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THE NEGŪB TUNNEL

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It is evident from Assyrian records, relief's and present features in the landscape that Neo-Assyrian kings devoted considerable effort toward the construction of canals to irrigate the environs of their capital cities.[1] The water delivered by these installations would have changed the appearance of the Assyrian countryside by facilitating the growing of luxuriant gardens[2] which not only provided Assyrians with exotic fruits and pleasant living conditions but also demonstrated their king's mastery of nature. One example of this activity is the Negūb Tunnel.

The author visited Negūb in September 1977 to undertake a survey of the tunnel and its immediate area. He is most grateful to the Director of Antiquities of Iraq for permission to complete the fieldwork and for the facilities that were made available. Manhal Jabur the Director of the Nineveh Expedition and Inspector for Mosul Antiquities is to be especially thanked as is Salim Younis who represented the State Organization for Antiquities and Heritage and who bore the discomforts of the work. The visit was made possible by a grant from the British School of Archaeology in Iraq which is gratefully acknowledged as is the assistance of Professor Oates and of Nicholas Postgate, then Director of the British Archaeological Expedition in Iraq. The invaluable help of Ismael Hussain Hijara during the fieldwork was also appreciated.

The tunnel is located on the northern bank of the Greater Zab River opposite the modern village of Quwair at the start of a canal which followed the contour firstly to the south-west and then north to finish in the area of Nimrud. The canal is still visible along much of its course and is best shown on the map completed by Commander Felix Jones in 1852. [3]

Aššurnasirpal 11 (884-859 B.C.) records that he constructed a canal called *Patti Hegalli* from the Upper Zab to irrigate the land by the Tigris.[4] This canal is said to have cut through the mountain to its summit. Later kings are also mentioned in texts relating to this canal system. A broken text on a wall slab from the palace at Nimrud reveals that Tiglath Pileser III (745-727 *B.C.)* undertook restoration work to the Kalhu canal system. [5] When Layard visited the tunnel at Negūb he observed an inscribed stone tablet which recorded the work of Esarhaddon (681-669 B.C.) [6] who, it appears, may have been responsible for constructing the tunnel which now remains open.[7] Unfortunately the text was destroyed soon after Layard's visit.

The area of Negūb has ample evidence of these kings' activities (Fig. 1). The course of the Nimrud canal as it leads away from Negūb is clear from the rock

1. J. Reade, Studies in Assyrian Geography, *Revue d'Assyriologie* 72, (1978), 47-72, 157-80.
2. *Revue d' Assyriologie* (1978), 174.
3. *Journal of the Royal Asiatic Society* (1853*)*, 297-397 ; See J. Reade, *Revue d'Assyriologie* (1978), 62, 63, note 38.
4. D. D. Luckenbill, *Ancient Records of Assyria and Babylonia (L.A.R.), Vol. 1,* The University of Press (Chicago, 1926), 186.
5. L.A.R I, 270.
6. A. H. Layard, N*ineveh and its Remains (*3 edn.), (London, 1849), 80-81; *L.A.R.* II, 278-9.
7. D. Oates, *Studies in the Ancient History of Northern Iraq,* British Academy (Oxford, 1968), 47.

