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'Ayn Ghazāl: A Comparative Study of the 1983 and 1985 Statuary Caches

Introduction

The recovery of two caches of lime plaster statues at the PPNB site of 'Ayn Ghazāl in 1983 and 1985 respectively has initiated a welter of activity related to the investigation of the manufacturing techniques, and the identification of materials used in the process, and also, speculation concerning the purpose these figures served and some reflection on the artistry and sophistication of their creators.[1] Running in tandem with these issues has been concern over the preservation of the statues. Research efforts at both the Institute of Archaeology, London and the Conservation Analytical Laboratory of the Smithsonian Institution, Washington, D.C. have been directed towards developing the best possible course of treatment given the present state of the art/science of conservation. The condition of the statues and the materials used in their manufacture pose unique problems for the conservator.

Condition and Technology

Plaster

The location on the site of the two statue caches has had a considerable impact on their condition. Both caches were affected by the construction of a motorway through the site in the mid-seventies (which led to the discovery of the site). Adjacent to the motorway, running along its length, a section was cut out of the slope to create a terrace to accommodate the movement of bulldozers and other heavy equipment.

The 1983 cache lay approximately 1.5m below this cut. The vibration and weight generated by the machinery were partially dispersed by the intervening occupation layers; however, the resultant crushing, cracking and breaking of the objects were severe. The statues had originally been constructed on a reed/rush core which had deteriorated completely. The voids thus created have either all but disappeared as a result of compression caused by the overburden of soil and compounded by the bulldozer traffic, or are filled with a free-flowing silt containing a high proportion of plaster crumbs which were originally intermeshed with the uneven perimeter of the organic core. Where the front and the back of the statues have compacted, the plaster is virtually pulverized or has achieved the new shape through the formation of a myriad of fine networks of cracks (FIG. 1).

1. 1983 cache (having been inverted in the field during lifting) undergoing excavation in the laboratory.

[1] For the discovery and nature of the 1983 cache of statues, see Rollefson 1985, Tubb 1985 and Tubb 1987. For the statues excavated in 1985, see Rollefson and Simmons 1986.

The presence of the second cache was suspected in 1984 when material similar to that of the first cache was observed to be eroding out of the vertical side of the terrace cut for the bulldozers. That part of the contents of the cache which had been subjected to this gradual exposure, in a zone which would have formed an evaporation front for moisture in the ground, has sustained severe water damage, perhaps also attributable to an ancient intrusive pit. Until the second cache could be lifted the following season, the exposed area was back–filled to try to arrest any further deterioration (FIG. 2).

Apart from the differences in condition attributable to the particularities in situation then, the plaster of both caches varies in the degree of its fragility from extremely fragile to relatively sound. In addition, where the plaster of adjacent figures has been in intimate contact, not separated by even a millimetre of pit fill, presumed cycling of the calcium carbonate between carbonate and bicarbonate in response to moisture in the burial environment has resulted in the formation of a natural cement in these areas.

Another factor contributing to differences in condition of the two caches may have been modifications in production method and/or compositional differences of the plaster. Evaluation of this evidence by Tubb and Grissom is still incomplete and, subsequently, it is not altogether clear whether or not perceived differences are the result largely of semantics and methodology. Should this prove to be the case, they may be deemed insignificant as research and collaboration progress.

Only a small number of plaster samples from the 1983 cache has been subjected to X–ray diffraction, scanning electron microscopy (SEM) and energy dispersive X–ray analysis by M. Fabrizi of the Institute of Archaeology and S. Tarling of Birkbeck College in London thus far. The results of these tests reveal a content of 89–90% calcite (calcium carbonate), 8–10% α-quartz (silicon dioxide) and a 0–3% mixture of three phases the best matches for which are fairchildite ($K_2Ca(CO_3)_2$), ferroan dolomite ($Ca(Mg[0.67]Fe[0.33])(CO_3)$ and buetschlite ($K_2Ca(CO_3)_2$). A comparison of a limestone sample from an outcrop on the site and of plaster samples using scanning electron microscopy reveals a marked morphological difference. The former is characterized by clearly defined particles and appears to be fairly crystalline. By contrast, the latter are characterized by a much smaller grain size with areas which tend to be amorphous or colloidal structurally. The lime plaster from the statues is rich in nannofossil content, however. Experiments conducted at the Institute of Archaeology in

2. Detail of 1985 cache undergoing excavation in the laboratory. N.B. The bituminous mastic used to decorate the eyes has been removed temporarily prior to consolidation of the statues.

London revealed that at temperatures of 700°C the structure of these nannofossils begins to soften and break down. Comparison of statue plaster with wall plaster reveals that the latter contains far fewer nannofossils.

Tubb has concluded, therefore, that a nannofossil rich mineral source, perhaps the chalk referred to by Mandel and Simmons (1988: 431) as being abundant in the area, was crushed and used as a filler to modify the working properties of the slaked lime putty. Certainly, too little quartz is present to have reduced shrinkage sufficiently for the plaster to perform satisfactorily. Indeed, it is possible that the quartz is present not intentionally but rather as a constituent of the stone used for calcination. The proportion of filler to slaked lime is normally on the order of 3:1 (Ashurst 1983: 19). Some of the nannofossils may be present as survivors of incomplete calcination, but the large quantities present in the statue plaster as opposed to the finer wall plaster lead inexorably to their identification as the mineral aggregate fraction of the plaster.

Stated simply, the 1983 statues are lime plaster consisting of recarbonated lime, a relatively small amount of sand and a high proportion of nannofossil rich calcite.

