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‘Ain Ghazal Excavation Reports
Volume 3

Symbols at ‘Ain Ghazal

edited by

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‘AIN GHAZAL ARCHAEOLOGICAL RESEARCH PROJECT

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This volume is

dedicated with gratitude to

Pierre Bikai

ACOR Director 1991-2006

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Chapter 6.1

THREE PLASTER FACES

Carol A. Grissom and Patricia S. Griffin

Abstract: *Laboratory examination and conservation treatment are described for three early MPPNB plaster faces excavated at 'Ain Ghazal in 1985. Impressions on interior surfaces indicate that the faces were modeled on crania and apparently removed from them prior to deposition. Impressions of cordage were found below teeth areas, and impressions of grassy material in cranial cavities, such as the eye orbitals. Analytical studies indicated that the plaster was made by mixing marl from the site with a substantial amount of lime. A thin layer of iron-oxide-red-pigmented plaster colored the exterior of the faces pink. Bitumen decorated closed eyes.*
Key Words: *'Ain Ghazal, lime plaster, cranium, skull, faces, bitumen*

INTRODUCTION

The subject of this chapter is a small cache of three early PPNB plaster faces, each covered by a thin layer of pink-colored plaster and depicted with closed, bitumen-inlaid eyes (Pl. 6.1.1). The faces were modeled on human crania, placing them in the category of "plastered skulls" found in later deposits at 'Ain Ghazal (see Rollefson *et al.* 1985, Chapter 6.2; Rollefson 1986; Rollefson and Simmons 1985, 1986, 1987a, 1987b, 1988), as well as many other MPPNB sites (Arensburg and Hershkovitz 1988; Bienert 1991, 1995; Garfinkel 1994; Bonogofsky 2006). Since all bone was missing from the deposit, however, it would be incorrect to refer to these objects as plastered skulls, and we have chosen the term "plaster faces" instead. "Mask" has sometimes been used for similar items, but that term is misleading because it implies that a plaster face might have been worn or was a complete entity separate from the cranium. On the contrary, the configuration of plaster on the crania required that the faces be broken for removal. The term "plastered skull" has been retained for the general artifact category. When an individual exemplar is described in detail, the substrate is referred to as a cranium if the mandible was absent; it is referred to as a skull only if all head bones were used for the artifact.

ARCHAEOLOGY

Field Excavation

Remains of the three plaster faces were found at the end of the 1984 season at 'Ain Ghazal in a depression measuring *ca.* 40 x 30 x 20 cm at Square 3081, Locus 139 (Rollefson 1986; Rollefson and Simmons 1986, 1987b; Mathias 1984). At that time it was believed that the find consisted of one to four statue heads similar to those of plaster statue Caches 1 and 2 (see chapter 7 in this volume). Bone was entirely absent from the pit, and plant and cordage impressions on interior surfaces were thought to be comparable to interior surfaces of the plaster statues. It became clear that the three faces had instead been modeled on crania modified with plant fibers and plaited cordage only when reassembly was nearly complete (Fig. 6.1.1).

The excavators reported that the burial pit had been cut into culturally sterile base clay and that the plaster fragments were covered with a fill of fine clay and small fragments of chalk and yellowish floor plaster (Rollefson and Simmons 1987b). This interment was later covered by redeposited clay that eventually became

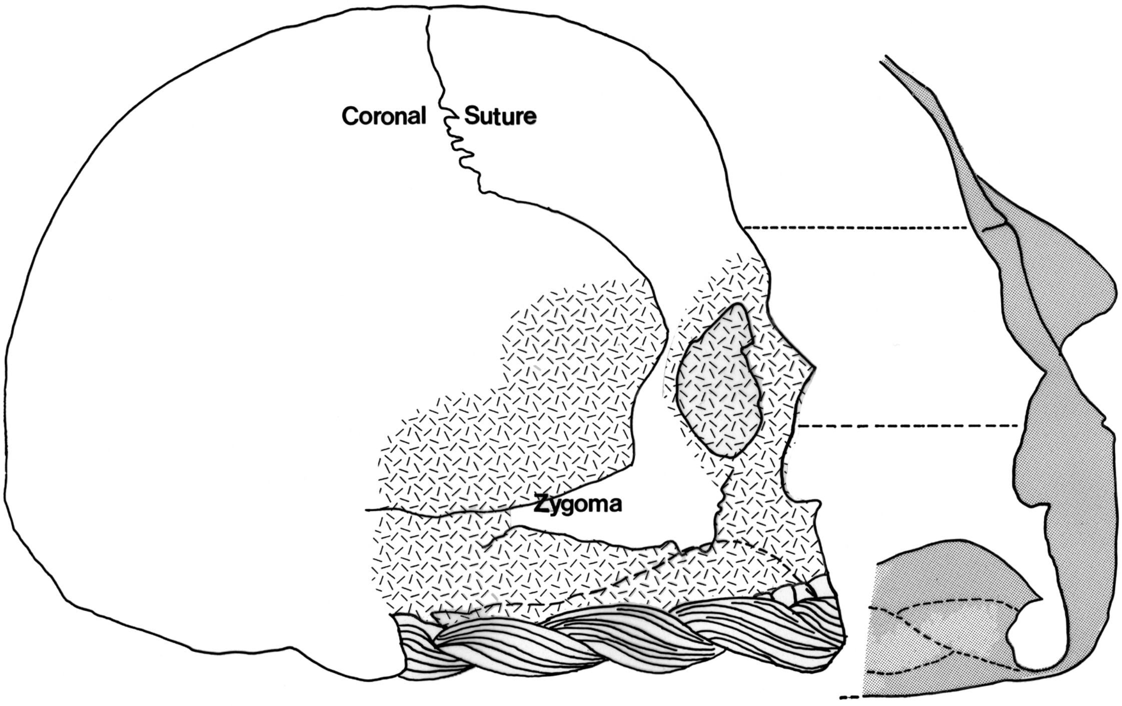

Fig. 6.1.1. Construction of plaster faces: left, the cranium from the exterior, resting on a plaited cord and amended with fiber stuffing (hatched); right, plaster section through the center of the face. Plaster eyes and mouth are linked by dashed lines to positions on the cranium.

compacted, characterized as a stable surface for an unknown period of time. Carbon-14 analysis of charcoal from a stone-lined pit stratigraphically above the plaster faces produced an MPPNB date of 7100 ± 80 bc; the calibrated date is 8227 ± 122 BC (sample GrN-12965). Based on this date, it is thought that the plaster faces constitute the earliest dated group of anthropomorphic plaster sculpture found in the Near East.

Positions of the faces in the pit can be seen by comparing numbered fragments shown in site documentation and drawings that accompany reassembled faces. Figures 6.1.2 and 6.1.3 show that the central facial areas of Faces 2 and 3 were buried face down, intact, and lying side-by-side, with Face 2 slightly overlapping Face 3. The position of Face 1 is less clear: proper right fragments were removed in 1984 before photographs were taken or positions recorded, and remaining fragments appeared mixed up when photographs were taken in 1985, whether because of irregular burial or later disturbance. Nevertheless, fragments of Face 1 were generally next to Face 2 on the opposite side from Face 3.

Shortly after its discovery, the pit was backfilled, because it was late in the season, and blocklifting was planned for the following summer. In the summer of 1985 conservator Lynn Grant prepared for this procedure by exposing the upper surfaces of fragments. During the night prior to scheduled blocklifting, uninvited visitors to the site broke and scattered fragments (Figs. 6.1.4-6.1.5). Fortunately one can account for all fragments shown in photographs taken before the disturbance. After the vandalism, loose fragments were assigned identification numbers, lifted individually, and packed. Although only an estimated 30% of the plaster fragments remained in the ground, they were blocklifted using the technique employed by Tubb for statue Cache 1 (see Grissom, Chapter 7.1, Fig. 7.1.3). The area containing the remains was pedestaled, covered with aluminum foil, surrounded by a crate, cushioned by polyurethane foam, and inverted (thus, laboratory excavation photographs and drawings show the cache inverted from its position in the field). Shortage of time prevented the normal procedure of removing soil overlying the plaster fragments after inversion.

Fig. 6.1.2. The pit after discovery in 1984. Photograph by C. Blair.

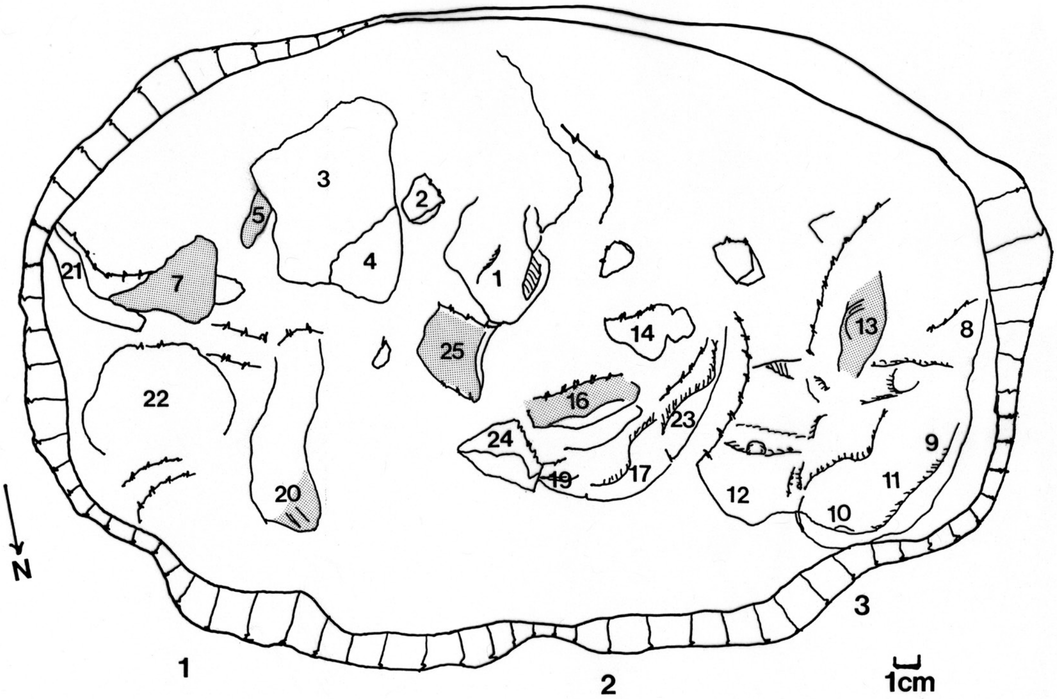

Fig. 6.1.3. Drawing of same area as the previous; after St. J. Simpson. Numbers along the bottom indicate the approximate location of each face. Pink-colored exterior surfaces are indicated by shading. Numbered fragments can be correlated with those on reassembled faces.

Fig. 6.1.4. The pit following disturbance in 1985. Photograph by C. Blair.

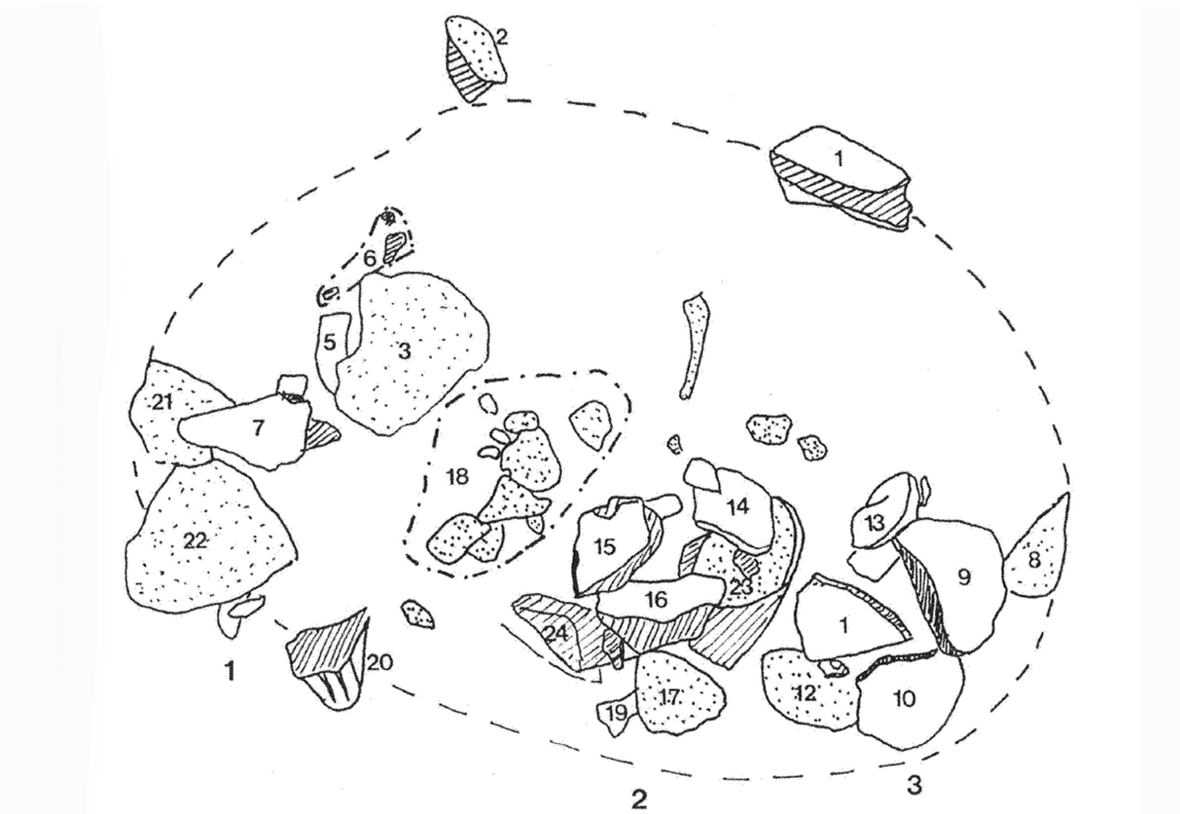

Fig. 6.1.5. Drawing of same area as the previous; after L. Grant. Numbers along the bottom indicate the approximate location of each face. Fragments were lifted individually except for 12, which was block-lifted; all were incorporated in reassembled faces except for 1, 13, and 14 (see Pls. 6.1.8c-d). Interior surfaces are indicated by dots; newly broken surfaces are indicated by parallel lines; a dashed line identifies the perimeter of the pit.

