Tur Imdai Rockshelter: Archaeology of Recent Pastoralists in Jordan

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Excavation of a rockshelter in southern Jordan yielded a record of habitation by pastoralists beginning about A.C. 1650 and continuing to the present. Ethnography and oral history associate the site with the Bedul Bedouin of Petra over the past century. The 3.6 m deep deposits yielded seven radiocarbon dates, microbotanical remains, goat and sheep bones, and a variety of artifacts. There was a shift in use of the shelter in the late 17th century from relatively stable residential occupation, including the use of coarse ware ceramics, to frequent short-term use. The deposits also indicate a cool and/or moist period in the late 17th century, providing evidence for local expression of the “Little Ice Age.”

Introduction and the Archaeology of Pastoralists

Excavated as part of a multifaceted project on the ethnoarchaeology of the Bedul tribe of Bedouin at Petra, Jordan, Tur Imdai Rockshelter offers a glimpse of pastoral activity in the area over the past three centuries. A fine-grained stratigraphic sequence yielded evidence of change in occupational intensity related to the nature of mobility and evidence for climatic change in the late 17th and early 18th centuries A.C. A variety of artifacts, including lithics, coarseware ceramics, and other debris was recovered that correlates closely with a suite of radiocarbon dates. Oral histories and genealogies of Bedouin informants link the site to Bedul Bedouin occupants in the 19th century. The excavation, analyses, and ethnographic information pertaining to the site of Tur Imdai contribute to the emerging study of pastoralist archaeology of sw Asia.

Pastoralists have long been recognized as a significant component of life in the region, but have been cast in the categorical terms of the “desert and the sown” (Bell 1985). The notion that there are issues here beyond mere typology has directed attention in recent symposia away from conceptualizing the continuum as an ebb and flow among polar opposites and toward the dynamic relationship between nomadic and settled populations in sw Asia.

The problem is both historiographic and archaeological, and in terms of the latter, it amounts to a situation where the “strong patterns” (Plog 1984: 218) of settled peoples shape the interpretation of the weak and more-poorly understood archaeological patterns of mobile peoples. This problem has been noted in several regions of the world (see Adams 1978, 1984; Freidel 1983; Rosen 1993; Upham 1984), and Eric Wolf (1982) has observed that the theoretical consequence of the problem is the creation of “people without history.” Much recent attention has been paid to this issue in the American Southwest, where the weak pattern of foragers is now seen as crucial to understanding the dynamics of settled life (Rushforth and Upham 1992; Sullivan 1994; Upham 1988, 1994a, 1994b).

The emerging archaeology of pastoralists holds the potential not only to better recognize pastoralists in the archaeological record, but also to enable the weak patternning of mobile peoples to be elevated from the status of epiphenomena to more fully assess the variability of lifeways, and focus on behavioral dynamics rather than on the behavior of bounded archaeological and/or historical types. We aim to contribute to the emerging archaeology of pastoralists in sw Asia (e.g., Banning 1993; Chang and Koster 1986; Cribb 1991; Bar-Yosef and Khazanov 1992).

Site Description and Ethnohistorical Setting

Tur Imdai is located in sw Jordan in the foothills of the Wadi ’Araba, about 5 km NW of Petra (Fig. 1). It is situated on the north side of the Wadi Musa/Wadi Siyaghe drainage, at an elevation of 470 m asl, just west of the debouchment of the stream from the mountains into the Wadi ‘Araba. Tur Imdai is an expansive south-facing alcove 40 m long ×
12 m wide × 30 m high situated in a quartz-porphyry massif (FIGS. 2, 3). The site was recorded in June 1988 and test excavated in February 1990. A problem-specific analysis of lithic debitage from the site has been reported (Kuijt and Russell 1993). Cultural deposits 3.6 m deep provide a detailed stratigraphic sequence with excellent correlation between material culture change and a sequence of seven radiocarbon dates beginning in the mid-17th century A.C. Sterile deposits were not reached in the test excavations.

