BIR UMM FAWAKHIR

Carol Meyer

The fourth season at Bir Umm Fawakhir in the central Eastern Desert of Egypt, from 16 November to 11 December 1997, was the longest one to date, and in many ways the most productive. The project completed a detailed map of the main fifth–sixth century Byzantine/Coptic gold-mining town, mapped in detail most of Outlier 2, found six more outlying clusters of ruins of the same date (Outliers 9 through 14), and documented Outliers 6, 7, 12, and 13. Late New Kingdom remains were identified in the Wadi el-Sid in 1996, and in 1997, some of the pharaonic mines as well. Finally, a specialist study of the ancient mines, mining, and ore reduction techniques was carried out.

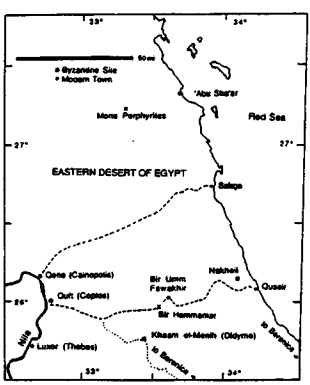

Figure 1. Map showing location of Bir Umm Fawakhir

The staff consisted of the author as field director; Lisa Heidorn as assistant director; Henry Cowherd, photographer; Bryan Earl, mining engineer; Alexandra O'Brien, epigrapher; Mohamed Badr el-Din Omar, geologist; Clemens Reichel, archaeologist; Leslie Boose, camp manager and draftsman; Sayyid Remany, driver; and Mohammed Rayyan and Mohammed Hamid, inspectors. As usual, thanks are due to many people and organizations, here listed roughly in chronological order: William Sumner and Gene Gragg, former and present directors of the Oriental Institute; Peter Dorman and W. Raymond Johnson, former and present directors of Chicago House; the American Research Center in Egypt and

especially Amira Khattab; Dr. Ali Hassan and Dr. Gaballa Ali Gaballa, former and present chairmen of the Supreme Council of Antiquities; WCSS/IBM; Tina di Cerbo, Ahmed Harfoush, Yarko Kobylecky and all the rest of the Chicago House staff for their support and hospitality; Dr. Gaber Naim, Chairman, and the Egyptian Geological Survey and Mining Authority; patrons Ida De Pencier, Mr. and Mrs. H. I. Meyer, Catherine Novotny-Brehm, Pennzoil, Dr. and Mrs. John Ryan, and Dr. Robert K. Smither.

Main Settlement

The Main Settlement at Bir Umm Fawakhir, so named to distinguish it from the outliers, was the focus of most of the work in 1992, 1993, and 1996 (fig. 3). The town lies in a long, narrow wadi, its steep sides define construction limits and its sandy bottom serves as the main street. Starting at the southeast end where the houses are less flood-damaged, the survey worked its way northwest season by season. In 1997 Buildings 153 through 237 and some of the surrounding topography were mapped, up to the end of the site at the northwest gate, a natural narrowing of the wadi (fig. 2). Here some granite boulders with wedge slots probably mark a small ancient quarry.

As in previously mapped parts of the site, all buildings appear to be domestic, either independent two- or three-room units, or several such units built together in larger agglomerated houses of as many as twenty-two rooms, or else one-room outbuildings. The site is sufficiently well preserved so that even at the northwest end not only walls, doors, and trash heaps could be plotted, but also features such as wall niches for storage and benches. No churches, storehouses, administrative or public buildings, or defensive structures have yet been located, though they might have existed closer to the wells and modern settlement where damage from wadi wash is heaviest. The 1997 buildings use the same construction techniques – granite cobble dry stone masonry – and lay-

