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Report on the beads and related objects from the Piprahwa stupa

Introduction

Piprahwa is a village near Birdpur in the Siddharthnagar district Uttar Pradesh, very close to the present Nepalese border. In 1897/8 William Claxton Peppé excavated a mound on his land. Among the finds was a vase with a Brahmi inscription identifying the site as a relic stupa of Buddha, and beads and related objects, a selection of which remained in the Peppé family. The Peppe group is collectively described as 'beads' in what follows for the sake of convenience, although not all are strictly speaking beads – the group contains objects that are small pendants, parts of what seem to be composite flowers, 'buttons' or appliqué ornaments, gold foil disks and unpierced stones, pearls and coral. This report is based on an examination of these beads on two occasions and with the limited time available only a small proportion of the beads could be studied in detail microscopically or gemmologically. A fuller study is highly recommended for the future when more time is available and analytical facilities, ideally Raman spectrography, available to provide accurate and non-destructive identification of all the materials.

Most of the objects are very fine quality examples of lapidary work. This high quality is particularly noticeable if the group is compared with most other 'stupa' finds from Afghanistan, Bangladesh, Pakistan and India. Considering the Piprahwa finds, and other beads from India, it is noteworthy that quality is often inversely proportional to size. It says much for the religious or ruling elite who would have owned or commissioned such ornaments – for them quality was as important as quantity

The materials

The beads are made of a variety of materials, including amethyst, aquamarine (blue beryl), carnelian (and etched carnelian and sardonyx), coral, citrine (yellow quartz), coral, garnet, glass, green chalcedony, iolite, pearl, rock crystal and shell.

Carnelian is a very common material for beads in India and its frequent rather clumsy workmanship may reflect its cheapness. Thus, the relatively small proportion of carnelian beads in the Piprahwa group is possibly to be taken as indication that it was something of an 'elite' group. The rock crystal beads are noteworthy for their abundance in the group and their high quality workmanship.

Particular mention can be made of the aquamarines, the carnelian variations and garnets.

Aquamarine

Aquamarine is a blue to blue-green variety of beryl, a beryllium aluminium silicate. Mineralogically speaking it is the same as emerald – the green variety of beryl. It is a hard gem, although brittle, and takes a good polish. It occurs in Afghanistan, Pakistan, Southern India and Sri Lanka, and at our current level of knowledge of these deposits and their characteristics, it is not possible to suggest a likely source for the Piprahwa stones. The Piprahwa examples include a hexagonal bead (photo upper right), probably a superficially polished crystal, and small but finely facetted barrel-shaped beads (photo right lower). The hexagonal bead is closely matched by one from the Bhir Mound at Taxila (Beck 1941 pl. 1, no. 28) which is, perhaps surprisingly, given a suggested date of the fifth century BC. Others of similar hexagonal, prismatic form, are known from the Bimaran Stupa 2 in Afghanistan (Victoria and Albert Museum 1880.3893.c) which is dated to ca 1st century AD. Another is from a reliquary box from Pakistan (Metropolitan Museum of Art, New York, dated ca 1st – 3rd cent AD 1987.258.2a–q). Very similar beads have been excavated also in China, such as in a tomb in Huangnigang, Guangzi Zhuang (now in Hepu County Museum) which are dated to 1st century BC/AD. A more pear-shaped example in a reliquary box from Pakistan can be dated to the 1st – 3rd century AD on the basis of accompanying coins (Metropolitan Museum of Art, New York, 1987.142.44a–m) – a shape matched also in the Huangnigang tomb group. An elongated, facetted aquamarine bead was found at Kondapur, but no date is given (Dikshit 1952 pl. 2 no. 99).

The small facetted aquamarine beads in the Piprahwa group are close to one from Dharmarajika Stupa (Beck 1941 pl. 10, 19) which is dated to the 1st century BC. In general, however, we can note

that small-scale facetted beads seem typical at Taxila in the 3rd cent – 2nd cent BC (ie Beck 1941 pl, 6, nos 30, 37 and 40). Early examples include those in amethyst from the Bhir Mount dated to the 3rd century BC. (Beck 1941 pl. 6, nos. 4 and 5). Small aquamarine beads were also found in two rock crystal reliquary containers found in the stupas of Bhattiprolu (Rea 1894 pl. 6, nos 19, 20 and 29). These have been dated to the third century BC.