Although prospects for conservation treatment seemed dismal, the small crate containing blocklifted fragments and six shoe boxes containing individual fragments were transported in 1986 to the Smithsonian Institution's Conservation Analytical Laboratory, now the Smithsonian's Museum Conservation Institute. The crate accompanied the larger crate containing fragments of statue Cache 2, sent to the same laboratory for treatment and described in Chapter 7.1 by Grissom.

Laboratory Excavation

Laboratory excavation of the small crate began at the end of October 1991 and was completed by the end of the year. First, packing materials that lay on top of the plaster face fragments were removed, then earthen materials using brushes, tweezers, and a blower bulb. The earthen materials, which had lain below the plaster faces before the deposit's inversion, consisted mainly of yellowish-white chalky lumps and brown-colored argillaceous soil. The soil was dry, hard, and cracked, apparently having dried and shrunk since blocklifting, because it was damp and solid when blocklifting was done (Grant 1986). Otherwise only fragmentary flints and a few small pieces of floor plaster were found, consistent with materials noted by excavators in pit fill above the deposit.

Removal of extraneous materials revealed a mostly single layer of plaster fragments lying face up in the crate (Fig. 6.1.6). Positions of Face 2 and Face 3 fragments proved to be consistent with those shown in site photographs taken before the disturbance. Since most fragments of Face 1 had been lifted individually in the field, only a small group of forehead fragments remained at the east end of the blocklifted material, contributing little further information about its original position. A preliminary examination report and treatment proposal were written (Griffin 1991), and the proposal was authorized shortly afterward during a visit to the laboratory by Safwan Khalaf al-Tell, then director of the Department of Antiquities of the Hashemite Kingdom of Jordan.

Most fragments were strong enough to be easily lifted from the crate with tweezers or fingers. Extremely thin and badly broken fragments of the forehead of Face 2 were an exception (Pl. 6.1.5d). In order to retain their relationships to each other, a group was removed as a unit after an aqueous solution of a weak adhesive had been applied (METHOCEL A15C). As remaining fragments were removed from the crate, they were assigned numbers correlated with locations on photographs taken of the deposit as laboratory excavation progressed.

Preservation and Burial

Considering its antiquity, most plaster was found in excellent condition. Fractured edges are almost always sharp and ceramic-like, distinct from "softer" break edges noted for Cache 2 statue plaster. As a result, many dissociated fragments could be assuredly joined by matching broken edges, and it is estimated that less than 10% of fragments found in the pit were not attached to the three faces (Pls. 6.1.8c-d). Plaster missing from the original application to the crania is considerable, however, estimated at about 40%. It is unlikely that missing plaster simply deteriorated during burial, because preservation of surviving plaster is so good. The absence of any bone in the pit, moreover, cannot be plausibly explained by deterioration during burial, since bone generally survives well at the site. Thus, it has been concluded that the crania and about 40% of the original plaster were not buried with the faces. In other words, at some point after the crania were plastered, the faces were removed and carefully reburied by themselves.

While plaster appears to have been applied to more than half of each cranium, it is extant in greatest quantity from central facial areas featuring the modeled eyes, nose, mouth, cheeks, and chin. The facial portion of Face 1 is complete except for the zone around the mouth. Face 1 also has all of one side and a substantial portion of the underside, making it the most complete overall of the three artifacts (Pls. 6.1.2a-d-6.1.4a-d, Figs. 6.1.7-6.1.9). The central facial area of Face 2 is missing the area around the proper left eye, and Face 2 has the only forehead section that extends to the original upper perimeter. Otherwise Face 2 is less complete than Face 1, with only part of an ear on one side and palate-filling plaster on the underside (Pls. 6.1.5a-d-6.1.6a-d). Face 3 has the most complete central facial region, and its eyes retain the largest quantity of bitumen inlay. It is the least complete overall, however, lacking entirely the sides, underside, and forehead sections (Pl. 6.1.7a-d, Pl. 6.1.8a-b). Fragments displaying facial features may have been reburied in larger quantity because they were more valued, but technical reasons are likely a more important factor in their survival.

Breakage of plaster necessarily occurred when the faces were removed from the crania before reburial, since geometry precluded intact removal on account of plaster encompassing more than half of each cranium's three-dimensional shape. Moreover, breakage would have been necessary for removal of plaster at undercuts, such as those at the zygomatic arch (Pl. 6.1.3c-d, Figs. 6.1.7-6.1.8). Thin plaster on top of cordage provided a natural location for breakage around the base of the cranium, probably contributing to limited survival of plaster below the cordage and on the underside of the cranium, *e.g.*, on Face 3 (Pl. 6.1.7c-d). Thin layers of plaster applied directly to bone would have been difficult to remove without breakage, accounting for poor representation of forehead plaster in the deposit. By contrast, generally thick plaster on the central facial regions would have been relatively easy to remove, enhanced by fiber stuffing that reduced adhesion to bone and eliminated undercuts.

Large facial sections appear to have been removed from the crania without breakage. The excellent alignment of central facial fragments of Faces 2 and 3 indicates that they were removed and reburied as units (Figs. 6.1.2-6.1.3), since it seems highly unlikely that broken pieces would have been assembled in place at the time of reburial. The unique forehead section of Face 2 provides an extraordinary example of intact reburial followed by post-burial fragmentation. The near-miraculous removal of this thin plaster section as a unit was clearly indicated by the alignment of its innumerable tiny fragments (Pl. 6.1.5d).

Similar patterns of breakage within each central facial area also suggest that fragmentation occurred during burial because of pressure from the overburden. Breaks radiate from the "circumference" of the face toward the central nose, probably formed as the weight of the overburden pressed on the inverted facial "dome." Nearly identical break locations on the three artifacts can also be attributed to junctures of thick and thin plaster, associated with similar patterns of plaster thickness produced by similar modeling, fiber stuffing, and bone structure. For example, fractures are found at the perimeters of each solidly modeled nose and nearly all oculars, which were more thickly plastered over fiber stuffing than adjacent bone. Breaks also occur consistently at incisions that delineate features, *e.g.*, through the mouth of Face 2 and at least one eye of each face. Stress concentrations at the incisions would have promoted cracking characteristic of brittle materials (Gordon 1988: 79-86). No evidence was observed of application of plaster in globs or horizontal strips, posited as a factor with respect to breakage for a plaster statue head found at Jericho (Kingery *et al.* 1992).

Finally, some damage occurred after the plaster faces were discovered. New breaks caused by site vandals are identified in Figures 6.1.4-6.1.5. Compared to fragments lifted individually in the field, blocklifted fragments are more fractured, and their surfaces, more powdery. Some damage may have occurred while the plaster was in the crate, related to drying and shrinkage of soil remaining over the plaster fragments, since there was insufficient time for its removal prior to transport.

THE PLASTER FACES

The three plaster faces are well-made and so similar with respect to both fabrication and style that they must surely have been made at the same time, if not by the same hand. They are hardly individuated enough to qualify as "portraits," as Kenyon designated plastered skulls found at Jericho (1957: 62-63). They are not identical, however, and could not have been made by a replicative process like molding. Features differ in small ways; for example, the noses of Faces 1 and 3 are straighter than that of Face 2.

Features are identically stylized. The mouths and closed eyes are represented by horizontal incisions at the center of slight, rounded protrusions. Incised edges, especially those for the eyes, are more rounded than comparable ones on faces of statues in Cache 2, apparently because burnishing eliminated sharp edges.

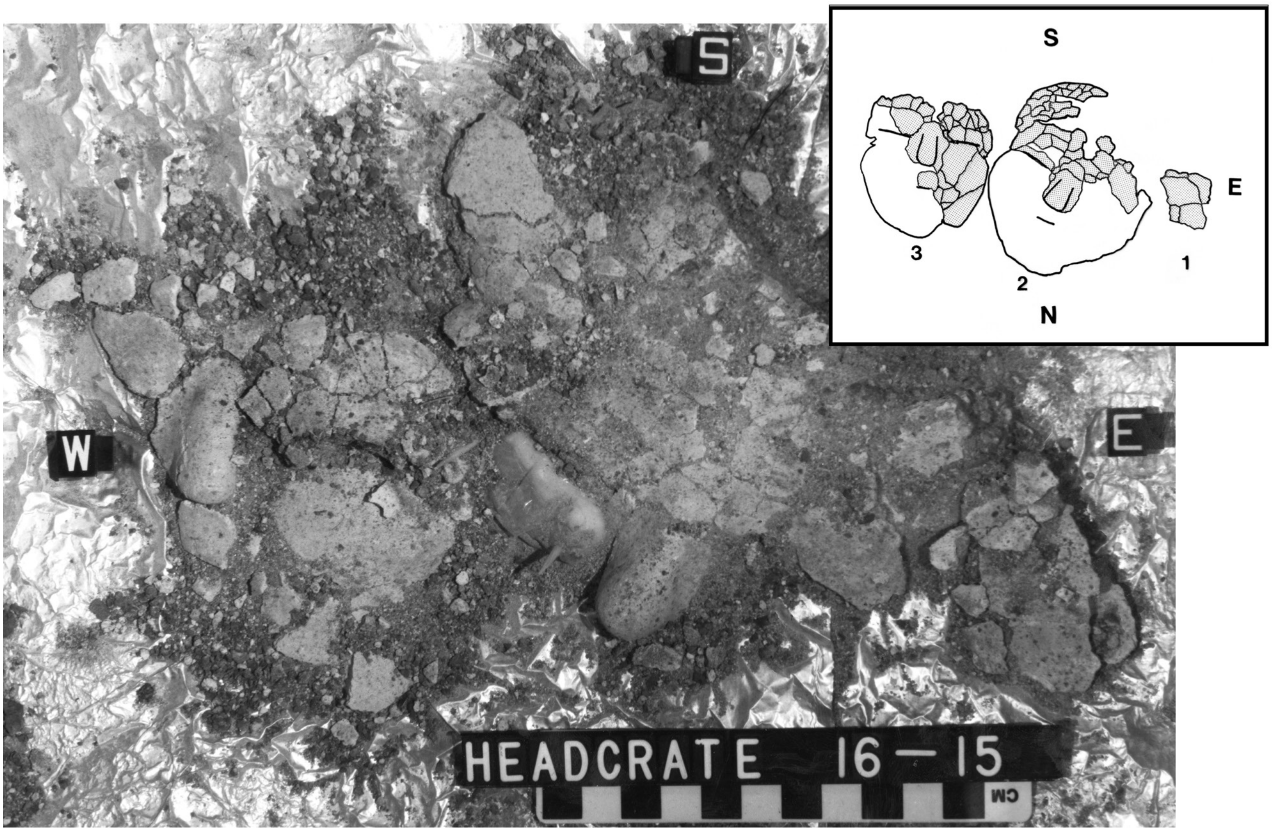

Fig. 6.1.6. The blocklifted deposit during laboratory excavation in 1991 (N.B., the deposit has been inverted from its position *in situ*). The inset drawing of Faces 2 and 3 identifies fragments in the deposit by shading; forehead fragments of Face 1 are at right.

Pink coloration visible inside the eye incisions indicates that the pink layer was applied after the incisions had been cut into the unpigmented layer. Eye grooves must have been entirely inlaid with bitumen, although only fragments survive. Wedge-shaped noses are made of solid plaster, the nostrils delineated by pairs of incised lines (Pl. 6.1.4d). The grooves are slightly wider than those for the eyes and mouth, measuring 0.1-0.2 cm compared to 0.1 cm for the mouth of Face 2. The nostril grooves are more irregular and show no pink coloration inside, suggesting that they were cut after the pink layer had been applied and that the area was little burnished afterwards. The ears are smooth, slightly elongated protrusions, which were placed higher relative to other features than is anatomically correct. The cheeks and sides of the head were modeled with smooth curves, while the underside of the head was essentially flat, rendering the plastered crania stable in upright position.

Facial areas are smaller than those of humans, since the plaster faces were modeled on crania alone. Overall plaster measurements are estimated at 17 x 15 x 14 cm, although none of the plaster faces is complete. Apparently in response to the absence of a mandible, each facial area is shortened vertically and relatively broader; features are located higher than those of the crania. To give an example, the plaster mouth is located at the center of the nasal cavity, and the plaster eyes are located above the eye orbitals (Figs. 6.1.1, 6.1.8-6.1.9, Pl. 6.1.7c-d). The plaster faces slant backwards from their bases, as is clearly shown in profile views of Face 1 (Pl. 6.1.3a, c). The angle of Face 2 should be similarly slanted. Losses between the chin and face permitted considerable play between fragments during reassembly, however, and a more likely original position became clear only after treatment had been completed (Pl. 6.1.6a-b). While the overall shapes of the plaster faces are provided by the crania, cranial details are only occasionally reflected in modeled plaster, such as the projecting malar that underlies the "cheek bone" plaster of Face 3 (Pl. 6.1.7a-d).

