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A NEOLITHIC BURIAL GROUND FROM UPPER NUBIA AS SEEN FROM RECENT WORK AT KADRUKA 23 (KDK23)

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An archaeo-anthropological excavation of a new cemetery

Located in Upper Nubia, within the northern Dongola Reach, the Kadruka concession lies between the areas of Kerma (to the north) and Kawa (to the south) and corresponds, mostly, to the Wadi el-Khowi, which is part of the former course of the River Nile (nowadays flowing some 19km to the west). Between 1985 and 2002, the whole concession was surveyed by Jacques Reinold, under the auspices of the SFDAS (Reinold 1987, 2001, 2004). He discovered more than 150 sites within the Kadruka district, among which he recognized 17 Neolithic burial mounds. Over the 17 years, he had the opportunity to excavate six of them either (almost) entirely (for KDK1 N=124; KDK13 N=c. 30; KDK18 N=165; KDK21 N=288 out of an estimated total of c. 300 burials), or partially (KDK2 N=116 out of an estimated total of 1000 burials; KDK22 N=30 out of 150 estimated burials). So there are more than 750 individuals from six cemeteries excavated by J. Reinold but none of those sites has been fully published and it is difficult to appreciate the representativeness of each burial sample. Since 2014, a multi-site and multidisciplinary project has operated at Kadruka (MaFSaK, Mission archéologique Franco-Soudanaise à Kadruka), jointly lead by Langlois, Chambon and Sellier, funded by QSAP-06, with the collaboration of SFDAS and NCAM, with two main focuses: the Neolithic funerary dimension, and the analysis of the settlements of the Neolithic and the pre-Kerma periods.

Part of the QSAP-06 project is the thorough excavation of a new cemetery from the Middle Neolithic period in the Kadruka area, namely the burial mound KDK23, discovered by Osman Idriss in the autumn of 1988 and first visited by Jacques Reinold in the winter of 1989 (after a test, he did not select KDK23 for further excavation). The present KDK23 excavation is much more than just a supplementary site in the Kadruka area; it should shed new light on Neolithic burial practices and funerary *chaînes opératoires*, and should provide definite bioarchaeological data to document a sequence of the “peopling corridor” of the Upper Nubian Nile Valley, as well as analysing evidence for the presumed hierarchisation of the Neolithic societies. KDK23 was chosen because of its intermediate dimensions (“only” 40m as diameter and 1,5m high above the plain) and of its relatively good preservation: In November 2013, scarce fragmented bones and a few potsherds seemed to indicate a low erosional impact and Reinold’s 1989 test work had barely affected the burials (encompassing cleaning of the surface, excavation of two child burials, a “q-shaped” superficial test trench and the reopening of a probable looter’s pit that provided parts of at least three skeletons).

Eventually the preservation of the human remains proved to be worse than expected: as usual in desert contexts, only the mineral portion of the bones is preserved, which produced a high level of fragmentation. The archaeo-anthropological excavation (six campaigns up to now)

needed to be slow and cautious because of the fragility of the bones, which was embedded in a very solid ground made of compacted silt layers from the Nile, and affected by a lot of fissures, all over the mound. Each bone was observed and recorded *in situ* and most of the biological and anthropological data was recorded directly in the field.

Spatial organisation

The KDK23 cemetery occupies the top of a small mound surrounded by palaeochannels of the ancient Nile. Usually but erroneously called a “*kôm*” (which means “*tell*”, by assimilation with Near-Eastern or Balkan Neolithic sites), this mound proved to be of natural origin, according to geomorphological study and electromagnetic survey. It represents the remnants of a terrace of the Nile, most probably surrounded by water in Neolithic times: an “island of the dead” in the middle of the ancient course of the River Nile.

There is no evidence for any other human activities apart from the Middle Neolithic burial ground on the mound. The first six working seasons have led to the discovery, excavation and full recording of 126 human burials, within an area of less than 110m² (in addition to one dog, one cattle deposit, and a few more undetermined features), which makes for a very high density of more than one subject per square-metre (Figure 1). The graves are neither visible from the surface nor underground: no burial markings could be detected, and it has been impossible to perceive the limits of any burial pits, apart from in a few exceptional cases (but the limits can often be assessed from the osteological analysis). Most of them are primary, individual burials but there is a high level of reopening, inter-cutting and disturbing of the graves. No direct dating of the human bones has yet been possible (no collagen was left for radiocarbon quantitative analysis, according to our preliminary tests) but other materials are being tested. According to grave-goods (pottery, faunal remains, lithic technology, etc.), the cemetery has been tentatively dated from the first half of the 5th millennium BC (Middle Neolithic A: Usai 2016), and most of the burials can be positively compared to those from R12 cemetery (Salvatori & Usai 2008) or from KDK21, both earlier than KDK1 (second half of the 5th millennium BC: Reinold 1987; 2001). Comparisons with smaller assemblages (for instance, el-Multaga, southern Dongola Reach: Peressinotto *et al.* 2004), with cemeteries from Early Neolithic (el-Barga: Honegger 2004), or with cemeteries from Central Sudan (el-Kadada, Ghaba: Reinold 1987; 1992; 2008; Salvatori *et al.* 2016) are beyond the scope of this paper.

The general view of the cemetery does not fit Reinold’s hypothesis of a concentric organisation around an earlier (and richer) burial at the highest point of the mound, and it is different from R12, which is less dense. Despite the small size of KDK23 mound, the burial ground occupies only a small part of it, more or less at the top but shifted northwards, probably no more than 25m north-south by 12m east-west. The limits of the cemetery have been clearly reached on the southern and eastern sides (Figure 1): No burial at all are to be found further eastwards or southwards, indicating that a physical limit should have initially existed. On this basis, the overall shape of the burial ground appears more or less ellipsoid and the final number might be around 200-250 individuals. The burial density is irregular: one can see many empty spaces compared to bundles of burials where many subjects are associated through reopening and inter-cutting of burial pits. The general organization is still visible: rows of burials are separated by narrow corridors without any grave. A main row, oriented NNW-SSE, is parallel to the eastern boundary of the cemetery and to another row (westwards); two short rows or bundles of graves lie N-S (bottom of Figure 1) and W-E (top of Figure 1). In our view, those are deliberate associations of individuals, with a clear intention of co-locating some people for social or family reasons.

