PRELIMINARY REPORT

AKORIS

2013

CORONA satellite image (1968)

HISTORY AND ANTHROPOLOGY
UNIVERSITY OF TSUKUBA

2014

Published for

PRELIMINARY REPORT
AKORIS
2013

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Printed by NAKANISHI PRINTING CO., LTD. Japan

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1 PREFACE

KAWANISHI, Hiroyuki

Epigraphic vestiges concerning Akoris, the Greek name for T3-dhnt in the New Kingdom and around the Third Intermediate Period, are mentioned below:

(1) According to the MM. G. Lefebvre and L. Barry report[1], at the time of 1903 and 1904 some stone blocks with the cartouche of Ramesses II were scattered in the Hypostyle Hall of the Western Temple constructed by the Roman Emperor Nero. This was the first scientific dig in the main area of the Akoris ruins.

(2) A large rock cartouche of Ramesses III, together with a relief depicting Ramesses III following Amen-Re before Sobek-Re, is extant on the western precipice 100m south of the city area[2].

(3) The Wilbour Papyrus, dated from the 4th year of the reign of Ramesses V, mentions the Amen Temple under the authority of the prophet Hōri in Akoris together with the domain under his authority[3].

(4) Two stelae donated by Pinudjem I and Osorkon III respectively were unearthed in the Western Temple Area by our mission[4].

(5) In one of two shafts in a funerary chapel (Tomb no. 3 in the report) adjacent to the Western Temple Area, a quadrupled wooden anthropomorphic coffin was found by H. E. Abou Seif in 1926[5]. P. Lacau's decipherment of the coffin text indicated that it was for the prophet of

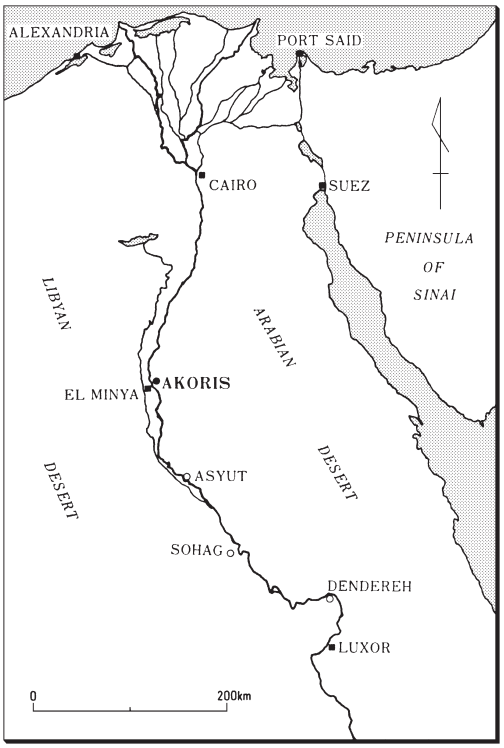


Fig. 1 Map of Egypt.

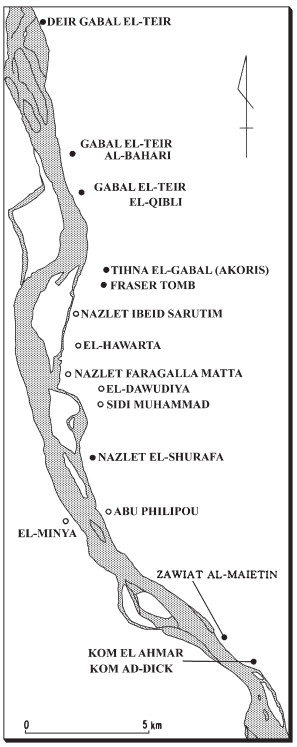


Fig. 2 Sites and villages near Akoris.

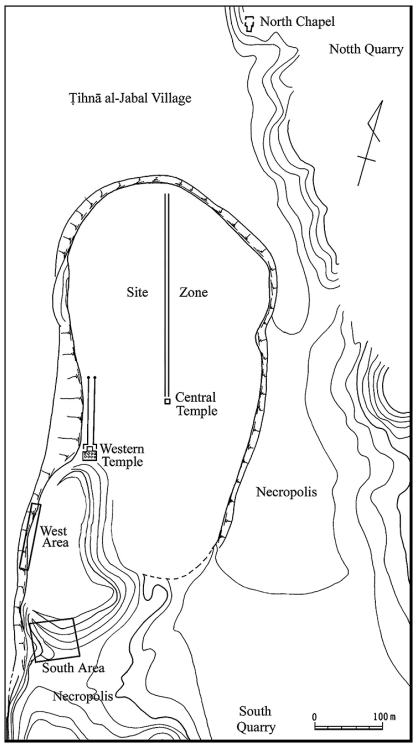


Fig. 3 Map of Akoris.

Amen, the governor of the town/city and the vizier, and his name was Ankh-Ounnofir[6]. Additionally based on the style of the coffin and funerary statuettes, he surmised that it was from the 20th–23rd Dynasties.

(6) The Pi(Ankh)y's triumphant stela says that his army attacked Akoris to destroy its ramparts and massacre the northern allied troops commanded by Tefnakt[7].

Thus, considering these epigraphic vestiges, Akoris seems to have been under the rigid control of the 19th and 20th Dynasties through the temple, and to have been a military and religious center in the antagonism between the north and the south districts when the Third Intermediate Period came. On the other hand, as shown in our previous reports, the southwest area, which occupied the opposite side of the Western Temple Area constructed on the north side of the crag, has been under excavation since 2002, and various kinds of archaeological relics dated from the end of the New Kingdom to the beginning of the Late Period have been revealed. These relics from this secular area suggest the social rise of the middle class in subsistence such as in trade and manufacturing, and burial customs.

The political appearance delivered by those epigraphic vestiges and the social, secular appearance shown by the archaeological evidence may be understood to be contradictory with each other. However, given that social mobility was increasing from the end of the New Kingdom with the weakening of dynastic supreme power, these two trends seem to be attributed to the urban conditions whereby the city was not confined to the political, religious center under the dynastic in those days.

Notes

1) Lefebvre, MM. G. et L. Barry, 1905 'Rapport sur les fouilles exécutées à Tehnéh 1903–1904', *ASAE* vol. 6, pp. 141–158.
2) Habachi, L., 1974 'Three Large Lock-Stelae Carved by Ramesses III near Quarries', *JARCE* vol. 11, pp. 69–75.
3) Gardiner, A. H. (ed.), 1948 & 1952 *The Wilbour Papyrus*, Oxford University Press.
4) Kawanishi, H. and S. Tsujimura (eds.), 1995 *Akoris: Report of the Excavations at Akoris in Middle Egypt 1981–1992*, Kyoto Shobo.
5) Abou Seif, H. E., 1926 'Rapport sur les fouilles faites à Tehneh en Janvier et Février 1926', *ASAE* vol. 26, pp. 32–38.
6) Lacau, P., 'Note sur la Tombe No. 3 de Tehneh', *Ibid*. pp. 38–41.
7) Grimal, N.-C., 1981 *La Stéle triomphale de Pi(ᶜAnkh)y au Musée de Caire (JE48862 et 47086–47089)*, *Études sur la Propagande Royale Égyptienne* I, pp. 46–49, IFAO.

2 PRELIMINARY REMARKS ON THE LABOR AND ORGANIZATION IN THE PTOLEMAIC QUARRIES NEAR AKORIS

SUTO, Yoshiyuki

Our investigations at ancient limestone quarries located in the vicinity of Akoris have been offering valuable insights into the organization of the labor force in one of the most important industries in Hellenistic Egypt[1]. The key evidence is the graffiti left on the vertical walls and horizontal ceilings of galleries often written in Greek and demotic side by side. Even today the most substantial contribution to the economic history of the activities at quarries in the Greco-Roman

Egypt is the monograph by K. Fitzler published more than a century ago[2]. While the papyrological evidences used by Fitzler and other scholars tended to be concerned with the administrative aspects of the quarries, such as the provision of foodstuff for the miners (e.g. P. Petrie II, 4 (8)), the graffiti left on the walls and ceilings provide vivid snapshots of the ongoing operations at these quarries under the Ptolemaic rule. Although there are still many uncertainties about the nature and function of these graffiti, it now seems worth while to summarize the basic feature of them in order to contribute to the better understanding of the workings of labor and organization in the quarries.

