MINING IN AL-BAHA REGION, SOUTH-WESTERN SAUDI ARABIA IN ISLAMIC-ERA: THE ARCHAEOLOGY OF ASHAM

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Abstract

During the early Islamic empire, gold and silver were necessary for minting coins for the single currency of the Caliphate to facilitate trade from the western Mediterranean to eastern Persia. Iron, copper and tin were also necessary to equip the armies needed to defend and expand the empire, as well as for construction and domestic use. Although people have focused on the Arab-Islamic expansion in terms of military, religious and trade aspects, the internal production of the state has been largely neglected (i.e. mining and making things, the physical basis of the civilization). Thus, studying mining settlements as a model of internal production settlements is necessary to enrich our understanding of mining activity and its role in Islamic civilization and the medieval world.

The importance of this study lies in studying the characteristics of the mining landscape in the region of Al-Baha, by analysing the mining activities taking place at the mining settlement of Asham, one of the most famous mining settlements mentioned by several classical Arab writers. These mining sites were surveyed generally and the mining tools examined. After completing the general survey, Asham settlement was surveyed intensively and excavated with six archaeological trenches to study the stratigraphy of the settlement in order to present an overview of the successive occupation levels and to expose more mining evidence. Materials recovered include over 1112 pieces of pounders and grinders, and 2153 fragments of pottery, soapstone and glass.

The study of the mining landscape in Al-Baha region indicates that there were at least three metals mined there during the Islamic era: copper, gold and silver. These metals were processed in three patterns of settlements of different compositions and functions with evidence of state supervision and integration with regional and international trade routes. The research critically analysed the classical Arab-Islamic narratives with regard to the archaeological evidence of tools and facilities.

The evidence confirms the extensive scale of mining activities in Al-Baha and its importance to the broader Arab-Islamic world. Rudimentary patterns of mining settlement were overhauled with extensive investment and state involvement during the classical Islamic civilization (c. 630-1100 CE), in the context of the great fillip Arabian trade received under the Umayyad and early Abbasid Caliphates which enabled full and stable exploitation of the natural factors amenable to mining in Al-Baha. The decline of the mining settlements was related to the political disintegration of the Abbasid Caliphate and the rise of a series of Turkic dynasties from the Seljuks onwards, reflected in the fact that the natural conditions still facilitate modern mining in the region, which poses a great threat to the important archaeological remains.

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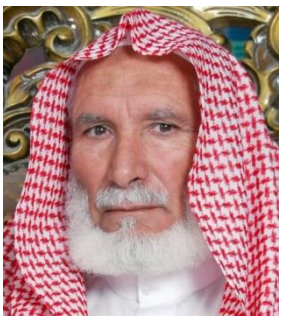
Dedication

A Special Dedication



This thesis is dedicated to the memory of my father, Ali Abadi, for all of his sacrifices, support and love, which have sustained me throughout my life. Without him, I would not be the person I am today. Since he left this world I miss him every day…

Abdullah

Declaration

This thesis is the result of the author's original work unless where specifically referenced in this work. Also, it has not been submitted for any other degree at this, or any other university.

Abdullah A. Alzahrani

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Chapter 1: Introduction

1.1 Introduction

The emergence of Islam took a decisive turn in the history of Arabia and beyond with the establishment of the Islamic state in Medina in 622 CE. The whole of Arabia, including the Yemen, quickly became Muslim during the lifetime of the Prophet, and thereafter the Arab-Islamic Empire expanded rapidly west and east. After the centre of the Islamic caliphate was transferred from the Hejaz to the Levant and Iraq, the Arabian Peninsula did not recede from the development of civilization. Historical studies and archaeological researches revealed that hundreds of towns spread along the trade and pilgrimage routes, boosted by the Islamic expansion, which added an international dimension to the latter (as compared to the pre-Islamic Arab pagan pilgrimages), and attested by several inscriptions spread in different locations of Arabia dating back to the medieval period (al-Rashid, 1986).

Traditional historiography has approached this period from a Eurocentric perspective, such as the famous Pirenne Thesis, according to which the Arab-Islamic expansion in the Levant and North Africa during the first Hijri (AH) century dealt the death blow to the Roman Empire (Pirenne, 1939); another explanation would be that the Roman provinces in those regions were revived by being again incorporated into a large single economy, the Arab-Islamic one (the Roman Empire having been overrun by the Barbarians and decidedly on the wane in the immediately preceding centuries). Moreover, many Western historical and archaeological studies of the Middle Ages focused on commercial movement and change, military conquest and religious practices.

Pirenne (1939) indicated that medieval period Arab-Islamic conquests occupied the eastern and southern Mediterranean towns (in two main waves, the first in the Levant and Egypt, and the second in North Africa and Iberia), basically destroying the traditional Roman Empire (Pirenne, 1939). In studying the economics of the period, Hodges (1989) concentrated on towns and commercial markets, and the trading system based on movable goods, weapons, textiles, jewellery, and tools of daily use. Movement of these productions through commercial cities in northern Europe also took place, and the lines of business and systems of trade exchange between these markets indicate that Europe did not merely hibernate following the political collapse of the Roman Empire until it arose, Phoenix-like, during the Renaissance (Hodges, 1989). As this study will show, the Arab conquests in fact

boosted trade within the regions formerly administered by the Roman Empire and beyond, extending as far as Scandinavia and Greenland.

However, most eastern archaeological research concerning this period in Arabia concentrated mainly on pilgrimage routes, particularly the stations. These stations were built along the routes from Egypt, Syria (al-Gabban, 1993), Yemen (al-Thanyan, 2000) and the Islamic east from Iraq (al-Rashid, 1993), as well as the archaeological remains for some sites and their inscriptions in Arabia (al-Zayalai, 1983), whereas other studies focused on Islamic art in fields such as ceramics, minerals, glass, wood and textiles, tracing the influence of the Sassanid and Byzantine empires (al-Basha, 1988).

Although these studies are extremely important and shed some light on hidden aspects of trade and the exchange of goods between towns, and urban living itself, none of these studies discuss the actual control of production and utilisation of resources. Selective approaches focus on particular types of evidence (e.g. trading places and pilgrimage stations, not places of production). The trading and routes of concern to most historians is likely underpinned by political expansion related to the control and exploitation of resources, an aspect of the period only tentatively acknowledged and understood in the field. The metal industry is one kind of production that presents an original contribution in the development of the Islamic state, and trade between its provinces and with Europe, which was underpinned by the mining industry.

Of all metals, gold and silver were particularly necessary in a fundamental way as the medium of exchange. The importance of minting coins by the Caliphate was twofold: most importantly, it created the new single currency of the Arab-Islamic Empire (with the main units of the dinar and dirham) to facilitate trade from the western Mediterranean to eastern Persia; additionally, the minting of coins was an important declaration of power (symbolically) and faith (literally) by the Government.

Another important concern was the arms industry, which in this period concerned the manufacture of shields, spears, swords, arrows and helmets. Empires needed these industries to protect and secure their borders. Additionally, metal objects such as trays, pitchers, plates, dinner tables and chairs, stoves, incense burners, mirrors, boxes, and shrines were essential for use in daily (domestic and public) life. Additionally, people did not forget jewellery, and the production of bracelets, earrings, necklaces, anklets, rings, crowns and coronets etc. continued. There was undoubtedly a large commercial complex

of metal extraction, refining and artwork in the large Arab-Islamic Empire of the Umayyad and Abbasid periods (from the seventh to the twelfth centuries CE), as evinced by innumerable artefacts and literary descriptions; however, archaeological exploration of the metal industry itself has apparently been beneath the notice of most scholars in the field.

The necessary raw materials for the mining industry in terms of quality and abundance are not available in all parts of the world, and the production of metal objects has always relied on the presence of traders to transport metals from sites of extraction and refinement to those of sale. Thus, mineral manufactures were essential to the economic engine of the Arab-Islamic provinces and their trade with the peoples north of the Mediterranean during the Middle Ages.

Most of this has been inferred; the questions remain of where these mineral resources actually came from, what tools and methods were used for their extraction and processing, and how people handled these ores using simple techniques in difficult atmospheres; and whether this was undertaken in special settlements (and whether these were the same or different), in order to convert the raw materials into various manufactures to meet the basic needs of the state, economy and daily living.

These issues increase the importance of studying production, particularly mining and its products, in the commercial exchange of goods and protecting the state, and other uses. Study should be directed to known mining settlements that produced these raw materials and manufactures, in order to understand the condition of those human societies and their important but indirect role in international trade. This can be achieved by analysing a combination of written evidence and information from field survey and investigation in mining settlement sites in the study area.

The settlement of Asham, a mining and production centre, will answer these questions and in the same manner open a new path to study the people who created these activities with simple techniques in difficult circumstances, making essential daily tools as well as luxury items. Asham settlement is a model of the new mining activity that flourished in the southern part of Arabia during the medieval period. In addition, this model which will shed light on the people who lived in this area during the period, touching the human side of creativity.

1.2 The importance of mining

For thousands of years, humans have been extracting minerals from the earth for their importance and use in the daily life. The earliest evidence of human mining appears to be that in the Qesem cave site, excavated by Avi Gopher near Tel Aviv, where flint mining dating back to 400,000 years has been detected (Kalman, 2010). Copper mining was begun between 6000-5300 BCE in North America (with smelting from 4000 BC), a mysterious phenomenon which ceased c. 1200 BCE, and may have been linked to the European Bronze Age (Coppens, 1999). Traditional archaeology affirms that holes and tunnels were being dug by around 6000 BCE for flint, which was the key material in the manufacture of tools and weapons. Copper was the first metal used in ancient Mesopotamia, near the headwaters of the the Tigris and Euphrates rivers, c. 4500 BCE (Durant, 1981). Substantial quantities of copper and bronze were found in the Ur civilization between 3500 to 3100 BCE (Shepherd, 1993).

Although objects found in various sites in Mesopotamia (as well as literary evidence) dating from the beginning of the 6th century BCE clearly display the importance of gold, such as the findings in Tel al-Sawwan near Samarra, and the discovery of the graves of Assyrian queens decorated with pure gold jewellery weighing nearly 40kg (Abu al-Soof, 1980), there are no mining sites in Iraq from the same period. Specialized studies indicated that mineral ores such as tin and copper may have been brought from the Taurus and the Zagros Mountains and smelted together in Mesopotamia. As Sumerian cylinder seals in Iraq indicate, the ships of Magan (Oman) and Dilmun (Bahrain) used to dock at Ur carrying different products from Oman, which were copper and precious stones, exchanged for silver and oils, grains, textiles and leather, but no mention is made of precious metals being imported from the Arabian Peninsula. Perhaps gold and silver were imported into Mesopotamia from Egypt and Nubia, or some mines in Asia, such as the Indus Valley Civilization, as well as precious metals looted from vanquished regional civilizations by successive conquers (Shepherd, 1993).

The people of the Nile Valley in Egypt were the first people to mine and refine gold and silver, in the dawn of civilization. These metals come as grains of free metal and meet in the form of veins at the bottom of rocks. These rocks, due to the impact of floods and rain, then break up and reach the rivers, particularly in the Upper Nile. Copper found in the tombs of al-Badari dates to approximately 4000 BCE (Durant, 1981); mined copper has also been discovered in the desert of Sinai (Shepherd, 1993). Flint, chert, copper and tin

mining was conducted in different areas of Western Europe and the Indian Subcontinent from the most ancient times. There is also ample evidence of the use of gold and the use of precious stones and other minerals for aesthetic or ceremonial value (Craddock, 1995).

People were making the alloy bronze from mined tin and copper by 3500 BCE. The development from flint to copper then bronze (and later iron) comprised the chief technological basis for early human civilization; all were based on mining. From the earliest civilizations, mining operations and the use of minerals were developed due to the malleability and multiple uses of the metals forged, particularly gold, silver and copper. People in these civilizations (i.e. Egypt and Mesopotamia) made cooking implements, tools, ornamental objects and jewels from mined metals. The Egyptians excelled in the making of objects d'art and statues of gold, whereas the Greeks and Romans excelled in the manufacture of weapons; Sumerians made great silver arms (al-Sarjani, 2000, 32-75).

The most documented cases of ancient mining stem from ancient Egyptian and Greek mining and mineral extraction in the islands of the Mediterranean (Shepherd, 1993). This tradition was continued by the Carthaginians, whose ruling oligarchy established and exploited the mines of Iberia (Church, 1886), and then by the Romans, who realized the value of mining in making their Empire wealthy and powerful, thus when they incorporated all the lands of Western Europe and the Mediterranean world in a unified imperium the trade in precious metals and gemstones was subject to notable state involvement, and direct control of mining was assumed by the imperial administration in each new province they conquered (something they did not generally undertake for other forms of trade) (Shepherd, 1993). By Roman times, the Arabian Peninsula was at the forefront of Arab lands in using mineral resources. Its products spread around Arabia and beyond, and its exports have always typically been greater than its imports. This made the standard of living in the commercial centres of Arabia relatively high, in ancient times and in the present day. The trade of raw minerals and processed gemstones have always been entrenched industries in the area (Ali, 2006).

Mining sites have been known in Arabia since ancient times, including in Yemen, throughout the area of the modern Arabian Gulf States (with the exceptions of Qatar, Bahrain and Kuwait) and the Levant. In the Arabian Peninsula, mining has been traced back to the age of the Arabian Kingdoms in the 1st millennium BCE. For example, in Yemen, the Sabaeans were famous for exploiting gold, and a large number of gold mines were found in Saba, corroborating the literary descriptions of them as one of the richest

nations in the region. Historical sources indicated that doors, ceilings and walls of Sabaean palaces and temples were all decorated with pure gold, silver and gemstones (Ali, 2006). The trade of raw and processed minerals and the export of gemstones from the 2nd millennium BCE were enabled by the continual exploitation of mines. The mine of al-Radrad, located in al-Jabali valley 60km east north of Sana'a, was considered to be one of the most famous pre-Islamic mines by al-Hamdani (1987) and exploited after rise of Islam. Passing through the eastern side of Arabia, the area where the modern states of Oman and the United Arab Emirates (UAE) are located had a long reputation in mining and copper smelting since 4th millennium BCE. Most mining works so far date back to the Umm an-Nar ('mother of fire') period, and continued to the later ages according to some archaeological finds found in these countries. The remains of the Samad site provide the most solid proof of mining in ancient Oman (Weisgerber, 1980, 115-126). In al-Hilo valley in the east coast of UAE, several copper mines were found dated back to that period (Prange et al., 1999, 187-192).

For the Levant, the earliest acknowledged copper mining in the world is identified with the Timna Valley (c. 5000 BCE). Egyptians mined for copper in Sinai between the 12th to 14th centuries BCE and had trade routes through Timna. They were followed by the Midianites (from north-western Arabia), then the Nabataeans prior to the Roman period. By the Islamic period the Umayyads mined until copper ore became rare. Many artefacts from prehistoric flint tools to fragments of pottery of the Iron Age as well as potsherds dated from Roman and Islamic times were found there (Shepard, 1993).The Finnan valley was mined as early as the 6th millennium BCE. Located on the east side of the Wadi Arabah (southern Jordan), it is considered one of the richest sites for copper mining and the near east archaeological surveys recorded more than 250 ancient mines, as well as between 150,000–200,000 tons of slag (Hauptmann, 1997). Several civilizations operated mines in this valley, including the Nabataeans, Romans, Byzantines and Arab Muslims. The remains of huge furnaces are still visible as evidence of copper smelting (Craddock, 2000, 151-165).

From classical antiquity into the medieval period, the vast emptiness of Arabia was sandwiched between two of the ancient world's great powers; to the north was the Roman Empire (later Christian Byzantium, with its capital in Constantinople), and to the east was the Persian Empire (the Sassanid Empire prior to the era of concern to this study). There were hundreds of external and internal trade routes traversing the Middle East and Arabia

that linked these great civilizations with each other, enabling the exchange of various goods, including raw minerals and metalwork (Ali, 2006).

During the classical Arab-Islamic era (from the seventh to the thirteenth centuries CE), Muslims made great efforts to exploit minerals and gemstones for the purposes of trade, and this was accompanied by chemical and geological investigations. Authors from the period mentioned mining and mines, particularly those from which gold and emeralds were extracted. The golden age of jewellery and precious stones in Arab civilization occurred under the famously luxurious Abbasid regime, during which gold, silver, and copper were brought from the central and the south-west Arabia (al-Jasir, 1976, 178), and emeralds, rubies, lapis lazuli and pearls were brought from Iran, Bahrain, Lebanon, India, Ceylon and Sudan (Ali, 2006). This was accompanied by the systematic study of metals and gemstones. Notable scholars in mining at the end of the Umayyad State and the beginning of the Abbasid State included Awn al-Abadi, Ayoub al-Basri, Bisher bin Hazan, Sabah bin Yaqob al-Kindy, Abu Abdullah bin Jassaas and Ibn Bahlul (al-Sarjani, 2000, 32-75).

With the prodigious Islamic conquests of the first two Islamic centuries (7^{th} to 8^{th} centuries CE) (Figure 1.1), Arabs and Muslims inherited many conquered nations' industries, and historians and travellers attempted to talk about them, including extensive discussion of the weaving of textiles (e.g. luxurious silk, clothes, carpets, rugs, tents and dyeing), metalwork and glassware (al-Bash, 1999).

There is no doubt that metal industries in all places are one of the fundamental pillars of the emergence of civilizations. The Islamic population used a lot of minerals such as gold, silver, copper, iron and bronze in different areas from the beginning of the Islamic state's formation, as mentioned previously. A brief overview of the use of minerals in the Islamic civilization is necessary at this point, by virtue of the focus of this study.

The Muslim caliphs quickly realized that in addition to the Islamic requirement that currency has an intrinsic economic value when cast in gold and silver, numismatic expression was a form of expressing power - engraved coins proclaimed the sovereignty of the particular caliph minting the coins, and of the Islamic Empire and its Arabism. Consequently, they were keen to engrave Islamic coins with religious expressions that reflected the doctrine of monotheism, written in Arabic. In addition, coins were inscribed with the caliph's name, to reinforce the legitimacy of his governance, which ensured the value of coins. These Islamic coins included the words: 'there is no god but Allah', 'Muhammad is the Messenger of God', 'there is no power except God', 'there is no winner

except Allah', 'Allah is our Lord, Muhammad is our Prophet', 'praise is to Allah, lord of the worlds', 'victory is only from God' and 'in the name of Allah' (al-Sharan, 2000).

Figure 1.1: The Growth of Cities and Trade in the Islamic World, 632-750 CE

Source: www.ruizspieces.com/hist/0403.html

Among the most prominent examples of the minting of coins in the Islamic state is the occasion on which the Umayyad Caliph Abd al-Malik bin Marwan founded a mint in Syria between 685 and 705 CE (65 to 86 AH) to translate previous coins handled by the Islamic population into Arabic. Prior to this time, the Arabs had no capacity to produce their own coins, and still used Byzantine or Persian currency; the word *dinar* is derived from the Latin *denarius* (Ettinghausen, 2001). Equally important, Egypt and Iraq contributed to the project of monetary reform. Arabic coins were subsequently struck in mints in Cairo and Baghdad, and were disseminated to become the fundamental currency of business transactions in the Gulf, the Mediterranean basin and beyond, including the famous dinar of the Anglo-Saxon King Offa (Yusif, 2008).

The dinars shown in Figure 1.2 were made with gold 'from the mine of the Commander of the Faithful' (an appellation of the Caliph), as the coins themselves affirm. Medieval Islamic scholars mentioned that the Caliph (al-Walid I) bought land in the area north-west of Makkah containing at least one gold mine, which enabled the identification of the site as Ma`din Bani Sulaim, a site still being mined today. Albeit the gold in these coins was

undoubtedly mined near Makkah, it is unclear whether the coins were subsequently minted in Damascus or on-site by mint workers in the Caliph's retinue; the fact that they were struck during times when al-Walid I was known to lead a pilgrimage from Damascus seems to favour the latter explanation (Lloyd, 2011).

Figure 1.2: Umayyad dinar, 92 AH/ 711 CE

Source: Lloyd (2011)

When the Islamic caliphate moved from Damascus to Iraq (and ultimately to Baghdad) after 750 CE/132 AH (subsequent to the Abbasid revolution), the Umayyad dinar was still in circulation in Egypt and Damascus for a long time using the same pre-Abbasid phrases, the only difference being the date of issue. By the year 814 CE/198 AH, mints began to strike coins showing the place of issue during the time of the Abbasid Caliph al-Ma'mun. For example, the names 'Egypt' and 'Iraq' appear on dinars subsequent to this time (an example in Egypt dates from 199 AH); such dinars were distributed in several cities in the most important capitals of the Islamic provinces, including in the Hejaz (Makkah and al-Madinah) and the Yemen (al-Sharan, 2000).

Several sources indicated that the mines of Arabia were used for such industries, and gold and silver mined there were transferred to Baghdad (al-Jasir, 1968). Later, some coins were minted in the Arabian Peninsula in cities not far from these mines (al-Sharan, 2008.

Another aspect of the importance of metals is that iron, copper and tin were also necessary to equip the armies needed to defend and expand the empire, as well as for construction

and domestic use. Several early biographies about the Prophet Muhammad and his companions spoke about swords attributed to them (e.g. *al-Batar* - 'jurisdiction' and *al-Masob* - 'doom'); although particular cases of swords identified from the period cannot be verified, this documentary evidence does however indicate that there was a thriving local sword industry, which used local metal ores (Ghanimah, 1994). Indeed, as affirmed by numerous *ahadith* (sayings/traditions relating to the Prophet and his companions), arms were prestige items of great value in Arabian society; Ali presented a shield to Fatimah (the daughter of the Prophet) as a dowry, and the Prophet himself pawned his own shield to buy food. Furthermore, the making of swords and military tools was considerably developed during the Middle Ages in the Islamic Empire. For example, some Arabic sources reported that when Abu Musa Mohammed al-Amin ascended to the Caliphate in 809 CE/193 AH, he ordered Fadel bin al-Rabi to conduct an inventory of the clothing, mattresses and utensils in the exchequer (*Bayt al-Mal*). He found extensive metalwork, including 10,000 swords adorned with gold and 50,000 unadorned, 150,000 spears, 100,000 arrows and a thousand shields, and 20,000 helmets. The statistics revealed by this early ninth-century spot-check demonstrate the importance of the use of metals in the preparation of Islamic armies (al-Gazwali, 2000). Arabic literature has retained various lattice images of weapons in the early Islamic period, especially the sword and its prestige, the beauty and the splendour of its material, and the virtue of blades of pure iron (Bindeham, 2006). However, it should be noted that armaments production was mainly a Levantine phenomenon from the Umayyad period to the 18th century, for obvious logistical reasons; Damascus was the capital city of the Umayyad state, and a nexus for military organisation in the Muslim world throughout history, as reflected in the famous Damascus steel (which notably depended on the import of steel ingots from India) (Verhoeven, Pendray and Dauksch, 1998). The Arabian Peninsula was more associated with precious metals and copper during the Islamic Middle Ages, as explained below.

Another metal industry is construction. Most construction of the period was undertaken with wood, stones and earth, but public works exhibited heavy use of metals. This is reflected in the construction of doors and windows for the holy mosques in Makkah and al-Madinah. For instance, Ibn Jubair (1977) described the door of the Kaba (the cuboid construction in Makkah, which all Muslims face in prayer) when he performed the Hajj in 1183 CE/579 AH in the time of Abbasid Caliph al-Moktafi li Amr Allah 1157 CE/552 AH:

> The door is 11x6 span made of silver, adorned with gold in splendid made clear, it has a frame in the above made of gold in the capacity of 2 span, and

> has also two Nqarah [earrings] of silver for hanging the door lock… there are historical texts inscribed by gold in the door consisting of long Arabic letters… (Ibn Jubair, 1977, 187).

Ibn AbdRabbo al-Qurtobi, an Andalusian traveller, described the Prophet's Mosque in al-Madinah when he visited it in the 13th century CE/7th AH. He reported that "the mosque has more than 25 doors made of copper, silver, ornamented on their faces by Quranic writings in gold..." (IbnAbdRabbo, 1999, 434).

Metals were also extensively used by artisans in centres such as Baghdad to create the great artwork for which classical Islamic civilization is renowned. Several Arabic and non-Arabic sources pointed to many fine metal objects created in the Islamic civilizations of the Middle Ages and the development of their industry. Metalworkers chiefly used copper, iron, bronze, silver and gold; a relatively limited range. The decoration of these objects was achieved by various methods, including hitting, casting in moulds, slitting, punching and *nielloing* (inlaying by enamel). *Niello* is a Persian word meaning (in terms of the metal industry) the drilling of required motifs on the main body of a utensil and then filling the split with wire of gold, silver or another metal of different colour from the main body (al-Basha, 1988).

Moreover, these objects played an influential role in the life of peoples, and some of them were suspended in mosques, palaces, houses, schools, and many others were heirlooms handed down through generations; others were uncovered by archaeological excavations in recent times. Arab metalwork was influenced by cultural exchange with the Byzantine and Sassanid empires even before the coming of Islam, but artefacts from the beginning of the Islamic era exhibit growth from these styles, showing a special character which distinguishes the Islamic arts of the Middle Ages (al-Basha, 1999).

The jewellery industry and gemstones were certainly affected by the economic and political condition of Islamic civilization. Jewellery was (as in most civilizations) considered a sign of the recognition of social position and status. For instance, wall paintings found in the palace of Amrah and Kerbat al-Mejar in southern Jordan dating back to the Umayyad period (660-750 CE/40-132 AH) represent some women's ornaments and jewellery, including earrings, bracelets and anklets, with the clear effects of Sassanid and Byzantine influence, reflecting that these were familiar to artisans imitating neighbouring civilizations. In subsequent periods, Muslim artists gave special attention to such motifs,

and came to excel in the forms art considered specialities of Islamic culture (Ettinghausen, 2001).

However, although interest in minerals and metal industries continued in the early Islamic period, this reached its apogee during the Abbasid period (750-1258 CE/132-656 AH), when artisans practised their industries on the traditional Sassanid style, adapted to be more compatible with Islamic culture, which entailed losing certain artistic themes and adding Islamic and Arabic phrases. Islamic metalwork exhibits a truly original and distinct approach from the early 900s CE, from both a practical and decorative perspective (Basha, 1999).

Mosul in Iraq was a noted centre of masterpieces in metalwork, particularly objects *nielloed* with gold and silver. A large number of such items are presented in Arab and European museums. Furthermore, metals were used in lustreware ceramics, which were known by that name for their use of metal oxides in overlay that gave metallic lustre, especially using gold after burning at a certain temperature. Lustreware ceramics are a renowned feature of centres of Islamic civilization (partly due to the Islamic prohibition of vessels of pure gold and silver), and they are of interest to researchers and scientists in many fields (Irwin, 1997).

The innumerable examples of the use of metal by the Arab-Islamic civilization reflect the fundamental need that civilization had for mineral ores, and the attention it paid to the exploitation of the diverse mines throughout the Islamic state in order to strengthen the influence of the state and the prosperity of its economy. As the original seat of the Islamic state, Arabia saw continuous mining activity during the first Caliphate in Madinah, in Damascus and later in Baghdad. As the leading economy in the world, the needs of the Abbasid state led to the exploitation of various ores in the mining areas of the Arabian Peninsula.

The best evidence for this fact is that there are hundreds of mining sites near the caravan routes of trade in the Arabian Shield, especially in the south-western part of the KSA and al-Baha region (the study area). Such locations were also the scene of different productive activities, as evidenced by some writings and inscriptions found around mining settlements and their mines.

Accessible references corresponding with field evidence indicated the mining of gold in Arabian mines. It is likely that the dominant metal exploited in the Arabian Peninsula was

gold, as evinced by the spatial distribution and the large ruins of mining related to it in al-Baha in the south-west of the KSA (al-Jasir, 1987). Silver and copper mines are also found in the region. These mines were being exploited during the Abbasid era, as indicated by numerous pieces of pottery painted green and blue, and shards of glass manufactured at the time, as well as the quantities of slag heaps of mining waste.

The majority of well-known and recorded mining sites noted by archaeological surveys in al-Baha region show the existence of residential areas containing the remains of walls and residential facilities next to mining facilities. One of these settlements is Asham (Zarins and Murad, 1981, 63-89). It has long been known by historians and archaeologists that Asham settlement was a famous mining settlement not only in al-Baha region but throughout the south-west of the Arabian Peninsula. Asham is an early Islamic town, now in ruins. It seems that the processes of mining and smelting raw materials in order to draw the veins of minerals and gold was not limited to Asham itself, but was also undertaken in the small towns and villages within the geographical location, such as Masodah.

There is no doubt at all that the settlement of Asham on the trade route from southern Arabia to the north made it the most important commercial mining settlement. This caravan route – from the Yemen to the Levant – was the most important trade road in the Peninsula from ancient times; Asham was a link in that chain. Trading caravans took numerous goods, including metals from southern Arabia, to Makkah, whereupon merchants would buy them and convey them to the Levant, Egypt and the Mediterranean basin (Ali, 2006).

This route continued into the Islamic period, and was intensified under the Umayyad and Abbasid regimes due to the large single currency zone extending from Iberia to central Asia, and the Yemen to Anatolia (as mentioned above). This boosted the Arabian metallurgical industry in various aspects during the first Islamic centuries and the Middle Ages. It is assumed that this route was one of the main channels in the mineral trade (extracted or manufactured goods) between the existing mining communities in Arabia and the peoples of the Mediterranean basin. Finally, it is sufficient for one to look at the settlement of Asham to see the evident establishment of human life interrelated in all stages of mineral production (extraction, processing and production).

1.3 The aim and objectives

Despite the importance of what has been shown above, many scholars and researchers have focused on the Arab-Islamic expansion in terms of military, religious and trade aspects, and the internal production of the state has been largely neglected - mining and making things, the physical basis of the civilization.

Most previous studies on the mining settlements in the south west of the KSA so far have been based on literary texts, and geographical and archaeological surveys carried out by the Saudi Commission for Tourism and Antiquities (SCTA) as part of the Comprehensive Archaeological Survey of the Kingdom of Saudi Arabia, which was conducted between 1976 and 1982. These works described the visible structures and gave some indication of smelting due to the amount of slag heaps widespread in these locations, without concentrated excavations to reveal the stages of occupation in these settlements. In addition, these archaeological works did not provide ample information about the stability (i.e. phases of occupation) in these locations, mining activities that took place in the settlements, or methods and tools for handling the raw materials.

Thus, studying the settlement of Asham in al-Baha as an example of mining settlements will enrich our understanding of production and its role in Islamic civilization and the medieval world.

The aim of this thesis is to study the mining activity, raw materials, methods, features and tools in the region of al-Baha by analysing the mining activities taking place at the mining settlement of Asham, and to investigate the natural and geographical factors which contributed to the continuation of mining activity there. In addition, it aims to demonstrate the phases of occupation in Asham from its establishment to its decline, and to recognise the economic and cultural role played by Asham settlement in the south of the Arabian Peninsula during the Islamic era. The objectives of this thesis are summarised in a number of questions related to mining in the study area:

1. What are the main characteristics of mining landscapes in al-Baha region?
2. What were the natural and geographical factors which made Asham the most important settlement and a model of a production site in the southwest of Saudi Arabia?
3. What methods of extraction and processing were conducted in Asham?
4. What were the materials, tools, methods and facilities of mining?

5. What are the architectural patterns associated with the mining processes and functions?

6. Was Asham site occupied only for mining purposes, or for other reasons?

7. What are the phases of occupation in Asham?

8. What was the economic and cultural role of Asham settlement and its association with other mining settlements in Arabia during the early Islamic centuries (7^{th} centuries CE)?

9. What types of artefacts and other archaeological remains are found in Asham, and were these objects created locally or imported?

1.4 The study area and Asham as a model mining settlement

This study has been implemented in the region known today as al-Baha region, which lies in the south-west of Saudi Arabia between Makkah and Asir regions (Figure 1.3). In fact there were three chief reasons to select this area for this study. Firstly, some early sources (9^{th} and 10^{th} centuries CE/3^{rd} and 4^{th} AH), such as Yaakoubi (1891) and al-Hamdani (1987 and 1990) indicated that the study area was one of the most important mining centres in the early Islamic period (7^{th} century CE) and beyond. Also, Asham was renowned as a location for the mining of gold south of Makkah, as mentioned in the same sources, and became famous as a prosperous mining city between the 7^{th} to 12^{th} centuries CE/1^{st} to 7^{th} AH (chapter 5).

Secondly, as a result of comprehensive archaeological surveys in al-Baha (Hester et al., 1984, 115-142), although limited, a large number of recorded sites were mining sites (chapter 4), characterized by mining evidence such as smelting furnaces accompanied by the remains of slag metal oxides, and some tools used at the time in mining operations.

Thirdly, many visits conducted by the author to numerous mining sites in the KSA as an archaeologist in the Department of Survey and Excavation at SCTA during the years 2001 to 2009 led to the observation that many mining sites and mining tools are more abundant in al-Baha region than in other sites in the Kingdom. Additionally, most of these sites are suitable for tourism development, which might lead to the loss of much archaeological evidence there. All the above-mentioned reasons indicate that the region of al-Baha, particularly the site of Asham, was a key component of the economy of the Islamic State in its early formation, and this in itself warrants further archaeological study.

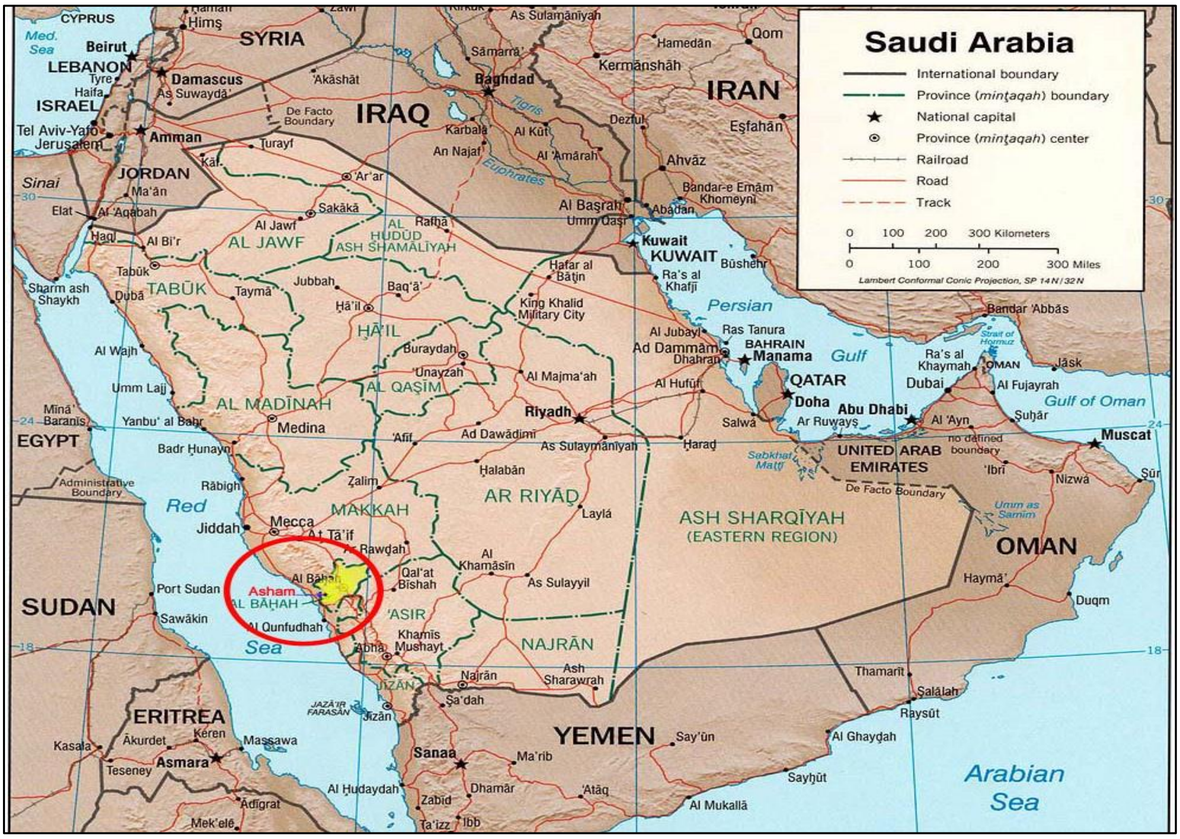


Figure 1.3: Map of the KSA showing the study area and Asham settlement

Source: www.vidiani.com/?p=4244

1.5 The general methodology of study

The study is based on various sources of information including study of multiple references relating to the mining (chapter 2), exploration of the archaeological record of SCTA (chapter 4), and a survey of the mining landscape in al-Baha region, with intensive survey and study of the stratigraphy of Asham settlement, followed by materials study and analysis.

Consequently, archaeological surveys provide a description of settlement locations, and a history of changes of settlement and landscape which can ultimately provide rough estimates of population levels. Surveys can also amplify and complement historical data and provide a range of information on economic, social and environmental conditions.

A clear plan for the archaeological survey has been created for various goals as detailed in chapter 4. After completing the field survey of mining sites in the region, Asham settlement (the model of a mining settlement) was surveyed intensively, and six archaeological trenches were dug for specific objectives as explicated in chapter 5. Due to the availability of archaeological materials of stone pounders and grinders, pottery and

glass in Asham more than in the other surveyed sites in al-Baha, a set of those materials was selected for study in more detail as presented in chapter 5.

1.6 Chapter structure and outline

This introductory chapter introduces the research background and the importance of mining, then outlines the aim and objectives, the study area, and the general methodology employed by this research. Chapter 2 reviews and evaluates previous mining studies in Arabia through a variety of sources and fieldwork studies, and archaeological works carried out in the KSA. Chapter 3 gives a background of the geology, geography and history of al-Baha region as a whole. The backbone of this thesis lies in chapters 4 and 5, which demonstrate the fieldwork in mining settlements in al-Baha generally and in Asham as a model of mining settlements in particular. Chapter 4 starts with a history of research in al-Baha region, then the current fieldwork of mining sites in al-Baha, including the methodology of fieldwork, the desktop survey of mining settlements in the records, the general archaeological survey of the mining settlements in al-Baha region and its results are presented. Chapter 5 relates the previous fieldwork to the mining settlement of Asham as a model of a production site using the intensive archaeological survey and excavation at the site of Asham and Masodah and their artefacts. Chapter 6 discusses mining furnaces and tools and their importance in understanding the internal production places, the role of Asham settlement in the development of mining in the south-west of the KSA, and Asham as an early Islamic city and its non-mining finds, then a comparative study of mining furnaces and artefacts of the study area with other mining sites in the KSA and beyond before ending in a general discussion and conclusion. The conclusion of the dissertation in chapter 7 reviews the significance of this study and suggests future work. Finally, Appendixes and the bibliography are appended at the end.

1.7 Conclusion

Having thus introduced the aim and objectives of this thesis, its study area and chapter structure outline, it only remains to re-emphasise the importance of studying places of production when considering any civilization. In the period of concern here – late antiquity into the Middle Ages – mining was fundamental to three of the most important facets of civilization, based on the significance of metal in the minting of coins, the arms industry and cultural metalwork.

The mines of Arabia had to meet the growing demand for metals in the Arab-Islamic Empire, which opened up new markets for the mineral-rich region. The abundance of gold, silver and copper in Arabia enabled the production of high quality coinage (i.e. commodity money of intrinsic value) which became the benchmark of the medieval world, and underpinned everything else in the Arab-Islamic Empire. It also made possible the enduring artistic masterpieces which are considered the legacy of Arab civilization.

This study focuses on the examination of archaeological and physical evidence, adding a lot of information on mining activity, and helping to fill a large gap in our knowledge by studying the Asham settlement as a place of production, which undoubtedly contributed to driving the economic engine and political and social trends that directed the Islamic state in its early era.

Today, after several decades of intensive archaeological studies in the Kingdom of Saudi Arabia, despite giving regard to mining studies and activities, the field remains short of the required level of understanding of mining. Previous studies on the production of precious metals in Arabia considered classical Arabic sources, the accounts of Western travellers, contemporary Arab writers, surveys of the Deputy Ministry for Minerals and Resources, and the Comprehensive Archaeological Survey program (which will be explicated and evaluated in the following chapter), but this research is the first comprehensive archaeological contribution of the important mining remains in al-Baha.

Chapter 2: Review of Mining Studies in Saudi Arabia

2.1 Introduction

This chapter reviews and evaluates the mining studies in the KSA using various sources, which can be classified to five categories: classical Arabic sources; the accounts of Western travellers; contemporary Arab writers; surveys of the Deputy Ministry for Minerals and Resources (DMMR); and the Comprehensive Archaeological Survey Program (CASP).

The importance of drawing on a wide array of sources is to show the progress in addressing the subject of mining since the 9th century CE/3rd AH to the present day, and to assay its evolution. As for the first category, Arabs knew and travelled throughout Arabia and adjacent lands from historic times, and formal geographers contributed to surveying the Peninsula after the coming of Islam, furnishing descriptions of many places and countries that they passed through or heard of. Many of them described some abandoned sites where they (accurately) described materials and shapes. Their writings and impressions therefore are most important sources to identify the antiquities and conditions of Arabia and its peoples.

Arabia remained an unknown region to Western travellers until the dawn of the Age of Exploration. Individual journeys to the Peninsula commenced from 1502 CE/908 AH, and numerous individual and organized visits continued into the 19th and 20th centuries CE for numerous reasons, including religious (messianic), political, economic, and scientific adventurism. Important information about the social, political and economic features of Arabia was recorded during these visits. The subject of mines occupied portions of these narratives and gave descriptive information on these mining sites.

For the contemporary Arab writers, the establishment of the modern KSA (1932 CE/1531 CE) led to extensive patronage of work to document the geographical features and historical events of archaeological sites throughout the Kingdom, with regard to a number of travellers, geographers and contemporary writers like al-Jasir and Mulhis, who lived through the establishment of the modern state. These contributions were useful for prominent archaeological sites, as well as for buried or relatively obscure sites such as those related to mining. In this sense their works underpin this study and the whole direction of archaeology in the Peninsula.

In addition to state mining surveys, another major undertaking during the formation of the KSA was the exploration and monitoring of archaeological sites by the Arabian-American oil company Aramco (now Saudi Aramco), which noted archaeological features while conducting geological research to detect oil fields and metals. Early field observations reported that the presence of oil in the Eastern Province and minerals in the western, northern and southern areas of the KSA. The recent missions working in the field of mining in that period and subsequently referred to a lot of mining sites in these areas which dated from the 7th to 12th centuries CE/1st to 6th centuries AH. This study benefited from the results of radiocarbon dating of some samples of pottery, bones and slag from different sites. Scientific monitoring of sites by material researchers paved the way for dedicated archaeological surveys.

Following the establishment of the modern KSA, previous barriers to educational and scientific research in Arabia caused by the multi-tribal apportionment of territories were removed, and the Government began to encourage scientific activities to increase awareness of the importance of science. Archaeology undoubtedly formed a key part of the cultural and scientific exploration of the KSA from the inception of modern scientific research in the area. The General Directorate of Archaeology and Museums (GDAM) was established for this purpose, which launched a five-year plan in year 1976 CE/1396 AH to survey the provinces of the KSA that is fundamental to studying mining in Arabia.

Each of these sources are explained and evaluated in more detail in the following sections, then the contribution of the current study to address mining will be presented before the conclusion in the final section is outlined.

2.2 Classical Arabic sources

The importance of studying mining and minerals in the Arabic and Islamic world is not a new field; several scholars made serious attempts in writing about this subject. Arab and Muslim scholars focused on the science of metals and extracting methods with reference to the ancient period. Unfortunately, few of these works have survived, possibly due to historical neglect in Arab and Islamic countries of economic aspects such as mining, in preference for orthodox Islamic, linguistic, historical and geographical studies.

However, the topic of mining and its mines in Arabia has been mentioned by several Muslim and Arab writers who visited or at least passed through the land. There are a number of sources, most of which are compiled in the books of *al-Hawliat* (annals), which

recorded Islamic history year by year. The oldest and most important of them are *Kitab al-Boldan* by al-Yaqubi (d. 862 CE/248 AH) ('The History of al-Yaqubi'), *Tarikh al-Umam wlmolok* by al-Tabari (d. 922 CE/310 AH) ('The History of Peoples and Kings'); and *al-Kamil fi al-Tarikh* ('The Complete History') by Ibn al-Athir (d. 1232 CE/639 AH).

The second type of Arabic sources is geography books, travel narratives and glossaries. These sources essentially focused on routes and kingdoms, including *Kitab al-Masalik wa al-Mamalik* by Ibn Khordadbeh (d. 912 CE/299 AH.) ('The Book of Routes and Kingdoms'); *Sefat Jazerat al-Arab* by al-Hamdani (d. 971 CE/360 AH) ('Description of the Arabian Peninsula); *Kitab Ahsan al-Taqasim fi Marifat al-Aklem* by al-Maqdisi (d. 1000 CE/390 AH) ('The Best Division of Exploration to Lands'); *Nuzhat al-Mushtaq fi Ekterak al-Afak* by al-Edrisi (d. 1164 CE/559 AH) ('Picnic of the Traveller in Reaching to Destinations') ; *Muajam Maestajam min al-Bilad Wlamawdi* by al-Bakri (d. 1145 CE/540 AH) ('Glossary of Unknown Lands and Portions'); *Muajam al-Buldan* by al-Hamwi (d. 1230 CE/627 AH) ('Glossary of Lands'); *Rehlat Ibn al-Mujawir; Tarikh al-Mustabsir,* by Ibn al-Mujawir (d. 1291 CE/690 AH) ('Journey of Ibn al-Mujawir'); and *Rehlat Ibn Battothah* by Ibn Battothah (d. 1377 CE/779 AH) ('Journey of Ibn Battothah'). References to these works are given below for modern editions.

It is generally agreed that the recognition of the presence of precious metals in the Arabian Peninsula was early. al-Hamdani (1987) stated that the Sassanids had prospected for gold and silver in some sites in Arabia, particularly in Najd and Yemen, and they opened a land route through the middle of Arabia for the transfer of silver to Persia.

Moreover, several historians, including al-Yaqubi (1992) and al-Maqdisi (1906), observed that gold and silver were among the major sources of wealth and trade for the merchants of Makkah before the rise of Islam to the south and north of Arabia. Makkan trade depended on two great caravans, one of which was in winter, when the caravans went to Yemen and Abyssinia, where the weather was warm, and the other was in the summer, to Syria where the weather was pleasant and the water cool. This tradition is referred to in the Quran:

> For the protection of the Quraish. The caravans to set forth safe, in winter and in summer. So, let them worship the Lord of this House. Who has fed them against hunger, and has made them safe from fear (Quran, Surah Quraish, 106:1-4).

In reference to the abundance and esteem of precious metals in Makkah, the Quran denounced avaricious lust for gold and silver in the eyes of humans and explicitly warned

against those who hoarded the metals rather than using them, warning that misers would be subjected to the wrath of God (see Quran, Surah al-Tauba, 9:35) (al-Tabri, 1988).

It seems that the Islamic state treasury at the beginning the Islamic era greatly benefited from the income mining revenues from its inception. Al-Samhodi (1984) reported that the Prophet Mohammad ordered Bilal Ibn al-Harith al-Muzani to take revenue from tribal mines located in the al-Quds Mountain close to the region of al-Madinah. Al-Yaqubi (1992), al-Tabari (1966), al-Maqdisi (1906) and others demonstrated that some gold mine owners supported the Islamic State from the production of their mines, contributing charity (tax) to the Islamic treasury in al-Madinah at the time of the Prophet Mohammad.

Numerous Arabic sources attempted to describe the mines in their different aspects in the beginning of Islamic state and subsequent stages. The most important mines mentioned are those of al-Nuqrah, Bani Sulaim, Bohran, and al-Biram. Al-Maqdsi (1905) and Ibn Khordadbeh (1985), highlighted the mine of al-Nuqrah, saying it had several wells and many minerals. Ibn Ishaq (2004), al-Bakri (1983) and al-Massoudi (2002) described the mine of al-Biram, pointing out that it was the property of Hajjaj al-Sulaimi, located in al-Foroa on the road between Makkah and al-Madinah. Ibn Saad (1980), al-Samhudi (1984) and al-Harbi (1981) mentioned that the mine of Bani Sulaim is located on the ancient trade route north-east of Makkah, belonging to the tribe of Bani Sulaim (most of these mines are archaeologically referred to during the comparative study presented in chapter 6).

Early Arabic sources refer to a lot of mines dispersed in Arabia that were exploited during the early Islamic period (7^{th} century CE), the most important of which was Mahdalzahb ('Cradle of Gold'), which is still being exploited in the present. It was located and described by many Arab writers, such as al-Hamdani (1974) and al-Harbi (1981), who said that the mine is to the southeast of al-Madinah and was owned by Bani Sulaim. As noted by Ibn Saad (1980) and Ibn al-Athir (1987), this mine was in operation at the time of the first Caliph in Islam, Abu Bakr al-Siddiq, and then activities continued into Umayyad era under the supervision of Khther Ibn Abdullah.

The second important mine in the Arabian Peninsula is that al-Nuqrah. It is in the west of Darb Zubaida in the separated road from al-Madinah to Makkah, in a location about 120km east of al-Moghaith, as described by al-Samhodi (1984) and al-Harbi (1981). Furthermore, they stated that the northern part of the mine was one of the valleys of Bani Abbs, who extracted an abundance of minerals.

In his commentary on the poem al-Ardai, al-Hamdani described the pilgrimage route from Yemen to Makkah, mentioning Banthrab as a village containing a lot of gold, trees and wells (al-Hamdani, 1974). In addition he observed that in the foothills of the al-Sarah Mountains there is a famous historic mining settlement and its mine called Asham town. Al-Hamdani also reported that this valley had some trees that were used in process of production of metals, the most of which are Tamarisk, al-Slam, al-Cbrom, al-Chouht, al-Chatt, Juniper, and al-Sidr (al-Hamdani, 1987, 283). This village was located in the present settlement of al-Maddn in the city of Bisha, in the southwest of Saudi Arabia.

Another example of mines in the southwest of Arabia is the mine of al-Kdmal and Dokan, as reported by Ibn al-Mujawir (1951) and Ibn Battothah (1992), who stated that it was half way between Makkah and Yemen, and that the mountains in the area were a place for the extraction of gold, silver and iron.

The available evidence of the large number of mines and minerals in Arabia is the prosperity of coinage and jewellery industry and its trade. This view is supported by al-Maqdisi (1906), who reported that the Caliph Abdul Malik bin Marwan 705 CE/68 AH minted huge amounts of money of high quality based on Arabia mines, whilst al-Samhodi advocated that the jewellery industry was well-known among people in the region of al-Madinah, especially in the Khiber and Fadak cities, which were known for the quality and accuracy of their metalwork (al-Samhodi, 1984). Hence, it is no surprise to find that the door of the Kabah in Makkah is inlaid with gold and silver, as well as doors and windows in houses and the metalwork of traders in the Hejaz area from the first phase of the Islamic era.

Strong evidence of a mining boom during the early Islamic centuries in Arabia required labour, whether domestic or foreign. Some sources such as al-Yaqubi (1988) and al-Massoudi (2002) indicated that Arabia was a destination of a large number of employers and traders, reflected in occupations and manual workers, including slaves (a corollary of the large number of Islamic conquests in different directions and existing pre-Islamic slave trading routes). Interestingly, the mining boom was accompanied by an expansion of commercial businesses internally and externally, as well as agricultural, industrial and mining activities too.

It is not surprising that mining and metalwork area in Arabia increased exports, whether of raw materials or manufactures. Al-Maqdisi (1906) noted that industrialization and export in the Middle Ages increased in Arabia, and as evidence of the maritime trade routes,

during this period the port of Aden in the south of Arabia became known as the Vestibule of China, the Portal of Yemen, the Cabinet of the West and the Mine of Businesses.

It can be said that descriptions in the contributions of Muslims and Arab historians, geographers and travellers who described many of those mines were limited, and their attention was generally confined to summarily mentioning the sites and not the actual mining activities undertaken in them and the neighbouring areas, which is a great loss as such activities are very hard to deduce now. Writers also used variant spellings of settlements, and sometimes even misplaced their locations, which can make their identification problematic.

It is only al-Hamdani among Muslim and Arab writers who gave significant attention to mining operations and the methods of extraction gold and silver of ancient peoples. He compiled *Ketab al-Jawhartain* ('The Book of Two Jewels') relating to gold and silver, in terms of their formulation and mining. The book was translated into German and published in both Arabic and German by Christopher Tool in Uppsala (Sweden) in 1968. Later on, the book was published by the journal of Dar al-Arab in Riyadh. Despite the loss of large portions of the book, it has become a keystone of studies on mining in Arabia, such as the contemporary scholars al-Jasir (1968), Sabir (1991) and others.

In this book, al-Hamdani described the tools used in the treatment of ores before he explained the operations in the treatment of gold and silver. He mentioned the form of gold grinders which consist two parts, upper and lower, and he pointed to the different types of grinders used for gold ore (al-Hamdani, 1987, 107). In addition, he identified specific types of wares used in this process such as pots, bowls and jars. For example, the pots used in heating the grains of gold or silver should be round at the base and narrow at the top, and may some contain side handles to enable easy lifting from the kiln, while bowls should be concave and wide in the base, with high and thick walls, and jars should have wide bodies and large necks (al-Hamdani, 1987, 107). Likewise, he described a gold furnace thus: "squared on the ground and the top is domed, and it has tube ends with a port 1.5 span in width to raise fire, the furnace has side corners for the pots to settle on after 3 building blocks are lifted..." (al-Hamdani, 1981, 101). The fuel of mining was also encompassed by al-Hamdani's explanations, and he listed several varieties of trees used thus, of which the acacia and juniper were preferred in mining due to generating more flames (i.e. heat) and less embers.

It can be inferred from his elaborate descriptions of the particulars of gold and silver extraction that al-Hamdani probably visited some mining settlements in Arabia, including Asham, due to the abundance of information included in his book. However, despite being a pioneer in this area, al-Hamdani only focused on the method of extraction of gold, silver and their treatment and did not mention other metals in the existing fragments of his work.

In any case, the process of mining gold and silver that mentioned by al-Hamdani in the 9th century CE/3rd AH are considered of most importance sources in studies concerning the method of mining gold and silver, from extraction to end products. This process starts by extracting the ore from quartz veins or digging down wells in which the ores found. The subsequent process comprises five stages; breaking, grinding, refining, heating in pottery and melting in furnaces, as described below.

The breaking stage starts by breaking up the quartz veins and rocks with hammers and pickaxes into small pieces of stone the size of coffee beans. Hand sorting is undertaken at this stage in order to separate the impurities of ore, then the ore is smashed until it becomes like a dust, which called ‘gold dust’ even when it is silver. After that, the gold dust is placed in grinders.

An equal amount of water is added to the gold dust in the basin of the grinder, and a matching quantity of mercury is poured in. The grinder wheel is then activated until the dust becomes smaller than kohl and the mercury is thickened with gold, then the mixtures are poured in a large bowl and the mercury goes up while gold dust remains in the bed of the bowl. In the refining stage, the gold dust is put in a piece of strong thick leather and tied well, then squeezed in the hand until the mercury comes out and the gold stays in shape of tiny grains of gold or silver. Although these grains (gold or silver) have been filtered from the mercury in this stage, traces of mercury remain stuck and thus the next stage is the final liquidation. Grains of gold or silver are places in a long-necked jar with a narrow mouth (hereinafter referred to as jar1) and filled with coal, then the jar’s slot is closed with a piece of thick cloth to lock up the grains and coal when the jar is inverted. Next, another identical or larger jar (jar2) is brought and half-filled with water and buried in a ground hole. Jar1 is then flipped over to face jar2 until both slots meet, then the contact area is mudded. Coal and firewood are heaped around jar1 and fire is lit from every side until the jars and their contents heat up as required. After cooling, the remains of fire are removed from jar1 and jar2 is separated, enabling the extraction of grains from jar1, which will be mostly atrophic because the mercury has transferred to jar2. However, in

order to produce highly pourable metal free of impurities for minting currency or other productions, these grains have to be melted in the shape of alloys gold or silver, which will be in the next stage.

In melting stage, the grains are taken and placed in large and thick walled pot, then the pot is placed on the inside of the furnace and some ash is thrown under these pots to avoid sticking with the base of the furnace (more than one pot can be placed). After firing the furnace, its mouth is closed, but the tube is left open to enable air into the fire chamber. After two or three hours the furnace is opened and the pots are lifted, then the gold or silver is poured into templates to be the shape of alloys. These explanations are very important in such study to identify the mining settlements features and tools used in methods of extraction and the purification of mineral ores.

2.3 Western travellers

Western travellers started to visit Arabia in significant numbers at the beginning of the nineteenth century, and continued to do so until the present. They recorded many observations about Arabia from different aspects and wrote brief accounts about this part of the world.

Although the first recognizably modern exploratory organised visits to Arabia commenced in 1791 CE, and despite the fame of some famous Western travellers, such as Niebour, Burkhardt, Philby, Jaussen, Savignac and Shaeger, their contributions focused on exploring the ancient sites in Arabia such as Stone Age settlements, drawings and ancient Arabic inscriptions, and little attention was given to minerals (al-Ansary, 2003). However, the pioneering tour of the German explorer Bernhard Moritz in 1852 CE/1268 AH led to the publication of his book *Metals in the Ancient Arabian Countries* in 1859, which was summarized into Arabic and published in Majalt al-Arab (al-Jasir, 1968, 798-846). He was followed by the British traveller Burton, who visited mining areas located along the coast of the Red Sea from the Gulf of al-Aqaba to Wadi al-Hamz, as part of his brief to write a report for the Ottoman Khedive in Egypt. He subsequently published *The Land of Madian* in 1879. Blanckenhorn (1914) and Twitchell (1930) later examined some mining areas, surveying the mineral resources there. Some of the early twentieth-century Western mining surveyors subsequently worked in the mining companies later established in Saudi Arabia.

As mentioned above, Bernhard Moritz recorded his observations about the minerals in Arabia. He reported that mines of various metals were among the most important wealth

sources in Arab lands, particularly gold mines. He found that gold mined in Arab lands was a famous and desired luxury from 500 BCE among neighbouring peoples such as the Hebrews, Phoenician and Assyrians. Accounts in the Old Testament of King Solomon sending trade missions to explore gold near the shores of the Red Sea, resulting in the acquisition of huge quantities of pure gold, indicates that the ancient Israelite kingdoms were aware of Arabian gold (al-Jasir, 1968, 798-846), and biblical references to some sites from which gold was taken, including Hoalh, Sheba and Ophir, are associated with Arab kings reputed to sell gold to King Solomon (al-Jasir, 1968, 798-846).

Moritz also pointed out that the presence of gold in the Arab lands was confirmed by historians and others, and also the gold has been found on the side of the mountain chain that separates the inside and between the coastal narrow areas, known as Tihama (al-Jasir, 1968). He located gold sites and noted that they were associated with places of granite. He listed many of these mines, some of which were in the Hejaz area, south of Asir, and in northern Yemen. Moritz suggested that the mining business in southern Arabia were continuous from 600 BCE until at least 800 CE/184 AH (al-Jasir, 1968, 798-846).

During his aforementioned employment in Arabia, Burton reported that free copper was present at three sites in the Valley of Sharma, north of al-Moelh town, approximately 175km southwest of Tabuk in the northwest of the KSA. He added that the first and largest site was close to the Valley of Sharma, roughly 6km north-west of Uyaynah; the second one was at the mountain of Uyaynah; and the third was on the Mutlay Mountain. Many gold mines from the period 846 to 861 CE/231 to 247 AH have been identified, the most important of which are al-Aerqah, al-Fara, Zool al-Marwa, Wadi al-Alkra, and other sites not far from al-Moelh, and several sites around al-Qurayat city in the north of the KSA (Burton, 1879).

Burton also recorded drawings and inscriptions on the granite rocks in al-Dawadmi, some 200km south of Riyadh. These sites dated from 800 CE/184 AH. Likewise, Burton observed other similar inscriptions and rook drawings in the western city of Taif. He suggested that these settlements (in al-Dawadmi and Taif) had to be mined during the period from 750 to 950 CE/132 to 339 AH. In the same area, Quinn analysed some samples of slag and glass by C14 from al-Dawadmi and Taif; the results confirmed the same period estimated by Burton (Quinn, 1964b).

In his survey of the oil fields of the Dead Sea region and minerals in the Land of Madian, Blanckenhorn mentioned the abundance of gold in Madian at large mines close to the port

of al-Wajh. He also highlighted some mines investigated by Burton (Blanckenhorn, 1914). In addition, he observed that gold is a companion to granite rocks (as noted above), and talked of the existence of some other metals such as silver in the mountains of al-Fihisat, south of Mguena, and iron (al-Titani) found in Uyaynah in the White Mountain. Blanckenhorn said that there are remnants of silver in the split of Ziba (Sharm Ziba) (Blanckenhorn, 1914). Furthermore, two essential cities in gold mining in the ancient period were selected: the old one near the beach of al-Wajh and in al-Qurayat city. The second core city of gold mining is the centre of al-Yamamah in the Najd Plateau, and he noted several gold mines in this area (Blanckenhorn, 1914).

Twitchelll is considered one of the most important travellers from a mining perspective, who examined the old gold mines in the Hejaz and Najd when he visited several mines in the south of the Madian: al-Madina, al-Taif and Mahdalzahb, Haliit and al-Dawadmi (Twitchelll, 1930). He suggested continuing mining in some mines noted by Burton. For this purpose, he also recommended the creation of an office for chemical analysis in al-Wajh or Yanbu. In addition, Twitchelll found evidence that the Arabs crossed the Red Sea and worked in mining in different parts of Africa (Twitchelll, 1932). He also reported the methods of transporting the metals and extracting the groundwater to be used for mining operations (Twitchelll, 1932).

However, for Western missions of individuals of travellers, not specifically interested in mining, their contributions were scant in minig field, with the exception of Moritz. Perhaps this was because they were concerned primarily with adventure; their scholarly contributions were chiefly geographical, historical, sociological and cultural.

Even those who did accord mining significant attention, such as Moritz, were largely speculative in the nature of their observations. For example, Moritz's assertion that mining was practiced from 500 BCE in the south of Arabia, without further investigation or analysis of C14, was unproven. Additionally, some Arabic sources indicated that mining in some of these sites was suspended, indicating that mining activity had ceased a long time ago (al-Estkri, 1927). Additionally, it should be noted that Burton did not visit many sites in the south and southwest of Arabia, so his knowledge of minerals in Arabia as a whole was not comprehensive.

Organized missions that visited the KSA, including the Canadian Mission in 1962, which included Frederick Went and William Reid (archaeologist and palaeographer, respectively) concentrated upon the north and northwest of the KSA. They visited some sites such as

Kaff, Ethra, Jobbah, Yatb, Hail, Faid, Domat al-Jandal, Taima and al-Ula. The Mission published several articles, entitled *Corpus from the North and North-west of the Arabian Peninsula* (University of Toronto, 1970) (al-Ansari, 2003), although there were no indications of mining activities in those sites.

2.4 Contemporary Arab writers

A number of contemporary Arab travellers, geographers and researchers contributed some works on historical, geographical and literary aspects. Of course mining and places of metals in Arabia took place in some of these contributions. These works focused on the identification of mines and their location in the KSA. Perhaps the most important of such studies are those of al-Jasir, Mulhis, al-Abid and al-Ghabban.

Al-Jasir highlighted many mines in his writings on the KSA. It seems that his works investigated the most important classical Arabic sources in mining, al-Hamdani's *al-Jawhartain* (al-Hamdani, 1987). Moreover he collected information about minerals in the KSA through classical Arabic sources such as of al-Bakri and al-Hamwi, as well as preliminary surveys conducted by the Deputy of Ministry for Mineral and Resources, and then he published several articles relating to mines (al-Jasir, 1968, 1969, 1970, 1987). Al-Jasir noted the remains of mining in al-Baha region, which are still visible at al-Kisamam and al-Aqiq. Furthermore, he identified eleven locations of gold mining, and nine of copper, in the valleys of Turabh and Tharad. Overall, he pointed out several places in the southwest area which played a major role in extracting minerals during the Umayyad and Abbasid periods (7^{th} to 13^{th} centuries CE) (al-Jasir, 1971). Moreover, al-Jasir (1968) pointed out to another study relating to mining in Arabia carried out by al-Abid. Al-Jasir reported that al-Abid presented useful information in a PhD thesis *Mining in the Medieval Centuries and their Places in the Arabian Countries* about the minerals of Arabia, taken from the Arabic geographers and historians (al-Jasir, 1968).

Contemporary scholars' contributions can be described as the real beginning of serious studies in the field of mining in Arabia. However, although al-Jasir's studies are still considered to be the foundation for all later archaeological studies in the field of Arabian mining, his writings focused on the north and south (al-Jasir, 1968), and he neglected the centre of Arabia. The existence of other very large ancient gold working settlements in the central region west of Riyadh, such as Samrahha (Kisnawi and Prentiss, 1982); southwest of Makkah, such as Mamilah (Smith, 1967); and several mines around the Cradle of Gold (Zarins et al., 1979) were not represented in A-Jasir's work. Al-Jasir often merely referred

to such sites and determined their locations using Arabic sources, noting their modern names; it seems that he did not visit mines in Arabia to write about mining practices or facilities next to mines, and tools of mining.

Malhes (1970) collected full information on metals in the KSA, and published the first part in the *Dictionary of the Arab Countries* under the section of al-Hejaz and Najd. He focused on the mines mentioned in early Arabic sources and later studies like al-Jasir's works (Mallhes, 1970). However, the proposed magnum opus of Malhes, his intended comprehensive glossary of minerals in the Arabian Peninsula, never materialised as he died before he completed this work, although some articles of this glossary were published in *Umm al-Qurra* newspaper.

There has been only one specific archaeological study about the mining settlements in the KSA that went beyond studying mines recorded by others. Al-Ghabban carried out an excavation of a mining settlement in al-Madinah region, Shoaib al-Massni. He examined a number of questions through the results of fieldwork including survey and excavation, and also results from studying the archaeological materials that were collected from this village. These questions were focused on activities that took place in the village (al-Ghabban, 2002, 35-77). Al-Ghabban also discussed information about types of mines and mineral ores around the village, and spoke about archaeological trenches and their results too. These trenches have shown four paved layers consisting of soft sand and mud. The archaeological artefacts found in layers 3 and 4 comprised a broken millstone, a grinder of gold, fragments of pottery (glazed and unglazed) and pieces of glass flasks used in mining operations and the separation of metals from each other (al-Ghabban, 2002, 35-77).

The contribution of Ghabban is considered a specialist archaeological study. He excavated in the site of al-Masni, even though it included only one mining settlement. However, one of the limitations with this study is that it does not clarify what the role of the settlement was during the Middle Ages, or its relationship to other settlements nearby, such as al-Nuqrah, al-Mawan and the Cradle of Gold; the study did not provide information on where mining operations were conducted, nor where production occurred in the settlements (e.g. whether these were within the village, or in other sites). In fact we do not know any accurate information about the details of mining operations in al-Masni.

2.5 Surveys of the Deputy Ministry for Minerals and Resources (DMMR)

The beginning of the mining contracts in the KSA was initiated in 1931, subsequent to the surveys of the American geologist Twitchelll (discussed above) concerning oil and minerals in the Kingdom at the request of King Abdul-Aziz. Twitchelll's work confirmed the existence of oil in the Eastern Province and gold in the Hejaz region (Sahal, 1999). For this purpose, the government of the KSA established the Bureau of Mines and Public Works (BMPW) in 1933 under the Ministry of Finance to oversee mining operations in the Kingdom. In 1952, the BMPW was restructured as the Directorate General for Oil and Minerals (DGOM), again under the Ministry of Finance. Then, in 1962, the DGOM was transferred into the Ministry of Petroleum and Mineral Resources as an independent directorate, to ultimately become the Directorate General of Mineral Resources (DGMR). In 1994 the government renamed the DGMR the Deputy Ministry of Mineral Resources (Sabir, 1991).

Contemporaneous with the beginning of oil extraction, in 1935 the Government signed an agreement with a British-American consortium (the Saudi Arabian Mining Syndicate [SAMS]) to invest in the ancient gold mine in the Cradle of Gold. The SAMS gained a privilege for 58 years to extract minerals and make commercial investments in a variety of mines in the KSA, including Mahdalzahb in the south-west of the region of al-Madian (Sahal et al., 1999).

The establishment of the DMMR in 1994 was considered the turning point in the field of mining in the KSA. Several mineral surveys and studies have now been carried out covering most of the country, identifying several ancient mining sites suitable for modern commercial investment.

The DMMR benefitted from a group of specialized experts in investing in ancient mines, chiefly Twitchelll and others such as Quinn, Smith and Schaffner. In addition, many samples of charcoal, bones and pieces of pottery and glass were analysed. The processes of chemical analysis of artefacts from the mines of the Cradle of Gold and Dulom demonstrated that these mining sites date back to 700-900 CE/18-289 AH (Sahal, 1999).

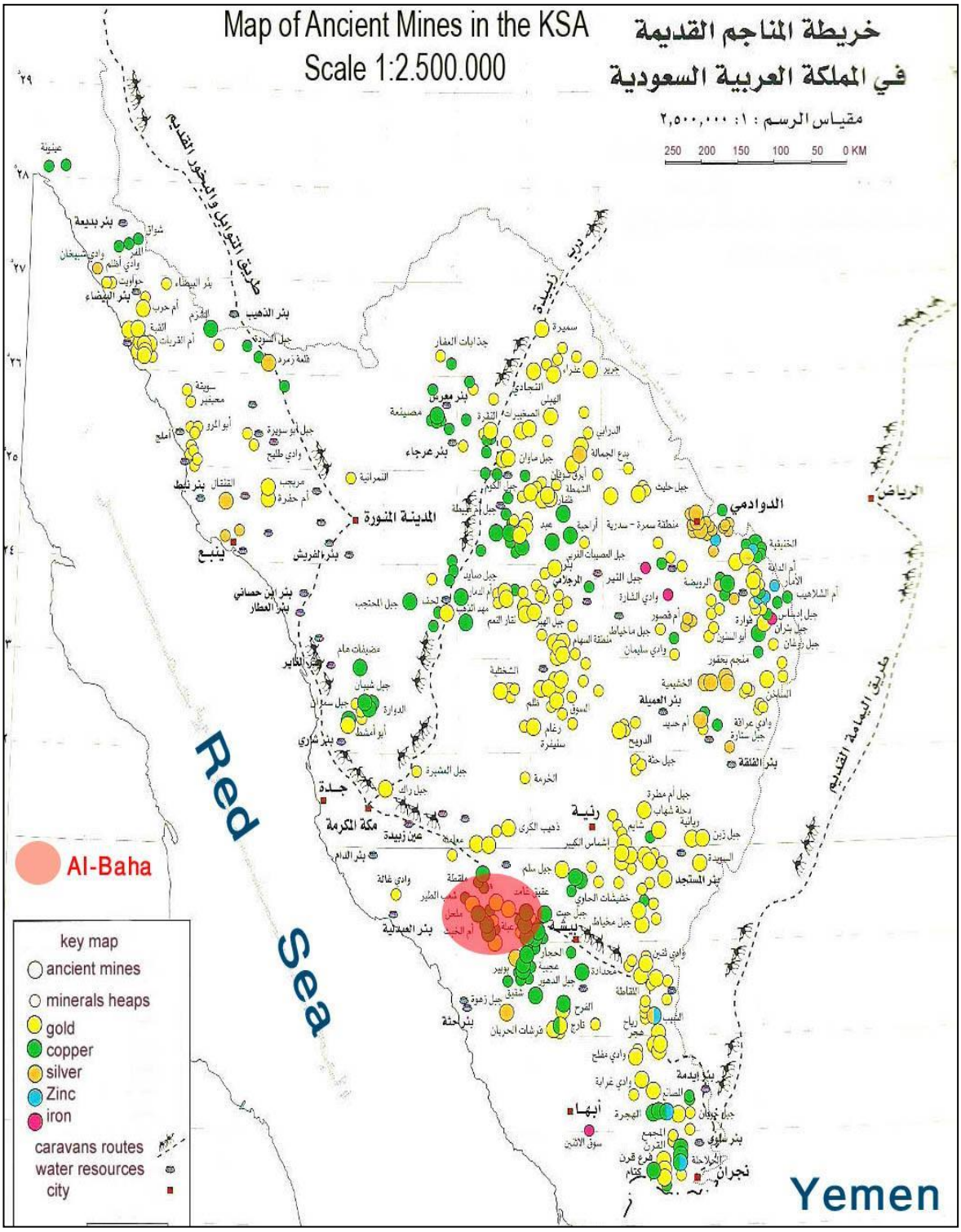


Figure 2.1: Map of mines recorded in the KSA by DAMMR

(after Sahal, 1999)

Similarly, Sabir (1991) conducted scientific studies based on information mentioned in classical Arabic sources and using modern methods for exploring mining sites. He mapped the wide distribution of mining sites in the KSA, concentrated on the Arabian shield (in the west of the Kingdom) (Figure 2.1). He carried out some investigations in several mines in

the KSA. He also suggested that the mining of gold and silver underwent at least three phases. The first of these was in the eleventh century BCE, when gold was extracted and transferred from the Arabian Peninsula to Mesopotamia. The second phase was between 961-922 BCE. The final phase was intermittent, during the Umayyad and early Abbasid dynasty. After that, the mining of gold and silver was suspended in the Arabian Peninsula for a period of 700 years until the establishment of the KSA in 1932 CE/1951 AH, when some mines were reopened (Sabir, 1991). Sabir (1991) also studied some mines in the eastern and central regions by analysing samples of coal in slag using C14. The results of this study indicated that the history of mining underwent two periods during the 7th and 8th centuries CE/1st and 2nd AH (Sabir, 1991).

In 1930, Twitchelll analysed a sample of slag from the Cradle of Gold to investigate the economic viability of the site, concluding that the mining activities dated from the early period of Islam (Twitchelll, 1930). Subsequent C-14 analysis from the same mine confirmed that the processes of mining were undertaken during the Abbasid period (786 to 1288 CE/170 to 678 AH) (al-Shanti, 2000).

Quinn reported that the mine of Ashmuta, close to al-Duawdmi in the central region, was rich in gold and probably used before 1258 CE/565 AH. He also said that the ancient pits reached a depth of 800 feet. Quinn also sketched a map showing the previous activities at the site (Quinn, 1963a).

Twitchelll discovered two silver mines, Samrah and al-Sudairih, in al-Dwadmi. He took sampling of the mineralization and drew geological maps (Twitchelll, 1932). Quinn (1963b) reported that Burg, who took samples in 1954 from Samrah mine, and found remains of pottery in Samrah village close to the mine, suggested that the mine of Samrah was used during the 7th to 9th centuries CE/1st to 3rd AH. Schaffner contemporaneously collected remains of glass found in the village of Samrah, and picked up pieces from various mines from the central province of the KSA. C14 results showed that the history of these samples back to 700 to 726 CE/78 to 104 AH (Schaffner, 1954).

However, archaeological investigations in Samrah highlighted that large pieces of pottery, glass, slag, animal bones and remains of buildings and mining tools indicate that the site was most intensively exploited during the Abbasid period (between 750 to 1288 CE/132 to 687 AH) (Kisnawi et al., 1983, 76-83). This would suggest that literary records of al-Aissain mine refer to the site of Samrah. Al-Hamdani pointed out that the mine had metals

and businesses, and that its location was five days by camel from al-Yamamah (al-Hamdani, 1971, 104).

Schaffner investigated the mine of Umaldamar (known as al-Aqiq mine in the south-east of the Madinah region), and he found the workings of previous copper mining and described that it was good for production. Schaffner estimated quantities of slag of about 100,000 tons containing a copper percentage of 1%. Large amounts of mining residues are also present. Moreover, C14 analysis showed the history of mining in Umaldamar down to 750 CE/132 AH (Schaffner, 1954).

Smith (1964) highlighted several mines in the north and west of al-Baha region. For example, he noted that copper mining in the Monhil mines north of the region date back to 750 CE/132 AH, according to the results of carbon dating. Consequently, he prepared geological maps for reinvestment the Monhil mine. Smith's survey of the east of al-Baha region led to him listing many mines, notably Rbzan, Gahabaltir and Muashoqh, dating them to 725 CE/106 AH.

A few decades ago, the DMMR carried out a geological survey and metal exploration in the whole country. This led to the production of databases containing geological, technical and economic information about mineral resources in the KSA. These databases included geological, geophysical and geochemical maps and maps of urban centres (Sahal et al., 1999). In fact, these maps were the foundation of early archaeological surveys of cities in the KSA, as will be shown below. In addition, DMMR's work published information on mineral resources (the old and the new) in the KSA. The lists of information mentioned mines for gold, silver, copper, iron, and even one site for chrome (Bulletin, 1956).

Despite their immediately commercial interest, the mineral survey works conducted in the KSA are evidently of great importance to mining studies, particularly the chemical analysis of ancient mining sites, as well as using dating methods such as C14. This has allowed the dating of sites (700 to 900 CE/81 to 287 AH), as well as a clearer idea about the mining process performed within them.

However, modern mining operations have damaged archaeological sites, leading to the blurring of the old mining activity at sites and erasing its features. Even after specific archaeological projects were begun by DMAM, there was no coordination between the DMMR and the DMAM for some mining sites. The researcher acquainted an official from

the DMAM with these issues in recent years in the mining sites of al-Ablah, Om aljanadel and Mhoih in al-Baha region (al-Zahrani, 2002).

In addition, the list of ancient mining sites compiled by the GDMR contained many mistakes for two main reasons. The first one is related to the transliteration of site names from Arabic into English, which is frequently inconsistent with the correct Arabic pronunciation; for example, the mine name of *Qasas* was transliterated to 'Adsas' (Bulletin, 1956, 123). The second one is related to geographical location. Many of these mining sites listed have changed their old names, by movements of tribes in the region, resulting in modern names for sites, and the neglect of old names. For example, the mine of al-Aqiq is now known as Umaldamar.

2.6 Comprehensive Archaeological Survey in the KSA

Since the establishment of the KSA, attention to archaeology has continued, resulting in the empowerment of the geological, geographical and archaeological surveys. Therefore, archaeological field surveys and excavations in various parts of the KSA have appeared. One of the most important events of the 1970s was the foundation of GDAM under the auspices of the Ministry of Education, which has become the primary organization concerned with archaeology and its study, and the protection and preservation of antiquities (al-Ansary, 2003). GDAM subsequently became known as DMAM, also under the auspices of Ministry of Education, in 1996 CE/1416 AH, when the archaeological works in the KSA were extended (al-Rashid, 1997).

However, since the end of the twentieth century, antiquities and archaeology in the KSA have come to be seen as an economic and touristic sector of the economy. A Saudi Council of Ministers Resolution in 2000 CE/1421 AH established the Supreme Commission for Tourism (SCT), stressing that the tourism sector is one of the most productive sectors (currently for indigenous tourism, with the potential for international tourism), and the SCT would increase investment opportunities and human resource development. Royal Order No. 2/A (2003 CE/1424 AH) was issued for the integration of Antiquities and Museums into the Supreme Commission for Tourism, to become a body responsible for implementing the functions of antiquities and to take responsibility for tourism. So, the name Supreme Commission for Tourism (SCT) was changed to Saudi Commission for Tourism and Antiquities (SCTA), with a focus on domestic tourism as a reality that requires a national authority responsible for planning and development, taking into account

the unique potentials of tourism and antiquities in the KSA relating to relatively undisturbed archaeological sites and Islamic and Biblical interest.

If we trace the development of archaeology within the KSA, we see that GDAM created many successful archaeological projects. The most important of these continued previous works such as supervising records, documents and inventories of archaeological sites, as well sites of architectural heritage. Recording ancient mining sites, ancient trade routes and pilgrimage routes accompanied the recording of ancient drawings and inscriptions throughout Saudi Arabia (al-Zahrani, 2007).

This was achieved by the GDAM five-year plan in 1976 CE/1396 AH to survey the provinces of the KSA with the participation of significant scientific missions of Western schools and universities in the field of antiquities, such as Harvard and Chicago Universities, the Institute of Archaeology at London University and others (Figure 2.2) (al-Ansary, 2003). This cooperation was necessary due to the limited national expertise in the field of archaeology at the beginning of establishment of GDAM.

Figure 2.2: Early archaeologists' mission in the KSA (SCTA archive).

A desire to gain the advantages of advanced Western scientific expertise in archaeology was reflected in the five-year CASP plan. The implementation of the plan began in 1976, depending on two main items: the administrative division of the KSA into six provinces (Central Province, the Eastern Province, Northern Province, North-Western Province, the

Western Province and the South-Western Province); and a set of maps prepared by the US Geological Survey and Arabian American Oil Company, under the auspices of the KSA (Figure 2.3). These twenty-one maps were issued by the Ministry of Petroleum and Mineral Resources. These maps contain a lot of natural and topographical information, sites of mines and settlements of mining (al-Zahrani, 2007). Hence the designation of archaeological sites and their labelling was applied according to the used maps at the beginning of the CASP, therefore every site contains two parts, for example: (1/206). The first part (1) symbolizes to the archaeological site that has been registered, and the second part (206) symbolizes to the designated portion of the map that has been registered the region (al-Zahrani, 2007).

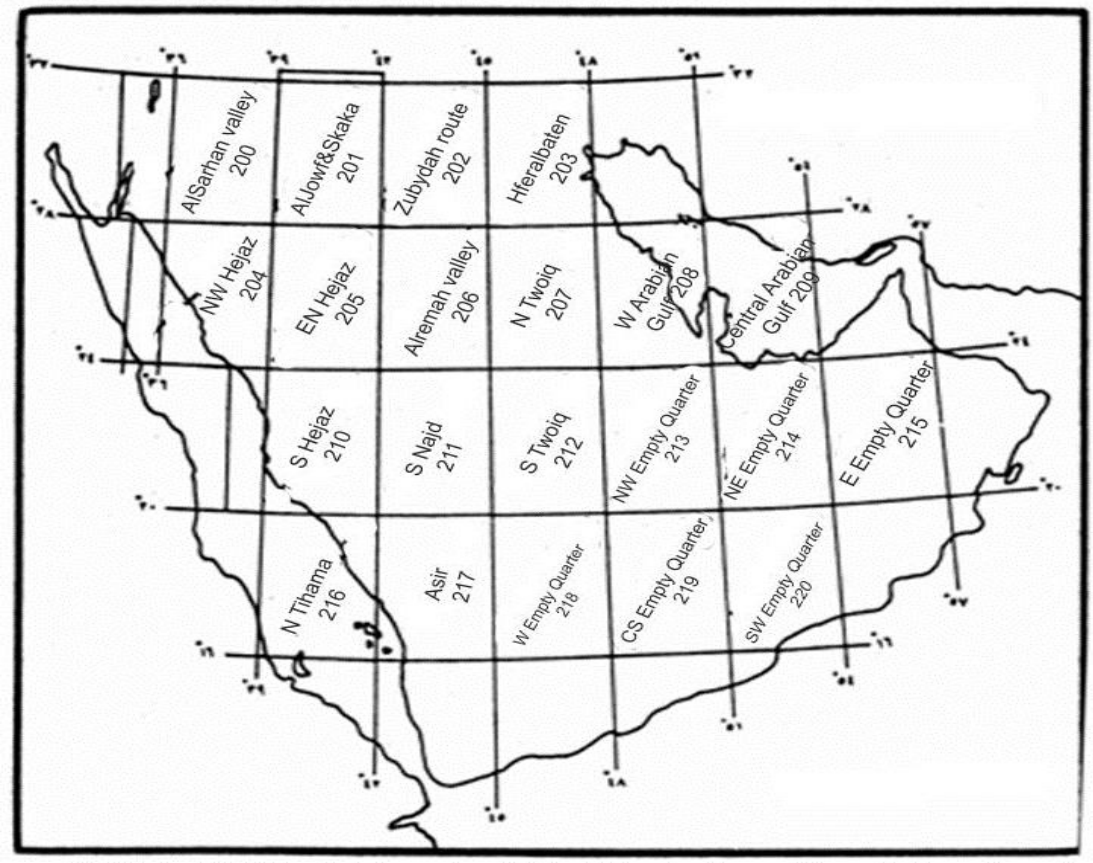


Figure 2.3: Cartographic division of the KSA

(al-Zahrani, 2007)

It should be noted that the archaeological survey was implemented in very difficult circumstances. For instance, most of the survey was carried out in remote areas, across unpaved roads or open desert. As a result, some work teams faced various risks such as traffic accidents, serious injuries or in the worst cases death. However, the program achieved their goals and recorded a lot of archaeological sites, including mining sites used

in different stages of the Islamic medieval period. With the passage of time, thousands of archaeological sites were recorded, and a variety of collections were transferred to archaeological stores in preparation for specialized scientific studies. As the chart below shows, there is a significant difference between the distributions of those recorded sites according to regions (Figure 2.4). Five regions, namely Tabuk, Riyadh, Makkah, Madinah and al-Sharqiyyah, have been extensively surveyed; whereas the other regions are relatively uncovered (this chart was constructed by the researcher based on a survey of SCTA archive). At any rate, sites throughout the KSA have included many varied items of stone tools and pottery.

