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Madâ'in Sâlih Report on the 2012 Season



October 2012

Foreword

The archaeological project at Madâ'in Sâlih has come to the end of its first four-year program of excavations, which covered the years 2008–2011, and has been followed by a first study season, in 2012, the preliminary report for which is in the following pages.

The detailed results of each of the four excavation seasons have been published either in a printed version (one volume printed in Riyadh in 2010) or on-line on the HAL site:

2008: printed volume. Nehmé L., al-Talhi D. and Villeneuve F. (eds) **2010:** *Report on the First Excavation Season at Madâ'in Sâlih, Saudi Arabia, 2008*, Riyadh: SCTA, 2010 (338 p.).

2009: volume of 305 p. <http://halshs.archives-ouvertes.fr/halshs-00548747/fr>

2010: volume of 314 p. <http://halshs.archives-ouvertes.fr/halshs-00542793/fr/>

2011: volume of 367 p. <http://halshs.archives-ouvertes.fr/halshs-00671451>

It seemed premature to begin a new four-year research cycle in 2013. Indeed, on the one hand there is still some material to study at the site (hence the second study season which will take place in early 2013), and on the other hand, it will be necessary, in 2013, to obtain a new excavation permit.

Introduction

The 2012 season is the first study season devoted to the material from Madâ'in Sâlih. During this season, fieldwork was limited to the restoration of certain trenches where the excavations were finished and to the geomagnetic survey of the residential area, in order to complete the coverage of all the surfaces which could be surveyed using this technique (this excludes bedrock, sand dunes etc.). This study season follows four years of excavations (2008–2011) during which a lot of material was recovered from the various trenches opened. **Furthermore, it precedes a new five-year program (2014–2018)**, the broad outline of which is presented in a separate report.

The almost systematic participation of several specialists right from the first excavation season has reduced the amount of material that needs to be studied at the end of the four years. There has understandably been some backlog in the study of the most abundant material types or where the specialists have not been able to participate in all the seasons, but that situation has been partly redressed in 2012 and the backlog will be completed during the second study season, anticipated for January and February 2013. These study seasons provide the basis for three publications, devoted respectively to Areas 1 and 2, the tomb IGN 117 and the banqueting halls excavated in and around Jabal Ithlib (see map **fig. 1**). A publication meeting, bringing together most people concerned, was organized in Paris in June 2012 in order to define a common charter for all the project's publications (standards, titles, content etc.) A reference document was created and distributed to all the authors. Finally, a large part of June was devoted to filing and managing the project's documentation (photos, plans, sections, pottery and object drawings, files etc.), so that each team member can access the documents he needs to work.

During the 2012 season, part of the field documentation which was needed to finish work in progress was also completed. This is the case, in particular, of the photographs of the monumental tombs needed for their publication, which has been too long delayed. Indeed, it was necessary to rephotograph the monuments that had metal access steps because they have been recently removed, in compliance with the UNESCO recommendations following the inscription of the site on the World Heritage List in 2008 (**fig. 2**). Furthermore, the author of the chapter on architectural decoration in the volume in preparation on the necropolises, J. Dentzer-Feydy, having established the list of figures needed, numerous photographs showing particular details of the façades were taken. Given that the lighting of the façades is very different at different times of day, this was a relatively long job.

Finally, various small field operations were undertaken by Z.T. Fiema, who made use of a week without workmen to check things in Area 9, and by F. Villeneuve, who completed his reconnaissance work on the rampart.

The table below presents the names and roles of all of this season's participants (**fig. 3**). When a preliminary report (deliberately short – this is not a pre-publication) appears in the following pages, the author's name is in bold.

| <i>Surname First name</i> | <i>Nationality</i> | <i>Affiliation</i> | <i>Role</i> |
|----------------------------|--------------------|---------------------------------|----------------------------------|
| Augé Christian | French | CNRS | numismatist |
| Benech Christophe | French | CNRS | geophysician |
| Bouchaud Charlène | French | Post-doctoral researcher | archaeobotanist |
| Dal-Prà Patricia | French | Institut National du Patrimoine | textile conservator |
| Delhopital Nathalie | French | Post-doctoral researcher | Anthropologist, Area 5 (IGN 117) |
| Douaud Rozenn | French | CNRS | draughtsperson |

| | | | |
|---------------------------|--------|----------------------------------|----------------------------|
| Eliès Sylvie | French | CNRS | draughtsperson |
| Fiema Zbigniew | Polish | Academy of Finland | archaeologist |
| Gerber Yvonne | Swiss | University of Basel | ceramicist |
| al-Hammâd 'Â'id | | SCTA | archaeologist, restoration |
| al-Hâ'itî Khaled | Saudi | SCTA | archaeologist, restoration |
| Leguilloux Martine | French | Associate researcher at the CNRS | leather specialist |
| al-Mûsa Mâher | Saudi | SCTA | archaeologist, restoration |
| Nehmé Laïla | French | CNRS | archaeologist, co-director |
| as-Sabhân Ibrahim | Saudi | SCTA, Masmak Museum | archaeologist |
| al-Talhi Daifallah | Saudi | University of Hâ'il | archaeologist, co-director |
| Villeneuve François | French | University of Paris 1 | archaeologist, co-director |

Restoration

Restoration work was undertaken by the Saudi members of the team, in two teams of two archaeologists, who took care of the partial restoration of Area 7, excavated by D. al-Talhi between 1986 and 1990, and of Area 2, excavated between 2008 and 2011 by Z.T. Fiema and J. Rohmer (**figs 4–5**). The 1,300 mudbricks made in 2011 (see the 2011 report, p. 15) were used to reconstruct one or two courses of the walls (**fig. 6**) while the clayey mortar, made from the “recipe” perfected in 2011, was used for the joints. One or two courses of the stone walls were also reconstructed (**fig. 7**), using sandstone blocks that have been specially re-cut by Afghan masons, who are known for their competence in this field. Insofar as the trenches had been covered with hessian canvas and sand after the excavation, the restoration required a lot of preliminary cleaning.

This work will continue in 2013, mainly in Area 2, where the restoration should be completed. For a complete report on the restoration, see the text in Arabic by I. as-Sabhân.

Geomagnetic survey

by Christophe Benech

The third season of geomagnetic survey on the site of Madâ'in Sâlih was carried out between 13 January and 4 February 2012 and covered 10.25 ha (**figs 8–9**). The aim of this season was to complete the geomagnetic map from the two preceding seasons. This map had revealed the spatial organisation of the residential area and had allowed the street network of the ancient town to be outlined.

The 2012 survey concentrated on the north-eastern part of the residential area. This is a heavily eroded area in which the underlying rock is visible on the surface in many places. In spite of this, it was interesting to cover the area in order to look for the presence of any remains which might have partly survived erosion and then to see how they might be integrated, by their position and orientation, into the known urban plan.

A few supplementary areas were also covered in the south of the residential area, in sectors accessible by the survey. Sand dunes, which are numerous in this part of the site, were therefore excluded because the results from the previous season showed that as soon as the sand is more than 1 m deep, the presence of any remains is masked.

The geomagnetic survey was carried out using the same equipment and the same methodology as before: measurements were taken with a G-858 Cesium magnetometer (Geometrics) measuring a vertical gradient. The recording speed along the grid lines was 0.1 seconds, in other words a measurement about every 10 cm along parallel lines spaced 1 m apart.

There were technical problems with the machine at the end of the season and this prevented the completion of a few squares in the northern part. These might have shown whether the wadi which drains the water northwards from the centre of the residential area reused the line of a hydraulic feature (channel or drain) dating to the period of occupation of the site.

Southern area

A few additional buildings have been identified in the south-western part, to the south of Area 9 (**figs 10-11**). There, we have observed a new change of direction in the orientation of the buildings, towards the east. As had been observed last year in other sectors, the orientation of the buildings seems to follow the topography: the change noted in 2012 marks the southern limit of the central depression of the residential area.

In this sector, it is difficult to see the street alignment because the area has been disturbed by a large ravine. Even the extension of the north-south street, which has already been recorded, remains problematical.

A little further south and separated from the previous sector by a sand dune, it was possible to cover an area of 0.5 ha (A on **fig. 10**). This sector is bordered on the east by an old military camp, the remains of which cause strong disturbances of the geomagnetic data, and on the south and west by a rock massif. Nevertheless, the plan of regularly oriented, rectangular buildings appears clearly in this small area. Their orientation is the same as that revealed in different parts of the site last year and which is also found again in rock-cut structures on the southern edge of the survey area.

Further east, an area of 1 ha was surveyed between two rock massifs which mark the southern edge of the residential area (**figs 12-13**). Unfortunately, some technical problems with the gradiometer make the map difficult to interpret. In the northern part, there are a few walls partly visible on the surface. They seem to have the same orientation as the structures in the previous sector. Further south, there does not appear to be any more constructions, but the quality of the data is such that it is difficult to determine the edge of the urban area in this part of the site with any certainty.

A little further north, the widening of the band surveyed last year disclosed an additional street, oriented north-south, with a relatively twisted course, which links up with one of the east-west streets already mapped (see **fig. 11**, in pink). This new street follows the general orthogonal plan, but there is no distinguishable extension to the north.

Around IGN 132

All the area around massif IGN 132 was covered this season (**figs 14-15**). The geomagnetic map shows a great density of buildings, which fall along two different orientations: the first (orientation 1) follows the orthogonal plan and is found on the west and south sides of the massif; the second (orientation 2), which was already visible in 2011, spreads across the north and east sides of the massif at an angle of approximately 36.6° E. The structures that follow orientation 2 are organized according to an orthogonal scheme and their maximum extent is fairly clear to the north-west and south-east. However, to the north-east, part of the structures seem to have disappeared due to erosion. To the south, a few traces appear in the middle of the buildings that follow orientation 1, which demonstrates clearly that orientation 1 is more recent than orientation 2. Orientation 2, which thus seems to be the

oldest one detected by the geomagnetic survey, is also identified in the form of long linear anomalies, particularly visible to the south of the massif, but whose origins remain unknown. These lines are recognizable on the surface and on the aerial images by the bushy vegetation which seems to grow better there.

Orientation 1 varies slightly in the south, by about 5°, in relation to the constructions and the wide east-west street located to the west of the massif. This street seems to continue, but with a dog-leg which lies in the unsurveyed part to the south of the massif and which is clearly needed to skirt around the massif. A few other structures also appear a little further south, but with a stronger deviation, approaching 15°. The hill in this sector, which had already been identified as man-made, seems to cover remains that are partly visible on the surface as well as on the geomagnetic map.

Around IGN 131

The sector north of massif IGN 132 is particularly eroded and the bedrock is exposed on the surface in many places. A few remains are, nevertheless, visible. Firstly, there is a strong magnetic anomaly whose origin, certainly man-made, remains enigmatic, but its orientation is clear and corresponds to orientation 2 of the structures further south.

A few other wall lines appear on the geomagnetic map, notably all around massif IGN 131, and they all follow orientation 1 (**fig. 16**). The continuation of the line of the north-south street that runs alongside trenches 2 and 8, identified during the previous season, is less clear further north. The 0.5 ha area over which the magnetometer did not work, clearly visible on the image, prevents us from seeing if it can be detected further north.

Finally, in the north, the line of the rampart is clear but the geomagnetic map does not add anything new to the configuration of this sector. The track that appears to the east of the mushroom Marbat al-Hisân represents the magnetic response to the road that used to pass that way, and not to the line of an ancient street.

Eastern sector

The survey covered 1 ha in the eastern part of the residential area, between the two enclosures (**fig. 17**). This area was chosen because of the limited accumulation of sand and because a few wall lines were visible on the surface. The geomagnetic map revealed a few structures which have resisted erosion. All follow orientation 1.

Northern sector

A test survey was carried out at the northern edge of the residential area, where excavation had uncovered a section of rampart and a few walls (**fig. 18**). The sector to the east had already been surveyed in 2010 and had revealed the line of the rampart. The area surveyed being quite limited, it is difficult to provide a precise description of the results, but it is clear that there are some structures against the rampart, either parallel or perpendicular to it.

Conclusion

This latest geomagnetic survey season has allowed us to cover virtually all the suitable sectors in the residential area, including several sectors at the edges of the ancient town, to the south-east, east and north. The results show that the orthogonal orientation (orientation 1 in this report) is found in many places, even if it was clearly altered subsequently. We do not have sufficient street alignments to confirm the coherence of an orthogonal plan inspired by the Hippodamian plan, but the fact that the same orientation is found in widely separated areas of the site suggests a program of urban planning across the whole of the ancient town. Such a plan was not necessarily fully implemented everywhere; for example, in the sector of massif IGN 132, an older organization based on a different plan (orientation 2) was partially “spared”. The heavy erosion that has affected all the north-eastern area prevents us from evaluating the density of occupation in this part of the town, but one can imagine that the few identified remains did not exist in isolation.

Study of the archaeobotanical remains

by Charlène Bouchaud

Sampling and processing

The aim of the post-excavation season was to process the sediment and artefact samples taken in 2011 (and earlier) and to prepare the archaeobotanical remains selected – seeds, fruits and carbonized and dried wood – for export to France.¹

The flotation machine was not used this year because of the construction of new buildings at the al-‘Ulâ museum, which prevented the correct disposal of the muddy water after flotation. Therefore, it was decided to dry-sieve the bags of sediments, sometimes with some manual flotation, particularly for samples rich in carbonized material. The sieves, with a mesh of 0.5 to 2 mm, were bought locally (flour sieves).

The following stratigraphic units sampled in the residential area and in tomb IGN 117 were selected for study (the majority of the archaeobotanical remains being preserved by carbonization, the stratigraphic units which contained dried material are followed by (d)):

10260, 10311, 10312, 10313, 10315, 10318, 10322, 10325, 10328, 10329, 10330, 10332, 10334, 10335, 10336, 10337, 10338, 25251B, 25415, 25417 (d), 27201, 27202, 27223, 27251, 27256, 50277, 50240 (d), 50295(d), 50298 (d), 50307 (d), 50308 (d), 50312 (d), 50327 (d), 60683_VS01 (d), 60687, 60690, 60700, 60701, 60705, 80224, 80233 (d), 80250, 80260, 80261, 80262, 80266, 80267, 80268, 80273, 80277, 80278, 80279, 80280, 80285, 90041, 90043, 90044, 90051, 91013.

Also, small fragments of desiccated worked wood found in IGN 117 were sampled (boards, tenons, pegs etc.): 50083_W02, 50223_W02, 50226_W08, 50228_W03, 502548W01, 50255_W01, 50256_W01, 50273, 50278_W01, 50281_W01, 50283_W01, 50288_W01, 50290_W01, 50291_W01, 50291_W02, 50294_W01, 50296_W01, 50298_W01, 50298_W02, 50301_W01, 50302_W01, 50303_W01, 50307_W01, 50308_W03, 50310_W02, 50310_W03, 50312_W01, 50312_W02, 50312_W03, 50317_W22, 50317_W24, 50329_W01.

All these samples are in the store-room of the “Hellenistic and Roman Near-East” team, in the Maison René Ginouvès in Nanterre. The analyses (morphological and anatomical identifications) and the interpretation will be carried out over the course of 2013.

The discovery of a date necklace

The most important discovery is that of the burial apparel of the occupants of tomb IGN 117. During this study season, the presence at the same time of the anthropologist, Nathalie Delhopital, of the textile specialist, Patricia Dal Prà, and of the leather specialist, Martine Leguilloux, led to the re-examination of some of the finds uncovered in previous years, notably those associated with the dressing of the bodies. The cleaning of two large pieces of mixed leather and textile (50083_T01 and 50240_L02) brought to light fragments of a desiccated date necklace – an unprecedented discovery in the Nabataean world.

Piece 50083_T01 was found in area A, on the chamber floor (see **fig. 65**). It is composed of superimposed layers of leather, cloth and a mixture of grease and a resinous material,² and it seems to be the part of the

1. Archaeobotanical laboratory of the National Museum of Natural History, UMR 7209, Paris and Maison René Ginouvès, UMR 7041, Nanterre.

