Ancient Metallurgy and Socio-economic Complexities in the 4th Millennium BCE on the Iranian Plateau

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Metalworking, due to its special technical and production-related characteristics, played a very important role in ancient societies and the study of the archaeological evidence related to it is fundamental to understand ancient socio-economic complexities. Mining, smelting, annealing, casting, production of ingot, as well as alloying, are some of the stages in the metalworking process. The present study analyzes the background of the specialized metal production on the Iranian Plateau and the related demand for raw materials or metal products.

The central, eastern, and south-eastern areas of Iran are here considered as the most important regions in the formation and expansion of the metallurgy in south-western Asia. In addition, the production and distribution of metal at the regional and trans-regional level was one of the most important factors in the formation and expansion of complex societies, and fostered the political economy and the emergence of agency institutions and sovereignty in these regions of Iran. Copper ingot was one of the commodities traded in the 4th millennium BCE and later. There are two other important points in the field of archaeometallurgy of Iran. Firstly, the specialized metal production process allowed just men to assign strict mining and smelting operations. Secondly, the rulers by means of the strategic activity of metallurgy provided the basis for the continuation of the social and economic benefits acquired by them and the sustainability of the state of society.

Keywords: *Archaeometallurgy, 4th Millennium BCE, Iranian Plateau, Socio-economic complexities, Specialized Production of Metal.*

Introduction

In the light of the goals of the Processual Archaeology, the theme of identifying and restructuring the technological, economic, social and ideological organizations of the past societies was taken into account. Gradually, the explanation of the changes and complexities of the societies began in the framework of economic and social archaeology, paving the way for the investigation on the technological, economic, social and political developments of societies through the analysis of craft specialization. The specialized production of objects and tools from the end of the 5th and during the 4th and 3rd millennium BCE, occurred in chain form, in which different groups were emphasized. The technical and industrial process was supported, guided and monitored by an agency or sovereignty. "During the last few decades, many studies have been done on the emergence of complex societies on the Iranian Plateau" (Hessari 2011: 37-38). Perhaps the Central Plateau of Iran would have had a larger share in this regard. Metalworking had more prominent features among the late prehistoric and proto-historic technologies. This art-industry was not at the disposal of all members of the community. Work in the mines as well as in the smelting and casting workshops needed expertise, perseverance, skill, precision and management. The Iranian Plateau became one of the pivotal points for the beginning of social and economic developments at the end of the 5th millennium BCE and onwards by taking advantage of talents in metallurgy and cultural and social preparation (Weeks 2013). The specialized activity became one of the important platforms for commercial exchanges and cultural interactions between the East and West of the Iranian Plateau in the proto-history and in historical periods. The specialized production of metal in these societies was conducted by technical groups such as miners, casters and smelter.

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South-eastern, eastern, and north-eastern regions of the Iranian Plateau are rich in terms of metal and non-metallic ores (Fig. 1). Metallic mines, old mining evidence and smelting slag heaps in different regions of Iran indicate the oldness and scope of mining and smelting activities (Momenzadeh 2004; Nezafati *et al.* 2008; Pigott 1999a-b; Vatandoust *et al.* 2011; Stöllner 2005). Based on the archaeological evidence, metal annealing was done by smelting furnaces and related instruments. The discovery of some archaeological materials in the Late Chalcolithic and Early Bronze Age sites indicated the existence of cultural interactions between some parts of the Iranian Plateau and other neighboring regions such as Mesopotamia (Curtis 1993; Matthews and Fazeli Nashli 2004; Avilova, 2008). The metal was obviously exchanged in the interaction cycle from the 4th millennium BCE. Therefore, the goods were produced for distribution at the local, intra-regional and extra-regional levels and the Iranian Plateau has played a significant role in the political, social and economic developments of proto-history and historical societies in south-western Asia (Rothman 2001; Kohl 1987). Metallurgy and related techniques are regarded as one of the most important factors affecting the occurrence of complexities on the Iranian Plateau, especially in the central and south-eastern regions of the country, due to technical difficulties and considerable dependence on governance and managerial supports. Therefore, the present study aimed to explain the mutual relation between

