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CHAPTER 2

Ancient Metallurgy in the Mountain Kingdom:

The Technology and Value of Early Bronze Age Metalwork from Velikent, Dagestan

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Copper ore deposits in the Caucasus Mountains appear to have been first exploited by the mid-fourth and perhaps as early as the fifth millennium BC (Chernykh 1992:32-35, 57-67; Kushnareva 1997:196-204). However, it is only with the regularization of metallurgical production in the Early Bronze Age (3500–2500 BC) that we find evidence for the use of metal goods in numerous and varied cultural contexts. During the Early Bronze Age in the early to middle third millennium BC, some 1500 metal objects were assembled in tomb 1 on mound III of the site of Velikent in Dagestan as grave goods that accompanied what was probably a successive series of interments in this collective catacomb tomb (Gadzhiev et al. 1995; 1997; see Kohl, chapter 1). Spectral-chemical analyses of the composition of these objects revealed the presence of tin bronze in approximately 8% of the tested sample (Gadzhiev and Korenevskii 1984). This represents a remarkably early example of the systematic use of tin bronze in Caucasia and much of the Old World in general.[1] If the proportion of objects made of tin bronze in the sample corresponds to the assemblage as a whole, it may number among the largest known collections of tin bronzes from any Early Bronze Age site.

Technical sophistication in Early Bronze Age metalwork is often judged by the presence or absence of tin bronze within an assemblage. There are good reasons for this, since the production of tin often involved techniques quite different from those that were more widely practiced in copper production (Yener 2000:111–123), while the addition of tin hardens copper and gives it a golden tint (Hamilton 1996:14). However, this position tends to equate cultural value with a somewhat simplistic, unidimensional vision of technical practice, while ignoring that making even the most common metal artifact was a complex and dynamic social enterprise (Yener 2000:9). There is compelling evidence that the Velikent metalwork was manufactured locally, yet the underlying sense in many studies of Early Bronze Age prehistory is that early innovations in metallurgy and other crafts originated in the civilization that was emerging in Mesopotamia during this period, and from there were disseminated to outlying areas including Caucasia (Yener 2000:5–6). That view is challenged here by an approach to the Velikent assemblage from the standpoint of how *value* was assigned to metalwork in local or regional systems of metal production, in which the significance of the Velikent tin bronzes is interpreted in relation to the assemblage as a whole, in an overall assessment of the production of metalwork and a theoretical approach to value. The point is not to reassert an old counter-claim that Caucasia was the true source of metallurgical innovations (Frankfort 1928). Rather, the aim is to reframe the problem to focus less on the origins of raw materials and metallurgical processes and to shift more toward the role of metalwork in social and cultural practices. In doing so, I hope to show that the kind of local perspective on material culture and value offered here has much to contribute to the study of interregional dynamics, an objective of current research on the Early Bronze Age in the Near East and neighboring areas (for example, Kohl, chapter 1; Stein 1998a; 1999b).

This essay begins with a discussion of recent research on the "tin problem" or attempts to identify the provenience of the tin ore that was exploited for the tin and bronze used during the Early Bronze Age in southwest Asia. It then shifts to defining an approach to ancient metalwork as the product of both technical and symbolic systems in which producers and consumers participated in the creation of value. This approach is then applied to an examination of how the different materials in the Velikent assemblage were used, including copper, silver, and alloys of copper with arsenic, tin, and silver. This interpretation addresses the ways in which technical and social practices influenced the formation of the Velikent assemblage locally, rather than situating the materials predominantly in a core-periphery relationship with adjacent regions. While this approach attempts to sidestep problems associated with the current heavy emphasis upon the procurement of raw materials over long distances, I do not mean to downplay the potential significance of imports. Clearly metal resources were moving across the landscape, sometimes in great quantities and over surprisingly long distances. Studies of the provenience of tin and other materials therefore remain essential to understanding the dynamics of long-distance exchange. However, studies of sources and patterns of long-distance flow are no substitute for a well-developed understanding of how imports were used in local material culture systems, which is vital to our knowledge of what was at stake in the local engagement in interregional exchange and its historic effects. In order to develop an adequate account of the relationship between the production and use of metalwork and its broader sociocultural significance, studies of interregional dynamics must be integrated with research on how metals were processed, worked, and used outside the putative centers of power and influence that are most often the focus of syntheses of Early Bronze Age prehistory.

VELIKENT AND THE TIN PROBLEM

The evidence for the production and use of metalwork during the Early Bronze Age at Velikent does not fit a spatial frame that links the appearance of tin bronze in western Asia to an exclusive network of long-distance exchange focused on elite consumption in Mesopotamia. Nor does it fit a theoretical frame of social evolutionism in which the development of bronze technology was a correlate of increasing social complexity in centers of urbanization. Studies of early metallurgy in southwest Asia have often shared an intellectual framework in which the discovery of tin bronze is cited as a pivotal moment in the unilineal evolution of technology and human progress, an understanding embedded in the notion of the "Bronze Age" itself (Yener 2000:4). Following Childe (for example, 1951), archaeologists have often associated the early use of tin bronze with the emergence of a "high technology" that accompanied the appearance of urban civilization during the Early Bronze Age in the Near East. This technology would then have been restricted for a considerable time to networks of production and exchange centered on early cities, which would have been the main beneficiaries of the technical and economic enhancements it conferred. However, in most regions tin bronze seems to have been adopted first for ornamentation—as appears to have been the case in northeastern Caucasia—and it was several centuries before it was exploited for economic and productive advantage (Renfrew 1986:144–145). Childe himself recognized that the widespread utilitarian use of bronze was preceded by the ornamental use of copper, but was mistaken in associating the appearance of bronze with a revolution in the use of metal technology, at least at the onset. The transition from the ornamental use to the "practical" use of copper and bronze would have varied from region to region, and probably involved protracted shifts in production and consumption in which the use of tin bronze in tools and weapons came to rival and sometimes surpass its use in ornaments. In this regard, the role of social values including aesthetic sensibilities in prehistoric economies (for example, Lechtman 1984) has received insufficient attention in Bronze Age archaeology.

The site of Velikent was used intermittently from the Late Chalcolithic to Middle Bronze Age period (ca. 3600–1900 BC) and is located in the Caspian littoral of southern Dagestan (see Kohl, chapter 1: figure 1.1). Spectral-chemical analysis was performed on a sample of 195 metal objects out of a total of approximately 1,500 from mound III, tomb 1 at Velikent, including the full range of tools, weapons, and ornaments in the assemblage (Gadzhiev and Korenevskii 1984; figure 2.1). That study found tin bronze in fifteen items (one dress pin, five rings, and nine bracelets) or 8% of the sample. All are ornaments and all but the pin were most likely intended for wear as bodily adornments. Recalibrated radiocarbon dates from more recently excavated tombs at Velikent have dated their use from 2879–2474 BC at mound V, tomb 1 to 2851–2367 BC at mound III, tomb 11 (2 sigma range; see Kohl, chapter 1). The close similarity of the architecture, collective burial practices, and material offerings of these tombs to mound III, tomb 1 indicates that the latter was probably constructed and used during the Early Bronze Age in the first half of the third millennium BC, and that the metal assemblage dates to this period.