An ordinary mortality profile without any selection

Despite the observations and measurements recorded in the field, it is often not possible to determine the individuals’ sex and age, apart for the non-adults’ age at death. When feasible,

this have been done by reliable and accurate methods (Bruzek 2002; Bruzek *et al.* 2017; Schmitt 2005; Moorrees *et al.* 1963a; 1963b, AlQahtani 2009; Primeau *et al.* 2016). The life-table, especially the probabilities of death, have been figured out according to Sellier's methodology (1996), which allows us to detect potential "demographic anomalies". The mortality profile of non-adults (Figure 2) fits well into the standard life-table (Ledermann 1969) corresponding to a life expectancy at birth of 30 years. In KDK23 cemetery, both sexes are buried and all ages are represented, from stillborn to old age. There is no evidence of any kind of selective burial practice, particularly for the youngest (Maines *et al.* 2017), and the mortality profile corresponds to an "ordinary" ancient mortality, an "attritional mortality" (without selection and without crisis). It contains females and males, with no significant differences (although a general sex-ratio cannot be calculated, due to the poor state of preservation of hip-bones), and adults and non-adults of all ages. Sex or age are not a criterion for spatial distribution within the cemetery, except for the youngest (stillborn, neonates and infants), concentrated at the top of the mound, with shallower burials. This "ordinary population" gives no argument for an elite burial ground.

Analysed as a whole, R12 cemetery appears totally different from KDK23 (Figure 2), with a clear burial selection: from Table 8.1 in Judd (2008, 84-86), we could determine the probabilities of death, which are much more accurate than mere percentages of the deceased: the probabilities of death for age-groups 0 year and 1-4 years are significantly different from the standard-table model, and are much too low for an ancient population (1q0= 95 ‰ and 4q1 = 70 ‰, three or four times lower than expected). This means that stillborn neonates, and infants were buried elsewhere and their corpses had no access to the R12 cemetery.

This burial selection can also be demonstrated, but only for the first age-group (0 year), at KDK18 and KDK1 (Maines *et al.* 2018; Maines 2019). If possible, it would be interesting to distinguished the two periods of the Middle Neolithic (A and B) at R12 (Salvatori & Usai 2008; Usai 2016), to see if that strong burial selection is typical (or not) of the second period, as it seems to be in the later cemeteries from Kadruka (KDK 18 and KDK1), as opposed to the earlier (KDK21 and KDK23) where it seems that the whole deceased population was admitted to the burial ground (Maines 2019).

Main burial features

The standard disposal of the dead is an individual primary burial (Figures 1 and 4, Plates 1, 2, 3), with the subject laid in a lateral right or left position, with flexed or hyper-flexed lower limbs (flexed hips and knees), and flexed forearms (hands often in front of the face or near the chin). A small majority rests on the left side (57/97, i.e. 59 ‰), much less than at R12 (82 ‰ of the determined position: Salvatori & Usai 2008, 129). In both KDK23 and R12 cemeteries, there is no correlation and no spatial distribution according to sex, age or position, but the clusters of associated and inter-cutting graves of KDK23 often clearly show a prevailing side, left (for instance, in the northern group) or right. The prevailing orientation of the corpse (Figure 3) is approximately on a NW-SE axis with a wide variability around it (a quadrant of nearly 100°), with 49 cases (including numerous neonates and infants) with the head to the NW and 31 to the SE (and the remaining 15 in the NE-SW quadrants). Within the compacted silts of the mound, it is usually impossible to detect the limits of the pit of any burial, the graves having been simply dug into the mound (the ancient terrace of the River Nile). Nevertheless, the position of the skeleton and the archaeo-anthropological analysis clearly show how narrow the grave was (1,2m at the most, for the maximal length/diameter, with a maximal depth of 0,7m), with many constraints that have often maintained the feet in a vertical position, and the spine or the neck in a bent position.

If one look closer, one can realise that some hands and feet that should have fallen down by the law of gravity are still in perfect connection and position, contrary to the rules of corpse decay (Duday *et al.* 1990; 2009; Sellier 1992), as if they had been maintained by desiccation

(prior to final decay). Conversely, quite a number of joints were not held in their strict anatomical position (for instance, rotation of the head of the humerus, as in Plate 2; slipping down of the scapula, dislocation of the sacro-iliac joint, etc.); such displaced bones are the signs of the former disposal of a corpse wrapping or of a cover that could have been a rug or an animal hide (now disappeared). In a few cases (Plate 3, Figure 4), the general hyper-flexed position suggests that the corpse has been tied. As for that specimen, St.93, is concerned, the strong constraints and the bundle-like overall aspect give evidence for a probable desiccated (i.e. naturally mummified) subject before its burial in the narrow grave.

The youngest individuals — stillborn, neonates and infants less than 1 year of age — are found in a greatmore differing positions than the older children and adults; almost all possibilities can be seen, even a prone and flexed position (“frog position”), as in the case of the neonate St.25 (Plate 4). For this age-group, displaced or moved bones are very common. Both those signs, manifold positions and numerous dislocations, are evidence for the use of small containers, like baskets, for the little corpses; this also explains why the infants’ pottery vessels are placed much higher than the skeletons (they were laid upon the basket).

On the mound, no sign of ritual or commemorative activities were left. Nevertheless, the burials were not forgotten, for many were associated with new ones, if not merely reopened. This means that the location of the graves was remembered (perhaps marked in a way that did not leave any remains) and, moreover, that the individuals’ identity was known. This provides evidence for deliberate association, reopening and inter-cutting of graves. An example of the association of five subjects is given in Figure 5: four stages to eventually gather one child of 6-7 years old and four adults.

Grave-goods

In KDK23 burials, grave-goods were mostly either equipment or food for the afterlife, or personal adornment (perhaps along with clothing?). In comparison to other cemeteries across the Kerma Basin, grave goods were not numerous, although it is rare that the deceased had no items at all. However, objects made of organic material could have disappeared. The standard deposit consisted of (usually) two pottery vessels (Plate 6) (sometimes one, seldom more than two: Plate 2); the pots were placed upon the corpse, usually upright (opening upwards), over the adults’ rug/cover and above the non-adults’ basket/container (Plates 4 and 5). They seem to be functional objects and a lot of them were worn, repaired (with frequent holes for repairing) and even trimmed and reshaped, as in the case of two specimens of caliciform beakers. They were probably containers for food or beverage, as illustrated by the vessels of the neonates and youngest infants: inside one of the vessels, there is always a sort of spoon, made of ceramic, a trimmed cup, or even an oyster shell (Plate 5).

