

VI- Conclusion:

In sum, the Timna site is considered one of the significant mines of copper that the ancient Egyptians controlled and used economically during the New Kingdom Period. Then, the site was reused during the Roman Period. Evidently, the technique, methods, workers, tools, inscriptions, documents, cult objects and deities were Egyptians. No archaeological evidence indicates the economic or military authority of King Solomon in the area. From this point of view, the Timna site has been a part of the native Egyptian land since the beginning of its ancient history, not an occupied territory for a short time. Mainly, the Timna site is located just 25km east of the modern political border of Egypt.

Ancient Egyptians knew this site since the Prehistoric Period, according to discoveries such as a simple bowl furnace (diameter c. 35cm) consisted of large local blocks dated to the Early Chalcolithic Age⁽¹⁾

All the workers of the Timna mine were Egyptians. Even so, the service assistants, who prepared foods for the mine's workers, were Egyptians. For example, one of those assistants was Ramses[m]pr[Rē], who held the title *wb3-nsw* 'royal butler' according to an undated rock graffito⁽²⁾.

In the Pap. Harris I, King Ramses III says: "(408) I sent forth my messengers to the mount of Atika, to the great copper mines which are in this place... these mines were found abounding in copper, it was loaded by ten thousand into their galleys; in order to send them to Egypt." The Atika site could be identified as Timna; because:

a) The name of *h3st ʿtk* 'Mount of Atika', which is mentioned in Pap. Harris I, 78, 1/2, the name of *TK* 'Atak' that appears in 1 Samuel 30, 30 as a copper mining area⁽³⁾.

b) The discovered cartouche of King Ramses III in the Timna mine (cf. supra) indicated the authority of this king on the Timna site, which was the primary mine of copper raw. On the other hand, Ramses III himself is the king of the Harris Papyrus events.

Accordingly, Harris Papyrus speaks about *h3st ʿtk* 'Mount of Atika' as the principal mine of copper raw, which we could simulate with the Timna mine.

"Das Expeditionswesen im ägyptischen Neuen Reich. Ein Beitrag zu Rohstoffversorgung und Aussenhandel", *SAGA* 21, 2002, S.3.

(1) A. HAUPTMAN and I. WAGNER, "Prehistoric Copper Production at Timna", in: *Metals and Mines. Study in Archaeometallurgy*, (eds.) D. HOOK and Others, London, 2007, p.67. J. HEEB and B.S. OTTAWAY, "Experimental Archaeometallurgy", in: B.W. ROBERTS, C.P. THORNTON (Eds.), *Archaeometallurgy in Global Perspective: Methods and Syntheses*, New York - London, 2015, 169, fig. 8.8.


(2) A.R. SCHULMAN, The Royal Butler Ramessesemperrē', *JARCE* 13 (1976), p.117.

(3) L. NIBBI, "A note on Atika/Attāka/Tāka and Copper", *DE* 32 (1995), p.74.

In 1962, an archaeological investigation of the Old Kingdom town of Buhen revealed some copper ore fragments produced in an old copper factory.¹ The results show the existence of the copper mineral in the ore materials⁽¹⁾. Since the 12th Dynasty, metals seem to have been exclusively monopolies of the royal court; because the mine management was entrusted to the high officials and princes, according to the texts discovered at many sites in Sinai⁽²⁾. Recent studies, however, have shown that the Egyptians of the late Middle Kingdom were conversant with Hmty km, the "black copper" of the ancient world, which current historians sometimes misidentify as "niello"⁽³⁾.

During these periods, copper was partially used to create artworks such as needles, tools, statues, weapons, costly ornaments, and cult objects⁽⁴⁾. The growing need for copper for the industry during the New Kingdom forced the Egyptians to discover new mines of copper more and more. Timna mine is one of the best copper extraction sites⁽⁵⁾. Evidently,

during 1400 years at about 10.000 Tons that is 7.7 Tons a year. See R.J. FORBES, *Metallurgy in Antiquity: A Notebook for Archaeologists and Technologists*, Leiden, 1950, p. 325; R.J. FORBES, *Studies in Ancient Technology*, Leiden, 1964, p. 44.

The reading of  *bi3* is possible *biA rwD*, but *xmt* (not *Hmty*) as well. This term, might refer to a three-stage production process. A. Nibbi, "Some Remarks on Copper," *JARCE* 14 (1977), pp. 59-66.

(1) See EL-S. EL-GAYAR and M.P. Jones, "A Possible Source of Copper Ore Fragments Found at the Old Kingdom Town of Buhen", *JEA* 75 (1989), p.31.

(2) R.J. FORBES, *op.cit.*, p.59; A. SHAHEEN, (In Arabic) *Sinai Peninsula. A historical and archaeological study until the End of the Middle Kingdom*, MA, Faculty of Archaeology – Cairo University, Unpublished, 1981, p.113 ff; P. Tallet, *op.cit.*, p.459.

(3) This is a copper-based alloy with trace quantities of gold, silver, and sometimes arsenic that develops a black patina following chemical treatment. Cf. A. GIUMLIA-MAIR and S. QUIRKE, "Black Copper in Bronze Age Egypt," *RdE* 48 (1997), pp. 95-108.

(4) S.A. SALEH, "Treatment and Restoration of a Corroded Copper Mirror", *MDAIK* 39, 1983, p.177.

(5) S. AUFRERE and Others, *L'Égypte restituée. Sites et temples des déserts. De la naissance de la civilisation pharaonique à l'époque gréco-romaine*, Paris, 1994, p.202; Th. Hikade,

globules after separating them mechanically from the slag-copper mixture. Then, this product is transported away to another unknown location (beside the site?), transforming it into objects such as implements, weapons, ornaments, royal or funeral productions⁽¹⁾.

V-4- Workers of the Timna mine:

W.A. Ward proved that the material refers to the Egyptian relations with Palestine-Syria and the Aegean world. It can be divided into the Pre-dynastic and Proto-dynastic Periods and the Old Kingdom⁽²⁾. Some scholars, including J. Černý and J.D. Muhly, concluded that the Ancient Egyptians did not extract copper but imported it from Greece (cf. infra). Additionally, M. Delcor declares that the workers of this mine were foreigners, not Egyptians⁽³⁾.

Otherwise, I am not of the previous opinion because metals, particularly copper, are found in many Egyptian sites like the Sinai Peninsula, Wadi Dara in the Eastern Desert, and Elephantine⁽⁴⁾. Up to the 3rd millennium B.C., the Egyptian workers had good knowledge of copper ores that they called / *bi3* "copper" in addition to the processes of the metal extracting that they called *bi3/hmt* "mine"⁽⁵⁾.

(1) J. OGDEN, *op.cit.*, p.150.

(2) W.A. WARD, "Egypt and the East Mediterranean From Predynastic Times to the End of the Old Kingdom," *Journal of the Economic and Social History of the Orient* 6 (1963), pp. 1-39.

(3) M. DELCOR, "Une allusion à 'Anath, déesse guerrière en Ex. 32:18?", *Journal of Jewish Studies* 33 (1982), pp.158-160.

(4) N. GRIMAL, "Travaux de l'Institut français d'archéologie orientale en 1993-1994," *BIFAO* 94 (1994), pp.423-434; A. ABD el-FATTAH, (In Arabic) *Mines and quarries in ancient Egypt*, Ph.D., Faculty of Arts - Tanta University, 2000, pp.25-27; W.M. Safai, (In Arabic) *Copper in Ancient Egypt from the Beginning of its appearance to the End of Archaic Period*, MA, Faculty of Archaeology – Cairo University, Unpublished, 2003, 12-14.

(5) *Wb.* III, 99; K. SETHE, "Hitherto unnoticed evidence regarding copper works of art of the oldest period of Egyptian History", *JEA* 1, 1914, 234 (n.2); W.C. HAYES, "The Pre-Dynastic Cultures of Upper and Middle Egypt", *JNES* 32 (1964), p. 273; B. ROTHENBERG, *Excavations at Timna Site* 39, p.4. A. Lucas calculated the total copper output of Egypt (including Sinai)



(Fig. 24)

A faience object bears Hathor name and title(1)



(Fig. 25)

A Ramesside scarab from Timna site(2)

The nature of these finds indicates the actual existence of ancient Egyptians on this site. On the other hand, there are no manufacturing tools in the extraction sites of the copper at Timna. A small copper awl was found at Site 375, but it was made of different copper components, slag and cuprous oxide, from Timna mine⁽³⁾. It seems possible that the Site of Timna was just the primary producing place to extract the copper

(1) *Ibid.*, figs. 86-87.