A standard graffito, either in Greek or demotic, is composed of three basic elements, date, personal name, and tripartite numeral. The date in a typical Greek graffito is almost invariably represented by the regnal year, the name of Egyptian month in the Greek financial calendar, and the single day. The way of presenting date in demotic graffiti seems to have been more varied. In sections J and L, where the extracting work was in progress around 35th year of Ptolemy II (251/0 BC), the demotic graffiti never mention the regnal year. Furthermore, the dates in these demotic texts of Sections J and L are presented with two or three consecutive months, apparently denoting a prolonged period, rather than a single day stipulated in their Greek counterparts. R. Takahashi once noted that the Greek writers/readers seem to have been interested in the precise day of completion of quarrying, the date of examination of the stone, or that of delivery, while demotic users were concerned with how many months the quarrying procedure took[3]. The result of the analysis of the tripartite numerals presented below, however, suggests that the "period" denoted in the demotic texts seems to have been related to a sort of administrative term rather than the duration actually needed in the quarrying itself. In other sections, demotic texts also stipulate a single date as their Greek counterparts do. Curiously enough, some Greek graffiti in Sections R and T seem to denote a certain period rather than a single day.

As for the month names, all of them are referred to in the Greek graffiti (Fig. 1), which strongly indicates that the quarrying was a perennial work, though a conspicuous seasonal fluctuation, the alternation of the first six busy months and the next six slack months on the financial calendar[4], suggests that not all the workers in the quarry were forced to work throughout the year. This observation corroborates the recent view that not only corvée labor but also paid labor was practiced in the quarries. It should also be noted that these graffiti were not the simple records of the daily progress of work, something like that we encounter in the quarries of Pharaonic times.

Personal names on the graffiti include that of the Greeks and of the Egyptians, even of the Jews in the case of the graffiti found beneath the unfinished colossus. Their distribution suggests that laborers were sometimes organized according to their ethnic groupings. For example, most of the personal names in Section F are that of the native Egyptians, while there are only Greek, or rather Macedonian, names observable in the graffiti of Section U. The fact that almost all of the Egyptian workers in Section F had a specific title designated with two letters E + L, certainly the *eleutherolatomos* (free-mason), suggests that they were not prisoners nor dependent laborers but free independent experts of mining. Hence the Greeks, who are usually presented without any specific titles, must have been also free laborers.

T. Endo has already elucidated the general principle of the tripartite numerals at the end of the

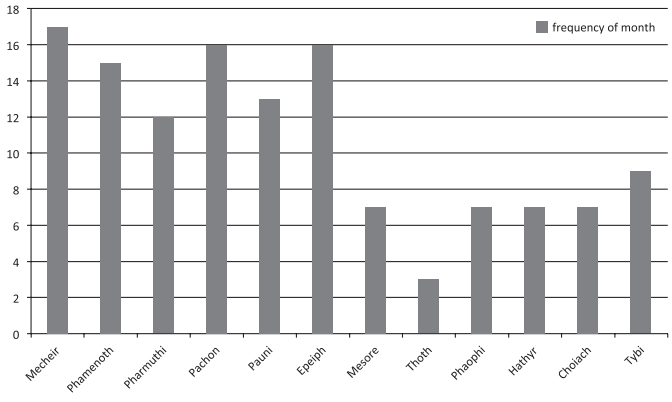


Fig. 1 Frequency of the month in the Greek graffiti.

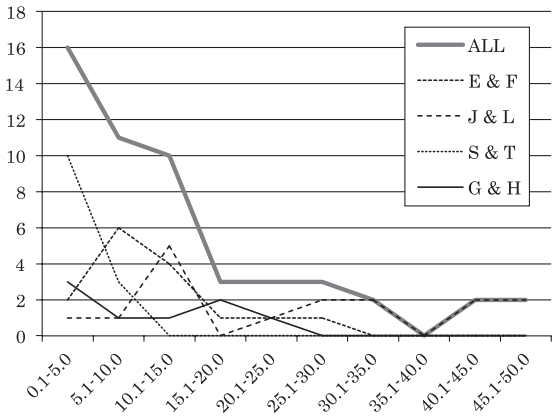


Fig. 2 Frequency of the volume (cubic cubit) in the Greek graffiti.

Fig. 3 Innermost wall of a small horizontal gallery below Section F.

graffiti. They represent width, depth, and height in horizontal galleries, and length (lateral width), height, and width in vertical trenches, precisely in this order. The basic unit seems to have been ca. 0.54m, which is fairly close to the royal cubit (0.525m) used in the Pharaonic times. It is now certain that most of the tripartite numerals in the graffiti refer to the volume of rocks removed during the course of cutting narrow trenches for the purpose of extracting large limestone blocks. In other words, the tripartite numerals are not related to the actual size of the blocks to be extracted. This observation strongly indicates that labor in the quarries was assessed in terms of the cubic capacity of the rock to be shifted, as was exactly the case with the contemporary enterprises on dykes and canals.

The frequencies of the cubic capacity are varied (Fig. 2). The shifted amount of rocks tends to be larger in vertical trenches (E & F, G & H, J & L) and smaller in horizontal galleries (S & T). Except for some extremely large amounts denoted in Sections L, the mean of the amount falls between 10–15 cubic cubits in vertical trenches, while that of horizontal galleries falls between 5–10 cubic cubits, respectively. Since the cutting of the galleries and vertical trenches seem to have been carried out by extracting smaller standardized blocks in a systematic way (Fig. 3), it is difficult to suppose that such works needed several months to complete.

It is thus very tempting to propose, though provisionally, that these graffiti were the end result of the assessments of the amount of labor in each mining unit of *latomoi* during specific period, the purpose of which must have been to calculate the appropriate wage or foodstuff for them.

Notes

1) Suto, Y. and R. Takahashi, 2012 'Bilingual Graffiti from the Ptolemaic Quarries at Akoris and Zawiyat al-Sultan', *Actes du 26^{e} Congrès international de papyrologie, Genève 16-21 août 2010*, pp. 729–738, Droz.

2) Fitzler K., 1910 *Steinbrüche und Bergwerke im ptolemäischen und römischen Ägypten: Ein Beitrag zur antiken*

Wirtschaftsgeschichte, Quelle & Meyer.

3) *Preliminary Report Akoris 2005*, pp. 21–23.

4) *Preliminary Report Akoris 2011*, pp. 18–23.

3 CLAY MAGICAL HUMAN FIGURINES UNEARTHED FROM TIHNA EL-GABAL (AKORIS)

HANASAKA, Tetsu

Introduction The purpose of this paper is to introduce the clay human figurines unearthed from Tihna el-Gabal (Akoris) during a decade of excavation seasons spanning 2002 to 2012. We discovered 69 figurines in total; 59 fragments from the South Area and 10 fragments from the West Area in Akoris [1)].

Generally speaking, clay figurines are crude and negligible products usually made and used by common people. They are different artifacts if compared with the valuable masterpieces produced for the elite. It is hard to generalize the ordinary forms and functions of clay figurines since they are not formalized in Egyptian art but come in various types manufactured and used in daily life in different communities. E. Teeter pointed out that clay figurines have been evaluated as artifacts used and produced by non-elites rather than art objects used and produced for elite and he categorized clay figurines as 'fork art'[2)].

There have been few similar examples found in other sites in Egypt or in neighboring areas that correspond to the figurines from Akoris. As the first step for further studies, this paper will begin by focusing on the basic features of these clay human figurines from Akoris, especially the manufacturing methods and their functions or use in daily life.

Location of our finds (Ch. 1 Fig. 3) The South Area of Akoris is the valley floor at the southwest end of the city zone and it extends down the south slope of the crag and stretches across the southern lowland to the next crag. We found many mud brick constructions and artifacts in the South Area, which have been dated from the end of New Kingdom to the Late Period (LP), mainly in the Third Intermediate Period (TIP), judging from our chronological studies of potteries and other archaeological remains. Unfortunately there were no fragments found *in situ*, but there are 59 fragments unearthed from the thick earthen fill of the South Area without a concentration of find spots and layers.

On the other hand, there are more than 60 rock-cut shaft tombs and tomb chapels built in or after the Old Kingdom in the West Area. There were 10 fragments unearthed from earthen fill that plugged up several tomb shafts. We found 4 fragments around the rock-cut *mastaba* which is the oldest archaeological construction in Akoris dating back to the 5th Dynasty of the Old Kingdom; one was unearthed from the entrance passage to the chapel, one from the small shaft tomb built in front of the façade and two from the northern shaft tomb built at the top on the rock-cut *mastaba*. There were many other finds which were unconnected to the grave goods that came from the upper layer. In our past studies we interpreted that these tombs and the whole region of the West Area

Fig. 1 Cobra figurine.

were reused during the TIP to the LP as a religious/ritual zone.

In addition we excavated various types of hand modeled clay figurine from the South and West areas; for example the clay cobra figurines counting almost 300 in total mentioned in our last report (Fig. 1)[3]. In that report, I pointed out that the clay cobra figurines belong to the first half of the TIP. Moreover, we can safely say that the excavation conditions and layers of the clay human figurines are identical to that of the clay cobra figurines. For this reason, it seems reasonable to infer that the clay human figurines belong to the almost same period as the clay cobra figurines. If we take an earlier belonging period regarding the clay human figurines, it could be dated between the ends of the New Kingdom to the beginning of the LP. Below we discuss the making methods and the functions of the clay human figurines.

