

KING SOLOMON'S MINES? A RE-ASSESSMENT OF FINDS
IN THE ARABAH

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My aim in this lecture is to reopen the question of the date of copper-mining operations in the southern Arabah. Until the 1960's it was believed, on the basis of Nelson Glueck's investigations, that mining and smelting camps in the Arabah, at Timna and elsewhere, were worked primarily during the time of Solomon and later, from the 10th century to the 6th century BC. In the 1960's, the Arabah Expedition, led by Beno Rothenberg, produced evidence for a much earlier dating. Dr. Rothenberg's book on the excavations at Timna, published in 1972, exploited the popular biblical associations of the site in its title - *Timna: Valley of the Biblical Copper Mines* - but it actually refuted that title by redating the supposedly Solomonic mining activity to the 14th-12th centuries BC, and affirming: 'There is no evidence whatsoever of any copper mining or smelting activities in the western Arabah later than the twelfth century BC until the renewal of the industry in the Roman period.'¹ This paper will question the accuracy of this statement, and will urge greater care in dating the finds from the Arabah. It will indicate various lines of evidence which strongly imply occupation and mining activity between the 10th and 6th centuries BC.

I A BRIEF HISTORY OF THE DEBATE

The Timna Valley lies 30 km due north of modern Elat, on the west side of the southern Arabah. This region of the Arabah was identified as a copper-smelting area as long ago as 1861. It was explored by F. Frank and N. Glueck in the 1930's, and it was Glueck's interpretation of the mining and smelting activities which prevailed until the

1. B. Rothenberg, *Timna: Valley of the Biblical Copper Mines* (London: Thames and Hudson, 1972) 180.

1960's. On the combined basis of historical probability and the pottery which he found at some of the Arabah sites, Glueck believed that the mines had been exploited from the time of Solomon onwards, down to the 6th century BC.

Glueck's convictions concerning the dates of the pottery which he found were derived largely from his excavations at Tell el-Kheleifeh. This site, which lies about 500 metres from the shore at the head of the Gulf of Aqabah, was identified by Glueck with both biblical Elath and Ezion-geber, Solomon's Red Sea port.² The latter identification has been strongly challenged,³ and Glueck's interpretation of part of the site as a copper refinery has definitely been proven incorrect,⁴ and was retracted by Glueck himself.⁵

Tell el-Kheleifeh was excavated by Glueck during three seasons in 1938-1940. The second level from the surface, called by Glueck Level IV, was the most important for establishing a chronology for the site, since it contained pottery bearing datable Edomite and Minaean inscriptions and also many items which 'evidence strong Assyrian influence and indeed are hardly distinguishable, if at all, from Assyrian parallels of the same period. Both the shape and hard metallic ware of many of them are in clear imitation of contemporary seventh-sixth centuries B.C. Assyrian metal and pottery vessels...'.⁶ Level IV therefore appears to date from the 7th-6th

2. N. Glueck, *BA* 28 (1965) 70-71.

3. Rothenberg, *PEQ* 94 (1962) 5-71.

4. *Ibid.*

5. Glueck, *BA* 28 (1965) 70-87.

6. Glueck, *Eretz Israel* 9 (1969) 53. Cf. *idem*, 'Tell el-Kheleifeh Inscriptions' in H. Goedicke (ed.), *Near Eastern Studies in honor of W. F. Albright* (Baltimore: Johns Hopkins, 1971) 225-242.

centuries.⁷ Glueck dated the preceding levels between the 10th and 8th centuries, believing that Solomon had founded the settlement as either Ezion-geber or a fortified outpost thereof. The date of these levels is questionable, however, since the site lacked proper stratification,⁸ and dating criteria do not appear to be very clear. Full publication of the excavations is unfortunately still awaited. However, it does seem, from parallels between the Tell el-Kheleifeh pottery and pottery from Nimrud, Umm el-Biyara, Tawilan and Buseirah, that occupation probably goes back at least to the 8th century BC,⁹ though it may go back no further.

As will be explained in more detail shortly, Tell el-Kheleifeh produced pottery styles similar to those which Glueck found at Timna and at other sites in the southern Arabah. It was to the dating criteria of Level IV at Tell el-Kheleifeh that Glueck appealed when he resisted the earlier dates for the Arabah sites put forward by Aharoni and Rothenberg in the 1960's.

Essentially, three types of pottery occur at Timna and other Arabah mining sites. There is, first, a coarse, hand-made variety, known as Negev, or Negebite, ware, which occurs at many sites in the Negev, Sinai and the Arabah. Secondly there is a sophisticated painted pottery decorated with geometrical designs, and sometimes with stylized birds, animals and men. It is wheel-made, pink-buff ware with a heavy slip. The designs are commonly red-brown and black. Originally described as 'Edomite' pottery, this type is now distinguished from other pottery of that name, being re-designated 'Midianite' pottery. (The new name was introduced after pottery of this type was found in the region of Midian in

7. Glueck sometimes referred to Level IV as beginning in the late 8th century BC (*BASOR* 72 [1938] 13; *BA* 28 [1965] 86). However, in *BASOR* 188 (1967) 24, he states that Level IV could date 'at the earliest' to the end of the 8th century, but 'belonged primarily ... to the seventh-sixth centuries B.C.'.
8. Cf. Glueck, *BASOR* 179 (1940) 14; E. K. Vogel, *IDBSupp* (Nashville: Abingdon, 1976) 869.
9. Vogel, *op. cit.* 869; cf. C.-M. Bennett in Moorey and Parr (eds.), *Archaeology in the Levant: Essays for Kathleen Kenyon* (Warminster: Aris and Phillips, 1978) 169.

1968 and published in 1970.¹⁰ Before 1970 the term 'Edomite' was therefore used for two types of pottery which are now sharply distinguished, and this must be borne in mind when the term 'Edomite' is found in the pre-1970 literature.)

The third type of pottery found at the Arabah sites is described as 'normal' wheel-made pottery resembling Early Iron Age I (1200-1000 BC) forms known previously from Palestine. This third type was singled out as a means of dating the other two during the surveys carried out by the Arabah Expedition in 1959 and the early 1960's. Of the three types of pottery found in the Arabah, dated comparative material existed for this one only. Its discovery alongside the other types therefore appeared to provide a much-needed criterion for dating them, and hence for dating the mining and smelting camps at which they occurred. The use of this pottery as a dating criterion was what first prompted a reassessment of Glueck's dates for the Arabah sites.

