Brilliant Things for Akhenaten -
The Production of Glass, Vitreous Materials and Pottery at Amarna Site O45.1

Auszug aus Chapter 1, The Coming Of Glass To Egypt, S. 1 - 9

Abb. 2009-2/xxx
Paul T. Nicholson, Brilliant Things for Akhenaten, Einband

Paul T. Nicholson
With contributions by
Rainer Gerisch, Rowena Hart, Gareth D. Hatton, Caroline M. Jackson, Ian Mathieson, Phillipa Payne, Jerome C. Rose, Andrew J. Shortland & Michael S. Tite
Illustrations by Elna Brook, Dorn Carran, Ian Dennis, Zadia Green, Howard Mason, James Newboult, Hendrikje Nouwens & Frances Taylor
Photographs by Caroline Jackson, Paul Nicholson, Gwil Owen & Anna Stagg

Excavation Memoir 80
Egypt Exploration Society 2007
© The Egypt Exploration Society 2007
ISBN 978-0-85698-178-4

Front Cover: Site O45.1 looking east. Kilns 2 and 3 are clearly visible in the centre of the photograph. „Kiln 4“ is to the south of „Kiln 2“ and „Kiln 6“ is visible at the extreme south where the boundary wall runs up to it. Part of the potter’s workshop can be seen at the extreme bottom left. [s. unten Abb. 2000-2/024]

Rear Cover: Clay mould (find no. 30547) for making a faience cartouche of the early name of the Aten.

Sold at the offices of the Egypt Exploration Society
3 Doughty Mews, London WC1N 2PG
available also from:
Oxbow Books Ltd
10 Hythe Bridge St, Oxford OX1 1HN
www.oxbowbooks.com
The David Brown Book Company
PO Box 511, Oakville, CT 06779, USA
(Phone: 860-945-9329; Fax: 860-945-9468)

Contents
Acknowledgements................................................ I
Introduction...........................................................V
Section I: The Amarna Glass Project
Chapter 1: The Coming of Glass to Egypt............ 1
Chapter 2: Archaeological and Technological Evidence ......................................................... 13
Chapter 3: Excavations at Site O45.1 ............ 27
Paul T. Nicholson & Rowena Hart
Chapter 4: The Furnace Experiment ................... 83
Paul T. Nicholson & Caroline M. Jackson
Chapter 5: Compositional Analysis of the Vitreous Materials Found at Amarna .............. 101
Caroline M. Jackson & Paul T. Nicholson
Chapter 6: A Reconstruction of Glass Production at Amarna............................................. 117
Paul T. Nicholson
Chapter 7: A Reconstruction of Faience Making at Amarna Site O45.1............................ 133
Chapter 8: A Reconstruction of Pottery Production at Amarna Site O45.1.......................... 149
Chapter 9: Conclusion ...................................... 157
Appendices
Appendix 1: Geophysical Report..................... 161
Ian Mathieson
Appendix 2: Report on the Faunal Material from Site O45.1 ........................................... 165
Phillipa Payne
Appendix 3: Charcoal Remains ......................... 169
Rainer Gerisch
Appendix 4: Human Remains............................. 177
Information Provided by Jerome Carl Rose
Appendix 5: Data Tables ..................................... 179
Caroline M. Jackson & Paul T. Nicholson
Appendix 6: Scientific Examination of Vitreous Materials and Associated Ceramics ........ 183
Andrew J. Shortland, Gareth D. Hatton & Michael S. Tite
Section II: Finds Catalogue ......................... 191
List of finds in numerical order ................. 299
Chapter 1
The Coming Of Glass To Egypt, S. 1-9

Introduction

This chapter [1] examines the origins of the glass industry in ancient Egypt and attempts to assess, independently of the recent work at Amarna, whether or not it is likely that there could have been an industry actually making glass rather than simply working it as early as the time of Thutmose III (1479-1425 B.C.). The locations of places mentioned in the text are shown on Map 1.1.

Early Glasses

There have been many reports of glass in Egypt before about 1500 B.C. (Lucas 1926, Beck 1934, Shortland 2001). However, many of the pieces cited - such as the famous „Bull Mosaic“ of Princess Khnumet [2] and the lion head amulet inscribed for Nubkheperre [3] - are now known to be of materials other than glass. Moreover, such genuinely early pieces as are known do not seem to represent a deliberate and regular production of glass, but rather may be the result of accidents during the production of faience or frit.

Two glass fragments from the tomb of Thutmose I (1504-1492 B.C.; tomb KV38) may represent early imports or belong to the time of his reinterment by Thutmose III (Roehrig 2005:67) [4]. However, Roehrig (2005:67) suggests that they might equally be the result of booty from the campaigns of Thutmose I in the Near East or trade with the region since other beads dating from the time of Ahmose through to Thutmose II (1492-1479 B.C.) are known from the excavations of the Metropolitan Museum of Art. Other early pieces of glass, including the well known flask [5] from the tomb of Maiberper (KV36) which is believed to be an import, and probably a royal gift, have recently been discussed by Lileyquist (2005) who also provides a timely summary of contact with the Near East around the reign of Hatshepsut (1473-1458 B.C.).

SG: Herrscher nach Nicholson [& Wikipedia]

18th Dynasty, New Kingdom:
Ahmose ... 1550-1525 B.C.
Amenhotep I ... 1525-1504 B.C.
Thutmose I ... 1504-1492 B.C.
Thutmose II ... 1492-1479 B.C.
Hatshepsut ... 1473-1458 B.C.
Thutmose III ... 1479-1425 B.C.
Amenhotep II ... 1427-1400 B.C.
Thutmose IV ... 1400-1390 B.C.
Amenhotep III ... 1390-1352 B.C.
Amenhotep IV / Akhenaten ... 1352-1336 B.C.
Semenchake ... 1337-1333 B.C.
Tutankhamun ... 1333-1323 B.C.
Ay [Eje II] ... 1323-1319 B.C.
Horemheb ... 1319-1292 B.C.
Ramesses I ... 1291-1290 B.C.