General information regarding the clay human figurines The clay human figurines from Akoris were roughly hand modeled using Nile silt and fine fired to a reddish-brown color. We have not found workshop or unfired clay examples, however it seems quite probable that these clay human figurines were manufactured somewhere around the South Area.

The figurines were clearly made to represent the human/anthropoid form. The artifacts have a large spherical head, a flat body pinched in what looks to be the abdomen/waist section, and arms and legs which project shortly outward at the four corners of the main body. However, these coarse figurines indicate no particular sexualized physical features such as breasts and genitals even though they are, so to speak, naked. Nor do they have facial expressions or depictions of hair. Thus we cannot distinguish their sex differences nor distinguish a representation of age from their appearance. Moreover, there are some fragments that do not look like human forms at first glance. These artifacts have irregular shaped and abbreviated bodies; that is to say they are rounded-triangle (ex. Fig. 2 nos. 11–13 and 26) or rectangular shapes without arms and legs (ex. Fig. 2 nos. 19–20 and 27). Even though there are many types of the body shape, we termed all of the fragments from Akoris 'human' figurines in this paper. This is because there are common external features on the figurines as described below, and so, we suggest, it is reasonable to suppose that they are the same figurines in kind with same functions.

Unfortunately, almost all the figurines unearthed from Akoris are in a fragmentary state. In many cases, the head part of the figurines is broken off entirely or badly chipped away. Among the 69 figurines there are 27 examples which have been retained almost whole from head to legs. The largest fragment within this collection of almost complete examples measures h. 9.10 × w. 5.50cm (Fig. 2 no. 1), the smallest one measures h. 5.71 × w. 3.12cm (Fig. 2 no. 20). It is likely that the average size of the figurines from Akoris would be about 7.5cm in height accounting the head part for one third in the total height, and the body would be approximately 4.5cm in width and 1.5cm in thickness.

Decorations The most characteristic feature of the figurines from Akoris is the small circular clay lump attached on the central line on the front of the body section. We have 54 figurines in total with these clay lumps, 47 of them have one lump. The lump was attached in the vicinity of the

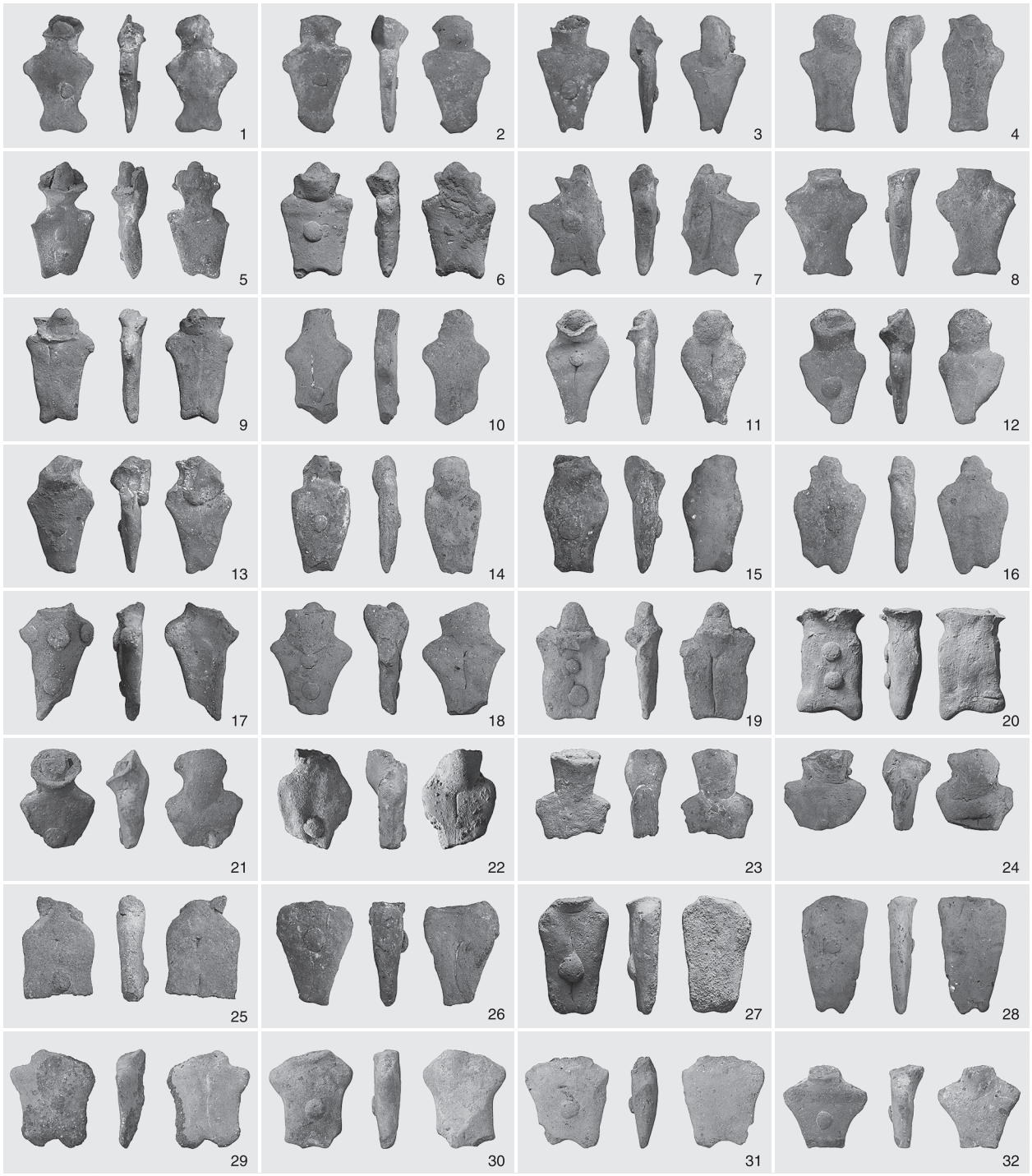


Fig. 2 Clay Human Figurines.

1: h. 9.10 × w. 5.50 cm (03-SA133); 2: h. 8.71 × w. 4.92 cm (02-SA087); 3: h. 8.70 × w. 4.98 cm (04-SA160);
4: h. 7.93 × w. 4.35 cm (02-SA247); 5: h. 8.20 × w. 4.36 cm (07-SA118); 6: h. 6.16 × w. 3.86 cm (08-SA159);
7: h. 7.35 × w. 5.10 cm (02-WA156); 8: h. 5.78 × w. 4.44 cm (07-SA253); 9: h.8. 35 × w. 4.89 cm (08-SA184);
10: h. 7.72 × w. 4.55 cm (02-SA008); 11: h. 8.68 × w.4.87 cm (07-SA336); 12: h. 7.58 × w. 4.32 cm (07-SA337);
13: h. 6.88 × w. 3.93 cm (07-WA067); 14: h. 8.79 × w. 4.28 cm (02-WA106); 15: h. 6.23 × w. 3.34 cm (04-SA214);
16: h. 7.45 × w. 4.58 cm (02-WA112); 17: h. 6.22 × w. 4.01 cm (07-SA289); 18: h. 8.35 × w. 6.35 cm (04-SA179);
19: h. 6.77 × w. 4.27 cm (07-SA072); 20: h. 5.71 × w. 3.12 cm (05-WA006); 21: h. 6.00 × w. 4.49 cm (07-SA148);
22: h. 5.58 × w. 4.02 cm (03-SA219); 23: h. 4.26 × w. 3.51 cm (06-SA045); 24: h. 5.80 × w. 5.14 cm (06-SA062);
25: h. 6.02 × w. 4.29 cm (03-SA168); 26: h. 5.50 × w. 4.30 cm (04-SA176); 27: h. 7.25 × w. 4.33 cm (06-SA344);
28: h. 7.91 × w. 4.69 cm (06-WA025); 29: h. 5.81 × w. 5.00 cm (07-SA248); 30: h. 5.74 × w. 4.76 cm (07-SA156);
31: h. 4.95 × w. 4.53 cm (07-SA167); 32: h. 5.03 × w. 5.05 cm (07-SA195).

abdomen or chest of the body section. It seems likely that this represents a protruding navel. Another 6 fragments have two lumps which are aligned vertically at the chest and the abdomen (Fig. 2 nos. 18–20), and one other fragment has four lumps at the chest (Fig. 2 no. 17), the abdomen and the shoulders at the front of the body section.

The other decoration seen on the figurines are red lines. We have 8 figurines with one to three red horizontal lines painted on the front of the body part, 5 of these examples have one red line (Fig. 2 nos. 6, 18 and 30), 2 examples have two lines and 1 example has three lines (Fig. 2 no. 11). We also note that a similar sort of decoration technique was confirmed on the clay cobra figurines unearthed from Akoris, counting 19 examples among 292 figurines in total.