2. On the contents of these compositions, see Mathe C., Archier P., Nehmé L. and Vieillescazes C., “The Study of Nabataean Organic Residues from Madâ’in Sâlih, ancient *Hegra*, by Gas Chromatography-Mass Spectrometry”, *Archaeometry* 51.4, 2009, p. 626–636. They are fatty acids (vegetal oils) and triterpenic components (the presence of α - and β - amyryn shows that these resins belong to the Burseraceae family, genus *Canarium*), and the considerable proportion of pentacyclic alcohols seems to indicate an elemi resin such as the African elemi. An additional analysis, carried out by C. Vieillescazes in 2010, showed the presence of another triterpenic resin, also belonging to the Burseraceae family – “real frankincense” (*Boswellia* spp).

shroud that covered the head (**fig. 19**). Four dates were found wedged in the roll that was probably at the back of the neck (**fig. 20–21**). They are attached to each other by a stalk or thread of plant material (**fig. 22**). Three imprints of dates are visible and there seems to be two more dates but they are hidden under a layer of bitumen.

Piece 50240_L02 was found near the previous one and represents the part that covered the right arm (**fig. 23**). The superposition of layers of leather, cloth and resin is identical to the first piece, and five dates attached by a small cord were also found in the folds of the cloth. The first three dates are parallel to the imprint of the arm and the next two are slanting slightly in the direction of where the torso must have been (**fig. 24**).

Since the superposition of the various materials is identical in both pieces, one can assume that they belonged to the same individual. The identification of the bones which correspond to these pieces confirms this assumption. The work and exchanges which this discovery generated between the various specialists has given rise to a few hypotheses on the method of inhumation of the individual: unclothed (see the report by M. Leguilloux), it was covered with substances composed of resins and fatty acids *before* a loose, long date necklace was placed along the front of the torso. The body was then wrapped in pieces of cloth and leather (for the various wrappings on the body, see the report by M. Leguilloux).

Regarding the date necklace itself, one can see that on both pieces the cloth is pleated at the level of the necklace, which leaves an empty space larger than the fruits themselves. This suggests that the dates were bigger at the time of the inhumation, probably more fleshy, and that they desiccated slowly, reducing in size accordingly. A loose date found in stratigraphic unit 50083 (**fig. 25–26**) and one taken from those associated with the leather and cloth piece (**fig. 27–28**) have been carefully examined. The fruits are perfectly preserved and very dry. The stones are present and the fruit is pierced in order to thread the small cord through. Another date of very similar appearance³ was found in the same area and was cut in half (50298_VS01, **fig. 29**) revealing that the stone had been pierced to allow a small cord to be threaded through. This demonstrates the use of a fairly accurate piercing technique.

This discovery is without precedent in the domain of Nabataean burial practices. It provides a new example of apparel associated with a body. The date necklace has no archaeological parallels. Necklaces of date flowers have been found in Roman Egypt but the fruits do not seem to have been used.⁴ A few rare, contemporary, examples can offer some comparative elements. Thus, we note the presence of dates in amulets making up the necklaces offered to babies in the community of the Tabelbala oasis in the Algerian-Moroccan Sahara: “Dates, a synonym for abundance, prosperity, multiplicity, produce a beneficial force”.⁵ In Egypt, there is a custom that travellers wear a date necklace around their necks, which provides them with a source of nourishment.⁶ A more detailed study of the objects and of archaeological, ethnographic and literary sources should allow us to judge the relevance of these analogies.

3. We assume that the fruits found loose in the sediment were part of the same necklace given their proximity with the pieces studied.

4. Schoske S., Kreissl B., Germer R., “*Anch*”, *Blumen für das Leben. Pflanzen im alten Agypten*. Staatliche Sammlung Ägyptischer Kunst, Vertrieb, K. M. Lipp, München, 1992.

5. Champault D. ‘Un collier d’enfant du Sahara algéro-marocain’, *Journal de la Société des Africanistes* 26, 1956, p. 198.

6. Personal communication, Cairo.

Textiles

by Patricia Dal-Prà

For the words followed by *, see the glossary.

The study of the textiles found in tomb IGN 117 continued in 2012. All the textile fragments found since 2008, which have been stored in good conditions of conservation in the museum stores, were spread out, numbered and classified by type. This arranging and preliminary sorting, which took about half the time available in the field, allowed a selection of around fifty pieces of cloth or groups of cloth to be selected for study. Few technical details were observed. A few selvages* were noted (50226_T22, **fig. 30.1**), some *cordelines** (50159_T01, **fig. 30.2**) and a few seams. Only one group of fragments has fringes (50226_T22, **fig. 30.3**). These fragments are all in plain* weave*, except for four of them which are in braided* weave (50312_T03, **fig. 30.4**, 50276_T03, 50253_T02), one derived from plain weave,⁷ and one fragment has tapestry (50240_T11, **fig. 30.5**).

The stratigraphy of the cloth wrapping the bodies is the same for all the fragments which have a complete series of leather and cloth (500283_T01 and T02 amongst others, **fig. 31–35**): under the leather there is a raw linen cloth which we called “thick cloth”. This coarse material covers a second cloth of raw linen, designated “fine cloth”. This in turn protects a very tight, red-coloured cloth, which is in direct contact with the body covered in resins and fatty acids.

The threads of these materials are simple, with an S-twist. The coloured cloth might be wool; the fibres and colouring will be analysed in order to identify them. Between the cloth layers there are layers of a hard, black substance of varying thickness (from 1 cm to 0.1 cm).

Thus, we can see the choice to use finer and finer materials to wrap the body, the cloth touching the body being of excellent quality.

The three pieces of cloth which covered the body were kept in place with straps. Of 131 fragments, 27 were selected for study because of their representative nature and the technical details they displayed. The straps are between 2 and 3 cm wide. They are made of raw linen, in *louisine** weave (50168_T04, **fig. 36.1**), with simple S-twisted threads.⁸ They were crossed over, then probably knotted, as demonstrated by fragments 50226_T05 (**fig. 36.2–36.3**), 50226_T24, 50229_T02, 50370_T05 (**fig. 37**) which are still associated with some linen cloth. However, no knots have been found.

These straps are often folded over and deformed by the tension they were subjected to when they were crossed over on the cloth (**fig. 38**),⁹ one of them is doubled over (50298_T02, **fig. 39**) and another is associated with goat leather (50302_T04, **fig. 40**).

Some fragments of small cords were also found but unassociated with any cloth (**fig. 41**).

The main result of this study season, apart from reviewing all the textiles and making the selection of the most representative pieces, is to have shown the succession of the three layers that covered the body of the dead before the final covering with a layer of leather.

7. Cloth in braided weave has been found in the excavations at Khirbet adh-Dharih.

8. Similar straps have been found in the excavations at Khirbet adh-Dharih.

9. 50088_T04, 50088_T05, 50205_T04, 50226_T05, 50273_T06, 50302_T04, 50370_T04.

Glossary:

- weave: style of crossing-over of the warp and weft threads
- *cordeline*: thick thread or bundle of a few threads joined to the outer edge of the selvedge to reinforce and fix the weft.
- selvedge: narrow edging formed on each side of the cloth.
- *louisine*: derived from of plain weave in which the warp threads are grouped in twos or more.
- braided: derived from plain weave in which both the warp and weft threads are grouped in twos or threes.
- plain (or tabby): weave in which the ratio is limited to two warp and two weft threads and in which the odd and even warp threads alternate with each pass of the weft, under and over the weft.

Study of leather objects from tomb IGN 117

by Martine Leguilloux

This report looks at the leather objects found in tomb IGN 117 during the 2008 to 2011 excavation seasons. The state of preservation of the pieces studied varies but is always reasonable in spite of their very fragmentary condition. The objects were made from tanned sheep and goat leather. They are very fine and of very good quality, the result of meticulous tanning. Leather was only rarely re-used.

The finds fall into three distinct types of objects, all associated with burial:

- shrouds, which covered the bodies and formed the fourth and final wrapping, the first three being made of linen cloth impregnated with gum Arabic resin. This final layer completed the wrapping of the body;
- the straps, which were used to keep the layers of cloth and leather in place around the mummy;
- shrouds for transportation, large pieces of rectangular leather used like a stretcher to carry the body to the tomb, and which was then used as a cover over the body.

Leather shrouds

This is the most common category of objects found. The shrouds were in contact with the layers of resin-impregnated cloth. The leather, which is very thin (0.8 mm thick on average), has become rigid and breakable, which explains the large number of fragments.

Manufacturing technique

These leather wrappings were made in the following way: rectangular panels were assembled with double seams of very tight stitching (5 stitches per cm). The main characteristic of these seams is to have been made using two different types of stitches: one first row is a straight stitch (**fig. 42**: seam A) the other is a row of overedge stitches (**fig. 42**: seam B). The panels were assembled in pairs, the edges of each overlapping by about 2 cm and then sewn together with the double seam.

The number of panels necessary for the creation of these shrouds is unknown and it is also impossible, for the time being, to know their finished size, though they must have been sufficiently large to wrap the corpse. Some pieces have many folds and thicknesses.

A rectilinear form was given to the mummy by tightening the extremities (head and feet), which would explain the shape of certain pieces (**figs 43–44**: 50088_L01).

The successive layers of textile and leather were bound with straps which kept the whole together. The straps were placed perpendicular to the length of the body and spaced about 7 cm apart. These bindings were tied

while the resin was still fresh, as is indicated by the negative impression they made when compressing the layers (**figs 43, 45**: 50292_L01).

The straps

The second most frequent category of objects is the leather straps. The binding of successive layers of cloth and leather was largely done using twisted strapping. A few fragments of braided binding indicates that a different type of strap was sometimes used.

Their traces are easily identifiable on the pieces on which they left an impression. The distribution of the binding was usually parallel and at right angles to the length of the body (for example 50168_L02, 50292_L01, see **figs 43, 45**). On some pieces, one can see some crossing at the shoulder level (50229_L03, **fig. 46**). Since these twisted bindings did not come in contact with the embalming resin, they have remained supple. However, they have been fragmented by the exposure of the mummies during the looting of the tombs, a fragmentation made easier by their method of production, which used no seams.

Manufacturing technique

All these straps (with the exception of the binding which is braided using three straps) were made using the same technique: strips of leather, 2 to 3 cm wide, were twisted until they rolled in on themselves. They were then lengthened by interweaving one end into new twisted strips (**fig. 47**, I and II). This technique allows long lengths of strapping to be made quickly with which one could achieve several revolutions around the mummy (**fig. 47**, III).

Many straps were linked with knots: three knots were observed, but the majority of pieces were knotted using two techniques (**figs 48**, B and C, **49**).

These knots must represent the final fixing of the straps around the mummies. However, a few might have been used to fix straps used for transporting the body to the tomb: in fact, some pieces of transportation shrouds had handles that still had fragments of twisted straps in them when they were discovered.

Transportation shrouds

Leather that has been in contact with resin is breakable and of a dark colour, unlike to the leather used for the transportation shrouds, which looks like chamois leather. Lighter in colour and thicker (1 mm and 1.2 mm), it has retained its pliability because it was not impregnated.

Unlike the leather shrouds destined to wrap the body, these open, rectangular pieces of leather have many additions sewn on: edging around all the edges and handles for gripping, three models of which at least were distinguished. They are identical from the point of view of the method of manufacture but they can be differentiated by the shape of the handles and certain decorative elements.

Manufacturing technique

These shrouds seem to have been destined only for the transportation of the bodies because they were free of any elements used in mummification (gum arabic, cloth). They differ in the details of their decoration, but they were made according to the same principles:

1/ They were composed of large panels assembled in fours with overlapping edges sewn together using specific stitching (**fig. 50**, I). The most common type of seam, with two rows of stitches, used two types of stitches, one row of overedge stitches and one of straight stitches. This method of stitching looks similar to that of the shrouds, but the stitches are larger (the overedge row at 1.5 stitches per cm; the straight stitch row is tighter but still done in a fairly open way, with 2 stitches per cm). The panels were then attached using three crossed seams: two lateral seams to attach the small sides – seam 1 to join panels A and B (**fig. 50**,

Seam 1), seam 2 for panels C and D (**fig. 50**, Seam 2) – and a central seam joining the two parts (**fig. 50**, Seam 3) (see photo **fig. 51**).

Two of the registered pieces are sewn differently, with one or two strips sown on flat over the joins between the panels (**figs 52–54**).

2/ The edges: the large pieces of leather are finished with edging consisting of a strip of leather sewn in place over the edge with a straight stitch (section A on 50226_L06: **figs 55–56**). This stitching was loose, with only 1 stitch per cm. Some edges also had bands sewn along them which served both as a decoration and as a reinforcement (section C on 50240_L03: **fig. 55**).

3/ Handles: apart from the method of assembly common to all the pieces, the shrouds/stretchers were equipped with handles to facilitate manipulation and transportation. Three distinct types of handles have been recorded (**figs 57–59**).

In two out of three cases, the handles point towards each other (**figs 60, A, 61**), but in each case there had to be some symmetry allowing the passage of the strap through the holes (for 50304_L01 and 50229_L06). In the case of 50229_L07, however, the hole is oriented at right angles to the edge (**figs 62–63**).

Two of the transportation shrouds were decorated with a leather band (50283_L01 and 50296_L01) positioned below the edge. In example 50296_L01, the decoration is completed by an S-shaped seam in straight stitch (**figs 60, B, 64**).

To conclude, the study of the leather helps us interpret the sequence of events of Nabataean burial ritual. Analysis of all the leather pieces has allowed us firstly to establish that the body was buried without clothes or shoes. It was placed in three layers of cloth impregnated with resin. The fourth wrapping was of leather, and the whole was fixed using bindings also of leather. Lastly, the body was deposited on an open leather wrapping which had been used as a stretcher to bring the mummy to its final resting place. These objects display some decorative elements of quality and their presence in the tomb indicates that this last wrapping was also used as the final shroud for the mummy.

Study of the bones from tomb IGN 117

by Nathalie Delhopital

During the 2012 season, the study of the bones from tomb IGN 117, excavated between 2008 and 2011, was completed. This work was carried out in two parts. Initially, we did the biological study (age, sex, metric and non-metric characteristics, pathology) of the bone found in area D during the 2011 season (**fig. 65**). Subsequently, we calculated the minimum number of individuals and looked for matching pairs. This work had several aims: to obtain the number of individuals buried and to understand how the bones had been displaced within the tomb.

Method

When faced with a multiple burial, an essential stage of the study is to estimate the minimum number of individuals (MNI) buried. The original number of individuals can never be known (Poplin 1976). The presence of many bones makes it difficult to count the number of individuals, a task often made more complicated by the fact that certain bones may not be preserved or may have been removed as part of the preparation for later burials and/or looting (Sellier and Guillon 2001). The MNI can provide insight into funerary customs. Indeed, it determines the proportion of bones relative to each other and thus the possible

presence of a secondary burial can be identified (Duday 1981; Chambon 1999). Creating comparative diagrams of different MNIs obtained by bone category shows the under- or over-representation of certain bones. This MNI is estimated based on the counting which is done in several stages (Villena-I-Mota 1997; Boulestin 1998), that is the MNI by frequency and the MNI by exclusion.

Results

Results of the study of area D

The minimum number of adult individuals for area D is seven. This number was obtained from only three bones: the cuboid, the 5th metatarsal and the first cervical vertebra. In area D, the bones of five adult individuals are well represented, so it is likely that the additional bones came from other areas. We recorded six immature individuals: two perinatals, two individuals aged 0 years, one aged 1–4/5–9 years and one aged 5–9 years. Thus, we have a total of at least eleven individuals for area D.

Around fifteen skull fragments belonging to a single skull were found in area D (**fig. 66**), as well as four hyoid bones¹⁰ and four mandibles. These elements allow us to suggest that all the skulls but one were displaced when the skeletons had completely decomposed because the mandibles and hyoid bones remained in area D. During the 2009 season, we noted an accumulation of skulls in the upper part of the pit-tomb, area B (**fig. 67**), and it is, therefore, very likely that these skulls came from area D.

In area D, we also noted the almost total absence of lower limbs (femurs and tibias); only two complete femurs and a few tibia fragments were found (see **fig. 66**). During our study, we were able to join the tibia fragment 50274_19 from area D with fragment 50178_20 from the pit-tomb.

These discoveries allow us to put forward the following hypothesis: the individuals in area D were buried lying east-west with the head to the west (cf. 2011 report, p. 82). Once completely decomposed, the skulls were picked up and moved towards the pit-tomb, as were the lower limbs (femurs and tibias). In the place where the lower limbs should have been, a sack containing hundreds of dates was found (cf. 2011 report, p. 82). Preparation for later burials in this part of the tomb is a possible explanation, but the complete absence of articulated bones equally suggests the possibility of looting.

