

The Nabataean Rock Carving Technique in Petra

by

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LIST OF ABBREVIATIONS

AA	Archäologischer Anzeiger
AASOR	Annual of the American School of Oriental Research
ACORN	The American Center of Oriental Research News Letter, Jordan
AD	anno domini, After Death
ADAJ	Annual of the Department of Antiquities of Jordan
AJA	American Journal of Archaeology
AfO	Archiv für Orientforschung
ARAM	ARAM: Journal of society for Syro-Mesopotamian Studies
AW	Antike Welt
BA	Biblical Archeology
BAR	British Archaeological Reports
BASOR	Bulletin of the American School of Oriental Research
BC	Before Christ
BJB	Bonner Jahrbücher
Br.	Bruünnow, R. E
c.	Circa, about
cent	century
cm	Centimeter
E	East

ed.	Edited by
Fig.	Figure
IEJ	Israel Exploration Journal
Ill.	Illustration
km	kilometer
m.	Meter
N	North
n.	Note
No.; no.	Number
PEF	Palestine Exploration Fund
PEQ	Palestine Exploration Quarterly
Pl.; pl.	Plate
QDAP	Quarterly of the Department of Antiquities of Palestine
R. Bibl.	Revue Biblique
SHAJ	Studies in the History and Archaeology of Jordan
S	South
USAID	U.S. Agency for International Development
Vol.	Volume
W	West

ABSTRACT

The Nabataean Rock Carving Technique in Petra

by

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Co-Chairs: Distinguished Professor Sharon C. Herbert and Distinguished Professor Henry T. Wright

This paper introduces the steps that the Nabataeans used to carve their simple, less elaborated façades and interiors of the caves in Petra. Because some of the façades and interiors of the caves were used as quarries, the quarrying system has to be examined also. This leads: 1) the inference of the different types and sizes of tools that the Nabataeans used, and 2) to the recording of the masons' marks. Both tools and masons' marks are discussed in separate chapters. These subjects are of great importance to the Nabataean studies, however they were hardly mentioned, much less previously examined in detail. To achieve the goal of the study of the carving technique and related subjects, two steps were followed: firstly, visiting Petra to examine the unfinished façades and interiors; secondly, searching in the available literature related to the above topics. My approach to the first was to conduct a survey of the whole site looking for and recoding the stages of carving. The cave's number of each example, if known, is shown on the map. The surveys in 1990-91 and 1993-94 revealed interesting results

forming the core of this dissertation and led to the discovery of the seven tooth chisel marks and the quarry evidence that shows how the blocks were extracted from the rocks. My concern is to present the Nabataean carving step by step from the very first chisel strike to the time when the deceased were buried in the loci, prepared for them, introducing the appropriate example for each step and describing the cutting technique, supported with photographs and drawings. Further information is included:- Time and labor, completing missing parts, arrangement and use of graves inside the chambers, the 45 degrees oblique lines that distinguishes the Nabataean chiseling and dressing from other ways of chiseling, and the use of plaster. I discuss the quarrying technique in detail and refer briefly to the stone transfer, the unique use of the stones in Qasr al-Bint Temple and the Urn Tomb staircase, the mortar used, the repairing of the broken pieces during their dressing, and give examples of quarries in neighboring countries. Finally, I provide an introduction to the study of the origins of the Nabataean carving technique, a subject that can only be elaborated when more detailed studies of earlier Iron Age carving techniques in the southern Levant are available.

CHAPTER 1

INTRODUCTION

I. The Nabataeans and Petra

Jordan is very fortunate to have among its important archaeological sites the remains and the carved monuments of the ancient city of “Raqmu,” “*Reqem*” (Zayadine, 1983: 220, 1971: 59; Browning, 1973:108, fig.52; Lindner, 1980:220, Abb.6), or Petra as it is called today. Petra is located about 250 km. south of Amman, the Jordanian capital [Map: 1]. The study of Petra, the capital of the Nabataean Kingdom [Maps: 2, 3], and its remains, buildings and the carved caves with their magnificent adorned façades would not be complete without the discussion of the Nabataeans themselves. A continuous and increasing interest has been developing in the last two centuries, and especially in the last several decades of the twentieth century, in the study of the Nabataeans and their capital at Petra. The interest has focused on a number of important questions. Who were the Nabataeans? Were they Arabs? What was their specific origin? And when did they come to Petra? Although it has been said to be an Arab tribe that came from the Arabian Peninsula, by the end of the fourth century B.C. they were already established in what was to become their capital city, Petra (Hammond, 1973: 9-14). The Nabataeans are identified as people from the Arab kingdom of Nabataea. They referred to themselves as Nabatu on their Aramaic inscriptions (Joukowsky, 1998: 15). The

Nabataeans are thought to have been originally a nomadic Badawin tribe with a simple culture. They came apparently from Arabia (Kennedy, 1925: 29). Roschinski wrote a detailed article about the history of the Nabataeans in which he discussed the land where they existed, the dark age of their history, their early history, the rise of their kingdom, the peak of their power, meeting the Roman empire, and finally, the decline of their polity (Roschinski, 1981: 1-26). (For the history of the Nabataeans, also see Patrich, 1990: 21, footnote 1). The questions of Nabataean origins and affiliations and many others were in recent years discussed and re-examined by several archaeologists in light of the results revealed from the latest archaeological research and excavations. But in spite of the abundant information and many conclusions of the research, the questions have not yet been resolved, and a continuous dispute still exists among archaeologists, as we see from the conclusions of the studies. Here, I will quote some of these conclusions to show the differences in the writers' points of view and research: e.g. John F. Healey concluded his article; "Were the Nabataeans Arabs?" writing, "It is far more likely that the Nabataeans were of Arab than Aramaean stock. It would, however, be more difficult to assign the Nabataeans to a particular branch of the Arabs, who were in various groupings at this date" (Healey, 1989: 43). Bienkowski concluded that, "...no precise date for the end of Edomite occupation is possible on the present archaeological evidence alone. As a result, continuity between Edomite and Nabataean settlements, as a distinct from populations, cannot yet be demonstrated" (Bienkowski, 1990: 39). And Graf (1990: 68) concluded his discussion on "The Origin of the Nabataeans", writing, "Of course, questions of origin are of little essence, unless the subject is of the primordial existence of the Nabataeans. I am not prepared to argue that the Nabataeans were the

autochthonic population of the al-Hasa region of northeast Arabia. What can be stated emphatically is that the linguistic, historical and geographical factors at present suggest the Nabataeans arose in the Mesopotamian sphere. Their relationship with the Nabayat of the earlier period should not be removed from consideration.”

The earliest known occupation in the area of Petra was during the Middle Paleolithic period, more than 50,000 years ago. Middle Paleolithic artifacts were found during the survey at the region of Jabal Hārūn [PI. 14] in 1998 by the Finnish expedition (Frösen, et al., 1999: 394). The region around Petra continued to be inhabited during the Upper Paleolithic period (before 13,000 B.C). Diana Kirkbride found one rock shelter with flint implements of this period (personal communication) as well as Neolithic village sites. The earliest Neolithic period, (8000 B.C.), is revealed by the excavations at al-Bayda’ (Beidha), about five km. to the north of the Petra basin, first discovered in 1956. Six levels of architecture representing four types of villages of the Natufian and pre-pottery Neolithic periods built on top of each other were discovered [PI. 1] (Kirkbride, 1962: 7, 1966: 8, 1968: 263; Harding, 1967: 118, Browning, 1973: 238; Khadija, 1981/82: 24-25; Byrd, 1989; Byrd et al., 2005). Recent excavations and surveys at Wādi al-Matahah by Brigham Young University in 1997 revealed chipped stone tools that identified three periods of occupation: Pre-Natufian, Early Natufian, and Late Natufian dated 15,000-10,000 B.C. (Johnson, 1999: 254-254, fig. 15). The area of Petra was part of the Edomite kingdom of the Early Iron Age, as indicated by the excavation by Crystal Bennett in mid 1960’s at Umm el-Biyārah [PI. 2] in the center of Petra (Bennett, 1966: 372-403; 1966a: 6-16) and at Tawilan [PI. 3] northeast of the modern town of Wādi Musa in the 1960s and 1970s (Bennett, 1967/68: 53-55; 1971: v-vii). Tawilan

was a large Edomite city that had its flourish during the 8th century B.C. Agriculture played an important role in its life. The inhabitants of Tawilan excelled in the potters' art. Some of its very fine pottery is equally as well fired and as thin as the now famous Nabataean pottery. It may well be a prototype for Nabataean pottery, which may prove to be indigenous (op.cit.). Excavations at both the small site of Umm el-Biyārah and the large site of Tawilan do not show evidence of any settlement earlier than the eighth century B.C. Tawilan occupation began in the eighth century B.C., but was at its most extensive in the 7th century B.C., while Umm el-Biyārah occupation belongs to the first half of the 7th century B.C. Both flourished from the end of the eighth century to the beginning of the sixth century B.C. (Bartlett, 1972: 32). The small settlements and cities of the Edomite Kingdom lost their short-lived prosperity and fell into ruin for some centuries, until Petra became the center of the Nabataean trading empire (Bartlett, 1972: 37). Bartlett concluded his paper "From Edomites to Nabataeans: The problem of Continuity", saying, "Between Edomites and Nabataeans there was continuity" (Bartlett, 1990: 34). Even today, we find ourselves face to face with the above-mentioned questions, that until now are not finally resolved and it is not the purpose of this dissertation to do so. But it is indeed necessary to refer to some of those who were and are trying to give answers to these questions.

Nabataean history was mentioned by several classical writers, particularly Diodorus of Sicily, Strabo, Pliny, Josephus, and others, (Hammond, 1987: 148). These Writers consistently called the Nabataeans 'Arabs' (Avi-Yonah, 1981: 160). The Greek historian, Diodorus Siculus who traveled in Egypt during 60-57 B.C. gave the first information about the Nabataeans. He pictured them as nomads, without agriculture and

houses, raising camels and sheep and pasturing them in the desert (Avi-Yonah, 1981: 160). They already trafficked the exotic products of Arabia, Africa and India. Strabo, the Greek geographer, writing about 24 B.C. described them not only as traders but also as dwelling of stone houses and practicing agriculture (Glueck, 1965: 4; Avi-Yonah, 1981: 161). In addition to the evidence of the development of the Nabataean agriculture that the recent excavations and surveys have revealed, there are representations of grape and vine leaves on the sooty vaulted ceiling of the mural in the “painted house” (Br. 849) of Siq al-Barid [Pls. 4-5] (The Siq or gorge is a deep, narrow pass between steep heights.), (Maurer and Maurer, 1980: 75, pls: 76 and 81, Glueck, 1956: 13-23, Figs. 1-3, and 1965: 5, 6, 291, Pls: 202-205a, Zayadine, 1997: 54-55 Abb. 52a-d; Yadin, 1965: 26; Hachlili, 1985: 121-126, and McKenzie, 1990: 152, Pls. 113-115). The fruits, flowers, pomegranates, and palm leaf designs and motifs which are employed in paintings, on the fine painted pottery [Pl. 6] that is found throughout Petra, on sculptures, and on the capitals of the columns [Pl. 7a-b] may have been inspired by plants growing in the gardens of Petra.

The last two centuries witnessed a number of travelers who during their visits to Arabia had visited and described Petra, its remains and the region with its people (for details see Ben-Arieh, 1972: 81-92; Browning, 1973: 61-78, and McKenzie, 1990: 1-2). Hundreds of books and articles were written discussing the Nabataeans’ philology, history, culture, religion, and, their capital Petra, with its remains, caves’ façades and architecture, temples and the residential area as well as other Nabataean sites. Exhibitions were organized to introduce this civilization to the broader world. Conferences were held in an attempt to find answers to the above-mentioned questions.

The following are some of the most important articles:- Graf, 1990: 45-75; Hackl, 1993: 5-13; Hammond, 1973: 9-40; Harding 1967: 118- 125; Lindner, 1980: 38- 117; Patrich, 1990: 21-36. Exhibits were opened: “Petra Königen der Weihrauchstrasse” opened in October 1970 in Luitpoldhaus Nürnberg; “Die Nabatäer Spuren einer arabischen Kultur der Antike” in both Kenstner-Museum in Hannover opened 28 November 1976- 30 January 1977 and in Liebighaus Museum alter Plastik in Frankfurt am Main, opened 25 March 1977- 8 May 1977; “Die Nabatäer Erträge einer Ausstellung” in Rheinischen Landesmusuem Bonn opened 24 May- 9 July 1978; “Kultur aus der Wüste die Nabatäer” in the Museum für Fölkerkunde in Vienna opened in October-November 1980; “Petra und die Weihrauchstrasse” in Le Point Gallery in Zürich in 1993; and the most recent exhibit in the American Museum of Natural History in New York, opened in October 2003 through July 2004 then moved to the Cincinnati Art Museum in Cincinnati/ Ohio, and Calvin College in Grand Rapids/ Michigan in 2005 and in 2006 in Canada. Conferences were held in Oxford (Aram Periodical, 1990: 1, 2) and in Petra itself (Zayadine, 1990: “Petra and the Caravan Cities”).

Generally, historians believe that the Nabataeans were a nomadic Arab tribe that moved from Arabia towards the north in the fourth century B.C. The first historical reference to the Nabataeans is in Diodorus Siculus’ account of several expeditions conducted against the Arab kingdom at Petra in 311 B.C., by the generals of Antigonus. They are described as completely nomadic (Graf, 1990: 51, footnote 30). Diodorus also described them as very wealthy people from the trade in Frankincense and myrrh. But Strabo mentioned that by 24 B.C. Petra had all the amenities of an ancient city, and the Nabataeans’ wealth resulted from the trade in aromatics (McKenzie, 1990: 1). For more

discussion of the descriptions of the Nabataeans by Diodorus and Strabo see also (Vycichl, 1990: 147; Hammond, 1965: 4). They traded not only with the Mediterranean countries but also with India, China and the Far East [**Maps: 4a-b**] (Gogte, 1999: 299-304). Trade was established between China and the Nabataeans before the first century B.C. Silk was imported from China and Damasks were exported to China. Literary and historical evidence refer to the strong trade between the Chinese and the Nabataeans by the way of the Red Sea before the first century A.D., and that the Chinese traded with a place called “Li-kan” the Chinese equivalent of Rekem the ancient name of Petra (for more on the trade with China see Murray, 1939:120-124). Petra flourished from the second century B.C. until after the Roman annexation in 106 A.D., even into the third century A.D. It was especially, prosperous during the reign of Aretas IV (9 B.C.- 40 A.D.) during which the Nabataeans reached a peak of cultural achievement (Hammond, 1965: 4). In addition to being traders and caravaneers, the Nabataeans made other remarkable achievements in the fields of architecture, most importantly the hydraulic installations, which include cisterns, channels, dams [**Pl. 8a, b, d (Br. 245)**] and terraces (Hammond, 1973: 72-73). Schmid excavated the area in front of the complex of the dam and the water cistern behind it [**Pl. 8d**], (Schmid, 2001: 176-182). The pottery water pipes are still in situ in the Siq (see the remains of a channel at the bottom of the mountain and few meters higher is the pipe covered with mortar and stones to protect the pottery pipes [**Pl. 8c**]). The Nabataeans also manufactured outstanding pottery, distinguished by its fineness, and thinness and painted with geometrical patterns, birds, palm leaves, fruits and vegetables such as dates, pomegranates, pepper and other colored designs [**Pl. 6**] (Schmitt-Korte, 1970: 47-57; 1976: 41-59; 1980: 174-197; 1980a: 198-

203, Patrich, 1990: 127, 111.42; Parlasca, et al., 1997: 131-137). Palm trees were also cultivated in the area. Palm trees were carved next to the altars [PI. 134]. The architectural fragments, which were found north of the Gate and west of the Baths, were also decorated with olives on branches of olive trees, oak, pine, grapes and wheat or barley. The carvings and decorations on the capitals of the columns indicate another important achievement in the field of agriculture. The ancient terraces were built all over the region, preventing the soil and trees from being washed away by floods. The paintings on the ceiling (Patrich, 1990: 111. 52) of the cave at Siq al-Barid provide additional evidence that the grapes were also planted in the area, [PIs. 4-5]. In the early 1960's, al-Bdul, the indigenous people of Petra were talking about an olive tree that grows in Petra on the north side of Wādi as-Siyyagh opposite al-Habis. Wild fig trees are still growing in the cracks of the rock in the Siq. The excavations of the Early Bronze Age III (ca. 2700-2300 B.C.) at Numeira, south of the Dead Sea, revealed the paleobotanical evidence of the above-mentioned plants (Morgan Harvey, 1999: 44-48, 282-284). A water channel, which is still in a very good condition, was used to carry the water from the end of Wādi Musa to a huge water reservoir in Wādi Arabah.

From about 150 B.C. on the Nabataeans were ruled by kings, who greatly extended their boundaries, both to the north and south (Hammond, 1965: 4). The queens also held a high position in politics and played a prominent role in public life, alongside their kings. For more information regarding the Nabataean women and queens see (al-Fassi, 2007 in general and specially Chapter Four (38-65). The queens' images appeared on the coins with the kings [PI. 9] (Glueck, 1965: 165, Pls. 58-63, bronze coins showing Aretas IV and Shaqilat I, Malichus II and Shaqilat II). (Lindner,

1989: 74: Abb. 24, a Nabataean bronze coin: double-portrait of Aretas IV (9 B.C.-40 A.D.) and Shaqilat, and page 83: Abb. 30: a bronze coin with double-portrait Rabel II (70-106 A.D.) and Gamilat, and (Lindner, 1981: 130) a silver coin with the image of Obada and Huldo), see also (Healey, 1997: 101-104 Abb; 110 shows Aretas IV and Shaqilat I and on another coin Abb.107, Obidas III (30-9 B.C) and his queen. There were eleven known kings during the Nabataean's history. For the chronology of Nabataea rulers, see Glueck (1965: 539-544), which was based on Starcky (1955: 81-106).

The Nabataeans also had a language and alphabet [**Table: II**]. The longest inscription in Petra [**Table: IIb**] is the one carved at the entrance of the Turkmaniyyah Tomb (Br. 634) [**Pl. 10**] (Harding, 1967: 133; Browning, 1973: 232-233, Figs. 11 and 169-170).

The oldest known Nabataean inscription, that of Elusa ca.164 B.C., mentions that the first king was Aretas I about 168 B.C. (Levy, 1996: 49-51, Abb. 6), 169 B.C. The last king was Rabbel II (70-106 A.D.), (Hackl, 1993: 13) or Malichus III? (106 A.D.) (Knauf, 1997: 15), see also Hammond (1973: 15-39), and Schmitt-Korte (1980b: 107) [**Table: 1a, b**]. Most of the structures and façade carvings are believed to be from the time of Aretas IV (9 B.C.- 40 A.D.). The Nabataeans struck their own coins for about two centuries. The earliest anonymous issues are attributed to Aretas II (reg.120/10-96 B.C.) or Aretas III (reg. 87/84-62) with recent finds supporting the earlier dating (Schmid, 2001: 408, see also his footnotes: 10, 11 and 12). The last Nabataean coins were struck by Rabel II between 70 A.D. and 106 A.D. For more details on Nabataean coins, see Meshorer (1975), al-Rawāḥinah (2002), Huth and van Alfvén (2010).

The Nabataeans had their own religion and built temples for their cultic use at Petra. Major temples, including the Temple of Qasr al-Bint (Br. 403) [PI. 11], the Winged Lions Temple, and the Great Temple are still under excavation. A probable unexcavated temple at al-Katutah south east of Qasr al-Bint, has remains of one column are still standing, while the other column drums are still a laying on the surface of the ground. Temples were also built at Khirbet at-Tannur, Wādi Rum, and Khirbet edh-Dharih, and al- Qasr/Karak in addition to those in Hauran. They worshipped a number of gods (At least 59 were noted by Brünnow and Domaszewski). Dushares [Pls. 130-2] was the god of the people and the personal deity of the royal family, and was represented in rectangular blocks carved in relief and set in recessed niches, often individually but in multiple groups in the Siq (Hammond, 1973: 50, 95-96), (see Ch. 5: 4e). Among the other gods were Thu ash-Shara which means in Arabic the one who owns, or was the "Lord" of, the Sharah mountains east of Petra, Atargatis, Allat, al-‘Uzza, al-Kutba, Shai‘ el-Quam, Ashr, and Qos (Hammond, 1973: 95-98; Zangenberg, 1991: 25-36; Zayadine, 1980: 108-117; Harding, 1967: 120, 128; Patrich, 1990: 50-112, and Murray, 1939:127-163). Zayadine divided the Nabataean Gods into two groups:- (a) The males: Allah, Hubal, Dushara, Shai‘ el Qaum, Lykurg, al-Kutba, Qaus, and (b) The Females: Allat, al-‘Uzza, Manat and Isis (op.cit.). These Gods and Goddesses were represented by the form of a squared block carved or scratched on the face of the rock with a trapezoidal base (Johnson, 1999: 253), and with or without an inscription. For more on Dusharas see Ch. 5: D. e, f, Pls. 130-132. Sir George Adam Smith mentions Dushares and Allat, and considers Dushares as a Sun God or it may mean Lord of the Shara, and Allat "the Mother of the Gods" (Kennedy, 1925: 34).

The decline of the Nabataeans and their capital Petra began when Bosra became the new capital of the new province of Arabia and Palmyra became the trade center of the Roman World in the Near East during the reign of Malichus II (40-70 A.D.) and the reign of Rabbel II (70-106 A.D.). The Nabataeans and Petra were conquered by the Romans in 106 A.D. under the leadership of the Emperor Trajan. The main remains of the Roman occupation are the Gate, which was built in 129 A.D. for the visit of Emperor Hadrian and the Latin inscription above the entrance of the façade of Sextus Florentinus Tomb (Harding, 1967: 132). Although the Nabataeans continued to exist and practice their script and cult festivals during the Roman domination, they lost their identity. Hellenistic, Roman and Parthian customs influenced all phases of Nabataean life (Hammond, 1965: 5). They continued producing pottery although it was not of the same high quality.

During the Byzantine period in the fourth century, Petra was the capital of the southern region, which was known as Palestina Salutaris/Tertia, and was the seat of a bishopric. During this period many Nabataean descendants converted to Christianity. The Urn Tomb was used as a church in 446 A.D. and the newly excavated church documents this Period (Joukowsky, 1998: 27-28). In 1973, the excavations below the Urn Tomb revealed a cave with Byzantine objects and a Nabataean eye-idol which indicates that both the Nabataean religion and Christianity were practiced at Petra at the same time (Zayadine, 1974: 137-9, Pl. LIX.1 No. 3; 1986: 254-257). In May 1992 the American Center of Oriental Research (ACOR) in Amman, started excavations on the north side of the Street of Columns (The Colonnaded Street) in Petra revealing a Byzantine church with a beautiful Mosaic floor (Schick, et al., 1993: 55-66) and

important burnt scrolls (see the Bikai's reports mentioned later, and Gagos and Frösén (1998)). In the early seventh century, Islam spread all over the region and the Nabataeans became Muslims and practiced agriculture, traded and built towns and villages (Hamarneh, 1990: 435).

The Crusaders arrived to the Holy Land at the end of June 1099 and captured a number of the Arab strong points, including Jerusalem. Baldwin I, who succeeded to the leadership of the Latin Kingdom after the death of his brother Godfrey in 1100, embarked upon extensive buildings operation in the south, and during 1115-1116, forts were established at esh-Shawbak, Wādi Musa, Aila and Jeziret Fir'aun (Hammond, 1970: 7). Two castles were built in Petra: el-Habis and el-Wu'ayra (Hammond, 1970: 12) both fell in the hands of al-'Adil, the brother of Salah ed-Din after the fall of Mont Re'al (Shobak) in 1189 (Hammond, 1970: 32). Not much is known about Petra in the Mamluk and the Ottoman Periods, since then the city was not mentioned until the visit of Johann Ludwig Burckhardt in 1812 who was followed by many other travelers as mentioned earlier above. It is said that the Howeitat tribe and the current local people of Petra (al- Bdul) are of Nabataean descent (Hamarneh, 1990: 435).

II. Research and Restoration at Petra

In 1970 Peter Parr published an important article under the title, "Vierzig Jahre Ausgrabungen in Petra" (Forty Years Excavations in Petra), which included a detailed study of excavations in Petra from 1930 to 1970 (Parr, 1974: 205-215). Twenty years later in 1990 a new version of the same paper appeared in English under the title "Sixty Years of Excavations in Petra A Critical Assessment," (Parr, 1990: 7-23) in which he

added the archaeological activities, which were conducted between 1970 and 1990. This was followed by a brief history of research and excavations at Petra by Martha Joukowsky in her 1998 book *Petra Great Temple Volume I: Brown University Excavations 1993-1997*, to which she added more information about the work that was carried out in the last decade until 1997 (Joukowsky, 1998: 38-42). The annual of the Department of Antiquities of Jordan and *Studies in the History and Archaeology of Jordan*, both published by the Department of Antiquities of Jordan, include the yearly results of the excavations and work that takes place in Petra and other sites in Jordan (Zayadine, 1981: 341-355).

Petra is one of the most important historical sites in the world and attracts tourists and scholars from all over the world. Its monuments rank among the most important cultural monuments in the world. In 1985 UNESCO inscribed Petra on the list of the World Cultural Heritage (Fitzner and Heinrichs, 1998: 341). It exhibits the beauty of the natural environment (the formation of the colored sand stone mountains) and the Nabataean skill of the craftsmanship (represented in the rock-carved façades and buildings) in such a unique and impressive way that it is almost impossible to find the right words to describe it. In 2008 Petra was ranked in the second place as one of the new Seven Wonders of the World. These chiseled and rock-cut façades with their chambers, the remains of constructed buildings above the ground as well as the recently excavated areas (temples, houses and churches) are suffering from environmental and human damage. The Jordanian Department of Antiquities has the responsibility to conserve, consolidate, restore, preserve and protect the archaeological sites in Jordan and particularly in the Petra Region. Therefore in 1968 a “Master Plan for the Protection

and Use of Petra National Park” was prepared for the Ministry of Tourism and Antiquities of Jordan, with the assistance of the Ministry of Information, helped by the United States Agency for International Development (USAID). Then in the early 1990s the Petra Region Planning Council was established.

Restoration work began as early as the fifties when the Department of Antiquities re-erected some of the columns on the southern side of the Colonnaded Street, the Temenos Gate and the broken column of al-Khaznah. This was followed by finishing the restoration of the fallen column of al-Khaznah in the early 1960s. The writer supervised the restoration work of the Department of Antiquities on the east wall as well as on the south-east corner of the temple of Qasr al-Bint [PI. 11a], the Monumental (Temenos) Gate and the Theater in 1962-1963, (Khadija, 1974: 201). In the middle 1970s the Department of Antiquities started the work at the staircase and arches of the Urn Tomb [PI. 26a, b] and continued restoring and consolidating the Temple of Qasr al-Bint again under the writer’s supervision and that of his colleagues. The restoration of the northern section of the façade of the Palace Tomb was also accomplished in the early 1980s. Since then more restoration and consolidation work has been and is taking place in the recently excavated temples: Temple of The Winged Lions was excavated by Hammond (1996), the Great Temple of Petra was excavated by Joukowsky (1998) and the Byzantine Church was Excavated by the American Center for Oriental Research in Amman (Schick, et al., 1993: 55-66; Bikai, 1996: 481-486; 1997: 339-342; Bikai, 1996: 487-489; 1997: 343-344). Necessary conservation and restoration of structures and wall-paintings was performed by a team from Intermonument Restauro under the supervision of U. Bellwald at the Swiss-Leichtenstein Excavations at az-Zantur (Kolb, et

al., 1998: 259). Research was conducted to examine the various mechanisms and rates responsible for sandstone weathering in an arid climate by controlling lithology, time, the initial surface condition, and the weathering influences in the sandstone architecture of Petra (Paradise, 1999: 354). The Theater was chosen for the analysis of sandstone weathering for a number of reasons, one of which was that the hewn nature of theater ensures that it has not been moved or rebuilt since its construction (Paradise, 1999: 357). A sampling scheme was used to measure differences between the presently weathered surfaces and the original surfaces dressed by the stonemasons. It was found that sandstone weathering in Petra's Theater is due to variations in rock matrix chemistry and the direction to which it exposed and related annual solar flux. For more details see Paradise's analysis and results (Paradise, 1999: 353-368). A joint team implemented by the Department of Antiquities and GTZ (German Technical Cooperation) started the Petra Stone Preservation Project at Tomb 825 in Petra (Aslan and Shaer, 1996). In 1980 Dr. Almagro M., director of the Natural Museum of Madrid, cleaned the painted ceiling and walls of the cave of Wādi as-Siyyagh [Pl. 12a] (Zayadine, 1981: 355, See also footnote No. 19), which indicates that the Horsfields noticed the stucco decoration of the houses, but were not able to reach the new cave (Horsfield, G. and A., QDAP 11, 1938: 16-17, Pl. XLIV, 1-2). A three year long research project entitled "Systematic registration and evaluation of damages at rock monuments in Petra, (1996-1999)", aimed at comprehensive damage diagnosis was initiated by Heinrichs, K. and Fitzner, B. with the cooperation of Jordanian authorities and was funded by DFG-Deutsche Forschungsgemeinschaft/Bonn (Germany). Twenty-two monuments were selected for detailed investigation based on a survey of monuments, considering variety of stone types

and monument characteristics, and interdisciplinary discussions with Jordanian scientists. Systematic studies were executed in Petra for better understanding of stone weathering and damages of the monuments (Fitzner and Heinrichs, 1998: 341-360; Heinrichs and Fitzner, 1999: 321-351 and Shaer, 2008: 341-345).

A number of surveys were carried out in Petra and the Region by a team from the Naturhistorische Gesellschaft in Nürnberg headed by Manfred Lindner with the cooperation of the Department of Antiquities of Jordan (Lindner, et al.: 1984; 84a; 1986, 1987, 1989a-e; Lindner, 1992; Lindner, et al., 1996; 1996a; 1997; Lindner and Zeitler, 1997/1998), see also Frösèn, et al., 1998: 483-502; 1999: 369-410; Johnson, 1999: 249-260; Donner and Sieg, 1998: 279-292 for their surveys at Jabal Hārūn, Wādi al-Matahah and the Upper Valley of the Hermitage near ed-Dayr, Petra (Zayadine and Hottier, 1976: 93-104).

Most of those who worked at or wrote about Petra were dealing with al-Bdul, the local people, in one way or another. We do not know exactly when these local people came to live in Petra. A detail study of al-Bdul was furnished by the late Kenneth Russell in which he refers briefly to the Liyathnah, the inhabitants of the ancient village of Elji east of Petra, part of modern Wādi Musa, and the ‘Amareen, the inhabitants of al-Baydha north of Petra. Then he talks about the origin of al-Bdul lineages and subtribal associations, their position in the history of southern Jordan and the influence of tourism on them from the 1920s until the present (Russell, 1993: 15-35). McKenzie made a detailed record of all those who in the nineteenth and early twentieth centuries referred to al-Bdul and their living in Petra (McKenzie, 1991: 139-145). The personnel of the Department of Antiquities and Al-Bdul have used some caves for habitation, and

modified them by adding walls, floors, doors, and windows [Pl. 13]. White or colored paint was also used on the walls and ceilings. Other caves were left open except for a rough stone-wall in front, not more than one meter high, and half a meter wide with an opening as an entrance to the cave. Dark soot, a result of smoke, covers the ceilings completely and most of the walls. Thick layers of dung, ash and stones cover the floors of many caves. In early 1960s there were only two hundred people living in the caves, but their number exceeded a thousand when they were moved to the new settlement at Umm Sayhun [Pl. 21b] beginning in 1985. Joukowsky also talks about al-Bdul and the origin of their name and the increase of their number (Joukowsky, 1998: 32-33; see also Khadija, 1974: 201-204; Fakhry, 1972: 19-20; Ajluni, 1956: 54-56). Bienkowski described in detail the caves in Petra, as well as, the life of al-Bdul in these caves, while they were in use and after al-Bdul moved from them to the new settlement at Umm Sayhun (Bienkowski, 1985: 149-160; Bienkowski and Chlebik, 1991: 147-180). A few families with their animals are still living in the caves awaiting the building of new houses. Some caves are now used by al-Bdul as restaurants and cafeterias. No additional stone cutting or quarrying has been undertaken by the inhabitants. They have never used these burial caves for their own deceased. Instead they used an area south of Wādi Farasah and on the way to Jabal Hārūn [Pl. 14a], where on the top, the Tomb [Pl. 14b] of Prophet Hārūn, the traditional burial place of Hārūn, Prophet Moses' brother, is located (Kennedy, 1925: 9, Fig. 21, for recent work at Jabal Hārūn see also Frösén, et al., 1999: 369-410).

III. Geological Environment and Setting

Jordan is located at the northern rim of the Arabian-Nubian shield, where three structural provinces are to be distinguished: (a-) the Arabo-Nubian shield founded on Pre-Cambrian igneous layers. Its northern margin is covered by thick layer of Cambrian to Cretaceous sandstone, which exists from the Moroccan Sahara across North Africa to Sinai, Jordan (at the northern rim of the shield) and Saudi Arabia. Russegger introduced the term “Nubian Sandstone” in 1847 and applied it to the Cretaceous sandstones in Upper Egypt (Pflüger, 1990: 52). The “Nubian Sandstone”, is characterized by its brown, yellow, or rose color, and is rich in quartz gravel. Such sandstone is well exposed at the east side of the southern and central Wādi Araba. (b-) the stable shelf:- The Tethys was an important ocean between Eurasia and Africa from the Jurassic to the Miocene periods, about 150 million to 15 million years ago. As Africa approached Eurasia, the Tethys disappeared, the Mediterranean being a small remnant of the Tethys. So there are Paleozoic Rocks on the “stable shelf (including most of the sandstone around Petra)”, but they are older than the Tethys. The shelf includes deposits of epicontinental and neritic sediments of the Mesozoic and Tertiary Tethys Sea, ranging from the Paleozoic to Cenozoic age, and includes most of southeast and central Jordan. It borders the northern margin of the shield. Petra belongs to the structural province of the stable shelf, and its location displays a complete sediment suite from Proterozoic Saramouj Conglomerates to Ordovician Disi Sandstone [**Tables: III-IV**]. (c-) the unstable shelf:- The sediments of this zone form a transition to the stable shelf, that occurs in northern and northeastern Jordan (Pflüger, 1990: 15, cited in Bender, 1968a: 17; 1974: 6).

Petra lies in the crescent-shaped Wādi Musa valley, which is situated in the Sharah Mountains at approximately 900m. above sea level (30° 20'N/ 35° 26'E) and is surrounded by vertical sandstone cliff mostly from Umm Ishrin Formation, that rises 100m. above the valley floor. The sandstones (Ram, Umm Ishrin, and Disi Formations) are underlain by an extensive pre-Cambrian (>ca.550 my) complex comprised of the Aqaba Granite, with gneisses and schists, and the Ahaymir Rhyolite and Diabases. These dark-colored rocks outcrop along the eastern slopes of Wādi 'Araba, in the eroded walls of Wādi as-Siyyagh, which is Petra's western drainage into the Rift Valley (Paradise, 1999: 354; 1998: 151). Petra is located in the stable shelf area, in a depression extending north to south within the Sharah mountain ridge, and extending eastward to the middle of the Arabian Peninsula, and along Arabia's southern coast as well as across the Negev and central Sinaitic Peninsula (Morgan-Harvey, 1999: 59). The Sharah mountain range that is dominated mainly by lime stones and sandstones extending for almost 75 km, from the south of Shawbak all the way to Ras en-Naqab. Petra is in an area predominantly of soft sandstone composed of Cambrian and Lower-Ordovician according to the lithology and stratigraphy of the sediments, [Table: III-IV]. [Table: IIIb] represents the different lithostratigraphical classifications of the lower Paleozoic clastic series in Jordan and Petra (Fitzner and Heinrichs, 1998: 342, Fig. 1: 344). In his recent study [Map: 5, Tables: IIIa, c, and IVb], "Flash Floods Conglomerates and Cambrian Transgression in Petra/Jordan", published in 1990, Pflüger's facies analysis and paleocurrent interpretation lead to a detailed picture of different sedimentary environments, geotectonic setting and also information on paleogeography. As an example, the transgressive cycle of the south-west Jordanian

Proterozoic, Cambrian and Ordovician clastica is studied in representative profile at Petra, and an emphasis was put on the interaction between transgression and Precambrian paleorelief (Pflüger, 1990: 13).

Pflüger's study in Petra revealed the following:-

A. Precambrian Basement

This is exposed in the northwestern third of the study area, and shows a distinct paleo-relief with smooth, trough-shaped valleys or gaps more than 150m. deep and paleoslopes dipping up to 35 degrees.

B. Proterozoic Sediments

These comprise the Saramouj Conglomerate, which is found along the western scarp of the Petraean sandstone terrace. Saramouj is a wādi at the southeastern end of the Dead Sea where the Saramouj Conglmerates reach a thickness of over 200 meters. At Petra these sediments are found at both sides of Wādi as-Siyyagh, on the north slope of Wādi Marwan, and the northeast slope of Jabal al-Barra.

C. Cambrian Transgression

This event deposited the Nubian sandstone [**Tables: IIIb-IVb**] which has been classified as follows:-

1- Saleb Arkose: It is the lowermost unit of the transgressive Cambrian sequence in Petra overlying the late Proterotic Saramouj Conglomerates and topped by the Nabataeica Sandstones. The Saleb Arkose indicates a reversal of Paleocurrent directions towards the north as well as by an angular unconformity (Pflüger, 1990: 124, Fig. 51: 125). It is found in Wādis Marwan, Siyyagh, and Dulaiya, and characterized by angular grains and a pink-brown or carmine color.

2- Nabataeica Sandstone: Fine rounded grains, with rose to light brown color. It is well documented by trace fossils as well as sedimentary structures and starts with shallow marine beds. It is found at Wādīs as-Siyyagh, ad-Dulaiya and Marwan.

3- As-Siyyagh Sandstone: This forms the impressive vertical cliffs along the western escarpment of the Nubian-type sandstone in Petra. It is distinguished by its uniformity with regard to bedding structures and sedimentary facies. It consists of subrounded quartz grains of coarse to medium grain size.

4- The Temple sandstone: The most obvious type in Petra. This kind of sandstone is known in central Wādi ‘Araba, Wādi Ramm, Mudawwara and Tubeiq. It is found all over the study area in Petra. It is not less than 105m. thick at al-Habis while it reaches a maximum thickness of 133m. at Jabal Hārūn. The sand grains are fine- to coarse-sized and subrounded. It is stained red by hematite grain coatings.

5- Al-Habis sandstone: This light-weathering coarse to medium grained sandstone is seen at the top of al Habis, Jabal ed-Dayr, al-Barra and the waist line of Umm el-Biyārah. It is about 35m. thick, better sorted and rounded than the previous ones and coarser than the Temple sand stone.

6- Ed-Dayr Sandstone: This forms the top of the mountains of Petra, al-Bayda’ (Beidha) and Sabra. It has a brownish color. The high grade of quartzose and kaolinitic cementation of this unit provides the highly resistant mountain cappings of Jabals ed-Dayr and Umm el-Biyārah, as well as a context for durable tombs. Vertical thicknesses vary from 120m. -140m.

D. Post- Cambrian Paleozoic

Disi Sandstone: A gradual transition from the Lower Cambrian ed-Dayr sandstones into massive, light-colored possibly Lower Ordovician sandstones of the Disi Formation occurs in Petra and the Wādi Rum regions. The coarser white sandstones cover the area of the modern resthouse and the Forum hotels. The façade of the tomb (Br. 454) [Pl. 47] located in Wādi al-Kharroubah provides a good example of the way in which lines of interstratified white sandstone weather very much faster than the harder red-colored rock (Kennedy, 1925: 58, Fig. 119).

E. Mesozoic

Two types are recorded:

1- This vari-colored sandstone is found along the western slope of the Shara mountains, north and south of Wādi Musa. It is 70m. thick and of white, purple, brown, and yellow colors.

2- Kurnub Sandstone follows stratigraphically the vari-colored sandstone and is about 20m. thick in the lower Wādi Musa.

F. Cenozoic

Two types exist:

1- Calcrete: found between Wādi Musa and al-Bayda' (Beidha) where the modern village of Umm Sayhun is located, and in south east of eth-Thughra.

2- Wādi Sediments: deposits are found in the wādi channels coming from the Shara cliff.

G. Modern Environment of Petra

The Sharah mountains are arid, dry and hot in the summer, wet and cold in the winter with rainfall averaging between 100-400mm, and with heavy snow fall in some

years. They are covered with oak and Juniper trees and other wild bushes. Other wild plants and flowers are common such as the white broom, star-thistle, iris scarlet poppies, squill, hakweed and oleander trees are all over the wadis. Some of these are poisonous to most animals. For more on plants in Petra and the surroundings see Wanke (1980:154-173). In the middle of the last century the inhabitants started planting olives, grapes, apples, figs and other fruit trees around their villages and towns. Large areas are planted with wheat and barley depending on the amount of the rainfall in that season. The government planted wide areas of the slopes of the Sharah with thousands of pine and other forest trees to help protect the soil from erosion.

Of animal life in Petra, a number of wild animals such as hyenas, jackals, and wolves are mentioned, but are seen rarely in the area. There are also gazelles, ibexes, hares, and coney. Different kinds of snakes, insects, caterpillars, spiders, lizards (especially the blue lizard), scorpions and reptiles are common. Birds such as white Egyptian vultures, nightingales bulbuls, ravens and many others are to be seen around Petra area. (For more on the Petra habitat, see Murray 1939). The people have brought in such domestic animals as sheep, goats, camels, donkeys, horses, mules, chickens, pigeons, and rabbits.

IV. Plan of Dissertation

In this dissertation two main subjects are to be studied and discussed, however other relevant topics which are also important and need to be discussed in order to complete this study. The first main subject concerns the methods used by the Nabataeans in carving the simple, less elaborated façades and the interiors of the caves.

The second main subject to be discussed in this dissertation is the Nabataean quarrying system. These two major subjects are of great importance to the Nabataean studies since they were hardly mentioned or previously examined in detail. To achieve this goal, two steps were to be followed: The first was to visit the site of Petra and spend enough time there to look at and examine the unfinished façades and interiors of the caves that are related to the subjects of this study, and the second step was to search in the available literature dealing with them. My approach on the first subject was to conduct a survey of the whole site of Petra looking for the unfinished façades and interiors and to record the stage of carving which each one reached. The surveys that I had conducted in 1990-91 and 1993-94 revealed very interesting results, which are the core of this dissertation. My concern here is to present the steps, which the Nabataeans followed in carving their caves, from the very first strike of the chisel on the surface of the mountain to the time when the deceased were buried in the loci prepared for them. I will introduce an appropriate example for each step and describe the cutting technique used, supported with photographs and drawings. In addition to this and so as to complete the study of this technique additional necessary information is included such as:- Time and labor needed for carving, completing missing parts with masonry, types of arrangements of graves inside the chambers and the way in which they were used, the 45° lines that distinguish the Nabataean chiseling and stone dressing from others and the use of plain or decorated plaster in and outside the caves. The cave number of each example will be shown on the map of Petra, if the number is known and found in the available literature (I follow Brünnow's numbers as presented in Kennedy 1925). I will also discuss the quarrying technique in detail and refer briefly to the transport of stone,

the unique use of the stones in two major buildings (Qasr al-Bint Temple and the Urn Tomb staircase), the mortar used, the repairing of broken stones during their dressing, and give examples of other quarries in other sites in some of the neighboring countries such as Egypt, Persia, and Syria.

To achieve the carving and the quarrying, the Nabataeans used tools of different types, sizes and uses. In addition, the quarryworkers, stone-cutters, sculptors and masons all left their marks on their works in the form of drawings, carvings or letters. These marks are found on the faces of the quarries and the stones of the built buildings, and in and outside walls of the caves. The tools and the mason's marks are briefly discussed to complete this dissertation.

It is also important to refer briefly, to the origin and of Nabataean carving and its influence on other carving styles. Finally, and as a result of the above mentioned topics, a conclusion is given to summarize the result of this research with the hope that this work will encourage scholars to study in more detail the topics discussed in this dissertation and try to shed more light on them with the use of modern technology in the future.

This study will highlight examples of rock carving of façades and interiors of caves that have remained relatively absent or unexplained in previous discussions. It is based on two seasons of survey of the simple carved façades and their interiors and the quarries in Petra. It is also a record of all the façades and caves used in this study. It forms a basic foundation to enable archaeologists to conduct further study to determine the sequence of chronology, which may lead to a new dating for the caves. Implications for future studies will be presented which will hopefully add to current and future

understanding of Nabataean culture and craftsmanship and its influence on regional architectural developments.

CHAPTER 2

THE PROCESS OF CARVING THE CAVES AT PETRA

The mountains of Petra are an outcrop of sandstone suitable for the carving of artificial caves, as well as to quarry the blocks of stone needed for buildings and tombs. In certain areas the rock is very hard and produces a good quality stone, which was used for buildings in the residential area, for temples, and for pavements such as that in the Temenos yard. In other areas, the sandstone was softer, and caves could be carved out. The stone-masons were very successful in choosing the location of the majority of the caves, quarries, and graves, especially the main ones such as ed-Dayr, al-Khaznah, and the Urn Tomb. Quarrying the sandstone was performed using the same process used for limestone quarrying.

The Nabataeans meticulously planned work in the caves. Some locations, like that of the Urn Tomb, the planners had to cut deep into the sloping side of the mountain in order to achieve the right height and size needed to carve the chamber, the façade and the courtyard in front of it. Accurate measurements were required in order to achieve such carved caves and façades. It is possible that with a closer examination of the façades and interiors of the caves would demonstrate that the craftsmen had specific plans, perhaps drawings, which they followed for each group of carvings that share similar façades or interior design.

The so-called Early Nabataean carvings are represented in many locations, such as those south of the Theater, and those at Wādi al-Mu‘aysrah ash-Sharqiyyah and others. In many books and articles, some of which were mentioned earlier and will be mentioned in the following pages, archaeologists have discussed the caves' façades concentrating on the geological, historical, or archaeological points of view as well as studying the effects of environment and human occupation on them. No one, however, has studied the stages of the carving of these façades as a process from the first strike of the chisel on the rock until after the deceased were buried. In this dissertation I propose series of stages as a process to explain the Nabataean rock carving technique, which was essential to the elaboration of the many caves.

I have chosen to study the more typical caves that have a simple unfinished carved façade and interiors since some of my colleagues have already furnished detailed studies on the larger, more elaborate finished façades (Browning, 1973; Zayadine, 1974; and McKenzie, 1990). The Nabataeans also used what we today would consider typical graveyards for burials, using graves dug in the ground. Examples can be seen at ath-Thugra on the way to Jabal-Hārūn and at the dump of Umm Sayhun quarry [Pl. 21c] at al-Najr. These, however, have not yet been excavated or dated. Kennedy also noted a very large number of ordinary burials, though he did not mention their locations (Kennedy, 1925: 73).

Several important questions are still to be answered. The intensive work which is being carried on by a number of archaeological expeditions may in the future find the answers to solve the following examples of such questions:- When did the idea of carving begin? Were first burials in pits or in caves? Was it a local development of carving of

caves in the Petra area? How did the first cave façade come to existence? What is the size of the earliest graves? Were the cave-houses carved where these tombs were carved or were the Nabataeans still living in tents or constructed houses? Why did they put the white lime or the white and dark brown or black paint on some of the gables, dentils, walls and façades? There are many such questions waiting for answers. Early Nabataean archaeology is little known and it will take time before these questions are answered.

The magnificent rock carved façades- some adorned with columns and statues- and chambers are the main existing features of Petra, in addition to the Temple of Qasr al-Bint, the Temple of the Winged Lions, Petra Great Temple, the Theater, and the Colonnade Street. They were the emphasis of study and research of many scholars since the visit of Johann Ludwig Burckhardt in 1812. The literature and number of those who wrote on Petra and the Nabataeans are very enormous and abundant. Among those are: H.A. al-Fassi (2007), W. Bachmann, (1921), Y. Ben-Arieh, (1972), J.-C. Bessac, (2007), I. Browning, (1973), R. E. Brünnow, and A. von Domaszewski, (1904, 1909), G. Dalman, (1908, 1911-1912), N. Glueck (1965), P. Hammond, (1965, 1973), L. Harding, (1967), G.&A. Horsfield, (1938), M. Joukowsky, (1998), A. Kennedy, (1925), N. Khairy, (1975), L. Laborde, (1836), M. Lindner, (1985), M. Lyttelton, (1990), J. McKenzie, (1990), M. Murray, (1939), A. Musil, (1907), A. Negev, (1986), P. Parr, (1990), S. M. Rababeh, (2005), A. Starcky, (1955), R. Stucky, (1990), T. Wiegand, (1921), F. Zayadine, (1990), and many others. Some scholars dealt with the façades chronologically and architecturally. Others discussed their function as to whether they were tombs, religious places, or dwellings. In this chapter, as a result of my survey of

all remains and caves with simple carvings on their façades or their interiors, I will present the developmental stages and process of carving from the start until the caves were ready to be used for whatever purpose that was intended. I will examine a sample of caves and describe them, trying to give a clear idea about the process of carving in each.

It is not easy to arrange the caves according to the stages of development of carving that each one reached, and say that certain carved façades fall into specific categories because each one differs from the others in spite of superficial similarities between some of them. Dating them needs more research, which I do not intend to do at this time. I will leave for the coming generation of archaeologists to determine their dates with future technology as it becomes available.

Most of the scholars and writers as well as visitors who admired the façades called these carvings into the rocks “tombs.” I consider this a serious mistake because they were not all tombs. Whatever the nature or purpose of the rock-cut carvings in Petra, including the decorated façades and chambers, the majority of them have burial chambers, but others have cisterns or water reservoirs, as for example, those at the western and northern sides of the High Place and al-Khubthah, and at other places. Some were used as triclinia. Among these are the Triclinium (Br. 65) opposite al-Khaznah, Bab al-Siq Triclinium (Br. 34), and the main Triclinium (Br. 235) in Wādi Farasah. They may have been used for religious or funeral ceremonies, or to hold feasts, water reservoirs, or for rock-cut cave dwellings as those located at al-Habis, opposite the theater and at other places in Petra (McKenzie, 1990: 107-108 and plates 171b, 172a-c). Brünow's list mentions more than sixty cave dwellings between the

Palace Tomb and the Hāret (Mughur) an-Nasārā area (Kenndy, 1925: 39), but that number has not yet been confirmed. And unless the interiors of the caves are cleared of the debris inside, it is impossible to find out whether but the caves were originally used as dwellings or as tombs. Dwelling caves are well known at Petra as revealed in the excavations by Murray and Horsfield at both Wādi abu-‘Ullaqa and the Wādi es-Siyyagh entrance (Zayadine, 1974: 139). The local people refer to a cave as *Kahf*, *Magharah* or *Harabah*. Their actual function can be determined only if they have been cleared or excavated and described. Previous discussions of the caves divided them into groups only according to the carvings of the façades and not according to their function [Table V] (McKenzie, 1990: 6, Table1). I will use the word “cave” as used by the local people to refer to all the artificially carved places with openings and chambers or small rooms, and not in reference to the natural caves in the mountains, the word “Monument”, to refer to all building remains in Petra and the word “Tomb” for any cave that has graves in it, and the word “Grave” to refer to the burial pits inside the chambers, or outside the caves.

During the two survey and research periods, I was able to recognize the steps that were used in carving Petra's façades and cave interiors. Photographs and drawings are used to demonstrate the steps of the carvings. I have tried to be as accurate as possible with my descriptions and measurements, in spite of the difficulty of reaching certain places because of their height, and the lack of financial means to hire an architect to help me during my work.

Many earlier scholars who published their work on Petra were impressed by the major façades such as al-Khaznah, ed-Dayr, and some of the other façades which differ completely from the ones that will be discussed in the following pages. This work

represents the Nabataean carvings some of which may have been carved in earlier periods, perhaps, centuries before the ones known as the “classical period” façades were carved.

When Kennedy conducted his study, he as well as others before and after him, dealt with the external appearance, assuming probably, that internally they are all alike in containing a rectangular chamber or chambers with wall niches, or shrines, and having raised benches on two or three sides. Externally, Kennedy argued that the façades show a continuous development from plainness to ornateness and from simplicity to complexity of design. Internally no such development is traceable (Kennedy, 1925: 45).

In fact, there is much variation in the interiors of the caves as well as on the exteriors. For example, there is variation in the way the interior was carved, the way the graves were carved and arranged, variation in the painted plaster that covers the walls, and variation in the inscriptions, animals, and other figures carved inside the main chambers, as well as variation in the overall size of the chambers.

In this dissertation, I will discuss the carving stages and technique of the group that has simple common architectural features and elements on their façades and interior chambers. This chapter and the following one are the core of this dissertation, focusing on the unfinished façades and interiors, little discussed by earlier scholars. I am not concerned with their exact dates. Rather, I will arrange them one after the other according to the amount of work completed on each one of them. I will not be dealing with the dating of these caves because this requires a special study. If there is any date given by another scholar, however, I will refer to it.

All investigators have noted that the carving of a façade in Petra started from the top and progressed downward [PI. 23] in contrast to building with masonry, which must start with a foundation progressing upward. Unfinished tombs throughout Petra demonstrate this carving method.

It is not easy to determine how many types of façades there are in Petra, and the surrounding area, because of the severe damage over centuries by natural erosion from rain, wind and earthquakes, and because of the damage that humans have caused. Some of the façades were separated completely from the monument leaving a large opening that looks like an actual doorway. These are seen at the lower eastern and northern side of al-Habis and Wādi ed-Dayr. These caves were probably dwellings and called by Brünnow “Zerstörte Gräber”, and not numbered in his list of over 520 Nabataean or classical façades (Kennedy, 1925: 39, 44 and 46).

I. Possibly Earlier Caves and Graves

A number of façades carved by the Nabataeans do not fall into the stages of chronological development, proposed by Brünnow (1904), Kennedy (1925), and others, for instance the Façades near the theater. Examples of unique and peculiar façades are wide spread throughout Petra like, those in Wādi ed-Dayr (Br. 450, 451), [PI. 15a, b] and south of the Lion's Tomb (Br. 452), also in Wādi ath-Thughrah, at the western side of the High Place and behind al-Habis (Kennedy, 1925: 42, Figs. 73, 74, 79 and 81). Such façades are often considered to be early types. Two of these (Kennedy, 1925: Fig. 73; Browning, 1973: 80-81, Fig. 31) [PI. 15a, b] possibly early façades are described with emphasis on their major architectural features. These are used by most scholars to

exemplify the unique types among the rectilinear façades in Petra. Unfortunately there is not enough evidence to propose the steps in carving these possibly early caves and their façades.

Façades of Tombs Br. 450 and 451, [PI. 15a, b]

Location: on the way to ed-Dayr (the Monastery), south of the Lion Tomb.

These two caves are tombs, for there are graves dug into their floors and bones were found in them.

These two façades fit into Browning's number one category which he and others call "Rectilinear façades" and consider them to be "probably the earliest form of decoration" (Browning, 1973: 80-81). Both façades have very simple decoration. The façade of the left (south) tomb (Br. 451) has a unique decoration which otherwise does not exist in Petra. On the top of the door are horizontal flat surfaces with a cut and a groove between them as if the builder intended to insert a pediment. A similar façade with a simple groove above the door is located at the western side of al-Mu'aysrah ash-Sharqiyyah [PI. 48a, see white arrow on far left]. The left façade also has a rectangular door opening with sunken pediment above it and a pilaster on each side of the door (Kennedy, 1925: 42, Fig. 731). The second or northern façade (Br. 450) has a wider door, about two meters wide, but is the same height as the first one. I believe that the extra width in this door is because the southern side was either weathered or worked in a later period to provide a wider door. It is obvious that the southern side was cut until it reached the pilaster. There are two simple pilasters, which extend almost two meters above the doorway. They had simple Nabataean capitals, which are now badly

damaged. It appears that there was a flat molding across the top. There is also a groove above the door, perhaps to insert a pediment.

A close examination of these two façades and of the area between them reveals several types of chisel marks, which indicate that the carving was not finished. The fine diagonal dressing is completed on the north pilasters of the south tomb on the right side. The dressing is finished with strokes forming curved lines [Pl. 15c], rather than straight lines. The chiseling on the area between the door and the same pilaster is in the form of unorganized straight lines, cut in several directions. Traces of small wide chisel marks are seen on the edges of the pilaster and in the shallow groove next to it. There is rough chiseling cut at the space between the two façades. On the side of the rectilinear portion of the southern façade there was an attempt to remove the rough chiseled area between the two façades, but it was not completed.

II. Simple Burial Features

It is important before discussing further the carving technique of the façades and the interiors of the caves to mention the other simple and common kinds of simple burials and caves found in the Petra region. Travelers, writers, and archaeologists who wrote about the architecture of Petra concentrated their efforts on the study of the decorated monumental façades of the caves, dismissing these simple façades from which they seemed to differ completely. A few of them were mentioned briefly by some writers (Hadidi 1981: 103-105). These simple façades may represent earlier Nabataean works, which were carved decades or even centuries earlier than the façade of al-Khaznah or ed-Dayr.

In addition to these two tombs with simple façades discussed above, there are other kinds of graves which also exist in Petra and the region, and will be briefly described:-

The first:- The shaft graves **[Pl.16]**, or tombs which are simple openings cut deep in the surface of the rock and are found in three variants:

a:-Simple single shafts or simple rock cut graves (Hammond, 1973: 48; Kennedy, 1925: 40, Fig. 65), (“offene Senkgräber” und waren mit einer oder mehreren Steinplatten zugedeckt, Musil, 1907: 50, Figs. 13-14, meaning “open shaft tombs covered with one or more stone slabs”) which are shafts cut directly into the rock itself. They are about 0.5-2.25 m. long, about 0.60- 0.80 m. wide, and 1.0- 4.0 m. deep. The difference in the measurements of these tombs is probably due to their intended usage for either an infant, child or an adult. The tops of most graves are recessed and rebated around the edges so that one large stone or several small stones will fit in the openings as covers. They are usually covered with slabs of sandstone or hard white limestone **[Pl. 16a]**. Limestone slabs (Kurdi, 1972: 85) formed the main covering material for the graves of the burials as at al-Khan Tomb (Br. 4) or 'Unayshu Tomb (Br. 813). In a shaft tomb in Area BI: I, located about 50.00 meters west of the Urn Tomb (Br. 772), **[Pl. 18a d, e]** (Zayadine, 1974: 139, Pl. LXII and XXIII; 1979: 185-191, Fig. I, Pls. LXXXIII-LXXXIX), however, sandstone slabs were also used instead of limestone.

No metal or wooden coffins have been found in Petra, but metal and wood were used for other purposes, as we will see later. The tombs are found alone or in groups. A group of 17 graves (Musil calls them “Senkgräber”) and considers them the oldest in Petra (Musil, 1907: 50, 72, fig. 13- 14) is located opposite the entrance to the Siq **[Pl. 16**

b, c]. This area seems to be a desirable location for burial. The inscriptions on the small obelisks, which were uncovered by a flood in March 1963 might support this hypothesis [Pl. 17c]. One of the obelisks is a cenotaph for a man who lived at “*Rekem*,” but died in Jarash and was buried there. “*Rekem*” is the ancient name for Petra (Browning, 1973: 108, Zayadine, 1980 and 1983: 220, Abb. 6 Lindner). Jarash is located 230 km. north of Petra. Given this example, it is also possible that the graves were for those persons killed defending their capital or for those who were traveling through with or without their caravans and died while in Petra. Perhaps the Nabataeans were unwilling to have them buried in their city for one reason or another. This type of grave is also found at ath-Thugra, ath-Thunabe, opposite the theater, Hāret (Mughur) an-Nasārā and al-Habis (Zayadine, 1983: 215) and Wādi Farasah (Kennedy, 1925: 40). These shafts have no staircases of any kind leading into them.

b:- graves with shafts leading to chambers below. In this type, a shaft was cut deep into the rock, measuring the same as the shafts of type a. They lead to a chamber in which the graves are dug in the floor [Pl. 18a], or deep into the walls, or into the walls then below into the floor. These graves are covered with slabs of one of the two above-mentioned types. In some cases, one or more burials are buried there, and in others two or more are buried above each other. One or more circular holes (cup holes) (0.20-0.30 m. diameter, 0.20-0.25 m. deep) are sometimes cut at one side of the opening [Pls. 18c, 137.14], or at one of the ends probably where the head is laid. Their function is probably religious and could be for sacrificing or washing. Their number may correlate with the number of burials inside the shaft. This needs further investigation by excavating some of these graves. A recent discovery of this kind of shaft tomb,

mentioned earlier, was excavated by the writer in Area BI.1 [PI. 18a] (in the 1973 and 1976 seasons). It consists of a shaft 2.05 m. by 0.75 m., and about 2.00 m. deep leading down to a chamber that has eight graves in it, (Zayadine, 1979, 185-191, Fig. 1 and Pls. LXXXIII-LXXXIX; 1989: 128, and in Lindner, 1983: 216 and 251-252, Abb. 3, see also Schmidt-Colinet, Weber and Zangenberg, 1997: 95-96, Abb. 97-98). The graves are dug in the floor: four in the north side and four in the south side. Grave 1 had four of six sandstone covering slabs in situ and above them were remains of a later skeleton with its skull, next to which were six bronze bells, two gold earrings, a silver drachma of Oboda 111 (30-9 B.C.), and several pieces of iron nails and painted pieces of Plaster. More skeletons and other objects were found in the other graves. The shaft opening is suitable to lower the body and it has four holes on each side [PI. 18d, e] to enable a person to climb into and out of the shaft. The first use of this shaft tomb was dated to the reign of Obodas III, and Aretas IV 9 B.C.-40 A.D. (Zayadine, 1973: 81-82; 1974: 139-140; 1989: 128, abb. 3).

c:- An unusual variant are two shaft graves (Br. 669) leading to two chambers at Hāret (Mughur) an-Nasārā where a façade was carved on the side of the rock. Perhaps this façade was started without knowing that the entrance will lead to the chamber of an earlier cut shafts with graves in them (Kennedy, 1925: 40, Fig. 66).

The second:- Simple opening carved into the face of the rock with no decorations at all [PI. 19a], or with a simple groove to divert the rain water away from the entrance [PI. 19b]. Sometimes a Nefesh (meaning soul or spirit, and represented by an obelisk with a rectangular base with or without an inscription on it, see Ch. 5: Dd, page 159, [PI. 129], or a Dushara (a rectangular block of stone put or carved in a niche that represents a

Nabataean God) or holes are carved on the side of the door [PI. 19b-c]. The opening might be:- the grave itself [PI. 19a] or it may lead to a small room where burials were laid on the floor [PI. 19d], or placed in graves cut into the floor as in the shaft tombs.

The third:- The Sahrij [PI. 20a, c] is a huge four-sided free-standing tower-like block of rock 6.00-10.00 m. high hewn and detached from the rock on four sides, with a chamber or grave at the Sahrij bottom or on it's top. The term literally means "cistern". Some are decorated with the typical crow-step or gables design on the top. The chambers are too small to be dwellings, but could be used to shelter guards, if those sahrijs were used as watch towers, since they are located at areas where people could enter into the city. The actual purpose of the sahrij is not known. There are twenty-six or more (Hammond 1973: 48) in and around Petra (Br. N0. 30, 69-73, 303, 307). They are called, "es-Sahrig," (Musil, 1907: 47-50, Figs. 11-12), "Block Monuments" or "Sahrij" (Kennedy, 1925: 41-42, Figs. 68-72, 174, 176-177, and 196), "Djin Blocks" (Browning, 1973: 105-6, 109-116, 132 and Fig. 48) and Ussishken calls them "Monolithic tombs (Jinn Blocks)," and mentions twenty eight of them hewn by themselves around Petra, (Ussishken, 1993: 266). Hadidi divides the Sahrijs into two types: plain block and Sahrij with pilasters and grooves for wood (Hadidi, 1981: 104, Fig. 1). In Winter 1978/79, Zayadine excavated possible graves [PI. 20a] associated with a sahrij (Br. 9), a Tower Tomb located opposite the Obelisk Tomb [PI. 20b]. The possible grave on its top measures 2.20 m. by 1.20 m. and 2.00 m. deep and was filled with sand (Zayadine, 1979: 192-194, Fig. 4, Pl. XC111; 1980: 227-229; 1986: 217-219). While examining the bibliography of the newly published book by Bessac (2007), a strange title of an article by Hermann Goetz drew my attention (Goetz, 1974: 245-248). The title

reads “An Unfinished Early Indian Temple at Petra, Transjordania.” I had never heard of an Indian Temple at Petra! In his article Goetz compares the left most of the Sahrijs [Pl. 20a] with Indian Temples because of the superficial similarity between the two.

But he leaves his tentative hypothesis to other scholars to evaluate in the future.

The fourth:- The fourth kind of tomb is a grave dug deep in the sand. The body of the deceased is laid in it, and then covered with sand. This kind is found on the way to Umm Sayhun, in the sand debris of Umm Sayhun quarry (al-Najr or an-Najr) [Pl. 21a]. Bones are to be seen on the side of the new cut road. Excavations at this site may determine the period of these burials and provide a detailed description of the grave and the burial. The deceased may have been buried during the quarrying or later. Al-Najr is also the name of the hill between the Obelisk ridge and Jabal Numair (Kennedy, 1925: 13).

The fifth:- Chambers with graves dug deep in the floor as in Zayd’s Tomb (Br. 825) [Pl.17a, b], or in the form of troughs carved in the back or the side walls whether they are horizontal, or deep into the wall then below the level of the surface of the floor, and in some cases like niches or corbelled recess dug high up in the façade or the back wall as in Wādi an-Numayr Tomb (Br. 258) [Pl. 22b] (Mckenzie, 1990: 149-150, Pls. 106-108) or the side walls as seen in the Tomb of the Soldier (Br. 239), [Pl. 26d], (Mckenzie, 1990: 147-8, Pl. 101a, b) in Wādi Farasah and other caves, (Kennedy, 1925: 40, Fig. 67 at al- Habis), or in the façade as in the Urn Tomb (Br. 772), (Mckenzie, 1990: 144-7, Pl. 95b) [Pl. 26a].

The sixth:- Chambers with entrance passages leading to them. Such a tomb is located about 20.00 m. east of the Obelisk Tomb (Dalman Nr. 47), where the graves are

dug in the floor. There is a similar tomb north east of the modern Resthouse (Dalman Nr.3). Zayadine calls these "Dromos-Gräber" after Dalman. For more details about the above mentioned types see (Zayadine, 1983: 218).

Little more can be said about these possibly earlier features without proper excavation and dating. I can now turn to the more complex "classical" façades and caves.

III. Carving the Unfinished Façades of the Caves:- Five Groups

In addition to the above mentioned examples of simple types of carved façades and caves, the survey revealed the following examples of more complex constructions which demonstrate the technique and steps followed in carving the façades and chamber's interiors.

The location of each cave was carefully chosen and planned. The rock was first cut down to create a perpendicular face, leaving buttresses on each side, which preserved their original form. The work began at the top of the façade, as in ancient Egypt (Murray, 1939: 52). To support this method, and before discussing the chosen examples, it is worth mentioning the well-known Unfinished Tomb (Br. 396) [PI. 23]. The façade is located on the east side of al-Habis. Though it may represent a later style of carving, but it affords a clue to the plan, which was pursued in carving the façades and interiors. This façade consists of a double cornice and a frieze in between. Under them is an architrave resting on four Nabataean capitals. The columns under the capitals were started but never completed. A similar façade with four capitals is the Turkmaniyyah Tomb façade (Br.633) [PI. 10], see also (Browning, 1973: 86-88, Figs.

34b-d). But the Unfinished Tomb façade has no gables or half gables on top of the upper cornice. There is an opening on each side between the capitals and a big one in the middle. There are two openings at the bottom one on each side. This may indicate that the carving of the façade and the interior were carried on at the same time. Other examples show that the front was marked out according to the style of the architecture adopted for the purpose, using the half gables [Pls. 24a, 25a], or the gables or any other type of carving chosen for that façade and then the capitals, pilasters [Pls. 25a, 31a-b], entrance and steps- if the steps were to be carved- were cut (Laborde, 1836: 156-157). When the level of the lintel of the entrance was reached, the entrance then was marked [Pls. 25, 40], and work continued to the bottom until the whole façade was completed. Then the work continued by hewing the entrance followed by the interior. These steps will be described in detail in the following chosen examples. Façades and entrances are rectangular and differ in their proportions. Early caves have small entrances [Pl. 19] when compared with the caves that have more elaborate facades. Some caves have more than one entrance and also have graves high above or to the sides of their entrances as in the Urn Tomb (Br. 772) [Pl. 26a], Wādi an-Numayr Tomb (Br. 258) [Pl. 22] and the Soldier Tomb (Br. 239) [Pl. 26d], (see Mckenzie, 1990: Pl. 98; Schmidt-Colinet, 1981: Pl. 23).

There are many unfinished façades and interiors, which demonstrate the stages and methods of carving and are discussed in the following sections of this chapter. The major unfinished façades are represented in the following four groups:-

Group 1:- Façades adorned with :

a) Half Gables on the upper storey or attic. They are also called “Step Tombs” [Pls. 24a, 25a, 27, 29a, 32a, and 48].

b) Complete Gables (4-6 Gables within Half Gables) [Pls. 33-38, 62a-b], also referred to as the Assyrian crowsteps or “Pylon” Tombs and are found in two types:-

1- Single Band Gables [Pls. 33, 36]

2- Double Band Gables [Pls. 37, 38, 62a-b]

The majority of the tombs at Petra have both types of decoration and some will be discussed in the examples to follow: [Pls. 24, 25, 27, 29, 33 and 37].

Group 2. Façades without Half Gables or Gables [Pls. 41 and 67a]: Unfinished façades without gables or half-gables but adorned with pediments, pilasters, capitals, and friezes are also found with unfinished interiors as in Wādi ed-Dayr [Pl. 41], Wādi an-Numayr [Pl. 22a] and Wādi al-Kharroubah [Pl. 47].

Group 3. Arched façades [Pls. 42, 44-46].

Group 4. Façades with large wide rectangular entrances [Pls. 31c, 50, 52a-b, 72]. Caves [Pl. 31c] at the north side of al-Khubthah, [Pl. 50a-e] the Museum/al-Habis, the Triclinium/Wādi Farasah, House opposite the Theater, at Siq al-Barid, and Triclinium opposite al-Khaznah, [Pl. 52a] at al-Mu‘aysrah ash-Sharqiyyah, and [Pl. 72] south ridge of the High Place are all with large wide rectangular entrances.

Group 5. Exceptions [Pl. 28]. There are many other façades that do not fall in one of the above groups, as those behind al-Habis, Hāret (Mughur) an-Nasārā and al-Mu‘aysrah. [Pl. 53] shows the different groups mentioned above.

Group 1. Façades adorned with:-

a: Half gable [Pls. 24, 25, 27, 29a, 32 and 48]

In this type, also called Cavetto type (single-divided crow-step), the attic storey has the half-gable steps facing each other covering the whole uppermost part of the façade. The number of steps varies from 3-5. The height, depth, and width as well as the distance between the steps also differ from one façade to another, in proportion to the size of the façade. The height of these half-gables sometimes reaches 3.0 m. They were carved as follows:- After choosing the location, the stone-carver or the stone-cutter⁽¹⁾ starts from the top smoothing the upper part of the façade as seen in the two examples at Hāret (Mughur) an-Nasārā, opposite the theater [Pl. 49a, b] and at al-Habis. Then the desired number of steps of the gables is carved [Pl. 24a]. The carving of these steps can be followed by carving of the cavetto cornice and a tenia then the sub-attic or the frieze [Pl. 27c]. In this particular façade, the entrance was started but not finished. There is no indication yet of capitals or the carving of the pilasters. The lower part was also not started. In three other façades located at Hāret (Mughur) an-Nasārā, opposite theater and in Wādi an-Numayr [Pl. 27a-b], it is notable that the attic, cavetto cornice, and tenia were finished, and then the work on the façades continued. The work stopped after part of the sub-attic was done. At the bottom of the first two are large unfinished openings leading to huge chambers. Such wide, irregular openings are common in Petra, but the so called Unfinished Tomb [Pl. 23], where work began at the top and proceeded downwards, has a well-cut opening at the south side where a pillar would have been carved directly under the second capital from the south [Pl. 23b] (Browning 1973: 49-50, 165, Fig. 16). This opening may have been associated with a façade cut, but

removed earlier, before the visible façade was started. In some cases the earlier façades were removed as a new design was planned (as seen at the upper part of the theater) or damaged by nature. That is probably why the carving at these façades stopped. The façades [Pl. 27], if they were completed, they would look like façade [Pl. 32]. In one particular façade with the gable located in the outer Siq (Br. 67), there is a second chamber with an elaborate door with what seems to be a third cornice between the gables (Kennedy, 1925: 49, Fig. 103), which makes it unique in Petra. Four of the above examples were chosen for discussion below:

Example [Pl. 24] Façade with Half Gables only

Location: opposite the Obelisk Tomb

The façade is facing east. The half gables are the only parts that are carved. There are five steps on each side. The lower two steps of the north half gable are not completely carved. The two trenches on the north and south sides indicate that the quarrying system was applied here. It is not known how the lower façade would have looked like when completed.

Example [Pls. 25, 40] Façade with Half Gables and Frieze

Location: west of Wādi al-Mu‘aysrah ash-Sharqiyyah

This façade is located at ath-Thunabe, west of al-Mu‘aysrah ash-Sharqiyyah facing east. It is 5.50 m. high and 4.75 m. wide. The top starts with the surface of the rock. First the uppermost surface of the rock was deeply cut, about 0.40 m. in the north and 0.25 m. in the south. From this level the half-gable steps were started. There are four steps on each side, followed by a cavetto cornice and tenia. Below the tenia are two pilasters with capitals. The lower part of the façade and the pilasters are not

completed. More rock was to be removed from the front by cutting deeper into the slope of rock as in [Pls. 25a, 40]. Between the two pilasters are two smaller pilasters with capitals and a sub-attic (lintel). Above the lintel is a groove perhaps to be filled with carved stones. There might have been a pediment above the doorway. The panel above the door was prepared either for writing an inscription or for inserting a marble piece with a written inscription into it. The opening of the entrance is marked and started, but only about 0.02 m. was cut and never completed.

The stage of completion is similar to the façades (Br. 530, 531), which are located at ath-Thunabe [Pl. 48b-c] and opposite the Obelisk Tomb [Pl. 24a], and the façade [Pl. 32], which is described below.

Other façades have a divided gable, cavetto cornice, taenia and a sub-attic, but above the entrance is only a freeze between two cornices resting on the capitals of the pilasters of the door and have no triangular pediments [Pl. 48]. Such façades share the main components: pediment, pilasters with capitals, architrave or a frieze and in some cases a cavetto cornice, a half gable on top of it, and other decoration.

Example [Pl. 29a] Façade with Half Gables and Plain Frieze

Location: al-Qantarah (or Qa' Braq) south west of al- Madras

This façade shows a different stage of carving where only the two half gables (single-divided crow-step with four steps) with a tenia under it, and a frieze below were carved. The rest of the façade has plain carving. There are no traces of pilasters or of a carved entrance. This façade's surface was carved all the way down almost to the level of the area surrounding it. However, the façade was not completely finished.

The stone-cutters were still removing the blocks from the front as indicated by two cut trenches on the sides at the bottom of the façade [Pls. 29a, lower right of 30].

Similar to this carving is the severely eroded façade located half way to Umm al-Biyārah [Pl. 29b]. It is a small cutting with a smooth façade. The outline is marked, as well as a tenia, but no more details are to be seen.

Example [Pl. 32] Complete Half Gable Façade

Location: at Wādi ed-Dayr behind the Lion Tomb on the right hand side and facing west.

This façade reveals the major components constituting the morphological structure of a tomb façade in Petra. The height is approximately 5.00 m. and the width is ca. 4.50 m. The major morphological characteristic is symmetry and the usage of basic geometric shapes: rectangles, triangles, and curved shapes. The components begin at the top with the completed upper half-gables. Below the five steps right at the center is a rectangular groove 1.6 m long, 0.15 m. deep and 0.25 m. high. This groove was probably to be filled with carved stones in the form of a cavetto cornice to fill the missing part of the cavetto cornice. The cavetto cornice was followed by the tenia, then the architrave above Nabataean capitals (McKenzie, 1990, diagram 14j). The capitals rest on cushions and pilasters. At the center of the lower part of the façade is a triangular pediment topped with acroterions on a sub-architrave and tenia under which is a lintel resting on two pilasters with simple Nabataean capitals. The lower part of the outer pilasters seems to be unfinished. The door was cut about one meter deep and the work stopped. Several façades with a similar type of carving are found in Petra.

b: Complete 4-6 Gables within Two Half Gables [Pls. 33-38 and 62a-b] are found in two types:-

1- Single band gables [Pls. 33-36]

Example [Pl. 33a] Façade with Single Band Gables only

Location: West of Wādi al-Mu‘aysrah ash-Sharqiyyah, east side of ath-Thunabe and north of the unfinished façade previously discussed [Pl. 25].

This façade is cut all the way to the bottom about 8.00 m. high and 5.00 m. wide. The upper part has a row of five gables with half gable on each side, resting on a tenia. Below it is another tenia. The façade is also not complete, but has an opening at the bottom leading to a chamber. Stones were quarried from the top.

Example [Pl. 33b] Façade with Gables and Partially Finished Frieze

Location: West side of Wādi ath-Thugrah on the way to Jabal Hārūn.

This is another unfinished façade, because if we look at the left side, we see that the carving is not completed. It has only a single-band of gables, but the band also runs to the sides of the façade. At both ends of the band is a half gable which forms with the other half of it a corner of 90° angle, as if each one of these gables is turned to form the beginning of a new band of gables on each side of the façade, but there is only one gable carved on each side in addition to this half gable. The work on the south side reached to the upper third of the doorway. This is the Assyrian style phase I according to Browning (Browning, 1973: 81-82, Fig. 30a-c). The lower part of the façade consists of a wide opening and a smaller one above it, which was probably a grave similar to those at the Urn Tomb façade.

Example [Pls. 33c, 34, 35 and 36a] (Br. 374) Façade with Partially Finished Gables and Frieze

Location: at the southeastern foot of Umm el-Biyārah

This façade is also attributable to Browning's Assyrian style for it has a single-band of gables between two teniae [PI. 33c]. The southern side was a quarry. The process of quarrying and façade-carving was taking place at the same time (see Ch. 3: II. 4) (Kennedy, 1925: Fig. 92) [PI. 35, 36a]. It has a single-band of seven three-step gables that ends with a half gable at the eastern end. The western end also has a half-gable. The tenia turns to the south following the slope of the rock, but no gables have been carved [PI. 35a]. The eastern side of the rock drops down sharply about 25 meters forming other façades of caves that had entrances and steps cut earlier [PI. 36a]. This eastern side also has a band of gables between two tenia which runs at the same level as the southern unfinished façade. The area surrounding this unfinished façade has other finished façades which are decorated with the same type of single or double-band gables decoration, and some have pediments and arched façades [PI. 34]. On the same edge of the mountain that slopes towards the south are four tombs with façades [PI. 35a]. The western two façades have remains of a tenia and a single-band of multiple gables while the eastern two directly below the unfinished façade have no decoration of any kind except for what might have been a pediment above the door [PI. 35a]. It is possible that these façades were carved earlier than the one above them. Alternatively, it could also be that after they started this façade, the artisans changed their minds, because they did not want to remove a huge mass of rock from the front of it, so they carved the lower

ones instead. It is also possible that this block was meant to be carved as a sahrij [Pl. 20a, c], but was never completed.

As we will discuss subsequently, the trenches and blocks are ready to be quarried from their original places, but work stopped (See Ch. 3. II. 4).

Example [Pls. 33d, 36b] Façade with Gables and Plain Frieze

Location: at the north western side of ath-Thunabe

This example is similar to the above façade [Pl. 36a] where only a single-banded gable with a tenia below it was carved, followed by a smooth area 1.50 m high, and finally a quarrying area. The rest of the façade is not finished, but at its bottom is an irregular opening leading to an unfinished chamber.

2- Double Band Gables [Pls. 37-38, and 62a-b]

Example [Pl. 37a] Façade with Double Band Gables only

Location: This façade is located at ath-Thunabe on the western side of Wādi al-Mu‘aysrah ash-Sharqiyyah.

The carved area is about 2.5 m. high and consists of two bands of multiple crow-step gables with a wide plain sub-attic storey between them (Browning, 1973: 82, Fig. 30d). It is 4.5 m, wide at the bottom and 3.5 m wide at the top. It has two taeniae between the two rows, each with three step gables. Under the lower row of gables, another tenia was started, but it was not finished. Whether this façade would have had a pediment, pilasters and other decorative ornaments is not known. Both bands end on the sides with a half-gable. The top of the southern half gable starts right with the surface of the rock. On the northern side, it is about 0.30 m below the level of the surface of

rock because of the slope of the original rock surface. Each band has five gables. Each gable has three steps on each side. There is an apron string course under the tenia.

Example [Pl. 37b] Façade with Unfinished Double Gables and Frieze

Location: This façade is located at Hāret (Mughur) an-Nasārā facing east.

It is about eight meters high and five meters wide with what seems to have been a simple rectangular entrance, 1.5 m. high and 1.0 m. wide, now damaged by widening, especially to the south of the entrance. The façade is cut 0.40- 0.80 m. deeper than the surface of the rock. It is attributable to the Assyrian type phase II of Browning's classification (Browning, 1973: 82-83, Fig. 30d). This façade has a double band of gables. Each band consists of four gables in between half gables, and each gable has three steps. This is an unusual façade because of the use of white paint on the upper band of gables, which is not seen on any other façade gables. The lower gables are only marked, but not carved and have rough surfaces. There is a tenia below the upper band of gables. The lower band of gables is between two tenias. The carving is not completed in either row of gables. Their shape was distinguished by the rough chisel marks, which differ from the rest of the façade. The teniae extend outward on both sides (about 0.15- 0.20 m.). Under the northern end of each tenia is a small carved area cut 0.25- 0.35 m. wide and 0.15 m. deep in the rock. Here, probably, where the stone cutters wanted to start cutting the façade into its final shape. The wide sub-attic between the two bands of gables is about two meters high.