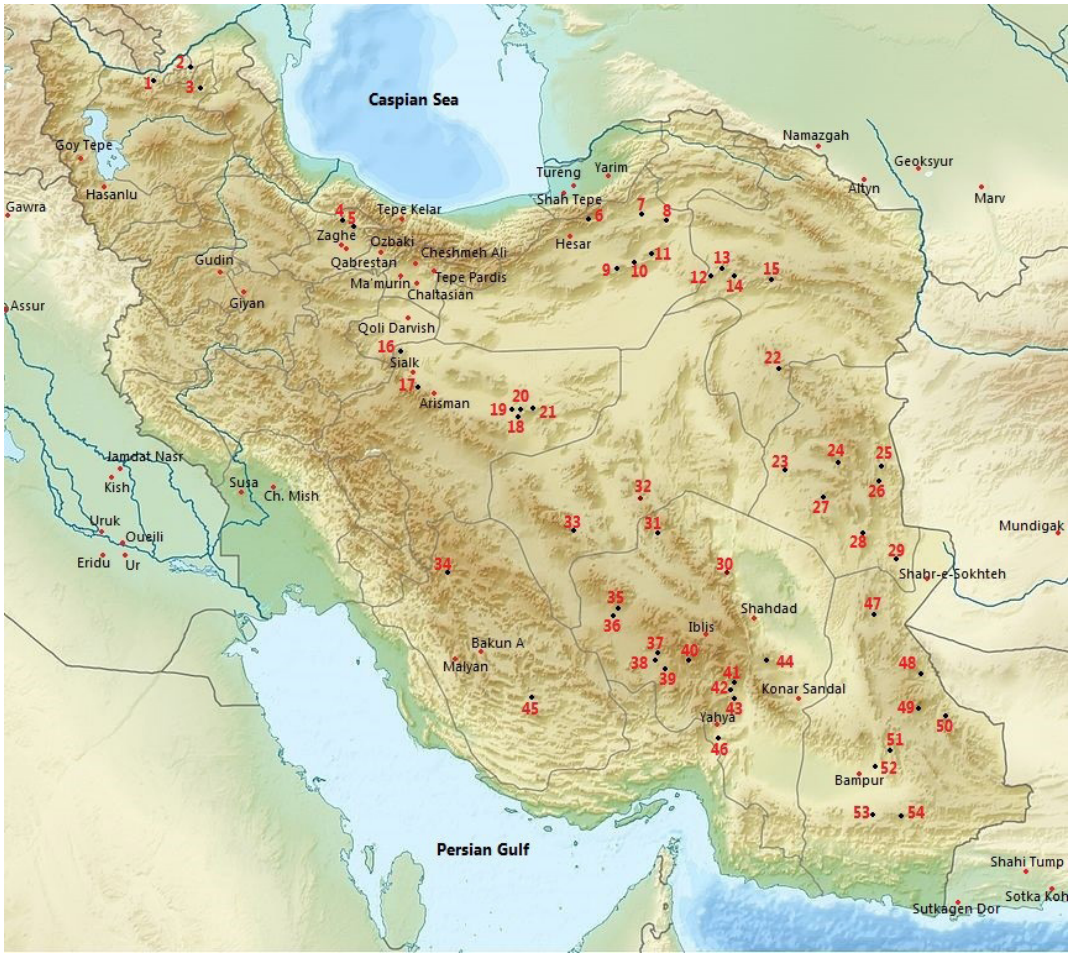


Fig 1. *Map of the most important 5th, 4th and 3rd millennium sites of Iran and the most important copper old mines*

1. Cheshmeh Khan 2. Aynelu 3. Mazraeh 4. Dizejin 5. Alamut 6. Biarjomand 7. Damanjala 8. Ma'dane Bozorg 9. Chah Mesi 10. Baghalu 11. Rugherlu Chah 12. Bato 13. Cheshmeh Gaz 14. Taknar 15. Sorkhdarreh 16. Veshnaveh 17. Ghamsar 18. Talkheh 19. Meskani 20. Talmesi 21. Chah Mileh 22. Kakhk 23. Gazu 24. Mir-e-Khash 25. Darmian 26. Lotfabad 27. Sehchangi 28. Ghaleh Zari 29. Gholleha 30. Khanuk 31. Narigan 32. Khoshumi 33. Khut 34. Khanegah 35. Darbidu 36. Meduk 37. Deh Siahan 38. Sarcheshmeh 39. Bolbolu 40. Ghaleh Narp 41. Tall-e-Ma'dan 42. Baghraii 43. Gerdu Kulu 44. Darbini 45. Kuhne Mes 46. Sheikh Ali 47. Chehel Koureh 48. Dargiyaban 49. Chah Doust 50. Sheikh Ahmad 51. Bazman 52. Ishpash 53. Sarsow 54. Kish Patiel

metallurgy and the agency and sovereignty in the late prehistoric and proto-historical communities of these regions as well as their relative advantages in the field of the industrial expertise.