Despite the parallels for aquamarine beads in other Indian and Pakistan finds, they are usually present in very small numbers, unlike at Piprahwa. This may be another indication of the elite nature of the Piprahwa deposit.

Aquamarine is seen occasionally in Western Asiatic seals from about the mid first millennium BC, but to my knowledge is not known in Classical jewellery, with the possible exception of occasional intaglios in rings, until Roman times, and then only very rarely. The Roman writer Pliny refers to beryl 'cylinders' from India which are probably the hexagonal prismatic beads as from Piprahwa. 'Cylinder' might not be a strictly geometric description of a hexagonal prism, but we can note that the Taxila example was described by bead expert Horace Beck as a 'hexagon cylinder'.

Carnelian

Carnelian is the orangey-red variety of quartz and is well distributed in India, Afghanistan and Sri Lanka. When the stone has red and white banding it is termed 'sardonyx'. Heating carnelian will often greatly enhance its colour, in both single-colour and banded 'sardonyx' form. Heating carnelian with an alkali will bleach or 'etch' it and so, from an early period, carnelian was painted with an alkali mixture and then heated to create white patterns (termed 'etched carnelian') or to imitate sardonyx. The Piprahwa beads include carnelian, sardonyx and etched carnelian. The basic carnelian beads here are of no great interest in terms of size or form, but there are three very finely made little carnelian cylinder beads with narrow etched bands (example shown in the photo right). These are good examples of the type, indeed more delicately worked than the comparable beads from Taxila. Unfortunately, again, they provide little clear dating evidence, The Taxila examples range in date from the 4th to the 1st century BC. Very similar beads were found at Wari-Bateshwar in what is now Bangladesh, a probable trading site occupied from the 4th century BC onwards, so clear dating is impossible (Hossain

2008, Jahan 2010). There seem to have been no etched carnelian beads from either Mahabodhi or Bhattioprolu.

In general etched carnelian beads are so numerous in the ancient world that the assumption is that almost any carnelian object with a white surface layer has been 'etched'. That this is untrue with the flower petal and flower-head ornaments in the present collection, is seen when these are closely examined (and contrary to what I originally assumed). One of the flower head beads or 'buttons' is shown right, with a side view of the white layer. The horizontal layering within the white is a clear indication that the white layer is natural – although the red colour may have been enhanced with heating. The same is true of the 'petal', presumably part of a composite flower – perhaps with the green chalcedony 'leaves' – as seen in the photos lower right. This is one of six such petals in the group. This use of fine quality sardonyx reinforces the impression of the care and desire for excellence that are generally evident with the Piprahwa material.

Garnet

Garnet is a term that covers a mineral 'family' with a range of compositions and colours. Best known are the reddish garnets of the pyrope-almandine series that range from a bright orangey red to a deep almost purple wine colour, largely depending on iron content. Red garnets are found in many neighbouring areas including India, Pakistan, Afghanistan and Sri Lanka. The extensive trade in garnets in antiquity has led to a considerable amount of recent research to try to determine sources based on composition, including trace elements, but there is still much to do, with insufficient data on the various deposits, to be able to identify sources with confidence.

Interestingly, there are very few garnets in the Piprahwa group and none of the rather coarse and irregular garnet beads as we find at Mahabodhi, and in Afghanistan in the Bimaran Stupa 2 and Hadda Stupa 10 deposits, and perhaps Wardak Stupa (for the Afghan stupa garnets see the curator's comments under the British Museum database entry for 1880.3885.a.). One garnet bead is reported from Bhattiprolu (Rea 1894 pl. 6 no. 19), but the small drawing gives little indication of its nature apart from its being of unimpressive size and shape. The irregular garnet beads from the Afghan stupa finds which are dated to the 1st – 2nd century AD, reinforce the view that the more refined workmanship we see at Piprahwa is indicative of an earlier date.

The garnets in the Piprahwa group are of particular fine colour and clarity and workmanship, although varying in hue. These include two very finely made 'triratnas', one shown right. It has been argued recently that the name 'triratna' is inappropriate since the symbol's name and meaning in early times is unknown (Bellina 2014 p. 359), but it will be used here for convenience. There is a similar garnet example, about 7 mm high, from the Taxila Dharmarajika Stupa dated to the 1st century BC (Beck 1941 pl VI no 33).