Preliminary results on the MNI and on matching pairs in tomb IGN 117

The study, which included all the bones from the tomb, allowed many bones to be joined and thus some new measurements could be taken, all the while paying attention to displacement of bones within the tomb. For example, of the forty-four right and forty-one left humeri counted, thirteen matching pairs were found; for the mandibles, forty-eight were counted of which twelve were glued back together.

It is very difficult to reconstruct an individual adult, particularly in the context of a collective tomb containing more than fifty adults. Pairing is usually limited to a single right or left bone (a humerus, for example) but it is difficult to reconstruct, for example, all the upper limbs, except in cases where there is pathology or particularly robust or gracile bones etc. Reconstruction is easier for immature individuals because they are less numerous and there is a difference in maturity between the individuals. All the results have not yet been analysed, but we can already say that the tomb contained fifty-one adults and twenty-nine immature individuals.

10. It is found above the larynx, in the anterior part of the neck, below the base of the tongue.

Whilst working on the pairing, we partly reconstructed the skeletons of two female individuals, one an adult (Sq-A1)¹¹ (fig. 68) and the other aged between 15 and 20 years (Sq-I1)¹² (fig. 69); this was done by observing the preservation of the body, the presence of any pathologies and the location of the various bones in the tomb. These individuals were well preserved (remains of skin) and the bones were found in or near coffin 1. Individual Sq-I1 had a ring on the left ring-finger, as did the female individual 50238 found in the bottom of the pit-tomb in 2009 (cf. 2009 report, p. 172–173). We noted that the right hand of the adult individual Sq-A1 was perfectly preserved, whereas the 4th metatarsal of its left hand had been removed (the only missing finger). This might indicate that individual Sq-A1 was wearing a ring on the ring finger, like adolescent Sq-I1, and that the finger might have been torn off to take the ring. Insofar as the two individuals Sq-A1 and Sq-I1 are the best preserved in the tomb and probably come from coffin 1, we might wonder whether these individuals might have been the object of a particular effort to preserve the bodies.

Conclusion

Eighty individuals were placed in tomb IGN 117, in shrouds and coffins accompanied by objects. The individuals were buried in different areas of the tomb: first on the ground in area A, then in the pit-tomb before it served as a dump area in order to place new individuals in area A. Subsequently, some individuals were placed in area D. These last required the displacement of skulls and lower limbs in preparation for burial. Individuals were later (or at the same time as those in area D) buried in area C.

It is interesting to note that only the individuals in area A underwent mummification processes, in particular those found in the coffin.

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11. We designated this skeleton Sq-A1 because the bones came from several *loci*: 50168, 50226, 50229, 50232, 50240, 50314.

12. We designated this skeleton Sq-I1 because the bones came from several *loci*: 50090, 50094, 50124, 50168, 50226, 50233, 50240, 50264, 50278, 50283, 50295, 50290, 50295, 50299, 50303, 50314.

Archaeozoology

by Jacqueline Studer

The archaeozoological analysis of the 2012 study season at Madâ'in Sâlih took place from 13 January to 5 February. The aim was to complete the data acquired during the preceding two seasons, in order to gather the maximum amount of information about the exploitation of domestic and wild animals coming from areas of the site that will be discussed in forthcoming monographs. Over the three weeks we analysed 6805 remains weighing a total of 20 kg, coming from Areas 1 and 2 and from burial contexts (IGN 117, Area 5). Singularly rich in bones, Area 1 deserves all our attention, all the more so since the archaeological layers, for the most part, are dated and not disturbed. The fauna was, however, too abundant for it all to be studied in so short a time. Therefore, a priority list of *loci* was drawn up in close collaboration with Guillaume Charloux and the two ceramicists, Caroline Durand and Yvonne Gerber, taking into account the archaeological data and the dating based on the ceramics and, to a lesser extent, the condition and quantity of the bone material. The *loci* chosen in 2012 are the following: 10057, 10059, 10061, 10071, 10085, 10096, 10130, 10133, 10146, 10148, 10151, 10154, 10156, 10157, 10174, 10192 and 10279. They contained a total of 4716 bones, a quantity that doubles the corpus already studied. The most unexpected new discovery is the presence of cattle, a species so far absent from Madâ'in Sâlih from all periods and all areas. The bovid remains an exception because it is represented by only one fragment of humerus (10279). It has a cut mark made with a knife which demonstrates the consumption of the meat. Whether this represents a piece of imported meat or the presence of cattle on the site remains an open question.

In Area 1 there was a small pit (*locus* 10130), probably Nabataean, which produced exclusively caprid bones. A slow and meticulous joining of the fragments allowed us to reconstruct six individuals as well as to understand the exploitation of the carcasses and the chain of events. The feature contained two complete carcasses of very young male kid goats, intentionally disarticulated with a knife and thrown anyhow into the pit. It seems unlikely that the meat had been saved to be eaten. The other individuals are represented by only a few bones or portions of carcasses. Two of them are of indeterminate caprids, one of which is a newborn, the other a sub-adult; the two others are sheep, one sub-adult and one adult. The particular content of this feature reveals an equally particular human activity. For the time being, we will limit ourselves to saying that these remains represent partial and complete carcasses, intentionally deposited in a small pit that had been dug to receive them.

In Area 2, only the faunal remains from *loci* 23020, 25008, 25012, 25061, 25408, 25413, 25416, 25417, 25420, 25422 and 25423 were analysed. Selected by the trench co-supervisor, Jérôme Rohmer, these *loci* produced 1076 bones the analysis of which will allow us to understand the reason for the presence of the mouse *Mus musculus* and the spiny mouse *Acomys* cf. *cahirinus* found in the large jar (25422_P01) studied in 2011.

Equally, we have looked at all the animal bones from tomb IGN 117. There remained a final collection of 387 whole but very small, bones, patiently sorted by Charlène Bouchaud from amongst the remains of sieving (mesh of 0.5 mm). This material is composed exclusively of reptile and rodent bones, small animals that can be described as intrusive whilst awaiting species identification which will be done using the reference collection in the Museum of Geneva.

The fauna collected in the complex IGN 132 contains 626 remains. These reflect the usual range of common butchery residue: sheep, goats and a few pieces of camels, gazelles, rodents, chicken, molluscs and fish.

In conclusion, the 2012 season greatly increased the archaeozoological data from Area 1, and allowed the inventory of the fauna from the courtyard of one of the dwellings in Area 2 and the analysis of all the faunal remains found in the tomb.

Pottery

by Yvonne Gerber

Only Y. Gerber was able to join the team in 2012, the other ceramicist on the project, C. Durand, having been detained in Amiens with teaching duties. The pottery being the most abundant material on the site, it is normal that a significant back-log in its study had accumulated over the course of the first four years of excavations. The paragraph below shows what was achieved in 2012 and what remains to be done:

Area 1 (particularly 10100, 10200, 1300): pottery read, all the important sherds drawn and the drawings checked and corrected.

Area 6, IGN 132: pottery read, counts done, drawings done and checked.

Area 9, ancient levels: stratigraphy reviewed in detail with the excavator, Z.T. Fiema, in order to re-evaluate the dating of the levels; sherds drawn and drawings corrected.

Area 3 (rampart in the widest sense): all the sherds from the 2010 and 2011 seasons have been dated and a selection of sherds to be drawn was made (drawings to be done in 2013).

- Area 2: dating done but not the counts. The drawings of the isolated sherds have not been checked.

- Area 8: the study of pottery remains to be done, but the excavator, S. Marion de Procé, must first make a selection.

Illustrations

Introduction

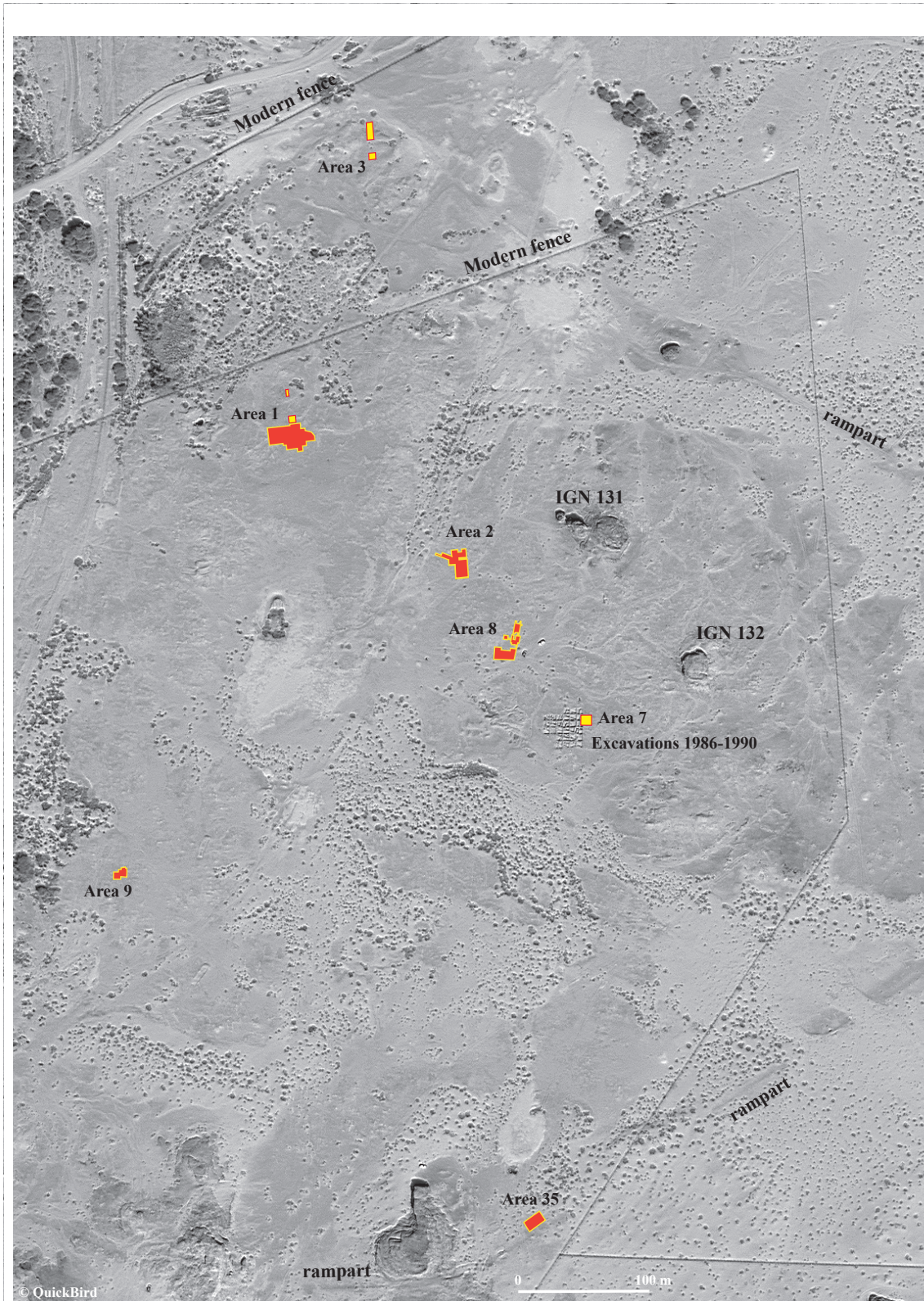


Fig. 1. Satellite image of the residential area showing the location of the trenches mentioned in the text



Fig. 2. Tomb IGN 99 before and after the removal of the metal access steps



Fig. 3. From left to right: ‘A. al-Hammâd, Kh. al-Hâ’iti, L. Nehmé, F. Villeneuve, R. Douaud, Y. Gerber, Ch. Bouchaud, N. Delhopital, Chr. Benech, S. Eliès, J. Studer, M. Leguilloux, P. Dal-Prà



Fig. 4. Area 2, south part before restoration



Fig. 5. Area 2, south part after restoration



Fig. 6. Rebuilding a mudbrick wall in Area 2



Fig. 7. Rebuilding a stone wall in Area 7

Geomagnetic survey

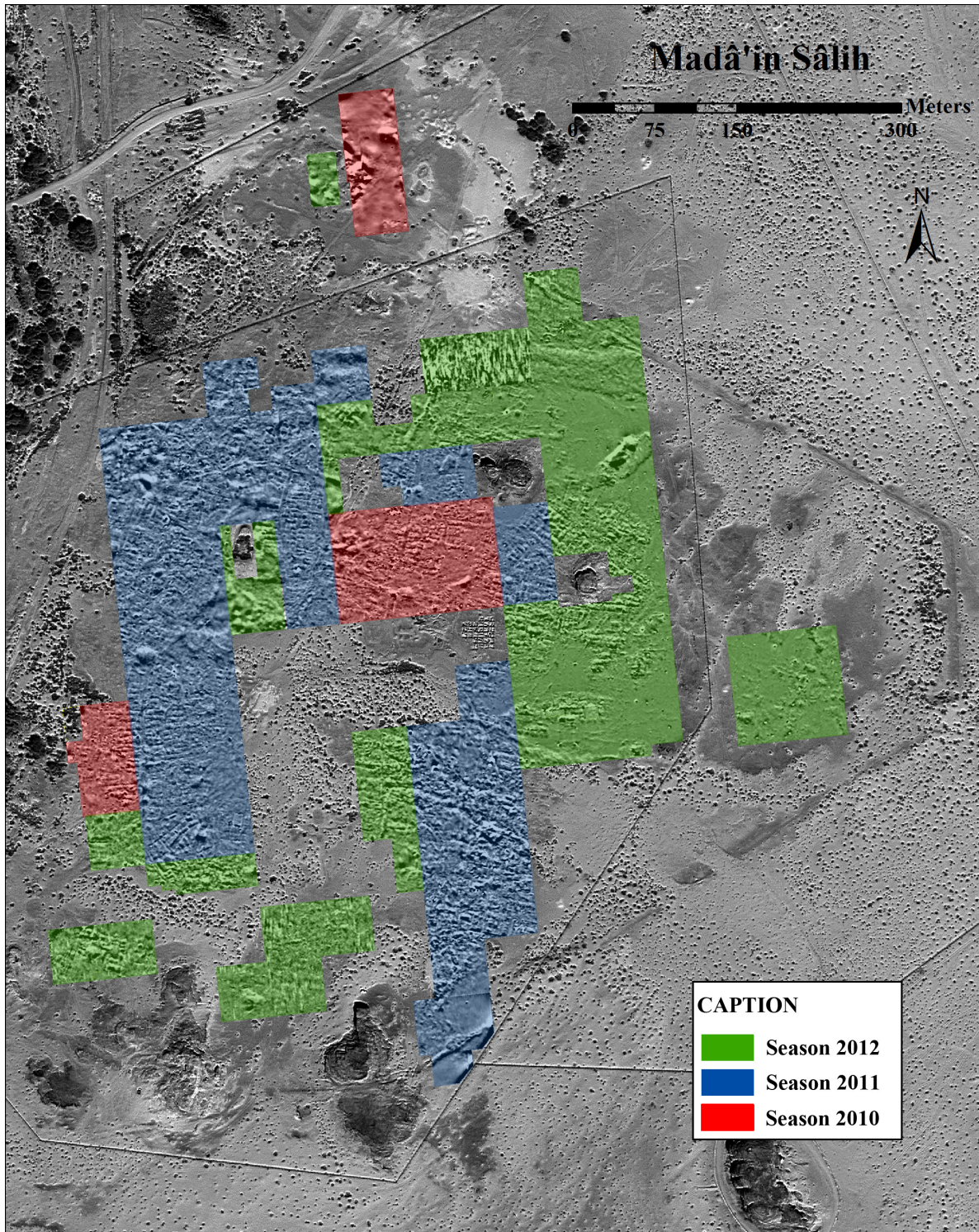


Fig. 8. Geomagnetic survey, areas covered during the 2010, 2011 and 2012 seasons



Fig. 9. Geomagnetic survey, results for the whole area (see following figures)