There are, however, several pieces which may be especially relevant to the present discussion but whose status must for the moment remain unclear. These are two
name beads [6] bearing inscriptions mentioning Hatshepsut and her steward Senenmut (Reeves 1986) which are now in the British Museum and a further example in the Metropolitan Museum of Art, along with two coloured examples [7]. The colourless beads were originally thought to be of rock-crystal, but are in fact of clear colourless glass and, although without a properly documented context, may originally have come from the foundation deposits of the Hathor shrine of Hatshepsut at Deir el-Bahri, believed to date from Year 7 of her reign (Reeves 1986:388). Since raw glass is naturally coloured with a greenish or brownish tinge due to impurities such as iron it must be decolourised in order to obtain such clear objects as these beads. Decolourisation is a sophisticated process and virtually all the glass known from ancient Egypt has a strong body colour, usually light or dark blue. That colourless glass could have been produced so early, either in Egypt or elsewhere, suggests a remarkable sophistication in this early glass industry. It is, of course, possible that the lack of colour results from very pure batch materials alone (below).

The composition of the beads has been analysed and has been found to be "compositionally similar to analyses of glasses from Tell el Amarna" (Bimson and Freestone 1988:11) [8]. This does not necessarily mean that the glass was made in Egypt, the beads may simply have been inscribed there, and indeed colourless glass from an inscription on a queen’s canopic jar of the Amarna period [9] has a different composition (Bimson and Freestone 1988:12), though it is similar to other glasses from Amarna [10]. The colourless glass of the canopic jar has twice the amount of lime present in the name beads. It may be that we are seeing an early stage of glass imported into Egypt and a later stage of local production, the change occurring during the Amarna period. Alternatively we may be seeing an Egyptian industry already established by the time of Hatshepsut and later changing its recipes to better utilise local raw materials. This may be indicated by the work done by Rehren (2000a), which suggests that the Hatshepsut / Thutmose III glasses were made by carefully selecting raw materials and then melting the total batch, whereas those of Amenhotep II and after use a different approach which Rehren (2000a:17) describes as "partial batch melting."

Whatever the position regarding the production of these glasses it is of interest that both the beads and the canopic jar, which were intended for a royal wife, have royal connections. The same is true of a light blue glass bead of unknown provenance [11] which bears on one side the name of Ahmose (1550-1525 B.C.) and on the other that of Amenhotep I (1525-1504 B.C.) (Brovarski et al. 1982: 169). The piece is regarded by Brovarski et al. as possible evidence for a co-regency bet-
The idea of glass being imported from this region was of fairly consistent size, perhaps ingots [Barren], whilst other pieces are shown as irregular lumps [Brocken]. The apparent raw glass is described as „Menkheperre lapis lazuli“ [15] to distinguish it from genuine lapis lazuli. Bianchi et al (2002:20) speculate that the King may have been so impressed by this new material that he chose to add his throne name to it. Not only is there deep blue glass in imitation of lapis lazuli, but also green glass shown as round cakes. These two are given the king’s throne name, this time as „Menkheperre turquoise / malachite“ [16].

Bianchi et al. (2002:20) convincingly argue that the green glass is meant in opposition to the blue which must have been considerably darker (though its colour is now lost on the Karnak relief), which one would expect given that it is meant to represent lapis lazuli. The authors estimate that 60 kg of the dark blue glass as ingots are represented plus a further 55 kg as lumps. Some 83.72 kg is estimated for the lighter blue / green glass (Bianchi et al 2002:21). The authors note that this distinction is interesting, since most of the vessels from the time of Thutmose III are in light blue, rather than dark and that the finds may therefore be unrepresentative.

Also shown are finished vessels in „Menkheperre turquoise / malachite“. Bianchi et al. (2002:22) argue that vessels of such size are never found in genuine turquoise or malachite, but only in vitreous materials. However, it is worth pointing out that although the vessels appear large, they are not drawn to scale, as can be seen by comparing them to the size of the supposed ingots. Furthermore, the shapes do not closely resemble any known glass vessels from the Egypt of Thutmose I-II, though there are vague similarities to the famous marbleised goblet from the tomb of the foreign wives of Thutmose III at the Wadi Qubbet el-Qirud [17] (see Lilyquist 2003, Lilyquist et al. 1993). The Petrie Museum also houses fragments of a faience vessel from Sinai [18] which is not a typically Egyptian shape and which seems to be derived from a metal proto-type. The scene may therefore represent vessels in vitreous materials other than simply glass.

Philip (2000:129) notes that fragments of glass vessel are known from Alalakh on the border between Syria and Turkey at around 1600 B.C., suggesting that the knowledge of core-formed vessels was already established there (contrary to the statements made by Kozloff 1992:374).

The tomb of Rekhmire (TT100), Vizier under Thutmose III and Amenhotep II (1427-1400 B.C.) at Thebes also contains relevant scenes. On the west wall of the hall in the second register from the top (Davies 1944:Plate XXI) are shown two vessels „apparently of glass“ (Davies 1944:28) which are amongst tribute brought by Syrians (Retenu). It is worth pointing out that, although glass may be a likely candidate for these vessels, they are, in detail, unlike any other glass vessels known to the author, and are arguably more similar to wooden dummy vessels representing stone [19].
The other tomb worthy of note in this context is that of Amenmose (TT89). This tomb supposedly dates from the reign of Amenhotep III (1390-1352 B.C.) but includes a scene of Thutmose III (Brock 2000:130). The presence of this ruler in a supposedly later tomb is seen by Brock (2000:137) as perhaps connected with scenes showing glass in tombs of his time, notably that of Rekhmire. The tomb of Amenmose shows what are believed to be dark blue glass ingots, although they are stated to be lapis lazuli, and are not given the Menkheperre prefix. They appear similar to the supposed ingots from the Annals of Thutmose III at Karnak [20]. The appearance of Thutmose III in this later tomb is strange, and one must wonder whether a scene has simply been copied, or even an unfinished tomb of that date been reused. Little weight should be attached to this scene for the moment.