Tur Imdai, which may be translated as “spacious” or “perpetual shelter,” is said by informants to have been a preferred site for winter encampments. Direct informant accounts from the early 20th century and oral history dating to the early to mid-19th century indicate that a local tribe of Bedouin, the Bedul, often moved their goat herds out of the highlands surrounding Petra to the lower elevations of the Wadi 'Araba to exploit the local winter vegetation and to escape the cold of the plateau.

The Bedul presently number about 1,000 individuals and continue to reside at Petra. They were the tribe encountered by the Swiss explorer J. Burckhardt in 1812 upon discovery of the ruins of the ancient capital of Nabataean Petra (Russell 1993). Oral history and archaeology indicate continuity prior to that time, but the absence of direct testimony makes it impossible to assign specific claims for earlier periods. The ethnohistory and
recent circumstances of the Bedul have been documented (Russell 1993; Simms and Kooing 1996), and documentation of the archaeological presence is in preparation.

Small-scale agriculture was also undertaken on the alluvial terraces of the Wadi Musa drainage in the vicinity of the rockshelter. A small water diversion dam and irrigation canal had been built or refurbished in the 1930s and 1940s on the south side of the former channel of the Wadi Musa, but only remnants of the clay-lined canal exist today. According to multiple Bedul informants, the al-Fuqarah subtribe of the Bedul hold traditional rights of cultivation in the immediate vicinity of the site, while the al-Muwasa and al-Ajdilat subtribes hold similar rights further downstream (Russell 1993). In recent years, Tur Imdai has been used by the Sa‘idiyin tribe.

Contemporary use of the site was documented in 1988: the site contained features common to other Bedouin rockshelters in the area, including fire hearths, a semicircular rock enclosure for goats, a short, low rock dividing wall, a stone platform of flat slabs used to store goatskin bags of dried yogurt (laban), and recent artifacts. By 1990, only the trash, hearths, and the dividing wall at the rear of the shelter remained, showing that modification of such sites is continuing.

The archaeological potential of the site for better understanding the post-urban history of the Petra region was apparent when it was recorded. A flash flood through the Wadi Musa drainage in 1963 killed several French tourists in the famous Siq of Petra (Starcky 1965: 95–97) and altered the course of the stream at Tur Imdai to expose a 2 m high × 18 m long profile of the archaeological deposits (FIG. 3). We suspected there were additional deposits below the exposed profile. Informants stated that the flood had washed away much of the site, and reported that the broad sandy plain that formerly extended from the front of the alcove was a favored location for often large camps employing black, goat-hair tents.

**The Excavation**

**Methods**

Three interconnected, 1 m wide trenches (F2–F4) were sequentially opened in the interior of the shelter. The excavation began at the profile exposed by the 1963 flooding and expanded horizontally as the depth of the deposits became evident (FIGS. 3, 4). Excavation and provenience recording proceeded by natural strata. In the upper 15 cm of the deposits, however, some strata identified here for the purposes of artifact and sample provenience contain several very thin layers of goat dung that could not be traced.
horizontally with confidence, even though they were observed and recorded in profile. In these cases, strata were identified only by readily traceable breaks between groups of thin layers of goat dung. Below about 15 cm the deposits contained more sand and rock, with breaks between occupational layers more frequently separated by culturally sterile strata. These were excavated and provenienced stratigraphically. All deposits, except the uppermost modern and highly fibrous strata (generally 0–15 cm) and levels of sterile colluvial material and rock fall, were sifted through 4 mm mesh screen. Artifacts were provenienced by strata and excavation unit, and their depth below the modern surface was recorded. Three sediment samples, two from fire hearths, were retrieved for flotation processing.