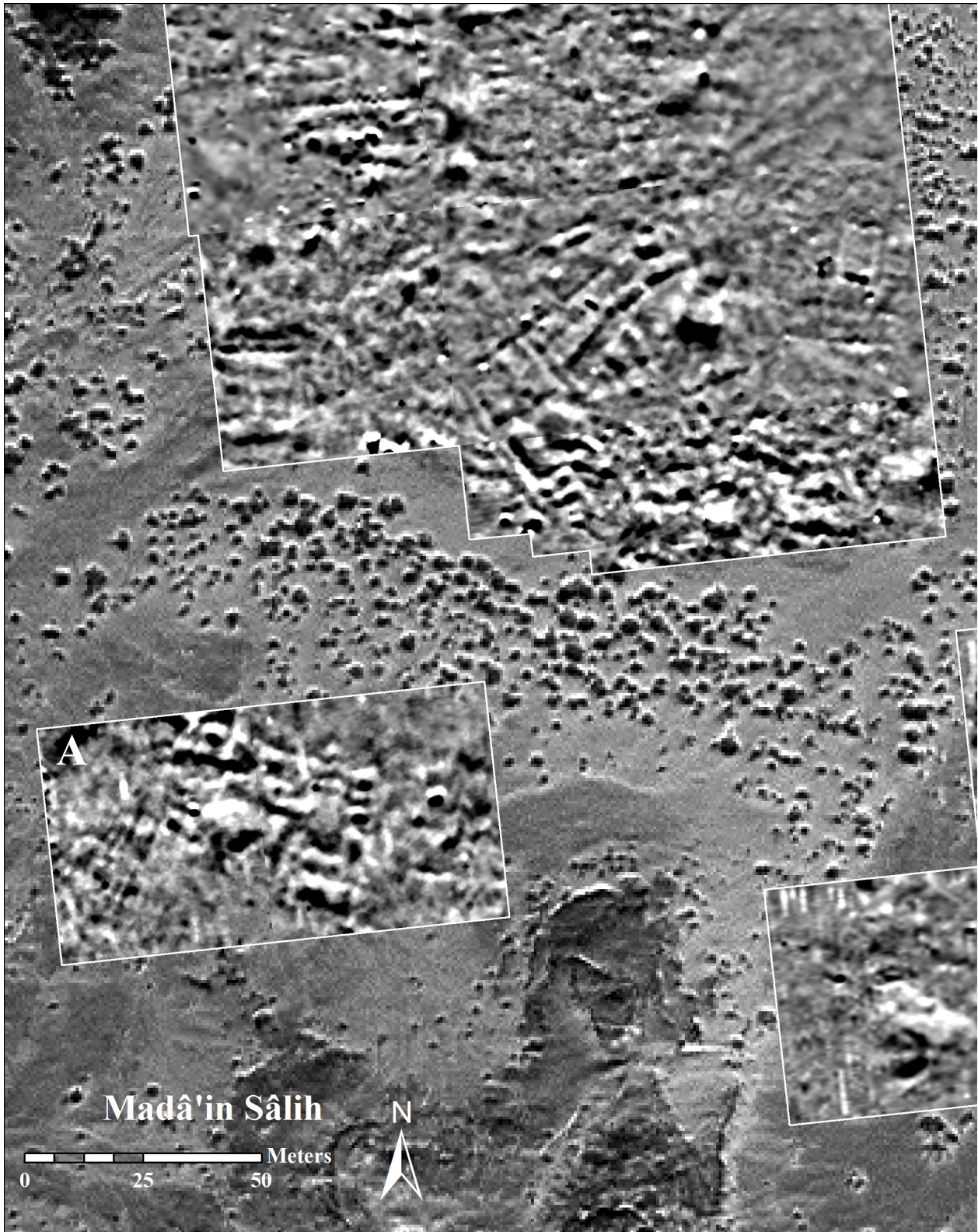


Fig. 10. Survey in the south-west sector, south of area 9

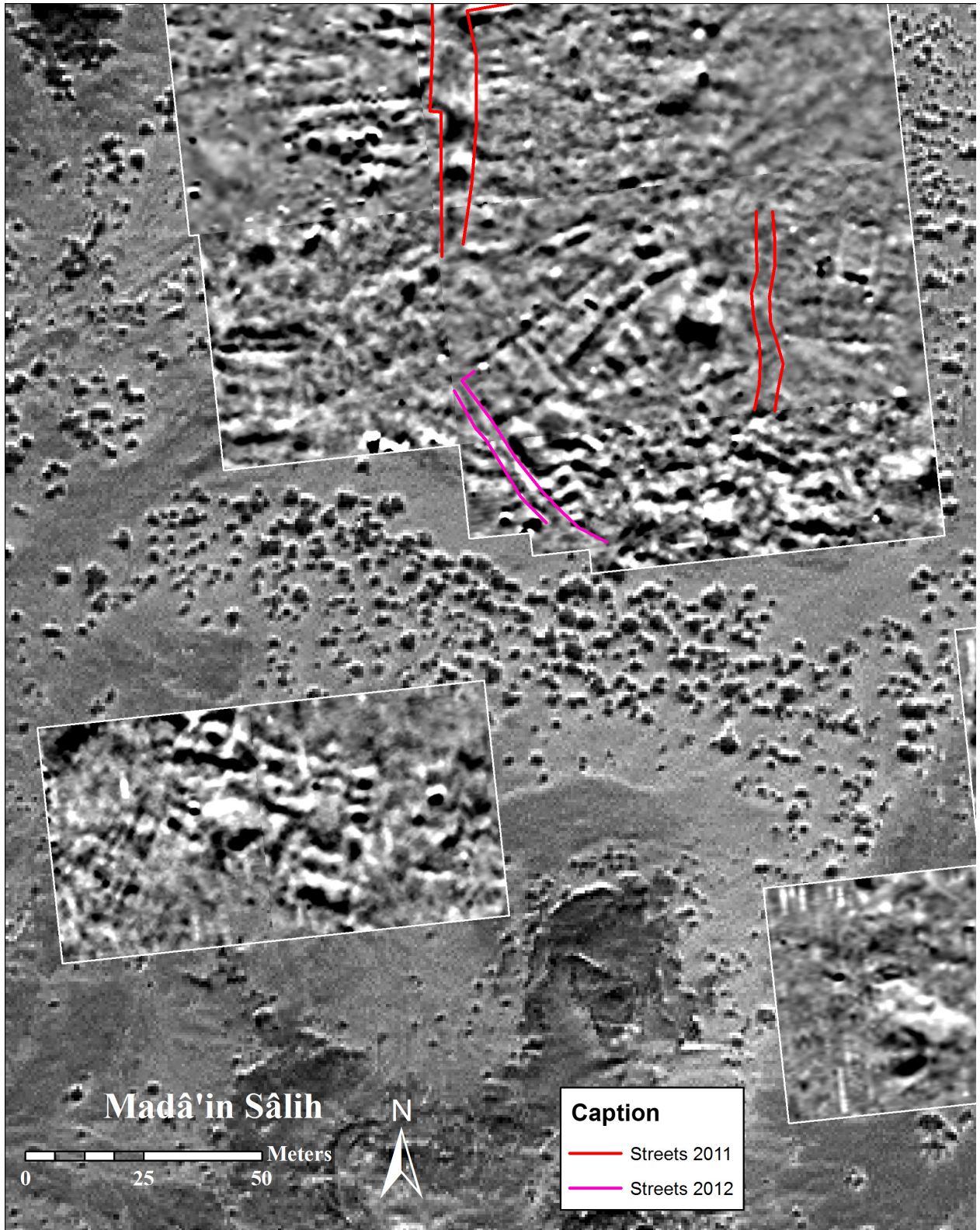


Fig. 11. *Idem*, interpretation



Fig. 12. Survey between two massifs in the south of the residential area

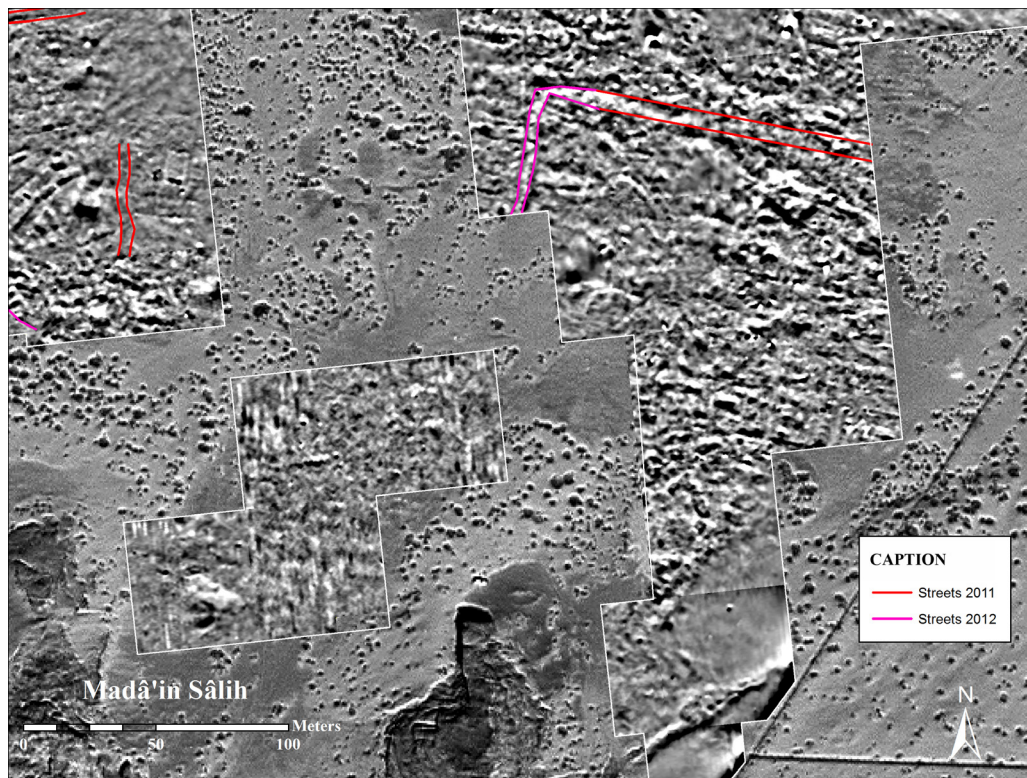


Fig. 13. *Idem*, interpretation

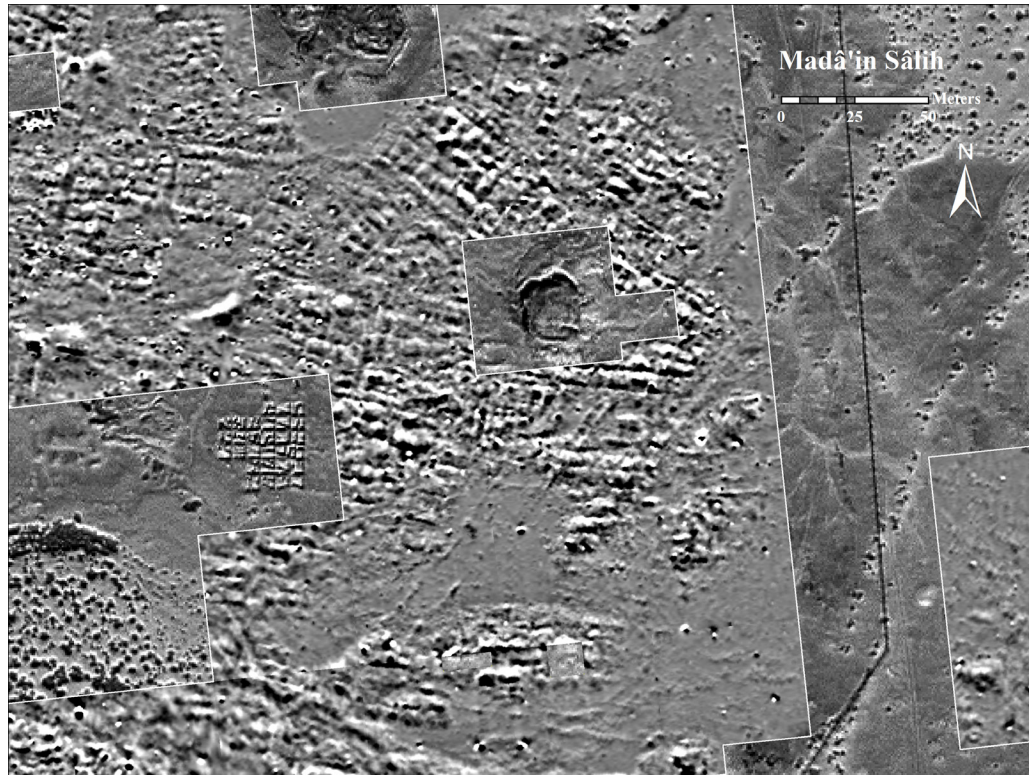


Fig. 14. Survey around massif IGN 132

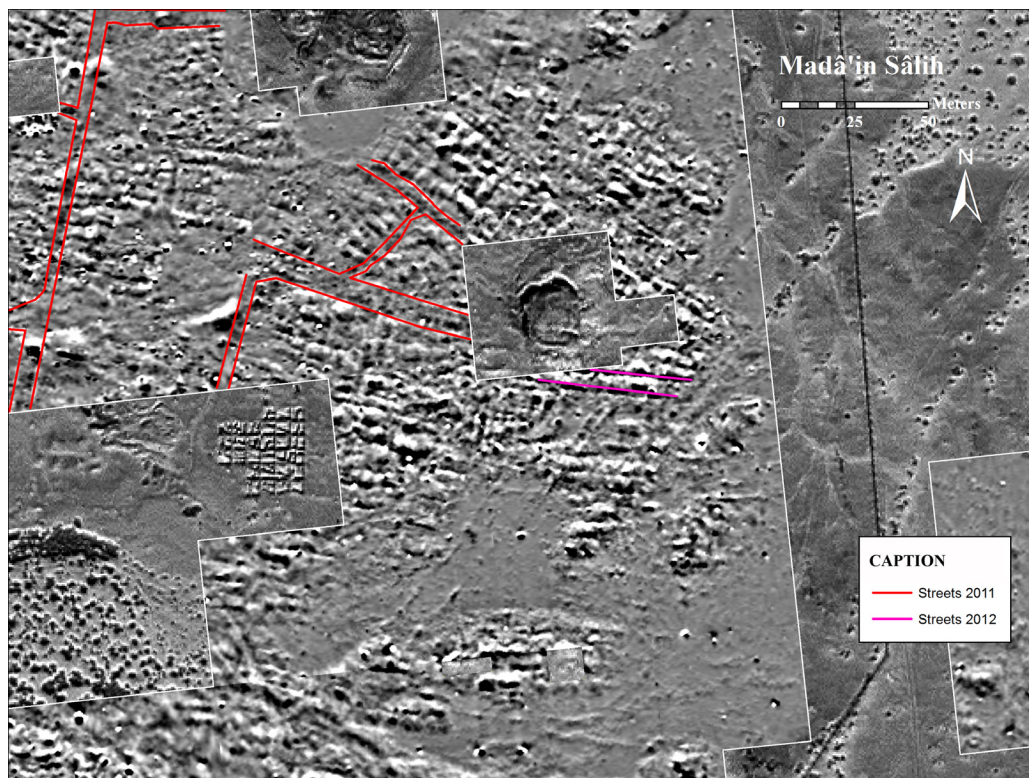


Fig. 15. *Idem*, interpretation



Fig. 16. Survey around massif IGN 131



Fig. 17. Survey in the eastern sector, between the two enclosures



Fig. 18. Survey at the northern edge of the residential area

Archaeobotanical remains



Fig. 19. Piece made of textile, leather and resin 50083_T01 (tomb IGN 117). External view



Fig. 20. Piece made of textile, leather and resin 50083_T01 (tomb IGN 117). Internal view

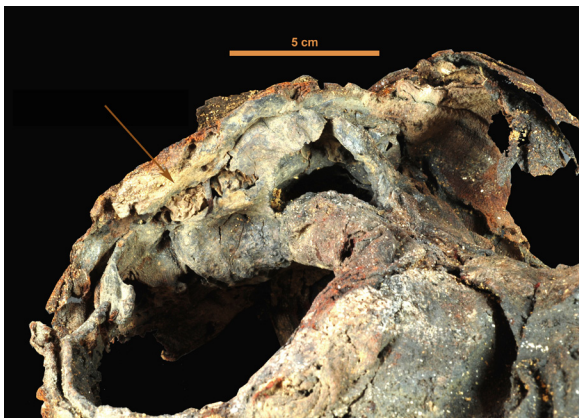


Fig. 21. Detail of piece 50083_T01. The arrow indicates the location of the dates attached with a small cord