Theoretical foundation of the study

The classic theory of change in the economic construction of societies through the agriculture and livestock, the evolution of social organizations, and the occurrence of the urban revolution (Childe 1951), provided some important theoretical frameworks for the study of the emergence of the part-time and full-time specialists. Later, the scholars explained the activities of this specialist social groups in a multi-stage process. The stages included the prospection and processing of raw materials and the production and distribution of goods. Thereafter, another approach emerged, which considered the importance of recognizing the natural environment in restoring the behavior of past peoples and the economic and social organizations of that period. Accordingly, some studies were conducted with bio-ecological approaches and the evolutionary explanation of cultural changes in relation to environmental resources (Clark 1989; Sahlins 1972; Service 1971).

Influenced by New Archaeology's approaches, some themes such as organization, method and scale of production and distribution, typology of consumable products and cultural interactions were proposed in the study of the cycle of producing an artifact (Costin 1991; Clarke 1995). Accordingly, the considerable theme of craft specialization was raised more targeted and systematic, and its relationship with the socio-economic complexities of the past societies became the subject of extensive studies (Brumfiel and Earle 1987; Postgate 2002; Chapman 2003).

Metalworking was an important and more specific multi-stage process in late prehistoric and proto-historic. Todays, archaeometallurgy is used to analyze the socio-economic complexities and cultural interactions of past societies. Understanding the process of manufacturing specialized metal will make us aware of the complexity of the past societies and their social and economic contexts. The current study aimed to investigate the craft specialization of metalworking during the late prehistoric and proto-history periods in Iran and to analyze and explain the activities of metalworkers and their support by agents, representatives, brokers and community rulers.

Methodology

Specialized metal production means the production and distribution of goods in an organized form and in specific scale. In any organized state, the quantity and quality of supply and the demand for products are closely related to each other and managed by agency or community governance. During the 4th and 3rd millennium BCE, a kind of cultural interaction was established among the communities in south-western Asia, in which the Iranian Plateau - especially its central, southeastern, and eastern regions - played a significant role. Therefore, the present paper examined the metallurgical evidence discovered in the ancient sites of some regions of Iranian Plateau using the already mentioned analysis method and theoretical foundation. Metallurgical finds, smelting and casting skills of metalworkers and socio-economic mechanisms were studied and their role in the process of specialization, the stages of socio-economic complexities and the beginning of sovereignties in the late prehistoric and proto-historic communities were explained.

Results

The study of social history from the archaeological point of view began in the late 19th century, aimed at the analytical study of the division and definition of the societies, as well as for their archaeo-sociological understanding. L. H. Morgan and A. B. Tyler, the pioneers of this study, used the term Social Development to express the divisions of human life periods, and their consideration influenced the process of studies on the origins of the family and the state (Gamble 2007).

In the first half of the 20th century, when the anthropological approaches gradually became more influential in archaeological studies and archaeologists took distance from a historical-

descriptive approach, technologies and livelihood tools were important indicators for defining the continuous stages of social evolution. Understanding the social organization of past societies, which has been less considered by archaeologists, became one of the main topics of the studies due to the influence of the New Evolutionism approach. Theories of anthropologists such as E. Service and M. Fried on the social and political organizations of the primitive societies provided an appropriate context for articulating ethnological analogies and the material evidence of past social organizations in archaeology. After classifying the early societies and explaining their social, political and economic evolution from a simple mode to a complex one, they proposed issues such as environmental-based expertise and redistribution of products under the supervision and support of a social center (Service 1962; Fried 1967). The themes of general evolution and special evolution (Sahlins and Service 1960), were manifested in Processual Archaeology (Binford and Binford 1968). Identifying the chiefdom societies and considering 20 features for them, C. Renfrew (1974) emphasized *specialization* as an important character of these communities.