(2) *Ibid.*, figs. 46-47.

(3) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p. 238.

V-3- More Discoveries in Timna Mine:

The archaeological work discovered many pieces at the Timna mine site, such as:

- The Menat fragment has a cartouche with Ramses II's name.
- Copper items
- Gold leaf.
- A few stone heads
- A seal from Egypt.
- A faience Hathor mask with her typical cow's ears (fig. 23).
- A faience object bears Hathor's name and title *Ht-hr, nbt mfk3t* "Hathor, Lady of the Turquoise" (fig. 24).
- Faience sistrum handle fragment⁽¹⁾.
- A fragment of the Merenptah cartouche⁽²⁾.
- A Ramesside scarab with an engraved base depicting a walking sphinx. Above there is hieroglyphic writing *ntr nfr* "the good god,"⁽³⁾ (fig. 25).



(Fig. 23)

A faience Hathor mask⁽⁴⁾

(1) B. ROTHENBERG, *op.cit.*, figs. 82.

(2) *Ibid.*, fig. 85.

(3) A.J. WILSON, "Timna's Ancient Mining Secrets", *Optima* 26, No. 1 (1976), p. 56.

(4) B. ROTHENBERG, *op.cit.*, fig. 89.



(Fig. 21)

The previous scene in details from the Theban tomb of the vizier Rekhmira (TT 100)



(Fig. 22)

A scene from the Theban tomb of the vizier Rekhmira (TT 100) shows making needles of copper⁽¹⁾

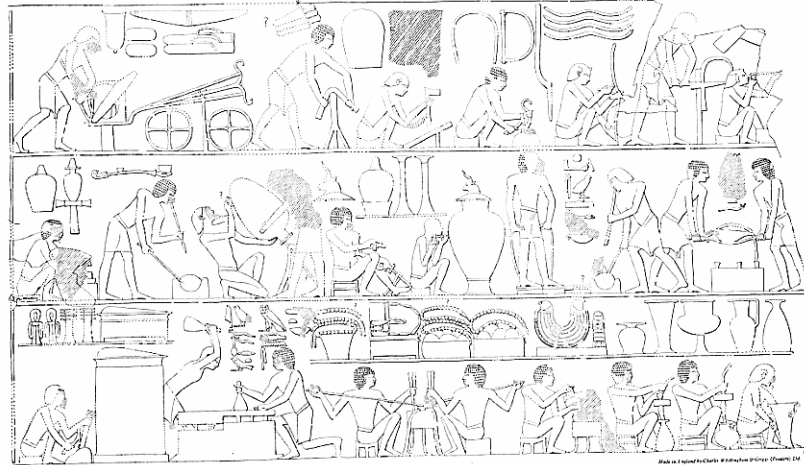
The Ramesside smelting furnace was also in the bowl style, but it was built into a unique hollow and was provided with tubing for two bellows:

- a) One is penetrating diagonally through the furnace's back wall.
- b) One is to go horizontally through the furnace's front wall.

This process caused an increase in furnace capacity in addition to copper production⁽²⁾. It must be noted that the depicted furnaces have the same shape as Timna furnaces.

(1) P.E. NEWBERRY, *op.cit.*, pl.25.

(2) *Ibid.*, p.110.



(Fig. 19)

A scene from the Theban tomb of Theban tomb of Puyemra (TT.39), showing metal-working and artefacts(1)



(Fig. 20)

A scene from the Theban tomb of the vizier Rekhmira (TT 100) (2)

(1) N.-G. DAVIES, *The tomb of Puyemrê at Thebes*, I, New York, 1922, 70-71, pl.23.

(2) P.E. NEWBERRY, *The life of Rekhmara, vezîr of Upper Egypt under Thothmes III and Amenhetep II (circa B.C. 1471-1448)*, Westminster, 1900, pl.28; H.-G. BACHMANN und B. ROTHENBERG, Die Verhüttungsverfahren von Site 30", in: *Antikes Kupfer im Timna-Tal. 4000 Jahre Bergbau und Verhüttung in der Arabah*, Bearbeiter: H.G. CONRAD und B. ROTHENBERG, Bochum, 1980, S. 230, Abb. 257.

furnace was filled up with smelting liquid, the copper and the slag were calm inside. In order to have the product of copper, the workers must break the vertical white sandstone walls of a furnace with stone hammers and copper nodules to extract the pure molten copper. By the previously mentioned method, about 20 kg of nodules could be mined by one man in a day's work, enough to produce 2-4 kg of refined copper. The copper and iron ore blend took place in the saucer-shaped hollows on the slopes next to the actual mining walls, where many grinding implements were found⁽¹⁾. The sand inside these hollows showed 0.1 to 0.25 per cent copper and 5-12 per cent iron⁽²⁾. It is noted that the amount of copper produced by one furnace was between 70 and 100 liters of copper per day⁽³⁾.

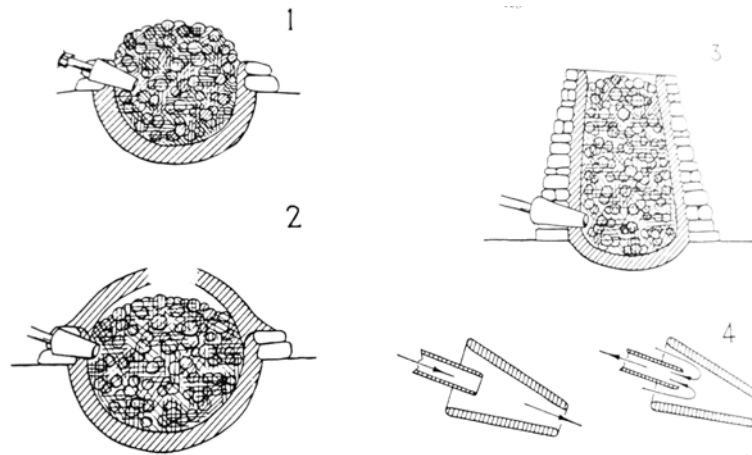
This method of the smelting process in these furnaces was similar to the ancient Egyptian method and furnaces depicted in the tombs' scenes during the New Kingdom Period. For example, there is a scene from the Theban tomb of Puyemra, the second priest of Amun, mid-Dynasty 18 (TT.39), (fig. 19), in addition to another scene from the Theban tomb of the vizier Rekhmira (TT.100), (figs. 20-22). They are showing metalworking by using heating⁽⁴⁾.

(1) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, pp. 230, 235. Twelve iron objects found in the temple of Hathor at Timna in the Sinai, which dates from the 19-20th Dynastie. Lead isotope analysis has shown that the iron objects are clearly a local product. The iron metal from which they are made was a rare and accidental by product of copper smelting and refining at Timna. See N. GALE and Z. STOS-GALE, "The 'Fingerprinting' of Metals by Lead Isotopes and Ancient Iron Production at Timna", *DE 1* (1985), pp.7-15.

(2) B. ROTHENBERG, *op.cit.*, p. 230.

(3) *Ibid.*, p. 236.

(4) J.F. MERKEL, "A Laboratory Reconstruction of Late Bronze - Early Iron Age Copper Smelting in the Arabah", in: *Midian, Moab and Edom. The History and Archaeology of Late Bronze and Iron Age Jordan and North-West Arabia*, (Eds.) J.F. A. SAWYER and D.J.A. CLINES, Sheffield, 1983, pp.125-128; J. OGDEN, *op.cit.*, pp.151, 156, Fig. 6.2.