Fig. 6.1.7. Face 1, three-quarter view of the front and proper left side.

Fig. 6.1.8. Face 1, three-quarter interior view of previous.

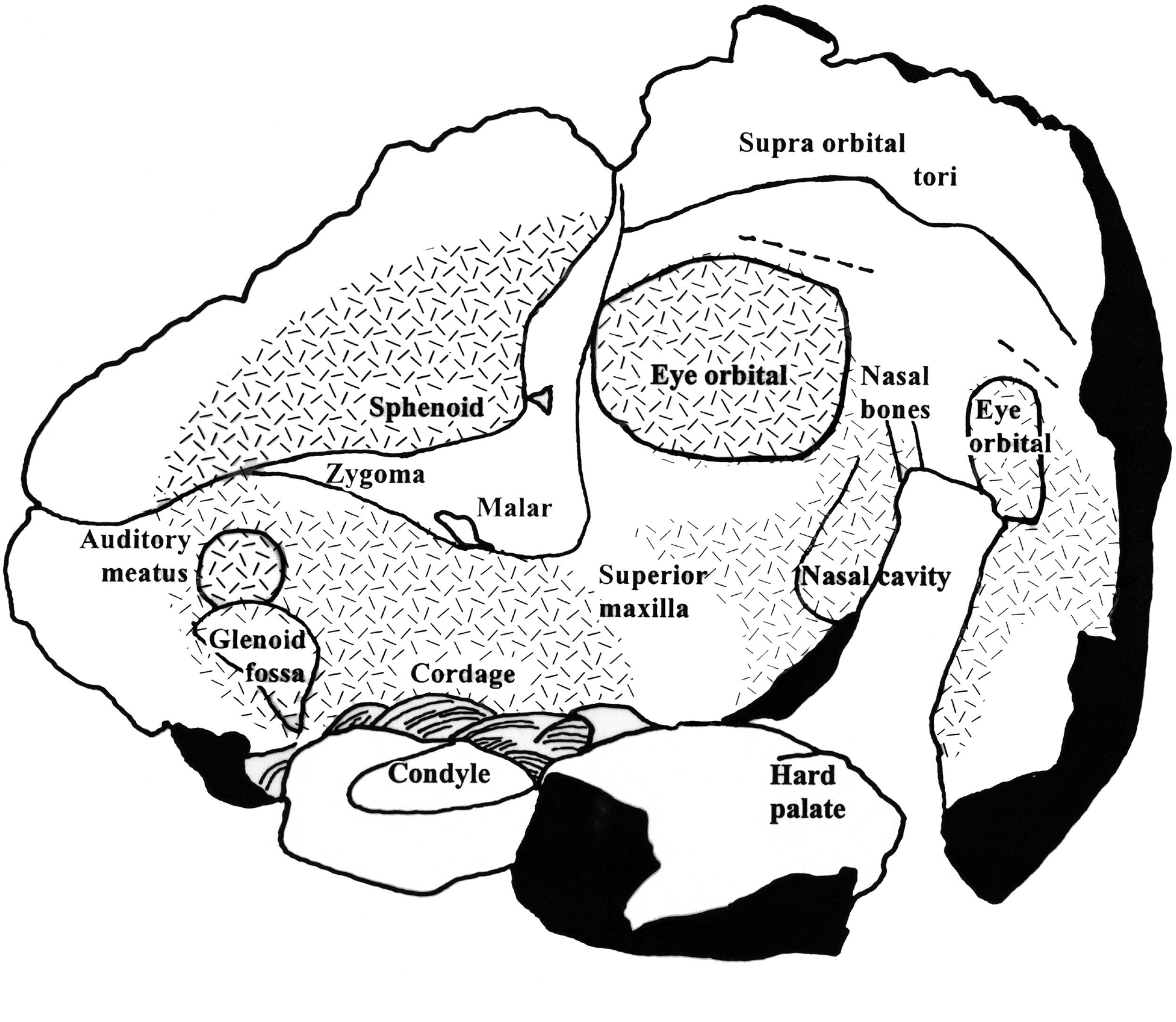

Fig. 6.1.9. Face 1, drawing after previous showing skeletal features, impressions of cordage, fiber-impressed areas (hatched), and bone-impressed areas (unshaded). Locations of eyes on the exterior are indicated with dashed lines. Exterior surfaces are solid black, and broken surfaces are shaded.

In addition to the facial region, plaster likely covered about half of each side and nearly all the underside of the crania, based on extrapolation of finished edges. Impressions on the undersides of edge fragments at the side and top of Face 2's forehead section indicate that the temporal line and coronal suture served as limits (Pl. 6.1.5d), higher on the crania than noted for other plastered skulls (Goren *et al.* 2001). Plaster over the coronal sutures appears to have been trimmed off after application, leaving a beveled edge without the pink layer (Pl. 6.1.5c). Perimeter fragments on the proper left side of Face 1 indicate a boundary extending diagonally downward from the temple to the mastoid at the lower back of the cranium (Pl. 6.1.3a-d). No finished plaster edges were identified underneath the crania at the back. Indeed the hindmost edges of surviving bottom fragments are relatively thick and show no signs of the tapering found on the top and side edges. However, alignment with finished edges on the side, such as those of Fragment 7 on Face 1 (Pl. 6.1.3b), would place the bottom back perimeter between the mastoids on each side, behind the foramen magnum at the center (Figs. 6.1.8-6.1.9; Pl. 6.1.4a). Thus, the calvarium and back of the cranium probably remained unplastered, but they may have been covered by decorative paint, bitumen, a wig, or headdress when originally displayed. Decorated crania have been found at other MPPNB sites, although none were plastered (see below).

Plaster thickness varied in accordance with cranial features, fiber stuffing, and modeling. Plaster that filled cavities under the head has the greatest thickness, measuring as much as 2.8 cm and 2.3 cm for palatal cavity filling of Faces 1 and 2; plaster applied to the area of a condyle and jugular fossa is 2.5 cm thick for unattached Fragment 1 (Pls. 6.1.8c-d). Over the fiber-stuffed eye orbitals, the modeled plaster cheeks are also reasonably thick, measuring as much as 2 cm. The solidly plastered noses protrude 1.8 cm, 1.6 cm, and 1.5 cm for Faces 1 to 3 respectively. Plaster tends to be thinnest where applied directly to bone, *e.g.*, over the zygomatic arch, which protruded from the side of the cranium, and on the forehead, whose plaster measured from 0.05 to 0.2 cm in thickness in the extant portion from Face 2. The pink surface plaster layer is quite thin, measuring 0.005-.025 cm on cross-sections viewed at low magnification.

Unpigmented plaster is believed to have been applied in a single session: no difference was observed from interior to exterior or any indication of layering, such as cleavage. Plaster was probably applied by the handful, as seemed most natural during replication experiments, and adjacent handfuls appeared to be invisibly merged during modeling. No evidence of individual application units were identified through examination or xeroradiography, as have been reported by other researchers on a Jericho statue head (Kingery *et al.* 1992). Good cohesion between unpigmented plaster and the pink-colored surface layer indicates that the former was still damp when the latter was applied. This is confirmed by cross-sections that showed mixing of the two layers (Pl. 6.1.1b).

The main body of plaster appears light tan in coloration but is classified as "white," comparable to 10YR 8/2 or between 2.5Y9/2 and 2.5Y9/1 using the Munsell system (Munsell 1975). Its color is indistinguishable from Cache 2 statue plaster when samples are placed side by side. The color of the surface plaster layer is light pink (Munsell 5YR 8/4), now slightly darkened by the consolidant.

The pink surface appears burnished. When viewed in cross-section under magnification, its upper surface is smooth (Pl. 6.1.1b), contrasting with the irregularity of its lower surface and the upper surface of the unpigmented plaster. Consistent with burnishing are compaction of the surface layer and greater fragmentation of surface particles visible with the scanning electron microscope (SEM). The surface is somewhat marred by striations, especially visible in raking light (Pl. 6.1.7b). These probably appeared after fiber mixed into the main body of plaster disintegrated, revealing voids as thin surface plaster above them was lost.

MATERIALS

In the following section, characteristics of materials used to make the plaster are described (see Griffin 1993 for details of analysis and results). Also described is evidence of bone, fiber stuffing, and plaited cordage, which are now entirely absent but have left excellent impressions on interior plaster surfaces.

Bone

Impressions on the interior of reassembled plaster faces show clearly that plaster was modeled on human crania rather than complete skulls, as is typical of the majority of plastered skulls found in the Near East. A cranium is easy to detach from a mandible once jaw ligaments have decomposed, and use of crania alone eliminates the need to fix the moveable lower jaw. The majority of MPPNB skeletons excavated at 'Ain Ghazal have been found with mandibles in place and crania missing, thought to have been retrieved from burials after decomposition of the jaw ligaments occurred (Rollefson *et al.* 1985: 105-110; Rollefson and Simmons 1988: 408-410).

Where plaster was modeled directly on the exterior of the cranium, it displays comparatively smooth interior surfaces; *e.g.*, on the interior of the faces' foreheads above the eye orbitals (Pl. 6.1.2d, Pl. 6.1.7c). Because of its smoothness, the fine impressions of coronal and temporal sutures could be distinguished on the interior of Face 2 before support materials were added (Pl. 6.1.5d). Similarly, linear protrusions of the supra orbital tori are visible on Face 1 (Figs. 6.1.8-6.1.9) and Face 3 (Pls. 6.1.7c-d). Smooth, bone-impressed plaster is also clearly visible in the distinctive zygomatic arch, formed by the malar, zygoma, and part of the maxilla. Where plaster was applied to the underside of the cranium, impressions are less smooth but characteristic, notably striations left by the palatine sutures (Pl. 6.1.2c, Pl. 6.1.4a). Fiber stuffing partially obscures impressions of bony surfaces in many areas, but cranial features can usually be discerned, *e.g.*, the edges of the eye orbitals and nasal cavities; the small hollows probably formed by protruding roots of teeth on Face 3 (Pls. 6.1.7c-d); and the auditory meatus, glenoid fossa, and condyle toward the back of Face 1 (Figs. 6.1.8-6.1.9, Pl. 6.1.4a). Plaster losses limited overall cranial measurements, but a few measurements could be derived from impressions, such as widths of the nasal cavity (4.0 cm for Face 2) and palates (3.5 cm for Faces 1 and 2).

Fiber Stuffing

Curving impressions of fibers on interior plaster surfaces indicate that cranial cavities and other areas were stuffed with plant material (Pl. 6.1.3d). Silicone rubber molds show that individual fibers were cylindrical, measuring 100-250 µm in diameter and as long as 4 cm. Such fineness, coupled with lack of plant structural features, indicates processing (J. McCorriston personal communication 1993). Side-by-side conglomerates of cylinders, measuring as wide as 1 mm (or 1,000 µm), however, indicate that processing was incomplete. The short fiber lengths suggest that plant stuffing may have been detritus of the manufacture other products, such as matting, fabrics, or cordage. Typically MPPNB fibers were derived from reeds or rushes and flax (Schick 1988), and use of armatures made of reeds or rushes for statue-making at 'Ain Ghazal indicates that they were available at the site (see Grissom, Chapter 7.1). Stuffing would have facilitated removal of the faces from the crania, although this was presumably an unintended consequence.

Cordage

Impressions in the plaster indicate that a loose three-strand braid was placed underneath teeth and/or teeth cavities, extending to the back between the mastoid and condyle on each side (Figs. 6.1.7-6.1.9, Pl. 6.1.4a-b). While impressions suggest that the end of the braid exited from the plaster toward the back of Face 1 (Pl. 6.1.2d), whether it actually did remains conjecture in the absence of perimeter fragments at the back. For the most part, the braid seems to have lain flat with its wider dimension horizontal, but it appears to have been twisted to a vertical position at the chin, almost certainly to enable it to curve around the front of the upper jaw (Pl. 6.1.7c-d).

Impressions of the braid measure a maximum of 1.7 cm in width and average about 0.5 cm in height. SEM examination of silicone rubber molds showed individual cylindrical fibers measuring 100-400 µm in diameter. They appear similar to those of fiber stuffing and would likewise have required processing. Twine made from

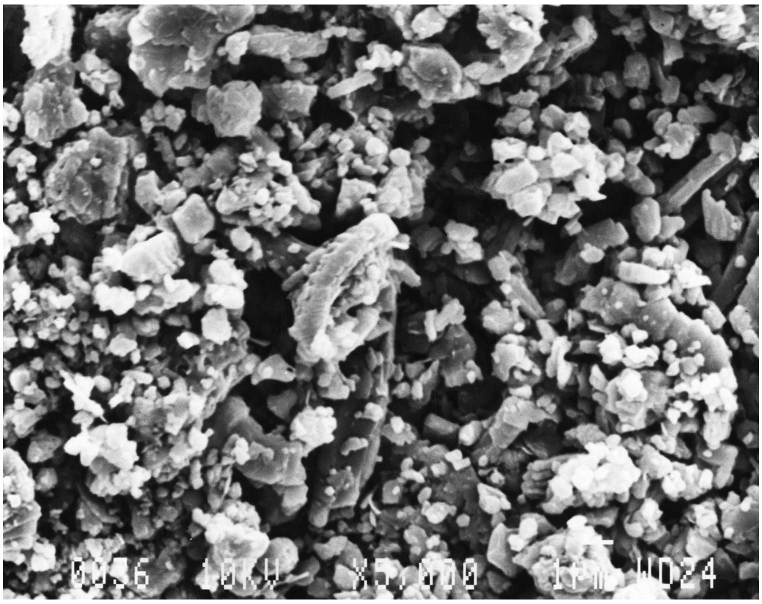

Fig. 6.1.10. SEM image of original face plaster, showing a coccolith at the center.

