Fabienne Médard, Christophe Moulhérat, Sophie Méry

Discovery of a charred yarn in a Bronze Age burial at Hili (Abu Dhabi region, United Arab Emirates)

Acta Archaeologica Lodziensia nr 50/1, 19-25

2004

Fabienne Médard, Christophe Moulhérat, Sophie Méry

Discovery of Charred Yarn in a Bronze Age Burial at Hili (Abu Dhabi Region, United Arab Emirates)

1. Context of the find

Research carried out in the Hili region is part of a cooperation programme between France and the United Arab Emirates: the French Archaeological mission, present since 1977, is one of the oldest foreign mission to work in this region. Research is presently led by Sophie Méry and Walid Y. al Tikriti and concerns an Early Bronze Age collective burial (N tomb of Hili), the study of which clarifies some aspects of funerary practices of this period in eastern Arabia (Fig. 1).

Data gathered has shown that the monumental circular tombs were not the only model of collective burial in use at the end of the III^{d} millennium B.C. in the Oman peninsula, funerary pits were also used during this period (Fig. 2: 1) [Méry *et alii* 2001: 161-178]. These graves were long considered, because of their apparent disorganization, as ossuaries resulting from the emptying of the nearby circular tombs. However the new excavations of Hili's funerary pit seem to challenge this hypothesis. The anthropologists of the mission (J. Rouquet, K. McSweeney, G. Basset and E. Gatto) have shown that this pit-grave far from being a simple annex had its own purpose. Presently it is not possible to say if the appearance of this kind of burial, very seldom attested until now in the United Arab Emirates, is from the later part of this period or not and must be interpreted as a sign of changed funerary practices at the end of the Umm an-Nar period. However ,it is certain that monumental circular tombs were still used by eastern Arabia village communities of the end of the III^{d} millennium B.C.

2. Archaeological remains

Tomb N of Hili is a deep earth pit-grave 8 metres long. Plan and construction techniques are very different from those of the graves of Umm an-Nar, classically witnessed in this period.

The filling of the pit-grave is not the result of a unique deposit but corresponds to a succession of three distinct layers. The most recent level, now entirely excavated, is made of primary deposits. The grave-pit was in use for an estimated time of less than two centuries during which more than 500 individuals, man, women and children were buried there. There is no evidence of sexual or age related selection (Fig. 2: 2).

Radiocarbon dating (on bones and charcoal) and typological chronology (mainly on pottery) place the utilization of the pit-grave at the end of the Umm an-Nar period, between 2200-2000 B.C. (Tabl. 1).

Anthropological analysis shows that the people buried in the grave suffered from malnutrition and other deficiencies, that may explain in part a life span of less than 40 years as well as a very high death ratio (1/3 of the remains belong to immature individuals). The grave also held hundreds of objects among which were pottery, metallic items and many shells and beads [Al Tikriti, Méry 2000: 205-219]. Testifying to the importance of the commercial and technical exchanges between populations sometimes very far off, many artefacts come from Mesopotamia, Iran and the Indus Valley. As is the case of the cornelian beads that come from the Indus region which are by far the most frequent decorative elements in tomb N at Hili.

At the centre of the upper deposit, the bodies, of which one was wearing a necklace made of sixteen cornelian beads, two artificial material beads (not studied) and one ophiolite, present traces of intentional cremation (Fig. 2: 3). Many of the beads of this necklace, all of them small, contained fragments of charred yarn within the perforation.

Protected until the cremation by the solid and covering envelope of the beads, the yarn did not undergo any changes except for the initial calcination. This process provoked modifications in yarn structure and is responsible for the reduction of its diameter. Tests made on hemp fibres have shown that when burnt