The groove that usually appears above the door is replaced by a carved simple cornice protruding about 0.15 m. It has a length of almost two meters. The height is about 0.20 m. No evidence of pilasters or capitals or any other decoration is evident on

this façade. The entry leading to the cave's interior measures about 6.00 m. N-S, 5.00 m. E-W, and 2.50 m. high. The lower part of this façade is weathered.

There are other examples with similar unfinished bands of gables. Two of them are located next to each other, on the western ridge of al-Khubthah, opposite Tomb 813, [Pl. 38]. Their façades are plain, except for the rough chiseling which marks a single-band of gables and a tenia below it. Evidence of another single-band of gables two meters higher is observed, but because of weathering it is difficult to distinguish. We know, however, that it must have existed because of the continuity of the band seen on the adjacent façade [Pl. 38a left] where another weathered façade is unfinished, and has the rough chiseling showing two teniae with a band of gables in between. Another example, is located opposite the theater, and has an unfinished interior [Pl. 62b]. This façade is badly damaged, but remains of an unfinished band of gables are visible above a tenia. Below the tenia is a sub-attic and underneath it, appears to be two other teniae and another row of gables. Part of the western side of the entrance of the cave is intact and shows three grooves, which are carved above the entrance.

Group 2. Façades with Door, but without Half Gables or Gables Pls [41 and 67a]

Example [Pl. 41a] Façade

Location: On the right, going to ed-Dayr behind the Lion Tomb.

This façade shows a very simple initiation of carving, in which a small amount of rock was removed from the western side of the mountain starting with negligible rock removal in the north and going deeper to the south for almost two meters in both of the upper and the lower ends to leave a smooth area almost 6.0 by 6.0 m. with a groove

above it to divert the water from the façade. A rectangular area (2.75 by 2.25 m.) is carved in the middle of this surface. On the upper part of this carved area the mason left a smaller (2.25 by 0.40 m.) pentagonal area, which protrudes out about 0.25 m., its upper line being triangular. The whole shape was intended to form a pediment over the entrance. Under this is another narrower rectangular shape, about 2.25 m. wide, 0.15 m. high, which protrudes out of the face of the rock about 0.15 m. The lower part of the façade also protrudes out about 0.03-0.05 m, from this upper carved surface. The façade has no marks to indicate subsequent intended steps of carving. One cannot see any guide line for the entrance, pilasters, or capitals as seen in other simple caves with triangular forms on top. The carving was not finished on the lower portion of the façade. It is also notable that the chisel marks are all going from left to right, which probably means that the stone-carver was left handed, holding the chisel with the right hand and the hammer with the left one.

Example [Pl. 41b] is another example of a façade most similar to the above unfinished façade and is located about 25.0 m. south of it. This façade has a triangular pediment with nothing above it. Below are two entablatures with a tenia between them resting on Nabataean capitals above two pilasters, one on each side. The entrance is badly damaged, so that it is not easy to determine how it was carved, though one can see what might be a tenia.

There are façades with entrances decorated with an architrave resting on the capitals of the pilasters. On the pilasters is a cornice, then a decorated or undecorated freeze [**Pl. 67a**], and on top of all, is the carved triangular pediment but no gables or half gables [**Pls. 41a-b and 67a**]. Pilasters and columns decorate the façades of Petra's

caves and buildings, just as they decorate the Egyptian tombs. There are no flutings in the columns or pilasters, but vertically ribbed columns were found at the Triclinium in Wādi Farasah and at the Winged Lion Temple. In addition to these façades and the ones mentioned earlier (Ch. 2a-b), more façades with different simple carvings are found throughout Petra, but they are not the subject of this study and are not included here.

Group 3. The Arched Façades [Pls. 42, 44-46]

There are 36 façades with arches carved above their entrances. The upper parts of these façades are in the form of a semi-circular arch. The arches are decorated with a gable [Pl. 44d], a circle [Pl. 45a (Br. 339, 340)], or a rosette in the tympanum [Pl. 46a, c] and in some cases they are plain and have no decoration [Pls. 44a, b, 45b (Br. 577, 579), 46b]. They were carved by the Nabataeans or during their time, but do not fall into the stages of development, proposed by Kennedy (1925), Brünnow (1904), and others. These façades, whether they are finished or not, are located in many places in Petra, for instance near the theater, at the bottom of Umm el-Biyārah, on the western sides of Wādi ed-Dayr, Wādi an-Numayr and west of Wādi al-Mu‘aysrah ash-Sharqiyyah. Though each one of these façades has the arch, but they differ from one another, and above the pilasters there are the bevelled or plain angled capitals. Several scholars have described these façades briefly, among them Kennedy (Kennedy, 1925: 45, Fig. 87), Musil (Musil, 1907: 118-120, Fig. 87), and Mckenzie (Mckenzie, 1990: 24, 167, Pls: 156b-c, 157e, 158f in Petra while Pl. 9d is the only arched Tomb at Medain Saleh in Saudi Arabia). Kennedy mentioned about 30 Arch-topped graves, carved by the Nabataean people, or at any rate in Nabataean times (Kennedy, 1925: 45, Fig. 87). Zayadine mentioned these

façades and divided them into two groups: one with one frame and the other with two frames, and dated the ones near the Theater to the 2nd- 1st century B.C. (Zayadine, 1983: 236-238). He did not mention that the ones with two arches have also two pilasters on each side [Pl. 45a right]. The outer arch- which consists of two parts, one inside the other- sits on the outer pilasters, while there is an entablature between the inner arch and the inner pilasters. The pilasters in the single arch and the inner pilasters in the double arches form the frame for the door opening [Pl. 45a]. Both parts of the arch in [Pl. 44b] do not cover the whole capital as in [Pl. 44a or 45]. None of them has an inscription on it so it could be dated. Also, none of these burials can be identified, so we can not affirm that they are tombs (See Mckenzie, 1990: 115).

Example [Pls. 44a, 45b on the right] Façades with an Arch and Upper Pilaster only

Location: At the west side of al-Mu‘aysrah ash-Sharqiyyah.

It only shows that the arch and the upper part of the Pilasters with the capitals finished. The trenches cut in front of the frieze indicate that blocks were still being quarried while façade was being carved, and then work stopped.

Group 4. The Unfinished Façades with Large Rectangular Wide Entrances [Pls.

22a, 50d, and 52a-b]

Petra exhibits many caves with façades that have large wide entrances [Pls. 22a, 31c, 50, 52a, and 72]. Some of them are so badly weathered that it is not easy to tell whether the work was completed or not. The examples chosen here are for the definitely unfinished façades. They include the following examples:-

Example [Pls. 31a-b, 50d] Façade with Upper Pilaster only

Location: At the northern side of Siq al-Barid

The façade [PI. 50d] is located between two other unfinished façades, facing the “Painted House.” Only the upper part of the pilasters and their capitals on both sides are finished. Even the interior of the cave is not finished. [PI. 31a-b] show the detail of the above example.

Example [PI. 52a-b] Façade with Pilasters and Plain Frieze

Location: At the west side of al-Mu‘aysrah ash-Sharqiyyah.

The façade (Br. 526) has unfinished pilasters with missing inserted capitals, and two entrances: a wide open one at the bottom, which is also not finished, and rectangular one above it. The upper one properly carved and has a groove above the door, but no other elaborations. See [PI. 48a; the cave on the far left with the arrow is PI. 52a], and (Ch. 2: VI. 3)

More of these façades are located at al-Habis, for example [PI. 50a (Br.400)] the cave used as a museum now, and [PI. 31c] at the north side of al-Khubthah.

Group 5. Exceptions [PI. 28]

Petra exhibits a number of façades that are not related in any way to the previous discussed examples. The examples on [PI. 28] are some of the exceptions. They are simple and some share one feature, which is the lintel above the entrance.

Examples of all unfinished types of Façades discussed above can be seen in the area located between Wādi ed-Dayr and Wādi al-Mu‘aysrah ash-Sharqiyyah. The area is a field of finished and unfinished façades [PI. 48a]. In most cases, half- gable façades and one band or two band gable façades are carved next to each other [PI. 39] (Br. 775),

and sometimes an arched one also. Study of the above examples, has answered part of the question, which was asked earlier: How was the carving of the façades of the simple tombs begun? The following examples will answer the second part of the question: How was the interior and its finishings carved?

The above-mentioned examples reflected the use of two techniques: The irregular hewing and the quarrying techniques, which are discussed below.

IV. Carving the Interior of the Caves Requires Three Stages

Carving the interior of the caves concerns three areas:- the entrance, main chamber interior, and the smaller inner chambers and their Graves or slots. Each of these steps will be discussed, introducing the different method techniques, which were used to complete the carving of the cave.

As we have discussed, Petra and the surrounding area consist of the residential areas, a large number of quarries, and hundreds of caves. The caves were used as tombs, dwellings, cisterns and tricliniae and were carved and hewn from the sandstone mountains. The majority of the caves share basic features on the façades:- the gables or half gables on the top, a cavetto cornice, a tenia, sub-attic, a frieze, an architrave, a pilaster or two on each side with Nabataean capitals, then a simple or decorated doorway as in the examples described earlier. Others are adorned with arches or have wide large entrances. There are few façades that do not share the same basic features such as the Khaznah, the Palace Tomb and others, known as the “Classical period monuments” (Browning, 1973: 90-99), which are not considered in this study.

Some of the caves were hollowed with chisels, such as the tomb on the western side of the High Place, as will be discussed later. Others were used as quarries to cut different sizes of stones such as the Palace Tomb, the cave on the way to Umm el-Biyārah, and the Theater. These types have been called “covered quarries” (Clarke, 1930: 13).

The method of the interior carving of the caves especially those which were to be used as tombs, shows another interesting process, which deserves careful study, see [PI. 79]. In this chapter, a number of distinguished interiors were selected for this study which introduces us to the steps that the Nabataeans followed to create chambers of different sizes for use as a living room, burial place, water cistern, or a triclinium, etc. They also show a pattern of skillful hewing (Ussishken, 1993: 283) and dressing which are seen throughout Petra in both the exteriors and interiors of the caves, as well as on masonry blocks and columns' drums, and which leave distinctive 45° marks [PI. 51], (Harding, 1967: 120). These marks are found on all building masonry (See Ch. 2: VI. 3 below).

Most of the cave interiors were difficult to study due to the amount of debris, which has been naturally or culturally deposited in them. Natural damage was caused by earthquakes, wind and rain. The severity of these earthquakes left some Petra caves with broken entrances. Some caves were filled with huge rocks that fell from their ceilings. The broken entrances allowed water to carry sand and stones into the chambers. Cultural damage can be attributed to the later occupations. For example, excavation at area B1.1, located 50 m. west of the Urn Tomb revealed that the shaft tomb in this area was disturbed by the tomb robbers of the Byzantine period (Zayadine, 1979:

197), and by the local people today who used the caves as dwellings and storage sheds for animals, or by unauthorized digs by irresponsible people whose aim is to sell artifacts to tourists.

The following examples require the three major stages in the carving of the entrances to the main chamber, followed by digging the main chamber itself, and then the graves or slots inside the main chambers (See Ch. 2 stage 3). In some cases the little chambers with graves were dug and used before finishing the main chamber, as seen for example in al-Kharroubah Tomb [Pl. 47].

Stage 1. Carving the Entrance of the Cave

The creation of the interiors starts by carving the doorway or entrance to the chamber. Two different hewing techniques were followed to carve the entrance. These two techniques are represented in the following unfinished examples studied during the survey: a) the **V** and **W** hewing method technique, and b) the irregular hewing technique:

a) The V and W Hewing Technique [Pls. 54-55]

There are three steps involved in this technique leading to [Pl. 55c], and the following three examples illustrate the steps used:-

The first example [Pl. 54a]: A square (0.95 by 0.95 m.) with chisel marks in the lower south corner illustrates the first step of carving. It is located on the way to Jabal an-Numayr. The stone-cutter marked the working area and started chiseling from the left lower corner moving upward and toward the center. The purpose of this carving is not known, but it was probably planned to be either a grave like the one dug on the way to ed-Dayr or a niche for a Dushara.

The second example [PI. 54b] is a carved area illustrating the second step in this technique. It is located at Qunb at-Turkmaniyyah where the stone-cutter marked the area of the opening with tiny holes, now weathered on both sides. Here the initial cut was followed by finishing the upper left corner. Then, from the lower left corner and about a meter above the surface of the ground, he started hewing deep into the rock making a slope towards the right and deeper in the rock. The cutting continued also at the left side going straight up towards the upper corner, cutting deeper into the rock until the desired depth was reached. As the mason carved higher and deeper, he chiseled both the left and right sides, creating a “V” formation at the top. The carved area covers almost the entire upper left half of the entrance. The chisel's marks on the right in this example show that the chisel was held with the left hand and hit with a hammer held with the right hand in an angle towards the bottom making a 45° line in relation to the vertical line in the middle. I would assume that the work would follow the same procedure to carve the upper right side of the area. The carved area would then look like a “W” deep in the corners with a hump in the middle. This shape will represent the upper half of the entrance. If the work had continued on in the first example, it would be in its first stage as seen in [PI. 54c and 55].

The third example [PI. 54c] that illustrates the third step in this entrance carving technique is located at Hāret (Mughur) an-Nasārā area, showing that when the stone-cutter finished the upper left corner, as explained above, he continued with the same technique hewing the upper right corner, leaving a hump between the two sides which goes all the way to the lower lintel. It is notable that part of the edge of the hump in the middle was removed while chiseling from the middle to the right. When the upper half

was finished, the work continued on the lower half, but the chisel was held pointed down, leaving vertical lines instead of 45° lines. A careful look at the vertical chisel marks at the lower half and corners [PI. 54b], indicates that a second procedure was followed hewing downwards leaving the hump in the middle until the bottom of the entrance was reached.

In these examples the dimensions of the opening are carved, but work stopped before it was completed, so it is not known whether both the second and third examples were intended to be the entrances of chambers or niches. Looking at the chisel marks, it appears that work had started from one of the corners until it reached a certain depth, in the third example it is about 0.30-0.40m; then work shifted to the opposite corner while the middle was not touched leaving a “W” like form. When the sides were finished the middle hump was removed. This method is discussed later while describing the hewing technique below.

b) Irregular Hewing Technique [Pls. 25,32]

This technique is represented by carving the entrances of two other unfinished caves. The first façade [PI. 25b] is located at ath-Thunabe west of al-Mu‘aysrah ash-Sharqiyyah facing east. The entrance measures (1.40 by 0.93m), and was outlined by a small trench, 0.06 m wide by 0.02m deep. The doorway inside this trench is not hewn regularly, but is created by tool marks in many different directions.

The second façade [PI. 32] is located on the right going up to ed-Dayr behind the Lion Tomb. This façade is approximately 5.0m high and ca. 4.5m wide. The hewn area is about 1.22m wide by 1.30m high and about 0.80-0.90 m deep in the upper part. The entrance as well as the whole façade were not completed and were not carved all the

way down to the level they were supposed to reach. The ceiling of the entrance is not flat but has concave form because the work was not completed. Here also, the marks are not regular. Again, reasons for not continuing the work are not known. Both examples [Pls. 25, 32] seem to be planned and designed by the same individual because of the similarity of the superficial components.

Stage 2. Carving the Main Chamber of the cave

Following completion of the entrance to the cave, two methods of carving the interior were utilized: a) The V and W Hewing method technique and b) Quarrying method technique.

a) The V and W Hewing Method

The main chamber hewing technique is represented by the following unique examples. I believe each shows one of the steps in the process of the interior carving:

Example [Pl. 56-58] :- A cave with unfinished interior located on the western side of the High Place, north of the Lion carving.

This complex [Pls. 56a, 57a] consists of the cave and a courtyard in front of it with a finished façade. Both are symmetrical with the natural slope of the mountain and face north.

The courtyard measures 4.30m by 2.85m. The northern side is about 0.80 m. high and most of its eastern half is missing. The eastern wall has an irregular form because of natural damage. A small portion of the eastern wall remains attached to the façade. The façade of the cave measures 6.00 m. high and 4.00 m. wide and extends about 2.00 m. to the north where a staircase descends. The western wall follows the dip of the slope. This triangular-shaped side formation begins in the upper corner with the

half gables at the top of the façade. It continues downward towards the north forming the western wall of the courtyard. This wall has a niche with a Dushara carved in it [PI. 56c].

The half gables at the top of the façade crown an architrave above a tenia. Another architrave sits on simple worn capitals that are resting on pilasters, one at each side. Below the lower the architrave is a doorway, which also is between another two smaller pilasters with capitals [PI. 56a-b].

The façade has a simple carved entrance, 1.40 m. high, 1.00 m. wide and 0.75m. deep leading into the cave, devoid of any decoration except for a series of holes surrounding it. They differ in diameter and depth, and both ranging from 0.05- 0.08 m. On the eastern side of the entrance is a small opening. It is not known whether this is an artificially carved opening or a natural phenomenon.

The interior of the cave [PIs. 57, 58] is not finished and has irregular walls. The carved area is approximately 3.20m S/N by 3.10m E/W. The remains of hewing inside indicates that the **V** and **W** hewing technique was used.

When the entrance was marked, the stone-cutter followed the **V** and **W** hewing technique mentioned above. Then, starting from the middle of one of the humps, cuts were made on both sides creating a central ridge. The lines to the right and left of the central ridge were chiseled to a depth of about 0.25m [PI. 58], at approximately 45 degrees to the side of the cave's entrance.

At the same time, when the stone-cutter was chiseling at this angle from the central ridge, he began chiseling a second course to the left of that angle. Both chiseled angles meet at a central line forming another inner 45 degree angle with the horizontal

line, but 90 degrees between them [PI. 58]. This method of hewing continued until the desired space or volume of the interior was reached. Then the **W** forms are removed starting from the floor up to the ceiling as seen in the cave on the way to the summit of Jabal an-Numayr [PI. 55a]. Then the tilted 45 degree lines [PI. 51] are carved as it will be discussed later in (Ch. 2. VI. C).

Many other examples of this method exist in Petra. It is visible in the cave located on the way to the top of Jabal an-Numayr just below the summit [PI. 55a] where the upper part of the south wall is not finished. This hewing technique was also used in a cave opposite the Theater [PI. 55b, c], to cut a grave in the northern wall but the grave is not completed. The same is in the cave at the bottom of the north side of al-Khubthah where the south wall is also not finished. Another cave is located on the east side of Wādi ed-Dayr. There are also exceptions as seen in a cave (Br. 64) opposite al-Khaznah, (Zayadine, 1981: 352, Fig. 7), in which neither the walls nor the floor or even the graves were finished and both the irregular and the **V** and **W** techniques were used.

b) The Quarrying Technique

This technique involves the removal of regular blocks to be used in the construction of the buildings. This method is clear in the following example:

Umm el-Biyārah Cave [Pls. 59-61]

This cave is located almost half way up to the summit of Umm el-Biyārah [PI. 59a] on the right hand side next to the destroyed gate. In front of the cave is a flat area, 7.25 m. from east to west and 3.00 m. from south to north, leading to an entrance measuring 2.50 m. wide and 2.00 m. high on the outside and 2.50 m. high on the inside. This entrance is 1.10 m. from the outside to inside and has remains of a lower lintel [PI.

59b]. On the east side of the entrance are two small cone-like carvings. The large one has four horizontal lines and the small one has two lines. Under them are five small holes [**Pl. 137.17**]. The dressing at the sides of the entrance is not finished.

The entrance leads north into the interior of the cave, which is roughly rectangular measuring 9.25 m. from east to west by 9.00 m. from south to north. The depth from the ceiling to the undug surface of the floor measures 1.65 m. The floor reveals an example of a closed quarry technique, evident from trenches dug around eight huge blocks, six of which were removed and two still remain in situ, ready to be quarried out [**Pls. 60, 61b**]. In the back, four new trenches were started to remove the blocks, but work stopped without cutting them deeper [**Pl. 61b**]. These trenches may be the bottoms of the earlier trenches, which were dug around previously removed blocks. Each block measures approximately 2.25 m. by 1.50- 2.00 m. The trenches between the blocks measure 0.40-0.50 m. wide, the depth and length is according to the desired size of the block. Some of the trenches were unfinished.

It is not known if smaller blocks were quarried from the area between the ceiling and the surface of the blocks, or if the **V-W** hewing technique previously discussed or the irregular technique were used. A dark residue covers a portion of the walls and ceiling as a result of the use of fire by local people in modern times.

The following examples of other caves' interiors show that this quarrying technique was applied when their chambers were hollowed: In the back wall of the interior of Palace Tomb [**Pls. 76-77**], in the northern vaulted entrance of the Main Theater [**Pls. 78**], in the cave at Wādi al-Kharroubah [**Pl. 47**], about hundred meters north of the

Lion's Tomb, and two other caves at the foot of al-Khubthah: one is south of the Urn Tomb and the other is east of Florentinus Tomb.

c) Irregular Method [Pl. 19a, c]

This technique was perhaps used when the Nabataeans first came to Petra and started carving the small caves whether to live in or use as burial chambers as discussed previously.

d) Interiors Subsequently Hewn Flat [Pls. 62 (Br. 802), 67, 72]

The three examples in these plates have no traces from which it would be easy to determine which technique was applied to carve their interiors. That means one of the three techniques was probably used. The walls and ceilings are almost finished except for the upper part of the western wall of cave [Pl. 67]. The caves in these plates are discussed in detail in the following section stage 3 below. Whether the irregular, V-W hewing or the quarrying technique was used, the final fine dressing of the walls consists of lines tilted at approximately 45° running from the ceiling to the floor [Pls. 51, 96], and from the top right to the bottom left. Only when the mason was left handed will the marks be running in the opposite direction, and this is very rare. A band of vertical lines, with variable distances between them, is carved from the top of the upper right side of each wall to the floor. There is also a band of horizontal lines on the top of each wall where it meets with the ceiling [Pl. 51b, c, e]. Both bands of lines are to help the mason hit the chisel to start the 45° lines. The ceilings have straight parallel lines, running east/west or south/north. The direction of the lines differs from one cave to another. In each finished cave, and in one of the upper corners, where the wall meets with the ceiling, a square or a rectangular form is carved close to the ceiling [Pl. 51c]. The size

of this form also differs from one cave to another. The lines of the square are also tilted at 45° and go in the opposite direction of the lines of the walls forming a 90° angle. McKenzie referred to this kind of fine tooling work and the squares in several pages, while describing the monuments. For example, describing the Urn Tomb (Br. 772) and the Soldier Tomb (Br. 239) and the Triclinium (Br. 235) opposite it, she writes “the main chamber walls are dressed (Pl. 51e) with tooling in neat lines tilted at forty-five degrees with a square hatched in the opposite direction in each top right corner and a band of lines across the top” (McKenzie, 1990: 144-149, Pl. 51). Actually, the squares do not exist in each top right corner as she wrote, and their number inside or outside the chambers differs from one cave to another. Usually, there is only one square in one of the interior upper corners. But in some cases the ceiling has a square at the same corner, where the square on the wall is. These squares do not seem to exceed four on both inside or outside walls of the caves. The most complex is that in one of Hāret (Mughur) an-Nasārā caves located north of Sadd al-Ma‘jan, facing east, in which, there are three squares in the northwest corner (one on the west wall, one on the north wall and the third above them on the ceiling), and one inside one of the corners of the graves in the south wall [Pl. 43e]. The Urn Tomb has three squares: Two in the interior: one at the top of the northeast corner of the north wall, one in the east top corner of the north wall of the middle recess of the east wall. The third is in the top south corner of the east wall of the south colonnade [Pl. 51c]. I have asked several people about the function of these squares, but no one was even able to give a suggestion. I considered them as a form of masons' marks, the lines in them perhaps representing the number of individuals or years that a certain team worked at that certain cave. However, in the summer of 2002, Dr.

Khair Yasine visited me in Ann Arbor and we had discussed the function of these squares. He suggested that they might have had a religious meaning.

I believe that the further and deeper into the rock the work was done the more workers were able to work inside and the faster and earlier the carving was accomplished. After the main chamber was finished, they could begin carving the smaller chambers with or without the graves in them, or the shafts for the burials. There is always an exception for each rule. In this case, the excavations carried by the Department of Antiquities at the end of 1970's inside the cave (Br. 64) opposite al-Khaznah revealed that the floor, the north wall and the chambers were not finished, though some of the graves in the chambers of the eastern wall were used (Zayadine, 1981: 352, Fig. 7).

Stage 3. Carving the small chambers and graves or slots inside the main chamber

Assuming the desired size or volume of the interior of the chamber is completed by using one of the above mentioned techniques, and the walls, ceiling and floor are flattened and smoothed, the locations of the graves or the graves' chambers are then planned to be carved in the walls of the main chambers, or to be dug in the floors, if the main chambers were to be used as tombs. A number of caves with unfinished graves' chambers in their walls show that both: a) The **V** and **W** [Pl. 55b, c] and b) The irregular hewing techniques [Pls. 65, 94b, c and 95c] were used to carve the small chambers and the graves:-

a) The V and W [Pl. 55b, c] hewing technique

The example that represents this technique is in the cave that is located opposite the Theater, facing west on the western side of al-Khubthah. The mason had marked the outline of the desired area to be carved in the middle of the north wall. He started

carving from the western side going towards the eastern side, using the **V** and **W** hewing technique and finished an area of about one meter high and about two meters long, and less than half a meter deep in the wall [**Pl. 55b**]. This area was intended to be similar to the grave carved in the eastern wall of the same cave [**Pl. 55c**]. The mason never had the chance to complete it. The cave needs to be cleaned from the debris to find out how far the outline goes towards the floor to be able to figure out the area of this carving. In this carved area are five V- shape trenches with four humps in between.

b) The irregular [Pls. 65, 94b, c and 95c] hewing method

This technique was used in several main chambers from which I have chosen these two examples. The first (Br. 802) [**Pls. 65**] or Hafeth's Cave (Hafeth is the name of the person who used to store his belongings in it) is located at the western ridge of al-Khubthah and discussed in detail below. The second [**Pls. 94b, c and 95c**] is located at Hāret (Mughur) an-Nasārā and mentioned briefly earlier. In both examples the chisels' marks indicate that the carving of the small chambers was done in an irregular way.

The following four examples represent the steps followed to determine the number, shape and decoration of the graves' small chambers in which most probably the irregular technique was used:

The first example Hafeth's Cave [**Pls. 62-66**] is exhibited in the interior of the cave located on the western ridge of al-Khubthah opposite the Theater, facing south. Its entrance is almost completely damaged by weather and earthquakes that left an opening 4.00 m. wide by 5.00 m. high [**Pl. 62**]. The interior measures 7.20 m. from east to west and 8.35 m. from north to south. The surface of the walls on the four sides and the ceiling are completely finished with all corners meeting at almost 90°. It is not obvious

whether the hewing or the quarrying technique was used to carve the interior of the main chamber itself. The surface of the floor is almost flat with some fallen rocks from the ceiling next to the entrance of the small chamber in the eastern wall. The walls and the ceiling are relatively smooth, but the chisel marks on the eastern wall, where the graves are marked to be carved, do not follow the Nabataean 45° chiseling pattern, but instead are irregular. There is a small window in the west side of the south wall, its base is about 3.30 m. from the floor. It measures 0.15 m. wide by 1.00 m. high from the outside, and 0.60 m. by 1.00m from the inside. It is not known, if the eastern side of the south wall had another window or not, because it is damaged.

The eastern wall [Pl. 65] however, reveals the hewing technique of one small finished chamber for a grave and five unfinished ones, all marked in preparation for carving. This finished small chamber measures 1.17 m. wide, 2.32 m. high and 2.80 m. deep into the rock, and 1.60 m. from the ceiling to the top of the chamber. Two of the unfinished small chambers are north of the finished chamber and three are to the south. The three on the south have weathered chisel marks, but most of the grooves are evident except for those in the lower area. Work on the upper half of the two unfinished northern small chambers had begun with irregularly patterned chiseling lines. Marks of at least two pointed chisels of different sizes were used. The sections between these chambers are smooth, distinct and about 0.60m. wide and 0.05 m. deep.

It is evident that five people were working on these five unhewn small chambers at the same time, because all of them reached the same level of completion, and each has a small trench dug on its side marking the opening of the chamber.

There are also three carved holes in this eastern wall. One is on the northern edge of the finished chamber. The second is on the north side of the unfinished chamber, which is located on the right of the finished chamber. The third hole is carved in the middle of the unfinished chamber located to the left of the finished one also. While the purpose of these holes is unknown, they may have been for hanging or to hold the plaster that covers the wall. These holes are two to three centimeters deep and the diameter is four to six centimeters.

The second example [Pls. 67-70] is exhibited in the interior of the cave located at Wādi an-Numayr. The cave faces north. The façade has two pilasters, one on each side, adorned with capitals, an architrave on top, and a frieze decorated with disks and vertical lines, and above all of them is a pediment. Such disks and vertical lines are typical to those on other Nabataean monuments, such as the Urn Tomb, and ed-Dayr.

The interior [Pls. 68b, 69-70] is unfinished and measures as follows: the east wall 8.65 m., the south wall 5.55 m., the west wall 8.32 m. and the north wall 5.65 m. The southern wall has three finished chambers, with a space that looks like a pilaster with a simple capital, between each pair of chambers. The average measurement of each chamber is: 2.88 m. long, 1.10 m. wide, and 2.60 m. high. The opening of each chamber is about 0.15 m. higher than the level of the main floor. Each chamber has a grave dug into its floor that measures 2.60 m. by 0.90 m. Their depths are not known because they are not excavated. The ledges of each grave are about 0.15 m. from the back wall of their chambers and 0.10 m. from the sides. These ledges were to hold the slabs covering the graves. The western wall shows the outlines of the five intended chambers [Pls. 68b, 69-70]. The space above the chambers up to the ceiling is irregular

and unfinished, but the chambers and the space between them have been finished with tilted lines at 45°. The carving of the capitals above the pilasters is not finished. The capital of the second pilaster from the north side is not carved but replaced by a stone carved specially to fit into it. The eastern wall has five chambers. A grave is visible only in the southern one [Pls. 69-70]. The pilasters between the chambers are carved with the forty-five degree tilted lines. Just below the ceiling are about ten horizontal lines. At the corner of the southern end of the eastern wall there are a number of vertical lines that together form a rectangular area [Pl. 68b]. Such an area is common in most of Petra's caves, as discussed above. The entrance and the previously mentioned small opening are in the northern wall.

The cornice, whether carved or replaced by an inserted carved stone, forms a band around the interior of the cave. The cave has the typical small square in the north east corner of the north wall similar to the rectangle mentioned above.

The ceiling is about 0.80m.-1.00m. above the top of the chambers. There is nothing of significance on the floor. It appears that the chambers with the graves were at one time used, but they were all robbed in antiquity. The frame carved around the chambers openings indicates that they were closed by doors or slabs. The upper portion of the western side of the entrance has deteriorated. There is an opening on the eastern side of the entrance, which was probably used for ventilation, but was damaged by the weather.

It seems that both interiors at al-Khubthah [Pl. 62] and Wādi an-Numayr [Pl. 67] were carved by the same group because of the similarity of carving and the height of the

graves' chambers, though the façades are different. These caves are separated half an hour walking around the northern end of the High Place Mountain.

A third example [**Pls. 72-75**] is exhibited in the interior of the main cave of a large complex located at the northeastern side of the High Place, facing north. The complex includes:- a) an open square courtyard 19.00 by 19.00 m., cut deep at the side of the rock. b) A large cave cut deep in the south wall of the courtyard, which will be discussed below. c) And to the west of the cave is a huge water reservoir with steps cut also from the rock leading to the bottom of it. It was full of rainwater, and impossible for me to get its measurements also to know the number of the steps. It has a basin in front of its western side. The water comes from the top and pours into the basin then into the reservoir. d) The western wall of the courtyard has another smaller cave facing east. Its façade is separated and lay in front of it. It has the half gables on it. e) The eastern wall has a series of niches on which the eastern ends of arches were resting, from which we can infer that there was a roofed area in front of the eastern wall. The whole area needs to be excavated to shed more light on this complex.

The entrance to the main cave has two openings, one on each side of it [**PI. 72**]. The width of each one is about 0.75 m. but the height is not easy to measure because of the sediment filling the area. If these two openings were windows, then the level of the original floor is more than one meter below the present surface of the debris in and outside the cave. Above the main entrance is the fourth opening, which might be for light. This upper opening has at the top an arch-like carving with holes (notches) for the door from the outside. The floor of this opening is tilted downwards to the inside. Above this opening are a few niches.

The interior of this cave is important for this study. It is a rectangular chamber that measures as follows: The northern and southern walls are 8.10 m. each. The eastern and western walls are 10.45 m. each. The ceiling [Pls. 73a, 75a] is 12.00- 15.00 m. high. The northern wall is about 1.30 m. thick. The walls are dressed with the 45° lines. This interior is significant because of the number of square holes carved decorating its walls. The east, south, and western walls each have five double, vertical rows of holes [Pls. 73, 75]. Each row has six holes. Each double row has eight holes on the top of it, including two holes of the vertical rows, which form the capital. The holes of the capitals are part of two other horizontal lines that run above the vertical rows. They are 0.50-0.60 m. apart horizontally and 0.30 m. vertically. A third row of 47 smaller holes runs above the first two rows on the southern wall, and the same on the other walls. They are 0.11 m. apart from each other. The holes of these rows and the capitals are smaller in size and measure than the holes mentioned above, see [Pl. 75b]. There is another horizontal line of larger holes going across the southern wall from west to east approximately three meters above the present floor. At the southern end of the western wall and about 1.50 m. from the ground, are two notches facing two other notches on the eastern wall probably to put stones for arches [Pls. 73b, d]. It is not easy to determine if they were carved before or after the main holes in the walls, but most probably at the same time. The lower parts of the middle rows of holes on both the western and the eastern sides are carved for unknown purposes. Also, on the southern end of the western wall are two hanging notches about two meters above the holes of the frame line. A horizontal line of thirteen holes, approximately 1.20 m. above the floor

exists at the northern side of the wall. Also, traces of holes are seen of the same design as those on the northern wall. The depth of the holes is about 0.10-0.15 m.

There are two explanations for the existence of these holes, both of which could be true:

The first, which is also seen in other places in Petra, is to hold the plaster or marble pieces similar to those found at the eastern faces of both vomitoria outer walls of Petra Main Theater. These walls are studded with plugging holes for marble facing (Hammond, 1965; 32, 68 Pl. XXII 3; McKenzie, 1990, 144), of which some pieces are still in situ and others have been removed by robbers, but the pattern of the holes could lead to the reconstruction of the facing design desired. Such a technique was employed and can still be seen at Qasr al-Bint. The holes on the outside surface of the front wall as well as the holes and plaster on the outside of the back wall of Qasr al-Bint, (Zayadine, 1987: 131, 135) provide clues helpful in solving the question behind the existence of the holes in the above discussed cave.

The second explanation is that the wide spaces between the holes mark the places where the small chambers for the graves were intended to be carved, and the narrow spaces were to mark the walls between the chambers. This conclusion is derived from the previous two examples at Wādi an-Numayr and al-Khubthah, which have similar plans for carving the chambers.

The fourth example [PI. 94a] is located opposite the Obelisk Tomb north of the unfinished façade. This example consists of the cave with a courtyard in front of it. The façade of the cave is similar to other unfinished façades [Pis. 25a, 40]. The entrance is mostly damaged by the weather. The interior is square and measures 5.25 m.

by 5.25 m. The western wall has three small burial chambers [Pl. 94c]. These chambers differ from the rest found in Petra [Pl. 95]. They are distinguished by three grooves cut into the sides of the north and south chambers, but no grooves are evident in the backs of the chambers. The dressing of the back of the chambers uses the irregular carving technique. The two chambers, to the north and the south, are 1.65m wide 2.45m. high, and extend about 2.00m deep into the wall. Whether these chambers have graves dug in their floors or not is unknown because of the debris that covers their floors. The distance between the grooves is 0.60 m. The depth of the grooves 0.15 m. in the front, but 0.10 m. in the back, and its depth into the rock is 0.08 m. [Pl. 94b]. The middle chamber is narrower, measuring 1.15 m. in width. On each side, there is a bench 0.25 m. wide and 0.40 m. high. This chamber has a grave dug in its floor, but it is full of debris and needs to be excavated to be described. The grooves served, most probably, so that slabs of stone or wooden boards could be used to form some sort of shelves, so more than one deceased could be buried in the chamber. During my visit in 1976 to Madain Saleh, known also as al- Hijr in Arabic and first recorded by the Greek and Roman writers and geographers under the name of Hagra (Department of Antiquities and Museum, Kingdom of Saudi Arabia 1975: 38), I noticed similar method of burying in one of the tombs. The difference is that the slots were carved above each other [Pl. 85] (pages 42 and 57 in Department of Antiquities and Museum, Kingdom of Saudi Arabia, 1975), but in Petra the slots were most likely separated by slabs of sandstone which were put in the groves to separate the bodies from each other.

In the light of this study, and in addition to other types of burying mentioned at the beginning of this chapter, one can conclude that the deceased were buried inside the main chambers in the following two ways:-

a- Laid on the floor of the small chambers, or on shelves as discussed in the fourth example [**Pls. 85, 94b-c**].

b- Put in graves dug in the small chamber, and again, in one case where one body was put at the bottom of the grave, then it was sealed by sandstone slabs, then a second body was laid on top of it, then sealed again with slabs as it was found in the tomb opposite al-Khaznah (Br. 64); (Zayadine, 1981: 352, Fig. 7). It is not known whether more bodies were buried on the top of the second burial or not.

The entrances of most of the caves mentioned above, if not all, probably, had doors of wood, metal, or stones, depending on the size of the opening, but no evidence of such doors exists. However, the entrance of al-Khaznah shows that it had a door of two pieces, one on each side, because of the two special carved areas one on each side of the entrance, at the threshold and the lintel. They most likely held wooden doors with metal frames. Remains of some white mortar are still seen in the south socket of the door. In addition to the large number of Bronze and Iron pieces, mainly nails [**Pl. 81b, c**], discovered in the excavations, the only evidence that supports the use of metal in the doors is found inside the Urn Tomb. A completely decayed iron piece, about half a meter long, attached to the wall with white mortar [**Pl. 81a**] is still in situ in the southern side of the broad recess in the center of the back wall of the tomb.

In addition to the information revealed from studying the interiors of the caves, there are four other important observations which were made during this study:-

1- It was noticed in an unfinished interior of one of the caves [PI. 82a] located southeast of ed-Dayr, that the ceiling (7.05 m. east/west by 6.40 m. south/north) is not finished with lines parallel to each others as the rest of the caves in Petra are, but instead, it is divided by eleven narrow strips running east/west, each is 0.05-0.08 m. and has 12-15 parallel lines within the strip. The spaces between these strips are divided into rectangular spaces by short strips running north/south in between the long east/west strips. These shorter strips have many lines parallel to the lines in the long strips [PI. 82b, c]. The rectangular areas formed by the strips are filled with many lines parallel to each other but perpendicular to the lines in the long strips. Around all of this is a border made up of eight lines. It is not easy to determine if this work was just a decorative element and the ceiling was not covered with plaster as the rest of the caves in Petra, or if it was another way to help holding the plaster to the ceiling.

2- This situation mentioned in previous paragraph is similar to the situation inside al-Khaznah. In January 1994, I cleaned an area of about 2.00 m. by 3.55 m in the north/east inside al-Khaznah [PI. 83a] to see if there were traces of quarrying. To my surprise, I found that the floor was also divided by strips going north/south parallel to each other, and these are also divided by other short strips going east/west similar to the above example, except that in al-Khaznah, there are no parallel lines, but random chisel marks. In early 1970 the department of Antiquities cleared part of the area in front of al-Khaznah. The work revealed about nine square meters which were paved with sandstone pieces similar to the al-Khaznah sandstone. It is possible that these pavement pieces were quarried from the interior of al-Khaznah, and the rectangular shapes inside represent the places where each pavement piece was quarried. During my visit in 1994

to Petra, unfortunately, there was only one piece of the pavement left *in situ* [Pl. 83d]. It is probably gone by now. This remnant measures 0.50x0.30 m. with a height of approximately 0.15 m. (writer's observation). It would have been a great idea to compare the pavement pieces with the rectangular marks inside and find the relationship between them and to prove if the pavement was quarried from inside al-Khaznah or not. Also, during my work at the Urn Tomb at the end of the 1970s, I cleared the upper part of the staircase leading to the courtyard in front of the tomb. I found that the original pieces of the steps had been removed, and used probably somewhere else in the past. However, the impression of the missing pieces on the mortar, which was used under them, was in such good condition, that I was able to reconstruct, and replace the missing steps by new ones, which were cut exactly the same sizes, according to the impression of the original missing pieces of steps. This could be done in the future to replace the missing pavement in front of al-Khaznah.

3- In two caves: one located south of the Urn Tomb and the other on the way to ath-Thughrah, very dark paint was used directly on the surface of the rock in the interior of the caves. It was applied to the south wall of the first cave [Pl. 82d] and on the ceiling of the second one, to draw the same pattern of straps and rectangulars as in the examples mentioned earlier. It was not used on plaster, as was the dark red paint in the Painted House in Siq al-Barid.

4- The presence of the square, or in some caves rectangular forms, which are hatched and exist in the upper corners in most of the finished interiors leads to unsolved questions: What is their function or meaning? Why did the Nabataeans carve them in the upper corners? Usually only one is carved but very rarely two or three are found in

the caves. The 45° lines in these squares are in the direction opposite to the 45° lines on the walls. In some cases the lines in the squares are vertical or horizontal [Pls. 51c, 68b] (see also McKenzie, 1990: Pl. 51).

The absence of inscriptions inside or outside the caves at Petra makes it difficult to determine when and who carved them, or who was buried in them. This contrasts with the tombs of Madain Saleh [Pl. 84] about 400 km. south of Petra; there each tomb façade has an inscription that carries the name of the king who was buried in it and the name of the stone-cutter and the date he worked on it. The absence of inscriptions at Petra may also signify changes that took place probably after the Roman invasion in 106 A.D. Exceptions at Petra are the long two inscriptions: one carved on the façade of the Turkmaniyyah Tomb [Pl. 10b] in Wādi at-Turkmaniyyah, and the second on the ceiling of Oboda's cave in Wādi an-Numayr [Pl. 86a], and a few other short ones: example of which can be seen in a cave opposite the Siq entrance, in a cave on the western side of Wādi al-Mu'aysrah ash-Sharqiyyah [Pl. 86b], and in a cave on the eastern side of al-Habis.

Almost all caves have suffered the ravages of time. The causes of their deterioration include: (a) the continuity of re-use of the caves in later periods, (b) the weather and the earthquakes, that damaged not only the buildings [Pl. 87] but left many of the caves without façades, and (c) their use by the local people in recent times as dwellings and for other purposes [Pl. 13], until most of the local inhabitants were settled in the new settlement at Umm Sayhun. Each one of these activities left its own imprints on the caves of Petra.

It seems that the caves with simple carved façades and interiors are similar to other tombs in the region, such as the tombs of Silwan east of Jerusalem. They both were cut directly from the rock either without façades, or with simple façades, which developed intricacies through time. The tombs of Silwan are older and have some similarities of carving and thus perhaps influenced the carving of some of Petra's caves. In addition, the style and the burial tradition of the Silwan tombs left their marks on the style of the rock tombs at Petra (Ussishkin, 1993: 332). The Silwan Tombs have been dated to a period before the Nabataeans occupied Petra (end of 8th century B.C. and later (Ussishkin, 1993: 327-332).

V. Time and Labor Needed for Carving a Cave's Interior

We should not think or imagine that a stone-cutter sat or stood and worked certain hours of the day or all day, with a chisel and hammer or a single- or double-pointed pick. The double pointed pick image is seen on some oil lamps found in Petra (Barrett, 1998: 277, Fig. 6.40. 95- P-179, Eros in shackles, p. 281, Fig. 6.51. 95-L-179). The image represented here is on a fragment of an oil lamp [Pl. 88a], that one of the local children at Petra had found. Luckily, he allowed me to photograph it.

Suppose a hard working stone-cutter with a pointed pick or with a hammer and a chisel started working on a chamber, how long would it take him to create a medium-sized chamber, or to cut a regular ashlar, such as those used in one of the temples or an ordinary building? The following experiment will give an idea about the time needed to carve a small chamber:-

Muhammad M. Salamah [PI. 89a] member of al-Bdul tribe in Petra, is a well-trained and skilled stone-cutter who worked under my supervision for a long time. I asked him to work on one of the fallen rocks [PI. 89] in the wādi below the northern side of al-Habis for one hour and fifteen minutes without rest. He followed what I consider a Nabataean technique exhibited on the face of the rock on the way to Jabal an-Numayr [PI. 54a] where a square, about 0.95 by 0.95 m. was marked by chiseling on the face of the rock. This ancient example shows that the work was started from the lower left corner going up at an angle toward the center and the upper right corner. The finished worked area covered only ca. 0.20 by 0.30 m. in the lower left corner. Therefore, in the experiment conducted, the same area was marked on the above-mentioned stone about 0.50 by 0.50 m. was marked. Muhammad worked using a meter, angle, hammer, a pointed and flat chisels [PI. 90a]. He started removing the irregular area from the upper right corner to level the surface, then started cutting into the rock trying to imitate the Nabataean carving by making lines of approximately 45° toward the lower left corner. When work reached the lower left corner, it was 0.02 m. deep from the surface at that corner, while the upper right corner was 0.06 m. Then he started breaking the distance between the lines to make finer lines. Almost half of the square was finished when the work stopped [PI. 89c]. Muhammad sharpened his tools using the sandstone as the Nabataeans did. The marks, where the Nabataeans sharpened their tools, are still seen at several places [PI. 90b]. The finished amount of work was (0.50 by 0.50 by 0.03 m. equals 0.0075 cubic meter). Assuming that Muhammad worked for eight hours, the volume carved will be $0.0075 \times 8 = 0.06$ cubic meters. That means one cubic meter needs 1.0×8 divided by $0.06 = 133.3$ hours. If for example, the volume of the interior

of the cave [PI. 64] that measures 8.45 m. by 7.15 m. by 4.00 m. = 241.67 cubic meters is to be hewn, using the hewing technique, it will take $242 \times 133 = 32186$ hours. If these hours divided by 8, the answer will be 4023 days, and if this is divided by 365, the answer is approximately 11 years. That means it would take 11 years for one mason to empty the volume of the cave. This is just a plain cave and one person, no smaller chambers, shafts or graves or any decoration and no other carving in the inside or the outside.

However, it would be impossible to estimate exactly the time needed, if it is assumed that the experimental quarrying technique was used to finish a similar cave, because we do not know either the size of the blocks that were cut and removed, nor the size of the trenches between the blocks nor the number of workers or the hours they worked daily. More carving and quarrying experiments are needed, if permitted by the Department of Antiquities of Jordan.

Hammond, who worked at Petra for several seasons, asked two stone-cutters, one in Amman and the other in Petra [PI. 91], about the minimum time required to shape a single average ashlar block: $0.59\text{m} \times 0.36\text{m} \times 0.31\text{m} = 0.0658$ cubic meter. He received two different answers. The first answer was 12 days and the second was 4 days (Hammond, 1996: 27). The two men are talking about two different kinds of stone. The stone in Amman is limestone, while in Petra it is sandstone. As someone who spent more than twenty years dealing with stone-cutters, I would not consider their answers to be accurate, because we have to keep in mind few factors that affect variation in stone-cutting: a- How are the stone-cutters paid, by hour or daily, or by measuring the length of the finished stones? b- Are they working for the government, a contractor, or for

themselves? Government workers are generally slower and paid less than those who work for a contractor. And c- The size of the original block from which the stone-cutter is trying to shape the ashlar block needed.

McKenzie mentioned in her study of the tombs of Madian Saleh (al-Hegr) [Pls. 84-85] in Arabia (now Saudi Arabia) that the investigation of the stone-cutters, their schools and work reveals the basis on which a façade may be attributed to an individual stone-cutter. Façades with identical moldings were found to be by the same stone-cutter, and the mean working life was twenty-five years (Mckenzie, 1990: 14).

VI. Additional Topics added to complete the Information on Carving the Caves

It necessary to discuss few other important topics, which are relevant to this subject:

A. Completing missing areas of the natural rock with masonry

The use of masonry to complete natural gaps or spaces is very common in Petra. Masonry is utilized in three ways:-

1- To fill and complete gaps in the natural formation of the mountain [Pl. 92] where the cave is carved. The followings are some examples showing the use of the masonry to fill these natural gaps:-

a- The Palace Tomb [Pl. 76b]:- most of the upper part of third storey was completed with cut blocks because of the slope at the edge of the mountain.

b- The Urn Tomb: The columns in the north side of the carved courtyard, and the complex of the vaulted area with the staircase leading up to the courtyard of the Urn Tomb, were all completed and built with masonry [Pl. 26a-c]. This complex is dated to

the Byzantine period, because of the Greek inscription A.D. 446/7 (Harding, 1967,132, Browning, 1973: 215) on the back wall, but the the sounding that was carried out by the writer in 1979, in the area that forms the corner between the north wall of the arched area and east-side of the northern end of the staircase, revealed first century B.C. / A.D. Nabataean pottery (unpublished). The sediment, in which the pottery was found, was dumped after the wall was built. This amount of pottery, the fine 45° Nabataean dressed stones, and the way they are built (see Ch.3: IV) prove without any doubt that this complex is Nabataean and not Byzantine. Anyhow, the date of this complex is not the subject of this dissertation. It will be discussed when the material of the sounding is published in the future. This is just a brief note to be considered in future studies.

c- It is also mentioned that the restored column, the third on the south of al-Khaznah façade [**Pl. 83a**] was built free-standing in antiquity (McKenzie, 1990: 140) and not carved. The recent restoration of this column in early 1960s included the use of some of the original column drums [**Pl. 83b-c**] and capital. The missing parts were replaced by new carved stone ashlar and modern cement. The upper part was covered with a mixture of light brownish sand and white cement added under the supervision of the writer in early 1962, to match as closely as possible, the original color of the surrounding area.

d- The water channel in the Siq [**Pls. 8c, 92a**]: In several locations in the Siq, it is evident that masonry blocks were used to fill the spaces under the water channel. Most obvious towards the entrance and the middle of the Siq, where huge blocks were placed under the channel to support it.

e- The water reservoirs: Some caves were used as water reservoirs. Their wide open entrances were blocked with stones covered with mortar to stop the water leak. Examples are located north of ed-Dayr, at the east side of al-Mu‘aysrah ash-Sharqiyyah [PI.92b], al-Khubthah, and the reservoir on the western side of the High Place, above the Garden Tomb (Br. 244) [PI. 8d]. These reservoirs were coated with cement.

f- The interior of the cave (now used as a museum) at al-Habis (Br. 400): The main chamber is 36 by 20 feet. There are two small chambers in the north and south sides of the cave. Above the north small chamber is another small room, which at one time had been a kind of a gallery at the end of the hall, quite open to the south, and was converted into a separate chamber by building the existing masonry wall across the front of it (Kennedy, 1925: 62-63, Figs. 134-135). Huge blocks of masonry were also used to complete the missing natural areas in both sides of the door of the southern chamber [PI. 92d]. Another example is the façade of the cave (Br. 676) at Hāret (Mughur) an-Nasārā [PI. 92e].

2- To replace parts of pieces probably damaged while working on the façades or the interiors, as in the inset pediments of the Corinthian Tomb (Br. 766) dated c. A.D. 40-70 (McKenzie, 1990: 152-154, Pl. 116,118) over the two doorways north of the main entrance [PI. 92c], and the capitals of the pilasters in the western wall inside of Wādi an-Numayr Tomb [Pls. 67, 68].

3- To insert into grooves carved for this purpose: For example, on the top of the niches out and inside ed-Dayr [PI. 93b-c], or the inset floral pilaster capital in the north wall at the opening of room (Br. 468) opposite ed-Dayr (McKenzie, 1990: 42, Pl. 45d) called also “Rankenkapitell” which is inserted in the right wall of the cella of the temple

opposite ed-Dayr (Lindner, 1984: 166, Pls. XXII: 2, XXIII: 1 and 1984a: 609, Abb. 10, 11). Also the capitals on the top of the pilasters on the façades of two caves at al-Mu‘aysrah ash-Sharqiyyah (Br. 526) [Pl. 52], for [Pl. 52c-d], (Br. 572) (see Bessac, 2007: 35, 156, Figs. 14, 177), or the cave on the way to Umm el-Biyārah (see Lindner, 1980: 282, Abb. 5).

B. Arrangement of Graves or Slots and their Use inside the Main Chambers

The interior of the caves (main chambers) served as mentioned earlier for several purposes: for living, ritual activities, cisterns, and burial areas. The focus here is how the burial places inside the caves were planned, arranged, then carved and used.

In order to adequately study the caves’ interiors in Petra, an organized study group ought to be formed to conduct extensive work to clean, excavate a number of interiors, and collect enough data and information that will shed more light on some of the Nabataean burial customs. Only a few interiors have been cleared of the debris, or scientifically excavated, studied and published. To name some: El-Khan (Br. 4) was excavated by Hammond and cleared by the department of Antiquities in 1961, and since 1964, it is used as a restaurant (Hammond, 1965: 7), Tomb 813 (Zayadine, 1986: 229-237), Tomb (Br.64) opposite al-Khaznah (Zayadine, 1981: 352-353 and 1986: 224-228), and a few others at the Outer Siq. Up to this date, no skeleton remains were collected, saved and studied. The chambers or the graves have not yet revealed a single sarcophagus of any kind. Although Kennedy mentions that in one of al-Khan chambers, there were two stone sarcophagi, he did not see the coffins himself, but he states this on the authority of several writers (Kennedy, 1925: 73). However, he did not mention any of the names of the writers.

The examples [Pls. 62-66, 67-70 and 72-75] discussed earlier in this chapter show that the typical way of preparing the graves is to dig the burial chambers in the walls of the main chamber, then cut the grave shafts deep into their floors. The number, size of burial chambers, the graves in them, the way they are arranged and used vary from one cave to another. Some consist only of a main chamber without smaller burial chambers hewn into their walls or floors. Others have smaller chambers carved in one or more of the four walls as seen in the main chamber of al-Khaznah, where each of the sides and the back wall has a huge chamber, but no graves were dug in their floors. The small burial chambers, in general, differ in size, usually have one grave, but in rare cases have two graves dug in their interiors. I have not seen a chamber with more than two graves in it. The cave that has the largest number of graves dug in its floor in Petra is the Zayd Tomb (Br 825) (McKenzie, 1990: 170, Pls. 165-166) opposite the eastern staircase of High Place at the end of the Outer Siq [Pl. 17a]. It is known as the tomb of Jakum, son of Zaidkumu, Zaidkumu son of Jakum. The name is mentioned in one of the Nabataean inscriptions carved at the base of the obelisk-shaped carvings (representing grave stelae or memorials) on the north wall (Lindner, 1985: 17), [Pl. 17d]. It has eighteen graves dug irregularly into its floor, of which two are cut inside the small chamber (like a niche) in the eastern wall [Pl. 17b]. They were perhaps for the father of the family, and his spouse, the rest were probably for other family members, unless this was a commercial tomb and the graves were sold individually to the public. A number of nefeshes with inscriptions are carved on the western side of the northern wall [Pl. 17e-g] and one at the south side of the entrance [Pl. 129.5]. The Nabataean word nefesh (Nafs in Arabic) means soul, self (Hammond, 1973: 50) or spirit and here it represents

the soul of the deceased. For more information on the nefeshes, see Ch. 5: Section I-D-d, Pl. 129. The graves were all robbed in antiquity and are now full of dirt and stones. However, if they were to be excavated, they may reveal important information concerning the traditional burial way, whether the deceased was put on his back or on his side and on which side, or was the floor or the bottom of the grave flat, or was it a raised area like a headrest for the head to rest on it. To date, no cases have been found where two or more bodies were buried in one grave together at the same time. As mentioned earlier in Ch. 2:II:1a, the burial shafts or graves were covered with slabs of limestone [Pl. 16a] and mortar in between. The mortar used was a mixture of lime, sand, ash and crushed pottery. The same mixture was used inside the cisterns, and is still used in Palestine and Jordan in spite of the availability of modern cement (See Ch. IIIf). The shafts or graves differ in size. There are usually four or five slabs resting on special rebated or recessed areas around the edges to cover each shaft. It is necessary to have a detailed study for interiors with graves, in order to be able to find the relationship between the way of carving the shafts, and how the location was chosen to be in the floor, or into façades, or walls inside, high close to the ceiling or the floor level. In some cases the graves that are close to ceilings are closed with stones as in Wādi an-Numayr [Pl. 22], or on the façades above the doors as in the Urn Tomb façade [Pl. 26a], and Hāret (Mughur) an-Nasārā. Slabs were used to cover the graves in the floors and masonry blocks for the graves dug in the walls instead of the slabs to close them, though one slab would have been enough to block the opening of the grave. Some graves were dug with their length into the rock while others horizontally. The length of each burial's shaft was determined by the height of the individual for whom the tomb was intended (see also

McKenzie, 1990: 113). Many other caves have unfinished graves that are dug in their walls or floors such as in the caves of Hāret (Mughur) an-Nasārā, Wādi Farasah (McKenzie, 1990: Pl. 134a), and Wādi al-Matahah (Johnson, 1999: 252, Fig. 6, Tomb 7, interior), [PI. 95c, h, i].

This study introduced three caves with distinctive burial methods:-

The first two caves are:- The first [PI. 94] opposite the Obelisk Tomb and the second (Br.64) opposite al-Khaznah are discussed in chapter 2.1V.3b earlier where in the first one, the bodies of the deceased were laid on shelves put in the grooves cut specially for them. In the second, two bodies were buried on top of each other in the graves inside the chambers at the eastern wall of cave (Br. 64). When the first body was laid on the floor of the grave, it was covered with slabs, and a second body was put on them, then was covered with slabs again. It is not known also whether other burials were buried on top of the second burial or if the chamber was closed or left open. The same method was used in the shaft tomb in Area BI: I., (see Ch. 2. II), [PI. 18a, e] where two burials were buried in the same grave and were separated with a layer of slabs.

The third is represented by the graves in the Broken Pediment Tomb interior (Br. 228) dated c. A.D.40-70 (McKenzie, 1990: 157-158, Pl. 132-134) where the west wall shows what might be a plan for two levels of graves. The lower chambers were dug into the wall but the upper level was planned but not dug (see McKenzie, 1990: Pl. 134a) [PI. 95h].

C. The 45° Lines and Their Finish

The mason's high standard of workmanship is indicated by their accurate work and the high quality of dressing the stones, inside and outside the walls of the caves

where they were finished. The art of dressing at 45° distinguishes the Nabataean stone dressing from any other kind of dressing, and shows the use of a single-ended pick or chisel forming rough equal individual diagonal and parallel lines tilted at forty-five degrees (Harding, 1967: 120; Mckenzie, 1990: 147-9, Pl. 1, and Schmidt-Colinet, 1981: 66, Abb. 7, 14), running from the ceiling of the cave to the floor or from the top to the bottom. The distance between the lines varies from 0.03-0.02 m. This is considered the first step towards finishing the surfaces. In a second step, a third line is cut between the first two lines, breaking the distance into two halves. The third step is to divide each of these two halves into two also, and so on. This method is repeated several times until the surface is completed or until the desired fineness or finish of the surface is reached. The degree of fineness of the surface depends on how many times the distance between the tilted lines is divided. The narrower the distance becomes, the finer the chisels were used. The interior walls of the Urn Tomb reveal in two places the marks of the stages of finishing the dressing of the steps mentioned above. The first place is on the western side of the north wall, where an unfinished area, about three meters high from the floor, right where the western wall meets the north wall [Pl. 96]. This area is almost one square meter, and shows three steps of chiseling forming the final stage of dressing the surface of the inner walls. The lower two meters of this wall has the final stage of the fine dressing. The western wall has an area north of the door, that shows three stages one higher than the other of dressing of tilted lines, [Pl. 51a]. An area of 0.30 m. by 0.25 m. is another unfinished example on the south wall about 1.50 m. high from the floor and to the east of the south door. Almost every finished interior has one square or more hatched in the opposite direction to the diagonal lines mentioned above, and even

on the outside as seen in the eastern corner of the south colonnade of the platform of the façade of the Urn Tomb, [Pl. 51c].

The fine diagonal tooling of the Nabataean mason [Pl. 51], which, though it may have been decorative in some cases, for the most part served to retain plaster, as for example at Qasr al-Bint (Debevoise, 1941: 54, foot notes: 78-79). Glueck also mentions that the earlier kind of drafting with the lines of tooling at the 45° angle served to hold in place the plaster which covered the inner and the outer faces of the walls at Khirbet Tannur Temple (Glueck, 1965: 183) [Pl. 31d]. Khirbet Tannur is located on the south side of Wādi al-Hisa on the road between al-Karak and at-Tafilah. I also believe that these lines on Petra's caves and buildings interior or exterior walls served to hold in place the plaster. It is obvious from the remains of the stucco and the plaster that the thin layers of stucco and plaster were applied on surfaces of stones of buildings, façades and walls of caves where fine dressings exist, whereas thicker layers were applied to coarser tooled dressings (see also Fitzner and Heinrichs, 1998: 343-344). Hammond wrote that, “the presence of the typical Nabataean diagonal dressing.... supposed that its purpose was to key stucco or plaster,” and continues, “However, this is open to question, for the lavish use of the dressing on corridor walls and other places would seem to indicate, it was a decorative device as well as, or rather than, a functional one” (Hammond, 1973: 77-78), (as mentioned above).

D. The Use of Plaster and Stucco [Pls. 5, 11, 12, 97, 137]

Fragments and remains of molded and painted plaster and stucco are found almost everywhere in Petra and the vicinity surrounding it. The majority of the walls of caves' interiors and the carved façades, if not all, were probably coated with molded and painted

stucco, as well as were the walls of the dwellings (Zayadine, 1987: 132-141, Figs.: 10, 19, 24; Debevoise, 1941: 54; Glueck, 1956: 13-23). It is obvious from the fragments found during the recent excavations at Petra that the walls of the buildings, or at least the major ones, were also plastered. The walls of the Great Temple, temple of the Winged Lions, az-Zantur excavated buildings, Qasr al-Bint and the Baths, all still have the white and colored plaster decorating their walls [Pls. 11, 97]. Plaster was found among the columns of Phase I (labeled Nabataean I) at Petra Great Temple, where eight interior bichrome plastered columns were erected on the building's flanks. The columns in this phase were decorated with deeply carved finely sculpted limestone Nabataean Corinthian capitals. Their column shafts were embellished with flat, red or yellow plaster at 3.76 m. from their attic bases, and above, with white ridged plaster until the beginning of the capital (Joukowsky, 1999: 200). Two wall fragments with partial painted inscriptions were also revealed (Joukowsky, 1999: 211, Figs. 19-21). A fragment of fresco showing a man's face drawn on it, in which the iris of the eye is pale blue, was among the pieces found in 1998 season of excavations at the Great Temple (Joukowsky, 1999: 211, 212, Fig. 21). Stucco was also found in the south corridor of the Great Temple (Egan, 2002: 347). Room 17, (dated to the early second century), at az-Zantur produced fragments of carved and stuccoed cornice. Figures 13 and 14 published by Kolb and Keller show pattern of polychrome octagons and squares which is terminated by a painted stucco profile with a key-pattern frieze (Kolb and Keller, 2002: 287, Figs. 13, 14). The staircase and the interior of the baths, which were excavated by the writer in 1968/69 were beautifully covered with colored plaster (Zayadine, 1987: 137-139, Figs.: 16-17, and 20-21, and McKenzie, 1990: 41, 138, Pls. 23b, c, 75 and 77a). The south, east and

north walls of Qasr al-Bint still hold large areas of neatly carved white plaster [Pls. 11, 97a, b].

The best known examples among the caves with painted plaster are: the cave at Siq al-Barid (Painted House 849 at Beidha) about 5 km. north of Petra [Pl. 5], the caves at Wādi as-Siyyagh, al-Habis [Pl. 12a, b] and al-Khubthah. Remains of stucco are still in situ on the walls of many other caves at Petra, e.g. opposite the theater, al-Mu‘aysrah al-Wusta, Wādi Farasah triclinium, caves on the way to ed-Dayr [Pl. 12c-e], and the caves used as a museum and offices next to it, to name some of them. Zayadine published a comprehensive study on decorative stucco at Petra (Zayadine, 1987: 131-142).

During his Journey through Arabia Petraea to Mount Sinai, Laborde observed among the ruins of Wādi Sabra, “...several columns of stone, covered with a coating of plaster and lime, on which we found remains of the deep red color with which they had been painted to imitate inlaid work”, (Laborde, 1836: 195-196). Wādi Sabra is a about three hours walk south west of Petra.

Though earlier scholars had paid attention to the painted plaster and stucco in Petra in the last century, none of them performed a systematic study of it. Kohl made a brief analysis on the stucco of Qasr al-Bint (Kohl, 1910: 15-22) and G. Horsfield had pertinent remarks regarding the rock-cut dwellings (Horsfield, 1938: 15ff.) and Cl. Vibert prepared drawings of some architectural stucco and fresco at Petra, (Zayadine, 1987: 131, see also footnotes 2-4).

Zayadine published a comprehensive study on decorative stucco at Petra (Zayadine, 1987: 131-142). He examined a few monuments using examples of stucco

selected from the tombs, the dwellings and the temples, to allow a comparative analysis with other Oriental and western Hellenised centers to obtain conclusions concerning the chronology of the monuments and the Nabataean contribution to the Hellenistic koine (Zayadine, 1987: 131). The conclusions of his study were that there is evidence of wide cultural connections of the Nabataeans with Hellenistic Greece, Alexandria and Italy. Alexandria had the strongest influence on the art of Petra as well as did other Hellenistic centers such as Pergamon, Priene in Asia Minor and Antioch in Syria and sites in Palestine (Marissa's tombs, Tell Anafa, Masada and Jericho are also considered as an intermediary). Finally, the Petra craftsmen had surpassed in some cases their Greek models (Zayadine, 1987: 142). In an effort to provide an accurate description of the color of the paint used on the recovered painted plaster from the temple of the Winged Lions at Petra, Hammond chose samples found at the temple for analysis which revealed the primary colors of the entire spectrum, plus a variety of mixed colors and gave a detailed description of each color (Hammond, 1996: 59-83). Stucco fragments, inscribed with Nabataean letters were also found during the excavations of Tomb 813 (Zayadine, 1987: 132) and the Great Temple (Joukowsky, 1999: 211).

In some cases the paint is used directly on the rock without applying first the plaster to the surface. Red, white, yellow, blue, and black are the predominant colors. These colors were used on the plaster covering the walls of the buildings in Petra representing an egg-and-dart motif. The dark-red and white paint on the façades of al-Khaznah, the Palace Tomb and the Corinthian Tomb and on the plaster inside the Baths was probably used to replace carved dentels or to mark the place where the dentels are to be carved on the façades. Black paint is seen in two cave interiors: the first interior is of

a cave [Pl. 82d] on the western side of al-Khubthah south of the Urn Tomb. The second interior is of a cave on the way to the Snake Monument (Br. 302) just south of the staircase at the bottom of Umm el-Biyārah. A white paint, that the writer observed, was also used on one façade at Hāret (Mughur) an-Nasārā to mark the gables on an unfinished façade [Pl. 37b]. It is important to mention that the small holes carved specifically in the walls of the buildings or the façades or interiors of the caves were designed to hold the stucco and plaster to the walls, and that the grooves in some façades were decorated with stucco cornices as in the case of façade (Br. 526) [Pl. 52a] and (Br. 575) where the pediment and the cornice were of stucco (Zayadine, 1987: 131, Fig. 3, 5). Wooden, marble or metal dowels were put in these holes (Hammond, 1973: 71). Such holes with or without dowels are visible at the walls of the Theater, Qasr al-Bint, caves' façades [Pl. 56a, c] and interiors [Pl. 73], and others. The entire scheme of decoration may be reconstructed from the positions of these holes (Debevoise, 1941: 53-54).

Plaster was also used to repair broken, chipped and missing fragments of the capitals of the columns, or in some cases the whole carved decoration of the capital was replaced with the plaster to match the capitals which are decorated with carvings [Pl. 97d]. The technique of coating the capitals with plaster suggests that the plain Nabataean capitals were decorated with added stucco vegetal scrolls (Zayadine, 1987: 139, Fig. 18).

A mysterious question, which will remain unsolved, is: why did the Nabataeans add the colored painted plaster and stucco to the surfaces of their caves, which are carved in the colorful sandstone mountains? The only answers I can think of are (1) perhaps to introduce their high standard of skill in the art of painting as they did in the art of

architecture, pottery, etc., to the nations around them, or (2) perhaps to protect the fresh surfaces of the caves or the stones of the buildings from deterioration by the weather.

The quarrying technique inside and outside the caves leads us to examine in Chapter 3 the quarrying locations and technique in Petra area. However, it is necessary to mention that quarrying inside the caves needed light. Some caves have windows, but normally they had no light. Small niches were carved for: placing lamps to provide light, while workers were cutting the stones.

⁽¹⁾ Mckenzie wrote that “the Nabataean word (*psl'*) describing the maker of the tomb is most accurately translated into English as “stone-cutter” rather than 'stone mason or sculptor” (Mckenzie, 1990: 14).

CHAPTER 3

THE QUARRYING TECHNIQUE

The Nabataean quarrying method has never been of much interest or concern to those who worked or are still working at Petra. Only a few have mentioned or described briefly some of the major quarries¹. I will refer to them or mention them through the discussion in this chapter. The purpose of the following discussion is not to submit a comprehensive analysis of the quarries and related topics, but to complete the study in the previous chapter, since some of the caves' façades and interiors were used as quarries when they were carved, with the hope that more attention will be paid to the quarries and a detailed study with the new technology will be carried out by the young archaeologists in the future. In this chapter I will present a short introduction to Nabataean quarrying from the moment the quarry site is chosen and the stone began to be cut from it, to the moment it was used to build in the wall of the building, giving a brief description of the steps in which the blocks went through. Usually, the quarries are chosen close to the construction site, but the Nabataeans also used their monuments' sites as quarries. In doing so, they achieved two goals: quarrying the blocks and at the same time carving the façades and interiors of the monuments. There are numerous Nabataean quarries in the center and the surroundings of Petra. They are marked by enormous straight cuts on the sides of the mountains, or by the visible trenches around the non-extracted blocks on the surface of the rock, and by the chisel marks on the faces of these straight cuts which bear

witness to the tools used and to the technique that was applied to bring blocks to finished form. From the chisel's marks we can determine the stages of the work done in the quarry or on the block and the function of the various tools used for the work. Because of the recycling of broken iron tools, the corrosion of the iron used and perhaps some other reasons, only a few discarded tools have been found. Three types of stones were used which came from three different places. Certain tools were employed for each stage of quarrying and for dressing the quarried blocks at the quarry and at the site of construction, as will be discussed later. Tool marks indicate that single or double-ended picks, hammers and chisels, as indicated by the tool marks, were used for cutting the trenches around the blocks. The following pages will offer a summary of the research which I carried out for this study.

The tools' marks and grooves or trenches which are seen on the mountains at Petra provide evidence that the ashlar blocks were quarried and extracted from the vertical cliff faces, both outside and inside of the caves, and from the horizontal flat rock surfaces as examples will show later in this chapter. The cleavages in the rocky mountains of Petra are often vertical and there are vertical faults extending from top to bottom of the mountains' face [Pls. 27c, 59a]. This was perhaps caused by a number of earthquakes that have struck the area. The area of Palestine and Jordan has been hit by several earthquakes in recent times (Yadin, 1965: 119). The effect of the several earthquakes that hit Petra city between the first and the eighth centuries A.D. had varying effects on different Petra structures (Hammond, 1965: 15, 20 and footnotes 19, 20 of Ch. II). Severe damage was caused by the earthquake of May 19 A.D 363 (Russell, 1980: 47-64; Hammond, 1996: 6). These effects are also seen in the Northern and

Northwestern sides of the quarry of Wādi as-Siyyagh, where huge blocks fell after the quarrying took place. However, we cannot determine which earthquake caused this damage. The sandstone formations in Petra area have horizontal laminations, which in some cases limit the height of the quarried blocks. Most faces of quarries are vertical and high and have the typical Nabataean chisels' marks. They are also distinguished by certain visible features:

a)-The horizontal lines of chiseling show the height of each course of the extracted stones. These lines are not only visible in the quarries [PI. 71b-c], but also at the façades [PI. 71a] and interiors [PI. 71d] of the caves.

b)-In many of the quarries, a pair of slots or footholds which are small shallow rock cuttings (Harding, 1967: 134) are often seen. These slots are clearly visible at both sides of al-Khaznah [PIs. 83a, 98e], at the quarries on both sides of Wādi as-Siyyagh [PI. 98a-c], the quarries east of the eastern staircase to the High Place [PI. 98d], and Umm Sayhun Quarry [PI. 98f]. They were to help quarrymen climb down to the working areas, when it became deep and hard to reach, and to climb up, when the work is over at the end of the day. Clarke mentions that these slots are for climbing up (Clarke and Engelbach, 1930: 13). However, it is more logical that they were used for both, down and up, because the quarrying at Petra started from the upper surface of the rock and proceed downwards to the level that could be reached from below without using the slots.

c)-The different types of masons' marks on the faces of quarries. Most common marks are the drawings of altars, or incised altars, (or such marks see Ch. 5a: 1, 2), and in some cases inscriptions or names of individuals who probably worked at that quarry.

Names of workers were also found in the quarries in neighboring Iran (Roaf, 1980: 70-71).

d)-Short vertical and longer horizontal quarrying grooves for separating the blocks are visible all over Petra. The best examples are seen at both sides of the urn at the top of ed-Dayr monument [PI. 99] and the south/east end of Wādi as-Siyyagh quarry [PI. 104a]. The area to the south of the Urn of ed-Dayr shows how the trenches were marked and dug [PI. 99a-d]. The area to the north of the Urn shows the uneven surfaces left after extracting and lifting the blocks, as well as the lower parts of the finished trenches around these surfaces [PI. 99e].

A thick layer of fine sand was probably heaped in front of the quarries, so the extracted blocks could be dropped from the top of the quarry, and not be damaged. The layers of sand are still seen in front of the High Place quarries, in front of ed-Dayr, and Umm Sayhun quarry [PI. 21a, c], where it covers a large area, and has not been washed away, in spite of the long period of time, since the quarrying took place. As the operation of quarrying continued, more and more sand accumulated as a result of cutting the trenches between the blocks, and the primary rough dressing that was applied to the blocks before they were transferred to the buildings' spots. The blocks were not finely dressed at the quarry in order to avoid damage while transporting them to the locations of buildings, where the final shaping and dressing took place, whether on the ground or after the blocks are lined in courses on the walls.

The sandstone and limestone were quarried with a similar technique. The pouring of water on dry wooden wedges was in my opinion not used in these sandstone quarries,

but this idea has yet to be tested. Extracting the blocks or ashlar is identical in all quarries at Petra⁽¹⁾, using the following steps:

The first step: A location of a quarry with stone adequate for the quality of ashlar to be extracted is chosen. The chosen quarrying sites were located not far from the sites of the construction and produced high quality of stones. The upper surface is cleared, flattened and the front was cut straight to the desired height of the blocks to be quarried or even a bit lower. Cutting sandstone at Petra involved a technique which enabled the Nabataeans to get the amount of stones needed for the buildings in as fast a way as possible (See Wādi ed-Dayr example in the following pages). The actual rock cutting technique began at the quarry site.

The second step: The size of each block is marked out, and three grooves- one on each side and one on the back that had to be straight and accurately delineated as they gave the block its desired shape and size. The grooves are then cut along the block's three sides and are deepened to the level of the bottom of the block face or even slightly below it. The grooves often took the form of trenches cut 0.20-0.40 m. wide and down to the desired depth. A trench, or groove was made [Pls. 99-101], and its vertical walls were maintained. The trenches were first dug by the use of a mason's pick. Short chisels were used to a certain depth, then long pointed one tooth chisel and a hammer were used to continue the digging, until the required depth was reached (Clarke and Engelbach, 1930: 17) [Pl. 99-101, 14]. At this point, the block is freed from the rock from the four sides while the underside remained attached to the main rock. Special grooves could be cut at the bottom of these trenches and more wooden wedges were inserted to direct the split. Rababeh referred to several examples where the groove was

used but he mentioned that "This groove has not been found in Petra, nor any trace of cuttings for crowbars", (Rababeh, S. 2005: 62-63). This statement is contradicted by what I discovered at the side of Wādi ed-Dayr [Pls. 100-101] and explained below regarding how the blocks were detached. This small quarry is similar to the example that Rababeh used in his study (Fig.3.18).

The third step: Initially, in ancient times, the stone blocks or slabs were severed from the main rock by means of wooden swelling wedges placed in the grooves. The wedges increase in size when wetted or moistened. They expand and crack the rock along the grooved line. As I have mentioned earlier, I do not believe that this technique was used in quarrying the sandstone in Petra. Instead, the underside is detached by horizontal cutting and by forcible removal with the aid of various mechanical means (Ussishken, 1993: 345). Ussishken has not given a description of these mechanical means. Till now, no one has given a detailed description of the means that were used to detach the blocks and slabs from the quarries at Petra. This step involves digging a number of slots under the front of the block, where suitable iron wedges or big chisels are inserted into these slots then hit fiercely with heavy sledge-hammers by a number of workers at the same time to liberate the desired block from the main quarry. The blocks were finally detached from below by the action of the metal wedges.

To obtain large blocks from quarries, wide trenches 0.40-0.60 m. had to be cut between the blocks to ease the work. Blocks were detached from the main rock by one of the two means:- a) Metal wedges which were hammered into slots cut especially for this purpose. The wedges could be driven between two metal strips on the sides of the wedges if the wedges were hammered vertically. This technique is known and still used

today in some modern quarries as at Jabal al-Ashrafiyyah in Amman [Pl. 102]. b) Wooden wedges which were expanded by being moistened with water as mentioned above. This technique may not have been used at Petra, since no evidence was ever found yet. Although, wedges and short wooden beams 0.10 by 0.10 m. and 1.00-2.50m. were used at Qasr al-Bint [Pls. 11, 97a, b] and others, these beams were perhaps used to decrease the effect of the earthquakes on the building. Stones were removed in roughly rectangular blocks from the main rock. This is followed by preliminary work such as trimming, and cleaning using the hammer, point chisel, or punch. The blocks may have been shaped into architectural or sculptural forms such as columns' drums and capitals. In some cases the huge blocks were split into two or more pieces as desired. This process in the quarries made moving the blocks easier.

The vertical faces of the blocks were cut out by means of the metal tools. A close examination of the quarries and the caves revealed that a metal pointed tool, probably a mason's pick was used in cutting the blocks. The pick is a form of a hammer pointed on both ends and weighing probably 1-2 kilograms [Pl. 88a]. Masons today call it "*Minqar*" or "*Munqar*" which means 'beak', a form that comes from the verb *naqara* in Arabic which means 'to peck'. The shaft of the pick varies from 40-60 cm in length, and it must be held by both hands, while the stone is carefully hit. The traces (curved in the form of lines) left on the faces of the quarries by this pick demonstrate how this tool was used [Pl. 88b, c]. The mason's pick leaves curved cuts lay more or less parallel. However, in some cases, one cannot be certain about the types or usages of tools from their traces on the stones. It may be a big pointed chisel or a pick that yielded the traces

on the rock. The chisel marks are either straight or un-oriented. Heavy tools such as sledge hammers would have more effect than the blows with light hammers.

The marks left on the rock surface after the extraction attested to the size of the quarried block. The bottom of the grooves cut around the block were unaffected by the quarrying process. The imprint left by these blocks has the form of a rectangle bordered by grooves as seen north and south of the Urn of ed-Dayr. The surface of this imprint is rough, and in places, its level is either slightly higher or lower than the bottom of the grooves in accordance with the way the block splits. The blocks were almost always quarried in parallel rows [Pls. 99, 100]. Single grooves served to extract adjacent blocks.

When one course of stone had been removed, a similar course was extracted below it, and work continued for similar courses as long as the rock provided the quality needed. In some areas the quarry looks like tiers of seats in a theater [Pl. 103]. Large number of blocks could be cut simultaneously. The unremoved blocks as well as the grooves and the imprints left by the removed blocks are clearly visible in many locations in the quarries [Pls. 20b: See white arrow, 99, 104].

The Nabateaens must have had much experience in how to choose the locations of the quarries before they started the procedure of quarrying. They have learned while carving the caves the quality of the stone that they were going to use in the buildings. It is clear that they also noticed that the beautiful colored areas in the mountains are the most affected by climate. Though the colorful stones are easy to cut and to carve, they avoided using stones from such areas as much as they could. I have noticed during my work that the walls of the stage of the main theater were built of such colorful stones

which I believe were quarried from the Palace Tomb area, because of the similarity of the colors in both. There is not much left of these walls; with only slight weathering or abrasion the sand grains are loosened. The popular belief that it was easy to carve Petra's monuments must come from the friability of this multicolored sandstone. However, it is not easy to determine from which quarry each building's stones were taken. It is possible that the stones used in houses or common buildings were extracted from quarries which were close to them in order to save time transporting them. For example, stones from Wādi as-Siyyagh quarries were most likely used for major buildings in the center of the city. Stones from the High Place quarries were used to build the building on the top of the High Place. Urn Tomb stones were used for its staircase and so on. In many buildings, one can see stones with different colors indicating that several groups worked on cutting stones from different quarries close to that building.