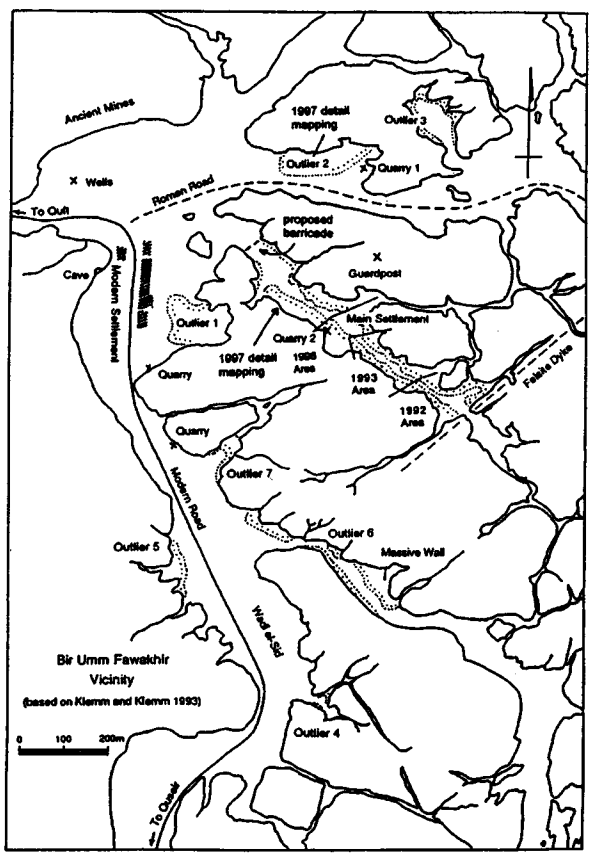

Figure 2. Bir Umm Fawakhir vicinity

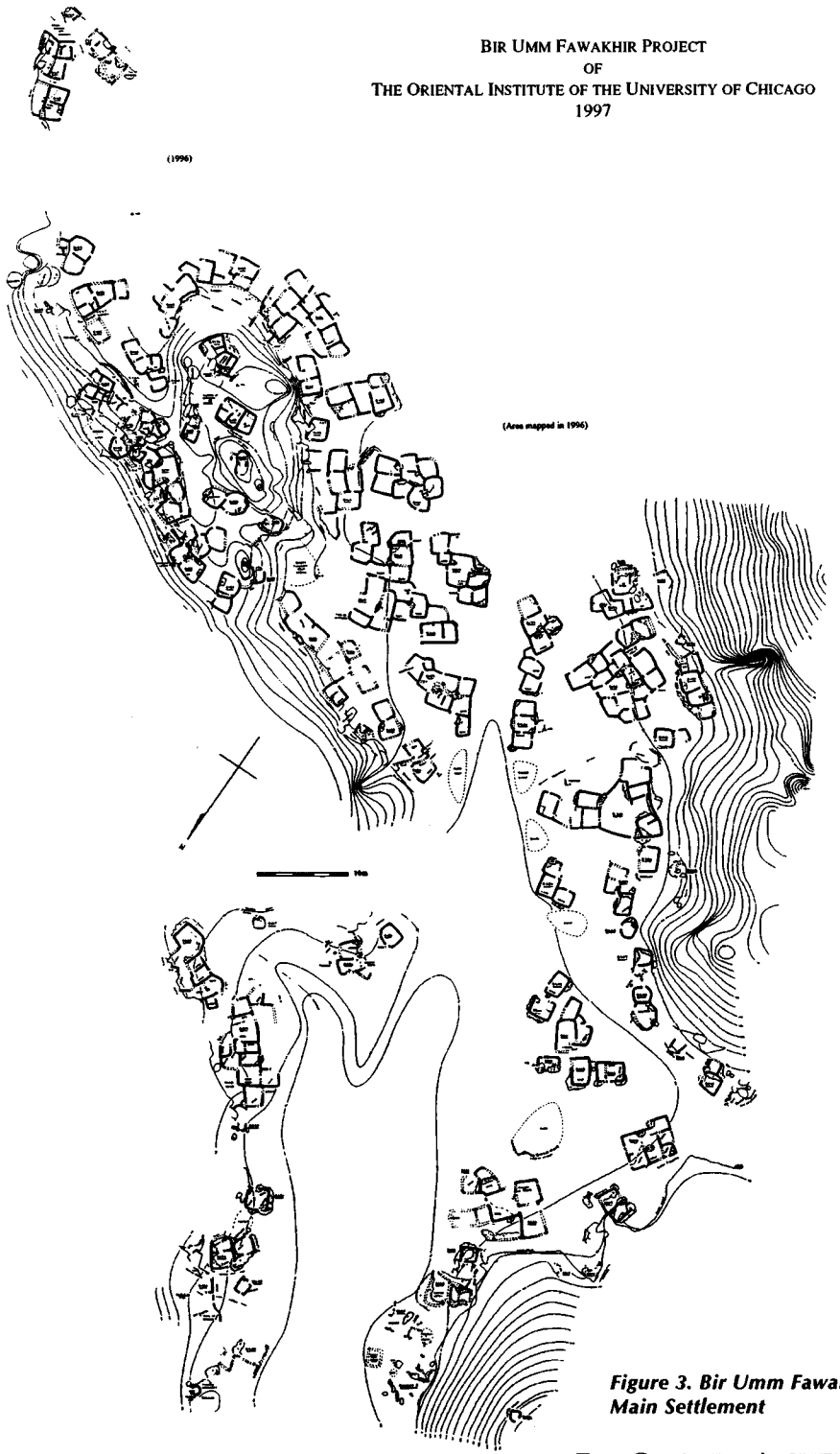

Figure 3. Bir Umm Fawakhir Main Settlement

Figure 4. View of Hillock (center) with Buildings 176 and 177, looking towards main street. Photograph by Henry Cowherd

out as the buildings mapped earlier, but apart from the ones on the Hillock they are not so well preserved, and in a few cases are reduced to mere house mounds.