(Fig. 18)

Tuyaeres in the smelting furnaces(1)

6) The smelting process in the Timna mine:

Briefly, let us discover how the copper was produced from copper ores through the archaeological remains of the Timna Site. The smelting process started with finely ground copper ores mixed in the correct proportions with iron, manganese oxides, seashells, and limestone, without any previous roasting process⁽²⁾. According to the analyses of the slag of Site 39 B at Timna, the copper ores contained silica and iron oxide that were added intentionally to the smelting process to facilitate the separation of the metallic copper from this gangue⁽³⁾. A minimal amount of water was possibly added to the process to palletize it and prevent the fine raw material from flying away. This product was poured into the open top of the smelting furnace onto a charcoal fire where the ore was reduced to metallic copper. The heavy metallic copper globules tended to sink through the fluid slag to the bottom of the smelting furnace. After the

(1) B. ROTHENBERG, "Copper Smelting Furnaces, Tuyaeres, Slags, Ingott-Moulds and Ingots in the Arabah: The Archaeological Data", p.39, fig.56.

(2) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p. 235.

(3) B. ROTHENBERG, *Excavations at Timna Site 39*, p.9.

forced through the tuyere is positioned at the junction of the dug-in bottom part of the hearth with the superstructure, approximately 20 cm above the furnace bottom⁽¹⁾. This type of furnace was known and used by Ramesside metalworkers at the Qantir site in the Delta⁽²⁾. The pot bellows were 6 liters in capacity⁽³⁾. Pumping the foot-operated pot bellows at a rate sufficient for adequate combustion was not too exhausting. A rate of 60 strokes per minute was easily sustainable for 20-30 minutes. With fast pumping by agile workers, a single set of well-constructed pot bellows may have reached a maximum of about 500 liters per minute⁽⁴⁾.

The use of valves in the leather tops of the experimental pot bellows caused a significant improvement in the airflow rate. This type of ventilation appliance must have been used as the temperatures reached in the discovered furnaces were 1180 – 1350°, which could not have been obtained without using an air blast to segregate the copper from the slag. The furnace itself showed intense heat at least 50 cm around it (fig. 18)⁽⁵⁾. This state would require artificial ventilation to keep the furnace hot, and the use of prevailing wind could also infringe on the maintenance of the proper reducing atmosphere⁽⁶⁾.

(1) B. ROTHENBERG, "Copper Smelting Furnaces, Tuyeres, Slags, Ingott-Moulds and Ingots in the Arabah: The Archaeological Data", p.109.

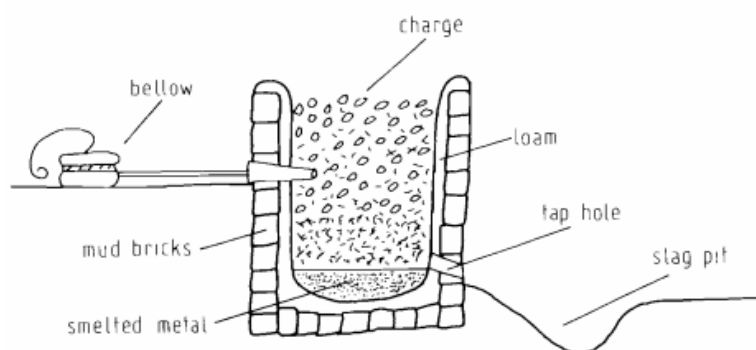
(2) J. OGDEN, *op.cit.*, p.168.

(3) B. ROTHENBERG, *op.cit.*, p.109. In spite of the large-scale Egyptian mining and smelting activities at Timna, Sinai, no bellows have come to light. See C.J. DAVEY, "Some Ancient Near Eastern Pot Bellows", *Levant* 11 (1979), p.109.

(4) B. ROTHENBERG, *loc.cit.*

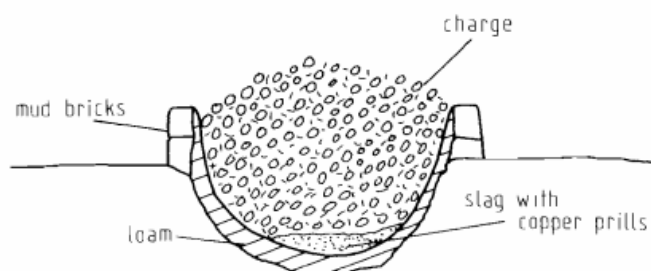
(5) B. ROTHENBERG, *Excavations at Timna Site* 39, p.7, fig. 15.

(6) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p. 235; B. ROTHENBERG, *Excavations at Timna Site* 39, p.15.



(fig. 16)

A furnace with a vertical shaft



(Fig. 17)

A furnace with pear-shaped(1)

For example, in Site 39 at Timna, a bowl-shaped smelting furnace up a hole in the ground was discovered. The inner furnace diameter, as found, was about 45 cm, its depth about 45 cm. A large rock was placed behind the furnace, probably a platform for the bellows. There was no lining inside this furnace, and most of the inner surface was missed. This lining of the inner walls was a layer of sandstone heated in contact with the metallurgical slag as a refractory material⁽²⁾. Many charred and slagged sandstone pieces were found at that site⁽³⁾.

The bellows of the furnace are located on the floor. The air direction

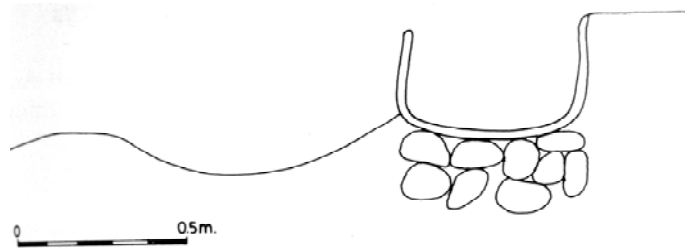
(1) B. SCHEEL, *op.cit.*, p. 16 (figs. 8, 9).

(2) B. ROTHENBERG, *op.cit.*, pp.1-3.

(3) B. ROTHENBERG, *Excavations at Timna Site 39*, p. 7.

sized fieldstones⁽¹⁾. Although the smelting furnaces, as found, appeared to be oval, their observable rock bottoms were round (fig. 15)⁽²⁾.

We have a lack of data concerning the furnaces because we destroy or discard them. The workers often even dismantled the remains of destroyed furnaces to use some of their parts in another, newly built furnace nearby. Sometimes only the lower part of the furnaces is found in situ, dug, or built into the ground⁽³⁾.



(Fig. 15)

Schematic drawing of a smelting furnace⁽⁴⁾

Evidently, we have two types of furnaces as follows:

- a) A furnace has a vertical shaft, sometimes with tapering walls and a flat bottom (fig. 16).
- b) A furnace is pear-shaped in its lower parts; sometimes, its bottom is concave and has a dome-shaped top⁽⁵⁾(fig. 17).

(1) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p. 235; B. ROTHENBERG, "Copper Smelting Furnaces, Tuyeres, Slags, Ingott-Moulds and Ingots in the Arabah: The Archaeological Data", in: *The Ancient Metallurgy of Copper*, (Ed.) B. ROTHENBERG, London, 1990, pp.9, 80.

(2) B. ROTHENBERG, "Copper Smelting Furnaces, Tuyeres, Slags, Ingott-Moulds and Ingots in the Arabah: The Archaeological Data", in: *The Ancient Metallurgy of Copper*, (Ed.) B. ROTHENBERG, London, 1990, p.16.

(3) *Ibid.*, p.1.

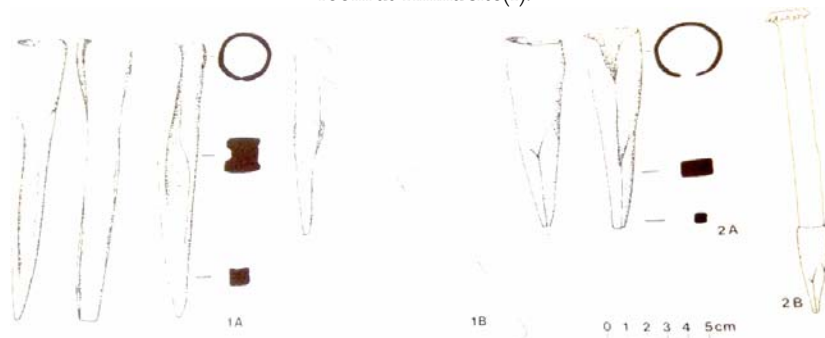
(4) *Ibid.*, p.3.

