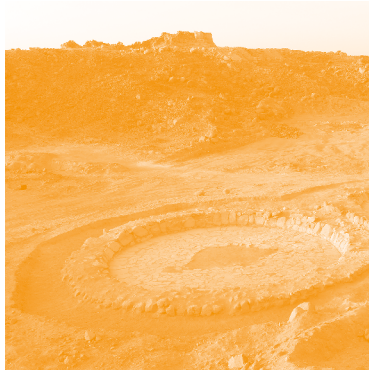
Gold-mining in the Eastern Desert of Egypt, from New Kingdom to medieval times. New insights from the Samut district



Abstract: Gold was plentiful in Egypt and had been used by the Pharaohs from the earliest times as a means of asserting their power. But the history and archaeology of the mining and production of Egyptian gold is a lot less known than the splendour of the country's kings.
Between 2013 and 2016, the French Eastern Desert expedition aimed to fill the gaps in our knowledge through the excavation of the gold-mining district of Samut, situated between Edfu and Marsa Alam. It hosts one of the largest and at the same time perfectly preserved Ptolemaic mineral processing sites of the region, Samut North. This enabled the first ever comparison between archaeological remains and the well-known treatise of Agatharchides of Cnidus exposing the terrible living conditions in the gold mines of the Ptolemies. Three other sites were also explored: the impressive village of Samut el-Beda, dated to the New Kingdom, and two small villages from medieval times. Structures and artifacts related to gold processing were discovered at all of the sites, supplying crucial data on the technological and organizational sides of gold exploitation over more than two millennia in the Eastern Desert.

Keywords: Egypt, Eastern Desert, gold processing, mine, Ptolemaic, New Kingdom, medieval period

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The monograph on the excavations of the sites dedicated to gold exploitation in the Samut district is already published (Redon and Faucher 2020). The present article is a summary and a presentation of the most striking results.

Gold was plentiful in Egypt and had been used by the Pharaohs since the beginning of Egyptian history as a means of asserting their power. But the history and archaeology of Egyptian gold, the mining operations, the gold production and its circulation are much less known than the splendor of the kings.

In a recent book Dietrich and Rosemarie Klemm listed more than 250 gold-mining sites all over the region, down into Nubia, dated from the Predynastic to modern times (Klemm and Klemm 2013). Not one has been properly excavated save for the Byzantine site of Bi'r Umm Fawakhir which had been briefly tested by Carol Meyer from the Oriental Institute of Chicago (Meyer et al. 2000; 2011). Prior to the deployment of the French program, the history of gold exploitation in the Eastern Desert was thus known chiefly from surveys and the study of ancient written sources.

In 1994, Hélène Cuvigny launched the French Archaeological Mission of the Eastern Desert (MAFDO), aimed explicitly at excavating the line of ancient roads in the Eastern Desert. For 20 years her itinerant mission excavated Roman forts (*praesidia*) once guarding the two main routes from the Nile Valley to Myos Hormos and to Berenike (Cuvigny 2003; 2011). In January 2013, Bérangère Redon, together with Thomas Faucher, succeeded Cuvigny at the head of the mission and chose to focus on Ptolemaic-age occupation of the Eastern Desert (331–30 BCE), maintaining the tradition of an itinerant mission along the ancient roads.