Methods Used in Making the Figurines In turn, we propose a general way of making the clay human figurines from Akoris may have been manufactured. The figurines were roughly hand modeled and we couldn't confirm traces of tool uses such as a spatula.

An important point to emphasize about the method used in making these figurines is the way of forming the head. There is a clay projection about 1-2cm long projecting from the body section (ex. Fig. 2 no.5). In other words we suggest that this projection is the 'neck' part of the figurines. The spherical head sections were formed by taking a lump of clay and wrapping it around the neck part.

Among the 69 figurines in total, there are 45 fragments which have retained the neck part. The neck parts could be recognized visibly as a result of breaking off in the middle in 5 fragments (Fig. 2 nos. 8 and 32) and completely peeling off the wrapping clay around the neck in 4 fragments (Fig. 2 nos. 10 and 19). In another 36 fragments, the wrapping clay that forms the head had been chipped off and the neck was exposed from this crack. If this breakage occurred by accident and not intention then, their broken points might be seen as indications of intensively at fragile points, for example the base of the neck part[4)]. However, it was observed that most of the examples were damaged in the middle front of the head part. That is to say it would seem as if they had been struck in the face. It is reasonable to assume that such damage could have occurred by adding pressure to the front of the head parts. This suggests that the figurines were broken intentionally. Given this theory as possibility, the function of such figurines is discussed below.

However, before focusing on the functions of the figurines, another point about the method of their manufacture should be highlighted. There are 26 examples which have a vertical fissure from their chest/abdomen parts to the end of their leg parts (ex. Fig. 2 nos. 7, 10, 19 and 22). It was clear that the fissures on both sides among 21 examples, alongside the position of the fissures, were coincident with each other (ex. Fig. 2 nos. 11 and 26). The small circular clay lump mentioned above had been attached on the vertical fissure of the front.

It seems likely that those fissures would be a jointed section. This could be accomplished by putting two clay lumps together or folding cylindrical piece clay in half in order to form the body part. A few examples have revealed a smooth inner cross section as a result of splitting at the jointed section (Fig. 3). We know that there were various ways to make figurines in ancient Egypt. One popular way to make figurines was molding and hand modeling with one clay lump. It could be said that the method of making these figurines from Akoris, that is to say joining two divided

small clay lumps together, was unusual.

On the other hand, there are some fissures which seem like they could be the traces of adhering bits together after cutting and dividing the body part. It is hard to make a judgment whether those fissures have occurred as a result of joining two separate clay lumps together or halving a single lump, inserting a cross section, and sealing the one fissure. If we regarded such fissures as an intentional incision after forming the body part, and not as a jointed section created through pressing two clay lumps together then this potentially has a connection with the function of these figurines. We should pay careful attention to the fact that the fissures have been clearly retained not erased by finishing the surface.

Fig. 3 Section view.

What did the figurines symbolize? Before we discuss the functions of the human clay figurines unearthed from Akoris, we ought to consider what human figurines symbolized or depicted.

Throughout all ages and in many places, people made various kinds of clay human figurines. There are many studies dealing with the female human figurines of the Neolithic Period in the Near East[5]. My goal is not to discuss those researches in detail but merely to point out that the gendered attributes of female figurines from those regions were emphasized via their physical features such as plump breasts, waist and hips, and such specimens are regarded as fertility cult figurines connected with the mother goddess cult. Several functions dealing with the figurines of the Neolithic Period in northwestern Iran have been pointed out by M. Voigt. She has classified five in particular; cult figurines, vehicles of magic, didactic or teaching figures, toys and representations of deceased persons[6].

Various kinds of female figurines were also manufactured throughout the time periods in ancient Egypt[7]. Many incentive studies were conducted on the female figurines, for example by P. J. Ucko, G. Pinch, A. Stevens, E. Teeter and still other scholars[8]. It was established that the aforementioned female figurines were regarded as a votive 'fertility figurine' which presided over not only the human fertility and the childbirth, but also wide functions such as the harvest of crops and the protector of the household[9]. It is clear that most of the figurines in ancient Egypt and the Near East were formed into female figurines owing to their physical features such as breasts, depiction of the genital area and long hair. In short, the figurines are considered to be made in the image of a woman or mother in the hope of human fertility, harvest of crops, protectors of household and so on.

On the other hand, the figurines unearthed from Akoris don't have any physical features showing sex differences. The only, and the most striking decoration of the figurines is a clay lump attached to the body part that seems to be a representation of a protruding navel. Similar representations were manufactured one many of the human figurines in Pharaonic Egypt; in this case the indication of a navel depicted by piercing dots and not by attaching a clay lump. Indeed piercing dots may be a usual way to depict a navel, but that way of depicting is not consistent in every example. If we think of the clay lump attached on the figurines as a navel, then it is possible that the figurines symbolize children, especially infants, who have protruding navels in many cases

and normally are not depicted expressing any gendered differences[10].

Nevertheless, there is an objection that can be raised against assuming theses navel-like aspects of the figurines are made in the image of children. In Egyptian arts, there were standard ways of depicting a child image. Images of S/he had a unique hair style called 'side lock of youth' and they are usually seen holding a finger to their lips. However, there were no typical features showing differences of sex or age on the figurines from Akoris, as I have repeatedly pointed out above. Even if it does not match the traditional/standard forms of child figurines in ancient Egyptian art, I suppose that the human figurines unearthed from Akoris symbolized the image of children.

Discussion The most important point in considering the functions of the figurines from Akoris is that the head part is broken off entirely, and seemingly, deliberately. The behavior of breaking something with wishes for goodness or illness could be categorized as 'magic' which tends to leave us in the modern world with the impression of unscientific and incomprehensible logic. However, the fact is many forms of magic exist regardless of location and era, and some such comparative forms of magic were introduced in *The Golden Bough* by J. G. Frazer. In this paper, I use a word 'magic' comprehensively to depict some behaviors whereby wishes good or ill, are desired. It is worth mentioning that magic can have a range of meanings used in ethnology and cultural/social anthropology[11].

In ancient Egypt, it is considered that magic lay at the very heart of religious ritual and liturgy and that this has an overlap with religion and medicine[12]. There were many kinds of magical behaviors related to the breaking of imitations; for example practices referred to as 'execration texts' and 'breaking red jars'. Those forms of magic considered the replication of a name and image could produce an effect in the real world. Such practices were categorized as 'sympathetic magic' or 'imitative magic' by J.G. Frazer.

It is easy to imagine that people desired good health and longevity for their children since there was a high rate of infant mortality in this ancient society. Making figurines of gods or enemies was regarded as an effective way of gaining control over evil forces in the real world[13]. It is quite likely that the people who lived in Akoris modeled the human figurines as the imitations of their children. They inflicted a symbolical and conceptual death to the figurines by breaking the head part as a substitute for children, thereby wishing for the vigorous growth of their children[14]. If we regard the fissures retained on the body part of the figurines as an intentional incision, as described above, then this could also be interpreted as a behavior designed to give symbolical harm to the figurines. Moreover, it is possible that people also hoped for the healthy life of their family, especially mothers who were in danger at the time of pregnancy and delivery.

We don't have much information about magical practices or in regard to religious beliefs and rituals among members of local villages and communities in ancient Egypt. Nevertheless, in such circumstances, we know that the minor gods *Bes* and *Pataikos* had a role as the protectors of family and childbirth and were popular and worshiped among the common people. We have found many small faience amulets formed depicting *Bes* and *Pataikos* from the South Area of Akoris. It could be safely said that the common people who lived in this area had hoped their pragmatic and everyday wishes would be granted; for example hoping to raise children in good health, wishing for an easy

delivery during childbirth and the welfare of the household.

In conclusion it seems reasonable that the clay human figurines from Akoris were manufactured and used as ritual items or charms in cult-magical/apotropaic conduct that was practiced only at Akoris. Furthermore, we have excavated other magical figurines, the aforementioned clay cobra figurines from the South and West Areas. Judging from the functions of the two kinds of the figurines, we may say that there were secular beliefs, or private/popular religious practices, associated with wishes in everyday life spread amongst the common people.