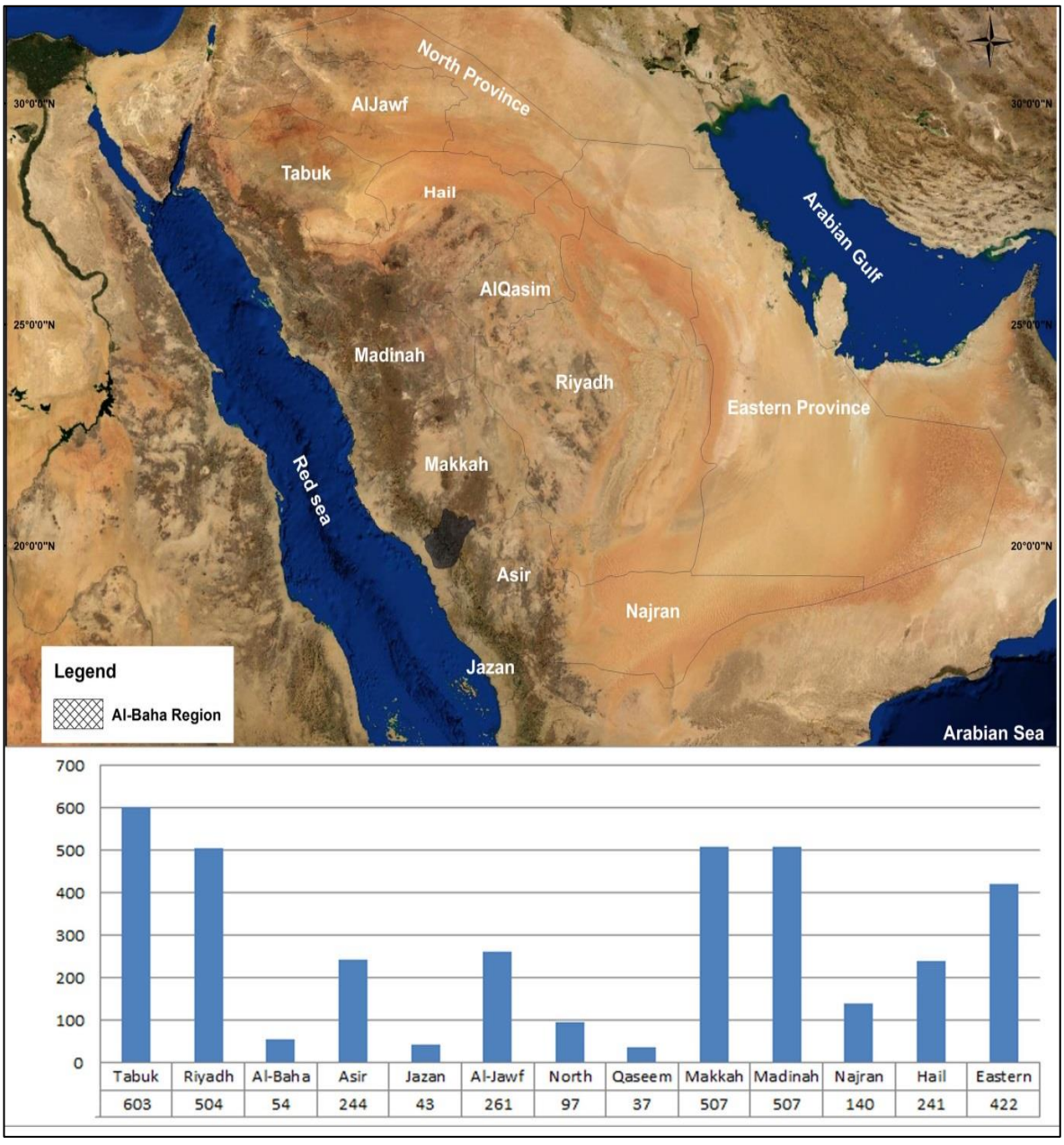


Figure 2.4: Distribution of archaeological sites in the KSA

By the end of the fifth season, the GDAM achieved initial information from those sites that were surveyed on one hand, but on the other it had still not surveyed many areas. The best description of the condition of the archaeological survey at that time was given by al-Masri, former director of the GDAM and responsible for the implementation of the CASP, which he mentioned in the opening of the fifth issue of *Atlal*:

> The contribution in part one of the issues brings to a close the primary phase of general investigation throughout the country namely the 'Comprehensive Archaeology Survey Program'… broadly speaking, that the total land area of Saudi Arabia has been primarily examined from an archaeological perspective…many area of the country were a little more than lightly examined. The hope is during succeeding phases of investigation these and thematic gaps and regional lacunae of coverage will be dealt with on more relaxed and extended basis… we evaluate the result of this five year intensive and extensive survey, the fact remains the same; firm knowledge about Arabia's antiquity is decidedly ten times or more better today than it was a mere half a decade ago. (al-Masri, 1981, 5).

The primarily archaeological survey works in the KSA have recorded several sites of mines, particularly gold, silver and copper mines, as well other minerals. Furthermore, mining settlements have been found close to some mines. These settlements were practicing mining activities such as extraction, processing and production.

Other archaeological studies have shown the presence of a number of circular test pits next to mines known as placer pits. These pits have been dug in separated places on around sides of mines. These pits represent one of the methods of searching for gold used in the past.

In addition, when recording mining sites, the CASP recorded many inscriptions and drawings, including Islamic inscriptions which contain religious texts such as supplications for the mercy and forgiveness of Allah (God) and testimonies of slavery to Allah. Likewise, drawings have been found expressing various social rituals perhaps practiced next to these mining settlements. The archaeological evidence suggests that these mining sites and their mines are based on or close to the ancient trade routes (also pilgrim routes). One of the surviving routes is the Zubaydah road, which starts in Iraq and passes central Arabia to reach Makkah (al-Dayel et al., 1979, 49-68). The trade route from southern Arabia to the Levant via Makkah is also littered with ancient mining settlements (al-Rashid et al., 2001, 199-150). It is assumed that these ancient routes were the main channels for the trade of minerals extracted between the mineral-based communities working in Arabia and the peoples of the Mediterranean Sea.

Archaeological studies have revealed the remains of barrack-like housing at mining settlements, for example in the Cradle of Gold, which suggests the presence of labouring teams in this mine, as well as places for the treatment of metals, such as melting furnaces, aquarium filtration and cooling (Zarins et al., 1979, 9-48). Likewise, on some stations along the Zubaydah route, such as Bani Salim's mine of al-Mawan (al-Dayel et al., 1979, 49-68), similar houses consisting of walls, windows and narrow corridors have been found in sites of Omalquriat, Garabah, al-Biram, Musinah and Turobah (Zarins et al., 1981, 9-36).

Furthermore, archaeological studies referred to the existence of large and different rooms with walls built of bricks and mud close to copper mines at the site of al-Noqrah (north and south). Additionally, different types of furnaces have been found that were used in the process of smelting operations, indicating extensive and focused mining activities practiced in the same location (Dejesus et al., 1982, 63-69).

In other sites in the northwest of the KSA, archaeological studies pointed to temporary settlements emerging from the relative scarcity of finds related to mining, including fragments of pottery, pieces of glass, grinders, and stone pounders. These settlements contained buildings with small rooms used in the mining of gold, silver and copper in Tabuk region at the sites of Hoitat, Humera, al-Hijar al-Moelh and al-Jadedah (Dejesus et al., 1982, 43-68).

Several architectural installations for smelting have been uncovered in two sites in the south-west of the KSA, in al-Siha and Athar. The former had a reputation for its involvement in minting during the Abbasid period. Large amounts of waste metals from smelting have been found at the site (Zarins and al-Zahrani, 1985, 69-112).

Surveys exhibited the remains of villages of gold and copper mining and a number of sites related to the operations of ancient mining. One significant mine is al-Ablah in Asir region. Al-Ablah contains the foundation of some three-hundred architectural constructions of large dimensions (10x12m). Apparently, this village must have housed about one-thousand workers. Similarly, al-Aqiq mine in al-Baha region contains approximately 100 similar structures to those in al-Ablah. Additionally, archaeological studies indicated pits in both sites extended to 500m, and another 50m of slag heaps. Some furnaces were noted to have been reused after being broken to extract the molten metal (Hester et al., 1984, 115-142).

Moreover, small units of interconnected rooms with a size of 3×4m were discovered in al-Aqiq and other sites in Mahwiyh, Minhel, Mhoih and al-Ablah. A large quantity of slag was found at these sites, along with cemeteries, a common trend in mining settlements (Hester et al., 1984, 115-142).

After examining most archaeological studies throughout the CASP and succeeding projects carried out by GDAM (DMAM/SCTA) in the field of mines and mining settlements during the period of 1976-2006 CE/1396-1427 AH, published in sporadic reports in the *Journal of Saudi Arabian Archaeology* (*ATLAL*), it can be said that the completed surveys reflect a poverty of knowledge about the vast area of the KSA. These surveys being preliminary works, can now be improved upon thanks to improved analytical capabilities and the increased ability to recognize and map sites using remote sensing or Google Earth.

Although no one can deny the contribution of these fundamental surveys and excavations which formed the foundation stone of archaeology in Saudi Arabia, the studies are too few, and some of them are unsystematic. The geographical imbalance discussed previously, reflecting an unfortunate convergence of the spatial positions scanned, is evidence of an absence of good logistical planning. For example, we find that the second visit to the southwest region of the KSA (Zarins et al., 1981, 9-36) included Dulm, Taif, Asir and the coast of Tihama adjacent to the Red Sea, while disregarding al-Baha and Bishah region. Although part of team surveyed mining sites in Tathleeth close to Bishah, al-Baha and Bishah contain more mining sites than Tathleeth and Asir; as well as logistical problems, the seasonal weather may have been a factor in this omission.

In terms of scientific treatment, some teams made assumptions based on the rationale in the field, while such assumptions should in fact be made in subsequent work; however, there were no interpretations for these assumptions. For instance, according to a report regarding mines and mining in the southwest of the KSA, Zarins et al. (1980, 9-34) reported that some of the recorded sites such as (217/103) date to the civilization of South Arabia period. It would be useful if the team carried out further fieldwork in this direction for this purpose, or at least studied the discovered materials through the following surveys to develop this view. Another example was the study of the Ktniah site (115-141) (Hester et al., 1984, 115-142). The report dated Ktniah to the pre-Islamic civilization period, with no evidence for this assumption.

Additionally, the illustrations which usually accompany any archaeological report are typically absent regarding Saudi mining archaeology. For example, a comprehensive

survey of mining activity in the south-western region (Zarins et al., 1981, 9-36) did not provide drawings for those settlements, but only made reference to the site number (for example, 217-116), and did not add a map showing the spatial distribution of sites, rendering the work incomplete.

In the site of al-Sadriah (Zarins et al., 1980, 9-34) despite the large area surveyed (400x400m) and the finding of a spread of pottery, porcelain, glass and silver coins at the site, there are no maps or figures to demonstrate either the layout of the site or the finds. In the same manner, recording more than 40 sites of mining in al-Dawadmi, and the most important mines in the KSA around the Cradle of Gold (210-64) and another site (210-67), no plans or photographs were attached showing architectural installations, which severely reduces the advantages of the report and its results.

The most obvious deficiency in the condition of archaeological study of mining in Saudi Arabia is that the most significant mining archaeological surveys were conducted almost three decades ago; there have been no subsequent surveys or special studies of ancient mines and their settlements. For example, no focused excavation has been conducted except in al-Noqrah (north and south) (Dejesus et al., 1982, 63-69).

Although extensive research has been carried out in northern KSA, no single study exists adequately covering ancient mines and their settlement. Most studies have concentrated upon other aspects, such as Stone Age sites, ruins of ancient buildings, dams and drawings.

The transliteration of the names of sites into English, and subsequent back-translation into Arabic, alongside inaccuracies in longitude and latitude coordinates (which was a difficult science prior to GPS systems) additionally renders many previous studies problematic (indeed useless, if sites cannot be identified and located).

Although surveys and initial reports were published in the *ATLAL*, most detailed information from studies remains unpublished and concealed in the original folders which contain valuable information and graphics executed manually and proficiently, and photographs of sites, some of which have subsequently been demolished.

Tentative efforts in archaeological mining fieldwork, as outlined above, have left room for a comprehensive archaeological study of mining activities in the KSA, of which this research can play a part concerning al-Baha region. The survey is the starting point for archaeological fieldwork and methods to discover and analyse mining settlements. One of

the main objectives of the survey is identifying the characteristics of mining landscape and patterns of its settlements and how mining evidence is presented in these sites in the form of surface collections. The study then focuses on the most famous mining settlements of the study area, exploring the factors that made Asham so important in the south-west of Arabia by intensive survey. Excavation will be carried out after completing the field survey on the Asham including six archaeological trenches of 5×5m, for the following objectives: to study the stratigraphy of the settlement in order to present an overview of the successive occupation level, and to identify the stages of the settlement and prosperity of the most prominent cultural characteristics through the variation of artefacts and mining tools and facilities from archaeological trenches. Also, a set of cultural items will be selected from Asham settlement to use for descriptive study. Additionally, a comparative study of the Asham remains and artefacts from similar mining sites in the KSA and nearby countries will be conducted.

As outlined above, the contributions of classical Arabs and Muslims present valuable indications relating to prominent and forgotten sites, including mining sites. These indicators have given a good impression that mining was energetic in different locations in Arabia, particularly in the Arabian Shield, especially in the area around and near the trade and pilgrimage routes. Hamdani (1987) in particular presented a wealth of information in his book *al-Jawhartain*, which is the definitive guide to minerology for his time (d. 947 CE/336AH) in terms of ores, purification methods, and examination of physical and chemical characteristics. Western researchers paid great attention to Arabian minerals from the 19th century, and the subject of mines occupied portions of these narratives, with descriptive information about mining sites. Although they made limited observations about mining in the south-west of Arabia, their contributions are useful about mining activities elsewhere in the KSA, especially in highlighting the features of mining sites and their relationship to social and political concepts.

The classical Arabic sources and the writings of Western travellers in Arabia formed the basis for modern mining studies since the integration of the KSA. For example, those studies made by the contemporary researchers such as Al-Jassir, Mulhis, and Al-Abid depended directly on those historical sources, which they complemented with statistical studies. In addition, the early geologists with the beginning of the KSA under the umbrella of the GDMR identified modern mining sites using these historical sources as a means to search for points of mining, enabling them to document and date some of those sites from the 7th to 12th centuries CE (1st to 6th AH).

These studies brought useful evidence to the archaeological record in terms of the inventory of mining sites and identification of their concentration, as well as the identification of their tools and means. Additionally, this paved the way for the GDMR to establish the chronology of these sites. Archaeologists played a major role in this geographical and historical enterprise through surveys, exploration and documentation of many archaeological sites in KSA, including mining sites. However, the interpretations of some mining issues remain problematic and a more lucid understanding of how the mining landscape was shaped by contextual factors throughout history is required. This study endeavours to fill this gap for mining settlements in the region of Al-Baha in the south-west of the KSA.

2.7 Conclusion

Previous work in the field of mines and mining in Arabia falls into five main categories, namely classical Arabic sources, travelogues of Western explorers, studies of Arab contemporaries, mineral surveys in the early 1930s, and finally comprehensive archaeological surveys from the 1970s onwards. Apparently there was no interest among earlier Arab writers to publish detailed books or researches dedicated to minerals in Arabia, showing mining methods and tools, or stages of occupation next to mines. All that remains from classical Arabic civilization are fragments scattered among various books, with the exception of the relatively extensive information presented by al-Hamdani's (1987) *Kitab al-Jawhartain*, which is seen a detailed study of all mineralogy of the time (d. 947 CE/336 AH), in terms of ores, purification methods, and examination of the physical and chemical characteristics of minerals.

Studies from the 19th century onwards began to contemplate the importance of mining sites, but remain vague on understanding mining operations, particularly in the southwest of the KSA. Arabia is of great importance in the Abrahamic religions, particularly Islam, thus the focus of writers on the area have traditionally viewed it through this prism, and not as an area of material concern. Thus mining has been ignored, and even where scholars and travellers (Muslim and non-Muslim) have endeavoured to write on mining in Arabia, the geopolitical context should be borne in mind. The classical Arabic geographers and historians (including al-Yaqub, al-Tabari, Ibn al-Athir, Ibn Khordadbeh, al-Hamadani, al-Maqdisi, al-Edrisi, al-Bakri) and travellers (Ibn al-Mujawir and Ibn Battothah), as well as Western travellers such as Moritz, Burton and Twitchelll all had their own motivations and agendas for concerning themselves with the hostile environment of Arabia.

Nevertheless, such writings formed the basis of the investigations of contemporary researchers like al-Jasir, Malhes, al-Abid and al-Ghabban on the history of Arabia and its archaeology. In addition, dramatic awareness of the importance of mining from the twentieth century onwards has brought state support (and resources) to study mining in the area more deeply. Albeit agencies are keen to support archaeological exploration of mining settlements, it can be a double-edged sword if archaeological value clashes with the financial opportunities of re-exploiting a mine, as experience shows that the latter invariably trump the former.

One of the most anticipated achievements of this research is to identify the tools, facilities and methods of mining and its contribution to the promotion of civilization, as well as knowledge of the impact of these settlements on other settlements nearby. It will highlight the advantages of these settlements and their various cultural heritage productions. This study will contribute to bridging this gap in the field of Islamic civilization studies (i.e. the material foundations of the civilization) in the study period.

Having discussed the mining studies in the KSA and how these studies developed passed by the time, and given summary analyses of the existing research, the background of study area geologically, geographically and historically will be demonstrated in the following chapter.

Chapter 3: Background of al-Baha Region

3.1 Introduction

This chapter defines the general profile of al-Baha region. First, it defines the geological characteristics of the region and its mineral resources that attracted ancient people. It also explores the geographical location, surface features, population and human activities, ancient trade routes and the folk commercial marketplaces. Finally, the historical record of the region during the early Islamic period (7th century CE), including the periods of the Prophet, the Pious Caliphs (his immediate successors), the Umayyad and Abbasid dynasties, the Ottoman state, and finally the Saudi state is demonstrated, concentrating on the mining aspects relevant to this study.

3.2 Geology and mineralogy

Geologically, the KSA is divided into four distinct and extensive terrains: the Arabian Shield, located in the west, comprising metamorphosed volcano sedimentary successions intruded by granite and gabbro; the Phanerozoic Arabian platform of classic, calcareous, and evaporite successions dipping gently eastward away from the Shield; the tertiary 'harrats' (extensive basalt plateaus) mainly overlying the Shield; and finally, the narrow Red Sea coastal plain of tertiary and quaternary sedimentary rocks and coral reefs (Bayer, 1984, 10).

The Arabian Shield (in which the study area is located) in Arabia and the Nubian Shield in Egypt and Sudan is part of the mountainous mass of east Africa. The Arabian Shield is partitioned from Nubian Shield by the Red Sea. the Arabian Shield occupies an area of 575000km^2 in Saudi Arabia as well as small areas in Yemen and Jordan. It is bounded on the west by the Red Sea and the coastal Tihama plain, and on the north and west by rocks of sedimentary cover (Figure 3.1). The length of this shield, including the extensions in the north-west and south-east, is about 1,800km, with a maximum width of about 700km (Bayer, 1984). Tectonic movement resulting from movement in the Red Sea rift created the mountains of the Hejaz and Asir in the western edge of Arabia (currently known as the al-Sarat chain). The low-eastern part of Arabia is under the influence of the tropical climate and sea-water rich shallow reef organisms covered by some sediment are then transformed into rock by the pressure. Over millions of years, a large store of oil resulted from those organisms. The area is underlain by the Precambrian age metamorphic and igneous rocks which form the Arabian Shield (Naeem, 1990).

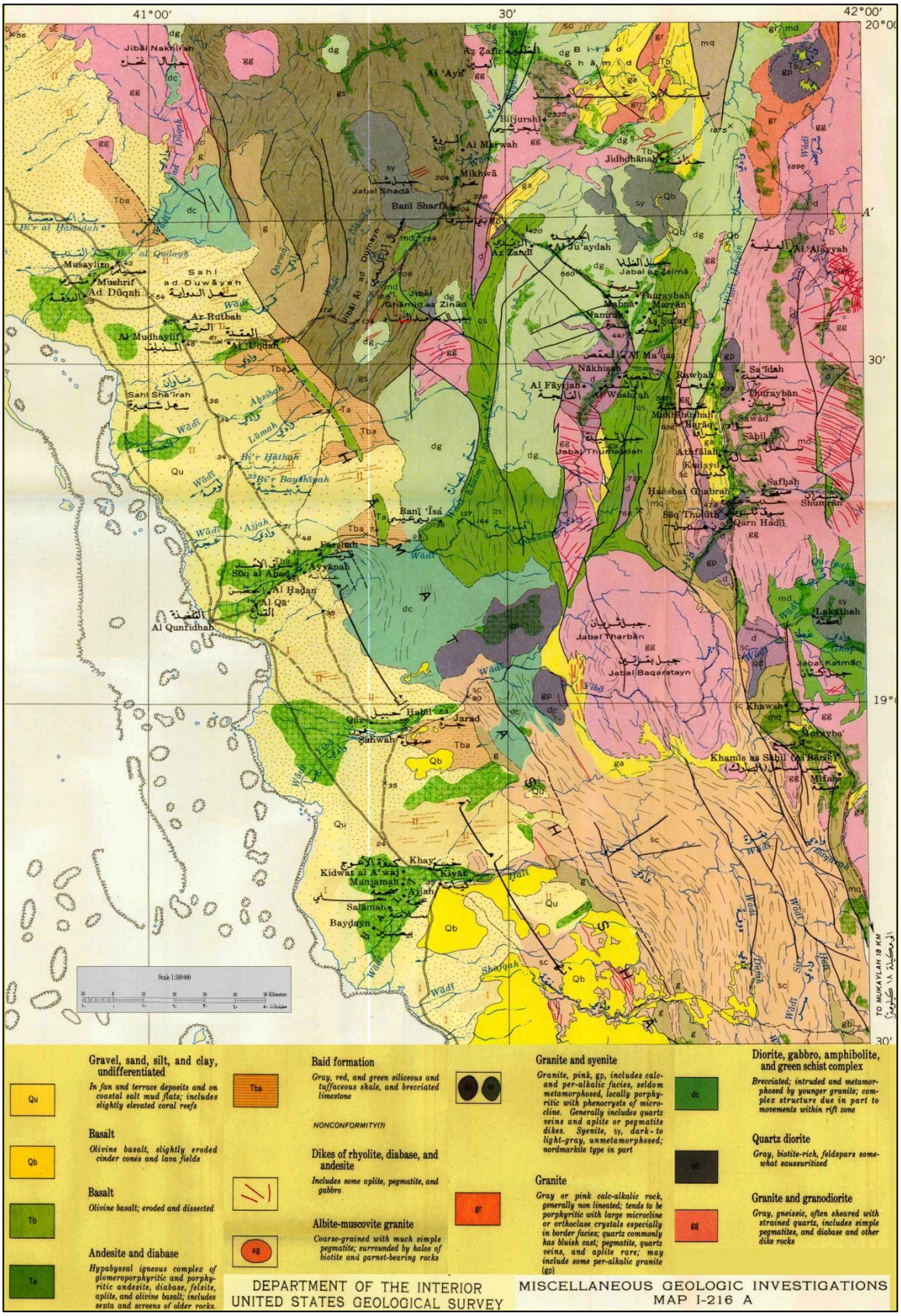


Figure 3.1: General geology of Al-Baha region south-west of Saudi Arabia

(after DMMR and Resources and USGS)

According to most geographers, the Arabian Peninsula is divided into five territories: Tihama, Hejaz, Najd, Arrod, and Yemen (al-Asfahni, 1968, 337). In this study, Tihama and Hejaz are the relevant territories as they form the major parts of al-Baha region. Tihama, the lowlands adjacent to the Red Sea, extends from Aden in the south to Aqaba in the north, while the Hejaz means the area that separates the Najd plateau and Tihama coast, which is part of al-Sarwat territory stretching from Yemen in the south to the Syrian Desert in the north (al-Asfahni, 1968, 342)

The Tihama sector is about 40km from the Red Sea with a gently westward dipping surface of subdued undulating topography covering quaternary deposits and stable dunes; eastwards, it increasingly rises to the Red Sea escarpment between al-Makhwah and al-Baha. Eastern Tihama near al-Makhwah is dominated by Shada Mountain, of resistant granite, rising 900m above the surrounding valleys. Water here is drained to the southwest by the al-Ahsabh Valley and its tributaries (Haster et al., 1984, 115-142). This valley rises along the escarpment where its headwaters are very steep, and falls rapidly to about 150m near al-Makhwah, where it flows southwest and is controlled by the structure of the underlying metamorphic rocks (Haster et al., 1984, 115-142).

The upper reaches of al-Ahsabh drainage contain the remains of quaternary gravel terraces, which stand from 1-5m above the current valley, and are well cemented and intensely oxidized, giving them a distinctive red colour. The ridge tops throughout the Tihama form a gently rising surface from the west to east. The higher ridges show a thin, well oxidized weathering profile, indicating the presence of a now highly dissected peneplain (Hester et al., 1984, 115-142).

The Hejaz sector has a gently northeast dipping surface, intensely dissected by a well-entrenched valley system. The area reaches a maximum elevation of 2500m at the mountain of Ibrahim to the northwest and falls to 1600m at Bishah in the east. The valley system is deeply entrenched with almost 1000m of relief along the Bidah Valley. There are several small flat interior basins located over easily weathered quartz diorite masses within the rugged north south ridge system. Al-Aqiq and other old settlement centres lie within the large area of Bidah (Hester et al., 1984, 115-141).

The Bidah Valley, containing non-ferrous metals such as copper, also contains a large number of mineralization sites of volcanic origin, formed in the volcanic rocks due to classic volcanic activity (e.g. fractured metamorphosis and folding). The most important mineralized sites are north and south Rabtan, Shiab al-Tair, Gahab and Lefe, Mahawih,

Alhabnt, Almndhh, Mount al-Azhar and others (Figure 3.2) (Volesky et al., 2003, 235-247). Al-Aqiq section contains the remains of quaternary basalts, which are part of a much larger basalt plain just north of the study area. Well oxidised quaternary surfaces, similar in appearance to those in the Tihama sector (particularly al-Ahsabh Valley), are preserved in the al-Aqiq section (Hester et al., 1984, 115-141).

Thus, this area is the source of precious metals such as gold, silver and base metals such as copper and zinc, in addition to some industrial metal ores. There are about 800 sites, 31 of which consist of more than 1000kg of gold per ton and 99 sites include less than this (al-Shanti, 2000). Specialized geological studies in al-Baha region demonstrated the existence of different sites for the presence of metals. These minerals are found in the veins of quartz in volcanic rocks, or in the rock underground. The sites of these metals are spread around the valley of Bidah, Torabh in the northeast of the study area, and around the Nawan Valley near the site of Asham.

Mineral resources are considered one of the most important economic resources in the KSA. Many precious metals have been discovered, including gold, silver, copper and other base metals such as zinc and tin, as well some industrial metals. As shown above, the Arabian Shield area and the study area are within the geographical boundaries in which the presence of these precious metals and base metals has been identified as a result of research and geological surveys carried out in different regions. More than 4000 sites of mineral deposits in the rocks of the south-western part of the KSA have been identified, as shown in Figure 3.3 (al-Shanti, 2000).

In order to achieve more resources, the government founded specialized private sector companies such as Maaden, and encouraged other companies to explore mineral investment. Maaden Company invested heavily in exploiting mining opportunities and enhanced mining of raw materials by employing modern technology to fully extract natural resources. Maaden invested 638 million riyals in the development of four projects aimed at producing gold in Mahdalzahb, Sukhaybarat (in the central part of the KSA), and Hajjar and Balgah in the south-western region. The production of these mines reached 300,000 ounces of gold and about 1 million ounces of silver, as well as yielding other metals such as copper and zinc (al-Dabbagh, 2004, 58).

Al-Baha is located within many of the mineral belts within the Arabian Shield. Although previous studies only focused on the small part of the area, there are current exploratory studies covering most parts of the region, including prospecting by an Australian company

(Syrah Resources Ltd.) for gold at old mining sites in Nawan in Tihama, and Maaden in the eastern part of the area where al-Aqiq and the Bidah Valley are located (al-Zahrani, 2004).

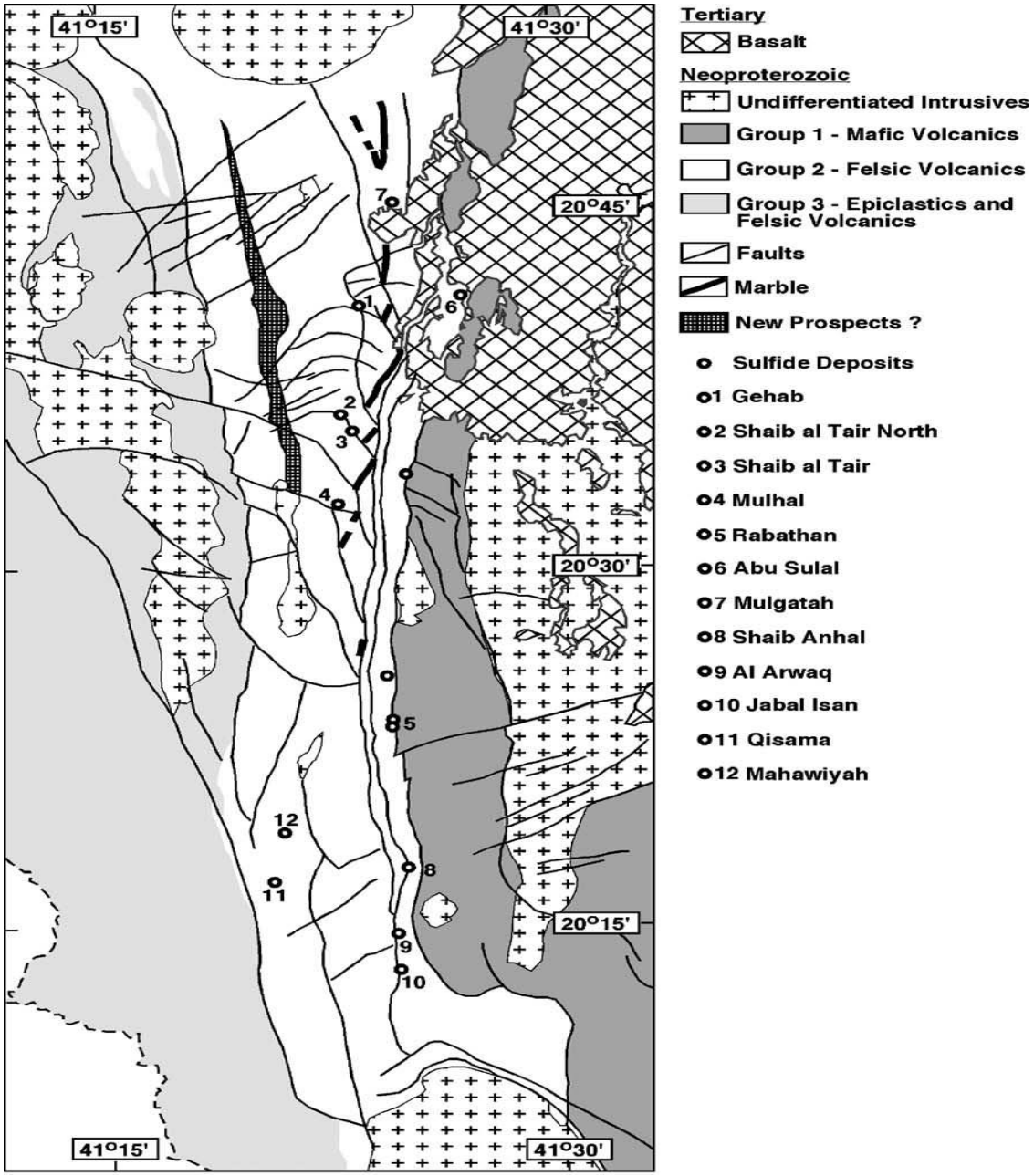


Figure 3.2: The most important mineralization sites in Bidah Valley north east of al-Baha

(Volesky, 2003)

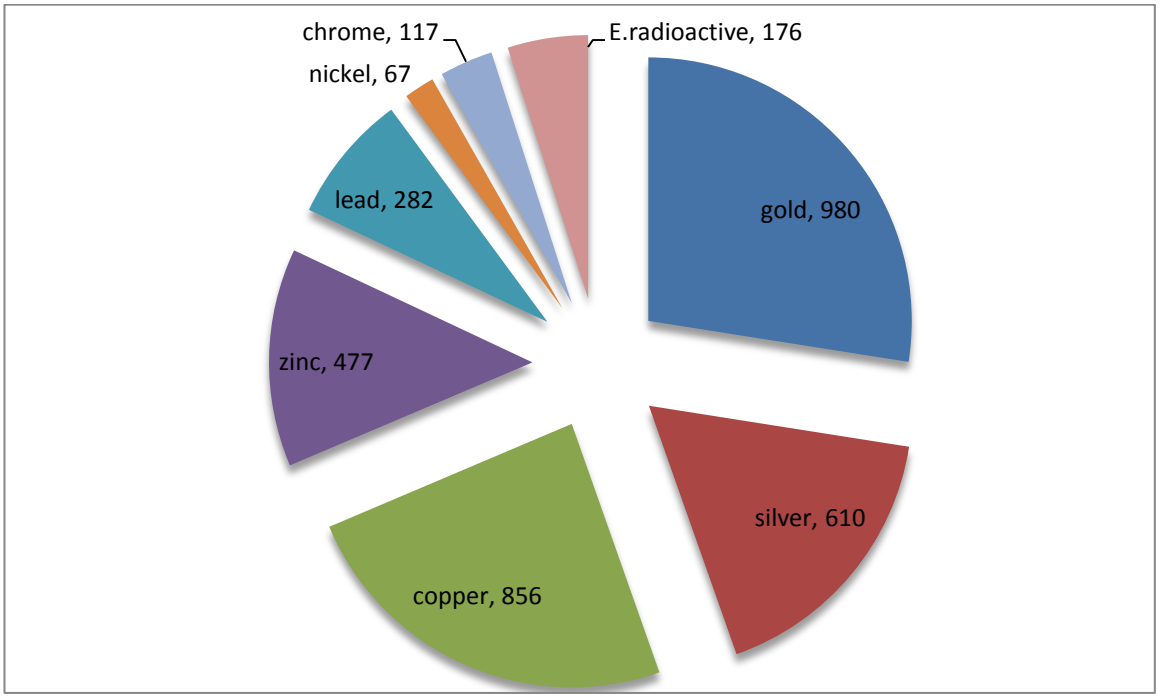


Figure 3.3: Mineral ores sites in the south-west of the KSA

Gold (Au79) has always been and remains the most coveted of metals. Gold has been regarded as a precious commodity since the most ancient times, probably originally due to its natural sheen and lustre, prominent features in the field of ornaments and decorations (which comprised portable wealth in traditional societies). Gold has characteristically been used in luxury items produced in numerous civilizations, such as jewellery, utensils and coins (Sahall, 1999). It is considered one of the most important mineral ores and is in widespread use for exchange and acquisition. The presence of gold is in the form of raw gold, in the form of particles or grains, or in a form mixed with other metals, such as copper (Craddock, 1995).

The major gold sites in the KSA are within the pre-Cambrian rock of the Arabian Shield, located in the western part of the Arabian Peninsula. Mineral studies, geophysical surveys, detailed maps, as well as fieldwork and drilling test samples with chemical analysis indicate the presence of gold. The vast majority of these sites have been examined and studied in different ways during the past fifty years, including sites in the east and north of al-Baha, such as al-Aqiq, Baogbog and Bidah, in addition to the eastern parts of the Red Sea coast on the Tihama Strip, such as Nawan and al-Ahsabh (al-Dabbagh, 2004, 63).

The other mineral synonymous with precious metals is silver (Ag47), of white colour, known since ancient times among Egyptians, Arabs, Chinese and others, who used it in the manufacture of jewellery and in medicine. Like gold, it has always been used in coinage,

but has always been regarded as being of less value. The degree of hardness is 2.5-3, the intensity is 10.5g/cm^3, and the colour white, with metallic lustre. It is found in the form of blocks or tree-shaped and interlocking yarns (al-Shanti, 2000).

In spite of the presence of 256 mines of silver in the Arabian Shield which are registered in the geological database at Saudi Geological Survey (SGS), the vast majority of these mines are small and require in-depth studies to ascertain the true potential of each deposit. However, a small percentage of silver metal is documented in the eastern part of al-Baha near the al-Hajjar mine, and deposits on the western sides of al-Mandaq (al-Shanti, 2000).

Copper (Cu29) has also been used by humans since prehistoric times, and was particularly important as an element in the alloy bronze, fundamental to the era known as the Bronze Age. Many of the most ancient mining sites within the Arabian Shield were related to the extraction and smelting of copper. Copper itself is ductile, malleable and conveys heat, thus it was traditionally an item of choice for kitchenware before its toxicity was discovered in the 20th century.

Several of the occurrences of mineral copper in the KSA have been studied, which have undergone detailed studies by DMMR and a number of geological missions contracted with the Ministry of Petroleum and Minerals Resources, and by a number of private companies that had been granted permits to explore. Most previous studies carried out in al-Baha focused on mineralization in the north-eastern area. The researches demonstrated some copper sites in al-Baha where Rbthan, Shabaltair Gahab are located along the Bidah Valley; in Kesimah site in the north of the region; and some scattered sites at al-Mandaq in the western part of the region (Sahall, 1999).

It can be concluded that the study area was an economic magnet since ancient times thanks to the availability of the number of mineral resources including gold, silver and copper evidenced by geological investigations. These elements were exploited in both Hejaz and Tihama. The presence of these ores was an influential factor in the spread of mining settlements and the diversity of their forms and activity sites.

3.3 Geography

Saudi Arabia is divided into 13 administrative regions. Al-Baha region lies in the south-west of the Kingdom of Saudi Arabia and is the smallest of the Kingdom's regions

(11,000km^2). It is surrounded by two regions, Makkah in the north, north-east and south-west, and Asir in the south (Figure 3.4) (al-Zahrani, 2007).

Al-Baha region is composed of highlands (currently known as al-Sarat rather than the traditional designation of Hejaz) and the lowlands sector (Tihama). It contains six provinces, the most important of which are Buljurshi, al-Mandaq, al-Makhwah, al-Qara, al-Aqiq, Qelwah and al-Baha City, the centre of the region. This region comprises 31 administrative centres and has a population of approximately 411,888 people (al-Saluk, 1996).

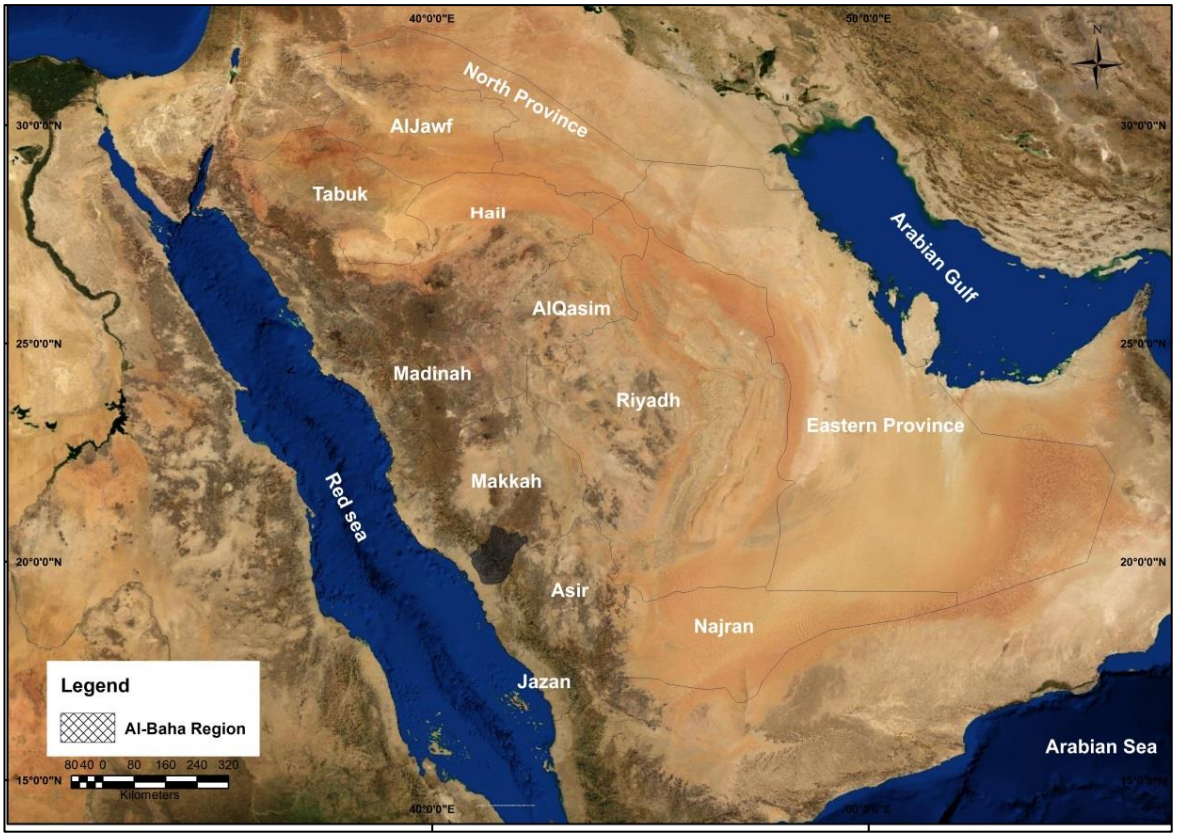


Figure 3.4: Location of al-Baha region

This part of Saudi Arabia is characterized by fertile soil, abundant water and the diversity of its geographical composition. These conditions led to the availability of diverse vegetation, including dense forests, woodlands and pastures, which led to the availability of different herds of animals and flocks of various birds. Thus, this large geographical area was the scene of the continuous activity of humans searching for food and stability.

The al-Sara mountain chain and the coastal plain of Tihama, the most remarkable characteristics of the al-Baha region, were covered with a network of commercial routes which played an increasingly prominent role after the advent of Islam, running between

Yemen in the south towards the western coastal areas of Arabia and joining with the holy cities of Makkah and al-Madinah and onward to Jordan and Egypt. Several early Islamic sites, including gold and silver mines and caravanserai, are located in this part of Saudi Arabia. Later on, people began to settle around such mining settlements such as al-Mamalah, Asham, and al-Asda.

3.3.1 Surface features

Although the region contains two main geographic sectors, al-Sarat and Tihama, there is a vast variation in the surface characteristics of both, and the region comprises a total of five sections. The first formation is the interior plains in al-Sarat, of which the most important terrain is characterized by clay rich represented by al-Aqiq province and valleys alternating with mountainous chains of schist rock. This section is represented by a conjunction area where Thrad and Raniah canyons meet, and circular plateaus of volcanic rocks as in Rafa mountain North of Jarab ravine and al-Harat. These are basaltic eruptions represented by al-Jabjaba, Kara and Jarab. The average elevation of this section above sea level is 1600m (al-Saluk, 1996).

The second formation is al-Sarat called al-Sheaaf, which is also deemed one of the most important topographic reliefs of the region. It is overspread by green valleys and shallow water basins. This is represented by Turbat Zahran valley, which starts from Bidan and Qarnzabi and ends at Turbat al-Bagom. Annual rainfall in this section is more than 350mm. Agricultural terraces have been constructed to overcome the rugged nature of the region, as precipitation is considered to be the traditional method of using water for cultivation purposes (al-Saluk, 1996).

Despite flow of the water running east and west of these plateaus, there is a narrow strip parallel to the slope shoulder unaffected by erosion factors. Most of al-Sarat towns and villages are located in this strip, because it is parallel to the hillock facing Tihama. The most important towns on this strip are al-Mandaq, al-Baha City and Buljurshi, as well as a number of villages. Elevation of this section above sea-level ranges from 2150 to 2500m. This section is considered the best summer resort in the KSA because of the presence of green forests and a moderate summer climate. The area includes several mining sites dispersed around this section (al-Zahrani, 2007).

The third formation is al-Asdar, which is located just between al-Sarat and Tihama. This section is not densely populated except for small villages (Asdar), such as Sdar Musaad,

where banana, coffee and sweet basil are cultivated. The highest elevation of this section above sea level is 450m (al-Saluk, 1996).

The fourth formation located in the Tihama sector is upper Tihama, which lies beneath the previous slope by at an elevation that ranges from 300 to 400m above sea level. Erosion factors have played a role in the formation of its plateaus and large valleys, which are exposed to violent flood waters. The most important mountains of this section are Nakhra hills in the north, upper and lower Shadwan, Nees, Raba and Farah. Farmers depend on flood waters for irrigation. Population gatherings are concentrated on the banks of these valleys and their conjunctions. Examples of these are al-Hajra, al-Shara, Qalawa, Makhwa and Batat. The most important valleys of upper Tihama from north to south are Aleyab, Doqa and al-Ahsabh, which are supported by tens of small wadis (al-Gamdi, 1997).

Finally, lower Tihama comprises coastal plains parallel to the Red Sea with a width of 30-60km. These are formed from granite and sedimentary rocks, such as Nawan, al-Jareen, Yabas, al-Siwaidy and lower Doqa (al-Gamdi, 1997).

Tihama is considered one of the important areas for urban development in the south-west of the KSA. It is an ancient region of settlement and passage of human immigration from Yemen to Syria. It contains valleys with waters following from al-Sarat to the Red Sea and fertile lands on its banks for cultivation, livestock and human settlement during the historical period.

3.3.1.1 Area

As shown above, al-Baha region occupies an area of 11433km^2. It is ruled by the regional Prince. Its administrative domain includes six provinces, of which four are in al-Sarat sector and two in Tihama sector. Each province is linked to a number of administrative centres, each of which is affiliated with a group of villages. The major cities of the region are Buljurshi, al-Mandaq, al-Aqiq, al-Qara are located in al-Sarat sector, while al-Makhwah and Qelwah are situated in Tihama sector (Figure 3.5 to 3.7) (HRH, 1996).

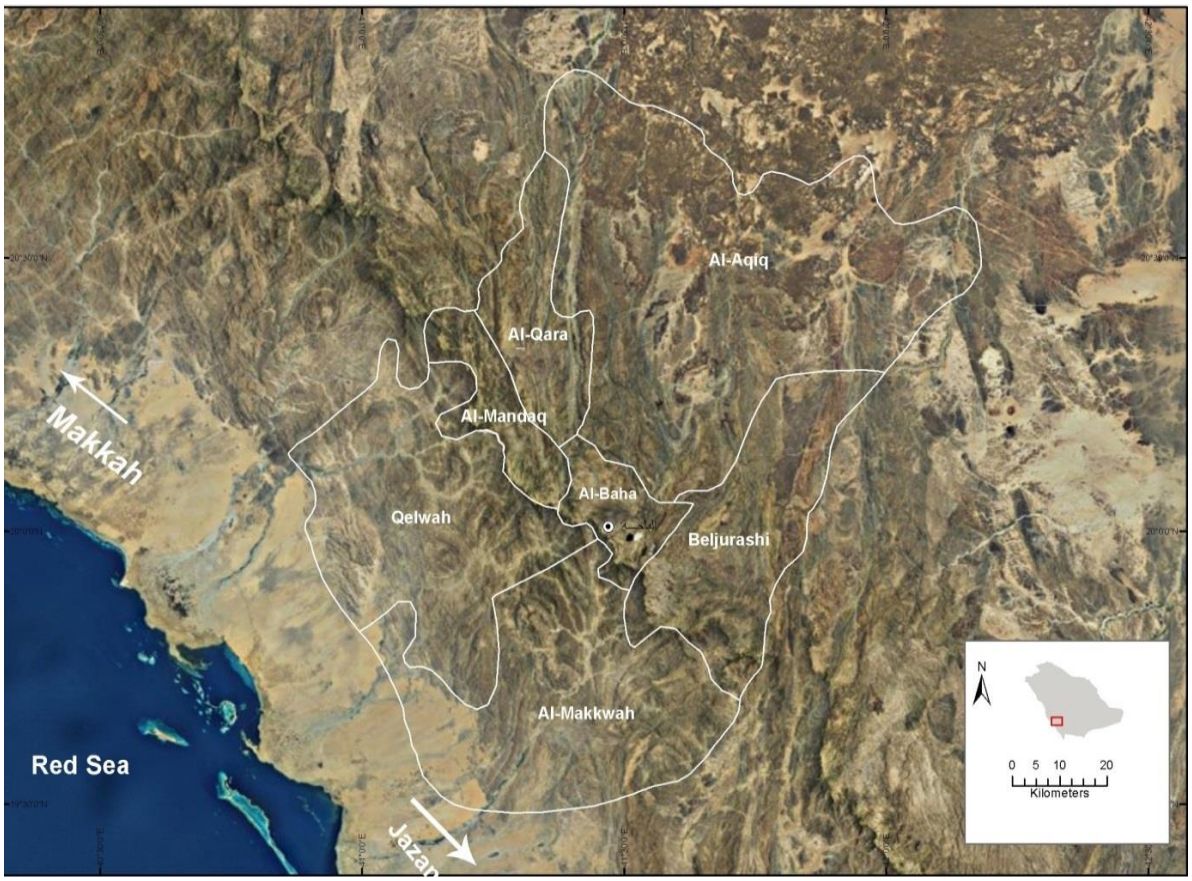


Figure 3.5: Map of al-Baha region showing the major cities in the region (provinces)

Buljurshi province, located 25km south of al-Baha City, is the leading and largest city of al-Baha region and the commercial and economic centre. It includes a lot of archaeological sites, of which the most important may be the old mountainous routes joining al-Sarat and Tihama. There is a weekly folk market in Buljurshi, which is still held every Tuesday (al-Hasel, 1997).

Al-Mandaq province is located on the summit of al-Sarat Mountain (al-Sheaaf) facing Tihama in the north of al-Baha region, approximately 40km from al-Baha City. The province includes various archaeological sites dominant by fortified villages and mountainous roads. There is also a weekly folk marketplace which is still held every Saturday (al-Zahrani, 1988).

Al-Qara is considered one of the key cities from an archaeological point of view, containing ancient mining locations and architectural heritage sites. It is approximately 40km to the north of al-Baha City. Its popular folk marketplace still exists and is held every Wednesday (al-Zahrani, 1988).

Al-Aqiq city is 50km east of al-Baha City. It is renowned for several diverse archaeological sites, of which the old mining locations are the most important, besides other sites containing large groups of rock drawings and inscriptions (al-Zahrani, 1988).

Al-Makhwah city represents the first town in term of area in Tihama sector. It is about 60km from al-Baha City. It has a prominent location on the plateau at the junction of the valleys Rash, Dayan, Saqama, Batat and al-Ahasaba. In this way it integrates with al-Sarat sector in al-Baha region, and represents the largest portion of Tihama. Al-Makhwah shows numerous traces of ancient settlement, headed by Theaeain village and other famous antiquarian features such as Asham village and al-Ahsabh. There is a folk marketplace in the province still held weekly every Tuesday (al-Saluk, 1996).

Qelwah city is considered to be the second town in Tihama sector, almost 80km south-west of al-Baha City. It contains several archaeological sites, of which al-Khalaf and al-Khaleef villages are the most notable. A popular marketplace is still held in the province every Monday (al-Zahrani, 2003).

Figure 3.6: The modern city of al-Baha

(photographed by Abdullrahman al-Ghamdi, 2013)

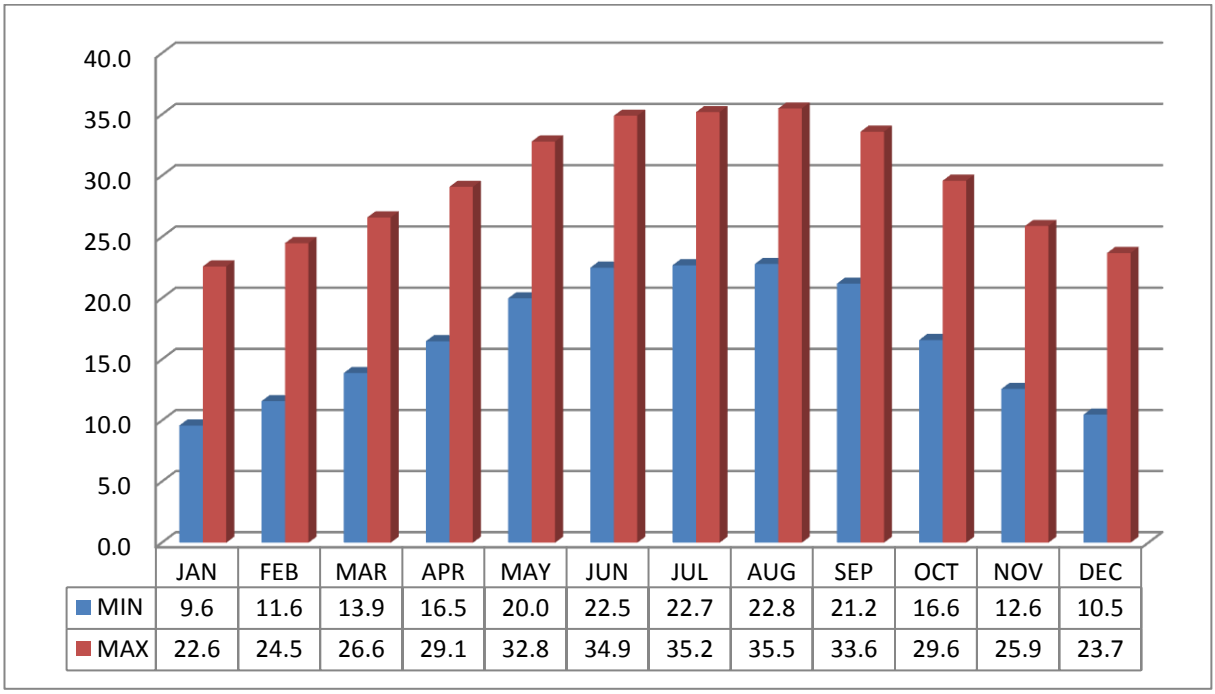
Figure 3.7: Overlooking Tihama from al-Sarat

(photographed by Talal al-Zahrani, 2013)

Generally, al-Baha region played an important role during the pre-Islamic period and the various Islamic eras. This is clear in the spread of the archaeological sites and the inherent folk heritage, which bears special features deemed to be a distinguished mark of its history, and it contains several antiquities associated with fortified villages spread in the region related to historical events and many notable heroes and poets of native tradition.

3.3.1.2 Climate

The climate of al-Baha region is typical of the south-west of Arabian Peninsula. Al-Sarat sector is characterised as moderate in summer time due to its elevation above sea level. Winter is moderate in coldness, and most rain falls in the late spring and early summer. Mild rain also falls because of the warm air masses coming from the Red Sea, causing variable rainfall in the region, resulting in the variety of climatic conditions dominant in al-Baha region (Figure 3.8) (al-Zahrani, 2007). In al-Sarat sector, located at an elevation of 2248m, the temperature reaches up to 20.8^{o} C in July, and average rainfall is 400mm per annum. The rate of relative humidity rises in the mountainous areas, especially in al-Mandaq, to 60% (and 54% in Buljurshi). In Tihama sector, located at an elevation of 60m, the temperature rises in July to 32.6^{o}C, with a rate of annual rain is not less than 150mm, with annual average humidity of 55% (al-Shahri, 2007). With its multi-climatic domains, al-Baha has become a popular tourist resort (Sarat in summer and Tihama in winter)



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MIN	9.6	11.6	13.9	16.5	20.0	22.5	22.7	22.8	21.2	16.6	12.6	10.5
MAX	22.6	24.5	26.6	29.1	32.8	34.9	35.2	35.5	33.6	29.6	25.9	23.7

Figure 3.8: Average minimum and maximum temperatures in al-Baha region during the last 28 years

(Presidency of Meteorology and Environment (PME), al-Baha Station, 2011)

3.3.1.3 Vegetation

Besides the ecological importance of vegetation and the implications it has on human habitation (of archaeological import), it is also the basis of the construction of different buildings in the region, and the facilities related to mining operations. Vegetation provided good fuel for the smelting process, the transportation of raw materials and soil, resulting in excavations of mines as well as other uses. Therefore, a brief overview of the vegetation profile of al-Baha is necessary for the purposes of this study. Vegetation in al-Baha region can be divided into four vegetation sections as follows: mountainous, plateaus, internal plains and valley vegetation. Mountainous vegetation is represented by several forests of dense vegetation cover due to the elevation of the region, abundant rainfall, high relative humidity and moderate temperature. The important vegetation found in this environment includes juniper, athab, shath, wild olive, acacia, cypress, coffee and pine (al-Sharif, 1995).

In the plateaus, high temperatures and little rainfall cause gradual decrease of vegetation cover and drought-resistant plants appear, such as matrimony vine (box thorn), *Harmel peganum* (African rue), cactus (Indian fig, prickly pear) and acacia (al-Shahri, 2007). The most common vegetation of the coastal plains includes lotus jujube (*nabk*), mimosa and tamarisk. In this distinct environment, clear concentrations of dense tress grow (al-Shahri, 2007). Valleys are very fertile due to mineral-rich streams, and vegetation cover is dense in

such areas. Important plant types in the valleys include acacia, cockscomb, doum and palms (al-Zahrani, 2009).

Usage of these vegetation types varies according to the architectural need, for example the lotus (*sidr*) and jujube (*nabk*) are used in building constructions such as houses, mosques and castles. Juniper is important for making building roofs. Jujube is integral to human life in the area, as humans consume its fruit; its leaves feed camels; and its blossoms support bee colonies. Lotus honey is the preferred honey in Arabia and has an exquisite flavour. All of these trees are available in and indigenous to the region, and historically there has been no need to import trees into al-Baha. Bushes such as wormwood and cockscomb have branches and rectangular leaves like jew's mallow, and are used in covering roofs to prevent rainwater leakage. They also have an aromatic smell, and are used for ornamentation and the cleaning of houses (al-Zahrani, 2007).

3.3.1.4 Water Sources

Rainwater is considered the main source for all water resources in the region, but Saudi Arabia has very low rainfall, most of which is lost due to evaporation. Water that does not evaporate moves along the surface of the ground slopes to the mountain passes and valleys for a limited period en route to the sea, and this water is not typically utilised (al-Zahrani, 2009).

In the modern KSA, water for human use comes mainly from desalinization plants, but natural sources continue to be widely used in al-Baha region, particularly for agricultural purposes. Historically, natural water resources in al-Baha were the main source for living, daily tasks, agricultural work and mining activities, as water is essential for breaking down rocks, supporting human populations (e.g. mining labourers and housing camps) and metals processing and purification. The most important historical water sources in al-Baha region are rainfall, perennial valleys, and underground water wells.

Rainfall in the region varies greatly between years; sometimes it is so abundant as to cause floods. Rain typically falls in two seasons: continental rain in winter and seasonal rain in summer. Annual rainfall recorded in al-Baha region during the last twenty-eight years demonstrates that there are large variations in rainfall throughout the year (Figure 3.9) (PME, al-Baha Station, 2011).

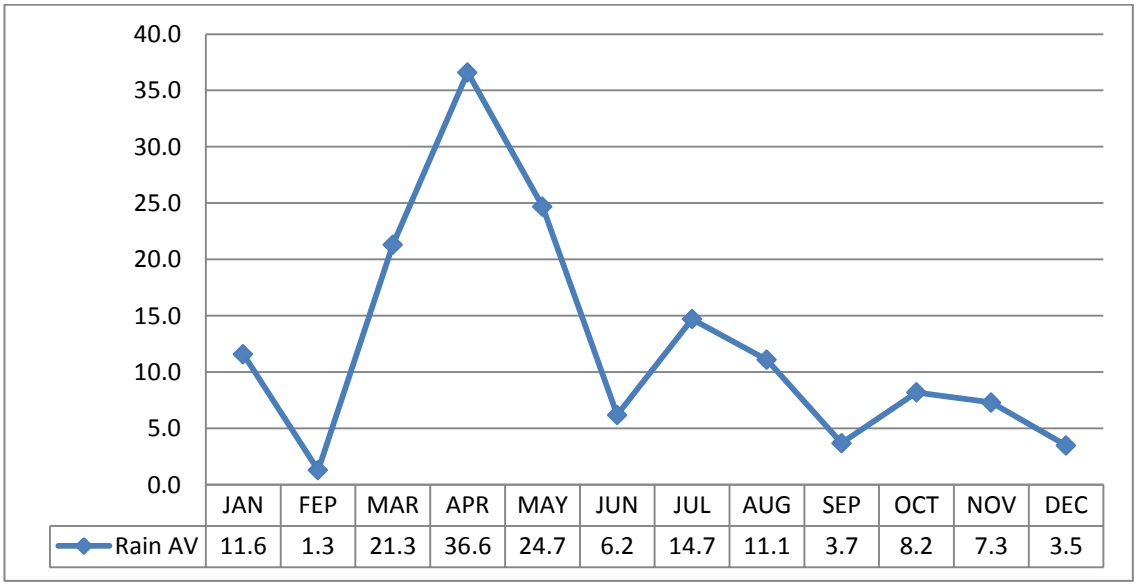


Figure 3.9: Average rainfall by month during the last 28 years (PME, al-Baha Station, 2011)

Valleys are considered the second most important source of water in al-Baha region. The surface area is covered by dense network of stream channels whose properties vary in regard to the number of tributaries and length. These receive a good quantity of water in case of heavy rainfall. The most famous valleys in al-Sarat sector in al-Aqiq city are Thrad and al-Aqiq, which flow in Ranyah valley toward Bishah city and al-Rub al-Khali (the Empty Quarter) desert. The most famous valleys in Buljurshi are Mutaf and al-Atfeen. In al-Baha City, the most famous valleys are Faiq and al-Mald valleys. In Mandaq al-Sadr the most notable Bidah Valley is found, and Tarba valleys in al-Qara (al-Saluk, 1996).

There is also a group of valleys in the western parts sloping from al-Sarat in the direction of Tihama sector and then flowing into the Red sea. The most important of these are al-Ahsabh, Nawan, Kanona, Qrma and al-Shara, joined to tributaries of many valleys in Tihama sector (al-Zahrani, 2007).

Wells are the third most important water source. Studies indicate that al-Baha suffers from a paucity of underground water, which is seasonal and available after rainfall at shallow depths in the sedimentary layers, which are not thick. The population in the region digs wells, some of which may reach 40m in depth. Water is abundant in these wells after heavy rainfall, and becomes scarce when rainfall quantity is less. Some of these wells dry up if rainfall is delayed (al-Saluk, 1996).

In a specialized study, the number of wells in Baha region was estimated to be 15,038 for drinking in both al-Sarat and Tihama sectors. There are also old wells excavated thousands

of years ago, with stones used in their construction, with different areas and medium or large openings. A recent development is artesian wells, dug with narrow openings and covered by metal surfaces to protect water from evaporation and pollution (al-Zahrani, 2009). It was found that there are many buried wells. On the other hand, some of these wells have been re-excavated recently for use in daily life routines and agricultural purposes.

3.3.2 Population and activities

Al-Baha region populations are descended from the Gamed and Zahran tribes. A statistical study conducted in 2007 CE/1428 AH indicated that their combined number is approximately 411,888 (Central Department of Statistics and Information, 2012). Gamed is known amongst historians and genealogists as the ancestor of the Gamed tribe from Azad Shanwa, named Gamed bin Abdullah bin Kaab bin al-Harith. The land was inhabited by his sons or descendants and hence the land was named after the tribe's forefather. In the ancient books it was known as Sarat Gamed. Gamed tribe is divided into three divisions: urban Gamed in al-Sarat, Gamed desert in the foothills of al-Sarat Mountains and desert and urban Gamed in Tihama (al-Gamdi, 1997). Zahran was named after the tribal patriarch Zahran bin al-Harith from Azad Shanwa. Zahran and Gamed meet in Kaab (Figure 3.10). In ancient books Sarat was referred to as Sarat Dos, Sarat Fahem and Sarat Adwan. Zahran is divided into two divisions: urban Zahran in al-Sarat and urban Zahran in Tihama (al-Zahrani, 1996).

Since the Middle Ages, al-Baha has been known as an area that supplies some parts of Arabia with a variety of agricultural crops such as wheat and cereals, raisin and almonds and some handicrafts of woollens and agricultural tools (Ibn Jubair, 1977). Therefore, both sectors of al-Baha (al-Sarat and Tihama) were a nucleus for broader regional activities. Conditions for agriculture and grazing are available and include grass and bushes, especially on hills, ravines, defiles and cultivated plains, particularly in the western, northern and southern parts. In addition, conditions prevailed in which minerals could be mined and raw materials could be processed. It is expected that agricultural crops and mineral production contributed to the commercial activity in the region during the early Islamic era.

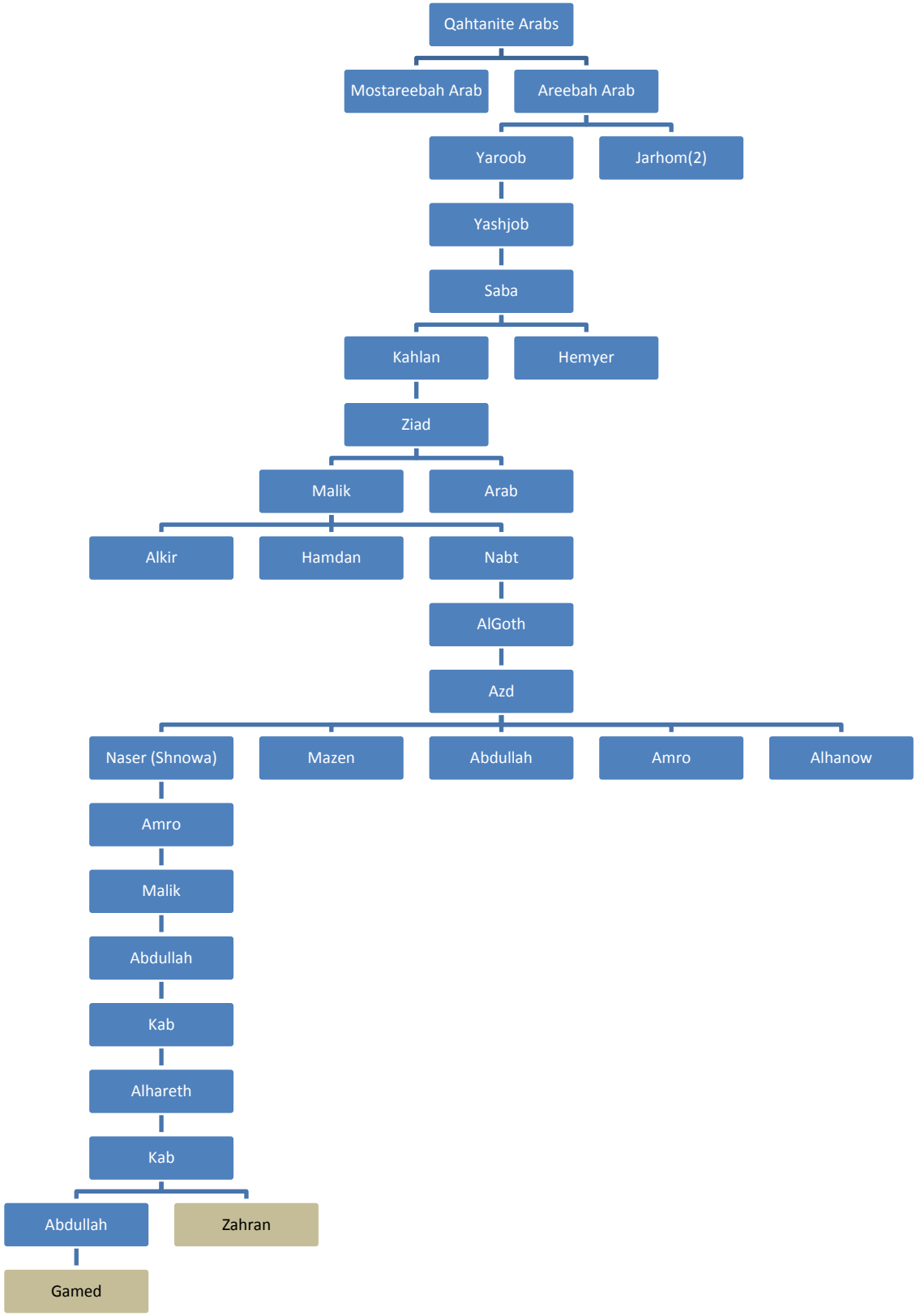


Figure 3.10: Family tree of Gamed and Zahrani

(al-Hasel, 1997)

Naturally, as a verdant region surrounded by desert communities, al-Baha region is fundamentally an agricultural area, and agrarian farming represented a major economic activity in the area throughout history. Its economy was and still depends to some extent on the various agricultural activities which fully meet its own needs and enable the export of surplus to neighbouring cities, especially al-Taif, Makkah and Jeddah (al-Zahrani, 1996).

Large continuous areas of agricultural land are not existent in the region; the cultivated individual areas do not exceed 800m^2, and in the fertile valleys along stream banks they decrease to an average area of 60m^2 in the form of agricultural terraces, which are the most prevalent form of agricultural land use in the area. No village of the valleys, plateaus and mountains of al-Baha region is free of such forms, where people practice their agricultural activity as a main career (al-Sharif, 1995).

The population adopted this method to enable them overcome the steep mountainous slopes, to preserve soil and humidity, and to increase the cultivated area by the erection of terraces (al-Shamrani, 1996). These terraces helped in the provision and retention of water for the longest possible period of time and reservation of the cultivated area of land. Eventually valleys become rich with trees such as lotus jujube (*nabk*), tamarisk and fig. Terraces above the valley watercourse are planted with wheat, barley, corn and some vegetables beside some fruits such as plum, peach, grape and pomegranate, whose quality is famous within the region and throughout the Peninsula. Farming is dependent on wells. These fertile areas are an important source for the local marketing of agricultural products to neighbouring markets in Arabian Gulf countries (al-Zahrani, 2007).

Since most fertile parts of al-Baha region are confined between the mountain masses, villages emerged near water sources and cultivated lands, and farms were established to bring manpower and permanent settlement. This situation led to settlement on valley banks and the building of dwellings and fortresses on high places to provide suitable locations to observe and protect the region during wars and invasions. However, economic activity in al-Baha region has traditionally relied on several foundations, of which arable agricultural production is merely one. Animal husbandry has long been practised in the area, such as the rearing of camels, sheep, cattle and goats. These animals provide their owners with milk and meat, and underpinned a thriving textiles industry. Women in some parts of al-Baha region were noted for knitting rugs and blankets from coloured pure wool, including the premium quality cloaks (*Abaah*) traditionally made of wool, called *Bidiyah* after the Bidah Valley in the east of the region. This is a heavy dress with two sizes, one for men

and the other for women. The dress is made of two separate pieces worked by women then sent to professional tailors who sew these two pieces together with coloured wool yarns. There is also an old tradition of weaving goat hair, producing garments used by the Bedouins in particular, and the optimum canvas for desert tents (al-Zahrani, 2007). The region remains a profitable centre for goat hair trade (goat hair tents are in strong demand, purchased mainly by affluent city-dwellers for their sojourns in the desert or for decorative purposes).

Other local products are the industry of agricultural tools such as ploughing, irrigation and harvesting tools. Traditional activities also include the mining of gold, copper and other metals, as well as epitaph-writing for tombstones; Islamic inscriptions indicate the names of writers in some parts of the region such as Asham, al-Khaleef and al-Ahsabh (al-Zahrani, 2007).

3.3.3 Ancient trading routes

Undoubtedly, the ancient trading routes in Arabia, of which al-Baha is a part, contributed in the servicing of the surrounding regions. This was indicated by explorers, historians and geographers, and their locations were verified by later researchers. These trading routes were interrelated with pilgrimage to Makkah, connecting Arabia to other outside territories from the pre-Islamic period, and they were given a fillip by the rise of Islam in Arabia and its spread beyond the Peninsula.

It is sufficient merely to allude to some routes outside the study region. The most important of these are the road from al-Kufa, known as the Zubaida Pathway (al-Rashid, 1993); the road from al-Bissra to al-Yamama; the road from Damascus (known as the Syrian Pilgrimage Road) (al-Harbi, 1981); the road from Egypt, which is known as the Egyptian Pilgrimage Road (al-Gabban, 1994); and the road from Oman to Makkah (al-Harbi, 1981). All of these roads led to Makkah and (by many subsidiary paths) to Madinah.

Several pathways of pilgrimage cross al-Baha region, taking pilgrims from Yemen to the holy places (Makkah and Madinah). This helped in the emergence of trading activity which was reflected in the growth of the local economy, the expansion of construction and population activity, and the planning and development of the villages and towns of the region.

Besides these main roads, other internal sub-roads stemmed from these to connect between villages, towns and local settlements. These external and internal roads contributed in the

linkage of Arabia, externally and internally. For instance, near Bidah Valley in the northern-east, sub-roads were utilised, particularly the Yemen Road, which passes several settlements (al-Thenayian, 2000). These internal roads formed a route for trade caravans and pilgrims, and were later known as Caravan Roads. Some of these start from al-Baha, specifically from Ragdan to Irq Bani Sar, then Madkhala, Bidah Valley, Bathan, Gatmiyah, Kharasan, Mashooqa, Qara, Susiya, White Shubae, Upper Mabae, Lower Mabae and then to Turba. These were formerly camel roads, and are called Camel Pathways (al-Zahrani, 2007).

Eventually, it became necessary to have a real road for the trade caravans, hence the road originated in the north-east of al-Baha region, part of the main road connecting al-Taif to the southern parts of Saudi Arabia. Al-Baha region could not easily be reached by car until a road was constructed from al-Taif to Bidah Valley, and it was itself initially a difficult pathway. It starts at al-Abtah market in Bidah Valley, where passengers are received and welcomed, trading goods are exchanged, and pilgrims pass to and from Makkah for Hajj and Umrah (al-Saluk, 1996). This road had been extended and improved to serve the remaining villages of the region, whereas Bano Amir from Zahran tribe built the road from Bidah to al-Irq Mountain and al-Zafera. Bano Adwan and Bano Hurair North of Zahran also built the road to Shumrakh and then to al-Taif (al-Zahrani, 2007).

These roads in al-Baha region were of great importance in the location of buildings, and the existence and distribution of folk marketplaces in the region is a clear indication of the commercial activity distinguishable in the area, manifesting the benefits of the utilisation of the roads.

3.3.4 Folk commercial marketplaces

These are forums or gathering places traditionally held before Hajj in the pre-Islamic and Islamic eras, which played an important role in Arab religious, cultural, economic and social life (Figure 3.11). The marketplaces were meeting points of trade caravans, and were protected by various legal mechanisms.

Diversification of crops and the difference of seasons in each town of Arab land helped in holding marketplaces in different times and places, representing a diverse market economy (in the traditional sense), such as frankincense in Zafar, Hijar and Bahrain; garments and swords in Yemen; tanned leather in al-Taif; and grapes, oil, raisins and silk textiles in the

Levant. Tradesmen used to take residence in the marketplaces while selling and buying until they concluded their business (al-Afgani, 1993).

However, these seasonal commercial marketplaces have been improved and converted into specialized markets not limited to the process of buying and selling; they became clubs where social and political affairs are conducted and laureate poets and writers compete in poetry and verse. Arabs traders and consumers move between these seasonal marketplaces throughout the year. There are almost twenty major markets throughout Arabia, and they play a key role in upholding the social cohesiveness of Arabia and in preserving traditional culture in the modern world. Traditionally, the main function fulfilled by the markets was to enable individuals to exchange goods and to meet communities' need to obtain imported goods in return for the surplus of the local products (al-Zahrani, 1988).

Figure 3.11: Distribution of local markets in Arabia continuing from the pre-Islamic era

(after Al-Afgani, 1993)

It seems that people of al-Baha region were pioneers in holding periodical markets and rooting them in their economic transactions. The ancient resources indicated that this economic practice goes back to the first half of the 13th century CE/7th AH. Ibn al-Mujawir in his statement about the road between Sada and al-Taif and description of the route

stations located in al-Baha region stated that “It is a market held on Friday and it is the market when people gather in the night of Friday” (Ibn al-Mujawir, 1954, 37).

This shows the effective role of the pilgrimage routes crossing the region and the formation of the road stations and their multiplicity. Many of these stations were actually trading markets for selling, buying and exchange of goods. The phenomenon of holding trading markets, particularly the periodic markets held on specific days of the week, still exists in al-Baha region (as mentioned above) as well as in all regions in the south and west of the Kingdom. It was a custom among tribes of Gamed and Zahran region that every tribe holds its special trading market on a known day of the week. The market was often held inside the biggest village or nearby. Besides this financial interest, there was a need for a social gathering of people individually or in groups, which reflects the importance and role of the market in fostering the ties of the members of single tribes, and between tribes (al-Thenayian, 2007).

The Sarat and Tihama people had historic and widespread fame in trading. Ibn al-Mujawir added that “when they [people of Sarat and Tihama] entered Makkah, they fill it with bread made of wheat, barley, fine flour, ghee, honey, sorghum, millet, almonds, raisins and the like” (Ibn al-Mujawir, 1954, 27). This commercial dealing between al-Baha and the cities of the Hejaz region continued for a long period. In addition, the Swiss explorer Burckhardt described the Makhwah town, stating in the year 1814 CE/1230 AH that Makhwah merchants traded with Makkah and Jeddah (Burckhardt, 1829). The enduring architectural remains of markets remains in Asham settlement are probably a strong evidence of the holding of a market in the region; indeed, it is inconceivable that the settlement did not have a market as a conduit for buying and selling, given the diverse activities practiced there and the large population, as elaborated in subsequent chapters.

Some resources stated that the Azd tribe had a market in Tihama called Hobasha, which is among the most famous Arab markets of the pre-Islamic era (others being Okaz, Ze Majna and Majaz). The Prophet Muhammad visited these markets as steward of the business of Khadeeja bint Khouwailid, later his wife (al-Hamwi, 1980). The Companion Hakeem bin Hazam narrated that “I have seen the Prophet Muhammad attend these markets and I have bought drapery from their textiles” (al-Azrqi, 1996, 34).

Al-Baha people used to visit these markets for selling and buying, as in Makkah. Al-Azrqi reported that: “When the caravan arrives from al-Sarat and al-Taif and other places, it carries wheat, grains, ghee and honey and distributes between the two lands where these

items are sold" (al-Azrqi, 1996, 124). Hence, it is no surprise to find the remains of pottery in the marketplace which was located on a high plateau on the banks of Qanona valley, which is famous for its flowing water and the density of its trees and plantations. There are also remains of circular grinders used to grind gold in a place west of the marketplace indicating the possibility of gold trading in the markets of the region.

The location of Hobasha market near Asham settlement in the North Tihama Mountains, and the place of the famous *athmad kohl* (eye liner) of Arabia, caused the market to be an important market for metal products according to al-Hamdani (1979). Hobasha market played a great role in commercial activity, and as it was located between mining locations (Asham and al-Ahsabh) associated with gold, lead and *athmad kohl*, it presumably was engendered by and promoted metal products, which were the most important assets there. Grains, dates and leather were also important items in the market, as the valley was famous for its abundant palm trees and grains. The market was also famous for the quality and popularity of its textiles, as mentioned previously.

Despite the vast changes wrought on Arabia by the coming of Islam, and by the coming of the modern globalized economy, some of the traditional markets continue to exist much as they did thousands of years ago, conducting trading transactions, the exchange of goods and services, and facilitating the maintenance of family, tribal and regional identities based around meeting to buy and sell. Nevertheless, many other markets dwindled and died because of the changing nature of Arabian society and economy, reflecting and shaping changing concepts of social and political life.

However, it appears from the above geographical profile that the study area was qualified to support large populations and their activities due to several factors. Firstly, the geographical and environmental diversity of the region (al-Sara and Tihama) led to diversity in climate, vegetation and water resources. Therefore several industrial activities including mining were prominent and implemented locally in settlements. Secondly, the trade routes and local markets were commercial outlets for productions of the region. The roundtrip of caravans and contact with local populations led to the expansion of architecture and commercial activity, which is positively reflected in the improvement of architectural planning of the towns and the steady increase in the economic activities of the region through three routes linking Yemen with Makkah passing through al-Baha region. Commercial markets also flourished in the region as in the rest of Arabia, functioning as seasonal forums and meeting places in addition to their economic roles in supply, demand,

buying and selling. This economic activity continued, based on mineral wealth and other products in the region, under the auspices of different political systems during the study period.

3.4 History

The south-west of Arabia was the scene of multiple human activities during the ancient ages and several civilizations rose and fell in this area. However, unlike the neighbouring Nile and Mesopotamian civilizations, with the possible exception of the Yemen the Arabian Peninsula did not become important in a global sense until the emergence of Islam.

Despite the civilizational role of al-Baha in the prehistoric period and the historical eras of the southern Arabian kingdoms, this historic record will focus on the Islamic period (7^{th} to 21^{st} century CE/1^{st} to 15^{th} AH), with some regard to the most prominent factors that founded Arabia culturally and economically in the pre-Islamic period.

Although the Islamic mission was multi-ethnic from its inception – with Sephardic Israelites, Abyssinians, Romans and Persians being prominent among the Companions of the Prophet – the fact that Arabia was the cradle of Islam meant that the Arabs had great prominence in the affairs of the Muslim world and in geo-politics during the Prophetic era, the rule of the Pious Caliphs, and the Umayyad and Abbasid dynasties. Al-Baha region was an important part of Arabia throughout the period, and after a disconnect caused by the collapse of late Abbasid authority (explored later in this thesis), it re-emerged as an economically important zone of the Ottoman Empire and remained so into the modern Saudi state; there has been permanent stability around some mining settlements, and a lot of recent re-investment in gold mines. In addition to that, the region was a natural conduit of commercial movements that contributed to the social and political history and economic status of Arab and Islamic civilization.

Despite its Arab-Islamic designation of *Jahiliyyah* (‘The Era of Ignorance’), referring to the deviation from Abrahamic monotheism by the descendants of Ismaeel/Ishmael (Sedqi, 1988, 313), the pre-Islamic period in Arabia was one of diverse intellectual and cultural creativity, as evidenced by many visible antiquities in Arabia.

Al-Baha area, which is known as the land of Gamed and Zahran, with its sectors al-Sarat and Tihama, was continuously inhabited during pre-Islamic ages, in which the area lived

under the shadow of Arabian paganism, characterized by the predominant worshipping of idols and images such as *Bait ze al-Khalsa* (‘Abode of Salvation’), *Sanam ze al-Kafeen* (‘Idol of the Dual Palm’) and *Sanam ze al-Shara* (‘Idol of Malice’) (Ali, 2006, 253).

The most prominent pre-Islamic civilizations of Arabia were the Southern Kingdoms, which extended from the beginning of the second millennium BCE until the advent of Islam (in the middle of the first millennium CE). These Kingdoms comprised the Minaeans, Sheba Qataban and Hadramout. The presence of large commercial cities such as Saba, Najran, al-Fao, Domaht al-Jandal and Thaj were the most important centres of this period. Moreover, existence of land trade routes linking between these major cities were the other mark of these kingdoms, and one of them passed through al-Baha area (al-Ansari, 2009).

3.4.1 The Prophetic Era (571-632 CE/53 BH-11 AH)

Islam began with the Revelation by Allah to His Prophet, Muhammad, in Makkah c. 613 CE. Following a period of intense persecution by the pagan Makkah elite, the Islamic state was established in al-Madinah in 622 CE/1 AH. All Arabian tribes quickly became Muslim during the subsequent decades. The Arabs gained a sublime understanding of Abrahamic monotheism with the coming of Islam, and gained greater cultural stature and attainment as a result. Al-Baha was converted to Islam in 628 CE/7 AH and was administratively affiliated with al-Madinah, the capital city of the early Islamic state. Delegations from the area came to al-Madinah and later Makkah, and established links between the area and Islamic communities throughout Arabia and beyond (Ibn Saad, 1985). Thus, the people of al-Baha were Muslim from the inception of the Islamic state, and contributed to the Companions of the Prophet.

3.4.2 The Pious Caliphate (632-660 CE/11-40 AH)

Following the death of the Prophet Muhammad in 632 CE/11 AH, he was succeeded by his Companions Abu Bakr (r. 632-634 CE/11-13 AH); Omar Ibn al-Khattab (r. 634-643 CE/13-23 AH); Othman Ibn Afaan (r. 643-655 CE/23-35 AH); and Ali Ibn Abu Talib (r. 655-660 CE/35-40 AH); collectively, these are known as the *Khulafah Rashidun* (the ‘Rightly Guided’ or ‘Pious’ Caliphs) (al-Yaqubi, 1999).

During the lifetime of the Prophet, the whole of Arabia was largely Muslim; Abu Bakr and Omar Ibn al-Khattab re-entrenched Islam in Arabia (the former quelled an apostate uprising immediately after the death of the Prophet), and the Arab-Islamic Empire was

extended into Mesopotamia, the Levant and North Africa (Egypt and the Mediterranean coast as far as Tripoli in Libya). Literally spearheading this movement, Arabian tribes migrated into the various countries occupied by the Muslims and had a profound cultural (i.e. religious) impact.

Despite rich literary evidence of tribesmen from al-Baha and their exploits outside Arabian Peninsula, there is a noticeable lack of literary information about al-Baha itself during this period. This reflects the fact that although Arabs remained integral to the Islamic state, Arabia itself became increasingly less important as the centre of Islamic governance was transferred from al-Madinah to Kufa, then to Damascus during the Umayyad Caliphate, then to Baghdad during the Abbasid Caliphate, then to Cairo during the Mamluk state, and finally to Istanbul during the Ottoman period. Arabia lost its supremacy and political importance, and the concern of successive regimes over the Peninsula itself was limited to the Hejaz, specifically the *Haramayn*, the two holy mosques in Makkah and al-Madinah, and the ports on the western coast (particularly Jeddah). The transfer of the locus of power outside Arabia led to a long period of silence concerning al-Baha during the Umayyad and Abbasid periods, with some exceptions mentioned previously.

According to historical sources, Arabia was an abundant source of minerals, which formed a significant part of trade between the Hejaz and the Levant and Iraq. There is no doubt that these minerals were transported from mines, especially in the south. There is historical evidence of mining works from the biography of Omar bin al-Khattab trading in gold and silver (al-Balathri, 1991).