**Depositional Sequence**

As shown in the stratigraphic profiles (FIGS. 5, 6), approximately 3.6 m of alternating cultural and natural deposits overlying a level of heavy rock fall from the rockshelter’s roof were exposed. The cultural deposits consist primarily of multiple layers of burned and unburned goat dung containing hearths, bones, lithics, ceramics, and other artifact debris. Dozens of distinct occupational surfaces are apparent in the profile, some exhibiting holes from tent pegs, filled with sand after removal of the tent (e.g., FIG 6, near the middle of the sequence). The non-cultural levels consisted of aeolian and alluvial sand layers and colluvial debris weathering from the roof of the shelter. The lowest level reached was a thick deposit of roof-fall, with stones too large for excavation to continue in a one-meter wide trench. It is strongly suspected, however, that earlier cultural deposits lie beneath it. A profile of the rockshelter itself (FIG. 7) shows that this was one in a series of roof-fall events that appear to form a dike or berm around the mouth of the shelter along the line of the shelter’s most recent overhang. Additional, earlier deposits may be preserved behind this berm.

The roof-fall events are separated by episodes of occupation and by thin alluvial deposits of silts with small amounts of fine sands and associated clay. Some of the silts are reddish-yellow in color, and represent flood deposits generated by heavy rains in the large catchment of the Wadi Musa drainage above Petra. Other thin alluvial layers are distinct yellowish silts characteristic of the nearby Wadi ed-Dileiyah, a drainage receiving runoff from the southern end of the Petra Valley. Thus, the flood events reflect episodic and in some instances highly local flooding. Four extensive alluvial strata (6–12 cm thick) and several other minor events were identified. The cultural layers between these events are significant, and, as will be described later, contain the bulk of the artifact assemblage.

After the earliest attested period of occupation, punctuated by eight distinct roof-fall events (often involving large
debris) and four intervening flood events, a multifaceted shift in depositional regime is apparent at a depth of 1.5–1.6 m when measured along the north profile (FIG. 6). Subsequent deposits consist almost entirely of thin cultural strata, with a single major aeolian episode involving clean, fine, dark red sands occurring early in this later sequence. The trend toward thinner strata in the upper section compared to the lower is apparent on the profile drawings (FIGS. 5, 6). Colluvial deposition continues, but never in sufficient quantity to constitute a separate depositional event. No further alluvial deposition is attested within the rockshelter prior to the 1963 flash flood.

**Chronology**

Seven radiocarbon dates are available from Tur Imdai. When the site was first recorded in 1988, three radiocarbon samples (88-1 through 88-3) were obtained from strata in the flood-exposed cutbank of the shelter deposits, just west of where the test trench would be placed during the 1990 test excavation. They consist of composite samples of dung and charcoal removed from exposed lenses in the cleaned profile. Their location is shown on Figure 3 and they are plotted on the excavation profile (FIG. 6) for comparative purposes, although they could not be stratigraphically correlated with the samples taken during the excavation. A fourth sample (88-4) was taken 22 m east of where the excavation would eventually be made from a thin charcoal, ash, and dung deposit at a depth of 1.5 m below the surface under colluvial deposits (FIG. 3).

Three more radiocarbon samples (90-1 through 90-3) were obtained during the 1990 excavation and are shown on Figure 6. Each of these is from well-defined hearth features and only chunks of wood charcoal were submitted.

Table 1 lists sample data, C$^{14}$ ages, and the calibrated age ranges (Stuiver and Reimer 1993). The calibrated ranges are reported to 95% confidence intervals. The ranges are relatively large due to multiple intercepts of C$^{14}$ age and the tree-ring record caused by the fluctuations in atmospheric C$^{14}$ levels characteristic of the late historical
period. For this reason, the contribution of the various ranges associated with each intercept to the total probability were also calculated according to Stuiver and Reimer, “Method B” (1993: 226). This information was compared with stratigraphic position and datable artifacts, such as machine-made glass and shells from repeater rifles. These comparisons, along with the calculation of probabilities, enable the most probable calibrated ages to be identified from the suite of possibilities. These are shown on Table 1 as calibrated A.C. ages and reflect the actual points of intersection between the C\textsuperscript{14} age and the tree-ringing calibration curves. They are also shown on the stratigraphic profile, along with the provenience of dated artifacts (FIG. 6). They are included not to imply that they are the precise dates, but as evidence of the accuracy of the general time periods, and to illustrate the internal consistency of the stratigraphic sequence. When utilized in conjunction with the artifacts, the calibrated ranges, and the contribution to probabilities, the most probable calibrated ages suggest the portion of the calibrated range in which the actual dates occur.