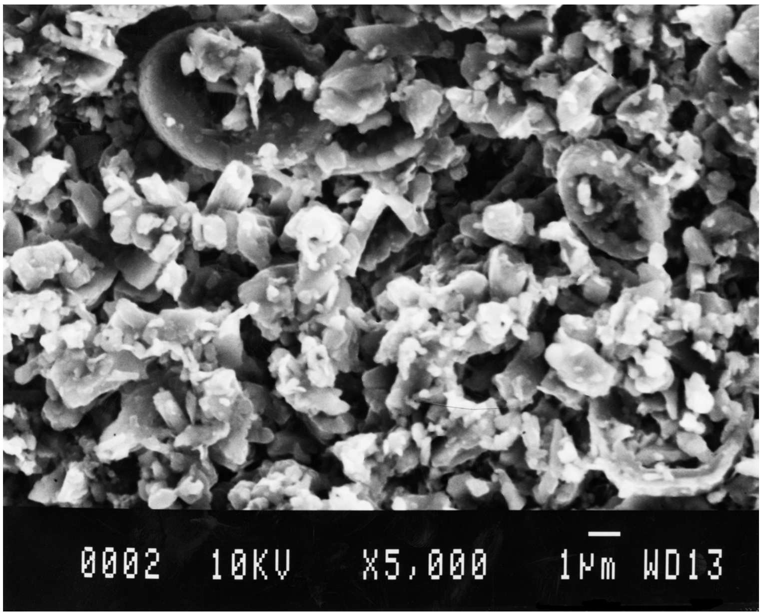

Fig. 6.1.11. SEM image of plaster made with 50% powdered ‘Ain Ghazal marl and 50% lime made from ‘Ain Ghazal marl.

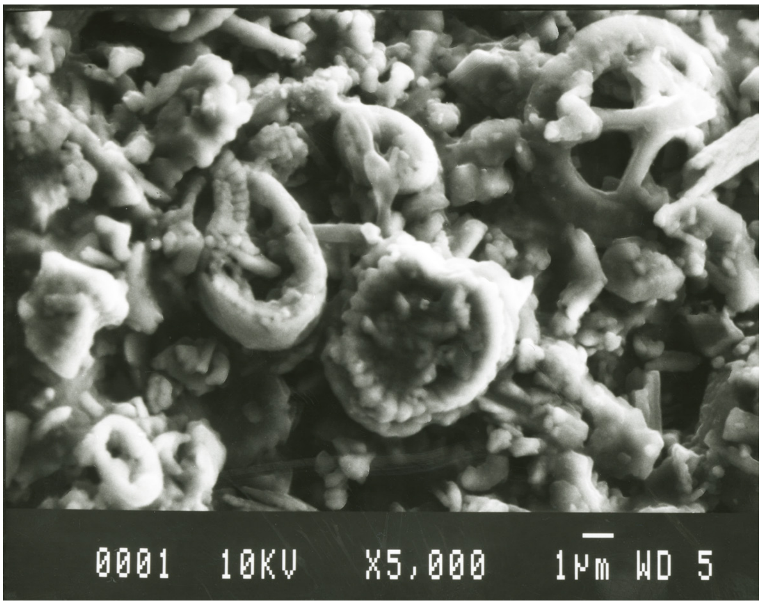

Fig. 6.1.12. SEM image of plaster made with 100% ‘Ain Ghazal marl, crushed and mixed with water.

reeds or rushes has been found at Nahal Hemar (Schick 1988), and reeds were reportedly used to make rope in Badarian Egypt (Lucas 1962: 134). Another possibility is date palm fibers, which are traditionally employed by Bedouins for making rope (Danin 1983: 127-129).

Plaster

Marl, a mixture of clay, calcium carbonate, and shell remnants, is found abundantly at ‘Ain Ghazal and was apparently the primary raw material for the plaster. This was shown by instrumental analyses, including powder camera X-ray diffraction analysis (XRD) that identifies crystalline materials and SEM energy dispersive spectroscopy (EDS) that confirms elemental constituents. XRD showed calcite to be the principal component of both white and pink layers of plaster, as well as the marl. The clay mineral montmorillonite, identified by XRD as the major component of the acid-insoluble fraction of the plaster (4-9 wt%), is also the second major constituent of marl (samples from three different areas at ‘Ain Ghazal had 5 wt%, 14 wt%, and 17 wt% acid-insoluble fractions). Lesser constituents of acid-insoluble fractions for both plaster and marl are quartz and feldspar. Translucent particles of finely divided quartz (less than 1% of the plaster) are visible on break edges, their identification confirmed by XRD. A small amount of feldspar was observed during microscopic examination, differentiated from quartz by albite twinning; its presence in ‘Ain Ghazal marl was confirmed by XRD. Opaque black inclusions are visible at low magnification in both plaster layers at break edges and were identified as carbon by XRD.

Considerable fine, plant-like material was incorporated in the main body of plaster, indicated by fiber impressions measuring about 0.01 cm in diameter and as long as 0.5 cm. Linear voids left by the fibers can be seen on Face 3 in raking light, where surface plaster was lost after fibers disintegrated (Pl. 6.1.7b) and in Xero-radiographs of thin, smooth-surfaced plaster fragments. Impressions appear similar to those of the fiber stuffing except that fibers are shorter. Plant fibers would have improved working properties and diminished shrinkage of the plaster, just as they perform these functions for ceramics. They were not observed in the fine-textured pink surface layer, probably because they would have compromised a smooth finish. It seems likely that mixing plant fibers into plaster was not an unusual practice in the MPPNB, although it has been noted only for plaster statues from ‘Ain Ghazal (see Grissom, Chapter 7.1) and plaster statue fragments found in the Nahal Hemar Cave (Bar-Yosef and Alon 1988; Goren *et al.* 1993).

Further examination indicated that the plaster was made by mixing the plant fibers with a large amount of powdered marl, a smaller amount of slaked lime made by calcining the marl (898^{o} C is the dissociation temperature of calcite at 1^{o}atm for a 100% CO_2 atmosphere), and water. Thin-section petrographic analysis (TSPA) showed the plaster to be finely divided but containing some large fossils (as large as 50 µm) that birefract in polarized light (Pl. 6.1.1b). When examined with an SEM (Fig. 6.1.10), the plaster appears mostly as rhombohedral particles of calcite (0.5-2 µm). Scattered throughout the sample are a few coccoliths (about 5 µm in diameter), which are calcareous fossils of the cellular structures of green algae (Black 1973). Finally, a few sub-micron rounded particles (<0.5 µm) are visible, which are typical of recarbonated lime but can also occur naturally in marly clay (Kingery *et al.* 1988).

Use of lime is difficult to determine because fully recarbonated lime and calcite deposited in sediments form the same crystalline compound (calcium carbonate), but several factors indicate that it was used in making the plaster. First of all, water resistance of the plaster indicates use of lime. Experiments showed that plaster made entirely from uncalcined ‘Ain Ghazal marl disintegrates in water, while plaster made with as little as 5% calcined marl does not. Secondly, while the presence of coccoliths precludes a 100% lime composition on account of decomposition of the calcitic fossils during calcination, SEM images show that relative amounts of coccoliths and sub-micron rounded particles compare well with those for standards made from 75% or 50% powdered ‘Ain Ghazal marl and corresponding percentages of carbonated lime (Fig. 6.1.11). Many more coccoliths can be seen in SEM images of 100% powdered ‘Ain Ghazal marl (Fig. 6.1.12). Compositions containing 50-75% marl approximate traditional mortar mixtures of two to three parts aggregate (in this case ground marl) and one part lime. Finally, carbon particles present throughout the plaster probably stem from the burning of fuel required to make lime.

Identification of calcium silicate in the plaster and use of other analytical techniques that might have confirmed the presence of lime proved inconclusive. Calcium silicates, produced by heating calcium carbonate in the presence of clay at temperatures somewhat higher than those required for calcination, can indicate use of lime. Their presence was suggested during experiments with replica plaster by partial hydraulic set of slaked marl samples heated between 700°C and 1000°C, but they were not conclusively found by XRD in either the original plaster or modern lime plaster made from 'Ain Ghazal marl. Calcium silicates can be difficult to identify by XRD, however, because they are somewhat amorphous, and they might have been present in a small percentage below the detection limit of the instrument. Differential thermal analysis (DTA) was performed on original plaster as well as samples made from 'Ain Ghazal marl heated to a range of temperatures. It has been suggested that the technique can be used to differentiate lime plaster from limestone, since the smaller particles of recarbonated lime decompose at lower temperatures, causing a shift and broadening of the reaction peak (Gourdin and Kingery 1975). Calcium carbonate decomposition temperatures varied for different marl samples from the site, however, and incomplete recarbonation during the experimental period precluded analysis of calcined samples. Other workers have used TSPA to identify lime (Goren and Goldberg 1991), but we found lime to be indistinguishable from finely divided marl particles using this technique.

The plaster used for the three faces has physical characteristics that readily distinguish it from plaster used for statues in Cache 2. It is of significantly higher quality: harder, denser, and finer in texture. Analyses showed that constituents of the two plasters are essentially identical, and we attribute the higher quality of face plaster to a greater percentage of lime (25-50%) than that estimated for the statues (10%). When compared with SEM and TSPA, the plaster of the three faces appears finer than the statue plaster. SEM showed fewer coccoliths and more submicron particles associated with recarbonated lime (*cf.* Grissom, Chapter 7.1, Pl. 7.1.10a). The face plaster contained more calcium carbonate than the statue plaster (4-9% acetic acid-insoluble fraction compared to 9-15%), probably because of slightly different sources at the site.

These qualitative differences between face and Cache 2 statue plaster stimulated a further heating experiment to better understand control of plaster-making, in particular to determine whether plaster was the product of a deliberate mixture of marl and calcined marl (lime) or rather use of incompletely calcined marl (Boulton 1988a). Chunks of marl (approximately 75 cm^3) were heated to a range of temperatures and examined with the SEM. As expected, those heated at temperatures in the range normally stated for lime production, 800-1000°C (Kingery *et al.* 1988; Boynton 1980), became cracked and powdery throughout, and SEM confirmed complete calcination, showing an absence of coccoliths. Those heated for only two hours at 50°C intervals between 500°C and 700°C, in contrast, showed distinct zones of powdery surface material that easily sloughed off. While the lumps appeared to remain unaffected, the powdery surface material had apparently been calcined, confirmed by alteration of coccoliths when examined by SEM. This suggested that although it would have required more effort for separation, powdery surface material could have been identified and harvested by ancient plaster-makers when marl was heated for relatively short periods of time as low as 500°C, much lower than previously supposed. Remaining lumps proved extremely difficult to grind, however, probably related to clay content. This property led us to conclude that incompletely calcined marl could not have been used to make the plaster; rather, unheated marl and fully calcined marl would have been used since they are easy to grind. Hence, slaked lime and ground marl must have been deliberately mixed, and it is likely that their percentages were purposefully chosen.

Samples of floor plaster from the site support the theory that plaster composition was deliberately selected for specific uses. Fine surface layers and coarser lower layers can be clearly differentiated with the naked eye and were confirmed by TSPA. Other authors have noted differences in the types and quality of plasters used within a single artifact as well as between different types of artifacts and between similar artifacts from different sites (Gourdin and Kingery 1975; Kingery *et al.* 1988; Goren and Goldberg 1991; Goren and Segal 1995; Hershkovitz *et al.* 1995a; Hershkovitz *et al.* 1995b; Goren *et al.* 2001).

Use of top-quality plaster to model the faces may have occurred for any number of reasons. Experience may have shown that use of a higher percentage of slaked lime produced more desirable properties, such as better response to burnishing or improved adhesion to bone. If there was a hierarchy of objects, a greater percentage of slaked lime might have been used for more valued objects, *e.g.*, for plastered skulls rather than plaster floors. Practice would likely have been inconsistent over time, in keeping with the plaster faces having been made centuries before the plaster statues. Economics and scale may have played a role. Use of a high percentage of slaked lime would have been an insignificant use of resources given the small amount of plaster required for the plaster faces, while for floors or statues it would have been a substantial quantity. Finally, one must consider that use of this particular plaster for the faces could have occurred by chance, although it seems the least likely explanation.

Pigment

The pink plaster, otherwise identical in composition to unpigmented plaster, was probably colored with a small amount of red iron oxide. EDS analysis detected a trace amount of iron in the pink layer, and optical microscopy suggested that the pigment is a natural ochre with a mix of particles. A poor-quality XRD pattern was dark with few legible lines, in itself consistent with an iron oxide pigment. This is attributed to iron oxide's small particle size, which renders it somewhat amorphous, as well as to secondary fluorescence of iron by the detector's copper k-alpha radiation.

