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Ancient Monuments Laboratory
Report 84/92

THE EXAMINATION AND IDENTIFICATION OF 29 BEADS FROM ARDLEIGH ESSEX

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Summary

Twenty nine faceted beads were submitted for identification of material. They were found to be made from a brown chalcedony, with dendritic and other inclusions, and probably came from Hungary.

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THE EXAMINATION AND IDENTIFICATION OF TWENTY NINE BEADS FROM ARDLEIGH, ESSEX. AML Site No. 880

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The beads were found in 1979-1980 during the excavation of a Bronze Age barrow, directed by John Hinchcliffe (Central Excavation Unit). The barrow contained the original cremation and six later inhumations. These are Roman of the late fourth century AD and the beads come from two of these secondary burials, 638 and 651.

The Material

Examination by low-powered microscope identified these beads as being made of chalcedony, a micro-crystalline quartz, and this was confirmed by energy dispersive X-ray fluorescence spectroscopy (ED-XRF) and by X-ray analysis in the scanning electron microscope (SEM-EDX). When viewed in the hand, they look orange-brown to very dark brown, but when looked at by strong transmitted light, or when held up to the sun, most become translucent crimson, with one or two looking orange. Some of the beads have a red gleam in reflected sunlight, and this must have looked very attractive when they were worn. These beads are too dark in colour to be described as cornelian, although they could possibly be described as sard. However, modern thinking in gemmology is to move away from descriptions which, though hallowed by antiquity, only really describe a colour.

All the beads have dark inclusions of some different material which SEM-EDX analysis suggests is probably iron. These are sometimes spherical or irregular rounded shapes, but usually they are dendritic and range from radiating out from a centre, giving the appearance of a black snowflake, to looking more like moss (see Plate 3). In one bead, AML 7910523, the dendritic inclusions bear a strong resemblance to water-weed. These inclusions look black by transmitted light but in bead AML 7910500, where there is a substantial conchoidal chip missing and the dendritic inclusions break the surface, the colour is gray and metallic. There are also colourless and white areas in the beads: occasionally, the latter may be secondary fillings of voids. In some beads, eg AML 7910456, there are narrow veins of colourless or cloudy chalcedony (see Plate 2). Occasionally they cut dendritic inclusions in two, so they must post-date the formation of the chalcedony and its inclusions. This probably indicates that at some time in the past the chalcedony has been shattered and fresh, colourless silica has been available to fill the gaps across the breaks.

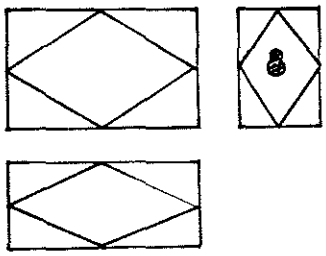
The shape and arrangement of the inclusions in one or two of the beads would allow them to be described as moss agates if their colour was paler, but the 'moss' and the variations in colour can only be seen by powerful transmitted light.

The Cut

The beads are basically rectangular in section but the surface has been cut into flat triangular and diamond shaped facets. Each face has a diamond shaped facet in the centre surrounded by four triangular facets, but these triangular facets are shared by adjoining faces. The maker probably took a pre-shaped rectangular piece of chalcedony and abraded off the eight corners, holding the rectangles at a low angle so that most material was removed along the long edges. This was continued until the points of the resulting triangles more-or-less touched each other, leaving a large diamond-shaped facet in the centre of each side. The bead was then polished. Usually, only the large diamond facets on the front and back of the bead were properly polished, and grinding/abrasion lines can be seen on all the other facets apart from the ends.

It was impossible to decide whether the holes in the beads were bored from one or both ends as the evidence is conflicting, see the discussion at the end. The hole is always much larger at one end than the other and almost invariably there are the remains of a small hole at the larger end which was drilled first, to one side of the present hole, and then almost destroyed by a hole made with a drill of greater diameter. The smaller end of the hole is always chipped round the edge. Some of the holes contain a soft white material, like chalk in texture. This does not come from the burial surroundings as the barrow was a soft loam, not chalk. No attempt was made to clear obstructed holes so as not to prejudice any future investigation as to what the beads might have been strung on. Examples are known strung on gold and silver wire. Most of the beads are chipped on at least the four main edges and on some beads the edges of the chips are worn and rounded.