I. The Technique of Quarrying (Extracting) the Blocks from the Quarries: Wādi ed-Dayr Example [Pls. 100, 101]

Wādi ed-Dayr Example [Pls. 100, 101]

This is only example in the whole of the Petra area that shows the wedging and extraction technique in using the grooves. Schmitt-Korte mentioned to me that another one exists at the High Place. I have searched the whole area, but I was unable to find it. The example used here, is located on the western side of Wādi ed-Dayr, opposite the new museum's building and about forty meters higher than the level of the wādi bed. The

quarry measures are 9.5m. east/west and 5.5m. south/north. The south and the east sides drop sharply straight down about 5.5 m., while the north side extends about 10.00 m. at the same level of the surface of the quarry. The western side is the very important discovery, because of the five wedges' slots cut at the bottom of the face of the block at a depth of 0.65 m. from the surface of the quarry, which means that the quarrying started from this point, and this is the first block to be quarried from this area. Two main parallel trenches (grooves) are cut east/west, crossed by four parallel trenches running north/south. The trenches are 0.15-0.30 m deep and 0.15-0.20m wide. The irregular depth and width mean that the trenches were not completed, but it shows that eight blocks are planned to be extracted from the rock. The wedges' slots or grooves are flat at the bottom with a concave top [Pls. 100, 101]. The slots are 0.20m. wide at the bottom, 0.15 m deep into the rock and 0.10m high in the front at the face of the rock. The chisels which were to be inserted into these slots to separate the blocks from the main rock must have had the same shape of the slots, but smaller in size so that they fit into them. They were at least 0.30 m. long. A few taps with a sledge hammer on these chisels which are inserted into these slots will easily liberate the block from the main rock. Here, the wet wooden wedges were not needed in these slots, since their depth is not sufficient, and they are under the block, and not at the sides, and it would be difficult to make the wedges wet. In this example, short, thick, and chiseled-shaped pieces of metal were put into those holes and were hit with heavy hammers (2-5kg.) by a number of people at the same time to separate the block from the main rock, since the channels or trenches were cut on the three remaining sides. It is also possible that the chisels were long, held by hand and hit by hammer. It is important to keep in mind that the

sandstone in Petra absorbs large amount of water when it is poured on it, specifically, in hot days. This makes the use of the wet wedges not easy because of the amount of water needed. It is also important to remember that it would take time for a wooden wedge to absorb water and expand. It would take too long, if wet wooden wedges were used to extract large quantity of stones needed to build the monuments or carve the caves in Petra. An experiment is necessary to examine both ways -the wet wooden wedges or the metal wedges and hammers suggested for this example- to find out which is faster and more economical, and which the Nabataeans used. I am not in a position that allows me to do such an experiment at this time.

While working at Petra, I noticed that the modern stone-cutters used tempered iron tools to handle the sandstone blocks [Pls. 89a, 90a, 91b]. They had additional sharpened tools on hand at all times, which they used to replace the tools before the edge wore. Tools are sharpened by using local sandstone from Petra. Ancient traces of sharpening marks are seen on the rock surface on the western stair-case of the High Place about twenty meters northwest of the Lion carving [Pl. 90b] and north of the capitals of the Unfinished Tomb of al-Habis [Pl. 23a: The white arrow indicates the location of traces of sharpening tools]. Even nowadays the stone-cutters who work at Petra still use the local sandstone for sharpening their tools. The tools were always sharp, and produced perfect lines of chiseling on the rock or stone. Marks left by the metal tools which are seen clearly in or outside the caves or on stones, show that each blow removed a fragment or several chips of the stone. The excavations of the Main Theater, al-Katutah and the temples at Petra revealed a large number of iron nails [Pl. 81b, c]. The metal finds prove that iron was widely available. A piece of an iron saw was also found

in 1965 excavations at Umm el-Biyārah, (see IVa). In August 2010, the inspector of Antiquities at Petra, Suleiman Farajat, told me that he found what it might be a Nabataean tool at ed-Dayr excavations, which he will publish in the future.

Steel tools are now used by the modern stone-cutters at Petra and in other places. The weight of the hammer is about one kilogram. The metal wedges would have been in a form of a thick rod [PI. 102] or of oval section, with a taper of about (4-8cm.) along their length and placed in the holes cut specially for the wedges. They are hammered gently but tightened into the holes by a heavy hammer. Then, the wedges are struck in succession one blow (hit) each with a sledge hammer being careful not to break the stones. Iron wedges must have been used also in the quarries for dividing large stones into smaller blocks. It was noticed at some of Qasr al-Bint masonry that very narrow trench of about 20 cm. long by 3-5 cm. wide and 5-8 cm. deep were cut, but then filled with a mixture of stone, pottery, marble pieces and mortar [PI. 105a]. It may be that these holes were for the wedges, to divide the blocks into two halves, while they were at the quarries, because of their heavy weight. It is also possible that the purpose was to join two blocks together or to hold the plaster to the wall. There are no traces- to my knowledge- that show that blocks were extracted from vertical cliffs by means of vertical grooves as seen in Silwan quarries (Ussishken, 1993: 354).

II. Types of Quarries

The extraction of stones and marks of quarrying are almost everywhere in Petra. Quarries in Petra could be divided into two groups: a) Open air quarries and b) cave interior (covered or closed) quarries:

A. Open Air Quarries

These are represented in following six types and located in several places:-

a) The Main Quarries

The main quarries are located at the sides of the Mountains [**Pls. 106-108**]: The stones were cut from the top to the bottom at the side of the mountain. The concentration of quarrying operations is at Wādi as-Siyyagh, the High Place, Umm Sayhun, and others.

The major and largest quarrying area in Petra runs on both sides of Wādi as-Siyyagh [**Pl. 106**] behind al-Habis, where Wādi al-Kharroubah Ibn Jurayma meets Wādi as-Siyyagh at the south side. The face of the quarries at as-Siyyagh takes a turn to the South facing the West. The chiseled walls of Wādi as-Siyyagh quarries provide “a counterpoint of hard, vertical lines and flat surfaces amid bold, rounded tumult of nature” (Browning, 1973: 168). The sheer cliff face has been cut and dressed to a very considerable height (Harding, 1967: 34). Some cuts are more than fifty meters high.

The size of the blocks, which were extracted from the quarries at Wādi as-Siyyagh, is not known, because there are no traces of the extraction of the blocks seen except at the eastern end of the quarry at the southern side of the wādi [**Pl. 104a**]. In other quarries, the blocks to be extracted are still in situ [**Pl. 104b-e**]. The trenches around the blocks are already cut showing the size of each block which measure 1.00-1.50 m. by 0.50-0.80 m. with a height of 0.40-0.60 m.

Quarrying at Wādi as-Siyyagh was probably at the end of 1st cent. B. C. and the beginning of the 1st cent. A. D., the period of Aretas IV (9 B.C. - 40 A.D.), because Qasr al-Bint and other nearby major constructed monuments are dated to this period. The

large scale of quarrying operations on both sides of Wādi as-Siyyagh and the other sites indicate that extensive group work was being carried out in the city.

The High Place Quarries [**Pl. 107**]:- The High place quarries are located in three places: Two are to the south of the summit: The first quarry [**Pl. 107a**] is about 400.00 m. to the south of the summit. It is about 150 m. long and about 3.00-6.00 m. high. It runs from the north-east to the south-west about 200 m. It has the best example of the tiers [**Pl. 103e**]. The second [**Pl. 107c**] extends from the south edge of the summit to the south for more than 75 m. and include two areas with obelisks [**Pl. 107d-e**]. Each of the obelisks is more than six meters high. The face of the quarry itself is about 40 m. east/west, and about 25 m. high, and has a number of short inscriptions which are probably names of those who worked there. At the western side, there are few unextracted blocks [**Pl. 104b-c**]. It is most likely that the remaining blocks of the building on the summit were extracted from this quarry. The third quarry [**Pl. 107b**] is on the eastern sides of the eastern staircase that leads from the outer Siq to the top of the High Place mountain. This quarry is half way to the top, and facing north. It is about 40 m. high and the quarried area in front of it is about 30 m. east/west and 10 m. north/south.

Umm Sayhun Quarry [**Pls. 21a, 103a, 108**] at al-Najr (Kennedy, 1925: 12-14, Fig. 39) is hardly mentioned by early scholars. It is located on the top of the mountain at the east side of the northern end of Wādi at-Turkmaniyyah, west of the road to the new village of Umm Sayhun, facing east and south. The top is about one thousand square meters where the unextracted blocks and their trenches are still seen. The front of the quarry is about 120 m. long, 28 m. high, and has good quality of stone which was probably used also in the major buildings. It would be easier to move the stones on

rollers from Umm Sayhun down to the center of the city rather than to roll them up from Wādi as-Siyyagh.

b) The minor Quarries

[Pls. 20b: Note white arrows, 109], only one course or layer of blocks was planned to be extracted from a horizontal surface of rock. At these quarries the trenches are cut around the blocks, but not a single block was extracted from its position. Such examples are located east of the Snake monument on the way to ath-Thughrah, also below the western edge of the High Place, Umm el-Biyārah south east of foot, at Qunb at-Turkmaniyyah and at the northwest corner of the platform of the Obelisk Tomb [Pl. 20b].

c) Tier or Step Quarries [Pl. 103]

In this type the stones were cut from the surface of the rock in a form of tiers one after the other. When the first layer of stones is extracted from the surface, the following layer is removed until it reaches the back of the quarried area, then it stops few centimeters in front of the upper layer end. The quarrying continues one layer after the other and each one is shorter than the one above it, and so on. After few layers of quarrying, and at the end of the work, the back of the quarried area becomes the face of the quarry, and it will look like the tiers or the seats of a theater. This provides an easier way to reach the top of the quarrying area than using the foot holds seen in the other types of quarries. This type is found at the top of the High Place south east of the Obelisks, on the top of Umm Sayhun (Kennedy, 1925: Figs. 41-43), at Hāret (Mughur) an-Nasārā, and on the way to Siq al-Barid at ash-Shammasa (Lindner, 2002: 234-236).

d) Caves' Façades used as quarries [Pls. 36, 99]

In these examples the blocks were extracted while carving the façades of the caves, as discussed earlier in Ch. 2: II (Group I, second type).

e) Column Drum Quarries [Pl. 110]

Two unique features, which I believe they represent Columns' Drums Quarries, were found:

The first [Pl. 110a-b] is located at the northwest edge of the High Place. The remains of what seems to be an unextracted drum are still attached to the main rock, and it looks like a supporting pillar in a room. It is actually in the center of a square area that measures 5.00 m. X 5.00 m. and the walls are about 0.70 m. thick. The drum itself is 0.80 m. high; its diameter is about 0.70 m.

The second [Pl. 110c-d] is located on the north side of Wādi as-Siyyagh north of al-Habis. The surface of the main rock slopes towards the south. The imprint of the drum is in a circular cut. The depth of this circular cut is not the same; it differs from one spot to the other, because of the slope of the surface of the main rock. Its depth is between 0.08-0.25 m. deep and 0.06 m. wide. The diameter of the drum measures 0.70 m. and its surface is at the same level of the surrounding rock.

The quarries in Petra were studied in detail in the last decade by the architect Shaher M. Rababeh and the stone-cutter Jean-Claude Bessac. Rababeh classified Petra quarries into three types: primary, leveling and tomb quarries, and gave examples of each type (Rababeh: 2005: 49-58, Figs. 3. 1-9). Bessac mentions eight kinds of quarries in his book. In addition to the ones I have mentioned above, he added concave and the underground quarries (Bessac, 2007, 12: 77-85). Earlier Pflüger divided the quarries

into three general shapes: vertical “zig-zag quarrying”, smooth vertical quarrying and conchoidal quarrying (Pflüger, 1990: 12, 1995: 281-295).

There are two important cases relevant to the quarrying and the carving of the façades, which must be mentioned before proceeding to the rest of the chapter. The first remarkable case is at Qunb at-Turkmaniyyah where the quarrying workers avoided the destruction of the façade of tomb (Br. 616) which is facing Qasr al-Bint Temple in the center of the city. The façade stands alone at the edge of the rock while a huge amount of blocks was quarried from the sides and back of it (See Browning, 1973: 234, Fig. 171, 1989: 239, Fig. 157, Rababeh, 2005: 51 and Bessac 2007: 12). In the second case the façades of a number of earlier caves above the Theater [Pl. 78a] were cut away during its construction (See Browning, 1973: 130, Figs. 75-6, Harding, 1967: 129).

f) Quarrying the Hard Limestone at Wādi Musa and Yellowish Soft Stones at al-Bastah [Pl. 111]

The Sharah mountains east of Petra were the source of both the hard limestone and the yellowish soft stone. As mentioned earlier in Chapter 2: II.1 [Pl. 16a], the white limestone was used in the pavement of the Siq and to cover some of the graves. Huge blocks of these stones were carried down by the ephemeral winter floods [Pl. 87a] (Pflüger, 1990: 149) through the tunnel at the entrance of the Siq to the center of the city then they were shaped at the spot where they were used. The soft yellow marl (Hammond, 1965: 73) stones were used for some of the statues and the columns and their drums. I believe that the major quarry is at the village of al-Bastah on the way to Ma'an about 20 km. east of Petra. They were transported most probably by carts drawn by

animals since they were much lighter and more delicate than the white stones. Also the road is going down hill and it is easy to pull the carts.

B. Caves' Interiors used as Quarries

These are also called covered or closed quarries, (Clarke, 1930: 15): Example are the interiors of: the Palace Tomb (Br. 765) [Pls. 76, 77], the Main Theater Northern Entrance (vomitorium sinistrum) [Pl. 78], the cave on the way up to Umm el-Biyārah [Pls. 59-61], and others.

As discussed in the previous chapter, in this type of quarry, the blocks were cut while carving the interior of the caves. The stones were subtracted from the main rock by cutting vertical trenches on all sides according to the required size needed. Several other examples were located during the survey. Among those are: the cave at Wādi al-Mu‘aysrah al-Gharbiyyah (al-Kharroubah) [Pl. 47], the cave south of the Urn Tomb [Pl. 82d], and the cave northeast of the Place Tomb, east of Sextius Florentinus Tomb (Br. 763) [Pl. 76d].

a) The Interior of the Palace Tomb

[Pls. 76a-c, 77], (McKenzie, 1990: 162-5, Pl. 150a):- The interior of the Palace Tomb is another example of interior quarrying. It is evident that the trenches cut at the top of the back of the recess in the back wall of the interior were designed to extract blocks, but the work stopped, and the recess was never finished. Probably the whole interior was quarried by the same way. It is also possible that the blocks were used to complete the upper part of the façade.

b) The Interior of the Northern Entrance to the Theater

[Pl. 78] The North Entrance (vomitorium sinistrum) one of the two rock-cut side entrances to the orchestra of the theater, (McKenzie, 1990: 143-144, and Hammond, 1965: 28-32, Pl. XIV.4) is another example of a covered quarry. Three blocks with trenches surrounding them are still *in situ* and ready to be extracted, but the work was not completed for one reason or another.

c) The interior of the Cave on the way to Umm el-Biyārah [Pls. 59-61]

This cave is located at the north terrace on the right hand on the way up to the top of Umm el-Biyārah. It was described briefly by Lindner (Lindner, 1980: 283, Abb. 7).

Three other caves' interiors show less activity inside them: Wādi al-Mu'aysrah al-Gharbiyyah (al-Kharroubah) Cave, [Pl. 47] shows that the quarrying was taking place and at the same time burial graves were dug and probably used before the interior was finished. The interior of the cave south of the Urn Tomb is uneven and not flat because the imprints of the extracted stones are irregular. While the interior of the cave east of Sextius Florentinus Tomb is flat and smooth, there is one block next to the eastern wall which was marked and freed from all sides from the main rock except at the base.

In both types, the open and the closed quarries, stones were extracted from the bedrock by cutting vertical trenches on all sides according to the required size. For covered quarries which are inside the caves, the masons cut the trenches between the blocks then separated them by driving wedges in from the front also. The stone-cutting in the unfinished caves mentioned above- The Palace Tomb, the northern (vomitorium sinistrum) of the Theater, the cave on the way to Umm el-Biyārah- was never completed. Caves are hewn into the rock, by generations of stone- masons who learned the skill from their ancestors. They followed the same method of carving used in the

open quarries, and using the same kind of tools. Clarke distinguishes between the open and closed quarry, (Clarke, 1930: 15). In an open quarry, a large number of stones is cut at one level, because the open area in the quarry is large, compared to the closed caves. It is notable that some of the open quarries look like tiers when work is stopped [Pl. 103]. The size of the stones was decided before they were cut as indicated by the trenches which are cut between the blocks. The study of the quarries must confront many features difficult to explain, especially when they are not clear because of the amount of debris accumulated in front of them.

III. Stone Transport to Buildings [Pl. 112], (Time and Labor to Transport)

Another important issue, which needs detailed research, is handling and transporting the stones from the quarries to the location of the building, whether they are far or close to one another. There are a few facts the Nabataeans had to consider: The location of the building in relation to the quarry and the distance between them, and the size and the quantity of the blocks needed played a major role in how to bring them to the site of the intended building. The ephemeral winter floods [Pl. 87a] (Pflüger, 1990: 149) brought the huge white limestone slabs to Petra from the Sharah Mountains, which could be carved into pavement stones and in some cases as covers for the tombs. Animals, (donkies, camels, mules, horses and oxen) (Hammond, 1996: 29-30) may have been used to carry the small blocks, or pull the carts with the stones from the quarries to the buildings' sites. Manpower was used to carry the ashlar after they were extracted to be put at the right places on the walls [Pl. 112]. Besides men and animals, metal or wooden rollers and crowbars could be used to help transport the blocks overland. It is

not easy to determine the time needed to bring the blocks to the buildings, for the same reasons and facts mentioned above: The distance, the size of the block, and the means used, whether humans or animals. For more details of the matter of transport from the quarry to the building site see Hammond (1996: 29-30).

IV. Unique and Distinctive Methods of Stones' Use in Buildings [Pls. 113-116]

The stone masonry in Petra hardly received any attention in the reports dealing with the stone working and the tools which were used to produce such masonry. Only Hammond discussed in detail all aspects related to the stone masonry at the Temple of the Winged Lions in Petra (Hammond, 1996: 25-30). In the following paragraphs, I will introduce two unique and distinctive Nabataean methods of stone masonry used in two major buildings: (1)- Qasr al-Bint (Br. 403), (Kennedy, 1925: 60, Fig. 126, for more detailed information and bibliography see also (McKenzie, 1990: 135-138), and (2)-the staircase of the Urn Tomb (Br. 772), (Kennedy, 1925: 55; McKenzie, 1990: 144-147) where such masonry was used in unique ways.

Both quarries and caves in Petra were the main source of the supply of stones for the buildings in residential areas. Exceptions are the two other types of stones which were mentioned earlier (Ch. 3: II A f) above, and were introduced to the city such as the soft yellowish stone from al-Bastah area 20 km. east of Petra, on the main road from Ma'an to Wādi Musa/ Petra, and the white limestone from the Sharah mountains 10 km. east of Petra. The first type was used for some of the columns' drums, bases, and capitals, mainly at the Main Theater and the Arched Gate area and the temples. The second type was used for the main road pavement through the Siq and the center of the

city and in some cases to seal the shaft graves [PI. 16a] to the east of the entrance of the Siq, the shaft tombs inside the chambers of al-Khan, (Br. 4) interior, as revealed while clearing it in 1961, by the Department of Antiquities, that these tombs were covered with this kind of limestone and mortar (writers' observation) and others.

It is very hard to distinguish between stones from the different quarries in Petra and to be able to date their use into different periods or types. Most of the excavated major architectural remains are dated between the late first century B.C. and the early first century A.D., mainly, during the reign of Aretas IV (9 B.C.- 40 A.D.). This implies that the main quarries were used around this era. There is no obvious mark that shows that the quarrying technique did change through time in Petra.

In the past, as it is today, preparations for foundations and buildings began before the masons started the building. The architects prepared the plans or the models for the proposed building. Stones are also chosen from certain quarries according to the demands of the owner of the building. Ancient Egyptians left actual plans and models of their work which are sufficient to represent what they intended to build or carve. They even made architectural drawings, like those found in Egypt's Valley of the Kings at Thebes (Clarke, 1930: 49, Figs. 50, 51, 52, on stone or on papyrus Fig. 49), or on wood (Fig. 57 from the *Journal of Egyptian Archaeology* IV: 194). On one façade and three interiors described above, lines were found, that indicate the future work plan. The façade [PI. 25] is located on the western side of Wādi al-Mu'aysrah ash-Sharqiyyah (pages 44-45) and the caves' interiors which are located at the western side of al-Khubthah (Hafeth's Cave) opposite the Theater (pages 68-70) [PIs. 62-66], inside of the cave of Wādi an-Numayr (pages 70-71) [PIs. 67-70], and the cave on the northern ridge

of the High Place (pages 71-74) [Pls. 72-75]. We may consider these lines as guidelines or sketch-plans for the purpose of guiding the workmen (Clarke, 1930: 48) to the next step of work. Also, some caves like the one opposite the Theater and in Wādi an-Numayr, as examples, indicate that certain measurements must have been used before carving any stone or cave's façade or interior. This was discussed in earlier section on tomb carving.

The foundations of the buildings at Petra, for example the foundations of Qasr al-Bint Temple proper were retained by massive ashlar. Some blocks [Pl. 113f] are as long as 2.00m. revealed by the excavations of (Trench X) by Parr in 1958-59, (Parr, 1960: 133, Wright, 1961a: 21). Zayadine re-examined this trench and I supervised the work which revealed that the foundation of the temple is built of leftover ashlar of local sandstone most probably from Wādi as-Siyyagh quarries, and small round limestones from the Wādi north of the temple, with mortar in between.

The main part of this building that I am concerned with here is: the course that consists of the square blocks (orthostats, c.1.60m. high) separated by four smaller rectangular blocks built on top of each other [Pl. 113d]. Earlier scholars published their interpretations concerning these square blocks and their function in the eastern wall of the temple. Kennedy wrote about the blocks that he saw in the western wall and described them as: "A peculiar arrangement of masonry (which originally must have been quite covered by the external shell) is seen in the base of the western wall. I have not seen it noticed before, and unable to suggest any reason for it" (Kennedy, 1925: 60). I think he saw the blocks of the eastern wall and not the western wall as he wrote. Until the last two decades the lower parts of the southern and western walls were not visible. But

after the removal of the sand from around the temple this row of stones on the south and the west walls saw the light. Each side consists of 10 square blocks of the same size as the ones on the eastern side separated from one another by a narrow piers of each built up from four small blocks (Wright, 1961a: 24). Three of these square blocks have fallen out from the northern end of the east wall while the rest are still in situ. During my work at Petra in 1962-63, I was instructed to fill the gaps of the fallen blocks with small stones then cover them with plaster as they originally were. That is how they are seen today. Kohl thinks they were used as decoration (see Wright, 1961a: 24, footnote 1). McKenzie quoted Wright saying that, "...the orthostats (h. c. 1.6 m) were made from re-used column drums and mortared into position (Wright, 1961a: 24-25, pl.1b)", (McKenzie, 1990: 136). Wright described them as: "This enigmatic constructionis none other than at basis an economic re-use of surplus materials. The weakness of this construction is demonstrated by the readiness with which they have fallen out of their mortared sockets" (Wright, 1961a: 24-25). The important point here is: That these blocks have peculiar shape. They look like column drums that are cut vertically into two halves. But, they actually are much less than half of the actual drum [Pl. 113b, e]. The width is sliced vertically also on both ends about 0.25 m. which gives the block the square shape, then they were placed into the walls of the temple, with the flat face out and the concave or curved side into the inside of the wall. I believe, also, as Kohl does, that the blocks were cut in purpose like this to fit the plan that the architects designed for the temple and not re-used column drums as mentioned above by Wright and McKenzie, and the idea of covering the walls with stucco and plaster was a later idea to protect the walls of the temple from deterioration by the weather.

Few questions remain unsolved: Why did the Nabataeans cut and built the blocks in this way? Were they aware of the weakness of this construction, and that these blocks will easily come out of the wall if an earthquake hits the area? This is what actually happened, and some of the blocks came out of the eastern wall and in 1962 they were replaced by smaller blocks and covered with plaster by the writer according to the instructions of the Late Director of the Department of Antiquities Dr. Awni Dajani, and the lack of the equipment to carry them to be put in their original places. This job could be done easily since the right equipments are available at the site.

The second Building is the staircase leading up to the Urn Tomb, [Pl. 26a, b] especially the part of the eastern wall that is built immediately behind the gate at the bottom of the staircase [Pls. 114-116]. The staircase starts from the north and goes up towards the south in front of the Urn Tomb. The distinctive part that concerns this subject is the part south of the gate and it is actually the eastern wall for the platform that follows the gate. It is 6.07 m. from north to south and consists of five pilasters each is 0.79 m. and protrudes out of the main wall 0.25 m. The distance between the pilasters is 0.59 m. The first seven courses at the bottom of the wall are 4.00 m. high and are unique and distinctive in the way their blocks are cut and built in the wall. The first two courses are built of huge blocks each is 0.70 m. high. They form the foundation of the wall. They are followed by a third course that is used as a leveling course for the following four courses. The seventh course of the pilasters, in fact, forms the beginning of an arch that goes over the platform. There were five arches built over the platform which means that the platform was covered. The construction of this part of the wall is unique in two ways: first the way the blocks were prepared and shaped to fit next to each

other and second the way they were built in the courses on top of each other [Pls. 114-116]. In front of this wall there is a shallow drainage which has a concave shape and it is 0.40 m. wide and 0.025 m. deep in the center. The southern end of the drainage, which starts at the bottom of the first step, is 0.10 m. higher than the northern end. This drainage is to carry the water from the steps to the outside area.

V. Repairing Broken Pieces of Masonry [Pl. 117]

The restoration works at the south east corner of Qasr al-Bint, the excavations at the Temple of the Winged Lions and the Church revealed a number of broken and mended ashlars. The Nabataeans knew how to fix the damaged pieces. They have used melted iron and lead to fix the broken pieces. The pieces found at the three places, show that a small trench was cut by pointed and flat chisels across the break of the broken pieces, according to the desired length as well as the depth and width. The two broken pieces then were held in position together and clamped very tight so that the molten iron would not leak when it is poured into the trench. Then the molten iron was poured into the trench where already a piece of lead rod is laid. The piece from the Temple of the Winged Lions [Pl. 117c] is similar to that published by Nylander and has the shape of double dove-tail (Nylander, 1970: 42, Fig. 10a). Nylander provided a detailed study of the clamps, -their types and how they were used- which were found in the Achaemenian monuments in Iran (Nylander, 1970: 42-45, Figs. 10a-11 and Table 1, p. 81; 1966: 130-146, see also Tilia, 1978: Pl. XLVII, Fig. 24). As far as I know, the above mentioned pieces are the only pieces that were found in Petra, and it is not easy to conduct a detailed study such that of Nylander on the clamps. More pieces need to be

found in Petra to support the results and conclusion which Nylander inferred from his study. I even doubt that the pieces I mentioned still exist. In some cases, the repair was made by using stone patches as mentioned earlier in completing missing parts (Tilia, 1978: Pl. XLVII, Fig. 23, see also Ch. 2: V1. D). This method of stone patches was also used in modern restoration work at Petra which I had supervised in the 1960s-1970s.

VI. The Use of Mortar [Pl. 105]

Mortar plays an important role in the construction of the buildings in the past as it does in modern times, whether it was used with stones or mud bricks. It could be either cement or mud mortar. It is notable that the cohesive power of mortar is related to the size of the stones or the bricks.

The Nabataeans used mortar carefully in their buildings. In some structures the joints between the stones are hardly seen. Mortar is used to balance the weight of the upper course on the one beneath it. Otherwise, blocks would crack if their weight was concentrated on one spot. A thick hard layer of mortar helps to furnish an even bed, set a block in its place, level the surface, distribute the weight on the lower course, and to prevent the blocks from breaking. Its lubricant quality helps heavy stones to be adjusted on walls. Its consistency depends on the weight of the stones. Enough mortar must be used to fill the gaps and the vertical joints between the stones. Great pressure is needed to force it out while it is still viscous.

A close examination of mortar used in the walls of different buildings in Petra indicates that, it contains sand, fragments of burnt charcoal, ash, Gypsum, yellowish dirt (soil), crushed pottery, and other impurities. The amount of each specimen differs from

one building to another for example the courtyard over the arches in front of the Urn Tomb was filled with small stones with yellowish mud. While the mortar under the slabs of the steps, [Pl. 26e] was of a different kind, that was very hard to break and consists of white lime, ash, sand, and crushed pottery, (writer's observation during the restoration in 1977-1981). There is a very thin layer of white cement (lime) between the courses of Qasr al-Bint. Water reservoirs' walls were covered with very hard Hydraulic mortar (cement) which consists of lime, gypsum, sand and crushed pottery sherds, according to several analyses made to study the Nabataean mortar, cement and plaster (Hammond, 1996: 24 and appendix 2, see also Schmid, 2001: 179, Fig. 28).

We do not know if mortar was used in all buildings, unless we take them apart. The upper surface of the stones and column drums were dressed in a rough way or hollowed in the middle [Pl. 105c, d]. (See the Winged Lion Temple report and pictures of columns' drums for the mortar). No outlet troughs are seen for the superfluous mortar that has been noticed in the column drums or other masonry work. Hands were used to spread the mortar because finger impresses can be seen in certain areas. Egyptians used trowels to spread mortar, (Hammond, 1996: 26-28). No trowels or any other tools for this purpose were found in Petra. Flat smooth limestone may have been used to smooth the mortar surfaces of the walls or floors. Such method was still used in the villages until recent years.

⁽¹⁾ Two new books with detailed chapters dealing with the quarries in Petra were published during finishing this paper:-

a- Rababeh, S. M. (2005). How Petra was Built. An Analysis of the construction Technique of the Nabataean Freestanding buildings and the ruck-cut monuments in Petra. Jordan. Oxford. (BAR International Series 1460), Ch.111:49-83.

b- Bessac J.C. (2007). La travail de la Pierre, Technique et Economie de la taille rupestre, Paris. Ch. 5:77-88.

CHAPTER 4

THE TOOLS

I. The Lack of Direct Evidence of Tools Used

Our Paleolithic ancestors carved their caves or dwellings with implements or tools of stone or bone, which they obtained from the surrounding area. In 1923, two paleolithic implements were found by Oscar Raphael on the bank of Wādi an-Nasārā on the area where it runs into Wādi Musa in Petra (Kennedy, 1925: 38, 39 and 81, Figs. 61, 62). But by no means were such façades and chambers in Petra carved with flint implements in a time when metal architectural fixtures (iron, copper and bronze) were used by the Nabataeans, and by their neighbors the Romans during the first century B.C. (Hammond, 1965: 66-67, Pls. XLIV, XLV), and used even in Petra by the Edomites long before the Nabataeans settled in it (Bennett 1966, 1966a). In 1965, the author found an iron saw in the area that he supervised during the excavations on top of Umm el-Biyārah directed by Mrs. Bennett. The excavations at the Temple of the Winged Lions (room 2) produced the primary evidence of metalworking. This workshop was used only for the repair or final finishing of metal products, not their initial production (Hammond, 1987: 137). In Egypt copper or bronze tools were used from at least the early third millennium B.C. (Clarke, 1930: 18). However, I do not believe that such tools were used for dressing in Petra, since iron was known and available in the area of Wādi Araba

west of Petra. The contemporary stone-workers and masons of the peoples in neighboring regions surrounding the Nabataeans, such as the Egyptians, Assyrians, Greeks, and Babylonians and Persians—used iron tools. Achaemenian stone-workers and masons in Iran also used iron tools, but there also very few stonemasons' tools have been found, mostly because of the corrosion of the iron used (Nylander, 1970: 23, note 50). The most common stone material that those nations used was the hard and soft limestone, hard granite, basalt, and marble. Various types of tools were used in the quarries and for dressing the stones such as: the pick (pickax), points, droves (broad-faced chisel for smoothening stone), flat, toothed or curved chisels, adzs, hammers, edged hammers and abrasives. The superficial tools' marks left on the surface of the quarries, façades and walls of the caves as well as on the masonry stones in Petra bear witness to the technique and tools used and show the stages of work finished. The marks also indicate that metal tools were used to cut or carve the façades and the architectural remains. It is also possible to determine, within limits, the kind of tool and its function from the marks if careful study and examination using technical instruments is conducted. A close examination of the quarries and the caves revealed that pointed metal tools, perhaps chisels, and mason's picks (pickaxes) were used to extract the blocks and to carve the façades and interiors of the caves. Such tools were also used to dig the trenches around the blocks in the quarries and maintain their vertical walls.

The deep trenches seen on the south side of the top of ed-Dayr indicate that the Nabataeans have used other tools such as the big long chisels, sledge hammers, picks (pickaxes) for quarrying, probably hoes to remove the accumulated sand and rock

fragments, and a measure, but as mentioned before, a detailed study is necessary in order to determine their unit of measure.

Other than the two representations of tools, which will be discussed later, and in spite of all the efforts that archaeologists have made, their excavations have not yet revealed one certain Nabataean mason's tool, a measuring unit, any written document or pictorial evidence that represents any kind of tools, their names, and the way in which they were used in Petra. Probably, the metal which was used for the tools was melted down and re-cycled for other purposes. It is not because of the corrosion of the iron that none of the tools was found, as mentioned above by Nylander, for a large number of iron nails and bronze pieces were found during the excavations, (Zayadine, 1979: Pl. LXXXVI; Hammond, 1975: Pl.XLV; 1965: 66-67), [Pl. 81b-c]. Iron and bronze pieces are still to be seen side by side with marble and wooden pieces in the walls of Qasr al-Bint and the Main Theater. These metal pieces were used to hold the plaster or marble to masonry walls (Hammond, 1973: 71) or were inserted between of the masonry of the courses of the walls, for that purpose or to level the stones in the courses instead of the wooden wedges that are used today. During the 1990 excavations at the Temple of Winged Lions, a chisel was found, but it is not known, whether it was for wood or stone (Hammond, 1996: 80-83). The only place that has remains of an iron frame still in situ, fixed to the rock with white mortar is inside the Urn Tomb. This iron piece is very corroded and its shape is hard to be distinguished [Pl. 81a]. A laboratory test would be useful to determine the components and date of this piece, if it lasts until someone pays attention to it. The remains are on the back wall inside the Urn Tomb in the south lower edge of the southern recess. Probably the recess had a door with an iron frame. If the

tiny corroded iron nails and frame fragments were found, why did not the bigger tools survive the corrosion? Regarding measuring tools, the Nabataeans probably used the cubit and footstep units, which were used during their period and till now, to measure the land, wall depth, or material sold. The cubit unit varied in measure from 0.44-0.53 m. This cubit unit was also known in Egypt and in the Old Testament (Ussishkin, 1993: 284).

Recently, Bessac published a detailed description of the tools that were used on the stone at Petra (Bessac, 2007: 40-59). One of the tools that he mentioned drew my attention. It is the pick that he found while exploring the Tomb (Br. 936) at al Habis above Qasr al-Bint in 1999 (Bessac, 2007: 41, Figs. 20-21, Rababeh, 2005: 60-61, Fig. 3.14). I believe that the pick was not an ancient one, but belonged to Salman al-Mawasa, the grandfather of Muhammad Salamah, one of the al-Bedul of Petra. I knew that man when I first came to Petra in 1961, when he was living in that cave.

At the present time, certain tools [Pl. 90a] are used in the quarries and at the construction sites: The sledge hammer (*mahaddah*), small hammer (*matraqah*), pointed pick (*fas*) and short or long, thin or thick, long or short pointed chisel (*izmil*), which were used to dig the trenches around the blocks. The lever or crowbar (*nukhul* or *bainsah*) was used to help moving big blocks. In these days the quarrymen also use the *shaquof*, a tool which is smaller and lighter than the sledge hammer with short handle and longer ends. It is thick broad (wide square or rectangular shape) at one end, and flat (5.0 cm. in width and 0.5 cm thick) at the other end. The pick or Pickax (*Minqar* or *Munqar* as discussed previously), which has two thick pointed ends, or broad ends (edged hammer). The (*shaquof*) is used at the quarry to give the block regular shape and to make it lighter

to move to the construction site. At the construction site, small pointed chisel (*izmil*) or toothed long pointed or claw chisel, with 2 or more teeth (*showkah*) and small hammer (*matraqah*) are used to flatten and smoothen the surface of the block. This step is followed by using the toothed pick or scraper (*shahuttah*), then the bushing hammer (*mattabah*), if a fine smoother surface is needed, while the flat, wide, and about 1cm. thick trimming hammer (*tombur*), and the flat, wide, drove or broad chisel (*isfeen*) are used at the edges of the blocks leaving fine work on the margins or the flat surfaces [Pls. 97c, 118d,e], and the square (*zaweyah*) is used to get 90 degree corners. However, we do not yet have any of these tools from archaeological contexts at Petra.

II. An Attempt to determine the Type of Tools from their Marks on the Faces of the Quarries, or the Caves' Walls and Masonry

The faces of the quarries, exteriors and interiors of the caves and many masonry blocks, whether used in the buildings or scattered all over the site, were examined carefully to determine the type of tools used for cutting or carving them from the marks left on them [Pls. 15c, 31a-b, 43, 51, and 58]. Latex molds were made for different dressed surfaces. Several types of tools were distinguished as a result of this work, in addition to the pickax mentioned earlier. These types are:

- a short and long one-tooth chisel with thick round pointed end,
- a short single-tooth chisel with a fine pointed end,
- a flat narrow (about 0.5 cm.) or broad (about 2.00cm.) flat end chisel,
- a three- or four- or seven-toothed chisel (see Ch. 4: IV).

These types produced the following different dressings:

1) The pointed pickax and the long or short chisel with thick round point were used as a first step to give the general shape of the cave or the stone and the primary rough dressing by applying diagonally and parallel blows [Pls. 43, 51a, 57b, 58, 65, and 96]. They were used all over the site, and it is not easy to distinguish between these tools from their marks. The pointed chisel was also used at the corners of the walls of the caves' interiors where five to twelve vertical or horizontal lines were cut to help the mason to dress the rest of the wall surface [Pl. 51b-c].

2) A chisel having a finer narrow point than the ones mentioned above was used in the second step to give a more accurate and finer secondary dressing. Accurate and fine secondary dressing with this chisel is found in many places as the front of al-Khaznah, the Urn Tomb façade, ed-Dayr and many others as well as on masonry [Pl. 51d-g]. It is precise and gives the work a clean cut and appearance.

3) A chisel with a broad (flat or wide) edge was used for basic rough dressing, while a chisel with narrow flat edged was also used for fine accurate dressing. Marks of both kinds are noticed in some caves as well as capitals [Pl. 118a, f and 136: 3-7, 11]. Traces of narrow flat edged chisel are found in a very good condition, at the ceiling of one of the water cisterns at the bottom of the northwestern ridge of the High Place. Both chisels were also used to furnish flat smooth areas like plaques for inscriptions. Broad edged chisel produced the incision dressing or narrow deep furrows.

4) Pointed or flat-toothed chisel with two or more points, like a comb was used for faster work to finish large areas in short time. Traces of these chisels are noticed on three architectural pieces: a drum and two capitals, which will be discussed in the following category (Ch. 4: IV).

Tools used now at work at Petra must be sharpened daily at the site by workers sitting next to the stone-cutters using certain kind of local sandstone and water. They must be taken at least once a week to a blacksmith to be heated and tempered.

III. Evidence of Pointed Chisel

The pointed chisel marks are the major marks that are found all over Petra's quarries, caves' walls, and buildings' stones, (see Ch. 4: II: 1 for details). The pointed chisel was used immediately after the pickax to remove the rough surface before getting to the finer dressing, see for example [PI. 118a, f].

IV. Evidence of Three or Four and Seven Toothed Chisels

An important discovery was the three architectural pieces which show evidence of the use of “toothed chisel” or “claw chisel” (Nylander, 1965: 50; Colledge, 1977: 135). The first piece is a capital among the masonry of the Temple of the Winged Lions that has marks of three, or four flat-toothed chisel. I tried very hard to distinguish whether the chisel had three or four teeth, but it was impossible, because the surface was badly damaged [PI. 119]. The second piece is also a capital deposited east of the Temenos Gate, which was found in good condition in 1950 during the clearance of the gate area (Wright, 1961: 127-134, Fig. 4). The capital has the marks of a flat-toothed chisel with seven teeth [PIs. 120-121]. It is an important discovery because it is the first time such marks were discovered. Its diameter measures 0.85 m., and 0.45 m. high. It does not belong to any of the gate's columns and may have come from one of the structures on both sides of the gate. Several scholars have published it: (Parr, 1960: 134-136; Wright,

1961: 127-134, Fig. 4; Glueck, 1966: 60; Zayadine, 1981: 353, Fig. 8; Lyttelton and Blagg, 1990: 95, Fig. 6: 4), but none of them remarked upon these marks which represent seven toothed flat chisel, [Pl. 120]. Blagg published a detailed article about this capital (Blagg, 1990: 131-137, Figs. 1-3). This capital could be dated to the early first century A.D. if it was from the Temple of the Winged Lions which is dated to the time of Aretas IV (9 B.C.- 40 A.D.) specifically c.A.D. 27/28 the probable completion of the temple, (Hammond, 1977: 151; 1987a: 129, 140). An accurate measurement of one of these chisel's marks shows that the width of the chisel was 2.8 cm. with seven teeth and six gaps between them [Pl. 121]. The impression of the chisel shows that the teeth were broad and the width of each tooth is 3.00 mm., and the space between each one of the teeth and the other is 1.00 mm. Traces of broad single tooth chisel (4.00 mm. wide) are found at the surfaces of the inner walls of the caves in Petra.

In Bessac's recent study, he claims that he found marks of a seven tooth chisel at al-Khaznah, (Bessac, 2007:49). I have not found any such tool marks at al-Khaznah, and he did not include any evidence to support his claim. Bessac also mentions two uses of the tools: functional and ornamental, giving examples of where these uses were found (Bessac, 2007: 60-76).

There are many stones with very fine typical Nabataean 45° dressing. The marks are very difficult to distinguish, whether they were left by one fine pointed chisel or toothed pointed chisel. In fact, the toothed chisel was known to classical stone mason's in Greece and texts indicates that the Achmemenids brought Ionian Greek stone-mason's to build royal palaces at Persepolis (Nylander, 1965: 50; 1966: 373-376; 1967: 56-59; 1970: 53-56). Nylander mentions in his conclusion of his discussion on Old

Persian and Greek stonecutting that “the toothed chisel is generally considered a Greek invention from the middle of the sixth century” (Nylander, 1965: 54, and footnote 35). Therefore, the Nabataeans may have got the idea of the toothed chisel from their neighbors who used it before them, if it was not a locally reinvented.

V. Evidence of a Pickax Tool on a Rock Face and on the Upper Half of Some Lamps [Pl. 88a]

As mentioned above, the evidence for such tool comes not from the identifiable traces of the tool on rock or masonry, but from a petroglyph of a pickax incised at Jabal al-Khubthah and from representations on lamps. A petroglyph of a pickax incised at the head of the large cistern below the High Place at Jabal al-Khubthah is reminiscent of the worker' tools (Lindner, 1997: 181-182, Fig. 12). This pick is smaller than an ax and has two sharp ends. At Present, it is called (*Minqar or Munqar*), and was used for the primary shaping of the caves and cutting the trenches in the quarries. Its two pointed sharp ends and its weight in addition to the force with which it is brought down, play a big role in quarrying. The fragment of lamp [Pl. 88a] (this picture is of a tiny pottery fragment which was shown to me by one of the children at Petra in 1993) and other similar pieces of oil lamps that have on the upper part a representation of a figure holding a pick in his hands and digging into the rock, as indicated by the lines below the pick. He has a chain tying his legs together just above the ankles. Lamps with such figures from Petra were published by the following: Horsfield G. and Conway A., (Horsfield, and Conway, 1941: 123, pl. XI, no°.49); Rosenthal, R. and Sivan, R. (Rosenthal, R. and Sivan, R., 1978: 34, no°124); Khairy N., (Khairy, 1990: 87); Lindner, M. (Lindner, 1997:

181-2, Fig.13); Shaer and Aslan (Shaer and Aslan, 1997: 225, fig. 17); Barrett, (Barrett, D., 1998: 277, Fig. 6. 40. 95-P-179; 1998: 281, Fig. 6: 51. 95-P-179, Eros in shackles); Rababeh, (Rababeh, 2005: 60-61, Fig.3.15a); and Bessac, (Bessac, 2007: 42, Figs. 22). The figure holds a pick with a pointed edge at each end of it, with lines indicating the marks of the hits of the pick on a surface, which represents the surface of the rock. Such representation of figure on lamps found in Petra was described as Eros (the God of Love of the Greeks) clothed and wearing leg shackles, accompanied by a basket and wielding a pickax and dated to the first century CE (Barrett, 1998: 277, Fig. 6: 40. 95-P-179, Eros in shackles). Two Panels of yellowish limestone with Eros and lion reliefs were found at Petra in which Eros appears without chains in his legs as seen on the lamp fragment (Parr, 1970: 348-381). It is hoped that one day excavations will reveal more evidence to solve the problems of the tools. At the least we can now say that the difference in the marks is the result of the use of two pointed chisels or pick-axes of two different sizes and of toothed chisels.

Though there is no published evidence of a stone-cutting tool of iron, we can point to iconographic evidence of picks, and can say that the difference in the marks is the result of the use of pointed chisels or pick-axes of at least two different sizes and of toothed chisels or chisel-picks. We can now turn from our discussion of the meager evidence for stone carving tools to the issue of signs deliberately carved on worked stone by the ancient masons of Petra.

CHAPTER 5

THE STONEMASONS' MARKS IN PETRA

The stonemasons' marks on dressed stones, on the faces of the quarries or the slopes of mountain, and on the flat rocks are very common and scattered all over Petra. They appear in several forms and shapes. The examples discussed below represent the forms and shapes of these marks in Petra. Numbers and letters, sometimes in combination with slashes, are carved pieces of columns', while drawings, carvings and inscriptions are found on the face of the rock or the quarries and in some cases on masonry blocks.

I. Types or Forms

The excavations of the Main Theater at Petra in 1961-1962, (Hammond, 1965), followed by the recent works at the arched Gate, and the temples of Qasr al-Bint, the Winged Lions, and the Great Temple, revealed a number of stones, some with letters, numbers, slashes, signs, and others with correction of errors of the guide lines for the final carvings of the details on the blocks [Pls. 122-124]. Some of these marks were studied and interpreted by the excavators as 'masons' marks' (Yadin and Negev call them "the stonedresser's marks" and Millard used the term "fitter's marks"), 'signs', 'symbols', 'guide lines' or 'inscriptions'. The marks were used to assist the masons to locate the order and the position of the stones in relation to the stones next to them in the building,

while the “guide lines” were to help carving the decoration of the capitals, correcting mistakes and applying the plaster on some other pieces, or to mark the locations of the small chambers in the main chambers, as explained later in the chapter.

Masons’ marks, symbols and signs are very common and found in several forms all over Petra. The following examples represent the forms in which they appear, whether as numbers and alphabetical letters, or slashes on the columns' parts: drums, bases or capitals, and building's blocks [Pls. 122-124] except for Nos. 41, 44, 46, 49, 53 and 54 which were found at the quarries. The writer, while clearing the area south west of the Tenemos Gate in 1962-3 in Petra, found pieces of drums, and bases, each have two letters on their margins which were carefully polished [Pl. 124: 36, 45, 50, 52], another piece is a capital that has four letters on its lower rim [Pl. 124: 55-56]. The letters may be the initials of the names of those who worked on them. Some marks are short or long inscriptions [Pl. 125]. Other examples are found in the form of drawings or carvings on the face of the rocks or quarries [Pls. 126-138], and as “Guide Lines” which were used to assist the stone-cutters carving the decoration on the capitals [Pl. 136] or marking the small chambers for the graves in the main chambers [Pls. 65, 67b], and in applying the plaster on some other pieces [Pl. 97d].

Hammond had published, in his recent article “Masons’ Marks and other Archaeological Signs” (2000), names of some scholars who found such marks in their excavations and referred to their explanations and interpretations in their publications. For example, G. R. Driver called the signs found on dressed stones at Jerusalem, 'mason's marks' and noted that Warren and Conder had thought that they were 'quarry-marks' (Driver, 1948: 115 and note 1). Driver also thought that the letters on stones from

Megiddo were “to show workers the order in which the pieces were to be laid in the building” (Driver, 1948: 115-116). But for the first five letters carved on the face of one of the steps of the palace of Lachish, Driver felt that they were either to help masons lay steps or an exercise from someone learning, or teaching, the alphabet (ibid: 116), and that the letters on the back of the ivory from Ahab's palace at Samaria were possibly to indicate order of application of the pieces. The letters on ivories were guides to the assembly of the pieces on whatever they had been applied, according to the analysis of J. W. and G. M. Crowfoot in 1938. A. R. Millard, in 1962, used the term “fitters' marks” for the alphabetic inscriptions and single letters on a number of examples of the Nimrud ivory hoard found by the British School of Archaeology in Iraq. He suggested also that the marks were used as “guides” or “check marks” to decorate the furniture. Hammond also noted in 1994 that S. Gibson and J. E. Taylor made a comprehensive list of marks on stones from their excavations beneath the Church of the Holy Sepulchre in Jerusalem. The list included the report in 1902 by Bliss and Maclister of Greek letters and or more vertical strokes on columns' drums from Tell el-Judeide (Hammond, 2000: 123). Hammond referred to the two columns marked with Nabataean letters found by Savignac and Horsfield during their work at the temple at Wādi Rumm in 1935 (Hammond, 2000: 124, see also Negev, 1965: 185-186, and foot note 1). A number of column drums with Greek letters were still laying down east of the Great Temple of Amman on the top of the citadel until the columns were re-constructed during the recent restoration work of the temple in the 1990s (Hammond, 1996: 42).

In 1963/64 excavations at Masada, Yadin found several masons' or stone-dressers' marks on the bases and column drums which indicate that the group of drums, capitals

and bases belonged to one of the columns. Many of these marks were made with the Hebrew letters of the square script characteristic of the Herodian Period. More than 22 columns were found. He found three groups of stone-dressers' marks. The first group was made with the letters *qof*, *bet*, *tet*, *shin* etc. accompanied by the numerals 1, 2, 3, etc. Each column was indicated by a letter and each drum had a numeral to indicate the place of the drum in the column. The second group was made with letters of Paleo-Hebrew script including the letters *dalet*, *zayn*, etc. and the third group was a series of columns with marks composed of geometric patterns (Yadin, 1965: 26-27, Pl. 21). Negev found twenty column-drums which had stone-dresser's marks on them on the western part of the acropolis of 'Avdat. The columns which had the marks on their drums were not all found in situ. The margins of the column-drums were carefully polished, while the rest of the stone surface was only roughly worked. The stone-dresser's marks were engraved near the lower margin of the drum on a small smoothed area, adjoining the margin proper easily observable by the masons handling the drums (Negev, 1965: 186-187, Pls. 33-37; Negev, 1977/36: 59, photo 71). A few pieces with letters on their margins were also found in Petra mainly west of the Gate in the Temenos area north of the south wall [Pl. 123: 36, 45, 50, Pl. 124: 52, 56]. Some of these pieces were published by Bennett in ADAJ, 1967/68 vols. XII-XIII: 53-55.

The excavations in 1961-1962 of the Main Theater at Petra, which was destroyed by the A.D. 363 earthquake, revealed enough examples of mason's marks to demonstrate the use of the marking system on stones. The marking examples included four entablature pieces, six bases and thirty-one columns-drums of the *scaena frons* (Hammond, 2000: 124; McKenzie, 1990: 35, 121) [Pl. 122: 1-12].

The masons and the quarrymen at Petra left their marks in most of the places where they worked. These marks may have been used to identify the different persons who worked at the quarry site or on the stone, and may represent the name of an individual, or a group, or the leader of the group. In other cases, marks carved on column drums may indicate that the pieces belong to a certain column, or show the order in which the pieces are organized and built on top of each other as mentioned earlier. For example Yadin's finds at Masada (Yadin 1965/15/1-2: 26-27, Pl. 21). Other marks such as drawings or carvings of altars may represent a religious belief. At the same time, there are masonry stones and quarries that do not have any signs or marks, which means that the person or the group who worked at the quarry or on the stones chose not to be identified.

The mason's marks at Petra are found in four types or forms: A) A form of numbers or slashes and Nabataean alphabetical letters (one letter or more) or a combination of both together on architectural masonry, especially columns' pieces [**Pl. 122**: 1-12 and some of those on **Pls. 122**: 13-124: 60]. B) A form of signs, symbols, or unidentified marks as some of those on [**Pls. 122**: 13-124: 60]. C) A form of names or short inscriptions [**Pl. 125**: 61-80]. D) A form of drawings or carvings [**Pls. 126-138**]. Examples are displayed to give the reader an idea of each type. I made a great effort to examine carefully every quarry exterior and interior of the caves, and masonry block whether in a wall of a building or on the ground. Over 260 examples were recorded, photographed and drawn. Because of the large number of these marks, I was unable to include all of them in this paper. I am sure there are more to be recorded, but I have missed them because of the difficulty of seeing or reaching them, or because they were

discovered after this work was completed. An example is the incised architectural sketch that shows a detail of column base, and the short inscriptions next to it, which Rababeh found on the way to the High Place from the Garden Tomb (Rababeh, 2005: 80, Fig. 3.33).

A. A form of numbers or slashes and Nabataean alphabetical letters on columns' pieces [Pl. 122: 1-12].

These examples are some of the pieces which were found during the excavations of the Main Theater at Petra, 1961-1962, (Hammond, 1965: 73-78, Pls. XXX111: 4, XXXV1: 2, 4; XLV111: 11, 14; XL1X.: 24, 25, 29; L. 32-34, 36-37). The marks are often very clear. Example [Pl. 122: 4] has the letter *he*, while the *x* represents the number 4 in Nabataean [Pl. 122: 5]. The left block in [Pl. 123: 28] has what might be two letters. One of them is similar to the letter on [Pl. 123: 34]. Examples [Pl. 122-123: 13-23] were found during the excavations of the Temple of the Winged Lions at Petra, 1974-2000. Six of these marked stones Nos. 13, 15, 17, and 21-23 were published by the excavator (Hammond, 1996: 49, Pls. 5-7). The letters may be the initial mark identifying a name of sculptor or a group of sculptors. Others came from the Great Temple (Joukowsky, 1998: 264, Fig. 6, 27), [Pl. 123: 34-35, 37]. A Nabataean letter (SH) incised in a tumbled building stone was detected by Lindner while exploring the rock opposite the ed-Dayr in 1982/1983, (Lindner, 1984: 164). The letter (Sh) is also inscribed on a column drum (Bessac, 2007: Fig. 70) from the Gate area and on one of the stones of the north face of the southern arch of the gate, and is similar to the forms that appear by the first century B.C. (Mckenzie, 1990: 36, Bessac, 2007: 64, Fig.

43; Parr, 1957: 11-12, Pl.XII), [Pl. 124: 52, 54]. Masons' marks were also found at other Nabataean Temples: at Khirbet at-Tannur, Khirbet edh-Dharrah (Hammond, 1996: 90-91), [Pl. 124: 55-60], at the temple in Wādi Rumm and on the western part of the acropolis of 'Avdat (Negev 1965/15/4: 186-187, Pls. 33-37).

B. Signs, symbols, or marks

Some pieces are more difficult to identify with certainty. As mentioned above, the signs, symbols, marks, and one letter or more were mainly used on pieces of columns or stones in buildings or in the quarries [Pls. 122: 13-124: 60].

C. Names or short inscriptions [Pl. 125]

The inscriptions are also of two types: short and long. The short inscriptions are the concern of this research because they consist of few letters and they usually introduce the name of the person who dressed the stone or worked at the quarry. Long inscriptions have other functions and will not be discussed here. In some cases, it is the name of a person who greets someone else who will pass by that area later. The selected inscriptions here introduce different types of letters and the way they were written, and a variety of tools' marks representing the kinds of tools that were used in writing the letters or the inscriptions. The condition of the surface weathering indicated that they were written or engraved in different periods. Some are weathered, aged and hardly visible, others are chiseled deep in the rock and very clear, while few are neatly incised and very easy to read. Further study is needed to determine their dates. The letters are found in different sizes and shapes. They differ from very thin to broad lines.

In some cases the letters were written by hitting a flat chisel at an angle, which left dots on the surface of the stone. An example of this method is an inscription on a marble piece, which the writer found in 1963 while clearing the area north east of the front of Qasr al-Bint [PI. 125: 80]. Another example exist on the face of the rock [PI. 125: 61-79, see also PI. 129: 9] which is written next to a nefesh north of the Lion's carving on the western way to the High Place.

D. Drawings or carvings

The drawings that are mentioned below [PI. 126-138] were mainly scratched on the face of the rock by using chisels of different sizes. In few cases the drawings were done by tiny holes made also by chisels e.g. [PI. 135: 2, 7]. Paint was used at Wādi as-Siyyagh [PI. 134: 1]. Drawings and carvings are of the following variants.

a) Unfinished drawings of altars [PI. 126]

Unfinished drawings of altars are common in the quarries. Some show only the upper half of the altar, which includes the two horns that represent the corners of the altar are carved. Others show the lower half that includes the base. The majority of these altars are carved. Nos. 6, 14-15 show that a pointed one toothed chisel was used to draw the altars. These three are located with others north of al-Khaznah in the Outer Siq.

b) Finished Drawings of Altars [PI. 127]

Representations of complete "Horned" altars are common in Petra, (Dalman, 1912: 51, Abb. 51), some carved in relief, others simply cut into a smoothed rock face,

which represent incense altars (Hammond, 1973: 50). They are found in different shapes and sizes, but they all share a rectangular base, a square or elongated body, and two horns on the top. In some cases they are found in relation to palm trees drawings [PI. 127: 8, 13] at the south and north quarries at Wādi as-Siyyagh, and [PI. 134: 3] at the High Place. [PI. 127: 4-5] were indicated not by straight lines but by hits with a pointed chisel. Only in two places were the altars fully carved: on a fallen rock at the north west of the summit of Umm el-Biyārah [PI. 127: 19] and on the western way to the top of the high Place opposite the Lion's carving [PI. 127: 21]. This last carving is the largest carved and best preserved and most important altar in Petra (Kennedy, 1925: 69, Fig. 170). A rectangular altar with horns on top of it is at the façade of the Soldier Tomb [PI. 127: 22]. Schmid noticed this altar (Schmid, 2001: 184, Fig. 35). He compares the Nabataean rock-cut altars with such horns in Petra with similar ones found in other sites in Egypt and Cyprus at the so-called ‘tombs of the kings’ at Nea Paphos. He argues that this type (the horned altars) and others of funerary architecture represent the Egyptian Alexandrian (Ptolemaic) influence on the Nabataean architecture, as discussed and illustrated by Schmid (2001: 184-185, Fig. 34). See also Murray (1939: 154, Figs.7, 8).

c) “V” Shaped Carvings indicating the Start of Carving an Altar [PI. 128]

The V shaped marks are seen in many quarries, the Siq entrance, the east staircase to the High Place, on the way to ed-Dayr, and at the bottom of Jabal an-Numayr. They are in several forms: individually, in groups, or connected with each other, deep or shallow or thin lines. They were an unsolved puzzle to me. My first suggested

explanation was that they were marks carved by persons who worked or passed by the place where they are carved. That was until I had decided to climb to the top of Jabal an-Numayr on December 10, 1993, where I found a group of ‘V’ Shaped Carvings on the face of the rock near the east end of a dam in Wādi an-Numayr [PI. 128: 13-14]. To my surprise I noticed there two carved altars. The area between each of the two horns of the altars is a ‘V’ carved deeply in the rock similar to the other V shapes carved in the other places. The carving of the two altars was very close and carved also like a “V” shape. This led to the conclusion that wherever this V shape is found, it means that the stone-cutters intended to carve an altar. Some of those “V” shapes were chiseled lines, and others were carved [PI. 128: 13-14].

d) Obelisks and Nefeshes [PI. 129]

A great number of nefeshes (also called obelisks or stelae) are carved or incised on the face of the rock in Petra, (see Ch.2: II, the second example p. 51). They have a conical or a pyramidal shape resting on a rectangular base with or without an inscription [PI. 17c, d], and crowned sometimes with what might be an urn or three corners of a star [PI. 129: 9]. They are found individually, in isolation, on the face of the rock north of al-Khaznah (Musil, 1907: 79, Fig. 44; and Dalman, 1912: 49, Abb. 49), south of al-Khaznah [PI. 129: 18], or the entrances of the caves [PI. 129: 5, 14-15, 20]. They are also found in groups: two are seen north of Siq al-Barid entrance at Siq Umm el- Hiran (Lindner, 1986: 112, Abb. 1, p.114), on the west side of the road to el-Beida (Beidha) near Shammaasa quarry; or the free standing two at the top of the High Place, which are considered the largest ones in Petra [PIs. 107: d- e, 129: 13, 16], (Browning, 1973: 207,

Figs. 143-144); or more than two as those which were uncovered by the flood in March 1963 east of the Siq entrance [Pl. 17: c-d], at the Obelisk Tomb entrance, or inside Tomb 825 [Pl. 17: e-g], and the outer siq [Pl. 132: 30], (Bessac, 2007: 321, Fig. 163). For more details on the stelae see Zayadine (1971: XII, 57-73; 1986: 226. Abb.18, 2: Patrich, 1990: 50-113, and Murray, 1939: 127-163).

e) Rectangular Forms representing one or more Dusharas [Pl. 130]

The Dushara is represented by a rectangular shape carved on the face of the rock or the quarry (Pflüger, 1990: 148). It is also represented by a rectangular stone cut and laid in a niche or in most cases carved as part of the niche itself (see Ch. 1: I, 10). They are found all over Petra individually or in groups of three or four stelae (Patrich, 1990. 80-81: 111.24- 25) or even more. The name 'Dushara' is conventional and the meaning may be something other than a reference to the god 'Dushara' or 'Thu esh-Shara.' Dusharas on this plate [Pl. 130] were produced not only by pointed chisels, but also by the flat wide ones as seen in [Pl. 130: 8]. It is notable that each of the locations illustrated in [Pl. 130: 6, 8 and 9] has two Dusharas attached to each other. They were probably carved by the same person or group who worked at these places. No. 13 has a Nabataean inscription under it. Dusharas with Nabataean inscriptions were found at the Winged Lions Temple by Hammond, at Qattar ed-dayr at Petra and at 'Ain ash-Shellalel at Wādi Rumm (Patrich, 1990: 84. 111.28, 52.4 and 60-62. 111. 9).

f) Niches with or without Dushara or Dusharas [Pl. 131-2]

Niches of different shapes and sizes are carved everywhere with or without a Dushara or Dusharas in them. I selected a number to be represented in this paper. They are found in singles or in groups of two or more. The niches seem to have developed from a very simple square or rectangular form [PI. 131] to elaborated larger sizes, decorated with columns and arches and with one or more Dusharas put inside them or carved in them [PI. 132], see (Murray, 1939: 137-142). They are seen carved between two palm trees, and in other cases they have holes at the top, probably for pegs on which to hang a curtain covering the Dusharas [PI. 132: 18]. They also have in rare cases a few letters or names [PI. 132: 6, 27]. A large number of them are published. See (Patrich, 1990: 50-113) and his footnotes.

g) Human's drawings or carvings [PI. 133]

The Nabataean stonemasons represented the human figure by two ways: drawing and carving. Drawings of human figures were produced by chisel scratches or by hitting the pointed or flat chisel gently against the surface of the rock. This action will leave a line or a thin shallow groove representing the human figure which the stonemason intended to draw or carve. They are found at the faces of the quarries or inside the caves [PI. 133: 1, 5, 11, 12-17]. Such drawings are found at the following places: No. 1 is at a quarry at the east staircase to the High Place. It shows the figure standing on a pedestal with hands raised up, and west of it is a Dushara. No. 5 is at the east face of the Quarry of Umm Sayhun. The figure here is standing straight with the hands along his sides. The stonemason probably wanted to have the figure inside a niche similar to Nos. 6 and 10. There are two niches, one on each side of the figure, and above all of them

are five holes probably for hanging a curtain to cover the whole carving. No. 11 is above the the entrance of the Triclinium north east of al-Khaznah which shows a standing person between two Dusharas with stretched open legs and arms, and it looks as if he has a bow in his hands, (Musil, A. 1907: 79, Fig. 48 and Dalman, G. 1912: 25, Fig. 13). Such drawings were found on the walls of caves at Beit Jibrín (Avi-Yonah, M. 1981: 31-32, Pl. 6.6). Nos. 12-17 is a scene of a few drawings on the north wall inside a cave to the north of the upper part of the Unfinished Tomb of al-Habis [**Pl. 23**]. From west to east are the following drawings: a rectangular shape which looks like a wagon (or ibex?). In front of this shape is a drawing of a standing human figure with arms opened wide. There is a line that connects the human figure with the shape as if he is pulling it. East of the figure is an unfinished drawing of an altar, which itself contains two drawings: a small one on top of the west corner and a larger one to the east of it. These two drawings may be crosses or representations of human figures. For such drawings see Humbert, J.P. and Desreumaux, A. (1987:336, Fig. 336). Dalman refers to such drawings as crosses (Dalman, G. 1912: 26, Abb. 14). Patrich considers them as human figures (Patrich, 1990; 157-165, III. 57). It is important to mention that the final dressing of the upper west corner of the north wall [**Pl. 43**], the cieling and the walls in the interior is not completed. The front of the cave does not exist and it is not known what kind of carving it had. But for the human carvings, they are found at several places at Petra [**Pls. 133**: 2, 3, 4, 6, 10, 18 and **135**: 1, 12]. No. 2 is located at the western side of the High Place. It consists of two parts: The lower is a niche that has the human figure standing next to a Dushara, and the upper part is another niche with three Dusharas in it, (for similar carving see, Dalman, G. 1912: 55, Fig. 56). Nos. 3-4 are

carved on the face of the rock south of the Palace Tomb. The figures have arms stretched out. No. 4 (Rababeh 2005: 51, Fig. 3.15.b) stands on a pedestal. No. 6 is carved on the top of Umm Sayhun quarry. It is a niche with a human figure carved in it. No. 10 is located on the way to the top of an-Numayr. It is a niche with a female figure. No. 18 is the carving in the middle of the siq. It is a bust of a human figure carrying a tree on its head, Nos. 6 and 10, consecutively. M. Schlumberger described the introduction of the human figure on capitals as a Nabataean custom (Avi-yonah 1981: 34, Fig. 6). Drawings of human feet are scratched on the surface of the rocks in several places: at ath-Thunabe [Pl. 133: 7-8], Wādi al-Muqaryif west of al-Beidha has also a hand carved to the north of the feet drawing, [Pl. 133: 9], and Umm el-Biyarah (Lindner, 1980: 313-315, Abb. 2), at Wādi Wagit at half way to the summit of Jabal Harun (Lindner, 1980: 274; Abb. 5, 6 and 314). Carvings of humans riding horses are on the lower part of al-Khaznah façade while human figures are also carved on the upper part of it.

h) Plants' drawings or carvings [Pl. 134]

Some of the capitals of the columns of al-Khaznah and the capitals [Pl. 7] which were found in the recent excavated Great Temple, the Winged Lions Temple, south of the Temenos Gate, the quarries, the caves and the Painted cave of Siq al- Barid, have carvings or drawings of what might be palm trees, and the others have drawings of plants. One palm tree is carved high up on the face of the quarry that faces north about one hundred meters south of the top of the High Place. The carving represents a tall trunk of a tree with several leaves on the top. To the west of it is a Dushara carving and to the

east is an altar carving [Pl. 134: 3]. The other tree carvings [Pl. 134: 1-2] are located at Wādi as-Siyyagh: The first is at the north side carved next to an altar and wheels of a (chariot?), and the second is at the western end of the south side where an altar between two palm trees is carved (Pflüger, 1995: 293, Fig. 6), Lindner, 1980: 36, Abb. 22, and Bessac, 2007: 14, Fig. 4. P. 211 and a third in the Siq (Dalman 1912: 44, Abb. 38). [Pl. 134: 4-5] shows palm tree branches carved on the caves' walls. Another interesting carving of a tree is found carved on top of a human bust with a head carving in a niche in the middle of the siq [Pl. 133: 18]. Avi-Yonah published a detailed study of plant ornament (Avi-Yonah, 1981: 66-117) with emphasis on the palm-tree representations (Avi-Yonah, 1981: 71-77), see also McKenzie (1990: 97). Schmid found at the excavation of the medieval structures in Wādi Farasa East some tombstones with a stylized tree of life (Schmid, 2004: 136.2, 168, Fig. 34a-c). For palm leaves and trees, see also (Hammond, 1996: 127, # 217 and p. 139: AEP '75, RI # 217 and 1981: 139, fig. 1; Patrich, 1990:92.111-131; and Morgan-Harvey, 1999: 22, 44). The representations of palm trees are well known from several limestone reliefs from Arabia and Yemen and dated to commonly between the 4th and the 1st century B.C. and remind us of abstract representations of the tops of palm trees.

i) Animals' drawings or carvings [Pl. 135]

Several animal's drawings and carvings are found in Petra. The most common ones represent snakes, camels, horses, lions, elephants, deers and birds. The carving of snakes exist in three places: the so-called "The Snake Monument" located on the way to Jabal Harun (Browning, 1973: 181, Harding, 1967: 134, pl. 16A, Kennedy, 1925: 70),

the carving of two snakes [PI. 135: 1] inside a tomb (Dalman n° 47) located east of the Obelisk Tomb where two snakes are seen biting a jackal. It is called the Serpent Tomb (Zayadine, 1975: 336, Fig. 2). Another snake carving is carved inside a cave on the south wall. It is more than a meter long carved under a niche that has two niches inside it, probably for Dusharas, and the snake is to protect them. The cave is located on the north western side of the High Place [PI. 135: 3].

Camel carvings are found in two places: in the middle of the Siq and north of ed-Dayr. In both carvings, there is a man leading the camels. A similar scene is found on a sarcophagus in Palmyra (Parlasca, 1986: 207, Abb.12). Drawings of camels are scratched inside the cave opposite the Siq entrance [PI. 135: 6] and ibexes on a rock surface at the north east side of Umm el-Biyarah [PI. 135: 7-8]. They are also seen in red paint along side deer drawings in the painted cave of Siq al Barid.

Two carved horses with riders are located on both sides of al-Khaznah and one horse carrying something on its back (idol or unfinished human figure?) is carved inside the Snake Monument mentioned above (Zayadine, 1980: 218, Abb. 4).

The largest lion carving [PI. 135: 10] is on the western side of the High Place. Two other carvings of lions are on both sides of the entrance of the Lions' Tomb on the way to ed-Dayr. Some Nabataean capitals are also decorated with carved heads of lions or other animals like rams [PI. 7 a- c].

Elephant heads are carved on the capitals of the columns (Joukowsky, 1998: 78, Fig. 2.25, Pl. 35, and p. 197-8: Figs.5.13-17, and on the back cover of the same book).

Deer (wild mountain goat or ibex) drawings are found in several places: Siq al-Barid Painted cave, The Garen Tomb, northeast side of Umm el-Biyarah and al-Habis [Pl. 135: 4, 5, 7-9]. See also (Lindner, 1986: 97, Abb. 14-15, Patrich, 1990; 157-165, III. 56).

The Birds are also represented by a drawing of a peacock on the surface of the rock at the north/west of Umm el-Biyarah (Lindner, 1980:313-315). Eagle carvings are at the al-Khaznah façade and north of the Siq entrance.

Bird paintings were also used in decorating the Nabataean pottery [Pl. 6: 36] (Schmitt-Korte 1980: 186, Abb.4.36) and in the paintings of Siq al-Barid [Pl. 5].

j) Guidelines for carving [Pl. 136]

Hammond discussed guidelines in detail, based on material he found at the excavations of the Main Theater and the Temple of the Winged Lions in Petra. Excavations at the Main Theater in 1961-1962 revealed tool marks on architectural blocks that indicated the use of chisel or pick there; scribe marks indicated compass and scribing tools (Hammond, 1973: 71). The cornice block [Pl. 122: 2-3] was engraved with the directions or guidelines for sculpture to be worked on the face. But errors in laying out the parts of the design are clearly to be seen (Hammond, 1965, 49 Pl. XXXV1. 2, 4), showing the manner in which simple geometry had been used to achieve the desired results (Hammond, 2000: 127). Five capital fragments found at the Winged Lions Temple had guidelines consisting of only simple lines marking the location of parts of the capital to be carved to assist workmen in the carving process. These arrangements were registered as: AEP 1974, RI #99, fig. 5, 1976, RI #4, 1976, RI #85, fig. 4, 1976, RI #89,

fig. 6 and 1977, RI #168 (Hammond 2000, 127-8 and 1996, 79,137). The excavations that I conducted in 1967-68, at the south of the Temenos Gate's area, which was probably the entrance to the Bath Complex, revealed a large number of architectural fragments with guide lines on them [Pl. 136: 3-13]. In addition to the markings of the above kinds, Hammond found other types of systems which served different purposes, but which are related in purpose to the markings found upon architectural stones. Two examples were referred to: in the plastering at Herod's Palace at Masada, lines were drawn on the plaster to guide the laying of mosaics, and at the Winged Lions' Temple lines, were drawn on columns to guide the plastering of the appliqué decoration during a redecorating phase (Hammond, 2000: 127-9).

Not only columns' drums and capitals carried the lines, but guidelines were also found on the face of the quarries [Pls. 124: 41, 44, 46, 49, 54, and 136: 1-2, 15, 17-18]. No. 15 was discussed earlier (in Ch. 2: IV. stage 1.a, first example [Pl. 54 a]). Other examples of guide lines were found at the baths' entrance: [Pl. 136: 3] is a base with a line dividing it into two halves, while Nos. [Pl. 136: 4-6] show {Bessac, 2007: 65, Fig.48} the lines on the top of the capitals. [Pl. 136: 13] is a capital with two angles, one to correct the other. Another mark is carved on the top of ed-Dayr, which represents a rock-carved geometrical design on the roof of ed-Dayr (Lindner, 1984: 171, Pl. XXV11: 2, Fig. 7 and 1984a: 619-620, Abb. 20-22 and 1986: 93, Abb: 8, McKenzie, 1990: 161, Pl. 142c, and Bessac, 2007: 98, Fig. 101). It is not known what these lines lead to. The dots that form a drawing of a pick at al-Khubthah (Bessac, 2007: 42, Fig.22) may lead to a complete line drawing. Another peculiar mark is found on one of the columns of Siq al-Barid caves, which represents a circle with two lines crossing the

center dividing the circle into four equal quarters [Pl. 136: 16]. Guidelines were also carved on the face of the rock to guide the stonecutters or carvers to the steps that they should follow to carve the façades of the caves [Pls. 25, 40, and 41, a c]. A number of caves have the guidelines on their interior walls [Pls. 62, 67], ceiling [Pl. 82] or floor [Pl. 83: e].

k) Holes used for climbing, hanging, plaster, religious purposes, and lifting [Pl. 137]

The holes that are mentioned below represent some of those found in Petra. They have several forms and uses or purposes. They are found for example on the faces of the quarries to help workers to descend to the quarrying area and to climb up from it [Pl. 98], or to Pl. 137: k .5, 13, 15], to get into the shaft tombs and out of them [Pl. 18: d, e], or to hang covers for the niches with Dusharas that are carved on the walls of the caves [Pl. 137:k.: 4]. This kind of hole is still used in the region to tie animals or to hang lamps or baskets. Holes were also used to hold the plaster inside the caves [Pls. 75, 137:k.:3, 6, 8-13; 12: a-e]. [Pl. 137:k.: 8-13] shows a number of holes, inscriptions and a thick layer of plaster covers the inner side of the eastern wall of a cistern, which is located at the eastern side of Wādi al-Mu‘aysrah ash-Sharqiyyah Pl. 28: c, 92: b]. [Pls. 137: k 1, 4, 6 ; 11, 78: a] show that the holes were also carved to hold the plaster on the inner [Pl. 12: a-e] and outer walls of the caves as well as the walls of the buildings such as Qasr al-Bint Temple or to hold the marble pieces to the front south wall of the Main Theater. In some cases, most probably they were for religious purposes such as the ones that are dug next to the openings of the shaft graves [Pl. 137: k.14] and on the surface of the rock at ath-Thunabe [Pl. 18: b]. These are more than twenty holes that are dug in

the rock, east of what seemed to be a seating bench for spectators to watch what might be a religious activity that took place there. To the west of these holes a bench is cut for the audience to watch a ceremony that may have taken place at that spot. A few were also dug on the surface of the rock on the way to the Snake Monument. Some architectural pieces such as column drums from the temples and the Colonnaded Street have holes for lifting them [Pls. 137: k.16 and 11], see also (Rababeh 2005: 104-5, Figs. 4.26-7, 133, Figs. 5.26-7). The drums also have a square with a hole in the center or just one of them, which were filled with mortar and pieces of stone to hold the drums together. [Pl. 137: k.2] located on the eastern way to the High Place and [Pl. 19: c] east of the Obelisk Tomb have lines of holes. Such holes are found on the way to ed-Dayr east of the Lion's Tomb. The excavation at the Main Theater revealed a number of cup-holes and tie-davits in the orchestra floor (Hammond 1965: 31 Pls. XVIII.4, XX1.1). Such tie –davits are still used to tie animals in stables or the walls of the houses in the villages.

l) Others: the games [Pl. 138]

Drawings and carvings of chiseled games at Petra are found at three locations:

1: Holes for three games [Pl. 138: 1, 2] were carved on the surface of a flat rock about 50 m. east of the Siq entrance. The first game [Pl. 138: 1] has a rectangular form with holes. The diameter of each hole is about 1-1.5cm. [Pl. 138: 2] does have the other two games, which are attached to each other. One is 0.60m by 0.22m and has 70 holes, and a smaller one of 0.36m by 0.30m that has 63 holes. It is not easy to determine the

date of this game. A similar game is still played by the local people of the area and in Palestine. It is called “Siega or Sieja” and is played by two persons. Each person has different kind of stones e.g., one plays with small round pebbles like marbles and the other plays with the pits of olives.

2: Two different kinds of drawings [Pl. 138: 3-5] were carved on the surface of a flat rock in the quarry. The quarry is located on the right hand, half way going up to the High Place using the east staircase south of the Theater. A group of three drawings [Pl. 138: 3-5]: a complete one is between two unfinished drawings, one above and the other below it. It seems that someone was trying to imitate the central one but failed in both attempts. They also are similar in appearance to the modern game called “Maze”.

Next to this group is the second drawing that shows only the upper part of an unknown drawing [Pl. 138: 6]. The lower part is not complete and part of the rock is damaged by the exposure to the weather. It may be that the intention of the person who carved it was to draw a human figure with the arms stretched up, a bird with broken wings, or it could be a new way of an altar drawing.

3: A drawing of a game [Pl. 138: 7] is carved on a flat surface of a rock at the north west of the top of Umm el-Biyārah. It consist of three parts: each one has two parallel sets of rectangular forms with different sizes. Two sets are next to each other while the third is below the left one. The top left one has two rows of eleven rectangles each, while the right one has two rows consisting of ten rectangles. The third exhibits two rows of nine rectangles each. It is possible that two persons shared and played the game, see also (Lindner,1980:313-315).

II. Places where mason's marks are found

A. In Quarries

Most of the quarries in Petra are located in a convenient location in the center of the city in order to transfer the stones to the planned buildings, and are a main source for the masons' marks. Some of these quarries have certain marks which may indicate specific religious meanings or may have close association to the Nabataean religion, for example: drawings and carvings of altars, plants, or human and animal representations and inscriptions as the previous masons' marks plates showed. Human figures drawings are carved at Umm Sayhun, High Place al-Habis, the Triclinum opposite al-Khaznah and the Palace Tomb [Pl. 133]. In some cases the figures show a standing person with stretched open arms and feet. Such drawings were found on the walls of caves at Beit Jibrín (Avi-Yonah, M. 1981: 31-32, Pl. 6.6). Another remarkable discovery is the mark of the big "V" shapes which indicate the beginning of an altar carving, are seen carved on the faces of the quarries or smooth surfaces such as those carved on the way at the eastern side of an-Numayr. [Pl. 128: 13, 14] I did not realize the function of these V shapes until I found them carved next to the altars on the way to an-Numayr. The inscriptions in the quarries [Pl. 125] may give the names, number, or information about those who worked or were in charge of the work, or the amount of work accomplished and number of ashlar extracted, perhaps the date of quarries etc. They may be dedicatory notes to a certain god or king. A special study of these inscriptions is needed to understand their function.

B. On Caves' Walls

The examples mentioned above reveal several kinds of different drawings or carvings on the inner or outer walls of the caves such as humans [133: 11, 15, 13], animals [Pls.135: i. 1, 3], plants [Pl.134: h. 1-3] and nefeshes, [129: d. 5]. The cave east of the Obelisk Tomb has the human and animals carvings (horses and snakes) [Pl. 135: i. 1]. Zayd's Tomb [Pl. 17] has the nefeshes with writing on the bases carved on the south wall and the north side of the entrance. The tomb opposite the Siq entrance has some drawings of camels.

C. On Masonry Stones

Some of the masonry of the buildings (blocks, columns' drums and capitals and even on a piece of the stairs on the way to ed-Dayr (put pictures) carry marks left by those who worked the stones. The back of the south wall of Qasr al-Bint has a number of blocks built in it that carry mason's marks [Pl.123: 25-33]. The north east corner of the foundation includes a block with one sign [Pl.123: 24]. A Nabataean letter [Pl. 124: 54] is inscribed on one of the ashlar's of the face of the southern wall of the south arch of the Temenos Gate (McKenzie, 1990: 36). Petra excavations at the following sites (to name some of them): the Main Theater in 1961-1962 (Hammond, 1965), Temple of the Winged Lions which started 1973 (Hammond, 1996, and later reports), in Petra the Great Temple which started 1993, "Forty-one of the ashlar's bore mason's marks, and all of were recorded. They are not presented in detail in this study; however, Figure 6.27 gives an illustration of several mason's marks" (Joukowsky, 1998: 114, 264, Fig. 6.27 on

pp. 266, 267 and later reports). The Byzantine Church which began 1992 (Schick, R. et al., 1993: 55-66), and az-Zantur which began 1988 also revealed masonry with mason's marks. See also Glueck (1965: 135, Pl. 133b), which mason's markings on top of a capital shows lines as those found by the gate at Petra.

The limestone and sandstone drums and capitals of the columns which were part of the Temenos Gate structure - some left where they were found, others now exhibited in front of the museums in Petra- carry the lines and the signs which the masons used to guide them to carve these capitals. In some cases there seem to be extra lines on the back of the capitals for corrections [Pl. 136]. See also the mason's markings on top of above capital of Altar III at Khirbet Tannur Temple (Glueck, 1965: 125, Pl. 133b). Some of these capitals show mistakes in the measurements and their corrections [Pl. 136: 13].

