CARRIER NETTING FROM THE PTOLEMAIC ROMAN HARBOUR TOWN OF BERENIKE (EGYPTIAN RED SEA COAST)[1]

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Abstract*:* The excavations at Berenike (Egyptian Red Sea Coast) yielded various examples of carrier netting, mainly from first century AD contexts. This paper presents the artefacts, describes and illustrates them. Preliminary conclusions are offered on the basis of comparison with material from other sites, especially Qasr Ibrim. The objects' representation in art and their occurrence in the archaeological record are discussed.

Keywords: cordage-netting-knots-Berenike
Palabras Clave: cordaje-redes-nudos-Berenice

INTRODUCTION

Among the cordage excavated at the Ptolemaic Roman harbour town of Berenike (Egyptian Red Sea Coast) are 142 pieces of netting. The netting originates from eight different trenches (figure 1), distributed over 32 different loci, including six baulk and trench cleaning loci and 41 pb[2]-numbers. The focus of the present work is on the netting not related to fishing, referred to as carrier netting (table 1). All 53[3] fragments originate from early Roman contexts (first century AD) with the exception of one complete net from trench BE94/95-1; this is dated to the fifth century AD or later. The knotless netting from trench BE96/…-10 will be dealt with separately; this fragment

[1] The excavations at Berenike were conducted by the University of Delaware (co-director S.E. Sidebotham) and the Leiden University (co-director W.Z. Wendrich) during 1994-2001.

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[2] A 'p(ottery) b(ucket)' is the smallest unit within each locus (see Wendrich 1996: 127). The field method is a modified Gezer excavation and recording system (Sidebotham *et al.* 1989: 134-136). Dating has been done on the basis of pottery; see http://www.archbase.com/, the database website of the excavations, for the complete dating of all loci, but also Veldmeijer, in review, a. BE99-31.ebc ….-h-7279. The pieces of cordage were registered on 18 December 2000. The trench however, was excavated during the 1999 season. Therefore no site identification number was given. The area where these trenches are situated are all dated to the first century AD. We decided to take the netting into the cordage database because of the preserved ring.

[3] Two entries are numbered 'several' and consist of isolated reef knots.

is also dated to late Roman times. The carrier netting originates from eight trenches (13 loci[4] and 15-pb numbers)[5].

Carrier netting is recognized by various characteristics. Netting made of grass or palm can be regarded as carrier-netting, because these materials are far less suitable for use in water. When soaked, they are more susceptible to deterioration[6], worsened by the generally low Cord Indices of Ply (CIP)[7] of grass cordage of this composition[8]. Furthermore, the soaked netting would be too heavy to work with easily and mending the netting would result in very weak spots because the newly inserted strings[9] cannot be tied properly to the wet netting. Although these repairs are weak spots in flax netting as well, flax can be tied more strongly. Fish-netting is made exclusively with mesh knots, even nowadays, whereas these knots are mostly not used in carrier netting.

The material[10]

The netting from Berenike is fragmented and deteriorated and complete carrier netting has not been recovered, except for one example from the fifth century AD (see below). The character of the handles of the Berenike netting, if there were any, remains obscure[11]. Handles in pottery carriers, for instance, were used to put a strong pole through to carry the heavy load, as is shown in scenes in art (see below). Moreover, Wendrich[12] published a reconstruction of a pottery carrier with handles recovered from Amarna and finds from Qasr Ibrim also show handles[13]. However, netting made with overhand knots, like the one excavated at Amarna, are not encountered in Berenike. This might indicate a different way of constructing netting in Pharaonic and Roman times. Other carrier netting with handles, though not pottery carriers, has

[4] But see the remarks on the loci of trench BE96/97-13 in Veldmeijer, in review, a.

[5] See note 2.

[6] Wendrich & Veldmeijer 1996: 289.

[7] The Cord Index of Ply (CIP) expresses the tightness of a piece of plied cordage.

[8] Veldmeijer, in review, a.

[9] Cordage with a diameter of less than 10 mm.

[10] Terminology is presented in detail in Wendrich 1991; Wendrich & Veldmeijer 1996. A discussion and evaluation of terminology in Veldmeijer, in review, b. For knots in general see Ashley 1993 and Veldmeijer, accepted.

[11] (Pieces of) handles are recovered but it is not possible to be certain on the origin of them. They might originate from netting as well as from baskets.

[12] Wendrich 1989; 1999.

[13] Veldmeijer & van Roode, forthcoming.

been reported from Roman Tebtunis[14]. The size of the netting depends on the size of the jar, which does not mean that netting was specifically made for one type of pottery; netting can be slightly adjusted to fit the size of the pottery.

The small meshed carrier netting, recovered from trench BE94/95-1[15] has already been discussed by Wendrich[16]. It is the only almost complete netting object: all other pieces of netting, fishing, carrier or hair netting alike, are small to large fragments. All but one site artefact registration number, containing ten pieces of netting, are made with zS_2[17] cordage (table 1). The diameters vary from 1.0 up to 3.5 mm for the yarn and 1.5 up to 5.1 mm for the ply[18]. The CIP varies from 50 to 71, which is a remarkable small variation compared to that with the fish-netting (33 up to 86[19]). Mesh size varied from small (9.8 mm) to large (41.4 mm).

Eleven pieces of netting (table 1) have been made with half knots[20]. All but the five pieces from BE01-48 originate from one trench, namely trench BE99-31, but both trenches have been dug in the same trash dump (figure 1) and are dated to the first century AD. The description presented here is based on the fragment shown in figure 2[21]. This netting is made with zS_2 grass cordage with a CIP of 71 and measures 200x330 mm. It contains 35 S[22] half knots which are 24.5 mm spaced. The mesh created has an opening of 31.2 mm. There is no indication of a top or bottom (which is also the case with the other ten pieces made with half knots). The lack of top or bottom makes the reconstruction of the knotting technique difficult but a possible way of knotting is shown in figure 2D. A string is laid in a curve next to the neighbouring string (2D, top left). The extremity marked 'I' is moved under

[14] Domning 1977.