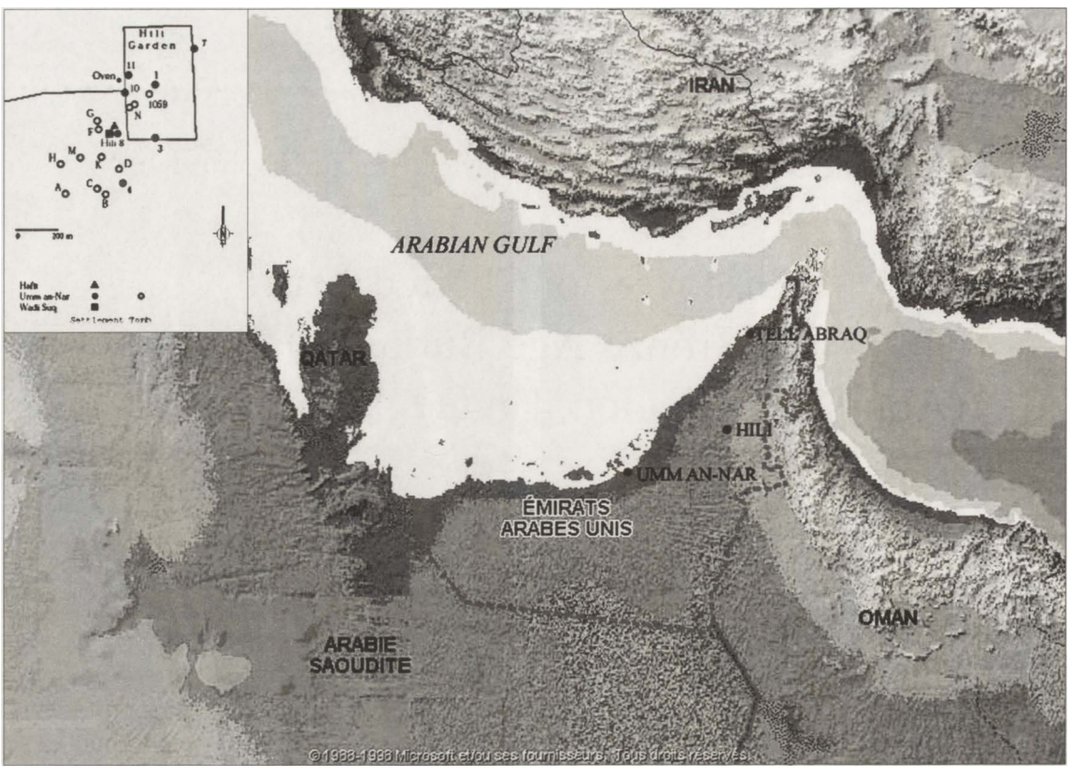


Fig. 1. Location and detailed plan of the site of Hili. The sites of Tell Abraq and Umm an-Nar where textile remains have also been found.

their diameter decreases especially in presence of oxygen and at very high temperatures [Srinivasan, Jakes 1997: 517-527].

Sediment infiltration inside the perforations gave cohesion to the whole. Being friable, and completely dried up by calcination, yarn samples were taken with great care so as to avoid breakage. The samples were examined in order to identify the fibres and to study the manufacturing techniques.

3. Analisys of yarn: material and methods

3.1. Preparation of the samples

In order to identify fibres it is necessary to make a longitudinal view and cross- section so as to show their main characteristics (diameter, presence of a central channel, morphology, ...). To do so a sample of yarn of less than 5 mm^2 is taken and covered with a thin layer of gold in order to study it on the scanning electronic microscope [Moulhérat 2000: 51-58].

The study of manufacturing techniques does not require any special preparation except consolidation of the yarn if it is too fragile. Every sample is studied under a binocular magnifying glass to determine its characteristics (direction of torsion, diameter of yarn,...).

3.2. Experimental conditions and equipment

The yarn was studied with the help of the following equipment:

– Binocular magnifying glass (Nikon SMZ-10A) equipped with a camera

– Scanning electronic microscope (Philips XL 30CP); maximum tension used 10kV.