The Hillock is a granite outcrop with two sizable buildings on top, Buildings 176 and 177, plus a few smaller structures (fig. 4). Between the Hillock and the cliffs to the northeast lies a gully with several well-preserved houses, especially Buildings 170, 172–174, and 175. Finds from the Hillock include a large number of grinding stones of all sorts, many dipinti (labels painted in red on wine jars), fragments of decorated glass beakers or lamps, and an unusual number of fine plates stamped with Coptic crosses and other Christian symbols. Further analysis of the pottery sample from Building 176 and other parts of the Hillock may point to functional or status-related differences from the rest of the community.

The detailed map and photographic record of the Main Settlement are now complete, and as such provide a rare opportunity to study an entire ancient community house by house, room by room, even without excavation. The only other completely plotted ancient Egyptian towns are New Kingdom Deir al-Medina; the fortified Roman town at the Mons Claudianus quarries; Karanis, which was abandoned about the time Bir Umm Fawakhir was founded; and Coptic Jême, which was excavated away to reveal Ramesses III's mortuary temple at Medinet Habu.

Outliers

A second survey team headed by Clemens Reichel began surveying Outlier 2 on 30 November and completed a detailed map of 57 out of 66 buildings. Outlier 2 was selected for intensive work because of its excellent preservation and its location (figs. 2 and 6). It lies in the broad wadi north of the Main Settlement, on the Roman road, between the wells and Quarry 1, thought to be Roman. Although insignificant

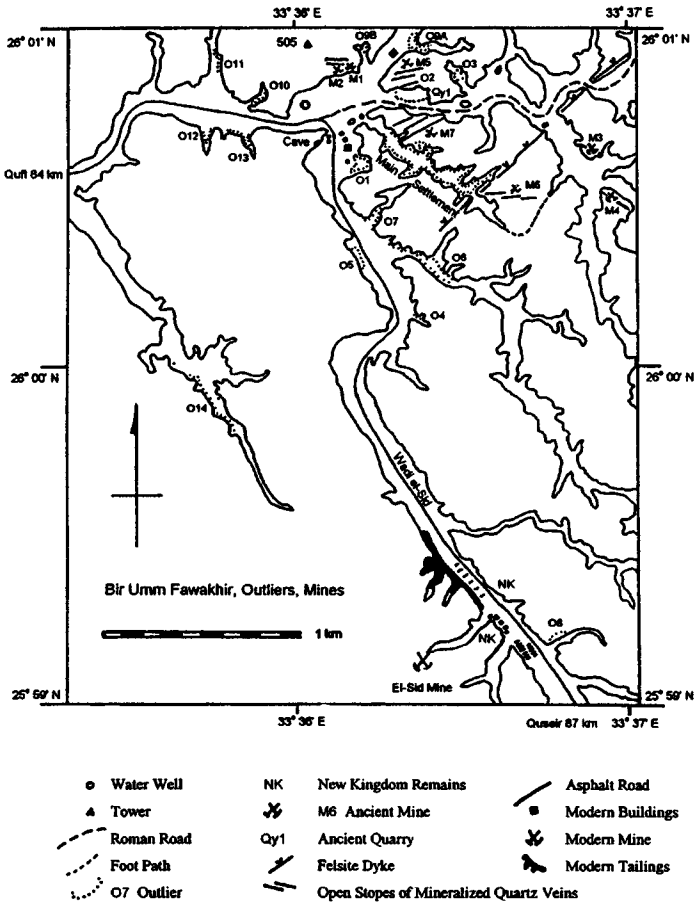

Figure 5. Bir Umm Fawakhir and Wadi el-Sid area, mines and outliers. Map by Mohamed Badr el-Din

compared to major quarries such as that at Mons Claudianus, Quarry 1 is the largest of the granite workings in the Bir Umm Fawakhir vicinity. Some of the houses in Outlier 2 appear to stand to their original height of roughly two meters, and some display features not evident in the Main Settlement, such as steps down into rooms, adjacent grain silos, complicated wall construction, and what looks like a large two-step bench (Building 54). The pottery is the same as that in the Main Settlement and is sufficiently abundant to indicate that Outlier 2 was residential and not a temporary work site, though it may not have been inhabited as long. Like the Main Settlement, one-room outbuildings are more common farthest from the wells, at the southeast end of Outlier 2, whereas multi-room agglomerated houses tend to occur closer in.