[15] BE94/95-1.031 0466-H-9035.

[16] Wendrich 1995.

[17] zS_2 and comparable formulae: The twist is the orientation of yarns, plies and cables, made visible by 'z' or 's' (yarns), 'Z' or 'S' (plies), '[Z]' or '[S]' (cable), '{Z}' or '{S}' (double cable). The central stroke of the letter marks the orientation. Thus $zS_2[Z_3]$ means that two z-spun yarns ($_2$) are twisted in S-direction. There upon three ($_3$) of these plies are cabled in [Z]-direction. Note that there are various ways of visualising the twist of cordage.

[18] Two or more twisted yarns. A ply is the second level of a string and rope.

[19] Veldmeijer & van Roode, in review.

[20] Note that netting with half knots, as presented here, differs from that presented by Wendrich (1991: Figure 24 (=30)). The different definition (*cf. ibidem*) is the reason for this.

[21] BE99-31.007 2887-h-3889.

[22] The description of the orientation of knots is comparable to the description of twist and composition, following the middle stroke of the 'S' and 'Z', see note 17.

the neighbouring string ('II') and into the curve just made (2D, top right). Pulling the extremity closes the half knot. In the next row, extremity 'I' is used as the tied string, (2D middle and bottom respectively). The strings change from active ('I'; the string that ties) to passive ('II'; the string that is tied), which results in a 'staircase-like' pattern (figure 2C).

Over 33 pieces of netting, made with reef knots[23], have been registered (table 1). Fourteen of these are made with SZ reef knots. It has not proved possible to identify the orientation of the reef knots in the other fragments. Making netting with reef knots is done in two ways, according to Ashley[24]. Figure 3A shows a reconstruction drawing in which the (thinner) strings are attached to a thicker string[25]. The way in which the strings are attached to the thicker top string or rope[26] is taken from BE99-31.ebc …-h-7279 (see figure 4). Obviously there are many ways of connecting the netting to a border string/rope. Both extremities of the two strings, marked 'I' and 'II' in figure 3A, participate in the knotting. Extremity 'II' of string 'a' is knotted into a reef knot together with extremity 'I' of string 'b.' Extremity 'I' of string 'a' is knotted into a reef knot with 'II' of another string, marked 'c.' The knotting is done downwards (i.e. in the figure; when using the work might be turned 45 degrees), taking the thicker border line as top, which results in horizontal reef knots. In this reconstruction each string participates with two other strings in the knotting of the reef knots. The reconstruction shows equally orientated reef knots, but an alternation of ZS and SZ rows is possible as well. It is not possible to differentiate between ZS and SZ reef knots unless both knots are used in the same object[27].

Another way of knotting netting with reef knots, mentioned by Ashley (*ibidem*), requires a netting needle. Figure 3B shows a reconstruction drawing in which two strings, attached to a border line as explained above, are knotted into a hitch. Then, the hitches are turned over by pulling the strings,

[23] See also Veldmeijer (1999: 267-269) for netting made with reef knots (BE96/97-13.002 2676-h-2302). Reef knots are also known as square knots.

[24] Ashley 1993: 65.

[25] If the production of netting with reef knots is compared to the production of netting with mesh knots, the thicker string is not necessarily the beginning of the netting. Often a thicker string is knotted at the end of the production process of netting made with mesh knots (Wendrich 1999: 293-295).

[26] Cordage with a diameter of 10 mm or more.

[27] For a detailed discussion on problems with reef knots see Veldmeijer, accepted.

marked 'II' in the figure, into the direction of the arrows. However, Ashley does not mention the fact that the hitch only changes into a reef knot if the part of the string, which is marked 'I' in the figure, is moved in the opposite direction[28]. This knotting, either done from left to right or from right to left, results in vertical reef knots.

The pieces of netting shown in figure 4 originate from a first century AD context[29] and are made of grass zS_2 cordage with a CIP of 47. The pieces, of which the circumference is shown in figure 4A, measure 510x770 mm and 180x1070 mm and contain >150 and >90 ZS reef knots respectively. The bottom ring[30] is used as starting point for the establishment of reef knots[31]. Half of the bottom ring is preserved and the reconstructed diameter is 45 mm.

Though small, pottery vessels with bases that fitted such rings are reported[32]. The bottom ring of the netting is made of three or four zS_2 strings but the exact number cannot be determined due to the fragmented state. The same is true for the diameter of these strings, but the minimal diameter is 2.5 mm for the yarn and 5.2 mm for the ply. The string that is used to knot the netting is folded over the ring (figure 4B). Due to the bad preservation it remains uncertain in which way these loops are locked; either half hitched around two of the extremities as shown in figure 4B left, or around one of the extremities as seen in figure 4B right.

The first row of reef knots is either made with the same string as the loops or a new string is inserted. Insertion of new string, either fastened by means of knots or twisted into the previous string, is inevitable during the following, continuous knotting of the netting (see the general description above). The average diameter of the mesh openings is 33.1 mm. The netting has three irregularities (figure 4C). One (figure 4C top left), is made by a piece of string running through several meshes. The string has a standard overhand knot but is not fastened to the netting, nor did it tie it. If not broken, it is hard to believe that it is some sort of repair. The exact meaning of this piece of string is unclear. The irregularities shown in figure 4C top

[28] On the relation between reef knots and hitches see also Veldmeijer (1999).

[29] But see note 2.