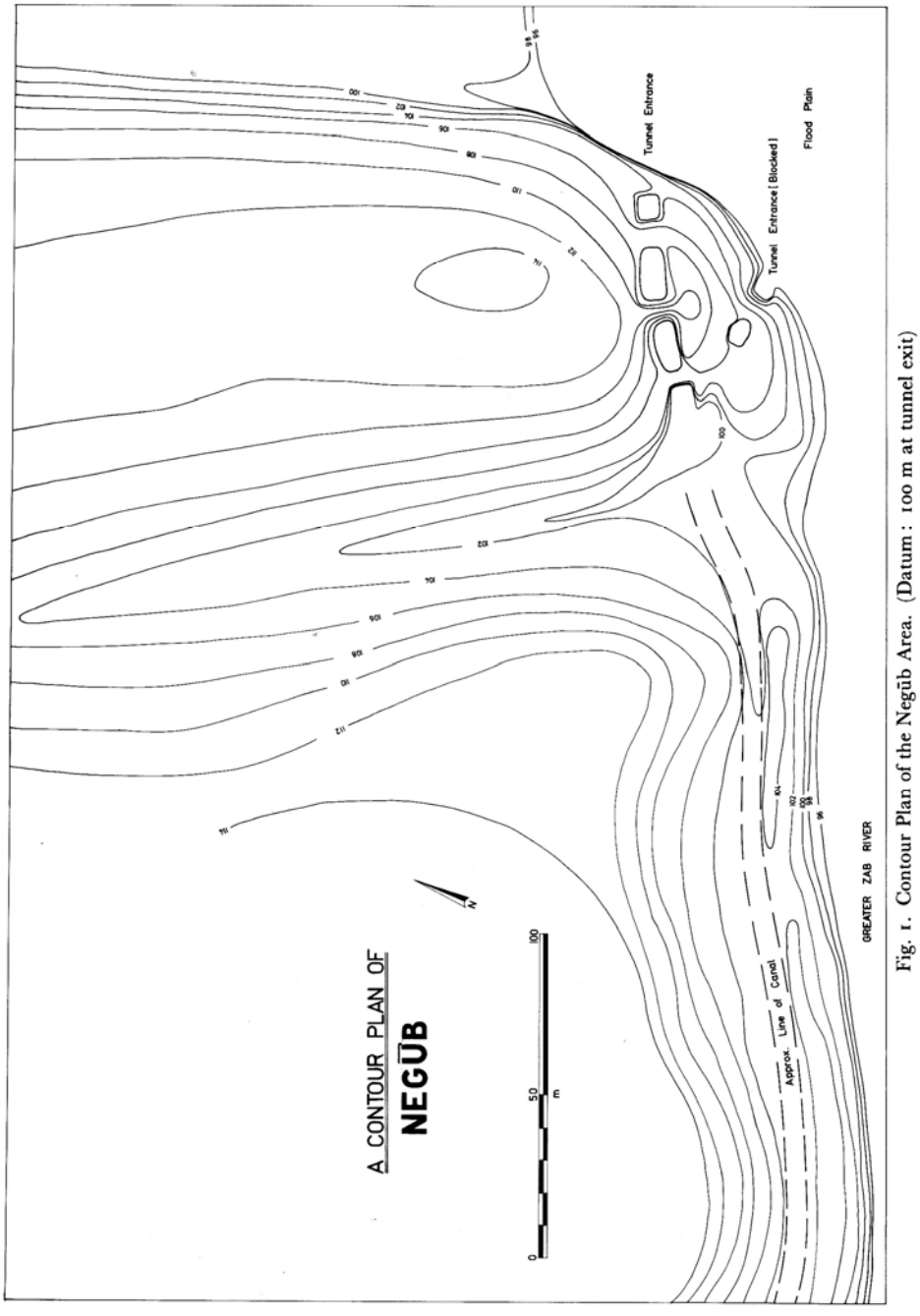


Fig. 1. Contour Plan of the Negūb Area. (Datum: 100 m at tunnel exit)

cuttings and the vegetation[8] which in the early autumn is concentrated along its path (Plate Va). There is no surface evidence of a canal which must have followed the valley between the bluff and the high ground to the west and connected the Nimrud canal with the cutting which was made through the bluff about 500 m north of the Negūb Tunnel and is still visible (Plate Vb). The valley has a comparatively steep gradient and the canal would have required numerous weirs to keep the water under control. The valley has been heavily eroded and the remains of these weirs or the canal banks can not be expected to have survived. The course of the canal east of the cutting in the bluff is evident for a distance of about 2.5 km where it meets the flood plain of the Greater Zab River. The river presently flows some distance to the south of this place but the growth of shoq[9] along the northern border of the plain shows that previously the river at least partially flowed past this point (Plate Vc). The depression through which the canal would have flowed is 8 m deep in places and the gradient is very flat. This canal system *may* therefore have been only of limited success because of severe silting caused by the slow rate of water flow along the section of canal east of the cutting in the bluff.