Plan view of the cut, (idealised).



The Beads

The beads comprise AML inventory numbers AML 7910456-458 and AML 7910500-525. A photograph of eight representative beads appears at the end of this report. (See Plate 1).

NB. All measurements are in given in the order length x width x thickness. As the beads are not square at the ends, the lengths quoted are the greatest length. All numbers, contexts etc, are taken from the bag and the label; some were more complete than others. The term 'pear-shaped' denotes a sharp change of direction between the smaller and larger components of the hole; 'egg-shaped' indicates a smooth transition.

AML 7910456; Grave 651, 29-650, B.I. 687

Size: 10.6 x 8.0 x 4.0mm

Black inclusions, mossy in appearance and broken up. This bead has two curious veins of translucent, colourless material running roughly parallel down its length, (see above, and Plate 2 at the end of this report). Inclusions cut by these veins continue on the other side of the veins as though the material had been split, moved slightly apart, and the space filled with the colourless material. The hole is obscured by the soft white material mentioned above. The larger end is pear-shaped and the remains of the small subsidiary hole can be seen as two marked ledges in the hole. One corner is badly chipped and there are chips elsewhere which have rounded edges.

AML 7910457; no grave no. on bag or label, 29-650

Size: 10.6 x 8.0 x 5.5mm

Black dendritic inclusions. There are marks like beach battering on one end and one facet. One end of the hole is egg-shaped and larger than the other and the entire hole is off-centre. Most of the facet edges are rounded. There is minor damage with rounded edges to the chips.

AML 7910458; no grave no. on bag or label, 29-650

Size: 10.6 x 9.1 x 4.8mm

A well cut bead with some chipping. Some black dendritic inclusions. There are two roughly parallel veins of paler chalcedony, not as distinct as AML 7910456. The larger end of the hole is egg-shaped and the remains of the subsidiary hole can be seen as a very small ledge in the hole. The smaller end of the hole is 'countersunk'. Part of the interior of the hole is obstructed with the white material mentioned above.

AML 7910500; Grave 638, 29-639, B.I.902

Size: 11.0 x 7.0 x 6.6mm

A very dark bead. Black dendritic inclusions, but looking gray and metallic where the surface is broken by a large conchoidal chip. The larger end of the hole is off-centre and egg-shaped, and tapers along its length from c 2.6mm to c 1.6mm in diameter.

AML 7910501; Grave 638, 29 639, B.I.902

Size: 14.2 x 9.1 x 4.5mm

A well cut bead with sharp facet edges, but marred by the standard of the polishing, for grinding lines are visible on all facets. There are black inclusions, with two areas of coarse, hard, white material breaking the surface. The hole is egg-shaped at the larger end, the subsidiary hole being very off-centre. The smaller end of the hole is centred.

AML 7910502; Grave 638, 29-639, B.I.902

Size; 10.6 x 7.5 x 5.3mm

A well cut bead with many black dendritic inclusions and some white ones. The hole is well centred which means, however, that the bead hangs badly on the string. The hole is bigger at one end than the other and the smaller end of the hole is roughly centred in a deep dished depression c 6.5mm in diameter. There is a curious 'flat' on one side of this hole, perhaps suggesting that the drill did not break through entirely.

AML 7910503; Grave 638, 29-639, B.I.902

Size: 11.6 x 9.2 x 5.2mm

A well-cut bead with many black inclusions and some white ones. The hole is much larger one end than the other, with just discernible remains of the subsidiary hole. There are good tool/abrasive marks in the hole.

AML 7910504; Grave 638, 29-639, B.I.902

Size: 12.2 x 7.7 x 4.9mm

Particularly attractive black dendritic inclusions with some white ones (see Plate 3). The larger end of the hole is slightly egg-shaped and chipped right to the edge of the bead where the subsidiary hole was. Marks left by the drill/abrasive are visible in the hole.

AML 7910505; Grave 638, 29-639, B.I.902

Size: 12.5 x 8.6 x 6.6mm

Many black dendritic inclusions and some white ones. One diamond side facet has had its edge polished off, possibly to remove chipping during manufacture. The larger end of the hole is egg-shaped, and there is a marked ridge in it. The entire hole is very off-centre. A cast taken of the inside of this hole might yield useful information as to the nature and shape of the abrasive/drill used.