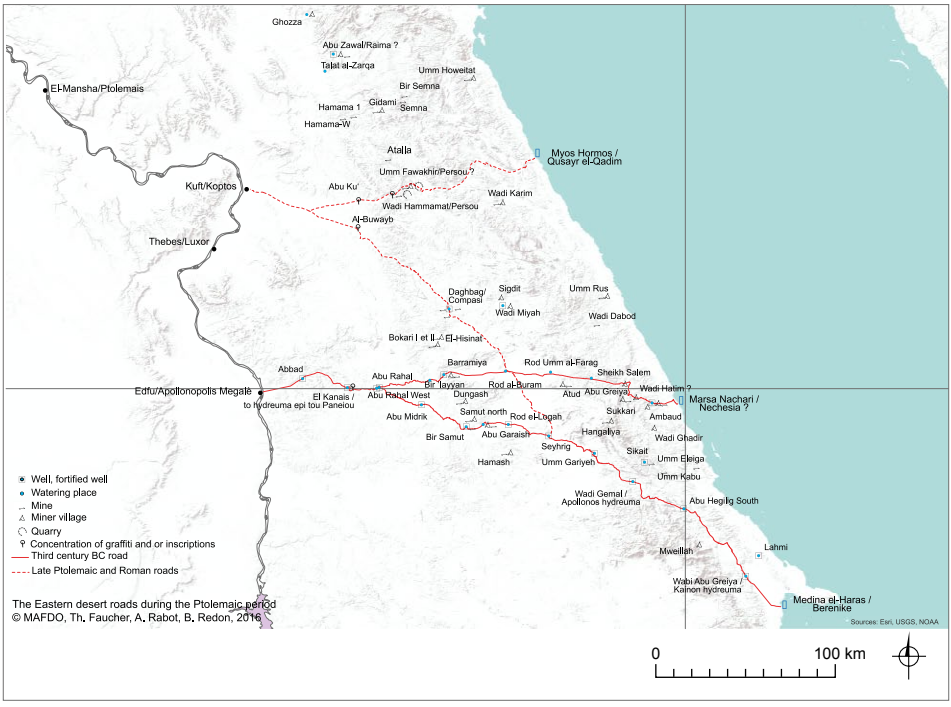

Fig. 1. Eastern Desert sites and roads in the Ptolemaic period (© MAFDO, Th. Faucher, A. Rabot, B. Redon, 2016)

The Ptolemaic period was crucial to the region in view of the massive investment by the Graeco-Macedonian dynasty of the Ptolemies [*Fig. 1*], founding harbors on the Red Sea and developing a network of roads, forts and fortified wells to advance traffic in the region (Desanges 1978: 252–279; Sidebotham 2011: Chapter 4; Gates-Foster 2012: 199–201; Redon 2018). It was also the time when gold exploitation peaked in the region, with the activation or reactivation of dozens of gold mines all over the region (Klemm and Klemm 2013: 12–15; Faucher 2018).

The program started in the district of Samut [*Fig. 2*], in the middle of the desert, between Edfu and Marsa Alam. Here were many well-preserved sites including a Ptolemaic gold mine, Samut North (Brun et al. 2013; Redon 2016a: 1329–1334; Redon and Faucher 2017: 104–106; 2020) and the largest Ptolemaic fortress of the region, located on the Edfu–Berenike road, Bi'r Samut (Redon 2016a: 1335–1338; Redon and Faucher 2017: 107–108). Smaller sites in the area were also surveyed, mapped and excavated, including Samut el-Beda from New Kingdom times, the Ptolemaic site of Abu Garaish, and two small medieval settlements (Marchand et al. 2019). Remains other

