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GEMSTONES

الكريمـــة الأحجـار

James A. Harrell

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The gemstones of ancient Egypt, broadly defined, include all rocks, minerals, and biogenic materials used for jewelry (beads, pendants, ring stones, and cloisonné inlays), amulets, seals, and other small decorative items (figurines, cosmetic vessels, and inlays in furniture and sculpture). At least 38 gemstone varieties were used by the Egyptians, but ancient mines in Egypt are known for only nine of these. Some of the gemstones were imported from sources in Asia while others certainly came from undiscovered Egyptian mines.

الأحجار الكريمة في مصر القديمة مصطلح شامل يتضمن كل أنواع الأحجار والمعادن والمواد العضوية المستخدمة في صناعة الحلي (مثل الخرز والدلايات والخواتم من الأحجار والتطعيم بالمينا) والتمائم والأختام والقطع الزخرفية الأخرى الصغيرة (مثل التماثيل الصغيرة وآواني مستحضرات التجميل وتطعيم الأثاث والمنحوتات). لقد استخدم المصريين القدماء ما لا يقل عن ثمانية وثلاثين نوع من الأحجار الكريمة، لكن المناجم القديمة في مصر لم تعرف إلا تسعة أنواع من هذه الأحجار ، بعض الأحجار الكريمة تم استيراده من آسيا بينما البعض الآخر من المؤكد أنها جلبت من مناجم مصرية لم تكتشف بعد.

The gemstones of ancient Egypt, broadly defined, include all rocks, minerals, and biogenic materials used for jewelry (beads, pendants, ring stones, and cloisonné inlays), amulets, seals, and other small decorative items (figurines, cosmetic vessels, and inlays in furniture and sculpture). The ancient Egyptian word most closely matching "gemstones" is *ꜥɜt* (*aat*), which was a general term for "mineral," but often with implications of value and rarity (Harris 1961: 21 - 22). Table 1 lists the 38 gemstone varieties used by the Egyptians and for each of these provides a general description of its appearance along with its extent of use, source(s), and, where known, ancient names. Illustrations of most of these gemstones are provided in Figures 2 through 25. Relatively few gemstones have known mines in Egypt and these are shown on the map in Figure 1 with the site numbers taken from the table. The use of other gemstone varieties is occasionally claimed in the Egyptological literature, but these are unconfirmed identifications. It is conventional to refer to the extraction sites for both gemstones and metals as "mines," and those for other kinds of stones (i.e., building, ornamental, and utilitarian) as "quarries," though there is no fundamental physical difference between the two groups of workings.

Ancient gemstones are usually identified on the basis of their macroscopic attributes (e.g., color, diaphaneity, luster, cleavage or fracture type, inclusions, and crystal form), and when individual loose stones can be examined, standard non-destructive gemological tests (e.g., refractive index, specific gravity, spectroscopic pattern, and polariscope response, among others) can be an effective means of recognition (Read 2005). Mohs scratch hardness and reaction to dilute acid, both only mildly damaging, can also provide useful information, but certain identification sometimes requires destructive analytical tests for mineralogy and chemistry (Aston et al. 2000: 67 - 69). Many gemstones lack rigorous or universally accepted definitions and so there can be some confusion over their names. A more serious problem, however, is

the many misidentifications published by scholars who are not well versed in gem recognition. The naming conventions employed in Table 1 follow those of Klein and Dutrow (2008), the latest edition of a long-used and widely respected mineralogy reference, and are consistent with the two most comprehensive and authoritative works on Egyptian gemstones: Andrews (1990: 37 - 65) and Aston et al. (2000).

Terminology and correct identification are not the only difficulties in a survey of ancient Egyptian gemstones. Nearly all objects with gemstones come from tombs, most spectacularly the royal and elite private ones, but these are only the rare burials that were overlooked or incompletely plundered by thieves. Also, whereas the rock and mineral varieties in Table 1 do not deteriorate over time, the biogenic ones do and so may not survive in the archaeological record. Thus, the material now preserved in museum collections is not fully representative of gemstone use for all periods and especially for all social classes. Most of ancient Egypt's tombs were robbed in antiquity, and the principal items sought were metals—especially gold—and gemstones. The metals were melted

Table 1. Gemstones Used by the Ancient Egyptians[1]

ROCKS AND MINERALS
beryl (transparent to translucent [$Be_3Al_2(Si_6O_{18})$]) with two color varieties 1. **aquamarine** (light to medium greenish blue to blue). Used: rarely in Pt/R only. Source: imported from India. Ancient names: *beryllion*/*berullus* (Greek/Roman). 2. **emerald** or **green beryl** (mainly light to medium green and translucent, rarely dark green and transparent; figs. 2, 28). Used: rarely in late Pt and commonly in R. Sources: six mines in the ancient *Mons Smaragdus* region at Gebel Zabara (no. 8; active R and Is), in Wadi Sikait (no. 9; active late Pt and R), at Gebel Umm Harba (no. 10; active R), in Wadi Abu Rasheid (no. 11; active R), in Wadi Nugrus (no. 12; active R), and at Umm Kabu (no. 13; active R). Some emerald may have been imported from India. Ancient names: *smaragdos*/*smaragdus* (Greek/Roman).
calcite [$CaCO_3$] with two color varieties 1. **common calcite** (translucent; white). Used: commonly in Pd and rarely thereafter for inlay. Source: no mine known, but almost certainly from the limestone in and near the Nile Valley either as crystal masses or white bands in travertine ("Egyptian alabaster"), one of the ornamental stones with many known quarries. Ancient names: unknown. 2. **Iceland spar** (transparent; colorless). Used: rarely in OK and NK/3IP. Source: no mine known, but probably from limestone like common calcite. Ancient names: unknown.
fluorite or **fluorspar** (transparent to translucent; commonly light or bluish green or yellow, but other or multiple colors are possible [CaF_2]). Used: rarely in Pd and Pt/R. Source: one mine at Gebel el-Ineigi (no. 5; ancient but specific period of activity unknown). Ancient names: probably *murrina* or *myrrhina* (Roman).

[1] Pd = Predynastic, ED = Early Dynastic, OK/1IP = Old Kingdom and First Intermediate Period, MK/2IP = Middle Kingdom and Second Intermediate Period, NK/3IP = New Kingdom and Third Intermediate Period, LP = Late Period, Pt = Ptolemaic Period, and R = Roman Period. The numbered sources are shown on the map in Figure 1.