D. Next to the Openings of the Shaft Tombs [Pl. 137: 14].

Holes in the form of deep cups are found in some cases beside the openings to the shaft tombs. Their number differs from 1-3. There is only one case where I found one shaft tomb with three cup holes next to the southwest end of the opening of the tomb at the bottom of Umm el-Biyarah on the way to the top. The same type of such cups is also found at ath-Thunabe [Pl. 18b], where a number of holes were dug in front of two rows of seats, which may indicate that the place was used for religious ceremonies.

The conclusion that could be drawn from the above information is that these more than 250 recorded marks represent:

- 1- a symbol of identification of an individual or a group.

- 2- the order in which the drums, columns or masonry are used.
- 3- a religious meaning.
- 4- the V shaped marks are simply the unfinished carvings of altars.

A thorough, detailed study is needed for these marks to shed more light on the quarries and the dates in which they were used, and if the workers were local or foreigners such as prisoners or artisans or artists who came through trade or were employed by the Nabataeans. The study may also enable us to find the connection between the individuals or the groups that worked at the quarries, the buildings or in carving caves.

CHAPTER 6

CONCLUSION

The study of the Nabataean Rock Carving Technique, before this work, focused on individual tombs or only a few tombs. Furthermore, research, including both excavations and surveys has concentrated on describing the monuments and dating them, as well as restoring and consolidating the excavated sites to protect them. But the quarrying of stone and the carving of the monuments were only briefly mentioned. This is why this work was needed.

I. Conclusions regarding the Nabataean carving technique

The Nabataean traders traveled to the east and traded with China. They must have seen the tombs of Achaemenids, the Indians, and the Central Asians on their way. They also traded with the West and reached the shores of Italy. They were perhaps influenced by Hellenistic and Roman architecture as well as Egyptian monuments. They did not imitate them but they created their own architecture. In the previous pages, I have sought to assemble the evidence, both old and new, and ideas in order to define the major aspects of the Nabataean technique of carving. At the end of the survey the following conclusions were considered as major achievements that were not previously noticed or clearly defined. Even when they were noticed they were not given the attention they deserve.

The study presented here in this research on the steps of carving façades and interiors and the quarrying methods, led to the following conclusions, as well as some suggestions for future research and study.

My main conclusions regarding the carving of the façades are as follows.

a) The type of façades developed at the same time and tend to be found in the same areas of the city, which indicates that they were designed by different groups of architects who worked on these façades at the same time and the same place as seen in **[Pl. 39a]** and not, as suggested by others, that they were made in different Periods (see table 5). In a number of areas, the unfinished façades with half gables, one or double bands of gables, and with arches are found abutting each other as seen at the south east foot of Umm el-Biyārah **[Pl. 34]**, or at ath-Thunabe East of Wādi ed-Dayr **[Pl. 36, 37a,b, 41, 44a,b, 46a,b and 48]**. This situation implies that the work on the different types of tomb façades was carried on at the same time and makes it difficult to say one type is earlier than the other.

b) Also, there is no relationship between the place where façades are located, the way they are oriented and the space they occupy, such that a certain type or group of tombs is located in a designated area in Petra. But in reality, all the types were carved next to each other.

c) It is important to mention that there are some tombs with simple finished façades with no gables or half gables or arches, but carved with completely different designs, see for instance **[Pl. 19, 28, 50]**. This is further evidence that there were different local carving traditions at Petra.

My main conclusions regarding the interiors are as follows.

d) The interior carving was often done in such a way that the resulting blocks could be used elsewhere. The caves were thus quarries.

e) Regarding the interiors, two methods were used to create them: hewing and quarrying. Many chambers were never fully finished. The size and volume of chambers is quite variable.

f) Also the arrangement of the graves inside the main chambers is quite variable. Recent excavations of the interiors of tombs have revealed graves in different positions, graves which were not finished, and graves which were finished but not used.

g) It is still not easy to determine the actual size of the working force that was involved in carving the caves at Petra and the time necessary to complete them. Schmitt –Korte and Bessac discussed these matters. Schmitt –Korte tried to estimate the time required to carve al-Khaznah, however this is an exceptional locality, and less elaborate monuments would have required less labor.

In addition to these main conclusions, other observations –such as the use of seven toothed chisel, the extraction of blocks from special quarries in the mountain, and the different kinds of mason’s marks—have been presented.

II. Notes on the origins of the Nabataean carving technique

Until more studies on sites with carving techniques contemporary with or earlier than the Nabataean monuments of Petra detailed in this study, it is difficult to discuss the origins of Nabataean carving techniques or influences upon their development. There are, of course many studies of Roman carving techniques in the Levant and the Eastern

Mediterranean, but these are later and not relevant to these questions. Also, there are studies of carving contemporary with or earlier than Nabataean carving techniques in regions far from the Levant, for example studies of Classical stone carving around the Aegean or of Achaemenid stone carving in Iran. Until there are studies of carving techniques from monuments of the pre Nabataean Edomite cities and cemeteries and contemporary sites in Syria, the Hejaz, and the Yemen, as well as of carving techniques in the southern Levant during the Achaemenid and Early Hellenistic periods, one can only introduce these issues.

A. Local Technique

The variety of unfinished façades, as for example the arch, half-gable, and gable façades on [PI. 34] and at the ath-Thunabe area, indicate that there were several groups or schools, each of which practiced its own way of carving. This diversification of carving techniques leads one to believe that the Nabataeans had their local indigenous traditions, but the local antecedents have not yet been discovered.

B. Influence through contact with Neighbors

The caves of Petra reflect a significant aspect of the city's material culture and bear witness to its role as capital, and to its wealth and relationship with neighboring countries such as Italy, Greece, Anatolia, Persia, and Egypt. It was their choice - not force - to adopt the art and culture of their neighbors and to introduce them to their own people. In spite of the fact that the Nabataean kingdom was surrounded by strong powers (the Persians, Antigonids, Ptolemies, and the Seleucids), the Nabataeans maintained their artistic independence until the Romans conquered the area in the year 63 B.C. Later in A.D.106 Trajan annexed their kingdom and established what was known

“Provincia Arabia.” The texts found in the Persepolis fortifications and quarries (Hallock 1969, Nylander 1965, 1970) and in the foundation inscription of the Darius II (The Great 522-486 B.C.) palace at Susa (Perrot 2010), mention the various countries, which supplied materials and labor. The Fortification Texts mention also numerous foreign workers as being in the vicinity of Parsa (Roaf, M. 1980: 70-71). The Nabataeans did not leave any documentary evidence like the above mentioned texts, which list the countries that the Nabataeans dealt with and which might have influenced their stone cutting and building techniques. It remains for future archaeologists to patiently collect and analyze the evidence from contemporary neighbors in order to facilitate the study of influences on Nabataean stone cutting.

III. Future prospects

In the light of this modest attempt to develop an overview of the carved monuments of Petra, using limited resources and traditional archaeological methods, it is possible to point to a number of future research directions. With the help of modern technology, much more can be learned about the caves of Petra.

a) If a number of caves could be excavated, then more information could be obtained which would help to date the façades and interiors and definitively confirm or refute earlier claims regarding the chronological order of the caves. Radiocarbon dating of small pieces of vegetation from mortars and plasters and of protein from human bones in the burial shafts will be helpful. Optically Stimulated Luminescence (OSL) dating of sediment in layers of masons’ debris in near the unfinished tombs is potentially more accurate than radiocarbon dating.

b) Human bone from the graves in cave have rarely been kept or studied, but even small fragments of bone and teeth from disturbed graves can inform us about the age and sex of the people buried, and ancient DNA from a number of graves in one cave could tell us how the people buried in a cave were related.

c) More rigorous timed experiments by the mason's of modern Petra, similar to those undertaken with Muhammad Salamah, could provide a much firmer estimate of the labor invested in building the caves.

d) All these efforts, and indeed any attempt at broader synthesis, would be facilitated by a complete remapping of the caves and other remains at Petra using very accurate modern satellite-based Geographical Positioning Systems.

I hope that this work will be the beginning of a period of more extensive research and study of the caves.

TABLES

The Nabataean Kings

PETRA (RAQMU)	
Zweieinhalb Jahrtausende Stadtgeschichte auf einen Blick	
7. Jh. v. Chr.	edomitische Siedlungen auf den Höhen um die Stadt
312	Erwähnung von Petra = Fels in griechischen Quellen
3. Jh.	älteste Erwähnung eines nabataischen Königs
129	Festgesandtschaft aus Priene
96	älteste datierte nabataische Inschrift
Nabataische Könige	
um 168	Aretas (I.)
120/10–96	Aretas II.
ca. 96–85	Obodas I.
um 85/84	Rabb'el I.
84–62/60	Aretas III.
84–72	Aretas <i>Philhellenos</i> , König von <i>Koile Syria</i>
62	Aretas, Klient Roms
62–60	Obodas II. (?)
59–30	Malichus I.
30–9	Obodas III.
9 v.–40 n. Chr.	Aretas IV.
9 v.–16	Huldu I., Königin
9–6	Syllaios Koregent
16–40	Šaqilat I., Königin
40–70	Malichus II. Šaqilat II., Königin
70–106	Rabb'el II.
70–75	Šaqilat II., Regentin
76–101	Gämilat II., Königin
102–106	Hägiru II., Königin
106	Malichus III.?
106	römische Okkupation, Bildung der <i>Provincia Arabia</i>
111–114	Anbindung an die <i>via nova Traiana</i>
114	<i>Petra Metropolis (Arabiae)</i>
117–222	städtische Münzprägung
124	<i>boulé</i> bezeugt
127	T. Aninius Sextius Florentinus, Statthalter
131	<i>Hadriane Petra Metropolis</i> , Besuch Hadrians
218/222	<i>Petra Colonia</i>
seit 347	Bischöfe aus Petra bezeugt
um 358	zur <i>Provincia Palaestina Salutans</i>
363	Erdbebenkatastrophe
um 400	zur <i>Provincia Palaestina Tertia</i>
419	Erdbeben
446	Urnengrab zur Kathedrale umgebaut
528–586	Papyri
551	Erdbeben
636	Beginn islamischer Herrschaft
7./8. Jh.	Niedergang der Stadt
1100	Wiederentdeckung durch Balduin I.
1118–1131	Kreuzfahrerfestung, Balduin II.
1217	Thietmarus besucht Petra
1812	Wiederentdeckung durch J. L. Burckhardt
1929	erste Ausgrabungen

a: (After Knauf, 1997)

DIE NABATAISCHEN KÖNIGE	
<i>Aretas I.</i>	um 169 v. Chr. (Haretat, Haritat)
<i>Aretas II.</i>	ca. 120–96 v. Chr. (Haretat, Haritat, Hérothymos, Erotimus)
<i>Obodas I.</i> , Sohn Aretas' II.	ca. 96–87 v. Chr. (Obodat, Abodat)
<i>Rabel I.</i> , Sohn Obodas' I. oder Aretas' II.	um 87 v. Chr. (Rabbel, Rabilos, Rabilus, Rabb'il)
<i>Aretas III. Philhellenos</i> , Sohn Obodas' I.	87–62 v. Chr. (Eine Tochter — Kypros oder Kypron — mit Antipater verheiratet?)
<i>Obodas II.</i> , Sohn Aretas' III.	62–56 oder 47 v. Chr.
<i>Malichus I.</i>	56 oder 47–30 v. Chr. (Miliku, Malichos, Malchos)
<i>Obodas III.</i> , Sohn Malichus' I.	30–9 v. Chr. Mit Kanzler Syllaios (Syllaios) Königin: Huldu (Huldo)?
<i>Aretas IV. Philopatris</i> (Philodemos, Rahem ameh, »der sein Volk liebt«)	9 v.–40 n. Chr. Eine Tochter mit Herodes Antipas verheiratet. 1. Königin: Huldu (Huldo) 2. Königin: Šaqilat (Suqailat) I.
<i>Malichus II.</i> , Sohn Aretas' IV.	40–71 Königin: Šaqilat (Suqailat) II.
<i>Rabel II.</i> , Sohn Malichus' II.	71–106 »Der sein Volk wiederbelebt und errettet (befreit) hat« oder »soter«. 1. Königin: Gämilat (Gumullat) 2. Königin: Hägiru (Hagiuro)

b: (After Schmitt-Korte, 1980)

Table 2

Forms of Nabataean Alphabets

Umschrift	Nabataean	Phoenician	Hebrew
a	𐤀	א	א
b	𐤁	ב	ב
c	𐤂	ג	ג
d	𐤃	ד	ד
e	𐤄	ה	ה
f	𐤅	ו	ו
g	𐤆	ז	ז
h	𐤇	ח	ח
i	𐤈	ט	ט
k	𐤉	כ	כ
l	𐤊	ל	ל
m	𐤋	מ	מ
n	𐤌	נ	נ
o	𐤍	ס	ס
p	𐤎	פ	פ
q	𐤏	ק	ק
r	𐤐	ר	ר
s	𐤑	ש	ש
t	𐤒	ת	ת

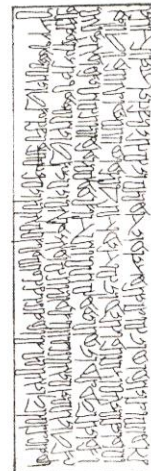
Datum n. Chr.	Lib. nr.	2112	2656	2668	3087	3389	Arabic
a	𐤀	ا	ا	ا	ا	ا	ا
b	𐤁	ب	ب	ب	ب	ب	ب
c	𐤂	ج	ج	ج	ج	ج	ج
d	𐤃	د	د	د	د	د	د
e	𐤄	ه	ه	ه	ه	ه	ه
f	𐤅	و	و	و	و	و	و
g	𐤆	ز	ز	ز	ز	ز	ز
h	𐤇	ح	ح	ح	ح	ح	ح
i	𐤈	ط	ط	ط	ط	ط	ط
k	𐤉	ك	ك	ك	ك	ك	ك
l	𐤊	ل	ل	ل	ل	ل	ل
m	𐤋	م	م	م	م	م	م
n	𐤌	ن	ن	ن	ن	ن	ن
p	𐤎	پ	پ	پ	پ	پ	پ
q	𐤏	ق	ق	ق	ق	ق	ق
r	𐤐	ر	ر	ر	ر	ر	ر
s	𐤑	س	س	س	س	س	س
t	𐤒	ت	ت	ت	ت	ت	ت

d.

Datum n. Chr.	4/5	72/3	90/100	125	1467
a	𐤀	א	א	א	א
b	𐤁	ב	ב	ב	ב
c	𐤂	ג	ג	ג	ג
d	𐤃	ד	ד	ד	ד
e	𐤄	ה	ה	ה	ה
f	𐤅	ו	ו	ו	ו
g	𐤆	ז	ז	ז	ז
h	𐤇	ח	ח	ח	ח
i	𐤈	ט	ט	ט	ט
k	𐤉	כ	כ	כ	כ
l	𐤊	ל	ל	ל	ל
m	𐤋	מ	מ	מ	מ
n	𐤌	נ	נ	נ	נ
o	𐤍	ס	ס	ס	ס
p	𐤎	פ	פ	פ	פ
q	𐤏	ק	ק	ק	ק
r	𐤐	ר	ר	ר	ר
s	𐤑	ש	ש	ש	ש
t	𐤒	ת	ת	ת	ת

c.

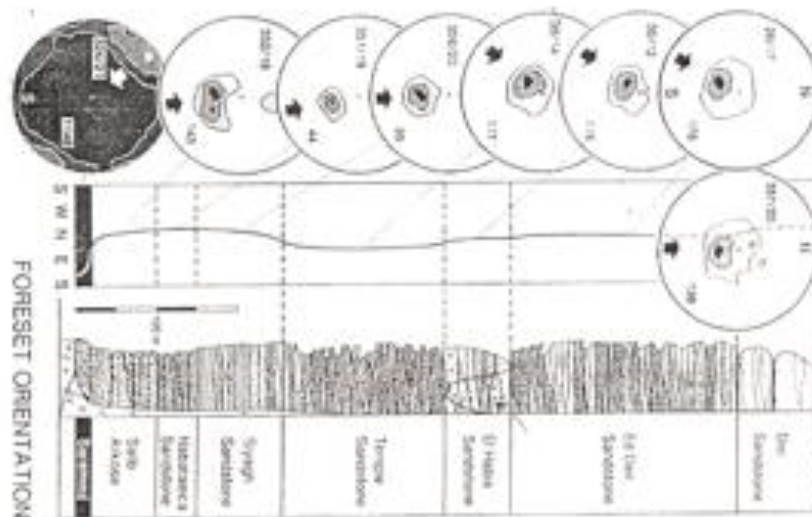
a.



b.

- a. After Healey Pl. 102 (1997)
- b. Turkmaniyyah inscription (After Healey Pl. 103, 1997)
- c. Cursive Nabataean alphabet (After Healey, 1997)
- d. After Roschinski, part of 4, page 44 (1981)

Nubian-Type Sandstones in Jordan



a. Summary of Paleocurrent Measurement in Late Proterozoic and Cambrian Sediments (After Pflüger, 1990)

Stratigraphic Unit	Paleocurrent Direction		Remarks
	Symbol	Direction	
Thin Sandstone	→	N	
(1) High Sandstone	→	S	
Thin Sandstone	→	SE	
Synclinal Sandstone	→	SW	
Heterogeneous Sandstone	→	NW	
Sandstone	→	NE	

Stratigraphic Unit	Paleocurrent Direction		Remarks
	Symbol	Direction	
Thin Sandstone	→	N	
(1) High Sandstone	→	S	
Thin Sandstone	→	SE	
Synclinal Sandstone	→	SW	
Heterogeneous Sandstone	→	NW	
Sandstone	→	NE	

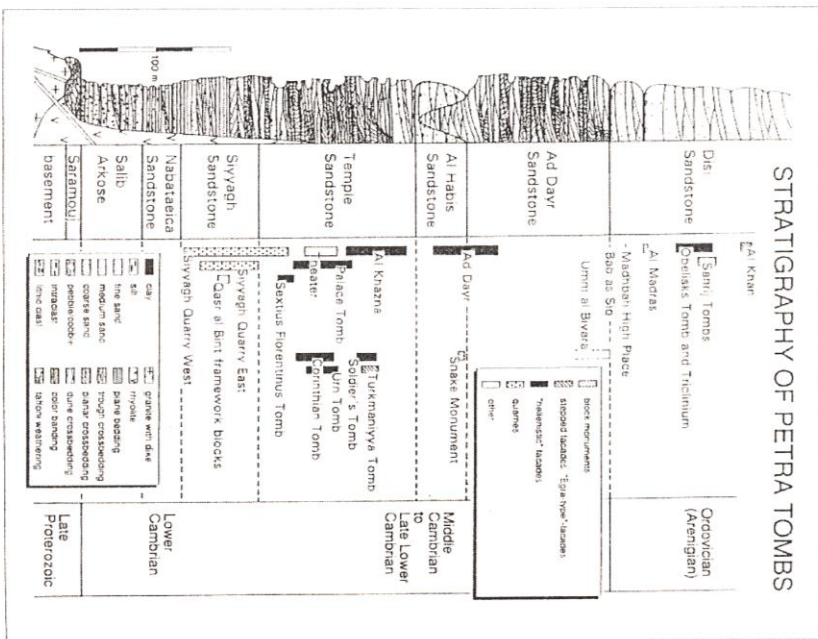
c. Comparison of Stratigraphic Studies on Nubian Sandstones in Jordan (After Pflüger, 1990)

b. Lithostratigraphy of Cambrian and Ordovician Sediments (After Fitzner, 1998)

Stratigraphy of Sandstone of Petra

MIDDLE TO LATE CAMBRIAN		LATE CAMBRIAN TO ORDOVICIAN
Ram-Sandstone Group		
Umm Ishrin Sandstone Formation		
Lower part (lln)	Upper part (ulin)	Disi Sandstone Formation (Di)
	Middle part (mln)	Disi Sandstone Formation (Di)
Temple Sandstone	Ed-Deir Sandstone	Disi Sandstone
		Habib Sandstone
Umm Ishrin Sandstone Formation		
		Disi Sandstone Formation; massive sandstone (Diw-nlsd)
		Upper part (ulin): - multicoloured, many medium-grained, massive sandstone - yellow, many medium-grained sandstone (ulh-vn-nlsd) - white, many medium-grained sandstone (ulh-vn-nlsd) with bluish subdiagonal - yellow, many medium-grained sandstone (ulh-vn-nlsd) - grey, many medium-grained sandstone (ulh-vn-nlsd) - red, many fine-grained sandstone (ulh-vn-nlsd) - white, medium-grained, massive sandstone (ulh-vn-nlsd) - white, medium-grained, massive sandstone (ulh-vn-nlsd) - yellow-brown, clayish, very fine-grained sandstone (ulh-vn-nlsd) - white to pale grey, clayish, very fine-grained sandstone (ulh-vn-nlsd) - yellow-brown, clayish, hard, very fine-grained sandstone (ulh-vn-nlsd) - violet, clayish, very fine-grained sandstone (ulh-v-nlsd) - yellow-brown, very clayish siltstone (ulh-v-nlsd)
		Middle part: - multicoloured, mainly fine-grained massive sandstone (ulh-v-nlsd) with bluish subdiagonal - white, many medium-grained sandstone (mlh-v-nlsd) - grey, many fine-grained sandstone (mlh-v-nlsd) - red, many fine-grained sandstone (mlh-v-nlsd) - yellow-brown, very fine-grained sandstone (mlh-v-nlsd) - white, grey to pale violet, colour-banded, clayish, very fine-grained sandstone (mlh-v-nlsd) - white, clayish, hard, very fine-grained sandstone (mlh-v-nlsd) - yellow-brown, clayish, hard, very fine-grained sandstone (mlh-v-nlsd) - violet, clayish, hard, very fine-grained sandstone (mlh-v-nlsd) - yellow-brown, very fine-grained sandstone (mlh-v-nlsd) - violet, very clayish siltstone (mlh-v-nlsd)
Lower part (lln): not considered		

a. Lithostratigraphy of Middle Cambrian to Early Ordovician. Petra/Jordan



b. Stratigraphy and Weathering Profile of Cambrian and Ordovician Sandstones Exposed in Petra, Jordan

Classification in Chronological Order of the Tomb Facades

<i>von Domaszewski</i> ¹ (1904)	<i>Browning</i> ² (1973)	<i>Dalman</i> ³ (1908)	<i>Kennedy</i> ⁴ (1925)
—	Rectilinear	—	Rectilinear
Pylon Tombs (from 6th cent. B.C.)	Assyrian Phase I (to at least 300 B.C.) Assyrian Phase II	Nabataean (3rd–2nd cent. B.C.)	Assyrian Type
Step Tombs	Cavetto Phase I	Hellenistic (1st cent. B.C. – 1st cent. A.D., includes Khasneh)	Cornice Type
Proto-Hegr Tombs	Cavetto Phase II		
Hegr Tombs (Aretas IV to after A.D. 106)	Double cornice Phase I Double cornice Intermediate Double cornice Phase II		
Gable Tombs (Ptolemaic period)	—	—	—
Roman Temple Tombs (after A.D. 106, includes Khasneh)	Nabataean Classical (85 B.C. – A.D. 106) Roman Classical (after A.D. 106)	Roman (after A.D. 106, N.B. does not include Khasneh)	Classical Type (after A.D. 106, includes Khasneh)
Arch Tombs (Seleucid and into Roman Period)	Arch topped tombs	—	—

1. R.E. Brünnow – A. von Domaszewski, *Die Provincia Arabia*, Vol. I, Strassburg (1904) 137–191.

2. I. Browning, *Petra*, London (1973) 79–99.

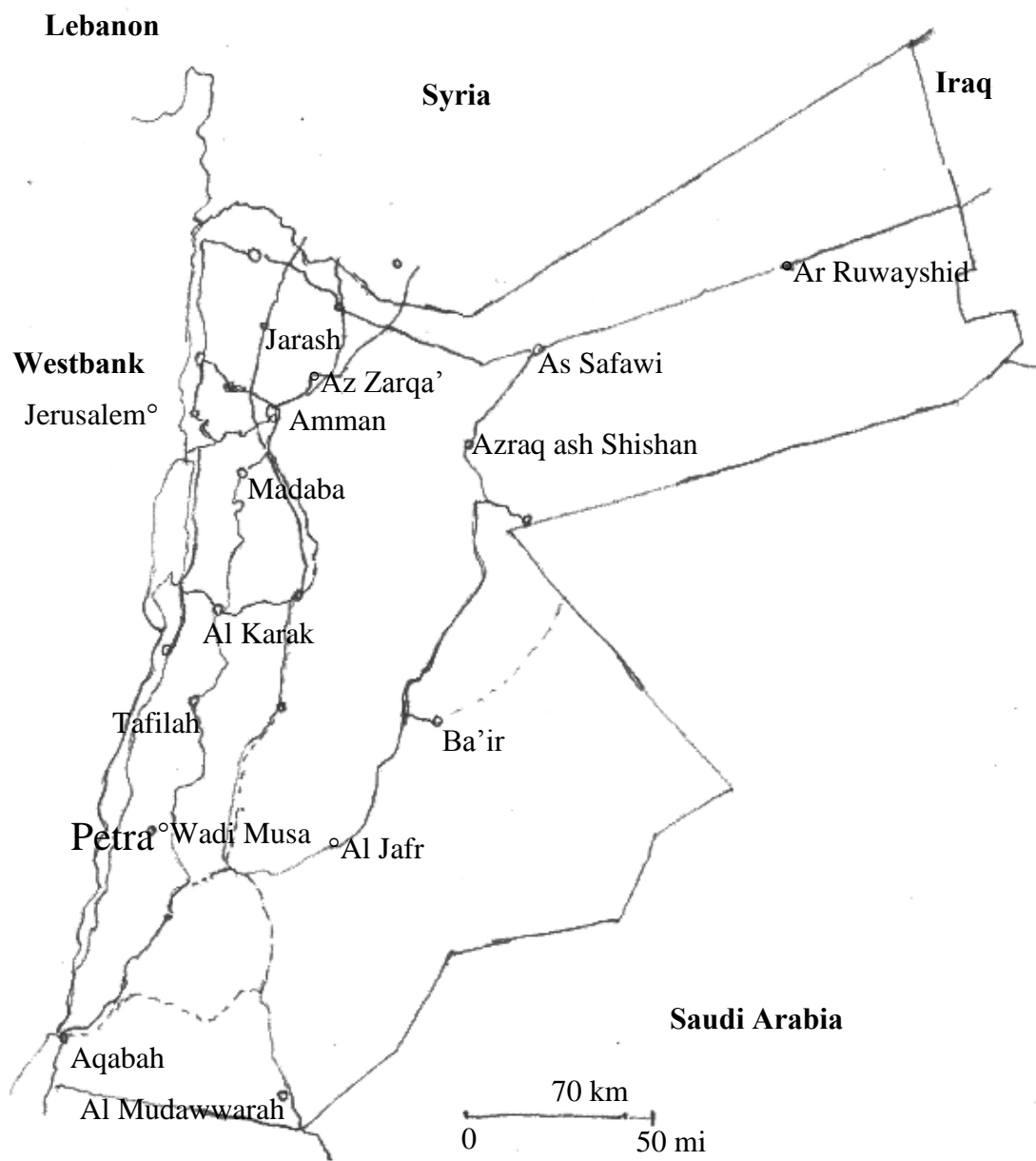
3. G. Dalman, *Petra und seine Felsheiligtümer*, Leipzig (1908) 47–48.

4. A. Kennedy, *Petra, Its History and Monuments*, London (1925) 38–61.

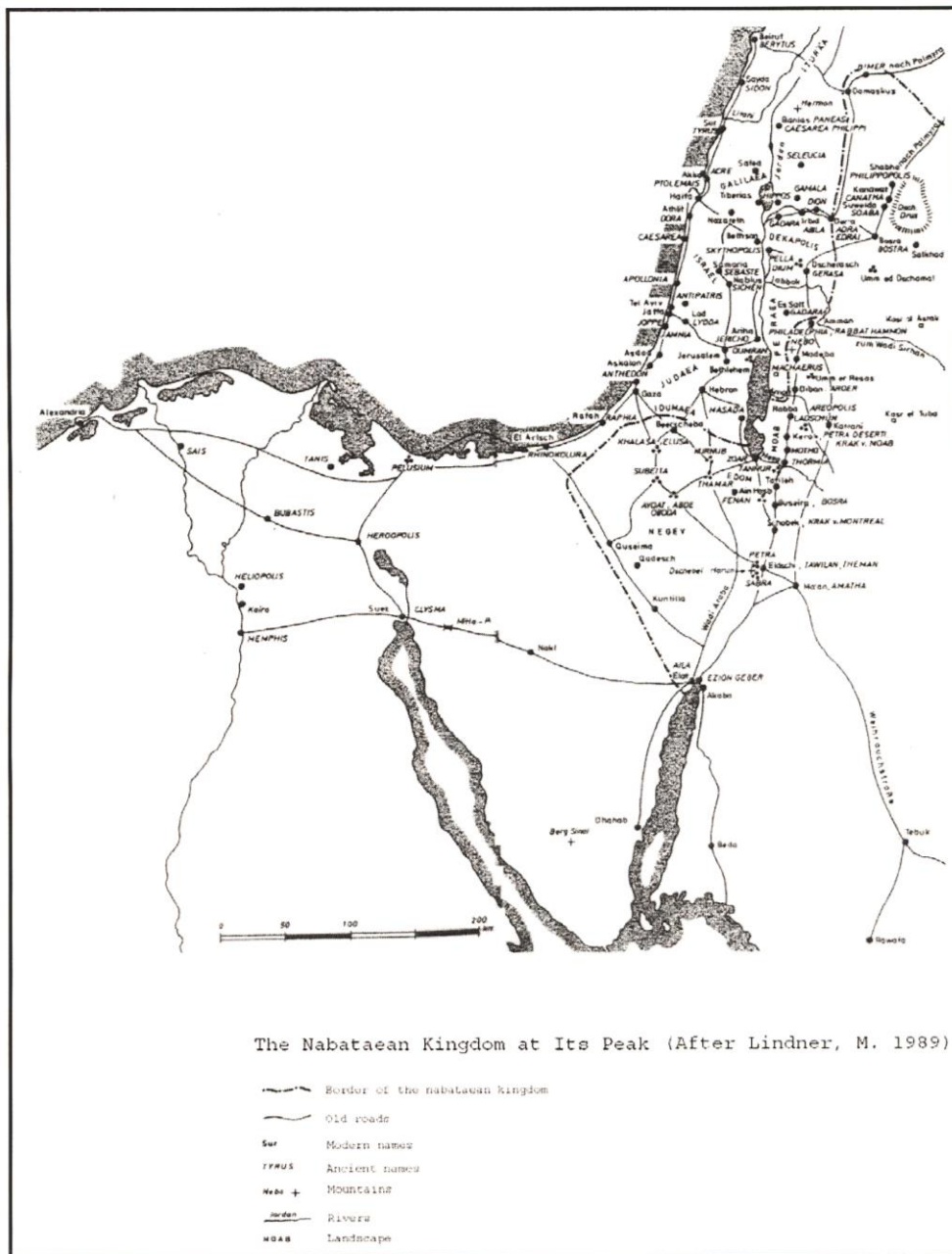
(After Mckenzie, 1990, Table I)

MAPS

Map of Jordan



The Nabataean Kingdom

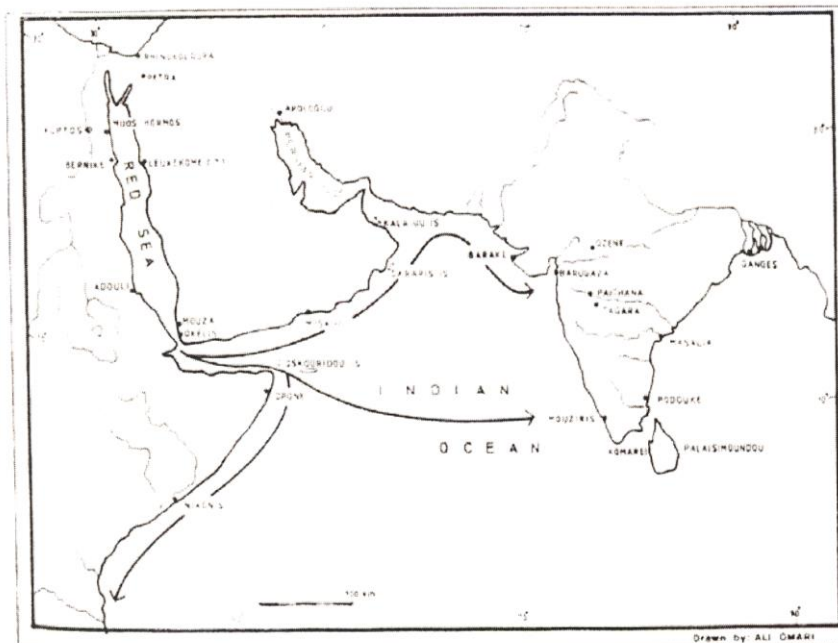


The Surroundings of Wādi Musa

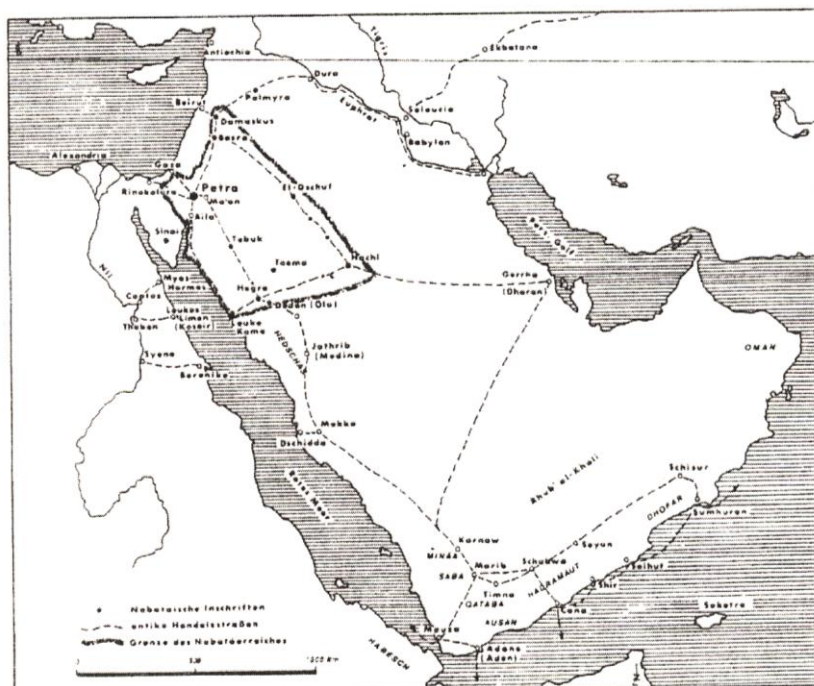


The surroundings of Wadi Musa (Petra) (after Musil 1907)

Sea and Land Roads during the Nabataean Period



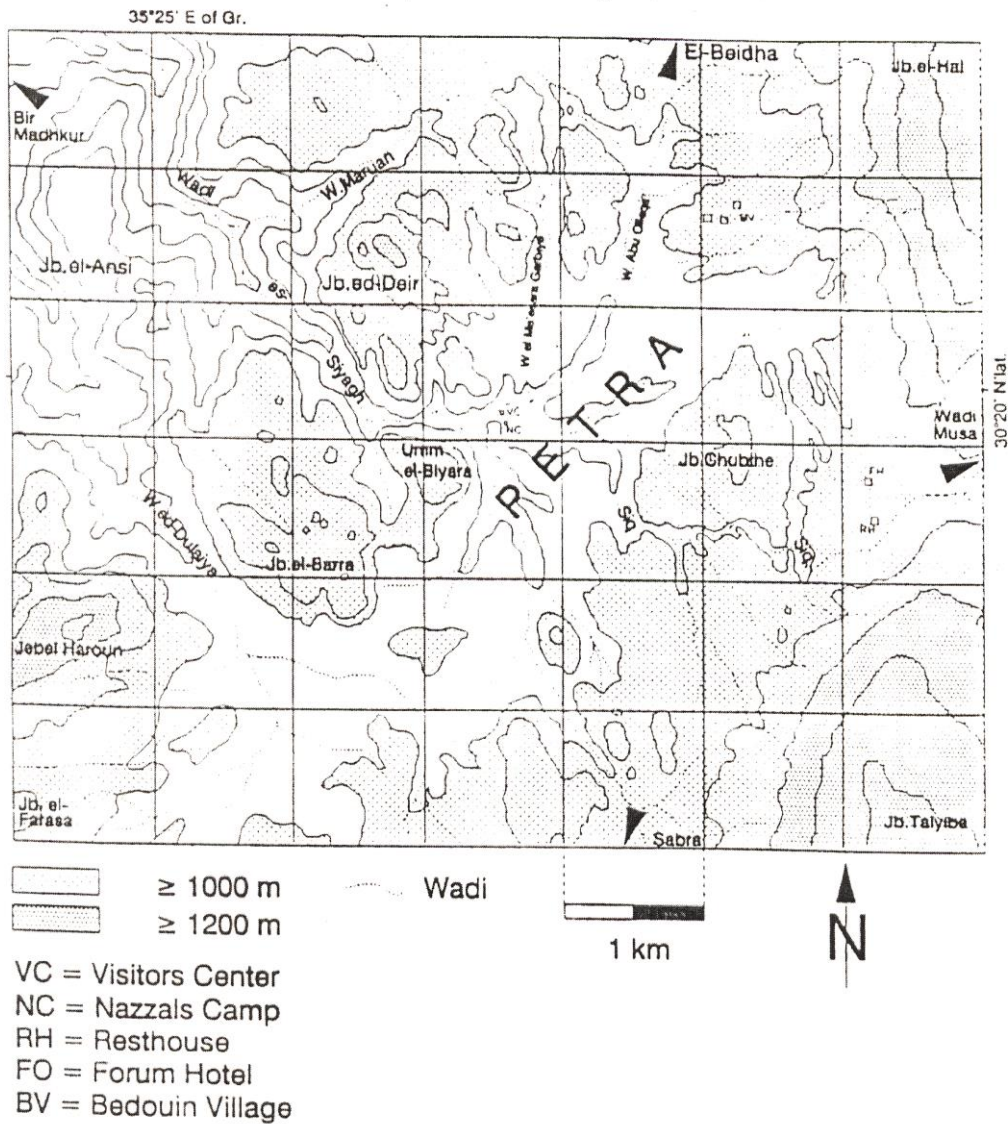
a: Major Sea-routes and Some Ancient Sites (After Gogte, 1999)



b: Incense Road (After Gauckler, 1989)

Study Area

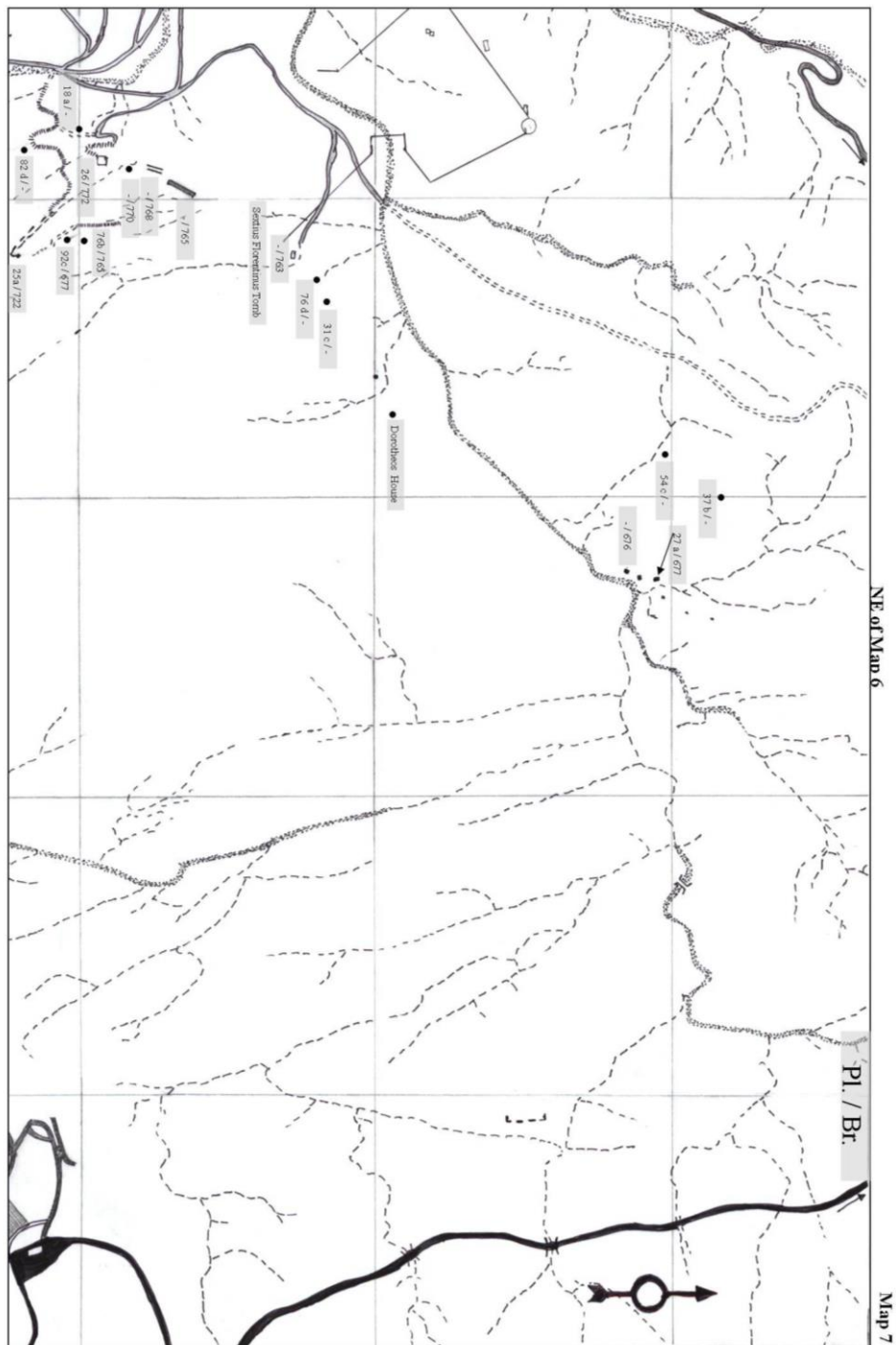
(After Pflüger, 1990)



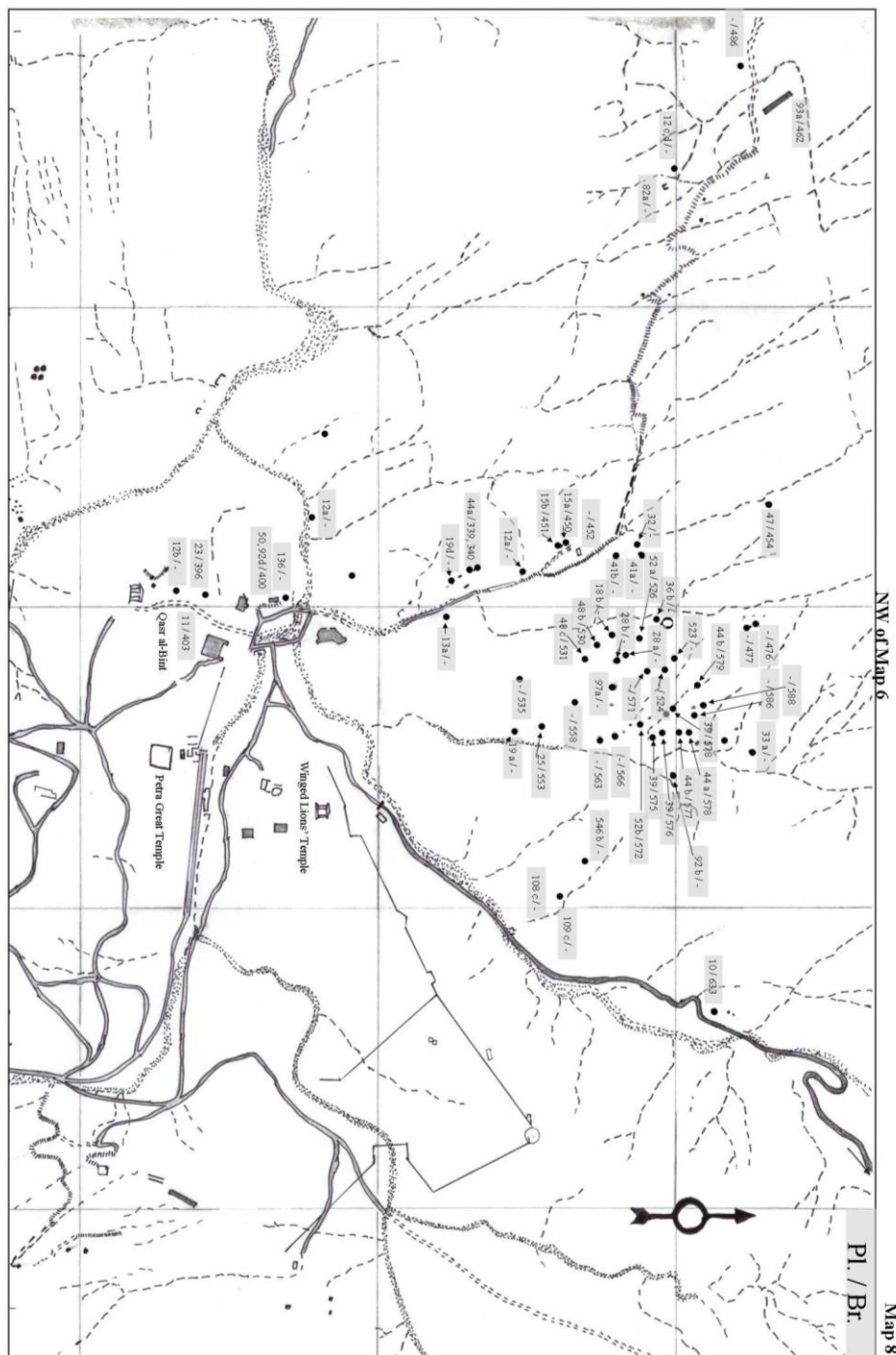
Petra Map



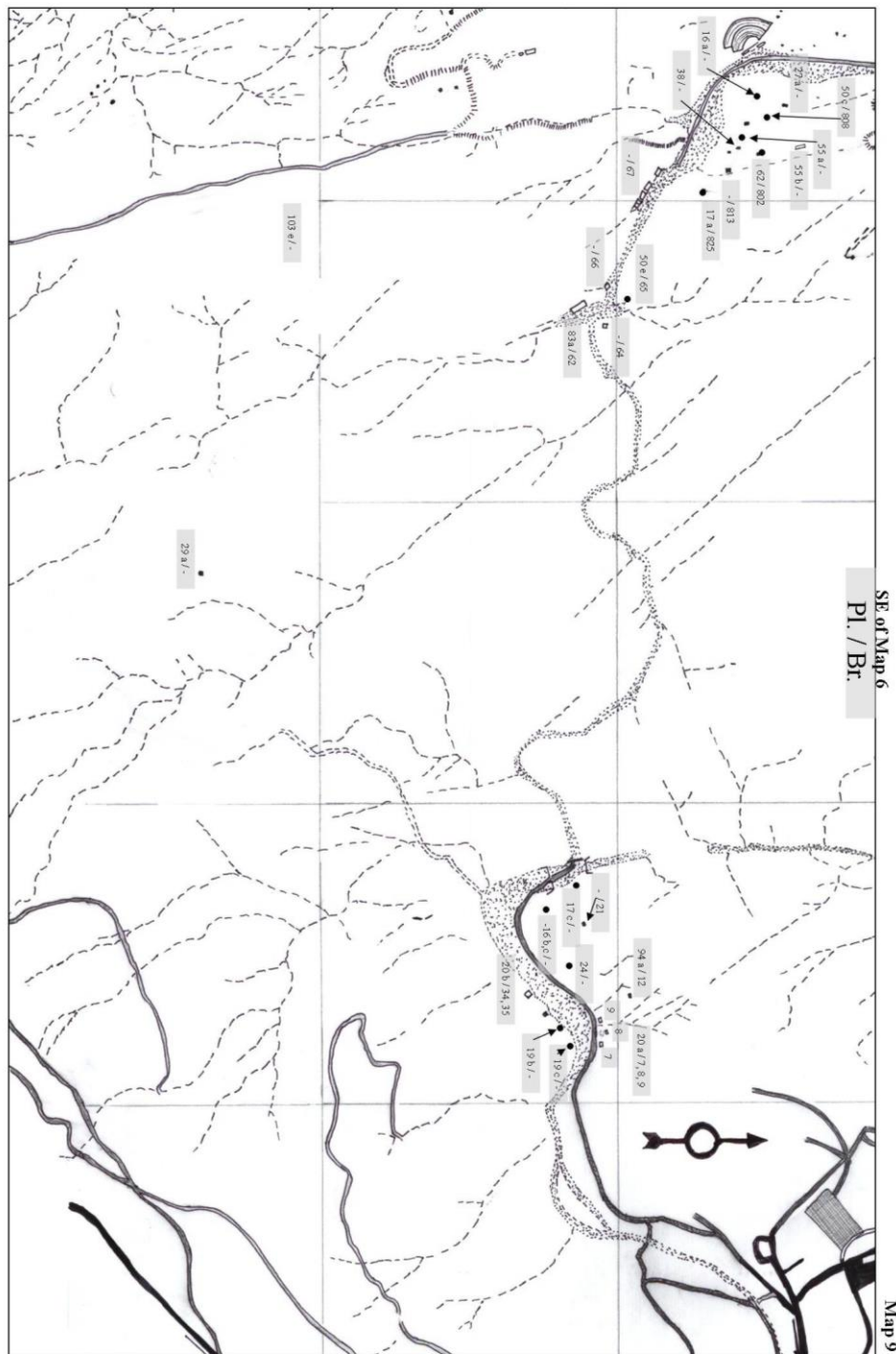
NE of Map 6



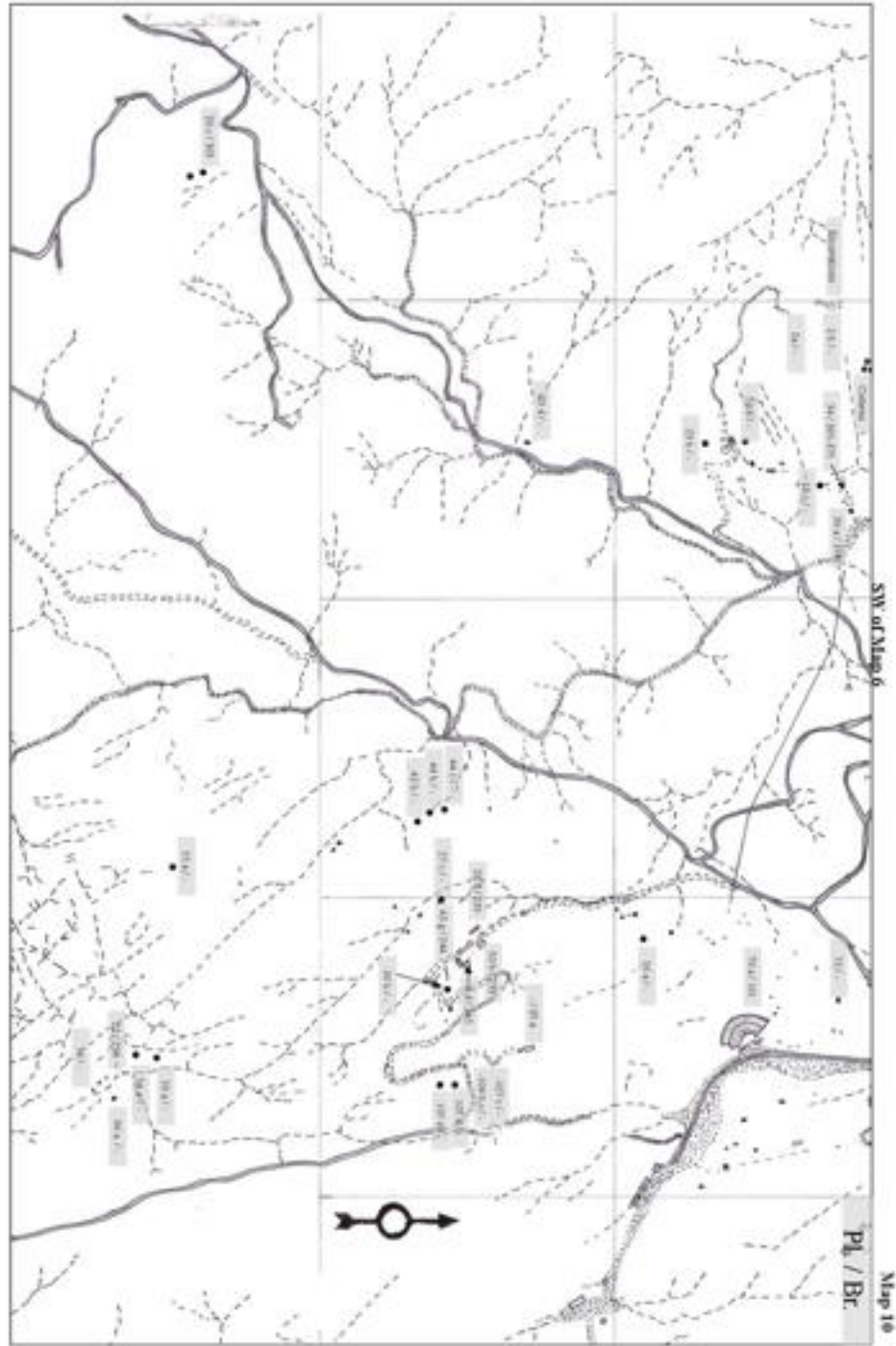
NW of Map 6



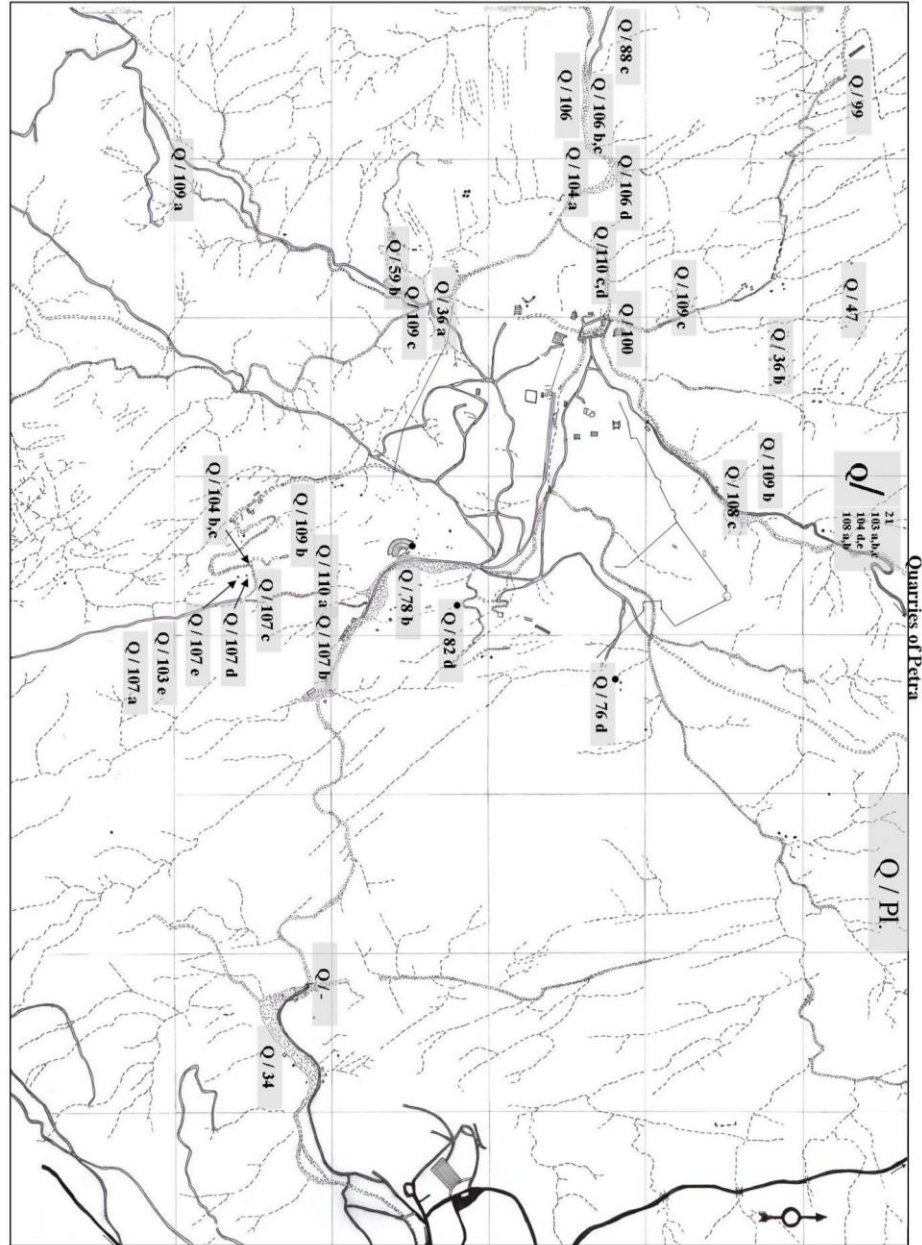
SE of Map 6



SW of Map 6



Quarries of Petra



PLATES

El-Beida (Beidha): Site and Excavation (s. 1966)



a. General view of el-Beida (Beidha) site



b. The excavations of el-Beida (Beidha)



c. Corridor workshop



d. Main house



e. Rectangular house



f. Circular house

Umm el-Biyārah



a. General view of Umm el-Biyārah (s. 1972)

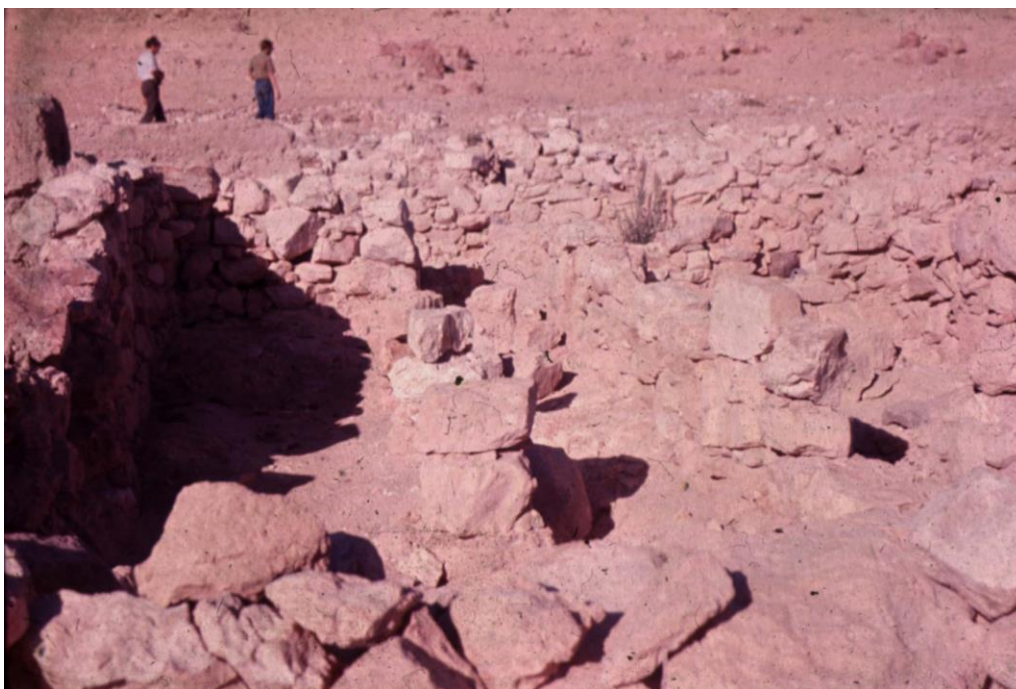


b. Excavations at Umm el-Biyārah (s. 1969)

Tawilan

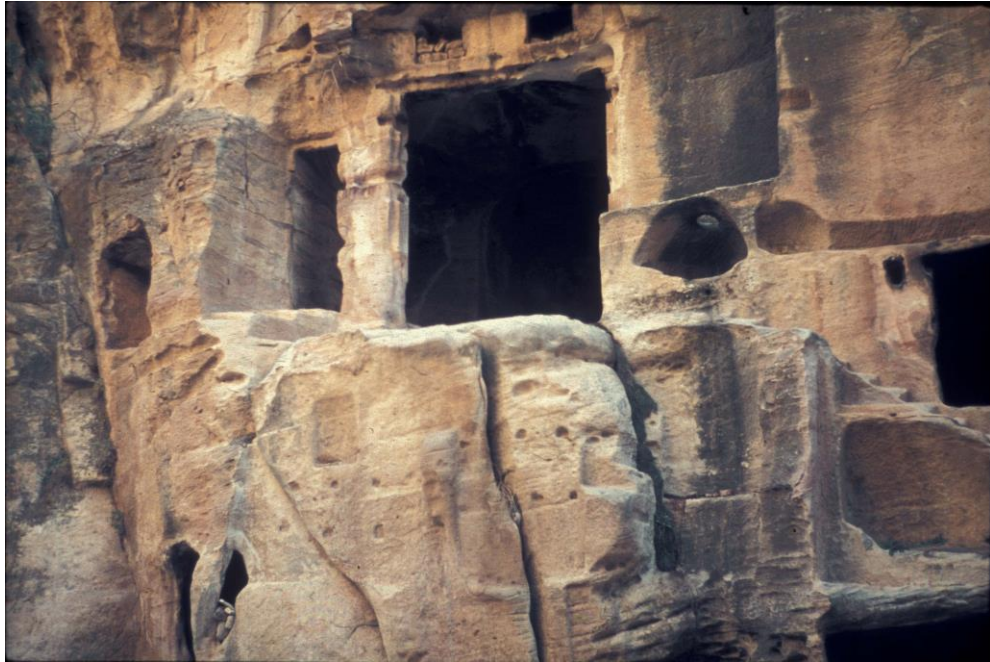


a. General view of Tawilan (s. 1969)

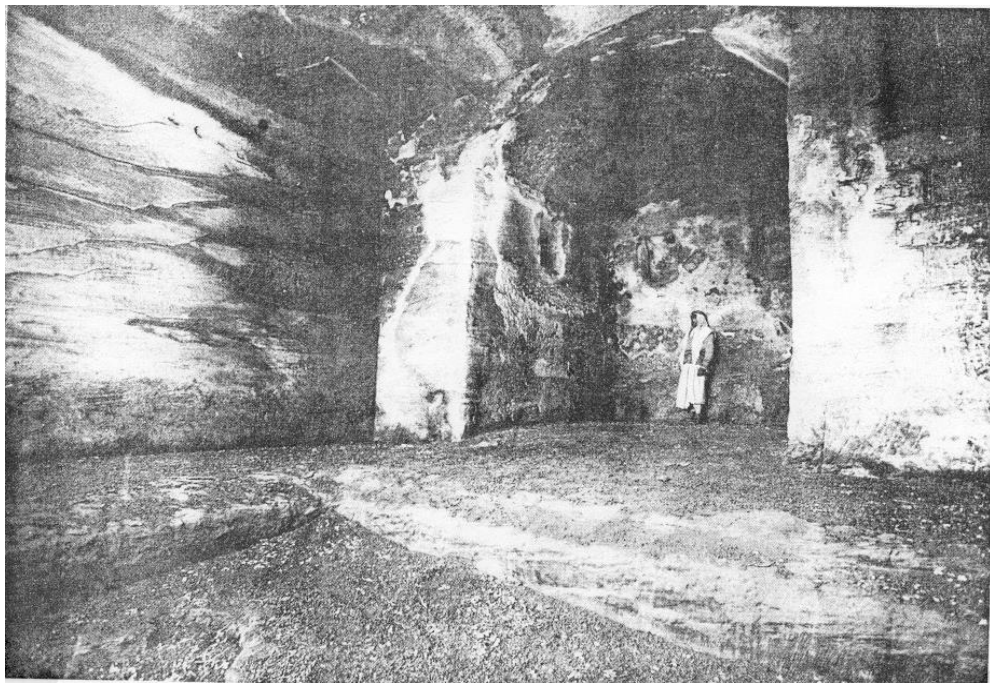


b. Excavations at Tawilan (temple?) (s. 1969)

The Painted House (Br. 849) at Siq el-Bārid



a. The façade (s. 3-8-2008)



b. Interior with vaulted alcove (after Glueck 1965)

The Painted House at Siq el-Bārid

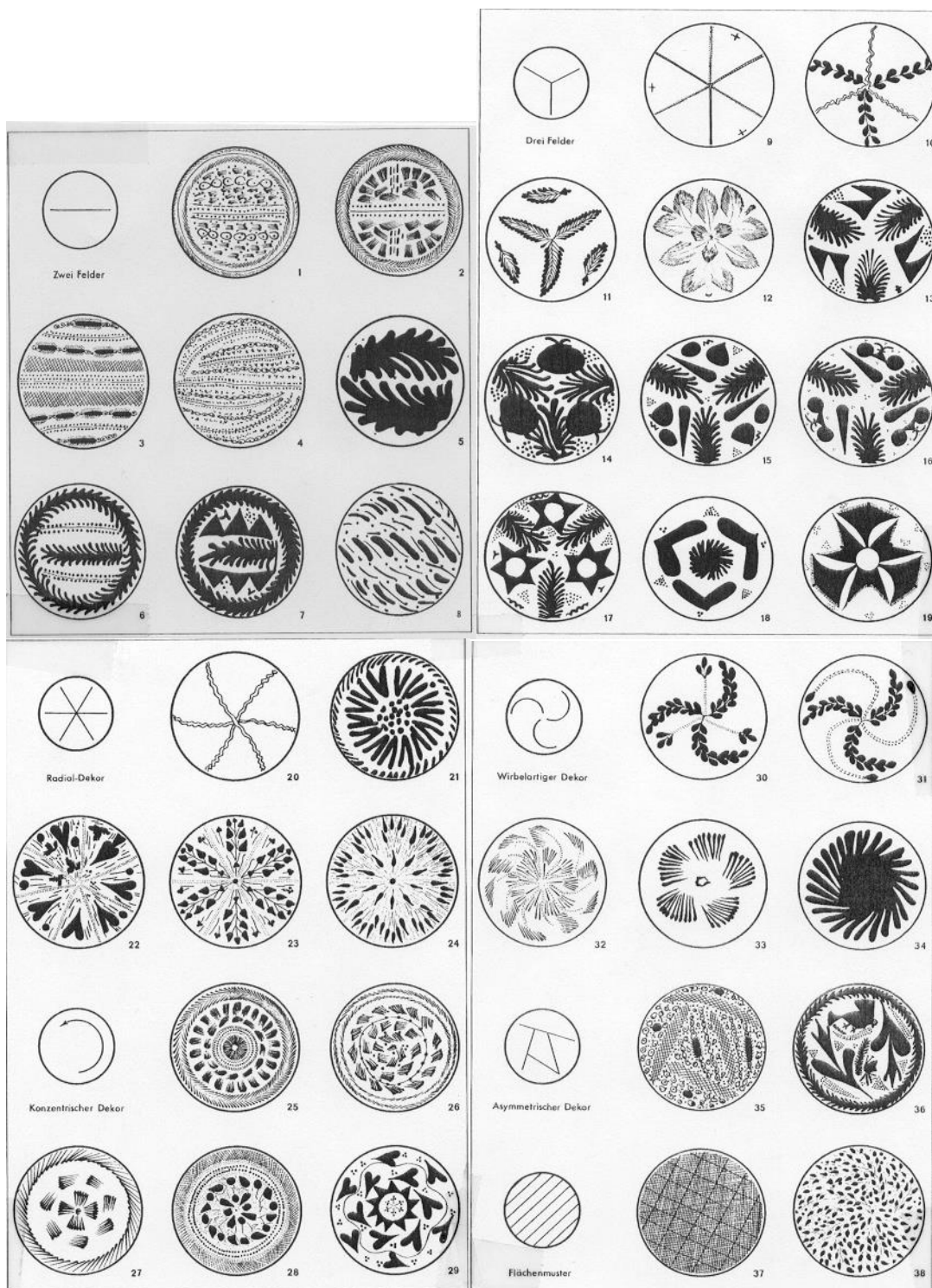


a. Mural on the ceiling (s. 1966)



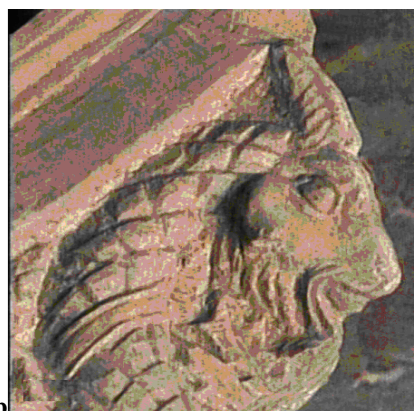
b. Details of part of the mural (s. 1966)

Designs on Painted Nabataean Pottery



a. After Schmitt-Korte, K. 1989: 214-217

Nabataean Capitals



a&b. Capitals decorated with plant and animal carvings / Winged Lions Temple



c. Capital from the Baths' area with carving of animal head



d. Capitals at one of Siq el-Bārid Caves (Br. 847)

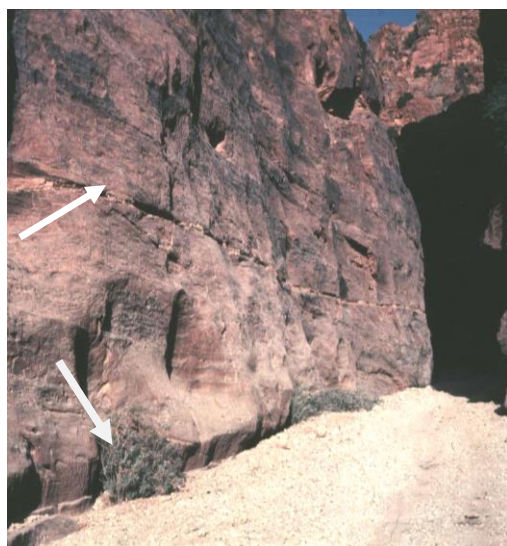
Hydraulic Instillations



a. Cistern at north side of al-Khubthah (16-13-1991)



b. Water channel above the Theater (14-21-1991)



c. Water pipe and channel at Outer Siq (s. 1972)



d. The Garden Tomb and Dam (Br. 244, 245) (9-21-1997)

Nabataean Coins with Images of Kings and Queens



a. King Aretas IV and Queen Shaqilat (Shaqilath) (after Lindner, 1989: 74)



b. King Rabel II and Queen Gamilat his sister and wife (after Lindner, 1989: 83)



c. King 'Oboda III and Queen Huldo (after Lindner, 1981: 130)

Turkmaniyyah Tomb (Br. 633)

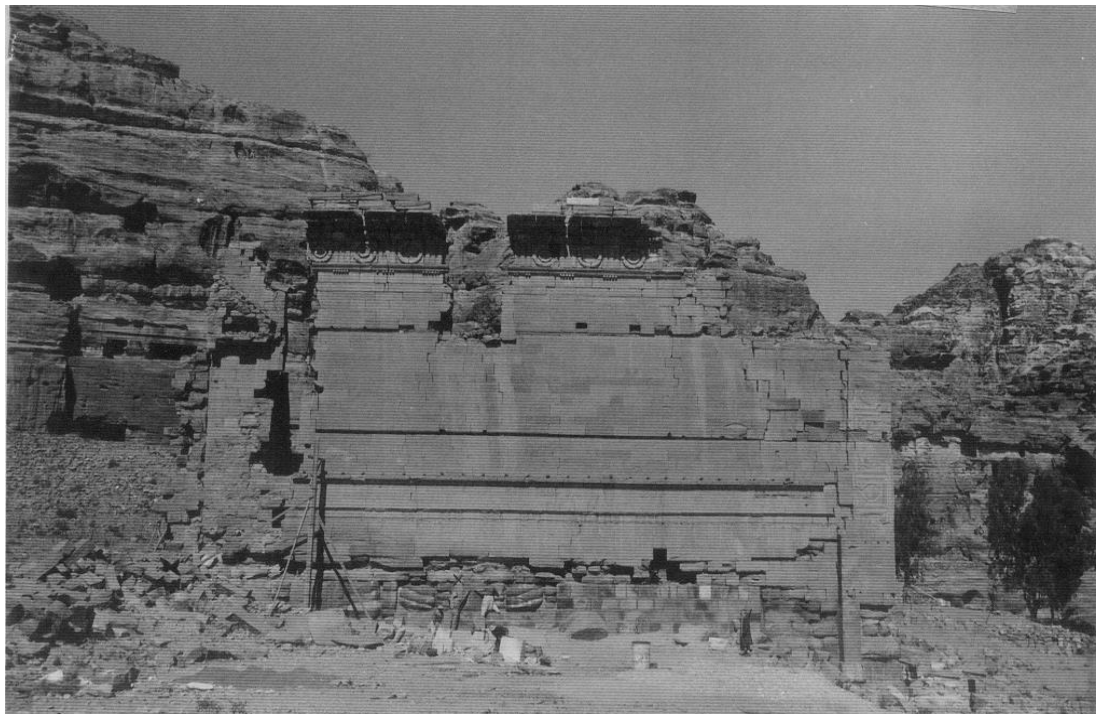


a. The façade (23-36-1991)

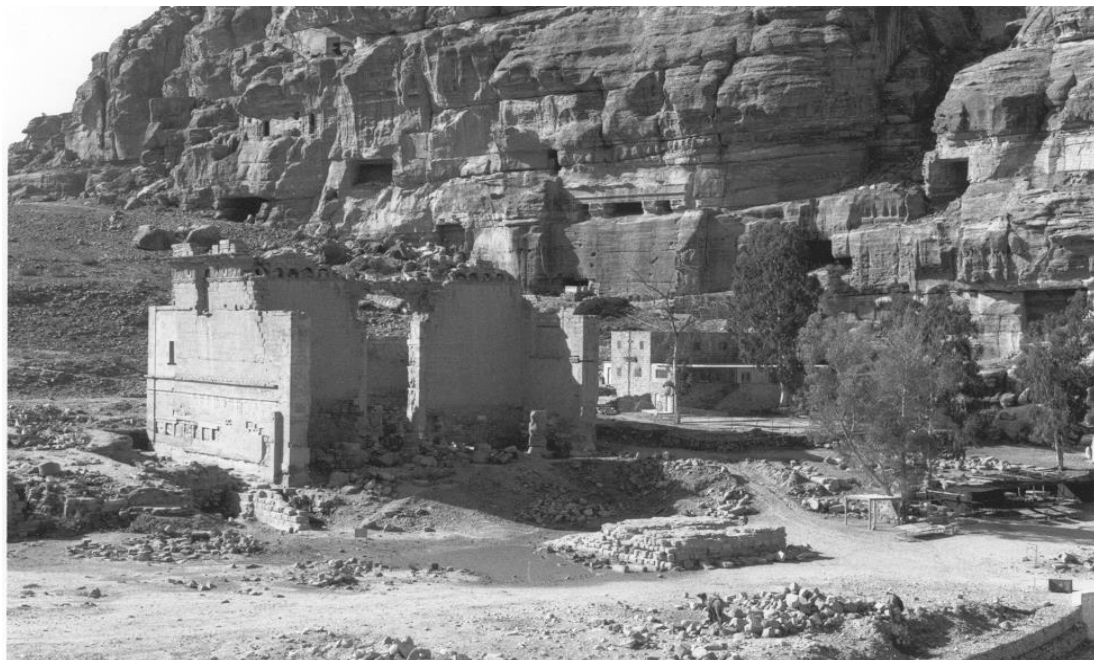


b. The inscription (23-37-1991)

Temple of Qasr al-Bint (Br. 403)



a. Start of the restoration at the eastern wall in 1962



b. The wall and corner after the restoration as seen in 1994 (11-22-1993)

Plaster in Caves



a. Ceiling of a Painted House in Wādi as-Siyyagh (21-0-1994)



b. Cave on east side of el-Habis (9-2-1991)



c. Tomb on the way to ed-Dayr (17-35-1991)



d. Tomb on the way to ed-Dayr (17-34-1991)



e. Next to the Lion Tomb on the way to ed-Dayr (5-1-1990)



f. Façades at ath-Thunabe

Current Use of Caves



a. New use of caves by al-Bdul (al-Bedul) until 1982

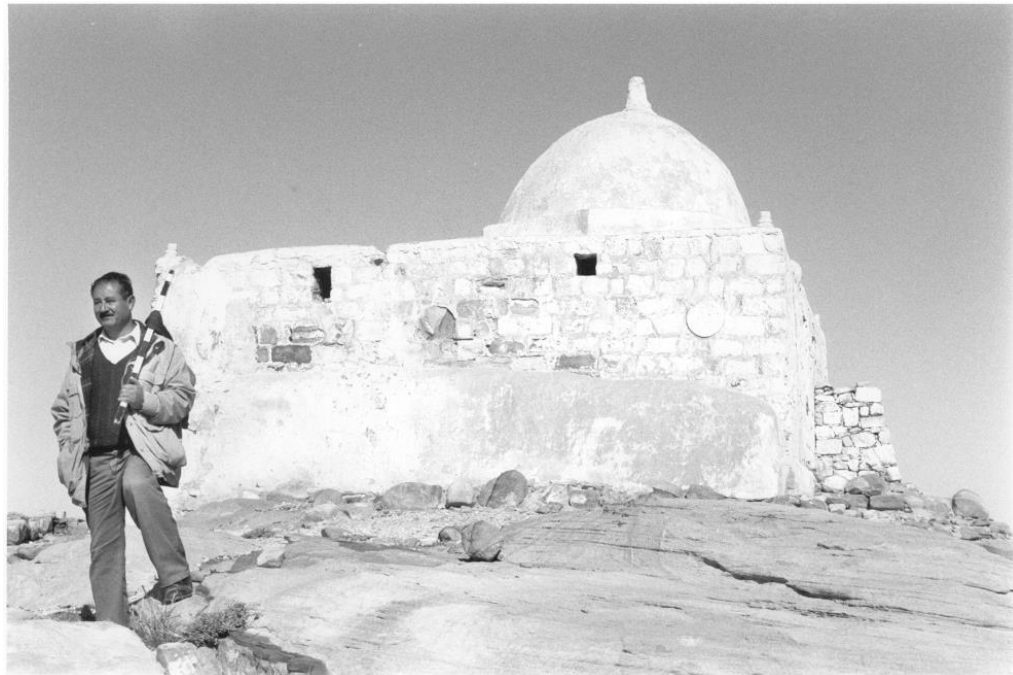


b. Cave used as a shop until 1982

Jabal Hārūn and Tomb

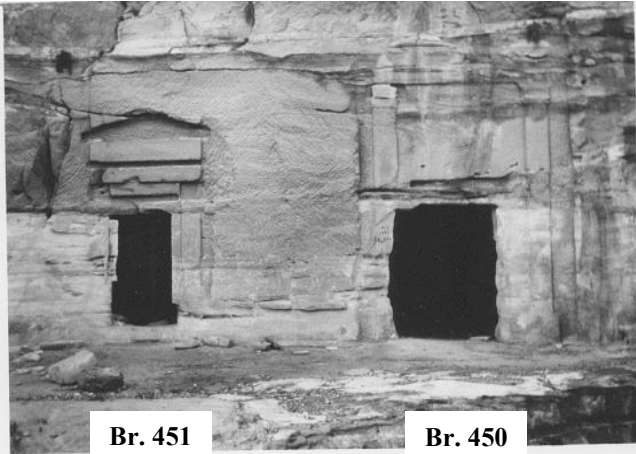


a. General view of Jabal Hārūn (s. 1994)

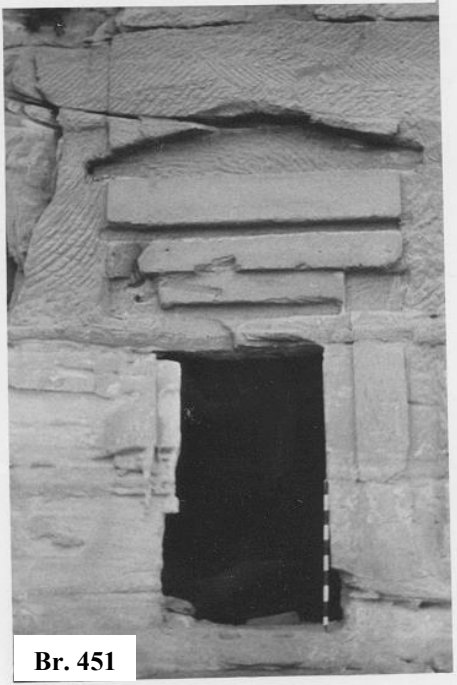


b. The Tomb of Hārūn (15-16-1994)

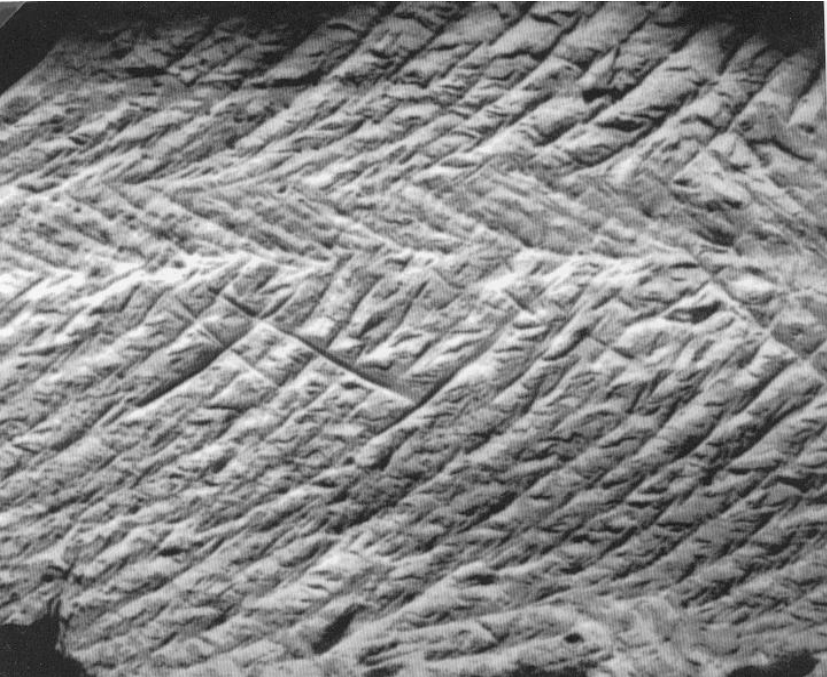
Tombs South of the Lions' Tomb (Br. 450, 451)



a. Rectilinear decoration on façade (5-6-1990)



b. Detail of Br. 451 in a (5-6-1990)



c. Concave shaped dressing on the right side of tomb above (23-20-1991)