In 1962, Y. Aharoni, who acted as the Arabah Expedition's main advisor on stratigraphical problems, expressed the opinion that it was unlikely that any of the Arabah pottery should be dated later than the 10th century BC.¹¹ Subsequently, the 'normal' wheel-made pottery was judged to be slightly earlier than this, and the other types were redated along with it. During excavations in 1964 at a smelting-camp known as Site 2, all three types were found together in a clearly stratified context. Rothenberg reported the significance of the finds as follows: 'The fact that ordinary Early Iron Age I pottery, including cooking-pots, was found in a stratified excavation together with the "Edomite" [= Midianite] and primitive Negev pottery, enables us accurately to date such pottery, found until now only on the surface. The pottery must be dated 12th-11th centuries B.C. and nothing later was found in the excavations.'¹²

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10. P. J. Parr, G. L. Harding and J. E. Dayton, 'Preliminary Survey in N.W. Arabia, 1968', *Bull. Inst. of Archaeology* 8-9 (1970) 193-242.
 11. Y. Aharoni, *PEQ* 94 (1962) 66-67.
 12. *PEQ* 98 (1966) 7; see also Rothenberg and A. N. Lupu, *Bull. Museum Haaretz* 7 (1965) 27.

Glueck was not convinced by these arguments and defended his own dating: 'The statements by Aharoni and Rothenberg, first that the Iron Age pottery ... belonged exclusively to the tenth century B.C., and then that this same pottery belonged exclusively to the twelfth and eleventh centuries B.C., with absolutely no other Iron Age pottery occurring in Wadi Arabah, are equally in error.'¹³

Albright initially supported Glueck's dating: '... Nelson Glueck's exploration of the copper mining sites in the Arabah ... was decisive in fixing both character and chronology of the ancient metallurgical operations south of the Dead Sea. For one thing, the early Iron Age pottery which has been found at many of those sites is ... definitely tenth century and thus probably Solomonic and not early Edomite. Every new discovery of pottery convinces me that Nelson Glueck is right in his chronology and that Aharoni and Rothenberg are wrong.'¹⁴

These defences of Glueck's dates appeared in print in 1969. That same year, excavations at Timna uncovered the remains of an Egyptian temple to the goddess Hathor. The temple was dated by a series of cartouches, spanning the period from the reign of Seti I (late 14th-early 13th century BC¹⁵) to the reign of Ramesses V (mid-12th century BC¹⁶). (K. A. Kitchen has pointed out that one badly damaged cartouche, described as a Ramesside cartouche when published in 1972,¹⁷ appears from its photograph to be the cartouche of a Tuthmosis, with historical probability favouring Tuthmosis III.¹⁸ A definite reading must await the publication of better

13. Glueck, *Eretz Israel* 9 (1969) 54.

14. See *ibid.* 54 n. 16.

15. Possible dates for Seti I are now 1305-1290 BC or 1294-1279 BC; see J. Ruffle, *Heritage of the Pharaohs* (Oxford: Phaidon, 1977) 62 for a table of the two dating schemes currently favoured for the XIXth Dynasty.

16. Possible dates for Ramesses V are now 1156-1152 BC or 1145-1141 BC.

17. Rothenberg, *Timna*, caption to pl. 76.

18. K. A. Kitchen, *Orientalia* 45 (1976) 262.

photographs and accurate drawings of the damaged stone.¹⁹⁾

Associated with the Egyptian material of the XIXth and XXth Dynasties were the same three types of pottery found together in the excavations at Site 2. One result of the temple finds was therefore a further upward revision of dates for the pottery and the mining activities, placing them 'between the end of the fourteenth century BC and the middle of the twelfth century BC'.²⁰ A second result was the conclusion that the Timna copper mines and others in the western Arabah 'were operated by Pharaonic expeditions of the XIXth to XXth Dynasties'.²¹

News of the Egyptian finds reached Glueck in time for him to mention them in the second edition of his book

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19. A. R. Schulman rejects Kitchen's reading of the cartouche in favour of the original Ramesside one (personal communication from B. Rothenberg, 1.6.1979), but a final decision cannot be taken without a proper publication of the stone. However, Kitchen's suggestion (*op. cit.*) that the first phase of the temple represents 'a limited Tuthmoside building and occupation' which was destroyed a considerable time before the reign of Seti I must be rejected; XIXth Dynasty cartouches also occur on the lowest temple floor (personal communication from Rothenberg, 1.6.1979).
 20. Rothenberg, *Timna* 180. The dating of finds to the late 14th century BC depends on the earlier dates for Seti I; see n. 15 above and *cf.* Rothenberg, *Timna* 163, where even earlier dates, now generally rejected, are given. Rothenberg has since suggested that the temple may have been founded during the reign of Ramesses II, notwithstanding the cartouches of Seti I: see *Encyclopedia of Arch. Excav.* vol. IV (Oxford: OUP; Jerusalem: Massada, 1978) 1190.
 21. Rothenberg, *Timna* 180.

The Other Side of the Jordan,²² but he still did not accept that his late dates for the pottery had been refuted. Elsewhere in the same work, he repeated his conviction that the dates claimed previously for the Arabah pottery by Aharoni and Rothenberg were 'mistaken assertions' stemming from 'a lack of knowledge of the pottery found',²³ and reaffirmed that the pottery should be dated 'between the tenth and sixth centuries B.C., beginning with the time of Solomon'.²⁴

Albright accepted the implications of the Egyptian finds. In 1971, shortly after Glueck's death in February of that year, he retracted his earlier statements, saying that he and Glueck had both been wrong in their dating of the Arabah pottery.²⁵ Albright himself died in September of the same year.

With Glueck's death and Albright's retraction, defence of the late dates came to an end. However, the earlier dates do leave certain problems unresolved. There is no denying that mining activities did take place in the Arabah at the time of Egypt's XIXth and XXth Dynasties, and all three types of pottery found at the mining and smelting sites were associated firmly with this Egyptian activity. But it is incorrect to say that 'there is no evidence whatsoever' for mining and smelting activities between the 12th century BC and the Roman period.²⁶ There is evidence, albeit indirect, for exploitation of the mines during the time of the Judaeen monarchy.

