1985 article on Egyptian colours (which I will discuss below).[14] In contrast to this, Blom-Böer does specifically treat my contribution from 1963, where the Egyptian world of colour was structured in terms of 'abstract' and 'concrete' colour words (which adumbrated the

13 Blom-Böer 1994. The quintessence of the study appears in her contribution to this volume.

14 Baines 1985.

slightly later Berlin and Kay system of Basic vs. non-Basic Color terms – and to which we will return again below). In dismissing this earlier approach, one must nevertheless recall that at that time, aside from treating the linguistic material, I was also attracted by curious inconsistencies in the art, whereby different colours were used in the depictions of seemingly identical objects. These seeming errors corresponded neither to the artistic canon nor to the expression in language, and seemed to imply both a strong red/yellow bias and a strong green/blue bias, in the sense that within each of these two ranges, objects could take on the 'wrong' alternative hue. There were, thus, discrepancies between the uses of pigments and usage in the language world. Needless to say, this matter deserves attention as it should throw light on the cognitive sphere, which in some fashion reflects the linguistic discourse. In fact, Blom-Böer's criticism was directed more at my statements concerning the use of pigments in painting than my claims about the linguistic formation of the Egyptian world of colour. Should I have been remiss, in this context, I can repeat that I do not insist on what I said about colours in painting: on the contrary, I consider a renewed and independent effort to study the paintings to be essential.

3.2 The vision of the creative craftsman

The creative craftsman must act, taking account of the hue and brightness of colours, rather than the linguistic expression. The linguistic world of colour, as the colours are realised through their naming with the Basic Color Terms does not correspond to what the craftsman sees with his eyes, nor does that world of colour correspond to the quantity of colour pigments at one's disposal to depict the real world. As an example, one can recall the colourful reproduction of the skin colours of men and women in Egyptian art (cf. Fig. 9): men are generally given a red skin, painted with red ochre, and women have yellow skin, painted with yellow ochre. Both of these colours lie in the linguistic 'red' range and, in reality, the distinction between the difference in the hue of the skin distinguishing men from women cannot have been that great. For the craftsman, the artistic distinction between man and woman was more important than the reality of colour. One must consider that the world of colour is primarily an image of the colours in the visible world and not an image resulting from the colour pigments used by the craftsmen at the start, nor yet an image demonstrating the preciosity of the colour materials.

Likewise, in the creative practice of the craftsmen, the treatment of the non-real world, the world of the gods, is not identical to the linguistic shaping of the world with the aid of the colour words. As remarked above, the skin of a divine being can be linguistically expressed as 'lapis lazuli coloured' or 'azure,' but it can also be artistically represented as green (cf. Fig. 8).

Fig. 9 ‘Typical’ colours used for men and women, with king (right) and female goddess (left).

3.3 The living world of colours

As we have seen, the distinction and naming of colours is a lasting process. In the course of history, the Egyptian-Coptic language changed the designation for ‘white/light,’ by changing words (*ḥḏ / ḥč̣ → wbḫ̮*), and there was also an extension of a distinction in the red range, namely by adding the designation for ‘light red’ (*mr/lš*). There were always colours, even in prehistory. Colour words are also not necessarily new inventions of the historical era, and therefore not necessarily dependent upon the prestige of colourful objects, nor dependent on the perspective as perceived by the craftsmen.

At least three of the four Basic Colour Terms are not purely Egyptian words that emerged in the course of the internal development of the Egyptian language. Instead, etymologically they can be followed back to Hamito-Semitic / Afroasiatic predecessors, the traces of which can be found in other Hamito-Semitic / Afroasiatic languages. This is hardly the place to go into phonetics and phonetic change, where it is now recognized that related languages can share words that have very different phonetic manifestations.[15] Taking account of the phonetic connections and recognising the relations, the following connections can be recognised as valid. Egyptian *km(m)* 'black' is related to a Syrian and Talmudic Hebrew *ʾkm* 'to be black.' Egyptian *dšr* / *ṭšr* 'red' is related to a Semitic *ṣḥr* 'to be reddish,' encountered in various Semitic languages: in Syriac with the meaning 'to blush' and in Arabic as 'light red,' 'yellowish,' etc. Of particular interest for us is that the Arabic word for 'desert' is derived from this Semitic colour word: the same word that has been adopted in English for 'Sahara.' Egyptian *wꜣḏ* / *wꜣč̣* 'to be green' is related with the Semitic and Berber *wrq* 'to be green.' Hamito-Semitic etymologies for the fourth basic term, *ḥḏ* / *ḥč̣* 'to be white,' have been proposed, but are not persuasive since the phonetic connections remain problematic. Such a primeval relation is not demonstrable in the Basic Color Terms *wbḫ* and *mr/lš*, which were adopted as colour words later. As far as I know, such relations cannot be demonstrated for the non-Basic Color Terms. On the other hand, the non-Basic Color Terms are largely etymologically dependent on the Egyptian designations for materials associated with these colours, which in some cases represent what are themselves probably loan words for materials (e.g., *ṯfrr* / *č̣frr*), probably adopted from the name of some land in some languages in Central, South, and Western Asia where, and through which, lapis lazuli travelled before arriving in Egypt.[16]

4 A scientific retrospective

A philological confirmation of the narrow limits (i.e., four or five Basic Color Terms) of the Ancient Egyptian Basic Color Terms as defined by Berlin and Kay Stages I to IIIA is in principle what I presented in 1963 in the *Zeitschrift für ägyptische Sprache und Altertumskunde,* which resulted from an independent philological investigation.[17] It need hardly be pointed out that at that time no one – neither the philologists nor the anthropologists – was talking about Basic Color Terms, since it was only in 1969 that Berlin and Kay published their stimulating slim volume, which transformed the discourse on the history of colour. I approached the issue from a linguistics perspective, and specifically a linguistic tendency, which was completely alien to Berlin and Kay, namely the content-oriented linguistics of Leo Weisgerber (1899–1985), to which I specifically appealed to in 1963.[18]

15 References to the relevant secondary literature can be found in Schenkel 2016, 180–182.

16 Cf. Warburton 2007; Aufrère 1991 II, 464, specifically refers to a modified version where a specific type of lapis lazuli is distinguished as coming from a specific region, which he identifies as Dapara, south of the Caspian Sea: "*ḫsbḏ n Tfrr* 'le lapis-lazuli du pays de *ṯfrr*.'" This can, however, be no more than a place of transit, as it is far from the mountains of Badakhshan whence the lapis lazuli came – and this reference demonstrates that both terms refer to the same mineral.

17 Schenkel 1963.

18 Schenkel 1963, 140; the work cited there appeared later in a third revised edition (Weisger-

John Baines, who was the first to project the Berlin and Kay concept onto Ancient Egyptian, actually lay closer to the anthropologists than the Egyptologists.[19] Initially, he was totally unaware of my Egyptological approach, and only after the fact did he realise that my approach was compatible with the Berlin and Kay project.

My own presentation of 1963 is obsolete in three decisive respects. First of all, in my revived concern with colour words, I have extended the dimensions of the data upon which I rely, above all by having access to and exploiting the Berlin Digitalised Slip Archive (which offers access to all of the references available to the editors of the Berlin Dictionary of Ancient Egyptian completed in 1931).[20] Secondly, partially as a result of consulting the Berlin Digitalised Slip Archive, I no longer see the focus of 'red' and 'green' in the schematic red-yellow and green-blue ranges (as is still the position held by the Berlin and Kay school), but rather that the focus of 'red' lies in the red range, and 'green' in the green range. Above all, I now fundamentally distinguish between the real world colours and the non-real world colours, with regard to the colours as they appear in the texts (to which I had not previously paid a great deal of attention).[21]

Finally, I would like to draw a general conclusion: we will never be able to reach a definitive result based exclusively on the methods of modern Egyptological philology alone, nor by means of advanced linguistics alone. Egyptologists occupied themselves rather carelessly and unsuccessfully with colour words before becoming aware of the questions raised by anthropology and general linguistics. Whether it was the content-oriented linguistics of Weisgerber, who provided an impulse to my own thoughts in 1963, or the anthropological view of Berlin and Kay of 1969, which brought John Baines 1985 onto the right track, it was the impulses of the broader, more experienced disciplines that opened the eyes of the Egyptologists. On the other hand, however, let us not fall victim to the illusion that we can simply project the non-Egyptological observations and conclusions onto the ancient Egyptian lexicon, as has been done and is perhaps still being done. It is imperative that the philologist use her/his own tools to see if the totality of the Egyptian textual corpus available to us can confirm a hypothesis drawn from outside. As far as the colour words we have treated are involved, I insist that further philological work remains to be done – and must be carried out. We should not lull ourselves into delusive certainty. Decisive in this respect is that neither general linguistics nor anthropology have remained at the same stage they were when the Egyptologists studying colour first encountered them decades ago.

ber 1962/1971), for colour terms, see volume I *(Grundzüge der inhaltbezogenen Grammatik)*, 170–173, 174–175 and volume II *(Die sprachliche Gestaltung der Welt)*, 286–294.

19 Baines 1985.

20 Accessible via http://www.aaew.bbaw.de/tla/ (accessed on 01/08/2019).

21 A list of the objects relating to the real world discussed here can be found in Schenkel 2007, §3; a list of the real world and non-real world objects, including references to the textual attestations, can be found in Schenkel 2016, §5.

5 Summary

At all times in the history of the Ancient Egyptian language, as represented in the written sources upon which we can draw (that is to say, from the dawn of the Egyptian state ca. 3000 BC to the European Middle Ages in the early second millennium AD), we have four Basic Color Terms: *km(m)* 'black', 'dark'; *ḥḏ* / *ḥč̣* (and later *wbḫ*) 'white', 'light'; *dšr* / *ṭšr* 'red', 'yellow', with the focus on red; *wꜣḏ* / *wꜣč̣* 'green', 'blue', with the focus in green. A 'light red' *mr/lš*, not initially present, but is differentiated during the latter part of this long history. And *wꜣḏ-wr* / *wꜣč̣-wr* 'blue' can be a 'very green', 'deep green', separated from the more general word 'green.'

As non-Basic Color Terms, we have *ḏꜥb* / *č̣ꜥb* 'charcoal black', 'raven-black' in the black range; *ṯmś* / *č̣mś*, *ṯ(w)r/wtr* / *č̣(w)r/wtr*, *jnś* / *i͗nś* 'red (or similar)' and *ḥrś* 'carnelian red' in the red range; *nb.y(.j)* / *nb·y(.i͗)* 'golden', 'yellow', and *ḏꜥm(.j)* / *č̣ꜥm(.i͗)* 'white-gold coloured', 'yellow' in the yellow range; *mfkꜣ.tj* / *mfkꜣ.ti͗* 'turquoise-like', 'turquoise-green' in the green range; and *ṯfrr(.j)* / *č̣frr(.i͗)* 'lapis lazuli-like', 'lapis lazuli blue' and *ḫśbḏ(.j)* / *ḫśbč̣(.i͗)* 'lapis lazuli coloured', 'azure' in the blue range.

Basic Color Terms are distinguished from the non-Basic Color Terms by three characteristics: firstly, the Basic Color Terms have a wider range of application (extension) than the non-Basic Color Terms; secondly, in contrast to the greater number of the non-Basic Color Terms, they generally have common Hamito-Semitic / Afroasiatic etymologies; and thirdly – a point which I did not develop here – all of the Ancient Egyptian Basic Color Terms are syntactically adaptive multifaceted verbs and not mere rigid adjectives, which is not the case with most of the non-Basic Color Terms.[22] The value of the materials to which the non-Basic Color Terms refer, plays a role, particularly in the case of blue, which applied to the characterisation of non-real world objects, above all.

22 For this, see Schenkel 2007, §2 and Schenkel 2016, §6.

Bibliography

Aufrère 1991
Sydney Aufrère. *L'Univers minéral dans la pensée égyptienne*. Bibliothèque d'étude 105. Cairo: Institut français d'archéologie orientale, 1991.

Baines 1985
John Baines. "Color Terminology and Color Classification. Ancient Egyptian Color Terminology and Polychromy". *American Anthropologist* 87 (1985), 282–297.

Berlin and Kay 1969
Brent Berlin and Paul Kay. *Basic Color Terms. Their Universality and Evolution*. Berkeley, Los Angeles, and London: University of California Press, 1969.

Blom-Böer 1994
Ingrid Blom-Böer. "Zusammensetzung altägyptischer Farbpigmente und ihre Herkunftslagerstätten in Zeit und Raum". *Oudheidkundige Mededelingen* 74 (1994), 55–107.

Erman and Grapow 1926/1931
Adolf Erman and Hermann Grapow, eds. *Wörterbuch der aegyptischen Sprache*. Leipzig: Hinrichs, 1926/1931.

Fuchs 2015
Robert Fuchs. "Material, Maltechnik, Herstellung und Restaurierung des Papyrus Amenemhet". In *Papyrus Amenemhet. Ein Totenbuchpapyrus der 18. Dynastie*. Ed. by I. Munro and R. Fuchs. Studien zu den Ritualszenen altägyptischer Tempel 28. Dettelbach: J. H. Röll, 2015, 107–213.

Hannig 2006a
Rainer Hannig. *Ägyptisches Wörterbuch. Vol. II. Mittleres Reich und 2. Zwischenzeit*. Vol. 2. Kulturgeschichte der antiken Welt 112. Mainz: Philipp von Zabern, 2006.

Hannig 2006b
Rainer Hannig. *Großes Handwörterbuch Ägyptisch – Deutsch (2800–950 v. Chr.).* Kulturgeschichte der antiken Welt 64. Mainz: Philipp von Zabern, 2006.

Ostwald 1928
Wilhelm Ostwald. *Die Farbenfibel*. Leipzig: Unesma, 1928.

Podestà 1941
Hans Podestà. *Der ordnungswissenschaftliche Aufbau des Farbkörpers*. Bücherei des Augenarztes 9. Stuttgart: Ferdinand Enke, 1941.

Schenkel 1963
Wolfgang Schenkel. "Die Farben in ägyptischer Kunst und Sprache". *Zeitschrift für ägyptische Sprache und Altertumskunde* 88 (1963), 131–147.

Schenkel 2007
Wolfgang Schenkel. "Color Terms in Ancient Egyptian and Coptic". In *Anthropology of Color. Interdisciplinary Multilevel Modeling*. Ed. by R. E. Maclaury, G. V. Paramei, and D. Dedrick. Amsterdam and Philadelphia: J. Benjamins, 2007, 211–228.

Schenkel 2016
Wolfgang Schenkel. "Die Farben aus der Sicht der Alten Ägypter". German. In *Zwischen Phologie und Lexikographie des Ägyptisch-Koptischen. Akten der Leipziger Abschlusstagung des Akademieprojekts "Altägyptisches Wörterbuch"*. Ed. by P. Dils and L. Popko. Abhandlungen der Sächsischen Akademie der Wissenschaften zu Leipzig, philologisch-historische Klasse 84.3. Stuttgart and Leipzig: S. Hirzel, 2016, 164–185.

Warburton 2007
David A. Warburton. "Basic Color Term Evolution in Light of Ancient Evidence from the Near East". In *Anthropology of Color. Interdisciplinary Multilevel Modeling*. Ed. by R. E. Maclaury, G. V. Paramei, and D. Dedrick. Amsterdam and Philadelphia: J. Benjamins, 2007, 229–246.

Warburton 2008
David A. Warburton. "The Theoretical Implications of Ancient Egyptian Colour Vocabulary for Anthropological and Cognitive Theory". *Lingua Aegyptia* 16 (2008), 213–259.

Weisgerber 1962/1971
Leo Weisgerber. *Von den Kräften der deutschen Sprache*. Düsseldorf: Schwann, 1962/1971.

Illustration credits

1 Photo: D. A. Warburton (courtesy of NASA). **2** Photo: W. Schenkel. **3** Image: Translated and modified by B. Nennstiel based on the original drawing by W. Schenkel in Schenkel 1963. **4** Image: W. Schenkel, adapted from Berlin and Kay 1969. **5** Image: W. Schenkel. **6** Image: W. Schenkel. **7** Image: W. Schenkel. **8** Photo: W. Schenkel. **9** Photo: W. Schenkel.

WOLFGANG SCHENKEL

Wolfgang Schenkel (Prof. Dr. phil.) is an emeritus professor of Egyptology at the Institute for Ancient Near Eastern Studies at Eberhard Karls Universität Tübingen. A selection of his publications include: *Tübinger Einführung in die klassisch-ägyptische Sprache und Schrift*, 5th Edition, Tübingen 2012; *Einführung in die altägyptische Sprachwissenschaft*, Darmstadt, 1990; *Memphis, Herakleopolis, Theben. Die epigraphischen Zeugnisse der 7.–11. Dynastie Ägyptens, Ägyptologische Abhandlungen 12*, Wiesbaden, 1965.

Prof. Dr. Wolfgang Schenkel
Institute for Ancient Near Eastern Studies (IANES)
Burgsteige 11
72070 Tübingen, Germany
E-Mail: schenkel@uni-tuebingen.de.

Theodora Moutsiou

Colour in the Palaeolithic

Summary

This brief contribution discusses the importance of colour in the Palaeolithic by looking into global archaeological examples of the use of red pigments, black rocks and white shells to build the case for a non-monochromatic Palaeolithic past. An oversimplified tripartite colour tradition (red, white, black) is discussed and briefly compared to later prehistory and the manifestation of a more colourful palette, as evinced in the archaeological record. The distinctive physical qualities of these coloured materials – colour, brilliance and rarity – are interpreted as holding a special symbolic meaning (social value) that allowed Palaeolithic humans to maintain communication and a feeling of belonging at an ever-expanding social landscape.

Keywords: colour; Palaeolithic; aesthetic; red; black; white; brilliance; distance; social value

In diesem Beitrag wird anhand globaler Beispiele die Verwendung von roten Pigmenten, schwarzen Steinen und weißen Muscheln erörtert, um die Bedeutung von Farben für eine nicht monochromatische paläolithische Vergangenheit hervorzuheben. Eine zu stark vereinfachte dreigliedrige Farbtradition (rot, weiß, schwarz) wird diskutiert und mit der späteren Vorgeschichte und der Manifestation einer bunteren Palette verglichen. Die ausgeprägten physikalischen Eigenschaften dieser Materialien – Farbe, Brillanz und Rarität – werden als Ausdruck einer besonderen symbolischen Bedeutung (sozialer Wert) interpretiert, die es dem paläolithischen Menschen ermöglichte, die Kommunikation und das Zugehörigkeitsgefühl in einer sich ständig erweiternden sozialen Landschaft aufrechtzuerhalten.

Keywords: Farben; Paläolithikum; Ästhetik; rot; schwarz; weiß; Brillianz; Distanz; sozialer Wert

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

1 Introduction

Colour is one of the neglected dimensions of Palaeolithic archaeology (but see Jones and MacGregor's volume on colours in later prehistory[1] and others[2]). This is surprising as the collection and use of pigments is argued to be one of the traits alleged to distinguish us from our evolutionary predecessors. Anatomically modern humans painted their world and they did so using natural materials – iron oxides (ochres, limonite), manganese oxides, charcoal, kaolin (white clay) and, on occasion, ground calcite (shell and bone). Our current knowledge of the Palaeolithic use of colour derives mainly – but not exclusively – from the examination of Upper Palaeolithic cave art.[3] Within this context the use of colour has been regarded as an exclusive feature of the presumably behaviourally advanced *Homo sapiens*. Archaeological evidence for the selection and use of red ochre in pre-sapiens assemblage,[4] however, suggests that this attribute of sophisticated symbolic behaviour[5] extends beyond our species.

This paper provides a very brief overview of the current state of research on the Palaeolithic use of colour conducted on a nearly three million-year part of the human past and using archaeological examples from around the world. As such, the paper does not claim to posit any new arguments on the subject nor to present an expert thesis on the topic. Instead, the following few pages constitute my own personal views on the matter inspired by some intriguing features of the Palaeolithic archaeological record, discussed in more detail below.

2 Red pigments

Deposits of ochre are relatively common, but of uneven quality. Ochre has been appreciated by humans for some time as the archaeological record suggests. The most famous example is Blombos Cave in South Africa, where engraved ochre was unearthed in 2002[6] followed a few years later (2008) by the discovery of an ochre processing workshop – complete with ochres, bones, charcoal, grinding stones, abalone *(Haliotis midae)* shell containers and mixing vessels, was uncovered from a layer dated to 100 000 years ago.[7] Even earlier than this is the evidence at the sites of GnJh-15 in the Kapthurin Formation of East Africa,[8] and at Twin Rivers in Zambia[9] where there is evidence of ochre use dating to approximately 300 000 years ago. However, the earliest secure evidence

1 Jones and MacGregor 2002.

2 E.g. Watts, Chazan, and Wilkins 2016; Rappenglück 2011; Barham 2002; Hodgskiss 2012; Dayet et al. 2016; Knight, Power, and Watts 1995.

3 E.g. Pike et al. 2012.

4 Watts, Chazan, and Wilkins 2016.

5 E.g.Barham 2002; McBrearty and Brooks 2000.

6 C. S. Henshilwood, d'Errico, et al. 2002.

7 C. S. Henshilwood, d'Errico, et al. 2011.

8 McBrearty and Brooks 2000.

9 Barham 2002.

for pigment use comes from Kathu Pan, Northern Cape, South Africa, from a context dating to ca. 500 000 years ago, making this the earliest known use of natural pigments by *Homo erectus*.[10] Examples of early pigment use also exist from other parts of the world: at Qafzeh Cave in Israel[11] evidence of ochre use is dated to 92 000 years ago and in Ifri n'Ammar, Taforalt and Rhafas in Morocco (92 000–60 000 years ago) shell beads were incorporated in beadwork designs that were deliberately covered with red pigment.[12] In Australia, at the rock shelter sites of Nauwalabila I and Malakunanja II pieces of red and yellow ochre along with worked pieces of haematite have been unearthed from horizons dating to ca. 55 000 years ago.[13] In Europe, Roebroeks and his colleagues discuss the use of red ochre by early Neanderthals at Maastricht-Belvedere, The Netherlands, at least between 200 000 and 250 000 years ago.[14]

Interestingly, these early cases of the collection and use of natural pigments are not accompanied by the use of colour for artistic depictions (*sensu* paintings), so it remains uncertain what these colouring agents where used for. Utilitarian functions have been suggested, such as insect repellent, sun-screen, medicine, hide conservation, or as hafting agents.[15] However, proposing the use of ochre for personal adornment as a more decorative or symbolic explanation (e.g., body/face painting) cannot be ruled out. A link with ritualism and shamanism has been suggested for the Upper Palalaeolithic (ca. 35 000–15 000 years ago) parietal art found in several European caves, although its purpose and roles remain unclear.

A stronger symbolic connection for ochre use within a Palaeolithic framework can be seen in its presence in burials on several occasions, signalling a link between red ochre and blood. A characteristic example is that of the Upper Palaeolithic triple inhumation of two men and a woman at Dolní Věstonice, Czech Republic (ca. 25 000 years ago). There, the heads of the two men and the groin area of the woman are covered with red ochre and ochre respectively.[16] This has previously been interpreted as a representation of an unsuccessful delivery.[17] Ochre use within a burial context has been recorded from Middle Palaeolithic horizons as well. Qafzeh Cave, in Israel (ca. 80 000–90 000 years ago), provides a good example as lumps of (red) ochre and shells with ochre stains have been unearthed from the site's Mousterian burial grounds.[18]

In many of the above examples, ochres with the strongest red hues were selected and on occasion, locally accessible ochres were ignored in favour of more remote ones with stronger colours.[19] This observation challenges a purely functional interpretation

10 Watts, Chazan, and Wilkins 2016.
11 Bar-Yosef Mayer, Vandermeersch, and Bar-Yosef 2009.
12 D'Errico, Vanhaeren, et al. 2009.
13 Clarkson et al. 2015.
14 Roebroeks et al. 2012.
15 Rifkin 2011.
16 Klima 1987.
17 Parker-Pearson 1999.
18 Bar-Yosef Mayer, Vandermeersch, and Bar-Yosef 2009.
19 Hovers et al. 2003.

for the Palaeolithic use of ochre.[20] However, the mere presence of ochre in Palaeolithic contexts does not imply that its use was always associated with 'special' (e.g., ritual) activities;[21] whether personal adornment originated in 'ritual' activities cannot be discounted, but at some point its use became an individual/social expression, as opposed to a cultural/ritual expression. Certainly, we cannot completely ignore the possibility of at least some symbolic significance of colours in the Palaeolithic for both sapiens and earlier hominins.

Red is the most frequently recorded colour of ochre recovered from Palaeolithic sites overall but it is certainly not the only one. Yellow ochre, with earth tones ranging from cream to brown, is also used at this time. Its use appears to be tied to the cave art of Upper Palaeolithic Europe, e.g. Chauvet and Lascaux, France, but an earlier appearance cannot at present be ruled out. In fact, it has been proposed that yellow and brown ochre pieces are under-represented archaeologically due to colour-changing transformative processes, i.e. heating.[22] Specifically, it has been suggested that the red colour can be achieved through the heating of earth-coloured iron products, either deliberately or by chance.[23] In any case, no symbolic connotations have been suggested with regards to the use of yellow/brown ochre and the intentional transformation of these colour variants to red signify humans' preference for the later colour.

And, of course, there is black, a colour that is predominantly a feature of the European archaeological record, associated both with Neanderthals and *Homo sapiens*. Black is seen in the sketches of various cave art depictions or in black *blocs* possibly for body painting, e.g. Pech-de-l'Azé I, France[24], although more functional reasons have also been suggested.[25] It is produced by either organic or inorganic means: charcoal, from the heating of wood/plant material with very restricted air supply, or soot, from the burning of animal fat in the first instance or manganese oxides, e.g. jet-black groutite, brownish-black hausmannite, dark steel-grey to black manganite, in the second. Discerning a symbolic connotation in the use of black is difficult; however, the selection of manganese oxides that had to be sourced from elsewhere, over the readily available fire products (charcoal/soot) needs to be addressed in behavioural terms.

Overall, the time involved in acquiring and treating the materials discussed above indicates a conscious goal-oriented investment, whose higher costs are outweighed by the benefits of owning the specific materials. These benefits are in my opinion social (behavioural) and directly associated with the physical properties of the selected materials.

20 Watts 2002.
21 Riel-Salvatore and Clark 2001; Wadley 2001.
22 Wreschner et al. 1980; Wadley 2009.
23 Wadley 2009.
24 Bordes 1972.
25 Heyes et al. 2016.

3 Black rocks

I will draw from another colourful material category to build my argument – lithics. In conventional lithic analysis, stone tools are functional items manufactured to perform everyday practical tasks.[26] They were traditionally, if tacitly, understood as a mundane feature of Palaeolithic life – until it was realised that not only was considerable effort invested in their manufacture,[27] but that aesthetics played a role in the selection of the raw materials used to make them.[28]

The most common raw material used in tool manufacture during the Palaeolithic in Europe was flint, mainly of black/dark colour, whose problematic chemical fingerprinting does not allow secure source-to-site associations. Deposits of flint occur throughout Europe, but some of the sites offer a higher quality of flint, and were sought out already in the Palaeolithic. Estimates of the distance flint travelled in the European Palaeolithic suggest ranges from 40 km to 300 km, although the longer distances were not recorded before the late Upper Palaeolithic (ca. 20 000–15 000 years ago).[29]

Obsidian, a naturally occurring glass of unique chemical composition with discrete source distribution, provides more concrete information regarding raw material movement in the Palaeolithic. Deposits of obsidian are not as common as those of flint, but regularly distributed in the region from central Europe, the Aegean and Anatolia to the African Great Rift Valley (Ethiopia, Kenya, Tanzania, and Eritrea). A recent study demonstrated that, contrary to the presumed local character of Palaeolithic movement, obsidian circulated at great distances. Examples include the Earlier Stone Age sites of Gadeb 8E and Olduvai Gorge in East Africa where the inferred minimum distances for obsidian exceed 100 km.[30] This is exceptional given the early dating of the sites at some one and a half million years ago. In the European archaeological record, obsidian appears from the Middle Palaeolithic onwards (with dates mainly clustering at ca. 50 000 years ago), exhibiting circulation ranges in the Upper Palaeolithic that exceeded 400 km.[31] In the Near East, obsidian use dates back to the Lower Palaeolithic (starting from ca. 360 000 years ago) but becomes more common from the Middle Palaeolithic onwards, similarly to Europe.[32]

The main feature that distinguishes obsidian from other known lithic materials is its colour and lustre: a rare and distinctive shiny black that clearly stands out.[33] The energy and effort invested in obsidian circulation, reflected in the distances transported, indicate that obsidian was highly valued, playing some role in the lives of the Palaeolithic people that selected it as part of their portable material culture. The suite of special

26 Andrefsky 2005².
27 Stout et al. 2005.
28 Moutsiou 2014.
29 Féblot-Augustins 1997.
30 Moutsiou 2014.
31 Moutsiou 2014.
32 Moutsiou 2014.
33 Torrence 2005.

physical characteristics of obsidian are responsible for this accrued value and defined its special meaning.

4 White shells

The only other distinctly colour-bearing material that reached a conmparable distribution in the Palaeolithic are shells, which have been documented as circulating at distances of a few hundred kilometres. Several examples derive from the Levant where shells have been found in association with Middle and Upper Palaeolithic horizons and interpreted as decorative items. Species include, but are not restricted to, *Nassarius, Glycymeris* and *Dentalium*. The only two known cases of a Middle Palaeolithic age are the Skhul and Qafzeh Caves, both in Israel, dated to ca.110 000 years ago and ca. 92 000 years ago respectively, where shells have been unearthed from campsites that also include burial grounds assigned to *Homo sapiens.*[34] Even though on these two occasions a direct association between shells and burials cannot be made, such occurrences are known from other parts of the world, e.g. the infant burial at Border Cave 3,[35] South Africa, dating at ca. 82 000 years ago. With regards to the Upper Palaeolithic, characteristic examples of the selection of shells for decorative purposes are Kebara Cave in Israel[36] and Üçağizli Cave (~40 ka) in Turkey.[37]

On the other side of the Mediterranean, recent research has demonstrated not only the use of marine shells for decorative purposes during the Palaeolithic but also their circulation at long distances. Three of the Moroccan sites yielding *Nassarius* beads are located 40 to 60 km inland;[38] the only site reported in Algeria, Oued Djebbana, is 190 km from the sea. Even though the number of occurrences is small, the mere presence of shells so far from the coast indicates clearly that they were desired possessions by their bearers. Their distinctive physical qualities, colour being among them, might have played a significant role in their 'desirability'.

In this category, it would also be appropriate to mention ostrich eggshell beads, ivory and perforated teeth, all naturally white coloured materials. Ostrich eggshell beads are reported at nine Middle Stone Age and early Late Stone Age sites from South and East Africa dated to Marine Isotope Stage 3 (60 000–27 000 years ago).[39] The earliest undisputed African example of ostrich eggshell personal ornamentation are 13 such beads from Enkapune Ya Muto in Kenya at 40 000 years ago.[40] Evidence from Eurasia

34 Bar-Yosef Mayer, Vandermeersch, and Bar-Yosef 2009.
35 D'Errico and Backwell 2016.
36 Bar-Yosef Mayer 2005.
37 Kuhn et al. 2001.
38 Bouzouggar et al. 2007.
39 Ambrose 1998.
40 McBrearty and Brooks 2000.

includes two perforated teeth, dated to 43 000 years ago, from Bacho Kiro in Bulgaria[41] and the terminal phalanx of a large bird of prey (eagle or vulture) incised for suspension found at the aforementioned Üçağizli Cave.[42]

Occasionally, beads made of these white materials, especially shells, exhibit evidence of red ochre residue,[43] as early as ca. 90 000 years ago.[44] It remains unclear as to whether the intention was to stain the bead material or whether the staining on the beads is a by-product of the beads' contact with, e.g., the thread that kept the beads together or the human body that wore them. It should also be noted that there is some evidence for the heating of shells, such as Taforalt, Rhafas and Ifri n'Ammar, which could be interpreted as a deliberate effort to change the colour of the material to either white (if heated in an oxidizing environment) or black/dark brown (if heated in a reductive environment in relatively high temperatures and with organic material).[45]

Beads made of the above materials are ethnographically perceived as special objects and their presence in an archaeological context signifies a decorative/symbolic purpose. Indeed, their presence in an archaeological assemblage is not the result of random collection of dead shells on a shoreline.[46] Rather, it appears that Palaeolithic humans were selective in their choice of shells for making ornaments, preferring comparatively rare varieties with luminous white or brightly coloured shells, some with arresting patterns.[47]

5 Brilliance – a unique aesthetic quality

Apart from their distinctive colours, black obsidian and white shells share another unique quality that is partly associated with their colours (in the way it enhances it) – brilliance. Ethnographic studies from around the world, including pre-Columbian America, Australia and South Africa, have demonstrated the significance of brilliance in denoting objects with spiritual power.[48]

For example, the Yolngu, Arnhem Island, Australia, consider brilliance as symbolic of life and well-being.[49] Such shimmering qualities are associated with, and can even represent or bestow, ancestral power to an object and/or its bearer. Similarly, in America, Amerindians across the continent attached special meaning to objects made of brilliant raw materials, regarding brilliance a metaphor for rulership and power. The Aztecs, for example, regarded obsidian as a divine stone with metaphysical powers.[50] Its unique

41 Kozlowski 1982.
42 Kuhn et al. 2001.
43 E.g. D'Errico and Backwell 2016.
44 D'Errico, Vanhaeren, et al. 2009.
45 D'Errico, Vanhaeren, et al. 2009.
46 D'Errico, C. Henshilwood, et al. 2005.
47 D'Errico, C. Henshilwood, et al. 2005.
48 Saunders 1999; Morphy 1989; Watts 1999.
49 Morphy 1989.
50 Saunders 2001.

visual properties were awarded such symbolic importance that since the classical period in Mesoamerica, obsidian came to be paralleled to a god, the omnipresent Quetzacoatl/Tezcatlipoca whose obsidian mirror exuded power through its brilliance (documented from around the beginning of our era).

The manifestation of importance attached to brilliance during the Palaeolithic is represented in the distances that brilliant items or raw materials travelled across the Pleistocene landscape. Obsidian is the most characteristic example as discussed earlier. However, this phenomenon is not exclusive to this raw material. Quartz, rock crystal and other rocks that exhibit similar qualities of light-reflectivity and shininess have been recorded as moving at ranges not documented for non-brilliant materials. For example, a few tools made of rock crystal that were transported from at least 300 km away have been documented from several Upper Palaeolithic sites in Hungary.[51]

A similar argument can be made for metallic variants of ochre. An interesting example is the South African Fauresmith industry where specularite use has been documented in association with assemblages dating to ca. 500 000 years ago.[52] Specularite is a dark, glittery form of haematite whose only known use (prior to metallurgy) is visual display. It has been unearthed in three early sites (Canteen Kopje, Wonderwerk and Kathu Pan) located in the Northern Cape Province with inferred minimum transfer distances ranging between 11 (Kathu Pan) and 38 (Wonderwerk) km. A maximum distance of 170 km (minimum 90 km) has been suggested for one of the sites (Canteen Kopje), but this has not yet been confirmed. The findings in Canteen Kopje and Wonderwerk indicate that Palaeolithic humans willingly undertook the difficult task of procuring exotic raw materials as long as the material's physical qualities equipped it with special value.

Ethnographic analogues offer further support to the above argument. In the Western Desert of Australia, for example, Aboriginal groups undertake long expeditions to acquire ochre from a specific location, namely the Pukardu Hill.[53] This ochre is reserved exclusively for particular purposes, specifically for decorating bodies and equipment for inter-group ceremonies or kept as highly valued goods for important exchange transactions at such meetings. Importantly, for all these groups, pigments were locally available in their own territories. However, they were all willing to travel hundreds of kilometres and invest time and effort in order to procure that specific material because the local varieties lacked the brilliant sheen of the Pukardu Hill ochre. The brilliant, shimmering, deep violet-hued red that characterises the Pukardu Hill ochre guaranteed it a special, symbolic value that made investment in acquiring this specific raw material worthwhile.

51 Dobosi and Gatter 1996.

52 Watts, Chazan, and Wilkins 2016.

53 McBryde 2000.

While its rarity and specific material qualities (brilliance, hue) enhanced the value of the Pukardu Hill ochre, the symbolic value attached to it, which allowed its bearers to associate themselves with the spiritual importance of the journey and to the quarry place itself, was no less significant. This symbolic value would have been particularly crucial in the social life of the humans involved in the material's use and circulation.

6 Palaeolithic colour symbolism – social value

The argument that coloured materials held symbolic meaning in the social sphere can be made for the Palaeolithic as well. Ochre, shells and obsidian are all "pieces of the natural world taken into the social domain".[54] The above rare raw materials differ from a plethora of other options in their exhibition of unique physical properties, particularly colour and brilliance. Their distinctive colours allowed humans to build associations with specific places and people. Such ability is particularly crucial when attempting to retain a feeling of relatedness at a distance.[55]

All objects have the potential agency to perform social roles. However, items with distinctive physical attributes will be far more successful not only in displaying meaning more efficiently but also in carrying this meaning to greater distances than items that do not exhibit these qualities. Distinctive physical features are the visual manifestation that a certain item derives from a specific place that is socially important to those in the know; similar to the totemic significance that Australian Aborigines ascribe to certain raw material sources.[56] The Palaeolithic humans involved in the circulation of such items may have valued them as signifiers of close totemic ties to a region of descent/kinship, as part of their own being. Even if this were not the case, it would be wrong to assume that a resource could be obtained without the establishment of some sort of social relationship linking the person to the source.[57]

Through the choice and use of specific raw materials, whose visual characteristics convert them into media, for their bearers these materials represent social relationships, evoking the memory of shared experiences and encounters. Unique visual attributes – predominantly colour and brilliance – heighten the feeling of familiarity, belonging, and tradition associated with a locality, place or landscape rich with individual and/or group experiences and accord the items with a unique value that is social.[58] More crucially, they allow objects and their bearers to communicate this feeling of 'belonging' even without the necessity of face-to-face interactions. Once communication is maintained *in absentia* it can overcome otherwise inconceivable distances. Colour is one of

54 Darvill 2002.
55 Moutsiou 2012.
56 Gould, Koster, and Sontz 1971.
57 Torrence 1982.
58 Gage et al. 1999.

the visual attributes that allowed Palaeolithic humans to do just that by condensing meaning and symbolically representing social value at an ever-expanding social landscape.

7 Palaeolithic versus Neolithic colour palettes

I have attempted to show that the importance of colour in the Palaeolithic lies in its power to denote meaning through physical attributes, enhancing or enabling social communication locally and inter-regionally. This communication appears to be primarily conveyed through brilliant varieties of red, black and white throughout the Palaeolithic, prior to and with the appearance of *Homo sapiens*. I have used pigments, obsidian and shells to discuss the 'Palaeolithic palette' because these three material categories exhibit clear evidence of high investment (for reasons discussed above) on behalf of the humans involved in their circulation and not because they were the only coloured materials used at that time (after all every material has a colour). The use of yellow ochre in the European Upper Palaeolithic paintings was the only real change we can detect before the advent of the Neolithic, when new colour categories, particularly greens and blues, are added to the material record.

8 Conclusion

Certainly, one can follow a long tradition – oversimplified with red ochre, white ivory and shells and black obsidian – of a tripartite colour tradition for a large part of the Palaeolithic. It seems that yellow ochre appears in the Upper Palaeolithic, and given the fact that the reds were consciously selected, the yellow must have been as well. The Palaeolithic palette appears definitely minimal, with a clear predominance of ochre, but should we imagine the Palaeolithic landscape as monochromatic? I should think not. Yet to understand the use and meaning of colours in the Palaeolithic, much work remains to be done.

Bibliography

Ambrose 1998
Stanley H. Ambrose. "Chronology of the Later Stone Age and Food Production in East Africa". *Journal of Archaeological Science* 25 (1998), 377–392.

Andrefsky 2005²
Jr. Andrefsky William. *Lithics. Macroscopic Approaches to Analysis*. Manuals in Archaeology. Cambridge and New York: Cambridge University Press, 2005².

Bar-Yosef Mayer 2005
Daniella E. Bar-Yosef Mayer. "The Exploitation of Shells as Beads in the Palaeolithic and Neolithic of the Levant". *Paléorient* 31.1 (2005), 176–185.

Bar-Yosef Mayer, Vandermeersch, and Bar-Yosef 2009
Daniella E. Bar-Yosef Mayer, Bernard Vandermeersch, and Ofer Bar-Yosef. "Shells and Ochre in Middle Paleolithic Qafzeh Cave, Israel. Indications for Modern Behavior". *Journal of Human Evolution* 56 (2009), 307–314.

Barham 2002
Lawrence S. Barham. "Systematic Pigment Use in the Middle Pleistocene of South-Central Africa". *Current Anthropology* 43.1 (2002), 181–190.

Bordes 1972
François H. Bordes. *A Tale of Two Caves*. New York: Harper and Row, 1972.

Bouzouggar et al. 2007
Abdeljalil Bouzouggar, Nick Barton, Marian Vanhaeren, Francesco d'Errico, Simon Collcutt, Tom Higham, Edward Hodge, Simon Parfitt, Edward Rhodes, Jean-Luc Schwenninger, Chris Stringer, Elaine Turner, Steven Ward, Abdelkrim Moutmir, and Abdelhamid Stambouli. "82 000-Year-Old Shell Beads from North Africa and Implications for the Origins of Modern Human Behavior". *Proceedings of the National Academy of Sciences* 104.24 (2007), 9964–9969.

Clarkson et al. 2015
Chris Clarkson, Mike Smith, Ben Marwick, Richard Fullagar, Lynley A. Wallis, Patrick Faulkner, Tiina Manne, Elspeth Hayes, Richard G. Roberts, Zenobia Jacobs, Xavier Carah, Kelsey M. Lowe, Jacqueline Matthews, and S. Anna Florin. "The Archaeology, Chronology and Stratigraphy of Madjedbebe (Malakunanja II). A Site in Northern Australian with Early Occupation". *Journal of Human Evolution* 83 (2015), 46–64.

D'Errico and Backwell 2016
Francesco D'Errico and Lucinda Backwell. "Earliest Evidence of Personal Ornaments Associated with Burial: The Conus Shells from Border Cave". *Journal of Human Evolution* 93 (2016), 91–108.

D'Errico, C. Henshilwood, et al. 2005
Francesco D'Errico, Christopher Henshilwood, Marian Vanhaeren, and Karen van Niekerk. "Nassarius Kraussianus Shells Beads from Blombos Cave. Evidence for Symbolic Behaviour in the Middle Stone Age". *Journal of Human Evolution* 48 (2005), 3–24.

D'Errico, Vanhaeren, et al. 2009
Francesco D'Errico, Marian Vanhaeren, Nick Barton, Abdeljalil Bouzouggar, Henk Mienis, Daniel Richter, Jean-Jacques Hublin, Shannon P. McPherron, and Pierre Lozouet. "Additional Evidence on the Use of Personal Ornaments in the Middle Palaeolithic of North Africa". *Proceedings of the National Academy of Sciences* 106.38 (2009), 16051–16056.

Darvill 2002
Timothy Darvill. "White on Blonde: Quartz Pebbles and the Use of Quartz at Neolithic Monuments in the Isle of Man and beyond". In *Colouring the Past: The Significance of Colour in Archaeological Research*. Ed. by A. Jones and G. MacGregor. New York: Berg, 2002, 73–91.

Dayet et al. 2016
Laure Dayet, Francois-Xavier Le Bourdonnec, Floréal Daniel, Guillaume Porraz, and Pierre-Jean Texier. "Ochre Provenance and Procurement Strategies during the Middle Stone Age at Diepkloof Rock Shelter, South African". *Archaeometry* 58.5 (2016), 807–829.

Dobosi and Gatter 1996
Viola T. Dobosi and István Gatter. "Palaeolithic Tools Made of Rock Crystal and Their Preliminary Fluid Inclusion Investigation". *Folia Archaeologica* 45 (1996), 31–50.

Féblot-Augustins 1997
Jéhanne Féblot-Augustins. "Middle and Upper Paleolithic Raw Material Transfers in Western and Central Europe. Assessing the Pace of Change". *Journal of Middle Atlantic Archaeology* 13 (1997), 57–90.

Gage et al. 1999
John Gage, A. Jones, R. Bradley, K. Spence, E. J. W. Barber, and Paul S. C. Taçon. "What Meaning Had Colour in Early Societies?" *Cambridge Archaeological Journal* 9.1 (1999), 109–126.

Gould, Koster, and Sontz 1971
Richard A. Gould, Dorothy A. Koster, and Ann H. L. Sontz. "The Lithic Assemblage of the Western Desert Aborigines of Australia". *American Antiquity* 36.2 (1971), 149–169.

C. S. Henshilwood, d'Errico, et al. 2002
Christopher S. Henshilwood, Francesco d'Errico, Royden. Yates, Zenobia Jacobs, Chantal Tribolo, Geoff A.T. Duller, Norbert Mercier, Judith C. Sealy, Helene Valladas, Ian Watts, and Ann G. Wintle. "Emergence of Modern Human Behavior: Middle Stone Age Engravings from South Africa". *Science* 295.5558 (2002), 1278–1280.

C. S. Henshilwood, d'Errico, et al. 2011
Christopher S. Henshilwood, Francesco d'Errico, Karen L. van Niekerk, Yvan Coquinot, Zenobia Jacobs, Stein-Erik Lauritzen, Michel Menu, and Renata Garcia-Moreno. "A 100 000-Year-Old Ochre-Processing Workshop at Blombos Cave, South Africa". *Science* 334.6053 (2011), 219–222.

Heyes et al. 2016
Peter J. Heyes, Konstantinos Anastasakis, Wiebren de Jong, Annelies van Hoesel, Wil Roebroeks, and Marie Soressi. "Selection and Use of Manganese Dioxide by Neanderthals". *Nature Scientific Reports* 6.22159 (2016), 1–9.

Hodgskiss 2012
Tammy Hodgskiss. "An Investigation into the Properties of the Ochre from Sibudu, KwaZulu-Natal, South Africa". *Southern African Humanities* 24 (2012), 99–120.

Hovers et al. 2003
Erella Hovers, Shimon Ilani, Ofer Bar-Yosef, and Bernard Vandermeersch. "An Early Case of Color Symbolism. Ochre Use by Modern Humans in Qafzeh Cave". *Current Anthropology* 44.4 (2003), 491–522.

Jones and MacGregor 2002
Andrew Jones and Gavin MacGregor, eds. *Colouring the Past. The Significance of Colour in Archaeological Research*. Oxford and New York: Berg, 2002.

Klima 1987
Bohuslav Klima. "Une triple sépulture du Pavlovien à Dolni Vestonice, Tchécoslovakie". *L'Anthropologie* 91 (1987), 329–334.

Knight, Power, and Watts 1995
Chris Knight, Camilla Power, and Ian Watts. "The Human Symbolic Revolution: A Darwinian Account". *Cambridge Archaeological Journal* 5.1 (1995), 75–114.

Kozlowski 1982
Janusz K. Kozlowski, ed. *Excavation in the Bacho Kiro Cave, Bulgaria (Final Report)*. Warsaw: Paristwowe Wydarunictwo, 1982.

Kuhn et al. 2001
Steven L. Kuhn, Mary C. Stiner, David S. Reese, and Erksin Güleç. "Ornaments of the Earliest Upper Palaeolithic. New Insights from the Levant". *Proceedings of the National Academy of Sciences* 98.13 (2001), 7641–7646.

McBrearty and Brooks 2000
Sally McBrearty and Alison Brooks. "The Revolution That Wasn't. A New Interepetation of the Origin of Modern Human Behavior". *Journal of Human Evolution* 39.5 (2000), 453–563.

McBryde 2000
Isabel McBryde. “Travellers in Storied Landscapes. A Case Study in Exchanges and Heritage”. *Aboriginal History* 24 (2000), 152–174.

Morphy 1989
Howard Morphy. “From Dull to Brilliant. The Aesthetics of Spiritual Power among the Yolngu”. *Man, New Series* 24.1 (1989), 21–40.

Moutsiou 2012
Theodora Moutsiou. “Changing Scales of Obsidian Movement and Social Networking”. In *Unravelling the Palaeolithic. Ten Years of Research at the Centre for the Archaeology of Human Origins (Caho, University of Southampton)*. Ed. by K. Ruebens, I. Romanowska, and R. Bynoe. University of Southampton Series in Archaeology 8. Oxford: Archaeopress, 2012, 85–96.

Moutsiou 2014
Theodora Moutsiou. *The Obsidian Evidence for the Scale of Social Life during the Palaeolithic*. British Archaeological Reports, International Series 2613. Oxford: Archaeopress, 2014.

Parker-Pearson 1999
Michael Parker-Pearson. *The Archaeology of Death and Burial*. Stroud: Sutton, 1999.

Pike et al. 2012
A. W. G. Pike, D. L. Hoffmann, Marcos García-Diez, Paul B. Pettitt, José J. Alcolea-González, Rodrigo De Balbin-Behrmann, C. González-Sainz, C. de las Heras, J. A. Lasheras, R. Montes, and João Zilhão. “U-Series Dating of Paleolithic Art in 11 Caves in Spain”. *Science* 336.6087 (2012), 1409–1413.

Rappenglück 2011
Michael Rappenglück. “The Palaeolithic colour paletter and charm of hues: Pigments in earlier prehistory (800 ka – 10 ka BP)”. In *Colours in Culture and Science*. Ed. by G. Wolfschmidt. Nuncius Hamburgensis. Beiträge zur Geschichte der Naturwissenschaften 22. Hamburg: Tredition, 2011.

Riel-Salvatore and Clark 2001
Julien Riel-Salvatore and Geoffrey A. Clark. “Grave Markers. Middle and Early Upper Palaeolithic Burials and the Use of Typochronology in Contemporary Palaeolithic Research”. *Current Anthropology* 42 (2001), 449–479.

Rifkin 2011
Riaan F. Rifkin. “Assessing the Efficacy of Red Ochre as a Prehistoric Hide-Tanning Ingredient”. *Journal of African Archaeology* 9 (2011), 131–158.

Roebroeks et al. 2012
Wil Roebroeks, Mark J. Siera, Trine K. Nielsen, Dimitri De Loecker, Josep M. Parésb, Charles E. S. Arpsd, and Herman J. Mücher. “Use of Red Ochre by Early Neanderthals”. *Proceedings of the National Academy of Sciences* 109.6 (2012), 1889–1894.

Saunders 1999
Nicholas J. Saunders. “Biographies of Brilliance. Pearls, Transformations of Matter and Being, c. AD 1492”. *World Archaeology* 31.2 (1999), 243–257.

Saunders 2001
Nicholas J. Saunders. “A Dark Light. Reflections on Obsidian in Mesoamerica”. *World Archaeology* 33.2 (2001), 220–236.

Stout et al. 2005
Dietrich Stout, Jay Quade, Sileshi Semaw, Michael J. Rogers, and Naomi E. Levin. “Raw Material Selectivity of the Earliest Stone Toolmakers at Gona, Afar, Ethiopia”. *Journal of Human Evolution* 48 (2005), 365–380.

Torrence 1982
Robin Torrence. “The Obsidian Quarries and Their Use”. In *An Island Polity. The Archaeology of Exploitation in Melos*. Ed. by C. Renfrew and M. Wagstaff. Cambridge and New York: Cambridge University Press, 1982, 193–221.

Torrence 2005
Robin Torrence. “Valued Stone - How So?” In *Many Exchanges. Archaeology, History, Community and the Work of Isabel McBryde*. Ed. by I. Macfarlane, M.-J. Mountain, and R. Paton. Aboriginal History Monograph 11. Canberra: Aboriginal History Inc., 2005, 357–372.

Wadley 2001
Lyn Wadley. “What is Cultural Modernity? A General View and a South African Perspective from Rose Cottage Cave”. *Cambridge Archaeological Journal* 11.2 (2001), 201–221.

Wadley 2009
Lyn Wadley. “Post-Depositional Heating May Cause Over-Representation of Red-Coloured Ochre in Stone Age Sites”. *South African Archaeological Bulletin* 64.190 (2009), 166–171.

Watts 1999
Ian Watts. “Origin of Symbolic Culture”. In *The Evolution of Culture: An Interdisciplinary View*. Ed. by R. Dunbar, Ch. Knight, and C. Power. Edinburgh: Edinburgh University Press, 1999, 133–146.

Watts 2002
Ian Watts. “Ochre in the Middle Stone Age of Southern Africa. Ritualized Display or Hide Preservative?” *South African Archaeological Bulletin* 57 (2002), 2–16.

Watts, Chazan, and Wilkins 2016
Ian Watts, Michael Chazan, and Jayne Wilkins. “Early Evidence for Brilliant Ritualized Display. Specularite Use in the Northern Cape (South Africa) between 500 ka and 300 ka”. *Current Anthropology* 57.3 (2016), 287–310.

Wreschner et al. 1980
Ernst E. Wreschner, Ralph Bolton, Karl W. Butzer, Henri Delporte, Alexander Häusler, Albert Heinrich, Anita Jacobson-Widding, Tadeusz Malinowski, Claude Masset, Sheryl F. Miller, Avraham Ronen, Ralph Solecki, Peter H. Stephenson, Lynn L. Thomas, and Heinrich Zollinger. “Red Ochre and Human Evolution. A Case for Discussion [and Comments and Reply]”. *Current Anthropology* 21.5 (1980), 631–644.

THEODORA MOUTSIOU

Theodora Moutsiou, PhD (London 2011), is a post-doctoral researcher at the Archaeological Research Unit, University of Cyprus. She holds a Marie Skłodowska-Curie Individual Fellowship (Horizon 2020) for her project entitled *Social Networking and Raw Material Selectivity in Early Prehistoric Mediterranean Seascapes (PRENET)*. Her main research interests are: obsidian, Palaeolithic, early aesthetics, raw materials movement and selectivity, cognitive/behavioural human evolution, social networks. Publications (selected): Pearce, E. and Moutsiou, Th., *Using Obsidian Transfer Distances to Explore Social Network Maintenance in Late Pleistocene Hunter-gatherers*, Journal of Anthropological Archaeology 36, 2014, 12–20; Moutsiou, Th., *The Obsidian Evidence for the Scale of Social Life during the Palaeolithic*. Archaeopress, BAR-IS 2613, 2014; Moutsiou, Th., *Changing Scales of Obsidian Movement and Social Networking*. In Ruebens, K. et al. (eds.), *Unravelling the Palaeolithic: Ten Years of Research at the Centre for the Archaeology of Human Origins (CAHO, University of Southampton)*, University of Southampton Series in Archaeology No. 8, 2012, 85–96.

Dr Theodora Moutsiou
Archaeological Research Unit
Gladstonos 12
Nicosia 1095, Cyprus
E-Mail: tmouts01@ucy.ac.cy; dora81m@yahoo.com

Daniella E. Bar-Yosef Mayer

The Colour of Ornaments in the Neolithic and Chalcolithic of the Levant: Their Symbolic Meaning and Economic Value

Summary

Humans' transition from a foraging economy to agriculture in the Neolithic of the Levant brought with it the first use of stone beads. These came in many colours and shapes, with a variety of green minerals dominating. Beads in white, red, yellow, brown, and black colours had been used previously, thus the occurrence of green beads was related to the onset of agriculture. Subsequently they were used as amulets to ward off the evil eye and as fertility charms. A synthesis of personal ornaments of the Chalcolithic period provides insight into the possible ways in which the society of agro-pastoralists used to decorate itself. The study of ornaments, their raw materials, and colours informs us on possible belief systems, at the time of religion formation. Their spatial distribution testified for economic ties of the period.

Keywords: Neolithic; Chalcolithic; beads; pendants; personal ornaments; Levant

Der Übergang vom einer wild- und feldbeuterischen Lebensweise zur Landwirtschaft im Neolithikum der Levante brachte die erste Verwendung von Steinperlen in vielen Farben und Formen mit sich, wobei grüne Mineralien dominierten. Weiße, rote, gelbe, braune und schwarze Perlen hatte es schon vor dieser Zeit gegeben, weshalb das Auftreten grüner Perlen mit dem Beginn der Landwirtschaft in Zusammenhang gebracht wird. Grüne Perlen wurden als Amulette zur Abwehr des bösen Blicks und als Fruchtbarkeitsbringer verwendet. Eine Zusammenschau persönlichen Schmucks im Chalkolithikum ermöglicht einen Einblick in die Art und Weise, wie sich eine agrarisch-viehzüchtende Gesellschaft geschmückt haben mag. Die Untersuchung des Schmucks, seines Materials und seiner Farben lässt aber auch Rückschlüsse zu auf antike Glaubenssysteme. Zudem erlaubt die räumliche Verteilung der Amulette Aussagen über wirtschaftliche Verbindungen jener Zeit.

Keywords: Neolithikum; Chalkolithikum; Perlen; persönlicher Schmuck; Levante

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

I thank David Warburton and Shiyanthi Thavapalan for inviting me to participate in the symposium *Economic Aspects of Colours in Early Antiquity* and for commenting on previous drafts of this paper. Thanks to my colleagues Alice Choyke and Dan'el Kahn for their advice, Tom Levy, Eli Yannai, Dina Shalem and an anonymous reviewer for their constructive comments on a previous version of this paper.

1 Introduction

Colour is part of the natural world surrounding humans, and during human evolution different colours gained various values and meanings. Their use in personal ornaments is ubiquitous, but their meaning less obvious. The study of personal ornaments is a developing sub-field of archaeology that incorporates the identification of raw materials used for ornaments, technological aspects of both raw material procurement and production and shaping of beads and other ornaments, as well as the social and economic context in which the ornaments were used and often exchanged.[1] These aspects stand in contrast with the 'small finds' attitude, which sees these artefacts as marginal and deserving superficial description at best. The use of beads is an expression of behaviour unique to *Homo sapiens*, and the earliest known beads, associated with early modern humans, were made of mollusc shells, discovered in Middle Paleolithic sites in Israel, Morocco and South Africa all dating to about 100 000 or so years ago.[2] An increase in the variability of raw materials emerges during the Upper Palaeolithic, mainly in Europe but also in Africa and Asia, when beads are made of bone, teeth, antler, ivory, and ostrich eggshells – all of biological origin. The colour of these artefacts is significant and is usually in different hues of white, yellow, brown, red and black.[3]

A major change occurred during the transition from hunting and gathering to agriculture in the Near East. This period spans the transition from the Pleistocene to the Holocene, and culturally it marks the passage from the last Epipalaeolithic culture, namely the Natufian, to Neolithic cultures. The first appearance of stone beads in the Levant is in the Late Natufian (ca. 11000–9500 cal BC). Their green colour and raw material is what distinguishes them from all other beads and pendants known to have been

1 E.g. Ludvik et al. 2015; Rehren et al. 2013; Poulin and Helwig 2016; Varberg, Gratuze, and Kaul 2015; Bar-Yosef Mayer 2015.

2 Bar-Yosef Mayer 2015. The practice of decorating the human body with pigments might antedate the use of personal ornaments, McBrearty and Brooks 2000.

3 Bar-Yosef Mayer and Porat 2008.

used previously. This incipient trend was strengthened during the Neolithic period, when a greater variety of green minerals was sought from various geographic sources.[4]

Here I shall attempt to review the available information on personal ornaments, mostly from Neolithic and Chalcolithic sites in the Levant, with an emphasis on the possible symbolism attributed to their colour, and some economic aspects. In order to assess their economic value, it is imperative to discuss the raw materials involved. Interpreting the symbolic aspect of ornament use is based on a variety of anthropological studies. These include 'classic' ethnographies that explain how various people attach specific meanings to specific colours, systems which are universal. But they also include the biologically-based studies of how different colours are viewed by the human eye and how different cultures perceive colour, as well as recent psychological experiments that attach brain activity to specific colours. Finally, I believe that the symbolic value of these artefacts is what creates their economic value, or the desire to own and use them, which is why these aspects are emphasised in this paper.

2 Types of personal ornaments

Personal ornaments are made up primarily of beads, but also of pendants and bangles, and these terms must be clarified: Beck's typology[5] divided beads according to length categories, by determining the proportion between the longitudinal axis (parallel to the hole) of the bead and its diameter. A *disk bead* is one in which the length is less than a third of the diameter; a *short bead* is one where the length is more than a third but less than 9/10 of the diameter; a *standard bead* is a bead in which the length is more than 9/10 and less than 1–1/10 of the diameter; a *long bead* is one where the length is more than 1–1/10 of the diameter.

Beck further observed the shape of the profile (straight, convex, concave, etc.), the geometric shape of the transverse section (perpendicular to the hole), resulting in about 1500 possible combinations of bead types, but many of them do not really exist.[6]

Pendants that are perforated differ from beads in that their holes are not in the centre of the artefact. Most pendants are elongated (but could also be trapezoidal, oval, etc.) and are usually perforated at one end, and may have more than one perforation (often two). A *bracelet* is a circlet made of numerous components (usually beads) and is intended to be worn on the arm or ankle, however, a *bangle* is a circlet made of a continuous homogenous material and is intended to be worn on the arm or ankle, thus its diameter is much larger than a bead.[7] While there are no strict rules on the actual sizes of the

4 Bar-Yosef Mayer and Porat 2008.
5 Beck 1928.
6 Bar-Yosef Mayer 2013.
7 Kenoyer, Vidale, and Bhan 1991.

artefacts, beads usually vary from minute (1 mm) to a few centimetres, while a bangle might be in the range of five to ten cm in diameter, or slightly more.

Typologically, there are several bead types in the Neolithic period, some of which can serve as chronological markers.[8] In the Chalcolithic, however, there seems to be a larger standardisation with the repertoire of most beads corresponding to Beck's Types I.B.1.b, I.B.1.f, or I.B.2.b. They are thus circular short beads with various profiles. Very few beads and pendants are unique in their typology. This suggests a fair amount of standardisation in the bead production, alongside some unique items, which could reflect individual expression.

Trapezoidal pendants (TP) were made of various raw materials, and some of them, especially the ones made of mother-of-pearl, were incised (Kissufim, Shiqmim and Cave of the Treasure).[9] Some are perforated, usually with two holes. Trapezoidal palettes are unperforated, but are considered here along with the TP as they could be worn as amulets if carried in a pocket or bag. Palettes were made of various raw materials and are considered ritual items.[10] Other pendants of crescent and other shapes are confined to Ghassul and Gilat, while at the *nawamis* burial grounds in the southern Sinai Peninsula, unique oval mother-of-pearl pendants were found.[11]

Bangles were made of the body whorl of *Lambis truncata*, a large Red Sea gastropod.[12] Many of the bangles had repair holes near their breakage lines, which indicates the value attributed to them. A unique bangle from Shiqmim was inlaid with glazed enstatite beads. Two parts of the same bangle were found in separate graves in Shiqmim, which suggests a spiritual value may have been attached to this artefact.[13]

The use of complete shells with a simple perforation increases significantly the shapes used for ornamentation, but here we treat them as a single group.

All the artefacts mentioned above are personal ornaments. In the Chalcolithic repertoire, we also encounter objects such as sceptres, mace heads and crowns, that may have been worn or used by individuals, but because these are perceived as related to public or formal rituals, they will not be discussed here.

3 Raw materials

The Neolithic and Chalcolithic personal ornaments exhibit a proliferation of a variety of raw materials, especially when compared to the previous Palaeolithic period. This is

8 Bar-Yosef Mayer 2013.

9 Bar-Yosef Mayer 2002a; Bar-Yosef Mayer, Porat, and Davidovich 2014.

10 Rowan, Levy, et al. 2006; Rowan and Golden 2009, 61.

11 Bar-Yosef Mayer 1999; Bar-Yosef Mayer 2002b.

12 Bar-Yosef Mayer 1999; Bar-Yosef Mayer 2002a; Bar-Yosef Mayer 2002b.

13 Levy 1987, 679 pl. 13.2b.

probably related to increase in craft production during these periods, clearly linked to changes in the economic basis of agriculture, which in turn were accompanied by social changes and the build-up of hierarchies.[14] It is imperative to survey these raw materials as they reflect several essential attributes pertaining to geographic origin and to colour, both of which might influence the symbolic and economic aspects attached to them.

There are several possible ways of presenting raw materials, for example, according to their physical properties, mineralogical characteristics, or geographic origin. Here I present them according to colour, following a general order of materials of biological origin, stones and minerals, and synthetic materials.

When discussing colour, it is important to keep in mind that colour is a function of humans' physical vision capabilities as well as a subjective definition that varies between individuals and cultures. Several methods of colour definition exist, particularly the Munsell Chart and the Pantone colour chart. However, when researching beads and ornaments, many of which have a combination of colours in them, the issue of classification for the sake of analysis is further complicated. Furthermore, on the broader cultural level, various languages share a universal system of basic colour categorisation, which might be tied to colour perception in the human eye.[15] According to Kay and McDaniel, the colour concepts in most human populations comprise white, black, red, green, yellow, and blue, and to a lesser extent brown, pink, purple, orange and grey. In other words, colour is a subjective matter for humans who choose it. Thus, the analyses here rely on the basic colours observed in the archaeological record, subjective as they may be.

The materials below were all found in various Neolithic and Chalcolithic sites of the Levant. Material descriptions follow Rapp and Aston et al.[16] Table 1 lists beads from Chalcolithic sites of the Levant by colour and raw material. Following is a description of materials by colour.

3.1 White/off-white/cream

Shell Shell beads are usually made of marine or freshwater molluscs, belonging to the gastropod, bivalve or scaphopod ('tusk shell') classes and are naturally or artificially perforated. In the Levant, shells made into beads were collected along the Mediterranean, Red Sea, the Nile River, as well as local freshwater sources. About 40 different species were selected to serve as shell beads with cowries, *Nerita*, *Lambis*, *Conus*, *Glycymeris*, *Cerastoderma,* and *Dentalium* among the most popular. Most

14 Levy 1998; Wright and Garrard 2003.

15 Berlin and Kay 1969; Kay and McDaniel 1978; Kwok et al. 2011; Lindsey and Brown 2009.

16 Rapp 2002; Aston, Harrell James, and Shaw 2000.

colour	material	Byblos[1]	Peqi'in	Tel Tsaf	H. Castra	Nahal Qanah
white	shell	B	B,G,V,MOP,S	G, V	C, G, V	B, C, S
	ostrich eggshell		B	B		
	animal tooth					
	ivory	B				
	bone	B	B			
	limestone	B	B			
	calcite		B			
	chalk		B			
	marble		B			
	rock crystal		B			
black	basalt		B			
	obsidian	B	B			
	haematite					
	unidentified			B		
red	red limestone		B			
	carnelian	B	B	B	B	B
	agate		B			
	clay/pottery					
green	apatite		B			
	turquoise		B			B
	chrysocolla		B			
	amazonite		B			
	serpentine		B			
	chlorite/schist					
	fluorite		B			
	olivine		B			
	glazed steatite paste		B		B	
	nephrite					
	unidentified			B	B	P
blue	lapis lazuli					B
brown	calcarenite		B			
purple	amethyst		B			
metallic colour	gold					
	electrum					
	silver	B, N				N
	copper		B			N

[1] Study is still underway (Artin 2010) and all ornaments have been listed tentatively as beads, although it is likely that other forms were present as well.

Tab. 1 Chalcolithic beads (part 1). Abbreviations: B = bead; C = cowrie; G = gastropod; MOP = mother-of-pearl pendant; N = bangle; P = pendant; S = scaphopod; TP = Trapezoidal palette or pendant; V = bivalve.

colour	material	Ben Shemen	Ghassul	N. Mishmar	Ein Gedi
white	shell	V	B, G, MOP, N, S, V	B, MOP	
	ostrich eggshell				
	animal tooth				
	ivory			P	
	bone		B	B	TP
	limestone	P	B	TP	
	calcite			B	
	chalk				
	marble				
	rock crystal				
black	basalt				
	obsidian				
	haematite		B		
	unidentified				
red	red limestone				
	carnelian		B	B	
	agate				
	clay/pottery				
green	apatite				
	turquoise				
	chrysocolla				
	amazonite				
	serpentine		B		
	chlorite/schist				
	fluorite				
	olivine				
	glazed steatite paste			B	B
	nephrite		B		
	unidentified	P			
blue	lapis lazuli			B	
brown	calcarenite				
purple	amethyst				
metallic colour	gold				
	electrum				
	silver				
	copper				

Tab. 1 Chalcolithic beads (part 2).

colour	material	Kissufim	Gilat	Shiqmim	Grar
white	shell		B, C, MOP, N, P, S, TP, V	B, G, MOP, N, P, S, TP, V	G, MOP, S, V
	ostrich eggshell		B	B	
	animal tooth				
	ivory		P		
	bone	MOP	B	B, TP	
	limestone		B, TP		TP
	calcite				
	chalk				
	marble				
	rock crystal				
black	basalt				
	obsidian				
	haematite				
	unidentified		TP		
red	red limestone				TP
	carnelian		B	B	
	agate		B		
	clay/pottery		B, TP		TP
green	apatite				
	turquoise		B		
	chrysocolla				
	amazonite		B		
	serpentine				
	chlorite/schist		B		
	fluorite				
	olivine				
	glazed steatite paste			B	
	nephrite				
	unidentified				P
blue	lapis lazuli				
brown	calcarenite				
purple	amethyst				
metallic colour	gold				
	electrum				
	silver				
	copper				

Tab. 1 Chalcolithic beads (part 3).

colour	material	Abu Matar	H. Beter	Arad V	Nawamis
white	shell	C, G, MOP		MOP	B, C, G, MOP, N, S, V
	ostrich eggshell				B
	animal tooth		P, V		
	ivory	N			
	bone	TP	TP		B
	limestone				B
	calcite				
	chalk				
	marble	TP			
	rock crystal				B
black	basalt				
	obsidian				
	haematite				
	unidentified				
red	red limestone			TP	
	carnelian				B
	agate				
	clay/pottery				
green	apatite				
	turquoise	TP			
	chrysocolla				
	amazonite				
	serpentine				
	chlorite/schist	TP			
	fluorite				
	olivine				
	glazed steatite paste				B
	nephrite				
	unidentified				B
blue	lapis lazuli				B
brown	calcarenite				
purple	amethyst				
metallic colour	gold				
	electrum				
	silver				
	copper	B			

Tab. 1 Chalcolithic beads (part 4).

mother-of-pearl pendants are made from bivalves, especially Red Sea *Pinctada* sp. and the Nilotic *Chambardia* sp.

Ostrich eggshell and animal teeth Ostrich egg shell were made into disk beads, but fragments of ostrich eggshell, present in many sites, and not worked into ornaments, are probably the remains of water flasks[17] or containers.
Animal teeth are rarely found, but in a few cases were made into pendants. To this group one should add hippopotamus ivory, which was used both as raw material for making figurines and for beads.[18]

Bone The colour of bone, shortly after the death of the animal is usually white or off-white,[19] but when found in sites it is usually brown, and is sometimes accidentally coloured by other materials such as natural manganese spots. Painted bone figurines were discovered at the Pre-Pottery Neolithic B (PPNB) site of Nahal Hemar Cave, where green dioptase, collagen, red ochre and lime plaster were identified on them.[20]

Limestone is a sedimentary rock and is the most common rock formation throughout the Levant, commonly available throughout the Levantine Neolithic and Chalcolithic range. Most ornaments are white, but yellowish, red and grey also exist.

Calcite and Dolomitic Chalk are variations of limestone and can be distinguished from each other using petrographic, SEM or XRF analyses.

Marble is a calcite that underwent metamorphosis, and can be distinguished from limestone by oxygen isotope analysis. This type of analysis was only done for a bead from Peqi'in[21], which is probably why, if it was more common, it was not identified in other sites, but also, it must have been brought from afar.

Rock Crystal (Clear Quartz) Quartz is a common mineral on earth and has a hardness of 7 on the Mohs scale (compared to 3–4 of limestone). Large crystals were used to produce clear beads, and they are grouped with the white materials for convenience, although their brilliance may reflect other properties.

17 Texier et al. 2010.
18 Levy and Alon 1992.
19 Luik 2007.
20 O. Bar-Yosef and Alon 1988.
21 Bar-Yosef Mayer and Porat 2013.

3.2 Red

Red limestone is the same as white limestone, but contains high concentrations of iron oxides, and is fairly common, and often found as simple short round beads.

Carnelian is a translucent red-to-orange quartz that contains iron oxides and comes in various colours from black to yellow. In India where carnelian pebbles are quarried for the jewellery industry, they are heated to produce a bright red colour,[22] a practice that apparently started in the Northern Levant in the PPNB.[23] In the northern Levant riverbeds transporting rocks and mineral from the Taurus mountain range in Turkey could have been the source of raw material while in the southern Levant the raw material is present as pebbles in the Negev (at Makhtesh Ramon) and Sinai deserts, and also in the Eastern Desert of Egypt.

Agate The colour of agate is variable. It is closely related to carnelian and contains quartz with iron and manganese oxides, and typically has bands with shades of black, brown, red, pink, orange, yellow and white.

Ochre is a form of red hematite (see below).

3.3 Black

Basalt The beads are black to brown in colour and could originate in the Galilee and Golan Heights. Due to the properties of this raw material it was used more frequently for making ground stone tools and vessels than for ornaments.

Obsidian, or volcanic glass, is usually black and glossy, and under the Scanning Electron Microscope (SEM) one can observe the flow texture and vesicles typical to this volcanic material. The most common source of obsidian is in eastern and central Anatolia.[24]

Hematite can be taken from the iron ore layers resting along an unconformity boundary developed between the late Cretaceous and early Tertiary formations in various locations, for example in the Negev.[25]

22 Kenoyer 1991.
23 Groman-Yaroslavski and Bar-Yosef Mayer 2015.
24 Yellin and Garfinkel 1986.
25 Rosen, Avni, and Bar-Yosef Mayer 2011.

3.4 Green and blue

Apatite Apatite is a phosphate mineral with a high content of calcium. Its source is most likely the Hatrurim Formation in Israel or the equivalent Dabba marbles of Jordan. It is usually greenish and was used to produce the earliest green stone beads and pendants in the Levant, but also exists in brown and red colours, depending on other elements that are included in it.[26] It seems to have gone out of favour during later periods, when better quality 'green stones,' mentioned below, came into use.

Turquoise originates in the copper mines of the Sinai Peninsula. While its colour is usually turquoise, it comes in many hues of blue to green and grey, and some black specimens are also known, especially at Nahal Hemar Cave. This raw material, like many other raw materials, and especially the green ones, is often misidentified if not tested in the laboratory.

Copper Minerals Several copper bearing minerals were identified, most notably chrysocolla which may have originated in either Feinan or Timna. Beads made of the metal copper are described separately (see below).

Amazonite This is a greenish-blue variety of microcline feldspar. Their source could be in the Sinai Peninsula, Egypt, or in northern Saudi Arabia, in the vicinity of Wadi Tbeik.[27]

Serpentine This mineral is rare in the archaeological record and was identified at Chalcolithic Peqi'in as a green-grey-black bead with white specks. The raw material may have been brought from northern Syria.

Chlorite/Schist a metamorphic rock probably of Anatolian origin was found at Gilat.

Fluorite A single transparent light-green bead, also from Peqi'in, is also known from predynastic Egypt.

Olivine A greenish-yellow translucent bead is represented by a single specimen from Peqi'in.

Glazed Steatite Paste This is a synthetic material, possibly the first of its kind, and has been described and discussed in detail elsewhere.[28] The beads contain silicon and

26 Gross 1977; Bar-Yosef Mayer and Porat 2008.
27 Fabiano, Berna, and Borzatti von Löwenstern 2004.
28 Bar-Yosef Mayer, Porat, Gal, et al. 2004; Bar-Yosef Mayer and Porat 2010.

magnesium found in metamorphic rocks such as serpentinite, and is also known as steatite or soapstone with traces of copper and iron. The texture of loosely-packed elongated columnar crystals with no preferred orientation seen in beads made of this material under SEM, indicates that this is not a solid, carved stone, but rather a paste that was prepared from pulverised rock, which was shaped and heated. The traces of iron and copper are probably related to the glaze, which gives it a greenish color. In archaeological sites, it is often found to be white as a result of chemical changes, and it is often misidentified as faience. It is likely that this material was invented in order to enlarge the supply of green beads and serve as substitute for those made of minerals, that were harder to obtain and harder to produce.

Lapis lazuli Lapis lazuli is not found anywhere in the Levant, and the closest source is in Afghanistan.[29] A lapis lazuli bead was found only at the Cave of the Treasure in Nahal Mishmar,[30] and two additional beads were discovered in the *nawamis* field of El Abar 27 in southern Sinai. The material identification of the former was based on its dark blue colour with typical small white veins and confirmed under SEM as containing lazurite and haüynite, minerals that are the components of lapis. Parallels are known from predynastic Egypt.[31]

3.5 Brown, purple and metal

Dark-Brown Calcarenite This is a type of limestone with large grains, the size of sand common in southern Jordan.

Amethyst is quartz with a clear purple colour and its probable source is in Egypt.

Metals and Metallic colours Metal ornaments are few, but are very valuable artefacts. Electrum and gold rings or bangles were reported from Nahal Qanah Cave where they were thought to be grave goods of high-ranking individuals.[32] The Chalcolithic cemetery at Byblos contained, among other beads and pendants, rings, bangles and other ornaments made of silver, as well as rare items of gold.[33] To this group we should add small copper beads. The latter, from Peqi'in, are usually green from corrosion when discovered, but in their fresh state would have had a bright 'copper colour', which is a metallic brown. Metals, and particularly gold, are considered to be valuable due to their brilliance.[34]

29 Casanova 1999.
30 Bar-Adon 1980; Bar-Yosef Mayer, Porat, and Davidovich 2014.
31 Petrie and Quibell 1896, 10, 44
32 Gopher and Tsuk 1996, 236; see discussion below.
33 Artin 2010.
34 Gaydarska and Chapman 2008.

4 A note on technology

Technological traditions of stone bead and pendant production in the Neolithic have only recently been studied in detail,[35] and the same traditions are present in the Chalcolithic with several innovations: the use of shell bangles made of a homogenous material is practiced for the first time, and the production of the first synthetic material is seen in the glazed enstatite beads.[36] It is possible that plaster, heavily used for construction in PPNB sites and also found in beads from Nahal Hemar Cave,[37] could be considered as a predecessor of this technology. Apatite coated calcite beads, a few of which were identified at Peqi'in,[38] may be a Chalcolithic innovation, but it requires further research.[39]

5 A note on trade and exchange

The variety of raw materials provides a wealth of information on the diverse geographic ties between populations of the Neolithic and Chalcolithic. Early evidence for the exchange of both raw materials and finished products exists at least from the Upper Palaeolithic with considerable intensification from at least the PPNA.[40] Raw materials were acquired from resources available around the sites and via trade over medium range distances such as the Red Sea and Mediterranean coasts (Fig. 1).

Other materials were brought from far greater distances as, for example, the Nile River where *Chambardia* shells were collected, the Eastern Desert in the Aswan region where sources of amethyst were found;[41] Southeast Turkey could have served as a source of schist and chlorite, while Afghanistan is the only known source of lapis lazuli. The source of the silver in Byblos is unknown[42] but the Levantine imported silver probably came from Anatolia, although the silver sources of Egypt cannot be ruled out.[43]

The distribution of *Lambis* bangles provides a link between the northern Negev population and the pastoral society that was interred in the *nawamis* burial sites of southern Sinai, on the one hand, and with predynastic populations of Egypt on the other.[44] Similarly, ostrich eggshell beads were found in large numbers at Tel Tsaf and a few at Gilat, as well as in the *Nawamis* graves.

35 Alarashi 2014; Groman-Yaroslavski and Bar-Yosef Mayer 2015.
36 Barthélemy de Saizieu 2003; Bar-Yosef Mayer, Porat, Gal, et al. 2004; Bar-Yosef Mayer and Porat 2010.
37 Kingery, Vandiver, and Prickett 1988.
38 Bar-Yosef Mayer and Porat 2013.
39 Technological aspects of bead manufacture cannot be discussed in detail here.
40 D. E. Bar-Yosef 1991; Bar-Yosef Mayer and Porat 2008; Groman-Yaroslavski and Bar-Yosef Mayer 2015.
41 Shaw and Jameson 1993.
42 Prag 1986.
43 Ogden 2000, 170–171; Moorey 1994, 232–240.
44 Bar-Yosef Mayer 1999; Bar-Yosef Mayer 2002b.

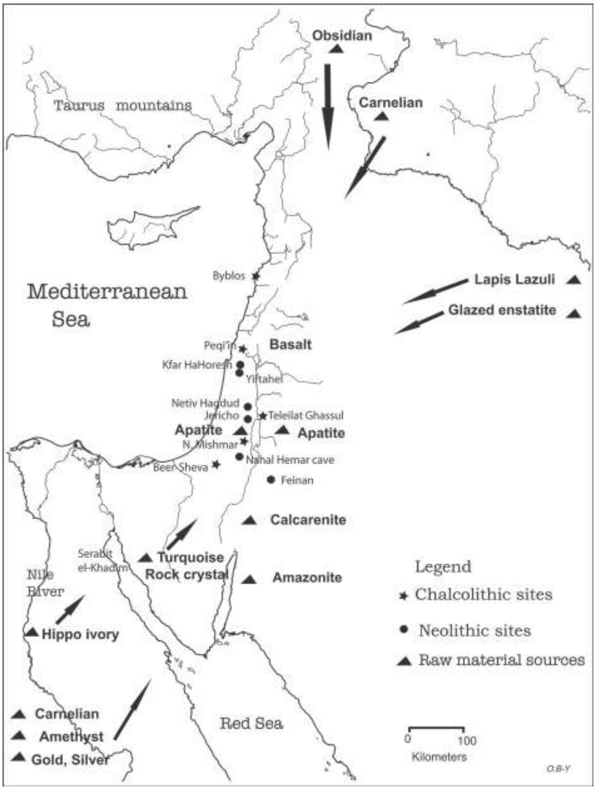

Fig. 1 Map of Levant depicting selection of Neolithic and Chalcolithic sites and possible sources of raw materials.

Certain aspects of trade and exchange networks may be inferred from combining information on personal ornaments with that of other crafts such as ceramics, metallurgy and lithics,[45] but this awaits further research.

6 Discussion: the meanings of beads and pendants

In discussing the religious, ritual, or symbolic aspects of beads and personal ornaments typical to the Neoltihic and Chalcolithic, beyond the beads themselves, I advocate relying on archaeological information such as the type of site in which they were found (habitation, cemetery, sanctuary, etc.), the specific archaeological context they were found in (structure, yard, burial, in a vessel, etc.) and information on the humans who owned or last used them (age, gender, social status).

45 E.g. Milevski 2013.

The issue of social status is vexing. As noted, we can see an increase in the abundance and quality of the materials used for personal ornamentation from the very end of the Palaeolithic onwards. Furthermore, we can not only see materials serving as an alternative for other materials which may have been scarcer – we have the evidence of long distance imports. However, from the archaeological record for most of this era, there are no recognised 'elites', and one cannot judge the matter. Whatever potential links between social stratification and ornamentation there might have been, simply cannot be recognised today. That there were differences in the use of ornamentation and its distribution in burials is clear, but what these manifestations meant socially in these pre-urban societies is not well understood.

Therefore, most information relating to personal and social roles is very limited, as is quantitative data: we are left with the ornaments themselves. This essay should serve as a first attempt at an overview in the hope that future research will expand on it.

Three distinct characteristics providing clues about beliefs are the material, colour and shape of personal ornaments; here I focus on colour.

6.1 Interpretation of beads based on colour

A large variety of stones and other materials are known today in some societies as bearing specific amuletic powers, however, these are extremely variable and differ from one culture to another.[46] Some universal and cross-cultural meanings of colours[47] may explain the choice of these beads for personal adornment in the Neolithic and Chalcolithic Levant. As explained above, it has been argued that colour concepts expressed in language in most human populations mostly correspond to six fundamental neural response categories: black, white, red, yellow, green, blue, and to a lesser extent also brown, pink, purple, orange and grey.[48] While the lack of evidence for a prehistoric Levantine language hinders the validation of these categories, it is nonetheless striking that the personal ornaments correspond to the main colour categories (see Table 1). The evolution of colour use by humans has been discussed in various publications.[49] In the absence of historic documents for these prehistoric periods, most of the interpretations concerning the meaning of colour are based on ethnographic knowledge gathered over the past 150 years or so.

Universally the colours have various meanings representing aspects of the individual's life cycle: birth, puberty, fertility, death; or representing the natural world around us: sun, sky, earth, water, plants and animals; and by association, they represent what

46 D. Morris 2003.

47 E.g. DeBoer 2005; Wierzbicka 2008.

48 Berlin and Kay 1969; Kay and McDaniel 1978, 630; Saunders 2000; Lindsey and Brown 2009; Baronchelli et al. 2010.

49 E.g. Gage 1999; Jones and MacGregor 2002; Kwok et al. 2011.

these cycles or cosmic entities stand for: health, strength, well-being, continuity, purity, etc.[50] In other cases, the colour of beads is informative: They indicate the wearer's ethnicity, community or subgroup, religion, wealth or gender.[51]

All authorities agree that white, black and red are the first colours to have linguistic expressions, and this is paralleled in the archaeological record: prehistoric art is based primarily on these three colours, with yellow and sometimes brown as well. Green and blue appear later, and specifically in the Levant, green beads appear for the first time in the Late Natufian culture, from ca. 11000 cal BC onwards and green is associated with the onset of agriculture.[52] Briefly, green stone beads are highly associated with the transition to agriculture and are encountered in all archaeological periods from the Neolithic onwards. Due to the association of the colour green with growth and fertility of crops in the fields, green beads may signify the wish for fertility and health of humans and by association were used in an apotropaic way to ward off the 'evil eye' that is responsible for the opposite condition. Often colour does not operate alone, as viewed in certain ethnographic studies, and depends on the combination with other colours, as well as shape, size, and material of which the beads are made.[53] Furthermore, they should be considered along with hairstyle, clothing, and other variables, and some meanings change over time.[54] In this review, colours are addressed in their most commonplace connotations.

White is often associated with purity and perhaps innocence as it relates to human milk and semen. In later periods, among Bedouin women, for instance, white beads serve to enhance the milk of a mother.[55] *Black* is associated with excreta and earth and denotes decay, but in ancient Egypt it is considered to represent depth and profundity.[56] *Red* universally connotes the colour of blood, upon which life depends and in ancient Egypt it symbolised energy, dynamism and power. It also embodies blood of sacrifice or resulting from violence, hence associated in ancient Egypt with the evil-tempered god Seth.[57] Spell 29b in the Book of the Dead that discusses a heart amulet made of *sehert* stone, apparently meaning carnelian,[58] further testimony to the relationship between heart and red.

I believe that although according to Kay and McDaniel the orange is a separate colour concept, it was used along with red and probably had the same meaning. This is also attested in various contemporary cultures.[59]

Kay and McDaniel list *green and yellow* as the next group of colours. Ethnographically, green or light blue indicates ripeness and fertility. In ancient Egypt, it is the col-

50 Gage 1999; Andrews 1994; Boric 2002, to mention just a few.
51 Wickler and Seibt 1995; Meisch 1998.
52 Bar-Yosef Mayer and Porat 2008.
53 J. Morris and Preston-Whyte 1994; Goren 1993.
54 Wickler and Seibt 1995, 392.
55 Goren 1993.
56 Andrews 1994.
57 Paine 2004.
58 Andrews 1994, 72.
59 J. Morris and Preston-Whyte 1994, 45; Wierzbicka 2008.

our of new vegetation and is symbolic of new life,[60] while yellow is more reminiscent of gold. Yet from an evolutionary perspective, yellow indeed appears before green, as in, for example, yellow ochre present in Palaeolithic sites.[61] In some Bedouin societies yellow beads are apotropaic against jaundice.[62] The role of green beads as amulets to ward off the evil eye and as fertility charms was discussed in detail elsewhere[63] and is supported by many ethnographic and linguistic accounts.[64]

Blue in ancient Egypt is the colour of the Nile's reviving waters. But it is also broadly interchangeable with green in its meaning of fertility and strength, which is best expressed by the term 'grue', a combination of green and blue.[65]

Brown and purple are presented by Kay and McDaniel[66] as less fundamental colours than the previous ones listed above. Indeed, they are very rare in the archaeological record of beads and ornaments. Only one purple bead made of amethyst was discovered at Peqi'in and nowhere else. One banded agate bead at Peqi'in had brown, white, and light yellow, and it is likely that the beauty of the bands was more important than the actual colours. Brown bone beads should be considered as white.[67]

Metallic ornaments and mother of pearl: Silver was associated with the moon by the Egyptians[68] and its presence in both predynastic Egypt and in Byblos is probably due to direct maritime connections between the two.[69] Gold is likewise shiny and may have a significance as part of the colour yellow, but also as being something shiny. The eight gold and electrum bangles from Chalcolithic Nahal Qanah cave are unique.[70] While typologically they are called bangles, they are too small to fit an adult human's arm. They are similar to Egyptian *awaw* bangles dated to the 18th dynasty, with eight such bangles from Aahhotep's grave.[71] While they could be considered amuletic, they could also serve as a form of storing wealth, and might not be Chalcolithic.

Beyond these historic and ethnographic-based perceptions, which show that colour influences cognition and behaviour through learned associations, recent experimental research shows that red and blue have different associations within the cognitive domain. Red is associated with dangers and mistakes, while blue is often associated with openness, peace, and tranquillity.[72] Mother of pearl is closest to white but is iridescent with hues of blue, green, pink and grey. Its shiny quality may put it along with shiny metal, where brilliance may be more important than actual colour. Mother of pearl is

60 Andrews 1994, 73, 103.
61 Hovers et al. 2003.
62 Goren 1993.
63 Bar-Yosef Mayer and Porat 2008.
64 Mershen 1989; J. Morris and Preston-Whyte 1994; Wickler and Seibt 1995.
65 Baines 1985.
66 Kay and McDaniel 1978.
67 See above.
68 Andrews 1990, 56.
69 Prag 1986.
70 Gopher and Tsuk 1996.
71 Andrews 1990, 183.
72 Mehta and Zhu 2009.

associated with water and fertility and was thought to cure fevers and headaches by the Greeks and Romans, and served for similar remedies by other cultures.[73]

These perceptions of colour, which cross many societies, and for which only very few examples were mentioned here, may have had the same associations amongst the Neolithic and Chalcolithic societies of the Levant (Fig. 2). To be able to infer more detailed associations would require more detailed information on the exact provenience of the personal ornaments within each excavation, and a much broader database with tight chronological control.

7 Economic aspects

Two elements played a role in the development and spread of beads and ornaments: craft specialisation and trade and exchange networks. Subsequently those contributed to the development, distribution and production of beads. Beads and pendants were first collected as ready-to-use perforated shells in the Middle Palaeolithic, but by the Upper Palaeolithic it is conceivable that in some parts of the world (especially in Europe) craftsmen were already spending a significant amount of time manufacturing various ornaments.[74] In the Levant this is more apparent as of the Late Epipalaeolithic with the carriers of the Natufian culture. With the onset of agriculture, which led to permanent settlement, populations grew. This led to a need to create certain decorative elements to distinguish one population group from another; the crowding of people led to an increase in disease which in turn required apotropaic means for ill people coping with their diseases; both the apotropaic needs, and the desire for good crop yields empowered the development of various belief systems. Alongside these circumstances, and parallel to the process of sedentism, populations explored more distant territories, possibly in search of suitable fields and resources, in search of pasture for the newly domesticated farm animals; and some may have been expelled from settled communities in the sown lands, and ended up populating the deserts. These population movements probably supported the discovery of new raw materials, as well as the spread of new technological innovations and the development of skills. But expeditions actively searching for specific raw materials, perhaps of specific colours, could have also been moving about, possibly on a seasonal basis when they were not needed in the villages; or, possibly, while roaming the land with their herds.[75] Skilled craftsmen, possibly ones who were experienced flint knappers, may have been those who initiated the use of various stones for pro-

73 Jackson 1917, 92; Saunders 2000.
74 E.g. Peschaux et al. 2017 and references therein.
75 E.g. Sadvari et al. 2015.

Fig. 2 Beads from the Chalcolithic burial site of Peqi'in, Israel.

ducing beads. They might have developed new technologies, with special attention for drilling and polishing of stone beads.[76]

The procurement of raw materials on the one hand, and the production of finished artefacts, steered the development of trade and exchange networks. Population growth not only created 'consumers' of beads, but also enabled the exchange of food surplus

76 Bar-Yosef Mayer, Porat, and Davidovich 2014; Groman-Yaroslavski and Bar-Yosef Mayer 2015.

from both domesticated plants and animals, in return for either raw materials or finished products. These interactions throughout the Levant – anywhere from Mesopotamia to Egypt and possibly as far as Cyprus in the West and Afghanistan in the East – are reflected in the presence of beads of materials far from their origins. This process, in turn, led to further intensification of human movements, social stratification, and may have contributed to the process of urbanisation that followed.