Table 1. Gemstones Used by the Ancient Egyptians[1]

garnet (transparent to translucent; medium to mainly dark red, brownish red, or purplish red in compositionally gradational pyrope and almandine sub-varieties [$(Mg,Fe)_3Al_2Si_3O_{12}$]; fig. 7). Used: commonly in Pt/R, and rarely from Pd to LP. Source: no mine known, but red garnet occurs in many of the metamorphic rocks in the Eastern Desert and Sinai, and probably also in placer deposits near the same rocks. Placer deposits with good quality almandine garnet are found in northern Sudan's Fourth Nile Cataract. During Pt/R, red garnet was heavily imported from India and possibly also Sri Lanka. Ancient names: probably ***ḥmɜgt*** [*hemaget*] (Egyptian); *anthrax* and *anthraka* (Greek); *carbunculus* (Roman).

hematite (opaque brownish black to black with submetallic luster to silvery gray with metallic luster [Fe_2O_3]; figs 8-9). Used: rarely from Pd to Pt/R. Source: no mine known, but both types of hematite are found in some igneous and metamorphic rocks in the Eastern Desert. Ancient names: probably ***bjɜ*** [*bia*] but also possibly ***bjɜ qsy*** [*bia qesey*], and ***bqs ꜥnḫ*** [*beqes ankh*] (Egyptian); *haematitis*/*haematites* (Greek/Roman).

lapis lazuli (opaque; a rock composed of dark blue lazurite [$(Na,Ca)_8(AlSiO_4)_6(SO_4,S,Cl)_2$] or haüynite [$(Na,Ca)_{4\text{-}8}(AlSiO_4)_6(SO4)_{1\text{-}2}$], both minerals of the sodalite group, with golden pyrite specks [FeS_2] and white calcite veins or patches [$CaCO_3$] as the main components; figs. 4-6). Used: commonly from Pd to LP, and rarely in Pt/R. Source: imported from northeast Afghanistan and possibly also neighboring areas in Pakistan. Ancient names: ***ḫsbd*** [*ḫesbed*] and also possibly ***tfrr*** [*tefrer*] (Egyptian); *sapphiros*/*sappirus* (Greek/Roman).

Libyan desert glass (translucent; light to medium greenish yellow meteoritic silica glass [SiO_2]). Used: confirmed only in an 18th Dynasty scarab in a pectoral belonging to king Tutankhamun. Source: the Western Desert near the Libyan border. Ancient names: unknown.

malachite (opaque; patchy to mainly banded light and dark green [$Cu_2CO_3(OH)_2$]; fig. 10). Used: rarely from Pd to NK/3IP as a gemstone, but commonly for paint pigment and eye shadow in all periods. Sources: malachite is the principal ore mineral for copper and so comes from the numerous copper mines in the Sinai Peninsula and Eastern Desert. Ancient names: ***šsmt*** [*shesmet*] and probably also ***wɜḏ*** [*wadj*] (Egyptian); probably *smaragdos*/*smaragdus* (Greek/Roman).

microcline feldspar (translucent to opaque [$KAlSi_3O_8$]) with two color varieties

1. **amazonite**, **amazonstone** or **green feldspar** (light or medium green to mainly bluish green; figs. 3-5). Used: commonly from MK/2IP to NK/3IP, and rarely from Pd to OK/1IP and LP to Pt/R. Sources: two mines at Gebel Migif (no. 6; active NK, 18th Dynasty) and in Wadi Fayrouz at Gebel Hafafit (no. 7; active Pt and R) plus probably one or more undiscovered sources in the same general area. Ancient names: ***nšmt*** [*neshmet*] and possibly also ***ḥsg*** [*heseg*] (Egyptian); probably *smaragdos* and possibly also *iaspis* (Greek); *smaragdus* and possibly its sub-variety *galactites* (Roman).

2. **common microcline** (orange to mainly pink). Used: rarely in MK/2IP. Source: no mine known, but granitic rocks with large microcline crystals occur abundantly in the Eastern Desert and Sinai, and at Aswan. Ancient names: unknown.

Table 1. Gemstones Used by the Ancient Egyptians[1]

muscovite mica (transparent to translucent; light to medium brownish yellow [$KAl_2(AlSi_3O_{10})(OH)_2$]). Used: rarely in Pd and later by Nubia's Kerma Culture. Source: no mine known, but muscovite deposits are commonly associated with pegmatite veins in the Eastern Desert. Ancient names: *specularis lapis* (Roman).

jade or **nephrite** (translucent; light to dark green in compositionally gradational actinolite and tremolite [$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$]). Used: confirmed only in an 18th Dynasty ring bezel belonging to king Tutankhamen. Much of what has been called nephrite, jadeite or jade is apparently either green chalcedony, green jasper, or serpentinite, the latter one of the ornamental stones. Source: no mine known, but possibly associated with serpentinite in the Eastern Desert. Ancient names: unknown.

obsidian (translucent; light to dark brownish black to black volcanic silica glass [SiO_2]; fig. 11). Note that what has been reported as smoky quartz is probably pale obsidian. Used: rarely from Pd to Pt/R. Source: imported either from the Eastern Mediterranean or especially the southern Red Sea. Ancient names: probably ***mnw km*** [*menew kem*] (Egyptian); probably *liparaios* (Greek); *obsianus lapis* (Roman).

peridot (transparent to translucent; light or medium green to mainly yellowish green olivine [$(Mg,Fe)_2SiO_4$]; fig. 12). Used: rarely in Pt/R. Source: one mine on Zabargad (or St. John's) Island in the Red Sea (no. 15; active Pt/R). Ancient names: *topazos/topazion* and *chrysolithos* (Greek); *topazus/topazum* and *chrysolithus* (Roman).

quartz [SiO_2] with macrocrystalline and microcrystalline varieties

Macrocrystalline quartz with four color varieties

1. **amethyst** (transparent; light to dark violet or purple; figs. 2-4, 28). Note that what has been reported as rose quartz is probably pale amethyst. Used: commonly in MK/2IP and Pt/R, and rarely from Pd to OK/1IP and NK/3IP to LP. Sources: two mines at Abu Diyeiba near Wadi Waseef (no. 4; active Pt/R), and near Wadi el-Hudi (no. 14; active MK). Ancient names: ***ḥsmn*** [*hesmen*] (Egyptian); *amethystos/amethystus* (Greek/Roman).

2. **citrine** (transparent; light to medium yellow or brownish to reddish yellow). Used: rarely in Pt/R. Source: either imported from the East or, from the early Roman Period onward, produced by heat-treating Egyptian amethyst. Ancient names: possibly *chrysolithos/chrysolithus* (Greek/Roman).

3. **milky quartz** (translucent; white). Used: rarely from Pd to MK/2IP. Source: no mine known, but milky quartz occurs abundantly in veins throughout the Eastern Desert and at Aswan. Ancient names: possibly ***mnw ḥḏ*** [*menew hedj*] (Egyptian).

4. **rock crystal** (transparent; colorless; fig. 13). Used: rarely from Pd to Pt/R. Source: no mine known, but rock crystal deposits occur widely across the Eastern Desert, including the amethyst mines. Ancient names: possibly ***mnw ḥḏ*** [*menew hedj*] (Egyptian); *krystallos/crystallus* (Greek/Roman).

Microcrystalline quartz – **chalcedony** or **agate** (mainly fibrous/chalcedonic silica and translucent) with seven color varieties

Table 1. Gemstones Used by the Ancient Egyptians[1]

1. **carnelian** or **cornelian** (medium to dark orangey red, brownish red or red; note that during the Roman Period, but possibly earlier as well, carnelian color was often enhanced by heat treatment; figs. 4-5, 7, 14-16) plus **sard** (medium to dark orangey brown, reddish to yellowish brown or brown and gradational with carnelian). Used: commonly from Pd to Pt/R. Sources: one mine at Stela Ridge near Gebel el-Asr, principally for carnelian and sard but also for common and other chalcedonies (no. 16; active mainly MK but with OK and R traces) plus, for other periods, one or more undiscovered sources in Egypt's deserts or, perhaps, in southern Egypt's and northern Sudan's Nile River terrace gravels. Ancient names: ***ḥrst*** [*herset*], and also occasionally ***ḥrst dšr*** [*herset desher*] and ***ḏrtt*** [*djertet*] (Egyptian); *sardion*/*sarda* (Greek/Roman).