(5) *Ibid.*, p.4.



(Fig. 13)

Tools, such as axes, adzes used in stone working of the copper extraction in the displaying room at Timna site(1).



(Fig. 14)

Some discovered tools of Timna mine(2)

4) Fuel:

The local acacia trees were brought from a nearby area of Palestine as fuel in the smelting furnaces to reach their temperature of 1100° (3).

5) Furnaces:

The smelting furnaces were built from rocks around a dug-out pit filled with sand, and they were built on a roughly laid foundation of medium-

(1) B. SCHEEL, *op.cit.*, p. 47.

(2) H. G. CONRAD and Others, *op.cit.*, S. 84, Abb. 73.

(3) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p.232; B. ROTHENBERG, *Excavations at Timna Site* 39, pp. 9-10.



(Fig. 12)

The mortars made from granite or limestone used for grinding the slag⁽¹⁾

3) Smelting tools:

Logically, the workers of the smelting mines, especially Timna, need the tools to dig tunnels through the stones while searching for copper ore. Thus, it is not strange that flint tools, slag fragments, and some pottery were found on the floor, right up to the curb of the smelting furnace⁽²⁾. In addition to the copper axes, the stone hammers grinded the white sandstone walls to prepare the raw copper for smelting in the furnaces. The discovered tools of the Timna mine were in Egyptian style. They are preserved in the Institute of Archaeology of the Hebrew University. The others are now in the show hall at the beginning of the touring exhibition of the Timna site (figs. 13, 14)⁽³⁾.

(1) H.G. CONRAD and Others, *op.cit.*, S.171.

(2) See C.T. SHAW, *loc.cit.*

(3) See A. BERCOVICI, "Flint Implements from Timna Site 39", in: *Chalcolithic Copper Smelting*, (eds.) Rothenberg, B. and Others, London, 1978, pp.16-20.



(Fig. 11)

Imagining scene of the workers while they cut the material into blocks to be easily lifted by the ropes up to the entrance top of the principal tunnel

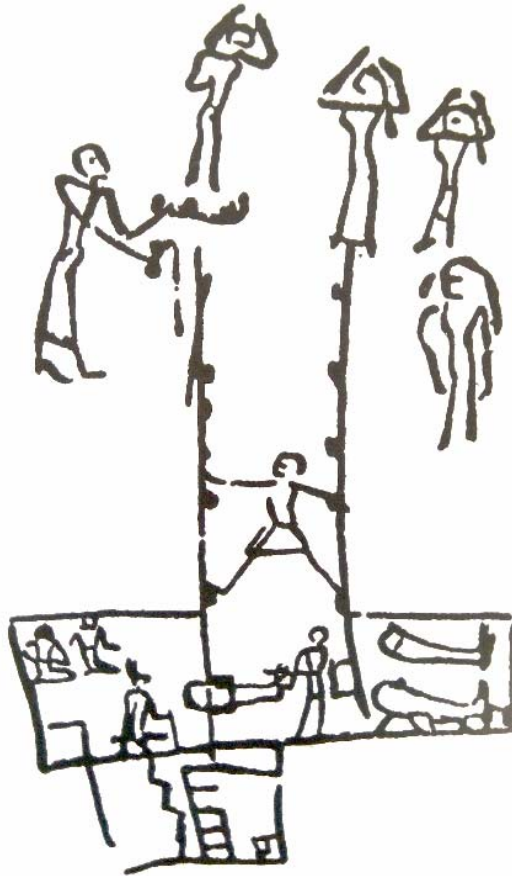
2) Grinding of copper slag:

The copper slag of Timna is a very inhomogeneous composition that had to be crushed into small fragments in order to extract the entrapped copper prills and pellets. The examination of copper slag from Timna proved that the operations were small-scale and conducted in small furnaces⁽¹⁾. The grinding of copper slag was done by mortars made from granite or limestone with a smooth, wide hollow (fig. 12). The profound rounded nature of the cavity suggests grinding or pounding in a vertical motion⁽²⁾. Therefore, the investigation and mining were complicated and needed excellent experience because the metal was impure copper, containing 97-98 per cent⁽³⁾.

(1) Ch. MILTON and Others, "Slag from an ancient copper smelter at Timna, Israel", *Historical Metallurgy* 10, 1976, p.33.

(2) See C.T. SHAW, "New Kingdom Mining technology with reference to Wadi-Arabah", in: *Proceedings of 1st International Conference on ancient Egyptian Mining & Metallurgy and Conversation of metallic artifacts, Cairo 10-12 April 1995*, (ed.) E. Feisal, Cairo, 1995, pp.1-13.

(3) B. ROTHENBERG, *Excavations at Timna Site* 39, p.10.



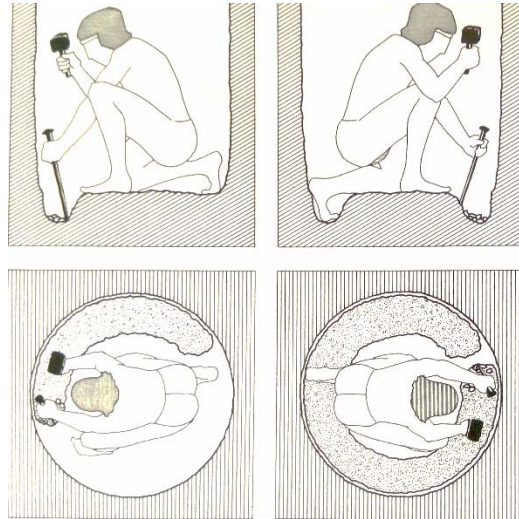
(Fig. 10)

Shaft of the ancient Egyptians tombs with side holes (1)

The workers cut the material that contains raw materials into blocks that the ropes can easily lift to the entrance top of the principal tunnel (fig. 11). Then, the material was transported by trolleys to the smelting place to extract native copper⁽²⁾.

(1) *Ibid.*, S. 78, Abb. 61.

(2) B. ROTHENBERG, *Excavations at Timna Site* 39, p.9.



(Fig. 8)

The workers dug several trial trenches or tunnels through the rocks(1)



(Fig. 9)

Chalcolithic copper mine in Timna Valley Tunnel

(1) H. G. CONRAD and Others, "Untersuchungen zur Bergbautechnik und ihre Interpretation", in: H.G. CONRAD and B. ROTHENBERG, *Antikes Kupfer im Timna-tal*, Bochum, 1980, S.74, Abb. 52.

following stages:

1) The search for the raw material of copper:

In the beginning, the workers dug several trial trenches or tunnels through the rocks to search for the raw material of copper (fig. 7)⁽¹⁾. When they find some positive results of that raw material, they continue to work through the subordinated tunnels of the main tunnel and trace the veins of that raw material (figs. 8-9). The deepest tunnel in Timna is 42 m⁽²⁾. The workers went down into the shaft through holes in its sides. The same method was used by ancient Egyptians to go down into the subterranean part of the tomb to put the deceased body in the burial room (fig. 10).



(Fig. 7)

The pit shaped hole⁽³⁾

(1) B. ROTHENBERG, "Copper Smelting Furnaces, Tuyeres, Slags, Ingott-Moulds and Ingots in the Arabah: The Archaeological Data", in: *The Ancient Metallurgy of Copper*, (Ed.) B. ROTHENBERG, London, 1990, p.8.

(2) J.M. TEBES, *op.cit.*, p.127, fig.13.

(3) Cf. P.T. CRADDOCK, "From the hearth to furnace: evidences for the earliest metal smelting technologies in the eastern Mediterranean", *Paléorient* 26, 2 (2000), p.151-165.

vi) The most recent cartouche discovered in this temple belonged to King Ramses V. It proves that the presence of ancient Egyptians was attested until the 20th Dynasty at least⁽¹⁾.

d) Timna's operations appear to have ceased after King Ramses V's reign⁽²⁾. Therefore, there is no evidence of any copper mining activities on this site later than the 12th century B.C., until the renewal of the mining during the Roman Period⁽³⁾.