Lisa Heidorn and Henry Cowherd described, sketched, and photographed Outliers 6 and 7 in the wadi immediately south of the Main Settlement, though the ruins were not plotted with surveying equipment. One hundred and six buildings were recorded, though five are modern and a few others badly preserved. The houses in Outliers 6 and 7 are similar to the ones in the Main Settlement, though almost all are the simpler two- or three-room individual houses and potsherds are much sparser. The most peculiar feature is a complex, Building 26, set in a side bay (fig. 7). Very steep cliffs enclose the area on the north and east, and massive (75 cm) walls on the south and west almost close off the area. The building within the enclosure has two very thick (65 cm) walls running out from the nearly perpendicular north cliff, but no trace of a wall on the south. The interior space is divided by a thinner wall and a third room was attached on the west. This is the one structure at the site that does not appear to be domestic, but we have as yet no explanation of its function.

The Roman road runs east past the wells, across a wide, sandy open area, and past Outlier 2 and Quarry 1. Opening to the northeast just past the wells is another wide, dead-end wadi that was not investigated earlier because of modern construction. A walking survey, however, located Outliers 9A just east of the chief engineer's house and 9B in a deep bay west of the house. The bay had a number of looted graves on the slopes, one of which yielded an "incense burner" of extremely soft stone (fig. 8). The item has carved lines but no trace of burning.

Outliers 10 and 11, just past a natural gate leading to the Bir Umm Fawakhir area, have few huts and some pottery, but they lie, abruptly, in another geological zone, dark Precambrian ultramafics versus the Fawakhir granite of the Main Settlement area. Outliers 12 and 13, on the other side of a modern road and selected for further work because of their geological location, were described and sketched by Alexandra O'Brien. In all, sixty-five structures were noted, but most are simple one- or two-room huts badly tumbled. Pottery is not abundant but is similar to that from the Main Settlement. Evidence of mining and tunneling was noticed on hillsides between Outlier 12 and 13. Finally, Mohamed Badr el-Din found Outlier 14 in a remote wadi south of the Wadi Hammamat road. A good three kilometers from the wells by wadi bottom, it is, however, only a sixth of that distance by path up, over the mountain ridges, and down to the Wadi el-Sid near the modern mines (fig. 5).

At Bir Umm Fawakhir, then, we can investigate not only an entire ancient town but also many peripheral features such as ancient roads, paths, wells, cemeteries, guardposts, quarries, mines, and outlying work or residential areas. The earlier estimate of a little over a thousand inhabitants in the Main Settlement now seems conservative. It was based on the assumption that every one of the outliers represented

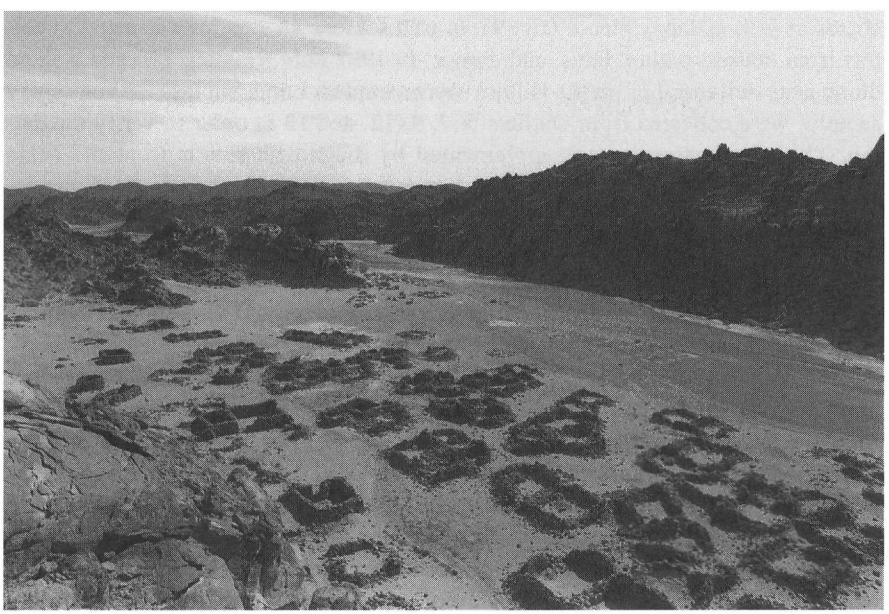

Figure 6. Outlier 2, view to southeast with Quarry 1 and Roman road to right. Photograph by Henry Cowherd