Notes

1) See, *e.g.*, *Preliminary Report Akoris 2002(–2012);* Hanasaka, T., 2009 'Fertility Magical Practice in Akoris', *Tsukuba Archaeological Studies*, vol. 20, pp. 51–74 (in Japanese).
2) Teeter, E., 2010 *Baked Clay Figurines and Votive Beds from Medinet Habu*, The Oriental Institute of the University of Chicago. He expressed that the material of the figurines -clay- may be classified as folk art, but 'the figurines have much to tell art historians'. Various kinds of figurines suggest 'considerable communication between the artisans of the elite and non-elite, and non-elite's exposure to formal art styles'.
3) Hanasaka, T., 2012 'Clay Cobra Figurines Unearthed from Akoris (Tihna el-Gabal)', *Preliminary Report Akoris 2011*, pp. 4–14.
4) There are many studies argued about the breakage of various kinds of clay figurines. See e.g., Kletter, R., 2001 'Between Archaeology and Theology: the Pillar Figurines from Judah and the Asherah', *Journal of the Study of the Old Testament Supplement Series*, vol. 331, pp. 179–216; Waraksa, E. A., 2009 *Female Figurines from the Mut Precinct: Context and Ritual Function*, Academic Press Fribourg; Wilson, P., 2011 *Sais I: The Ramesside-Third Intermediate Period at Kom Rebwa*, EES.
5) See, e.g., Mellaart, J., 1967 *Çatalhöyük: A Neolithic Town in Anatolia,* McGraw-Hill; Voigt, M., 1983 *Hajji Firus Tepe, Iran: The Neolithic Settlement*, University of Pennsylvania; Cauvin, J., 2000 *The Birth of the Gods and the Origins of Agriculture,* Cambridge University Press.
6) Voigt, M., 1983 *ibid*.
7) There is an interpretation that there was no mother goddess cult in ancient Egypt, as like that of in the Near East. e.g., Bergamini, G., 1988 'Religious and Funerary Practices in Egypt Prior to the Pharaohs', in Roveri, A. M. D. (ed.), *Egyptian Civilization: Religious Beliefs*, pp. 20–37, Instituto Bancario San Paolo di Torino.
8) See, *e.g.*, Ucko, P. J., 1968 *Anthropomorphic Figurines: Of Predynastic Egypt and Neolithic Crete with Comparative Material from the Prehistoric Near East and Mainland Greece,* A. Szmidla; Pinch, G., 1983 'Childbirth and Female Figurines at Deir el-Medina and el-'Amarna', *Orientalia* 52, pp. 405–414; Pinch, G., 1993 *Votive Offering to Hathor*, Griffith Institute; Stevens, A., 2006 *Private Religion at Amarna: The material evidence,* BAR1587; Teeter, E., 2010 *Baked Clay Figurines and Votive Beds from Medinet Habu,* The Oriental Institute of the University of Chicago.
9) E. Teeter (2010, *ibid*. p27) summarized that 'the female figurines are clearly related to fertility... However, it is a mistake to assume that the figurines were related strictly to childbirth. In ancient Egypt, images of fertility were often more general allusions to health and rejuvenation.'
10) There is an example with a clay lump on the abdomen of a figurine in the book by E. Teeter (2010); No. 106, p. 93. This is the only example resemble to the examples from Akoris as far as I am aware. However, E. Teeter interpreted a clay lump as a representation of a phallus and categorized this figurine as a male figurine.
11) Evans-Pritchard, E. E., 1976 (1937) *Witchcraft, Oracles and Magic Among the Azande*, Oxford University Press.
12) Shaw, I. and P. Nicholson (eds.), 2008 (1995) 'Magic', *The British Museum Dictionary of Ancient Egypt*, The British Museum Press.
13) Waraksa (2009, pp. 112–113) interpreted that the breakage of female figures was a symbolic, protective action to the object's initial function. And then, the breaking the figurine would protect both the sufferer and the priest/magician from a recurrence of the disease.
14) It can be objected that the figurines would not been fired if people modeled them with the intention of breaking. However, we haven't found the unfired examples from Akoris. It may be conjectured that people gave symbolical birth to the clay figurine as an imitated living child by firing.

4 THIRD INTERMEDIATE PERIOD BURIALS AT AKORIS

TSUJIMURA, Sumiyo

Two necropolises belonging to the Third Intermediate Period were found at Akoris. One that we call "the West Area" is located on a narrow shelf of the west side of the river terrace, facing the Nile Valley. Tombs around and toward the south of a rock-cut mastaba dated to the beginning of the 5th Dynasty are presumed to have been cut in the same period as the mastaba, however almost all of them were reused for burial in the TIP[1].

The other necropolis called "the South Area" is located on the south side of a crag rising on the river terrace. The necropolis is piled on the city formed in the beginning of the TIP, judging from unearthed pottery. The city spread from the slope under the crag to the foot of the opposite slope across a flatland. Though the excavated area is limited to the west end of the city, houses being close together, many silos and workshops were found there. In the 8–7century BC., tombs began to be built from shortly before the city was completely abandoned. A total of thirty-four tombs are distributed in the city area and on the lower part of the opposite slope[2] (Fig. 1, Table 1).

Tombs are classified into 6 anthropoid wooden coffins, 18 rectangular wooden coffins, 2 pits, 5 jar burials and a basket burial. The anthropoid wooden coffins were limited to use for adults, while rectangular wooden coffins were made to suit the body size of both adults and children. Children lying in rectangular wooden coffins are older than three years old except for the 1–2 years old child (No. 1 in 2008), and coffins for children were widely scattered in the city area in the same way as coffins for adults. Compared to these wooden coffins for children, jar and basket burials for

Fig. 1 The distribution of tombs in the South Area.

Table 1 Burials in the South Area.

Year	Tomb No.	Coffin Type	Size of Coffin (m)	Sex	Age	Direction of the head	Comments
2004	No. 1	Wooden coffin (Anthropoid)	1.90 × 0.46	Female	30–35 yars old	W	
	No. 2	Wooden coffin	1.33 × 0.33		8–9 years old	E	
2005	No. 1	Wooden coffin	1.5 × 0.7				empty
	No. 2	Wooden coffin	0.5(+) × 0.3				empty
	No. 3	Wooden coffin (Anthropoid)	2.05 × 0.5	?	35–40 years old		
	No. 4	Wooden coffin (Anthropoid)	1.91 × 0.51	Female	30–35 yars old	N	
	No. 5	Wooden coffin		Female	senior	SW	
2006	No. 1	Wooden coffin	0.9 × ?		Infant		
	No. 2	Wooden coffin	1.3(+) × 0.5	Female	adult	W	
	No. 3	Wooden coffin (Anthropoid)	2.0 × 0.5	Female	adult	W	Trepanned skull
	No. 4	Shaft surrounded by mud bricks	2.2 × 1.5				empty
2007	No. 1	Wooden coffin	0.7 × 0.35		3 years old	W	
	No. 2	Wooden coffin	1.4 × 0.29		8–10 years old	W	A pair of shoes
2008	No. 1	Wooden coffin	0.9 × 0.2		1–2 years old	E	
	No. 2	Wooden coffin (Anthropoid)	2.0 × 0.39	Male?	adult	NW	
	No. 3	Wooden coffin	0.53 × 0.35		5–6 years old	E	
	No. 4	Wooden coffin (Anthropoid)	1.8 × 0.49	Female	20 years old	W	
2010	No. 1	Wooden coffin		Female?	adult	W	Pit (2.32 × 0.58)
	No. 2	Wooden coffin	1.47 × 0.43		adult	W	
	No. 3	?		Male	30–40 years old	W	Pit (1.60 × 0.44)
	No. 4	Wooden coffin	1.00 × 0.30		infant	?	
	No. 5	Wooden coffin	1.88 × 0.50	Female	30–40 years old	W	A sandal
	No. 6	Jar			new born		Jar is wrapped with a mat
	No. 7	Wooden coffin (Anthropoid)	1.92 × 0.46	Female	20–30 years old	W	Pit with a clay roof Pit (2.00 × 0.74 × 0.90)
				Male	14–15 years old		scuttered
				Male	adult		scuttered
				Female	15–16 years old		scuttered
	No. 8	Wooden coffin	0.45(+) × 0.36	Female	16–20 years old	?	
	No. 9	Wooden coffin	0.78 × 0.24		infant	W	
	No. 10						may not be a tomb
	No. 11	Jar			new born		
	No. 12	Jar			new born		
	No. 13	Jar			new born		
	No. 14	Wooden coffin	0.95 × 0.28		3 years old	W	A bronze pin with beads, amulet
	No. 15	Wooden coffin	1.27 × 0.27		7 years old	W	
	No. 16	Basket	0.73 × 0.25		1 years old		
	No. 17	Jar			new born		
	No. 18				adult		scuttered

newborns and un-weaned babies under and around one year old are found at the south end of the city area and on the south slope going up from there (Fig. 2).

Babies bending their arms and legs were wrapped with cloth and were put into jars from their legs. Their posture and a direction of their head for the mouth of jar looks like a fetus in the uterus. A baby body lying in a basket is wrapped with cloth, too. The basket made of palm leaves with rope handles was cut at the mouth, whose piece covers on the body. Ropes at four tied the basket wrapping the body, but two ropes of them are missing.