Plaster samples from the 1985 cache, on the other hand, reveal that the statues are made of a water resistant plaster, composed principally of calcium carbonate, with significant amounts of clay and small amounts of quartz. Acid digestion of samples from this cache showed an average of 13% by weight for the clay/soil fraction. X–ray diffraction analysis of the clay fraction showed a 14A clay mineral, probably montmorillonite; analysis of the soil–sized fraction showed quartz and augite. The sand fraction was less than 1% by weight. There is abundant marl at the site, and there is good evidence that this was the raw material for the statues. SEM comparison of samples from the 1985 cache and samples of local marl show many similarities, including the presence of fossils known as coccoliths (Boulton 1988: 44).

There is less certainty, however, on the extent to which the marl was heated. Crystallites, the small submicron particles which are characteristic of calcined lime, are not visible with a scanning electron microscope, although they were produced when the marl was heated to 850°C. After samples of the marl were heated in the laboratory to temperatures of 650°C, scanning electron microscopy showed the fossils beginning to decompose; at 700°C the fossils had disappeared (Boulton 1988: 45–48). The temperature of 650°C would have been about the minimum for calcination to have occurred: the disassociation temperature for pure limestone varies from 660°C to 898°C, depending inversely on the efficiency with which carbon dioxide is removed; however, the temperature can be lower in the presence of impurities.

Practical experiments made with ground marl show that a water resistant material can be made with either a small percentage of lime plaster (for example, 10%) or with some heating (for example, 600°C). In either instance, the SEM appearance of the marl is not visibly altered and matches that of the figure plaster.

An interesting side line is being examined by J. Burnett[2] of the Micropalaeontology Unit, University College London because of the abundance of nannofossil material in the plaster samples. She has separated out the nannofossils from samples taken from Figures 35 (Reema), 37 (Pescennia Nigra), 38 (Zeina) and Dumpies 5 (Scaramouche), 33 (Uriah), identified them and isolated the age–indicative species so that a geological date can be given to the mineral source. The results have been mid upper Cretaceous, more precisely, Turonian and Santonian, and support the obvious assumption that the raw material was local in origin (Bender 1974: 77–78, and FIG. 76) .

Armatures

The statues were formed by modelling the wet plaster on a reed/rush core, identified as either *Phragmites* which grows in Jordan along streams and rivers or *Arunda* by D. Cutler of the Jodrell Laboratories, Kew Gardens in London, which served as an armature for them. The bundles of reeds were secured, reinforced and spliced together using twine. Impressions of the reeds/rushes and of the twine have been beautifully preserved in the plaster.

The cores of the dumpies from the 1983 cache consisted of a simple bundle of reeds which extended from the heads down through the centres of the bodies from half to three–quarters of their total heights, leaving broad solid bases on which they would have been quite stable and rendering them ultimately portable. Only one bust has been found to date in the 1985 cache, and this has not yet been fully excavated so that its internal structure remains unknown.

The construction of the armatures of the full figures was much more complex. In the case of Reema, Figure 35, and Zeina, Figure 38, which have been thoroughly examined, two bundles of reeds extended through the legs to shoulder height separated by a third bundle between them running through the torso, neck and into the

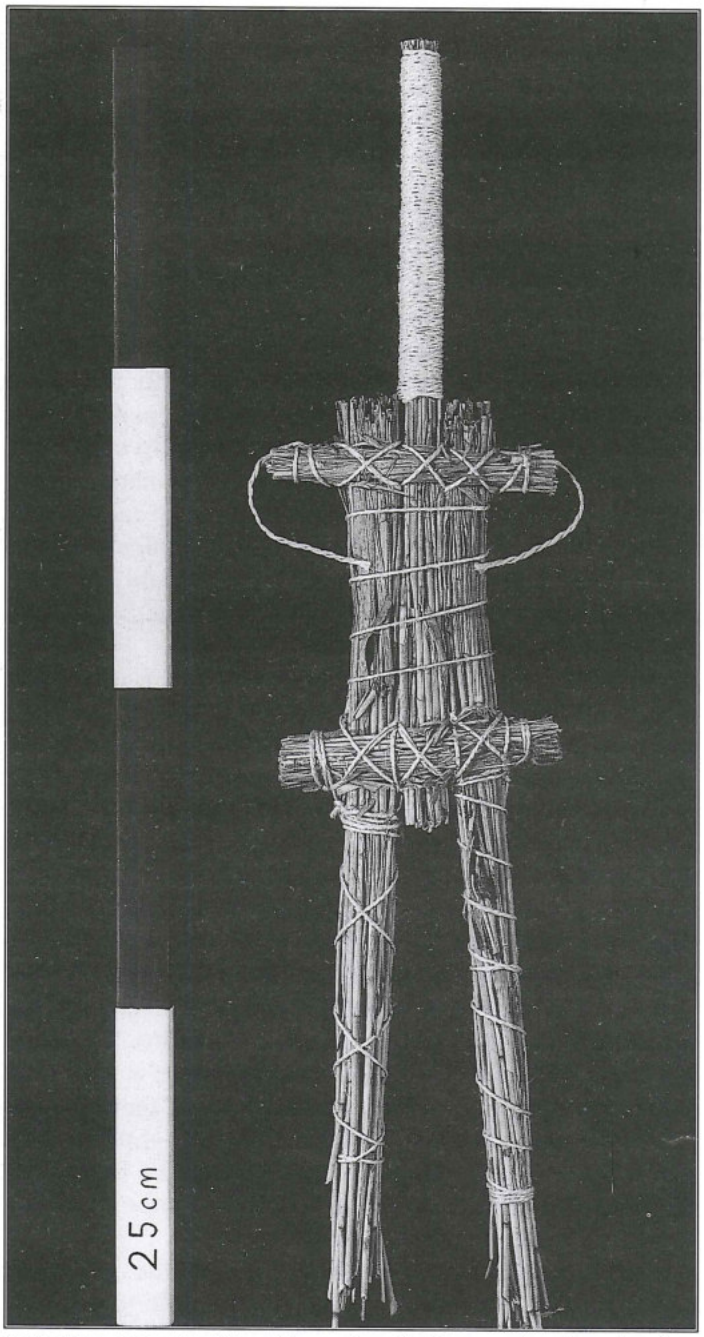
[2] Tubb is grateful to the following for their invaluable contributions: A. Roy and R. White of the National Gallery, London; M. Fabrizi and E. Titford of the Institute of Archaeology, London; J. Burnett of the Micropalaeontology Unit, University College London; S. Tarling of Birkbeck College, London; and D. Cutler of Jodrell Laboratory, Kew Gardens, London. She is also deeply indebted to P. Dorrell and S. Laidlaw for all their efforts in documenting the work photographically and to the Palestine Exploration Fund for kind permission to print two photographs from the Garstang archive. Tubb is also extremely grateful to the Department of Antiquities of Jordan and particularly Dr A. Hadidi, Dr G. Bisheh and Dr S. Tell for their unstinting support over the years.

