

# Carnelian



C-1

A short necklace featuring a gold capped long carnelian barrel bead strung with two hundred fifty granulated gold ring beads. Two small carnelian beads face the gold capped center bead; there are two smaller gold capped carnelian barrel beads at the back of the necklace. Gold beading tips and a hook and eye clasp complete the necklace.

The gold capped center bead is 6.8 cm in length and 8.1 mm in diameter at the center of the bead. The drill hole diameter is 3.5 mm. The caps are 1.7cm in length and 7.2 mm in diameter. The two small carnelian beads that face the center capped bead are 4.25 mm in diameter and 2 mm in length. The granulated ring beads are 3.8 mm – 3.5 mm in diameter graduating to smaller size to the back of the necklace. The capped carnelian beads at the back of the necklace are 1.82 mm and 1.9 mm in length. The carnelian beads are 3.8 mm in diameter. The diameter of the drill holes is 1.8 mm. There are two larger granulated ring beads between each of the capped carnelians and the beading tips, both two layers of six grains. These are 5 mm in diameter. There are two single layer beads of this size facing the small carnelian beads next to the ends of the gold caps of the center bead. The beading tips are cylinders with one open end, the other pierced for the string to pass through, the knots being hidden within the cylinders. Circlets of wire attach to the sides of these cylinders and pass over the open end and provide the attachments points for the hook and eye clasp. The gold is all 20k.

The center bead is a long barrel carnelian tube bead from the Indus Valley, located in present day Pakistan and India. The constricted cylinder drills that made it possible to drill such long holes, and bead making debris have been found at the workshop city of Chanhudaro in the Indus Valley. There is

also evidence of production of these beads at two great urban centers, Mohenjodaro and Harappa. They may have only been made between 2450 to 1900 BC at Chanhudaro, a period of just a few hundred years. Constricted cylinder drills were less likely to seize up during the drilling of the hole, but often the holes were stepped to smaller sizes as they progressed, sometimes leaving three channels within the bead, each smaller than the last and then stepping up to a larger size (or sizes) from the center out to the end of the bead. Unfortunately, pushing this technology to the limit resulted in very thin walls at the ends of the beads which are often chipped. Gold caps both protect the ends and hide damage as is the case with this bead. Although one end was broken, large caps have restored the beauty of this ancient masterpiece of lapidary work. When illuminated from behind, the layers in the carnelian are clearly visible. A small amount whitening from long exposure to alkaline soil is visible on one end of the bead. It has only affected the layers in the banding which are presumably less dense or more porous and can absorb water.



C-1

There are two hundred fifty gold ring beads in the necklace. These are made up of six granules which have been fused together by means of the granulation process. This technique, used in the ancient world, allows high carat gold ( and silver ) to be fused without the use of solder. Very fine detailed work can be accomplished by this means, which would not be possible by other techniques of joining. When small pieces of gold wire are heated to a molten state, the surface tension of the liquid metal automatically produces a spherical shape. One thousand five hundred such granules went into the making of this necklace.

The necklace is 17 13/16 inches (45.3 cm) in length.

The necklace weighs 41.5 gm.





C-2 A necklace of nine gold capped agate beads, carnelian, quartz and jasper, alternating with ten





C-2

The two cylinder beads at the back of the necklace are probably two thousand years old as is the center jasper bead. All the other agate barrel beads are four thousand years old. The shapes are right for this period but the large drill holes of 3 mm and larger are a sure indication. Drill hole diameters of 2 mm are usually about two thousand years old if the shapes of the beads are typical of that era as well. The six sided carnelian beads may also be from this middle period but they may later. When diamond drills were used the drill holes were typically much smaller. The dating is uncertain.

The necklace is 19 5/8 inches ( 50.8 cm) in length.

The necklace weighs 56.3 gm.



C-3 C-4 C-5



C-3 C-4 C-5

### C-3

A necklace of ninety-seven small agate beads, carnelian with transparent and opaque white quartz layering, alternating with gold beads: 20 winged discs, 38 cylindrical tubes and 76 granulated ring beads. The agates are flattened rectangular shapes; the top and bottom surfaces curve towards the edges leaving the center of the bead thicker to accommodate the drill hole. The center bead is a flattened barrel shaped bead. It is 8 mm in length, 6 mm in width at the middle and 3.5 mm in width at the ends. The diameter of the drill hole is 2mm. The agate beads faced by the granulated ring beads are 5 mm in length, 5 mm to 5.5 mm in width and 3 mm in thickness. The smallest agate beads, facing the gold tubes, are 3.5 mm in length, 4 mm in width and 2.5 mm in thickness. All the drill hole diameters are 2mm. The gold tabular beads, "winged discs," are 5.5 mm in length and 6.2 mm in width. The gold tubes are 4 mm in length and have a diameter of 2.5 mm. The granulated ring beads are also 2.5 mm in diameter. There are a pair of cylindrical agate beads at the very back of the necklace, 6 mm in length and 3.5 mm in diameter. These provide the transition to the cylindrical beading tips of the same diameter. The cylinders are open on one end; the other end is pierced for the string to pass through. The knots are hidden in the cylinders. Attached to the sides are loops of wire to which the hook and eye clasp are attached. All the gold is 20k. The agate beads are two thousand years old.

The necklace is 30 3/8 inches (77.5 cm) in length.

The necklace weighs 24.5 gm.