The Velikent site is a combination of a small to moderate size Late Chalcolithic to Middle Bronze Age village with Early to Middle Bronze Age cemeteries on at least two of the five mounds that make up the site, covering a total area of approximately 28 ha (see Kohl, chapter 1). Although archaeologists have traditionally linked the appearance of tin bronze with urbanization, the Velikent tin bronzes still fall within the accepted window for the early adoption of tin bronze and would be a sizable example at that.[2] There are no known sources of tin in the Caucasus Mountains (Selimkhanov 1978; Palmieri et al. 1993). The tin in the Velikent bronzes, like that used in Early Bronze Age urban centers to the south (Stech and Piggott 1986), was probably imported.

The present discussion is less concerned with identifying the physical source of Early Bronze Age tin than with examining why the Early Bronze Age people of Velikent were interested in things from the outside. Ethnographic literature describes how hierarchies of goods are established in their use in broader realms of social experience involving the social organization of space and the control of knowledge. Value is assigned to some things on the basis of the "sheer distance [over which they are acquired] and the magical or symbolic potency associated with distance or with distant places and polities." Control of the access to the power and esoteric knowledge embodied in those goods is a means of creating political and ideological distance in society (Helms 1988:13, 119). This social distancing often encompasses the special skills and knowledge needed to produce extraordinary goods, that can convey to artisans such as metalsmiths an exceptional status, whether positive or negative. The metalsmith's craft itself may be conceived of as originating from a distant source (Eliade 1978; Helms 1988:12-13). While in some instances the value of tin bronze may have been linked to the source of the tin itself, its real social importance was more likely associated with its role in creating social distance through transfer of a sense of otherness to the owner or wearer. This, coupled with the early dating and number of tin bronzes from Velikent, suggest that they should be not be approached as having been derivative of contemporary developments in the early urban centers of Mesopotamia—where tin bronze was also a novel element of material culture at this time—but as a local phenomenon. The question then becomes, how was tin bronze employed in relation to the Early Bronze Age material culture of the site and region?

First, it is instructive to look closely at recent research on the "tin problem" or attempts that have been made using several lines of evidence (archaeological, geological, and textual) to identify the source(s) of the tin used during the Early Bronze Age in southwest Asia (for a comprehensive summary, see Weeks 1999). Recent research on the tin problem is largely concerned with trying to identify the patterns in which tin circulated in long-distance exchange and their social implications, rather than how tin was used in the localities in which it is found. This distinction is important, since a lack of understanding of the role of tin in local social and cultural practices also limits the possibility of interpreting its significance in local and long-distance interactions.

Archaeologically, the earliest known tin bronzes in Mesopotamia are generally accepted to be a handful of objects from the Y cemetery at Kish dating to the Early Dynastic I period or the early third millennium BC. Tin bronzes were not present in substantial quantities in the region until the Early Dynastic III period (ca. 2600–2400 BC), when a large number were included in the in the royal cemetery at Ur (Moorey 1985; Müller-Karpe 1991). Tin bronze also appears in a cache of small anthropomorphic figurines at Tell Judeidah in northern Syria dated ca. 3000 BC and in a few objects from neighboring sites (Stech and Piggott 1986:52). It also occurs in possibly contemporaneous levels in sites in southeastern and central Anatolia, such as Tarsus and Alaca Hüyük (Yener and Vandiver 1993; Muhly 1993:240-242; see also Yener 2000:28–29). We know now that tin bronze is present in at least 15 objects dating to ca. 2850–2400 BC at Velikent, and probably many more. The alloy is more broadly distributed by the end of the third millennium BC and is present in many sites throughout western Asia during the second millennium BC.

The main textual sources for the early tin trade are cuneiform tablets from Mari in Syria and Kültepe-Kanesh in central Anatolia (Muhly 1973:288–335; Yener 2000:11–12). These date to the Old Assyrian period, ca. 2000–1600 BC (Kuhrt 1995:74–117). The tablets discuss tin traveling by various means to Susa, Mari, Assur, and Assyrian trading colonies including Kanesh, ultimately from some unspecified source somewhere in the East, while tin is also said to have arrived in Mesopotamia together with lapis and jade from Meluhha, presumed to be the Harappan civilization of the Indus Valley. Since there is no evidence for the early exploitation of tin in South Asia, it is unlikely to have been the source. However, Afghanistan (Stech and Piggott 1986:44–45) and the Zeravshan Valley of Uzbekistan and Tajikistan (Boroffka et al. 2000) are possible sources. The reasoning in the archaeological discussions of these texts is that the sources of tin referred to in Old Assyrian text are the same sources that were exploited during the Early Bronze Age. This argument is more convincing if the object is to establish *numerous* possible sources rather than the *sole* source of Early Bronze Age tin, an issue covered more fully below.

From a geological perspective, the crux of the tin problem lies in the small number of verified sources of tin in western Asia. Where they do exist there is little evidence that they were exploited in the Bronze Age (Weeks 1999:50–51). However, metallic ores are widespread in the highland frontiers of the Near East in Anatolia, which some researchers have favored over more distant localities as one source for Early Bronze Age tin. For example, cassiterite has been identified in shafts and galleries that were worked from the Chalcolithic to the Byzantine period in the Kestel mine in the Taurus Mountains of southeastern Turkey and was processed into metallic tin nearby at the Göltepe site (Yener and Vandiver 1993; Yener 2000:71–110). The strength of the evidence for Early Bronze Age tin production in Anatolia has been questioned on several occasions (Hall and Steadman 1991; Pernicka et al. 1992; Muhly 1993; Weeks 1999:50). Amongst other objections, there has been strong skepticism on the grounds that Early Bronze Age tin mining in Anatolia would have involved dependence on many small sources instead of one large one (Yener 2000:72), the argument being that a system founded on numerous sources would have been too unreliable for the purposes of an elite exchange network centered on Mesopotamia. However, over time a mosaic of nearer and more distant sources would have been much more resistant to unforeseen contingencies in supply than any single source. Tin has been detected geologically in other parts of Anatolia and in other locations on the fringes of the ancient Near Eastern ecumene, altogether representing a multiplicity of potential Early Bronze Age tin sources (de Jesus 1980; Kaptan 1983; Muhly 1993; Rapp et al. 1996; Yener 2000:72).

Recently, attempts have been made to settle the tin problem by linking finished objects to ore sources through lead isotope analysis (Stos-Gale et al. 1984; Stos-Gale 1989; Pernicka et al. 1990; Weeks 1999). Isotopic profiles of sources tend to be distinctive according to the age of the deposit, and are unaltered by the physical and chemical transformations that occur in processing ore into metal. In other words, the isotopic profile of an ore is the same as the metal made from it. Therefore, lead isotope analysis is a potentially powerful method for determining provenience. Because the trace element profiles of ores are often drastically altered in the transformation of ore into metal, lead isotope analysis has become widely favored over trace element analysis in provenience studies. However, trace element analysis is not rendered completely obsolete by the lead isotope method. Lead isotope analysis is more effective in identifying the sources of ore used to produce groups of artifacts and associated metallurgical debris than the source of metal in individual objects, while trace element analysis is still useful for proveniencing the metal in large assemblages of metalwork (Northover 1989). In either case, the larger the sample size, the more accurate the results. Finally, any attempt to determine the provenience of the metal in artifacts is vulnerable to the uncertainties introduced by alloying and recycling, which mixed metals from different sources together. Thus, while isotopic analysis is without question a viable tool for sourcing ancient metal (Tite 1996), care must be taken in its application and archaeologists must exercise their discretion when using its results.