Fig. 22. Detail of piece 50083_T01



Fig. 23. Piece made of textile, leather and resin 50240_L02 (tomb IGN 117). Internal view. The arrow indicates the location of the dates



Fig. 24. Detail of piece 50240_L02 showing the five dates



Fig. 25. Desiccated, pierced date, found in stratigraphic unit 50083. Profile view



Fig. 26. *Idem.* Upper face



Fig. 27. Desiccated, pierced date, found on piece 50083_T01. Profile view



Fig. 28. *Idem.* Upper face



Fig. 29. Desiccated, pierced date (50298_VS01), cut in half. Profile view

Textiles

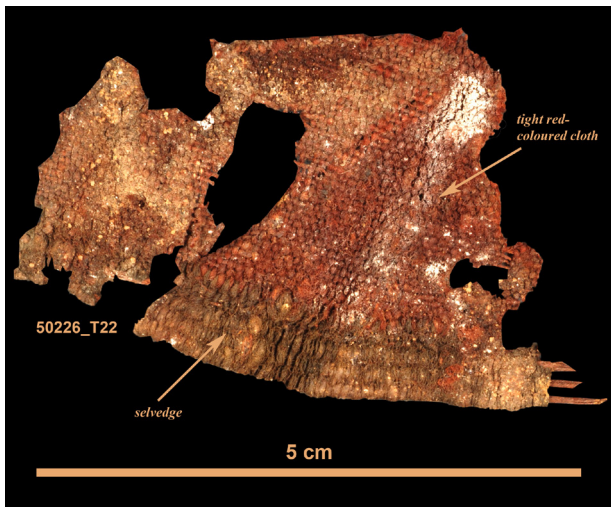


Fig. 30.1. Selvedge on fragment 50226_T22



Fig. 30.2. Cordeline, fragment 50159_T01



Fig. 30.3. Fringes on fragment 50226_T22

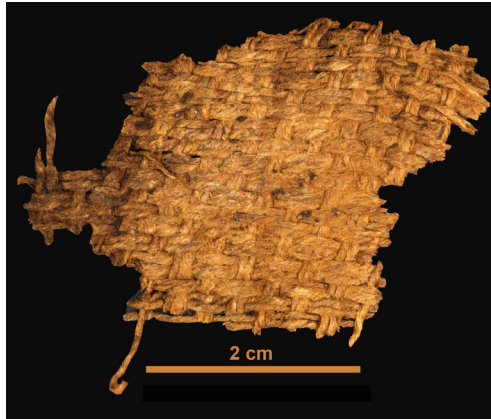


Fig. 30.4. Braided weave,
fragment 50312_T03

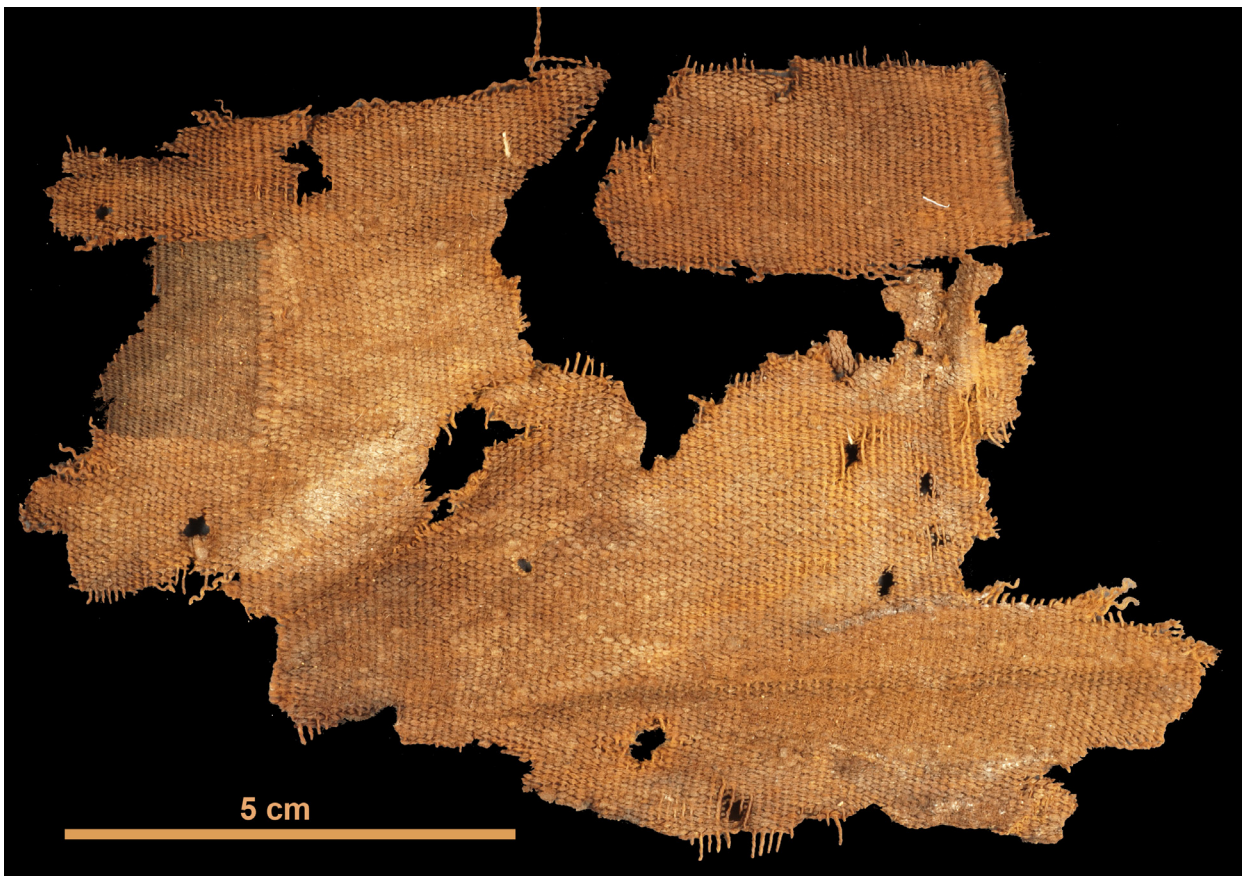


Fig. 30.5. Fragment of tapestry on fragment 50240_T11

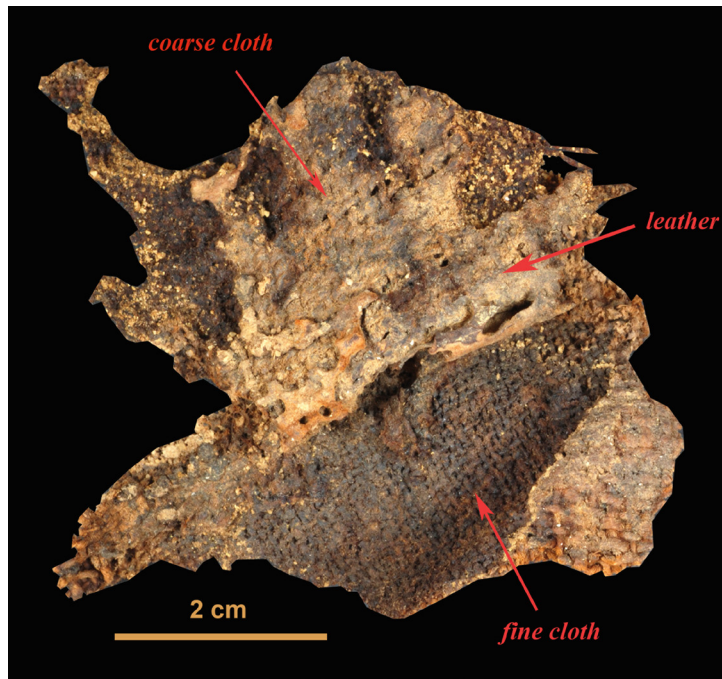


Fig. 31. Fragment 50283_T01, leather and layer of cloth (therefore, exterior side)

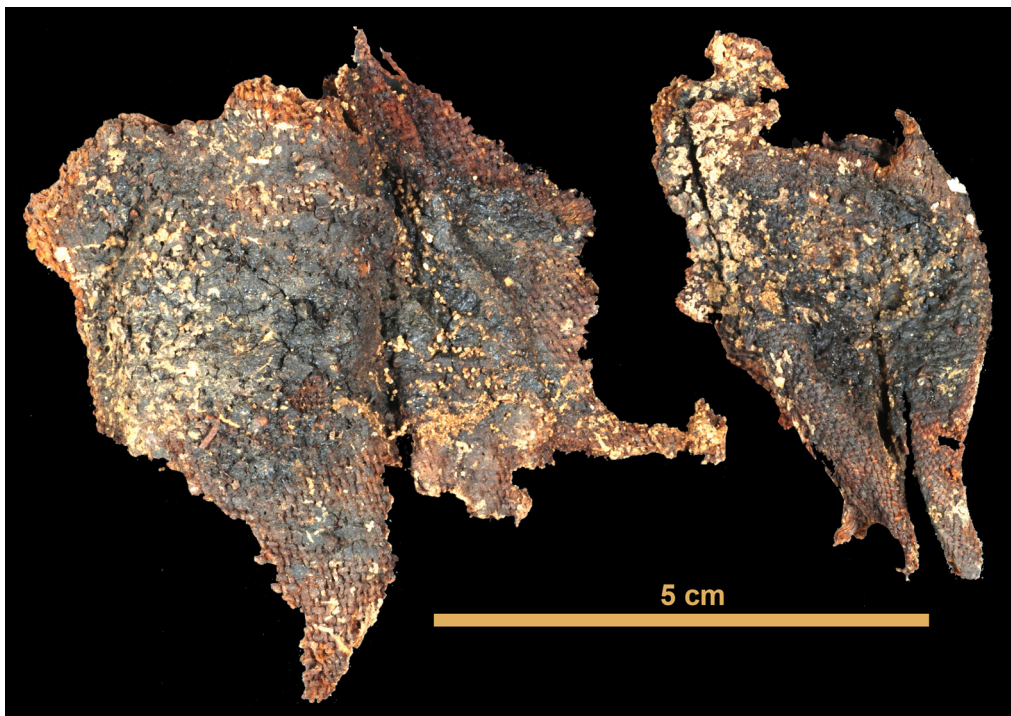


Fig. 32. Fragment 50283_T01, resins and layers of cloth (body side)

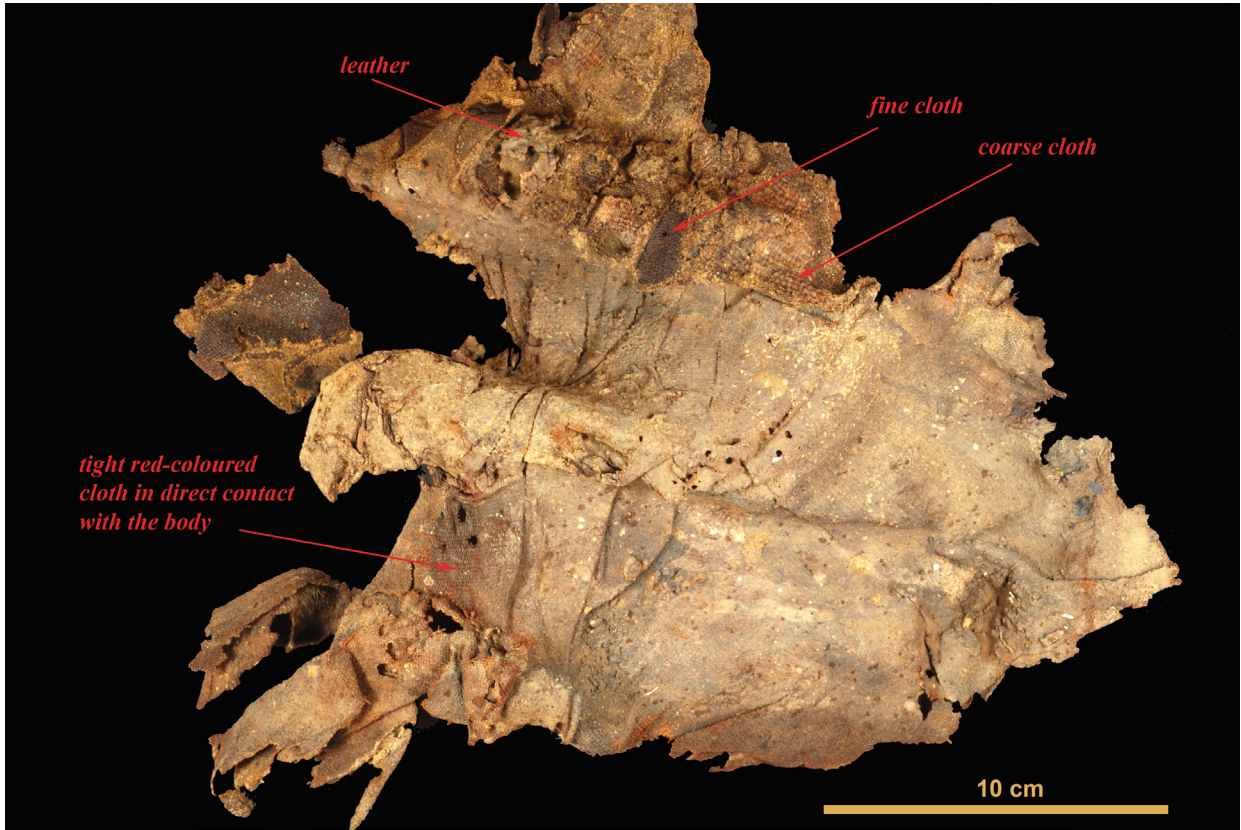


Fig. 33. Fragment 50283_T02, view of what is visible of the superimposed layers of cloth and leather

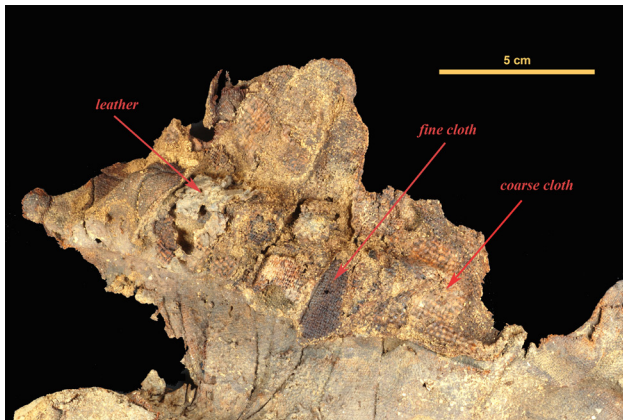


Fig. 34. Fragment 50283_T02, detail of the superimposed layers of cloth, from the finest (against the body) to the coarsest (last layer before the leather)