3.4.3 The Umayyad Period (660-750 CE/40-132 AH)

The Umayyad dynasty, founded by the Companion Muawiyyah Bin Abu Sufyan, with its capital in Damascus, was preoccupied by military expansion, particularly under the viceroy al-Hajjaj Bin Yusuf (d. 714 CE/95 AH), and the financial exploitation of provincial regions in Central Asia, which fuelled the Abbasid revolution that culminated in 750 CE/130 AH. Unfortunately, Umayyad texts contain little specific information about the south-west of Arabia, with which al-Baha was administratively affiliated in Umayyad governance.

Historical sources refer to the Caliph Abdul Malik bin Marwan benefitting from Arabian ores with regard to minting some gold coins, including from the Cradle of Gold. The southern Arabian mines were one of the strategic concerns of the Umayyad state, which collected mineral wealth and transferred it to the Levant (al-Jasir, 1971). The presence of

numerous mines in Arabia, particularly in the south of the Peninsula, resulted in the establishment of some mineral industries including extracting and production. These mining works required intensive labour, as well as relatively advanced knowledge of mining and manufacturing technology. This is reflected in the Hobasha market, 90km southwest of the study area, which was known as a slave market and was probably used to source labour for the mines (al-Hamawi, 1979, 2/210). The number of slaves increased significantly in the Hejaz and Yemen during the Umayyad period and beyond. One Umayyad caliph was recorded to request that the governor of Makkah buy a number of slaves with their wives and assign them to Wadi Bisha (east of al-Baha) for use in projects including mining (al-Hamawi, 1979, 5/158).

3.4.4 The Abbasid Period (750-869 CE/132-256 AH)

The Abbasid dynasty was erected upon the defeat of the last Umayyad army, whereby Damascus was conquered. The Abbasids subsequently built and settled in Madinat al-Salaam ('The City of Peace') in Iraq, which came to be known by its Persian name of Baghdad. In contrast to the highly centralized Umayyad oligarchy with military provincial governors, the Abbasids promoted a system of provincial autonomy (initiated by Harun al-Rashid; Sourdel, 1970, 118). A scion of the Umayyads who escaped liquidation by the Abbasids established an Umayyad emirate in Iberia (al-Andalus), which despite later styling itself a 'Caliphate' had generally cordial relations with the rest of the Muslim world, and paralleled the similar Abbasid civilization in Baghdad in cultural refinement and the advancement of learning. This, along with the rich cultural patronage of the ruling elite, resulted in a plethora of historical and geographical works about the numerous Muslim provinces and beyond. Even as the Abbasid dynasty ceased to have effective power, becoming the prisoners of the Buwayhids and later becoming ceremonial figures of the Seljuks before their ultimate demise at the hands of the Mongols in the 13th century CE (al-Zaylai, 1981), the cultural life of the Muslim world in Arabia was rich. Abbasid-era travelogues describe Arabia in terms of places, houses, political diversity, generosity and religious status.

One of the foremost Abbasid-era travellers was an Iberian, Ibn Jubair (of the 12th century CE/6th century AD), who travelled to the al-Sarat people, partially incorporated in al-Baha region. Ibn Jubair described the al-Sarat agricultural activities, villages and commissariat, and the gifts they offered to the people of Makkah (Ibn Jubair, 1977, 110). Ibn al-Mujawir

(of the 13th century CE/7th AH) also mentioned numerous aspects of social life in the region (which he personally visited), noting that:

> There is a place built of stone and gypsum in each village and everyone had storage to safeguard his possessions and only takes his daily food. Every village is ruled by a sheikh (chieftain), old in age and great in mentality and perspicacity, and when he judges any matter nobody shares with him their opinion or contradicts his rule (Ibn Mujawir, 1951, vo1, 27).

Ibn al-Mujawir in his travel described al-Sarat, and the homes and fortresses of its people, who had great trust in and dependence on each other. His description was a testimony that they had not been affiliated to any certain authority; only the leaders of the tribe had power and sovereignty. His account is an indication that the people were knowledgeable of the arts of architecture and building and had mental capacity in the management of their affairs. This account tallies with the architectural formations dominant in the area, especially with regard to the materials and the qualities of homes and places, relevant to concurrent to the area of concern to this study, no doubt underpinned by the trading and pilgrimage routes upon which these travellers journeyed.

The Islamic inscriptions found in a large number of scattered archaeological sites in the study area belong to the early Islamic and Medieval ages. These inscriptions extend from 779 CE/157 AH to 1185 CE/581 AH, engraved with the prevailing Kufic script. Their contents comprise Quranic verses and religious supplications; some of the latter pray for Abbasid caliphs (al-Thenayian, 2007). In addition, quantities of ceramic and glass pieces have been discovered around several mines and mining settlements in the region. The manufacturing and style of decoration of these artefacts are close to the Samarra style in Iraq (al-Jasir, 1971). Moreover, chemical analysis and carbon dating of quantities of slag from some mining sites such as Mashokah, al-Kesimah and al-Aqiq also proves that these mining sites were existent during the Abbasid period (Hester et al., 1984, 115-142).

Consequently, all prior field evidence confirms that the study area was deeply linked to the capital of the Islamic state in Bagdad, and that it was a source of materials and wealth to the Abbasid state.

In this particular period, several mines in south-west Arabia were invested in, especially mines of gold, silver and copper. It is obvious that the complex processes involved dictate that the mining industry does not flourish except in places of stability, security and the availability of raw materials and labour. Therefore, the Abbasid government was keen to

send teams to those lands to work in the field of mining. This is evidenced by the presence of hundreds of old mining sites distributed near the trade caravan routes in the Arabian Shield, in the south-western part of the KSA, and that this was accompanied by cultural development, attested by the emergence of some writings and inscriptions that date back to this period.

Most of the field studies conducted on samples of slag and pottery in the mining sites in the south-west of Arabia refer these mining works (including mining settlements in al-Baha) to the years 720 to 798 CE/103 to 182 AH, indicating continuity from the Umayyad to Abbasid periods (Smith, 1940). There is no doubt that mining was increasingly important during this period as the borders of the Islamic world began to stabilise and the economic integration of the provinces accelerated under the *Pax Islamica*. The treasury of Baghdad needed gold ores to produce currencies as well as other metals for weapons and domestic uses. This is confirmed by the presence of minting houses in Arabia, especially in Makkah and Tihama (Athar), and in Yemen, and these probably depended on exports from mining settlements in the study area. The minting houses were almost certainly distributed more widely within the Peninsula (otherwise the establishment of minting houses in the south-west of Arabia for a predominantly extra-Arabian Islamic economy would not make logistical sense).

3.4.5 The Ottoman Period (1299-1923 CE/693-1341 AH)

The Ottoman state reached the peak of its glory and power during the 16th to 17th centuries CE/10th and 11th AH. The empire had expanded to include vast areas of the three continents of the old world: Asia, Africa and Europe. The heart of the Ottoman Empire lay in Asia Minor, south-east Europe and the south Mediterranean coast (al-Hasan, 2009). Following the conquest of the Mamluk Sultanate by Selim I, by 1517 CE/923 AH the Ottomans came into possession of the Hejaz and the Sultans were able to proclaim themselves Caliphs. The Ottomans allowed the Hejaz a large degree of autonomy under Sharifian appointees, a system which came to be utilised throughout Arabia. However, outside the Hejaz, Ottoman authority was not clear-cut; in reality, the affairs of the Bedouins of Arabian deserts were not of concern in the luxurious Topkapi court, which oversaw the disastrous and "incompetent" decline of the Ottoman state, during which the "arteries of bureaucracy hardened", corruption became endemic, and the economy was stifled during the 17th to 18th centuries (Kennedy, 1998, 10-7). Prior to the late 19th century CE/14th century CE, the Arabs of the Peninsula enjoyed *de facto* independence, with the

exception of Ottoman punitive expeditions launched from Egypt against the nascent Saudi state (discussed below).

The Ottomans attempted to reverse this decline with Turkish modernization (*Tanzimat*) during the 19th century CE and the pan-Islamic project of the Sultan Abdul Hamid II (r. 1876-1907 CE), which resulted in increased Ottoman attention to the provinces of Arabia, enabled by improved communications due to the Suez Canal (from 1869 CE/1268 AH) and the Hejaz railway (begun in 1900 CE/1318 CE). The Ottoman state was sending military supplies to Arabia from 1870 CE/1287 AH via the Suez Canal to its garrisons in Arabia, including in al-Baha region, as well as for its wars in Yemen (al-Hasan, 2009). The Hejaz railway, a *waqf* (charitable) endowment ostensibly for the benefit of pilgrims, was accompanied by increased administrative attention in the running of the *Haramayn* and the appointment and salaries of officials, alongside extended military reach by the Ottoman armies into Arabia. Railways were integral to military thinking under the German model during this time (later expressed in the Schleiffen Plan in WWI), and Prussian officers were hired as military advisers by the Sultans from the early 19th century CE.

Increased Ottoman penetration of Arabia via sea routes and railways was not solely for the symbolic importance of the *Haramayn* (and the pan-Islamic support the Ottomans benefitted from among Muslims across the globe due to their status as Caliphs and Custodians of the Two Holy Sanctuaries); mineral resources were an important consideration of the Ottoman Empire in Arabia, and there is no doubt that sending some experts to look for these metals in Arabian Peninsula was a concern of the Ottoman rulers. The European empires whom the Ottomans were attempting to emulate exploited mineral wealth throughout their colonies; thus it was natural that they would seek to exploit the minerals of their own "possessions" in the Middle East. One example of this is the aforementioned Burton expedition, sponsored by the Khedive of Egypt, Ismail I, to prospect for gold in Midian in the 1870s (Farwell, 1963/1990, 327-331). This expedition arrived in western Taif, near al-Baha (chapter 2.3), but it seems that the dysfunctional political situation in the Gamed and Zahran lands made it impossible to identify the mining sites there.

This situation enabled the Ottoman state to impose its supremacy on the western and southern parts of Arabia via its clients, including the Sharif of Makkah in the Hejaz and the Rashid tribe in Najd (al-Shehri, 1998). The increased Ottoman presence was initially of great utility to the Ottoman appointees, but was resented by those who did not wish to be

controlled by the distant Turks. The Ottoman Empire was keen to take advantage of the mineral ores available in the south of Arabia that was seen as the welfare basket of Arabia.

3.4.6 The Saudi Era (1744 CE/1157 AH to present)

The Saudi dynasty originated in the central area of Arabia. In the middle of the 18th century CE/12th AH, Arabia was divided into several parts: Najd region in the centre, under the influence of families such as al-Saud in al-Direah; al-Ahssa region in the east, ruled by the family of Zamil al-Jabri, followed by Ottoman authority and rule of Bani Khalid (Abdullrahman, 1981). The Hejaz region, including the area from the eastern shore of the Red Sea into the centre, from Asir Tihama in the south to al-Aqaba in the north, was under the rule of the Makkan nobility (*Ashraf*), under the auspices of the Ottomans (al-Ajlani, 1993). As has been noted, during that period a lack of religious and political cohesion prevailed throughout Arabia.

The most significant intellectual movement to arise in Arabia during recent centuries was the reformism of Sheikh Mohammed Bin Abdul Wahhab in the 18th century CE against the perceived heterodoxies and superstitious which he argued had taken Muslims away from the fundamentals of the Islamic creed. Following initial rejection by his own society, the Hanbali jurist Mohammed Bin Abdul Wahhab contracted an alliance with Mohammad bin Saud, the Governor of al-Diraeh, in 1744 CE/1157 AH, in which the latter permitted the former to propagate his doctrine of a return to pure *Tawhid* (monotheism) and pledged to support, defend and assist him (al-Othimen, 1999). Contemporary historians typically assert that the Ottomans were dedicated to the destruction of the Saudi-Wahhabi movement from its inception (Abdullrahman, 1981), but it was only after the Saudi conquest of the Hejaz in 1803 CE/1221 AH, a direct challenge to Ottoman sovereignty, that the Ottomans mobilized against them.

The Ottoman viceroy of Egypt, Mohammed Ali Pasha, launched the punitive expedition to recover the Hejaz for the Ottomans and destroy the Saudi movement. In 1815 CE/1230 AH the Ottoman forces (comprised chiefly of Turks and Libyans) moved from Makkah to Bisilah site near al-Taif, where the Saudi army lead by Abdullah bin Saud and his brother Faisal camped. The Saudi forces included numerous tribal cohorts, including Gamed and Zahran (the people of al-Baha), Asir, Shamran and others (Burkhart, 1829).

With the nascent threat of direct Ottoman control, many Arabian tribes attempted to separate and form independent governments. Consequently, Gamed and Zahran land found

itself between two discordant governments: the Sharif in the Hejaz supported with arms and money from the Turks, and the Asir government in the South, attempting independence from the Ottomans and to repel the Turkish invasions and expansion of influence (al-Zahrani, 2007). Thus, the land of Gamed and Zahran, between the Sharifian and Asir governments, experienced great instability during the whole period of the conflict, and both tribes suffered economically and in terms of deaths and casualties.

With the First World War, the Ottomans were forced to delegate power to the Ayid family (rulers of Asir), being absolutely preoccupied with the Arab Revolt in the Hejaz as far as Arabia was concerned (al-Riyahni, 1972). After subsequent years of political instability the region came under the rule of Abdul Aziz Abdurrahman al-Saud (founder of the modern Kingdom of Saudi Arabia) in Najd, who then unified all of the area that was known as the 'Kingdom of Nejd and Hejaz' to become the Kingdom of Saudi Arabia in 1932 CE/1351 AH.

After the establishment of the KSA many studies on mining appeared. Those provided by the Ministry of Petroleum and Mineral Resources, begun with the establishment of the Saudi Arabia mining syndicate from 1932 to 1950 CE, resulted in the redevelopment of the old mines in south-west Arabia and examination of the effectiveness of the rest.

In addition, geological and geographical maps for all regions of the KSA, including al-Baha, were prepared on a scale of 1:500000 in 21 maps, enabling the General Directorate of Mineral Resources in 1961 to map 253 mining sites on a scale of 1:100000. The Kingdom was keen to take advantage of the experience of some experts in mining, such as Blanckenhorn (1914) and Twitchell, and this led to several ancient mining sites being earmarked for investment. By the year 1973 CE/1393 AH a number of specialist studies for all regions of the KSA were presented with maps of mineralization belts, cities, and volcanic areas, hydrologic and geophysical features. Later, several discoveries and mining explorations were conducted in the study area.

Additionally, archaeological investigation of the Kingdom was encouraged from the early 1970s onwards with the establishment of GDAM, a body responsible for antiquities in the Kingdom, followed by other stages related to administration attachment (Chapter 2.6). This facilitated archaeological works by many researchers and archaeologists related to mining in this period. For example, the contributions of al-Jasir from 1968 to 1987 recorded many mining sites across the KSA. CASP is the biggest archaeological achievement which recorded more than 4,000 archaeological sites, including the mining sites in al-Baha.

Furthermore, three archaeology departments in different universities were founded and archaeological sites were opened up for international missions.

After this historical presentation of the region, it can be concluded that the mines in the region were exploited and mining was practised during the early Islamic century (7th century CE), the era of the Prophet of Mohammad and the Pious Caliphs, then under the Umayyad and early Abbasid states prior to a decline before resumption under the Ottomans, who sent missions to search for minerals but whose project was aborted due to the First World War. The modern Saudi state encouraged investment in these mines, in addition to encouraging archaeological studies in this area to preserve the historic inventory of these mining settlements.

3.5 Conclusion

This chapter has reviewed the natural environment of al-Baha region with all its components in terms of geological formation and mineral ores, and geographical location, terrain, and surrounding natural and climatic conditions, as well as economic and cultural resources. These factors played a key role in social life since the dawn of its creation. The al-Sarat mountains and its highlands as well as the valleys and plains of Tihama have sustained human life for thousands of years due to availability of water resources and mineral wealth, enabling general stability around the large settlements, particularly mining ones. Also, this chapter has presented a historical profile of al-Baha region, especially since the advent of Islam.

In regard to mineral resources in the study area, it has been shown that al-Baha is between areas located on the Arabian Shield where various deposits of metals exist. Therefore, the presence of these ores was an influential factor to attract the population of Arabia since ancient times, and archaeological evidence is still clear on the surfaces dating from the early Islamic period and before.

Geographical features such as varying terrains in the area (al-Sarat and Tihama), diverse vegetation and the different climates and sources of water were factors in the growth of populated settlements, used for activities associated with the exploitation of mineral ores and other activities such as agriculture and handicrafts. The trade routes that criss-crossed the region stretched from southern Arabia to the north and east through the Hejaz region (Makkah and Madinah), passing Arab cities and markets and contributing to the economic and cultural diversity of the fabric of regional society. Therefore, the existence of these

routes and markets, accompanied by cultural and social overlap, played a key role in establishing common commercial and cultural relations between al-Baha and neighbouring communities.

In addition, the mining settlements such as al-Aqiq, Asham, and al-Ahsabh in the past were scattered centres surrounded by those trade routes and some of them contained central markets serving the surrounding areas and stations for pilgrims coming from southern Arabia. However, today these settlements have merged into the large city of al-Baha, and modern generations preserve the names of those settlements without knowledge of the purpose of their existence, which dates back more than 12 centuries.

Historically, the study area was from the pre-Islamic period a scene of political and cultural conflict. Politically, it was fluctuating between the tribal systems of the Kingdoms of Yemen, al-Hirah in the north-east (Iraq), and al-Ghassanid (in Levant) in the north-west. Culturally, primary subsistence activities such as agriculture, mining and blacksmithing existed; however, the Arabs disdained such menial tasks, and they were considered the preserve of slaves. Many Arabs worked in trade, which was active at important sites and respected by the population of the Hejaz, including the Quraish and Arabian elite in Makkah.

Many transformations occurred in the political situation and socio-economic development following the advent of Islam. Al-Baha came under the government of Madinah and then of Damascus, Baghdad, Cairo and finally Istanbul, reflecting the changing loci of power in the Muslim world. The Islamic state was favourable to the mining activities in south-western Arabia, with the new currency of the Caliphate requiring indigenous gold and silver, as the traditional use of Byzantine dinars and dirhams (*drachma*) became obsolete. The Umayyad Caliphate began to mint a single currency especially for the Islamic state based on Arabian mines, in particular those of the study area. This attitude towards professions was new among Arabs and comprised a revolution in thought and the value of the work.

Both geographical and historical data confirm the geographical composition and political conditions prevalent in the area, as well as signs to identify the factors forming the Arab community of which al-Baha was a part, and they identify the economic situation and organization in consumption of commercial goods available in the region.

The previous transitions in the Arab community revolutionized its cultural significance and led to openness with the outside world by investing and trading in mineral ores, whether locally or externally. The region of al-Baha was affiliated with the Islamic state during the early Islamic centuries, and was coveted by independent governments in the late Middle Ages and modern times. During the early modern era the region was part of the political and economic stagnation and disintegration that occurred throughout the Muslim world, until the political stability and modern globalised life brought to Arabia by the modern Kingdom of Saudi Arabia in the 20th century.

The rich natural factors and colourful history of the region mean that it is replete and renowned for its varied archaeological sites from different eras, and it remains for archaeological research, particularly studies of the mining landscape, to expose new facts in this period of history, which is the subject of the next chapter.

Chapter 4: Al-Baha Research History and Mining Sites Survey

4.1 Introduction

Mining in al-Baha region has received little attention from previous archaeological studies. This chapter critically traces the history of research throughout the archaeological contributions that have been paid to al-Baha concentrating on those which are relevant to this study, namely by the projects of the Deputy Ministry for Antiquities and Museums (DMAM, later the Saudi Commission for Tourism and Antiquities, SCTA) and the interdisciplinary researches. After that, our mining fieldwork and its results will be exhibited. This fieldwork may be divided into two main phases and each of phases has limited targets as will be demonstrated below. The first phase was a desktop survey of mining sites through paper records for Saudi archaeology in SCTA. The second stage was the archaeological survey of the mining sites in al-Baha itself as a region. This section also contains a brief overview of the main mining evidence recovered from all sites.

4.2 Research history

Al-Baha region boasts numerous archaeological sites stretching across various ages. The prosperity of these sites was primarily associated with the passage of trade caravans which were loaded with goods of various kinds traversing between southern Arabia and the north. In addition, other sites grew upon the output of mines of different metals. That being the case, it must be that the region and its population and towns gained a great advantage from the synergy between mineral production and metallurgy as well trading crossroads. This human activity left many examples of material through the accumulation of experience during long centuries. However, far too little attention has been paid by SCTA, and from some interdisciplinary researches carried out by several archaeologists and other professionals in the area of this study. The focus of the following section will be only on the mining aspect, with quick reference firstly to non-mining archaeological activities that have been carried out in the region by SCTA and some interdisciplinary researches.

4.2.1 SCTA explorations and interdisciplinary research of non-mining sites

Since the beginning of the CASP, the fieldwork surveys focused on general survey of the region recoding various sites from pre-history to of historical periods including rock drawings and inscriptions and southern ancient trade routes sites. Consequently, many sites include civil architecture, such as palaces, houses, mosques, cemeteries, markets, wells and

canals; and military architecture, such as forts, walls and towers have been recoded (Kabawi et al., 1990, 41-53; Killick et al., 1981, 43-58; see Appendix 1 for these recoded sites).

Another archaeological activity within the area is the survey of the southern ancient trade routes. The importance of survey and documenting the course of the trading route stems from its ancient existence (it is pre-Islamic, and is referred to in the Quran as the winter and summer route, as mentioned in chapter 2.2), and its identification as the route used by the elephant of Abraha (the Ethiopian Christian viceroy in southern Arabia for the Kingdom of Aksum) in the Abyssinian campaign to destroy the Kaabah in 570 CE. In addition, during the Islamic era the route transported pilgrims between Sana'a and Makkah. Thus, particular programs were organized to record and document the paths of this route and their stations over four seasons (al-Nasser et al., 1988, 123-138). The third season was conducted between the Asir region and al-Baha region, covering up to 200km of the study area, identifying several sites (al-Saluk et al., 2002, 146-156). The rock drawings and inscriptions survey conducted during the initial survey campaign of CASP in the region during 1990 CE/1410 AH, identifying several rock drawings sites containing paintings of animals from 3000 BCE were found, along with one undated Kufic inscription (Kabawi et al., 1990, 35-40).

However, in terms of interdisciplinary researches there are a small number of specialized studies in the study area in different fields such as the Islamic settlements and their inscriptions (al-Zaylai, 1996), pilgrim routes and their stations (al-Thenayian, 2000), and architectural and cultural heritage (Dostal at al., 1983; al-Abodi, 1994; al-Zahrani, 2007). Some of these studies referred briefly practising mining as a part of population activities in the region.

4.2.2 SCTA mining and mining settlements surveys

A single archaeological survey of the mining sites has been carried out in the southwest of the KSA within study area. By 1983 CE/1403 AH a team undertook a three-month mission to scan the ancient mines and mining sites in al-Baha region. Three camps were set up in various locations in the area. The first team was in the west of Tabalh, some 80km east of the region to survey sites in the eastern and northern parts of the region. The second camp was in al-Makhwah province, 70km south of al-Baha, to survey sites in the Tihama sector. The third camp was inside the city of al-Baha, to record the ancient mines and mining sites in al-Baha itself and Buljurshi (Hester et al., 1984, 115-142). The results of the survey

were encouraging; the team recorded about 23 mines and settlements sites plus 44 sites in difference field of archaeology in al-Baha region. The survey concluded that mining in these sites (n=23) date back to the period of the civilization of Southern Arabia, but much of the evidence was from the Islamic period. Also, these mining sites ranged from simple mines to large settlements.

One of these sites is al-Mamalah site (210/99), located 13km east of al-Aqiq city. Grooves were dug at the site almost 90m long, to a depth of between 6-12m and a width of 2-3m near these grooves the village appears, which consists of small houses (around 100 homes). This village was transacted by a street 6m in width extending from north to south, and small roads and lanes forking off it. Also, there are medium-sized yards and remains of grinding stones that may have been used to crush the raw materials that extracted from grooves. An inscription was found between the stones of the buildings dated 1803 CE/1218 AH, during the Ottoman period. Moreover, other mines registered by this survey included Bugbg (210/114) in al-Aqiq town, and al-Wakrah (210/117) northeast of Mashokah, as well Asham town (216/222) in Tihama. The team concluded that all these sites were dedicated to the extraction of gold. The team also described some slag samples collected from the various mines, of which the most important were Kutnah (210/94), al-Manazal (210/95) and Mahoih (210/97) (Hester et al., 1984, 115-142).

Despite the extreme importance of these mining surveys (conducted in a period in which the architectural facilities and surface objects were in better condition than in the present day) to understand the mining in the landscape and its setting, they did not interpret the assigned function of buildings in terms of mining aspects, especially in al-Mamalah. Plus, their concern with mining largely stopped at miners' housing, ignoring other purposes concerning the processing of raw materials and production stage. In contrast, in the north-western area of the KSA, another archaeological team carried out a mining survey in al-Nuqrah and interpreted and analysed many aspects related to mining and associated facilities and objects (Dejesus et al., 1982, 63-79). Consequently, these surveys in al-Baha did not provide ample study of archaeological materials spread on the surface that have now disappeared due to weather factors, human interventions and modern mineral extraction in some of these sites. Such artefacts need to be studied to form a picture of the stages of production in the landscape. Previous surveys did indicate the presence of inscriptions dating back to 1803 CE/1218 AH at the site of al-Mamalah, as mentioned previously, indicating relatively late endurance of mining, although it is not clear whether this represented continuity from the classical Arab-Islamic period or a novel enterprise.

This survey did not demonstrate many details about the nature of the business of mining and its role in the production of mineral ores, or link the site with other mining neighbourhood settlements.

In terms of survey the region, previous mining survey focused on the southern and north-eastern parts, and ignored mining sites in the north-west, particularly in proximity to the city of al-Mandaq, where there were many settlements that have mostly disappeared today, particularly those settlements linked to commercial routes of the western region and Tihama sector through the mountain roads, whose remains are still visible, and were probably used for the separation of ores, particularly gold and silver transported to al-Asda, Asham and other sites.

It is clearly from the foregoing that the previous studies focused on general and fast survey on al-Baha within the neighbouring areas, and ignored other mining sites in Tihama, in addition to the omission of examination of available archaeological material on the surfaces. Also, examination of patterns of settlement and their role in mining to understand the human activity that took place on this earth since the early Middle Ages remains to be undertaken.

The next section presents the results of comprehensive survey of mining sites obtained from the SCTA record and surveyed of 42 mining sites through the fieldwork of this study between 2010 and 2011, to shed more light on mining in al-Baha region.

4.3 Current fieldwork of mining sites in al-Baha region

As mentioned previously, the fieldwork in this study consists two main phases: the desktop survey in the SCTA archive and the general archaeological survey of the mining sites in al-Baha region itself. The aims and methods and results of each are explained below.

4.3.1 Desktop survey of the SCTA's paper record

This is the first phase, which was completed in Riyadh before commencing the ground survey. The main purpose was to identify the characteristics of mining settlements in the KSA in terms of architectural facilities and artefacts relating to mining operations, and compare what is available in the study area. Additionally, the desktop survey sought to identify the accurate locations of these mines and settlements and their relationship to each other within the study area.

The lack of geographical methodology in some previous surveys obliged this study to look at all parts of this record as the original team recorded the mining sites within the overall activities of general survey. The searching in these files was implemented according to the archaeological divisions of CASP and one separated survey to al-Baha carried out in 2008 shown below (Table 4.1). The results of this survey were recorded in a form that was set out in advance, to make sure of the mining sites and explore the advantages of these sites and their surface artefacts for later comparative and analytical study (for this form see Appendix 2).

No.	General folder	No. of files	No. of pages
1.	Mining	3	309
2.	South-western	2	232
3.	Northern Area	16	2375
4.	Western Area	12	1576
5.	Eastern Area	2	1005
6.	Central Area	8	1402
7.	Pilgrimage routes	5	10061
8.	Zubidah Route	8	768
9.	Trade routes	3	200
10.	Rock drawings	10	2109
11.	Al-Baha Survey 2008	2	106
	Total	71	20143

Table 4.1: Distribution of CASP in the SCTA's archive

4.3.1.1 The desktop survey and its results

Chapter 2.6 outlined how the CASP was carried out from 1976 to 1981, recording various sites numbering approximately 4000 (al-Masri, 1981). Using this previous information was essential before ground survey was initiated, as it allowed the study to benefit from existing information on mines and settlements in existent maps of archaeological surveys prepared and released by the CASP. However, the extraction of information relating to mining from PR was not an easy task for many reasons. For instance, many of these files have been improperly preserved for more than 30 years, together with the administrative papers relating to archaeology in the KSA. Also, these files migrated from one place to another numerous times during the movement of the headquarters of the Deputy Ministry for Antiquities and Museums (DMAM). This movement caused damage to some files and the loss of others. Recently, the DMAM (before integrating with SCTA) converted these hard copies to digital format by scanning each page in each file. This was undertaken for two reasons: in order to ensure the preservation and good condition of records, and in preparation for linking these soft copies to the digital system for archaeological sites in the

KSA in the future (al-Zahrani, 2007). The desktop survey in PR was implemented by reviewing all previous files and filling in forms then transferring the data to the digital record prepared in advance for the conforming stage and subsequent phases. This survey was carried out with invaluable assistance of some researchers at the Research Center at SCTA.

However, as stated in the desktop survey, this stage required a survey of PR containing more than 4000 sites, including mining sites, registered in 71 files. This record provided some drawings and pictures in monochrome and in colour. The desktop survey in the PR of the archaeology and museums sector revealed that the number of known mining sites in the KSA including al-Baha is 81 sites as sorted by the regions (Table 4.2). In addition, Figure 4.1 shows that the highest percentage of these mining sites in the KSA is in the south-west area, especially al-Baha.

Of mining sites identified, 23 (listed in Table 4.3) are located in al-Baha. Half of them were recoded as mines, most of them for copper, and the remained were recoded as settlements, regardless of their sizes. As pointed out earlier, there locations were estimated using geographical maps, which made reaching these sites difficult during ground survey in this study.

	Region	**No. of mining sites**	**Archaeological Area**	**No. of mining sites**
1	Riyadh	2	Central Area	11
2	Al-Qasim	9		
3	Al-Sharqyah	4	Eastern Area	4
4	Hail	0	Northern and North-Eastern Area	19
5	Al-Jowf	0		
6	Tabuk	19		
7	Al-Hodod al-Shamliyah	0		
8	Al-Baha	23	South-Western Area	36
9	Asir	12		
10	Jazan	1		
11	Najrn	0		
12	Makkah	3	Western Area	11
13	Al-Madinah	8		
	Total	**81**	**Total**	**81**

Table 4.2: Distribution of mines and mining settlements in the KSA resulting from SCTA paper record

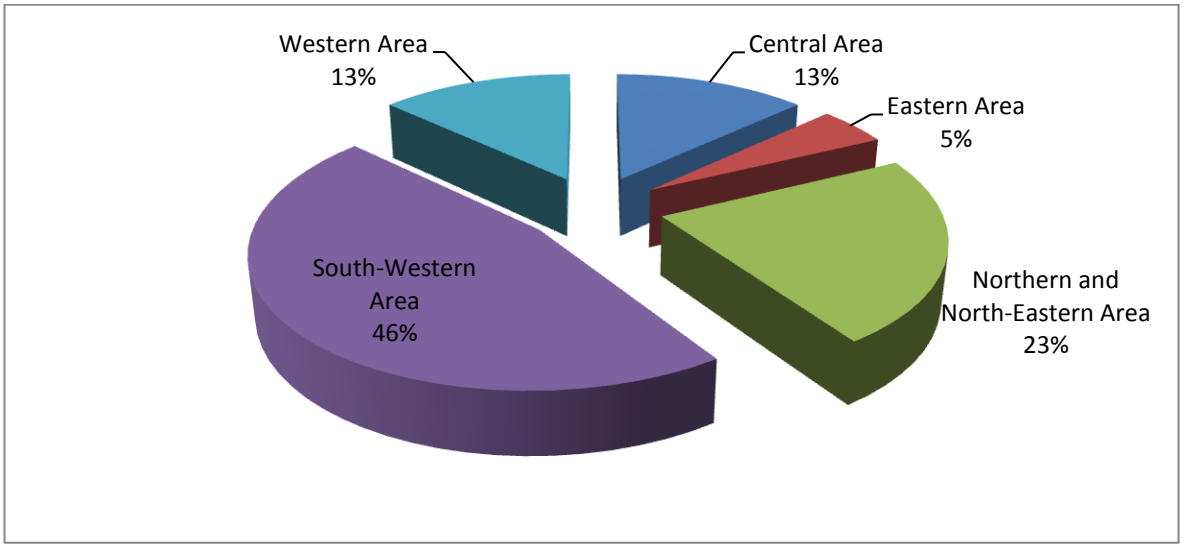


Figure 4.1: Proportion of mines and mining settlements in the KSA according the desktop survey

	Location No.	Site name	Information Source	X	Y
1.	210/114	Bugbag	CASP of Western 1980. P65	(none)	(none)
2.	(none)	Logbah	CASP of Western 1980. P65	(none)	(none)
3.	210/95	Almanzal	CASP of Western 1980. P645	(none)	(none)
4.	210/97	al-Kisemah	CASP of Western 1980. P644	(none)	(none)
5.	(none)	al-Mahoyah	CASP of Western 1980. P648	(none)	(none)
6.	(none)	al-Sout	al-Baha Survey 2007. Form 12	41 12 00.1	20 21 59.8
7.	(none)	Rabtahn	al-Baha Survey 2007. Form 32	41 23 58.5	20 35 17.7
8.	(none)	al-Safar	al-Baha Survey 2007. Form 10	41 20 55.3	20 06 02.2
9.	(none)	Alshkran	al-Baha Survey 2007. Form 23	41 35 20.1	19 51 01.0
10.	210/114	Aqiqgamid	al-Baha Survey 2007. Form 11	41 42 06.8	20 17 00.9
11.	(none)	Kabthalmadan	al-Baha Survey 2007. Form 17	41 20 59.4	20 14 59.9
12.	(none)	Wadi sabih	al-Baha Survey 2007. Form 33	41 19 56.1	20 17 03.3
13.	(none)	Ain kithmah	al-Baha Survey 2007. Form 44	41 34 59.7	20 02 59.4
14.	(none)	Memoir	al-Baha Survey 2007. Form 36	41 20 01.9	20 14 00.1
15.	210/99	Almamlah	CASP of Western 1980. P70	41 40 53.8	20 20 41.7
16.	(none)	al-Safra	al-Baha Survey 2007. Form 6	41 12 53.4	20 19 59.1
17.	221/216	al-Asda	CASP of Western 1980. P68	41 19 23.3	19 37 37.8
18.	222/216	Asham	CASP of Western 1980. P65	41 12 42.4	19 36 37.0
19.	234/216	Masodah	CASP of Western 1980. P66	41 12 35.9	19 40 37.1
20.	(none)	Omaljanadel	al-Baha Surey 2007. Form 89	41 20 45.7	20 25 10.0
21.	210/115	Jabal doba	CASP of Western 1980. P73	41 43 00.1	20 29 57.9
22.	210/94	Qutnah	CASP of Western 1980. P66	41 59 12.4	20 05 55.6
23.	(none)	Waqrah	CASP of Western 1980. P66	(none)	(none)

Table 4.3: Mines and mining sites in al-Baha identified from SCTA paper record

4.3.2 General survey of mining sites

The survey of mining sites was done in accordance with standard methodology in all parts of the region. For instance, all information gathered from desktop survey was reinvestigated on the ground (with mistakes in names modified and the accurate positions noted). In addition, new sites were recorded following observation and consultation with local people. All listed sites recorded in desktop survey and this phase were entered in

digital record in Excel to be ready for further use. For the current survey, initially, the region was divided into two main zones according to geographical formation; the highland (al-Sarat) and the lowland (Tihama) (Figure 4.2). The objectives of this phase included identifying the nature of mines and mining sites on the ground, as well to detect the patterns of mining settlement and its function, and to pick up available samples of artefacts from these sites to be used for comparative and analytical studies.

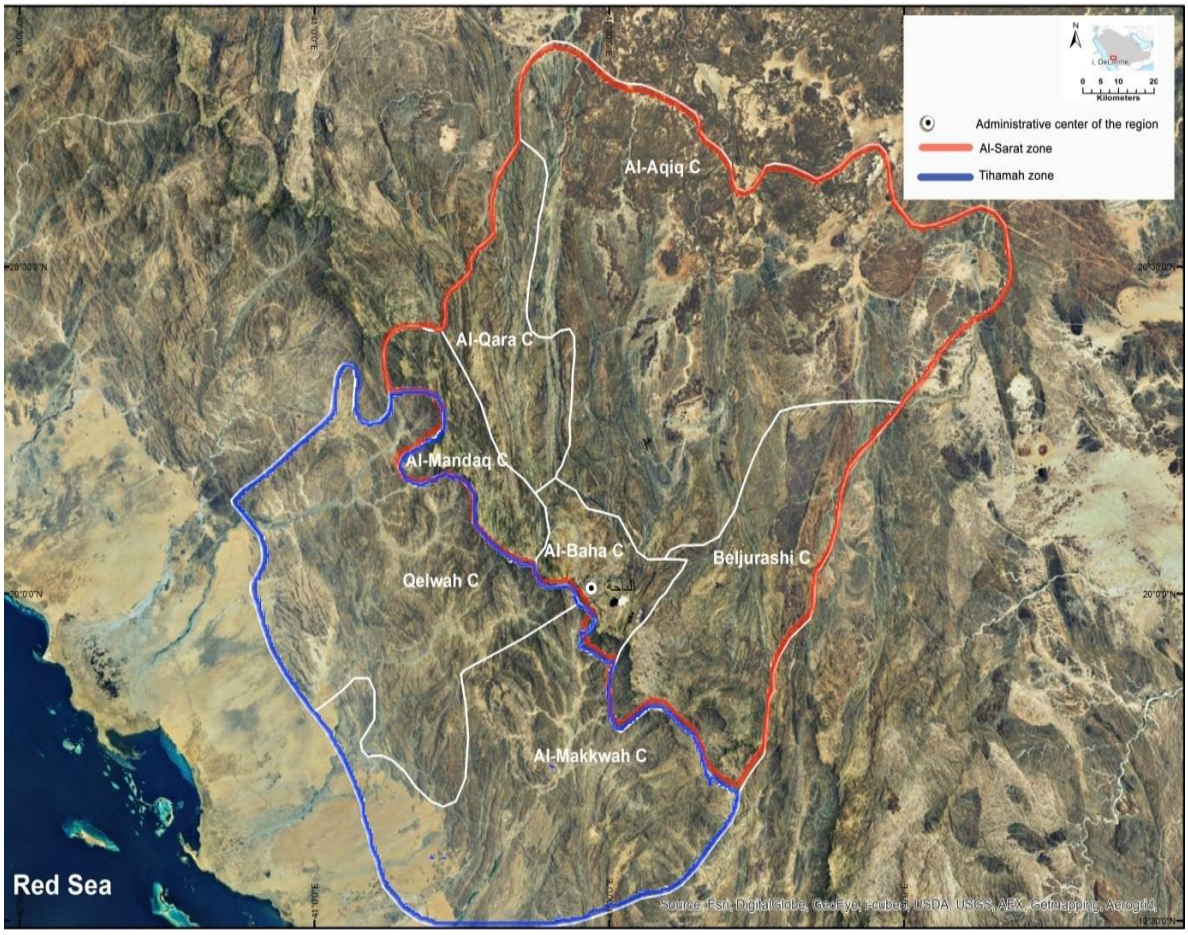


Figure 4.2: The two surveyed zones in al-Baha region (al-Sarat and Tihama)

It should be noted that the former phase, desktop survey, was essential to the execution of this phase, to identify topographies and mines associated with these settlements. Neighbouring areas were surveyed to identify any new sites linked with original one. All structures and signs of occupations were recorded and available surface selections of artefacts picked up.

In terms of surface materials, the most surveyed objects were of stone tools, pottery glass and slag. Therefore, quantities of these objects were picked up and preserved in al-Baha Museum in a private store, except the stone tools (which were studied in the field due to the difficulty of transferring them to the workshop). However, there was a clear scarcity of

surface objects (stone, pottery and glass) in the 39 surveyed mining sites except for at al-Asda, Asham and Masodah, where objects abound. Therefore, the most noticeable surface objects in all the sites (42) will be reviewed in this chapter in general and the study of mining settlements samples will be selected for Asham and Masodah in chapter 5. However, the implementation of the current fieldwork in accordance the methodology set out above in previous mining sites recorded will be addressed below as well as sites discovered by this study, and the results of this survey are explored.

4.3.2.1 The survey of mining sites and its results

The first footprint of the fieldwork was the reinvestigation of the mining sites in al-Baha region and repositioning them correctly using GPS, then applying these sites on a GIS map. This stage included picking up some artefacts from these sits. As mentioned above, tracing the locations of those sites (Table 4.3) was the first step in implementation of the survey in al-Baha using maps and asking local people, then surveying the zones (Figure 4.3). As a result, the archaeological survey revealed most features, tools and facilities in the mining landscape in al-Baha region. 23 mining sites have been reinvestigated and 19 new mining sites discovered disaggregated by zones (highlands and lowlands) (Table 4.4).

Site	Ores	Site type	Re.	Slag Heaps	Grinder	Pounder	Pottery	Glass	Furnace
al-Sarat Zone									
1.Kayalalmusnah	C	S	SCTA	10	0	0	0	0	0
2. AlFondrah	C	M	SCTA	5	3	7	0	0	0
3.al-Waqrah	C	S	SCTA	0	0	0	0	0	0
4.Memoir	C	S	SCTA	0	0	0	0	0	0
5.Omaljanadel	C	S	SCTA	9	0	0	0	0	0
6.al-Sout	C	M	SCTA	3	0	0	0	0	0
7.Rabtahn	G	M	SCTA	8	4	11	0	0	0
8.Shobaltaier	G	S	AB	0	8	6	0	0	0
9.al-Kesimah1	C	M	SCTA	13	3	9	0	0	2 S
10.Kabthalmadan	C	M	SCTA	5	0	0	0	0	0
11.Wadi Sabih	C	M	SCTA	0	0	0	0	0	0
12.al-Asafr	C	M	SCTA	0	0	0	0	0	0
13.Mahoih	C	M	SCTA	8	0	0	0	0	0
14.al-Kesimah2	C	M	AB	3	0	0	0	0	3 P
15.al-Haqah	C	S	AB	300	6	32	0	0	1 P
16.al-Safer	C	M	AB	3	0	0	0	0	1S
17.al-Kajah	C	M	AB	0	0	0	0	0	0
18.Almanzal	G	S	SCTA	0	2	0	0	0	0

Site	Ores	Site type	Re.	Slag Heaps	Grinder	Pounder	Pottery	Glass	Furnace
19.Ain Kithmah	C	M	SCTA	0	0	0	0	0	0
20.Bani Sar	C	S	AB	0	0	0	0	0	0
21.Thrad	CG	S	AB	0	0	0	0	0	0
22.Jabal Doba	C	S	SCTA	0	5	12	0	0	0
23.Aqiqgamid	C	M	SCTA	0	0	0	0	0	0
24.Qutnah	C	S	SCTA	10	3	15	0	0	0
25.Logbah	G	S	SCTA	PS	6	10	0	0	0
26.Almamlah	G	S	SCTA	PS	9	0	11	0	0
27.Bugbg	G	M	SCTA	7	6	0	0	0	0
28.al-Qaryah	C	S	AB	12	23	22	0	0	0
29.Alshkran	C	M	SCTA	0	0	0	0	0	0
Tihama Zone									
1.al-Asda	G	S	SCTA	PS	81	100	0	0	0
2.Asham1	G	S	SCTA	PS	463	296	210	12	0
3.Masodah1	G	S	SCTA	PS	163	174	48	8	0
4.Honaf	G	S	AB	0	0	4	0	0	0
5.al-Safaridah	C	S	AB	0	4	2	0	0	0
6.Yabas	G	S	AB	0	2	3	0	0	0
7.al-Khytan	G	S	AB	0	0	0	0	0	0
8.Asham 2	G	M	AB	0	0	0	0	0	0
9.Asham 3	G	M	AB	0	0	0	0	0	0
10.Masodah 2	G	M	AB	0	0	0	0	0	0
11.Masodah 3	G	M	AB	0	0	0	0	0	0
12.al-Hashas	G	S	AB	0	3	2	0	0	0
13.al-Jahily	G	S	AB	0	7	0	0	0	0

Table 4.4: Mines and mining settlements in al-Baha region

SN; site number in CASP, M; mines, S; settlement, AB: recoded by author; SCTA: recorded by Antiquities

In the following sections, the most prominent features of mining landscape in each zone will be reviewed that characterised by presence of settlements including houses, mining evidence, and sometimes palaces and mosques beginning with zone in the highlands (al-Sarat), then the lowlands (Tihama), giving some information about mining in those large settlements.

- *Al-Sarat*

This zone is located in the high area of the region and rising from 1500 to 2800m above the sea level, and occupies north, west, middle and east south sides of the region. It consists of the following modern cities; al-Qara, al-Mandaq, al-Baha city, al-Aqiq and Buljurshi

(Figure 4.3). The majority of recoded mining sites were located in the north side of this zone, where al-Qara city is situated. Those sites were surveyed during CASP (Hester et al., 1984, 115-142) and resurveyed again in this study with the addition of three large sites: al-Haqah and Kesimah2 were discovered (Table 4.4, Figure 4.3).

During this survey 10 mines were investigated, most of which were devoted to copper extraction, although a few of them were for gold (Table 4.4). Half of this group contains evidence of mining, such as the remnants of the slag as well as cylindrical pounders and millstones while there are no remains of kilns around these mines. It is certain that copper was smelted whether in pottery or stone kilns as a result of presence of slag found around the mines. The remaining half of this group did not include any mining evidence, which would suggest that the ores were transferred to the settlements nearby for further processing.

Also, there is also a group of nine surveyed small settlements with a few rooms (1-3 rooms) distributed in a small space. These settlements contain a small number of pounders and millstones and small slag heaps. Few of these settlements did not contain any mining evidence beyond the rubble of rooms scattered on the ground. These settlements were probably temporary sites for mining use at certain times, not requiring permanent residence. There are many examples of this model is found in many parts of Arabia (as presented in chapter 6.6). As noted earlier, the concentration of such sites is in the northern, western, central and eastern areas of this zone, but there is a significant lack in the number of mining sites (mines and settlements) in the south of this zone, where only one mine was recorded.

On the other hand there seems to be settlements where mining was extensive due to the remnants of mining or occupation evidence in these sites. For example, most of these settlements contain remnants of mining comprises quantities of surface slag, in addition to multiple architectural facilities, whether for housing or may be related to practicing mining. In the north of al-Sarah zone, the locations of the large settlements were in the bank of valleys Qurish and Bidah, which are two of the famous valleys in the region known as sources of water. This part also was very rich in woodland that provided fuel and construction timbers, particularly acacia trees (al-Sharif, 1995). Al-Kesimah settlement (SNU), which is located in the current village of al-Kesimah, around 40km north of al-Baha City (Table 4.4, Figure 4.4), covered an approximate area of 800×300m. The settlement comprises western and eastern parts, the former of which is on the hill, which

includes mines in the form of grooves and cracks characterized by abundant quartz extending around 200m from south to north, as well as another mine in the eastern tip of the hill, 12m in diameter with no great depth. On the west side there is also some evidence of smelting, and more than three foundations of circle stone furnaces, and large amounts of slag. Most of this mining evidence was not noted before this survey, so it was recorded as a new site (al-Kesmah2). The eastern part is the main settlement is on located on the eastern side which is listed in SCTA record under the name of al-Kesimah (referred to as Kesimah1 in this study). It consists of a small number of separate rooms (a maximum of seven). Each room is around 4x5m, and all are built of stone slabs, and some long pieces of slag were also used as material to construct some buildings. Perhaps there were a lot of buildings there, however the new project of public roads that divide the settlement have demolished much archaeological evidence there.

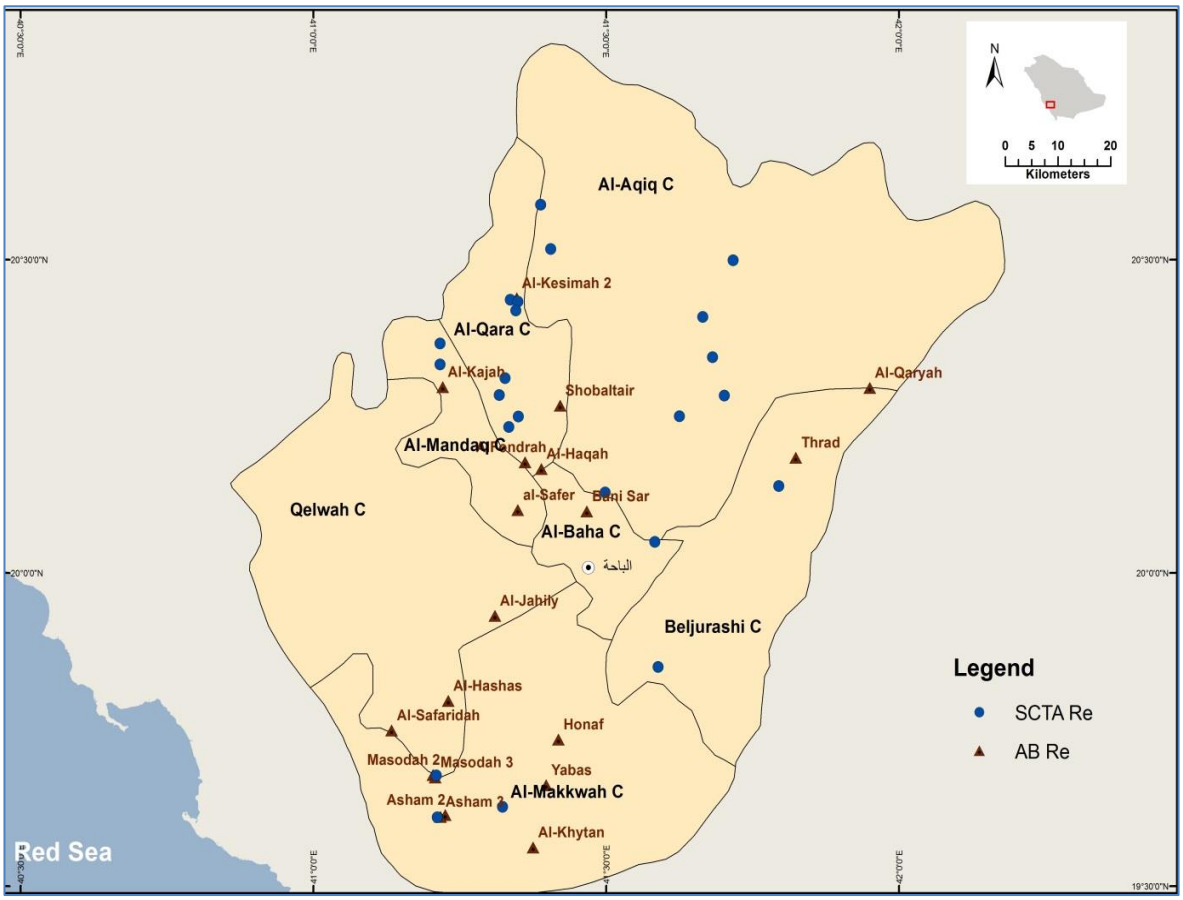


Figure 4.3: Mines and settlements recoded by SCTA and by this study (AB)

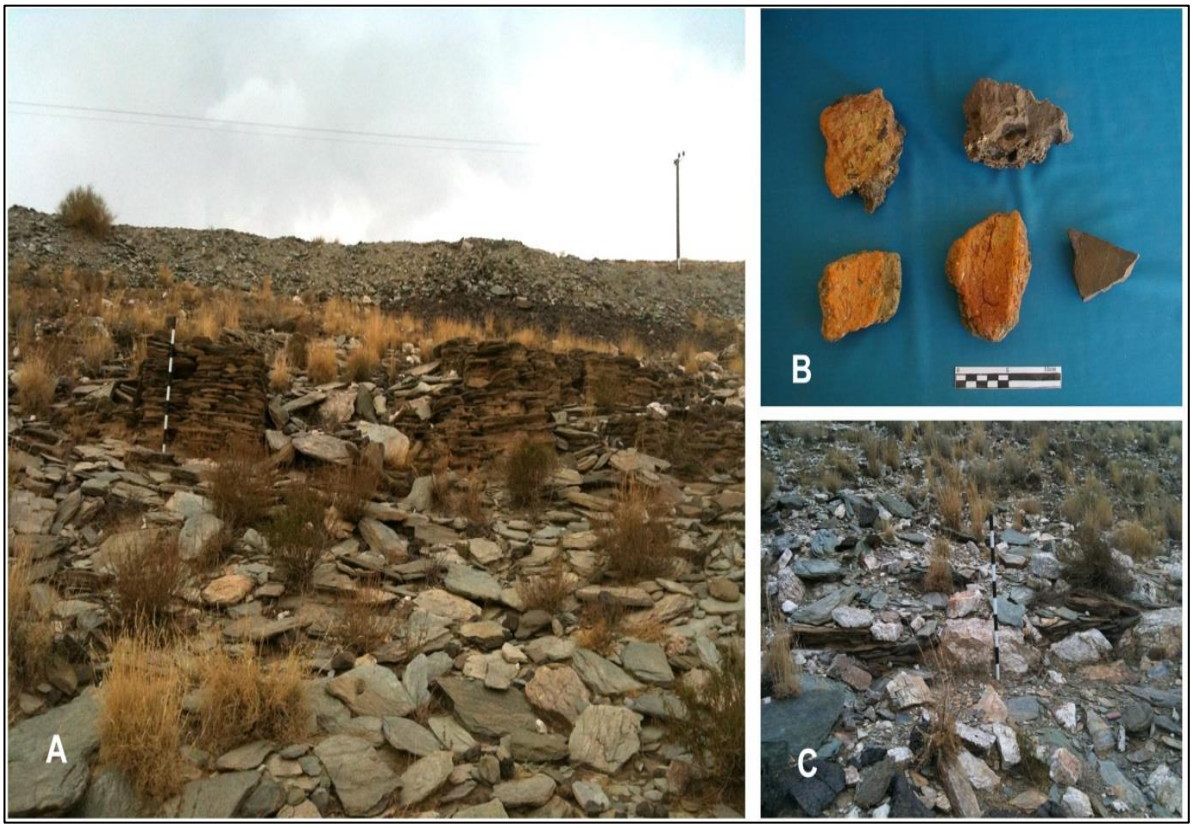


Figure 4.4: Al-Kesimah settlement

A: general view, B: fragments of pottery furnace wall, C: stone circle furnace

It appears that mining copper may have spread to another site north of the former site to Kayalalmusnah as a part of this operation. Kayalalmusnah settlement (210/99) is located in the existing village of Menhil, 5km north of al-Kesimah (Table 4.4, Figure 4.3). It was a settlement of mining for copper and occupies an approximate area of 800×800m. The survey also discovered several facilities such as six residential rooms, each of which covered an area of roughly 3×3m, built with stone slabs; and indications of surface mining through some cracks and holes in the ground noted there. Furthermore, pieces of slag proliferate on the surface, in addition to scattered pieces of broken millstones made of volcanic stones. Unfortunately, the water company which carries water from Ardah (150km north of al-Baha region) to al-Baha and its villages has destroyed many of the mining features of the site. It seems that these two settlements were large, but modern construction works destroyed many site contents including stone tools and buildings (Figure 4.3).

In the south of al-Qara city the survey revealed al-Haqah copper mining settlement. This settlement is located south of Bedah valley, 30km north of al-Baha city (Table 4.4, Figure 4.3). It covers an area of around 1000x500m. It contains several destroyed buildings

built of stones, mostly dwellings of 1-3 rooms. In the middle of settlement there is a large building, possibly a palace judging from its size and location in the middle of the settlement, as well as the prevalence of many of these schemes in most of the early Islamic cities in Arabia (al-Rashed, 1984). It occupies an area of 15×20m, containing four rooms in the western side and a rectangular yard in the east. There is a graveyard in the southern part of the settlement containing a group of graves for adults as well as a cemetery for children in the far south. Massive quantities of slag resulting from the smelting process in the form of high hills have been observed in the west and east of the settlement. On the west side, a rectangular building next to a slag hill has been found that also contains the remains of furnace walls and a ventilation tube.

Despite the existence of extensive building foundations in al-Haqa (Figure 4.5), the historical and geographical sources do not mention this settlement. Additionally, the archaeological teams during CASP and after did not reach it. The survey for this settlement revealed that this settlement was probably a major centre for mining copper in the area due to the large size of the residential area and hundreds of tons of slag smelted there. The dilapidated condition of furnaces remains indicates that they were intensively used, and the geographical location of the settlement is near one of the most famous valleys in Arabia (Bidah Valley), noted for relatively dense vegetation, particularly acacia and juniper trees, which formed essential resources for the miners. The natural resources of water and trees contributed to sustaining mines and mining communities, and rooms in the residential areas may have been devoted to the store of large quantities of firewood needed for the production processes.

In the western side of al-Sarah zone where al-Mandaq city are located, the archaeological survey uncovered a number of long channel copper mines; however no mining settlements have been identified on this part. Among the mines surveyed by this study is al-Safer mine and Khajah mine (perhaps they were noted by the DMMR survey as local people said but there is no indication in minerals reports about it) (Table 4.4, Figure 4.3). Al-Safer mine is located on the summit of a mountain in the existing village of al-Mashiyah, 40km north-west of al-Baha. This copper mine comprises a group of grooves 10m in length and 7m in width. As well as a small cave found at the top of the mountain there are small pieces of stone extracted during mining. At the bottom there are foundations of a stone circle furnace of area 2x1.50m. Moreover, there are indications of smelting on some rocks around the mines. A long road (23m in length, 1.2m in width and 90cm high) constructed from small stones extends from north to south. This route might have been erected to link the mine

and the local routes in this part of region. No remains of buildings and surface artefacts at all have been discovered there (Figure 4.6). It seems that the mining copper and smelting process in al-Safer were practised directly near the mine due to presence of quantities of slag hills and stone furnaces, then the final products were possibly transported to other settlements using the local roads which are still visible near the mines.

Al-Khajah mine was discovered archaeologically by this study in this zone. It is situated in the existent village of al-Khajah (Table 4.4, Figure 4.3). The area of the mine is an estimated 20×20m, considered the most distinctive in the region in terms of being a large mine extracting copper. The entrance of the mine is 1.3m in width, and leads to a channel up to 70m in depth reaching to the other side of the mountain, but the inner mouth of the mine was closed recently in order to avoid animals falling inside. Surface mining is evidenced by many cracks, grooves and small holes above and around the mine. There is a real absence of any cultural materials around this mine, including grinders, pounders and slag (Figure 4.7). In addition, despite the big size of the mine and its capacity, no settlement is evident nearby, which confirms that mining processes such as crushing and smelting were practiced at other sites, or perhaps moved out of the area to external sites dedicated to smelting.

In the eastern side of al-Aqiq city, in the volcanic areas (*Harrt*), one of the biggest mining settlements in the region (al-Mamalah (210/99)) was investigated and recorded during the CASP (Hester et al., 1984, 115-142), and revisited in this study (Table 4.4, Figure 4.3). This settlement contains many architectural facilities within high walls, 1m above the ground surface. Most of it comprises the residential area in a circular area. The advance of mining spread over the surface, including remains of volcanic millstones, and mines to extract the minerals found in the form of horizontal deep grooves in the southern side of settlement. There are graves in the southern part of the location, containing approximately 150-200 tombs. A few broken pottery sherds scattered on the surface and four rock drawings between the building materials were found. Its location near the southern trade route, and at the foot of Aqiq mountain, which is very rich in gold and silver to the present day (Sahal, 1999), all of which combine to make the export of ores and production to another settlement possible (Figure 4.8).

Figure 4.5: Al-Haqah settlement

A: general view of al-Haqah settlement and slag hills, B: remains of a large building, C: fragments of furnace, D: part of ventilation tube to the furnace with remains of slag

Figure 4.6: Al-Safer mine

A: general view, B: a path used to transport the ores from the mine, C: extracted rubbles from the mine mixed with some pieces of slag

Figure 4.7: Al-Khaljah mine

A: general view of inside al-Khajah mine, B: the closed mouth leading to the interior tunnel

The Madden Company is currently mining for gold around al-Mamalah. Although the mining in this settlement could have produced a great deal of gold, silver and copper, there are no visible remains of furnaces for smelting; future excavation at this site is anticipated to reveal such evidence. However, previous survey indicated that the architectural style in this settlement suggests al-Mamalah was occupied in the period of the Southern Arab Kingdoms (1st millennium BCE to 7th century CE), which are characterized by double walls and the use of large blocks of stone as well as type of pottery (Hester et al., 1984, 115-142). No similar pattern was surveyed in the rest of the study area, but some Islamic inccriptions and pottery suggest that the site continued to be used in the Islamic period.

Figure 4.8: Al-Mamalah settlement

A: general view, B: surface collections of pottery, C: the mine of the settlement located between houses

In addition, al-Qaryah settlement was discovered in the east of this zone. The settlement is at the eastern end of Tharad valley. It is a large settlement covering 500×800m, containing several destroyed stone houses, and to the east on a high mountain there are grooves of up to 50m depth that were used to extract minerals. On the surface there is some evidence of smelting, such as the remains of few slag hills and melted stones, which may have been used in the process of metal casting. There are no visible surface artefacts. This settlement was probably a subsidiary of the larger settlements like al-Mamamalh or outside the study area in al-Ablah settlement.

- *Tihama*

Turning to theTihama zone, it is located 60km south of al-Baha in lowlands and occupies an area between the south and south-western of the region. This zone comprise of two modern cities al-Makhwah and Qelwah zones (Figure 4.2), the archaeological

investigations show that the mining gold and silver in particular were very famous in this zone. Key mining settlements in Tihama include al-Asda (221/216), Asham (216-22) and Masodah (234/216) all of which were recoded by the CASP but without supplementary information. Eight new mining sites (four mines and four settlements) were discovered by this study. The mines are located near the main sites of Asham and Masodah and were not recorded or mentioned by the CASP (Hester et al., 1984, 115-142). These mines are Asham2 and Asham 3, and Masodah2 and Masodah3 (Asham1 and Masodah1 were identified by the CASP) (Table 4.4, Figure 4.3). The four newly discovered settlements are Honaf, al-Safaridah, Yabas and al-Khytan, all located in the eastern part of al-Makhwah near the Yabs valley. These settlements contain small separated rooms of between 1-3 rooms each, and a few pounders and grinders were scattered on the surface. These settlements were probably ancillary to the larger centres of Asham and al-Asda because they have the same features in terms of constructing buildings and pounders and grinders, and may have been temporary settlements associated with those permanent sites.

The al-Asda (221/216) settlement is located in the west bank of al-Ahsabh valley, about 20km west of al-Makhwah city (Table 4.4, Figure 4.3). It covers an area of 6000×800m, and is considered to be one of the most famous archaeological sites in terms of gold mining settlements in the region. It contains several destroyed buildings, including residential houses, a large palace, a mosque and a cemetery. The houses extend everywhere and have adjoining walls. Each house has between two to four rooms of minimum area 5×5m. The palace is rectangular (30×20m), and has three cylindrical towers in each wall, and narrow windows distributed in all the walls. In the middle there is a square open courtyard, on whose eastern side the mosque is located. The courtyard is rectangular (15×10m), and contains three parallel rows to the prayer wall (*qiblah* wall) and niche (*mehrab*) in an obtuse arch. The cemeteries found in the north and some graves have gravestones documenting the buried, written in Kufic pattern. All of these buildings are built of stone slabs 1m wide and 3m high. In addition, various millstones, particularly the upper part, and spherical pounders for crushing mineral ores were scattered on the surface, as well as a variety of pottery and glass. Special rooms probably dedicated to mining functions were also observed in the north of the settlement. Moreover, the mines are located in the west and east, and the effects of mining are still clearly visible (Figure 4.9).

The spread of pounders and grinders in high density in al-Asda settlement in addition to the presence of the most important and largest of Tihama valleys (al-Ahsabh) suggests that there were grate mining gold took place in this settlement plus, there is great interest in

terms of planning settlement where variety of constructions and complex architectural buildings.

In the south-west of this zone where Qelwah city is located, two new mining gold sites were surveyed during this study: al-Hashas and al-Jahily. Both contain the same geographical features built on a high plateau in addition architectural shape with high-walled buildings. A few grinders and pounders were found on the surface of these settlements. The most distinctive characteristic of these settlements is that they were located on high hills away from the valleys, but they contained wells for fresh water. This location enabled the development of agricultural terraces, which is considered a hallmark of these two settlements not seen elsewhere in the area of Tihama. Both settlements have of complex units made the settlements as fortified villages on the high hill. Their graveyards were found down the hill, containing some undated inspirations.

However, the mining processes of precious metals necessitate the presence of many constructions besides the mining tools such as pounders and grinders, as well as water for washing. The majority of the settlements in Tihama contain all of the facilities needed for the production of metals by the population, and for their daily lives (e.g. housing, shops, mosques and manufacturing places close to the mines). Defensive towers surround some of them. Most of their locations are in the margins of the famous valleys in this zone, such as Yabs, al-Ahsabh and Nawan. These factors support the practicing of mining and production of raw materials, including ore extraction from mines and surfacing mining, along with valleys for the washing of mineral ores and manufacturing workshops in the settlements.

The following section explores the mining evidence including settlements, tools, furnaces and slag surveyed through the two zones to show how this evidence aided to identify the size and type of occupation at these sites.

Figure 4.9: Remains of al-Asda settlement

A: general view, B: view of large building in model of settlement, C and D: some mining tools from surface

4.5 Mining evidence

As mentioned earlier, the most of the surveyed sites in both al-Sarat and Tihama have mining landscape features such as houses, workshops, mosques, shops, wells, graveyards, and towers and also some slag heaps, remnants of furnaces, and some objects of pounders and grinders, and pottery. Generally, there are two different ores mined in these sites. In al-Sarat zone, almost all extraction was of copper, as confirmed by the slag heaps, except al-Mamalah, where both gold and silver were mined alongside copper. However, in the Tihama zone all sites were devoted to gold and silver mining according to numerous pounders and grinders found there, and only one site was clearly identified with copper (as evidenced by some slag around the site). It is likely some copper smelting was practiced in dedicated gold and silver sites, in narrow limits, as deduced from scatterings of some slag pieces on the surfaces of these sites.

4.5.1 Mines and their forms

Mines and extraction of raw materials pits are the most prominent signs of mining in the study area, especially around workshops for raw processing such as smelting and refining. The survey in the study area has revealed 19 separate mines in four forms, plus those mines located in the settlements (23 mines) (Figure 4.10). A site can contain more than one form of mine depending on the nature of the ground and the presence of ores. Mines come in the forms of deep holes, deep grooves, caves and surface cracks in the ground, as defined below:

Deep holes

A deep pit with a length of approximately 20 to 100m vertically (or sometimes horizontally), 1m in diameter, increasing when going deeper and multiple holes would probably converge in a single wider hole at the end of digging. This form is found in gold mining sites such as Asham mine, Masodah and Yabs. This form is found near some valleys, which suggests the use of water to wash mineral ores, and this form was found in copper mining sites at Aqiqgamid and Jabal Doba.

Deep grooves

Ground cracks could be formed naturally or dug by humans to a length of up to 100m, with width ranging between 1 to 2m and depth to 3m. This form is susceptible to caving due to tracing the presence of metal ores. Mineral studies on some of these mines indicate that

they were allocated to tracking quartz veins carrying gold grains (Sahall, 1999). Al-Mamalah (Figure 4.8) and al-Qaryah, al-Wakrah and Tharad are examples of this form; all are gold mining sites.

Caves

In the form of gaps in the mountains stretching approximately 20 to 70m, caves may be opened to the other side or not. This form is allocated to the extraction of copper ore and models are found in the western of al-Sarat zone in al-Safer and Khalja mines (Figure 4.6, Figure 4.7). The lack of settlements near the mine is a notable feature of this form. Ores may have been preliminarily smelted near the mine and then transferred to specialized settlements, which would have been territorial smelting centers such as the large settlements in al-Baha region.

Surface cracks

Shallow longitudinal grooves extending up to about 100m and possibly intermittent in accordance with the ore followed, surface cracks can be seen in many surveyed sites in this study, especially in al-Sarat zone, including al-Sout and al-Fondrah,. There are some signs of burning on these cracks, suggesting the use of fire to dismantle the stones from each other. Mineral studies suggest that these grooves were allocated to the extraction of gold ore because of the existence of quartz stones, in addition to copper ores in other sites.

4.5.2 Mining settlements and their patterns

Settlements are one of the most prominent forms of evidence of mining in the region, providing an abode for miners and their families for extensive and long-term mining operations. There is a clear difference, according to environmental composition of Al-Baha (as will be discussed later see 6.5). Three patterns of settlements were noted during the archaeological survey (Figure 4.10), each of which was assigned a code as follows:

1. Pattern A - simple separated housing units.
2. Pattern B - many separated housing units.
3. Pattern C - complex and interconnected units.

The division of these patterns was according to general plan and availability of architectural facilities (Table 4.5). The presence of these facilities in each pattern depends on the size and pattern of the settlement, as explained below.

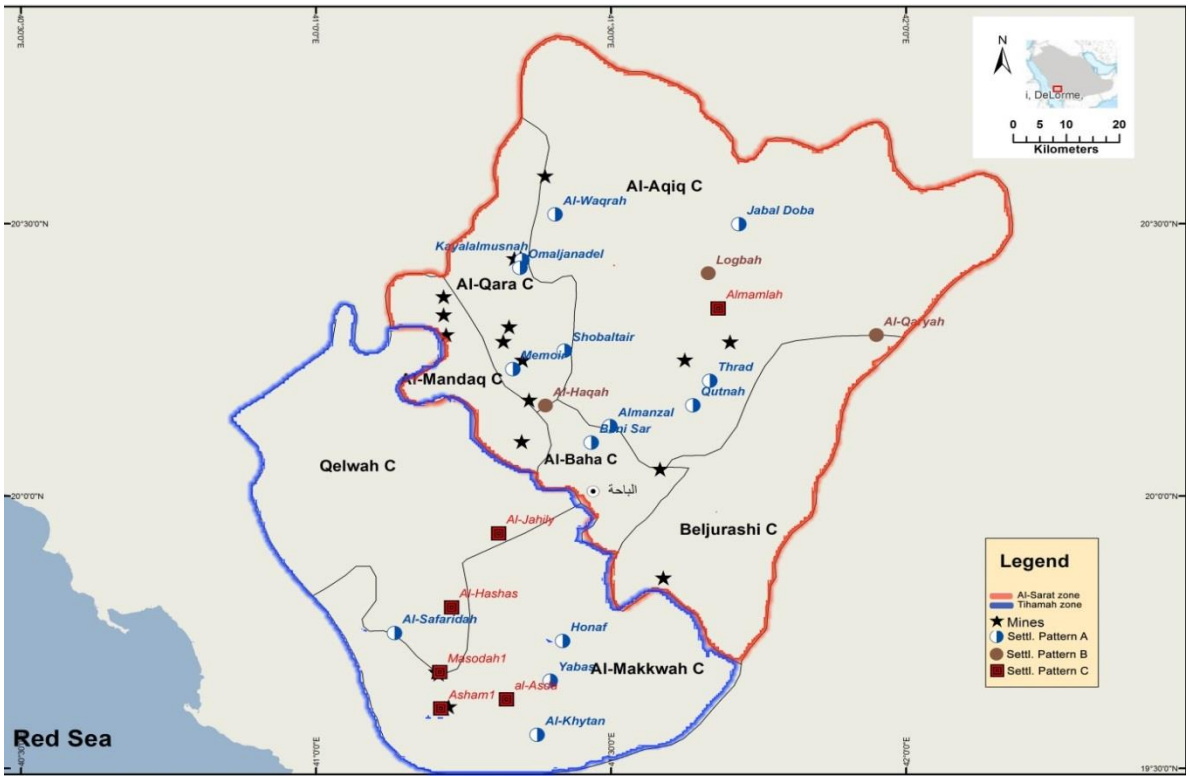


Figure 4.10: Surveyed mines and patterns of mining settlements

NU	Settlement name	Nearest city	X	Y	Recorded by	Ore mined
Pattern A: Simple separated housing units						
1	Kayalalmusnah	Al-Qara	41 20 57.3	20 26 00.84	SCTA	C
2	Shobaltair	Al-Qara	41 25 16.23	20 16 1.72	AB	G
3	Al-Kesimah	Al-Qara	41 20 27.3	20 18 58.41	SCTA	C
4	Al-Waqrah	Al-Qara	41 24 19.9	20 31 02.4	SCTA	C
5	Bani Sar	Al-Baha	41 28 00.5	20 05 54.5	AB	C
6	Almanzal	Al-Baha	41 29 54.12	20 07 43.26	SCTA	G
7	Honaf	Al-Makhwah	41 24 649	19 44 030	AB/NA	G
8	Al-Safaridah	Al-Makhwah	41 08 14.00	19 44 56.00	AB/NA	C
9	Yabas	Al-Makhwah	41 23 49.63	19 39 41.00	AB/NA	G
10	Al-Khytan	Al-Makhwah	41 22 29.74	19 33 43.49	AB/NA	G
11	Memoir	Al-Qara	41 20 01.9	20 14 00.1	SCTA	C
12	Omaljanadel	Al-Qara	41 20 45.7	20 25 10.0	SCTA	C
13	Jabal Doba	Al-Aqiq	41 43 00.1	20 29 57.9	SCTA	C
14	Qutnah	Al-Aqiq	41 59 12.4	20 05 55.6	SCTA	C
15	Thrad	Al-Baha	41 29 57.3	20 07 42.24	AB	G
Pattern B: Many separated housing units						
1	Al-Haqah	Al-Qara	41 23 21.4	20 09 57.8	AB	C
2	Al-Qaryah	Al-Aqiq	41 56 59.28	20 17 43.74	AB	CG
3	Logbah	Al-Aqiq	41 39 54.05	20 24 32.18	SCTA	C
Pattern C: Complex and interconnected housing units						
1	Al-Hashas	Qelwah	41 13 48.21	19 47 45.24	AB/NA	G
2	Al-Jahily	Qelwah	41 18 35.67	19 55 54.77	AB/NA	G
3	Al-Mamalah	Al-Aqiq	41 40 53.88	20 20 41.76	SCTA	G
4	Al-Asda	Al-Makhwah	41 19 23.3	19 37 37.8	SCTA	G
5	Asham1	Al-Makhwah	41 12 42.4	19 36 37.0	SCTA	G
6	Masodah1	Al-Makhwah	41 12 35.9	19 40 37.1	SCTA	G

Table 4.5: Distribution of settlements according the pattern of settlement

Pattern A: simple separated housing units

This pattern consists of three to ten housing units in each settlement, with small rooms. The average unit is about 48m^2 in area, and each unit contains 1-3 rooms. This plane does not contain auxiliary facilities such as shops, mosques and towers. In addition, the construction of these units uses locally available materials of slab stones and some long pieces of slag particularly for copper settlements. Perhaps these units were allocated for the temporary stay of miners near the mines, as well to manufacturing activities between these units. This type can be seen in 15 settlements most located in al-Sarat zone and few in Tihama zone (Table 4.5, Figure 4.11).

Figure 4.11: A model of mining settlements - Pattern A (Thrad settlement, al-Sarat zone)

Pattern B: Many separated housing units

This pattern comprises about 10-50 housing units, with medium and large rooms, and areas ranging from 75m^2 to 192m^2, containing 1-5 rooms. Additional facilities such as streets and lanes separating units were also found, as well as shops, palace and mosques, which often occur in the medle of settlements. Graves are found in dedicated burial sites. In these settlements, the workshops are located between the residential units, intersecting the residential areas. Some individual works probably took place in this pattern due to the diversity and amount of slag heaps. Three settlements in the al-Sarat zone represent this pattern, all primarily devoted to copper mining (Table 4.5, Figure 4.12).

Figure 4.12: A model of mining settlements - Pattern B (al-Haqah settlement, al-Sarat zone)

Pattern C: Complex and interconnected housing units.

This pattern contains many roughly 60 to 300 housing units, each of which has 2 to 5 rooms, plus courtyards linked to some of these units in front or behind. The average area of each unit ranges from 60m^2 to 100m^2. This type is similar to the second type in terms of the presence of additional facilities, but has more of them, such as multiple graveyards, large areas for commercial shops, and towers surrounding the settlement from three sides or more, with the mines being located in the outer periphery of the residential zone. In some cases, there may be some units separated by a small space close to the general plane, but interconnected with each other so that it does not effects on plane system for the settlement. Evidence of this pattern can be seen in only five settlements, four of which are in Tihama and one in al-Sarat; all of them are for mining gold (Table 4.5, Figure 4.13).

Figure 4.13: A model of mining settlements; Pattern C (al-Asda settlement, Tihama zone)

4.5.3 Tools

Mining tools are found in varying proportions as a result of the size and pattern of settlement, as well as existed next to some independent mines. The most prominent mining surveyed tools in this study, pounders and grinders and remains of pottery and glass, are presented briefly below and analysed in a more detail in chapters 5 and 6.

Pounders and grinders

Pounders and grinders proliferated at the mining settlements and were spread across the surface. Given the prevalence of volcanic stones in the northeast and east of the region, some of these tools were made of solid stone besides lava stones. 705 pounders were counted in surveyed sites mostly in Asham, Masodah and Asda then scattered in few numbers in the rest of sites (Table 4.4). These pounders came in three shapes; 1) cylindrical, 2) spherical, and 3) spindle. They were used as hammers, especially those with circular shapes, as well as to grind the raw materials (ores) by rolling the surface of slab stone. 801 grinders were counted in these sites and come in four shapes; 1) millstone with one basin; 2) millstone with two basins (both known as *Rahi*, they include two sections, basin and molar, both of which were manufactured of solid or volcanic stone; the type of two basins, in which the additional basin is located on the opposite side of the lower part, was probably used for different metals than those used in the previous basin); 3) slabs grinder; and 4) hand grinder. The presence of these stone tools (pounders and grinders) in

mining sites is essential for crushing raw materials and freeing it from other stones in the processing of mining (as mentioned in some sources cited in chapter 2,2 and discussed in chapter 6.2.2). The presence of the volcanic stones is to catch quantities of raw materials between small apertures. It seems that the diversity of pounders and grinders depends on the size of settlements. Temporary settlements (Pattern A) contained a small number of these tools while the number is increased in the large settlements (Pattern C). These types were found in abundance in Asham, Masodah and al-Asda, then in fewer numbers in the other sites (Table 4.4).

Pottery

Pottery is one of the necessary tools in the mining settlements for use in the mining process or at least among the used daily tools. 229 fragments (including unglazed and glazed pottery) were picked up from surveyed sites. They belonged to various wares including pots, bowls, plates, cups. Most of these pieces were found in the Tihama zone (Asham and Masodah); al-Sarah zone was largely devoid of pottery with the exception of a few pieces from Logbah and al-Mamalah sites.

Glass

In addition to general domestic use, glassware is an integral part of tools used in mining processes, particularly to store several chemical materials used in operations. However, glassware is rare in surface finds from al-Baha settlements, which is largely attributable to its ability to be broken more easily than other tools. Only 20 pieces of glass were found, in Asham and Masodah.

4.5.4 Furnaces

Furnaces are one of the most important evidences of mining sites, albeit full furnaces are rare due to breakage and the extraction of molten metal. However, this survey revealed a small number of furnaces fragments. These furnaces are of two types, clay and stone circular furnace. Both of these types are known in many mining settlements the KSA and the countries beyond (chapter 6.6). The pottery furnace is very common in mining settlements. Although there are a few remnants of such furnaces, no full furnace was found. There is a possibility that the furnaces were detachable, and were removed after the smelting process to extract the ore and reused when needed. Such furnaces are similar in composition and form. They were handmade with mostly reddish yellow clay, and

contained a large amount of chaff, gravel and organic material. Some quantities of slag appear on the edges of these remains (e.g. two pieces, No. 521 and 537) (Figure 4.5).

Generally, pieces from sites in this study were compared with some proposed forms of kilns in neighbouring countries (Weisgerber, 2008, 1613-1624). Clay furnaces had a pyramidal shape, with a wide base roughly 1m across, ranging 10-15cm in thickness, and narrowing to 40cm across towards the apex to reach a height of 60cm in most cases. Four fragments of clay furnace were found in al-Sarat zone (Table 4.4) Most of these remains were found in high places, to obtain natural air supply for increasing the degree of temperature. The fuel for the furnaces assumedly was charcoal made from the acacia trees found in local valleys (which have a high glue content and burn hotly), and was used to heat copper ore with basaltic stones or slag. This is evidenced by the large quantities of slag hills and dense vegetation across the region.

Stone furnaces were found in al-Sarat zone namely in sites al-Kesimah2, al-Haqah and al-Safer. The circular stone furnace model was constructed on mountain slopes to benefit from the rock interface. probably used for smelting in the case of use it rather than clay furnace or for purifying after smelting the copper in the clay furnace throughout channels reaching between them. This type is semi-round in shape, with diameters of 1-1.5m, and walls of approximately 20cm width, 30cm above the ground surface. The material of construction consists of small stones and quartz (Figure 4.6).

These pieces of furnaces were only discovered in al-Sarat zone and were primarily devoted to copper smelting. Even in known gold mining sites in al-Sarat and Tihama, furnaces dedicated to gold were not found.

4.5.5 Slag

Slag is a prevalent feature of mining sites in al-Baha region in the form of heaps and pieces scattered in the surface. The slag heaps were found abundantly in mining sites in al-Sarat zone, with more than 400 heaps of approximate height 2.5m, with an average diameter of 2m, plus surface pieces. These heaps and pieces feature different colours, ranging from chocolate to dark brown and grey, with a soft feeling. They contain some bubbles on their surface in the colour of green oxides; in general they are in strong condition. In spite of the presence of slag heaps being one of the most important hallmarks of mining sites, no gold mining sites in this survey contained such heaps. Small pieces of 10cm length, mostly in a weak condition, were scattered on the surface. This probably confirms that these sites

practiced copper mining in a narrower form compared to what was found in other copper mining sites in al-Sarat zone. Also, these weak remains of slag could be smelted more than once in order to extract the most gold amount from this pieces, unlike the stronger metals that were smelted once (according to an interview with Eng. Mubark al-Shikh who was the manager of copper project in al-Hajar mine, on 13.11.2011).

Figure 4.14: Slag heaps in a mining settlement (al-Haqah site, al-Sarat zone)

4.6 Conclusion

This chapter has examined the previous studies and surveys in al-Baha region in several aspects before moving to the current fieldwork. In particular, the archaeological survey of mining sites in al-Baha within the south-west area of the KSA, with overview of non-mining surveys conducted during the last three decades, unveiled a fascinating history of human settlement and activity in the region from the Stone Ages to modern times. In terms of mining studies in the region, tracing these works discovered that they have some shortcomings in terms of concentrating on tools and facilities found in these sites and clarifying their role in the mining process. However, recoded mining sites resulting from the review of previous studies and derived from desktop survey of paper record of SCTA (23 sites) have paved the way for this study to trace the mining sites in al-Baha in the ground and to discovered new mining sites (19 sites) and to provide the missing links in the chain of mineral ores studies in Arabian history.

In the current mining sites survey conducted by this study, al-Baha region has been surveyed in two zones; the Highlands (al-Sarat) and the lowland (Tihama). This survey included 42 discovered mining sites (23 prior, 19 new) that contain much valuable

information on the medieval period (confirmed previously by the radiocarbon measurement carried out on some samples of slag from Mahoih (210/97) and another site from Rabtahn and al-Kesimah (Smith, 1964)). However it may be hard to give absolute dates for these sites mainly the region contains many non-mining sites, unless organized excavations confirm that these sites reveal the stages of occupation evidenced by cultural materials, especially since these sites witnessed civilizational encouters from the third millennium BCE onwards. Future studies may reveal some of these facts and features of mining in this period.

Throughout the surveyed sites in this study, copper mining sites were found to be more widespread than gold mining sites (23 against 7), especially in al-Sarat zone. However, gold mining sites were abundant in Tihama zone, with 12 sites compared to a single site for copper (Table 4.4). Many of these sites are located in strategic positions close to water sources (valleys) and other raw materials.

Despite the mining evidence noted and recovered from all sites being similar in terms of their patterns of mining and settlements, the quantity and density of tools and facilities varied between sites. In al-Sarah zone, especially in the northern and north-western parts, with high mountainous territory, mines were characterized by ground surface cracks and caves or channels that extend approximately 20-100m following seams of mineral ores. In the east, close to al-Aqiq city, mines are found in the form of deep ground cracks or in a few cases deep wells. Few mines in this zone contain nearby settlements, but there is some smelting evidence due to amount of slag found nearby. In contrast, in Tihama zone, mines feature deep holes of 20-100m depth where the ores are found and surface mines of around 200m in diameter. In most of surveyed sites in this zone mines were found close to the settlement where the ores were processed.

In terms of mining settlements where the ores were processed and miners and their families settled, three patterns of settlements, A, B, and C were classified according to the general scheme of these settlements. Pattern A is simple separated housing units containing 1-10 housing units, comprising temporary settlement for miners and probably manufacturing activities related to mining, whether for copper or gold. Pattern A has few architectural buildings except houses. It is more common than the other settlement patterns, with 14 recorded settlements.