8 Conclusions

Neolithic and Chalcolithic personal ornaments were made of many diverse raw materials transformed by craft specialists into beads, pendants, and bangles. Their colours imply possible uses as amulets with specific meanings, mainly associated with fertility and protection.

For us, these objects of personal adornment testify to some kind of status. Personal ornaments are sometimes seen as prestige goods. Their value is closely related to raw material production and trade, and exchange routes and exchange practices. It is highly likely that the few lapis lazuli beads encountered in the Levant were highly prized. Kerner[77] views pottery production in the Levantine Chalcolithic as low-level specialisation, possibly at household level. Metal and ivory finds, on the other hand, are considered mostly prestige goods requiring highly skilled craftsmanship. Selection of raw materials, and probably the overall use of personal ornaments expanded during the Neolithic, and more so during the Chalcolithic (in comparison to the preceding Palaeolithic). This is likely due to increases in craft production, probably linked to fundamental social changes.[78] This latter aspect speaks for more elaborate practices, which may allow personal ornaments, or most of them, to be considered as prestige goods.

Clues for how these symbolic items were used in the Chalcolithic may be easier to understand due to the formalising of religious practices in the Chalcolithic.[79] In some of the prominent Chalcolithic sites with relatively large assemblages such as Peqi'in the ornaments were grave goods intended to serve the dead. More specific ritual uses may be implied at Gilat, where people came to worship at the temple from as far as the Nile, the Red Sea and the Mediterranean coast, as evidenced by the mollusc shell species. These populations may have exchanged shells and other types of ornaments for cult services, or used them as offerings. At the same time, gathering for rituals may have set the scene for exchange of these items.[80] They may have been used in similar ways at Ghassul and En Gedi.

77 Kerner 2010.
78 Levy 1998.
79 E.g. Rowan and Golden 2009.
80 Bar-Yosef Mayer 2006.

Chalcolithic society is taken to be a hierarchical society of farmers, or a chiefdom-type of society, in constant interaction with pastoralists surrounding their permanent settlements. Both the settled and nomadic (or partly nomadic) populations used personal ornaments to decorate themselves, but also used them as apotropaic amulets in different aspects of their daily lives. To do that, they procured a large array of raw materials, and produced a broad variety of personal ornaments. It is tempting to suggest that the dominance of white, red, and green personal ornaments portrays them as optimistic folks.

Bibliography

Alarashi 2014
Hala Alarashi. *The Epipalaeolithic and Neolithic Personal Adornments from Syria (12th–7th Millennium BC). Techniques and Uses, Exchanges and Identities*. Lyon: University of Lumière-Lyon 2, 2014.

Alon and Levy 1990
David Alon and Thomas Evan Levy. "The Gilat Sanctuary: Its Centrality and Influence in the Southern Levant during the Late 5th to Early 4th Millennium B.C.E". *Eretz-Israel* 21 (1990), 23–36.

Amiran 1978
Ruth Amiran. *Early Arad*. Jerusalem: Israel Exploration Society, 1978.

Andrews 1990
Carol Andrews. *Ancient Egyptian Jewellery*. London: British Museum Press, 1990.

Andrews 1994
Carol Andrews. *Amulets of Ancient Egypt*. Austin: University of Texas Press, 1994.

Arad-Ayalon n.d.
Noga Arad-Ayalon. *Report on the nawamis*. Report on File. Jerusalem: Israel Antiquities Authority, n.d.

Artin 2010
Gassia Artin. "The Necropolis and Dwelling of Byblos during the Chalcolithic Period. New Interpretation". *Near Eastern Archaeology* 73 (2010), 74–84.

Aston, Harrell James, and Shaw 2000
Barbara G. Aston, A. Harrell James, and Ian Shaw. "Stones". In *Ancient Egyptian Materials and Technology*. Ed. by P. T. Nicholson and I. Shaw. Cambridge and New York: Cambridge University Press, 2000, 5–77.

Baines 1985
John Baines. "Color Terminology and Color Classification. Ancient Egyptian Color Terminology and Polychromy". *American Anthropologist* 87 (1985), 282–297.

Bar-Adon 1980
Pessah Bar-Adon. *The Cave of the Treasure. The Finds from the Caves in Nahal Mishmar*. Jerusalem: Israel Exploration Society, 1980.

D. E. Bar-Yosef 1991
Daniella E. Bar-Yosef. "Changes in the Selection of Marine Shells during the Transition from the Natufian to the Neolithic". In *The Natufian Culture in the Levant*. Ed. by F. Valla and O. Bar-Yosef. International Monographs in Prehistory. Ann Arbor: Berghahn Books, 1991, 629–636.

O. Bar-Yosef and Alon 1988
Ofer Bar-Yosef and David Alon. "Nahal Hemar Cave. The Excavations". *Atiqot* 18 (1988), 1–30.

O. Bar-Yosef, Belfer-Cohen, et al. 1986
Ofer Bar-Yosef, Anna Belfer-Cohen, Avner Goren, Israel Hershkovitz, Ornit Ilan, Henk K. Mienis, and Benjamin Sass. "Nawamis and Habitation Sites near Gebel Gunna, Southern Sinai". *Israel Exploration Journal* 36.3–4 (1986), 121–167.

O. Bar-Yosef, Belfer, et al. 1977
Ofer Bar-Yosef, Anna Belfer, Avner Goren, and Patricia Smith. "The *nawamis* near 'Ein Huderah (Eastern Sinai)". *Israel Exploration Journal* 27.2–3 (1977), 65–88.

Bar-Yosef Mayer 1999
Daniella E. Bar-Yosef Mayer. *The Role of Shells in the Reconstruction of Socio-Economic Aspects of Neolithic Through Early Bronze Age Societies in Southern Sinai*. Ph.D. Dissertation. Jerusalem: Hebrew University of Jerusalem, 1999.

Bar-Yosef Mayer 2002a
Daniella E. Bar-Yosef Mayer. "Egyptian-Canaanite Interaction during the Fourth and Third Millennia BC. The Shell Connection". In *Egypt and the Levant. Interrelations from the 4th through the Early 3rd Millennium BCE*. Ed. by E. C. M. van den Brink and Th. E. Levy. London: Leicester University Press, 2002, 129–135.

Bar-Yosef Mayer 2002b
Daniella E. Bar-Yosef Mayer. "The Shells of the Nawamis in Southern Sinai". In *Archaeozoology of the Near East V*. Ed. by H. Buitenhuis, A. M. Choyke, M. Mashkour, and A. H. Al-Shiyab. ARC-Publicaties 62. Groningen: ARC, 2002, 166–180.

Bar-Yosef Mayer 2006
Daniella E. Bar-Yosef Mayer. "Marine and Riverine Shells at Gilat". In *Archaeology, Anthropology and Cult. The Sanctuary at Gilat, Israel*. Ed. by Th. E. Levy. London: Equinox, 2006, 320–326.

Bar-Yosef Mayer 2013
Daniella E. Bar-Yosef Mayer. "Towards a Typology of Stone Beads in the Neolithic of the Levant". *Journal of Field Archaeology* 38 (2013), 129–142.

Bar-Yosef Mayer 2015
Daniella E. Bar-Yosef Mayer. "Nassarius Shells. Preferred Beads of the Palaeolithic". *Quaternary International* 390 (2015), 79–84.

Bar-Yosef Mayer and Porat 2008
Daniella E. Bar-Yosef Mayer and Naomi Porat. "Green Stone Beads at the Dawn of Agriculture". *Proceedings of the National Academy of Sciences of the USA* 105 (2008), 8548–8551.

Bar-Yosef Mayer and Porat 2010
Daniella E. Bar-Yosef Mayer and Naomi Porat. "Glazed Steatite Paste Beads in the Chalcolithic of the Levant. Long Distance Trade and Manufacturing Processes". In *Techniques and People. Anthropological Perspectives on Technology in the Archaeology of the Proto-Historic and Early Historic Periods in the Southern Levant*. Ed. by S. A. Rosen and V. Roux. Jerusalem: Centre de Recherche Français de Jérusalem, 2010, 111–123.

Bar-Yosef Mayer and Porat 2013
Daniella E. Bar-Yosef Mayer and Naomi Porat. "Beads". In *Peqi'in. A Late Chalcolithic Burial Cave, Upper Galilee, Israel*. Ed. by D. Shalem, Z. Gal, and H. Smithline. Jerusalem: Ostracon and Israel Antiquities Authority, 2013, 337–349.

Bar-Yosef Mayer, Porat, and Davidovich 2014
Daniella E. Bar-Yosef Mayer, Naomi Porat, and Uri Davidovich. "Personal Ornaments at Nahal Mishmar". *Near Eastern Archaeology* 77 (2014), 267–273.

Bar-Yosef Mayer, Porat, Gal, et al. 2004
Daniella E. Bar-Yosef Mayer, Naomi Porat, Zvi Gal, Dina Shalem, and Howard Smithline. "Steatite Beads at Peqi'in. Long Distance Trade and Pyro-Technology during the Chalcolithic of the Levant". *Journal of Archaeological Science* 31 (2004), 493–502.

Baronchelli et al. 2010
Andrea Baronchelli, Tao Gong, Andrea Puglisi, and Vittorio Loreto. "Modeling the Emergence of Universality in Color Naming Patterns". *Proceedings of the National Academy of Science of the USA* 107 (2010), 2403–2407.

Barthélemy de Saizieu 2003
Blanche Barthélemy de Saizieu. *Les parures de Mehrgarh. Perles et pendentifs du Néolithique préceramique a la période Pré-Indus*. Paris: Editions Recherche sur les Civilisations, 2003.

Beck 1928
Horace C. Beck. "Classification and Nomenclature of Beads and Pendants". *Archaeologia* 77 (1928), 1–76.

Berlin and Kay 1969
Brent Berlin and Paul Kay. *Basic Color Terms. Their Universality and Evolution*. Berkeley: University of California Press, 1969.

Boric 2002
Dusan Boric. "Apotropaism and the Temporality of Colours. Colourful Mesolithic-Neolithic Seasons in the Danube Gorges". In *Colouring the Past. The Significance of Colour in Archaeological Research*. Ed. by A. Jones and G. MacGregor. Oxford and New York: Berg, 2002, 23–42.

van den Brink et al. 2004
Edwin C. M. van den Brink, Liora K. Horwitz, Hamoudi Khalaily, Nili Liphschitz, Henk K. Mienis, and Yossi Nagar. "A Chalcolithic Dwelling and Burial Cave at Horvat Castra". *Israel Exploration Journal* 54 (2004), 129–153.

Casanova 1999
Michèle Casanova. "Le lapis-lazuli dans l'Orient ancien". In *Cornaline et pierres précieuses. La Méditerranée, de l'Antiquité à l'Islam*. Ed. by A. Caubet. Paris: La Documentation Française, 1999, 189–210.

DeBoer 2005
Warren R. DeBoer. "Colors for a North American Past". *World Archaeology* 37 (2005), 66–91.

Dothan 1959
Moshe Dothan. "Excavations at Horvat Beter (Beersheba)". *Atiqot* 2 (1959), 1–71.

Fabiano, Berna, and Borzatti von Löwenstern 2004
Marzia Fabiano, Francesco Berna, and Edoardo Borzatti von Löwenstern. "Pre-Pottery Neolithic Amazonite Beads-Workshops in Southern Jordan". In *Acts of the XIVth World Congress of the Union of Prehistoric and Protohistoric Sciences (UISPP), Liege (Belgium), 2nd–8th September 2001*. British Archaeological Reports, International Series 1313. Oxford: Archaeopress, 2004, 265–275.

Gage 1999
John Gage. "What Meaning had Colour in Early Societies?" *Cambridge Archaeological Journal* 9 (1999), 109–126.

Garfinkel, Ben-Shlomo, and Kuperman 2009
Yosef Garfinkel, David Ben-Shlomo, and Tali Kuperman. "Large-scale Storage of Grain Surplus in the Sixth Millennium BC: The Silos of Tel Tsaf". *Antiquity* 83 (2009), 309–325.

Gaydarska and Chapman 2008
Bisserka Gaydarska and John Chapman. "The Aesthetics of Colour and Brilliance – Or Why Were Prehistoric Persons Interested in Rocks, Minerals, Clays and Pigments?" In *Geoarchaeology and Archaeomineralogy: Proceedings of the International Conference, 29–30 October 2008, Sofia*. Ed. by R. I. Kostov, B. Gaydarska, and M. Gurova. Sofia: St. Ivan Rilski, 2008, 63–66.

Gilead 1995
Isaac Gilead. *Grar: A Chalcolithic Site in the Northern Negev*. Beer Sheva: Ben Gurion University of the Negev Press, 1995.

Gopher and Tsuk 1996
Avi Gopher and Tsvika Tsuk. *The Nahal Qanah Cave. Earliest Gold in the Southern Levant*. Tel Aviv: Institute of Archaeology of Tel Aviv University, 1996.

Goren 1993
Orna Goren. "Jewelry of Bedouin Women in the Negev and Sinai". *Israel Am ve-Erets, Yearbook of Erets-Yisrael Museum Tel Aviv* 25/26 (1993), 291–300.

Groman-Yaroslavski and Bar-Yosef Mayer 2015
Iris Groman-Yaroslavski and Daniella E. Bar-Yosef Mayer. "Lapidary Technology Revealed by Functional Analysis of Carnelian Beads from the Early Neolithic Site of Nahal Hemar Cave, Southern Levant". *Journal of Archaeological Science* 58 (2015), 77–88.

Gross 1977
Shulamit Gross. *The Mineralogy of the Hatrurim Formation*. Bulletin (Makhon ha-ge'ologi (Israel)) 70. Jerusalem: Geological Survey of Israel, 1977.

Hovers et al. 2003
Erella Hovers, Shimon Ilani, Ofer Bar-Yosef, and Bernard Vandermeersch. "An Early Case of Color Symbolism. Ochre Use by Modern Humans in Qafzeh Cave". *Current Anthropology* 44 (2003), 491–552.

Jackson 1917
John W. Jackson. *Shells as Evidence of the Migration of Early Culture*. London: Longmans, Green & Co., 1917.

Jones and MacGregor 2002
Andrew Jones and Gavin MacGregor. *Colouring the Past. The Significance of Colour in Archaeological Research*. Oxford: Berg, 2002.

Kay and McDaniel 1978
Paul Kay and Chad K. McDaniel. "The Linguistic Significance of the Meanings of Basic Color Terms". *Language* 54 (1978), 610–646.

Kenoyer 1991
Jonathan M. Kenoyer. "Ornament Styles of the Indus Valley Tradition. Evidence from Recent Excavations at Harappa, Pakistan". *Paléorient* 17 (1991), 79–98.

Kenoyer, Vidale, and Bhan 1991
Jonathan M. Kenoyer, Massimo Vidale, and Kuldeep K. Bhan. "Contemporary Stone Bead Making in Khambhat, India. Patterns of Craft Specialization and Organization of Production as Reflected in the Archaeological Record". *World Archaeology* 23 (1991), 44–63.

Kerner 2010
Susanne Kerner. "Craft Specialization and Its Relation with Social Organisation in the Late 6th to Early 4th Millnnium BCE of the Southern Levant". *Paléorient* 36.1 (2010), 179–198.

Kingery, Vandiver, and Prickett 1988
W. David Kingery, Pamela B. Vandiver, and Martha Prickett. "The Beginnings of Pyrotechnology. Part II. Production and Use of Lime and Gypsum Plaster in the Pre-Pottery Neolithic Near East". *Journal of Field Archaeology* 15 (1988), 219–244.

Kwok et al. 2011
Veronica Kwok, Zhendong Niu, Paul Kay, Ke Zhou, Lei Mo, Zhen Jin, Kwok-Fai So, and Li Hai Tan. "Learning New Color Names Produces Rapid Increase in Gray Matter in the Intact Adult Human Cortex". *Proceedings of the National Academy of Sciences of the United States of America* 108 (2011), 6686–6688.

Lee 1973
John Robert Lee. "Chalcolithic Ghassul: New Aspects and Master Typology". Unpublished Ph.D. Dissertation, Hebrew University of Jerusalem. 1973.

Levy 1987
Thomas E. Levy. *Shiqmim I. Studies Concerning Chalcolithic Societies in the Northern Negev Desert, Israel (1982–1984)*. British Archaeological Reports, International Series 356. Oxford: Archaeopress, 1987.

Levy 1998
Thomas E. Levy. "Cult, Metallurgy and Rank Societies. Chalcolithic Period (ca. 4500–3500 BCE)". In *The Archaeology of Society in the Holy Land*. London: Leicester University Press, 1998, 226–244.

Levy and Alon 1992
Thomas E. Levy and David Alon. "A Corpus of Ivories from Shiqmim". *Eretz-Israel* 23 (1992), 65–71.

Lindsey and Brown 2009
Delwin T. Lindsey and Angela M. Brown. "World Color Survey Color Naming Reveals Universal Motifs and Their Within-Language Diversity". *Proceedings of the National Academy of Science of the USA* 106 (2009), 19785–19790.

Ludvik et al. 2015
Geoffrey Ludvik, J. Mark Kenoyer, Magda Pieniążek, and William Aylward. "New Perspectives on Stone Bead Technology at Bronze Age Troy". *Anatolian Studies* 65 (2015), 1–18.

Luik 2007
Heidi Luik. "Dazzling White. Bone Artefacts in Bronze Age Society – Some Preliminary Thoughts from Estonia". In *Colours of Archaeology. Material Culture and Society. Papers from the Second Theoretical Seminar of the Baltic Archaeologists (BASE) Held at the University of Vilnius, Lithuania, October 21–22, 2005*. Ed. by A. Merkevičius. Interarchaeologia 2. Vilnius, 2007, 49–64.

Mallon, Koeppel, and Neuville 1934
A. Mallon, Robert Koeppel, and Rene Neuville. *Teleilat Ghassul I*. Rome: Institut Biblique Pontifical, 1934.

McBrearty and Brooks 2000
Sally McBrearty and Alison S. Brooks. "The Revolution That Wasn't. A New Interpretation of the Origin of Modern Human Behavior". *Journal of Human Evolution* 39 (2000), 453–563.

Mehta and Zhu 2009
Ravi Mehta and Rui Zhu. "Blue or Red? Exploring the Effect of Color on Cognitive Task Performances". *Science Express* 5 (2009), 1–5.

Meisch 1998
Lynn A. Meisch. "Why Do They Like Red? Beads, Ethnicity and Gender in Ecuador". In *Beads and Bead Makers*. Ed. by L. D. Sciama and J. B. Eicher. Oxford: Berg, 1998, 147–176.

Mershen 1989
Birgit Mershen. "Amulets and Jewelry from Jordan – A Study on the Function and Meaning of Recent Bead Necklaces". *Tribus* 38 (1989), 43–58.

Milevski 2013
Ivanir Milevski. "The Transition from the Chalcolithic to the Early Bronze Age of the Southern Levant in Socio-Economic Context". *Paléorient* 39.1 (2013), 193–208.

Moorey 1994
Peter Roger S. Moorey. *Ancient Mesopotamian Materials and Industries. The Archaeological Evidence*. Oxford: Clarendon Press, 1994.

D. Morris 2003
Desmond Morris. *Body Guards. Protective Amulets & Charms*. Ben Shemen: Modan, 2003.

J. Morris and Preston-Whyte 1994
Jean Morris and Eleanor Preston-Whyte. *Speaking with Beads. Zulu Arts from Southern Africa*. London and New York: Thames and Hudson, 1994.

Ogden 2000
Jack Ogden. "Metals". In *Ancient Egyptian Materials and Technology*. Ed. by P. T. Nicholson and I. Shaw. Cambridge and New York: Cambridge University Press, 2000, 148–176.

Paine 2004
Sheila Paine. *Amulets. A World of Secret Powers, Charms and Magic*. London: Thames and Hudson, 2004.

Perrot 1955
Jean Perrot. "Excavations at Tell Abu Matar, near Beersheba". *Israel Exploration Journal* 5 (1955), 73–84, 167–189.

Perrot and Ladiray 1980
Jean Perrot and Daniel Ladiray. *Tombes à ossuaires de la région cotière Palestinienne au IVe millénaire avant l'ère chrétienne*. Paris: Association Paléorient, 1980.

Peschaux et al. 2017
Caroline Peschaux, Grégory Debout, Olivier Bignon-Lau, and Pierre Bodu. "Magdalenian "Beadwork Time" in the Paris Basin (France). Correlation Between Personal Ornaments and the Function of Archaeological Sites". In *Not Just for Show. The Archaeology of Beads, Beadwork and Personal Ornaments*. Ed. by D. E. Bar-Yosef Mayer, C. Bonsall, and A. M. Choyke. Oxford: Oxbow Books, 2017, 19–38.

Petrie and Quibell 1896
W. M. Flinders Petrie and James E. Quibell. *Naqada and Ballas*. London: Bernard Quartich, 1896.

Poulin and Helwig 2016
Jennifer Poulin and Kate Helwig. "The Characterisation of Amber from Deposit Sites in Western and Northern Canada". *Journal of Archaeological Science, Reports* 7 (2016), 155–168.

Prag 1986
Kay Prag. "Byblos and Egypt in the Fourth Millennium BC". *Levant* 18 (1986), 59–74.

Rapp 2002
George Rapp. *Archaeomineralogy*. New York: Springer, 2002.

Rehren et al. 2013
Thilo Rehren, Tamás Belgya, Albert Jambon, György Káli, Zsolt Kasztovszky, Zoltán Kis, Imre Kovács, Boglárka Maróti, Marcos Martinón-Torres, Gianluca Miniaci, Vincent C. Pigott, Miljana Radivojević, László Rosta, László Szentmiklósi, and Zoltán Szőkefalvi-Nagy. "5000 Years Old Egyptian Iron Beads Made from Hammered Meteoritic Iron". *Journal of Archaeological Science* 40 (2013), 4785–4792.

Rosen, Avni, and Bar-Yosef Mayer 2011
Steven A. Rosen, Yoav Avni, and Daniella E. Bar-Yosef Mayer. "Shells, Beads, and Other Artifacts". In *An Investigation into Early Desert Pastoralism. Excavations at the Camel Site, Negev*. Ed. by S. A. Rosen. Los Angeles: Cotsen Institute of Archaeology Press, 2011, 147–154.

Rowan and Golden 2009
Yorke M. Rowan and Jonathan Golden. "The Chalcolithic Period of the Southern Levant. A Synthetic Review". *Journal of World Prehistory* 22 (2009), 1–92.

Rowan, Levy, et al. 2006
Yorke M. Rowan, Thomas E. Levy, David Alon, and Yuval Goren. "Gilat's Ground Stone Assemblage. Stone Fenestrated Stands, Bowls, Palettes and Related Artifacts". In *Archaeology, Anthropology and Cult. The Sanctuary at Gilat*. Ed. by T. E. Levy. London: Equinox, 2006, 575–684.

Sadvari et al. 2015
Joshua W. Sadvari, Michael Charles, Christopher B. Ruff, Tristan Carter, Milena Vasić, Clark S. Larsen, Daniella E. Bar-Yosef Mayer, and Chris Doherty. "The People and Their Landscape(s) Changing Mobility Patterns at Neolithic Çatalhöyük". In *Assembling Çatalhöyük*. Ed. by I. Hodder and A. Marciniak. Leeds: Maney Publishing, 2015, 59–74.

Saunders 2000
Barbara Saunders. "Revisiting Basic Color Terms". *Journal of the Royal Anthropological Institute* 6 (2000), 1–99.

Shaw and Jameson 1993
Ian Shaw and Robert Jameson. "Amethyst Mining in the Eastern Desert. A Preliminary Survey at Wadi El-Hudi". *Journal of Egyptian Archaeology* 79 (1993), 81–97.

Silvain n.d.
Marion Silvain. "A Technological Study of Ornaments from the First Half of the 5th Millennium B.C. in Southern Levant: Tel Tsaf Stone Beads and Pendants". Tel Tsaf Archives, n.d.

Texier et al. 2010
Pierre-Jean Texier, Guillaume Porraz, John Parkington, Jean-Philippe Rigaud, Cedric Poggenpoel, Christopher Miller, Chantal Tribolo, Caroline Cartwright, Aude Coudenneau, Richard Klein, Teresa Steele, and Christine Verna. "A Howiesons Poort Tradition of Engraving Ostrich Eggshell Containers Dated to 60 000 Years Ago at Diepkloof Rock Shelter, South Africa". *Proceedings of the National Academy of Science* 107 (2010), 6180–6185.

Ussishkin 1980
David Ussishkin. "The Ghassulian Shrine at En-Gedi". *Tel-Aviv* 7 (1980), 1–44.

Varberg, Gratuze, and Kaul 2015
Jeanette Varberg, Bernard Gratuze, and Flemming Kaul. "Between Egypt, Mesopotamia and Scandinavia. Late Bronze Age Glass Beads Found in Denmark". *Journal of Archaeological Science* 54 (2015), 168–181.

Wickler and Seibt 1995
Wolfgang Wickler and Uta Seibt. "Syntax and Semantics in a Zulu Bead Colour Communication System". *Anthropos* 90 (1995), 391–405.

Wierzbicka 2008
Anna Wierzbicka. "Why There Are No 'Colour Universals' in Language and Thought". *Journal of the Royal Anthropological Institute* 14 (2008), 407–425.

Wright and Garrard 2003
Katherine Wright and Andrew N. Garrard. "Social Identities and the Expansion of Stone Bead-Making in Neolithic Western Asia. New Evidence from Jordan". *Antiquity* 77 (2003), 267–284.

Yellin and Garfinkel 1986
Joseph Yellin and Yosef Garfinkel. "The Source of Archaeological Obsidian from a Pre-Pottery Neolithic B Site at Yiftahel, Israel". *Paléorient* 12 (1986), 99–104.

Illustration and table credits

ILLUSTRATIONS: 1 D. Bar-Yosef Mayer. 2 After Bar-Yosef Mayer and Porat 2013. Courtesy of Israel Antiquities Authority. **TABLES:** 1 D. Bar-Yosef Mayer. Sources: Artin 2010; Alon and Levy 1990; Amiran 1978; Arad-Ayalon n.d. Bar-Adon 1980; O. Bar-Yosef, Belfer, et al. 1977; O. Bar-Yosef, Belfer-Cohen, et al. 1986; Bar-Yosef Mayer 2002b (Kissufim); Bar-Yosef Mayer and Porat 2013; Dothan 1959; Garfinkel, Ben-Shlomo, and Kuperman 2009; Gilead 1995; Gopher and Tsuk 1996, 128–129; Lee 1973; Levy 1987; Mallon, Koeppel, and Neuville 1934; Perrot 1955; Perrot and Ladiray 1980; Rowan, Levy, et al. 2006; Silvain n.d. unpublished; Ussishkin 1980; van den Brink et al. 2004.

DANIELLA E. BAR-YOSEF MAYER

Daniella E. Bar-Yosef Mayer (Ph.D. 2000, Hebrew University of Jerusalem) is a zooarchaeologist specialising in molluscs from archaeological sites. She is collections manager for palaeontology and archaeomalacolgy at The Steinhardt Museum of Natural History at Tel-Aviv University. She published more than a hundred papers on mollusc shells and stone beads from archaeological sites as tools for studying past symbolic behaviour and past economies.

Dr. Daniella E. Bar-Yosef Mayer
The Steinhardt Museum of Natural History
Tel Aviv University
Tel Aviv 69978, Israel
E-Mail: baryosef@tauex.tau.ac.il

Gonca Dardeniz

Significance of Colour in the Second Millennium BC: The Perception and Use of Glass at the Centre and Periphery of the Hittites

Summary

This paper is an attempt to understand the perception of colour of glass in the second millennium BC by providing specific examples from the capital of Hittites, Boğazköy/Hattuša (Çorum, Turkey) in Central Anatolia, and from the North Syrian Tell Atchana/Alalakh (Hatay, Turkey), which served as a vassal to the Hittites in the Late Bronze Age. By discussing both archaeological and linguistic evidence from these two case sites, the perception of colour in glass and value of certain types of colours at the center and periphery of the Hittite Empire are discussed.

Keywords: colour; glass; second millennium BC; Anatolia; Boğazköy/Hattuša; Tell Atchana/Alalakh

In diesem Artikel wird versucht, die Wahrnehmung der Farbe von Glas im zweiten Jahrtausend v. Chr. zu verstehen, und zwar anhand konkreter Beispiele aus der Hauptstadt der Hethiter, Boğazköy/Hattuša (Çorum, Türkei) in Zentralanatolien und aus dem nordsyrischen Tell Atchana/Alalakh (Hatay, Türkei), Vasall der Hethiter in der späten Bronzezeit. Anhand archäologischer und linguistischer Belege aus diesen beiden Fallbeispielen werden die Wahrnehmung von Farbe in Glas sowie der Wert bestimmter Arten von Farbe im Zentrum und an der Peripherie des hethitischen Reiches diskutiert.

Keywords: Farbe; Glas; zweites Jahrtausend BC; Anatolien; Boğazköy/Hattuša; Tell Atchana/Alalakh

I would like to thank David Warburton and Shiyanthi Thavapalan for the organisation of the *Economic Aspects of Colours in Antiquity* conference and all the participants for the stimulating discussions on various perspectives of colour research. I would like to also thank Professor Belkıs Dinçol for her invaluable input and inspiring dialogues on the glass of the Hittites. I owe deep gratitude to Dr. Hasan Peker who read and commented on this manuscript, as well

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

as drew my attention to various specific aspects of the Hittite language and chronology. I am grateful to Professor Tayfun Yıldırım who allowed me to work on this manuscript during excavation season in the Resuloğlu excavation house, Çorum (Turkey).

1 Introduction

Colour is a physical property of materials encapsulating both practical and symbolic meaning.[1] In the second millennium BC, colour was used to distinguish between natural and artificial,[2] sacred and profane, genuine and impure. Colour served as a means of measuring and estimating the quality and thus the value of materials. Drawing on archaeological and written evidence from the capital of the Hittite Empire, Hattuša (today Boğazkale in Çorum province of Turkey), and the capital of a vassal state of that empire on the northern Syrian periphery, Alalakh (today Tell Atchana in Hatay province of Turkey), I analyse the evidence of the colours of glass in the second millennium BC in terms of linguistic, conceptual, material and economic aspects.

The Hittites established an empire with Hattuša as its capital around 1650 BC, ruling central Anatolia as well until ca. the beginning of 12th century BC, and expanding into the northern Levant and northern Mesopotamia from ca. 14th century BC.[3] They used colours to designate precious materials, especially the properties of metals and stones, which were attributes of prestige and status in Hittite society.[4]

2 Lexicographical evidence

The Hittites wrote their own language using cuneiform signs and a combination of Sumerian logograms and Akkadian syllables. Hittite scribes usually wrote the words we interpret as names for colours and the related materials with Sumerian word signs (small caps) or phonetically written Akkadian words (italics).

However, the Hittites also had their own words. In the Hittite language, *ḫarki* means 'white, bright',[5] but it was usually written with the Sumerian word sign BABBAR. The

1 The abbreviations used here follow those listed in CDLI.
2 Beretta 2009.
3 For the chronology of the Hittites, a calibrated middle chronology is followed (Peker 2009; Peker 2013).
4 Finley 1999, 27.
5 Puhvel 1991, 169.

term KÙ.BABBAR means 'silver', literally 'white/pure metal'.[6] This connection between the colour white and silver might have been due to the natural hue of the metal, but was more probably stimulated by the idea of 'brightness' and/or shine of the substance, since colour is perceived as consisting of hue, brightness and saturation.[7] However, one must distinguish between origins – when the Sumerian word might have meant more 'bright' than 'white' – and second millennium BC usage, when the word certainly meant 'white', and thus the Hittite word probably designated the hue we recognise, while the nuance of 'bright' was certainly also preserved in the Sumerian.

2.1 Stones

Colour is a distinctive visual quality of gemstones. Lapis lazuli, rock crystal, blue stone – referred as coming from the *Takniịara Mountain* – were listed in a ritual text for constructions.[8] In the inventory lists, which include metals, wools and textiles, furniture to clothing, accessories, semi-precious stones, and jewellery, chests decorated with blue stones and Egyptian style[9] gold,[10] handles decorated with "Babylon stone",[11] and various objects such as birds and sphinx figures, jewellery made of gold and blue stone were listed.[12] The use of diverse media – in objects composed of several metals, precious and semi-precious stones – amplified the effect of colour. David Warburton suggests that not only the materials but also the combinations are important; the use of lapis lazuli with gold stimulates a different perception than lapis lazuli with silver.[13] The detailed definitions of artefacts and explanations of materials in Hittite inventory lists support this argument.

Carnelian, Babylonian stone, *dušû*-stone, marble, *parašḫa*-stone (from ancient Marḫaši, perhaps modern Halil-rud in Iran[14]), *lulluri*-stone, *ku(wa)nnan*-stone are also cited as precious materials in many archival resources.[15] Among these words for precious and semi-precious stones, *ku(wa)nnan* is well worth noting since the Linear B Mycenaean word *ku-wa-no* (text PY TA 714) was used for blue coloured glass.[16] In the Hittite language *ku(wa)nnan* is used for dark blue coloured materials and jewellery, especially beads made out of azurite which is also blue coloured.[17] Akkadian *uqnû* (whence came the Hittite *ku*[*wa*]*nnan*) meant lapis lazuli, as did the Sumerian ZA.GÌN also used by the Hittites.

6 This construction is similar to the ancient Egyptian language; see Scheel 1989, 17, and also the chapter by Schenkel and the introduction in this volume.
7 Jameson, Highnote, and Wasserman 2001.
8 Savaş 2006, *KBo* IV: 1 obv. I.
9 'Egyptian style' might refer to gold imported from Egypt; or it might designate gold with copper, which has a reddish colour.
10 *KUB* XII: 1 rev. 1–44.
11 *KUB* XLII: 78 obv. II 3–26.
12 Košak 1978.
13 Warburton 2007.
14 Steinkeller 1982; Steinkeller 2006.
15 Baltacığlu 2006; Dönmez 2013; Savaş 2006; Siegelová 1984; Ünal 2003. Examples of records could be found in *KBo* XXVI: 105 obv. IV 17–19 and *KBo* XV: obv. I 8–9.
16 Oppenheim 1970, n. 14.
17 Çınardalı-Karaaslan 2013; Ünal 2003.

2.2 Metals

Colour words are also used to differentiate between different qualities of the same material. For instance, GUŠKIN is the logogram for gold; GUŠKIN *qadu* URUDU was used to describe a reddish gold, literally 'gold with copper,' while GUŠKIN SIG_5 *qadu* and/or GUŠKIN SIG_5 *qadu* URUDU defined 'fine (quality) gold with copper.' Similarly, AN.BAR GE_6 was 'black/dark iron' – often understood as meteoric iron – though it could well be pig iron which is a blackish coloured and low quality intermediate product of iron production. AN.BAR BABBAR might describe 'white iron,'[18] or it might be 'shining/bright iron,' and AN.BAR SIG_5 is 'good iron' signifying the differences in the quality of iron.

These examples demonstrate that the use of words which we translate as 'white,' 'black,' and 'red' were not solely indicative of the visual appearance of these materials but also took account of their type, composition and quality in relation to the colours (in the sense of hue) to a considerable extent.

2.3 Textiles

However, this link with the precious materials was both broken and transformed with colours of textiles, where the colour of the precious material was preserved – but the material itself absent, the colour being reproduced by yet other materials (some expensive, some not, see the chapter by Quillien in this volume). Here, we are certainly coming to real designations of colours. As among other peoples of the Levant and Western Asia, colours themselves were associated with prestige and signs of high status among the Hittites. Textiles dyed red (SA_5) and blue (ZA.GÌN, a word for lapis lazuli) were favoured and are thus frequent in the textual records, where we encounter Sumerian, Akkadian, and Hittite words. Red robes and blue vests were registered in several inventory lists.[19] An Akkadian word designating some type of green (*ḫaṣartu*, also written with the Sumerogram SIG_7 [SIG_7], which is the usual writing for 'green,' equivalent to Akkadian *warqu*), the Akkadian for purple *(ḫašmānu)*, a version of an Egyptian loanword *(ḥsmn)* for amethyst, and the Sumerian for white (BABBAR) were used to describe coloured textiles and garments, which were among the most highly valued commodities recorded on cuneiform tablets.[20] In magical activities red, blue, black, white, and yellow[21] coloured wools were

18 Košak 1982.

19 Košak 1978; Košak 1982, 4–154.

20 This article follows the translation given in Košak 1982. She noted that the words for colours were agreed upon except for *ḫašmānu*, which was translated as "blue-green" (CAD Ḫ: 142), "bläulich". (von Soden 1985), and "(blue) purple, dark green" by Goetze 1956 (Košak 1982, 201). Dietrich and Loretz 1966 and Ünal 2007 also favoured the translation "blue-green, purple". Landsberger rejected this and translated the phrase *ḫašmāni ša tâmti* as "rotpurpur" and *hazartum* A.AB.BA as "blaupurpur" Landsberger 1967.

21 *Hahli-*; *hahhaluwant-*, *hahliwant-*, *hahlawant-*, "yellow, green" see Puhvel 1991, 3–4. This corresponds to the ambiguity of Akkadian *warqu*, which can be 'yellow'

specifically mentioned for exclusive use during the practices.[22] In purification rituals white, red, yellow, and green strings (mostly made out of wool) are known from literature such as the Ašhella ritual.[23]

2.4 Glass

Various permutations of Sumerian and Akkadian words for lapis lazuli were also used to designate glass, and the colour blue. As the textual records imply, coloured stones were regarded as valuable materials. Because of their rarity, striking colour and texture, the gemstones were considered prestigious symbols; as luxury goods, they were exclusively available to the elite. These stones with the desired colours could, however, be imitated in synthetic media, where glass served as an excellent candidate.

Intended to mimic gemstones, glass of the second millennium BC cannot be appreciated without considering the colour value of the artefacts. With the emergence of the glass industry, a new stage in technology – tightly associated with the colour palette of this new material – was established. Easily available raw materials, namely silica, soda, and lime, were transformed into a colourful and bright material with the addition of metal oxides; this required specialised craftsmanship as well as very special technological knowledge. Glass in the molten state could be shaped, reshaped, and moulded into objects of desire.[24] Aside from the variety of its colours, the shine and transparency of glass allowed it to compete in value with gemstones. Furthermore, through the process of working and shaping glass, several favourite colours could be applied to the same object, amplifying the visual attractiveness of the final product.

3 Early glass production

The deliberate production of glass was doubtless preceded by unconscious experimenting or practicing with what would become glass; this must have started long before 1500 BC.[25] According to archaeological records, glass as a material made its earliest appearance in history — most probably — at the beginning of the third millennium BC somewhere in Mesopotamia. Its intentional production and widespread use started in the second part of the second millennium BC.[26]

The total number of glass objects that can be dated to much earlier than the mid-second millennium BC is very limited and includes beads but no vessels. The earliest

or 'green'.
22 Ünal 2003, 31.
23 Dinçol 1985.
24 Beretta 2009.
25 Beck 1934; Lucas and Harris 1962, 464–465; Barag 1970; Barag 1985; Henderson 2013.
26 D. Oates, J. Oates, and McDonald 1997; Oppenheim 1970; Barag 1985.

glass beads are allegedly from northern Mesopotamia, from level 4 of Nineveh Great Pit MM;[27] however, there is some doubt about their dates.[28] Thus another bead from the Amuq Plain site of Tell Judaidah (phase G), attributed to the early third millennium BC is probably the oldest known.[29] Tantalizing are what appear to be waster droplets of glass from Nippur in southern Mesopotamia and Tell Brak in northern Mesopotamia dating to the Akkadian period or earlier (early second half of third millennium BC),[30] but these could be derived from other pyrotechnological processes. From the late third millennium is a lump of raw blue glass recovered at ancient Eridu (Tell Abu Shahrein) in modern Iraq.[31] Yet most of these isolated finds are probably not real products of intentional production; but rather, more probably by-products of over firing in glaze working.[32]

In western Anatolia, three small glass spheres and a glass bead were found in Troy IIg (ca. 24th – 23th centuries BC), although the contexts from these early excavations are not secure.[33] In the Middle Bronze Age, central Anatolian sites Büyükkale IVd[34] and Alişar Stratum II[35] yielded glass beads. At Alalakh Level VII (ca. 1650?–1600 BC), polychrome glass beads were reported, though again, the stratigraphy is under debate.[36]

Given all of the doubts about the earliest traces of glass (due to uncertainty about the manufacturing process and/or the chronology), at the moment it would appear that the earliest known deliberately manufactured glass bead is that from Tell Judeidah, dating to the first half of the third millennium BC, and it is followed by the other Anatolian and northern Syrian/southern Anatolian pieces just mentioned. This could mean that Anatolia was a centre (if not the centre) of continuous glass working during the earliest period of experimentation.

The earliest evidence for glass vessels and figurines, which are accepted as an aspect of established glass production, first appears towards the end of the Middle Bronze Age (ca. 1600? BC). Therefore, real glassmaking is considered to have begun in the second part of the second millennium BC. The first attempts at the production of this colourful material seem to have been initiated in Western Asia (including south-eastern Anatolia), with not only blue and green, but also turquoise, yellow, white, red, and lavender.[37] The earliest polychrome glass vessel fragment (AT/39/225), which is transparent blue

27 Beck 1933, 180–181, pl. LXXIX, 25–26.

28 Beck reported two glass beads: one is pale blue and the other one is green. However, the exact dating of the archaeological context is not clear (Moorey 1994, 190).

29 This bead is pale yellow-green (R. Braidwood and L. Braidwood 1960, 341). Shortland described the bead from Tell Judaidah as “the most reliably dated early glass bead” (Shortland 2012, 44). Although there are grounds for doubting the exact date, it does almost certainly belong to the first half of the third millennium.

30 D. Oates 2001, 217, 220.

31 Hall 1930, 213; Barag 1985, no. 179; Henderson 1997.

32 Moorey 1994, 192.

33 Schliemann 1884, 478–480.

34 Boehmer 1972, 175, no. 1809.

35 von der Osten 1937, 284–85, fig. 309.

36 Woolley 1955, 269.

37 Dillon 1907, 39; Lucas and Harris 1962, 465.

and decorated with white feather-like designs, was recovered from Alalakh Level VI (ca. 1600–1500 BC), along with a couple of other glass artefacts from the same level such as a green coloured glass disk or roundel inlay (AT/47/59).[38]

4 Glass at Tell Atchana/Alalakh

The following section deals mainly with the glass corpus of Tell Atchana/Alalakh recovered for the greatest part by the first excavator, Sir C. Leonard Woolley (between 1936–1939, and 1946–1949), and briefly touches upon the newly unearthed workshop debris with remnants of glass production. By evaluating the Late Bronze Age glass corpus of the site, the next section aims to frame the value of the colour of glass within the settlement.

Modern Tell Atchana, where the ancient city of Alalakh stood, is located in the Hatay plain of Antioch, today known as the Amuq Valley. Alalakh has primarily been a second millennium BC settlement and after a gap at the end of the 14th century BC, it was re-settled in the Early Iron Age.[39] Alalakh was once the capital of the small Bronze Age state called Mukish. In the Middle Bronze Age, Alalakh was subservient to the kingdom of Yamhad, based at Aleppo. Its allegiance shifted to the Mitanni (perhaps at Level V and Level IV [?]) in the first century of the Late Bronze Age and later to the Hittite Empire (Levels III–0?) in the 14th century BC. The city and its territory are located on an interregional communication route on the border linking Anatolia, the Levant, and inner Syria (and thus leading on to both Mesopotamia and Egypt). As the site had access to the sea via the Orontes River, it was connected to Cyprus and the Aegean.[40]

The geographical setting of the site is advantageous since the surrounding land was arable and the mountainous zones close to the settlement (i.e. Amanus and Taurus Mountains) served as forestry, metal, and stones resources. This situation not only offered tremendous benefits for industrial production activities, but it also served as a pivotal zone in long-distance trade. For second millennium BC interregional trade, access to Anatolia was possible via northern Syria, which made the Amuq Valley a key locale in interregional commerce. Access to crucial raw materials and being part of the long-distance trade networks must have prompted the local production of both luxury and daily items.

The geopolitical location and impact of different cultures created a hybrid material culture woven in colours at the site through the Middle and Late Bronze Ages. The vitreous assemblage, especially the glass of the Late Bronze Age Alalakh has a wide colour-

38 Woolley 1955, 298, 300–301.

39 Yener 2013; Yener, Horrowitz, and Akar [in preparation].

40 Woolley 1955; Yener, Edens, et al. 2000; Yener 2005; Yener 2010.

palette, although mostly dominated by blue. The eyes of the statue of king Idrimi, which was found in a pit in Level Ib but should be attributed to Level IV are made of dark blue glass. Two virtually twin female figurines made of glass and sometimes identified as Ishtar were found at Alalakh: one from Level VI (ca. 1600–1500? BC) and today in the Hatay Archaeology Museum, and the other from Level V (ca. 1500–1450? BC) and today in the British Museum. The Level VI figurine (AT/48/4) recovered from the temple context is recorded as being "blue" by Woolley,[41] but recent investigations at the Hatay Archaeology Museum show that its original colour was closer to turquoise.[42] The identification of the "later", Level V twin figurine (AT/39/106; BM130076) as blue is accurate. Recently, another blue glass figurine excavated by Woolley was added to the corpus of female glass figurines from Alalakh.[43]

Glass artefacts with vibrant colours and decoration first flourished in Level VI and continued through the subsequent phases of Alalakh (Level V–0), yielding blue, turquoise, green, yellow, amber, and white coloured glass vases, beads, amulets, and figurines. Fragments of polychrome glass appeared in Level V. A glass vessel with seed (or drop) pattern decoration (ATP/47/51),[44] and fragments of blue and yellow wave-decorated glass vases (AT/39/76) were also recovered from this level. The graves[45] of Level V are rich in glass goods. Among the most important grave goods of Level V is one of the above-mentioned female 'twins': the blue glass figurine (AT/39/106) of a woman clasping her breasts, recovered from grave (ATG/39/44) along with silver and bronze artefacts.[46] The artefact is heavily weathered, and therefore appears opaque white today, but was indeed originally blue.

In Level IV (ca. 1450–1400? BC), a group of three polychrome glass vessel fragments from room 30 of the Level IV palace were documented as AT/38/181B.[47] Dan Barag also noted these glass vase fragments with the same number, though he referred to them as one body fragment of a beaker.[48] However, when I revisited the fragment in 2014,

41 Woolley 1955, 247, pl. LVIb.

42 An interesting feature of this figurine was documented in 2015. This figurine was known as being of blue glass; however, a possibly fresh break on the back of the figurine, close to the head, shows that the figurine is actually opaque turquoise coloured glass. The confusion in colours might be attributed to its blue-coloured twin (AT/39/106), which was recovered in Level V and became quite popular as a part of the Alalakh selections in the showcases of the British Museum Levantine galleries. Scholars, while referring to the British Museum figurine, confused the levels and documented it as a Level VI artefact, which most probably caused this discrepancy. Woolley also documented the object as blue. This might be due to his confusion of the Level VI and Level V twin figurines in his final publication. The Level VI figurine is in the Hatay Archaeology Museum and he might not have had a chance to revisit the colour of the artefact for the final publication (Woolley 1955, 247).

43 It was found in a grave in Level II but since Woolley documented it loosely as "glass paste", it was generally identified as frit or faience, and thus did not get sufficient attention from glass scholars.

44 Woolley 1955, 297, 298, fig. 74a: 5.

45 ATG/39/44, ATG/39/80, ATG/39/111, AT/46/318 are some of the graves yielded glass artefacts at Alalakh. ATG stands for 'Atchana Grave' in Woolley's recording system.

46 Woolley 1955, 220.

47 Woolley 1955, 126.

48 Barag 1970; Barag 1985, 43, no. 10A.

it was nothing but a lump of vitrified material and it is very hard to claim that it is a piece of a glass vase. Above Room 30 of the Level IV palace, several small fragments of glass sherds belonging to the rim and neck of a core-formed bottle were recovered (AT/38/181).[49] The surviving glass core of the bottle appears light blue or green. The body was decorated with white and yellow flatter or zigzag designs and the rim has blue and white twists.[50] These fragments were first found at a higher level than Level IV and thus Woolley attributed them to Level III (ca. early 14th century BC) but, for an unknown reason, he later attributed all of the fragments back to Level IV. These fragments were mended sometime before 1970 – and most probably during Woolley's time – since Barag recorded the object as mended in 1970.[51] Woolley broadly mentioned having found fragments of glass vases in Room 30 or 31.[52] In Room 31 of the palace, part of a glass bowl with yellow and blue wavy-lined patterns were found (AT/38/176).[53] This fragment belongs to a piece of rim with feather decoration in a darker grey colour.

In Level IV, glass was also among the grave goods. Among many examples, in the inhumation grave ATG/39/35 (containing three bodies), white and blue frit beads were recovered from an infant skull along with a glass fragment and a lapis lazuli ring (AT/39/91).[54]

Level III (ca. early 14th century BC) produced a fair amount of polychrome glass objects. Wavy-line designed glass vase fragments and a white glass vase with an oval inlaid spot (AT/46/144) were recovered from this level. The vitreous beads of Level III were mainly discovered in graves.

In Level II (ca. mid–late 14th century BC?), a white glass vase with an oval spot inlay (AT/46/75) was recovered at this level among many other glass vase fragments. AT/46/22 was found in the 'treasury' of Level II and was a part of the rim of an open bowl, probably ca. 7 cm in diameter.[55] It is blue glass with white and yellow decorations and the rim has a feather decoration in yellow. A similarly fine example decorated with blue- and yellow-coloured comb and meander designs on the opaque white base (AT/39/149) belongs to a fragment from the body of a core-formed vase, though Woolley claimed it as a neck fragment of a bottle.[56] At the temple in Level I, phase A (ca. late 14th century BC) a polychrome glass vessel was found without an AT number.[57]

The existence of such a rich glass corpus at Alalakh and the continuity in the existence of vitreous materials as far as Level 0 signifies a continuous demand for glass at

49 This object is also referred to as AT/38/181A (Woolley 1955, 126; Barag 1985, 42, no. 8).

50 Woolley 1955, 302, 298, fig. 74b: 4.

51 Barag 1970, 151–152.

52 Woolley 1955, 126.

53 Woolley 1955, 126, 300, 298, fig.74b: 2.

54 Woolley 1955, 214.

55 Woolley 1955, 301, 298, fig. 74b: 1.

56 Woolley 1955, 301, 298 and fig. 74b: 5; Barag 1985, 43, no. 9. Barag noted a similar vase from the tomb of Maherpra from Egypt dated to about the 15th century BC; based on typology, he suggested a Mesopotamian origin (Barag 1970, 183, fig. 94).

57 Woolley 1947, 60.

Alalakh. The heavy accumulation of glass objects and fragments in the rooms of the palace and the fact that it was found with other valuable items like precious metals and ivory indicates that glass was possessed and probably highly appreciated by the high ranking of the community. Furthermore, the presence of glass artefacts, especially female figurines, in temple and grave contexts implies that glass must have been ritually and religiously esteemed.

Based on the evidence he had, Woolley proposed that these glass objects represent luxury imports for a royal city.[58] Recent research indicates that all the glass objects were not all imports[59] but the appearance of glass artefacts at Alalakh – first at Level VI and then the rich artefact corpus of Levels V and IV with close parallels to the materials from Nuzi, Tell Brak, and Tell el-Rimah – should be linked to the effects of the political domination of the Mitanni. The Mitanni Empire spread out across northern Mesopotamia after the Hittite conquest of Babylon in 1595 BC, but later fell victim to the Hittites and Assyrians at the end of the 14th century BC. Mitanni-style glass is widely celebrated, and at Alalakh this Mitanni influenced glass tradition persisted through the final phases (Level III–0) of the settlement, when it fell under the political control of the Hittites. Although the city survived the end of Hittite hegemony in the region and glass consumption continued, the city was abandoned only shortly thereafter, at the end of the Late Bronze Age.

The existing evidence indicates that although there are glass artefacts dated to Level VI, the coloured glass consumption accelerated with Late Bronze Age I (ca. 1500–1400 BC) at Alalakh and continued until the end of the settlement. It will be relevant to the discussion here that the new series of excavations under the direction of K. Aslıhan Yener at the site confirms the use of glass at the settlement in Levels III–0.[60]

As noted, Woolley claimed that the glass he found at Alalakh was imported. However, recent excavations at the site have yielded a glass-related multipurpose craft area in strata of the settlement dated to around the 14th century BC. The exact chronological relation of this newly excavated area to the Woolley's contemporary levels (Level III and II) is not yet fully published, but this indicates that at least some of the later glass at Alalakh was locally produced.

The craft area was at the southern part of the mound (Area 4 according to Yener's excavation system) just 300–400 meters away from the palatial and temple area. In this craft area, over a hundred bits of glass vases and beads, pieces of glass ingots, and a crucible fragment were recovered along with a pyrotechnical installation in one of the trenches (Square 64.72). The pyrotechnical installation has a diameter of approximately 80 cm, was made of mud bricks, and was almost oval in shape. It suffered severely, and

58 Woolley 1955, 301.

59 Dardeniz 2016; Dardeniz Forthcoming.

60 Yener 2010; Dardeniz 2016.

had been cut by another architectural (most probably also pyrotechnical) unit indicating continuous production activities at this part of the mound. Though this archaeological evidence makes it impossible at this stage to comment further on the installation and its features, such as the level of vitrification or plastering. It is important to note here that compared to the fully excavated glass kilns of Amarna,[61] the kiln at Tell Atchana is heavily damaged. Thus the artefact corpora in and around the pyrotechnical installation such as the crucible fragment are used to establish a solid backbone when arguing in favour of glass production-related activities in the area.[62] Furthermore, besides beads, the existence of blue- and amber-coloured glass vase fragments points towards to an advanced stage in glass production.

One of the glass ingot fragments, which is blue in colour, was found in the installation. This *in-situ* assemblage is dominated by light, dark blue and turquoise. Glass vase fragments with blue base colours were found decorated with yellow and white, which agrees with the Woolley's artefactual assemblage in terms of colour. Preliminary archaeometric investigations show the colorant for blue and turquoise was copper, yellow was lead and antimony was detected as the opacifier. Furthermore, isotopic investigations (strontium and neodimyum) on an amber-coloured vase fragment hint at a non-Egyptian and non-Mesopotamian origin, supporting the conclusion that the local glass industry at Alalakh may have been a production centre, and not just a processing centre.[63] This recent research at the site shows that blue-, turquoise-, and amber-coloured glass was locally produced here, at least to a certain extent, demonstrating not only consumption, but also production, of glass.

For a couple of centuries, there was continuous production of glass at Alalakh; however, any potential evidence for glass production during periods prior to the early 14th century BC is not (yet) available. The evidence from Levels III–0 as well as the new evidence for glassmaking presented here indicate that even the political hegemony at Alalakh switched from Mitanni to Hittite, the demand for, and use of, blue-, turquoise-, yellow-, and white-coloured glass continued both as household luxury items and grave goods.

61 Nicholson 2007.

62 For a plan of the area and a comparison of Tell Atchana plan with Amarna O.45.1 glassmaking area see Dardeniz 2014, 172, fig. 4; Dardeniz 2017, 149–150; see also Hodgkinson, this volume.

63 Dardeniz 2014; Dardeniz 2016; Dardeniz Forthcoming. The details of the archaeological contexts and archaeometric investigations on the glass corpus of Tell Atchana/Alalakh is a part of my doctoral dissertation entitled *Vitreous Material Crafting in the Second Millennium BC: Glass, Faience and Frit Production at Tell Atchana, ancient Alalakh* with publication rights reserved by the excavation director.

5 Glass at Boğazkale/Hattuša

The rich and colourful array of glass finds at Alalakh – situated on the periphery of the Hittite Empire during the Late Bronze Age – presents a striking contrast to the meagre finds at the capital of the Hittite Empire, Boğazkale/Hattuša. Ayşe Baykal–Seeher and Jürgen Seeher[64] recorded that between the 1978 and 2003 excavation campaigns only twenty-five objects of glass, faience and frit were recovered, and most of those are beads.[65]

A rectangular bead from Boğazköy Sarıkale dated to Büyükkale IV (ca. 1700 BC) was among the earliest glass artefacts.[66] Four fragments belonging to a yellow and red opaque glass vase were recovered in the Boğazköy Büyükkale III period (14th century BC) and the upper part of a glass female figurine dated to the 14th century BC was recovered at the site.[67] A casting mould for spacer beads were also found in Boğazköy, though this mould might well serve for faience or frit beads or even metal (gold) too.[68]

The artefactual assemblage is minimal, but written sources tell more about glass among the Hittites. A tablet mentioning the manufacture of red (?) glass was found at Boğazköy (*BM* 108561).[69] According to Leo Oppenheim, the palaeography of the tablet does not reflect the characteristics of a Hittite scribe, but rather shows Syrian influences.[70] Kaspar K. Riemschneider published two tablets related to glass among the Hittites,[71] *KBo* XVIII 201 and *KBo* VIII 65, where a substance called ^{NA4}KÁ.DINGIR.RA is mentioned twice. Riemschneider translated ^{NA4}KÁ.DINGIR.RA as "Babylonian stone" *(Babylonstein)* and accepted it as an artificially produced stone, in other words: glass. Anna. M. Polvani suggested that ^{NA4}KÁ.DINGIR.RA is a type of quartz with a colour varying from red to maroon-brown.[72] Rather than an end product, she argued that it was a mineral ingredient used as an intermediary during glass production.

A significant artefact relevant to these discussions was recovered in Boğazköy in 2003. It is a sandstone mould (4.1 cm x 3.4 cm x 1.8 cm) with miniature images of Hittite gods on both sides along with Luwian hieroglyphic inscriptions including the term ^{NA4}KÁ.DINGIR.RA "Babylonian stone".[73] Since such figurines of Hittite gods made of

64 Baykal-Seeher and Seeher 2003, 52–53.

65 To the best of my knowledge – based on publications since 2003 – no glass artefacts dated to the Hittite levels of Boğazkale/Hattuša have been recovered since then.

66 Boehmer 1972, Lev. LXIII, nos.1809–1811.

67 Boehmer 1972, 174–175, 180; pl. LXIII no. 1802; pl. LXV no. 1861. Artefacts documented as glass were found at sites located in the Hittite heartland, such as Alişar, Afyon–Yanarlar, Afyon–Kusura, Gordion, Kaman–Kalehöyük in the Hittite Old Kingdom periods (ca. 1650–1500 BC) (Moorey 1994; Çınardalı-Karaaslan 2013, 42–43, with references cited). On the other hand, a re-examination of these artefacts is necessary to clarify whether these are glass, faience or frit. However, sites yielding glass artefacts dated to the period of the Hittite Empire (ca. 1355–1190 BC), such as Büklükale will be touched upon briefly below but a detailed discussion is beyond the scope of this paper.

68 Boehmer 1972, 217–218, pl. LXXXVII no. 2229.

69 Rosenkratz 1965.

70 Oppenheim 1970, 67.

71 Riemschneider 1974.

72 Polvani 1988, 145–148.

73 Baykal-Seeher and Seeher 2003, 101, 103, figs. 1, 2.

lapis lazuli are known from textual sources, it was assumed that the mould was used for casting similar statues of gods in blue coloured glass, to imitate the lapis lazuli versions.[74] A similar mould to Boğazköy's was found at the Hittite settlement Ortaköy-Šapinuwa (Çorum province of Turkey) where more than 200 moulds were recovered[75] and some of which might be most probably linked to the production of vitreous materials especially glass. Unfortunately, a complete study and publication of these moulds are not available yet.

Why glass was referred as 'Babylonian stone' in this manner is not yet clearly understood. The Hittites might have imported a particular type or colour (possibly blue) of glass from Babylonia, and therefore identified it as 'Babylonian stone.' Alternatively, they might have been producing glass according to a Babylonian recipe, and consequently acknowledged it with this designation. It is also possible that merchants from Babylon or the military contacts of the Hittites with the region might have caused the introduction of glass to the Hittites, and that it was thus named accordingly. It is important to note here that neither in the Hittite capital nor in central Anatolia has any trace of a manufacturing unit making and/or working with glass ever been identified[76] – with the exception of the recent finds at Tell Atchana which was linked to central Anatolia but geographically could be identified as more northern Syrian than Anatolian.

Eḫlipakku, a term of Hurrian origin linked to glass, is also attested in the second millennium BC texts of Boğazköy, Alalakh,[77] Ugarit, Qaṭna,[78] Nuzi, Ascalon, and the inventory lists of objects sent from Mitanni to Egypt.[79] Seven Amarna letters sent from the ruler of Ascalon to the Egyptian Pharaoh and three letters sent from Jurşa[80] to Egypt

74 Baykal-Seeher and Seeher 2003.

75 Süel 2015, 172.

76 A promising research project on Anatolian glass is now ongoing at Büklükale, a Hittite settlement located at Kırıkkale almost 100 km from the south-eastern part of Ankara. In Level 3, dated to the Late Bronze Age period, the Büklükale team found a glass vase without a base in the 2011 season. This glass vase fragment was core-formed and defined as Mesopotamian style. It was found together with glass pendant fragments (Matsumura 2012, 426–27). The archaeometric research on the artifacts is ongoing by Professor Julian Henderson (Henderson et al. 2018) but the complete set of results has not become available yet. Based on these analyses, further elaborations could be done on the possible production centers in Anatolia.

77 Oppenheim refers to a tablet from Alalakh that apparently mentions *eḫlipakku* (Oppenheim 1973; for edition, see Wiseman 1953, no. 440: 6–8). Oppenheim's reading of the relevant line is as follows: 1-*en a-ar-za-ar-ni eḫ*[!]-*li*(copy *še*)-*ba-ag-gi* and 1-*en ma-áš-ḫé* KÙ.GI *ḫi-a-ru-uḫ-ḫé ši-na-am-ni ma-ni-in-ni eḫ-li* (copy *tu*)-*ba-ag-gi*. However, Wiseman did not follow. I consulted Professor Belkis Dinçol and Dr. Hasan Peker for a reading of the tablet. They noted that reading *eḫlipakku* in the text, as Oppenheim did, is not really possible and is an unsupported reading since such a reading was not observed in the general corpus. Furthermore, if the word is *eḫlipakku*, then the scribe must have made several scribal errors, which is not common in the literature either. Therefore, a re-evaluation of the Alalakh tablet seems necessary.

78 It is mentioned among temple jewellery from Qaṭna (Oppenheim 1973).

79 Oppenheim 1973, 259.

80 Jurşa has been proposed as the ancient name of the archaeological site of Tell Jemmeh (in Mazar 1951, 38–41).

also mention the word *eḫlipakku*.[81]

Relevant to the discussion here is a text from Boğazköy.[82] The tablet *CTH* 241.2 = *IBoT* 1: 31 is from a chest inventory and refers to a linen garment with knots in the colour of *eḫlipakku*-stone.[83] If *eḫlipakku* means raw glass,[84] then the garment should be the colour of raw glass – throwing up the question of the default colour of glass for the Hittites. Raw glass must have signified a desired colour among the ruling class and elites.

The archaeological evidence for the possible default colour of glass may come from the Late Bronze Age Uluburun shipwreck, which probably dated to around the end of the 14th century BC.[85] The boat sank with its full cargo and the ensuing excavation provided an almost complete picture of Late Bronze Age goods traded in the eastern Mediterranean, including Egypt, the Levant, Cyprus and the Aegean (at least).[86] The cargo of the Uluburun ship included 175 glass ingots coloured blue and turquoise demonstrating these colours as the most popular colours of glass for the elite in the late second millennium BC.[87] There were also at least two lavender- and one amber-coloured ingots found in the cargo.[88] Thus, in this sense, the default colour of the *eḫlipakku*-stone must have been blue or turquoise reflecting lapis lazuli as likewise suggested by the 'Babylonian stone.' This is supported by the queen's chest inventory, as the blue colour was likewise favoured for wool and garments. Due to its alleged healing and magical properties, it would be logical to argue that *eḫlipakku*-stone coloured garments were blue or turquoise.

Another word related to glass is *mekku*. Semitic in origin, *mekku* has been understood as a kind of precious stone, a mineral, a stone colour, a type of raw glass, or a primary glass.[89] In a Hittite text[90] NA4*MEK*[*KU*] was interpreted as a semi-precious stone or raw glass[91] though an attestation to its colour is impossible with existing evidence. The word was also used in ten letters sent from Abimilki, the king of Tyre, to the Egyptian

81 *EA* 14; *EA* 331, Text C4779, (12221), Copy: *WA* 200 and *EA* 323, *BM* 29836, Copy: BB 53. For details of these texts see Moran 1992. For further references see CAD E: 51.

82 I would like to thank Dr. Hasan Peker for drawing this tablet to my attention.

83 *IBoT* 1 31 10 (Goetze 1956, 32): 1 GADA *eḫ-li-pa-ki* SIR-*ma*. See also Goetze 1956, 36 and Košak 1982.

84 For the definition of *eḫlipakki* see Black, Georg, and Postgate 2000.

85 The wood from the rudder (without bark) gave 1314+15/-26 with 2σ= 95.4% according to dendrochronology (Newton et al. 2006). An exact dendrochronological dating for the Uluburun wreck is still debated.

86 Bass et al. 1989; Pulak 2005.

87 The chemical compositional analyses of blue and turquoise ingots from Uluburun have shown that these ingots were coloured with either cobalt or copper (Brill 1999; Jackson and Nicholson 2010). The existing interpretation suggests Egypt and the Near East as the origin of the Uluburun glass ingots (Pulak 2008). It is important to note that examinations on their chemical composition are ongoing. Further research focusing on the major and minor components of these ingots supported with isotopic research will reveal whether Egypt was the origin of all glass ingots or whether there were any other suppliers of copper-coloured, lavender, and amber-coloured glass ingots (see also Pulak 2008, 293).

88 Pulak 2008, 293, 313, cat. no.189

89 Oppenheim 1970; Polvani 1988; Ünal 2007, 443.

90 *KBo* XVI: 68 2

91 Polvani 1988, 127 with references cited.

Pharaoh. It is mentioned in texts from Ugarit as well; beads and amulets made of *mekku* in Assyria were also documented.[92]

The Hittite term *zapzagai-zapzagaia* is also related to glass though its translation is controversial. A tablet recovered from Ortaköy-Šapinuwa refers to a glass-like material as *zapzagaia*.[93] In a Hittite tablet[94] with a text concerning an eight-day funerary ritual *zapzagai* weighed in the pan of a scale (with bread and cheese in the other pan) was mentioned and translated as glass,[95] although there is no solid evidence that *zapzagaia* means glass in Hittites; it might refer to a type of glazed material. Further evaluation could be possible when the Ortaköy-Šapinuwa tablets are fully published.

6 The social and economic value of glass in the second millennium BC

The reasons why glass appeared at the time it did remain unclear.[96] Oppenheim argued that a new technology was introduced to the Near East during the time of the Mitanni Empire around the 15th and 14th centuries BC, when scholars were associating Hurrian speaking people with new technological innovations such as horse-drawn chariots, composite bows, and scale-armour for men and horses.[97] This set of innovations included core-formed glass vessel production and vitreous material industries.[98] However, the evidence discussed above definitely demonstrates that glass or pre-glass can be traced back to the early third millennium – long before the appearance of the Hurrians. In this case, the literary and archaeological evidence must be considered together, and the relation of Mitannian cultural sphere to glassmaking might be revised.

The archival resources point at the adoption of glass as an imitation of prestigious stones such as lapis lazuli. Whether the attraction of producing glass was related to its colour or whether it should be linked to its economic value is not yet clearly understood. Even though glass only mimicked precious stones, it has been suggested that it may have been valued as highly as gold[99] and that it was a luxury product and a valuable material figuring in tribute lists. Evidence for this argument was found in the relief in the 'Hall of the Annals' of the temple at Karnak in Thebes, where Thutmosis III depicted the

92 Oppenheim 1973, 263; see CAD M II: 7 for further references.

93 Coşkun 1997. *Zapzagai-*, *zapzaki-*, *zapzigi-* is translated as referring to glass and vessels made from it (Weeks 1985, 82). Ahmet Ünal (Ünal 2016, 605) translated ^{NA4}*zapzagai-*, *zapzaki-*, *zapziki-* and ^{NA4}*zapzagaya* as glass, frit, glass paste, transparent stone, obsidian (?). The transparent stone in Ünal's translation could be rock crystal but a clearer terminology for glass seems necessary for philological attributions.

94 *KUB* 30.24a+*KUB* 34.65: obv. I 15.

95 Kassian, Korolev, and Sidel'čev 2002; Otten 1958, 58.

96 Henderson 2013.

97 De Vaux 1967; Klengel 1978; Moorey 1986.

98 Peltenburg 1971; Peltenburg 1987.

99 Schlick-Nolte 1968.

booty from his Syrian campaigns to the temple. Among the booty, at least two baskets of 'precious stones' were recorded, along with baskets of goods labelled as lapis lazuli and turquoise, which were probably in reality glass or faience imitations of precious stones.[100] In the Amarna Letters, Egyptian pharaohs asked the rulers of Western Asia (i.e. Mesopotamia, Palestine and Lebanon including Ascalon and Tyre) to send them *eḫlipakku* and *mekku*. This must be considered in light of the evidence of glass production at this time in Egypt (see Hodgkinson in this volume) without disregarding the fact that existence of a local industry or production would not prevent importing a similar material.

The earliest glasses of Egypt, dated to the reign of Thutmosis III, were associated with Mesopotamia, which was actually under the Mitannian influence during this period. The depiction of glass ingots among the precious stones on the temple walls provoked scholars to establish linkages between Egypt and "somewhere in Mesopotamia," mostly referring to northern Mesopotamia, in terms of glass artefacts.

Archaeometric research is ongoing to fully identify glasses excavated from mostly the northern Mesopotamian sites like Nuzi, Tell Brak, and Tell Rimah though a comprehensive characterisation of 'Mesopotamian glass' is not succeeded yet. Furthermore, the terminology pertaining to glass in the languages of ancient Mesopotamia has not been completely mastered, and possible links in the glass trade between Egypt and Syria or the Levant cannot really be studied; nor can potential tributaries or partners who may have sent glass to Egypt during the reign of Thutmosis III identified with confidence.

Yet, Shortland specifically mentions the archaeological material from Tell Atchana in this context – but then tentatively wanders further East and Northeast.[101] The evidence presented here might imply that one could isolate Alalakh as having potentially been important. Even though there are gaps in the textual records, a historically relevant argument to glass might be made here. Michael C. Astour[102] identified Alalakh among the place-names in the north Syrian lists of Thutmosis III. According to the annals of Thutmosis III, it is known that Alalakh gave tribute to Thutmosis III. Although the content of the tribute is not clear, it might well have included glass. We cannot be certain unless a textual record confirms such a relation, but Alalakh with its flourishing vitreous corpus during that period, its demonstrated ability to produce glass only slightly later, and its being known as tributary to Tuthmosis III could be added together to make Alalakh a possible donator of glass to Egypt.[103]

Textual records and archaeological evidence show that glass was a prestigious material during the second millennium BC. Evidently it was fit for kings, and thus palatial

100 A. Sherratt and S. Sherratt 1991; Shortland 2001; Shortland 2012, 55.

101 Shortland 2012, 44–61.

102 Astour 1963.

103 Recent chronological synchronisms indicate that the king on the throne of Alalakh sending tribute to Egypt could be either Idrimi (Yener, Horrowitz, and Akar [in preparation]) or Niqmepa (Peker 2009).

or elite involvement not only in production, but also in gift exchange follows. Oppenheim suggested that the introduction of glass and its technology first appeared at the royal court level as gift exchange (finished objects rather than raw materials and artisans), delivery or tribute, or trade-goods, rather than due to political or military situations.[104] He wrote "political and military power do not necessarily promote intellectual and artistic influences across boundaries."[105] His contention is supported by the situation in Boğazkale/Hattuša and Tell Atchana/Alalakh. Even though the control of Alalakh shifted from the Mitanni to the Hittites, the artistic trends or technological innovations inherited from Mitanni did not seem to influence the Hittites to the same extent.

Archaeological contexts related to glass production unearthed during the new series of excavations on the mound demonstrated that Alalakh was involved in – at least in the case of blue- and amber-coloured – primary glass production,[106] whereas a workshop related to glass production has not yet been identified in Boğazkale/Hattuša. Furthermore, the accumulation of glass artefacts at Alalakh and the rarity of glass in Hattuša might be a result of the choices of elites or high-status individuals rather than the economic value of glass.

Why was glass not preferred in Anatolia? This is a new topic for research. Tahsin Özgüç who excavated Kültepe/ Karum Kaneš for more than half a century, proposed a theory for the faience uncovered at Kültepe from the early second millennium BC, an idea that might have been valid for glass as well. Özgüç argued that faience was a substitute for stone and metal due to its visual attractiveness – especially colour – and since Anatolia was rich in various stones and metals, there was no need to establish a faience industry in central Anatolia [107] though he proposed faience workshops around southern Anatolia that produced artefacts for Anatolian taste.[108] Textual records imply that the Hittites related glass with coloured stones, and thus they might have been less interested in coloured glass since they already had easy access to reserves of coloured stones. On the other hand, coloured stones cannot be reshaped (to a certain degree they can be shaped, but not much, and they cannot be completely recycled) or moulded as glass can be. However, the existing evidence gives the impression that the workability did not play an extensive role at least selecting between glass and coloured stones.

I argue that the Hittites to a certain extent demanded especially blue coloured glass though it is hard to fully understand the social and economic value of it. Based on the textual records (i.e. royal inventories), it would be logical to propose that glass was highly valued. Furthermore, the 'Babylonian stone' inscribed mould recovered in Boğazköy and its relation to glass indicates that the Hittites at least practiced glassworking if not

104 Oppenheim 1973, 264.
105 Oppenheim 1973, 264.
106 Dardeniz 2014; Dardeniz 2016; Dardeniz Forthcoming.
107 Özgüç 1986, 203.
108 Özgüç 1986, 207.

also glassmaking mentioned in the fragmentary tablets. At this stage of elucidating Hittite glass, its colours and significance, the prompt publication of moulds related to vitreous materials and tablets linked to glass found in Ortaköy-Šapinuwa is of crucial importance.

7 Conclusions

Glass was among the luxury objects appreciated by the elite and thus found its place in the international trade network of the ancient world. The political and symbolic value of glass in trade and the exchange of luxury goods and materials must have had a special significance in terms of its consumption among high status individuals.[109] The successfully produced glass of the second millennium BC was a newly introduced material with its vivid colours and chromatic appeal played a special role in this trade as demonstrated by the glass ingots from the Uluburun shipwreck.

The glass corpus of Tell Atchana/Alalakh is dominated by blue, but also includes turquoise, yellow, amber, white, green, and red. It is certain that the colour of glass played a significant role in expressing and determining its economic value at Alalakh (and elsewhere). The existence of blue and green female figurines and glass vases in temple and grave contexts, the use of blue glass for the eyes in the king's statue, etc. demonstrate that glass with its selection of specific colours not only had symbolic but also prestigious connotations.

Boğazkale/Hattuša reveals a very different picture when compared to Alalakh. Within the limits of the existing evidence, the elite of the capital of the empire seemed to have been less interested in this artificially coloured stone. Despite the scarcity of material evidence, the textual records imply that glass enjoyed a high economic value, as inventory lists record the 'imitation' along with precious metals and stones. Based on Egyptian evidence, Paul T. Nicholson argued that rather than mimicking semiprecious stones, coloured glasses themselves used to be accepted as types of stones.[110] His argument now finds support from central Anatolia from the Hittite capital, where most probably blue coloured glass appears as a type of highly valued stone. With the existing evidence, I argue that the Hittites appreciated coloured glass as a type of valuable stone and practiced at least glassworking as the moulds for glass evidence.

Research focusing on the colour of glass suffers from a failure to understand the perception of colours in the past. This perception must have varied greatly among different cultures[111] among which the Hittites might well suit for detailed studies. Further

109 Sinopoli 1994; A. Sherratt and S. Sherratt 1991.

110 Nicholson 2012, 11.

111 Berlin and Kay 1969.

research combining archaeological evidence with the linguistic data may hopefully provide a better understanding on how colour was perceived at the centre and periphery of the Hittites in the second millennium BC.

Bibliography

Astour 1963
Michael C. Astour. “Place Names from the Kingdom of Alalaḫ List of Tuthmose III. A Study in Historical Topography”. *Journal of Near Eastern Studies* 22.4 (1963), 220–241.

Baltacığlu 2006
Hatçe Baltacığlu. “Güneş Kursları, Alaca Höyük ve Arinna”. In *Hayat Erkanal'a Armağan, Kültürlerin Yansıması*. Ed. by B. Avunç. Istanbul: Homer Publications, 2006, 129–137.

Barag 1970
Dan Barag. “Mesopotamian Core-formed Glass Vessels (1500–500 BC). An Edition of the Cuneiform Texts which Contain Instructions or Glassmakers with a Catalogue of Surviving Objects”. In *Glass and Glassmaking in Ancient Mesopotamia*. Ed. by A. L. Oppenheim. Corning Museum of Glass Monographs 3. Corning, NY: Corning Museum of Glass Press, 1970, 131–197.

Barag 1985
Dan Barag. *Catalogue of Western Asiatic Glass in the British Museum*. Vol. 1. London: British Museum Publications Limited, 1985.

Bass et al. 1989
George F. Bass, Cemal Pulak, Dominique Collon, and James Weinstein. “The Bronze Age Shipwreck at Uluburun. 1986 Campaign”. *American Journal of Archaeology* 93 (1989), 1–29.

Baykal-Seeher and Seeher 2003
Ayşe Baykal-Seeher and Jürgen Seeher. “Götterbilder aus Babylonstein? Eine hethitische Gußform aus Boğazköy-Hattuša”. *Istanbuler Mitteilungen* 53 (2003), 99–111.

Beck 1933
Horace C. Beck. “Beads from Nineveh, with Special Reference to Those Found in the Great Pit MM”. In *The British Museum Excavations in Nineveh 1931–1932*. Ed. by R. Campbell Thompson and M. E. L. Mallowan. Liverpool Annals of Archaeology and Anthropology 20. 1933, 179–186.

Beck 1934
Horace C. Beck. “Glass Before 1500 BC”. *Ancient Egypt and the East. Index 1932–1935* (1934), 7–21.

Beretta 2009
Marco Beretta. *The Alchemy of Glass, Counterfeit, Imitation and Transmutation in Ancient Glassmaking*. Science History Publications. Sagamore Beach: Watson Publishing International LLC, 2009.

Berlin and Kay 1969
Brent Berlin and Paul Kay. *Basic Colour Terms. Their Universality and Evolution*. Berkeley and Los Angeles: University of California Press, 1969.

Black, Georg, and Postgate 2000
Jeremy Black, Andrew Georg, and Nicholas Postgate, eds. *A Concise Dictionary of Akkadian*. Wiesbaden: Harrassowitz, 2000.

Boehmer 1972
Rainer M. Boehmer. *Die Kleinfunde aus Boğazköy*. Berlin: Mann, 1972.

R. Braidwood and L. Braidwood 1960
Robert Braidwood and Linda Braidwood. *Excavations in the Plain of Antioch I. The Earlier Assemblages Phases A–J*. Chicago: University of Chicago Press, 1960.

Brill 1999
Robert H. Brill. *Chemical Analyses of Early Glasses*. Vol. 1 and 2. Corning, NY: The Corning Museum of Glass, 1999.

CAD
A. Leo Oppenheim, John A. Thorkild Jacobsen, Civil Brinkman, Robert D. Briggs, Erica Reiner, Martha T. Roth, and Ignace J. Gelb, eds. *The Assyrian Dictionary of the Oriental Institute of the University of Chicago*. Chicago: Oriental Institute, 1956/2011.

CDLI
Cuneiform Digital Library Initiative. *Abbreviations for Assyriology*. 2016. URL: http://cdli.ox.ac.uk/wiki/doku.php?id=abbreviations_for_assyriology (visited on 15/08/2019).

Çınardalı-Karaaslan 2013
Nazlı Çınardalı-Karaaslan. “Arkeolojik ve Filolojik Veriler Işığında M.Ö. 2 Binde Frit, Fayans, ve Cam Malzeme Üzerine Bir Çalışma”. *Belleten* 77.278 (2013), 15–72.

Coşkun 1997
Yaşar Coşkun. “Cam Hamuru, Fayans”. *Archivum Anatolicum-Anadolu Arşivleri Emin Bilgiç Anı Kitabı Ankara Üniversitesi DTCF Eskiçağ Dilleri ve Kültürleri Dergisi* 3 (1997), 67–73.

Dardeniz Forthcoming
Gonca Dardeniz. “The Preliminary Archaeological and Scientific Evidence for Glassmaking at Tell Atchana/Alalakh, Hatay (Turkey)”. *Anatolian Archaeological Studies* 25 (Forthcoming).

Dardeniz 2014
Gonca Dardeniz. “Alalakh (Tell Atchana Höyük). Geç Tunç Çağı’nda Cam Üretimine Ait Yeni Bulgular [Alalakh (Tell Atchana). The New Scientific Results on Glassmaking in the Late Bronze Age]”. *Arkeometri Sonuçları Toplantısı* 29 (2014), 165–173.

Dardeniz 2016
Gonca Dardeniz. “Glassmaking and/or Glassworking. Revisiting Scientific and Archaeological Evidence from the Late Bronze Age Anatolia [Cam üretmek ve/veya Cam işlemek. Anadolu’da Geç Tunç Çağı Verilerinin Bilimsel ve Arkeolojik Olarak Gözden Geçirilmesi]”. *Arkeometri Sonuçları Toplantısı* 31 (2016), 147–158.

Dardeniz 2017
Gonca Dardeniz. “Sharing Technologies and Workspaces for Ceramic and Vitrified Material Production at Tell Atchana-Alalakh”. In *Overturning Certainties in Near Eastern Archaeology. A Festschrift in Honor of K. Aslıhan Yener*. Ed. by C. Maner, M. T. Horowitz, and A. S. Gilbert. Leiden: Brill, 2017, 139–156.

Dietrich and Loretz 1966
Manfried Dietrich and Oswald Loretz. “Der Vertrag zwischen Suppiluliuma and Niqmadu. Eine philologische und kulturhistorische Studie”. *Die Welt des Orients* 3 (1966), 206–245.

Dillon 1907
Edward Dillon. *Glass*. London: Methuen, 1907.

Dinçol 1985
Ali M. Dinçol. “Ashella Ritüeli (CTH 394) ve Hititlerde Salgın Hastalıklara Karşı Yapılan Majik İşlemlere Toplu Bir Bakış”. *Belleten* 69.193 (1985), 23–35.

Dönmez 2013
Sevgi Dönmez. “Hitit Döneminde Anadolu’da Değişim Aracı Olarak Kullanılan Madenler”. Dissertation, Ankara University. 2013.

Finley 1999
Moses I. Finley. *Ancient Economy*. Berkeley: University of California Press, 1999.

Goetze 1956
Albrecht Goetze. “The Inventory IBoT 1:31”. *Journal of Cuneiform Studies* 10 (1956), 32–38.

Hall 1930
Henry R. Hall. *A Season’s Work at Ur*. London: Methuen, 1930.

Henderson 1997
Julian Henderson. “Scientific Analysis of Glass and Glaze from Tell Brak and Its Archaeological Implications”. In *Excavations at Tell Brak. Vol.1. The Mitanni and Old Babylonian Periods*. Ed. by D. Oates, J. Oates, and H. McDonald. McDonald Institute Monographs. Cambridge and London: British School of Archaeology in Iraq, 1997, 94–95.

Henderson 2013
Julian Henderson. *Ancient Glass. An Interdisciplinary Exploration*. Cambridge and New York: Cambridge University Press, 2013.

Henderson et al. 2018
Julian Henderson, Simon Chenery, Jane Evans, Kimiyoshi Matsumura, Sachihiro Omura, and Eddy Faber. “Hittite and Early Iron Age Glass from Kaman-Kalehöyük and Büklükale, Turkey: Evidence for Local Production and Continuity?” *Anatolian Archaeological Studies* XXI (2018), 70–84.

Jackson and Nicholson 2010
Caroline M. Jackson and Paul T. Nicholson. “The Provenance of Some Glass Ingots from the Uluburun Shipwreck”. *Journal of Archaeological Science* 37 (2010), 295–301.

Jameson, Highnote, and Wasserman 2001
Kimberly A. Jameson, Susan M. Highnote, and Linda M. Wasserman. "Richer Color Experience for Observers with Multiple Photopigment Opsin Genes". *Psychonomic Bulletin & Review* 8 (2001), 244–261.

Kassian, Korolev, and Sidel'čev 2002
Aleksej S. Kassian, Andrej Korolev, and Andrej V. Sidel'čev. *Hittite Funerary Ritual. Šalliš waštaiš*. Münster: Ugarit, 2002.

Klengel 1978
Horst Klengel. "Mitanni. Probleme seiner Expansion und politischen Struktur". *Revue Hittite et Asianique* 36 (1978), 91–115.

Košak 1978
Silvin Košak. "The Inventory of Mannini (CTH 504)". *Linguistica* 18 (1978), 99–123.

Košak 1982
Silvin Košak. *Hittite Inventory Texts (CTH 241–250)*. Heidelberg: Carl Winter, 1982.

Landsberger 1967
Benno Landsberger. "Über Farben im Sumerisch-Akkadischen". *Journal of Cuneiform Studies* 21 (1967), 139–173.

Lucas and Harris 1962
Alfred Lucas and John R. Harris. *Ancient Egyptian Materials and Industries*. 4th ed. Histories and Mysteries of Man. London: Edward Arnold, 1962.

Matsumura 2012
Kimiyoshi Matsumura. "Büklükale Kazısı 2010". *Kazı Sonuçları Toplantısı, 4. Cilt* 33 (2012), 421–436.

Mazar 1951
B. Mazar. "Yurzah=Tell Jemmeh". *Bulletin of the Israel Exploration Society* 16 (1951), 38–41.

Moorey 1986
Peter R. S. Moorey. "The Emergence of the Light, Horsedrawn Chariot in the Near East c. 2000–1500 BC". *World Archaeology* 18 (1986), 196–215.

Moorey 1994
Peter R. S. Moorey. *Ancient Mesopotamian Materials and Industries. The Archaeological Evidence*. Winona Lake, IN: Eisenbrauns, 1994.

Moran 1992
William L. Moran. *The Amarna Letters*. Baltimore, MD, and London: The John Hopkins University Press, 1992.

Newton et al. 2006
Maryanne W. Newton, Sahra Talamo, Cemal Pulak, Bernd Kromer, and Peter Kuniholm. "Uluburun Batığının Tarihlendirilmesi". In *Uluburun Gemisi. 3000 Yıl Önce Dünya Ticareti*. Ed. by Ü. Yalçın, C. Pulak, and R. Slotta. Deutsches Bergbau Museum, 2006, 117–118.

Nicholson 2007
Paul T. Nicholson. *Brilliant Things for Akhenaten: The Production of Glass, Vitreous Materials and Pottery at Amarna Site O.45.1*. London: Egypt Exploration Society and Oakville, Connecticut: David Brown Book Co, 2007.

Nicholson 2012
Paul T. Nicholson. "'Stone... that flows': Faience and Glass as Man–made Stones in Egypt". *Journal of Glass Studies* 54 (2012), 11–23.

D. Oates 2001
David Oates. "Third Millennium BC Glass, Frit, and Faience Objects". In *Excavations at Tell Brak. Vol. 2. Nagar in the Third Millennium BC*. Ed. by D. Oates, J. Oates, and H. McDonald. McDonald Institute Monographs. Oxford: Oxbow Books, 2001, 217–219.

D. Oates, J. Oates, and McDonald 1997
David Oates, Joan Oates, and Helen McDonald. *Excavations at Tell Brak, Vol. 1: The Mitanni and Old Babylonian Periods*. McDonald Institute Monographs. Oxford: Oxbow Books, 1997.

Oppenheim 1970
A. Leo Oppenheim. "The Cuneiform Texts". In *Glass and Glassmaking in Ancient Mesopotamia*. Ed. by A. L. Oppenheim, R. H. Brill, D. Barag, and A. V. Saldern. Corning, NY: Corning Museum of Glass Press, 1970, 2–104.

Oppenheim 1973
A. Leo Oppenheim. "Towards a History of Glass in the Ancient Near East". *Journal of the American Oriental Society* 93 (1973), 259–266.

von der Osten 1937
Hans H. von der Osten. *The Alishar Hüyük: Seasons of 1930-32: Part II*. University of Chicago Oriental Institute Publications 29. Chicago: Oriental Institute Press, 1937.

Otten 1958
Heinrich Otten. *Hethitische Totenrituale*. Berlin: Akademie Verlag, 1958.

Özgüç 1986
Tahsin Özgüç. "Glazed Faience Objects from Kanish". In *Insights Through Images. Studies in Honor of Edith Porada*. Ed. by P. Matthiae and M. van Loon. Malibu: Undena Publications, 1986, 201–208.

Peker 2009
Hasan Peker. "Suriye Üzerindeki Hitit Hakimiyetinin Kurulması. M. Ö. II. Binyılda Eski Yakındoğu'da Süper Güçler ve Küçük Devletler". Dissertation, Istanbul University. 2009.

Peker 2013
Hasan Peker. "International Relationships and Political Instruments of the Hittite State. War and Diplomacy". In *Hittites. An Anatolian Empire*. Ed. by M. Doğan-Alparslan and M. Alparslan. Istanbul: Yapı Kredi Yayınları, 2013, 64–79.

Peltenburg 1971
Edgar J. Peltenburg. "Some Early Developments of Vitreous Materials". *World Archaeology* 3.1 (1971), 6–12.

Peltenburg 1987
Edgar J. Peltenburg. "Early Faience. Recent Studies, Origins and Relations with Glass". In *Early Vitreous Materials*. Ed. by M. Bimson and I. Freestone. British Museum Occasional Paper 56. London: British Museum, 1987, 5–29.

Polvani 1988
Anna M. Polvani. *La terminologia dei Minerali nei testi Ittiti I*. Eothen. Florence: Elite Edizioni Librarie Italiane Estere, 1988.

Puhvel 1991
Jaan Puhvel, ed. *Hittite Etymological Dictionary. Vol. 3. Words Beginning with H*. Vol. 3. Trends in Linguistic, Documentation 5. Berlin and New York: Mouton and de Gruyter, 1991.

Pulak 2005
Cemal Pulak. "Discovering a Royal Ship from the Age of King Tut. Uluburun, Turkey". In *Beneath the Seven Seas Adventures with the Institute of Nautical Archaeology*. Ed. by G. F. Bass. London: Thames and Hudson, 2005, 34–47.

Pulak 2008
Cemal Pulak. "The Uluburun Shipwreck and Late Bronze Age Trade". In *Beyond Babylon. Art, Trade, and Diplomacy in the Second Millennium BC*. Ed. by J. Aruz, K. Benzel, and J. M. Evans. New York and New Haven: Metropolitan Museum of Art and Yale University Press, 2008, 289–310.

Riemschneider 1974
Kaspar K. Riemschneider. "Die Glassherstellungen in Anatolien nach Hethitischen Quellen". In *Anatolian Studies XXXV, Presented to H. G. Gütterbock on the Occasion of His 65th Birthday*. Ed. by K. Bittel, P. H. J. Houwink ten Cate, and E. Reiner. Istanbul: Nederlands Historisch-Archaeologisch Inst. in het Nabije Oosten, 1974, 263–278.

Rosenkratz 1965
Bernhard Rosenkratz. "Ein hethitischer Wirtschaftstext". *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 57.1 (1965), 237–248.

Savaş 2006
Savaş Ö. Savaş. *Çivi Yazılı Belgeler Işığında Anadolu'da (İ.Ö. II. Binyılda) Madencilik ve Maden Kullanımı*. Ankara: Türk Tarih Kurumu, 2006.

Scheel 1989
Bernd Scheel. *Egyptian Metalworking and Tools*. Shire Egyptology. Aylesbury: Shire Publications, 1989.

Schlick-Nolte 1968
Birgit Schlick-Nolte. *Die Glasgefäße im alten Ägypten*. Berlin: B. Hessling, 1968.

Schliemann 1884
Heinrich Schliemann. *Troja. Results of the Latest Researches and Discoveries on the Site of Homer's Troy*. London, 1884.