[30] It is called 'bottom ring' because the toe (bottom) of the amphora is put in the ring; the ring in contrast is the starting point of knotting the netting.

[31] Although the small piece of netting has no bottom ring and thus no starting point, the orientation of the reef knot is the same as of the larger piece because the two pieces originate from the same carrier netting.

[32] For instance Tomber 1999; pers.com. Pearce 1999.

right and bottom on the other hand, have been made to repair the netting. The repair top right shows the repair of a hole by means of a string of which one extremity is knotted to the netting at one side of the hole by means of half knots. The netting on the other side of the hole is pulled by the other extremity after which it crosses the gap and is folded around the same netting as it has knotted. Figure 4C bottom shows a repair by means of one string. The string has been fastened to one side of the netting by means of a half knot. It ties another string in the middle of the hole, also by means of a half knot, after which it forms a reef knot with a side mesh, thus connecting two sides of the damaged part. The third side is connected, too, because the string has been knotted to this part of the netting by means of a half knot. The other extremity has been tied in.

Another piece of carrier netting from the same period, though from another trench, is shown in figure 5[33]. The netting consists of one large piece and several isolated knots and originates from a first century AD context. It is most likely made of grass, but a certain identification could not be obtained due to the deteriorated condition. The cordage has a zS_2 composition with a CIP of 67. The piece measures 290x370 mm and contains SZ reef knots. The bottom ring, used as the starting point, has an inside diameter of 27.0x37.3 mm and is slightly malformed. The width of the ring, measured from the inside to the outside, is 16.1 mm, which results in a total outside diameter of 60 mm. The ring is 16.5 mm thick. It is not possible to determine the nature of the core of the ring (unspun material, plied or cabled[34] cordage etc.) due to the loops of the netting. These loops ('I' in the figure 5B) connect the netting to the core and are very tightly pushed together. The loops are tied at the inside and outside of the ring by means of a twined string (see inset figure 5B for the pattern). Most likely this construction is comparable to the technique shown in figure 4. Certainty on this however cannot be obtained without damaging the ring which we were anxious not to do. The loops at the ring have been used to connect the first row of knots. The first row of reef knots is connected in the same plane as the loops (see 'I' in the figure).

In other words, when looking at the netting from a side, the first row of knots faces in side view. The next row of knots, marked 'II' in the figure, connects two knots of the first row in such a way that the orientation of the knots changes from a side view to a view *en face*, which continues throughout

[33] BE99-29.007 0554-h-3892.

[34] A strand, which is formed by two or more twisted plies. A cable is the third level of string and rope.

the rest of the netting. The new view is obtained due to the 90-degree angle with the first row of knots. The meshes created this way have an average opening of 35.4 mm (the first row of meshes are not taken into account in calculating the average mesh size, because these meshes have a different shape and are much smaller).

Carrier netting made with mesh knots is an exception, because almost all carrier netting is made with other knots. Fish-netting on the other hand, is made exclusively with mesh knots, even nowadays. The production of mesh knot carrier netting is assumed to be comparable to the knotting of fish-netting (except, of course, the adding of floats and weights and the like)[35]. The netting shown in figure 6[36] is made with grass zS_2 string with a CIP of 50. The piece originates from a first century AD context and measures 1060x580 mm. It contains 15 rows of S orientated mesh knots[37]. The meshes have an average opening of 22.9 mm. The edge of the netting consists of a zS_3 string, which has a slightly larger diameter. The CIP however is slightly less (48). A zS_2 string runs through the openings created by the zS_3 string, which is still partly in place. Most of these meshes, 16 up to the concreted part, are pointed, which is an indication of the force that was exerted on them by pulling the zS_2 string in the opposite direction. This side of the netting however, is not the side at which the knotting was started[38]. Three repairs are observed of which one is shown in figure 6D left. Three zS_2 strings are folded over the string between two mesh knots. Thereafter, these three strings are cabled into an $[S_6]$ cable. This cabling is done very tightly because the cable tends to curl. The diameter of this piece of cordage is 7.4 mm and contrasts sharply with the diameter of the cordage from which the netting is made because this cordage has an average diameter of 3.3 mm. A CIP/CIC cannot be determined due to the irregular plying/cabling. It is unclear how the other end of the string is tied to the netting. Another damaged part is repaired by mesh knotting a thick piece of zS_2 string with a diameter of 6.1 mm into a damaged part (not illustrated). The third damaged part is repaired by hitching a piece of rope, with a diameter of 10.4 mm and a CIP of 64, at

[35] On the knotting of fishing netting see Wendrich (1999: 293-295) and Veldmeijer & van Roode, in review.

[36] BE99-31.007 2887-h-3888.

[37] The exact number of knots cannot be determined due to the concreted and curled part. This part is not retrieved in order to protect the non-concreted part from salt encrustment. It was therefore detached from the non-concreted part.

[38] Wendrich 1999: 293-295.

both sides of the mesh knot, as seen in figure 6D right. The zS_2 string is cabled [S_2] after the hitch. Another example of carrier netting made with mesh knots consists of three pieces[39] and originates from a context that is dated to the first century AD.