Pattern B is many separated housing units as s fixed settlement contain from 10-50 housing units found with medium and large rooms. There are improvements in terms of additional

facilities such as streets, shops, palace and mosques, which often take place in the centre of the settlement, and dedicated burial sites, are found. In this pattern, the workshop areas are located between residential units. Only three settlements of this pattern were found, all of which were located in al-Sarat zone. This would suggest that this pattern was customized to regional copper smelting centres due the presence of numerous of slag heaps in this pattern. Copper ores were probably brought to such settlements from small ancillary mines to be smelted.

Pattern C is complex and interconnected housing untis containing about 60-300 dwellings of 2-5 rooms each, plus courtyards linked to some of these untis in front or sometimes behind. This pattern is larger than Pattern B in terms of size, and was characterized by the presence of additional facilities such as multiple graveyards, large areas for commercial shops, and towers surrounding the settlement from three sides or more, with the workshop areas being located in the outer periphery of the residential area. This pattern is interesting though rare, with only three settlements recorded. Such large and organised settlements have many dated inscriptions which would suggest that these settlements are among the early Islamic towns in the south of Arabia, and that they were primarily devoted to gold mining, being exclusive to the Tihama zone.

The artefactual mining evidence is similar *within* most sites although it varies *between* sites. None departed from the general framework of mining tools defined above (stone tools comprising pounders and grinders, pottery both unglazed and glazed, glass and slag). In terms of quantification, the survey revealed that there is a significant lack of findings from al-Baha itself; significantly more findings of greater diversity were uncovered in three settlements in Asham, Masodah and al-Asda. This would suggest that the greatest mining enterprises were located in the latter settlements. As mentioned previously, three types of pounders were uncovered in this survey: cylindrical, spherical and spindle, in the same manor, four types of grinders were noted: millstones with one base, and two bases, slab stones and hand grinders. The function for these stone tools was breaking and crushing the ores after the extraction stage (from the mines), whether this was performed within the mines themselves or the materials were transferred to the workshop in the settlements.

The survey indicated that no settlement has remains of pottery (unglazed and glazed) and glass on the surface except Asham, Masodah and Asda. The pottery found in these sites appears similar in terms of fabrics and surface treatments, of varying quantity. The most

significant reason for the absence of surface collections from other settlements could be that they are unfenced; enabling inquisitive people to pick up such pieces, as well as natural factors such as floods and rains that could shovel many of them away.

It is known that the process of mining requires furnaces for smelting and treating ores. Thus, two types of furnaces were recognised, pottery furnace and stone furnaces. The pottery kilns were found in copper settlements among rubbles of buildings and sometimes in the slag heaps, while the stone kilns allocated in the slope of mounds to benefit from the rocky tip as a furnace wall and whether in settlements or near some mines. Perhaps the smelters used locally available materials in the fuelling of smelting, notably the acacia trees which are still prevalent in the valleys.

Finally, slag in the form of heaps and pieces were found in density in most copper mining settlements, and some pieces were scattered on the surface in copper and gold settlements. Slag also found in cases of weak and strong conditions, indicating the times of smelting (high smelting time produces weak slag, and vice-versa). This would suggest that the large slag heaps in some sites indicate low-density ores.

Despite the importance of the information gathered by the general survey in al-Baha region to answer some certain level of questions relating to mining in the landscapes and the sites, it remains insufficient to meet the required purpose to understand these settlements and their functions, and their importance and role in the history of human civilization. In order to multiply the information available concerning mining in these settlements, it is important to ascertain a deeper understanding of mining settlements by intensive survey and excavation in one of these settlements. By merging the surface evidence with the results of the investigation undertaken by this study, it is possible to draw a picture of production places in the medieval period in the south-east of Saudi Arabia. Thus, the next chapter presents the intensive survey and excavation in Asham settlement and its artefactual evidence, in order to explore the tools and means associated with mining in the region.

Chapter 5: The Settlement of Asham

5.1 Introduction

This chapter focuses on the archaeology of Asham as a model of mining settlement, including the Masodah village belonging to the main settlement. It commences with an overview of the site background in terms of location and natural factors, geographical features, population and governance, and the most famous neighbouring Islamic sites. It then presents an examination of the research history of the settlement, followed by the current fieldwork in Asham. This fieldwork aims to understand the mining landscape in Asham settlement; in the site of Asham itself and surrounding areas, and Masodah. The fieldwork in both sites (Asham and Masodah) contained intensive survey including surface materials of constructions and artefacts, in addition to detecting underground archaeological evidence by dug six trenches. All this is to understand the process of production practiced at Asham settlement and to clarify its relationship to other sites nearby. Asham settlement was eligible for the production of large quantities of gold ore in particular, and other raw materials by virtue of the quality of its mine and its location near both land and maritime trade routes.

5.2 Site background

5.2.1 Location and natural factors

Asham is located in Tihama sector in the south-west of al-Baha region at the contact line of the coastal plain with the western mountains of al-Baha, 15km north of Nawan centre and 80km to the west of Qelwah province. Geographical and historical sources say that Asham settlement included the following villages: Asham village, the capital of the territory, Masodah, al-Asda, Nasayeb and Ahsabh. Those historians depended on the similarity of visible constructions and the synchronization of the dated tombstones in these villages.

Probably the first to mention Asham in the Arabic references was al-Yakoubi (d. 897 CE/284 AH), who said “For Makkah its clans: al-Sarat, Asham, Bishah and al-Serein” (al-Yakoubi, 1892, 316), then Ibn Khordadbeh (d. 912 CE/300 AH), who mentioned Asham among Makkah’s territory in Tihama, saying “And its compounds in Tihama Dankan and Asham” (Ibn Khordadbeh, 1985, 133).

The Yemeni geographer al-Hamdani (d. 955 CE/344 AH) described Asham twice, first as a station on the Yemeni Hajj route: “The old road rises to Upper Haliy then to Asham,

passing by Leth and Markob to Yalamlam" (al-Hamdani, 1974, 304). The other important script of al-Hamdani about Asham appears in his book about the metals of the Arabia, in which he refers to the presence of gold in Asham: "For the known metals, Asham's metal [Asham mine] from Kenana town and its good red gold making 104 dinars and it is of abundant quality" (al-Hamdani, 1987, 86).

Al-Hamawi (d. 1225 CE/622 AH) reported that "Asham is located to the east of Tihama following the mountains from Alhasaba [al-Ahsabh] and I think its people are the Azad because at the bottom of their mountains nearby are the homes of Kenana… and it was a village abandoned before the seventh Hijri century [13 CE]" (al-Hamawi, 1979, 314). Al-Edrissi (d. 1165 CE/560 AH) counted Asham as one of Makkah's territories when he said "Makkah has its metropolises, which are the fortresses, some in Tohama Dankan, al-Serine, al-Safih, Asham, Bish and Aak" (Al Edrissi, 1989, 145).

Clearly there is consensus among geographers and historians that Asham oversaw a major region, including several villages during six centuries of Islamic history (7^{th} centuries CE). Plus, this historical fame did not achieve for the rest of the other settlements in al-Baha region. It appears that Asham was not present before the Islamic era, because the Arabian sources talking about the history of pre-Islamic Arabia do not refer to this location despite extensive Arab interest in trading metal ores between the north and south of the Peninsula. Even if we disregarded the historical records of the site, the remaining archaeological evidence does not suggest pre-Islamic occupation. Therefore, Asham was populated specifically by the Islamic State in response to its demand for metals.

5.2.2 Geographical characteristics

Tihama, which includes Asham, is famous for numerous short valleys characterized by being narrow with high, steep sides in its upper tracks that cross the mountain range. These short valleys gather in larger ones with increased width and opened up sides with less steepness in the plain area. At the end, the valleys diversify and dump what they carried of silt residues, forming delta-like areas with a wide range of desert and coast where the sand is mixed with mud, providing a base for farming and settlement (Philby, 1952).

Asham settlement is surrounded by many valleys along the foothills of al-Sarat mountain chain (Figure 5.1). One of these important valleys is Qurma. It starts from the East Mountains of Qelwah province then connects with several ravines near Asham, such as al-Thuaban, al-Karban, and Abufura. This valley extends only a few kilometres to the north

of the settlement and passes through some villages before flowing to the sea (al-Zaylai, 1983).

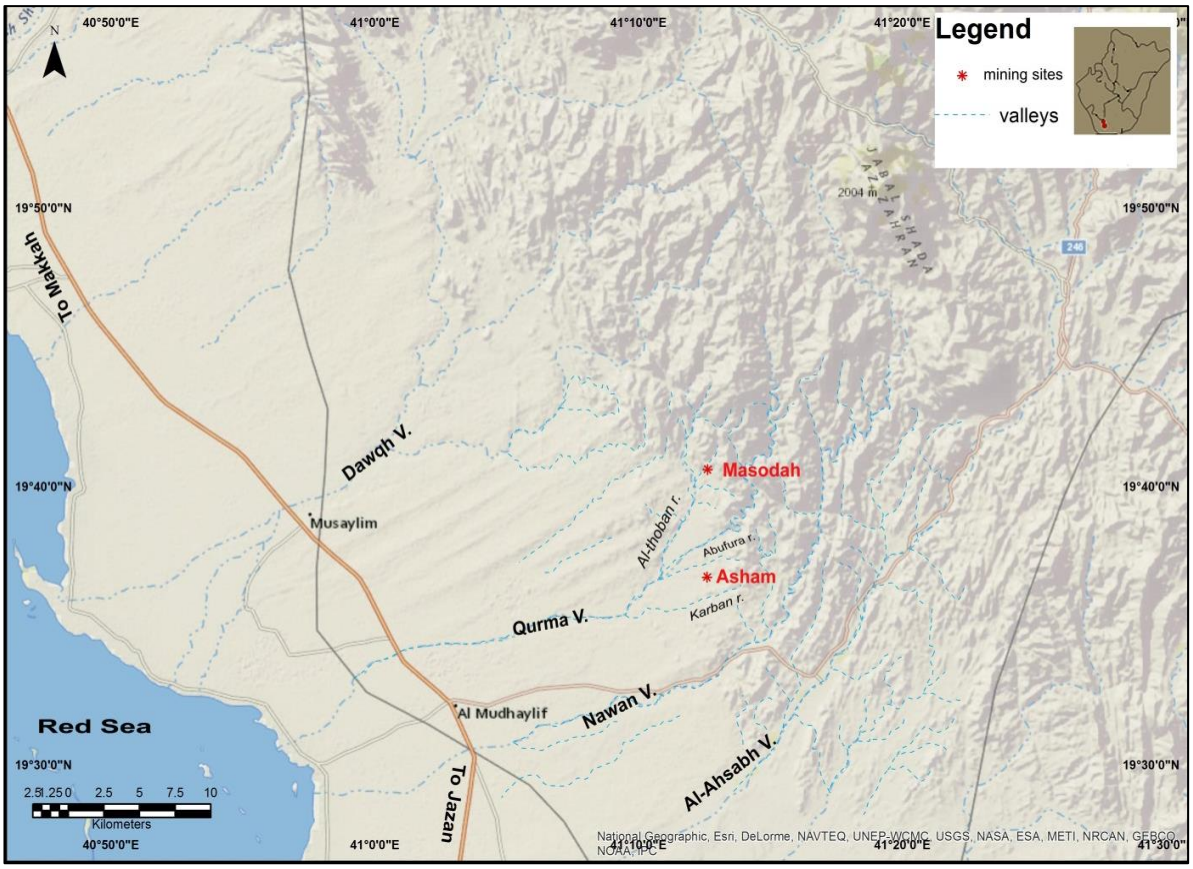


Figure 5.1: Location of Asham and Masodah

The second famous valley is Nawan. It is bigger than Qurma valley and south of it. It starts from the eastern mountains of Qelwah province then passes south of Asham and finally pours into the Red Sea. It is a huge wadi with regular seasonal floods (al-Jasir, 1971, 203). Further south, there is the valley of al-Ahsabh, which is considered the oldest, longest and most famous one in Tihama. It starts from al-Sarat Mountains and is confluent with many tributaries before finally flows to the Red sea (al-Saluk, 1996).

Collectively, these valleys are a supply of water and rich vegetation supporting human settlements, offering good conditions for practices associated with precious metals mining; consequently, many villages emerged on their banks throughout history. Furthermore, the topographical studies of the areas near Asham have shown that the mud located at the beginning of the road to Asham from the south-west side indicates the presence of a huge dam that was built to preserve water for Asham and its near villages (al-Sharif, 1995). This indicates that Asham flourished not only industrially, but also the agriculture was one of its main resources. Additionally, specialized studies inspecting the sand have proven that it is

one of the most silica-rich soils; this confirmed that Asham was very rich with metal ores. It appears that the establishment of Asham near the plains area was mainly justified by mining, which requires resources such as water, crops and timber.

5.2.3 Population and governors

Although the geographical and historical resources referred to the people who populated Asham as being from Azd and Kenanah, they did not refer to the settlement's rulers, despite it being one of the most significant territories under the suzerainty of Makkah. However, literature studies for a group of inscriptions by al-Zailayi (1999) indicated that the rulers who governed Asham in the second half of the 10th centuries CE/4th AH century till the late 11th centuries CE/5th AH century were referred to by the terms "Prince" (*amir*, in three inscriptions) and "Sultan" (in two sites in al-Ahsabh, near Asham). The inscriptions indicate that the local rulers were from the al-Owaid family, descended from Obaid Allah, and it is probable that this family ruled Asham from the 10th century CE/4th AH, possibly an official extension of *de facto* rule by that family from the system of provincial semi-autonomy promoted by Harun al-Rashid (d. 809 CE) (al-Zailayi, 1999, 408). It seems that the increasing importance of the mining industry based around Asham brought the ruling local elite into closer proximity and cooperation with the Abbasid state centred in Iraq (7th to 12th centuries CE/1st to 6th AH).

5.2.4 Islamic inscriptions

Asham is considered one of the biggest archaeological sites in the south-west of Saudi Arabia, containing many historical indications, particularly tombstones, visible constructions and archaeological hills. More than 200 tombstone inscriptions were found in Asham, in different shapes and contexts. Many of the inscriptions are undated, but those carrying a date range from 774 to 1057 CE/157 to 449 AH. These inscriptions carry a lot of facts about mortality, such as titles, nicknames and offices, as well as aesthetic values in the development of Arabic writing decoration. Most of these inscriptions were engraved in un-dotted Kufic script. The Islamic calligraphers were very creative in making the tombstones at Asham, and the inscriptions reveal a great deal of artistic merit, and they indicate the high educational level of the milieu of Asham in terms of accurate and apt use of Quranic epigrams, and the high quality masonic finishing. The names of the calligraphers are signed, the most important being Mohammad Bin al-Tofaill Ahmad al-Haffar, Ibrahim Bin Ishak and others (for these inscription, see al-Faqih, 1992b).

5.2.5 Famous neighbouring Islamic sites

A number of important historical Islamic sites are located near Asham, related with the continuance of pre-Islamic trade and pilgrimage routes and markets. In order to fully comprehend the commercial and civilizational context of Asham settlement, it is necessary to consider these peripheral sites, particularly in regard to comparative study of Asham's artefacts. The chief sites are Hobasha market, al-Serain and Athar (Figure 5.2).

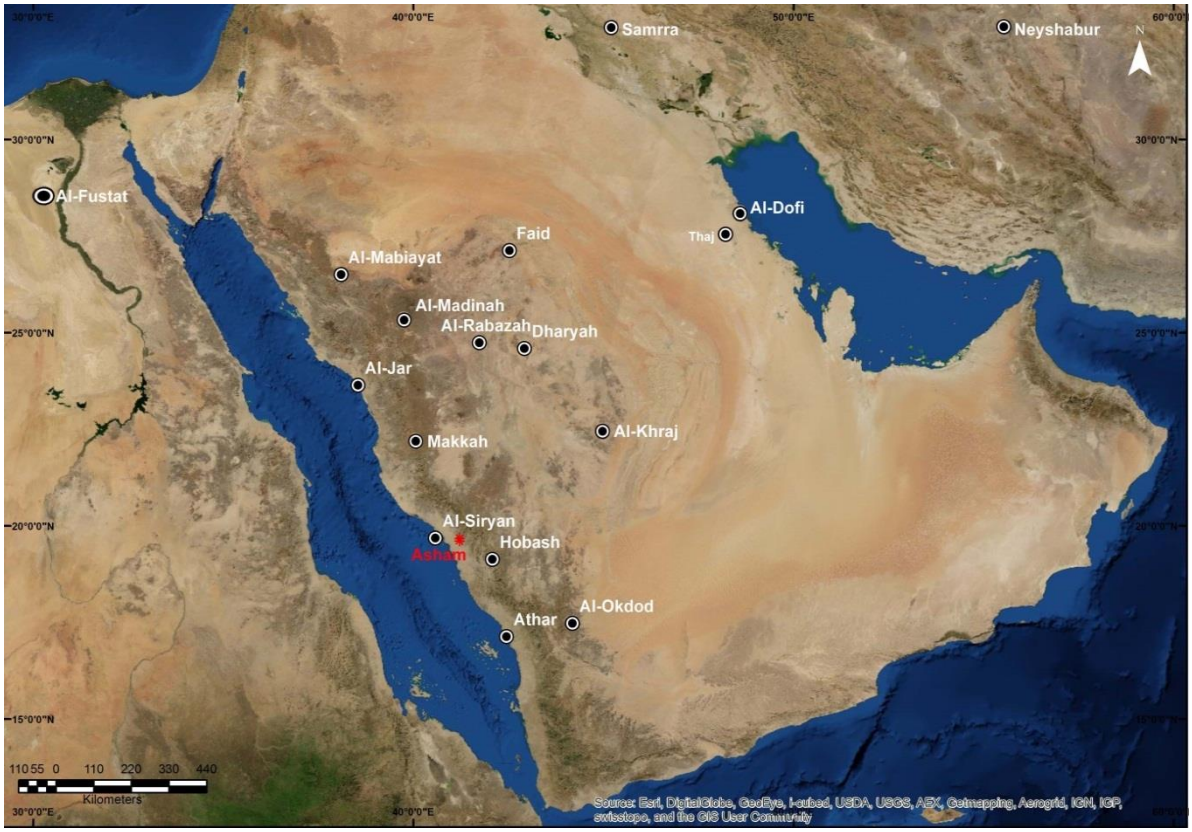


Figure 5.2: Map showing famous neighbouring Islamic sites (Hobash market, al-Siryan and Athar)

5.2.5.1 Hobasha market

Hobasha market is located 70km south of Asham. It is one of the oldest Arabian markets from the pre-Islamic era (al-Afgani, 1993). This market had a great deal of influence on the trading business with Asham because it was considered the most important resting station for the pilgrims on the Hajj route. Additionally, Asham and Hobasha were both administered by the province of Makkah during the early Islamic era. It is expected that there was commercial relations between the two locations at least to cover the needs of goods and available labour.

5.2.5.2 Al-Serain

Al-Serain is one of the famous cities located on the coast of the Red Sea, about 43km south of al-Laith City, around 80km west of Asham (Al Fakih, 1992a). From the early Islamic era, al-Serain was also governed from Makkah. Its chief importance lay in the fact that it was a harbour for the area of Hejaz and al-Sarat. Moreover, it is located on the coast and intersected by the land maritime Hajj road connecting Yemen and east Africa with the Hejaz (al-Thenayian, 2008). At the end of the 11th century CE/5th AH, al-Serain became one of the great cities in south of Arabia and its architecture, including markets, bathrooms and a mosque, were built on the sea coast surrounded by a wall that also enclosed its harbour. Clay was used in its architecture and what the surrounding environment had to offer in terms of wood. The population depended on agriculture, especially corn and sesame, livestock and trading with nearby urban areas like Athar and al-Harda cities (Al Fakih, 1992a; al-Thenayian, 2008). Its commercial ties may have extended to Asham, particularly as it had a commercial harbour facilitating the easier transport of metals from Asham by sea.

5.2.5.3 Athar

Athar (or the Sulaimany territory) is also one of the famous sites on the Red Sea coast in Jazan region, located about 40km to the north-west of the current city of Jazan (al-Zaylai, 2003). It also fell under the auspices of Makkah from the 7th century CE/1st AH. Its coast played a part in local, regional and global trading besides the service provided to the pilgrims coming from Oman, Yemen, east Africa and other places, linking the marine and coastal routes.

Athar's reputation matured in the 10th century CE/4th AH. It became a big city containing a number of sub-cities and internal urban and coastal areas like al-Serain, Halai Ibn Yaakoub and Beish. Athar continued being a trading and rest station for pilgrims until the second half of the 13th century CE/7th AH (al-Zaylai 2003).

Athar city is notable for having contained a mint, striking gold coins bearing the legend "*Athari Dinar*" from the 10th century CE/4th AH. One of the oldest collections of golden dinars was struck in Beish in 914 CE/302 AH, while the latest was struck in Athar in 1002 CE/393 AH (al-Thenayian, 2008).

Accordingly, Asham was located in a strategically important position in terms of several factors: geographically, around two fertile valleys, Nawan and Qurma, near the richest

mines in the south of Arabia and amendable to human activities; economically, not far from the commercial coastal cities that represented ports for its productions. The economic and social growth in Asham extended from the 9th to 12th centuries CE/3rd to 6th AH. It seems that Asham was deserted in the 12th century CE/6th AH, and its population moved to al-Ahsabh, as confirmed by tombs interpreted as representing the cessation of mining in Asham and its territories (villages).

5.3 Research history

Although Asham is of the most important archaeological sites in al-Baha in particular and in the KSA in general, no significant change has happened in the field of archaeological research since the last survey of mining through the CASP in the south-western area (Hester et al., 1984, 115-142), with some exceptions, including the efforts by al-Zaylai. Al-Zaylai (1983) investigated the emirates in the region of Makkah, including some surface surveys and study of a number of Islamic inscriptions in some towns ruled from Makkah during the 9th to 13th centuries CE/3rd to7th AH, including al-Serain, Aleib, Asham and Masodah (al-Zaylai 1983). In addition, he studied a number of inscriptions related to the governing families in Asham and its territories (al-Zaylai, 1999). Al-Faqih (1992) in his studies about Tihama territories and its inscriptions shed light on Asham (al-Faqih, 1992). All those studies are useful to this research, therefore having some background about them will give knowledge of the research history of Asham as summarized below before the current fieldwork was conducted.

5.3.1 SCTA explorations

Since the beginning of the CASP, the fieldwork surveys focused on many archaeological aspects including the ancient mines and mining sites. As mentioned in chapter 4, by 1983 CE/1403 AH a team undertook a three-month mission to survey the ancient mines and mining sites in al-Baha region in three camps which were set up in various locations in the area. This was the pioneering endeavour in the region, followed by a survey 50km south of Asham (Hester et al., 1984, 115-142). This season recorded about 65 sites in al-Baha region; three of these sites were located in Tihama (Asham, Masodah and al-Asda). However, early surface studies suggested that the stone tools such as millstones and pounders found there did not in themselves comprise sufficient evidence that Asham was part of a mining area for the processing of mineral ores in the medieval period. This suggestion came through the initial interpretations adopted on the surface evidence without

any attempt at excavation to reveal more evidence relating to the mining and its tools and methods.

5.3.2 Specialized researches

There are a small number of specialized studies in the settlements of Asham in different fields in archaeology such as the Islamic settlements and inscriptions. One of these studies related to the policy of Makkah and its towns in the medieval period. Al-Zaylai (1983) prepared historical and archaeological study of the most distinguished archaeological sites in the Tihama, including Asham, al-Syrian, al-Kolf and al-Khalif. This study treated these sites in terms of location and extreme geographical and subordination policy of sites during that period and their association with the Emirate of Makkah. He described archaeological sites including houses and mosques, commercial markets and some surface artefacts, and reported to the metal of Asham. Al-Zaylai also revealed more than 40 Islamic inscriptions found in these sites, including the names of Asham itself and of some Ashmains who died and were buried there (al-Zaylai, 1983).

Despite the importance of this study as a pioneering archaeological study of surface phenomena and artefacts, it did not address the mining process despite the visibility of mining tools in these settlements, as well as the solid existence of Asham in an apparently unobtrusive location during the early history of Islam. No consideration was given to the purpose of mining and investment in minerals resources in order to strengthen the Islamic State treasury by using ores for minting the new single currency and funding the State.

Similarly, al-Faqih (1992b) carried out extensive studies on the archaeological remains, especially on epigraphs at the archaeological sites of Asham, Masodah, Nasaib and al-Ahsabh (South and North), all of which were located within the geographical area of al-Baha and were essential mining sites during the Middle Ages. He deduced from the epitaphs that the population originated from the tribes of the Hejaz, and he demonstrated the characteristics of these gravestones and foundation epigraphs in Asham, which amounted to nearly 200 inscriptions. This group is covering a period of time from the 7th to the 11th centuries CE/1st to mid-5th AH. They reflected the level of development of the Arabic script with improved line and decoration. In addition, the development of commercial activity and economic development is reflected in the production of these epigraphs, as well as educational development through the emergence of names of scholars and scientists included in the texts (al-Faqih, 1992). The study also involved a group of eight important inscriptions in Masodah, one of which dates from 774 CE/157 AH. Many

inscriptions had been moved during the last period, as in the other archaeological sites (al-Faqih, 1992). Similar to al-Zaylai, no attention has been paid to mining in these settlements, despite it being known that the main purpose of the establishment of these settlements was related to mining.

However, the evidence of inscriptions is useful in clearly reflecting the social growth in these settlements underpinned by the continuation of mining. The mention of political figures charged with administering Asham is itself indicative of state overseeing or involvement in mining. Additionally, mining needs labour and materials not usually found within a single locale.

Although archaeological studies undertaken by SCTA and specialized studies (al-Faqih, 1992; al-Zaylai, 1984, 1999) conducted during the last three decades unveiled a fascinating history of human settlement and activity in Asham settlement, which are an integral part of the story evolution of human civilization in Arabia, mining has clearly been neglected.

Therefore, the current study focusses on those previously overlooked aspects regarding places of production and their characteristics, tools and means through intensive surveys at Asham and Masodah and by studying surface collections, then archaeological excavations to detect these tools and methods and stages of occupation in the these two sites and study of trench collections.

5.4 Fieldwork in Asham and Masodah

As a result of the general survey of mining settlements in al-Baha, it was decided to focus on survey and excavation in two sites Asham and Masodah as a model of mining settlements (Masodah, located 5km north of Asham and one of its villages) due to surface stone artefacts found there (such as millstones, stone pounders etc.).Therefore, the fieldwork in Asham settlement divided into two main phases: intensive archaeological survey in the sites of Asham and Masodah, then the excavation in both sites which is second phase of fieldwork in this study. Advanced stages carried out for fieldwork, including general preparation and providing possible means for implementation, are outlined in this chapter.

5.4.1 Methodology

5.4.1.1 The intensive archaeological survey and sample collection methodology

This stage is important because Asham and Masodah are the models of mining settlements in this study, and as noted previously these sites must be studied in detail. It consisted of an intensive survey of the sites of Asham and Masodah in order to identify the features of the mining landscape, capture surface findings, and place the locations of trenches according to excavation goals. Archaeological survey was conducted in the areas selected by iron fence in Asham and by concrete blocks in Masodah and also covered the outside archaeological area in order to identify surrounding mines and any other archaeological sites associated with the main site (Figures 5.3 and 5.4).

Although the importance of mapping sites in general is acknowledged, this was not undertaken as part of this survey due to the absence of a Total Station while conducting the fieldwork, in addition to the distance between the sites Asham for Masodah to make the grid. Therefore, this survey divided each site into three zones, since this division is particularly amenable to both sites.

In terms of the surface collection strategy in Asham and Masodah, it was conducted by collecting the samples from the main archaeological zone for each site (selected by iron fence in asham and slabstone in Masodah; Figures 5.3 and 5.4), which are all scattered on the surface of both sites. The criterion of choosing stone tool samples of grinders and pounders was represented all different shapes as possible, while wares (samples of pottery, soapstone and glass) of different functions (pots, bowls, jars, cups and containers) were considered with regard to their thickness, especially since these standards are important in mining. In addition, the standard colour and decoration were taken into account to compare the site with others in Arabia.

Then, both sites were photographed, and surface samples were picked up and finally bagged with comprehensive documentation. Moreover, the most prominent architectural phenomena were recorded and photographed, and satellite images (from Google Earth) were used during the archaeological survey in these two sites.

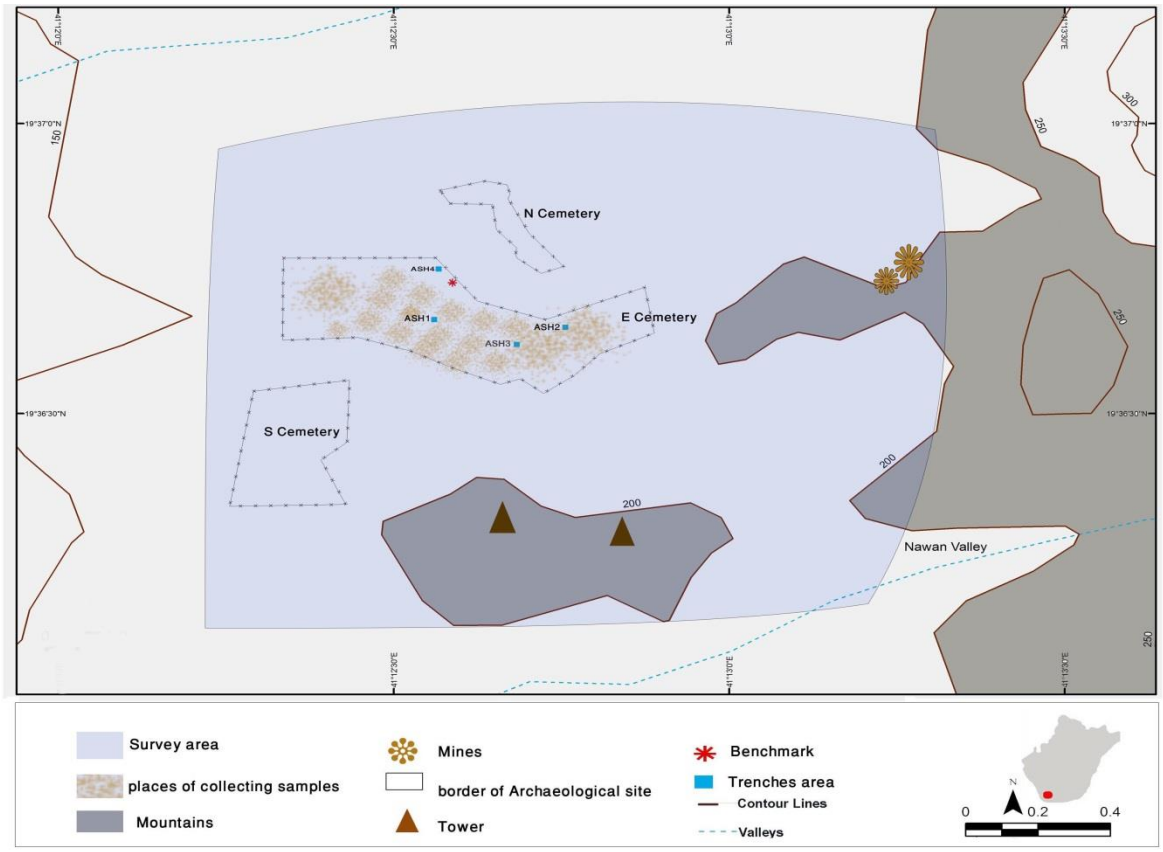


Figure 5.3: The fieldwork in Asham

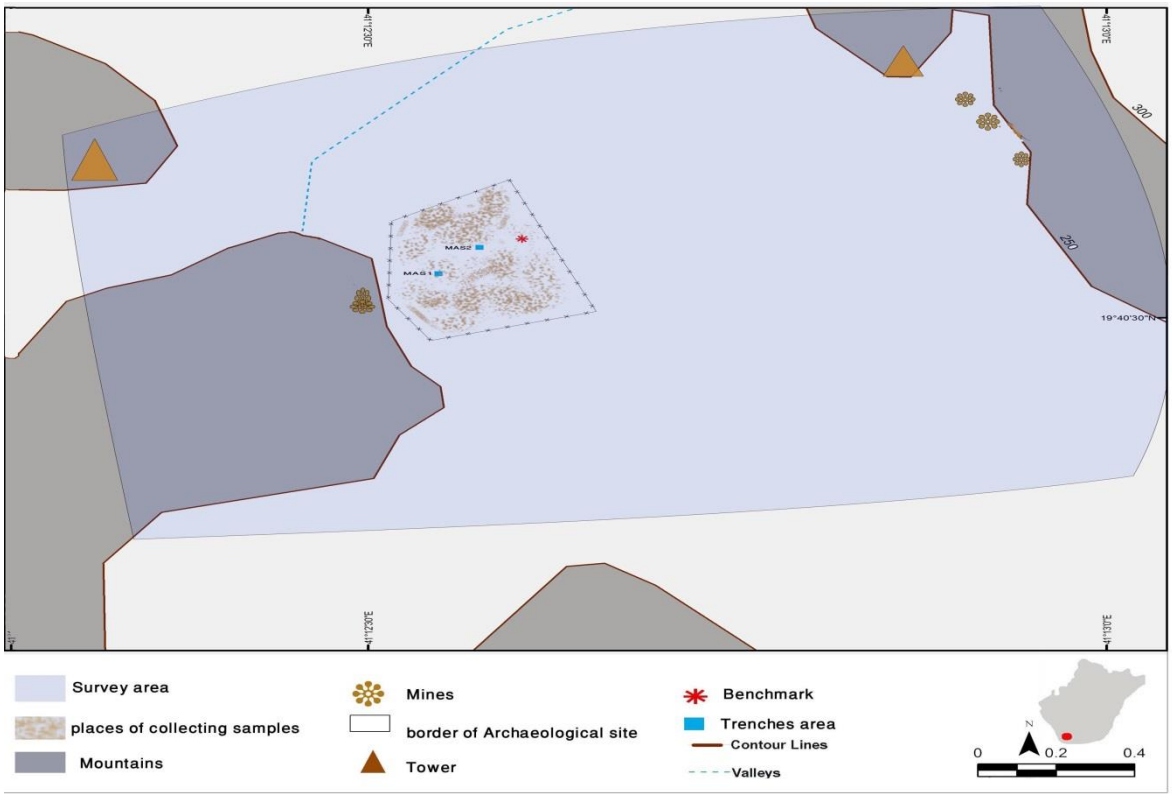


Figure 5.4: The fieldwork in Masodah

5.4.4.2 Excavation methodology

The intensive surveys on Asham and Masodah implemented during the second phase of fieldwork led to the formation of a preliminary picture of the importance of the sites as mining settlements due to the numerous tools for mining, and the sites are characterized as large in size, breadth and multiplicity of features, relics and architectural ruins. Some of these were buried; other architectural units appeared above the level of the ground, including the houses, towers and the mosque. It is not possible to complete the picture of the mining settlements without disclosure of what is found under the rubble. Thus, from this standpoint and within the goals of this study, archaeological excavation was conducted at Asham and Masodah with one specific methodology, aiming to show stages of occupation as possible, measure the density of archaeological artefacts, identify the kinds of the tools used in mining and non-mining, detect any evidence for the processing of raw materials (such as the remains of metals or smelting furnaces), and any other means that describe the business of mining. The excavation phase was undertaken in two main stages.

At the beginning of work, the benchmarks in Asham and Masodah sites were determined. In Asham, the benchmark was selected on the northern side of the archaeological boundaries above a small hill next to an iron network. It focused on an iron column at point N 19 36 43.8 E 41 12 35.7, rising 272m above sea level. In Masodah, it was determined on the eastern side of archaeological boundaries on an electricity column at the point N 19 40 35.38 E 41 12 36.42, rising 215m above sea level. Six archaeological trenches were identified in various sizes as required by the goals of the excavation and the nature of the site. Four of them were at the site of Asham and the rest were in Masodah. The six trenches were each given a short name. For example, ASH1 represents trench one in Asham and MAS1 denotes trench one in Masodah etc (Figure 5.3 and 5.4). These trenches were planned in the ground with cotton rope and metal pegs. The trenches were distributed in different parts of the archaeological sites, as shown in the table below (Table 5.2).

Positions for the removal of spoil in both settlements were determined at the outset. Each trench had approximately two locations for this, to ensure it was empty of archaeological remains. In addition, these positions were located in opposite directions from the wind; the soil at the sites is particularly sandy, and could easily blow back to the site. The spoil removal from trenches was undertaken by handcart. Some of the spoil removal soil was sieved in these locations (using a 5mm sieve) to detect any small findings.

After planning the trenches, digging was initiated. All excavation processes were carried out by the author and the Manager of the Archaeology Department in al-Baha, and then four labourers took over the transfer spoil removal to the locations specified in advance. Excavation was implemented according to scientific methods. First, each trench was cleaned of stones, and surface artefacts were collected in special bags. Second, the digging was done with spits of 5 to 10cm in each stage of digging until the bedrock. Small artefacts found in the soil during excavation were taken into account. Consequently, soil where artefacts were found was sieved to make sure it was free of extra findings. Finally, all layers were accurately described, including layer cumulative nature and colour, size, depth and condition, according to the specific form (see Appendix 3).

Archaeological loci were documented with specific cards, and photographed by scales size 0.50, 1, and 2m, with north arrow, as well the location of the benchmark, in addition to measurements such as length, thickness, height, shape, construction technology and function at the site, and layer to which the artefact belongs. All photography was conducted during the digging stage, with all steps moment-by-moment from beginning to end. Some notable artefacts found in the trenches were imaged in their layer from different angles. Imaging was conducted at appropriate times during sunrise and sunset, according to suitable scales and north arrow.

Mining and non-mining artefacts during the excavation, such as pottery (glazed and unglazed) and glass, and were labelled with information such as date and place of discovery, item type and layer, and serial numbers referring to trench were assigned. Graphics and pictures were compiled in one record. Finally, artefacts were placed in special bags, taking into account the separation of fragile samples, and samples of the photography and study were put in special bags in preparation for subsequent phases. At the end of each day, all discovered artefacts were transferred in special boxes to al-Makhwah Museum. Also, a report was written on all stages of excavation and artefacts, including serial numbers of images, as well drawings executed in the field.

After completion of fieldwork, the layers were drawn manually (due to the lack of a Total Station machine), in the process of concluding trenches that carried distinctive archaeological finds. Sections for the trenches whose measurements were taken in the field were later drawn with AutoC CE software.

5.4.4.3 The artefacts collecting and analysis methodology

As it mentioned earlier in chapter 4, the surface materials (stone tools, pottery, soapstone and glass) scattered in Asham and Masodah will were subsequently studied in more detail on order to identify the tools and facilities of mining, as all of these artefacts (including expected excavated materials form the six trenches) are available abundantly there, as well as the tools widespread in mining settlements in terms of extraction, manufacturing and production. Therefore, studying these materials will reveal mining evidence that took place in these settlements by analysing Asham artefacts. The heavy surveyed and excavated stone tools (pounders and grinders) were photographed and classified in the field due to the difficulty of moving them to the workshop of study samples, while the lighter ones (less than 2kg) were moved to the workshop with the rest of the collections. All surveyed and excavated collections from Asham and Masodah were washed with renewed water more than once. Subsequently, they were cleaned with soft brushes to remove impurities. These objects were then placed in the sun until completely dry. After that, all objects were typologically classified based on the material type (stone tools, unglazed pottery, glazed pottery, soapstone, and glass). Subsequently, a comprehensive digital record was made of all objects. As a first stage to document the objects, the record contains the basic data, namely site name, position, type of ore, and part of item and function. Each piece was then weighed in grams.

In terms of the study of mining evidence, groups from each category were selected according to specific criteria, whereas the rest of objects were deposited in the warehouse of the Archaeology Office in al-Baha.

As for the stone tools (1096 in total, comprising pieces of pounders and grinders surveyed and excavated), 427 mining tools were selected for the study selection. The criterion of choosing this group was implemented by noting the diversity of these tools and their differences in form.

A total of 2009 pottery fragments were surveyed and excavated, from which 77 unglazed and 44 glazed fragments were selected for deeper study, also according to specific criteria. They contained bases, or rims, or both, to facilitate the process of identifying the type of vessel, and a set of body sherds illustrating decoration as well as a selection of handles to identify their shapes. Both the unglazed and glazed pottery fragments were subjected to study by identifying the fabric of each piece, average thickness, firing degree, and function of vessel (using the methods of Orton, Tyers and Vince, 1993). The contouring section and

size of vessel was then identified, including composition and structural details of vessel, followed by checking the colour of paste, core, inner and outer surfaces, by passing each fraction on Munssel soil colour charts. The hand lens of 1×30 was used to examine the organic and inorganic impurities, hardness of paste, and style of manufacturing. After that, the treatment of the internal and external surface of the piece was observed.

Of 138 fragments of glassware surveyed and excavated, 28 pieces were selected for further analysis of average thickness, firing degree and function and shape of vessel. The colour of paste, core, inner and outer surfaces, the hardness of paste, and the style of manufacturing were examined. After that, the treatment of internal and external surfaces of the piece was detected. Finally, decorative methods on each piece and the method of execution were noted, and decorative elements identified.

Each piece of study selection was given a serial number with the basic information in the record of objects (site name, and ore etc.) and was weighed again individually in grams. Each piece was photographed using a scale of 1-10cm, especially some pieces which contained decorations and graphics. A set of typical artefacts were chosen and drawn directly by using squares of paper and transparent paper. Drawings included faces, thickness etc., according to the scale 1-2cm.

It should be noted that the distinguishing between mining wares and non-mining is undertaken in this analytical study of selection. Al-Hamdani's account regarding mining wares presented in chapter 2 included discussion of hard fabric, as well as high thickness of walls and containing handles or side edges inclined to outside for the pots, and length of necks with narrow mouth for the jars, plus the capacity of bowls. All of these criteria were considered, in addition to other considerations such as the presence of any signs of melting on the edges or of these wares, and discovery of these pieces in smelting areas beside furnaces was also noted in this study.

As for non-mining wares, some standards have been taking into account such as ornamentation carried on each piece, as well as the prevalence of such these pieces at other nearby sites adjacent to the study area in Arabia and beyond (as discussed in chapter 6.6). However, the order of reviewing both surveyed and trenched objects is related to their priority with regard to the mining process (as described in chapter 2.2), starting with breaking by stone tools and then refining, heating and melting by using pottery soapstone and glass wares.

5.4.2 Intensive archaeological survey

5.4.2.1 Asham

Archaeological survey was conducted in the areas selected by the fence in Asham and nearby (Figure 5.3 and 5.5). This area is surrounding by many ravines, such as al-Kerian, which extends from the east to the south, and Abu Fariah, and a massive series of sand dunes in the north, west and south, which makes it difficult to access the site by conventional transport. The archaeological area occupies an area of about 278m from north to south, and 951m from east to west.

Figure 5.5: General view of Asham

Generally, Asham contained buildings constructed in accordance with the criteria of Islamic architecture. This means that these buildings did not depend at their inception on specialized architecture or planning only, but also on the mores of Islamic tradition and law. These criteria were equivalent to modern building laws. The provisions of the architecture in Islamic jurisprudence (*Ahkam al bonyan fi al fiqeh alaslami*) were replicated throughout the Muslim world automatically, without the need for official inspection (al-Mosawi, 1982). These foundations relating to planning, distribution and function for all buildings in early Islamic towns started from Madinah after the Hijrah. The fundamental urban planning of Madinah was based on the residential, commercial and cemetery zones, and this pattern was replicated throughout most cities in the early Islamic period. Correspondingly, Asham may be divided into residential zone (RZ), commercial zone (CZ) and graveyard zone (GZ) (Figure 5.6).

- The residential zone (RZ)

Housing is one of the most important facilities affected by the criteria of Islamic architecture, particularly with regard to the orientation, location and style of building, taking into account simplicity, privacy and compatibility with the environment in addition to conformity with Islamic cosmography. All of these aspects were clearly manifest in the building of homes across the Islamic world. Therefore, Asham homes mostly consist of small houses, rectangular or square in shape. Its architecture is characterized by strong construction and interconnected buildings. Some of these homes are independent and out of the architectural fabric of this zone, however these separated houses are located along streets and alleys. In the eastern side of this zone there are foundations of buildings, some rising up to 2m, built on two segregated high hills, and their architectural remains show that they are the remains of controlling towers.

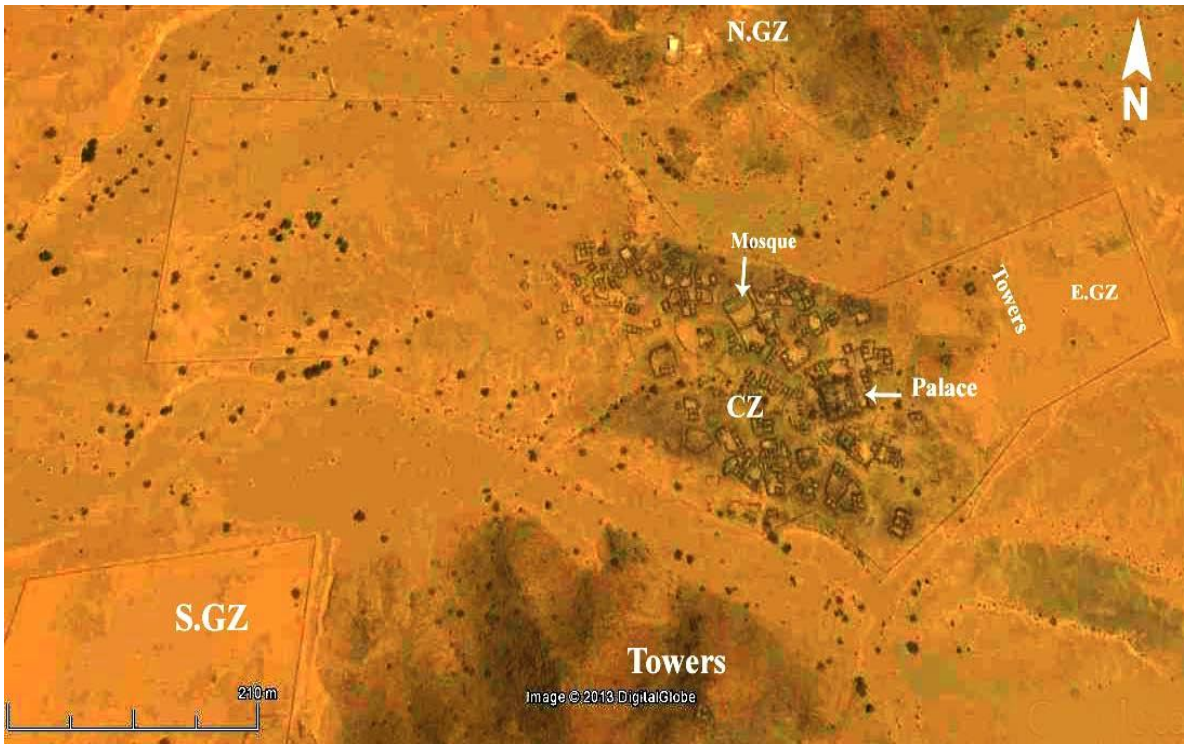


Figure 5.6: Satellite image for Asham, CZ: commercial zone, GZ: graveyard zone

(Google Earth, historical imagery 16.4, 2004)

The architectural units are spread in a sandwiched area 223m from south to north, and 688m east to west. There are up to 100 houses, which range in size from 50 to 90 m^2. Each house consists of 2-4 rooms, and a courtyard in front of the house devoted to the practice of family activities, and perhaps to house livestock. Notably, there was no reference to the use of mortar in the buildings. Additionally, some millstones can be seen used as building

materials, particularly in foundations. The condition of these buildings at present does not indicate the ceilings of these homes, which were presumably timber. Perhaps these ceilings were used in more recent periods after the site was abandoned for use in modern buildings, or used a fuel Among the ruins of this zone, there is also a large building, presumed to be a palace, the largest residential building, with an area of 900m^2, surrounded by high towers in each corner, and provided by an external well in the north. This palace contains 15 rooms distributed around a central courtyard, opening toward the centre. It was the seat of government of Asham, and those rooms may comprise the divan. The divan was one of the facilities of the early Islamic period which Muslims were keen to establish at the beginning of the formation of the Islamic state, functioning as the governor's residence (al-Mosawi, 1982).

Such large complexes buildings were built in most cities that had a provincial ruler, constructed in the centre of the settlement adjacent to the Jummah mosque (reflecting the Prophet's house in Madinah adjoining his mosque), enabling the interaction between the ruler and the people for the purposes of prayer, consultation and justice. It is possible to confirm by existence of some inscriptions using the term "Prince" at Asham that the divan was the headquarters of the ruling prince and his entourage. These houses (including the palace) are joined by longitudinal and transverse corridors ranging from 1-2m in width to ensure the population access to the mosque and the business district. Some sources indicate the presence of dated and undated inscriptions found between the stones of buildings (al-Faqih, 1992b; al-Zaylai, 1983).

The mosque is considered to be the most important form of Islamic architecture; it was the central convergence point for village planning and where meetings were held, and it was also the primary educational and social institution. It also had a clear impact on the pattern arrangement of populations (al-Kahlwai, 2000, 15). The earliest mosques in the Islamic world were simple enclosures formed from clay-brick walls roofed with timber and leaves. They contained a niche marking the direction for prayer (qiblah), a pulpit, and a small courtyard attached to the mosque in which worshipers could meet after prayers to hear conversations and exchange news. The minaret became a standard feature in larger settlements, and a pond was built where possible for ablution (Kahlawi, 2000, 178). These elements can be seen in Asham's mosque, which is one of the earliest mosques in the south-west of Arabia.

Asham's mosque is located on the north-western side of the residential area and includes a

stone foundation referring to the date of reconstruction in the year 1023 CE/414 AH, endowed by Prince Abdullah bin Owaid (al-Zayla'i, 1984). It has a large area 24m from east to west, 31m from north to south, and in the middle there is a courtyard of 13×31m, as well as rundown foundations of quadripartite minaret located in the south-eastern corner of the mosque. The mosque consists of three fundamental parallel qiblah walls, extending 24m from east to west, and 12m from the qiblah wall to courtyard. Furthermore, a single row of 5m in width was also found at the back of the mosque. The niche is 2.3m in width and 2m in depth in the middle of the north-eastern wall (the qiblah wall), while the southern and western walls included two entrances, each of 1.5m width.

Given the large area of Asham's mosque and its being one of the largest mosques in the southwest of the Arabia, it functioned as a significant venue for congregational prayer five times a day, and in the weekly Friday prayers, at which time it would be a meeting point for residents of the territories adjacent to Asham when they came to hear the sermon, pray, socialize and buy and sell in the market.

Towers are another type of basic Islamic architecture that spread throughout the Islamic world. Towers were ubiquitous features of city walls during the Middle Ages, such as at Baghdad, Fez, Cordoba, Cairo, Sana'a, Zabid, Madinah and Diriyah (Mahir, 1986). As a gold mining centre and a node of local governance, Asham was a strategically important site and had to be defended. Archaeological surveys showed a group of defensive towers in the settlement. In the western edge of the residential zone there are remains of the foundations of a wall of 40cm width, surrounding this zone from south to west and linking with the twin towers mentioned above. This wall is also a border between this zone and the graveyard (Figure 5.6). Ibn Khaldoun (1996) stated that an urban site should be protected on all sides, by means of hills or walls and towers to observe the surrounding environment (Ibn Khaldoun, 1996, 113). This condition is obvious in Asham with the existence of towers in the south eastern area, built on the high hill to control transients around the settlement.

- Commercial zone (CZ)

The market is also an important facility in Islamic urban planning and architecture in terms of its position in the settlement, the presence of shops, conditions of ownership and planning. Islam has always been keen on trading, and urged the continuance of pre-Islamic markets as sources of livelihood, trade, and crafts. This trend is known in all early Islamic urbanism (al-Mosawi, 1992). Islam has developed standards and laws applicable to all

owners of these markets and also codified the buying and selling system, so Asham market one of these resources of wealth and trade.

In Asham settlement, the commercial area is located at the south side of the residential zone (Figure 5.6). The market consists of two rows of small shops in a converged space facing each other. These rows are separated by various streets of 6-7m width. Most of these shops are rectangular (roughly 10×4m). Furthermore, they are divided into two parts, rear and front, and it seems that one chamber was used to store goods, and the second for the display of merchandise. Other shops contain three sections, as well as two shops in the north with only one section in each of them. Close to the market in the western side there is also an open area, perhaps devoted to periodic markets or buying commodities such as livestock (some examples of this kind of market still exist in some parts of al-Baha region, as discussed in chapter 3). These shops were built in the form of longitudinal extensions of 30m based on stone slabs. All its sections are identical and compatible with foundations of market systems in Islamic jurisprudence.

- Graveyard zone (GZ)

The Islamic system did not permit sophistication in the work of shrines and tombs, despite what is found in some other Islamic sites outside Arabia. Therefore, the simplicity of implementation and burial can be seen in Asham settlement of three cemeteries by digging a rectangular trench and stone slabs to determine the campus of the grave. However, burial areas are distributed in three locations in Asham.

The first one occupies the eastern side within the boundaries of the archaeological site (170×131m) and contains a group of graves of adults and children. A group of gravestones found there date to the 11th century CE/5th AH. Perhaps this cemetery is the main cemetery in Asham, due to the large number of graves (Figure 5.6).

The second cemetery is located on the south side within the separated iron fence not far from the main site. It occupies an area of 393x250m and contains a number of graves, and some foundations of buildings, as well as several gravestones dated to 853 CE/239 AH, as well as 24 undated gravestones estimated to be from the 9th century CE/4th AH. Sand erosion has obliterated many features of this cemetery (for these gravestones, see al-Zaylai, 1983).

The third cemetery is located on the north side, surrounded by an iron fence (305×130m). This is perhaps the most important of the grave sites in Asham, due to the careful shaping of the stones, 50 of which are dated to the 9th to 11th centuries CE/4th to 6th AH.

- Neighbouring zone

Archaeological survey extended to the areas adjacent to the site by about 2km on all sides, including the mountains that surround Asham from the south, east and north. The most prominent and closest of these mountains is the shortest, al-Masane, situated on the south side of al-Doho mountains in the east and north were surveyed, and found to contain features of surface mining. The western side, dominated by sand dunes, is devoid of any archaeological features. At the top of al-Masani there are the remains of two towers, the taller of which is located in the south, and the shorter in the south-east. Both of them are stone ruins with short walls of 1-1.5m. These towers are characterized by wide walls in the lower parts, narrowing in the upper parts. These towers were probably related to those in the residential zone (mentioned above). The towers can be seen for a long distance around the Asham, suggesting that they may have been used as road markers (a common feature on the pilgrim routes).

The area of mineral ore extracted was discovered in the eastern mountains (al-Daho) around 900m from the Asham site, confined in a ravine between two small mountains extending over 600m from south to north. Three long, deep pits are still visible with clear entrances ranging in diameter from 50-100cm. Indications of surface mining in these mountains include marks from the striking of chisels on the faces of the rocks and the clear marks of burning from the surface of faces.

Perhaps the existence of this mine in this ravine was a good place to take advantage of obtaining large quantities of gold ore, washing the gold in the water, and then transporting it to Asham for further treatment (Figure 5.7). The natural resources of the valleys were thus the basic materials of early civil settlements in Asham, providing resources and livelihoods, in terms of food, wood, water and mineral ores, and the means of processing those ores to sustain an urban community.

Figure 5.7: General views of Asham mine and mining pits

5.4.2.2 Masodah

The survey was carried out at Masodah in the archaeological area located by cement slabs, 1km from north to south, and 0.5km east to west plus to the neighboringarea (Figure 5.4 and 5.8). The small size of Masodah has led to the assumption that it lacks architectural facilities. Its general shape did not come out of the framework of Asham in terms of planning and building functions. Masodah may be divided into three zones: residential RZ, graveyard GZ and neighbouring zone NZ, as explored below (Figure 5.9).

Figure 5.8: A general view of Masodah

- The residential zone (RZ)

The same architectural foundations found in Asham were used in constructing the dwellings in Masodah: suites of housing units, multiple rooms in addition to presence of paths and corridors between these houses. The residential area represents the biggest zone of the settlement, located in the north. The remains of housing spread out over an area of 200x300m, built with local stones. The average area of each house is nearly 90m^2. The height of remaining walls varies from 1-180cm in height, and 80cm in width. Each house consists of 2-4 rooms, and a back yard probably relating to some activities such as buying and selling or animal husbandry.

It appears that some of the existing buildings have been recently reconstructed for agricultural purposes or daily requirements, and some Islamic inscriptions were added to these buildings at a later period. Additionally, some building materials have been reused in other functions, such as circular stones and small yards being covered with wood in order to protect new-born sheep until the shepherds return from the fields (a common and ancient agricultural practice in the region).

There are the remnants of a tower (3×3m) overlooking the residential zone. This tower is located on the eastern side of Masodah. It was built of large stones without mortar. These towers probably housed people who had some function of controlling and perhaps protecting the mining district in Masodah, as in Asham.

There are three wells on the western side of the zone, ranging in diameter from 1.5-2m, built of carefully cut stones from the surrounding mountains. They represent the water resources of the village for watering and using in mining operation. These wells also were located on one of the roads associated with the coastal trade route stretching from Yemen to Makkah through the settlement of Asham.

- The graveyard zone (GZ)

The GZ was similar to that in Asham. This zone is located on the south side of the main site. Several graves are distributed in this area, which contained a large number of dated and undated Islamic inscriptions. Subsequently, these inscriptions were removed to the three museums mentioned previously. Some graves were identified by the use of thick stone planted on the borders of each grave, as well as some white quartz stones

disseminated on the surface of these graves, a tradition used in the region to indicate the social status of a person who was buried there.

- Neighbouring zone (NZ)

The survey in Masodah covered a distance of about 2000m, in order to identify any other sites or features of mining relating to the main site. The site is surrounded by a chain of hills and mountains from the east and west, interposed by huge sand dunes covering some hilltops. Between these hills there are some sub-roads for trade routes adjacent to the settlement. Surface mining has been discovered on the western side of the settlement, with the spread of stones in the form of veins of quartz.

Three mines for extracting mineral ores have been detected in the edge of the settlement. Two of them in the west side have grooves extending almost 24m, showing the mining and mineral ores (Figure 5.9). These grooves intermittently extend toward the southwest entrance of the settlement. The third mine is in the east edge on the top of the hill, but the mine hole has been closed with stones (perhaps when the mine was depleted). Pieces of millstones, stone pounders and slag are spread on this hill, as well as burning surfaces that were clearly noted in this part of the settlement.

A few mine holes were found in the far eastern side on the mountains, locally called al-Thoban ('the snake'), at a distance of 1100m from the settlement. One of these investigated mines has a depth of more than 50m and a hole shaft of diameter 80cm. This type of mining is known as tunneled mining. Mineral extraction demonstrated mining work at the edges of the entrance to mine. Stone tracks extend between the settlement and these mines, but they are mostly eroded by rainfall and other natural factors. These tracks were probably constructed to transport minerals from the mine to the settlement for subsequent processing.

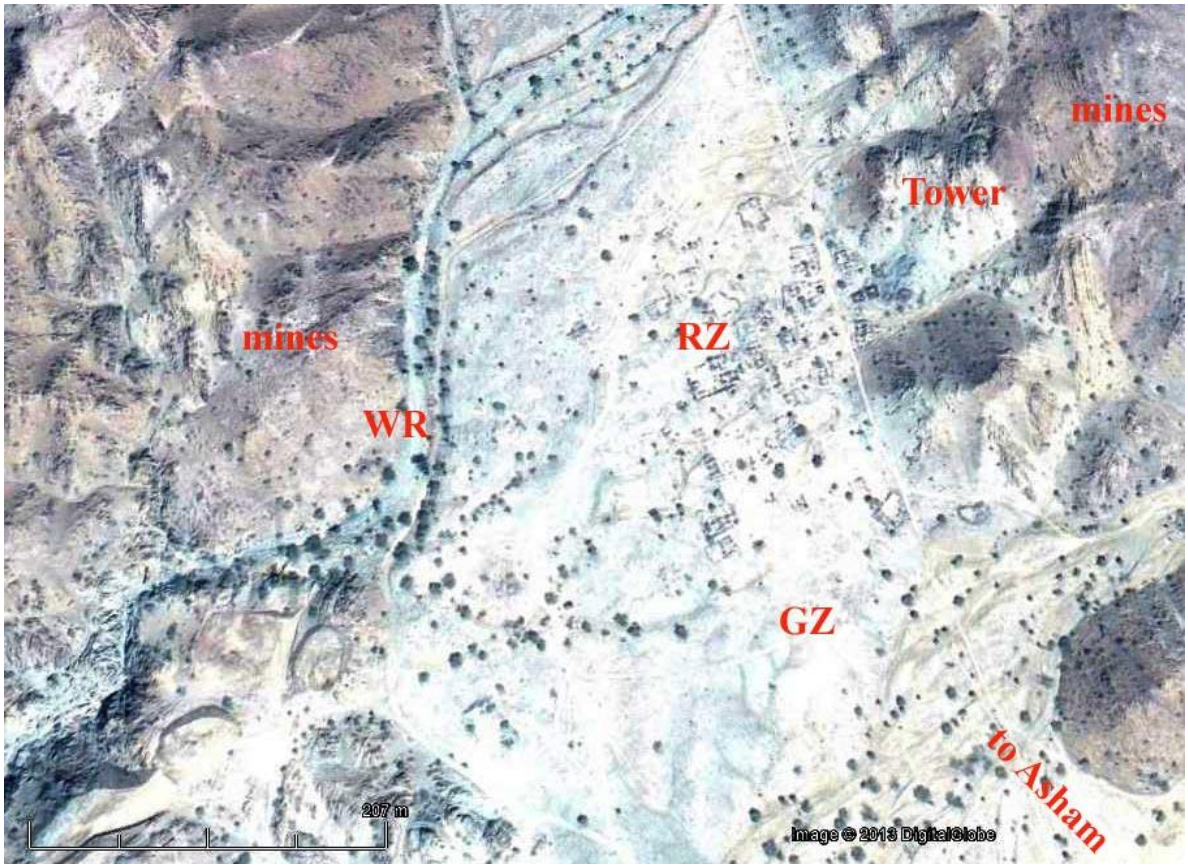


Figure 5.9: Satellite image for Masodah village

RZ: residential zone, GZ: graveyard zone, WR: water resources

(Google Earth, historical imagery 3.2, 2011)

Both Asham and Masodah sites are located on the banks of the former valleys, as mentioned previously (Nawan and Qurma). These valleys were within normal resources to provide sustenance for this population as well as to carry out mining activities on its banks. This is due of its fertile and flowing water running through the ages. Agricultural fields can be clearly seen on the western side of the village Masodah, which was supplying the two villages (Asham and Masodah) with its products such as corn, millet and wheat. Furthermore, some animals have been domesticated which confirmed by presence of some special installations found in Asham and Masodah, which are assets of the architectural basics available in the traditional architecture in the region.

5.4.3 Surveyed objects

The intensive archaeological survey of Asham and Masodah revealed 1096 objects, including 470 pounders and 626 grinders, studied and classified in the field, in addition to 286 pieces of unglazed and glazed pottery, and some glass. Subsequently, 53 pieces were selected for detailed study, most of which were picked up from Asham and few form Masodah. These samples can be classified into four groups, namely stone tools, unglazed pottery, glazed pottery, and glass as outlined below.

5.4.3.1 Stone tools

The physical remnants of industrial activity which took place in Asham and Masodah consist of large numbers of tools for the treatment of mineral ores, which are spread across the surfaces in both settlements, including pounders and grinders. Pounders (*madaqat)* are essentially for use in breaking rocks. These pounders, manufactured from solid local stone, were used in crushing operations. Large quantities of these pounders were found next to grinders. Three types of these pounders were grouped into three types:

Type A: long cylindrical form long rod of stone (50×10cm), used for grinding by rolling on the flat surface.

Type B: spherical form of stone with a diameter of approximately 10cm, used for hammering.

Type C: spindle shaped, around 30cm in length, tapered on the head sides used for rolling on slab stone.

All of These types were found in abundance in the Asham and Masodah settlements (Figure 5.10, Table 5.1).

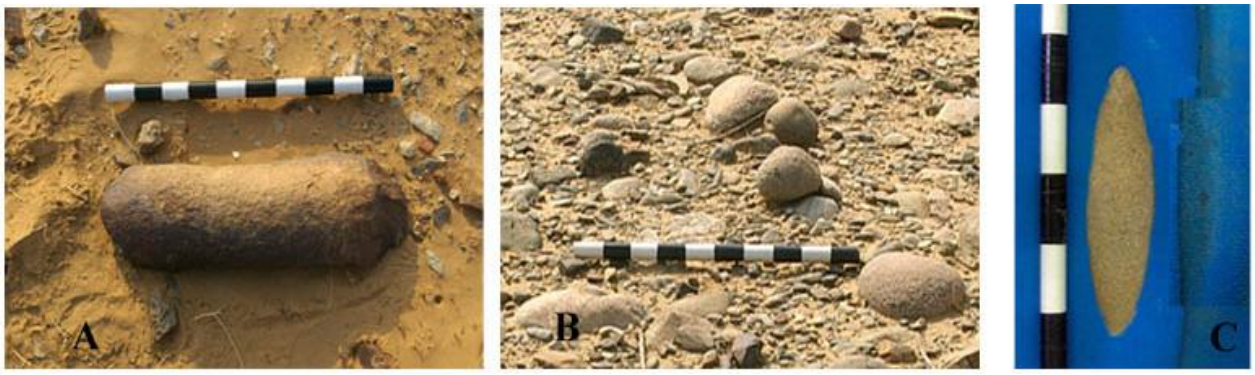


Figure 5.10: Surveyed pounders from Asham and Masodah

A: cylindrical, B: spherical, C: spindle

The grinders are used in the second part of the crunching process. Four types of these grinders in Asham and Masodah were sorted.

Type A: a millstone (*rahi*) with one basin

Type B: also a millstone but with two basins.

Type C: stone slabs.

Type D: spherical grinder.

Types A and B mainly consist of a lower fixed part (basin) and another moving upper part (molar), made of different shapes, kind or tough. The lower part is made hollow basin to a depth of between 10-40cm, while the molar is flat and less in diameter to fit with basin. Where a second basin exists opposite to the first one it is made in the same way, to enable usage in both directions. The reason for this might be because the miners were forced to shape the second basin bottom after the first one was destructed in order to maintain the grinder. Type C is the stone slabs. This grinder is a rectangular piece of stone slab (50×20cm), in most cases slightly concave at the bottom, with a smooth and flat surface made of stone plates available in mountains nearby the sites. Type D is spherical grinder. This grinder is one spherical piece of 30cm diameter, hollowed out in the centre by digging operation, and may have commonly been used in settlements in grinding cereals (millet) as a result of the current location near the valleys, particularity in Masodah (Figure 5.11, Table 5.1).

Tool/Site	Grinders				Total	Pounders			Total
	Millstone		Slabs	Hand grinder		Cylindrical	Spherical	Spindle	
	1 basin	2 basin							
Asham	123	9	214	117	463	125	139	32	296
Masodah	63	17	0	83	163	55	30	89	174
Total	186	26	214	200	626	180	169	121	470

Table 5.1: The amount of grinders and pounders in Asham and Masodah

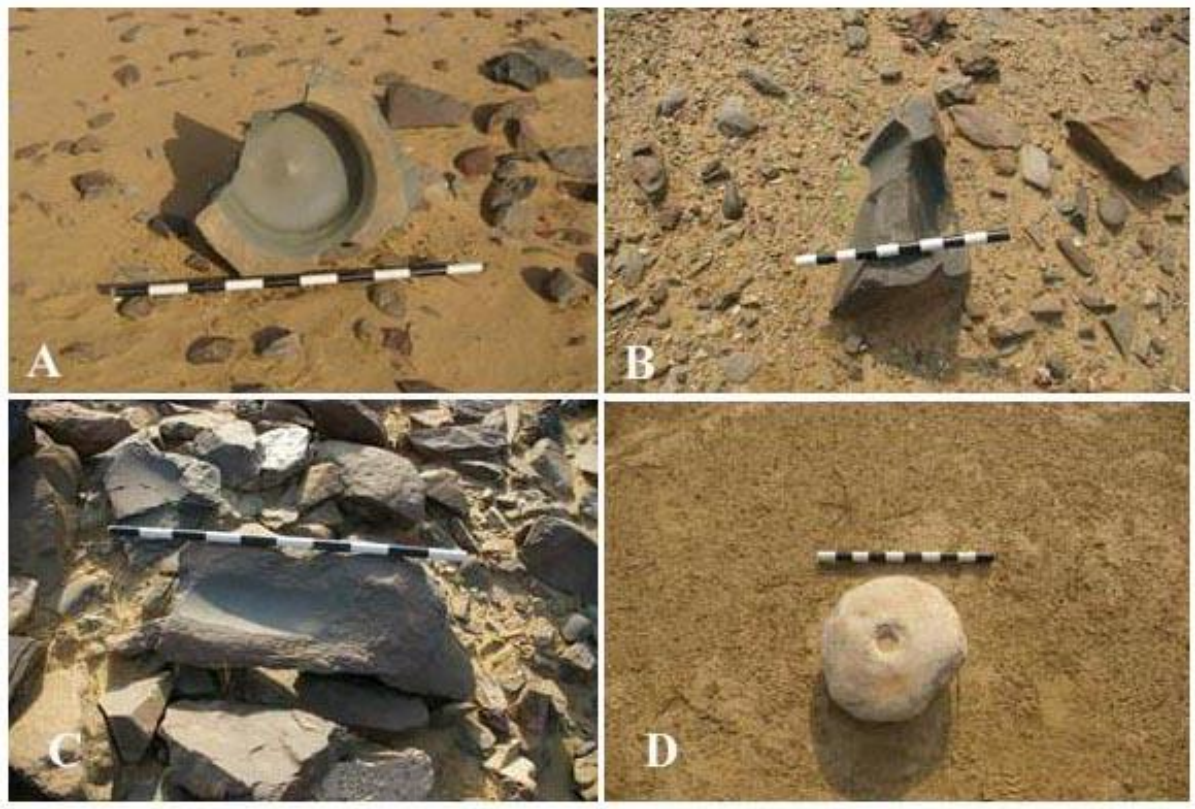


Figure 5.11 : Four surveyed types of grinder from Asham and Masodah

A: millstone with one basin, B; with two basins. C: slab type, D: spherical grinder

5.4.3.2 Unglazed Pottery

A huge number of sherds were scattered in Asham, and a few in Masodah. Around 134 pieces of unglazed pottery of various sizes, shapes and uses were picked up from the surfaces, and 14 pieces were selected for further analysis. According to the external colour of paste and the thickness, this group can be classified into three groups: red paste (RP) and thick walls, in reddish yellow paste (RYP) and mid-thick walls, and in pale paste (PP) and thin walls (see Figure 5.12, Figure 5.13; Appendix 4).

- Unglazed pottery in red paste (RP) and thick walls

This category consists of 12 pieces, nine from Asham and three from Masodah. It contains fragments of bodies, horizontal handles, and flared rims. These pieces represent various sizes of jars, cooking pots and one cup. The thickness ranges from 5-30mm. The manufacturing of these pastes were implemented by the wheel, except the handmade handles.

The cores of these pieces are red, dark and bluish grey as a result of the kind of soil used and the technique of shaping. In addition, they contain impurities such as sand and minute bits of limestone, chaff, organic materials, and tiny holes. The hardness ranges from roughly harsh to partially smooth and smooth. Most of these fragments showed complete firing, though a few were incompletely fired. The surface treatment was carried out by adding slip of pure red colour in wheel grooves. In terms of decoration, the decorated pieces include parallel grooves, corrugated like shark teeth sandwiched between two friezes, as well as forms of foliage executed by tiny incisions. Also, rows of triangles are perforated from the central portion, executed by the mould.

- Unglazed pottery in reddish yellow paste (RYP) with mid-thick walls

This sort contained eleven pieces, six of which were from Asham and five of which were from Masodah. Fragments of oval bodysherds and flared rims were found. These pieces belong to different sizes of jars, cooking pots and one bowl. The average thickness ranges from 5-10mm. All of these pieces were manufactured by wheel. The core of this sort is reddish yellow, green and gray in colour, according to the kind of soil. Also, they contain large quantities of impurities such as organic materials, grains of sand, white gravel and limestone, and some tiny cavities. However, a few of these pieces are empty of impurities. The hardness of this group ranges from rough to harsh, with complete firing. The surfaces are treated by adding a slip of reddish yellow colour with soft feeling by hand and piece of cloth; many wheel grooves are shown in outer surfaces. The decorated artefacts of this group have horizontal wavy grooves sandwiched between two parallel friezes, in addition to sharp wavy lines, and some incised grooves to downside. All decorative elements are executed by thin and middle notched.

- Unglazed pottery in pale paste (PP) with thin walls

This type contains two pieces from Asham; a flat base and a flared rim. They belong to a cup and cooking pot. The thickness ranges between 4-5mm. These pieces were manufactured by wheel. The core of these two pieces contains light brown paste, and grains of sand, and small holes were also noted. One of them has no impurities. The hardness is generally smooth and the pieces were completely fired. Surface treatment is manifest in the parallel grooves to all internal and external surfaces, and wet manual straightening from the same material. Decoratively, the cup has diagonal opposite grooves in the head, resembling fan palms. All these decorative items were inscribed in the main clay.

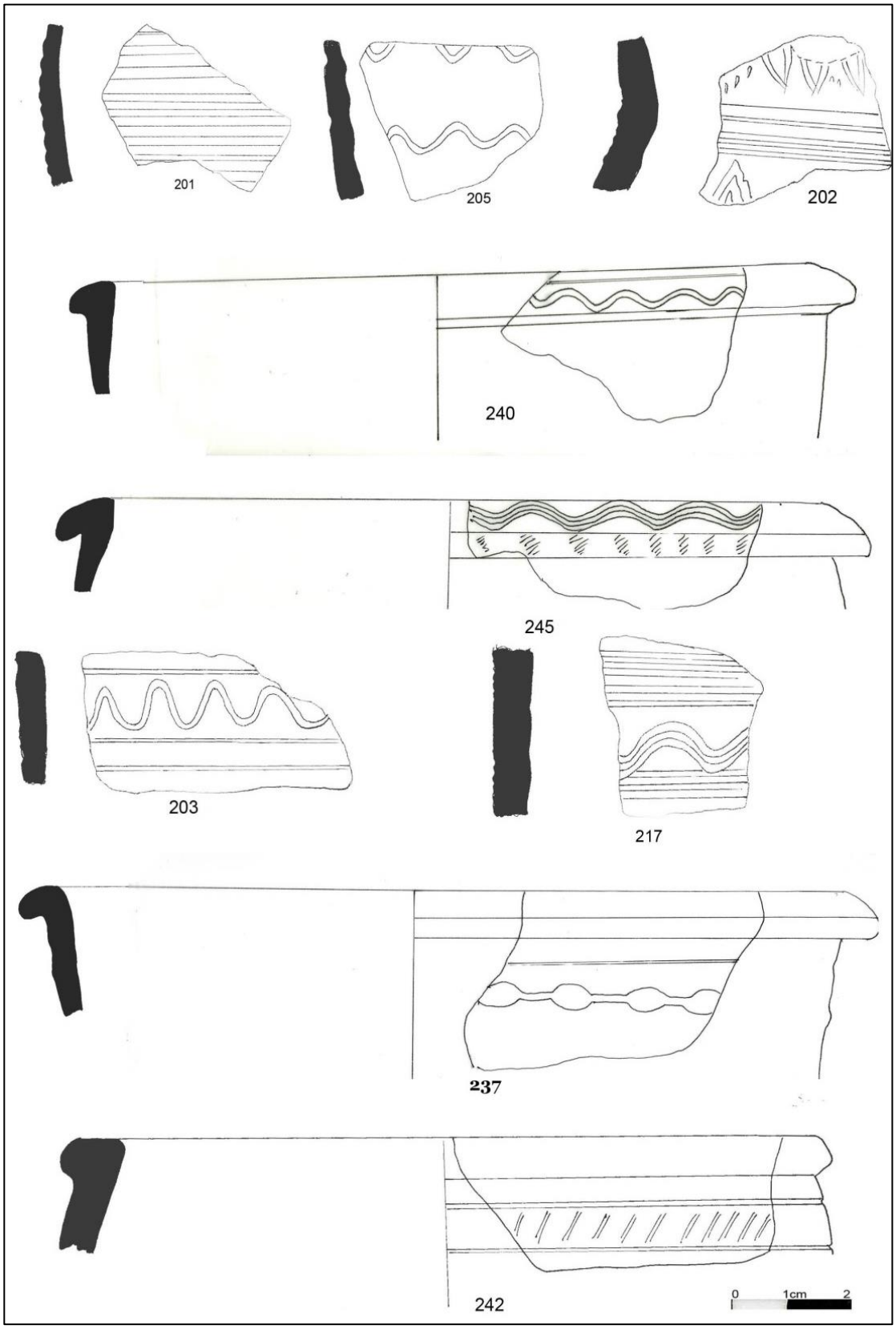


Figure 5.12: Drawings of some studied samples of unglazed pottery

RP (no. 201, 205, 202, 240, 245) and RYP (no. 203, 217, 237, 242) from Asham and Masodah surface

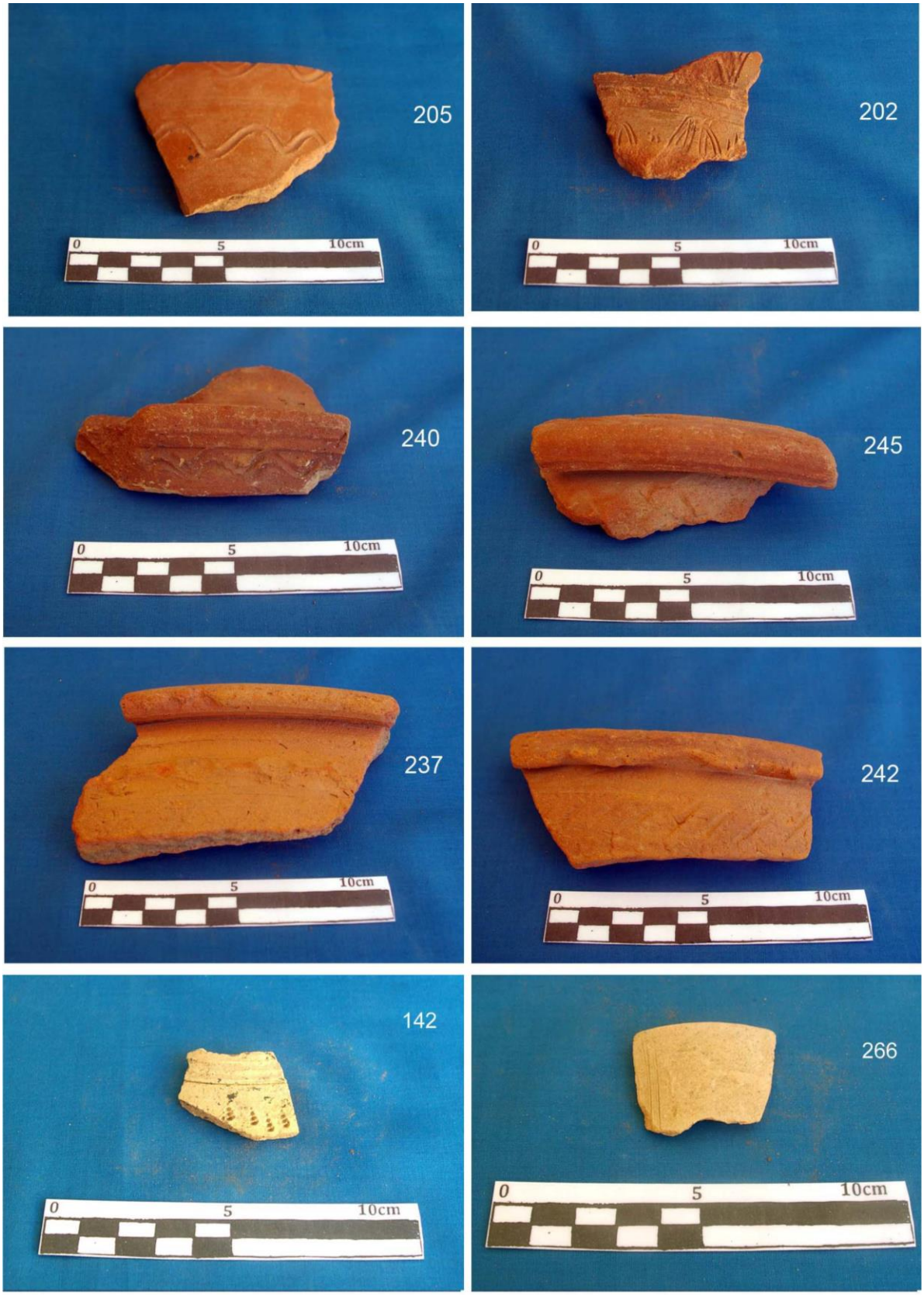


Figure 5.13: Photos of some studied samples of unglazed pottery

RP (no. 205, 202, 240, 245), RYP (no. 237, 242) and PP (no, 266 and 142) from Asham and Masodah surface

5.4.3.2 Glazed pottery

This group of artefacts was plentiful in Asham and a few specimens were gathered from Masodah. A total of 92 pieces were recovered, of which 17 pieces were selected for study purposes. According to the type of coating, the category can be broken down into three types: alkaline glaze (AG), pottery coated glaze (CG). Each variety is outlined below (Figure 5.14, Figure 5.15, Appendix 5).

- Alkaline glaze (AG).

This category contains six pieces. They belong to two concave bases of cups, flared rim to a bowl, and their thickness is between 5-9mm. These pieces were manufactured by wheel. The fabric of this group is characterized by colours of pink and light brown in the core, as well as grains of sand, minute bites of gravel and small cavities. It is roughly harsh, and the degree of firing is complete. The treatment of internal and external surfaces was implemented by adding alkaline green slip, and wheel grooves shown on the outer surfaces. The decoration is non-existent in these fragments except one piece (No. 264) with wavy deep grooves on the inner surface of the original paste.

- Coated glaze pottery (CUG)

This type contains ten pieces and represents flat and concave bases, oval body sherds and flared and vertical rims, these fragments belong to bowls and jars. The average thickness is 5-10mm. All these wares were manufactured by speed wheel. The fabric is characterized by the colour of light reddish brown and strong brown in the core. The fabric contains some impurities, such as grains of sand and black dense gravel, and some tiny pits. In addition, the feeling of these pieces is roughly harsh, and they were fired completely.The surface treatment included parallel grooves on all internal and external surfaces. Both surfaces were treated with a layer of milky colour and yellow, light olive brown, pale green and light yellowish brown under the glaze layer and sometimes above. The glazer decorated these pieces by attaching a ground layer of dark green then implementing various ornamentations, such as a wide web starting from the edges to the bottom. In addition, on the outer surface there are protruding grooves executed on the paste and coated with a layer of light olive brown colour.

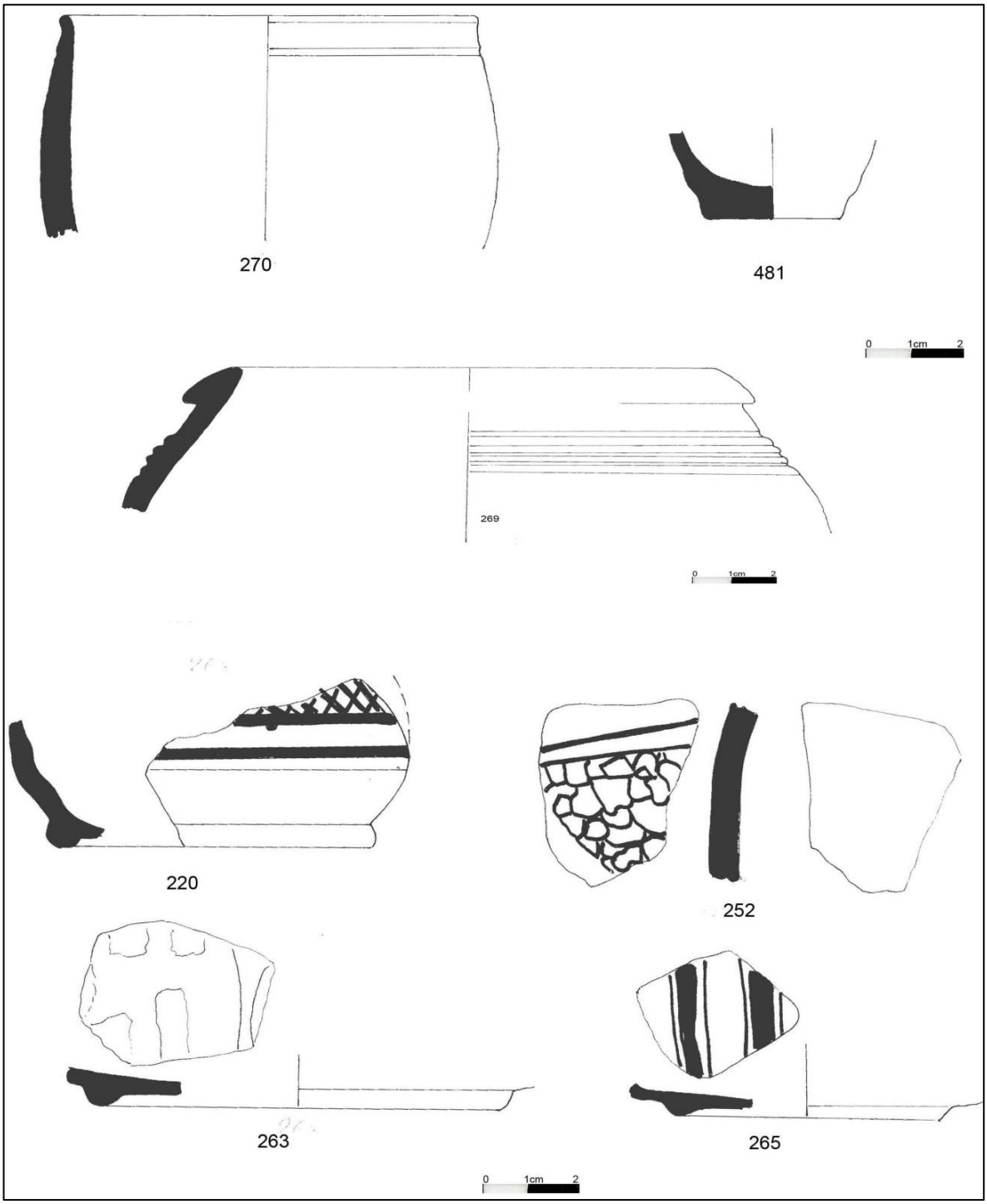


Figure 5.14: Drawings of some studied samples of glazed pottery

AG (no. 270, 281), CUG (no.269, 220, 252, 263, 256) from Asham surface

Figure 5.15: Photos of some studied samples of glazed pottery

AG (no. 270, 281), CUG (no.269, 220, 252, 271) from Asham surfaces

5.4.3.3. Glassware

The surface of Asham and Masodah included 20 fragments of glass pieces. Most of them are transparent, and pale green or pale yellow in colour. Eight pieces were selected for

study. These pieces represent flat and concave inside bases, and cylindrical body sherds. They come from bottles and one cup, and are of thickness ranging from 1-3mm. They were made by casting in the mould, and free blowing (see Appendix 6, Figure 5.16, Figure 5.17). The paste of these glass pieces was coloured transparent green, free of impurities. The surface treatment was including rolling above soft ground, particularly for pieces manufactured by free blowing. Ornate pieces of this collection contain concave lines and the forms of the comb teeth facing heads, all of which elements were applied by tiny notches before cooling.

