

***The Social Context of Technological Change: Egypt and the Near East, 1650–1550 BC: Proceedings of a Conference Held at St. Edmund Hall, Oxford, 12–14 September 2000*, edited by Andrew J. Shortland. Oxford: Oxbow Books, 2001. x + 273 pp., 50 figures, 42 plates, 13 tables. Paper. \$45.00. [Distributed in North America by The David Brown Book Company]**

This interesting collection of papers had its origin in a meeting at St. Edmund Hall, Oxford, in September 2000. Shortland's motivation for organizing the conference was to respond to the fragmentation in the study of ancient technology and to bring together researchers from different fields with an emphasis on discussion and exchange of ideas. The restriction to this specific geographic area and time period—1650–1150 (not 1650–1550 B.C. as stated on the misprinted cover)—was intended to allow for maximum interaction among the participants. The choice of the Late Bronze Age in the Near East and Egypt was particularly apt since, as Shortland has noted, this was a period that witnessed considerable technological innovation in several areas.

The book has 14 chapters, covering a number of the key technologies of the period as well as several general topical discussions. The technological papers include chapters on stone vessel production, in Crete (Jacke Philips) and the Levant (Rachel Sparks); the provenance of Palestinian amphorae (Bourriau, Smith, and Serpico); glass and faience production at Amarna (Shortland, Nicholson, and Jackson); gold and granulation in the Bronze Age Mediterranean (Thea Politis); Minoan foreign relations and copper metallurgy in Crete (Stos-Gale); social influences on the development of glass production in Mesopotamia and Egypt (Shortland); the organization of glass-working sites at Qantir (Rehren, Pusch, and Herold); and glazing technologies in the ancient Near East and Egypt (Paynter and Tite). The more general papers include a discussion of the mobility of artisans and technology transfer in Western Asia and Egypt in the Late Bronze Age (Moorey); technological change in the East Mediterranean Bronze Age (Andrew and Susan Sherratt); Egyptian and Hyksos military hardware (Shaw); society and technology in the Late Bronze Age as indicated through cuneiform sources (Robson); and a summary chapter on the transition from Bronze to Iron (Haarer). This review will not discuss every contribution but is intended to highlight some of the key papers and general aspects of the volume.

Moorey's chapter on the mobility of artisans and opportunities for technology transfer during the Late Bronze Age, and especially of "elite" technologies, through both military and diplomatic activities, is particularly interesting. Moorey's emphasis is on the role that official and royal correspondence and gift exchange played in the transfer of technologies between the major powers of the Late Bronze Age Near East and Egypt. In particular, he cites military technology as particularly susceptible to this

transfer, with the Egyptian adoption of a number of Western Asiatic "inventions," including the chariot and scale armor. That this technology transfer often included the exchange (usually a loan but in some cases a permanent transfer) of the artisan or tradesman and not simply the technological know-how is evident from the royal correspondence that Moorey cites and often can be inferred from the artifactual evidence. He notes that the surviving texts from Amarna and Boghazköy provide ample evidence of these contacts and technological exchange between the "Great Kings" at the courts of Hatti, Egypt, and Kassite Babylonia. Moorey also notes that the evidence for technological transfer at the level of "itinerant craftsman," while less obvious due to a lack of official documentation, is no less likely a source for the movement of technological innovations, although much harder to trace. This paper, like the Sherratts' paper that follows, is a very interesting and thought-provoking one. While Moorey does not provide extensive examples of the specific transfers of technology, he places these transfers in the context of the Late Bronze Age Near East and Egyptian world and draws our attention to the social contexts of technological innovation and transfer at this time.

