A PRELIMINARY OVERVIEW OF ANCIENT EGYPTIAN STONE BEADS

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Abstract

Stone beads are one of the most common artifacts of ancient Egypt, but despite this they have received little attention from scholars. The first and only attempt at a comprehensive study is the late 1930's investigation of Nai Xia, who looked at beads in all materials at what is now the Petrie Museum of Egyptian Archaeology, University College London, UK. The present survey builds on the work of Xia, and offers summaries on two aspects of stone beads: first, the relative amounts of rock and mineral varieties used during each period of Egyptian history; and second, the changes in bead form, perforation and polish through time for broad categories of stone.

Introduction

Beads are probably the largest group of ancient Egyptian artifacts with hundreds of thousands of them in museum and private collections, and in antiquity storehouses. They were used for jewelry and other ornamental applications, including necklaces and broad collars, bracelets, anklets, earrings, belts, girdles, designs on fabrics and leather, and other strung and sewn constructions. The term 'bead' as used in the present work refers to a solid material cut or formed into a simple, decorative shape that is perforated for stringing. Some beads by virtue of their larger size, pendulous shape or off-center perforation may be thought of as 'pendants' but such objects are merely a type of bead. The more elaborately carved amulets and cylinder and stamp (button) seals were commonly perforated and strung on string, but these fall outside the realm of beads.

Any survey of ancient Egyptian beads must begin with the monumental treatise of Nai Xia, a late 1930's study that has only recently been published (Xia, 2014). Xia did a systematic examination of beads of all types in the Petrie Collection in London (now the Petrie Museum of Egyptian Archaeology, University College London) and he supplemented this with less rigorous examinations of beads in Cairo's Egyptian Museum and Oxford's Ashmolean Museum along with published descriptions of beads from the Egyptological literature. Only the beads from the Roman and later periods in the Petrie Collection were left incompletely studied, which was due to the onset of World War II. After the war, many more beads were added to the collection in the Petrie Museum and although described by various but unknown museum staff members, they were not investigated as thoroughly as the beads in Xia's study. All the beads in this collection—actually just the objects containing them—are now accessible through the museum's online catalogue, often with photographs (http://petriecat.museums.ucl.ac.uk/). Hand-written notecards with Xia's original descriptions are also viewable online through the museum's website at http://www.ucl.ac.uk/library/digital-collections/collections/xianai.

The present survey is concerned only with beads made from rocks and minerals. In addition to Xia (2014), it draws on other published sources: primarily Aldred (1971), Andrews (1990: 37-52), Andrews & Wilkinson (1981), and Lucas (1962: 386-421); and secondarily Ogden (1982), Scott (1964), Vilímková (1969), and Wilkinson (1971). Further information comes from the the British Museum's online collections catalogue (http://www.britishmuseum.org/research/collection_online/search.aspx) and the present author's own examination of beads in the Petrie Museum plus more casual observations made on beads displayed in other museums, especially Cairo's Egyptian Museum.

Rocks and Minerals Used for Beads

The greatest challenge for anyone studying stone beads is to correctly recognize the rocks and minerals used. Museum catalogues and the archaeological literature are rife with incorrect identifications. This is understandable given that the people doing the descriptions are usually neither geologists nor gemologists. Even among these specialists, especially the geologists, few are skilled at the megascopic identification of rocks and minerals. The task is made more difficult by the necessity of avoiding destructive testing methods. The examiner is therefore forced to rely on a limited toolkit. This should include, at the very least, a bright white light source, magnifying glasses ranging in power from about 3X to 10X, a strong rare-earth magnet, a 'pocket' spectroscope, and a polariscope. The latter two instruments, both popular with gemologists and inexpensive, are especially useful for transparent and semi-transparent minerals. If the situation allows it, two only slightly damaging tests can also be applied: Mohs scratch hardness, and reaction to dilute acid. Both were employed by Nia Xia. A final complication in identifying some rock and mineral varieties is that they have no universally accepted definitions. Thus two examiners may correctly identify the same stone according to the different schemes they follow and so end up giving it different names.