C-3 C-4 C-5

C-4 A necklace of fifty-three barrel shaped agate beads, carnelian and transparent and opaque white

quartz, alternating with gold beads. The agate beads are barrels shaped, the five largest have the following dimensions: middle bead 2.8 cm in length, width at middle 8.4 mm, width at ends 5 mm, diameter of drill hole 3 mm. A similar bead (to the left in the photograph), length 1.72 cm, width at center 6.3 mm, width at ends 5 mm, diameter of drill hole 3 mm. The bead opposite the previous, (right side of photograph, bottom end dark brown instead of the carnelian-quartz carnelian color combination sequence of the others), length 1.78 cm, width at center 5.9 mm, width at ends 4.5 mm, drill hole diameter 3 mm. The next similar bead back from this, length 8.5 mm, width at center 5.3 mm, width at ends 4 mm, diameter of drill hole 3 mm. The opposite bead in the necklace, (back from no.2. above, left side of photograph), length 1.45 cm, width at center 5.5 mm. Width at ends 4.3 mm, diameter of drill hole 3 mm. These five beads are the same type found in the bead cloak of Queen Pu-abi, now in the British Museum. They are Sumerian, from about 2500 BC. Sir Charles L. Woolley in his excavations at Ur in Mesopotamia (1922-34) uncovered in shaft graves in the royal cemetery the jewelry of Queen Pu-abi (along with her body and the bodies and jewelry of many male and female attendants).

There are four smaller agate barrel beads (each faced with a gold bead made from a tapered wire, wound into a spiral): Length 9 mm, width 4 mm, end width 3.2 mm, hole diameter 1.8 mm. The remaining barrel beads are 5 mm in length, 3.2 mm in width, 3 mm width at ends and drill holes of 1.8 mm diameter.

The twenty-two gold tubes are 6 mm in length and three mm in diameter. The eighteen spiral wound beads are 5 mm in diameter and 3.5 mm in length graduating down to 3.8 mm diameter and 2.3 mm in length. There are two larger and ten smaller granulated beads made from three layers of six grains fused in a circle, the center circle being made of larger grains. These range in size from 5 mm (two beads) to 4 mm in diameter (ten beads). As in the previous necklace, there are gold beading tips and a hook and eye clasp. The gold is 20k.

The necklace is 24 3/8 inches (62.6 cm) in length.

The necklace weighs 62.6 gm.



C-3 C-4 C-5

C-5 A necklace of forty-nine barrel shaped agate beads, transparent and opaque white quartz and carnelian, alternating with gold beads - cylindrical tubes and granulated ring beads. The center bead is fitted with gold caps. The center bead is 2 cm in length, 8.5 mm in width at the center, and 6.5 mm wide at the ends. The drill hole diameter is 3mm. The length of the bead with the gold caps included is 2.3 cm. The ends are 7.8 mm in diameter. As in the previous necklace, this center bead is the same type as found in the bead cloak of Queen Pu-abi, now in the British Museum, excavated by Sir Charles Woolley at Ur in Mesopotamia (1922-34). Two bicone barrel beads with similar carnelian-quartz-carnelian banding are 1.3 cm and 1.4 cm in length. They are 1.64 cm wide at the center and have end diameters of 4.3 mm. The hole diameters are 2.8 mm. There are a pair of short barrel beads, (also faced with double layer granulated ring beads, as are the previous pair of barrel beads), Length 1.4 cm, width at center 5.6 mm, end width 4mm, hole diameter 2.4 mm. Length 8.3 mm, width at center 5.7 mm, width at ends 4 mm, hole diameter 2.3 mm. The remaining barrel shaped agate beads range from 6.2 mm in length, 4.1 mm wide, hole diameter 1.5mm, to 4.9 mm in length, 3 mm wide, hole diameter 1.3 mm. There are also four straight cylinder beads 6 mm in length and 3.4 mm in diameter, with drill holes 1.3mm in diameter. One of these has been artificially patterned with a white line at the end. This is the result of painting on the design with an alkaline solution which has been mixed with a natural plant resin to improve adhesion and then heating over a charcoal fire. It was obviously important to have the carnelian banded with white or clear quartz, and when the banding was lacking, it was artificially produced. This leads us to speculate that there were very definite symbolic meanings in the forms and colors of the beads which have been lost in time.

The gold tubes are 5.4 mm in length and 3mm in diameter. The four layer granulated beads that face the center bead are 5.5 mm in diameter. It is 4.5 mm in length. The sixteen double layer granulated ring beads range from 6 mm in diameter to 4 mm. There are an additional twenty granulated ring beads

in the necklace. There are two very small agate barrel beads that sit next to the beaded caps of the center bead. These allow the necklace to curve gently at the bottom by providing a pivot point on which the large granulated beads can rest. A set of gold beading tips and a hook and eye clasp complete the necklace.

C-5

The necklace is 19 7/8 inches (51.8 cm) in length.

The necklace weighs 26.6 gm.



C-6

A necklace of seven long tapered carnelian beads with gold capped ends alternating with large gold

granulated beads of five layers. The necklace is completed by gold beading tips and a hook and eye clasp.



C-6

The seven carnelian tube beads that make up this necklace are from the Indus Valley, located in present day Pakistan and India. The beads are remarkably consistent in size and shape; matching sets of these beads are rare. The dimensions are as follows ( from top right: (1.) Length with caps 4.58 cm, length of bead 3.8 cm, width at center 7.5 mm, width at ends 4 mm, hole diameter 2.5 mm. (2.) Length with caps 4.5 cm, length of bead 3.75 cm, width at center 8.4 mm, width at ends 4.4 mm, hole diameter 2.5 mm. (3.) Length with caps 4.41 cm, length of bead 3.78 cm, width at center 7.9 mm, width at ends 5 mm, hole diameter 2.5 mm. (4.) Length with caps 4.63 cm, length of bead 3.92 cm, width at center 8.9 mm, width at ends 5.2 mm, hole diameter 2.5 mm. (5.) Length with caps 4.5 cm, length of bead 3.6 cm, width at center 7.9 mm, width at ends 5 mm, hole diameter, 2.5 mm. (6.) Length with caps 4.55 cm, length of bead 3.8 cm, width at center 8.3 mm, width at ends 5 mm, hole diameter 2.5 mm. (7.) Length with caps 4.74 cm, length of bead 3.9 cm, width at center 7.3 mm, width at ends 4.6 mm, hole diameter 2.5 mm.