head. At both hip and shoulder level the width of the armatures was extended by the addition of horizontal cross members of reed/rush bundles. Long pieces of twine were either looped around the bundles or crossed over around them to secure these elements in the leg and torso areas. Beginning at the bottom of the neck, a long piece of twine was lashed around the reed bundle thereby forming a continuous cover of it from the base of the neck to the top of the head, leaving the reeds to project slightly at the apex. The arms were modelled around a single piece of twine extending from the reed core in the shoulders of the figures. The figures have holes in their feet through which the reed bundles projected for at least 18cm based on evidence in the pit fill. These extensions, when embedded in a floor, would have provided an anchorage for the figures lending them stability when standing but also rendering them stationary (FIG. 3). While there are holes in the heels of the 1985 cache figures, damage to the area of the cache where they are located precludes the presence of such evidence.

The uneven contours of the armatures served as an ideal surface for the plaster to key into. Additionally, Tubb suggests that the reeds were probably used in a green state which would have reduced the tendency for water from the wet plaster mix to have been drawn into the armature ultimately decreasing the strength of the plaster and increasing the likelihood of it cracking. Evidence that the reeds used to form the cross–members were folded at their outer limits rather than cut as evinced in the plaster impressions supports the theory that the reeds were not dry during the formation of the armatures.

The use of an organic core in conjunction with plaster can then be seen to be a tradition spanning nine thousand years. It was observed by Strabo (XVI.1: 5–6) in Babylon, recorded in Hall 41 at Persepolis (Schmidt 1939: 54, FIG. 33) and documented by Wulff (1966: 135) in Iran as recently as 1966.

The amount of plaster around the bundles varies substantially throughout each statue. At some points the plaster wall is very thick and at others, as thin as a few millimetres. In some locations on the 1985 statues it appears that a thin, final layer was applied to the surface: this layer has a tendency to exfoliate.



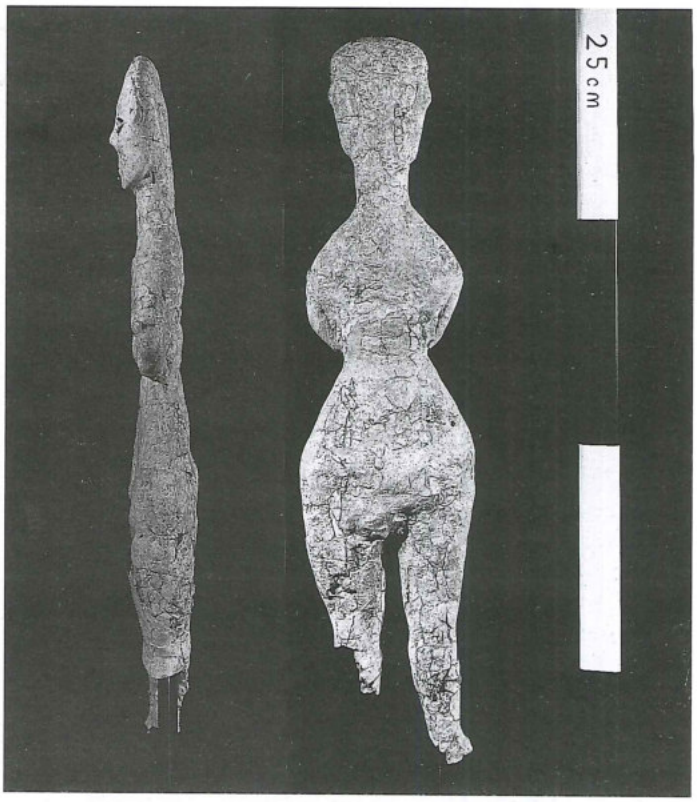
3. Modern reconstruction of a reed and twine armature based on impressions noted in the interiors of Figures 35 and 38, Reema and Zeina (1983 cache). N.B. The reeds extending below the twine on the legs represent the projecting bundles which would originally have served to anchor the statues.