The paper by Andrew and Susan Sherratt is also concerned with broader issues of technology. In this case, however, the development and transfer of technology and technological innovation are reviewed in terms of social models of production and consumption in an attempt to contextualize these processes. They apply (in an appropriate manner) contemporary terms and concepts in use by economic historians, such as "import substitution" and "added value," in order to explain the development, adaptation, and adoption of technologies across the region by different cultural groups through time. They argue that technologies spread and are adopted in specific ways which they term a "technological dialectic": a two-sided process in which emerging technologies spread based not just on "technological choices" but on cultural decisions that mirror social and often ideological processes. This recognizes that technology transfers sometimes also involve an element of resistance, based on local perspectives, which can lead to changes, innovations, and improvements that reflect differing motives in different areas. Technological transfer and change is therefore not to be seen simply in terms of utilitarian adaptation or evolutionary processes, but rather as being socially embedded in cultural choices.

The Egyptian adoption of military technology, in particular the horse-drawn chariot and the composite bow, are explored in the chapter by Ian Shaw. Shaw outlines the emergence of these important military technologies in terms of their composite parts as well as by the political and social contexts in which they developed. Following Renfrew (1986; quoted by Shaw on p. 60), he argues that "the decisive innovation in the development of a new commodity is generally social rather than technical"; and, in the case of the Egyptian New Kingdom, adoption of these important aspects of military hardware occurs only

once the social and economic conditions emerge that support their useful employment. Shaw suggests that although access to a number of the component materials (specific types of wood, horses, etc.) may not have been possible prior to the defeat of the Hyksos, many of the technical skills required to develop these technologies existed in Middle Kingdom Egypt. The final defeat of the Hyksos provided the ultimate link that not only broadened Egyptian access to Western Asiatic materials and craftsmen, but also produced the broader context within which these technologies could be employed—that is, in an increasingly militarized Egyptian society and in the building of the New Kingdom Empire. Innovation and adoption of technology, then, is seen not only in terms of the possibilities of the technology, but also as socially driven, in this case by the imperial ambitions of the pharaohs of the New Kingdom.

Sparks's chapter on stone vessel workshops in the Levant reviews evidence from the "obsidian workshop" discovered by Woolley at Tell Atchana and looks at gypsum vessel production in the Jordan Valley of the southern Levant. This analysis is undertaken by Sparks in order to study "the nature and extent of workshops through manufacturing debris and discards . . . and [to offer] a quantitative and stylistic analysis of the distribution of the finished products." Despite the lack of architectural plans or detailed stratigraphic notes by Woolley, Sparks reviews the evidence from the workshop and provides a useful overview of the materials, which include raw materials, a number of vessels in varying states of completeness, and a selection of tools. From this very sparse data, Sparks suggests that the production of these obsidian vessels was under the control of the state or temple, which she infers from (1) the proximity of the workshop to both the temple and palace areas nearby, and (2) the "high degree of organization and wealth" required to obtain the raw materials via long-distance trade networks. Although there is reasonably good evidence to support this sort of attached specialization in the region at this time, the evidence provided here does not necessarily warrant these conclusions.

The second part of this paper traces the production, distribution, and stylistic variation of gypsum vessels in the southern Levant during the Middle Bronze Age to Late Bronze Age. Evidence for possible workshops at both Beth Shan and Jericho are reviewed, as are the variations in vessels at these and other Middle Bronze Age/Late Bronze Age centers in the southern Levant. Sparks suggests that, in contrast to the situation at Tell Atchana, gypsum vessels were produced in larger quantities, were more standardized, and were made from locally available materials. In her view, the evidence indicates that these vessels were aimed at an emerging "middle rank" of individuals, as opposed to the formalized palace-based exchange networks hypothesized for the Tell Atchana obsidian vessels. The evidence for this contrast in both production and exchange networks is not wholly convincing.