The constricted cylinder drills that made it possible to drill such long holes, and bead making debris have been found at the workshop city of Chanhudaro in the Indus Valley. There is also evidence of production of these beads at two great urban centers, Mohenjodaro and Harappa. They may have only been made between 2450 to 1900 BC at Chanhudaro, a period of just a few hundred years. Constricted cylinder drills were less likely to seize up during the drilling of the hole, but often the holes were stepped to smaller sizes as they progressed, sometimes leaving three channels within the bead, each smaller than the last and then stepping up to a larger size (or sizes) from the center out to the end of the

bead. These beads appear to be drilled from each end with the two holes meeting in the center. The beads are unusual in several regards. The form is slightly different from the typical long Indus carnelian tube beads. They are slightly shorter and the proportions are more exaggerated. The width in the center is proportionally thicker; the centers almost appear to bulge. The bead caps taper in at the ends to a smaller diameter than the ends of the beads which accentuates the effect.

There are six large gold granulated beads 7.5 mm in diameter and 6.2 mm in length. They are made of five layers of rings of eight granules each. The granules in the center ring are the largest and each ring decreases in size to either side of it, moving to the ends of the bead; the number of granules stays the same but their size decreases. An eight-ball ring separates the last bead caps from the beading tips. The beading tips are open ended cylinders, the closed end with a hole for the string to pass through. The knotted ends are hidden in the cylinders. A stirrup of flattened wire attaches to the sides of the cylinders providing a loop for the attachment of the hook and eye clasp. The gold is 20k and has been patinated.



C-6

The necklace is 16  $\frac{3}{4}$  inches (43.2 cm) in length.

The necklace weighs 44 gm.





C-7

A necklace of twenty-five carnelian “bow” beads alternating with small round carnelian beads each

faced with pairs of two layer ring beads. The bow beads decrease in size very slightly towards the back: Length 1.25 cm - 1.05 cm, width at center 5.05 mm – 5.0 mm, width at ends 3.5 mm – 3.0 mm, hole diameter 2. mm. The 28 small carnelian beads are 3 mm in diameter. There are 52 two layer granulated ring beads (3 mm in diameter). Gold beading tips and a hook and eye clasp complete the necklace. The beading tips are open ended cylinders, the closed end with a hole for the string to pass through. The knotted ends are hidden in the cylinders. A stirrup of flattened wire attaches to the sides of the cylinders providing a loop for the attachment of the hook and eye clasp. The gold is 20k and has been patinated. The carnelian beads are a deep, rich color and are probably about two thousand years old.



The necklace is 17 ½ inches (45.1 cm) in length.

The necklace weighs 18.1 gm.



C-8

A necklace of twenty-one carnelian “bow” beads and twenty-two small agate, carnelian and quartz, barrel beads alternating with 42 small collared gold round beads. Gold beading tips and a hook and eye clasp complete the necklace. The bow beads graduate in size: Center bead, length 1.38 cm, width at center 5.9 mm, width at ends 3.5 mm, hole diameter 1.8 mm. Typical size, length 1 cm, width at center 5.5 mm, width at ends 3 mm, hole diameter 1.5 mm. Smallest, length 8mm, width at center 4.5 mm, width at ends 3 mm, hole diameter 1.5 mm. The small agate barrel beads are 3.8 mm in length and 3 mm in diameter. The drill hole diameters are around 1mm – 1.25 mm. Some of the beads show whitening due to exposure to alkaline soil. The collared gold beads are 4.4 mm in length and have diameters of 4 mm. There is a border of small grains surrounding the hole which form the collars. The beading tips are open ended cylinders, the closed end with a hole for the string to pass through. The knotted ends are hidden in the cylinders. A stirrup of flattened wire attaches to the sides of the cylinders providing a loop for the attachment of the hook and eye clasp. The gold is 20k and has been patinated.



C-8

The necklace is 21 1/8 inches (53.5 cm) in length.

The necklace weighs 17.8 gm.



C-8



C-9

A necklace of two hundred fifty six-ball granulated ring spacers, two gold bicones and five tabular carnelian beads. The center bead has a white circle around the inside edge of each face, a so-called “etched” carnelian. The bead is 1.08 cm in length, 1.35 cm wide and 4.3 mm thick at the center. The drill hole diameter is 2.2 mm. On one side a small chip in the edge interrupts the white line that has been applied to decorate the bead. The two tabular carnelian beads to either side of the center bead are 7.25 mm in length and width. They are 3 mm in thickness and have drill hole diameters of 1 mm. The pair of tabular carnelian beads at the back of the necklace are slightly smaller: length 6.5 mm, thickness 2.7 mm - 3.2 mm. The granulated ring beads are 2.8 mm in diameter. A pair of gold bicone beads separate the three tabular carnelian beads at the center. They are 4.5 mm in length and 4.5 mm wide at

the center. A pair of beading tips and a hook and eye clasp complete the necklace. The beading tips are cylinders with one open end, the other end with a hole for the string to pass through. The knots are hidden inside the cylinders. At the open end are two circlets of gold wire which attach to the sides of the cylinders. These provide the attachment loops for the hook and eye clasp. The gold is 20k.

The center bead has a circle on each side, artificially patterned by painting on an alkali solution and then heating over charcoal. In ancient times the alkali solution was made by burning certain desert plants and then mixing the ash with gum arabic derived from the acacia thorn bush to improve adhesion. The ash (potash) contains potassium and sodium carbonate which changes the chemical composition of the agate as it is heated. It acts very much like a flux and melts into and fuses with the surface. This eye bead is from the early period of production of "etched" (a misnomer that stuck) agates and carnelians in ancient India - of about four thousand years ago. The granulation process used to make the 250 ring beads is also ancient and had to be rediscovered in modern times. It is a way to fuse high carat gold (and silver) without the use of solder. But it requires time and patience. Fifteen hundred individual grains had to be made and then fused in hexagonal rings to produce this necklace.