**Interpretation and Climatic Implications**

The radiocarbon dates indicate occupation from the middle of the 17th century A.C. through the historical present. An initial period of alternating roof-fall, occupation, and flood deposition was underway during the 17th century and apparently ended in the early 18th century. At that time, a shift in depositional regime occurred that is marked in its early phase by a prominent aeolian deposition of clean, fine, dark red sands. While this aeolian event might represent a long period of time during which there was no human occupation of the site, the homogeneous nature of the sand deposit more probably reflects a single depositional episode, perhaps restricted to a few years, when drying of the formerly active floodplain promoted aeolian reworking of alluvial sediments. Whatever the cause, it was the last major non-cultural depositional event within the shelter, for above it, cultural deposits represent frequent, short-term occupations that were virtually continuous through the present.

Presumably, the shelter was repeatedly subject to the sort of degradation events represented by the historic flash flood of 1963, and the stream channel of the Wadi Musa periodically shifted its course from the north to the south side of the drainage. The very existence of the shelter is undoubtedly due to stream erosion. Prior to 1963, however, the stream channel had been in its southerly position long enough for a broad sandy plain to develop between it and the mouth of the shelter. This plain consisted of several
meters of deposition overlying the northern drainage channel of the Wadi Musa. According to Bedul informants, the Wadi Musa drainage had "always" been within its southern channel.

The deposits indicate that flash floods equivalent to that of 1963 had not occurred since the early 18th century. Prior to that time, it appears that rainfall and runoff conditions in the Wadi Musa catchment had been sufficient for generating flash floods that reached the rockshelter. Further, environmental conditions during that period also promoted repeated roof-fall events.

The period from the 16th through the 19th centuries is a time when some areas of the world experienced more frequent episodes of cooler than normal temperatures. First recognized by increased glacial activity in central Europe, the "Little Ice Age" is a vague concept that is highly variable in expression (Lamb 1977). Only a few periods within the Little Ice Age, up to several decades each, appear to be synchronous across the northern hemisphere, including the period from the late 17th to early 18th centuries (Jones and Bradley 1992: 659). Southwest Asia represents a geographic gap in data for this period, although glacial development on Mount Ararat in Turkey and from Levantine historical sources suggests a very generally understood moist episode at different times between the 15th and 19th centuries (Bintliff 1982: 513-514).

At Tur Imdai, the combination of alluvial events, followed quickly by aeolian deposition, together with the active roof-fall, suggests that the formation of the deposit was climatically driven. The dating of this regime is consistent with increased water flow in the Wadi Musa, consequent to either cooler temperatures, increased precipitation, decreased evapotranspiration, or combinations of these factors. The dating of these events at Tur Imdai—the second half of the 17th to the early 18th centuries—suggests that we may be observing one of the hemispheric
climatic departures subsumed under the term “Little Ice Age” in the Petra area.

**Recovered Materials and Analyses**

**The Lithic Assemblage**

It is apparent from the lithic materials recovered at Tur Imdai that chipped stone industries continued to play an important role in the daily life of nomadic peoples from the 17th through the 19th centuries A.C. An analysis of the Tur Imdai lithic tools and debitage and their implications for a variety of problems in lithic analysis and pastoralist archaeology has been published (Kuijt and Russell 1993). Rather than restate that work, only a brief summary is included here.

A total of 12 stone tools and 254 items of debitage were recovered from the excavation. The tools are of three types, including shaped hematitic sandstone used as whetstones to sharpen iron tools (knives?), flint strikers (briquets) for starting fires, and gunflints. A single hammerstone was also recovered. The debitage largely results from use of a hammer and anvil technique on small cobbles, leading to bipolar reduction.