Based on the above, the Hathor temple data indicates the existence of lengthy Egyptian control over the Timna site. Copper mining was not a one-time event as some scholars previously claimed⁽⁴⁾, but instead it continued throughout the New Kingdom period. As a result, settlement remains were discovered, such as simple resting houses dedicated to Timna mine workers and the temple of Hathor at the Timna site⁽⁵⁾. However, the Timna mine production was under the authority of the Ancient Egyptians during the New Kingdom Period. There was no foreign control or exploitation of that mine during the Late Bronze and Iron Ages.

V-2- Technique of Copper Extraction at Timna:

Although the Timna mine was ideal for metal exploitation, the mining technology changed considerably from time to time⁽⁶⁾. The site of Timna had special techniques for copper extraction that passed through the

(1) J.J. BIMSON, *op.cit.*, p.100.

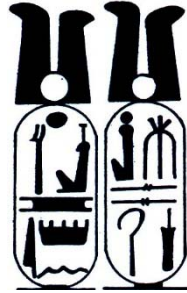
(2) Cf. J. WEINSTEIN, "The Collapse of the Egyptian Empire in the Southern Levant", in: *The Crisis Years: The 12th Century B.C. From Beyond the Danube to the Tigris*, (Ed.) W.A. WARD and Others, KENDALL, 1992, pp.148-150; J. Ogden, *loc.cit.*

(3) B. ROTHENBERG, *loc.cit.*

(4) P. TALLET, *op.cit.*, p.478; E.J.M. COLE, *Decline in Ancient Egypt? A reassessment of the Late New Kingdom and Third Intermediate Period*, A thesis submitted to the University of Birmingham for the degree of Doctor of Philosophy, Birmingham, 2016, p.46.

(5) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p. 201; B. ROTHENBERG, *Excavations at Timna Site* 39., p. 86; J.J. BIMSON and J.M. Tebes, *op.cit.*, p.81.

(6) *Ibid.*, p. 229.



(Fig. 5)

Monumental double cartouche of king Ramses III(1)



(Fig. 6)

A rock stela of king Ramses III (?) and Hathor(2)

related to the king Ramses III (Dynasty 20); because the second part of its inscription records the royal name HqA Iwnw (Smayt) "The ruler of Luxor," which is the known title of Ramses III. Cf. O. Lipschitz, "Timn'a", *Israel Exploration Journal* 22 (1972), p.158; R. VENTURA, "An Egyptian Rock Stela in Timna", *Tel Aviv* 1 (1974), pp. 60-63, pl. 1 (fig. 1). In general, I'm of the opinion that last suggestion is acceptable.

(1) *Ibid.*

(2) B. ROTHENBERG, "Die archaologie des Verhüttungsverfahrens von Site 30", in: *Antikes Kupfer im Timna-Tal. 4000 Jahre Bergbau und Verhüttung in der Arabah*, (hrg.): H.G. CONRAD und B. ROTHENBERG, Bochum, 1980, S. 210, Abb. 230.

c) Some inscribed Egyptian finds bear the cartouches of the pharaohs from the 18th until the 20th Dynasties⁽¹⁾, such as:

i) K. Kitchen reads an inscription discovered in the Timna mine on an inscribed block of this temple site bearing a Thutmose III cartouche⁽²⁾.

ii) G. Pinch examined the styles of numerous votive offerings to Hathor and concluded that they were made at Timna as early as Amenhotep III's reign⁽³⁾. Therefore, these remains of the Hathor temple date back to the 19th or 20th Dynasties and may go back to the 18th Dynasty.

iii) A discovery of a bracelet bearing the king's cartouche of Seti I (of the 19th Dynasty) in the remains of the Hathor temple of Timna indicates that the temple may have been built in the reign of King Seti I at least.

iv) A discovery was made in 1972 on the rock-face of Timna Mine, a large monumental hieroglyphic inscription of Ramses III's cartouche. It is inscribed in sunk relief and measures 40×60 cm (fig. 5)⁽⁴⁾.

v) A rock stela was discovered on a cliff about 20 m above this temple in 1972⁽⁵⁾. Its inscriptions are written in hieroglyphics and dated to King Ramses III (?)⁽⁶⁾, (fig. 6).

(1) J.J. BIMSON and J.M. TEBES, *op.cit.*, p.80.

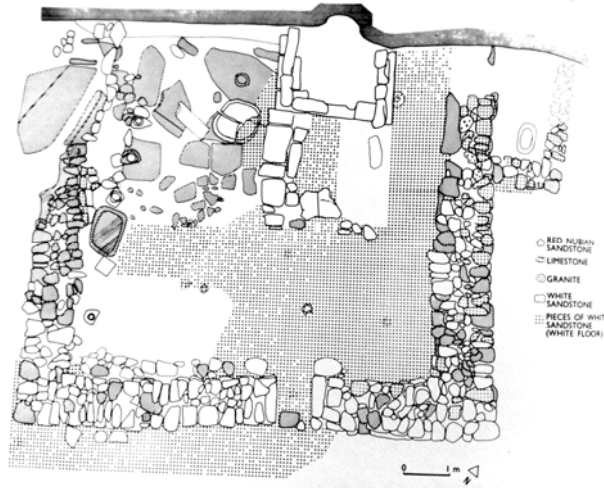
(2) K. A. KITCHEN, "A Pre-Ramesside Cartouche at Timna", *Orientalia* 45 (1976), p.264. According to B. Rothenberg, the temple was destroyed by an earthquake or rockfall from the adjacent cliffs in the Stratum III, but the worship was renewed without restoring the temple in the Stratum II where many sherds of worshippers came from. The temple became only a shrine that was ended by another rockfall, after which the site was abandoned until the Roman Period. See B. ROTHENBERG, *op.cit.*, p.272.

(3) G. PINCH, *op.cit.*, p.67.

(4) R. GIVEON, "Egyptian Inscriptions and Finds from a Temple in the Timna Area", p.50; M. GÖRG, "Der biblische Name des Kupferminengebiets von Timna", *Biblische Notizen* 65, 1992, S.5-8; P. TALLET, *op.cit.*, p.469.

(5) This rock stela was c. 90^{cm} height, 55^{cm} width. See B. ROTHENBERG, *The Egyptian Mining Temple at Timna*, p. 85, pl.104.

(6) Its inscription mentions the arrival of the Royal Butler *Ramesue-[em]-per-Re* who attested during the reigns of Ramses II and Merenptah. K.A. KITCHEN, "Two Notes on Ramesside History", *Oriens Antiquus* 15 (1976), p.311. Otherwise, this stela could be



(Fig. 3)

Plan of Hathor Temple in Timna Site⁽¹⁾



(Fig. 4)

Discovered temple of Hathor in Timna mine⁽²⁾

(1) B. ROTHENBERG, *op.cit.*, p. 128; B. ROTHENBERG, "Was Copper smelted in Ancient Temples? - more about crucible smelting, *Pallas* 50, *Mélanges C. Domergue*, II, 1999, p.170, fig. 4.

(2) *Ibid.*, p.169, fig. 3.

5) J.J. Bimson presents a hypothesis concerning the existence of a port near the Timna Valley, where the boats of Solomon sailed to the other settlements on the Red Sea to transport the products of the Timna mine⁽¹⁾.

The previous hypothesis of Bimson does not depend on any archaeological or textual evidence. What is more, there is no holy text in the Bible that indicates the existence of any Philistine settlement on the shores of the Red Sea⁽²⁾. On the contrary, the Ancient Egyptians had complete control of the Timna mine according to the following archaeological remains:

a) There is no actual archaeological evidence of the so-called "King Solomon's mines"⁽³⁾.

b) The temple's remains refer to the ancient Egyptian goddess Hathor (figs. 3, 4)⁽⁴⁾. Moreover, a settlement of ancient Egyptian workers might be around the temple in the area of the copper deposits.

(1) J.J. BIMSON, "King Solomon's Mines? A Re-assessment of Finds in the Arabah", *Tyndale Bulletin* 32, 1981, p.149; J.J. BIMSON and J.M. TEBES, *op.cit.*, p.78.