The earliest history of the triratna symbol is unclear, but Marshall notes, in the context of shell examples, that triratna pendants were one of the principle pendant shapes of the Mauryan period. Dikshit quotes several examples from Indian sites, none with clear dating (Dikshit 1952 pp. 7-8) and more recently Jyotsna has said that the type is found from the 5th century BC until the 3rd century AD and cites several examples for different Indian sites (Jyotsna 2000 pp. 55-56). A fine shell example from Taxila of the 3rd century BC is illustrated by Beck (Beck 1941 p. 7, no. 7). When referring to a stone triratna from Taxila, he commented that 'Like most Mauryan work, the carving is strikingly neat and precise' (Marshall 1951 p. 505). The earliest representation of triratna jewellery in wear that I have found is on the sandstone statue of a young woman shown right. This is from Bharhut, N. India and now in the Museum of Fine Arts in Boston (Inv. 31.435). It is dated to ca. 120 BC.

Iolite

Iolite is a transparent, violet-blue form of the mineral cordierite, a magnesium iron aluminum silicate which is found in Southern India and Sri Lanka. It is extremely rare in early jewellery anywhere in the ancient Old World with few confirmed examples. One problem is its susceptibility to degradation with time – degradation that is likely to be significantly reduced if it has lain in a context which was very dry, sealed or both. There are at least six examples of small tetrahedra in iolite among the Piprahwa group, and two other similar tetrahedra which might be pale iolite or rock crystal. They are small, precisely formed and unperforated, and their original use is unknown. Postel illustrates two small tetrahedra similar to the Piprahwa ones, one in 'black jasper', one in carnelian, although these seem to be drilled as beads and have no given provenance and are presumably surface finds from India (Postel 1989 p. 253). The tetrahedron is a symbol of the four elements in Tantric Buddhism and research might determine whether this concept can be dated back as early as the Piprahwa finds.

In any case, iolite beads or related objects do not seem to be reported elsewhere in early Indian or Pakistani finds and this again spotlights the seemingly special nature of the Piprahwa deposit.

Technique

The first point to make is that comparing the quality of workmanship of most of the Piprahwa group with those from other stupas, quickly reveals the technical quality of the former and indicates that it must have been made or collected for a person or purpose of considerable importance.

As noted above with regard to the materials used, the time available did not allow an in-depth examination of more than a handful of the beads. The group would well reward a longer study in due course.

The manufacture of stone beads consists of several steps, typically these can include:

- Initial shaping

- Drilling
- Carving/engraving
- Final shaping and polishing
- Other decoration such as 'etching'

Initial shaping

The raw materials can be crystals, pieces of stone broken from larger rocks or small pebbles from river or gravel beds.

The shape, symmetry and glossiness of a crystal would have made it instantly attractive and small crystals could be pierced for threading or suspension with various degrees of effort – from using as-found, to shaping so that only vestiges of the original crystal form are still recognisable. Examples of clearly crystal-derived objects in the Piprahwa group include the small rock crystal (D 27), which is a simple pierced crystal, and the finely finished rock crystal and aquamarine beads which retain the hexagonal prismatic form of the initial crystals. Small garnet crystals were also sometimes pierced and used as beads with little or no additional work, but there are no examples in the present collection. Pearls, of course, needed no work other than drilling and of the pearls in the Piprahwa group, the largest one and many of the smaller are left unperforated. The small pieces of branch coral are also undrilled.

Agates, carnelian and other members of the so called cryptocrystalline quartz family do not occur as crystals of a size or shape suitable for bead making, but they do occur in nodules and water-worn pebbles that could be shaped to form beads. In recent times in many parts of the world beads in such materials have been chipped to approximate shape – termed pre-forms - using a metal spike, the stone being held against the spike and struck with a horn-headed hammer. The apparent traces of percussion marks seen on some ancient beads suggest that this technique, or a version of it, is very ancient and thus probably used in the initial shaping stages for at least some of the Piprahwa beads.