AML 7910506; Grave 638, 29-639, B.I.902

Size: 13.1 x 10.5 x 5.1mm

Black dendritic inclusions. There are well defined marks similar to beach battering on the end of the bead at the larger end of the hole and this end is barely finished at all. The larger end of the hole is irregular, with remains of the subsidiary hole. The smaller end of the hole has a flat on it, see AML 7910502. All facet edges are rounded.

AML 7910507; Grave 638, 29-639, B.I.902

Size: 11.2 x 10.7 x 4.0mm

The bead is in good condition, although there is some chipping, and it retains a good polish. There are some black dendritic inclusions. The larger end of the hole is egg-shaped, with no obvious trace of the subsidiary hole.

AML 7910508; Grave 638, 29-639, B.I.902

Size: 10.2 x 9.7 x 7.0 - 6.3mm (bead tapers)

Black dendritic inclusions, and two areas of white material below the surface. The hole is markedly off-centre and there is a slight change in its direction. The larger end is pear-shaped with the subsidiary hole better centred than the larger hole.

AML 7910509; Grave 638, 29-639, B.I.902

Size 11.3 x 8.5 x 4.3mm

This bead is very dark in colour with many black dendritic inclusions. It has two extra facets diagonally opposite each other on the ends. A vein of colourless material crosses the bead cutting the black inclusions in two, showing that it post-dates their formation. The larger end of the hole is pear-shaped and the subsidiary hole is very off-centre the same side as the hole at the other end of the bead.

AML 7910510; Grave 638, 29-639, B.I.902

Size: 11.4 x 8.4 x 5.4mm

Very similar to AML 7910509. Veins of colourless material cross the bead, but in this case the black inclusions do not touch them. There are areas of banding as in agate. The larger end of the hole is slightly egg-shaped, and there appears to be a slight 'bend' in one side of the hole wall.

AML 7910511; Grave 638, 29-639, B.I.902

Size: 13.6 x 9.8 x 4.7mm

Some black inclusions, but less clear than usual; the bead looks 'muddy'. Most facets are well polished, except for the end which has the smaller hole, which is hardly polished at all. The subsidiary hole has almost disappeared but there is a slight ledge on one side of the hole.

AML 7910512; Grave 638, 29-639, B.I.902

Size: 12.7 x 9.4 x 5.2mm

Very striking black dendritic inclusions and some white ones. There are marks like that of beach battering on one end, but the facet edges are not eroded. The larger end of the hole is pear-shaped and the bottom of the subsidiary hole appears as a ledge in the side of the main hole.

AML 7910513; Grave 638, 29-639, B.I.902

Size: 11.0 x 8.9 x 5.0mm

Very good condition with black inclusions mainly as speckles. The larger end of the hole is pear-shaped, with a marked ledge showing the bottom of the subsidiary hole. The hole appears to change direction slightly and the smaller end of the hole is very off-centre.

AML 7910514; Grave 638, 29-639, B.I.902

Size: 10.8 x 9.0 x 5.4mm

Black dendritic inclusions and many fractures filled with white opaque material. The facet edges are very rounded and there are marks like beach battering on one end. The larger end of the hole is slightly egg-shaped and the smaller is off-centre. The hole appears to change direction slightly and there is an area of roughness in the middle.

AML 7910515; Grave 638, 29-639, B.I.

Size: 12.1 x 8.8 x 5.0mm

Black inclusions and a healed crack. The larger end of the hole was originally pear-shaped and the marks of the smaller drill can be seen in the side of the hole, ending in a distinct ledge. This hole gives a good idea of the shape of the end of the drill. It would be worth-while taking a cast if there is any interest in how these holes were drilled. The smaller hole in the other end of the bead is very off-centre in a 'countersunk' hollow.

AML 7190516; Grave 638, 29-639, B.I.902

Size: 12.7 x 9.1 x 4.6 - 4.1mm

A badly cut bead with an extra facet, possibly to disguise a large chip. The bead is chipped and worn, with marks like beach battering on both ends and one narrow side. The triangular facets are unusually small. There are black inclusions and colourless areas and also many small cracks like stress cracks down the length of the bead. The larger end of the hole is pear-shaped and the hole changes direction slightly along its length.