(2) Apparently, the purpose of those scholars is to prove the authority of the Israelite monarchy on such these historical sites, but without any archaeological evidence. For example, they identified the site of Tell el-Kheleifeh, which was a Pharaonic mining harbor according to the discovered remains, with Solomon's port of Ezion-Geber (Biblical Elat). They defined the location of this supposed port in front of the island of Jeziret al-Farun, some 10 km south of Modern Eilat, and 250 m offshore the Sinai mainland as they suggested. Cf. A. FLINDER, "The Island of Jezirat Fara'un. Its Ancient Harbour, Anchorage and Marine Defense Installations", *The International Journal of Nautical Archaeology and Underwater Exploration* 6 (1977), p.139; B. ROTHENBERG, *op.cit.*, p.272; A. FLINDER, "Is This Solomon's Seaport?", *Biblical Archaeological Review* 15 (1989), p.43.

(3) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p.180.

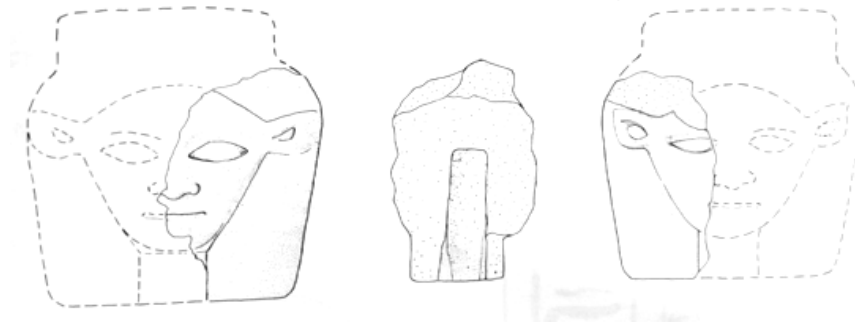
(4) E. WEIDNER, "Wâdî Timna", *AfO* 23 (1970), p.196; B. ROTHENBERG, "Un temple égyptien découvert dans la Arabah", *Bible et Terre Sainte* 123 (1970), p.6; B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p. 201.

4) M. Delcor claims that the goddess Anath was represented as a cow during the Ramesside Period; thus, confusion happened between her and Hathor. Accordingly, the goddess of Timna was Anath, not Hathor.

Delcor's argument is complex, even confused. Several details need to be discussed as follows:

- a) The mentioned name of the temple goddess in the inscriptions was Hathor's, not Anath.
- b) Anath was the war goddess, not a mining goddess.
- c) Hathor, not Anath, was the guardian of Sinai's Serabit-Khadem copper and turquoise mines, where many votive offerings were made to her⁽¹⁾.
- d) The discovered remains of the column-statues in the temple courtyard are related to the symbol of Hathor (fig. 2).

Based on all the previous notes, the hypothesis of incarnation between Anath and Hathor in the Timna mine is not acceptable.



(Fig. 2)

The discovered remains of column-statues related to the symbol of Hathor⁽²⁾

(1) G. MUMFORD, "Egypt's New Kingdom Levantine Empire and Serabit el-Khadim, including a newly attested votive offering of Horemhep", *JSSEA* 33 (2006), p.159.

(2) B. ROTHENBERG, *The Egyptian Mining Temple at Timna*, p. 1.

the context of the Shosu-Bedouins⁽¹⁾. From my side, I reject the previous view because Shosu wore a typical headdress and a tasselled kilt⁽²⁾; thus, they are easily recognisable in pictorial representations. If they dwelled or worked in the Timna area, they would leave monuments or drawings on this site, but this did not happen. Therefore, there is no specific archaeological evidence for the connections between the Shosu and the Proto-Israelites.

3) Another view states that the Midianites dwelt on the site after the Egyptians stopped exploiting Timna mines during the Third Intermediate Period. The Midianites then converted the site into a tent shrine. They worshipped Hathor in her temple, where offerings were discovered, such as a tiny copper serpent with a gilded head⁽³⁾. The Midianite people traced their ancestry back to Midian, an Abrahamic ancestor. They made their home in "the land of the east" (Genesis 25:6). However, later in their history, the Midianites had nomadic inclinations, leading most academics to conclude that Midian's country lay on both sides of the Gulf of Aqaba, especially the land of Edom under the Trajan reign (A.D. 98-117)⁽⁴⁾. In my opinion, the previous view is not accepted because there is no clear evidence that proves that Midianites worshipped Hathor in Timna. Even so, the tiny serpent was just one amulet presented to Hathor by an ancient Egyptian worker at Timna mine in order to receive the fertility blessing of Hathor.

(1) R. GIVEON, *Les bédouins Shosou des documents égyptiens*, Leiden, 1971, p.204; N. NA'AMAN, "The Town of Ibirta and the Relations of the 'Apiru and the Shosu", *GM* 57 (1982), p.33; M. BIETAK, "Comments on the 'Exodus'," in: *Egypt, Israel, Sinai, Egypt, Israel, Sinai. Archaeological and Historical Relationships in the Biblical Period*, (Ed.) A.F. RAINEY, Tel Aviv, 1987, p.171.

(2) R. GIVEON, "The Shosu of Egyptian Sources and the Exodus", in: *Fourth World Congress of Jewish Studies. Papers*, I, Jerusalem, 1967, pp.193-196.

(3) A.J. WILSON, *op.cit.*, p.33.

(4) The Midianites "had golden ear-rings, because they were Ishmaelites" (Judg. VIII. 24). Thus, they belonged to "people of the East" Bedawin and tent-dwellers. Cf. R.F. BURTON, *The Gold-mines of Midian and the Ruined Midianite Cities*, London, 1878, p. 204.

opinion, it ought to note the following points:

a) The previously given dates are not accurate or compatible, according to the opinion itself. Thus, there is no relationship between the date of this pottery and the time of King Solomon.

b) Some pottery sherds, found in the temple of Hathor in the Timna Valley, were votive offerings to this goddess⁽¹⁾. Pottery, though breakable packing material, would, therefore, travel over long distances. This interpretation would explain the presence of imported Arad-type or Canaanite pottery in the Timna site. The metal was mined in arid areas; therefore, the miners would need the unattainable necessities of life⁽²⁾. The nearest village to the working area of Timna mine was in the south of Palestine, where they brought food and drink inside such pottery containers. I am of the view that there was not any authority from King Solomon in the Timna area.

2) R. Giveon tried to identify the land of *ḫḫḫ* "metal" (= copper, gold, silver⁽³⁾) with the Timna mine where the Shosu-people lived and participated in copper production during the 20th Dynasty⁽⁴⁾. Other scholars tried to place the appearance of Proto-Israelites, called 'apirw', in

'Fortresses' of the Negev Highlands: Sedentarization of the Nomads", *Tel Aviv* 11 (1984), p.197.

(1) G. PINCH, *Votive Offerings to Hathor*, Oxford, 1993, p. 64.

(2) B. ROTHENBERG, *Excavations at Timna Site* 39, p.4.

(3) *Wb.* V, 67 (6).

(4) The name of Shosu appeared as an active factor in history from the time of Ramses III. In the Great Papyrus Harris and his temple at Medinet Habu, there are several reliefs showing them as prisoners of war, and as soldiers in the Egyptian army. They lived in the region of Seir, in southern Transjordan during the New Bronze Age. More specifically the *Shosu* are said to be living in a region called Qhqh, which Helck connects with a verb meaning "to hammer" (gold, copper or silver). If we take the indications of the papyrus from the time of Ramses IX as pointing to the point of departure of the *Shosu* "who have come to attack Egypt," and not as the scene of these attacks, it may not be impossible that this Qhqh was connected with the copper-mining district of Atak of Papyrus Harris. See W. Helck, "Eine Briefsammlung aus der Verwaltung des Amuntempels", 6 (1967), S. 140; R. Giveon, "The Shosu of the Late XXth Dynasty", *JARCE* 8 (1969-1970), pp.51-52; J.M. Tebes, *op.cit.*, p.136.

on isolated hilltops and rocky mountain slopes near the Timna site and its close surroundings⁽¹⁾. Without, however, locating the original copper mines or sources that had undoubtedly fed these camps. The Timna mine has been explored from south of the Dead Sea to north of the Aqaba Gulf⁽²⁾. B. Rothenberg sketches the history of the investigations into the Timna Valley site, up to the Arabah-Expedition's excavations of the New Timna Project in the years 1974-1976⁽³⁾. The copper mineral deposits of the Timna mine attracted the Pharaohs to send large expeditions there.