Bitumen

Bitumen inlays, found most abundantly in the eye incisions of Face 3, are black, glassy, and brittle. Bitumen could have been easily obtained from the Dead Sea, only a day's walk from 'Ain Ghazal (Rollefson and Simmons 1987a). Although it was a common material throughout the ancient world (Forbes 1936; Connan and Deschesne 1992) and used to decorate plaster statues at 'Ain Ghazal (see Chapter 7), to date this use of bitumen does not appear to have been reported within the corpus of plastered skulls found in the Near East.

MANUFACTURE

Manufacturing techniques were elucidated by close examination of interior surfaces of the three plaster faces, which showed that the crania had been modified with fiber stuffing and cordage before plaster was applied. Neither of these materials has been reported for use in manufacturing other MPPNB plastered skulls, at least in part because evidence of their presence is normally obscured by bone or restoration materials. Study of the manufacturing techniques was enhanced by replication experiments using a plaster mixture based on 'Ain Ghazal marl, applied to a human cranium modified with grassy stuffing and cordage.

Impressions on interior plaster surfaces indicate that fiber stuffing was used to fill out regions below the zygomatic arch, resulting in a more oval face and rounded cheeks, and to occlude cranial apertures such as the eye orbitals and nasal cavities (Figs. 6.1.8-6.1.9, Pls. 6.1.7c-d). The fiber stuffing not only reduced the amount of plaster that had to be applied, probably enabling modeling to be accomplished using a single layer of unpigmented plaster, but also prevented cranial interiors from being filled with plaster. For the most part, other methods for closing cranial apertures have not been reported in the literature. Exceptions include plaster, used to plug the apertures of 'Ain Ghazal Skull 88-1 (see Schmandt-Besserat, Chapter 6.2), and use of an organic bitumen-like material postulated for occlusion of the the nasolacrimal canal of a plastered cranium found at Kfar Hahoresh (Goren *et al.* 2001). Plaster filling of the cranial interior has been noted with respect to Jericho plastered skulls by Strouhal (1973), but such internal plaster is most likely from post-excavation restoration.

The function of the plaited braids remains unclear. The braid might have been used to prevent protrusion of sharp skeletal material through plaster in the dental area, like the molars that protruded through plaster on the underside of a cranium found at Kfar Hahoresh (Hershkovitz 1995a: 781); to keep the substantial stuffing at the side of the head in place; or to increase the stability of the skull in upright position. Replication experiments, however, showed that the cranium could be easily plastered in the absence of the braid, without any of the posited drawbacks. There remains the possibility that the braid enabled the plastered skull to be secured to something behind it, if indeed it exited from the plaster at the back. Another suggestion has been that cordage added height to the crania, compensating for the absence of mandibles, but its small vertical dimension (0.5 cm) scarcely affects height. Plastering a cranium that rested on cordage has not been previously reported, but evidence of this fabrication detail can only be seen where exposed by damage or imaged by techniques such as computer tomography. Cordage was integral to fabrication of armatures for the plaster statues at ‘Ain Ghazal, however, and it was commonly used at other Neolithic sites. Well-preserved pieces of actual cordage made mostly from monocotyledons have been found at Nahal Hemar (Schick 1988; Shimony and Jucha 1988), including cordage around which lime plaster beads were formed (Kingery 1988).

Replication experiments showed that the cranium probably lay on its back surface during plastering, as this proved to be the only position in which all surfaces could be plastered at once. In this position the central facial area was also conveniently uppermost for modeling the features. Cranial features like the coronal suture and temporal line, apparently boundaries for the original faces, proved natural as borders. Application of a thin layer of plaster directly on bone in the forehead region proved natural, as did thicker application over grassy stuffing, in keeping with the original faces. Features were modeled, and after they were complete, the plastered skulls were set upright in normal position. This produced a slight flattened ridge at the perimeter of the underside, comparable to that on the undersides of the plaster faces. A day later the pink plaster coating was applied and burnished, with optimum burnishing results achieved after about a day’s drying of the pink plaster. A surface similar to the original could be achieved during replication only by rubbing with smooth, hard silicate stones, not just the fingers moistened with water. A smooth-surfaced flint fragment from the Cache 2 statue pit and an agate gilding burnisher were successfully used for burnishing.

SIMILAR MPPNB ARTIFACTS

Other plaster skulls and statues excavated at ‘Ain Ghazal bear some similarities to the three plaster faces in conventions of depiction, although all are considerably later in date (see also Schmandt-Besserat, Chapter 6.2 for stylistic comparison to similar artifacts). Eyes, mouths, and nostrils are also delineated with incised lines. Bitumen decoration was also used on other plaster artifacts found at ‘Ain Ghazal, including for the eyes of all plaster statues (Chapter 7.1) and probably some plastered skulls. One eye of a plastered skull excavated in 1988 had cleaner plaster in the pupil area, for example, suggesting that it was originally decorated with bitumen (Boulton, personal communication; Simmons *et al.*1990; Bonogofsky 2006: 20); these areas appear similar to areas of bitumen detachment noted during treatment of Cache 2 plaster statues. A much more fragmentary plastered skull excavated at ‘Ain Ghazal in 1983 probably also had open eyes delineated with bitumen, but it retains plaster only in one eye socket and a black substance on the surface that has not been identified (Rollefson and Simmons 1988; Butler 1989). Plaster appears to have been applied mainly in a single layer for the three plaster faces, just as plaster seems to have been applied in a minimum number of layers of the same composition whenever possible for fabrication of Cache 2 plaster statues (Grissom, Chapter 7.1; Grissom 2000). This is in contrast with the application of multiple layers of different composition found on plaster artifacts at other sites (see below). The pink-colored plaster layer on the surface of the three plaster faces has not been found on other artifacts at ‘Ain Ghazal (and few if any MPPNB plastered skulls), but traces of decorative pigments have been found on plaster statues in both caches and on unplastered skull fragments (Rollefson 1985: 56).

Stylistically, however, other anthropomorphic plaster artifacts found at ‘Ain Ghazal bear only a distant resemblance to the three plaster faces, possibly because of different dates. Wide-open eyes contrast with the closed eyes of the three plaster faces, and longer, more rectilinear statue heads contrast with the oval plaster faces. Although the plastered skull excavated in 1988 at ‘Ain Ghazal belongs to the same artifact category as the three faces, the pointed corners of its eyes and slightly upturned nose more closely resemble those features on statues in Cache 2. Features on the 1988 skull are also larger than the three plaster faces, perhaps because the face was modeled on a complete skull. Its lower face was absent from the burial, but modeled features are located in the same places as skeletal counterparts, suggesting that a missing mandible was also plastered (Boulton 1988b).

Among other MPPNB plastered skulls, a plastered cranium found at Kfar Hahoresh is most similar to the three plaster faces, its eyes likewise depicted closed and its mouth made with a horizontal slit between protruding lips (Hershkovitz *et al.* 1995a, 1995b; Goring-Morris *et al.* 1995; Goren *et al.* 2001). Its proportions are also similar, although the face is broader. Plaster on the Kfar Hahoresh skull likewise contained lime and has survived in excellent condition, but it was applied in multiple layers of increasing quality, perhaps an alternative strategy to use of fiber stuffing. An organic material was reportedly used to prevent plaster from leaking into the cranium through the nasolacrimal canal.

Although it retains its mandible, a plastered skull found at Beisamoun, now exhibited at the Israel Museum in Jerusalem, also appears similar in form to the three faces from ‘Ain Ghazal, perhaps because it is close in date (Ferembach and Lechevallier 1973). Its eyes are depicted closed, and its ears are single protrusions like those of the three plaster faces. The nostril apertures are depicted by round depressions, however, rather than linear incisions. The surface coating on a more fragmentary plastered skull found at Beisamoun, now at the Prehistoric Museum of Kibbutz Ma’ayan Barukh, is similar to that on the three faces from ‘Ain Ghazal in consisting of a layer of plaster mixed with red pigment rather than the plaster having been coated with pigment. Crushed calcite was also mixed into the surface layer, however, and the result is described as a reddish glimmering material rather than pink (Goren *et al.* 2001).

Several of the many plastered skulls found at Jericho have facial shapes somewhat similar to the three faces from ‘Ain Ghazal, but depiction of features is distinct (Kenyon 1981: pls. 50-59). Most eyes of plastered skulls found at Jericho were decorated with bivalve shells that represent open eyes, as were those of a plaster statue found at Jericho by Garstang [Israel Museum, Jerusalem, IDAM 35.3289 (Garstang 1935: 53)]. The only exception is a plastered skull with inlaid cowrie shell eyes placed horizontally, considered to represent closed eyes [Kenyon’s D111 (Reg. 534), now at the Ashmolean Museum, Oxford, Reg. 195-565]. The nostrils of one Jericho head appear to be depicted by elongated indentations similar to those of the plaster faces [Kenyon’s E22 (Reg. 3657) at the Rockefeller Museum, Jerusalem (JPE 121.32)]. That same plastered skull has ears depicted by single protrusions similar to those of the ‘Ain Ghazal plaster faces, while the ears of another are more ring-shaped [Kenyon’s D112 (Reg. 532), now at the Jordanian Archaeological Museum, Amman (J 5758)]. The majority of Jericho plastered skulls are missing plaster in the region of the mouth, but those with mouths are depicted with softly modeled lips instead of the linear incisions of the three plaster faces, *e.g.*, Kenyon’s D110 (Reg. 531) and D114 (Reg. 530); Archaeological Museum, Amman (J5756 and J5757). Only one plastered skull found at Jericho was modeled on a complete skull, and its proportions are elongated (D112). As it had been for the three plaster faces from ‘Ain Ghazal, in several instances the solution to the reduced skull was reduction in facial size; *e.g.*, on Kenyon’s D115 (Reg. 533), now at the Royal Ontario Museum, Toronto. The plastered skull at the Rockefeller Museum, in contrast, has closer to normal facial proportions because its chin was built up with plaster, and its modeled facial features match skeletal features fairly well (Goren and Segal 1995).

As is also the case for plaster statues found at Jericho, plastered skulls from Jericho exhibit multiple layers of plaster of distinctly different composition, varying from coarse lower plaster to finer finishing material (Kingery *et al.* 1988; Goren and Segal 1995; Goren *et al.* 2001). A mixture of marl and lime was been found in the outer layer on two plastered skulls from Jericho, but the plaster contains far more silica and less lime than the three ‘Ain Ghazal faces, and it is generally described as poor in quality and condition. Some Jericho plastered skulls also had colored surfaces, but it is not always clear if pigment was bound with plaster. The top layer of the skull D115 at the Royal Ontario Museum is described as having a pink-colored skim coat on its surface (Kingery *et al.* 1988), apparently similar to that of the three ‘Ain Ghazal faces, although this has not been confirmed. Two skulls examined in Amman may also have red pigment incorporated in a plaster outer layer, as the surfaces appear pink (skulls D110 and D114, both in Amman). Skull D114 at the museum in Amman is notable for multiple black stripes painted directly on its unplastered skull.

The Jericho cache containing seven skulls (D110-116) represents the only other group that has been published in sufficient detail to compare its consistency as a whole with the ‘Ain Ghazal group of three faces. These plastered skulls from Jericho are more different from each other in terms of materials and style, perhaps accounting for Kenyon’s belief that they were “portraits.” It seems more likely, however, that the variation is related to fabrication by several hands, perhaps at different times, as noted by Strouhal (1973). The modeling of D112, for instance, is more refined than for any other skull, in addition to its exceptional modeling on a complete skull rather than a cranium. Skulls D110, D 113, and D114 have oval faces distinct from the square shape of D115. Surface treatments also vary considerably, from those with pink skim coats to those with grayish, apparently original surfaces, such as that of skull D112 examined in Amman.

Plastered skulls have also been found at Tell Ramad (Ferembach 1970; De Contenson and Liere 1966; De Contenson 1967, 1971; Bienert 1991; Bonogofsky 2006), but they are the least similar to the three plaster faces from ‘Ain Ghazal. Comparison of features is precluded by the poor condition of plaster surfaces, but facial proportions of the Tell Ramad artifacts are much more elongated than those of the three plaster faces. This is in part because they were modeled on skulls that retained mandibles, but they also have unique, modeled plaster necks. The excavators suggested that these plastered skulls were meant to be placed on headless plaster statues found nearby, but recent scholarship suggests that the statues had damaged, schematic heads instead (Garfinkel 1994). The relatively small size of the statues also makes placement of plastered skulls on them improbable.

All MPPNB plastered skulls lack plaster where hair would be on the top and back of the cranium, with the possible exception of the skull excavated at ‘Ain Ghazal in 1988, which had plaster attached to an occipital bone (Simmons *et al.* 1990). This suggests that there might have been cranial decoration imitating hair or head coverings. Alternatively, actual hair or head coverings were used but have not survived. In addition to striped decoration found on Jericho skull D-114, two painted crania have been found at ‘Ain Ghazal in separate deposits, although it cannot be known if they had been part of skulls with plastered faces because the facial areas of the skulls were missing (Rollefson 1985, 1986). Unusual collagen (initially identified as bitumen) “nets” and grooved decoration found on crania in the Nahal Hemar Cave might have represented headdresses, like the linen headdress also found at the site, although those crania show no evidence of plaster faces (Arensburg and Hershkovitz 1988; Yakar and Hershkovitz 1988; Nissenbaum 1997).