Items of personal adornment as well as other objects were closely associated with the body. Beads, necklaces, etc. were made of a range of materials including amazonite, cornelian, ceramic, and ostrich egg-shell; ivory bangles were made from hippopotamus tusk and there were some stone labrets (one *in situ*, in front of the chin of St.135, which originally pierced the deceased’s lower lip). Bone artefacts included awls, chisels, needles, etc.; and there were polished stone axes, flint flakes and lunates *in situ* corresponding to a tool such as a sickle. Usually, artefacts were standardised and the same object was present in quantity; there was sometimes a kind of prevailing artefact in some burial (e.g. bone artefacts or stone axes or lunates/sickles, etc.). Nevertheless, these grave-goods included non-functional or unfinished artefacts (e.g. pre-formed ostrich-egg-shell beads, pre-shaped flint cores, etc.), with, quite often, raw material (cattle or gazelle bones, flint pebbles, red or yellow colourant, half an elephant tusk: Plate 2). Mussel or oyster shells were sometimes numerous and could have been a sort of container, like the sheath/container made of a hippopotamus tusk (Plate 6). There were also “symbolic” objects such as bucrania (one or two, usually cattle; like the pottery vessels, bucrania were positioned near the edge of the pit and over the body), probably referencing a

herding context (sickles or microliths could similarly evoke agricultural activities). Artefacts and raw material are often close together (Plates 1, 2), sometimes along the back of the corpse or under the head, as if in a container or perhaps in relation with the wrapping/covering of the body.

There is a special distribution of the wealthiest graves (Figure 1). The transition from no grave-goods (or only pots) to more than 15 different categories of grave-goods, shows the richer deposits located within a small area, near the top of the mound, to the north of the present excavation.

Unusual burials

Some of those individuals with many grave-goods, or with special grave-goods, might have had a special status within the KDK23 living population. This was probably the case for the elderly woman, St.148 (Plate 2), who has a wealthy burial, as far as the number and variety of grave-goods is concerned, including half of an elephant tusk (a unique specimen in the cemetery); or the case of another woman, St.131 (Plate 1), who was buried with many sickle elements and bone artefacts.

Some unique cases of disposal of the dead must also be mentioned (the latter two subjects are also unusual because they suffered a violent death, see below). St.144-145 (Plate 7) is actually a double burial (that is two simultaneous inhumations) of two women and St.89 (Plate 8) is the sole secondary burial of the cemetery. It is a very partial skeleton whose bones have been collected long after the body decayed and the main joints dislocated, and it was brought back to KDK23 for burial. The skeleton only encompasses: the cranium, the mandible (completely separated from the cranium), a large part of the left upper limb (scapula, clavicle, humerus, radius, ulna, trapeze carpal bone, 4 metacarpals and 1 phalanx), the right hip-bone and the proximal 4/5 of the right femur, 6 right and 5 left ribs, the whole thoracic column, plus the 2nd and 7th cervical and the 1st lumbar vertebrae. Among those dislocated and separated remains, we unexpectedly found some bones with good preserved articulation (in their natural anatomical position): the left elbow and the column from C7 to L1 with the five left ribs still in position (Plate 8). It can be inferred that these connected remains became naturally desiccated (mummified) and were then put, with the other bones, in a bag for transportation and secondary burial at KDK 23 (reconstruction: Plate 8).

Interpersonal violence

Four individuals have been the victims of extreme violence, as evidenced by several blunt-force traumas with impact markers specific to perimortem fractures on “fresh” bone (Walker 2001; Symes *et al.*, 2012; Loe 2016). These preliminary observations concern the secondary burial St.89, one of the subject of the double burial St.144-145 and two individual burials (St.134 and St.152). St.152 is the only male (30-49 years old), and shows a single blunt-force trauma, inside the left pelvis, near the iliac crest and the antero-superior iliac spine. The mark of the weapon corresponds perfectly to the edge of a stone axe (like those found in other burials). St.134, a 30-39 years old woman, shows exactly the same type of trauma, at the same place (a little lower and more inside the left pelvis), also due to the edge of a hafted stone axe (Plates 6 and 9). The woman St.144 (a middle-aged adult) has been buried at the same time as St.145 (an adult, possibly female); she presents a multi-fractured skull, with at least three impacts on the right frontal and parietal bones, due to a heavy tool (the missing fragments have fallen inside the cranium) and several blunt-force marks on the anterior and right lateral faces of the last three thoracic vertebrae, T10, T11 and T12 (the weapon penetrated the right side of the abdomen). The secondary burial St.89 (Plate 8) is that of a 30-59 year old woman; her cranium has a large perimortem blunt-force trauma all along the left fronto-parietal zone (up to the eyebrow) (Plate 10); three impacts of a pointed weapon (pike or spear) penetrated her right

pelvis (and perforated the acetabulum) (Plate 11), and her right femur has been broken perimortem (distal fracture, near the knee).

The blows, often repeated in the same place, have affected the cranium (two cases), the thigh, abdomen (lower thoracic vertebrae), and pelvis (three cases), and all were applied face to face, at point blank range with a hafted weapon (spear or hafted stone axe); each producing a lethal wound. The victims with many traumas (St.89 and St.144) have been “over-killed” or were facing several assailants. Each of the four cases is different and there is nothing like a scheme or repetitive sequence. If different disposals of the dead have been granted to them (secondary, double, simple primary), they nevertheless are all fully integrated into the cemetery and into the overall funerary practices of the population, even if St.89 probably died far away (the remains being repatriated later as a secondary burial). Thus, there is no evidence either for sacrifice, execution or for “accompanying death” (Testart 2004). Conflict or interpersonal violence are the best hypotheses.