A. Sherratt and S. Sherratt 1991
Andrew Sherratt and Susan Sherratt. "From Luxuries to Commodities. The Nature of Mediterranean Bronze Age Trading Systems". In *Bronze Age Trade in Mediterranean*. Ed. by N. H. Gale. Jonsered: P. Åstroms, 1991, 351–386.

Shortland 2001
Andrew J. Shortland. "Social Influences on the Development and Spread of Glass". In *The Social Context of Technological Change. Egypt and the Near East, 1650–1550 BC*. Oxford: Oxbow Books, 2001, 211–222.

Shortland 2012
Andrew J. Shortland. *Lapis Lazuli from the Kiln. Glass and Glassmaking in the Late Bronze Age*. Leuven: Leuven University Press, 2012.

Siegelová 1984
Jana Siegelová. "Gewinnung und Verarbeitung von Eisen im Hethitischen Reich im 2. Jahrtausend v. u. Z." *Annals of The Náprstek Museum* 12 (1984), 71–168.

Sinopoli 1994
Carla M. Sinopoli. "The Archaeology of Empires". *Annual Review of Anthropology* 23 (1994), 159–180.

von Soden 1985
Wolfram von Soden. *Akkadisches Handwörterbuch. Unter Benutzung des lexikalischen Nachlasses von Bruno Meissner (1868–1947), Band 1: A–L*. Wiesbaden: Harrassowitz, 1985.

Steinkeller 1982
Piotr Steinkeller. "The Question of Marḫaši. A Contribution to the Historical Geography of Iran in the Third Millennium BC". *Zeitschrift für Assyriologie* 72 (1982), 237–265.

Steinkeller 2006
Piotr Steinkeller. "City and Countryside in Third Millennium Southern Babylonia". In *Settlement and Society. Essays Dedicated to Robert Mc.C. Adams*. Ed. by E. C. Stone. Los Angeles: Cotsen Institute of Archaeology, University of California, 2006, 185–201.

Süel 2015
Mustafa Süel. "Ortaköy-Şapinuva 2014 Kazı Çalışmaları". In *5. Çorum Kazı ve Araştırmalar Sempozyumu*. Ed. by Ö. İpek. Ankara: Dumat Ofset, 2015, 169–184.

Ünal 2007
Ahment Ünal. *Multilinguales Wörterbuch des Hethitischen. A Coincise Multilangingual Hittite Dictionary. Hititçe Çok Dilli El Sözlüğü I–II*. Hamburg: Verlag Dr. Kovač, 2007.

Ünal 2003
Ahmet Ünal. "Magic Among the Hittites and Ancient Anatolian Tribes [Hititlerde ve Çağdaşı Kavimlerde Büyücülük]". In *Elemterefiş Magic and Superstition in Anatolia [Elemterefiş Anadolu'da Büyü ve İnanışlar]*. Ed. by E. Işın. Istanbul: Yapı Kredi Yayınları, 2003, 18–35.

Ünal 2016
Ahmet Ünal. *Hititçe-Türkçe, Türkçe-Hititçe Büyük Sözlük. Hattice, Hurrice, Hiyeroglif Luvicesi, Çivi Yazısı Luvicesi ve Palaca Sözcük Listeleriyle Birlikte*. Ankara: Bilgin Yayınevi, 2016.

de Vaux 1967
Roland de Vaux. "Les Hurrites de l'historie et les Horites de la Bible". *Revue Biblique* 74 (1967), 481–503.

Warburton 2007
David A. Warburton. "Basic Color Term Evolution in the Light of Ancient Evidence from the Near East". In *Anthropology of Color. Interdisciplinary Multilevel Modeling*. Ed. by R. E. MacLaury, G. V. Paramei, and D. Dedrick. Amsterdam and Philadelphia: John Benjamins Publishing Company, 2007, 229–246.

Weeks 1985
David M. Weeks. "Hittite Vocabulary. An Anatolian Appendix to Buck's Dictionary of Selected Synonyms in the Principal Indo-European Languages". Dissertation, University of California, Los Angeles. 1985.

Wiseman 1953
Donald J. Wiseman. *The Alalakh Tablets*. Occasional Publications of the British Institute of Archaeology at Ankara 2. London: British Institute of Archaeology at Ankara, 1953.

Woolley 1947
C. Leonard Woolley. "Atchana 1946". *Man* 58 (1947), 60–61.

Woolley 1955
C. Leonard Woolley. *An Account of the Excavations at Tell Atchana in the Hatay, 1937–1949*. London: The Society of Antiquaries of London, 1955.

Yener 2005
K. Aslıhan Yener. *The Amuq Valley Regional Projects. Vol. 1. Surveys in the Plain of Antioch and Orontes Delta, Turkey, 1995–2002*. University of Chicago Oriental Institute Publications 131. Chicago: Oriental Institute of the University of Chicago, 2005.

Yener 2010
K. Aslıhan Yener, ed. *The 2003–2004 Excavations Seasons. Vol. 1. Tell Atchana, Ancient Alalakh*. Istanbul: Koç University Publications, 2010.

Yener 2013
K. Aslıhan Yener. "New Excavations at Alalakh. The 14th–12th Centuries BC". In *Across the Border. Late Bronze-Iron Age Relations between Syria and Anatolia. Proceedings of a Symposium Held at the Research Center of Anatolian Studies, Koç University, Istanbul, 31 May – 1 June 2010*. Istanbul: Koç University Press, 2013, 11–36.

Yener, Edens, et al. 2000
K. Aslıhan Yener, Christopher Edens, Timoty P. Harrison, J. Verstraete, and Tony J. Wilkinson. "The Amuq Valley Regional Project 1995–1998". *American Journal of Archaeology* 104 (2000), 163–220.

Yener, Horrowitz, and Akar [in preparation]
K. Aslıhan Yener, Mara H. Horrowitz, and Murat Akar. *Tell Atchana, Ancient Alalakh, Volume 2: The Late Bronze Age II City*. Istanbul: Koç University Publications. In preparation.

GONCA DARDENIZ

Gonca Dardeniz (Ph.D. Koç University, 2016) is a Postdoctoral Researcher at State University New York at Buffalo Department of Anthropology. Her research focuses on the development and spread of metals, vitreous materials (glass, faience, frit) and their technologies as well as on craft specialisation theories across Anatolia and the broader Near East in the third and second millennia BCE. In recent years, her archaeological field work has centered on Early to Late Bronze Age settlements in Central and Western Anatolia as well as Northern Syria.

Dr. Gonca Dardeniz
State University New York
Buffalo Department of Anthropology
380 MFAC Ellicott Complex
University at Buffalo-SUNY
Buffalo NY 14261, USA
E-Mail: goncadardeniz@gmail.com

Anna K. Hodgkinson

Manufacturing Colourful Glass Objects in New Kingdom Egypt: A Spatial and Statistical Analysis

Summary

This paper discusses a central aspect in the study of glass-working in New Kingdom Egyptian (ca. 1550–1077 BC) royal cities: the colours of the raw material, their application and symbolism. Concentrations of glass-working items are analysed spatially and statistically in order to gain information on colour preference, the administration and control of raw glass and colourants as well as some technical aspects of glass-working. The study is based on artefactual and archaeological evidence from the New Kingdom sites of Amarna and Gurob.

Keywords: ancient Egyptian glass; colourants; spatial analysis; GIS

Dieser Artikel behandelt einen zentralen Aspekt bezüglich der Untersuchung der Glasverarbeitung des ägyptischen Neuen Reichs (ca. 1550–1077 v. Chr.): die Farben des Rohmaterials, deren Gebrauch und Symbolik. Konzentrationen von für die Glasverarbeitung aussagekräftigem Fundmaterial werden durch Statistik und Raumanalyse auf Fragestellungen wie Farbpräferenz, die Verwaltung und Kontrolle von Rohmaterial, sowie auf einige technologische Aspekte der Glasverarbeitung untersucht. Diese Studie basiert auf Kleinfunden, wie auch Bodenbefunden aus den Siedlungen des ägyptischen Neuen Reichs, Amarna und Gurob.

Keywords: altägyptisches Glas; Farbstoffe; Raumanalyse; GIS

The author would like to thank the following people for their help with this publication by providing access to archaeological data, archive material and images and for proof reading: Barry J. Kemp and Anna Stevens (Amarna Project), Ashley Cooke (World Museum, Liverpool), Ian Shaw (University of Chester), Friederike Seyfried (Egyptian Museum and Papyrus Collection, Berlin), Alan Hodgkinson and Yann Hamon. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 653188.

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

1 Introduction

This paper discusses a central aspect of glass-working in New Kingdom Egyptian (ca. 1550–1077 BC) royal cities: the colours of the raw material, their application and symbolism. By means of spatial and statistical analysis the distributions and concentrations of glass-working items is discussed in order to gain information on colour preference, the administration and control of raw glass and colourants as well as some technical aspects of glass-working.

The analysis of the spatial distribution of archaeological evidence of glass-working at the site of Amarna has permitted the examination of the data at a deeper level and detection of distribution patterns and clusters. In addition, some non-spatial data from the New Kingdom settlement of Gurob in the Fayum has been considered and compared with the evidence from Amarna (see Fig. 1). The colours of glass-working evidence found at five distinctive workshops excavated at Amarna are discussed and compared and conclusions drawn on their roles in the local glass industry.

The archaeological and statistical evidence points towards a dispersed glass industry at Amarna, with workshops being specialised in the production of glass objects from different colours. Although the dark blue cobalt colourant appears to have been subject to royal control elsewhere in Egypt, the evidence suggests that at least at Amarna this was no longer the case.

Amarna, or Tell el-Amarna, lies in Middle Egypt, ca. 60 km south of modern Minya. Founded by the king Akhenaten in his fifth regnal year, the city was established in a brief space of time as a new city for the sun god Aten and abandoned soon after the end of his reign, which is known as the Amarna Period (ca. 1353–1336 BC). The buildings were made out of mud-brick with rare stone elements, and they include vast palaces, temples and other institutional buildings together with large areas of settlement containing both elite and non-elite houses and workshop areas. The main part, or core, of the city, without its outliers in the desert, can be subdivided into a series of suburbs, which, from north to south, are known as the North City, together with the North Palace, the North Suburb, the Central City (containing the main temples and great palace), the Main City (North and South, separated by a wadi) and the South Suburb.[1] The Deutsche Orient-Gesellschaft, who carried out archaeological work at Amarna between 1911 and 1914 developed a grid system of 200 x 200 m squares across the city, the individual numbering of the buildings excavated in each square resulting in their alphanumerical identifiers (i.e. building P47.1 being the first building identified in gridsquare P47).[2] Gurob lies in

1 The suburbs treated in this paper have been abbreviated as follows: CC = Central City, MCN = Main City North, MCS = Main City South and South Suburb.

2 Borchardt and Ricke 1980, 11–12, although this incorrectly states that a 100 x 100 m grid was used.

Fig. 1 Map of Egypt showing Amarna and Gurob.

the Egyptian Faiyum region, ca. 16.5 km southeast of modern Faiyum city (Fig. 1). The ancient site includes a palace believed to have housed the harem of the ramesside kings, as well as a temple, large areas of settlement and vast cemeteries.[3] In addition, a small industrial site lies to the northeast of the palace (Fig. 22). While Gurob has yielded finds from all periods of Egyptian history, the bulk of the objects from here have been dated to the New Kingdom.[4]

2 The archaeological evidence of glass-working

While raw glass-making and the manufacture of artificial pigments such as Egyptian Blue, together with faience-manufacture, also occurred in the New Kingdom cities,[5] this paper discusses primarily the archaeological evidence of glass-working. This comprises items such as glass rods, -bars and -strips (frequently with tool marks), fragments from glass ingots, lumps and any other raw glass items. These articles were used for the manufacture of finished glass objects such as small, decorative vessels and items of jewellery among other things (see Fig. 2).

The first glass to appear in Egypt during the New Kingdom is believed to have been imported from the Near East, in the region of modern Syria rather than being produced locally,[6] although it has been established that glass was being produced from its raw materials in Egypt at the very latest by the Amarna Period.[7] Raw glass was made from silica, soda and lime, the source of the silica being quartz pebbles or sand, while the soda came from plant ashes, added to the mixture as a flux, lowering the melting temperature of the raw glass batch from ca. 1700°C to around 1100°C.[8] The lime acted as a stabilising agent, although it is not clear whether this was added intentionally to the batch or if it entered the mixture with sand or the plant ash. While open fires and bonfires can reach temperatures up to 1000°C, a closed, or updraft kiln is necessary for the higher temperatures.[9] It is believed that the colourants were added directly to the raw mixture.[10] Raw glass was produced in the shape of ingots, which were usually circular and moulded in standardised cylindrical pottery vessels, the presence of which in the archaeological record having been interpreted as an indicator of raw glass manufacture,[11] but also as

3 Kemp 1978; Lacovara 1997, 300.

4 Shaw 2011, 454.

5 E.g. Smirniou and Rehren 2011; Shortland and Tite 2000; Nicholson 2007, 117–132.

6 Oppenheim 1973, 262. However, Shortland states that glass may have even been accidentally produced before 1550 BC, with a local workforce producing small amounts of cobalt-blue glass (Shortland 2004).

7 Smirniou and Rehren 2011, 58.

8 Shortland 2009, 2.

9 Nicholson 2010, 2–3.

10 Nicholson 2007, 122; Shortland 2000; Shortland 2012, 156.

11 Nicholson 2007, 115, 123–125, Shortland 2009, 2: However, these vessels may have been used for the production of secondary ingots from recycled or ground up glass rather than primary ones: Smirniou and Rehren 2016, 52.

Fig. 2 Finished glass objects and glass-working items from Amarna mounted on cards by F. Spurell, excavated by Petrie in 1892. Liverpool World Museum acc. no. 56.20.628 and 56.20.629.

vessels for the secondary manipulation of glass. Complete glass ingots from Late Bronze Age archaeological contexts are rare. A large number, ca. 175, were found in the Uluburun shipwreck,[12] which sank shortly after the Amarna Period.[13] Since the dark blue ingots from the Uluburun shipwreck are chemically similar to dark blue glass objects found at Amarna,[14] it has been suggested that these were originally produced there. The absence of cylindrical vessels on the shipwreck may be another indicator of this, since it

12 The Uluburun shipwreck is the wreck of a cargo which sank in the Late Bronze Age ship discovered off the southern Turkish coast in the 1980s (Bass 1986, 296; Yalçin, Pulak, and Slotta 2005, 576).

13 This is based on a scarab bearing the name of Queen Nefertiti, the wife of Akhenaten as well as radiocarbon dates: Newton et al. 2005, 115–116; Yalçin, Pulak, and Slotta 2005, 598.

14 Jackson and Nicholson 2010, 299.

may demonstrate that the ingots were not transported in their moulds, although this is uncertain.

Glass-working in the Late Bronze Age was probably carried out using small domestic ovens and bonfire pits, especially since the temperature required for the working of glass into finished objects, i.e. its point of viscosity, lies at just above 800°C.[15] Indeed, the small number of large and substantial firing structures throughout Amarna, together with numerous glass-working materials in domestic buildings, shows that the colourful core-formed glass vessels and items of jewellery, which make up part of the archaeological record in the New Kingdom royal cities were produced in domestic contexts or workshops.

Since the raw materials of faience are the same as in raw glass (although in different quantities) and because of the fact that the temperature required is virtually the same as for the working of glass,[16] these industries frequently occurred together in the archaeological record. The thousands of ceramic moulds found throughout Amarna demonstrate that faience-manufacture also took place at a household level. Faience is a vitreous quartz, also described as 'glazed composition', and the raw mass is usually moulded, but also sometimes free formed and fired. The raw mass was frequently coloured with copper, although faience of various colours and polychrome objects were also produced during the New Kingdom. It may be due to this that the first glass objects were coloured with copper rather than with cobalt, the same being the case with early and predynastic glazed stone and faience objects.[17]

2.1 Colours and colourants used in the manufacture of ancient Egyptian glass

The variety of colours in both glass and faience items dating to the New Kingdom – both raw material and finished objects – is large. However, the most common colour combination found on 18th dynasty glass vessels and some beads consisted of (dark) blue glass that was decorated with spirals or wavy thread designs in opaque white and yellow.[18] The white colour of the glass was achieved using calcium antimonate, and the yellow was produced with lead antimonate.[19] In addition to blue, white and yellow, glass was also coloured violet or amethyst (manganese), black (manganese), brown (iron oxide) and red to red-brown (reduced copper oxide). Green, opaque glass also exists (copper and lead antimonate), and recent research has shown that this has a similar

15 Nicholson 2007, 118.
16 Nicholson 2007, 133–135; Eccleston 2008.
17 Nicholson 2012, 12.
18 Stern and Schlick-Nolte 1994, 32, although Petrie states that he discarded the numerous monochrome vessel fragments and only brought back the polychrome ones, implying that large quantities of monochrome vessels must have existed at Amarna (Petrie 1894, 16).
19 Shortland 2002, 518.

chemical profile to glass objects from Mesopotamia.[20] All these colours can be found in the archaeological record, both in finished objects and in items related to glass-working. Glass was frequently, but not exclusively opacified, particularly since traces of iron oxide in the raw material could lend the intended colourless glass a green or brown shade.[21] However, dark blue and turquoise glass was often intentionally left translucent. While the colourant of the dark blue shades is cobalt, the lighter blues and turquoise were achieved using copper oxide.

2.2 The social context of glass in ancient Egypt

It has been argued that glass, particularly blue glass, was regarded by the ancient Egyptians as a type of stone, rather than a direct imitation of the semi-precious material.[22] Early glass objects include small pieces of sculpture and jewellery that were made using a combination of casting and carving techniques.[23] The discovery of a workshop producing agate and glass jewellery using stone-working methods, including the carving of both raw stone pebbles and glass bars to produce amulets and beads at Amarna site M50.14–16,[24] emphasises this hypothesis. The same is the case with the description of glass brought as war spoils to Egypt in the Annals of Thutmosis III in Karnak, where glass ingots are described as 'Menkheperre lapis-lazuli' *(ḫsbḏ)* and 'Menkheperre Faience or Turquoise / Malachite' (*ṯḥn.t*[25] or *mfkꜣt*).[26] This is a direct parallel to the ancient Near Eastern denomination of glass as 'lapis lazuli from the kiln' (i.e. artificial stone) as opposed to 'lapis lazuli from the mountain' (i.e. natural, quarried or mined stone).[27] In addition, the Karnak Annals list the glass and stone imports after precious metals, perhaps because the latter products were considered to be of a lesser value.[28]

There are some Egyptian textual sources referring to 'faience makers', mainly dating to the New Kingdom, and from a variety of sources and sites, listed by Shortland.[29] These titles include that of the 'Overseer of faience-makers', namely *ỉmy-rꜣ ṯḥntyw*, from the coffin of a 13th dynasty individual named Debeheni, and an *ỉmy-rꜣ ỉrw ḫsbḏ*, from a papyrus dating to the 19th dynasty. Two additional 'Chief faience makers' are known: A Hatiay, whose New Kingdom funerary stela mentions him as a *ḥry ỉrw ḫsbḏ n nb tꜣwy*,

20 Varberg et al. 2016.
21 Shortland, Hope, and Tite 2006, 591.
22 Nicholson 2012, 11.
23 See Schlick-Nolte, Werthmann, and Loeben 2011, 27–36, for some examples of early glass sculpture and the article as a whole for examples of carved glass objects.
24 Hodgkinson 2015, 282, cf. Hodgkinson 2017, 100, 232
25 Faience was referred to by the Egyptians as *ṯḥn.t*, which can be translated as 'dazzling' or 'gleaming' (Hannig 2001, 960–961).
26 Wreszinski 1923, 40; cf. Nicholson 2012, 17–18 and Shortland 2012, 142. Menkheperre is the throne name of 18th dynasty pharaoh Thutmosis III.
27 Shortland 2012, 140.
28 For the hierarchical ordering of minerals in Egyptian texts organised as lists, see Baumann 2018, 507–511 and 543–545.
29 Shortland 2000, 71; cf. Nicholson 2007, 145–146 and Hodgkinson 2017, 10–11

while a man named Ptahmose, from the Egyptian New Kingdom, bears the same title, mentioned on a papyrus. a faience funerary stela dating to the reign of Ramesses II, mentions a 'faience maker' (titled *ỉrw ḫsbḏ n Imn*) named Rekhamun. It may be possible that these 'faience makers' also acted as 'glass makers' or 'glass workers', especially since the materials that they were known to process, according to their titles, were *ṯḥn.t* and *ḫsbḏ*, the latter either meaning lapis lazuli or, possibly, blue glass,[30] which also occurs in the Annals in the Festival Hall of Thutmose III at Karnak.

2.3 The symbolism and value of colourful glass in ancient Egypt

The colour blue, particularly its darker shades, had a special significance and religious connotation in ancient Egyptian culture, this being the colour of the night sky and the sea.[31] Hieroglyphs depicting such elements were frequently coloured blue and aspects of deities were painted or inlaid in blue as well. This phenomenon is reflected in presentations of royalty in the New Kingdom, including the blue inlays in the mask of Tutankhamun (Cairo JE 60672), which are made from lapis lazuli and blue glass. Other objects from the tomb of Tutankhamun include a pectoral in the shape of a winged scarab from lapis lazuli (Cairo JE 61888). This item depicts the solar deity Khepri, impersonating rebirth as well as forming part of the king's name, *nb-ḫpr.w-Rʿ*. The scarab has golden wings, and this combination is well-attested in ancient Egyptian literature. Some Egyptian texts make reference to body parts of deities being from lapis lazuli, such as the 'Book of the Heavenly Cow' (3:7), which describes the sun-god, Ra, as having "...hair from real lapis lazuli".[32] The 'Hymn to the Sun-God' describes a lapis lazuli-coloured sky in the shape of Nut, the sky-goddess,[33] while describing the rays of the sun as being from the same material.[34] A reference is made to turquoise being the colour of the sky,[35] as well as the primeval waters being from lapis lazuli.[36]

It is believed that both light and dark blue-coloured faience, glass and pigments were produced due to the fact that the natural sources of the colour, turquoise, lapis lazuli and green feldspar had to be imported from far away, from the Sinai and modern day Afghanistan, the artificial products being imitations of these semi-precious stones.[37] It can be said that a set of dark blue (cobalt-coloured) 14th – 13th century BC axes found at Nippur were designed to imitate lapis lazuli and its overall mottled appearance through the inclusion of white microcrystalline phases.[38] This has not been observed with any ancient Egyptian glass objects. The colours yellow and white are believed to

30 Shortland 2007, 264–265; Hannig 2001, 619–620.
31 Nicholson 2011, 2–3.
32 Monfort 2016.
33 Assmann 1975, 132 (l. 18).
34 Assmann 1975, 133 (l. 8).
35 Assmann 1975, 231 (l. 42).
36 Assmann 1975, 232 (l. 23).
37 Oppenheim 1970; Warburton 2007, 241.
38 Walton, Eremin, et al. 2012, 840, 850.

be imitations of gold and silver or electrum, the skin and the bones of the gods. The ancient Egyptian word *ḥḏ* is the term used for both 'white' and 'silver'.[39] While it can be postulated that the dark blue colour of glass vessel designs can be considered an imitation of the precious lapis lazuli stone, with the yellow and white threaded designs possibly imitating the gold-coloured pyrite and calcite inclusions, it is more likely that the wavy lines imitate silver or gold foil applied to the vessels. Indeed, some examples of monochrome vessels decorated with gold foil still exist, such as the turquoise cosmetic vessel EA24391, dating to the reign of Thutmose III in the British Museum,[40] which is based on contemporary stone vessels, such as a group kept in the Metropolitan Museum of Art, New York.[41] Since the glass vessels were used for the storage of precious liquids, it is possible that the wavy pattern imitates the 'water' or '*n*' hieroglyph, which consists of a zigzag line for water or liquid.[42]

2.4 The symbolism and value of glass products and raw materials for glass production

A large number of glass vessels and fragments of these have been found and now form part of museum collections worldwide. The shapes of these core-formed[43] glass containers are based on that of small-scale stone vessels, including amphoriskoi, krateriskoi and alabastroi alongside kohl jars, juglets, chalices and bowls. An example of this has been given above, in the case of the gold-rimmed vessel EA24391. The purpose of these objects was to contain precious substances, such as perfumes, oils and eye make-up, making them elite items. Items of jewellery were also produced in both monochrome and polychrome glass, and these objects range from small and simple, spherical beads to elaborately manufactured beads with threaded and twisted designs. Prior to the manufacture of (dark) blue glass vessels and jewellery, glazed steatite and faience were used from as early as the predynastic period and the Old Kingdom respectively to produce small containers and body adornment.[44]

In addition, blue pigment was manufactured artificially in the form of the Egyptian blue before the advent of glass in New Kingdom Egypt. The manufacture of this calcium copper silicate (using almost identical ingredients to raw glass) required high temperatures of up to 1000°C, and the context of its manufacture is not entirely clear,

39 See Warburton 2007, 231.

40 Nolte 1968, 47, pl. I, 1.

41 Roehrig, Dreyfus, and Keller 2005, 218–219, see also the similarly-shaped cosmetic vessels from serpentine: Roehrig, Dreyfus, and Keller 2005, 217.

42 This is Gardiner, N 35 (Gardiner 1999, 490).

43 For an introduction to the core-forming technique see Stern and Schlick-Nolte 1994, 28–37.

44 Nicholson 2012, 12.

although it is believed to have been produced at Amarna and Qantir[45] during the New Kingdom.

As mentioned above, the colourant used in the manufacture of dark blue pigment,[46] glass and faience was a cobalt bearing alum, which was sourced in the western desert, near the Kharga and Dakhleh oases.[47] It was used in the manufacture of dark blue glass and faience objects from the reign of Thutmosis III in the early 18th dynasty,[48] just shortly after the advent of glass in Egypt from the Near East. For this reason, the raw colourant together with the resulting dark blue glass was considered to have been a royal monopoly during the New Kingdom. A second source of cobalt primarily used in Mesopotamian glass objects including the above-mentioned axes from Nippur has recently been identified, although only by means of chemical analysis, while the actual location of this source remains unknown.[49] It is worth noting here that the number of Mesopotamian glass objects from the Late Bronze Age coloured with cobalt is very small and that the glass items from this region have commonly been found to be coloured with copper.[50]

The cobalt colourant was not only employed in the manufacture of glass, but it was also used to provide the colour for the blue-painted pottery vessels known from the Egyptian New Kingdom, primarily from Malqata and Amarna. These vessels were considered luxury items and were usually found in ceremonial contexts, the blue decoration most frequently representing depictions of floral (lotus-) garlands.[51]

Copper oxide, the raw material used for the lighter shades of blue, was much more abundant and readily available than cobalt, being obtained as a side-product from metalworking.[52] Chemical analyses have been carried out to test and confirm the colourants used in the manufacture of blue glass objects.[53] Some objects have been found to contain traces of both cobalt and copper, indicating the use of a mixture, or, possibly, recycling, although this can only be determined by means of chemical analysis.[54]

2.5 Amarna and the international trade of blue glass

Previous research has established that Amarna was a centre for the production of blue glass, while other centres in Egypt and around the Mediterranean simultaneously pro-

45 Qantir is the site of ancient Pi-Ramesses, the capital of the ramesside kings (ca. 1190–1080 BC), situated in the eastern Nile delta.
46 Such as that used on the blue-painted pottery, see Shortland, Tite, and Ewart 2006, 159. See also Kaczmarczyk 1986.
47 Kaczmarczyk 1986; Shortland and Tite 2000, 150; Shortland, Tite, and Ewart 2006, 166–167; Abe et al. 2012, 1797.
48 Shortland, Tite, and Ewart 2006, 162.
49 Walton, Eremin, et al. 2012, 848, 851.
50 Shortland, Tite, and Ewart 2006, 163.
51 Shortland, Tite, and Ewart 2006, 163; Shortland and Eremin 2006, 93.
52 Nicholson 2007, 103.
53 E.g. Shortland, Hope, and Tite 2006, 591–593; Molina et al. 2014.
54 See Smirniou and Rehren 2016, cf. Hodgkinson 2016.

duced glass of other colours, which was then traded.[55] While the earliest glass is believed to have been imported into Egypt from the Near East, the glass ingots from the Uluburun shipwreck and the discovery of similar ingots at Amarna may indicate that glass from Amarna travelled the Mediterranean as a valued trade product. In addition, dark blue glass objects (primarily beads) found in the Mycenaean world have a chemical fingerprint matching that of glass from Amarna and Mesopotamia, indicating that the knowledge of manufacture of this material did not travel while the raw material did.[56] Other possible evidence of later trade is the discovery, by chemical analysis, that at least some of the green glass found at Amarna was initially produced in Mesopotamia, as mentioned above.[57]

We can say that blue glass was considered a popular high-status item during the Late Bronze Age, which was produced and traded between Egypt, Mesopotamia and the rest of the Mediterranean area. It has also been demonstrated that this material was regarded as equal to stone, although not as valuable as precious metals including gold and silver.

However, the nature and internal and external organisation of the workshops that produced raw glass and finished glass objects is unknown. The following analysis therefore addresses the question of the role played by the different colours in these workshops at Amarna and Gurob, in order to determine whether it is possible to attest the importance of the different shades of blue. It will be tested whether they were subject to royal control, and the role of the white and yellow glass items and the other colours used in glass-working during the New Kingdom.

This paper draws on, and to an extent adds to, a paper by Kozloff,[58] which focusses on the variety of shades of blue in glass, faience and pigments found at the sites of Malqata[59] and Amarna. Kozloff's study concluded that Amarna's workshops produced less cobalt- than copper-coloured, i.e. light blue and turquoise glass;[60] and the present study will test this theory. Because of the results of this study and due to the fact that copper was more easily obtainable than cobalt, it is expected to find a greater quantity of light blue or turquoise glass objects and glass-working items at Amarna.

55 Rehren 2014, 219.
56 Walton, Shortland, et al. 2009, 1502.
57 Varberg et al. 2016.
58 Kozloff 1994.
59 Malqata is the site of a palace belonging to Amenhotep III, the father and predecessor of Akhenaten in the 18th dynasty. The settlement lies on the west bank in the area of modern Luxor, near the mortuary temples of the New Kingdom pharaohs and the Valley of the Kings.
60 Kozloff 1994, 185.

3 A spatial and statistical analysis of coloured glass objects at Amarna

In order to understand the management and control of the coloured glass items found at Amarna, and consequently their economic value, spatial and statistical analyses were carried out and a series of maps and charts was produced showing the distribution of these coloured objects. This was done with a focus on the various shades of blue, opaque yellow and white glass objects, since these were most commonly encountered in finished objects, but it also includes the range of other colours manufactured in glass. The detailed analysis addresses and highlights the importance of cobalt and copper coloured glass at Amarna and Gurob. It has furthermore identified two distinctive centres of glass-working in Amarna's Main City North and South, which were manufacturing light and dark blue glass objects respectively.[61]

A database of a total of 2421 glass objects from the Central and Main City at Amarna, including a total of 1691 items interpreted as evidence of glass-working forms the basis for this research, including information from both modern excavation and survey work as well as excavations carried out since 1891, when Petrie worked at Amarna.[62] Please refer to Appendix 1 for a summary of the methods and data sources used for this analysis.

3.1 Overall analysis of glass objects (including glass-working items)

Fig. 3 shows the interpolated raster image based on the total of objects from glass, both finished and raw material for processing, found in each of the buildings at Amarna. It is evident that numerous objects were found in the area of site O45.1 in the MCN, excavated in the 1990s, which is supposed to be the same general area in which Petrie encountered his "glass-factories".[63] The so-called palace waste heaps, which were also examined by Petrie, likewise yielded large quantities of both raw glass and fragments of finished glass vessels.[64] Additional hotspots can be found at site Q48.4 in the south-eastern area of the MCN, a workshop complex excavated in the 1980s,[65] as well as in the area of the early 2000s excavation encompassing the House of Ranefer, the small houses within so-called Grid 12 and N50.23.[66] This dataset is enhanced by the presence of over 500 glass objects found in 2014 in the domestic workshop complex M50.14–16.[67] However, when the data from the new excavations is ignored and a new Inverse

61 See footnote 2 for the abbreviations used for the suburbs of Amarna discussed in this paper.

62 Petrie 1894.

63 Petrie 1894, 25; Nicholson 2007, 14.

64 Petrie 1894, 16, and see Appendix 1 therein for the data sources. The palace waste heaps were most probably a large communal waste disposal area which contained waste from both the Central City and the northern Main City at Amarna.

65 Kirby 1989, 15–63; Nicholson 1989, 64–81.

66 Kemp and Stevens 2010a.

67 Hodgkinson 2015, 282.

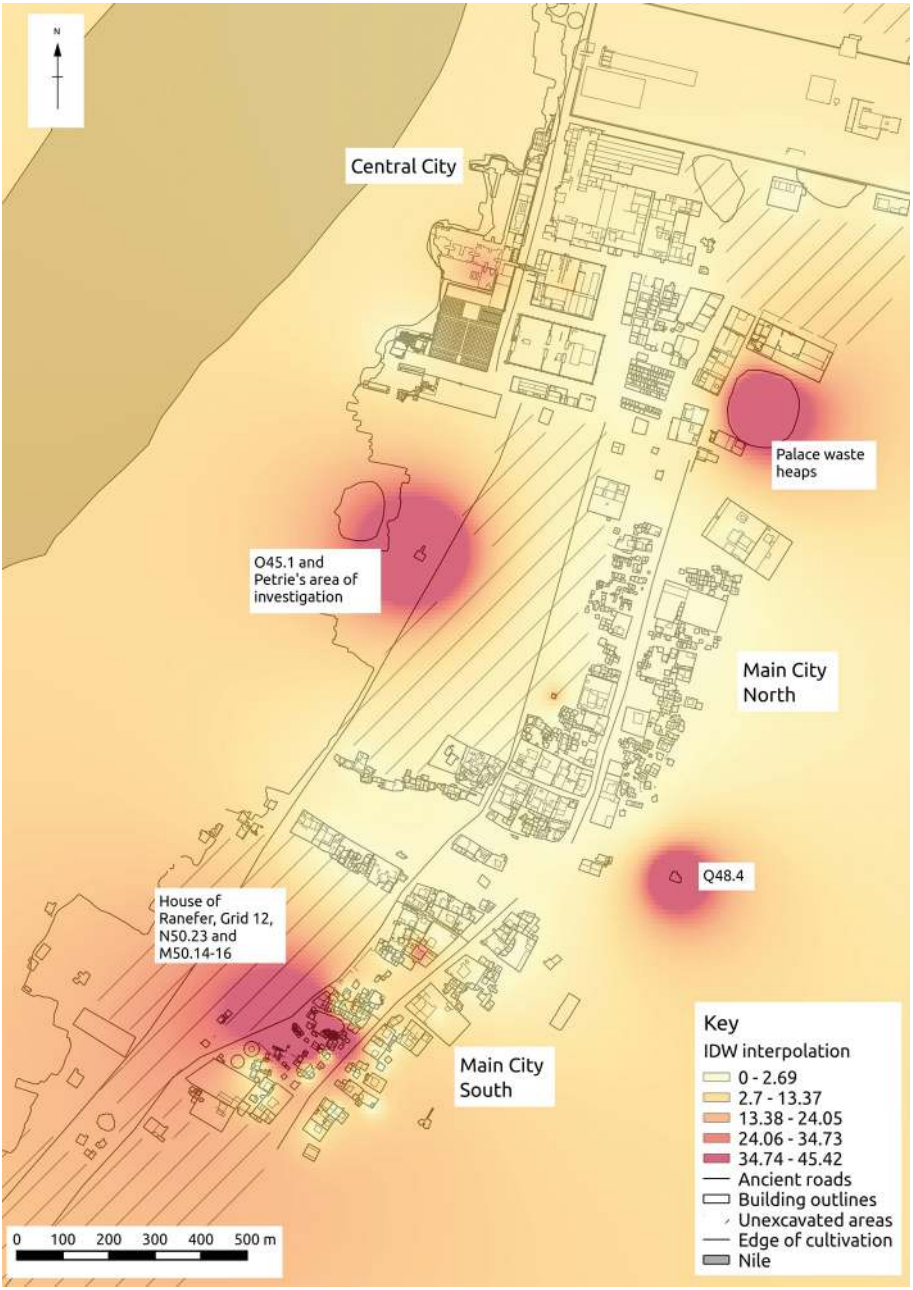

Fig. 3 Interpolation based on all glass objects regardless of colour with a recorded findspot found at Amarna.

Distance Weighted (IDW) interpolation[68] produced (Fig. 4), hotspots can only be seen in the area of the palace waste heaps and the palace itself, with a few smaller hotspots in the houses of the Main City. Much of this material is made up of finished glass vessels.

In order to understand the distribution and spatial organisation of glass-working related materials, a series of interpolations has been produced of only these materials. Fig. 5 and Fig. 6 show the density of objects classified as evidence of glass-working from all excavations and only from old excavations respectively. While the same hotspots are visible in Fig. 3 as in Fig. 4, the latter also including the finished objects, Fig. 6 shows a large hotspot in the area of the palace waste heaps as well as a faint concentration in the central area of the MCS. Fig. 7 shows an IDW interpolation based only on the data from old excavations from the MCS, thus excluding the influence of the data from the CC waste heaps. One hotspot becomes very obvious, and is due to a series of domestic workshops, one of which is house N50.23, a building already excavated by the Deutsche Orient-Gesellschaft (DOG) in the 1910s and found to contain evidence of glass and faience manufacture.[69] The British excavations in the same general area also noted large amounts of glass-working waste and raw materials in the vicinity of the House of Ranefer as well as workshop M50.14–16, although they did not draw any conclusions from this regarding the general area.[70]

The graph in Fig. 8 compares the ratios of finished glass objects and glass-working materials from each of the analysed suburbs at Amarna. While the CC dataset does not include any modern excavation data, the material recovered from this area at the beginning of the 20th century is far more numerous than that recorded from the Main City, where only modern excavations have confirmed the existence of large amounts of glass-working activity. It is, in fact, probable that the large amount of glass rods in the Petrie Museum, London from Amarna, but without a precise archaeological context, are in fact from this area in the CC.[71]

A total of 960 pieces of blue glass-working objects encompassing many shades of blue and turquoise with a specific find context were found at Amarna. The graphs in Fig. 9 and Fig. 10 show the ratios and counts of blue glass objects as well as those considered evidence of glass-working by suburb. As already stated, no data from modern excavations has been included for the CC and it can be observed that the shades of the blue glass from the old excavations in this part of Amarna have frequently not been specified. Furthermore, no blue glass-working objects have been registered from the CC, this part of the city having yielded a relatively high number of objects of unknown colour.

68 See Appendix 1.
69 Borchardt and Ricke 1980, 311–312.
70 Peet and Woolley 1923, 9–15, 19.
71 A rough quantification of the glass-working finds from Amarna has resulted in a total number of about 4300 objects.

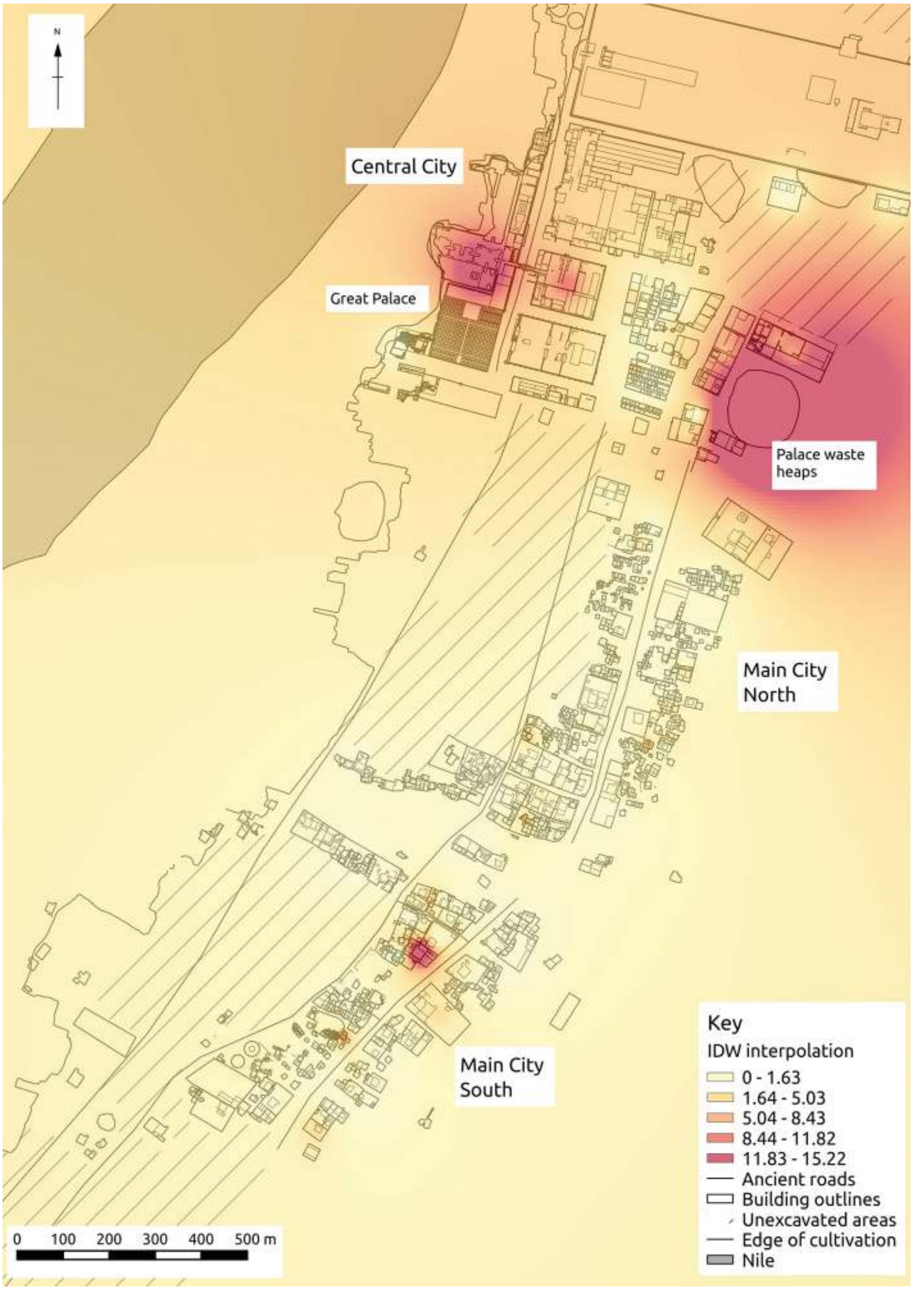

Fig. 4 Interpolation based on all glass objects regardless of colour – only from old excavations – with a recorded findspot found at Amarna.

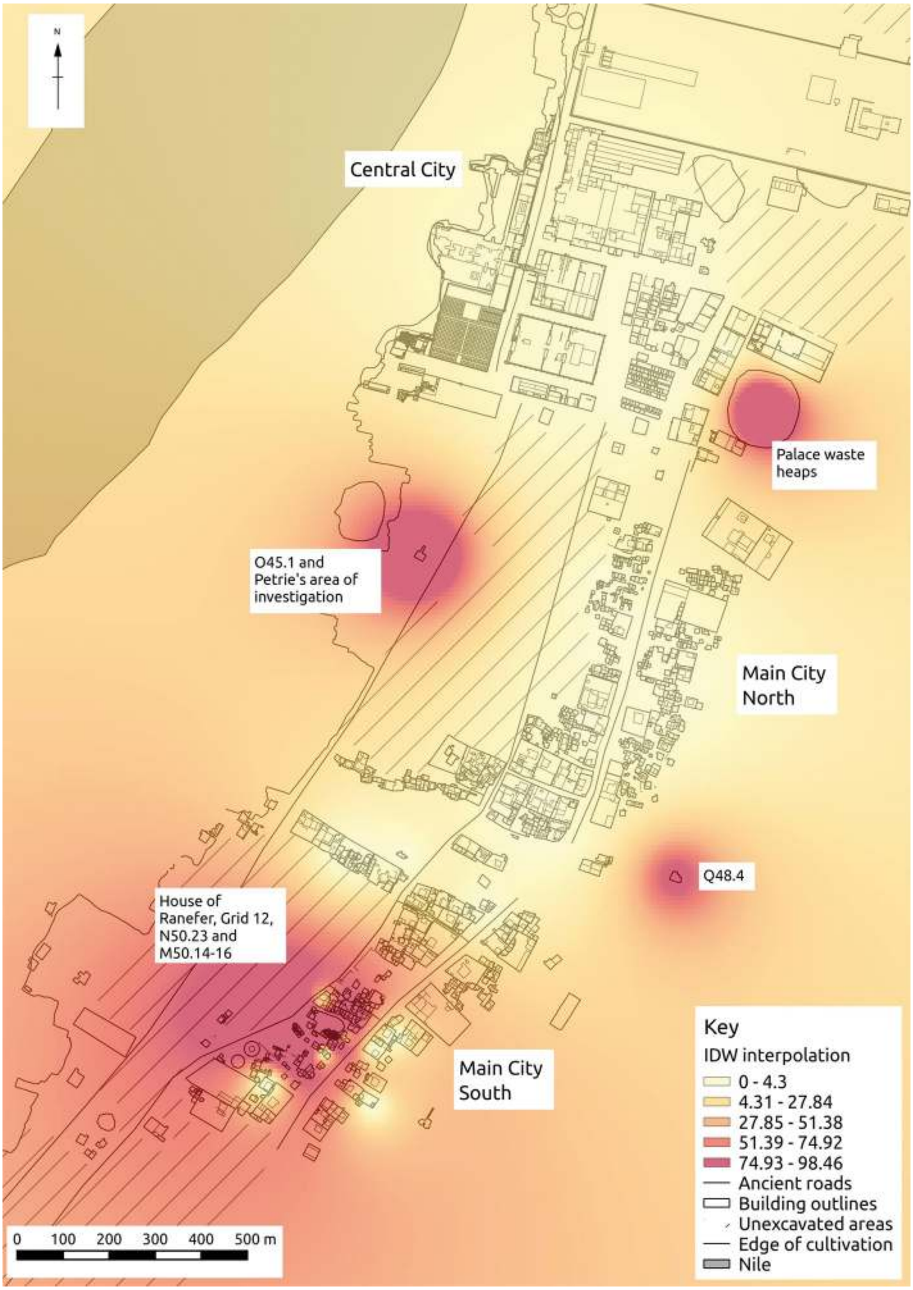

Fig. 5 Interpolation based on all glass-working objects regardless of colour with a recorded findspot found at Amarna.

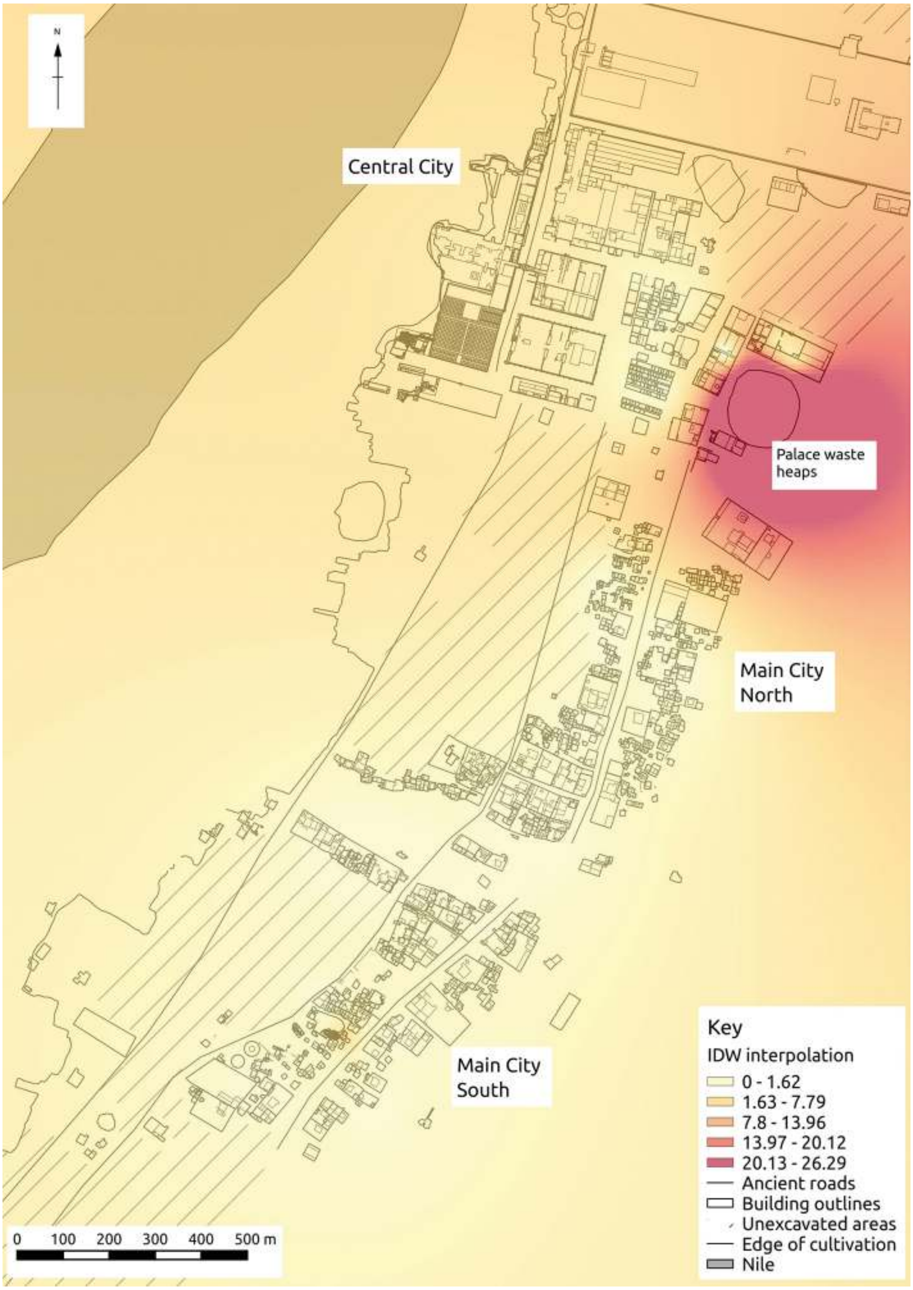

Fig. 6 Interpolation based on all glass-working objects regardless of colour – only from old excavations – with a recorded findspot found at Amarna.

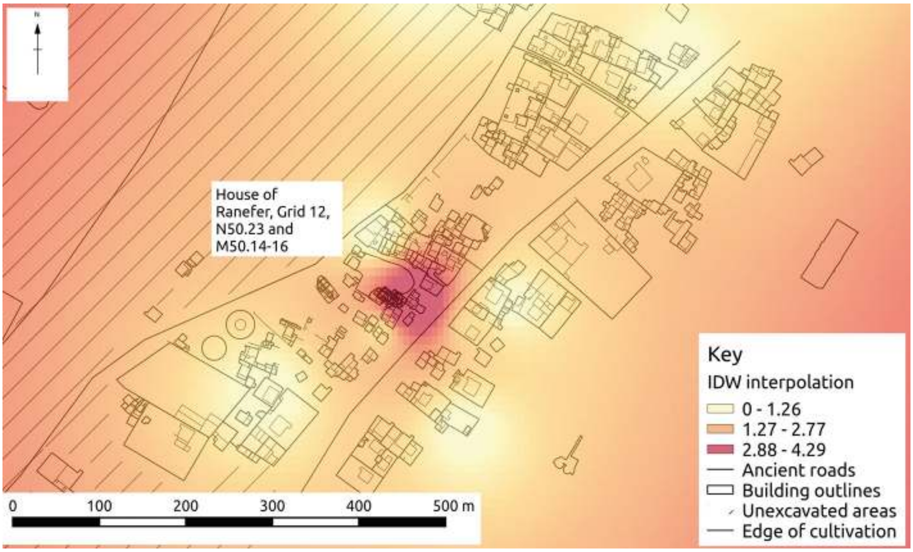

Fig. 7 Interpolation based on all glass-working objects regardless of colour – only from old excavations – from the Main City South at Amarna.

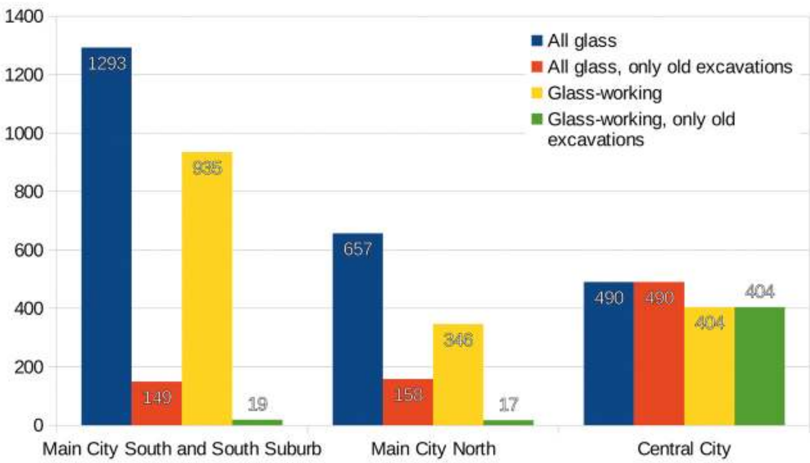

Fig. 8 The ratios of finished glass objects and glass-working items regardless of colour from old and modern excavations found in the analysed suburbs at Amarna.

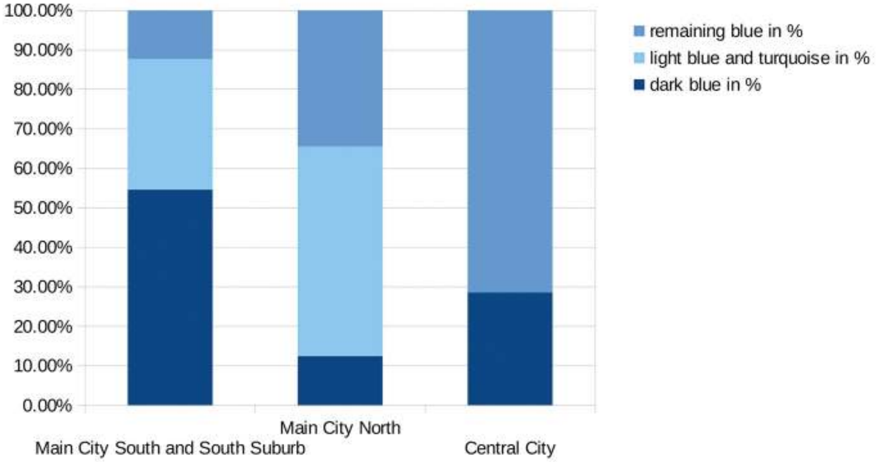

Fig. 9 The ratios of all blue glass objects and glass-working items from the analysed suburbs at Amarna.

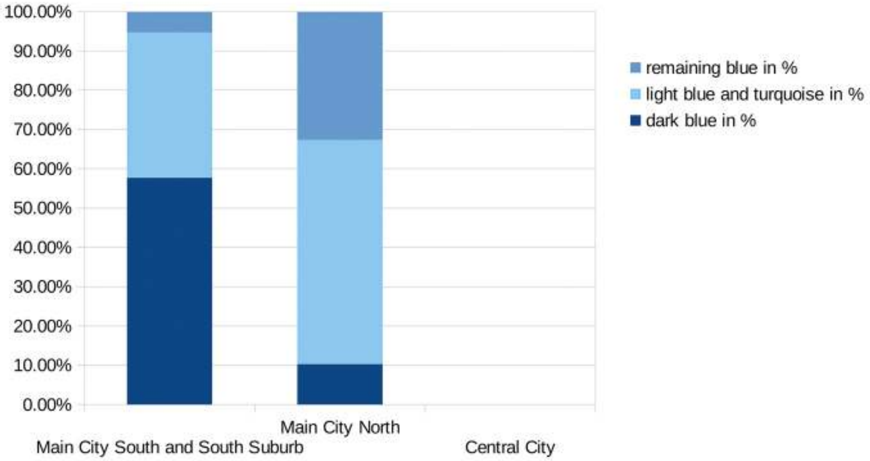

Fig. 10 The ratios of the blue glass-working items from the analysed suburbs at Amarna.

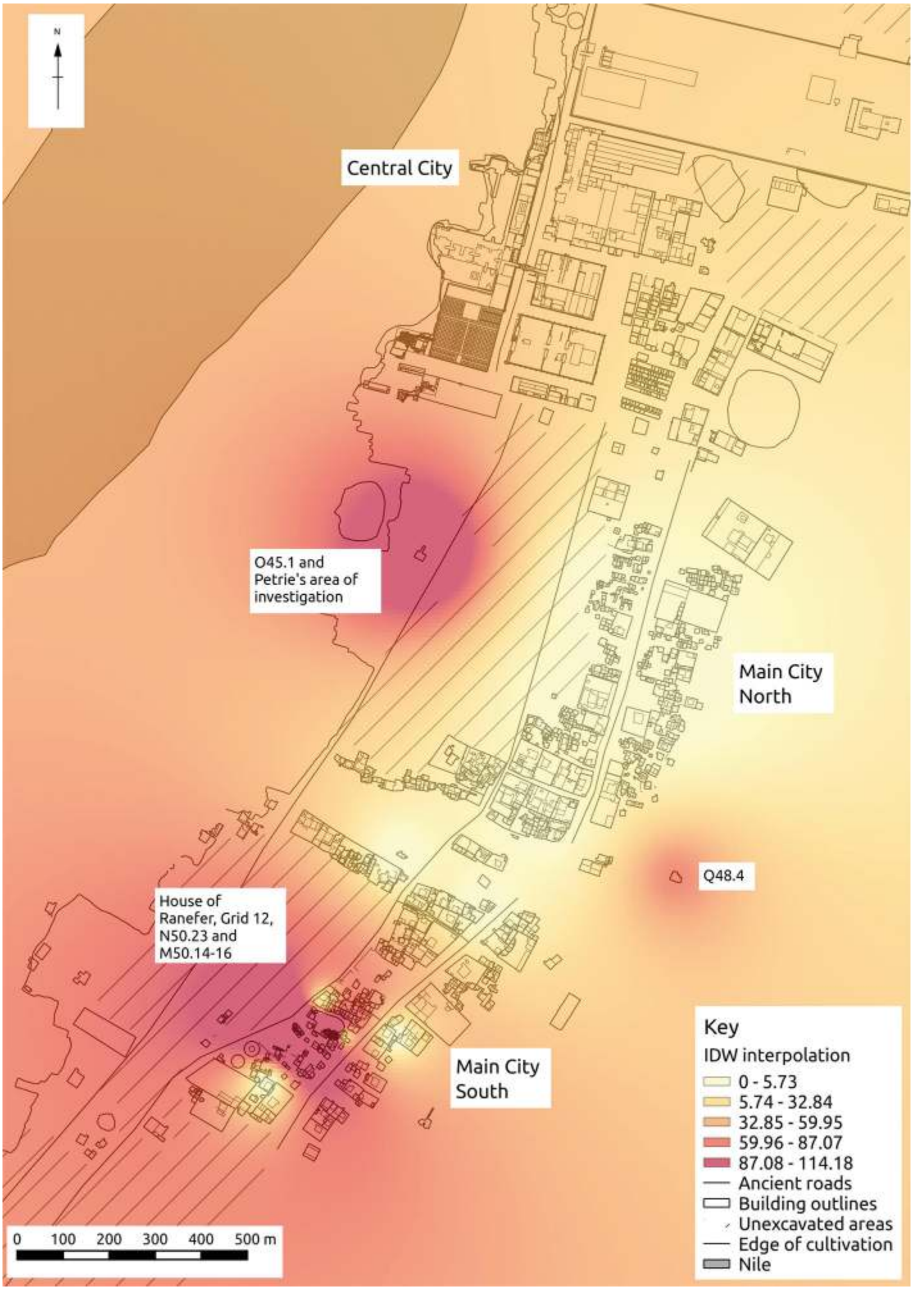

Fig. 11 Interpolation based on all blue glass-working items with a recorded findspot from the Central and Main City at Amarna.

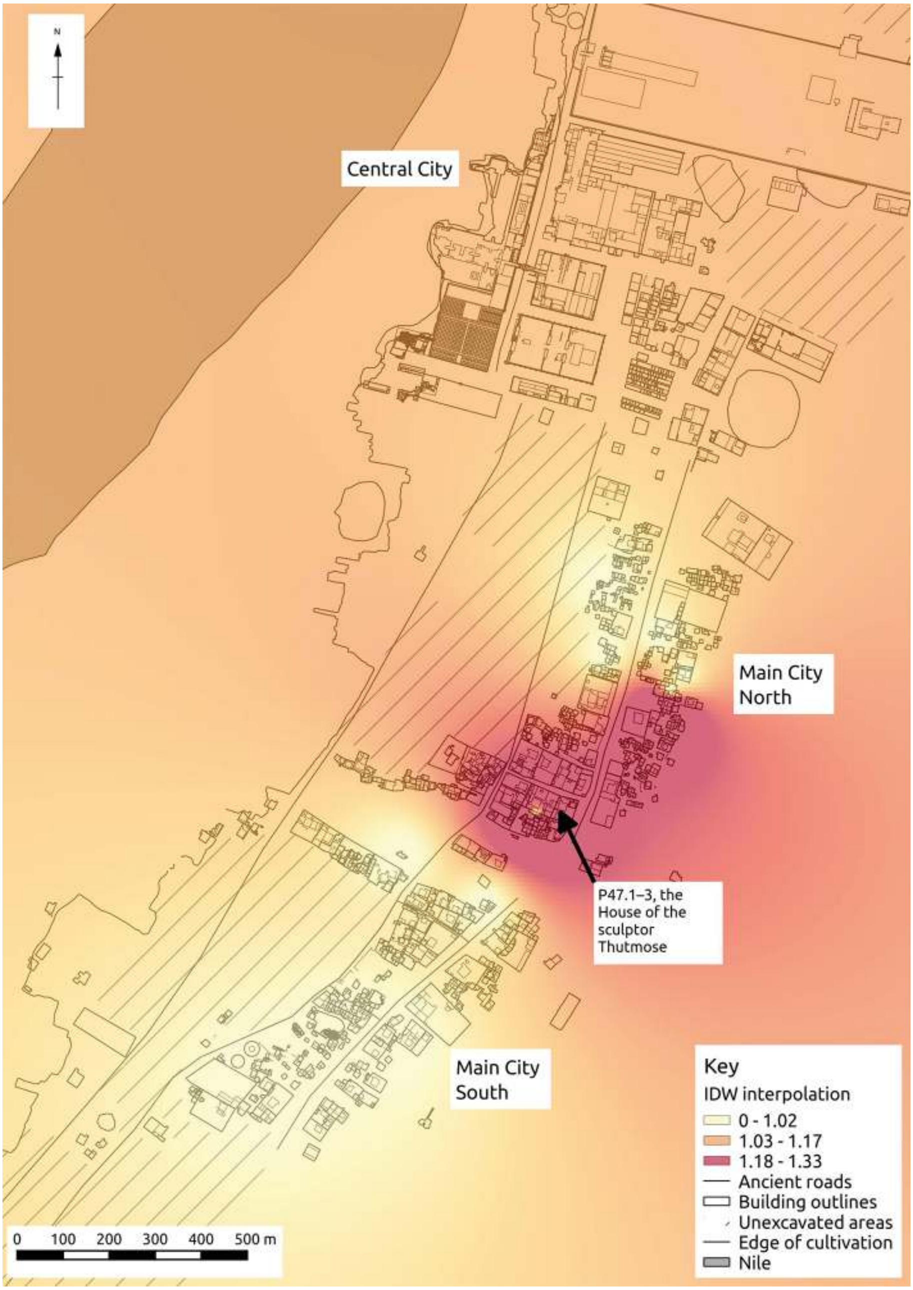

Fig. 12 Interpolation based on all blue glass-working items with a recorded findspot – only from old excavations – from the Central and Main City at Amarna.

The concentrations of blue glass in the modern areas of excavation, O45.1, Q48.4 and the MCS (Ranefer, Grid 12, N50.23 and M50.14–16) stand out in Fig. 11. The interpolation of only the old excavation data (Fig. 12) leads to a concentration in the southern half of the MCN, around P47.1–3, the House of the sculptor Thutmose, whose workshop yielded the famous bust of Nefertiti.[72] This large hotspot, however, is based solely on the occurrence of 1–2 objects of blue glass found during old excavations in five houses.

The same analytical method has been applied to dark blue glass-working objects, with similar results: the bulk of the data from old and new excavations is concentrated in the MCS, while the old excavation data shows a spread of glass-working objects throughout the MCN, with a concentration around the Thutmose workshop (see Fig. 13 and Fig. 14). The area encompassing the House of Ranefer, Grid 12, N50.23 and M50.14–16 previously lacked depth of excavation and coverage prior to 2000, although glass-working activity at site M50.14–16 had previously been registered.[73]

The bulk of lighter blue and turquoise glass-working items (Fig. 15) comes from modern excavations, and the highest concentrations can be seen in the north-western part of the MCN, in the area of workshop O45.1. Since the excavation of this workshop in the 1990s, it has been acknowledged as responsible for the processing and perhaps even the production of blue glass.[74] The bulk of the light blue glass objects found at Amarna coming from site O45.1, the output from this workshop stands in contrast to the domestic sites in the MCS.

3.2 Yellow and white opaque glass

Fig. 16 shows the distribution of glass-working objects from yellow, largely opaque, glass. Once again, a concentration can be observed in the industrial quarter of the southern MCS. Although modern excavations at M50.14–16 yielded the highest number of yellow glass items for the manufacture of finished goods, the distribution of objects purely from old excavations is similar, with two yellow glass rods coming from N50.26.[75]

The distribution pattern of white, opaque glass items, both finished and raw glass items for working, is very similar to that observed above for the yellow glass-working objects (Fig. 17). Again, the highest concentration can be observed in the southern half of the MCS. This is due to the modern excavation data, with the highest number of white glass-working objects coming from the Grid 12 and the M50.14–16 excavations. Old excavation data is less frequent, but still occurs in this area, with very little evidence from other parts of the city.

72 Borchardt and Ricke 1980, 97.

73 Peet and Woolley 1923, 19.

74 Nicholson 2007, 115.

75 Borchardt and Ricke 1980, 315.

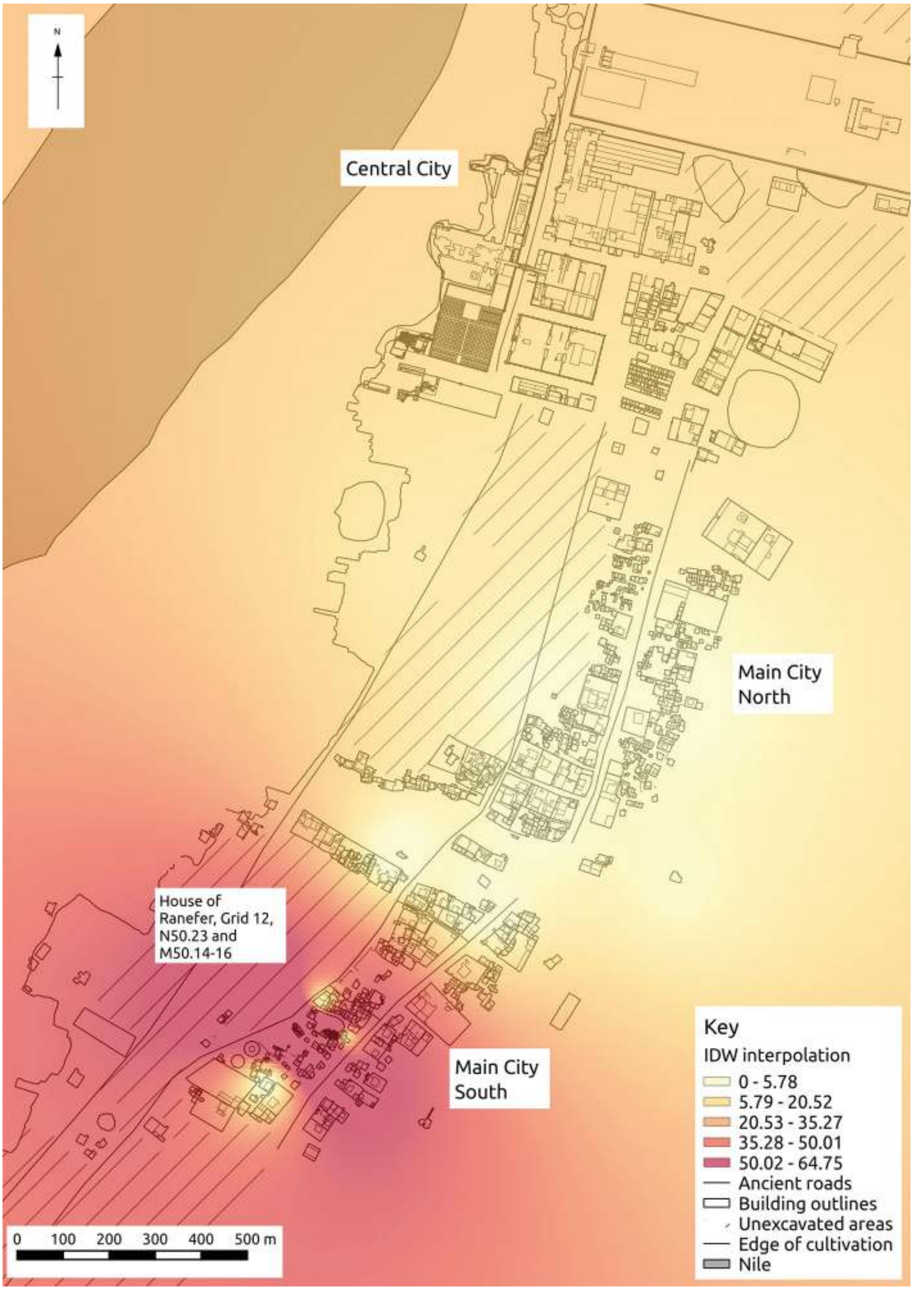

Fig. 13 Interpolation based on all dark (cobalt) blue glass-working items with a recorded findspot from the Central and Main City at Amarna.

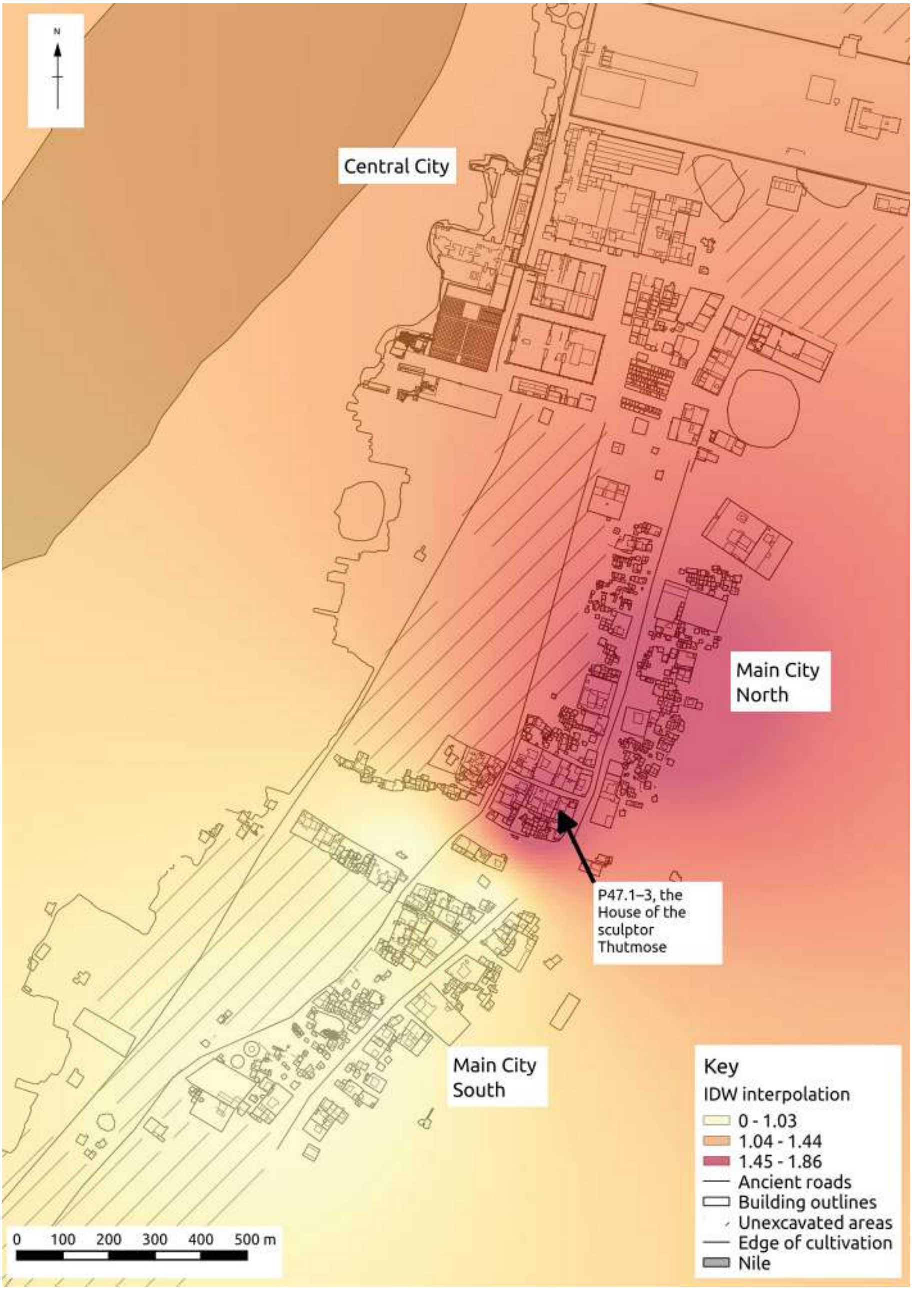

Fig. 14 Interpolation based on all dark (cobalt) blue glass-working items with a recorded findspot – only from old excavations – from the Central and Main City at Amarna.

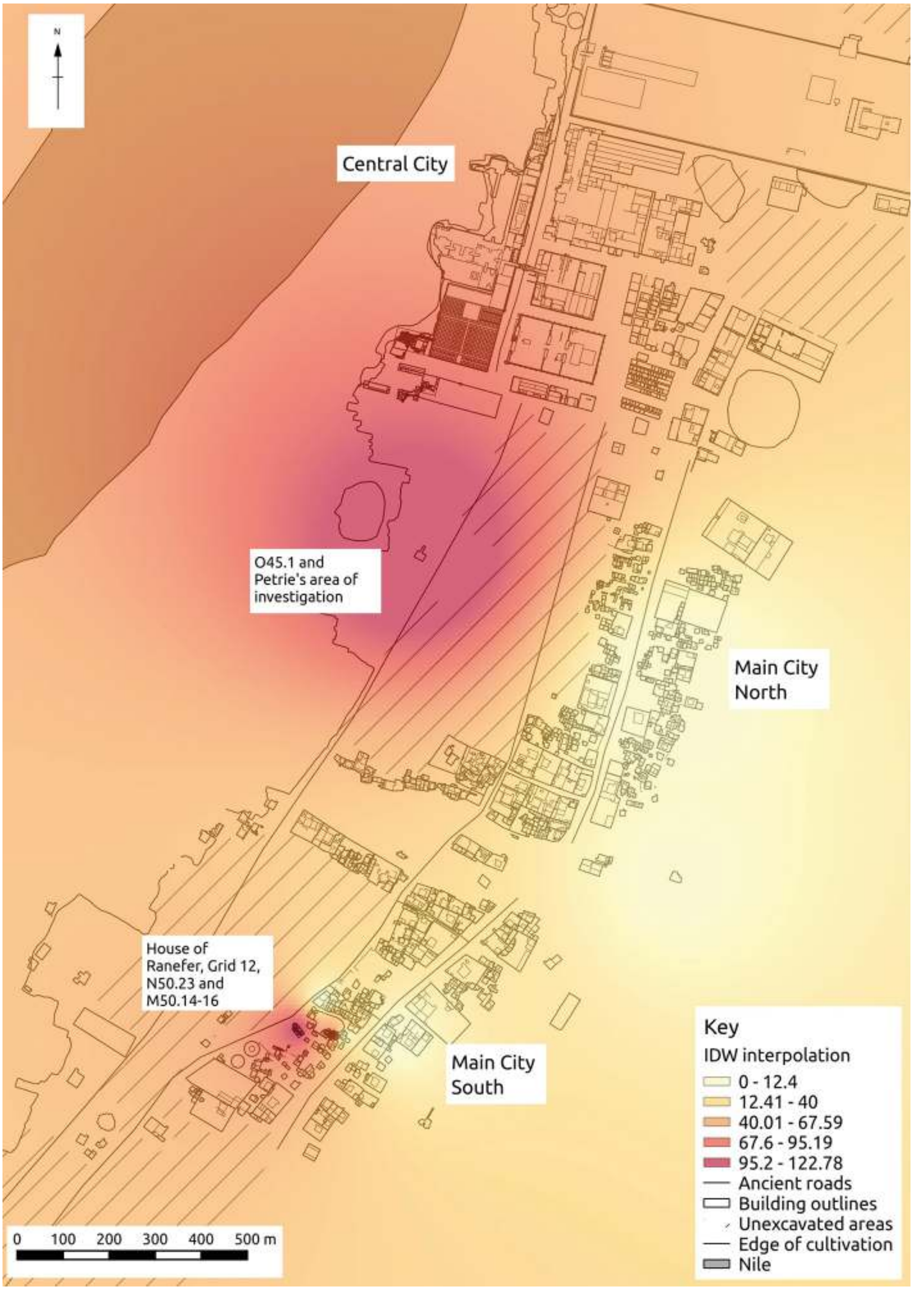

Fig. 15 Interpolation based on all light blue and turquoise (copper) blue glass-working items with a recorded findspot from the Central and Main City at Amarna.

Fig. 16 Interpolation based on all opaque, yellow glass-working items with a recorded findspot from the Central and Main City at Amarna.

Fig. 17 Interpolation based on all opaque, white glass-working items with a recorded findspot from the Central and Main City at Amarna.

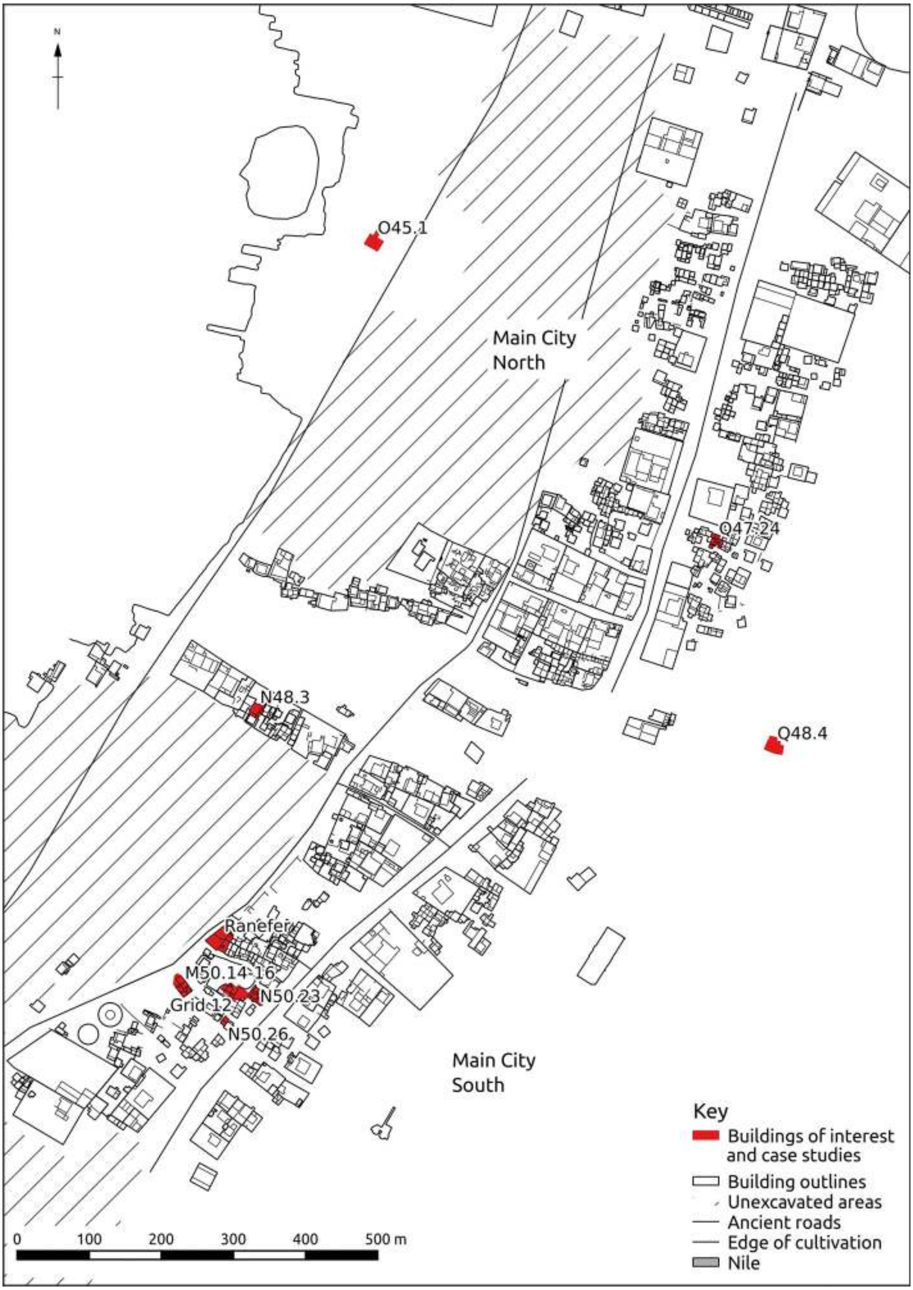

Fig. 18 Map of Amarna showing the findspots of blue, yellow and white glass-working items discussed in the text together with the case studies.

Only two buildings at Amarna were found to contain glass-working items from blue, yellow and white glass, these being M50.14–16 (MCS) and Q48.4 (southern MCN), both modern excavations. However, this is probably due to much information being lost during the excavations at the beginning of the 20th century, resulting in an incomplete record. However, it may be of some importance that the only five houses yielding yellow glass-working objects, Q48.4, Q47.24 and M50.14–16, N50.26, as well as N48.3 all lie either in the southern MCN or the northern or central parts of the MCS (Fig. 18). Of these, only Q48.4 and M50.14–16 contained both blue and yellow objects. The ratios of blue to yellow glass-working objects at these sites were recorded as 27:1 and 33.2:1 respectively. When only the buildings with blue and white glass-working items were selected, the House of Ranefer (N49.18), Grid 12 and M50.14–16 (all MCS) and building Q48.4 (MCN) demonstrated blue to white glass-working ratios of 8:1, 14.2:1 and 35.6:1, and 41.5:1 respectively, the ratios of blue to yellow of white glass-working objects at sites M50.14–16 and Q48.4 being the most similar.

3.3 Summary

It may thus far be stated that two distinctive centres of glass-working existed at Amarna's Main City North and Main City South, concentrating on the manufacture of glass items from light blue and dark blue glass respectively. It must, however, be borne in mind that much material can no longer be provenanced to precise sites within Amarna, which may alter this observation. The locations of these industrially active buildings are somewhat marginal, with site O45.1 being located at the far western edge of the MCN, Q48.4 at the southeastern border of the MCN, and the buildings in the MCS towards the southern edge of the city. The prevailing wind coming from the north ensures that the CC palace is not affected. The houses to the south of the latter still include elite buildings, although these are highly dispersed and few in number (see Figs. 8–10).

4 Case studies of modern excavations

Since a large number of museum objects from Amarna have lost their archaeological context within the city, and the results of the spatial analysis may therefore be biased, five individual excavation projects carried out at Amarna since the 1980s will be discussed as case studies. These modern projects were subject to careful and systematic excavation, the sieving of spoil and careful recording of finds, resulting in a much larger and more complete record. From north to south, these are O45.1 (north-western MCN, 1993–2003), Q48.4 (south-eastern MCN, 1987), the House of Ranefer (N49.18, 1996, 2002–2004), the Grid 12 excavations, together with house N50.23 and the site M50.14–16 (all southern MCS, 2004–2005) (Fig. 18).

4.1 O45.1

O45.1 was excavated in the 1990s and contained just over 300 glass objects, 213 of which were considered evidence of glass-working, i.e. excluding fragments of jewellery and other finished items. In addition, ca. 50 pieces of frit were found, alongside ca. 200 pieces of waste material, including vitrified kiln wall, slag and metal-working waste, together with ca. 70 faience moulds, indicating busy faience production at the site. Five industrial kilns and ovens were excavated: two of these structures had thick and complex wall patterns with heavy vitrification and evidence of a dome on the inside, indicating that they were fired in order to achieve high temperatures. Others were smaller and less substantial and had probably been used for the manufacture of faience and pottery. It has been suggested that the two large ovens excavated at O45.1 may have been used for the production of raw glass, and experiments have shown that they were at least capable of reaching temperatures sufficient for the production of glass from its raw ingredients.[76] Direct archaeological evidence of this exists in the form of semi-fused glass objects, discovered by means of optical and chemical analysis.[77] In addition, ca. 60 cylindrical vessel fragments may indicate that glass ingots were produced at this site. Nicholson has stated that a large number of these contain traces of copper-coloured glass, which may indicate that they were used for the production of ingots of this colour.[78] The excavated area measures 375 m^2, the full extent of the building itself being far larger: the workshop itself is set in a courtyard belonging to a large building visible on satellite images and contour lines, but due to its highly industrial and specialised character it has been interpreted as being an institutional rather than a domestic workshop.

4.2 Q48.4

Q48.4, the second case study, was excavated in the 1980s and yielded just under 180 glass objects, 110 of which were classified as glass-working remains, including some small fragments of slag.[79] While the excavated area of ca. 400 m^2 encompasses most of the domestic building and its working areas, the excavated area also contained a large well, which ensured the water supply for this somewhat marginal, domestic building. Q48.4 contained ca. 10 fireplaces, ovens and kilns, which would have been used for food preparation as well as for the manufacture of faience, glass items and pottery. These structures, being small in size, were not as complex as those excavated at site O45.1, but would still have been able to reach temperatures of 800 to 900°C.[80]

76 Nicholson and Jackson 2007, 98.
77 Nicholson and Jackson 2007, 108–111.
78 Nicholson and Jackson 2007, 115.
79 Kirby 1989, 15–63 and Amarna Object Database.
80 Eccleston 2008.

4.3 The House of Ranefer: N49.18

The elite house of the chariotry officer Ranefer was originally excavated in 1921 by the EES,[81] and new investigations at this site were carried out in 2002–2004 by the EES under the direction of Barry Kemp.[82] The present dataset therefore combines objects from both early and recent excavations. Just short of 50 glass objects have been catalogued for this site, the bulk of the original corpus no doubt having been lost during the early excavations, which contributed only a small number of items. Outside the house, in 'Street A', the ancient road bounding the house to the northwest, the excavators found "pieces of rod-glass, imperfect glass beads, etc., and it is clear that one of the buildings in this neighbourhood was engaged in the manufacture of glass".[83] Unfortunately, the exact number and colours of objects from this dump was never recorded. The house itself, together with its side-buildings encompasses an area of ca. 840 m^2, which includes a courtyard with the remains of six circular ('bee-hive') granaries. Despite this, no ovens have been recorded at this building, indicating that glass-working either did not take place at this location and that raw materials were administered from here for working at a different site, or that the archaeological evidence of ovens has simply not survived.

4.4 Grid 12 and N50.23

Grid 12 was excavated by the EES / Amarna Project in the early 2000s, and covers an area of 525 m^2 in 5 m^2 squares.[84] These new excavations brought forth a total of nine houses, some of which were previously unknown, and all of which were small in size. It is evident that these buildings formed a functional unit,[85] since room plans were not well defined and the houses shared boundary walls and courtyards. Thus, it can be said that they were involved in the same domestic and industrial activities. The objects from all houses in Grid 12 have been treated together in this study. Slightly less than 500 glass objects were found, 376 of which are glass-working related. In addition, ca. 30 faience moulds were found, as well as ca. 200 crucible and tuyère fragments, indicative of metal-working.[86] The most common type of household oven found in houses of all sizes at Amarna is the clay-lined beehive-type, and the area of the Grid 12 excavations yielded several fragments of ceramic clay liner, some of which were found in pits, but without any certainty of being in situ. In addition, the southern courtyard contained three possible fire-pits that may have been used as bonfires for industrial and / or domestic purposes.[87]

81 Peet and Woolley 1923, 9–15.
82 Kemp and Stevens 2010a, 11–186.
83 Peet and Woolley 1923, 15.
84 Kemp and Stevens 2010a, 187–298.
85 See the definition of a 'corporate group' of houses as defined by Hayden and Cannon 1982; cf. Shaw 1988, 46.
86 Kemp and Stevens 2010b.
87 Kemp and Stevens 2010a, 221.

Domestic building N50.23 was initially excavated in 1912 by the DOG, and re-examined in the early 2000s by the EES / Amarna Project, simultaneously to the Grid 12 excavations.[88] The area of the house and its eastern surroundings, a total of ca. 320 m^2, were examined. Excavations, both old and modern, yielded 46 glass objects, 40 of which are considered evidence of glass-working. This corpus has been considered together with the objects from Grid 12 due to the proximity of the two sites to each other. N50.23 was recognised as a glass-workshop by the DOG, and three ovens were found inside the house and its eastern courtyard.[89]

4.5 M50.14–16

The southernmost of the case studies is site M50.14–16. Initially excavated by the EES in 1922, it was already recognised as a glass-factory.[90] The original excavators found some walls of house M50.16, preserved up to a height of 1.6 m, and painted, in addition to a 'glaze kiln' in courtyard M50.14. The domestic building M50.16 and a large portion of courtyard M50.14 were re-investigated by the author and team in 2014, when an area of ca. 217 m^2 was opened.[91] Unfortunately, the site was heavily damaged due to flooding, collapse and weathering of the walls, and no traces of painted plaster were discovered. Instead of the aforementioned kiln located in 1922, a concentration of vitrified oven debris was found to the south of M50.16. The original site plan being erroneous (with a rotation and displacement error) it is not certain whether the concentration of debris is at the location initially noted as the site of the 'glaze kiln.' A series of 10 pits were excavated in courtyard M50.14, some of which had ashy fills, and sometimes brick rubble and occasionally pieces of charcoal. It is therefore possible that industrial activities at this site involved the use of bonfires and fire-pits, similar to those found at Grid 12. Some of the pits excavated in 2014 may have been clay-lined, as indicated by the vitrified debris. The 1922 and 2014 excavations at the site yielded a total number of 564 glass objects, 472 of which can be considered evidence of glass-working.[92] The original publication speaks of "glass and glaze slag, and fragments of the pots used in the kiln for standing the glazed vessels on",[93] therefore it can be assumed that an unknown number of finds related to glass-working has now been lost. The 2014 excavations also discovered over 50 fragments of cylindrical vessels, possibly indicating that either primary or secondary glass ingots were produced at the site (see above, O45.1). In fact, the discovery of

88 Borchardt and Ricke 1980, 311–312; Kemp and Stevens 2010a, 387–398.
89 Borchardt and Ricke 1980, 311.
90 Peet and Woolley 1923, 19.
91 Hodgkinson 2015.
92 A second season of excavation was carried out at site M50.14–16 in the autumn of 2017 and numerous further glass objects have been found. However, the data from this season had not been evaluated by the time this paper was published.
93 Peet and Woolley 1923, 19.

a large blue ingot fragment with a chipped surface and numerous glass fragments of various colours demonstrate that ingots were worked and re-molten into finished objects at this site. The ingot fragment is of particular interest since it is of the same overall dimensions and colour category as the bulk of the 175 glass ingots found in the Uluburun shipwreck.[94] A second, more unusual ingot was found at the site, this being almost complete, and smaller in diameter. Despite the thick weathered surface crust affecting the appearance of the object, an old break shows the dark blue core glass. Its unusual shape and matrix make it a possible example of ancient glass recycling, although this remains to be determined by means of chemical analysis. Although ingots and ingot fragments are known from Amarna,[95] this is the first such item from a secured archaeological context. While M50.14–16 yielded limited evidence of metal-working, five faience moulds were found in 2014 (in addition to one found in 1922), as well as a large number of faience items including bead wasters. Furthermore, a total of 1135 kg of raw red agate (or chalcedony) was found, ranging from chipped pebbles via debitage to unfinished beads. Since a small number of carved glass amulets and inlays were found at the site, it can be said that craftsmen at the site were working different materials of various colours with similar techniques. In the case of M50.14–16 we can speak of a domestic complex with an integrated workshop that was specialised in the manufacture of jewellery from various vitreous materials and stone.