Professor Oates has identified the canal east of the Negūb Tunnel as the original system built by Aššurnasirpal II[10]. This certainly seems probable as the reference to the cut made "through the mountain to its summit" in the Aššurnasirpal text suitably describes the cutting through the bluff north of Negūb. He also suggests that the canal may have continued for a further 17 km to the confluence of the Greater Zab and its tributary the Khazir. Felix Jones mapped the canal east of Negūb, although he makes it a little longer than it presently appears. Further to the east he plots the path of a 7 km long "*qanat* type" tunnel which seems to have received water from the River Khazir and brought it to the canal east of Negūb. This may be similar to Sennacherib's (704-681 B.C.) water system for supplying Erbil.[11] However the Greater Zab River intervenes and has destroyed any other features. There are no known ancient references to these works extending to the Khazir River and their purpose is also hard to determine given the proximity of the Greater Zab River to the canal.

At Negūb itself there are two tunnel systems. The shorter of the two was driven through the south-eastern end of the bluff and is now completely blocked (Plate Vd). Professor Oates has suggested that this tunnel may represent the work of Tiglath Pileser III.[12] The drainage from the area immediately to the north-west of Negūb flows through the other tunnel which has no doubt remained open since it was last used. It is therefore reasonable to assume that the blocked tunnel is the earlier of the two. This assumption is supported by the fact that the blocked tunnel would have been easier to construct and in its position is unlikely to have been as effective as the longer tunnel.

The tunnel which is still open and which was surveyed is attributed to Esarhaddon

8. Mainly - *shoq,* شوك Prosopis Farcta, a spinous or, prickly shrub which grows in alluvial soils, especially those with shallow ground water in areas such as depressions around wells, river valleys on alluvial plains and by canals. See C. C. Townsend & E. Guest, *Flora of with Iraq,* vol. III. Ministry of Agriculture and Agrarian Reform Republic of Iraq (Baghdad, 1974) 38-42.
9. See note 8.
10. *Studies in the ancient History of Northern Iraq,* 46.
11. F. Safar, Sennacherib's Project for Supplying Erbil Supplying Erbil, *Sumer 3* (1947) , 23-5
12. *Studies in the Ancient History of Northern Iraq, 47.*

on the basis of the inscription found by Layard.[13] It is cut through the bluff in an easterly direction so that the tunnel entrance would directly have faced the current of the Greater Zab River. At the time of the survey the river was flowing some distance to the south of the bluff and the water at the entrance of the tunnel came from a back water of the river (Plate VIa). If the river flowed past the bluff, as it no doubt does in the winter and spring, its level would be above the tunnel entrance and there is no reason why this should not have been the normal state of affairs throughout much of the year when the tunnel was constructed.

The bluff through which the tunnel is driven consists of a coarse conglomerate with occasional horizontal bands of mudstone and is moderately hard. It has therefore successfully resisted erosion by the swift flowing river and would have made excavation laborious. The tunnel itself is in fact a series of tunnels joining the bottoms of a number of large rectangular shafts (Fig. 2). The sides of the shafts are battered, no doubt to ensure stability (Plate VIb). Narrow stairways were cut into the southern sides of the shafts up which workmen would have carried the excavated material in a manner not dissimilar to that depicted on the Sennacherib palace reliefs of work in the Balatai quarries.[14] These stairways have eroded and although still clearly visible, they could not now be safely used. The largest shaft is 15 m by 4 m at