4. Results and discussion

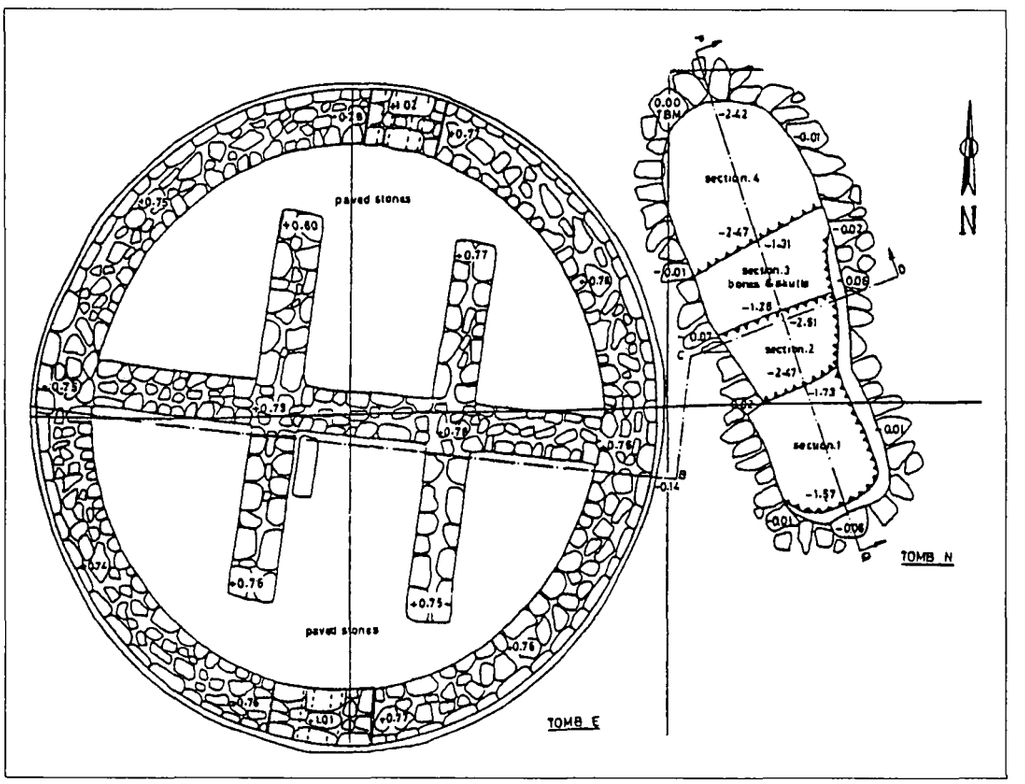
4.1. Fibres identification

Without in-depth examination and in comparison with other discoveries made in the same geographical area (Fig.1), we thought that Hili's yarn could be made out of flax [Frifelt 1991: 117]. However examination of the samples has showed that the fibres were of vegetable origin but they lacked the characteristics of flax.

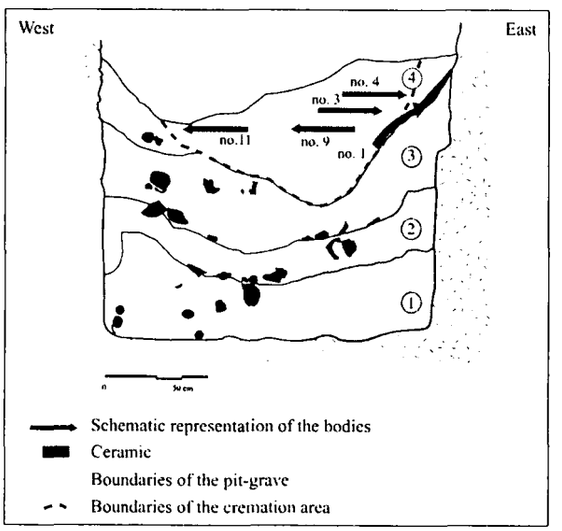
The state of conservation of the yarn fragments precludes a standard examination of the fibres with an optical microscope; so it is necessary to use an electronic microscope. Because of its depth of field, it allows high magnification of the fibres in three dimensions.

The examined fibres are in very compact bundles of different dimensions that distinguish them from "liberian" fibres (flax, hemp, nettle, jute). that are most often isolated or in very narrow bundles (Fig. 3: 1, 2).

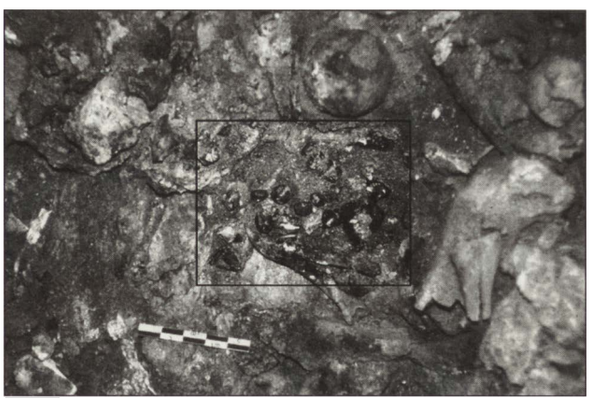
The cross-section of these fibres shows an important lumen (2/3 of the surface of the fibre), probably accentuated by calcination, as well as flexion folds characteristic of support fibres.