AML 7910517; Grave 638, 29-639, B.I.902

Size: 10.8 x 9.4 x 4.3mm

This bead is much more orange in colour than the others and virtually opaque. It could be made from material from a different source. There are some black inclusions. The facet edges are shinier than the rest of the bead, possibly through wear against a fine surface. The larger end of the hole is pear-shaped. The subsidiary hole was bored at an oblique angle to, and well to one side of, the wider hole, although it is cut by the main hole. There is a distinct ledge where this subsidiary hole ends.

AML 7910518; Grave 638, 29-639, B.I.902

Size: 14.1 x 9.9 x 5.4mm

A noticeably well cut bead from the point of technique, even though now chipped. The facet edges are sharper and the points of the diamond facets meet better than usual on these beads but the actual diamond facets are asymmetric. The polishing, however, has been skimped as usual; only the two large diamond facets back and front have been properly polished and grinding lines remain on all the other facets. There are some black dendritic inclusions and small internal cracks and voids. The larger end of the hole is more like a figure 8 than a pear as both the intersecting drill holes are about the same size. The smaller end is in a marked depression which is probably a chip as it does not extend all round the hole.

AML 7910519; Grave 638, 29-639

Size: 12.2 x 8.2 x 5.2mm

As above, noticeably well cut, but not well finished. Poorly polished, especially on the triangular and side facets. There are black dendritic inclusions. The hole is partly obstructed, but appears to change direction. The larger end of the hole is virtually round, but there is a slight bulge on one side with a matching small ledge in the hole. The smaller end of the hole is very off-centre.

AML 7910520; Grave 638, 29-639, B.I.902

Size: 12.5 x 8.9 x 6.5mm

A very well cut bead, but now somewhat chipped. Many small black inclusions, some connected by black lines which may be filled channels. The larger end of the hole is not quite round, but no trace of another subsidiary drill hole was seen. The smaller end of the hole is off-centre.

AML 7910521; Grave 638, 29-639,B.I.902

Size: 13.2 x 7.3 x 4.2mm

A very dark, reasonably well cut bead, but as usual, only the two large diamond facets back and front are at all well polished; all the other facets have grinding lines on them. There are black dendritic inclusions. The larger end of the hole is circular and seems to be just one drill hole, but it is far too big for this relatively thin bead so part of the edge of the bead has broken away and this may have removed the subsidiary hole. The smaller end of the hole is badly off centre.

AML 7910522; Grave 638, 29-639, B.I.902

Size: 10.4 x 9.1 x 4.2mm

A very dark bead, squarer than usual, with some rather odd black inclusions. There are fractures on each end of the bead with frosted surfaces rather than the typical waxy fracture expected with chalcedony. They appear to follow natural faults in the material and may relate to a translucent milky vein which passes diagonally through the bead. The larger end of the hole was pear-shaped but now looks round owing to part of the end of the bead breaking away. There are the remains of a subsidiary drill hole entering it at an angle.

AML 7910523; Grave 638, 29-639, B.I.902

Size: 12.3 x 8.3 x 4.0mm

A well cut stone with an unusually well centred hole, but with only the main diamond facets properly polished, as usual. Extremely good examples of greenish-grey dendritic inclusions just below the surface on one side, resembling water weed. There are also some white areas or filled voids. The larger end of the hole appears to be a single hole with no obvious trace of the subsidiary hole and the smaller hole at the other end of the bead is deeply recessed.

AML 7910524; Grave 638,29-639, B.I.902

Size: 11.0 x 8.6 x 4.6mm

A well-cut bead, but very dark, muddy, and for the most part opaque. There are black inclusions including numerous very small ones, and clouds of what seem to be single or two phase inclusions. The hole is obstructed with the white material mentioned before. The larger end of the hole is pear-shaped and c 2.3mm in diameter and the remains of the subsidiary hole, which is better centred than the final hole, can be seen, but the change in diameter of the hole has been smoothed out. The smaller end of the hole is c 1mm in diameter and is situated in a 'countersunk' depression c 4.5mm across which looks man-made.