2. **common agate** (parallel, curved to wavy concentric bands with alternating lighter and darker colors – typically white or light gray with dark gray, brown or black; fig. 15). Used: rarely from Pd to Pt/R. Source: no mine known, but agate pebbles and nodules are occasionally found in the Eastern Desert and Sinai. Imported from India during Pt/R. Ancient names: possibly ***ḥḏ*** [*hedj*], ***kȝ*** [*ka*], ***kȝ ḥḏ*** [*ka hedj*], or ***kȝj km*** [*kai kem*] (Egyptian); *achates* and possibly *onychion* (Greek); *achates* (Roman).

3. **common chalcedony** (white or pale gray to mainly bluish white/gray; fig. 16). Used: rarely from Pd to Pt/R. Source: one mine at Stela Ridge, near Gebel el-Asr. Ancient names: probably ***ḥrst ḥḏ*** [*herset hedj*] (Egyptian); probably *leuachates* and possibly also *cerachates* and *ceraunia* (Roman).

4. **green chalcedony**[2] (light to medium green). Used: rarely from Pd to Pt/R. Source: one mine at Stela Ridge, near Gebel el-Asr. Ancient names: possibly ***prḏn*** [*perdjen*] (Egyptian); probably *prasinos* or *prasitis* (Greek); *prasius* (Roman).

5. **onyx** (parallel, planar layers with alternating white or light gray and dark gray or black; fig. 15). Used: commonly in Pt/R, and rarely in Pd, NK/3IP, and LP. Source: imported from India during Pt/R and possibly from other Eastern sources earlier, although small amounts can be found at the Stela Ridge mine (see carnelian). Ancient names: possibly ***kȝ km*** [*ka kem*] (Egyptian); *onychion* (Greek); *onyx lapis* (Roman).

6. **sardonyx** (parallel, planar layers with alternating white or light gray and reddish or brownish colors; fig. 15). Used: commonly in Pt/R, and rarely in NK/3IP and LP. Sources: imported from India during Pt/R and earlier probably from the same sources as carnelian. Ancient names: possibly ***kȝ ḥḏ*** [*ka hedj*] (Egyptian); probably *onychion* (Greek); *sardonyx* (Roman).

7. **silicified** (or **petrified**) **wood** (grayish to brownish with wood-fiber texture, fine-grained; can contain abundant granular/non-chalcedonic silica). Used: rarely in NK. Source: no mine known, but probably from occurrences in the Western or Eastern Deserts near Cairo. Ancient name: possibly ***ḫt-ʿwȝ*** [*khet-awa*] (Egyptian).

Microcrystalline quartz – **jasper** (mainly granular/non-chalcedonic silica and opaque) with three color varieties

2 The terms bloodstone (or heliotrope), chrysoprase, plasma, and prase refer to different varieties of greenish microcrystalline quartz (both fibrous chalcedony and granular jasper), but are inconsistently used in the archaeological and geological literature and so have no clear meaning.

Table 1. Gemstones Used by the Ancient Egyptians[1]

1. medium to dark **red** (fig. 17). Used: commonly from Pd to Pt/R. Source: no mine known, but red jasper is commonly associated with metavolcanic rocks in the Eastern Desert. Ancient names: ***ḫnmt*** [*ḫenmet*] and ***mḫn(m)t*** [*mekhen(m)et*], and possibly ***ḥkn*** [*heken*] (Egyptian); probably *haematitis* (Greek); possibly *sarda* (Roman).

2. medium to dark **green**[2] (fig. 18). Used: rarely from Pd to Pt/R. Source: no mine known, but green jasper occasionally occurs in the Eastern Desert in the same metavolcanic rocks as red jasper, but is much rarer. Ancient names: ***nmḥf*** [*nemhef*] and ***šhrt*** [*seheret* or *sehret*], and possibly ***prḏn*** [*perdjen*] (Egyptian); probably *iaspis* and also possibly *prasinos* or *prasitis* (Greek); possibly *prasius* (Roman).

3. **yellow** (fig. 19). Used: rarely in Pd and NK/3IP. Source: no mine known, but almost certainly from the Eastern Desert. Ancient names: unknown but possibly the same as red jasper.

sapphire (transparent to translucent; light to dark blue corundum [Al_2O_3]). Used: rarely in Pt/R. Source: imported from Sri Lanka and possibly India. Ancient names: *hyakinthos*/*hyacinthus* (Greek/Roman).

turquoise (opaque; light to medium green to greenish blue or light blue with the blue color degrading over time to green due to dehydration [$CuAl_6(PO_4)_4(OH)_8{\cdot}5H_2O$]; figs. 4, 6). Used: commonly in MK/2IP and NK/3IP, and rarely from Pd to OK/1IP and LP to Pt/R. Sources: two mines in the Sinai at Serabit el-Khadim (no. 2; active MK to LP) and in Wadi Maghara (no. 3; active ED to NK) plus a possible third source at the Bir Nasib copper mine (no. 1; active MK to NK). Ancient names: ***mfkꜣt*** [*mefkat*] (Egyptian); probably *smaragdos* (Greek); *callaina* (Roman).

BIOGENIC MATERIALS

amber (translucent; light to dark yellowish to reddish brown fossil tree resin; fig. 20). Used: rarely from NK/3IP to Pt/R. Some of what is reported as amber is non-fossilized tree resin. Source: imported from northern Europe through the Mediterranean region. Ancient names: *elektron* and also probably *ligyrion* and *lyngurion* (Greek); *sucinum* (Roman).

coral (opaque; white and light to medium red or pink marine coral). Used: commonly in Pt/R and rarely in Pd. Sources: the Red and Mediterranean Seas. Ancient names: *korallion* or *kuralion* (Greek); *coralliticus* (Roman).

ivory (opaque; white or light yellowish white elephant or hippopotamus tusk; figs. 21-22). Used: rarely from Pd to Pt/R. Some of what is reported as ivory is probably bone. Sources: originally hippopotamuses in Egypt; later, elephants via Nubia and Punt. Ancient names: ***ꜣbw*** [*abu*] (Egyptian); *elephantinon* (Greek); *eboreus* (Roman).

pearl (translucent to opaque; mainly white or silvery gray; figs. 23, 28). Used: commonly in Pt/R. Source: probably the Red Sea but possibly also imported from the East. Ancient names: *physi* and *pinninu* (Greek); *margarites* (Roman).

Miscellaneous **shells**, including ostrich egg, mother-of-pearl (the iridescent nacre from oysters and other mollusks), whole marine and riverine mollusks, and tortoise (figs. 24-25). Used: commonly in Pd and rarely thereafter. Sources: Egypt and Red Sea. Ancient names: unknown.