Influenced by Cultural Ecology Approach, K. Flannery (1972) considered the sustainability condition of a cultural ecosystem in the exchange of materials and energy between the environment and its populations and acknowledged that the domain of decision-making and the hierarchical organization of the complex governance societies is regarded as the most important characteristics. Later, his view was modified, since the members of human societies are most important in a living social system for ecological analysis. However, data processing plays a crucial role in a natural system or cultural ecosystem (Chapman 2003). In the recent system, central institutions and economic classes are formed, and a variety of technical and professional decisions are at the disposal of a governance institution. Therefore, the study of the decision-making and the development of societies in terms of complexity structures are essential for understanding the early states. The hierarchy of decision-making in ancient societies was developed in response to the greater need for the exchange of information, discipline and legislation. The approach of Flannery was changed by H. Wright and G. Johnson, since the specialized administrative activities were conducted to control the components of the community in a governmental community. “Based on this perspective, the policy included administrative affairs, institutional control, and various decision-making. Therefore, in these societies, the first form of decision-making was evident through the specialization in the production and transport of goods” (Wright and Johnson 1975: 267).

The need of societies to create complex production and exchange mechanisms led to the emergence of different individuals as agent, broker and ruler, who paved the way for the formulation of managerial regulations. In complex societies, the bases of implementing political management on the production sources and distribution of goods developed considerably, and the specialists' needs for raw materials created complex systems (Wright 1984; Brumfiel and Earle 1987; Earle 1997).

Based on the analysis of the specialized production of metal in the late Chalcolithic and Early Bronze Age of the Iranian Plateau, metallurgy was one of the most important and influential specializations in the process of social complexity and the initiation of an industrial economy was based on politics and management in these communities. Metalworking depended upon environmental capabilities and the exchange of processed materials and manufactured goods within the support and supervision framework of one or more governance centers. Specialized metal production in the research periods included mining, ore reduction, casting and alloying. The process was disrupted if it was not supported and directed by agencies and elites of the managerial or sovereignty institutions. Hot and cold hammering methods which did not require a very high technique was available for the societies existing between simple and complex state. This situation was observed in Zagheh (Malek Shahmirzadi 1977) and Yahya VII and VI (Heskel and Lamberg-Karlovsky 1986). However, in the following periods, when mining and the extraction of ores and their smelting was begun, metallurgy entered a specialized and complex stage. Evidence of mining and copper slags were reported near Tepe Yahya in an area named Sheykh-e- Āli

(Figs. 2 and 3) which is related to Yahya IVC (Berthoud *et al.* 1979). Hammering, smelting, annealing and alloying capabilities are four main copper characteristics. The annealing characteristic of copper resulted in achieving the melting, casting, and alloying techniques, respectively. "Arsenical copper or copper-base alloy was produced in Yahya VIA and subsequent periods as an early chalcolithic village in SE Iran" (Thornton 2010: 33). The success in the last two stages depended on some abilities such as knowledge of metal compounds, high skill in metallurgy techniques, the disposal of mineral and environmental resources, as well as social and cultural preparedness (Ottaway 2001).



Fig. 2: *Kerman, Ancient Mine of Sheykh-e- Āli*

Zagros Mountains, southern slopes of the Alborz and the sides of the central desert of Iran have enjoyed these abilities. The communities living in these areas could manage and support the process of specialized production of metal and alloy manufacturing during the Chalcolithic and Bronze Ages due to their social and cultural capacities (Moorey 1969; Tylecote and Mckerrell 1970; Thornton 2009; Pigott and Lechtman 2003; Stöllner *et al.* 2004). Further, they succeeded in making advanced metallurgy and developing their relationship with other communities at the intra-regional and extra-regional level.

The copper mines of Iranian Plateau have carbonate, sulfide, and oxide minerals of malachite, azurite and cuprite and their mineral form is often streaky (Bazin and Hubner 1967; Ghorbani 2013). Mining and extracting the streaky mines are easier and ancient mining evidences are observable in most of them. Probably, the reduction of metal-rich minerals was conducted around the mines, and produced slags accumulated in the area. The less metal-rich mineral stones were crushed, processed and condensed by using an aqueous mechanism. Therefore, they had to carry mineral stones to get the required water.

Some of the operations used in smelting stage includes finding an appropriate location to make furnaces, providing necessary equipment, creating buildings and lateral spaces, selecting the right wood for coal production and their storing. Smelting, melting and casting operations were conducted in Tepe Qabristan at a workshop (Majidzadeh 1976). In this workshop, hundreds of pieces of mineral stones were obtained, which probably were the same minerals processed and condensed. Old mining and slag heaps were observed in an area known as Eipak in Eshtehard on the edge of Qazvin plain which is located in a straight line less than 100 km from Qabristan (Figs. 4 and 5). In addition, the smelting and casting techniques was reported at Arisman (Chegini *et al.* 2004) and Tepe Sialk (Malek Shahmirzadi 2004).