AML 7901525; Grave 638, 29-639, B.I.902

Size: 10.3 x 9.0 X 5.6mm

This bead is darker than usual and squarer in shape; it is also worn and chipped. It contains mossy black inclusions, white inclusions and milky white areas. The larger end of the hole is pear-shaped and the subsidiary hole is better centred than the final hole. The smaller end of the hole is off centre but not chipped. The end of the bead is only partly finished.

Discussion

Chalcedony beads of this type have been found on other sites, but they are not common and are usually described as cornelian. One was found at Caerleon, Wales, in the excavation of the Legionary Fortress Baths, and Zienkiewicz (1986, 154) cites a necklace of eight faceted beads and one different found in a late Roman grave in the Lankhills Cemetery, Winchester (Clarke 1979, 294-5, fig 70), and a gold necklace decorated with similar faceted beads, (Marshall 1911, no 2743, pl LVI) in the British Museum, supposedly found near the temple of Apollo at Curium, Cyprus. (Marshall identified the beads as garnet, but they are now described as cornelian). However, the fact that they were thought to be garnet, popularly always considered to be red, suggests that these beads are made of the same, or similar material to the Ardleigh beads.)

There are further examples in the Beck Collection, housed in the Museum of Archaeology and Anthropology at Cambridge, from the National Museum of Hungary, 'thought to be Migration Period' and another single example from Kerch, in the Crimea. These beads are virtually identical in material and cut to the Ardleigh beads.

In the Lankhills Cemetery report, to which the reader is referred, Clarke (1979, 295) reviews where what he calls cornelian beads of this type have and have not been found. It appears that although they are rare or non-existent in most of Europe, both types of bead found on the Lankhills necklace occur in Romania, 'but they are above all typical of Sarmatian-period cemeteries in Hungary, where they might almost be described as a type fossil'. This statement, taken along with the fact that the beads in the Beck Collection from the National Museum of Hungary are so very similar to the Ardleigh beads, strongly suggests that these beads come from Hungary and are very likely to have been made there. It is possible that the Ardleigh beads are the largest properly provenanced collection of this type of bead in north-west Europe.

The marks seen on some of the beads and described as looking like beach battering are interesting. One suggestion is that they are indeed percussion marks, and that they came from the beads being tumble-polished in a stream. If this is so, it is difficult to see why the marks do not cover the entire surface, and to explain how the facet edges were not destroyed, as the force needed to produce the percussion marks must be

considerable. The obvious explanation is that the marks are percussion marks caused by beach, or wave, battering and that the raw material has at some time formed part of a beach. This does not necessarily mean that the makers of the beads found the chalcedony on a contemporary beach; the beach may have been an ancient one now cut by rivers etc so that its pebbles have been transported considerable distances. Perhaps these marks would repay further investigation into their origin.

The holes. Traditionally, hard stone beads have their holes bored from both ends and this is still the practice in beads made in India. Piercing from both ends frequently means that there is a sharp ridge where the holes do not meet exactly, and this ridge cuts the string of a necklace very quickly unless the beads can be immobilised in some way. Threading the beads on metal links might achieve this. There are various reasons why hard stone beads are pierced from both ends, despite the resulting ridge. One is that there is a danger of extensive chipping round the exit hole if the bead is pierced from one end only.

Almost without exception, the smaller end of the hole in the Ardleigh beads has either got extensive chipping round it, or else it is set in what seems to be a man-made depression, which may be intended to tidy up the edge of the hole. Occasionally the hole has a flat on it, eg AML 7910506, suggesting that the drill broke through incompletely. These, with the fact that this end of the hole is frequently very off-centre, suggest that this smaller end is the exit hole. The larger end of the hole is even more puzzling. A small hole appears to have been drilled part-way into the bead and then another hole has been drilled with a larger drill to one side of this initial hole, cutting into it to give the characteristic egg or pear shape. If the small hole was not intended as a starter hole for the drill, what was its purpose? It is sometimes better centred than the wider hole. The larger drill hole is wider than the hole at the other end of the bead, so unless it wore very badly it cannot have gone right through the bead. Why then does the smaller end of the hole look like an exit hole?