Smaller pebbles or rough shapes formed by chipping would be taken to the next stage by grinding. This could be done by rubbing on or with abrasive stone blocks, or by being held against a rotating grinding wheel. In India the latter has been traditionally made of shellac mixed with emery or other abrasive and such a technique was probably in use at the period of the Piprahwa beads. Bellina has recently argued for such use (Bellina 2014), although there are alternatives.

Grinding with successively finer abrasives will slowly improve the surface finish and indeed with the finest abrasives will produce the end polish.

At some point, often before final polishing and sometimes before final shaping, the beads were drilled

Drilling

The nature of the drills

The drills were powered by bow, as still seen in use in some parts of the world, the beads firmly clamped in place, probably usually with wood. Bow drills were used for bead drilling since the Bronze Age.

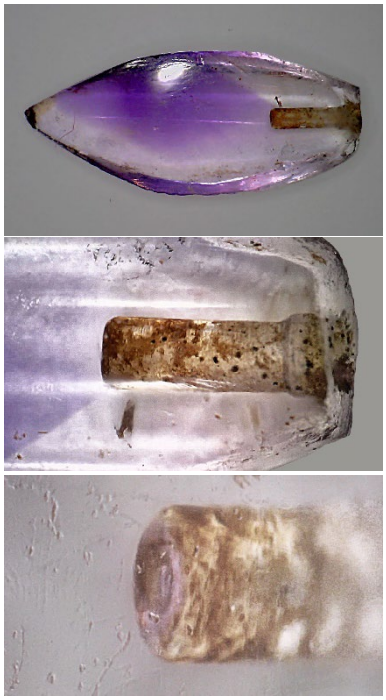
The drill itself of necessity had to be of a material harder than the stone being worked, or used in conjunction with an abrasive. In the earliest times stones were drilled with flint points but by about 2000 BC copper drills in conjunction with an abrasive were coming into use and also, about the same times the abrasive could be emery – the mineral corundum. Emery is far harder than sand which had earlier been a functional and readily available abrasive.

There are three possible forms of drills which may have been used for the Piprahwa beads:

1. A drill of wood or metal tipped with one or two diamond chips
2. A narrow metal rod in conjunction with an abrasive
3. A narrow metal tube in conjunction with an abrasive

The drill holes in nearly all the Piprawha beads are near-cylindrical and range from about 0.65 mm upwards, though seldom over about 1.3 mm. This compares to the beads and small pendants classified as Indian in style from Khao Sam Kaeo in Thailand, where very small perforations diameters – from 0.6 to 1.6 mm – were noted with the finer 'Indian' quality beads (Bellina 2014).

The Piprahwa group is particularly informative because it includes several small objects which have perforations that only pass partly through them. This means that the end of the drill hole is visible to some extent, as with the amethyst 'petal', in the photo right. Here the near cylindrical drill hole is about 0.7 mm diameter, and the abrasive marks on its wall can be seen as shallow grooves. The hole was started with a slightly larger diameter drill for the first fraction of a millimetre, as is visible in the photo middle right. Use of drills of varied diameters can be seen in several of the Piprahwa beads and is unlikely to be deliberate. Of particular note here, as with almost all of the cases where the end of the perforation is visible, the end of this drill hole has a central projection, appearing like a dimple in the photo of this same amethyst petal lower right.



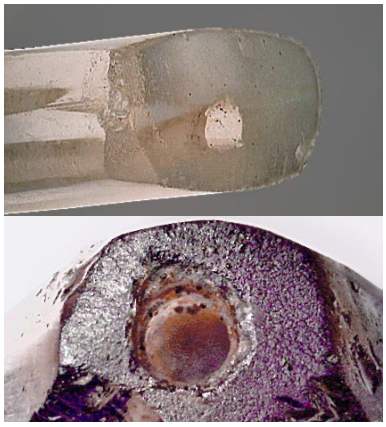
In theory, this type of small dimple or projection at the end of a drill hole rules out the use of a solid metal rod drill plus abrasive and points to either a tubular drill in conjunction with an abrasive or a diamond-tipped drill. In the case of the diamond tipped drill this can have a single diamond chip, or a pair of diamond chips, as recorded in use with modern Indian bead makers and also likely in antiquity. Although tubular drills were being used, in Egypt at least, by the mid-second millennium BC, they can probably be ruled out here because of the lack of taper in the perforations - the abrasive will wear away the drill as well as the gem being drilled (Gwinnett and Gorelick 1991). Besides, to drill the narrow holes in the finer Piprawha beads, tubular drills would have had to have walls barely 0.2 mm thick and although the production of copper or iron sheet this thickness is not impossible, it is unclear how this could then be bent into a relatively even tube. We are thus left with diamond drills as the most likely tool for at least some of the Piprahwa material. Diamond drills are believed to have come into use by the mid-first millennium BC (Gwinnett and Gorelick 1991; Ogden 2018).