C-9

The necklace is 16 5/8 inches (42.4 cm) in length.

The necklace weighs 23.7 gm.



A necklace of sixty-six etched carnelian beads alternating with sixty-five granulated ring beads. The beads graduate in size. A pair of gold beading tips and a hook and eye clasp complete the necklace. The gold is 20k.

The etching of agate and carnelian beads is accomplished by painting onto the surface of the bead as alkali ( potash, white lead, and washing soda have all been reportedly used), and then subsequently firing the bead. This permanently whitens the area of the bead covered with the alkali. The whitening is not merely a glazing of the surface. The surface is often unaffected by this process; the whitening actually occurs beneath the surface and extends downward into the stone. The whitened areas may be raised on some specimen; in a few cases, the designs are sunken into the stone, the solution having acted like a flux as it was absorbed into the surface and melted the structure of the agate or carnelian. Etched beads have been manufactured since very early times. Beck attributed the specimens known to him to three main periods: Early (before 2000 BC), Middle (300 BC to 200 AD), and Late (600 to 1000 AD). Francis has expanded and revised this dating as follows: Early (2700 BC to 1800 BC), Middle (550 BC to 200 AD), and Late (224 to 642 AD). Etched beads from the earliest period have been found mainly at Mesopotamian and Indus civilization sites. The centers of their manufacture discovered so far are the Indus civilization sites of Lothal and Chanhu Daro. Middle period etched beads were found mainly at Indian subcontinent sites. Francis makes a strong case that the centers of manufacture of Late period etched beads was Iran and dates them to Sassanian times (224 to 642 AD).

Most of the beads in this necklace appear to be from the Middle period, but there are a few that are Early. Three beads are unusual: The center bead, a tapered barrel shape, has five white lines that are at the bottom of five grooves that have been shaped around the outside, down the length of the bead. These troughs have been rounded so that the bead appears to swell around the constrictions of the white lines. Two other beads have black lines instead of white and a whitened background. Beck devised a classification system calling white lines on a natural background "Type I" and those that are first whitened and then have black lines put on them "Type II." Exposure to alkaline soil over a period of time will also whiten the surface, and it seems that this process, essentially the same chemistry as artificially whitening, will also turn the white line dark. (It is now an open question whether or not these "Type II" beads were deliberately and intentionally produced or if they are merely the result of accidental processes).

The dimensions of the beads are as follows ( beginning top right going clockwise):

1. Length 5.2 mm, width 3.4 mm, width at ends 2.6 mm, hole diameter 1 mm. A barrel with one stripe.
2. Length 4.5 mm, width 3.5 mm, hole diameter 1.5 mm. A barrel with one stripe.
3. Length 4.8 mm, width 5 mm, thickness 2mm, hole diameter 1.1 mm. A diamond shape with two concentric diamonds.
4. Length 6.5 mm, width at center 3.2 mm, width at ends 2 mm, hole diameter 1mm. Similar to No. 1.
5. Length 4.9 mm, width 4 mm, hole diameter 1mm . Cylindrical with three diamonds around outside. The lines cross where the diamonds touch.
6. Length 4 mm, width 4.1 mm, thickness 2.5 mm, hole diameter 1 mm. Tabular with six dots in a circle, on each side.
7. Length 6.1 mm, width 4 mm, thickness 2.5 mm, hole diameter 1 mm. Spectacle shaped with a white line running around the inside edge on one face.
8. Length 4.9 mm, with 5 mm, hole diameter. 1 mm. Spherical with one hemispherical stripe.
9. Length 4.9 mm, With at center 3.9 mm, width at ends 3.1 mm, hole diameter 1 mm. A barrel with two enclosed shapes, "eyes," one on each side.
10. Length 4mm, width 3.9 mm, hole diameter 1 mm. A sphere with two circles, "eyes," opposite sides.