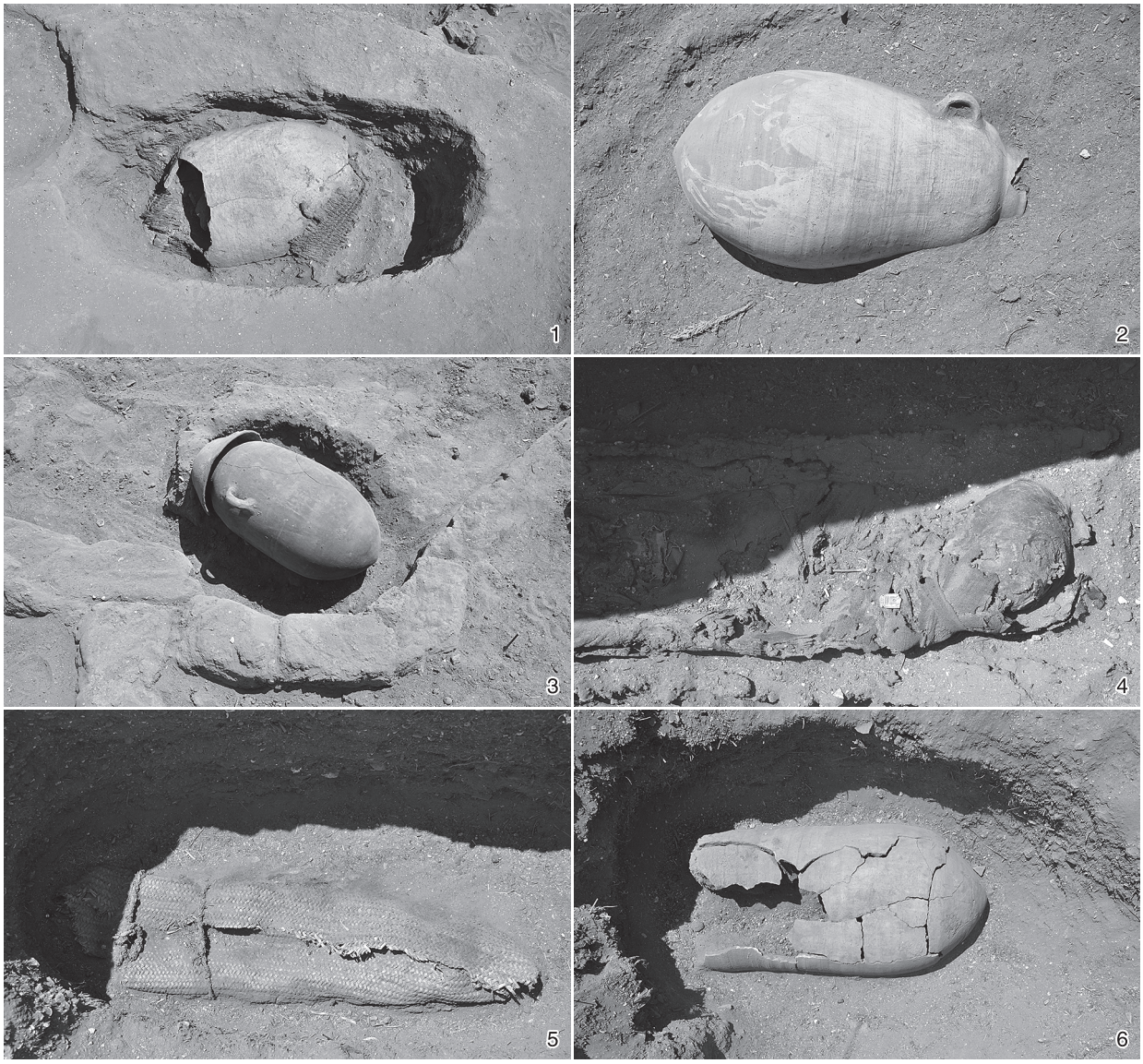


Fig. 2 Young children burials in 2012 at the South Area.
1: Tomb 6; 2: Tomb 11; 3: Tomb 13; 4: Tomb 14; 5: Tomb 16; 6: Tomb 17.

Loise Steel who studied burials in Cyprus at the beginning of the Iron Age described that newborn and pre-term infants deposited in jars were buried in domestic structures and along the city wall[3]. It has been generally assumed that they were not only buried by different way from older children and adults but also excluded from the formal cemetery like jar burials in Cyprus because they were not accepted as members of society. Though there is a little bit of latitude for age of babies contained in jar compared with babies of jar burials in Cyprus, jar burials in the South Area at Akoris are also concentrated at the end of necropolis and segregated from children more than two years of age and adults. However, they were given a formal burial wrapped with cloth in the same manner as adults, not treated slightingly. Baby burials are probably segregated from older children and adults burials by a special view of life and death like a rebirth of babies into this world rather than that a baby was not a member of the community.

The number of unearthed adult burials in the South Area is 15 in total less than child burials

18, and is classified into male 3, female 9 and unknown 3. Necropolis in which adult females children predominate are reported not only in Akoris but also in other sites. For example, adult male, adult female and children account for 10%, 43%, and 47% of total burials respectively in the TIP cemetery at Matmar[4]. Furthermore, necropolis in the same period where two adult females and seven children were found was reported in Site 8 at Abydos. In this site, child burials are divided into three types by the deceased's age, jar burials for fetus, oval pits for 1–2 years and rectangular wooden coffins for 5–6 years. Concerning the adult females, Diana Craig Patch shows a view that females are mothers who have died in childbirth or from miscarriages, or women having to do with maternity as midwives or wet nurses[5]. Although there is no scientific evidence to reveal a blood relation among the dead, an adult female and child buried in close vicinity at Akoris are probably to have been a mother and a child (No. 1 and No. 2 in 2004, No. 3 and No. 4 in 2008). Though three adult males should have been fathers if other females away from a child were also mothers of the child buried in the area, a number of both sexes are obviously unbalanced.

An adult male was unearthed with an adult female and two juveniles from a deep pit with a clay roof (No. 7 in 2010). In No. 7, the male and two juveniles were buried one after another above an adult female lying in an anthropoid wooden coffin on the bottom of the pit. Judging from its depth and a clay roof, it is probable that the tomb was dug with an intention of plural burials from the beginning. They are supposed to have been a family and died for a short term by food poisoning or infectious diseases.

Funeral goods are poor without distinction of age or sex, nevertheless many amulets like Pataikos and Bes were found in the city area. Funeral goods found in tombs are as follows: a bronze pin with beads and an Udjat-eye putting on the breast of a three years old infant (No. 14 in 2010), a pair of leather shoes placed under the head of 8–10 years old child (No. 2 in 2006) and a leather sandal placed under the right knee of 30–40 years old female (No. 5 in 2010). It is notable that footwear as funeral goods were found from the tombs for a child and for a female. If the shoes and the sandal were prepared for a journey to the next world, children older than 5–6 years are supposed to have shared a view of life and death with adults, different from newborns and un-weaned babies.

As the above mentioned, results of our excavations in the South Area emphasize an imbalance between males and females in addition to many children. A shortage of male could have been filled up unexcavated places in the South Area, if the imbalance cannot be solved in the West Area. Tombs in the West Area are classified into three types, a shaft tomb, a tunnel-shaped tomb and a tomb chapel (Table 2). All shaft tombs dated from the Old Kingdom were reused in the TIP except for No. 16 in 2006 keeping their original burial. On the other hand, a tunnel-shaped tomb and tomb chapel date from the TIP, however some funeral goods belonging to the Late Period are mixed in tomb chapels. Furthermore, tomb chapel No. 23 and No. 42 in 2007 possibly have been disturbed in the Coptic Period. The types of coffins are rich in variety, in addition to anthropoid and rectangular wooden coffins usually found from shaft tombs, an anthropoid pottery coffin in the tomb chapel and an anthropoid clay installation in a tunnel-shaped tomb were found respectively.

Unearthed human bones were identified as 15 adult males, 12 adult females and 7 children

Table 2 Burials in the West Area.