In summary, there is no clear consensus on the source and networks for the distribution of tin in the Early Bronze Age. Although many researchers favor a distant eastern source as suggested by second millennium BC texts from Syria and central Anatolia, there is archaeological and geological evidence that a number of smaller sources were also used during the Early Bronze Age in highland Anatolia and elsewhere at the frontiers of the ancient Near East. While some regard Afghanistan as the likely candidate for this elusive eastern source (Stech and Piggott 1986; Weeks 1999), evidence of early tin mining further north in Central Asia has been discussed in Russian sources since at least 1950 (Litvinskii 1950). Following these leads, a recent expedition found mid- to late second millennium BC Andronovo potsherds in several shafts used in mining cassiterite and stannite in Tajikistan and Uzbekistan (Boroffka et al. 2000), and it is possible that further research will uncover evidence of earlier exploitation. Tin and nephrite from eastern sources is also present in archaeological deposits of the Seimo-Turbino horizon which are spread across the steppes and forest-steppe of Eurasia and date to the first half of the second millennium BC (Chernykh 1992:215–234). This means that eastern tin from Central Asia was also traveling long distances to the northwest at the same time that was reported moving west to the Near East in Old Assyrian texts. Thus, in terms used by Smith and Badalyan elsewhere in this volume (chapter 7), networks for the acquisition of tin were not centered on Mesopotamia like the spokes of a wheel but enveloped most of western Asia in a complex web of trading relationships that extended well beyond the core areas of urbanization.

It is within this analytical context that the Velikent assemblage is currently situated, joining an often contentious debate over the interregional dynamics of the Early Bronze Age metals trade. With the joining of new analytical techniques to theoretical priorities developed out of world-systems theory and colonial studies, the West Asian tin trade has become a hot topic for many American and European archaeologists outside Russia. But the situation is different in the Russian and Soviet tradition of archaeological research within which the Velikent metalwork has been previously studied. Researchers in the Soviet Union conducted more than thirty- five thousand analyses of the composition of copper and bronze artifacts from Eastern Europe, Eurasia, Central Asia, and Caucasia in the collective investigation of historical links between the metallurgical traditions and archaeological cultures in these areas (Chernykh 1992:16). This work continues on a much smaller scale in the CIS today. Yet despite their differences, there are subtle commonalities between Western research and archaeometallurgy in the former Soviet Union. In the latter, a sharp line has been drawn between *metallurgy* as the production of metal from ore and *metalworking* as the manufacture of metal objects by techniques such as casting, forging, annealing, and drawing, in which metallurgy is viewed as having had greater significance in the history of cultures since it is a necessary precondition of metalworking (Chernykh 1992). Research on the tin problem emphasizes metallurgy in a similar though less obvious way. The study of metal sources is closely connected with metallurgy in that it often presupposes a direct link between objects and ore sources, while less attention is paid to how metals may have circulated for extended periods and in different forms than those in which they have been found. These concerns are more closely tied to metalworking activities that occurred after the initial processing of ore into metal (Northover 1989). Downplaying the importance of metalworking can lead to a false impression that its goals and techniques remained fixed through time and in separate contemporary settings. More important, the privileging of metallurgy over metalworking creates the impression that the value of materials, such as tin and bronze, to the people who used them is rooted simply in the distance that separated consumers from source, or a community's position within the trading network. However, the evidence for how imported metal was worked and used in separate regions may tell a very different story.

METAL TECHNOLOGY AND VALUE

In moving away from a unidimensional "distance= value" model, it is critical that we situate material culture within a local sense of technical and social practice. This involves an understanding of material culture production not simply as manufacturing techniques but, more profoundly, as a process through which meaningful objects are created in productive acts that are at the same time technical and symbolic (Munn 1977, 1986; Lemonnier 1992; Dietler and Herbich 1998). There has been a growing awareness in archaeology of the importance of the concept of value for understanding the role of commodities in ancient economies, but this has generated few explicit discussions of value itself (but see Renfrew 1986; Bailey, ed. 1998; van Wijngaarden 1999). Archaeologists have most often approached value in relation to circulation and consumption (for example, Parker Pearson 1984; Orser 1986; Hodder and Preucel, eds. 1996:106–107; van Wijngaarden 1999), and less frequently by linking changing technologies to historical changes in the cultural value systems that influenced economic activities (Lechtman 1984; Renfrew 1986; Bradley 1988). This tendency to emphasize circulation and consumption mirrors a similar inclination in sociocultural anthropology (for example, Appadurai, ed. 1986; Miller 1995; Douglas and Isherwood 1996), which arose in part as a response to the inflated role that was previously given to production in the social sciences, as in Marxian approaches that viewed the development of human societies as determined by their "productive bases" (Wittfogel 1957; Friedman and Rowlands, ed. 1977). However, rather than arriving at new understandings of production, in some cases there has been a move toward overdetermining the role of consumption (Miller 1995).

Artisans create material value by manipulating materials to conform to aesthetic and other social and cultural values in technical practice, value that is affirmed or redefined after production. Given a set of objects for which a coherent social and cultural context can be established—such as the metalwork from mound III, tomb 1 at Velikent, which was assembled through the mortuary practices of people with a shared material culture—value may be interpreted archaeologically from the correspondences between the ways in which objects were made and used, that harken back to the choices and skill with which productive goals were met in technical practice. Objects are also subject to redefinitions in meaning and value in their individual histories, through their role in significant events, changes in ownership, and in crossing social boundaries (Douglas and Isherwood 1996; Kopytoff 1986; Dietler and Herbich 1998). In such cases objects often move from one sociocultural context to another, and thereby enter new fields of associations. In addition, sweeping revaluations of types and classes of things, such as "precious" metals or industrially "useful" materials, may occur through broader shifts in production, circulation, and consumption (Renfrew 1986; Appadurai 1986:34–35). Detailed information on methods of production is often available through analysis of the artifacts themselves, while evidence for the paths that objects took in movements across landscapes and through diverse hands is often less accessible to archaeology. The study of production is therefore as crucial to archaeological research on value as the studies of circulation and consumption that have recently dominated the theoretical horizon of the discipline.

Modern economics generally approaches value in terms of supply and demand, in which value is tabulated as price or a quantity of common currency that is used to commensurate between goods and services. This approach can be traced to historical Western economic theories and definitions of rationality of the eighteenth and nineteenth centuries (Dumont 1977, Young 1978). However, in their ethnographic and textual investigations, anthropologists and historians have encountered widely varying cultural and historical definitions of value. This relativist response to neoclassical universalism has been accompanied by a move toward more "emic" understandings of significance and value. An anthropological definition has emerged in which value is "general and relational rather than particular and substantive"; products and actions embody "a differential proportion of some homogenous potency" that forms a parameter along which their value can be measured (Munn 1986:8–9). Although theories of value differ sharply on particular points, a brief review generally supports the importance of relationality. Aristotle held that the value of things is or should be related to the status of the individuals to which they are due (Polanyi 1971). Smith saw the natural value of products as measurable in relation to the labor expended in production (Smith 1937). Neoclassical economists further developed this theory by arguing that value is determined in the relationship between labor and fixed capital (Young 1978:31) and that rational actors choose between alternatives to maximize preferences and utility (Gudeman 1985:222). While Marx largely maintained the formalism of earlier theories, his discussion of commodity fetishism is a persuasive critique in which he noted that consumers' fascination with commodities is not commensurable in terms of labor or notions of utility attached to use value (Marx 1971). Kopytoff (1986) attributes this fascination to a cultural process of valuation in which the meaning of things is continually redefined in successive episodes of circulation. Material value would therefore be *intersubjective*, arising from the relationship between desiring consumers and objects with their own social lives.[3] For Simmel (1978) value is also intersubjective and arises from the desire for objects and the ways in which they somehow resist those wishing to possess them. The distance between economic objects and those who desire them is overcome reciprocally in exchange, through the sacrifice of some other object that is desired by another (Appadurai 1986:3).