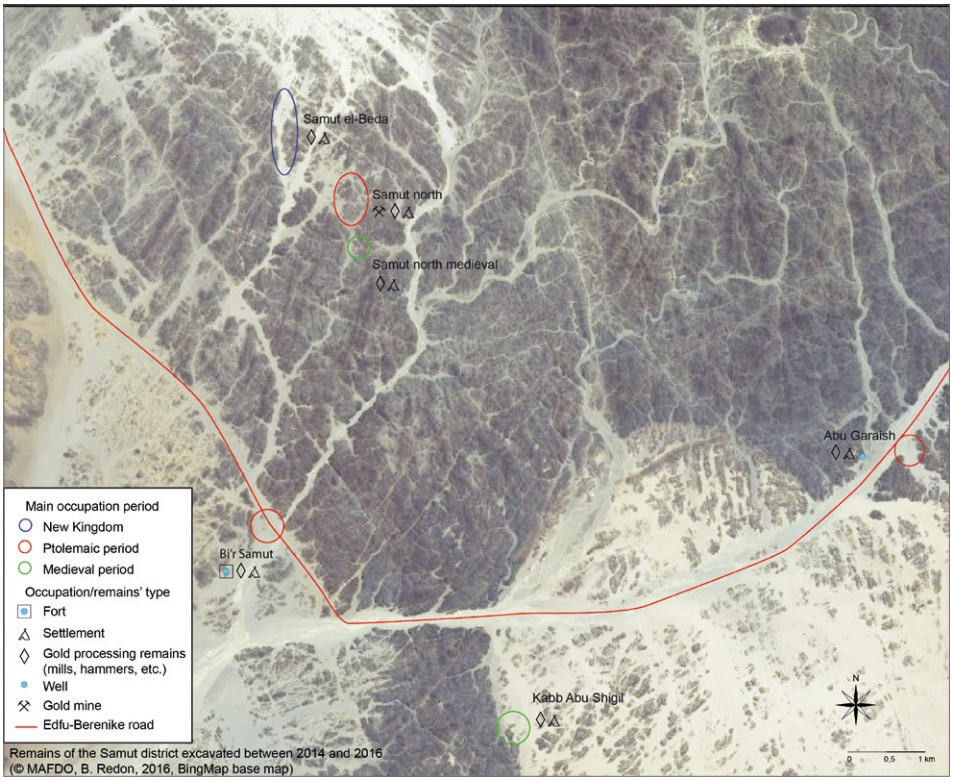

Fig. 2. Remains of the Samut district excavated between 2014 and 2016 (© MAFDO, B. Redon, 2016, BingMap base map)

than Ptolemaic were not neglected despite the focus on Ptolemaic-age material, all the more so because of the horrendous modern gold rush in the region, which is devastating the still well preserved ancient sites.

After a survey in 2013, three excavation campaigns were conducted in the district of Samut between 2014 and 2016, with a team composed of more than 15 scholars and 20 Egyptian workers .

The current presentation is focused on gold exploitation in the Samut area and its evolution through times, from the mining village of Samut el-Beda dated to the New Kingdom period, through Samut North, a mining complex in operation during the first decades of Ptolemaic rule in Egypt, to a couple of small medieval villages from the 8th–10th centuries CE. Structures and artifacts related to gold processing were uncovered at all of the explored sites, yielding crucial data for understanding the technological and organizational evolution of gold exploitation over time in the Eastern Desert.

GOLD PROCESSING IN THE NEW KINGDOM

Many royal inscriptions mention expeditions into the Eastern Desert in search of gold, led by officials at the head of armies of miners (Černý 1947; Rothe, Rapp, and Miller 1996; Rothe and Miller 1999; Peden 2001: 117, Note 363; Rothe, Miller, and Rapp 2008). Significantly, the first preserved map produced in Egypt is of the valuable gold mines in the area of Wadi Hammamat (Harrell and Brown 1992). Gold has been exploited in the region since Predynastic times, Pharaonic activity peaking apparently during the New Kingdom as evinced by texts mentioning the quantities of gold gathered every year. Dozens of mining sites from this period have been recorded but none had been excavated (Klemm and Klemm 2013: *passim*) until 2015 and 2016 when Julie Marchand and Alexandre Rabot, assisted by Isabelle Goncalves and Mariola Hepa, surveyed and partly excavated the New Kingdom miner village at Samut el-Beda.

SPATIAL ANALYSIS

One of the most important miner settlements in the region, Samut el-Beda is located a few kilometers north of Samut North. Unlike other Pharaonic settlements of its kind, usually composed of only a few dozen of huts, Samut el-Beda consists of altogether 218 huts and structures scattered over a distance of one kilometer on the lowest parts of the hill slopes on both sides of a wadi of this name [*Fig. 3*], as well as on small hills and in three secondary wadis.

Such an arrangement of the huts makes it easy to collect gold-bearing quartz in the wadi (no trace of vein mining is evidenced and the quartz containing gold elements was probably collected from the wadi surface and near the veins). The location on the hill slopes is justified by the need to stay safe and dry in case of flash flooding in the area.

Made of local stones (granite or granodiorite), almost all the sructures are rectangular in shape, measuring 4 m by 9 m on average, with simple internal organization

Fig. 3. Samut el-Beda. Hut 101 with a general view of the wadi in the background (©MADFO, J. Marchand)

Fig. 4. Samut el-Beda. Pharaonic mining tools (©MAFDO, J. Marchand)

of space. Some huts have a small yard excavated directly in the gebel, possibly as a workplace. A few huts show a complex plan with a zigzag entrance and a back room. In the secondary wadis, three-room structures are more frequent. One hut is located in the overhead part of the gebel slopes and has a general view of the entire wadi: it has been identified as a possible guard's hut.

