

Patrick E. McGovern
Museum Applied Science Center for
Archaeology (MASCA)
and Near East Section
University Museum,
University of Pennsylvania
Philadelphia, PA 19104
USA

Patrick E. McGovern

Technological Innovation and Artistic Achievement in the Late Bronze and Iron Ages of Central Transjordan

It has been claimed that “the motive power of a culture...lies in its technology, for here it is that energy is harnessed and put to work” (White 1949). If so, then adopting the best technology available, from whatever source, or developing it locally is of supreme importance for any culture.

In our pragmatic world, technology is divorced from art, with rare exceptions (e.g. computer graphics). In antiquity, by contrast, art and technology were intimately associated. Cyril Stanley Smith (1970), a metallurgist and historian of science, has stressed that technology is the integrated work of man’s hand, eye, and mind, individuals being responsible for inventions. An equally important concept, emphasized by Smith, is that technological advance is often motivated by aesthetic as well as practical considerations.

The association of “Art and Technology” and its impetus to cultural development is evident throughout the archaeological record of Jordan — from the Neolithic plaster statues to the monumental stone architecture of the Decapolis cities to the frescoes of the Umayyad desert palaces. To assess adequately such achievements, including the two case studies from the Late Bronze and Iron Ages of central Transjordan that are presented here, a range of theoretical issues need to be addressed.

A Theoretical Framework

Technology is tied to art, because any artistic expression depends on its medium, viz., the extent to which materials and production methods set specific boundary conditions as to which styles are possible and most suitable.

Pottery-making illustrates this close coupling of art to its medium (McGovern 1986b), which also applies to other crafts and industries. In brief, the form and decorative details of a pottery vessel are the end-products of a complex, industrial sequence. Beginning with the selection and preparation of raw materials (clay and tempering materials), the process continues with fabrication (whether by coiling, slab-building, wheel-throwing, etc.), definition of rims, bases, and other features by scraping,

smoothing, slipping, and/or painting of the surface, baking the vessels in the sun, and finally firing them in a kiln or an open fire.

There is nothing special *per se* about this sequence of pottery-making operations; potters the world over go through essentially the same steps. Pottery industries, however, will differ because of raw material quality — some potters have access to better clays or are more adept at preparing their clays — or equipment availability (power-driven turntables and high-temperature kilns, for example, enable a better product to be produced more efficiently).

Because of the close association between art and its medium, the emergence and subsequent development of a stylistic tradition is very much dependent on the underlying technological traditions. In general, any stage in the industrial sequence may impact on another stage in the same sequence. For example, the beautifully contoured and painted Chocolate-on-White/White Slip vessels, dating to Late Bronze IA and concentrated at many sites in the Jordan Valley and on the plateau, could only be achieved within a wheel-throwing tradition which employed fine clays, slips, and paints.

Once a stylistic tradition, which is well adapted to underlying technological traditions, has been established, some variations will occur within the constraints of materials and methods. A strong conservative tendency is partly due to the repetitive tasks of pottery-making, which require complex hand-eye coordination and are often learned at a young age. Fixed motor habits are needed to make numerous pottery vessels of the same type. But, stylistic changes are made intentionally (if only to relieve the boredom!), and others occur unconsciously, as it were, over extended time periods (and are particularly valuable in the archaeological seriation and dating of pottery types). But what does it take to introduce a major change in materials, techniques, and ultimately styles?

Cross-cultural contacts can have a major impact on how native industries change and develop (McGovern

1989a). These contacts can be direct through trade goods, itinerant craftsmen, written records, or native craftsmen being educated abroad; or ideas, whether written or oral, and materials can be transmitted through second-party and more distant purveyors. The contacts can be voluntary or forced. Hands-on, apprenticeship training in a craft is especially effective in transferring technology. Such transferrals generally involve adaptations, even innovations, due to cultural and environmental differences.

The styles and techniques of one craft, however, can also be transferred to or "borrowed" from another craft within the same society, especially if their workshops are near one another. Pyrotechnologies illustrate the point: once fire has been used in making lime plaster or simply cooking food, other materials — clay, metals, silicates — might intentionally or accidentally be treated with it. Firing temperatures for different materials will differ, and modifications and adaptations of kilns, such as the standard double-chambered pottery kiln (with separate firing and baking chambers) in contrast to a small single-chamber unit for smelting metal ore, will be needed.

Lacking adequate textual evidence, some critical factors in the transfer process will never be known. Besides material and technical constraints (raw materials, climate, water regimes, tools, and so forth), which can be assessed to varying extents, very little information may be available about the specific social arrangements (for example, land-tenure and inheritance practices) and other political and economic factors (labor supply, capital formation and investment, craft secrecy, the extent to which artifacts are markers of status, diet, group identity, religious values, etc.).

In the Third World today, the potter may not be able to afford a wheel or a high-temperature kiln, or be able to hire additional assistants to expand his operation. To appeal to the tourist trade or the art market, changes in traditional technology and styles can be a necessity (Graburn 1976). Investment costs, with an uncertain outcome, must consequently be weighed against the economic survival of the craftsman and his/her family.

The low socio-economic status of many craft specialists in societies around the world today, however, need not have been the case in antiquity. Ceramic materials, for example, as among the earliest man-made synthetics, were viewed as almost miraculous replications of naturally occurring minerals, metals, and other substances, often associated with specific deities (McGovern 1989b). Judging from the large percentage of cultic and other special artifacts made from pottery, silicate materials, and metals found in public buildings and tombs, these crafts and industries were often of central cultural significance. Even Egyptian gods were willing "to get their hands dirty"; Khnum, a major god of creation, is often

depicted in reliefs as a potter throwing vessels and other divine figures on a turntable. Lesser human practitioners of such crafts might then have risen to higher socioeconomic positions and had more opportunity for experimentation in a relatively "open" society — i.e., one that is willing and able to entertain non-traditional religious, artistic, and technological concepts.