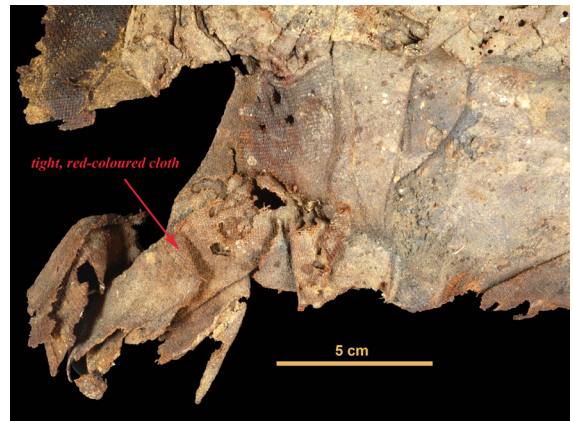


Fig. 35. Fragment 500283_T02, another detail

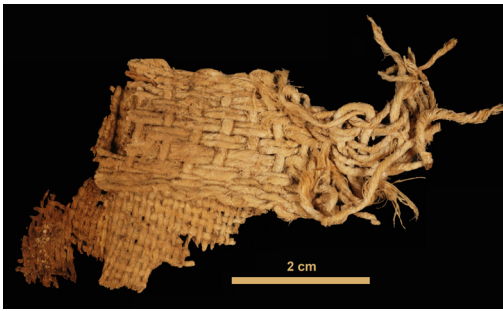


Fig. 36.1. *Louisine* weave on strap 50168_T04

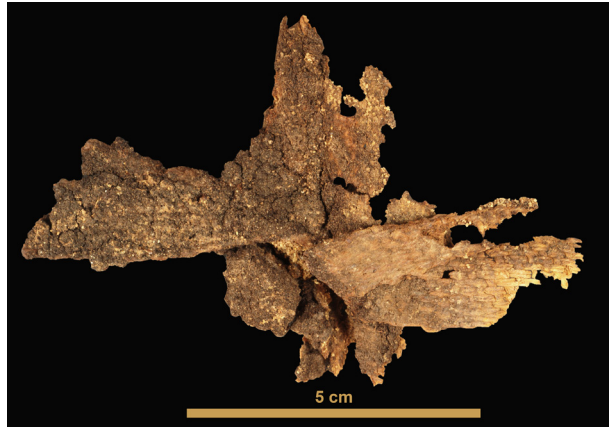


Fig. 36.2. Knotted strap 50226_T05

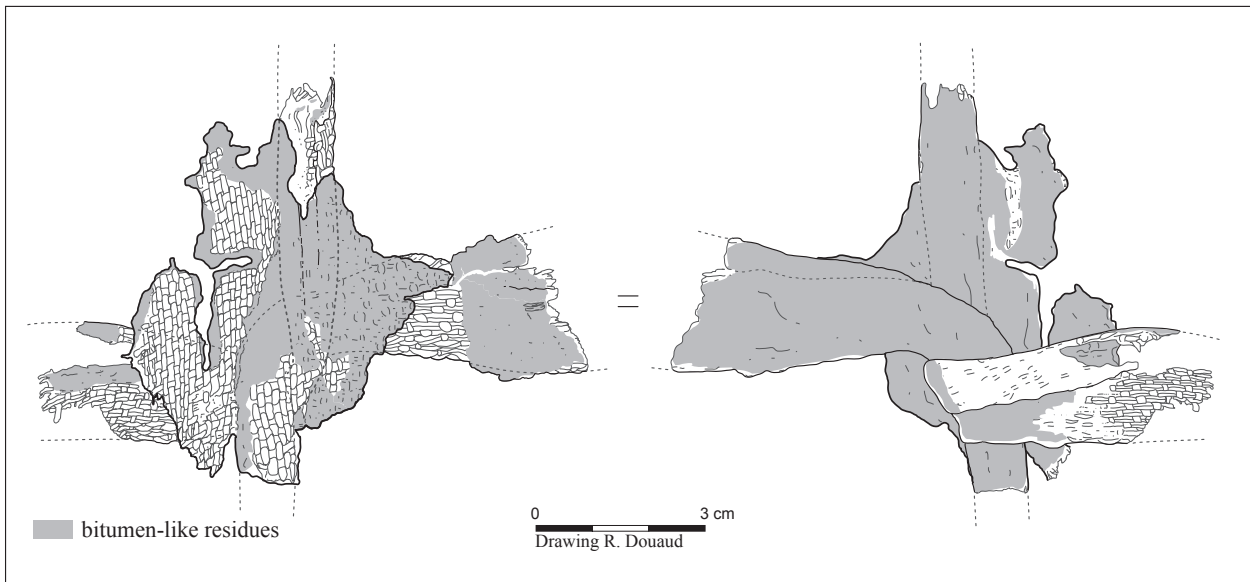


Fig. 36.3. *Idem*, drawing

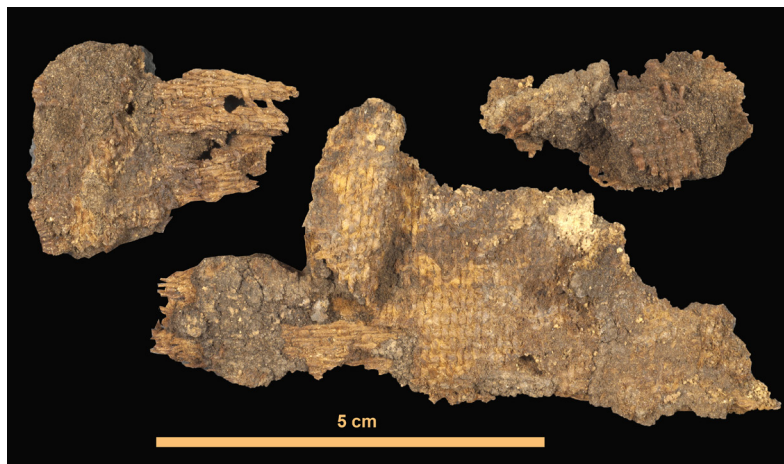


Fig. 37. Knotted strap 50370_T05



Fig. 38. Strap 50088_T05,
folded due to tension



Fig. 39. Doubled strap 50298_T02

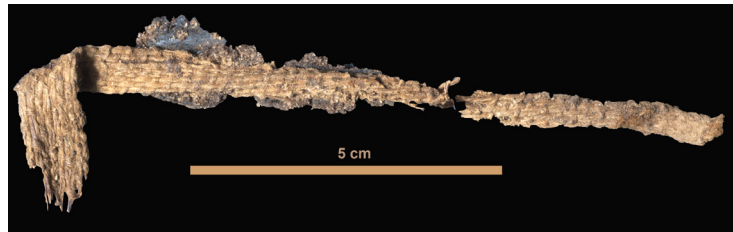


Fig. 40. Strap 50302_T04, associated with goat leather



Fig. 41. Fragment of small cord 50168_T01

Leather

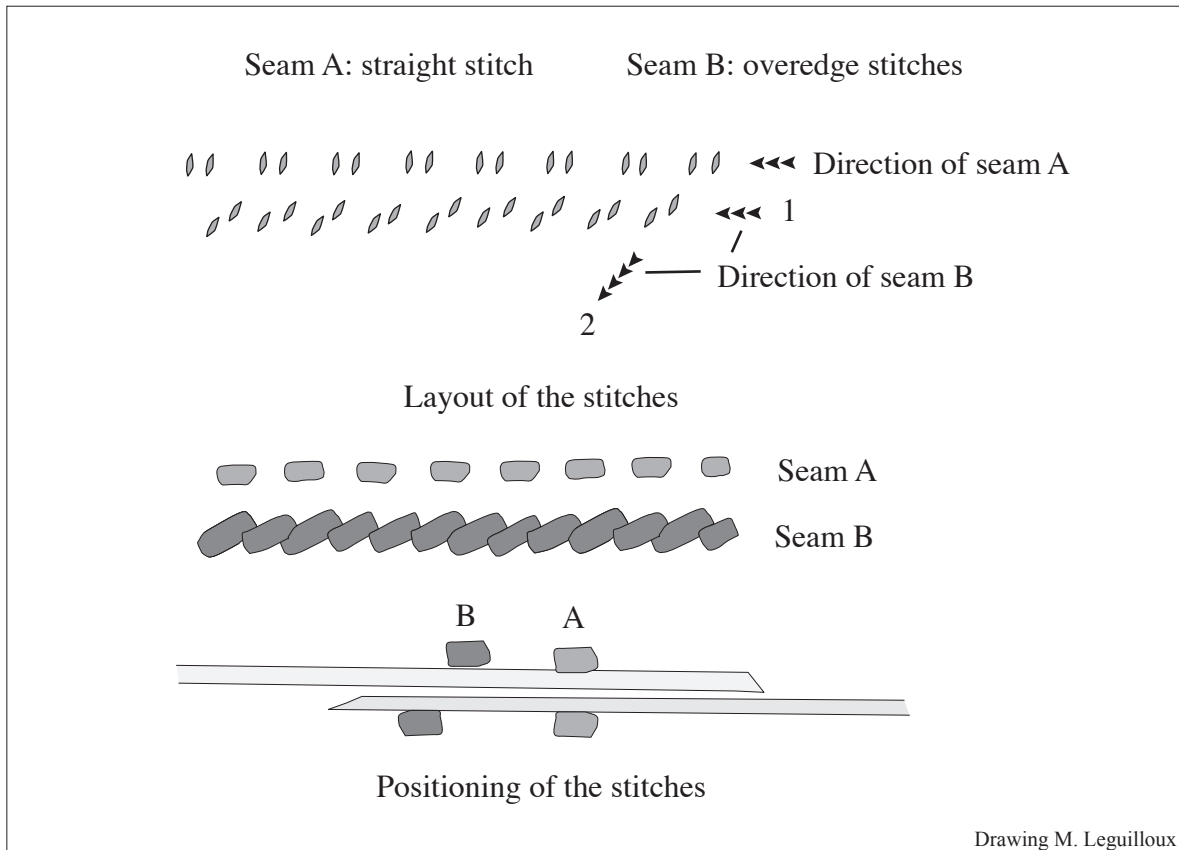


Fig. 42. Description of stitches on the shrouds

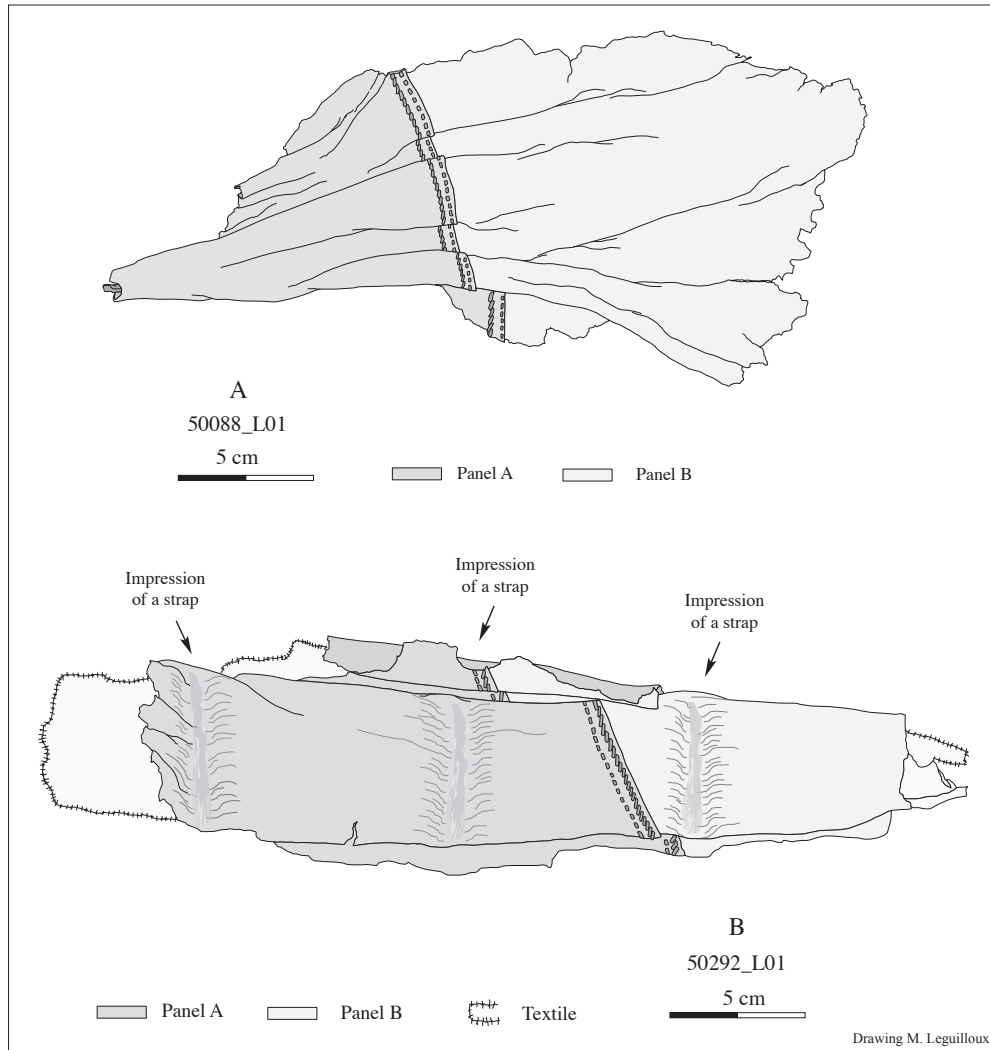


Fig. 43. Technique for wrapping the mummies: A. piece used at the head or feet; B. piece showing the compression caused by the straps.



Fig. 44. Fragment of leather 50088_L01



Fig. 45. Fragment of leather 50292_L01. The impressions left by the binding are clearly visible