However, skilled labor, technical knowledge, and the physical properties of things all set parameters within which value operates. Marx (1971:48) viewed commodity exchange as the creation of use values for others, suggesting a degree of reflexivity between producers and consumers in definitions of value. Economic anthropologists generally accept that in most societies the relations amongst people are more important than the relations between people and things, an idea first forcefully developed by Mauss, who saw gift giving as a powerful way of building social bonds in which gifts convey something of the giver's self (1990). However, there is a need for greater emphasis on the attachments artisans form with their creations and the ways they may convey the essence of their creators. This dynamic would arguably have been strong in the production of metalwork in Early Bronze Age Caucasia where the spatial and social distance between those who made and used it may have often been quite small (see below).[4] A reexamination of the role of production thus offers the possibility of new insights into the full range of activities through which value is socially constituted in material culture.

Value is, of course, historical. Historical, cultural understandings of the proper ways to utilize materials and techniques in making things, of how a particular kind of object should look, feel, and function, and of what makes some things exceptional in relation to others all influence the social construction of material value. Technical knowledge and practice also structures what is possible to achieve through production. Value and technology are reproduced through interrelated activities of production, circulation, and consumption that are altered through the incorporation of new objects, materials, techniques, and uses of things that are introduced by individuals or groups. Since these are collective activities that are linked to even broader sets of social relations, changes in technology and value have potentially profound social repercussions. The knowledge and practices that structure value judgments can endure for long periods. Alterations in the activities through which value and technology are reproduced can have historically transformative effects with unforeseen consequences.

The physical and chemical nature of metals also introduces theoretical and methodological implications for the study of technology and value. The production of metalwork is a reversible process in which artifacts may be converted into other things through the proper application of heat and force. If someone with metal goods is skilled in metalworking or has access to someone that is, the *convertibility* of metalwork creates a tension between the durability of objects on the one hand and their potential reuse as raw materials on the other. How this tension is resolved is situational and depends not only on knowledge of metalworking but also on how metalwork is valued by those who own it, and how that material value matches the reigning local constellation of social values. In some situations objects are preserved; in others the attraction held by the possibility of creating new material value may result in the recycling of old objects into new. The tension between the durability of metal objects on the one hand and their convertibility on the other matches two ways anthropologists have identified in which people perceive material value: at the level of object in which value is defined by its individual history, and as an attribute of a material or class of objects that is more easily exchanged than things with a singular value (Graeber 1996, 2001). Metalwork partakes of both kinds of value in the sense that a metal object has an individual history as well as a mutability that allows for its transformation into new forms and into new substances, as in the alloying of copper and tin to make bronze.

With the foregoing in mind, it is important that archaeologists approach the value of ancient metalwork as neither a function of any single characteristic, such as the presence or absence of tin, nor the raw distance from consumer to source, but as relational and built up from shifting combinations of meaningful qualities achieved by artisans in technical practice. This vantage point allows for an archaeological investigation of how value was transformed as materials and objects traveled between contexts of production and consumption and across social boundaries, and for an examination of continuity and change in productive techniques in relation to the adoption of new objects, materials, and uses for things. By establishing value conceptually in the relationship between technological and social practices, archaeology may move beyond its traditional exclusive focus on economics to include an account of the symbolic dimensions of value rooted in aesthetics. This is manifest, for example, in the creation of objects of high value through feats of technical virtuosity, in the application of aesthetic sensibilities in technical practice (Gell 1992). As sign vehicles, objects bring up different interpretants—the signs brought to mind—for different subjects, and in their fabrication, objects are instilled with physical characteristics widely evocative of particular qualitative associations. The characteristics so constructed can be said to operate as "qualisigns" (Peirce 1955; Munn 1986:17) that embody multiple, interrelated qualities that are fundamental aspects of a more comprehensive whole, in this case the economic and symbolic aspects of the social practices surrounding the production and use of metalwork. Although there is no strict agreement between subjects on the meaning of things, the social identities of producers and consumers are still coproduced through the value acts performed in the creation of evocative qualities in objects, and in their use in social interactions. However, since the associations evoked by the characteristics of things and related value acts vary from subject to subject, objects are vulnerable to revaluations that can transform structures of value if new associations become incorporated into technical and social practice.

Early Bronze Age metalwork was the product of a complex series of operations that normally included several different activities: the mining of ore, its transformation into metal (by smelting and other processes which varied according to the raw material and metal product), sometimes combining metals to create alloys, and the manufacture of finished objects by metalworking techniques such as casting and forging. Each operation represents an opportunity for the transformation of value (1) through investments of materials, fuel, knowledge, labor, and special tools and installations; (2) in the circulation of raw materials and unfinished products between social units; and (3) in profound redefinitions of the form and significance of metal products in their metamorphosis from raw materials to objects and sometimes from one object, or one material, into another. Metalwork and value are therefore coproduced in a temporally extended and often spatially divided process. The spatiotemporal dynamics of the creation of value through the production and use of metalwork have profound implications for the social identities of the individuals involved, and in their self-other relations within the more comprehensive whole in which value operates (cf. Munn 1986:16–18). Information on the provenience of raw materials gathered through research on the tin problem has been creatively employed in the study of cross-cultural social relations in the Early Bronze Age metals trade. However, understanding the local significance of metals depends as much, or more, upon knowledge of the techniques used to work with *all* the materials present in an assemblage, the goals of technical production, and how metal objects were used, as it does with knowing the source of the metals themselves. After all, the scarcity of an import may indicate high value in one instance and simply the lack of local interest in another. The correspondences present (or lacking) in different kinds of evidence provide investigators with a potential means of telling the difference between apathy and interest, and for answering a wide range of other equally important questions as well. This approach is applied in the discussion of Early Bronze Age metalwork from Velikent that follows.

THE TECHNOLOGY AND VALUE OF EARLY BRONZE AGE METALWORK FROM VELIKENT

As noted earlier, recalibrated radiocarbon dates from two of the catacomb tombs at Velikent and close similarities in the architecture, burial practices, and material offerings in the dated and undated tombs indicate that they were constructed and most heavily used in the Early Bronze Age, or the early to middle third millennium BC. Twelve catacomb tombs are currently known from three mounds at Velikent (mounds III, IV, and V; see Kohl, chapter 1, figure 1.2). The interiors of the tombs were dug into the natural clay terraces that make up the mounds, and the underground chambers were reached by a *dromos* or vertical shaft connected to a short, slanted entrance tunnel sealed by an upright stone slab suitable for reuse (Gadzhiev et al. 1995:140–141; see Kohl, chapter 1, figure 1.4). The tombs contain a remarkable number of burials and an unusually large concentration of wealth for the Early to Middle Bronze Age in northeastern Caucasia. Mound III, tomb 1 contained some 1,500 metal objects along with the remains of as many as one hundred men and women (Gadzhiev and Korenevskii 1984; Gadzhiev et al. 1995:141).