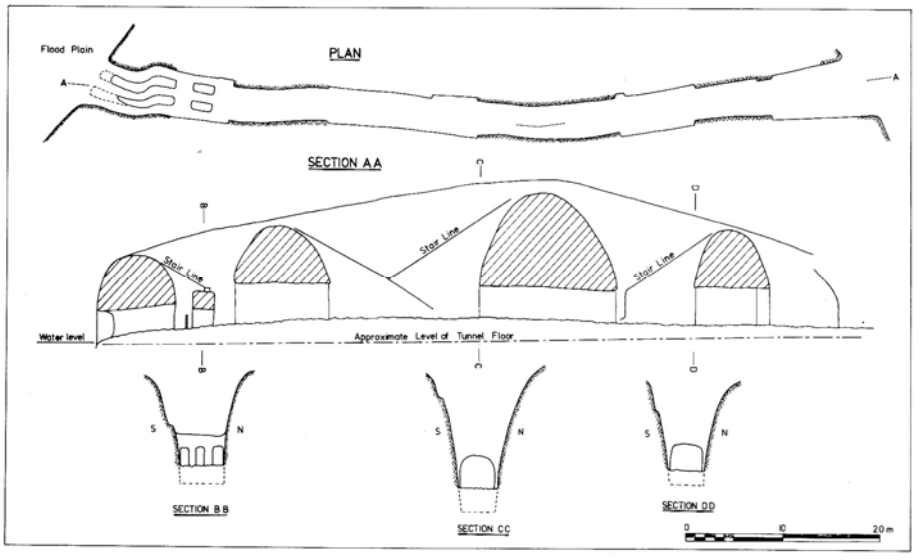


Fig. 2. Plan and Sections of the Negūb Tunnel.

13 *Studies in the Ancient History of Northern lraq*, 47.

14 A. H. Layard, *Monuments of Nineveh II, Pl.* 15, Slab 64*;* See J. Reade, *Revue d'Assyriologie* (1978), Fig. 5a, 76.

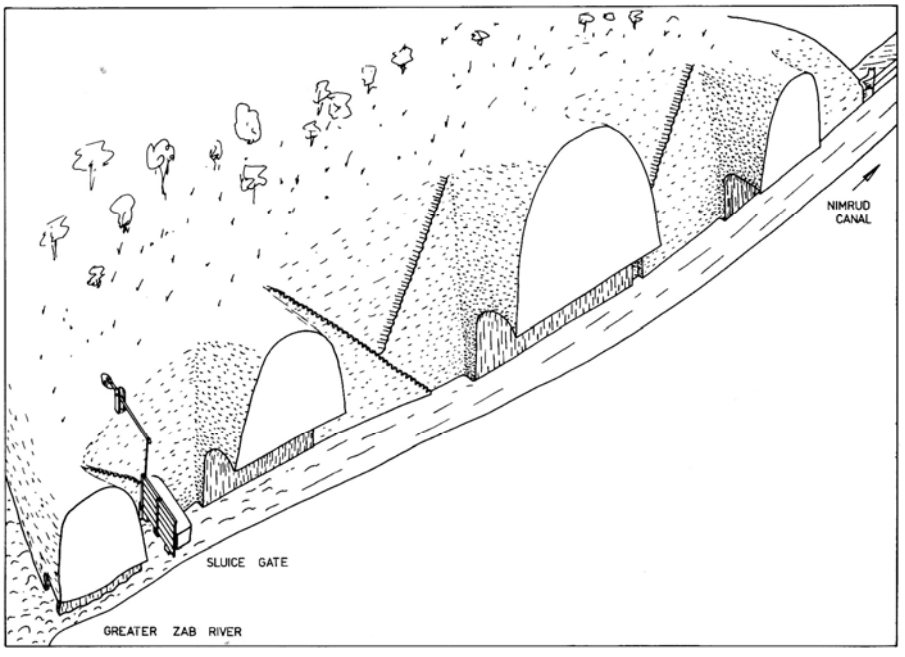


Fig. 3. Isometric Drawing of a Suggested Reconstruction of the Negūb Tunnel.

the bottom and was about 15 m deep. Tunnels were driven between the shaft bottoms and the longest of these is about 14 m. They are at present about 3 m in height and have an estimated 1-2 m of silt on the bottom. The tunnels vary in profile from a circular arch to almost a flat-back.

The tunnel entrance is located at the base of the eastern face of the bluff where it has suffered the full effects of the fast flowing Greater Zab River (Plate VIc). The entrance consists of three separate tunnels, each slightly less than a metre wide with a similar distance between them. These tunnels are 8 m long and follow a sinuous path to the first shaft. This shaft is of particular interest because it is intersected by an unexcavated partition of rock which has three openings corresponding to those of the tunnel entrance. The partition has a flat top 3 m above the silt on the bottom of the excavation and the remains of a stairway descending to it. Immediately to the east of the partition two vertical grooves 0.3 in wide and 0.2 in deep are cut into the side of the shaft. The function of the partition was probably the regulation of the water flow, and so it is possible that the grooves were guides for a sluice gate which could be raised or lowered against the partition. Grooves for sluice gates were also

found at the entrance of the Erbil water tunnel[15] and have also been seen by the author at Bavian near the entrance of the Nineveh canal.