New funerary features

The image of the KDK23 cemetery, as it emerges, is altogether different from other Neolithic burial grounds from Upper Nubia. It is indeed an “ordinary” population, with all categories represented (according to sex, age, occupation, etc.), involved in herding and agriculture, with strong links to a domesticated world (sickles, cattle bucrania, etc.). In addition, it is an organised group managing a clear spatial distribution of the deceased on this “island of the dead”, with numerous deliberate associations or gathering of subjects, and with some individuals having a special status probably linked to their occupation. Other new features are to be underlined, such as the evidence for containers (baskets for infants?), corpse wrapping, and perhaps rugs (or mats or animal hides) for adult burial; all of which might be connected to the transportation of the dead to/on the island.

Around half of the KDK23 cemetery has been excavated so far, but we do not yet know if that half is representative of the whole. Indeed, each campaign has brought new and distinct burials, providing original data. In 2014, the important result was the high proportion of infants and neonates; in 2015, the first dense rows of burials began to appear; the following year, burial with bucrania multiplied and an unusual secondary burial was found; the first 2017 campaign showed much deliberate gathering and inter-cutting of graves, and the second brought to light the wealthiest burials; and finally, the last season provided the first double burial (one with lethal injuries). We can fear (and be delighted at the same time) the variability of KDK23 funerary practices, for other new burial features will surely appear in the coming years.

References

- AlQahtani, S. J., 2009. *Atlas of Tooth Development and Eruption*. Website Queen Mary University London, Barts and The London School of Medicine and Dentistry. www.atlas.dentistry.qmul.ac.uk (accessed 25.08.2017).
- Bruzek, J., 2002. ‘A Method for Visual Determination of Sex, Using the Human Hip Bone’. *American Journal of Physical Anthropology*, 117, 157-168.
- Bruzek, J., Santos, F., Dutailly, B., Murail, P. & Cunha, E., 2017. ‘Validation and reliability of the sex estimation of the human os coxae using freely available DSP2 software for bioarchaeology and forensic anthropology’. *American Journal of Physical Anthropology*, 164, 440-449.
- Duday, H., 2009. *The Archaeology of the Dead. Lectures in Archaeoethnology*. Oxford : Oxbow Books.
- Duday, H., Courtaud, P., Crubézy, É., Sellier, P. & Tillier, A.-m., 1990. ‘L’anthropologie “de terrain” : reconnaissance et interprétation des gestes funéraires’. *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, 2, 29-49.

- Honegger, M., 2004. 'Settlements and cemeteries of the Mesolithic and Early Neolithic at el-Barga (Kerma region)'. *Sudan & Nubia*, 8, 1-6.
- Judd, M., 2008. The Human Skeletal Analysis. In Salvatori S. & Usai D. (eds.), *A Neolithic Cemetery in the Northern Dongola Reach: Excavation at Site R12*, 83-104. London : Sudan Archaeological Research Society/Oxford (UK) : Archaeopress.
- Ledermann, S., 1969. *Nouvelles tables-types de mortalité*. Paris : I.N.E.D./Presses Universitaires de France.
- Loe, L., 2016. Perimortem Trauma. In Blau S. & Ubelaker D. H. (eds.), *Handbook of Forensic Anthropology and Archaeology. Second Edition*, 346-372. New York (USA)/Abingdon (UK) : Routledge.
- Maines, E., 2019. *Diversité biologique et archéologie de la mort : une approche populationnelle et culturelle du Néolithique soudanais (Haute-Nubie)*, Thèse de Doctorat d'archéologie pré- et proto-historique. Paris : Université Paris 1-Panthéon-Sorbonne (unpublished PhD).
- Maines, E., Sellier, P. & Langlois, O., 2018. 'Revisiter un ensemble funéraire du Néolithique soudanais : le cimetière Kadruka 18 (fouilles J. Reinold)'. *Routes de l'Orient*, hors-série 3, 16-30.
- Maines, E., Sellier, P., Chambon, P. & Langlois, O., 2017. 'Burying Children and Infants at Kadruka 23: New Insights into Juvenile Identity and Disposal of the Dead in the Nubian Neolithic'. In Murphy E. & Le Roy M. (eds.), *Children, Death and Burial: Archaeological Discourses*, 43-55. Oxford (UK) : Oxbow Books.
- Moorrees, C. F. A., Fanning, E. A. & Hunt, E. E. Jr., 1963 a. 'Formation and Resorption of Three Deciduous Teeth in Children'. *American Journal of Physical Anthropology*, 21, 205-213.
- Moorrees, C. F. A., Fanning, E. A. & Hunt, E. E. Jr., 1963 b. 'Age Variation of Formation Stages for Ten Permanent Teeth'. *Journal of Dental Research*, 42, 1490-1502.
- Peressinotto, D., Schmitt, A., Lecomte, Y., Pouriel, R. & Geus, F., 2004. 'Neolithic nomads at El Multaga, Upper Nubia, Sudan'. *Antiquity*, 78, 54-60.
- Primeau, C., Friis, L., Sejrsen, B. & Lynnerup, N., 2016. 'A Method for Estimating Age of Medieval Sub-Adults From Infancy to Adulthood Based on Long Bone Length'. *American Journal of Physical Anthropology*, 159, 135-145.
- Reinold, J., 1987. 'Les fouilles pré- et proto-historiques de la Section Française de la Direction des Antiquités du Soudan : les campagnes 1984-85 et 1985-86'. *Archéologie du Nil Moyen*, 2, 17-67.
- Reinold, J., 1992. 'Développement d'un cimetière néolithique de type familial : le cas du cimetière néolithique d'El Kadada (district de Taragma) au Soudan central'. *Archéo-Nil*, 2, 115-127.
- Reinold, J., 2001. 'Kadruka and the Neolithic in the Northern Dongola Reach'. *Sudan & Nubia*, 5, 2-10.
- Reinold, J., 2004. 'Le Néolithique soudanais : funéraire et structures sociales'. In Guilaine J. (ed.), *Aux marges des grands foyers du Néolithique. Périphéries débitrices ou créatrices ? Séminaire du Collège de France*, 151-174. Paris : Éditions Errance.
- Reinold, J., 2008. *La nécropole néolithique d'el-Kadada au Soudan central. Les cimetières A et B (NE-36-O/3-V-2 et NE-36-O/3-V-3) du kôm principal*. Paris : Éditions Recherche sur les Civilisations.
- Salvatori, S. & Usai, D. (eds.), 2008. *A Neolithic Cemetery in the Northern Dongola Reach: Excavation at Site R12*. London : Sudan Archaeological Research Society/Oxford (UK) : Archaeopress.
- Salvatori, S., Usai, D. & Lecomte, Y. (eds.), 2016. *Ghaba. An Early Neolithic Cemetery in Central Sudan*. Frankfurt am Main : Africa Magna Verlag.