For the basic information on rocks and minerals needed for their identification, standard reference works on mineralogy, petrology and gemology should suffice. Those favored by the present author include: Klein & Dutrow (2007) for minerals; Blatt (1992), Boggs (2009), and Tucker (2001) for sedimentary rocks; Best (2013), Frost & Frost (2013), Philpotts & Ague (2009), and Winter (2010) for igneous and metamorphic rocks; and Anderson & Payne (1998), O'Donoghue (2006), and Read (2005) for gems and gemological techniques. Good general treatments of both minerals and the three rock groups are provided by Klein & Philpotts (2016), and Sen (2001).

The approach taken in this survey is to first consider all the rock and mineral varieties used by the ancient Egyptians. These are reported in Harrell (2012a, 2012b, 2012c and 2012d), where the nomenclature employed is based on the most widely accepted mineralogical, petrological and gemological definitions and classifications. Although these stones were used for a wide variety of applications, most were also the material of beads. Because the literature on Egyptian beads is sometimes incorrect or indefinite on the stone identities, this information must be interpreted in light of what rocks and minerals were actually used in Egypt. The result is presented in Table 1. For each type of stone, the table provides its basic characteristics, the extent of its use in each period of Egyptian history, and its known or potential sources. Where the nomenclature of Xia and others differs from that employed in the table this is commented upon in the footnotes. It will, of course, occasionally happen that beads of other, rare stone types are encountered and so Table 1 does not identify every possibility, but it does include the vast majority of them.

Bead Form, Perforation and Polish

Table 2 summarizes the changes through time in bead form for broad categories of stone, and in bead perforation and polish for the harder stones. It is based mainly on Xia (2014) but also, for pre-New Kingdom beads, on the British Museum catalogue of Andrews & Wilkinson (1981). The typological nomenclature is kept simple and conforms to what, in practice, is most commonly used. Alternative terms are given in the footnotes. The more elaborate form classifications of Beck (1928) and Van der Sleen (1967) may eventually be applied to useful effect but at this early stage of investigation their time-consuming implementation would do more to impede progress than promote it. The main information missing from this table is bead size as no measurements were reported by Andrews & Wilkinson (1981) and Xia (2014). For a discussion of how beads were shaped, polished and perforated, see Andrews (1990: 67-81), Harrell (2012c), Stocks (2003: 203-224), and Xia (2014: 27-36).

Concluding Remarks

The overview of stone beads presented in this paper is preliminary given that only a small fraction of extant beads have been considered and also because the information on bead material and form is not fully integrated. Nevertheless, it is a good start, provided the beads included are collectively representative of what was used during the various periods of ancient Egyptian history. They mainly reflect what is found in common burials. The beads from elite private and royal tombs would be expected to include a higher percentage of the more valuable or prestigious stones, but it is not known to what extent this is actually the case since these tombs were so thoroughly plundered in antiquity.

The next step is to look at a larger sampling of beads and thereby refine the information in Tables 1 and 2. Ideally, however, the study of stone beads should go beyond this with descriptions of bead form, size, perforation and polish for each stone variety during every historical period. This will require a prodigious effort over many years and is probably beyond the capability of any one person to do. Not all the extant beads, of course, need to be examined but a good statistical sampling of them is necessary. It is not clear at this point what constitutes such a subset, but it may be that the bead collections in only a few museums are sufficient (perhaps the large, accessible collections in the Ashmolean, British and Petrie Museums). The most practical approach in future studies is to focus on either particular time periods or stone varieties with the bead descriptions adhering to a common nomenclature. The identification of rock and mineral varieties will still be a challenge for some investigators, but with the list of possible stones in Table 1 the difficulties are now greatly reduced. The combination of these studies will eventually produce the comprehensive account of ancient Egyptian stone beads that is now lacking. This same approach is also needed, of course, for beads in other materials (i.e., amber, bone and ivory, coral, faience, glass, metal, and mollusc and ostrich shell). With such a compendium in hand, it should be possible to date an archaeological site by its bead corpus alone. This, and the standardization of bead descriptions, are the ultimate goals of studies like those of Nai Xia and later investigators.

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Table 1. Ancient Egyptian stone beads: Changes in rocks and minerals used over time.