In this smelting method, as a kind of pyro-metallurgy, mineral ore was melted, the waste impurities of copper rock were physically combined with each other, and copper was formed as bullets among them. The copper bullets were collected and used by breaking impurities. This technique was reported as one of the common methods for copper ore extraction in Tepe Qabristan (Majidzadeh 1979), as well as Tel-e-Iblis (Dougherty and Caldwell 1967; Pigott and Lechtman 2003) and Tepe Hesar

(Pigott 1982). Recent archaeo-metallurgical survey that identified ancient mines and slag sites on the northern edge of the Dasht-e Kavir Desert (Roustaei 2012) are analyzable in the framework of the type of smelting methods which was common in the ancient sites of this region such as Tepe Hesār. The ancient metalworkers extracted the metal after thawing and smelting the copper ore completely. Shredded ancient slag heaps (Fig. 6), of course caused by such a method but without an exact dating has been observed by the writer in the vicinity of the vertical and horizontal tunnels of the ancient mining (Fig. 7) in Hari Dargiyabān, south of Zahedan.



Fig. 3: *Kerman, Ancient Mine of Sheykh-e- Āli, Slag Heaps*



Fig. 4: *Eshtehard, Eipak, Horizontal Holes of Old Mining*

In northwestern of Zahedan another important area which is called Chehel Kureh (40 Mines) is very important. Some evidence were found, such as slag heaps (Fig. 8), vertical and horizontal shafts and tunnels (Fig. 9), as well as furnaces remains (Fig. 10).

Molten copper was shaped in various forms or as ingots by casting method. Ingots can be used in re-casting, and more importantly, they represent a ready commodity for exchange. Ingot production was reported at Tepe Hesār (Tosi and Bulgarelli 1982) and Tepe Yahya in the middle of the 4th millennium BCE, during the VA period (3300-3600



Fig. 5: *Eshtehard, Eipak, Slag Heaps*



Fig. 6: *Zahedan, Hari Dargiyabān, Slag Heaps*



Fig. 7: *Zahedan, Hari Dargiyabān, Old Mining*

BCE) (Lamberg- Karlovsky 1971). Evidence for ingot production was obtained from Tepe Qabristan (Majidzadeh 1976) too.



Fig. 8: *Zahedan, Chehel Kureh, Scattered Slags*

Improvements in metallurgy were probably due to the advances in other technologies supported by community agents and rulers. Copper smelting was associated with making advanced pottery kilns and the production of pottery in a controlled atmosphere (Streily 2001). Advanced pottery furnaces were discovered at Tepe Qabristan. The remnants of the copper smelting workshop discovered at Qabristan II9 indicated that advanced pottery, smelting and casting methods of metallurgy, and possibly the ingot production, were conducted in parallel (Majidzadeh 1977). Previously, the smelting of minerals and casting in the Qabristan was dated about 4600 BCE (Majidzadeh 1976). However, the newest dating in this area determined the approximate date of 4100 BCE for this important event (Fazeli Nashli *et al.* 2005). Furthermore, the Tel-e-Iblis excavations considered the same date for this innovation (Caldwell 1967). The present writer believes that the recent date is more correct. Therefore, these communities achieved advanced metallurgy and possessed its complex mechanisms in the late 5th millennium BCE They recognized their ecosystem and tracked and obtained ores in the surrounding areas. Then, by processing and reducing the ores, they obtained the necessary metal materials and produced specialized metal. The agency and governance system was developed due to these developments in order to provide technical