The paper by Shortland, Nicholson, and Jackson discusses glass and faience manufacture at Amarna. The evidence for production and distribution is based largely on Nicholson's excavation of a workshop for vitreous materials and pottery at O45.1 and on Shortland's survey of glass and faience distribution at Amarna. The authors believe that glass was likely a royal monopoly produced at large specialized centers (such as Qantir), in contrast to the widespread and less tightly controlled production of faience. It seems that while the workshop evidence indicates that both glass and faience items were likely produced in the same workshops at Amarna, these two vitreous materials had very different distributions within Amarna, which suggests that the value and role of each material was quite different. The widespread distribution of faience indicates that it was both common and of relatively low value and that it may well have been the subject of private exchange. In contrast to this, glass was tightly controlled both in terms of initial production and object manufacture, was a more highly specialized technology, and circulated largely within the Egyptian court. The evidence for this distinction between glass and faience is compelling, providing a solid case for the social contexts of Egyptian glass production at Amarna during this period.

Zofia Stos-Gale's paper on Minoan foreign relations and copper metallurgy in Proto-Palatial and Neo-Palatial Crete focuses on the evident change in the source of copper between these two periods. On the basis of lead isotope analysis, Stos-Gale is able to determine the shifting patterns of copper exchange on the island, which she sees as occurring before and after about 1700 b.c. The absence of copper on Crete makes it possible to follow these exchange patterns by looking at the varying places of origin, from the Aegean to Cyprus, Anatolia, and the Near East. Stos-Gale takes as her sample 118 Pre-Palatial and Old Palace weapons and tools and contrasts these with 300 Minoan artifacts from the 17th through 12th centuries. The lead isotope evidence for these copper objects suggests that copper from the Cyclades was the primary source during the Pre-Palatial and Old-Palace periods (49 and 53 percent, respectively), but that this declined in the Neo-Palatial and Post-Palatial periods, with Lavrion becoming the primary supplier (44 and 51 percent, respectively). Copper from Cyprus declines from the Pre-Palatial period (29 percent) to the Old Palace period (16 percent) but then becomes more or less stable in the Post-Palatial. The only other significant shift concerns the beginning of copper importation from the Taurus region in the Old Palace period (3 percent), which increases significantly during the Neo-Palatial and Post-Palatial periods (18 and 25 percent, respectively). Stos-Gale concludes that Cyprus played an important role in supplying copper to Crete throughout the Bronze Age, but that Crete was primarily reliant on Aegean sources, despite the fact that these sources shifted from the Cyclades to Lavrion during the later phase of the Bronze Age. Perhaps the most interesting data here, however, is the increasingly important role that the Taurus

ore sources played throughout the later phases of the Bronze Age. This may be related to the importation of tin during this period, judging from initial similarities of the Ulu Burun tin ingots to lead and copper sources from the Taurus Mountains region.

Andrew Shortland's paper considers the evidence for the invention of glass production in Mesopotamia and Egypt and then goes on to explore the social aspects that influenced the spread of glass-making technology in Egypt. Shortland reviews the textual and representational evidence for the earliest glass in Egypt from Tuthmosis III's dedicatory reliefs at Karnak and determines that light blue and dark blue glass were imported from Babylonia and possibly also from the Kingdom of Mittanni. He then turns to the small sample of glass vessels (12, plus fragments) from the same period to examine stylistic aspects of these early vessels as well as the production methods used. He concludes that light blue glass was predominant, that a wide range of decorative styles was used, and that vessels were produced by both cold-working (as with stone vessels of the same period) and core-forming techniques. The analytical evidence for vessels from this period suggests that the copper blue glass (both light blue and dark blue) likely originated in Egypt, judging from the chemical composition. Similarly, the lead isotope analysis of a lead antimonite yellow colorant used both on the sole example of a marbled vessel and in the yellow decoration of another reveals an Egyptian source of this glass. The wider implication of this is that, although glass was evidently imported into Egypt as part of its imperial expansion, the Egyptians very soon thereafter began to produce their own glass. The compositional analysis as well as the evidence for early manufacturing techniques imply Egyptian production of vessels and show a possible shift in production methods from cold-working to casting and eventually core-forming. According to Shortland, the evidence therefore indicates a transitional experimental period of glass production during the reign of Tuthmosis III which becomes more formalized during the reign of Tuthmosis IV.