- Schmitt, A., 2005. 'Une nouvelle méthode pour estimer l'âge au décès des adultes à partir de la surface sacro-pelvienne iliaque'. *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, 17, 89-101.
- Sellier, P., 1992. 'The Contribution of Paleoanthropology to the Interpretation of a Functional Funerary Structure : the Graves from Neolithic Mehrgarh IB'. In Jarrige C., Gerry J. P. & Meadow R. H. (eds.), *South Asian Archaeology 1989*, 253-266. Madison : Prehistory Press.
- Sellier, P., 1996. 'La mise en évidence d'anomalies démographiques et leur interprétation : population, recrutement et pratiques funéraires du tumulus de Courtesoult'. In Piningre J.-F. (ed.), *Nécropoles et société au premier âge du Fer : le tumulus de Courtesoult (Haute-Saône)*, 188-202. Paris : Éditions de la Maison des Sciences de l'Homme.
- Symes, S. A., L'Abbé, E. N., Chapman, E. N., Wolff, I. & Dirkmaat, D. C., 2012. 'Interpreting Traumatic Injury to Bone in Medicolegal Investigations'. In Dirkmaat D. C. (ed.), *A Companion to Forensic Anthropology*, 340-389. Chichester (UK) : Wiley Blackwell.
- Testart, A., 2004. *Les morts d'accompagnement. La servitude volontaire I*. Paris : Éditions Errance.
- Usai, D., 2016. 'A Picture of Prehistoric Sudan: The Mesolithic and Neolithic Periods'. In *Oxford Handbook Online*. Oxford : Oxford University Press. DOI 10.1093/oxfordhb/9780199935413.013.56 (accessed 22.01.2018).
- Walker, P. L., 2001. 'A Bioarchaeological Perspective on the History of Violence'. *Annual Review of Anthropology*, 30, 573-596.

Captions of the Figures

Figure 1. Schematic plan of KDK23 burial ground, with the grave-goods as the key-feature (from white to dark purple: no grave-good or only pottery vessels to more than 15 different categories of grave-goods). The known boundaries of the cemetery are indicated by the dotted line (East and South). Drawing by P. Chambon.

Figure 2. Probabilities of death (calculation according to Sellier 1996) for the non-adult age-groups of KDK23 (N = 126) and R12 (N = 168), compared with a standard life-table from Lederman 1969 (expectancy of life at birth of 30 years, ± 2 SE). Please note that those figures are not mere percentages of the deceased. Figures for R12 are recalculated from Judd 2008, 84-86 (tabl. 8.1). Drawing by P. Sellier.

Figure 3. Orientation of the KDK23 burials (feet at the centre, head on the circumference), showing the prevailing SE-NW (49 cases) and NW-SE (31 cases) feet-head orientations over a total of 95. Stillborn, neonates and infants are in red (prevailing position: head to the NW), other non-adults in green, adults in black. Drawing by P. Chambon.

Figure 4. St.93 (drawing P. Chambon).

Figure 5. Four stages of the St.97-110 ensemble from KDK23. St.125 (child, 6-7 years old) and St. 122 (middle-aged adult female) were laid first (originally undamaged and complete), later damaged by the reopening of the grave and the deposits of St.109 (elderly adult, sex indeterminate), then St.110 (adult, sex and age indeterminate). The last step is the upper deposit of St.97 (young adult female), a complete but fully dislocated skeleton, probably coming from an earlier stage of the reopening (Drawing by P. Chambon).

Captions of the Plates

Plate 1. St.131: very wealthy burial of an elderly woman: containing many bone tools, lithic segments *in situ* corresponding to a sickle, raw bone material, a stone palette, mussel shells, flint flakes, and a bracelet in hippopotamus ivory. Most of her artefacts and her stock of bone material are gathered at her back (a kind of “tool box”?).

Plate 2. Two stages of the excavation of burial St.148 (an elderly woman), one of the wealthiest graves: five vessels (including one caliciform), many bone tools, lithics, raw bone material (mostly cattle ribs), a stone palette, mussel shells, a needle, beads (semi-precious stone and ceramic), coloured pebbles, and half of an elephant tusk (lower level).

Plate 3. St.93: hyper-flexed individual, with many burial constraints, giving evidence for the tying up and probable previous desiccation of the body.

Plate 4. St.25: stillborn/neonate burial in a prone and flexed position (“frog position”), with two pottery vessels.

Plate 5. St.37: neonate burial with two pottery vessels on the subject and an oyster shell (like a spoon into the largest pot).

Plate 6. St.134: burial of a 30-39 year old woman, with a large bucranium, two vessels, and a case or sheath made of hippopotamus tusk.

Plate 7. St.144-145: a double-burial of two adult women (buried simultaneously); on the left, St.144 shows a multifracted skull due to perimortem blunt-force trauma.

Plate 8. Two stages of the excavation of the secondary burial St.89, with a proposed reconstruction: a sort of bag containing some selected mummified remains of an adult female of 30-59 years of age (reconstruction: C. Martha).

Plate 9. St.134: perimortem blunt-force trauma at the medial (inner) part of the left hip-bone, compared to a polished stone axe from another burial (note how the edge of the axe fits the wound).

Plate 10. St.89: blunt-force trauma on left fronto-parietal area of the cranium.

Plate 11. St.89: medial and lateral view of right os coxae (hip-bone) with 3 perimortem traumas (number 1 perforated the acetabulum).