Hut walls are preserved about 0.80 m-to-1.00 m high. Interior furnishings must have been of wood to judge by the middle-sized postholes. Small fireplaces (probably cooking places) were recorded in the centre of the structures; a hearth in the corner of the overhead house may have acted as a brazier. A light roof, made of woven wool, palm fronds or vegetal mats and fibers is suggested by the presence of two big holes in the ground, one in the middle, one along the lateral wall of a hut.

Five of the huts were excavated: three are located in the wadi, at the northern and southern ends and in the centre, the fourth on the middle slope of the gebel and the fifth in the main secondary wadi. They all show the same very simple stratigraphy, with only one sequence of occupation, materialized by one or two floors made of clay set on natural rock, and then the abandonment layer, consisting of sand and blocks coming from wall collapse.

STRUCTURES LINKED TO MINERAL PROCESSING

Stone tools are present all over the surface of the site, especially in the lower part of the wadi slopes. Several kinds have been registered, all made of hard granite or granodiorite: anvils and hammers, mortars and pounders, a grinding table and grinders [*Fig. 4*]. They were used to crush and then to grind the quartz in order to ultimately obtain a white powder called "flour" by the Greeks (like Agatharchides) and modern miners likewise.

Some basins have been recorded on the site, always in the near vicinity of the huts. They are too small to be associated with the washing process taking place after the grinding operation and in any case there is not enough of them for the huge quantity of powder that was probably produced in the village. It means that the last stages of the gold processing from quartz to metal (washing and melting) must have taken place most likely in the Nile Valley where water and fuel were readily available.

POTTERY AND CHRONOLOGY OF OCCUPATION

Pottery sherds are scarce, found in secondary contexts only, connected with complex structures (composed of two or three rooms). This is one of the reasons why the remote wadis where these structures are located have been assumed to be living areas and places for food preparation, but not working areas, which were more likely to be found in and near the huts.

The few pottery vessels are mainly cups, carinated(?) bowls and storage jars. No fine vessels and no imports were found. The small number of vessels (the minimum number [MNI] is 44), combined with the fact that there are too few tools for a long period of work, leads to the hypothesis that the working seasons during the New Kingdom were very short and/or seasonal. A short span of occupation is also recognized at other sites in the Eastern desert such as Wadi Allaqi (Giddy 1998: 39), Bir Umm Fawakhir (Meyer et al. 2011: 8–9) and the Marsa Alam area (Rothenberg et al. 1998).

PTOLEMAIC GOLD PROCESSING

SAMUT NORTH MINE

The main source of knowledge about gold exploitation in the Eastern Desert during the Ptolemaic period is the treatise of the historian Agatharchides of Knidos, who described, at the end of the 2nd century BCE, the horrendous living conditions of miners in the gold mines of the Ptolemies (Agat. Cnid. V, 22–29 quoted by Diod. Sic. III, 12–14 and Phot. 250, 23–29; see Marcotte 2017). The introduction of his chapter about the Ptolemaic mines of the Eastern Desert runs as follows:

> "At the extremity of Egypt ... lies a region which contains many large gold mines, where the gold is secured in great quantities with much suffering and at great expense. ... For the kings of Egypt gather together and condemn to the mining of the gold such as have been found guilty of some crime and captives of war, as well as those who have been accused unjustly and thrown into prison because of their anger, and not only such persons but occasionally all their relatives as well, by this means not only inflicting punishment upon those found guilty but also securing at the same time great revenues from their labours. And those who have been condemned in this way ... work at their task unceasingly both by day and throughout the entire night, enjoying no respite and being carefully cut off from any means of escape; since guards of foreign soldiers who speak a language different from theirs stand watch over them, so that not a man, either by conversation or by some contact of a friendly nature, is able to corrupt one of his keepers. 13. ... For no leniency or respite of any kind is given to any man who is sick, or maimed, or aged, or in the case of a woman for her weakness, but all without exception are compelled by blows to persevere in their labours, until through ill-treatment they die in the midst of their tortures. Consequently the poor unfortunates believe, because their punishment is so excessively severe, that the future will always be more terrible than the present and therefore look forward to death as more to be desired than life" (Diod. Sic. III, 12).