As a final theoretical point, if one were to single out the most important long-term, internal cultural factor contributing to technological and artistic change, that would be increasing social stratification and political centralization, often accompanied by increasing population (for references, see McGovern 1989a). This development can markedly alter the supply and demand conditions of production by enlarging markets, creating better transportation systems, concentrating capital formation, and contributing to more diversified tastes and needs within the society. Assuming that rational economic decisions will eventually prevail, any threat to the existing power structure has been minimized, and craftsmen or their organizations have access to capital and are "open" to change, then changes in the craft's organization (for example, from household to mass production), investment structure, and products (by targeting specialized sectors of the market) will be the ultimate outcome. By the multiplier effect, the emergence of a specialized industry, here considered as the independent variable, could propel the culture in the direction of ever greater stratification and centralization.

Because of the numerous permutations of the various environmental, individual, and cultural factors in any given instance of artistic creation or technological innovation, many different outcomes are possible. The dominant matrix of factors leading to a particular outcome can sometimes be reconstructed *ex post facto*, but the predictive power of this "general systems" model is limited. Reconstructing the origins and subsequent development of an ancient style or technique solely on the basis of archaeological evidence is extremely precarious. Archaeological data represent a very small, highly selective fraction of the original technology. Even with written contemporaneous records, which present their own problems of interpretation, it is doubtful that the relative significance of the various factors involved in a given instance of an artistic or technological achievement can be unequivocally demonstrated.

Two Case Studies from Jordan: Iron/Steel Jewelry and Stone Statuary

These theoretical considerations of how art and technology are interrelated and can change or remain the same through time, set the stage for two instances of innovative developments under very different cultural circumstances during the Late Bronze and Iron Ages of

central Transjordan.

The Iron/Steel Jewelry of Transjordan

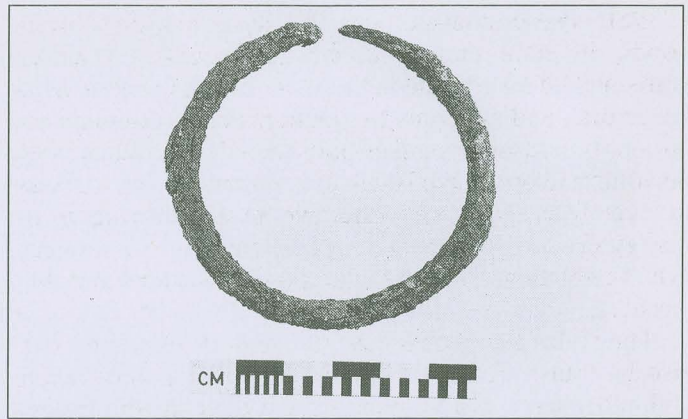
In updating my treatment of a central Transjordanian iron and mild steel industry, beginning toward the end of the Late Bronze Age and continuing into the Iron Age, there is no need to reiterate the stylistic and technological details of the jewelry from the Baq'a Valley here (McGovern 1986a) (FIG. 1a-c). Suffice it to say that the eleven iron/steel anklets, bracelets, and rings, together with forty additional fragments, from the Baq'a Valley, constituted a significant increase in the number of published iron artifacts from Jordan.

Similar iron jewelry artifacts of early Iron date had already been reported from sites within a 10 to 50 km radius of al-Baq'a — in tombs at nearby Mādabā (Harding 1953) and on Jabal an-Nuzha in 'Ammān (Dajani 1966). One weapon — an iron knife — was found in a tomb at Tall as-Sa'idiyya in the Jordan Valley (Pritchard 1980: 20, FIG. 15.6). Most recently (1987), iron jewelry of the same types as those from al-Baq'a have been reported from a tomb at Pella of early Iron Age date, with over a hundred burials (pers. comm., S. J. Bourke, May 19, 1988). Technical analyses of this jewelry from Pella, as well as Mādabā, Jabal an-Nuzha, and Tall as-Sa'idiyya, have not yet been published, so it is uncertain whether they are made of iron or a true steel.

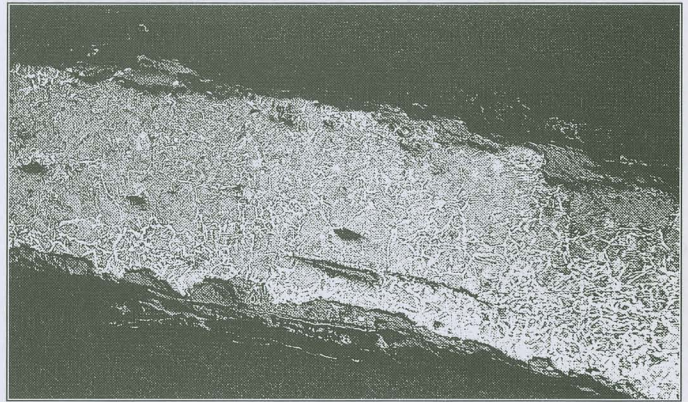
The Pella discovery is intriguing in view of a single piece of steel from the same site, which was first reported to be of Middle Bronze Age date (Smith *et al.* 1984), over 500 years earlier than the early Iron Age group. Not surprisingly, the Middle Bronze piece is now seen as belonging to the end of the Late Bronze Age (Smith 1984: 474). The transitional Late Bronze-Iron Age jewelry at Pella indicates that iron — very likely steel — jewelry was available on a fairly large scale during this period.