Known Rocks and Minerals	Extent of Use by Period[1,2]										Known and Potential Source(s)[1]
	Pd	ED	OK	1IP	MK	2IP	NK	3IP	LP	Pt-R	
beryl, **green** or **emerald**: translucent, mainly light to medium green, rarely dark green and transparent [$Be_3Al_2(Si_6O_{18})$].[3]										■	Eastern Desert – in biotite schist. Six mines known in the *Mons Smaragdus* district at Gebel Zabara (R), in Wadi Sikait (late Pt-R), at Gebel Umm Harba (R), in Wadi Abu Rasheid (R), in Wadi Nugrus (R), and at Umm Kabu (R).
calcite with three main varieties [$CaCO_3$]											
sparry calcite: transparent to translucent, colorless to white, and coarsely crystalline. Called **Iceland Spar** when transparent and colorless. Indistinguishable from the colorless calcite layers in travertine.[4]	▪	▪	▪	▪	▪	▪	▪	▪		▪	Nile Valley – in limestone. Many quarries known ranging in age from OK to R.
travertine or **Egyptian/oriental alabaster**: alternating bands of translucent to opaque, white, finely crystalline calcite, and transparent to translucent, pale brown (or pale gray if sun-bleached) coarsely crystalline calcite.[5]	▪	▪	▪	▪	▪			▪			Nile Valley – in limestone. Many quarries known ranging in age from OK to R.
limestone: translucent to mainly opaque, various colors – white, pink, buff, brown, red, green and black, and fine-grained, massive.[6] Includes red-and-white 'breccia.' When white, may be indistinguishable from the white calcite layers in travertine unless fossiliferous.	■	▪	▪	▪	▪	▪	▪	▪			Nile Valley; also Eastern Desert for most recrystallized limestones. Many ancient quarries known. Red-and-white limestone breccia probably from el-Issawia Sharq near Akhmim.
fluorite (or fluorspar): transparent to mainly translucent; commonly white or light green, but other or multiple colors are possible [CaF_2]).[7]	▪										Eastern Desert – in pegmatite veins. One mine known at Gebel el-Ineigi (Pd).

Known Rocks and Minerals	Extent of Use by Period[1,2]										Known and Potential Source(s)[1]
	Pd	ED	OK	1IP	MK	2IP	NK	3IP	LP	Pt-R	
garnet, red: transparent to translucent, medium to mainly dark red, brownish red, or especially purplish red in compositionally gradational spessartine (Mn-rich), pyrope (Mg-rich) and almandine (Fe-rich) sub-varieties [$(Mg,Mn, Fe)_3Al_2Si_3O_{12}$].	▪	■	▪	▪	■	■	◼	▪	▪	■	Eastern Desert and Sinai – in some metamorphic rocks and also in placer deposits near these rocks; northern Sudan – in placer deposits along the Nile's Fourth Cataract and in the Bayuda Desert. No ancient mine known. Definitely imported from India during Pt-R.
gypsum: transparent and colorless if **selenite**, or translucent and white if fine-grained and either fibrous (**satin spar**) or massive (**alabaster** or **alabastrine**) [$CaSO_4 \bullet 2H_2O$].[8]	▪	▪		▪			▪				Nile Valley and Faiyum Depression – gypsum veins in sedimentary rocks. Two quarries known in Faiyum at Umm el-Sawan (ED-OK) and Deir Abu Lifa (ED or OK?). Red Sea coast – bedded deposits in sedimentary rocks with two quarries known at Wadi el-Anb'ut (R) and on Ras Banas (Pt-R).
hematite (or haematite): opaque, sub-metallic reddish-brown to mainly brownish black or black [Fe_2O_3].	▪	▪	▪		◼	▪	▪	▪	▪	▪	Eastern Desert – in pegmatite and other mineralized veins. No ancient mine known.
lapis lazuli: opaque rock composed of dark blue lazurite [$(Na,Ca)_8(AlSiO_4)_6(SO_4,S,Cl)_2$] or haüynite [$(Na,Ca)_{4-8}(AlSiO_4)_6(SO_4)_{1-2}$], both minerals of the sodalite group, and usually with golden pyrite specks [FeS_2] and white calcite veins or patches [$CaCO_3$] as the main components.	▪	▪	▪ [26]	▪ [26]	◼	▪	▪	■	▪	▪	Badakhshan region of northeastern Afghanistan where ancient mines occur.
malachite: opaque, patchy to mainly banded light and dark green [$Cu_2CO_3(OH)_2$].[9]	▪				▪		▪			▪	Eastern Desert and especially Sinai – in mineralized veins. It is the principal ore mineral for copper and many mines are known in both regions.
microcline feldspar – translucent to opaque with two color varieties [$KAlSi_3O_8$]											