**The Ceramic Assemblage and a Lesson from Pastoralist Archaeology**

A total of 72 ceramic sherds were recovered from the excavation (Table 2). Most were body sherds, although a few diagnostics were also recovered. Sixty-five of the 70 sherds are from strata lying between 157 to 232 cm below the surface, representing the lower component of deposits characterized by occupations separated by roof-fall and flooding events (Fig. 6). These ceramics are overwhelmingly hand-built coarse wares. Judging from the diagnostic

Figure 7. Profile through the rockshelter, looking west.
Table 1. Radiocarbon sample data, C\textsuperscript{14} ages, calibrated ranges, and calibrated ages.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Depth (m)</th>
<th>Lab no.*</th>
<th>C\textsuperscript{14} age yrs B.P.</th>
<th>Cal A.C. ages\textsuperscript{a}</th>
<th>Cal A.C. ages\textsuperscript{b}</th>
<th>Most probable cal. ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>88-2G</td>
<td>1.23</td>
<td>28065</td>
<td>101 ± 1</td>
<td>1822–1955</td>
<td>1889, 1907, 1954</td>
<td>1889, 1907</td>
</tr>
<tr>
<td>88-1</td>
<td>.3</td>
<td>28066</td>
<td>90 ± 60</td>
<td>1669–1786</td>
<td>1792–1950</td>
<td>1896, 1902, 1955</td>
</tr>
<tr>
<td>90-1</td>
<td>.7</td>
<td>36367</td>
<td>130 ± 50</td>
<td>1663–1955</td>
<td>1922, 1954</td>
<td>1695, 1725, 1816</td>
</tr>
<tr>
<td>90-2</td>
<td>1.15</td>
<td>36368</td>
<td>130 ± 50</td>
<td>1663–1955</td>
<td></td>
<td>1695, 1725, 1816</td>
</tr>
<tr>
<td>88-3</td>
<td>1.9</td>
<td>28063</td>
<td>190 ± 70</td>
<td>1631–1955</td>
<td>1943, 1954</td>
<td>1675, 1777, 1798</td>
</tr>
<tr>
<td>88-4</td>
<td>1.5</td>
<td>28064</td>
<td>200 ± 70</td>
<td>1627–1955</td>
<td>1946, 1953</td>
<td>1672, 1781, 1795</td>
</tr>
<tr>
<td>90-3</td>
<td>2.3</td>
<td>36369</td>
<td>260 ± 50</td>
<td>1511–1954</td>
<td>1487–1686††</td>
<td>1654</td>
</tr>
</tbody>
</table>

\*All samples were analyzed by Beta Analytic, Coral Gables, Florida, presented as RCYBP (radiocarbon years before A.C. 1950), using a half-life of 5568 years. The error represents one standard deviation (68% probability).†Determined using the computer radiocarbon calibration program CALIB (Stuiver and Reimer 1993). Ranges represent 95% confidence interval unless otherwise noted.\‡Actual intercept point(s) between the C\textsuperscript{14} age and the tree-ring calibration curve.§Samples 88-1 to 88-4 taken from exposed profile in 1988 (see Figure 3).**Contribution to probabilities is 3% (Stuiver and Reimer 1993: 226).††Contribution to probabilities is 70% (Stuiver and Reimer 1993: 226).

Sherds and compositional variations in fabric/ware, a minimum of 18 vessels is represented (Table 2). With the exception of two sherds, all of the ceramics are from cooking pots (11) and storage vessels (5). All of the cooking pots were hand-built, as were three of the five storage vessels. Coarse wares such as these are expediently manufactured and it is suspected that all of these hand-built vessels were manufactured by the shelter’s inhabitants. Ceramics similar to those from Tur Imdai were recently found during the clearance of historic pastoralist deposits from ancient tombs at Petra and Barid (Sulieman Farajat, personal communication, 1991). The diagnostic sherds from Tur Imdai are shown in Figure 8.

The ceramic assemblage is important because, for the first time, a corpus of hand-built coarse wares of the recent historical period has been securely dated. In the absence of dating, it is always tempting to assume that such coarse ceramics are generally ancient, ignoring the probability that similar expedient wares have been produced during various periods from the Neolithic through the ethnographic present. Although such temporal assumptions would be questionable when applied to sherds collected during surface surveys, they would also be dubious when applied to ceramics obtained during excavations in the absence of independent chronological evidence such as radiocarbon dating.