Iron or steel artifacts of early Iron Age date, including jewelry, weapons, and tools, have also been excavated at other eastern Mediterranean sites (Waldbaum 1978) — in particular Cyprus and Syria, where large groups are reported. For example, thirty-five iron objects, mainly jewelry, from Period I tombs at Ḥamā have been published. Jordan, however, is now clearly “on the map,” and if the Jordanian discoveries of the last fifteen years are any measure, the numbers and relative percentages for Transjordan compared to other regions could become even more pronounced in the future.

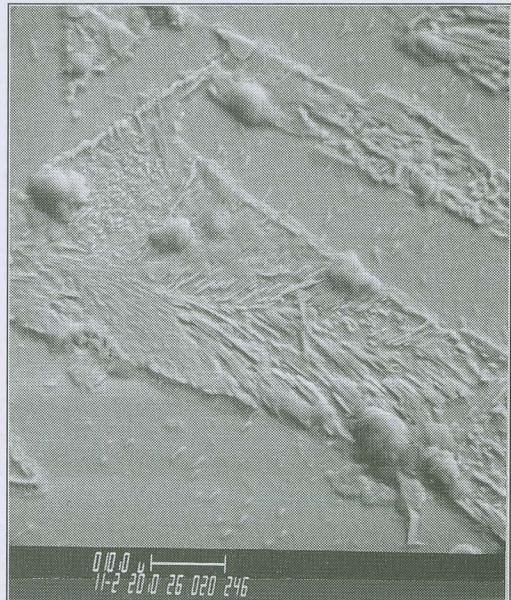
When analyses of Palestinian iron artifacts, with well-preserved intact metal, have been done, they have often turned out to be of a mild steel (Muhly *et al.* 1990). Why is the early iron from these sites so often steel? Is the new metal the result of an intentional, innovative process or simply an accidental accompaniment of ironworking?



1a. Mild steel anklet/bracelet from Cave A2 (Late Bronze IA), Jabal al-Hawāya, Baq'a Valley (registration data with line-drawings in McGovern 1986a: FIG. 84.11).



1b. Cross-section of mild steel anklet/bracelet (registration data with line-drawings in McGovern 1986a: FIG. 84.54) at 24x magnification, showing extensive carburization with Widmanstätten patterning.



1c. Scanning electron micrograph, 1100x, of anklet/bracelet cross-section shown in 1b. Nodular carbides are visible at the interface between pearlite and ferrite regions. (Photographs courtesy of N. Hartmann and H. Moyer).

Although some of the metallographic evidence is open to debate, the prevalence of iron and steel during this period at a number of sites in the eastern Mediterranean points to intentionality, if only at the empirical level — i.e., knowing how to steel iron without being able to explain the process scientifically. The al-Baq'a jewelry thus shows uniform carburization throughout the cross-section of the metal artifacts which were examined.

If steeling iron artifacts were an intentional development, then the question may be posed whether the initial impetus for the innovation of steel at this time necessarily involved the mechanical properties of the metal? If one follows the traditional view that the Philistines, one of the Sea Peoples, introduced ironworking into Palestine near the beginning of the Iron Age (Wright 1939), then it is a short step to proposing that iron and/or steel was of particular importance in conquering the native peoples and environment, i.e., as weapons in war and as axes and ploughs to clear forests and plow fields for agriculture.

Transjordan clearly underwent a major cultural transformation at approximately the same time that the Sea Peoples were establishing themselves in the Levant. The Late Bronze city-state system of Transjordan collapsed, and a dispersed network of small villages emerged, with a much lower standard of living and fewer foreign contacts in the early Iron Age (McGovern 1986a). Except for the single Tall as-Sa'idiyya knife, however, the mild steel artifacts from the Transjordan are exclusively jewelry items. Their ornamental nature would then suggest that the hardness of the metal was less important to the smith than its aesthetic qualities: color, sheen, and/or the jingling sound of a pair of anklets or bracelets that were worn together. Aesthetic appeal need not involve magic (cf. Muhly *et al.* 1990). Rather, mild steel artifacts could be another example of the adoption of a new form or process, perhaps as visible symbols of a new order. Iron/steel jewelry could also be a repository of wealth. The shift from wheel-thrown to coil-built pottery, with the appearance of several new types in Iron IA, also reflects the artistic and technological change of the period (McGovern 1986a; 1986b).

Where were the steel artifacts made that have been excavated in Transjordan? There is no compelling reason for arguing that these artifacts had to be imported. The pottery found in the tombs at the various sites in central Transjordan are of local types, and other artifacts, apart from marine shells, are of types common enough at many early Iron Age sites on the plateau and elsewhere in Palestine.

It has been argued that the adoption of iron technology in its early stages throughout the eastern Mediterranean area was encouraged by a reduced or inconsistent availability of copper and/or tin (Snodgrass

1971; Maddin *et al.* 1977). As a result of the socio-political upheavals that characterized the last two centuries of the second millennium BC, trade routes from Afghanistan, where important tin ores are known to have been exploited in the second millennium, would have been cut off, and craftsmen would have turned to alternative metal ores.