II EVIDENCE FOR MINING AND SMELTING DURING THE 10TH-6TH CENTURIES BC

The arguments to be presented here are best grouped under four headings.

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22. Glueck, *The Other Side of the Jordan* (New Haven: ASOR, 1970) 93-94.
 23. *Ibid.* 73.
 24. *Ibid.*
 25. Albright, *BASOR* 202 (1971) 4.
 26. Rothenberg, *Timna* 180.

1. *Historical and economic probability*

The arguments under this heading do not amount to evidence in the strict sense, but they certainly deserve serious consideration.

In stating the supposed lack of archaeological evidence for mining activities during the time of Solomon, Rothenberg has claimed that the negative results 'are well corroborated' by the Bible. He refers to 1 Chronicles 18:8 and 22:3, where it is stated that the bronze (or copper) which Solomon used for the temple furnishings was provided in advance by David, who acquired it from Tibhath and Kun, cities in the Aramaean kingdom of Zobah, between Damascus and Hamath.²⁷

However, it is unlikely that the bronze temple furnishings were Solomon's only need for a supply of copper. 1 Kings 9:26-8 tells us that from Solomon's port of Ezion-geber, near Elath on the shore of the Red Sea, a valuable trade was carried out. It is specifically stated that gold, almuq wood and precious stones were brought back from Ophir via this port (9:28; 10:11). 1 Kings 10:22 adds that every three years the combined fleets of Solomon and Hiram of Tyre, who had helped Solomon establish his Red Sea trading enterprise (9:27), brought back gold, silver, ivory and exotic animals, presumably via this same port. We are not told what Solomon's maritime merchants traded in order to obtain these luxuries, but whether his port lay at Tell el-Kheleifeh as Glueck suggested, or at Jeziret el-Farun as argued by Rothenberg,²⁸ the copper mines of the Arabah were close at hand, offering Solomon a valuable trading commodity. It simply would not make economic sense for the mines to lie unworked during the reign of Solomon, when the organization for their effective exploitation certainly existed, and a port with an expanding maritime

27. *Ibid.*

28. Rothenberg, *Negeb: Archaeology in the Negeb and the Arabah* (Tel Aviv: Ramat Gan, 1967) 189-213.

trade had been established nearby.²⁹

During the 9th and 8th centuries BC, Edom, and especially the southern Arabah, was much fought-over (2 Ki. 8:20-22; 14:22; 16:6). Dame Kathleen Kenyon, writing before Glueck's dating of the mining activity was questioned, remarked: 'The mineral wealth of the district is no doubt one reason for the prolonged struggles between Israel and Edom, for its control was clearly of great

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29. The suggestion that Solomon used some of the copper from the Arabah mines as an article of exchange in his Red Sea traffic was originally made by Glueck, *AASOR* 15 (1935) 51. Before Rothenberg's excavations brought new dating criteria to light, K. M. Kenyon, *Archaeology in the Holy Land* (London: Benn, 1960) 257, stated that, even without the dating evidence which Glueck claimed from the pottery, 'it would have been not unreasonable to suggest that the most flourishing period for this exploitation [of the Arabah mines] was that of the reign of Solomon. The control of mineral resources provides one explanation for his wealth, for its products supplied export goods to be exchanged for the luxuries we know he imported'. (See, however, subsequently Kenyon, *op. cit.*, 3rd ed., 1970, 346.) It is interesting that an economist, Dr. S. Mage, recently wrote to the *Biblical Archaeology Review* describing as an 'odd notion' the present view that the mines were not exploited in Solomon's time, while a few kms to the South a port and trading fleet were being built. He commented: 'As an economist, I can state with absolute certainty that this account violates the most elementary laws of economics...' (*BAREv* 4/3 [1978] 48f). Rothenberg in *PEQ* 94 (1962) 42 remarks that 'there is no evidence whatsoever for the assumption that Solomon exported copper ... in exchange for gold, silver, etc.'. This is true, but the assumption is no less reasonable for that, and the economic argument is very compelling.

economic importance.'³⁰ After the initial challenge to Glueck's dates, when Aharoni and Rothenberg had suggested that mining in the Arabah ceased after the 10th century BC, G. E. Wright remarked: 'If that were the case, we would be at a loss to explain the reason for the fighting in the area during the 9th and 8th centuries ... Glueck claims repeatedly to have found Iron II pottery (9th-7th cents. B.C.) at the mining sites. While I myself have not had a chance to examine the material, one would think it very strange if material from that date were not found.'³¹

These arguments are not so strong as the argument for Solomonic exploitation of the mines, but once it is admitted that copper-mining in Solomon's time is a strong probability on economic grounds, it is equally probable that a mining industry, and access to the Red Sea coast, remained important in the following centuries.

2. *The origin of slag at Tell el-Kheleifeh*

It is now widely known that Glueck's interpretation of one of the buildings at Tell el-Kheleifeh as a smelting furnace was incorrect. In the light of Rothenberg's compelling arguments against this interpretation,³² Glueck retracted it.³³ The building concerned appears to have been a storehouse or granary. However, the Tell el-Kheleifeh excavations did produce some evidence, though slight, for metal-working activities. In the article in which Glueck retracted his original interpretation of the site, he went on to say: '... We should like to underscore the fact that industrial and metallurgical activities did indeed take place in the various periods of occupation of Tell el-Kheleifeh. Copper slag was definitely found in the excavations, as well as remnants of copper implements and vessels.'³⁴

30. Kenyon, *op. cit.* 256.

31. Wright, *BA* 24 (1961) 61.

32. See n. 3 above.

33. See n. 5 above.

34. Glueck, *BA* 28 (1965) 75; *cf.* *The Other Side* (1970) 115. Glueck earlier reported finds of slag at Tell el-Kheleifeh in *BASOR* 65 (1937) 13; *BASOR* 71 (1938) 5.