Shaft Graves



a. Single shaft grave with white limestone covering slabs, located opposite the Theater (20-3-1991)

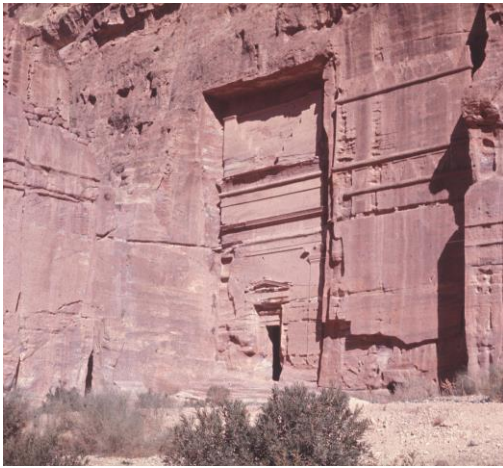


b. Shaft graves in groups opposite es-Siq entrance (2-24-1991)



c. Shaft graves in groups opposite es-Siq entrance (3-2-1991)

Zayd Tomb (Br. 825) and Nefeshes



a. The tomb's entrance (s. 1970)



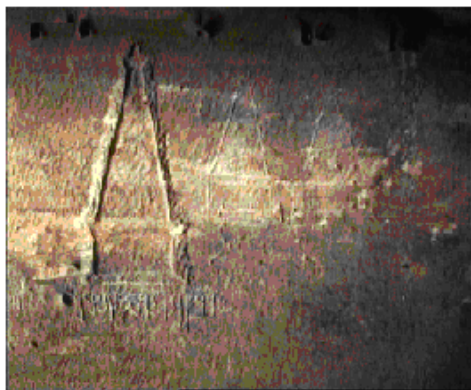
b. The tomb's interior (s. 1970)



c & d. Obelisks (Nefeshes) with inscriptions opposite es-Siq's entrance (s. 1970)



e. Nefeshes inside Zayd's Tomb



f. Detail of 'image e' (s. 1970)



g. Detail of 'image f' (s. 1970)

Shaft Tombs and Cup Holes



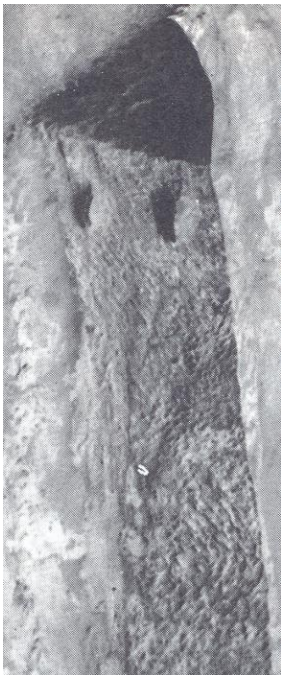
a. Area B west of the Urn Tomb (notice the shaft tomb in the middle)



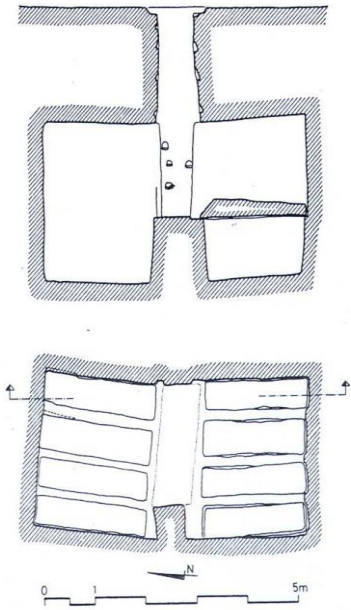
b. Cup Holes at ath-Thunabe (2-3-2000)



c. Cup holes next to a shaft tomb below Umm el-Biyārah (10-13-1993)



d. Shaft Tomb area B1-1 (after Zayadine, 1979)

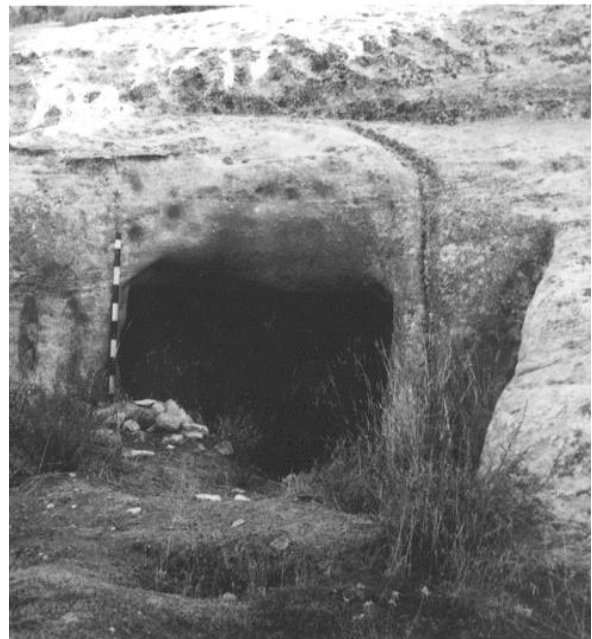


e. Ground plan and section of shaft tomb in area B1-1 (after Zayadine, 1989)

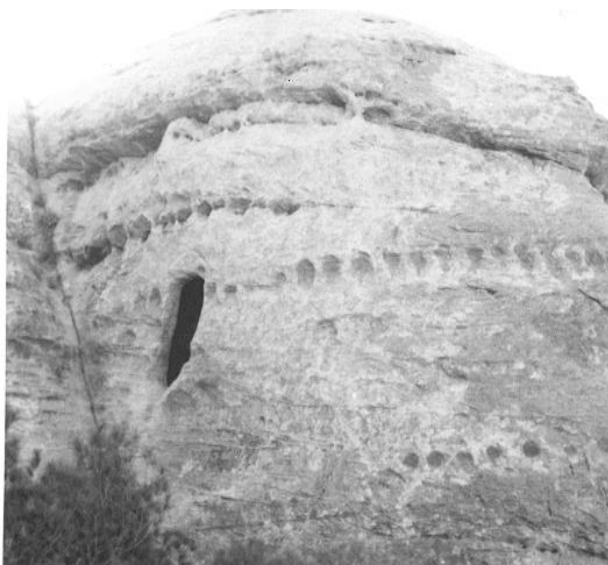
Simple Cave Openings



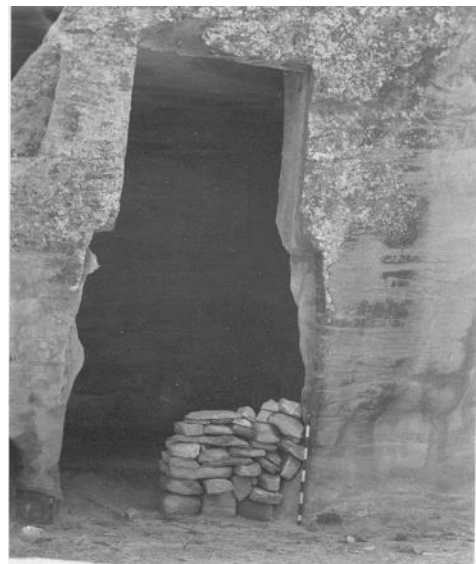
a. Cave with simple opening at ath-Thunabe (17-17-1991)



b. Cave with a simple opening, with a groove and Dushares east of the Obelisk Tomb (2-20-1991)

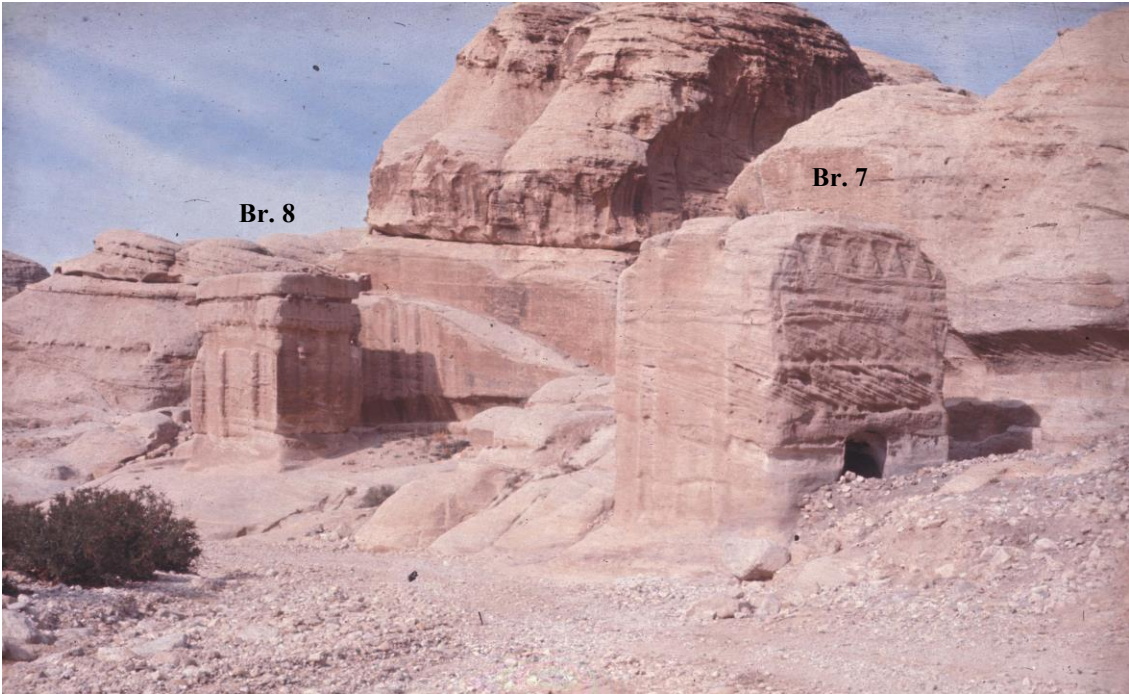


c. Simple opening and holes east of the Obelisk Tomb (2-19-1991)

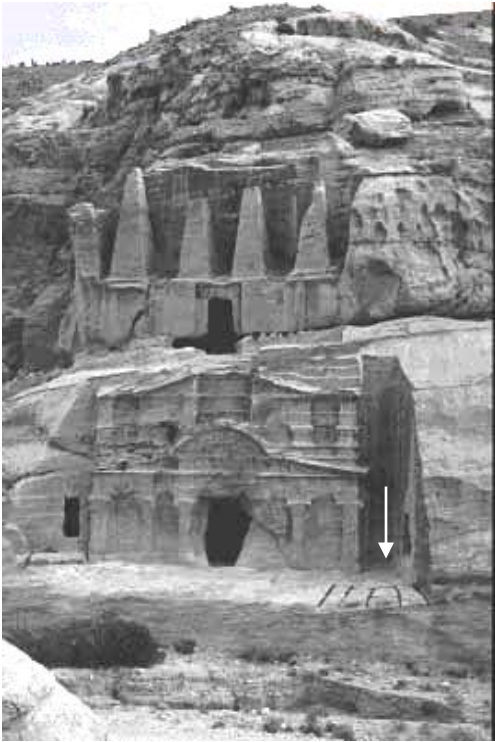


d. Rectangular simple opening leading to a small chamber/ way to ed-Dayr (17-33-1991)

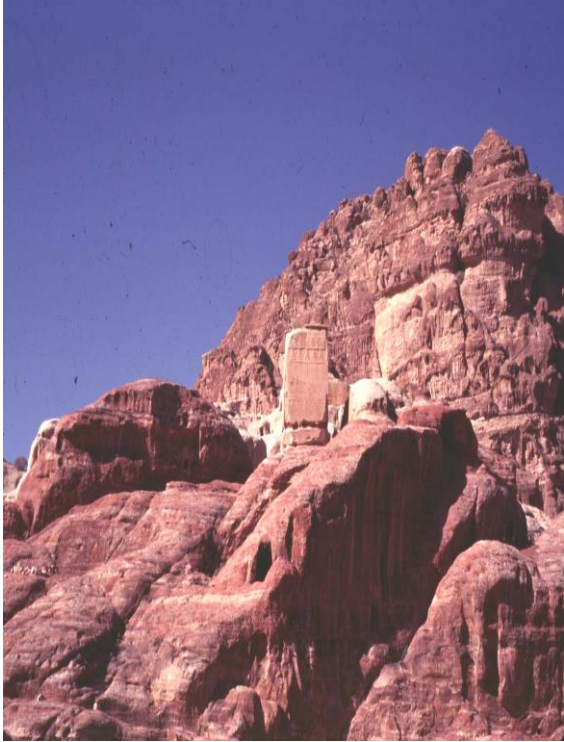
The Sahrijs



a. Sahrijs opposite the Obelisk Tomb (Br. 7&8) (2-23-1991)



b. Triclinium and Obelisk Tomb (Br. 34, 35) (19-19-1991)



c. Sahrij at ath-Thughrah (Br. 303) (13-18-1991)

Umm Sayhun Quarry



a. The quarry and sand debris in the front (11-24-1993)

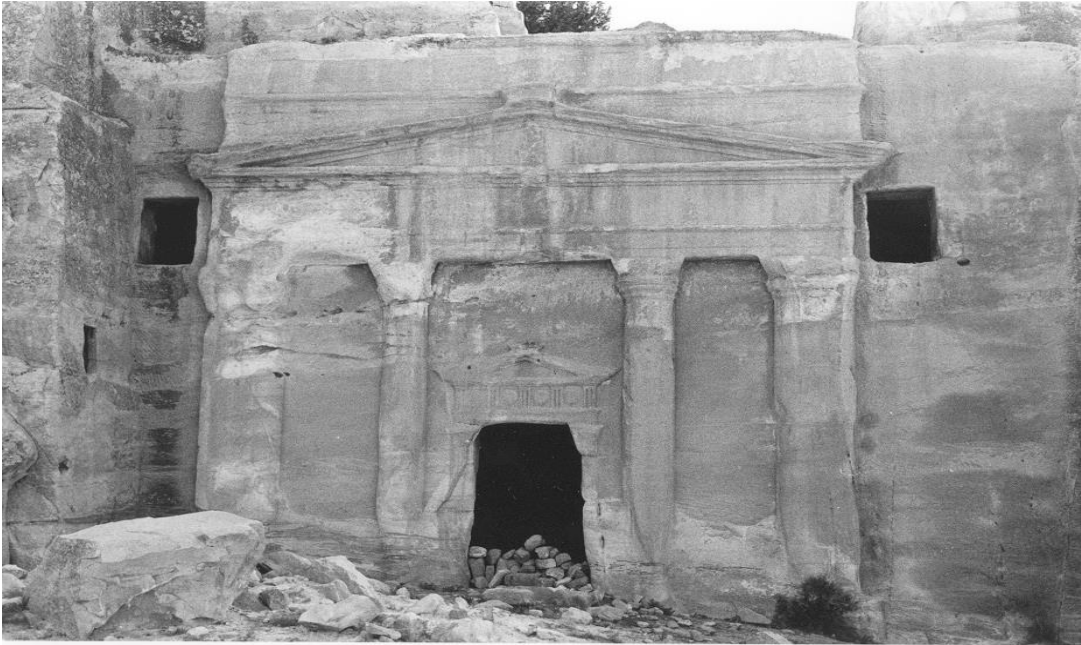


b. The village of Umm Sayhun in 2008



c. Accumulation of sand from the quarry (4-6-1991)

Façade and Interior of Tomb (Br. 258) at Wādi an-Numayr



a. Façade with troughs (5-11-1997)

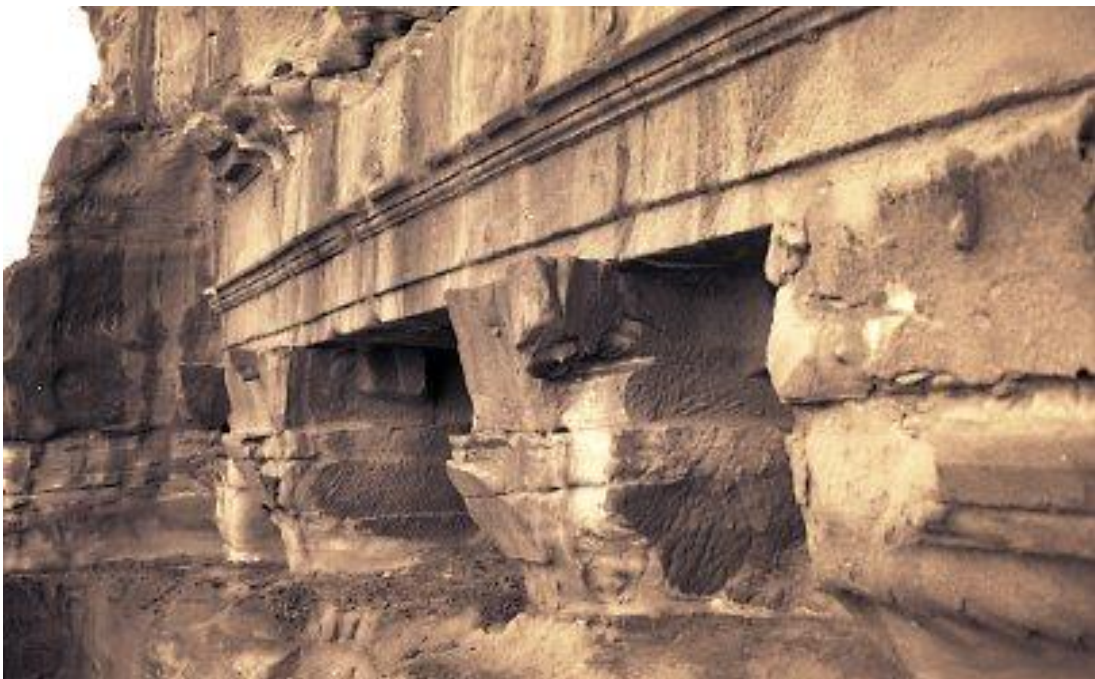


b. Interior with corbelled recesses of (a) above (5-5-1997)

The Unfinished Tomb of al-Habis (Br. 396)



a. The entire façade

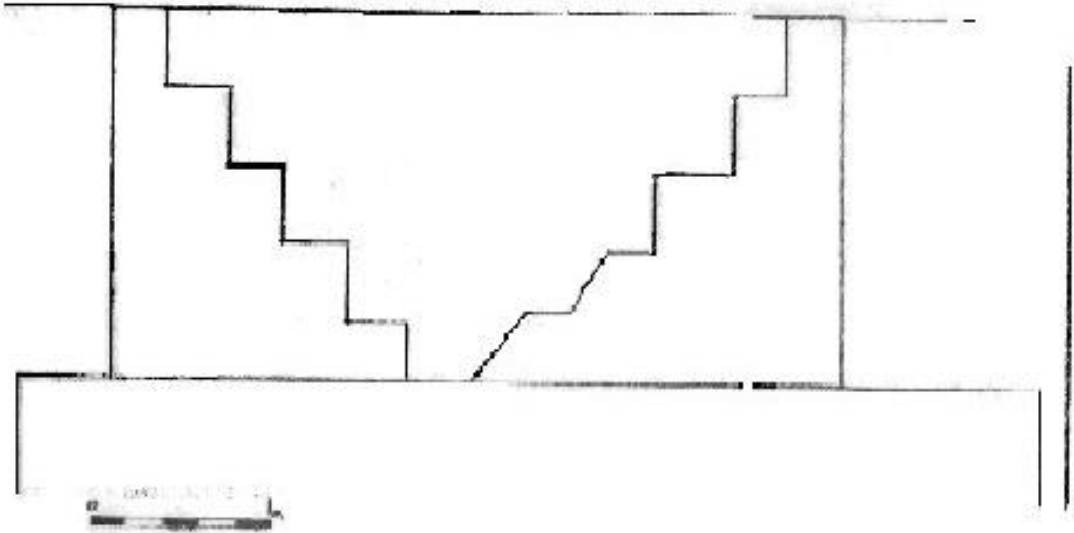


b. Start carving the Façade (17-18-1994)

Unfinished Façade

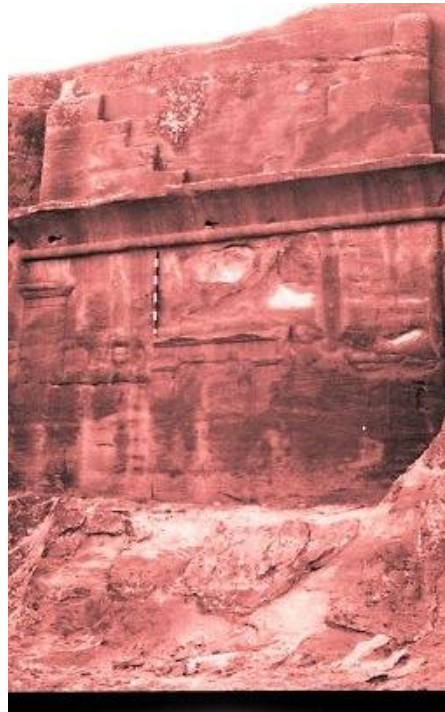


a. Opposite the Obelisk Tomb (3-14-1993)

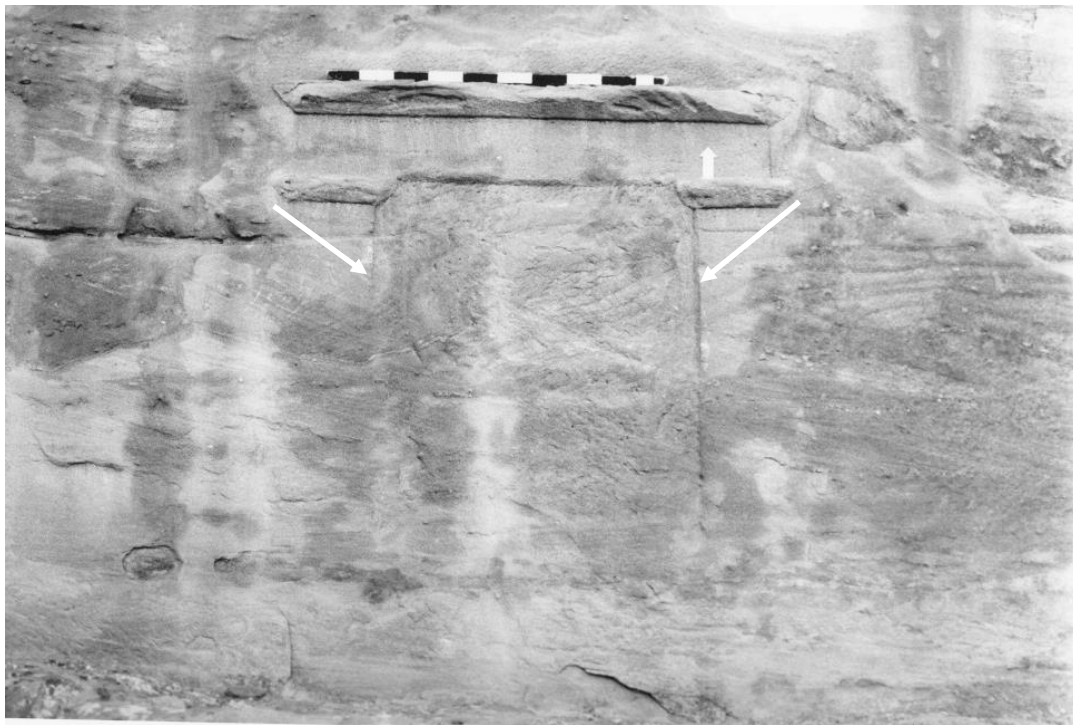


b. Drawing of the façade in a.

Unfinished Façade at al-Mu‘aysrah ash-Sharqiyyah (Br. 553)



a. The façade (drawing Pl. 40) (20-21-1994)



b. Detail of the lower part of a, showing an entrance marked but not carved (20-22-1994)

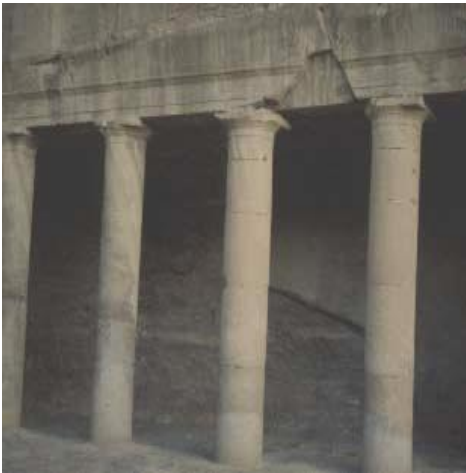
The Urn Tomb (Br. 772) and the Soldier Tomb (Br. 239)



a. General view of the Urn Tomb (Br. 772) (1-22-2000)



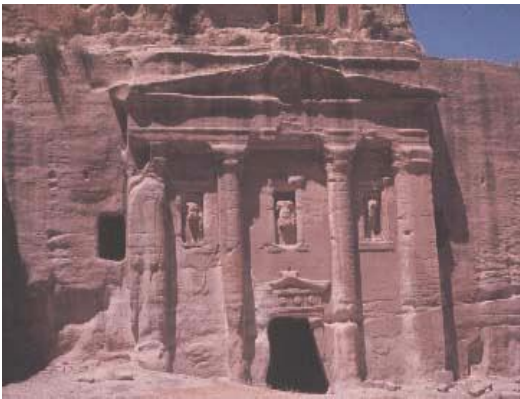
b. Staircase under restoration (s.1978)



c. Columns of the Urn Tomb, north side (s. 1979)

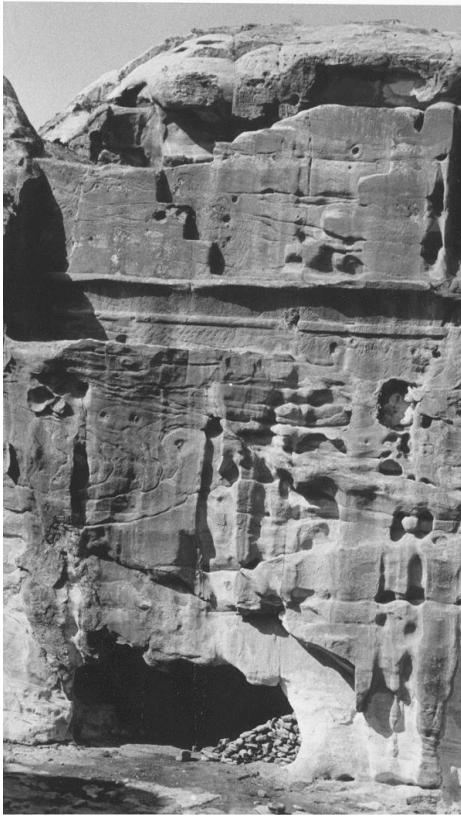


e. Slab's impressions at the Urn Tomb staircase (s. 1978)

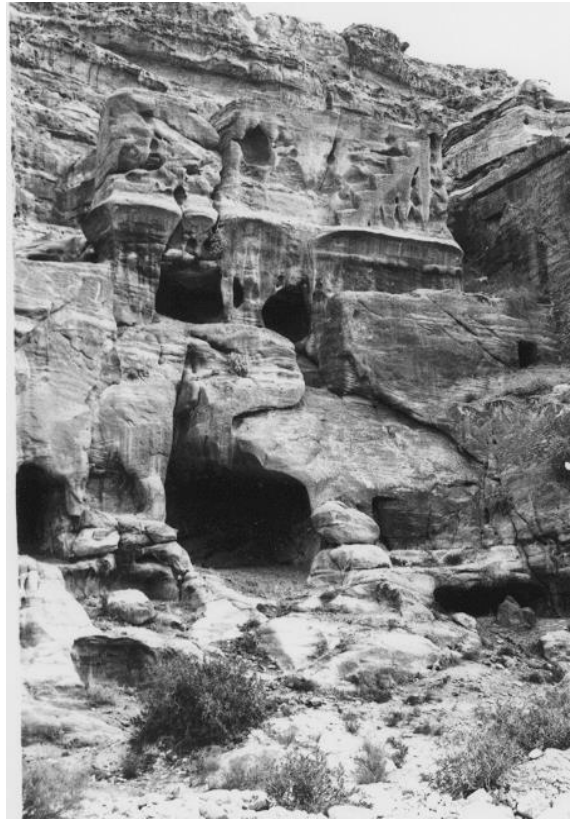


d. The Soldier Tomb (Br. 239) (s.1972)

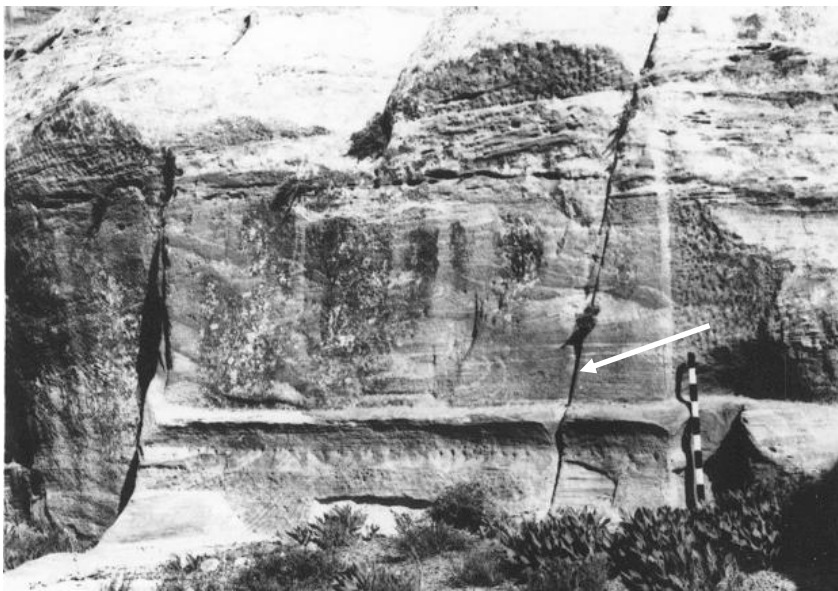
Examples of Unfinished Half Gable Façades



a. Mughur an-Nasārā (Br. 677)
(4-12-1993)



b. Opposite the Theater (12-24-1993)



c. Wādi Farasah (6-5-1993)

Group 5 - Exceptions



a. South of Umm Sayhun (22-12-1994)

b. Ath-Thughrah (13-15-1991)



c. Al-Mu'asrah ash-Sharqiyyah
(15-1-1991)

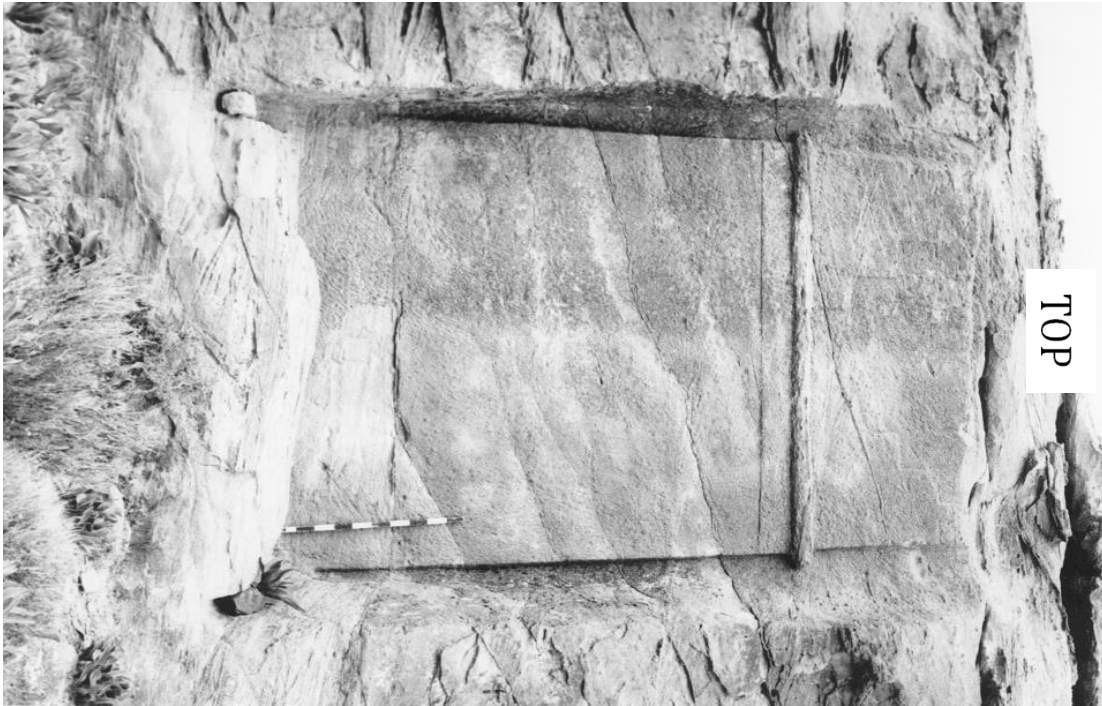
d. Tombs North of al-Khaznah
(10-18-1991)



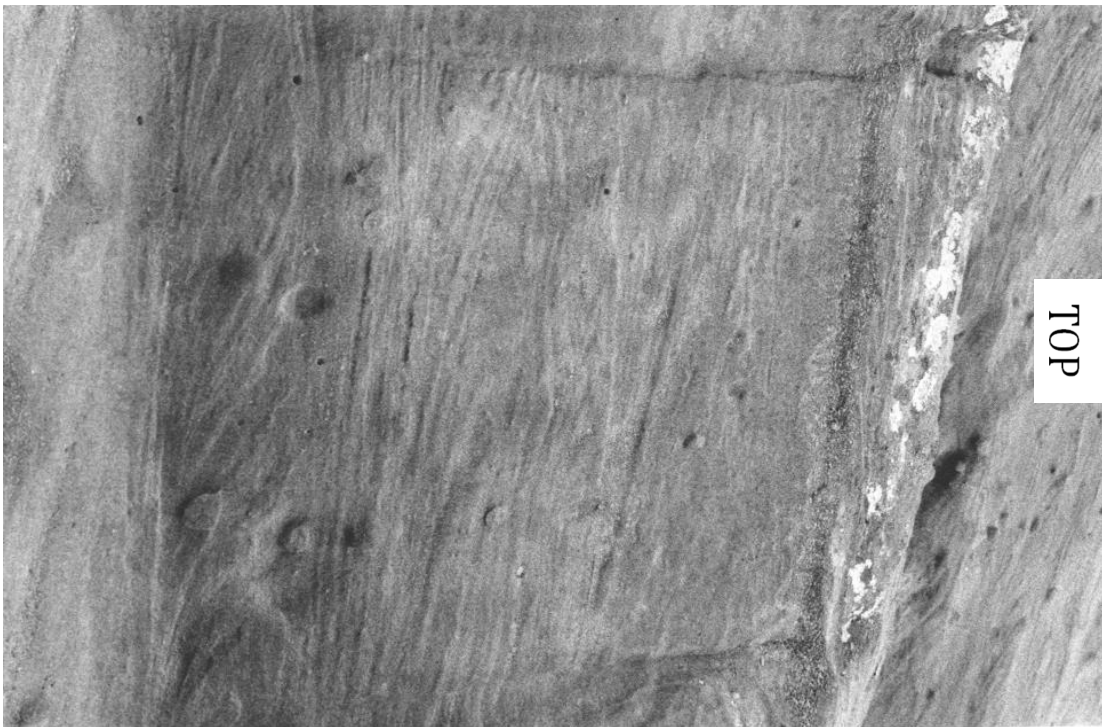
e. Opposite the Theater (11-21-1993)

f. Al-Habis / Behind the Museum
(1-20-1993)

Façade Carving

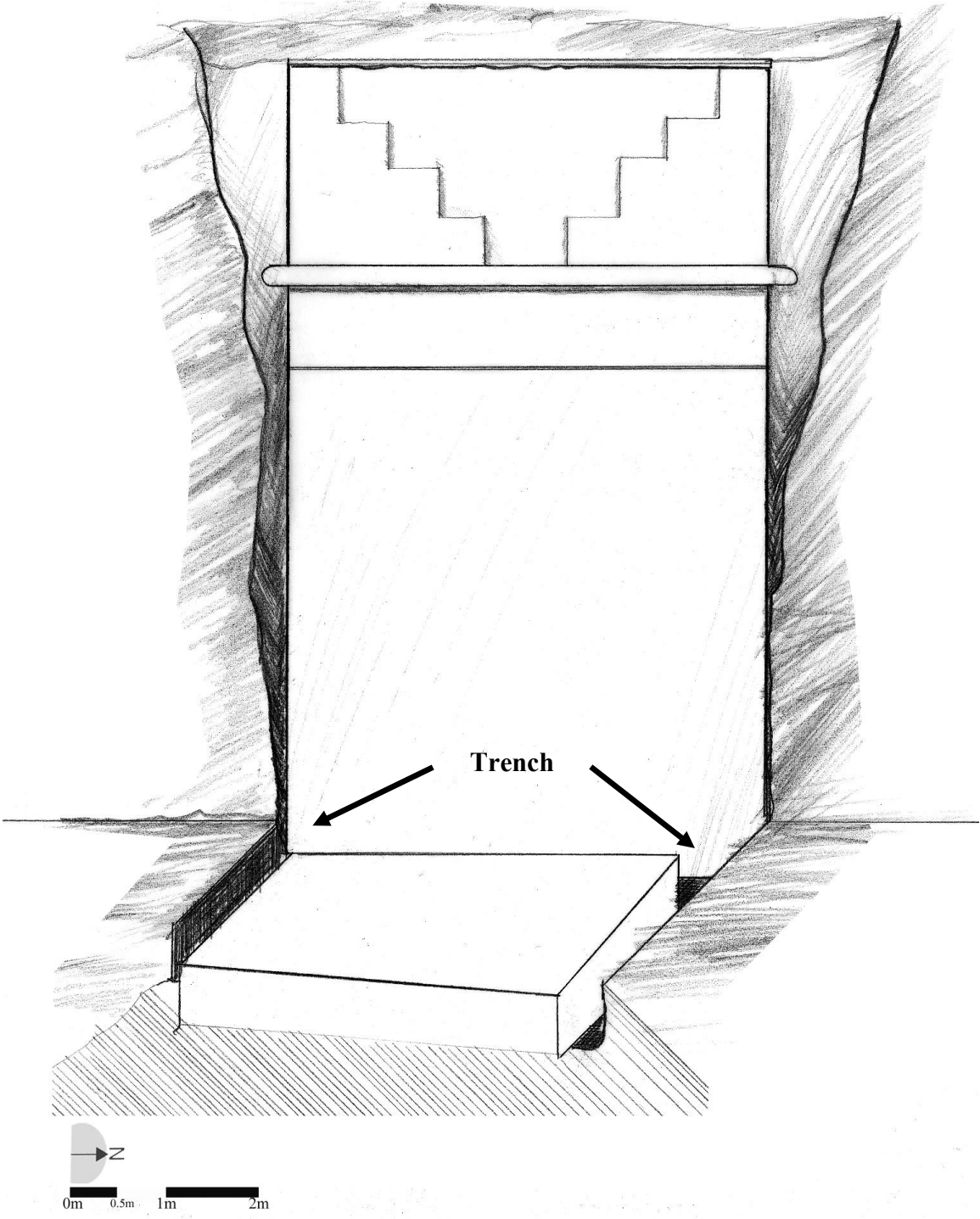


a. Unfinished façade at Al-Qantarah (1-20-1994)



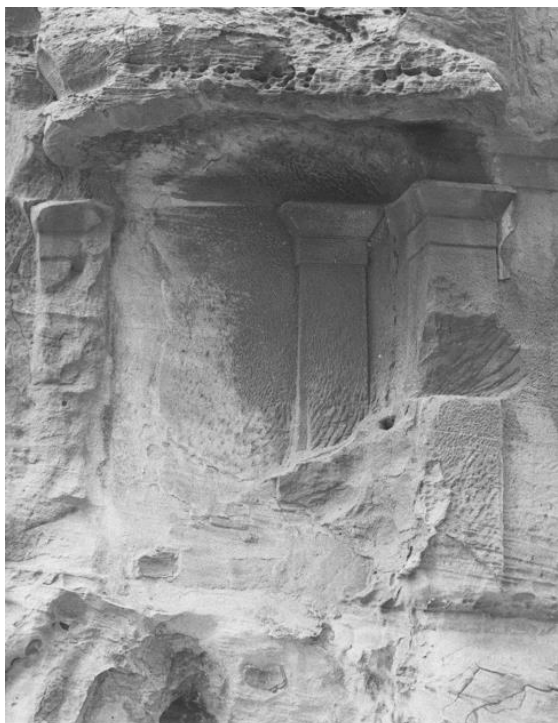
b. Unfinished carving on the way to Umm el-Biyārah (10-20-1993)

Al-Qantarah Façade



Drawing of (Pl. 29a)

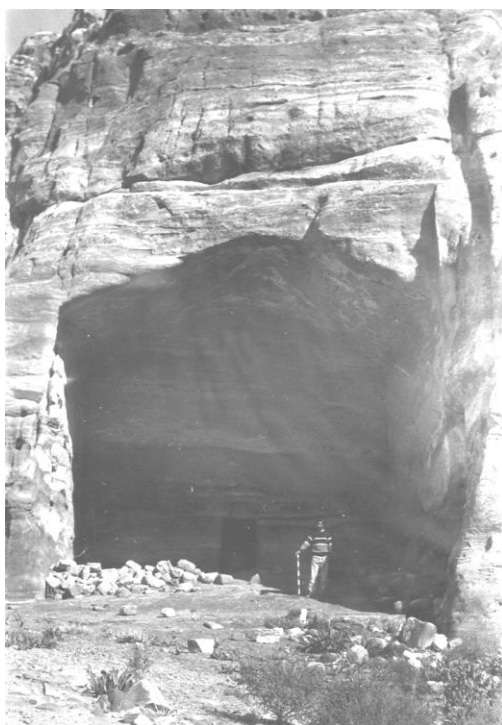
Unfinished Façades of Group D



a. At Siq al-Bārid (15-20-1994)

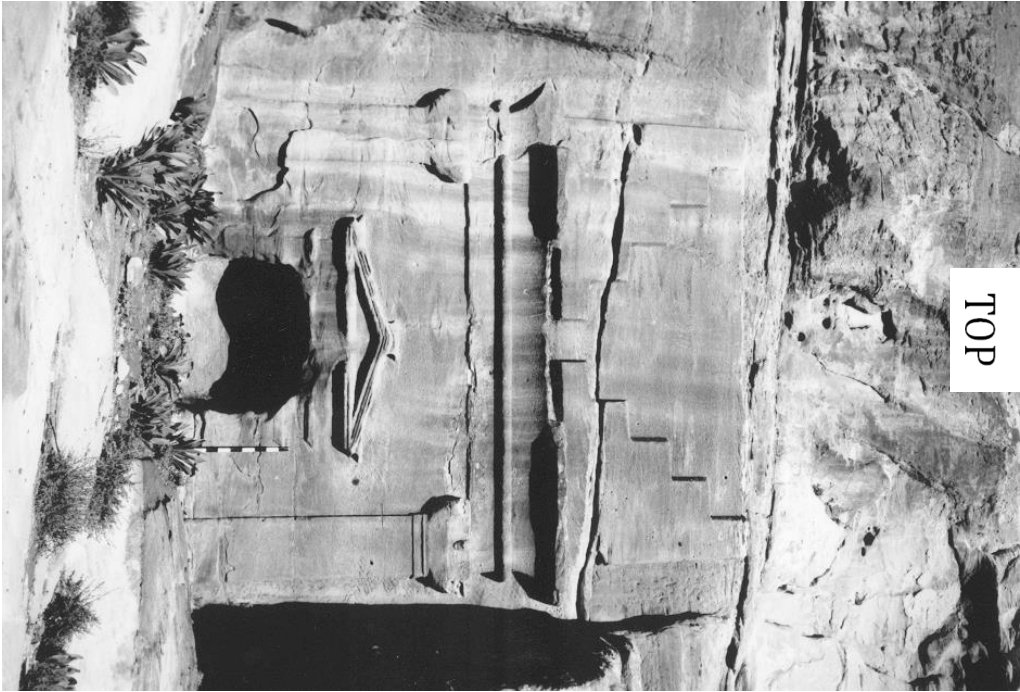


b. Detail of (a)

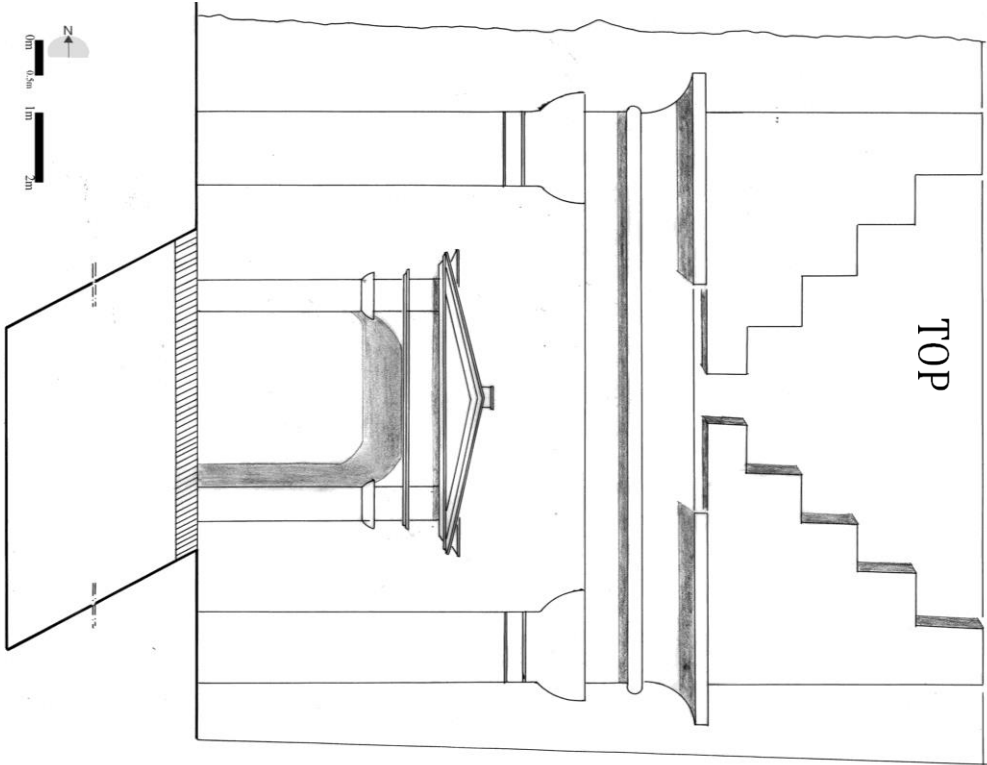


c. Cave north side of al-Khubthah (16-8-1991)

Half Gable of Unfinished Façade



a. Unfinished façade at Wādi ed-Dayr (18-8-1994)

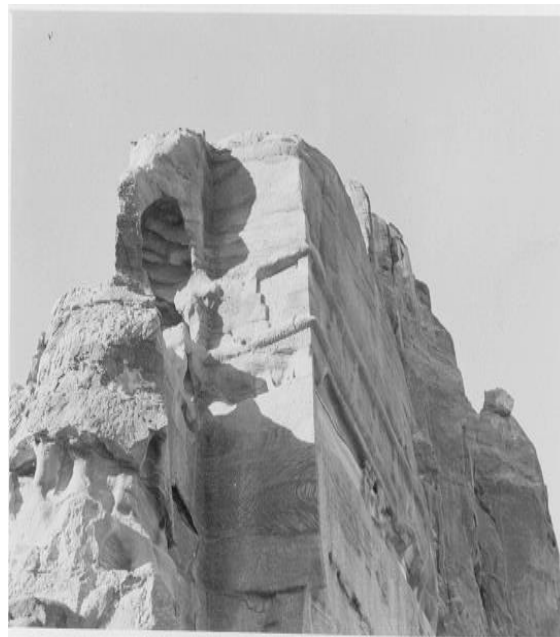


b. Drawing of the façade (a)

Unfinished Façades with Single and Double Bands of Gables



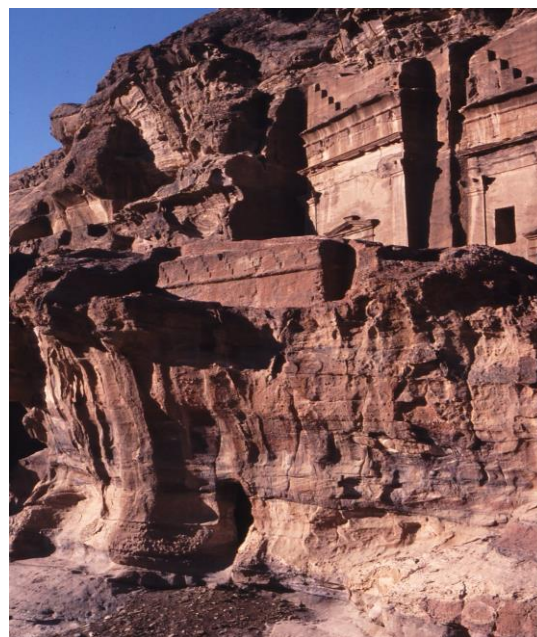
a. At ath-Thunabe (17-21-1991)



b. On the way to Jabal Hārūn (14-18-1991)

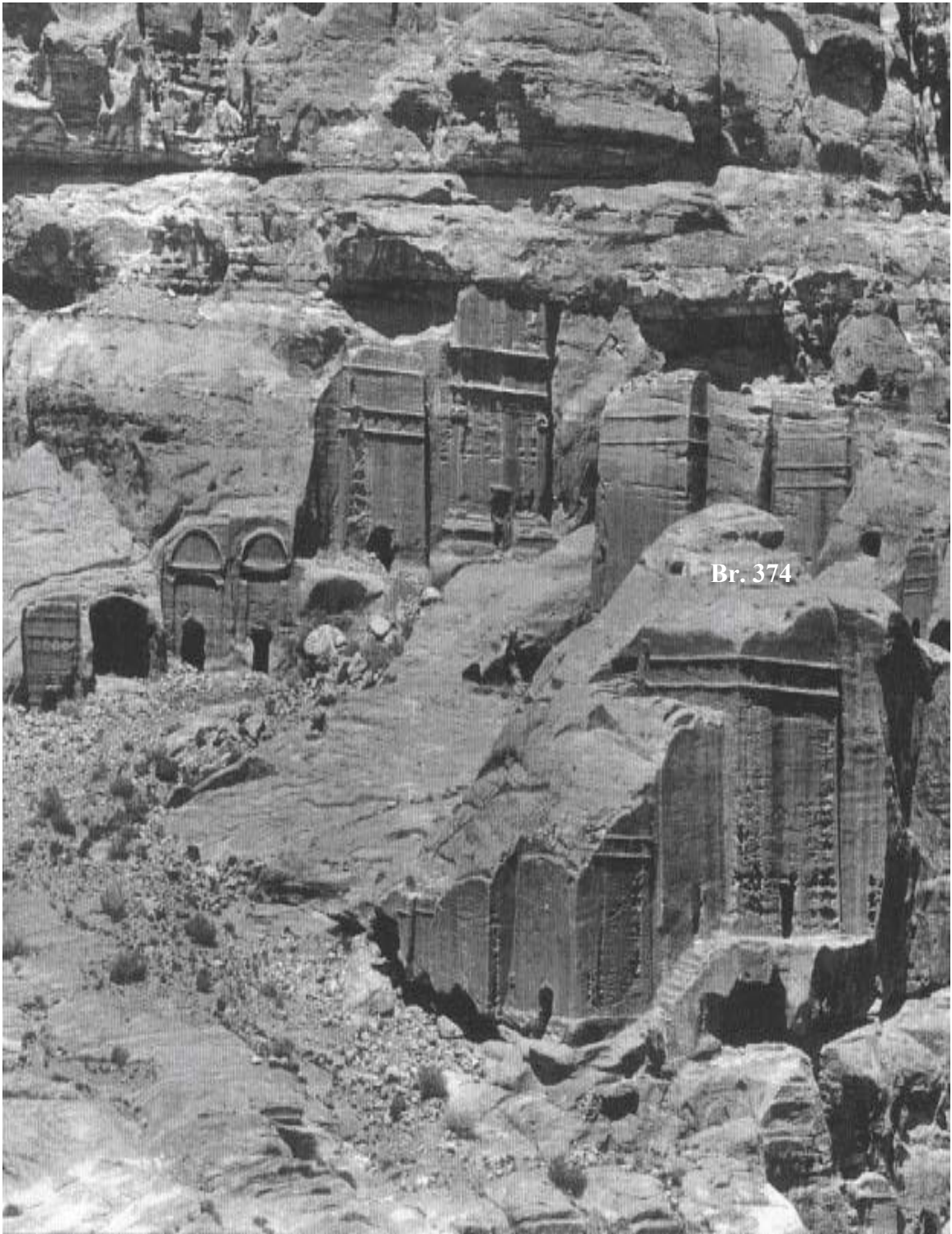


c. At the foot of Umm el-Biyārah
(Br. 374) (10-15-1993)



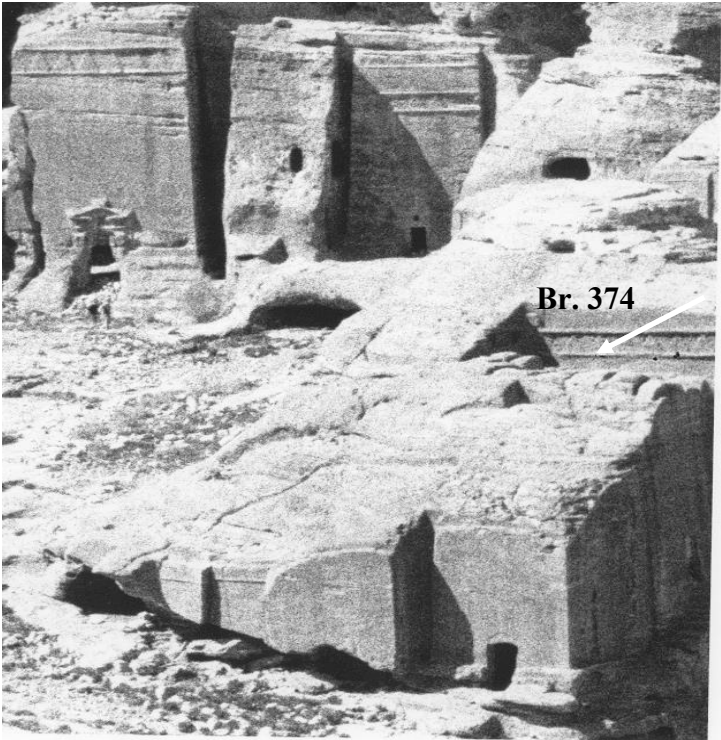
d. At ath-Thunabe (s. 2-21-2008)

Group of Finished and Unfinished Façades (Br. 365-375)



a. Façades at the eastern foot of Umm el-Biyārah (17-5-1994)

Examples of Unfinished Facades

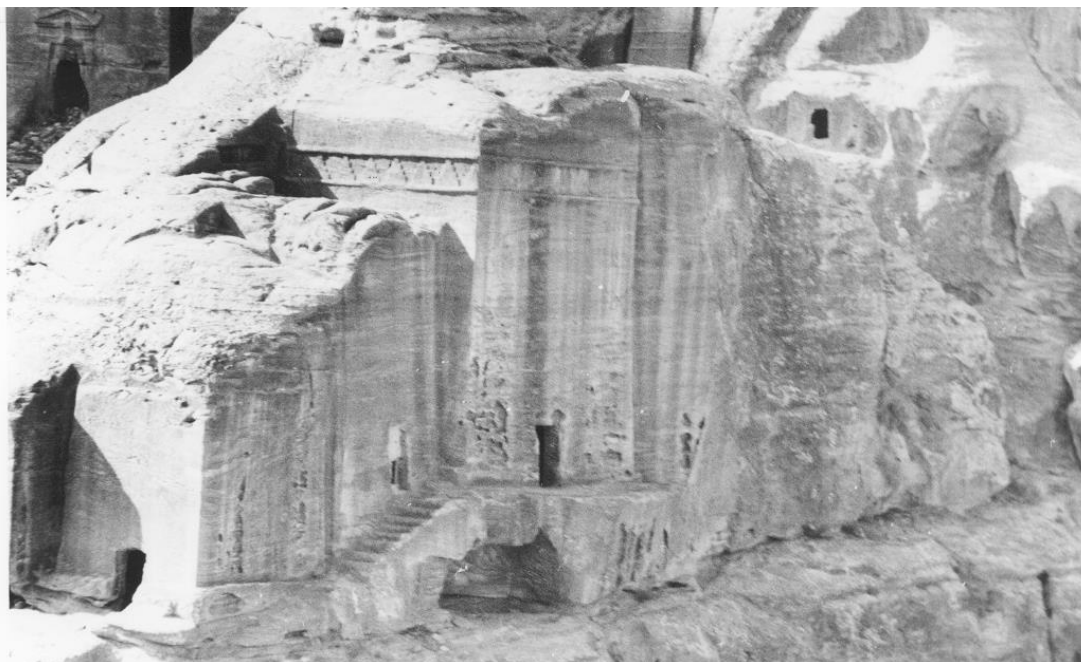


a. Group of façades with gables, two with no decoration, and two with a single band of gables (3-15-2000)

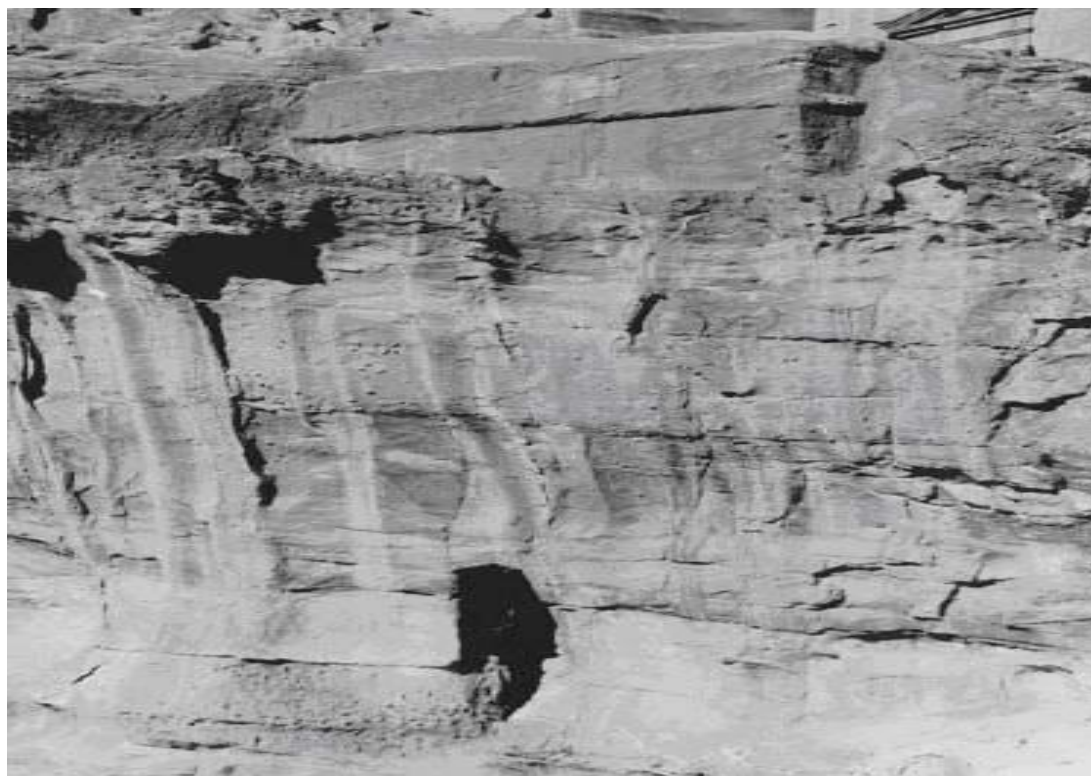


b. West corner of façade (Pl. 33c) showing half-gable (Br. 374) (10-16-1993)

Detail of Unfinished Façades



a. At the foot of Umm el-Biyārah (right side of Pl. 34) (Br. 374) (17-5-1994)



b. At ath-Thunabe (detail of Pl. 33d) (2-35-2000)

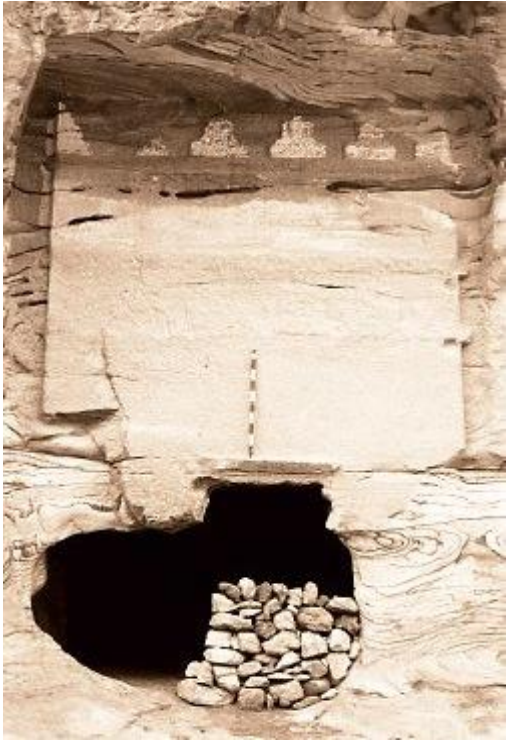
Examples of Unfinished Façades with Double Band Gables



a. At ath-Thunabe (s. 2-14-2008)

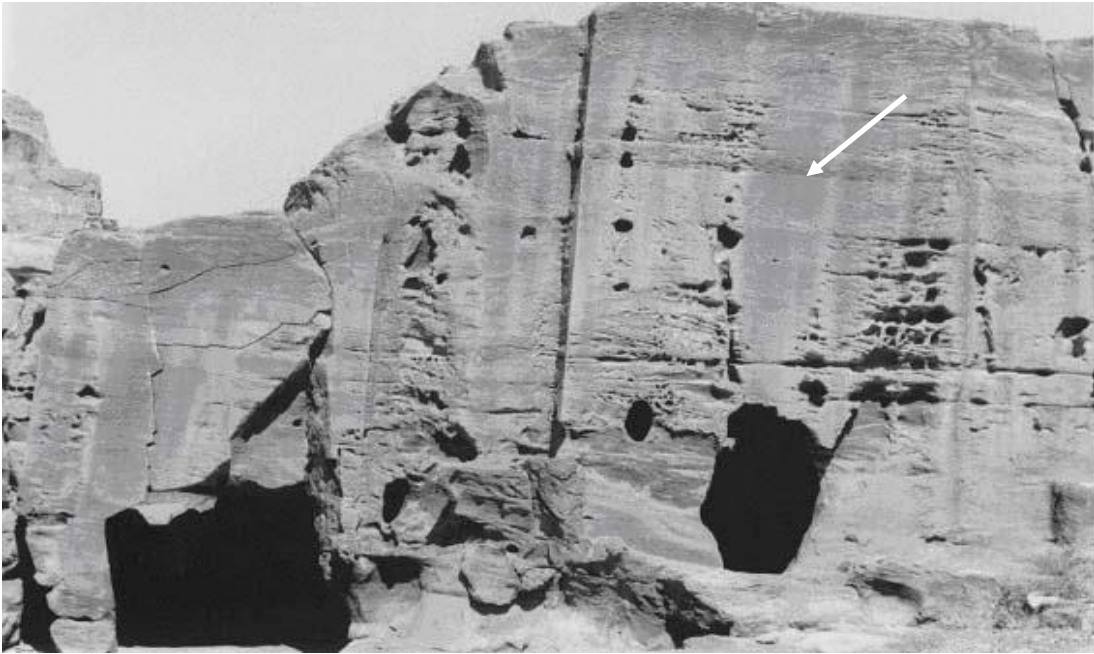


c. (s. 2-24-2008)

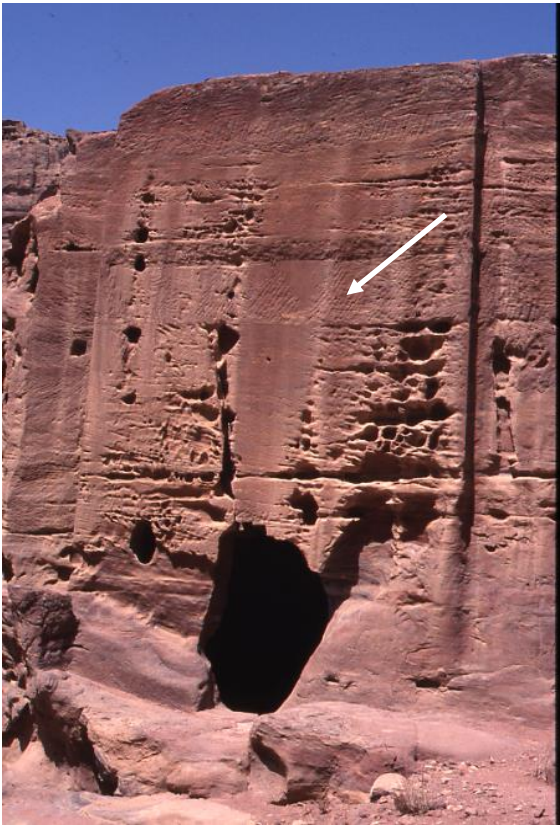


b. At Mughur an-Nasārā with a row of white painted gables (5-3-1993)

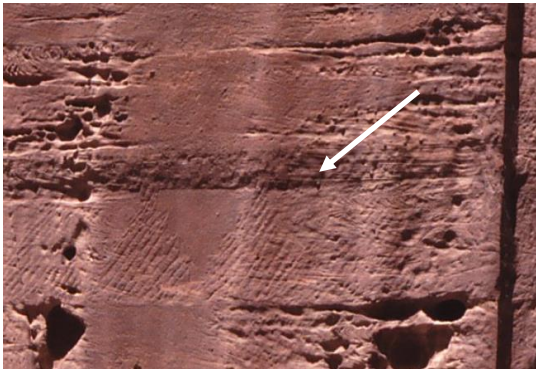
Unfinished Façades at the West Ridge of al-Khubthah



a. Façades showing marked but uncarved gables (26-33-1991)

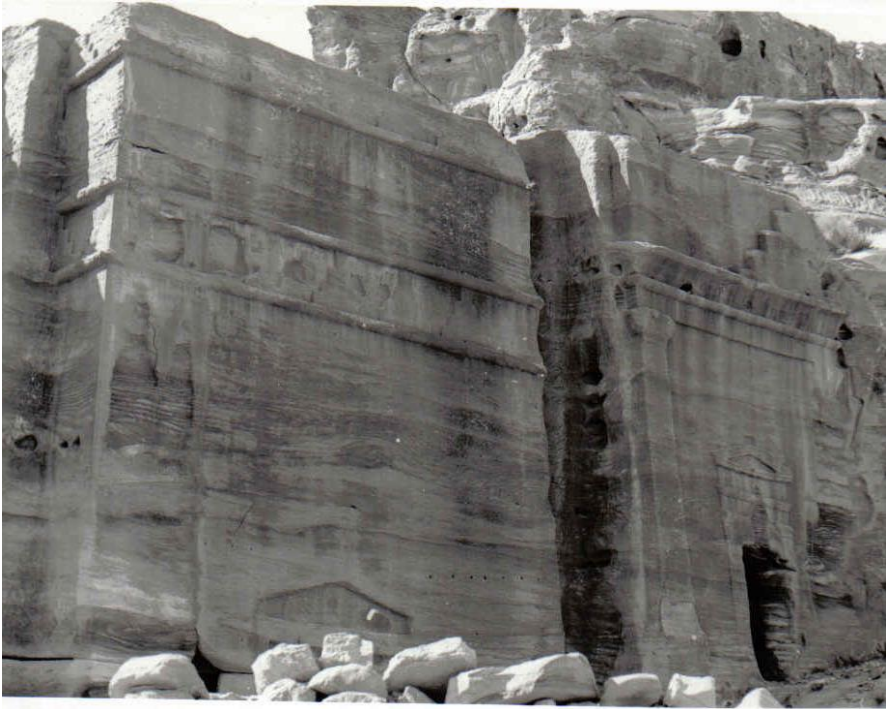


b. Detail of the right side of (a) (s. 2-3-2008)



c. Detail of 'image b'

Half Gable and Double Band Gable Facades



a. At al-Mu'aysrah ash-Sharqiyyah (Br. 577, 578) (2-19-2000)

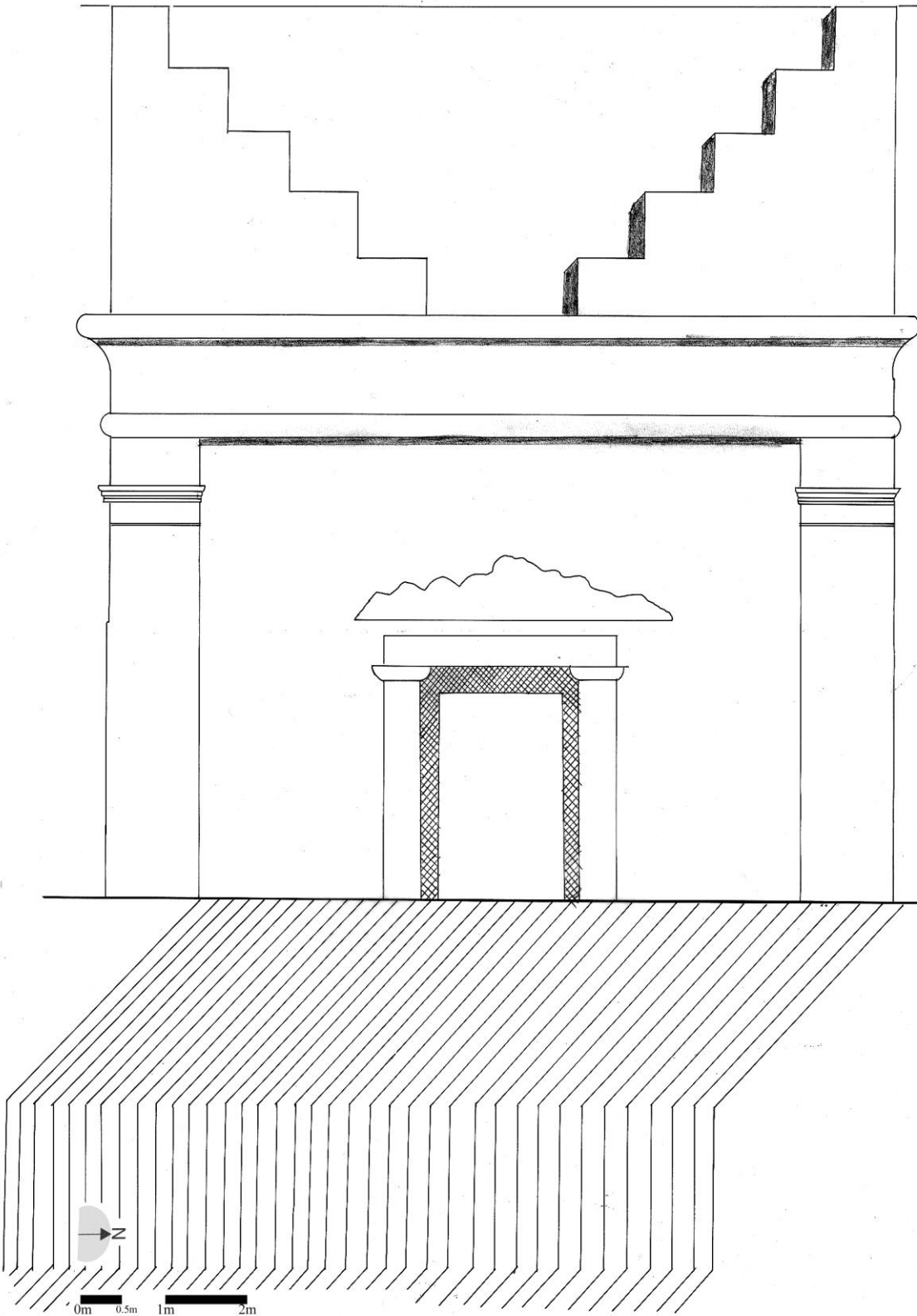


b. (Br. 577) Detail of the left of (a) (2-12-2000)

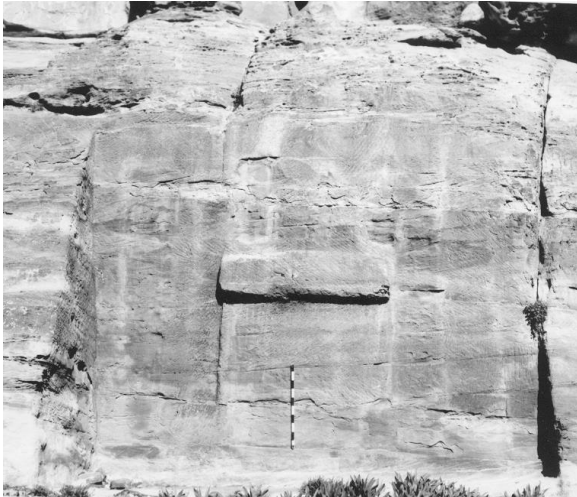


c. Detail of the right of (a) (Br. 578) (2-11-2000)

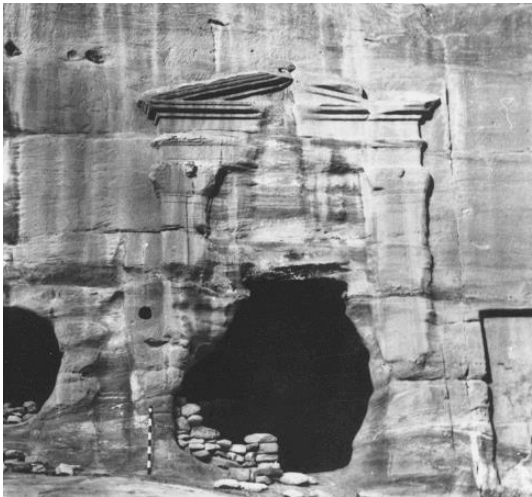
Elevation of Plate 25a



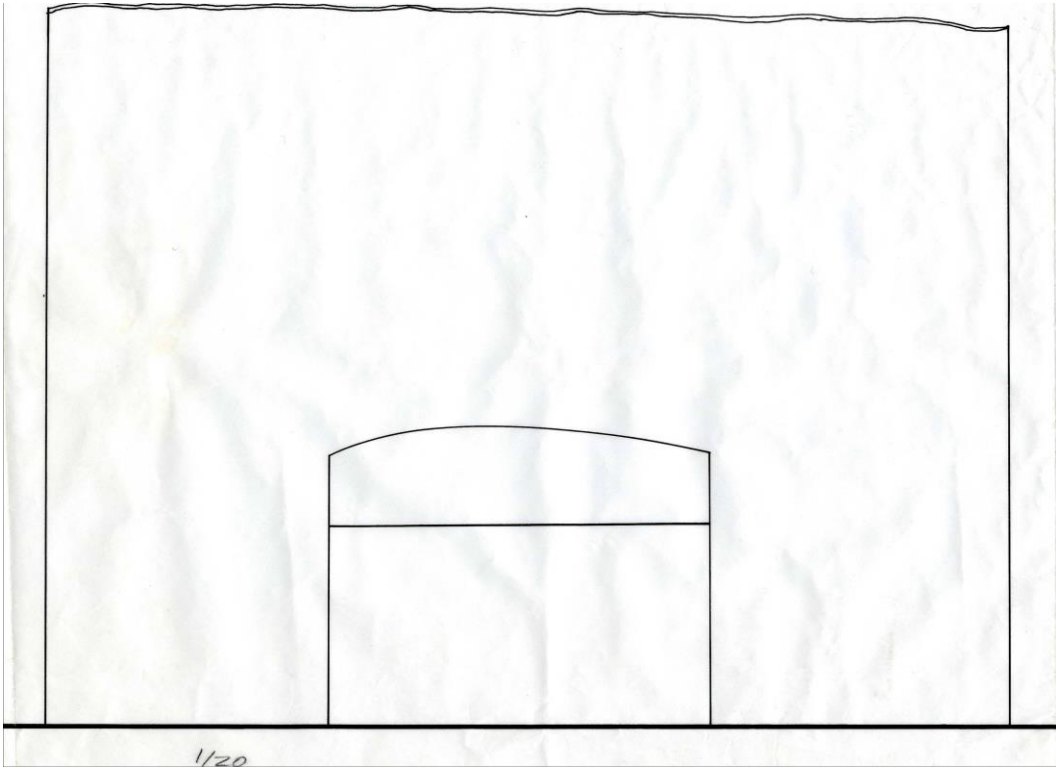
Examples of Unfinished Façades



a. North of the Lion Tomb (18-9-1994)



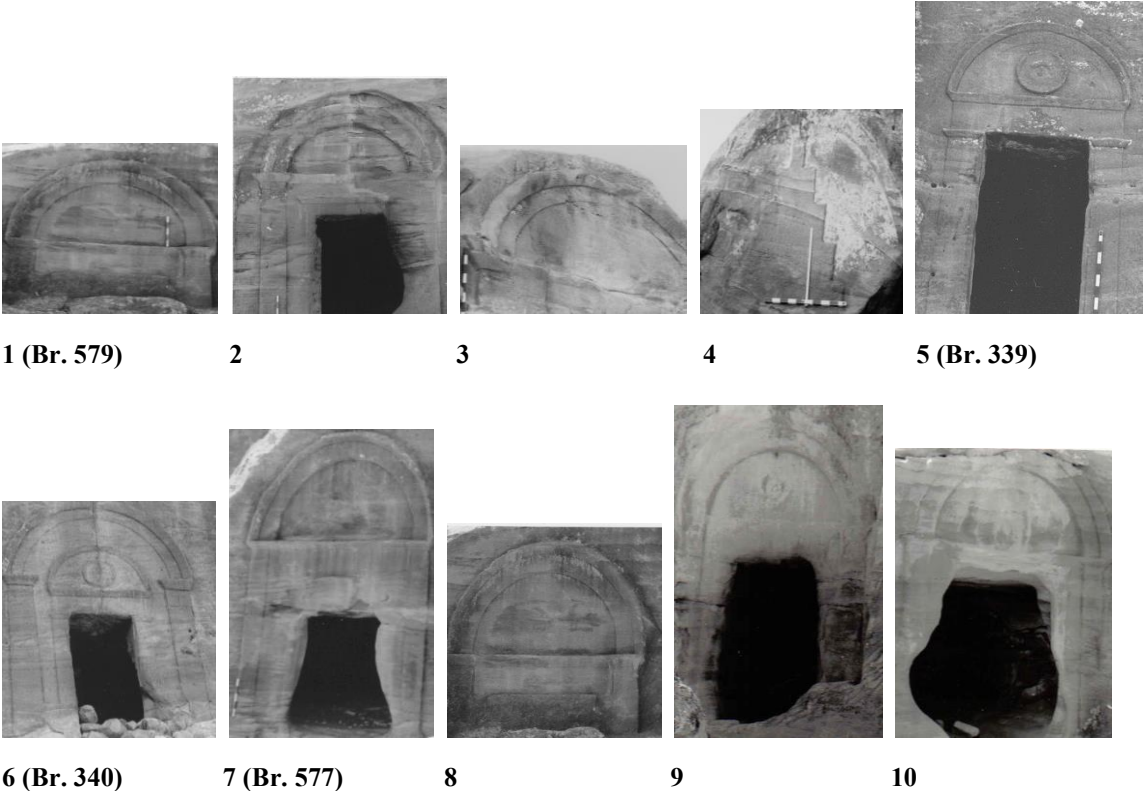
b. South of façade (a) (24-3-1991)



c. Drawing of (a) above

Scale 1:20

Chart of Arched Façades and Façade at Wādi an-Numayr

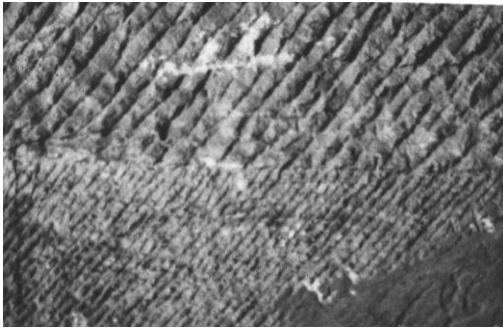


a. Arched Façades

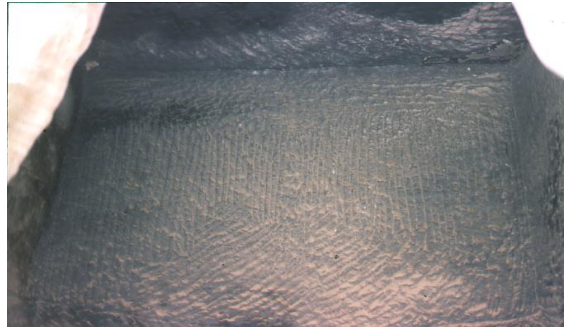


b. Façade with an arch carved above the entrance/ Wādi an-Numayr (17-12-1994)

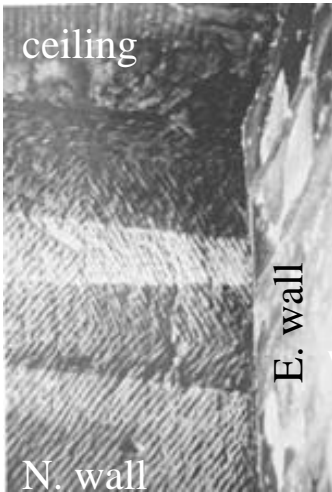
Unfinished Interiors and Façades



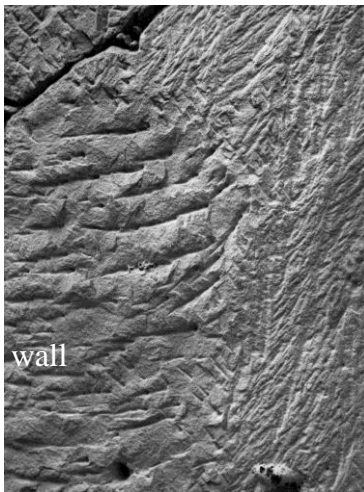
a. At Siq al Bārid (15-21-1994)