The consistently high tin bronzes of early Iron Age jewelry from al-Baq'a (averaging 10.6% tin), much higher than the tin contents of bronzes of earlier date in the same region (average of 7.8% for the Late Bronze period from c. 1550 to 1200 BC), suggest that this model does not apply to the Transjordanian plateau. A similar phenomenon has recently been documented for early Iron Age Greece (Waldbaum 1989), where high-tin bronze artifacts — often jewelry — are found in association with iron artifacts. Unless they had a means of enriching the tin contents of older bronzes, which is highly unlikely, the local metalsmiths must still have had additional supplies of tin. Other Near Eastern tin sources — in Anatolia, Egypt, and Lebanon — are known, but whether they were exploited in the early Iron Age is unknown. Even if these mines were worked and the ores processed, one would still need to explain how during a period of evident contraction in trade, tin reached Transjordan and Greece.

Waldbaum (1989) interprets these findings in light of Wertime's hypothesis (1982; 1983) that extensive deforestation of the Near East had occurred by the later second millennium. Since iron ore is more efficiently smelted than copper ores (Horne 1982), iron production might then have gradually gained in importance as a response to ecological pressures. In fact, copper smelting need not be more inefficient (see references in Muhly *et al.* 1990), depending upon other variables (type of furnace, beneficiation of ores, etc.). Thus, even if it can be demonstrated that environmental deterioration occurred toward the end of the Late Bronze Age (Waldbaum 1989: 119-120), the ecological model for the shift from copper/bronze to iron/steel is inherently weak.

Another scenario may be proposed for the innovation of iron and steel in Transjordan (McGovern 1987). In the wake of economic and social dislocations at the end of Late Bronze Age, the urban population apparently dispersed into hinterland areas where alternative subsistence strategies were required. Under these circumstances, new ores might have been experimented with and a new technology of ironworking might have been developed, which included the steeling of the metal (cf. Stech-Wheeler *et al.* 1981). Although the necessary impetus for the full development of an iron/steel industry might have come from farther afield, the available archaeological evidence from central Transjordan, where few foreign contacts are evident in the Iron IA period, suggests that a na-

tive iron/steel industry was established near the end of the Late Bronze Age.

Iron ore deposits of limonite and hematite exist north and northwest of al-Baq'a in the Wādī az-Zarqā' and 'Ajlūn regions (Basha 1968). Recent geological investigation has revealed further extensions of these hydrothermally deposited iron ore veins striking southwest toward the Rift Valley (Mikbel *et al.* 1985).

Limited archaeological investigation in the 'Ajlūn, where some roads are literally lined with slag, has thus far uncovered only medieval Islamic smelting operations (Coughenour 1976), but preliminary surveys by the author at a smelting site only 10 km north of al-Baq'a, Dhahrat Abū Thawwāb, has yielded early Iron Age sherds. The chemical composition of one well-fused piece of slag from this site, as determined by proton-induced X-ray emission (PIXE) spectrometry, is similar to that of one of the al-Baq'a iron/steel artifacts, particularly in having an elevated cobalt content (0.3-0.5% by weight). This finding is especially noteworthy, because a small group of red glass beads and a horned eye bead were found in association with the iron/steel artifacts in the al-Baq'a burial cave, and they also show elevated cobalt. Since the glass has a very high iron oxide content (average of 48.7%), it is quite possibly a re-worked slag, perhaps a spin-off product of the primary metals industry.

Preliminary archaeological and archaeometallurgical surveys in the vicinity of the other iron ore deposits to the north and west of 'Ammān — e.g. Jil'ad — suggest that medieval smelting is best represented (Gordon *et al.*, nd). Only Tall adh-Dhahab al-Gharbī appears to have had definite smelting activity earlier than the Islamic period — in the late Hellenistic period (Gordon and Villiers 1983).

Sites close to the iron ore deposits, such as Dhahrat Abū Thawwāb and Jil'ad, are in relatively fertile areas, along the watershed at a higher elevation than al-Baq'a, and probably received more rainfall. In a period of climatic deterioration and deforestation such as the Late Bronze-Iron Age transitional period is argued to have been, the iron-ore regions would have been a preferred direction for human populations to move toward and settle. Today, these regions have extensive tracts of oak forests; if similarly well-forested in antiquity, building and fuel needs, the latter a high priority for an iron/steel industry, could have been met.

It may be proposed that native metalsmiths began to exploit local iron ore deposits on a large scale when the Late Bronze culture began to disintegrate and decentralize. It is also possible that metalsmiths from farther south in Wādī 'Arabah — who already had experience in flux copper ores with iron ores (Conrad and Rothenberg 1980) — might have contributed to the de-

velopment of the new technology. The prevalence of Red Sea molluscs in the al-Baq'a burial caves, which yielded the iron/steel jewelry, points to contacts from this direction.

Until excavations are carried out at several of the iron ore mines and smelting sites, we cannot be certain which, if any, were a source of the al-Baq'a steel or were even in operation during the Late Bronze-early Iron transitional period. West of the Jordan River, some evidence of Late Bronze-early Iron iron smelting has been reported from Khirbat al-Mashāsh in an-Naqab, Kamid al-Lawz in the Biqā' Valley of Lebanon, and Tel Yin'am in the Lower Galilee (see Muhly *et al.* 1990).

The Unique Statuary of the Later Iron Age

The Ammonite culture emerges in this proposed iron-working region later in the Iron Age. It is uniquely characterized by massive circular and rectangular buildings, constructed of unhewn, dry-laid boulders of limestone, sandstone, and flint, which are distributed over a 20 km radius around the 'Ammān citadel. These structures are discussed in detail in the paper that I presented at the fourth International Conference on the History and Archaeology of Jordan (McGovern 1992).