Even if the text is two centuries later than the Samut North mine as dated by the pottery and ostraca (see below), and beyond the rather sordid content of this text, Agatharchides' testimony could be quite realistic.

The text continues with a thorough description of different stages of the mining process from extraction to production of gold. The excellent preservation of the mining settlement remains at Samut North, excavated by Jean-Pierre Brun, Faucher and Redon, have enabled for the first time a c omparison of archaeological reality with Agatharchides' testimony.

ORE EXTRACTION

The first described operation was ore extraction:

> "The boys there, who have not yet come to maturity, entering through the tunnels into the galleries formed by the removal

> of the rock, laboriously gather up the rock as it is cast down piece by piece and carry it out into the open to the place outside the entrance" (Diod. Sic. III, 13).

In Samut North [*Fig. 5*], the main vein of quartz (which contained small particles of gold) was exploited over a distance of 280 m. One form of exploitation was an open-air excavation with small galleries (the "tunnels" of Agatharchides). Another took the form of an underground operation, with four wells from 13 m to 64 m deep. Examination by the team speleologists (Florian Téreygeol, Adrien Arles and Joseph Gauthier) revealed the wells to be of modern date, dug probably by an English mining company in 1903–1904. Thus, the Ptolemaic mine was an open-air facility, which probably yielded around 100 kg of gold from Samut North's vein.

CRUSHING, GRINDING AND WASHING

Once extracted from the vein, quartz was crushed and then reduced into powder [*Fig. 6*]. This corresponds both to the testimony of Agatharchides and to the remains found during the excavations.

> "Then those who are above thirty years of age take this quarried stone from them and with iron pestles pound a specified amount of it in stone mortars, until they have worked it down to the size of a vetch. Thereupon the women and older men receive from them the rock of this size and cast it into mills of which a number stand there in a row, and taking their places in groups of two or three at the spoke or handle of each mill they grind it until they have worked down the amount given them to the consistency of the finest flour" (Diod. Sic. III, 13).

In the field, several zones of ore crushing were found, delimited by low walls, with fragments of quartz scattered on the surface along with a few mortars and crushers. The largest area is located near Building 2 and the main vein. The grinding operation took place in area 3, where two tangent mills [*Fig. 7*], of about 10 m in diameter each, were discovered. At first identified as two heavy mineral processing plants used to wash the quartz powder (Klemm and Klemm 2013: 241–243; Redon and Faucher 2015), these two circles were reinterpreted as huge mills, used to grind the ore and produce quartz powder (Redon and Faucher 2016). The main axis of the mill can still be seen, sealed, in the center of one of the circles, and in the paved floor around the circumference of the two circles a depression left undoubtedly by the passage of a heavy millstone. These remains correspond particularly well with what Agatharchides described.

Two other operations followed the grinding, terminating ultimately in the acquisition of the precious metal: first, the flour was washed on wooden tables and then the gold thus obtained was melted. No remains that could be associated with certainty with these two steps were observed at Samut North. Moreover, there was absolutely no evidence of any kind of water storage devices. This may lead to the hypothesis that the quartz flour was taken to the Nile Valley to undergo these operations there, probably because water (and fuel to a lesser extent) was not available in sufficient quantities at the mining site.