1



2



3

Fig. 2. 1 – Hili: schematic plan of the two funerary monuments after restauration. *S. Méry*; 2 – Hili N tomb: Cross-section of the pit-grave. *S. Méry*; 3 – Hili, N tomb: necklace made of cornelian beads. *Photo: G. Basset.*

Tabl. 1. Chronological tables. *S. Méry.*

B.C.	Archaeological sequence of the Oman Peninsula		French excavations	
			Settlements	Tombs
3100	*Early Bronze Age*	HAFIT	P I	Hafit tombs Cairns 1-6
2900				
2700				Hili tomb M
2500		UMM AN-NAR	*Hili 8* P II	
2300				
2100				Hili North tomb A **Hili tomb N**
1900	*Middle Bronze Age*	WADI SUQ	P III	
1700				
1500				

Their diameter is often less than 10 µm, a phenomenon probably increased by calcination. This is very different from usually observed "liberian" fibre diameters (between 15 and 40 µm).

Despite the extreme difficulties of observation, we may exclude "liberian" fibres and envisage instead the use of tow coming from tree species whose bark is said to be at "teille" or "tille" i.e. bark whose internal living part is rich in long, resistant and durable fibres [Vaucher 1993: 34].

As the state of conservation did not enable definition of the exact nature of the liber used, the research has been oriented towards the examination of the environmental data, likely to give indications on the vegetal cover. Anthracological analysis [Tengberg 1998: 162) made on remains gathered at Hili, revealed the presence of many vegetable species for period II (Umm an-Nar period: 2700-2000 B.C.): *Acacia sp.; Calligonum sp.; Chenopodiaceae, Phoenix dactylifera, Tamarix, Ziziphus spina-christi.* Flax was not cultivated at the site and among the identified species only *Phoenix dactylifera* (date palm) could have supplied abundant enough textile fibre (information F. Dupeyron, Laboratoire de paléobotanique de l'Université de Paris VI-Jussieu). However observations made on date palms fibre bear no similarities with the fibres found at Hili.

4.2. Technical analysis

The technical analysis of the yarn was based on 3 fragments measuring respectively 4, 5 and 6 mm in length and 1-1,5 mm in diameter.

Preliminary examination with the binocular magnifying glass revealed the presence of many plied-together elements (S torsion) (Fig. 3: 3).

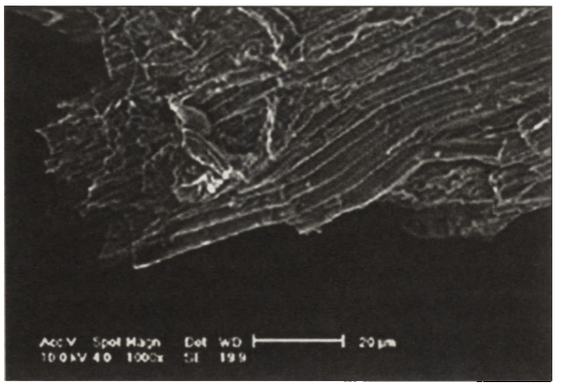
We have temporarily concludes that Hili yarn was plied in S direction, from 4 to 6 simple yarn twisted in S direction too. The conservation of fibres did not allow more precisions about the exact number of simple components. However, it is unusual to twist and ply in the same direction : generally, a plied yarn in S consists of two or several simple yarns in Z (Fig. 3: 5).

Further examination with the electronic microscope allowed us to study the detail of the torsions. In fact, it was not a plied yarn but a simple yarn: what we had previously identified as simple yarn, was made of juxtaposed strips plied together. The effect of torsion can be confusing and was wrongly interpreted during the first examination (Fig. 3: 4).