A dramatic native art form is associated with the large-scale architecture that develops in the Iron Age in the 'Ammān area and continues down to at least the Persian period. More than thirty painted limestone and (very occasionally) basalt statues and heads have been found on the Citadel and at several outlying sites (Barnett 1951; Ma'ayeh 1960; Tell 1967-68; Zayadine 1973; 1991: PLS. 38-45; Zayadine *et al.* 1989; Horn 1973; 'Arajān — Khairi 1970; Khirbat al-Ḥajjār and Abū 'Alandā — Ibrahim 1971).

The statues were not recovered from secure archaeological contexts, so they can only be broadly dated to the Iron IIB-C period. Based on associated archaeological material, an eighth-seventh century BC dating has been proposed (Dornemann 1983: 154). The palaeography of the inscription on the Yarah 'Azar statue (below) (FIG. 2), which includes the mention of the Ammonite king Sanipu, very probably the same Sanipu who submitted to Tiglath-pileser III in 733 BC, dates this example to the late eighth century.

Dornemann (1983: 154-160) conveniently summarizes the pertinent stylistic details of the statues and heads, and illustrates many of them. The statues, which are sometimes represented by only a head or torso, were evidently intended to be free-standing. Approximately 50 to 80 cm in height, they are smaller than life-size. Except for one possible female from Khirbat al-Ḥajjār, all are males. When preserved, the statues have heavy, squared-off bases, and show no evidence of attachments at the top or bottom (contrast the double-faced female heads, below).



2. Statue of Yarah 'Azar, from the 'Ammān Citadel (Iron IIB-C). Ht. 48 cm. (Jordan Archaeological Museum; photograph courtesy of F. Zayadine).

The male statues are of a composite Egyptian, Syrian (including Phoenician and Aramaean), and Mesopotamian style. Briefly, Egyptian influence is apparent in the stance, the position of arms at the sides of the body or sometimes with a clenched fist against the chest, a lotus held in one hand, the *atef* crown, and/or possibly a long tunic. Syrian and Mesopotamian stylistic features, which are difficult to distinguish because of Assyrian influence throughout the region, include coiffures (with hair coils, sometimes ending in "corkscrews," and headbands), fringed shawls and sashes, earrings and armbands, heads which are disproportionately large in comparison to their bodies, and/or large (sometimes inlaid) eyes. Some features, such as the beard cut away on each side of the chin

to form a point below the mouth on several examples, are unparalleled.

The division of the male statues into "Egyptianizing," "Transjordanian," and "Syrian" groups, as Dornemann proposes, is of doubtful value, since many of the same or similar features are shared by all the examples. The supposed more Egyptian, Transjordanian, or Syrian influences displayed in a group of pieces is difficult to assess, because of the evident syncretism of artistic conventions throughout the Near East at this time. When and if better dated and provenienced examples become available, then the finer typological distinctions might be related to specific cultural spheres.

The uniqueness of the statues — in particular, the fact that they were free-standing — marks them as a native central Transjordanian art form. No comparable statues have been found in Iron Age sites in Palestine, nor in Egypt, Syria, and Mesopotamia. The Ammonite inscription on the base of one statue is significant; it has been reconstructed to read [...]*sw yrḥ zr/[br z]kr br snb*, "...of Yarah 'Azar, son of Zakir(?), son of Sanipu" (Barnett 1951: 35, PL. 13; also see Bordreuil 1973). Zayadine's proposal (1974; 1991) that the statue represents an Ammonite king, giving his ancestry from former kings, is in accord with Assyrian records that mention a king of Ammon named Sanipu in the time of Tiglath-pileser III. The *atef* crown on several of the heads fits this interpretation, since in Egypt the *atef* crown was associated with the deified pharaoh. *Atef*-crowned, unidentified figures are also known from the Nimrud ivories (Mallowan 1966: FIGS. 469, 470, 504, 525, PL. IX) and Persian figurines (e.g. Negbi 1967: 17, PL. 11.67). These statues could then have served, not unlike similar monumental statues in Egypt and Mesopotamia, to demonstrate in visible form the authority of the Ammonite ruler, albeit as an Assyrian vassal. The possibility, however, that the *atef*-crowned statues might represent deities cannot be excluded.

The origins of such artistic syncretism in Transjordan is unknown. Because of the scarcity of securely dated Iron I and Iron IIA-B remains in Jordan generally, one can only guess at how such a unique art form arose. A nascent Ammonite kingdom, however, might well have emerged by later Iron I, with a concomitant growth of the population in the Greater 'Ammān region. A proliferation of massively constructed buildings and complexes of buildings throughout the region had certainly occurred by the Iron IIC/Persian period. A comparable settlement pattern, with similarly constructed buildings, possibly has its roots in the Late Bronze Age (McGovern 1992). But when did the intensification and expansion of settlement begin? Was it a gradual or relatively fast process? More information about the earlier part of the Iron Age is crucial in assessing how political centralization

and social stratification developed in the area. Architects, stone masons, and other personnel would have been needed for the large-scale building construction, and in time, especially if economic and political contacts with neighboring cultures were established, a local school of sculpture might well have arisen. A local architectural school in Moab might also explain the production of the Balū'a, Jabal Shihān, and Mesha basalt stelae.