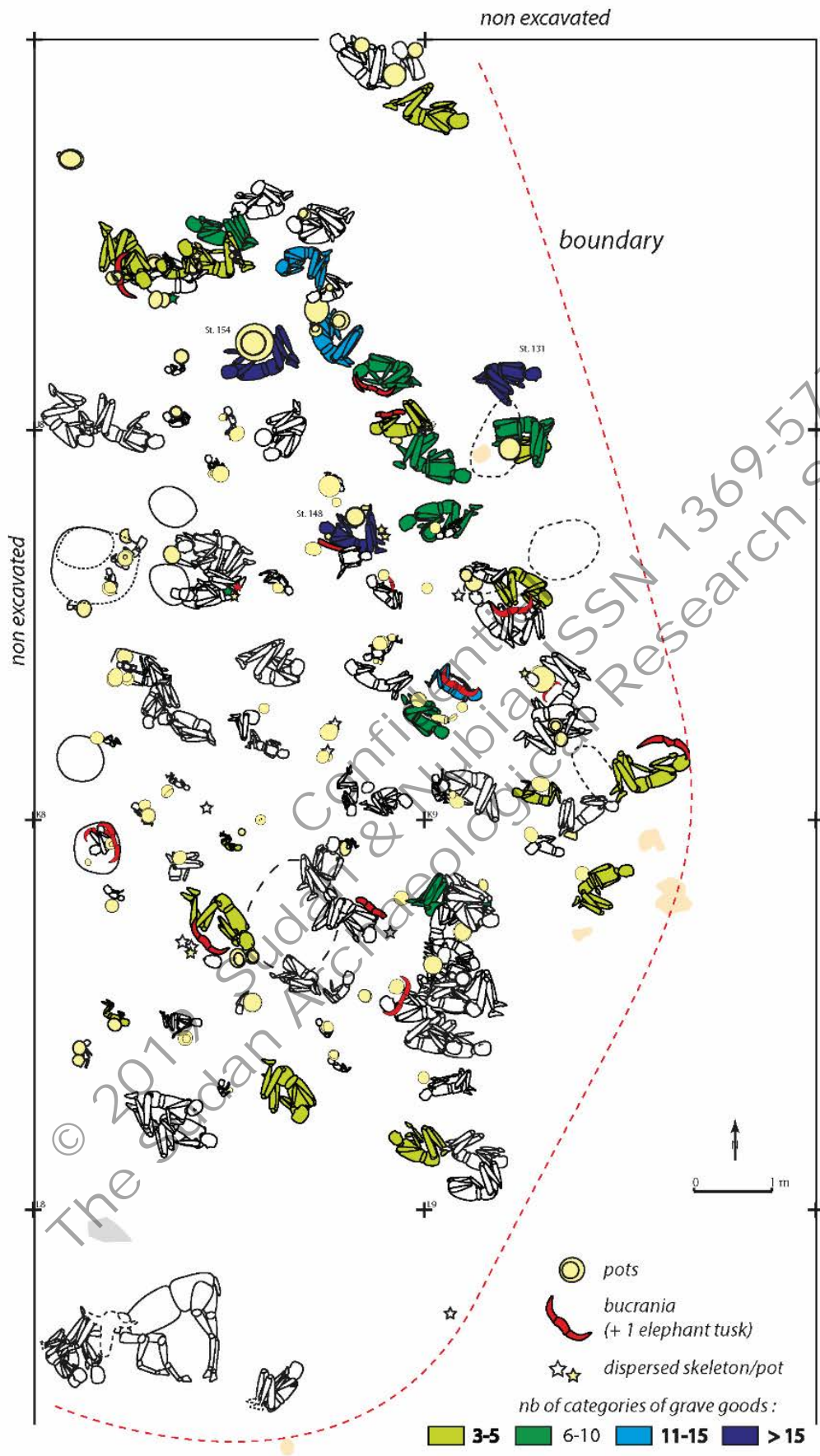


Figure 1

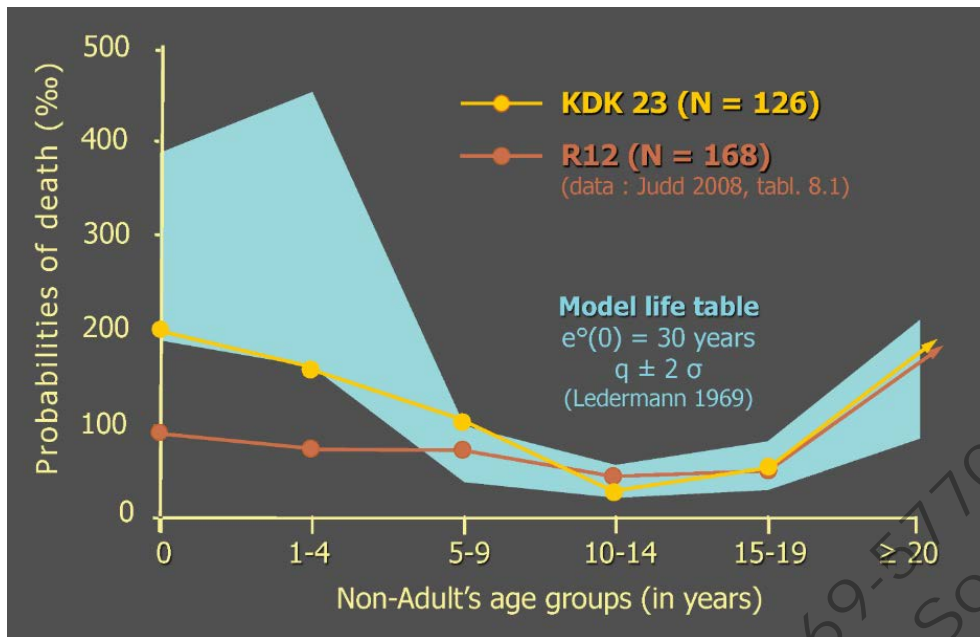


Figure 2

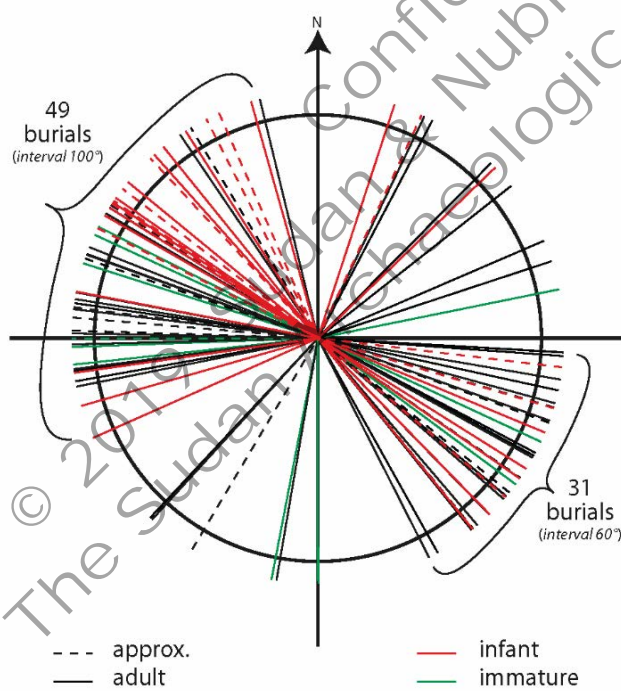


Figure 3