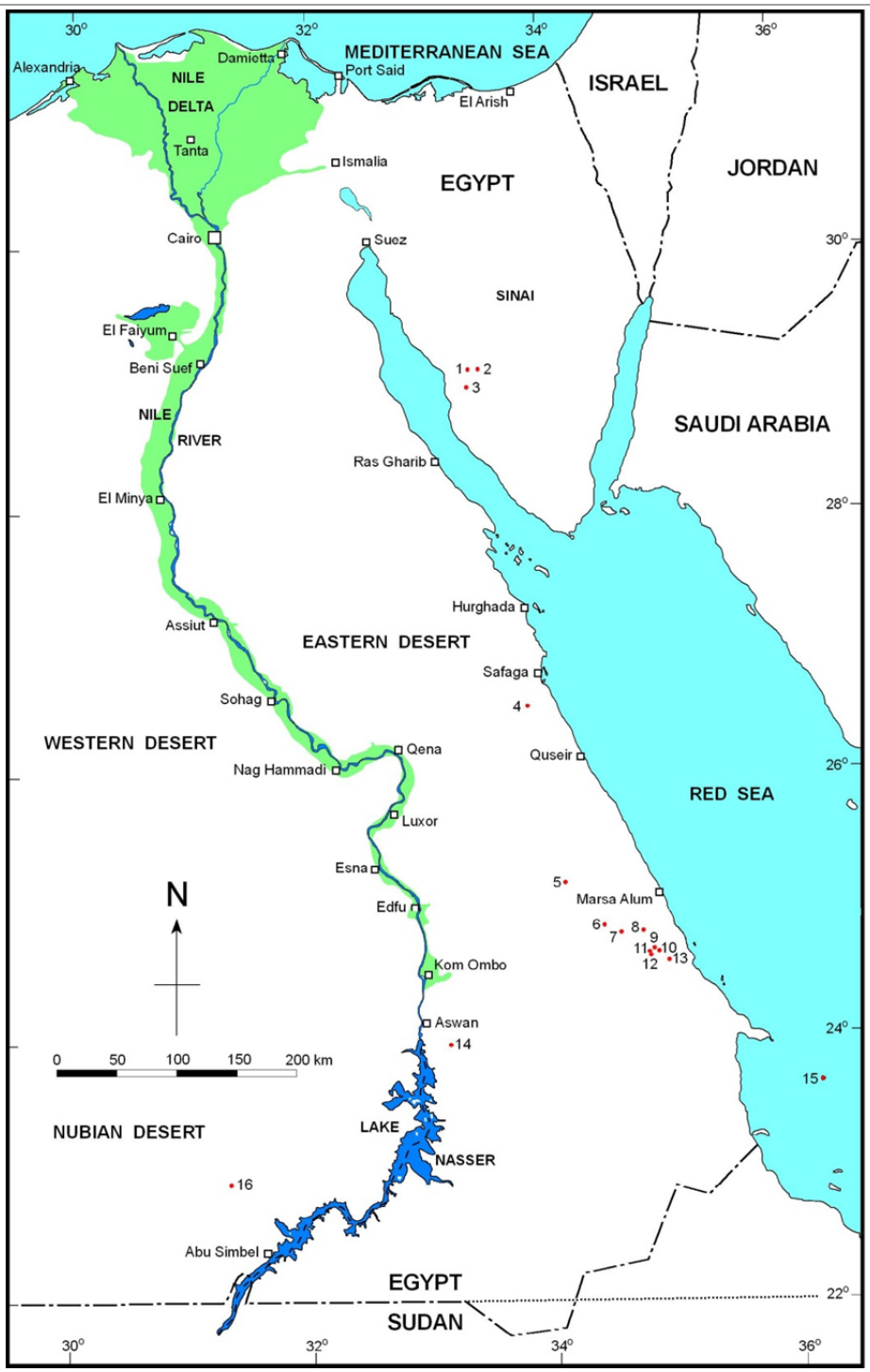

Figure 1. Map of ancient Egyptian gemstone mines (numbered).

Figure 2. Necklaces, possibly from Egypt, similar to those depicted in Figure 28 mummy portrait. Inner: gold and amethyst cabochons. Early third century CE, Roman Period. Outer: gold and emerald beads (hexagonal crystal segments). Second century CE, Roman Period.

Figure 3. Necklace with convex bicone beads of amethyst and a central amazonite *Ba* bird amulet. Egypt, Middle Kingdom.

down and recast, but the gemstones were merely reused, although perhaps in a recut form. Consequently, a significant portion of the gemstones used in any given period was probably recycled from earlier times.

Figure 4. Necklace with drop beads of amazonite (light bluish green), carnelian (orangey-red), lapis lazuli (dark blue), and gold, and smaller spherical beads of amazonite, amethyst (purple), turquoise (light blue), and gold, plus pectoral with cartouche of Senusret II and cloisonné inlays of carnelian, lapis lazuli, and turquoise set in gold. Tomb of princess Sithathoryunet, el-Lahun, Dynasty 12.

With the exceptions of precious emerald and sapphire, the materials in Table 1 are, at best, what today would be called "semi-precious" stones. The ancient Egyptians chose gemstones not only for their visual effect in a particular application, but also for the symbolic or magical significance of their color. Red (in carnelian, garnet, and some jasper) connoted life-sustaining blood, power and vitality, and the sun; green (in amazonite, some chalcedony, some jasper, malachite, and some turquoise) signified rebirth in the afterlife, fertility, joy, and lush vegetation; dark blue (in lapis lazuli) represented the all-embracing and protective night sky; and light blue (in some turquoise) symbolized the primordial waters and daytime sky. Funerary amulets prescribed in the *Book of the Dead* sometimes called for specific stones with characteristic colors, e.g., ***shrt*** (probably green jasper) for "heart-shaped" amulets in Chapter 29B; ***nmḥf*** (green jasper) for "heart scarab" amulets in Chapter 30B (see fig. 18); ***ḫnmt*** (red jasper) for "girdle-tie-of-Isis" amulets in Chapter 156 (see fig. 17); and ***nšmt*** (green amazonite) for "papyrus scepter" amulets in

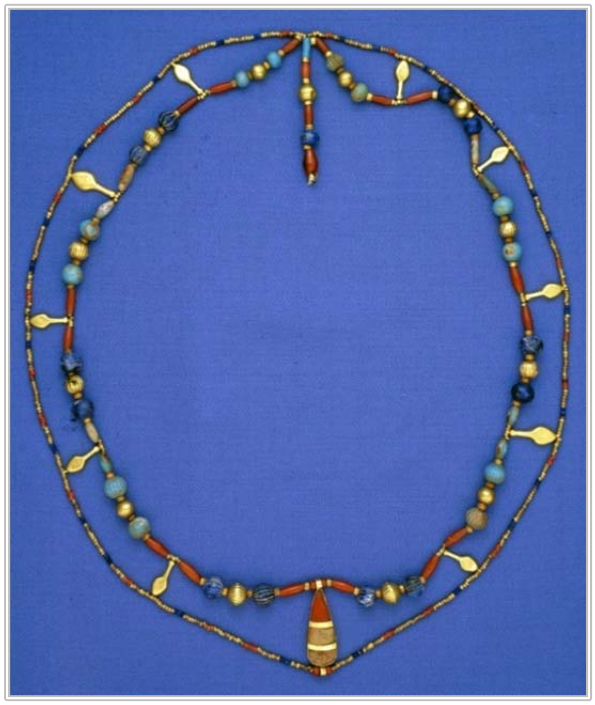

Figure 5. Originally loose jewelry elements restrung as a necklace, with amazonite (large bluish-green convex bicone and oblate spheroid beads—both smooth and ribbed), carnelian (large orangey red convex bicone and tiny cylindrical beads), lapis lazuli (large dark blue oblate spheroid beads—both smooth and ribbed), dark blue glass (large oblate spheroid and tiny cylindrical beads replacing lapis lazuli in the design), and gold. Thebes, Tomb of the Three Princesses, Dynasty 18.