If these beads were all drilled from both ends it was done with exceptional skill, as there is only occasionally a trace of a ridge. Finally, if casts are taken of the insides of the holes to analyse the tool marks, the casts should be examined by ED-XRF, or similar, to see if traces remain of any metal chain which the beads might have been strung on: the Caerleon bead was strung with silver.

Acknowledgments

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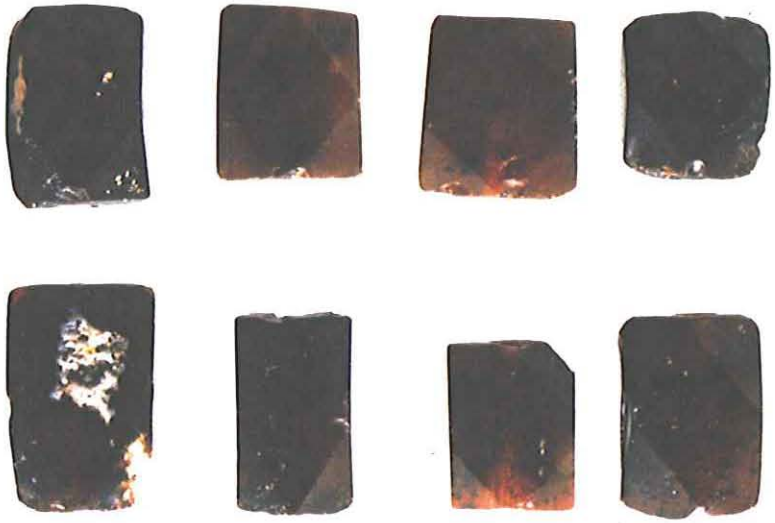

PLATE 1. A representative sample of the beads approximately twice real size.

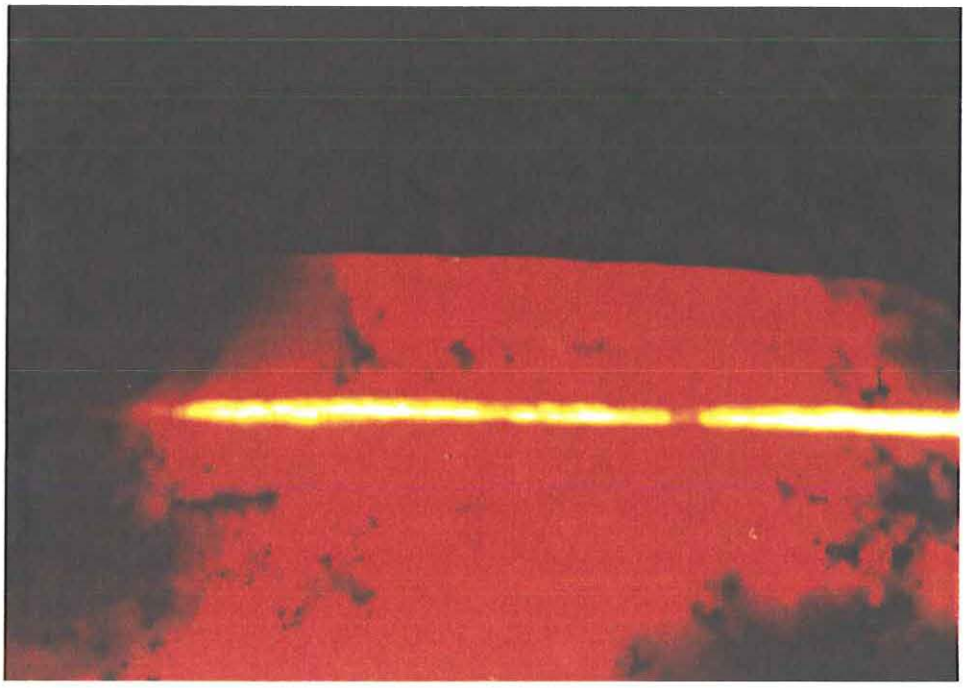

PLATE 2. Translucent vein of chalcedony.
AML 7910456, (Wild film 48)
Field of view is c 8.3 x 5.6mm

* see Library copy for originals of photos.

PLATE 3. Black dendritic inclusions.
AML 7910504, (Wild Film 48)
Field of view is c 8.5 x 5.6mm