The netting is made of grass zS_2 string with a CIP of 54. The average size of the opening of the meshes is 26.1 for the smaller pieces and 30.3 for the larger piece. The piece, shown in figure 7, consists of a bottom ring with a piece of netting[40]. The ring is comparable to the bottom ring shown in figure 5 and has an inside diameter of 27.5 mm. The thickness of the ring is 19.4 mm and the width, top view, is 15.5 mm. The attachment of the netting to the ring differs from the previously discussed rings. The exact attachment cannot be determined without damaging the ring and the netting, which has therefore not been done. It is certain however, that one knot is inserted at the top of the ring, marked 'I' in figure 7B, whereas the next one is inserted at the bottom of the ring, marked 'II' in the figure. This results in a first row of knots that face outwards, as are the following rows. This contrasts with the netting previous discussed in which the first row of knots makes a 90 degree angle relative to the bottom ring. The knots at the top are connected with the neighbouring knot at the bottom, by means of a knot of the following row, marked 'III' in the figure. The knots in the first row are close together leaving small, nearly closed meshes. The meshes of the netting further away from the ring are larger (inset figure 7B). The netting shows loops, which are made of zS_3 string (*cf.* the netting shown in figure 6). The CIP of this zS_3 string is 62. The largest piece has a repair that is made with a thicker string (diameter of 5.8 mm); it is knotted with a mesh knot.

Another knot is made in the opposite direction; possibly this is a repair as well. Twining is used to secure the attachment of the netting to the ring (*cf.* figure 5).

Use of carrier netting

Despite the fact that pottery is probably the most extensively studied artefact category, surprisingly little attention has been given to the transport of these items and even less to the individual moving of (large) pottery vessels. Although a detailed study is in progress, we present a few examples of pictorial evidence of the transport of pottery by means of carrier netting.

[39] BE99-31.sbc 3957-h-3891.

[40] BE99-31.sbc 3957-h-3891.

Pottery and especially large vessels and amphorae were, according to tomb scenes, often transported by means of carrier netting[41]. Many scenes in tombs of Pharaonic periods depict this means of transport and provide insights into the use of such carrier netting.

However, scenes also depict people carrying amphorae on their necks[42]. Transport over relatively short distances or transfer from one ship to another and comparable activities were probably done without netting. Often these jars have handles but netting was still used to carry handled amphorae, probably for transport over larger distances. The New Kingdom tomb of Wah (Thebes nr. 22) shows an amphora with handles, carried in a carrier (figure 8). Here, the spike is put in the ring. The netting recovered in Amarna, was also reconstructed with the idea that the spike was put into the ring[43]. But the bottom of a pot does not necessarily protrude through the ring in order to retain its position in the netting.

A complete pot with carrier netting in situ from Qasr Ibrim shows that the bottom rests upon the ring in pretty much the same way as on a pot stand[44]. Some depictions show the bottom ring on the outside of the jar or show carriers without a bottom ring. The use of the ring depended on the shape of the pottery as well (different forms of pottery, more specifically amphorae, are encountered in Berenike); evidence from Qasr Ibrim suggests that carriers without a bottom ring were used as well.

Strong poles might have been put through the handles of the nets to carry the heavy load, as is shown in scenes in the New Kingdom tomb of Rekhmira[45]. Though not found at Berenike, we should like to mention some netting from elsewhere, as for instance that found at Qurneh[46]. Some of these pieces are elaborate knot-works and used to carry small pots. Probably, these were made for a special purpose, for instance to carry pots used in a ritual or for being interred (the instances have been found in an intact burial of the 18th dynasty).

[41] Literature refers to the nets as sling (Wendrich 1989); we prefer to use the term ‘pottery carrier’ because this term immediately makes clear what is meant. Terms including reference to ‘amphorae’ are to be avoided as not all pottery carried with netting was amphorae.

[42] Casson 1994: 103 (figure 76), 132 (figure 96).

[43] Wendrich 1989: 183-186; 1999: 204-205.

[44] Veldmeijer & van Roode, forthcoming.

[45] For instance Davies 1943: plate L; another instance is shown in figure 8.

[46] Petrie 1909.

Another example of elaborate knotting can be seen in the Cairo Museum. It is hard to believe that this netting was made with the idea of transporting pots and a more decorative function seems to be more plausible. These items are included in future studies[47], but it can be easily assumed that these nets were made for long term use.

The netting from Qasr Ibrim, mentioned above, is thought to have a far shorter lifespan and might have been made for single use only, based on the simple construction and the string used (only spun and not twisted).

Netting was not used just for carrying amphorae or other pottery. Stalks of grain were transported in netting sacks, either carried by a man, as depicted in the tomb of Menena[48] or by an animal. This latter method of transport was still prevalent in Egypt at the beginning of last century[49] and can be seen even today. A complete net from the Roman town of Tebtunis[50] had also large meshes (much larger even than the meshes encountered in Berenike). According to the author[51]: "In view of the small overall size but very large mesh of this netting, it would hardly have been useful for fishing or fowling. It clearly seems to have been intended as a general utility netting for holding or transporting bulky objects, or securing a load on the back of a pack animal…". The latter seems less probable, because in such a case the netting could be tied at the top, or as mentioned above, netting sacks could be used, and this theory gives no explanation for the handles.

In general, the meshes of these netting sacks and carrier nets are large. As table 1 shows, the mesh size of the Berenike netting is relatively small. Consequently, it is tempting to conclude that remains of netting sacks are not among the netting material recovered there. However, the nature of the excavated netting does not exclude a use for transporting items other than pottery, despite the relatively small mesh size. Furthermore, the nature of cordage is such that one always has to reckon with multiple applications, for netting as well as for other cordage.

Discussion

As has been stated above, the research into carrier netting is still in its infancy. This article is the first in a series of articles presenting detailed

[47] Veldmeijer & van Roode, forthcoming.

[48] Gutgesell 1997.

[49] Blackman 2000: 173, 177 fig. 104.

[50] Domning 1977.

[51] Domning 1977: 57.

research on cordage. The project, based on archaeological evidence, will include pictorial evidence as well.

The surviving carrier netting is generally of solid construction. The nets have been carefully made; the bottom rings are sturdy. Although three kinds of knots (reef knots, half knots and mesh knots) have been used to make the netting, the reef knot is the most common knot as is to be expected in carrier netting. The repairs are not as carefully executed; sometimes even half-knots have been used, which loosen easily.