The first aspect of the tunnel which requires comment is the fact that it runs up hill from the entrance. While the present gradient is the result of the silt which has deposited on the bottom of the tunnel it is possible to estimate the rise which would have been necessary for the tunnel to connect with the canal. In doing this it is estimated that there is about 1.5 m of silt at the tunnel exit, giving a rise of about 3 m over the length of the tunnel. It is normal for river diversion channels to have negative grade at their beginning to dissipate the water flow energy and reduce the stream flow rate so that the canal banks are not eroded. The fall of the Greater Zab River and therefore its flow energy are considerable at Negūb and so it appears that not only was a rise of three metres required to control the flow but also an entrance of restricted cross-sectional area and a regulator with a sluice gate were needed.

Both the open and blocked tunnels at Negūb are formed from a series of tunnels connecting a line of shafts. This design appears to be very inefficient as it required the removal of a vast amount of rock which would not have been necessary if a single tunnel had been constructed, and the reason for this is not immediately obvious.

The sinuous path of the entrance tunnels seems to indicate a survey error which may testify to a general inability in such skills that could have limited the length of tunnel that the Assyrians were prepared to excavate from two directions. Tunnels of considerable length were driven with great accuracy to provide the cities of ancient Israel with water[16] and this skill would have been available to the Assyrians. No survey errors are evident in the rest of the tunnel and so it is more likely that the error at the entrance occurred because of the extremely difficult circumstances of the work. Survey control at the commencement of a tunnel is never easy because of the difficulty of maintaining the control, and in this instance the problems encountered by the excavation crew at the tunnel entrance, where they must have started work in the river and could not establish a back-sight, cannot be underestimated.

It is possible that tunnels such as this would experience a certain amount of silting. Access to the tunnel for maintenance would therefore have been important and the large shafts with their stairways would have provided this. However access is equally well afforded by the type of canal cutting made by Aššurnasirpal near Negūb and so this of itself does not provide the main design criterion for the tunnels at Negūb.

The *qanat* design is thought to have been applied to a number of Assyrian water supply projects[17] following the campaign of Sargon II (721-705 B.C.) to Urartu in 714 B.C.[18] But if the first of the two tunnels at Negūb is the work of Tiglath Pileser III, the design employed at Negūb pre-dates this contact. Dimensionally, the Negūb tunnels bear little resemblance to the normal *qanat* which consist of small diameter vertical shafts connected to each other by narrow tunnels. The purpose of the systems are also different in that the *qanat is* dug to obtain underground water while

15. F. Safar, *Sumer* 3 (1947), 25

16. D Cole, How Water Tunnels Worked, *Biblical Archaeology Review* 6, No. 2. 8-29; R. S. Lamon, *The Megiddo Watersystem,* Chicago University Press (Chicago 1935).