The copper implements need not, of course, have been manufactured on the site, as Glueck himself admitted; and the amount of slag was very small, but its existence cannot be ignored altogether. Glueck also states that fragments of raw ore were found at Tell el-Kheleifeh.³⁵ Whatever the extent of metal-working carried out at the site (and it was probably minimal), it can hardly be imagined that the copper came from anywhere other than the Arabah mines; so its presence seems to be evidence for some exploitation of the mines during at least the 8th-6th centuries BC.³⁶

3. *The date of the Arabah pottery*

Glueck repeatedly described much of the pottery from the Arabah as Iron Age II, whereas Aharoni considered the same pottery to be Late Bronze Age - Iron Age I and no later. We have seen that Glueck consistently rejected the earlier dating, and it was stated above that his grounds for doing so were related to his finds at Tell el-Kheleifeh. Glueck reported finds of both Negev and Midianite wares in the Tell el-Kheleifeh excavations, and on this basis he affirmed the Iron Age II date of both varieties. The problems surrounding the date of these pottery types must now be examined in more detail.

35. *The Other Side* (¹1940) 93; cf. *BASOR* 65 (1937) 13.

36. Cf. G. E. Wright, *BA* 24 (1961) 61. Rothenberg does not deny the occurrence of slag and raw ore at Tell el-Kheleifeh; see *PEQ* 94 (1962) 47 n. 11. However, Glueck's statement in *BASOR* 159 (1960) 14, that fragments of pottery crucibles coated inside with slag, similar to fragments found in the Arabah, were found at Tell el-Kheleifeh, was incorrect; see Rothenberg, *PEQ* 94 (1962) 47 n. 10. If it is suggested that the pieces of slag and raw copper relate to Level V, they could date as late as the 5th century BC, but Glueck was clearly of the opinion that they related to various phases of occupation.

i. Negev ware.

The coarse handmade Negev ware³⁷ was initially found at Tell el-Kheleifeh, where it occurred both on the surface and in the excavations.³⁸ At first Glueck suggested that the vessels he found were crucibles used in copper-smelting operations, but he abandoned this view when he found the same pottery at many sites throughout the Negev. Glueck dated its period of use as extending from the 10th century BC to the end of the Iron Age.³⁹

The discovery of this pottery in association with XIXth-XXth Dynasty Egyptian material at Timna pushed back the date for its origin to the late 14th or 13th century BC, and this led Rothenberg to suggest that, not only at the Arabah mining sites, but also throughout the Negev, this pottery marked settlements of pre-Israelite date.⁴⁰

However, recent excavations at Negev sites have led to disagreement with Rothenberg's theory. Excavations at Horvat Ritma, about 35 km south of Beersheba, have uncovered a fortress evidently built according to a detailed preconceived plan. There are examples here of a four-room house design and methods of construction typical of Israelite sites. Negev pottery occurs here,

37. For illustrations of this ware see photographs in *PEQ* 94 (1962) pls. XI:1-5; XII:9-14; also drawings in Rothenberg, *Timna* 107, fig. 31; 118, fig. 35.

38. Glueck, *BA* 28 (1965) 75.

39. *The Other Side* (²1970) 98. He noted too, however, that similar pottery had been found in Arabia, dated to about 400 BC (*BA* 28 [1965] 76), and I am informed by Dr. Rothenberg (personal communication, 1.6.1979) that examples in the Arabah also occur in a Roman context. With the Timna examples now pushed back to the 14th or 13th century BC by the Egyptian finds, this pottery appears to have been in use for a very long period indeed.

40. Rothenberg, *Negeb* 96; *Timna* 180-182.

along with wheel-made Israelite pottery dated broadly to the 11th-9th centuries BC. The finds have led Zeev Meshel to conclude that Horvat Ritma, along with the network of Negev strongholds of which it is a part, was built in the 10th century BC under a centralized authority, as part of a project initiated by either David or Solomon, and not by autochthonous tribes in the premonarchic period.⁴¹ Negev ware occurs at a number of sites dated by other finds to the 10th century BC.⁴² Recent excavations at Tell el-Qudeirat (Kadesh-barnea) have revealed that this pottery occurs there in all the Israelite strata, which extend from the 10th to the 7th or 6th century BC,⁴³ and not only in the pre-fortress level as was concluded after the initial soundings.⁴⁴

It would be inaccurate, therefore, to say that the Egyptian finds at Timna proved Glueck's dates for this pottery to be incorrect. His dates were correct, so far as they went; that is, Negev ware was in use during the 10th-6th centuries BC. The Egyptian finds pushed back the date of the earliest known examples, without refuting the later dates. It appears to have been premature to conclude that none of the Arabah's Negev ware could be of later date than the 12th century BC.

ii. Midianite ware.

Turning to the painted ware now known as Midianite pottery, previously included in the Edomite corpus, we meet with a different situation. The conclusion reached following the Timna excavations was not that this pottery's dates must simply be extended to include an earlier period, but that the period of its use must be redated completely. That is, Glueck's dates for a 7th-6th century use of this pottery have been totally rejected. In attempting to assess the correctness or otherwise of this conclusion, we reach the thorniest of all the problems involved in dating the Arabah mines.

41. Z. Meshel, *Tel Aviv* 4 (1977) 110-135; see esp. 132 for disagreement with Rothenberg's view of the Negev forts.

42. *Ibid.* 125.

43. R. Cohen, *IEJ* 26 (1976) 202; Z. Meshel, *op. cit.* 125.

44. Cf. M. Dothan, *IEJ* 15 (1965) 139.

Here, disagreements between excavators do not simply concern the *interpretation* of the facts, but extend to the bare facts themselves. In clarifying the issue as far as possible, it will help to return to the beginning of the dating controversy.