11. Length 5.5 mm, width 5.5 mm, hole diameter 1 mm. Tabular with a circle of eight dots on each face.
12. Length 5 mm, width 6 mm, thickness 2.5 mm, hole diameter 1 mm. Flat rectangular with two circles stacked to make an "8" on each face.
13. Length 5.2 mm, width 4 mm, hole diameter 1.6 mm. A barrel with two stripes.
14. Length 4.5mm, width 4.9 mm, hole diameter 1.5 mm. A sphere with three circles around the outside.
15. Length 5 mm, width 5 mm, thickness 2.3 mm, hole diameter 1.2 mm. Tabular with ten dots in a circle on each face.
16. Length 5.6 mm, width 6.2 mm, thickness 2.8 mm, hole diameter 1 mm. Diamond shape with a white line around the inside edge forming a diamond with a white dot in the center (both sides).
17. Length 5.8 mm, width at center 4.2 mm, width at ends 3.5 mm, hole diameter 1.6 mm. A barrel with one stripe.
18. Length 3.3 mm. Width 4.2 mm, hole diameter .9 mm. A drum shape with a zigzag line going around the outside. There are three points at each end.
19. Length 1.12 cm, width 4.2 mm, width at ends 3.5 mm, hole diameter 1.8 mm. Whitened by burial in alkaline soil. Three black stripes, a "Type II" in Horace Beck's terminology.
20. Length 3.4 mm, width 4.2 mm. hole diameter 1.5 mm. An irregular drum shape with one stripe.
21. Length 9 mm, width at center 5 mm, width at ends 3.5 mm, hole diameter 1.9 mm. A tapered barrel with one stripe. Compare No. 3. Early Period.
22. Length 5.2 mm, width 5.5 mm, hole diameter 1 mm. A sphere with zigzag line going around the outside. There are two points at each end making four zones within each is a short white line (parallel to drill hole).
23. Length 6 mm, width at center 5mm, width at ends 4 mm, hole diameter 1 mm. Tapered barrel with one stripe. A tapered barrel with one stripe. Compare No. 3. & No. 21.
24. Length 3.5 mm, width 6.1 mm, thickness 3.4 mm tapering in to top and bottom edges, hole diameter 2 mm. An "eye" on each face. Probably Early Period.
25. Length 7.8 mm, width at center 5.5 mm, width at ends 4.3 mm, hole diameter 2 mm. Compare with No. 21. Early Period.
26. Length 3.4 mm, width 5mm, hole diameter 1.5 mm. A drum shape with two stripes.
27. Length 6.8 mm, width at center 5.5 mm, width at ends 4.8 mm, hole diameter 1.4 mm. A barrel shape with one stripe.
28. Length 3.2 mm, width 5 mm, hole diameter 1.4 mm. A drum shape with one stripe.
29. Length 1 cm, width 5.8 mm, width at ends 4.2 mm, hole diameter 2 mm. A tapered barrel shape with a white line going round the outside at each end. Two diamonds in the middle on opposite sides.
30. Length 4.5 mm, width 6 mm, hole diameter 2mm. An irregular flattened sphere with three circles on the sides.
31. Length 1.7 cm, width at center 5 mm, width at ends 3 mm, hole diameter 2 mm. A tapered barrel with three lines going around the middle; imitation of natural banding patterns.
32. Length 6.3 mm, width 6.8 mm, hole diameter 1.9 mm. A spherical bead with a net pattern based on a dodecahedron. Each cell is a pentagon. Whitened by alkaline exposure during burial.
33. Length 1.5 cm, width at center 6.1 mm, width at ends 4 mm, hole diameter 2 mm. The bead is a tapered barrel, shaped with five rounded "valleys," at the bottom of each is a white line. It is rare to have a bead that is both shaped and decorated with the shaping obviously meant to interact with the white lines. Early period.
34. Length 3.5 mm, width 5.9 mm, hole diameter 1.3 mm. Three circles, "eyes" around the outside of a flattened sphere. Compare to No. 29.
35. Length 7.3 mm, width at center 5.5 mm, width at ends 4.5 mm, hole diameter 1.5 mm. A barrel

- shaped bead with one stripe. Compare with No. 27.
36. Length 4.2 mm, width 6.55, thickness 3.8 mm, hole diameter 1mm. Each side has a white line following the outside edge to make a rectangle.
  37. Length 1.06 cm, width at center 1 cm, width at ends 3.2 mm, hole diameter 1.4 mm. A barrel with one stripe. Compare with No. 21.
  38. Length 4.2 mm, width 4.5 mm hole diameter 1 mm. A drum shape with two stripes. Compare with No. 26.
  39. Length 6.5 mm, width 5.6 mm, width at ends 4.9 mm, hole diameter 2.3 mm. A barrel shaped bead with one stripe. Early Period. Compare with no. 34.
  40. Length 5 mm, width 6.5 mm, thickness 3.6 mm, hole diameter 1.5 mm. A tabular bead with a thick white line parallel with the drill hole.
  41. Length 3.5 mm, width 4mm, hole diameter 1.5 mm. A drum shape with two stripes. Compare with No. 37 & 26.
  42. Length 6.1 mm width at center 5.5 mm, width at ends 3.5 mm, hole diameter 1.5 mm. A barrel with one stripe. Compare with Nos. 38. 34. & 27.
  43. Length 4.5 mm, width 5 mm, hole diameter 1.3 mm. A sphere with a zigzag line – three points on each end.
  44. Length Length 7.5 mm, width at center 5 mm, width at ends 3.4 mm, hole diameter 1.5 mm. A barrel with one stripe. Compare with Nos. 38. 34. & 27.
  45. Length 4.1 mm, width 5 mm, hole diameter 1 mm. A sphere with one stripe. Compare with No. 8.
  46. Length 6.9 mm, width at center 4 mm, width at ends 3.2 mm, hole diameter 1.6 mm. A barrel shape with lines around the ends and a wavy line around the center zone creating two spaces on opposite sides. Two small triangles, the bases being the end bordering lines, extend into the two zones. (The lines of the triangles are partially missing).
  47. Length 3.4 mm, width 4.3 mm hole diameter 1.6 mm. A flattened sphere with one stripe. Compare to Nos. 48. & 44.
  48. Length 5.5 mm, width 4 mm, hole diameter 1.2 mm. A barrel with lines around the ends . Two half circles, like “D's” are in the central zone, between the borders. Two triangles , their bases being one of the border lines around the end, fill the curved spaces between the “D's.” The bead has been whitened by exposure to alkaline soil. (In order to execute this complex design in such a small space, the white lines had to be extremely narrow).
  49. Length 2.9 mm, width 4.4 mm, hole diameter 1 mm. A drum shape with one stripe. Compare with No. 28.
  50. Length 1.1 cm, width at center 4 mm, width at ends 3.1 mm, hole diameter A tapered barrel bead with one stripe. Longer and thinner in proportions than Nos. 44. 38. 34. & 27.
  51. Length 5.3 mm, width 6.2 mm, thickness 2.2 mm, hole diameter 1 mm. A diamond shaped tabular bead with a white diamond outlining each face. Compare with No. 59.
  52. Length 6.1 mm, width 4.5 mm, thickness 2.5 mm tapering to the outer edges, hole diameter 1 mm. Two white lines, one in the center and one to the side and slightly curving, imitate natural banding.
  53. 5.9 mm, width at center 4.2 mm, width at ends 3.3 mm, hole diameter 1.3 mm. A barrel with one stripe. Compare with No. 17.
  54. Length 5 mm, width 5 mm, hole diameter 1 mm. A tabular bead with eight dots around the inside of the outer edge of the circle. Compare with No. 5r7.
  55. Length 7.3 mm, width at center 4.1 mm, width at ends 2.1 mm. Hole diameter 1mm. A barrel bead with one stripe that zigzags very slightly.
  56. Length 4.7 mm, width 4 mm, width at ends 3.2 mm, hole diameter 1.2 mm. Three elongated diamonds around the bead.