4.6 Evaluation

Fig. 19 shows the ratios of glass-working items from Amarna of all colours except blue. As mentioned above, the EES excavations at the House of Ranefer frequently failed to note the colour of glass, resulting in a high number of glass objects of unknown colour from this location. At the same time, only four different colours were registered at this site. Unfortunately, glass-working objects were often discarded after discovery, or given to museum collections without a proper record, so that it is no longer possible to gain any information on them.

The colour ratios of the two workshops M50.14–16 and Q48.4 are similar with regard to yellow, white, violet and green glass. No black glass was found at M50.14–16, although it was present at sites Grid 12 / N50.23, O45.1 and Q48.4. By contrast, M50.14–16 contained almost 20% brown and ca. 10% colourless glass, the largest amount of this colour category, followed by Grid 12 / N50.23. While opaque red to red-brown glass, was found at all sites, a high concentration of this can be seen at Grid 12 / N50.23.

94 Hodgkinson 2015, 284. See the introduction to this paper for an overview of the Uluburun shipwreck.

95 See Nicholson 2007, 23 for E5645 in the Garstang Museum, Liverpool.

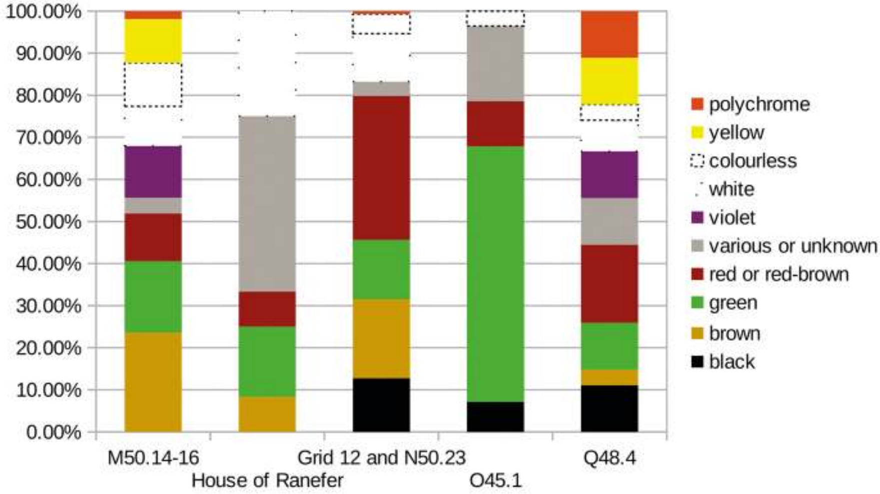

Fig. 19 The ratios of glass-working items from all colours except blue in the case studies at Amarna.

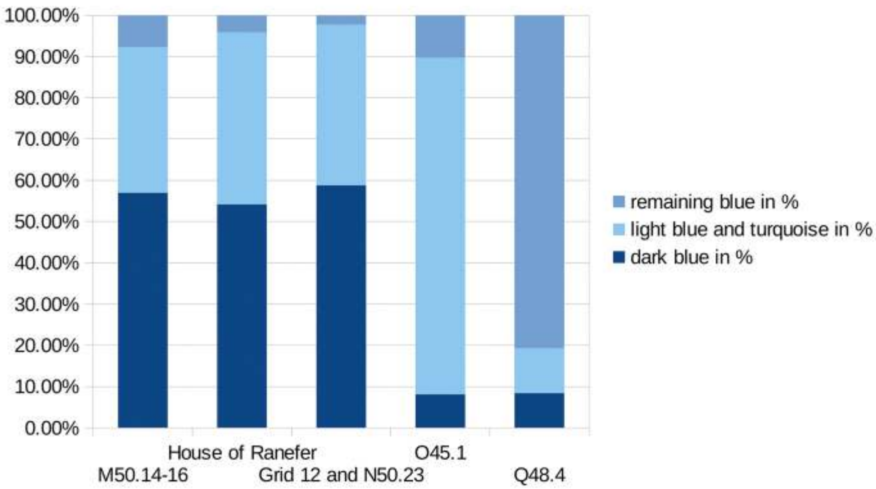

Fig. 20 The ratios of blue glass-working items in the case studies at Amarna.

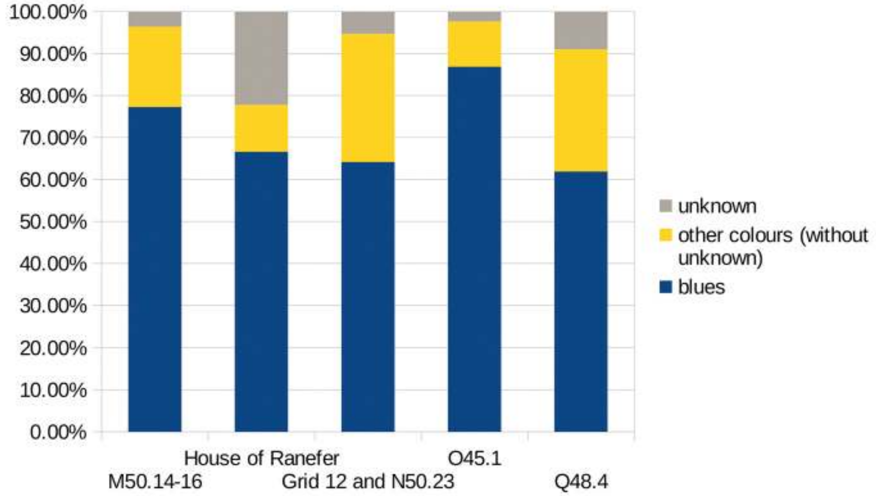

Fig. 21 The ratios of blue glass-working items and those of different colours from the case study sites at Amarna.

Fig. 20 shows that while the House of Ranefer contained the highest number of objects, the colours of which have not been recorded, the subdivision of blue items from this building has been more precise. This is not the case with Q48.4, which, however, contained the smallest number of blue glass-working objects and the second smallest overall number of objects in this study after the House of Ranefer. The three case studies M50.14–16, the House of Ranefer and Grid 12 / N50.23, all of which lie close to each other in the MCS, contained very similar ratios of dark blue (in most cases cobalt-coloured), light blue (copper-coloured) and general 'blue' items. Interestingly, the number of dark blue glass-working objects was always ca. 10–20% higher than of glass-working objects from light blue glass. By contrast, the material corpus from site O45.1 is made up of 88.4% of blue glass, the highest of all case studies, 79.4% of which in turn are light blue in colour. This phenomenon matches the large number of opaque green glass items, both containing copper as a base colourant.

As already noted, the bulk of the light blue glass objects found at Amarna comes from the MCN. Fig. 21 compares the colour ratios of glass-working objects from the case studies, including the blue glass and those of other colours. It is evident that the least homogeneous finds corpus in terms of glass colours came from Grid 12, followed by the House of Ranefer, while O45.1 appears to have yielded the largest number of blue objects.

Yellow glass-working objects appear to have been found only in buildings M50.14–

16 and Q48.4. Since this is produced by adding lead antimonate to the batch glass, it is possible, but not imperative that the occurrence of yellow glass can be linked to the quantities of intended colourless objects with a light brown colour at these two sites. The prevalence of green glass from site O45.1 is obvious. This site is the only one apart from the House of Ranefer that contained a very low number of different colours. Ca. 90% of the green glass used in the present analysis is opaque. The chemical composition of this green glass is similar to that of yellow glass in that it contains lead antimonate, which is added to light blue glass.[96] Although some of the green glass from Amarna has been shown to originate in Mesopotamia,[97] it is still possible that the colourant was added to the raw glass on site. Since O45.1 also yielded large numbers of light blue and turquoise, copper-coloured glass, it is likely that this was used as the basis for the addition of lead antimonate colourant.

Opaque white glass-working objects were found at almost all of the case study sites except workshop O45.1. This colour was achieved by adding calcium antimony as an opacifier to the glass batch.[98] All five modern excavations discussed in this paper also contained some colourless glass. Most of the lighter translucent brown glass-working objects were probably intended to be colourless (see above). Both colourless, clear and brown glass, as well as that with a light green tint, were also turned into finished objects, such as items of jewellery.

4.7 Summary: the manufacture of coloured glass objects at Amarna

The examination of the case studies has demonstrated that blue is indeed the most common colour of glass-working items found in the workshops of the Main City at Amarna (Figs. 19–21). A greater percentage of dark blue, i.e. cobalt-coloured glass can be found in the Main City South, and the presence of the two dark blue glass ingots found at M50.14–16, together with the cylindrical vessels, may indicate that these were produced and / or re-worked at this site. This may have taken place in the fire pits or the kiln in M50.14–16. Unfortunately, the fact that only kiln debris was found, makes the reconstruction of the work-flow difficult. The large workshop O45.1 in the northern Main City North, by contrast, appears to have been more specialised in the manufacture of blue and turquoise glass items, some of which may have also been taken to the Main City South workshops to be re-worked there. O45.1 may have also produced raw glass ingots. The opaque green glass, together with the light blue glass from this site, demonstrates the use of lead antimonate in this workshop. Yellow glass only appears to have been manufactured or processed at sites M50.14–16 and Q48.4, while white glass is present

96 Shortland 2002, 518.

97 Varberg et al. 2016.

98 Shortland 2002, 518.

throughout the Main City South and less represented in the Main City North. Therefore, it may be possible that the bulk of the manufacture of dark blue, yellow and white glass items took place within the Main City South workshops.

Both black and violet (amethyst-coloured) glass was coloured using manganese. All case studies, except perhaps the House of Ranefer yielded some glass-working objects of at least one of each colour. The smallest proportion of manganese-coloured glass comes from O45.1, while the bulk was found at sites M50.14–16 and Q48.4. This set of colours did not appear to cluster in any particular area of the city. Colourless and brown, translucent glass-working objects seem to have been used (if not produced) notably in the Main City South. Finally, the cluster of red glass-working materials coming from the Grid 12 excavations could be related to the evidence of metal-working found at the site, and the large amounts of copper and copper-alloy found here.[99]

In brief, it can be stated that – based purely on the glass-working materials with a precise provenance within Amarna – the majority of glass-working activity took place both in the workshops of the Main City North such as O45.1, which specialised in the manufacture of glass with a copper colourant, and the Main City South, which was generally more diverse in glass colours, and which processed more cobalt as a raw material and colourant.

5 Gurob

The first series of excavations at Gurob took place under the direction of W. M. Flinders Petrie between 1888 and 1890.[100] The unfortunate circumstance of Petrie having to leave his assistant, W. O. Hughes-Hughes in charge of excavations in 1889–1890 resulted in huge loss of data since Hughes-Hughes failed to produce any excavation record and his site diaries are now either lost or never existed. Later excavations, such as those carried out by Loat in 1904,[101] and Brunton and Engelbach in 1920[102] have been somewhat more precise in providing information on objects and their find locations. The most recent mission to the site, the University of Liverpool Gurob Harem Palace Project (GHPP), has recorded precise locations of objects, most of which are surface finds that have moved from their original place of deposition.[103] All of the 28 glass objects from the work of the GHPP between 2006 and 2012 have been included in the present study together with 558 additional objects from old excavations, notably from Petrie's work, and they were catalogued in the museums in Brussels (Cinquantenaire Museum), Manchester, Liverpool (World Museum), Oxford (Ashmolean Museum) and London (British

99 Kemp and Stevens 2010b.
100 Petrie 1890, 32–40; Petrie 1891, 15–21.
101 Loat 1905.
102 Brunton and Engelbach 1927.
103 Shaw 2011, 459–460.

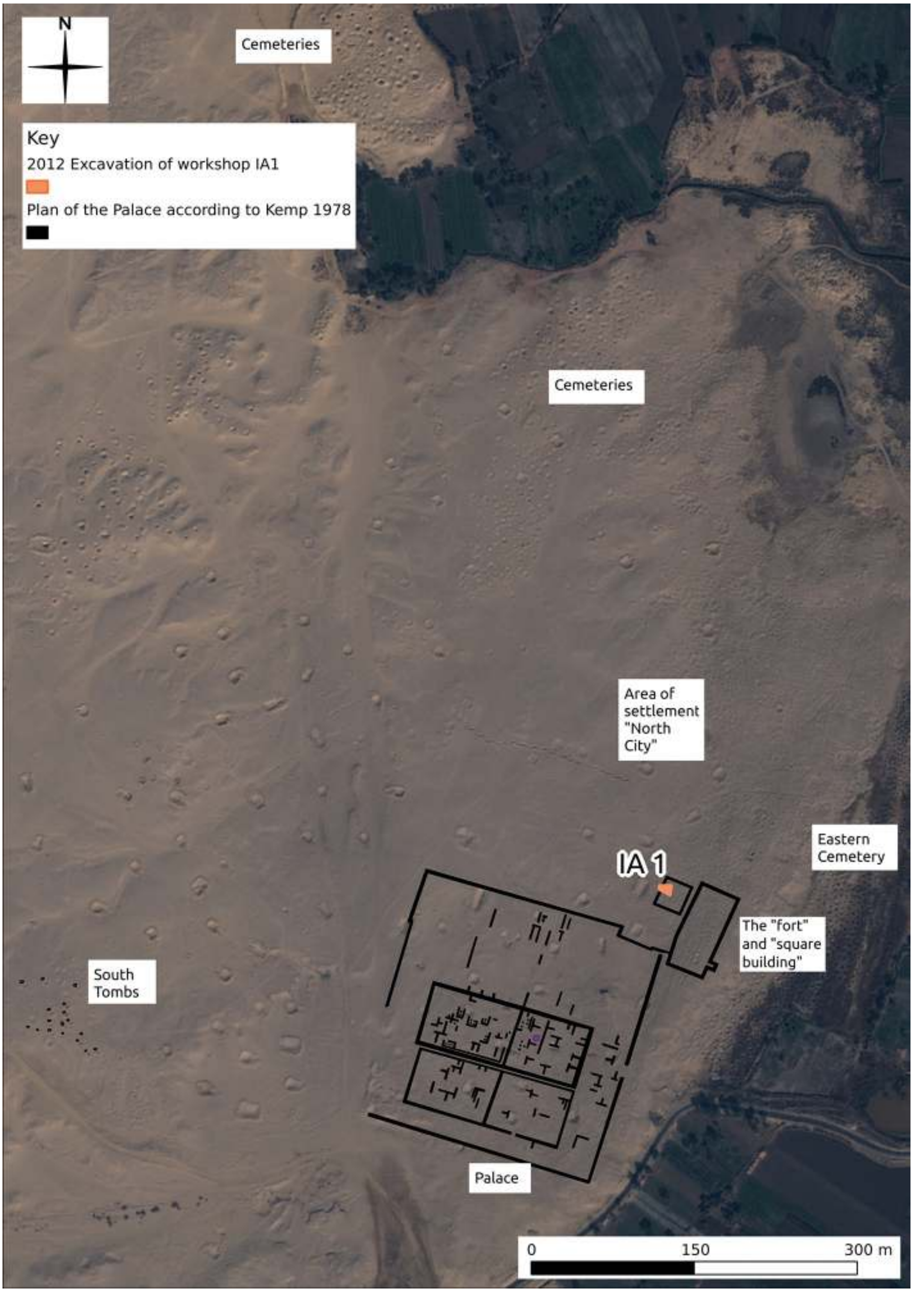

Fig. 22 Map of Gurob showing the location of the New Kingdom buildings and workshop site IA1.

Fig. 23 Finished glass objects and glass-working items from Gurob mounted on cards by F. Spurell, excavated by Petrie between 1888 and 1890. Liverpool World Museum acc. no. 56.20.632 and 56.20.637.

Museum). Whilst working in Egypt, Petrie frequently sent items of interest to his friend, Flaxman Spurell, in London, who arranged them by colour and function on a set of cards, now housed in the World Museum, Liverpool.[104] These cards include glass objects from Gurob, many of which are finished and unfinished beads (Fig. 23). The total number of 586 glass objects includes 128 items considered evidence of glass-working. In the case of Gurob, especially since only a very small number of objects come from a precise findspot, the spatial factor has not been considered.

The workshop located at Gurob was examined and partially excavated by the author between 2009 and 2012.[105] This workshop lies to the northeast of the palace, west of an area previously described as the 'fort', in a 'small square building' (see Fig. 22). This site

104 Cooke 2015.

105 Hodgkinson 2012, cf. Hodgkinson 2017, 248–261.

Fig. 24 The two ovens excavated at Gurob site IA1 by 2012.

was of particular interest since it was originally published as containing "later glass factories and lime kilns".[106] Two large ovens were located, one of which was fully excavated, while only the rough plan of the other one has been established (Fig. 24).

While the western oven may have been used for the firing of pottery, the eastern, slightly smaller one has thick walls and evidence of a domed superstructure has also been found. Although this might indicate high-temperature firing, such as glass-working or even -production, no evidence of this has been found during the excavations at this site. Because of the poor preservation of the archaeological remains, it has been impossible to establish a secure date on these features. While Gurob as a whole has yielded glass and evidence of glass-working, it cannot be confirmed that the craft took place in this particular workshop.

The graph in Fig. 25 summarises the colours of all glass items from Gurob considered in this study. The first observation is that, as in the case of Amarna, a large number of glass objects are blue in colour, many of which have a darker shade. A small number of light blue or turquoise and unspecified blue items have also been found. The preference for dark blue objects has also been reflected in the choice of base colour for polychrome objects, usually glass vessels, but also items of jewellery. All other colours encountered at Amarna have also been found at Gurob. The quantities of green, colourless and unclassified glass-working objects being approximately similar at the latter site, with some red or red-brown glass also present. However, the presence of a high number of yellow glass objects stands out clearly, as does the smaller, but proportionally still significant amount of white glass objects.

Fig. 26 shows the ratios of glass-working objects from Gurob. Again, the tendency towards a use of blue glass is visible, with turquoise and light blue glass being almost half as much as the dark blue, together with both the green and yellow glass-working

106 Brunton and Engelbach 1927, 3.

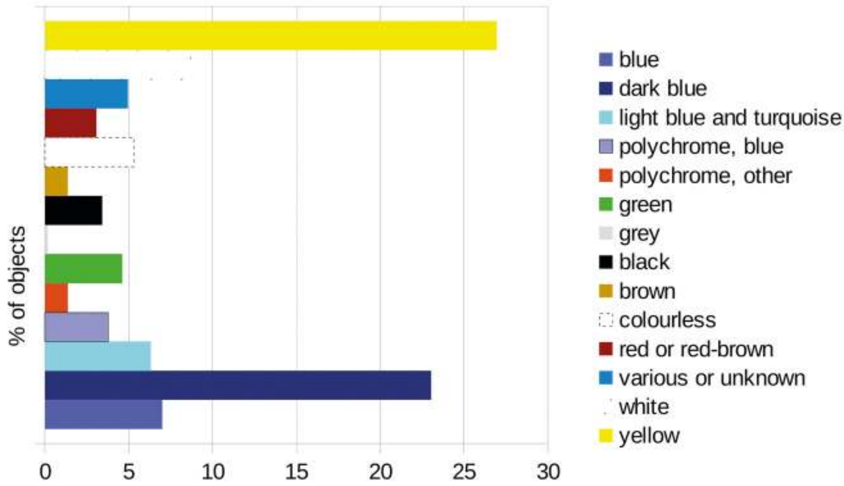

Fig. 25 The ratios of all glass objects and glass-working items from Gurob included in this study regardless of colour.

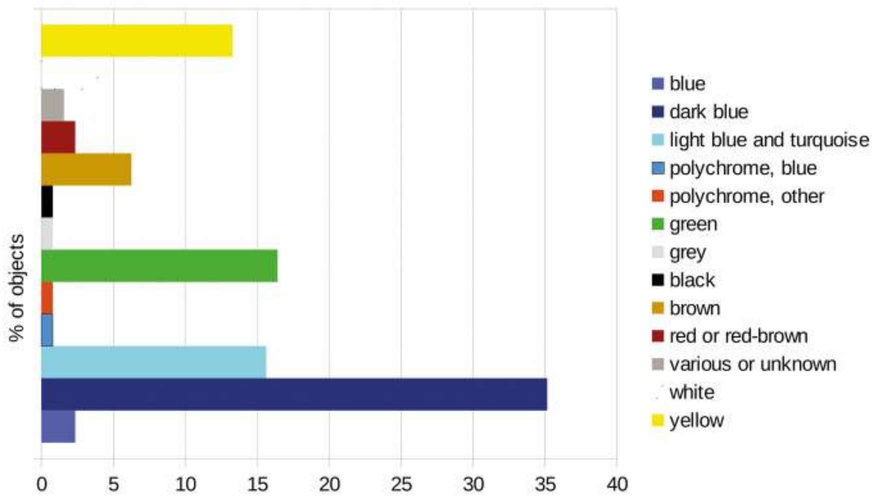

Fig. 26 The ratios of all glass-working items from Gurob included in this study regardless of colour.

items. Although no colourless glass-working objects have been registered, ca. 6% are brown, translucent items. It has to be pointed out at this point that over 70% of the objects considered evidence of glass-working from Gurob are unfinished beads, with protruding, unpolished trails. This can be seen in Fig. 23, an example of glass items from Gurob in the Spurell Collection.

5.1 Summary: the manufacture of coloured glass objects at Gurob

The prevalence of dark blue glass-working items from Gurob reflects the preference for dark blue glass artefacts observed for the whole of the New Kingdom. Together with the large amounts of light blue and turquoise, i.e. copper-coloured, green and yellow glass, evidence exists at Gurob for the extensive use of copper- and lead antimonate-based colourants in addition to cobalt, although it is possible that chemical analysis might or might not provide information on a greater use of cobalt at Gurob.

6 Summary and conclusions: glass-colours at Amarna and Gurob

Overall, the objects from the three suburbs at Amarna discussed in this paper (Fig. 27) and Gurob (Fig. 26) demonstrate that there was indeed a preference for blue glass in the manufacture of prestigious objects including vessels and items of jewellery. However, Kozloff's statement that copper-coloured glass-working objects at Amarna outnumber the cobalt-coloured glass-working items[107] has been disproved through the data from recent excavations, ratios of both dark blue and light blue glass-working objects from Amarna being similar.

With the bulk of the dark blue glass-working items having been found in domestic workshops in the MSC, it is possible that the cobalt colourant (or the raw cobalt-coloured glass) did not stand under direct royal control despite the fact that it had to be sourced from the far-away western desert oases. With a high amount of glass-working material coming from the House of Ranefer, however, it is possible that the administration of industrial activities in the MCS was centred at this building. The largest amount of blue and turquoise glass came from O45.1, a high-temperature workshop with specialised kilns in the direct vicinity of the palaces of the CC may furthermore suggest that the manufacture of copper-coloured glass, at least at Amarna, equalled that of dark blue glass in economic terms.

The distribution patterns of coloured glass objects throughout the glass workshops at Amarna may indicate that this had practical reasons. The amount of green glass in

107 Kozloff 1994.

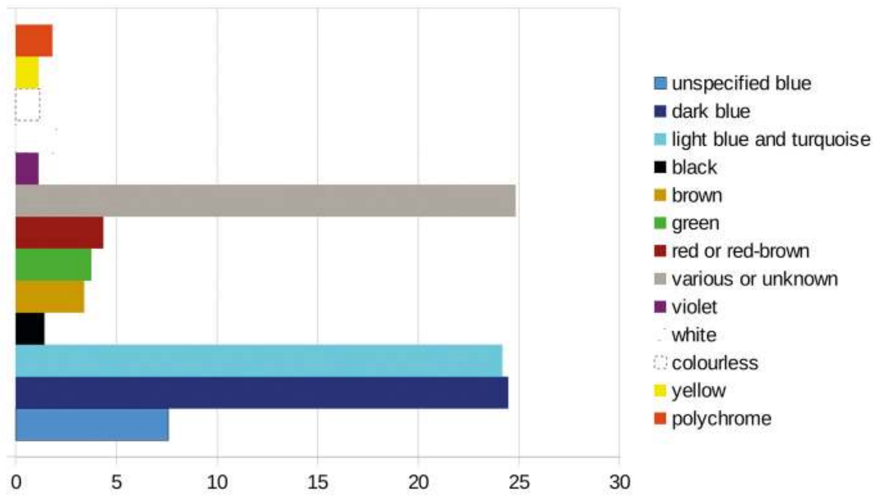

Fig. 27 The ratios of all glass-working items from Amarna included in this study regardless of colour.

O45.1 for example, may indicate that lead antimonate was added to copper-coloured glass at this workshop. The data from Gurob used for comparison has demonstrated that the popularity, and probably the accessibility of dark blue glass for the manufacture of glass items continued after the Amarna Period. This would have been the case until at least the ramesside period, when workshops at Qantir / Pi-Ramesse produced vast quantities of red glass.[108] The continuity of the use of other glass colours, in particular of yellow and white glass shows that there does not appear to have been a change in colour preference. Gurob, like Amarna, was a palace site with the need for luxury goods, and although we know of many high-status imports to the settlement, the evidence of glass-working shows that the inhabitants were industrially active.

The question of raw glass manufacture in the analysed workshops at Amarna is still a difficult one. We are lacking both archaeological and chemical analytical evidence. However, with the specialisation of the large workshop O45.1 on copper-coloured glass and the presence of two high-temperature ovens, it is possible that at least this apparently state-controlled workshop manufactured raw glass. While the household workshops of the Main City South appear to have processed a larger variety of colours for finished glass items, it cannot be said for certain whether the raw glass was also produced at these sites, or even whether it was coloured at these locations. The fact that both workshops O45.1 and M50.14–16 yielded large quantities of cylindrical vessels may point towards

108 Pusch and Rehren 2007.

glass production taking place in these two separate workshops, although M50.14–16 may have been producing secondary, rather than primary ingots.

In summary, this paper has demonstrated that the glass workshops of New Kingdom Egypt were loosely organised and that their output depended, to an extent, on specialisation and the access to and the practicalities of the mixing of colourants to raw glass. The distribution of the finished objects including glass vessel fragments, with the largest concentration being discarded in the area of the palace waste heaps of Amarna indicates that the blue glass as a manufactured product may have been of a lesser value than the stones it was intended to imitate. Both polychrome and monochrome vessels were discarded and at least the fragments making up this large dump were not recycled.

7 Appendix 1: data sources and GIS methods

Only objects with a secure archaeological context or at least a house-number for reference were included in the spatial analysis, enabling them to be located within a GIS framework, the software package used being Quantum GIS (QGIS). Glass-working related objects from materials other than glass, such as cylindrical vessels that have been interpreted as moulds for glass ingots[109] and other production waste including vitrified mud-bricks (i.e. oven or kiln waste) have not been included in the present study. A series of database queries were made using Standard Query Language (SQL) and the output attached to the GIS framework, which contains a vector layer of all buildings of the core settlement at Amarna. These queries produced the numbers of objects by classification and colour. This information was subsequently attached to the building polygons in the GIS, and a centroid[110] was created for each building. The centroids in turn permitted the creation of raster maps based on the density of artefacts found across the site. The density of finds was interpolated using an 'Inverse Distance Weighting (IDW)' algorithm.[111] These IDW maps were styled in 'singleband pseudocolour' with the density being presented as a 'cumulative count' of 2% – 98% rather than the exact values. This style, together with a 40% overall transparency, permits areas of high object concentrations or hotspots to stand out clearly while the underlying basemap remains visible.

The bulk of the data was gathered using both published information and archival material from the Deutsche Orient-Gesellschaft 1911–1914 and the Egypt Exploration Society (EES) 1921–1936.[112] In addition, published and unpublished information from excavations and survey work undertaken by the EES and the Amarna Project between

109 Nicholson, Jackson, and Trott 1997, 144.

110 A centroid is a point in the geographical centre of a polygon containing the same attribute information.

111 Connoly and Lake 2006, 94–97.

112 Borchardt and Ricke 1980; Peet and Woolley 1923; Frankfort and Pendlebury 1933; Pendlebury 1951.

1977 and 2014, apart from the objects from ongoing excavations at the Great Aten Temple (2012 until present), have also been included.[113] The discrepancy of data quality and quantity between the old and the modern excavations have produced a methodological problem. The pre-modern excavations sometimes failed to note exact quantities, using descriptive terms such as 'several' and 'many' to indicate object quantities. The methodology has been adapted for this issue, assigning these 'bulk' finds a quantity of 'five' – a relatively high number of finds in a building. One exception is the so-called palace waste heaps, in which Petrie found at least 750 vessel fragments from which he reconstructed a total of ca. 150 complete vessels.[114] However, since more material has since been found in this area, a nominal value of 300 has been used.

Much material from pre-modern excavations, particularly those undertaken by Petrie in the late 19th century,[115] can be found in museums worldwide, and their archaeological context has long been lost. These objects have not been included in this evaluation since they cannot be incorporated into the GIS framework (see Fig. 2). By contrast, objects from modern excavations, most of which are still stored in the Amarna site magazine, are numerous. This is due to the fact that excavations nowadays are very precise, spoil is sieved thoroughly and objects are recorded individually and in great detail. These objects can now be traced to secure archaeological contexts or, if in tertiary position, they can at least be assigned a house number. This necessitates a critical assessment and a distinction of data from old and modern excavations.

A further issue has to be considered when the distribution patterns of the colours discussed in this paper are discussed: the old excavations records frequently exclude detailed descriptions of archaeological finds, and accurate colour descriptions are often missing. This applies particularly to the specific shades of blue objects. Some objects were even catalogued or published without any information on their overall colour. For this reason, it has been necessary to classify some of the blue glass objects as 'blue' rather than 'light' or 'dark blue' and the glass of unknown colour, or, in the case of object groups of mixed colour, as 'various or unknown'.

113 See Kemp 2012 for an overview of work undertaken since 1977.

114 Petrie 1894, 16.

115 Petrie 1894.

Bibliography

Abe et al. 2012
Yoshinari Abe, Rodan Harimoto, Tadashi Kikugawa, Ken Yazawa, Akiko Nishisaka, Nozomu Kawai, Sakuji Yoshimura, and Izumi Nakai. "Transition in the Use of Cobalt-Blue Colorant in the New Kingdom of Egypt". *Journal of Archaeological Science* 39 (2012), 1793–1808.

Amarna Object Database
The Amarna Project, ed. *Amarna Object Database*. URL: http://www.amarnaproject.com/pages/recent_projects/material_culture/small_finds/database.shtml (visited on 08/11/2018).

Assmann 1975
Jan Assmann, ed. *Ägyptische Hymnen und Gebete*. Die Bibliothek der Alten Welt, Reihe "Der Alte Orient". Zurich and Munich: Artemis & Winkler, 1975.

Bass 1986
George F. Bass. "A Bronze Age Shipwreck at Ulu Burun (Kaş). 1984 Campaign". *American Journal of Archaeology* 90.3 (1986), 269–296.

Baumann 2018
Stefan Baumann. *Schatzkammern. Ihre Dekoration und Raumkonzeption in ägyptischen Tempeln der griechisch-römischen Zeit*. Studien zur spätägyptischen Religion 19. Wiesbaden: Harrassowitz, 2018.

Borchardt and Ricke 1980
Ludwig Borchardt and Herbert Ricke. *Die Wohnhäuser in Tell El-Amarna. Ausgrabungen der Deutschen Orient-Gesellschaft in Tell El-Amarna, Band V*. Wissenschaftliche Veröffentlichungen der Deutschen Orient-Gesellschaft 91. Berlin: Mann, 1980.

Brunton and Engelbach 1927
Guy Brunton and Reginald Engelbach. *Gurob*. British School of Archaeology in Egypt / Egyptian Research Account 41. London: Quaritch, 1927.

Connoly and Lake 2006
James Connoly and Mark Lake. *Geographical Information Systems in Archaeology*. Cambridge Manuals in Archaeology. Cambridge: Cambridge University Press, 2006.

Cooke 2015
Ashley Cooke. "Flaxman Spurrell's Experiments with Egyptian Colours". In *Experiment and Experience. Ancient Egypt in the Present*. Ed. by C. Graves-Brown. Swansea: The Classical Press of Wales, 2015.

Eccleston 2008
Mark Eccleston. "Replicating Faience in a Bread Oven at Amarna". *Egyptian Archaeology* 32 (2008), 33–35.

Frankfort and Pendlebury 1933
Henri Frankfort and John D. S. Pendlebury. *The City of Akhetaten. Part II. The North Suburb and the Desert Altars, the Excavations at Tell El-Amarna during the Seasons 1926–1932*. Excavation Memoirs 40. London: The Egypt Exploration Society, 1933.

Gardiner 1999 [1957]
Alan Gardiner. *Egyptian Grammar. Being an Introduction to the Study of Hieroglyphs*. 3rd ed. Oxford: The Griffith Institute, 1999 [1957].

Hannig 2001
Rainer Hannig. *Großes Handwörterbuch ägyptisch-deutsch (2800–950 v. Chr.). Die Sprache der Pharaonen*. Marburger Edition. Kulturgeschichte der antiken Welt 64. Mainz: Philipp von Zabern, 2001.

Hayden and Cannon 1982
Brian Hayden and Aubrey Cannon. "The Corporate Group as an Archaeological Unit". *Journal of Anthropological Archaeology* 1 (1982), 132–158.

Hodgkinson 2012
Anna K. Hodgkinson. "Excavation of the 'Industrial Area'. IA1, in: Shaw, I. M. E., 2013. The Gurob Harem Palace Project, Spring 2012". *Journal of Egyptian Archaeology* 98 (2012), 46–48.

Hodgkinson 2015
Anna K. Hodgkinson. "Archaeological Excavations of a Bead Workshop in the Main City at Tell El-Amarna". *Journal of Glass Studies* 57 (2015), 279–284.

Hodgkinson 2016
Anna K. Hodgkinson. "Amarna Glass. From Egypt through the Ancient World". *Egyptian Archaeology* 48 (2016), 23–27.

Hodgkinson 2017
Anna K. Hodgkinson. *Technology and Urbanism in New Kingdom Egypt*. Oxford Studies in Egyptian Archaeology 1. Oxford: Oxford University Press, 2017.

Jackson and Nicholson 2010
Caroline M. Jackson and Paul T. Nicholson. "The Provenance of Some Glass Ingots from the Uluburun Shipwreck". *Journal of Archaeological Science* 37 (2010), 295–301.

Kaczmarczyk 1986
Alexander Kaczmarczyk. "The Source of Cobalt in Ancient Egyptian Pigments". In *Proceedings of the 24th International Archaeometry Symposium*. Ed. by J. S. Olin and M. J. Blackman. Washington, DC: Smithsonian Institute, 1986, 369–376.

Kemp 1978
Barry J. Kemp. "The Harim-Palace at Medinet El-Ghurab". *Zeitschrift für Ägyptische Sprache und Altertumskunde* 105.1 (1978), 122–133.

Kemp 2012
Barry J. Kemp. "Tell El-Amarna from 1914 to Today". In *In the Light of Amarna. 100 Years of the Nefertiti Discovery. Exhibition Catalogue*. Ed. by F. Seyfried. Berlin: Ägyptisches Museum und Papyrussammlung, Staatliche Museen zu Berlin, 2012, 50–55.

Kemp and Stevens 2010a
Barry J. Kemp and Anna Stevens. *Busy Lives at Amarna. Excavations in the Main City (Grid 12 and the House of Ranefer, N49.18). Vol. I. The Excavations, Architecture and Environmental Remains*. Excavation Memoirs 90. London: The Egypt Exploration Society, 2010.

Kemp and Stevens 2010b
Barry J. Kemp and Anna Stevens. *Busy Lives at Amarna. Excavations in the Main City (Grid 12 and the House of Ranefer, N49.18). Vol. II. The Objects*. Excavation Memoirs 91. London: The Egypt Exploration Society, 2010.

Kirby 1989
Christopher Kirby. "The Excavation of Q48.4". In *Amarna Reports V*. Ed. by B. J. Kemp. Occasional Publications 6. London: Egypt Exploration Society, 1989, 15–63.

Kozloff 1994
Arielle P. Kozloff. "The Malqata/El-Amarna Blues. Favourite Colours of Kings and Gods". In *Chief Of Seers. Egyptian Studies in Memory of Cyril Aldred*. Ed. by E. Goring, N. Reeves, and J. Ruffle. New York: Kegan Paul International, 1994, 178–192.

Lacovara 1997
Peter Lacovara. "Gurob and the New Kingdom 'Harim' Palace". In *Ancient Egypt, the Aegean, and the Near East: Studies in Honour of Martha Roads Bell, Vol. I*. Ed. by J. Phillips, L. Bell, and B. B. William. San Antonio: Van Siclen Books, 1997, 297–306.

Loat 1905
William L. S. Loat. *Gurob*. British School of Archaeology in Egypt / Egyptian Research Account 10. London: Quaritch, 1905.

Molina et al. 2014
Glòria Molina, Giliane Odin, Trinitat Pradell, Andrew J. Shortland, and Michael S. Tite. "Production Technology and Replication of Lead Antimonate Yellow Glass from New Kingdom Egypt and the Roman Empire". *Journal of Archaeological Science* 41 (2014), 171–184.

Monfort 2016
Raymond Monfort. *Le Livre de la Vache du Ciel / The Book of the Divine Cow*. Journal/Portal: Independent website on the tomb of Seti Ist including translations. URL: http://sethy1.free.fr/vache1.html#ligne (visited on 26/06/2016).

Newton et al. 2005
Marianne W. Newton, Sarah Talamo, Cemal Pulak, Bernd Kromer, and Peter Kuniholm. "Die Datierung des Schiffswracks von Uluburun". In *Das Schiff von Uluburun. Welthandel vor 3000 Jahren. Katalog der Ausstellung des Deutschen Bergbau-Museums Bochum vom 15. Juli 2005 bis 16. Juli 2006*. Ed. by Ü. Yalçin, C. Pulak, and R. Slotta. Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum 138. Bochum: Deutsches Bergbau-Museum, 2005, 115–116.

Nicholson 1989
Paul T. Nicholson. "The Pottery Kilns in Building Q48.4". In *Amarna Reports V*. Ed. by B. J. Kemp. Occasional Publications 6. London: Egypt Exploration Society, 1989, 64–81.

Nicholson 2007
Paul T. Nicholson. *Brilliant Things for Akhenaten. The Production of Glass, Vitreous Materials and Pottery at Amarna Site O45.1*. Excavation Memoirs 80. London: The Egypt Exploration Society, 2007.

Nicholson 2010
Paul T. Nicholson. *Kilns and Firing Structures*. Journal/Portal: UCLA Encyclopedia of Egyptology. 2010. URL: http://escholarship.org/uc/item/47x6w6m0 (visited on 25/07/2016).

Nicholson 2011
Paul T. Nicholson. *Glassworking, Use and Discard*. Journal/Portal: UCLA Encyclopedia of Egyptology. 2011. URL: http://escholarship.org/uc/item/2w17t0cw (visited on 11/06/2016).

Nicholson 2012
Paul T. Nicholson. ""Stone...That Flows". Faience and Glass as Man-Made Stones in Egypt". *Journal of Glass Studies* 54 (2012), 11–23.

Nicholson and Jackson 2007
Paul T. Nicholson and Caroline M. Jackson. "The Furnace Experiment". In. Excavation Memoirs 80. London: The Egypt Exploration Society, 2007, 83–100.

Nicholson, Jackson, and Trott 1997
Paul T. Nicholson, Caroline M. Jackson, and Katherine M. Trott. "The Ulu Burun Glass Ingots, Cylindrical Vessels and Egyptian Glass". *Journal of Egyptian Archaeology* 83 (1997), 143–153.

Nolte 1968
Birgit Nolte. *Die Glasgefäße im Alten Ägypten*. Münchner Ägyptologische Studien 14. Berlin: Bruno Hessling, 1968.

Oppenheim 1970
Adela L. Oppenheim. "The Cuneiform Texts". In *Glass and Glassmaking in Ancient Mesopotamia*. Ed. by A. L. Oppenheim, R. H. Brill, D. Barag, and A. Saldern. Corning, NY: Corning Museum of Glass, 1970, 2–104.

Oppenheim 1973
Adela L. Oppenheim. "Towards a History of Glass in the Ancient Near East". *Journal of the American Oriental Society* 93 (1973), 259–266.

Peet and Woolley 1923
Thomas E. Peet and C. Leonhard Woolley. *The City of Akhenaten. Part I. Excavations of 1921 and 1922 at El-Amarna*. Excavation Memoirs 38. London: The Egypt Exploration Society, 1923.

Pendlebury 1951
John D. S. Pendlebury. *The City of Akhenaten. Part III. The Central City and the Official Quarters. The Excavations at Tell El-Amarna during the Season 1926–1927 and 1931–1936*. Excavation Memoirs 44. London: The Egypt Exploration Society, 1951.

Petrie 1890
William M. F. Petrie. *Kahun, Gurob and Hawara*. London: Kegan Paul, Trench, Trübner & Co., 1890.

Petrie 1891
William M. F. Petrie. *Illahun, Kahun and Gurob*. Warminster: Aris & Phillips, 1891.

Petrie 1894
William M. F. Petrie. *Tell el-Amarna*. London: Methuen, 1894.

Pusch and Rehren 2007
Edgar B. Pusch and Thilo Rehren. *Hochtemperatur-Technologie in der Ramses-Stadt: Rubinglas für den Pharao*. Forschungen in der Ramses-Stadt. Die Grabungen des Pelizaeus-Museums Hildesheim 6. 2 Bde. Hildesheim: Gerstenberg, 2007.

Rehren 2014
Thilo Rehren. "Glass Production and Consumption between Egypt, Mesopotamia and the Aegean". In *Proceedings of a Workshop at the London 7th ICAANE in April 2010 and an International Symposium in Tübingen in November 2010, Both Organised by the Tübingen Post-Graduate School "Symbols of the Dead"*. Ed. by P. Pfälzner, H. Niehr, E. Pernicka, S. Lange, and T. Köster. Qatna-Studien, Supplementa 3. Wiesbaden: Harrassowitz, 2014, 217–224.

Roehrig, Dreyfus, and Keller 2005
Cathrine H. Roehrig, Renée Dreyfus, and Cathleen A. Keller, eds. *Hatshepsut. From Queen to Pharaoh*. Exhibition Catalogue 2005. New York and New Haven: The Metropolitan Museum of Art and Yale University Press, 2005. URL: http://www.metmuseum.org/art/metpublications/hatshepsut_from_queen_to_pharaoh# (visited on 15/08/2019).

Schlick-Nolte, Werthmann, and Loeben 2011
Birgit Schlick-Nolte, Rainer Werthmann, and Christian E. Loeben. "An Outstanding Glass Statuette Owned by Pharaoh Amenhotep II and Other Early Egyptian Glass Inscribed with Royal Names". *Journal of Glass Studies* 53 (2011), 11–44.

Shaw 1988
Ian M. E. Shaw. "A Statistical Analysis of Artefacts at El-'Amarna, Egypt". PhD, University of Cambridge. 1988.

Shaw 2011
Ian M. E. Shaw. "Seeking the Ramesside Royal Harem. New Fiieldwork at Medinet El-Gurob". In *Ramessid Studies Presented to Prof. Kenneth Kitchen*. Ed. by M. Collier and S. Snape. Bolton: Rutherford Press, 2011, 453–463.

Shortland 2000
Andrew J. Shortland. *Vitreous Materials at Amarna*. British Archaeological Reports, International Series 827. Oxford: Archaeopress, 2000.

Shortland 2002
Andrew J. Shortland. "The Use and Origin of Antimonate Colorants in Early Egyptian Glass". *Archaeometry* 44.4 (2002), 517–530.

Shortland 2004
Andrew J. Shortland. "Hopeful Monsters? Invention and Innovation in the Archaeological Record". In *Invention and Innovation. The Social Context of Technological Change 2. Egypt, the Aegean and the Near East, 1650–1150 BC*. Ed. by J. D. Bourriau and J. Phillips. Oxford: Oxbow Books, 2004, 1–11.

Shortland 2007
Andrew J. Shortland. "Who Were the Glassmakers? Status, Theory and Method in Mid-Second Millennium Glass Production". *Oxford Journal of Archaeology* 26.3 (2007), 261–274.

Shortland 2009
Andrew J. Shortland. *Glass Production*. Journal/Portal: UCLA Encyclopedia of Egyptology. 2009. URL: http://escholarship.org/uc/item/4jv3f665 (visited on 25/07/2016).

Shortland 2012
Andrew J. Shortland. *Lapis Lazuli from the Kiln. Glass and Glassmaking in the Late Bronze Age*. Studies in Archaeological Sciences 2. Leuven: Leuven University Press, 2012.

Shortland and Eremin 2006
Andrew J. Shortland and Katherine Eremin. "The Analysis of Second Millennium Glass from Egypt and Mesopotamia. Part 1. New WDS Analyses". *Archaeometry* 48.4 (2006), 581–603.

Shortland, Hope, and Tite 2006
Andrew J. Shortland, Colin A. Hope, and Michael S. Tite. "Cobalt Blue Painted Pottery from 18th Dynasty Egypt". *Geological Society, London, Special Publications* 257 (2006), 91–99.

Shortland and Tite 2000
Andrew J. Shortland and Michael S. Tite. "Raw Materials of Glass from Amarna and Implications for the Origins of Egyptian Glass". *Archaeometry* 42.1 (2000), 141–151.

Shortland, Tite, and Ewart 2006
Andrew J. Shortland, Michael S. Tite, and I. Ewart. "Ancient Exploitation and Use of Cobalt Alumns from the Western Oases of Egypt". *Archaeometry* 48.1 (2006), 153–168.

Smirniou and Rehren 2011
Melina Smirniou and Thilo Rehren. "Direct Evidence of Primary Glass Production in Late Bronze Age Amarna, Egypt". *Archaeometry* 53.1 (2011), 58–80.

Smirniou and Rehren 2016
Melina Smirniou and Thilo Rehren. "The Use of Technical Ceramics in Early Egyptian Glassmaking". *Journal of Archaeological Science* 67 (2016), 52–63.

Stern and Schlick-Nolte 1994
E. Marianne Stern and Birgit Schlick-Nolte. *Early Glass of the Ancient World 1600 BC–AD 50*. Stuttgart: Verlag Gerd Hatje, 1994.

Varberg et al. 2016
Jeanette Varberg, Bernard Gratuze, Flemming Kaul, Anne Haslund Hansen, Mihai Rotea, and Mihai Wittenberge. "Mesopotamian Glass from Late Bronze Age Egypt, Romania, Germany, and Denmark". *Journal of Archaeological Science* 74 (2016), 184–194. DOI: doi:10.1016/j.jas.2016.04.010.

Walton, Eremin, et al. 2012
Marc S. Walton, Katherine Eremin, Andrew J. Shortland, Patrick Degryse, and Sarah F. L. Kirk. "Analysis of Late Bronze Age Glass Axes from Nippur. A New Cobalt Colourant". *Archaeometry* 54.5 (2012), 835–852.

Walton, Shortland, et al. 2009
Marc S. Walton, Andrew J. Shortland, Sarah Kirk, and Patrick Degryse. "Evidence for the Trade of Mesopotamian and Egyptian Glass to Mycenaean Greece". *Journal of Archaeological Science* 36 (2009), 1496–1503.

Warburton 2007
David A. Warburton. "Basic Color Term Evolution in the Light of Ancient Evidence from the Near East". In *Anthropology of Color. Interdisciplinary Multilevel Modeling*. Ed. by R. E. MacLaury, G. V. Paramei, and D. Dedrick. Amsterdam and Philadelphia: John Benjamins Publishing Company, 2007, 229–246. DOI: 10.1075/z.137.

Wreszinski 1923
Walter Wreszinski. *Atlas zur altägyptischen Kulturgeschichte*. Leipzig: Hinrichs, 1923.

Yalçin, Pulak, and Slotta 2005
Ünsal Yalçin, Cemal Pulak, and Rainer Slotta. *Das Schiff von Uluburun: Welthandel vor 3000 Jahren. Katalog der Ausstellung des Deutschen Bergbau-Museums Bochum vom 15. Juli 2005 bis 16. Juli 2006*. Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum 138. Bochum: Deutsches Bergbau-Museum Bochum, 2005.

Illustration credits

1 A. K. Hodgkinson. **2** Reproduced courtesy of National Museums Liverpool (World Museum). **3–21** A. K. Hodgkinson. **22** © The Gurob Harem Palace Project. **23** Reproduced courtesy of National Museums Liverpool (World Museum). **24** © The Gurob Harem Palace Project, photo by H. Brahe. **25–27** A. K. Hodgkinson.

ANNA K. HODGKINSON

Anna K. Hodgkinson, PhD. is a Post-doctoral Research Fellow at the Excellence Cluster Topoi. Her research focuses on Late Bronze Age (LBA) Egyptian settlement archaeology, (LBA) glass industries and chemical analysis of LBA glass objects. Her publications on these topics include: *Technology and Urbanism in Late Bronze Age Egypt*. Oxford Studies in Egyptian Archaeology 1, Oxford: Oxford University Press, 2017; *Amarna Glass: from Egypt through the Ancient World*. Egyptian Archaeology 48, 2016, 23–27.

Dr. Anna K. Hodgkinson
Freie Universität Berlin
Fachbereich Geschichts- und Kulturwissenschaften
Ägyptologisches Seminar
Fabeckstraße 23–25
14195 Berlin, Germany
E-Mail: hodgkinson.anna@gmail.com

Shiyanthi Thavapalan

Stones from the Mountain, Stones from the Kiln: Colour in the Glass Texts from Ancient Mesopotamia

Summary

Colour is key to the development of glass technologies in the Near East. The rise in demand for rare and expensive minerals prompted craftsmen to look for alternatives for traditional raw materials. A substance that could be made in large quantities using local materials and that could mimic the visual qualities – colour, lustre, brightness – of minerals, glass became a widely circulated commodity after the 3rd millennium BC. This paper concerns Mesopotamian *duḫsu*-glass, whose colour has been long-debated. *Duḫsu* was one of the most important stone, wool, leather, and glass colours in the 2nd millennium BC. An examination of the Akkadian glass recipes combined with analyses of samples of ancient glass permits the identification of this colour and the precious stone it was meant to emulate.

Keywords: Mesopotamia; colour; Akkadian glass recipes; *duḫšu*; calcite; Marḫaši

Farbe war ein Schlüsselelement für das Aufkommen und die Entwicklung der Glastechnologie im alten Orient. Die steigende Nachfrage nach seltenen und wertvollen Mineralien und Metallen veranlasste die Handwerker, nach Alternativen für traditionelle Rohstoffe zu suchen. Als Substanz, die in großen Mengen aus lokalen Materialien hergestellt werden konnte und dabei in der Lage war, die visuellen Eigenschaften – Farbe, Glanz, Helligkeit – seltener Mineralien nachzuahmen, wurde Glas nach dem dritten Jahrtausend v. Chr. zu einem weit verbreiteten Erzeugnis. Dieser Artikel behandelt das, was die Mesopotamier *duḫšu*-Glas nannten und dessen Farbe seit langem diskutiert wird. Das Wort *duḫšu* kennzeichnete im zweiten Jahrtausend v. Chr. eine der wichtigsten Farben für Stein, Wolle, Leder und Glas. Durch die Kombination einer philologischen Untersuchung der akkadischen Glastexte zu *duḫšu* mit der Analyse von Proben aus antikem Glas ist es nun möglich, die Farbe *duḫšu* und den Edelstein, den sie nachahmen sollte, zu identifizieren.

Keywords: Mesopotamien; Farbe; akkadische Glasrezepte; *duḫšu*; Calcit; Marḫaši

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

In the Akkadian language, colour words frequently take their meaning from the brightness and lustre characteristic of particular substances, such as stones and dyes.[1] Although the words for such materials are well attested in the textual record, precise identification of their colour values remains difficult. This is because terminology for *realia* can rarely be concretely linked to archaeological finds in ancient Mesopotamia. This paper examines the language of colour in a group of cuneiform texts that concern the production of glass. Glass offers a unique opportunity to correlate the lexical and physical evidence for colour since there are ancient recipes that record the colourants used to achieve artificially the visual appearance of precious stones, information that can be compared to archaeological finds. In 1970, working with Robert H. Brill at the Corning Museum of Glass, A. L. Oppenheim published all the Akkadian glass texts known to him at the time.[2] Most of Oppenheim's interpretations of the terminology relating to colour in these texts have remained largely unchallenged. However, there is now a wealth of new archaeological and technical evidence for glass unavailable to Oppenheim at that time.[3] This includes the physical remains for colourants, usually in the form of frits and mineral ores, which can be analysed chemically. The present contribution will restrict itself to the study of one type of glass, *duḫšu*, the colour of which has been debated in the Assyriological literature since the 1960s. It will demonstrate that *duḫšu*-glass was produced

1 The abbreviations used here follow those listed in CDLI.

2 The Assyrian texts from Nineveh, belonging to the series called "The Door of the Kiln" *(bāb kūri)*, were first recognised as glassmaking recipes by H. Zimmern and R. Campbell Thompson almost a century ago (Zimmern 1925; Thompson 1925). In 1970, A. L. Oppenheim assembled all the texts relating to glass production known to him at the time in *Glass and Glassmaking in Ancient Mesopotamia*. The work is divided into three sections: the first contains Oppenheim's editions and translations of the recipes and the 'ingredient lists' (*maškantu*-texts) with extensive commentary. The inclusion of some new fragments from Assurbanipal's libraries in Nineveh as well as a Middle Babylonian tablet recovered from Babylon (*VAT* 16453) increased the corpus of texts on this subject. Oppenheim also provided a re-edition of the Hittite glass text (*BM* 108561), previously understood as an economic document. In the second section, R. H. Brill offered a technical discussion about the ingredients named in the recipes and the process of glassmaking to complement this philological study. He also described the results of an experiment aimed at reproducing *zukû*-glass following the instructions given in the texts. In the final section, D. Barag and A. von Saldern provided a catalogue of the surviving ancient glass from Mesopotamia dating from ca. 1500 to 500 BC. Since this monumental work, the meaning of the glass texts has been discussed by Robson 2001 and Shortland 2008.

3 For instance, studies investigating the raw materials employed for producing glass include Henderson 1985 (summary of colourants); Brill and Cahill 1988 (red opaque glass); Freestone 1987 (red opaque glass); Freestone 1991; Shortland 2002 (antimonate colourants); Reade, Freestone, and Simpson 2005 (cobalt blue glass); Walton et al. 2012 (cobalt blue glass). For archaeological evidence for glassmaking and glassworking sites in the ancient Near East and the distinctions between them, see Rehren and Pusch 1997; Rehren and Pusch 2005 (Qantir-Piramesses, 13th century); Nicholson 2007 (Tell el-Amarna, 14th century); Dardeniz this volume (Tell Atchana, 14th century). The debates over the technological issues involved in glass production and the connection between this industry and glazing, ceramics and metallurgy has been summarised by Fenn 2015.

to emulate banded yellow calcite, which was brought into Mesopotamia from eastern Iran beginning around the mid-third millennium BC.

Descriptions of the various qualities, types and forms of glass are found in many kinds of cuneiform documents. Administrative records that reflect the day-to-day economic and social activity in the ancient Near East contain such information as the manufacture, exchange, and movement of both raw materials and finished products. More evocative literary works like narratives and rituals allow us to understand some of the cultural meanings associated with these coloured materials. Not surprisingly, the vocabulary relating to glass is most highly developed in the so-called glass texts, which specify the ingredients and instructions necessary for manufacturing certain coloured glasses.

Generally speaking, coloured glasses are named after shining stones in Akkadian. Dark blue glass is designated metonymically as "lapis lazuli" (Sumerian ^{na4}ZA.GÌN, Akkadian ^{na4}*uqnû*) and red-orange glass as "carnelian" (^{na4}GUG, ^{na4}*sāmtu*). As in the case of stone terminology, geographic designations occasionally qualify the names of glasses that appear in the glass recipes. In such cases, the Mesopotamian text known as "The stone, its appearance is…" *(abnu šikinšu)*, which records the names and visual characteristics of all the minerals known to the ancient Babylonians, is useful for pinning down the exact colour of the glass. Thus, the glass given the name "Marḫašian carnelian" in one recipe may be understood in light of the following entry in the stone list: "Carnelian with yellow spots, its name is Marḫaši".[4] The glasses called "Elamite carnelian" and "Assyrian carnelian" are not found in the Mesopotamian stone list.[5]

In a few cases, the hue of a glass named after a stone is further clarified in the glass texts with an abstract colour term. Examples of this include "red(-tinted) lapis lazuli-coloured glass" (^{na4}*uqnû sāmu*) and "bright/white(-tinted) *duḫšu*(-coloured) glass" (^{na4}*duḫšu peṣû*). As a rule, the most psychologically salient verbal colour terms – that is, those colour words that appear in the Mesopotamian lexical lists (black/dark, white/light, red/vivid and yellow-green/pale) – are the ones used as modifiers. A brief commentary,

4 *STT* 108/109, 9: ^{na4}GUG SIG$_7$ *tak-pat* ^{na4}GUG *mar-ḫa-ši* MU-*šú*. This description suggests that the natural stone was covered with yellow markings. The recipe for Marḫaši carnelian glass (§N in Oppenheim, Brill, and Barag 1970, 53) calls for the addition of a yellow colourant (Sumerian IM.SIG$_7$.SIG$_7$), a fact that can be reconciled with this description. It should not disturb us that a hue other than red should be associated with carnelian in ancient texts. In fact, the natural colour of carnelian ranges from yellow to orange-red to brown-red; the red is due to the presence of iron oxide, usually in the form of haematite. Roasting yellow chalcedony at temperatures between 250° and 350°C will result in a more vivid red colour in the stone, which is then called carnelian. It is possible that the ancient Mesopotamians imported chalcedony of various colours from Iran and the Indian subcontinent and 'processed' them locally in this manner, just as J. A. Harrell has argued the ancient Egyptians did (Harrell 2012, 5, and Harrell 2016). Given the strong association with carnelian and the colour red, however, it is more likely that the majority of the stones were treated in the east and sent red to Mesopotamia.

5 Recipes §I and §J in Oppenheim, Brill, and Barag 1970, 50.

explaining a particular colour designation may also occur. For instance, "green(-tinted) *duḫšu*(-coloured) glass" (^{na4}*duḫšu arqu*) is likened to turquoise (^{na4}*ašgikku*) in one recipe,[6] while the ingredients listed for "Assyrian carnelian-(coloured) glass" (^{na4}GUG *aššur*^{ki}) are identical to those for "Assyrian alabaster(-coloured) glass" (^{na4}*parūte aššur*^{ki}).[7] Instances where the final product of a recipe is described with the phrase "(the glass) has the appearance of X or Y material" (*zīm* X or Y *šaknu*) clearly indicate that craftsmen sought to imitate the appearance of certain precious substances, and that this desire drove innovation and development in this craft. Glass is a substance that could be manufactured in large quantities using locally available materials. It could also mimic the visual qualities – lustre, light-reflectivity, surface patterns and, most importantly, colour – of highly appreciated stones. The prices of stones such as lapis lazuli, carnelian, turquoise and the material central to the present discussion, *duḫšu*, were generally quite high and it seems there was a market for (presumably cheaper) substitutes for them in the form of glass. It is therefore no coincidence that the earliest examples of glass in the archaeological record are dark blue, imitating lapis or azurite and pale blue-green, imitating turquoise – exactly as the names imply.

The notion that coloured stones were prototypes for faience and glass has been discussed by others.[8] According to von Saldern, this link between the two media extends to the types of objects produced and to the specialists tasked with their creation:

> Carving techniques in glass had certainly been developed in workshops that served the 'rich and powerful' with costly vessels of semi-precious stone while decorative motifs were borrowed from vessels of stone or metal. *With some degree of certainty one can state that practically all glass made up to the time when glass-blowing became generally accepted followed, in form and decoration, vessels made of other materials, that is stone (alabaster, etc.), semi-precious stones, precious metals such as gold and silver, bronze and ceramics*. The more elaborate the decoration of a glass vessel the more likely is it that it was inspired by prototypes in a more expensive ware.[9]

6 Recipe §18 4′, 15′–16′ (Oppenheim, Brill, and Barag 1970, 47–48): "[I]f you want to make [the mixture] for turquoise-(coloured) glass … You take it out (of the kiln) and it is green(-tinted) *duḫšu*-glass that has been processed twice." ([*šum-m*]*a a-na* ^{na4}ÁŠ.GI$_4$.GI$_4$ *x* […] … IZI *ta-šár-rap tu-še-lam-ma* ^{na4}DUḪ.ŠI.A SIG$_7$ *ša 2-šu tu-ur-ru an-ni-tu*)

7 The ingredients for both types of glass, given in recipes §J and §K, are the same Oppenheim, Brill, and Barag 1970, 50: one mina of *duḫšu*-glass and fifteen shekels of *tuzkû*-glass.

8 And may be summarised by Barag's observed that, "All Mesopotamian glass of the second half of the second millennium BC, as well as Egyptian New Kingdom and Mycenaean glass of the same period, imitates precious and semi-precious stones. The blues are often similar to lapis lazuli or turquoise, yellow possibly represents an attempt to imitate gold, and white and red-brown imitated stone in these colours." (Barag 1985, 37.)

9 Von Saldern 1991, 112. Italics mine.

However, while it is clear that the advent of glass-production as well as innovation in glass-working is closely tied to the appearance of stones and metals – certain colour combinations and patterns on Bronze and Iron Age glass vessels were evidently inspired by those on genuine stones – it is equally clear that the economic value of glass and stone is more complex than what the 'genuine' versus 'imitation' paradigm would suggest.[10] Colour is of central concern to this issue of value. It was using colour as a facet of artistic expression that glass-makers of the ancient Near East found new ways to express their interpretation of natural substances and, in some ways, surpassed their limitations, by changing traditional relationships between medium and form. For instance, with glass, it became viable and indeed fashionable to produce 'lapis lazuli' vessels and axe-heads in the second millennium – forms of artefacts that were difficult to achieve in the genuine material given the rarity of larger pieces and their correspondingly exorbitant prices.[11]

The language of colour is also exploited in the glass texts to elucidate technical processes. In ancient times, the changing shades of the glass-melt being heated in the kiln helped the craftsman measure temperature. Once the molten glass had acquired a certain shade and viscosity, the glassmaker could be confident that the desired atmosphere within the furnace had been reached and that the batch was homogeneously mixed. In the case of the Akkadian glass texts, it is clear that the scribe deliberately selected colour words that would evoke the glowing appearance of the glass-melt, "(pale) yellow" *(arqu)*, "golden" *(ḫurāṣu)*, "glowing red" *(ruššû)* and "ripe grape" *(karānu bašlu)*, for descriptions to this end. Primitive yet accurate, later glassmakers relied on this visual cue as well. The Benedictine monk, author and compiler of Latin manuscripts, Theophilus Presbyter (ca. 1070–1125 AD), for instance, described the importance of timing in producing coloured glass at length in his *De diversis artibus* (II: 7–8) using colour words in the same manner as the Akkadian exemplars. He explains:

> If you see [the glass in] the pot changing to a saffron yellow colour *(croceum colorem)*, heat it until the third hour and you will get a light saffron yellow *(croceum leue)*. Work up as much as much as you want of it in the same way as above. And if you wish, let it heat until the sixth hour and you will get a reddish saffron yellow *(croceum rubicundum)*. Make from it what you choose. But [alternatively] if you see [the glass in] any pot happening to turn a tawny colour, like flesh *(fuluum colorem…qui carni similis est)*, use this glass for a flesh-colour,

10 Nicholson 2012; Shortland 2012, 141–145.

11 From the early fourth to the mid-third millennium BC, lapis lazuli was primarily used to make personal ornaments, cylinder seals, amulets and inlays. Small-scale statuary was only occasionally produced with this material (Moorey 1999, 89). Larger objects made of this precious stone, such as the spouted cup, dagger-hilt and whetstone found in the so-called 'royal tombs' of Ur, are very rare. The surviving material record indicates that genuine lapis lazuli was not used for vessels after the Early Dynastic III period (ca. 2500–2350 BC) (Moorey 1999, 51).

> and taking out as much as you wish, heat the remainder for two hours, namely from the first to the third hour and you will get a light purple *(purpuream leuem)*. Heat it again from the third to the sixth hour and it will be a reddish purple and exquisite *(purpurea rufa et perfecta)*.[12]

Finally, it should be borne in mind that as in many living and dead languages, there is no abstract word for 'colour' in Akkadian. It is not possible to ask "what colour is X?" Nor are there Akkadian treatises that articulate in abstract terms how the ancient Mesopotamians understood the nature of colour. And yet, it is clear from the written sources that they viewed it as an essential component of natural and artificial substances. Colour was considered an important aspect of the outward appearance *(šiknu*, *zīmu)* of things, which explains its presence as a descriptive category in the handbooks for herbs *(šammu šikinšu)*, stones *(abnu šikinšu)* and snakes *(ṣēru šikinšu)* as well as in word lists.[13] It was also possible to talk about colour using a comparison such as "like" *(kî*, *kīma)*. The term *duḫšu* is attested in both these constructions. In one glass recipe entitled "If you want to make *duḫšu*(-coloured) glass", the last preserved line reads, "After you see froth (forming) and if the (molten glass) assumes the appearance of (genuine) *duḫšu*-stone…".[14] In a medical omen, the colour of a sick man's urine is likened in colour to *duḫšu*-leather and *duḫšu*-stone by means of a simile, using Akkadian *kīma*.[15]

1 *Duḫšu*-wool and leather

In the cuneiform textual record, a variety of referents – objects made of wool, leather, stone and of course glass – are described as *duḫšu*, suggesting a resemblance between these materials. The fact that *duḫšu*-wool is listed with dyed textiles in administrative records confirms that this resemblance is colour-based.[16] In ancient times, the characteristic appearance of *duḫšu*-wool and leather was achieved artificially, by the dyer and tanner ($^{\text{lú}}$*ṣārip*$^{\text{síg/ kuš}}$*dušê*). From the written evidence for *duḫšu*-wool and leather alone, it is not possible to pinpoint the colour value of this term. Both materials were manufactured in small quantities for certain luxury items such as expensive fabrics and shoes. In

12 Translation by Hawthorne and Smith 1979, 55, 57.

13 CAD Š II: 436–439.

14 Tablet B §16, 39′ (Oppenheim, Brill, and Barag 1970, 47): [*šumma* $^{\text{na4}}$DU]Ḫ.ŠI.A *a*-[*na epēšīka*]. The heading for the recipe can be securely reconstructed based on parallels. Tablet B §16, 53′ (Oppenheim, Brill, and Barag 1970, 47): TA IGI *ma-am-ma tam-mar-ma šum-ma* NA$_4$ *up-pu-u*[*q*] *ù zi-im* $^{\text{na4}}$DUḪ.ŠI.A *it-taš-kin*.

15 *BAM* 114 8 with parallel in 161 iv 2′–3′: DIŠ KÀŠ-*šú* GIN$_7$ $^{\text{kuš/na4}}$*duḫ-ši-e* NA BI NA$_4$ G[IG] "If a man's urine is like *duḫšu*-leather/stone (in colour), he is [sick] with stones."

16 As opposed to past suggestions that the term might refer to a certain technique or process, such as decorative bead-work (Dalley 2000, 16), tanned leather (Scurlock 2008, 174–176), or waterproof fabric (Durand 2009, 154).

the Syrian kingdom of Mari, for instance, a single mina of *duḫšu*-wool cost one shekel of silver in the mid-18th century BC.[17] That this commodity was expensive is evident when its price is compared to that of un-dyed wool from the same period, which ranged between fifteen and twenty minas per shekel of silver.[18] At the cost of thirty minas per shekel of silver, goat hair was much cheaper.[19] A specialist was tasked with the production of both leather and wool, another indication of its high value or else the complexity involved in the technology. Although the specialist entrusted with producing *duḫšu*-wool appears in Mari texts,[20] one concrete reference suggests that dyed fleece was imported from Babylonia and then worked locally. In a letter to the king Yasmah-Addu, a certain Uṣur-awassu writes: "Since the caravans from Babylon no longer come, *duḫšu*-wool is scarce in this country. Now, if my lord has *duḫšu*-wool available, let him send two minas so that I may finish this garment for the arrival of my lord …".[21]

Dyeing rawhides to achieve the colour typified as *duḫšu* involved the use of a copper compound.[22] Only goatskin and occasionally also sheepskin was used by the tanner of *duḫšu*-coloured leather ($^{\text{lú}}$*ṣārip* $^{\text{kuš}}$*duḫšê*). In one text dating to the mid-20th century, we are told that between thirty-three and thirty-six grams (four to four and one third shekels) of copper was necessary to colour one skin.[23] It has been suggested that the copper compound in question might be verdigris, which is not a naturally occurring substance but must be artificially manufactured.[24] The oldest surviving recipe for producing verdigris is from the *Papyrus Graecus Holmiensis*, a collection of chemical recipes from the early 4th century AD, recorded in Greek on papyri and discovered in Thebes, Egypt:

> *P. holm*. 74: "Preparation of Verdigris for Emerald"[25]
>
> Clean a well-made sheet of Cyprian copper by means of pumice stone and water, dry, and smear it very lightly with a very little oil. Spread it out and tie a cord around it. Then hang it in [a] cask with sharp vinegar so that it does not touch the vinegar, and carefully close the cask so that no evaporation takes

17 M.8208 (*ARM* 30 296): ½ SU KÙ.BABBAR *a-na ši-im* ½ MA.NA $^{\text{síg}}$DUḪ.ŠÚ.A *ša a-na ši-pi-ir ku-ra-ri ša* ($^{\text{giš}}$)IGI.KAK ŠU.TI.A *ṣíl-lí-*($^{\text{d}}$)*nu-nu* "Half a shekel of silver for the purchase of half a mina of *duḫšu*-wool, for the work of *kurārus* for lances. Received by Ṣilli-Nun(n)u."

18 M. 11281, *ARM* 21 216 and *ARM* 22 262.

19 M. 10699.

20 For instance, in M.6784 (*ARM* 25 342: 5), where the wools are destined for a *mardātu*-tapestry.

21 M. 5702 (*ARM* 26 285: 12–17): *iš-tu* KASKAL K[Á.DINGIR.RA]$^{\text{(ki)}}$ *la i-la-ka* $^{\text{síg}}$DUḪ.ŠÚ.A *i-na ma-a-tim an-*[*ni-tim*] *i-ta-aq-*{*ra*}*r*[*a*] *i-na-*[*an-na šu*]*m-ma* $^{\text{síg}}$DUḪ.ŠÚ.A *i-na qa-at b*[*e-lí-i*]*a i-*[*ba-aš-š*]*e*$_{20}$*-e* 2 MA.NA $^{\text{síg}}$DUḪ.ŠÚ.A *be-*[*lí li-iš-pu-u*]*r-ma* [*ki-ma*] *a-na a-la-ak be-lí-ia* TÚG *š*[*a-tu*] *ú-*[*qa*]*-t*[*u*]

22 *BIN* 9 nos. 107, 187, 455, 46. Crawford 1948; Stol 1980/1983; Van de Mieroop 1987.

23 Isin I (Ishbi-Erra Yr. 3): BIN 9 455 and Van de Mieroop 1987, 31.

24 Stol 1980/1983, 534.

25 Translation by Caley 2008, 65.

> place. Now if you put it in in the morning, then scrape off the verdigris carefully in the evening, but if you put it in in the evening, then scrape it off in the morning, and suspend it again until the sheet becomes used up. However, as often as you scrape it off again, smear the sheet with oil as explained previously. The vinegar is (thus rendered) unfit for use.

Using verdigris to colour oil-cured and tanned goat hides could have resulted in a distinctive yellow-green shade of leather.[26] Regrettably, Akkadian written sources do not mention the colourant used to produce *duḫšu*-wool. While there is no dye known from the ancient Near East that can achieve green directly, it is possible to dye textiles green by mixing more commonly available blue and yellow dyes. A range of colours, including shades of green, could also be obtained from the indigotin-containing leaves of the woad plant.[27] In his study of the Mesopotamian leather industry, Stol suggested that verdigris, functioning simultaneously as mordant and colourant, was the only green dyestuff in the ancient world.[28] In the following recipe from the 4th century AD, verdigris is used to modify the base dyestuff, which is the celandine plant:

> *P. holm*. 139: "Dyeing of Colors"[29]
>
> By celandine one means a plant root. It dyes (a) gold color by cold dyeing. Celandine is costly, however. You should accordingly use the root of the pomegranate tree and it will act the same. And if wolf's milk is boiled and dried it produces yellow. If, however, a little verdigris is mixed with it, it produces green; and safflower blossom likewise.

In brief, despite the suggestive evidence within the cuneiform record and elsewhere, the colour of the *duḫšu*-wool and leather cannot be fixed with any certainty.

26 Outside the leather industry, verdigris is attested as a mineral pigment in ancient Egypt. The oldest attestation of this dates to the 13th century BC Eastaugh et al. 2004, 385–386. Verdigris pigment has not been found in Mesopotamia. Classical authors as Vitruvius (1st century BC) and Pliny (77 AD) called this substance *aeruca* or *aerugo* "copper rust". Theophrastus (ca. 315 BC), who describes verdigris as copper soaked in wine leaves, mainly describes the medicinal value of this substance (Eastaugh et al. 2004, 385–386).

27 Cardon 2007, 373–374.

28 Stol 1980/1983, 534, citing Lombard 1978, 143.

29 Translation by Caley 2008, 65.

2 *Duḫšu*-stone and chlorite

The ancient Babylonians believed that *duḫšu*-stone came from regions situated to the east of Mesopotamia: the land of Marḫaši, said to be east of Anšan (modern Tell Malyan),[30] and the mountain Zar-duḫ-a.[31] *Duḫšu*-stone is attested in the textual record as early as the third millennium BC. In a commemorative inscription, the Old Akkadian king Rīmuš (ca. 2278–2270 BC) claims he tore out the very foundations of Marḫaši from the land of Elam, defeated its king Abalgamaš and brought back *duḫšu,* diorite and other precious stones as booty.[32]

Pale green chlorite, which is also called steatite, soapstone and serpentine in secondary literature,[33] is generally thought to be the mineralogical correlate for *duḫšu*-stone.[34] P. Steinkeller has proposed that Marḫaši, named in cuneiform texts as the source of *duḫšu*, refers to the region of Halil-rud in Jiroft, where around three-hundred tells have been found, some of which are as large as a hundred hectares and feature monumental architecture.[35] Excavations have revealed that the Jiroft region was a center for the manufacture of chlorite vessels. Steinkeller's case for connecting the 'land of Marḫaši' to Jiroft and chlorite rests on two carved chlorite vessel fragments.[36] These pieces share decorative motifs with the Jiroft-ware *and* bear an inscription by Rīmuš, claiming to be the conqueror of Marḫaši, making it very likely that these very vessels were part of the booty

30 The evidence, summarised by Steinkeller, falls into three categories: (1) The lexical literature, in which ^{na4}*duḫšu* is followed by the adjective "Marḫašian;" (2) Two Sumerian literary texts, the myth Enki and Ninḫursaĝ and a hymn to Ninurta (= Ninurta G), both of which imply that *duḫšu*-stone is a natural resource of the land of Marḫaši; (3) Historical inscriptions from the reign of Rīmuš discussed below (Steinkeller 1982, 448–449 and nos. 37, 38, 62).

31 This according to the *lipšur litanies* 25 (Reiner 1956, 132).

32 E2.1.2.8, caption 1–5 (*RIME* 2 = Frayne 1993, 58): ESI DUḪ.ŠI *ù* NA$_4$.NA$_4$ *ša al*$^!$*-qé-ù* SAG NAM.RA.AK *pá-ra-aḫ-súm*^{ki} "Diorite, *duḫšu*-stone and (various) stones which I took as booty of Marḫaši".

33 According to Moorey, "… the various members of the chlorite schist family are hopelessly confused in the literature, since they may not be easily distinguished by eye, this term is loosely used in reference to 'chlorite' and 'steatite (talc)'" (Moorey 1999, 37).

34 The alternative ^{na4}*duḫšu* = 'rock crystal' was first proposed by Thompson 1936 and is accepted in the *AHw* I: 179, by Michel 2001 and Durand 2000, 15–17. Rock crystal is a hard, brittle, transparent, macrocyrstalline variety of quartz. It was primarily used for cylinder seals and beads, but rock crystal vessels and figurines have also been recovered from ancient Mesopotamia and Syria (Moorey 1999, 95–96). In my view, *duḫšu* cannot be rock crystal for the following reasons: (1) The most striking feature of this mineral is the fact that it is transparent and generally colourless. Therefore, it is unlikely that Akkadian-speakers would choose its name to characterise the appearance of tanned leather, brightly dyed wool and opaque yellow glass (discussed further below); (2) There is no material or inscriptional evidence linking rock crystal with either Rīmuš or his campaign to Marḫaši; (3) Rock crystal only becomes a popular material for small vessels in the first millennium BC (Moorey 1999, 95), by which time glassmakers had learned to make transparent glass.

35 Steinkeller 1982; Steinkeller 2006; Steinkeller 2012.

36 A 5298 at the Pergamon Museum is of unknown provenance, while U. 231 (*BM* 116455a) at the British Museum was discovered at Ur.

from the Marḫaši campaign.[37] Although the identification of *duḫšu-stone* as chlorite and as a pale green colour has been accepted in scholarly literature,[38] there is compelling evidence from the Akkadian glass recipes pointing to it actually being a shade of yellow (see Fig. 1).

3 *Duḫšu*-glass

Glass offers a unique opportunity to establish the colour of *duḫšu* because the ancient recipes specify the raw materials used to produce it. Comparing this information with samples of Mesopotamian glass and recent scientific analysis indicates that *duḫšu* was a lead-antimonate based opaque yellow glass. The glass texts reveal that in addition to the ingredients necessary to make the basic glass batch – silica from the powdered quartz pebbles, plant-ash, and lime – the essential substance called *tuzkû* gave *duḫšu*-glass its characteristic colour.

Like several other substances named in the recipes, *tuzkû* is a vitreous material that contains antimony, the agent that makes Near Eastern glass opaque.[39] Oppenheim called such substances primary glasses because they appear as ingredients in complex recipes for making high quality coloured glass and because their main function was to modify the colour and/or opacity of the basic glass batch.[40] Recently, chemical analysis has shown that Mesopotamian glassmakers utilised two types of antimony-based opacifiers: calcium antimonate and lead antimonate. Detected in white, green, blue, and purple glasses, calcium antimonate is the more prevalent opacifier. Lead antimonate, on the other hand, is generally only found in opaque yellow glasses.[41] Given that *tuzkû* only appears in recipes for producing one colour of glass, namely *duḫšu*, it is possible to surmise that *duḫšu* is a lead-antimonate-based glass. Lead and antimony, the chemical

37 On the issue of 'fingerprinting' the chlorite vessels found in Mesopotamia, it should be noted that Jiroft was by no means the only Iranian source for chlorite. Nearby Tepe Yahya was another large production centre for vessels of this stone (Kohl 1975; Kohl 1978). It is not possible to trace the source of the Mesopotamian chlorite to a particular Iranian site because X-ray diffraction analysis suggests that various centers were producing identical vessels, using stones from different sources. The chlorite used at a particular site could vary in composition and colour as well (Kohl 1979, 146). That is to say, even if the two chlorite vessels discussed by Steinkeller were taken as booty from Marḫaši, the stone itself could have been mined elsewhere.

38 E.g. Schuster-Brandis 2008, 407–408; Abrahami 2014. Cf. Oppenheim, who thought the colour of *duḫšu*-stone and the glass produced in imitation of it must be a greenish-yellow (Oppenheim 1948), brownish-orange (Oppenheim 1966) or yellow (Oppenheim, Brill, and Barag 1970) because it was used to decorate the sun disk (Sumerian AŠ.ME, Akkadian *šamšatu/šamšu*), which suggests a bright yellowish colour.

39 Oppenheim, Brill, and Barag 1970, 20–21.

40 Other such primary glasses that feature in the glass texts are *būṣu*, *anzaḫḫu* and *kutpû*.

41 Henderson 1985; Henderson 2013; Freestone 1991; Shortland 2002.

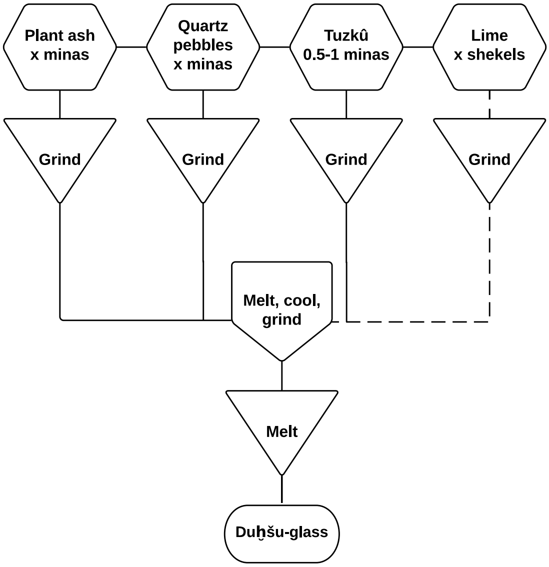

Fig. 1 Schematic representation of the recipe for *duḫšu*-glass (Oppenheim, Brill, and Barag 1970, 47–48).

signatures of opaque yellow glass, also appear as raw materials in the so-called *duḫšu* 'Ingredient Lists' *(maškanti duḫši)*. The Middle Babylonian glass text *VAT* 16453[42] contains eight entries listing the necessary ingredients and their measurements for producing two varieties of *duḫšu*-glass: "red(-tinted)" and "light/white(-tinted)". In three of these (§§b, c and d), lead *(abāru)* and *tuzkû*-glass are listed together. In view of their roles as colourant and opacifier, the small quantities given for each seem appropriate.

The final piece of evidence connecting *duḫšu* with the colour yellow is a badly damaged prescriptive recipe for making *tuzkû* (see Fig. 2).

The names of two yellow mineral pigments, *kalû* and *kalgukku*, are preserved there.[43]

42 Found in a private residence in Babylon and dates to the 12th century or later (§§a–h in Oppenheim, Brill, and Barag 1970, 65–66).

43 The identification of *kalû* (Sumerian IM.GÁ.LI, IM.KAL) as yellow ochre is based on the following considerations. According to cuneiform sources, *kalû* is a mineral pigment that was routinely used to paint inexpensive clay figurines (see CAD K: 94 for examples). In the Akkadian poem Nergal and Ereškigal, a mixture of *kalû* and *kalgukku*-minerals is said to mimic the appearance of gold (*SBTU* 1 17–18, 7'–9'). Texts dating to the Neo-Babylonian period indicate that *kalû*-mineral and beeswax were used to make the surface of writing boards. According to Stol 1998, 347–348, and Volk 1999, 286 and n. 61, ochre, not orpiment as it was previously thought, is the more suitable mineral for making beeswax pliable enough to create the overlay for such boards. The presence of ochre on wax writing boards is attested in Roman Egypt and in Europe (from the Middle Ages to the Early Modern Period). The use of yellow ochre is well documented on painted plaster, ceramic and stone objects from the ancient Near East (Moorey 1999, 328). It is sometimes mixed with Egyptian blue to produce shades of green. It remains unclear what chemical role the iron oxide-based ochre plays in this recipe for producing the yellow-antimonate *tuzkû*-

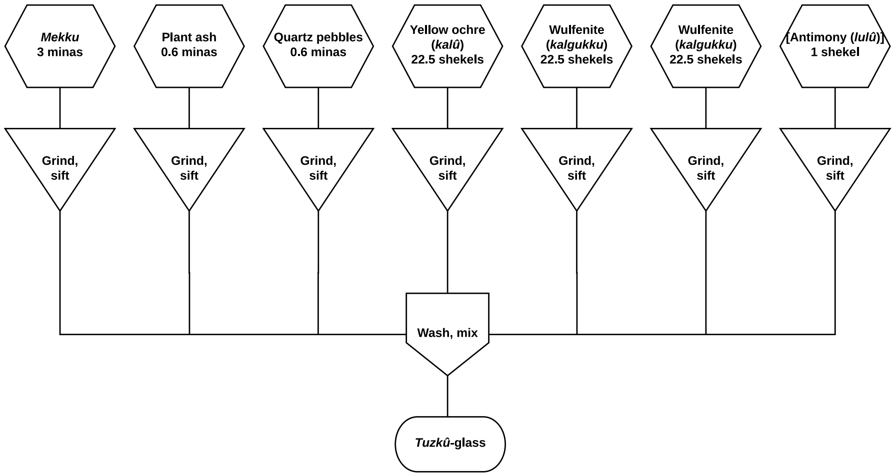

Fig. 2 Schematic representation of the recipe for *tuzkû*-glass (§U in Oppenheim, Brill, and Barag 1970, 55–56).

It is possible that the naturally occurring lead-based minerals wulfenite,[44] bindheimite[45] or massicot[46] were employed by the ancient craftsman to colour glass yellow.[47] Unfortunately, there is no archaeological evidence for yellow glass colourants in raw form that could confirm this supposition. A piece of lead wire, flakes of which could have been worked into the basic glass batch, was found at the 14th-century glass-making workshop at ancient Alalakh.[48]

glass. *Kalgukku* (Sumerian IM.GÁ.LI.GUG) is likewise a mineral pigment. It is often mentioned with *kalû* (e.g. in the lexical literature, in the aforementioned poem Nergal and Ereškigal, in rituals that involve the use of pigments and in the glass texts). The two words are also lexically connected, since *kalgukku* is written with the word signs for *kalû* plus that for carnelian; this has led some scholars to identify this substance as red ochre (Oppenheim, Brill, and Barag 1970, 52 n. 58; Joannès 1984, 144). At Mari in the 18th century BC, *kalgukku*-mineral was frequently used by leather workers (*ARM* 23 nos. 208–211). In two unedited texts from the same city and period, *kalû* and *kalgukku* appear beside madder, alum and another pigment, Egyptian blue, [na4]*zagindurû* (M.10816 and M.11218, discussed by Arkhipov 2010). Given its role as colourant in the recipes for *tuzkû* and gold-coloured *zukû*-glass (Tablet D §L in Oppenheim, Brill, and Barag 1970, 51–52), I propose to identify this substance as a naturally occurring lead-based mineral. The colour of most earthy yellow pigments such as ochre, massicot and bindheimite may be manipulated with heat treatments to achieve warmer yellow, orange, red and brown-red tones, a fact that may explain the association between yellow and red pigments in the Mesopotamian lexical literature.

44 Wulfenite ($PbMoO_4$) is a lead ore that occurs in yellow, yellow-orange or red-orange crystals. It was identified among the cosmetic pigments from the Royal Cemetery at Ur (Bimson 1980, 77).

45 Bindheimite ($Pb_2(Sb,Bi)_2O,OH$) is a naturally occurring mineral that has the same chemical composition as the synthetically manufactured pigment Naples Yellow.

46 Reported on a palette dating to ca. 400 BC (Lee and Quirke 2000, 115).

47 On this subject Henderson writes, "Before the second century BC yellow glasses were coloured and

In sum, given that its essential component *tuzkû* contains antimony and that it is associated with lead, *duḫšu*-glass must be basically opaque and yellow in colour. The glass texts also inform us that by modifying the ingredients of the basic recipe, it was possible to achieve slight variations in the shades of *duḫšu*. One type of *duḫšu*, the product of the recipes from the cities of Babylon and Nineveh, was a true glass, presumably of high quality, that could be melted and used for making glass vessels and ornaments. It resembled genuine *duḫšu*-stone imported from the East in colour and lustre: essentially buff-yellow, although lighter and rosier shades of this glass could be made as well. According to the authors of the glass texts, the green-tinted variety *(duḫšu arqu)* of *duḫšu* resembled turquoise (^{na4}*aškikku*). A second type of *duḫšu*, presumably of lower quality, was used as an ingredient in the recipes for producing Assyrian alabaster and carnelian-coloured glasses (§§ K, J).[49]

4 *Duḫšu*-stone and banded calcite

In light of the glass recipes, which point to *duḫšu* being characteristically yellow in colour, it is no longer possible to identify genuine *duḫšu*-stone as green chlorite. I propose instead that *duḫšu* refers to the characteristically banded, yellow colour of calcite vessels, produced in eastern Iran and brought to Mesopotamia in the second half of the third millennium BC.

Light-coloured soft stones like calcite, limestone and gypsum were locally available in Mesopotamia, occurring in outcrops along the Tigris and Euphrates riverbanks north of Baghdad.[50] The use of calcite for small objects and vessels has a long history in this region, spanning prehistoric times to the mid-first millennium BC.[51] However, the Iranian calcite brought back as spoils of war in the east held a particular allure for the Babylonians because of its distinctive colours, attractive banding, translucence and, as Potts has argued, its "foreignness".[52] During the Early Dynastic III period (ca. 2600–2350 BC), calcite from Iran displaced darker igneous stones as the preferred material for

opacified by the presence of lead antimonate crystals (Rooksby 1962, 23). A lead antimonate occurs naturally as Bindheimite ($Pb_2(Sb,Bi)_2$ O,OH), so an impurity of bismuth in ancient lead antimonate opacified glasses might show that this mineral had been used as an opacifier. In the process of heat-treating lead-containing batches, a reaction between lead and antimony would also have produced opaque yellow lead pyroantimonate ($Pb_2Sb_2O_7$) which would remain incompletely dissolved in the glass under oxidizing conditions; in this case the shapes of the lead antimonate crystals would reflect the heat treatment that the glass batch had been subjected to." (Henderson 2000, 35–36).

48 G. Dardeniz, State University of New York, personal communication.

49 *Duḫšu peṣû* is the main ingredient for producing Assyrian *parūtu* 'alabaster(-coloured)' and Assyrian *sāmtu* 'carnelian(-coloured)' glass (§J and §K in Oppenheim, Brill, and Barag 1970, 50).

50 Potts 1989, 129 and n. 2.

51 Moorey 1999, 77–78, 81; 74–76 (seals), 21–35 (statuary), 344–345 (terminology in Akkadian).

52 Potts 1989, 143.

	Rīmuš A	Rīmuš B	Rīmuš C	Rīmuš D	Rīmuš E
Dolomite	1	–	–	–	–
Chlorite/steatite	0	–	2	–	–
Diorite	–	1?	1?	–	–
"Marble"	9	–	–	3	2?
Limestone	1	–	–	2	–
"Alabaster"	1	–	–	–	1
Calcite	7	–	–	16	2
Total	19	1	3	21	5

Tab. 1 Summary of the stone vessels from the reign of Rīmuš (after Potts 1989, 149–151).

small vessels deposited in graves in the south; this roughly coincides with the earliest campaigns to Iran mentioned by Sumerian rulers. Plain vessels made of banded calcite become the standard divine offering, both by private citizens and royalty, between the Early Dynastic III and Ur-III periods (ca. 2600–2004 BC). In the first half of the second millennium, calcite vessels are mainly found in temples, although this might be due to chance in excavations.[53]

Significantly, the archaeological record is marked by an influx of yellow calcite during the reign of the Old Akkadian king Rīmuš (ca. 2278–2270 BC), who claims to have conquered Marḫaši, the region associated with *duḫšu*-stone in later Babylonian tradition.[54] In fact, Rīmuš explicitly claims to have brought back *duḫšu*-stone as booty from this very campaign. Most of his booty vessels that contain an inscription commemorating the victory at Marḫaši, Rīmuš A in Table 1, are made of banded yellow calcite.[55]

53 Potts 1989, 143 and Potts 1993, 387. See also Moorey, who noted that calcite "…was a stone much favoured for vessels in third-millennium Iran and this is the most likely source of much of the calcite used for vessels in southern Mesopotamia in the fourth to early second millennia BC" (Moorey 1999, 37).

54 As Moorey observed, "It is significant that *white and yellow calcite, often banded, is the predominant material among the stone vessels bearing dedications by Rimush (c. 2278-2270 BC) to Enlil 'when he had conquered Elam and Parahshum, from the booty of Elam,' found at Tell Brak, Khafajah, Nippur, and Ur*. Some of the few vessels bearing Naram-Sin's (*c.* 2254-2218 BC) 'booty of Magan' inscription are also banded calcite (cf. Potts, T. F. 1989: 126 ff., 131 ff., figs. 12, 13; Potts, D. 1990: i. 139-41). As banded calcite has not yet been associated with [areas away from the littoral regions of the Persian] Gulf areas either as a raw material or as manufactured goods, this reinforces the view that such vessels are products of workshops in eastern Iran or beyond." (Moorey 1999, 45). Italics mine.