Fig. 46. Fragment of leather 50229_L03

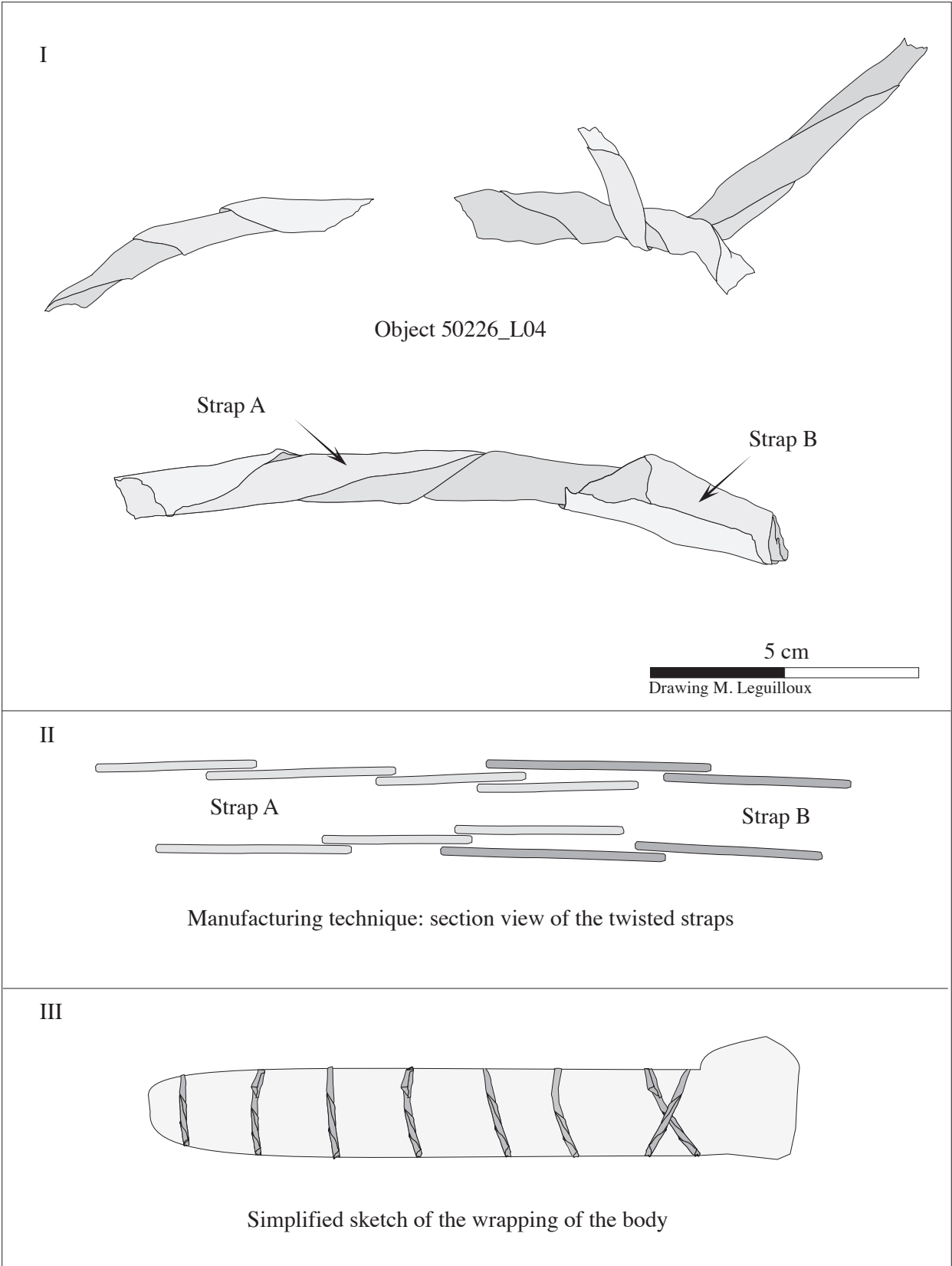


Fig. 47. Manufacturing technique for the straps to bind the mummies

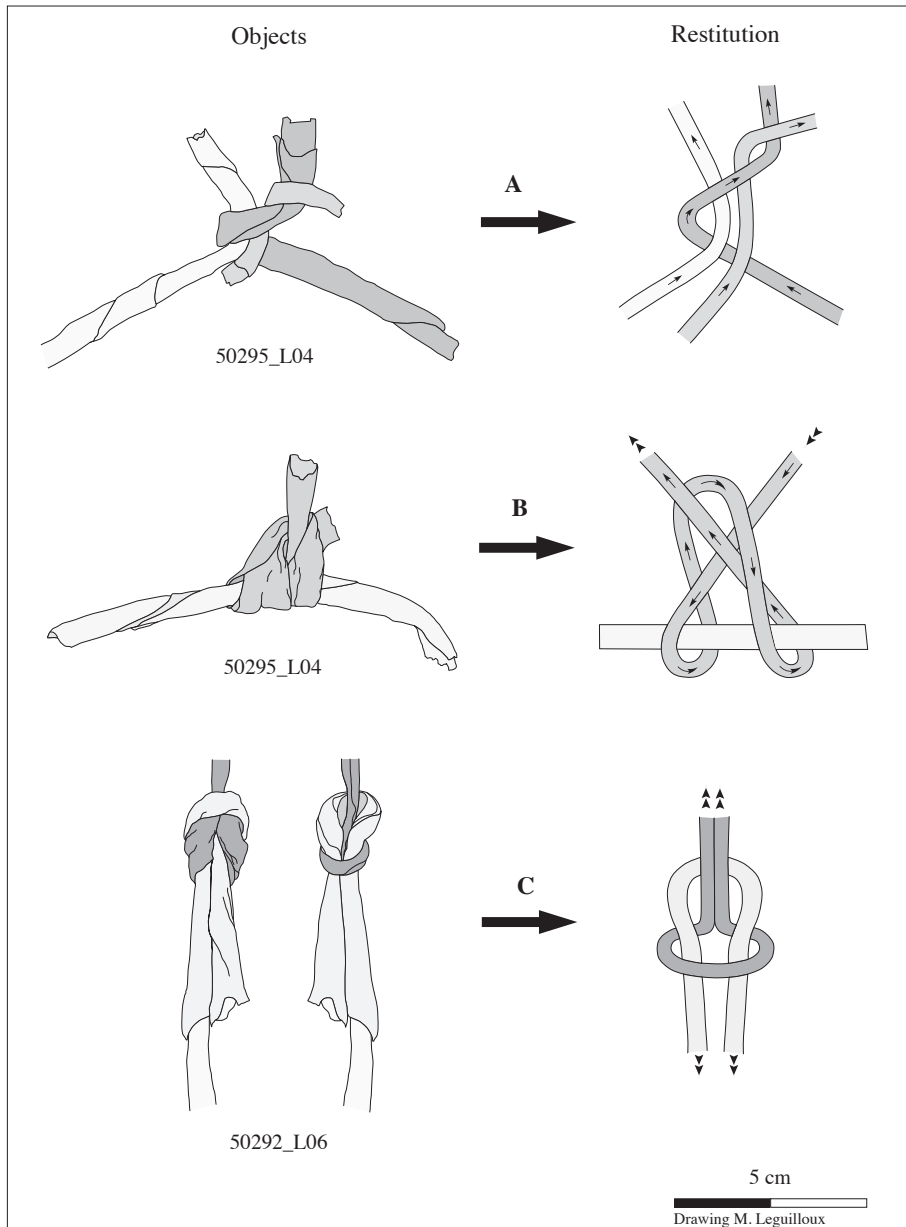


Fig. 48. Types of attachment according to the methods observed: methods A, B and C



Fig. 49. Knot 50295_L04

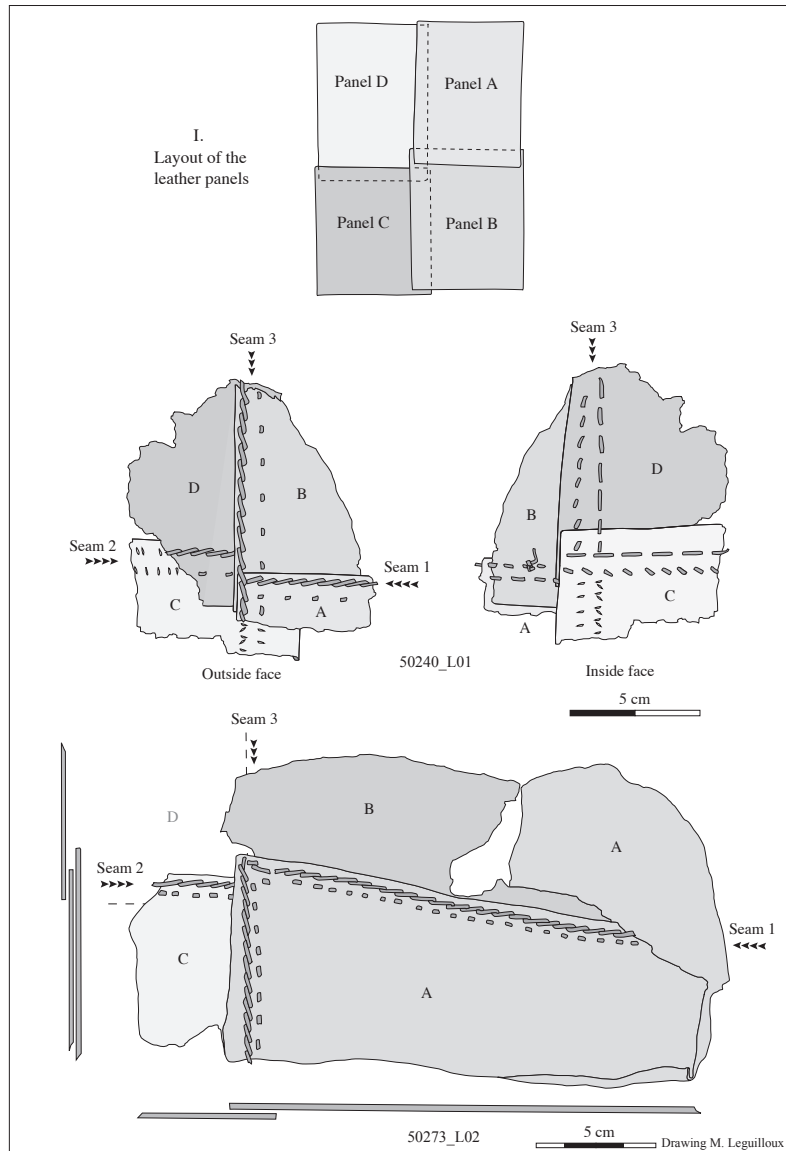


Fig. 50. Placement of the panels (A to D) and seams (Seam 1 to 3)

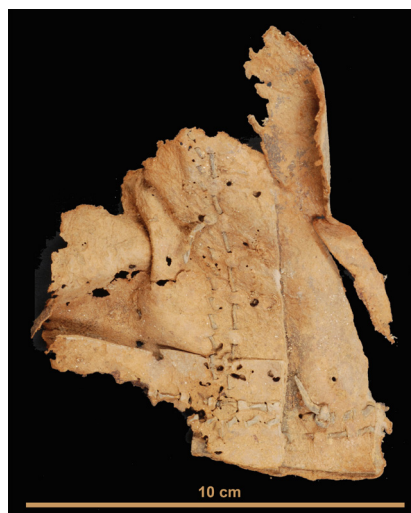


Fig. 51. Panels A to D on 50240_L01, flesh side

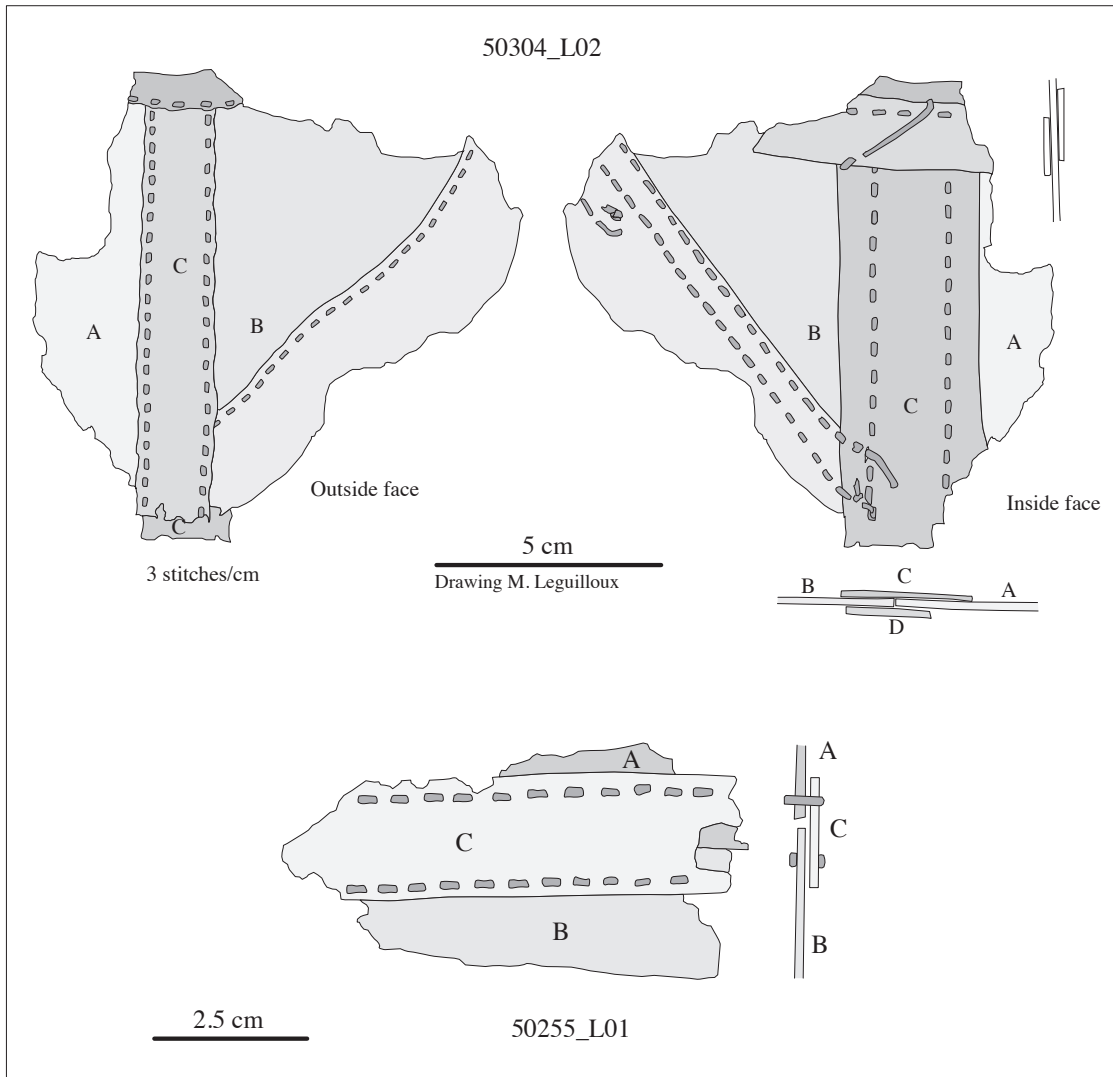


Fig. 52. Assembly technique for the seams on the wrappings used for transportation 50304_L02 and 50255_L01

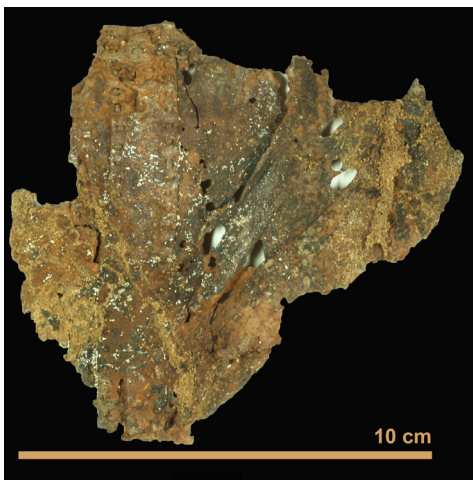


Fig. 53. Transportation wrapping 50304_L02 outside face

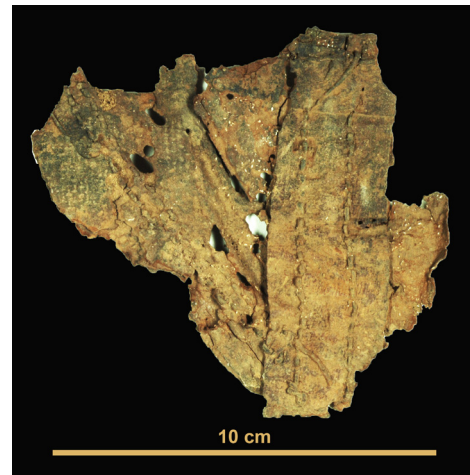


Fig. 54. Transportation wrapping 50304_L02 inside face

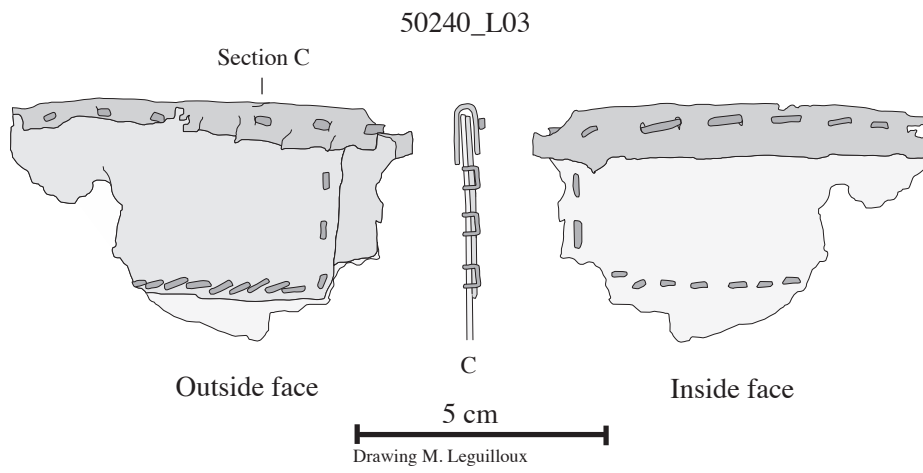
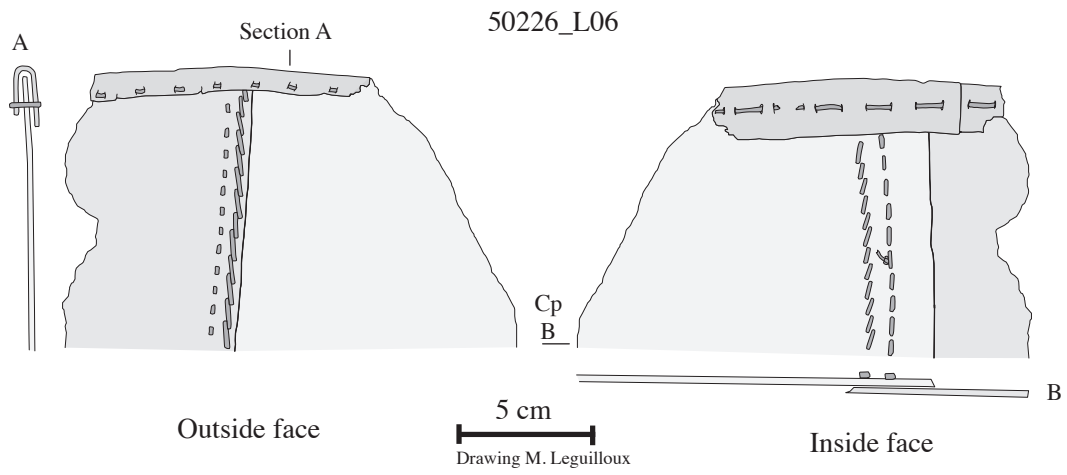