Surface Decoration

In both caches, a black mastic was used to delineate the eyes and create the irises/pupils (FIGS. 4, 6, 8-11). Optical microscopy of a sample from the 1983 cache revealed two components: 1) bitumen characterized by transparent brown, structureless, low relief, irregularly shaped particles, and 2) charcoal characterized by brown and black, small, opaque, elongated and splintery particles. Gas chromatography coupled with mass spectrometry was also used on a 1983 cache sample by R. White of the National Gallery, London, and suggested a bituminous component as part of a composite mastic.

The eyeliner was pressed into a groove cut around the eyeball (FIG. 2). It overlays the groove, whose edges are rounded, and stands somewhat in relief. The irises/pupils, on the other hand, were simply applied to the plaster surface of the eyeballs at their centres, the natural tack of the bitumen alone being relied upon for adhesion.

4. Front of Figure 35, Reema, after conservation (1983 cache).



5. Side and back of Figure 35, Reema, after conservation (1983 cache).

The bituminous mastic is now extremely brittle, frequently fractured to the point of being shattered, occasionally displaced and often missing at least in part.

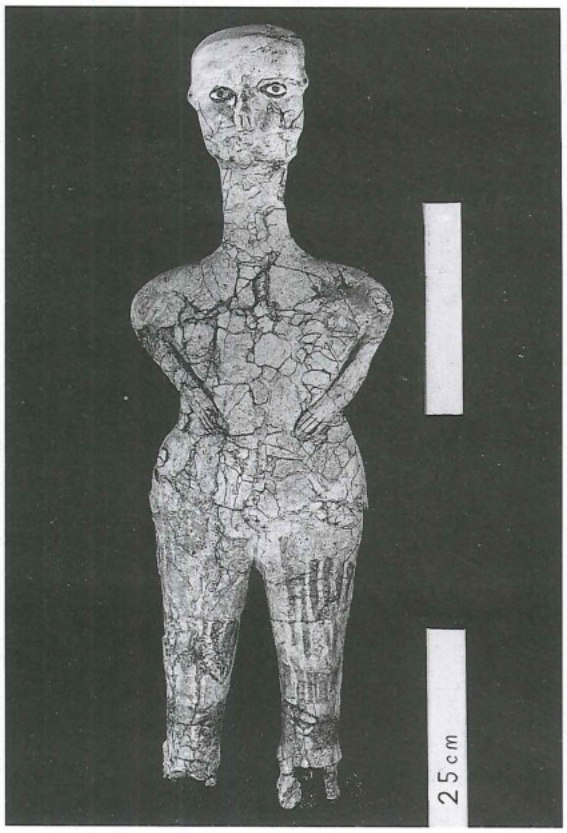
A dusting of large translucent emerald green crystals was applied to the eyeliner of some of the 1983 cache statues and has been identified using X–ray diffraction as dioptase, a hydrated copper silicate, by A. Roy of the National Gallery, London. This pigment has also been identified as a colourant on PPNB plaster beads from the Nahal Hemar Cave (Kingery 1988: 45). However, no traces of dioptase have been found to date on the 1985 cache statues.

The eyeballs of some of the 1983 statues are startling white in appearance which has led to speculation that they may have been built up to their full roundedness using a purer, whiter plaster (Tubb 1985: 118). This remains conjectural. This feature has not been observed by Grissom on the 1985 group, although the faces in general seem to be smoother and whiter than other portions of the statues. A fine white limewash/plaster was certainly applied to the heads and necks of the 1983 dumpies which have been examined.

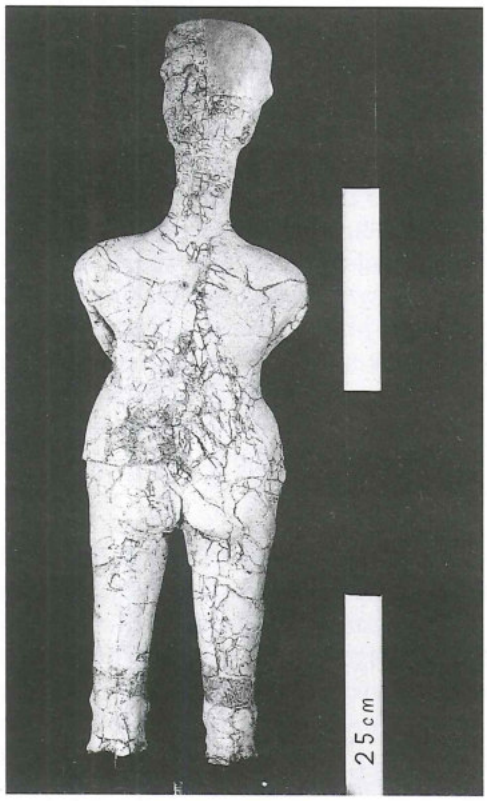
Carbon black and ochres including haematite (identified by X–ray diffraction and polarized light microscopy) were used to embellish the 1983 statues whereas no traces of colour have been found on the 1985 statues to date. The pigments on the 1983 statues are often poorly preserved from which it is evident that they were not applied to the wet plaster in a true fresco technique but were applied to the substrate when it was dry, probably mixed with an organic binding medium. The medium has deteriorated with time leaving the paint extremely friable and vulnerable (FIGS. 6-8, 12).