55 A total of ninety-six inscribed 'booty' vessels dedicated as votive offerings in Sumerian cities were collected and studied by Potts (Potts 1989). The inscrip-

The number of calcite vessels with Rīmuš inscriptions may in fact be higher than is indicated here, since the terminology used in the secondary literature to describe calcareous stones is somewhat complicated. According to T. F. Potts, "All the inscription A vessels that have been inspected or are reliably described are carved from calcite, which may vary in colour from white to yellow or pale brown, and is usually attractively banded. This is variously described in the literature as 'alabaster', 'onyx', 'marble', 'dolomite' or 'gypsum'."[56] The yellow colour of the calcite vessels from Rīmuš's reign is comparable to the lead-antimonate yellow glass rod pictured in Fig. 3.[57]

Concerning the resemblance between stone and glass, it is also significant that some of the calcite vessels excavated in southern Mesopotamia and Iran have white, red, and green veins and zones – a reality that may correspond to the terms *duḫšu peṣû*, *duḫšu sāmu* and *duḫšu arqu* in the glass texts.[58]

The corpus of inscribed 'booty' vessels collected and studied by Potts speaks highly in favour of the idea that calcite and not chlorite is the *duḫšu*-stone to be connected with Rīmuš's conquest of Marḫaši. The calcite vessels from his reign far outnumber the chlorite ones and they also contain the inscription stating that they were taken as booty during the Elamite campaign. One possible objection to the identification of *duḫšu*-stone as yellow calcite is the fact that the writing on the vessels themselves names Elam as their origin. However, in the lengthiest account of the Marḫaši campaign, the battle is described as being fought against a coalition, including Elam, Zaḫara, Gupin and Meluḫḫa, which assembled to confront the Akkadian army at Marḫaši.[59] Thus, as

tions by type are: **Rīmuš A:** "To Enlil (or Sin), did Rīmuš, king of the world, when he had conquered Elam and Marḫaši, from the booty of Elam, dedicated (this)." **Rīmuš B:** "For Enlil, Rīmuš, king of the world, conqueror of Elam and Marḫaši." **Rīmuš C:** "Rīmuš, king of the world, conqueror of Elam and Marḫaši". Rīmuš D: "Rīmuš, king of the world." **Rīmuš E:** Uncertain. The two most common forms of these 'booty' vessels, the tall cylindrical vases and sub-conical bowls, were both manufactured in banded calcite (Potts 1989, 137).

56 Potts 1989, 127. Casanova observed the same about the light-coloured stone vessels from Susa (Casanova 1991, 11–15).

57 For fragments of calcite vessels with inscription by Rīmuš, see e.g. *BM* 116436 (from Ur); *BM* 127340 (from Nagar); *BM* 1882,0714.1013 (from Sippar); *BM* 42367 (probably from Sippar); *BM* 91020 (from Sippar).

58 According to Moorey, "Distinctive banded calcite is first used for vessels in the middle of the third millennium BC both at Ur and at Susa. It is sometimes distinguished by its colouring, shades both of red and green. This stone is distinct from a type of gypsum, also tinted red (rose) or green, which had long been used in the region and may have come from sources relatively close to Susa in the Zagros mountains (cf. Morgan 1999: 48ff.)" (Moorey 1999, 45).

59 E2.1.2.8, 1–18; 25–28 (RIME 2 = Frayne 1993, 57–58): *a-ba-al-ga-maš* LUGAL *pá-ra-aḫ-śum*^{ki} *iš*$_{11}$*-ar ù za-ḫa-ar*^{ki} *ù* NIM^{ki} ⌜*ù*⌝ [*g*]*u-pi-in*^{ki} ⌜*ù*⌝ [*me*]*-luḫ-ḫa*^{ki} *i*[*n qá*]*b-lí pá-*[*ra-aḫ*]*-śum*^{ki} ⌜*a*⌝-[*na*] ⌜REC 169⌝ *ip-ḫu-ru-ni-im-ma* X […] UD *i*[*n ba-rí-t*]*i* [*a-w*]*a-an*^{ki} *ù* [*śu-śi-im*]^{ki} *in* Í[D *qáb-l*]*í-tim s*[*i-id-ga*]-⌜*ù*⌝ GÌR.NÍTA [*pá-ra-aḫ-śum*]^{ki} […] X NIM^{ki} ⌜*ik*⌝*-mi* … *rí-mu-úś* LUGAL KIŠ NIM^{ki} *i-be-*[*al*] ^{d}*en-líl* ⌜*u-kál-lim*⌝ "[Rīmuš, king of the world] was victorious over Abalgamaš, king of Paraḫšum. Zaḫara, Elam, [G]upin and [Me]luḫḫa assembled in Pa[raḫ]šum for battle … but he, (Rīmuš) captured S[idgaʾu], the general of [Paraḫšum] (and) [the king of(?)] Elam i[n betwe]en (the cities of) [Aw]an and [Susa], by the '[Mid]dle Ri[ver]'… (thereby) Rīmuš, king of the world, rule[d] Elam. Enlil showed (him the way)."

Fig. 3 Yellow glass rod (ÄM36904). Amarna, 14th century BC.

Potts has argued, it is best to understand these vessels as "broadly 'Elamite'; whether they came from highland Elam-Paraḫšum or from lowland Elam (Susiana) remains unclear."[60] From the point of view of material (banded/veined calcite) and form, close parallels for the Rīmuš vessels have been found at sites in Iran (e.g. Shahdad, Shahr-i Sokhta, Susa), Afghanistan (e.g. Mundigak) and southern Turkmenistan.[61] As to the origins of the stone, this question is difficult to answer.[62] Given the geographic distribution of the vessels and Rīmuš's inscriptions, Iran is the likeliest source. One large calcite vessel production site in the third millennium was Shahr-i Sokhta in Iranian Seistan; here, craftsmen deliberately chose distinctively banded calcite[63] that may have originated in nearby deposits.[64]

Of great relevance to the question of the commercial value of *duḫšu*-stone in the early second millennium and how it was brought to Mesopotamia is a text from the

60 Potts 1989, 129.

61 Potts 1989, 129–130. See Casanova 1991, 57, for the Susa vessels.

62 Calcite occurs in Afghanistan (e.g. Kuh-i Khan Nashin, located 250 km east of Shahr-i Sokhta) and in Pakistan (e.g. Nok Kundi). The Iranian sources are vast, according to Ciarla, who observed, "The major recorded occurrences of this material, however, are in the eastern side of the so-called Kuh-i Birjand ridge, the orographic sill that edges the western side of the Sistan delta basin separating it from the Lut depression of Iran. These low hills are made of Tertiary sediments particularly rich in mineral resources with a wide variety of minerals present in quantity. Here calcites can be collected both from veins, on average 20–40 cm thick, and from secondary deposits where the material occurs as rolled pebbles on average 15–25 cm in diameter with exceptional boulders up to 50 cm in diameter. Calcite, again mostly in the form of rolled pebbles, are also available in gravel fans at the foot of the Kuh-i Malik Siah, approximately 120 km southwest of Shahr-i Sokhta along the present-day Zabul-Zahidan highway (Constantini and Tosi 1977, p. 334)" (Ciarla 1979, 321–322).

63 The most common variety of calcite used at this site for making vessels, referred to as 'Oriental Alabaster' in the secondary literature, has red, brown, hazel-brown and green veins and zones (Ciarla 1979, 322; Casanova 1991, 57).

64 Calcite, diorite, flint/chert, jasper, chalcedony and basalt deposits have been found near Shahr-i Sokhta (Ciarla 1979, 321, and references therein).

Mari archives (A.2993+A.4008).[65] In it, a royal agent by the name of Yassi-Dagan is tasked with selling *duḫšu*-stone at a certain price fixed by the king and with purchasing tin or lapis lazuli with the silver he receives for it. Yassi-Dagan speaks of the changing price of *duḫšu*-stone, depending on local availability. It seems that he is purchasing the tin, and perhaps also the lapis lazuli, from a dealer in Ešnunna. We gather from this situation that calcite *(duḫšu)* and lapis lazuli were transported from the east along separate overland trade routes in this period. Presumably, the Mariotes acquired *duḫšu*-stone through the northern 'Great Khorasan Road' that traversed Tepe Hissar and the Diyala river. The lapis lazuli mined in Badakhshan very likely entered Mesopotamia through the southern trade route, via Anshan and Susa.[66] This would explain why the king of Mari had to rely on the Mesopotamians for it. Ešnunna appears to have been a hub for exchange between the Syrian kingdoms and southern Mesopotamia.

We are not given the exact price of *duḫšu*-stone in the text nor are we told where the Mariotes acquired it. However, the high value of this substance is evident for the Mari agent is given strict instructions by the king to negotiate firmly with the dealer in Ešnunna and by any means possible to sell the stone either at or above the set price. Moreover, we can infer that this set price was high enough to purchase lapis lazuli, the value of which was two or three times higher than silver in this period.[67] Concerning the price of precious minerals, C. Michel observed that commercial value drops the closer one gets to the source.[68] Warburton has demonstrated this by comparing the price of lapis lazuli in the early second millennium: at Larsa, one shekel of lapis cost two shekels of silver, whereas in Anatolia, the price was three shekels of silver.[69] A.2993+A.4008 tells us that *duḫšu*-stone, probably raw and unworked, likewise had a fluctuating price in silver and that in the mid-18th century BC, the Mesopotamians were willing to sell lapis lazuli and tin to acquire it.

5 Conclusion

The case of *duḫšu* tells us something about the relationship between technological advancement and economic forces in the ancient world and its effect on language. It is often assumed that the high demand for precious stones imported into Mesopotamia in the third millennium pushed the development of coloured glass in the second millennium BC. This appears to be true of blue and blue-green stones such as lapis lazuli,

65 Durand 2000, 15–17.
66 Warburton 2008, 221; For the movement of goods between Iran and Mesopotamia in the third millennium, see Potts 1993, 389–390, and references therein.
67 Warburton 2016, 112.
68 Michel 2001, 349.
69 Warburton 2008, 220–221.

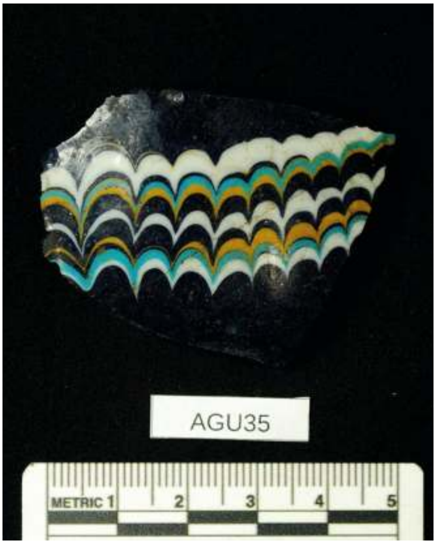

Fig. 4 Fragment of a glass vessel with yellow threaded decoration (ÄM30848).

Fig. 5 Fragment of a vessel with yellow threaded decoration (E5613_1_3).

azurite and turquoise. In the case of the earliest yellow and red glass in Mesopotamia, however, the correlation between the demand for minerals and the production of glass is not so straightforward. There is clear evidence indicating the high value of and demand for calcite commodities as early as the third millennium BC but the technology for producing a more readily accessible alternative in the form of glass was not yet known at this time. Lead antimonate-based yellow glasses first appear in the archaeological record at around mid-second millennium, in 18th dynasty Egypt (1550–1307 BC). The yellow glass from mid-to-late second millennium strata at Mesopotamian and Syrian sites (Yorghan Tepe/Nuzi, Tell al-Rimah/Karana, Tell Brak/Nagar, Tell Atchana/Alalakh, Aqar Quf/ Dur Kurigalzu and Qal'at Sherqat/Assur) have a similar chemical composition. But by time, there is a significant drop in the number of banded calcite vessels being brought into Mesopotamia from Iran. In other words, glass imitating calcite was 'invented' when less and less genuine Iranian calcite was available.

And yet, yellow glass was not produced to either satisfy or fill a gap in local demand for yellow stone commodities. It was never used to make popular types of calcite vessels such as tall cylindrical vases or sub-conical bowls. Instead, it was mostly used to create trailed and threaded designs on fancy glass vessels, reminiscent of the striations on genuine calcite (Figs. 4 and 5).

The fact that the names of precious stones were deliberately adopted to designate coloured glasses is obviously key to the issue of each substance's relative value in ancient times. As pointed out in the introduction, several of the contributions in this volume address this topic (Hodgkinson, Dardeniz). Here, I wish to draw attention to the transfer of cultural significance, from one medium to the other, which accompanied such sharing on the level of language. It is not enough to say that since the material qualities of the stone, especially its hue and lustre, are being emulated in glass, the two media are not distinguished in language. I propose instead that the name for calcite was adopted for yellow glass because it evoked the 'exotic' appeal of Iranian calcite, traditionally a much-coveted and beloved stone, and because the composition of yellow glass lent itself to certain decorative techniques on luxury glass vessels that brought to mind the natural markings on this stone.[70] It is not from perceptions of colour, but rather from materials that characteristically embodied colour and the social meanings accrued by those materials as people used them, that Akkadian metonymic colour words take their meaning and value.

70 Thavapalan 2019 (3.5.2).

Bibliography

Abrahami 2014
Philippe Abrahami. "Wool in the Nuzi Texts". In *Wool Economy in the Ancient Near East and the Aegean*. Ed. by C. Michel and C. Breniquet. Ancient Textiles Series 17. Oxford and Philadelphia: Oxbow Books, 2014, 283–309.

Arkhipov 2010
Ilya Arkhipov. "Zagidrûm". *NABU* 2 (2010), 1.

Barag 1985
Dan Barag. *Catalogue of the Western Asiatic Glass in the British Museum*. Vol. 1. London: British Museum Publications, 1985.

Bimson 1980
Mavis Bimson. "Cosmetic Pigments from the Royal Cemetery at Ur". *Iraq* 42 (1980), 75–77.

Brill and Cahill 1988
Robert H. Brill and Nicholas D. Cahill. "A Red Opaque Glass from Sardis and Some Thoughts on Red Opaques in General". *Journal of Glass Studies* 30 (1988), 16–27.

Caley 2008
Earle R. Caley. *The Leyden and Stockholm Papyri. Greco-Egyptian Chemical Documents From the Early 4th Century AD*. Cincinnati: The Oesper Collections University of Cincinnati, 2008.

Cardon 2007
Dominique Cardon. *Natural Dyes. Sources, Tradition, Technology and Science*. London: Archetype Publications Ltd., 2007.

Casanova 1991
Michèle Casanova. *La vaisselle d'albâtre de Mésopotamie, d'Iran et d'Asie centrale aux IIIe et IIe millénaires av. J.-C.* Centre de Recherches d'Archéologie Orientale, Université de Paris I, 9. Paris: Éditions Recherches sur les Civilisations, 1991.

CDLI
Cuneiform Digital Library Initiative. *Abbreviations for Assyriology*. 2016. URL: http://cdli.ox.ac.uk/wiki/abbreviations_for_assyriology (visited on 20/06/2019).

Ciarla 1979
Roberto Ciarla. "The Manufacture of Alabaster Vessels at Shahr-i Sokhta and Mundigak in the 3rd Millennium BC. A Problem of Cultural Identity". In *Iranica*. Ed. by G. Gnoli and A. V. Rossi. Seminario di Studi Asiatici Series Minor 10. Naples: Istituto Universitario Orientale, 1979, 319–335.

Crawford 1948
Vaughn E. Crawford. "Terminology of the Leather Industry in Later Sumerian Times". Dissertation Department of Near Eastern Languages and Civilizations, Yale University. 1948.

Dalley 2000
Stephanie Dalley. "Hebrew Taḥaš, Akkadian Duhšu, Faience and Beadwork". *Journal of Semitic Studies* 45.1 (2000), 1–19.

Durand 2000
Jean-Marie Durand. *Les Documents épistolaires du palais de Mari*. Vol. 3. Littératures anciennes du Proche-Orient 18. Paris: Éditions du Cerf, 2000.

Durand 2009
Jean-Marie Durand. *La Nomenclature des habits et des textiles dans les textes de Mari*. Archives Royales de Mari 30. Paris: CNRS Éditions, 2009.

Eastaugh et al. 2004
Nicholas Eastaugh, Valentine Walsh, Tracey Chaplin, and Ruth Siddall. *Pigment Compendium. A Dictionary of Historical Pigments*. Oxford: Butterworth-Heinemann, 2004.

Fenn 2015
Thomas R. Fenn. "A Review of Cross-Craft Interactions between the Development of Glass Production and Pyrotechnologies of Metallurgy and Other Vitreous Materials". *Cambridge Archaeological Journal* 25 (2015), 391–398.

Frayne 1993
Douglas Frayne. *Sargonic and Gutian Periods (2334–2113 BC)*. The Royal Inscriptions of Mesopotamia, Early Periods 2. Toronto: University of Toronto Press, 1993.

Freestone 1987
Ian Freestone. “Composition and Microstructure of Early Opaque Red Glasses”. In *Early Vitreous Materials*. Ed. by I. Freestone and M. Bimson. British Museum Occasional Papers 17. London: British Museum Press, 1987, 173–191.

Freestone 1991
Ian Freestone. “Technical Examination of Neo-Assyrian Glazed Wall Plaques”. *British Institute for the Study of Iraq* 53 (1991), 55–58.

Harrell 2012
James A. Harrell. *Gemstones*. Portal: UCLA Encyclopedia of Egyptology. 2012. URL: https://escholarship.org/uc/item/57f2d2sk (visited on 20/07/2019).

Harrell 2016
James A. Harrell. “Carnelian and Gypsum: Newly Discovered Sources for Ancient Egypt”. Abstract Booklet 44–45 Presented at the 67th Annual Meeting of the American Research Center in Egypt, Atlanta, GA. 2016.

Hawthorne and Smith 1979
John G. Hawthorne and Cyril S. Smith. *Theophilus: On Divers Arts. The Foremost Medieval Treatise on Painting, Glassmaking and Metalwork*. New York: Dover Publications, 1979.

Henderson 1985
Julian Henderson. “The Raw Materials of Early Glass Production”. *Oxford Journal of Archaeology* 4.3 (1985), 267–291.

Henderson 2000
Julian Henderson. *The Science and Archaeology of Materials. An Investigation of Inorganic Materials*. London and New York: Routledge, 2000.

Henderson 2013
Julian Henderson. *Ancient Glass. An Interdisciplinary Exploration*. Cambridge and New York: Cambridge University Press, 2013.

Joannès 1984
Francis Joannès. “Textes №91 À 245”. In *Archives Administratives de Mari I*. Ed. by D. Charpin and Jean-Marie D. Archives Royales de Mari 23. Paris: Éditions Recherche sur les Civilisations, 1984, 83–226.

Kohl 1975
Philip L. Kohl. “Carved Chlorite Vessels. A Trade in Finished Commodities in the Mid-Third Millennium”. *Expedition* 18.1 (1975), 18–31.

Kohl 1978
Philip L. Kohl. “The Balance of Trade in Southwestern Asia in the Mid-Third Millennium BC”. *Current Anthropology* 19 (1978), 463–492.

Kohl 1979
Philip L. Kohl. “Physical and Chemical Analyses of Soft Stone Vessels from Southwest Asia”. *Archaeometry* 21 (1979), 131–159.

Lee and Quirke 2000
Lorna Lee and Stephen Quirke. “Painting Materials”. In *Ancient Egyptians Materials and Technology*. Ed. by P. T. Nicholson and I. Shaw. Cambridge and New York: Cambridge University Press, 2000, 104–120.

Lombard 1978
Maurice Lombard. *Les Textiles dans le monde musulman du VIIe au XIIe siècle*. Etudes d’économie médiévale 3. Paris, The Hague, and New York: Mouton, 1978.

Michel 2001
Cécile Michel. “Le Lapis-Lazuli des Assyriens au début du IIe millénaire av. J.-C”. In *Veenhof Anniversary Volume*. Ed. by W. H. van Soldt. Publications de l’Institut historique-archéologique néerlandais de Stamboul. Leiden: Nederlands Instituut voor het Nabije Oosten, 2001, 341–359.

Van de Mieroop 1987
Marc Van de Mieroop. *Crafts in the Early Isin Period. A Study of the Isin Craft Archive from the Reigns of Isbi-Erra and Su-illisu*. Orientalia Lovaniensia Analecta 24. Leuven: Peeters, 1987.

Moorey 1999
Peter R. S. Moorey. *Ancient Mesopotamian Materials and Industries. The Archaeological Evidence*. Winona Lake: Eisenbrauns, 1999.

Nicholson 2007
Paul T. Nicholson. *Brilliant Things for Akhenaten. The Production of Glass, Vitreous Materials and Pottery at Amarna Site O45.1*. London: Egypt Exploration Society, 2007.

Nicholson 2012
Paul T. Nicholson. "'Stone… That Flows'. Faience and Glass as Man-Made Stones in Egypt". *Journal of Glass Studies* 54 (2012), 11–23.

Oppenheim 1948
A. Leo Oppenheim. *Catalogue of the Cuneiform Tablets of the Wilberforce Eames Babylonian Collection in the New York Public Library. Tablets of the Time of the Third Dynasty of Ur*. American Oriental Series 32. New Haven: American Oriental Society, 1948.

Oppenheim 1966
A. Leo Oppenheim. "Mesopotamia in the Early History of Alchemy". *Revue d'Assyriologie et d'Archéologie Orientale* 60 (1966), 29–45.

Oppenheim, Brill, and Barag 1970
A. Leo Oppenheim, Robert H. Brill, and Dan Barag. *Glass and Glassmaking in Ancient Mesopotamia*. Corning Museum of Glass Monographs 3. New York: The Corning Museum of Glass, 1970.

Potts 1989
Timothy F. Potts. "Foreign Stone Vessels of the Late Third Millennium BC from Southern Mesopotamia. Their Origins and Mechanisms of Exchange". *Iraq* 51 (1989), 123–164.

Potts 1993
Timothy F. Potts. "Patterns of Trade in Third-Millennium BC Mesopotamia and Iran". *World Archaeology* 24.3 (1993), 379–402.

Reade, Freestone, and Simpson 2005
Wendy Reade, Ian Freestone, and St John Simpson. "Innovation or Continuity? Early First Millennium BCE Glass in the Near East. Cobalt Blue Glasses from Assyrian Nimrud". In *Annales du 16e Congrès de l'Association Internationale pour l'Histoire du Verre, London 2003*. Ed. by Association Internationale pour l'Histoire du Verre. Nottingham: Association Internationale pour l'Histoire du Verre, 2005, 23–27.

Rehren and Pusch 1997
Thilo Rehren and Edgar B. Pusch. "New Kingdom Glass-Melting Crucibles from Qantir-Piramesses". *Journal of Egyptian Archaeology* 83 (1997), 127–143.

Rehren and Pusch 2005
Thilo Rehren and Edgar B. Pusch. "Late Bronze Age Glass Production at Qantir-Piramesses, Egypt". *Science* 308 (2005), 1756–1758.

Reiner 1956
Erica Reiner. "Lipsur Litanies". *Journal of Near Eastern Studies* 15 (1956), 129–149.

Robson 2001
Eleanor Robson. "Society and Technology in the Late Bronze Age. A Guided Tour of the Cuneiform Sources". In *The Social Context of Technological Change*. Ed. by A. J. Shortland. Oxford: Oxbow Books, 2001, 39–58.

von Saldern 1991
Axel von Saldern. "Roman Glass with Decoration Cut in High-Relief". In *Roman Glass. Two Centuries of Art and Invention*. Ed. by M. Newby and K. S. Painter. London: The Society of Antiquaries of London, 1991, 111–121.

Schuster-Brandis 2008
Anais Schuster-Brandis. *Steine als schutz- und Heilmittel. Untersuchung zu ihrer Verwendung in der Beschwörungskunst Mesopotamiens im 1. Jt. v. Chr.* Alter Orient und Altes Testament 46. Münster: Ugarit, 2008.

Scurlock 2008
Joann Scurlock. "On Some Terms for Leatherworking in Ancient Mesopotamia". In *Proceedings of the 51st Rencontre Assyriologique Internationale, Held at the Oriental Institute of the University of Chicago, July 18–22, 2005*. Ed. by R. D. Biggs, Myers J., and M. T. Roth. Chicago: Oriental Institute Publications, 2008, 171–176.

Shortland 2002
Andrew J. Shortland. "The Use and Origin of Antimonate Colorants in Early Egyptian Glass". *Archaeometry* 44.4 (2002), 517–530.

Shortland 2008
Andrew J. Shortland. "Cuneiform Glass Texts. A Question of Meaning". In *Archaeology, History and Science. Integrating Approaches to Ancient Materials*. Ed. by T. Rehren and M. Martinón-Torres. Walnut Creek, CA: Left Coast Press, 2008, 61–75.

Shortland 2012
Andrew J. Shortland. *Lapis Lazuli from the Kiln. Glass and Glassmaking in the Late Bronze Age*. Studies in Archaeological Sciences 2. Leuven: Leuven University Press, 2012.

Steinkeller 1982
Piotr Steinkeller. "The Question of Marḫaši. A Contribution to the Historical Geography of Iran in the Third Millennium BC". *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 72 (1982), 237–265.

Steinkeller 2006
Piotr Steinkeller. "New Light on Marhaši and Its Contacts with Makkan and Babylonia". *Journal of Magan Studies* 1 (2006), 1–17.

Steinkeller 2012
Piotr Steinkeller. "New Light on Marhaši and Its Contacts with Makkan and Babylonia". In *Aux Marges de l'Archéologie. Hommage à Serge Cleuziou*. Ed. by J. Giraud and G. Gernez. Paris: De Boccard, 2012, 261–274.

Stol 1980/1983
Marten Stol. "Leder(industrie)". *Reallexikon der Assyriologie und Vorderasiatischen Archäologie* 6 (1980/1983), 527–543.

Stol 1998
Marten Stol. "Einige kurze Wortstudien". In *Festschrift für Rykle Borger zu seinem 65. Geburtstag am 24. Mai 1994*. Ed. by S. M. Maul. Cuneiform Monographs 10. Groningen: Styx, 1998, 343–352.

Thavapalan 2019
Shiyanthi Thavapalan. *The Meaning of Color in Ancient Mesopotamia*. Culture & History of the Ancient Near East 104. Leiden: Brill, 2019.

Thompson 1925
Campbell R. Thompson. *On the Chemistry of the Ancient Assyrians*. London: Luzac, 1925.

Thompson 1936
Campbell R. Thompson. *A Dictionary of Assyrian Chemistry and Geology*. Oxford: Clarendon Press, 1936.

Volk 1999
Konrad Volk. "Imkerei im alten Mesopotamien?" In *Landwirtschaft im Alten Orient. Ausgewählte Vorträge der XLI. Rencontre Assyriologique Internationale, Berlin, 4.–8.7.1994*. Ed. by H. Klengel and J. Renger. Berlin: Reimer, 1999, 279–290.

Walton et al. 2012
Marc Walton, Katherine Eremin, Andrew J. Shortland, Patrick Degryse, and Kirk Susanna. "Analysis of Late Bronze Age Glass Axes From Nippur. A New Cobalt Colourant". *Archaeometry* 54.5 (2012), 835–852.

Warburton 2008
David A. Warburton. "The Theoretical Implications of Ancient Egyptian Colour Vocabulary for Anthropological and Cognitive Theory". *Lingua Aegyptia* 16 (2008), 213–259.

Warburton 2016
David A. Warburton. "Ancient Color Categories". In *Encyclopedia of Color Science and Technology*. Ed. by L. Ronnier. New York: Springer, 2016, 1–9.

Zimmern 1925
Heinrich Zimmern. "Assyrische chemisch-technische Rezepte, insbesondere für Herstellung farbiger glasierter Ziegeln, in Umschrift und Übersetzung". *Zeitschrift für Assyriologie und Vorderasiatische Archäologie* 36 (1925), 177–208.

Illustration and table credits

ILLUSTRATIONS: **1** Image: S. Thavapalan. **2** Image: S. Thavapalan. **3** Photo: A. Hodgkinson. Permission: © Ägyptisches Museum und Papyrussammlung der Staatlichen Museen zu Berlin – Preußischer Kulturbesitz. **4** Photo: A. Hodgkinson. Permission: © Ägyptisches Museum und Papyrussammlung der Staatlichen Museen zu Berlin – Preußischer Kulturbesitz. **5** A. Hodgkinson. Permission: image courtesy of the Garstang Museum of Archaeology. **TABLES:** **1** After Potts 1989, 149–151.

SHIYANTHI THAVAPALAN

Shiyanthi Thavapalan (Ph.D. Yale University, 2017) is a visiting assistant professor of assyriology and archaeology at Brown University. Her research interests include colour, ancient technologies and crafts (glass-working/-making, dyeing, metallurgy, painting), Assyrian palace architecture and Akkadian recipes and technical texts.

Dr. Shiyanthi Thavapalan
Department of Egyptology and Assyriology
Brown University
Box 1899
2 Prospect Street, Room 202
Providence, RI 02912, USA
E-Mail: shiyanthi.thavapalan@aya.yale.edu

Louise Quillien

The Economic Role of Coloured Textiles in Babylonia (1st Millennium BC)

Summary

This paper investigates the economic and social role of coloured luxury textiles in 1st millennium BC Babylonia. The manufacture of these objects required rare raw materials imported from outside Mesopotamia through commercial or diplomatic channels. The Babylonian craftsmen developed special skills in the dyeing and weaving of these textiles. The costs were high and only a limited number of people could afford them, especially outside temple and palace contexts.

Keywords: textiles; economy; society; dyes and colours; craftsmanship

Dieser Beitrag untersucht die wirtschaftliche und soziale Rolle von farbigen Luxustextilien im 1. Jahrtausend v. Chr. in Babylonien. Die Herstellung dieser Objekte erforderte seltene Rohstoffe, die aus dem außermesopotamischen Raum über kommerzielle oder diplomatische Kanäle importiert wurden. Die babylonischen Handwerker entwickelten besondere Fertigkeiten beim Färben und Weben dieser Textilien. Sie waren sehr teuer und nur wenige Menschen konnten sie sich leisten, insbesondere außerhalb von Tempel- und Palastkontexten.

Keywords: Textilien; Ökonomie; Gesellschaft; Färben und Farben; Handwerkskunst

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

Many classical authors from the first centuries AD mention Babylonian textiles and their colours.[1] Pliny the Elder wrote in his *Natural History* (VIII: 74): "Babylon was very famous for making embroidery in different colours, and hence stuffs of this kind have obtained the name of Babylonian."[2] During the Hellenistic and Roman periods, the term 'Babylonian' was used to qualify a certain type of luxurious and coloured garment, even if these garments did not really come from Babylon. Did the cuneiform sources, dating from the Neo-Babylonian period to the beginning of Hellenistic times (from the 6th to the 3rd centuries BC), already testify to the existence of this production of these textiles? In the present study, I will focus on the production of luxury coloured garments in Babylonia, in order to see if their shade or technique of manufacturing were special and could have increased their economic value. After presenting the evidence about coloured textiles, I will describe the techniques of manufacturing, before assessing their prices and social uses, in order to understand the economic role of coloured textiles in Babylonia.

The first millennium BC cuneiform documentation about textiles comes mostly from the two sanctuaries of Uruk and Sippar (Warka and Abu Habbah respectively, in southern Iraq today). Uruk, in the south of Babylonia, was an important city dominated by the temple of Ištar (Eanna) and, during the Hellenistic period, the temple of Anu (Bīt-Rēš). The 20th century excavations of the Eanna temple brought some 8000 cuneiform tablets dating from the first millennium BC to light; the texts deal with the daily operations of the sanctuary (cult, administration, justice, correspondence, and private affairs of the urban elite linked to the temple).[3] Sippar was a smaller city in the north of Babylonia, not far from the capital, Babylon. The 50 000 cuneiform tablets found in its temple, the Ebabbar, devoted to the god Šamaš, are of a similar nature.[4] These documents are written in cuneiform on small clay tablets in the Akkadian language. The words are either written in Akkadian (syllable by syllable), or using Sumerian ideograms.

1 The abbreviations used here follow those listed in CDLI, and the following: Bertin: unpublished copies by G. Bertin of tablets from the British Museum; *Zawadzki Garments II*: Zawadzki 2013.

2 Plin. *HN* 8.74. Bostock and Riley 1855, 92–93. Silius Italicus (1st century AD) wrote that in the Punic War (*Pun.* 14.658): "her tapestry (of Syracuse) wrought with ruddy gold and reproducing in the woof living likeliness of men, might rival the fabrics wrought by the shuttles of Babylon or by Tyre" Duff 1927, 320–321. Flavius Josephus (1st century AD), describing the Temple of Salomon in *The War of the Jews*, mentions a Babylonian curtain (BJ 5.207): "It was a Babylonian curtain, embroidered with blue, and fine linen, and scarlet, and purple: and of a texture that was truly wonderful. Nor was this mixture of colours without its mystical interpretation: but was a kind of image of the universe. For by the scarlet there seemed to be enigmatically signified fire; by the fine flax, the earth; by the blue, the air; and by the purple, the sea" (Whiston 1737). Arrian (2nd century AD) described Cyrus's grave in Pasargadae in this way (*Anab.* 6.29.5): "in the chamber was placed a golden sarcophagus, in which Cyrus' body had been buried; a divan stood by the sarcophagus, and this divan had feet of wrought gold; its coverlet was of Babylonian carpets, and for an undercovering, purple rugs. Upon it was placed a tunic and vests also of Babylonian workmanship" (Robson 1933, 196–197).

3 van Driel 1998.

4 Mac Ginnis 1995, 13–14 and Jursa 2005, 116–117.

The texts concerning textiles in these two temple archives are mostly administrative lists and memoranda, written by the temples' scribes, to organise and control the manufacturing of garments for the cult.[5] Indeed, the statues of the gods worshiped in these sanctuaries were dressed in beautiful garments, and their cellas were adorned with curtains, tablecloths, veils and blankets. Part of these textiles were coloured. According to the archives, they were made with wool dyed with precious materials by teams of craftsmen working for the temples. The natural hues of raw wool were not mentioned in these documents. Thanks to the Eanna and Ebabbar archives, we can see the inner-workings of the textile industry and the techniques familiar to the Babylonian craftsmen.[6] These temple archives mostly concern the urban elite. But the lists of wool and garments issued as rations to the dependant workers of the temples delineate the textiles worn by a population with low status. These, as we shall see, were neither dyed.

Some private archives found in temples and private houses do offer insights about the everyday use and value of coloured textiles in Babylonian society.[7] These sources come from a variety of cities: Babylon (today Hilla, Tell Babil), the capital, about 85 km from modern Bagdad, Borsippa (Birs Nimrud, 20 km north-west of Babylon), Nippur (Tell Nuffar, 260 km south of Babylon) and Ur (Tell al-Muqayyar, located in the south of Babylonia).[8] From these texts, which include dowries, contracts and letters, we can observe the significance of coloured garments made with dyed wool in a wider social context, albeit one limited to the upper class of the urban society.

The cuneiform documentation coming from Babylonia allows us to focus on the period between the emergence of the Neo-Babylonian Empire under Nabopolassar (626 BC) until the beginning of the Achaemenid Empire (from the conquest of Babylonia by Cyrus in 539 BC to the reigns of Darius I [521–486 BC] and Xerxes I [486–465 BC]). Archives from the late Achaemenid and Hellenistic periods are less numerous. Since the Late Assyrian era, the Aramean vernacular language – written on perishable materials such as leather and papyrus – was increasingly used for accounting and records so that much is lost.

During the first millennium BC, Babylonia became a part of a wider empire. The establishment of the Neo-Babylonian Empire (626–539 BC) and the Achaemenid Empire (539–330 BC) facilitated the movement of people and goods between Babylonia and its neighbours.[9] Indeed, materials also started to circulate more widely within Babylonia,

5 Oppenheim 1949; Zawadzki 2006; Zawadzki 2013; Beaulieu 2003.

6 Prosopographies of the first millennium BC urban Babylonian elite, including craftsmen, have been published by Kümmel 1979; Payne 2007 for Uruk, and Bongenaar 1997 for Sippar.

7 A synthesis of these private archives and their contents can be found in Jursa 2005.

8 On some garments used in non-cultic contexts in first millennium Babylonia see Zawadzki 2010 and Joannès 2014.

9 Jursa 2010; Graslin 2009.

including purple wool and precious imported dyes.[10] Silver was increasingly used as a means of payment.

1 The coloured textiles and their raw materials

1.1 Definition of the coloured textiles

Coloured textiles are described in the texts in several ways. The colour of the object or its material of composition can be explicitly stated: “one mina forty-five shekels (875 grams) of red wool, the weight of the *nēbeḫu*-belt for the god Šamaš” or “1 *naḫlaptu*-outer garment of red wool.”[11] The texts can also indicate that the materials given to craftsmen to make a garment are coloured: “half mina six shekels (300 grams) of blue-purple wool for the garments of the gods Šamaš and Bunene (given to) the craftsman Bakûa.”[12] Wool was the main raw material for textiles in Mesopotamia, linen was also used but was usually undyed.[13] The colour is linked to the raw material, not to the garment itself, as the example above shows.

The terminology of coloured textiles is written either in Akkadian with a syllabic writing or in Sumerian with a combination of ideograms. A determinative can precede the word and indicate the nature of the object: a fabric, wool, a plant, etc. For instance, red wool is written with the Sumerian determinative for wool ‘SÍG,’ followed by the syllabic signs *ta-bar-ru* for *tabarru*, red-coloured wool in Akkadian. In Sumerian, the same word is written with the ideograms $^{\text{síg}}$ḪÉ.ME.DA.

In Babylonia, during the first millennium BC, the most frequent wool colours mentioned in texts about everyday economic and administrative transactions are red (Akkadian $^{\text{síg}}$*tabarru* / Sumerian $^{\text{síg}}$ḪÉ.ME.DA) and blue-purple wool ($^{\text{síg}}$*takiltu* / $^{\text{síg}}$ZA.GÌN.KUR.RA)[14]. Less common are red-purple wool ($^{\text{síg}}$*argamannu* / $^{\text{síg}}$SAG), apple(-coloured) wool ($^{\text{síg.(giš)}}$*ḫašḫūru* / $^{\text{síg.(giš)}}$ḪAŠḪUR), the unknown $^{\text{síg}}$ÌR.Ú.MA.MEŠ wool and green wool ($^{\text{síg}}$*ḫaṣaštu*). A dyeing recipe also mentions pale blue ($^{\text{síg}}$*urrīqu*), dark blue

10 About the increasing role of silver in the Babylonian economy during the first millennium BC, see van Driel 2002 and Jursa 2010.

11 First extract: *Zawadzki Garments II* n°170: 4: 1 1/3 MA.NA 5 GÍN $^{\text{síg}}$ḪÉ.ME.[DA] KI.LAL $^{\text{túg}}$⸢ÍB⸣.LÁ *šá* $^{\text{d}}$UTU, Nabuchadnezzar II, Sippar. Second extract, *YOS* 17 307: 3: 1 $^{\text{síg}}$GÚ.È *šá* $^{\text{síg}}$*ta-bar-ru*, Nabuchadnezzar II, Uruk.

12 *Nbn* 880: 1–4: ½ MA.NA 6 GÍN $^{\text{síg}}$ZA.GÌN.KUR.RA *a-na* TÚG$^{\text{ḫi.a}}$ *šá* $^{\text{d}}$UTU *u* $^{\text{d}}$*bu-ne-ne* $^{\text{I}}$*ba-ku-ú-a*, Nabonidus, Sippar.

13 About the importance of wool in the economy and textile production of Mesopotamia, see Breniquet and Michel 2014. About the use of linen in first millennium BC Babylonia, see Quillien 2015.

14 For comparison, see the vocabulary of dyed wool in Neo-Assyrian period presented in Gaspa 2018, 61–67.

(^{síg}*uqnâtu* / ^{síg}ZA.GÌN), and blue-green or purple (^{síg}*ḫašmānu*) wool.[15] But these shades do not appear in everyday documentation. The words designating the different natural colours of this fibre (brown, beige, dark...) are unknown.[16] When 'wool' is mentioned without any specification, it means natural undyed wool. Therefore, during the first millennium BC, the Akkadian vocabulary for red and for blue wool was highly developed, but the green and yellow variants were rare, and the brown and orange absent, perhaps because they were understood as reddish shades.

Several types of texts help us understand the process of manufacturing coloured textiles. The temple archives of Uruk and Sippar, containing lists of the dyes given to the weavers-of-coloured-clothes (*išpar birmi*, a class of craftsmen), lists of raw materials purchased by merchants indicating the provenance of dyes, and a wool dyeing recipe describing the procedure for dyeing wool in one or several colours.[17] Thanks to these documents we know that some of the base materials used to make coloured textiles were produced in Babylonia, and that others were imported. The raw wool was local. Indeed, wool was one of the main commercial products of Babylonia and the temples and kings had a great number of large herds.[18] A huge part of this wool production was sold, one way that wool could be acquired by people who did not possess sheep. Another part was redistributed as rations to the temple's dependant workers.[19] Beyond that, however, some dyes used to make coloured textiles were also imported into Mesopotamia. I will here take the example of the two colours of wool that are most frequently attested in the Neo-Babylonian cuneiform documentation of the temples: red wool and blue-purple wool.

15 This dyeing recipe, unique to the Neo-Babylonian period, *BM* 62788+82979, was published by Leichty 1979 and the complete edition is in preparation by Irving Finkel and Hero Granger-Taylor. The term *ḫašmānu* is translated "a blue-green color" by the CAD H: 142, where this meaning is deduced from the identification of the *ḫašmānu* stone with the azure *ḫašmānu* one. But the CAD also links the word with *ḫašḫūru*, the apple-(coloured) wool which it translates "greenish". Nevertheless, van Soldt translates *ḫašmānu* in the Ugaritic texts as "red-purple", arguing that it was the Akkadian equivalent of Ugaritic *pḥm*, the colour of the glowing charcoal (Landsberger 1967, 158; van Soldt 1990, 344). This term is attested in Neo-Babylonian documentation only in the dyeing recipe *BM* 62788+82979, where we learn that it was obtained by double dyeing blue wool with an unknown plant. Thus, it must refer to a mixed colour with some blue in its composition – perhaps green or a shade of purple.

16 But the terms white and black appear to qualified textiles. On the translation of the Akkadian vocabulary of colours, see Landsberger 1967; Boehmer 1971. For first millennium wool colours, see Payne 2007, 134–137; Zawadzki 2006, 40–49.

17 For examples of dyes given to workers at Sippar, see Zawadzki 2006 and at Uruk, see Payne 2007. Lists of raw materials purchased by merchants are studied by Oppenheim 1967; Joannès 1999; Graslin 2009; Kleber 2017. The dyeing recipe is *BM* 62788+82979, edited by Leichty 1979.

18 On sheep breeding, see Breniquet and Michel 2014; van Driel 1993; Kozuh 2014.

19 Kleber 2010.

1.2 Identification of the raw materials

Red wool (^{síg}*tabarru*) could be made with three materials, according to the dyeing recipe *BM* 62788+82979 and the cuneiform documentation from the temples: the *inzaḫurētu*, *ḫūratu* and *ḫatḫurētu* dyes.[20] *Inzaḫurētu* might have been kermes *(Kermes vermillo)*, a little parasite living on oak trees whose eggs, piled and dried, gave a very strong and brilliant red dye.[21] Meissner identified *ḫurḫurātu* as kermes thanks to a text from Nuzi mentioning "*ḫurḫurātu* from worms".[22] Landsberger suggested that the word *ḫurḫurātu* was the precursor of *inzaḫurētu* and linked this word with Syriac *zᵉḥōrīta* and the Aramaic *zᵉḥōrīt*, which mean scarlet.[23] Kermes produces a bright red dye, in contrast to the madder, which gives a red-orange shade. The kermes oak *(Quercus coccifera)* grows near the Mediterranean Sea, in the Levant and Turkey.[24]

Another hypothesis would be to identify this dye with the Armenian cochineal *(Porphyrophora hamelii)*, an insect coming from present-day Armenia. Indeed, in Neo-Assyrian times, the kings often took red wool as booty from the Ararat valley in North Assyria and in the Urartu region.[25] These areas may have had a specialisation in the dyeing in red.

The term *inzaḫurētu* generally appears without a determinative in Neo-Babylonian documentation, whereas vegetal dyes are preceded by the determinative for wool, plant or grass. This might indicate its animal nature. But there are exceptions. In three texts from Uruk, it is preceded by the Sumerian determinative "ú" (plant, grass).[26] In an-

20 The Akkadian word *tabarru* is translated "red wool" by the CAD T: 21 and "rote Wolle" by the *AHw* 1298. It is the equivalent of the word "*nabāsu*" according to the lexical list Hh. XIX 78–78a. *Nabāsu* was more frequent in older periods (CAD N: 21–22, AHw, 697). The *nabāsu* wool is associated in several texts with the colour of blood (occurrences in CAD N: 21). According to Zawadzki, *nabāsu* seems to be a synonym of *tabarru* in Neo-Babylonian texts, because the word is used in contexts where *tabarru* should appear (Zawadzki 2006, 41). But it could also be a special shade of *tabarru*-red, because the two words appear side by side in *YOS* 17 307, as Zawadzki notes. Landsberger 1967, 168, links the Akkadian *tabarru* with the Hurrian word *tabriḫu*.

21 The translation of *inzaḫurētu* proposed by Oppenheim (Oppenheim 1967, 242) "woad" *(Isatis tinctoria)*, cannot be accepted. *Inzaḫurētu* is a red dye and woad dyes material blue. Furthermore, the craftsmen often received alum together with *inzaḫurētu*, and the technics of dyeing with woad do not involve alum, in contrast to the kermes. The translation "kermes" has been followed by Payne 2007 and Kleber 2017.

22 Meissner 1925, 14–15.

23 Landsberger 1967, 168–69; CAD H: 250.

24 Townsend, Evan, and Al Rawi 1980, lists the oak species present in Iraq and do not mention the kermes oak.

25 Forbes 1956, 102; Al-Jadir 1974. Red wool appears in the booty of Sargon II, although it is not specified which dye was employed (Mayer 2013, 366).

26 The text where the word is preceded by 'ú' is *PTS* 2098 (Kleber 2017, n°18), it is a list of goods imported from abroad. But in the three texts of the same dossier, the term appears without a determinative (see Kleber 2017). In *GCCI* 2 121 and *YOS* 7 183, the word is preceded by the word sign ú too. The two texts are lists of garments for the cult of the *miḫṣu pēṣû* type Payne 2007, where *inzaḫurētu* usually appears without determinative. Note that in *YOS* 7 138, the term is written with the determinative ú in line 4 and without in lines 24, 28 and 31. If it were clearly a plant, the determinative would have been included in all the texts, as for the *ḫūratu* (madder)

tiquity, kermes was often mistaken for a plant, because of its resemblance to seeds or berries.[27]

Another way to produce red wool (^{síg}*tabarru*), well attested in cuneiform texts, involved the use of *ḫūratu* dye (Sum. ^{giš}ḪAB). The meaning of *ḫūratu* has been debated. François Thureau-Dangin and Benno Landsberger identified it as the gallnut.[28] The Akkadian dictionaries chose another translation, "sumac".[29] These two interpretations were based on the fact that *ḫūratu* was given to leather workers, and that both gallnut and sumac were good tanning agents. But they dyed wool brown. The translation proposed by Martin Stol is more probable: "madder".[30] He deduced this meaning from an Ugaritic word, *pu-wa-tu*. Madder-*ḫūratu* was given to leather workers with alum and may have been used to dye leather, and not to tan it.[31] Madder is native to the Mediterranean Basin and the Middle East. Nowadays, the plant is grown in the lower forest zone and sometimes on the cultivated irrigated plains of Iraq. Madder grows more frequently in Syria, Levant and Turkey.[32] Different varieties of madder yield different shades of orange-red on the wool.

The last way to dye wool red *(tabarru)* according to the cuneiform sources was to use *ḫatḫurētu* dye. This dye is mentioned in the recipe *BM* 62788+82979 and in only ten texts belonging to the temple archives of Uruk and Sippar that deal with textile industry.[33] It does not appear amongst the textile products imported from the west. The *ḫatḫurētu* dye remains unidentified. Perhaps *ḫūratu* meant the imported madder and *ḫatḫurētu* the local one.[34] But this is a hypothesis that is not yet supported by textual sources.

Blue-purple wool (^{síg}*takiltu*) appeared in lists of goods imported from the Levant to Mesopotamia. As the meaning 'blue-purple' has been established by linguistic arguments and as the Levant was a place of production of purple textiles dyed with murex, one can identify *takiltu* wool with real purple, or with its imitations.[35] The murex is a

always preceded by '^{giš}', the determinative of wood. Maybe the scribe was not sure of the nature of the material.

27 Furthermore, at Ugarit, according to van Soldt, *ḫurḫurātu* is qualified as 'seeds', probably because the dried insects look like small berries. He remarks that in antiquity, kermes was often considered as a part of the tree on which it was growing (van Soldt 1990, 347).

28 Thureau-Dangin 1920, 28–29; Landsberger 1967, 169–171.

29 AHw, 538 "Gerber-Sumach"; CAD H: 247–248; Stol 1980, 533.

30 Stol 1980, 533.

31 Chamoising, the technique of tanning with oil, is the more ancient, Chahine 2005. In the Neo-Babylonian tablets mentioning the use of oil, *ḫūratu* and alum with leather (for instance *Camb* 155), the craftsmen may have a mixed technique between tanning and dyeing, technique described for the Roman period by van Driel-Murray 2002, 251–265, and for Mesopotamia by Scurlock 2008.

32 Townsend, Evan, and Al Rawi 1980, 626.

33 *BM* 62788, *Nbk* 180, *GCCI* 1 308, *NCBT* 461 (Payne 2007, 118), *PTS* 3116, *YOS* 17 252, *YOS* 19 282, *YBC* 9030, *UCP* 9/2 p. 85 n°12 and *PTS* 3243 (Payne 2007, 135).

34 Cardon 2003, 105 wrote that the dyeing recipe *BM* 62788+82979 may have mentioned several species of madder plant.

35 Landsberger 1967, 155 and 162. Blue-purple wool, ^{síg}*takiltu*, was the equivalent of the Sumerian ^{síg}ZA.GÌN.KUR.RA, literally: "lapis lazuli wool from

family of molluscs that live in the Mediterranean Sea and in the Persian Gulf.[36] The main producers of purple in the Levant during the first millennium BC were the Levantine cities, especially Tyre and Sidon.[37] For instance, a cuneiform text from Sippar mentioned blue-purple wool coming from Byblos.[38] The wool was transported to Mesopotamia already dyed because the process of dyeing with murex has to be done near the sea. The long-distance transportation of the murex dye was complex and there is no sign of the existence of such practice in Babylonia.[39]

To counter the monopoly of the Levantine cities and the high price of real purple textiles, techniques to make imitation purple wool were invented in antiquity.[40] The Neo-Babylonian recipe *BM* 62788+82979 from Sippar describes one of these techniques. Despite the fact that such knowledge was available in Babylonia, several points suggest that most of the purple wool used by the temple craftsmen was genuine. Indeed, at Uruk and Sippar, blue-purple wool was rarely purchased locally with silver entrusted to craftsmen. Furthermore, the temples themselves were in charge of the supply. This means that purple wool was not easily available on the local market. Dyeing in blue-purple, according to the recipe *BM* 62788+82979, requires blue wool, and therefore a blue dye.[41] But blue dye was never entrusted to craftsmen.[42] Lastly, we will see further on that blue-purple wool was very expensive. Nevertheless, there are cases of blue wool made locally in the Uruk documentation, as remarked by Elizabeth Payne: *uqnâtu* and *takiltu ša pî ruqqi,* the blue and blue-purple wool "from the cauldron".[43] Kristin Kleber proposed that this reference specifically distinguished imitation purple from the genuine article. But as the expression appears rarely, most of the purple wool seems to be genuine.[44]

the mountain". It was, according to the CAD T: 70–73 "a precious blue-purple wool"; and according to the *AHw*, 1306 "blaue Purpurwolle". The word *takiltu* is etymologically linked to Hebrew *teḵēlet* which is a blue-purple according to Ziderman 1987, 25. For an analysis of the production and use of purple wool in Syria and Mesopotamia in the Bronze Age, see Thavapalan 2018.

36 The murex-brandaris gives red shades on the wool (the red-purple or Tyrian purple), and the murex-trunculus gives the blue-purple shades (amethyst), according to Koren 2005; about the murex in the Mediterranean Sea: Cardon 1999, and in the Persian Gulf: Edens 1999.

37 Jensen 1963. But the Levantine cities were not the only producers. A lot of murex shells have been found for instance on Crete and in the Cyclades (Faure 1991), at the archaeological site of Ugarit, and they date from the 13th century: Thureau-Dangin 1934; Schaeffer 1951.

38 Dandamaev 1995, 29–31.

39 A technique of transportation in liquid form was known in Roman times according to Macheboeuf 2004, 142, but in cuneiform texts, the purple is always imported in the form of dyed wool, and there is no Akkadian word for murex dye.

40 Cardon 2003, 109, 378 and 323, describes some of these techniques: mixing woad with madder, orchil – a kind of lichen, gallnut.

41 Unfortunately, the passage mentioning the blue dye is broken.

42 But as there are not a lot of good natural blue dyes, one can suppose that it was woad (indigo was from Asia, woad from Europe). It had to be imported. According to Cardon, *Isatis spp*. is native to the Middle East (Cardon 2003, 283).

43 Payne 2007, 137.

44 Kleber 2017.

The primary mordant used for dyeing process, especially for the dyeing with madder or kermes, was alum. But this mineral did not exist in Mesopotamia. Egyptian alum and "alum from Kašappu" are mentioned in the cuneiform texts from Sippar and Uruk.[45] The Egyptian Oases of Dakhla and Kharga were the main places where natural alum was extracted in ancient times.[46] The location of Kašappu has not yet been identified with certainty, but it could be a place where alum coming from islands like Aegean Melos and Levantine Cyprus, was traded. Indeed, there are natural deposits of natural alum on these islands.[47]

Local dyeing materials are less often mentioned in the texts. This is probably the case of the *kasû* plant, not studied here, but appears as a dye product in the dyeing recipe of Sippar *BM* 62788+82979.[48] According to this text, local plants like the *kasû* were used to imitate more precious materials like red-purple wool *(argamannu)*. As a lot of plants have dyeing properties, it is probable that other local plants may have been used to dye wool, but they are not mentioned in the texts, maybe because they were common and cheap.

1.3 The means of transportation

The dyes most often mentioned in the Uruk and Sippar temple archives are the precious ones. To import these dyes, the temple of Uruk organised commercial expeditions. Capital subsidies were given to merchants who had to bring back dyes and other rare products. In the inventories of imported goods, we find Egyptian linen, *inzaḫurētu* (kermes or Armenian cochineal), *ḫūratu* (madder), blue-purple wool and alum.[49] The merchants probably did not travel across Egypt and Turkey themselves to find these products, but rather purchased them from trading posts such as Carchemish or Thapsaque on the Upper Euphrates.[50] The king also supplied temples with precious materials. In the text *YOS* 19 287, dating from the third year of Nabonidus' reign, the king's son, Bēl-šar-uṣur, gave

45 For instance: alum from Egypt is mentioned in *Nbn* 214: 3: 12 GÍN KÙ.BABBAR *a-na* 10 MA.NA [na4]*gab-bu-ú šá mi-ṣir*"; alum from Kašappu in *YOS* 3 14: 8–9: 2 GUR [na4]*ga-bu-ú šá* [kur]*ka-šap-pu*.

46 Picon, Vichy, and Ballet 2004.

47 Picon, Vichy, and Ballet 2004.

48 The *kasû* plant is translated "mustard" by Landsberger and Gurney 1957/1958 and is well attested in many other texts dealing with its medical and culinary uses CAD K: 248–250. *BM* 62788+82979 is the only text where it is attested as a dyeing agent. As mustard seeds do not have dyeing properties, one may consider another translation of this word. Stol has enumerated many possibilities and proposed that it was the cuscuta, Stol 1994, 175. This plant does indeed dye in red, and was used for this purpose, for instance, in 19th century Northern France, but the colour is weak, according to Roucel 1803, 113. About the debates on the *kasû* plant see also Zadok 1997 and Vargyas 2001, 199.

49 Some of these expeditions are known for the Eanna of Uruk, the merchants are going to the Levant (*YOS* 6 168; *TCL* 12 84; *PTS* 2098; *NCBT* 644, year 6 of Nabonidus); or to the Trans-Euphrates (*YOS* 7 63, date lost). See Oppenheim 1967, 236–254; Graslin 2009 and Kleber 2017.

50 Graslin 2009.

twenty *kurru* of alum in a liquid form or in powder (3600 litres) to the temple of Uruk. The king of Babylon probably acquired these materials, not by commercial expeditions but through taxation or warfare.

Beside organised commercial expeditions of the temples or the kings and wars, there existed individual exchanges of dye products, especially imported ones. For instance, in several letters coming from Uruk and Babylon, written in the temple milieu or in private archives, the senders requested from their superiors, alum, blue-purple wool, *inzaḫurētu* dye (kermes/Armenian cochineal?).[51] Furthermore, the craftsmen of the temples often bought imported goods such as alum, kermes, madder and flax, locally.[52] The availability of these products on local markets, especially at Sippar, is a sign of the existence of independent trade channels not controlled by the temples or the palace. This could indicate that the wearing of coloured garments was not limited to the temple and palace people but was more widespread in society, of course by people who could afford it.

The imported dyes and coloured wool were mostly transported in solid form. The dyes were transported within clay jars and alum in a special container called *gurābu*, probably a bag.[53] Linen and purple wool were imported in the form of threads or fabrics. Blue-purple wool was transported in linen bags.[54] On rare occasions alum was transported in liquid form or in powder.[55] These products seem to have been carried in a more convenient form for the long-distance transportation.

Generally speaking, the Babylonian people preferred doing their own dyeing and weaving with these imported materials rather than buying finished textiles from abroad, probably to be able to create their own shades and their own type of coloured fabrics. The only exception was the purple wool which had to be imported pre-dyed because the dyeing work with murex had to be done near the sea. The Babylonian craftsmen developed their own, original, technical understanding of working with coloured textiles.

51 In the Uruk text *YOS* 3 14, the sender asks his brothers to send him alum, the people are probably member of the temple's personnel or administration. *YOS* 3 94, also from Uruk, is a letter from two textile craftsmen, to their father dealing with the supplying of blue-purple wool for the manufacturing of the garments of the gods. *CT* 22 98 in this letter from a private archive, the sender is at Babylon and asks his brother to send him *inzaḫurētu* dye and alum.

52 *CT* 55 364, *Camb* 11, *GCCI* 1 327, *Nbn* 370.

53 *TCL* 12 84: 14–15: 3 DUG *kan-da-a-nu šá* ⸢ŠIM⸣.ḪAB ; 2 $^{\text{dug}}$ŠAGAN.MEŠ *šá in-za-ḫu-re-*⸢*e-tú*⸣; *TCL* 12 84: 5–6: 3 GÚ.UN 53 MA.NA GAB-*ú šá* KUR *mi-ṣir a-di gu-ra-bu*. For *gurābu*, see CAD G: 136 "*gurābu* A 1. bag 2. reinforcement around an earthenware jar"; *AHw*, 299 "*gurābu* II", "Sack, Umhüllung".

54 *TCL* 12 84: 12–13: ⸢$^{\text{síg}}$⸣ZA.GÌN.KUR.RA *a-di* 2 $^{\text{gada}}$⸢*na*⸣ *aṣ-ra-pa-a-tú*.

55 *YOS* 19 287.

2 The manufacture of multi-coloured textiles

2.1 The craftsmen

A special category of craftsmen was in charge of the dying and preparation of coloured wool: the weavers-of-coloured-clothes *(išpar birmi)*. This profession appears in first millennium BC Mesopotamia and may be a sign of the apparition of new specialised skills in the manufacture of coloured textiles.[56] The profession of weaver-of-coloured-clothes is mainly attested in the temple archives and these craftsmen were among the temple personnel. They were in charge of dyeing wool and the manufacture of small coloured decorations.[57] The coloured wool they prepared was used by prebendary weavers of the highest status to manufacture garments for divine statues.

The cuneiform texts dealing with the craftsmen working for the urban elite in private workshops are far rarer. There are some working contracts for the employment of launderers, and apprenticeship contracts for several textile professions.[58] One of these contracts is for learning *subattu birmu*-work, that is to say the manufacturing of a luxurious coloured garments decorated with trimmings or embroideries.[59] Therefore, the urban elite wore coloured clothes made with dyed wools and precious garments were not confined to the temples and palaces alone.

2.2 The techniques used to make coloured textiles

Did the Babylonian craftsmen master special skills that would have made their textiles original compared to their neighbours? Catherine Breniquet studied Mesopotamian weaving techniques practised in the third millennium BC using archaeological and iconographical data.[60] She found that craftsmen used the horizontal loom, the warp-weighted loom, and the vertical loom with two beams. The technique of tablet weaving might have been used too, but further evidence is needed to confirm this point.[61] All these looms allow playing with patterns and colours. It seems, according to the Babylonian temple archives, that the fabrics were seldom dyed entirely. The wool seems to have been dyed before weaving. Most of the texts record a small quantity of coloured wool mixed with normal wool to make a single garment. For instance, the *tunšu* blanket weighed thirty-one minas and twenty shekels (15.7 kilograms) including only five minas of coloured wool (2.5 kilograms) and one mina of linen (500 grams).[62] The blanket was

56 On the occurrences of the *išpar birmi* profession, CAD I: 253–254.

57 Bongenaar 1997, 308–209; Zawadzki 2006, 59–60.

58 Waerzeggers 2006; Hackl 2010.

59 Jursa 2006, n°9.

60 Breniquet 2008.

61 Perforated cards have been found, however, it is not certain that they were used for tablet weaving. See, for instance, the series of objects B15293 from Ur, housed in the Pennsylvania Museum of Philadelphia.

62 *Zawadzki Garments II* no. 14.

probably woven in un-dyed, white wool and the coloured wool used for its decoration. This suggests the use of embroidery, or the sewing of woollen decoration (trimmings, gallons, tassels, elaborated fringes) onto the garments. Indeed, the coloured wool may have been used as an adornment.

Furthermore, some texts mention coloured wool removed from these garments without destroying the textile, to be used in another way: "half mina of blue-purple wool from the *lubāru*-garment for the god Šamaš, six shekels of blue-purple wool from the *lubāru* garment for the god Bunene, ten shekels of ditto for the god Adad, [from (these) *lubā*]*ru* garments (wool) was removed."[63] Trimmings are easier to remove than embroidery. Furthermore, the title that dyers bear in the temple documentation is "weavers of *birmu*". The Akkadian word *birmu* (Sumerian GÙN.A) could have meant precisely these special ways of manufacturing coloured textiles, such as trimming or embroidery.[64]

2.3 Colours and patterns: how coloured textiles can carry meanings

Seldom do texts describe patterns or images made on garments. This is only the case with the garments of the priests. According to an Uruk Hellenistic ritual, the priests authorised to enter into the temple *(ērib bīti)* had to wear a garment with embroidered representations of seven gods during this ritual: "The names of seven images of the gods which are embroidered on the *ḫullānu* of the *ērib bīti* priests (are): the two little Gemini, Ennun silimma, Maskim-silimma, Udug-azida, Udug Agabbu and Nin-kî-šarra".[65] The

63 *Zawadzki Garments II* n°644: 14–17: 1/2 MA.NA $^{\text{túg}}$SÍG.ZA.GÌN.<KUR>.RA *šá* TÚG$^{\text{ḫi.a}}$ *šá* $^{\text{d}}$UTU / ⸢5 {GÍN}⸣ GÍN *šá* TÚG$^{\text{ḫi.a}}$ *šá* $^{\text{d}}$*bu-ne-ne* / 10 ⸢GÍN⸣ KI.MIN *šá* KI.MIN *šá* $^{\text{d}}$IM / [TA TÚG$^{\text{ḫ}}$]$^{\text{i.a.meš}}$ *na-si-iḫ* (Zawadzki 2013, 535–536).

64 The dictionaries translate *birmu* as follows: "a trim woven of several colours" according to the CAD, and a "bunter Stoff", according to the *AHw* (CAD B: 257–258 "*birmu* A"; *AHw*, 129 "*birmu* I"). The second meaning of the word *birmu* is "a seal impression", and is not related to textiles. According to B. Landsberger it is "farbige (billigere) Wolle, nicht spezifiziert", Landsberger 1967, 160. In the cuneiform documentation of the first millennium BC, *birmu* is a substantive meaning a specific textile material for instance: "one *naḫlaptu*-garment *birmu* (…) of the goddess Aia" (*Zawadzki Garments II* n°196: 10–11: 1 *na-ḫa-lap-tu*$_4$ *bir-mu* (…) *šá* $^{\text{d}}$*a-a*, Sippar, reign of Cyrus). Indeed, the word appears in the position of a coloured wool: "[one] *naḫlaptu*-garment *birmu* 3 *naḫlap*[*tu*]-garments of red wool ($^{\text{síg}}$*nabalsu*) 1 *naḫlap*[*tu*]-garment of blue-purple wool ($^{\text{síg}}$*takiltu*) (…) for the Queen of Sippar" (*Zawadzki Garments II* n°193: 12–14: [1-*et* $^{\text{túg}}$]*na-ḫal-*⸢*ap-tu*$_4$*bir-mu*⸣ 3-*ta* ⸢$^{\text{túg}}$⸣*na-ḫal-*⸢*ap*⸣-[*tu*$_4$] *na-bal-s*[*u*] 1-*et* $^{\text{túg}}$*na-ḫal-*⸢*ap*⸣-[*tu*$_4$] $^{\text{síg}}$ZA.GÌN.KUR.R[A], Sippar, reign of Nabonidus). If it was a wool of one colour, why was this colour not stated as usual? We can suppose that the word *birmu* can mean either multi-coloured wool or a special textile raw material like trimming. As noted above, *birmu* is also employed in the expression *išpar birmi* at Sippar and Uruk, which means: "weavers-of-coloured-clothes" Bongenaar 1997; Zawadzki 2006; Payne 2007. These craftsmen were clearly distinct from the linen weavers, so they must have worked exclusively with woollen textiles. Here, the word *birmu* mean all the colours (or some colours) without precision.

65 *UVB* 15 40, quoted according to the translation of Joannès 2014, 448, based upon the edition of the text by Falkenstein 1959.

verb here translated as "to embroider" is *šapû*, and not *maḫāṣu* (to weave).[66]

This suggests that Babylonian craftsmen made special use of embroidery and trimming to apply colourful designs onto fabrics, at least when using precious dyed wool. These two techniques may have been recognised as characteristics of Babylonian textiles, but contemporary mentions of the reception of these textiles abroad are lacking.

3 The economic value of the coloured textiles

3.1 Prices

The study of the prices of the raw materials used to make the coloured garments helps to identify which categories of the population could afford them in Babylonia. Some texts from Uruk and Sippar mention craftsmen or merchants buying dyes and coloured wool locally or at trading places. These texts give an idea of the prices of these materials, which we have summarised in the following tables 1–5.[67] To give a rough scale of these prices, at least half a shekel of silver was needed to feed a man in barley for one month.[68]

It is difficult to interpret the cost of commodities in cuneiform sources because prices vary with the availability of the material, the bargaining between traders, the quality of the merchandise, and many other elements not mentioned in the texts. But we can nonetheless observe general trends. The price of one mina of *inzaḫurētu* dye (kermes/Armenian cochineal?) ranged between 0.2 and fifteen shekels of silver (i.e., between a bit more than one gram and 125 grams of silver for 500 grams of dye), with most of the attestations of prices between one and three shekels of silver (eight to twenty-five grams of silver) (Tab. 1–1). There is no major difference between the prices mentioned in the documentation of Uruk and those of Sippar, even though the dye was usually purchased abroad at Uruk, while at Sippar, it was acquired on the local market.

66 The verb *šapû*. It is translated "to wrap, to fasten with laces, thongs" by the CAD Š: 490 "*šapû* B", and "to weave" by Zawadzki 2010, n°67 and n°472. According to the Neo-Babylonian texts, the verb means an action realised with small quantities of coloured wool on woven garments, as for instance in the texts *CT* 44 73; *Zawadzki Garments II* n°472; *NCBT* 988; *NCBT* 90; *YOS* 19 275; *VS* 20 15; *PTS* 2576; *YOS* 19 218. We can propose for the verb *šapû* in this context the translation "to embroider," which can be applied to coloured wool or golden appliqués when they were added to woven textiles in order to sew patterns on them. On *maḫāṣu*, to weave see CAD M: 78: "*maḫāṣu* 3a".

67 Partial inventories of dye prices were presented by Payne 2007; Graslin 2009; Kleber 2017. *PTS* 3348 is quoted by Payne 2007, 139; *PTS* 2098 and *PTS* 3116 are published by Kleber 2017, nos.18 and 4. *YOS* 19 282 has been collated by Payne 2007, 138. *NCBT* 758 is quoted by Payne 2007, 136.

68 2.56 shekels was the mean price of a GUR of barley (180 litres) during the period under consideration here and the monthly ration for a worker ranged between 36 and 180 litres of barley according to Jursa 2010, 447–449 and 669–672. These rations may have also fed the worker's family.

Text	Date	*inzaḫurētu* (minas)	Silver (shekels)	Price (shekels of silver for one mina)	Summary
SIPPAR					
BM 69003 (*Zawadzki Garments II* n°550)	Nbk II 19.VII.0 (522 BC)	12.5	30	2.4	Silver given to a temple craftsman for (buying) dye.
BM 73111 (*Zawadzki Garments II* n°520)	Nbn 28.IV.4 (552 BC)	60.92	130	2.1	Silver given to a craftsman for (buying) dye.
Nbn 214	Nbn -.II.5 (551 BC)	18	30	1.7	Silver given to a craftsman for (buying) dye.
CT 55 862	Nbn 10.IV.8 (548 BC)	31.66	49	1.5	List of imported products (purple wool, alum, honey)
Nbn 428	Nbn 10.V.10 (546 BC)	41.25	50	1.2	List of expenses of the Ebabbar-temple, silver given to a craftsman for (buying) dye.
Nbn 538	Nbn 6.VII.11 (545 BC)	30	50	1.7	Silver given to a craftsman for (buying) dye.
Cyr 253	Cyr 2.II.7 (532 BC)	1.85	1.75	0.9	Silver given to a craftsman for (buying) dye.
Camb 11	Camb 12.X.0 (528 BC)	2	2	1	Silver given to a craftsman for (buying) dye.
Camb 175	Camb -.VI.3 (527 BC)	3.33	5	1.5	Silver given to a craftsman for (buying) dye.
Camb 404	Camb -.XI.7 (522 BC)	8	21	2.6	List of expenses of the Ebabbar-temple, silver given to a craftsman for (buying) dye.
BM 65104 (*Zawadzki Garments II* n°607)	Dar Ist 21.VI.2 (520 BC)	21	5	0.2	Silver given to a craftsman for (buying) dye.
BM 62552	Dar -.-.8 (514–513 BC)	0.33	5	15	List of expenses of the Ebabbar-temple, silver given for (buying) dye.

Tab. 1 *inzaḫurētu* prices.

Text	Date	*inzaḫurētu* (minas)	Silver (shekels)	Price (shekels of silver for one mina)	Summary
Dar 516	Dar 1st 20 (502–501 BC)	60	240	4	List of expenses of the Ebabbar-temple, silver given for (buying) dye.
CT 55 350	Dar 1st - (521–585 BC)	1.73	3.5	2	Silver given to a crafts-man for (buying) dye.
CT 57 255	Dar 1st - (521–585 BC)	10	10	1	List of expenses of the Ebabbar-temple, silver given to a craftsman for (buying) dye.
BM 61226 (*Zawadzki Gar-ments II* n°611)	Dar Ist - (521–585 BC)	20	22.5	1.1	List of expenses of the Ebabbar-temple, silver given to a craftsman for (buying) dye.
URUK					
BIN 1 162	Nbk II 3.VIII.31 (574 BC)	2.5	10	4	List of merchandise imported from the west with their prices
PTS 3348	Nbk II -.XIIb-31 (576 BC)	19.5 22.17	58.5 66.5	3.0 3.0	List of merchandise imported from the west with their prices
GCCI 1 211	Nbk II 22.II.35 (570 BC)	0.33	1	3	Silver given to a crafts-man for (buying) dye.
YOS 6 168 and *PTS* 2098	Nbn 7.VII.6 (550 BC)	81.33 31.33	122 48.5	1.5 1.5	List of merchandise imported from the west with their prices
BIN 1 4	Cyr? (558–529 BC)	60	90	1.5	Letter dealing with the sending of dye, cedar, purple wool

Tab. 1 *inzaḫurētu* prices (cont.).

Text	Place / date	Dye (in minas)	Silver (in shekels)	price (in shekels of silver for one mina)	Summary
BM 83377 (*Zawadzki Garments II* n°445)	Sippar / Nbn 5.XII.2 (553 BC)	60	1 talent of wool =15 shekels of silver	0.25	Silver given to a craftsman for (buying) dye.
YOS 6 168	Uruk / Nbn 7.VII.6 (550 BC)	120	30	0.25	List of merchandises imported from the west with their prices
BM 63899 (*Zawadzki Garments II* n°534)	Sippar / Nbn 22.V.14 (542 BC)	150	60	0.4	Silver given to a craftsman for (buying) dye.
BM 64869 (Tarasewicz 2009, n°8)	Sippar / Dar 1st -.XI?. 11 (510 BC)	60	12	0.2	List of expenses of the Ebabbar-temple, silver given for dye.
Dar 516	Sippar / Dar 1st 20 (502–501 BC)	60	90	1.5	List of expenses of the Ebabbar-temple, silver given for dye.

Tab. 2 *ḫūratu* prices. The equivalence one talent of wool = fifteen shekels of silver is based on the average value of four minas of wool for one shekel of silver.

There are only four mentions of *ḫūratu* (madder) prices (Table 2). This dye is a variety of local or imported madder. This is sufficient for detecting a clear trend. One mina of *ḫūratu* cost between 0.25 and 0.4 shekels of silver (two to three grams of silver for 500 grams). *Ḫūratu* was cheaper than *inzaḫurētu*. Indeed, the dyeing plants are usually less expensive than the dyes coming from animals: madder is usually cheaper than kermes.[69]

The *ḫatḫurētu* prices range between 2.4 and 5.4 shekels (twenty and forty-five grams) of silver for one mina of dye. The prices given for *ḫatḫurētu* (a variety of madder?) (Tab. 3) are in the same range as the imported *inzaḫurētu* dye (kermes/Armenian cochineal?) (Tab. 2); this could indicate that the *ḫatḫurētu* was not a local dye either, if we suppose that local products are in general cheaper than imported ones. Otherwise we have to consider that *inzaḫurētu* (kermes/Armenian cochineal?) was rare enough to be expensive.

69 According to Cardon 2003, 479, the price of kermes in the Middle Ages varied according to its quality but always remained high.

Text	Place and date	Dye (in minas)	Silver (in shekels)	Price (in shekels of silver for one mina)	Summary
YOS 19 282	Uruk / Nbn 28.III.4 (552 BC)	7.25	21.75	3	Delivery of dye against silver to the Eanna temple.
GCCI 1 308	Uruk / Nbn 20.IX.8 (548 BC)	2.58	6.2	2.4	Delivery of silver for dye, to the Eanna temple
PTS 3116	Uruk / Nbn 6.VIII.14 (542 BC)	35.25	192.25	5.4	Buying of dye by the Eanna temple to a man.

Tab. 3 *ḫatḫūru* prices.

When blue-purple *takiltu* wool is mentioned in lists of imported merchandise, we can guess that it was genuine purple, dyed with murex (Tab. 4). When the blue-purple wool was bought locally, it may have been imitation purple, made with local plants. But the high prices of blue-purple wool on the local market suggest that it was real purple. Blue-purple wool was much more expensive than the raw dyes like *inzaḫurētu* and *ḫūratu*. The price of one mina of blue-purple wool varied between six and fourteen shekels (fifty and 117 grams) of silver with most of the attestations of prices at ten shekels (eighty-three grams) per mina (500 grams) of wool. As a comparison, the average price of raw wool on the Babylonian market during the Neo-Babylonian period was 0.25 shekels (two grams) of silver for one mina. The purple wool was forty times that amount.

As with dyes, alum prices were not lower when the merchandise was purchased locally as opposed to when it was imported (Tab. 5). The prices varied between 0.3 and 1.2 shekels (2.5 and ten grams) of silver for one mina of alum, with an average price of 0.43 shekels (four grams of silver). In ancient times, the word for alum signified a wide range of products, of different qualities.[70] This explains the variation in price.

With the information on the prices of dyes, coloured wool and alum, it is possible to estimate the price of the multi-coloured garments made by Sippar's craftsmen for the gods. For instance, from the text *Nbn* 794, to make the *ḫuṣannu* belt of the goddess Annunītu, the craftsmen needed three shekels (twenty-five grams) of blue-purple wool (approximately 0.5 shekels – four grams – of silver for the blue-purple wool worth ten shekels per mina – eighty-three grams of silver for 500 grams of dye), eleven shekels

70 Picon, Vichy, and Ballet 2004.

Text	Place / date	Wool (in minas)	Silver (in shekels)	Price (in shekels of silver for one mina)	Summary
VS 20 15	Uruk / Nbk II 25.VIII.11 (594 BC)	0.2	2	10	Silver given to a craftsman for wool
YOS 17 210	Uruk / Nbk II 4.XI.22 (582 BC)	0.05	0.5	10.0	Silver given to a craftsman for (buying) wool
NCBT 758	Uruk / Nbk II 3.XIIb.42 (562 BC)	0.9	9	10	Delivery of wool to the temple by a craftsman
Nbn 1101	Sippar / Nbn 4.VII.- (556–539 BC)	0.27	2.75	10.2	Silver given to a craftsman for (buying) wool
YOS 19 218	Uruk / Nbn -.XI.4 (552 BC)	0.5	3	6	Silver given to a craftsman for (buying) wool
YOS 6 168	Uruk / Nbn 7.VII.6 (550 BC)	16.25	160	9.8	List of merchandise imported from the west with their prices
CT 55 868	Sippar / Nbn 20.VI.7 (549 BC)	9.17	57	6.2	Delivery of wool to the temple by a craftsman
GCCI 1 382	Uruk / Nbn 18.IV.11 (545 BC)	8	68	8.5	Delivery of wool to the temple by a craftsman
BM 60847 (*Zawadzki Garments II* n°500)	Dar 1st. 3.X.26 (496 BC)	0.35	3.5	10	Silver given to a craftsman for (buying) dye.
BM 75676 (*Zawadzki Garments II* n°508)	Sippar / Dar 1st 3.-.34 (488-487 BC)	0.25	3.5	14	Silver given to a craftsman for (buying) wool

Tab. 4 Blue-purple wool prices.

(ninety-one grams) of *inzaḫurētu* dye (approximately 0.36 shekels of silver as the dye was worth two shekels per mina) and ten shekels of alum (approximately 0.1 shekels of silver if the alum worth 0.6 shekels per mina), a total of almost one shekel of silver.[71] As the *ḫuṣannu* of Annunītu weighed a total of seven shekels (fifty-eight grams), it was a small piece of fabric.[72] Even if only small quantities of coloured wool were used, the raw materials were expensive. While this estimate is hypothetical and is based on the average prices of the materials, it nonetheless gives an idea of the cost of coloured garments.

3.2 Who could afford coloured garments?

According to Michael Jursa, the average wage of a temple worker was about two to three shekels of silver a month under the reign of Nabonidus (556–539 BC).[73] This was just enough to cover basic needs and the coloured wool was not accessible for this category of population. Thus, coloured garments made with imported dyes may have been a marker of socio-economic boundaries in ancient times. Not everyone could wear scarlet and purple. Most of the coloured garments that occurred in the cuneiform texts (Tab. 6[74])

71 *Nbn* 794: 1–5: 11 GÍN *in-za-ḫu-re-e-ti* / 10 GÍN $^{\text{na4}}$*gab-ú* / 3 GÍN $^{\text{síg}}$ZA.GÌN.KUR.RA / *a-na* $^{\text{túg}}$NÍG.ÍB.LÁ / *šá* $^{\text{d}}$*a-nu-ni-tu*$_4$. One can deduce from this text that the *ḫuṣannu* was made of three shekels of blue-purple wool and four shekels of red wool, because its total weight is of seven shekels. The dyers used a significant weight of dyes and alum compared to the quantity of wool (eleven shekels of dye and ten shekels of alum for four shekels of wool). Maybe the dyer had to do several baths, or dyed more wool at the same time. Furthermore, the quality of natural alum could be bad compared to the going standards in antiquity.

72 On the weight of the *ḫuṣannu* of Annunītu, see Zawadzki 2006, 101. The *ḫuṣannu* is "a sash, a belt" according to the CAD Ḫ: 259 and a "Leibbinde" according to the *AHw*, 261.

73 According to Jursa 2010, 812, "wages for full time employment (...) range between 1.33 and four shekels of silver per month. Wages under two shekels are found in Uruk only. Six of the ten wages fall into the bracket of two to three shekels, which can be considered the normal range for full-time employment in northern Babylonia under the reign of Nabonidus." Salaries of the temple workers were mostly paid in kind. At Uruk, only 5.7% of the salaries under Nebuchadnezzar were paid in silver according to Jursa 2010, 553–554.

74 *pu-qu*: "With. ref. to a garment" CAD P: 514; "back of the knees," Heeßel 2000, 30 n. 48; "achtgeben auf" *AHw*, 879. This textile only appears in this text. On can suggest that it was a garment for women. *gammidatu*: "a garment for women" Zawadzki 2010, 418–419; *gammidatu, gammidu*: "a cloth" CAD G: 36; "ein Gewand" *AHw*, 279. This name of textile is of Aramaean origin, and appears in Neo-Assyrian documentation. Made of wool, it appears in dowries (e.g. *BM* 76136), in the equipment of a lord (e.g. *TCL* 9 117), can be exchanged for silver (e.g. *VS* 4 157) and is also attested as a garment for female singers of the Esagil temple (*BM* 64780 Jursa 2002, n°1 on 107–108). *šundu*: Hapax. According to the CAD Š III: 303: "a kind of wool"; *AHw*, 1276 *šundu* II "eine Wolle." $^{\text{túg}}$LAM.LAM: The Akkadian equivalent of this textile is not known. The $^{\text{túg}}$LAM.LAM is mentioned in two dowries (e.g. *BM* 76136; *TBER* 93–94), and seems to be a luxurious textile. In text *L* 1639, its price is given in dates and is expensive Joannès 1989, 39 and 239. See Joannès 2014, 451 and Zawadzki 2010, 419. *guzguzu*: see CAD G: 127 *gulēnu (gulānu)* "(a coat)"; "ein Obergewand" *AHw*, 296; Quillien 2013; Payne 2013. *širʾam*: the *širʾam* was a part of the soldier's uniform. The CAD S: 313 defines *siriam* as "1. leather coat 2. (a garment);" *AHw*, 1029 *sari(j)am* "Panzer(hemd)". See Zawadzki 2010, 414; Mac Ginnis 2012: "a tabard". *suḫattu*: according to Jursa 2006, 206 the *suḫattu* was a prestigious and expensive item but this textile cannot be identified with certainty.

Text	Place / Date	Alum (in minas)	Silver (in shekels)	Price (in shekels of silver for one mina)	Summary
PTS 3092	Uruk / Nbk 12.VI.5 (600 BC)	53.8	67.3	1.2	Delivery of alum to the Eanna by a merchant.
Nbn 214	Sippar / Nbn -.II.5 (551 BC)	10	12	1.2	Silver given to a craftsman for (buying) alum
GCCI 1 327	Uruk / Nbn 28.VI.5 (551 BC)	1.5	1	0.7	Alum carried off by a messenger of the Eanna
CT 55 862	Sippar / Nbn 10.IV.8 (548 BC)	42	19	0.4	List of imported merchandises with their prices
CT 55 364	Sippar / Nbn 11.V.- (556–539 BC)	9	6	0.7	Silver given to a craftsman for (buying) alum
Bertin 1889	Sippar / Camb -.-.4 (526–525 BC)	6	3	0.5	Silver given to a craftsman for (buying) alum
YOS 19 287	Uruk / 7.III.3 (-)	3 *pānu*	10 shekels	3.3 shekels of silver for one *pānu* (36 liters)	Merchandises coming from Babylon brought to the Eanna
PTS 2098	Uruk / [Nbn 7.VII.6] (550 BC)	233	77.7	0.3	List of merchandises imported from the west with their prices

Tab. 5 Alum prices.

are made for the cult, especially to dress the cultic statues during special ceremonies. But this may have something to do with the unequal repartition of the documentation (as preserved today), as what we have mostly comes from the temples. Indeed, the texts coming from private archives or dealing with non-cultic affairs such as contracts, letters or dowries mentioned coloured garments used by men or women, despite their high cost. Even there, however, coloured garments seem to be less numerous than un-dyed ones.

The colours of garments are rarely noted in private archives. Colour is mentioned indirectly, in cases where the quality or appearance of the wool is described. The material is stated only when it is precious, like wool coloured with imported dyes or purple wool. One cannot exclude the possibility that unspecified garments were in fact dyed, but with cheaper, local dyes, which were not considered interesting enough to record in dowries or inventories. Only some garments are made with the special techniques of embroidery or trimming and are designated *birmu*. The table shows that even inside the elite group, only some garments were made with precious dyes and colours. Only the $^{\text{túg}}$LAM.LAM, the *širʾam* and the *suḫattu* are textiles clearly used by men and women in the civil context, whereas the *gammidatu* and the *guzguzu*, even if they appear here in private lists of garments, are also used for the cult. Garments dyed with imported materials were rare even in the upper category of the urban population. One can suppose that precious dyes were more frequent at the royal court of the Babylonian king, but the documentation on palatial textile production have not been recovered.

A single text attests to the existence of social rules about the wearing of certain colours. This tablet from Babylonia records a trial and evokes a royal order of the Achaemenid king Cambyses, prohibiting slaves from wearing red-purple garments.[75]

As our textual documentation mostly comes from the religious and urban elite, we are not well informed about the wearing of coloured clothes by the common people. The mordant, alum, was also a costly imported material. Generally speaking, it is possible that the population with low incomes wore clothes coloured with plant dyes or else with the natural hues of wool. These colours were less prestigious than the high-quality imported dyes used to adorn the garments of the gods.

75 It is not certain if this royal order was ever really implemented. The text is *Camb* 321 and was edited and discussed by Wunsch and Magdalene 2012. The discovery of Iranian textiles dating to some time between the Achaemenid to Sassanid periods (400 BC – 500 AD) in the salt mine of Chehrābād, Iran, revealed the presence of red wool dyed with madder (*Rubia tinctoria*), an indigotine dye (*Indigofera tinctoria* or *Isatis tinctoria*) and a yellow dye (maybe *Reseda lutea*) on textiles used by the miners. Purple from murex was not found. See Hadian et al. 2012.

Textile	Place / Date	Material	Example in texts
pu-qu (hapax)	? / Nabû-nāṣir 1.IV.3	Blue-purple wool and red wool	*BRM* 1 5: 6-8: 1 GÍN síg*ta-kil-ti* / 12 GÍN síg*ta-bar-ri* / *a-na* túg*pu-qu šá* mí*šu-šá-a-a-a'* "One shekel of blue-purple wool, 12 shekels of red wool for a *puqqu* textile belonging to fŠu-šaia'."
gammidatu "a garment"	Sippar / Ner -.VIII.3	Blue-purple wool, red wool, apple-coloured wool	*BM* 64798: 1-6: ⌜1/3⌝ MA.NA síg*ta-bar-ri* / 5/6 MA.NA síg*ta-kil-tu₄* / ⌜1⌝ MA.NA na4*gab-bu-ú* / [x MA].NA giš HAŠHUR *a-na* [*ṣi*]*-bu-tu₄ šá* 2-[ta] / [túg]*gam-mi-da-*⌜*tu₄*⌝ (published by Zawadzki 2010, 425–426). "1/3 mina of red wool, 5/6 mina of blue-purple wool, 1 mina of alum, [x mi]nas of apple-dye, for the *ṣibtu* belonging to 2 *gammidatu* garment."
gammidatu "a garment"	Uruk / achéménide	"*šundu*" wool	*GCCI* 2 361: 5-7: [x+] 2 *gam-mi-da-a-ti šá* SÍG *šu-un-du* / *a-na* 4 MA.NA KÙ.[BABBAR] / *gam-mi-da-a-ti šu-pi-e-*⌜*e'*⌝ "x+2 *gammidatu* in *šundu* wool for 4 minas of silver, *gammidatu* embroidered."
túgLAM. LAM	Text discovered at Susa, Babylonian origin / NB	embroidered	*TBER* 93-94:17: ⌜1-*en*⌝ túgLAM.LAM *šá bir-mu*, "One lamlam-garment with embroidery." Durand 1981, n°93–94; Joannès 1984, 72–73 and Roth 1989, n°34.
guzguzu "a rich fabric or a coat"	Uruk / Nbk II 12-xi- 16	red wool	*UCP* 9/2 12: 1–4: 53 GÍN *dul-lu šá a-na* / síg*tab-bar-ri šá a-na* / 1 túg*guz-guz šá muḫ-ḫi šu-ub!-ti* / *šá* gišGIGIR "53 shekels (for) the work of red wool for a *guzguzu* for the top of the chariot."
širʾam "a tabard"	Uruk	red-purple wool	*GCCI* 2 361: 1-2: ⌜1⌝-ME 17 túg*šir-a-am*meš *šá* ŠÍG ⌜x⌝ḫi-a [x *širʾam*] *šá* síg sag "117 *širʾam*-tabards in [x] wool, [x *širʾam*]-tabards in red purple wool."
suḫattu	? Artaxerxes 18	embroidered	Jursa 2006, n°9: 3: *dul-lu su-ḫat-tu₄ bir-*[*mi*] "The work of (manufacturing) the *suḫattu* garment embroidered."

Tab. 6 Coloured textiles.

4 Conclusion

Different materials were used to make coloured garments during the Neo-Babylonian period. The temples, where the garments offered to the gods were manufactured, used materials of high quality, such as blue-purple wool and precious red dyes, Egyptian linen, and alum. These materials came from outside Mesopotamia, through warfare or trade. The documentation attests that coloured wool and materials were available on the urban markets in Babylonia, so they could have been more widespread in society rather than having been confined to the religious sphere. The cost of these products indicates that it was a social marker of the elite and that the majority of the population could not afford such textiles. Indeed, coloured garment dyed with precious materials were rare even in the dowries and inventories of rich families. Thus, colour was a marker of socio-economic boundaries.

The skills of the Babylonian craftsmen explain why they preferred to make the textiles locally with imported materials rather than to import ready-made wool and textiles when possible. Babylonian craftsmen learned to use imported dyes themselves. Some of the local dyes were used to imitate the precious imported dyes. If local plants were also used to dye textiles, they were rarely mentioned in the texts. This does not prove that they were uncommon dyes, but rather shows that they were not considered precious and were not often used by the religious and urban elite. The luxurious coloured textiles were probably embroidered ones or textiles adorned with trimmings, even if other techniques could be used, too. This technique is a speciality claimed by the textile craftsmen called the weavers-of-coloured-clothes. It is possible that some specialised craftsmen had their own urban business, as the working contract for a *suḫattu birmu* garment shows. The manufacture of coloured garments made with precious dyes was a specialised production, not mass production, due to the cost of the raw materials.

We might wonder if, as during late Hellenistic and Roman times, the coloured garments of Babylonia were known abroad. Govert van Driel proposed that textiles may have been the main product Babylonia exported in the first millennium BC.[76] Trade of textiles is well known for older periods of Babylonian history. For instance, during the Old Assyrian period, some of the fabrics sold by the Assyrian merchants in Anatolia originally came from Babylonia.[77] But the textiles exported by these merchants in Anatolia were mostly mentioned without a qualification of colour and therefore were probably

76 van Driel 2002, 328, see also Jursa 2010, 220. The cuneiform documentation attests economic circulation of many products coming from abroad in Babylonia, including silver. Money-based exchanges were increasing during the first millennium BC, Jursa 2010. Evidence is lacking about the goods Babylonia may have sold in return. Even if part of this wealth came from the booty of royal military campaigns, the textile trade may have played its part.

77 On the Old-Assyrian trade, see Veenhof 1972; Michel 2006.

un-dyed.[78] The evidence concerning first millennium BC Babylonian textile exports remains scarce, and the attested trade channels also concern garments and fabrics with no mention of colour. In the end, it is manifest that Babylonian craftsmen already mastered the skills of manufacturing coloured garments with precious dyed wool in the 6th to 3rd centuries BC but their export during this period remains hypothetical.