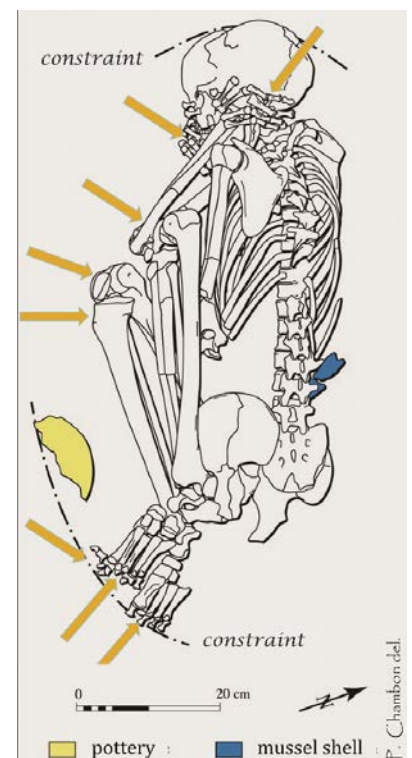


Figure 4

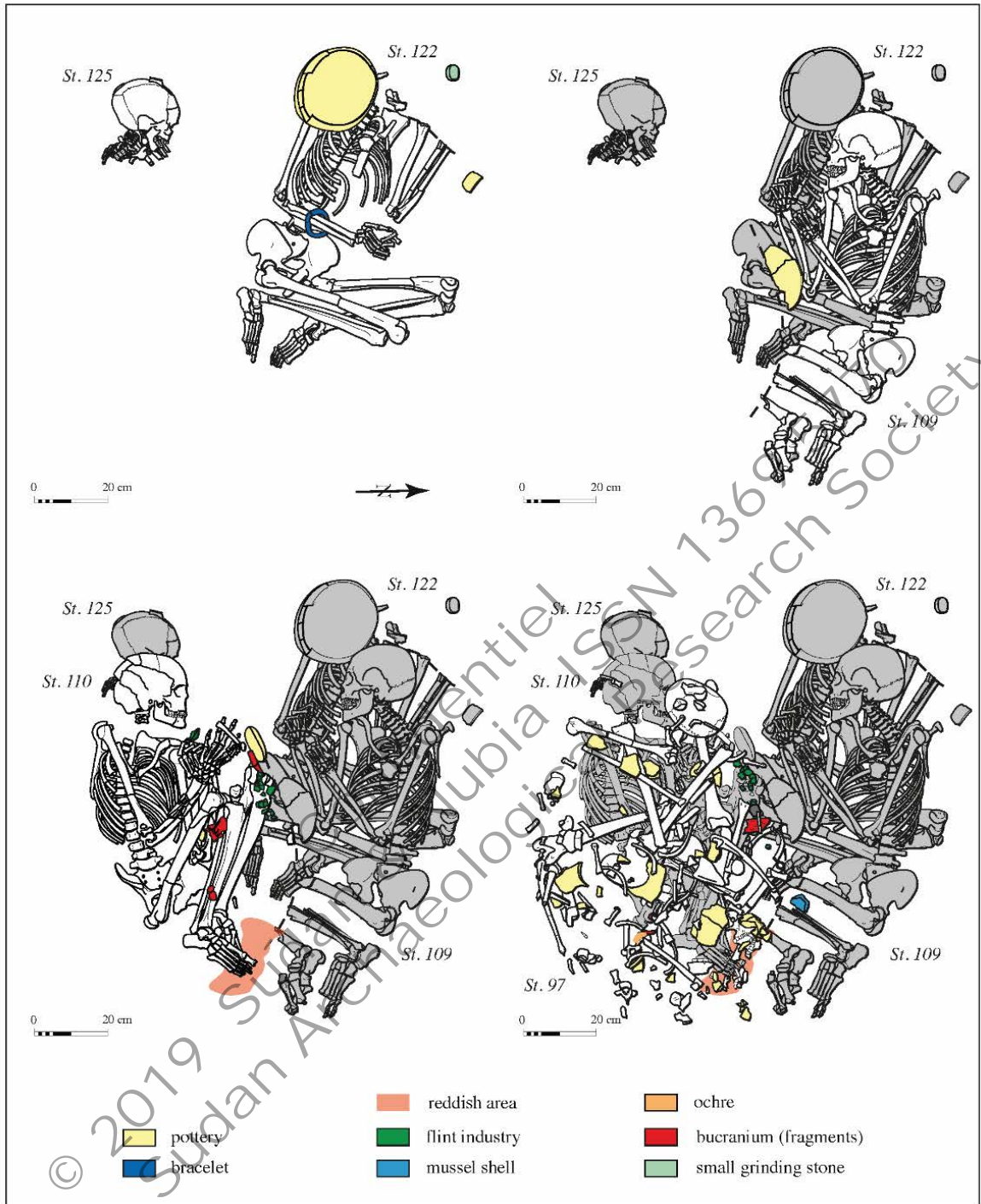


Figure 5



Plate 1

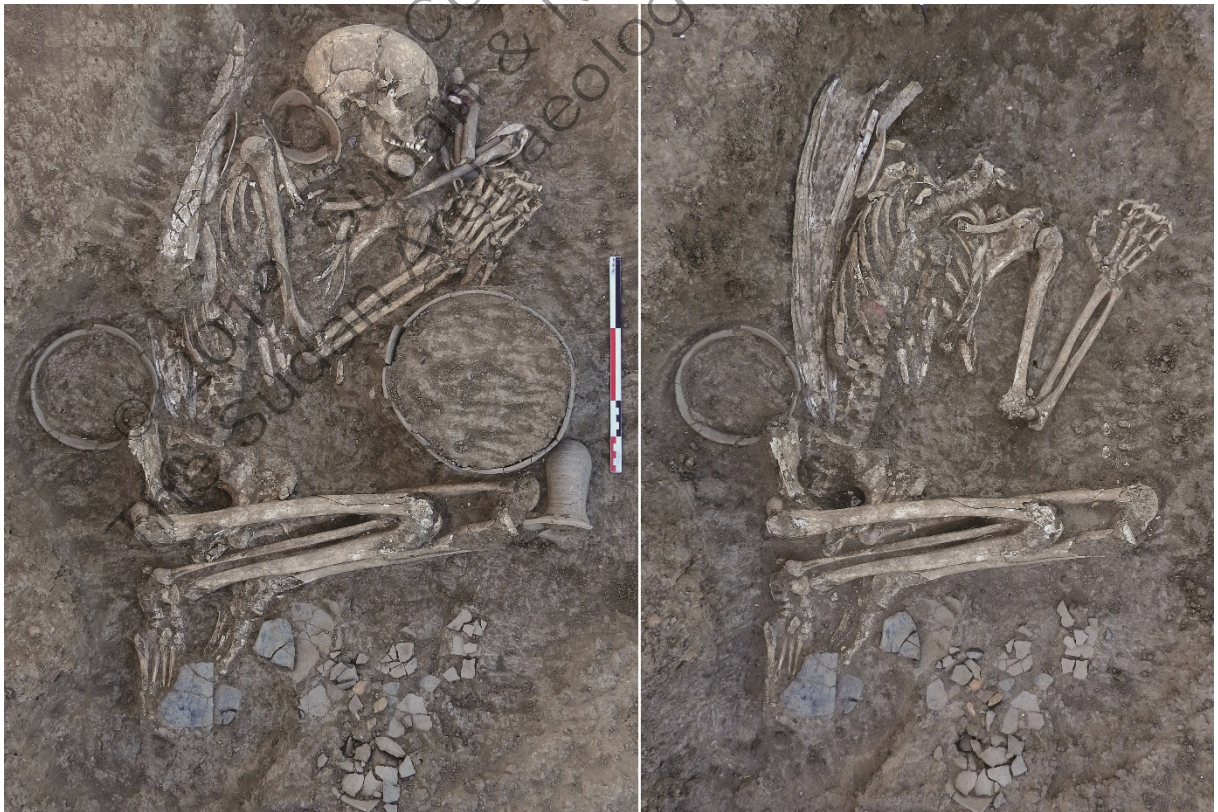


Plate 2



Plate 3