The unique double-faced female heads from the Citadel pose similar problems of dating, stylistic affinities, production, and purpose as do the free-standing statues. The group of four female heads were found secondarily built into a Hellenistic drain (Tell 1967-68) (FIG. 3). Based on the palaeography of the Ammonite letters incised on the back of the eye inlays, the heads are dated to the eighth century BC (Bordreuil 1973) or the seventh-sixth century ('Amr 1988: 60, with comparisons to Herr 1978: FIGS. 42.31, 42.44, 43.25, 45.31, 45.36). Dornemann (1983: 162) argues for a sixth century date for one of the female heads, based on stylistic peculiarities that appear on later *protomai* from Western Mediterranean sites and on figurines and molds from Iron IIC contexts at 'Ammān and al-Muqābilayn. The female heads are thus approximately contemporaneous with the statues.

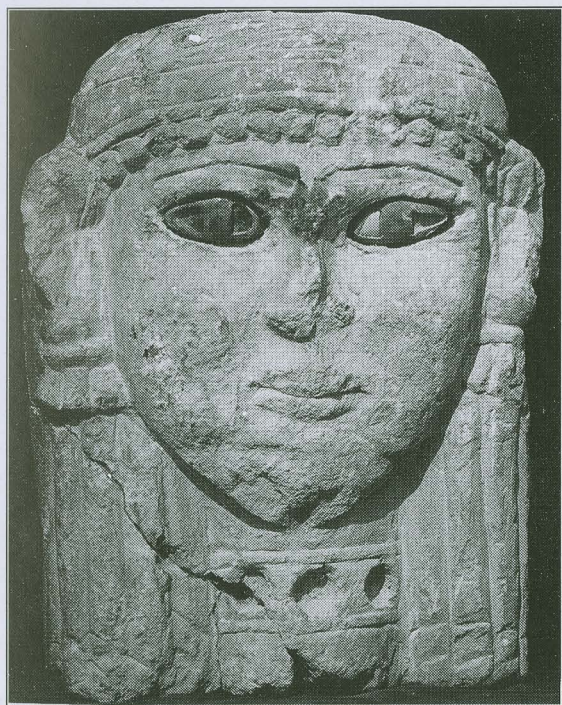
Kay Prag (1987) has convincingly argued that the female heads served as ornate balustrades, perhaps together with proto-Aeolic capital elements, in a multi-niched window. The four limestone examples are approximately the same size — about 26 cm in height, and about 21 cm

in thickness and width — and share the same stylistic features with minor variations.

The famous "Woman at the Window" ivories, which are well-represented at Nimrud, Khorsabad, and Arslan Tash (for references, see Prag 1987), with a single example from Samaria (Crowfoot and Crowfoot 1938: PL. 13.2), are remarkably similar to the 'Ammān female heads. Despite the differences in artistic medium and size, the heads' large eyes which were inlaid with ivory and black stone for the iris and outline of the eye, the long straight hair plaits held with a headband, the earrings comprised of a hoop and three drop pendants (similar to those worn by several of the statues — above), the choker necklace which was also originally inlaid, and the over-all proportions of the face are very comparable to the same features on the ivories. Moreover, the ivories are generally dated to the eighth century, as are most probably the female heads.

One problem stands in the way of the interpretation that the heads were used as balustrades. Assuming that the ivories are based on architectural analogies, as attested by the finding of proto-Aeolic capitals in many Near Eastern sites, why has only 'Ammān thus far yielded such female head sculptures? The heads almost certainly were intended as architectural elements, because cylindrical holes are drilled in the top of each (according to Zayadine 1991, the bottoms were likewise drilled). This has suggested to some investigators (Zayadine 1973: 34-35; Abu-Dayieh 1979: 363-364; Dornemann 1983: 161) that the heads served as column capitals, which are most similar to Hathor capitals in Egypt, Sinai, and contemporaneous Cyprus (viz., the prominent, frontal position of the ears on three of the heads is reminiscent of the cow ears of Hathor). Again, the artistic syncretism of the period precludes a definitive solution.

The broader significance of the female heads has been widely debated. Safwan Tell (1967-68: 9) has argued that they represent Ishtar or 'Ashtoreth, to whom a temple was dedicated on the Citadel. Prag (1987: 125-126) also relates the heads to a religious structure to Atargatis/Ishtar, as based on the identification of the "Woman at the Window" as 'Ashtarte/Atargatis/Aphrodite (see Barnett 1975: 150, 202). Hathor capitals also suggest a temple (Dornemann 1983: 163), since Hathor, as the Egyptian goddess of foreign lands and the "Lady of Turquoise," was often identified with a principal female Canaanite deity, whether 'Ashtarte, 'Asherah, Baalat, or a local equivalent. Most recently, Abdel-Jalil 'Amr (1988) has identified the female heads with the Egyptian tutelary goddesses, Isis and Nephthys. Given the artistic and religious syncretism of the period, and lacking other information, such as inscriptions, inferences about the identity of the female heads are premature (see Abu-Assaf 1982: 59, 83). One should also not rule out a pure-



3. Double-faced female head, from the 'Ammān Citadel (Iron IIC). Ht. 30 cm. (Jordan Archaeological Museum; photograph courtesy of F. Zayadine).

ly artistic function for the double-faced female heads.

Conclusions

The Bronze and Iron Ages of the ancient Near East are periods of major advances in many crafts and industries — metallurgy, ceramic production, ivory- and bone-working, seal carving, etc. Central Transjordan shared in these developments, more often absorbing technological advances and artistic idioms from its more powerful neighbors and adapting them to its own needs and circumstances.