Comparison of the netting from Berenike with material from other sites leads to the preliminary observation that three types of netting can be distinguished: the well-made netting discussed in this paper, which was used until beyond repair, the coarse netting made of yarns and knotted with half-knots or the knotless netting which appears to have been made for one-time use only, and the netting made by means of decorative elaborate knotting. Possibly, this last-mentioned netting was used to hang pots from the ceiling to keep them away from crawling insects, rodents and the like. This can still be observed in present-day Nubia. They might even have been used in ritual contexts (including burials) as well.

As far as the preservation is concerned, in general only the lower parts of the netting have been preserved. This part is the most sturdy element of the construction, with a larger density of the netting around the bottom ring. Another reason for the poor preservation is the nature of the material used. The perishable character of objects made of organic material such as netting results in the survival of relatively few finds. The perishable character of this type of netting is even further increased due to the relatively low CIP of the cordage used. As a result, it is even more susceptible to deterioration and hence has not survived. Another reason for the relatively low amount of cordage finds is that cordage is a multi-purpose, multi-functional and above all re-usable item and organic material was often used, when discarded, as fuel for ovens and kilns.

The carrier netting has been recovered mainly from the early Roman contexts; only one piece of netting can be dated to a fifth century AD context. The lack of material from the centuries in between these two periods can be explained by the fact that no trash dumps from this era have been excavated. The explanation for the lack of netting from the fifth century AD trash dump is more difficult. One possible reason is that the nature of the deposit was not related to the activities for which these nets would have been used. The fifth-

century excavated trash dump in the middle of the town is a domestic waste heap whereas the early Roman dump contained much more industrial material. Other explanations need to be considered as well, however.

The absence of carrier netting in the fifth century AD might also reflect a different way of handling and transporting the large quantities of pottery still transiting through Berenike in this late period. Pictorial evidence from the Pharaonic era indicates that netting was used to carry pottery with handles (amphorae) as well as pottery without handles. Judging from the absence of carrier netting in later contexts, changes apparently occurred in the traditional way of transporting goods; in this period the pottery might have been transported by hand. Roman representations of ships unloading cargo show pottery being carried on the shoulder or by hand; no carrier nettings are depicted.

Transporting by hand, in turn, might be explained by the fact that in general the pots were smaller and easier to carry by hand and/or by means of ropes through the handles. In short, the absence of netting from later periods may be attributed to both the nature of the excavated dumps and/or a possible change in methods of transporting cargo.

Acknowledgments

W.Z. Wendrich and R. van Walsem are acknowledged for reading earlier drafts of the manuscript; J.P. Wild and F. Wild are acknowledged for reading the manuscript and checking English. S.E. Sidebotham and R. Tomber are thanked for the remarks on the transportation theory. P.J. Rose and the EES are acknowledged for allowing us to use the Qasr Ibrim material for comparison and J. Spencer is thanked for his assistance in the study of Qasr Ibrim material in the British Museum, London. We thank E. Endenburg for the production of various figures and his assistance in field work and A.M. Hense is thanked for reworking the photographs.

REFERENCES

ASHLEY, C. W. 1993. *The Ashley book of knots*, New York/London/Toronto/ Sydney/Auckland, Doubleday.

BLACKMAN, W.S. 2000. *The fellahin of Upper Egypt*, Cairo, The American University in Cairo Press (Classic Reissues).

CASSON, L. 1994. *Ships and seafaring in ancient times*, London, British Museum Press.

DAVIES, N. DE G. 1943. *The tomb of Rekh-mi-Re at Thebes*, New York, The Metropolitan Museum of Art.

DOMNING, D. P. 1977. «Some examples of ancient Egyptian ropework». In: *Chronique d'Égypte* LIL, pp. 49-61.

GUTGESELL, M. 1998. «Economie en handel». In: SCHULZ, R. & M. SEIDEL, (eds.), *Egypte, het land van de farao's*, Köln, Könemann Verlagsgesellschaft, pp. 371-375.

MACKAY, E. 1916. «Note on a new tomb (no. 260) at Drah Abu'l Naga, Thebes». In: *Journal of Egyptian Archaeology* 3, pp. 125-126, plates XIV, XV.

PETRIE, W. M. F. 1909. *Qurneh*, London, Memoir(s) of the Egypt Exploration Fund (British School of Archaeology in Egypt 16).

SIDEBOTHAM, S. E., RILEY, J. A., HAMROUSCH, H. A. & BARAKAT, H. 1989. «Fieldwork on the Red Sea Coast. The 1987 Season». In: *Journal of the American Research Center in Egypt* 26, pp. 127-166.

TOMBER, R. S. 1999. «The pottery». In: SIDEBOTHAM, S.E. & W.Z. WENDRICH, (eds.). *Berenike 1997. Report of the 1997 excavations at Berenike and the survey of the Egyptian Eastern Desert, including excavations at Shenshef*. – Leiden, Centre of Non-Western Studies (CNWS Publications, special series no. 4), pp. 123-159.

VELDMEIJER, A. J. 1999. «The cordage». In: SIDEBOTHAM, S.E. & W.Z. WENDRICH, (eds.), *Berenike 1997. Report of the 1997 excavations at Berenike and the survey of the Egyptian Eastern Desert, including excavations at Shenshef*. – Leiden, Centre of Non-Western Studies (CNWS Publications, special series no. 4), pp. 257-276.

VELDMEIJER, A. J. In review, a. «A basic statistical description of archaeological cordage. A case study of the material from the Ptolemaic Roman harbour site Berenike (Egyptian Red Sea Coast)». In: *PalArch, series archaeology of Egypt/Egyptology*.