Figure 6. Amulet in form of *Ba* bird with cloisonné inlays of lapis lazuli (dark blue), turquoise (light blue), and, on shoulder and tail, brownish-gray steatite in gold setting. Possibly from Saqqara, Late or Ptolemaic Period.

Chapters 159 - 160 (Harris 1961: 112 - 116, 123 - 124, 130). Additional common associations between amulet and stone type are sub-metallic hematite for the "headrest" amulet (see fig. 8), and obsidian for the "two fingers" amulet (Andrews 1994: 104). Similarly colored materials were sometimes substituted for these gemstones.

Glass with red, green, and blue colors was widely used to imitate gemstones beginning in the 18th Dynasty. Also at this time, imitation carnelian was made by setting colorless rock crystal over a red paste. Colored faience (glazed composition; see Nicholson 2009) was another inexpensive substitute for gemstones used from the late Predynastic Period onward. These practices became so prevalent that ancient texts mentioning some of the more valuable gemstones (e.g., amazonite, lapis lazuli, and turquoise) sometimes appended the word *mꜣꜥ* (*maa*), meaning "true," to indicate their authenticity. The color of a material was, nevertheless, often more important than its preciousness, as is evidenced by the combination of cheap glass and costly gemstones in much of the royal and elite private jewelry from the Middle Kingdom onward.

The most commonly used gemstone in Dynastic Egypt was carnelian, with amazonite, amethyst, red jasper, lapis lazuli, and turquoise next in abundance. The other gemstones in Table 1 were rarely used in comparison. Amethyst and carnelian continued to be among the principal gemstones of Ptolemaic and Roman Egypt, but changing tastes, new domestic discoveries, and imports from distant lands brought another group of gemstones into popularity, including aquamarine, common agate, coral, emerald, red garnet, pearl, peridot, onyx, sapphire, and sardonyx. Engraved colored transparent gemstones (aquamarine, red garnet, and sapphire, among others) and cameos in onyx and sardonyx were especially fashionable during the Ptolemaic and Roman Periods, and Alexandria was one of the main centers where such objects were produced for both local consumption and export to the larger Mediterranean market. The Alexandrian gem trade left its influence on the Greek Septuagint Bible, the earliest surviving version of the Old Testament. This was translated from the original Hebrew in Alexandria during the Ptolemaic Period and the Septuagint's many references to gemstones reflect

Figure 7. String of spherical beads of red garnet and, at each end, beads of carnelian (orangey red). Egypt, possibly Middle Kingdom.

Figure 8. Submetallic hematite headrest amulet. Egypt, Late Period.

Figure 9. Metallic hematite Taweret figure. Egypt, Dynasty 26.

to some degree what was then popular in this Mediterranean emporium (Harrell 2011).

The most frequently mentioned gemstones in Dynastic texts, often together and in connection with other precious materials, are amazonite, carnelian, lapis lazuli, and turquoise. The colors of these gemstones are certainly partly responsible for the high esteem in which they were held, but they were difficult to obtain and so this also contributed to their value. Turquoise came from the Sinai Peninsula's Serabit el-Khadim and Wadi Maghara mines (nos. 2 and 3, respectively, in fig. 1; Petrie 1906: 34 - 169; Giveon 1978: 55 - 135; Chartier-Raymond et al. 1994) and lapis lazuli was brought from the Badakhshan region of northeast Afghanistan (Herrmann 1968; Wyart et al. 1981) and possibly also adjacent areas in Pakistan. Certainly in the 18th Dynasty as well as in the Ptolemaic and Roman Periods, amazonite came from Egyptian mines on the Eastern Desert's Gebel Migif and Gebel Hafafit (nos. 6 and 7, respectively, in fig. 1), and workings from other periods may yet be discovered in this region where more amazonite deposits are known (Harrell and Osman 2007). Nevertheless, amazonite is a relatively scarce gemstone in Egypt and so it has been suggested (e.g., Lucas 1962: 394; Andrews 1994: 103) that some of it was imported at great expense from the ancient mine at Zuma in southeast Libya's Eghei Mountains (Jérémine et al. 1951; de Michele and Piacenza 1999), although there is no archaeological evidence to support this.

In addition to amazonite and turquoise, ancient Egyptian mines are known for carnelian and the common and green chalcedonies at Stela Ridge (no. 16 in fig. 1; Engelbach 1933: 68 - 69 and 1938: 372, 387; Bloxam 2006), amethyst at Abu Diyeiba and Wadi el-Hudi (nos. 4 and 14, respectively, in fig. 1; Fakhry 1952; Shaw and Jameson 1993; Klemm et al. 2002; Harrell and Sidebotham 2004; Harrell et al. 2006; Sidebotham et al. 2008: 277 - 285), emerald at the six *Mons Smaragdus* mines (nos. 8 - 13 in fig. 1; Jennings et al. 1993; Shaw et al. 1999; Harrell 2004; Sidebotham et al. 2004 and 2008: 285 - 302), fluorite at Gebel el-Ineigi (no. 5 in fig. 1; El Ramly et al. 1970: 18), and peridot on the Red Sea island of Zabargad (no. 15 in fig. 1; Gübelin 1981; Harrell

Figure 10. Malachite scarab amulet. Egypt, possibly New Kingdom.

Figure 11. Obsidian sphinx figure, possibly of Amenemhat III. Egypt, Dynasty 12.

and Bloxam 2010). Most of the other rock and mineral gemstones in Table 1 (common agate, common calcite and Iceland spar, red garnet, hematite, jasper, malachite, common microcline, muscovite mica, milky quartz, rock crystal, and silicified wood) are known to occur in the Eastern Desert or Sinai and these regions are probably where they were obtained. Egypt's Western Desert is another possible source for silicified wood and it certainly supplied the famous Libyan desert glass (de Michele 1997, 1998). For the latter, the only known example of its use is for the scarab at the center of a famous pectoral belonging to king Tutankhamen (Cairo Museum JE 61884). A few of the Dynastic rock and mineral gemstones in Table 1 (nephrite, onyx, and sardonyx) are not known to occur in Egypt, but it is conceivable that they are

Figure 12. Peridot ring stone carved with male head, possibly Ptolemy XII. Egypt, mid-first century BCE, Ptolemaic Period.

Figure 13. Rock crystal (colorless quartz) cosmetic jar with hieroglyphic inscription: "offering given by the king" and "towards the gods." Egypt, possibly Middle Kingdom.

Figure 14. String of convex bicone and drop beads and central "leg" amulet of carnelian with inhomogeneous coloring. Egypt, Dynasty 6.