Previously in the Early Bronze Age, burials throughout Caucasia were usually single or collective inhumations in small pits, within or outside settlements and sometimes under house floors. The dating of the Velikent tombs roughly corresponds to an era when the number of settlements had begun to diminish throughout Caucasia, possibly in association with increased dependence on seminomadic sheep-goat pastoralism (Kohl 1992). There is no strong indication of social stratification among the burials in the tombs; indeed the practice of collective interment suggests strong lines of social solidarity as well as an egalitarian ethos. However, we have no way of knowing what percentage of the deceased from the population at any given time was interred within them. In contrast to tomb 1, tomb 12 on mound III contained the remains of fewer (no more than fifteen) immature individuals that were buried without metal goods but instead with some 340 ceramic vessels, far greater than the 200 pots estimated for metal-rich tomb 1 (Magomedov personal communication 1998). This evidence suggests that metalwork and ceramics were incorporated into Early Bronze Age social practices at Velikent, involving age-graded formulations of equality and hierarchy. Ethnographic research has shown the intimate connection between gender associations and the production of value (Munn 1986:16–18). Representation of gender in burials may have strongly influenced valuations of the metalwork that was placed in the Velikent tombs. Unfortunately, this may never be satisfactorily demonstrated, since these are collective tombs in which objects and skeletal remains have in many cases become hopelessly mixed together.

The vast number of metal objects in the Velikent tombs suggests that there were restrictions in their transfer and circulation among the living, and that they instead became funerary offerings or were a form of personal property that remained with their owners in death. Spheres of exchange (Bohannon 1955) may have been present that would under ordinary circumstances prohibit the direct exchange of metal for other kinds of objects. Metalwork may have moved within a different sphere of exchange than, for instance, some forms of ceramics that, unlike metal, are ubiquitous in living areas at Velikent. Where spheres of exchange are present, social sanctions may bar the use of one potential "currency," such as food, for certain transactions, such as payments of dowry and bridewealth, that may require transfers of less perishable items such as metal. According to Morris (1986) the involvement of metalwork in the "destruction" of wealth in burials is an archaeological register of gift economies, in which the objective is not to gain economic power through the accumulation of wealth but to secure influence through generosity. The acquisition and social use of metalwork probably involved delicate social maneuvering and political savvy, whether for displays of wealth and status, navigation between spheres of exchange, or attaining influence through successful demonstrations of generosity in a gift economy.

All told the Velikent tombs suggest a form of social organization in which lines of solidarity occupied heterarchically privileged positions derived from size and endurance. Some of the tombs were more heavily used than others, and it is plausible that different tombs were used by distinct social groups, possibly corporate groups organized by family or lineage. If so, the greater use of some tombs than others and differences in the quantity and quality of offerings within separate tombs may indicate that some corporate groups were more successful in self-perpetuation, and exercising and maintaining power and influence, than others.

The metal artifacts from mound III, tomb 1 may be broken down into three classes of objects—weapons and tools, ornaments, and bodily adornments—for which specific substances (copper, arsenic bronze, tin bronze, or silver and copper-silver alloys) were selectively used (Gadzhiev and Korenevskii 1984:9; figures 2.1–2.2; table 2.1). Within these three classes, a very limited number of types of objects account for some 1,500 artifacts in the assemblage: (1) tools and weapons are represented by shaft-hole axes, hafted knives, chisels, flat axes, and awls; (2) ornaments include dress pins, anchor-shaped pendants, medallions, tubular beads, spirals, breast cups, and small caps; and (3) bodily adornments are comprised of rings and bracelets (figure 2.1; table 2.1). The marked consistencies in the form and composition of these objects indicates the high level of congruence that existed between the practices of local makers and users of metal goods that would have generated these consistencies.

Spectral-chemical analysis was performed on a sample of over 10% of the assemblage (N=195), encompassing its full range of tools, weapons, ornaments, and adornments (Gadzhiev and Korenevskii 1984:19). Almost the entire sample is represented by three compositional groups: unalloyed copper, arsenic bronze, and tin bronze. The three exceptions are one bracelet containing 90% silver and two others cast in an alloy of 70% copper and 30% silver (Gadzhiev and Korenevskii 1984: table, nos. 29998, 30078, 30079). One-third of the tin bronzes also contain arsenic in levels over 1%, and are perhaps more accurately described as a ternary alloy of copper, tin, and arsenic. However, there is no apparent distinction between the use of tin bronze and this alloy in the assemblage (figure 2.2).

Except for one predominantly silver bracelet, all of the objects are copper-based, and all but the three bracelets containing silver were found to have arsenic in levels from 0.1% to 20%, with the majority in the range of 0.01% to 5% (Gadzhiev and Korenevskii 1984:19, table).[5] Besides the two copper-silver bracelets, the copper-based objects can be said to form two groups: *arsenic bronze*, in which arsenic is present in levels of 1-20%, and *unalloyed copper*, with arsenic content