Figure 7. Outlier 6, Building 26 in deep bay, houses in foreground. Photograph by Henry Cowherd

temporary shelters or work areas, even Outlier 2 with its carefully constructed houses and silos.

Artifacts

As before, the project collected controlled sherd samples from selected areas in order to obtain a more representative sample of all pottery types at the site, body sherds as well as fancy pieces (fig. 9). In past seasons an attempt was made to collect from houses, outbuildings, and dumps. In 1997 only Building 176 and a sherd dump near Building 177 on the Hillock were sampled. Large but less rigorous sherd samples were collected from Outliers 6, 7, 9, 12, and 13 in order to verify the dating. These collections were supplemented by diagnostic sherds from the Main Settlement, outliers, and the New Kingdom mine area. Given the dearth of inscriptions or texts from or about ancient Bir Umm Fawakhir, the pottery is our main dating evidence. This large corpus, together with those from previous seasons, will be prepared for publication by Lisa Heidorn, the project's ceramist. As Bir Umm Fawakhir is essentially a one-period site, the corpus should be valuable to those working with material from longer-lived and more confused sites.

The corpus of dipinti, labels on wine jars, increased by thirty-six, but as before most are fragmentary, cursive, and faded and as yet provide little information. Typically one large, sprawling label was written on the shoulder of a large wine jar and a second, smaller one upside down under or near one of the handles. New this season was a number of potmarks scratched on vessels after firing (fig. 8). In addition to the unburnt "incense burner" from Outlier 9B, the farthest end of 9A yielded a slotted milling stone of a type well known from Roman and later contexts. It is carved with the Greek letters "AP" and made of a non-local basalt (fig. 10). Another unburnt "incense burner" was retrieved from the Main Settlement, as well as a small