Condition before Burial

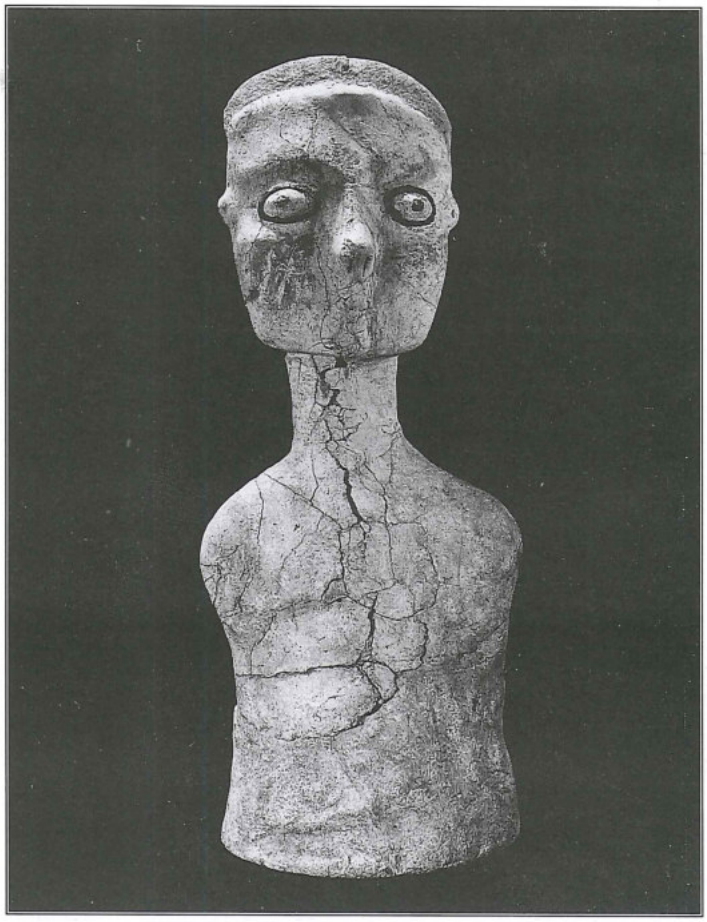
The 1983 statues had sustained pre–depositional damage. Irises/pupils are often missing and, in no case, are the fronts of feet still in alignment. It is unclear how much of this damage should be attributed to their disturbance when the reed extensions were presumably levered out of the ground prior to removal of the statues for disposal in the pit, and how much to the results of general wear and tear which could have occurred in their primary location. Also, although most of the statues



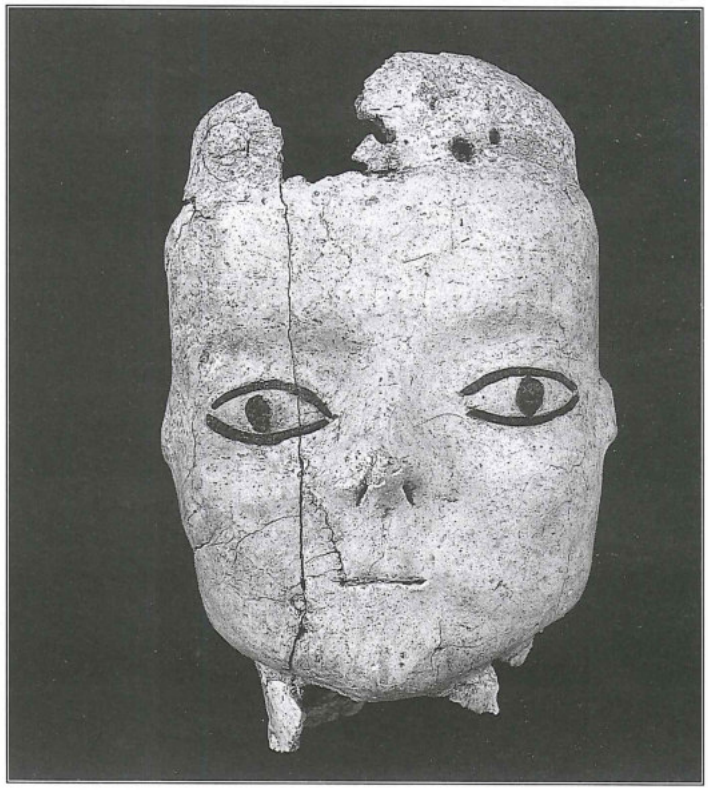
6. Front of Figure 38, Zeina, after conservation (1983 cache).