Two case studies — the iron/steel industry of the Late Bronze and early Iron Age, and architectural statuary of the late Iron Age — illustrate how central Transjordanian societies could also be innovative. The iron/steel industry very likely developed in response to a cultural and economic reorientation — with the disintegration of the Levantine city-state system and the emergence of small, isolated villages. Craftspeople, who were perhaps originally copper/bronze metalsmiths, were probably thrown out of work during the economic and social upheaval. Under relatively deprived circumstances, they might have experimented with local iron ores, applying known smelting and fabrication technology, to produce a material with special aesthetic and functional properties when steeled. The ornamental nature of the artifacts thus far excavated — anklets, bracelets, and rings — suggests that the utilitarian properties of the iron/steel were less important than its aesthetic qualities.

In contrast to the lower standard of living and limited foreign contacts of the early Iron Age, the Iron IIB-C period in the Greater 'Ammān region was one of the most prosperous periods in Jordan's history. Although the capital of Rabbath 'Ammon was controlled by outside powers during much of this time, an architectural school developed that produced a unique statuary, reflecting the international character of the period in its syncretistic Egyptian, Syrian, and Mesopotamian style.

The significant interrelationships between technology and artistic expression in Bronze and Iron Age central Transjordan have only been broached here. The later Iron Age of Transjordan is characterized by a wide spectrum of technologically and artistically sophisticated artifacts. For example, red and black slipped and burnished, wheel-made bowls (similar to Assyrian "Palace Ware"), intricately carved seals (again with many Assyrian and Babylonian motifs), and painted horse and human figurines of unique types were very likely locally produced in the 'Ammān region. These crafts probably were preceded by developments earlier in the Iron Age. Much more study of each artifactual class — typologically, chronologically, and technologically — is needed, before we can assess the specific Transjordanian elements, and how they were transferred to and/or de-

veloped independently within central Transjordan.

Bibliography

- Abu-Assaf, A. 1982. Untersuchungen zur Ammonitischen Rundbildkunst. *Ugarit-Forschungen* 12: 7-102.
- Abu-Dayieh, A. 1979. *The Ammonite Art of Sculpture from 9th-6th Centuries B.C.* Unpublished M. A. thesis, University of Jordan [Arabic].
- 'Amr, A.-J. 1988. Four Unique Double-Faced Female Heads from the Amman Citadel. *PEQ* 120: 55-63.
- Barnett, R. D. 1951. Four Sculptures from Amman. *ADAJ* 1: 34-36.
- 1975. *A Catalogue of the Nimrud Ivories in the British Museum.* London.
- Basha, S. H. 1968. *Stratigraphic Accumulation, Origin and Prospection of Iron Ore Deposits at Warda—Southern Ajlun District.* Amman: Natural Resources Authority.
- Bordreuil, P. 1973. Inscriptions des têtes à double face. *ADAJ* 18: 37-39.
- Conrad, H. G. and Rothenberg, B. (eds.) 1980. *Antikes Kupfer im Timna-Tal: 4000 Jahre Bergbau und Verhüttung in der Arabah (Israel).* *Der Anschnitt*, vol. 1. Bochum: Bergbau-Museum.
- Coughenour, R. A. 1976. Preliminary Report on the Exploration and Excavation of Mugharat el Wardeh and Abu Thawab. *ADAJ* 21: 71-78.
- Crowfoot, J. W. and Crowfoot, G. M. 1938. *Early Ivories from Samaria.* London: Palestine Exploration Fund.
- Dajani, A. K. 1966. Jabal Nuzha Tomb at Amman. *ADAJ* 11: 48-49.
- Dornemann, R. H. 1983. *The Archaeology of the Transjordan in the Bronze and Iron Ages.* Milwaukee: Milwaukee Public Museum.
- Gordon, R. L., Knauf, E. A., Hauptmann, A. and Roden, C. nd. *Antiker Eisenbergbau und alte Eisenverhüttung im 'Aglun.* Unpublished manuscript.
- Gordon, R. L. and Villiers, L. 1983. Telul edh Dhahab and its Environs Surveys of 1980 and 1982: A Preliminary Report. *ADAJ* 27: 275-289.
- Graburn, N. H. H. 1976. Introduction: Arts of the Fourth World. Pp. 1-32 in N. H. H. Graburn (ed.), *Ethnic and Tourist Arts: Cultural Expressions from the Fourth World.* Berkeley: University of California.
- Harding, G. L. 1953. Four Tomb Groups from Jordan: An Early Iron Age Tomb at Madeba. *PEFA* 6: 27-41.
- Herr, L. 1978. *The Scripts of Ancient Northwest Semitic Seals.* Missoula, MT: Scholar's Press.
- Horn, S. H. 1973. The Crown of the King of the Ammonites. *AUSS* 11: 170-180.
- Horne, L. 1982. Fuel for the Metal Worker: The Role of Charcoal Production in Ancient Metallurgy. *Expedition* 25: 6-13.