Discovering some evidence about the specialization of these communities in the exchange and transfer of goods is essential. The analysis of finds such as tokens, seals, seal impressions, Proto-Elamite tablets and sealed mud pieces resulted in the reconstruction the exchange system, the analysis of the administrative system, and the institutional production and distribution organization of these communities (Schmandt-Besserat 1974, 1992). In addition, such evidences were discovered in different regions of Iranian Plateau (Moghimi and Fazeli Nashli 2015; Alizadeh *et al.* 2013; Pittman 2013; Hessari 2011). These administrative tools indicated the existence of a commodity exchange system such as ingots and metal products. The archaeological studies confirmed the prevalence of links among the cultures of the eastern part of the Iranian plateau such as southern Turkmenistan, the Hirmand and Kerman regions with each other, as well as the Mesopotamia in the late 4th millennium as well as during the 3rd millennium BCE (Hermann 1968; Lamberg- Karlovsky and Kohl 1971; Lamberg - Karlovsky and Tosi 1973; Pittman 1984; Cortesi *et al.* 2008). For instance, lapis lazuli and copper were commonly traded through the Great Road of Khorasan during the late Ubaid period and the Uruk in the north of the Mesopotamia, and during the periods of Jamdat Nasr, the Old Dynasties and Akkad in its south region (Kohl 1978; Muhly 1985). The stability of security along the pathways during the 4th millennium BCE can be studied through some archaeological evidence. At the same time with Uruk, the large centers in the Zagros valleys controlled the plains and communication paths (Henrickson, 1994; Weiss and Young 1975). Based on some evidence, pack animals such as donkey and horse were used during the 4th millennium BCE and at the end of the 5th millennium in the Iranian Plateau (Matthews and Fazeli Nashli 2004). Archaeozoological studies in Zaghe and Sialk resulted in identifying horse-related bones, which provided important evidence for analyzing the transportation methods in these periods (Fazeli Nashli and Young 2008; Mashkour 2003).

The role of the central Zagros region is evident in establishing economic relations between Iran and Mesopotamia at the end of the 4th millennium BCE The goods were transported along the communication routes of the region and were secured through strategic deployments located in

major valleys. The discovered evidence of the Late Susiana 1 in Qomrud area (Kaboli 2000) during the late 5th millennium BCE, the discoveries of Qolidarvish (Alizadeh *et al.* 2013) during the late 4th millennium and early 3rd BCE, the beveled rim bowls discovered from Qabristan Period IV (Majidzadeh 1976) and Arisman (Chegini *et al.* 2004) during the 4th millennium BCE, and the discovery of these bowls, clay tablet, cylindrical seals, and large four handle jars in the residential and administrative space of Gudin V (Weiss and Young 1975) and Tepe Sofalin near Varamin in south of Tehran (Hessari 2011) demonstrated that the central plateau of Iran and the central Zagros played an important role in this area.



Fig. 9: *Zahedan, Chehel Kureh, Vertical Digging of Ancient Mining*

Major developments in the regions of south-western Asia took place at the end of the 5th millennium and during the 4th millennium BCE. The Ubaid culture flourished in the south of Mesopotamia, and then was replaced by the Uruk culture (Matthews 2003). Large settlements emerged using irrigation-based farming systems. The level of knowledge and application of specialties reached its maximum growth. Innovations such as the use of the fast-wheel pottery and the production of more varied stone tools and instruments emerged. At the beginning of this period, the chiefdoms or the early states tried to expand their political and economic influence in wider geographical areas. The communities of the Central Plateau and the eastern and south-eastern regions of Iran at the end of 4th millennium and early 3rd millennium BCE played an important role in the economic developments through commodities such as metal. The consumers of metal products at the trans-national level mainly lived in Mesopotamia and south-western Iran (Moorey 1994; Stech and Pigott 1986). Copper entered into Susiana Plain in the middle of the 4th millennium BCE and by the end of the millennium was traded between the Iranian Plateau and Mesopotamia (Amiet 1993). During that period, the use of metal along with precious and semi-precious stones was of great importance in the temples and palaces of Mesopotamia (Moorey 1988).



Fig. 10: *Zahedan, Chehel Kureh, Remains of a Smelting Furnace*

Accordingly, the study of the components of specialized metal production in communities located on the Central Plateau, in eastern and south-eastern Iran can contribute to the analysis of the socio-economic complexities in the late prehistoric and proto-history periods. In most of these sites, there is some evidence of the administrative system and the organization for the institutional production and distribution, considered as support data in this area. Nevertheless, the informative potential of ancient metallurgy is not applied in these analyses. Although the archaeometallurgical operations can be described through economic geology, geochemistry, mining archeology, and ancient metallurgical researches, a few studies were conducted in this field (Stöllner 2003). Moreover, no significant study was observed on the relationship between advanced metallurgy in these areas and themes of ancient sociology such as governance and agency. The lack of theoretical studies in Iranian archeology led to failure in using the archaeometallurgy capabilities for sociological explanation of past societies. Although more cases can be used to explain this issue, only two instances can be sufficient.