78 The attestations of coloured textiles for exportation are rare, according to Michel and Veenhof 2010, 252.

Bibliography

Beaulieu 2003
Paul-Alain Beaulieu. *The Pantheon of Uruk During the Neo-Babylonian Period*. Cuneiform Monographs 23. Leiden and Boston: Brill, 2003.

Boehmer 1971
Rainer M. Boehmer. "Farben". In *Reallexikon der Assyriologie und vorderasiatischen Archäologie. Vol. 3. Fabel – Gyges und Nachtrag*. Ed. by E. Ebeling and B. Meissner. Berlin: De Gruyter, 1971, 19–24.

Bongenaar 1997
Arminius V. C. M. Bongenaar. *The Neo-Babylonian Ebabbar Temple at Sippar. Its Administration and Its Prosopography*. Uitgaven van het Nederlands Historisch-Archaeologisch Instituut te İstanbul 80. Leiden: The Netherlands Institute for the Near East, 1997.

Bostock and Riley 1855
John Bostock and Henry T. Riley. *Pliny the Elder: The Natural History*. London: Taylor and Francis, 1855.

Breniquet 2008
Catherine Breniquet. *Essai sur le tissage en Mésopotamie, des premières communautés sédentaires au milieu du IIIe millénaire avant J.-C.* Travaux de la maison René-Ginouvès 5. Paris: De Boccard, 2008.

Breniquet and Michel 2014
Catherine Breniquet and Cécile Michel. *Wool Economy in the Ancient Near East and the Aegean: From the Beginnings of Sheep Husbandry to Institutional Textile Industry*. Ancient Textiles Series 17. Oxford: Oxbow Books, 2014.

Cardon 1999
Dominique Cardon. *Teintures précieuses de la Méditerranée. Pourpre, kermès, pastel*. Carcassonne: Musée des Beaux-Arts de Carcassonne, 1999.

Cardon 2003
Dominique Cardon. *Le monde des teintures naturelles*. Paris: Belin, 2003.

Chahine 2005
Claire Chahine. "L'utilisation de l'alun dans la transformation de la peau en cuir". In *L'alun de Méditerranée*. Ed. by J.-P. Borgard, J.-P. Brun, and M. Picon. Paris: Centre Jean Bérard, 2005, 59–68.

Dandamaev 1995
Muhammad A. Dandamaev. "A Governor of Byblos in Sippar". In *Immigration and Emigration within the Ancient Near East. Festschrift E. Lipinski*. Ed. by K. van Lerberghe and A. Schoors. Orientalia Lovaniensia Analecta 65. Leuven: Eisenbraun, 1995, 29–31.

CDLI
Cuneiform Digital Library Initiative. *Abbreviations for Assyriology*. 2016. URL: http://cdli.ox.ac.uk/wiki/abbreviations_for_assyriology (visited on 30/07/2019).

van Driel-Murray 2002
Carol van Driel-Murray. "Ancient Skin Processing and the Impact of Rome on Tanning Technology". In *Le travail du cuir de la Préhistoire à nos jours. Actes des XXIIe rencontres internationales d'archéologie et d'histoire d'Antibes, 18–20 octobre 2001*. Ed. by F. Audoin-Rouzeau and S. Beyries. Antibes: Association pour la Promotion et la Diffusion des Connaissances Archéologiques, 2002, 251–265.

van Driel 1993
Govert van Driel. "Neo-Babylonian Sheep and Goats". *Bulletin of Sumerian Agriculture* 7 (1993), 219–258.

van Driel 1998
Govert van Driel. "The 'Eanna Archive'". *Biblioteca Orientalis* 55 (1998), 59–79.

van Driel 2002
Govert van Driel. *Elusive Silver. In Search of a Role for a Market in an Agrarian Environment. Aspects of Mesopotamia's Society*. Uitgaven van het Nederlands Historisch-Archaeologisch Instituut te İstanbul 95. Leiden: The Netherlands Institute for the Near East, 2002.

Duff 1927
James Duff. *Tiberius Catius Silius Italicus: Punica*. Cambridge, MA: Harvard University Press, 1927.

Durand 1981
Jean-Marie Durand. *Textes Babyloniens d'époque récente*. Recherches sur les civilisations 6. Paris: Éd. A.D.P.F., 1981.

Edens 1999
Christopher Edens. "Khor Ile-Sud, Qatar. The Archaeology of the Late Bronze Age Purple-Dye Production in the Arabian Gulf". *Iraq* 61 (1999), 71–88.

Falkenstein 1959
Adam Falkenstein. "Zwei Rituale aus seleukidischer Zeit". In *Vorläufiger Bericht über die von dem Deutschen Archäologischen Institut und der Deutschen Orient-Gesellschaft aus Mitteln der Deutschen Forschungemeinschaft unternommenen Ausgrabungen in Uruk-Warka, Winter 1956–1957*. Ed. by H. Lenzen. Berlin: Mann, 1959, 36–44.

Faure 1991
Paul Faure. "La pourpre, invention égéenne ". In *Thalassa. L'Egée préhistorique et la mer. Station de recherches sous-marines et océanographiques, Calvi, Corse, 23–25 avril 1990*. Ed. by R. Laffineur and R. Basch. Aegeum 7. Liège: Université de Liège, 1991, 311–314.

Forbes 1956
Robert J. Forbes. *Studies in Ancient Technology. Vol. IV. Fibres, Washing, Dyeing, Weaving*. Leiden: Brill, 1956.

Gaspa 2018
Salvatore Gaspa. *Textiles in the Neo-Assyrian Empire, a Study of Terminology*. Studies in Ancient Near Eastern Records 19. Berlin and Boston: De Gruyter, 2018.

Graslin 2009
Laëtitia Graslin. *Les échanges à longue distance en Mésopotamie au Ier millénaire. Une approche économique*. Orient & Méditerranée 5. Paris: De Boccard, 2009.

Hackl 2010
Johannes Hackl. "Apprenticeship Contracts". In *Aspects of the Economic History of Babylonia in the First Millennium BC. Economic Geography, Economic Mentalities, Agriculture, the Use of Money and the Problem of Economic Growth*. Ed. by M. Jursa. Alter Orient und Altes Testament 337. Münster: Ugarit, 2010, 700–725.

Hadian et al. 2012
Manijeh Hadian, Irene Good, Mark P. Pollard, Xian Zhang, and Richard Laursen. "Textiles from Douzlakh Salt Mine in Chehr Abad, Iran. A Technical and Contextual Study of Late pre-Islamic Iranian Textiles". *International Journal of Humanities* 19 (2012), 152–167.

Heeßel 2000
Nils P. Heeßel, ed. *Babylonisch-assyrische Diagnostik*. Alter Orient und Altes Testament 43. Münster: Ugarit, 2000.

Al-Jadir 1974
Walid Al-Jadir. "Préparation et entretien des étoffes par les artisans assyriens". *Sumer* 30 (1974), 129–147.

Jensen 1963
Lloyd B. Jensen. "Royal Purple of Tyre ". *Journal of Near Eastern Studies* 22.1 (1963), 104–118.

Joannès 1984
Francis Joannès. "Contrats de mariage d'époque récente". *Revue d'Assyriologie et d'archéologie orientale* 78 (1984), 71–81.

Joannès 1989
Francis Joannès. *Archives de Borsippa. La famille Ea-Ilûta-bâni. Étude d'un lot d'archives familiales en babylonie du VIIIe au Ve siècles av. J.-C.* Hautes Etudes Orientales 25. Geneva: Droz, 1989.

Joannès 1999
Francis Joannès. "Structures et opérations commerciales en Babylonie à l'époque néo-babylonienne". In *Trade and Finance in Ancient Mesopotamia. Proceedings of the 1st MOS Symposium*. Ed. by J. G. Dercksen. Uitgaven van het Nederlands Historisch-Archaeologisch Instituut te İstanbul 14. Leiden: The Netherlands Institute for the Near East, 1999, 175–194.

Joannès 2014
Francis Joannès. "Fabrics and Clothes from Mesopotamia during the Achaemenid and Seleucid Periods. The Textual References". In *Wool Economy in the Ancient Near East and the Aegean. From the Beginnings of Sheep Husbandry to Institutional Textile Industry*. Ed. by C. Breniquet and C. Michel. Ancient Textiles Series 17. Oxford: Oxbow Books, 2014, 454–465.

Jursa 2002
Michael Jursa. "Florilegium babyloniacum. Neue Texte aus hellenistischer und spätachämenidischer Zeit". In *Mining the Archives. Festschrift for Christopher Walker on the Occasion of His 60th Birthday*. Ed. by C. Wunsch. Babylonische Archive 1. Dresden: ISLET, 2002, 104–130.

Jursa 2005
Michael Jursa. *Neo-Babylonian Legal and Administrative Documents. Typology, Contents and Archives*. Guides to the Mesopotamian Textual Record 1. Münster: Ugarit, 2005.

Jursa 2006
Michael Jursa. "Agricultural Management, Tax Farming and Banking. Aspects of Entrepreneurial Activity in Babylonia in the Late Achaemenid and Hellenistic Periods". In *La transition entre l'empire achéménide et les royaumes hellénistiques, vers 350–300 av. J.-C.* Ed. by P. Briant and F. Joannès. Paris: De Boccard, 2006, 137–222.

Jursa 2010
Michael Jursa. *Aspects of the Economic History of Babylonia in the First Millennium BC. Economic geography, Economic Mentalities, Agriculture, the Use of Money and the Problem of Economic Growth*. Alter Orient und Altes Testament 377. Münster: Ugarit-Verlag, 2010.

Kleber 2010
Kristin Kleber. "Eanna's Trade in Wool". In *Aspects of the Economic History of Babylonia in the First Millennium BC. Economic Geography, Economic Mentalities, Agriculture, the Use of Money and the Problem of Economic Growth*. Ed. by M. Jursa. Alter Orient und Altes Testament 337. Münster: Ugarit, 2010, 595–614.

Kleber 2017
Kristin Kleber. *Spätbabylonische Texte zum lokalen und regionalen Handel sowie zum Fernhandel aus dem Eanna-Archiv*. Babylonische Archive 7. Dresden: ISLET-Verlag, 2017.

Koren 2005
Zvi C. Koren. "The First Optimal All-Murex All-Natural Purple Dyeing in the Eastern Mediterranean in a Millennium and a Half and Its Colorimetric Characterization". *Dyes in History and Archaeology* 20 (2005), 136–149.

Kozuh 2014
Michael Kozuh. *The Sacrificial Economy. Assessors, Contractors, and Thieves in the Management of Sacrificial Sheep at the Eanna Temple of Uruk (ca. 625–520 BC)*. Exploration in Ancient Near Eastern Civilization 2. Winona Lake: Eisenbrauns, 2014.

Kümmel 1979
Hans Martin Kümmel. *Familie, Beruf und Amt im spätbabylonischen Uruk. Prosopographische Untersuchungen zu Berufsgruppen des 6. Jahrhunderts v. Chr. in Uruk*. Abhandlungen der Deutschen Orient-Gesellschaft 20. Berlin: Mann, 1979.

Landsberger 1967
Benno Landsberger. "Über Farben im Sumerisch-Akkadischen". *Journal of Cuneiform Studies* 21 (1967), 139–173.

Landsberger and Gurney 1957/1958
Benno Landsberger and Olivier R. Gurney. "Practical Vocabulary of Aššur". *Archiv für Orientforschung* 18 (1957/1958), 328–341.

Leichty 1979
Erle Leichty. "A Collection of Recipes for Dyeing". In *Studies in Honor of Tom B. Jones*. Ed. by M. A. Powell and R. H. Sack. Alter Orient und Altes Testament 203. Kevealer: Neukirchener Verlag, 1979, 15–20.

Mac Ginnis 1995
John Mac Ginnis. "Letter Orders from Sippar and the Administration of the Ebabbara in the Late-Babylonian Period". *Orientalistische Literaturzeitung* 94 (1995), 45–49.

Mac Ginnis 2012
John Mac Ginnis. *The Arrows of the Sun: Armed Forces in Sippar in the First Millennium BC*. Babylonische Archive 4. Dresden: ISLET-Verlag, 2012.

Macheboeuf 2004
Christine Macheboeuf. "Pourpre et matières textiles. Des ateliers aux tabernae". In *Purpurae vestes. Actas del I Symposium Internacional sobre Textiles y Tintes del Mediterráneo en epoca romana (Ibiza, 8 al 10 de noviembre, 2002)*. Ed. by C. Alfaro, J. P. Wild, and B. Costa. Valencia: Universidad de Valencia, 2004, 137–144.

Mayer 2013
Walter Mayer. *Assyrien und Urartu I. Der Achte Feldzug Sargon OO. Im Jahr 714 v. Chr.* Alter Orient und Altes Testament 395. Münster: Ugarit, 2013.

Meissner 1925
Bruno Meissner. *Studien zur assyrischen Lexikographie*. Vol. 1. Mitteilungen der Altorientalischen Gesellschaft 13.2. Leipzig: Harrassowitz, 1925.

Michel 2006
Cécile Michel. "Femmes et production textile à Aššur au débu du IIe millénaire avant J.-C." *Techniques et Culture* 46 (2006), 285–301.

Michel and Veenhof 2010
Cécile Michel and Klaas R. Veenhof. "The Textiles Traded by the Assyrians in Anatolia (19th–18th Century BC)". In *Textile Terminologies in the Ancient Near East and Mediterranean from the Third to the First Millennia BC*. Ed. by C. Michel and M.-L. Nosch. Ancient Textiles Series 8. Oxford: Oxbow Books, 2010, 210–271.

Oppenheim 1949
A. Leo Oppenheim. "The Golden Garments of the Gods". *Journal of Near Eastern Studies* 8.3 (1949), 172–193.

Oppenheim 1967
A. Leo Oppenheim. "Essay on Overland Trade in the First Millennium BC". *Journal of Cuneiform Studies* 21 (1967), 236–254.

Payne 2007
Elizabeth Payne. "The Craftsmen of the Neo-Babylonian Period. A Study of the Textile and Metal Workers of the Eanna Temple". Dissertation, Yale University. 2007.

Payne 2013
Elizabeth Payne. "Two Tablets from the Yale Babylonian Collection Mentioning the Guzguzu Garment". *NABU* 1 (2013), 25–27.

Picon, Vichy, and Ballet 2004
Maurice Picon, Michèle Vichy, and Pascale Ballet. "L'alun des oasis occidentales d'Egypte". In *L'alun de Méditerranée*. Ed. by J.-P. Borgard, J.-P. Brun, and M. Picon. Paris: Centre Jean Bérard, 2004, 43–57.

Quillien 2013
Louise Quillien. "Túg-LUM-LUM = túg-guz-guz. A New Interpretation of the "Guzguzu" Garment in First Millennium BC Mesopotamia". *NABU* 1 (2013), 21–25.

Quillien 2015
Louise Quillien. "Flax and Linen in the First Millennium Babylonia BCE. Origins, Craft Industry and Uses of a Remarkable Textile". In *Prehistoric, Ancient Near Eastern & Aegean Textiles and Dress. An Interdisciplinary Anthology*. Ed. by M.-L. Nosch, C. Michel, and M. Harlow. Ancient Textiles Series 18. Oxford: Oxbow Books, 2015, 271–298.

Robson 1933
Iliff E. Robson. *Arrian Anabasis Alexandri (Book V–VII) Indica (Book VIII)*. Cambridge, MA: Harvard University Press, 1933.

Roth 1989
Marta Roth. *Babylonian Marriage Agreement, 7th–3rd Centuries BC*. Alter Orient und Altes Testament 222. Münster: Ugarit, 1989.

Roucel 1803
François-Antoine Roucel. *Flore du nord de la France, ou description des plantes indigènes et de celles cultivées dans les départemens de la Lys, de l'Escaut, de la Dyle et des Deux-Nèthes, y compris les plantes qui naissent dans les pays limitrophes de ces départements*. Paris: Me veuve Richard, 1803.

Schaeffer 1951
Claude F. A. Schaeffer. "Une industrie d'Ugarit, la pourpre". *Annales archéologiques de Syrie* 1.2 (1951), 188–192.

Scurlock 2008
Joann Scurlock. "On Some Terms for Leatherworking in Ancient Mesopotamia". In *Proceedings of the 51st Rencontre Assyriologique Internationale, Held at the Oriental Institute of the University of Chicago, July 18–22, 2005*. Ed. by R. B. Biggs, J. Myers, and M. T. Rot. Studies in Ancient and Oriental Civilization 62. Chicago: The Oriental Institute, 2008, 171–176.

van Soldt 1990
Wilfried H. van Soldt. "Fabrics and Dyes at Ugarit". *Ugarit-Forschungen* 22 (1990), 321–357.

Stol 1994
Marten Stol. "Beer in Neo-Babylonian Times". In *Drinking in Ancient Societies. History and Culture of Drinks in the Ancient Near East. Papers of a Symposium Held in Rome, May 17–19 1990*. Ed. by L. Milano. Padua: Sargon, 1994, 155–183.

Stol 1980
Martin Stol. "Leder(industrie)". In *Reallexikon der Assyriologie und vorderasiatischen Archäologie. Vol. 4. Klagegesang – Libanon*. Ed. by E. Ebeling and B. Meissner. Berlin: De Gruyter, 1980, 532–535.

Tarasewicz 2009
Rodaslaw Tarasewicz. "Bird Breeding in Neo-Babylonian Sippar". *Kaskal* 6 (2009), 151–214.

Thavapalan 2018
Shiyanthi Thavapalan. "Purple Fabrics and Garments in Akkadian Documents". *Journal of Ancient Near Eastern History* 3/2 (2018), 163–190.

Thureau-Dangin 1920
François Thureau-Dangin. "Notes assyriologiques. XXIX. L'alun et la noix de galle". *Revue d'Assyriologie et d'archéologie orientale* 17 (1920), 27–31.

Thureau-Dangin 1934
François Thureau-Dangin. "Un comptoir de laine pourpre à Ugarit, d'après une tablette de Ras-Shamra". *Syria* 15.2 (1934), 137–156.

Townsend, Evan, and Al Rawi 1980
Mark C. Townsend, Guest Evan, and Ali Al Rawi, eds. *Flora of Iraq. Vol. 4. Part 1 and 2*. Vol. 4. Baghdad: Ministry of Agriculture, 1980.

Vargyas 2001
Peter Vargyas, ed. *A History of Babylonian Prices in the First Millennium BC*. Heidelberger Studien zum Alten Orient 10. Heidelberg: Heidelberg Orientverlag, 2001.

Veenhof 1972
Klaas R. Veenhof. *Aspects of Old Assyrian Trade and Its Terminology*. Studia et Documenta 10. Leiden: Brill, 1972.

Waerzeggers 2006
Caroline Waerzeggers. "Neo-Babylonian Laundry". *Revue d'Assyriologie et d'archéologie orientale* 100 (2006), 83–95.

Whiston 1737
William Whiston. *The Genuine Works of Flavius Josephus, the Jewish Historian*. London: W. Bowyer, 1737.

Wunsch and Magdalene 2012
Cornelia Wunsch and Rachel Magdalene. "A Slave Is Not Supposed to Wear Such a Garment!" *Kaskal* 9 (2012), 99–120.

Zadok 1997
Ran Zadok. "On Aromatics and Reeds". *NABU* 2 (1997), 51–52.

Zawadzki 2006
Stefan Zawadzki. *Garments of the Gods. Studies on the Textile Industry and the Pantheon of Sippar According to the Texts from the Ebabbar Archive*. Orbis Biblicus et Orientalis 218. Fribourg and Göttingen: Academic Press and Vandenhoeck & Ruprecht, 2006.

Zawadzki 2010
Stefan Zawadzki. "Garments in Non-Cultic Context". In *Textile Terminologies in the Ancient Near East and Mediterranean from the Third to the First Millennia BC*. Ed. by C. Michel and M.-L. Nosch. Ancient Textiles Series 8. Oxford: Oxbow Books, 2010, 409–429.

Zawadzki 2013
Stefan Zawadzki. *Garments of the Gods. Vol. 2. Texts*. Vol. 2. Orbis Biblicus et Orientalis 260. Fribourg and Göttingen: Academic Press and Vandenhoeck & Ruprecht, 2013.

Ziderman 1987
Irving Ziderman. "First Identification of Authentic Tekhelet". *Bulletin of the American School of Oriental Research* 265 (1987), 25–33.

Table credits

1–6 L. Quillien.

LOUISE QUILLIEN

Louise Quillien (Ph.D Université Paris – Panthéon-Sorbonne) is a specialist of Ancient Near Eastern History and a member of the laboratory *Histoire et Archéologie de l'Orient Cunéiforme* (HAROC) / *Archéologie et Sciences de l'Antiquité* (ArScAn) at Paris-Nanterre. She wrote her doctoral thesis on textiles in Babylonia during the 1st millennium BC and her research focuses on economic and social history, history of crafts techniques and material culture in Mesopotamia.

Dr. Louise Quillien
HAROC-ArScAn laboratory
21 allée de l'Université
92000 Nanterre, France
E-Mail: louise.quillien@gmail.com

Ingrid Blom-Böer (with David A. Warburton)

The Composition of the Colour Palette and the Socio-Economic Role of Pigments Used in Egyptian Painting

Summary

The acticle is based upon the results of around 1400 samples (of which 1380 were pigments) from 145 Egyptian monuments dating from Dyn. 5 to the Roman era (ca. 2390 BC – 100 AD), collected in four campaigns by the Max-Planck-Institute in Heidelberg. The focus is upon natural and artificial pigments, as well as esteem, prices and provenance of the colour material. Also colour symbolism and the available colour names are being discussed: Egyptian craftsmen were dictated by the available pigments and their utility, trying to get the best results for the owner of the tomb or temple.

Keywords: colour; socio-economic; decay; Egyptian; Roman; pigments

Der Artikel basiert auf die Erforschung von ca. 1.400 Proben (1.380 Pigmentproben) aus 145 ägyptischen Monumenten, die von der 5. Dynastie bis in die Römische Zeit (ca. 2390 v. Chr. – 100 n. Chr.) datiert werden. Die Farbproben wurden vom Max-Planck-Institut in Heidelberg in vier Kampagnen gesammelt und der Schwerpunkt liegt sowohl auf natürliche als auch auf künstliche Pigmente und deren Wert, Preis und Herkunft; Farbsymbolik und Farbbezeichnungen werden ebenso berücksichtigt. Ägyptische Handwerker waren abhängig von den ihnen zur Verfügung stehenden Pigmenten und deren Brauchbarkeit und versuchten das beste Ergebnis für den Grab- und Tempelbesitzer zu erreichen.

Keywords: Farbe; sozial-ökonomisch; Zerfall; ägyptisch; römisch; Pigmente

This chapter is largely based on a contribution on Egyptian pigments (Blom-Böer 1994), in German, exhaustively summarising the results of a Max-Planck-Institute project, generously funded by the Volkswagen-Foundation. This English text was produced with the extensive assistance of David A. Warburton, who translated and summarised the most important issues treated in the German text (aside from enlarging on a few details of colour), as well

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

as adding in some socio-economic references, and drawing on some more recent literature to supplement that mentioned in the original. Although dated, the 1994 article is still frequently cited for pigments in Egyptian art; readers are thus advised to turn to that publication and the bibliography there – as well as taking more recent literature into consideration (some of which is discussed here). In order to bring the 1994 text up to date, it would be necessary to revive the project, enlarge the number of samples, and redo those done. As – for many reasons – this will probably not be achieved in the foreseeable future, this summary is offered to facilitate access to the German text, which has numerous easily accessible tables complementing the text and providing details on both pigments and chronology.

1 Introduction

When painting, Egyptian craftsmen and artists worked together to produce both artificial colours and finished surfaces on which to paint, so that they could produce that impression of the world they wished to convey in their imagery. Their selection of colours was dictated by the pigments they used.

What were these pigments and where did they come from? Why were they chosen? How were decisions influenced by social constraints or possibilities? What kind of chemical reactions could have changed the hues over time? These were among the questions that arise when dealing with traces of colour in ancient artwork.

From 1980 to 1991, a joint project of the Max-Planck-Institute for Nuclear Physics in Heidelberg and several Egyptological Institutes aimed to investigate these and other questions. Initially, the Egyptological partners were from the University of Heidelberg (1980–1982), from the University of Constance (1982–1984) and from the Pelizaeus Museum in Hildesheim (1987–1991). I participated in the final years of the project (1989–1991).

The goals were set at the start of the project: (1) identifying as many natural and synthetic colours as possible; (2) linking the natural pigments to deposits scientifically; (3) establishing when the deposits were exploited; (4) studying improvements in every use of colour over time comprehensively; (5) exploring all direct indications of trade involving imported pigments; (6) investigating the possibility of a relationship between the collapse of the central state and the supply of colour materials; (7) attempting to establish whether the use of colours and access to resources depended upon the social position of those commissioning temples or tombs.

In four campaigns (1981, 1982, 1988, 1989) the natural scientists from the Max-Planck-Institute and the University of Munich's Institute for Crystallography and Mineralogy collected altogether around 1400 samples (of which 1380 were pigments) from 145 Egyptian monuments dating from Dyn. 5 to the Roman era (ca. 2390 BC – 100 AD). The role of the Egyptologists involved was to use the materials and resources customarily available to answer the questions outlined. The aim was to get a good idea of the pigments used and to try to gain insights into the underlying concepts and purpose.

The main results of the project were essentially published in two parts: the natural science work in a report to the Volkswagen Foundation,[1] and my own Egyptological contribution on the pigments,[2] and this contribution is largely intended as a summary of that. However, at least in part as a result of this project, the Egyptological literature on colours and pigments has since made substantial process. Thus, some of this more recent work must be incorporated here. On the other hand, however, the venerable volume on *Egyptian Materials and Industries* by Lucas (and edited by Harris)[3] has not been completely superseded by Nicholson and Shaw's monumental *Egyptian Materials and Technology*,[4] especially as work continues at a rapid pace.[5]

2 Procedures

The most important part of our project was assuring a statistically reliable set of samples throughout Egypt, but this was not always possible due to, e.g. (a) the inaccessibility of monuments, (b) the fact that most of the samples come from Thebes, and (c) the reality that in many cases our scientific aims necessarily came into conflict with the imperative of preserving the monuments. Where possible, our samples were taken from slightly damaged yet accessible parts of monuments – and in any case our samples of 1–5 mg left no visible damage. The colours were initially determined using the *Munsell glossy colour charts*. However, the contrast of sunlight, artificial light, shadows, surfaces, in the different contexts investigated etc. inevitably meant that the colours we saw – whether identical or different – were never really comparable, and it was impossible to use the charts as they could not assure consistency.

Samples were taken from 3 sites in Lower-Egypt, 5 sites in Middle Egypt and 17 in Upper Egypt, for a total of 145 sampling points, broken down into 18 temples, 15 royal tombs, 104 private tombs, and 8 sarcophagi. The largest single group were from the New Kingdom monuments at Thebes.

1 Schiegel, Weiner, and El Goresy 1992.
2 Blom-Böer 1994.
3 Lucas and Harris 1962.
4 Nicholson and Shaw 2000.
5 E.g., Davies 2001, appeared a year after Nicholson and Shaw 2000.

3 Colour

Colour is an optically stimulated, visually conveyed, sensual response to light, characterised by hue, saturation and luminosity. *Paint* is a dissoluble or indissoluble organic medium of colour in a compound solution. *Pigment* is a practically indissoluble organic or inorganic colourful or colourless medium of colour in a solution or adhesive compound. *Perception of colour* is invariably the result of *stimulation* caused by *optically processed light*. The response is not, however, exclusively physical as the cognitive impact depends upon environmental context and psychological perception.[6]

The Egyptians were exemplary in the active use of colour in conveying conceptual meanings: the very word *jwn.w*, translated by us as 'colour', was also used by the Egyptians to designate 'character' in the sense of depth, as well as 'skin' in the sense of superficial appearance – and also 'vein of ore' in the sense of 'hue' and hardness. 'Light' and 'dark' meant that through day and night, even time could be divided into polar colour opposites with their own contradictions. 'Blackness' and 'darkness' were usually negative, but the dark colour of the soil was not only associated with the depths of the Netherworld and death but also fertility. 'Green' was associated not only with the fertility of growing vegetation, but also the hue of minerals, and thus amulets signifying strength and fertility. In contrast to the natural colours – black, green, white – 'red' was special, being associated with danger: the desert was the 'red' land, in contrast to the fertile 'black' land of the Nile valley and delta. However, 'red' was also the colour of the sun, and thus preferred for amulets and festive clothing. 'White' was purely positive: the crown of Upper Egypt, purity of mind, shining attire; the bones of the Gods were white (literally 'silver') as was the moon. 'Yellow' was golden, like the flesh of the immortals; their skins were the blue of lapis lazuli – of which amulets and jewellery were made.

These six colours – black, blue, green, red, white, yellow – were the main colours used in Egyptian art of the third millennium BC (Early Dynastic Period and Old Kingdom), but they only had abstract colour words (Schenkel, also in this volume) for four of these colours (black *km*, green *wꜣḏ*, red *dšr*, white *ḥḏ*).[7] Significantly, in their language and artwork, the Egyptians tended towards purer colours, such as using what we visibly perceive as an intensive black when painting Anubis – although jackals are hardly black at all. There thus seems to have been a cognitively clear tendency to favour stronger colours (in the sense of saturated hues), and a system for linking materials and colours when painting.

Striking for us is that the apparent inconsistencies in the application of hues appear most frequently in places where red and yellow are 'confused' in the sense of violat-

6 For general contemporary discussions of colour, one can gain access to approaches to colour in the journal of the Tübingen project, *Colour Turn*.

7 The colours are consciously listed in the arbitrary English alphabetical order.

ing a general tendency of usually using one of the two colours when depicting specific categories or phenomena with paint; and the same occurs with green and blue.[8]

In the absence of abstract colour words for blue and yellow, it is tempting to suggest that a lack of a linguistically based system of cognitive communication may on occasion have led to these seeming anomalies. Yet the skin colours of men and women are consistently distinguished (easily recognisable as dark red or brown and off-white or yellow) – but there are no abstract colour words for the colour of the male and female skins (although, ironically, *jwn.w* 'colour' is also used for 'skin'!).

Thus, while there may have been a perception/expression complication in dealing with clearly visible phenomena where red flows into yellow (as with the sun) and green into blue (as with water), there were also social issues apparently dictating that upper-class women be generally lighter than men. Beyond that, one has the symbolic significance of the colours; an extraordinary case of some potential importance in this sense is that the heart – which was frequently depicted red – occasionally appears white, probably because of the association with purity.[9]

Another very peculiar challenge is dealing with our understanding of the texts and relating these to hues. There seem to have been multiple reds, and one can translate the Ancient Egyptian term *mšr.w* for 'evening' as 'evening light' (*Abendrot*, as e.g., Assmann does),[10] and thus – through a metathesis – relate this to the Coptic word *mrš*, which Schenkel recognises as being a real colour term in Coptic. In this case the additional word for red might exist – but we may never know which hue would correspond to it in the art.

Yet the Egyptians definitely had a system based on striving for certain colours, and were able to adhere to that system in art – even when the lexical basis is not recognisable to us (cf. Fig. 1 for an example of the Egyptian use of colour). What we certainly cannot judge is where we cannot recognise that problems with the pigments themselves may have had an influence on Egyptian use of colour.

4 Socio-economic aspects

In order to paint, the pigments must have been extracted from the earth and transported to the craftsmen who could mix their colours on site. The craftsmen were paid for their work by their employers, both from the private sector and the state sector. However, the

8 Schenkel 1963.

9 In one easily illustrated case, the heart serves as a mere hieroglyph (as part of a sentence), and yet is deliberately painted white; cf. contribution by Schenkel, this volume, Fig. 8: last column of text at top, the extreme right, hieroglyph at right in middle of column.

10 Assmann 1983, XXII, 248.

Fig. 1 Egyptian painted relief from Hawara with a quail chick (Middle Kingdom, reign of Amenemhat III, ca. 1853–1806/05 BC), the Egyptian hieroglyph for 'w' (Gardiner 1982, 472, G 43).

details of these commercial and administrative arrangements – quarrying, mining and construction – are not entirely clear.

Obviously, the state sector was the most important employer of the best craftsmen (or the purchaser of their production), but the overall importance of the state in the employment of average craftsmen is not clear. Bronze Age Egyptian history is conveniently divided into the Old, Middle and New 'Kingdoms,' when the land was unified (ca. 2600–2200, 2000–1650 and 1500–1200 BC), with the intervening periods of civil war or fragmentation (2200–2000, 1650–1500 BC) conveniently identified with the euphemism of 'first' and 'second' 'Intermediate' periods. That powerful kings during periods of 'national unity' collected taxes and demanded labour to build splendid monuments for themselves is rather evident – and these major monuments have a greater chance of having left sufficient remains to be identified, if only because the weaker kings of periods of disunity will simply have dismantled and re-used the earlier monuments.

Cemeteries and cities will have been plundered during brief ages of chaos where only powerful warlords could assure peace for their own people. It follows that craftsmanship was not the highest priority when the country collapsed – and craftsmanship was one of the main beneficiaries of a system where successful rulers dedicated temples to the gods who provided their legitimacy during eras of unity. The courts of those kings who had the means to invest in their tombs had a kind of economic 'multiplier' effect during eras of peace, prosperity and unity as the courtiers would emulate the kings in prestige constructions. This much is evident.

However, there are also the problems of paradigms of thought and anachronistic concepts. For a century or so, it was assumed that the state controlled the economy – and this idea is still maintained in an era when the evidence points in a very different direction. Beyond that, there is the naïve idea of simply projecting modern concepts back into the distant past. In this sense, it is significant that for the original Max-Planck-Institute project, it was simply assumed that only "technical improvements" *(Verbesserungen)* in artistic techniques over time were of interest,[11] and that the issue was documenting these. In fact, of course, the architectural history of Egypt reveals that one can document and trace declines in the quality of workmanship and resources that may have political explanations. Today, we can also recognise a progressive increase in sacrifices made in the interests of a gradually growing awareness of 'efficiency', as defined in market terms (most obvious in the increasing use of less and cheaper materials in the construction of monumental pyramids – which eventually culminated in the disappearance of the genre).

Given the importance assigned to the political rather than the commercial in trade relations, it is frequently, although anachronistically, assumed that in Egypt trade ceased when the central administration was divided, and that the trade routes were blocked during these eras of division. Yet there is no reason to believe that local princes and warlords could not create peaceful domains in their own regions where commerce went on. Furthermore, the texts themselves confirm that trade took place with the other kingdom in a divided country (specifically stated e.g., in the *Teaching for Merikare*, 70–75) – and the descriptions of Avaris have its ports full of trade vessels under the 'Hyksos'-rule which divided the land (Stele of Kamose). In this sense, there is a grave danger of numerous unjustified assumptions either forming questions or contributing to 'explanations' leading to a certain amount of circular logic in discussing the reason for the use of pigments.

That said, we can concede that there was a kind of transformation in the final era of the Bronze Age (the New Kingdom, ca. 1500–1200 BC), when beauty was particularly esteemed, both in personal grooming and in art. Associating the decadence of that age with a blossoming society, administration and economy may not be illegitimate. But in this sense, the extended palette of colours corresponded to an increasing appreciation of colour in the context of social change, and was hardly exclusively a reflection of economic and political developments.

The social situation in Egypt was very complicated. According to our understanding, the craftsmen in Deir el-Medina were officially engaged by the highest authorities of

11 *Eine gründliche Studie der über die Jahrhunderte erfolgten technischen Verbesserungen jedes Farbpigments* […] (Blom-Böer 1994, 55). "A thorough study of the technical improvements in every colour pigment accomplished over the centuries […]."

the Egyptian state to excavate and decorate the royal tombs in the Valley of the Kings.[12] However, they were also organised into workshops which manufactured and sold private funerary equipment to the Theban elite. Documents from these private ventures reveal that they purchased expensive materials for the decoration of coffins – and that the cost of these materials added to the final price of the coffins.[13]

Of particularly high value was orpiment (a natural sulphide of arsenic similar to realgar) which was used as a substitute for gold foil, as gold foil would have been far more expensive. It is not known in Egypt before the New Kingdom, and may have been imported from abroad. The green colour was also expensive as it had to be manufactured by grinding frit, which was locally produced from copper. In principle, the green was usually manufactured by treating 'Egyptian blue', and thus a multi-levelled process probably involving several different workers (from mining to firing to grinding and mixing). Apparently, malachite was occasionally used to produce green directly, but this was rare.

Cooney observes in one case, that the cost of expensive decoration with orpiment and green-frit paint "may account in part for the price [of a specific coffin] being 10–15 *dbn* above average".[14] In general, Cooney reckons that the most valuable component of a coffin price was neither the wood nor the decoration, but rather the craftsmanship (not the labour time as we understand it, but rather the reward for skilled workmanship), which may have accounted for 50% of the value of ordinary coffins.[15]

Therefore, this higher price probably means that these pigments were expensive. It is significant that these materials had an impact on the price, since it means that the materials were not given to the craftsmen by their wealthy patrons who wished to have these products used on their coffins (for then, there would have been no influence on the price – since the workmanship remained the same). And it also implies that the workers at Deir el-Medina did not pilfer state magazines to get their materials: evidently, they purchased the goods, including the imported orpiment. In this sense, the materials were following two separate routes to the artisans at Deir el-Medina. On the one hand, materials were gathered and processed in Egypt; on the other, they were imported from afar and distributed via the market. As we will see, with the exception of frit, orpiment and realgar, most of the other elements contributing to colour pigments were easily available locally. But nevertheless they had to be procured by market processes in the New Kingdom.

The means by which these processes functioned, however, is hardly clear. As the chapter by Hodgkinson (in this volume) shows, it is difficult to distinguish between (a) private domestic glass and faience production and (b) official, state-controlled production at the Egyptian capital of Amarna. We also have no idea of the degree to which the

12 Valbelle 1985; Černý 1973.

13 Cooney 2007.

14 Cooney 2007, 117.

15 Cooney 2007, 113.

state sponsored (and/or taxed) production for the market by private or official parties. What we do know is that in Papyrus Harris I, faience and frit were frequently delivered to the temples in the form of finished products (e.g., amulets, beads, necklaces: P. Harris I 33b, 13; 34a, 4; 34a, 7; 41a, 13–15; 55a, 16), yet the raw materials (frit as crushed faience, P. Harris I 34a, 6; 53b, 2) also occur – all mixed up with imported plants, spices, wood, precious stones, ordinary minerals, and incense, etc. In another context, soda, galena and malachite (P. Harris I 38b, 2; 38b,5–6) are mixed up with incense, onions, grapes and other fruits, along with honey.[16]

This confirms that the New Kingdom state had large stocks of commodities and that the raw materials for the synthetic pigments were delivered by the state to the temples. However, the absence of the less expensive and more easily accessible natural pigments – such as ochre – would imply that these remained largely a matter of the private sector. And, at least some of the faience and frit production will have been private. In this sense, the documentation confirms that a large part of the pigments market was in private hands in the New Kingdom.

The state may have been more deeply involved in the economy in the Old Kingdom, but we know that the owners of private tombs confirmed that the craftsmen and workers had been amply rewarded for their work[17]– and thus it is highly probable that the tomb owners paid market prices for materials as well. However, if we are to judge by the evidence of Deir el-Medina, it would appear that the craftsmen purchased, prepared and applied the materials. The tomb-owners then acquired the materials when paying the craftsmen for their efforts.

In one instance, the wife of an early Old Kingdom tomb owner informs us that her husband – the Vizier Nefermaat at the beginning of Dyn. 4 – developed a special technique of having the written colours prepared so that they could not be erased: *swt jr nṯr.w=f m sš n s:jn=f*, "He made his gods [meaning the hieroglyphs, DAW] in writing which cannot be effaced."[18] He did this by specifically setting prepared colours deep into specially formed cavities cut into the stone in order to assure that the colours would not fade or peel off. Unfortunately, as a result of a process of drying, some blocks of colour did in fact fall out of the walls, but the implication is that the tomb-owner organised and financed the operation. As one of the most important members of the elite, he obviously had the means – but the technique did not catch on, implying or demonstrating that others chose the cheaper means.

However, as we have seen, even in the New Kingdom, when striving for a more perfect yellow or orange, those who could afford imported orpiment chose to encourage

16 For references to P. Harris I, cf. Grandet 2005, 269–295 for the translations, with attached notes and references.

17 Strudwick 2005, 251–260.

18 Translation DAW, from Petrie 1892, pl. 24, upper right.

the craftsmen to use that, rather than the locally available ochre products. In the same way, people who had the means tried to use huntite to achieve a more perfect white; the use of huntite gradually increases from marginal beginnings in the Predynastic era to a more widespread use in the New Kingdom (following a slight increase in the Middle Kingdom).[19] Huntite was apparently locally available, but in general calcium carbonate and calcium sulphite were more common whites. It would appear that – with the exceptions of perhaps orpiment and huntite – the same materials were available to all. Thus, in terms of the quantities of pigments used, wealth and status will have had an influence, but not necessarily in terms of quality.

5 The colours, alphabetically

Ideally, when starting their work, the craftsmen will have had a white surface, formed of plaster *(qḏ)* or limestone *(jnr ḥḏ)*. Conceptually, this will have been a white wall *(jnb.w ḥḏ)*, to which they were applying colours. The word *jwn.w* designated the 'abstract colour' at which the craftsmen were aiming whereas *ḏr.wy* or *ry.t* were the generic terms for the pigment that they employed, with *ry.t km.t*, *ry.t wꜣḏ.t*, *ry.t dšr.t* – 'black paint', 'green paint', 'red paint' respectively – being documented. Thus, the generic terms do not really aid us, as we are aiming at specifics, but they do bring the two worlds together: the ideal colour aimed at, and the pigments used to that end.

5.1 Black

On the monuments, black is almost invariably carbon, mostly soot.

The Egyptian word for 'black' was *km*; the terms known for the pigment are 'charcoal' *ḏʿb.w* and *wbd.w* 'soot' (derived from the word for 'to burn', 'fire', *wbd*, *wbd.t*); (*msdm.t* 'galena', 'black eye paint' was never used as a pigment in artistic painting).

Our investigation demonstrated that soot was continuously used for black from Dyn. 5 to Dyn. 26, all across Egypt.

5.2 Blue

In Egypt, the use of blue is first documented with azurite, a mineral found in the eastern and western deserts, as well as the Sinai, sometimes even on the surface, together with malachite. When ground, it loses colour, but the fine grains increase its capacity to compound well with an adhesive. Over time, it tends to change to malachite green.

19 Heywood in Davies 2001, 5–9.

However, it is hardly documented and its lack of popularity was probably due to the development of Egyptian blue, using copper.

Egyptian blue (frit) was the most important blue pigment; it was probably produced by heating ground blue frit while adding lime. The essential element is the rare cuprorivait, which is here created synthetically.

Amarna blue is fully synthetic, as there is no mineral corresponding to its makeup. It was made using cobalt – but only on pottery during Dyns. 18 and 19.

The Egyptian word for 'blue' was *ḫsbḏ*, literally 'lapis lazuli' (and modified as *mꜣꜥ*, 'real' when the stone was meant, meaning that the term also referred to a synthetic substance). The Egyptian word *mfkꜣ.t*, 'turquoise' was also used to designate synthetic creations such as 'Egyptian blue.' In terms of hue, the mineral turquoise ranges from blue to green.[20]

Our investigation demonstrated that Egyptian blue was used from Dyn. 5 into the Roman era.

5.3 Brown

The ochre (iron oxide) of the Dakhla Oasis is a particularly good brown, but one can also get satisfactory results by painting red on black and yellow on hematite, or by combining with lime.

As noted, the Egyptians do not seem to have had a real term for 'brown.'[21] The Egyptian word for red or red-brown ochre, *ṯmḥ.y*, suggests a Nubian origin (as does the word for yellow ochre, *stj*).

Our investigation demonstrated that ochre was used for brown throughout, until the Ptolemaic era

5.4 Green

In Egypt, malachite is widely assumed to be the most commonly used and earliest green pigment, being locally available in Sinai and the eastern deserts. A couple of cases of the use of malachite as a pigment are documented – but in our project, we found no evidence of malachite: it is highly probable that the Egyptians realised early on that it was chemically unstable and the colour did not hold.

What they used since Dyn. 6 was the synthetic 'green frit' – and by the New Kingdom, frit had completely replaced the conscious use of copper chloride (another synthetic colour pigment used at least through the Middle Kingdom). A 'copper-glass' pig-

20 DAW distinguishes between *ḫsbḏ* 'lapis lazuli' as 'dark blue'; and *mfkꜣ.t* 'turquoise' as 'light blue.'

21 DAW contends that the term *rwḏ.w* – related to red quartzite – was a term for a dark or pale red close to 'brown' – but this is not accepted.

ment was probably also used for green. Significantly, copper chloride and malachite are both forms of decaying frit – and thus identifications of either may be misleading and mistaken.

The Egyptian word for 'green' was *wꜣḏ*; the word *šsm.t* could refer to the mineral malachite. The Egyptian word *mfkꜣ.t*, 'turquoise' was also used to designate synthetic creations such as 'Egyptian blue'. In terms of hue, the mineral turquoise ranges from blue to green.

Our investigation demonstrated that green frit was used throughout the period studies, all across Egypt; the 'copper-glass' pigment was used in the Old and Middle Kingdoms, all across Egypt (probably for green).

5.5 Grey

Grey was usually a mixture of black and white: plaster and charcoal, plaster and lamp soot, or pale yellow earth (ochre?) and lamp soot.

The Egyptians do not seem to have had any particular word for 'grey'. It has been proposed that *ḏḥ.t* is a term for 'grey', potentially supported by the similarity of the words for 'tin' *(ḏḥ)* and 'lead' *(ḏḥ.tj)* suggesting that a word might have been drawn from these grey materials.

Our investigation demonstrated that soot (occasionally mixed with white pigments) was used for grey from Dyn. 5 to Dyn. 20, throughout Egypt.

5.6 Orange and pink

Orange was rarely used, and when so was a combination of ochres. Pink was generated with ochre and plaster.

The Egyptians did not have any specific abstract words for 'orange' or 'pink'. The Egyptian word *kṯ*, 'safflower' may have been used to designate the colour orange. If they referred to it, 'pink' was probably part of 'red'. Regardless, the Egyptians used a material to create colours for which there was no word in their vocabulary.

Our investigation demonstrated that orange was mostly made out of ochre (occasionally mixed with white pigments), from Dyn. 6 through the Roman era, all across Egypt. Pink was – as far as the samples in the project are concerned – generally restricted to Upper Egypt, but documented already in Dyn. 5 and until Dyn. 20.

5.7 Red

Red ochre (found near Aswan and in the western desert oases) was the most common red pigment. Used since Predynastic times, it still enjoyed a good reputation in classical antiquity. Haematite and realgar were also used – but exposed to sunlight, realgar can decay to orpiment (since the two are closely related chemically).

The Egyptian word for 'red' was *dšr*; other abstract terms might have included *tms/ṯms* 'red'; quite different are *ḥrs.t* 'carnelian', and *ẖnm.t/ẖn.t* 'red jasper', *mnš.t*, *ṯmḥ.y* for 'red ochre', and *ꜣw.t-jb* for 'realgar', etc.

Our investigation demonstrated that ochre was used throughout the period, all across Egypt. As a red pigment, hematite was documented in private and royal monuments from Dyn. 6 to 18, but rarely and mostly in Upper Egypt; realgar was found only twice (once royal, once private) in Dyn. 18 Thebes.

5.8 White

Calcium carbonate is the most common white; it can be enhanced with an underlying layer of magnesium calcite, of which huntite is the most significant pigment. Huntite could be used both alone and as a part of a compound, being ideal as it not only has a strong 'colour', but also excellent adhesive qualities. Although widely assumed that huntite was rare before the New Kingdom, it was actually used since the Old Kingdom (but not in the Predynastic era).[22]

Virtually all of these whites were originally shells (geologically speaking), but the Egyptians also used crushed shells for white – as well as other pigments (including white lead ore).

The Egyptian word for white was *ḥḏ* (literally 'silver'), used to describe limestone (and thus calcium carbonate); *qḏ* meaning 'plaster' may have referred to the compound calcium sulphate; no term for 'huntite' has been proposed, and *qḏ* may have served this role as well (or indeed *ḏr.yw ḥḏ*, the generic 'white pigment', cf. infra).

Our investigation demonstrated that calcium sulphate was continuously used for white from Dyn. 5 to Dyn. 20 all across Egypt. Calcium carbonate was used continually from Dyn. 5 to the Ptolemaic era all across Egypt. Magnesium calcite was found in a few royal and private monuments from Dyn. 12 and Dyn. 18 to Dyn. 20 in Thebes; and huntite during the same time-span, in both Upper and Middle Egypt.

5.9 Yellow

In Egypt, various different materials were used to create yellow (sandstone, lead oxide, calcium carbonate with an organic substance, etc.), but yellow was almost always made with ochre.

22 Heywood in Davies 2001, 5–9.

Jarsosite is also known in Egyptian art, but (in contrast to ochre) is not naturally present in Egypt; jarosite is allegedly known from Cyprus. However, it is possible that if 'deliberately' created in Egypt, it was probably an unconscious accident – and that most of the cases where it has been recorded (from the Middle Kingdom) may well be a matter of natural decay. Nevertheless, Lee and Quirke conclude that "Jarosite, despite being a rare mineral, ought therefore to be considered among the list of known Egyptian pigments".[23]

As its name (Latin *Auripigmentum* 'gold pigment') suggests, orpiment is superior to all substances in imitating the colour of gold, in both hue and luminosity. The quality was such that it was used on some New Kingdom royal quartzite sarcophagi (where cost will hardly have played a role). Not native to Egypt, orpiment may be found in Anatolia, Armenia, Kurdistan, or Iran; additionally, it was found in the Uluburun wreck – and is thus a demonstrable trade good. Orpiment appears more frequently since Dyn. 18, but the usage goes back to at least the Middle Kingdom (and probably the Old Kingdom).

An 'economical' means of heightening the shine and saturation of ochre was to combine layers of ochre and orpiment, as was demonstrably the case in the New Kingdom. Usefully, fragments of actual orpiment pigment were found on the floors of New Kingdom private tombs where no orpiment was detected in the decoration.[24] This means (a) that the use of orpiment may have been more widespread than is apparent today, and (b) that the technique of using layers of ochre and orpiment may have heightened the effect of the ochre while minimalising the use of orpiment.

There is no abstract term for 'yellow' in Egyptian. There is thus some confusion about the Egyptian term for 'yellow', since one must distinguish between the hue and the materials. Terms such as *mnš.t* and *sty/stj* designate ochre (through a link with Nubia, which seems to have given its name to the material). The word for orpiment was *qnj.t* – and the goal of using orpiment was to come close to 'gold' so that *nb.w* 'gold' would be what the Egyptians used for 'yellow', rather than the pigments which imitated it.

Our investigation demonstrated that yellow ochre was used throughout the period investigated; we only found orpiment in New Kingdom Thebes (in royal and private contexts). Orpiment-with-ochre was also found in (New Kingdom) Middle Egypt.

5.10 Products of decay

Our investigation concluded that copper chloride (green), malachite (green) and jarosite (yellow) were all products of decay.

23 Nicholson and Shaw 2000, 116.

24 Lee and Quirke in Nicholson and Shaw 2000, 115.

6 Surface preparation and adhesives

In the case of faience, the colour was literally melted to the surface of the object and thus there was no question of preparation. With wooden figurines, the colours might be absorbed by the wood – but at least they stuck! With stone, the Egyptians were faced with very different problems. In some cases, they would deliberately choose black granite-diorite, red quartzite, yellow jasper, etc. as the base. However, their preferred surface was the bright white limestone of certain outcrops in the Nile Valley.

Yet, regardless of the inherent quality of the stone, they still insisted on painting it. In some cases, the surfaces were simply made smooth, occasionally with raised or sunk relief. When freshly cut, the rock surfaces may have absorbed some of the hue from small particles clinging to the wall, and thus assured that the hue remained on the surface. In other cases (as at Thebes), however, they actually had to create an artificial surface of white plaster to overcome the inadequacy of the limestone. Regardless of the disadvantage, the plaster has the advantage of assuring that the paint – if skilfully and patiently applied – would stick.

Regardless, once the desired surface had been reached or achieved (after drying in Egypt where fresco was not the norm), the application of the paint could commence. Some materials – such as soot and ochre – can actually adhere to a surface on their own. And, as noted above, by grinding minerals to a fine grained mass, they could be rendered more amenable to the adhesive sticking power essential in paint. However, without adhesives, most materials will not remain in place – and one should recall the experiment of Nefermaat mentioned above, indicating that virtually from the time that the Egyptians began to adorn their tombs with large surfaces of colour at the beginning of Dyn. 4 (as opposed to the [small] slab stelae which dominated in the preceding dynasties), they confronted the problem of getting the colour to stick.

Evidence suggests that most of the colours were made by using inorganic minerals whereas virtually all of the adhesives proposed seem to have been organic materials. Yet apparently gum Arabic – the favourite proposition – has never been found. Oil and fat figure prominently among the precious ointments of the Egyptians, but "have not been identified as binding media in ancient Egyptian paints", and there is likewise little evidence of resin.[25] Glue (made of protein collagen, found in tendons, etc.) was likewise certainly available – but has rarely been demonstrated.[26] Egg white was also available, but like bee's wax rarely demonstrated.[27] Honey and glucose are hardly demonstrated. More promising seems to be acacia gum, and also other unidentifiable arboreal gums.[28]

25 Newmann and Serpico in Nicholson and Shaw 2000, 491.

26 Newmann and Serpico in Nicholson and Shaw 2000, 475, 483.

27 Newmann and Serpico in Nicholson and Shaw 2000, 480, 489, 491.

28 Newmann and Serpico in Nicholson and Shaw 2000, 488–490.

This evidence would suggest that it was in fact very ordinary local organic adhesives (such as the acacia) that served to bind the inorganic pigments to the surfaces.

The Egyptian word for 'adhesive' was *qmy.t* 'resin' – giving rise to our word 'gum.' Acacia gum was *qm.yt n.t šnḏ.t*.

Our investigation demonstrated that plant gums were used – but it proved impossible to reach definitive conclusions and the study of adhesives was abandoned.

7 Summary

Black (charcoal, soot), blue (Egyptian blue), brown (ochre), green (green frit), orange (ochre), red (ochre), white (calcium carbonite) and yellow (ochre) were used from the Old Kingdom to the Ptolemic or Roman periods.

Calcium sulphate (white), grey (soot [with white pigments]) and pink (red ochre [with white pigments]) were used from the Old Kingdom to Dyn. 20, the green copper-glass pigment was found in samples from the Old Kingdom to Dyn. 12.

Haematite (red), huntite (white), magnesium calcite (white), orpiment (yellow) and realgar (red) are pigments that deserve more attention.

The preference for huntite clearly corresponded to a desire for a finer white. The appearance and use of the exotic material orpiment means that the Egyptians were able to appreciate a new colour which matched their needs. The use of realgar may match the same situation: exotic and striking.

Oversimplifying, the Egyptian colour words mentioned here thus fall into three categories: (1) abstract terms (such as *km* 'black,' *wꜣḏ* 'green,' and *dšr* 'red'), (2) terms for high value materials (such as *ḫsbḏ* 'lapis lazuli' / 'blue,' *mfkꜣ.t* 'turquoise / blue, green,' *ḥḏ* 'silver' / 'white,' *nb.w* 'gold' / 'yellow'), and (3) technical terms for the materials used in order to depict these colours (such as *stj* 'ochre,' *qny.t* 'orpiment,' *wbd.w* 'soot'). Thus, in some cases, the words for pigments refer to one single colour and item (e.g., *qny.t* 'orpiment'), a word covering several domains (e.g., *wꜣḏ* 'green'), or several words designating more or less the same thing (e.g., *ḏʿb.w* 'charcoal' and *wbd.w* 'soot' may have been used interchangeably in certain contexts).

It follows that where no word has been identified, the pigment was (1) unknown or not consciously created (e.g., jarosite), (2) the Egyptians used different words indiscriminately (e.g., *stj* 'ochre'), (3) the pigment was known, but a specific term was not used (e.g., huntite?), or (4) the pigment was known, but the name has not yet been identified.

While working, the craftsmen may have used generic terms for specific products, so that e.g., 'huntite' might simply have been that specific 'white pigment' *(ḏr.yw ḥḏ)*. One should never forget that the scribes were not the craftsmen, but rather the administrators who recorded and the poets who described. Somehow the craftsman had to receive the materials they required and when necessary the scribes had to record them (in documents) or to describe phenomena (in poetry) – and thence bring terms into the language. In this fashion different usages emerged, creating difficulties for the philologists and scholars in the academic disciplines relating to colour.

This issue of the conceptual colours, the materials and the pigments, is extremely important and can be illustrated in the case of red. Significantly, although we generally allow only the one word *dšr* for 'red', Schenkel does suggest that *tms/ṯms* might have served as a near alternative or synonym for *dšr* – but definitely with some kind of nuance of a different hue. Schenkel also suggests that the evolved form of *mrš* might have served for 'light red' in Coptic, at the end of Egyptian history.[29] Obviously, this latter Coptic word could be related to the ancient Egyptian term for ochre, *mnš.t*, adduced above (but also to Egyptian *mrš*, as translated by Assmann and noted by us above). Schenkel cites a couple of texts which relate *tms/ṯms* to a specific plant or tree, and thus suggests that we should not unhesitatingly follow Lefebvre in thinking that it might have been ochre.[30] In this latter case, we have a clear confusion of (a) a colour in the real world (b) being perceived as being similar to the colour of a plant – and (c) the ochre that may have been used as a pigment to re-create that colour.

And, here, most curiously, we have the remarkable case of a painter's palette preserved from ancient Egypt with eight oval cavities containing the much used blocks of dry pigment: red, black, white, red (traces only), blue, green, yellow, and red.[31]

In effect, we learn that these are the eight colours they assumed relevant to painting – and that the selection includes three different pigments which we would call 'red'. The Egyptians must have distinguished these consciously – conceptually and in practice –, and thus (along with the standard term for 'red'), the various terms for ochre also played a role as conceptual colours, as well as ephemeral organic materials which may never have served as pigment, but did serve as conceptual templates. This situation offers food for thought.

Obviously, there are two general conclusions to this study. Firstly, more work must be done in the field to identify the pigments used, and their origins. Secondly, one must link the abstract colours and the colours used in the artwork to come closer to understanding what the Egyptians understood, and how they used and perceived colour.

29 Schenkel 2007, 223–224.

30 Schenkel 1963, 140–141. Significantly, the passages cited by Schenkel are similes, *mj jrtyw tms*, "like the colouring [=secretions or leaves?] of the *tms/ṯms* plant".

31 Hayes 1959, II, 146.

8 Procedures in the past

From the decoration of the representative buildings of ancient Egypt, it is evident that the Egyptians had a very real understanding of the value of colour, both in terms of the effect at which they aimed and the expenses involved in eliciting a response.

Every single room of every monument will have had its own specific requirements and thus one cannot generalise about procedures. However, the stone walls had to be prepared – whether the constructed stone walls of a temple or the excavated walls of a rock-cut tomb. Once the surfaces were prepared and the paints mixed, the colours were applied to the walls, usually in a series, sometimes with several layers, beginning with white followed by yellow, red, green, blue and ending with black, as required. Technically, the Egyptians aimed at a bright polychrome colour scheme. In principle, the decoration corresponded to the function of the room – and thus each one was specific.

The actual execution of the decoration may have taken but a few days or hours (according to the size, expectations and demands), but the conceptual development will doubtless have been more complicated. Where the schematic conception was more or less set (as in the tombs of the Theban officials), the tomb owner was probably consulted about his preferences and expectations. Where the building was unique – as with the temples built for specific gods – the king himself may have contributed to the outlines of the plans, supported by the highest secular and religious officials.

9 Costs, supplies and sources

We know that these major projects were complicated affairs. One Middle Kingdom record of a mission sent to the Wadi Hammamat suggests that the leader took some 17 000 men into the desert, bringing back 60 sphinxes and 150 statues. He was out there for 30 days, and probably required slightly less than 200 000 loaves to take care of the whole team (including bakers and sandal makers, as well as masons and men dragging stones, along with a retinue of high officials and supervisors).[32] Having cut the stones in the desert and dragged them into the valley, they had to be put in place and painted.

Above we noted that the workers at Deir el-Medina sold their hand-crafted coffins for a specific price, which combined materials and workmanship. When the workers were building tombs, they seemed to have estimated the value of their work in terms of surface area painted rather than hours or time spent excavating. The state also paid them a wage, which amounted to 5500 litres/year of grain for a single worker, and thus slightly less than 200 000 litres a year for a team of around 30–35 workers (some earning

32 Cf. Warburton 2012, 81.

more).[33] The royal tombs could be completed (i.e., excavated and decorated) in less than ten years. Estimates for the time required range from as low as two years for the excavation, and another two or so for the decoration to five to seven years for the minimal whole. The latter is a figure that one could propose; once the basic work had been done, work could have proceeded at a leisurely pace until the death of the sovereign.[34] Then the final preparations had to be done urgently, and the project came to a close with the burial.

Thus, one has several different means of estimating the costs of construction: on the one hand, the state calculations which were based on time and the commercial activities which seem to have been based on the work. However, it seems that isolating the time spent decorating alone probably cannot be estimated: even in the royal tombs, excavation and decoration was carried out simultaneously. However, the work did have a cost, beyond the price of the materials. We may assume that the state supplied all of the materials required for the excavation and decoration of a royal tomb – although individual workers may have had their own preferred tools, the pigments will have been provided by the state.

Some of those pigments were acquired in Egypt, others were acquired abroad. Private traders, such as the owner of the boat which met its fate at Uluburun, can have brought pigments from abroad directly to the markets of the eastern Mediterranean – and both the Egyptian state and the craftsmen could have purchased them. It is very clear that the New Kingdom Egyptian state was as keen on the use of orpiment as it was on the use of blue glass and thus we can see the Egyptian state and the craftsmen meeting on the markets.

The Egyptian state was definitely deeply involved in the mining of gold (in Nubia), turquoise (in Sinai) and amethyst (near Aswan) – and keen on acquiring lapis lazuli and rock crystal from abroad. However, we have little indication that the state was concerned with carnelian. Significantly from, e.g., P. Harris 15a, 15, we know that the state delivered carnelian to the temples. Yet there is far more testimony to silver, gold, lapis lazuli, amethyst, etc. in P. Harris than carnelian. This would imply that the state did not necessarily assign it a high value, but also that it might not have really have found it necessary to regulate supplies. Thus – while the state despatched missions into the deserts to acquire stones for statues as well as gold, turquoise and amethyst – the carnelian produced in Egypt was apparently either acquired on the market or through taxation.

33 For details, cf. Janssen 1975, 455–471; Valbelle 1985; Černý 1973.

34 Valbelle 1985, 91; Černý 1973. The fact that the tomb of Seti was successfully completed although he reigned for around a decade must be compared with the incomplete state of the tombs of his immediate predecessors, Horemhab (who reigned for more than a decade) and Ramesses I (who probably did not reign for more than two years at the most). Here, one could sense that political difficulties interfered with progress – but the quality of the finished work in all three tombs compares favourably with that executed for sovereigns who ruled longer.

Gum and charcoal are among the items figuring in the very fragmentary Turin tax-lists,[35] meaning that they were delivered by the people of Egypt to the state. Significantly, gum was also purchased by the workmen at Deir el-Medina – and Janssen remarks that "gum will have been quite expensive … though of an adhesive only small quantities will have been needed".[36] And this leads to a very significant hint at the control of production: faience appears abundantly in P. Harris (with its offerings of goods from the state to the temples), and this might imply that the state actually had substantially more control of the production of faience than of carnelian. As we know that during the New Kingdom faience goods were acquired on the market,[37] one can imagine parallel production – or that state dependents were also involved in the production of faience for the market (as we know was the case a couple of centuries later, from the Neskhons shabti decrees, for which, see the introduction of this volume).

Under the circumstances, one could speculate that the production of carnelian, gum, charcoal, ochre and other goods may have been taxed (rather than controlled), with the goods coming into the hands of the state in order to decorate its monuments. At the same time, however, the same materials will have reached the markets whence the craftsmen at Deir el-Medineh could acquire them as well. This, in turn, would suggest that the craftsmen left it to their clients to decide about the costs of the materials in private dealings – while the state would decide where it desired to use the more expensive materials and in what quantities.

10 Conclusion

The choice and use of colours in the colour symbolism of the ancient Egyptian religious texts was determined by rituals, local cult practices, and other givens or eventualities. The concept of four as a comprehensive concept of global unity (e.g., North, South, East, West; before, behind, left, right) complemented fundamental dualities (e.g., past and future; heavens and netherworld; Upper Egypt and Lower Egypt; the red sandy deserts and the black soil of the Valley and Delta, etc.) and thus created a basis for dualities (black and white; red and white; black and red; green and red) within a scheme of four colours (black, green, red, white) offering a harmonious account of the world, from the time of its creation.

While the Egyptians had abstract terms for these basic colours (*km* black; *wꜣḏ* green; *dšr* red; *ḥḏ* white), they did not adopt abstract terms for blue (using lapis lazuli) and

35 Warburton 1997, 161 (gum in the Turin tax lists).

36 Janssen 1975, 447.

37 Janssen 1975, 306.

yellow (using gold), both of which as materials and colours were highly esteemed, involving the use of synthetic blue frit and expensive orpiment to imitate these materials in the production of coloured artwork. Yet, the reality was that all of the colours had to be manufactured, and thus we find a range of materials used for red – as well as the other colours. In this fashion, the use of pigments was a practical means of depicting colours (to convey symbolic meanings about this world and the Beyond), and the means available (ochre, orpiment, frit etc.) were selected according to the priorities of the one commissioning the project. Thus, the craftsmen had to deal with several different concepts of colour, including not only the vague ideas of hue, saturation and luminosity, but also the conceptual words (e.g., red) and the pigments (ochre, realgar, etc.) they used to represent those colours in a persuasive and satisfying fashion.

The actual pigments used to decorate the surfaces were determined by the materials available, their nature and utility. Beyond that, however, was always that aesthetic sense of the craftsman balancing colours and the conceptual guidance of the one commissioning the work. Regardless, the language was very poor in compassion to the range of colours which lay at the disposal of the Egyptian craftsmen – and were put to good use.[38]

38 It is absolutely essential to recall that the processes of decay prevent us from understanding exactly what the Egyptians projected onto their art – and also that photographic and artistic reproductions likewise have their own limits.

Bibliography

Assmann 1983
Jan Assmann. *Sonnenhymnen in Thebischen Gräbern*. Theben Bd. 1. Mainz: Philipp von Zabern, 1983.

Blom-Böer 1994
Ingrid Blom-Böer. "Zusammensetzung altägyptischer Farbpigmente und ihre Herkunftslagerstätten in Zeit und Raum". *Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden* 74 (1994), 55–107.

Černý 1973
Jaroslav Černý. *A Community of Workmen at Thebes in the Ramesside Period*. Bibliothèque d'Étude 50. Cairo: Institut Français d'archéologie Orientale du Caire, 1973.

Cooney 2007
Kathlyn M. Cooney. *The Cost of Death. The Social and Economic Value of Ancient Egyptian Funerary Art in the Ramesside Period*. Egyptologische Uitgaven 22. Leiden: Nederlands Instituut voor het Nabije Oosten, 2007.

Davies 2001
W. Vivian Davies, ed. *Colour and Painting in Ancient Egypt*. London: British Museum Press, 2001.

Gardiner 1982
Alan H. Gardiner. *Egyptian Grammar. Being an Introduction to the Study of Hieroglyphs*. Oxford: Oxford University Press, 1982.

Grandet 2005
Pierre Grandet. *Le Papyrus Harris I*. Bibliothéque d'ètude 109. Cairo: Institut Francais d'Archéologie Orientale, 2005.

Hayes 1959
William C. Hayes. *The Scepter of Egypt*. New York: Metropolitan Museum of Art, 1959.

Janssen 1975
Jacob J. Janssen. *Commodity Prices from the Ramesside Period*. Leiden: Brill, 1975.

Lucas and Harris 1962
Alfred Lucas and James R. Harris. *Ancient Egyptian Materials and Industries*. London: Edward Arnold & Co., 1962.

Nicholson and Shaw 2000
Paul T. Nicholson and Ian Shaw, eds. *Ancient Egyptian Materials and Technology*. Cambridge and New York: Cambridge University Press, 2000.

Petrie 1892
W. M. Flinders Petrie. *Medum*. London: D. Nutt, 1892.

Schenkel 1963
Wolfgang Schenkel. "Die Farben in ägyptischer Kunst und Sprache". *Zeitschrift für ägyptische Sprache und Altertumskunde* 88 (1963), 131–147.

Schenkel 2007
Wolfgang Schenkel. "Color Terms in Ancient Egyptian and Coptic". In *Anthropology of Color. Interdisciplinary Multilevel Modelling*. Ed. by R. E. MacLaury, G. V. Paramei, and D. Dederick. Amsterdam: J. Benjamins, 2007, 211–228.

Schiegel, Weiner, and El Goresy 1992
S. Schiegel, K. L. Weiner, and A. El Goresy. "Endbericht an die Volkswagen-Stiftung über das Projekt ‚altägyptische Pigmente'". Bericht Max-Planck-Institut für Kernphysik. 1992.

Strudwick 2005
Nigel C. Strudwick. *Texts from the Pyramid Age*. Writings from the Ancinet World 16. Leiden and Boston: Brill, 2005.

Valbelle 1985
Dominique Valbelle. *Les ouvriers de la tombe. Deir el-Médineh à l'époque ramesside*. Bibliothèque d'Étude 96. Cairo: Institut Français d'archéologie Orientale du Caire, 1985.

Warburton 1997
David A. Warburton. *State and Economy in Ancient Egypt*. Orbis biblicus et Orientalis 151. Fribourg: University Press, 1997.

Warburton 2012
David A. Warburton. *Architecture, Power, and Religion. Hatshepsut, Amun & Karnak in Context*. Beiträge zur Archäologie 7. Berlin and Münster: LIT Verlag, 2012.

Illustration credits

1 Photo: ©Rijksmuseum van Oudheden, Leiden.

INGRID BLOM-BÖER

Dr. Ingrid Blom-Böer is a scientific employee in the Cologne Institute of Conservation Sciences. Her recent research is on socio-economic history of colours in the textile industry in Germany in the project *Weltbunt – Die Welt wird bunt* (2017–2020). During her studies in Egyptology Blom-Böer focussed on archaeology, objects and museum topics. She was also involved in a major project on colour in Ancient Egypt in the Pelizaeus-Museum in Hildesheim together with the Max-Planck-Institut in Heidelberg.

Dr. Ingrid Blom-Böer
Technische Hochschule Köln
Campus Südstadt
CICS – Cologne Institute of Conservation Sciences
Institut für Restaurierungs- und Konservierungswissenschaft
Ubierring 40
50678 Köln, Germany
Weltbunt – Die Welt wird bunt
E-Mail: ingrid.blom-boeer@th-koeln.de
www.th-koeln.de/cics

Fritz Blakolmer

The Language of Colour and Material: Were Architectural Façades in the Aegean Bronze Age Brightly Painted?

Summary

When considering Minoan and Mycenaean iconography, the exterior architecture appears to have been richly polychrome. When comparing this iconographic rendering with the archaeological evidence of house façades in the Aegean Bronze Age, the picture is quite different from that of imagery. This leads us to an alternative assessment of colour aesthetics in Aegean arts. Since the polychromy of iconographic architectural elements corresponds with the richly chromatic rendering of landscape and fauna, the reproduction of architecture was transformed by the specific artistic 'language of colour': gloss and glows, heteromorphics, irregularity and further qualities of the appearance of different materials could be the methodological key to an understanding of the abstract coloration in iconography.

Keywords: colour; Aegean Bronze Age; architecture; Minoan and Mycenaean prehistory; abstract colouration

Obwohl nach Aussage der Ikonographie die Außenfassaden minoisch-mykenischer Gebäude reich polychrom waren, ergibt die spärliche archäologische Evidenz für verputzte Außenwände doch ein anderes Bild. Dies gibt Anlass zu einer Neubeurteilung der Farbenästhetik in der ägäischen Bildkunst. Da die polychrome Wiedergabe architektonischer Elemente jener von Landschaft, Pflanzen und Tieren entspricht, wurde auch Architektur nach denselben künstlerischen Mechanismen der ägäischen ‚Farbensprache' gestaltet: Glanz und Schimmer, heteromorphe, unregelmäßige Oberflächen sowie weitere Eigenschaften des Erscheinungsbildes unterschiedlicher Materialien dürften den methodischen Schlüssel für unser Verständnis der Farbabstraktion in der Ikonographie der minoisch-mykenischen Frühzeit bilden.

Keywords: Farbe; ägäische Bronzezeit; Architektur; minoisch-mykenische Frühzeit; Farbabstraktion

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

I am very grateful to David Warburton and Shiyanthi Thavapalan for the invitation to participate at this conference and to Sarah Cormack for revising the language of this paper.

1 Introduction

Let me start by quoting one of Berlin's most famous archaeologists, Gerhart Rodenwaldt, who, about a century ago, described the appearance of the Minoan palace at Knossos as follows:

> Wenn wir uns aber in der Vorstellung das Bild des Palastes mit seiner Vielheit von Ecken und Vorsprüngen, von Stockwerken, Dächern, Terrassen, Gärten, mit der Farbigkeit seines Holzfachwerkes und bunter Inkrustationen ergänzen, dann entsteht ein Gemälde von phantastisch malerischem Reiz.[1]

During the past century of research, our understanding of the appearance of Aegean Bronze Age architecture has developed and changed. Nowadays, on the one hand, we have a multitude of different sources at our disposal informing us about the materials used in Minoan and Mycenaean architecture, the principles of construction, technical mechanisms of building houses up to a height of three stories as well as the refinements of interior decoration of vernacular and especially so-called 'palatial' architecture.[2] On the other hand, after more than 140 years of excavations, we also possess a multitude of architectural representations in artistic media such as mural painting, seal images, vase painting, vessels made of stone or metal, and works of faience and ivory, several of them in rich polychromy.[3] In contrast to the original architectural remains themselves, these images, dating from the 17th through the 13th century BC, constitute a source of secondary character and inform us only indirectly about the architecture, in encoded form, through the iconographic 'language' of Aegean artists. This 'artistic language' is dominated by simplifications, abbreviations and the choice of characteristic elements in order

1 Rodenwaldt 1921, 6. "If we imagine the view of the palace with its multitude of corners and bastions, multiple stories, various roofs, terraces, gardens – and completed this with the colours of its timber construction and colourful inlays – we are overwhelmed by a fantastic painting." (translation David A. Warburton).

2 Fyfe 1903; Driessen 1989/1990; Küpper 1996; Palyvou 1999a; Palyvou 2005a; Hitchcock 2000; Darcque 2005; J. W. Shaw 2009; J. W. Shaw 2015; McEnroe 2010.

3 Boulotis 1990; Schoep 1994; Krattenmaker 1995; Nörling 1995; Pavúk 2002; Palyvou 2005b.

Fig. 1 Miniature fresco from Akrotiri, Thera, Town V.

to visualise multi-storeyed buildings of elevated, 'palatial' character, sacral architecture as well as entire settlements in their natural setting (Fig. 1).

All these ancient polychrome representations of Aegean architecture share one remarkable feature, namely their brightly painted façades in colours such as yellow, red and blue. Since Arthur Evans's pioneer excavations in the early 20th century, the predominant opinion is that Aegean iconography accurately reflects the bright artificial colouring of building façades, projecting architraves, beam heads, columns and additional structural features.[4] This is remarkable in as far as the primary evidence of the architectural remains themselves scarcely informs us about the actual chromatic appearance of the façades of Minoan and Mycenaean buildings.

Thus, the question I will put forward in this contribution is: how are we to imagine the colour and appearance of Bronze Age Aegean architectural façades? At first glance, this sounds like a very simple question which could easily be answered by combining the image we gain from the iconography with the results of the studies of the architecture itself. However, with regard to the colouration, Minoan and Mycenaean iconography followed its very particular path, and the use of a distinct colour by the Aegean artist for depicting a motif is anything but clearly determined by what we would today call its 'real appearance.' Therefore, the problem arises of whether architectural façades in the Aegean Bronze Age were really brightly painted; or should we assume that Aegean painters were not so much inspired by any original colouration, but merely by the chromatic qualities of the architectural materials and principles themselves as suggested by the statement of Rodenwaldt mentioned above?

4 Heaton 1911, 704; Rodenwaldt 1921, 35; Lawrence 1957, 27; Graham 1962, 147, 188–199, fig. 121; Morgan 1988, 13, 73–74; Boulotis 1990, 423, 445; Waterhouse 1994, 167–168; Klynne 1998, 216–218, 223–224 with fig. 9.

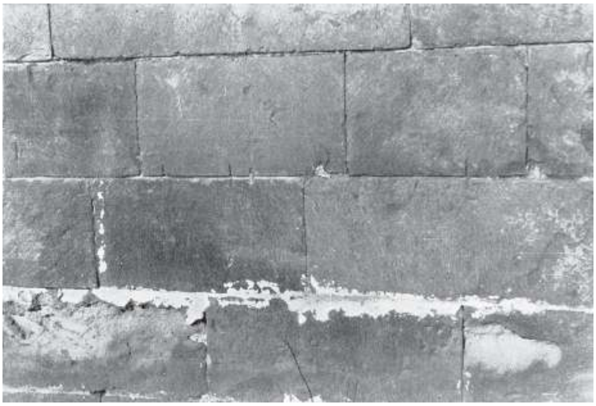

Fig. 2 Ashlar wall in corridor 41 of the palace of Phaistos.

2 The iconography in the light of the architectural evidence

When investigating the chromatic appearance of Aegean architecture through the lens of the iconographical sources, we gain a highly ambiguous result. Let us begin with the walls of architectural façades: in Aegean art, these are mainly portrayed as brightly polychrome ashlar masonry suggesting that the surfaces of the exterior walls were originally plastered and painted (Fig. 1).[5] In reality, however, the exterior walls of Aegean architecture were built of rubble, mud-bricks or ashlar masonry.[6] One explanation of this colouration could be to ascribe these bright colours to the natural appearance of the various stones used as ashlar blocks: blue and yellow indicating tuff and red indicating ignimbrite.[7] An alternative explanation is that the exterior walls were coated with coloured plaster.[8] However, for good reasons,[9] some doubt has been raised on the original assumption that Minoan ashlar walls were brightly painted murals.[10] On several ashlar blocks of the western façade of the palace at Malia a thin layer of white plaster was still visible.[11] The western ashlar façade of the palace at Phaistos has preserved traces of plaster in the interstices possibly painted in red[12] which led to the assumption that it could have been covered in its entirety with red paint;[13] in fact, this manner of plastering seems to have left the original stone surfaces visible (Fig. 2).[14]

5 Morgan 1988, 73–74; Doumas 1983, 53; Boulotis 1990, 423, 445; Waterhouse 1994, 167–168; Palyvou 2003, 217–218, 227; J. W. Shaw 2009, 75–76, 147.

6 Palyvou 2005b, 189–192.

7 Palyvou 2005b, 191.

8 Palyvou 2005b, 189.

9 J. W. Shaw 1971, 107–108, figs. 125–126; J. W. Shaw 2009, 75–76; Klynne 1998, 216.

10 Heaton 1911, 704; Rodenwaldt 1921, 35; Graham 1962, 147, 188–189, fig. 121; Westerburg 2001, 10 with n. 53.

11 Charbonneaux 1928, 357; J. W. Shaw 1971, 108, 217, fig. 247 b; J. W. Shaw 2009, 76, figs. 119, 255 b; Pelon 1980, 67; Nörling 1995, 11.

12 Pernier 1935, 184–186, figs. 77–78; Pernier and Banti 1951, 225, fig. 139; p. 429–130.

13 Cf. A. J. Evans 1901/1902, 66.

14 J. W. Shaw 1971, 108; Hult 1983, 46.

This sealing of the interstices between the ashlar blocks, which is also attested on other Minoan buildings[15] could have fulfilled protective functions[16] as well as aesthetic ones as it emphasises this prestigious style of masonry. In Mycenaean palatial architecture the blocks of conglomerate seem to have remained visible[17] and occasionally plastered interstices are preserved as well.[18]

Interestingly enough, in Aegean mural painting situated in interior rooms, large-scale ashlar masonry has been imitated by depicting isodomic blocks in plain monochrome white with thin horizontal and vertical interstices painted in red. This is clearly attested in the 'House of the Frescoes' at Knossos (Fig. 3),[19] in the Minoan murals at Tell el-Dab'a[20] and in the house of Plakes at Mycenae.[21] In the representation of a shrine façade in Xesté 3 at Akrotiri on Thera (Fig. 4) the ashlar masonry has likewise been traced with thin black lines on the plain white surface.[22]

What is remarkable in these representations of large-scale, 'real' ashlar masonry is that, in all these cases, the ashlar blocks are by no means depicted in bright colours.

For mud-brick and rubble masonry with wooden beams in the Aegean, we might postulate a protective covering of the exterior walls with mud plaster, which is preserved only rarely, however.[23] At Malia whitish, yellowish, reddish and bluish mud plaster has occasionally been preserved *in situ*,[24] while in the settlement of Palaikastro white-yellow stucco covered the dado zone of the exterior rubble walls of several buildings.[25] However, Allan Klynne's 1998 reconstruction of the palace at Knossos, showing brightly painted exterior walls which he proposed were covered with *terra rossa* (Fig. 5),[26] cannot be supported by any archaeological finds.[27] Does this scant primary evidence really support the image of brightly coloured outer façades as indicated by Aegean imagery?

Moreover, we probably have to add further reservations: the small faience plaques of the 'Town mosaic' from Knossos (Fig. 6)[28] as well as the architectural terracotta models, most of which are from Middle Minoan Crete,[29] may constitute a special case with regard to their colouration, despite the fact that a prominent position has been ascribed to them in this discussion. Since their colouring is closely related to the Kamares painting

15 Nörling 1995, 11.
16 Nörling 1995, 12; J. W. Shaw 2009, 75.
17 Küpper 1996, 89–90, 114–115.
18 Wace 1921/1923, 298–299, fig. 55; Nörling 1995, 34–35.
19 A. Evans 1928, 443–444, fig. 260; Immerwahr 1990, 145, 178 (Kn no. 43).
20 Bietak, N. Marinatos, and Palivou 2007, 42; Bietak, Rüden, et al. 2012/2013, 139.
21 Iakovidis 2013, 237, pl. 72.
22 Vlachopoulos 2008, 451, 456, figs. 41.10–11; Vlachopoulos 2015, 59, fig. 14 d; Alexopoulos 2008, 389–390, fig. 1.
23 Küpper 1996, 98–99, 113–115; Nörling 1995, 10–11, 15, 20, 44; Dandrau 1997, 325–327; Palyvou 2000, 431–432; Palyvou 2005b, 189, 191.
24 Dandrau 1997, 325–327.
25 Sackett and Popham 1965, 253; MacGillivray et al. 1987, 141.
26 Klynne 1998, 216–218, 223, fig. 9.
27 Driessen 1999a, 124–125.
28 Foster 1979, 99–115, figs. 30–82; Boulotis 1990, 422–425, figs. 1–2; Waterhouse 1994, 165–174, pls. XXI–XXVI.
29 Schoep 1994; Rethemiotakis 2010.

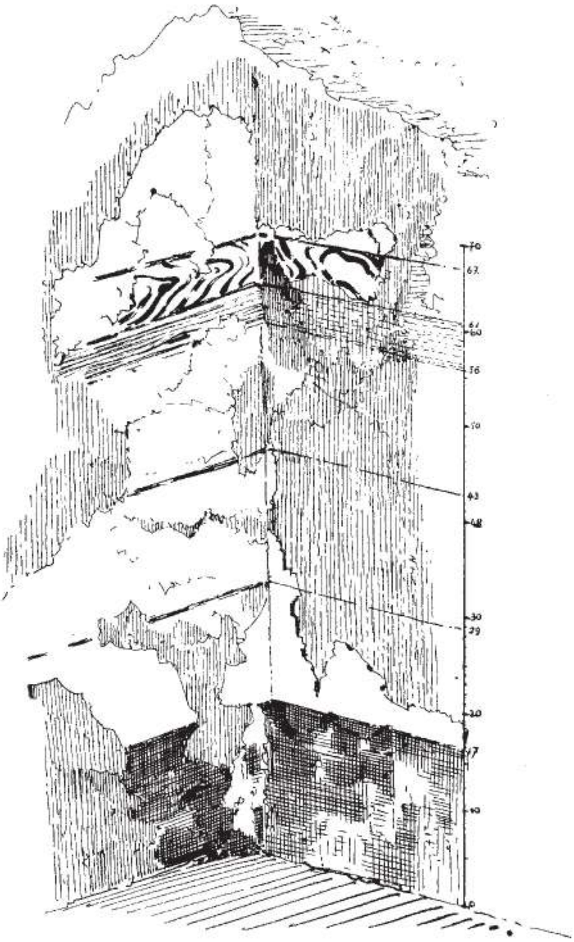

Fig. 3 Mural decoration of Room H in the 'House of the Frescoes' at Knossos.

style of this period with its trichromy of black, white and red (as the accentuating third colour), their light, dark and red hues are highly variable and ornamental in character and can hardly be taken in a literal sense.[30]

More fruitful is the evidence provided by the well-preserved architectural remains from Akrotiri on Thera. In this settlement a rough mud plaster in grey, yellowish or reddish is preserved *in situ* on the exterior façades of several town houses.[31] The south façade of building Xesté 3, for example, was covered in its lower part with lime plaster

30 Blakolmer 2004, 62; Blakolmer 2015, 23.

31 Palyvou 1999b, 180–188; Palyvou 2005a, 117–118, fig. 162; Palyvou 2005b, 189; Doumas 1983, 53; S. Marinatos 1968, 42; Sinos 1987, 305, 311–312; Morgan 1988, 73–74; Nörling 1995, 20.

Fig. 4 Mural painting in Xesté 3 at Akrotiri, Thera.

Fig. 5 Reconstruction of the palace at Knossos after Allan Klynne, 1998.

and yellow/orange paint,[32] whereas the north façade of the 'House of the Ladies' was covered with a reddish lime plaster coat.[33] As on Crete, stucco with traces of red and

32 Palyvou 1999b, 181–182, fig. 87; Palyvou 2000, 431 with n. 11; Palyvou 2005b, 189; Doumas 1996, 170–171.

33 Palyvou 1999b, 181; Palyvou 2000, 431 n. 11.

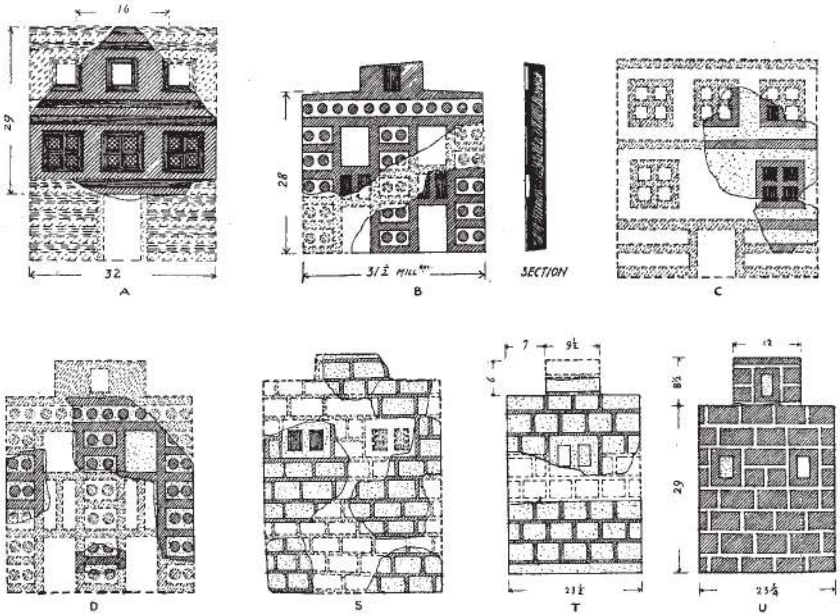

Fig. 6 Several plaques of the 'Town mosaic' from Knossos.

orange was found in the interstices of ashlar blocks at Akrotiri, for example, on the façade of Xesté 4 (Fig. 7).[34]

Concerning the projecting cornices or architraves in the Aegean, a lime plaster coating is preserved on several façades in Akrotiri.[35] Large-scale stucco relief fragments found in the 'Blocked Corridor' in the palace of Knossos represent projecting cornices separating two superimposed relief friezes in the interior room (Fig. 8).[36] Although they formed part of iconographical scenes in the inner-room, they could well reflect the appearance of such structural features on actual outer façades. It is remarkable that only the middle one of the three projecting cornices was accentuated by a painted decoration, namely a dentate band of alternating blue and dark grey zones, a common border motif that is also well-known as a framing ornament of Aegean mural paintings and textile garments.[37] Other fragments of stucco reliefs of architectural character from the interior decoration mostly present their unpainted white surfaces.[38]

34 Palyvou 1999b, 181, 183–185, figs. 90–91; Palyvou 2005b, 191 n. 33.

35 Palyvou 1999b, 185–186, fig. 92.

36 A. J. Evans 1900/1901, 88–90; A. Evans 1921, 687–688, fig. 506; A. Evans 1930, 514, fig. 359; Fyfe 1903, 116, fig. 28–29; Kaiser 1976, 281, fig. 457.

37 Blakolmer 2000a.

38 Kaiser 1976, 265, 275–276.

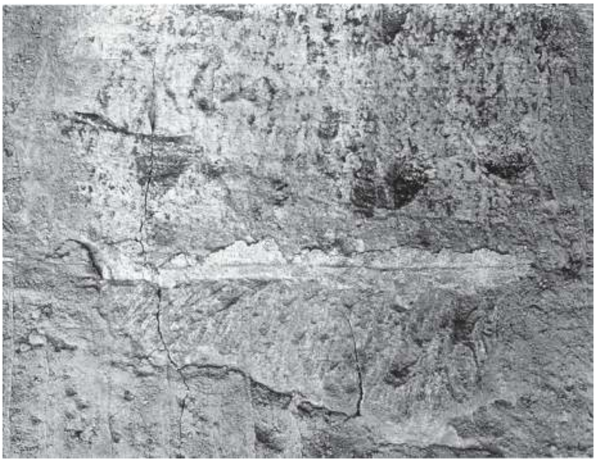

Fig. 7 Façade of Xesté 4 at Akrotiri, Thera.

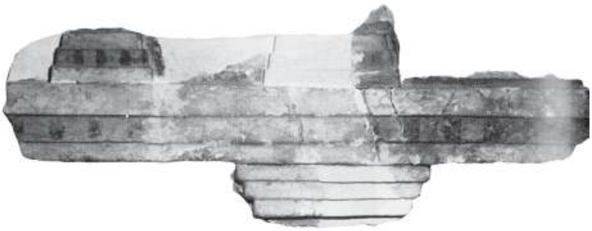

Fig. 8 Architrave in stucco relief from the 'East Hall' at Knossos.

A distinct problem is the design of architectural façades in inner courts of palaces and houses in the Aegean. Here, painted plaster is preserved slightly more frequently than on exterior façades as is demonstrated by examples in Mochlos,[39] in the form of red and grey painting in a light-well in the palace of Phaistos[40] and painted stripe decoration at Palaikastro.[41] In the palace of Mycenae the dado zone of the ashlar murals in the 'Great Court' in front of the 'megaron' was plastered and decorated with a polychrome half-rosette frieze (Fig. 9).[42]

Painted plaster also decorated the open entrance hall of the 'megaron' at Mycenae,[43] and this has been observed in the case of the projecting *antae* of the 'megaron' at Tiryns as well.[44] The murals as well as the floor of the so-called 'Queen's Court' in the palace of

39 Seager 1909, 301.
40 Pernier 1935, 262.
41 Bosanquet 1901/1902, 315; Bosanquet 1902/1903, 288, 291; Bosanquet and Dawkins 1923, 148.
42 Wace and Lamb 1921/1923a, 191–192, fig. 37; Wace 1949, 76, figs. 30, 89 d, 90 a.
43 Wace and Lamb 1921/1923b, 234–235, fig. 46, pl. XXXV a; Hult 1983, 52.
44 Dörpfeld 1886, 301; Siedentopf 1975, 117; Küpper 1996, 113–114.