Table 2. Attributes and depth (below surface) of ceramic sherds from Tur Imdai.

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Number of sherds</th>
<th>Minimum number of vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Hand-built</td>
</tr>
<tr>
<td>38–69</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>85–108</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>136–157</td>
<td>5</td>
<td>–</td>
</tr>
<tr>
<td>157–169</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>169–202</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>202–221</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>221–232</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Totals</td>
<td>72</td>
<td>68</td>
</tr>
</tbody>
</table>
An example comes from a re-examination of ceramics, at the request of W. J. Jobling, from the rockshelter component of Tell al Kharaza, located near Hummeina in southern Jordan (Jobling 1983). The site was tested in 1981 by the late C.-M. Bennett. On the basis of the recovered ceramics (mostly hand-built, coarse ware body sherds), occupation was dated from the Pottery Neolithic to the Middle Bronze Age. Additional similar sherds in the vicinity were used to suggest an Iron Age use of the area as well. Upon re-examination by Russell, it was apparent that the fabrics and forms of all of these ceramics fall within the range of variability exhibited by the Tur Imdai ceramics. The Kharaza ceramics may indeed be ancient, but this interpretation cannot be sustained on the basis of ceramic morphology alone. In the absence of independent chronological evidence, it is possible that the occupations in the Kharaza rockshelter may result from late historic Bedouin occupation, and like much pastoralist archaeology, remain unrecognized.

Faunal Remains

Fragmentary faunal remains were encountered throughout the deposits, but the majority were recovered from the lower component characterized by alternating roof-fall and flooding events. Examination shows that most are of sheep or goat, and consist primarily of cut or split long bones. Many were burned, although it is unclear whether the burning was from primary or secondary cooking, or from post-depositional charring as a result of the widespread and slow-burning dung fires that are attested in the deposits. Additional analysis of the faunal collection has not been done.

Glass, Cartridges, Metal, and Miscellaneous Items

Fragments (N = 10) of machine-made glass objects were encountered in the uppermost levels of the site. Eight of the 10 were of clear glass, one was of brown glass, and one of green. Most of the clear fragments appear to derive from small tea glasses like those used today. A single green glass bead (7 mm diameter, 5 mm thick) was recovered in unit F4 between 38 and 69 cm in depth. In unit F2, a small fragment of a multi-colored glass bracelet was recovered from 45–65 cm. Similar glass bracelets have been found in late 19th-century Bedouin burials at al-Lejjun (S. Thomas Parker, personal communication, 1990). The only other glass encountered was in F4 at 221–232 cm, and consists

Figure 8. Diagnostic ceramic sherds of the mid-17th to mid-18th century from Tur Imdai.
of a small lump of badly-oxidized blue-green glass, possibly a bead fragment.

Four corroded rifle cartridges were recovered from the F2 and F4 trenches in the upper 45 cm of deposits. These are .303 caliber shells for either Lee Enfield or Mauser-type repeater rifles. Such rifles were presumably introduced to the Petra area towards the end of the 19th or in the early 20th century (Libbey and Hoskins 1905: 100–104). After the First World War, repeater rifles are said to have been numerous and cheap in the region (Philby 1925: 3).

One piece of rusted wire, a small wire hook, and a long (14.5 cm), pointed iron pin with a small loop at one end were recovered in the upper 40 cm of deposits. The latter was identified by informants as a peg for pinning the back wall onto a tent. A small, nondescript piece of flattened rusted iron with a loop at one end was found at 45–65 cm depth, while a fragment of a hand-wrought nail was found in 65–92 cm. A small piece of flattened iron at 85–108 cm was the only other metal object found.