It is clear, however, that Mitanni was a source of glass, and one which Egypt was exploiting into the Amarna period, as is evidenced by the Amarna letters. However, this does not mean that all glass was imported to New Kingdom Egypt or that the Egyptians could not make their own glass as some have suggested (Newton and Davison 1989:62). Such a conclusion overlooks Petrie’s (1925:72) view that „artificers were brought in“.

One should look now at those actual examples of glass vessels known to be of the reign of Thutmose III and examine how they relate to the local versus imported debate.

Shortland (2001:214-15) follows Nolte (1968:46-50) in attributing 12 vessels or vessel fragments of glass to the reign of Thutmose III. Of these, two belong to the same vessel [21], whilst another, though relevant to the discussion, is believed to be glassy faience rather than glass [22]. In other words, there are actually only 10 examples of glass vessels from this reign. Shortland (2001:215-16) notes that the commonest body colour is light blue. He goes on to note that this is not surprising because so much light blue glass was being imported. However, his evidence for this comes from the Annals of Thutmose III, a figure which he gives as 10913.8 dbn or 993 kg (2001:213). This is indeed a significant figure and implies glass production, albeit outside Egypt, on a hitherto unexpected scale. However, Shortland’s reading of this figure from the Annals is probably incorrect, the actual figure being probably 913 dbn or 83.72 kg, as quoted by Bianchi et al. (2002:20).23

The scene shows 24 lumps of „Menkheperre lapis lazuli“, which may be dark blue glass or Egyptian blue, no weight is given but Bianchi estimates each lump at 2.5 kg yielding some 60 kg of dark blue glass (Bianchi 2002:20-21). To this must be added the similar material from a third tray shown in the scene, whose text is only partly preserved, to give a figure of at least 115 kg of dark blue glass.

It would seem then (contra Shortland) that more dark blue glass was imported than light blue, and yet most of the vessels we have (which account for nowhere near the 83.72 kg let alone the 993 kg figure) are light blue.

Shortland (2001:217) rightly notes that dark blue may also be achieved using high levels of copper, and it would be interesting to know whether the single known dark blue piece [24] is coloured with copper or cobalt.

This raises the question of where all the dark blue glass has gone. Why do we have only one piece from the reign of Thutmose III when it seems that it was commoner than the light blue? Could it be that the dark blue glass was made into beads or other small items which have largely been ignored? Such dark blue glass as occurs in inlays from the tomb of the foreign wives of Thutmose III seems to be coloured by cobalt (Lilyquist 2003:124-25) though this is, of course, a tiny sample of all those beads known. Could most of the material have been worked and sent out of Egypt to vassal states whilst the genuine lapis remained in the country? As Kemp (pers. comm.) has pointed out, much of what is shown in the Karnak reliefs is now lost, and it is certainly true that this must be the case for much of the glass. As a recyclable material it is also possible that some of it was melted down and used again.

Abb. 2000-2/038 (Maßstab ca. 100 %)
Krateriskos
opak-dunkelblaues Glas, weiße, gelbe u. hellblauen Glasfäden
H 9,5 cm
Kairo, Ägypt. Museum
aus Wildung 1984, Kat. Nr. 60, S. 128

The Thutmose III Vessels

Attention should also be paid to the vessels dated to the reign of Thutmose III (1479-1425 B.C.), since the security of the dating of some may be open to question. These are shown in Table 1.1 (below)[ 25].

Most secure are those vessels from the tomb of the foreign wives of Thutmose III in the Wadi Qirud. These vessels comprise the marbleised vessel of glassy fai-
ence [26], which though relevant is not of glass, the lotus chalice bearing the incised cartouche of Thutmose III [27] and according to Nolte (1968:48) the kohl vessel [28]. However, this latter was actually purchased by the Metropolitan Museum of Art in 1926, having originally been acquired by Hood around 1860. Lilyquist (2003) does not list this last vessel as part of the contents of the tomb, which would be reasonable if it were not located until August 1916 as she states (2003:27). Her view (Lilyquist pers. comm.) [29] is that the vessel is a miniature ointment jar “certainly not from the Wady Qurud” (sic). All that can be said of the piece therefore is that it was bought in Qurneh around 1860, and is of a style which is not dissimilar to other vessels of the time of Thutmose III. Thus we have only one glass vessel from the Wadi Qirud tomb.

Table 1.1. Glass of Thutmose III.

<table>
<thead>
<tr>
<th>Number</th>
<th>Shape / Type</th>
<th>Body colour</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munich AS630</td>
<td>Chalice</td>
<td>Light Blue</td>
<td>Core-formed</td>
</tr>
<tr>
<td>Ashmolean E2451</td>
<td>Chalice</td>
<td>Light Blue</td>
<td>Core-formed</td>
</tr>
<tr>
<td>MMA23.9*</td>
<td>Lotus Chalice</td>
<td>Light Blue</td>
<td>Cast and cold worked</td>
</tr>
<tr>
<td>BM 24391</td>
<td>Kohl pot</td>
<td>Light Blue</td>
<td>Drilled and cold worked</td>
</tr>
<tr>
<td>UC 19657</td>
<td>Kohl pot</td>
<td>Light Blue</td>
<td>Drilled and cold worked</td>
</tr>
<tr>
<td>MMA26.7.1179</td>
<td>Kohl pot</td>
<td>Light Blue</td>
<td>Drilled and cold worked</td>
</tr>
<tr>
<td>Cairo 24959</td>
<td>Kohl pot</td>
<td>Dark Blue</td>
<td>Cold worked</td>
</tr>
<tr>
<td>Cairo 24961</td>
<td>Handled vessel</td>
<td>Light Blue</td>
<td>Core-formed</td>
</tr>
<tr>
<td>Cairo 24960 &amp; Brooklyn 53.176.4</td>
<td>Rounded vessel</td>
<td>Light Blue</td>
<td>Core-formed</td>
</tr>
<tr>
<td>BM 47620</td>
<td>Jug</td>
<td>Light Blue</td>
<td>Core-formed with powdered glass decoration</td>
</tr>
<tr>
<td>MMA26.7.1175*</td>
<td>Krateriskos</td>
<td>Marbleised “Glassy faience”</td>
<td>probably core-formed</td>
</tr>
</tbody>
</table>