CONSERVATION TREATMENT

Given here is an abridged version of the final treatment report (Griffin 1993), filed with eight volumes of documents for the project at the Smithsonian’s Museum Conservation Institute under No. 5336. Treatment was relatively straightforward. After fragments had been removed from their storage boxes or excavated in the laboratory, they were cleaned and lightly consolidated to strengthen them for reassembly. The degree of consolidation was less than that required for reconstruction of Cache 2 statues, because the plaster had considerable inherent strength and density; moreover, the reassembled faces are not heavy. Based on results of testing, fragments were consolidated with a 4% solution in toluene of Acryloid B-72. The consolidant was applied at least two times by pipette to unpigmented surfaces until fragments appeared saturated. During the process, fragments lay face down partially submerged in a container filled with large glass microballoons. This served to slow evaporation of solvent and prevented formation of a B-72 skin on the exterior surface that would have increased darkening of its pink coloration. Conservare OH, a catalyzed ethyl silicate solution used to strengthen Cache 2 statue plaster, was rejected because it darkened the pink surface unacceptably during testing, and the additional strength it provided seemed unnecessary. A dilute solution of Methocel A15C was used to consolidate, reattach, and protect bitumen that filled the eyes.

Most fragments could be joined by matching break edges, but annotated photographs taken on site and during laboratory excavation proved essential for complete reassembly and documentation. Re-attachment was done using a concentrated solution of Acryloid B-72 dissolved in acetone.

Of the small number of fragments that were not attached, a few large ones can be associated with specific heads based upon positions in the pit (Pls. 6.1.8c-d). Fragments 1 and 14, with cordage impressions indicating that they are from the underside, are most likely from Face 2. Another small fragment (16.15M) may be associated with Face 2’s proper left eye, while 16.18A is likely the p.l. eye of Face 2 or possibly the p.r. ear of Face 1. Of three ear fragments, the largest (Fragment 13) is likely the proper right ear of Face 3, while the other two (5.1c and 5.3c) cannot be associated with specific heads, since they were removed without recording in 1984. Other unattached fragments are small (<2 cm in diameter), and most lack the pink surface layer.

Although the three faces have considerable losses, the plaster's strength permitted minimal use of auxiliary support materials so that most impressions on interior plaster surfaces could remain visible for study. Only in-filling essential for stability was done: this was thought to be appropriate because the faces seem to have been buried as fragments. Fills were limited to three areas on Face 2 where adjoining surfaces matched poorly (Pls. 6.1.5a-b). The largest is between the palate-filling plaster fragment underneath the head and the modeled chin; as noted above, the fragments are now believed to have been incorrectly positioned, resulting in the face being more perpendicular to the base than it was originally. On the proper left side, gaps between a large fragment group and the central facial region were bridged with fills. Finally, many small losses were filled in the badly fragmented and flattened forehead section after its shape and angle were adjusted by comparison to a study skull. Prior to gapfillng, a stiff polyester plain-weave fabric was adhered overall to the back of the forehead fragments with Acryloid B-72, and a thin, pigmented layer of plaster of Paris was added to the underside of the fabric to provide additional support that would not be affected by high temperatures. Patches of spun-woven polyester tissue were adhered to reinforce the undersides of other joins. On the surfaces, a gap-filling putty was applied, made of microscopic glass microballoons (Scotchlite Glass Bubbles), Acryloid B-72, and dry pigments to match the color of unpigmented original plaster. Finally, modern materials were toned with acrylic emulsion or watercolor paints to match adjacent surfaces.

The intensive campaign of examination, research, and treatment culminated in an exhibition of the reconstructed plaster faces at the Smithsonian's Arthur M. Sackler Gallery (Gunter 1996), followed by exhibition in Paris at the Institut du Monde Arabe (Kafafi and Rollefson 1997; Grissom 1997) prior to their return to Amman in the Hashemite Kingdom of Jordan in December 1997. At that time they were installed at the Jordanian Archaeological Museum on the citadel by Grissom.

Brass spider wall mounts were made by independent mountmaker Bob Fugelstad for exhibiting the heads at the Arthur M. Sackler Gallery; these allow maximum access to the reverses for study. The mounts were altered for insertion into case decks prior to exhibition at the Institut du Monde Arabe. They were inserted vertically into pine blocks at the citadel in Amman.

Products used for treatment

Acryloid B-72, ethylmethacrylate copolymer, Röhm and Haas, Philadelphia, PA 48640
METHOCEL A15C, methylcellulose, Dow Chemical Company, Midland, MI 48640
Scotchlite Glass Bubbles (C15/250): 3M, St. Paul, MN 55144

CONCLUSION

The important role played by trained conservation staff in the recovery of the plaster faces cannot be overemphasized. On account of blocklifting on site and transport of material to a conservation laboratory for extended treatment, a seemingly hopeless conservation task instead produced displayable artifacts that are the oldest dated MPPNB anthropomorphic plaster material found in the Near East to date. The burial of the plaster faces without the crania on which they were modeled is also unique within the genre of plastered skulls, perhaps providing new insights into ritual behavior. Moreover, the absence of the crania enabled examination of interior surfaces that would otherwise be inaccessible, providing an exciting opportunity for understanding the fabrication process. Study of plaster technology has also been valuable. The plaster's excellent condition is astounding considering the age of the faces, superior to that of statues found at the site that are later in date. Laboratory experimentation showed that plaster making was controlled and energy efficient.

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Conservation treatment of the plaster faces and analytical work was performed principally by Patricia Griffin, then an archaeological conservation intern under the supervision of Carol Grissom at the Smithsonian Institution’s Conservation Analytical Laboratory, now the Smithsonian’s Museum Conservation Institute. Many other individuals at the laboratory, however, were essential for completion of the project. Holly Lundberg assisted with reassembly, Anne Liégey proved a valued colleague during treatment, and Harriet Beaubien provided advice at various stages of the project. Ellen Rosenthal assisted with last-minute preparation before exhibition. Ann Boulton provided information about the 1988 plastered skull found at ‘Ain Ghazal and set the course for analytical work on lime plaster found at the site. Melanie Feather, Camie Thompson, and Charles Tumosa provided technical support for SEM examination, EDS analysis, and xeroradiography. Pamela Vandiver shared observations on floor plaster and limestone rocks from the site, as well as regarding other MPPNB plaster. Thanks go particularly to Lambertus van Zelst, then Director of the Conservation Analytical Laboratory, for his support of the project over many years.

Photographs and drawings were made by the authors unless indicated otherwise.

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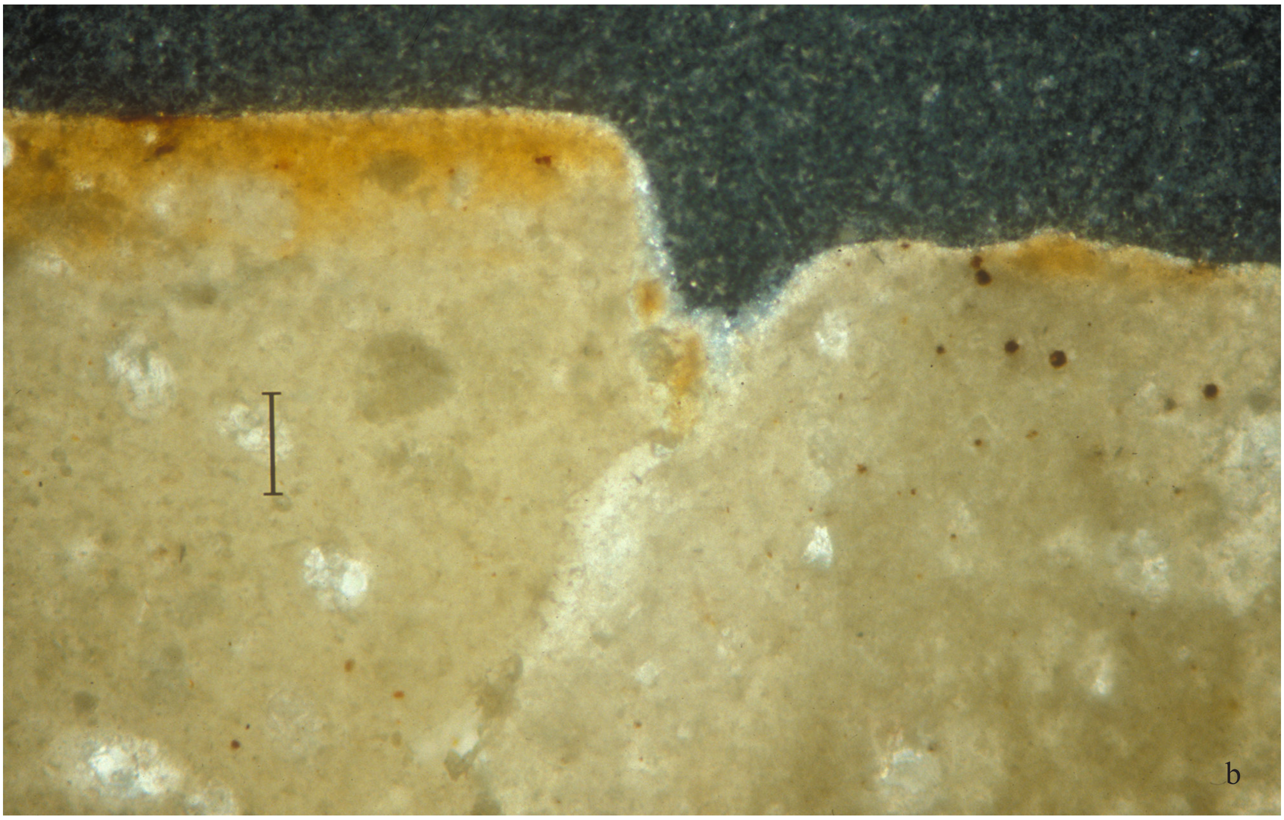

Plate. 6.1.1. a) Three plaster faces excavated at ‘Ain Ghazal in 1985, front view after reassembly. Left to right, Faces 3, 2, and 1. Photograph courtesy Arthur M. Sackler Gallery of Art, Smithsonian Institution, Washington, D.C; b) Thin-section of face plaster showing pink surface layer at upper edge. Bar superimposed on the image at left measures 100µm.

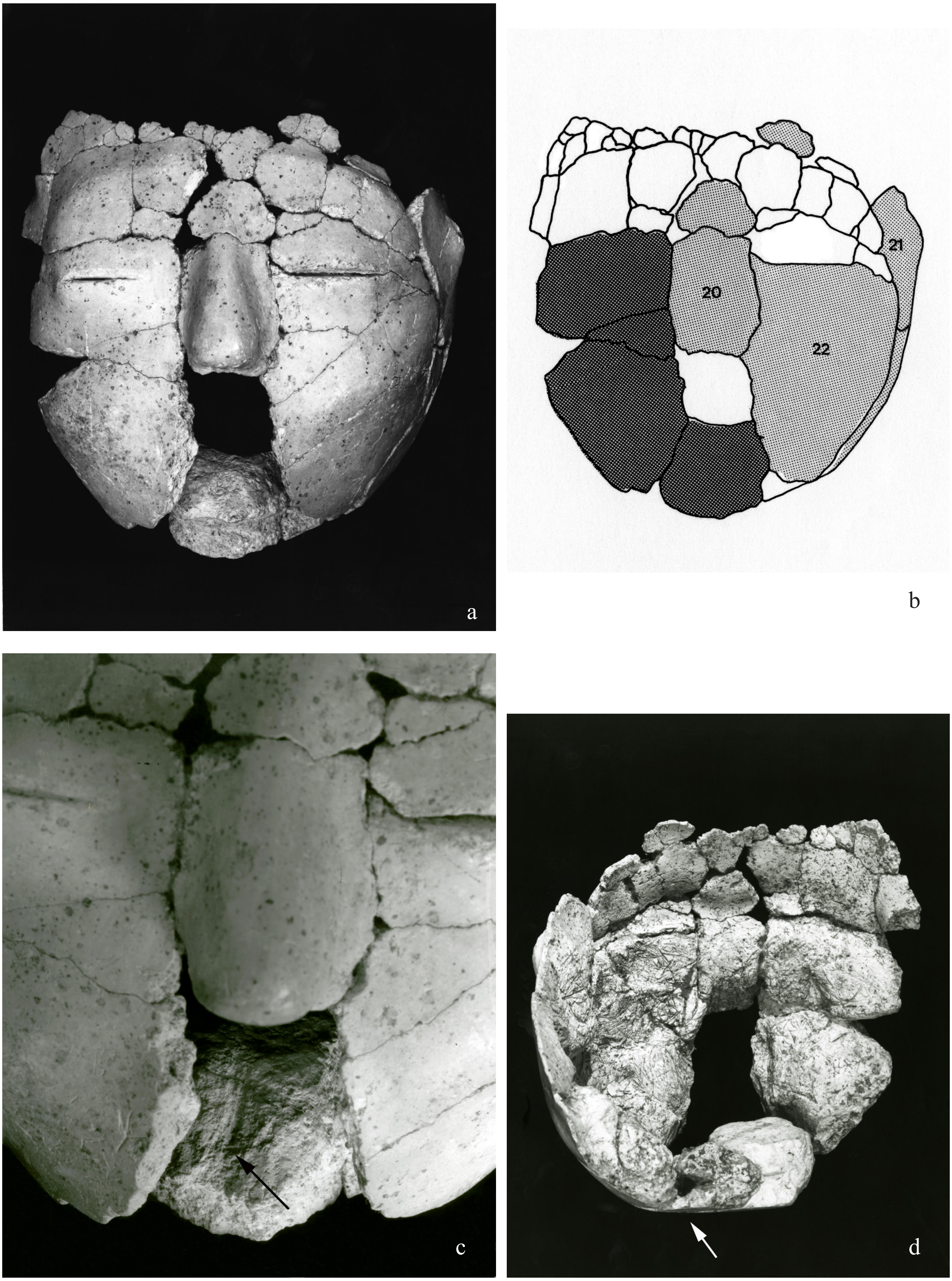

Plate. 6.1.2. a) Face 1, front view; b) Face 1, drawing after the previous, with fragment identifications corresponding to those in Figure 6.1.3 and Figure 6.1.5. Fragments lifted individually in 1984 have dark shading; those lifted in 1985, light shading; and those blocklifted in 1985, no shading; c) Face 1, detail of previous, with impressions of palatine sutures indicated by an arrow; d) Face 1, interior front. Void left by plaited braid is indicated by an arrow.