Two small nodules of high grade, metallic-looking hematite were found, one from the upper 45 cm of deposits and the other between 157–169 cm. The first is cylindrical in form (approximately 2.4 cm long and 1.3 cm in diameter). The second piece is roughly rectangular (3.4 cm × 1.9 cm × 2 cm). Neither exhibits evidence of abrasion or use, although they certainly occur at the site as a result of human activity. Such hematite nodules are suspected to have been the source of the pigments used on early Nabataean painted wares (James Mason, personal communication, 1991), and their presence at Tur Imdai may indicate a local source.

Other objects include a small piece of red canvas-like material and a fragment of a knife-sharpened stick (38–69 cm), a short length of twined cord (108–136 cm), and a twig from a grape vine (245–335 cm). The latter may reflect the presence of grape vines upstream from Tur Imdai near the middle of the 17th century. It may have derived from gardens nearby in Wadi Siyagh, where the Bedul currently grow grapes, or from further afield in the vicinity of the village of Wadi Musa, known in the past as Elji.

**Microbotanical Remains**

Three sediment samples consisting of the entire contents of two fire hearths and a bulk sediment sample were recovered during the excavation and subjected to flotation processing. The horizontal locations of the samples are shown on Figure 5 and the vertical locations are plotted onto Figure 6 for comparison to the radiocarbon dates.

The sediment samples were processed in their entirety in a mechanical flotation device. Table 3 describes the contents of the three samples. In addition to the remains from the flotation analysis, an uncharred grain of barley was found during the excavation in the upper 45 cm of the deposits, placing it in the 20th century. Perhaps the sample of greatest interest is No. 2, containing charred seeds from three wild species and over 100 charred seeds of domesticated lentil. Sample 2 was a bulk sediment sample taken from a 2–3 cm thick stratigraphic layer comprised orange sediments, mottled with ash, charcoal, and charred goat dung. The sample depth of 190 cm places it in the last half of the 17th century (see FIG. 6). The seeds are from a type of lentil common to Southwest and Central Asia, known as *Microperma*, characterized by seeds ranging from 2–6 mm in diameter. It is impossible to conclude whether the lentils at Tur Imdai were brought to the site from an external market or grown nearby by the local inhabitants. Lentils were an early domesticate in SW Asia (Zohary 1972). As a legume, they are considered an excellent crop for rotation with wheat and barley, and are also cultivated on marginal lands where drought, pests, and weed competition are problems (Summerfield, Muhlbauer, and Short 1982: 6, 8). It is interesting that charred seeds of *Malva neglecta* were found in the same sample. It is a common weed on

**Table 3. Flotation samples from Tur Imdai (locations shown on FIG. 5).**

<table>
<thead>
<tr>
<th>Sample number</th>
<th>Depth (cm)</th>
<th>Volume (liters)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>157–169</td>
<td>1.5</td>
<td>Fire hearth. No botanical remains. Sandy sediment with fragments of charred wood. Urine and dung common. Dung fire with no botanicals.</td>
</tr>
<tr>
<td>2</td>
<td>190</td>
<td>2</td>
<td>Bulk sediment sample from thin layer. 100+ charred lentil seeds (<em>Lens culinaris</em>-domesticated). Charred seeds of <em>Malva neglecta</em>, <em>Euphorbia</em>, and <em>Amaranthus</em>. Other unidentifiable wild seeds, but no grasses. One burned bone fragment.</td>
</tr>
<tr>
<td>3</td>
<td>230</td>
<td>5.5</td>
<td>Large fire hearth. No seeds, but numerous small wild flower heads (not grass). Numerous and tiny rock spalls from firing of rocks and some flint debitage. Charred wood fragments.</td>
</tr>
</tbody>
</table>
disturbed soils in the Petra area. Reportedly intolerant of extreme heat or cold (Summerfield, Muehlbauer, and Short 1982: 5), lentils would have to be a winter or spring crop in the vicinity of Tur Imdai, the season when the site was most used, according to informants. The cultivation of crops would also be consistent with the relatively stable residential pattern indicated by the remains at Tur Imdai for the period prior to the early 18th century. As interesting as they are inconclusive, the lentils may be evidence of a mixed pastoral-agricultural system in the Petra area during the late 17th century.