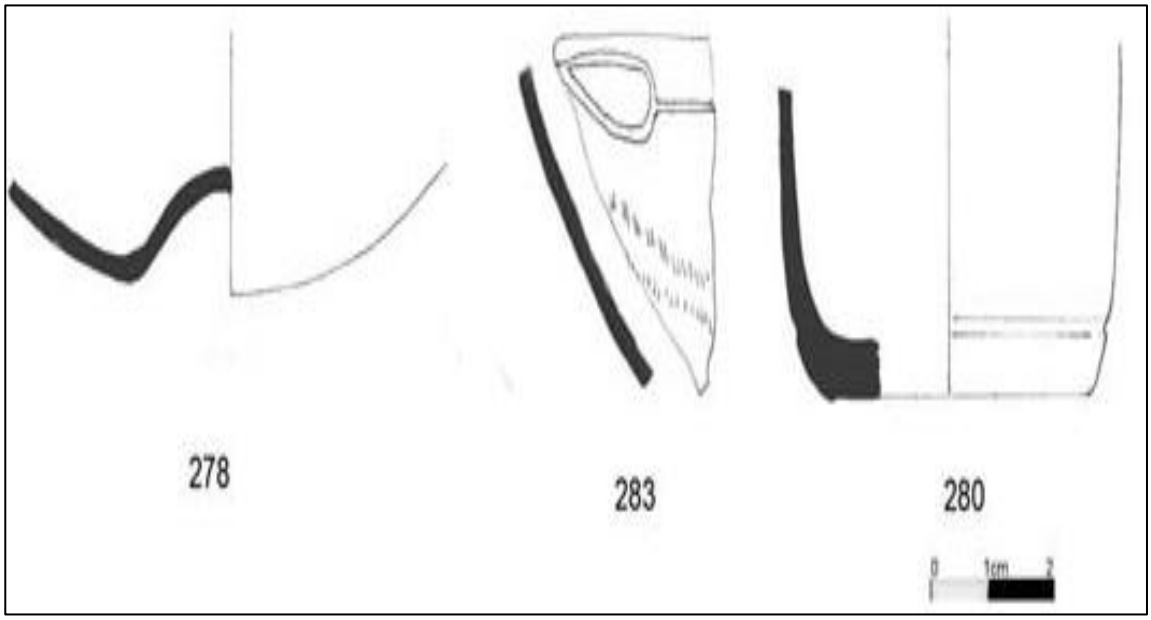


Figure 5.16: Drawings of some studied samples of glass fragments from Asham surfaces

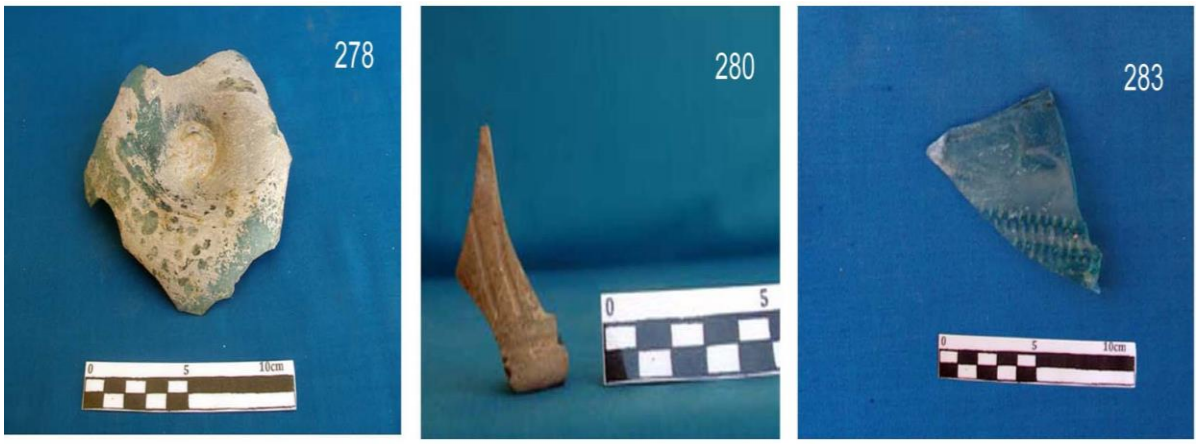


Figure 5.17: Photos of some samples of glass fragments from Asham surfaces

However, stone, pottery and glass tools are still clear on the surface of Asham and Masodah, which indicates the continuity of mining activities in the settlements. The presence of these tools, plentifully and in a variety of forms, emphasizes employment in

the mining business, particularly stone tools, which are missing in the non-mining sites from the same period (e.g. Athar and al-Serain). The pottery presence in these sites is also indicative of mining due to the types RP and RYP (with thick walls) being suited to mining processes (as explained previously). Some remnants of smelted materials were also spotted in some of these unglazed wares. However, it is likely that the above wares were used in many activities, whether in mining or non-mining daily use (e.g. for cooking and serving foods).

5.5. Excavations in Asham

The second fundamental investigation for mining settlement features in this study is excavation. Six trenches were excavated in Asham and Masodah. Four of them were in Asham, namely ASH1, ASH2, ASH3 and ASH4 (Figure 5.18); and two in Masodah, namely MAS1 and MAS2 (Table 5.2). The description of excavation will be explicated for each trench with reference to the most important artefacts in brief (more detailed accounts of these artefacts are given Appendixes 7 to12). It should be taken into account that the excavation revealed some layers described in chronological order from the latest to oldest.

Trench	**Size**	**Zone**	**Position X (N) Y (E)**		**Elevation (m)**	**Distance from benchmark (m)**
Benchmark in Asham		**3 (RZ)**	**19 36 43.8**	**41 12 35.7**	**272**	**--**
Ash1	5x5	RZ	19 36 39.71	41 12 33.59	172	125 south west
Ash2	5x5	RZ	19 36 38.91	41 12 45.31	173	376 east
Ash3	3.7x7	CZ	19 36 37.15	41 12 40.92	170	303 southeast
Ash4	5x5	RZ	19 36 45.00	41 12 34.0	168	39 northwest
Benchmark in Masodah		RZ	19 40 35.38	41 12 36.42	215	--
Mas1	2x2	RZ	19 40 33.02	41 12 34.6	214	123 west
Mas2	5x5	RZ	19 40 33.02	41 12 32.90	211	55 west

Table 5.2: The position of trenches in Asham and Masodah

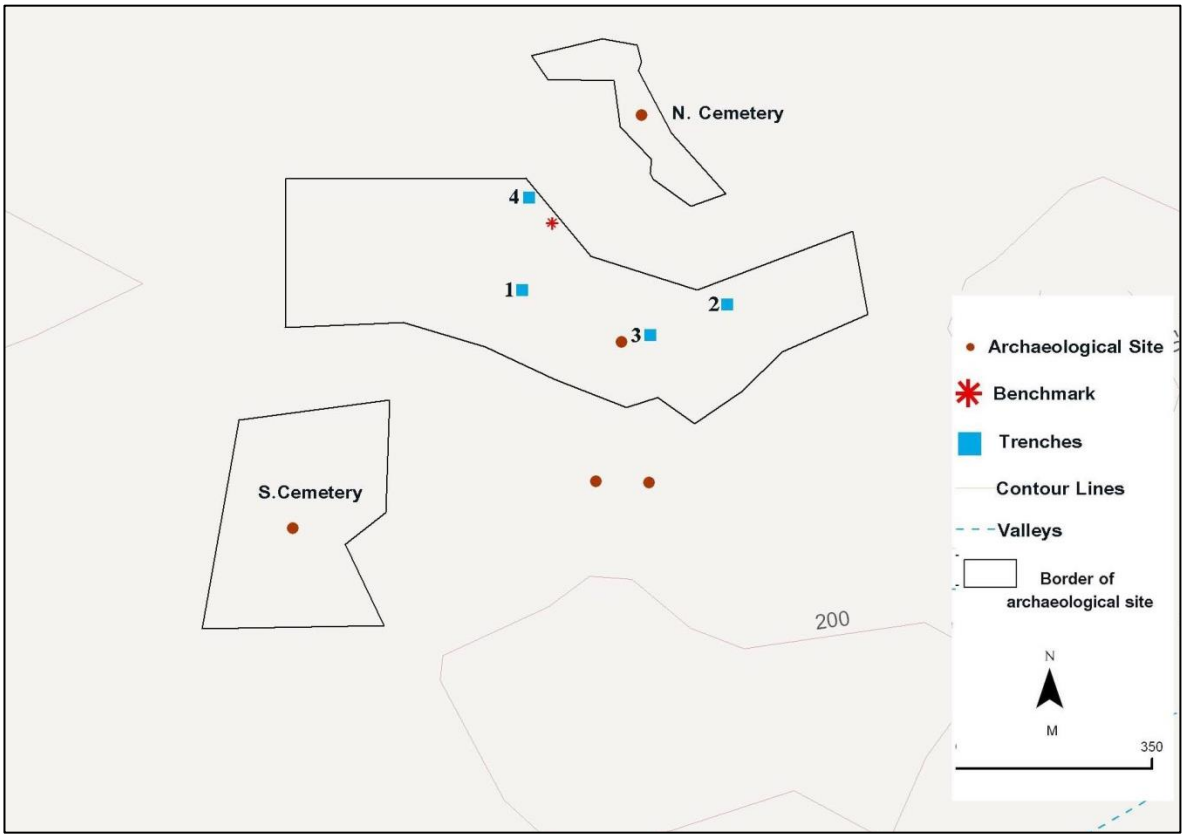


Figure 5.18: Locations of trenches in Asham

5.5.1 ASH1

This trench is located at the west entrance of site in RZ (Table 5.2). The trench is among the six towers, which contain only some collapsed walls on the surface. The main purposes of electing this location were to measure the density of archaeological artefacts, especially since the site is located near the residential buildings in the north-west of the site, and on the path to the area of mines, and it contains a spread of large quantities of pottery (unglazed and glazed) and glass. Additionally, the trench aims to ascertain whether there are foundations of other buildings, which may represent stages of occupation. However, removing the ruins of walls from the buildings nearby was the first stage. Then surface artefacts were collected, represented in stones, pottery and glass. Next, the surface layer was scraped off. Two test pits (ASH1-a and ASH1-b) were dug in the south-west corner. Eventually, two archaeological loci (below) and 419 pieces, with a total weight of 10,302kg, were revealed in this trench (see Appendix 7 for the excavated objects) (Figures 5.19 -5.21).

Locus 1: It is an uneven layer, medium in hardness, with thickness of 20-25cm in the southern parts and 5-10cm in the northern parts. This layer consists of light brown sands, small scattered sandstone deposits mixed with some quartz, and plant roots. Several

artefacts of different shapes and sizes were found in this layer, including bases, body sherds, handles and rims of pots made of clay and glass, plus a few marine shells. However, the most notable archaeological artefact is the remains of a decorated glazed jar found at a depth of 10cm in the centre of ASH1. Two fragments of this jar were also found in the northern part of ASH1.

Locus 2: It is a fragile layer of yellow sand, free from impurities and artefacts, containing only some plant roots. This layer was detected after test pit was dug at ASH1-a (size 2x2m) in the eastern corner of ASH1 to test the density of artefacts where changes were observed in the colour and nature of soil from the former layer (Locus1), to make sure of the current locus and to vertically follow it. Another test pit, ASH1-b (1.8×0.5m) was dug in the eastern corner for more investigation. The excavation of ASH1-b revealed that it is devoid of any cultural materials or impurities, and contains only light yellow soft sand. It is certain that this locus is continuing in the other parts of ASH1. The thickness of this layer ranges from 1.8-2m, and was the end of digging in this trench.

The variety of archaeological finds of pottery and glass in the surface layer and layer one which reached to 412 pieces of ASH1 indicate that this side probably was a corridor between houses, as cooroborated by the presence of large quantities of soft sand in the rest of the layers where no architectural locus was detected.

Figure 5.19: ASH1

A: general view of trench, B: test pit ASH1-a, C and D: selections of excavated objects

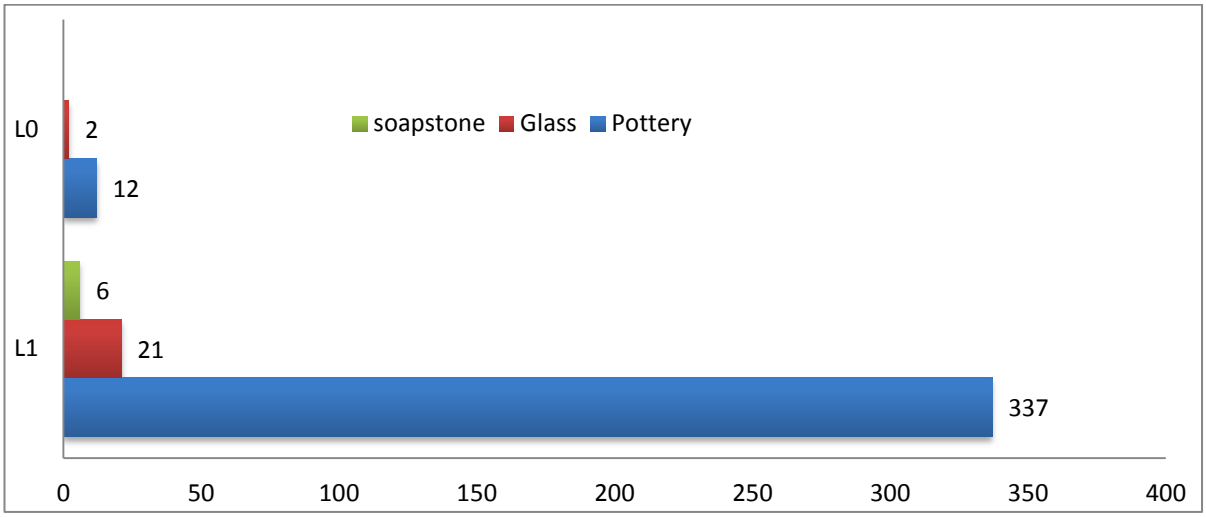


Figure 5.20: Number of objects by type in each layer

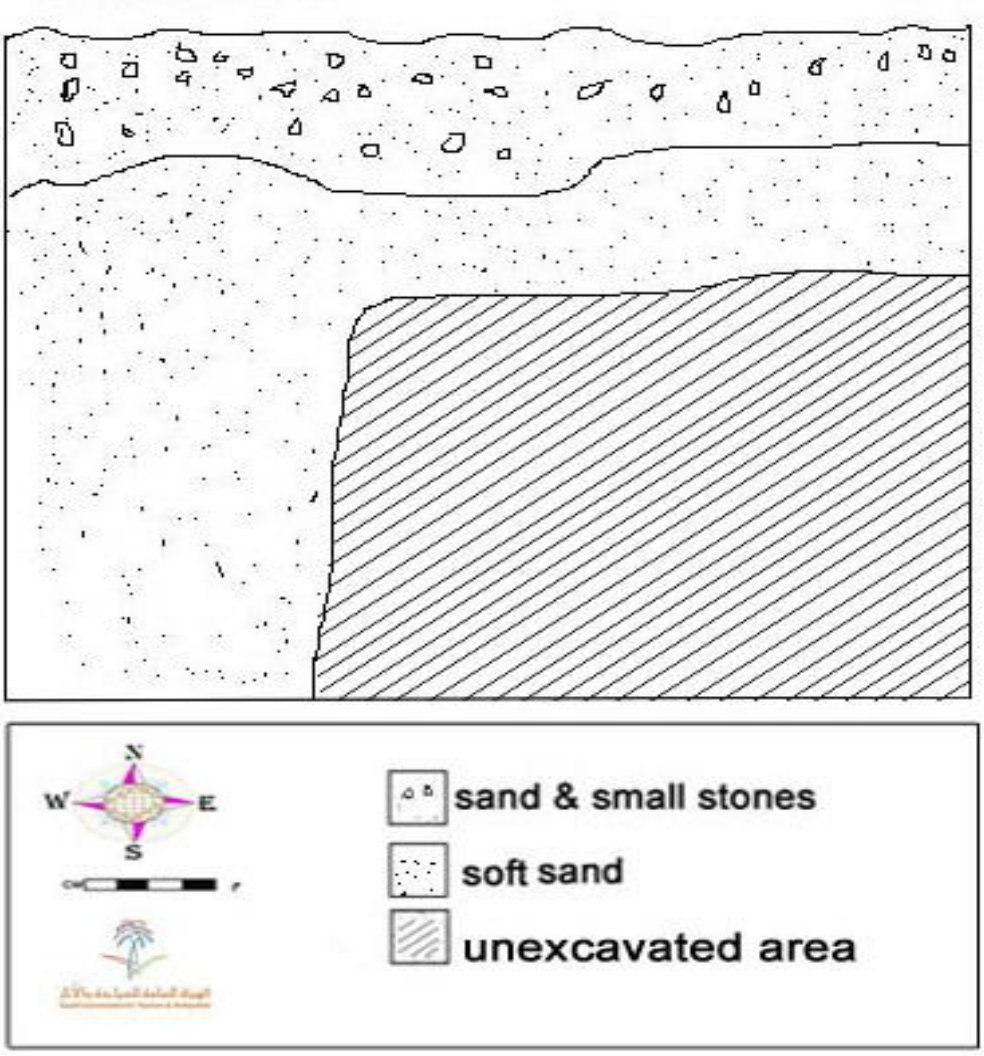


Figure 5.21: Sketch of south side of ASH1

5.5.2 ASH2

This trench is located at the western edge of Asham, almost external to the residential zone (Table 5.2). This location is also near a twin-tower configuration, with opposite towers on each of two hills close to the foundation of an external wall, between the residential and graveyard zones. A quantity of unstructured stones stacked on top of each other was noted there. The position of this trench was selected according to a number of reasons, including to examine the amount of artefacts from the eastern edge, especially as its location is at the end of the residential zone, for comparison with artefacts from ASH1, ensuring that the stacked stones and remains of building foundations confirm the position of a spoil place for the residential zone.

Detaching the compacted stones was the first stage before digging the trench. These stones were relatively large and medium, some of them well trimmed and cut off with dark brown in colour, also, may be used for the purposes of construction. Then, surface collections of broken pottery with variety of shapes and sizes, and pieces of slag have been picked up and bagged. Subsequently, drilling procedure begun by carefully removing the surface layer and following layers. Then, three test pits ASH2-a, ASH2-b, and ASH2-c in the east edge have been dug down. Eventually, six archaeological loci and 722 pieces of objects in total weight of 16, 190kg of pottery and glass have revealed in this trench (see Appendix 8 for the excavated objects) (Figures 5.22-5.24).

Locus 1: It is a loose layer of sand, with uneven ground. The ground layer is unclear and thick, approximately 40cm in the eastern edge while not exceeding 10cm in the western tip. This layer is composed of a high quantity of red sand mixed with a little ash and charcoal of dark grey colour, mixed in some parts with some animal bones, a variety of broken pieces of pottery (unglazed and glazed) and glass in the forms of bases, body sherds, handles and rims. The upper part of a millstone was found in this layer.

Locus 2: It is a midden pit (*madfan*) with a semi-circular shape of 70cm diameter. This locus is located roughly in the centre of the trench at a distance of 2m from the eastern wall, 2m from the northern wall. It was apparently allocated to waste disposal, and contains broken pottery and glass. These remains are mixed with quantities of sand, small gravel, coal and animal bones.

Locus 3: It is a fallen wall located in the eastern side of trench, 1.7m from the northern edge of the trench. This wall is 75cm wide, with unknown depth. It was built with small

stones which unorganized positioning, without using mortar. Quantities of pottery, bones of animals, and small pieces of coal were found among the stones. It appears to be flurried from the adjoining building, which is part of ASH2.

Locus 4: It is a harsh and flat layer composed of full soft reddish yellow sand with thickness of 160cm. This layer was discovered after digging downward the sub-trench ASH2-a (5× 2m area, 80cm depth) in the eastern edge. Digging in ASH2-a uncovered the rest of the above mentioned fallen wall which was constructed on a soft ground.

Locus 5: It is another waste pit appeared in the south edge of main trench. It occupies an area 70cm in diameter and 70cm in depth. Although large quantities of charcoal, small stones, pieces of pottery (unglazed and glazed), glass, and animal bones were discarded in the pit, layer is empty of artefacts. Continued digging in test pit ASH2-a followed Locus 4. The ground is not fully cleared and does not contain any impurities or artefacts. Amounts of ash were noted permeate this layer in the west to a depth of 150cm. The two test pits, ASH2-b and ASH2-c, occupying areas of 1.7×0.9m and 1.7×1.1m respectively, were excavated in the northern corner in order to follow-up Locus 4, which was found to continue with the same features to the bedrock.

The discovered archaeological loci in this trench confirm that this area was dedicated to garbage disposal from some homes, but not all, as inferred from the lack of waste appropriate to the size and number of houses in Asham. Perhaps each group of units had its own midden. Additionally, the style of burying this waste was identified by oval shapes distributed in convergent spaces then filled with waste. This oval hole was dug to a depth of 70cm in the longest case. Only surface slag was found, with no remains of smelting works or metal residues within these pits or outside the scope of digging, which suggests that the industrial area was far from the residential area. The remains of 391 cultural materials such as pottery and glass confirmed that these tools been used in the daily life of the settlement. This material is similar to what was found in the northern side of the site (ASH1) within the first layer in terms of colour paste, manufacturing which indicates on phase of occupation between the two sides.

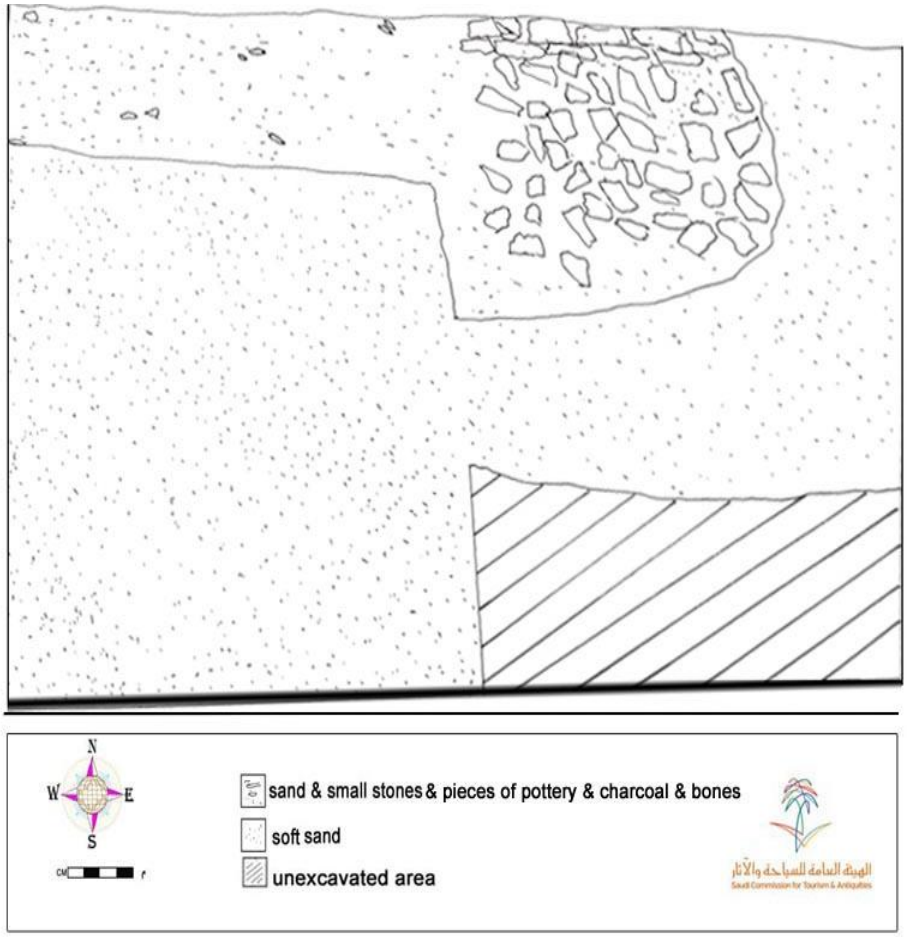


Figure 5.22: Sketch of east side of ASH2

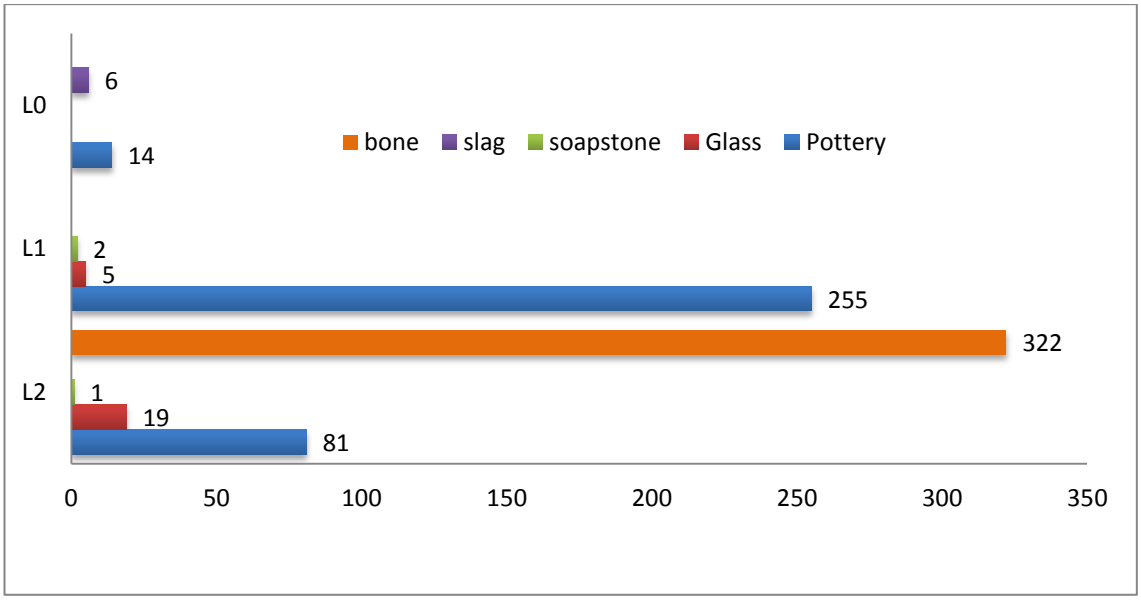


Figure 5.23: Number of objects in each layer to ASH2

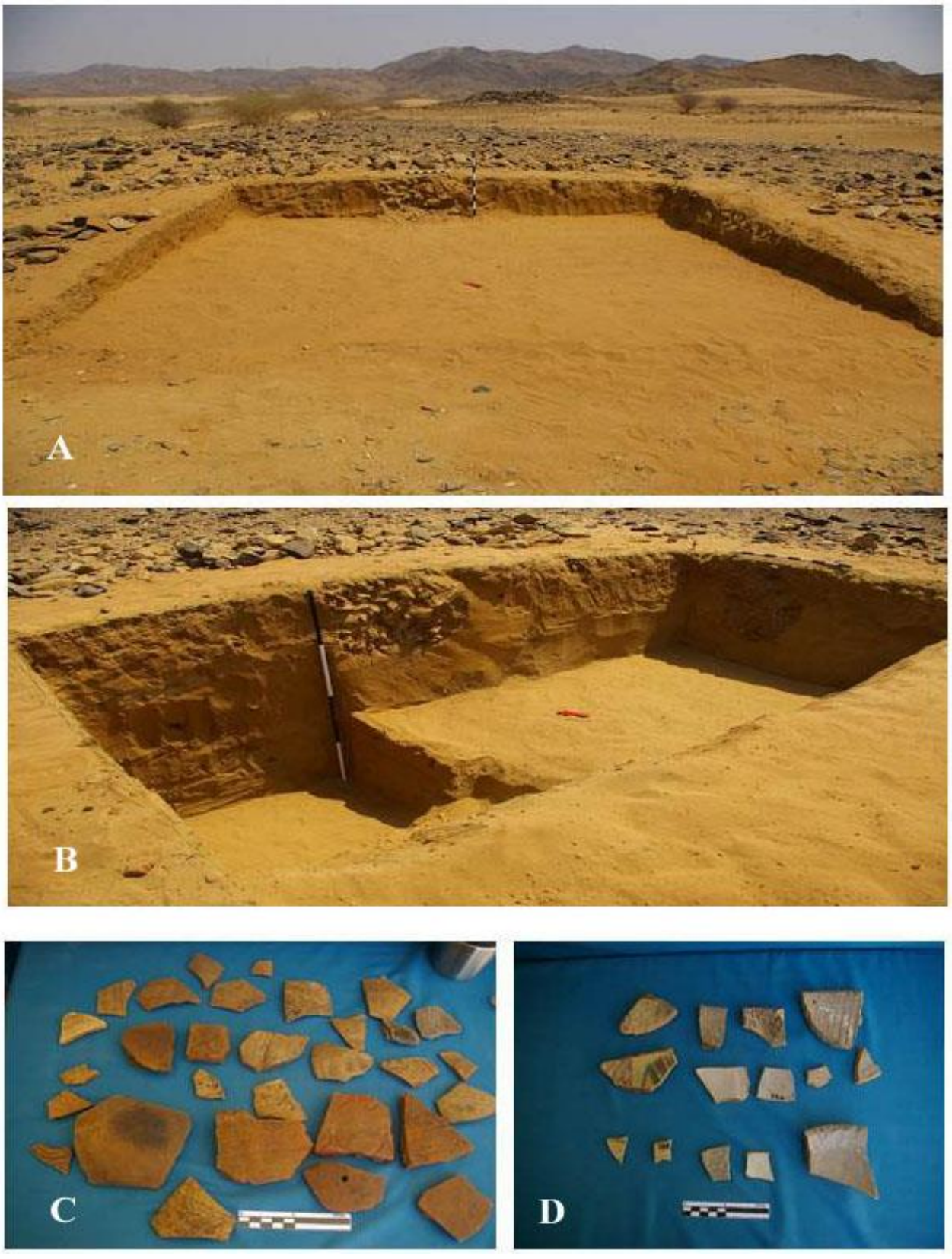


Figure 5.24: ASH2

A: general view of trench, B: test pit ASH2-a and -b, Loci 3 and 4, C and D: some excavated objects

5.5.3 ASH3

This trench is located in the commercial zone on the west side of the residential zone (Table 5.2). This location oversees the commercial lines adjacent to the borders of the settlement; an area also faced towers built on the southern of settlement. The main targets for choosing this location were to investigate the existence of any tools relating to mining, the depth of walls and any occupation phases in the settlement. Initially, the ruins of stone in the surface layer were extracted from the shop that fallen throughout years from the neighbouring shops walls and nearby shops. Moreover, the walls of this trench were restored during excavation by replacing the stones in their original position where possible. No surface artefacts were found in this level. This stage revealed the sections of shop (two sections, rear and front). Excavation in this trench included digging a test pit ASH3-a in the past section of a shop, occupying an area of 3.7×1.3m. In addition, the process of excavation was continued to 200cm in depth until the bedrock. Subsequently, the excavations exhibited three archaeological loci in ASH3-a, and 204 artefacts with a total weight of 31,514kg (see Appendix 9 for the excavated objects) (Figures 5.25-5.27).

Locus 1: It is a broken red sandy layer and oblique toward the north, with clear ground and a thickness of 40cm. Half of its contents is rubble, mixed with less than half of fallen stones from exterior walls, a few of small stones, and coal, as well as quantities of archaeological artefacts including bases, body sherds, handles and necks for pottery (unglazed and glazed) and glass.

Locus 2: It is a rubble layer of white sand, some 50cm thick. It has clear, uneven ground and very harsh composition, probably due to demolished rocks. It contains rubble, clay, small pieces of stones, and lots of rocks, with large quantities of artefacts, including bases, body sherds, handles made of pottery (unglazed and glazed) and glass.

Locus 3: It is a loose rubble layer a little hard and made up on the ground layer with thickness of 30cm. This layer was used to support the ground layer. It has broken composition southward, with clear ground. It mostly contains equivalent percentages of rubble, sand, rocks, and small stones, and it permeated by small amounts of ash. Differently shaped artefacts for different functions were found in this layer, including bases, body sherds, necks, handles of clay and glass, and grinders for mining (spherical hand querns and other cylindrical items), bricks for kilns, horns of animals, part of a jar made of soapstone and pieces of bone. Finally, excavation under the foundation walls in

this layer showed that this is the last and oldest layer in ASH3, and revealed that the walls were built on a foundation of sand.

This trench is only within the architectural units in the commercial zone. The excavation revealed many falling stones from the side walls of the next shop. In addition, the users of this shop had refurbished it multiple times, judging from the large deposits of rubble in the rear section of the shop. Archaeological remains contained mining tools (spherical and oval pounders). These tools and the presence of 175 residues of pottery and soapstone may indicate the practice of grinding and smelting raw materials in this zone as an initial phase in processing ores prior to move them to kilns. The presence of the remains of animal bones indicated butchery for settlers and shoppers from nearby villages.

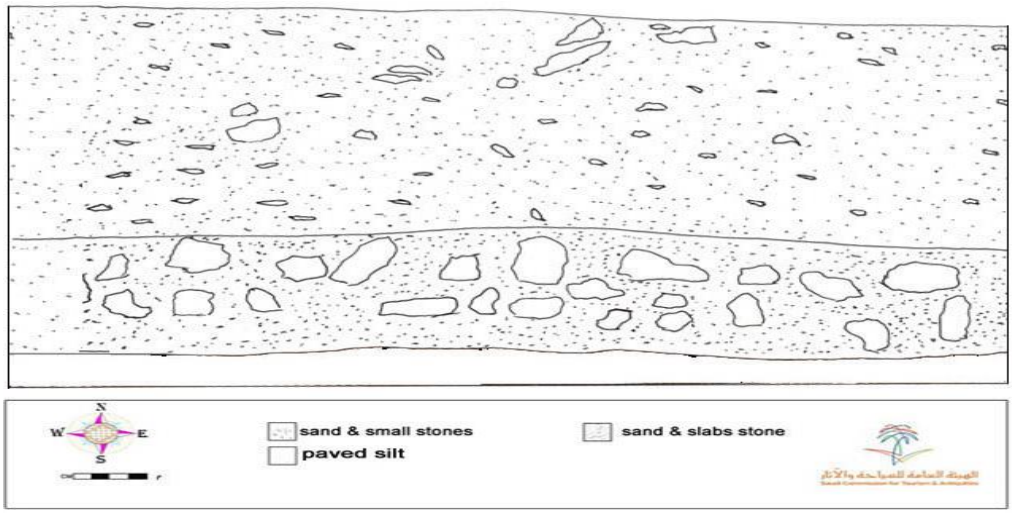


Figure 5.25: Sketch of ASH3

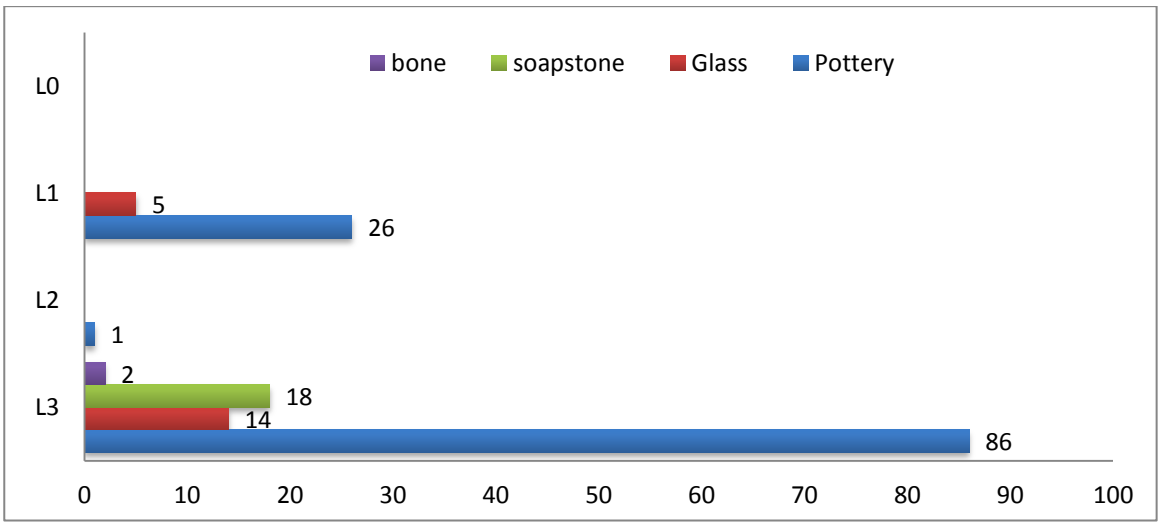


Figure 5.26: Number of objects by type in each layer to ASH3

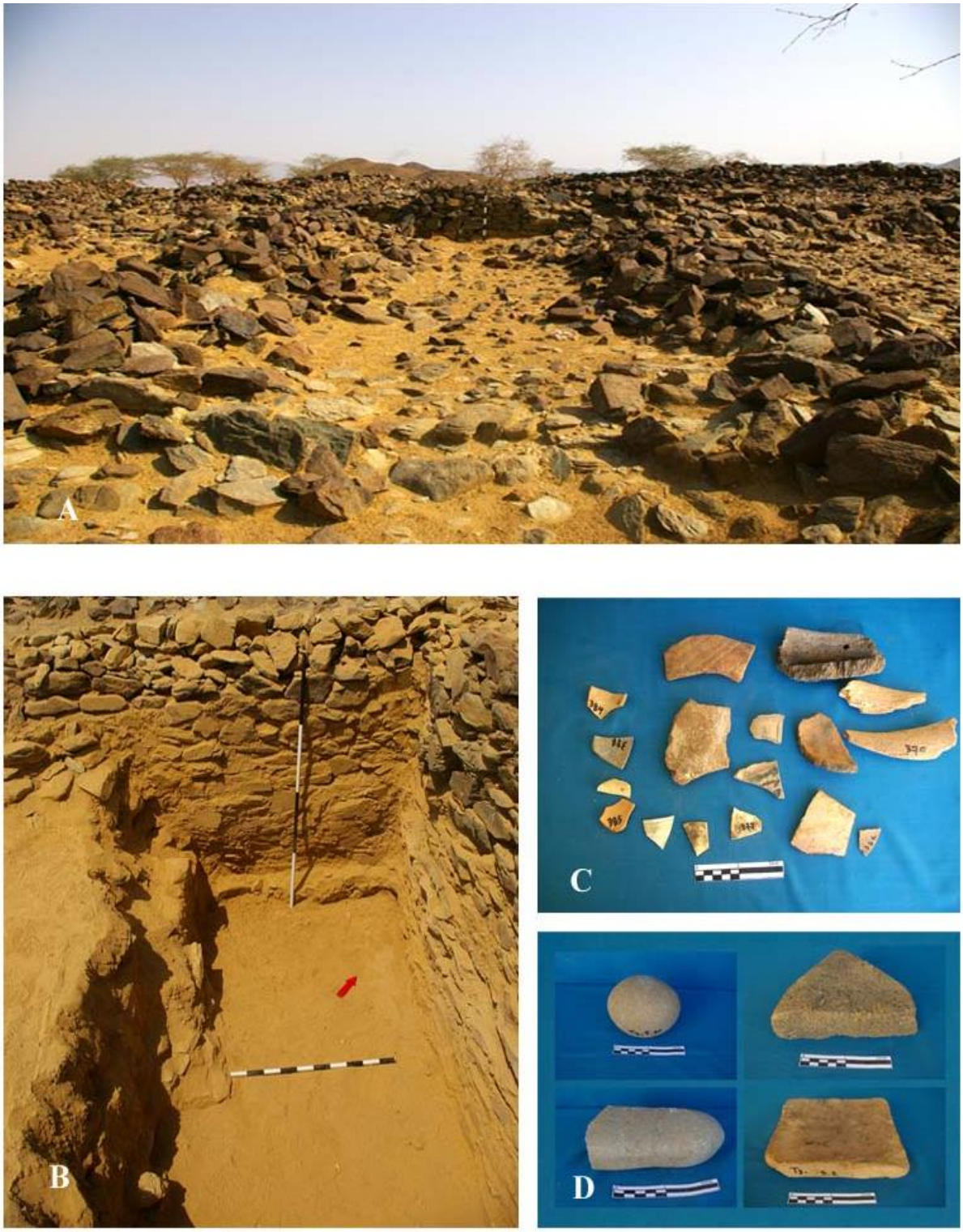


Figure 5.27: ASH3

A: general view of trench, B: test pit ASH3-a, C: some excavated objects, D: some excavated mining tools

5.5.4 ASH4

This trench is located at the north end, outside the residential zone (Table 5.2). The intensive archaeological survey revealed many surface artefacts spread over the

foundations of unclear walls. For this purpose, and for other objectives (namely identifying the foundations of buildings and linking them with the density on the surface findings; identifying whether any artefacts or tools were related to mining practices; tracking layers when the trench was located at a lower area compared with previous trenches), the excavation involved picking up the medium-sized stones and quartz that show signs of burning, and then digging step by step. Eventually, four archaeological loci were recorded in this excavated trench. 1490 artefacts with a total weight of 71,702kg were found, including pottery and glass, and the remains of red bricks and slag (see Appendix 10 for the excavated objects) (Figures 5.28-5.31).

Locus 1: It is a sandy layer of 30cm thickness, with hard and clear ground. It contains some rubble mixed with small stones and reddish broken brick, and some ash, which made its colour dark grey, mixed with reddish due to the presence of brick remains. It additionally contained some animal bone, bases, body sherds, handles, and rims made of pottery (unglazed and glazed) and glass.

Locus 2: It is a smelting furnace found in layer 1 (locus 1). This furnace is located roughly 1.5m from the southern edge and 80cm from the east edge. In the outer sector it is built in the form of an oval belt, ranging from 50-100cm in width. It covers an area of 3.75x3.50m, with a height of 50cm from the ground layer. The furnace is built on a terrace rising 10cm from the geological layer. The materials of construction are small stones, rubble in between well-constructed parts, and mud in some parts to strengthen the walls. It seems that the furnace was covered with red bricks, due to appearance of large amounts of reddish brick widespread around it. In the inner sector, the furnace has an upper slot 70cm in diameter and 1.1m in depth (to the ground). The ground and walls are coated by a layer of carbonate silica. This hole was filled with soft sand, and a large quantity of slag (slag samples were taken to the Maddan Company for possible analysis). Moreover, the furnace contains a ventilation slot on the west side in a circular form, 30cm in diameter. This slot might reach through tube under the walls to the oven in order to set fire (this tube has not been excavated for yet, to avoid damaging the furnace). A large quantity of ash was noted around the outer sector.

Locus 3: It is a red sand layer of 20cm thickness. It contains various artefacts, including bases, body sherds, rims made of pottery and glass, and large amounts of ash and slag from the east edge, mixed with fractures of reddish brick and large quantities of coal and slag from the west edge. These features identify it as a place to collect the waste of the furnace

after smelting metals, and those elements (ash, slag and pottery) continue from the west to the north side of ASH4, but in diminishing quantities.

Locus 4: It is a yellow solid sandy layer mixed with some grit. It is 5-10cm in thickness. Its contents show that this layer is the geological layer, and it does not contain any archaeological evidence.

Through exploration in this trench, the loci have revealed that there is a difference in terms of thickness and hardness. The occurrence of the kiln was detected at a low level for residential and commercial areas. All these indications refer to this site being used for industrial works due to its proximity to the valleys and their branches, as well as the mine, in addition to the density of archaeological findings of pottery, in particular 599 pieces, in addition to differences in the quality of pottery at this site, which tends to rigidity and harshness.

The presence of this coarse pottery in abundance in this part suggests daily use, and importance for mining. The contents of this paste comprise different materials of soapstone, coarse clay and small stones which are components to strengthen the walls of pottery in acts of smelting gold and silver. Furthermore, such pottery was used as lateral knobs to contribute to removing pots from the furnace. This is compounded by the presence of clay lids, which were used to close the kiln after flaring. The large amounts of ash and charcoal on and within the kiln suggested large works of smelting in this zone of Asham.

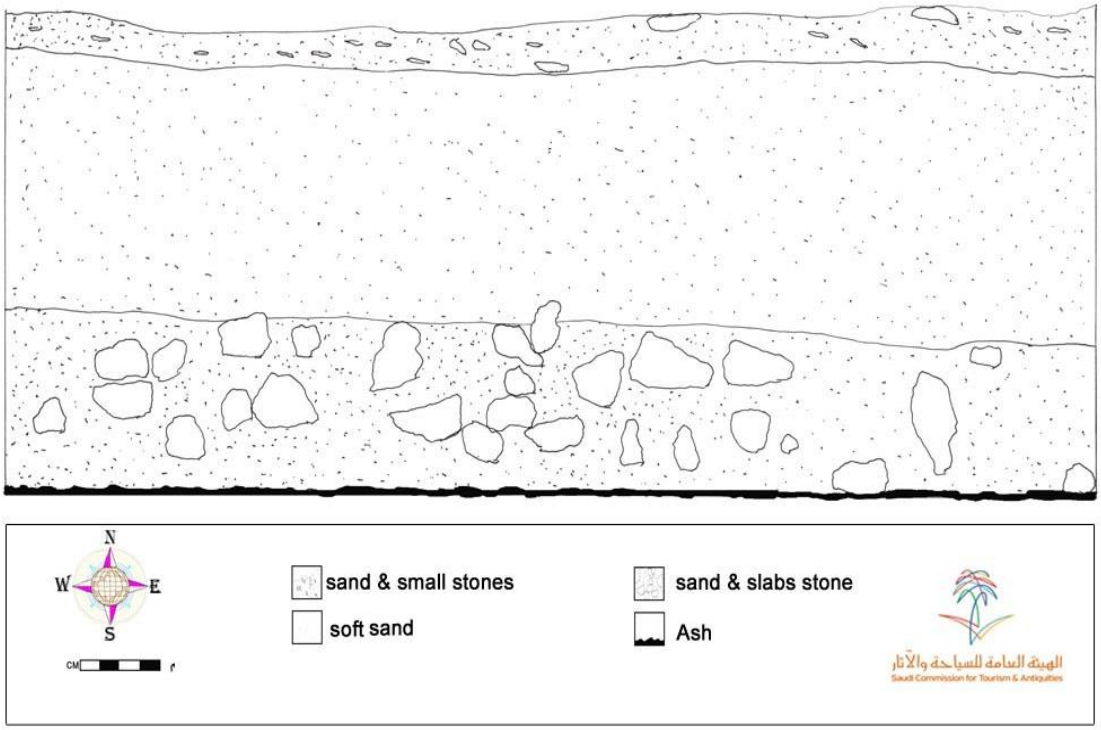


Figure 5.28: Sketch of east side of ASH4

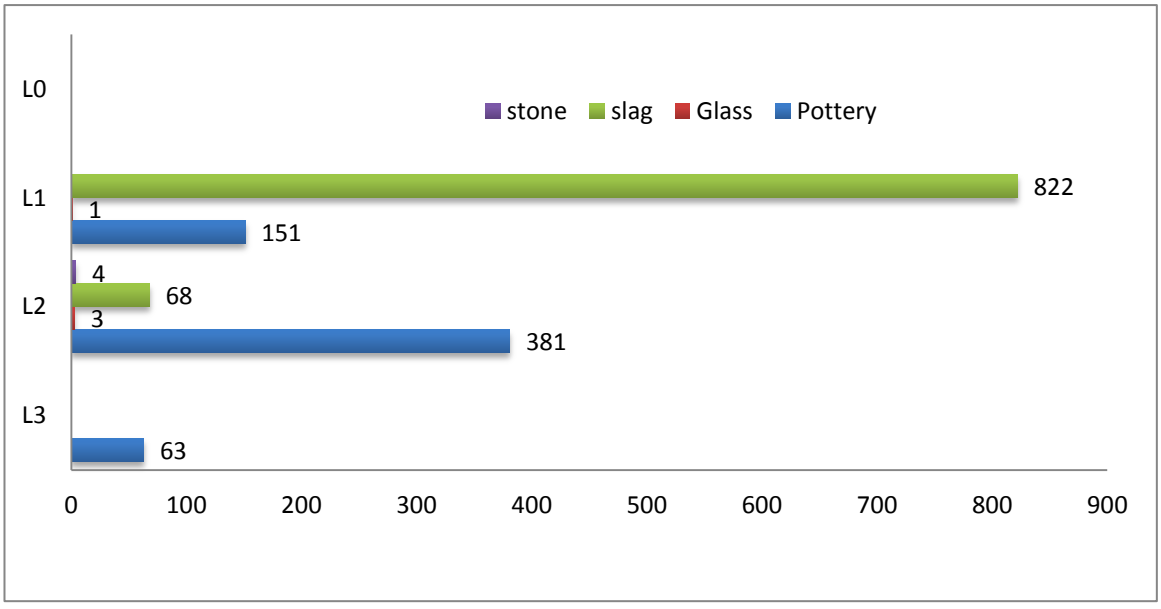


Figure 5.29: Number of objects by type in each layer of ASH4

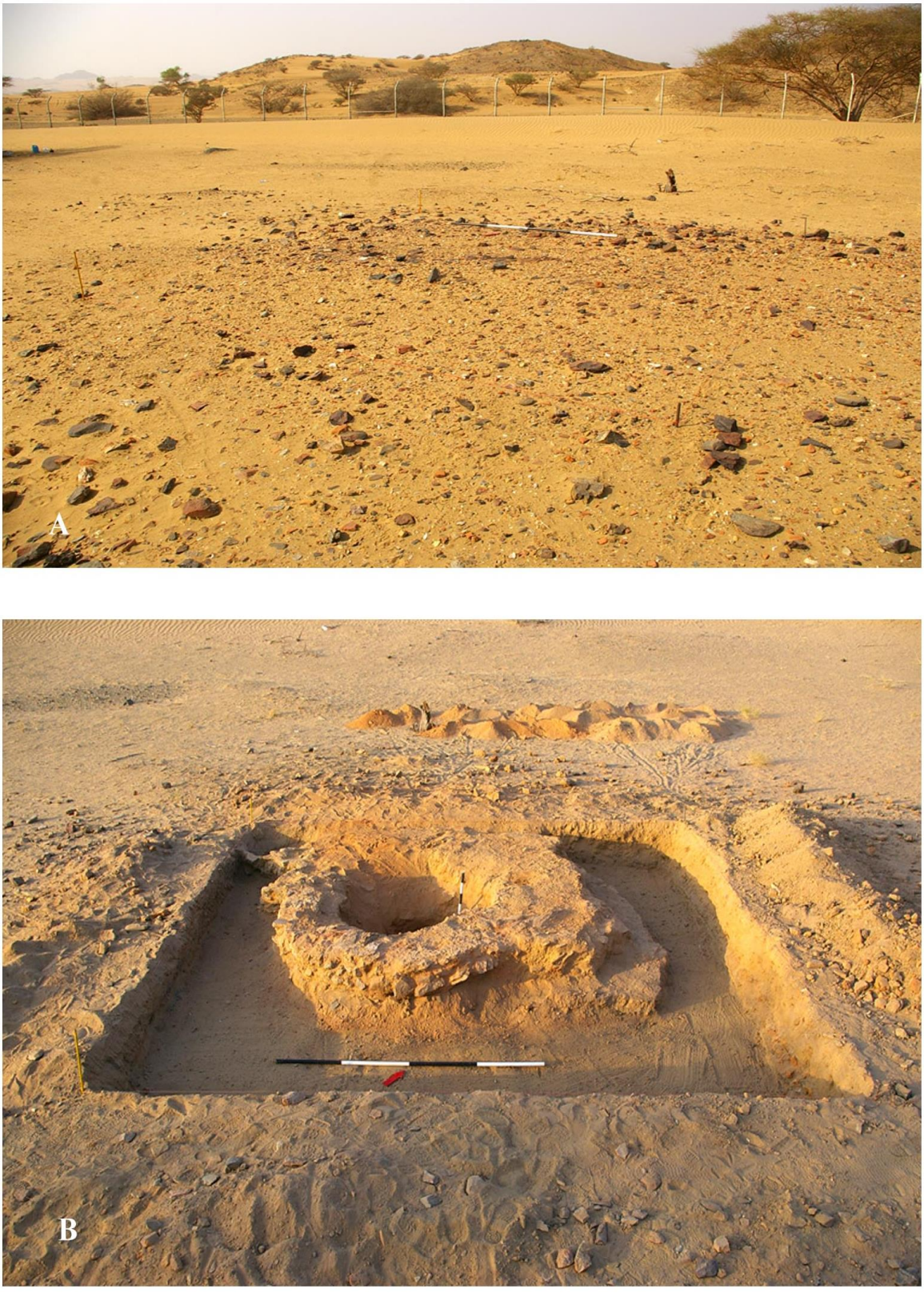


Figure 5.30: ASH4 general view

A: general view of trench: B: excavated area showing furnace

Figure 5.31: ASH4 and some excavated tools

A: south side of trench, B and C: some excavated mining tools

5.6 Excavations in Masodah

The excavation in Masodah site carried out in two trenches (Table 5.2), namely MAS1 and MAS2 (Figure 5.32).

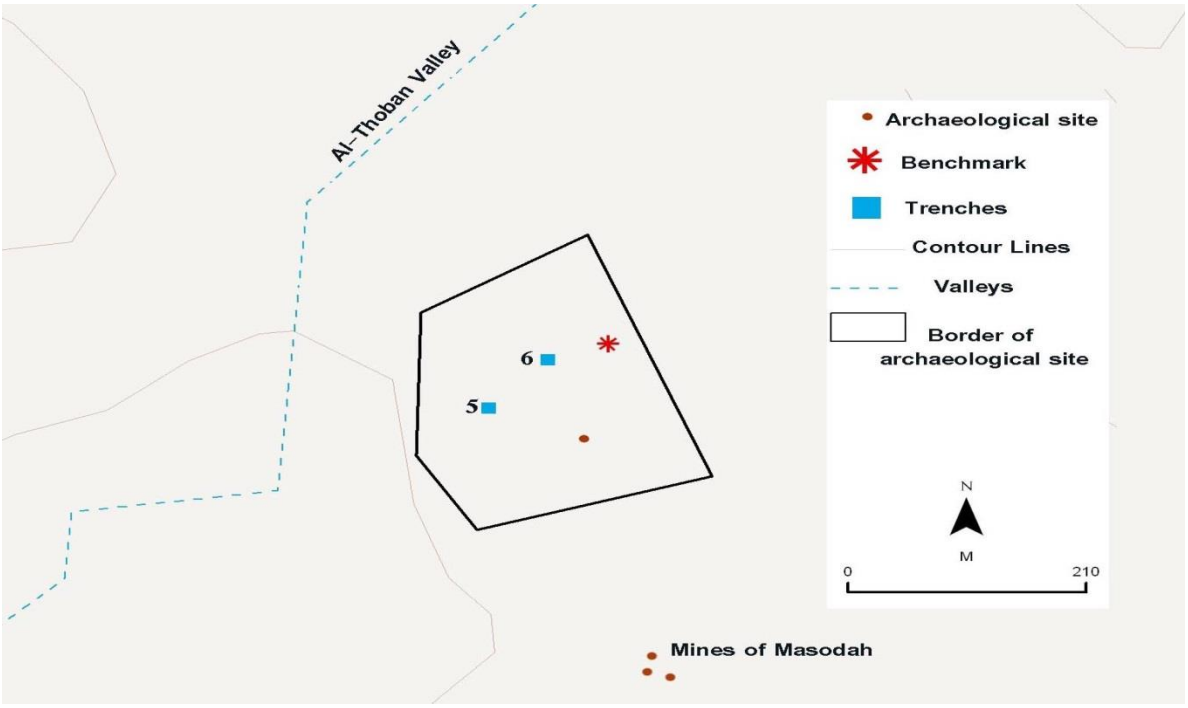


Figure 5.32: Locations of trenches in Masodah

5.6.1 MAS1

This trench is situated almost in the centre of Masodah on a small hillside next to a number of residential buildings (Table 5.2), occupying an area of 2×2m. The objectives of excavation in MAS1 were to ascertain the intensity of artefacts (particularly the low proportion of surface artefacts) and to compare them with those in Asham, and to investigate the foundation of buildings and follow the phases of occupation. The first action was to clean the surface of fallen stones, which enabled the collection of available archaeological artefacts, including a few pieces of pottery, followed by the digging of test pit MAS1-a, of 1×2m area in the southern corner, at a depth of 180cm. Excavation in this trench revealed six archaeological loci and 14 remains of pottery (see Appendix 11 for the excavated objects) (Figures 5.33-5.35).

Locus 1: It is a loose oblique layer, pale brown in colour. The thickness ranges from 55-100cm, with a clear floor. It contains much rubble moved by floods, and some soft grit that proliferates in neighbouring valleys. It also contains some fallen construction stones from the outer walls. This layer contains no cultural materials.

Locus 2: It is a hard soil layer, pale brown in colour, 20-30cm in thickness, with a partially clear floor. It contains of high level of sand, and some small grit. This layer was also devoid of artefacts

Locus 3: This locus and beyond was excavated after digging sub-trench A. Locus 3 is a fine layer, grey in colour, of 7-10cm in thickness. It contains a high percentage of ash and coal, mixed with a little sand and some animal bones. Again, no archaeological artefacts were found in this layer

Locus 4: It is a hard sand inclined layer, with thickness ranging from 8-10cm. It includes lots of sand and a few small stone. There are no artefacts in this locus.

Locus 5: It is an inclined sandy layer, yellow in colour, with a clear floor, and thickness ranging between 6-10cm. It is composed of full rubble mixed with a few small stones. This layer is empty of artefacts.

Locus 6: It is a loose soil layer, medium in hardness, pale brown in colour. Its thickness is 15-20cm. It is placed above the bedrock, possibly to support the main ground layer. It contains much rammed debris, some mixed small pebbles, and coal, and a few fallen stones. Some archaeological artefacts of various sizes and functions were discovered, including body sherds and handles made of pottery. A small hole was dug under the basis of the south-eastern wall to ascertain the ground of this layer, whereupon it became clear that the walls were built on a solid geological layer.

The archaeological excavation in this trench indicated that there is a large amount of ash, which confirms the occupation in this small village, whether for mining or the service of miners, in the settlement of Asham. Due to the location of Masodah on flat ground, the grit has overcome many layers of this trench. Although few archaeological objects have been found in this part, this may be due to small excavated area of MAS1. Fourteen broken remains of pottery vessels were revealed. These findings represent simple industry and roughness of paste, with large amounts of sand on the outer surface in addition to the core. Moreover, they are not tantamount to the quality industry that has been identified in Asham.

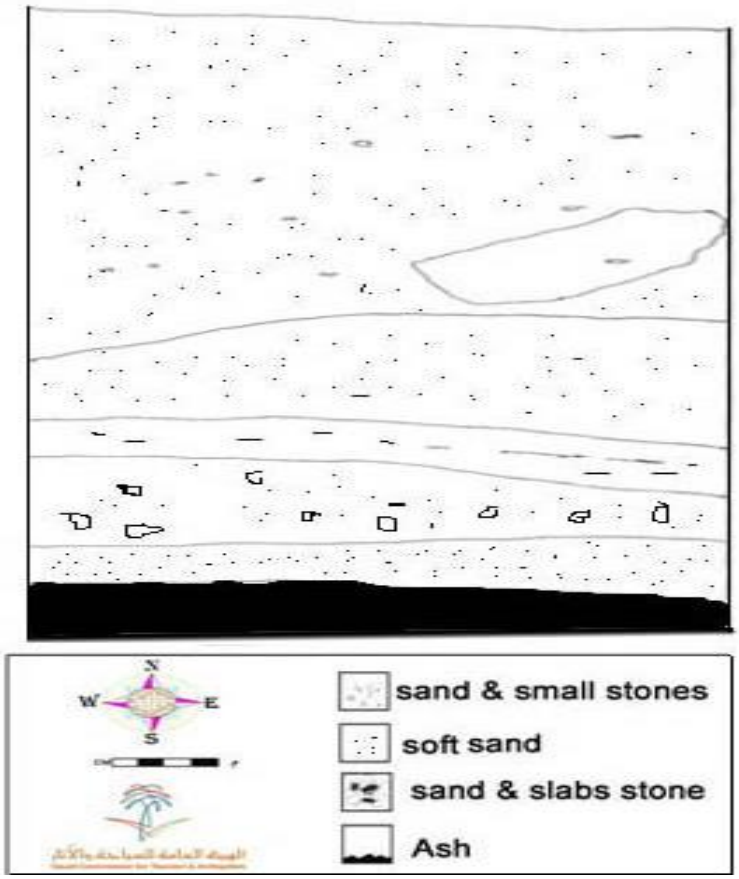


Figure 5.33: Sketch of east side of MAS1

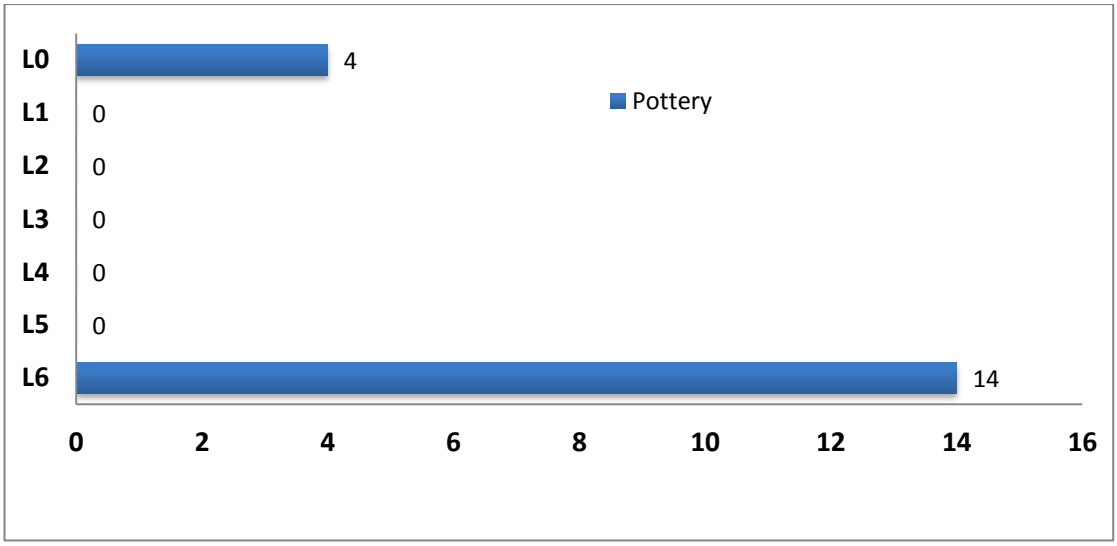


Figure 5.34: Number of pottery objects in each layer of MAS1

Figure 5.35: MAS1

A: general view of trench

B: excavated test pie of MAS1-a, C: excavated area of MAS1, D: some excavated objects

5.6.2 MAS2

This trench is located approximately in the middle of the residential zone between groups of buildings (Table 5.2). Pieces of the upper parts of millstones were spread around the trench, possibly carried there by floods or other natural factors. Wall foundations were observed there, making it easier to track them during excavation. The main aims for digging in this position were to make sure of the intensity of artefacts and compare them with those from Asham, and to ascertain the stages of occupation in Masodah and their characteristics.

The first step was to clean up the surface layer from stones, which were within the outer walls of neighbouring buildings; no surface artefacts were found. The first excavation included digging test pit MAS2-a (area 2×5m) from the south side to track layers, and then the other part was removed at the end of the excavation. Four archaeological loci were revealed in this trench, and 333 artefacts collected, with a total weight of 14,752kg (see Appendix 12 for the excavated objects) (Figures 5.36-5.38).

Locus 1: It is a loose sandy layer of pale brown colour. The thickness of layer is 35cm and has clear ground. It consists of much fetched rubble from floods, mixed with some small stones, and a few medium-sized falling stones of walls. In addition to the base of a millstone, and broken fine pottery found around.

Locus 2: It is a solid muddy layer of 35cm thickness, with a clear floor. It contains much soft soil, fetched from the valley nearby, mixed with few pieces of animal bones and small pieces of stones, and falling walls stones. Various sizes of body sherds of pottery and glass were found in this locus.

Locus 3: It consists largely of broken rubble from fallen stones of walls, but its ground is clear. The thickness is 20cm. it contains small amounts of coal, pieces of animal bones, pieces of bases, body sherds, handles and necks with rims made of pottery (unglazed and glazed) of multiple shapes, shells, and pieces of thin glass. This layer was raised in the geological layer during the construction stage.

Locus 4: It is a small furnace found in layer 3. It is located 60cm from the southern corner of this trench and 45cm from the western wall. The outer sector occupies an area 75x50cm, shaped by slabs of stone, rising from the ground layer by 17cm. In contrast, the inner section is covered with a solid rock layer on all sides, and slips of gypsum are distributed

in each corner to prevent the escape of heat. Some pieces of slag and coal were found inside and around it. Perhaps this small oven was devoted to the smelting metals.

Locus 5: It is the basin of the millstone also revealed in layer 3. It is 50cm in diameter, 9cm high from the ground layer. This millstone is placed near to the furnace and fixed in the ground layer. It was certainly used for grinding metals and then smelting them in the oven. Remains of ash, coal and slag were also found next to the millstone.

The final stage in this trench represented in digging a small test pit (20×20cm) next to the western wall to make sure of the geological layer; excavation in this trench ended at this level

Digging in this trench showed that there is substantial evidence of smelting, marked by the grinding of raw materials using spherical stone grinders beside the smelting furnace. However, it seems that the smelting works in these furnaces were conducted in open furnaces, and this trend is defined in some settlements, which requires the separation of raw materials and impurities. These types of furnaces are open most of the time and might have also been used in the cooking process.

The cultural materials were manifest in quantities of pottery, including the 284 pieces of jars with high necks used in heating gold /silver grains (chapter 6, section 6.2.1). Additionally, the use of small glassware was definitely to store chemical materials used in the separation of raw materials and other materials. The discovered stratigraphic in this trench indicated that the occupation in this village represents one phase due to the similarity of archaeological finds in each layer, as well as the failure to find the foundations of constructions in this part. This indicates that settlement in this village included not only mining activity, but also supplying food and other services to the miners. The shape of furnace was found in MAS2 is open from the inside and perhaps such furnaces exists in many unexcavated houses associated with mining activities.

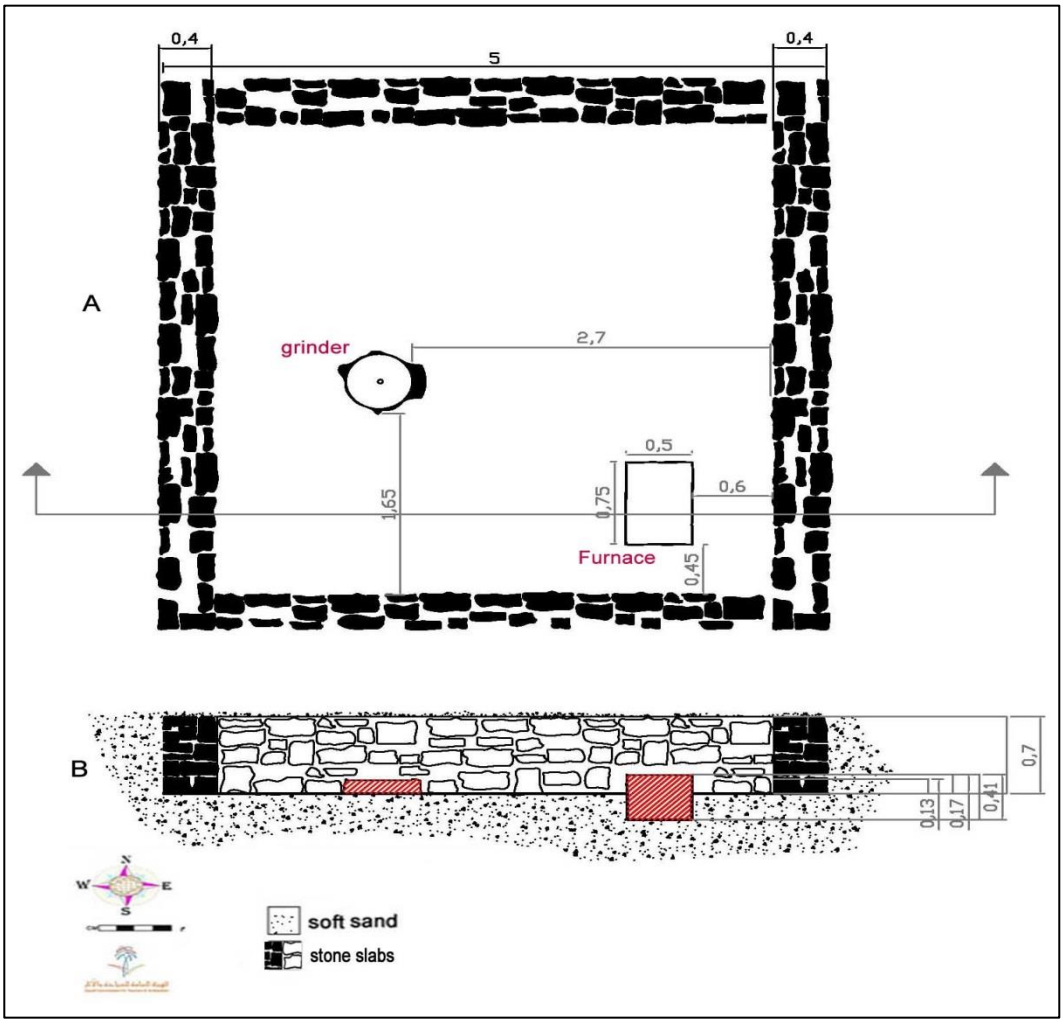


Figure 5.36: A) Plan of MAS2, B) sketch of the south wall

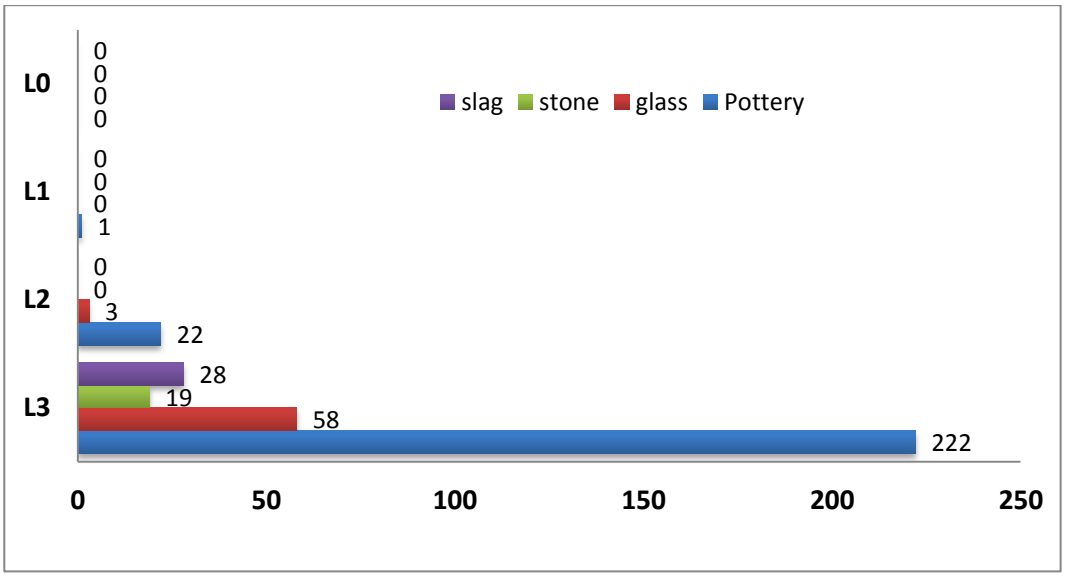


Figure 5.37: Number of objects by type in each layer of MAS2

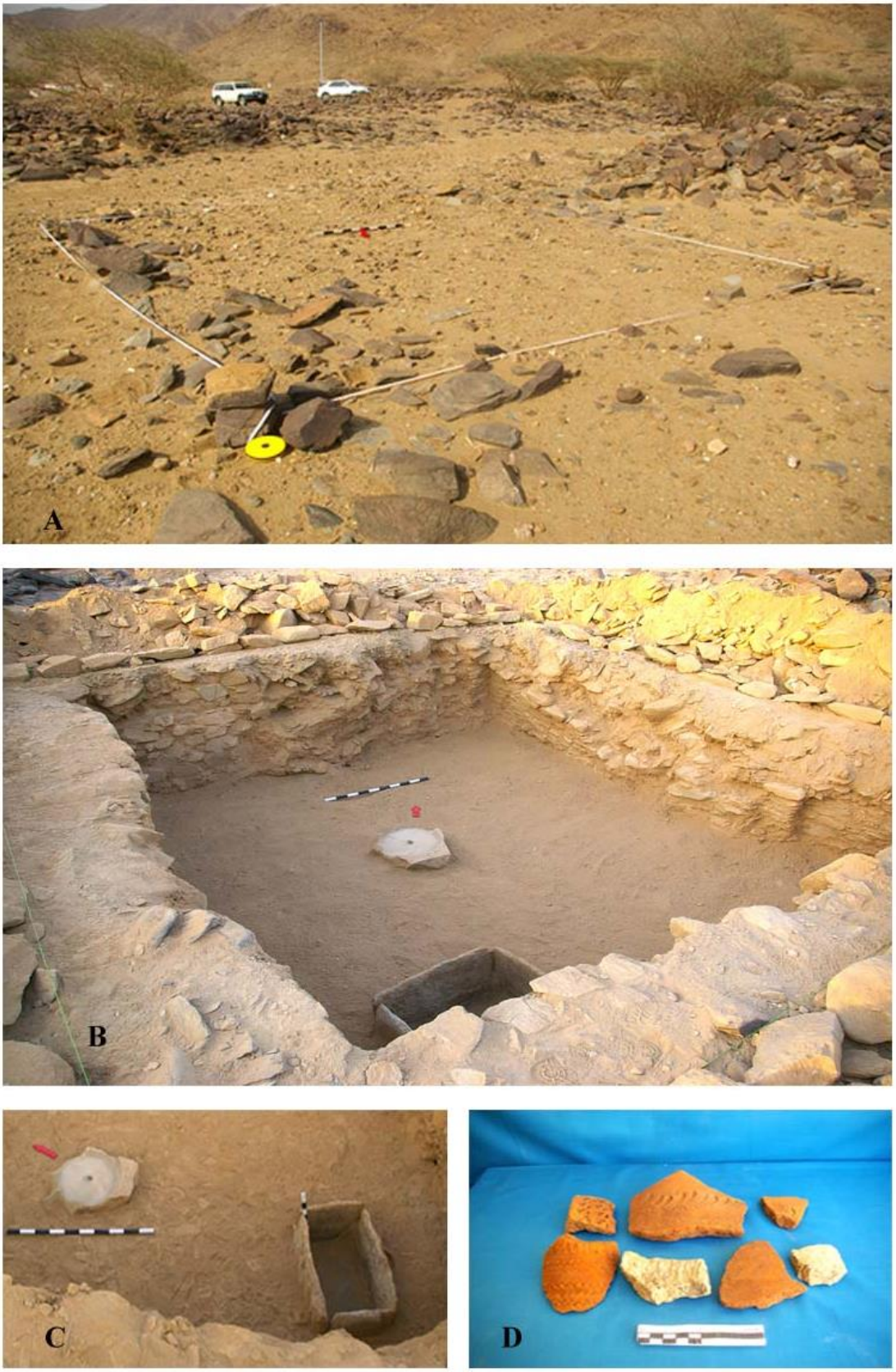


Figure 5.38: MAS2 general view and excavated objects

A: general view of trench, B: excavated of MAS2, C: locus 4 melting furnace, locus 5 basin of millstone, D: some thick excavated objects of MAS2

5.7 Trenches collections

Excavations in the trenches ASH1, ASH2, ASH3, ASH4, MAS1 and MAS2 revealed 3182 objects with a combined weight of 127,374 kilograms. This collection may be divided according to the same classifications as the surface collection from Asham and Masodah into five groups according to the ores, including stone tools, unglazed pottery, glazed pottery, glass and slag. It should be noted that the excavation also discovered other materials, particularly animal bones (324 pieces) and marine shells (two pieces). However, in this study, these groups were not studied due to the unremarkable findings of shells and animal bones, and the remoteness of their relevance to the main subject of this enquiry.

Although some pieces of slag were recovered from ASH4 and MAS2 (where the furnaces were found), slag in general did not appear abundantly in Asham and Masodah as heaps but in pieces near the kilns. Chemical analyses of samples of slag form Asham and Masodah showed that these samples contained: gold (0.30%), silver (0.40%) and copper (0.03%) from Asham; and gold (0.00%), silver (0.30%) and copper (0.10%) from Masodah (analysed at Hajjar Mine Project by Madden Company in October 2011). Perhaps the raw materials were smelted in those furnaces which are different from those known in other sites in Arabia.

Other samples of study selection of stone, pottery and glass were selected for more detailed study characterized by decorative or functional elements indicative of the civilizational development in Asham and Masodah, as presented below.

5.7.1 Stone tools

Stone tools (pounders and grinders) appeared in excavation layers in few number compared those found in the surface, where six pieces of stone tools were detected in the trenches, made of solid and volcanic stones. Five pounders were found in different layers (Figure 5.39). These pieces represent two spherical pounders of approximately 10cm in diameter, and three cylindrical pounders sized roughly 15x5cm. They were carefully cut off from local stone in the region. In addition, two basins of millstones made of solid stone were excavated in MAS2 (above), plus, a piece of molar for millstones made of lava with thickness of 50mm revealed in ASH3. It has many cavities used for crushing metals. This type of stone does not show any surface treatment and only the edges were finished in order to fit with the lower part of the millstone.

Figure 5.39: Studied samples of stone tools from ASH4

Pounders (no. 507, 508) and remain of grinder (no. 504)

5.7.2 Unglazed pottery

The number of unglazed pottery resulting from the trenches totalled 1627 sherds, in different layers, of which 54 were selected for further study. According to the external colour of paste, this selection might be categorised into four types namely: red paste (RP) with thick walls, reddish yellow (RYP) with mid-thick walls, dark paste (DP) with thin walls and pale paste (PP) with thin walls (see Appendix 13) (Figures 5.40-5.42).

- Unglazed pottery in RP with thick walls

This type is one of the most common in Asham and Masodah, where 12 pieces were found in the trenches of study selection. These pieces are fragments of concave bases, oval and square bodies, a lateral handle, cylindrical necks, and flared rims. They belong to jars, cooking pots, containers, furnace covers, head of pot and incense burner. The thickness of these pieces ranges from 5-30mm. These fragments were manufactured by speed wheel, except the head, handles and lid, which are made by hand, as well as the incense burner, which was made by mould. The fabric of these artefacts is characterized by red, reddish brown and pink paste in the core, possibly due to different soil and the degree of firing. In addition, they contain quantities of impurities such as organic materials, limestone and bits of sand and soapstone, as well as many cavities. Its hardness ranges between harsh and rough, and all of them were fired in complete condition. The surfaces were treated by adding an external slip of red color painted on the surfaces. Moreover, some small grooves around bodies and rims were noted, probably added using a piece of cloth or the wheel. The decorative pots of this type are represented in the form of adjoining geometric decorations, deep wavy grooves and sometimes straight executed by tiny incision. Rows of triangles holed from the inside were applied by mould.

- Unglazed pottery in RYP with mid-thick walls

Nine pieces of unglazed RYP were found in trenches of study selection at Asham and Masodah. These pieces are fragments of cylindrical bodies, vertical and flared rims and vertical handles. They belong to jars, cooking pots and containers, in addition to two square pieces of bricks that could be used in furnaces or to cover the floors. The average thickness ranges from 10-20mm. All of these pieces were manufactured on fast wheel except the handle, which was handmade. The paste of this type features various colours in the core, such as reddish yellow, pale brown, and dark greenish grey, depending on the kind of soil used and shaping. The pieces contain large quantities of impurities, specifically bits of sand, limestone, and organic materials. The paste was not devoid of tiny cavities. Most of these figments are roughly harsh, and the rest is very harsh. Moreover, the degree of firing varied from unfired to completely fired. However, all surfaces were treated by the wheel in from of many grooves, as well as slip of reddish yellow colour carried out manual. Decorated vessels of this group contained corrugated grooves similar to shark teeth style, belts of straight and broken lines and lines. All of these decorative elements were executed by tiny cuts in bodies and rims.

- Unglazed pottery in DP with thin walls

Four pieces of unglazed pottery in DP were studied represented in fragments of oval horizontal bodies, and vertical and flared rims. These fragments belonged to cooking pots and large jars as well as a cover for an oven provider with an upper pierced handle. The thickness of this type was between 5-10mm. In terms of manufacturing, all of these fragments were made on the speed wheel; only the handle was made by hand. The core of these pieces contains paste of dark brown or reddish brown colour, as well as some impurities, for example bits of sand, organic materials, and some tiny holes. The hardness of these samples varied from rough to harsh, and they were completely fired. The surface treatment was done by rubbing external surfaces with a layer of brown colour as well as wheel grooves executed before burning. The decoration in this group is represented in wavy grooves topped with a ledge in the form of straight lines, as well as decoration elements like the teeth shark under the rims, all former elements engraved in tiny cuts. Another pattern of decoration was found on bodies, a continuous belt consisting of diamond shapes surrounded by rectangular ones; this motif was applied by mould.

- Unglazed pottery in pale paste (PP) with thin walls

29 pieces of unglazed pottery in PP were studied. These pieces are fragments of flat bases, oval and pair bodies, cylindrical handles, cylindrical necks, and flared rims. They belong to various sizes, including cooking pots, cups and containers. The average thickness is 1-5mm. All pots were manufactured by the fast wheel except the handmade handle. The fabric of these fragments contained paste of pale brown, yellowish brown, pinkish white, and pale white colour.

This variation depends on the kind of soil and the technique of shaping. Most of these pieces contain large quantities of impurities, often in the core and sometimes in the inner surface, in the form of dense gravel, black sand, grains of quartz, tiny bits of limestone, some organic ingredients, and some tiny cavities; however, a few of these pieces are free of impurities. Pieces feel harsh, rough, smooth and very smooth. They are all completely fired. All internal and external surfaces were handled by rubbing with a layer of various colours (as mentioned above), as well as parallel grooves carried by wheel.

Although only a few pots are decorated, some of these pieces included a variety of decorative motifs such as geometric triangles, and parallel, intersecting and undulating grooves (horizontal and vertical). Moreover, several plant leaves were employed as elements of decoration. These decorative elements are implemented in bodies, rims and in handles.