In review, b. «Archaeologically attested cordage. Terminology on the basis of the material from Ptolemaic Roman Berenike (Egyptian Red Sea coast)». In: *Eras*.

Accepted. «Knots, archaeologically encountered: a case study of the material from the Ptolemaic Roman harbour Berenike (Egyptian Red Sea Coast). In: *Studien zur Altägyptischen Kultur* 34 (2005/06).

VELDMEIJER, A. J. & S. M. VAN ROODE. In review. «Fishing netting from Berenike (Egyptian Red Sea Coast)». In: *Antiquity*.

Forthcoming. «Carrier netting from Qasr Ibrim, Egypt».

WENDRICH, W. Z. 1989. «Preliminary report on the Amarna basketry and cordage». In: KEMP, B.J., (ed.), *Amarna reports V*. – London, Egypt Exploration Society, pp. 169-201.

WENDRICH, W.Z. 1991. *Who is afraid of basketry; a guide to recording basketry and cordage for archaeologists and ethnographers*. Leiden, Centre of Non-Western Studies (CNWS Publications).

1995. «Basketry and cordage». In: SIDEBOTHAM, S.E. & W.Z. WENDRICH, (eds.), *Berenike '94, preliminary report of the excavations at Berenike (Egyptian Red Sea Coast) and the survey of the Eastern Desert*. Leiden, Centre of Non-Western Studies (CNWS Publications, special series no. 1), pp. 68-84.

1996. «The finds, introduction». In: SIDEBOTHAM, S.E. & W.Z. WENDRICH, (eds.), *Berenike '95, preliminary report of the excavations at Berenike (Egyptian Red Sea Coast) and the survey of the Eastern Desert*. Leiden, Centre of Non-Western Studies (CNWS Publications, special series no. 2), pp. 127-145.

1999. *The world according to basketry: interpretation of basketry production and basket makers in ancient and modern Egypt*. Leiden, Centre of Non-Western Studies (CNWS Publications).

WENDRICH, W. Z. & VELDMEIJER, A. 1996. «Cordage and basketry». In: SIDEBOTHAM, S.E. & W.Z. WENDRICH, (eds.), *Berenike '95, preliminary report of the excavations at Berenike (Egyptian Red Sea Coast) and the survey of the Eastern Desert*. Leiden, Centre of Non-Western Studies (CNWS Publications, special series no. 2), pp. 269-296.

FIGURE TEXTS

Table 1. Carrier netting, quantified per context. The table lists various aspects of the netting such as material, size and knots ('-' = not taken). The entries marked with * (trench BE94/95-01) originate from a fifth-sixth century AD deposit. The others all originate from a first century AD deposit.

Figure 1. The location of Berenike on the Red Sea Coast of Egypt. Inset: Map of the Ptolemaic Roman harbour site Berenike, with trenches that produced cordage indicated in grey. Maps by A.M. Hense.

Figure 2. A: Piece of netting, knotted with half knots (BE99-31.007 2887-h-3889). Scale bar photograph = 100 mm. Photograph by R. Bakker (Courtesy of the University of Delaware / LeidenUniversity / UCLA Berenike project).

B: Shadow drawing (scale bar = 30 mm).

C: Reconstruction drawing (not to scale).

D: Possible sequence of knotting (not to scale, see text for explanation of Roman numerals). Drawings by A.J. Veldmeijer/E. Endenburg.

Figure 3 A, B. Two ways of making netting with reef knots. The letters and Roman numerals are explained in the text. Not to scale. Drawings by A.J. Veldmeijer/E. Endenburg.

Figure 4. A: Outline of the two pieces of netting (BE99-31.ebc …-h-7279).

B: Two possible means of securing the string to the bottom ring.

C: Repairs. Not to scale. Drawings by A.J. Veldmeijer/E. Endenburg.

Figure 5. A: Large piece of carrier netting made with reef knots (BE99-29.007 0554-h-3892). Scale bar = 100 mm. Photograph by R. Bakker (Courtesy of the University of Delaware / LeidenUniversity / UCLA Berenike project).

B: Reconstruction drawing of the attachment of the piece of netting to the bottom ring. See figure 4 for alternative ways of attaching the netting to the ring. It is assumed that one large piece of string is wrapped several times because this is stronger than knotting different strings. Inset shows the pattern displayed by the security of the attachment of the netting to the bottom ring. Not to scale. Drawings by A.J. Veldmeijer/E. Endenburg.

Figure 6. A. Carrier netting made with mesh knots (BE99-31.007 2887-h-3888). Scale bar = 100 mm. Photograph by R. Bakker (Courtesy of

ENTRE PÁGS. 24 Y 25 VAN LAS PRIMERAS 8 P. DEL PLIEGO (1)

the University of Delaware / LeidenUniversity / UCLA Berenike project).

B: Shadow drawing. Scale bar = 30 mm.

C: Outline of the netting (not to scale).

D: Reconstruction drawing of the piece of netting, hatched in C.

E: Repairs (I, II, III from left to right, not to scale). Drawings by A.J. Veldmeijer/E. Endenburg.

Figure 7. A: Carrier netting made with mesh knots (BE99-31.sbc 3957-h-3891). Scale bar = 100 mm. Photograph by R. Bakker (Courtesy of the University of Delaware / LeidenUniversity / UCLA Berenike project).

B: Reconstruction drawing of the attachment of the netting to the bottom ring of the carrier. Inset: Schematic drawing of the distribution of mesh size. Not to scale. Drawings by A.J. Veldmeijer/E. Endenburg.

Figure 8. Offering bearers carry a large amphora by means of netting, hung on a pole. From the tomb of Wah, Thebes, New Kingdom (Drawing by E. Endenburg after MacKay, 1916: plate XIV).