Known Rocks and Minerals	Extent of Use by Period[1,2]										Known and Potential Source(s)[1]
	Pd	ED	OK	1IP	MK	2IP	NK	3IP	LP	Pt-R	
amazonite (or amazon stone) or **green feldspar:** light or medium green to mainly bluish green and occasionally greenish blue).[3]	▪	▪	▪	▪	■	■	▪	■	▪	■	Eastern Desert – in pegmatite veins and wadi gravels derived from them. Two mines known at Gebel Migif (NK:18) and in Wadi Fayrouz at Gebel Hafafit (Pt-R).
common microcline: orangy to pinkish.					▪						Eastern Desert and Aswan – in pegmatite veins and coarse-grained granitic and granodioritic rocks, and wadi gravels derived from them. No ancient mine known.
muscovite mica: transparent to translucent; light to medium brownish yellow [$KAl_2(AlSi_3O_{10})(OH)_2$]).	▪										Eastern Desert – in pegmatite veins. No ancient mine known.
obsidian: translucent, light to dark brownish black or black volcanic silica-rich glass.[10]	▪	▪			▪						Eastern Mediterranean or southern Red Sea – in volcanic rocks.
olivine or **peridot**: transparent to translucent; light to medium yellowish green [$(Mg,Fe)_2SiO_4$].[11]	▪ ?				?[27]					▪	Red Sea – in peridotite. One mine known on Zabargad (St. John's) Island (Pt-R).
quartz – macrocrystalline varieties [SiO_2]											
amethyst: transparent to translucent, light to dark violet.	▪	▪	▪	▪	■	■	▪	▪	▪	■	Eastern Desert – in quartz veins. Three mines known in Wadi Abu Had (ED: 1), near Wadi el-Hudi (MK) and at Abu Diyeiba near Wadi Waseef (Pt-R).
milky quartz: translucent, white. Occasionally coated with a blue or less commonly green, copper-based glaze.[12]	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Eastern Desert and Aswan – in quartz veins and wadi gravels derived from them; also in Nile River terrace gravels. No ancient mine known.
rock crystal: transparent, colorless. Occasionally coated with a blue, copper-based glaze.											Eastern Desert – in quartz veins. No ancient mine known except for the ones also supplying amethyst.

Known Rocks and Minerals	Extent of Use by Period[1,2]										Known and Potential Source(s)[1]
	Pd	ED	OK	1IP	MK	2IP	NK	3IP	LP	Pt-R	
smoky quartz: transparent to translucent, pale to dark brownish or grayish.[13]	▪										Eastern Desert – in quartz veins. No ancient mine known.
ferruginous quartz: translucent, yellowish, brownish, orangy or reddish.[14]		▪	▪				▪	▪	▪		Eastern Desert – in quartz veins and wadi gravels derived from them; also in Nile River terrace gravels. No ancient mine known.
quartz – microcrystalline varieties [SiO_2]: translucent; mainly fibrous/chalcedonic quartz = **chalcedony**											
agate: either **banded** with alternating layers of different colors or **variegated** in patterns of two or more colors.[15]	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	Eastern Desert – as nodules in metavolcanic rocks and in wadi gravels derived from them; also in Nile River terrace gravels. No ancient mine known.
onyx, a sub-variety of banded agate: parallel, planar layers with alternating white or light gray and dark gray or black. Distinguished from common banded agate which has curved concentric layers.	▪			▪	▪			▪	▪	■	Unknown. Possibly Nile River terrace gravels but definitely imported from India during Pt-R.
sardonyx, a sub-variety of banded agate: parallel, planar layers with alternating white or light gray and reddish or brownish colors.[16]	▪						▪	▪		▪ ?	Same sources as carnelian with which it usually occurs. Possibly also Nile River terrace gravels, but definitely imported from India during Pt-R.
carnelian (or cornelian): medium to dark orange, orangy red, brownish red or red. Includes the rarely used **sard**, which has a more brownish color and is gradational with carnelian. Some lighter-colored stones are commonly but incorrectly identified as carnelian.	■	■	■	■	■	■	■	■	■	■	Nubian Desert – in veins. One mine known at Stela Ridge (MK); probably also imported from northern Sudan where it occurs in the Nile River terrace gravels; and possibly manufactured by heat-treating drab-colored (brownish or yellowish) chalcedony pebbles in Nile River terrace gravels.
chalcedony, **common**: fairly uniform coloration in white or pale colors of gray, yellow and brown; occasionally light bluish white/gray in the **sapphirine** sub-variety.[17]	▪	▪	▪	▪	▪	▪ ?	▪	▪	▪	▪	Nubian Desert – in veins; and probably other unknown sources. One mine known at Stela Ridge (MK).
other colors, especially green.[18]	▪	▪		▪				▪	▪		Unknown.