- Ibrahim, M. M. 1971. Two Ammonite Statuettes from Khirbet El-Hajjar. *ADAJ* 16: 91-97.
- Khairi, N. 1970. 'Aragan Statue. *ADAJ* 15: 15-18.
- Ma'ayeh, F. S. 1960. Recent Archaeological Discoveries in Jordan. *ADAJ* 4-5: 114-115.
- Maddin, R., Wheeler, T. and Muhly, J. D. 1977. Tin in the Ancient Near East: Old Questions and New Finds. *Expedition* 19: 35-47.
- McGovern, P. E. 1986a. *The Late Bronze and Early Iron Ages of Central Transjordan: The Baq'ah Valley Project, 1977-1981*. University Museum Monograph 65. Philadelphia: University Museum.
- _____. 1986b. Ancient Ceramic Technology and Stylistic Change: Contrasting Studies from Southwest and Southeast Asia. Pp. 33-52 in, *Technology and Style. Ceramics and Civilization*, vol. 2, ed. W. D. Kingery. Columbus, OH: American Ceramic Society.
- _____. 1987a. Central Transjordan in the Late Bronze and Early Iron Ages: An Alternative Hypothesis of Socio-Economic Transformation and Collapse. Pp. 267-273 in A. Hadidi (ed.), *Studies in the History and Archaeology of Jordan III*. Amman: Department of Antiquities.
- _____. 1989a. Ceramics and Craft Interaction: A Theoretical Framework, with Prefatory Remarks. Pp. 1-11 in P. E. McGovern (ed.), *Cross-Craft and Cross-Cultural Interactions in Ceramics*. Ceramics and Civilization, vol. 4, ed. W. D. Kingery. Westerville, OH: American Ceramic Society.
- _____. 1989b. Cross-Cultural Interaction: The Late Bronze Egyptian Garrison at Beth Shan. Pp. 147-195 in P. E. McGovern (ed.), *Cross-Craft and Cross-Cultural Interactions in Ceramics*. Ceramics and Civilization, vol. 4, ed. W. D. Kingery. Westerville, OH: American Ceramic Society.
- _____. 1992. Settlement Patterns of the Late Bronze and Iron Ages in the Greater Amman Area. Pp. 179-83 in, *Studies in the History and Archaeology of Jordan IV*. Amman: Department of Antiquities.
- Mallowan, M. E. L. 1966. *Nimrud and its Remains*. 3 vols. London: Collins.
- Mikbel, S. R., Saffarini, G. A. and El-Isa, Z. H. 1985. New Iron Occurrence West of Amman, Jordan. *Dirasat* 12: 113-124.
- Muhly, J. D., Maddin, R. and Stech, T. 1990. The Metal Artifacts. Pp. 159-176 in V. Fritz, *Kinneret: Ergebnisse der Ausgrabungen auf dem Tell el-Oreme am See Gennesaret 1982-1985*. Wiesbaden: Harrassowitz.
- Negbi, O. 1967. A Deposit of Terracotta and Statuettes from Tell Sippor. *'Atiqot* 6: 1-27.
- Prag, K. 1987. Decorative Architecture in Ammon, Moab and Judah. *Levant* 19: 121-127.
- Pritchard, J. B. 1980. *The Cemetery at Tell es-Sa'idieyeh, Jordan*. Museum Monograph 41. Philadelphia: University Museum.
- Smith, C. S. 1970. Art, Technology and Science: Notes on their Historical Interaction. *Technology and Culture* 11: 493-549
- Smith, R. H. 1984. Excavations at Pella of the Decapolis, 1979-1985. *National Geographic Research* 1: 470-489.
- Smith, R. H., Maddin, R., Muhly, J. D. and Stech, T. 1984. Bronze Age Steel from Pella, Jordan. *Current Anthropology* 25: 234-236.
- Snodgrass, A. M. 1971. *The Dark Age of Greece*. Edinburgh: Edinburgh University.
- Stech-Wheel, T., Muhly, J. D., Maxwell-Hyslop, K. R. and Maddin, R. 1981. Iron at Taanach and Early Iron Metallurgy in the Eastern Mediterranean. *AJA* 85: 245-268, 481.
- Tell, S. K. 1967-68. Recent Ammonite Discoveries. *ADAJ* 12-13: 9-12 [Arabic section].
- Waldbaum, J. C. 1978. *From Bronze to Iron: The Transition from the Bronze Age to the Iron Age in the Eastern Mediterranean*. Studies in Mediterranean Archaeology 54. Gothenburg: Studies in Mediterranean Archaeology.
- _____. 1989. Copper, Iron, Tin, Wood: The Start of the Iron Age in the Eastern Mediterranean. *Archeomaterials* 3: 111-122.
- Wertime, T. A. 1982. Cypriot Metallurgy against the Backdrop of Mediterranean Pyrotechnology: Energy Reconsidered. Pp. 351-361 in J. D. Muhly, R. Maddin and V. Karageorghis (eds.), *Early Metallurgy in Cyprus, 4000-500 B.C.* Nicosia: Department of Antiquities.
- _____. 1983. The Furnace Versus the Goat: The Pyrotechnologic Industries and Mediterranean Deforestation in Antiquity. *Journal of Field Archaeology* 10: 445-452.
- White, L. A. 1949. *The Science of Culture*. New York: Farrar, Straus and Cudahy.
- Wright, G. E. 1939. Iron: The Date of its Introduction into Common Use in Palestine. *AJA* 43: 458-463.
- Zayadine, F. 1973. Recent Excavations on the Citadel of Amman. *ADAJ* 18: 17-35.
- _____. 1974. Note sur l'inscription de la statue d'Amman J. 1656. *Syria* 51: 129-136.
- _____. 1991. Sculpture in Ancient Jordan. Pp. 31-61 in P. Bienkowski (ed.), *The Art of Jordan: Treasures from an Ancient Land*. Liverpool: National Museum and Galleries on Merseyside.
- Zayadine, F., Humbert, J.-B. and Najjar, M. 1989. The 1988 Excavations on the Citadel of Amman: Lower Terrace, Area A. *ADAJ* 33: 357-363.