Figure 15. String of convex bicone and barrel beads of common agate (black/dark gray and white wavy banding), onyx (black/dark gray and white planar banding), sardonyx (reddish brown and white planar banding), and carnelian (solid orangey-red). Tell Dafana, Egypt, Roman Period.

Figure 16. Chalcedony buttons of both the common (white) and carnelian (orangey-red) varieties. Egypt, possibly Late Period.

present and their deposits have merely been overlooked. Coral, pearl, mother-of-pearl and other mollusc shells, and tortoise shell undoubtedly came from the Mediterranean or Red Sea, and ostrich shell (Phillips 2000) and hippopotamus ivory (Krzyszkowska and Morkot 2000) would have come from Egypt's Eastern Desert and Nile Valley, respectively. In addition to lapis lazuli, gemstones imported from distant sources included amber probably from the Baltic region of northern Europe, obsidian (Zarins 1989; Bavay et al. 2000) and elephant ivory (Krzyszkowska and Morkot 2000) from the southern Red Sea region, and, during the late Ptolemaic and Roman Periods, a variety of gemstones (mostly aquamarine, red garnet, onyx, sapphire, and sardonyx) from India and Sri Lanka.

The source of ancient Egypt's most popular gemstone, carnelian, is something of a mystery. The only known mine is the aforementioned Stela Ridge in Egypt's Nubian Desert. This site, which also supplied the common and green chalcedonies, but not amethyst as commonly reported, dates mainly to the Middle Kingdom but also bears faint traces of Old Kingdom and Roman activity. Where the Egyptians obtained the prodigious amounts of carnelian used both before and after the Middle Kingdom is unknown. It is often repeated in the

Figure 17. Red jasper girdle-tie-of-Isis amulet. Egypt, New Kingdom.

Figure 18. Dark green jasper heart-scarab amulet set in hollow sheet-gold plinth. Hieroglyphic inscriptions from *Book of the Dead*, Chapter 30B, on sides and bottom. Qurna, Egypt, Second Intermediate Period (reign of Sobekemsaf II, Dynasty 17).

Egyptological literature that carnelian pebbles are commonly found in the wadi gravels of the Eastern Desert (e.g., Lucas 1962: 391), but this is not true. The claim is based on an early misidentification of ordinary (non-chalcedonic) quartz pebbles with reddish (iron oxide) coloring as carnelian. However,

Figure 19. Yellow jasper plaque of Amenhotep II inscribed with figure of a horse and hieroglyphs for "Amun," "great," "majesty," and "he is strong." Egypt, Dynasty 18.

Figure 20. Amber Taweret amulet. El-Amarna, Dynasty 18.

this gemstone, along with common agate and sardonyx, is found in the Nile terrace gravels in the Fourth Cataract region of northern Sudan (Harrell 2010: 72 - 74) and so may have been imported from there, but similar deposits have also been reported along the Nile in Nubia near Wadi Halfa (e.g., de Heinzelin and Paepe 1965: 45). Given that lapis lazuli was able to travel from Afghanistan to Egypt as early as the late Predynastic Period, it is conceivable that during the Dynastic Period some carnelian came from distant Asian sources such as the famous carnelian deposits in western India's Gujarat state, which are known to have been exploited since the third millennium BCE (Kenoyer et al. 1994: 284). The Fourth Cataract is also a possible source for the red garnet used by the Egyptians, as this area has abundant gem-quality

Figure 21. Hippopotamus ivory figure of a woman. El-Badari, Egypt, Predynastic Badarian Period.

Figure 22. Elephant-ivory cosmetic jar in the form of a hippopotamus. El-Mustagidda, Egypt, Predynastic Badarian Period.

Figure 23. Gold wire and pearl earring. Berenike, Egypt, Roman Period, second century CE.

crystals in the placer deposits of the seasonally dry Nile River channels (Harrell 2010: 81 - 82). Although rocks with red garnet are relatively common in the Eastern Desert and Sinai, the crystals found so far are all of either poor quality or minute size.

Mining and Carving

The extraction technologies employed at ancient Egyptian gemstone mines are essentially the same as those at the ornamental stone quarries (see Harrell 2012b), but the small crystal masses and thin veins where gemstones are typically found resulted in generally smaller workings. Both hand-held and hafted stone tools known as pounders or mauls were used to hack out pieces of gem-bearing bedrock. Although copper and, later, bronze picks and chisels were available during the Dynastic Period, they were too soft to work the hard igneous and metamorphic rocks in which most gemstones occur, and for these the stone tools were superior. Stone tools were largely replaced by "iron" ones (actually low-grade steel) toward the end of the Late Period. Mine excavations were usually surface pits

Figure 24. Shell-bead girdle or belt. El-Mustagidda, Egypt, Pan-grave culture, Second Intermediate Period.

Figure 25. Mother-of-pearl shell pendant or amulet inscribed with cartouche of Senusret I. Egypt, Dynasty 12.

and trenches, but those for emerald and turquoise also involved underground excavations like those found in the ancient gold workings.

The raw gemstones, always occurring in relatively small pieces, would have been carried from the mines on the backs of men or pack animals (probably donkeys). They were brought to workshops where they were laboriously fashioned into their many forms, with beads being the most common. During the Dynastic Period, the Egyptians had no abrasive material harder than the hardest gemstones they worked, which were the many quartz varieties with a Mohs hardness of 7. It is often claimed that the Egyptians used emery (a granular combination of corundum and iron oxide, Mohs = 8-9) as an abrasive, but there is no credible archaeological evidence for this. What the Egyptians surely did use, and which they had in great abundance, was silica (SiO_2) in its many forms, most notably: massive microcrystalline quartz (chert or flint), massive macrocrystalline quartz (silicified sandstone or quartzite), and loose macrocrystalline quartz (sand). Any material can be cut, ground, and polished by the material itself—the process simply takes longer than when a harder abrasive is used. Silica was thus a sufficiently effective abrasive for the Dynastic gemstones. During the late Ptolemaic and Roman Periods, diamond (Mohs = 10) and corundum (Mohs = 9) were almost certainly imported into Egypt from India and used as abrasives, especially for the harder gemstones like emerald (Mohs = 7.5-8) and sapphire (blue corundum). Emery from Mediterranean or Eastern sources may also have been employed as an abrasive at this time.