As early as the first season of excavations at Tell el-Kheleifeh in 1938, Glueck reported the discovery there of 'scarce painted pottery', some of which was indistinguishable from pottery previously found in Transjordan.⁴⁵ Glueck later referred to this as 'Edomite' pottery, but it is clear from subsequent publications that he grouped two kinds of painted ware together in this term: the type for which the term 'Edomite' has been retained, as well as the type now known as Midianite ware. His classification of both of these as 'Edomite' was in keeping with his view that Levels III-IV at Tell el-Kheleifeh marked Edomite occupation, and therefore that all types of pottery from those levels were Edomite wares.⁴⁶ A photograph of a painted jar from Tell el-Kheleifeh was published in 1959; the jar is ascribed in the caption to Iron Age II.⁴⁷ This particular item is certainly Midianite.⁴⁸ Further Midianite pieces from Tell el-Kheleifeh were published later.⁴⁹

The painted pottery discovered in the Arabah by Rothenberg's expedition is all Midianite, though it was originally described as Edomite in line with Glueck's classification; none of the ware currently known as

45. Glueck, *BASOR* 71 (1938) 14-15.

46. Cf. e.g. *BASOR* 79 (1940) 13 for Glueck's description of late Level III and Level IV as 'Edomite'.

47. *BA* 22 (1959) 104, fig. 16B, illustrating an article on Glueck's work by G. E. Wright.

48. As is clear from the details published by Glueck in *BASOR* 188 (1967) 11-12. The same jar is again illustrated there, figs. 1:2 and 5:1.

49. *Ibid.* fig. 4:3-5; cf. J. E. Dayton, 'Midianite and Edomite Pottery', *Proc. of 5th Seminar for Arabian Studies, Oxford 1971* (1972) 25. Further items of Midianite ware from Tell el-Kheleifeh remain unpublished.

Edomite was found there.⁵⁰

When the Arabah Expedition reported its finds of Midianite pottery in a stratified context at Site 2, Glueck's earlier discovery of the same ware at Tell el-Kheleifeh was unfortunately overlooked. A report of the 1964 excavations at Site 2 referred to the painted ware as 'Pottery found until now by surface survey in Transjordan only (and not even reported from the excavation of Tell el-Kheleifeh!)...'.⁵¹ The occurrence of this type of pottery at Tell el-Kheleifeh was subsequently acknowledged, but in the context of a brief report that in 1966 Aharoni had examined a collection of Tell el-Kheleifeh material in Cincinnati, and had found all the Midianite sherds to have come from outside the excavations.⁵² In the same year that this statement appeared, Glueck published several items of Tell el-Kheleifeh pottery, including some Midianite sherds.⁵³ In this publication, the Midianite sherds are stated to have some from Level IV, that is, the level which produced Assyrian and other datable material of the 7th-6th centuries BC.⁵⁴

50. Confirmed by Rothenberg in personal correspondence.

51. Rothenberg and A. N. Lupu, *Bull. Museum Haaretz* 7 (1965) 27. This report naturally refers to the Midianite pottery as 'Edomite'. Cf. Rothenberg in *PEQ* 98 (1966) 7, repeating the statement that such pottery had been 'found until now only on the surface'.

52. See Rothenberg, *Negeb* 284 n.88. A failure to acknowledge the occurrence of Midianite sherds at Tell el-Kheleifeh reappears in a report by Rothenberg and Lupu, *Bull. Museum Haaretz* 9 (1967) 69-70 ('... In all the many Iron Age sites known to us in the Central and South Negev, and in the Arabah, not even one 'Edomite' [Midianite] sherd was found'), in spite of the fact that the report contains a reference (n. 12) to the book by Rothenberg in which the existence of the Tell el-Kheleifeh sherds is acknowledged!

53. *BASOR* 188 (1967) 8-38, esp. 10-15; see ns. 48 and 49 above.

54. Glueck again ascribed one of these vessels to Level IV in *Eretz Israel* 9 (1969) 54.

It is unfortunately impossible to resolve this contradiction in favour of either claim, since the extant records of the Tell el-Kheleifeh excavations do not sufficiently clarify the contexts of the relevant sherds.⁵⁵ As noted already, the excavations at Tell el-Kheleifeh lacked proper stratification,⁵⁶ and this may have left open to question the exact relationship of the Midianite sherds to the occupation periods. There can be no doubt that Glueck and Aharoni approached the dating of the Midianite sherds with different views on what that relationship was likely to have been. Only a renewal of excavations at Tell el-Kheleifeh, with greater precision in the observation and recording of the contexts of finds, is likely to solve the question of whether Midianite pottery occurs there in a clearly stratified context with Assyrian wares of the 7th-6th centuries BC. For the time being, we must live with two conflicting statements on the matter, both made almost thirty years after Glueck's excavations. If greater weight is given to the opinion of the excavator, however, the late use of Midianite pottery would seem to be established.

Apart from the Timna excavations, there are no other sites at which Midianite pottery occurs in a stratified and datable context. In the Hedjaz, where Midianite pottery was discovered during the 1968 survey of N.W. Arabia,⁵⁷ it occurs along with true Edomite pottery on the surface, but not in a stratified context. The true Edomite pottery is dated to the 8th-7th centuries BC and differs in various ways from the Midianite ware. The composition of the clay is quite different,⁵⁸ as are the

55. Personal communication from Mrs. E. K. Vogel, 12.6. 1979.

56. See n. 8 above.

57. See n. 10 above.

58. For visible differences in the clays see the descriptions in Dayton, *op. cit.* (n. 49 above) 26-27. Differences in workmanship, technology and geographical origin are confirmed by petrographic analysis (personal communication from Dr. M. Hughes, 6.3.1979; Dr. Hughes was kind enough to send me the results of unpublished analyses of Midianite and Edomite pottery by A. Slatkine; *cf.* also Slatkine, *Bull. Museum Haaretz* 15/16 (1972/73) 101-111).

shapes of the vessels, the Edomite ones showing strong Assyrian influence. There are some similarities, however, in the bichrome painted designs. The painted decoration of the Edomite pots is undeniably simpler and cruder than that of the Midianite ware, and is confined to geometrical designs; but some of those designs do bear resemblances to the Midianite patterns. Criss-cross trellis designs, zigzags, crosses alternating with vertical lines in an encircling design, parallel lines and horizontal ladder patterns are features of both Midianite and Edomite painted decoration.⁵⁹ A bowl found in a late 7th or early 6th century context at Nimrud also bears the horizontal ladder pattern and horizontal bands, with a cream slip, typical of some Midianite vessels.⁶⁰ Therefore, while the Midianite pottery is certainly of different origin and manufacture from the Edomite ware, the painted designs make some degree of chronological overlap perfectly plausible. It remains a tantalizing possibility that Midianite pottery was indeed in use in the 7th century BC as Glueck believed, and as his attribution of fragments to Level IV at Tell el-Kheleifeh would demand if correct.⁶¹