The royal tomb itself (KV34) was discovered by Victor Loret on February 12th, 1898 (Reeves 1990a:19) but there is evidence that the tomb had at some time been heavily plundered (1990a:23). Four pieces of glass are associated with the tomb. There is a dark blue glass lid [30] and a light blue core-formed vessel with handle support [31]. These definitely come from the tomb, as does a light blue fragment of core-formed vessel with yellow and dark-blue decorative band [32] now in Cairo. This piece is usually reckoned to be from the same vessel as that now in the Brooklyn Museum [33] which is the same in colour and decoration, though it does not join with the Cairo fragment. It is therefore reasonable to assume that it came from the original burial.

There is, however, a further piece of glass which has also been associated with the tomb [of Thutmose III]. This is the exceptionally well preserved juglet now in the British Museum [34]. This piece is in light blue and decorated with dark blue, yellow and white. The yellow has been used to enamel a floral motif on the vessel as well as to add an inscription for Thutmose III himself. According to Cooney (1976:71), no contemporary record of the acquisition of the piece by the museum exists, although Budge (1925:391) states that it probably came from the burial of the king. Cooney accepts this view and suggests that it came to the museum between 1870 and 1872, during which time the royal cache (DB320) was being looted (Cooney 1976:71). The unusual decoration, which is arguably more „Near Eastern“ than Egyptian (but see now Roehrig 2005:69), and the light blue body colour, as well as the inscription, all argue for a Thutmose III date. Thus, although the provenance cannot be accepted without question, it does seem likely that it belonged to the pharaoh concerned.

The royal tomb itself (KV34) was discovered by Victor Loret on February 12th, 1898 (Reeves 1990a:19) but there is evidence that the tomb had at some time been heavily plundered (1990a:23). Four pieces of glass are associated with the tomb. There is a dark blue glass lid [30] and a light blue core-formed vessel with handle support [31]. These definitely come from the tomb, as does a light blue fragment of core-formed vessel with yellow and dark-blue decorative band [32] now in Cairo. This piece is usually reckoned to be from the same vessel as that now in the Brooklyn Museum [33] which is the same in colour and decoration, though it does not join with the Cairo fragment. It is therefore reasonable to assume that it came from the original burial.

There is, however, a further piece of glass which has also been associated with the tomb [of Thutmose III]. This is the exceptionally well preserved juglet now in the British Museum [34]. This piece is in light blue and decorated with dark blue, yellow and white. The yellow has been used to enamel a floral motif on the vessel as well as to add an inscription for Thutmose III himself. According to Cooney (1976:71), no contemporary record of the acquisition of the piece by the museum exists, although Budge (1925:391) states that it probably came from the burial of the king. Cooney accepts this view and suggests that it came to the museum between 1870 and 1872, during which time the royal cache (DB320) was being looted (Cooney 1976:71). The unusual decoration, which is arguably more „Near Eastern“ than Egyptian (but see now Roehrig 2005:69), and the light blue body colour, as well as the inscription, all argue for a Thutmose III date. Thus, although the provenance cannot be accepted without question, it does seem likely that it belonged to the pharaoh concerned.

One more vessel also bears the prenomen of the king, and is now in the Munich collection [35]. This is a light blue core-formed chalice decorated in dark blue and yellow and with the cartouche of the king in dark blue. The cartouche itself is at something of an angle and the hieroglyphs are grouped toward the top edge of the name-ring. The rim is uneven. The piece once belonged to the Dodwell collection and was bought in 1832, probably at Thebes (Newberry 1920; Nolte 1968:48). It is not possible to give a more definite provenance to the piece, though I would agree with Nolte (1968:49) that it is contemporary with Thutmose III and not a later piece belonging to the Theban ruler Menk-
heperre of the 21st Dynasty. The quality of the glass seems altogether better than comparable later glasses. Nonetheless, one should bear in mind that the piece lacks a definite provenance.

Of a similar form is a plain light blue chalice from the Ashmolean collection [36]. The piece comes from Tomb 58 at Gurob (Loat 1904:7). It has been dated to the reign of Thutmose III, largely by comparison with the Munich piece. Thus, although it has a provenance, its dating largely relies on the unprovenanced Munich piece. So, although the comparison seems a fair one, one must proceed with caution.

Abb. 2000-2/007 (Maßstab ca. 250 %)
Kopf Amenophis II.
opak-blaues Glas, H 4 cm
Ägypten, 18. Dynastie, 1435-1415 v. Chr.
Corning Museum of Glass, Corning, NY
aus Charleston 1990, S. 21

Last in the Thutmose III group are two kohl pots. One of these [37] comes from Riqqeh cemetery B and, although illustrated in the publication (Engelbach 1915:16 and pl. 12 no. 14), the rest of the contents of the tomb are not published. Thus the dating is based on the fact that stone kohl pots of this type were popular during the reign of Thutmose III. The vessel has provenance but the dating cannot be relied upon. That same dating is then used to provide the date for an unprovenanced piece in the British Museum [38], a light blue vessel with its rim, foot and lid decorated with gold leaf. The vessel was acquired by the museum in 1892 (Nolte 1968:47). These two vessels must be regarded as having the least satisfactory dating of all.

In summary then, the two kohl pots rely only on style for their dating. The Ashmolean chalice relies on the Munich chalice, itself unprovenanced - though probably of Thutmose III. The British Museum juglet has no provenance, and though the dating seems very probable, it cannot be certain. The ointment vessel in the Metropolitan Museum [39] is no longer regarded as from the Wadi Qirud burials and so cannot be dated with certainty. The Metropolitan Museum’s lotus chalice is the only certain glass vessel from the tomb of the foreign wives. This leaves four fragments, three of which are certainly from the tomb of the king himself [40] and one which is almost certainly from the tomb, as it seems to be the same vessel as one of these certain pieces [41].