Known Rocks and Minerals	Extent of Use by Period[1,2]										Known and Potential Source(s)[1]
	Pd	ED	OK	1IP	MK	2IP	NK	3IP	LP	Pt-R	
quartz – microcrystalline varieties [SiO_2]: opaque (more deeply colored because of impurities); mainly granular quartz but commonly a mixture of both granular and fibrous quartz = **jasper** or **chert/flint**											
medium to dark **red jasper**.[19]	▪		▪	▪	▪	▪	■	▪	▪	▪ ?	Eastern Desert – veins in metavolcanic rocks and wadi gravels derived from them. No ancient mine known.
medium to dark **green jasper**.[18, 19]	▪		▪		▪	▪	▪	▪	▪		
other colors, especially brown, gray and black.[10]	▪							▪	▪	▪ ?	Nile Valley – chert/flint in limestone. Numerous quarries known in Eastern Desert, Faiyum and Kharga.
serpentinite: opaque rock consisting largely of serpentine-group minerals (antigorite, chrysotile and lizardite) [$Mg_3Si_2O_5(OH)_4$] with a variety of accessory minerals, especially magnetite [Fe_3O_4]. The rock is typically mottled with lighter and darker shades of green but commonly is yellowish-green and, when magnetite is abundant, can have black magnetic patches. If oxidized, the rock may exhibit shades of brown or red.[11, 19, 20, 21]	■	■	▪	▪	▪	▪	▪			▪	Eastern Desert – many outcrops and in wadi gravels derived from them. One known quarry near Wadi Umm Esh (R).
steatite or **soapstone**: opaque rock consisting largely of talc [$Mg_3Si_4O_{10}(OH)_2$] with a variety of accessory minerals, commonly chlorite mica and serpentine. Highly variable in color but generally greenish gray or grayish to brownish green, but sometimes light to dark gray or nearly black. If oxidized, the rock may exhibit shades of brown or red. Usually coated with a green (very rarely blue), copper-based glaze.[20, 21]	⬛	■	■	■	■	▪	▪	▪			Eastern Desert – many outcrops. Six quarries known in Wadi Saqiyah (R), Wadi Abu Muawad (R), Wadi Mubarak (LP:26 & R), Wadi Abu Qureya (R?), Gebel Rod el-Baram (R), and Wadi Sikait (R).
turquoise: opaque, light to medium green to greenish blue or light blue with the blue color degrading over time to green due to hydration [$CuAl_6(PO_4)_4(OH)_8 \cdot 5H_2O$].[22]	▪	▪	▪	▪	■		▪	▪		▪	Sinai – nodules in sandstone. Two mines known at Gebel Maghara (ED to NK) and Serabit el-Khadim (MK to LP) with a possible third mine at Bir Nasib (MK to NK).