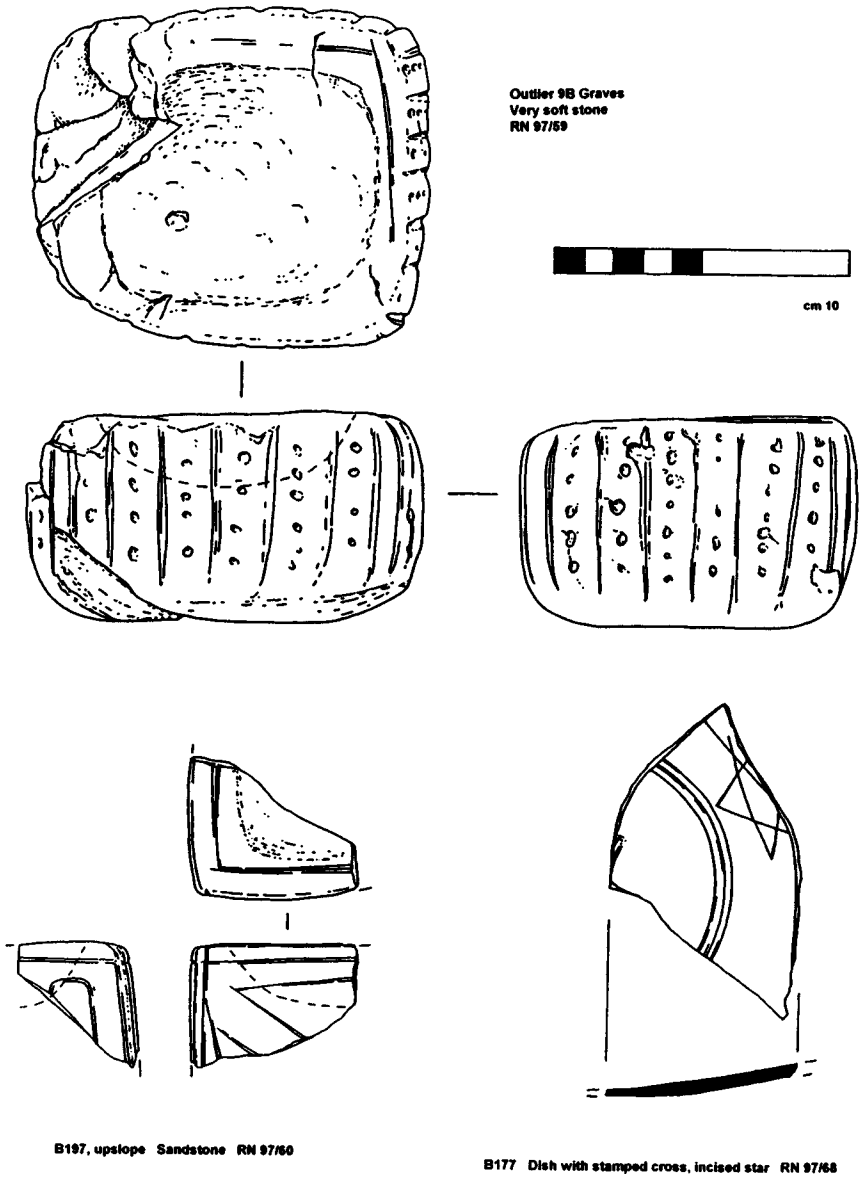

Figure 8. Incense burners and pot marks

steatite bowl and large pieces of what might have been a decorated stand of very porous pottery.

New Kingdom Mines

During the 1996 season, the project found late New Kingdom remains on top of a hill across the road from the modern mining camp in the Wadi el-Sid. Mining activity in the 1940s and 1950s was believed to have destroyed all evidence of mining there apart from scattered bits such as potsherds in the mine tailings, so it was grati-

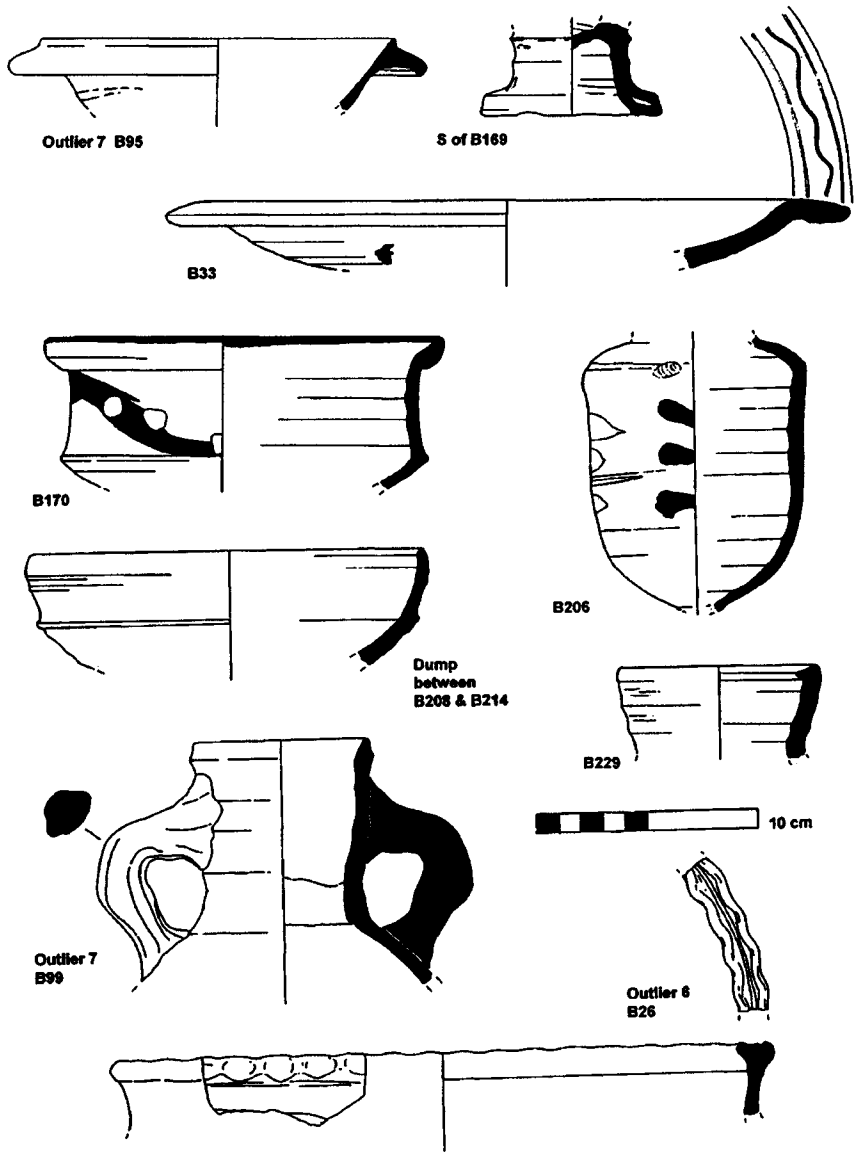

Figure 9. Sample of Bir Umm Fawakhir pottery

fying to discover a late New Kingdom sherd dump, graves, and what appear to be guardposts. The Wadi el-Sid mines have been called the richest gold mines in all Egypt, so it is probable that the ancient miners started there and only moved to the low-yield ores at Bir Umm Fawakhir when the older mines were played out by ancient techniques.