Theoretically, there is an opinion that tries to add a new historical phase. It is a supposed connection between ancient Palestine during the reign of King Solomon and the site of Timna mine in the 10th Century B.C, or to the end of the Judean monarchy in the 6th Century B.C. Their suggestion is based on the following points:

1) Those scholars suggested that Timna Mine was under the control of Solomon, at least through trade⁽⁴⁾. They dated the Edomite pottery⁽⁵⁾ from Timna mine between the 13th and 8th Centuries B.C. ⁽⁶⁾, or between the 10th and 6th Centuries B.C. ⁽⁷⁾. Before leaving the previous

(1) F. FRANK, "Aus der Arabah 1," *ZDPV* 57, (1934), pp. 191-280; N. GLUECK, "Explorations in Eastern Palestine II," *AASOR* 15, (1935), pp. 1-202.

(2) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p.37; B.S. Dhillon, *Mine Safety: A Modern Approach*, London, 2010, p.1.

(3) B. ROTHENBERG, "Introduction", in: *Antikes Kupfer im Timna-Tal. 4000 Jahre Bergbau und Verhüttung in der Arabah*, (Hrg.): H.G. CONRAD und B. ROTHENBERG, BOCHUM, 1980, S.17-32; A.J. WILSON, *The Living Rock: The Story of Metals Since Earliest Times and Their Impact on developing civilization*, Cambridge, 1994, p.14.

(4) B. ROTHENBERG, "King Solomon's Mines no more", *The Illustrated London News* 255, No. 6798 (1969), pp.32-33; A.J. WILSON, *op.cit.*, p.32.

(5) The Edomites lived in the southwestern Jordan and parts of Palestine in the 1st Millennium B.C. (= the Iron Age), and they probably occupied this area about the 13th Century B.C. See J.R. Bartlett, *Edom and the Edomites*, Sheffield, 1989, p.122.

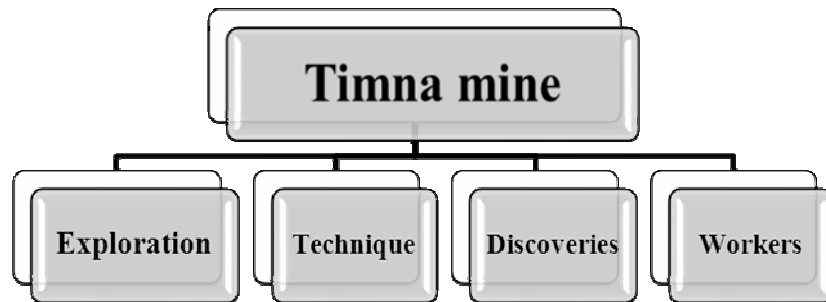
(6) J.J. BIMSON and J.M. TEBES, *op.cit.*, p.77.

(7) N. GLUECK, *The Other Side of the Jordan*, New Haven, 1970, p.73; B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, p.180; I. Finkelstein, "The Iron Age

formations⁽¹⁾. The ore of Timna is composed of azurite nodules, malachite, manganese, and chalcocite. It contains up to 37 per cent copper, found in abundance⁽²⁾, especially in the depth of the sandstone layers where the copper ores can be plentifully extracted⁽³⁾.

V- Authority history of Timna mine:

The ancient Egyptians exploited the raw materials at the site of Timna in the New Kingdom Period. Four points will be discussed in this context as follows (fig. 1):



(Fig. 1)

Main topics of studying the Timna mine

V-1- Exploration of Timna mine:

The first mention of the Timna Valley in modern studies as a site for copper smelting was by J. Petherick in 1861⁽⁴⁾. Then, the site was partly explored and described by A. Musil in 1902⁽⁵⁾. Both F. Frank and N. Glueck announced discovering evidence of seven smelting camps with slag heaps

(1) B. ROTHENBERG, *Timna. Valley of the Biblical Copper Mines*, London, 1972, p.18; A.J. WILSON, "Timna. Cradle of the World's Copper Mining Industry", *Mining Magazine* 136, 1977, pp.262-271; J. Ogden, "Metals", in: *Ancient Egyptian Materials and Technology*, (Eds.) P.T. NICHOLSON and I. SHAW, Cambridge, 2006, p.150.

(2) B. ROTHENBERG, *op.cit.*, pp.18, 20; B. Rothenberg, *Excavations at Timna Site 39. A Chalcolithic Copper Smelting Site and Furnace and its Metallurgy*, London, 1978, p.1.

(3) B. ROTHENBERG, *The Egyptian Minong Temple at Timna*, London, 1988, p. 1.

(4) J. PETHERICK, *Egypt, the Soudan and Central Africa*, London, 1861.

(5) Cf. A. MUSIL, *Arabia Petraea*, 2 Vols, Vienna, 1902-1908.

The mining activity of the Timna mine reached its peak in the New Kingdom Period in two subordinated stages; a steatite scarab represented the first one enabled us to date such a site to the reign of King Ramses II (c. 1279-1212 B.C. ⁽¹⁾) of the 19th Dynasty cf. *infra*. The next phase of the site is reflected in the remains of the Hathor temple. The structure has a lot in common with the Serabit el-Khadîm temple. Theoretically, an earthquake decimated the temple structure of the Timna site that was reconstructed by Ramses III (1186–1155 B.C.) and Ramses V of the 20th Dynasty (c. 1149-1145 B.C. ⁽²⁾). The Timna site is dated to the Late Bronze-Early Iron Age, and it includes metal objects such as arrowheads, rings, hooks, toggle pins, and spear butts. These objects assisted in attributing a more concise date to the pottery⁽³⁾. The copper mining area of Timna is mentioned in Pap. Harris I, 78, 1/2 as atk ('Atika') and in 1 Samuel 30, 30 as 'TK' (cf. *infra*)⁽⁴⁾.

IV- The economic importance of Timna mines:

The copper smelting of the Timna mine may be known during the Late Neolithic Period⁽⁵⁾, but without considerable evidence. When metal products became essential during the New Kingdom, the need, especially for copper, increased. Thus, the ancient Egyptians searched for new sources of copper near known sites such as the Sinai Peninsula.

The discovered mine in the Timna Valley was a series of cylindrical shafts linked through underground galleries in the Mesozoic rock

(1) R. DREWS, *The End of the Bronze Age: Changes in Warfare and the Catastrophe Ca. 1200 B.C.*, Princeton, 1993, p. 5.

(2) *Ibid.*, p. 154.

(3) B. ROTHENBERG, *Were these King Solomon's Mines? Excavations in the Timna Valley*, New York, 1972, p. 105; Reviewed by S. de Jesus Prentiss in the *AJA* 78, No. 3 (1974), p. 299.

(4) M. GÖRG, "Der biblische Name des Kupferminengebiets von Timna," *Biblische Notizen*, 65 (1992), S. 8. Though A. NIBBI considers the toponym to most likely refer to the mountain called Attāka, situated to the east of Suez. Cf. A. NIBBI, "A Note on Atika/Attāka/Tāka and Copper," *DE* 32 (1995), pp. 67-74.

(5) A. THOMPSON, *Origins of Arabia*, New York, 2013, p.85.



(Map. 1)

Map of major copper production sites in the Southern Levant (Google maps)

III- Timna Date:

The choice of the Timna mine is ideal in this historical and archaeological context. Copper smelting activities are linked to some stone enclosures and building foundations dated by archaeologists from pre-dynastic times to the Roman Period⁽¹⁾. This long time could be divided into some phases. J.J. Bimson suggested that the copper industry of Timna mine had been active during three main phases⁽²⁾:

1. Chalcolithic and Early Bronze Age (c. 4500-3600 B.C.)
2. Egyptian rule, especially during the New Kingdom (c. 1539–1075/1545-1062 B.C.)⁽³⁾.
3. Roman Period (30 B.C.- A.D. 395)⁽⁴⁾.

(1) B. ROTHENBERG, *The Egyptian Mining Temple at Timna*, London, 1988, p. 1; S. Aufrere and Others, *op.cit.*, p.247.