During the course of this study it has been possible to examine one additional vessel which may also belong to the reign of Thutmose III. This piece was collected by Sir John Gardner Wilkinson (1797-1875) and subsequently donated to Harrow School [42]. The piece is in light blue glass with yellow and dark blue trail decoration, and its form is very similar to the piece in the Ashmolean collection. If the dating of the Ashmolean and Munich pieces is correct then it is likely that this piece also dates to the reign of Thutmose III (for a more detailed discussion of the vessel and its origin see Nicholson 2006a).

Abb. 2000-2/008 (Maßstab ca. 180 %)
Kopf Amenophis III.
opak-blaues und gelbes Glas, H 3,8 cm
München, Staatl. Sammlung Ägypt. Kunst
aus Kühne 1999, S. 468, Abb. 14

Clearly, the status of some of the Thutmose III glass is uncertain and in the absence of analytical studies of all of the pieces caution must be exercised. However, it may be possible to make some observations on technological grounds, and group the pieces accordingly.

The two kohl pots, whose attribution to Thutmose III is arguably least secure, both seem to be cast and then drilled; that is, the technology is closely akin to the working of stone whose form they imitate. The same holds true of the kohl or ointment vessel originally thought to be from Wadi Qirud, but whose provenance and date have been shown to be uncertain. The lid from a kohl pot found in the tomb of Thutmose III [43] is also cold-worked, suggesting that it belongs with this little group. The elegant lotus chalice from the Wadi Qirud burial is also cast and cold-worked.
The British Museum juglet has no exact parallel (see however Roehrig 2005:69) though its shape is similar to the - apparently much larger - vessel shown in the Tomb of Rekhmire (TT100) and discussed above. Its very accomplished decoration, of a type not otherwise known from Egypt, suggests a foreign source. It is core-formed, however, and so treated in a manner distinct from stone.

Also core-formed are the two chalices now in Munich and the Ashmolean Museum. Although one of these has a cartouche, the workmanship is much less confident than we see on the juglet. The other fragments all come from core formed-vessels, the standard of workmanship is good, but not as high as in the British Museum juglet.

Abb. 2000-2/030 (Maßstab ca. 100 %)
Syrische Göttin Astarte
gepresstes Glas, ursprüngl. dunkelblaues Glas, L 8,5 cm
Nordsyrien, 1400-1200 v. Chr.
British Museum, London
aus Lierke 1999, S. 67

It might tentatively be suggested that what we see here amongst the Thutmose III glasses are an early stage in which glass is treated as stone and is worked cold, perhaps from imported ingots. This cold technology is gradually replaced by hot-working inspired by vessels such as the juglet. This vessel may have been imported into Egypt or made in Egypt by foreign craftsmen brought in to establish such an industry. In the two core-formed chalices and the core-formed vessel fragments from KV34 we may see the earliest steps in a native Egyptian core-formed glass industry (c.f. Shortland 2001:220) [44].

It is, of course, possible that some of these steps went on almost simultaneously, but the fact that coldworking of vessels, particularly drilling them, dies out after this time may be significant. Unfortunately, only a few of the important vessels attributed to this reign have been subject to analysis. Those which have been exami-
The Glass of Amenhotep II and Thumose IV

As early as the reign of Amenhotep II (1427-1400 B.C.), the refinement of the quality of glass production had already begun (Nolte-Reifor 1967:151, Rehren 2000a:17). From the tomb of Amenhotep II (KV35) itself come 76 vessels which are exceptional for their size, the largest [46] being some 40 cm in height (Nolte 1968:54 and Taf. II:2). The body colour of these vessels tends to be from dark to translucent copper blue, though there are some light blue examples along with white and „Tyrian Purple“ (Nolte-Reifor 1967:151) and brown. Decoration is usually in yellow, white and light blue or green. Marbled patterns are common but there are also garlands and arcades as well as early attempts at feathering, „Mosaic patterns“ (Nolte-Reifor 1967:151) are also present, as on the rosettes seen on the two unusual ribbed or lobed vessels from the tomb [47].

The reign of Amenhotep II can be seen as a time of transition from - apparently - small-scale production, albeit becoming increasingly refined, to larger groupings of glass workers, which Nolte (1968) has attempted to identify as workshops on the basis of stylistic similarities between products. It need not be supposed that the production of glass was suddenly on a very much larger scale, however. It may be that what we are seeing is the completion of the establishment of an Egyptian glass industry, one which was now working glass primarily as a material in its own right, rather than treating much of it as a substitute for stone and to be worked in the same manner. This change may also be reflected in the technology, and Rehren (2000a, 2000b) argues that materials were no longer carefully selected, but that a „partial batch melting“ system was employed.

This new era begins with the reign of Thutmose IV (1400-1390 B.C.) from whose tomb (KV43) come 35 vessels. None of these are on the same scale as those from the burial of Amenhotep II but two thirds of them (Nolte-Reifor 1967:151) are of dark blue glass which uses cobalt as a colorant. This is surely significant, since there is a source of cobalt in Egypt itself, and though it may have been exploited earlier, the reign of Thutmose IV may mark its first major exploitation. These sources are in the Dakhla and Kharga oases (Kaczmarczyk 1986; 1991:195) of the Western Desert and would perhaps have required military expeditions to exploit them, something already well established for quarrying operations.

This new era also sees the firmer establishment of the vessel shape corpus, with krateriskoi and amforiskoi dominant, and the end of lotus chalices and drilled kohl vessels. Thread decoration is confined to yellow, white and blue, and the garland and feather patterns become established as the decorative norm. Within these norms Nolte (Nolte-Reifor 1967, Nolte 1968) has sought to identify particular Werkkreise. These make use of the characteristics of the decoration, since particular craftsmen are likely to have particular ways of thread-trailing, and particular patterns would only remain in fashion for a certain time. Shapes and colours are also attributed to particular time periods.