Year	Tomb No.	Coffin Type	Size of Coffin (m)	Sex	Age	Direction of the head	Comments
2002	South shaft	Wooden coffin (Anthropoid)	1.18 × 0.45	Male	mature	S	
2003	OK Mastaba						
	No. 5	Wooden coffin	1.30 × 0.42		5–6 years old	N	A cat mummy beside No. 5
	No. 6	Wooden coffin			3 years old		
	Group 1						
	South C.	Wooden coffin		Male	50–60 years old		gathered
				Female	50 years old		gathered
	West C.	Pottery coffin (Anthropoid)	1.90 × 0.45	Male	senior	W	
				Male	20–30 years old	E	
		around the coffin		Female	20–30 years old	E	
				Male	20–30 years old		assorted
					2 years old		assorted
					adult		assorted
	Group 2						
	No. 1	Wooden coffin	1.10 × 0.46	Female	mature	N	
	No. 3			Male	mature	N	
	No. 6	Clay installation	1.93 × 0.52	Female	mature	E	hydrocephalus?
	No. 7			Male?	mature	W	
	Group 3						
	No. 1			Male	adult	N	
2004	No. 4			Female	40 years old		
	No. 5			Male?	senior		
2006	No. 12	Wooden coffin (Anthropoid)	1.90 × 0.52	Male	senior	N	
	No. 16	Wooden coffin		Female	adult		The 5–6th Dyn.
	No. 21			Female	adult		An ibex-like animal beside the dead
	No. 22				7–8 years old	N	Trepanned skull
2007	No. 9	Wooden coffin (Anthropoid)	1.58 × 0.4	Female	senior	W	
	No. 18 (T.chapel)	Wooden coffin (Anthropoid)	2.26 × 0.76	Male	senior	S	
	No. 23 (T.chapel)						Disturbed in the Coptic period
	North S.			Female	mature		
				Male	senior		Trepanned skull
				Male	adult		
				Female	adult		
				Female	adult		
					new born		
					2–3 years old		
					5–6 years old		
	South S.			Female	adult		
				Male	adult		
				Male	adult		
					2 years old		
	No. 42 (T.chapel)			?	adult		Coptic burial

who are older than two years without a newborn and an un-weaned baby. Two children of 5–6 years old and 7–8 years old were buried independently in a shaft tomb the same as an adult burial, but others were buried with adults in tomb chapels. The ratio of children to adults in the West necropolis is approximately 20%, lower than half the ratio in the South Area. Even if only shaft

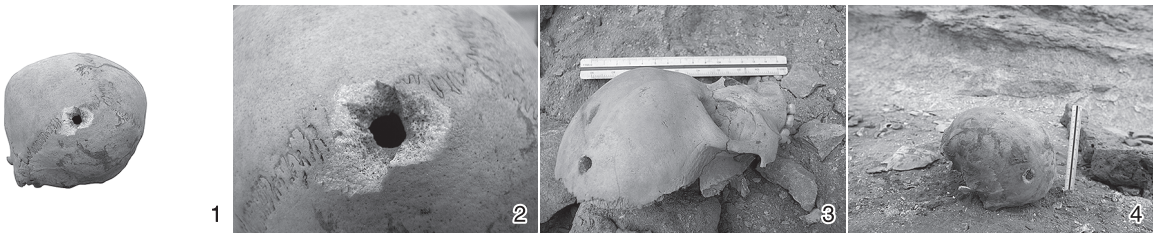


Fig. 3 Trepanned skulls.
1: No. 3 in 2006; 2: No. 3 in 2006 (an enlarged photo); 3: No. 22 in 2006; 4: No. 23 South Shaft.

tombs dated to the TIP were counted to remove fear of including later burials, the ratio of children to adults is almost the same. There is no difference in the ratio between males and females, either.

Compared to burials in the South Area, funeral goods are remarkably rich in the West Area. Besides amulets, various kinds of funeral goods of figurines of Thoth and Osiris made of bronze, a bird-shaped figurine made of wood, crocodile-shaped figurines made of clay, cowries, pottery etc. were found. In addition, two kinds of animal mummies were offered to the dead. One is a cat lying beside a child body in No. 5 in 2003, the other is a herbivore like ibex lying beside a female in No. 21 in 2006. These differences in burials between the South Area and the West Area are supposed to have origin in a difference of social classes, elite/non-elite, to which the dead belongs. Meanwhile, there are features in common to two classes. One is that children older than two years were treated like adults in types of coffin and kinds of funeral goods, the other is that newborns and un-weaned babies are excluded from the cemetery.

Trepanned skulls[6] Three trepanned skulls were found among human bones unearthed from the South area and the West area (Fig. 3). A trepanned skull of a mature female found in the South area (No. 3 in 2006) remains in so good condition that it is filled with a brain. That is, the small hole near the left Sutura lamdoidea in Os occipitale was opened not to discharge a brain. Chisel marks 3mm in width carefully scraped from diagonally outside around the hole 6mm in diameter show that it was the artificial hole. Two trepanned skulls were found in the West necropolis. A skull supposed to be 7–8 years old in a shaft tomb (No. 22 in 2006) has a hole of the almost same size as the above-mentioned skull near Sutura colonalis in Os frontale. Chisel marks whose edge is narrower than the above-mentioned skull remain around the hole. The other is a trepanned skull of a senior male in a tomb chapel (No. 23 in 2007). A hole opened in left Os parietale is a little bigger and has an oval shape of 7 × 10mm. Because none of these tree skulls shows the growth of bone around the hole, they would not have lived long after an operation.

Notes

1) *Preliminary Report Akoris 2002 (–2008)*.
2) *Preliminary Report Akoris 2004 (2006–2010, 2012)*.
3) Steel, L., 1995 'Differential Burial Practices in Cyprus at the Beginning of the Iron Age', in Cambell, S. and A. Green (eds.), *The Archaeology of Death in the Ancient Near East*, pp. 199–204, Oxbow.
4) Brunton, G., 1948 *Matmar*, G. Brunton..
5) Patch, D. C., 2007 'Third Intermediate Period Burials of Young Children at Abydos', in Hawass, Z. and J. Richards (eds.), *The Archeeology and Art of Ancient Egypt; Essays in Honor of David B. O'Connor*, Vol. II, pp. 237–255, SCA.

6) J. F. Nunn shows a skull discovered at Lisht (Brested, J. H., 1930 *The Edwin Smith Surgical Papyrus*), the skull of Princess Horsiesnest Meritaten (Ghaliiounghui, P., 1973 *Magic and Medical Science in Ancient Egypt*) and a skull of a child as examples of trephining (Nunn, J. F., 1996 *Ancient Egyptian Medicine*, University of Oklahoma Press.). Besides, Nesperennub's skull with a small cavity is possible to have been trepanned and healed because the cavity gets larger outward from the inside in the CT image of the skull, but the author described that a tumor might have been responsible (Tylor, J. H., 2004 *Mummy: the inside story*, Britishu Museum Press.).

5 LASER SCANNING IN AKORIS

HORI, Yoshiki and AJIOKA, Osamu

Laser scanning provides us with a new dimension in archaeology and architectural history. This technique was introduced to archaeology around 10 years ago (having been long used in other area such as engineering and medical science), and now is widely applied, either in the field (surveying) and or in object scanning. Although some leading companies, such as Leica, Riegl and FARO, provide the general-purpose or all-purpose standard scanners, many companies are continuing innovating with new technology, including new software. This makes it we still find difficulty to in exercising choice both of the best machine and the best software for the tasks we wish to undertake. Now, we chose the Faro Focus 3D for our research, on account of by its mobility, as it only weighs (5kg).

At first, a brief explanation about machines used in laser scanning must begin this report. A laser scanner seems something like a digital camera in comparison, in which, and we can take a 360° panoramic picture simply by releasing the shutter. Yet, but in order to attain to profession or avoid mistakes, we have to understand its mechanical and electronic contrivance workings. A guidebook, which explains the principles and management of laser scanning for Heritage, has been published in 2011. In that guide, a generic definition of a laser scanner from Böhler and Marbs is given, 'any device that collects 3D coordinates of a given region of an object's surface automatically and in a systematic pattern at a high rate achieving the results in near real time'[1)].

And, as seen in Fig. 1, there is a variety of techniques available to generate three dimensional survey information. But it is important that the method should be chosen is appropriate for the scale at which they it might be used. And scale is determined by the size of the object they could one wishes be used to measure, and by the number of measurements they might be used one wishes to acquire. The complexity of the object determines the number of measurements.

Generally, the principle upon which a scanner operates will be one of three forms of ranging technology: triangulation, time-of-flight, and phase comparison. Triangulation scanners, covering

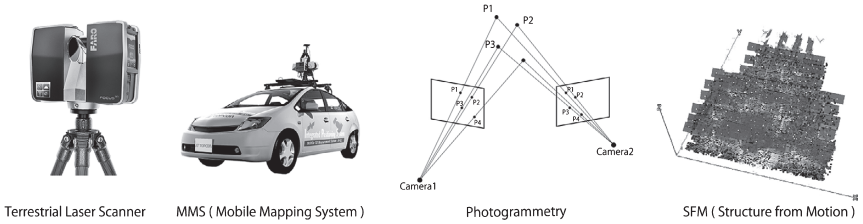


Fig. 1 Techniques of 3d survey information

the objects in very short range of 1 to 5cm, calculate the measurements of 3D coordinates by triangulating the position of the laser light with the accuracy within 0.05–0.1mm. In a time-of-flight system a laser pulse is sent to the object and the distance between the transmitter and surface is computed from the travel time between the signal transmission and reception, providing a reading accurate to within 3–6mm (Fig. 2).