(2) J.J. BIMSON and J.M. TEBES, "Timna Revisited: Egyptian Chronology and the Copper Mines of the Southern Arabah", in" *Antiquo Oriente* 7, 2009, p.76.

(3) A. DODSON, *op.cit.*, p. 164 W. CHRISTENSEN, *op.cit.*, p. 143.

(4) *Ibid.*, p. 165.

Moreover, J. Černý quoted that "the copper was mined and smelted in the Sinai Peninsula probably at an early period, but there is not a scrap of evidence to believe that the miners were Egyptians⁽¹⁾." The latter part of the previous opinion was the primary motivation of this study to clarify the nationality of those workers who practised the craft of copper mining on the eastern edge of the Egyptian Peninsula of Sinai.

Furthermore, the research tries to shed valuable light on the methods and techniques of those miners, especially the smelting technology of the mines, which remains unclear. It also tries to define the far eastern border of the actual historical existence of the Ancient Egyptians near the Sinai Peninsula, just according to the archaeological evidence. On the other hand, it will discuss the opinion that King Solomon (c. 970–931/960–920 B.C. ⁽²⁾) later exploited and exported the copper of the Timna mines through a port facing the island of Salah al-Din in the Red Sea cf. *infra*.

II- Timna location:

The Timna Valley is located at the southern end of the Negev desert, part of the Arabian Desert (Map 1), approximately 20-30 km north of Elat, in the Aqabah Gulf of the Red Sea⁽³⁾. This valley is horseshoe-shaped and covers some 70 km². In the centre, there is the hill of Timna, c. 453 m above sea level⁽⁴⁾.

(1) J. ČERNÝ, *The Inscriptions of Sinai from Manuscripts of Alan H. Gardiner and T. Eric Peet edited and completed*, II, London, 1955, p. 7.

(2) S. WEITZMAN, *Solomon. The Lure of Wisdom*, New Haven – London, 2011, p. xxi.

(3) R. GIVEON, "Egyptian Inscriptions and Finds from a Temple in the Timna Area", in: *Proceedings of the Fifth World Congress of Jewish Studies, Jerusalem, 3-11 August 1969*, Jerusalem, 1971, p.50; P. Tallet, "Notes sur la zone minière du Sud-Sinaï au Nouvel Empire", *BIFAO* 103 (2003), p.469; J.M. Tebes, *Unearthing the Wilderness: Studies on the History and Archaeology of the Negev and Edom in the Iron Age*, Leuven, 2014, p.48.

(4) M. GÖRG, *Beiträge zur Zeitgeschichte der Anfänge Israels. Dokumente - Materialien - Notizen*, Wiesbaden, 1989, S. 175.

the source of copper utilised by the ancient Egyptians during that time remains a mystery. Some scholars, such as J.D. Muhly, assumed Egypt obtained its copper needs from Cyprus in the Pre-Dynasty Period⁽¹⁾. There have been no published lead-isotope studies of copper-based artefacts from Egypt dating before the 1st millennium B.C. The chemical composition of seventeen artefacts from the Amarna metals (c. 1353–1336/1349–1333 B.C.⁽²⁾) was compared with other Eastern Mediterranean metals in the Late Bronze Age (c. 1500–1200 B.C.⁽³⁾). Lead-isotope analyses cannot provide definitive information about the various metal sources used in Egypt during this period⁽⁴⁾. On the other hand, the manufacture of oxhide ingots was not a monopoly of Cyprus. Many of these oxhide ingots, produced from copper ore deposits, existed previously or concurrently with Cyprus⁽⁵⁾.

(1) J.D. MUHLY, *Copper and Tin. The distribution of mineral resources and the nature of the metals trade in the Bronze Age*, Ph. Dissertations, Yale University, 1969, 308 (fn.491). Some beads of red garnet for ornament were discovered at Kalavassos in the Larnaca District of Cyprus. They are dated to the Chalcolithic age that equal to the Predynastic Egypt. Thus, the Greece might obtain their needs of ornaments from Egypt in exchange for the copper in that time. Cf. G. Mumford, "Mediterranean area," *The Oxford Encyclopedia of Ancient Egypt* 2, 2001, p. 359; A. Shahin, (In Arabic) "Egyptian-Cypriot Relations in the Late Bronze Age to the Third Century B.C.," *Book of Proceedings of the First International Conference: Egypt and the Mediterranean Countries through the Ages Held during the period from 15-18 October 2014, Faculty of Archeology, Cairo University*, Cairo, 2014, p. 252.

(2) A. DODSON, *Amarna Sunset*, Cairo – New York, 2009, p. 164. W. Christensen, *Great Empires of the Past: Empire of Ancient Egypt*, New York, 2009, p. 143.

(3) GUY D. MIDDLETON, *Collapse and Transformation: The Late Bronze Age to Early Iron Age in the Aegean*, Oxford, 2020, p. 9.

(4) Z. STOS-GALE and Others, "The Origins of Egyptian Copper: Lead-Isotope Analysis of Metals from El-Amarna," in: *Egypt, the Aegean and the Levant. Interconnections in the Second Millennium BC.* (Ed.) W.V. Davies and L. Schofield, London, 1995, pp. 134–135.

(5) Cf. Z. STOS-GALE, "Oxhide Ingots and Egyptian Metallurgy," in: *Proceedings of Colloquium "The Archaeology, Geography and History of the Egyptian Delta in Pharaonic Times."* Wadham College 29-31 August, 1988, Oxford, Oxford, 1989, pp. 285–291.

Abstract

Mining in ancient Egypt goes back to pre-dynastic Egypt because it has substantial mineral resources. Accordingly, the ancient Egyptian miners had long experience in mining. The research tries to shed valuable light upon the methods and technique of those miners to extract the copper depending on the archaeological findings because texts of the site at hand are scarce. It sketches the work system of this society through the site of Timna Valley that located some 25 km north of the modern site of Eilat. In particular, the study discusses the economic value of ancient Egyptian mines outside the traditional borders of Ancient Egypt. In sum, Timna site considered one of the major mines of copper that ancient Egyptians had controlled and used it economically along the New Kingdom Period. Evidently, the technique, methods, workers, tools, inscriptions, documents, cult objects and deities inside that site were Egyptian.

Keywords: Copper slag; Smelting tools; Royal butler; Ramses, Hathor; Arabah; Mining; Furnace; Chalcolithic Age.

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* *

I- Introduction:

Copper was the most common metal for a long time in ancient Egypt. It was made into tools, weapons and vessels. Since the Chalcolithic Age (c. 4500-3600 B.C.), ancient Egyptians have made more copper products at many sites, such as the Badarian site, 30 km south of Assiut city⁽¹⁾. To date,

(1) B. SCHEEL, *Egyptian Metalworking Tools*, Princes Risborough, 1989, p. 14.



Copper Extraction in the Timna mine. An Archaeological and Historical Study.

(*)MOHAMED MAHMOUD KACEM

ملخص

يعود التعدين في مصر القديمة إلى ما قبل الأسرات في مصر لأنها تمتلك موارد معدنية كبيرة، بما في ذلك الأحجار والمعادن. وفقاً لذلك، كان عمال المناجم المصريون القدماء لديهم خبرة طويلة في التعدين. يحاول هذا البحث إلقاء ضوء قيم على أساليب وتقنيات هؤلاء العمال لاستخراج النحاس اعتماداً على المكتشفات الأثرية لأن النصوص ذات الصلة بذلك الموقع قليلة. إنها تحاول رسم نظام العمل لهذا المجتمع من خلال موقع وادي تمنا الذي يقع على بعد ٢٥ كم شمال موقع إيلات الحديث. تناقش الدراسة بشكل خاص القيمة الاقتصادية للمناجم المصرية القديمة خارج الحدود التقليدية لمصر القديمة. باختصار، يعتبر موقع تمنا أحد مناجم النحاس الرئيسية التي سيطر عليها المصريون القدماء واستغلوها اقتصادياً طوال فترة المملكة الحديثة. من الواضح أن التقنية والأساليب والعمال والأدوات والنقوش والوثائق ومتعلقات العبادة والآلهة داخل ذلك الموقع كانت مصرية.

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