Raw pieces of gemstone were first roughly shaped by a combination of chipping and grinding, the latter probably done on a slab of silicified sandstone. Hand-powered drills were used to pierce beads and other objects carved from gemstones. Such drills were equipped with a bit consisting of either a chip of chert or a copper/bronze wire that was used together with fine quartz sand, which did the actual cutting under the impulse of the wire bit. Bavay et al. (2000: 12 - 13) report a notable collection of tiny chert drill bits and partially drilled

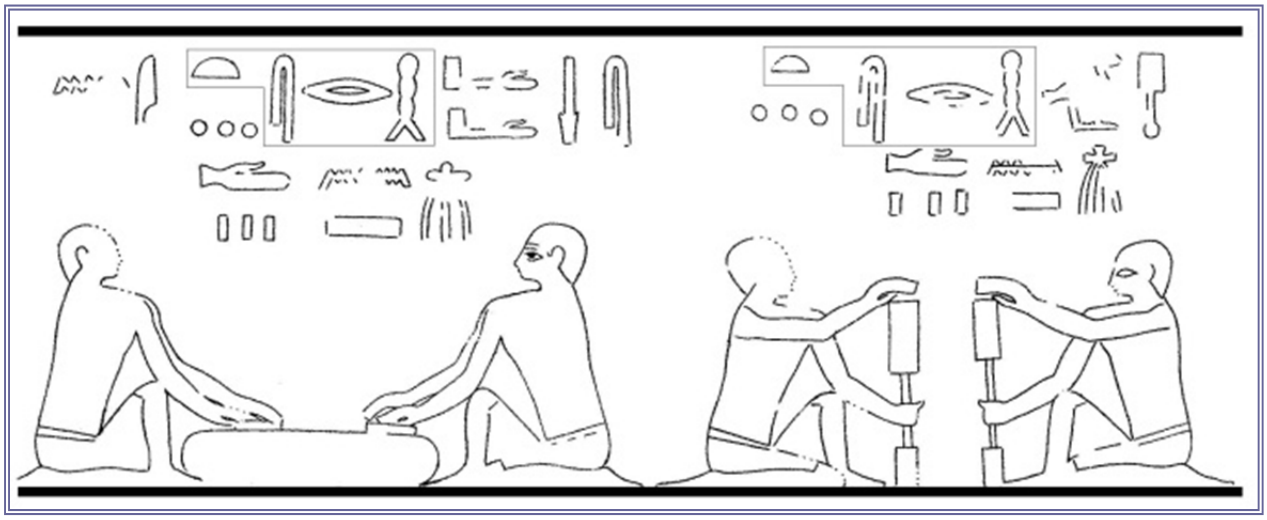

Figure 26. Carnelian bead-manufacturing scene from tomb of Aba at Deir el-Gebrawi, Egypt, Dynasty 6.

amethyst, carnelian, obsidian, and rock crystal beads and flakes that were recovered from a deposit at Hierakonpolis dating to either the Early Dynastic Period or Old Kingdom (now in the Petrie Museum of Egyptian Archaeology, London, UC 14877). Drills were originally driven by hand with a back-and-forth twisting motion. This is depicted in the right vignette of the 6th-Dynasty tomb scene in Figure 26, where the hieroglyphic text above says "lapidaries (*msnšdw*) boring (*wbꜣ*) carnelian (*ḥrst*)." The rotation was done more efficiently with bows, where the bowstrings were intertwined around one or more drill shafts, and this process is illustrated in an 18th-Dynasty tomb scene in Figure 27. The gemstone being drilled is not specified, but the orange color of the finished bead strings to the right of the workmen suggests that it was carnelian. Although the ancient Egyptian bead drills were primitive and cumbersome, they were nevertheless effective as experimentally demonstrated by Gorelick and Gwinnett (1990) and Stocks (2003: 203 - 224). Figures 26 and 27 also illustrate the final step in the preparation of beads: polishing. In Figure 26, the text above the left vignette says "lapidaries polishing (*snʿ*) carnelian" but it is not clear how this was accomplished from the drawing. The two workmen appear to be rubbing pieces of carnelian across the surface of a rock slab, and if this was a hard rock like silicified sandstone, then it seems only a rough smoothing effect could be achieved by this means. If, however, fine quartz sand had been added to the slab's surface then this could conceivably result in polishing. In Figure 27, the worker at the center of the scene is bent over a table and rubbing the beads over one another by hand, and in this way polishing them. On the ground, below him and the workers with bow drills, are vessels, apparently with spoons, which must be for the quartz sand abrasive. Thus sand was added not only to the drill holes, but also to the mass of beads being polished. These same manufacturing techniques would have been applied to other gemstone objects. Carving and engraving, in the case of seals and other glyptic works, was probably done with a chert graver or perhaps the same kind of drill used to perforate beads. Polishing may also have been done the same way as it was for beads, but for the larger objects it was probably accomplished through rubbing with a fine quartz sand paste applied, perhaps, with a piece of cloth or leather.

Archaeologists and art historians have not only the gemstone objects themselves to study, but also many depictions of gemstone jewelry on tomb and temple walls, mummy coffins, and statues. An especially vivid example of this is the Roman-era mummy portrait in Figure 28. The woman in this portrait wears emerald and amethyst necklaces of similar date and appearance to those shown in Figure 2.

Figure 27. Carnelian bead-manufacturing scene from tomb of Sobekhotep at Thebes, Dynasty 18.

Figure 28. Mummy portrait of woman wearing earrings and inner necklace of emerald and gold, and outer necklace of amethyst and gold with two pearls dangling from the large emerald cabochon in center. (Note that the two necklaces resemble those in Figure 2.) Hawara, Egypt, Roman Period, early second century CE.

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The most comprehensive treatments of ancient Egyptian gemstones are Andrews (1990: 37 - 65) and Aston et al. (2000), with the latter replacing the still useful Lucas (1962). Andrews (1990 and 1994) are the best references on ancient Egyptian jewelry and amulets, both with many excellent color photographs. Vilímková (1969), Aldred (1971), and Wilkinson (1971) are earlier but still valuable accounts of Egyptian

jewelry. DePutter and Karlshausen (1992) provide examples of Egyptian objects made from many of the gemstones (as well as ornamental stones) and supply good color photographs of them. Harris (1961: 95 - 140) discusses ancient Egyptian names for gemstones, and Shaw (2002) and Wendrich et al. (2003: 53 - 62) consider mining and trading expeditions for Egyptian gemstones. Related UEE articles are Bloxam (2010) on general quarrying and mining, and Harrell (2012a, 2012b, 2012c) on building stones, ornamental stones, and utilitarian stones, respectively.

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Image Credits

Figure 1. Map of ancient Egyptian gemstone mines (numbered). Drawing by author.

Figure 2. Necklaces, possibly from Egypt, similar to those depicted in Figure 28 mummy portrait. Inner: gold and amethyst cabochons. Early third century CE, Roman Period. London, British Musuem EA 2749. Length 40 cm. Outer: gold and emerald beads (hexagonal crystal segments). Second century CE, Roman Period. London, British Museum EA 2731. Length 41.6 cm. Photograph courtesy of the British Museum.

Figure 3. Necklace with convex bicone beads of amethyst and a central amazonite *Ba* bird amulet. Egypt, Middle Kingdom. London, British Museum EA 35116. Length of necklace 45.9 cm; height of amulet 2.16 cm. Photograph courtesy of The British Museum.

Figure 4. Necklace with drop beads of amazonite (light bluish green), carnelian (orangey-red), lapis lazuli (dark blue), and gold, and smaller spherical beads of amazonite, amethyst (purple), turquoise (light blue), and gold, plus pectoral with cartouche of Senusret II and cloisonné inlays of carnelian, lapis lazuli, and turquoise set in gold. Tomb of princess Sithathoryunet, el-Lahun, Dynasty 12. New York, Metropolitan Museum of Art 16.1.3. Length of necklace 82 cm; width of pectoral 8.3 cm. Photograph courtesy of The Metropolitan Museum of Art.