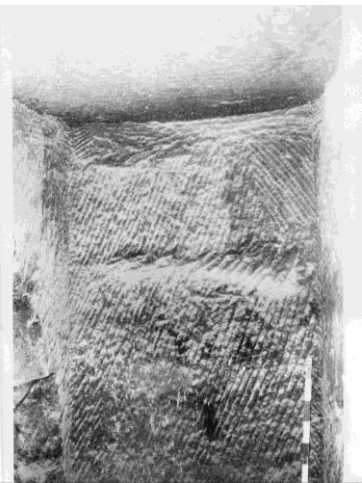
b. At Siq al Bārid (s. 3-7-2008)



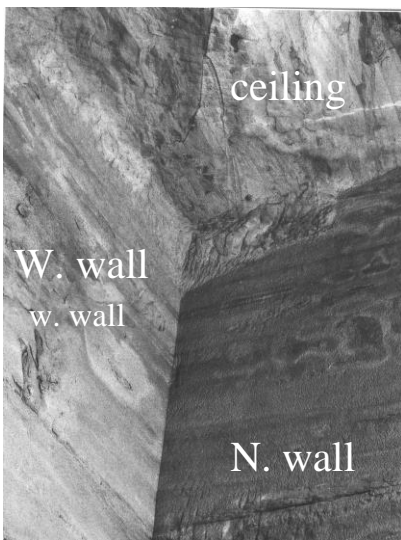
c. At Siq al Bārid
(9-1-1997)



d. Inside the Urn Tomb
(12-22-1993)



e. Mughur an-Nasārā
(4-24-1993)



f. Cave interior at al-Habis
(17-16-1994)



g. Façade of the Garden Tomb
(Br. 244) (9-22-1997)

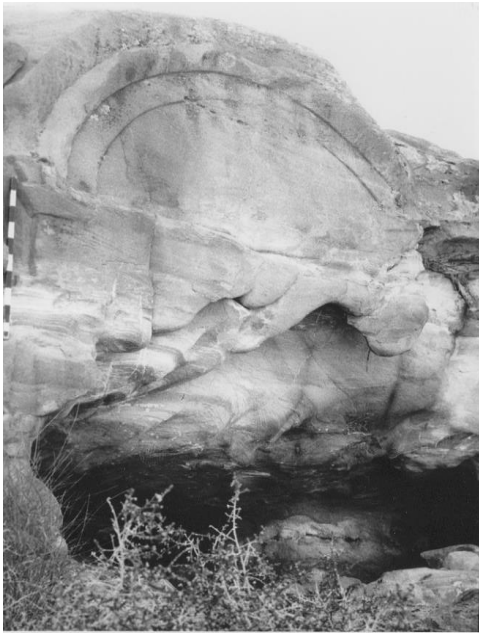
Arched Façades West of al-Mu‘aysrah ash-Sharqiyyah and Wādi an-Numayr



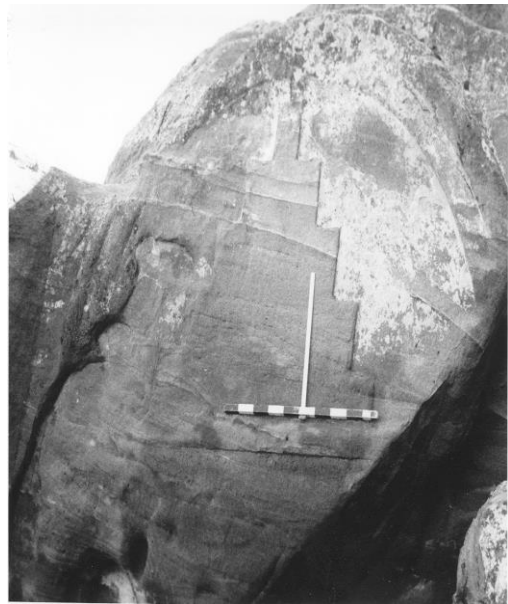
a. Unfinished façade (Br. 579)
(2-18-2000)



b. Finished façade (Br. 578)
(2-11-2000)

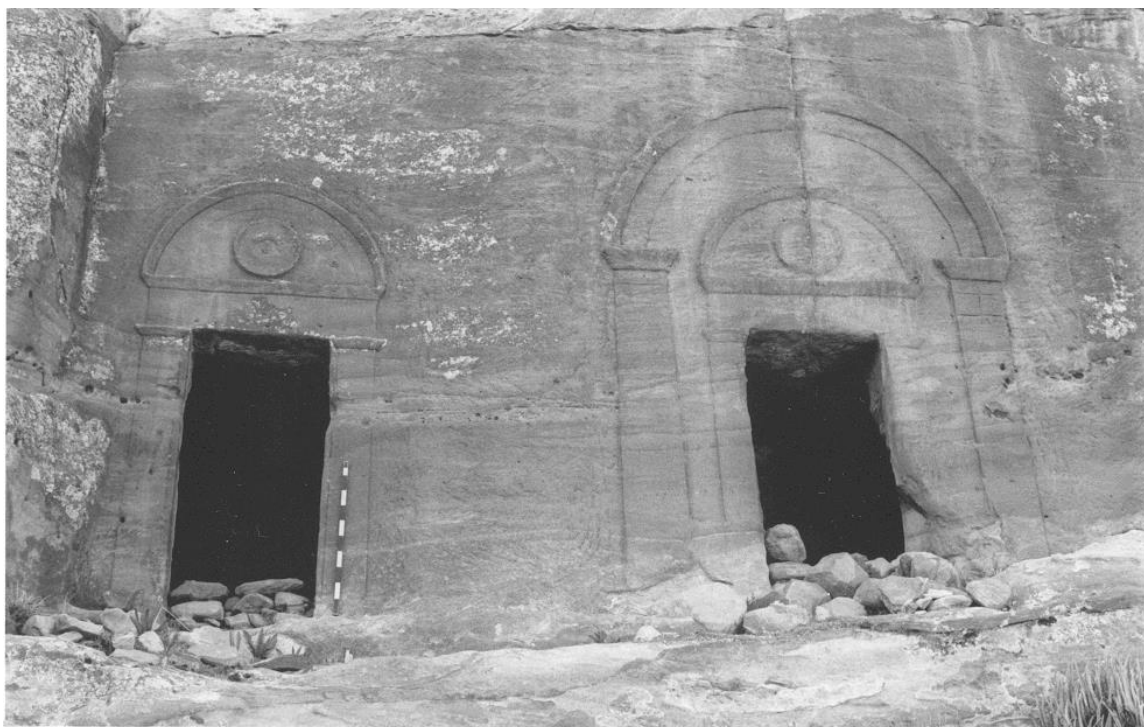


c. West side of Wādi an-Numayr
(17-6-1994)

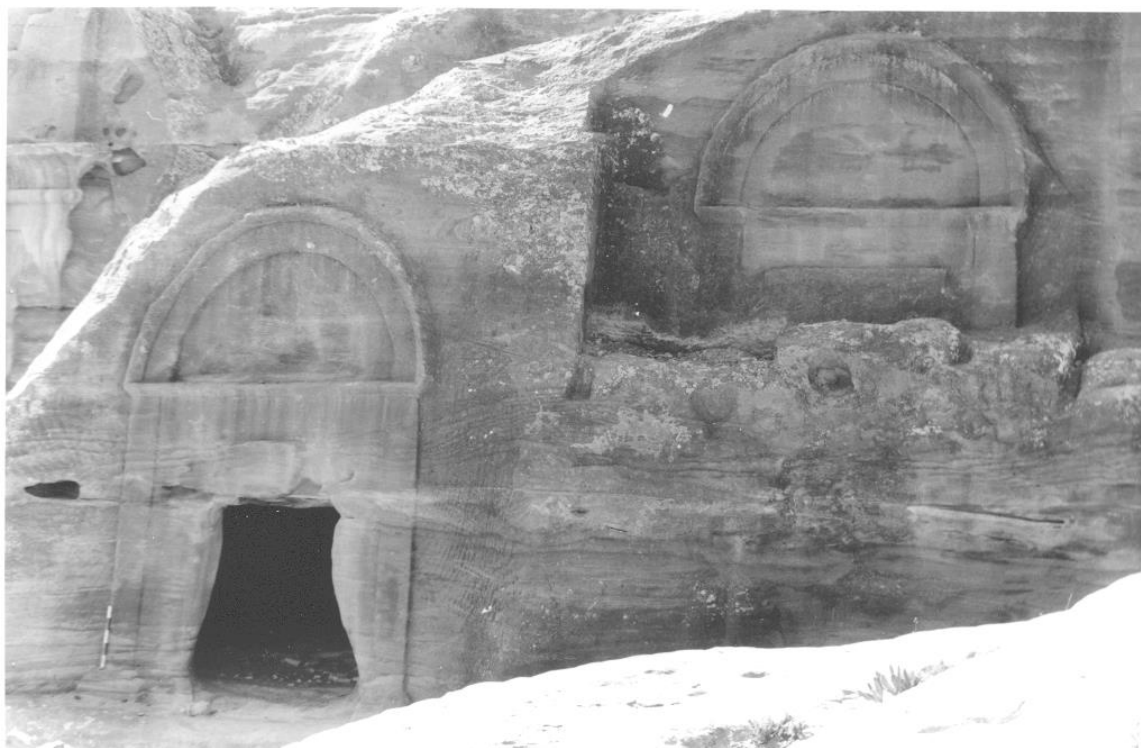


d. West of Wādi an-Numayr
(17-10-1994)

Arched Façades



a. West of Wādi ed-Dayr (Br. 339, 340) (7-11-1993)



b. West of al-Mu'aysrah ash-Sharqiyyah (Br. 577, 579) (2-21-2000)

Arched Façades



a. (2-15-2000)
a & b. At al-Mu'aysrah ash-Sharqiyyah

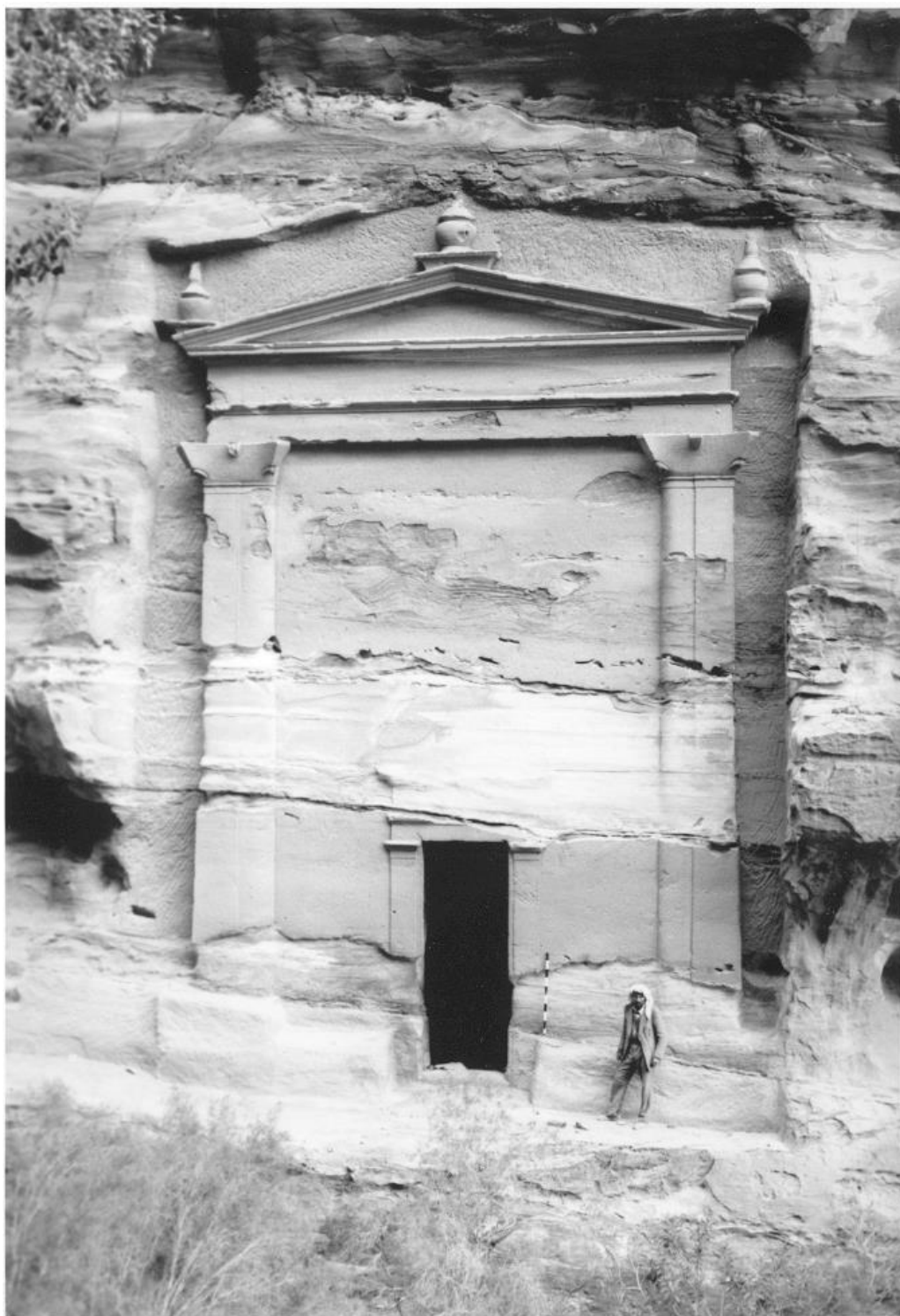


b. (2-17-2000)



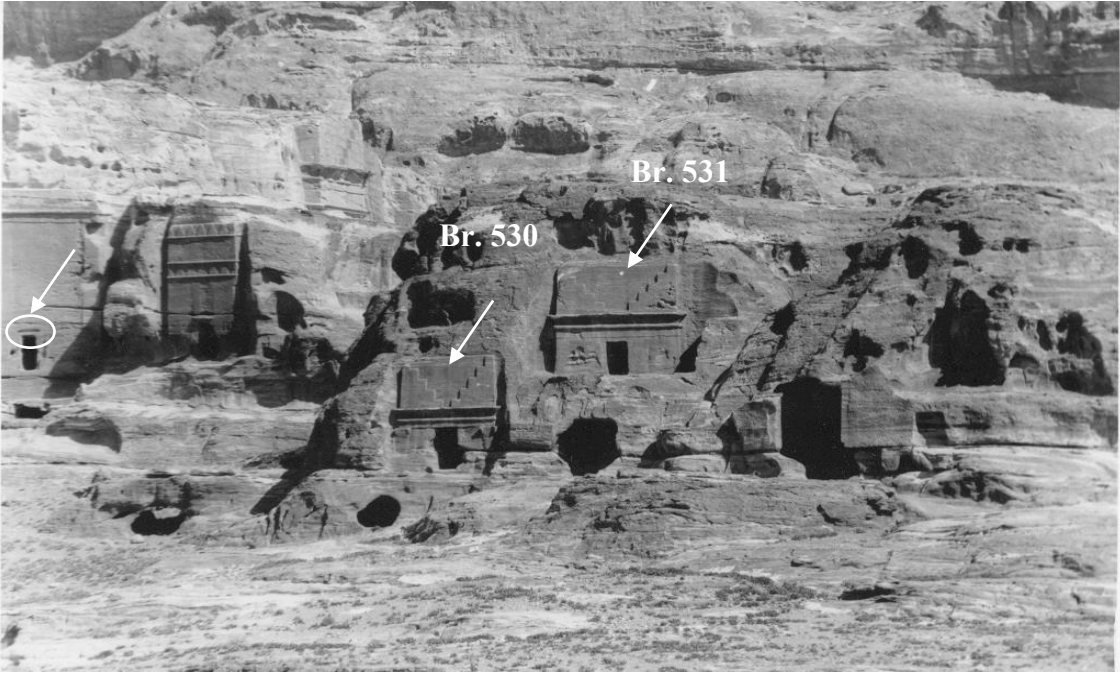
c. Detail of Rosette in (a) (2-16-2000)

Interior Quarrying



a. At Wādi al-Mu‘aysrah al-Gharbiyyah (al-Kharroubah) (Br. 454) (18-3-1994)

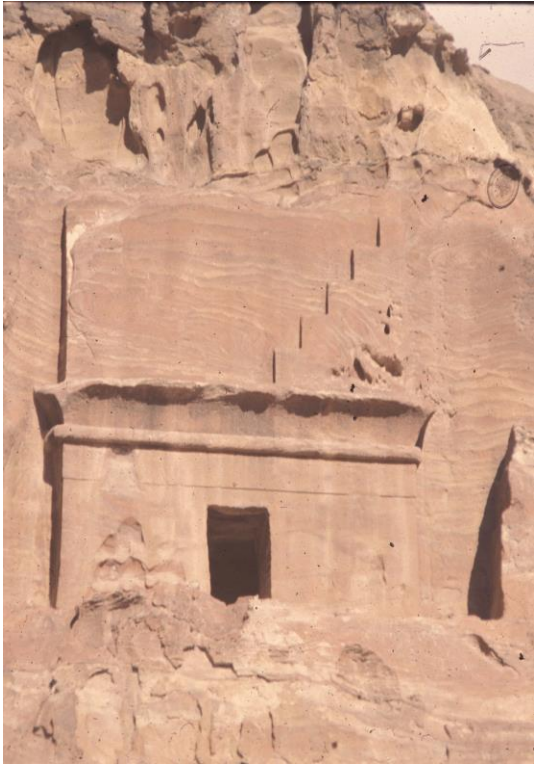
Unfinished Half Gable Façades at ath-Thunabe



a. General view (1-1-2000)

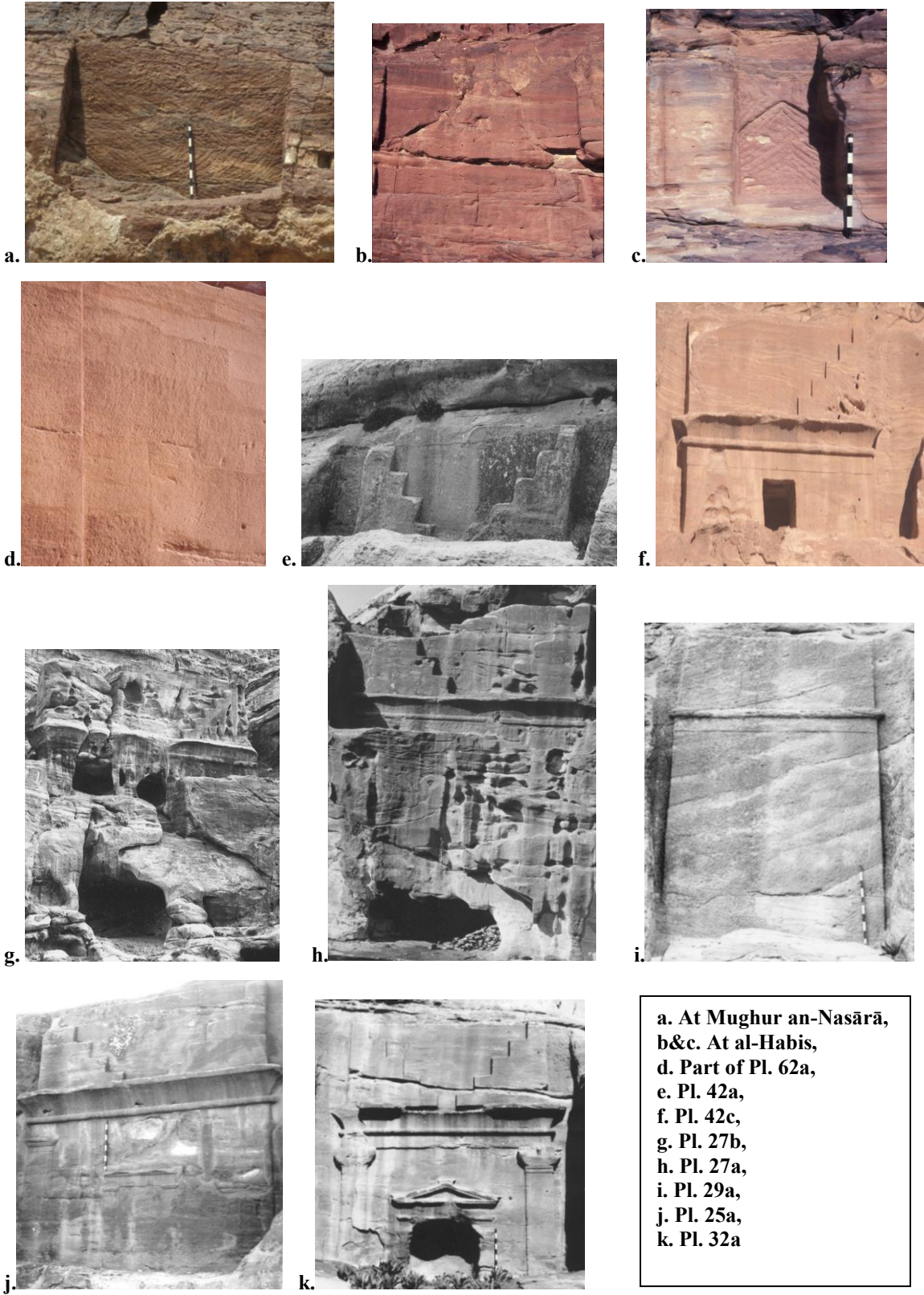


b. Details of (a) (Br. 530) (2-30-2000)

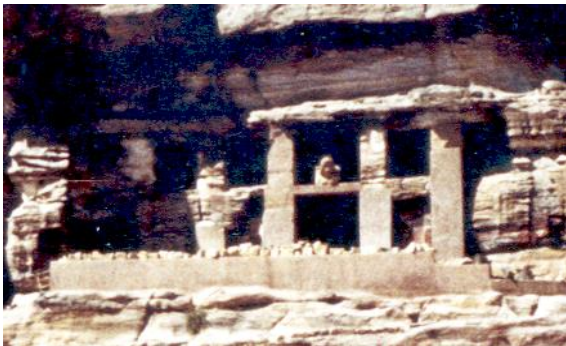


c. Details of (a) (Br. 531) (2-32-2000)

Carving Progression of Façades with Half Gables



Rectangular Façades without Carving



a. Cave (Br-400) /al-Habis (Museum now)



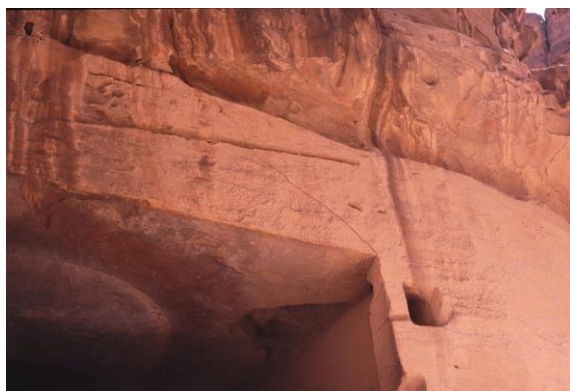
b. Triclinium exterior (Br-235)/ Wādi Farasah (after McKenzie 1990: Pl. 103a)



**c. House opposite the Theater (Br. 808)
(s. 3-5-2008)**



**d. Opposite the Painted House at Siq al-Bārid
(s. 7-8-1993)**

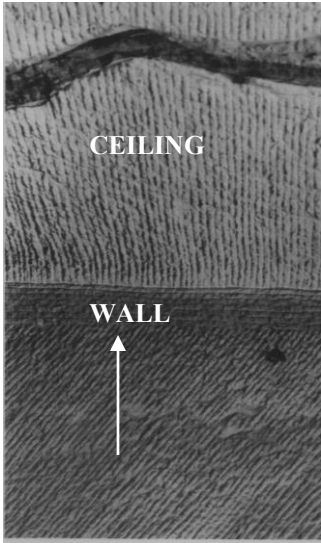


**e. Triclinium (Br. 65) opposite al-Khaznah
(s. 1-23-2008)**

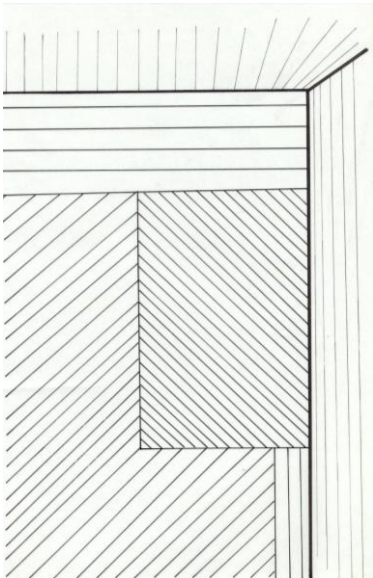
45 Degree Stone Dressing



a.



b. (8-3-1997)



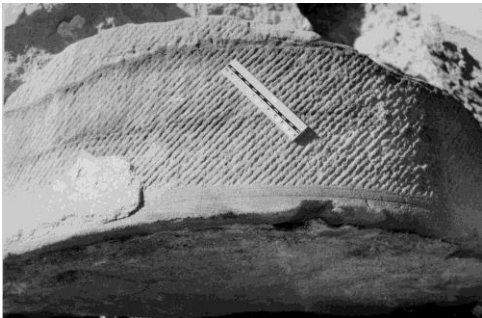
c.



d. (13-0-1993)



e. (9-23-1997)



f. (8-8-1991)

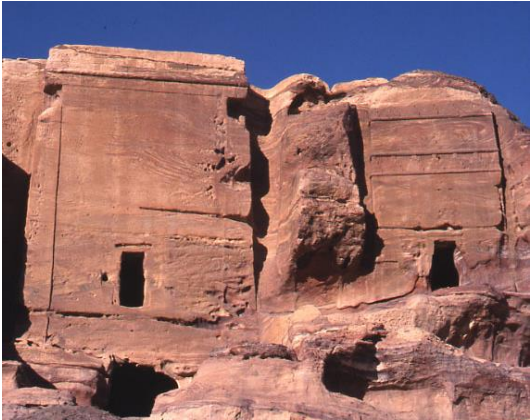


g. (9-13-1991)

a & c. West Wall/ Urn Tomb
c. SE corner outside/ Urn Tomb
g. From Zip-Atuf Temple

b & e. On an interior cave wall/ Siq al-Bārid
d & f. On a masonry block/ Temple of the Winged Lions

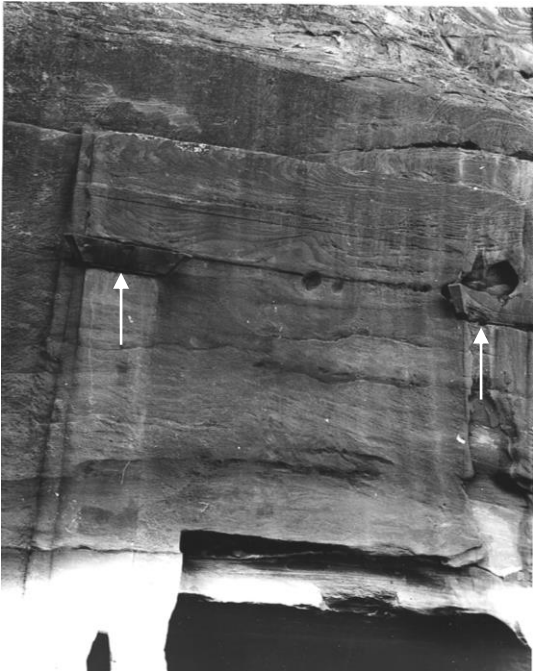
Inserted Capitals



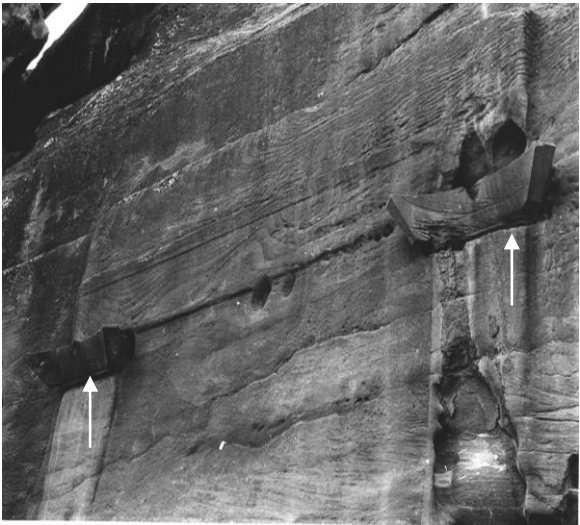
a. Missing capitals/ west of Wādi al-Mu‘aysrah ash-Sharqiyyah (Br. 526) (s. 2-22-2008)



b. Detail of a. Missing capitals/ west of Wādi al-Mu‘aysrah ash-Sharqiyyah (Br. 526) (s. 2-33-2000)

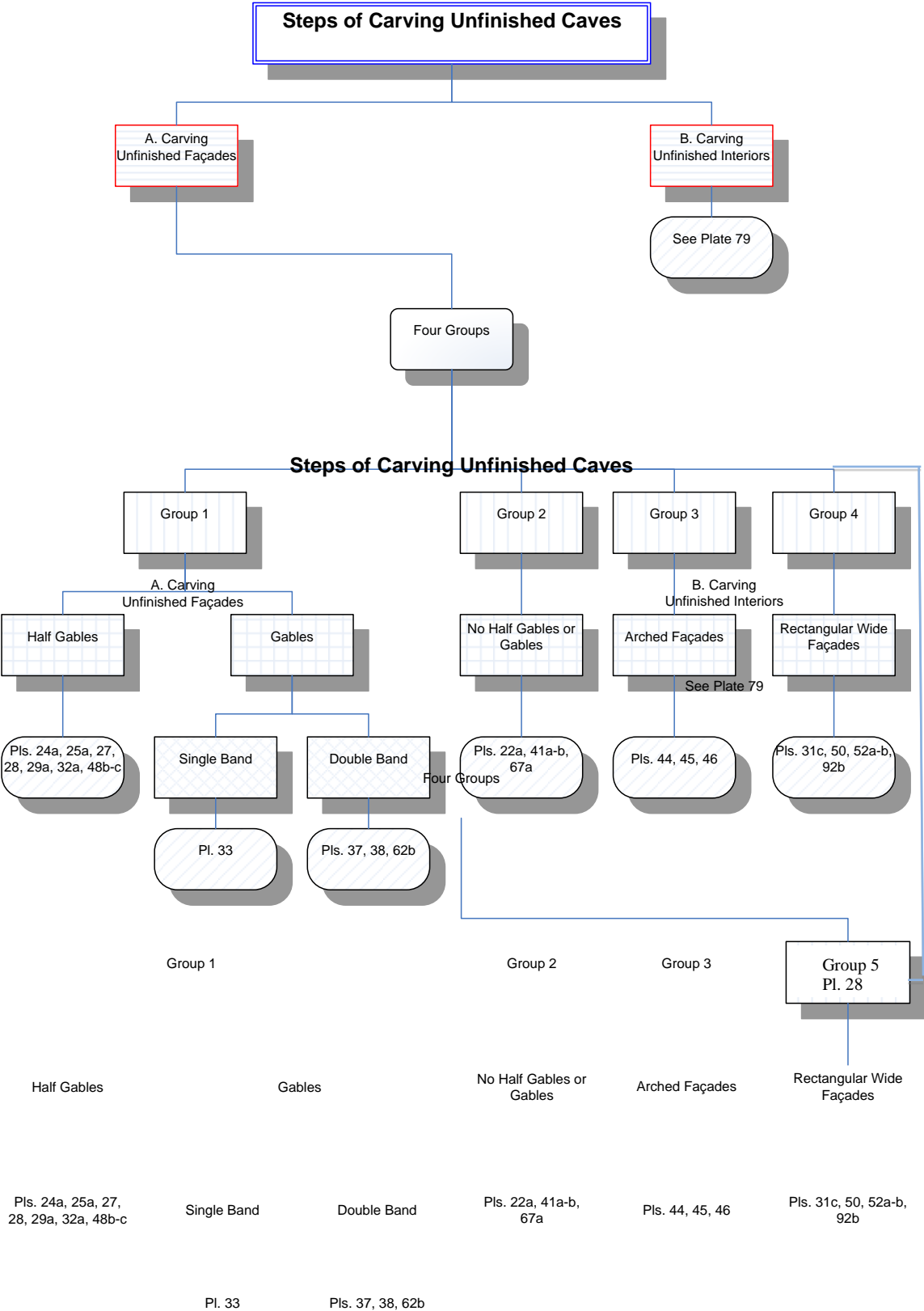


c. Inserted capitals/ al-Mu‘aysrah ash-Sharqiyyah (Br. 572) (2-21-2000)

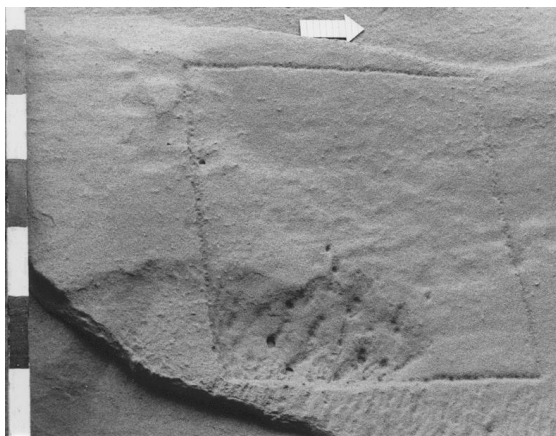


d. Detail of (b) above (2-22-2000)

Steps of Carving Unfinished Caves



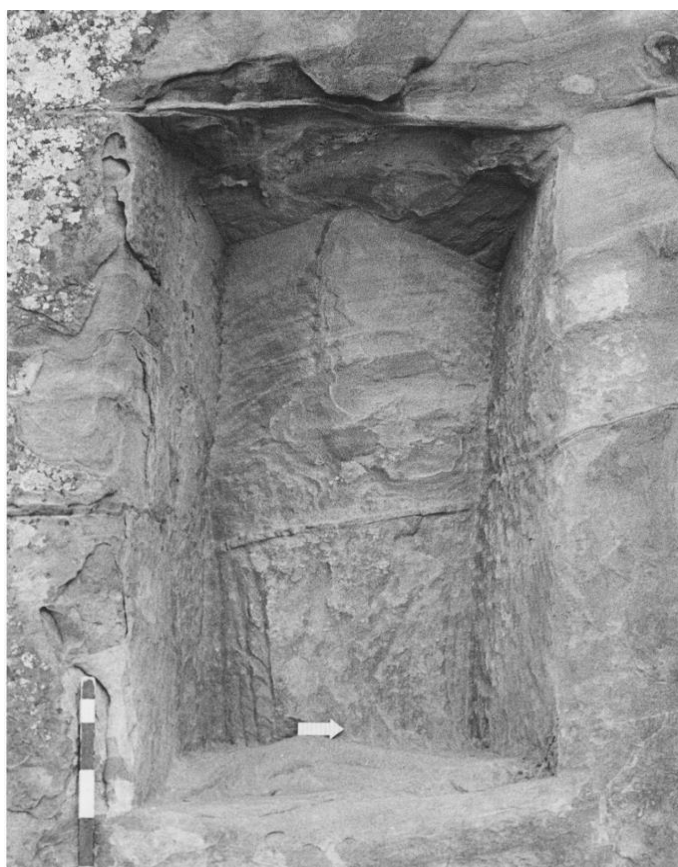
Entrance Carving



**a. On the Way to Jabal an-Numayr
(9-14-1993)**

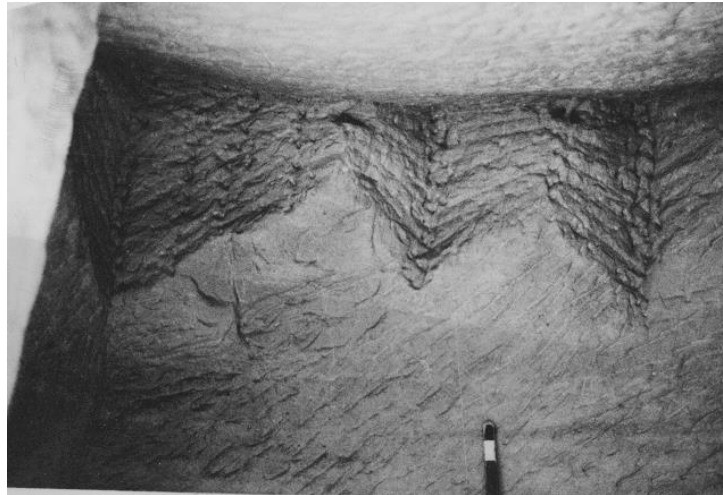


**b. Carving at Qunb at-Turkmaniyyah
(13-22-1991)**



c. Carving at Mughur an-Nasārā (4-11-1993)

The “VW” Carving Technique



a. W shaped carving on the way to Jabal an-Numayr top (9-24-1993)



b. Interior of cave opposite the Theater (12-1-1993)

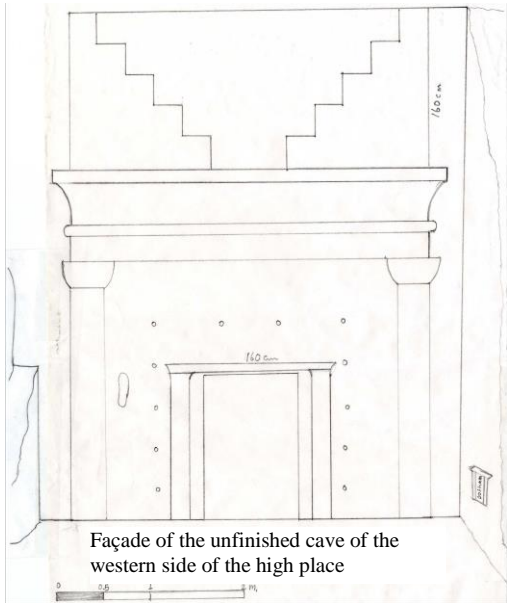


c. Detail of the north wall in (b) (12-0-1993)

Cave N.W. of the High Place



a. Façade (1-17-1997)

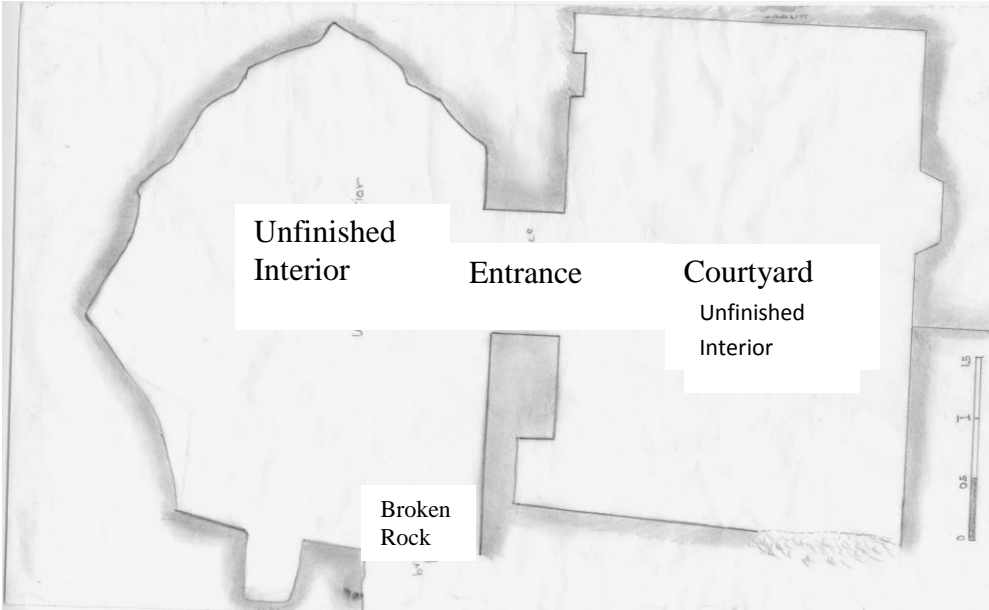


b. Sketch of a

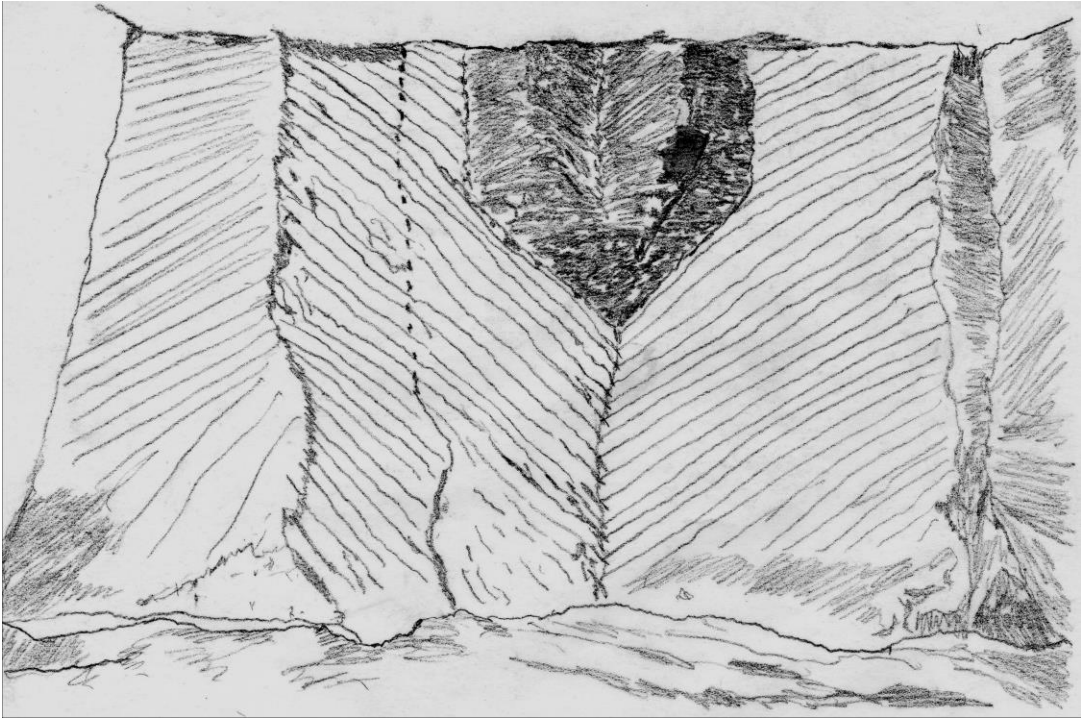


c. Dushares / west wall of courtyard of a (15-25-1991)

Cave at Pl.56 a

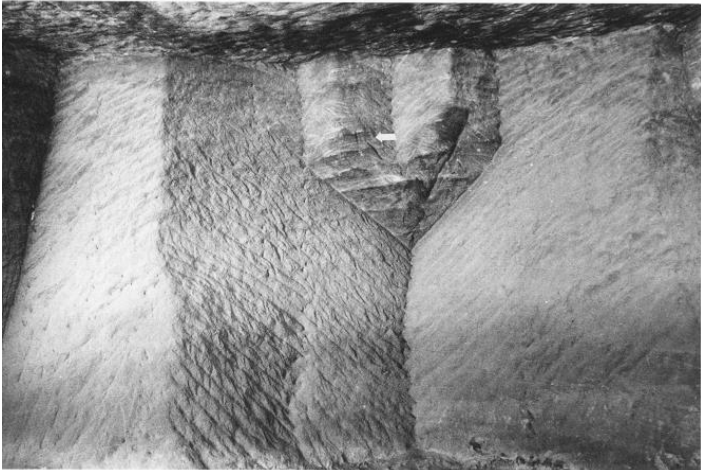


a. Top plan drawing of Pl. 56a

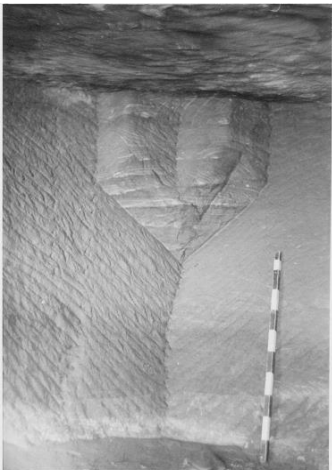


b. Sketch of Pl. 58a

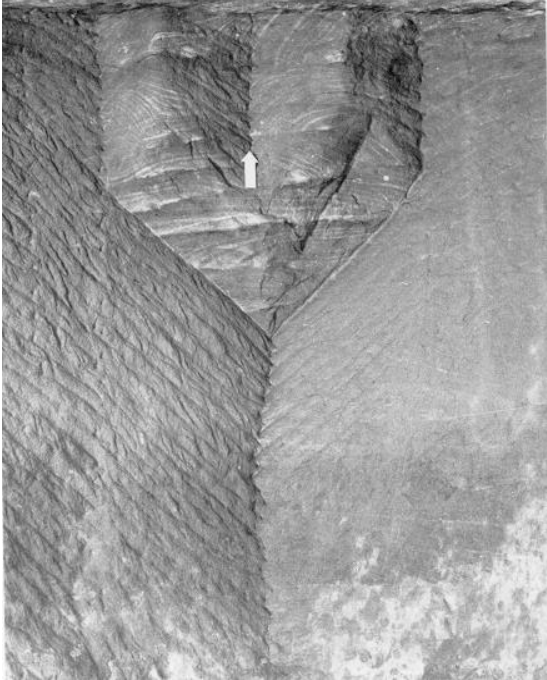
Interior Carving



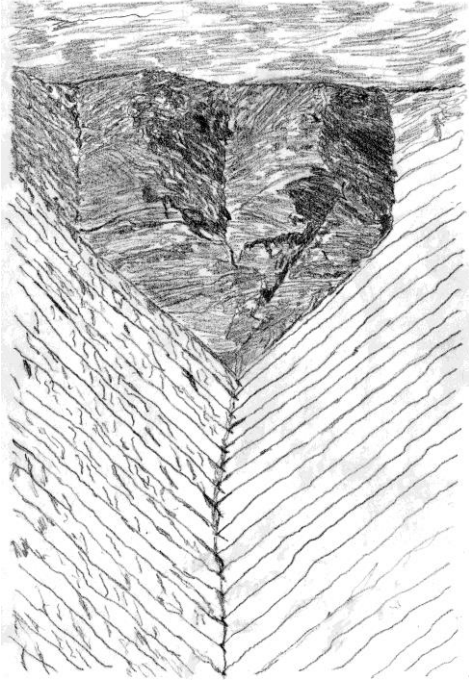
a. V shaped carving inside Pl.56 a (1-12-1997)



b. Detail of a (15-26-1991)



c. Detail of b (1-13-1997)

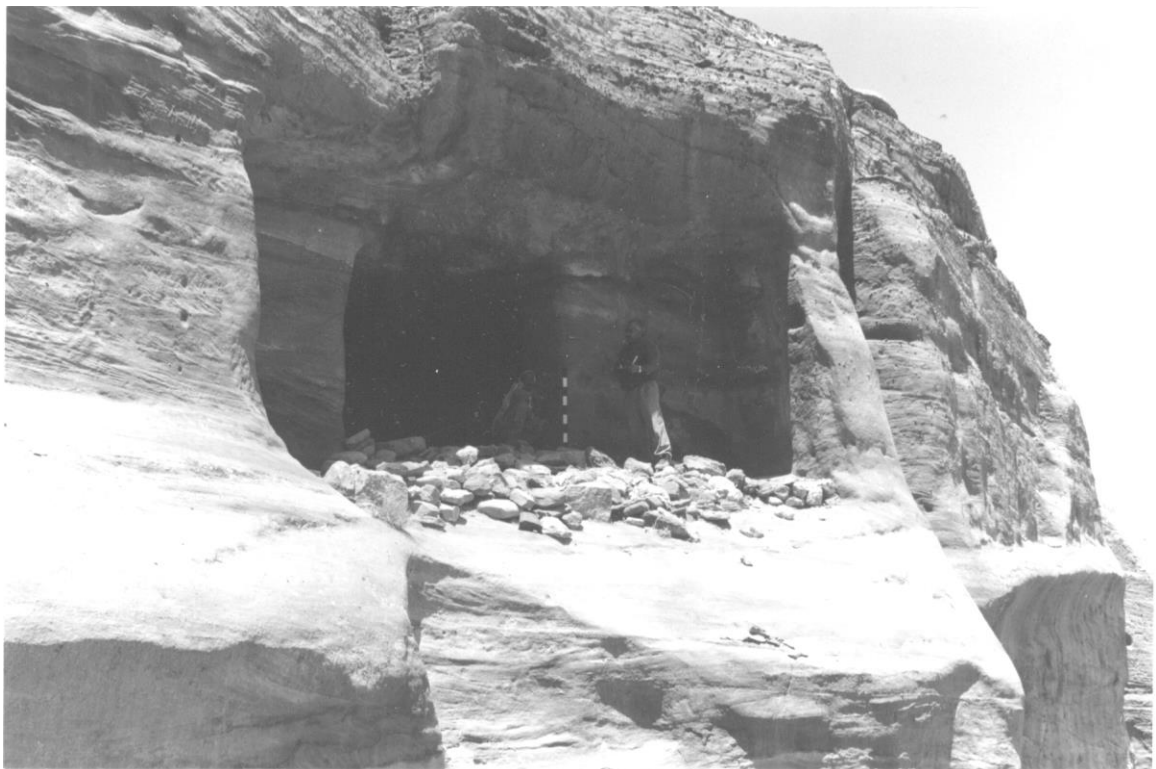


d. Sketch of c

Cave Quarrying Technique



a. General view of Umm el-Biyārah (x marks the location of the cave in b) (s. 1996)

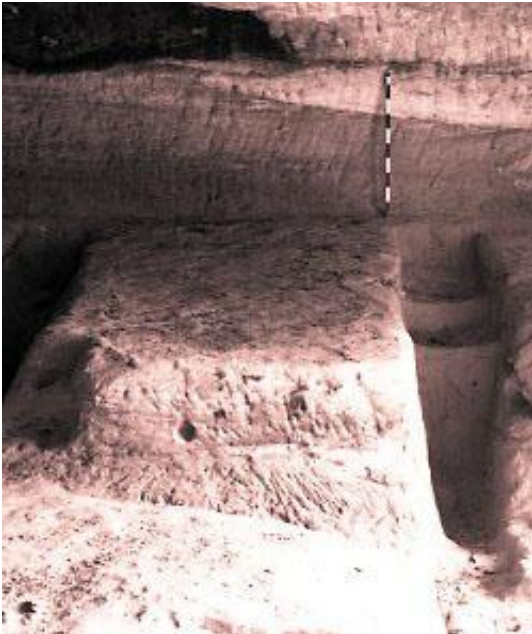


b. Entrance to cave on the way to Umm el-Biyārah marked X in a (3-11-2000)

Cave Quarrying Technique



a. Quarrying blocks from the floor of cave 59b (7-12-1997)

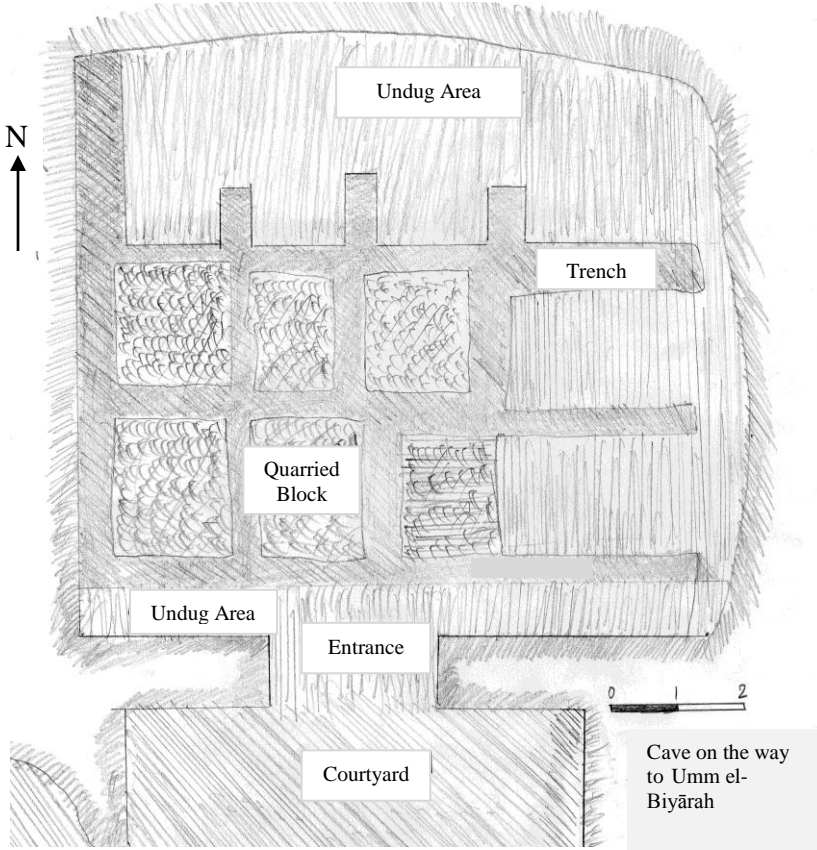
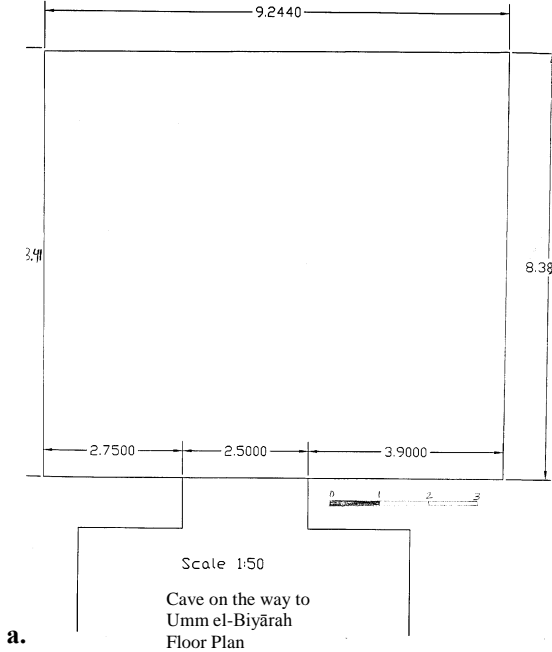


b. Detail of block quarried in (a) (11-00-1993)



c. South west corner of (a) (11-0-1993)

Cave Quarrying



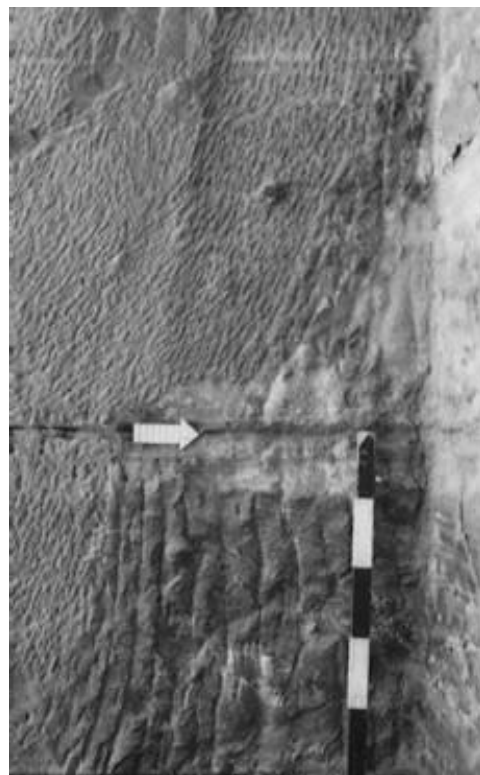
Al-Khubthah Cave with Unfinished Interior (Br. 802)



a. Entrance to the left cave (1-10-2000)

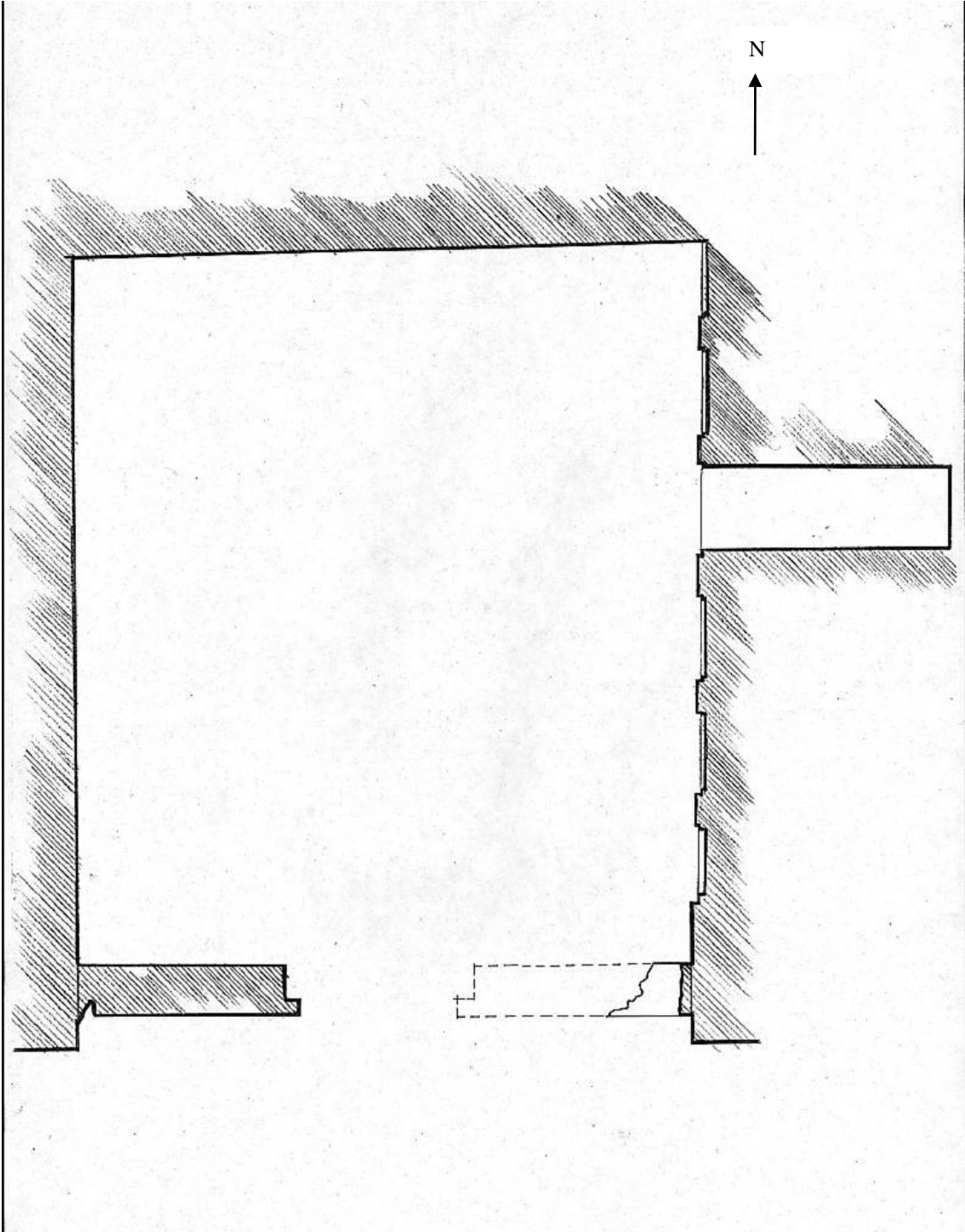


**b. Detail of the entrance in (a)
(s. 2-6-2008)**



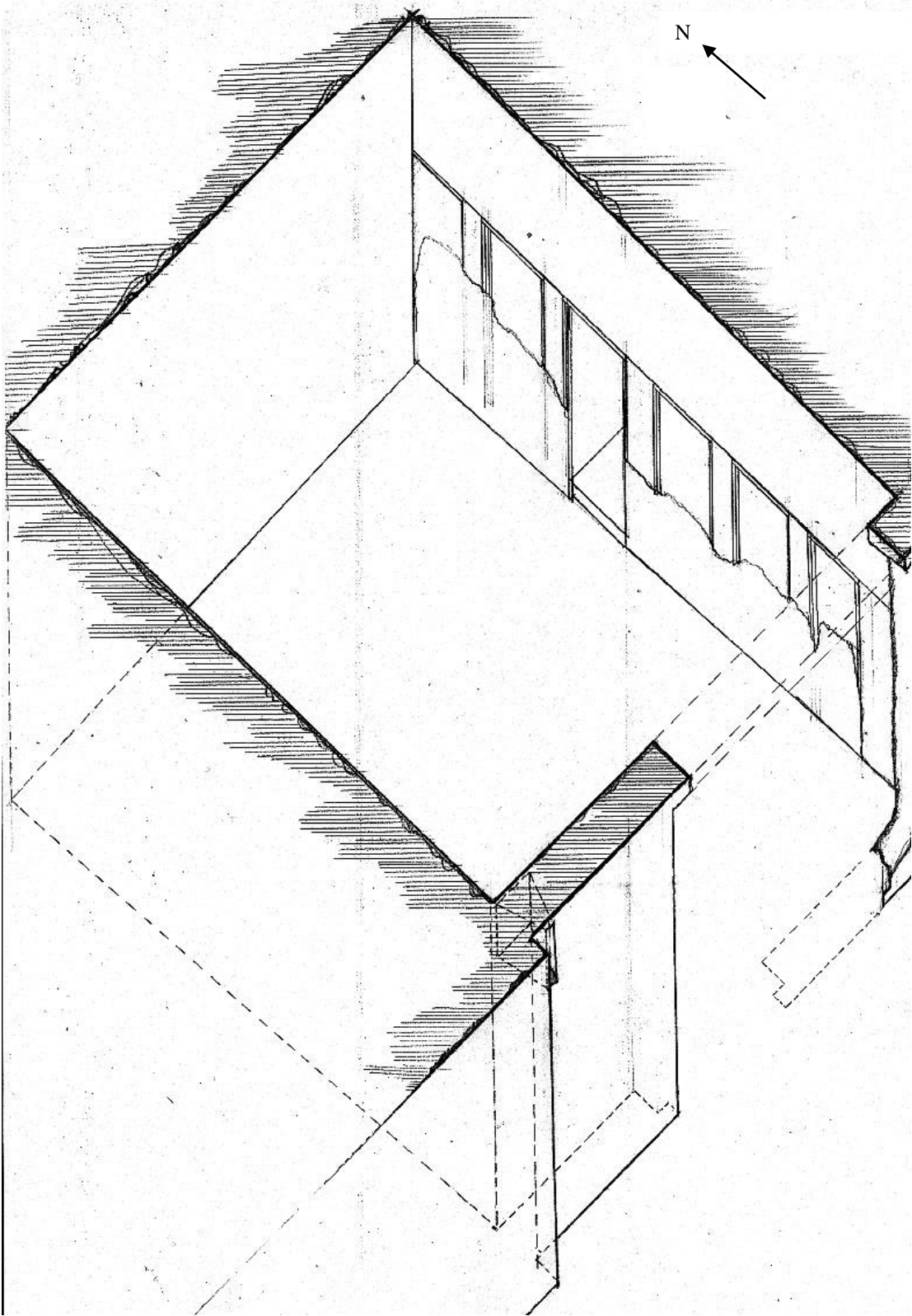
**c. Unfinished area on north wall in (a)
(11-17-1993)**

Al-Khubthah Cave



Top plan drawing of interior of Pl. 62 a. left cave

Al-Khubthah Cave

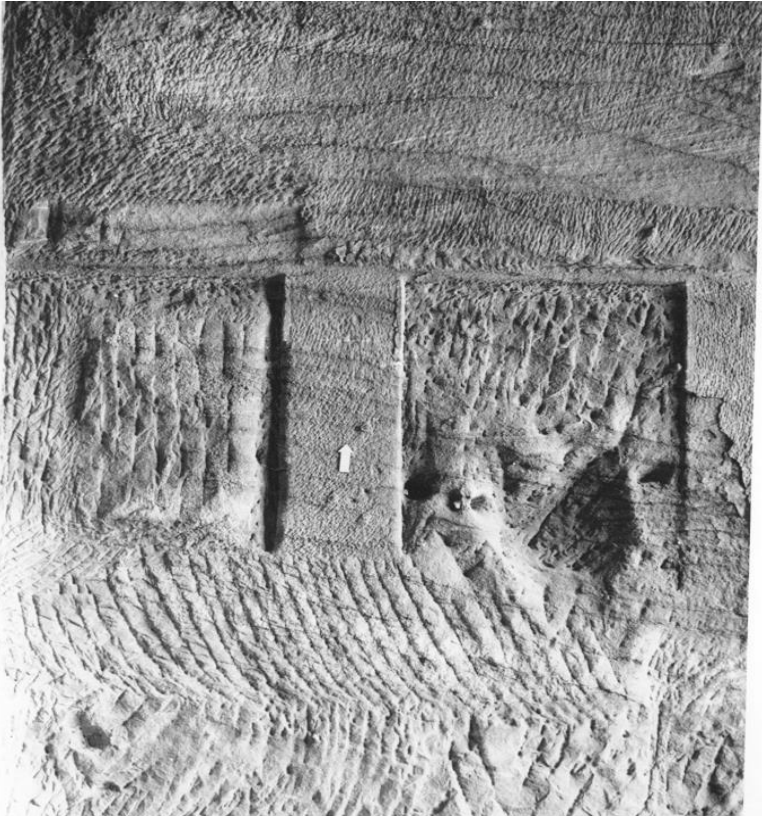


Axonometric drawing of interior of (Pl. 62)

Al-Khubthah Cave

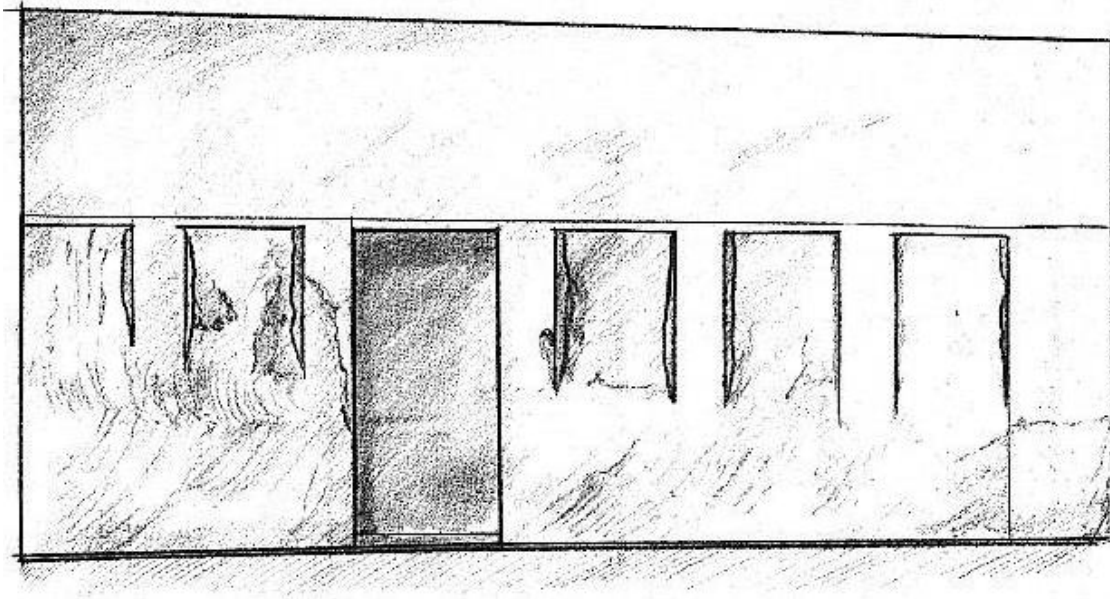


a. The east wall with one chamber carved into it (2-24-1997)

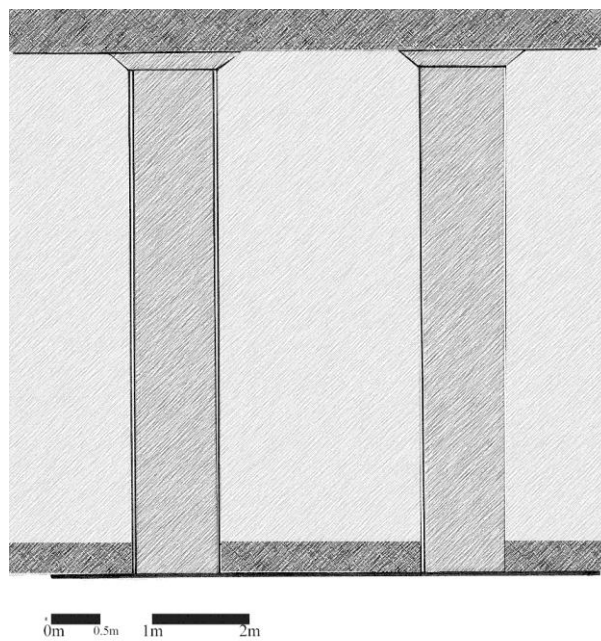


b. Detail of the chiseling of the north side of the east wall (7-3a-1997)

Al-Khubthah Cave

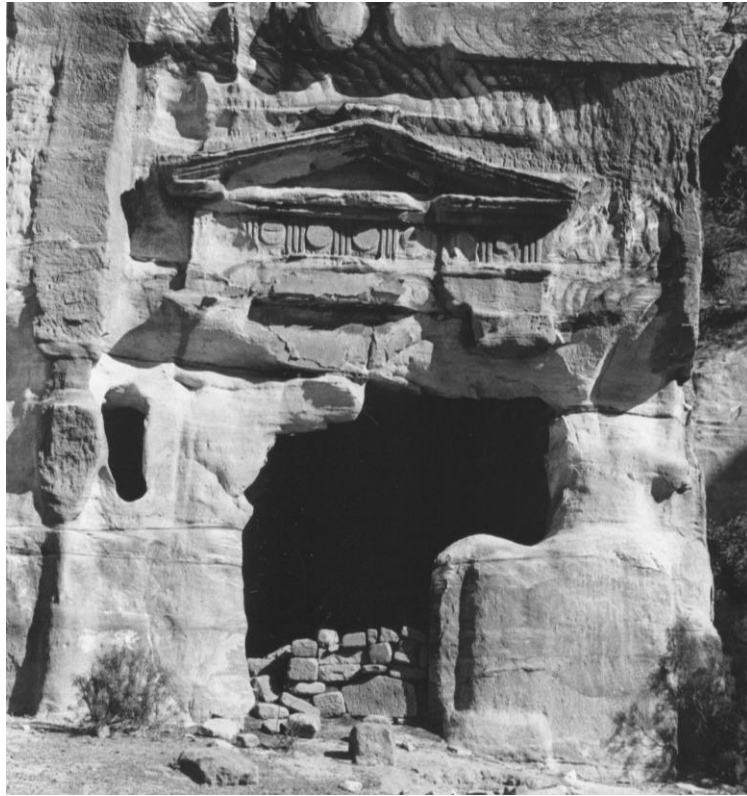


a. Interior elevation of eastern wall of (Pl. 62)

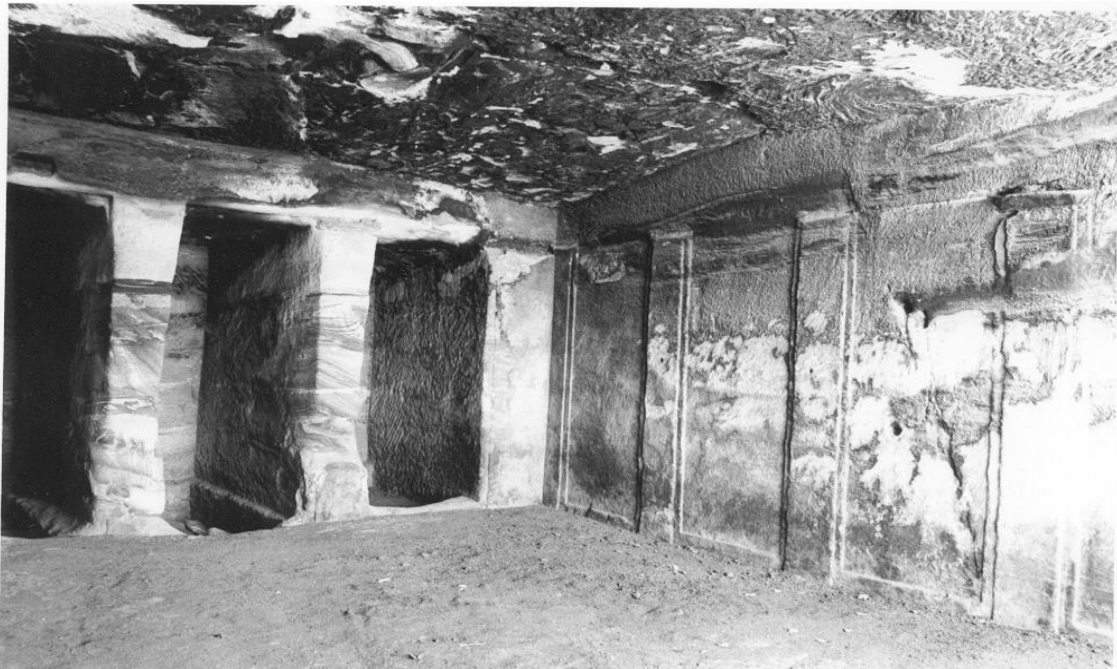


b. Drawing of an un-carved chamber between two columns on the western wall of Wādi an-Numayr cave (Pl. 67b)

Wādi an-Numayr Cave



a. Façade (6-12-1993)

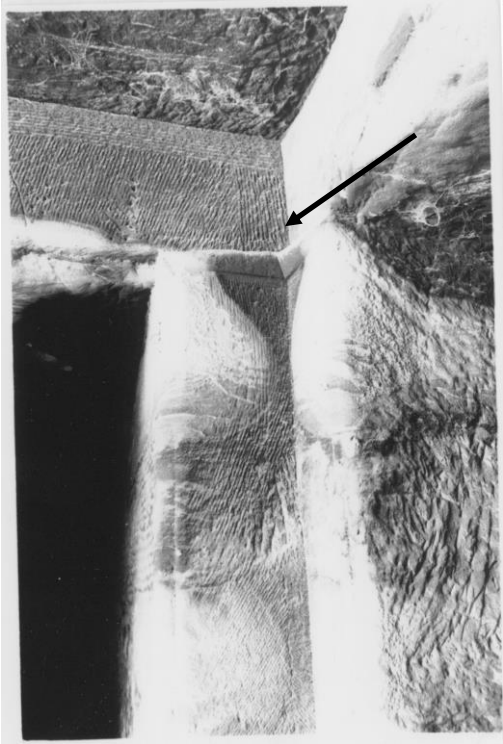


b. The interior south-west corner carving (2-2-1997)

Wādi an-Numayr Cave



a. The interior of chamber with an undug grave/east wall (5-6-1997)

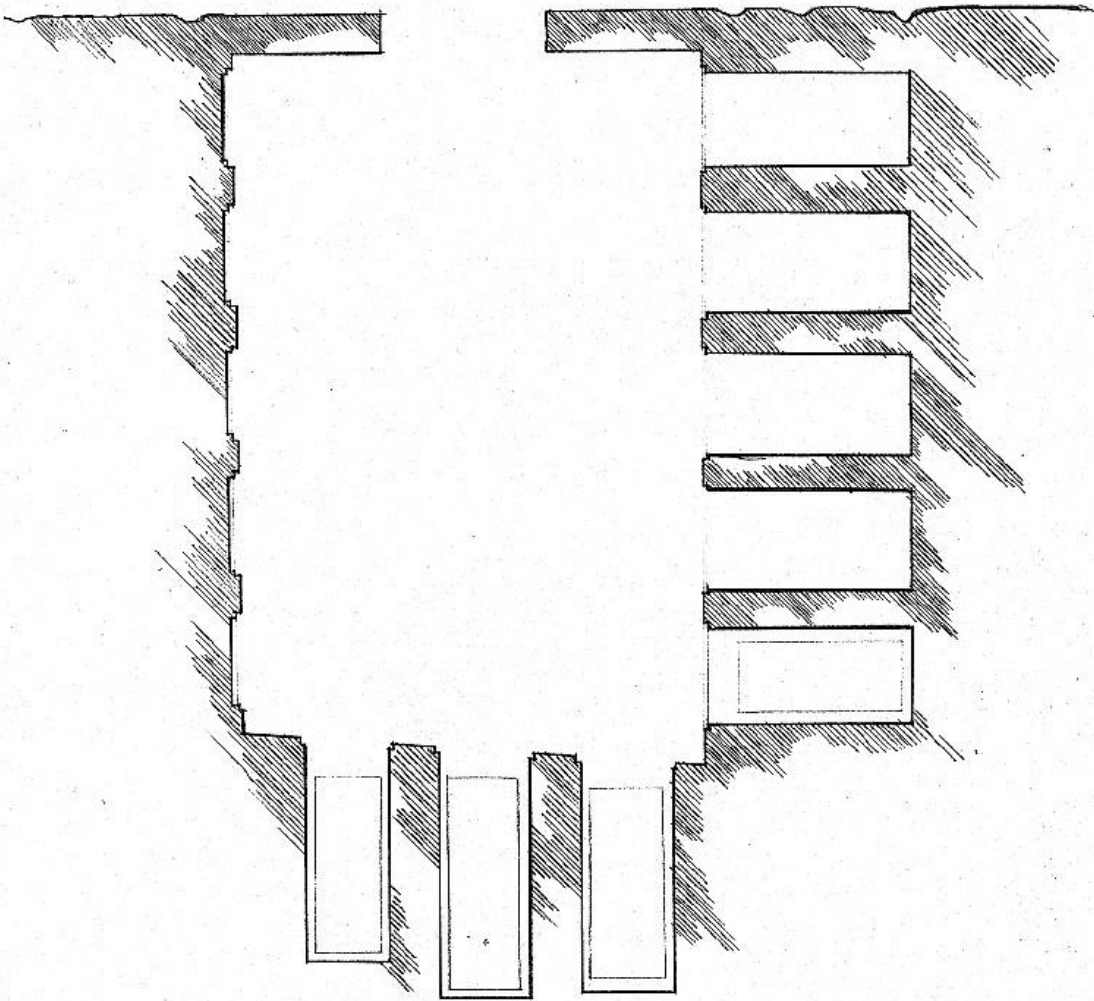


b. Square in south-east corner (2-10-1997)



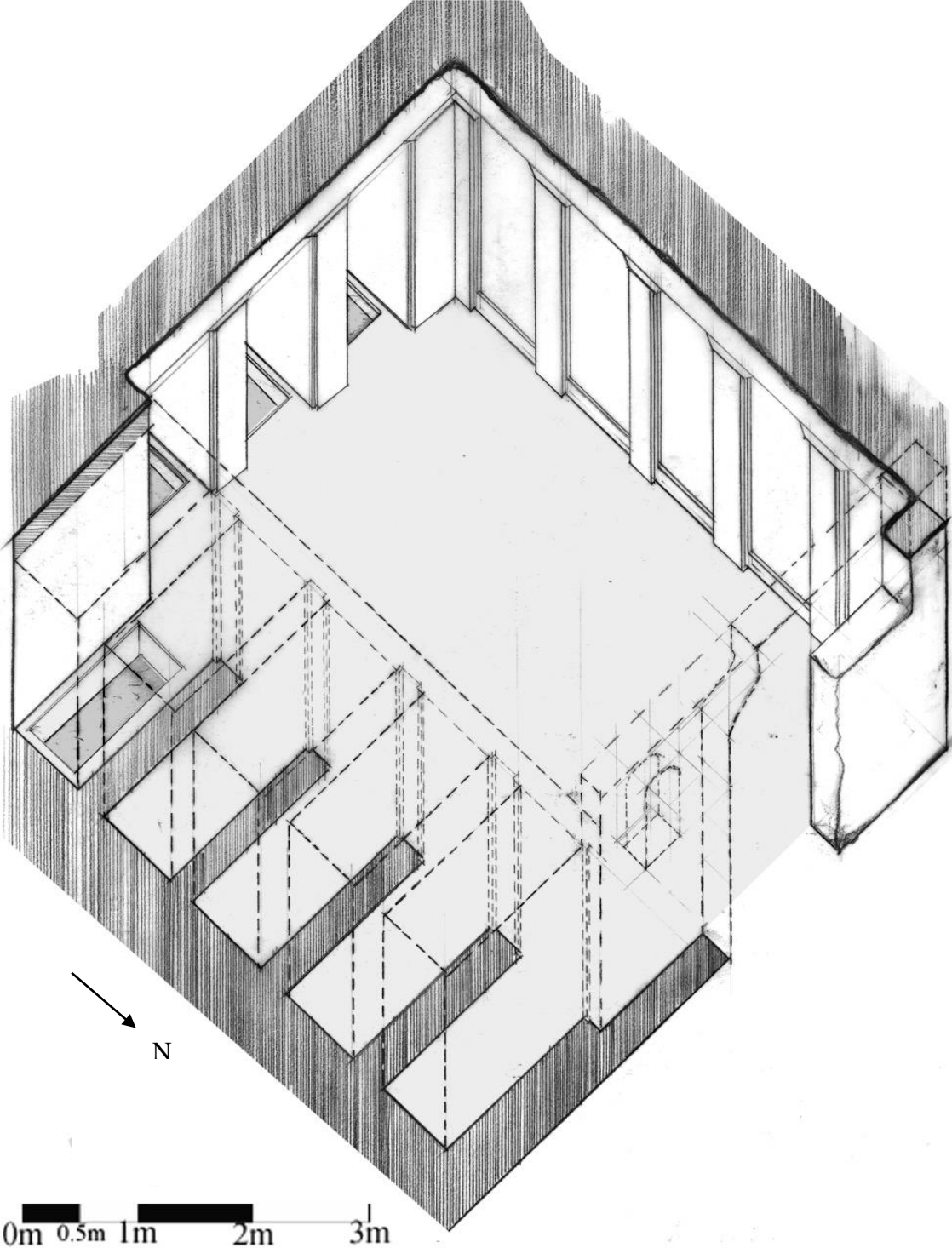
c. Detail of eastern wall (2-9-1997)

Wādi an-Numayr Cave



Floor plan of the interior of cave in (Pl. 67a)