The burial of Thutmose IV also marks the last great find of glass in a funerary context; most of that known from subsequent reigns has been found on settlement sites. Because of the uneven nature of settlement excavation in Egypt it is not possible to put too much weight on this apparent change, but it is tempting to assume that a local industry is now producing glass on a somewhat greater scale than previously, so that it is more widely available, albeit only within elite circles.

It can be suggested that access to raw materials, such as cobalt, was probably a royal prerogative, and that access to glass is a mark of status, although Kemp (pers. comm.) has rightly pointed out that sumptuary laws would be needed if access to cobalt and glass were to be deliberately controlled. However, given that cobalt may have had to be acquired by expeditions, access to it may have been restricted simply by access to the supply. Since glass was also a relatively new material, and one which often used cobalt, it too would have been in limited supply and most likely to find its way into the hands of the wealthiest individuals. Here it differs from blue-painted pottery, which was also coloured with cobalt.

The pottery technology was relatively simple, and the end product correspondingly less expensive, despite its exotic colourant. Glass, in contrast, was less common because it was a new, and perhaps controlled, technology and used the expensive colourant material.

Thus we find, from the time of the very earliest sculpture in glass, a royal portrait head of Amenhotep II [48] (Goldstein 1979). It seems possible that, by assembling the makers of glass and the materials for its production, the Palace had some control over the dissemination of glass to its most worthy courtiers. This apparently began in this same reign when Amenhotep II presented a glass shabti to his First Steward Kenamun [49] (Cooney 1960:11). A similar presentation is known from the subsequent reign of Thutmose IV, who presented a similar piece to the royal tutor Hekareshu [50] (Cooney 1960:11). Although there may have been no formal prohibition on the use, or even making, of glass outside Palace circles, the limitation of its supply and the limitation of access to certain materials may have had the effect of making glass a material for the upper echelons of society, at least in its earliest stages.

Glass in the reign of Amenhotep III

The reign of Amenhotep III (1390-1352 B.C.) marks a departure from the pattern of evidence which has been discussed so far. His reign „was one of the most prosperous and stable in Egyptian history. His great-grandfather, Tuthmosis III [sic], had laid the foundations of the Egyptian empire by his campaigns into Syria, Nubia and Libya. Hardly any military activity was called for under Amenhotep“ (Clayton 1994:115).

Amenhotep III comes to the throne at the height of an established and consolidated empire and quickly establishes himself as the archetypal oriental potentate (see Kozloff et al. 1992). If we are right in believing that glass came to Egypt largely as a result of the conquests of Thutmose III, then the subsequent two reigns may be seen as establishing and developing this in-
dusty such that under Amenhotep III it is ripe for expansion.

Expansion does not, however, imply cheapening. Glass is still a product of royal interest, as is witnessed by the blue glass head, believed to be of Amenhotep III, now in the Miho Museum in Japan [51] (Goldstein www1), continuing the fashion for high status sculpture in glass. Indeed, it may be that such moulded and then cold-worked, objects represent a hitherto unrecognised aspect of Egyptian glass production - the moulding of softened glass. This would allow the making of objects at lower temperatures than might normally be expected.

Links with Mitanni (known to the Egyptians as Naharin) continued by a diplomatic marriage of Amenhotep III to Gilukhepa, a daughter of Tushratta King of Mitanni, in his tenth regnal year. She arrived in Egypt with a retinue of some 317 persons, and is but one example of the ongoing, and increasing, foreign presence at the court of Amenhotep. Such outside influences, combined with the growing wealth of Egypt through the exploitation of Nubian gold and through foreign trade, led to a period of artistic and craft development.

It is perhaps not surprising then, to find that glassmaking appears to have been one of the crafts taking place in Amenhotep III’s palace complex at Malkata (Chapter 5). Malkata is certainly no ordinary settlement, and the royal interest in glass is obvious. It is also apparent that excavation of non-funerary sites has much to tell us about the early stages of glass production, and one should not overlook the likelihood that similar installations may have existed earlier. Instead of dealing with only a few fragments of vessel glass there are now many hundreds known from Malkata and elsewhere (Nolte 1968:65), reflecting the opulence of the reign.

There is much similarity in the glass from Malkata and that from Amarna, suggesting that at least some of the craftsmen may have moved to the new city during the reign of Amenhotep IV / Akhenaten (1352-1336 B.C.).

Despite general similarities, A. P. Kozloff in preparing for the exhibition Egypt’s Dazzling Sun, examined over 1000 fragments and complete vessels and found “a definite evolution in the design, color [sic], and technical execution of core-formed glass vessels from Malqata to el-Amarna” (Kozloff 1992:375). Vessels from Malkata were (1) predominantly cobalt blue, (2) more opaque than those from Amarna, (3) often fitted with feet which were separately made and attached, (4) provided with pommel handles on jars, (5) often bearing unmarvelled decoration, (6) frequently with spiral formed two-tone rods used on rims, lips, shoulders or handles and (7) were normally of elegant shape (Kozloff 1992:376). The shapes were small jars and small amphorae, as well as palm-column kohl tubes.

The finished Amarna pieces show far fewer examples of cobalt blue glass with two-tone rims etc., and Kozloff considers examples of these to be imports from Malkata, or they may have been made early on by the Amarna glassmakers, if these individuals were themselves transplants from Malqata [sic]” (Kozloff 1992:376). There are also types of glass from Amarna which are unknown at Malkata, and the following were distinguished (1) mid-blues and blue-greens coloured with copper are in quantity equal to the cobalt blues, (2) greater translucency in blue glasses except where made milky by lead, (3) thin, angular or S-shaped handles on Krateriskoi, (4) greater variety of colours, notably opaque yellow, white and red, especially yellow or white with inset blue and white „eye” shapes and crisscrossed rods of blue and white, (5) well marveled surface decoration, (6) heavier more squat proportions and (7) so-called pilgrim flasks and hemispherical bowls are more common and palmcolumns less popular (Kozloff 1992:376).