Known Rocks and Minerals	Extent of Use by Period[1,2]										Known and Potential Source(s)[1]
	Pd	ED	OK	1IP	MK	2IP	NK	3IP	LP	Pt-R	
Miscellaneous Igneous and Metamorphic Rocks											
diorite or **quartz diorite**: opaque macrocrystalline igneous rock, speckled black and white.[23]	▪	▪	▪	▪	▪		▪	▪	▪	▪	Eastern Desert – many outcrops in central part. Five quarries known, two for pegmatitic diorite at Gebel Umm Naqqat (Pd-ED & R) and Wadi Umm Shegilat (R), and three for quartz diorite at Wadi Umm Balad (R), Wadi Barud (R) and Wadi Fatiri el-Bayda (R).
andesite porphyry: opaque igneous rock with microcrystalline black matrix and large rectangular to lath-shaped white or light grey plagioclase feldspar phenocrysts.[24]	▪	▪									Eastern Desert – rare outcrops. No ancient quarry known.
anorthosite gneiss: translucent macrocrystalline metamorphic rock with light grey bytownite plagioclase feldspar and dark green to black hornblende.					▪						Western Nubian Desert – only one outcrop known with Chephren's Quarry (Pd-OK & MK:12).
metagreywacke: opaque metasedimentary rock (with claystone, mudstone, siltstone and sandstone sub-varieties), dark gray to mainly greenish gray or grayish green.[25]	▪	▪					▪			▪	Eastern Desert – many outcrops in central part. Many quarries known in Wadi Hammamat (Pd-R).

Notes to Table 1:

[1] Pd = Predynastic period (Badarian, Naqada I and II), ED = Early Dynastic period (Dynasties 0-3), OK = Old Kingdom (Dynasties 4-6), 1IP = First Intermediate Period (Dynasties 9-11), MK = Middle Kingdom (Dynasties 11-14), 2IP = Second Intermediate Period (Dynasties 15-17), NK = New Kingdom (Dynasties 18-20), 3IP = Third Intermediate Period (Dynasties 21-25), LP = Late Period (Dynasties 25-30), and Pt-R = Ptolemaic and Roman periods. A dynasty within a period is sometimes indicated: e.g., NK:18.

[2] Relative abundance symbols for usage: ■ = abundant, ■ = common, ▪ = rare, and blank = either not used or not reported in the literature consulted. For the hard stones reported by Xia, these levels correspond to >10% (of all hard stone beads) for abundant, 1-10% for common, and <1% for rare. In all periods, carnelian constitutes about half or more of the hard-stone beads.

[3] Amazonite is sometimes misidentified as “beryl”, “chrysoberyl” or the nebulous “matrix-of-emerald” and “mother-of-emerald”. It has also been misidentified as “mica” because of the common biotite mica inclusions in Egyptian green beryl.

[4] Includes Xia’s “Iceland spar” and “calcite.”

[5] Includes Xia’s “alabaster”.

[6] Includes Xia’s “white”, “pink”, “buff”, “brown”, “black” limestones; “marble”; “white and red limestone breccia”; and “green calcite”.

[7] Most, if not all, of what Xia has identified as “halite” or “rock salt” and “anhydrite” is fluorite.

[8] Some of what Xia identifies as “anhydrite” [$CaSO_4$] may be the very similar-looking selenite gypsum if not fluorite.

[9] Green turquoise is sometimes misidentified as malachite.

[10] Some black chert/flint may be misidentified as obsidian.

[11] Serpentinite has commonly been mistaken for “olivine” by Xia and others.

[12] Includes the “quartzite” of some workers.

[13] Some of what has been identified as smoky quartz may actually be pale obsidian.

[14] Includes Xia’s “translucent to near opaque” colored quartz and also his “yellow quartz.”

[15] Many scholars report onyx and sardonyx as “agate” or “banded agate” rather than as separate sub-varieties. However, the planarity of the bands which distinguish onyx and sardonyx from other banded agates is often unrecognizable in the typically small beads. Variegated agate has spotted, mottled, veined, streaked, brecciated, and dendritic patterns. Xia’s “wood opal” and “moss agate” and what others might call “petrified or silicified wood” are variegated agates. The terms “agate” and “chalcedony” are sometimes used interchangeably to refer collectively to all varieties of fibrous/chalcedonic microcrystalline quartz. More usually, however, “agate” is applied to the banded and conspicuously variegated varieties, and “chalcedony” to the more uniformly-colored varieties. Also, for some scholars, including geologists with no recourse to microscopic analyses, the term ‘chalcedony’ is applied to any translucent, microcrystalline quartz regardless of whether the quartz is granular or fibrous.

[16] Commonly misidentified as carnelian in the archaeological literature. Xia includes “sardonyx” and “sard” in his “carnelian”.

[17] The name sapphirine is sometimes informally applied to other pale blue minerals, but none of these were used in antiquity.