Rehren, Pusch, and Herold discuss the organization of the Egyptian glass industry based on the excavation and analytical evidence from the Ramesside glass workshops at Qantir-Piramesses sites Q I and Q IV. This "case study," as Rehren, Pusch, and Herold refer to it, is used to test a model of production that distinguishes between "primary" glass production workshops and "secondary" artistic workshops, where the glass ingots produced at the primary workshops are utilized at the secondary workshops to create glass objects of all kinds. In their attempt to reconstruct the operations of the workshop, the authors use the analogy of "material culture as text" (Tilley 1991). They describe the exercise as being like trying to reconstruct an entire workshop manual from a few unpaginated, scattered pages, not knowing how many pages are missing or even whether the pages they have are from the same original manual. This is a very useful analogy for the interpretation

of archaeological evidence in the context of an industrial workshop, where the vast majority of the evidence is not in situ and where there are various phases of activity. The difficulty lies in the fact that the wide range of materials must be identified according to "the range of materials produced and/or worked, and the nature of possible techniques involved before allocating groups and classes of finds to these different materials and techniques" (p. 226). The workshops at Qantir-Piramesses sites Q I and Q IV are identified as specializing in copper-related compounds such as bronze, red glass, Egyptian blue, and faience. The authors make a very strong case not only for the separation between primary glass production centers (specific to certain colors of glass such as at Qantir-Piramesses) and "artistic" workshops where the glass was worked into objects, but they also are able to show the changing nature of workshops over time. While it is easy to surmise that local and specific needs will create change within workshops over time, it is quite hard to tease this out of the fragmentary archaeological evidence. Nevertheless, they have managed to make a convincing case for just such a scenario at Qantir-Piramesses, which contributes to both our research methodology and interpretation of industrial complexes.

Paynter and Tite examine the evolution of glazing technologies in the ancient Near East and Egypt and address the differing trajectories of Mesopotamian and Egyptian adoption of the practice of glazing. Through a combination of analytical techniques, they examine the various types of glazed objects from 1500 B.C., including stone, faience, and clay. In particular, they assess the absence of Egyptian glazing of clay objects during a time when this was a more common practice in Mesopotamia. The technical analysis of glazing methods and outcomes is very well presented, and some possible technical reasons are proposed for the absence of Egyptian glazing of clay. Despite this, the authors seem to favor a social explanation for this absence, suggesting that, despite the feasibility of the process, it may not have been adopted because of other cultural or social factors.

In conclusion, the contributions to this volume represent a very interesting collection of papers, all in some way relating to the main theme of "technological change." The degree to which they are successful in presenting this change in terms of the "social context" is, however, quite varied. As is usual in conference proceedings, some papers stand out as more successful and likely to endure in the literature than others. In this volume, the papers by Moorey and Andrew and Susan Sherratt fall into this category. Finally, the volume suffers from several minor problems, first among which is the poor copyediting which, along with the very obvious error in the title (mentioned above), includes numerous typographic and spelling errors, as well as a few instances of obvious word omissions. These deficiencies aside, the volume is a very interesting and useful one which highlights some of the more interest-

ing research into ancient technological processes in progress in the ancient eastern Mediterranean at this time.

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Early Cyprus: Crossroads of the Mediterranean, by Vassos Karageorghis. Los Angeles: The J. Paul Getty Museum, 2002. 229 pp., 424 color and black-and-white photographs and drawings. Cloth. \$70.00.