The Werkkreise

In the 1960s Birgit Nolte attempted to define a series of Werkkreise (Nolte-Reifor 1967, Nolte 1968). It should be borne in mind, however, that most of this material comes from funerary contexts, and that - with the exception of Amarna - there is insufficient evidence from actual workshops on which to base such a classification and as Kemp (pers. comm.) has pointed out, the absence of good evidence from Memphis presents major difficulties for a classification of this kind. Kozloff’s (1992) observations go beyond those of Nolte in terms of dating, but the Nolte classification is still widely referred to and it is worthwhile summarising it here for the period up to and including the reign of Amenhotep IV [Echnaton].

Werkkreis I covers the period from Thutmose IV to Amenhotep IV. It began production at an unknown site under Thutmose IV, moved to Malkata, and thence to Amarna. The Krateriskos is the preferred shape, and less commonly the Amphoriskos or lentoid flask, which first appears under Amenhotep III. The dominant base colours are sky blue and dark blue with contrasting decorative threads in white, yellow and blue tones. The decorative patterns are highly consistent with finely drawn out feathering on the necks and garlands on the bodies (Nolte-Reifor 1967:151).

Werkkreis II begins early in the reign of Amenhotep III and continues into that of Amenhotep IV. The workers are believed to be based first at Malkata and then at Amarna. As might be expected from the proximity of this workshop to Werkkreis I at Malkata, there was influence between the two workshops. The characteristic feature here is the garlands which form elegant swirls on the necks and bodies of Krateriskoi, Amphoriskoi and lentoid flasks. Yellow, white and sky blue appear on dark blue to translucent copper blue body glasses. Very rarely white or sky blue base glass is also used (Nolte-Reifor 1967:151-52). Note that dark blue is now a predominant body colour, perhaps confirming that exploitation of the Western Oases for cobalt was now well established.

Werkkreis III is also dated to Amenhotep III and IV. The body colour is most commonly dark blue, more rarely sky blue, and the forms are Amphoriskoi, Krateriskoi and occasionally bottles with handles as well as
jugs. The decoration is in yellow, white, sky and dark blue. The vessel necks and bodies are decorated with very fine feather patterns, sometimes accompanied by arcades or garlands. The decorative scheme is sometimes divided into two by horizontal threads (Nolte-Reflor 1967:152).

As well as the core-formed vessels there are also mosaic glass bowls, and - exclusively from Amarna - small gold-yellow or faint-blue pieces with layered eyes, dripped on circular layers of glass of varying dimensions and colour.

Abb. 2000-2/032 (Maßstab ca. 100 %)
Herz-Skarabäus der Tuju aus Theben-West, Tal der Könige
opak blauenes Glas und grünlicher Feldspat, L 5,3 cm
Ägypt. Museum Kairo
Tuju war die Großmutter Echnatons [ca. 1400 v. Chr.]
aus Nofretete 1976, Kat. Nr. 33

Conclusions

It appears that the development of glass in Egypt is bound up with influences from outside the Nile Valley, and that the material - perhaps because of its exotic nature - is quickly a focus of royal patronage, and possibly monopoly.

Most of the evidence for glass in this earliest phase comes from funerary contexts. This may reflect the limited utilisation of glass in Egypt at this time, but may equally be a factor of the limited investigation of settlement sites. The matter of funerary contexts, and indeed the social status of glass, may be settled by the investigation of a cemetery belonging to the ordinary people of Amarna begun in 2006. Whilst this post-dates the earliest glass in Egypt, it may give an indication of just how widely glass was used beyond elite contexts.

When settlements are examined it would not be surprising to find the establishment of at least limited workshops as early as the time of Thutmose III. However, it is to the reign of Amenhotep III (1390-1352 B.C.) that one must look for our earliest evidence of production sites. Manufacturing evidence forms the subject of the next chapter.

Buch Rückseite:

This book examines the coming of glass to Egypt and its relationship to the production of faience and pottery, particularly at Amarna site O45.1. The text combines excavated evidence with experimental archaeology and laboratory analyses to give a reconstruction of the production of glass and other materials at Amarna, both in terms of technology and social context. The excavations carried out by Flinders Petrie at Amarna (1891-1892) are reassessed in the light of the new work and finds from that time put into a broader perspective.

Abb. 2000-2/019
Karte „Die natürlichen Rohstoffe des alten Ägypten“, Ausschnitt
Amarna liegt ungefähr in der Mitte des Ausschnitts am Nil
Wadi Natrun liegt süd-westlich des Nil-Deltas
Qantir liegt süd-östlich des Nil-Deltas
am rechten oberen Rand liegt Palästina, aus dem das Rohglas
für die ägyptischen Glasmacher gekommen sein könnte
aus Baines 1980, S. 21

Dr. Paul Nicholson is Senior Lecturer in Archaeology in the Cardiff School of History and Archaeology at the University of Cardiff. He has undertaken fieldwork for the Egypt Exploration Society at Amarna, Kom He lul (Memphis) and in the Sacred Animal Necropolis at North Saqqara, in addition to participating in excavations elsewhere in Egypt. Dr. Nicholson’s particular research interests are in early technology and archaeological science and his recent publications include Ancient Egyptian Materials and Technology (co-edited with Ian Shaw, 2000) and The British Museum Dictionary of Ancient Egypt (co-authored with Ian Shaw, 1995, reissued 2003). Several papers on the excavation of the glass factory at Amarna have appeared including one in the Journal of Glass Studies 37 (1995).
Literaturangaben aus PK 2000-2 ... / Auszug