It was, and often still is, usual to drill a bead from both ends, the two perforations meeting, with more or less precision, somewhere in the middle. This is clearly seen with many of the transparent beads in the Piprahwa group, such as the rock crystal bead, right. Drilling from both ends could reduce the need for longer drill holes and prevented the stone from fracturing as the drill broke through at the far end. It did mean, however, that care had to be taken to get the two holes to meet accurately – it was a highly skilled procedure.

Considerable heat can be generated in drilling. Today water is often used to keep the stone cool, but it is not known if this approach was used in antiquity. The lateral markings around the drill hole, looking like cracks, as seen in one of the Piprahwa rock crystal beads right, resemble the heat marks modern lapidaries encounter when a gem overheats in polishing and may be similar. Such heat marks are normally only encountered in sapphires although it seems highly improbable that this or other rock crystal beads in Piprahwa group are white sapphires.

Many of the Piprahwa beads have small fractures around the entrances to the perforations. Since these perforations are double ended, this fracturing cannot have been caused by the drills breaking through the stone. Such chipping does not resemble that caused by wear since it is seen around perforations on objects where it cannot be associated with wear, such as with the carnelian and aquamarine dotted 'buttons, as seen here, right. This localised chipping can thus be identified as caused by either drill movement against the stone as drilling began or the deliberate roughening of the stone surface prior to drilling to help the drill get 'purchase'. Very similar – and non-deliberate – hole-edge chipping can be seen in trial pieces made by Gorelick and Gwinnett using a diamond-tipped lapidary drill of supposed ancient type (1988 pls 2 and 2a).

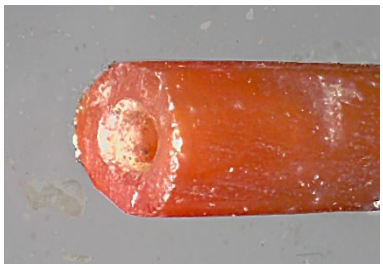
In some cases the ends of the beads were ground flat after drilling, presumably to remove this localised chipping. The finely ground, but not polished end of the rock crystal bead, upper right is evidence for this, while the amethyst, lower right, clearly had its end rather coarsely ground after the drilling was carried out. This can be seen in the way the abrasion extends over the chipped surface



Carving

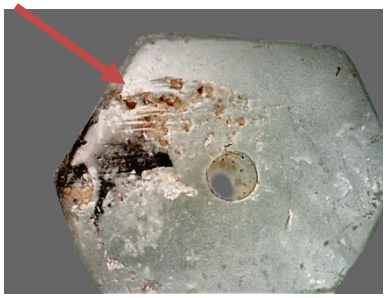
Carved objects in the Piprawha group, such as the triratnas and the flower heads, show the use of a tool or tools that produced U-shaped channels. The marks left by such a tool can be seen clearly between the petals on the amethyst flower head, right. There are two possible tool types used. One is a file-like implement, either a small stick of abrasive or a piece of wood fed with abrasive powder. The other possibility is a rotating wheel, as used in gem engraving. Rotating engraving tools using small wheels, probably usually of copper fed with emery powder, are known from the Mediterranean world from the Bronze Age onwards, and their use in India by the time of the Piprawha group is almost certain. The curved, engraved channels on one of the triratna pendants, right, strongly points to the use of a wheel engraving tool, while the other triratna has straight depressions that could be wheel tool or 'file'. Nevertheless, it is likely that the wheel tool was used in most cases since it is quick and accurate.