It came as a further surprise, then, to find on the top of the mountain, immediately above the modern crushing mill, pharaonic sherds, huts, and mines. The most readily identifiable sherds are burnished jars; the huts are simple, roughly square

rims of stones, but again some are associated with sherds, and the mines are open cast trenches, now silted in and no more than a meter deep at most. This is typical of many ancient mines and quarries. They were never particularly large or elaborate in the first place and have since experienced centuries of erosion and fill. The trenches at Wadi el-Sid are marked as ancient, however, by the dimpled crushing stones beside them, by the amount of silt washed in, and by the simple technology. What is interesting is that this represents hard rock mining, and hacking quartz ore out of granite is far more difficult than panning alluvial gold. The Fawakhir granite is fractured, jointed, and in places rotten, but the quartz veins are tough. Hard rock mining requires a large labor force, in contradistinction to the lone miner and mule hoping to strike it rich. The thousand-odd inhabitants of Bir Umm Fawakhir would have been none too many. Such a labor force requires recruitment, organization, and supply, and as a result it is the organizers who will be enriched, not the miners. They may make a living, but the gold itself will go to Thebes, Constantinople, Johannesburg, or wherever.

Mining Study

Mr. Bryan Earl, a retired mining engineer who has worked with a number of archaeological projects, and Mohamed Badr el-Din Omar, a geologist from the Egyptian Geological Survey, carried out an investigation of the ancient mines and ore reduction techniques. Five mines were inspected and ore samples from Mine 3 were crushed and concentrated. Analyses of the samples are still under way.

As indicated, the oldest mines in the Wadi el-Sid are simple open cast trenches. In the Coptic/Byzantine period the miners still followed the quartz veins down from the surface of the mountain, only they went far deeper, in places cutting underground. Some of the shafts are revetted with stonework or have dry stone masonry platforms at the rim. The horizontal drives opening at the level of the wadi bottom are modern efforts aimed at reaching the lower levels of the same quartz veins the ancients attacked from above. The modern efforts were not always successful; many broke through to shafts where ancient workmen had already removed the ore.

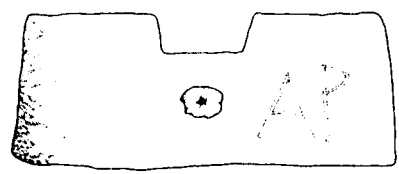

Figure 10. Slotted mill stone with lead plug and inscription (12.5 cm high, 32.0 cm wide at base). Drawing by Alexandria O'Brien

Five horizontal mines shafts (fig. 5) and several new quartz veins with open cast mines were investigated and mapped. Ore samples were collected from Mine 3, which is typical of this kind of mine and also far enough away from the modern road and settlement to be relatively undisturbed. The quartz ore samples were further selected for the most heavily mineralized pieces, usually pyrite and chalcopyrite. The chunks were crushed to about the size of rock salt with an iron pounder from the modern crushing mill and then ground to the consistency of face powder on a magnesium steel bucking plate. In past seasons the project identified two or three main types of ore crushing stones at Bir Umm Fawakhir, dimpled crushing stones, rotary querns, and oblong, slightly dished stones somewhat like metates. During the 1997 season we found even more types of grinding stones, primarily around the wells and along the road to the Wadi