Explaining the role of gender in past cultures and civilizations is one of the most important issues in Social Archeology. The question is related to the role of gender in metallurgy with simple or advanced methods. The rulers, agents or brokers through their authorities provided the conditions and possibilities for role playing for men and women in the society (Perry 2008). However, the specialized metal production process allowed them to assign strict mining and smelting operations only to men. Therefore, explaining the role of women in the metallurgy process from the perspective of Gender Archeology is considered as an important question. Of course, the archaeological data and basically the questions and methods in the archaeology of Iran are not appropriate to conduct the study on the skeletons to find out the type of employment of deceased during their lifetime based on their status. However, the archaeometallurgy in the Iranian Plateau has such a capacity to pose such questions.

As another example, if agency and sovereignty are considered as an opportunity given to brokers and rulers of the community, it is worth noting that they have tasks and strategic duties in relation to the goals of the community. Therefore, they should always monitor the status quo of the community and offer the desired situation for the future which in optimistic state resulted in emerging desirable and sustainable social changes in the society. However, this desirability and sustainability may not always end in favor of the community. Therefore, the guidance and support of the metallurgy process as a strategic activity and a special opportunity afforded to the rulers of the community provided the basis for the continuation of the social and economic benefits acquired by them and the sustainability of the state of society. These two instances illustrated that the specialized metal production research on the Iranian Plateau requires the development of a wide-ranging and extensive research and executive program.

Conclusions

The beginning of the socio-economic complexities of the past societies during the late Chalcolithic and Early Bronze Age as well as their expansion in historical periods is related to factors which are identified and studied as the main and secondary indicators. These components are categorized and analyzed in five groups including a) settlement pattern, b) types of technologies, c) level of progress in agriculture and livestock breeding, d) the data related to the administrative system and institutional production, and e) the evidence of belief and ideology. Metallurgy, belonged to a variety of technologies, is important among the various indicators used to analyze the complexities of societies. Basically, the technology is complex. The searching of mines to provide metal materials, ore processing, casting, smelting, annealing, ingot production, and alloying, were difficult and complex from the technical and industrial perspective.

In addition, success in each of these stages requires a group decision-making, planning and support for managing the problem of needs and how to overcome them and, actually, managing the developments of society. For instance, the discovery of mines and the extraction of metal minerals were difficult and required agents and brokers to convince a part of the community of metalworkers to do the hard work. If the fuel, the water and the wind required for smelting were available, the extracted ores would be melted in the vicinity of the mines, otherwise they had to carry them to the places where these conditions were available. The ingot production and alloying is regarded as another instance. Making these metal products could not be emerged as a simple need. However, it arose from an intra-regional and even extra-regional necessity. The main question raised here is whether these flows and processes were possible without the support and guidance of those having the motive and purpose of regulating the affairs.

Nowadays, the metallurgy is widely used in research to explain the cultural changes and analyze the complexities of the past societies. The Iranian Plateau, especially margin of the two deserts, is considered as one of the main origins of metallurgy and metal smelting in south-western Asia. During the last decades, archaeological discoveries resulted in the finding of a wealth of evidence in this area and provided researchers with valuable data. Therefore, the metallurgy technology began in the late 5th millennium BCE and developed in the 4th and 3rd millennium BCE in Iran, due to its mineral

talents and internal and external needs, and more importantly, it took place within the framework of a governance and managerial organization.

However, it is worth noting that the informative potential of ancient metallurgy in archaeological sites of Iran has not been utilized appropriately so far. The study of ancient metallurgy has not a good place among Iranian researches, due to several important reasons such as the lack of the required tools, as well as the lack of facilities and credentials for implementing related projects. Recognizing and studying various stages of metallurgy, such as mining archeology and laboratory testing of metal objects, requires a good financial reputation. Although efforts have been made to equip facilities and provide laboratories for the technical study of metal objects, they are not adequate. The relevant organizations and research institutes, private laboratories and universities have serious weaknesses in this respect. In addition, obtaining a license for sampling these objects in the property of the Iranian Cultural Heritage Organization is a very difficult task. Therefore, in order to conduct the targeted studies in the field of ancient metallurgy, a comprehensive research program should be developed and implemented in this field.

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