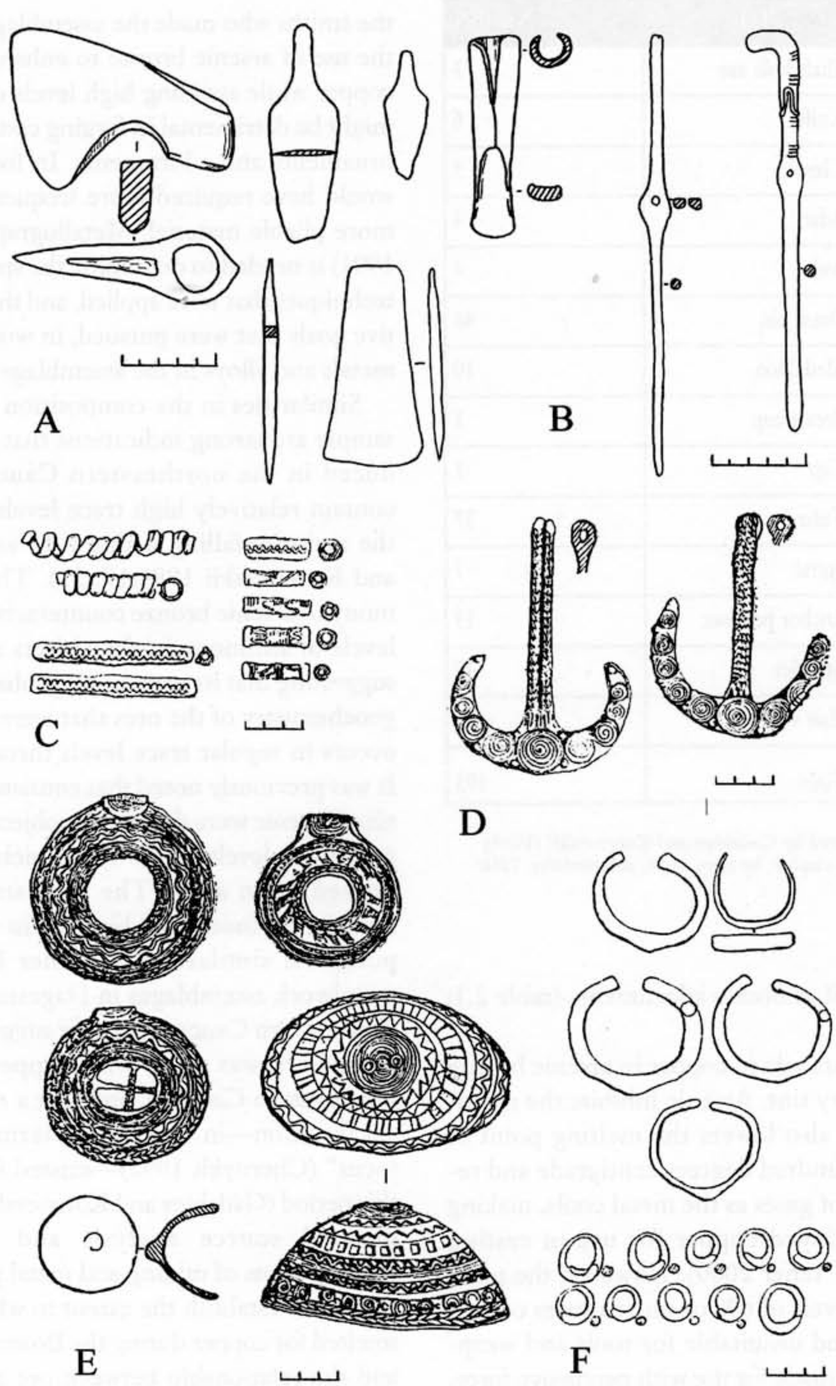

Figure 2.1 Metal finds from Velikent mound III, tomb 1: *a*, axes, knives, chisels, awls; *b*, dress pins; *c*, tubes, spirals; *d*, anchor pendants; *e*, medallions, breast cup, cap; *f*, bracelets, rings. *Figure prepared by D. Peterson after Gadzhiev and Korenevskii 1984:Figs. 2–8.*

below 1% (0.1–0.9%).[6] The concentration of arsenic in the artifacts almost invariably depends on the kind of object that was manufactured. In other words, just provisioning smiths with metal was only one small part of the production of valued goods. Only one of the tools and arms in the sample, a knife, contains arsenic in a level that suggests intentional alloying (2.3%), while a few types of ornaments (spirals, pins, and beads) also tend to be made of unalloyed copper rather than arsenic bronze (Gadzhiev and Korenevskii 1984:19, table, no. 29969; figure 2.2). There was apparently a tendency to reserve arsenic bronze for the other types

Class	Type	Number
Tools and weapons	Shaft hole axe	3
	Knife	6
	Chisel	3
	Adze	4
	Awl	4
Ornaments	Dress pin	46
	Medallion	10
	Breast cup	1
	Cap	1
	Tube	37
	Spiral	7
	Anchor pendant	13
Bodily adornments	Bracelet	30
	Hair ring	30
	Total	195

Table 2.1 Artifacts analyzed by Gadzhiev and Korenevskii (1984) from Velikent mound III, tomb 1, by class, type, and number. *Table prepared by D. Peterson.*

of ornaments as well as bodily adornments (table 2.1; figure 2.2).

The addition of arsenic to copper in arsenic bronze gives copper a silvery tint. Arsenic inhibits the oxidation of copper and also lowers the melting point of copper by several hundred degrees centigrade and reduces the emission of gases as the metal cools, making it superior to unalloyed copper for use in casting (Hamilton 1996:14; Yener 2000). However, the presence of arsenic in levels of 6% or more causes copper to become brittle and unsuitable for tools and weapons, especially those made for use with percussive force, such as axes, adzes, and chisels. The selection of arsenic bronze for ornaments and the tendency to avoid its use in tools and weapons shows that the smiths who made the assemblage knew of the practical dangers of arsenic alloys and consciously manipulated the relationship between form and media. While the arsenic content of ornaments in the sample tends to be much higher than that of tools and weapons, the level of arsenic in ornaments also rarely reaches or exceeds 6%. In combining casting and forging techniques in making ornaments, the smiths who made the assemblage may have favored the use of arsenic bronze to enhance the castability of copper while avoiding high levels of arsenic because it might be detrimental in forging cast blanks into finished ornaments and adornments. In forging, brittle metal would have required more frequent annealing than a more pliable material. Metallographic research (Scott 1991) is needed to determine the specific metalworking techniques that were applied, and the particular productive goals that were pursued, in working with different metals and alloys in the assemblage.

Similarities in the composition of the items in the sample are strong indications that the metal was produced in the northeastern Caucasus. The objects contain relatively high trace levels of antimony, with the majority falling within 0.15 and 0.3% (Gadzhiev and Korenevskii 1984:19, 23). The addition of antimony to arsenic bronze counteracts brittleness, but the levels of antimony in the objects are well below 1%, suggesting that its presence is probably the result of the geochemistry of the ores that were used. Bismuth also occurs in regular trace levels throughout the sample. It was previously noted that consistently high trace levels of arsenic were detected in objects in which it is only present in levels below 1%, which cannot be characterized as an alloy. The consistent trace levels of arsenic, antimony, and bismuth in the sample, and typological similarities to other Early Bronze Age metalwork assemblages in Dagestan and elsewhere in northeastern Caucasia, further suggest that the Velikent metalwork was made with copper produced within northeastern Caucasia, and that a regional metallurgical tradition—in Chernykh's terms, a "metallurgical focus" (Chernykh 1992)—existed in Dagestan during this period (Gadzhiev and Korenevskii 1984:24–25). Additional source analysis and more systematic investigations of mining and metal production sites are needed to establish the extent to which local ores were smelted for copper during the Bronze Age in the region, and the relationship between ore sources and sites in which copper was worked and used.

Sulphidic ores, which are typically rich in arsenic (Lechtman 1999), are widely available in the Caucasus Mountains (Chernykh 1992:60; Palmieri et al. 1993). However, the Caucasus are a formidable physical barrier in relation to Dagestan. Proceeding almost directly from the Black Sea coast in the west, the Great Caucasus closely approach the Caspian shoreline just south of Velikent at Derbent (see Kohl, chapter 1). At Velikent, a lowland corridor only 20 km in width

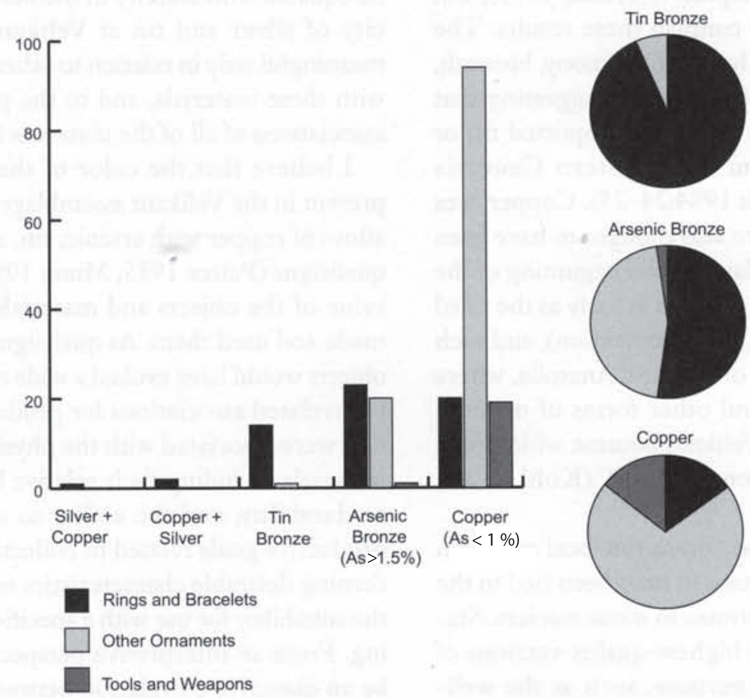

Figure 2.2 Composition of metalwork from Velikent mound III, tomb1. *Figure by D. Peterson based on data from Gadzhiev and Kornevskii (1984).*

separates the Caucasus foothills from the Caspian and was probably even narrower in the Early Bronze Age when Caspian Sea levels were higher (Gadzhiev et al. 1995). While Velikent itself lies in an easily traversed lowland corridor, getting metal or ore to Velikent from even the nearest sources in the northeastern Caucasus would have been a challenging undertaking.