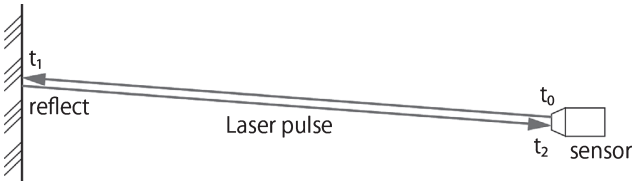


Fig. 2 Principle of "time of flight"

As opposed to the time-of-flight scanners, phase-comparison scanners can obtain the distance between the scanner and the target by detecting differences in the laser pulse emitted and the returning pulse. Phase-comparison systems have much higher rates of data capture, recording nearly one million points in a second, which results in a point cloud of greater detail. By calculating the average measurement of the points, the image produced is accurate to within 0.5mm to 1mm. Phase-comparison systems tend to be much more mobile than other scanners, with the laser emitter and receiver weighing just 5kg as FARO Focus 3D that we chose.

One of the most important considerations to be made is how many measurements are required. This decision is crucial in setting up the scanner, as it determines how much space to allow between the measured points, which can be as small as 0.1mm. The level of resolution also needs be chosen wisely. A higher resolution means better image quality, so naturally this is preferable, but, as a greater resolution requires more RAM to store it, this can present us with a problem. Unfortunately, we cannot predict exactly what level of resolution is required, as the naked eye cannot always see the intricacies of certain objects and they may result in a picture which requires greater memory than initially expected.

The data created by a laser scanner can describe record an entire whole ancient city by in more than several millions of three-dimensional points. This point clouds model of Akoris, includes more than 10 million of three-dimensional points in black and white, has been measured during 2010 and 12 (Fig. 3). In this investigation we used the advanced measuring method covering the long range: the Ilris 3D- scanning system of Ilris, in which more than 2,000 scanning laser beams can be emitted in one second and in which the an object can be described as the aggregation of points having three dimensional coordinates. The whole city wall was separately measured into more than 200 point-clouds of more than a million dots.

The history of Akoris, covered with mud-brick buildings, which can be traced back 2200 or 2300 years from its end in 8th century. The development of the site, coincided with the rise of New Kingdom from a local power in the Middle Egypt. The normal building materials were mud brick and re-used stone blocks. The average mud-brick masonry wall is coursed horizontally and, in all other respects, it is from top to bottom an absolutely homogeneous, uniform mass. A frequent mode of the construction involved the used of the barrel vault on the ground floor, on which the ground or first floor rest, and wooden beams supporting the floors above or roof spanned between the walls to a level of approximately 3 or 4m. The mud-brick dwellings especially exposed for over centuries, have weathered considerably since they were uncovered, making our laser-scanned records irreplaceable.

Fig. 3
Result of laser scanning

Fig. 4
The monolithic column

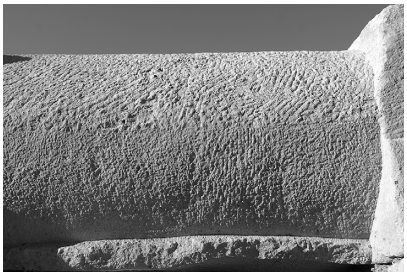


Fig. 5
Straight lines by a pointed chisel

One of our most valuable discoveries and findings from quarries of Akoris area of the Middle Egypt is that waste and blocks abandoned, which sometimes obstructed work and transport, were widely scattered over the platform and work area. Large amounts of waste must have been emitted in the working area in the course of the extracting, processing, and transporting in the quarries, whence we can trace the changes that affected the productivity and engineering innovations which occurred at the quarries or were introduced from the outside of Egypt. There was were plentiful supplies of identical limestone in and around the river Nile and the Mediterranean Sea, and in the Ptolemaic and Roman periods the local limestone was in fact already being used regularly in monuments or ordinary buildings. A monolithic column (Fig. 4) 30m long and 3m diameter in section excavated in 2001 lied lay down in an east-west direction of east and west along the city wall constructed in the Last Pharaohs at the north-west of the site, near the border with Tihna village. From ancient quarries around Akoris, the stone blocks could be carried to the working area located in the outside of the city.

This monolithic column we found had been fated to be abandoned, since any because of a failure in technique had operated for in its processing progress by ancient masons. If any trouble had not been caused, this monolithic column would have been has been transported to the suburban port of the River Nile after finishing the processing. Thanks to the failure, we have an opportunity to survey and understand in detail how the masons have processed such a megalithic and monolithic stone block into an ordered size of column with a high degree of accuracy.

Observing the sectional shapes provided from by the point cloud data, and along with the chisel marks, gives us the understanding about the process needed to shave off the stone block into a polygonal section. The lower part of the cylindrical part is shaven in straight lines by a pointed chisel (Fig. 5). It is considered that this technique is to shave the surface of the stone into a plane surface. In the case of shaving a polygonal surface into a round shape, the wooden curve, which has been also used in the Greek mainland, must hold into the surface vertically. To hold it vertical accurately, the guideline is required. The curve following the guide tapes, which have been stretched between the possibly cross-shaped rulers, could be set onto the surface vertically.

Tasks potentially suitable for the application of laser scanning as below[2)].

1) Contributing to a record before renovation of a subject or site, which would help in the design process as well as contribute to the archive record
2) Contributing to a detailed record where a feature, structure or site might be lost or changed forever, such as in an archaeological excavation or for at a site at risk
3) Structural or condition monitoring, such as looking at how the surface of an object changes over

time in response to weather, pollution or vandalism

4) Providing a digital geometric model of an object from which a replica can be generated for display, or as a replacement in a restoration scheme
5) Contributing to three-dimensional models, animations and illustrations for presentation in visitor centres, museums, through the internet and through the media (enhancing accessibility/ engagement and helping to improve understanding)
6) Aiding the interpretation of archaeological features and their relationship across a landscape, thus contributing to understanding about the development of a site and its significance to the area
7) Working, at a variety of scales, to uncover previously unnoticed archaeologically significant features – such as tool marks on an artifact – or looking at a landscape covered by sand
8) Spatial analysis, not possible without three-dimensional data, such as line of sight or exaggeration of elevation

Finally, in Akoris, we have to apply proper method of recording on those tasks as below.

1) and 2) do not only include laser-scanning, but also photos, sketches, and other recording methods. But laser-scanning could be effective for shorter working hours and reduction of labours.

3) Middle range scanner, such as Focus 3D, could be suitable for this contribution.

4) Object scanning using arm-based scanners, handheld scanner, and optical scanners could be expectable, but materials, such as marble or mud brick, could exert their influence on the result of scanning.

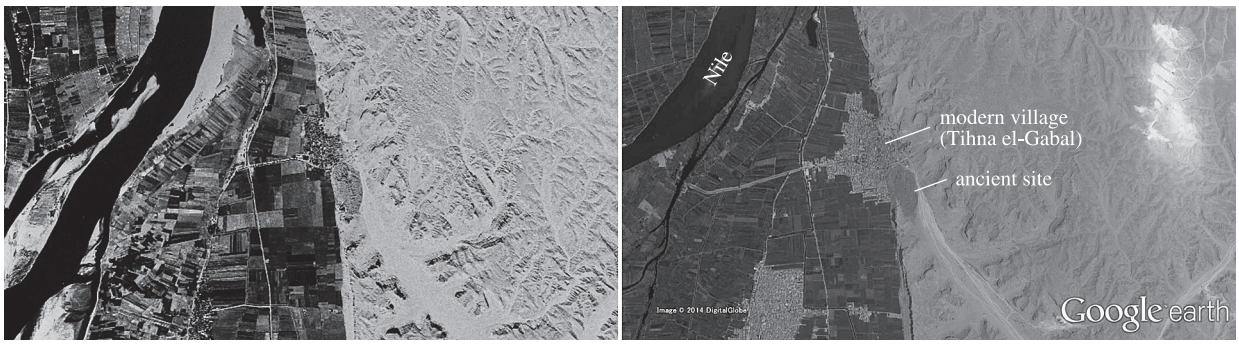
5) This task has been already accomplished in these recent several years. Three dimensional animation will be popular for archaeology soon.

6) and 7) Long and middle range scanners could be suitable for this task and colour mapping could be a key technology.

8) and all, relationship between an operator of laser scanner and a researcher is crucial for success in spatial analysis and ideally a laser-scanning, which is worked as desired, could be managed by researchers.

Notes

1) Böhler, W. and A. Marbs, 2002 '3D Scanning Instruments', *Proceedings of CIPA WG6 Scanning for Cultural Heritage Recording* (September 1–2, Corfu, Greece), pp. 9–12.
2) Jones, D. M. (ed.) 2011 *3D Laser Scanning for Heritage (second edition), Advice and guidance to users on laser scanning in archaeology and architecture*, English Heritage.



Satellite images
left: Corona satellite image (1968 November 9th)
credit to Center for Advanced Spatial Technologies, University of Arkansas/U.S. Geological Survey CORONA Atlas of the Middle East (http://corona.cast.uark.edu/)
right: Landsat satellite image (2014 March 31st)
credit to Google Earth