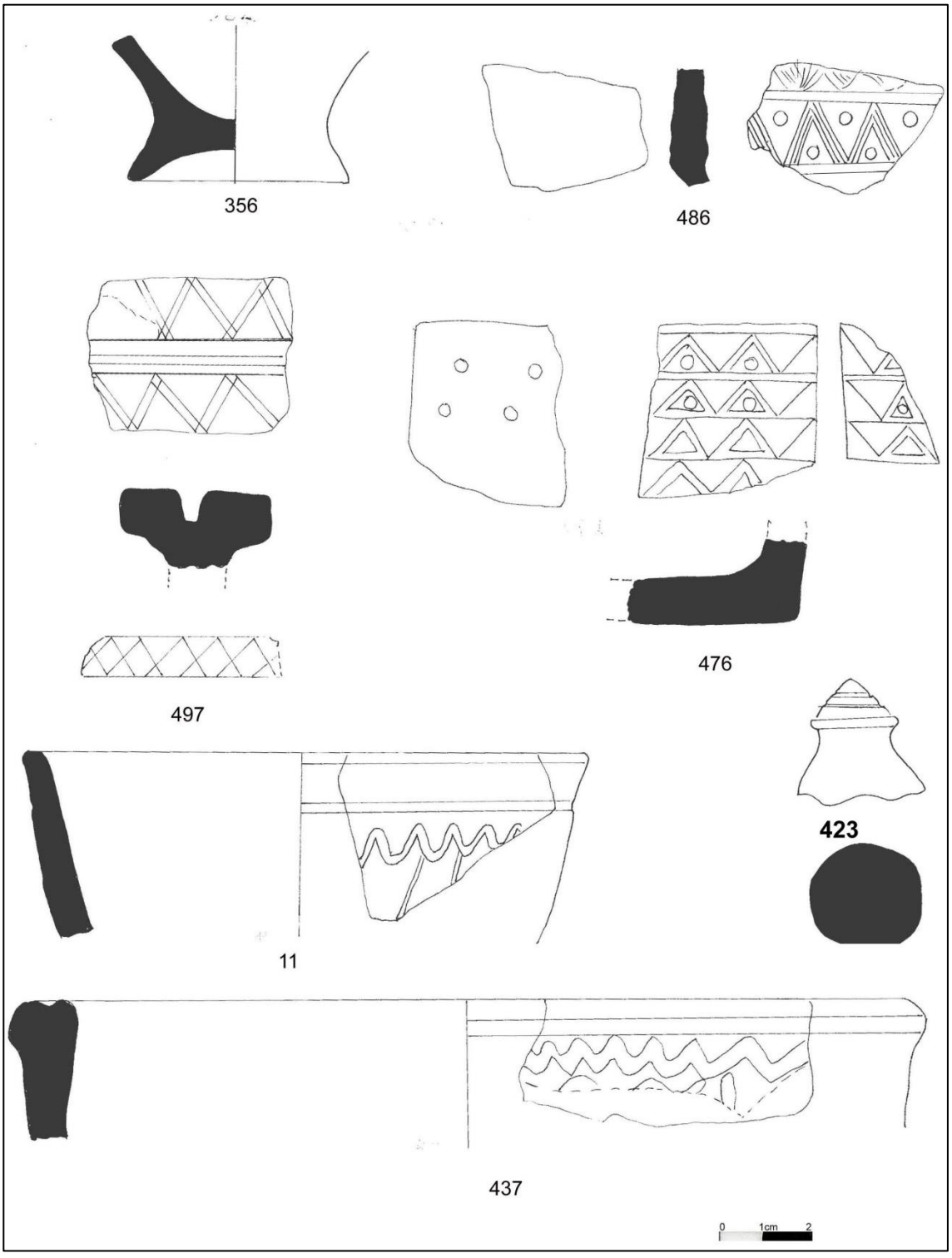


Figure 5.40: Drawings of samples of RP and RYP unglazed pottery from Asham and Madodah

Type RP (no. 356, 486, 467, and 476) and type RYP (no. 11, 423, and 437)

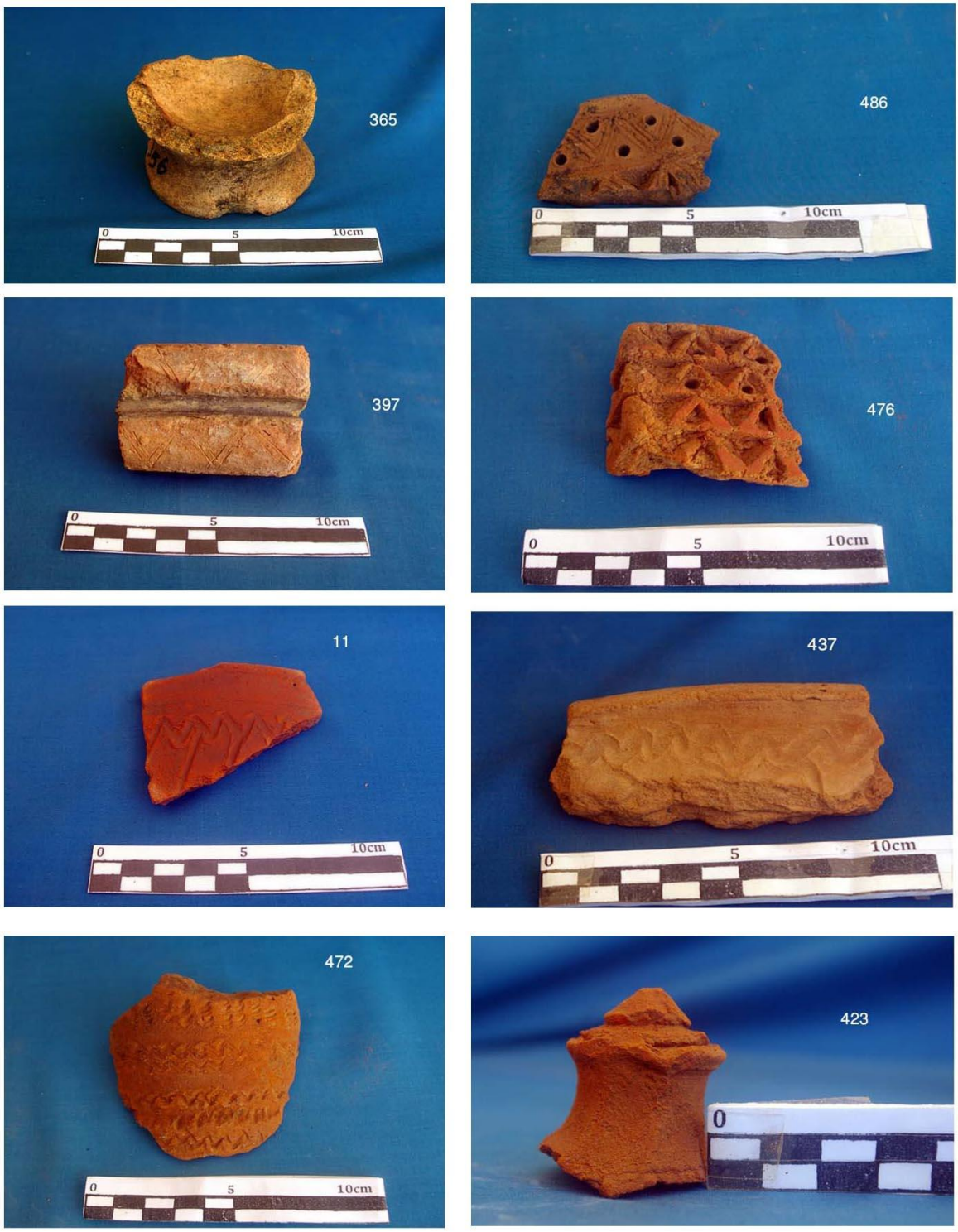


Figure 5.41: Photos of samples of RP and RYP unglazed pottery from Asham and Masodah trenches

Type RP (no. 356, 486, 467, and 476) and type RYP (no. 11, 437, 423 and 472)

Figure 5.42: Photos of samples of DP and PP unglazed pottery from Asham and Masodah trenches

Type DP (no. 206, and 369) and type PP (no. 168, 61, 160, and 480)

5.7.3. Glazed pottery

Glazed wares are considered one of the most famous tools used in mining settlements. 124 pieces were discovered in trenches in both Asham and Masodah settlements. The study selection reached 31 pieces. The type of painting on these samples can be classified into four categories: alkaline glaze (AG), coated glaze (CG) and lusterware glaze (LG) and tin glaze (TG) (see Appendix 14) (Figures 5.43-5.45).

- The alkaline glaze (AG)

Six pieces of AG pottery were studied, these pieces are fragments of flat and concave bases, oval and cylindrical bodies, a vertical handle, and straight and flared rims. These pieces belong to jars, bowl and cups. The thickness of fragments is 5-10mm. These pieces

were manufactured on a fast wheel except the handle. The fabric of alkaline glazed pottery featured various colours in the core between pale yellow, very pale brown, light yellowish brown and pink. These fabrics contained quantities of impurities such as grains of sand, limestone, and granules of coal. Likewise, internal cavities were noted in these pieces; the hardness ranged from roughly harsh to partially smooth, and the degree of burning was complete.The surface treatment of these fragments was implemented by painting the interior and exterior surfaces with alkaline coated in blue, green and greenish grey (on both surfaces) except the piece No. 189, which was only painted on the outer surface. The decoration was applied in forms of compacted layers of braids, and forms of hanging ropes from the rims to the bottoms of wares. Both of these forms were executed on the outer surface on the main dough in the mould and in grooves.

- The coated glaze pottery (CG)

Fourteen fragments of CG pottery were studied. These pieces are flat with concaved bases, oval and pearl bodies, and slightly flared rims. They belong to various sizes of jars, bowls, plates, containers and cups. Thickness ranges from 3-10mm. All of these fragments manufactured on the speed wheel, and the effects of wheel grooves are shown on internal and external surfaces. The fabric of these pieces is distinguished by the variations of core colour, including strong brown, reddish brown and light reddish brown, pink and pale yellow. They contain some impurities like bits of black and white stone, small gravel, and limestone, and include some tiny crevices. Some of these pieces are free of impurities. All of these pieces are roughly harsh to smooth in hardness, and firing was complete. Surfaces inclusions in these pieces were noted; they were coated under a and above the glazed layer of different colours, including milky and pale light brown and mixed with yellow, olive, green, and pale yellow, multiple gradient, green, and olive spotting with green. In terms of ornamentation in this group, some of these decorative fragments contained several forms of networks of varying breadth, well painted from the edges towards the bases. Parallel horizontal lines cover the inner surfaces. This decoration is executed in a dark brown and green with a brush, and sometimes fingers were used, especially on the edges of these lines. Wheel grooves are deeply cut in the same paste and pre-coated to varying degrees.

- The lusterware glaze (LG)

Seven pieces of LG were found, distributed in both sites. These pieces are fragments of concave and trumpet bases, oval bodies, and flared rims. They belong to bowls and plates. The thickness of this category is between 3-7mm. All of these fragments were

manufactured on the speed wheel. The paste of these pieces is coloured light yellowish brown, pink, and light reddish brown. Half of them include bits of sand, limestone, and gravel, whereas, the rest have no impurities. Tiny bits were scattered in an unorganized fashion in all pieces of this group. The pieces are of hard and rough or smooth (equally). The degree of firing was complete in all pieces. Besides, surfaces treatment were soft and coated with layer in various colour including; shiny milk, shiny silver and grey. The decoration of this group mostly represents in animal forms of fish, butterfly wings which painted by very fine brush informs of gold and olive lines additionally, the use of red paint to cover some gaps. Furthermore, geometric forms of lattice and horizontal lines which are hanging from the edge to the bottom of the pots have been noted. It is notable on some decorated that these elements implemented by adding later in the final installation phase of lustre. Thus, the lines are raised on the surfaces. All geometric shapes executed with brown and light olive.

- The tin glaze (TG)

Four pieces of TG were found in Asham and Masodah. These pieces are fragments of vertical and flared rims, and oval bodies. They belong to bowls and one plate. The thickness ranges from 3-5mm. They were manufactured on the wheel. The fabric of this category is a paste of pale yellow and brown colours. They contain some impurities, such as grains of sand, small stones and limestone. They contained tiny holes. The hardness is smooth in most pieces, and they were fired completely. The surfaces were treated by the layering of different colors, including white and grey on under the glazed layer, and it was noted that some of these coatings were thick and some crushed (*makcar*) pieces. Two pieces are decorated. No. 196 features a floral decoration consisting of a soft branch ramified to some graceful leaves executed in dark blue. This decoration was applied to the inner surface using a small brush. No. 200 displays green dots on the edge, unequally spread over the surfaces.

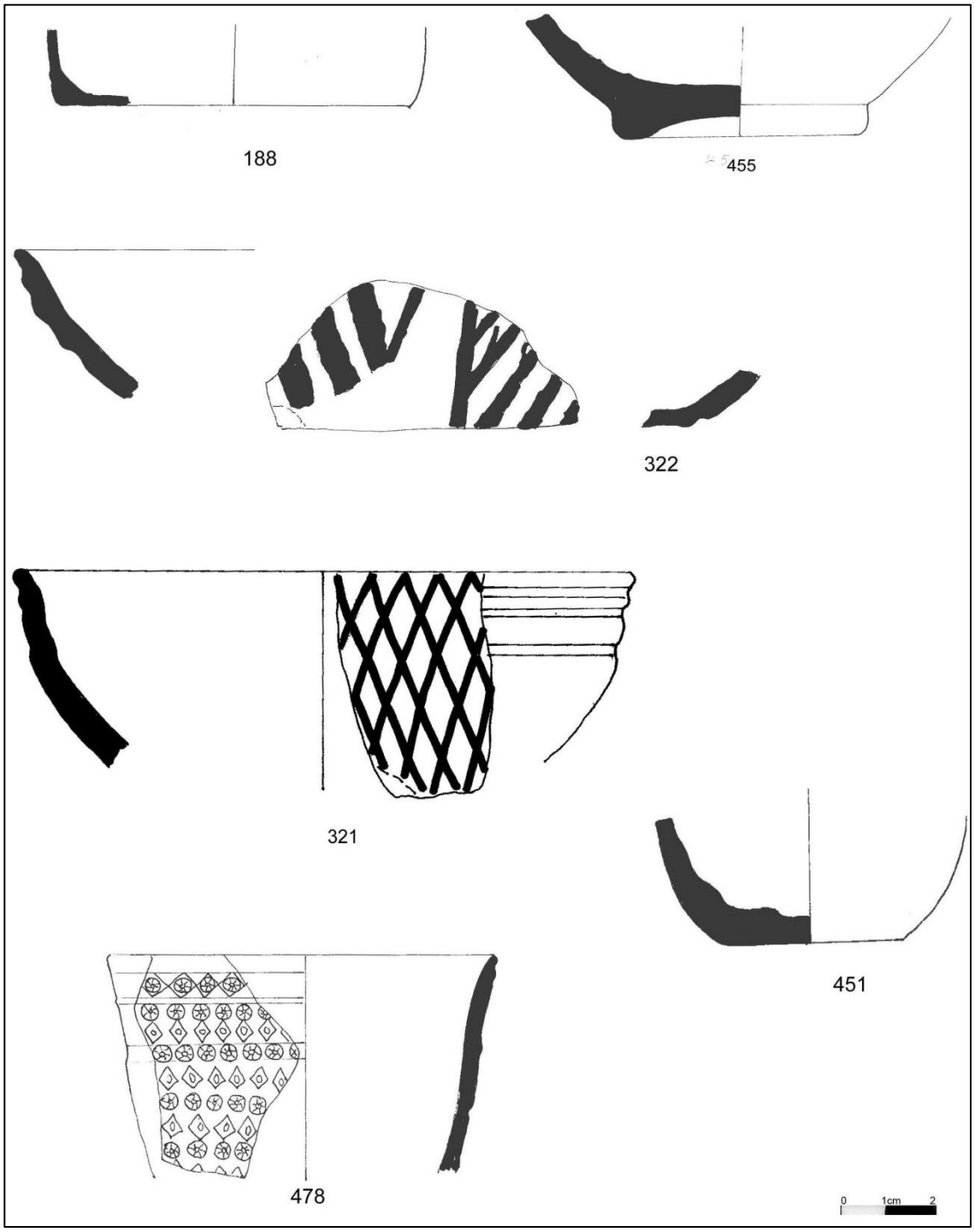


Figure 5.43: Drawings of samples of AG and CG glazed pottery from Asham and Masodah trenches

Type AG (no. 188, and 455) and type CG (no. 322, 321, 451, and 478)

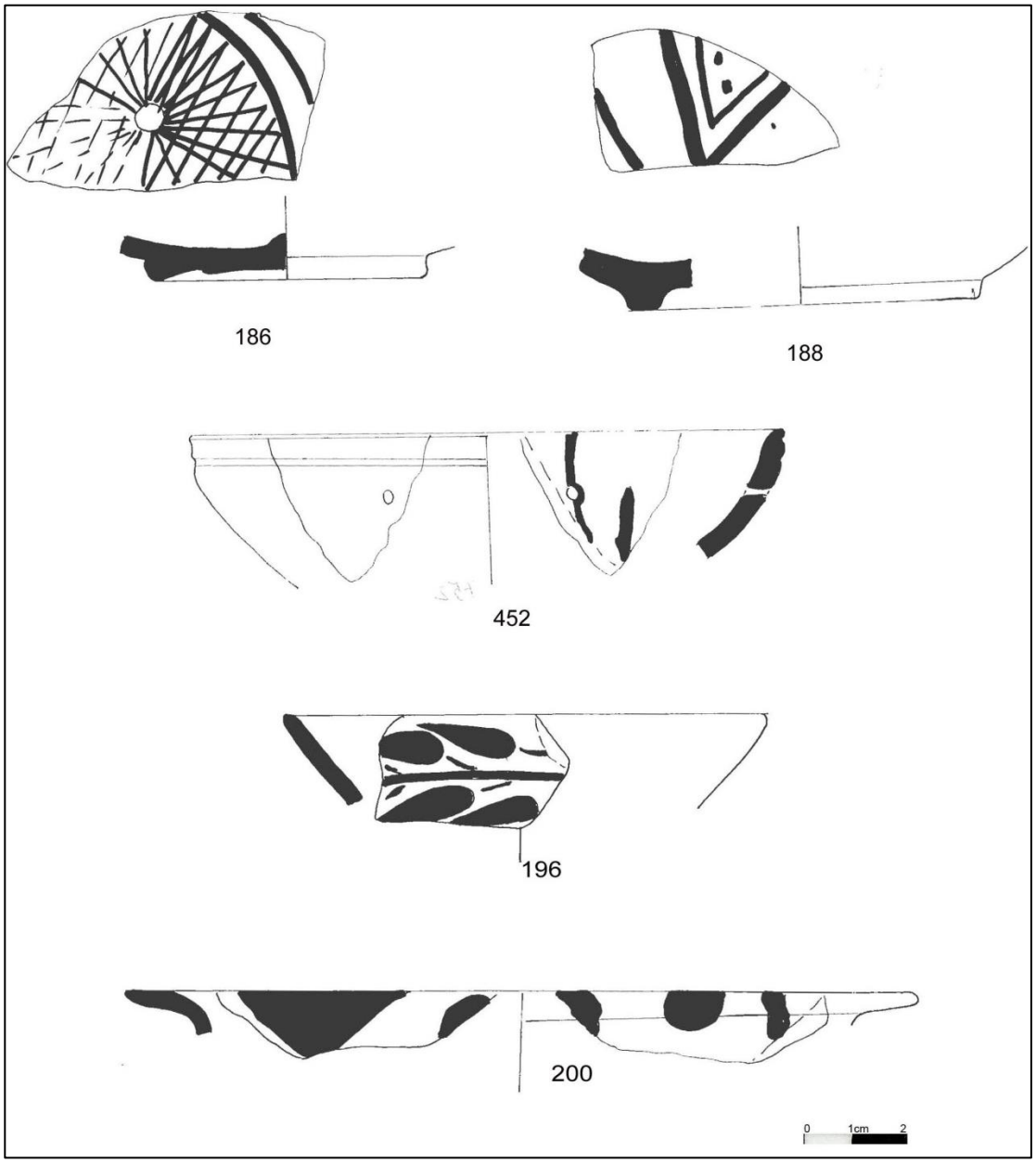


Figure 5.44: Drawings of samples of LG and TG glazed pottery from Asham and Masodah trenches

Type LG (no. 186, 188 and 452) and type TG (no. 196, and 200)

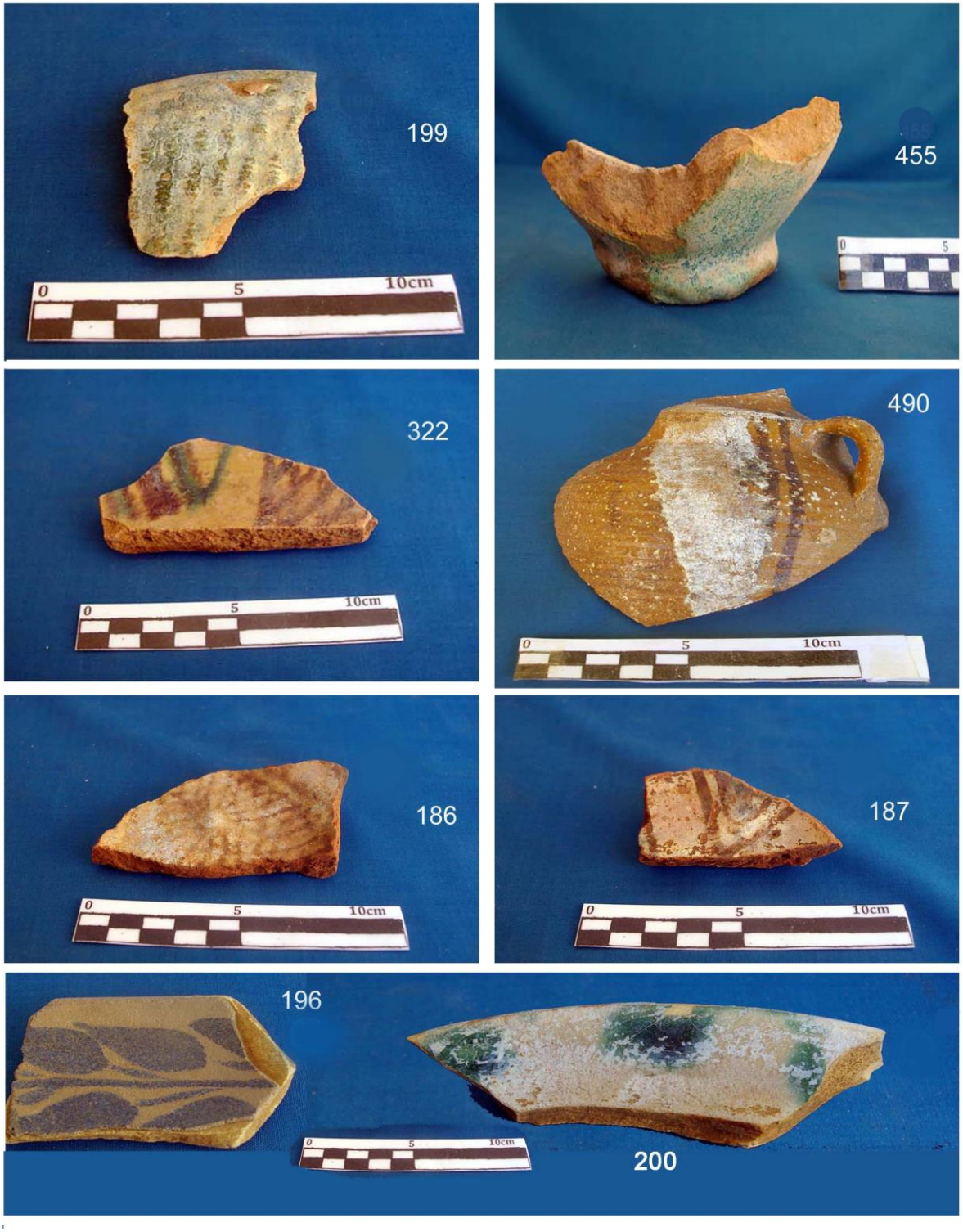


Figure 5.45: Photos of samples of LG, CG, and TG glazed pottery from Asham and Masodah trenches

Type AG (no. 199 and455), type CG (no. 322, and 492), type LG (no. 186 and 187) type TG (no. 196 and 200)

5.7.4. Soapstone wares

Soapstone of the most important wares associated with the mining settlements. 44 pieces were found in Asham and Masodah. All pieces of this type are considered one pattern. Eight pieces were selected for more detailed study (see Appendix 15), (Figure 5.46). These samples are remains of flat bases, oval bodies and vertical rims. All of these pieces were from cooking pots. The average thickness ranges from 4-9mm. The manufactured of these pieces involved carving them directly out of the original stone. These wares were made of grey stones, looked easy to crumble, and had a soapy feeling in their surfaces, where indications of manufacturing are still obvious. The surface treatment was implemented by notching and trimming all the surfaces, as well as attaching handles along the body by relief engraving. Also, some of them were painted with tar inside and outside. Although the decorations are generally non-existent, some micro-grooves and appeared on the external surfaces, perhaps intended to model decorative elements.

Figure 5.46: Two samples of remains of cooking pot and bowel made of soapstone from Asham and Masodah trenches

5.7.5 Glassware

Excavations in trenches discovered 131 panes of glass of different sizes and functions. Subsequently, 28 pieces were determined as a study sample. These glasses varied between transparent glass and dark glass (see Appendix 16), (Figure 5.47 and 5.48). These fragments are flat with concaved bases, oval bodies, and flared rims. They belong to bowls, plates, bottles and cups, and one handle. The thickness of these glasses ranges between 1-7mm. Some of them were manufactured by free blowing and others by blowing into a mould, and handles were handmade. The paste of these glasses is free of impurities, smooth, and well fired. The surface treatment was implemented by adding a layer of transparent, pale green and yellow, as well as the olive colour, some contain dark colour of blue and green. There are some decorative elements such as wavy parallel lines like shark

teeth pattern, deep incisions, opposite comb teeth, and plant leaves, all of which were executed by relief cut.

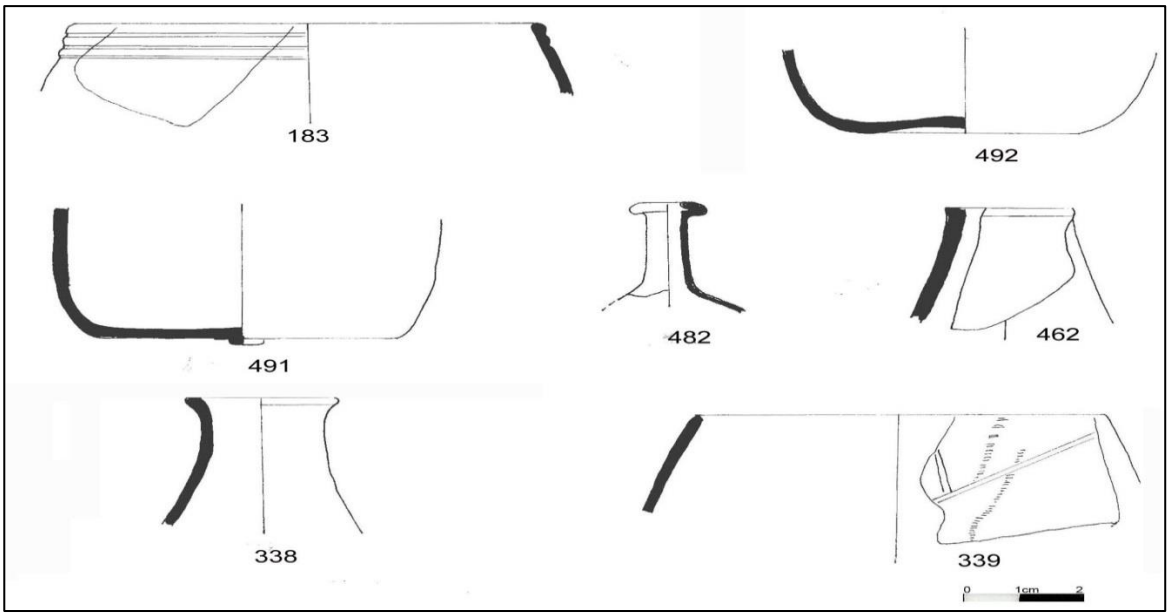


Figure 5.47: Drawings of samples of glassware from Asham and Masodah trenches

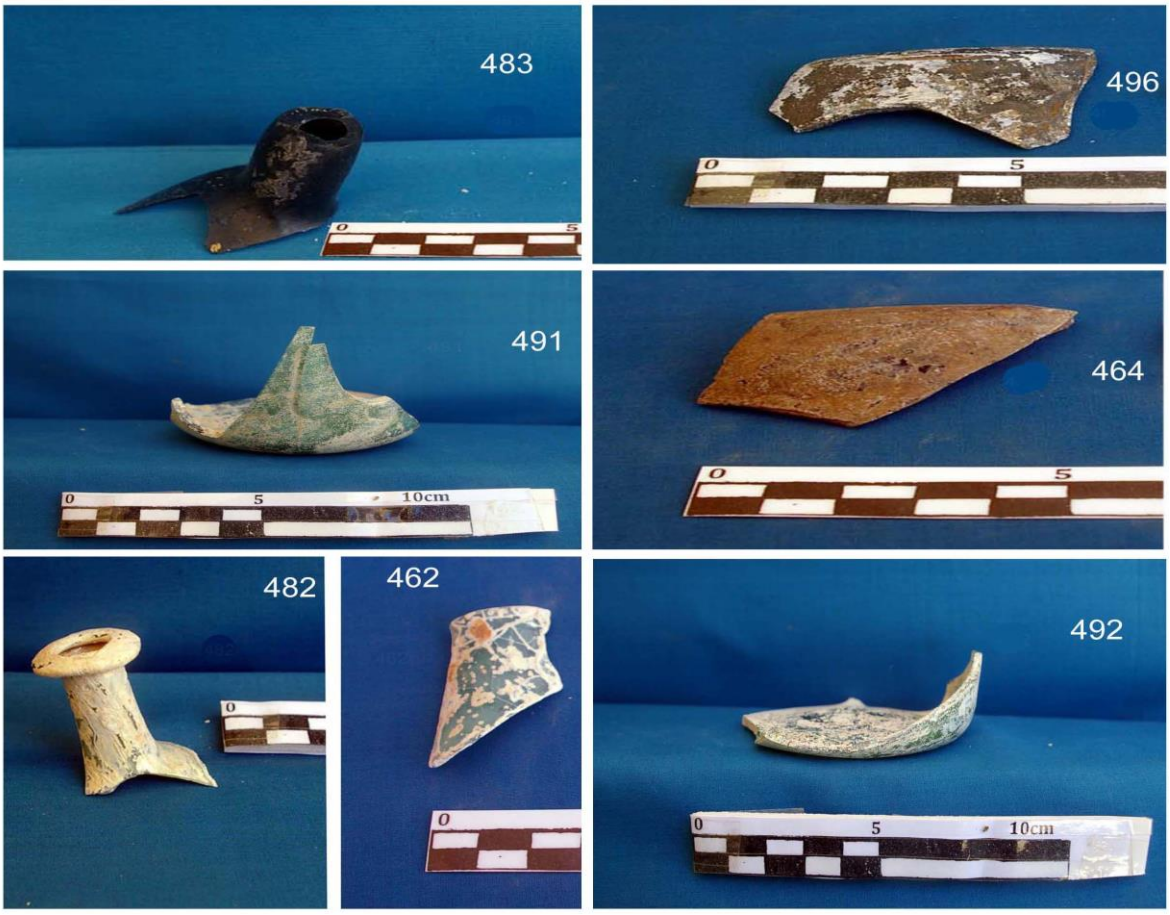


Figure 5.48: Photos of samples glassware from Asham and Masodah trenches

It is clear that the most objects from the suface and ternces in Asham and Masodah are similar in terms of types and methods of manufacture and decoration, which would suggest that the continuation of using these patterns. In addition, these objects played two key roles at least; one in use in the mining practice as wares to filter, heat and melt the grains of gold or silver, two in daily use in terms of cooking and serving food for the settlers. In any case, that this examined group are frequent in many mining and non-mining sites, which confirms their use in both cases.

However, the similarity of tools and wares in Asham and Masodah suggests that the continuation of occupation there was dependent on their status as specialised sites for mineral ore extraction and processing, which is why their tools and wares were similar and suited to this purpose. Also, there was probably no occupational or technological evolution in mining at the site (according to outcomes of study data). The fact that the site stopped at the height of a period of prosperity was probably a result of the political situation in Arabia and elsewhere. However, this does not mean that no other models of tools and wares were found. Rather the commercial traffic between the region and external centers of commerce elsewhere in the Islamic world mean that future excavations are likely to yield significant quantities of pottery varying in shapes, patterns and decorative elements, which would raise big questions for researchers about the history of the settlement of the site.

5.8 Conclusion

This chapter has examined Asham settlement, including Masodah, as model of mining settlement in al-Baha region in the Islamic period. It shown the archaeological previous studies in Asham before the current fieldwork of this study involved. Undoubtedly, the distribution of various artefacts mining and non-mining in reflects the importance of settlement and the level of civilizational development. The current fieldwork conducted intensive survey and collecting more surface finds then six trenched have been dug in Asham and Masodah. This has included artefactual study for both surface and trenched finds.

The intensive survey revealed that Asham was planned according to the prevailing model of early Arab-Islamic cities. This is confirmed by the existence of housing with interconnected untis and the multiplicity of its facilities in the internal and external area, as well as shops with several sections and extensive commercial squares, and the mosque, which mediates Asham to gather neighbourhood residents and nearby villagers, and was a meeting point that contributed to education and linked the surrounding communities.

The presence of the towers in high places at the southwest side of Asham and between houses formed a defensive system for the settlements. This would be interpreted by the excellence and fame of Asham and the quality of its mines that brought greater attention to finding government supervision of the mining businesses in this settlement and the presence of military facilities to protect and defend it. Consequently, the social and economic climate of south-western Arabia was relatively stable and safe for the first five centuries of Islamic history (7^{th} to 12^{th} CE). This stability generated extensive architectural fabric of residential, commercial and religious installations. Also, one of the most substantial reasons for the breadth of construction and multiple facilities in Asham is the migration of some residents of the neighbouring villages to work in mining activities and crafts and other industries that required such mining city. This also contributed to extending mining processes to the neighbouring village of Masodah and probably to other temporary settlements nearby. Therefore, the same condition can be seen in Masodah in terms of the presence of those facilities in spite of the lack of architectural buildings there.

It is notable that the location of Asham and Masodah near the mouths of sub-valleys such as al-Kirbean, Firyaan and al-Thoban would suggest that streams were used for workings to wash mineral ores after extraction. Irrigation is also manifest in the field system found in the western side of Masodah. These fields were watered by branches and channels of those valleys. It is certain that these fields were one of the most important sources of sustenance of Asham settlement, and their irrigation channels and field walls are visible on the surface at present.

Excavations in Asham and Masodah revealed internal stratigraphy was at a depth of more than a metre from the remnants of the visible walls to their bases. There were so far no signs of cultural remains under the latest excavated layer that would represent the pre-Islamic period. It was noted from the excavation in Asham that the foundations of walls have been put on the layer of soft sand, which was examined by test pits in Asham, while the foundations of walls at Masodah were established on bedrock, possibly due to its geographical features containing a solid rock layer that eliminates the presence of sand dunes. Conversely, Asham contains large amounts of sand, as the site is located on a series of sand dunes.

As pointed out previously, Asham and Masodah had an abundance of mining evidence in the form of stone tools, pounders (n=470) and grinders (n=626). This would suggest a large number of sites involved in the production of gold and silver, with Asham being a

key centre. The study selection of these tools demonstrated that they have varied in shape, with pounder types A, B, and C. A is cylindrical (n=180); B is spherical (n=169); and C is spindle (n=121). Grinders were in four shapes: A is millstones with one base (n= 186); B is millstones with two bases (n=26); C is slab (n=214); and D is hand grinder (n=200).

The surveyed and excavated artefacts included 1860 pieces of unglazed pottery, 124 pieces of glazed pottery and 132 fragments of glass, all of them have the same composition and characteristics as models found aboundantly in many contemporaneous Muslim metropolises. The study selection of these fragments (77 unglazed, 44 glazed, 8 soapstone and 28 glass) show that they were used as wares, including cooking pots, bowl, jars, cups, plates and containers for mining purposes and daily life.

However, the best evidence of the production capacity and its size is the presence of furnace remains in Asham and Masodah that may also have been used for heating and melting the ores, as suggested by pieces of slag scattered around the furnaces. The surveyed areas adjacent to the kiln in Asham (ASH4) also suggest the presence a belt of furnaces used for smelting ores.

By merging the field evidence from surface mining settlements, particularly Asham and its trenches, and the analysis of the mining landscape presented in chapter 4, it is possible to draw the picture of mining landscape and its tools, methods and production places in the Islamic era in the south-east of Saudi Arabia, as explored in the following chapter.

Chapter 6: Discussion

6.1 Introduction

In the last two chapters, archaeological works in al-Baha region have been shown through previous work carried out in the region over four decades, either through organized missions or specialized studies of different aspects with a focus on the mines and their settlements. These chapters also uncovered that the region included various archaeological surveys; however, the portion of mining surveys was low, as in the rest of the KSA.

This study has conducted a comprehensive survey of the mining settlements in al-Baha and recorded 19 new sites for mining, in addition to a previously recorded 23 sites through SCTA activities, and a collection of samples from the surface of these sites as available. Asham settlement in the south-west of the region was then studied as a model of mining settlements through survey and excavation in six trenches (in Asham and Masodah), and analytical study of surveyed and trenched artefacts was conducted.

This chapter discusses the mining evidence and its importance, the variation of types in terms of furnaces and tools of mining, and the particular significance of Asham settlement in mining, with consideration of thematically and geographically broader areas in terms of non-mining finds in Asham settlement. Subsequently, the distribution of mining settlements in al-Baha region and their relationship with non-mining sites is considered, followed by a comparative study of mining furnaces and artefacts of study area with other mining sites in the KSA and beyond in the sixth section, finishing with a general discussion and conclusion in the final section of this chapter.

6.2 Mining furnaces and tools in the internal production places

The furnaces and tools surveyed in the mining zones (al-Sarat and Tihama) played a specific role in the process of mining in addition to their use as tools in daily life. Before discussion of furnaces and tools of mining, it is appropriate to point out that the fieldwork in this study surveyed many pounders and grinders in settlements (chapter 4), especially in Asham. Additionally, two furnaces for smelting were discovered in Asham and Masodah (chapter 5). These surveyed tools and furnaces are physical examples of what al-Hamdani (1987) explained in 9th centuries CE/3rd AH century when he indicated the method of extracting and treating gold and silver. Therefore, depending on the al-Hamdani's explanations of the stages of mining gold and silver from quartz veins and some rocks

(chapter 2), and the surveyed and excavated tools and wares of this study (chapters 4 and 5), the process of mining gold can be illustrated in five stages including breaking, grinding, refining, heating in pottery and melting in furnaces (Figure 6.1). Also, it can be noted here that due to the presence of gold in the form of sand and in running water in form of grains ('surface mining'), these collected grains were probably treated in the same process, at least as far as melting in the furnace is concerned.

As for the mining of copper, although several sources confirmed that the Arabs were known to melt mineral ores copper did not receive as much attention in those sources as gold and silver, which are singled out for lengthy explanations (e.g. al-Hamdani, 1987). However, available sources regarding Arabia are corroborated by the indications of several fieldwork surveys carried out in the KSA and beyond (Dejesus et al., 1981, 61-63; Weisgerber, 2003; Zarins et al., 1981, 63-89). It is most likely that copper received less attention in classical sources due to its cheaper value, and possibly because the smelting of copper was not as complicated as the processing of gold and silver.

Copper processing was practised in two stages: crushing the stones until they become hazelnut-sized balls, then smelting them in furnaces as mentioned in chapter 4. The most commonly tools used in the process of extracting and processing copper ore were stone hammers and pounders. In addition to smelting itself, some pottery of daily use was probably used in ancillary processes such as the washing or storing of copper grains. An illustration of the processes in copper extraction according to tools and some fragments of furnaces found in the copper mining settlements represent the same techniques that were used in the study area and beyond (Figure 6.2).

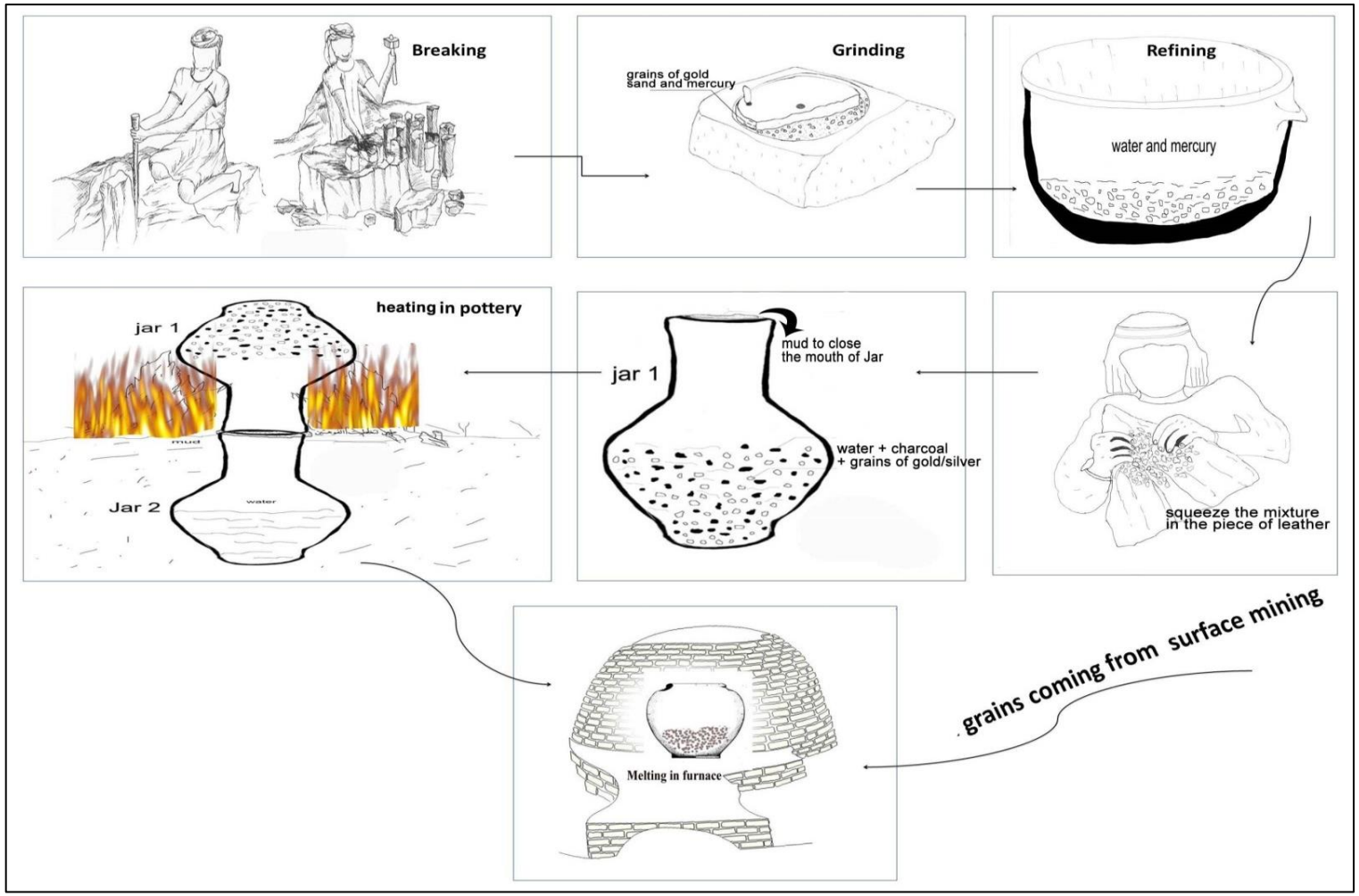


Figure 6.1: Gold/silver mining process from mining surface and extraction from quartz and rocks

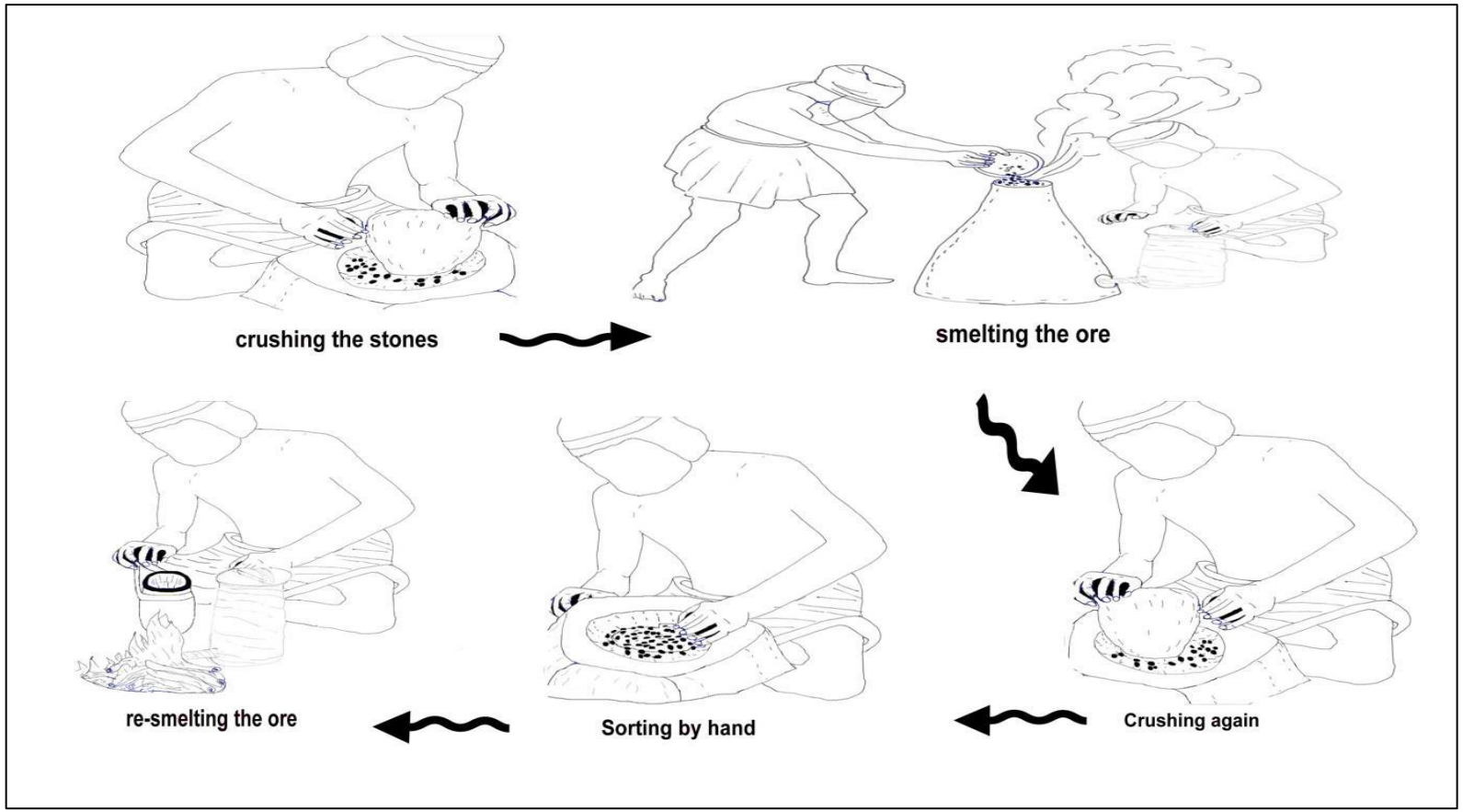


Figure 6.2: Process of extracting copper

(I greatly benefited in illustrating this process from scientific papers that were presented in the Historical Metallurgy Society Research in Progress Conference, November, 2012 at Newcastle University. Particularly the paper presented by Yvette Marks: *Any way the wind blows: A re-assessment of the working parameters of the Bronze Age Aegean perforated furnace* (Marks, 2012))

6.2.1 Furnace types

Furnaces of different shapes and sizes have universally been used in mining, as mentioned in the early chapters. They were essential in treating ores to extract the pure metal end-product. Two types of furnaces, for silver and gold, were uncovered in this study, as detailed below. The copper smelting furnaces are considered a distinctive sign in mining settlements in al-Baha region, particularly the zone of al-Sarat (Table 4.4). The clay furnace in pyramid shape is frequent and has been observed throughout the Arabian Peninsula (Dejesus et al., 1981, 63-79; Weisgerber, 2008). The surveys in this study indicated the existence of remnants of this type in two settlements, al-Haqah and al-Kesimah (Figure 6.3). These remains consist of clay walls and tubes to blow into the furnace and copper slag. The tube could be used to pour the copper into a bowl of pottery for the filtering stage. Maybe these parts were broken after extracting the pure copper. This can be confirmed by the existence of similar characteristics to some furnaces in the north-west of the KSA (Dejesus et al., 1981, 63-79). It should be noted that there are few such furnaces compared with the amount of slag heaps resulting from copper production in these sites, which suggests that they were intensively used during smelting copper. Subsequently, these furnaces became weak in their walls and were broken and finally obscured by the slag hills. The presence of furnaces alongside the slag and with some melted stones and animal bones around is a normal and known result in mining sites throughout the KSA (Dejesus et al., 1981, 63-79) and indeed it can be inferred that this was a universal feature of pre-modern furnaces as such materials were a cheap source of fuel for smelting.

The second type of copper smelting furnace is the stone circular type. This type is larger than the clay one and is mostly found next to some mines in the zone of al-Sarat in al-Safer and al-Asfar mines, and in al-Kesimah settlement. These furnaces were shaped with local materials and stone, and were placed on the slope in order to benefit from a natural wall on one side. Few of these furnaces are found relative to the number of copper mining sites. Additionally, their location was not associated with the existence of settlements nearby. This would imply that copper smelters may have practised smelting at the mine as an initial smelting stage and then transferred ore to other sites within the region and beyond for more refined processing.

Perhaps the presence of two types of furnaces may be related to production phases. The roasting sulphur process may have been done as a first stage in a stone furnace, then the process of smelting ores conducted in clay furnace. There is no existing evidence to

support this supposition for the study area, but this production method has been proven in similar sites elswhere (Western, 1984, 2-13).

Figure 6.3: Two types of copper smelting kilns

(left) remains of clay kilns from al-Haqah settlement, (right) stone circular kiln from al-Kesimah settlement

The archaeological survey in this study has not revealed any gold smelting furnaces in any zone (al-Sarat and Tihama); such furnaces could still be beneath the surface. However, the excavations undertaken in this study discovered traces of gold furnaces in two sites (Asham and Masodah). These furnaces were also essentially important in the process of refining and melting the pure gold into ingots in the later stages. The description of gold and silver furnaces was reported by al-Hamdani (1987), as mentioned in chapter 2.2, who noted them as being squared at the bottom and rounded at the top, with a dome shape, and a low door of 30cm, and side corners for the pots to settle on after three building blocks are lifted.

Despite the furnace found in Asham being similar to that described by al-Hamdani (Figure 6.4), there is a difference in the inside of the furnace. For example, in Asham it is covered with a silica layer on the walls and base, according to the results of analyses of this sample by the Madden Company (chapter 5.7). It seems that a layer of silicate was used to insulate the interior of the kiln. Note that this layer is used locally in gold melting furnaces in modern mining (according to the personal interview with Engineer Mubarak al-Shiki, the manager of al-Hajjar mine, and the field visit to the gold furnace on 21st October, 2011). Also, the excavated area in ASH4 showed the way to shut down this furnace. According to the types of pottery found, the lid made of clay with a round head was used to open a hole by pulling a rope attached to the cover when it was hot. Further excavations in the industrial area in Asham and Masodah could reveal more information about the

items of this furnace, especially the surface indicators in Asham, for example the presence of a lot of this type due to presence of smelting remains as well as the effects of the walls of these furnaces.

In spite of the presence of remains of manufacturing pottery and glass on the surface of the site, it cannot be assumed that this furnace was dedicated to pottery, because the pottery and glass kilns are quite different in shape from these furnaces and the way they were covered from the inside (for the pattern of pottery kilns see Frank, 1982; for glass kilns see Orton et al., 1993).

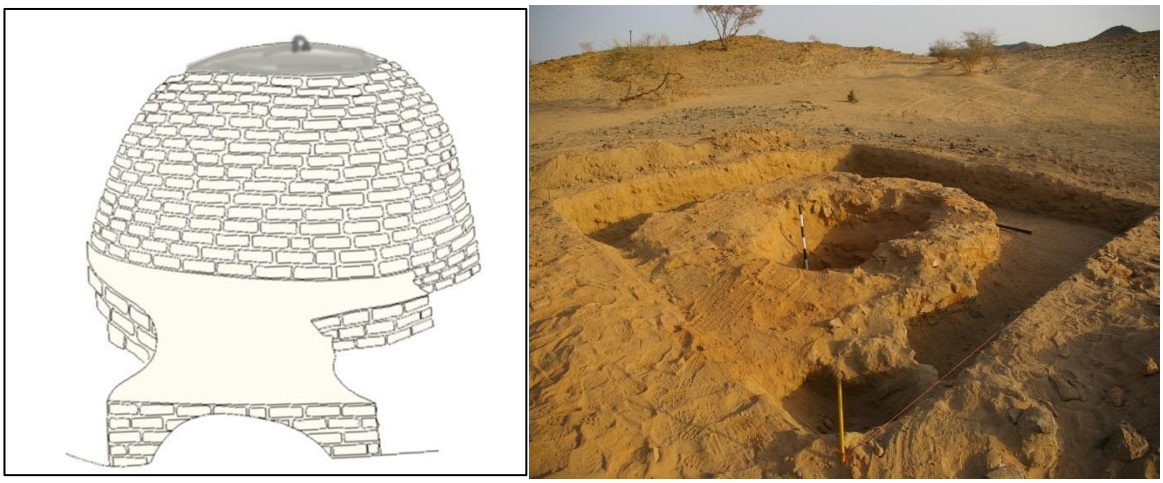


Figure 6.4: Expected and actual furnace

(left) prospective form of furnace based on al-Hamdani's description; (right) excavated furnace in ASH4

The second type of gold melting furnace is small, as described in chapter 5. This type was probably used to treat raw materials or to perform additional processes to purify and melt the ores within the house. This smelting was probably carried out by the householders inside their homes. Basins of millstone were found next to the furnace in MAS2, indicating the processing of ores by grinding then melting in the furnace, as described in chapter 2.2. It is possible that some homes in Masodah and Asham also contain similar models of this form.

Another possibility is that this type of furnace was used to fire stoves to prepare food, but sitting places to prepare food were found with different types of furnace in non-mining settlements in Arabia contemporary to Asham settlement. these were lined with mud, with no trace of silica. Some excavations in al-Rabazah (al-Rashid, 1986), Faid (al-Hawas, et al., 2010, 39-74) and al-Mabiayat (al-Omer, 2011) revealed these special food furnaces, which are lined with mud. Besides, the models for these special ovens to prepare food

found in the region differ from melting furnaces. Perhaps this type of furnace discovered here was later used to make food, but originally it was dedicated to melting the grains of gold or silver (Figure 6.5).

Figure 6.5: Smelting furnace and food kiln

(left) food kiln in Faid site, (right) excavated smelting furnace in MAS2

6.2.2 Mining tools

The tools (stones, pottery, soapstone and glass) are remarkable in mining settlements in the KSA in general and al-Baha area in particular. Perhaps the biggest distinguishing mark between these materials is the presence of pounders (*madaq*), which are not widely abundant in non-mining sites, and grinders (*rahi*) in various shapes. Additionally, wares made of pottery, soapstone and glass are associated with these stone tools for the mining works in addition to their functions in daily life, shared by all sites in Arabia.

It should be noted that there is an absence of other mining tools in these settlements. Among the tools supposed to be found associated with mines worldwide are digging and hammer-cutting stones, used in extraction and ore trimming. These tools were not found in the study area or in the rest of the mining sites in the KSA. Perhaps the pioneer miners used the same tools they used to trim slabs of stone when they built their homes, using stone and wood hammers, crowbars and gunpowder to dismantle the rocks and extract ores. It is clear that a regional industry of construction, agricultural and other tools was needed. The absence of remains of these tools around mines is possibly attributed to miners who worked in these mines, transferring their equipment with them to be used in

other professional work. Additionally, further archaeological excavations would probably uncover additional tools around the mines.

The surveyed and excavated tools in mining sites in this study reached 1,308 pieces, including full pounders and grinders (mostly full basin parts), and 2,213 pieces of pottery, soapstone, glazed and glass materials. These tools were expected in such sites and their diversity is acceptable, especially since these tools are important for the extraction of mineral ores, processing and production. Therefore, the order of discussing the mining tools below is according to their use in the processes of mining illustrated above (Figure 6.1 and Figure 6.2, and described earlier in chapters 2 and 4). This begins with the essential mining tools made of stone (pounders and grinders) in the stage of breaking, crushing and grinding the ores, then wares in the stage of smelting,refining, heating and melting. The surveyed and excavated pounders and grinders revealed 711 pounders and 805 grinders, which will be discussed respectively to identify their patterns and the extent of distribution locally and outside the KSA. It should be noted that these tools were concentrated in gold mining settlements more than in copper ones, which suggests that their function was essentially for processes particular to gold and silver ores (Table 4.4).

6.2.2.1 Pounders

The stone pounders of this study were made of local stones and weigh 0.500-2kg. Generally, they were cylindrical (type A) 5×15cm approximately; spherical (type B); and spindle shaped (type C) (Figure 6.6, Figure 6.7). Numerous surveyed pounders were used in the mining works for splitting rocks and mineral ores and converting them into small pieces to be crushed, ready for grinding in the subsequent phase (Figure 6.1, Figure 6.2). Effects of hammering are still clear in the heads and sides of these pounders which confirm their use in mining processes. Pounders of types A and D were used by putting the ore in the millstones, especially the slab, and the grinding process was done by rotation of the pounder on the ore. Type B was used by hammering on the ore. These tools were mostly used in the early processing stages (i.e. breaking) before the ores were ground in millstones.

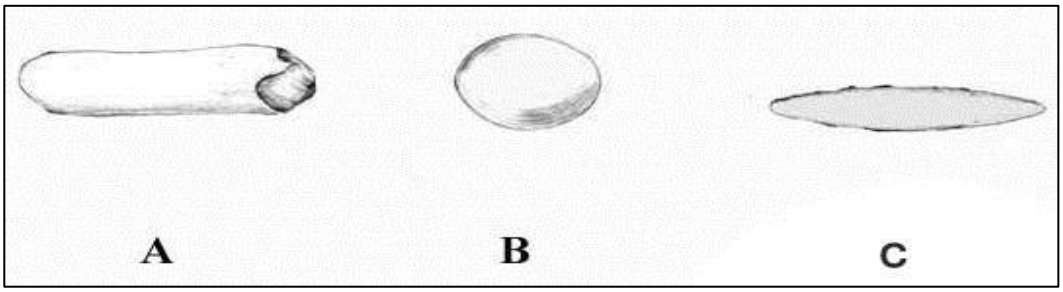


Figure 6.6: Three patterns of surveyed and excavated pounders

A: cylindrical, B: spherical, C: spindle

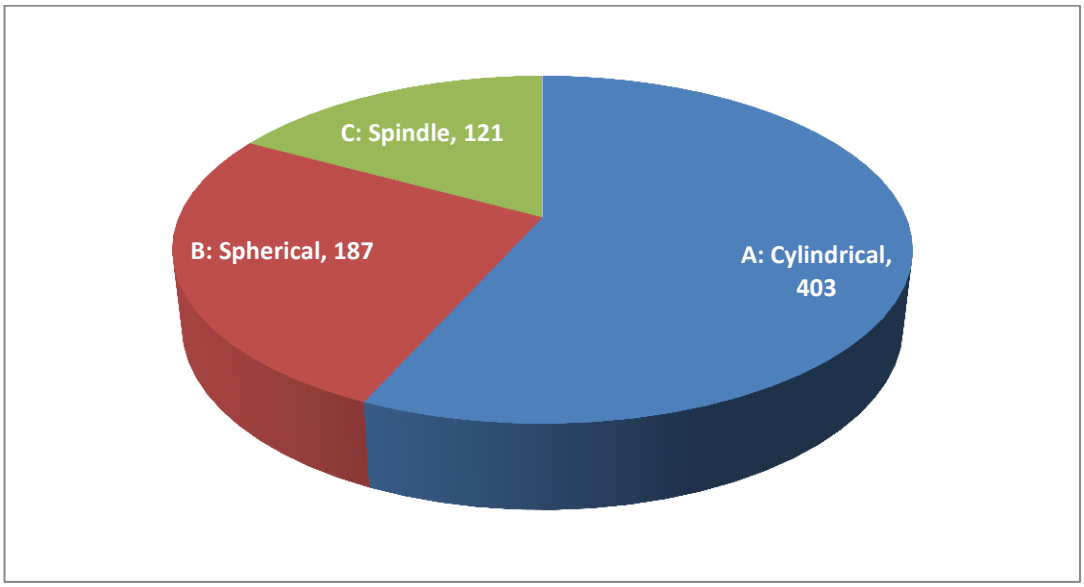


Figure 6.7: Amount of surveyed and trenched pounders by type

6.2.2.2 Grinders

Grinders are one of the most famous implements used in mining. In general, the grinders come in four types including type A millstone (with one basin); type B (contains two basins); type C (slab grinder); and type D (spherical grinder) (Figure 6.8, Figure 6.9). As mentioned previously, the shape of a gold millstone described by al-Hamdani is no different from what was found in mining settlements, particularly type A (al-Hamdani, 1987). Types A and B are of round shape, distinguished by deep holes and accurately and skilfully cut stone which is generally flawless, as the process was intended for crushing the gold dust. This would explain the abundance of these hardened millstones, particularly in the gold mining settlements (al-Mamalah, Asham and Masodah), to retain the ores and ensure no leakage of processed materials, especially when mixed with liquid such as water and mercury (Figure 6.2).

It seems possible that these millstones (A and B) were used in mining works, confirmed by being found in a trench in Masodah (MAS2) next to a small melting furnace surrounded by slag and ash. Also, the analysed samples taken from this trench indicated silver and copper (0.30% and 0.10% respectively), which suggests the possibility that there was also some copper processing practised on the site in a limited way, or perhaps during the process of extracting gold from the ore, which also includes large quantities of copper. The two types of grinders found in abundance in Asham and Masodah were types C and D, which were absent in the other settlements despite being serviceable in copper extraction. These two types were probably used anywhere during travels between the settlements, workshops and mines or indoors to meet the required amounts of gold or silver (Figure 6.8, Figure 6.9).

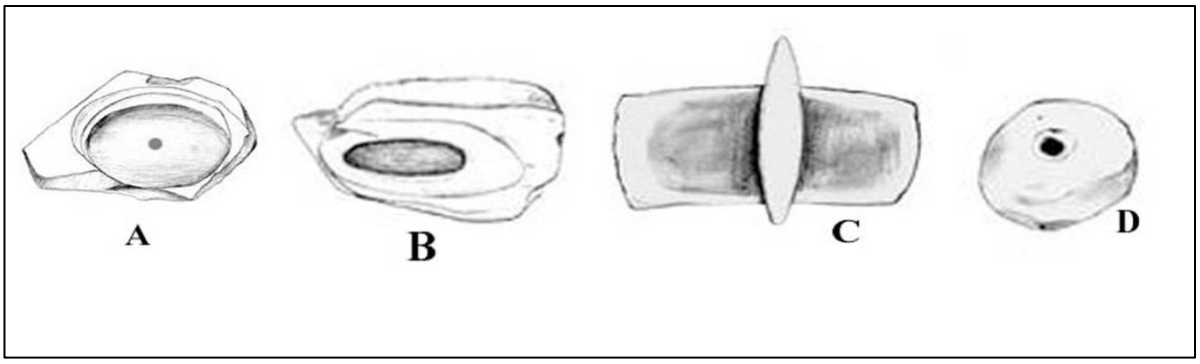


Figure 6.8: The four surveyed and excavated types of grinders

A: with one basin, B: contains two basins, C: slab, D: spherical shape

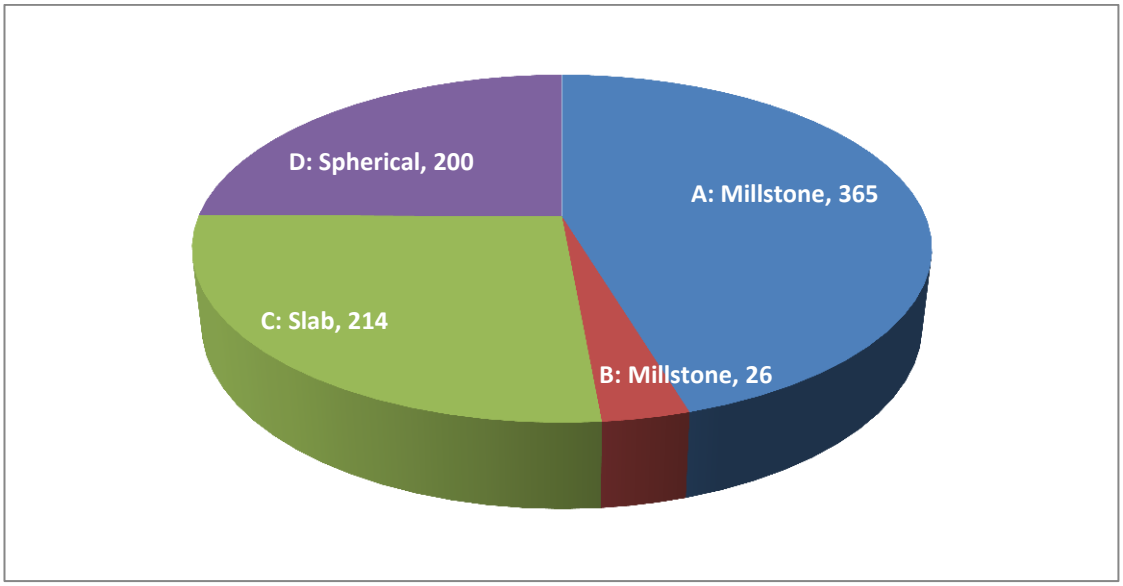


Figure 6.9: Amount of grinders surveyed and excavated by type

6.2.3 Wares

Wares of pottery or soapstone and glass are the next most common mining tools. They played a very important role in the process of mining, particularly in the stage of refining, heating, and melting, as mentioned above (Figure 6.1, Figure 6.2). A strong relationship between these wares and mining has been reported in the literature. Al-Hamdani (1987) confirmed this with regard to the tools for refining and melting gold and silver (chapter 2). This study revealed that most of these wares were found in Asham and Masodah during the survey and excavation and they were less prevalent in the other settlements of al-Baha region. In contrast, many pieces of these wares were found in mining settlements elsewhere in the KSA, for example in the Cradle of Gold (Zarins et al., 1979, 9-36) and al-Noqrah (north and south), where large quantities were found for use in such operations (al-Rashid, 2003; Dejesus et al., 1981, 74). These wares were also surveyed in the south-west (Hester et al., 1984, 115-142) as well as in Shu'eib's al-Masani, close to Madinah (Al Ghabban, 2000, 44-89).

In this study, 314 fragments of wares made of pottery, soapstone and glass recovered from survey and excavation were possibly used in mining (Figure 6.10). Most of these fragments of wares were found in ASH4 and MAS2 next to the furnaces, which confirm their usage in mining processed, and few were found in other trenches. Most of these fragments were from bowls, jars, pots, cups and other containers. The most distinguishing feature of these wares (with the exception of the cups), is a high thickness, ranging between 5-30mm, and containing hard ingredients) (Figure 6.10, see Appendix 13 for studied fragments).

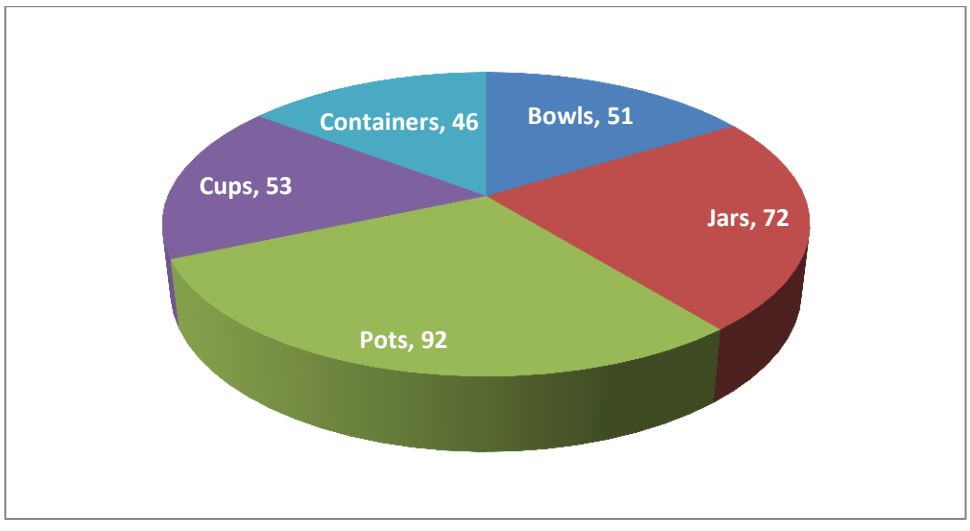


Figure 6.10: Amount of surveyed and excavated wares used in mining processes

- Bowls

Pottery bowls functioned in the mining process in the stage of refining, to contain the mixture after being taken out of the grinders. Six fragments of bowls were studied in detail. The average thickness of these bowls ranges from 5-30mm. Their cores were red, dark and bluish grey as a result of the kind of soil used and the techniques of shaping, and the ingredients were mixed to be solid during the mining processes. All had flat bases and half oval bodies, with rims varying from flared to vertical according to the needs of carrying. The presence of large amounts of residues perhaps indicates their use in mixing materials with each other (sand water and mercury), especially in the phase of refining after using large quantities of these materials.

- Jars

As mentioned previously, pottery jars are important in the process of heating the grains of gold and silver. These wares should have special features to fit with the required characteristics of mining processes in terms of the narrow necks (easily closed) wide bodies (to contain the material to be processed), harsh surface treatment and strong enough walls (to withstand smashing during high firing). Ten pieces found during excavations have these characteristics, indicating their use in the heating of gold or silver grains, which probably does not refer to use in aspects of daily life.

- Pots

In melting the grains into ingots special pots were needed with stronger and thicker walls made of hard clay or soapstone. The analysed pots (23 fragments) were flat based, to be placed within the kiln; had a domed body to contain grains; and had an out-turned rim to facilitate lifting the pot from the kiln. Some contain side handles for easier lifting from the furnace (with iron tongs). A few of them also had a horizontal handle. They comprised hard fabric including impurities such as sand and minute bits of limestone, chaff and organic materials; the surface treatment was carried out by adding slips of dark colours, such as red and grey brown for the soapstone pots. It has been noted that they were coated with a tar layer inside and externally in order to prevent leakage and to maintain temperature during heating.

- Cups

It is not certain that there is a special type of cup in terms of ingredients and surface treatments used in the mining process, but they were necessary in the process in terms of measuring the quantities (weight) of gold or silver ores, as well as to contain water and mercury among other chemicals used during the operation in the stage of grinding. However, the discovery of a small number of cups (4 fragments) in ASH4 and MAS2 made of pottery shows the first evidence for using them during mining.

- Containers

Among the numerous containers required by mining settlements are glass bottles, particularly to store chemical materials. Mercury was used to pick up grains of gold or silver and sometimes lead was used in the extraction of silver. Zinc sulphate (white vitriol) used to be mined from the Yam area close to Najran (al-Marihi, 1992). It was used with salt and water to extract both gold and silver. These materials were needed to preserve some of these chemical liquids used in processing raw ores after extracting them from the mines. Therefore, they are very important in such mining settlements. Surveyed and excavated pieces of glass tools in the study area affirm their use for mining purposes. It is difficult to distinguish between the glass containers used in mining from those used in daily life, but it is likely that bottles with spherical bodies and narrow necks were favoured in mining, as found in other sites in the KSA (Dejesus et al., 1981, 74).

This study examined 10 samples of bottles. It was found that most of them were locally manufactured (based on the casts of manufactured glass found in Asham, and the tube used in the cutting process and the handmade handles of some covers noted during surveys and excavation). There are two types, transparent and dark, with flat and concave bases, and oval and vertical shapes, and side handles and tight necks and vertical or outward edges. Thickness ranges between 1-5mm and its paste is pure with complete firing. All glass vessels were made by mould blowing except the handles, which were handmade. Their surface is lackingof any decorations.

Some containers made of glazed pottery could be popular in refining and transferring ores. Their importance lies in handling raw materials; a glazed layer is one factor to ensure no leakage of chemical materials during the refining stage. Some glazed wares might have been used as containers to keep precious molten materials after they were treated, and used to transfer them to other processing centres (e.g. mints) in Arabia and beyond. Several

archaeological studies in Arabia indicated that coins were stored in such pots (al-Ghabban, 2000, 44-89). This study found numerous examples of glazed pottery that could be used for transferring the grains of gold and silver to another place, particularly those featuring thick walls.

Pottery lids were also found that were used to seal furnaces during firing for melting gold or silver grains. Al-Hamdani noted that these lids were made of clay and closed tightly (al-Hamdani, 1987, 107). Two excavated lids in ASH4 were made of pottery in a circular shape with a thickness between 10-15mm. The structure of those pieces indicates the presence of some solid materials and others, including organic and non-organic materials and small stones, both made by hand. One of these lids contained a pierced head to enable lifting the lid by inserting a rope. This is a unique example among mining sites in the KSA, possibly due to the lack of archaeological excavation demonstrating these forms.

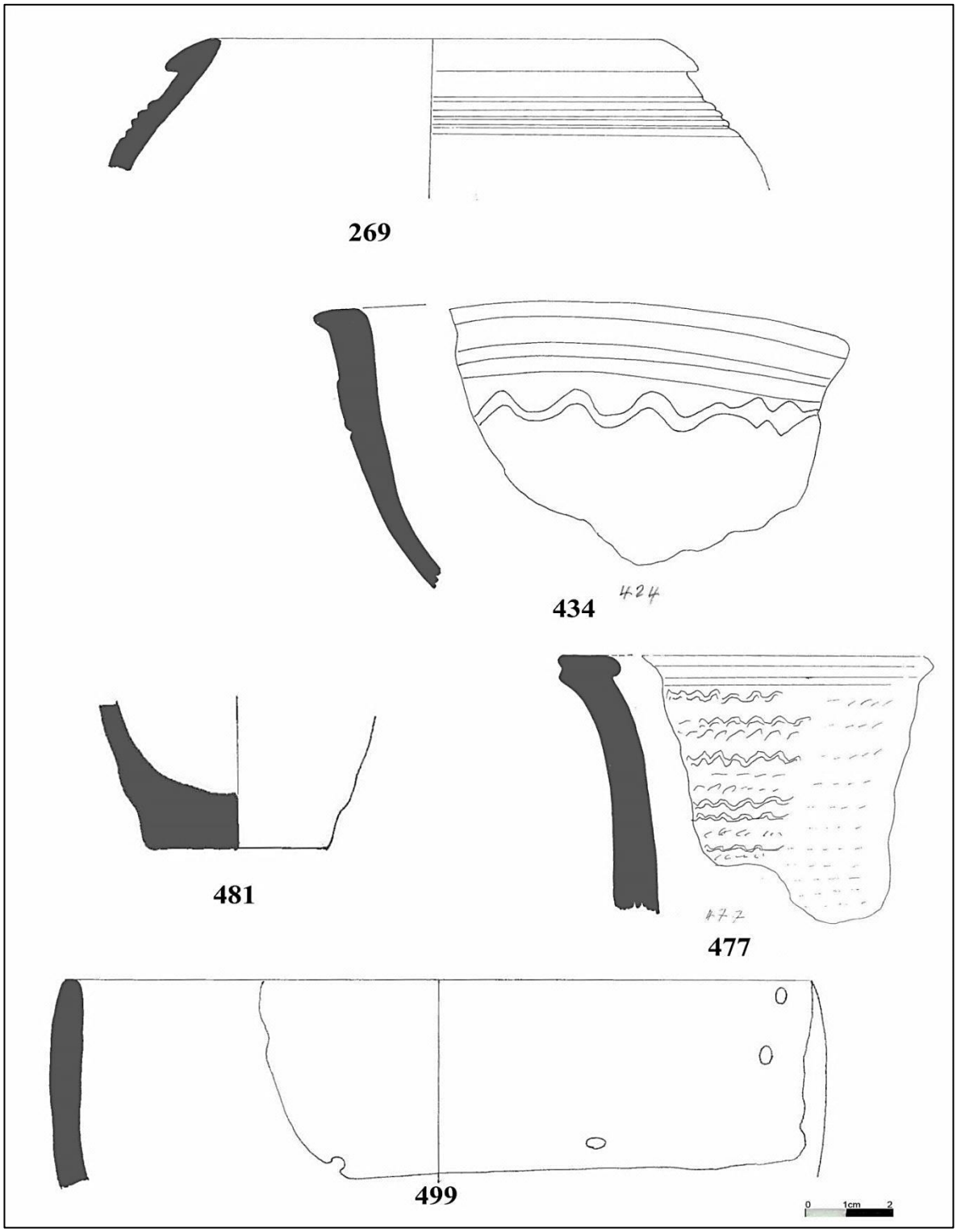


Figure 6.11: Some fragments of mining wares

269: bodysherd and rim for glazed pot from Asham; 434: bodysherd and rim for unglazed pot from ASH4; 474: long neck and rim for unglazed jar from MAS2; 481: base of glazed cup from Asham; 499: remains of bodysherd and rim for pot of soapstone from ASH3.

In brief, all these mentioned tools are essential to aid in identifying the mining process. Therefore, the surveyed and excavated tools from those settlements, even though some are few in number, were serviceable in a great variety of mining processes. However, these tools cannot be distinguished from items of daily (i.e. non-mining) use without understanding the process of mining, especially as these tools could be used in non-mining activities (for example, millstones and pounders could be employed to grind grains of wheat and corn, and wares could be used for eating and drinking). The focus of this study on these tools and tracking mention of them in the available sources has aided in drawing a profile of what was happening in mining settlements, as illustrated above (Figure 6.1, Figure 6.2). As mentioned earlier, most mining evidence, including furnaces and tools, were found in Asham, whether on the surface or below ground. In addition, we assume that these wares were made locally, whether for mining or other uses, as the process of mining requires production of many such containers, since they are to heat the grains and then have to be broken to extract the contents. So, existence of a local industry of these wares was a necessary requirement for the continued operation of mining and for domestic use.

The presence of such large quantities of grinding tools and wares indicates that Asham was one of the most important mining settlements in Arabia, and perhaps was a pioneer in the field of mining in the period of this study. To shed more light on the role of this settlement in the growth of mining, the most influential factors that made Asham the preeminent mining settlement in the region and perhaps beyond are discussed below.

6.3 The role of Asham settlement in the development of regional mining

Several factors (discussed below) aided Asham in contributing to the development of mining in the south-west of Arabia. Perhaps the most important was the political dimension. As mentioned earlier, Asham was a capital of a group of small settlements including Masodah, al-Ahsabh, al-Nasiab in addition to small scattered villages nearby (chapter 5.2), and this study has revealed the similarity of materials scattered on the surface as well as similar architectural styles in these settlements and Asham.

Also, the existence of a number of inscriptions citing political figures settled in Asham to consolidate stability and overse the implementation of mining is another evidence for its importance. This was based on natural factors such as the availability of ores in the Asham Mountains as well as the valleys surrounding the settlement that contributed to the provision of means of living. In terms of wider economic factors, access to trade routes,

local markets and sea ports surrounding Asham facilitated the export of products and import of needed materials for the settlement and its ancillary towns.

6.3.1 Tombstones of Asham

Accurate studies of the inscriptions found at the Asham between the 1st to 6th centuries AH (7th to 12th CE) reveals the evolution of learning in terms of the development of Arabic writing and the implementation of a variety of writing styles (e.g. Kufic and Nausk), as well as decorations (floral, geometric and sometimes calligraphic) (see al-Zaylai, 1983 and al-Faqih, 1992b). This sheds some light on the nature of society in the site and the extent of its social development, as reflected in the inscriptions. In other words, several stages of civilizational development are reflected in the quality and accuracy of the implementation of these inscriptions. The historical and literary sources indicate that medieval Islamic cities and settlements are distinguished by signs of prosperity in architectural planning, production of cultural materials, and coins, weights and measures discovered in these sites, all of which contribute to knowledge of the economic development of these cities (al-Basha, 1988). The development of techniques of engraving and writing on these slabs is further evidence of the growth and cultural sophistication of these settlements, which was a direct result of the political and economic stability in the settlement based on the growth and continuity of mining activities.

For instance, the inscriptions during the earliest phase of Islamic-era mining (the 7th to 8th centuries CE/1st to 2nd AH) represent the beginning of stability and engraving on stone without decorative elements. Clear weaknesses in syntax and other mistakes are apparent, as well as a relatively unsophisticated technique. They belong to a community composed mostly of the labouring class (al-Faqih, 1992b, 122). These examples indicate that Asham settlement did not surpass the crude phase of development in mining at this stage. Later, from the 9th to 12th centuries CE (3rd to 6th AH), the inscriptions increase in quantity and quality. For example, in these inscriptions the social status and personal glorification of the owners of writings clearly appears (al-Faqih, 1992, 132). Perhaps the presence of these social figures was caused by the importance of the mining settlements, bearing in mind that this region had the highest investment activity in mineral ores in Arabia during the 7th to 12th centuries CE (1st to 6th AH) (al-Sarjani, 2000, 32-75).

In addition, these inscriptions indicate the extent of population growth in Asham, which induced the ruling prince Yala bin Abdullah to order the construction of a large mosque in Asham (evinced by the memorial inscription of the mosque, dated Rabi Alawal 414

AH/July 1023 CE) (al-Zailayi, 1983, 173). The area of the mosque could accommodate approximately 1120 people, which indicates that Asham was also a gathering place (e.g. for trade or mining works) in the south of Arabia according to the immemorial features of trade within the Peninsula. However, the information contained in the inscriptions stretching from the 7th to 12th centuries CE/1st to 6th AH does not suggest the exact reasons for Asham's establishment. These inscriptions suggest that there was a high population density related to an increase in the urban infrastructure and the multiplicity of facilities, and it had become an economic hub attracting many employers, crafts and industries. It can be presumed that the presence of the ruler and ancillary professional trades, reflected in the increasing sophistication of aesthetic services such as inscriptions (mentioned above), indicates the presence of a burgeoning middle class in the settlement.

6.3.2 Mineral ores and natural factors

It is known that precious metals such as gold and silver, and the more functional metal copper, were one of the most basic needs during the Islamic state's formation. Mineral ores underpinned a great economic engine, especially during the 9th century CE/3rd AH, which witnessed enormous economic development for the Arabs, and the government (among others) was keen to identify and control the mines of these precious resources. The obvious effects of Abbasid industry are apparent in Asham's artefacts, as in other Islamic sites in al-Kufa and Samarra. Asham became one of the first mines in Arabia, which drew the attention of the State.

The numerous fragments of pottery and glass found in this settlement indicate that there was significant economic activity in the field of mineral resources. The existing raw materials extracted from Asham mines fed global markets for such raw materials and products from different manufactures, whether manufactured locally in Arabia or externally in other cities and regions of the Abbasid state.

Moreover, the presence of plentiful mineral ores, which are still available today according to specialized modern mining studies, and the need to meet the requests received from the state treasury helped the development of Asham and brought a lot of experts in the exploration for gold and silver, which were extracted and processed in the same location, as indicated by the amount of stone tools for grinding raw materials and purifying them, which was more extensive in Asham than in other settlements in al-Baha.

By virtue of being located in the area of contact with the al-Sarat Mountains, containing quantities of different metal ores, as well as sandy areas containing gravel and soft sand bearing grains of gold with impurities, which were washed and drained near valleys (al-Thoban, Dogah and Nawan), Asham attracted many miners who were fully aware of the exploration and processing potential of these metals or probably forced to work by those who controlled their labour. Through the presence of many architectural facilities, as well as surveyed and excavated objects that need more workers such as the large millstones illustrated in this study, it is clear that Asham was an administrative centre for the mines and settlements in the south of Arabia. Miners and labourers (probably including slaves) flocked to work in the mines or process mineral ores. All amenable factors were available from the internal and international trade routes, as well as the seaports for Asham through the Red Sea that made the export of its products easy.

It is also very noticeable that these raw materials and this mining activity were surrounded by controlled security. For example, the existence of towers in both Asham and Masodah protected the habitants and the workers of the settlement, as well as production itself. It is historically well known that the Abbasid state was keen in the majority of their provinces to establish towers on high hills to protect settlements, especially those with important economic and political functions liable to internal and external risks (al-Mosawi, 1982). The architectural planning and elements of the towers show that they contain surveillance posts on all sides. In addition to this, these towers could be mechanisms of control over workers employed in mines and settlements by the state to ensure they completed the work assigned to produce the required quantities of gold and silver within the required time.

It seems that the available minerals in Asham and its villages and the practice of mining limited other activities such as agriculture and animal husbandry. It is known that many of the towns that date back to the Islamic period, especially in the southwest of Arabia, flourished with agriculture and traded agricultural products (Ibn Almujawir, 1951). However, Asham does not have these farms, but Masodah could (within narrow limits) meet the needs of the population for food. Given that agricultural and pastoral activities require more time for return on investment compared to mining, and are highly vulnerable in terms of damage to crops by insects and floods, miners were more privileged in their employment than agricultural workers. As a result, many farmers who grew corn, sesame and millet perhaps became miners for gold and silver, or smelters for these metals, whether part-time (seasonal) or full-time, especially as Asham was obliged to pay a tax for the

benefit of the regional governor and then to the state treasury (as in other Islamic cities), so mining became the region's specialised economic activity.

In addition, valleys and vegetation were considered the most important natural resources in Asham settlement. These resources were the sources of stability in the settlement. Valleys in Tihama, including al-Ahsabh, Nawan and Dogah, were among the richest valleys in Arabia, attracting people since ancient times. Additionally, vegetation allowed relatively secure food supplies to the settlement and wood used in mining. Some of these timbers came from gum trees such as juniper and cypress, acacia and *sidr*, which were among the most important trees that grow in the region. Also, they were a favourite wood in the process of mining according to al-Hamdani (1987), as mentioned in chapter 2.2.