7. Back of Figure 38, Zeina, after conservation (1983 cache).



8. Front of Dumpy 33, Uriah, after conservation (1983 cache).



9. Head of Statue 1 during conservation (1985 cache).

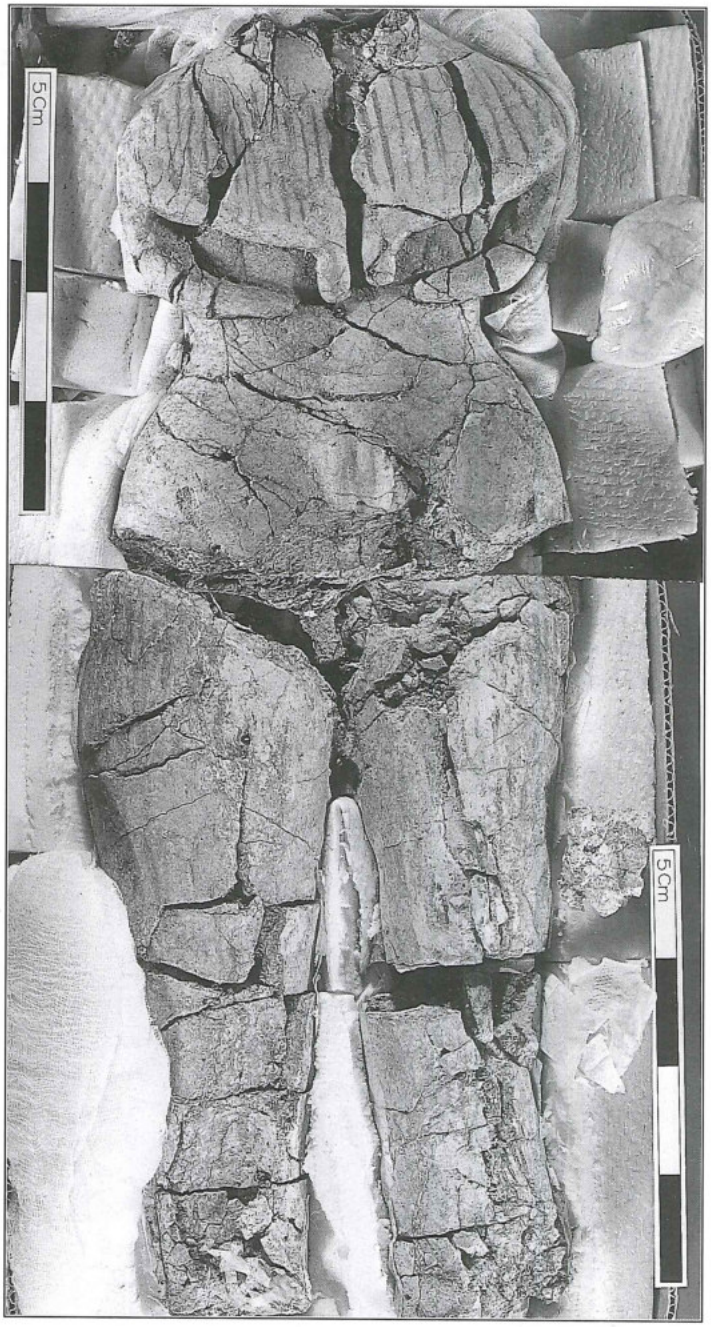
10. Heads of Statue 3 during conservation (1985 cache).

11. Head of Statue 4 during conservation (1985 cache).

were virtually intact when buried, one, at least, must have been a jumble of fragments, two heads were broken in half and located in different positions in the pit and a few bodies with missing heads and vice versa are present. It is possible that headless bodies and bodiless heads will marry up as conservation proceeds.

It is not clear to what extent the 1985 statues were damaged prior to deposition.

Certainly, both caches were interred in pits specially



12. Front of Figure 37, Pescennia Nigra, after separation from the other statues (1983 cache).

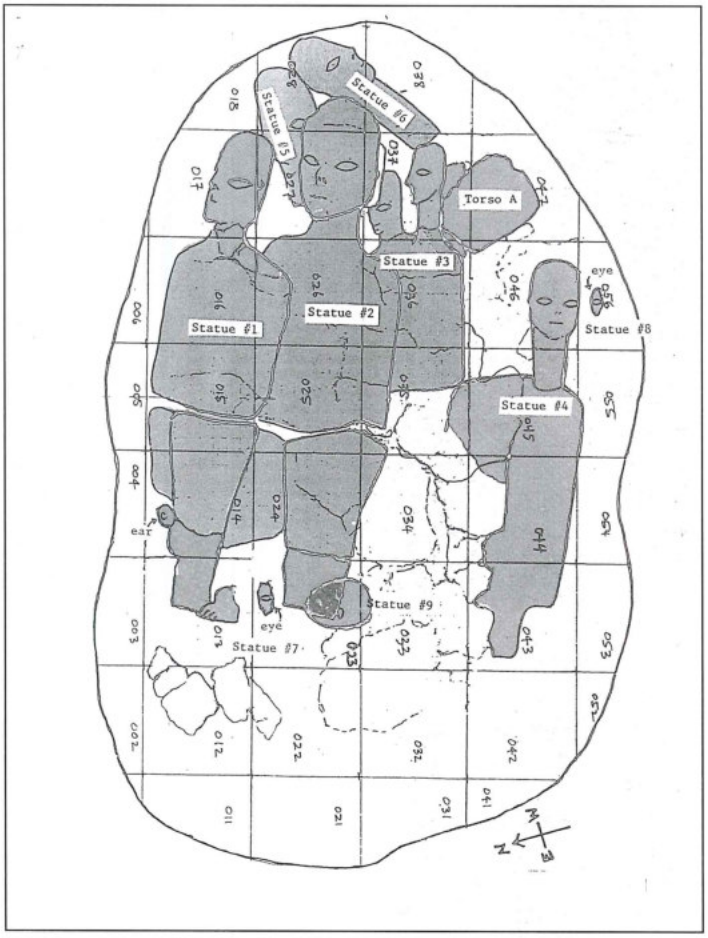
dug for them with the bottoms roughly levelled. The statues were placed in their respective pits with care, not unduly exaggerated. In the case of the 1983 cache, the chief concern seems to have been to stack the statues in stable piles, effectively layers, with an apparent disregard for the orientation of the heads in terms of directional bearing and whether they were face up or down. At the foot of the upper tiers, the dumpies (with the exception of Dumpy 33, Uriah) were arranged in an arc conforming to the edge of the pit and were stacked in interleaved piles, top to tail. This has resulted in severe damage to those

heads which were wedged between two solid dumpy bases. Despite this care, the stacks did still slip but only to a limited degree.

The 1985 statues were arranged in their pit so that about half of the pit contains a single layer and the other half multiple layers. One of the figures was originally placed directly facedown and the remainder were slightly sideways. All the intact heads are found at one end of the cache although fragments of heads have been found elsewhere. A more or less central figure with the largest head seems to dominate the cache. One might speculate that this could represent the head of a family, surrounded by family members (FIG. 13).