Finishing and polishing



In contrast to the precise shaping and polishing of most of the Piprahwa beads, there are some with apparent poorer workmanship, but which may be unfinished. For example, the near-cylindrical bead shown right (C116) is one of several carnelian beads where the sides are formed of flat facets that are

uneven in width and not polished. It seems possible that this and the others like it were still to be given a final grind and then polish to cylindrical shape. As note above drill holes would often be made prior to final shaping and polishing, since the bead could be rotated using the drill hole. The significance of unfinished beads, if that is what they are, in the Piprawha assemblage is unclear and the reason why the bead making was interrupted a matter of speculation. It is, however, a possible indication that unfinished beads at an archaeological site are by no means a clear indication of it being a bead-making workshop – as is sometime assumed.



Final polishing followed several stages of grinding with successively finer abrasive, each step improving the finish and eradicating the earlier grind marks. This can be a very laborious process, and, in some cases, polishing has not fully removed earlier abrasive marks. This can be seen in the aquamarine bead, right, where distinct horizontal grinding striations can be seen in in one area, despite the good polish on other areas.

Polishing was carried out on a flat rubbing table, or using an emery impregnated wheel or sticks and other implements with emery. The use of a grinding wheel on a horizontal axis powered by a bow is first attested in the West in Roman times and an import from the East is quite possible. However, the assumption (such as by Bettina 2014 *passim)* that flat ground or polished surfaces, evidenced by parallel grinding or polishing striations, on beads implies use of rotary wheels may not be correct. In Medieval Europe, the usual way to grind and polish gems was by rubbing with an abrasive on a stationary, flat table made of marble, wood or other material. This could produce very flat surfaces and some good if not highly sophisticated faceting. Indeed, a stationary table may well be a better choice for the production for small facetted beads such as in the Piprahwa group than a rating wheel.

Polished concave surfaces, such as on the sardonyx ‘petal’, right, were almost certainly made with a rotating tool, probably like the little rotating ball engraving tools used by lapidaries more recently. A similar tool must also have been used to create the precise hemispherical depressions in the flower heads

There is a further manner of polishing beads and this is by placing a number of them in a leather bag with abrasive and rolling them about for a length of time. This process has been used in recent times and is a primitive form of 'tumble polishing'. Its use in antiquity has been suggested, but it is really only suitable for rather unsophisticated beads and it probably has no relevance for the Piprahwa beads..

Dating

It is notoriously difficult to date assemblages of beads accurately. With the present group, the range of gem materials and, in particular, the high quality of the lapidary work suggest a date between about 300 BC and 100 BC. Bellina dated the Indian bead and pendant types from Khao Sam Kaeo, Thailand to the 'late centuries BC and early centuries AD with the earlier 'finer' group to the 4th to 3rd century BC. The forms of the beads can sometimes provide closer dating, but this relies on firmly dated comparisons. In his article on the Piprahwa Stupa, William Peppé noted the close similarity between his ornaments and those published by Alexander Rea which had come from reliquary containers, one also with relics of Buddha, from Bhattiprolu in Southern India. Despite the rather cursory nature of Rhea's descriptions and drawings, this is essentially true. Unfortunately, the dating of the Bhattiprolu finds is not certain, but it has been argued that the inscriptions there 'cannot be placed later than 200 B.C., and may even be a little older.' More recent dating has given a slightly wider margin.

The rarity of garnet beads in these Stupa finds in general, and Piprahwa in particular, might also be taken as dating evidence. Indian garnet beads have been long believed to have been a major industry and export at that period in antiquity, garnets being the most popular gem in Hellenistic Greek and Roman jewellery. Indeed, a huge number of unworked garnets and garnet beads have been excavated at the trading centre of Arikamedu in southern India, a centre mentioned in Roman texts (Schmetzer *et al* 2017). However, so far there seems no clear evidence that garnets were being worked at, or traded, through Arikamedu site before the 1st century BC. This might be taken to suggest that garnets only became more commonly mined and worked in, and traded from, India after this period. Indeed, Bellina's recent work on the beads from Khao Sam Kaeo in Thailand, a major trading centre in 4th – 1st centuries BC, reveals that that among the Indian imports, garnet beads were also rare – agates and carnelian being the most abundant (Bellina 2014 p. 358). Thus, the relatively low proportion of garnets in the Piprahwa find may be a further

indication that it dates to before the 1st century BC. However, even at Kondapur, the number of garnet beads was 'extremely small' (Dikshit 1952 p. 9).