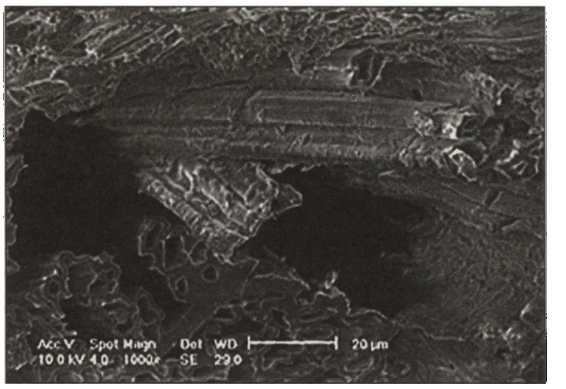
This structure in strips is characteristic of liber which is used in more or less large strips, depending on the diameter of the yarn, thread or cord from which is made. Fibre strips found at Hili measure roughly 0,2 mm in diameter when they are twisted. We estimate the length of a non-plied band at 0,5 mm.

The studied yarn is made of 5 small strips of liber of approximately the same width. This regularity may result from the natural separation of liber during the process of transforming of fibre into yarn. Experimentation shows that this phenomenon occurs when making strips of liber: a vegetable lash is twisted between thumb and index and this repetitive movement softens the liber that splits naturally into thin strips of approximately the same width. Torsion is then applied to all the small strips which turn simultaneously in the same direction (Fig. 4: 1, 2).

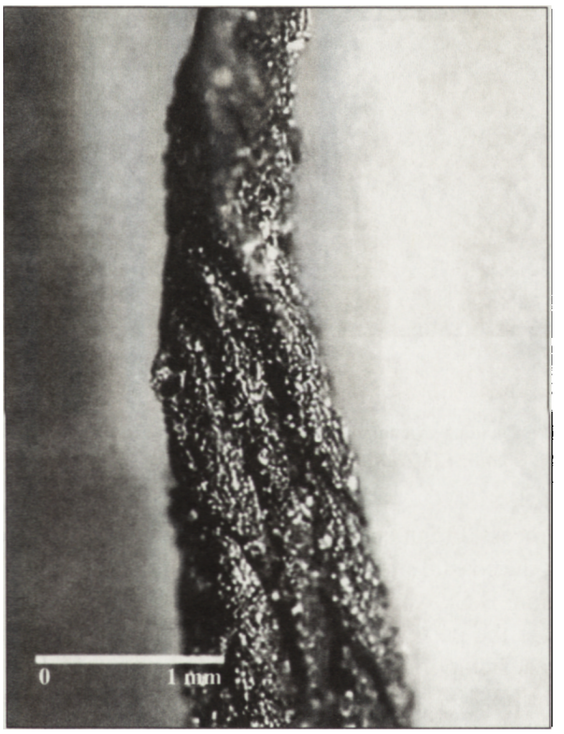
Fragments of yarn gathered in the burial of Hili are reminiscent of this manufacturing technique.