Stylistic Comparison of Physical Attributes

Both caches contain statues which can be ascribed to two broad categories based on size and on development of the bodies below the neck. The smaller group measures 35cm in height on average. Their bodies are largely featureless which has led to them being referred to as dumpies or busts (FIG. 8). The heads, however, have had the same degree of attention lavished on them as have those of the full figures. Tantalizingly, the bust from the 1985 cache appears to be two–headed (FIG. 10).[3] The larger group measures approximately 90cm in height. Their heads, in particular, and torsos are quite flat supported by well–rounded heavy thighs and legs. The weight of the bodies is evenly distributed on both legs (FIGS. 4-7, 12).



13. Drawing of 1985 cache during excavation in the laboratory as of November 1991.

Although the faces of the statues within each cache differ, it is still easy to distinguish the members of one from the other. Not surprisingly, the eyes are a dominant feature. Those of the 1983 cache tend to be larger and more elliptical. They have a staring, unfocussed, rather wide–eyed appearance which renders them remote from the viewer, lending them a sense of latent power. The eyes of the statues in the 1985 cache seem flatter, with more pointed corners (FIGS. 9-11). Although the irises/pupils of the 1983 cache are invariably round, they differ markedly in diameter from statue to statue. The irises/pupils of the 1985 cache seem to have a slightly rounded diamond shape which is rather cat–like. The ears of the 1983 cache are present as small protuberances often with small central depressions roughly impressed in them. The ears of the 1985 cache, on the other hand, are much more realistic in appearance having been modelled with greater care. The brow lines, cheeks and upper lips of the statues of both caches are rounded and exhibit skilled shaping of the plaster. The mouths of the 1983 statues are represented by a short simple horizontal slit. Those of the 1985 statues are represented by a wider linear incision, turning up slightly at the corners. The noses of the 1983 cache are very pronouncedly retroussé with the nostrils designated by two incised lines. The noses of the 1985 cache are only slightly upturned with the nostrils marked by either two linear incisions softened in outline or two rounded depressions. The chins of the 1985 cache are all cleft in contrast to the 1983 cache. The faces of the 1985 cache more closely resemble the plastered human skull recovered from 'Ayn Ghazāl in 1988 (Simmons *et al.* 1990: 109, FIG. 2).

The tops of the heads are invariably recessed from the faces and vertical. Grissom observes that this area is rougher in texture than the smoothed faces of the 1985 statues and suggests that a cloth or representation of hair might once have been attached at this point. A concentration of carbon particles has been noticed in this area on some of the 1983 statues (Dumpy 33, Uriah, for example) although the textural difference does not always seem to occur.

The necks of the statues of both groups vary considerably but some are unusually long. In the 1985 cache, the neck for one of the heads (Statue 6) is slightly longer than the head itself, while the necks of other statues

[3] At the time of writing this paper, Statue 3 of the 1985 cache had not been fully excavated and put together in order to confirm its having two heads.

(Statue 2, for example) have a more normal proportion of 40% of the length of the head.

The bodies of the 1985 figures are relatively featureless apart from sloping shoulders and delineation of the attachment of the thighs to the torso by a horizontal depression (FIG. 2).

In sharp contrast, the bodies of the 1983 figures are highly individual. Disproportionately small arms lie against the body curving onto the front of the torso to varying degrees. Occasionally, the arms terminate by tapering off (Figure 37, Pescennia Nigra). In others, the hands are endowed with fingers whose divisions were created by deeply incising the plaster (Figures 35 and 38, Reema and Zeina). The figures are characterized by narrow waists and broad hips. Three of the figures have been invested with sexual attributes. Pendulous breasts grace the upper torsos of Figures 8 and 35, Astarte and Reema. The pudenda of Figure 37, Pescennia Nigra, are depicted displaced upward on the lower abdomen. The buttocks of Figure 38, Zeina, are represented in some detail. Undulations in the plaster of the upper thighs may represent folds of fat (Figure 35, Reema). The knees and ankles are evident on the figures of both caches. Short strokes, occasionally longer lines and small blocks of colour have been used on the heads, bodies and legs of many of the figures. Whether these embellishments represent tattooing, cicatrix, cosmetics and/or clothing is unclear. The fronts of the feet are also not uniform and range from extraordinarily skilled naturalistic representations complete with toes and toenails to unimaginative featureless plaster shapes.

An indication that polydactyly was indigenous to the inhabitants of 'Ayn Ghazāl is suggested by the representation of a six–fingered hand (Figure 35, Reema) and a six–toed foot fragment from the 1983 cache.

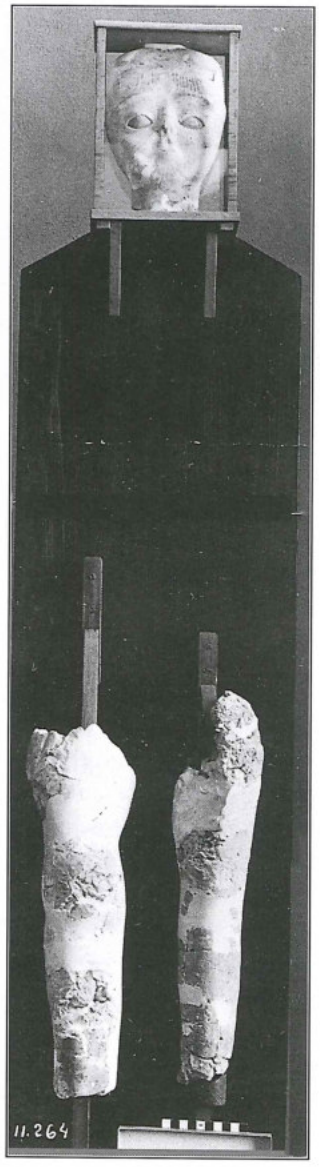
It is possible that the differences highlighted in this discussion are attributable to different dates for the two caches. Radiocarbon accelerator dates for the 1983 cache are 8700 +/- 80 and 8660 +/- 80 BP (Hedges *et al.* 1989: 228). Based on stratigraphical evidence, Rollefson (pers. comm. 1992) suggests that the 1985 cache may be later.