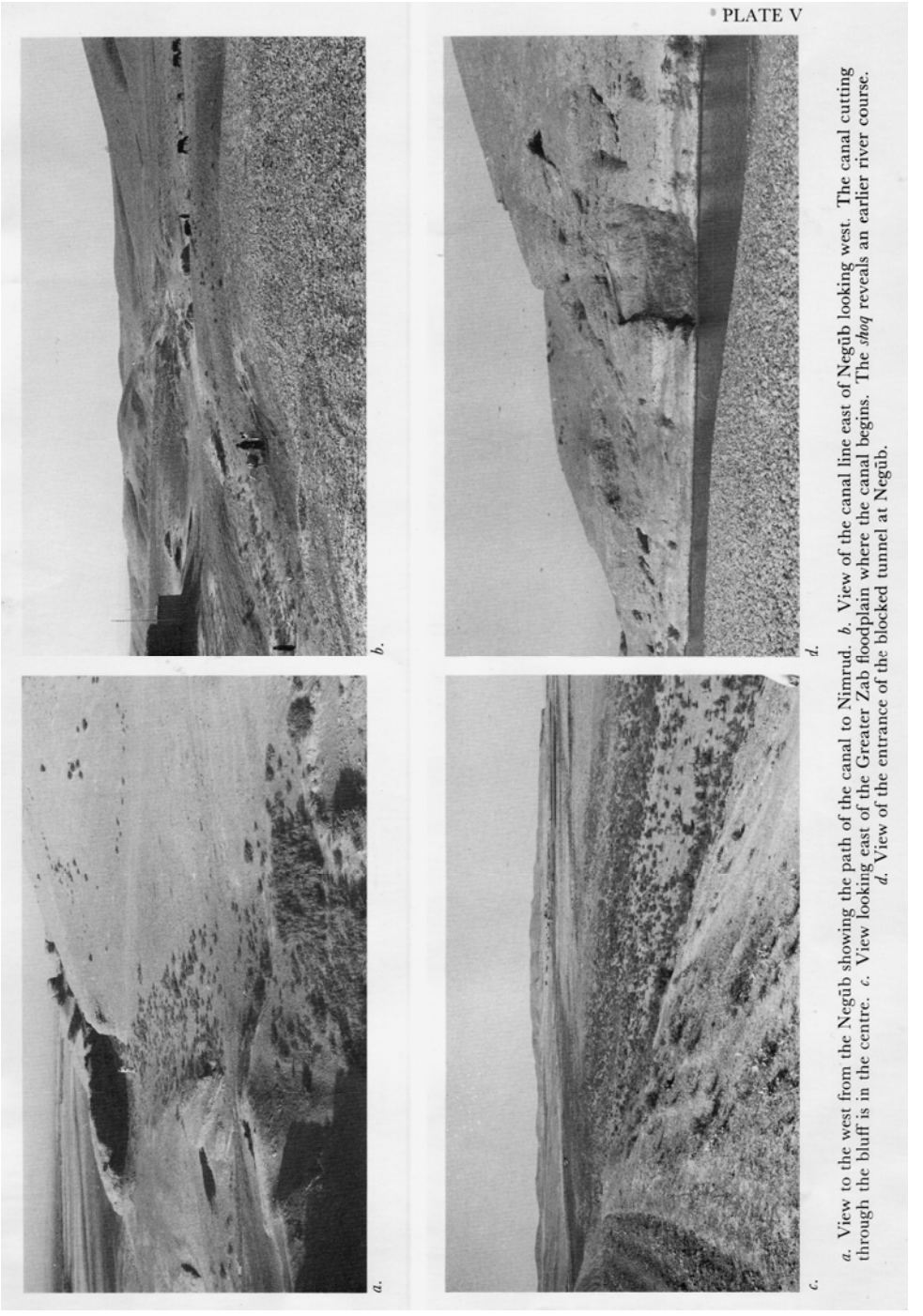
17. R. J. Forbes, *Studies in Ancient Technology*, vol. 1 (Leiden, 1955), 155.

18 J. Laessoe, The Irrigation System at Ulhu, 8th Century B. C.,*J.C.S.* 5 (1951), 21-32.

the tunnels at Negūb simply conveyed water. There is a similar purpose for the shafts in both systems which were required for access and ventilation, but this by itself does not provide a very strong point of similarity between the two systems.