Wādi an-Numayr Cave

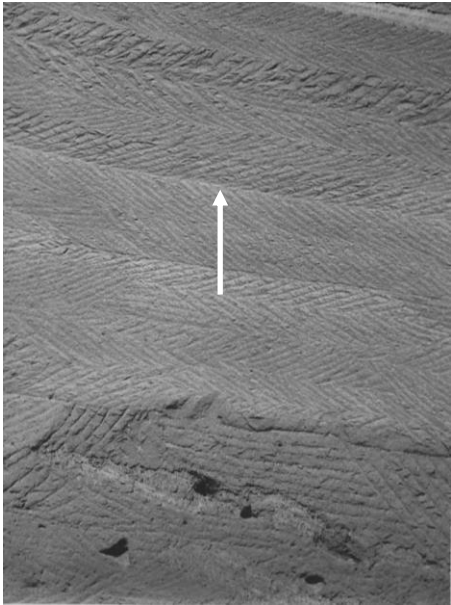


Axonometric view of the interior of cave seen in (Pl. 67a)

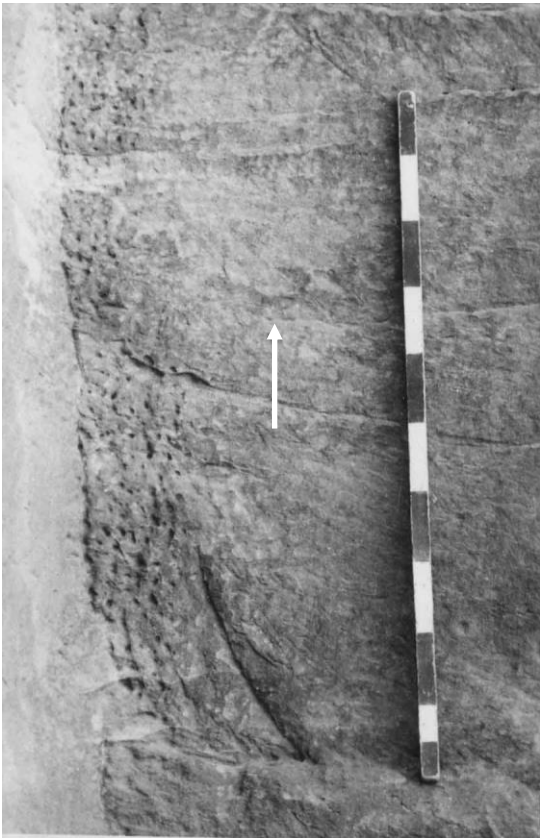
Levels of Quarried Stones



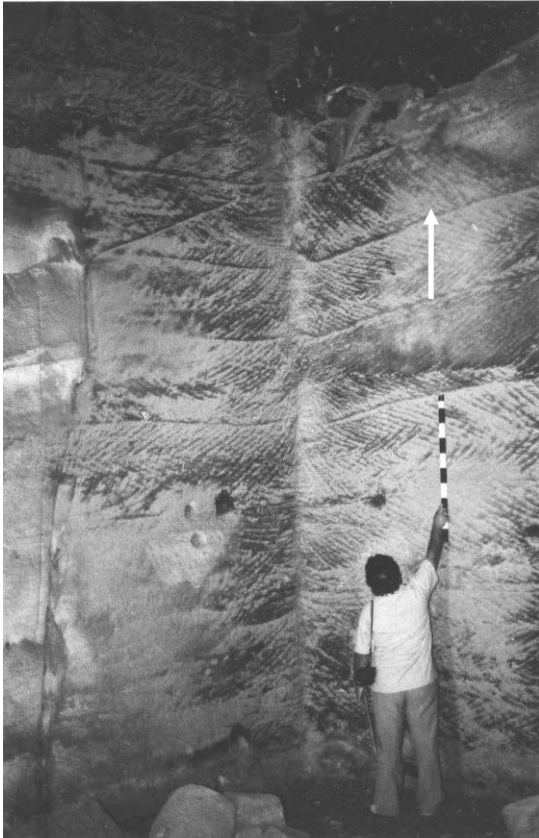
a. Tomb façade/west side of al-Khubthah (11-16-1993)



b. Wādi as-Siyyagh quarry (7-3-1990)

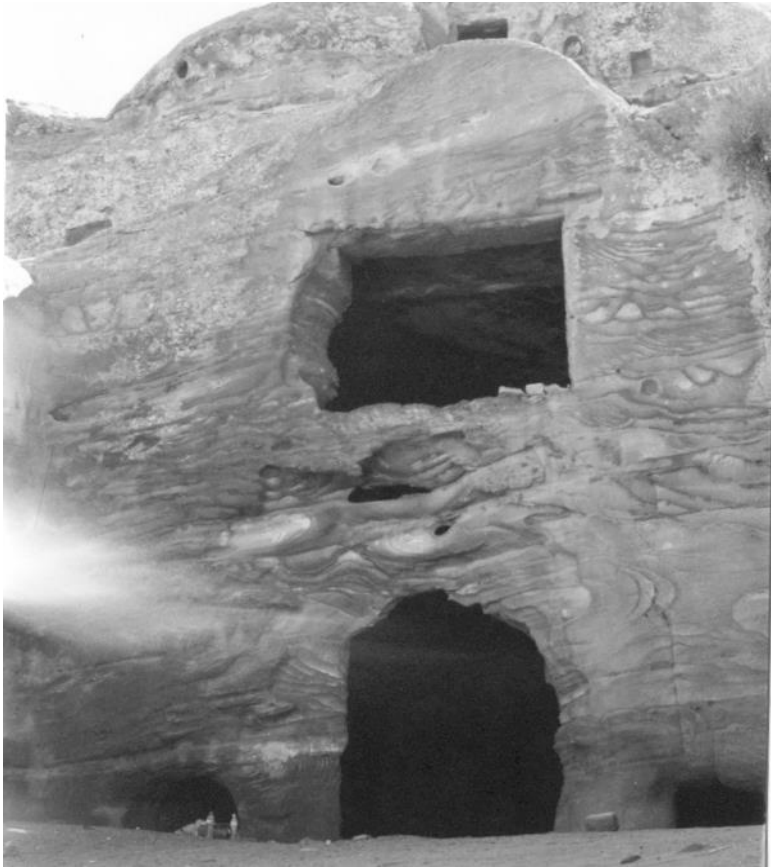


c. Al-Najr (Umm Sayhun) Quarry (4-2-1991)

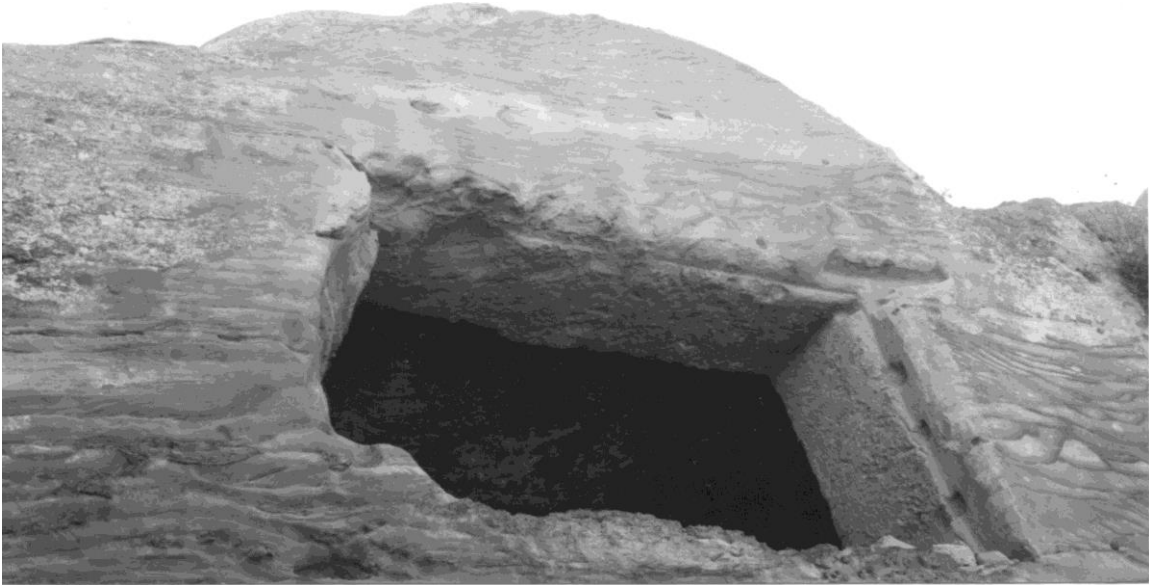


d. Tomb Interior /Wādi an-Numayr (Br. 258) (6-6-1993)

Cave at the North-East Ridge of the High Place



a. Façade facing north (21-22-1997)

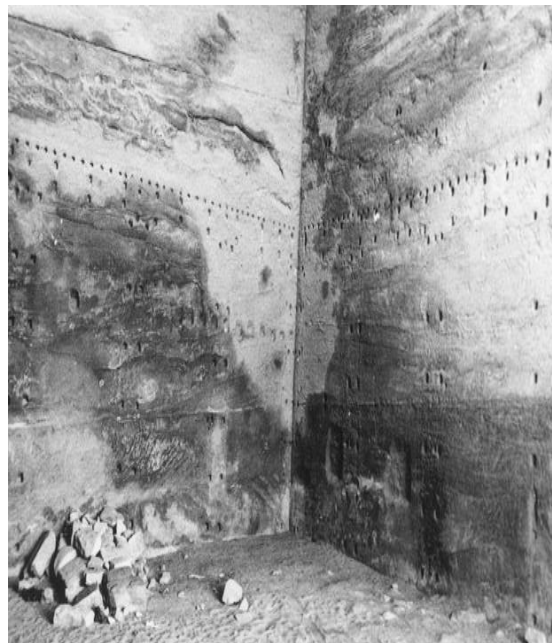


b. Detail of upper part of façade (a). Notice the holes for the door on the western side

Detail of the Interior Walls of the Cave in Plate 72



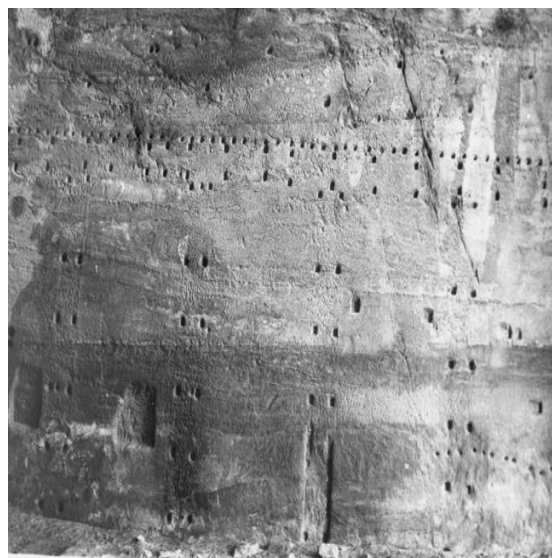
**a. South wall from floor to ceiling
(2-14-1997)**



**b. Southwest corner, lower part
(2-19-1997)**

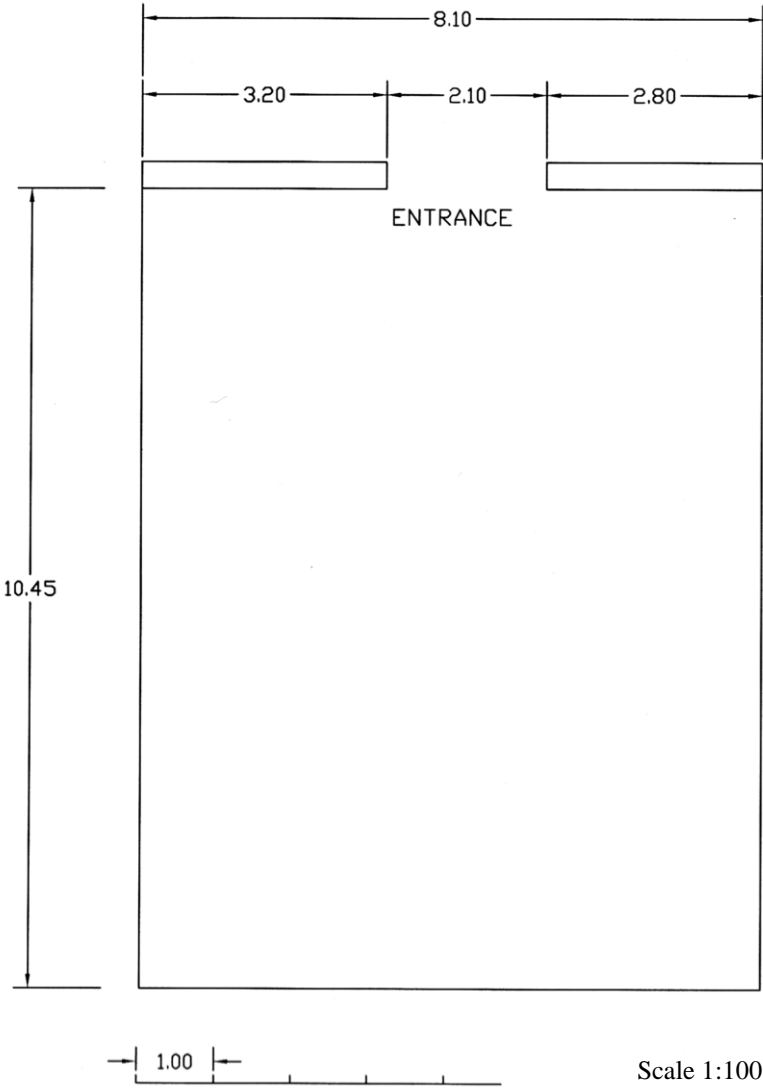


**c. Detail of lower part of south wall
(2-15-1997)**



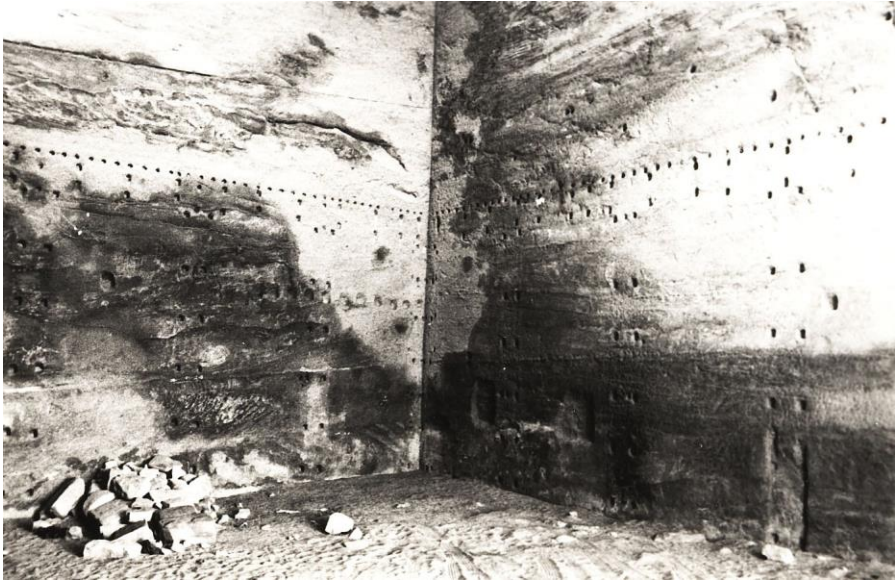
**d. Detail of lower part of west wall
(2-16-1997)**

Cave at the North-East Ridge of the High Place (Pl. 72)

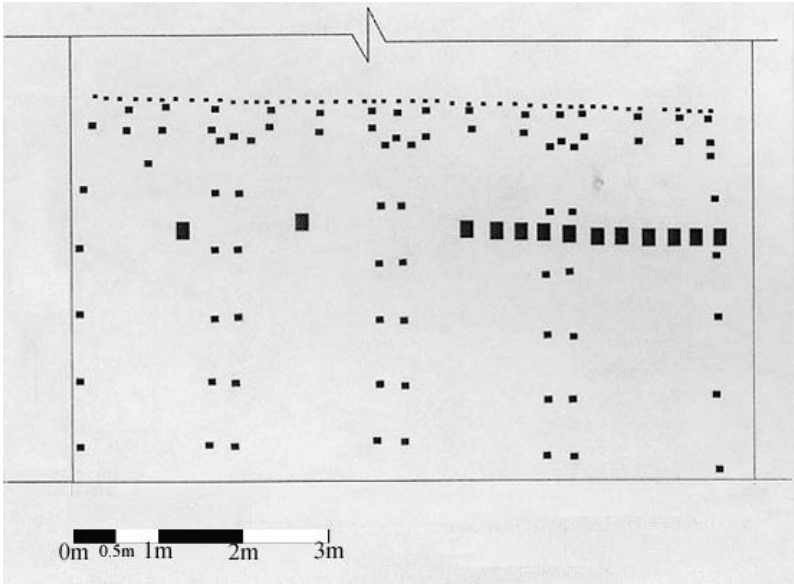


Ground floor plan for the cave at the north side of the High Place

Cave at the North-East Ridge of the High Place



a. Southwest corner (2-19-1997)

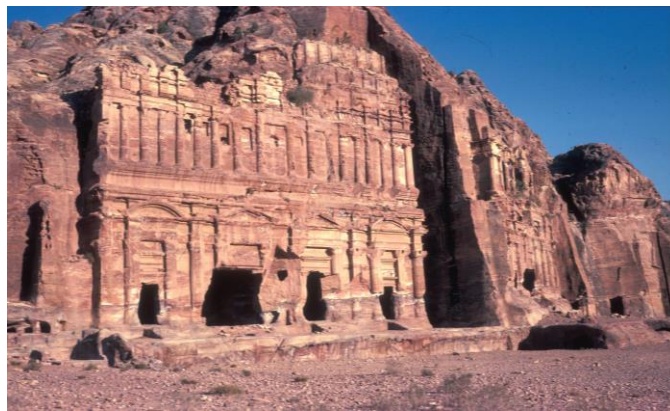


b. Detail of holes in the south wall interior of (Pl. 72)

The Palace Tomb Area



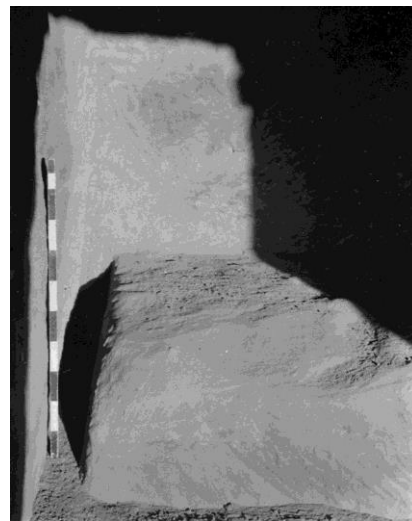
a. General view (s. 1981)



b. The Palace Tomb (Br. 765) façade (s. 1966)

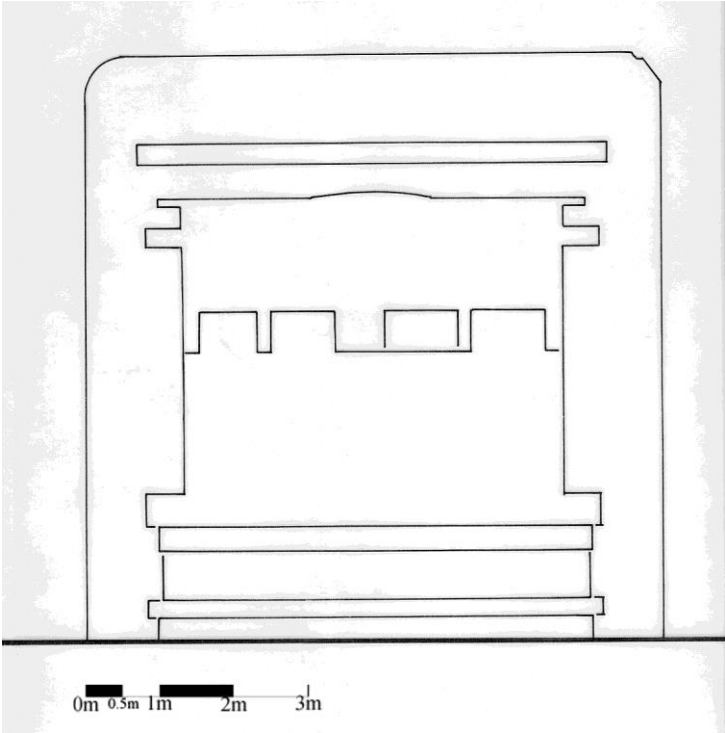


**c. Quarry inside (b)
(17-3-1991)**

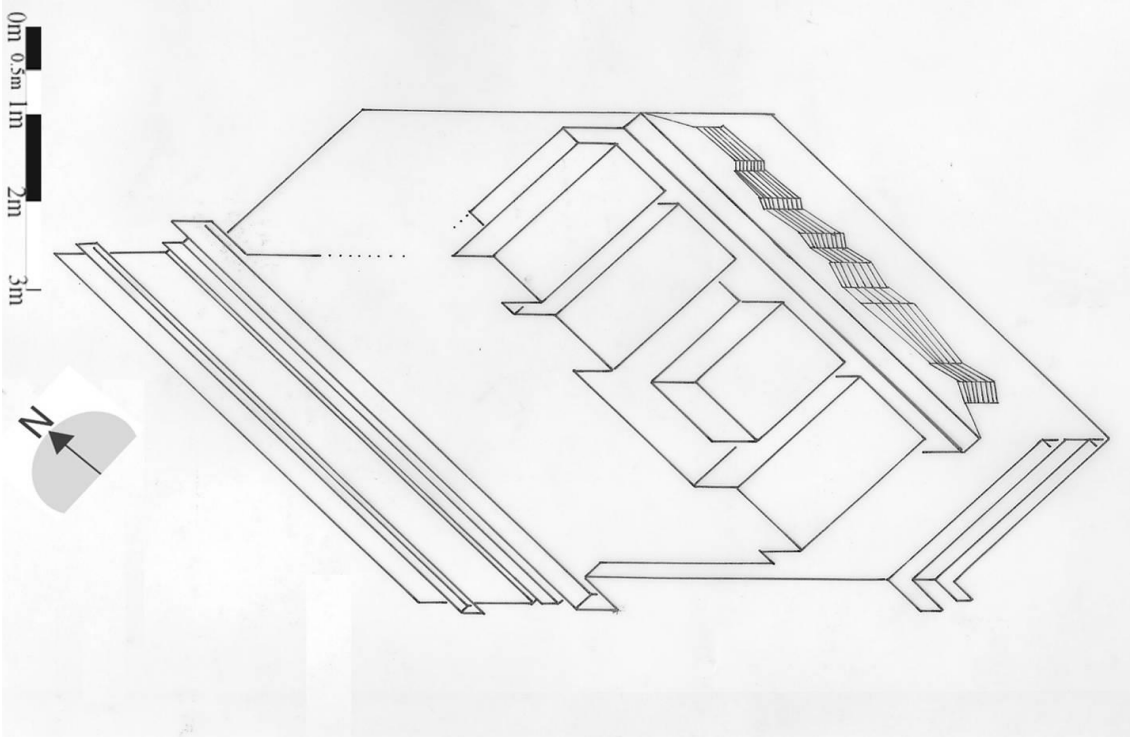


**d. Quarry inside a cave east of
the Palace Tomb (16-17-1991)**

The Palace Tomb



a. Elevation of east wall of the Palace Tomb quarry



b. Isometric view of east wall of the Palace Tomb quarry

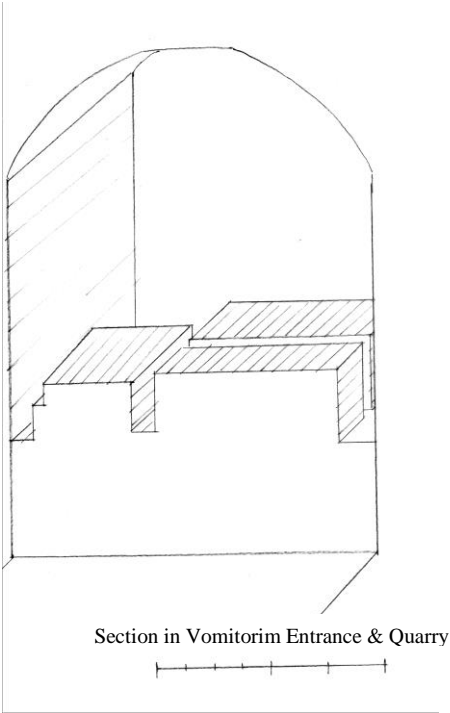
The Theater (Br. 161)



a. Theater (s. 1966)

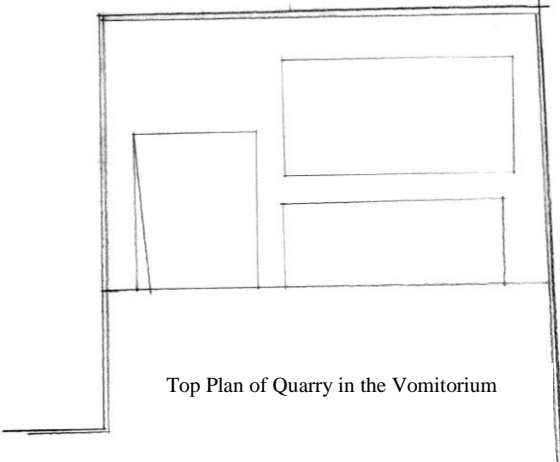


b. Quarry in the Theater (20-2-1991)



Section in Vomitorium Entrance & Quarry

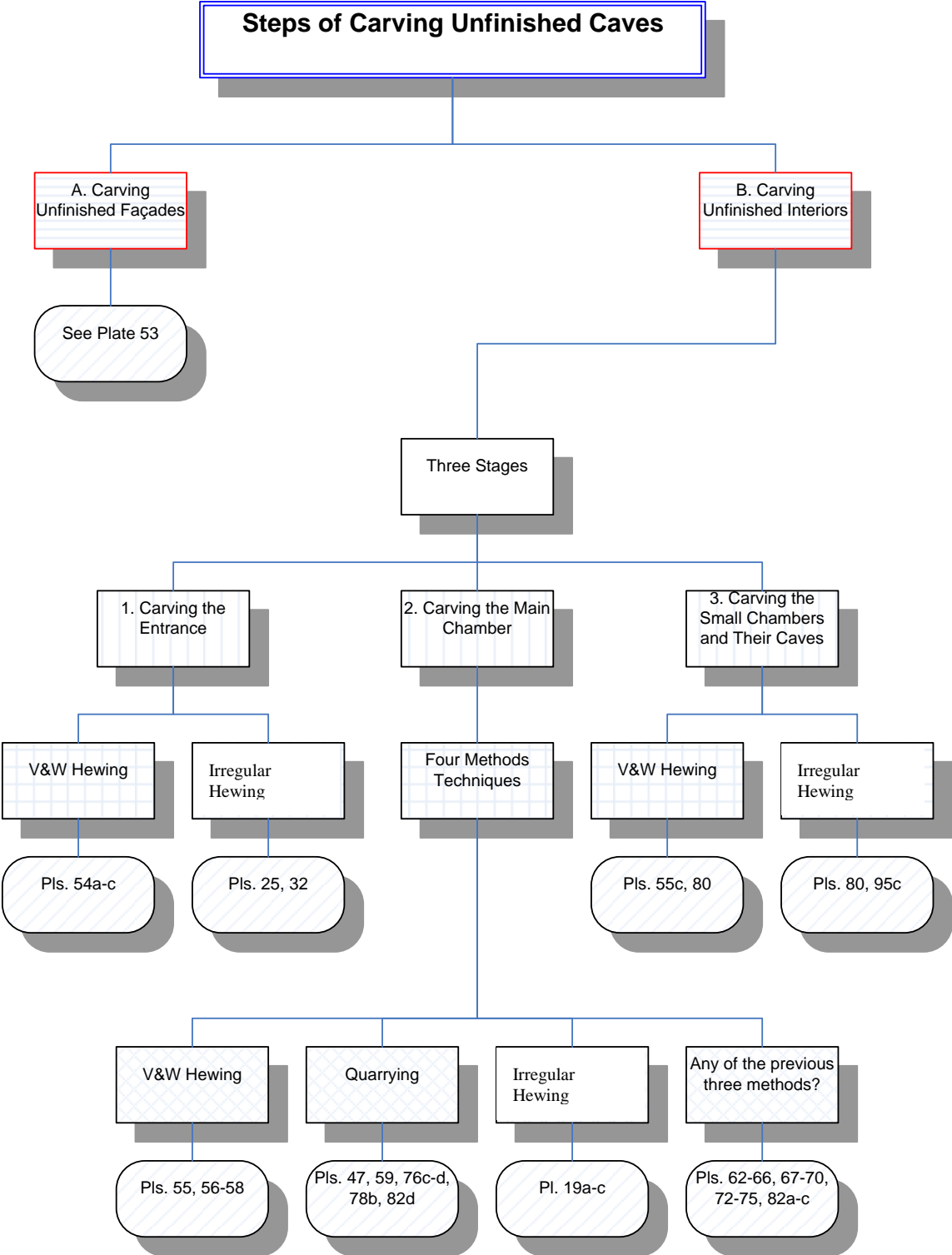
c. Drawing of (b)



Top Plan of Quarry in the Vomitorium

d. Top plan drawing of (b)

Flow chart of Interior Carving



Grave Carving in the Interior

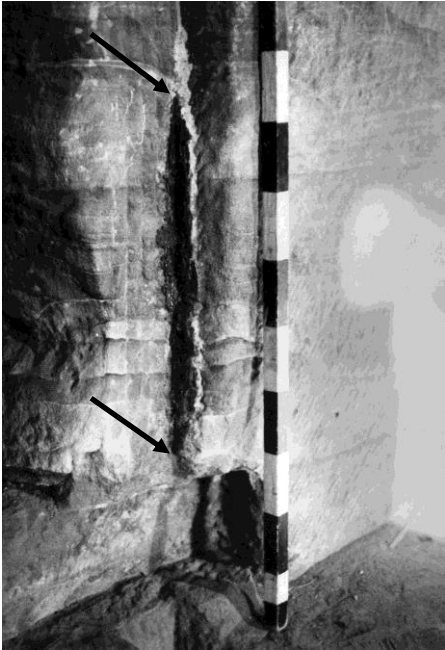


a. The “VW” technique inside cave opposite the Theater (12-0-1993)

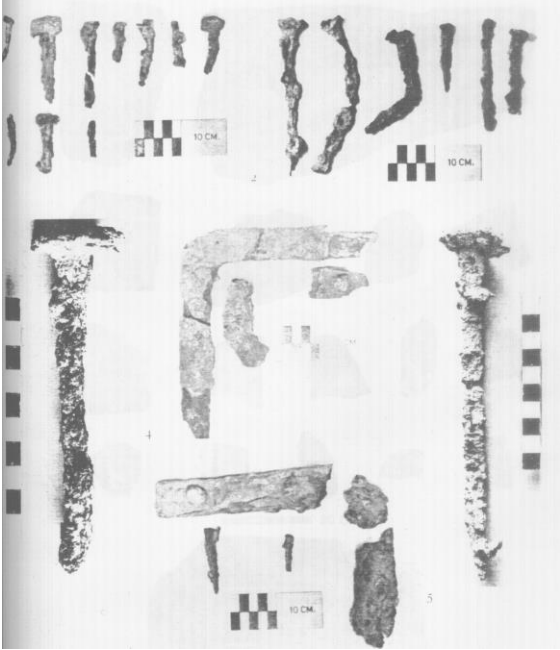


b. At Mughur an-Nasārā (5-1-1993)

Iron Pieces



a. A decayed iron piece situated inside the Urn Tomb (2-11-1993)

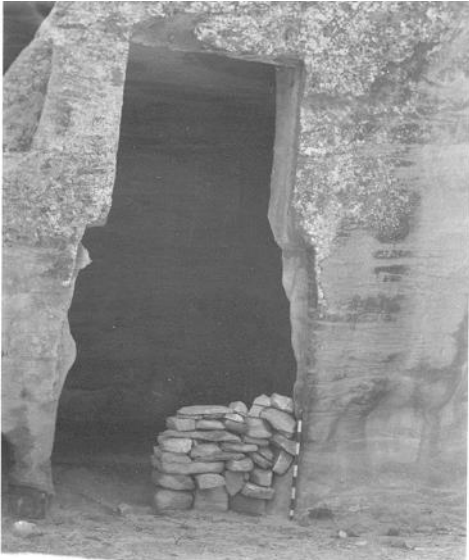


b. Nail and clamp fragments (after Hammond, 1975: Pl. XLV)



c. Nails from Tomb BI-1 (after Zayadine, 1979: Pl. LXXXVI)

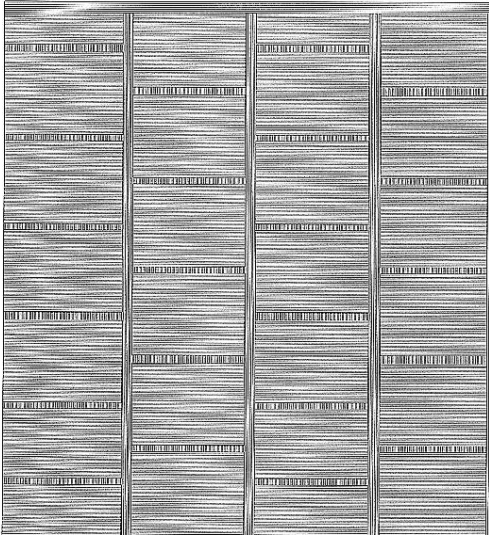
Patterns on the Ceiling and Wall



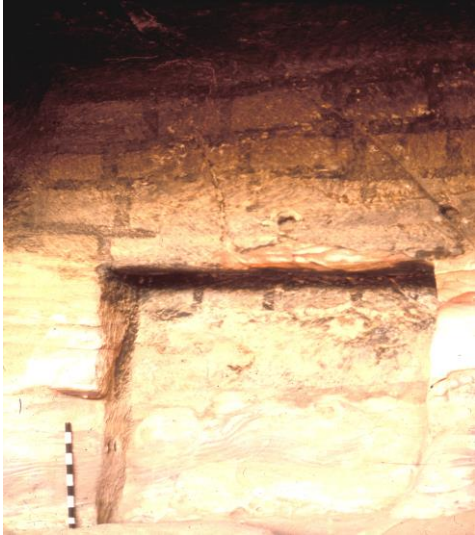
a. Cave entrance on the way to ed-Dayr (17-33-1991)



b. The ceiling of cave in a (17-31-1991)

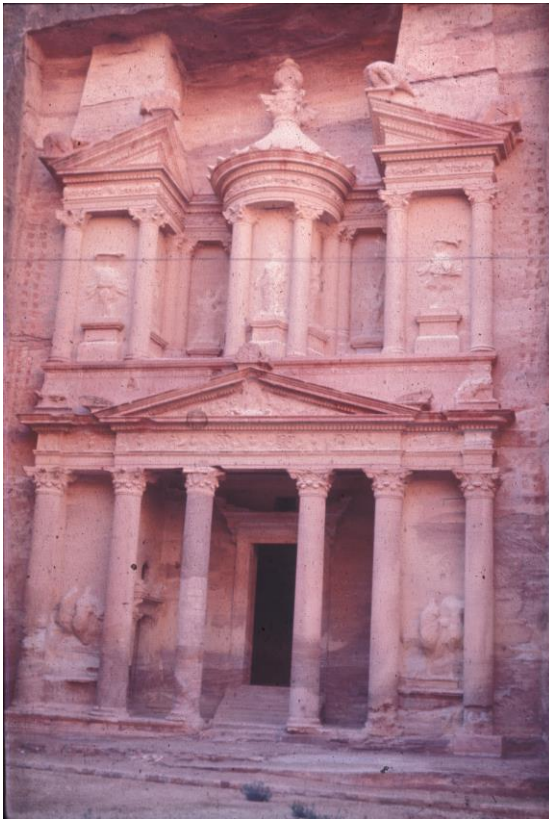


c. Drawing of the ceiling in b

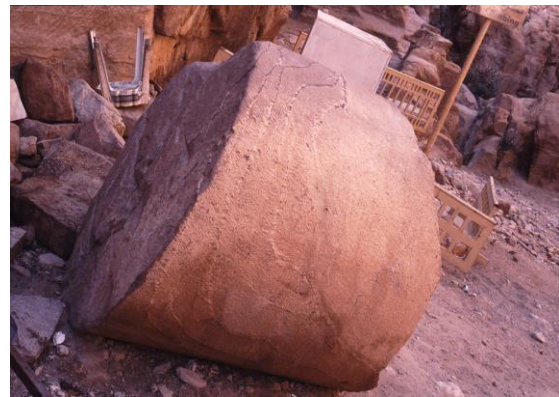


d. Cave south of the Urn Tomb (24-32-1991)

The Cutting and Use of Slabs



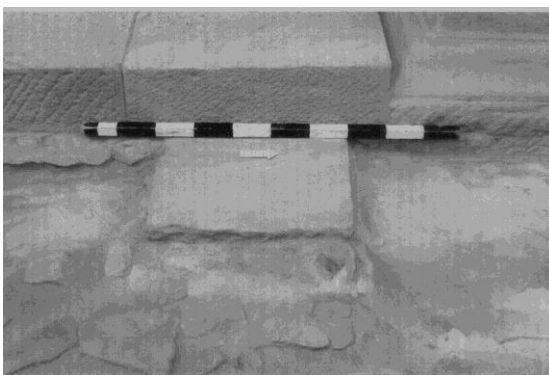
a. al-Khaznah (Br. 62) (s. 1978)



b. (s. 1-22-2008)



c. (s. 1-20-2008)
b & c. Fragments of the broken column



d. The only slab left in situ in front of al-Khaznah (12-12-1993)

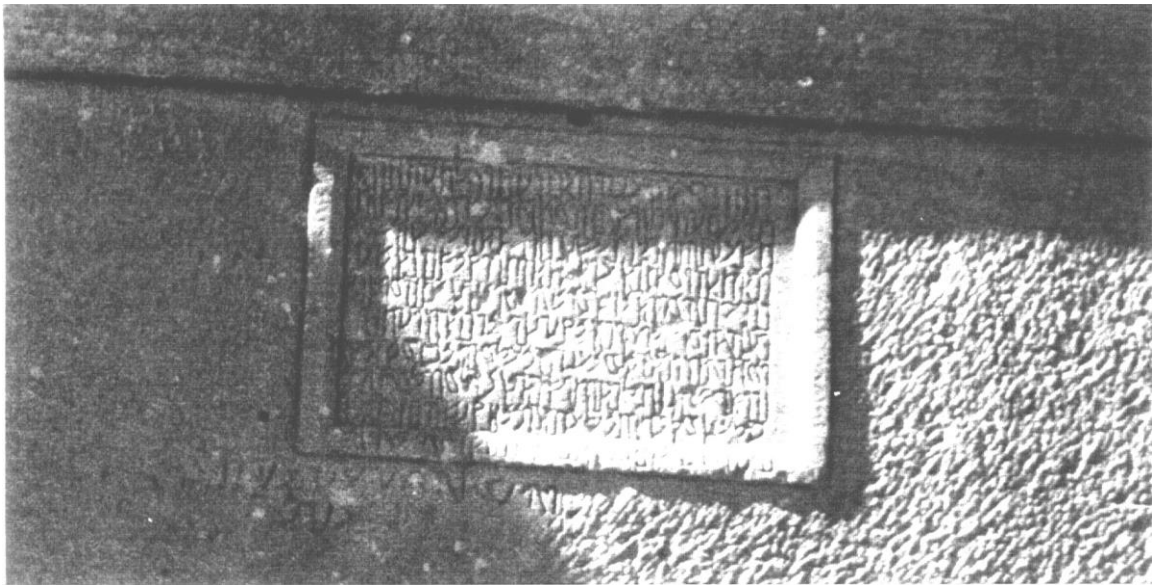


e. al-Khaznah interior floor (7-13-1997)

Madain Saleh (Hegr)



a. Façades of the tombs at Qasr al-Bint (s. 1976)



b. Nabataean inscription above a façade of a tomb at Qasr al-Bint stating the name of the deceased and the year of his death. See also *Saudi Arabian Antiquities* (1975: 42) (s. 1976)

Burial Chambers at Madain Saleh (Hegr)*



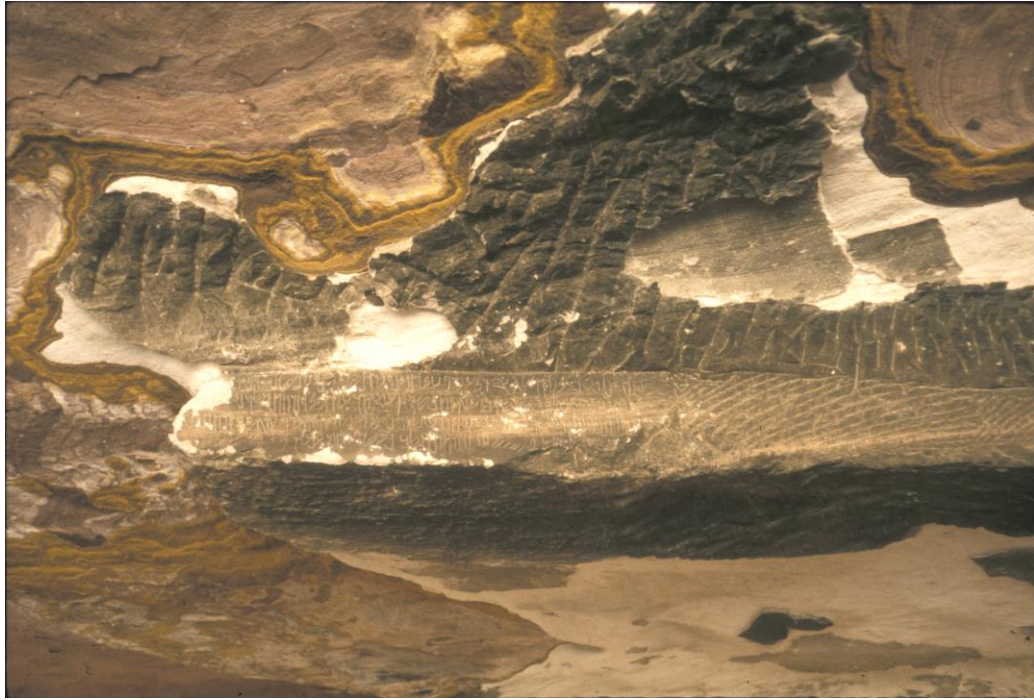
a. Chambers in the wall (s. 1976)



b. Chambers in the walls with shelves (s. 1976)

* Tombs interiors at Madain Saleh, showing rectangular burial slots (Saudi Arabian Antiquities, 1975: 56)

Nabataean Inscriptions at Petra



a. 'Oboda inscription at Wādi an-Numayr (9-8-1994)



b. Inside the cave at al-Mu'aysrah ash-Sharqiyyah (20-25-1994)

Floods' Damage



a. Flood at the center of Petra



b. Fallen walls in wādi / opposite Qasr al-Bint

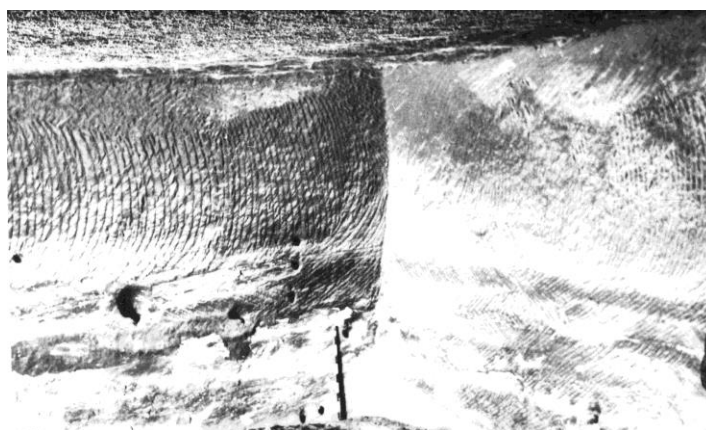


c. Fallen walls in Wādi Sabrah / South-west of Petra (13-2-1993)

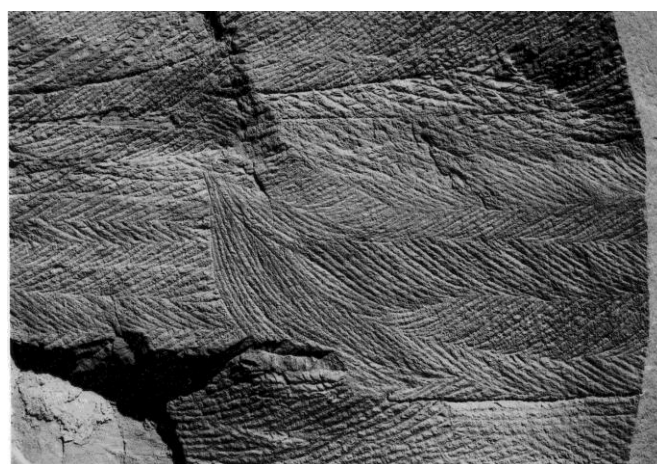
Pointed Pick and its Dressing



a. Fragment of an oil lamp showing a pick in use

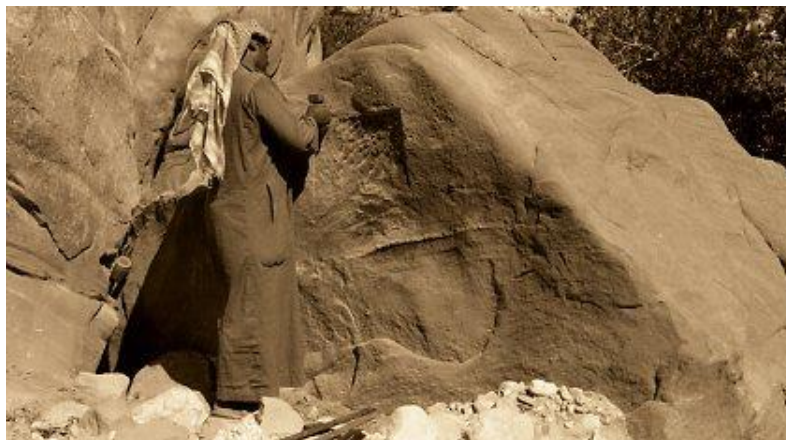


b. Traces of pointed pick (2-29-1990)



c. Traces of pointed pick / Wādi as-Siyyagh quarry (18-25-1994)

Rock Carving Experiment



a. Muhammad's carving experiment on a fallen rock (22-6-1993)

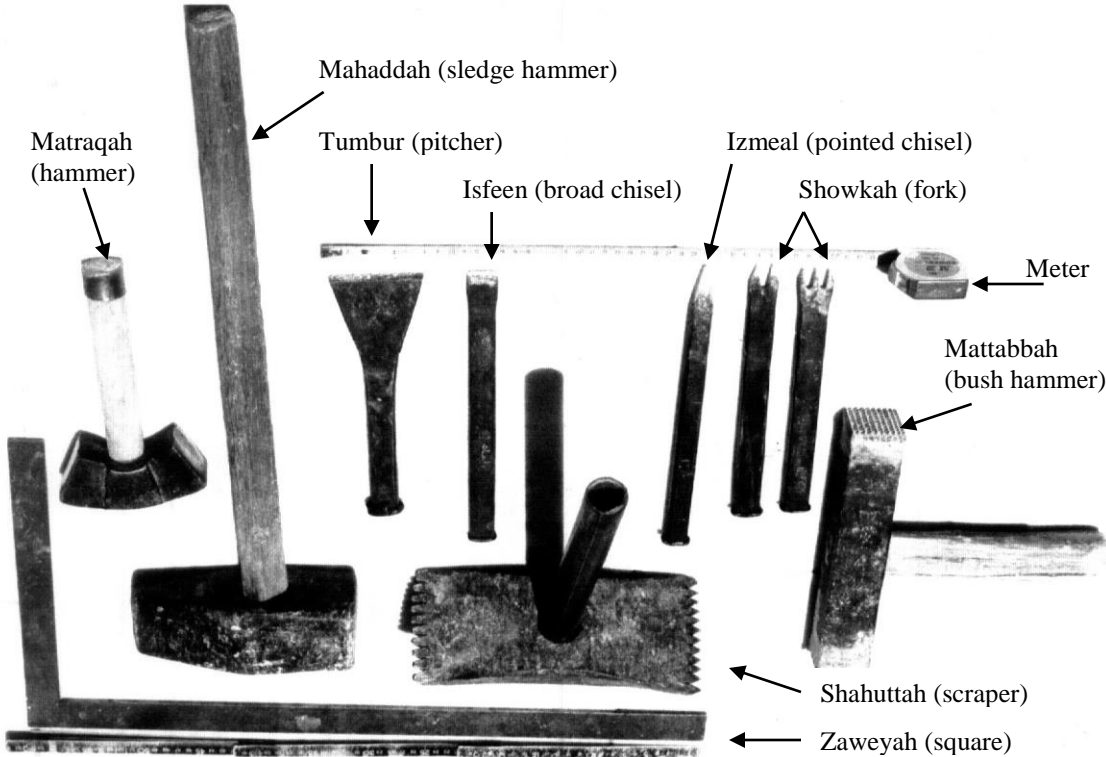


b. Outline for the experiment (22-5-1993)



c. Result of the experiment (22-7-1993)

Stone-cutter's Tools



a. Modern tools (3-3-1997)



b. Ancient traces resulting from the sharpening of tools on rock north of the Lion's carving / west side of the High Place (3-2-1993)

Stone-cutters



a. In Amman working on limestone (3-4-1997)



b. In Petra working on sandstone (s. 1979)

Stone Use



a. Water channel in the Siq (3-19-1990)



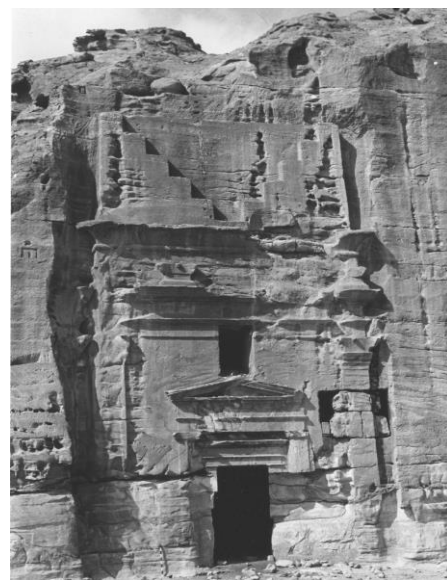
b. Reservoir at al-Mu'aysrah
ash-Sharqiyyah (15-6-1991)



c. Corinthian Tomb (Br. 766) façade (17-8-1991)



d. Museum (Br. 400) interior /al-Habis
(18-31-1991)



e. Façade at Mughur an-Nasārā
(Br. 676) (4-17-1993)

Ed-Dayr



a. General view of ed-Dayr (Br. 462) (15-24-1994)

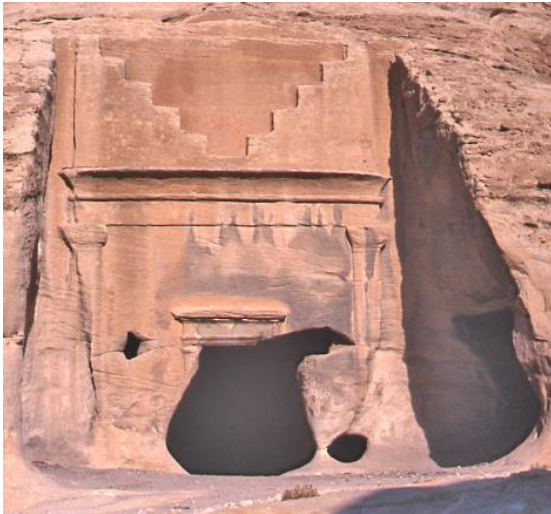


b. Entrance (5-23-1990)

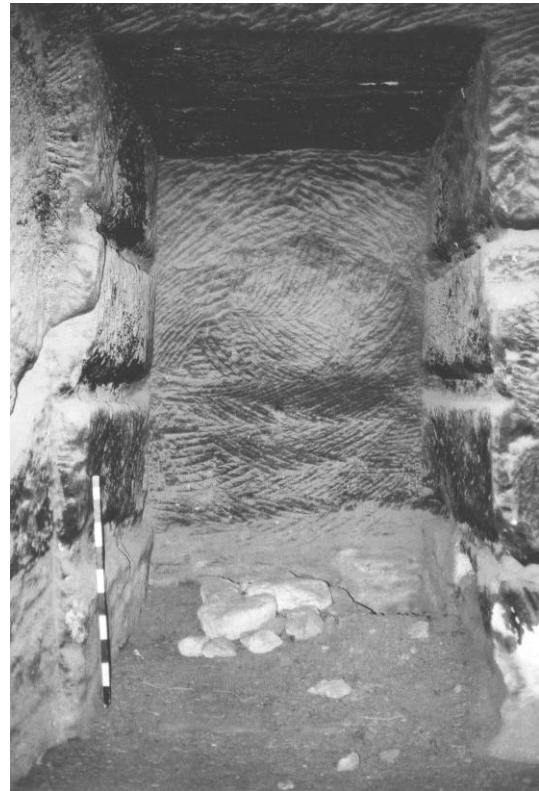


c. Arch above niche inside ed-Dayr (s. 3-21-1990)

Tomb with Shelved Chambers Opposite the Obelisk Tomb



a. Tomb façade (s. 1-14-2008)



b. Detail of shelved chamber from (a) (3-16-1993)



c. West wall in a with three shelved chambers (3-17-1993)

Tombs' Arrangement



a. Opposite the Theater (24-24-1991)



b. Wādi ath-Thughrah (7-19A-1997)



**c. Mughur an-Nasārā
(5-1-1993)**



**d. Way to ed-Dayr
(5-2-1990)**



**e. Mughur an-Nasārā
(4-23-1993)**



f. Opposite the Theater (24-27-1991)



g. Wādi Farasah (15-34-1991)



**h. Tomb of the broken pediment
interior (after McKenzie, 1990: Pl. 134)**

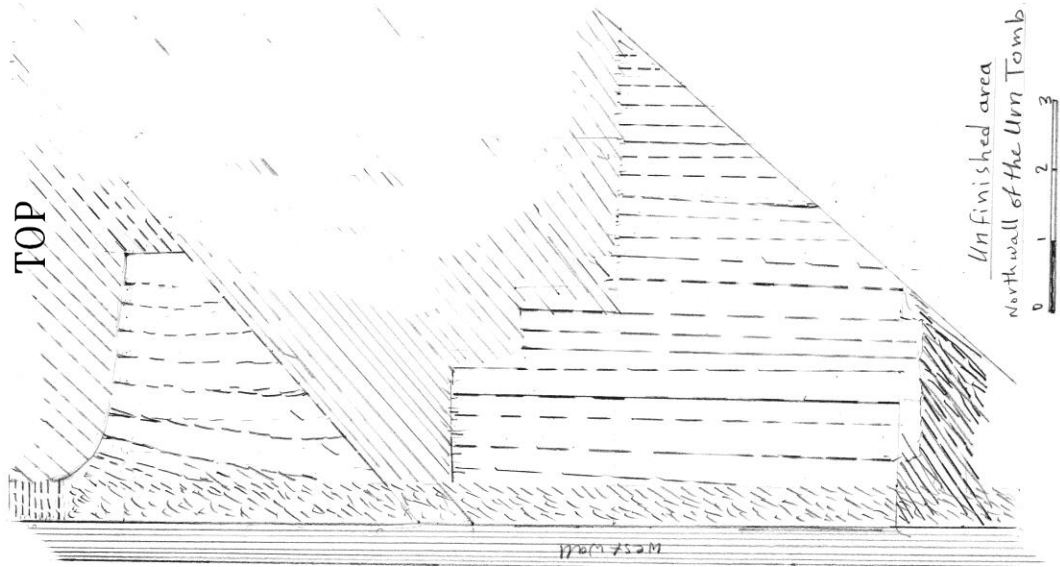


**i. Wādi al-Matahah Tomb 7 interior
(after Johnson, 1999: 252 Fig. 6)**

Urn Tomb Unfinished Dressing

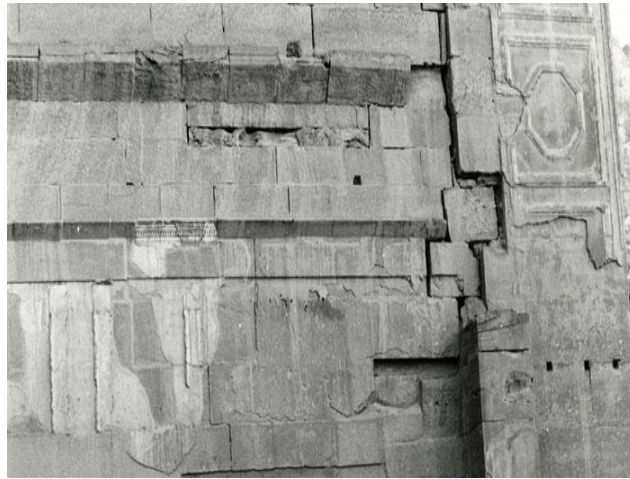


a. North wall of the Urn Tomb (5-6-1993)



b. Drawing of (a) Unfinished area north wall of the Urn Tomb

Plaster and Stucco on Building's Walls and stones / Petra



a. East wall of Qasr al-Bint (5-23-1997)



b. South wall of Qasr al-Bint (3-3-2000)

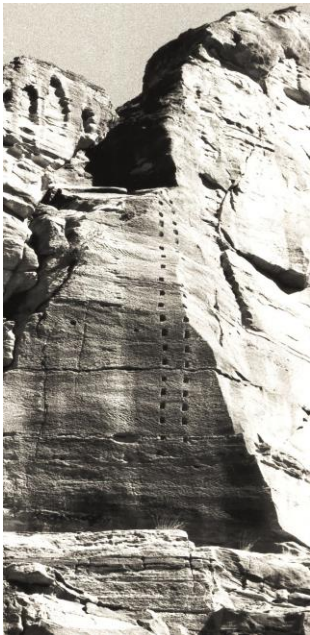


c. Drum from Temple of the Winged Lions (8-8-1991)

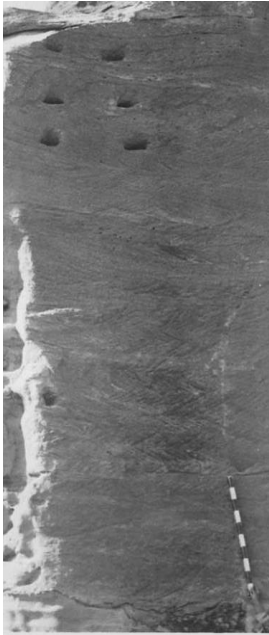


d. Capital from the Baths (7-18-1991)

Slots (Foot-holds) for Climbing in Quarries



a. (18-10-1994)



b. (13-21-1991)



c. (10-8-1991)



d. (10-7-1991)



e. (24-8-1991)



f. (3-9-1993)

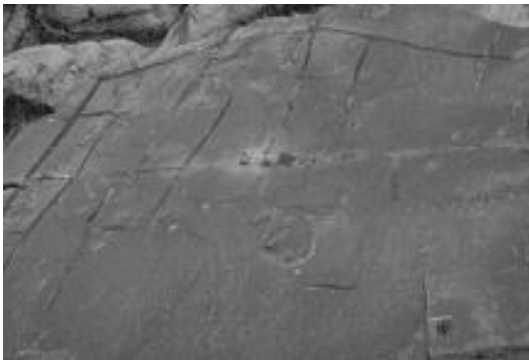
a, b, & c. Wādi as-Siyyagh
e. North Side of al-Khaznah

d. East of High Place
f. Umm-Sayhun Quarry

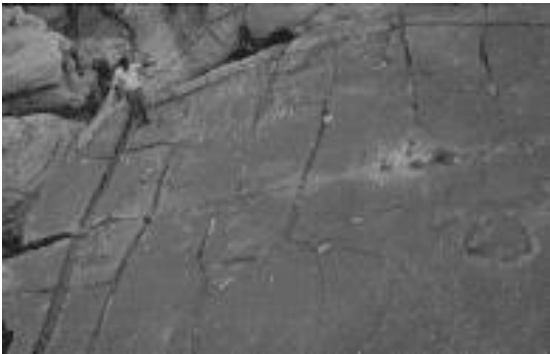
Trenches for Extracting the Blocks from ed-Dayr Monument



a. (23-8-1991)



b. (23-6-1991)



c. (23-7-1991)



d. 23-9-1991)



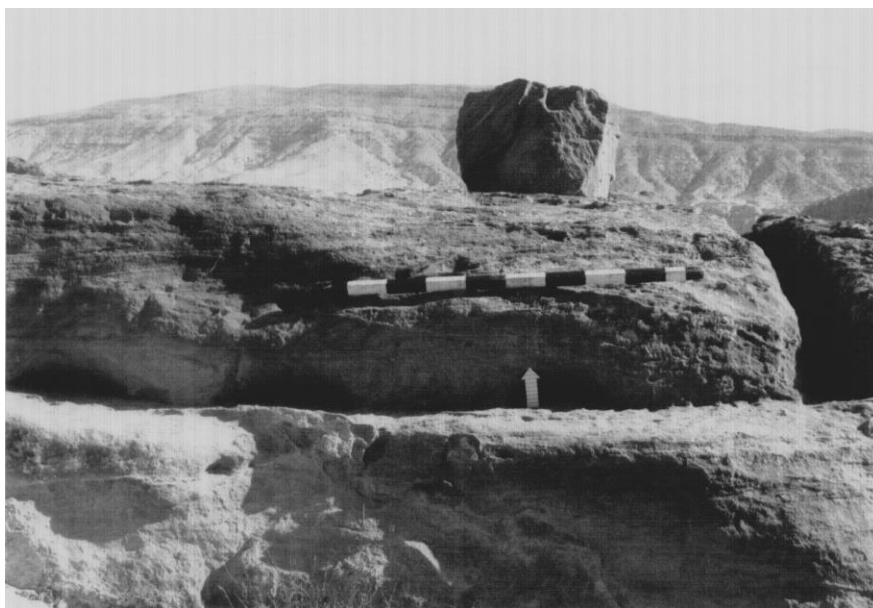
e. (23-3-1991)

a-d. South of the Urn
e. North of the Urn

Wādi ed-Dayr Quarry

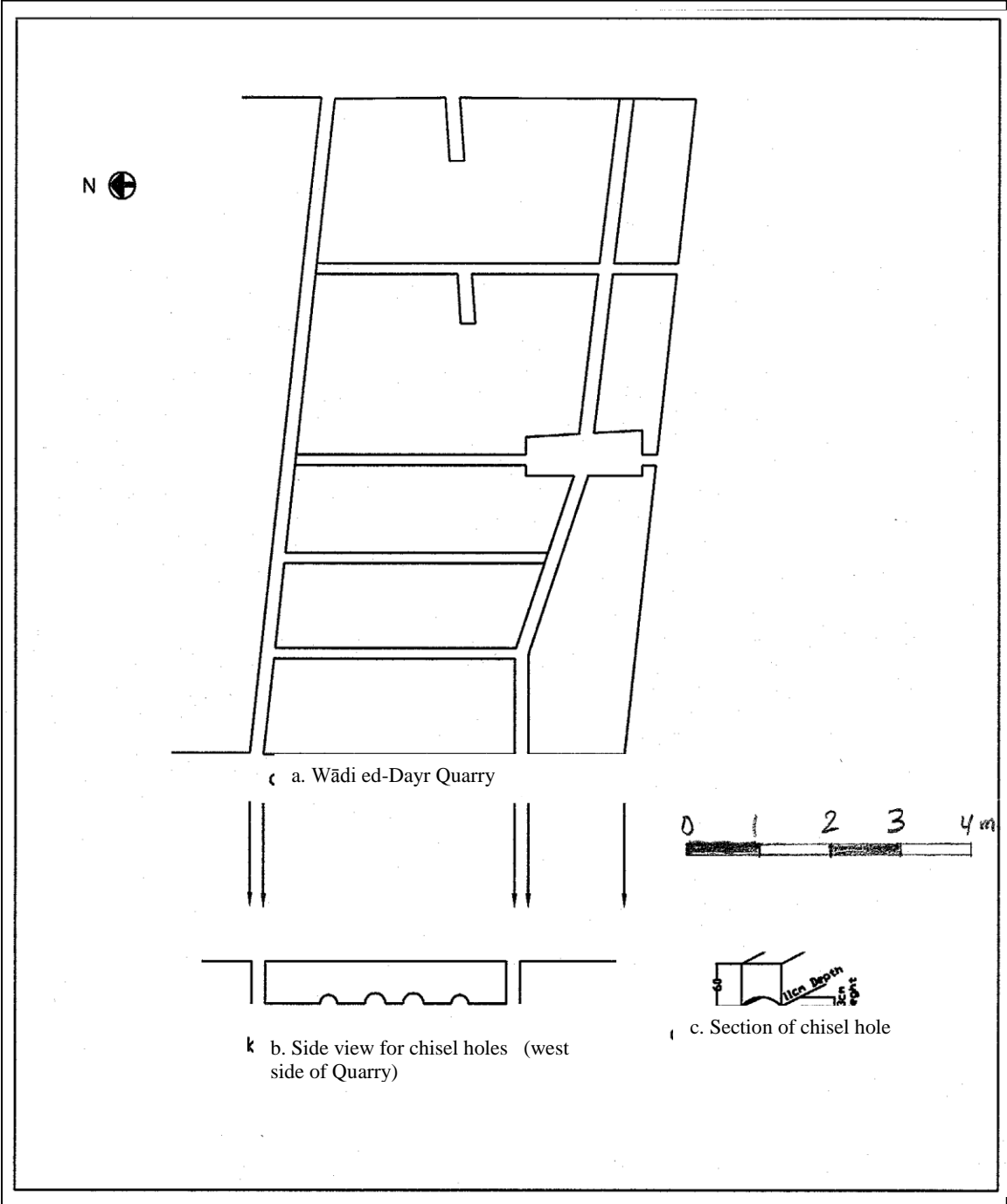


a. General view of quarry (7-0-1993)



b. Detail of chisel's holes of (a) (6-21-1993)

Top Plan and Side Section of Wādi ed-Dayr Quarry



Jabal al-Ashrafiyyah Quarry/ Amman



a. (21-12-1994)



b. (21-11-1994)



c. (21-9-1994)



d. (4-4-1997)

a & b. General view of quarry

c & d. Detail of wedges

Open Quarries in Form of Steps or Tiers of Seats



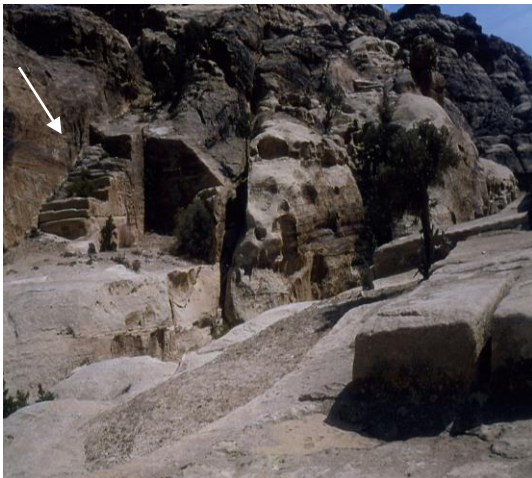
a. (3-34-1991)



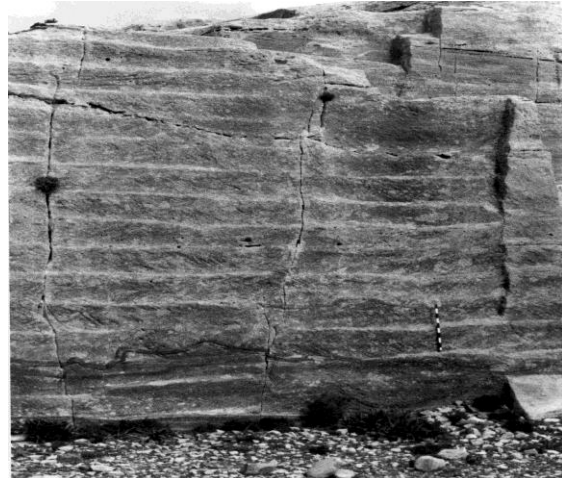
b. (16-28-1991)



c. (16-23-1991)



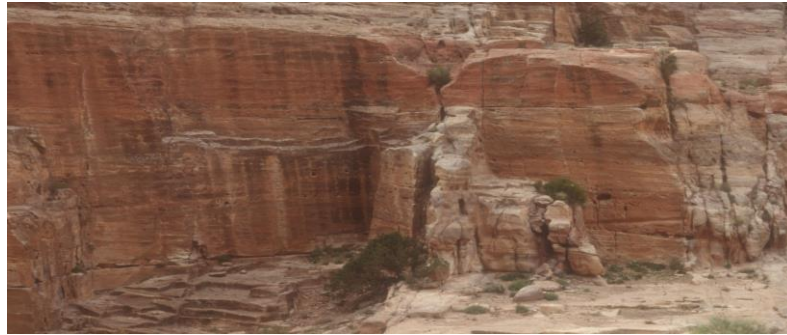
d. (7-6-1993)



e. (20-13-1994)

- a. General view of Umm Sayhun quarry
- b & c. Detail of tiers on top of Umm Sayhun quarry
- d. Ash-Shammāsa quarry on the way to Siq al-Bārid
- e. Tiers at south quarry at the High Place

Un-removed Blocks from Open Quarries



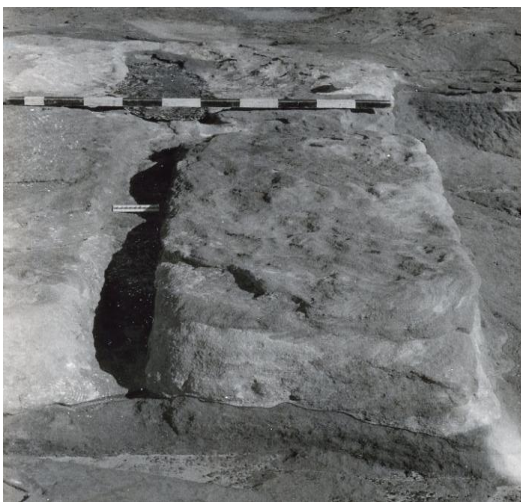
a. (20-34-1991)



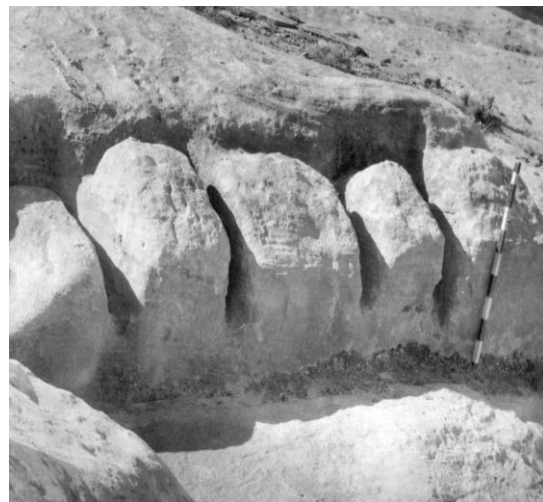
b. (12-4-1991)



c. (12-5-1991)



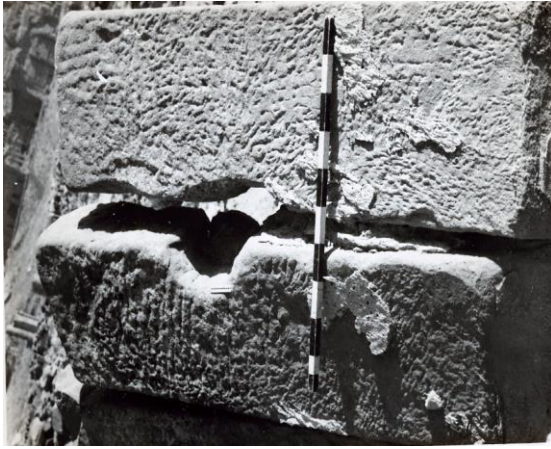
d. (16-21-1991)



e. (16-24-1991)

a. At Wādi as-Siyyagh Quarry/South side
b & c. Main quarry on top of the High Place
d & e. On top of the Umm Sayhun

The Use of Mortar



a. Masonry from Qasr al-Bint (8-31-1991)



b. Column drum from the Great Temple (18-8-1991)



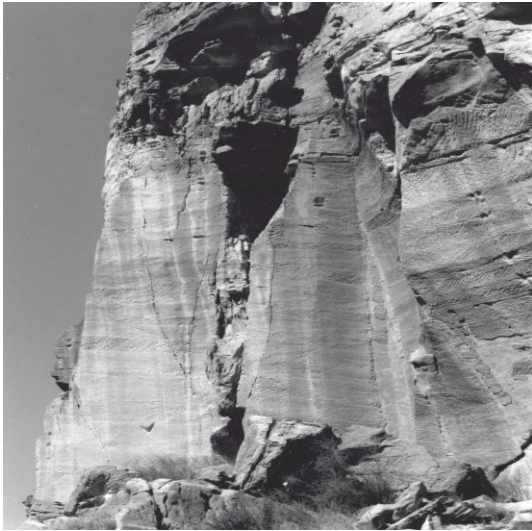
c. (7-35-1991)



d. (7-34-1991)

c & d. Column drums from the Temple of the Winged Lions

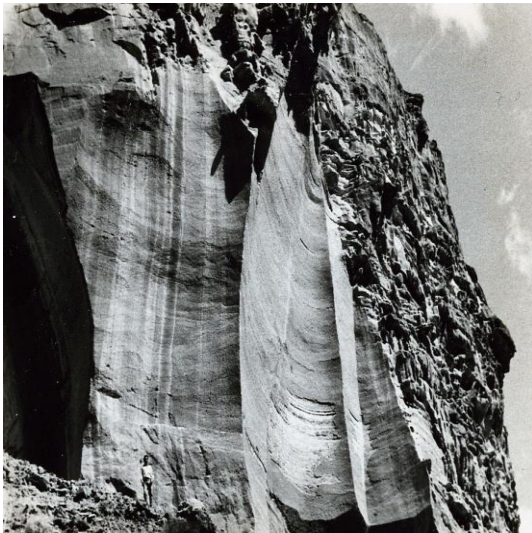
Open Quarries – Main Quarries at Wādi as-Siyyagh



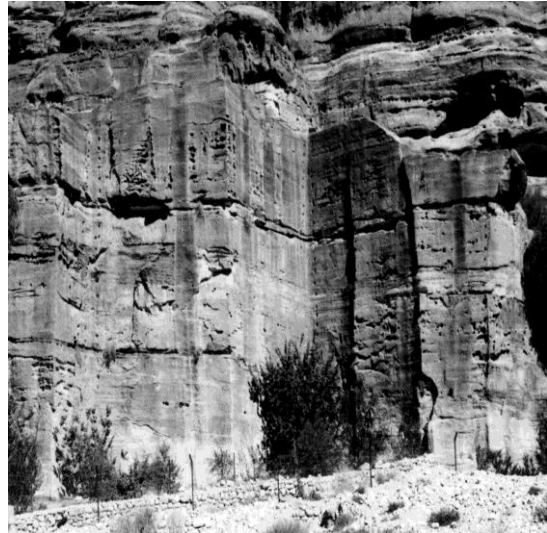
a. (18-24-1994)



b. (6-1-1991)



c. (6-27-1991)



d. (1-20-1991)

a, b, & c. General views of western part of the north side of Wādi
d. East part of the north side of Wādi

Open Quarries – Main Quarries at the High Place



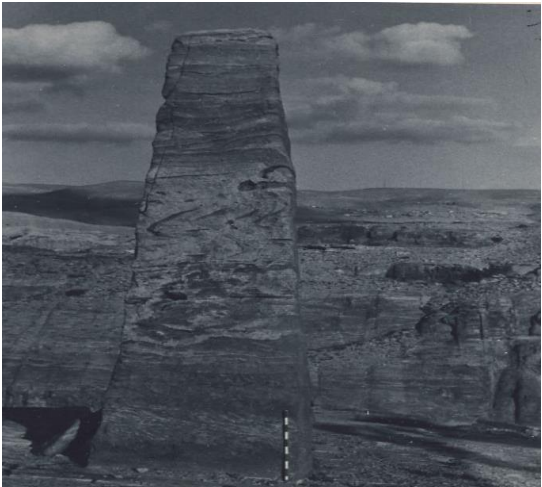
a. (12-15-1991)



b. (s. 2-5-2008)



c. (11-17-1991)



d. (12-14-1991)



e. (12-11-1991)

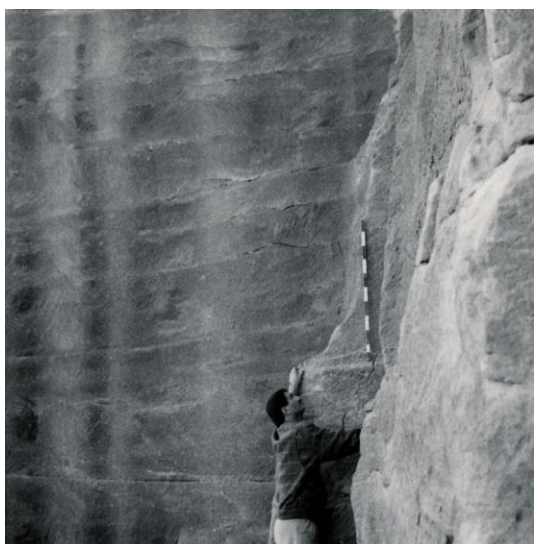
a. South main quarry
c. North main quarry

b. East of the Eastern stair-case to the High Place
d & e. The two Obelisks on top of High Place

Main Quarry at Umm Sayhun



a. General view of the top of Umm Sayhun Quarry (16-26-1991)



b. Levels of quarrying at Umm Sayhun quarry (4-10-1991)



c. Qunb at-Turkmanniyah quarry (14-1-1991)

Open Quarry/Minor Quarries



**a. On the way to ath-Thughrah
(14-17-1991)**



**b. West side of the High Place
(14-22-1991)**



**c. South east of Umm el-Biyārah
(10-17-1993)**

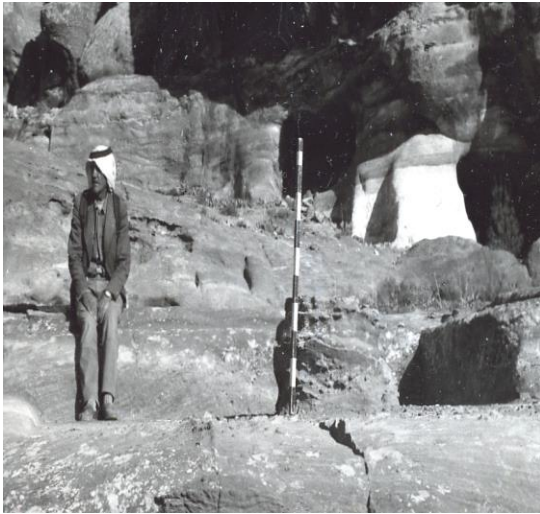


**d. At Qumb at-Turkmaniyyah
(14-0-1991)**



e. At Sayl ed-Dayr (7-15-1993)

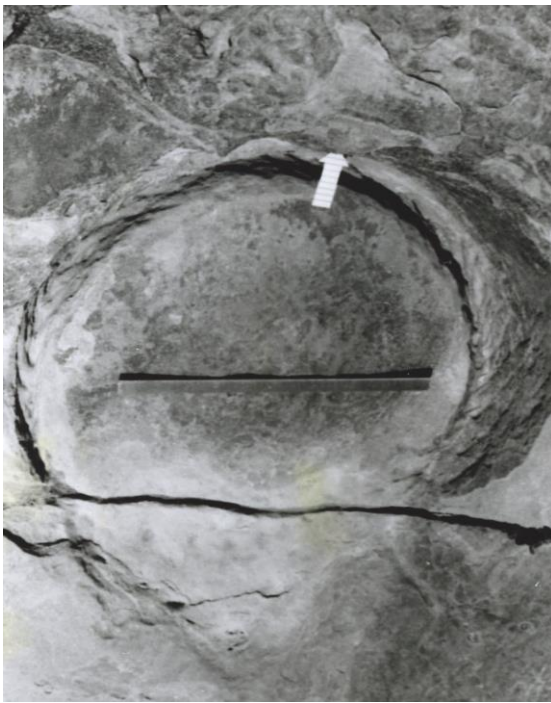
Open Quarries / Quarring Columns' Drums



a. West side of the High Place
(15-35-1991)



b. Detail of (a)
(17-4-1994)



c. North side of Wādi as-Siyyagh
(21-8-1994)



d. Detail of (c)
(21-7-1994)

Open Quarries / Bastah



a. Yellowish soft Stones quarry at Bastah (24-15-1991)



b. Excavations of the Neolithic site at Bastah (24-12-1991)

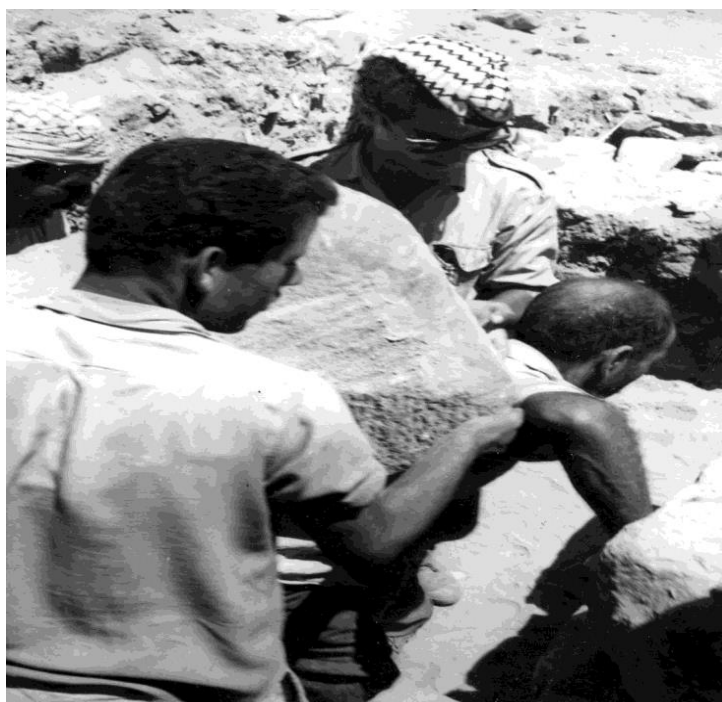


c. Deserted modern houses at Bastah (24-14-1991)