1

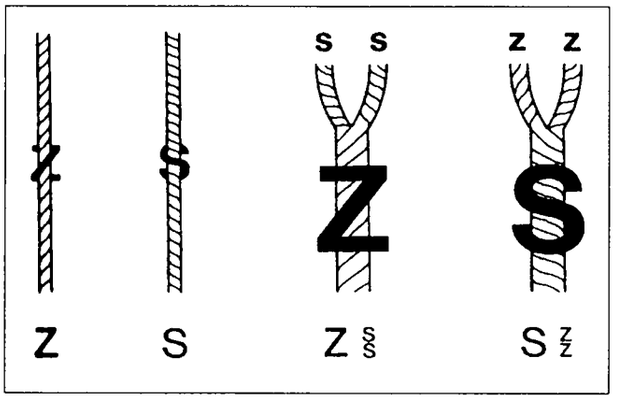


2



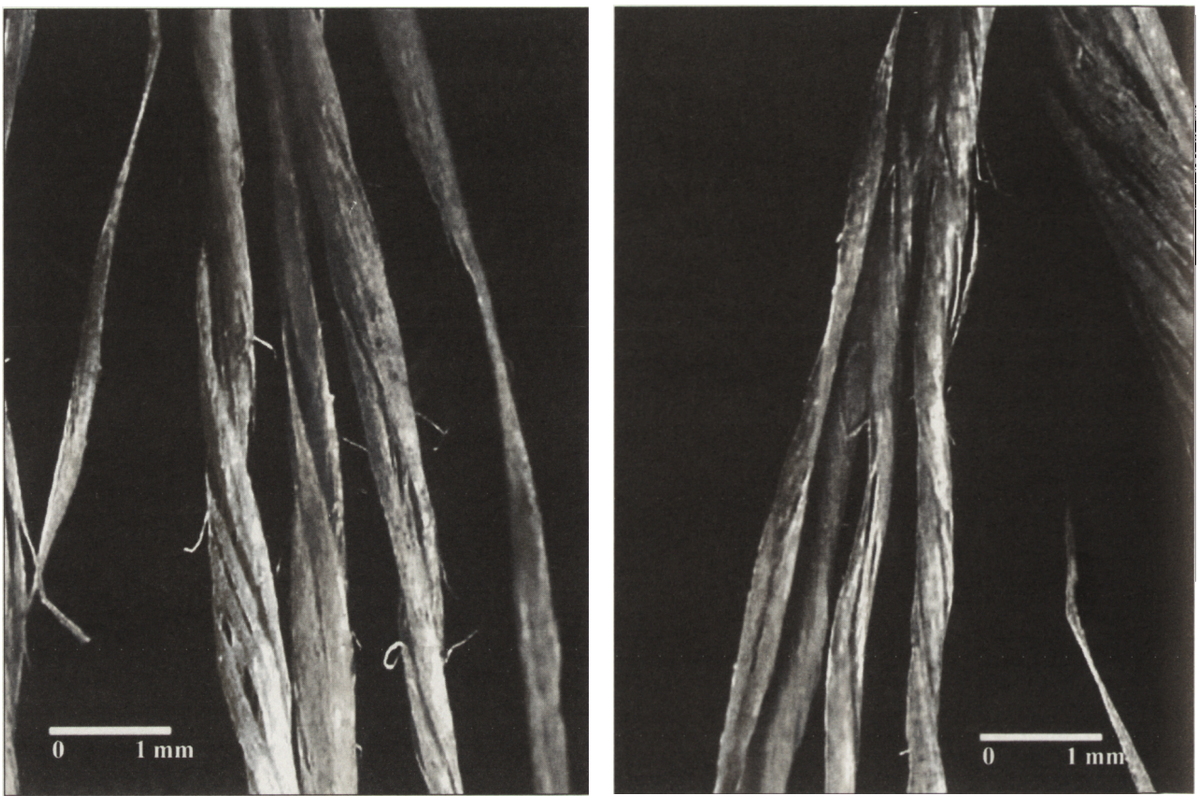
3

4



5

Fig. 3. 1 – longitudinal views and cross-sections of fibre bundles (scanning electronic microscopy X1000). *Photo: Ch. Moulhérat*; 2 – longitudinal view of fibre bundles (scanning electronic microscopy X1000). *Photo: Ch. Moulhérat*; 3 – Hili, N tomb: longitudinal view of Hili yarn made of many bandlets of S twisted liber (binocular magnifying glass). *Photo: F. Médard*; 4 – Hili, N tomb: longitudinal view of Hili yarn (binocular magnifying glass). *Photo: F. Médard*; 5 – plied yarn made out of two simple yarns twisted: direction of torsion is shown by the oblique bar on S and Z letters [L. Bender-Jorgensen, 1986].



1 2

Fig. 4. 1 – natural separation of a strip of liber (limetree liber) in smaller bundles when making yarn. *Photo: F. Médard*; 2 – bundles of liber making a simple yarn. *Photo: F. Médard.*

The analysis of the fibres and the study of the technical characteristics tend to confirm the use of liber as textile fibre: the yarn that held together the pearls of the necklace may have been made without tools with fibres selected for their fineness. The yarn as it is now measures roughly 1 mm in diameter and despite the alteration of the fibres it could not have been larger than the diameter of the bead perforation i.e. approx. 1,5 mm.

5. Conclusion

Yarn from N grave of Hili is precious not only for the information it directly gives us but also because it belongs to a category of remains rarely represented in this region for this period. Given that most of the excavated sites in eastern Arabia are funerary sites, the destruction of textiles can be explained by the action of micro-organisms produced by the decomposition of the bodies. However, it happens that some elements may be locally preserved: this being the case for two textile fragments found at the site of Tell Abraq, (end III^{d} millennium B.C., Umm al Qaiwain, UAE) [Reade, Potts 1993: 99-106]. In contact with metallic objects (spear point and ankle ring in copper or bronze) they have been preserved through a mineralization process. Fragments of yarn have also been discovered at the coastal site of Umm an-Nar (middle III^{d} millennium B.C., Abu Dhabi Emirate, UAE), preserved inside the perforations of many steatite and cornelian beads imported form the Indus region (see Fig.1) [Frifelt 1991]. These finds show that an environment hostile to the preservation of organic materials can sometimes hold unexpected remains, so greater care should be taken during the excavations. As for the elements gathered at Hili and Umm an-Nar, beads often constitute a favourable support for the preservation of yarn. Their examination gives information on both the environment and the know-how of protohistoric populations.