57. Length 4.4 mm width 4.4 mm, hole diameter 1 mm. A tabular bead with eight dots around the inside of the outer edge of the circle. Compare with No. 54.
58. Length 6.5 mm, width at center 4.1 mm, width at ends 3 mm, hole diameter 1 mm. A barrel with one stripe. Irregularly shaped.
59. Length 5 mm, width 5.9 mm, thickness 2.5 mm, hole diameter 1 mm. A diamond shaped tabular bead with a diamond outlining the outer edge of the faces. Compare with No. 51.
60. Length 6 mm, width 4.1 mm, width at ends 2.5 mm, hole diameter 1 mm. A barrel bead with end bordering lines and a zigzag line in the central zone; the points are connected to the borderlines which makes six pentagonal cells, three on each end alternating around the central zigzag. Compare to No. 32, the round version of this barrel bead.
61. Length 6.5 mm, width 3 mm, hole diameter 1.3 mm. A triangular prism shaped bead with two white stripes towards the ends.
62. Length 6.3 mm, width 3.5 mm, hole diameter 1 mm. Similar to the previous, No. 61.
63. Length 5.2 mm, width 3 mm, hole diameter 1mm. Similar to the previous two, Nos. 62. & 63.
64. Length 6.2 mm, width 3.1 mm, hole diameter 1.2 mm. Irregularly shaped with two white stripes, one of which is a zigzag with three points.
65. Length 4.5 mm, width 3.4 mm, hole diameter 1.5 mm. A cylinder with three stripes.
66. Length 4.4 mm, width 2.6 mm, width at ends 2.8 mm, hole diameter 1mm. A barrel with one stripe. Compare with No. 4.



C-10 Nos. 36. 35. 34. 33. 32. 31. 30. 29. 28. 27. 26.



C-10

Nos. 31. (partial) 30. 29. 28. 27. 26. 25. 24. 23. 22. 21. 20. 19. (partial)



C-10

1. Nos. 23. (partial), 22. 21. 20. 19. 18. 17. 16. 15. 14. 13. 12.



C-10

Nos. 15. (partial) 14. 13. 12. 11. 10. 9. 8. 7. 6. 5. 4. 3. 2. 1.

C-10

The necklace is 20 5/8 inches (53.5 cm) in length.  
The necklace weighs 22.2 gm.



C-10 Nos. 1-7





C -11

A necklace of twenty-eight cylindrical carnelian beads alternating with twenty-seven turquoise beads ,

each faced with two granulated gold ring beads. The center turquoise bead is elliptical or oval shaped; the remaining turquoise beads are small discs. A set of gold beading tips and a hook and eye clasp completes the necklace. The gold is 20k.

The center bead is 1.65 cm in length, 8.8 mm wide at the center , 4 mm wide at the ends and 3.4 mm in thickness. The hole diameter is 2 mm. Gold tubes have been inserted into the holes to correct for some slight chipping at the drill hole, a not uncommon fate for many ancient beads. The turquoise discs are 1.5 mm in length and 3.4 mm in diameter. The hole diameters are 1.5 mm. The carnelian beads are 10 mm – 6.5 mm in length, 4mm -3mm in diameter, with drill hole diameters of 1.5 mm. All the beads are ancient, probably from about two thousand years ago. The beads have been selected for their deep rich colors.

C-11

The necklace is 18 5/8 inches (47.5 cm) in length.  
The necklace weighs 47.5 gm.



C-12





C-12

A necklace of fifty-seven etched carnelian beads – twenty-eight round (or short cylinders) and twenty-nine barrel beads alternating, with fifty-six gold granulated ring beads spacing them. A set of gold beading tips and a hook and eye clasp complete the necklace. The gold is 20k.

The etching of agate and carnelian beads is accomplished by painting onto the surface of the bead as alkali (potash, white lead, and washing soda have all been reportedly used), and then subsequently firing the bead. This permanently whitens the area of the bead covered with the alkali. The whitening is not merely a glazing of the surface. The surface is often unaffected by this process; the whitening actually occurs beneath the surface and extends downward into the stone. The whitened areas may be raised on some specimen; in a few cases, the designs are sunken into the stone, the solution having acted like a flux as it was absorbed into the surface and melted the structure of the agate or carnelian. Etched beads have been manufactured since very early times. Beck attributed the specimens known to him to three main periods: Early (before 2000 BC), Middle (300 BC to 200 AD), and Late (600 to 1000 AD). Francis has expanded and revised this dating as follows: Early (2700 BC to 1800 BC), Middle (550 BC to 200 AD), and Late (224 to 642 AD). Etched beads from the earliest period have been found mainly at Mesopotamian and Indus civilization sites. The centers of their manufacture discovered so far are the Indus civilization sites of Lothal and Chanhu Daro. Middle period etched beads were found mainly at Indian subcontinent sites. Francis makes a strong case that the centers of manufacture of Late period etched beads was Iran and dates them to Sassanian times (224 to 642 AD).

The dimensions of the beads are as follows:

1. A barrel with one stripe- Length, 7.2 mm, width at center 4 mm, end width 3 mm, hole diameter 1.5 mm. Some whitening due to burial in alkaline soil.
2. A round bead with one stripe- Length 3.8 mm, width 4.3 mm, hole diameter 1.5mm. Carnelian is a dark color.