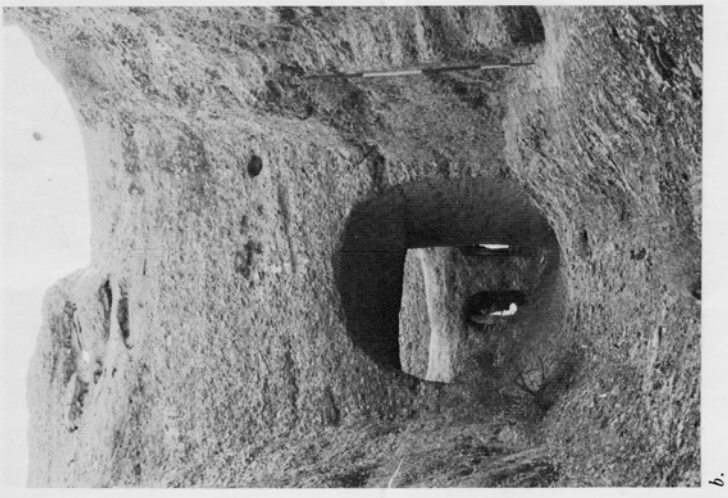
Assyrian canal constructions were labour intensive affairs which were probably completed in some haste. The driving of a single tunnel is a slow operation because of the limited number of excavation work places. The system adopted at Negūb would have involved the simultaneous sinking of three shafts and then the driving of each tunnel from both directions thus overcoming this limitation. This system can be considered a development from Assyrian quarry operations and in particular the canal work of Aššurnasirpal II who "cut through the mountain to its summit" near Negūb. Instead of completely excavating a cut through the hillside, this later method was more efficient because it involved less excavation without greatly reducing the number of work places. The number of excavating work places remained high because the tunnels were comparatively short and a certain amount of sinking would have continued after the tunnels were commenced. This method required skilful planning to ensure that tunnels met precisely and that levels were correct. The Assyrians would have had such skills available to them following their conquests in Palestine and Syria where numerous water tunnels had been built.

PLATE V



a. View to the west from the Negūb showing the path of the canal to Nimrud. *b*. View of the canal line east of Negūb looking west. The canal cutting through the bluff is in the centre. *c*. View looking east of the Greater Zab floodplain where the canal begins. The *shoq* reveals an earlier river course. *d*. View of the entrance of the blocked tunnel at Negūb.

PLATE VI



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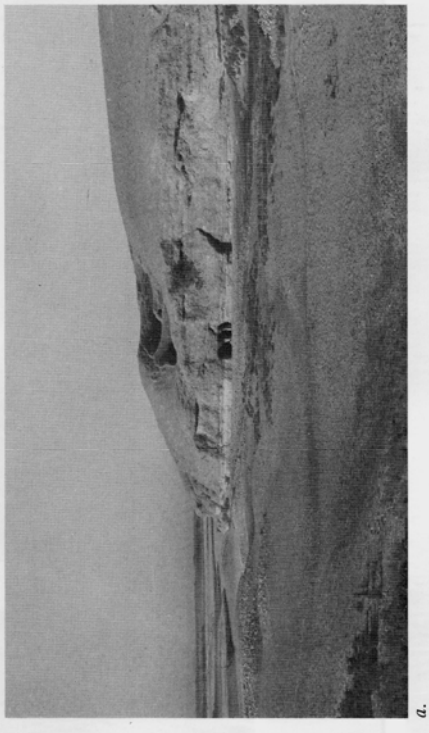

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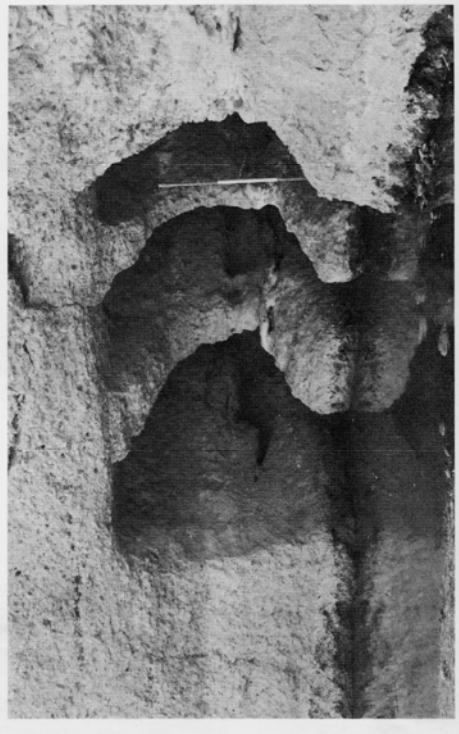

a. View looking west to Negūb. A backwater comes from the river past the bluff. *b.* View of the middle shaft looking east. The stairway remnants are on the right and the regulator is through the tunnel. *c.* The tunnel entrance.