The analysis of textiles coming from Tell Abraq and Umm an-Nar shows that they were made of flax fibres which we do not know if they were imported or if they belonged to a wild species (*Linum bienne* Mill.) or to a domestic one (*Linum usitatissimum* L.). The find of Hili also fails to answer the question of the importation of raw material: if the absence of flax among the vegetable remains gathered on the sites of the Oman peninsula raises questions concerning its origin, the problems tied to the identification of liber do not enable us to determine if it is a local plant or not.

As the remains are scant and do not allow a thorough reflexion, hypotheses must remain largely open. The importation of cornelian beads being confirmed for the site of Hili, it is possible that the necklace was imported already mounted. The presence of many beads that could be of local origin (ophiolit, artificial material.) does not contradict this hypothesis: they could have been added later to the necklace.

These results suggest caution concerning future identifications that will certainly reveal a greater diversity of materials as we have observed in Western Europe at the same period [Médard 2000].

BIBLIOGRAPHY

Tikriti W.Y., Méry S.
2000 *Tomb N at Hili and the question of the subterranean graves during the Umm an-Nar period,* "Proceedings of the Seminar for Arabian Studies", 30, 205-219.

Bender-Jorgensen L.
1986 *Forhistoriske textiler i Skandinavien,* [in:] *Det kongelige nordiske oldskriftselskab*, København.

Frifelt K.
1991 *The Island of Umm an-Nar, 1. Third Millenium Graves. Aarhus,* "Jutland Archaeological Society Publication", 26, 1.

Médard F.
2000 *L'artisanat textile au Néolithique. L'exemple de Delley-Portalban II (Suisse) 3272-2462 avant J.C.*, Collection Préhistoires 4, Editions Monique Mergoil, Montagnac.

Méry S., Rouquet J., McSweeney K., Saliège J.-F., Al Tikriti W.Y.
2001 *Re-excavation of the Early Bronze Age collective Hili N pit-grave (Emirate of Abu Dhabi, U.A.E.): results of the first two campaigns of the Emirati--French Project,* "Proceedings of the Seminar for Arabian Studies", 31, 161-178.

Moulhérat Ch.
2000 *Un exemple de conservation providentielle: les textiles minéralisés par les produits de corrosion,* [in:] *La conservation-restauration en archéologie: objets composites, traces et prélèvements, XVI^{ème} journées des restaurateurs en archéologie, 25-26 juin 1998,* Saint-Denis, Conservation-Restauration des biens culturels, Cahiers techniques no. 5, 51-58.

Reade W.J., Potts D.T.
1993 *New evidence for late third millennium linen from Tell Abraq, Umm al-Qaiwain, UEA,* "Paléorient" 19 (2), 99-106.

Srinivasan R., Jakes K.A.
1997 *Optical and scanning electron miscroscopis study of the effects of charring on indian hemp (Apocynum cannabinum L.) fibres*, "Journal of Archaeological Science", 24, 517-527.

Tengberg M.
in print *Paléoenvironnements et économie végéatle en milieu aride. Recherches archéobotaniques dans la région du Golfe arabo-persique et dans le Makran pakistanais (IV^{ème} millénaire avant notre ère – I^{er} millénaire de notre ère)*, Thèse de Doctorat, Université de Montpellier II, 1998.

Vaucher H.
1993 *Guide des écorces*, Delachaux et Niestlé, Neuchâtel.

Fabienne Médard
UMR 7055: Préhistoire et Technologie
21 allée de l'Université
92023 Nanterre cedex.

Christophe Moulhérat
UMR 171: Centre de Recherche et de Restauration
des Musées de France
6 rue des Pyramides
75041 cedex 01 Paris.

Sophie Méry
UMR 7041: Archéologies et Science
de l'Antiquité
21 allée de l'Université
92023 Nanterre cedex.