Stone Transport



a. Transporting statue from the Theater to the Museum using men power (1962)



b. Stone-cutter carrying head of statue to the Museum (1962)

Unique Use of Stone at Qasr al-Bint Walls



a. East Wall (5-22-1997)



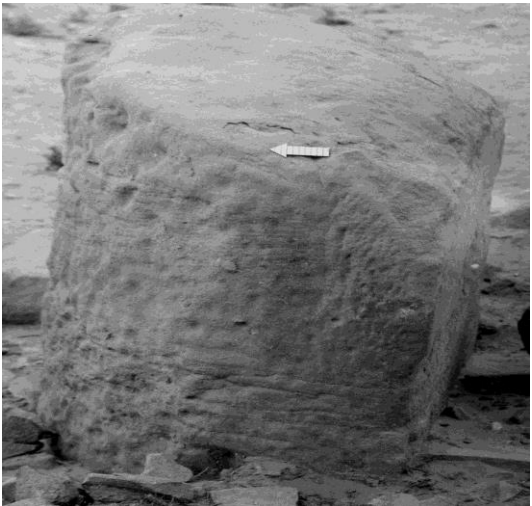
b. Detail of (a) with a fallen block (8-35-1990)



c. West wall (3-1-2000)



d. Detail of (c) (3-0-2000)



e. Fallen block of (b) (5-21-1997)



f. Northeast corner of east wall (18-2-1991)

East Wall of the Staircase of the Urn Tomb

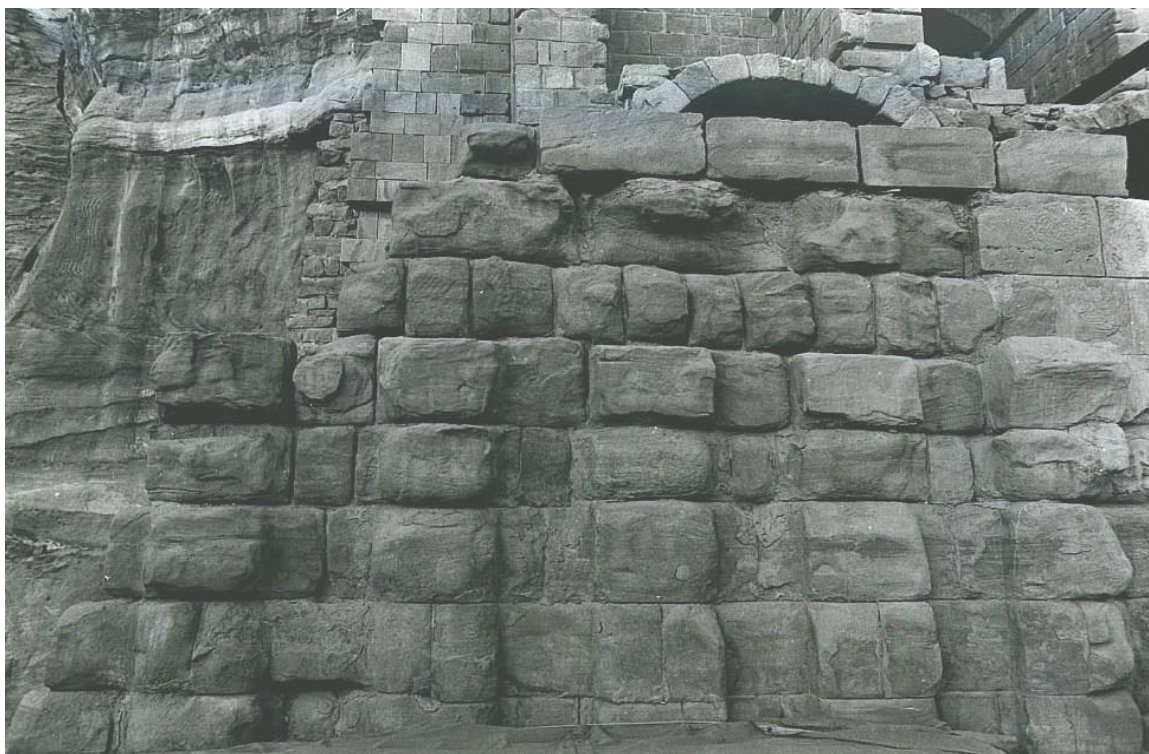


a. From north looking south (11-8-1993)

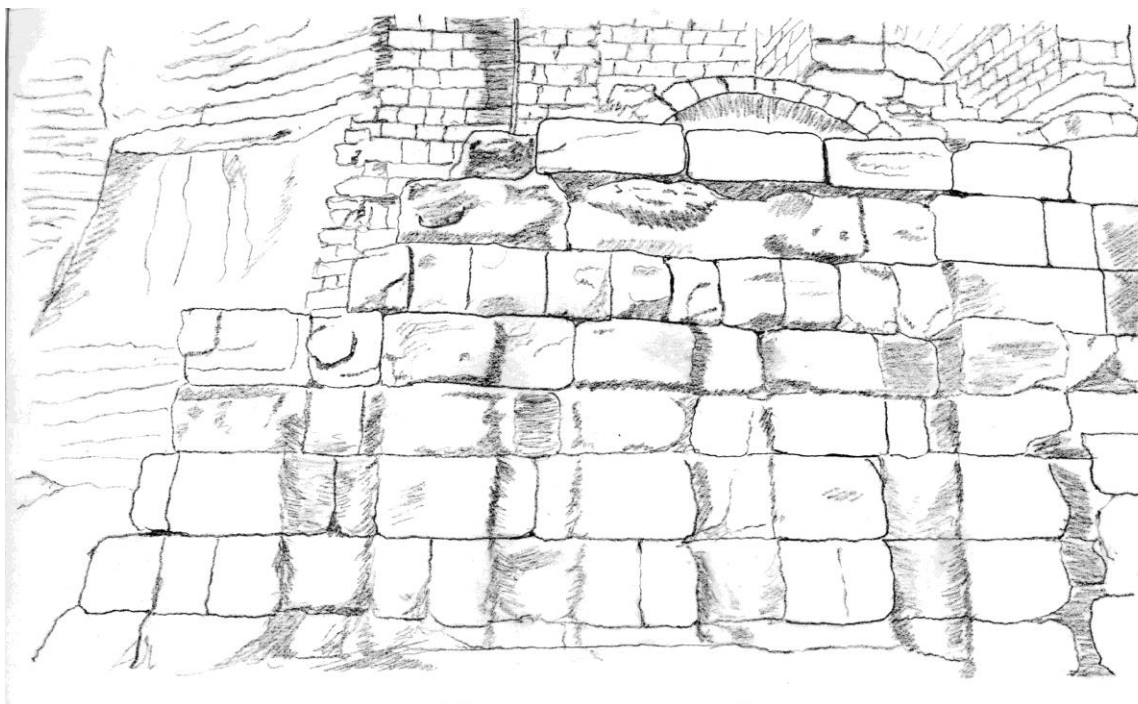


b. From south looking north (11-9-1993)

Eastern Wall of Staircase of the Urn Tomb

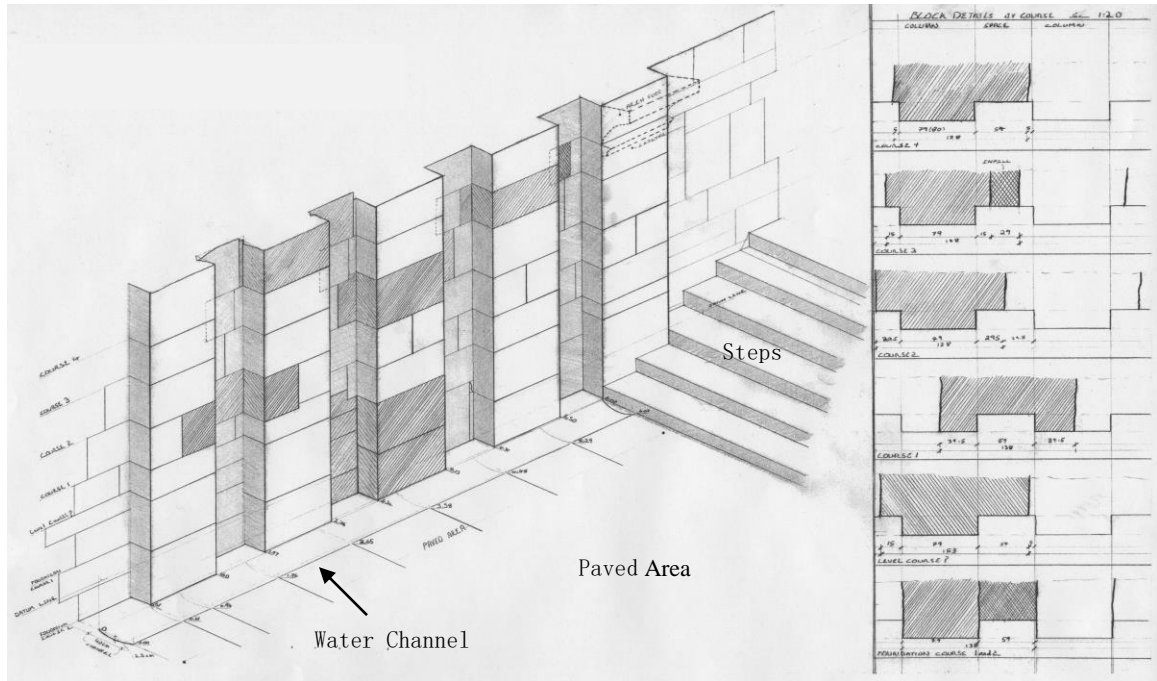


a. The upper four courses left of the eastern wall (7-4a-1997)



b. Drawing of (a)

Urn Tomb Staircase

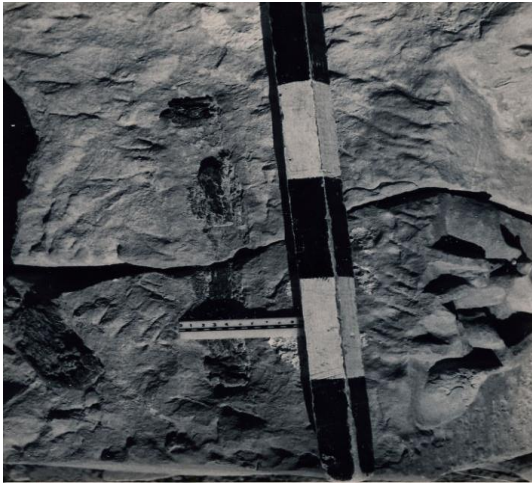


a. Urn Tomb staircase northeast end of east wall, isometric drawing

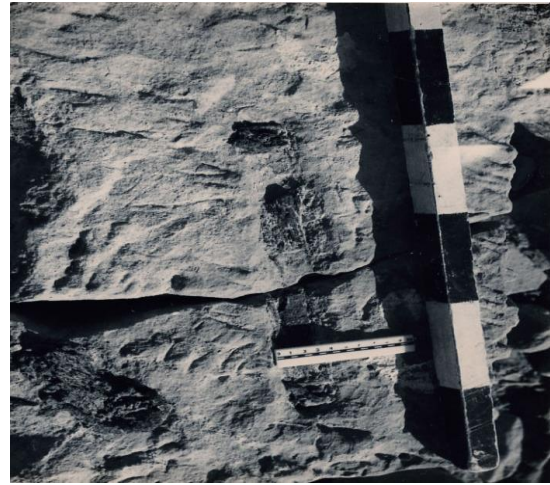


b. Staircase leading to the Urn Tomb (17-15-1991)

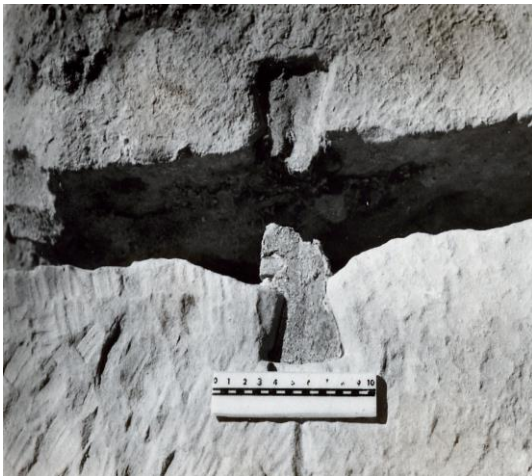
Repairing Broken Masonary



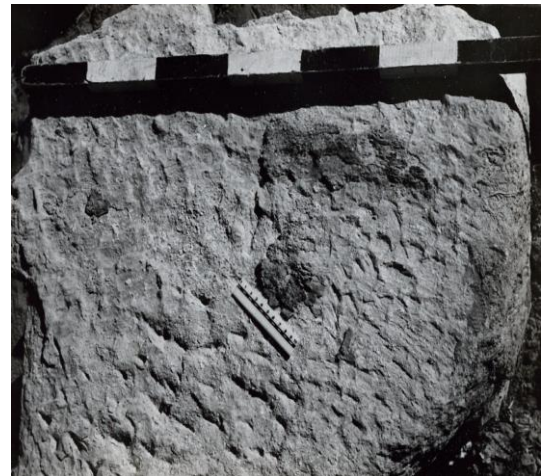
a. (8-28-1990)



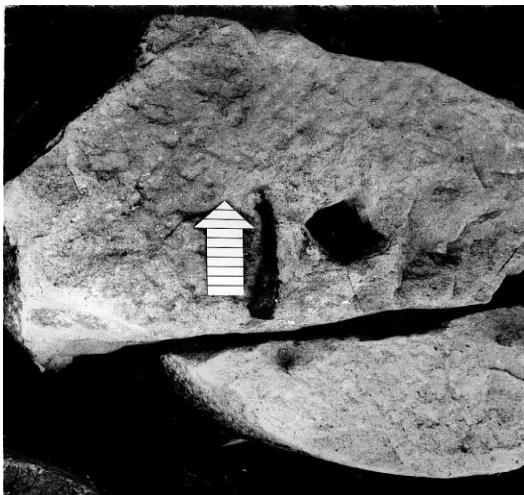
b. (8-27-1990)



c. (8-5-1990)



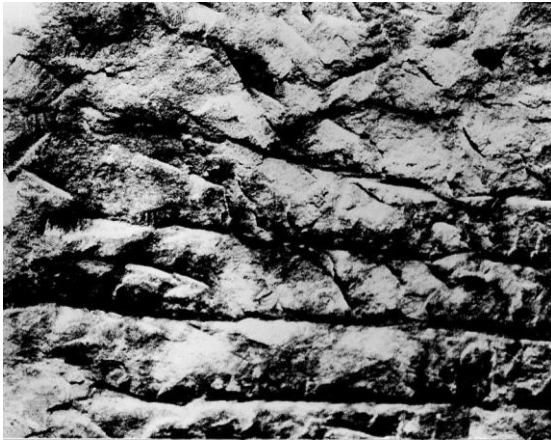
d. (9-32-1990)



e. (14-15-1994)

a & b. From Qasr al-Bint east wall
c. From the Winged Lions' Temple
d. Iron nail in soft yellow stone from
the east wall / Qasr al-Bint
e. Reused Nabataean drum in the church

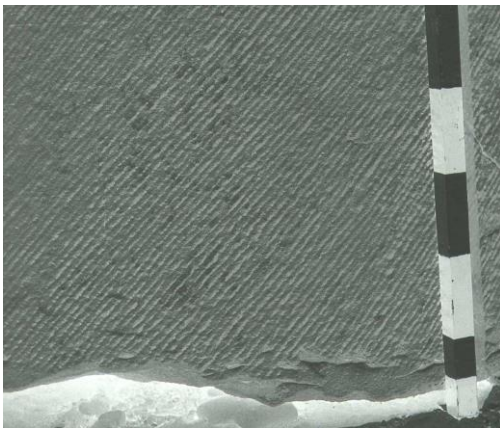
Traces of Chisel's Marks



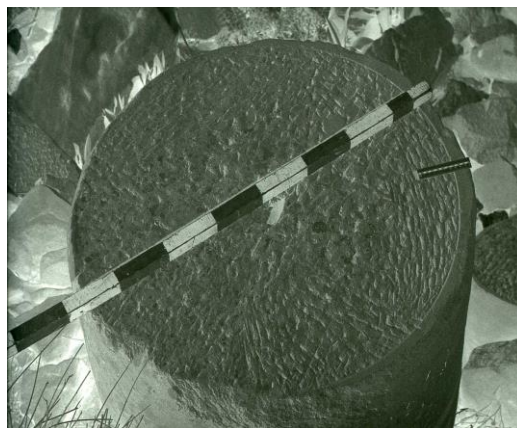
a. Ceiling of cave next to Museum
(16-00-1994)



b. North wall inside the Urn Tomb
(23-30-1991)



c. (23-17-1991)



d. (9-6-1991)



e. (23-21-1991)

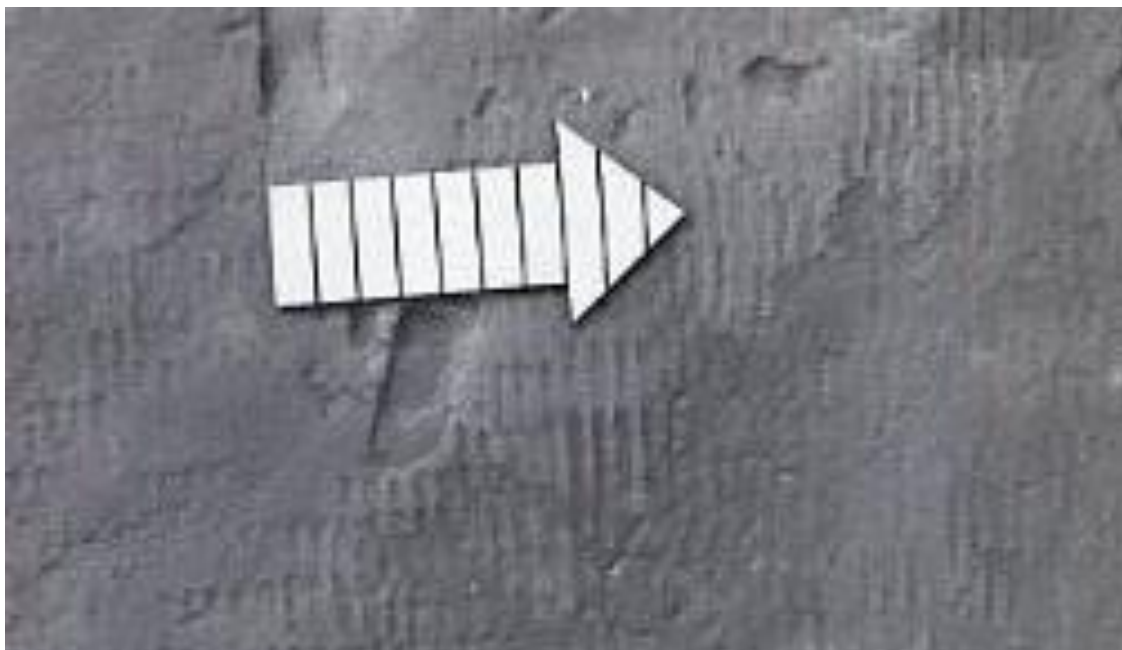
c & d. Column drums



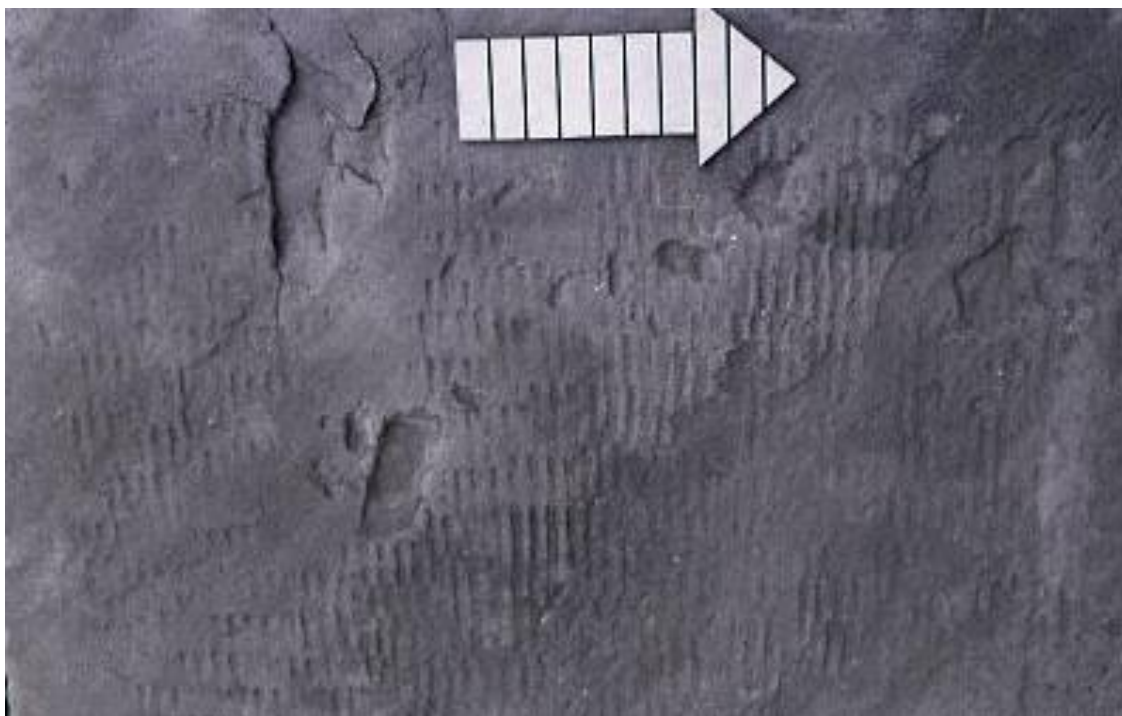
f. (23-23-1991)

e & f. Tombs north of the Lion Tomb

Traces of Three to Four Toothed Chisel



a. (14-11-1994)



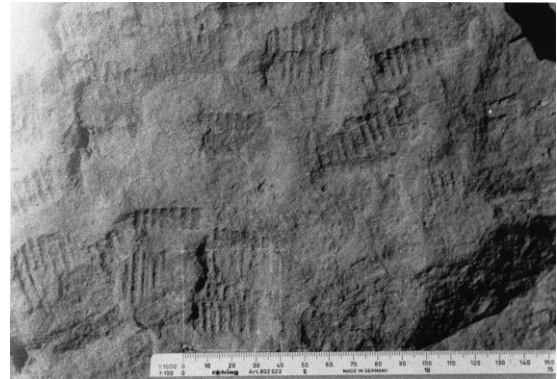
b. (14-12-1994)

a & b. Stone fragments from Temple of the Winged Lions

Marks of Seven Toothed Chisel



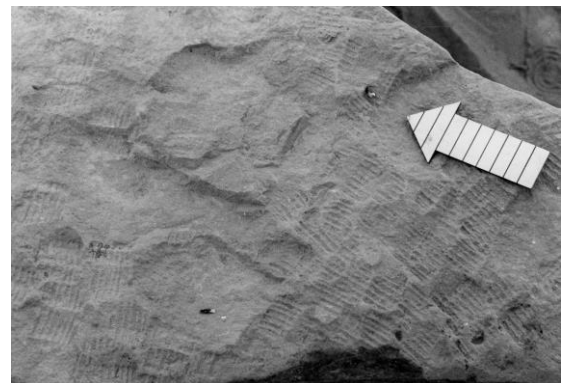
a. Capital with marks of Seven Toothed Chisels Arched Gate/ Petra Center (18-9-1991)



b. (16-16-1994)



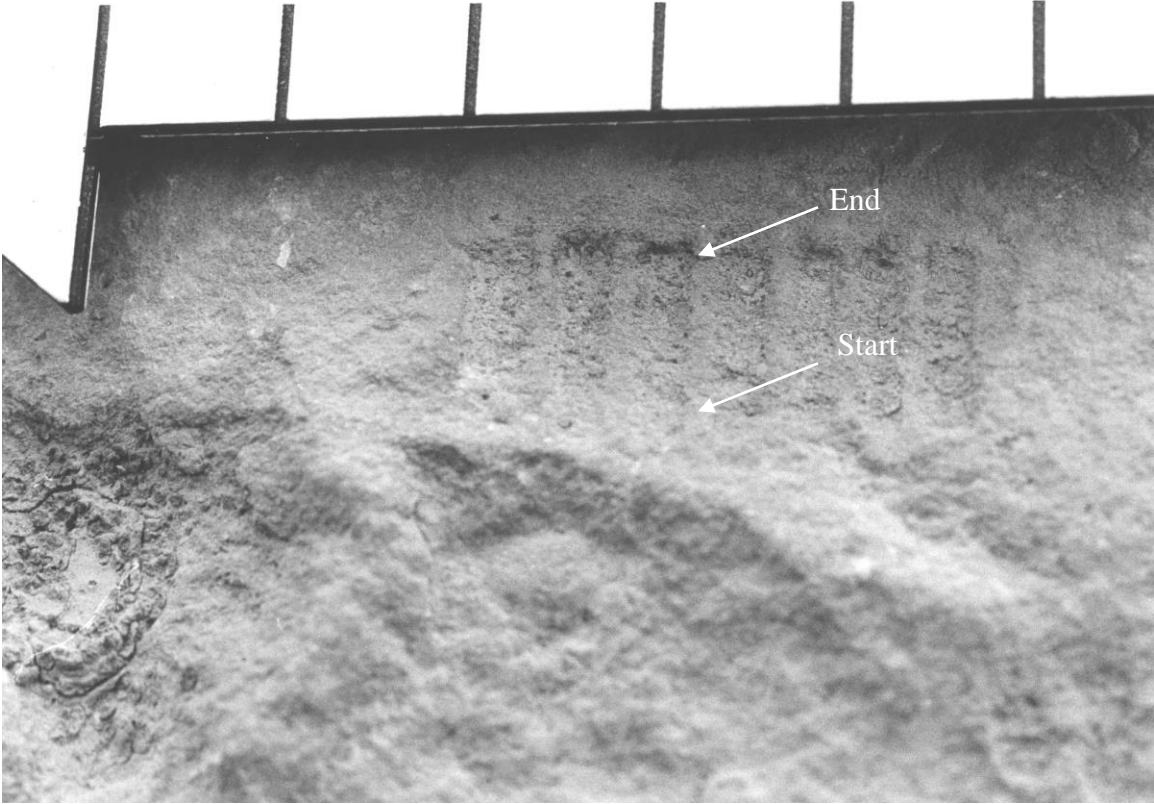
c. (16-15-1994)



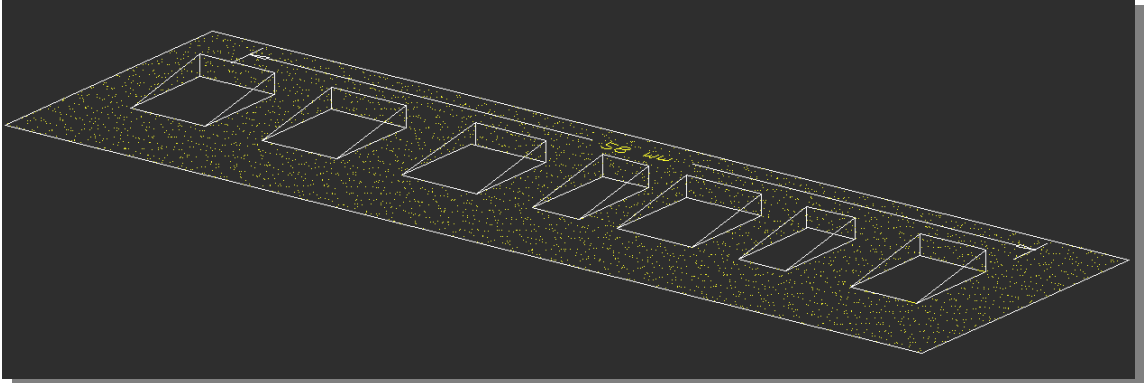
d. (7-33-1997)

b-d. Marks of seven toothed chisels on capital in (a)

Marks of Seven Toothed Chisel



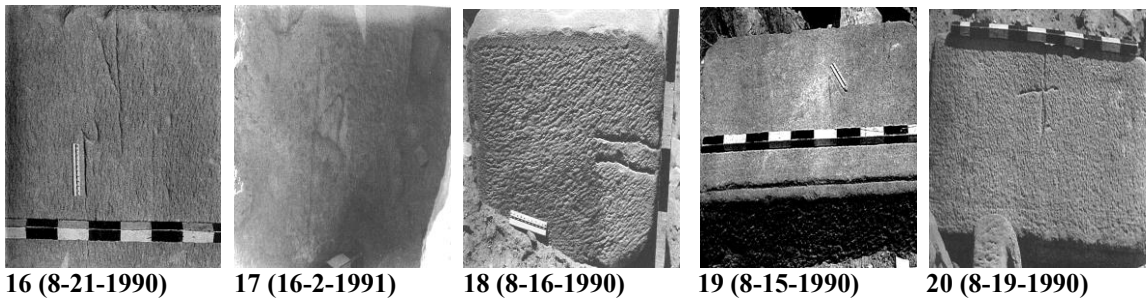
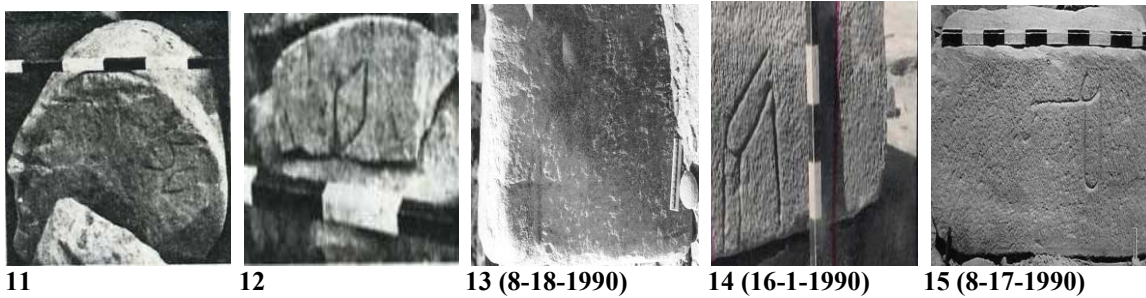
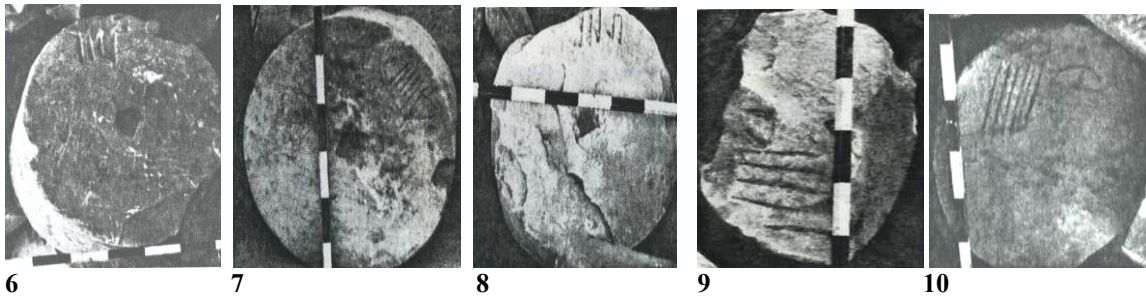
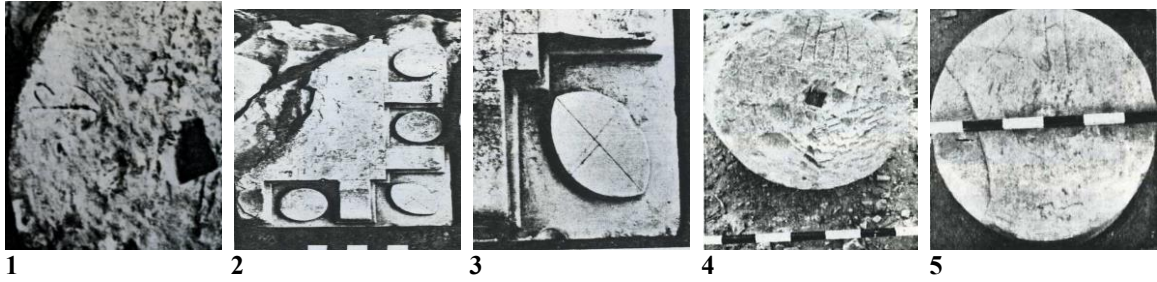
a. Details of the chisel's marks (7-31-1997)



b. Detail drawing of (a)

The Stonemasons' Marks in Petra

I – A & B A Form of Numbers, Slashes, Nabataean (Nab) Alphabetical Letters (one letter or more), Signs and Symbols (Pls. 122 - 124).

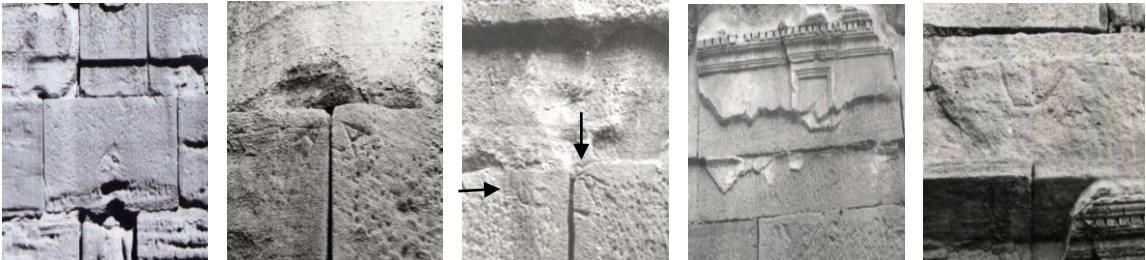


The Stonemasons' Marks in Petra

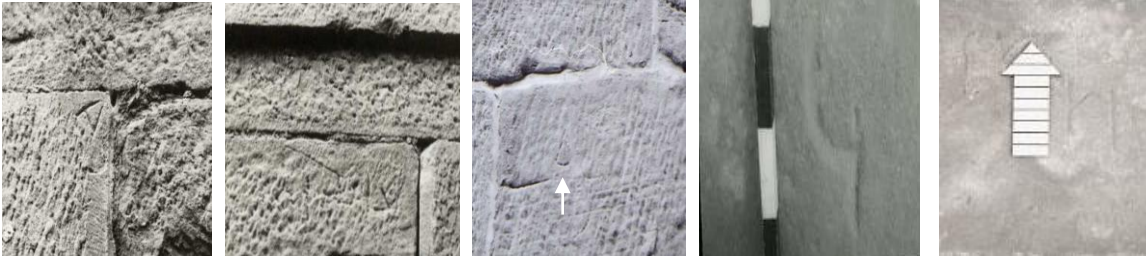
Continued from Plate 122



21 (8-13-1990) 22 (8-10-1990) 23 (13-7-1994) 24 (Qasr al-Bint) 25 (3-2-2000)



26 (3-4-2000) 27 (7-24-1997) 28 (7-25-1997) 29 (5-24-1997) 30 (7-26-1996)



31 (7-28-1997) 32 (5-25-1997) 33 (7-30-1997) 34 (1-15-1993) 35 (1-16-1994)



36 (1-13-1993) 37 (1-14-1993) 38 (4-16-1990) 39 (17-36-1991) 40 (7-25-1990)

The Stonemasons' Marks in Petra

continued from Plate 123



41 (6-3-1990)



42 (2-22-1993)



43 (1-10-1993)



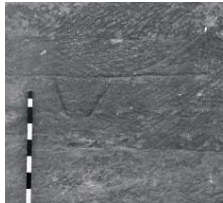
44 (4-7-1993)



45 (9-16-1990)



46 (4-8-1993)



47 (26-13-1991)



48 (16-6-1991)



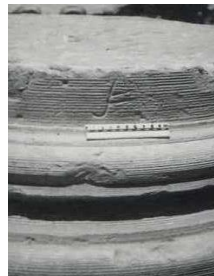
49 (11-11-1991)



50 (5-20-1997)



51 (14-14-1994)



52 (23-18-1991)



53 (23-33-1991)



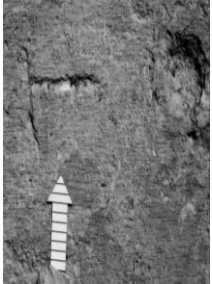
54 (s. 2-10-2008)



55 (s. 2-8-2008)



56 (s. 2-8-2008)



57 (3-15-1997)



58 (32-1-1997)



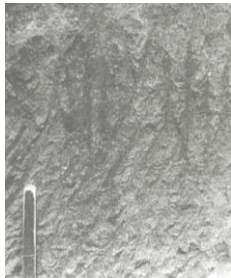
59 (3-23-1997)



60 (3-22-1997)

The Stonemasons' Marks in Petra

I - C. Names or Short Inscriptions



61 (11-5-1991)



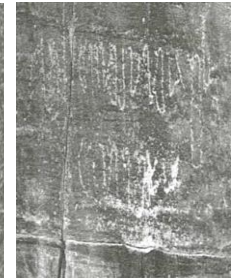
62 (12-1-1990)



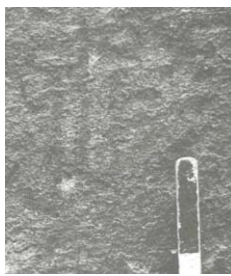
63 (12-2-1991)



64 (11-25-1991)



65 (12-20-1991)



66 (11-6-1991)



67 (15-21-1991)



68 (15-23-1991)



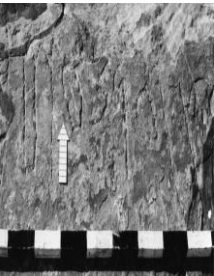
69 (5-10-1990)



70 (11-7-1991)



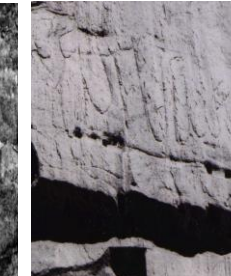
71 (2-25-1993)



72 (8-17-1993)



73 (9-18-1997)



74 (19-12-1994)



75 (20-6-1991)



76 (9-00-1993)



77 (20-11-1991)



78 (20-21-1993)



79 (s. 1970)



80 (found by the author in 1963)

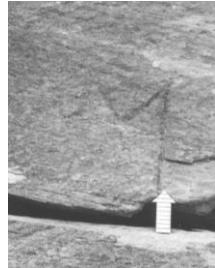
The Stonemasons' Marks in Petra

I - D. Drawings or Carvings (Plates 126-138) representing:

a. Unfinished Altars



1 (8-37-1990)



2 (4-9-1993)



3 (6-24-1990)



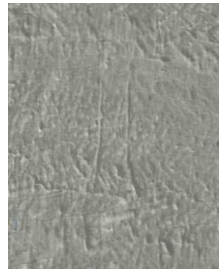
4 (7-8-1990)



5 (7-7-1990)



6 (9-36-1990)



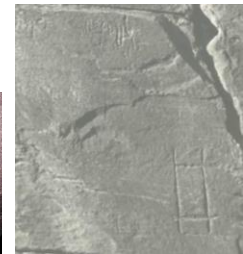
7 (10-6-1990)



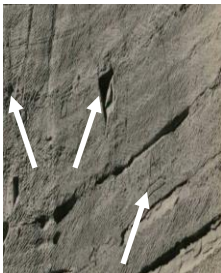
8 (4-4-1993)



9 (2-22-1997)



10 (12-3-1990)



11 (7-11-1990)



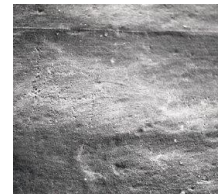
12 (details of 11)



13 (details of 11)



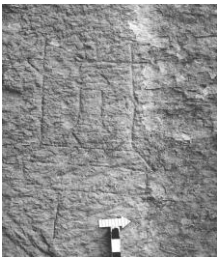
14 (9-37-1990)



15 (9-36-1990)

The Stonemasons' Marks in Petra

b. Finished Altars



1 (4-3-1994)



2 (3-33-1990)



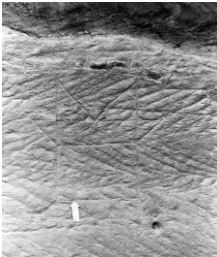
3 (3-31-1990)



4 (s. 1-24-2008)



5 (s. 1-24-2008)



6 (8-6-1993)



7 (6-23-1991)



8 (6-7-1990)



9 (6-8-1990)



10 (7-1-1990)



11 (18-17-1994)



12 (18-18-1994)



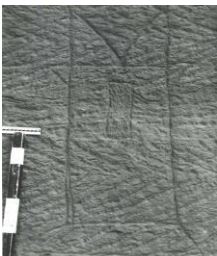
13 (19-14-1994)



14 (19-6-1994)



15 (19-9-1994)



16 (4-25-1990)



17 (6-15-1990)



18 (19-16-1994)



19 (1-7-1993)



20 (7-22-1994)



21 (6-1-1994)



22 (6-4-93)

The Stonemasons' Marks in Petra

c. V Shaped Carvings indicating start carving the alters



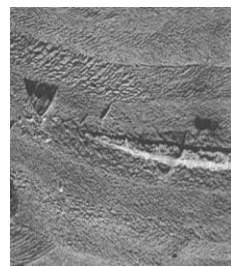
1 (3-21-1993)



2 (10-11-1990)



3 (11-14-1990)



4 (6-16-1990)



5 (6-4-1990)



6 (6-19-1990)



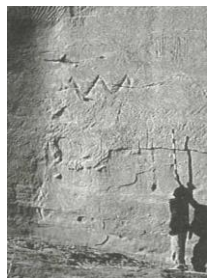
7 (6-21-1990)



8 (18-15-1994)



9 (16-34-1991)



10 (16-35-1991)



11 (4-13-1990)



12 (5-17-1990)



13 (10-8-1993)



14 (10-9-1993)



15 (13-8-1991)



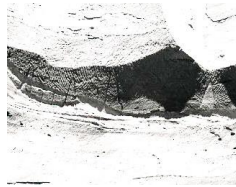
16 (13-9-1991)

The Stonemasons' Marks in Petra

d. Obelisks and Nefeshes



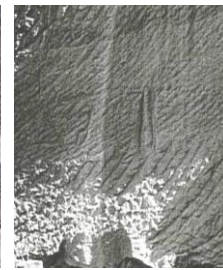
1 (19-6-1994)



2 (19-8-1994)



3 (19-17-1994)



4 (6-17-1990)



5 (s. 2-2-2008)



6 (6-36-1990)



7 (6-9-1990)



8 (19-2-1993)



9 (12-23-1991)



10 (14-26-1991)



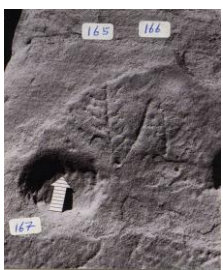
11 (17-12-1991)



12 (7-17-1994)



13 (6-19-1994)



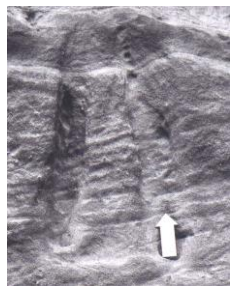
14 (10-21-1993)



15 (3-12-1990)



16 (2-17-1994)



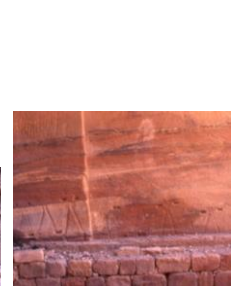
17 (2-20-1994)



18 (s. 1-21-2008)



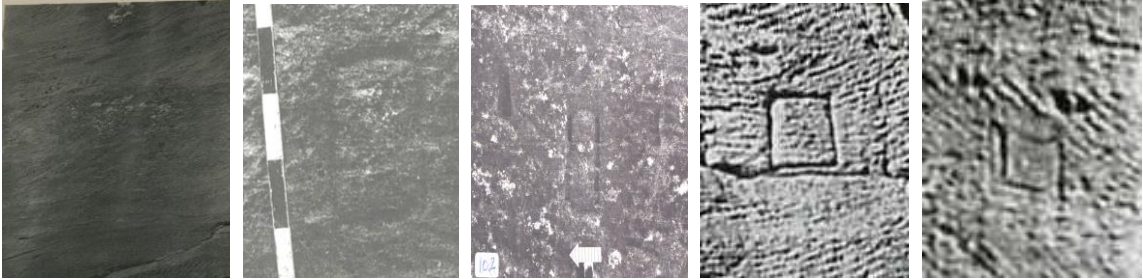
19 (s. 1-16-2008)



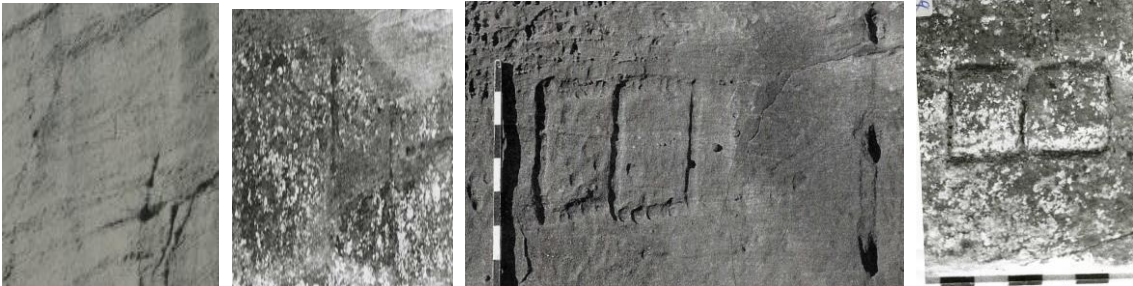
20 (s. 1-26-2008)

The Stonemasons' Marks in Petra

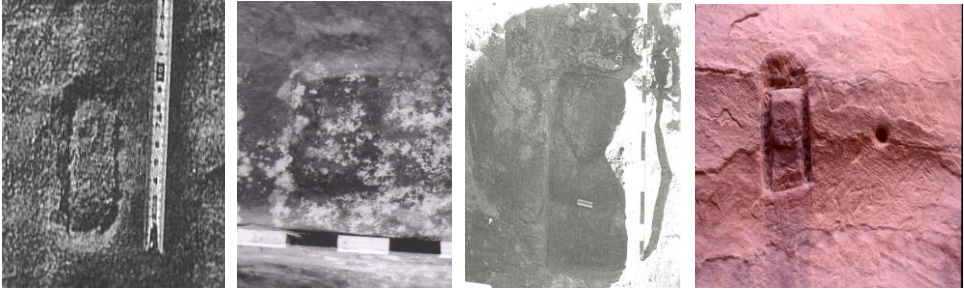
e. Rectangular Forms Representing Dushares/ Dusharess



1 (10-10-1990) 2 (11-13-1990) 3 (5-20-1993) 4 (7-6-1990) 5 (6-5-1990)



6 (7-12-1990) 7 (14-6-1991) 8 (14-2-1991) 9 (14-3-1991)



10 (5-8-1990) 11 (1-22-1993) 12 (16-27-1991) 13 (s. 1-19-2008)

The Stonemasons' Marks in Petra

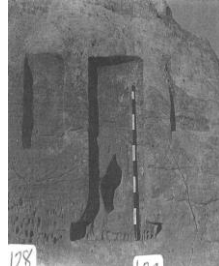
f. Niches with or without Dushares or Dusharess:



1 (14-14-1991)



2 (14-16-1991)



3 (14-4-1991)



4 (4-17-1990)



5 (20-4-1994)



6 (13-25-1991)



7 (16-22-1991)



8 (16-7-1991)



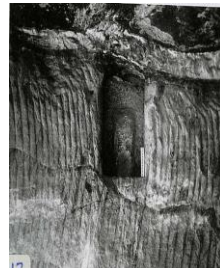
9 (14-27-1991)



10 (17-2-1991)



11 (4-6-1993)



12 (5-35-1990)



13 (2-16-1990)



14 (9-17-1993)



15 (9-16-1993)

The Stonemasons' Marks in Petra

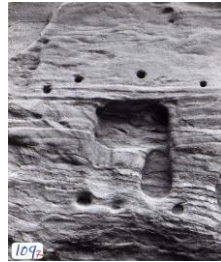
Continued from Plate 131



16 (2-21-1993)



17 (9-13-1993)



18 (2-19-1993)



19 (1-21-1993)



20 (s. 1970)



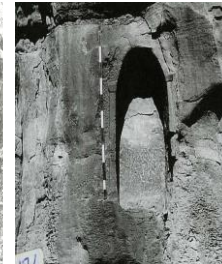
21 (10-23-1991)



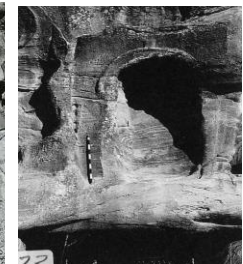
22 (14-25-1991)



23 (16-16-1991)



24 (5-9-1990)



25 (5-26-1990)



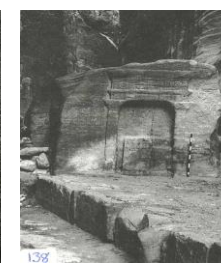
26 (16-18-1991)



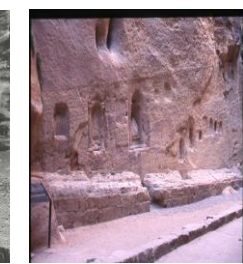
27 (1-6-1993)



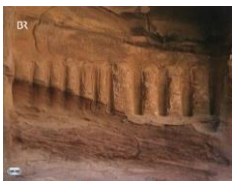
28 (3-20-1990)



29 (3-22-1990)



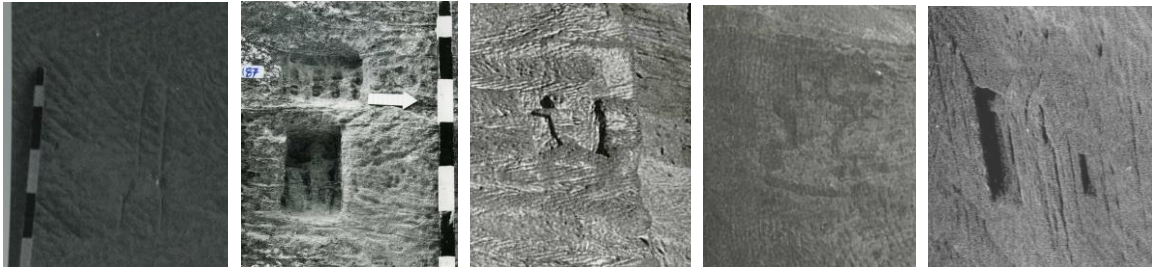
30 (s. 1-16-2008)



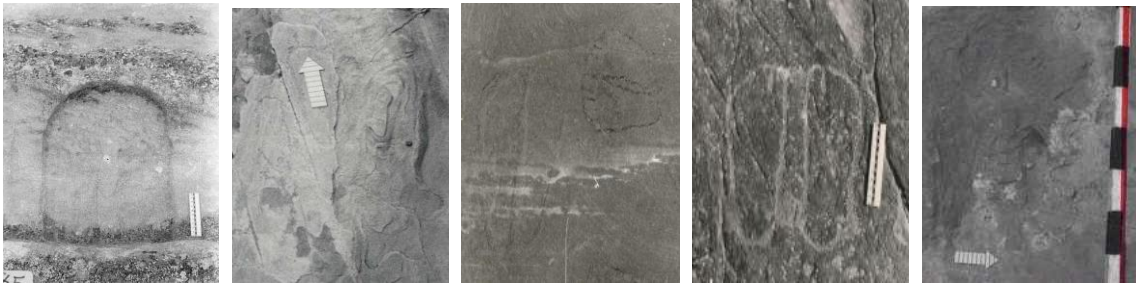
31 (s. 1970)

The Stonemasons' Marks in Petra

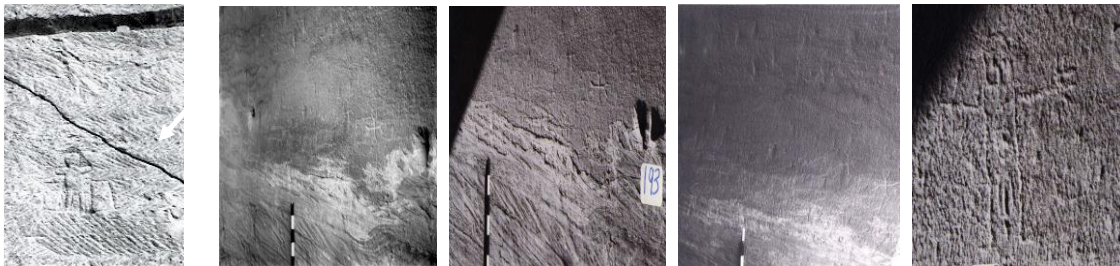
g. Humans' Figures [Pl. 133]:



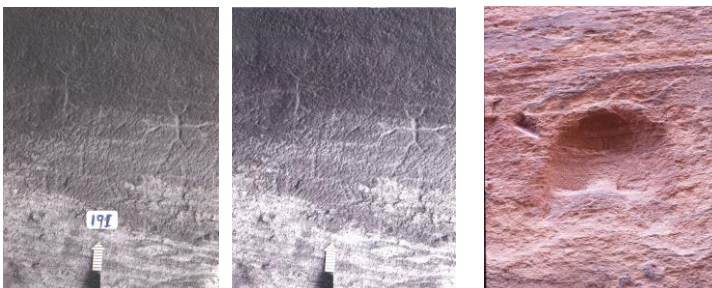
1 (10-24-1991) 2 (5-18-1994) 3 (17-11-1991) 4 (17-5-1991) 5 (16-31-1991)



6 (16-25-1991) 7 (8-1-1993) 8 (8-6-1997) 9 (9-5-1990) 10 (9-20-1994)



11 (4-36-1990) 12 (14-23-1994) 13 (17-15-1994) 14 (17-23-1994) 15 (17-13-1994)



16 (17-24-1994) 17 (17-17-1994) 18 (s. 1-17-2008)

The Stonemasons' Marks in Petra

h. Plants



1 (19-10-1994)



2 (18-20-1994)



3 (12-17-1991)



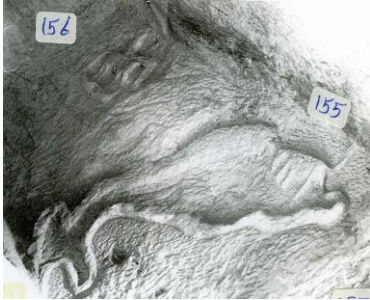
4 (16-9-1994)



5 (15-11-1991)

The Stonemasons' Marks in Petra

i. Animals



1 (3-9-1990)



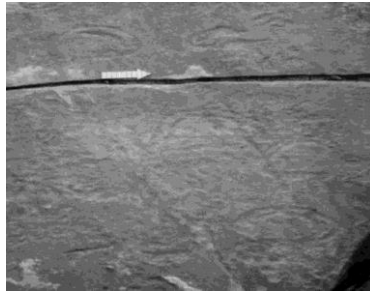
2 (9-37-1990)



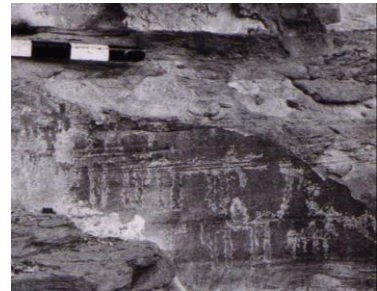
3 (14-24-1991)



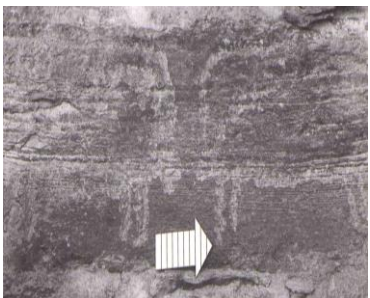
4 (10-0-1990)



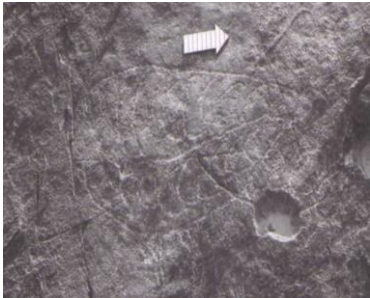
5 (1-4-1993)



6 (10-22-1993)



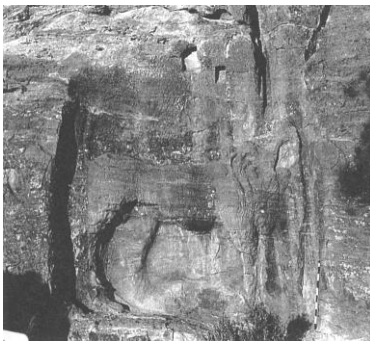
7 (10-23-1993)



8 (1-2-1993)



9 (15-15-1991)



10 (12-24-1991)



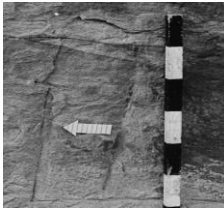
11 (s. 1-18-2008)



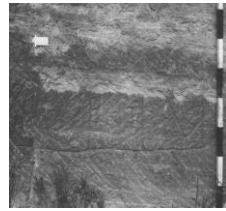
12 (5-35-1990)

The Stonemasons' Marks in Petra

j. Guide Lines for Carving



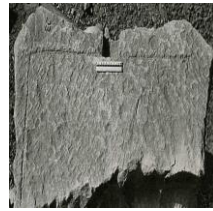
1 (4-10-1994)



2 (4-2-1994)



3 (7-23-1990)



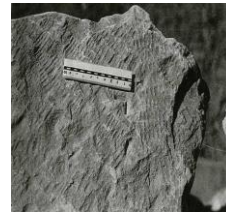
4 (7-15-1990)



5 (7-16-1990)



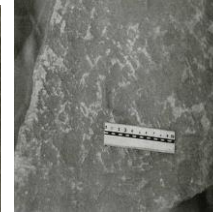
6 (7-17-1990)



7 (7-21-1990)



8 (7-25-1990)



9 (7-22-1990)



10 (7-26-1990)



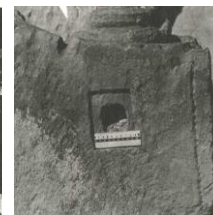
11 (7-27-1990)



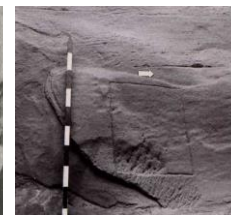
12 (7-30-1990)



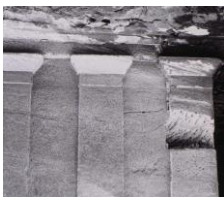
13 (9-34-1990)



14 (8-29-1990)



15 (9-14-1993)



16 (9-6-1997)



17 (5-00-1993)



18 (20-8-1991)



19 (3-11-1997)

The Stonemasons' Marks in Petra

k. Holes used for Climbing, Hanging, Plaster or Religious Purposes



1 (10-18-1991)



2 (10-19-1991)



3 (10-12-1991)



4 (14-26-1990)



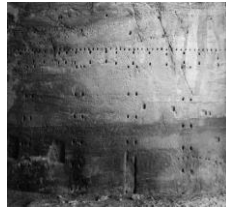
5 (10-23-1991)



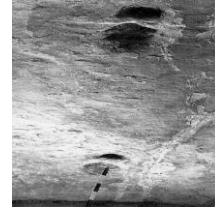
6 (6-2-1993)



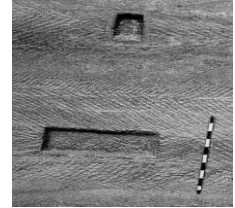
7 (14-25-1991)



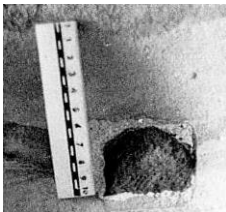
8 (2-16-1997)



9 (15-13-1991)



10 (15-10-1991)



11 (15-8-1991)



12 (15-9-1991)



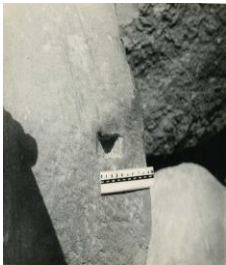
13 (15-5-1991)



14 (10-13-1993)



15 (20-7-1991)



16 (8-22-1990)

The Stonemasons' Marks in Petra

I. Others: Games



1 (3-5-1990)



2 (3-6-1990)



3 (10-25-1991)



4 (9-15-1997)



5 (9-16-1997)



6 (9-17-1997)



7 (1-3-1993)

APPENDICES

Appendix 1: Catalogue of Mason's Marks

The Stonemasons' Marks in Petra

I – A&B. A form of numbers, slashes, Nabataean (Nab.) alphabetical letters (one letter or more), signs, and symbols [Pls. 122-124].

Plate No.	Location	Description
122. 1	Main Theater	Detail, end of column drum (marl), Showing tie- hole and Nab. mason's marks, (Hammond, 1965: 45, Pl. XXX111. 4).
122. 2		Cornice corner block, Type `2'; note mason's planning lines, (Hammond, 1965: 49, Pl. XXXV1. 2).
122. 3		Cornice corner block, detail of no. 2 above, showing mason's correction of planning lines, (Hammond, 1965: 49, Pl. XXXV1. 4).
122. 4-5		Columns' drums showing Nab. stonemason's marks, (Hammond, 1965: 73, 76, 77, Pl. XLV111. 11, 14).
122. 6-8		Columns' drums showing Nab. stonemason's marks, (Hammond, 1965: 76- 77, Pl. XL1X. 24, 25, 29).
122. 9-12		Columns' drums showing Nab. stonemason's marks, (Hammond, 1965: 76- 78, Pl. L 32, 34, 36, 37).
122. 13-14	Winged Lions' Temple	Marked surplus ashlars, west corridor (Hammond, 1996: Pl. 5. 2).
122. 15-16		Marked surplus ashlars, west corridor (Hammond, 1996: Pl. 6. 1-2).
122. 17-18		Marked surplus ashlars, west corridor (Hammond, 1996: Pl. 7. 1-2). See [Pl. 122. 24] below.
122. 19		Marked cornice stone. The upper right corner has the same mark on [Pl. 122. 16].
122. 20		Marked surplus ashlars.

The Stonemasons' Marks in Petra

Continued from Plate 122

123: 21-22		Marked surplus ashlars.
123. 23		The High place A vertical line with a Nab. inscription next to it, west side.
123. 24		Qasr al-Bint Marked masonry in situ in south wall/ south east corner of foundation. See [Pl. 122. 17] above.
123. 25	Qasr al-Bint/ South wall.	Two blocks: one has two marks and the other has one mark.
123. 26		Three blocks: each with one mark on the upper corner.
123. 27		Detail of No. 26. Two blocks with the marks facing each other.
123. 28		Detail of No. 26. Block with one mark on the corner.
123. 29		Three blocks each with one mark facing each other.
123. 30		Block with one mark in the middle of it.
123. 31		Block with one mark in the upper right corner.
123. 32		Block with one Nab. letter or more in the upper right corner.
123. 33		Block with mark on the upper left corner.
123. 34	The Great Temple	Column drum with a Nab. letter or a sign.
123. 35		A piece of a step? With a Nab. letter.
123. 36	The Gate area	Column drum with few Nab. letters.
123. 37	The Great Temple	A piece of pavement from the northeast corner of the temple.
123. 38	Way to ed-Dayr	Remains of the staircase with few Nab. letters on one of the steps.
123. 39		Fragment of the step in no. 38 above with the letters.
123. 40	The Baths' area	A Nab. letter (M?) on a capital from the Baths' area.

The Stonemasons' Marks in Petra

Continued from Plate 123

124. 41	Wādi as-Siyyagh	A mark like an arrow at the north side quarries.
124. 42	Nazzal's Camp	A Nab. letter (G ?) on one of the steps to Nazzal's Camp.
124. 43	Umm el-Biyārah	Nab. letters on the top of Umm el-Biyārah.
124. 44	The Siq Entrance	Two Nab. letters? North side quarry.
124. 45	The Temenos	Two Nab. letters. South wall west of the Gate.
124. 46	The Siq Entrance	Two Nab. letters? North side of quarry.
124. 47	The Turkmaniyyah	Unknown mark at Qunb at-Turkmaniyyah quarry.
124. 48	The Palace Tomb	Nab. letter (H?) on a block opposite the Palace Tomb.
124. 49	The High Place	Mark of an arrow or letter at the east staircase to the High Place.
124. 50	The Temenos area	Column drum with two Nab. west of the Gate.
124. 51	The Church area	Nab. capital reused at the church, with an (X) mark.
124. 52	The Gate area	Column base with a Nab. letter (sh).
124. 53	The Urn Tomb	Letters or a carving? South of the Urn Tomb.
124. 54	The Gate	Nab. letter (sh) on the south wall of the south door.
124. 55		Capital from the Gate area with few Nab. letters at the lower rim.
124. 56		Detail of capital [Pl. 124. 55], showing the letters.
124. 57-60	Kh. adh-Dharīh	Examples of Nab. letters or signs.

The Stonemasons' Marks in Petra

I - C. Names or Short Inscriptions [Pl. 125]

125. 61	The High Place	Nab. inscription of 4-5 letters, east staircase.
125. 62-63		Nab. Inscription, quarry facing south
125. 64		Nab. Inscription, east staircase
125. 65		Nab. Inscription, west staircase, north of the Lion carving.
125. 66		Nab. Inscription, east staircase.
125. 67-68		Nab. Inscription, west side of the High Place
125. 69	Ed-Dayr way	Nab. Inscription, written with pointed chisel.
125. 70	The High Place	Nab. Inscription, east staircase.
125. 71		Nab. Inscription, west staircase north of the Lion carving.
125. 72	Al-Khubthah	Nab. Inscription, on the way from the north side.
125. 73	The High Place	Nab. Inscription, west side
125. 74	Wādi as-Siyyagh	Nab. Inscription, north side of wādi
125. 75		Few Nab. Letters, north side.
125. 76	Wādi an-Numayr the dam.	Nab. Inscriptions, on the way to the top next to
125. 77-78	Wādi as-Siyyagh	Two Nab. Short inscription.
125. 79	Qasr al-Bint	Short inscription with the name of Aritas.
125. 80	Temenos area	Marble plaque with Nab. inscription that mentions the names of the Nabataean king Malichus II (A.D. 40-70) and his queen Shaqilat

The Stonemasons' Marks in Petra

I - D. Drawings or Carvings [Pls.126-138] representing:

a. Unfinished Alters [Pl.126]

126. 1	Al-Habis	Drawing of an altar top with few Nab. letters below it. East side of al-Habis
126. 2	The Siq entrance	Right side of top of an altar drawing, north side quarry.
126. 3	Wādi as-Siyyagh	Upper part of an altar, north side quarries
126. 4		Two upper parts of altars, north side quarries
126. 5		Upper part of an altar, north side quarries.
126. 6	The Outer Siq	upper part of an altar, north of al-Khaznah.
126. 7	The High Place	Lower part of an altar, east staircase quarry.
126. 8	The Siq entrance	Lower part of an altar, north side quarry.
126. 9	The High Place	Lower part of an altar, at the cistern entrance at north east side of the mountain.
126, 10		Middle part of an altar, on the upper part of the quarry north of the Obelisks.
126. 11	Wādi as-Siyyagh	Three drawings of:- a complete altar no. 13, and two upper parts of altars only no. 12
126. 12-13		Detail of [Pl. 126. 11]
126. 14-15	Al-Khaznah	Drawings of alters on the face of the rock at the Outer Siq north of al-Khaznah. See [Pl. 132. 2] animal drawings.

The Stonemasons' Marks in Petra

b. Finished Altars [Pl. 127]

127. 1	The Siq Entrance	Drawing of an altar with a Dushara (?) inside. North side quarry.
127. 2-3	As-Siq	Two drawings of altars' one above the other.
127. 4-5	The Outer Siq	Two drawings of altars'. North of al-Khaznah.
127. 6	Al-Khubthah	Drawing of an altar. On top north of the cistern.
127. 7-10	Wādi as-Siyyagh	Drawing of an altar. North side quarries.
127. 11-13		Drawing of an altar. South side quarries.
127. 14-18		Drawings of altars. North side quarries.
127. 19	Umm el-Biyārah	Carvings of altars. Fallen rock, northwest corner.
127. 20	Al-Mu'aysrah al-Gharbiyyah	Drawing of an altar. West side of wādi.
127. 21	The High Place	Carving of an altar. West side opposite the lion's carving.
127. 22	Soldier Tomb	Rectangular altar with horns on top of it at the façade of the Soldier Tomb

The Stonemasons' Marks in Petra

c. V Shaped Carvings indicating start carving the altars [Pl. 128]

128. 1	The Siq Entrance	North side, at the eagle carving quarry.
128. 2-3	The High Place	East staircase quarries.
128. 4-8	Wādi as-Siyyagh	North side quarries.
128. 9-10	Al-Far' at-Tawel	lower quarries, west of Wādi at-Turkmaniyyah
128. 11	Way to ed-Dayr	Half way to ed-Dayr
128. 12	Ed-Dayr	On the southern side of the façade
128. 13-14	Wādi an-Numayr	“V” shape and altar, next to the dam.
128. 15-16	At-Turkmaniyyah	Qunb at-Turkmaniyyah

The Stonemasons' Marks in Petra

d. Obelisks and Nefeshes [Pl. 129]

129. 1	Wādi as-Siyyagh	Unfinished obelisk next to an altar, North quarries.
129. 2		Four obelisks with two altars between them. North quarries.
129. 3, 4, 6, 7		Unfinished obelisks. North quarries.
129. 5	Zayd Tomb	On the south side of the entrance [Pl. 17a].
129. 8	Wādi as-Siyyagh	Nefesh in the middle of the north quarry
129. 9	The High Place	Drawing of an obelisk. West staircase north of the Lion fountain.
129. 10		Two Nefeshes in an arched niche. North side of the mountain.
129. 11	The Palace Tomb	Nefesh. Palace Tomb area.
129. 12	Al-Mu'aysrah al-Gharbiyyah	Unfinished drawing of a nefesh
129. 13	Wādi ed-Dayr	Two nefeshes next to a cave entrance. West side of wādi.
129. 14	Umm el-Biyārah	Obelisk next to the cave entrance. On the right to the top.
129. 15	The Obelisk Tomb	At the cave entrance. East of the Obelisk Tomb.
129. 16	The Main Theater	Three nefeshes. South of the Theater.
129. 17		Nefesh in a niche. South of the Theater
129. 18	Al-Khaznah	Obelisk south of al-Khaznah
129. 19-20		Obelisks north of al-Khaznah, next to the entrance of the caves.

The Stonemasons' Marks in Petra

e. Rectangular Forms representing Dushara/ Dusharas [Pl. 130]

130. 1	As-Siq	Dushara with a Nabataean inscription under to it
130. 2	High Place	Rectangular form. East staircase.
130. 3		Rectangular form. West staircase close to the unfinished cave [Pl. 56].
130. 4	Wādi as-Siyyagh	Square form. North side quarry.
130. 5		A square with two hanging holes for a cover. North side quarry.
130. 6		Rectangular form. North side quarry.
130. 7	At-Turkmaniyyah	Rectangular form. Qunb at-Turkmaniyyah
130. 8		Two rectangular forms. Qunb at-Turkmaniyyah
130. 9		Two almost square forms. Qunb at-Turkmaniyyah
130. 10	Way to ed-Dayr	Rectangular form. Half way to ed-Dayr
130. 11	Umm el-Biyārah	Rectangular form. Way to Umm el-Biyārah.
130. 12	Umm Sayhun	Rectangular form. On top of the quarry.

The Stonemasons' Marks in Petra

f. Niches with or without Dushara or Dusharas [Pl. 131]

131. 1-2	Ath-Thughrah	Two small rectangular niches. On the way to ath-Thughrah.
131. 3	At-Turkmaniyyah	Rectangular niche with a smaller one on each side. At Qunb at-Turkmaniyyah.
131. 4	Way to ed-Dayr	Rectangular niche with a smaller one inside it.
131. 5	Al-Madras	Rectangular niche with a square cut in front of it.
131. 6	At-Turkmaniyyah	Small rectangular niche. At Qunb at-Turkmaniyyah
131. 7	Umm Sayhun	Small rectangular niche. On top of the quarry.
131. 8	Al-Khubthah	Three niches. North side of mountain.
131. 9	The High Place	Group of niches. One has a Dushara. North side of mountain.
131. 10	Al-Far' at-Tawel	A small niche with a Dushara and inscription. East side.
131. 11	Siq Entrance	A small niche with a Dushara. North side quarry
131. 12	Ed-Dayr	A small niche with a Dushara Ed-Dayr area.
131. 13	The Obelisk Tomb	A small niche with a Dushara. West of cave entrance.
131. 14	An-Numayr	Niche with Dusharas. Staircase to the top.
131. 15		Two rectangular niches with Dusharas. Stair-case to the top.

The Stonemasons' Marks in Petra

f. Niches with or without Dushara or Dusharas [Pl. 132]. Continued from Plate 131.

132. 16	Main Theater	Niche with a Dushara, south of the Theater.
132. 17	An-Numayr	Rectangular niche with Dushara, next to 'Obadah tomb.
132. 18	The Main Theater	Rectangular niche with a Dushara, south of the theater.
132. 19	Al-Habis	Small square niche with a Dushara, behind the museum.
132. 20	As-Siq	Two niches next to each other on the north side of the Siq
132. 21	The High Place	Uncarved niche with a Dushara, east staircase.
132. 22		Unfinished arched niche, north side of mountain.
132. 23	Al-Khubthah	Arched niche with a Dushara, north side of mountain.
132. 24	Way to ed-Dayr	Arched niche with a Dushara, south of ed-Dayr.
132. 25	Ed-Dayr	Arched niche in a rectangular niche north of ed-Dayr.
132. 26	Al-Khubthah	Arched niche north side of mountain.
132. 27	Umm el-Biyārah	Two niches with altar and Dushara north/ west side.
132. 28	As-Siq	Elaborated niche with six Dusharas on top, middle of Siq.
132. 29		Niche with an Eye Idol Dushara, middle of the Siq
132. 30		A group of niches in the middle of the Siq
132. 31		A group of Dusharas in the middle of the Siq

The Stonemasons' Marks in Petra

g. Humans' Figures [Pl. 133]

133. 1	The High Place	Drawing of a human figure. East staircase.
133. 2		Carving of human and Dusharas. West staircase.
133. 3	The Palace Tomb	Carving of human figure. South of the Palace Tomb.
133. 4		Carving of human figure on a pedistal. South of the Palace Tomb.
133. 5	Umm Sayhun	Drawing of human figure between two niches. East side of the quarry.
133. 6		Carving human of figure in a niche on the summit of the quarry.
133. 7	Ath-Thunabe	Drawing of human footmarks.
133. 8		Drawing of human footmarks.
133. 9	Al-Bayda'	Drawing of human footmarks. At Wādi al-Muqaryif west of Bayda' (Beidha) excavations.
133. 10	An-Numayr	Carving of a female figure in a niche on the way to the top.
133. 11	Al-Khaznah	Carving of a small figure of a man above the Triclinium entrance opposite al-Khaznah. See [Pl. 50e]
133. 12	Al-Habis	Inside a cave from west wall towards east wall showing drawings.
133. 13		Eastern part of wall with the drawings above.
133. 14		The middle part of the drawings above.
133. 15		Detail of the first human figure on the western side of the wall.
133. 16		Detail of the two figures and an altar between them, on the eastern side of the wall.
133. 17		Detail of the two figures only.
133. 18	As-Siq	Carving of human bust with head carrying a tree on it, on the south side in the middle of the Siq.

The Stonemasons' Marks in Petra

h. Plants [Pl. 134]

- | | | |
|--------|-----------------------------|--|
| 134. 1 | Wādi as-Siyyagh | Drawing of a palm leaf, north side quarries. |
| 134. 2 | | Two palm trees with an altar between them. South quarries. |
| 134. 3 | The High Place | Drawing of a palm tree between an altar and a Dushara. Quarry south of the Obelisks. |
| 134. 4 | Umm el-Biyārah | Carving of a palm leaf between two niches. At the Unfinished Tomb [Pl. 59b] outer wall east of the entrance. |
| 134. 5 | Al-Mu‘aysrah ash-Sharqiyyah | Drawing of a palm tree between two inscriptions, inside water cistern on the east side of wādi. |

The Stonemasons' Marks in Petra

i. Animals [Pl. 135]

135. 1	Obelisk Tomb	Carving of a horse rider and two snakes catching an animal. Carved on the western wall inside a cave east of the Obelisk Tomb.
135. 2	Al-Khaznah	Drawings of two deer carved with pointed chisel. Outer Siq north of al-Khaznah.
135. 3	The High Place	Carving of a snake inside a cave. North side of the High Place.
135. 4	Al-Habis	Drawing of three deer.
135. 5	Umm el-Biyārah	Several deer drawings on top of Umm el-Biyārah.
135. 6		Drawings of deers and camels. Northeast side of the mountain.
135. 7		Drawing of two deer facing each other.
135. 8		Drawing of a peacock located at the northwest side of mountain on the top.
135. 9	Al-Mu‘aysrah ash-Sharqiyyah	Drawing of a deer?
135. 10	The High Place	A huge carving of a lion carved at the west side of the High Place
135. 11	As-Siq	Carving of two camels on the south side in the middle of the Siq.
135. 12	Ed-Dayr	Carving of two camels and a man north of ed-Dayr.

The Stonemasons' Marks in Petra

j. Guide Lines for carving [Pl. 136]

136. 1, 2	The Siq Entrance	Lines, purpose is unknown. Quarry north of Siq's entrance.
136. 3	The Baths	Base of a column with lines on the rim and the middle.
136. 4		Part of a capital with guide lines on top.
136. 5		Detail of No. 4 above.
136. 6		Detail of Guide lines on a capital.
136. 7-11		Small 90 degree angles carved on top of capitals.
136. 12		Wide angle carved on top of a capital.
136. 13	Qasr al-Bint	Capital with two correction lines forming 90 degree angles.
136. 14		A cornice piece with guide line and a square with hole in the middle from the east wall upper cornice.
136. 15	Wādi an-Numayr	A square with chisel marks in one corner.
136. 16	Siq al- Barid	A circle with lines crossing the center dividing the circle into four equal parts on one of the caves' columns at siq al-Barid.
136. 17	Mughur an-Nasārā	Lines. Next to Br. 676. Purpose is Unknown.
136. 18	Wādi as-Siyyagh	Lines. South side below Umm al- Biyārah. Purpose is unknown
136. 19	Kh. ad-Dharīh	Lines on a piece of column.

The Stonemasons' Marks in Petra

k. Holes used for climbing, hanging, plaster or Religious purposes [Pl. 137]

137. 1	Al-Khaznah area	Several holes around and at the north side of a cave's entrance located north of al-Khaznah.
137. 2	The High Place	Line of holes along the edge of the rock at the eastern staircase.
137. 3		Single unfinished hole for hanging next to a pair of vertical lines of holes for climbing. East staircase.
137. 4		Niche surrounded with holes and two Dusharas inside.
137. 5		Unfinished hole for hanging. East staircase.
137. 6		Holes for holding plaster. located on the inner wall above the entrance of the Triclinium. Western side of the High Place.
137. 7		Two horizontal lines above an arched niche inside a cave. Northwest side of the High Place.
137. 8		Horizontal and vertical lines of different sizes of holes covering the inner walls of the cave. Northeast side.
137. 9	Al-Mu'aysrah ash-Sharqiyyah	Two hanging holes about 1.20m. apart above each other, on the eastern wall inside a water reservoir [Pls. 28 c, 92b]. East side of Wādi. Probably for holding the plaster to the wall.
137. 10.		Rectangular hole in reservoir [Pl. 28 c] about 0.50m above the level of the plaster. Above it is another almost square one.
137. 11		Hole for plaster. East wall of the reservoir [Pl. 28 c].
137. 12		Detail of No. 11 above.
137. 13		Hole for hanging. East wall of the reservoir [Pl. 28 c].
137. 14	Umm el-Biyārah	Three holes next to the opening of a shaft tomb located at the southeast foot of Umm el-Biyārah. Used for funeral or religious Purposes?
137. 15	Wādi as-Siyyagh	Unfinished hanging hole. At the eastern end of the south side below Umm el-Biyārah.
137. 16	Winged Lions' Temple	Column's drum showing one of the four holes used for lifting.

The Stonemasons' Marks in Petra

I. Others: Games [Pl. 138]

- | | | |
|--------|-----------------------------------|--|
| 138. 1 | The Siq entrance | Game of rectangular form 0.45m. X 0.20m., and has 40 holes. |
| 138. 2 | | Two games next to each other. One measures 0.60 X 0.22m., and has 70 holes. The other measures 0.36 X 0.30m., and has 63 holes. |
| 138. 3 | The High Place/
east staircase | Three drawings which might be sort of a game. The largest and complete main drawing is in the middle. The other two, above and below the main one are smaller and not finished. |
| 138. 4 | | The main drawing in No. 3 with the small one above it. |
| 138. 5 | | The same drawing in No. 3 with the smaller drawing below it. |
| 138. 6 | | Part of a drawing. Purpose is not known. |
| 138. 7 | Umm el-Biyārah | A game that consists of three parts. Each one contains two rows of rectangular shapes next to each other. The right two are longer and have 20 rectangles, the left ones are shorter and each has 22 rectangles. A third set is below the left one and has 18 rectangles. This game is found on the top of the northwest side. |

Appendix 2: Catalogues of Exhibits

Die Nabatäer Spuren einer arabischen Kultur der Antike, (Hannover), 1976.

Kultur aus der Wüste die Nabatäer, (Wien),1980.

Die Nabatäer Erträge einer Ausstellung im Rheinischen Landesmuseum Bonn (24 May-9 July 1978, (Bonn), 1981.

Der Königs weg 9000 Jahre Kunst und Kultur in Jordanien (1987) in Köln1988, in Mainz 12 March11- June1989, in München 30 Nov. 1988 - 19 Feb.1989 and in Schallaburg April-Nov. 1988.

Petra und die Weihrauchstrasse, Ausstellung Antikenmuseum Basel and Sammlung Ludwig, St. Albansgraben 5,4051 Basel, (Zürich),1993.

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