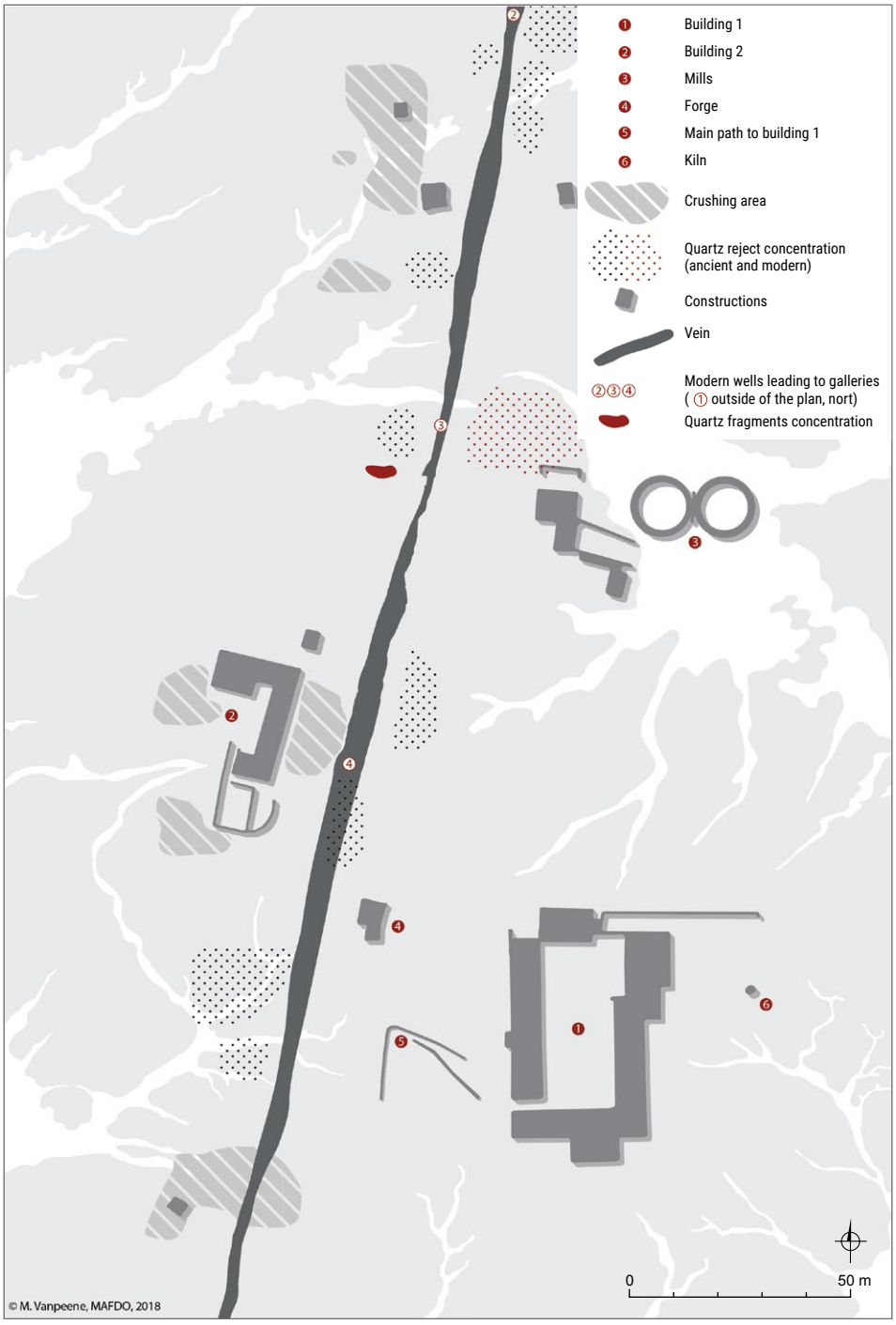

Fig. 5. Samut North: general plan of the Ptolemaic gold mining settlement (© MAFDO, M. Vanpeene, 2018)

Fig. 6. Samut North. Crushing area near Building 2 (© MAFDO, Fl. Téreygeol)

Fig. 7. Samut North. Two quartz mills (© MAFDO, G. Pollin, Ifao)

LIVING QUARTERS AT SAMUT NORTH

Two buildings at Samut North were destined for use by the many occupants—soldiers, administrators, technicians and miners (presumably convicts and prisoners of war; Redon 2016b).

Building 1 is located on top of a hill overlooking the entire area. It is more or less rectangular and composed of four wings built around a central courtyard. It has sometimes been described as a fort because of its elevated position and its massive walls, but it has four entrances and no towers to protect the doors and corners of the building. It is therefore not strictly speaking a fort, but rather a building intended to host the commander, a troop of soldiers and part of the miners working in the vicinity.