3. A tapered barrel shape with four stripes, two at each end zone- Length 1.26 cm, width 4.2 mm, end width 2.8 cm hole diameter 1.8 mm. Early Period.
4. A roughly shaped short barrel with a zigzag (three points to each end).- Length 3.8 mm. Width 4.4 mm, hole diameter 1.2 mm.
5. A cylinder with the ends very rounded, two stripes- Length 8.2 mm, width 4.6 mm hole diameter 1 mm. Lines are thicker on one side.
6. A round bead with three lozenge shaped “eyes” - Length 4.6 mm, width 5 mm, hole diameter 1 mm.
7. A barrel bead with three stripes- Length 8 mm, width 5 mm, width at ends 3.4 mm, hole diameter 1.5 mm. Early Period.
8. A short cylinder bead with one stripe- Length 4 mm, width 4.5 mm, hole diameter 1.2 mm.
9. A barrel bead with two stripes- Length 8.9 mm, width 4.9 mm, hole diameter 1.2 mm
10. A short cylinder bead with one stripe- Length 3.1 mm, width 5 mm, hole diameter 1 mm.
11. A barrel with three diamonds , their points touching at the center ( or three “X's” with their legs meeting at the ends of the bead)- Length 7.5 mm, width 4.5 mm, end width 3 mm, hole diameter 1.6 mm. Carnelian is a dark color and white lines are thin and worn in places.
12. A round bead with three circles or “eyes”-Length 4.5 mm, width 5.3 mm, hole diameter 1.2 mm. Carnelian is a dark color.
13. A barrel with two stripes- Length 9.3 mm, width at center 4.9 mm, end width 3.5 mm, hole diameter 1.9 mm. Early Period. Whitening on one side from burial in alkaline soil.
14. A round bead with a zigzag (three points at each end)- Length 4.9 mm, width 5.2 mm, hole diameter 1.9 mm.
15. A barrel with three stripes- Length 9.5 mm, width 5 mm, end width 3.5 mm, hole diameter 1.8 mm. Early Period.
16. A drum shaped cylinder with a zigzag- Length 4 mm, width 5 mm, hole diameter 1.1 mm.
17. A barrel with three stripes- Length 1.1 cm, width 5 mm – 5.9 mm (flattened shape), end width 4.8 mm – 4 mm, hole diameter 2.2 mm. Early Period.
18. A round bead with one stripe- Length 4.5 mm, width 5.9 mm, hole diameter 1.2 mm.
19. A barrel bead with four lines, one end missing, three lines, two in the center and one on each end, one of which is missing- Length 1 mm (complete it would be 1.3 mm), width at center 5.9 mm ,end width ( on unbroken end) 4.5 mm, hole diameter 1.8 mm. Early Period.
20. A round bead with a zigzag (four points at each end) and stripes at the ends- Length 4.2 mm, width 5.7 mm, hole diameter 1.2 mm. Classic Middle Period bead.
21. A barrel bead with three black lines- Length 1.25 cm, width 6.1 mm, end width 4.3 mm, hole diameter 2 mm. Early Period. Whitening due to burial which also affected the lines turning them black. Beck called these Type II, but this is probably not an intentional treatment.
22. A round bead with a white stripe- Length 4 mm, width 5.3 mm, hole diameter 1.2 mm. Carnelian is a dark color.
23. A barrel bead with three stripes- Length 8.6 mm, width 6.2 mm, hole diameter 1.22. Middle Period.
24. A round bead with three diamonds, a line inside the diamond- Length 4.5 mm, width 6 mm, hole diameter 1.2 mm.
25. A barrel with four lines- Length 1.55 cm, width 6.8 mm- 6 mm (slightly flattened shape)- end width 4 mm. Hole diameter 2 mm. Early Period.
26. A round bead with a zigzag (four points at each end)- Length 5.5 mm, width 6 mm, hole diameter 1 mm. Carnelian is a dark color. The white lines are slightly orange due to exposure to alkaline soil.
27. A barrel bead with five lines encircling- Length 1.32 cm, width 6.3 mm, hole diameter 1.3 mm. Middle Period.

28. A round bead with a zigzag (five points at each end)- Length 5.5 mm, width 6 mm hole diameter 1 mm. Whitened due to burial in alkaline soil.
29. A barrel with four lines- Length 1.15 cm, width 7 mm -6.2 mm (slightly flattened shape), end width 4.6 mm- 4.9 mm, hole diameter 1.2 mm.
30. A short drum shaped cylinder with one stripe- Length 4.1 mm, width 5.2 mm, hole diameter 1.1 mm.
31. A barrel bead with five lines- Length 1.59 cm, width at center 6.5, end width 4.6 mm, hole diameter 1 mm. Middle period. Whitening due to exposure to alkaline soil.
32. A truncated bicone with a sharp center line and one stripe going around- Length 4.9 mm, width at center 5.5 mm, width at ends 3.9 mm, hole diameter 1.5 mm. Whitened due to burial.
33. A barrel with five lines- Length 1.55 cm, width at center 6.3mm, width at ends 4.9 mm, hole diameter 1.2 mm.
34. A round bead with a zigzag (three points)-Length 5 mm, width 5.2 mm, hole diameter 1.2 mm.
35. A barrel with three stripes- Length 1 cm, width at center 6mm, width at ends 4.5 mm, hole diameter 1 mm. Orange on one end and quartz on the other. Two lines in the quartz zone and the third divides the orange end from the quartz zone.
36. A drum shaped cylinder with one stripe- Length 3.9 mm,width 5.3 mm, hole diameter 1 mm.
37. A barrel with three lines- Length 1.2 mm, width 6.3 mm, width at ends 5 mm, hole diameter 2 mm. Early Period
38. A round bead with a zigzag (four points at each end) a dash in each of the zones (parallel to the drill hole)- Length 5 mm, width 5.5 mm, drill hole diameter 1 mm. Middle Period.
39. A barrel with three lines- Length 9 mm, width 6.1 mm, width at end 4.9 mm, drill hole diameter 1 mm.
40. A round bead with one stripe- Length 5.5 mm, width 5.3 mm , hole diameter 2 mm. Early Period. Very red on one side and the line is missing.
41. A barrel with three lines- Length 9.2 mm, width at center 5mm-5.5mm (slightly flattened), width at ends 4 mm, hole diameter 1.2 mm.
42. A drum shaped cylinder with a stripe that wobbles about the center- Length 3.9 mm, width 5.5 mm, width at ends 4.1 mm, hole diameter 1 mm. Jasper, red on one side, pale on the other.
43. A barrel with three thin stripes- Length 9 mm, width 5 mm, end width 4 mm, hole diameter 1.7 mm. Early Period.
44. A round bead with a zigzag (four points at each end)- Length 5 mm, width 5.3 mm, hole diameter 1.2 mm.
45. A barrel bead with three stripes- Length 8 mm, width 5 mm, end width 3.5 mm, hole diameter 1.2 mm.
46. A round bead with a zigzag (three points at each end)- Length 4.9 mm, width 5.1 mm, hole diameter 1.2 mm.
47. A barrel bead with lines encircling each end and a zigzag in the central zone (three points at each end)- Length 8.1 mm, width at center 5 mm, end width 3.1 mm, hole diameter 2mm. Early Period. Very dark color red carnelian.
48. A drum shaped cylinder bead with a zigzag (seven points at each end)- Length 3.9 mm, width 4.8 mm, hole diameter 1 mm.
49. A barrel bead with two lines slightly off center- Length 9.2 mm, width at center 4.9 mm, width at ends, hole diameter 1 mm. Lines missing in red zone on back.
50. A truncated bicone with a stripe at the center (similar to No. 32)- Length 4mm, width at center 5 mm, hole diameter 1.2 mm.
51. A barrel bead with three white lines- Length 8.1 mm, width at center 4.9 mm, end width 3.8 mm, hole diameter 1.3 mm.