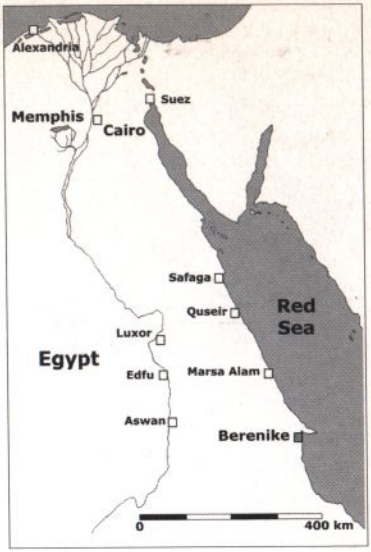


Figure 1

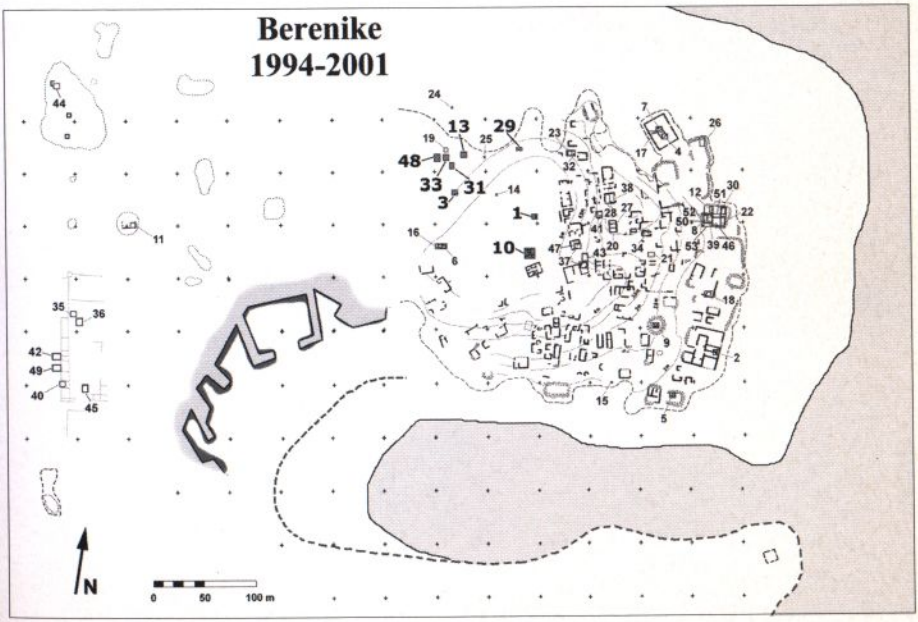
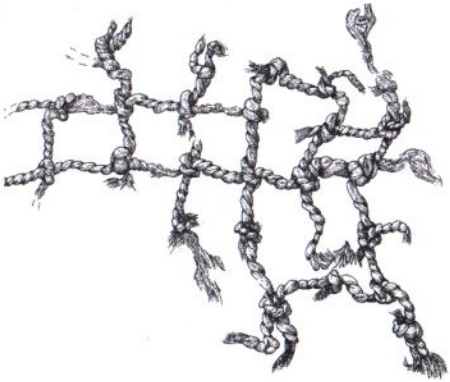


Figure 1, inset

Figure 2A



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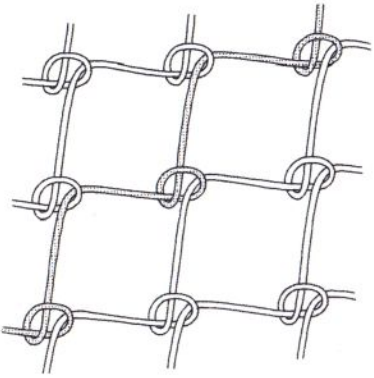