Figure 5. Originally loose jewelry elements restrung as a necklace, with amazonite (large bluish-green convex bicone and oblate spheroid beads—both smooth and ribbed), carnelian (large orangey red convex bicone and tiny cylindrical beads), lapis lazuli (large dark blue oblate spheroid beads—both smooth and ribbed), dark blue glass (large oblate spheroid and tiny cylindrical beads replacing lapis lazuli in the design), and gold. Thebes, Tomb of the Three Princesses, Dynasty 18. London, British Museum EA 66827. Length of outer string 65.5 cm. Photograph courtesy of The British Museum.

Figure 6. Amulet in form of *Ba* bird with cloisonné inlays of lapis lazuli (dark blue), turquoise (light blue), and, on shoulder and tail, brownish-gray steatite in gold setting. Possibly from Saqqara, Late or Ptolemaic Period. Brooklyn, Brooklyn Museum of Art 37.804E. Height 3.1 cm; width 6.8 cm. Photograph courtesy of The Brooklyn Museum of Art.

Figure 7. String of spherical beads of red garnet and, at each end, beads of carnelian (orangey red). Egypt, possibly Middle Kingdom. London, Petrie Museum of Egyptian Archaeology UC 51423. Length approximately 58 cm. Photograph copyright: Petrie Museum of Egyptian Archaeology, University College, London.

Figure 8. Submetallic hematite headrest amulet. Egypt, Late Period. London, British Museum EA 8308. Height 2.5 cm; width 4.5 cm; depth 1.5 cm. Photograph courtesy of The British Museum.

Figure 9. Metallic hematite Taweret figure. Egypt, Dynasty 26. London, British Museum EA 64594. Height 6 cm; width 1.8 cm. Photograph courtesy of The British Museum.

Figure 10. Malachite scarab amulet. Egypt, possibly New Kingdom. London, Petrie Museum of Egyptian Archaeology UC 52072. Height 2.0 cm; width 1.4 cm. Photograph copyright: Petrie Museum of Egyptian Archaeology, University College, London.

Figure 11. Obsidian sphinx figure, possibly of Amenemhat III. Egypt, Dynasty 12. London, British Museum EA 65506. Width 2.8 cm; length 5.2 cm. Photograph courtesy of The British Museum.

Figure 12. Peridot ring stone carved with male head, possibly Ptolemy XII. Egypt, mid-first century BCE, Ptolemaic Period. Michael J. Shubin Collection ms-010. Height 8.5 mm; width 7.4 mm; thickness 3.1 mm. Photograph courtesy of Lisbet Thoresen.

Figure 13. Rock crystal (colorless quartz) cosmetic jar with hieroglyphic inscription: "offering given by the king" and "towards the gods." Egypt, possibly Middle Kingdom. London, Petrie Museum of Egyptian Archaeology UC 69831. Height approximately 1.5 cm; width approximately 1.0 cm. Photograph copyright: Petrie Museum of Egyptian Archaeology, University College, London.

Figure 14. String of convex bicone and drop beads and central "leg" amulet of carnelian with inhomogeneous coloring. Egypt, Dynasty 6. London, Petrie Museum of Egyptian Archaeology UC 51356. Length approximately 51 cm. Photograph copyright: Petrie Museum of Egyptian Archaeology, University College, London.

Figure 15. String of convex bicone and barrel beads of common agate (black/dark gray and white wavy banding), onyx (black/dark gray and white planar banding), sardonyx (reddish brown and white planar banding), and carnelian (solid orangey-red). Tell Dafana, Egypt, Roman Period. London, British Museum EA 23471. Length 35 cm. Photograph courtesy of The British Museum.

Figure 16. Chalcedony buttons of both the common (white) and carnelian (orangey-red) varieties. Egypt, possibly Late Period. London, Petrie Museum of Egyptian Archaeology UC 58016. Diameter 1.1 - 1.2 cm; thickness approximately 0.7 cm. Photograph copyright: Petrie Museum of Egyptian Archaeology, University College, London.

Figure 17. Red jasper girdle-tie-of-Isis amulet. Egypt, New Kingdom. London, British Museum EA 20641. Height 6.0 cm. Photograph courtesy of The British Museum.

Figure 18. Dark green jasper heart-scarab amulet set in hollow sheet-gold plinth. Hieroglyphic inscriptions from *Book of the Dead*, Chapter 30B, on sides and bottom. Qurna, Egypt, Second Intermediate Period (reign of Sobekemsaf II, Dynasty 17). London, British Museum EA 7876. Length 3.8 cm; width 2.5 cm. Photograph courtesy of The British Museum.

Figure 19. Yellow jasper plaque of Amenhotep II inscribed with figure of a horse and hieroglyphs for "Amun," "great," "majesty," and "he is strong." Egypt, Dynasty 18. London, British Museum EA 4077. Height 0.6 cm; length 1.8 cm; width 1.3 cm. Photograph courtesy of The British Museum.

Figure 20. Amber Taweret amulet. El-Amarna, Dynasty 18. London, Petrie Museum of Egyptian Archaeology UC 68089. Length 2.4 cm; width 1.7 cm; thickness 1.1 cm. Photograph copyright: Petrie Museum of Egyptian Archaeology, University College, London.

Figure 21. Hippopotamus ivory figure of a woman. El-Badari, Egypt, Predynastic Badarian Period. London, British Museum EA 59648. Height 14 cm; width 3.8 cm; thickness 2.2 cm. Photograph courtesy of The British Museum.

Figure 22. Elephant-ivory cosmetic jar in the form of a hippopotamus. El-Mustagidda, Egypt, Predynastic Badarian Period. London, British Museum EA 63057. Height 5.9 cm; length 7.3 cm. Photograph courtesy of The British Museum.

Figure 23. Gold wire and pearl earring. Berenike, Egypt, Roman Period, second century CE. Excavation registry number BE97-17.036, 2436 b-D-4848. Height 2.7 cm. Photograph courtesy of Berenike Project/Bastiaan Seldenthuis.

Figure 24. Shell-bead girdle or belt. El-Mustagidda, Egypt, Pan-grave culture, Second Intermediate Period. London, British Museum EA 63257. Length 55.3 cm; width 3.2 cm. Photograph courtesy of The British Museum.

Figure 25. Mother-of-pearl shell pendant or amulet inscribed with cartouche of Senusret I. Egypt, Dynasty 12. London, British Museum EA 65268. Diameter 11.4 cm. Photograph courtesy of The British Museum.

Figure 26. Carnelian bead-manufacturing scene from tomb of Aba at Deir el-Gebrawi, Egypt, Dynasty 6. Drawing adapted by author from Davies 1902: pls. 13 and 14 (the original color painting is still in situ). Outlines of the word for carnelian (*herset*) have been added.

Figure 27. Carnelian bead-manufacturing scene from tomb of Sobekhotep at Thebes, Dynasty 18. London, British Museum EA 920. Height 66 cm; width 79 cm. Photograph courtesy of The British Museum.

Figure 28. Mummy portrait of woman wearing earrings and inner necklace of emerald and gold, and outer necklace of amethyst and gold with two pearls dangling from the large emerald cabochon in center. (Note that the two necklaces resemble those in Figure 2.) Hawara, Egypt, Roman Period, early second century CE. London, British Museum EA 74706. Height 38.2 cm; width 20.5 cm. Photograph courtesy of The British Museum.