There is evidence that the Velikent assemblage was preceded by a long history of metalsmiths working in the immediate region. An ingot of metal identified as copper was found in an early occupation level in mound 1 (Gadzhiev 1991)[7] and a shaft-hole axe casting mold was found in an early context in a settlement area on mound II (see Kohl, chapter 1). A small sounding excavated at Kabaz Kutan, located only 8 km west of Velikent, yielded a crucible and a casting mold from stratigraphic layers that have been radiocarbon dated to the early third millennium BC, or roughly contemporary to the Velikent assemblage (2 sigma; see Kohl, chapter 1). Prills of copper or bronze have also been found within and near hearths on mound 2 at Velikent. Large numbers of hammerstones occur throughout the settlement areas on mound I and mound II, some of which may have been used to crush ores and fluxes in preparation for smelting or metalworking.

In chapter 1, Kohl discusses new lead isotope analyses that support the conclusion that Velikent smiths used imported tin to make bronze. However, previous spectral-chemical analyses may indicate that imported tin was added to copper made in the northeastern Caucasus to produce metalwork locally (Gadzhiev and Korenevskii 1984). Fifteen of the artifacts from the sample are tin bronzes containing tin in concentrations from about 1% to 10% (Gadzhiev and Korenevskii 1984:24–25, table). The objects are one pin, five rings, and nine bracelets (figure 2.2). Like arsenic, the addition of tin hardens copper and makes it easier cast. The difference is that tin can be added to copper in greater proportions than arsenic (to about 12%) before it causes the alloy to become brittle. Early Bronze Age metalworkers in the region apparently used tin bronze almost exclusively for adornments (rings, bracelets) that were worn directly on the body. The tin bronzes are distinguished from the other objects in the sample by elevated levels of lead and nickel, probably as a result of mixing copper with tin or bronze that was saturated with these elements (Gadzhiev and Korenevskii 1984:24–25). Lead isotope analysis of objects from the sample has indicated that the tin came from the same eastern source as tin in Early Bronze Age metalwork from Oman (see Kohl, chapter 1; Weeks 1999), but more testing is needed to confirm these results. The tin bronzes share the same levels of antimony, bismuth, and arsenic as the rest of the sample, suggesting that they may have been made by mixing imported tin or bronze with copper from northeastern Caucasia (Gadzhiev and Korenevskii 1984:24–25). Copper ores with high nickel content are also thought to have been mined in the Armenian upland by the beginning of the second millennium BC and perhaps as early as the third (A. T. Smith 2001, personal communication), and such ores are also characteristic of Iran and Anatolia, where Kura-Araks-like pottery and other forms of material culture similar to that of Velikent became widespread in the early third millennium BC (Kohl 1992; Kushnareva 1997).

The technical leap embodied in the local adoption of tin bronze at Velikent seems to have been tied to the demand for silver and tin bronze in *status markers*. Status markers tend to be the highest-quality versions of something with no other purpose, such as the well-worn example of a tea service of fine china as it stands in relation to everyday dishes (Douglas and Isherwood 1996:85). There also tends to be an inverse relationship between the rank value and frequency with which an object was used. The lesser value of necessities is belied by their use in frequent, low-esteem events, while luxuries are reserved for highly esteemed, low-frequency events (Douglas and Isherwood 1996:83). The types of objects with the most "versions" at Velikent are bracelets and rings. The rings were made in copper, arsenic bronze, and tin bronze while the bracelets were made in those materials as well as silver and copper-silver alloys (figure 2.2). By analogy this multiplication of versions, and the fact that rings and bracelets had no other apparent use than as bodily adornments, suggest that they served as status markers used in conjunction with funerary events. Moreover, the death of an individual is itself a singular occurrence, and in most cases mortuary ceremonies are known ethnographically to be highly esteemed events (Metcalf and Huntington 1991). The level of mortuary ceremonialism evident in the Velikent tombs supports this analogy.

The "highest quality" versions of these status markers would have been those made with silver and tin. They are the most infrequently occurring materials in the assemblage, and were probably the most difficult to acquire and those likely to have elicited the most interest. However, difficulty of acquisition should not be equated with scarcity in the normal sense. The scarcity of silver and tin at Velikent would have been meaningful only in relation to other positive associations with these materials, and to the positive and negative associations of all of the materials in the assemblage.

I believe that the color of the different materials present in the Velikent assemblage—copper, silver, and alloys of copper with arsenic, tin, and silver—served as qualisigns (Peirce 1955; Munn 1986:17) of the relative value of the objects and materials to the people who made and used them. As qualisigns, the color of metal objects would have evoked a wide range of different but interrelated associations for producers and consumers that were associated with the physical properties of the materials including their relative hardness, brittleness or durability, and the ability to use them to execute productive goals related to collective sensibilities concerning desirable characteristics in metalwork, such as the suitability for use with a specific technique like casting. From an interpretive perspective, there need not be an objective correlation between a particular color and material in each object. For example, the similarity in the color of arsenic bronze to silver, and the selective use of both for ornamentation but not in tools and weapons, suggests that arsenic bronze may have been meant to emulate silver.[8] In some cases the silver color of arsenic bronze may have also been used to dissemble silver as a more valuable material.

Silver was identified in only three objects and is therefore by far the least frequently occurring material and was arguably considered the most valuable metal in the assemblage. Silver is very rare in Early to Middle Bronze Age metalwork from Eurasia and Caucasia (Chernykh 1992:143), and its source is open to question. It is available at various points in the Caucasus Mountains including parts adjacent to lowland Dagestan, but in smaller quantities than copper ores. In this case the difficulty of acquiring silver may be related not to long distance exchange but rather to its limited availability in the physical environment. Knowledge of techniques for winning silver may have also been less widespread than knowledge of copper smelting. The addition of silver, like arsenic and tin, inhibits oxidation and hardens copper (Lechtman 1984), and in the percentages present in the bracelets from Velikent has a much lighter color than copper or bronze. If color served as a qualisign in value judgments, the concentrations of 30% and 90% silver in the bracelets would have been sufficient to distinguish its presence among the other objects in the assemblage.

But if silver was so valuable, why mix it with copper? The metal technology used to make the metalwork from Velikent was largely copper-based, and the silver present may have been derived from copper-silver deposits. In addition, the mixture of copper and silver is desirable in that it forms a harder material than copper and a more ductile metal than silver alone. Although arsenic bronze also has a silvery hue, smiths and experienced consumers would have been able to thwart attempts to dissemble alloys of silver and copper with high arsenic bronze by identifying the greater durability of the former and the brittleness of the latter.

In some ways the metalwork from Velikent is distinct in form from Early Bronze Age metalwork from neighboring regions (Gadzhiev and Korenevskii 1984:11–17). The shaft-hole axes with downward curving blades (figure 2.1) are quite distinct from Kura-Araks shaft-hole axes in southern Transcaucasia. The straight and crosier-shaped dress pins (figure 2.1) are without parallels in Caucasia. Their closest analogies occur in the eastern Mediterranean but in later contexts (ca. 2300–1600 BC).