[18] The terms bloodstone (or heliotrope), chrysoprase, plasma and prase refer to different sub-varieties of translucent to opaque, greenish microcrystalline quartz (both fibrous and granular types), but are too inconsistently defined in the archaeological and geological literature to be useful here.

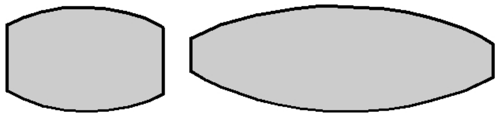
[19] These stones are commonly low-grade metamorphic rocks and so are technically metajasper. Some of what has been called green jasper by archaeologists may actually be serpentinite.
[20] This is the "serpentine" of Xia and many other authors. Serpentinite is sometimes mistaken for steatite or jade (including jadite and nephrite).
[21] This is not only Xia's "steatite" and "soapstone" but also his "talc schist" or "schistose talc" and perhaps also his "schist". Steatite is sometimes mistaken for serpentinite. The glaze commonly flakes off, leaving the steatite appearing as if it were originally unglazed.
[22] Faience and glass with a light blue color are sometimes mistaken for turquoise.
[23] Includes Xia's "speckled diorite."
[24] Includes Xia's "black and white porphyry".
[25] Includes Xia's "durite" and "slate".
[26] Lapis lazuli is noticeably rarer during these intervals than in the Predynastic and Early Dynastic periods.
[27] I am aware of only one object of peridot, a scarab in the Petrie Museum collection (UC52076), that may date to the Middle Kingdom. I question, however, the dating and think a Ptolemaic or Roman age for this object cannot be ruled out. A later date makes much more sense in terms of the known archaeology of the only potential peridot source on the Zabargad Island.

Table 2. Ancient Egyptian stone beads. Changes in basic typology, perforation and polish over time.

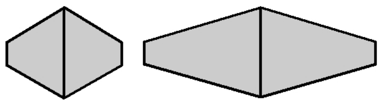
Interval[1]	**Stone Type[2]**	**Bead Typology[3]**	**Hard Stone[4] Bead Perforation and Polish**
Predynastic Period	hard, (glazed) steatite & soft	disc > cylinder$_S$ >> barrel$_S$ & biconic$_S$ > ball, chip, pebble & other	double conical >>> single plain & other (rough to dull/slight polish)
Early Dynastic Period	hard	disc >> barrel, cylinder & drop > ball, pebble & other	double conical >> double parallel (moderate polish)
	(glazed) steatite & soft	disc > cylinder$_L$ > ball, barrel$_L$ & other	
Old Kingdom	hard	disc > barrel$_{S\&L}$, biconic$_{S\&L}$ & cylinder$_{S\&L}$ > ball, drop & other	double conical (preferred for short beads) >> double parallel (preferred for long beads) > single plain (moderate polish)
	(glazed) steatite	cylinder$_{S\&L}$ > disc > ball, barrel$_{S\&L}$ & biconic$_{S\&L}$ > other	
	soft	ball, barrel, cylinder & disc (*too rare for ranking*)	
First Intermediate Period	hard	disc > ball, barrel$_{S\&L}$ & biconic$_{S\&L}$ > cylinder$_{L>S}$ & other	double conical >> single conical, double parallel & single plain (moderate polish)
	(glazed) steatite	barrel$_L$ & cylinder$_L$ >> ball, disc & other	
	soft	ball, barrel, biconic, cylinder & disc (*too rare for ranking*)	
Middle Kingdom	hard	ball, bionic$_{L>S}$ & disc >> barrel$_{L>S}$ > cylinder$_{L>S}$ & other	double conical (preferred for short beads) & double parallel (preferred for long & spheroid beads) >> single plain > single conical (high polish; the most highly polished beads of any period!)
	(glazed) steatite	cylinder$_L$ >> barrel$_{L?}$ > ball, disc & other	
	soft	biconicL > ball & barrel$_{S\&L}$ > others	
Second Intermediate Period	hard	ball >> disc > barrel & biconic > cylinder & other	single conical >> double parallel > double conical > single plain (moderate polish?)
	(glazed) steatite	ball, barrel & cylinder mainly	
	soft	ball, cylinder & disc mainly	
New Kingdom	hard	ball >> biconic > barrel, cylinder, disc & other	single conical >>> double conical, double parallel & single plain (moderate polish)
	(glazed) steatite	barrel	
	soft	barrel & disc	
Third Intermediate Period[5]	hard	ball & cylinder >> barrel & disc > biconic & other	single conical & grooved > sawn-and-filled (lapis lazuli only) & double parallel > double conical & single plain (often dull/slight polish)
	(glazed) steatite & soft	ball & barrel mainly	
Late Period[5]	No information		
Ptolemaic and Roman Periods	hard	ball >> biconic & faceted > barrel, disc & other	double parallel >> grooved > single conical & single plain (moderate polish but more uneven than in earlier periods)
	(glazed) steatite	faceted	
	soft	cylinder & faceted	