59. For typical Midianite decoration see Rothenberg, *Timna* 94-95, nos. 48-54; 108, fig. 32; 118, fig. 35; 154-155, figs. 46-47; 160, pls. XXII-XXIV; also Glueck, *BASOR* 188 (1967) 9, fig. 1:1-2; 16, fig. 4: 3-5; 19, fig. 5:1; Parr et al., *op. cit.* (n. 10 above) 230-233, figs. 15-16; Dayton, *op. cit.* (n. 49 above) 34-37, pls. I-IV. For examples of Edomite decoration see Glueck, *BASOR* 188 (1967) 11, fig. 2:1, 3-17; 19, fig. 5:2; 35, fig. 4:1-8; C.-M. Bennett, *Levant* 6 (1974) 23-24, figs. 15-16, esp. 16:9; *Levant* 7 (1975) 12, fig. 7.

60. Cf. J. Oates, *Iraq* 21 (1959) 138.

61. While preparing this paper, the writer was informed of an unconfirmed report that Saudi Arabian excavators have discovered Midianite pottery in a Neo-Babylonian context at a site in the Hedjaz. If correct, this would establish a 7th-6th century use of this pottery, and would increase the plausibility of Glueck's attribution of the ware to Level IV at Tell el-Kheleifeh. However, the report should be treated with caution until the identification of the ware as Midianite (rather than Edomite), and its stratigraphical association, have both been confirmed.

iii. *Pecked and incised ware.*

Finally with reference to the pottery, Glueck did find other sherds at the Arabah mining sites for which comparative material suggests a late date. One sherd from Timna and three from mining and smelting sites in the Wadi Amrani (or N. Amram; also in the western Arabah, about half way between Timna and modern Elat) have incised and pecked decorations paralleled by designs on vessels from Tell el-Kheleifeh, some of which are specifically said to come from Level IV.⁶² Even if the reference to Level IV is treated with caution, one of the Tell el-Kheleifeh vessels with pecked indentations is certainly of 7th-6th century date, being a small bowl 'fashioned in imitation of Assyrian fluted or embossed metal vases', like many of the vessels which characterize Level IV.⁶³ In the Wadi Amrani Glueck also found a fragment of a bowl with a spatulate bar-handle on the rim.⁶⁴ Handles of this type occur on Iron II vessels from Tawilan, Buseirah and other sites in Edom and Moab, and are closely related to the so-called 'trumpet-lug' handles on the 7th century BC 'Assyrian

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62. The sherds from W. Amrani and Timna were collected in 1955 and 1959, and first published by Glueck in *BASOR* 159 (1960) 12, fig. 6; see now *BASOR* 188 (1967) 14, fig. 3:1-3 (from W. Amrani) and 3:4 (from Timna), and the discussion of parallels, *ibid.* 17-18. Aharoni also published sherds from Timna decorated with incised lines and dots, *PEQ* 94 (1962) pl. XII:7-8. He suggested that these, and the ones published earlier by Glueck, belonged to the same culture as the 'Edomite' (i.e. Midianite) painted pottery, and to the same chronological horizon, and hence wished to redate them along with the latter type.
63. Glueck, *Eretz Israel* 9 (1969) 53 and pl. VII:2; also 52, fig. 1:2.
64. *BASOR* 188 (1967) 14, fig. 3:8; on p. 17 it is stated that all sherds in fig. 3 are from W. Amrani except for 3:4; see also *BASOR* 159 (1960) 12, caption to fig. 6.

Palace Ware'.⁶⁵ Glueck also refers to examples from Tell el-Kheleifeh, including one specifically from Level IV,⁶⁶ but even if these are discounted, the parallels from elsewhere still favour a late date for the Wadi Amrani sherd. Also from Wadi Amrani, Glueck has published a fragment of a high ring-base from a large storage jar, describing it as 'closely related' to the base of a large ovoid jar, with a Minaean inscription, from Tell el-Kheleifeh.⁶⁷ Again, the Tell el-Kheleifeh jar is ascribed to Level IV, and it is in any case dated to the 7th-6th centuries on the basis of its Minaean lettering.⁶⁸ Four of these sherds from Wadi Amrani, and the one from Timna, are described as having a highly burnished, dark reddish-brown slip, of the same type as that on the 7th-6th century Minaean jar.⁶⁹ It is of course possible that further comparative studies, with a new examination of the sherds at first-hand, will produce parallels of an earlier date; for the moment, however, these sherds do seem to imply some occupation of the Arabah sites during the 7th or 6th centuries BC.

As a result of this brief survey of some of the Arabah pottery,⁷⁰ we may conclude that certain types are not at all incompatible with the late dates originally

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65. *BASOR* 188 (1967) 18-20 and ns. 42-46. To Glueck's parallels should now be added the bar-handles on bowls from Buseirah, C.-M. Bennett, *Levant* 6 (1974) 23, fig. 15:12-13; also *Levant* 7 (1975) 14, fig. 8:1 and 4. Buseirah's pottery is 8th-7th centuries BC; Bennett, *Levant* 9 (1977) 9-10.
66. *BASOR* 188 (1967) 20-21 and fig. 4:10-11.
67. *Ibid.* 23 and fig. 3:11.
68. *Ibid.* 24.
69. *Ibid.* 23.
70. Note that in 1970 Rothenberg wrote, concerning the 'normal' wheel-made LBA-Iron Age pottery: '... Re-investigation of the pottery found in the Arabah and Sinai showed that most of the "Iron Age" pottery reported so far seems to be Ancient Egyptian. The accurate date of these sherds is still under investigation; in Timna all Egyptian ware is dated by inscriptions to the 19th-20th Dynasty'; *PEQ* 102 (1970) 29. I am informed by Rothenberg (personal communication, 1.6.1979) that petrographic studies have confirmed the Egyptian origin of this ware from Timna.

envisaged by Glueck. The Negev ware is clearly not to be confined to the 13th and 12th centuries BC; it continued in use throughout the period of the monarchy and beyond. It may well be that Midianite pottery was also produced at a late date, and the sherds discussed in the last paragraph all appear, on present evidence, to have good parallels in the 7th-6th centuries BC.