6.3.3 Trade routes, local markets and marine ports

The emergence of cities in Arabia was associated with at least with three main functions: the capitals of political entities, base stations on the trade route to receive taxes and provide protection and services for the convoys, and pilgrim stations (al-Rashid, 2004). In the case of Asham, it was in a privileged location in the first five Islamic centuries, located between the holy city of Makkah and south-western Arabia, connected to marine ports in Athar and al-Serain on the Red Sea, and commercial centres in Yemen by the trade route from south of Arabia passing Asham and then to the north. This location lent Asham a distinctive economic dimension in those centuries as a pilgrim and market station (evidenced by its large market capacity and multiple shops) as well as a commercial mining settlement; it was undoubtedly one of the largest and most important urban settlements in the southwest of Arabia. This study revealed that the market, depending on its scheme and multiplicity of shops, followed the Arab market model that evolved elsewhere in the Muslim world, such as in al-Kofah, al-Mosel and al-Basrah (al-Mosawi, 1982).

The architectural planning of the market reflects the commercial density of Asham. In ASH3, special mining tools of stones, pottery and soapstone used in heating and melting gold and silver were discovered. Furthermore, the presence of large quantities of coarse pottery devoted to gold filtration confirms that this market was formed as a result of extensive mining work and trade. As the regional economic hub, the study would suggest Asham linked residents in the agricultural highlands (al-Sarat) and the lowlands (Tihama), the latter of whom brought goods from the sea; Asham was the focal point of exchange between these areas. Above all, the presence of a large market among these mining and non-mining settlements in the region makes it possible that Asham was the central

industrial region in the south-west of Arabia, and no comparable market has been found in the other settlements.

The port (*furdah*) was a key feature of early Islamic cities, used to export and import goods to meet the needs of the population. There were many examples of such cities in Arabia such as al-Jar (SNU), formally the port of the west of Arabia (for al-Madinah) from Egypt (al-Rashid, 2003). Al-Deafi (163/208) was the harbour for the east of Arabia (for Thaj) before and after Islam (al-Hajeri and al-Safi, 1989, 41-53) (Figure 6.12).

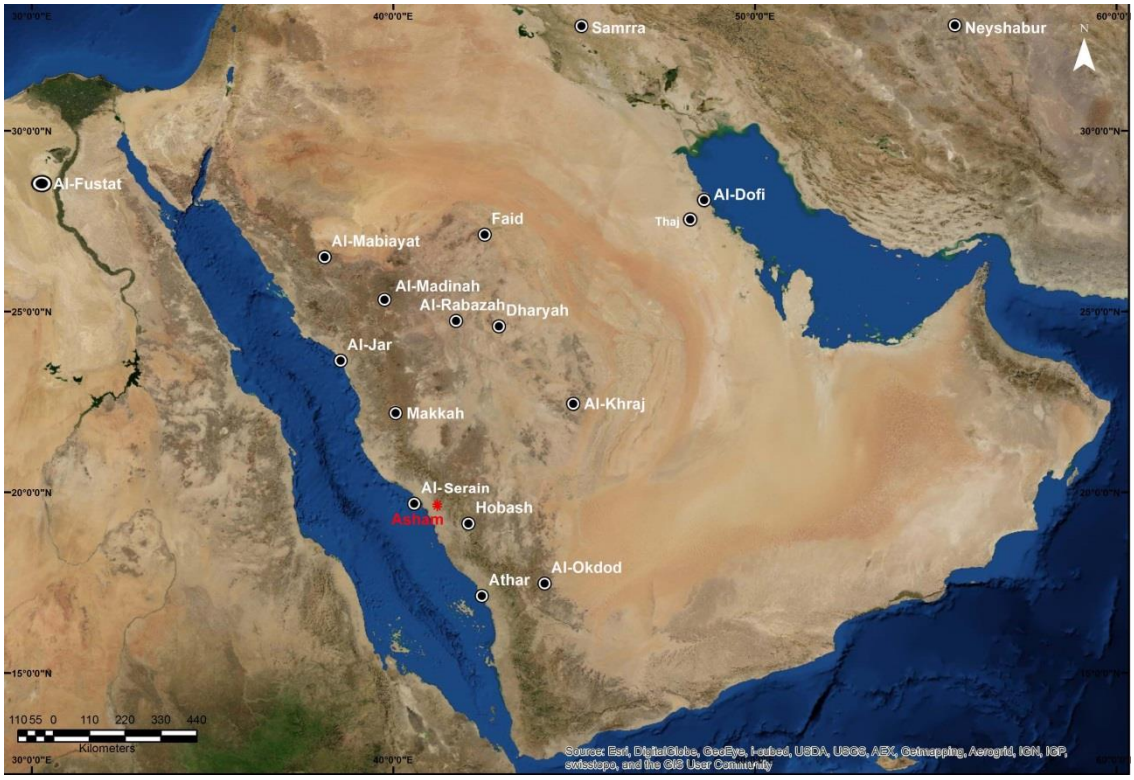


Figure 6.12: Commercial settlements and ports contemporary to Asham

Asham certainly had links to commercial ports such as those under the ambit of al-Madinah, on the Red Sea coast, as observed previously (chapter 5.2.5), linking Asham and neighbouring towns such as Masodah, al-Ahsabh and al-Nasaib with maritime trade. One manifestation of this is the revelation by archaeological studies that pottery and glass in these ports was identical to the types and styles surveyed and excavated in Asham.

Al-Serain was the most impotrant port near Asham. There were many similarities between Asham's cultural materials and those had found in al-Serain, such as pottery and glass (as discussed below). Another similar characteristic to Asham is the inscriptions found in cemeteries in al-Serain site, dated and undated, from the 8th to 12th centuries CE (2nd to 6th AH), which is parallel to the occupation in Asham.

The concatenation of natural, economic and political factors thus rendered Asham the predominant mining and commercial centre in the region, and this was reflected not only industrially but in terms of the cultural and civilizational level. The similarities in the surface and excavted materials recovered from Asham suggest that Asham was for five centuries an important urban Islamic city as a production centre, and for communication and sharing knowledge and experiences with other areas of the Islamic world.

6.4 Asham as an early Islamic city and its non-mining finds

The medieval period witnessed many Muslim kingdoms in Arabia and beyond due to the decentralization of the Abbasid state and the organic proliferation of Islamic states on the peripheries of the Arab-Islamic civilization. This engendered the growth of cities and increasing inter-city economic integration in a trans-continental system of trading stretching from Iberia to Sind (Blair, 2011).

In Arabia, the emergence of Islamic-era cities was associated with a variety of issues, including economic, military, religious, social and political factors. Those cities began as urban nuclei and then evolved thanks to the effect of civilizational influences. The classical Abbasid era, particularly between the 8th and 10th centuries CE/2nd and 4th AH, was an important stage in the history of Arab-Islamic urbanisation, and witnessed the creation of cities including Kufa, Baghdad and Samarra in Iraq, and Fustat in Egypt, in addition to those established in the centre of Arabia such as al-Rabazah, al-Mabiayat and Fiad, and Asham, Athar and al-Serain in the south (al-Mosawi, 1982). There are many similarities between the cities in the system of plans and locations of mosques, government buildings, markets and residential areas as well as archaeological artefacts. The only major differences relate to the spatial organisation of these buildings and construction materials, which vary according to the geographical region.

Indeed, even on the peripheries of the Arab-Islamic zone during the early Islamic centuries one finds commonalities in urban design and in the nature of artefacts. While Fustat is usually considered the most important city on the African Continent during these centuries, the economic integration of northern and eastern Africa into the Islamic world was in fact much more extensive than traditionally supposed, and indeed was a continuation of ancient links between the Horn of Africa and the Yemeni-Arab civilization. In particular, on the east coast of Africa, the city of Kilwa in Tanzania, which became a major trading centre with cultural and trade links to Arabia, played a major role in the history of the region's

economic, social and political development. Archaeological investigations in East Africa revealed examples of Islamic pottery and coins as well as the architectural characteristics of mosques and their counterparts in the Arab-Muslim world, especially those found in Tanzania in the sites of Kilwa and Songo Mnara, which evidence common civilizational links between the Arab world and Africa (for these archaeological investigations, see Wynne-Jones, 2007, 368-380; Wynne-Jones and Fleisher, 2010, 2-8).

Similar findings emerged from the fieldwork of Asham that link the settlement to the wider Islamic world, in terms of architectural landmarks such as homes, mosques, and cemeteries, as well as tombstones that extended from the 7th to 12th centuries CE/1st to 7th AH, cultural materials, pottery and glass (chapter 5); all are comparable with those in contemporaneous Islamic cities elsewhere in Arabia and in the wider Islamic world. This leads to the inference that Asham was not merely a mining settlement in the sense of a camp or remote outpost; it was an Islamic metropolis and a regional capital for small towns like al-Ahsabh, Masodah and al-Nasaab. Objects surveyed and trenched in Asham during this study confirm this opinion, as more of these finds of pottery and glass are related basically to non-mining uses comparable to those in other cities nearby and beyond. Many non-mining pieces can be identified through the appearance of dense motifs scattered in different types of wares identical to various samples found in stations in the pilgrimage roads across Arabia and abroad in Egypt, Iraq, the Levant and Iran that developed in the same period. The Asham fragments will be discussed below in accordance with their quantity, starting with unglazed pottery, then glazed pottery and glass (Figure 6.14).

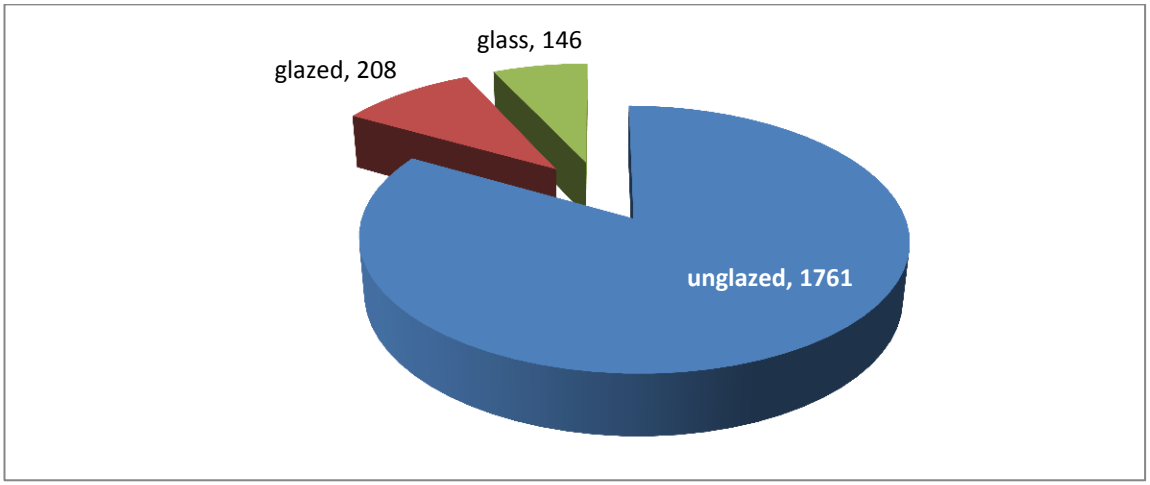


Figure 6.13: Non-mining surveyed and trenched unglazed and glazed pottery and glass from Asham (including Masodah)

6.4.1 Unglazed pottery

This type of pottery could be employed for mining purposes as mentioned above, as well as for domestic functions. Analytical study of these samples from Asham enabled identification of models used in various daily lives of pots, jars, bowls, plates, cups and censers. These wares are characterized by medium to thin walls (thickness between 0.01 to 10mm) and intensity of decorations on bodies and edges, although this does not necessarily mean they were not used for mining. The selected samples for the study, which amounted to 43 fragments, revealed that the differences in the kind of soil used in preparing those pots varied from reddish yellow to pale brown, white yellow and pink colour. These patterns of unglazed pottery in reddish yellow (RYP) and pale paste (PP) are very common in the majority of archaeological sites associated with Asham.

The 15 pieces studied from unglazed pottery of reddish yellow colour with mid-thick walls (RYP) from the surface and trenches of Asham and Masodah led to the conclusion that this pattern was widespread in Asham and its decorative elements are similar to those discovered in other sites. It dates back to the pre-Islamic period and has been found in al-Okdod in Najran (Zarins et al., 1982, 35-36), but it was also frequently used in Islamic sites, and several archaeological Islamic sites in the KSA dated this pattern from 7th to 9th centuries CE/1st to 3rd AH. The archaeological surveys and excavations in Athar, al-Serain, Hamadana and al-Sharaga sites yielded patterns for pots and bowls that closely match the decorative and synthetic characteristics of Asham samples (Zarins and al-Badr, 1986, 36-57). Other identical models are found in the lower layers of the archaeological trenches in Dharyah (al-Otibi, 2008, 195) and other sites in the north-west of the KSA in al-Mabiayat (al-Omer, 2008) representing jars and bowls of various sizes decorated with light straight lines. Some examples of this pattern were found in al-Okaider palace in Jordan, characterised by thick walls, rough clay and a lack of decorations except some wavy lines and using a reddish yellow slip on these wares (Saura, 1982, 332-345).

The unglazed pottery in pale paste (PP) with thin walls is abundant in Asham and Masodah. This type of pottery does not fit with the acts of smelting and melting ores, so its presence here certainly represents other functions than mining operations. Most finds were of this type, with 31 pieces studied from Asham and Masodah, and they were mostly similar to fabrics in the KSA and elsewhere in Arabia from the same period (7th to 11th centuries CE/1st to 5th AH). A quantity of PP found in excavation layers in al-Rabazah site was characterized by the purity of its paste in most cases, with light density and light colours, such as brown, yellow, pink and white (al-Rashid, 1984). Also, similar samples of

PP pattern were surveyed and excavated alongside Iraqi pilgrim routes, represented by jars, bowls and cups of various sizes with light straight lines (al-Otibi, 2008, 195). Outside the KSA, full pots and remains of jugs, jars and cups were surveyed and excavated from Samarra featuring oval bodies, long necks and thin walls with some floral decoration (Herzafied and Manṣūr, 1985). In Nishapur, numerous water jugs featured similar oval and spherical bodies and cylindrical handles. Some fractions in these wares were made of impure clay and their walls are thin, although they display diverse geometrical and floral decorations (Wilkinson, 1973).

6.4.2 Glazed pottery

This study discovered large fragments of glazed pottery during the archaeological surveys and excavations in Asham (including the site of Masodah), which is a very common material in many non-mining archaeological sites. The majority of these wares do not fit the role assigned to mining work and were probably used in ancillary works. 208 fragments of glazed pottery were discovered in this study in the surface and trenches ASH1, ASH2, ASH3, ASH4 and MAS2. Due to the importance of this type of pottery in these settlements in terms of uses to provide food for the population and miners, different styles of this type were found which are widespread in many Muslim cities. The 49 studied pieces (27 bowls, 3 cups, 1 jug, 9 jars and 5 plates) demonstrated that these fragments represent most widely-spread Islamic glazed pottery: the alkaline glaze (AG), coated glaze pottery (CG), tin glazed (TG) and the lusterware glaze (LG). These samples were similar to glazed wares found in abundance in the KSA and abroad (Figure 6.14), and some of these sherds of types AG and CG are considered common among Islamic cities from the 7th to 12th centuries CE, while other shereds were particular to TG and LG, dated between ends of 8th to 11th centuries CE.

The alkaline glaze (AG) was found in Asham during the survey and trenches. 9 fragments were analysed and identified as representing a pattern common in other settlements in the KSA and abroad, dating from between the 7th and 12th centuries CE/1st and 6th AH (al-Rashid, 1986). In the KSA, archaeological studies discovered samples of AG coloured blue and green with various decorations and shapes in a number of neighbouring sites near the study area and more distant ones. In the southern area of the Kingdom, particularly in al-Okdod site, the archaeological excavations discovered fractions of alkaline glazed, blue and green pottery (Zarins et al., 1983, 35-36). Additionally, green and blue glaze is considered widespread in archaeological layers in al-Mabiayat site in the north-west of the

KSA (al-Omeir, 2011, 14). The pattern of AG was also found in the archaeological excavations in Samara, Sosoa and Siraf, and there is clear similarity between AG from Asham and those from Samara regarding the kind of light paste and green glazing in addition to the braided decoration applied to the main paste before glazing. All of these fragments dated from the period of concern (Herzfeld and Manṣur,1985).

Other glazed pottery in Asham and Masodah is the coated glazed (CG) recovered by this study including 24 fragments recovered from survey and excavation. Analysis of these samples indicated some key similar features with other pieces in the KSA and neighbouring areas; all of them dated between the 9th to 11th centuries CE (3rd to 5th AH) (al-Thenayian, 2007). For example, archaeological excavations in al-Rabazah found this pattern distinguished with dark brown decorations under the glaze layer (al-Rashed, 1986, 439). Some fragments of the pattern above the glazed layer were discovered during archaeological surveys in al-Serein site in al-Qunfidah city, comprising four models represented by three fractions of bowls, in addition to one piece from a pot found in Athar site (al-Thenayian, 2007). Models of coated pottery above the glaze were found with decorative elements concentrated in lattice shapes and lobed circles and rosettes and branches, in addition to the palm fans in archaeological layers in several sites in the KSA such as al-Qaa' and Zabala sites (al-Hawass, et al., 2010, 39-74; al-Rasid, 1986;). Furthermore, the CG was also found in Egypt in trenches in al-Fustat, with fragments representing a group of bowls and plates with spotted colours on a yellow or olive ground, whereas some fragments were also found in Samara, Siraf and Sosa within the archaeological layers and surfaces (Philoin, 1980, 41).

The tin glazed (TG) pottery also was a remarkable feature in Islamic settlements. The four pieces of TG studied from Asham show some correspondence. This pattern was found through archaeological surveys and excavations in the KSA dated between the 9th to 11th centuries CE (3rd to 5th AH), and the common characteristics of this group of Asham are shared with those sites. For instance, fractions of white tiny glazed pottery excavated in Dharyah site represent the remains of bowls and plates (al-Otibi, 2008). Finds from the Iraqi and Shami pilgrim paths and stations also displayed this pattern (al-Rashid, 1984). Several fragments of TG pattern, particularly white tin, were excavated in Samara in Iraq, and most of these samples dated on 8th CE /2nd AH (al-Otibi, 2008, 216; Arthur, 1947).

The final pattern of gazed pottery is the lusterware glaze (LG) which is a notable development in urban Islamic settlements. The seven studied fragments in trenches in

Asham show that they were similar to those found in various sites in the KSA and beyond. The archaeological studies in the KSA provided many pieces of this pattern dated between the 9th to 11th centuries CE (3rd to 5th AH). In al-Serain site for example some patterns similar to those on Asham fragments were found. These fractions contained horizontal light olive tape and geometrical decoration of light olive colour (al-Thenayian, 2007). In Jarash site in Asir some similar pieces were found during the first season of the excavation of the site and the decorations were nets, floral designs and animal figures on the outer and inner surface, coated with shiny yellow colours on white ground (al-Zahrani, 2010). A fraction of LG ware also was found in al-Mabiayat site, distinguished by geometrical, calligraphic and plant decorations, made with olive painting on white background (Gilmore et al., 1985, 109-126). In Egypt, Iraq, the Levant, Iran and North Africa (al-Tayesh, 2000), the American Mission discovered a glass cup in al-Fustat in 1965 decorated with lustre with the name of Prince Abdul Samad Ali on it (an Egyptian potentate), dated from 155 AH (772 CE). Also, some pots were found in Samara (Iraq) decorated with golden and dark brown lustre pattern with dotted shapes and several decorative elements (Philoin, 1980).

Figure 6.14: Selections of glazed pottery from different Islamic sites

A: fragment of alkaline glazed from Faid site (al-Hawas et al., 2010,39-74); B: splotch glazed from Athar site (after al-Thenayian, 2008, 117); C: multicolour glazed from al-Mabiayat site (al-Omer, 2008, 54), D: tin glazed from Dharyah site (al-Otibi, 2008, 196); C: multicolour glazed from Faid site (al-Hawas et al., 2010, 39-74)

6.4.3 Glassware

Glassware is an integral part of daily life in any settlement. This study discovered 146 pieces of glass. The 27 study pieces were mostly locally manufactured. The casts of manufactured glass in Asham, and the tube used in the cutting process and the handmade handles of some covers were noted during surveys and excavation. Samples of studied glass similar to those of this study were found in several archaeological sites in the KSA and abroad, all dated to the same period between the 7th to 12th centuries CE/1st to 6th AH. For example, near to Asham, archaeological survey found large amounts of fragments of glassware in Athar site, of long and tight necked bottles, and plates of various shapes and uses in blue and green. These samples contain distinctive decorations, and most of them are locally made; they are no different from those found in Asham (Zarins et al., 1985, 65-107). Similar glassware was also excavated in Jarash site (217/118) in the south-west of the KSA. These pieces of bowls and plates come in blue, green and transparent glass colour. Some of them have geometrical decorations and various drawings (al-Zahrani et al., 2014, 185-212).

Archaeological works in al-Mabiayat site discovered similar pieces of glass to this study's samples, locally made in blue, green and dark blue (al-Omeir, 2011). Glassware fragments are widely associated with archaeological discoveries throughout the Arab world from this period. For instance, in Qasar al-Akhadeir site in the Levant (specifically in modern Jordan) pieces of bowls, jars and plates were found similar to those in Asham in shape, manufacture and colours dating from the second half of the 8th century CE (2nd AH) (al-Otibi, 2008, 262).

Based on the preceding outline of surveyed and excavated fragments of pottery (unglazed and glazed) and glass from Asham (including Masodah), it is clear that the finds are similar to those found elsewhere in the KSA and beyond. This reflects the widespread extent of glassware use for non-mining purposes in Asham during the early Islamic area beside the mining activities. These fragments evidence the role of Asham settlement as an Islamic city playing an economic and commercial role in the southwest of the Arabian before its later decline by the end of the 6th century AH (12th CE), when the living conditions in the middle of Arabia and the Hejaz dramatically changed for the worse because of the discord that pervaded the Abbasid state, such as encroaching Turkik power in Central and Western Asia and tribal rebellions. A number of tribes in Arabia revolted due to economic factors and ambitions for power.

The collapse of the Abbasid state undermined security and stability, and precipitated the deterioration of existing facilities on the pilgrim routes, disrupting the pilgrimage and Arabian trade. Settlements such as al-Rabazah, Faid, al-Jar, al-Mabiayat and Asham were based on these caravans and their merchants; as a result, those settlements and others lost their economic function, and consequently their importance in Islamic history. These factors may explain the relatively good correlation between the decline of mining and the destruction of the settlement, because Asham's materials of pottery types conclude with the end of the 12th century CE/6th AH century, indicating the severance of its link with the rest of the Muslim world.

6.5 Distribution of mining settlements and relationship with non-mining sites

This study indicated that the number of registered mining sites in al-Baha during the CASP reached 23 sites, while the current research discovered about an additional 19 sites, making a total of 42 sites. Of this total, 19 sites are mines and 23 are settlements. Surveys in this study have shown that mines were similar to many mining sites in the KSA and abroad, which were deep holes, deep grooves, caves and surface cracks, their size varying according to the location of the mine. Settlements come in three patterns, which suggest some degree of regulation, ranging from simple to complex patterns. Simple separated housing units found in Pattern A represent the extraction and initial treatment of primitive mining operations, while Pattern B sites are distinguished by more numerous housing units associated with being regional smelting centres. The most complex interconnected housing units found in Pattern C indicate controlled, large production centres. These settlements are located between several non-mining sites and they played other roles in the history of the region. The distribution of these mines and settlements will be discussed according to the available mining evidence for copper and gold from the mining landscape sites in the highland zone (al-Sarat) and the lowland zone (Tihama) (Figure 6.15).

Other archaeological sites (non-mining sites) dating to the pre-Islamic and Islamic periods (before and after 7th century CE respectively) are discussed with reference to each zone in order to recognize their relationship with the mines and settlements (Figure 6.16, Figure 6.17). The recorded sites (n=146) do not represent all actual archaeological sites in the region; many were not surveyed and all periods are not represented. Moreover, the modern mining exploration will also be referred to with relation to each zone where

possible to confirm that the main cause for abandonment of these mines and settlements was not the exhaustion of the mines, but the geopolitical reasons mentioned above.

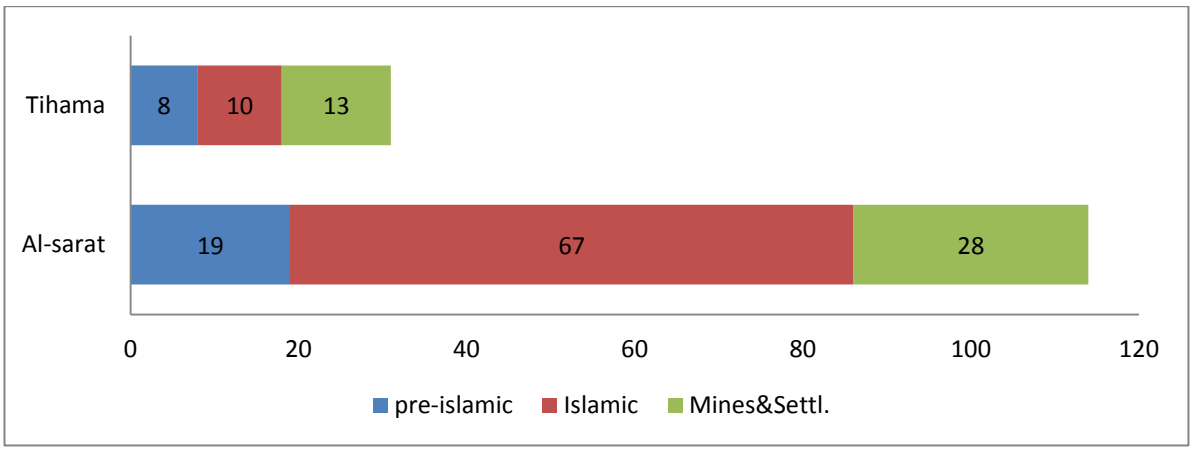


Figure 6.15: Amount of pre-Islamic and Islamic non-mining and mining sites in al-Baha region (al-Sarat and Tihama)

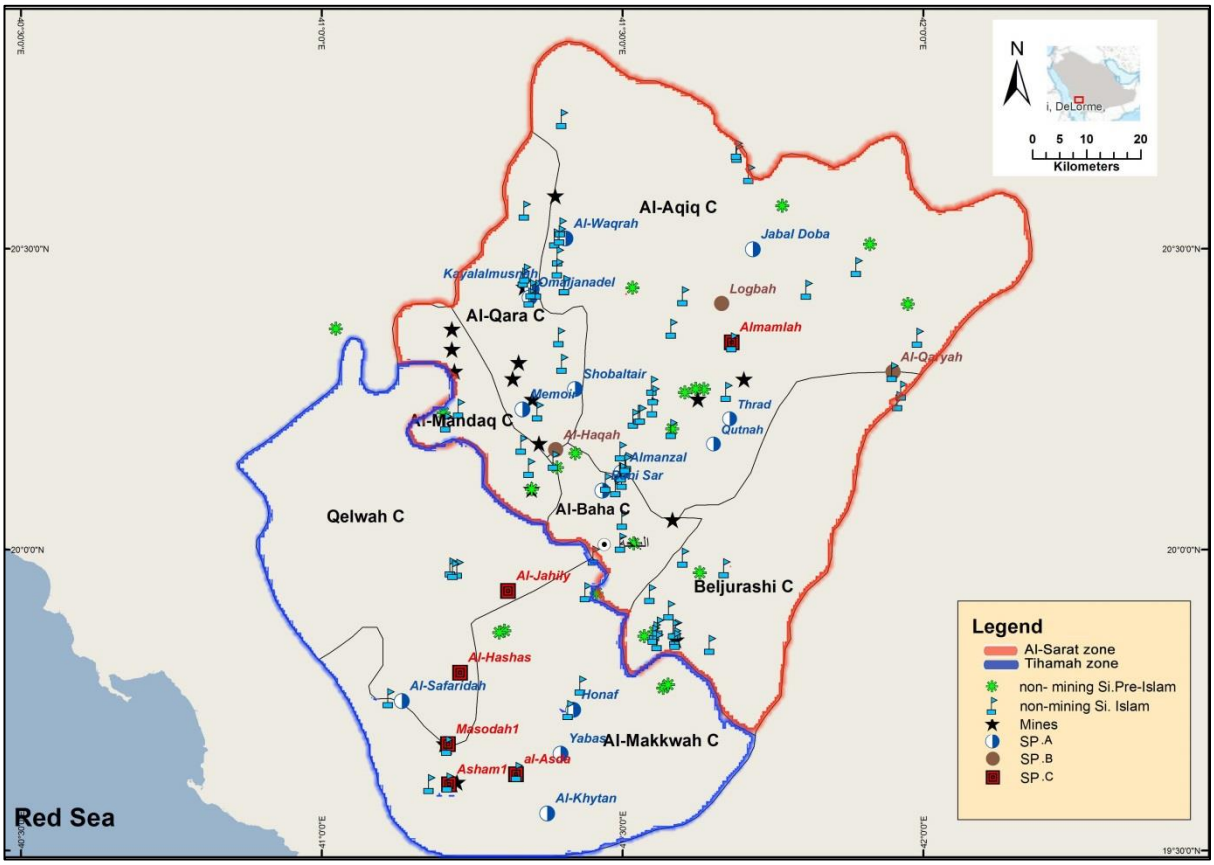


Figure 6.16: Distribution of pre-Islamic and Islamic non-mining sites, and mining sites in al-Baha region according to each surveyed zone

6.5.1 Mining sites in the highland (al-Sarat) zone

This zone occupied the biggest part of the region in terms of geographical area, so it is expected that many human activities would be reflected here. The diversity of human activity evident in al-Sarat zone is highly important in general archaeological terms. It contains 86 non-mining sites, representing 19 pre-Islamic sites containing nomadic inscriptions, and 67 Islamic sites containing Islamic inscriptions. However, modern mining explorations in the south-east of this zone (where Beljurshi city is located) are not encouraging for the extraction of gold and silver ores, although the Madden Company is preparing technical and economic studies in order to develop copper mining there. These economic studies have indicated the difficulty of implementing the project economically in Buljurshi due to the small size of deposits and the high cost of ore extraction (al-Dabbag, 2004). Perhaps this also explains why fewer copper mining sites were recorded in the region generally and in this zone particularly. Only one mine for the extraction of copper was found there, and there were no indications of settlements. It seems that the existence of Buljurshi in the shadow of the commercial ports did not make it a point of attraction or sustained economic activity, or perhaps miners were not attracted to this zone due to its distance from roads, making the carrying of equipment and materials (including ores) difficult and prohibitively expensive.

It seems that the absence of mining sites is quite similar with some minor differences in the western side of this zone; only two mines to extract copper and two stone furnaces beside the mines were noted. This is despite mineral explorations indicating the abundance of metals, including precious metals (gold and silver), and a licence for mining was granted to Syrah Resources Ltd. (an Australian mining company). These mines are considered the biggest in the region, yet there is no indication of surface materials relating to historical mining activities (slag and furnaces) or a pattern of mining settlement nearby the mines. Even the existing architectural patterns in this part of the zone are inconsistent with the nature of the mining settlements recorded in all regions. This probably would suggest that the copper was preliminarily smelted near the mines and then, without surrounding infrastructural support, transferred to larger production centres (e.g. Pattern B) by mobile miners.

However, most of the mining sites are concentrated in the northern and eastern sides of al-Sarat zone, including settlement Patterns A (simple separated housing units) and B (many separated housing units). Modern mining studies confirm the continued exploitation of precious metals in these parts more frequently than others in al-Baha region. For example,

the Madden Company has operated three mines producing gold and is currently developing several mining projects, including the Bugbg and Qutnah Mines and in Wadi Bedah (al-Dabbag, 2004). The eastern part of this zone contained 12 mining sites (nine settlements and three mines), the latter of which were too far from the settlements to indicate close association, and there are no indications of ruined buildings or surface materials nearby that could be exploited by miners; it seems likely that the ores were carried to and processed in al-Mamalah settlement, which is the nearest centre.

The north of this zone contained 14 mining sites (nine mines and five settlements), more than have been recorded there previously. There are several possible explanations for the higher number of mining sites in the east and north of the zone, such as being located near the precious metal deposits (Smith, 1964), and the availability of nearby vegetation, which contributed to the smelting of copper ore (i.e. wood fuel for this operation), as well as the locations of these settlements being on the banks of the largest valleys in al-Baha region (Aqiq, Tharad, Quraysh and Bedah valleys). These valleys aided the occupation in these settlements, and they were also well located in proximity to the commercial network linking al-Baha to the rest of Arabia, which made local and international markets accessible. Towers and fortified villages and paths of trading routes have been found in this zone, which are considered a hallmark of the region's history and heritage. Intriguingly, many of these forts were used by farmers as astronomical observatories. They used the shadow of towers which refer to agricultural markers (*maradim*) used to indicate phases of the moon suitable for agriculture, grazing, harvesting and other agricultural processes, and to identify new moons (the Arabs have always used a lunar calendar). It can be speculated that such sites were probably part of a system of productive human activity taking place in the region. For example, the techniques of *maradim* may have been used in mining, whether in this zone or elsewhere, whereby seasons when rainfall or flooding are likely can be identified, which could close mines or inhibit mining processes, especially smelting (particularly in open areas). The paths of trade routes between al-Sarat and Tihama facilitated the transfer of mineral ores to lowland areas (and thence to larger roads or marine ports). The ancient trade routes that were passing near non-mining settlements in al-Sarat zone no doubt led to the integration with other productive activities as well as the participation of local people in the mining business.

6.5.2 Mining sites in the lowland (Tihama) zone

The zone is located in the south and east of the region and played an important role in Islamic history due mainly to the many sea ports located there, which were used for trade and the pilgrimage to Makkah, whether by sea or land. Therefore, many settlements were established in these parts, including mining settlements. This zone contains 18 non-mining sites, particularly Islamic settlements and local markets, which emphasizes the important role of the zone in the region's history. The most notable Islamic site was continuously occupied from the 7th to 12th centuries CE (1st to 6th AH), as dated from inscriptions, and it contains mosques, wells and paths reaching up to the highlands (al-Sarat). In fact, the architectural formation and layout of houses and the principle of the mosque in these non-mining settlements are similar to some of those found in mining settlements.

The modern mining exploration studies carried out by the Syrah Resources Ltd. from 2009 to 2011 identified large amounts of minerals including gold and silver, and they highly recommended investment in this zone, particularly for gold and silver (al-Dabbag, 2004). This gives a good explanation for the greater number of gold and silver settlements in Tihama than in al-Sarat. 13 mining settlements with their mines were recorded in this zone near the city of al-Makhwah and Qelwah and various archaeological objects were found there, especially from Asham and Masodah, indicative of large settlements on the Pattern C (complex and interconnected housing units) and other settlements from Pattern A (simple separated housing units) probably linked with the large settlements (Pattern C). These two plans of settlements confirm that there was an extensive mining business in Tihama zone, especially in the field of the production of gold and silver, as evidenced by numerous grinders and pounders on the surface.

Additionally, the presence of valleys with running water (al-Ahsabh and Doqah) throughout the year around these settlements directly enriched them economically and socially. The agricultural and mining activities in this zone were undoubtedly intertwined, and it seems highly probably that mining in Asham, Masodah, al-Ahsabh and al-Hashas was undertaken by seasonal agricultural workers due to increasing demands for production.

These mining sites in both al-Sarat and Tihama were probably a continuation of pre-existing pre-Islamic mining works, as suggested by the existence of some nomadic (Thamudic) inscriptions which carry drawings of animals, as well as the inscriptions engraved on the rocks near the sites in all settlements (except at Asham and Masodah, where no evidence from the pre-Islamic period has been found).

As observed previously, it is probable that mining in the Islamic period erased the traces of previous mining. However, this suggestion requires an in-depth study to prove these inferences in those unexcavated settlements, and there is some urgency in this affair given the widespread destruction of archaeological evidence and features of previous mining settlements in eastern Arabia (Wilkinson, 2003, 204).

In general, the main findings concerning mining settlements in this study refer to furnaces and mining tools, non-mining finds and settlement patterns. Two types of furnaces have been discovered, clay and circular stone, for copper, gold and silver, both large and small, whereas the mining tools were various grinders (pounders and grinders) and wares (bowls, jars, pots, cups and containers). Three varieties of shapes for the pounders were classified (type A, cylindrical; type B, spherical; and type C, spindle) along with four types of grinders recovered from survey and excavation (type A, with two circular pieces of stone basin (lower part) and quern (upper part); type B, with a rectangular or square base containing two basins in both sides (used interchangeably) with a circular quern; type C, slab stone; and type D, with spherical stone). In addition, five surveyed and excavated sorts of wares made of pottery and soapstone and glass were suggested as being used in mining processes. Most of these fragments were found next to the furnaces, which confirm the usage of those wares in mining processes, and fewer were found in other trenches.

The obvious explanation for the multiplicity of tools and means for production focused in one settlement (Asham) is that the greatest output of mineral ore production occurred there, which requires the presence of a lot of these tools, in addition to its logistical advantages accrued from its proximity to trade routes. A strong relationship between patterns of settlements and mining activity is clear from this study: Pattern A (simple separated housing units) for the initial treatment of ores; Pattern B (many separated housing units) as smelting regional centres; and Pattern C (complex and interconnected housing units) as major settlements for distributing and also production of gold and silver.

An objective of the study was to identify whether Asham was occupied for mining or other purposes. The study of some non-mining samples of unglazed and glazed pottery and glass of Asham settlement indicates that in addition to (and complemented by) its role as a major mining centre, Asham settlement had an important historical and cultural role as a trading and pilgrimage station in the southwest of the Arabian Peninsula during the course of Islamic history, as affirmed by the similarity of finds with those from contemporaneous known metropolises.

The results of this study will now be compared to the findings of previous work to show where corresponding and contrasting evidence had been found elsewhere in Arabia

6.6 Comparative study of al-Baha mining sites with other mining sites in Arabia

This discussion includes a comparative study between mining sites in al-Baha region with the archaeological artefacts found in mining sites of similar cultural phases across Arabia. Similar findings have been made in mining settlements elsewhere in the KSA and Arabia, as discussed below.

6.6.1 Mining sites in the KSA

Mining sites are spread in different parts of the KSA, mostly concentrated in the Arabian Shield. The features, tools and materials of these sites are similar to each other to some extent, including al-Baha mining sites. Most (if not all) mining sites were operational during the 7th to 12th centuries CE/1st to 6th centuries AH, according to archaeological evidence and results of C14 undertaken upon some samples of charcoal, and pottery evidence. It is certain that mining activity during this period was an extension of pre-Islamic mining, and is comparable to contemporaneous features in surrounding areas in Arabia, such as those in the Levant, Iraq and the east of the Peninsula.

Archaeological mining studies in the KSA have generally been restricted to the surveys undertaken by SCTA over four decades during the CASP, with the exception of a special work by al-Ghabban in the settlement of Shueib al-Masane in north-western KSA (chapter 2.3). Despite the large number of archaeological surveys and excavations across the KSA, no in-depth scientific studies for the southtren area are available at present based on results of organized archaeological excavations in projects dealing with mining settlements, their tools and furnaces; the only available literature comprises some initial reports undertaken during the archaeological survey of those mining settlements and the reference to the most prominent cultural materials of surface collection and minority from excavations. It is however quite useful to draw on some similar available settlements patterns based on their schemes, materials of grinders, and wares pottery (unglazed and glazed) soapstone, and glass, as well as previously identified shapes of furnaces for the purpose of comparison. The foremost mining sites in the KSA are outlined below, arranged according to the archaeological area division of the Kingdom, starting with the closest areas to al-Baha where mining is expected to be more similar, followed by the various

areas (regardless of the number of mining sites distribution in each) with a brief outline of their sites. In addition, comparison of settlements in al-Baha with those described in available scientific reports and studies for the rest of the KSA are made (see some of these sites in Figure 6.17).

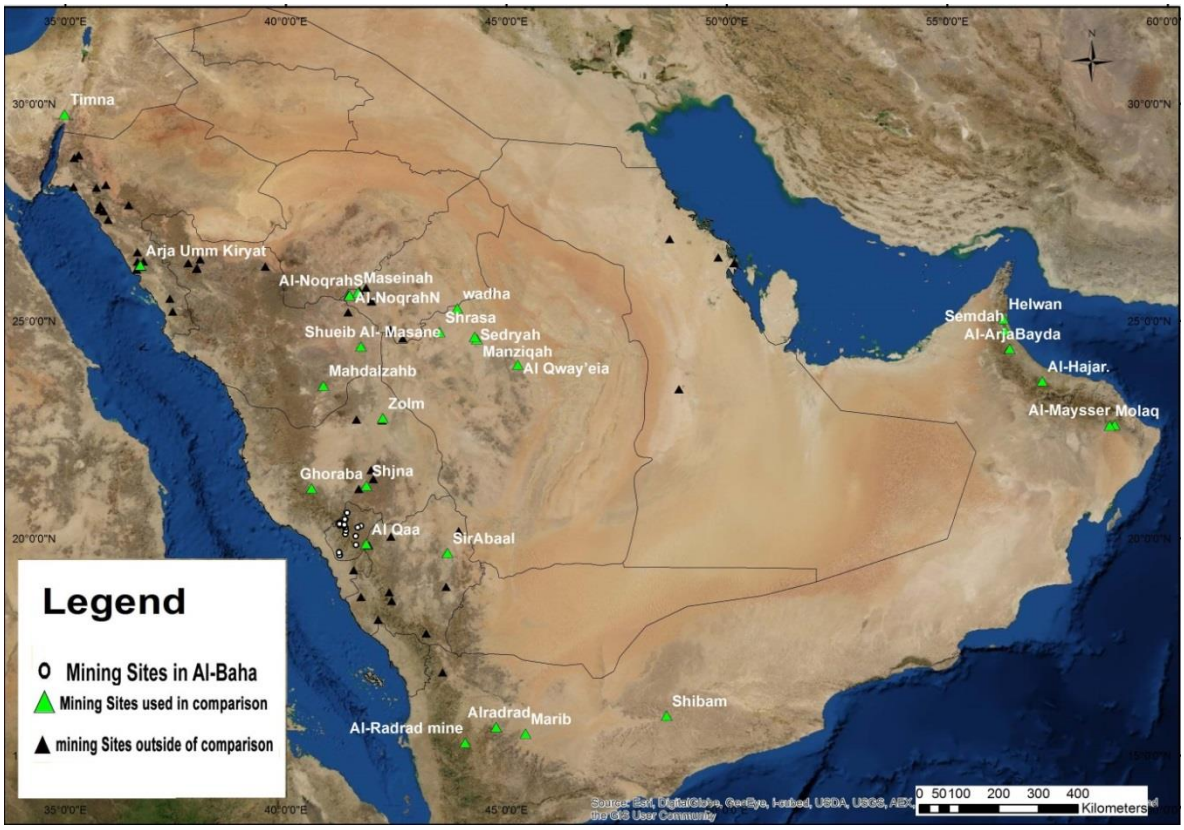


Figure 6.17: Mining sites in Arabia

6.6.1.1 South-western KSA

From the limited initial surveys carried out by SCTA in the south-western KSA, it can be said that there is a great similarity between the mining tools and the remains of the clay furnaces in these settlements and the study group of tools and furnaces in al-Baha. For example, in Tabalh, 48km west of Bishah, grinders were found similar to those in al-Qaa site (210/93) (Hester et al., 1984, 115-142), and similar to those from most of al-Baha's settlements (types A and D). Additionally, a few glazed ware fragments (type AG) scattered on the surface of the site were similar in composition and surface treatment to those of samples in Asham and Masodah. 25km east of the Tathlith valley, archaeological surveys discovered the site of SirAbaal (217/155), containing 30 small separated units of architectural structures dispersed about some holes used in mining for gold and copper (Zarins et al., 1981, 9-42). Numerous stone grinders were found, similar to those in al-Baha settlements of type A, particularly in Asham, Masodah and al-Ahsabh. In this site

remains of wares made of unglazed pottery were also found dated approximately to 7th CE/ 2nd AH centery, especially the red paste (RP), in addition to glazed pottery of blue and green alkaline (AG) and multiple coatings, similar to the study group from Asham and Masodah in terms of manufacturing, surface treatments and colouring (Figure 6.18, no. 1, 6, 8, 14, 16 and 18).

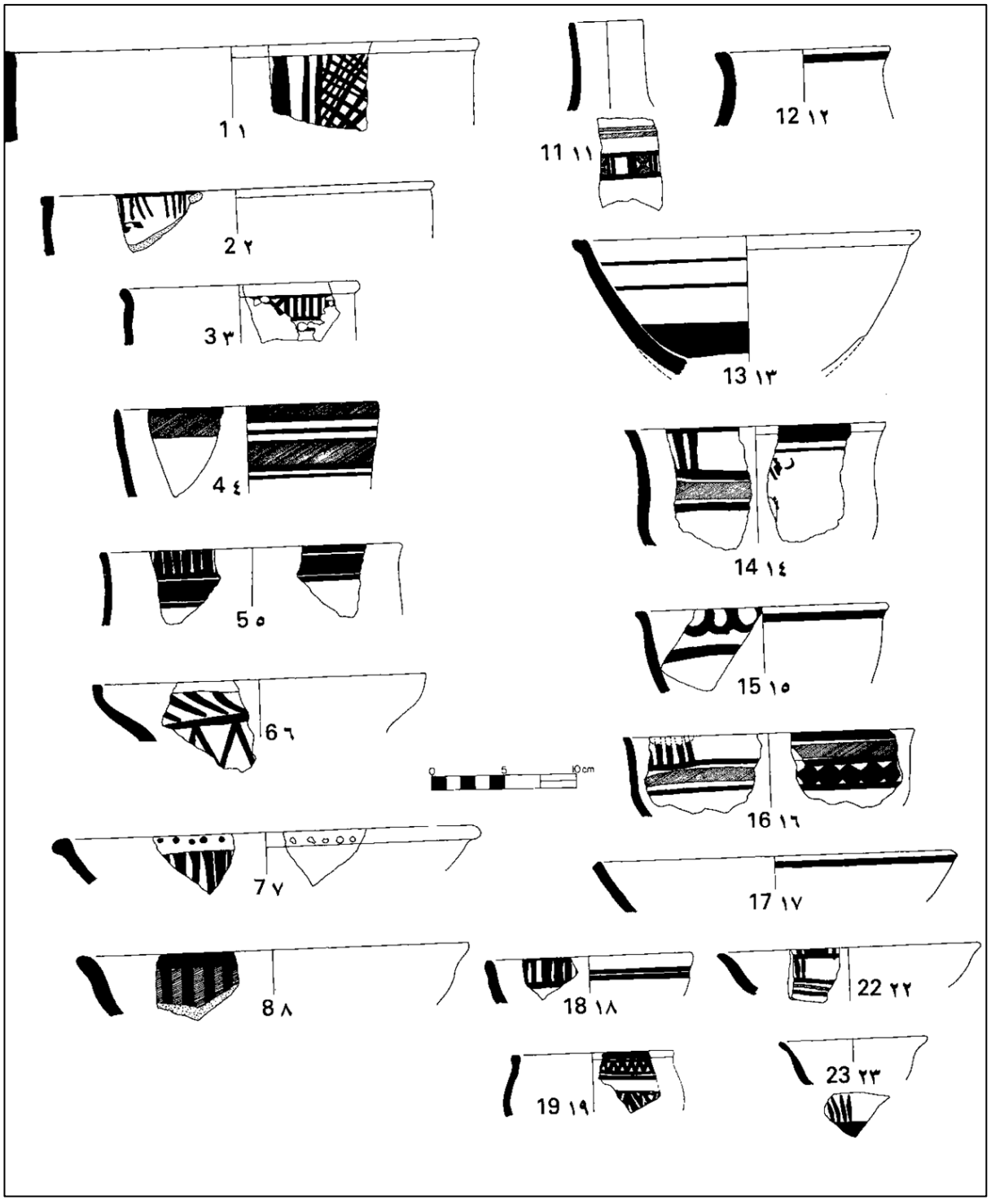


Figure 6.18: Fragments of glazed pottery from SirAbaal

(217/155) (SW KSA) similar to al-Baha (no. 1, 6, 8, 14, 16 and 18) Zarins et al. (1981, 9-42)

6.6.1.2 Western KSA

The preliminary results of the extensive survey and excavation undertaken in this area produced quantities of mining tools such as grinders, pots and containers made of pottery and glass in a variety of types. In Madinah region, al-Noqrah (southern and northern), which was a station for the pilgrimage route from al-Kufa to Makkah, was also a famous mining settlement in western KSA (chapter 2.6). Samples of hand millstones and other round ones (*rahi*) made of diorite and basalt specially for grinding gold ore were found in southern al-Noqrah (205/1001). Testing ore remains identified copper and gold in these grinders (Dejesus et al., 1982, 63-96). Elsewhere, similar grinders to the al-Baha grinders of types A and D were found in al-Mwan site (SNU) on the edge of the al-Noqrah north site, where workshops for mashing quartz stones were found (Dejesus et al., 1982, 63-96, plate no. 91). In the sites of western Kom (206/1001) and eastern Kom (206-1001) hand grinders similar to those in al-Ahsabh and Masodah type D were found, but of different sizes. Also, excavated pieces of pots made of soapstone were found at the site of al-Noqrah north in area A, trench 5, associated with a millstone made of basalt (Dejesus et al, 1982, 74). Large amounts of wares made of red pottery were found in al-Noqrah north site (205/1002) within trench A, with some kiln fragments mixed with slag, bones, charcoal and a covered wall of a kiln. The study suggested that the furnace was domed, made of reddish brick stone (Dejesus 1982, 63-96); this kiln appears to follow the same model as the gold furnace found in Asham (Figure 6.19). Large amounts of fragments of clay copper kilns were found in different locations of al-Noqrah south, especially in Maseinah site (205/1007), and these kilns were found covered with a layer of slag in their tubes (Dejesus et al., 1982, 63-96). These kiln fragments are quite similar to those in al-Haqah site and al-Kesimah site in terms of shape and composition (above Figure 6.3 left).

Similar furnaces were also found in al-Noqrah north site (205/1002) in area A, trench 4. The kiln has slots to pour down the ore, and charcoal, bones and slag were found inside. Additionally, parts of the kiln were coated with a layer of silica, and it is possible that the kiln was dome shaped, built of reddish bricks (Dejesus et al., 1982, 63-96). The shape of this furnace is similar to those found in Asham in terms of archaeological evidence around the furnace, as mentioned earlier.

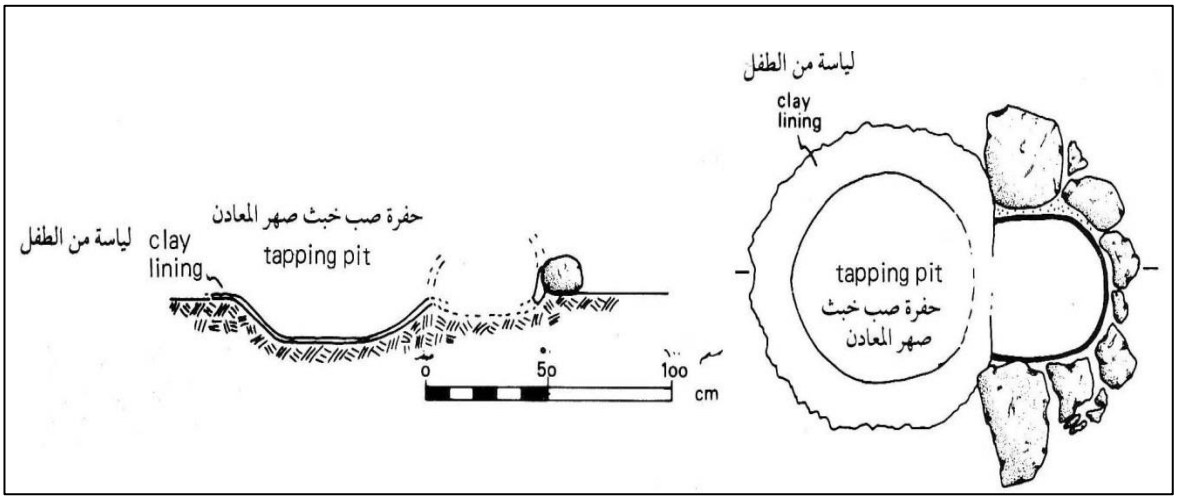


Figure 6.19: Smelting furnaces from al-Noqrah

North site (205/1002), trench A (Dejesus, 1981, 63-96, plate 78)

Shueib al-Masane mining settlement in the north-west of the Madinah region is dated c. 8th century CE/2nd AH. Fragments of white and pink granite millstones were found on the surface there (al-Ghabban, 2000, 44-89) .The archaeological study revealed fragments of wares with various patterns of surveyed and excavated unglazed and glazed pottery, mostly pots, bowls, cups and plates, as well as different shapes of excavated glassware including jugs and bottles used for various purposes, including mining and medical usage. The study suggested that all these tools were used in the mining process (al-Ghabban, 2000, 53) . There are several similarities between tools in this settlement and those in Asham and Masodah in terms of pounders of types B and C, and grinders of types A, C, and D. Additionally, some wares made of unglazed pottery type RYP and PP, and glazed pottery type AG, CG and LG and some dark glasses are also similar (al-Ghabban, 2000, 53, plates 15 to 17) .The settlement pattern here is also similar to those in al-Baha settlements Pattern A in addition to the mosque, which is located in the south-western area in Shueib al-Masane settlement.

In the Mahdalzahb (Cradle of Gold) site (210/64 and 210/67), the scientific team revealed a number of complex ruined buildings distributed in large areas which is similar the Pattern C in this study. Additionally, stone grinders, unglazed pottery and blue glazed pottery related to mining in the 11th century CE (5th AH) (according to radio carbon dating by the US Geological Survey) also carry the same manufacturing characteristics attributed to some mining wares excavated in Asham settlement (Zarins et al., 1980, 9-36, plates 23 to 26). In Taif city, archaeological surveys discovered three gold mining sites, the most important of which is the Ghoraba settlement (210/51). This settlement comprises a group

of houses intersected by narrow lanes, which the team guessed originally dates back to the pre-Islamic period (Zarins et al., 1980, 9-36). A large number of pots and jars fragments made of pottery were found there, including unglazed, glazed and soapstone, similar to those found in al-Baha of type RP (Figure 6.20, no. 2, 9-12, and 17-18).

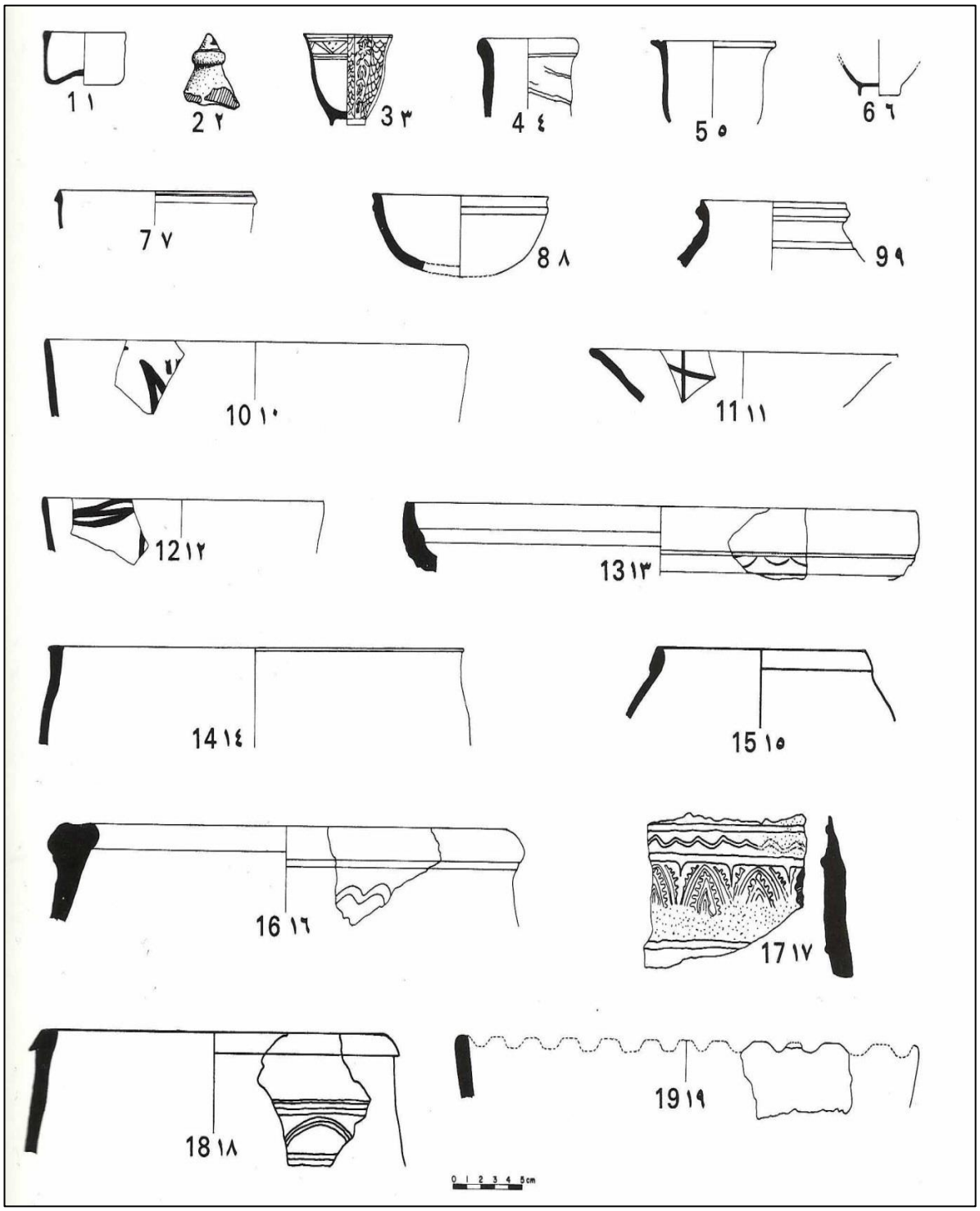


Figure 6.20: Fragments of glazed and non-glazed pottery, soapstone ware and glass from mining sites in Taif

No. 2, 9 to 12, and 17 to 18 (Zarins et al., 1980, 9-36, plate 24)

6.6.1.3 The central and northern areas

In the site of al-Qway'eia (84/212), about 200km south of Riyadh, archaeological survey revealed some gold, silver and copper mining settlements. Large-sized millstones were found in one of the copper mining settlements similar to those surveyed in al-Baha settlements, especially grinders of type A. Pieces of soapstone wares were found at a gold mining settlement in Zolm, 600km west of Riyadh, representing a collection of large pots, plates and lamps distinguished in shape and strapping, representing all the early phases of making those pots (Zarins et al., 1980, 9-36). These pieces carried the same characteristics as the trench artefacts from Asham and Masodah, as containers for materials of processing in terms of manufacturing and sizes (Figure 6.21. no. 17-22 and 27-28).

In addition, four mining settlements (206/48 A, 51/55/79) found between al-Dawadmi and Taif contain clear separated architectural constructions made of mud which is similar the Pattern B in this study. Grinding tools (pounders and grinders) as well as the remains of pottery for pots and bowls of various sizes polished with alkaline glazed, as well as a quantity of glass fragments with long and narrow necks were found in these settlements which contain the same features as those found in Asham and Masodah (Figure 6.22, no. 6 and 7) (Zarins et al., 1980, 9-36).

In the north area, the archaeological survey of north-western KSA revealed some mining settlements associated with gold, silver and copper. In the site of Umm Hoytat (204/1012 to 1031), located 20km north-east of al-Wajh city, 29 mines and settlements of gold mining were found. Pounders and grinders found in these sites are similar to those surveyed in al-Baha, particularly Asham type A and C (kasnawi et al., 1983, 76-83) (Figure 6.21).

However, the spread of the above mentioned tools, furnaces and architectural patterns in settlements in different areas of the KSA suggests the widespread establishment of mining in the Islamic era, which would be corroborated by similar evidence in areas adjacent to Saudi Arabia, as discussed in the following sections.

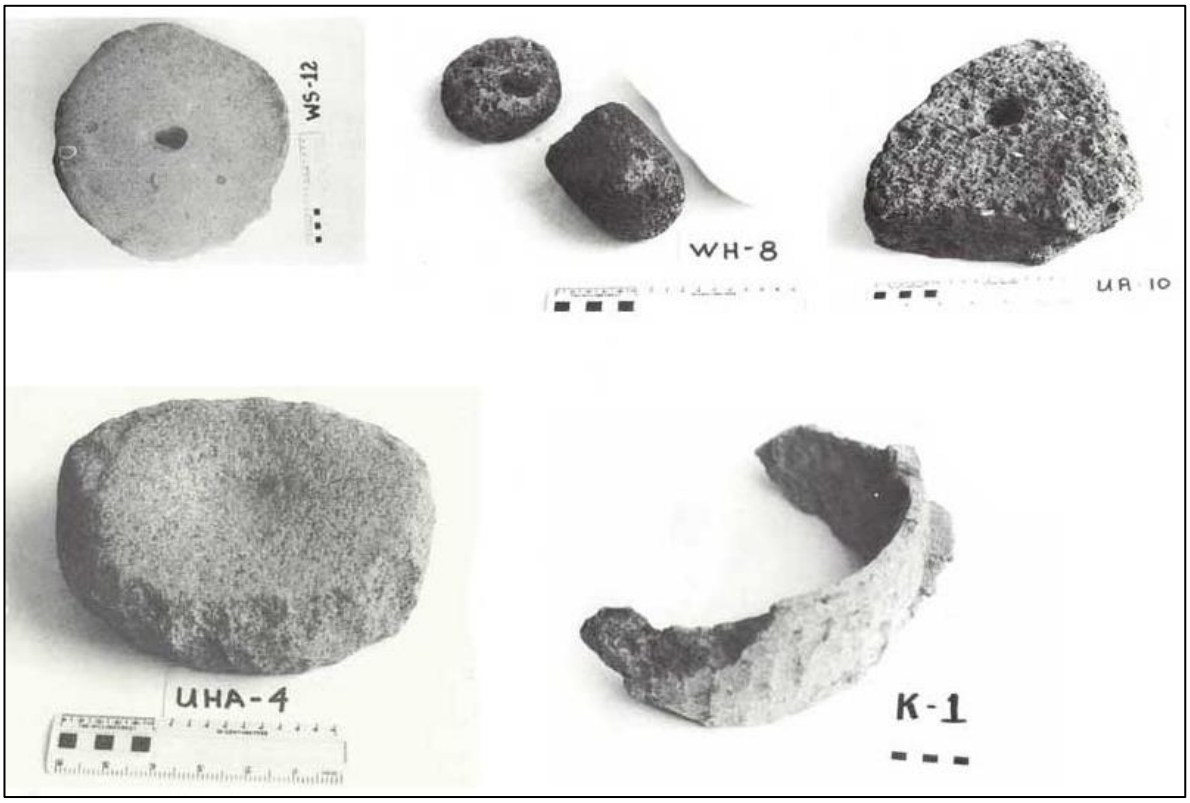


Figure 6.21: Gold grinders and pounders, and part of soapstone pot from the site of Umm Hoytat

(204/1012 to 1031) in northern KSA (Kasnawi et al., 1983, 76-83, plates 47 to 50)

6.6.2 Mining in neighbouring areas of the KSA

Mining has been known in the Middle East since ancient times and throughout the historical period (chapter 1.3), including in Yemen and throughout the area of the modern Arabian Gulf states. The order in which these areas are discussed reflects their regional links with the study area within the geographical context of southern Arabia. The close trade connection between Yemen and the study area was extended by the latter functioning as a conduit to overland trade with southeast Arabia and the Gulf countries since pre-Islamic times, via several trade roads stretching from Yemen to east of Arabia that pass through the study area and nearby.

6.6.2.1 Yemen

Despite Yemen's long civilization and history of mining, particularly its famous silver mines such as Sahbam near the Murib dam (al-Arshi, 1939), archaeological works on mining remain scarce (for example, there is no Yemeni archaeological record of ancient mines). The mine of al-Radrad, located in al-Jabali valley 60km east north of Sana'a, was considered to be one of the most famous mines by al-Hamdani (1987). The archaeological

surveys in al-Jabali valley revealed several materials and tools used in the mining process which were carbon dated to the medieval period (e.g. slag and pottery) (Benoit et al., 2003). In addition, a joint Yemeni-French geo-archaeological team rediscovered the al-Radrad mine and its village Samik (Figure 6.17) (Robin, 1987, 123-124), but the most important archaeological surveys and their finds were conducted in a different season by the French mission representing the National Centre for Scientific Research (CNRS). These surveys revealed a large number of broken and crushed stones which evidenced treatment prior to being transported to the smelting workshop, and also found the remains of furnaces for smelting silver which are generally similar in characteristics to those found in al-Baha (Benoit et al., 2003). Moreover, a preliminary survey including collecting various types of pottery, slag, and fragments of furnace walls and grinders and survey of settlements nearby was carried out by a French team in 2004. They recorded additional information and collected samples of slags and walls of furnaces which are still under study (Audrey and Tereygeol, 2006, 187-200). Despite the failure of these reports to illustrate the type of furnace (being preliminary reports of the surveys), the available descriptions suggest it is similar to what was excavated in ASH4 in terms of materials and construction, and to the description of al-Hamdani (chapter 2.2).

The mining settlements found there come in two types, both of which are close to the small mines in Majna and a hill overlooking the valley of al-Jabali and Shutayba. Type one is a small number of housing units (four settlements) which is probably equivalent to the Pattern A in al-Baha region, with minor differences in terms of containing circular rooms. Some wares made of clay with different colours, ranging from dark brown to pale and thick to thin walls, and slag covered an area of the settlements (Figure 6.22). The second type is more prolific, with 20-30 housing units and cemeteries located in Wadi al-Khaniq (two settlements) that correspond to Pattern B in al-Baha region. Quantities of coarse pottery with a thickness of 3-5cm were collected. In addition, large quantities of glazed pottery (AG) were also found. These fragments of pottery represent pots, jars and small cups used for the subsistence of the miners and their families. A few sherds of glass were also found there (Peli and Tereygeol, 2007, 187-200). Some of the elements of decorations in these fragments are similar to those found in the study area, especially in Asham and Masodah (Figure 6.22).

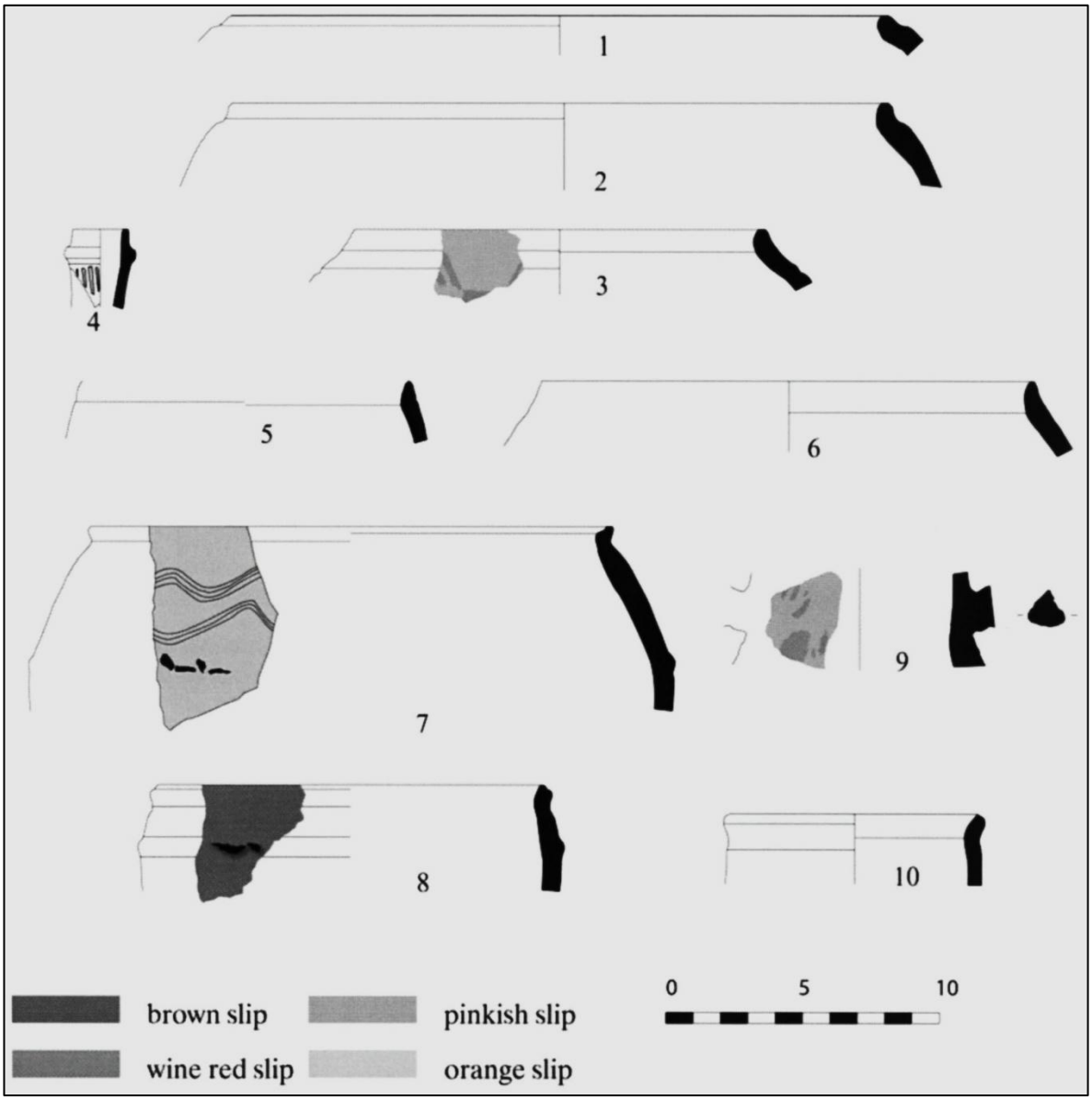


Figure 6.22: Remains of surveyed pottery from al-Radrad site in Yemen

Source: Peli and Tereygeol (2007, 187-200)

6.6.2.2 Oman

Al-Maysser settlement is the richest copper centre in Oman, and large amounts of slag were found there in addition to clay furnaces next to some grinders and hand pounders. Some Islamic sites in Omani villages were also found in Bayda containing many of these mining tools (Figure 6.23). The archaeological report noted that miners in the Islamic period used the same design of tools dating from 3000 BCE (Prange et al., 1999, 187-192). One evidence that confirmed the continuity of mining in these settlements is that some mosques were found next to some mining centres in Al-Arja valley close to some slag piles, and in Samad and Molaq sites a group of mosques was found; only the standing

walls remain, but their design makes their identification obvious (Wilkinson, 2003, 204). In addition, the type of furnaces found in Semdah, where it was preferred to build ovens downhill to make use of the mountain edge as a wall for the furnace (see Figure 18 and 19 in Weisgerber, 2006), was clearly similar to al-Baha settlements in al-Haqah and al-Kesimah which suggests using the same technique in smelting the copper.

Some remains of glazed and unglazed pottery were found in in Lasail and Semdah sites dating from the 9th century CE similar to the patterns found in Samera'. Additionally, carbon dating of some coal samples from some kilns in Lasail and Semdah showed that they go back to the period 840-980 CE (Weisgerber, 2008). Several surveyed and trenched fragments of unglazed and glaze pottery wares from Asham and Masodah have similar characteristics to those from found in Samera which means similar to Lasail and Semdah finds in terms of outer coats and decorative elements.

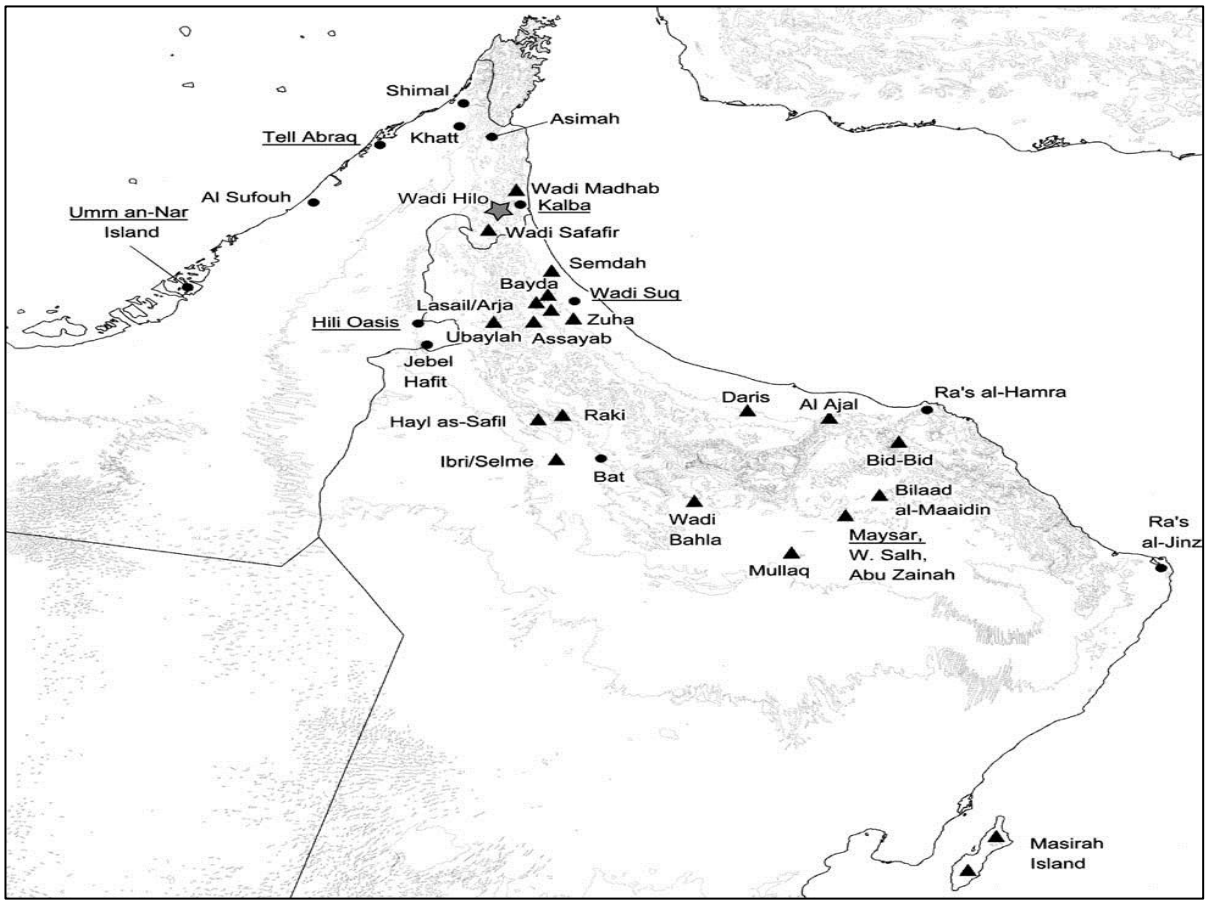


Figure 6.23: Mining sites in Oman and UAE

Source: Kutterer and Jasim (2009, 245-254)

6.6.2.3 United Arab Emirates

Although mining in UAE continued from the Bronze Age to the Islamic period in various forms, registered sites are still below the expected amount. However, two sites are known to be the most important copper mining sites in UAE: Hilo-1 and al-Safarfir, the latter of which practised mining in the Islamic era. Hilo-1 mining site is located around 15km from the east coast of UAE in al-Hilow valley (Figure 6.23). In spite of some residential settlements, Islamic tombs and watch towers around the site, copper mining works dating from the Islamic era have not been found yet. The dating of the sites is inferred from the carbon dating of charcoal from mining sites, identified as belonging to the Umm an-Nar era (2000-3000 BCE) (Kutterer & Jasim, 2009, 245-254). Excavation in this site revealed a workshop for processing raw copper, as evidenced by copper residuals and copper alloys with a high concentration of raw copper in the site (Kutterer and Jasim, 2009, 245-254). In al-Helwan valley, a few stone pounders of different sizes were found, used to crush the stones for the primary mining work to mine for raw copper in the site, and later used in constructing Islamic tombs in different periods. This example, the use of slab stone as a border for tombs, is frequently seen in Masodah in the south cemetery (as described in chapter 5), and its use as a building material is manifest in Asham in the mosque and some houses.

AsSafarfir an early Islamic mine for copper site is located south of Ras al-Khaimah, on the south bank of al-Safarfir valley (Western, 1984, 2-13). In fact, this site reminds us Pattern B in the al-Baha region, particularly since it has some settlements consisting of mines, roasting pits, 9 furnaces and a cemetery. Also, a few square and rectangular rooms scattered near the mine were noted. However, the furnaces here seem more distinct than those from al-Baha, especially those sandwiched between two walls of almost 8m width, used as a platform for smelters and as a protective wall against erosion of the furnace and the maximum width for each kiln 1.31m, with a height of 0.61m (Western, 1984, 2-13).

Most of the structures such as houses and the mosque in al-Safafir are similar to those found in some copper mining sites in the study area, with some differences in the form of construction, in addition to style of placing the kilns and their multiplicity. Fragments of unglazed wares were found with red colour and thick and thin walls. Some of these pieces have decorations in the form of wavy grooves similar to those found in settlements of al-Baha. In addition, the remains of glazed wares found in al-Safafir feature on the surface milky or tiny glazing scattered in abundance on the site; similar glazed wares were found in Asham and Masodah (Figure 6.24).

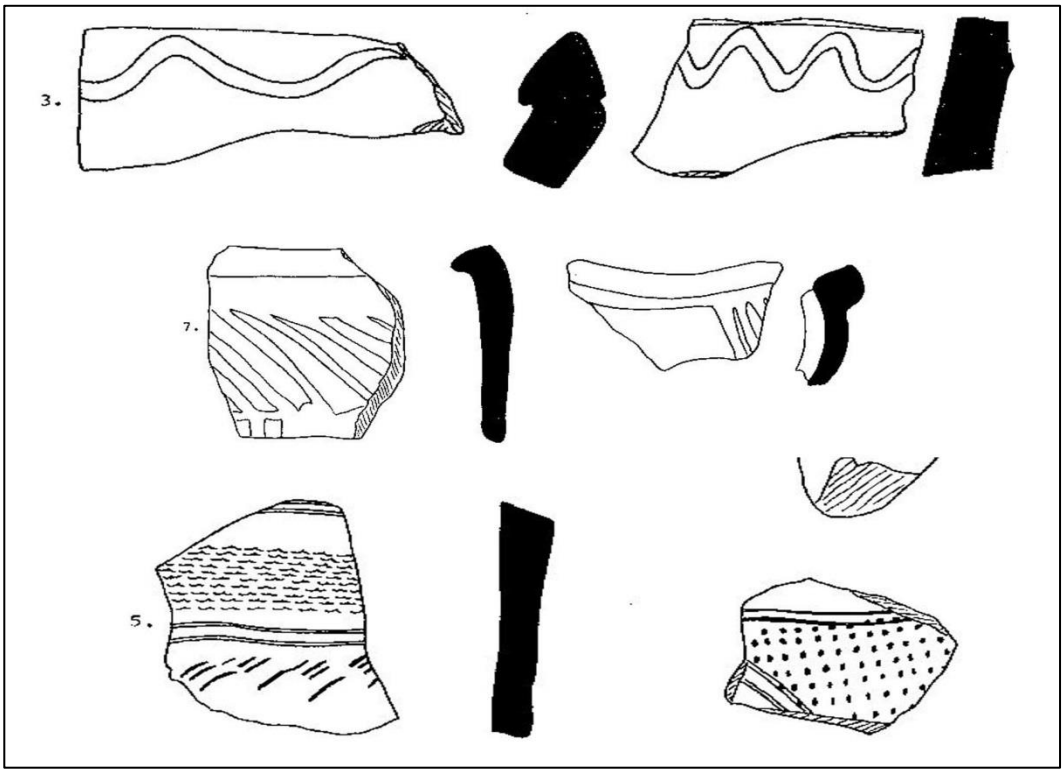


Figure 6.24: Remains of pottery from al-Safafir site, south of Ras al-Khimah (UAE)

(after Western, 1984)

To conclude the discussion of mining sites in the KSA and abroad with the findings from al-Baha, there are some similarities with the sites surveyed and excavated in the study area in terms of the spread of mining tools (pounders and grinders, wares, and furnaces of smelting) as well as settlement patterns despite some contrasting features. It can therefore be summarised that with regard to mining tools, the pounders and grinders of ores are frequent features among all settlements in this study area. All the types of grinders found in these mining sites displayed a variety of sizes and shapes, but were broadly similar across mining sites. It should be noted that the millstones with double-basin (type B) were not found elsewhere in Saudi Arabia, even in other gold mining settlements, and they appear to be unique to Asham and Masodah, which would indicate there was major development in the techniques of grinding here. In addition, the wares (including pots, jars, cups, bowls and other containers) are also generally similar in the majority of settlements. In particular, some wares made of coarse pottery consisting of pieces of stone, straw and small pieces of soapstone appear to have been commonly used for mining purposes, as well as glazed wares and glass used as containers to save materials before and after mining. No doubt these tools also were employed in non-mining functions as appears to be the case in the study sites. In terms of furnaces, the remains of furnaces usually are not available in large quantities on the surface of these settlements. The remains of a few copper smelting

furnaces were found in the northern region of the site of Ummamel and al-Huwaitat, similar to those in the study area. In spite of limited excavations thus far undertaken in the mining settlements, there are good examples of excavated furnaces in the western area in the al-Noqrah north and south similar in planning and construction to the furnaces of Asham.

As for the types of settlements, Pattern A (simple separated units with a small number of rooms) is very common throughout the south-western area, especially in the site Srabl (217/155), as well as in the western region in the settlements of Shoaib al-Masani, Ummamel and al-Hoitat. The second type of separate units with many rooms (Pattern B) is more frequent than the former. Some settlements in the western area featured multiple rooms, particularly in the industrial areas on the edge of these settlements. Such settlements in the central area similar to this pattern are found in al-Sadreyah, al-Qieyah, Ghrabah and al-Tawilah. It is somewhat surprising that a quantity of pottery was noted in the two patterns (A and B) which is not found in the study area. Complex interconnected units (Pattern C) are frequent along the pilgrim routes like Mahdalzahb and al-Noqrah (south and north), which contain intensive archaeological remains of pottery and glass, suggesting a large capacity of occupation in these locations. The finds of this pattern are consistent with those surveyed and excavated settlements in the study area.

Other areas of Arabia benefited from the economic impetus of mineral ore exploitation during different periods prior to the Islamic era, evidenced by remains of heavy mining works featuring grinders and pounders, slags and wares used in mining processes being widespread and mining settlements being found in areas neighbouring the KSA. In Yemen, the mining concentrated on silver exploitation prior to and during the Islamic period, and archaeological studies have revealed that the most important of these sites, al-Radrad, is similar to what was found in al-Baha area in terms of the diversity of settlements (particularly Patterns A and B), in addition to the similarity to one furnace in terms of shape and components with the Asham kiln in ASH4. The pounders and grinders found in this site are also similar to those found in al-Baha in terms of form and function (grinders type A and D). Also, there were some similarities in finds from al-Jabali and from al-Baha, particularly the presence of hard pottery type red paste and the alkaline type surveyed and trenched in Asham and Masodah.

Mining in the south-east of Arabia in Oman and UAE was concentrated on copper smelting more than on other forms from the Bronze Age to the Islamic period. Many of their mining

settlements do not differ significantly from those surveyed in the study area, particularly Pattern B. In addition, large quantities of unglazed and glazed pottery are similar, as well as the shape of smelting kilns (although the construction of kilns in Oman and UAE is characterised by belts of furnaces). It can be said that the copper mining in the south-east of Arabia was contemporaneous or perhaps more sophisticated than al-Baha, particularly with regard to the Islamic period, which is also confirmed by radiocarbon tests on samples from Oman. It seems that the mining activity in the Islamic period is not yet clear in UAE; only the appearance of few settlements which may contain non-mining evidence were found nearby.

6.7 General discussion and conclusion

This chapter outlined that at least three metals were mined in al-Baha region during the early Islamic period into the late Abbasid era (7^{th} to 12^{th} centuries CE), which are copper, gold and silver. These metals were processed in temporary and fixed settlements. This process involved breaking the copper ores and smelting in furnaces found in 23 copper mining settlements and near the mines (where settlements were not present) in the study area. Gold mining was also practised intensively in 19 settlements in the study area in simple surface mining and ore extraction from quartz veins and some rocks, which involves several phases in terms of extracting, breaking, grinding, refining, heating in pottery and melting in furnaces, each of which is detailed above.

The more complex processes naturally involved specialised furnaces and tools. Four different furnaces of various shapes and sizes were used in mining to treat the ores and extract the pure metal. Two types of furnaces were used in the copper settlements and mines (clay and stone kilns), and two varieties of gold kiln were excavated (oval shaped in Asham and cuboid in Masodah).

The tools most commonly used in the process of extracting and processing ores in these settlements were pounders and grinders, for breaking and crushing the copper ores, and pulverising the gold ores. These tools were scattered and noted frequently on the surface of these settlements in varied amounts. Copper miners may have used some pottery pots in daily use during the washing or storing of some copper grains. However, using various wares made of pottery, soapstone and glass was required in gold mining, including bowls, jars, pots cups and other containers. These wares played a substantial role in processes of mining, particularly in the stage of refnring, heating, and melting, according to al-Hamdani (1987), and their existence in the gold settlements was noted.