Notes to Table 2:
[1] For time intervals see footnote 1 in Table 1.
[2] According to Xia's definitions and using the terminology in Table 1, the "soft" stones include sparry calcite, travertine, limestone, gypsum, fluorite, hematite, malachite and serpentinite. Apart from the "glazed steatite", Xia considered everything else a "hard" stone.
[3] Relative abundances of the following bead forms are indicated:

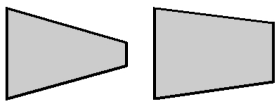
i. Barrel: short or long, circular cross-section, widest in the middle and smoothly tapering toward each end ('lenticular' when very elongated).



ii. Biconic, biconical or bicone: short or long, circular cross-section with back-to-back cones joined in the middle at their widest ends ('lenticular' when very elongated).

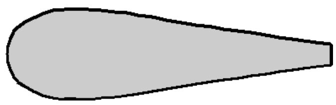


iii. Conic, conical, cone or unicone: short, circular cross-section, narrowing from one end to the other.

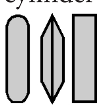


iv. Cylinder or cylindrical: short or long, circular cross-section with a constant diameter from one end to the other.

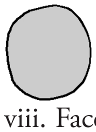
v. Drop or tear-drop: long, circular cross-section with diameter increasing from the truncated end to the well-rounded end.



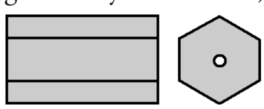
vi. Disc (disk) or ring: thin, circular cross-section; comes in barrel, biconic and cylinder sub-varieties.



vii. Ball or spheroidal: roughly spherical to somewhat oblate or ellipsoidal.



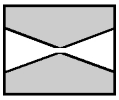
viii. Faceted: short or long, polygonal cross-section with multiple flat, ground surfaces; note that naturally faceted crystals are sometimes used for beads (e.g., green beryl or emerald).



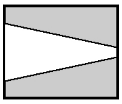
ix. Natural pebble: irregular rounded form.
x. Chip: irregular pieces of broken stone.
xi. Other: any of the above when too infrequent to be specifically noted.

[4] Relative abundances of the following bead perforation types are indicated:

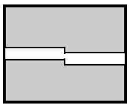
i. Double cone, conical or biconical: conical bores drilled or pecked from both ends.



ii. Single cone, conical or uniconical: conical bore drilled or pecked from one end.

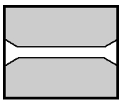


iii. Double parallel or double tube: straight tube-like bores drilled from both ends and slightly offset.

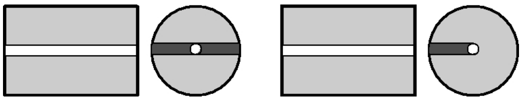


iv. Single plain or single tube: straight tube-like bore drilled from one end.

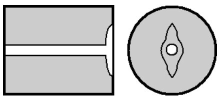
v. Chamfered single plain/tube: initially conical bores drilled or pecked at both ends transitioning to a single plain bore drilled in the middle.



vi. Sawn and filled: cylindrical bead sawn in half longitudinally and then re-joined with a blue frit cement but with a threading hole down the center left unfilled. Sometimes only sawn halfway and then filled with cement.



vii. Grooved: groove pecked at one or both ends to initiate perforation followed by either double parallel or single plain bores from drilling.



Because of the ease of drilling, many different perforation types occur in steatite and other soft stones in every period. There are, thus, no consistent differences or trends over time.

[5] Xia (2014) combines the Third Intermediate and Late Periods under the heading of 'Late Period'. Essentially all the stone beads he describes for this group are from the Third Intermediate Period (Dynasties 21-25).

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