<table>
<thead>
<tr>
<th>Autor 1</th>
<th>Autor 2</th>
<th>Titel</th>
<th>Verlag</th>
<th>Jahr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barag</td>
<td></td>
<td>Dan P., Mesopotamian Glass Vessels of the Second Millennium B.C., Journal of Glass Studies, Jg. 4, Corning 1962</td>
<td></td>
<td>1962</td>
</tr>
<tr>
<td>Eggebrecht</td>
<td></td>
<td>Arne u.a., Ägyptens Aufstieg zur Weltmacht, Ausst.-Katalog, Hildesheim 1987</td>
<td></td>
<td>1987</td>
</tr>
<tr>
<td>Fortin</td>
<td></td>
<td>Michel, Syrien - Wiege der Kultur, Ausstellungs-Katalog, Mainz 1999</td>
<td></td>
<td>1999</td>
</tr>
<tr>
<td>Harden</td>
<td></td>
<td>Donald B., Glas der Cäsaren, Ausstellungs-Katalog, Mailand 1988</td>
<td></td>
<td>1988</td>
</tr>
<tr>
<td>Lierke</td>
<td></td>
<td>Rosemarie, Antike Glaspföreis, Mainz 1999</td>
<td></td>
<td>1999</td>
</tr>
<tr>
<td>Nicholson</td>
<td></td>
<td>Paul T., Egyptian Faience and Glass, Buckinghamshire1993</td>
<td></td>
<td>1993</td>
</tr>
<tr>
<td>Özgüç</td>
<td></td>
<td>Tashin, Die Hethiter und ihr Reich, Stuttgart 2002</td>
<td></td>
<td>2002</td>
</tr>
<tr>
<td>Roaf</td>
<td></td>
<td>Michel, Weltatlas der alten Kulturen, Mesopotamien, München 1990</td>
<td></td>
<td>1990</td>
</tr>
</tbody>
</table>

Siehe unter anderem auch:

PK 1999-2  Charleston, SG, Erstes Milchglas aus Venedig; Auszug aus Charleston, Masterpieces of Glass


PK 2000-3  Lierke, Ein paar Randnotizen zum Ausflug ins Altertum; Nachtrag zu PK 2000-2

PK 2000-5  SG, Form-geblasenes Glas (Schale Ennion, 1 Jhdt. n.Chr.)

PK 2001-3  Lierke, Mit 'Versuch und Irrtum' durch die Geschichte der antiken Glastechnologie

PK 2001-5  SG, Rosetten und Glasperlen aus dem minoischen Kreta

PK 2001-5  Lierke, Ägyptisches Glas aus Amarna; Nachtrag zu PK 2001-3

PK 2001-5  SG, Türkis-opake Schale aus Chorasan - geschliffen oder gepresst?

PK 2002-2  SG, Kamen die ägyptischen Glasmacher der Amarna-Zeit aus Mitanni?

PK 2002-2  Nachtrag zu PK 2000-2

PK 2002-2  SG, Ägyptischer Halskragen mit Rosetten, Sammlung Ludwig, Basel

PK 2002-3  Lierke, Edles Pressglas - ein Irrtum wird geklärt

PK 2002-3  SG, Auszug aus Wamser 1998 und Stiegemann 2001, Glasfunde (formgeblasen und gepresst) aus byzantinischem Herrschaftsbereich

PK 2002-3  Stern, Achaemenidische Glasschale im Inventar des Parthenon in Athen

Pressglas-Korrespondenz 2009-4

PK 2002-3 SG, Zur Herstellung der achaemenidischen Schalen aus Glas: "Cast and Cut?"
PK 2002-3 Triantafyllidis, Neue Funde zur Herstellung von Glas im klassischen und hellenistischen Rhodos
PK 2003-1 SG, Pressform für einen Schmuckanhänger aus Fayence aus dem alten Ägypten
PK 2003-1 SG, Bianchi u.a., Reflections on Ancient Glass from the Borowski Collection - Biblical Lands Jerusalem [Überlegungen zu antikem Glas ...]
PK 2003-1 SG, Eine in einer Hohlform geprägte Schale aus Quarzkeramik aus dem Iran (Chorasan)
PK 2003-1 SG, Auf der Suche nach den ältesten Rosetten der Welt
PK 2003-1 SG, Becher aus Fayence und Ägyptisch Blau: Vorbilder von Achaemenidischen Schalen aus Glas?
PK 2003-2 Carboni, Verwendung von Glas als Dekoration in der Architektur der islamischen Welt
PK 2003-4 Carboni, Drei Medaillons mit eingepressten Motiven und Inschriften - Islamisches Glas
PK 2004-1 Lierke, Über Diatrete und andere geschliffene antike Gläser - Spurensuche und Folgerungen
PK 2005-4 SG, Lierke, Die Hedwigsbecher - Das normannisch-sizilische Erbe der staufischen Kaiser. Ein neues Buch zur Glasgeschichte
PK 2006-3 SG, Andenken-Plaketten an den Säulenheiligen Simeon Stylites in Syrien aus Pressglas
PK 2007-3 SG, Barovier Montasti, Carboni, Emailliertes Glas zwischen dem Östlichen Mittelmeer und Venedig (Schale Chorasan)
PK 2007-3 Verità, Einfluss der Islamischen Tradition auf Chemie und Technologie von Glas aus Venedig
PK 2008-3 SG, Ein interessantes Buch: Jonathan M. Bloom, Arts of the City Victorious - Islamic Art and Architecture in Fatimid North Africa and Egypt
PK 2009-1 Othman, Die Techniken der Glasherstellung in Syrien in byzantinischer Zeit und ihre Entwicklungphasen (mit Literaturangaben)
PK 2009-1 Thiel, SG, Diatretbecher - „in mehreren Arbeitsschritten gepresst und nachgeschliffen“
PK 2009-3 SG, Menninger, Untersuchungen zu den Gläsern und Gipsabgüssen aus dem Fund von Begram (Afghanistan), Würzburg 1996
PK 2009-4 SG, Ein wichtiges Buch: Lierke, Die nicht-geblasenen antiken Glasgefäße ... Deutsche Glastechnische Gesellschaft, 2009
PK 2009-4 Barag, Socio-Economic Observations on the History of Ancient Glass
PK 2009-4 Nicholson, Brilliant Things for Akhenaten - The Production of Glass, Vitreous Materials and Pottery at Amarna Site O45.1