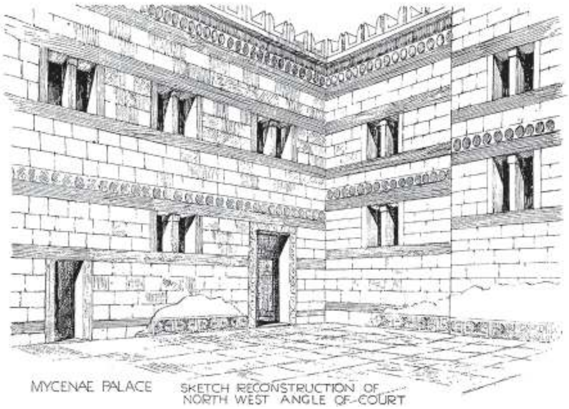

Fig. 9 Reconstruction of the 'Great Court' in the palace of Mycenae.

Pylos possessed a thick plaster coating[45] and were possibly covered by a roof for shade.[46] These and further observations make it reasonable to conclude that, in the Aegean understanding, inner courts were seen as part and parcel of the interior architecture instead of an exterior space, which makes their decoration with painted plaster very plausible. Thus, the conclusion drawn by Robert C. Bosanquet, "we have to imagine the upper storeys of 'Mycenaean' Palaikastro painted like Modern Greek churches with red and yellow stripes",[47] might have been premature.

The same also seems to apply to interior paintings in Minoan *stoai*, although these paintings were visible even from outside the building. The interior back wall of the *stoa* at Kommos, for example, presented painted mural decoration,[48] and painted plaster has also been reported from the *stoa* at Ayia Triada.[49] This type of architectonic space belongs, without any doubt, to the interior of a building and cannot be attributed to the exterior façade of the respective buildings.

Although it is typical of Aegean architecture that exterior walls never display iconographical scenes and ornamental motifs,[50] ornamental friezes framing selected entrances might have constituted a possible exception. While ornamental zones of running spirals or rosettes framing the doors as reconstructed in the palace at Knossos are not attested by actual fresco finds in domestic architecture,[51] this feature is evidenced, at least indirectly, for example, by the entrances to Mycenaean *tholos* and chamber tombs.[52] Furthermore, a Mycenaean terracotta house model from the Menelaion shows a volute-like pattern

45 Blegen and Rawson 1966, 208.
46 Kilian 1984, 42.
47 Bosanquet 1901/1902, 315.
48 M. C. Shaw 2006, 220–229, 1080–1081, pls. 2.40–41.
49 Privitera 2015, 88.
50 Hood 1978, 86.
51 Cameron 1974, 207.
52 Long 1974, 53 n. 77; Kontorli-Papadopoulou 1987, 152–153, pl. XLV; Sgouritsa 2011, 737–753.

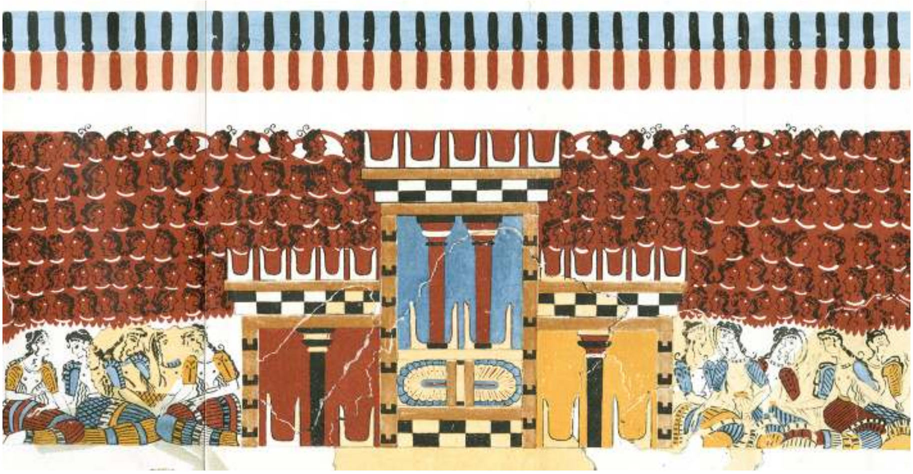

Fig. 10 Miniature frieze from Knossos.

or a horizontal spiral frieze on its façade[53] similar to one depicted on the (sepulchral?) building represented on the painted sarcophagus from Ayia Triada.[54] Further evidence of this meaningful variant of decoration of the façade of ritual architecture is provided by the representation of a shrine on the 'Shrine rhyton' from Kato Zakros[55] and in the mural paintings in Xesté 3 at Akrotiri (see Fig. 4).[56] However, the contexts and functions of this decoration on Minoan and Mycenaean façades suggest that this distinct form of exterior decoration was anything but typical of Aegean secular as well as palatial architecture. In contrast, it could have marked the entrance of selected sacred and sepulchral monuments and might therefore be seen merely as the exception proving the rule.

To briefly summarise these observations, the question arises whether this evidence really suffices to claim that Aegean exterior façades were in their totality artificially coloured in deep red, blue or yellow, so that this colouration became a stereotypical characteristic of architectural representations in Minoan, Cycladic and Mycenaean iconography (see Figs. 1 and 10).

Neither the frequency nor the vivid colours as represented in images are clearly attested by the archaeological evidence; and even at Akrotiri on Thera, despite the mostly excellent state of preservation of its architecture, many façades remained unplastered and unpainted.[57] The plastered interstices of the ashlar blocks, most probably, left the

53 Catling 1989, 173, pl. 35; Catling 2009, 276–278, Ill. 23–24, pl. 117; Schoep 1994, 202.

54 Long 1974, 49–50, pl. 19; Militello 1998, 159, pl. 14 a.

55 Platon 1971, 164, Col. pl. 77.

56 Vlachopoulos 2015, 59, fig. 14 d.

57 Palyvou 1999b, 181–182.

Fig. 11 Mural painting showing beam-ends from the palace of Pylos.

original stone surfaces visible, a fact that clearly contradicts the depictions of polychrome ashlar masonry in Aegean art. The predominance of façades resembling the elaborate ashlar walls in images does not correlate to the archaeological reality either; this could be explained only by postulating plastered outer walls with painted or incised interstices in order to imitate ashlar blocks in a sort of *trompe l'œil*, which appears highly speculative in light of the actual evidence.[58] As a consequence, Jörg Schäfer could have been right when he concluded: "Die gelbe, blaue und rote Farbe der Bauten ist sicherlich weitgehend wirklichkeitsfremd."[59]

When considering the colouration of further architectural elements, a prominent example is the red filling of the windows on some plaques of the 'Town mosaic' from Knossos (Fig. 6).[60] Evans's interpretation of them as translucent, oiled, parchment-like material[61] is as dubious as the proposal of viewing them as curtains[62] or painted window shutters.[63] As already mentioned above, the most probable explanation of the red windows on these faience plaques is the purely decorative character of the accentuating red hue according to the ornamental use of colours in the Kamares style.

The row of round beam heads, reflecting the ends of beams dividing the storeys and transversally reinforcing rubble masonry or mud-brick walls,[64] forms a further structural element in Aegean images. Their representation in red, yellow or blue was interpreted

58 Contra: Charbonneaux 1928, 357.

59 Schäfer 1977, 15; see also Nörling 1995, 10, 15, 44. "The yellow, blue and red colouring of the buildings is certainly largely fictive." (translation David A. Warburton).

60 A. Evans 1930, 342; Müller 1915, 268; Doumas 1983, 52; Morgan 1988, 77, 79–81.

61 A. J. Evans 1901/1902, 18–19; A. Evans 1930, 342; Müller 1915, 268; Foster 1979, 107.

62 Foster 1979, 107.

63 Lawrence 1957, 27; Immerwahr 1990, 67. Contra: Palyvou 1999b, 406–407; Palyvou 2005b, 196.

64 A. Evans 1921, 221; Lang 1969, 18; Morgan 1988, 75–77; Crowley 1989, 169–170; Nörling 1995, 18–19; Demakopoulou et al. 1996, 29, fig. 63; Palyvou 2005b, 190; Devolder 2005/2006; Bietak, Rüden, et al. 2012/2013, 139, fig. 6; Iakovidis 2013, 237.

as plastered and painted covering of wooden beam-ends[65] or as their revetment with discs of terracotta or stone.[66] The hitherto meagre archaeological evidence is provided by faience discs with rosettes coloured in red-brown and pale green from the throne-room of the palace at Knossos[67] which, however, could also belong to some decorative installation in the interior of the room. Interestingly enough, mural painting fragments from Corridor 45 of the Mycenaean palace at Pylos represent at least six discs with a diameter of 32 cm which were painted alternately in brown and black and which were accompanied by a zone imitating a wooden beam (Fig. 11).[68]

Although this obvious imitation of the entablature in real scale could well reflect the painting of wooden beam-ends, it is remarkable that the colours used come close to the natural appearance of wood[69] and are by no means as glaringly bright as in small-scale representations of architecture in Aegean art. In contrast to that, comparable circles painted in blue on plastered stone blocks are known from the building Xesté 3 in Akrotiri[70] and the large-scale imitation of a rectangular beam head in the so-called 'Caravanserai' at Knossos was painted in blue as well.[71] As one would expect, in the terracotta models of architecture the beam-ends were executed mainly as red dots and circles and therefore hardly give us any reliable information on their real colouration.

A prominent architectural element iconographically represented in variegated colours is the Aegean column consisting of a wooden shaft tapering downwards and standing on a low stone base.[72] Arthur Evans's reconstruction of the columns in his 'Palace of Minos' in red, yellow, white and black was based exclusively on the rich evidence of brightly coloured columns in mural paintings and terracotta house models from Knossos (Fig. 10).[73] Not untypical of the archaeological approach in the early 20th century, Evans's architect, Theodore Fyfe, interpreted Minoan columns painted in orange as representing the original colour of wood and perceived those painted in black as made of "old and seasoned wood".[74] Nevertheless, the predominant opinion to date is the assumption that they were plastered and painted wooden shafts.[75] Leaving aside a few charred remains of wood,[76] the only material evidence of wooden columns is provided

65 Fyfe 1903, 113–114, 124; A. Evans 1921, 221; Lang 1969, 18; Morgan 1988, 76; Nörling 1995, 18–19.

66 True 2000, 347.

67 Evans 1899/1900, 41–42; A. Evans 1935, 940–941, fig. 912.

68 Lang 1969, 11, 136, 145, 153–154 (14 F 45), pls. 89, 137, J; Immerwahr 1990, 145, 200 (Py no. 26); Palyvou 2005b, 190; cf. also Aravantinos and Fappas 2015, 334–335, fig. 13.

69 Lang 1969, 136.

70 Palyvou 1999b, 183–184, fig. 89; Palyvou 2000, 430; Palyvou 2005b, 190.

71 A. Evans 1928, 108, fig. 49.

72 Nörling 1995, 50–51; Küpper 1996, 97, 113; Eichinger 2004; J. W. Shaw 2009, 79–86.

73 A. J. Evans 1900/1901, 2; A. J. Evans 1904/1905, 25; A. Evans 1921, 343, 443; Schoep 1994, 192, 194, 200–202, figs. 16–21; Palyvou 2003, 217–218, 227.

74 Fyfe 1903, 114, 127; Lang 1969, 136.

75 Wurz 1913, 32; Nörling 1995, 50–51; Küpper 1996, 96–98, 113.

76 A. Evans 1921, 342–344; A. Evans 1928, 692; J. W. Shaw 2015, 77–81, fig. 3.20.

Fig. 12 Stucco ring around column base in the palace of Pylos.

by some bronze plates with nails found in the 'megaron' of the palace at Mycenae.[77] Although they clearly confirm the existence of bronze fittings at the bottom of a wooden shaft, they may well have constituted a unique instance of a repair rather than a feature common to the decoration of Aegean columns.[78] In the palace of Pylos the imprints of the concave fillets of wooden columns are preserved in several stuccoed rings where the shafts were inserted (Fig. 12);[79] several of these low base rings were coloured in red which, however, does not inform us about the colouring of the wooden shafts themselves.

Thus, the question arises: is the reconstruction of brightly coloured Aegean columns as represented in images really defensible? Or could it be that the 'language of images' deceives us by simulating polychromy on a structural feature which, in fact, was not actually originally decorated with applied colour?

In concluding the archaeological evidence, it has to be emphasised that we can indeed find several hints for shaping our imagination of how architecture in the Aegean Bronze Age might have appeared. This image, however, hardly corresponds with the

77 Tsountas 1888, 66–67; Wace 1921/1923, 243–244; Iakovidis 1983, 61; Küpper 1996, 96–97.

78 Cf. a bronze sheet decorating the capital of a wooden column of the archaic period in Olympia: Hampe 1938.

79 Blegen and Rawson 1966, 56–57, fig. 47; Küpper 1996, 96–98; see also an example in Tiryns: Müller 1930, 128 with n. 1.

iconography of brightly coloured house façades and further architectural elements. Although several examples of plaster coating and also occasional traces of paint can be adduced, the evidence remains disparate and some indications even argue against the artificial covering of stone, wood and other building materials. It must be stressed that, from the methodological point of view, it is difficult to prove the existence of coloured façades to the same degree as to disprove it on the basis of the archaeological record. However, even if architectonic elements were plastered and painted to a large extent, it is doubtful that they correlated with the glaringly colourful image of architecture in Aegean mural paintings. As a consequence, instead of understanding the polychromy of architecture in Aegean iconography in a literal sense, as artificially painted buildings, we should envisage possible alternative explanations for the choice of such colours by the artists.

3 An alternative model for explaining the polychromy in the representation of Aegean architecture

Aegean iconography is first and foremost a medium of communication and not a reflection of what we are used to calling 'reality' nowadays. This statement, simple though it may be, could provide the key to an adequate understanding of the brightly coloured architectural façades in Aegean imagery. The selection of colours for depicting distinct objects could be primarily an aesthetic problem rather than one of photographic reproduction.

This principle is well demonstrated by Minoan and Mycenaean painted imitations of gypsum plates in dado zones of interior rooms[80] as well as of stone vases (Fig. 13).[81] By using concentric curves and other abstract geometrical forms in variegated colours, Aegean painters 'translated' their understanding of the polished, plain surfaces of veined gypsum panels into their artistic 'language of colour'. The Aegean understanding of stone as possessing chromatic qualities is also well exemplified by the deliberate play with decorative effects in the floor paving composed of different stone materials such as reddish or bluish schist, creamy limestone, brownish gritstone, veined marble, breccia and conglomerate.[82] That the colour of the building material mattered in Aegean architecture is demonstrated also by the conscious application of varying stone material for column bases and murals:[83] "colours are carefully matched to create intentional effects:

80 Rodenwaldt 1919; Hirsch 1977, 25–27; Niemeier 1996.

81 Mantzourani 1995; Televantou 1996, 144–145, fig. 8; Doumas 1992, 96–97, figs. 63–64; Reusch 1956, 10, no. 29, pl. 10.

82 Schott 1960, 75; J. W. Shaw 1971, 113–114; J. W. Shaw 2009, 28; Dimou, Schmitt, and Pelon 2000; Nörling 1995, 10, 15, 44.

83 A. Evans 1921, 210–111, 370, fig. 268; Driessen 1999b, 232–233.

corner stones alternate from black to red, frames have different colours for each side [...] colour is everywhere" (Clairy Palyvou).[84] All these examples clearly show *how* Aegeans experienced and characterised stone surfaces, namely as heteromorphous, irregular, diversified and brightly polychrome materials. As a consequence, it is obvious that, in these cases, the colours used did not reproduce an artificial colouration of the object itself, in the sense of painted façades, but, instead, colour reflected the surfaces of the stones themselves, their heterogeneity, consistence, brilliance and other visual qualities in encoded form and in an exaggerated, abstract artistic manner.

There is a further argument that strongly suggests that the polychromy of architecture in Aegean art should not be taken as strictly 'realistic.' Non-realistic, abstract, bright colours occur also on many other groups of objects represented in Minoan and Mycenaean iconography.[85] The artistic phenomenon of an abstract colour can be observed, for example, in the depiction of floral motifs such as crocuses and lilies painted in white and red or papyrus plants given in blue and yellow, while the leaves of the olive tree could be rendered in green, red, black and white (Fig. 14).

Although, nowadays, we are inclined to represent the Aegean landscape in green and brown with rocks depicted in grey and the open sky in blue, in Minoan and Mycenaean landscape painting, quite a different choice of colours occur: terrain elements and formalised backgrounds indicating the great outdoors were represented in red, yellow, blue and many other colours (Fig. 1). The contours of the terrain are depicted in an indefinite, imprecise and ambiguous manner and only sporadically can the horizon be defined. Representing the sky was of minor interest, and the colour green is nearly absent in Aegean depictions of nature. Although the sea is mostly rendered in blue, occasionally it can also be reproduced in violet. It has to be emphasised that this style of colouration in Minoan and Mycenaean painting can by no means be explained exclusively by connecting it with the colourful volcanic rocks of the island of Thera-Santorini. Furthermore, for the rendering of animal hides, all colours were utilised irrespective of their connection to what we might call 'reality.' The hides of the bulls were characterised by colourful patches of brown, yellow and black, but also of blue and red, and the glossy bull-horns were painted in white or in blue. In mural paintings from Tiryns the hide of deer was depicted in red, blue, orange and pink, whereas fresco fragments from Tiryns and Pylos show dogs in white, red, blue, black and rose (Fig. 15). The shining bodies of dolphins were depicted with undulated zones painted in yellow, blue, white and red. It is true that one could well apply a coat of plaster or paint to an architectonic façade; however, it is hardly possible to change the natural colour of plants, rocks and animal-skins. Thus, it is possible that the pictorial style of the abstract colouration common in

84 Palyvou 2000, 431–432.

85 Blakolmer 2015, 25–27; Blakolmer [in press].

Fig. 13 'Vase fresco' from the West House of Akrotiri, Thera.

Aegean iconography could also have been applied to architectonic materials and their surfaces consisting of stone, wood and mud plaster.

In the early Greek language written in the syllabic Linear B script on late Mycenaean clay tablets, there exist even several expressions which could well be interpreted in the sense of an abstract colour.[86] The most obvious example is the description of a bull by the

86 Petruševski 1968, 680; Blakolmer 2000b, 228; Blakolmer [in press].

Fig. 14 Mural painting fragment from Knossos.

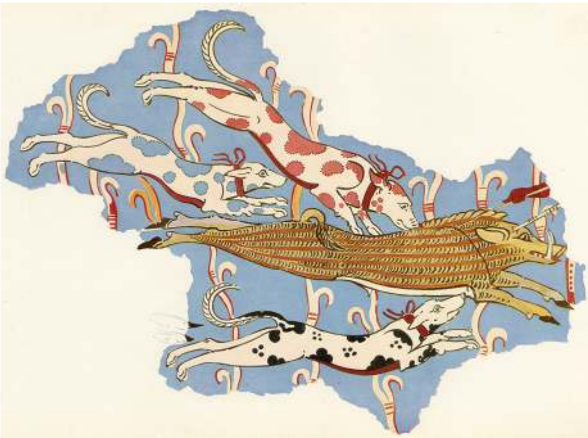

Fig. 15 Fragments of the hunting frieze from Tiryns.

term *wo-no-qo-so* (woinok^{w}-orsos, οἴνοψ-*ορσος), meaning "wine-coloured on its back side".[87] This reminds us of the Homeric formula οἴνοπα πόντον, "the wine-coloured sea".[88] In both cases, it is obvious that this expression points to a wider metaphorical meaning, beyond a positivistic description of bull hides. An abstract, polysemantic meaning may also be attributed to the Linear B description of bulls as *po-da-ko* and *to-ma-ko* (πόδαργος and στόμαργος), meaning "with white or quick legs" and "with a white or swift mouth" respectively.[89] These and further examples demonstrate that, in the Aegean mind, colour itself was not seen as a strictly isolated phenomenon.

87 Gallavotti 1957, 7; Petruševski 1961; Petruševski 1968, 680; Aura Jorro and Adrados 1993, 444. See also Mühlestein 1967.

88 Platnauer 1921, 159; Dürbeck 1977, 188–191.

89 Gallavotti 1957, 7; Petruševski 1968, 680; Heubeck 1974; Aura Jorro and Adrados 1993, 360.

4 Conclusion

To sum up: it is obvious that the bright colouration of architecture in imagery informs us about the social and cultural meanings of colour in the Aegean Bronze Age. While the inner courts and interior rooms and stoai may have been elaborately painted, there is little archaeological evidence that the outer façades were similarly decorated. Yet, representations of the external architecture hint at decoration. However, there is a high probability that the colours used by Aegean painters for depicting outer architectonic façades and further structural features were not chosen in order to faithfully reproduce actually painted architecture, but for reflecting the heterogeneous materials and the character of their surfaces in an expressive style, in a word: their 'polychromy'.

According to their 'language of colour and material', the painters tackled the task of reproducing the appearance of the architecture and of reflecting its polychrome character in a style akin to impressionism and expressionism and by using the entire palette of contrasting colours. For the depiction of entire settlements in mural painting, the painters harmonised the colours of single building façades and combined contrasting hues in order to give an overall impression of the ensemble of architectonic façades with their plurality of polychrome materials.

Thus, the colours in architectural representations of the Aegean, probably, did not literally reproduce how the buildings really were constructed, in a strictly positivistic sense; instead, they might reflect how Minoans and Mycenaeans perceived them in the light of their surfaces, materials and colours – a distinct aesthetic sensibility and an intellectual attitude towards the natural environment which basically differs from that of modern times in that it points to describing things by feeling and experiencing instead of operating with strictly positivistic classifications. Gloss and glows, heteromorphics and irregularity, change and movement, i.e. the polychrome appearance of different materials and their surfaces, probably can be considered, at least, as one methodological key to our understanding of ancient chromatics.

Obviously, our modern standardising and strict categorisation of colours hardly corresponds to the Aegean understanding of forms and colours, which was dominated by the attraction provided by heteromorphous materials, irregular shapes and polychromy. Metaphorical physical 'abstraction' must have constituted a pervasive issue in the Aegean access to light and colour as well as categories such as movement and change. This phenomenon also results from the special use of early Greek colour terms as well as from the visual arts in classical antiquity and in several other cultures, and thus points to the otherness and strangeness of the approach to colour and light in the Aegean Bronze Age in comparison to our modern times. The modern understanding of colour with its cold green as well as dead brown and blue colour shades, comparable to that of Roman paintings,[90] underwent the occidental tradition of clarification and intellectual emancipation from the emotional feeling of colours. Thus, the chromatics of the Bronze Age Aegean can appear to the modern eye today, at first sight, only as incomprehensible and full of contradictions.

90 Blakolmer 2015, 20–21, figs. 1–2.

Bibliography

Alexopoulos 2008
Georgios Alexopoulos. “Το ιερό και το μιαρό. Συμβολική και λειτουργική επιβεβαίωση μιας κοινότητας”. In *Ακρωτήρι Θήρας. Τριάντα χρόνια έρευνες, 1967–1997, Επιστημονική συνάντηση, 19–20 Δεκεμβρίου 1997*. Ed. by C. G. Doumas. Athens: He En Athenais Archaiologike Hetaireia, 2008, 367–422.

Aravantinos and Fappas 2015
Vassilis Aravantinos and Ioannis Fappas. “The Mycenaean Wall Paintings of Thebes. From Excavation to Restoration”. In *Mycenaean Wall Painting in Context. New Discoveries, Old Finds Reconsidered*. Ed. by H. Brecoulaki, J. L. Davis, and S. R. Stocker. Meletemata 72. Athens: National Hellenic Research Foundation, 2015, 316–353.

Aura Jorro and Adrados 1993
Francisco Aura Jorro and Francisco Adrados, eds. *Diccionario griego–español I, Diccionario Micénico II*. Madrid: Consejo superior de investigaciones científicas, Instituto de filologia, 1993.

Bietak, N. Marinatos, and Palivou 2007
Manfred Bietak, Nanno Marinatos, and Clairy Palivou. *Taureador Scenes in Tell el-Dab῾a (Avaris) and Knossos*. Denkschriften Gesamtakademie Wien 43. Vienna: Österreichische Akademie der Wissenschaften, 2007.

Bietak, Rüden, et al. 2012/2013
Manfred Bietak, Constance von Rüden, Johannes Becker, Johannes Jungfleisch, Lyvia Morgan, and Erico Peintner. “Preliminary Report of the Tell El-Dab῾a Wall Painting Project – Season 2011/2012”. *Egypt and the Levant* 22–23 (2012/2013), 131–147.

Blakolmer 2000a
Fritz Blakolmer. *Das minoisch-mykenische ‚Zahnornament‘ und die ionischen Apatourien. Eine farbengeschichtliche Vermutung*. Forum Archaeologiae. Zeitschrift für klassische Archäologie 14. Mar. 2000. URL: http://farch.net (visited on 30/06/2016).

Blakolmer 2000b
Fritz Blakolmer. “Zum Charakter der frühägäischen Farben. Linear B und Homer”. In *Österreichische Forschungen zur Ägäischen Bronzezeit 1998. Akten der Tagung am Institut für Klassische Archäologie der Universität Wien, 2.–3. Mai 1998*. Wiener Forschungen zur Archäologie 3. Vienna: Phoibos, 2000, 225–239.

Blakolmer 2004
Fritz Blakolmer. “Colour in the Aegean Bronze Age. From Monochromy to Polychromy”. In *Colour in the Ancient Mediterranean World, Conference, University of Edinburgh, 10th–13th September 2001*. Ed. by L. Cleland, K. Stears, and G. Davies. British Archaeological Reports, International Series 1267. Oxford: Archaeopress, 2004, 61–67.

Blakolmer 2015
Fritz Blakolmer. “La couleur dans l’iconographie minoenne et mycénienne. Formes artistiques et réalité visuelle”. *Studi micenei ed egeo-anatolici* N.S. 1 (2015), 19–41.

Blakolmer [in press]
Fritz Blakolmer. “Des couleurs fantastiques. Fonctions expressives et valeurs abstraites des couleurs dans l’iconographie et les textes en Égée minoenne et mycénienne”. In *Les couleurs dans l’Antiquité, MOM, Lyon, 15–17 décembre 2015*. Ed. by I. Boehm and B. Helly. In press.

Blegen and Rawson 1966
Carl W. Blegen and Marion Rawson. *The Palace of Nestor at Pylos in Western Messenia I*. Princeton: Princeton University Press, 1966.

Bosanquet 1901/1902
Richard C. Bosanquet. “Excavations at Palaikastro I”. *Annual of the British School at Athens* 8 (1901/1902), 286–316.

Bosanquet 1902/1903
Richard C. Bosanquet. “Excavations at Palaikastro II”. *Annual of the British School at Athens* 9 (1902/1903), 274–387.

Bosanquet and Dawkins 1923
Robert C. Bosanquet and Richard M. Dawkins. *The Unpublished Objects from the Palaikastro Excavations 1902–9, Part I*. British School at Athens, Supplementary Paper 1. London: Macmillan, 1923.

Boulotis 1990
Christos Boulotis. "Villes et palais dans l'art égéen du IIe millénaire av. J.-C." In *L'habitat égéen préhistorique. Actes de la Table Ronde internationale organisé par le CNRS, l'Université de Paris I et l'École française d'Athènes (Athènes, 23–25 juin 1987)*. Ed. by P. Darcque and R. Treuil. Bulletin de correspondance hellénique, Suppl. 19. Athens: École française d'Athènes, 1990, 421–459.

Cameron 1974
Marc Cameron. "A General Study of Minoan Frescoes with Particular Reference to Unpublished Wall Paintings from Knossos I". Phil. Diss., University of Newcastle-upon-Tyne. 1974.

Cameron and Hood 1971
Marc Cameron and Sinclair Hood, eds. *Sir Arthur Evans' Knossos Fresco Atlas*. Farnborough: Gregg Press, 1971.

Catling 1989
Hector W. Catling. "A Late Bronze Age House- or Sanctuary-model from the Menelaion, Sparta". *Annual of the British School at Athens* 84 (1989), 171–175.

Catling 2009
Hector W. Catling. *Sparta. Menelaion I. The Bronze Age*. British School at Athens, Supplementary Volume 15. London: The British School at Athens, 2009.

Charbonneaux 1928
Jean Charbonneaux. "Notes sur l'architecture et la céramique du palais de Mallia". *Bulletin de correspondance hellénique* 52 (1928), 347–387.

Crowley 1989
Janice L. Crowley. *The Aegean and the East. An Investigation into the Transference of Artistic Motifs between the Aegean, Egypt, and the Near East in the Bronze Age*. Studies in Mediterranean Archaeology, Pocket-Book 51. Jonsered: P. Aströms, 1989.

Dandrau 1997
Alain Dandrau. "La construction en terre dans le monde égéen protohistorique. Les matériaux et leurs propriétés". Phil. Diss., Paris I. 1997.

Darcque 2005
Pascal Darcque. *L'habitat mycénien. Formes et fonctions de l'espace bâti en Grèce continentale à la fin du IIe millénaire avant J.-C.* Bibliothèques des Écoles Françaises d'Athènes et de Rome 319. Paris: École française d'Athènes, 2005.

Demakopoulou et al. 1996
Katie Demakopoulou, Nicoletta Divari-Valakou, Paul Aström, and Gisela Walberg. "Excavations in Midea 1994". *Opuscula Atheniensia* 21 (1996), 13–32.

Devolder 2005/2006
Maud Devolder. "From the Ground Up. Earth in Minoan Construction Techniques, the Case of Building 5 at Palaikastro". *Aegean Archaeology* 8 (2005/2006), 65–80.

Dimou, Schmitt, and Pelon 2000
Eleftheria Dimou, Anne Schmitt, and Olivier Pelon. "Recherches sur les matériaux lithiques utilisés dans la construction du palais de Malia. Étude géologique". *Bulletin de correspondance hellénique* 124 (2000), 435–457.

Dörpfeld 1886
Wilhelm Dörpfeld. "Die Bauwerke von Tiryns". In *Tiryns. Der prähistorische Palast der Könige von Tiryns*. Ed. by H. Schliemann. Leipzig: Brockhaus, 1886, 200–352.

Doumas 1983
Christos G. Doumas. *Thera. Pompeii of the Ancient Aegean*. London: Idryma Theras Petros M. Nomikos, 1983.

Doumas 1992
Christos G. Doumas. *The Wall-Paintings of Thera*. Athens: Thera Foundation, 1992.

Doumas 1996
Christos G. Doumas. "Ανασκαφή Ακρωτηρίου Θήρας". *Praktika* 1993 (1996), 164–187.

Driessen 1989/1990
Jan Driessen. "The Proliferation of Minoan Palatial Architectural Style. (I) Crete". *Acta Archaeologica Lovaniensia* 28–29 (1989/1990), 3–23.

Driessen 1999a
Jan Driessen. "'The Archaeology of a Dream'. The Reconstruction of Minoan Public Architecture". *Journal of Mediterranean Archaeology* 12 (1999), 121–127.

Driessen 1999b
Jan Driessen. "The Dismantling of a Minoan Hall at Palaikastro (Knossians Go Home?)" In *Meletemata. Studies in Aegean Archaeology Presented to Malcolm H. Wiener as He Enters His 65th Year, 1*. Ed. by P. P. Betancourt, V. Karageorghis, R. Laffineur, and W.-D. Niemeier. Aegaeum 20. Liège and Austin: Histoire de l'art et archéologie de la Grèce antique, Université de Liège, 1999, 227–235.

Dürbeck 1977
Helmut Dürbeck. *Zur Charakteristik der griechischen Farbenbezeichnungen*. Bonn: Habelt, 1977.

Eichinger 2004
Wolfgang Eichinger. *Die minoisch-mykenische Säule. Form und Verwendung eines Baugliedes der ägäischen Bronzezeit*. Hamburg: Verlag Dr. Kovac, 2004.

Evans 1899/1900
Arthur J. Evans. "Knossos I. The Palace". *Annual of the British School at Athens* 6 (1899/1900), 3–70.

A. J. Evans 1900/1901
Arthur J. Evans. "The Palace of Knossos". *Annual of the British School at Athens* 7 (1900/1901), 1–120.

A. J. Evans 1901/1902
Arthur J. Evans. "The Palace of Knossos". *Annual of the British School at Athens* 8 (1901/1902), 1–124.

A. J. Evans 1904/1905
Arthur J. Evans. "The Palace of Knossos and Its Dependencies". *Annual of the British School at Athens* 11 (1904/1905).

A. Evans 1921
Arthur Evans. *The Palace of Minos at Knossos I*. London: Macmillan, 1921.

A. Evans 1928
Arthur Evans. *The Palace of Minos at Knossos II*. London: Macmillan, 1928.

A. Evans 1930
Arthur Evans. *The Palace of Minos at Knossos III*. London: Macmillan, 1930.

A. Evans 1935
Arthur Evans. *The Palace of Minos at Knossos IV*. London: Macmillan, 1935.

Foster 1979
Karen Polinger Foster. *Aegean Faience of the Bronze Age*. New Haven and London: Yale University Press, 1979.

Fyfe 1903
Theodore Fyfe. "Painted Plaster Decoration at Knossos. With Special Reference to the Architectural Schemes". *Journal of the Royal Institute of British Architects* 10 (1903), 107–131.

Gallavotti 1957
Carlo Gallavotti. "Nomi di colori in miceneo". *La parola del passato* 52 (1957), 5–22.

Graham 1962
James W. Graham. *The Palaces of Crete*. Princeton: Princeton University Press, 1962.

Hampe 1938
Roland Hampe. "Ein bronzenes Beschlagblech aus Olympia". *Archäologischer Anzeiger* (1938), 360–369.

Heaton 1911
Noel Heaton. "Minoan Lime Plaster and Fresco Painting". *Journal of the Royal Institute of British Architects* 18 (1911), 697–710.

Heubeck 1974
Alfred Heubeck. "Mykenisch PO-DA-KO und TO-MA-KO". *Kadmos* 13 (1974), 39–43.

Hirsch 1977
Ethel S. Hirsch. *Painted Decoration of the Floors of the Bronze Age Structures on Crete and the Greek Mainland*. Studies in Mediterranean Archaeology 53. Gothenburg: P. Åströms, 1977.

Hitchcock 2000
Louise A. Hitchcock. *Minoan Architecture. A Contextual Analysis*. Studies in Mediterranean Archaeology, Pocket-Books 155. Jonsered: P. Åströms, 2000.

Hood 1978
Sinclair Hood. *The Arts in Prehistoric Greece*. Harmondsworth: Penguin, 1978.

Hult 1983
Gunnel Hult. *Bronze Age Ashlar Masonry in the Eastern Mediterranean. Cyprus, Ugarit, and Neighbouring Regions*. Studies in Mediterranean Archaeology 66. Gothenburg: P. Aströms, 1983.

Iakovidis 1983
Spyros E. Iakovidis. *Late Helladic Citadels on Mainland Greece*. Monumenta Graeca et Romana 4. Leiden: Brill, 1983.

Iakovidis 2013
Spyros E. Iakovidis. *Ανασκαφές Μυκηνών IV, Η οικία στις Πλάκες*. Athens: He En Athenais Archaiologike Hetaireia, 2013.

Immerwahr 1990
Sara A. Immerwahr. *Aegean Painting in the Bronze Age*. University Park, PA, and London: Pennsylvania State University Press, 1990.

Kaiser 1976
Bernd Kaiser. *Untersuchungen zum minoischen Relief*. Bonn: Habelt, 1976.

Kilian 1984
Klaus Kilian. "Pylos. Funktionsanalyse einer Residenz der späten Palastzeit". *Archäologisches Korrespondenzblatt* 14 (1984), 37–48.

Klynne 1998
Allan Klynne. "Reconstructions of Knossos. Artists' Impressions, Archaeological Evidence and Wishful Thinking". *Journal of Mediterranean Archaeology* 11.2 (1998), 206–229.

Kontorli-Papadopoulou 1987
Litsa Kontorli-Papadopoulou. "Some Aspects Concerning Local Peculiarities of the Mycenaean Chamber Tombs". In *Thanatos. Les coutumes funéraires en Égée à l'Âge du Bronze. Actes du colloque de Liège (21–23 avril 1986)*. Ed. by R. Laffineur. Aegaeum 1. Liège: Histoire de l'art et archéologie de la Grèce antique, Université de Liège, 1987, 145–160.

Krattenmaker 1995
Kathleen Krattenmaker. "Architecture in Glyptic Cult Scenes. The Minoan Examples". In *Sceaux minoens et mycéniens. IVe symposium international, 10–12 septembre 1992, Clermont-Ferrand*. Ed. by I. Pini and J.-C. Poursat. Corpus der minoischen und mykenischen Siegel, Beiheft 5. Berlin: Mann, 1995, 117–133.

Küpper 1996
Michael Küpper. *Mykenische Architektur. Material, Bearbeitungstechnik, Konstruktion und Erscheinungsbild*. Internationale Archäologie 25. Espelkamp: Marie Leidorf, 1996.

Lang 1969
Mabel L. Lang. *The Palace of Nestor at Pylos in Western Messenia II. The Frescoes*. Princeton: Princeton University Press, 1969.

Lawrence 1957
Arnold W. Lawrence. *Greek Architecture*. Harmondsworth: Penguin, 1957.

Long 1974
Charlotte R. Long. *The Ayia Triadha Sarcophagus. A Study of Late Minoan and Mycenaean Funerary Practices and Beliefs*. Studies in Mediterranean Archaeology 41. Gothenburg: P. Aströms, 1974.

MacGillivray et al. 1987
Jeremy A. MacGillivray, L. Hugh Sackett, Jan Driessen, and D. Smyth. "Excavations at Palaikastro, 1986". *Annual of the British School at Athens* 82 (1987), 135–154.

Mantzourani 1995
Eleni Mantzourani. "Notes on the Depiction of Various Types of Vases and Vessels in Aegean Wall-Painting". In *Klados. Essays in Honour of J. N. Coldstream*. Ed. by C. Morris. London: University of London, 1995, 123–141.

N. Marinatos 2016
Nanno Marinatos. "Myth, Ritual, Symbolism and the Solar Goddess in Thera". In *Metaphysis. Ritual, Myth and Symbolism in the Aegean Bronze Age. Proceedings of the 15th Aegean Conference, Vienna*. Ed. by E. Alram-Stern, F. Blakolmer, S. Deger-Jalkotzy, R. Laffineur, and J. Weilhartner. Aegaeum 39. Leuven and Liège: Peeters, 2016, 3–11.

S. Marinatos 1968
Spyridon Marinatos. *Excavations at Thera I*. Athens: He En Athenais Archaiologike Hetaireia, 1968.

McEnroe 2010
John C. McEnroe. *Architecture of Minoan Crete. Constructing Identity in the Aegean Bronze Age*. Austin: University of Texas Press, 2010.

Militello 1998
Pietro Militello. *Haghia Triadha I. Gli affreschi*. Padua: Bottega d'Erasmo, 1998.

Morgan 1988
Lyvia Morgan. *The Miniature Wall Paintings of Thera*. Cambridge and New York: Cambridge University Press, 1988.

Mühlestein 1967
Hugo Mühlestein. "Le nom des deux Ajax". *Studi micenei ed egeo-anatolici* 2 (1967), 41–52.

Müller 1915
Kurt Müller. "Frühmykenische Reliefs aus Kreta und vom griechischen Festland". *Jahrbuch des Deutschen Archäologischen Instituts* 30 (1915), 242–336.

Müller 1930
Kurt Müller. *Tiryns III. Die Architektur der Burg und des Palastes*. Augsburg: B. Filser, 1930.

Niemeier 1996
Wolf-Dietrich Niemeier. "On the Origin of the Mycenaean Painted Plaster Floors". In *Atti e Memorie del Secondo Congresso Internazionale di Micenologia, Roma – Napoli, 14–20 ottobre 1991*. Ed. by E. De Miro, L. Godart, and A. Sacconi. Incunabula Graeca 98.3. Rome: Gruppo editoriale internazionale, 1996, 1249–1253.

Nörling 1995
Thomas Nörling. *Altägäische Architekturbilder*. Archaeologica Heidelbergensia 2. Mainz: Philipp von Zabern, 1995.

Palyvou 1999a
Clairy Palyvou. "Theran Architecture through the Minoan Looking Glass". In *Meletemata. Studies in Aegean Archaeology Presented to Malcolm H. Wiener as He Enters His 65th Year, 1*. Ed. by P. P. Betancourt, V. Karageorghis, R. Laffineur, and W.-D. Niemeier. Aegaeum 20. Liège and Austin: Histoire de l'art et archéologie de la Grèce antique, Université de Liège, 1999, 609–615.

Palyvou 1999b
Clairy Palyvou. *Ακρωτήρι Θήρας. Η οικοδομική τέχνη*. Athens: He En Athenais Archaiologike Hetaireia, 1999.

Palyvou 2000
Clairy Palyvou. "Concepts of Space in Aegean Bronze Age Art and Architecture". In *Proceedings of the First International Symposium 'The Wall Paintings of Thera', 30 August–4 September 1997, 1*. Ed. by S. Sherratt. Athens: Thera Foundation, 2000, 413–436.

Palyvou 2003
Clairy Palyvou. "Architecture and Archaeology. The Minoan Palaces in the Twenty-First Century". In *Theory and Practice in Mediterranean Archaeology. Old World and New World Perspectives. An Advanced Seminar in Honor of Lloyd Cotsen*. Ed. by J. K. Papadopoulos and R. M. Leventhal. Los Angeles: Cotsen Institute of Archaeology at UCLA, 2003, 205–233.

Palyvou 2005a
Clairy Palyvou. *Akrotiri Thera. An Architecture of Affluence 3500 Years Old*. Philadelphia: INSTAP Academic Press, 2005.

Palyvou 2005b
Clairy Palyvou. "Architecture in Aegean Bronze Age Art. Façades with No Interiors". In *Aegean Wall Painting. A Tribute to Mark Cameron*. Ed. by L. Morgan. British School at Athens Studies 13. London: British School at Athens, 2005, 185–197.

Pavúk 2002
Peter Pavúk. "The City on the Slope. Some Observations on Two-Dimensional Representations of Architecture in Aegean Art". In *Mauerschau. Festschrift für Manfred Korfmann I*. Ed. by R. Aslan, S. Blum, G. Kastl, F. Schweizer, and D. Thumm. Remshalden-Grunbach: Greiner, 2002, 567–583.

Pelon 1980
Olivier Pelon. *Le palais de Malia V*. Études Crétoises 25. Paris: Paul Geuthner, 1980.

Pernier 1935
Luigi Pernier. *Il palazzo minoico di Festòs I*. Rome: Libreria dello Stato, 1935.

Pernier and Banti 1951
Luigi Pernier and Luisa Banti. *Il palazzo minoico di Festòs II*. Rome: Libreria dello Stato, 1951.

Petruševski 1961
Mihail D. Petruševski. "Wo-no-qo-so". *Ziva Antika* 11 (1961), 250.

Petruševski 1968
Mihail D. Petruševski. "Les désignations de couleur en grec mycénien". In *Atti e Memorie del 1° Congresso Internazionale di Micenologia*. Ed. by Congresso Internazionale di Micenologia. Rome: Ed. dell'Ateneo, 1968, 680–685.

Platnauer 1921
Maurice Platnauer. "Greek Colour-Perception". *Classical Quarterly* 15 (1921), 153–162.

Platon 1971
Nikolaos Platon. *Zakros. The Discovery of a Lost Palace of Ancient Greece*. New York: Charles Scribner's Sons, 1971.

Privitera 2015
Santo Privitera. "A Painted Town. Wall Paintings and the Built Environment at Late Minoan III Ayia Triada". In *Mycenaean Wall Painting in Context. New Discoveries, Old Finds Reconsidered*. Ed. by H. Brecoulaki, J. L. Davis, and S. R. Stocker. Meletemata 72. Athens: National Hellenic Research Foundation, 2015, 66–90.

Rethemiotakis 2010
Georgios Rethemiotakis. "A Shrine-Model from Galatas". In *Cretan Offerings. Studies in Honour of Peter Warren*. Ed. by O. Krzyszkowska. British School at Athens Studies 18. London: British School at Athens, 2010, 293–302.

Reusch 1956
Helga Reusch. *Die zeichnerische Rekonstruktion des Frauenfrieses im boiotischen Theben*. Abhandlungen der Deutschen Akademie der Wissenschaften zu Berlin. Berlin: Akademie Verlag, 1956.

Rodenwaldt 1912
Gerhart Rodenwaldt. *Tiryns II. Die Fresken des Palastes*. Mainz: Philipp von Zabern, 1912.

Rodenwaldt 1919
Gerhart Rodenwaldt. "Mykenische Studien I. Die Fußböden des Megarons von Mykenai". *Jahrbuch des Deutschen Archäologischen Instituts* 34 (1919), 87–106.

Rodenwaldt 1921
Gerhart Rodenwaldt. *Der Fries des Megarons von Mykenai*. Halle: Niemeyer, 1921.

Sackett and Popham 1965
L. Hugh Sackett and Marvin R. Popham. "Excavations at Palaikastro VI". *Annual of the British School at Athens* 60 (1965), 248–305.

Schäfer 1977
Jörg Schäfer. "Zur kunstgeschichtlichen Interpretation altägäischer Wandmalerei". *Jahrbuch des Deutschen Archäologischen Instituts* 92 (1977), 1–23.

Schoep 1994
Ilse Schoep. "'Home Sweet Home'. Some Comments on the So-Called House Models from the Prehellenic Aegean". *Opuscula Atheniensia* 20 (1994), 189–210.

Schott 1960
Auguste Schott. "Minoische und mykenische Palasthöfe". *Jahreshefte des Österreichischen Archäologischen Instituts* 45 (1960), 68–80.

Seager 1909
Richard Seager. "Excavations on the Island of Mochlos, Crete, in 1908". *American Journal of Archaeology* 13 (1909), 273–303.

Sgouritsa 2011
Naya Sgouritsa. *Remarks on the Use of Plaster in Tholos Tombs at Mycenae. Hypotheses on the Origin of the Painted Decoration of Tombs in Mainland Greece*. Journal/Portal: CSPS Online Publication 2. 2011. URL: http://www.nottingham.ac.uk/csps/documents/honoringthedead/sgouritsa.pdf (visited on 30/06/2016).

J. W. Shaw 1971
Joseph W. Shaw. *Minoan Architecture. Materials and Techniques*. Annuario della scuola archeologica di Atene e delle missioni italiane in oriente 33. Rome: Istituto poligrafico dello stato, 1971.

J. W. Shaw 2009
Joseph W. Shaw. *Minoan Architecture. Materials and Techniques*. Studi di Archeologia Cretese 7. Padua: Bottega d'Erasmo, 2009.

J. W. Shaw 2015
Joseph W. Shaw. *Elite Minoan Architecture. Its Development at Knossos, Phaistos, and Malia*. Prehistory Monographs 49. Philadelphia: INSTAP Academic Press, 2015.

M. C. Shaw 2006
Maria C. Shaw. "Plasters from the Monumental Minoan Buildings. Evidence for Painted Decoration, Architectural Appearance, and Archaeological Event". In *Kommos V. The Monumental Minoan Buildings at Kommos*. Ed. by J. W. Shaw and M. C. Shaw. Princeton and Oxford: Princeton University Press, 2006, 117–235.

Siedentopf 1975
Heinrich B. Siedentopf. "Die Fresken". In *Führer durch Tiryns*. Ed. by U. Jantzen. Athens: Deutsches Archäologisches Institut Athen, 1975, 117–122.

Sinos 1987
Stefan Sinos. "Beobachtungen zur Siedlung von Akrotiri auf Thera und ihrer Architektur". In *Ägäische Bronzezeit*. Ed. by H.-G. Buchholz. Darmstadt: Wissenschaftliche Buchgesellschaft, 1987, 288–313.

Televantou 1996
Christina A. Televantou. "Τα ποικίλα σκεύη των Θηραϊκών τοιχογραφίων. Συμβολή στην τεχνογνωσία του προϊστορικού Αιγαίου". *Archaiologike Ephemeris* 133.1994 (1996), 135–154.

True 2000
Marion True. "The Role of Formal Decorative Patterns in the Wall Paintings of Thera". In *Proceedings of the First International Symposium 'The Wall Paintings of Thera', 30 August–4 September 1997, 1*. Ed. by S. Sherratt. Athens: Thera Foundation, 2000, 345–358.

Tsountas 1888
Christos Tsountas. "Ανασκαφαί Μυκηνών του 1886". *Praktika* 1886 (1888), 59–79.

Vlachopoulos 2008
Andreas Vlachopoulos. "The Wall Paintings from the Xeste 3 Building at Akrotiri. Towards an Interpretation of its Iconographic Programme". In *Horizon. A Colloquium on the Prehistory of the Cyclades, McDonald Institute for Archaeological Research, University of Cambridge, 25–28 March 2004*. Ed. by N. Brodie, J. Doole, G. Gavalas, and C. Renfrew. Cambridge: Stavros Niarchos Foundation, 2008, 451–465.

Vlachopoulos 2015
Andreas Vlachopoulos. "Detecting 'Mycenaean' Elements in the 'Minoan' Wall-Paintings of a 'Cycladic' Settlement. The Wall-Paintings of Thera and Their Iconographic Koine". In *Mycenaean Wall Painting in Context. New Discoveries, Old Finds Reconsidered*. Ed. by H. Brecoulaki, J. L. Davis, and S. R. Stocker. Meletemata 72. Athens: National Hellenic Research Foundation, 2015, 37–65.

Wace 1921/1923
Alan J. B. Wace. "Excavations at Mycenae. The Tholos Tombs". *Annual of the British School at Athens* 25 (1921/1923), 283–402.

Wace 1949
Alan J. B. Wace. *Mycenae. An Archaeological History and Guide*. Princeton: Princeton University Press, 1949.

Wace and Lamb 1921/1923a
Alan J. B. Wace and Winifred Lamb. "Excavations at Mycenae. The Court". *Annual of the British School at Athens* 25 (1921/1923), 188–204.

Wace and Lamb 1921/1923b
Alan J. B. Wace and Winifred Lamb. "Excavations at Mycenae. The Megaron". *Annual of the British School at Athens* 25 (1921/1923), 232–257.

Waterhouse 1994
Helen Waterhouse. "The Knossos 'Town Mosaic' Reconsidered". *Cretan Studies* 4 (1994), 165–174.

Westerburg 2001
Jörg Westerburg. “Ein Rekonstruktionsvorschlag zum Nordostbau des ‘Nestor-Palastes’ in Pylos. Die erste Stoa auf dem griechischen Festland?” *Archäologischer Anzeiger* (2001), 1–12.

Wurz 1913
Erwin Wurz. *Der Ursprung der kretisch-mykenischen Säulen*. Munich: Georg Müller und Eugen Rentsch Verlag, 1913.

Illustration credits

1 After Doumas 1992, 70, fig. 35. **2** After Pernier and Banti 1951, 225, fig. 139. Granted by the Scuola Archeologica Italiana di Atene. **3** After A. Evans 1928, 443, fig. 260. **4** After N. Marinatos 2016, pl. V b. **5** After Klynne 1998, 223, fig. 9. **6** After A. Evans 1921, fig. 226 A–D, S–U (facing p. 306). **7** After Palyvou 2005a, 118, fig. 162. **8** After Kaiser 1976, fig. 457. **9** After Wace 1921/1923, 191, fig. 37. **10** After A. Evans 1930, pl. XVI, facing p. 47. **11** After Lang 1969, pl. 137. Courtesy of The Department of Classics, University of Cincinnati. **12** After Blegen and Rawson 1966, fig. 47. Courtesy of The Department of Classics, University of Cincinnati. **13** After Doumas 1992, 97, pl. 64. **14** After Cameron and Hood 1971, pl. D 3. **15** After Rodenwaldt 1912, pl. XIII.

FRITZ BLAKOLMER

Fritz Blakolmer is Associate Professor at the Department of Classical Archaeology at the University of Vienna, where he teaches Minoan and Mycenaean Archaeology. His main research interests are the arts of the Aegean Bronze Age, the history of research and of artistic reception, colour and its significance in antiquity, and tomb forms of Classical Lycia. He has published widely on all these topics.

Ao. Univ.-Prof. Mag. Dr. Fritz Blakolmer
University of Vienna
Department of Classical Achaeology
Franz Klein-Gasse 1
1190 Vienna, Austria
E-Mail: Fritz.Blakolmer@univie.ac.at

Lydia Pelletier-Michaud

Colour me Greek: Poetic Value, Economy of Language and the Chromatic Vocabulary in Roman Elegy

Summary

In the long quest for the true meaning of ancient colour terms, poetry has often been perceived as an unreliable source. Although scholars have been more sensitive to the complexity of colour use in ancient verse in the last decades, the key role of poetry in ancient conceptions of colours has yet to be fully recognised. As shows the example of adjectives referring to purple dye, the significance of colour terms often lies in the poetic tradition. The ancients themselves considered Homer as the highest authority regarding colour. In Roman elegy, colour semantics are the product of a rich intertextual dialogue with earlier Greek verse. This very process of creative *imitatio* may have played a significant role in the emergence of abstract, modern colour categories.

Keywords: colour terms; Greek; Latin; poetry; Homer; Ovid; purple dye

In frühen Studien zu den Farbenbezeichnungen in der Antike galt oft die Dichtung als unzuverlässige Quelle. Auch wenn die Forschung mittlerweile die Komplexität des Themas Farbe in der antiken Dichtung erkannt hat, wurde der Dichtung als Schlüsselrolle bei der Farbkonzeption bislang wenig Beachtung geschenkt. Dabei belegen beispielsweise Adjektive, die sich auf den Farbstoff Purpur beziehen, ihre Bedeutsamkeit in der poetischen Tradition. Bei den alten Griechen wurde Homer höchste Kompetenz in Bezug auf Farbe zugeschrieben; in der römischen Liebeselegie lässt sich Farbsemantik als Produkt eines intertextuellen Dialogs mit den früheren griechischen Dichtern verstehen. Das Verfahren der kreativen Nachahmung könnte eine bedeutende Rolle bei der Entstehung abstrakter, moderner Farbkategorien gespielt haben.

Keywords: Farbbezeichnungen; Altgriechisch; Latein; Dichtung; Homer; Ovid; Purpurfarbstoff

The author would like to express her warmest thanks to the editors of this volume for their help in refining earlier versions of this paper.

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

1 Making sense of colour in ancient poetry

It was poetry, and more prominently the Homeric epics, which first drew attention to the specifics of colour semantics in ancient cultures: following the remarks on Greek and Latin chromatic vocabulary contained in Goethe's *Farbenlehre*,[1] scholars expressed their astonishment at the colour imagery they found in Homer. Goethe himself had stressed that language was "symbolic, figurative", and the words but a "reflection" of colour.[2] Yet early philologists – such as the later British Prime Minister Gladstone – thought this vocabulary represented the way the Greeks had perceived their environment in the archaic period: a world where there was no blue sky and where the sea was either "grey" (πολιός), "violet-like" (ἰοειδής) or "wine-faced" (οἶνοψ). Ancient Greeks, so they thought, had a hard time coping with colours, for their vocabulary was "immature" and "defective".[3] Maybe their sense of sight was not developed enough to allow them to perceive the whole range of colours?[4] Or maybe, when it came to colour, they simply did not care about accuracy?[5] The first colour-oriented philologists had such a fixed idea of what Homer (8th century BC) should have been seeing that they hardly paid any attention to what he was actually singing. Once these ethnocentric and evolutionary approaches were finally rejected, poetry itself immediately became the next suspect. The specialist of Latin vocabulary, André, made an important step forward when he stated that "perception and denomination are two different things"; but he then went on to add that poets were giving a distorted account of reality, for their emotions were altering their perceptions.[6]

Over the course of the last few decades, the prevailing research angle on colours in the Greco-Roman world has taken a major turn for the better. Historians now generally recognise the fact that they are facing a cultural phenomenon and that the first step towards its understanding should be to be ask ourselves "what did colours mean to the ancients?". Answering this question requires an effort of immersion in another world, one with its own sensibilities, with its own frame of reference: we must distance ourselves from the modern, occidental dominant viewpoints and seek the cultural and affective significances of coloured realities specific to other civilisations. The ongoing debate about colours in antiquity has recently benefitted greatly from new anthropological approaches, such as Bradley's survey on early Roman empire and Grand-Clément's

1 Von Goethe 1810 *(Historischer Teil)*. The famous passage about ancient languages was written by the philologist F. W. Riemer, and not by Goethe himself.

2 Von Goethe 1810 (*Didaktischer Teil*, § 751): "Man bedenkt niemals genug, dass eine Sprache eigentlich nur symbolisch, nur bildlich sei und die Gegenstände niemals unmittelbar, sondern nur im Widerscheine ausdrücke".

3 Gladstone 1858, 457–499; Platnauer 1921, 162; Osborne 1968, 283.

4 Gladstone 1858, 488.

5 Platnauer 1921, 262.

6 André 1949, 11.

exploration of the ancient Greek 'sensory landscape'.[7] Various multidisciplinary collaborations also allowed an enlightening dialogue between archaeological evidence and various literary testimonies.[8]

One consequence of this most welcome renewal is that poetry and semantics no longer stand at the forefront of this research field. Paradoxically, whilst most of the literary sources over which we dispose to study colour terms in ancient cultures are poetry – and although scholars have been increasingly sensible to the richness and sophistication of ancient verse for its use of colour –, there have been few studies focusing on the specificities of poetic language.[9] Philologists from the 19th and 20th centuries often saw poetry as a particularly challenging type of written testimony, which frustrated their thirst for an objective, scientific truth. Viewed from their positivistic perspective, the poetic nature of the sources seemed unfortunate, for it was depriving them of an objective rendering of the material world in which they were produced.[10] But the intuition that science has straight answers concerning colours is, in large part, an illusion. Newton himself, after having made the demonstration that white light is heterogeneous, proposed that it was composed of seven kinds of coloured light, the proportions of which were to be derived from the harmonics of the seven musical tones.[11] Categorising and naming the colours is not an exact science: it is a cultural construct in which, for the Greeks and the Romans at least, poetry certainly played a role of first importance.

In the past, a great deal of philological interest in chromatic vocabulary has expressed an attitude implying that colour terms were part of a rigid system (a colour adjective = a specific hue) and focused on breaking the code. One of the privileged methods was to gather the various instances of a single term through the whole Greek or Latin corpus and try to isolate the meaning that would fit all contexts of use. This approach is of course reductive: it denies the polysemic nature of so-called colour terms and does not take into account the relationships between texts from different periods. Finding the same poetic use of a given colour term in texts separated by centuries does not mean

7 Cf. their respective monographs, Bradley 2009 and Grand-Clément 2011. Both authors are also responsible for numerous engaging articles about more specific issues regarding colours in antiquity.

8 See for example Carastro 2009; Pigeaud 2007; Rouveret, Dubel, and Naas 2006; Cleland, Stears, and Davies 2004; Beta and Sassi 2003 and Villard 2002.

9 Some authors did focus on a poetic corpus: Irwin 1974 presents a thorough survey of the poetic use of κυάνεος and χλωρός – but essentially, her discussion remains a quest for a valid translation for each term. Edgeworth 1992 (drawn from his dissertation of 1974), engaged in a discussion on the literary function of colour terms in Virgil – a pioneering work in many aspects, but giving far too much importance to the so-called 'symbolic' meaning of colours. His steps were followed by Clarke 2003 (on Catullus, Propertius and Horace). Dimakopoulou 2010, despite an outdated bibliography (her book reproduces the text of her thesis of 1980), offers to this day one of the most valid and sensible analyses of the poetic value of a Greek chromatic vocabulary (χλωρός, χλωρηΐς). Grand-Clément's works (cf. *supra*), although not specifically focused on the literary function of colour terms, also proves how much history can benefit from a sensible, literary analysis of poetic sources.

10 See Maxwell-Stuart 1981, 4–5.

11 Newton 1721^3, 134.

that this phrase was 'formulaic' and therefore trivial: to the opposite, it could very well indicate a conscious, meaningful allusion by the more recent author to a predecessor. Letting go of the idea of identifying a precise chromatic meaning for each Latin or Greek colour-term can feel unsatisfactory at first; but as we shall see, it allows a much more far-reaching understanding of ancient sensibilities towards colour.

2 The Roman elegy, or how to write a Greek poem in Latin

When engaging with literary sources, one must be particularly attentive to the nature and function of the studied texts. In the case of Roman elegy, which can be read on many levels, these parameters often remain puzzling. The elegists themselves claim to settle for a minor form of poetry, telling personal, casual stories happening in Rome and celebrating a marginal way of life. But this narrative constitutes essentially a literary statement: elegists reject the heavy structure proper to epic poetry to embrace the aesthetics of the Alexandrines. In fact, Ovid (43 BC – 17/18 AD) and his predecessors produced an ambitious, learned literature, the main subject of which is literary creation itself: elegy is above all a commentary on ancient texts. Like Callimachus (ca. 310–235 BC) and Philetas of Cos (ca. 340–285 BC), whom they claimed as models, Roman elegists practiced *imitatio* as a creative process: they forged their own poetic language using archaic material and took up the mission of endowing the Greek heritage with a Roman reality.[12] Alexandrian authors inspired them for their aesthetics and creative process, but they found their poetic material in the whole Greco-Roman tradition. Homer, whom Hellenistic poets considered to be the ultimate, insuperable model,[13] remained their privileged source.

Colour itself is often the main subject of the elegist's complex imagery: colourful realities, including precious materials such as exotic dyes, appear in similes developed to highlight the beauty of bodies, for example. These comparisons, which at first sight seem to refer to material culture, are above all literary in nature. In order to understand the value and meaning of colour terms used by the Roman elegists, it is necessary to trace their texts back to their Greek models.[14]

This paper will focus on (1) the use of precious materials, especially purple dye, in the elaboration of poetic imagery and (2) the intertextual connections between Greek and Latin references to colour; it will also explore (3) the fluid relationship between coloured materials, poetic canons and colour as an abstract concept, in the texts of Ovid

12 See Pierre 2005 and Dupont 2004, especially about the phrase *ego qui primus*.

13 See Cusset 1999, 163.

14 This approach was followed in my dissertation: Pelletier-Michaud 2016b (supervised by A. Baudou and A. Grand-Clément). The publication is currently in preparation.

in particular; finally, (4) we will see how poetry might have played an important role in the emergence of abstract colour categories.

3 Coloured materials: the corrupting power of purple

In the Roman elegiac corpus, dyes and dyed fabrics are commonly mentioned amongst precious materials such as gold, precious stones, pearls and rare seashells. Women especially covet these luxury products because of their beauty and prestige, which influence their price, along with their rarity and exotic origin.[15] Roman elegists refer mainly to the prestigious and versatile dye obtained from the murex snail, the *purpura* or *color purpureus*. Purple dye gave textiles a profound and fast colouration in various hues, depending on the technique used, the most prestigious coloured wool being the doubled-dyed Tyrian purple. As a precious good, purple dye is frequently evoked by adjectives recalling its Phoenician origins *(Tyrius*, *Sidonius)* or the murex snail *(ostrinus)*, which qualify garments *(uestis, sinus, palla, amictus)*, wool *(uellus)* or, in the case of the toponymical adjectives, the mollusc itself *(murex, concha, ostrum)*. To a much lesser extent, elegists also mention the *color puniceus* (or *poeniceus*). This adjective echoes the Greek φοινίκεος (and φοινικόεις), which probably designate kermes, the crimson coloured dye obtained by crushing the parasitic insects of the kermes oak which was used for the Spartan military mantle – the φοινικίς.[16] Although the Latin *puniceus* evokes the Punics, it also hints, like φοινίκεος, at their ancestors, the Phoenicians – the same people who famously produced the best murex dye, at Tyre amongst other places.[17] The elegiac *puellae* can boast of "Sidonian" or "Tyrian" *(Sidonius, Tyrius)* apparel in their wardrobes – or at least they wish that they could – and they are proud to be seen wearing it.[18]

Elegists make various associations between the colour and the Levant *(Oriens)*: not only because oriental countries provide the dyes (also referred to as *colores*), but also because these countries are themselves coloured by the Dawn (e.g. the "Red Sea"[19]), as their inhabitants are "coloured" *(colorati)* because of the proximity of the rising sun.[20] However, there is a great variation in the countries that are considered to be part of the "Realm of the Dawn or the Sun" by Augustan authors: occasionally Ethiopians,

15 On purple dye in the Roman world, see Reinhold 1970 and Bradley 2009, ch. 7. See also Bradley 2013, 135–138 (discussed *infra*).

16 See Grand-Clément 2011, 165–169, about both dyes and their Greek names in archaic poetry.

17 The two dyes appear nonetheless to have specific origins, the *color puniceus* being associated with Carthage. Cf. Tib. 2.3.57–58: *Africa puniceum purpureumque Tyros*.

18 Cf. Tib. 3.3.18; 3.8.11 and Prop. 2.16.55; 4.5.22. For a discussion on the literary connotations of *purpureus* and the perception of purple clothes in Rome, see Bradley 2009, ch. 7. The Latin adjective *puniceus*, often considered as a rare synonym for *purpureus*, was generally given little attention.

19 Cf. Tib. 2.2.16 and 3.8.19–20 and Prop. 3.13.6. Cf. also Schenkel, this volume.

20 Cf. Prop. 3.13.15–16.

Egyptians, Phoenicians, Arabs and Indians seem to be mere variants of 'the Orientals' and poets often disdain geographical consistency.[21]

Whilst the sun-coloured inhabitants of the East are considered pure-hearted – probably a reminiscence of Homer's "blameless Ethiopians" (ἀμύμονες Αἰθίοπες),[22] whose name derives from αἴθω, 'to kindle', and ὄψ, 'face' – the Roman elegists establish a strong association between exotic, expensive dyes and moral corruption, for they are said to cause the death of love and poetry. Beautiful and costly purple garments stir up the greed, especially amongst girls who then become more prone to sell their favours in exchange for expensive gifts: greedy girls prefer a rich and vulgar lover to the poor but sincere *poeta amator*.[23]

In the Homeric epics, weaving purple is a typical activity for aristocratic women,[24] but only the heroes wear mantles of purple (πορφύρα) or Phoenician crimson (φοῖνιξ). Roman elegists did not ignore the political prestige of murex purple – worn by Hellenistic kings and Roman emperors[25] – and the military significance of the Punic kermes, but they mainly displayed these precious dyes as instruments of vanity for corruptible women. In this context, the value of both dyes becomes mainly aesthetic and monetary; this builds a striking contrast with their prestige in the epics. But we must be careful not to read it as a direct critique of Roman society. In fact, this attitude towards purple was neither new, nor specific to Latin poets: as Grand-Clément observed, purple dye has enjoyed an ambiguous connotation amongst Greek writers since the Median wars, when it became associated with the Persian kings, effeminacy and barbarian luxury.[26]

4 *Purpureus*, a noble adjective

Precious dyes such as purple and kermes are closely linked to negative moral values when evoked by the elegists as commercial goods. When they appear in comparisons focusing on their visual appearance, however, or when their qualities are recalled through derived adjectives, they seem to be invested with the opposite affective connotation. The

21 For example, Indians are often said to be "neighbours of the Red Sea". About the frequent confusion of India and Ethiopia throughout Graeco-Roman antiquity, see Schneider 2004.

22 Cf. Hom. *Il.* 1.423. In the *Iliad*, the Ethiopians also appear as the only mortals whose company is still enjoyed by the Olympians.

23 Cf. Tib. 3.3.49–58 and also Prop. 3.13, who sets up the moral superiority of women in Oriental lands against the corruption of Roman women wearing precious garments imported from these very regions.

24 Cf. Hom. *Il.* 3.121–133. This theme is also echoed by Latin poets (cf. Prop. 1.3.41 amongst others).

25 See Reinhold 1970 and Bradley 2009, ch. 7.

26 Grand-Clément 2011, 332–335. See also Bradley 2013, 136, on Pliny and the complex association between purple dye *(purpura)* and greed *(auiditas)*.

adjective *purpureus* recurs in descriptions of beautiful bodies of attractive and innocent-looking young women: desirable girls have "purple cheeks", "purple lips".[27] Moreover, *purpureus* can evoke the blush *(rubor)*, which physiologically translates the moral quality of modesty *(pudor)*, for the ability to turn red *(rubere)* – that is, to express the feeling of shame – can be interpreted as a proof of intact morals.[28] *Purpureus* can also qualify abstract ideas such as feelings and character traits. Ovid applies it to *pudor*, stressing the nobility and authenticity of his own modesty, which he claims to be the kind that makes one's face turn purple-like, an individual quality that a girl should value more than a prestigious family name or an important heirloom.[29] In Ovid's verses, *purpureus* is also a recurrent epithet of Love – Cupid himself *(Amor)*.[30] The contrast is striking with Homeric πορφύρεος, of which frequent utilisations concern – besides textiles – rough waters, death and blood.[31] With the adjective *purpureus*, the lost prestige of royal purple reappears in a new form, vested with a moral signification and an erotic quality. In many respects, the way Roman elegists employ the adjective *purpureus* mimics the lyric use of πορφύρεος.[32] Within this Greek corpus, Eros wears a "purple-dyed chlamyd" (πορφυρία χλαμύς)[33] or plays with a "purple ball" (σφαῖρα πορφυρῇ);[34] the "golden Aphrodite" of Homer (χρυσῇ Ἀφροδίτη)[35] can also become "purple" (πορφυρῇ Ἀφροδίτη) in lyric poetry.[36] And while the Greek precedent for the *purpureus* modesty is absent, there is an occurrence of the adjective used to qualify a body: in Simonides, a girl makes her voice heard through her "purple mouth" (πορφύρεον στόμα).[37]

This last example, transmitted as a fragment by Athenaeus (ca. 2nd – 3rd c. AD), is quoted in the course of a long discussion about the interpretation of colour terms in poetry: in the passage of the *Deipnosophists* in question, the narrator recalls the anecdote of a teacher who publicly criticised Sophocles (ca. 497–405 BC) for what he believed to be a mistaken use of the adjective πορφύρεος. The story goes as follows: as wine was poured in a banquet, Sophocles, praising the beauty of the cupbearer, declaimed a verse from Phrynichos about the "light of love glow[ing] on his purple cheeks" (λάμπει δ' ἐπὶ πορφυρέαις παρῇσι φῶς ἔρωτος).[38] The teacher was shocked and objected that it

27 Cf. Ov. *Am.* 1.4.22 *(p. genae)*; 3.14.23 *(p. labella)* and Catull. 45.12 *(p. os)*.

28 This recurring Ovidian theme is theorised by Seneca (cf. Sen. *Ep.* 1.11). Cf. Bradley 2009, 150–159.

29 Cf. Ov. *Am.* 1.3.14.

30 Cf. Ov. *Am.* 2.1.38; 2.9b.34; *Ars am.* 1.232.

31 Elegists also sometimes recall these Homeric associations, but only very marginally. Cf. Prop. 2.26a.5 *(p. fluctus)* and Ov. *Tr.* 4.2.6 *(p. sanguis)*. Propertius also directly translates the unique "purple rainbow" of Homer: cf. Prop. 3.5.32 *(p. arcus)* and Hom. *Il.* 17.547 (πορφυρέη ἶρις).

32 About the connotations conveyed by πορφύρεος in Greek Archaic poetry subsequent to Homer, see Grand-Clément 2004 and Grand-Clément 2011, 119–121.

33 Sapph. 54 LP.

34 Anac. 358.1.

35 Cf. Hom. *Il.* 3.64. Cf. also Ov. *Am.* 2.18.36 *(aureus Amor)*.

36 Anac. 357.3.

37 Simon. 585.1.

38 Cf. Ath. 13.81. The Greek text is taken from the edition by G. Kaibel (Stuttgart, Teubner, 1962 [1890]). See Pelletier-Michaud 2016b, 2–6 and *Annexe A* for a longer discussion and literature references.

would be ill-advised for a painter to represent the face of a boy using purple dye, because it would not be beautiful. The teacher was immediately derided by Sophocles for not understanding the poetic meaning of πορφύρεος and for interpreting the verse in a very narrow sense.

Like the lyric πορφύρεος, *purpureus* is imbued with a poetic value that goes beyond the prestigious epic purple or the corruptive purple of the Persian kings; its significance can also not be reduced to the appearance of the murex pigment used by dyers and painters.[39] However, it would certainly be going too far to imply that *purpureus* does not evoke colour; the subsequent examination of an Elegiac *topos* should convince us that it does – but not necessarily the specific hue of a dye.

5 The 'red-and-white portrait' technique: picking 'flowers' from amongst Greek poets

Roman elegists used references to colour in order to create complex imagery and associations of various kinds; the most developed of these might be called the 'red-and-white portrait'. This signature literary device consists of a specific type of *ekphrasis*, in which a body is glowingly depicted by emphasising two main contrasting hues by the means of various similes.[40] The importance of this *topos* goes beyond Roman elegy, but it seems to play an important unifying role in the poetry of Tibullus, Propertius and Ovid (like Virgil, all Augustan age, BC/AD). One of the richest examples is to be found in the second book of the *Amores*, when Ovid portrays the reaction of Corinna after *ego* has lost his temper and has shouted at her. Using various comparisons, he describes the blush rising to her face:

[…]
Haec ego, quaeque dolor linguae dictauit; at illi
Conscia purpureus uenit in ora pudor,
Quale coloratum Tithoni coniuge caelum
Subrubet aut sponso uisa puella nouo,
Quale rosae fulgent inter sua lilia mixtae,
Aut ubi cantatis Luna laborat equis,
Aut quod, ne longis flauescere possit ab annis,
Maeonis Assyrium femina tinxit ebur.

39 About the use of murex purple by Greek painters, see Brecoulaki 2014, 9–12.

40 About the 'red-and-white portrait' tradition, see ch. 3 in Pelletier-Michaud 2016b.

Hic erat aut alicui color ille simillimus horum,
Et numquam casu pulchrior illa fuit.[41]

[…]
So were the words pain had dictated to my tongue; as for her,
A purple modesty rose upon her guilty face,
Like the sky, coloured by the wife of Tithonus,
Or like a girl reddens from inside as her new husband sees her;
Like roses shine when they mix with their lilies,
Or like the Moon, when she faints because her horses have been spellbound;
Or like the Maeonian woman dyes the Assyrian ivory
So it won't yellow over time.
So was her colour, or at least was it very similar to one of those,
And she may never have looked any prettier.

Muted by the violence of her jealous lover's anger, Corinna answers with a change of complexion. Without uttering a word, she instantaneously turns Ovid's animosity to lust. These verses are a response to a better-known passage of Latin literature: Virgil's portrait of Lavinia. In the *Aeneid*, the sudden *rubor* of the young woman is also irresistibly attractive, but has an opposite effect on the narrative: the seducing blush of Lavinia unleashes Turnus' fury and convinces him to engage in a fatal duel with Aeneas. In the Greek epics, almost a millennium earlier, and in Virgil's imitation of Augustan age, female beauty is a motor of war, whereas in Roman elegy, it vanquishes violence and sublimates it into desire. Whilst distancing himself from the martial themes of epic poetry, Ovid rivals Virgil and repatriates the *topos* in the territory of elegy: he recalls that before Virgil, Propertius and Tibullus had produced their own 'red-and-white portraits'.[42] Playing with the language of colour, Ovid engages in a dialogue not only with Augustan poets, but also with his Greek models: the portrait of Corinna is a florilegium of learned literary quotes.

From a strictly chromatic perspective, portraits such as the one by Ovid could be called redundant because they appear to gather many paradigms of the same contrast. This would be true if their main purpose was descriptive accuracy; but, while evoking different coloured realities, each simile is also an indirect yet fairly recognisable citation. In his portrait, the Augustan Roman Ovid (43 BC – 17/18 AD) interweaves allusions to Late Republican Catullus (87/84–57/54 BC), to the Alexandrian poets (of the Hellenistic

41 Ov. *Am.* 2.5.33–42. Except for Athenaeus' excerpts (see note *supra*), Greek and Latin texts are quoted from the editions of the *Collection des Universités de France* (Paris, Les Belles Lettres). All translations are my own.

42 Cf. Verg. *Aen.* 12.64–69, Tib. 3.4.29–34 and Prop. 2.3a.9–12.

period), but also to Sappho (630/612–570 BC) and, most importantly, to Homer (of the 8th c. BC). This is not the place to analyse them all thoroughly, but we can point out a few intertextual connections. The image of the blushing bride and the contrasting flowers recalls and reinvents a verse in Catullus' wedding song – where the girl's face shines with the glow of poppies and chamomile –, a song itself using Alexandrian imagery derived from Sappho and Homer.[43] The allusion to a 'blood moon' – the rare phenomenon of a full eclipse during which the moon takes a reddish hue, here presented as the result of a magical curse – is also borrowed from the imagery of Sappho.[44]

The two similes framing the Ovidian portrait, pointing more directly to Homer, deserve our full attention. The first one is a dense assemblage of allusions to the Homeric Dawn: "like the sky, coloured by the wife of Tithonus". In the space of this single verse, Ovid brings together several epic *loci*: he recalls the verses of the *Iliad* in which Homer evokes *Êôs*, the Goddess of Dawn, as she leaves the bed of her husband Tithonus,[45] but also the numerous other passages in which Homer employs his famous epithet of Dawn, "rose-fingered" (ῥοδοδάκτυλος).[46] More than a sky coloured by the rising sun, the expression Ἠὼς ῥοδοδάκτυλος suggests the image of the Goddess of Dawn as a woman who has delicate, rose-like fingers. The Homeric reference to the flower does not concern only its colour: other qualities such as fragrance, softness, delicacy and fragility are also conveyed in the simile.[47] But Ovid, producing an interpretative imitation of his model, makes a chromatic reading of the Greek adjective: he merges two Homeric images which not explicitly focused on chroma to present the Dawn as a new paradigm for the *rubor* – that is the reddening hue of a blushing face.

We move on to the simile closing the portrait of Corinna by Ovid: "like the Maeonian woman dyes the Assyrian ivory so it won't yellow with time". This colourful image is particularly rich, with two geographical references (Asia Minor, Assyria) and the mention of a precious raw material (ivory) being cured with a dye in order to prevent its natural *color* from being tainted by the passage of time. Before discussing the possible archaeological parallels, we shall look into the literary models that are involved. The first reference that comes to mind is Catullus' *Epyllion*, a miniature epic whose centerpiece consists in the rendering of the myth of Ariadne. The passage is introduced as a depiction of mythological figures embroidered on "a purple veil dyed with the rosy

43 Cf. Catull. 61.192–195. For a survey of the Greek sources of Catullus, cf. Pelletier-Michaud 2016b, 138–141.

44 Cf. Sapph. 96.8 LP, where the poetess compares a beautiful woman to a ῥοδοδάκτυλος moon, presenting an innovative use of epic vocabulary.

45 Cf. Hom. *Il.* 11.1–2.

46 E.g. Hom. *Od.* 2.1; *Il.* 1.477 (see *infra* about the recurring Homeric verse and one particular use of ῥοδοδάκτυλος). For the purpose of my demonstration, I deliberately avoid the standard English translation "rosy-fingered" (E. Spenser, late 16th century) because the adjective 'rosy,' which constitutes in itself a chromatic interpretation, narrows the sense of the Greek epithet.

47 See *infra*.

stain coming from a conch" *(tincta roseo conchyli purpura fuco)*, covering a seat adorned with the "Indian tooth" *(Indus dens)*.[48] These two convoluted paraphrases clearly hint at a well-known poetic *locus*: in fact, they recall the very verses from the *Iliad* in which the 'red-and-white portrait' seems to originate.

The passage in question, from Book IV, proves to have a capital importance for later poets. It is an ekphrastic parenthesis depicting Menelaus, whose thigh has just been hit by an arrow and is being covered with his blood:

> Ἀκρότατον δ' ἄρ' ὀιστὸς ἐπέγραψε χρόα φωτός·
> Αὐτίκα δ' ἔρρεεν αἷμα κελαινεφὲς ἐξ ὠτειλῆς.
> Ὡς δ' ὅτε τίς τ' ἐλέφαντα γυνὴ φοίνικι μιήνῃ
> Μῃονὶς ἠὲ Κάειρα παρήιον ἔμμεναι ἵππων·
> Κεῖται δ' ἐν θαλάμῳ, πολέες τέ μιν ἠρήσαντο
> Ἱππῆες φορέειν· βασιλῆι δὲ κεῖται ἄγαλμα,
> Ἀμφότερον κόσμός θ' ἵππῳ ἐλατῆρί τε κῦδος·
> Τοῖοί τοι, Μενέλαε, μιάνθην αἵματι μηροὶ
> Εὐφυέες κνῆμαί τε ἰδὲ σφυρὰ κάλ' ὑπένερθε.
> Ῥίγησεν δ' ἄρ' ἔπειτα ἄναξ ἀνδρῶν Ἀγαμέμνων,
> Ὡς εἶδεν μέλαν αἷμα καταρρέον ἐξ ὠτειλῆς·
> Ῥίγησεν δὲ καὶ αὐτὸς ἀρηίφιλος Μενέλαος.[49]

> At the end, the arrow sunk into the man's skin;
> Immediately, a blood of dark clouds flowed from the wound,
> Like when a woman bathes an ivory in crimson dye,
> A Maeonian or a Carian, to make a bridle's cheek-ornament.
> It lies in the chamber; numerous are the horsemen
> Who pray they could be sporting it; but this *agalma* is reserved for the king:
> It is an ornament for the horse and a glory for the horseman;
> So did your blood bathe your shapely thighs, Menelaus,
> And your calves, down to your beautiful ankles.
> He shivered, then, Agamemnon, the leader of men,
> When he saw the black blood flowing from the wound;
> He also shivered himself, Menelaus, beloved of Ares.

Here, the body of Menelaus is compared with a beautifully crafted object, an "*agalma*",[50]

48 Cf. Catull. 64.47–49.
49 Hom. *Il.* 4.139–150.
50 About the term ἄγαλμα, which designates a precious, admirably crafted object imbued with prestige and reserved to an elite group, see Grand-Clément 2011, 266–278.

made of ivory and embellished with a precious dye – as we saw, the term φοινῖξ points towards kermes but also evokes Phoenician craftsmanship. This colourful portrayal of a wounded warrior can be linked to the motif of the eroticised death.[51] On the one hand, the horrible sight of the billowing blood – rendered by αἷμα κελαινεφές, "blood of dark clouds", and μέλαν αἷμα, "black blood" –, evokes threatening death and causes heroes such as Agamemnon and Menelaus to shiver.[52] But on the other hand, the blood covering the limb is also compared to a noble dye adorning a precious ivory. This imagery, along with the mention of "beautiful ankles", recalls the descriptions of female bodies in Homer. The depiction highlights Menelaus' value as a king and a warrior, his beauty, but also his vulnerability as a mortal.

The vivid description by Homer of an ivory bridle ornament being stained immediately raises the question of the possible historicity of the practice described,[53] especially since epigraphic records from the Bronze Age also suggest an ancient practice of staining ivory as a process conferring more value to the plain material.[54] Before getting on with our literary analysis, let us take a careful look to the archaeological parallels that have been suggested. First, we note that these texts are well known to specialists of ancient ivories, to the point that they seem to have influenced archaeological observations: Barnett, relying solely on Homer's verses, went as far as to assert that "in Greek times, the staining of ivory was done by women in Anatolia" and identified "purple stains" observed under gilding on ivories from Nimrud as the result of similar treatment,[55] an interpretation that has since been repeated.[56] However, although polychromy on carved ivories is well attested from the Bronze Age onwards in the Near East and, to a lesser extent, in the Aegean, [57] archaeological founds do not directly support the evidence of the written sources. Data are often incomplete and must be handled carefully, since the current appearance of the artefacts has been affected by burial conditions and often also by inadequate modern treatments. However, recent micro-X-ray analyses offer promising

51 See Lauraux 1977.

52 The verb μιαίνω, 'to stain, dye', can also be used in a pejorative sense ('to taint'). About the co-presence of two different colours (black and crimson) in this passage, see remarks *infra*.

53 I thank F. Blakolmer, S. Thavapalan, D. Warburton and D. Wicke for their precious hints and references regarding the archaeological evidence of polychromy on ancient ivories.

54 Tablets from the Amarna correspondence attest to the Babylonian king Burnaburiash requesting and receiving from Amenhotep III (14th c. BC) "coloured" or "stained" objects carved in ivory as part of the Near Eastern diplomatic system of gift exchanges. Cf. *Amarna letter no.* 11 (rev. 6–12) and esp. *no.* 14 (col. iv 2–19), in which KAxUD *pí-ri bá-aš-lu* is mentioned 16 times about various objects (cf. Rainey 2015, 102–103 and 124–127). Güterbock 1971 also observed that Hittite inventories from Anatolian Boğazköy (also second millennium BC) distinguished luxury objects of 'red' and 'white' ivory.

55 Barnett 1957, 155–157.

56 Relying on Barnett, Moorey and Connor also called such purple colouring "stain" or "dye" (Moorey 1994, 127; Connor 1998, 48–51).

57 Various methods included gilding, inlaying and painting. See Herrmann 1986, 59 (about ivories found in Nimrud) and Poursat 1977, 48 (about Mycenaean ivories).

results. They have revealed that purplish stains observed on Levantine ivories from the site of Arslan Tash in northern Syria were in fact composed of nanoparticles of gold; they could result from the gilding itself,[58] but could also be due to the presence of gold in the burial context.[59] The red tinge of ivory carvings from Anatolian Acemhöyük (2nd mil. BC), also enthusiastically associated to textual evidence from the same region,[60] poses the same problem: although it is possible to determine the nature of the pigment causing the reddish tinge (iron oxide), careful observations suggest that in many cases, its presence might very well not be original, let alone the result of an intentional process.[61] Nonetheless, both textual and archaeological records strongly suggest that the verses from the *Iliad* are reminiscent of ancient oriental practices.[62] The most striking connection between the Homeric text and material Levantine ivories concerns their original provenance (Anatolia for the Bronze Age, Phoenicia and South Syria for the Iron Age)[63] and their function: luxurious bridle ornaments. Numerous ivory pieces of horse trappings, most probably produced in the Levant and some of which show painted patterns, were found in Nimrud (in modern Iraq) and Arslan Tash.[64] Just like the *Iliad*'s ivory cheek ornament, lying in a chamber and reserved for the king, Levantine ivory blinkers were found accumulated as booty in treasure rooms of Assyrian palaces.[65]

The Homeric simile should certainly not be read as direct testimony to a specific Anatolian technique. However, the passage is key for our understanding of the cultural construct that we find in later poets: regardless of its historic accuracy, the figure of the Maeonian woman ivory dyer constitutes in itself an authentic poetic landmark.

58 Fontan and Reiche 2011, 291.

59 Affanni 2015, 64.

60 See Bourgeois 1992 and, more recently, Simpson 2013, 257–258. Willing to link archaeological finds to textual evidence, the latter emitted the hypothesis that the red colour of Anatolian ivories was due to a clay slip used both as a base for gilding (bole) and as a paint.

61 See Lapérouse 2008, 85, and Aruz 2008, 90.

62 Carter 1985, 11–12 made a careful reading of the Homeric verses and observed that the imprecise vocabulary for "blinker" (παρήϊον) suggested a foreign reality.

63 Cf. Herrmann and Laidlaw 2012–2013, 94, for the Phoenician provenance and the dating (11th – late 8th c. BC) of ornamental ivories found in Nimrud; cf. Winter 2010, 286 and 290, about coloured ivories from Arslan Tash having been produced in Damascus at the time of king Hazael (841–805 BC).

64 See Orchard 1967 and Gubel 2005. According to the Amarna letters, King Tušratta of Mittani (a kingdom in northern Syria) offered a set of bridles made of a specific kind of ivory (*gilamu*-ivory) to Amenhotep III (14th c. BC). Cf. *Amarna letter no.* 22, 15 Rainey 2015, 160–161).

65 Wicke 1999, 804, who makes no mention of the poet, describes the function of ancient oriental ivory blinkers made of precious materials in a sentence that reads like a paraphrase of Hom. *Il.* 4.145: "[sie stellen] einen zusätzlichen Schmuck des Pferdes dar und unterstreichen den Reichtum und Status seines Besitzers".

6 An outstanding model of *ekphrasis*

The successive rewriting of Homer by Catullus, Tibullus, Propertius, Virgil and Ovid leads us to believe that the passage from the *Iliad* was considered especially representative of archaic Greek poetic mastery. We can suppose that, after receiving special attention from the erudite poets of the Hellenistic period – who were also critics and scholars –, it became a prominent model for the composition of an *ekphrasis* and might have been used to teach this technique in the Roman rhetorical educational *cursus*.

Like Ovid's, the Homeric dyer is a woman of Maeonia – or Caria; again, we note the imprecision of an Eastern origin. There is no consensus in the antiquity about the identity of Maeonia, but we can safely assume that it designates an area in Asia Minor – it was probably Homer's name for Lydia.[66] The hesitation between two Anatolian kingdoms seems to be a Homeric way of referring to this geographic region.[67] In archaic poetry, Anatolia is frequently associated with beautifully crafted objects, such as the famous Lydian embroidered mitra to which Pindar compares his well-crafted poem.[68] In Latin poetry, the adjective *Maeonius* becomes a synonym for 'Homeric'; [69] it has even been supposed that Maeonia was Homer's fatherland. But I propose that it was this particular passage that triggered the Roman association of Homer with Maeonia.

The gender of the Anatolian craftsperson, a woman, deserves some remarks, for it does not seem to reflect ancient practices.[70] Ovid's *Metamorphoses* also feature a mythological character who appears as an avatar of the Homeric ivory dyer: Arachne, the embroiderer who defied Athena. A "Maeonian" woman and the daughter of a humble purple-dyer, she was famous for her mastery "through all Lydian cities".[71] The Ovidian character of Arachne might express the poet's willingness to give a more acceptable version of the Homeric Maeonian craftswoman: she is connected to Anatolia and to the technique of purple dyeing, but she masters a womanly craft, the textile art of embroidery. We also note that, interestingly, Ovid and Catullus move ivory's provenance further East, in Assyria (precisely where Phoenician ivory carvings were accumulated in the first mil. BC) and that Catullus recalls the dye Homer called "Phoenician" (φοῖνιξ) with the mention of marine purple dye, a product for which Tyre and Sidon were famous.

66 Cf. Hom. *Il.* 2.864–866, where Maeonians are associated with Mount Tmolus, a Lydian mountain.

67 Cf. Hom. *Il.* 3.401 and 18.291.

68 See Grand-Clément 2011, 274 and 436–437 about Pind. *Nem.* 8.15–16.

69 See Sfyroeras 2014, 246 n. 25 for numerous examples.

70 The professional weavers and dyers attested in ancient Near Eastern written sources are male.

71 Cf. Ov. *Met.* 6.5–13.

7 'Poetic matter'

Concluding his 'red-and-white portrait', Ovid insists on the difficulty of accurately describing Corinna's *purpureus color*: "so was her colour, or at least was it very similar to one of those". Browsing through his repertoire, he has searched for the perfect simile to illustrate her charming complexion. His verses, illustrating the complexity of putting colour into words, are not only a display of virtuosity and literary knowledge, but also a contribution to enriching the poetic meaning of *purpureus*.

In Ovid's portrait of Corinna, as well as in similar *ekphrases* found in other Augustan poets and in Hellenistic authors, colour terms are obviously not used to produce a description of an existing object, the purpose of which would be chromatic accuracy. The aim of these poets is rather to model their own *creation* as a beautifully crafted work of art that can arouse admiration, made out of 'poetic matter': various poetic references to colour are put together to offer a new image, as a painter would use different colours to create a picture, a representation that is of far greater aesthetic value than the pigments themselves. The materials composing the palette of the elegists are poetic by nature: they are to be found through the entire Greek tradition – Homer remaining the first and ultimate model. The value carried by adjectives such as *purpureus* lies in their association with 'precious' authors – that is, prestigious models.

The beautifully crafted ivory cheek-piece dyed by a Maeonian woman becomes emblematic of the art of the poet, a creator of beautiful images. Augustan poets themselves recall the horsemen from the original Homeric simile, coveting the precious ornament: with their successive rewritings, they rival in a competition to tie the Homeric *agalma* to their own name.[72]

8 From materiality to abstraction

Looking back at Homer's example, we can observe that the nuance of blood is not the only focus of the simile: blood is compared to a crimson dye, but the poet also emphasises the opacity and darkness of the liquid, calling it "dark-clouded" and "black" (κελαινεφής, μέλας). The Homeric image also concerns the dyeing process itself: it is about a bright white element (thigh/ivory) being covered by a colouring, darkening liquid (blood/dye).

The image from the *Iliad* is composed with one complex comparison stressing multiple similitudes between its topic and its vehicle; in Ovid, on the contrary, the simile contains various undeveloped vehicles put together as variations to illustrate a single

72 See note *supra* about the meaning of ἄγαλμα.

topic. This hoarding process has a remarkable effect: it causes colour to stand out. What we would call the 'red colour' appears as the only common denominator between dawn, the blush of a bride, roses, a 'blood moon,' and the unnamed dye. This seems to be one of the characteristics of the elegists' specific meaning of *purpureus*: Ovid, at least, clearly considers it as a kind of *rubor*.[73] The adjective *purpureus* does not refer especially to the hue(s) of purple dye: it is a fairly abstract term that appears to represent a prestigious variation of the idea of 'red' – the concept that stands at the junction of all coloured realities tied up together in the simile.