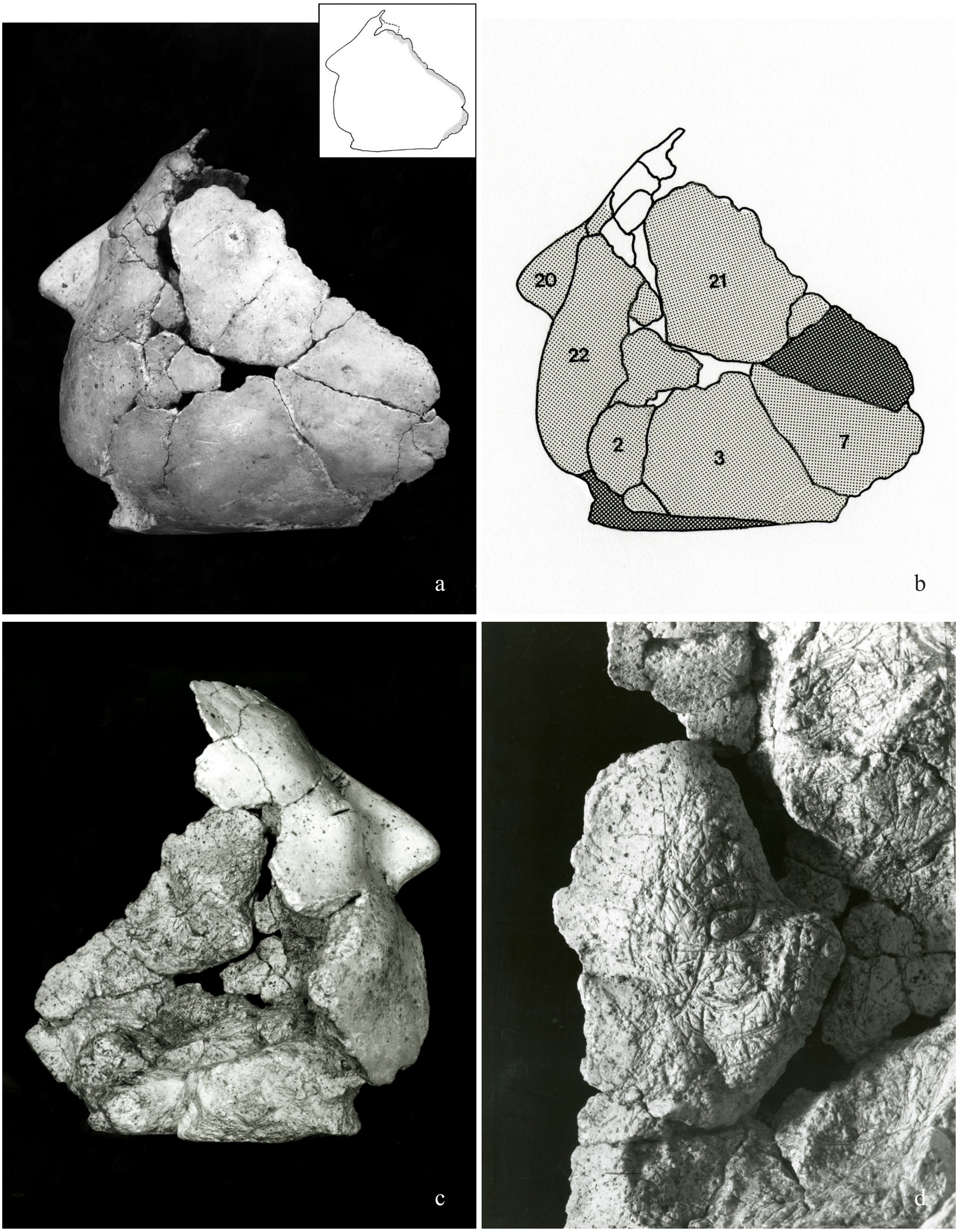

Plate. 6.1.3. a) Face 1, left profile. Inset drawing shows finished edges of plaster with shading; b) Face 1, drawing after previous, with fragment identifications corresponding to those in Figure 6.1.3 and Figure 6.1.5. Fragments lifted individually in 1984 have dark shading; those lifted in 1985, light shading; and those blocklifted in 1985, no shading; c) Face 1, right profile, revealing p.l. interior; d) Face 1, detail of previous, showing finished perimeter edges at left and impression of the zygomatic arch at right (in shadow).

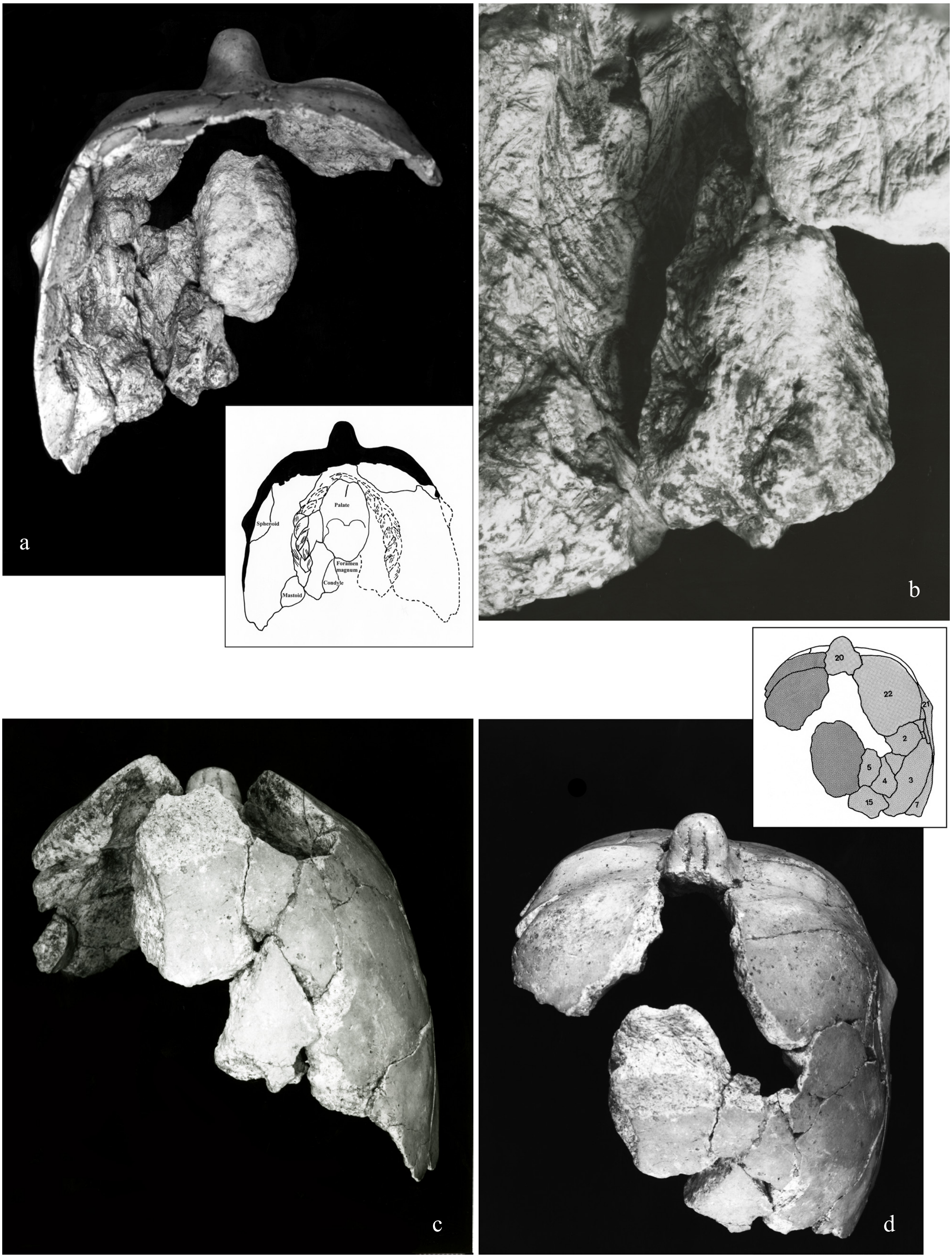

Plate. 6.1.4. a) Face 1, top view. Inset drawing identifies cranial areas; extrapolated plaster and cordage are indicated by dashed lines, and exterior plaster is solid black; b) Face 1, detail of previous showing cordage-impressed plaster; c) Face 1, bottom view; d) Face 1, oblique view of bottom. Inset drawing shows fragment identifications corresponding to those in Figure 6.1.3 and Figure 6.1.5. Fragments lifted individually in 1984 have dark shading; those lifted in 1985, light shading; and those blocklifted in 1985, no shading.

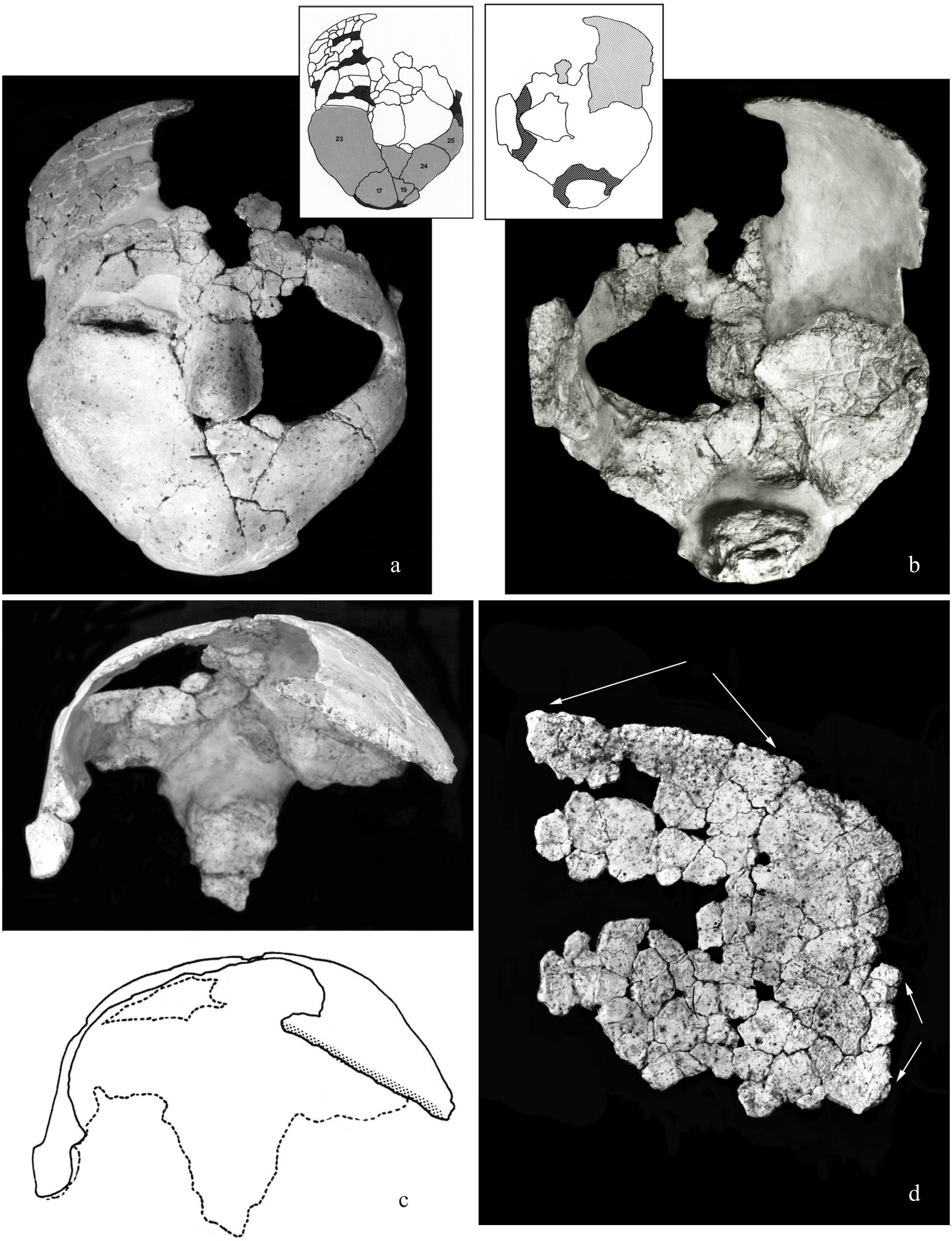

Plate. 6.1.5. a) Face 2, front view. Inset drawing shows fragment identifications corresponding to those in Figure 6.1.3 and Figure 6.1.5. Fragments lifted individually in 1984 have dark shading; those lifted in 1985, light shading; those blocklifted in 1985, no shading; and fill is solid black; b) Face 2, interior front. Inset drawing shows area supported overall on the reverse (light shading) and gaps that were filled (dark shading); c) Face 2: above, top view with forehead in focus; below, drawing after previous; shading indicates finished edge at the top of the forehead; d) Face 2, detail of forehead interior before application of supporting layers. Impressions of cranial sutures are indicated by brackets.