**Summary and Conclusions**

The test excavations at Tur Imdai provide a well-dated archaeological exploration of a late historic Bedouin occupation in sw Asia in a stratigraphic context documenting change through time. While such deposits frequently occur in caves and shelters, they are often shallow and are commonly ignored. The test excavation shows that the comparatively deep deposits at Tur Imdai provide a relatively fine-grained record of human habitation in the Petra region from the mid-17th century to the present. It is also apparent that, consistent with informant and historical data, Bedul Bedouin occupation of the Petra region extends further into the past than has generally been credited, although no claim by any specific tribe can be made for the entire sequence (Russell 1993).

The lithic materials recovered at Tur Imdai demonstrate that chipped stone industries continued to play an important role in the daily life of pastoralists in recent centuries. Chipped stone was used for fire strikers (“briquets”) and gunflints, while flakes and blades served as expedient cutting tools (Kuijt and Russell 1993). Combined with other study documenting the persistence of stone tool technology into the Iron Age (Bawden, Edens, and Miller 1980; Miller 1984), as well as classical and later Arabic periods (Miller 1984), the nature and attributes of historical lithic technologies are becoming better known. This circumstance alone will direct attention to a pastoralist archaeology and open the possibility that assemblages that are presumed to be old because they contain lithics or crude ceramics, may in fact represent the weak archaeological pattern of pastoralists recent or ancient.

The above point was specifically illustrated using the ceramics from Tur Imdai in comparison with a re-examination of sherds from the rockshelter component of Tell al Kharaza in southern Jordan. This analysis shows that ceramics previously interpreted as Neolithic to Iron Age fall within the range of variability for the coarse wares from Tur Imdai that are well-dated to the 17th and 18th centuries. Regardless of the actual age of the Kharaza coarse wares, the point of this comparison is to allow for an archaeological recognition of a pastoralist presence given the expectation that pastoralism represents a fundamental element in the cultural infrastructure of sw Asia rather than an ebb and flow between the desert and the sown.

The depositional sequence at Tur Imdai suggests that the period prior to the early 18th century was relatively cool and moist. This interpretation is consistent with a widespread climatic departure in the northern hemisphere at that time suggesting it was also expressed in the Petra region. This period was followed, beginning in the early 18th century, by conditions more similar to those of today. Numerous Bedouin groups moved into Jordan from the Hijaz and the interior of Arabia during the 16th and 17th centuries (Peake 1958: 85–86; Shoup 1980: 46, 74; Hiatt 1981: 2, 31). These movements may have been related to favorable environmental conditions relative to those in the deserts further south. At Tur Imdai, these movements may be evident in the lower component which dates to that time. Deposits in the lower component indicate occupations of greater intensity. Occupational layers were the most substantial encountered, and contained the highest frequencies of artifacts and sheep and goat bone. The prevalence of ceramics indicates occupations of greater duration or redundant use of sites where equipment, such as ceramics for future use, and stored items were cached. The recovery of domesticated lentils from a level dating to the late 17th century may reflect the presence of a mixed pastoral-agricultural system at this time, or at least an economic association with farmers. These patterns may indicate greater settlement stability at the site as populations of pastoralists in southern Jordan increased in the 16th and 17th centuries.

The occupational strata in the period after the early 18th century at Tur Imdai reflect numerous, relatively brief occupations characterized by strata of burned goat and sheep dung and leaving far fewer artifacts. Occupation after the early 18th century was frequent and near-continuous, but each occupation appears less intensive. The gunflints appear within this depositional unit and persist through most of the 19th century, at which time repeater rifles were introduced.

While it has long been known that Bedouin societies played a major role in the culture history of Jordan, studies directed at the archaeological identification and nature of Bedouin sites hold potential for broadening our conception of “Bedouin” adaptive strategies, and for conceptualizing pastoralists in more dynamic terms. With the emergence of an archaeology of pastoralists comes an identity of its own and a recognition that the history of sw Asia is more than an ebb and flow among the urban and rural, the desert and the sown.
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