Most of these mining settlements played an important role in Islamic history according to indications in some classical sources. However, Asham was preeminent in its cultural and economic role among the regional settlements as one of the largest and best known mining centres among historians and geographers. Therefore, Asham was chosen as a model mining settlement, and intensively surveyed and excavated in this study in order to find out the main factors that aided Asham to contribute to the development of mining in south-western Arabia. The political dimension was found to be significant in Asham, as it was a capital for a group of small settlements nearby, and it enjoyed the availability of natural resources such as gold and silver in the Asham Mountains, and the valleys surrounding the settlement, which facilitated mining processes and human habitation. Trade routes and local markets and nearby sea ports were also key factors underpinning the growth of mining around Asham and in al-Baha generally. The fieldwork confirmed that Asham was not merely a mining settlement; it was an Islamic metropolis analogous to other urban centres in Arabia, as evidenced by the quantity of finds there including cultural materials comparable to other cosmopolitan cities in the Islamic world.

Although the Levantine civilization of the Umayyads was linked to southern Arabia due to mining and other factors, as mentioned previously, the cultural artefacts for this period pale in comparison with the abundance of those dating from the Abbasid era. These cultural materials evince direct interactions and trade with other centers in Arabia, including Makkah, al-Madinah and al-Rabazah, as well as cultural links with cities further afield, such as Samarra and Baghdad (attested by the presence of advanced glazed ceramics in Asham, TG and LG, which were famous in Samarra and Baghdad and become widely used in Arabia). On a more direct level, as an important centre of mineral production, Asham was directly linked to the most important Islamic metropolises, as expressed in the presence of fortified, state-supervised mining camps and the transport of gold and silver to Iraq, either in minted form for subsequent minting in Iraq or to decorate palaces and other uses. Due to the high security involved, and the relatively sophisticated architecture of the magistrate's palace in Asham (by regional standards), it is possible that a culture of consumption and possibly gift giving developed between the elite around the magistrate in Asham and higher echelons of administration in Baghdad; under such an arrangement, the stability and security of the gold supply would be rewarded with gifts of prized glazed wares. This would certainly be commensurate with immemorial traditions of Semitic trade and would be equivalent to performance-related bonuses in modern parlance.

However, it is more likely that most wares represent consumption by the wealthy inhabitants of Asham, who prospered from mining and agriculture and were able to trade for goods from traders and pilgrims from Iraq, buying glazed wares and keeping abreast of the latest cosmopolitan fashions. This is further evinced by the observation by the Andalusian traveler Ibn Jubair that the population in southern Arabia engaged in commerce with Iraqi pilgrims (Ibn Jubair, 1977, 113). Thus there were direct material connections during the Middle Ages between the region of al-Baha and the Mesopotamian heartland of the Abbasid state.

The current findings add substantially to our understanding of mining in the southwest of Arabia. There was a hierarchy of types of mining settlements in al-Baha region, which can be classified into three patterns: simple separated housing units (Pattern A), many separated housing units (Pattern B); and complex interconnected housing units (Pattern C). This hierarchy seems to have played different functions. Pattern A was employed for extracting the required quantity of ores as a first stage of a long process, and places were erected for mobile miners to spend their time of rest and refreshment before leaving these settlements and returning to their homes at the end of the day. The extracted mineral ores were then transferred by animals via internal paths to larger smelting settlements (Pattern B) to complete the work of production. The larger settlements (Pattern C), formed (or at any rate were subsequently supervised) under governmental authority, oversaw the mining activities conducted in settlements on Patterns A and B, in addition to their specialization in the production of gold/silver ore, as in Asham, and they marketed the ores through commercial ports nearby. Pattern C probably performed multiple functions in social, religious and cultural aspects, as reflected in their cosmopolitan areas (with sections for housing, commerce and industry). Pattern C settlements (e.g. Asham) thus became well established settlements and held stronger attractions for residents. However, more intensive studies, survey and excavation are still needed for all patterns to provide more archaeological evidence to confirm the validity of this hypothesis.

NU	Settlement name	Nearest city	X	Y	Recorded by	Ore mined
Pattern A: Simple separated housing units						
1	Kayalalmusnah	al-Qara	41 20 57.3	20 26 00.84	SCTA	C
2	Shobaltair	al-Qara	41 25 16.23	20 16 1.72	AB	G
3	al-Kesimah	al-Qara	41 20 27.3	20 18 58.41	SCTA	C
4	al-Waqrah	al-Qara	41 24 19.9	20 31 02.4	SCTA	C
5	Bani Sar	al-Baha	41 28 00.5	20 05 54.5	AB	C
6	Almanzal	al-Baha	41 29 54.12	20 07 43.26	SCTA	G

7	Honaf	al-Makhwah	41 24 649	19 44 030	AB/NA	G
8	al-Safaridah	al-Makhwah	41 08 14.00	19 44 56.00	AB/NA	C
9	Yabas	al-Makhwah	41 23 49.63	19 39 41.00	AB/NA	G
10	al-Khytan	al-Makhwah	41 22 29.74	19 33 43.49	AB/NA	G
11	Memoir	al-Qara	41 20 01.9	20 14 00.1	SCTA	C
12	Omaljanadel	al-Qara	41 20 45.7	20 25 10.0	SCTA	C
13	Jabal Doba	al-Aqiq	41 43 00.1	20 29 57.9	SCTA	C
14	Qutnah	al-Aqiq	41 59 12.4	20 05 55.6	SCTA	C
15	Thrad	al-Baha	41 29 57.3	20 07 42.24	AB	G
Pattern B: Many separated housing units						
1	al-Haqah	al-Qara	41 23 21.4	20 09 57.8	AB	C
2	al-Qaryah	al-Aqiq	41 56 59.28	20 17 43.74	AB	CG
3	Logbah	al-Aqiq	41 39 54.05	20 24 32.18	SCTA	C
Pattern C: Complex and interconnected housing units						
1	al-Hashas	Qelwah	41 13 48.21	19 47 45.24	AB/NA	G
2	al-Jahily	Qelwah	41 18 35.67	19 55 54.77	AB/NA	G
3	Almamlah	al-Aqiq	41 40 53.88	20 20 41.76	SCTA	G
4	al-Asda	al-Makhwah	41 19 23.3	19 37 37.8	SCTA	G
5	Asham1	al-Makhwah	41 12 42.4	19 36 37.0	SCTA	G
6	Masodah1	al-Makhwah	41 12 35.9	19 40 37.1	SCTA	G

Table 6.1: The distribution of patterns of settlement in the study area

The available surface evidence, such as the diversity of grinding tools and quantities of pottery and glass, as well as the slagheaps, add to the multiplicity of architectural facilities, and this hierarchy perhaps indicates that there was a qualitative excellence linked to the type of metal (copper, gold or silver) produced in those settlements. Therefore, the production of copper ore was of great strategic interest during the period of study, and copper mining was practised in groups or individually according to the patterns of settlements (Pattern A: 9 settlements; Pattern B: 2 settlements), whereas there was extensive interest in gold mining in all patterns of settlements (Pattern A: 5 settlements; Pattern B: 2 settlements; Pattern C: 6 settlements) (Table 6.1).

Archaeological surveys clearly show that there was great interest in Pattern C settlements, particularly regarding the extraction of gold. These settlements were controlled by the state itself, which organized their affairs; this is reflected in their extensive facilities and elaborate architectural planning (e.g. interconnected buildings and fortification by external towers; internal walls; and strategic defensive locations on high hills, as in the Tihama settlements in general).

In sites elsewhere in the KSA, the Patterns A and B are very common, as mentioned above, but the Pattern C is less prevalent. Outside the KSA, some mining settlements contained temporary settlements in Oman and UAE, even though different terms are used to describe them (i.e. seasonal camps) to prepare the ores then transfer them to production sites. This

style is abundantly evidenced in the copper mining settlements in these areas. Pattern B contains other facilities such as mosques and graves, and specialised industrial zones, as seen in al-Safafire and al-Arj settlements. Pattern C has no parallel in settlements outside the KSA, suggesting that this pattern was instituted by the state for the purposes of gold production, and the details of this pattern are still unclear due to the lack of archaeological studies in the gold mining settlements. Patterns A and B are the most common in these settlements inside and outside the KSA.

Many surveyed and excavated pounders, grinders and pottery tools were found in most of these mining sites in the study area, elsewhere in the KSA and in the rest of Arabia, albeit in varying shapes and sizes. Most pounders were cylindrical and spherical in shape, while grinders were found in the shape of millstones, spheres and slabs. The tools of pottery found in the study area are similar to other samples scattered in sites in the KSA and Yemen, Oman and UAE in abundance in similar features in terms of outer colour and the thickness of the walls, with some remains of slag indicating use in mining. In addition, similar decorations, especially for those used in daily life, as well as samples of glazed pottery were found in most of these sites dating from the same historical period.

Furnaces for smelting copper at these sites (in the study area, the KSA, and abroad) came in two forms: a pottery kiln available in abundance in the copper mining settlements, and a stone kiln in oval shape common in most mining sites. A special type was found in Oman and UAE comprising a belt of a group of furnaces confined between two walls. This type is absent in other sites, including the study area. The gold and silver kilns were in two types: the large and oval shape, and the simple cuboid shape. The first was found in Asham, al-Noqrah, Mahdalzahb, and in al-Radrad in Yemen, while the second one is rare so far in the mining settlements and was found only in Masodah.

In conclusion, the surveyed and excavated data from this study highlighted the historical, civilizational and cultural and economic importance of all of these mining settlements across al-Baha area toward the composition of the Islamic state through the provision of mineral ores. Within the same context, the mining of copper and gold were central resources for the Islamic state, particularly the latter, resulting in direct state intervention and control of the sources of gold production. In the following chapter the outcomes of this study and suggestions for further study are expounded.

Chapter 7: Conclusion

7.1 Introduction

The mining sites in al-Baha region in the south-west of Saudi Arabia are considered one of the most important production sites in the Middle Ages that had a significant role in the formation of the Islamic state at the beginning of its composition and beyond. The importance of this study lies in studying the characteristics of the mining landscape, particularly mining settlements in the region of al-Baha, by analysing the mining activities taking place at the mining settlement of Asham, and to investigate the natural and geographical factors which contributed to continuation of mining activity there. In addition, it demonstrates the phases of occupation in Asham, and recognises the economic and cultural role played by Asham settlement in southern Arabia during the early medieval Islamic era.

The study contained seven chapters. Chapter 1 comprised the introduction to this thesis, including the aims and objectives of the research and the importance of the subject. In order to understand the mines and mining site as well as explore the study area before addressing the research questions, an overview study of previous sources and the backgrounds of al-Baha region were given in chapters 2 and 3 respectively. Chapters 4 and 5 presented fieldwork to answer the research questions in al-Baha as a region (chapter 4), and in Asham as a mining model extensive fieldwork was conducted. These chapters were followed by the discussion (chapter 6) and the conclusion of the study (chapter 7).

The study has sought to answer the research questions for the model of mining settlements (Asham). These questions concern the natural and geographical factors that made Asham the most important settlement and a model production site in al-Baha region, with reference to the main methods of mining extraction and processing conducted in Asham, the materials, tools and furnaces of mining, the main function of Asham site (whether for mining purposes or for other reasons), the phases of occupation, the economic and cultural role of Asham settlement and its association with other mining settlements in the al-Baha region during the early Islamic centuries (7^{th} to 12^{th} centuries CE) and types of artefacts and other archaeological remains found in Asham. Given that the internal production of the Islamic state has been largely neglected in previous studies (both western and eastern), despite mining and making things being the physical basis of the civilization.

This study has contributed to bridging this gap in the field of Islamic archaeology concerning internal production sites in Arabia. Particularly, it has studied mining landscape settings and evidence of tools and furnaces used in mining. General archaeological survey in the mining settlements and excavation in the model of these settlements revealed abundant mining evidence; chiefly tools and furnaces, and the patterns of these settlements in the early medieval period.

This chapter aims to outline the main results of the study organised under four main key results: landscape setting, form of associated settlements, form of mining activities and beyond, and social context of landscape and its settlements and its implications. Limitations of the study and future directions are presented in the final section.

7.2 Landscape setting

Arabian mining sites are particularly concentrated within the Arabian Shield in the West of Saudi Arabia and encompassing the study area (Figure 2.1). This geological shield formed a natural conduit for various human activities since the pre-Islamic era, according to the remains of fixed architectural monuments, rock inscriptions and cultural materials. The distribution and proliferation of these sites is notably based near ancient trade and pilgrimage routes, from Iraq, such as Darb Zubaydah on the route from Iraq to Makkah (Al- Rashid, 1984), which passes Samira, Nejadi and Al-Noqrah among other mining sites, reaching to the Cradle of Gold. Similarly the south to north routes from the Yemen to the Levant also pass through the region (al-Thenayian, 2000), linked to Al-Madan, Ablah, Al-Aqiq and Asham. In addition to these main arteries of trade, numerous smaller local routes integrated the mineral ore production and processing sites, along with ancillary agricultural villages. This is confirmed by the analysis of written evidence, desktop survey and the general survey of mining settlements in al-Baha region (chapter 4).

At this point, this study is able to draw a clear picture of how these mining landscapes were controlled and exploited during early Islamic period (7^{th} to 12^{th} centuries CE), and the main characteristics of the mining landscape setting in al-Baha region. This mining landscape consists of a set of basic elements to fulfill the purposes of mining in the region. These elements, as we pointed out in the previous chapters, are mines, settlements, smelting places and slagheaps. Ancillary elements erected to meet the needs of miners and other settlers include houses and the network of roads between the mines and settlements and other internal and external settlements, as well as agricultural fields, mosques and cemeteries. Most of those elements were found in the study area according to the pattern of

the mining settlement. Thus, this study confirms that there were at least three metals mined in al-Baha region during the period of study, which are copper, gold and silver. These products were processed in temporary and fixed settlements in al-Baha region, as shown in chapters 4 and 6.

These settlements used the primary raw materials available in the region as construction materials; stones in building walls, timber for doors, columns and roofs. Both materials were transported with relative ease from their sources (the surrounding mountains and valleys) to the place of building and construction materials were not bought in from outside markets.

The natural and geographical factors, including access to ores and water availability used to wash and process these minerals are the most general patterns of mining landscape that aided the extraction and processing of these metals. These metals were known to the inhabitants of Arabia, as confirmed by the considerable body of Arabic literature on the science of chemistry of minerals and gemstones in the Islamic world, the most important of which for this study are by al-Hamdani (1987) (*Kitab al-Jawhariyan*), and al-Baryoni (1998) (*Kitab Aljmaher fi marifat al-Jawhher*). Given the academic reflection of prevailing knowledge given by such manuscripts, it is certain that the miners on the ground certainly possessed knowledge of various kinds of metals, their conditions and methods of processing them.

The study noted that copper mining sites were found to be more widespread than gold mining sites, especially in highland areas (al-Sarat) (18 copper, 6 gold), and their mines were typically in the shape of caves or channels that extend approximately 20-70m into the mountains in the north. In the far east of the region, mines were found in the form of ground cracks or deep wells. Gold mining sites were more abundant in the lowland area (Tihama) than copper settlements (13 gold, 1 copper) and their mines were characterised by deep holes of 20-100m depth and surface mines of around 200m in diameter.

The survey in this study noted a clear distinction in the gold mining settlements, particularly in Tihama, more than copper throughout the whole region in terms of the availability of the defence system and planning of settlements. This suggests that gold mining in al-Baha was one of the places fundamental to the Islamic economy during the period of study, which needs more attention. These sites in Tihama were under the direct control of Makkah and were more accessible than sites in Sarat, compounding their importance as sites for precious metals. Additionally, the fame and the quality of Asham's

gold probably spurred the emergence of several more transient settlements around Asham to take advantage of mining techniques that took place in the main centre.

7.3 Form of associated settlements

Based on the study of literature sources and depending on surface and excavated materials as demonstrated in chapters 4, 5, and 6 of this study, the overall form of the mining in al-Baha was practised in different ways. Smelting copper was identified in 23 copper mining settlements and near the mines for those having no settlements in the study area. Gold mining was practised intensively in 19 settlements in the study area in two ways: surface mining, which is very simple, and extracting from quartz veins and some rocks, which takes several phases in terms of extracting, breaking, grinding, refining, heating in pottery and melting in furnaces. Most of the gold mining settlements were controlled and surrounded by several towers placed on high hills forming a defensive system for the settlement; this system of defensive fortifications was not found in copper settlements.

According to the general survey of mining settlements, this study suggested that the mining in al-Baha region was practised in three general hierarchy patterns of mining settlements: simple separated units of a few housing units (10 settlements discovered); separated units with many housing units (2 settlements discovered); and complex and interconnected with many housing units (5 settlements discovered).

An implication of this is the possibility that the temporary settlements probably served as initial processing centres (Pattern A) for required quantity of ores (extracting ores) and places of mobile miners who spend their time of rest and lunch there, and then they leave these settlements at the end of the day to their homes or maybe these labourers were forced to live in these small settlements, which lie some distance from settlements of Patterns B and C, and it is likely that male workers lived here alone, without their families. The extracted mineral ores would be then transferred by animals via internal paths to large territorial smelting settlements (Pattern B) to complete the work of production in advanced stages for weighing to test its quality or kept in private stores until the distribution phase. The superior settlements (Pattern C) were formed (or quickly came to be) under governmental authority to oversee the mining business from tributary settlements of Patterns A and B, in addition to their specialization in the production of gold/silver ore, as in Asham, and marketed the ores through commercial ports nearby. Pattern C would have performed numerous other functions in social, religious and cultural aspects, as reflected in the more extensive and varied town planning (e.g. multiple cemeteries and more elaborate

residential, commercial and industrial zones). However, although these broad outlines in settlement differentiation are clear, more intensive studies, survey and excavation are needed for all patterns (A, B and C) to exhibit more archaeological evidence to confirm the validity of this hypothesis.

The presence of mining evidence, particularly mining tools (pounders and grinders), is well represented in most of these settlements, but the largest numbers of stone tools surveyed and excavated were in gold settlements; Asham and Masodah (the models of mining in this study) have a similar number of tools to the total of those found from the other 40 sites in al-Baha combined.

The study area, as demonstrated in the comparative study in chapter 6, demonstrated more common local and widespread settlement hierarchy patterns. Mining settlements on Patterns A and B are abundant in the rest of mining sites in the KSA and beyond, but the C pattern is rare among these settlements. Some mining sites contained temporary settlements (Pattern A) in the study area similar to those found in Oman and UAE, even though they are described in different terms (i.e. 'seasonal camps'). The fixed settlement (Pattern B) type is also common, for example Al-Safafir (in UAE) and al-Arja (in Oman) settlements. The third type (complex interconnected units) has no prevalence outside the KSA, and it seems this type was instituted for gold production. However, the existence of this pattern as a definable type remains tenuous due to the lack of archaeological studies in gold mining settlements. The first and second types are the most common in settlements inside and outside the KSA.

7.4 Form of mining and other activities

Since mining is an economic activity of human society in Arabia, which was undertaken under the direct supervision of the Islamic state, there are some basic stages universally used for the production of pure metals. By combining some indications in the available sources and from the surveyed and excavated evidence of the study area, this study notes that it is certain that the mining process underwent different stages according to the type of metal to be produced. This process begins with breaking down source rocks and grinding the mineral ores, followed by multiple smelting with respect to copper, whereas the gold and silver underwent several additional phases, namely refining, heating and melting as discussed in chapter 6**.** Significant evidence for these processes was found in the study area, as detailed in chapters 4 and 5.

This study discovered that stone tools related to mining (pounders and grinders) in terms of extracting and breaking the rocks are well represented in these mining settlements in different shapes and quantities. Pounders came in three types; type A: cylindrical, type B: spherical, and type C: spindle. However the grinders profiled in four shapes: type A: millstones one basin, type B: millstones two basin, type C: slab stones and type D: hand grinder. Most sites shared all types of pounder, with greater concentration in gold mining sites, particularly in the Tihama area. Grinders of type of A, B, C and D were frequent in all gold settlements while only one type is common in copper settlements (type A). These tools are varying in quantities in most settlements, especially of settlements of Patterns B and C.

Furthermore, there was a quantity of wares used during the smelting, refining, heating and melting process. The surveyed settlements and the excavated artefacts from ASH1, ASH2, ASH3, ASH4, MAS1 and MAS2 as discussed in chapter 6, uncovered some bowls, jars, pots cups, containers made of pottery, soapstone and glass, with features and fabrics suitable to be used in this process. Copper smelting may have used some of these wares during the washing or storing some copper grains. However, using those above wares was essential in gold mining including bowls, jars, pots cups, containers for the purpose mentioned earlier.

For the methods of smelting and melting these ores two types of kilns were discovered to smelt copper: pottery furnace and stone furnace, as shown in chapter 4. The pottery furnace is dominant in most copper settlements while the stone furnace is rare. Also, two types of gold furnaces were excavated in Asham and Masodah, the larger of which is similar to that described by al-Hamdani (1978) for gold furnaces in the 9th centuries CE/3rd AH, and probably one of a series of furnaces in the settlement not yet excavated. This type may have been used for the heavy smelting, while the smaller one seems to be for private use and could be found in each house, probably used for small acts of smelting.

These activities may have brought a lot of workers and craftsmen to the area because of the high demand from the state, though the current study was unable to address these considerations. However, some available sources indicated that a large number of slaves were working in different parts of Arabia; for example, an estimated 2000 slave miners worked in al-Radrad mines (al-Hamdani, 1974, 292). Also, there are brief references to the purchase prices of mining slaves, which were estimated from 800 to 20,000 dirhams (see for example, Ali, 2006, vol. 7, 466). The working conditions of workers, and whether they

were paid in cash or in a portion of production, remain unknown. All these concerns are unknown in the available sources.

7.5 Social context and its implications

The growth of mining during the period of this study contributed to turning the southwest of Arabia into a productive economic landscape driven by the Islamic state to meet its needs. Therefore, mining settlements became a destination for many craftsmen and workers, either those who were highly skilled in dealing with these metals or slaves brought to Arabian markets and worked under the command of their masters. The larger settlements like Asham became early Islamic cities in their own right within the Muslim world. Generally, most of these settlements date from the early Islamic period, as evidenced by excavations in Asham, which revealed no sign of cultural remains under the latest excavated layer that would represent the pre-Islamic period. Also, it is clear that these settlements, including Asham, were abandoned during the 12th century CE/6th AH, along with most cities in the coastal plain like Athar and al-Serain in the south and most settlements in the centre of Arabia (e.g. Al-Rabazah, Faid and others. See al-Zailayi, 1983 and al-Rashid, 1986).

The fieldwork conducted by this study in Asham confirmed that Asham was not merely a mining settlement; it was an Islamic metropolis comparable to other important sites in Arabia and beyond. This is evidenced by the quantity of finds emanating from the fieldwork of Asham, including cultural materials, pottery, and glass comparable to contemporaneous metropolises in across the Arab and Islamic world such as in Kufa, Baghdad, Samarra and al-Fustat and others.

In addition, Asham was the capital of a territory containing small towns nearby, located on the banks of the valleys Doqah and al-Ahsabh including Masodah, al-Asda and possibly extended to the bottom of Sarat mountain where the villages al-Khalf and Khalif are located due to the similarity in the pattern and writing style of inscriptions and monumental architecture. Perhaps the governor (Prince al-Awed) mentioned in inscriptions from the beginning of the 8 CE/2 AH century managed the affairs of this territory (see more information about all these inscriptions in Zaylai, 1999, 399-451) and oversaw mining and tax-gathering, as well as representing the government. Therefore, the surveyed and excavated objects from Asham were not found in other sites of al-Baha region with the same degree of abundance and diversity, due to Asham being a regional capital.

The thriving of mining activity in Asham in the study period was reflected in: 1) settlement expansion and increase of buildings and multiplicity of facilities, including houses, mosque, market, cemeteries and industrial zone; and 2) extending mining processes to the neighbouring village of Masodah.

7.6 Conclusion, future directions and challenges

This study, as with other archaeological studies, faced several limitations that may be taken into account in future investigations in the field of mining. Firstly, this study was primarily intended to explore the mining settlements throughout south-west Saudi Arabia, including Asir, Najran and Jazan, but because of the large area and the limited time the study could only encompass one region of south-west Arabia, at al-Baha. Therefore, more researches are needed to better understand the mining landscape. Although it is possible to say that most of the mining works date from the early Islamic period, more intensive archaeological excavations in other settlements are needed to support this assertion.

There are several questions raised by this study, particularly in the three key areas. The first relates to the historic expansion of mining sites in the KSA; for example, are there mining sites dating back to the pre-Islamic period, and if so, what is the extent of change in this transitional phase through these two periods with respect to the tools, settlement patterns and practices, and was mining continued into the Islamic era? Secondly, the pattern of these settlements needs more archaeological investigations to detect some additional facilities. For example, what archaeological materials for these patterns (especially Patterns A and B) were dedicated to the stores for agricultural produce, what was the daily diet in these settlements, and what was the nature of their production? Thirdly, the question of labour in these settlements remains one of the most enigmatic; what were the working conditions and wages? To what extent was slave labour employed, and where were these slaves drawn from? Did miners constitute an aristocracy of labour, were they seasonal miners, or did they constitute an underclass in the wider region (as potentially reflected in whether they were confined to edges of settlements)? Although such questions are very hard to answer in the absence of literary sources, some of them could be addressed through a future comprehensive work.

There are some problems and possibilities relating to these mining landscape sites. For example, most sites are threatened with destruction in modern works encouraged by mineral investment, especially as the KSA is going to invest in large metal projects in the Arabian Shield with various companies, both nationally and internationally. The DMMR

issued around 1565 mining licenses in 306 mining areas, including the study area. Additionally, the civilizational development in the KSA requires creating more highways and delivering services such as electricity and water to towns and villages, which requires a large area and substantial landscape modification. There is no doubt that these modern mining works and ground services would hide a lot of past human activities and destroy their facilities in addition to surface evidence. A limited number of sites are still safe from such modern works, and their archaeological potential suggests they would contribute to mining landscape studies. Based on the importance of such sites in the development of Arab-Islamic and world civilization, as outlined in this study and inferred from others, it is advised that the companies investing in mining and other activities in the KSA invest in cultural preservation as part of their corporate social responsibility, and that the government facilitate and guide this conservation, even if it is limited to the proper archaeological works and adoption of archaeological projects to study these sites prior to their destruction.

Therefore, in future there are good opportunities to discover more mining sites in the KSA and examine landscape settings by carrying out a general survey of these sites, particularly in the south-west. Then, a detailed work in these sites can be executed such as collecting pottery and slags. This would tell us the broad functions and indications of various patterns of mining settlements, and explore the hierarchy of these settlements. This in turn will answer a number of questions relating to mining in the landscapes and the sites. After those questions are answered, other questions can be posed and probably answered by doing intensive work in the sites, including ground survey, collecting finds and maybe geophysical survey to detect any remnants of metal coins and other metal objects. Excavation could shed more light on many unclear matters in mining, such as operational methods, tools and facilities, and places of labour and their materials as well phases of occupation around mining settlements; some of them probably represent pre-Islamic period mining, and it is expected that the Islamic state did not begin fostering mining in the region based on a tabula rasa; some knowledge of minerals in the region can be inferred to have existed prior to the Islamic era. It is presumed that as yet unknown or recently discovered sites will be more intact than more famous sites, rendering them of greater archaeological potential.

Overall, this study is considered an early step towards the study of mining sites in south-western Saudi Arabia, through general surveys of mining sites in al-Baha region and excavation in the settlement of Asham, the most prominent site for extraction of gold. This

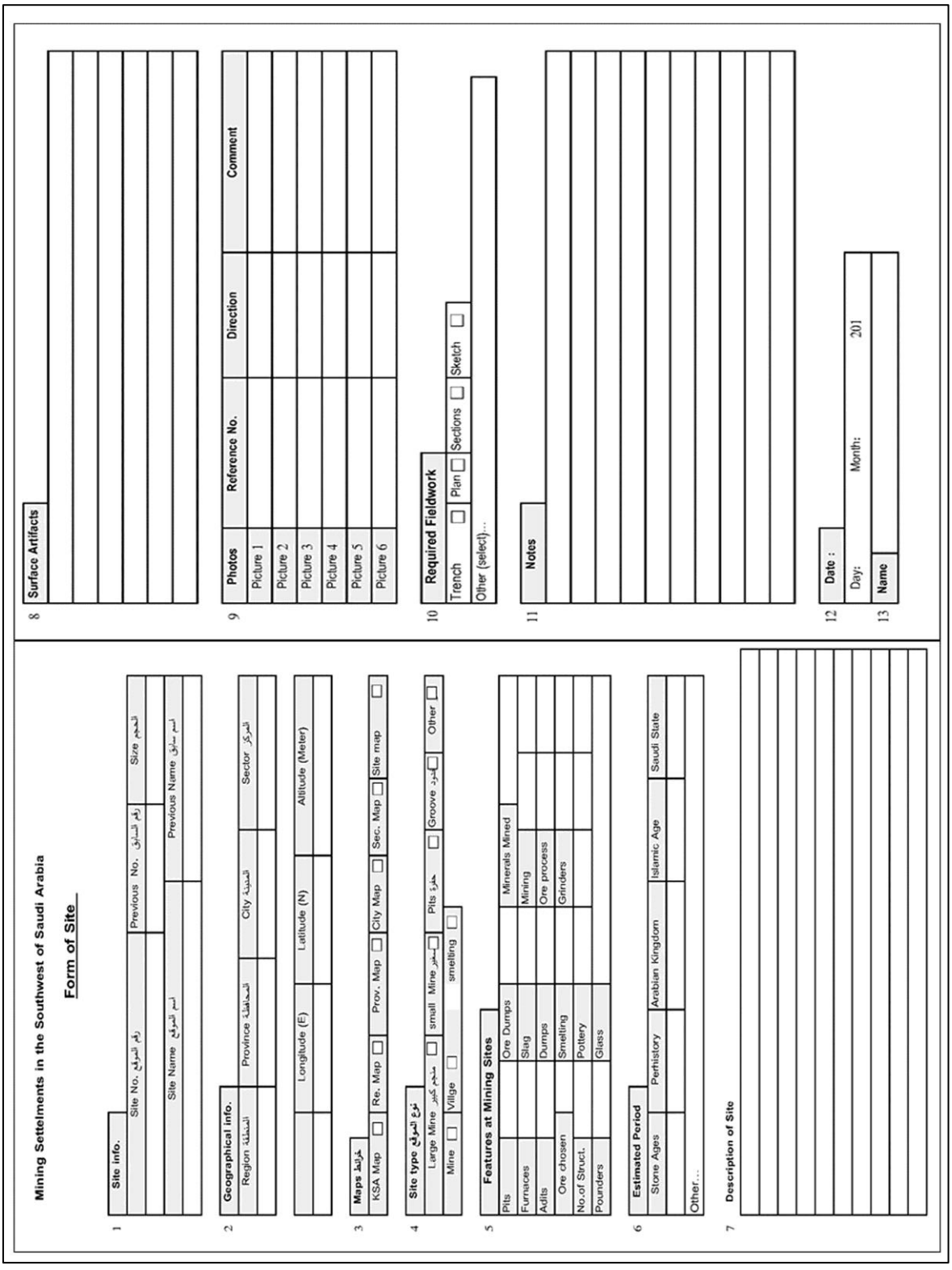
study paves the way for further archaeological studies in this field, and could also be used for comparison purposes for further mining settlement studies in other parts of the KSA and beyond.

Appendix 1: Non-mining sites in al-Baha region (SCTA survey)

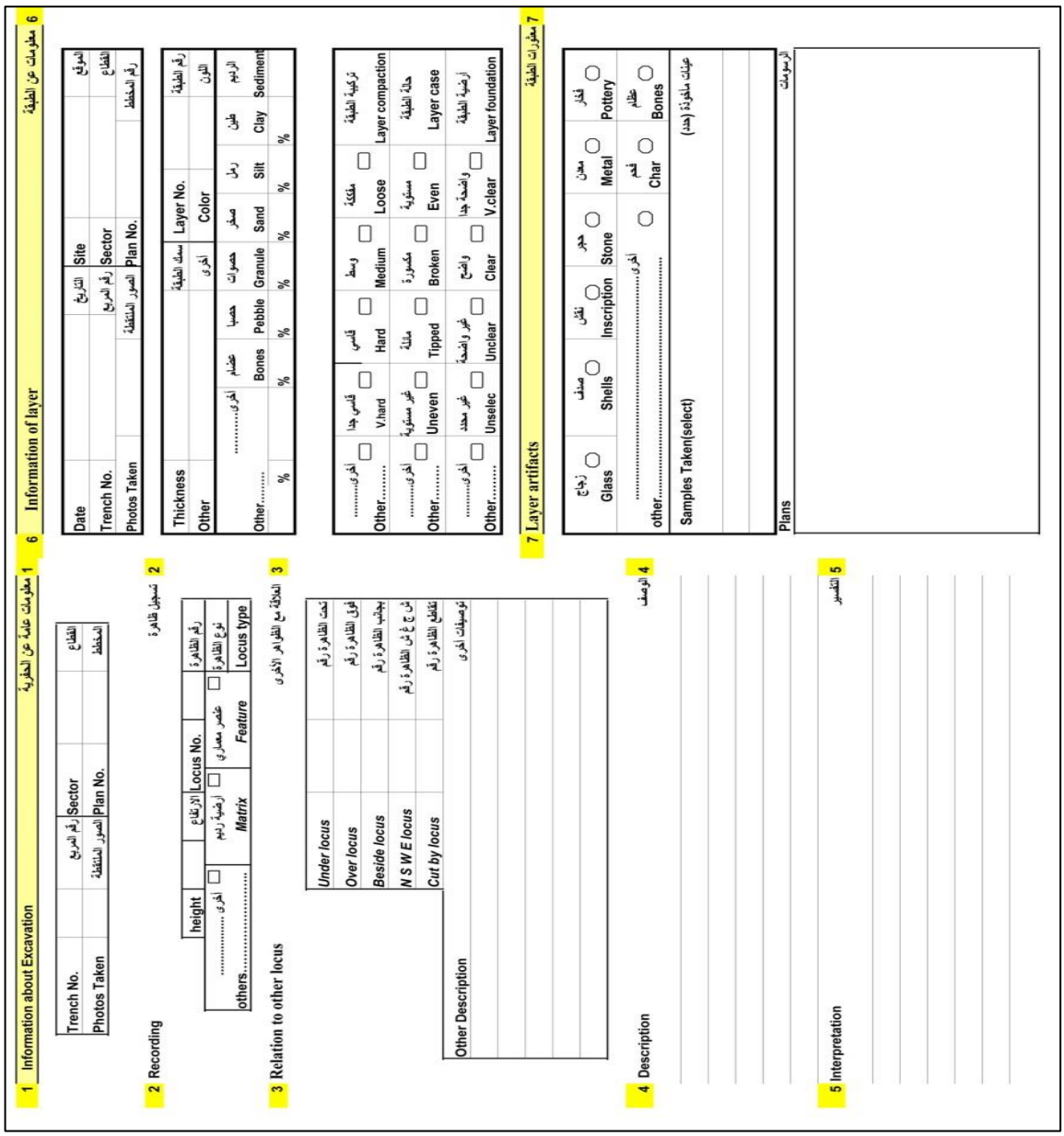
(r: site of rock art, SUN : sites unknown number)

N	Site name	Site number	Project name carried out in al-Baha
1.	al-Herath	(216/2r)	The survey of drawings and inscriptions
2.	al-Asda	(216/3r)	
3.	and Honif	(216/4r)	
4.	Tharad	(210/13r)	
5.	Abu al-Hosin	(216/7r)	
6.	Luqman	(216/4r)	
7.	al-Kara	(216/8r)	
8.	al-Mattaha	(216/6r)	
9.	al-Manzal valley	(210/16r)	
10.	Tharad valley	(210/15r	
11.	al-Malad site (216/93)		The survey of architectural heritage
12.	of Bohor	(217/77)	
13.	al-Akhih 1	(217/81)	
14.	al-Akhih	(217/82)	
15.	al-Mqatil tower 1	(SNU).	
16.	al-Mqatil tower 2	(SNU).	
17.	al-Jaber	(SNU	
18.	Rems village	(SNU)	
19.	al-Fothla fort 1	(SNU)	
20.	al-Fothla fort 2	(SNU)	
21.	Rwadat Bani Seed	(217/78)	
22.	Mashokah	(210/107)	
23.	al-Makhwah	(216/5)	
24.	al-Ahsbah North and South	(216/3)	
25.	Theeyan	(SNU)	
26.	Logbah	(SNU)	Survey of the Southern Ancient Trade Route
27.	Jarab	(217/72)	
28.	al-Koriha	(SNU)	
29.	Hrat al-Bakom	(SNU)	

Appendix 2: Form of recording a mining site



Appendix 3: Form of excavation and artefacts record



8 Feature locus — 8 العناصر المعمارية

Type							العنصر المعماري
Position							الموقع
height		الارتفاع	Width		العرض	Length	الطول
Courses height				ارتفاع المدماك	Courses width		عرض المدماك
Composition							المكونات

Interpretation — التفسير

Other — اخرى

9 List of artifacts recording — 9 كشف تسجيل المعثورات

م No	رقم الكيس Bag No	العدد Number	النوع Kind	الوصف والتفسير Description	ملاحظات Remarks

Others attachments — مرفقات اخرى

Appendix 4: Studied samples of unglazed pottery (surface)

No.	Site	Part of item	Weight	Colour	Thick	Firing	Function	Shape	Feel	Core colour	Inclusions	Manuf	Decoration
Type: Unglazed pottery in red paste (RP) and thick walls													
201	ASH	bodysherd	64	10R 5/6 red	10	complete	jar	horizontal or vertical elliptical body	partially smooth	R. sand and lime small holes	the part outside coated in different colour reddish yellow (5YR. 6/5) and cuts and grooves. Inside coated brown (7.5YR. 5/4)	wheel	group of grooves in form of comb teeth duplicated between two lines
202	ASH	bodysherd	44		5		jar	horizontal or vertical elliptical body	Rough	R. some atoms of ash and small holes	none		grooves in form of plant leaves as a series under the compact group of parallel rows. these forms executed by cut
205	ASH	bodysherd	50		5		jar	horizontal or vertical elliptical body	partially smooth	R. clear of impurities.	none		wide parallel undulating grooves executed by small cut.
231	ASH	handle	48		20		jar	vertical handle	smooth	the same colour with small holes and limes	the part outside coated in different colour reddish yellow (5YR. 6/5)		none
240	ASH	bodysherd & rim	80		10		pot	flared rim	Rough	R. some sand grains.	cuts meddle deep		wavy grooves in the top of rim
245	ASH	bodysherd & rim	100		10		pot	flared rim		R. And some sand grains.	none		none
277	ASH	handle	4		25		cup	vertical handle		dark bluish grey (gley2 4/1). some organic materials	none		motifs of the triangles opposite the head since it is confined within a rectangular applied by template
556	MAS	bodysherd	40		8	incomplete	jar	ovoid		R. mixed with grey paste 5/6.Some bits of sand, gravel and organic materials. Tiny holes	fine feeling on the same colour		none
555	MAS	base	8		7	complete	cup	flat		R. Some sand grains, and small chaff, lime, organic materials. Tiny holes	fine feeling on the same colour		none
534	MAS	bodysherd & rim	98	2.5YR 5/6 red	5	incomplete	pot	ovoid	rough	red and grey paste. sand grains, chaff, and small holes	none	wheel	belt of fingering stamps
539	MAS	rim	23	2.5YR 5/6 red	7	complete	pot	flared	rough	red paste and sand grains and lime, and many small cavities	none	wheel	none
540	MAS	bodysherd	56	2.5YR 5/6 red	4	incomplete	pot	ovoid	rough	red and grey. and sand grains, chaff, white gravel and small holes	none	wheel	none
Type : Unglazed pottery in reddish yellow paste (RYP) with mid-thick walls													
203	ASH	bodysherd	50	5YR 6/5 reddish yellow	5	complete	jar	horizontal or vertical elliptical body	Harsh	RY. Bits of sand	Cuts	wheel	wavy grooves
217	ASH	bodysherd	52		10		jar	horizontal or vertical elliptical body		RY. Powderly sand	Cuts		wavy grooves confined between two eaves of parallel grooves
237	ASH	bodysherd & rim	167		10		cooking pot	flared rim		greenish grey GLEY1. 5/1.) organic materials and some small holes	Cuts		belt of circles applied by finger
242	ASH	bodysherd & rim	106		10		pot	flared rim		RY. Small pits and atoms of lime	Cuts		none
243	ASH	Rim	46		10		pot	vertical rim	Rough	RY. clear of impurities	Cuts		wavy grooves above a row of grooves in form of comb teeth
548	MAS	bodysherd	35		5		jar	ovoid		RY. bits of sand, chaff, organic materials. Tiny holes	fine feeling on the same colour		none
557	MAS	bodysherd	47		7		jar	ovoid		RY. some bits of sand, chaff, organic materials. Tiny holes	fine feeling on the same colour		none
523	MAS	bodysherd	87		10	incomplete	jar	ovoid	Rough	grey paste. sand grains and organic materials	none	wheel	deeply grooves, belt of fingering stamps
524	MAS	rim	88		5	incomplete	pot	vertical		grey paste. sand grains, organic materials and quartz	bits of quartz in the inner surface	wheel	deeply grooves, belt of fingering stamps
525	MAS	rim	79		7	complete	pot	flared		red paste and sand grains, and small holes	none	wheel	wavy grooves, and teeth shark shape
526	MAS	rim	102		5	incomplete	pot	flared		red and grey paste. sand grains, and small holes	None	wheel	none
528	MAS	rim	44		5	complete	pot	flared		red paste. sand grains, small white gravel and small holes	None	wheel	None
537	MAS	bodysherd	234		80	complete	part of furnace	circular	Harsh	red paste. sand grains, small white gravel, chaff and organic materials	None	hand	None
538	MAS	rim	55		10	complete	pot	vertical	Rough	red paste. sand grains and lime, and small holes	None	wheel	None
Type : Unglazed pottery in pale paste (PP) with thin walls													
266	ASH	base	4	10YR 6/3 pale brown	3	complete	pot	flat base	smooth	R. clean of any impurities	cuts and feeling on the same colour	wheel	none
142	ASH	rim	5		3		cup	flared rim		R. some small sand and small holes	cuts and feeling on the same colour		fan palms

Appendix 5: Studied samples of glazed pottery (surface)

No.	Site	Part of item	Weight	Thick	Firing	Function	Shape	Feel	Core colour/impurities	Inclusions	Manuf.	Decoration
Type: Alkaline glaze (AG)												
264	MAS	base	18	5	complete	cup	concave base	Rough	7.5YR 6/3. light brown. And some lime and sand grains	both surfaces covered by green alkaline layer	wheel	inner side has grooves model
270	MAS	bodysherd& rim	34	9		bowl	Ovid vertical body and slightly flared rim		7.5YR 7/3. pink. It has small holes and atoms of limes	both surfaces coated in green alkaline layer		none
481	MAS	base	57	7		cup	concave base and vertical ovoid body		7.5YR 7/3. pink. It has small holes and atoms of limes	both surfaces coated in green alkaline layer		none
Type : The coated glaze pottery (CUG)												
533	MAS	bodysherd & rim	24	7		bowl	ovoid and flared rim		pale yellow (10YR 6/3). Sand grains and small holes.	both surfaces coated in green alkaline layer	wheel	none
560	MAS	bodysherd	15	5		bowl	ovoid		light brown (7.5YR 6/4) small stones and small holes	both surfaces coated in green alkaline layer	wheel	none
561	MAS	base	33	10		jar	flat		Light brown (7.5YR 6/4). small stones and small holes	both surfaces coated in blue alkaline layer	wheel	none
220	ASH	base	52	5	complete	jar	disk base	Rough	5YR. 6/4 light reddish brown. some small holes and sand grains and ash	Outer surface is coated in light olive brown upper the glazed layer. The inner is covered the same clay.	wheel	two ledges fill by greenish grey layer. Above the ledge narrow web All lines painted by brush with brown colour.
252	ASH	bodysherd	22	8		plate	flat base and vertical rim		5YR. 6/4 light reddish brown. some small holes and sand grains, lime and quartz	both surfaces coated in pale yellow upper the glazed		inner surface, Splash decorations bordered inside rectangle shape. All these decorations painted in dark and light brown, also, some empty spaces filled with pale green
263	ASH	base	30	8		plate	flat base		5YR. 6/4 light reddish brown. some small holes and sand grains	both surfaces covered by light olive brown layer upper the glazed		glow Intersecting lines executed by dark and light brown and, some empty spaces interspersed by dark green layer by feeling
265	ASH	base	12	4		bowl	concave base		5YR. 6/4 light reddish brown. some small holes and sand grains	Outer surface is coated in green upper the glazed layer. Inner surface id coated in very pale brown		Paralleled lines. Each line consists from 2-3 colours, brown green and light brown yellow and black executed by brush.
271	ASH	base	24	8		bowl	vertical rim		5YR. 6/4 light reddish brown. some small holes and some limes	both surfaces coated in pale green upper the glazed layer		overlapping triangles toward the centre of bowl executed in brown with fine brush. These triangles are glowing by green
272	ASH	base	24	10		bowl	vertical rim		5YR. 6/4 light reddish brown. Some small holes. sand grains	both surfaces covered by olive upper the glazed whereas splash green around the rim in inner surface.		lines painted in dark brown
274	ASH	bodysherd & rim	26	8		bowl	flared rim		5YR. 6/4 light reddish brown. some small holes and sand grains and grains of ash	the outer surface is coated in light olive brown upper the glazed layer whereas The inner covered by thin light yellowish brown		overlapping triangles the central one covered with a network, used the green to cover the room among first and two triangles. All decoration is executed in brown with fine brush
415	ASH	bodysherd & rim	8	5		bowl	slightly flared rim		5YR. 6/4 light reddish brown. some small holes and sand grains	both surfaces coated in pale olive upper glazed		in inner, web lines starting from rim toward down painted by brush in dark brown
260	ASH	bodysherd	4	5	complete	bowl	Ovoid	Rough	5YR. 6/4 light reddish brown and some pits	inner side coated in milky layer under the glazed	wheel	wide web painted by dark green
269	ASH	bodysherd & rim	212	10		jar	Spherical body and flared rim		7.5YR. 5/6 strong brown. And there are some small holes and bits of sand	layer of glazed in the outer surface and		Protruding grooves executed on the dough and coated with layer of light olive brown colour.

Appendix 6: Studied samples of glass (surface)

Code	Site	Part of item	Weight	Sort	Colour	Thickness	Firing	Function	Shape	Feel	Core colour/impurities	Inclusions	Manufacturing	Decoration
278	ASH	Base	72	Transparent	pale green	1	Complete	Bottle	protruding to the inside base	smooth	pale green	None	free blowing	none
280	ASH	Base	8	Transparent	pale yellow	3	Complete	Bottle	flat base and vertical body	smooth	pale yellow	None	blown into mould	curved lines
283	ASH	Bodysherd	4	Transparent	pale green	2	Complete	Bottle	horizontal or vertical ovoid body	smooth	pale green	None	blown into mould	decorations in form of facing comb teeth, and foliage
529	MAS	Bodysherd	4	Transparent	pale green	2	Complete	Bottle	ovoid body	smooth	pale green. Free of impurities	None	blown into mould	None
530	MAS	Bodysherd	6	Transparent	pale blue	3	Complete	Bowl	ovoid body	smooth	pale blue. Free of impurities	None	blown into mould	None
531	MAS	Bodysherd	3	Dark	Blue	2	Complete	Bowl	ovoid body	smooth	bule. Free of impurities	None	blown into mould	None
532	MAS	Handle	6	Transparent	pale green	5	Complete	Bowl	Longitudinal	smooth	pale green. Free of impurities	None	hand	Spring cuts

Appendix 7: Distribution of artefacts for ASH1

(P = pottery)

Spit	Ore	Part of items	No.	T weight grams	Layer	Depth (cm)
0	Unglazed-P	Base	5	20		0
0	Glazed-P	Base	2	12		0
0	Glazed-P	Body sherds	7	116		0
0	Glazed-P	Body sherds & handle	2	10		0
0	Glazed-P	Handle	1	2		0
0	Glass	Body sherds	2	4	0	0
0	Unglazed-P	Body sherds	12	316		0
0	Unglazed-P	Body sherds & handle	3	24		0
0	Unglazed-P	Handle	8	42		0
0	Unglazed-P	Rim	12	146		0
1	Soapstone	Base	6	78		5
1	Glazed-P	Base	1	20		5
1	Glazed-P	Handle	1	6		5
1	Shell	Body sherds	1	12		5
1	Glass	Handle	1	1		5
1	Unglazed-P	Base	10	394		5
1	Unglazed-P	Body sherds & neck	3	12		5
1	Unglazed-P	Body sherds	25	864		5
2	Unglazed-P	Body sherds	52	1528		10
2	Unglazed-P	Base	11	442		10
3	Glazed-P	Body sherds	5	44		15
3	Unglazed-P	Body sherds	48	1360		15
3	Unglazed-P	Body sherds & neck	5	104		15
3	Unglazed-P	Handle	7	116		15
3	Unglazed-P	Rim	4	88		15
3	Unglazed-P	Body sherds & rim	4	20		15
3	Unglazed-P	Base	3	50		15
3	Glazed-P	Rim	2	22		15
3	Glass	Rim	2	4	1	15
3	Glazed-P	Body sherds & rim	5	198		15
3	Glass	Base	2	112		15
4	Glazed-P	Base	6	134		20
4	Glazed-P	Body sherds & rim	9	104		20
4	Glass	Body sherds	8	40		20
4	Unglazed-P	Body sherds	42	1144		20
4	Unglazed-P	Body sherds & handle	6	66		20
4	Unglazed-P	Handle	11	142		20
4	Unglazed-P	Body sherds & rim	9	526		20
4	Unglazed-P	Base	3	152		20
4	Glazed-P	Rim	1	6		20
5	Glazed-P	Body sherds	9	89		25
5	Glass	Body sherds	7	44		25
5	Glass	Body sherds & rims	1	30		25
5	Unglazed-P	Body sherds& neck	2	20		25
5	Unglazed-P	Body sherds	41	1278		25
5	Unglazed-P	Handle	5	104		25
5	Unglazed-P	Body sherds & rims	6	250		25
5	Unglazed-P	Base	1	6		25
	Total		**419**	**10302kg**		

Appendix 8: Distribution of artefacts for ASH2

Spit	Ore	Type	No.	Weight	Layer	Depth
0	Unglazed-P	Body sherds	7	758	0	0
0	Unglazed-P	Body sherds & rims	5	376		0
0	Slag	Body sherds	6	175		0
0	Glazed-P	Body sherds & rims	2	26		0
1	Unglazed-P	Body sherds	6	750	1	5
1	Unglazed-P	Base	4	410		5
2	Unglazed-P	Handle	6	168		10
2	Unglazed-P	Base	4	570		10
2	Unglazed-P	Body sherds	18	1046		10
2	Glazed-P	Base	1	42		10
2	Stone	Body sherds & rims	1	36		10
3	Unglazed-P	Body sherds & rims	4	466		15
3	Unglazed-P	Base	5	568		15
3	Unglazed-P	Body sherds	26	1339		15
3	Glazed-P	Body sherds	9	108		15
3	Glazed-P	Body sherds & rims	7	82		15
4	Unglazed-P	Handle	3	30		20
4	Unglazed-P	Handle & body sherds	1	16		20
4	Unglazed-P	Body sherds & rims	4	62		20
4	Unglazed-P	Body sherds	16	842		20
4	Glazed-P	Body sherds	6	64		20
4	Stone	Base	1	622		20
5	Unglazed-P	Handle & body sherds	3	48		25
5	Unglazed-P	Body sherds & rim	6	250		25
5	Unglazed-P	Body sherds	23	702		25
5	Unglazed-P	Neck & rim	2	22		25
5	Glazed-P	Body sherds	5	192		25
5	Glass	Base	1	92		25
6	Unglazed-P	Handle & body sherds	1	23		30
6	Unglazed-P	Base	6	134		30
6	Unglazed-P	Body sherds	39	662		30
6	Glazed-P	Body sherds & rim	5	32		30
6	Glass	Body sherds	3	14		30
6	Glazed-P	Body sherds	1	14		30
7	Unglazed-P	Handle & body sherds	1	30		35
7	Unglazed-P	Body sherds	22	748		35
7	Glazed-P	Body sherds	7	36		35
7	Glazed-P	Base	1	16		35
7	Glass	Body sherds	1	12		35
8	Unglazed-P	Base	6	104		40
8	Glazed-P	Body sherds	2	58		40
8	Unglazed-P	Body sherds	22	226		40
9	Glass	Base	4	28	2	45
9	Unglazed-P	Base	7	192		45
9	Unglazed-P	Body sherds	18	238		45
10	Glass	Neck & rim	2	18		50
10	Glass	Body sherds	13	94		50
10	Glazed-P	Base	4	52		50
10	Unglazed-P	Handle	4	56		50
10	Unglazed-P	Body sherds & rim	9	174		50
10	Unglazed-P	Body sherds	8	234		50
10	Bones	Body sherds	322	1403		50
11	Unglazed-P	Body sherds	7	130		55
12	Stone	Hammer	1	1490		60
12	Unglazed-P	Body sherds	24	110		60
Total			**722**	**16190kg**		

Appendix 9: Distribution of artefacts for ASH3

Spit	Ore	Type	No.	T weight	Layer	Depth (cm)
2	Unglazed-P	Base	2	2364	1	10
3	Unglazed-P	Body sherds	6	154		15
3	Glass	Body sherds	4	6		15
4	Unglazed-P	Body sherds	3	94		20
4	Glass	Body sherds & rim	1	6		20
5	Unglazed-P	Handle	1	102		25
5	Unglazed-P	Base	1	110		25
6	Unglazed-P	Body sherds	3	94		30
7	Unglazed-P	Body sherds	4	88		35
8	Unglazed-P	Body sherds	5	84		40
8	Unglazed-P	Handle	1	44		40
10	Unglazed-P	Body sherds	4	142	2	50
11	Unglazed-P	Handle	2	54		55
12	Unglazed-P	Body sherds	5	32		60
13	Unglazed-P	Body sherds	1	16		65
14	Glazed-P	Handle	1	16		70
15	Glass	Body sherds	1	2		75
20	Glazed-P	Body sherds	2	12		100
21	Unglazed-P	Body sherds	11	140		105
22	Unglazed-P	Body sherds	20	246		110
23	Unglazed-P	Base	3	38		115
24	Unglazed-P	Body sherds & rim	1	144	3	120
24	Unglazed-P	Handle	3	40		120
25	Glazed-P	Base	1	2		125
25	Glazed-P	Neck	1	2		125
26	Glazed-P	Body sherds	3	6		130
26	Glass	Body sherds & rim	2	12		130
27	Glass	Body sherds	10	16		135
27	Unglazed-P	Body sherds	10	66		135
27	Glazed-P	Body sherds	1	8		135
27	Unglazed-P	Body sherds &neck	1	16		135
28	Unglazed-P	Body sherds & rim	8	104		140
28	Unglazed-P	Body sherds	9	138		140
28	Unglazed-P	Base	3	446		140
28	Soapstone	Body sherds	6	190		140
28	Soapstone	Body sherds & rim	1	188		140
28	Soapstone	Body sherds	4	388		140
29	Unglazed-P	Body sherds	10	142		145
29	Soapstone	Base	1	574		145
29	Soapstone	Body sherds & rim	1	332		145
30	Unglazed-P	Base	8	2534		150
30	Soapstone	Body sherds	1	1054		150
30	Stone	Hammer	2	2112		150
30	Stone	Base	4	380		150
30	Bones	Horn	2	32		150
30	Unglazed-P	Body sherds	28	736		150
30	Glass	Base	2	8		150
Total			**204**	**13,514kg**		

Appendix 10: Distribution of artefacts for ASH4

Spit	Ore	Type	No.	T weight	Layer	Depth (cm)
1	Unglazed-P	Body sherds	28	1938		5
2	Unglazed-P	Body sherds & rim	7	696		10
2	Unglazed-P	Handle	1	40		10
3	Unglazed-P	Body sherds & rim	9	738		15
3	Unglazed-P	Rim	2	44		15
3	Unglazed-P	Head	1	26		15
3	Unglazed-P	Handle	4	164		15
3	Unglazed-P	Body sherds	15	930		15
4	Unglazed-P	Rim	3	68		20
4	Unglazed-P	Base	3	262		20
4	Glass	Body sherds	1	2		20
4	Slag	Body sherds	154	2345		20
4	Unglazed-P	Body sherds & rim	4	214	1	20
4	Slag	Body sherds (in furnace)	14	17065		20
4	Unglazed-P	Base	3	32		20
4	Unglazed-P	Body sherds	2	10		20
4	Stone	Hammer	1	1142		20
5	Unglazed-P	Base	7	420		25
5	Unglazed-P	Body sherds & rim	3	162		25
5	Glazed	Body sherds	2	70		25
5	Unglazed-P	Body sherds	38	1774		25
6	Glazed	Body sherds & rim	1	22		30
6	Unglazed-P	Body sherds	18	1366		30
6	Slag	Body sherds	654	12351		30
7	Unglazed-P	Base	4	246		35
7	Unglazed-P	Body sherds & rim	5	280		35
7	Unglazed-P	Body sherds	39	645		35
7	Unglazed-P	Body sherds & handle (in furnace)	1	232		35
8	Unglazed-P	Base	3	308		40
8	Unglazed-P	Body sherds & rim	11	556		40
8	Unglazed-P	Body sherds	21	424		40
8	Slag	Body sherds	55	1984		40
9	Unglazed-P	Body sherds & rim	10	402		45
9	Unglazed-P	Rim	3	100		45
9	Unglazed-P	Body sherds	54	2770	2	45
9	Glazed	Body sherds	2	8		45
9	Glass	Body sherds	2	4		45
9	Glass	Body sherds & rim	1	6		45
10	Unglazed-P	Body sherds & rim	8	1050		50
10	Unglazed-P	Base	2	22		50
10	Unglazed-P	Body sherds	86	3420		50
10	Unglazed-P	Rim	2	94		50
10	Slag	Body sherds (in furnace)	13	3739		50
11	Unglazed-P	Body sherds & rim	10	808		55
11	Unglazed-P	Body sherds	120	5915		55
12	Unglazed-P	Body sherds & rim	8	624		60
12	Unglazed-P	brick	8	4638	3	60
12	Unglazed-P	Body sherds	46	1524		60
12	Unglazed-P	Base	1	22		60
Total			**1490**	**71702kg**		

Appendix 11: Distribution of artefacts for MAS1

Spit	Ore	Type	No.	T weight	Layer	Depth (cm)
0	Unglazed –P	Body sherds	4	317	0	0
34	Unglazed –P	Body sherds	6	306	6	170
33	Unglazed –P	Body sherds & rims	2	246		165
36	Unglazed –P	Handle	2	14		180
Total			**14**	**883kg**		

Appendix 12: Distribution of artefacts for MAS2

Spit	Ore	Type	No.	T weight	Layer	Depth (cm)
5	Unglazed-P	Neck	1	714	1	25
11	Glazed-P	Body sherds	1	6	2	55
12	Glass	Body sherds	3	4		60
17	Unglazed-P	Body sherds	15	2006	3	85
18	Glass	Base	1	26		90
18	Unglazed-P	Base	37	1614		90
18	Unglazed-P	Body sherds	114	4816		90
18	Unglazed-P	Body sherds & neck	1	24		90
18	Unglazed-P	Handle	10	122		90
18	Glass	Body sherds	10	20		90
18	Glass	Body sherds	33	184		90
18	Shell	Body sherds	1	8		90
18	Soapstone	Body sherds	19	462		90
19	Glazed-P	Body sherds	3	164		95
19	Glazed-P	Base	2	190		95
19	Glazed-P	Rim	3	28		95
19	Unglazed-P	Body sherds & rim	18	1244		95
19	Unglazed-P	Body sherds	19	2424		95
19	Glass	Body sherds	12	12		95
19	Glass	Neck & rim	2	10		95
19	Slag	Body sherds	28	674		95
Total			**333**	**14752**		

Appendix 13: Studied samples of unglazed pottery (Trenches)

No.	Site	Spit	Part of item	Weight	Colour	Thick	Firing	Function	Shape	Feel	Core colour/impurities	Inclusions	Manuf.	Decoration
Type: Unglazed pottery in red paste (RP) with thick walls														
80	ASH1	3	bodysherd &neck	102	2.5YR 5/6 red	15	complete	jar	vertical elliptical body	rough	red. sand, limes. and small holes.	none	wheel	wavy lines sandwiched between two frieze; decoration applied by small cut
448	ASH1	5	bodysherd	38		10	complete	jar	horizontal or vertical elliptical body	harsh	reddish brown. 5yr. 5/3.	none	wheel	tiny parallel grooves; others wavy
356	ASH2	2	base	152		5-10	complete	censer	concave base	harsh	pink 5YR. 7/4. small lime and sand and organic	coated from the same colour in the core which covered the outside area and inside	wheel	none
486	ASH2	7	bodysherd	28		5-10	complete	censer	horizontal or vertical elliptical body	harsh	red. Small sand	none	wheel	a row of holed triangles between two eaves
394	ASH3	3	bodysherd	62		10	complete	jar	horizontal or vertical elliptical body	partially smooth	red. Small sand	wheel grooves and wet feeling by red colour	wheel	compacted chains under each other applied by insertion
397	ASH3	5	handle	102		20	complete	cooking pot	horizontal handle	harsh	red.	none	wheel	compacted triangles in the surface of handle and group of adjoining rhombuses at top and bottom of handle
423	ASH4	3	head	26		30	in complete	jug	conical	rough	same and small limes and sand and small holes	none	hand	none
427	ASH4	6	bodysherd	68		15	complete	cover	round	harsh	reddish brown. (5YR. 5/3). some organic materials	none	wheel	grooves and impressed finger tipping
433	ASH4	10	bodysherd & rim	262		5-15	complete	jar	flared rim	harsh	reddish brown (5YR. 5/3)	none	wheel	two wavy grooves in form of snake applied on top of rim
443	ASH4	7	bodysherd	42		5-10	complete	pot	horizontal or vertical elliptical body	smooth	red. lime, and sand small holes.	none	wheel	wheel parallel grooves on concave vertical lobes executed by fingers
476	MAS2	18	bodysherd	60		10	complete	censer	square	rough	reddish brown. Small holes	none	wheel	repeated triangles with small circular holes, sandwiched between four rows.
477	MAS2	5	neck	714		30	complete	canteen	cylindrical body and flared rim	harsh	brown	wheel grooves into inside	wheel	wavy grooves around the neck
Type: Unglazed pottery in colour of reddish yellow (RYP) with mid-thick walls														
10	ASH1	0	bodysherd	26	5YR 6/5 reddish yellow	10	complete	jar	horizontal or vertical elliptical body	harsh	RY. some sand grains and small holes	cuts and handy feel	wheel	parallel small grooves connected with wavy grooves as well as inclined grooves
11	ASH1	0	bodysherd & rim	40		10	complete	bowl	vertical rim and spherical body	rough	RY.	cuts	wheel	wavy grooves; between them, inclined lines
328	ASH2	2	handle	42		20	complete	jar	vertical handle	rough	RY. small holes and sandy	handy feel	hand	none
503	ASH3	18	Brick	2364		50	Complete	base for oven	square	harsh	none	none	mould	none
505	ASH3	2	Brick	2534		50	Complete	base for oven	square	harsh	none	none	mould	none
419	ASH4	2	bodysherd & rim	192		10	Complete	cooking pot	vertical elliptical body and flared rim	harsh	RY. small holes	none	wheel	wavy grooves on the top of rim
434	ASH4	10	bodysherd & rim	300		10-20	incomplete	cooking pot	vertical elliptical body and flared rim	rough	dark greenish grey (GLEY1. 4/1) and small holes, sand, and organic Ma.	From inside there are small straws by using some textiles for soft feeling	wheel	shark teeth grooves
437	ASH4	10	bodysherd & rim	94		12	complete	cooking pot	flared rim	rough	RY. looser fabric and small holes	none	wheel	snake grooves on the top of rim
460	MAS2	19	bodysherd & rim	194		10-15	complete	canteen	cylindrical body and flared rim	harsh	RY. small holes and sand	none	wheel	none
471	MAS2	17	bodysherd	300		15	incomplete	canteen	cylindrical body	rough	red (10R 6/5) mixed with dark greenish grey (glay1. 4/1). some organic, sand, and small holes	none	wheel	wavy grooves like snake below tape of holed circle
472	MAS2	17	bodysherd	118		10	complete	canteen	cylindrical body	harsh	very pale brown (10YR 8/4) some small holes and limestone	none	wheel	repeated wavy grooves like shark teeth below belt of small grooves.
Type: Unglazed pottery in dark paste (DP) with thin walls														
206	ASH2	5	bodysherd	56	7.5YR 5/4 brown	5-10	complete	jar	horizontal or vertical elliptical body	smooth	half is red 10R 5/6 and other is brown	cuts smoothly	wheel	small grooves in form of incomplete plant leaves
344	ASH2	3	bodysherd & rim	136	5YR 3/2 dark reddish brown	5	complete	jug	X	rough	DRB. clear of any impurities	handy feel	wheel	none
369	ASH2	3	bodysherd	16		5	incomplete	jar	rectangle	harsh	DRB. clear of any impurities	handy feel	wheel	decorative belt contains rhombus confined in a rectangular applied by mould.
395	ASH3	4	bodysherd	42	7.5YR 5/4 brown	10	complete	pot	horizontal or vertical elliptical body	harsh	light brown. some sand grains and small holes and	none	wheel	wavy grooves
441	ASH4	7	bodysherd	232	5YR 4/1 dark grey	10	complete	cover	Round	powdery	DG. small holes with some basaltic grains	none	hand	none
461	MAS2	18	bodysherd & rim	88	7.5YR 5/4 brown	10	complete	pot	vertical rim	rough	red. 2.5YR.5/6. Lime and sand,	none	wheel	shark teeth grooves, with a straight groove above to the rim

No.	Site	Spit	Part of item	Weight	Colour	Thick	Firing	Function	Shape	Feel	Core colour/impurities	Inclusions	Manuf.	Decoration
Type: Unglazed pottery in pale paste (PP) with thin walls														
34	ASH1	0	bodysherd & rim	3	10YR 6/3 pale brown	2	complete	cup	flared rim and cylinder body	smooth	light brown (7.5YR 6/4) sand grains and small holes	cuts and handy feel	wheel	opposite grooves meet in the head in form of tree leaves
167	ASH1	4	bodysherd &handle	20		3		jar	horizontal elliptical body		pale brown. Sand grains	cuts	wheel	none
168	ASH1	4	bodysherd &handle	18		3		jar	spherical body		pale brown. Sand grains	cuts	wheel	none
171	ASH1	4	handle	18		10		cooking pot	curved handle		light brown (7.5YR 6/4) and small holes and piece of ash	none	hand	none
175	ASH1	5	handle	22		5		pot	curved handle		pale brown. Compacted fabric	none	hand	none
447	ASH1	5	bodysherd	6		3		jar	horizontal or vertical elliptical body	rough	yellowish brown (10YR 6/4) and some sand	none	wheel	compacted grooves between parallel grooves
61	ASH1	1	base	52	7.5YR 8/2 Pinkish White	1-3		jar	flat base	partially smooth	PW. Sand grains with small holes	none	wheel	none
450	ASH1	4	base	18		2-5		jar	flat base		same and free of impurities except some small holes	very fine cut none	wheel	none
160	ASH1	4	bodysherd	48	10YR 8/3 very pale brown	5		jar	horizontal elliptical body		VPB. clear of impurities	none	wheel	decorative belt consists of lobes (oval oblique) and hollow inside, many blind holes at the base of lobes, under there are two eaves. these decorations implemented by using a mould and a pointed tool.
162	ASH1	4	bodysherd	40		5		pot	horizontal elliptical body		Light yellowish brown (10YR. 6/4) sand grains and small holes	none	wheel	belt of decoration contains of chains of come teeth
309	ASH2	12	bodysherd	18	10YR 6/3 pale brown	3		jar	horizontal or vertical elliptical body	smooth	brown (7.5YR 5/4) sand stone	cuts	wheel	none
327	ASH2	2	handle	30		15		Canteen	vertical handle		light brown (7.5YR 6/4) small holes	none	hand	none
334	ASH2	7	handle & bodysherd	34		4		jar	vertical elliptical body and curved handle	rough	brown (7.5YR 5/4) some small sand and clean	colour inside is the same of core and there are stadium cuts	wheel	grooves separated by trappings of plant leaves in form ×
349	ASH2	4	bodysherd & rim	6		2		cup	vertical rim	smooth	PB. Clear fabric only some small holes	cuts	wheel	none
351	ASH2	10	bodysherd & rim	8		2		cup	vertical rim	partially smooth	PB. Clear fabric only some small holes	cuts	wheel	wavy grooves
365	ASH2	3	bodysherd & neck	10		4		cup	cylindrical body and flared rim	rough	PB. free of impurities	cuts	wheel	none
484	ASH2	5	bodysherd & neck	22		4		jar	vertical elliptical body	partially smooth	yellowish brown (10YR 6/4). some organic and ash with small holes	inside there are cuts by wheel and outside coated from the colour motioned	wheel	inclined lines among grooves around the neck
485	ASH2	6	bodysherd	10		4		jar	horizontal or vertical elliptical body	smooth	yellowish brown (10YR 6/4) and some sandy atoms	none	wheel	grooves around neck between them repeated decoration in form of X
332	ASH2	5	handle	20	7.5YR 8/2 pinkish White	4		cooking pot	curved handle	partially smooth	PW. no impurities and small holes	none	hand	none
359	ASH2	6	base	14		5		jug	flat base and cylinder body	rough	PW colour and no impurities	none	wheel	none
361	ASH2	9	base	26		5		jug	flat base and vertical elliptical body	rough	PW and free of impurities	none	wheel	none
362	ASH2	8	base	20		5		jar	flat base	rough	PW and free of impurities	none	wheel	none
301	ASH2	3	bodysherd	22	10YR 8/3 very pale brown	5		jar	pear body	partially smooth	VPB. And very clean from any impurities	none	wheel	grooves in the form of straight lines and the other curved separated by floral forms
303	ASH2	6	bodysherd	10		5		jar	horizontal or vertical elliptical body	smooth	light yellowish brown (10YR. 6/4) and clean from any impurities	none	wheel	parallel grooves over a row of triangles
385	ASH3	27	base	4	10YR 6/3 pale brown	2		cup	flat base and elliptical body	smooth	light brown (7.5YR 6/4) no industries	cuts and textiles	wheel	none
375	ASH3	29	base	48	2.5Y 8/3 pale yellow	1		cup	flat base	very smooth	PY and clean from impurities	none	wheel	none
379	ASH3	28	bodysherd & rim	4		2		cup	cylindrical body and vertical rim	smooth	PY. clear of any impurities	cuts	wheel	tiny grooves under straightforward lines
480	ASH4	4	bodysherd & base	10		5		cup	desk base	very smooth	PY. clean of impurities	fine cuts	wheel	none
470	MAS2	18	handle	32	10YR 8/3 Very pale brown	10		jar	curved handle	smooth	light brown (7.5YR 6/4) no industries	none	hand	none

Appendix 14: Studied samples of glazed pottery (Trenches)

No.	Site	Spit	Part of item	Weight	Thick	Firing	Function	Shape	Feel	Core colour/impurities	Inclusions	Manuf.	Decoration
Type: The alkaline glaze (AG)													
188	ASH1	4	base	12	7	complete	bowl	flat	rough	10YR 6/4 light yellowish brown; some small holes and sand grains	none	wheel	none
189	ASH1	5	bodysherd	24	10		jar	ovoid	partially smooth	2.5Y 8/2 pale yellow and it has small holes	outer surface is coated in bluish grey and inner is the same core colour		none
199	ASH1	4	bodysherd & rim	30	5		bowl	horizontal ovoid	rough	7.5YR 7/3 pink. atoms of lime and sand grains and small holes	both surfaces are coated in green alkaline layer.		decorations in the form of ropes dangle toward the base
431	ASH4	5	bodysherd	62	6		jar	ovoid	partially smooth	10YR. 8/4 very pale brown. small holes and sand grains	both surfaces coated in blue alkaline		outer surface, compacted ropes under each other.
449	ASH1	4	handle	12	15		jar	Cylindrical	rough	10YR 6/4 light yellowish brown. some holes and sand grains	both surfaces coated in greenish grey layer		none
455	MAS2	19	bodysherd & base	110	10		jar	disk base and vertical ovoid	rough	10YR. 8/3 very pale brown some sand grains	both surfaces covered by pale green layer		none
192	ASH1	3	bodysherd	22	5		canteen	vertical rim	rough	5YR. 6/4 light reddish brown. some sand grains	both surfaces coated in dark yellowish brown		horizontal grooves on the same paste
Type : The coated glaze pottery (CG)													
322	ASH2	5	bodysherd & base	66	10	complete	plate	flat base	rough	5YR. 6/4 light reddish brown. loose clay with many small holes.	outer side coated in green layer and inner coated with thick pale yellow layer	wheel	web lines toward the centre of plate painted by brush with brown and green
323	ASH2	5	bodysherd & rim	54	9		bowl	flared rim		5YR. 6/4 light reddish brown. loose clay with many small holes.	outer side coated in very pale brown layer and near the rim, inner coated with pale yellow layer.		lattice lines toward the centre of plate painted by brush with brown and green
324	ASH2	5	bodysherd & rim	26	9		bowl	flared rim		5YR. 6/4 light reddish brown. small holes.	both surfaces coated in olive layer.		network lines toward in the centre of bowl painted by brush with dark brown
354	ASH2	3	base	18	5		bowl	flat base		5YR. 6/4 light reddish brown. And loose clay with many small holes	both surfaces coated in olive yellow and splash of green		wheel grooved on the main paste.
368	ASH2	6	bodysherd	14	9		bowl	oval		5YR. 6/4 light reddish brown some small bits of stone	outer side coated in layer of light yellowish brown and inner side by partially with the same outer colour and pale green		brown parallel lines
451	ASH1	3	base	38	10		cup	concave base		reddish brown. 5YR. 5/3. some small pits and sand grains	wheel grooves in outer side, and layer of olive yellow in the inner side		none
490	ASH1	3	bodysherd & rim	96	3		jar	pear		7.5YR. 5/6 strong brown. small holes.	outer surface coated with dark yellowish brown under the layer of glazed attached with handle		wheel point parallel grooves on the same paste, as well as vertical lines panted by very dark brown
321	ASH2	6	bodysherd & rim	2	5	complete	bowl	vertical rim	rough	5YR. 6/4 light reddish brown. some holes and sand grains	both surfaces coated in pale yellow	wheel	inner surface, network painted in dark brown by brush
386	ASH3	26	bodysherd	8	5		bowl	oval	partially smooth	5YR. 6/4 light reddish brown. some small holes and atoms of lime	both surfaces coated in very pale brown with points green		paralleled lines pained by feeling in dark green
456	MAS2	19	bodysherd & rim	186	10		jar	horizontal ovoid body and vertical rim	partially smooth	10YR.6/1gray. some sand grains	both surfaces covered by light olive brown		none
463	MAS2	18	bodysherd	6	7		jug	horizontal ovoid body	partially smooth	5YR. 6/4 light reddish brown. some small holes and sand grains	both surfaces coated in pale brown		none
478	MAS2	10	bodysherd & rim	36	6		jug	vertical rim and cylinder body	rough	7.5YR 7/4 pink. some holes and much of sand	both surfaces coated in milky.		in outer surface, belt of overlapping rhombuses under each other. executed by mould
493	ASH2	0	bodysherd & rim	12	5		bowl	vertical rim	rough	5YR. 6/4 light reddish brown. some small holes and sand grains	both surfaces coated in pale olive		none
Type: The lusterware glaze (LG)													
187	ASH1	4	base	52	5	complete	bowl	concave base.	rough	5YR. 6/4. light reddish brown. small holes and some sand grains.	both surfaces coated in milky layer with glory grains	wheel	lines panted by small brush with brown colour in forms *mutakateah*.
186	ASH1	4	base	30	7		bowl	trumpet for circular base	rough	5YR. 7/4 pink. small holes and sand grains	Inner surface is coated in milky layer with glory grains and brown lines. outer is coated in olive layer		in inner surface there is circular network painted with brown colour surrounded by two outer circles coated in pale green. and all the previous decoration implemented on shiny silver ground
314	ASH2	3	bodysherd	2	5		plate	ovoid	smooth	5YR. 7/4 pink.	both surfaces coated in shiny silver layer		in the inner surface, overlapping oval shapes of various sizes might be form is eye of fish painted by olive colour on the
320	ASH2	6	bodysherd	8	3		bowl	ovoid	smooth	5YR. 7/4 pink. few small rocks	both surfaces coated in soft grey ground		decorations in the form of a butterfly wings panted in pink, pale yellow and olive implemented professionally
392	ASH3	10	bodysherd & rim	8	5		bowl	vertical rim	smooth	2.5y. 6/3 light yellowish brown.	both surfaces coated in soft olive layer with golden lines.		green splashes surrounded by hue yellow line implemented on the smooth olive yellow ground for both surfaces
452	ASH1	4	bodysherd & rim	28	5		bowl	rim is introverted into inside	rough	5YR. 7/4 pink. small holes and sand grains	inner surface is covered by on the milky ground		dangling lines to the centre of the pot painted with a brush a thin brown and green on the floor of shiny silver colour. as plating the outer surface venting ground colour

No.	Site	Spit	Part of item	Weight	Thick	Firing	Function	Shape	Feel	Core colour/impurities	Inclusions	Manuf.	Decoration
459	MAS2	18	base	40	5		bowl	concave base.	rough	5YR. 7/4 pink. small holes and sand grains	outer surface is covered by white ground		overlapping triangles emanating from a central circle panted by small brush with brown colour. many of the decorative layer removed by natural impact, while there is a clear gloss on the inner surface
Type: The tin glaze (TG)													
196	ASH1	5	bodysherd & rim	8	3	complete	plate	plain rim	smooth	2.5Y 8/3 pale yellow.	both surfaces coated in grey	wheel	decorative belt on the inner surface consists twigs branches of foliage painted in dark blue
200	ASH1	4	rim	10	4		bowl	flared rim		2.5Y 8/3 pale yellow. clean of impurities	both surfaces coated in tin layer		green splash separating on the rim in both surfaces
318	ASH2	4	bodysherd	16	5		bowl	ovoid		10YR. 8/8 yellow. some small sand grains and lime.	both surfaces coated in tin layer		none
432	ASH4	6	bodysherd & rim	22	5		bowl	flared rim		10YR. 7/4. very pale brown. some grains of sand and lime. some holes	both surfaces coated in tin layer		none

Appendix 15: Studied samples of soapstone (Trenches)

No.	Site	Spit	Part of item	Weight	Sort	colour	Thickness	Function	Shape	Feel	Inclusions	Manufacturing	Decoration
63	ASH1	1	base	52	soapstone	grey	4	pot	flat base vertical body	powdery	none	cut	none
64	ASH1	1	base	26		grey	4	pot	flat base vertical body				
292	ASH2	6	bodysherd	28		grey	4-9	pot	vertical ovoid body				
350	ASH2	2	bodysherd & rim	36		grey	4-9	pot	vertical ovoid body and vertical rim				
497	ASH2	4	base & bodysherd & rim	622		grey	7	pot	flat base and rounder body and vertical rim				
374	ASH3	30	base & bodysherd	252		grey	4-9	pot	flat base vertical body		lateral handle		
499	ASH3	29	bodysherd & rim	332		grey	7	pot	vertical rim		some holes		
469	MAS2	18	bodysherd & rim	188		grey	6	pot	vertical rim	powdery		cut	

Appendix 16: Studied samples of glass (Trenches)

No.	Site	Spit	Part of item	Weight	Colour	Thick	Firing	Function	Shape	Core colour/impurities	Inclusions	Manufacturing	Decoration
56	ASH1	1	handle	6	olive	5	Complete	cup	spherical	olive. free of impurities	covered by sandy layer	hand	none
43	ASH1	0	bodysherd	2	pale green	2		cup	and flared rim	PG. free of impurities	none	blown into mould	none
182	ASH1	5	bodysherd & rim	12	pale green	4		bottle	cylindrical concave neck and flared rim	PG. free of impurities		blown into mould	none
183	ASH1	4	bodysherd & rim	6	pale green	2		bowl	horizontal ovoid body and vertical rim	PG. free of impurities		blown into mould	none
184	ASH1	4	bodysherd & rim	10	pale green	2		bowl	horizontal ovoid body and vertical rim	PG. free of impurities		blown into mould	deep grooving
185	ASH1	4	bodysherd	2	pale green	2		bowl	horizontal or vertical ovoid body	PG. free of impurities		blown into mould	none
491	ASH1	3	base	66	pale green	2		bottle	flat base and cylindrical body	PG. free of impurities		free blowing	none
492	ASH1	3	base	44	pale green	2		bottle	flat base and cylindrical body	PG. free of impurities		free blowing	none
335	ASH2	9	base	6	pale yellow	1		bottle	flat base and vertical body	PY. free of impurities		blown into mould	none
336	ASH2	9	base	6	pale yellow	2		cup	flat base and vertical body	PY. free of impurities		blown into mould	none
338	ASH2	10	neck & rim	14	pale green	3		bottle	cylindrical concave neck and flared rim	PG. free of impurities		blown into mould	none
339	ASH2	10	bodysherd & rim	8	pale green	1		bowl	vertical ovoid	PG. free of impurities		blown into mould	intersecting lines and holes like comb teeth
495	ASH2	5	base	92	pale green	2		bowl	flat base and horizontal ovoid body	PG. free of impurities		free blowing	none
281	ASH3	3	rim	2	pale green	1		cup	flared rim	PG. free of impurities		blown into mould	none
381	ASH3	27	bodysherd & rim	2	pale green	1		cup	flared rim	PG. free of impurities		blown into mould	raised grooving
383	ASH3	25	neck	2	pale green	2		bowl	cylindrical neck and flared rim	PG. free of impurities		blown into mould	deep grooving
387	ASH3	26	bodysherd & rim	4	pale green	2		bowl	horizontal ovoid body and vertical rim	PG. free of impurities		blown into mould	deep grooving
399	ASH3	5	neck & rim	6	pale green	2		bottle	flared rim	PG. free of impurities		free blowing	none
462	MAS 2	18	bodysherd & rim	10	pale green	3		bottle	pyramidal neck and vertical rim	PG. free of impurities		blown into mould	none
482	MAS 2	19	neck & rim	6	pale green	1		bottle	cylindrical neck and flared rim	PG. free of impurities		blown into mould	none
489	ASH4	30	base	8	dark blue	1	Complete	bottle	Protruding to inside base	DB. free of impurities	none	free blowing	none
496	ASH4	9	bodysherd & rim	6	dark blue	2		bowl	horizontal ovoid body and flared rim	DB. free of impurities	outer surface is coated in black layer	blown into mould	
458	MAS 2	18	base	26	dark blue	7		plate	flat base	DB. free of impurities	both surfaces covered by grey layer		
464	MAS 2	18	bodysherd & rim	10	dark green	2		bowl	horizontal ovoid body and flared rim	DG. free of impurities	outer surface is coated in black layer		
483	MAS 2	19	bodysherd & neck	4	dark blue	2		bottle	horizontal ovoid body and cylindrical neck	DB. free of impurities	none		

Appendix 17: Archaeological sites used in comparative study

N	Site name	Site number	Archaeological area	Region
1.	Athar	(none)	Southern area	Jazan
2.	al-Serein	(none)	Southern area	al-Qunfidah
3.	al-Mabiayat	204/43	Northwestern area	al-Madinah
4.	al-Rabazah	(none)	Northwestern area	al-Madinah
5.	Faid	206/03	Northern area	Hail
6.	Dharyah	(none)	Central area	al-Qasim
7.	AlQaa	(none)	Northern area	al-Hodoalshamlyah
8.	al-Okdod	168/217	Southern area	Najran
9.	al-Kharj	207/21	Central area	Riyadh
10.	Zabala	(none)	Northern area	al-Hodoalshamlyah
11.	Jarash	217/118	Southern area	Asir
12.	al-Noqrah S	205/1001	Western area	al-Madinah
13.	al-Noqrah N	(none)	Western area	al-Madinah
14.	Tablah	(none)	Southern area	Asir
15.	SirAbaal	217/155	Southern area	Asir
16.	al-Mawan site	(none)	Western area	al-Madinah
17.	Haql	(none)	Northern area	Tabuk
18.	Mahdalzahb	210/64	Western area	al-Madinah
19.	Ghoraba	(none)	Western area	Taif
20.	al-Qway'eia	84/212	Central area	Riyadh
21.	Wadha site	206/79	Western area	Riyadh
22.	Umm Hoytat	204/1012	Northern area	Tabuk
23.	al-Jar	(none)	Western area	al-Madinah
24.	al-Deafi	163/208	Eastern area	al-Sahrqyah
25.	al-Sharja	217/172	Southern area	Jazan

List of Abbreviations

AG	Alkaline glaze
AH/BH	After/Before Hijrah (the Islamic calendar, dating from July 622 CE)
AMS	Antiquities and Museums Sector
ATLAL	The Journal of Saudi Arabian Archeology
BMPW	Bureau of Mines and Public Works
BMPW	Bureau of Mines and Public Works
CASP	Comprehensive Archaeological Survey program
CUG	Coated glaze pottery
DGMR	Directorate General of Mineral Resources
DGOM	Directorate General for Oil and Minerals
DMAM	Deputy Mister for Antiquities and Museums
DMMR	Deputy Ministry for Minerals and Resources
DP	Unglazed pottery in dark paste
GDAM	General Directorate of Archaeology and Museums
KSA	Kingdom of Saudi Arabia
LG	Lusterware glaze
PP	Unglazed pottery in pale paste
RP	Unglazed pottery in red paste
RYP	Unglazed pottery in reddish yellow paste
SAMS	Saudi Arabian Mining Syndicate
SCTA	Saudi Commission for Tourism and Antiquities
SGS	Saudi Geological Survey
TG	Tin glaze
USGS	United State Geological Survey

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