4. Radiocarbon dates from Timna

To date, two series of radiocarbon dates for mining and smelting activities at Timna have been published in the journal *Radiocarbon*. Several of these dates provide confirmation of activity between the 10th and 7th or 6th centuries BC.

During the Arabah Expedition's surveys of the Timna Valley in 1959-1961 and 1967, shafts and galleries were found in the white sandstone formations at the base of the Timna Cliffs (Site 212). The tunnels were excavated in 1974-1976 with the collaboration of specialists from the German Mining Museum of Bochum. Some of the shafts and galleries contained pottery of the Early Bronze Age. Others contained Late Bronze Age - early Iron Age pottery, contemporary with the Ramesside finds from the Egyptian temple.⁷¹ Samples of charcoal from an 'Egyptian tunnel' at Site 212 were submitted for radiocarbon tests. Results were obtained from seven samples from the mine. Charcoal from two slag piles was also tested.

Of the seven results from the mine, two (HAM-213-214) fall around 2000 BC and are not relevant to the present discussion. They presumably relate to activity in the EBA, as evidenced by some of the pottery found. The other five are as follows:⁷²

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71. Rothenberg, *Encyclopedia of Arch. Excav.* vol. IV (Oxford: OUP; Jerusalem: Massada, 1978) 1186, 1201-1202; cf. *Buried History* 13 (1979) 49.
 72. H. W. Scharpenseel, F. Pietig and H. Schiffmann, *Radiocarbon* 18/3 (1976) 286-287.

No.	C14 date (uncalibrated)	Calibrated (MASCA) ⁷³
HAM-207	960 BC (\pm 70)	1030-1100 BC (\pm 70)
HAM-208	960 BC (\pm 60)	1030-1100 BC (\pm 60)
HAM-210	1100 BC (\pm 70)	1270 BC (\pm 70)
HAM-211	690 BC (\pm 60)	800 BC (\pm 60)
HAM-212	830 BC (\pm 90)	900 BC (\pm 90)

The results are published uncalibrated, and the accompanying comment states that all five of them are compatible with an estimated origin in the time of Solomon.⁷⁴ One of them, however, could equally well relate to activity in the 12th century BC (HAM-210). HAM-211 and 212 may attest activity later than Solomon's reign. The two dates obtained for charcoal from the slag piles were:

No.	C14 date (uncalibrated)	Calibrated (MASCA)
HAM-215	2070 BC (\pm 100)	2490-2540 BC (\pm 100)
HAM-216	1390 BC (\pm 60)	1600-1630 BC (\pm 60)

The latter is compatible (if uncalibrated) with workings in the 13th century BC, while the former may indicate an origin in the EBA.

More recently, four more dates were obtained for samples from Timna.⁷⁵ Excluding one which apparently relates to Nabataean or Roman workings (BM-1116: AD 5 ± 309), these are:

No.	C14 date (uncalibrated)	Calibrated (MASCA)
BM-1115	890 BC (\pm 51)	940-990 BC (\pm 51)
BM-1117	829 BC (\pm 55)	900 BC (\pm 55)
BM-1162	530 BC (\pm 35)	500-640 BC (\pm 35)

BM-1115 came from a pit in Area E of the Ramesside smelting camp, Site 2. BM-1117 relates to charcoal in a layer 'immediately overlying' remains of the Egyptian temple of the 13th-12th centuries; it was originally

73. The calibrated dates are derived from the tables in E. K. Ralph, H. N. Michael and M. C. Han, 'Radiocarbon Dates and Reality', *MASCA Newsletter* 9/1 (1973) 1-20.

74. *Radiocarbon* 18/3 (1976) 287.

75. R. Burleigh and A. Hewson, *Radiocarbon* 21/3 (1979) 349.

thought to come from a furnace associated with pottery of the 1st century AD, but in view of its radiocarbon date, it is suggested that the furnace may not be associated with the 1st century pottery, or that the charcoal came from a lower level of the temple site.⁷⁶ BM-1162 is said to provide a date for slag from Stratum I of Site 30, another Ramesside smelting-camp. Pottery from this stratum is described as Iron Age I, and the underlying levels (Strata II-III) produced the same mixture of Midianite, Negev and ordinary wares which occurs at Site 2 and in the Egyptian temple, as well as some pottery of Egyptian origin.⁷⁷

From the two series of radiocarbon dates published so far, eight, if uncalibrated, are compatible with mining and smelting activities between the 10th and 6th centuries BC, - the period to which Glueck had previously dated such activity on the basis of the pottery finds. If the dates are calibrated, the picture does not greatly change, since only one of these eight dates becomes too early to relate readily to workings in the 10th century BC,⁷⁸ while the lowest date may still fall within the 6th century BC.

Some of these dates are surprising in view of the apparent associations of the samples; they appear to relate in some cases to the workings dated, on the basis of the Egyptian finds and early Iron Age pottery, to the 13th-12th centuries BC. However, there are too many dates for them to be dismissed as anomalies, and, unless something is seriously wrong with Egyptian chronology, they must relate to distinct and later activity.

76. *Ibid.* 350.

77. Cf. Rothenberg, *EAE* vol. IV (as n. 71 above) 1200-1201.

78. *I.e.* HAM-210, with a calibrated date of 1270 BC. HAM-207 and 208 still relate feasibly to Solomonic activities, since the possible corrections indicated (± 70 and ± 60 years respectively) allow dates as low as 960 and 970 BC; these calibrated dates are ambiguous, however, relating equally well to activity in the 12th century BC.