52. A short barrel bead with a stripe that wobbles about the center (similar to No. 42)- Length 3.8 mm, width 4.5 mm, hole diameter 1.2 mm.
53. A barrel bead with two stripes- Length 9.6 mm, width at center 4.5 mm, end width 2.9 mm, hole diameter 1.2 mm. Whitening due to burial.
54. A drum shaped cylinder with one stripe- Length 4 mm, width 4.2 mm, hole diameter 1 mm
55. A cylinder with rounded ends with two stripes. The stripes are slightly indented into the stone.- Length 8.9mm, width 4.1 mm, hole diameter 1.2 mm.
56. A truncated bicone with one stripe (similar to Nos. 42. & 52.)- Length 3.5 mm, width 3.5 mm. Hole diameter 1.2 mm.
57. A barrel bead with two stripes that wobble around the circumference- Length 9.2 mm, width 4.1 mm, end width 3.2 mm, hole diameter 2 mm. Early Period. The curving of the lines is meant to imitate natural banding.

C-12

The necklace is 22 inches (55.5) in length

The necklace weighs 28.2 gm.



C-13

A necklace of two hundred sixty-four etched carnelian beads spaced with turquoise disc beads and organized into four strands which are fed into two large round gold beads framing a rhomboid shaped tabular bead of carnelian and quartz. Gold beading tips and a hook and eye clasp complete the necklace.

The rhomboid carnelian bead is 2.4 cm in length, 1.8 cm in width at the widest point and 4.4 mm in thickness at the middle. The ends are 4.8 mm in width and the drill hole is 2 mm in diameter. There is some minor chipping along one of the thin outer edges. The etched carnelian beads are round tabular beads with white circles outlining their two faces, rectangular tabular beads with white lines outlining their rectangular faces and oval shapes, similarly decorated. The beads are 5 mm in length. The

rectangles are 3.0 mm – 3.8 mm in width, the ovals are similar in size. They are 2.5 mm to 3.0 mm in thickness. The turquoise discs are 3 mm in diameter and 1 mm in length. The drill holes of all the small beads are 1 mm or slightly less.

The gold spheres are 8.2 mm in diameter. The spheres in the beading tips are 7.2 mm in diameter. The 20k gold is alloyed with silver. The gold has been patinated and given a darker hue.



The center bead is a Bronze age bead from 2,000 BC from what is now present day Afghanistan. The etched carnelian beads in this necklace are difficult to date and probably date from late in the history of their production. The etching of agate and carnelian beads is accomplished by painting onto the surface of the bead as alkali ( potash, white lead, and washing soda have all been reportedly used), and then subsequently firing the bead. This permanently whitens the area of the bead covered with the alkali. The whitening is not merely a glazing of the surface. The surface is often unaffected by this process; the whitening actually occurs beneath the surface and extends downward into the stone. The whitened areas may be raised on some specimen; in a few cases, the designs are sunken into the stone, the solution having acted like a flux as it was absorbed into the surface and melted the structure of the agate or carnelian. The etching of agate and carnelian beads is accomplished by painting onto the surface of the bead as alkali ( potash, white lead, and washing soda have all been reportedly used), and then subsequently firing the bead. This permanently whitens the area of the bead covered with the alkali. The whitening is not merely a glazing of the surface. The surface is often unaffected by this process; the whitening actually occurs beneath the surface and extends downward into the stone. The whitened areas may be raised on some specimen; in a few cases, the designs are sunken into the stone, the solution having acted like a flux as it was absorbed into the surface and melted the structure of the agate or carnelian.

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The necklace is 24 1/8 inches (61.6 cm) in length.

The necklace weighs 44.8 gm



Carnelian

C-1.....	\$14,000
C-2.....	\$10,750
C-3.....	\$7,500
C-4.....	\$9,000
C-5.....	\$8,750
C-6.....	\$18,250
C-7.....	\$6,750
C-8.....	\$6,955
C-9.....	\$8,800
C-10.....	\$10,300
C-11.....	\$3,600
C-12.....	\$9,750
C-13.....	\$7,500