Fig. 55. Transportation shroud: example(s) of edging

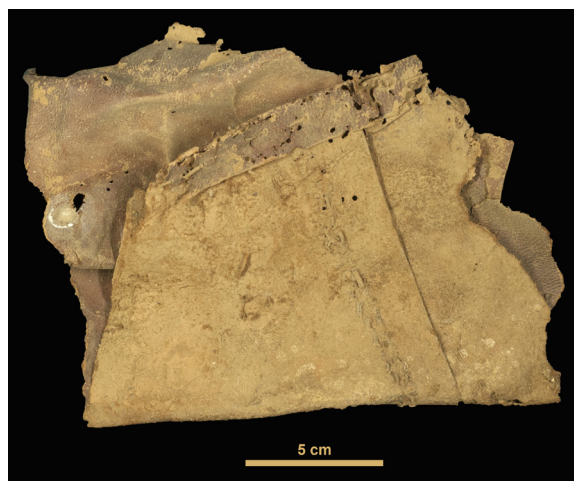


Fig. 56. Transportation shroud 50226_L06

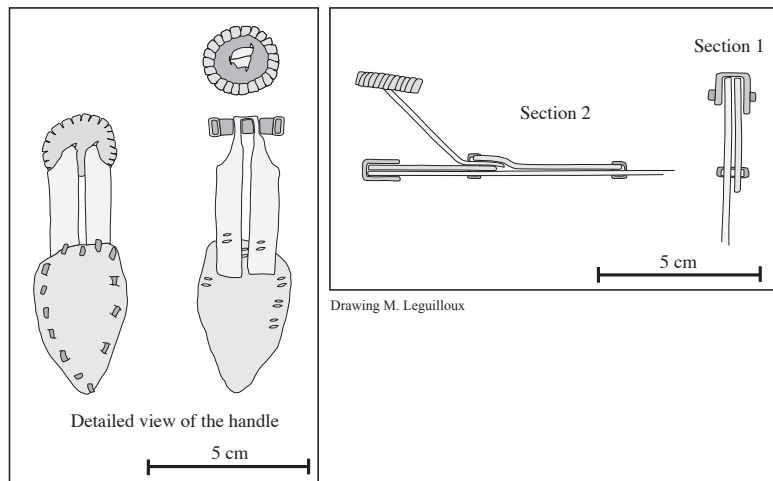
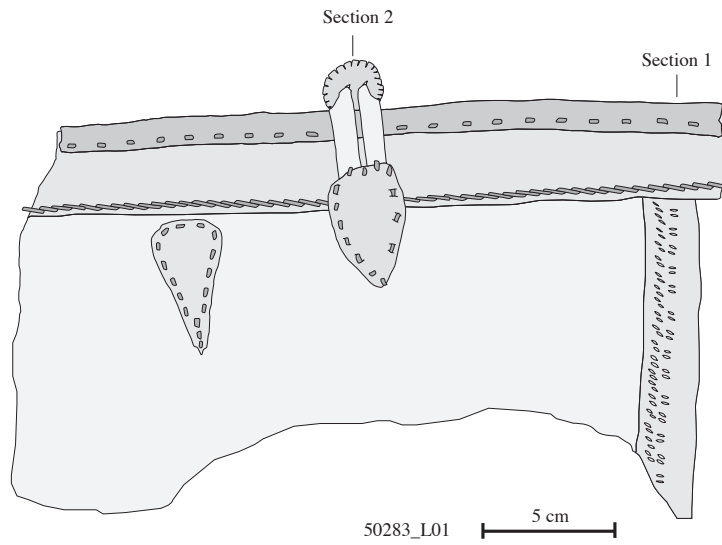


Fig. 57. Transportation shrouds: the handles of example 50283_L01



Fig. 58. Photo of the handles on the transportation shroud 50283_L01



Fig. 59. Another handle on the same shroud

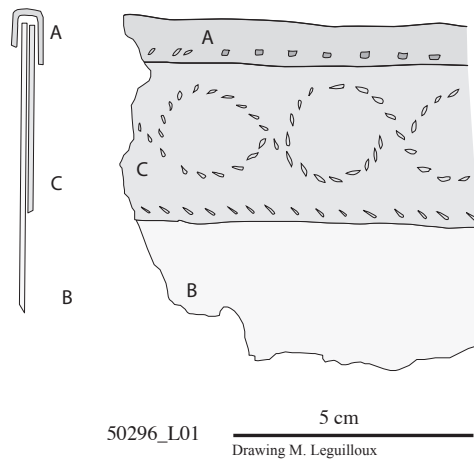
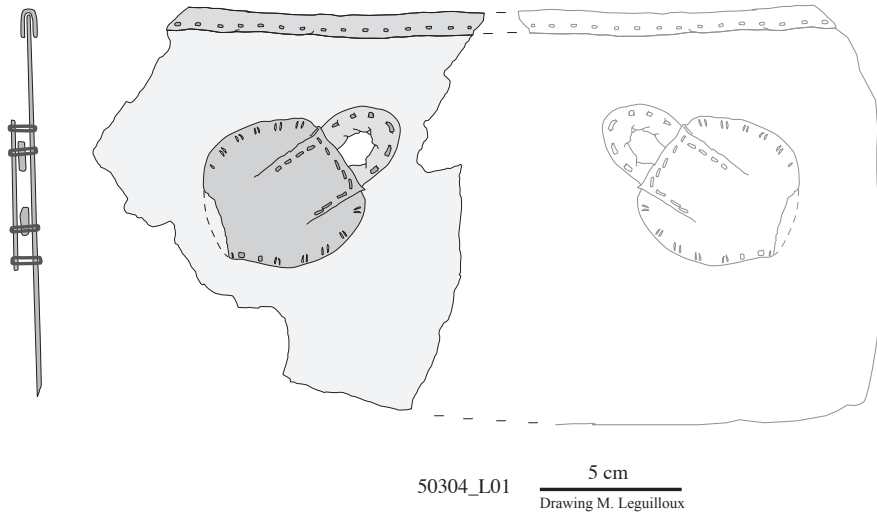


Fig. 60. Transportation shrouds: A. The handles of example 50304_L01. B. Decorative edging on example 50296_L01

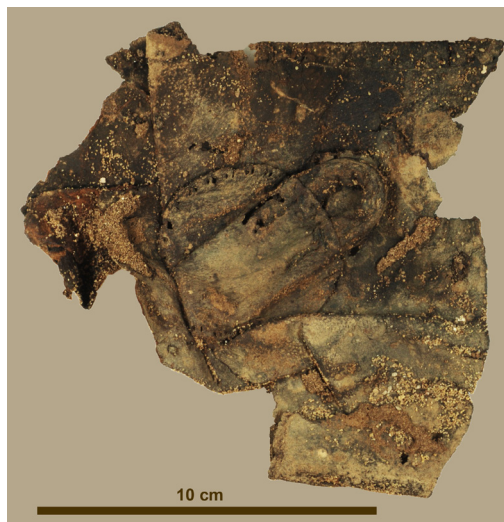


Fig. 61. Handle of shroud 50304_L01

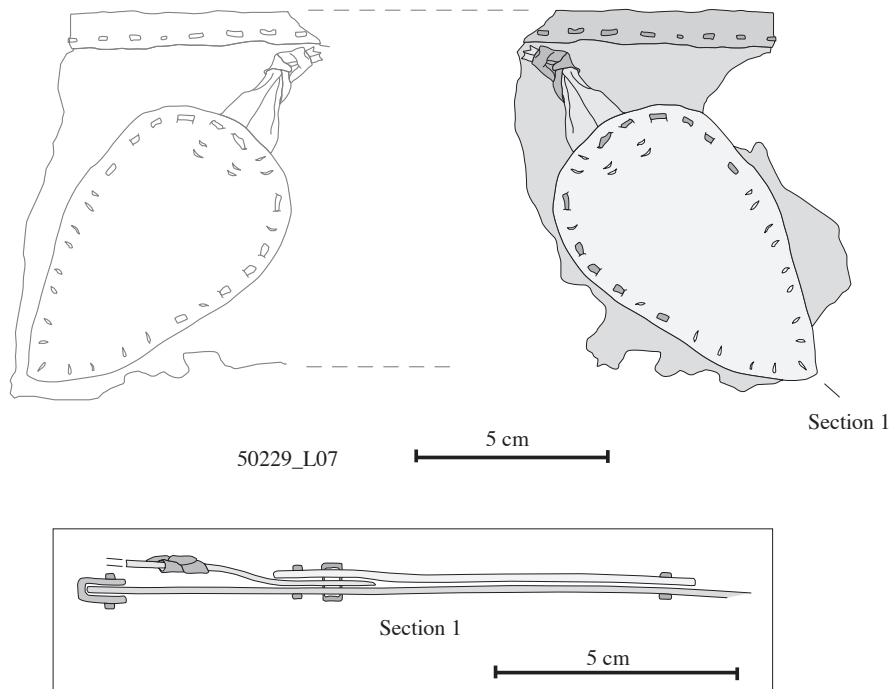


Fig. 62. Transportation shrouds: edging and handle of example 50229_L07



Fig. 63. Handle of shroud 50229_L07: the hole is oriented at right angles to the edge (external face on the left, internal face on the right)

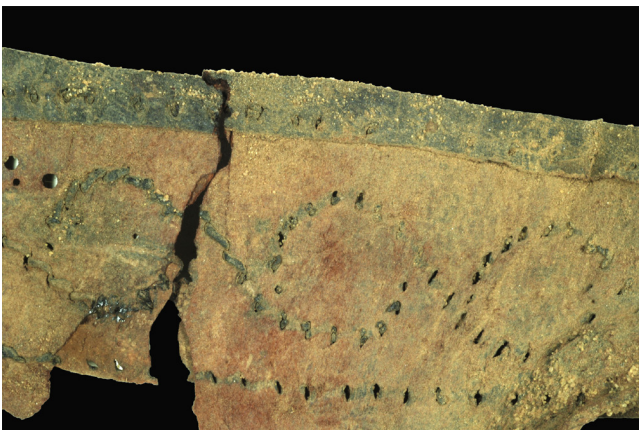


Fig. 64. S-shaped seam using straight stitching on leather shroud 50296_L01

Human bones

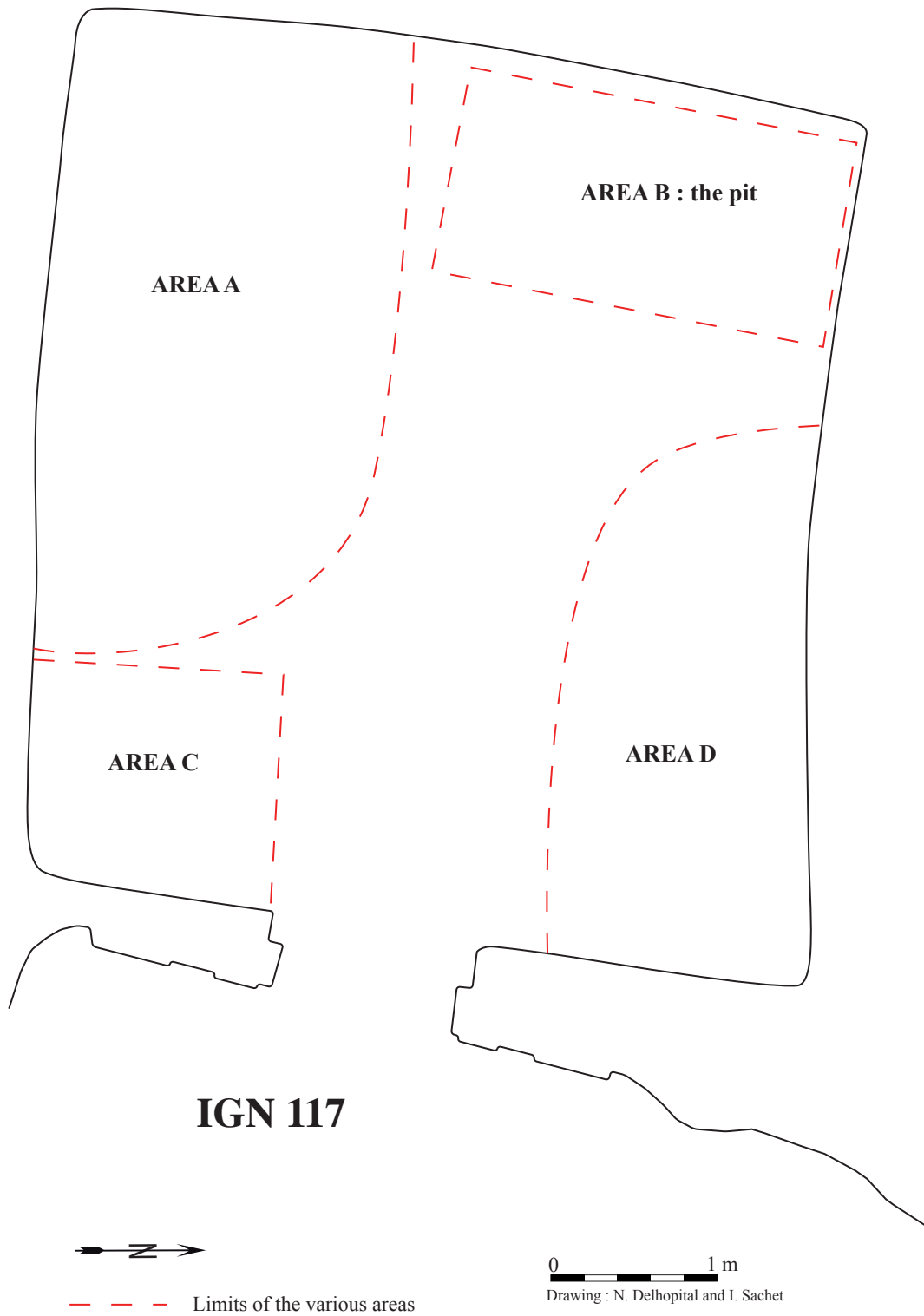


Fig. 65. Distribution of the various areas in the tomb.



Fig. 66. Bones of adult individuals found in area D (except the vertebrae and ribs)

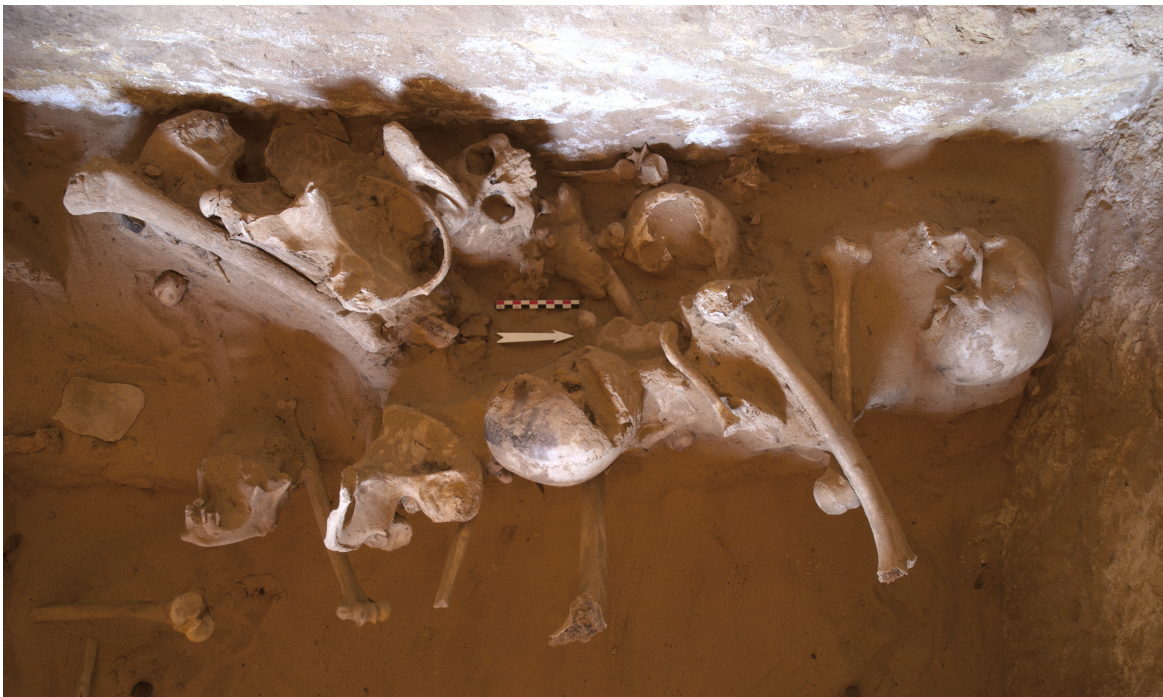


Fig. 67. Group of skulls found in the upper part of the pit in 2009



Fig. 68. “Reconstructed” female adult individual Sq-A1



Fig. 69. “Reconstructed” immature female individual (between 15 and 20 years old) Sq-II