Many rooms yielded equipment and artifacts that established their function as a kitchen, several storerooms and a possible chapel. The most interesting data, however, is to be found in the east wing [*Fig. 8*], where three large rooms were located (Redon 2016b). They are equipped with lateral benches and divided into three parts by low walls. The entrance to these three rooms was guarded by rooms which could have been a gatehouse. In the three large rooms, fragments of quartz and steatite were found in great quantities, in various stages of work, most likely trinkets produced in free time. In light of these finds, it seems reasonable

Fig. 8. Samut North. Two dormitories in the east wing of Building 1 (© MAFDO, G. Pollin, Ifao)

to interpret these three rooms as living quarters (dormitories) and maybe also as working places for the miners. One identical oblong room, equipped with bunks, was found in Building 2, located near the main vein and the main crushing areas. The dormitories of Samut North can be compared to the buildings known in the Roman world as *ergastula*, which housed slaves employed to work in the fields, mines and quarries (see, for example, Mackensen 2005: 88–89). They also resemble the barracks discovered in Giza, which no doubt housed the pyramid workers (Wetterstrom 2002).

FINDS AND CHRONOLOGY OF OCCUPATION

A study of the pottery and of the palaeography of a very small number of ostraca found in Building 1 demonstrates that the occupation of Samut North goes back to the last quarter of the 4th century BCE, countering the hitherto accepted date for Ptolemaic investment in the Eastern Desert in the reign of Ptolemy II (see, for example, Desanges 1978: 247–248). It now looks as if Ptolemy I, father of Ptolemy Philadelphus and founder of the Ptolemaic dynasty, invested massively in the gold mine at Samut North at the very beginning of his reign, presumably in a quest for gold to bolster his authority.

The site of Samut North was dedicated entirely to gold exploitation, perhaps on a seasonal basis, and appears to have been abandoned within less than ten years for unknown reasons.

MEDIEVAL GOLD PROCESSING

No Roman occupation is attested in the Samut area which is in accordance with what is known: the Roman emperors had authority over other gold mines and did not need to reactivate the Ptolemaic mines. Demand for Egyptian gold revived in 559 CE, when the edict of Justinian mentioned the "light weight" of *solidi* (as explained in Meyer et al. 2000: 4). However, gold started to be exploited again in Samut in the medieval period, although in a different manner and with different equipment than before. It corresponds to the period of the medieval "gold rush" in the Eastern Desert during the 9th–10th centuries CE attested by geographers and chroniclers (Hasan 1967: 50), aiming to meet to the need of the new Abbasid economy in Egypt.

SPATIAL ANALYSIS

Two medieval sites, Samut North and Kabb Abu Shigil, were excavated by Marchand and Rabot in 2016. They are located, respectively, less than 600 m south of the Ptolemaic site of Samut North and between Bi'r Samut and Abu Garaish, 5 km from Samut North. Their layout and structures are alike: huts, hillside terraces, working places and washing areas. The 29 huts of the Samut North camp, as well as the 32 that composed the settlement of Kabb Abu Shigil, are located mainly in the lowest part of the wadi. Taking Samut North as an example [*Fig. 9*], hillside terraces in the mountains were prepared to optimize the location of huts. These one-roomed structures on an oblong plan

have walls about 0.60 m high. The walls are built rather roughly of drystone. The doors all face the wadi, often located in the corners, and the thresholds are about 0.40 m to 0.60 m wide. There was no evidence of the roofing in the archaeological record but one can assume light roofs that protected at least the workers from the sun.

STRUCTURES LINKED TO MINERAL PROCESSING

Medieval Egyptian authors do not mention in their texts how gold was exploited in the Eastern Desert, but they describe the galleries where gold was found and water used to wash it (see, for example, al-Hamdani, quoted in Dunlop 1957: 44, folio 26b). In early medieval times, gold was exploited either by mining from veins, as explained by the South Arabian geographer el-Hamdani (Dunlop 1957), or extracting it from alluvial sands. In ther Samut camp, the second variant must have predominated.

Stone tools were also found here in number, scattered on the surface. On the terraces, crushing work places are of three types: for preparing big, medium and small fragments of quartz. Next to the huts, or just inside their entrances, grinding tables and rotary mills were used to reduce the quartz fragments into flour. This probably took place on a tanned hide or a textile so as not to lose any quartz powder. Six rotary

Fig. 9. Medieval village of Samut North: general plan (©MADFO, M.Vanpeene, 2018)

mills [*Fig. 10*] were found in the village. Their lower parts are about 0.40 m in diameter, their upper halves being a bit smaller to allow the movement of the now missing wooden handle.