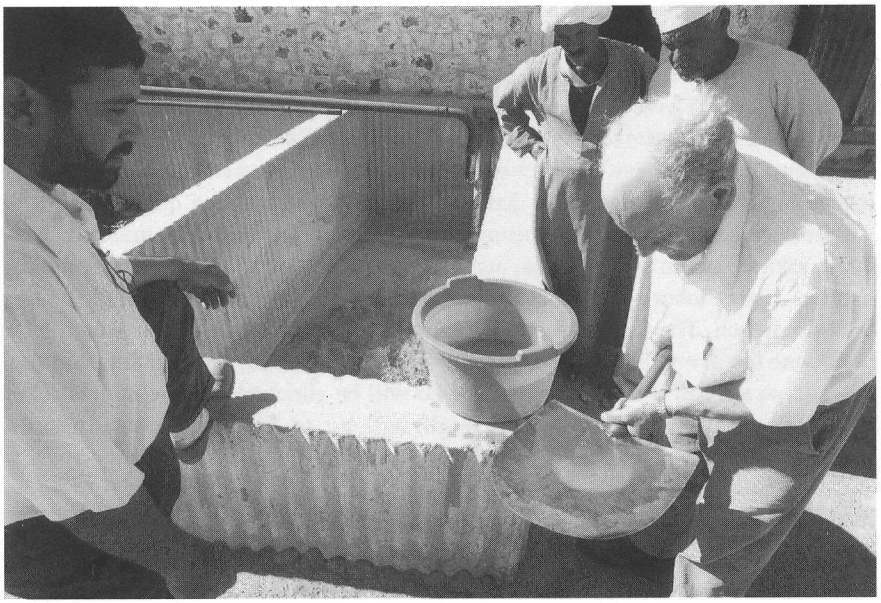

Figure 11. Bryan Earl washing ground ore on vanning shovel. Photograph by Henry Cowherd

el-Sid camp, including deep, ski-slope grinding stones, two-handled millstones(?) of porphyritic granite, slightly convex stones, and very large, slightly dished stones. Whatever the grinding implements workers used at which period, it is clear that they had to reduce the ore to powder to obtain any gold at all.

The finely ground Mine 3 sample was washed on a broad, shallow Cornish vanning shovel, and swirled to deposit the heavy material near the rim (fig. 11). The lighter silica fraction can be poured off a corner of the shovel. The residue of dark concentrate is then scanned, in this case with a loupe, for visible gold flecks. At best they are not obvious. A washed concentrate might have been as far as the ancient workmen got at Bir Umm Fawakhir. It would have been safer to transport sacks of black concentrate to the Nile Valley than gold dust, there is so far no evidence at all for smelting at Bir Umm Fawakhir where fuel would have been at a premium, and extracting gold from this kind of ore is actually quite complicated and perhaps better undertaken by skilled craftsmen in the Nile Valley.

The minerals present in the gold quartz of Bir Umm Fawakhir include pyrite (FeS_2), limonite ($2Fe_2O_3.3H_2O$), chalcopyrite ($CuFeS_2$), galena (PbS), sphalerite (ZnS), perhaps stibnite (SbS_3), hematite (Fe_2O_3), arsenopyrite ($FeAsS$), and pyrrhotite ($Fe_{1-x}S$). The notable thing is that most of these are sulfides, much more difficult to smelt than oxide ores. Two methods of extracting gold were known in antiquity, mercury and lead processing, though mercury is not suitable for this kind of ore nor is it generally associated with Egyptian metalworking. Lead processing, or cupellation, is a two or three step process. First, the smelters have to heat the concentrated ore, which will separate into two layers, one containing copper and iron on top and one with lead on the bottom. Adding lead can facilitate the process, and the above-mentioned galena and stibnite already have lead in them. The lead contains

the gold and silver. The lead material is then placed on a bed of calcined bone, brick dust, or something porous. The whole is heated in the presence of air until the lead melts to liquid litharge that soaks into the porous bed and the gold-silver beads are left on top. If necessary, the gold and silver can be separated by the very ancient technique of pickling with salt or acid.

That the Coptic miners were using such a sophisticated technique to win gold from a difficult, low-yield ore is in itself interesting, but how much older is the lead processing technique? One of the oldest references is in Diodorus Siculus of the first century BC, based in large part on Agatharchides of the previous century. Diodorus describes only a one-step lead process, but nonetheless a lead process. There are some possible earlier textual references, depending on how one interprets them, but we do not know when cupellation was invented or when it came into use in Egypt. The question is this, if the pharaonic workers were not mining quartz ores with a lot of sulfides, what were they mining? It is important to remember that the easily worked ores are long gone and all that is now left is what no one wanted. If the ancients were extracting such ore, grinding it to powder, and washing and concentrating it, how did they finally extract the gold? Could simple, extensive, and repeated washing have sufficed, or did they use a lead process? If so, was this a brand-new technique and one that for the first time permitted the Egyptians to exploit the quartz ores in the Eastern Desert instead of depending on alluvial gold from farther south? We do not know the answers at this time, but these are questions we hope to pursue in the future.