The metal objects from tomb 1 also share all of the typological parallels that Kohl notes for the metalwork from mound III, tomb 11 in chapter 1. While these objects include forms that are widely distributed throughout Caucasia and southwest Asia in the Early and Middle Bronze Age, our knowledge of the techniques used in making them is much more limited. Formal similarities in the typology of metalwork from different regions may mask differences in productive technologies that may not become apparent until metallographic analysis is performed to identify the metalworking techniques that were used to make these objects (Scott 1991). Since there seems to have been a profound correspondence between technical practice and the meaning and value of metalwork, differences in technology would suggest differences in value. The characteristics that would have made the objects valuable were achieved through technical practice, and it is likely that the techniques, skill, and knowledge of the smiths who made the Velikent metalwork were iconicized (Munn 1986:16–17) as valuable in themselves. The cross-cultural significance of metalsmiths has been well demonstrated by Eliade (1978), but cannot be overemphasized since early metal production in Caucasia is often treated as derivative of technologies that originated in the urban centers of southwest Asia, while the role of local metalworkers is largely ignored.

While all marking of difference should not be read as hierarchy, value conceptually entails a process of hierarchization (Munn 1986:18). This examination of Early Bronze Age metalwork from Velikent suggests that the physical properties of metals, their practical performance both during and after production, and the relative difficulty in acquiring them were involved in the hierarchical ordering of materials and objects. However, the production, use, and value of metalwork underwent profound historical changes in different localities. Dumont's (1980) notion of *situational hierarchy* is a means for conceptually exploring hierarchies of value as structures in process. According to Dumont, idea-values are ranked in such a way that "high" ideas contradict and contain "low" ones, a relationship he refers to as *encompassment* (Dumont 1980:224–225). Another property of the ranking of idea-values is *reversal*. "[H]ierarchy is bidimensional, it bears not only on the entities considered but also of the corresponding situations, and this bidimensionality entails the reversal" (Dumont 1980:224–225). In other words, in certain situations objects of lesser value become more important than those of higher value, a situation that may be accompanied by a reorientation of hierarchical relations. The selection of unalloyed copper for tools and weapons in the Velikent assemblage was related to knowledge of the practical dangers of arsenic bronze, as well as the selection of bronze and silver for use in adornments. Thus the hierarchical priority of those materials was less relevant from the standpoint of the practical use of implements, at least as long as they were reserved for adornment. The bidimensionality of hierarchical values could have been involved not only in temporary reversals as discussed by Dumont but also in broader revaluations of materials and objects, and the principles governing their use.

The hierarchy of value in the Velikent metalwork would have been embodied socially through bodily adornment, a practice closely associated with the social inscription of concepts of personhood, and an important mechanism for naturalizing social categories and behavioral expectations in the formation of social identities among closely interacting members of a group (Dietler and Herbich 1998:242). The bidimensionality of the hierarchy appears to have been manifest in relation to difficulty of acquisition and practical performance. The superior performance of tin bronze over unalloyed copper and arsenic bronze during and after production, and its greater availability in relation to silver, may have opened the way for practical revaluations of the associations evoked by the characteristics of metalwork, and hence the socially prescribed uses of materials.

The distribution of silver and tin was limited and may have been controlled by a privileged few, but the legitimate uses of metals and metalwork were related to practices and associations that may have often been outside the direct control of an elite. Therefore even where an elite instigated contestations of legitimacy, such as the use of tin bronze for its practical advantage in tools and weapons versus a traditional use in adornment, these contests may have led to unforeseen results that would have brought the terms of legitimacy itself into question. For example, the increasing use of tin bronze for tools and weapons over the course of the Bronze Age had its technical and economic advantages, but also promoted the production of greater quantities of the alloy, and thereby lessened its effectiveness in creating or highlighting social distance. The revaluation of the utilitarian uses of bronze in relation to bodily adornment may have also drawn into question the value of other materials reserved for adornment and their legitimizing effect in local social practice.

CONCLUSION

The study of the relationship between the technology and value of Early Bronze Age metalwork from northeastern Caucasia is important for several reasons. Syntheses of the Early Bronze Age in southwest Asia have structured archaeologists' expectations concerning material culture practices in Caucasia during that period. The immense assemblage of metalwork from the tombs at Velikent represents a technological complexity in both metallurgy and metalworking that rivals that of more socially complex Early Bronze Age urban centers to the south. Similarly, the early and systematic use of tin bronze at Velikent indicates that Early Bronze Age societies in northeastern Caucasia had established trade networks necessary to acquire the materials needed to fabricate metalwork on a similar order to contemporary workshops in southwest Asia. Theories of value and ethnographic research on the formation of value indicate that the production and use of objects are joined in the creation of value as a social process, and suggest that even where cross-cultural exchange has a significant role in the acquisition of materials and objects for local production and consumption, their form, meaning, and significance are profoundly transformed in local practice. Developing an adequate account of the early commoditization of metals and its broader sociocultural significance in western Asia will require further research on how metals were processed, worked, and used outside of urban centers in the south. Doing so will enhance our understanding of the role of metalwork and technology in Early Bronze Age societies, and the nature and historical impact of interregional connections in the material culture practices of distant and diverse social groups.

I have argued that during the Early Bronze Age at Velikent, metalwork was implicated in a social process of hierarchization involving both the production and use of metal objects, in which shifts in production and consumption were linked to changes in joint constructions of value and related technological and social practices. In acquiring tin for bronze, this process would have included interaction with distant polities with potentially transformative effects. However, this influence would have depended on how those interactions were integrated into local practice, so that in many ways this process remained a fundamentally local phenomenon even at the level of cross-cultural interaction.

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NOTES

1. This paper uses the term "tin bronze," the alloy of copper and tin, rather than the more traditional "bronze" in order to distinguish it from "arsenic bronze," the alloy of copper and arsenic that was widely adopted much earlier in the Old World than tin bronze (in relation to the Caucasus, see Chernykh 1992). It also follows the archaeological convention of identifying an alloy by the presence of a secondary (and sometimes tertiary) elements in levels of 1% or more (for example, Chernykh 1992:145), whether it was achieved through the direct mixture of processed metals or by other means including cosmelting or fluxing (Lechtman 1999; Yener 2000).
2. Care must be taken not to conflate the adoption of the material with its discovery, especially in terms of a unilineal history. For instance, Yener (2000) discusses Chalcolithic copperwork with high tin content (>1%) from Anatolia. As Renfrew (1986) has argued, it is the widespread adoption, and not the discovery, of a technology that is important to the understanding of prehistoric society.
3. Munn (1986) discusses a more specific notion of intersubjectivity in relation to value than the one suggested here.
4. This in no way means that definitions of value derived from the knowledge of producers and consumers were identical nor that they were the same among individuals within those groups. The ramifications of this are dealt with later in this chapter.
5. Their table of data on the composition of all 195 items indicates that although the proportion is unspecified, arsenic *is* present in the objects that contain silver (Gadzhiev and Korenevskii 1984: table. nos. 29998, 30078, 30079).
6. This differs from a bimodal distribution of "low arsenic" at levels of 0.1–1.5% and "high arsenic" in levels of 1.5–5% discussed in the original study (Gadzhiev and Korenevskii 1984). For the sake of simplicity, I have chosen to focus instead on the 1% threshold typically used to distinguish an alloy (see note 2).
7. Whether or not it is an alloy remains to be determined.
8. Thanks to Kathleen Morrison and K. Aslihan Yener for first pointing this out.