More than an aesthetic description, the contrasting portrait technique also illustrates the mechanism of colour abstraction. Wittgenstein once accurately stated that the only possible means of defining a colour in words was to list different examples of realities representative of this colour.[74] When poets, like Ovid, line up different images taken from their predecessors out of various contexts as illustrations of the same colourful expression, they accomplish two things: they contribute to setting the scope of a colour term, and they also carry out the very mental process through which the abstract idea of a colour can emerge.

Bradley recently argued that in ancient thought, colour was predominantly an "object-centred" experience and that, being "attached so closely to actual *things* in the world, it could mobilize the full range of senses […]".[75] Pursuing his argument, Bradley insisted that colours in antiquity did not, like in the modern West, rely on "a predominantly abstract system of colours": "our 'green'", he writes, "can describe plants, parrots, emeralds, sick faces, and so on. Ancient colours appear to have worked rather differently".[76] Bradley is admittedly right about modern categories being ineffective to understand ancient conceptions of colour and his survey effectively brings to light how the modern obsession with colour and visual perceptions has overshadowed the importance of other senses in the Roman experience of the world. However, I am convinced that we can credit the Romans – at least from the Augustan period – with the ability to conceive colour in a fairly abstract manner. Bradley himself perceived, in Pliny the Elder's (23–79 AD) negative remarks on purple dye and its use in first-century Rome, the Aristotelian frustration of a Roman author facing his contemporaries' tendency to isolate abstract visual properties from complex realities.[77] I argue that poets, by exposing colour terms

73 Bradley 2004 defends the idea that the Latin substantive *rubor* is not an abstract colour term, but refers specifically (and concretely) to the blush. I think that the term can have both meanings: the poetic interplay through which the elegists present diverse coloured realities as equivalents – or expressions – of *rubor* involves an abstract concept.

74 Wittgenstein 1977, §68.

75 Bradley 2013, 131–132.

76 Bradley 2013, 130.

77 Cf. Bradley 2013, 135–138 about Plin. *HN* 9.124–134. Pliny himself, in his down-to-earth description of dyeing techniques involving smelly shellfish, also relies – once namely – on the Homeric use of πορφύρεος to describe the murex purple's appearance ("similar to an angry sea"; "the colour of clotted blood"). Cf. Plin. *HN* 9.127 *(color… iras-*

to various contexts in their complex similes, played an important role in this trend that is part of the path that led to modern colour categories.

In another poem, which describes how Corinna's beautiful looks remained unchanged despite her infidelity, Ovid refers more directly to colour using the substantives *candor* and *rubor*:

Candida candorem roseo suffusa rubore
Ante fuit; niueo lucet in ore rubor.[78]

Radiant white, with a rose-like red spreading under this radiant white;
So was she before; [now] red shines in her snowy face.

Although two adjectives contain comparisons to concrete coloured realities, respectively to the rose *(roseus)* and the snow *(niueus)*, this elegiac couplet is also loaded with abstract colour terms, in adjectival *(candidus)*, substantive *(candor, rubor)* and verbal *(suffundere, lucere)* forms. In these verses, the poet recalls a common literary imagery in a much subtler way, using colours almost as a painter would. The context makes their poetic meaning clear for Ovid's readers: the presence of the famous contrast in the form of abstract colour terms is sufficient to evoke the whole poetic tradition of the 'red-and-white portrait'.

9 Latin colour terms saturated with Greek poetry

The adaptation of Homeric imagery in Roman elegy provides many examples of complex compound epithets having their poetic significance being transferred into single colour terms. As I pointed out, the meaning of the phrase Ἠὼς ῥοδοδάκτυλος, "rose-fingered *Êôs*", cannot be reduced to the colour of the rose. The same is true of the other recurring epithet of the Dawn in Homer, κροκόπεπλος, "robed in saffron". This compound adjective brings together a woman's garment (πέπλος, the *peplos*) and a flower (κρόκος, the crocus). The term κρόκος also designates saffron, the precious yellow-orange dye obtained from the crocus, which the context of clothing immediately calls to mind. But like the rose, the crocus flower evokes more than a colour. As Grand-Clément pointed out, the flower itself has purple petals, yellow stamens, and its stigmas, from which saffron tincture is obtained, are red. Not only can κρόκος evoke various distinct

centi similis mari) and e.g. Hom. *Il.* 14.16 (πορφύρεον κῦμα); Plin. *HN* 9.135 *(laus ei summa in colore sanguinis concreti, nigricans aspectu idemque suspectu refulgens, unde et Homero purpureus dicitur sanguis)* and Hom. *Il.* 17.360–361 (πορφύρεον αἷμα).

78 Ov. *Am.* 3.3.5–6.

colours, but since saffron is used as a seasoning and a fragrance, it also hints at sensorial qualities beyond the visual.[79] In addition to this, saffron was assigned magical properties by the Greeks and also had a specific use in their nuptial rituals.[80] When we encounter Ἠώς κροκόπεπλος in Homer, our modern sensibilities lead us to a colourful image: a woman wrapped in a saffron-dyed, that is a golden, yellow garment, seems a perfect representation of the goddess of Dawn. There is of course no reason to reduce the rich Homeric allusion to a mere chromatic indication. However, the Latin reworkings of this image can help understand why such a reading seems so natural: when Augustan poets made various allusions to both Homeric epithets, it was mainly by stressing their visual aspect and by means of simple colour terms.

One of these colourful references to Homer is found in Propertius. When the poet finds out that Cynthia is becoming vain because of his laudatory poems composed in her honour, he regrets having praised her complexion *(color)* by comparing it to the rose-like Dawn *(roseus Eous)*: he now acknowledges that she was using make-up and therefore did not deserve the compliment.[81] Propertius' verse about Cynthia's untrue *color* recalls the Homeric epithet ῥοδοδάκτυλος, but it deprives it of its specificity (the fingers) and instead focuses on colouration. The poet reduces it to an appearance that can be counterfeit using pigments: after having taken her beauty to the heights of Homeric perfection, he then sends it back down to the mundanity of her cosmetic boxes.

Ovid offers a particularly sophisticated example of such textual interplay in a poem of the *Amores* in which he evokes the "purple hand" *(purpurea manus)* of Aurora.[82] Recalling the Homeric epithet about the fingers of the goddess, the Latin poet uses an adjective to qualify a specific part of the body; but the usual vehicle of the comparison (roses) is replaced by an allusion to purple dye. A luxury import whose value compares with that of precious metals – and the production of which involves a long and laborious process –, murex dye has little in common with the short-lived beauty of a flower. Moreover, one of the rose's most frequently emphasised qualities is its fragrance, whereas the dye, as Bradley recently pointed out, is famous for its offensive smell which could persist long after the dyeing process and even inconvenience the wearer's neighbours.[83] Since their non-visual characteristics are dramatically opposed, the only quality the purple-dyed wool and the rose have in common is their rich texture and their beautiful, similar colour. In order to recall the Homeric expression Ἠὼς ῥοδοδάκτυλος, Ovid evokes a reality, the extra-chromatic qualities of which diverge completely from the original. This process emphasises the fact that hue has become the main focus, which is confirmed in

79 Cf. Bradley 2013, 135 about the fragrant *crocota* and its association with flowers and femininity.

80 About the complex, multisensory associations carried by both flowers referred to in the Homeric epithets of the Dawn, see Grand-Clément 2011, 103–106.

81 Cf. Prop. 3.24.7–8: the "radiant white" *(candor)* in her face had been "feigned" *(quaesitus)*.

82 Cf. Ov. *Am.* 1.13.10.

83 Cf. Bradley 2013, 135–138.

the punch line: the poem is a prayer to Aurora, whom the poet asks to delay her rise in order to let him enjoy a longer night with his lover; in the last verses, the Dawn, shamed by the poet for being unfaithful, turns red *(rubere)* – the morning has come.[84] The full richness of the Ovidian verses can only be enjoyed if the reader is aware of the Homeric text, for the whole poem constitutes a humorous Roman staging of the famous episode of the *Odyssey* in which Ulysses and Penelope, finally reunited, enjoy a long first night together thanks to Athena, who delayed the Dawn.[85] While remaining faithful to his model, Ovid nonetheless creates a new, etiological interpretation of the Homeric verses and reconciles the anthropomorphic representation suggested by the ancient poetic *topos* (a goddess with 'rose-like' fingers) with the natural phenomenon personified by Êôs / *Aurora* (the moment of the day when the sky turns red): Dawn becomes a guilty goddess who blushes with shame.

The epithet κροκόπεπλος triggered the creativity of Ovid in the same way: the poet frequently refers to the Homeric compound by means of simple colour adjectives, such as *luteus*[86], which derives from the substantive *lutum*, 'weld' *(Reseda luteola)*, an orange-yellow vegetal dye a lot less expensive and precious than saffron.[87] Ovid's rewriting gives a modernised version of the Homeric imagery: he suggests the picture of a woman wearing a saffron-coloured (saffron-*like*) dress, just as a Roman woman would. Ovid also calls Aurora a goddess with "saffron hair" *(crocei capilli)* to whom a "blond" *(flaua)* woman can be favourably compared: he transfers the colour of Êôs from her garment (κροκόπεπλος) to her hair.[88] Although *croceus* and *flauus* are semantically distinct and usually used in separate contexts, Ovid emphasises the chromatic connection that they share: there seems to exist an abstract idea – an abstract colour – that reconciles the specific nuances of blond hair and saffron dye. An ultimate example of his poetic economy of means, Ovid also simply calls Aurora "the blonde", *flaua*.[89] Here, building on the Homeric tradition, the Roman poet evokes the Dawn using a single colour adjective as a substantive.[90] Ovid's mastery of poetic colour goes even further: after having captured the complex imagery of the Homeric Dawn in a single colour term, he then proceeds to

84 Cf. Ov. *Am.* 1.13.47–48.

85 Cf. Hom. *Od.* 23.241–246. The Homeric verse hinted at by Ovid is one of only two occurrences of Ἠὼς ῥοδοδάκτυλος in the *Odyssey* (and also the very last) that varies from the 'formulaic' verse in which the Dawn returns, time and again, invariably "early-born" (ἠριγένεια). The famous verse ἦμος δ'ἠριγένεια φάνη ῥοδοδάκτυλος Ἠώς recurs twenty times in the *Odyssey* and twice in the *Iliad*.

86 Cf. Ov. *Met.* 7.703 *(lutea Aurora)* and 13.579–580 *(Memnonis lutea mater)*.

87 According to Servius (*ad Verg. Aen.* 7.26), *lutum* gives a *croceus* colour to fabrics. See *infra* about Virgil's passage itself and about Ovid's mention of a woman's garment mocking saffron's colour.

88 Cf. Ov. *Am.* 2.4.43.

89 Cf. Ov. *Am.* 1.13.2.

90 For a similar association, cf. Virgil's colourful verses where both Homeric epithets for the Dawn are evoked in the form of two simple Latin adjectives (Verg. *Aen.* 7.25–26: *Iamque rubescebat radiis mare et aethere ab alto / Aurora in roseis fulgebat lutea bigis […]*). About the adjective *flauus*, see also Bradley's insightful remarks in his introduction (Bradley 2009, 1–6).

illustrate how, operating in reverse, poetic colour can also provide meaning and value to hues otherwise deprived of context. Describing a low-price garment, he compares it to the "saffron-coloured mantle" of the Dawn *(croceus amictus)*: just call a yellow fabric *croceus* and it becomes the saffron veil of Ἠὼς κροκόπεπλος.[91]

The Roman personification of Dawn, Aurora, inherited only partially the qualities of her Homeric ancestor Êôs: in her Latin version, the "rose-fingered" (ῥοδοδάκτυλος) or "saffron-robed" (κροκόπεπλος) Greek goddess often became simply purplish red or golden yellow. Narrowing the scope of Homeric adjectives to chromaticism, Latin poets made possible new associations with colourful realities – such as murex dye or blonde hair.

To conclude this series of Latin minimalist renditions of Greek images, we move on to the recurring expression *candida puella*, "white girl", used by the elegists to evoke various Homeric similes highlighting the white gleam of a young woman's skin.[92] This expression is also a concentrated version of epic imagery for female beauty: in Homer, girls and the goddess Hera, for example, are "bright white-armed" (λευκώλενος).[93] The *Odyssey* also contains a more developed passage in which the whiteness of the skin is strongly associated with female beauty: when Penelope is about to finally get her husband back, Athena lets her fall asleep to prepare her for this encounter. The goddess embellishes her looks by making her "whiter than a sawn ivory" (λευκοτέρην … πριστοῦ ἐλέφαντος).[94] This verse may answer a latent question about the Ovidian verses rewriting the Homeric *agalma*-passage, "the Maeonian woman [who] dyes the Assyrian ivory / so it won't yellow with time". Although there is archaeological evidence for the existing practice of covering precious materials with even more precious coatings,[95] the idea of using a *dye* on an object in order to prevent its natural *colour* from fading raises some questions.[96] A hint at the solution might lie in the fact that the actual colour of ivory is not bright white: its appearance is closer to an 'eggshell', an off-white, creamy hue. But here, Homer refers to a transitory state of the material: he suggests that freshly sawn ivory presents a whiter, brighter and smoother surface. The Ovidian idea of dyeing ivory to protect its appearance from degradation could very well be about preserving some very specific, very literary pieces of ivory: the famous similes of Homer. With

91 Cf. Ov. *Ars am.* 3.169–187, esp. 179–180. In this passage, Ovid lists various colours of fabrics that can be bought cheaply instead of expensive purple wool and describes them using poetic imagery. The use of vegetal dyes to imitate pricier materials, especially murex purple, is not only attested in ancient Greece and Rome (cf. Reinhold 1970, 53; Bradley 2009, 201–202) but also in Bronze Age Mesopotamia (cf. Thavapalan 2018, 171).

92 This expression is frequent in Catullus, Elegists' most important surviving Latin model (e.g. Catull. 13.4; 35.8).

93 E.g. Hom. *Il.* 1.195; 3.121.

94 Cf. Hom. *Od.* 18.196.

95 See Di Paolo 2015, 75.

96 This idea makes sense if we understand the term *color* more generally as 'appearance' or 'surface': as Connor 1998, 44, points out, ivory, like wood, is a vascularised living matter whose appearance and texture rapidly degrades unless it is protected with a surface coating such as paint or varnish.

his own *coloratum ebur*, Ovid brings together and revives both poetic images about ivory from the *Iliad* and the *Odyssey*: the white, freshly sawn ivory emphasising Penelope's delicate beauty and the dark red, dyed ivory resembling Menelaus' bloodied thigh. Ovid thus ensures that the famous Homeric *colores* are kept throughout the passage of time.

10 Greek poets in Rome

Let us return once again to the anecdote from Athenaeus about the teacher who took poetry all too prosaically. In response to his ignorant remark, Sophocles mocked the man by suggesting that, being shocked by a "purple cheek", he presumably would not either appreciate Simonides' "purple mouth", nor the adjective ῥοδοδάκτυλος, for "if someone was to dip his fingers in rose-coloured dye, he would end up with the hands of a purple-dyer – not those of a beautiful woman".[97] Sophocles' quick-witted answer triggered the mirth of all the men taking part in the banquet: the teacher had been ridiculed by the implication that he could not even appreciate Homer's poetry. The allusion required no more than the epithet ῥοδοδάκτυλος to be understood by the whole party – including the teacher himself, who then remained speechless. Knowledge of the Homeric epics is one of the most important cultural elements that unites the Greeks: not being able to enjoy Homer is the same as being a barbarian.

Roman elegists, in that respect, deserve to be called Greek far more than does the poor teacher humiliated by Sophocles. Like the erudite poets of the Hellenistic period, their works constantly yet subtly quote and interpret Greek archaic verse. Homeric poetry, especially, seems to provide an inexhaustible source of inspiration, a literary treasure upon which they build their own poetic language. The value and meaning of the colour terms used by Roman elegists lie in their literary past: like πορφύρεος, *purpureus* is a noble adjective, not only because it recalls precious dyes coming from the distant East, but above all because its use builds on the language of Homer, the poet *par excellence*.

However, the elegist's awe of Homer's authority was not the kind of reverence that forbids initiative. On the contrary, Latin poets did not hesitate to offer innovative readings of Homeric verses; any room left for interpretation steered their creativity and allowed them to express their originality. Ovid might be one of the best examples of such 'original imitation' – for in the centuries that followed, his authority rose to approach the status of a Roman Homer. Reviving and transforming Homer's imagery, they contributed to build the cultural conglomerate that surrounds the complex semantics of colour terms.

97 Note that "murex dye-colour" and "rose-colour" are again presented as chromatic equivalents here.

11 Conclusion: Poetry matters

In the past, much effort has been expended at 'scraping the poetic varnish' off Greek and Latin verses, entertaining the hope that it would allow a view into the poets' everyday environment. Just as the excessive cleaning of ancient ivories leads to an irreparable loss of data, this attitude was counter-productive: the poetic context in which colour terms appear is inseparable from their meaning. Moreover, when it comes to poetic imagery, the question of possible 'inaccuracies' or 'anachronisms' regarding hues and pigments is simply not relevant: Ovid's verses should not be read as a mirror of contemporary practices, but as a cultural product perpetuating a Greek poetic tradition.[98] If we approach the chromatic allusions by poets looking for consistency with material culture, we might miss the most important part of their testimony. But when it is studied for what it is – literature –, poetry can provide valid historical information.

Poetry is not a mere reflection of the ancient coloured world: it fully contributes to it. Literary monuments such as Homer and Ovid are authors in the etymological sense of the word: they possess the *auctoritas* necessary to establish the correct contexts of use for colour terms, thus both enriching and fixing their meanings. Their famous verses act as beacons, indicating how colour semantics shall and shall not be used in otherwise quite uncharted territory. Thanks to later poets, their heritage sometimes transcends the barriers of languages: deeply imbedded in Western culture, some of their powerful imagery continue to influence the way we use colour terms in the spoken language of everyday life. [99]

Modern colour terms are not, I am convinced, as free from the fetters of conventions as we like to imagine them.[100] To illustrate his idea that in modern thought, unlike in antiquity, colours rely on "a predominantly abstract system of colours" and can easily be transferred from one context to another, Bradley pointed out the fact that the English 'green' can characterise "plants, parrots, emeralds, sick faces, and so on".[101] It is remarkable, in my opinion, that all the examples of 'green' realities enumerated by Bradley are also attested uses of either *uiridis* or χλωρός (or even both).[102] When we think of realities

98 See Connor 1998, 59, who assumes that "Ovid knew of a contemporary practice of dyeing ivory", for his allusion "would otherwise simply be an anachronism".

99 The French '*pourpre*' for example, which was, like *purpureus*, famously used by authors who emulated Greek lyric poetry, shares affective and aesthetic connotations with the Latin adjective (e.g. Ronsard, 16th century, whose well-known verses compare the complexion of a beloved woman to the "robe de pourpre" of a rose).

100 Cf. Pelletier-Michaud 2016a, 281–282.

101 Bradley 2013, 130.

102 Plants and foliage are the most common context of use of both Greek and Latin adjectives, e.g. Tib. 2.1.40 *(uiridis frons)*, Ov. *Am.* 1.14.22 *(uiride gramen)* and Theoc. *Id.* 11.13 (χλωρὰ βοτάνη); for the parrot, cf. Plin. *HN* 10.117 *(psittacus… uiridis)* and possibly Ov. *H.* 15.38 *(uiridis auis)*; for emeralds, cf. Tib. 2.4.27 *(uirides smaragdi)*; and for a complexion "greener than grass", cf. the famous verse by Sappho (Sapph. 31.14 LP, χλωρότερος… ποίας).

representative of a given colour, the first examples that come to mind are often present in ancient literature: in modern Western spoken languages, the use of colour terms does, to a large extent, obey to unspoken rules, many of which appear to be inherited from ancient cultures – especially from poetry.

As we have seen, the very act of exposing colour terms to new interpretations is central to the process that leads to the abstraction of colours. This is precisely what Greek poets as early as Sappho, as well as their later Roman successors – especially Ovid – were achieving when they used Homeric colour vocabulary in innovative contexts. The comparison, a device so typically representative of Homer's descriptive technique, appears as a necessary first step towards the creation of an abstract colour concept.

Poetic *exempla* can also provide basis for theoretical considerations. The importance of poetry for the question of colour theorising is reflected in ancient discourses about chromatic vocabulary, such as the famous discussion between Fronto and Favorinus narrated by Gellius.[103] Comparing the semantic range of Greek and Latin colour vocabulary – applying a system that is strikingly similar to those utilised in certain modern linguistic theories, in which specific terms are subordinated to 'basic' terms corresponding to wider colour categories –, both parties evoke various poetic examples in order to support their claims. When colours are the center of a discussion, poetry, Homer's especially, seems to set the standard.

Taking a deeper look at Greek and Roman poetry permits a more nuanced understanding of colours and their many values. Not only do we begin to appreciate how they were conceived of in antiquity, but we also become wise to the various twists and turns that led to the cultural meanings constructed around colours and to how they shed light on the origins of modern colour categories.

103 Cf. Gell. *NA* 2.26.

Bibliography

Affanni 2015
Giorgio Affanni. "Protocol for the Examination of the Ancient Ivories from Arslan Tash. A Palaeo-Technological Approach". *Altorientalische Forschungen* 42.1 (2015), 59–70.

André 1949
Jacques André. *Étude sur les termes de couleur dans la langue latine*. Paris: Klincksieck, 1949.

Aruz 2008
Joan Aruz. "Central Anatolian Ivories". In *Beyond Babylon. Art, Trade, and Diplomacy in the Second Millennium BC*. Ed. by J. Aruz, K. Benzel, and J. M. Evans. New York, New Haven, and London: Metropolitan Museum of Art and Yale University Press, 2008, 82.

Barnett 1957
Richard D. Barnett. *A Catalogue of the Nimrud Ivories*. London: British Museum, 1957.

Beta and Sassi 2003
Simone Beta and Maria Michela Sassi, eds. *I colori nel mondo antico, esperienze linguistiche e quadri simbolici*. Fiesole: Edizioni Cadmo, 2003.

Bourgeois 1992
B. Bourgeois. "An Approach to Anatolian Techniques of Ivory Carving During the Second Millenium BC". In *Ivory in Greece and the Eastern Mediterranean from the Bronze Age to the Hellenistic Period*. Ed. by J. L. Fitton. London: British Museum Press, 1992, 61–66.

Bradley 2004
Mark Bradley. "The Colour 'Blush' in Ancient Rome". In *Colour in the Ancient Mediterranean World*. Ed. by L. Cleland, K. Stears, and G. Davies. Oxford: John and Erica Hedges Ltd., 2004, 117–121.

Bradley 2009
Mark Bradley. *Colour and Meaning in Ancient Rome*. Cambridge and New York: Cambridge University Press, 2009.

Bradley 2013
Mark Bradley. "Colour as Synaesthetic Experience in Antiquity". In *Synaesthesia and the Ancient Senses*. Ed. by S. Butler and A. Purves. The Senses in Antiquity 1. Durham and Bristol, CT: Acumen, 2013, 127–140.

Brecoulaki 2014
Harikleia Brecoulaki. "'Precious Colours' in Ancient Greek Polychromy and Painting. Material Aspects and Symbolic Values". *Revue Archéologique* 57.1 (2014), 3–35.

Carastro 2009
Marcello Carastro, ed. *L'Antiquité en couleurs*. Grenoble: Jérôme Millon, 2009.

Carter 1985
Jane Burr Carter. *Greek Ivory-Carving in the Orientalizing and Archaic Periods*. Outstanding Dissertations in the Fine Arts. New York and London: Garland Publishing, 1985.

Clarke 2003
Jacqueline Clarke. *Imagery of Colour and Shining in Catullus, Propertius and Horace*. New York: Peter Lang, 2003.

Cleland, Stears, and Davies 2004
Karen Cleland, Liza Stears, and Glenys Davies, eds. *Colour in the Ancient Mediterranean World*. Oxford: John and Erica Hedges Ltd, 2004.

Connor 1998
Carolyn L. Connor. *The Color of Ivory. Polychromy on Byzantine Ivories*. Princeton: Princeton University Press, 1998.

Cusset 1999
Christophe Cusset. *La muse dans la bibliothèque. Réécriture et intertextualité dans la poésie alexandrine*. Paris: CNRS éditions, 1999.

Di Paolo 2015
Silvana Di Paolo. "Beyond Design and Style. Enhancing the Material Dimension of Artefacts through Technological Complexity". *Altorientalische Forschungen* 42.1 (2015), 71–79.

Dimakopoulou 2010
Adrienne Dimakopoulou. *Chlôrêis aêdôn, pâle rossignol. Une étude sémantique*. Paris: Apolis Éditions, 2010.

Dupont 2004
Florence Dupont. "Comment devenir à Rome un poète bucolique? Corydon, Tityre, Virgile et Pollion". In *Identités d'auteur dans l'Antiquité et la tradition européenne*. Ed. by C. Calame and R. Chartier. Grenoble: Jérôme Millon, 2004, 171–189.

Edgeworth 1992
Robert J. Edgeworth. *The Colors of the Aeneid*. New York and Bern: Peter Lang, 1992.

Fontan and Reiche 2011
Elisabeth Fontan and Ina Reiche. "Les ivoires d'Arslan Tash (Syrie) d'après une étude de la collection du Musée du Louvre. Mise en œuvre du matériau, traces de polychromie et de dorure, état de conservation". *ArcheoScience. Revue d'archéométrie* 35 (2011), 283–295.

Gladstone 1858
William E. Gladstone. *Studies on Homer and the Homeric Age*. Vol. 3. Oxford: Oxford University Press, 1858.

von Goethe 1810
Johann Wolfgang von Goethe. *Zur Farbenlehre*. Stuttgart: Cotta, 1810.

Grand-Clément 2004
Adeline Grand-Clément. "Histoire du paysage sensible des Grecs à l'époque archaïque: Homère, les couleurs et l'exemple de πορφύρεος". *Pallas* 65 (2004), 123–143.

Grand-Clément 2011
Adeline Grand-Clément. *La fabrique des couleurs. Histoire du paysage sensible des Grecs anciens (VIIIe s.–début du Ve s. av. n. è.).* Paris: De Boccard, 2011.

Gubel 2005
Eric Gubel. "Phoenician and Aramean Bridle-Harness Decoration. Examples of Cultural Contacts and Innovation in the Eastern Mediterranean". In *Crafts and Images in Contact. Studies on Eastern Mediterranean Art of the first Millenium BCE*. Ed. by C. E. Suter and C. Uehlinger. Fribourg and Göttingen: Academic Press and Vandenhoeck & Rupprecht, 2005, 111–147.

Güterbock 1971
Hans G. Güterbock. "Ivory in Hittite Texts". *Anadolu* 15 (1971), 1–7.

Herrmann 1986
Georgina Herrmann. *Ivories from Room SW37, Fort Shalmaneser*. Ivories from Nimrud 4. London: British School of Archaeology in Iraq, 1986.

Herrmann and Laidlaw 2012–2013
Georgina Herrmann and Stuart Laidlaw. "Assyrian Nimrud and the Phoenicians". *Archaeology International* 16 (2012–2013), 84–95.

Irwin 1974
M. Eleanor Irwin. *Colour Terms in Greek Poetry*. Toronto: Hakkert, 1974.

Lapérouse 2008
Jean-François de Lapérouse. "Technical Notes on the Metropolitan Museum Ivories". In *Beyond Babylon. Art, Trade, and Diplomacy in the Second Millennium BC*. Ed. by J. Aruz, K. Benzel, and J. M. Evans. New York, New Haven, and London: Metropolitan Museum of Art and Yale University Press, 2008, 85.

Lauraux 1977
Nicole Lauraux. "La 'belle mort' spartiate". *Ktèma* 2 (1977), 105–120.

Maxwell-Stuart 1981
Peter G. Maxwell-Stuart. *Studies in Greek Colour Terminology. Vol. I: γλαυκός; Vol. II: χαροπός.* Mnemosyne Supplementum 65. Leiden: Brill, 1981.

Moorey 1994
Peter R. S. Moorey. *Ancien Mesopotamian Materials and Industries. The Archaeological Evidence*. Oxford: Clarendon Press, 1994.

Newton 1721³ [1704]
Sir Isaac Newton. *Opticks, or: A Treatise of the Reflections, Refractions, Inflexions and Colour of Light*. London: Innys, 1721³ [1704].

Orchard 1967
Jeffrey J. Orchard. *Equestrian Bridle-Harness Ornaments*. Ivories from Nimrud 1. London: British School of Archaeology in Iraq, 1967.

Osborne 1968
Henry Osborne. "Colour Concepts of the Ancient Greeks". *British Journal of Aesthetics* 8.3 (1968), 269–283.

Pelletier-Michaud 2016a
Lydia Pelletier-Michaud. "Aux origines poétiques de la couleur: pour une approche littéraire des lexiques chromatiques anciens. L'exemple des élégiaques latins et de leurs modèles grecs". *Anabases* 23 (2016), 278–289.

Pelletier-Michaud 2016b
Lydia Pelletier-Michaud. "Évolution du sens des termes de couleur et de leur traitement poétique. L'élégie romaine et ses modèles grecs". Dissertation, Université Laval. 2016.

Pierre 2005
Maxime Pierre. "Rome dans la balance. La poésie augustéenne imite-t-elle la poésie grecque ?" In *Façons de parler grec à Rome*. Ed. by F. Dupont and E. Valette-Cagnac. Paris: Belin, 2005, 229–254.

Pigeaud 2007
Jackie Pigeaud, ed. *La couleur, les couleurs. XIe Entretiens de La Garenne-Lemot*. Rennes: Presses universitaires de Rennes, 2007.

Platnauer 1921
Maurice Platnauer. "Greek Colour-Perception". *The Classical Quarterly* 15 (1921), 153–162.

Poursat 1977
Jean-Claude Poursat. *Les ivoires mycéniens. Essai sur la formation d'un art mycénien*. Bibliothèque des écoles françaises d'Athènes et de Rome 230. Paris and Athens: De Boccard and École française d'Athènes, 1977.

Rainey 2015
Anson F. Rainey. *The El-Amarna Correspondence. A New Edition of the Cuneiform Letters from the Site of El-Amarna based on Collations of all Extant Tablets*. Vol. 1. Leiden and Boston: Brill, 2015.

Reinhold 1970
Meyer Reinhold. *History of Purple as a Status Symbol in Antiquity*. Studies in Latin Literature and Roman History, VI , 116. Brussels: Latomus, 1970.

Rouveret, Dubel, and Naas 2006
Agnès Rouveret, Sandrine Dubel, and Valérie Naas, eds. *Couleurs et matières dans l'Antiquité. Textes, techniques et pratiques*. Paris: Éditions Rue d'Ulm, 2006.

Schneider 2004
Pierre Schneider. *L'Éthiopie et l'Inde. Interférences et confusions aux extrémités du monde antique (VIIIe siècle avant J.-C.–VIe siècle après J.-C.).* Rome: École française de Rome, 2004.

Sfyroeras 2014
Pavlos Sfyroeras. "Like Purple on Ivory. A Homeric Simile in Statius' Achilleid". In *Flavian Poetry and Its Greek Past*. Ed. by A. Augoustakis. Leiden and Boston: Brill, 2014, 235–248.

Simpson 2013
Elizabeth Simpson. "An Early Anatolian Ivory Chair. The Pratt Ivories in The Metropolitan Museum of Art". In *Amilla. The Quest for Excellence. Studies Presented to Guenter Kopcke in Celebration of His 75th Birthday*. Ed. by R. B. Koehl. Philadelphia: INSTAP Academic Press, 2013, 221–261.

Thavapalan 2018
Shiyanthi Thavapalan. "Purple Fabrics and Garments in Akkadian Documents". *Journal of Ancient Near Eastern History* 3.2 (2018), 163–190.

Villard 2002
Laurence Villard, ed. *Couleurs et vision dans l'Antiquité classique*. Mont-Saint-Aignan: Publications de l'université de Rouen, 2002.

Wicke 1999
Dirk Wicke. "Altorientalische Pferdescheuklappen". *Ugarit-Forschungen* 31 (1999), 803–852.

Winter 2010
Irene J. Winter. "Is There a South Syrian Style of Ivory Carving in the Early First Millenium BC?" In *On Art in the Ancient Near East. Vol. 1: Of the First Millenium BCE*. Leiden and Boston: Brill, 2010, 279–334.

Wittgenstein 1977
Ludwig Wittgenstein. *Bemerkungen über die Farben (posthumous)*. Berkeley and Los Angeles: University of California Press, 1977.

LYDIA PELLETIER-MICHAUD

Lydia Pelletier-Michaud (Ph.D. Université Laval, 2016) is an associate member of Patrimoine Littérature Histoire-Erasme at the Université de Toulouse II. Her publications on the topic of colour language in ancient Greek include: *Aux origines poétiques de la couleur : pour une approche littéraire des lexiques chromatiques anciens. L'exemple des élégiaques latins et de leurs modèles grecs*, Anabases 23, 2016, 278–289; *Évolution du sens des termes de couleur et de leur traitement poétique : l'élégie romaine et ses modèles grecs*, doctoral dissertation, Université Laval, 2016 (book in preparation).

Dr. Lydia Pelletier-Michaud
E-Mail: lydia.pelletier.michaud@gmail.com

Cecilie Brøns

Ancient Colours: Perspectives and Methodological Challenges

Summary

The discourse around the material aspects of ancient colours has largely been dominated by ancient polychromy studies. However, as the present volume shows, colour was not restricted to paint and was everywhere in the ancient world. There were many ways of incorporating and manipulating colour – with gemstones, glass, metals, pottery, textiles, leather, fur, shell, bone, ivory, teeth, feathers, and plants. This illustrates how diverse the study of colour is. The present contribution discusses some of the methodological issues related to the study of colourful materials in the ancient world, such as the challenges in interpreting iconographical and written sources, the use of colour imitations and 'fakes', raw materials and overlaps in craft traditions, as well as colour trade and production.

Keywords: colourants; pigments; colour imitations; craft traditions; colour trade; interdisciplinary research

Der Diskurs über die materiellen Aspekte antiker Farben war bislang weitgehend von polychromatischen Studien dominiert. Wie der vorliegende Band zeigt, war Farbe in der Antike jedoch erstens nicht auf die Behandlung von Oberflächen beschränkt und zweitens überall zu finden. Es gab viele Möglichkeiten, Farbe einzubringen und zu manipulieren – mit Edelsteinen, Glas, Metallen, Keramik, Textilien, Leder, Pelz, Muscheln, Knochen, Elfenbein, Zähnen, Federn und Pflanzen. Dies zeigt, wie vielfältig die Erforschung von Farbe ist. Der vorliegende Beitrag diskutiert einige methodische Fragen zum Studium farbiger Materialien aus der Antike, wie die Herausforderung, ikonographische und schriftliche Quellen zu interpretieren, die Verwendung von Farbimitaten und ‚Fakes', Rohstoffe in handwerklichen Traditionen sowie Farbhandel und -produktion.

Keywords: Farbstoffe; Pigmente; Farbimitate; Handwerkstraditionen; Farbhandel; interdisziplinäre Forschung

Shiyanthi Thavapalan, David Alan Warburton (eds.) | The Value of Colour. Material and Economic Aspects in the Ancient World | Berlin Studies of the Ancient World 70 (ISBN 978-3-9820670-1-8; DOI: 10.17171/3-70) | www.edition-topoi.org

I am very grateful to Shiyanthi Thavapalan and David Warburton for arranging a very inspiring conference as well as their kind invitation to contribute to this publication. I am very thankful for all their insightful comments and suggestions which have greatly improved my text. I owe a depth of gratitude to the Harvard Center for Hellenic Studies, where I was a fellow when writing this article. Furthermore, I am grateful to the Carlsberg Foundation for funding the interdisciplinary research into ancient polychromy carried out at the Ny Carlsberg Glyptotek in Copenhagen.

1 Introduction: more than polychromy?

The discourse around the material aspects of ancient colours has largely been dominated by ancient polychromy studies. The term 'polychromy' comes from the Greek words *poly* (πολύς 'much'/'many') and *chroma* (χρῶμα 'colour') and means 'multi-coloured'. Polychromy thus covers the use of many colours, especially in connection with paint applied onto architecture and sculpture.[1] Colours were an important aspect of ancient artefacts, but due to unfavourable conditions of preservation, to the fragility of paint, and, not least, to actual cleaning, the majority of the original colouration on ancient Near Eastern, Greek and Roman artefacts has disappeared. Yet this knowledge is not something new: at least since the 17th century, scholars have been aware that ancient sculptures and temples were once brightly painted. This is attested by early scientific documentation consisting of descriptions from excavations and water-coloured drawings of sculptures and architectural fragments (Figs. 1–2).

However, this knowledge somehow failed to diffuse widely amongst the general public, but also to some extent among scholars who, perhaps more or less consciously, chose to focus on white as an aesthetic that appealed to western ideals of a civilised, political past.[2] And so, colours have since lived in the shadows of the sculptural and architectural qualities of ancient built spaces.

White is the first colour that comes to mind when one thinks of ancient Mediterranean art and architecture. However, the white marble objects we see in museums today are far from representative of ancient art. This 'revelation' that ancient white marble

1 For the research history of ancient polychromy, see e.g. Østergaard and Nielsen 2014; Liverani and Bankel 2004.

2 The topic of ancient colours, sculptural polychromy, in particular, is still delicate. Thus, Sarah E. Bond, a scholar who specialises in Roman history and works as an assistant professor in the classics department at the University of Iowa, has recently (2017) received death threats and is being targeted by the alt-right for publishing an article on polychromy in the ancient world. See: https://www.artforum.com/news/id=68963 (visited on 15/10/2017).

Fig. 1 Illustration from Ludvig Fenger's *Dorische Polychromie* from 1886.

Fig. 2 Watercolour of antefix from the Athenian Acropolis. Painted by the Danish architect Gottlieb Bindesbøll in 1835.

was originally covered with paint has a significant 'wow factor,' and has therefore largely dominated the discussion as well as the dissemination of ancient colours. For example, ancient polychromy has been the focus of several special exhibitions during the past fifteen years or so, the best-known being the travelling exhibition *Gods in Colour (Bunte Götter)*, curated by Vincenz Brinkmann and Ulrike Koch-Brinkmann, which has been shown in a host of museums in Europe and the United States, drawing millions of visitors. Other examples include the exhibitions *Classicolor* and *Transformations – Classical Sculpture in Colour*, curated by Jan Stubbe Østergaard, at the Ny Carlsberg Glyptotek in Copenhagen (Figs. 3–6).[3]

3 E.g. The Glyptotek, Munich (2004), the J. Paul Getty Villa, Malibu (2008), Arthur M. Sackler Museum, Harvard (2008), the Pergamon Museum, Berlin (2010), Kunsthistorisches Museum, Vienna (2013), the Ashmolean, Oxford (2015). Furthermore, at the Ny Carlsberg Glyptotek two special exhibitions, ten years apart, have been presented: *ClassiColor* (2004), which was realised in collaboration with the Staatliche Antikensammlungen und Glyptothek in Munich and the Musei Vaticani and *Transformations. Classical Sculpture in Colour* (2014).

Fig. 3 View from the exhibition *Transformations – Classical Sculpture in Colour* at the Ny Carlsberg Glyptotek in 2014.

Fig. 4 The Roman portrait of the emperor Caligula (left) and three different reconstructions of its polychromy. View from the exhibition *Transformations – Classical Sculpture in Colour* at the Ny Carlsberg Glyptotek in 2014.

However, as the present volume shows, colour was not restricted to paint, but was everywhere in the ancient world. There were many ways of incorporating and manipulating colour – with gemstones, glass, metals, pottery, textiles, leather and fur,[4] as well as other organic materials like shell, eggshell, bone, ivory, teeth, feathers, and plants. This illustrates how diverse the study of colour is. For the historian, the challenge is, of course, that many of these materials are organic, meaning that they are usually no longer discernible in the archaeological record.

Another fact that is perhaps evident but nonetheless important to stress, is that colours were not a prerequisite of the classical world but were part of lived life from the earliest history of mankind. This is illustrated by several of the contributions in this volume, exemplified in the contribution by Moutsiou, who remarks that the earliest secure evidence of the use of pigment may date to as early as ca. 500 000 years ago; thus, colours

4 The significance of the different colours of Ancient Near Eastern cattle was addressed at the conference in a paper by Rosel Pientka-Hinz.

Fig. 5 Reconstruction of a head of a warrior from the Aphaia temple on Aegina. View from the exhibition *Transformations – Classical Sculpture in Colour* at the Ny Carlsberg Glyptotek in 2014.

were already socially meaningful during the Palaeolithic – consciousness of this is nevertheless neglected in scholarship. Since at least ca. 35 000 years ago, material colours in the form of red and yellow ochre, white ivory, and shells as well as black obsidian have gradually played an increasingly central role in signalling social values and symbolism. The confirmation of this is reinforced by Bar-Yosef Mayer, whose contribution concerns personal ornaments in the Neolithic and Chalcolithic periods and which focuses specifically on coloured stone beads in white, red, yellow, brown, black, and green, the latter related to the introduction of agriculture.

Many of the contributions in this book concern these materials, attempts to artistically depict their colours as well as attempts to synthetically imitate them. On the other hand, however, one of the most challenging problems is that a good part of the discourse about these material colours is based on various texts describing or somehow related to them. This makes it very difficult to follow a straight line when trying to summarise the key points of the discourse on the materiality of ancient colours addressed in this book.

A further problem is that – even in cases or situations where we can be certain about the colours we see or read about – our myopic attention to colour inevitably neglects the fact that colours do not stand alone, but are part of the entire fabric of life. This is probably much more so today than in antiquity, which, however, only enhances the importance and effect of the colours used, since they would have stood out even clearer. This means that individual colours should not be studied or considered alone,

Fig. 6 View from the exhibition *Classicolor* at the Ny Carlsberg Glyptotek in 2004.

but should be viewed and interpreted as part of a larger context. To approach the significance of these colours and their effect on ancient, lived, societies, we should therefore strive to see 'the big picture' by including context, not simply as the specific, physical place an artefact was recovered, but also the kind of site, the time period to which it belongs, associated artefacts, original use, etc. This also means that not only the individual colours and their materials, but also their combinations are important. As an example, it created a unique effect and stimulated a clear perception, when a coloured material, such as a stone, was used together with one material rather than another. The effects and perceptions of using different combinations are therefore a crucial aspect of lived colours.

This raises further interesting inquiries for several of the contributions in this book, e.g. in relation to the Neolithic and Chalcolithic ornaments studied by Bar-Yosef, since these would never have been experienced alone, but together with attire, including garments in various colours, as well as other types of ornamentation including make-up, body paint, wreaths, garlands, specific coiffures, etc. Furthermore, these ornaments should also be interpreted in relation to the occasion when they were worn, by whom, as well as whether they were associated with other accessories or insignias such as sceptres, maces, and crowns, which are also encountered during and since the Chalcolithic.

The painted sculptural reconstructions offered by the Brinkmanns are thus but a hint of the colours experienced in antiquity – and one should not forget the experience of seeing only one of their statues in a hall filled with the familiar monotone white artworks to which we have become accustomed. Moreover, the artefacts we see today on exhibit in museum collections are far removed from their original context, which would have included sound, smell, taste, touch, etc. An ancient cult statue, for example, would have had a very different expression and effect standing in a dark temple lit by torches or oil lamps, painted in bright colours and dressed in textiles, surrounded by the sound of people performing rites and the smells of sacrifices and incense. Our modern experience of the same artefact now situated in a silent and clean 'white cube' museum is very clinical when compared to the ancient lived experience.

In the opposite sense, individual colours will also have been more striking against a monotonous background, precisely as happens when excavators have the rare experience of encountering the striking impressions of colourful stones, gold or glass appearing out of the dust. Obviously, we only rarely have access to information concerning the effects of colours in the lived context; and we are particularly exposed to lacunae in our access when taking account of the (missing) organic materials. Yet simply realising this and taking it into consideration in our interpretations minimises the risk of creating distorted views of ancient colours.

2 Is what you see (or read) what you get?

One of the many questions that emerges from this publication are the difficulties involved in interpreting the iconographical evidence with regard to colours. Iconography is an important source of information about ancient societies but making sense of images can be very difficult; and yet we often take the process of interpreting images very much for granted. A challenge in interpreting ancient iconography is therefore determining *how* we interpret what we see.[5] The most important problem for the use of iconography as a source for understanding how people lived and thought is the extent to which it corresponds to ancient reality. Certainly, images are not simple replicas of

5 Ekroth 2009, 91; Bérard and Durand 1989, 23.

Fig. 7 Examples of pigments used by ancient painters: red and yellow ochre, carbon black, cinnabar, realgar, orpiment, green earth, malachite, and azurite.

reality and it is clear that they were not produced to document or to provide empirical information about everyday life. Rather, images reflect the perceptions, ideologies, and ideas of the society in which they were produced.[6] Reading images is not just a question of decoding a single meaning, since the interpretations of images varies from one context to another, with different viewers and with different expectations.[7] Blakolmer addresses this issue in his contribution on the polychromy of the architectural façades in the Aegean Bronze Age, in which he argues that the colours used by the Aegean painters for depicting these façades were not chosen in order to faithfully reproduce actually painted architecture, but rather to reflect the heterogeneous nature of the materials and their surfaces. This is an important reminder – in particular for a publication focused solely on colour – that indeed not everything in the ancient world was necessarily brightly coloured.

When dealing with ancient iconography, particularly regarding colours, it is also important to note that what we see today is not necessarily the same as what met the ancient viewer. First of all, the colours may have faded due to exposure to sunlight, heat, moisture etc. and the colours may originally have been much brighter (Fig. 7).

Furthermore, some pigments are known to change colour due to chemical changes caused by degradation phenomena. How ancient polychromy can 'deceive' is illustrated

6 Ekroth 2011, 7, 11; Brøns 2016.

7 See Brøns 2016, 13–14.

by Blom-Böer's contribution on ancient Egyptian painting, as she explains how the pigment realgar – when exposed to sunlight – can degrade to orpiment. These two pigments are very closely related chemically, but have different hues: realgar is orange while orpiment is bright yellow. Another example is the blue pigment azurite, which can degrade to tenorite, which is black in colour and to malachite, which is green. Malachite thus occurs both as a green pigment and as a degradation product of azurite in connection with ancient painted surfaces. Malachite is quite interesting, since it is often assumed to be the most commonly used and earliest green pigment to have been used; but as shown by Blom-Böer, it is highly probable that the ancient Egyptians realised early on that malachite was chemically very unstable and therefore did not use it often. The synthetic pigment Egyptian blue, which was invented by the third millennium BC and used all over the Mediterranean littoral up through at least the medieval period, is generally a very stable pigment, which, however, in some instances has been shown to have become brownish green or even black.[8] The final example given here is ochre, which was a commonly used pigment. Ochre is sensitive to oxidation and hydration. Yellow ochre can therefore be turned red by heating the goethite (FeOOH) in the ochre and converting it to hematite. Thus, exposing yellow goethite to temperatures above 300 degrees will gradually dehydrate the mineral, converting it first to orange-yellow and then red as hematite is produced. Such colour changes in ochre has been attested for several ancient contexts, e.g. wall-paintings from Pompeii and Herculaneum, where yellow ochre used for wall-paintings turned red due to the heating associated with the Vesuvian eruption.[9] It should also be taken into account that the use of varnishes and binding media can have a darkening effect. Studies of ancient Egyptian artefacts, for example, have shown that varnishes and binding media that were originally colourless had turned brown.[10] Thus, we should often consider the possibility that what we see depicted today does not necessarily reflect the ancient original appearance.

A similar complication presents itself with textual sources. With regard to colours, written documents are constrained by genre in much the same way as visual media, since each type of text will privilege particular and often contradictory images of the thing, person etc. being described. Furthermore, the authors were usually upper-class males writing for their peers, which of course affects their literary representations. For example, descriptions of the colours of dress in the Roman period, purple especially, primarily served other functions: for instance, it might serve as a shorthand for character, gender, or moral values. And so it is sometimes impossible to ascertain how much of the rhetoric was simply literary fiction used for effect.[11]

8 Daniels, Middleton, and Stacey 2004.

9 Faivre 2016, 560.

10 Daniels, Middleton, and Stacey 2004.

11 Harlow and Nosch 2014, 12.

One approach to studies of colour in literary sources is presented in the contribution by Pelletier-Michaud, which deals with poetic value and chromatic vocabulary in Roman elegy. She demonstrates that poetry can indeed only provide valid historical information when studied as what it is: literature. Thus, we cannot conclude anything about material colours such as pigments, for example, and she stresses that poetry should be read as a mirror reflecting cultural values rather than contemporary practices. She concludes that we cannot "scrape the poetic varnish of Greek and Latin verses, entertaining the hope that it would allow a view into the poets' everyday environment". This approach would be counterproductive, since the poetic context in which the colour terms are used is inseparable from their meaning.

A further challenge is highlighted by Blom-Böer, who stresses the difficulty of interpreting texts about pigments that were not written by the craftsmen who actually used them but rather by scribes or administrators, who did not necessarily have the technical knowledge (or indeed the interest!) to be able to record everything precisely, which might cause difficulties for philologists today. Also, when dealing with epigraphy as well as written accounts it is important to consider that all written sources are selective. This means that inscriptions, for example, represent decisions about inclusion and exclusion, and that we cannot expect them to tell the full story. This means that it is not possible – or at least that it is extremely difficult – to draw firm conclusions about materials, objects, colours etc., which are *not* recorded in for example the archival material dealt with by Quillien or Thavapalan.

3 Faking it? Ancient colour imitations

The imitation of precious colours using cheaper materials was a widespread phenomenon in antiquity. Among the best-known and documented examples of this is the imitation of the so-called true purple dye, made from the extracted glands of certain species of sea mollusc (*Bolinus brandaris*, *Hexaplex trunculus*, and *Stramonita haemastoma*). The production of true purple dye was a laborious process and the final product was therefore extremely expensive and so reserved for the richest strata of society. For this very reason, the purple dye was widely imitated and 'fake' dyes were common. This is attested in several late antique textiles from Egypt, where a mixture of plant dyes (such as madder and woad) has been used to imitate 'real' purple. The imitation of mollusc purple dye for textiles is also attested in written sources, for example by Pseudo-Democritus in his book *On Purple* from the 1st c. AD, as well as in the Leiden and Stockholm papyri. These documents, which were recovered at Thebes in central Egypt and date to the late 3rd or early 4th

c. AD, contain dye recipes, primarily for imitations of true shellfish purple.[12] Furthermore, the term *pseudoporphyros*, meaning 'false' or 'fake' purple is used in a papyrus from the 3rd c. AD from Oxyrhynchos, which mentions a woman's "shirt of false purple".[13] The imitation of expensive dyes some seven to eight hundred years earlier is addressed in Quillien's contribution where she highlights a Neo-Babylonian recipe from Sippar that describes one such technique. However, based on her study of commodity prices in the 7th and 6th c. BC, Quillien concludes that the majority of textiles mentioned in the Babylonian temple archives were dyed primarily with genuine expensive dyes, such as kermes or true purple.

Yet other costly and colourful materials were imitated using cheaper or at least more readily available raw materials. Thus, the earliest producers and consumers of glass sought to imitate the qualities of minerals and stones: the dark blue glass should imitate lapis lazuli and azurite, while pale blue frits should imitate turquoise, malachite, or green gemstones.[14] This is also the argument in the contribution by Dardeniz, who argues that the mass-produced opaque blue glass was used/adopted in ancient Anatolia as a substitute for the much sought-after gemstone lapis lazuli. And yet, as she further argues, glass was not necessarily considered a 'cheap' material, since it is frequently recorded in royal inventory lists alongside precious metals and stones. Such imitations are also addressed in the contribution by Thavapalan, who demonstrates that the names of imported stones that were considered 'exotic' in Mesopotamia were deliberately adopted to designate coloured glasses in the Akkadian language, which again speaks to cultural if not economic value. Hodgkinson also addresses this issue in relation to ancient Egypt, where it has been argued that dark blue glass was regarded as a type of stone rather than a direct imitation, which is in clear contrast to the situation for textiles.[15]

The issue of fakes and imitations is important because the social significance of colours was closely linked to the material value of the different colourants, whether precious stones such as lapis lazuli, metals (gold in particular), exclusive pigments or dyes, since these were reserved for the elite strata of society due to their high cost. Through dress and decoration, colour communicated different aspects of personhood and identity such as gender, age, ethnicity, religion, and not least social status. In the Classical Mediterranean area, purple was the most socially loaded colour, associated with the uppermost social strata due to its extreme value. In ancient Greece, purple was a colour of royalty, but also a significant colour used in the sanctuaries for the cult statues and certain religious personnel. In some sanctuaries, visitors were even forbidden to wear purple, underlining its religious significance.[16] In later times, the association of purple with the elite is illustrated by the fact that the use of this particular colour was gradually

12 Caley and Jensen 2008.
13 Bogensberger 2017.
14 Fenn 2015, 392.
15 Nicholson 2012.
16 Brøns 2016.

monopolised by the Roman imperial court. This monopoly included not only textiles, but also other luxury materials such as purple porphyry. In time, the ancient observer was "(...) trained politically, philosophically and linguistically to connect this dye with the body of the emperor."[17] The implementation or use of colour was thus a way to position oneself (and recognise the placement of others) within the social hierarchy, visually and economically, which again underlines the close correlation between colour and value.

4 Raw materials and overlaps between craft traditions

When one is dealing with the production aspects of colours, it is important to remember that several components were often needed: paint is made from a mixture of pigments (organic or inorganic) and binding media (milk, egg, oils, animal glue, etc.), plant- and animal-based dyes often require a mordant (alum being one of the most common in ancient times), while glass is made from silica, soda, and lime together with a metallic colourant. However, research into the materiality of ancient colours has generally been fixated on one specific category of materials, e.g., the pigments used for painting stone and terracotta or the colourants used for dyeing wool. The difference between pigments and dyes lies in their solubility: pigments are practically insoluble in the medium for application and are dispersed in it as solid particles (each usually measuring less than 1μm). Dyes, on the other hand, are adsorbed in dissolved form by the substrate, yarn for instance, and then fixed there by hydrogen bonding or a chemical reaction with the substrate involving the formation of poorly soluble salts or pigments so that it is difficult or impossible for the dye to diffuse out of the substrate.[18] Some colourants, such as madder, were often used in the Mediterranean littoral as well as in Roman Egypt for painting in the form of lakes. Lakes are coloured inorganic-organic hybrid materials, which were used in antiquity as pigments. They were obtained by precipitation or adsorption of naturally occurring dyes onto an insoluble and white organic substrate. According to historical sources, the most common mordant used in lake preparation was aluminium (potash alum).[19]

Several organic colourants can be used for textiles as well as for painting. This is the case, for instance, with kermes (from scaled insects of the species *Kermes vermilio*), woad *(Isatis tinctoria)*, indigo *(Indigofera tinctoria)*, and purple (from three species of molluscs: *Bolinus brandaris*, *Hexaplex trunculus*, and *Stramonita haemastoma*). Real purple dye made from murex snails was among the most famous and expensive dyes in antiquity, used

17 Bradley 2009, 207; Brøns and Skovmøller 2017.

18 Mollet, Grubenmann, and Payne 2001, 399.

19 Clementi et al. 2008, 25; Brøns and Sargent 2018.

for precious textiles already in the Bronze Age. A famous, albeit later, example is the Hellenistic gold and purple cloths recovered in the tomb of Philip II in Vergina. But as early as the Bronze Age, it was also used in the form of pigments for wall-paintings from Akrotiri, Thera (early second millennium BC), for tomb paintings in the Tomb of the Palmettes in Mieza (second half of the 3rd c. BC) and Tomb Ayios Athnasios in Thessaloniki (last quarter of the 4th c. BC), as well as for Hellenistic terracotta figurines and marble vessels.[20]

Madder is also of particular interest for the issue of cross-craft interactions. On the one hand, the root of the plant was commonly exploited for its dye, at least from the late third millennium BC onwards in the Near East. On the other, aside from Egyptian blue, it is also one of the earliest known and widespread, mass-produced pigments.[21] For example, the madder that is attested as crops in Mycenaean Palace records (designated by the Linear B term *po-ni-ki-jo*) is generally interpreted as destined for textile dyeing.[22] One is tempted, though, to consider the possibility that this madder may have also been used for painting the palace walls or for other types of colouration, e.g. perfumes.[23] Dyeing cloth with madder is thought to have been introduced into Egypt during the Eighteenth Dynasty (1550–1292 BC), most likely from the Levant.[24] There is also evidence for madder being used to colour wool and leather in Syria in the early second millennium (e.g. at Mari, Tell Hariri) and in southern Mesopotamia from the end of the third millennium onwards.

In the Mediterranean littoral, there are two dominant species of madder which have been used as colourants since antiquity: *Rubia tinctorium L.*, known as common madder and *Rubia peregrina L.*, known as wild madder.[25] The main colouring compounds in these two species are two hydroxyanthraquinones, alizarin (1,2-dihydroxyanthraquinone) and purpurin (1,2,4-trihydroxyanthraquinone).[26]

Madder is used as a mordant dye. Mordants are so-called coordination metals that form a bridge between the textile fibre and the dye, resulting in a dye-metal-textile complex. The most important mordant is the aluminium ion, mainly extracted from alum

20 Chrysikopoulou 2005; Vlachopoulos 2016; Brecoulaki 2006; Maravelaki-Kalaitzaki 2003; Brecoulaki, Kavvadias, and Verri 2014; National Archaeological Museum of Athens, inv. nos. A11363, A11372, A12904.

21 Daniels, Devièse, et al. 2014, 13; Kakoulli et al. 2017, 106.

22 *Po-ni-ki-jo* is a cultivated plant delivered by the Cretan villages in rather large quantities. It is often recorded with coriander and other spices, Nosch 2017, 22–25; Murray and Warren 1976; Foster 1977.

23 The use colouring of perfumes is described by Theoprastus, *On Odours*: "The dye used for colouring red perfumes is alkanet; the sweet marjoram-perfume is dyed with the substance called *khroma* (dye), which is a root imported from Syria." (translation by Hort 1916). It is quite possible that this root is madder.

24 Daniels, Devièse, et al. 2014, 13.

25 Karapanagiotis and Karadag 2015, 183.

26 Kakoulli et al. 2017, 106.

(potash alum).[27] Madder dye produces a range of colours from yellow through orange to red and purple or brown.[28]

For polychrome painting, madder extracts may have been used directly or for preparing pigments. However, as most organic colourants, including madder, are soluble, they cannot be mixed directly with a binding medium and therefore cannot be used as a pigment (with the exception of indigo and saffron). In general, pigments prepared from soluble, natural colourants, known as lakes, are formed by extracting the colourant components of e.g. the madder root into water and then precipitating (or adsorbing) the dye onto a colourless or white, insoluble substrate.[29] The white inorganic substrate could be chalk, limestone or shells, alum, gypsum, white clay or earth or the so-called *creta anularia* – a mixture of ground glass and chalk. A solid pigment could also be produced by letting the liquid in the colourant solution evaporate.[30] An alternative method of obtaining the dyestuff was to extract the colourant from shears and clippings of dyed textiles in the presence of alkaline compounds. This method was used at least from the 14th to the 19th c. AD to prepare red lakes such as cochineal, kermes, and madder, the production of which required a large quantity of raw materials,[31] but was most likely also known far earlier. In brief, the development of the techniques and procedures involved in dyeing and painting probably went in parallel, or at least with relatively short spans of time, before techniques were adopted from the one or the other of these domains. This is further illustrated by the practice of painting textiles, as revealed in the preserved examples of painted shrouds from Late Antique Egypt, primarily the 2nd c. AD (Fig. 8).[32]

Another potential overlap between craft industries and the raw materials they use may be found in the production of glass, faience, and vitreous pigments. Raw glass was made from silica (from quartz pebbles or sand), soda (from plant ashes and natron), and lime. The synthetic pigments Egyptian green and Egyptian blue were made from a mixture of similar components: silica (quartz), lime, copper, and alkali.[33] Furthermore, copper, as well as iron or cobalt, was used to imbue glass with a blue colour. Both types of production needed ovens capable of reaching very high temperatures. This possible overlap in production is highlighted in the contribution by Hodgkinson, which focuses on the production and distribution of glass in New Kingdom Egypt. During this period, the manufacture of glass, faience, and synthetic pigments were probably carried out in the same workshops.

27 Kirby, van Bommel, and Verhecken 2014, 25.
28 Eastaugh 2004, 244.
29 Kirby, van Bommel, and Verhecken 2014, 28.
30 Daniels, Devièse, et al. 2014, 17.
31 Clementi et al. 2008, 25; Daniels, Devièse, et al. 2014, 22; Kirby, van Bommel, and Verhecken 2014, 32–33.
32 E.g. Metropolitan Museum of Art, no. 09.181.8.
33 For Egyptian blue, see e.g. Tite and Shortland 2003; Verri 2009; Skovøller, Brøns, and Sargent 2016; Rodler, Artioli, et al. 2017.

Fig. 8 Painted linen shroud depicting a woman wearing a fringed tunic, ca. 170–200 AD. L. 230 cm. W. 111 cm. Metropolitan Museum of Art, New York, no. 09.181.8.

The production and trade of glass in the Bronze Age is also addressed in the contribution by Dardeniz, which concerns the use of glass among the Hittites. Dardeniz argues that glass was likely to have been transferred from Anatolia, more specifically Alalakh, to Egypt during the reign of Thutmosis III (1479–1426 BC), probably in the form of tribute. As she mentions, "the depictions of glass ingots among the 'precious stones' on the temple walls provoked scholars to establish linkages between Egypt and 'somewhere in Mesopotamia,' mostly referring to northern Mesopotamia, in terms of glass artefacts." It thus appears that the import of glass from Mesopotamia to Egypt occurred simultaneously with local large-scale production at Amarna, for example. Yet the two contributions also illustrate that there are still large gaps in our overall knowledge of early glass production: where and when was it produced? Was it exported and if so, to where? Especially the identification of glass working facilities and production sites in the archaeological record would be of great value for such studies.[34] In this respect, it could be interesting to see whether such productions took place near or together with specific pigment productions.

Hodgkinson's contribution furthermore shows that blue was the most common colour of glass working in the workshops at the palace sites of Amarna and Gurob. This is also the case in the contribution by Dardeniz, which also documents a preference for blue glass. This could possibly strengthen the idea of a connection between the production of blue pigments such as Egyptian blue (as well as Amarna blue) and blue glass and faience. However, as long as we still lack more solid archaeological and archaeometric evidence, this remains mere speculation.

A final example is the possible overlap between metals and pigments. An example is azurite, which has a characteristic blue colour and was used in ancient times as an ore of copper, as a pigment, a cosmetic, and possibly as a gemstone. Azurite is mentioned by ancient authors such as Theophrastus (ca. 371–287 BC), who in turn is quoted by Pliny (ca. 23–79 AD) who referred to it as Cyprian blue, due to its origin in the copper mines of Cyprus.[35] Azurite occurs naturally in many parts of the world, including Egypt, where it was used as a pigment, perhaps as early as the Fourth Dynasty.[36] It was also widely used in the Mediterranean area, probably already from the Early Cycladic Period (ca. 2800–2300 BC) onwards.[37] It is a copper carbonate hydroxide mineral with

34 See also Fenn 2015, 396.

35 Eastaugh 2004, 39. Theophrastus, *On Stones*, 55: "Just as there is a natural and an artificial red ochre, so there is a native *kyanos* and a manufactured kind, such as the one in Egypt. There are three kinds of *kyanos,* the Egyptian, the Scythian, and the Cyprian. The Egyptian is the best for making pure pigments, the Scythian for those that are more dilute. The Egyptian variety is manufactured, and those who write the history of the kings of Egypt, state which king it was who first made fused *kyanos* in imitation of the natural kind." (translation by Caley and Richards 1956).
Plin. *HN* 33.57: "The blue pigment is a sand. In old days there were three varieties: the Egyptian is thought most highly of; next the Scythian mixes easily with water, and changes into four colours when ground, lighter or darker and coarser or finer; to this blue the Cyprian is now preferred. To these were added the Pozzuoli blue, and the Spanish blue, when blue sand-deposits began to be worked in those places." (translation by Rackham 1938). However, the possibility that these authors are in fact referring to Egyptian blue, cannot be excluded.

36 Gettens and Fitzhugh 1993, 23. See also Nicholson and Shaw 2000.

37 Azurite is in fact attested already in the Neolithic period (Çatal Hüyük, levels VIII–VI and Azmak). Azurite was not exclusively used for pigments, but also for cosmetics and as burial offerings. In ancient Greece, azurite pigments have been recovered in

a chemical composition of $Cu_3(CO_3)_2(OH)_2$ and is a secondary mineral that usually forms when carbon-dioxide-laden waters descend into the earth and react with subsurface copper ores. Similarly, malachite is another copper carbonate mineral that forms under conditions similar to azurite. These minerals are often found in the same deposit and are often bound or interwoven with one another. This illustrates how the mining of a metal, in this case copper, can be related to procurement of pigments, for example. The potential connection between metallurgy and glass has been discussed by Fenn, who argues that their connection derives from shared aspects of their technologies, e.g. they are both hot technologies, involving very high temperatures. This could have led to cross-craft interactions, possibly related to the close proximity of workshops (which would have facilitated the exchange of knowledge and innovations), as has been attested in New Kingdom Egypt at the site of Qantir (ancient Piramesse).[38]

Such overlaps in the use of raw materials as well as production technologies may indicate that – to a far higher degree than expected – we are dealing with an overlap between the various craft traditions, with regard to the transfer of technical knowledge as well as the use and procurement of raw materials for colouration in the ancient world.

5 Colours, production, and gender

This raises further questions, for example regarding the division of labour along social lines, since craft industries are generally considered gendered spaces. Thus, textile production is considered a female craft, meaning that women and girls carried out the work in almost every stage of production, at least in the entire Mediterranean area, from washing, sorting, and combing the fibres, to spinning, weaving, and dyeing.[39] However, it should of course be noted that men are also known to have carried out textile production

marble vessels dating to the early Cycladic period, although its application within a paint layer on Cycladic artefacts is not yet satisfactorily documented (Museum of Cycladic Art, Athens, inv. no. NΓ0591 and NΓ0592). In fact, the use of azurite in Greek polychromy and painting does not seem to have been common Brecoulaki 2014. Examples of its use in Roman sculptural polychromy include the portrait of Hostius Capito from the sanctuary at Nemi (Ny Carlsberg Glyptotek, inv. no. IN 1437), where azurite is possibly used to highlight the inscribed letters, Skovmøller and Sargent 2013. Another example is the so-called Vicomagistri relief, dated to the Julio-Claudian Period, where azurite was used for the background, Liverani 2014.

38 Fenn 2015, 395; Shortland 2012, 94–96. This idea is not new, however, the possible connections between metallurgy, glass, and glazes were already suggested in the early 20th century by an anonymous reviewer in the journal *Ancient Egypt* (1914, 188). Fenn 2015, 394.

39 This is not the case in Mesopotamia, where the weavers, dyers, and cleaners were men. An example is the weaver of many-colored cloth mentioned in the contributions by Quillien. See also the contribution by Thavapalan for the Akkadian terms.

in the ancient Mediterranean world, although the evidence is relatively meagre.[40] Other crafts, such as painting, appear to have been considered 'male crafts', although this is rarely directly addressed. This has caused a somewhat subconscious association between women and dyes and men and pigments. But as shown, the raw materials needed for these crafts were often the same. Does this mean that women and men respectively procured these plants themselves for their specific production or simply that they went to the same shop at the market to buy either the raw materials in the form of e.g. madder roots, saffron, or kermes or prepared pigments or dyes? Or did they buy the threads/yarn already dyed? There is no simple answer to this, but the existence of ancient 'colour traders' dealing with raw materials as well as pigments and dyes ready for use is obviously of great interest to the study of ancient colours, their production, and economy.

An interesting, albeit late, example illustrating the ambiguity in the trade involving colours, is the Roman *purpurarii*, recorded in Latin epigraphy. The *pupurarii* are defined as engaged in both the preparation of purple dye as well as its commercialisation, and it is generally thought that their activities were tied exclusively to aspects of the textile trade, although it has been suggested recently that the *purpurarii* also sold the meat from sea molluscs, which is edible and remains a delicacy in some Mediterranean countries today.[41] Yet, so far, no one has considered the possibility that the *purpurarii* also dealt with purple pigments. This is simply to show how we need to be more flexible in our interpretations of ancient source material, particularly when it comes to our understanding of production activities related to colours. The case of the Roman *purpurarii* also reveals how professions become gendered in the historical record: although there is evidence for female *purpurarii*, it is men who are typically given this epithet in epigraphy. A woman by the name of Veturia Fedra is identified as *purpuraria Marianeis* in inscription from the late Republican Period, Marianeis referring to the area around the Marian monuments on the Esquiline.[42]

Questions about gender and production are obviously difficult to address in situations where we do not have written records that speak to these matters. Quillien's article is one of the contributions in this volume that addresses the question of who were involved in production. The cuneiform archives from the sanctuaries of Uruk and Sippar in the mid-first millennium BC reveal a wealth of information with regard to the production, consumption, and value of textiles in ancient Babylonia. What this source material also informs us is that a special category of craftsmen ($^{\text{lú}}$*išpar birmi*) was in charge of the

40 For a discussion of the involvement of male weavers in the production of the peplos for Athena on the Athenian acropolis, see Brøns [in press]. For the possibility of male textile workers in Iron Age Italy, see Brøns 2013. In Egypt, men are depicted weaving in a celebrated representation from an 18th Dynasty tomb (third quarter of second millennium BC).

41 Lowe 2017, 154; Hughes 2007, 8.

42 CIL 6.37820. Lowe 2017, 155.

dyeing, preparation, and weaving of the coloured wool. However, in contrast to the situation in the Mediterranean, most of the recorded weavers in the Babylonian archives are men, indicated by their names, which are recorded in the ration lists.

6 Colour on the move

Several of the contributions in this volume address the topic of the movement of colourful substances across great distances. Some, e.g. Bar-Yosef Mayer and Hodgkinson, specifically address the trade in semi-precious stones like lapis lazuli. This particular gem was mined in northern Afghanistan from at least the fourth millennium BC and traded to Mesopotamia, Egypt, Greece and Rome throughout antiquity; it was particularly valued for its intense blue colour. It was primarily used as a stone either for entire objects, such as figurines and vessels or for jewellery, amulets, and inlays, for example. There are only a handful of known ancient examples of lapis lazuli used as a pigment,[43] known as ultramarine. It does not appear to be widely used until the medieval period in Europe, where it was used by painters through the Renaissance.[44] When finding lapis lazuli in archaeological contexts it is thus an indicator of trade, whether as a raw material or finished product, or of gift giving.[45] Obsidian is another commodity that was moved through trade, since, as documented by Moutsiou, this naturally occurring volcanic glass circulated across great distances as early as the Palaeolithic. Colourful materials were also moved through less peaceable means. As Thavapalan discusses, the kings of southern Mesopotamia in the late third millennium BC made a point of boasting that they brought back yellow calcite as booty from their military campaigns in Iran. The exotic appeal this stone held in the historical imagination of the Mesopotamians can be documented even centuries later, when merchants from Syria and Mesopotamia haggle over the selling price of calcite to purchase tin and lapis lazuli. A final example is the stone amethyst, which was mined in Egypt and from there exported throughout the Mediterranean littoral.[46]

Other clear indications of trade are the rare occurrences of shipwrecks carrying cargo, one of the most famous example being the Uluburun shipwreck, which sank

43 A rare example of the identification of ultramarine used for the polychromy of an ancient artefact is a Classical marble *pyxis*, Brecoulaki 2014, 155. Furthermore, a recent study has proven the use of lapis lazuli as a pigment for the polychromy of Palmyrene sculptures, Hedegaard and Brøns 2019.

44 A famous example is the painting by Vermeer, *Girl with pearl earring* from 1665.

45 This is attested e.g. in the Amarna letters where lapis lazuli was moved from Babylonia to Egypt in the form of gifts.

46 Other possible indicators of trade are amber, jade, and specific species of shells.

in the Late Bronze Age, off the coast of southern Turkey. The ship carried a cargo of, among other goods, blue glass ingots, very likely produced at the site of Amarna.[47]

Such identifications of the source of raw materials can contribute to the reconstruction of ancient trade routes and can help to better understand economic aspects of ancient civilisations. However, this is often a difficult topic to address, since it can be hard, if not impossible, to determine exactly where a pigment or a glass ingot, for example, was produced or which mines certain stones came from. However, methods within the natural sciences can occasionally be of assistance in this matter. One such method is isotope analyses, which have long been applied to archaeometric provenance studies. The lead (Pb) isotope approach was developed to differentiate the geological origin of ancient metal artefacts,[48] which can subsequently lead to potential geographic regions or mining districts that may have supplied sources. In archaeometry, lead isotope analysis (LIA) is a widely used method to determine e.g. the potential sources of raw materials of various inorganic artefacts,[49] as well as the environmental contamination related to ancient industrial activities.[50] Combining Pb and Cu isotope analyses represent an even more powerful tool for provenance studies.[51] In a recent study, this method was applied to copper- and silica-rich Egyptian blue pigments in order to investigate the provenance of the copper component. Furthermore, copper isotope analysis was also applied to Egyptian blue pigments to facilitate future studies of copper isotopes in such materials. The lead isotope data (LID) of the investigated pigments were compared to reference LID of copper minerals of European, Near and Middle Eastern, and North African ores that have been exploited at a time relevant for the studied pigments. In this way, it was possible to identify the copper sources used for the production of the Egyptian blue pigment from different Egyptian, Etruscan, and Roman painted artefacts.[52]

A similar study has been carried out on reliefs from the Ishtar gate and processional way in ancient Babylon. This has shown that variations in trace elements, lead and copper isotopes can be useful for complementing an archaeological investigation of potential geological sources of raw materials. Consistent with archaeological evidence and ancient texts detailing trade in metals, Turkish ore deposits are tentatively proposed as possible sources of the metal oxide colorants used for the investigated glazes from three Neo-Babylonian reliefs.[53] One can only hope that further provenance studies will expand our knowledge of ancient trade.

47 See Hodgkinson, this volume.
48 E.g. Stos-Gale and Gale 2009.
49 E.g. Wolf et al. 2003; Shortland 2006; Artioli et al. 2016.
50 E.g. Delile et al. 2014; Fagel et al. 2016.
51 See Rodler, Artioli, et al. 2017 with further references.
52 Rodler, Artioli, et al. 2017.
53 Rodler, Klein, et al. 2019. Three reliefs were investigated: Ny Carlsberg Glyptotek, inv. nos. 2808, 2810, 2811.

7 Final remark

This brief epilogue illustrates the many reasons to study colours in ancient societies and the endless directions into which research can advance. However, as is evident from several of the contributions of this publication, one of the more promising ways forward is to pursue an interdisciplinary approach combined with specialist studies. By integrating archaeological, historical, and linguistic studies with methods and technologies in the natural sciences, it becomes possible to ask and answer entirely new research questions. However, this is far from being a new idea: the last three decades have seen a steady growth of application of natural scientific methods to modern archaeology, which increasingly crosses academic boundaries to investigate past human-environmental relationships and material culture. Yet, as regards studies of ancient colours, there are still many areas that remain unexplored or deserve further attention. Interdisciplinary research will especially be helpful in analyses of the material aspects of colours such as polychromy and original appearance, techniques and craftsmanship, production and provenance – aspects which are also beneficial to discussions of ancient trade and economy.

Bibliography

Artioli et al. 2016
Gilberto Artioli, Ivana Angelini, Paolo Nimis, and Igor M. Villa. "A Lead-Isotope Database of Copper Ores from the Southeastern Alps. A Tool for the Investigation of Prehistoric Copper Metallurgy". *Journal of Archaeological Science* 75 (2016), 27–39.

Bérard and Durand 1989
Claude Bérard and Jean-Louis Durand. "Entering the Imagery". In *A City of Images. Iconography and Society in Ancient Greece*. Ed. by C. Bérard and D. Lyons. Princeton, NJ: Princeton University Press, 1989, 23–38.

Bogensberger 2017
Ines Bogensberger. "Purple and Its Various Kinds in Documentary Papyri". In *Textile Terminologies from the Orient to the Mediterranean and Europe, 1000 BC to 1000 AD*. Ed. by S. Gaspa, C. Miche, and M.-L. Nosch. Oxford: Oxbow Books, 2017, 235–249.

Bradley 2009
Mark Bradley. *Colour and Meaning in Ancient Rome*. Cambridge: Cambridge University Press, 2009.

Brecoulaki 2006
Hariclia Brecoulaki. *La peinture funérarie de Macédoine. Emplois et fonctions de la coleur, IV lieme s. Av. J.-C.* Meletemata 48. Athens: De Boccard, 2006.

Brecoulaki 2014
Hariclia Brecoulaki. ""Precious Colours" in Ancient Greek Polychromy and Painting. Material Aspects and Symbolic Values". *Revue Archaeologique* 57 (2014), 1–36.

Brecoulaki, Kavvadias, and Verri 2014
Hariclia Brecoulaki, George Kavvadias, and Giovanni Verri. "Colour and Luxury". In *Transformations. Classical Sculpture in Colour*. Ed. by J. S. Østergaard and A. M. Nielsen. Copenhagen: Ny Carlsberg Glyptotek, 2014, 152–165.

Brøns 2013
Cecilie Brøns. "Manners Make the Man. Challenging a Persistent Stereotype in Italian Iron Age Graves". *Analecta Romana Instituti Danici* 38 (2013), 53–77.

Brøns 2016
Cecilie Brøns. *God and Garments. Textiles in Greek Sanctuaries in the 7th to the 1st centuries BC*. Ancient Textiles Series. Oxford: Oxbow Books, 2016.

Brøns [in press]
Cecilie Brøns. "The Peplos Paradigm. Textiles and Textile Production on the Athenian Acropolis". In *The Parthenon: Color, Materiality and Aesthetics*. Ed. by M. Abbe and N. Norman. In press.

Brøns and Sargent 2018
Cecilie Brøns and Maria Louise Sargent. "Pigments and Dyes. The Use of Colourants for the Depiction of Garments on Egyptian Mummy Portraits in the Ny Carlsberg Glyptotek". In *Textiles and Dyes in the Mediterranean Economy and Society*. Ed. by M. Gleba, M. S. Busana, F. Meo, and A. Tricomi. Purpureae Vestes VI. 2018, 481–490.

Brøns and Skovmøller 2017
Cecilie Brøns and Amalie Skovmøller. "Colour-Coding the Roman Toga. The Materiality of Textiles Represented in Ancient Sculpture". *Antike Kunst* 60 (2017).

Caley and Richards 1956
Earl Radcliffe Caley and John Francis Richards. *Theophrastus On Stones*. Columbus, OH: Ohio State University, 1956.

Caley and Jensen 2008
Earle Radcliffe Caley and William B. Jensen. *The Leyden and Stockholm Papyri. Greco-Egyptian Chemical Documents from the Early 4th Century AD*. Cincinnati: Oesper Collections in the History of Chemistry, University of Cincinnati, 2008.

Chrysikopoulou 2005
Elisabeth Chrysikopoulou. "Use of Murex Purple in the Wall-Paintings at Thera, Akrotiri". *ALS* 32 (2005), 77–80.

Clementi et al. 2008
Catia Clementi, Brenda Doherty, Pier Luigi Gentili, C. Miliani, A. Romani, B. G. Brunetti, and A. Sgamellotti. "Vibrational and Electronic Properties of Painting Lakes". *Applied Physics A* 92.1 (2008), 25–33.

Daniels, Devièse, et al. 2014
Vincent Daniels, Thibaut Devièse, Marei Hacke, and Catherine Higgit. "Technological Insights into Madder Pigment Production in Antiquity". *The British Museum Technical Research Bulletin* 8 (2014), 13–28.

Daniels, Middleton, and Stacey 2004
Vincent Daniels, Andrew Middleton, and Rebecca Stacey. "The Blackening of Paint Containing Egyptian Blue". *Studies in Conservation* 49.4 (2004), 217–230.

Delile et al. 2014
Hugo Delile, Janne Bilchert-Toft, Jean-Philippe Goiran, Simon Keay, and Francis Albarède. "Lead in Ancient Rome's City Waters". *Proceedings of the National Academy of Sciences* 111 (2014), 6594–6599.

Eastaugh 2004
Nicholas Eastaugh, ed. *The Pigment Compendium. A Dictionary of Historical Pigments*. Amsterdam: Elsevier and Butterworth-Heinemann, 2004.

Ekroth 2009
Gunnel Ekroth. "'Why (Not) Paint an Altar? A Study of Where, When and Why Altars Appear on Attic Red-Figure Vases". In *The World of Greek Vases*. Ed. by V. Nørskov. Rome: Quasar, 2009, 89–114.

Ekroth 2011
Gunnel Ekroth. "Ull, pengar och sex. Tolkningar av ett attiskt, rödfigurigt vasmotiv". *Medusa* 32 (2011), 1–12.

Fagel et al. 2016
Nathalie Fagel, Marine Lechenault, Francois Fontaine, Elisa Pleuger, Joel Otten, Mohammed Allan, Matthieu Ghilardi, Nadine Mattielli, and Jean-Philippe Goiran. "Record of Human Activities in the Pb Isotope Signatures of Coastal Sediments from the Roman Archaeological Site of Cala Francese, Cape Corsica (France)". *Journal of Archaeological Science, Reports* 12 (2016), 770–781.

Faivre 2016
Damien Faivre, ed. *Iron Oxides. From Nature to Applications*. Weinheim: Wiley-VCH, 2016.

Fenn 2015
Thomas R. Fenn. "A Review of Cross-Craft Interactions between the Development of Glass Production and the Pyrotechnologies of Metallurgy and Other Vitreous Materials". *Cambridge Archaeological Journal* 50.1 (2015), 391–398.

Foster 1977
Ellen D. Foster. "Po-ni-ki-jo in the Knossos Tablets Reconsidered". *Minos* 16 (1977), 52–66.

Gettens and Fitzhugh 1993
R. J. Gettens and E. W. Fitzhugh. "Azurite and Blue Verditer". In *Artists' Pigments. A Handbook of Their History and Characteristics, Vol. 2*. Ed. by A. Roy. Vol. 2. Oxford: Oxford University Press, 1993.

Harlow and Nosch 2014
Mary Harlow and Marie-Louise Nosch, eds. *Greek and Roman Textiles and Dress. An Interdisciplinary Anthology*. Ancient Textiles Series 19. Oxford: Oxbow Books, 2014.

Hedegaard and Brøns 2019
Signe B. Hedegaard and Cecilie Brøns. "Pigments in Ancient Palmyra". In *The Road to Palmyra*. Ed. by R. Raja and A.M. Nielsen. 2019.

Hort 1916
Arthur F. Hort. *Theophrastus. Enquiry into Plants*. Loeb Classical Library 70. London: W. Heineman, 1916.

Hughes 2007
Lisa Hughes. "'Dyeing' in Ancient Italy? Evidence for the Purpurarii". In *Ancient Textiles. Production, Craft and Society*. Ed. by C. Gillis and M.-L. Nosch. Ancient Textiles Series 1. Oxford: Oxbow Books, 2007, 87–92.

Kakoulli et al. 2017
Ioanna Kakoulli, Roxanne Radpour, Yuan Lin, Marie Svoboda, and Christian Fischer. "Application of Forensic Photography for the Detection and Mapping of Egyptian Blue and Madder Lake in Hellenistic Polychrome Terracottas Based on Their Photophysical Properties". *Dyes and Pigments* 136 (2017), 104–155.

Karapanagiotis and Karadag 2015
Ioannis Karapanagiotis and Recep Karadag. "Dyes in Post-Byzantine and Ottoman Textiles. A Comparative HPLC Study". *Mediterranean Archaeology and Archaeometry* 15.1 (2015), 177–189.

Kirby, van Bommel, and Verhecken 2014
Jo Kirby, Maarten van Bommel, and André Verhecken. *Natural Colorants for Dyeing and Lake Pigments. Practical Recipes and Their Historical Sources*. London: Archetype Publications, 2014.

Liverani 2014
Paolo Liverani. "Per una "Storia del colore". La scultura policromia romana, un bilancio e qualche prospettiva". In *Diversamente bianco. La policromia della scultura romana*. Ed. by P. Liverani and U. Santamaria. Rome: Quasar, 2014, 9–32.

Liverani and Bankel 2004
Paolo Liverani and Hansgeorg Bankel, eds. *I colori del bianco. Policromia nella scultura antica*. Rome: De Luca, 2004.

Lowe 2017
Benedict Lowe. "Purpurarii in the Western Mediterranean". In *Treasures from the Sea. Sea Silk and Shellfish Purple Dye in Antiquity*. Ed. by H. Landenius Enegren and F. Meo. Ancient Textiles Series 30. Oxford: Oxbow Books, 2017, 154–158.

Maravelaki-Kalaitzaki 2003
Pagona-Noni Maravelaki-Kalaitzaki. "Pigment and Terracotta Analyses of Hellenistic Figurines in Crete". *Analytica Chemica Acta* 497 (2003), 209–225.

Mollet, Grubenmann, and Payne 2001
Hans Mollet, Arnold Grubenmann, and Helen Payne. *Formulation Technology. Emulsions, Suspensions, Solid Forms*. Weinheim: Wiley-VCH, 2001.

Murray and Warren 1976
Caroline Murray and Peter Warren. "Po-ni-ki-jo among Dyeplants of Minoan Crete". *Kadmos* 15.1 (1976), 40–60.

Nicholson 2012
Paul T. Nicholson. ""Stone... That Flows": Faience and Glass as Man-Made Stones in Egypt". *Journal of Glass Studies* 54 (2012), 11–23.

Nicholson and Shaw 2000
Paul T. Nicholson and Ian Shaw. *Ancient Egyptian Materials and Technology*. Cambridge and New York: Cambridge University Press, 2000.

Nosch 2017
Marie-Louise Nosch. "Mycenaean Textile Crops and Textile Workers". In *Tierra, territorio y población en la Grecia antigua. Aspectos institucionales y míticos*. Ed. by M. Oller, J. Pàmias, and C. Varias. 2017.

Østergaard and Nielsen 2014
Jan Stubbe Østergaard and Anne Marie Nielsen. *Transformations. Classical Sculpture in Colour*. Copenhagen: Ny Carlsberg Glyptotek, 2014.

Rackham 1938
Harris Rackham. *Pliny. Natural History. In Ten Volumes*. Loeb Classical Library. London: W. Heineman, 1938.

Rodler, Artioli, et al. 2017
Alexandra Rodler, Gilberto Artioli, Sabine Klein, Rainer Petschick, Peter Fink-Jensen, and Cecilie Brøns. "Provenancing Ancient Pigments. Lead Isotope Analyses of the Copper Compound of Egyptian Blue Pigments from Ancient Mediterranean Artefacts". *Journal of Archaeological Science* 16 (2017), 1–18.

Rodler, Klein, et al. 2019
Alexandra Rodler, Sabine Klein, Gilberto Artioli, and Cecilie Brøns. "Probing the provenance of archaeological glaze colorants: Polychrome faunal reliefs of the Ishtar Gate and the Processional Way of Babylon". *Archaeometry* 61.4 (2019), 837–855. DOI: 10.1111/arcm.12455.

Shortland 2006
Andrew J. Shortland. "Application of Lead Isotope Analysis to a Wide Range of Late Bronze Age Egyptian Materials". *Archaeometry* 48.8 (2006), 657–669.

Shortland 2012
Andrew J. Shortland. *Lapis Lazuli from the Kiln. Glass and Glassmaking in the Late Bronze Age*. Leuven: Leuven University Press, 2012.

Skovmøller and Sargent 2013
Amalie Skovmøller and Maria Louise Sargent. "Painted Portrait Sculpture from the Sanctuary of Diana Nemorensis at Nemi". In *Tracking Color. The Polychromy of Greek and Roman Sculpture*. Ed. by Jan Stubbe Østergaard. Preliminary Report 5. Copenhagen: Ny Carlsberg Glyptotek, 2013, 9–35.

Skovøller, Brøns, and Sargent 2016
Amalie Skovøller, Cecilie Brøns, and Maria Louise Sargent. "Egyptian Blue. Modern Myths, Ancient Realities". *Journal of Roman Archaeology* 29 (2016), 371–387.

Stos-Gale and Gale 2009
Zofia A. Stos-Gale and Noel H. Gale. "Metal Provenancing Using Isotopes and the Oxford Archaeological Lead Isotope Database (OXALID)". *Archaeological and Anthropological Sciences* 1 (2009), 195–213.

Tite and Shortland 2003
Michael S. Tite and Andrew J. Shortland. "Production Technology for Copper- and Cobalt Blue Vitreous Materials Rom the New Kingdom Site of Amarna. A Reappraisal". *Archaeometry* 45.2 (2003), 285–312.

Verri 2009
Giovanni Verri. "The Spatially Resolved Characterisation of Egyptian Blue, Han Blue and Han Purple by Photo-Induced Luminescence Digital Imaging". *Analytical and Bioanalytical Chemistry* 394 (2009), 1011–1021.

Vlachopoulos 2016
Andreas G. Vlachopoulos. "Purple Rosettes/Πορφυροί ρόδακες. New Data on Polychromy and Perception in the Thera Wall Paintings". In *Studies in Aegean Art and Culture. A New York Aegean Bronze Age Colloquium in Memory of Ellen N. Davis*. Ed. by R. B. Koehl. Philadelphia: INSTAP Academic Press, 2016, 59–76.

Wolf et al. 2003
Sophie Wolf, Sophia Stos, Robert B. Mason, and Michael S. Tite. "Lead Isotope Analyses of Islamic Pottery Glazes from Fustat". *Archaeometry* 45 (2003), 405–420.

Illustration credits

1 Courtesy of Heidelberg University Library, CC-BY-SA 3.0. **2** Courtesy of the Royal Danish Library – Danish National Art Library. **3–5** Courtesy of the Ny Carlsberg Glyptotek. Photos: Ana Cecilia Gonzales. **6** Courtesy of the Ny Carlsberg Glyptotek. **7** Courtesy of Signe Buccarella Hedegaard. Photo: Riccardo Buccarella. **8** Courtesy of the Metropolitan Museum of Art. Rogers Fund 1909.

CECILIE BRØNS

Cecilie Brøns is a Classical archaeologist specialised in ancient textiles and polychromy with a Ph.D. in textiles from the first millennium BC and post-doctoral research on the subject of polychromy of ancient Graeco-Roman art and architecture. She is currently the director of the interdisciplinary research project *Tracking Colour* at the Ny Carlsberg Glyptotek in Copenhagen, which is financed by the Carlsberg Foundation.

Cecilie Brøns
Ny Carlsberg Glyptotek
Dantes Plads 7
1556 Copenhagen, Denmark
E-Mail: cebr@glyptoteket.dk

SHIYANTHI THAVAPALAN is visiting assistant professor of Assyriology and Archaeology at Brown University (2019–2020). Her research is at the crossroads of philology and the history of science and technology. She has published several studies on the semantics of Akkadian colour terminology, ancient chemical recipes and the history of Mesopotamian crafts techniques and pyro-technologies.

DAVID WARBURTON is currently teaching the ancient Egyptian language at the Institute for the *History of Ancient Civilizations* in Northeast China. Within Topoi he was responsible for the Key Topic *Economy* from 2013 to 2017. His research interests are in understanding the emergence and development of economics, warfare, religion, cognition, architecture, science, and methodological issues such as mastering chronology, archaeological stratigraphy and language. The world of ancient colours is an encounter of mind and matter.

Within the BERLIN STUDIES OF THE ANCIENT WORLD series, monographs and volumes of all fields of ancient studies are published. These publications form the results of research conducted within the Excellence Cluster *Topoi. The Formation and Transformation of Space and Knowledge in Ancient Civilizations*, a research association between the Freie Universität Berlin and the Humboldt-Universität zu Berlin as well as the partner institutions Berlin-Brandenburgische Akademie der Wissenschaften, Deutsches Archäologisches Institut, Max-Planck-Institut für Wissenschaftsgeschichte and Stiftung Preußischer Kulturbesitz.
The series is part of the research platform *Edition Topoi* and fully accessible at www.edition-topoi.org.

ISBN 978-3-9820670-1-8

9 783982 067018

70 BERLIN STUDIES OF THE ANCIENT WORLD

www.edition-topoi.org