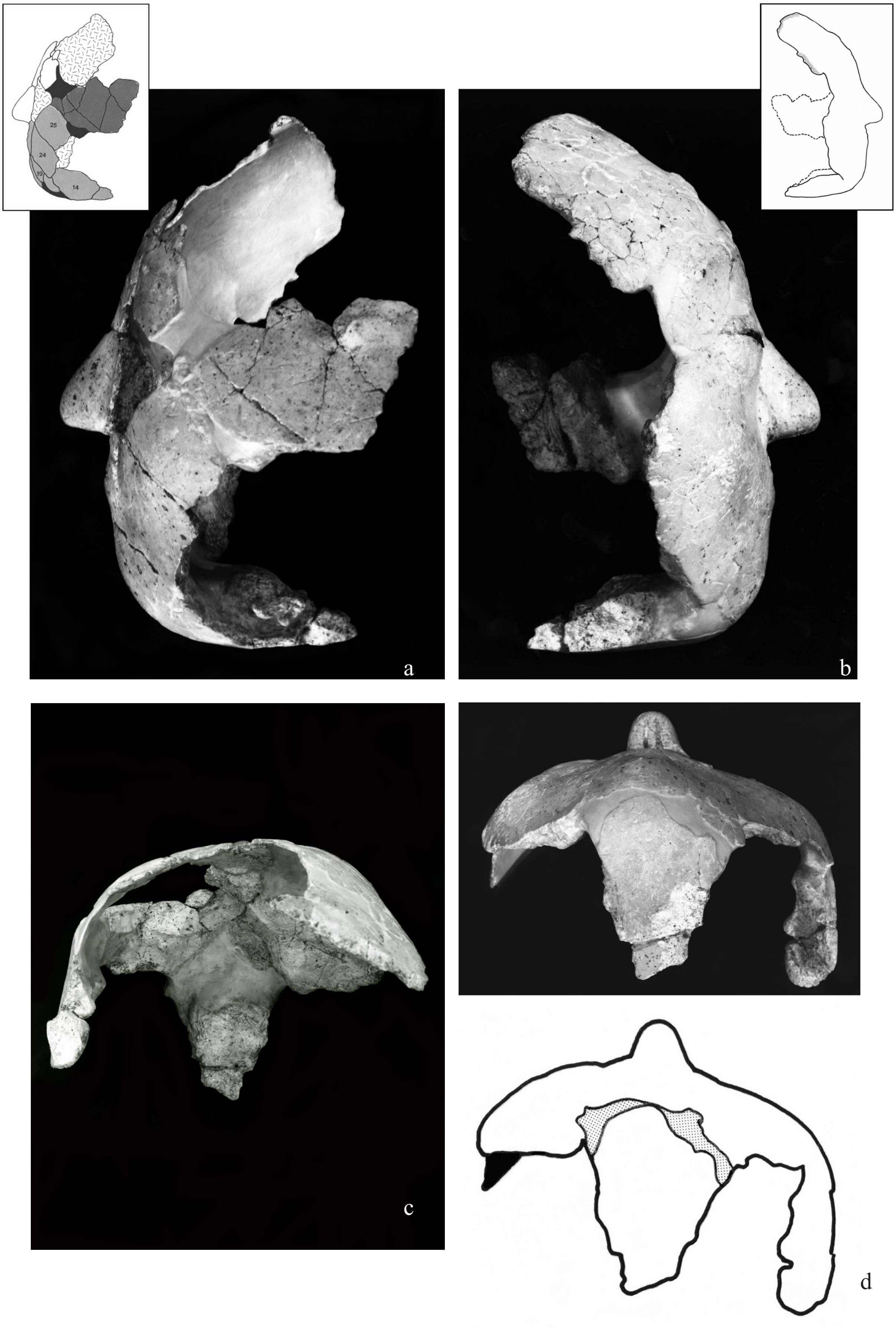

Plate. 6.1.6. a) Face 2, left profile. Inset drawing shows fragment identifications corresponding to those in Figure 6.1.3 and Figure 6.1.5. Fragments lifted individually in 1984 have dark shading; those lifted in 1985, light shading; those blocklifted in 1985, no shading. Interior surfaces are indicated by hatching, and filled areas are black; b) Face 2, right profile. Inset drawing shows finished edges at the top and p.r. side of the forehead (shaded); c) Face 2, top view, with palate in focus; d) Face 2: above, bottom view; below, drawing after previous shows fills (shaded) and supporting layer on interior (black).

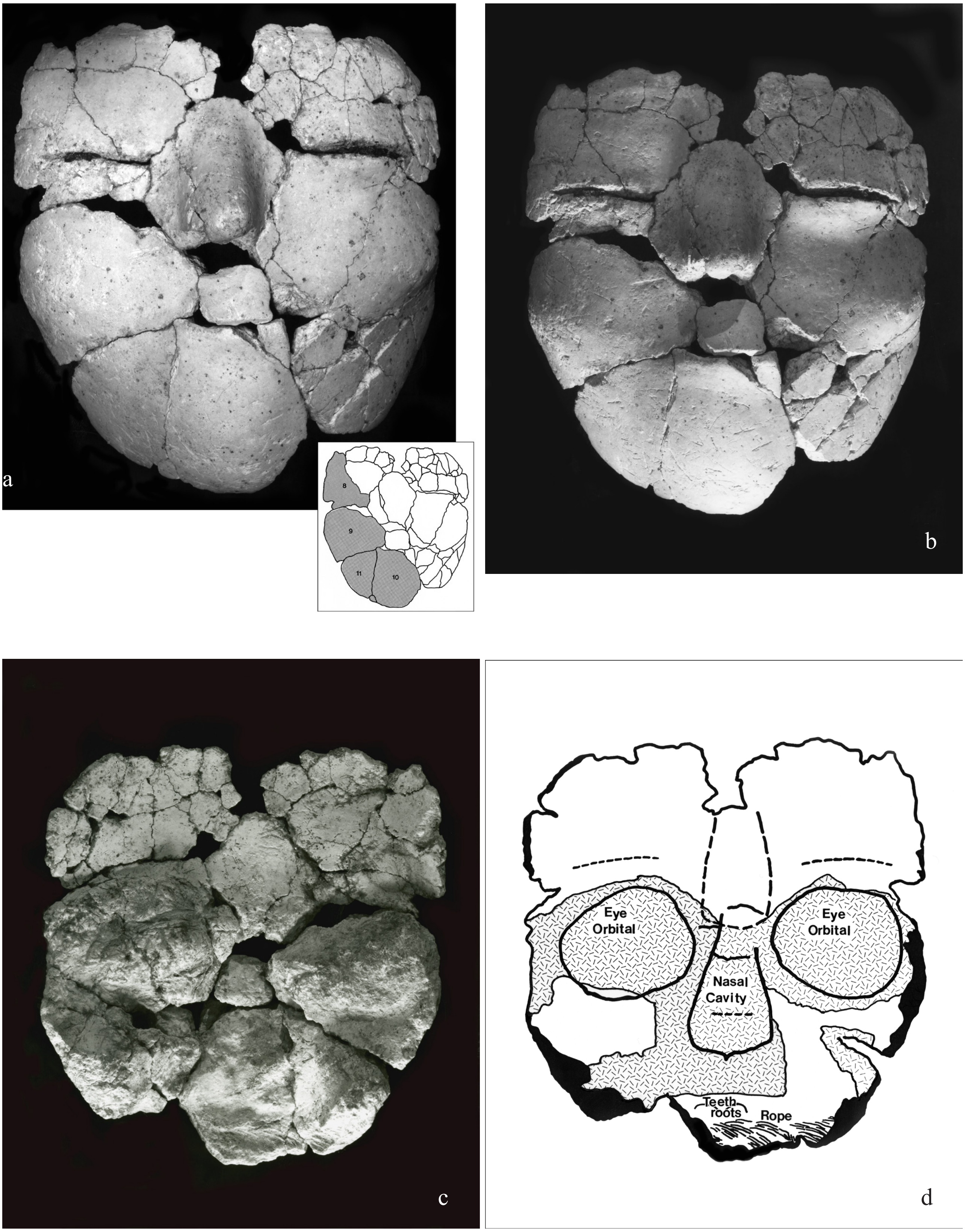

Plate. 6.1.7. a) Face 3, front view. Inset drawing shows fragment identifications corresponding to those in Figure 6.1.3 and Figure 6.1.5. Fragments lifted individually in 1985 are shaded, and those blocklifted in 1985 are without shading; b) Face 3, front view in raking light; c) Face 3, interior front in raking light; d) Drawing after previous, showing skeletal features, impressions of rope, hollows probably formed by teeth root protrusions, fiber-impressed areas (hatched), and bone-impressed areas (unshaded). Features modeled on the exterior are indicated with dashed lines.

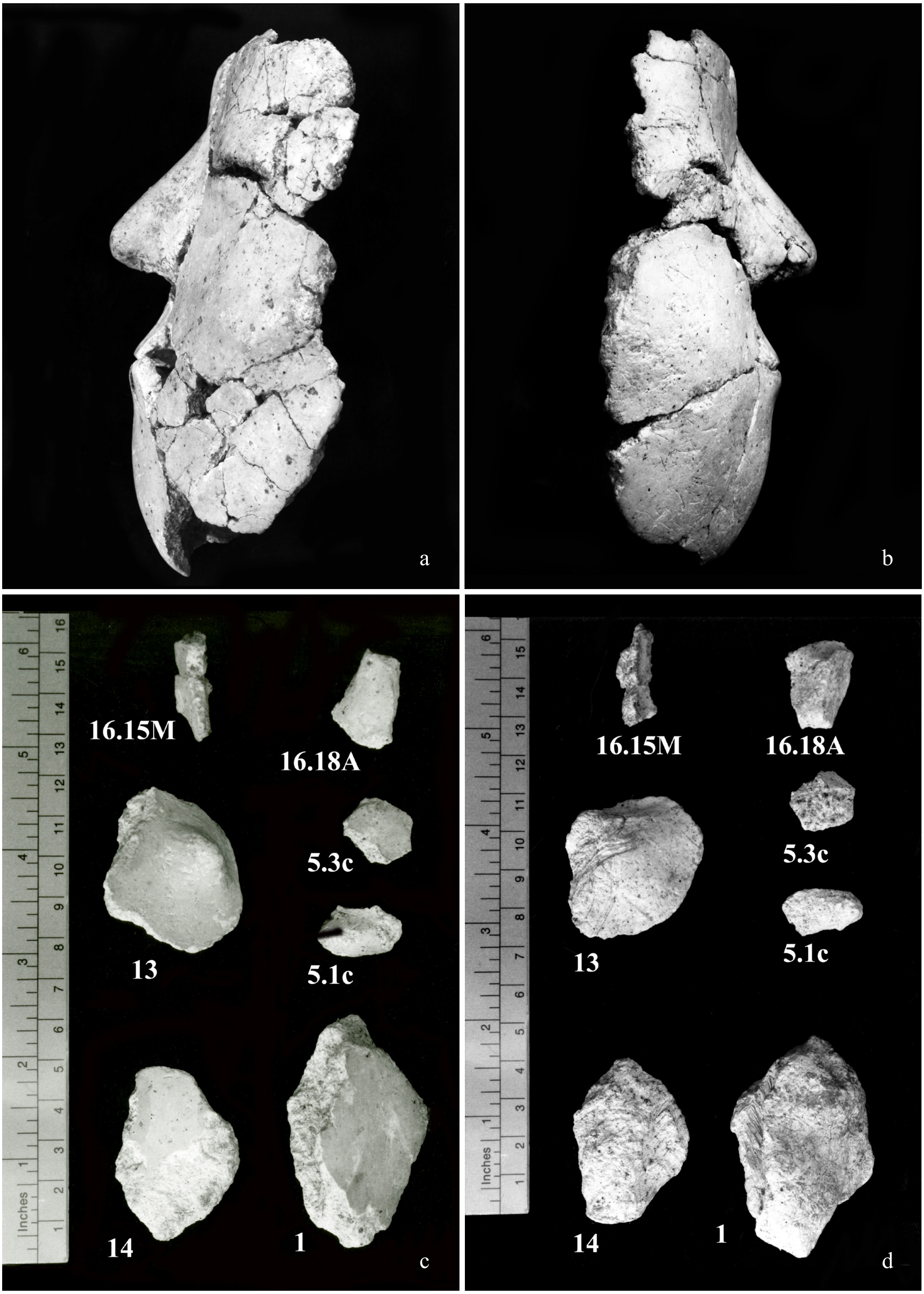

Plate. 6.1.8. a) Face 3, left profile; b) Face 3, right profile; c) Largest unattached fragments with pink exterior surfaces (see Fig. 6.1.3 for locations of fragments *in situ*); d) Interior surfaces of largest unattached fragments shown in the previous plate.