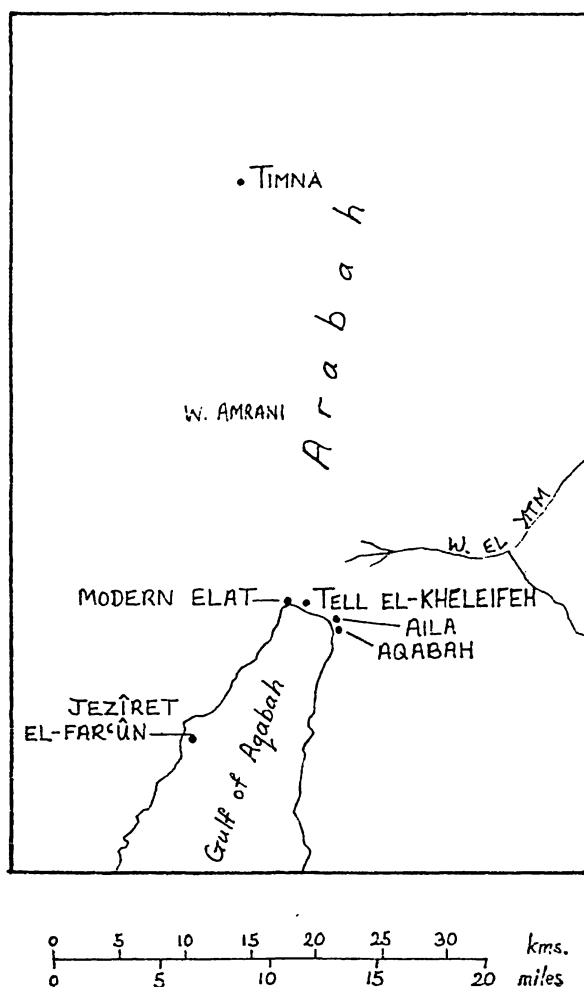
No material has been published so far which would help to identify these later miners and smelters, but Rothenberg has suggested that the radiocarbon dates discussed above reflect renewed Egyptian activity in the 10th-9th centuries BC, and possibly Edomite activity later.⁷⁹ In view of the very strong reasons, discussed above, for believing that Solomon would have exploited the Arabah mines in connection with his Red Sea trade, it is historically very probable that the activity attested in the 10th century BC was a Solomonic enterprise. However, evidence for an Egyptian presence in the Arabah during the 10th century BC would not be incompatible with this, in view of Solomon's close diplomatic relations with Egypt (1 Ki. 9:16, 24).⁸⁰ After Solomon's reign, control of the mines probably alternated between Judah and Edom until the 8th century BC, when Edom decisively regained control of Elath in the reign of Ahaz (2 Ki. 16:6).

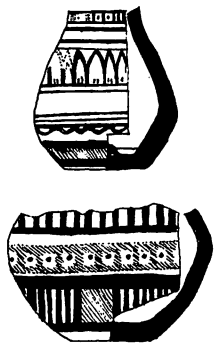
III CONCLUSION

Radiocarbon dates confirm that mining and smelting activities took place in the Arabah in the 10th century BC and later, perhaps into the 7th or 6th centuries EC. The range of radiocarbon dates for the first millennium

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79. Personal communications, 1.6.1979 and 12.11.1979. Some Philistine pottery was discovered at Timna in 1976, 'associated with a level of sophisticated smelters immediately above the Egyptian installations' (*Buried History* 13 (1977) 48), but its likely date has not yet been published.
80. It has been suggested by Glueck and others that Shoshenq I's campaign penetrated as far as Ezion-geber, which would imply Egyptian control of the Arabah from that time; but see the comments by K. A. Kitchen, *The Third Intermediate Period in Egypt* (Warminster: Aris and Phillips, 1972) 296 and n. 296. However, Egyptian occupation of the Arabah in the reign of Rehoboam is possible in view of the friendship between Hadad the Edomite and the Egyptian court, and the hostility of both to the kingdom of Judah (1 Ki. 11:14-25; 14:25).

BC corresponds well with the period to which Glueck had previously dated much of the Arabah pottery. It is probable that some of the pottery does indeed belong to this period, notwithstanding the currently accepted view that the Midianite, Negev and ordinary wares should be dated exclusively to the 14th-12th or 13th-12th centuries BC. Furthermore, a few fragments of slag found by Glueck in the excavations at Tell el-Kheleifeh point to some exploitation of the Arabah copper-mines during this same period. From an economic point of view, historical probability strongly suggests that in the 10th century BC the mines and smelting-camps were worked as part of a Solomonic enterprise, in connection with trade carried out from Ezion-geber. The attribution of mining and smelting activity in the Arabah to Solomon's time has been dismissed too readily. Within the reassessment of the history of mining in the Arabah, which the radiocarbon dates now demand, Solomonic activity contends most strongly for a place.

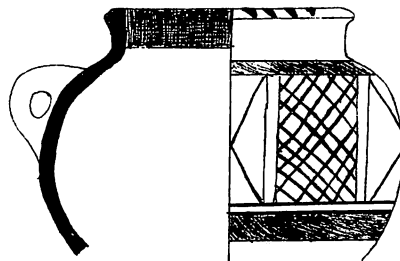




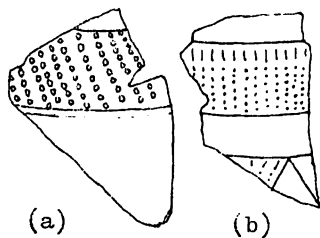
1. Midianite vessels
from the temple
site, Timna (after
Rothenberg, *Timna*
154, fig. 46:8,9).



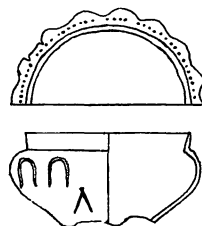
2. Midianite jar from
Tell el-Kheleifeh
(based on Glueck,
BASOR 188, 9 fig.
1:2 and 19 fig. 5:1a).



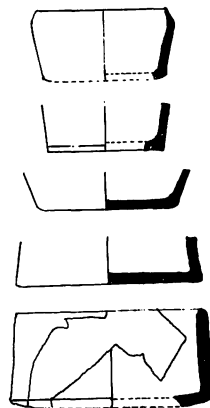
3. Edomite vessel
from Buseirah
(after C.-M. Bennett,
Levant 6, 24 fig.
16:9 (no. 260)).



4. Sherds with pecked and incised decoration, from (a) W. Amrani and (b) Timna (after Glueck, *BASOR* 188, 14 fig. 3:3,4).



5. Pecked and incised bowl in Assyrian style, from Tell el-Kheleifeh, level IV (after Glueck, *Eretz Israel* 9, 52 fig. 1:2).



6. Negev ware from Site 2, Timna (after Rothenberg, *Timna* 107 fig. 31:1-5).