Archaeological Parallels

The closest parallel for the 'Ayn Ghazāl plaster statues is the fragmentary remains of statues discovered from the Neolithic levels at Jericho by Garstang (1935: 166–167, and PLS. XXV, XXVI, LIIa-b, LIII; 1936: 70). Two separate deposits were recovered in 1935. In neither case had the individual statue fragments been in alignment at the time of deposition. Subsequent analysis of a sample from the head found in area 195 has been identified as lime plaster mixed with limestone fragments, quartz and clay (Kingery *et al.* 1988: 233; TABLE 2, 230; FIGS. 10.234, 11a&b.235). Restoration of the legs introduced a contrapposto stance which needs correcting in the light of archive photographs taken of the cache in 1935 and in the light of the 'Ayn Ghazāl statues (FIGS. 14, 15). This recreation led Garstang to attribute a sense of movement to the limbs of his figures (Garstang 1940: 57). He also maintained that the male figure was nearly life size but, again, this claim seems invalid based on inadequate evidence lending the reconstruction an attenuated appearance (FIG. 14).

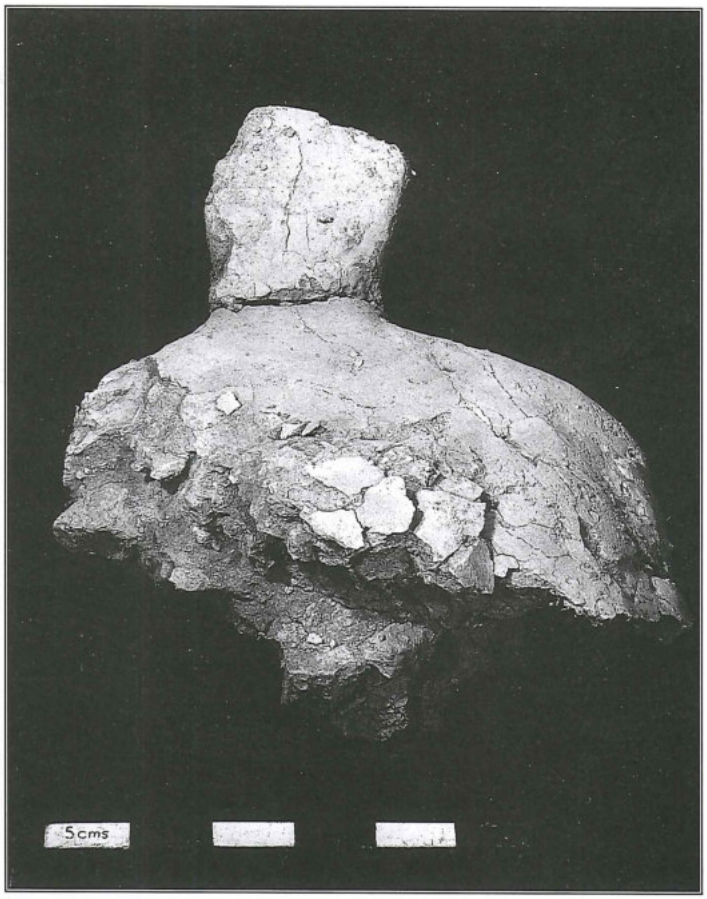
Jericho was again the source of Neolithic human figure fragments during Kenyon's 1957–58 excavation season (Kenyon 1960: 91–92 and PL. XIIa). These consisted of a number of heads which seem to have been featureless, spade–shaped and completely stylized although decorated in bands of red, brown and cream paint. Kenyon believed these figures were chronologically later than those of Garstang (FIG. 16).

More recently, Bar–Yosef recovered many fragments



14. Statue from Garstang's 1935 excavation season at Jericho after conservation as originally exhibited. (Courtesy of the Palestine Exploration Fund).

15. Legs of one of the statues from Garstang's 1935 excavation season at Jericho after conservation. Note contrapposto stance. (Courtesy of the Palestine Exploration Fund).



16. Head and shoulders of a statue from Kenyon's 1957–58 excavation season at Jericho after lifting but before reconstruction. (Courtesy of the British School of Archaeology in Jerusalem).

of a human statue from the Nahal Hemar Cave which he considers to be very similar to the 'Ayn Ghazāl figures (Bar–Yosef 1985: 3, 14).

Conclusion

Very briefly, functional analysis of the two caches indicates that they were cult figures. Their large numbers (approximately 26 in the 1983 cache and approximately 8 in the 1985 cache) and individual differences, coupled with the plastered skull tradition, may indicate a form of ancestor worship. Certainly, the statues are impressive technologically and imposing artistically. As the work proceeds, it is hoped to glean still more of their secrets albeit with the absolute knowledge that they will retain much of their mystery and all of their awesome presence.

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