A particularly vast hut is located at the end of the wadi. It measures 4 m by 7 m and is better built than the other huts in the village. Its door opens directly onto the washing area. The lower parts of some rotary mills are located inside and outside this building, indicating most probably intense crushing activities taking place in the middle of the camp. The quartz flour was then transported 10 m to the washing area [*Fig. 11*] composed of three masonry basins, built of four slabs set on edge. Two basins were connected by a small channel made also of slabs stood on edge. The structure should be completed with a wooden washing table, also called a sluice, on which the gold would be washed out of the quartz powder. The powder was probably placed in one pit, and then flushed several times on the surface of the sluice: the heaviest particles would run down with the water while the gold particles were stopped in the wood fibers as described by Agatharchides (Diod. Sic. III, 14) and el-Hamdani (Dunlop 1957: 44, folio 26b). The second basin served to collect the residues and the quartz powder. Equipment like this, along with similarly linked structures, is attested at other sites in the Eastern Desert, dated to the end of the Byzantine and the early Islamic periods (for example Klemm and Klemm 2013: 456 and 513; Meyer et al. 2011: 170). No sign of the final operation of the gold process, that is, purification of the metal by melting, was observed during a survey of the area. It might have taken place in the Nile Valley just as in the Pharaonic and Ptolemaic periods.

POTTERY AND CHRONOLOGY OF OCCUPATION

Pottery was the only other category of finds from the two villages.At Samut North potsherds were concentrated near the main house and the washing area. Few shapes were recognized, mostly wine amphorae originating from Middle Egypt and the Aswan region, cooking pots imitating stone ware, but also a kettle and some fine wares. The assemblage is generally to be dated from the end of the 8th through the 10th centuries (Marchand et al. 2019). Both villages were occupied for a very short time, perhaps only one season, probably because the yield was already quite poor when the Greeks left the area.

CONCLUSION

The results of the 2014–2016 campaigns of the French expedition at Samut illustrate gold exploitation in the district from the 2nd millennium BCE to the late 1st millennium CE. It was possible to compare textual and archaeological data, especially for the Ptolemaic period, with description in the written sources and to enhance knowledge of gold exploitation techniques and operations. Many tools and remains corresponding to various stages of the mining process were found at all the sites and almost the

Fig. 10. Rotary mills from the medieval village of Kabb Abu Shigil (©MAFDO, A. Arles, Arkemine)

Fig. 11. Washing area in the medieval village of Samut North (© MAFDO, J. Marchand)

entire process of ancient gold production is now understood. The only two steps of the process which remain unclear are the washing and transport—at least for the New Kingdom and Ptolemaic periods.

Nevertheless, these first results are isolated and it is now necessary to conduct a series of in-depth studies of sites comparable to those of Samut North, Samut el-Beda and the two medieval villages in order to reconstruct a more detailed history of gold exploitation in the Eastern Desert. These comparisons will help to verify the first hypotheses made in this study. First, how Ptolemy I's significant role in the exploitation of gold in the region may have encouraged his son's regional policy. Second, that only a part of the operational sequence of gold processing took place in the desert during the Ptolemaic and maybe the Pharaonic periods. It also needs to be explained why gold was washed in the desert during early medieval times, while it had to be transported to the Nile Valley for this stage of the process in earlier periods. Furthermore, the seasonality of gold exploitation in Pharaonic, medieval and perhaps also Ptolemaic times is still to be proven.

Finally, it remains to be understood why the Samut el-Beda settlement is so huge compared with other Pharaonic settlements, and why the medieval villages are, by contrast, very small in opposition to other contemporaneous mining villages in the area (such as Bir Umm Fawakhir and Wadi Allaqi during, respectively, the Byzantine and early medieval periods). Many other issues, so far not fully studied, have to be dealt with, in particular the mining tools and their evolution, as well as the productivity of the ancient mines.

To do so, the French expedition will continue to explore the mining sites of the region, all the more that they are in great danger of disappearance. A recent example of the damage caused by the current appalling gold rush comes from the Ptolemaic mine of Samut North. The site was massively destroyed by looters and gold diggers after the last season in January 2016 and is about to disappear completely. The scientific loss for the French expedition is significant, but it is also a symbolic loss for Egyptian heritage as a whole.

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