In 1982, Vassos Karageorghis (hereafter K.) published *Cyprus, from the Stone Age to the Romans* as a comprehensive survey to the material culture of ancient Cyprus (Karageorghis 1982). The volume quickly became the major reference for Cypriote archaeology. However, the pace of archaeological discovery and research in Cyprus has not slowed over the past two decades, so that the need for up-to-date syntheses of current theories and debates, as well as the expanded bibliography, for all periods is clearly required. To offer just one example, the dates for the earliest human occupations in Cyprus have been pushed back almost two thousand years (from the seventh to the ninth millennium B.C.) since K. published his survey 20 years ago! *Early Cyprus: Crossroads of the Mediterranean* represents an impressive and learned attempt to improve this situation and will be of interest not only to Cypriote scholars, but also to archaeologists and historians of the Aegean and eastern Mediterranean. As K. admits, the task of re-writing a comprehensive survey of 10,000 years of Cypriote history and archaeology is no longer the task of one scholar. As a result, he limits himself to three critical phases in Cypriote archaeology: (1) the Late Bronze Age (ca. 1600–1050 B.C.), (2) the Cypro-Geometric period (ca. 1050–750 B.C.), and (3) the Archaic period (ca. 750–480 B.C.).

From the outset, K. seeks to integrate the developments of Cypriote culture within the wider milieu of trans-Mediterranean interconnections. In setting up the Late Cypriote I period (LC I), K. emphasizes increased trade relations with the eastern Mediterranean and the Aegean, in

addition to the island's rich sources of copper and strategic location, as the context for the gradual emergence of urban centers in the latter part of the Middle Cypriote period (MC). Imported objects from the Syro-Palestinian coast, Crete, and Egypt found at several sites across the island (e.g., Enkomi, Morphou region, Myrtou-*Stephania*, and Palaepaphos), clearly illustrate Cyprus's newly elevated role in Mediterranean affairs. K. focuses particular attention on contact with Egypt and Crete. With the expulsion of the Hyksos (with whom Cyprus had some relations already at the close of MC III) and the establishment of the 18th Dynasty in Egypt under Ahmosis I (mid-16th century B.C.), the relationship between Cyprus and Egypt intensified. Accepting the identification of Cyprus as *Isy* and *Alashiya* (and thus following the majority of Egyptian, Near Eastern, and Cypriote archaeologists), K. stresses the importance of written records as evidence of intense contact between Egypt and Cyprus in LC I, primarily in the form of tributes and gift exchange. Such documents support contemporary archaeological evidence of Cypriote ceramic exports to Egypt (e.g., Base Ring I, White Slip I, and Red Lustrous Wheelmade wares).

The nature of relations with Crete is perhaps more elusive (especially in the 16th century B.C.); however, substantial amounts of Late Minoan pottery found on the island are likely the result of Crete's own expanded role in the eastern Mediterranean beginning in the 18th Dynasty (p. 16). In this context, K.'s survey of the undeciphered Cypro-Minoan script deserves special note. In particular, K. points out its complex origins characterized by Aegean characters (related to Linear A) inscribed on baked cushion-shaped tablets of Near Eastern type. K. attributes the appearance of the script in Cyprus to the necessities of increased administration that parallel those of the Minoan palace economy. He also makes the interesting suggestion (p. 19) that the diversity and distribution of inscribed objects found in Cyprus (which includes not only clay tablets, but also cylinder seals, clay balls, miniature copper ingots, and vessels of metal and clay) points to more widespread literacy than in the Aegean where written documents are confined to areas under the control of the palaces. K. also points to the archaeological and architectural evidence (in the form of destruction layers and fortresses) for internal unrest characteristic of MC III and early LC I Cyprus.

The next two chapters (Late Bronze Age II and III) treat the LC II period (ca. 1450–1200 B.C.). The role of Cyprus in the "international koine" of the Mediterranean during the 14th and 13th centuries B.C. and the extent of the island's external relations occupy the majority of the chapter on LC IIA–B. Evidence for this period is amplified by two noteworthy sources of information. The so-called Amarna Letters (ca. 1375–1350 B.C.) document the correspondences between the king of Alashiya (mentioned above) and the Pharaoh Akhenaton of Egypt. K. maintains his identification of Cyprus as Alashiya and follows B. Knapp (1996: 8) in arguing that the name refers to the whole of the island