Plate 4



Plate 5



Plate 6



Plate 7



Plate 8

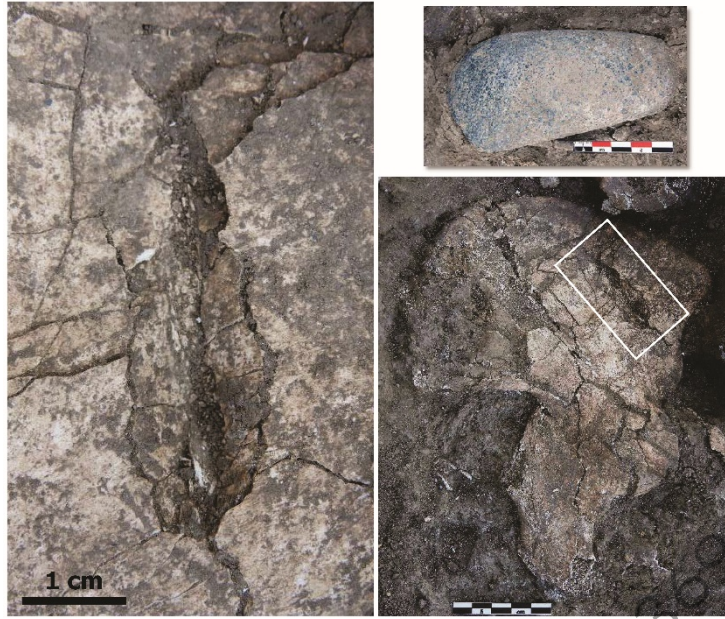


Plate 9



Plate 10

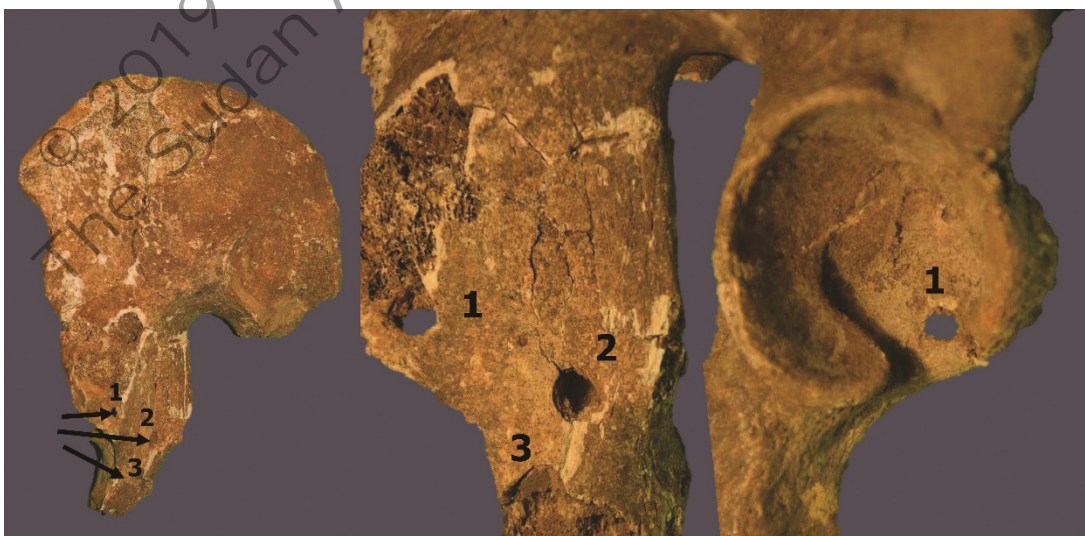


Plate 11