The bead forms provide no clear dating. Shapes could remain in use for centuries and, of course, old beads could circulate for many generations. Many of the shapes seen in the Piprahwa assemblage can be compared with those from Taxila found in contexts ranging from the 3rd to 1st centuries BC. The hexagonal aquamarine beads and the little facetted beads in aquamarine and other materials from Piprahwa are also paralleled in finds from the 4th to 1st century BC, as noted above. The same can be said of the star or flower-head motifs - there is a small shell flowerhead of the 1st century BC from Taxila, very close to those in the Piprahwa group (Beck 1941 pl. 7 no. 31).

As we have seen, even such distinctive forms as triratna beads in various gem materials are known from around the 5th – 4th century BC up until the early centuries AD and there seem to be no sure criteria on which to narrow this down – two near-identical, although rather crude, carnelian examples from Taxila are from opposite ends of this date range (Taxila plate 4, nos. 21 and 22.). Marshall lists four triratna pendants in gem materials from Sirkap, all of which came from the 'Saka-Parthian' levels – that is in the 2nd century BC (Marshall 1951 p. 737). Michel Postel illustrates a fine small triratna bead in carnelian or perhaps garnet, and several others in various materials, but unfortunately, he provides no further information other than that most of the beads he illustrated were surface finds. Small stone triratna beads have been reported from Khao Sam Kaeo in Thailand and identified as Indian type, but without clear dating, apart for likely being within the period of the trading site's heyday – 4th to 1st centuries BC (Bellina 2014 p. 354).

Another potential dating approach is the evidence of the sheet gold objects. The small flower-heads or stars in sheet gold are paralleled at other sites and permit no close dating, but the disks with impressed designs might be more useful. The Piprahwa circular disks bear swastikas or standing lions with a swastika in front and a triratna or similar emblem above – as noted by William Peppé. These are possibly the best dating evidence since the lion with swastika and emblem design is well known from the region. One specialist has told me that the disk design is an 'early Mauryan piece with Swastika and Nandi pada symbol which can be seen after the fall of the Achaemenid Empire in the Taxila Valley, on coins and other objects, especially jewellery'. Apart for the impressed designs, the workmanship of the gold provides no clear dating evidence. The work is

very unsophisticated with no soldered components - the tubular beads are just cylindrical rolls of sheet and the disks have no attachment holes or loops except one where the hole may be intentional or damage. The thin sheet gold was cut with knife (longer cuts) or small chisel (shorter cuts).

So far, I have not located jewellery parallels, but certainly the lion design is well known on Taxila coins, such as that illustrated right. These coins typically date to post-185 BC and the lions face left – unlike on the disks. If we travel south in India, however, and look at coins of the Satavahana Empire, we find coins with the lions facing right – as in the rather poor reproduction, right, from the British Museum catalogue of such coins (Rapson 1908 no. 36). Interestingly, the Satavahana coins of frequently made of lead (as is the sample shown – see discussion in Rea 1894 p. 21). The Piprahwa gold disks appear to have been made by impressing them with an intaglio punch – like a coin die. When impressing thin sheet gold, the gold has to be placed over a resilient material that will both support it and distort with it. Lead has long been used for this purpose. It seems a possibility that the Piprahwa gold disks were made with a coin die and maybe even that some of the lead 'coins' that have plain reverses may actually have been backings for such work.

The Taxila lion coins are dated to after the Greco-Bactrian invasion of India in 185 BC and the Satavahana Empire although formerly believed to have been founded as early as the third century BC, is now thought to date from the 1st century BC–2nd century AD. Further numismatic and iconographic research on the lion disks in the Piprahwa group is advisable to determine whether a pre-ca. 185 BC date is possible.

Summary

As far as can be determined from research to date, the materials and fine workmanship of the Piprahwa assemblage point with almost certainty to no later than the 1st century BC and quite probably a century or two before this. In 1997 the inscription on the vase from the stupa was dated 'confidently' to the first half of the second century BC (Dani 1997 p. 56) and this would seemingly fit well with the size, form and quality of the beads and related objects from the site. I

cannot comment on the accuracy of this dating of the inscription, but if the iconography of the lion disks allows a third century BC date, I see no intrinsic reason why the beads should not be as early as this.

Dr Jack Ogden
18 April 2018
E&OE

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