Figure 2C

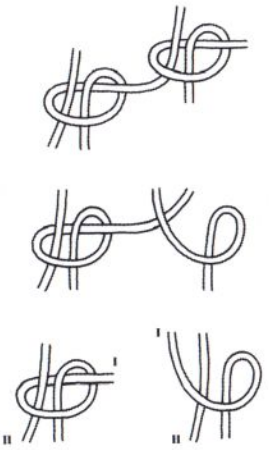


Figure 2D

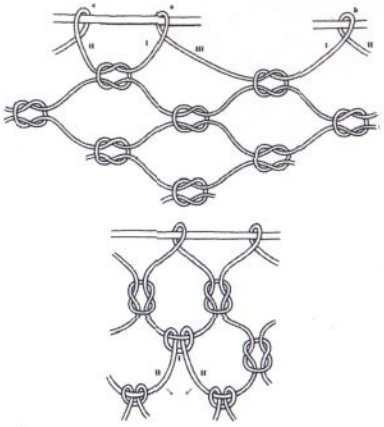


Figure 3A, B

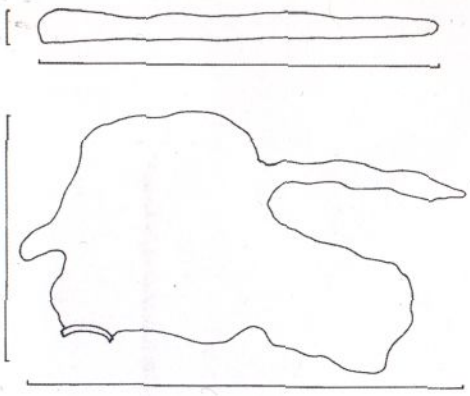


Figure 4A

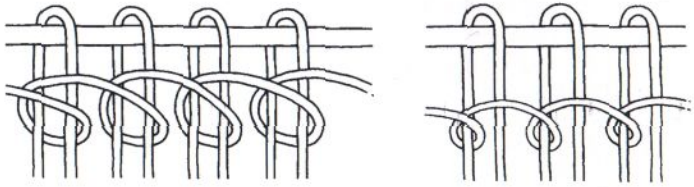
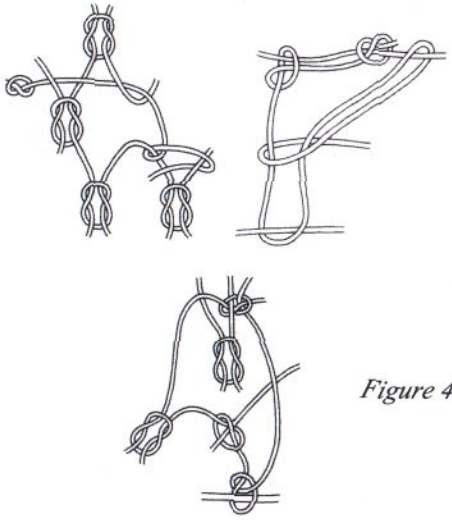


Figure 4B



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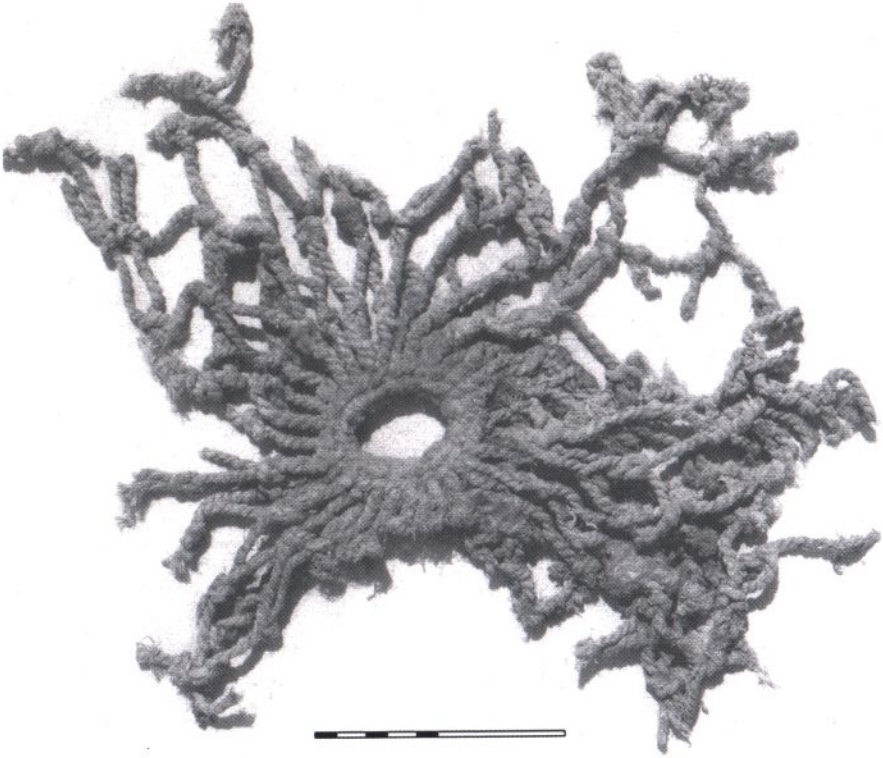

Figure 5A

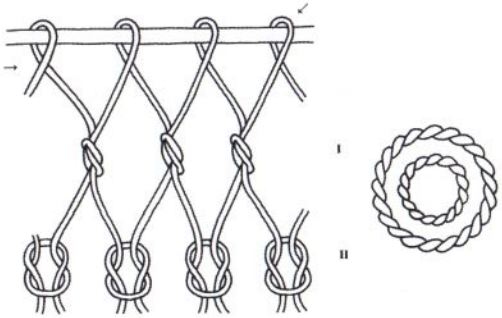

Figure 5B

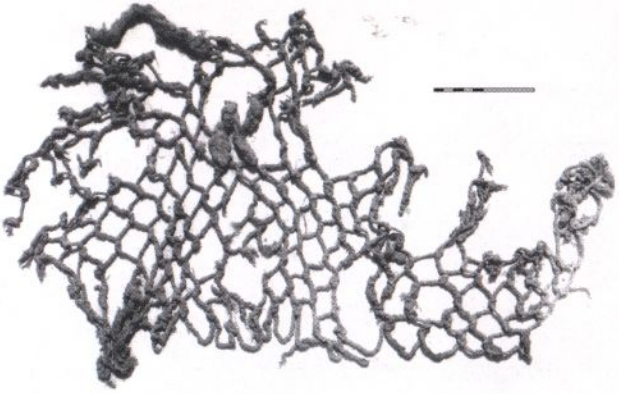

Figure 6A

Figure 6B

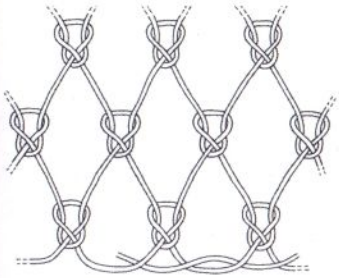

Figure 6C

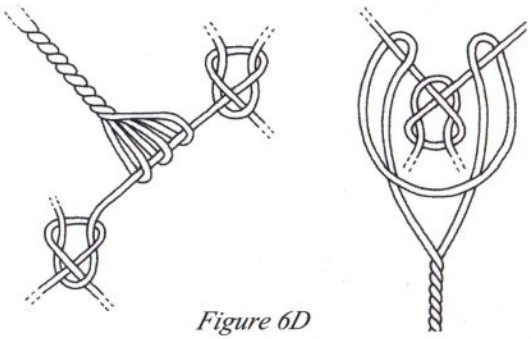

Figure 6D

Figure 7A

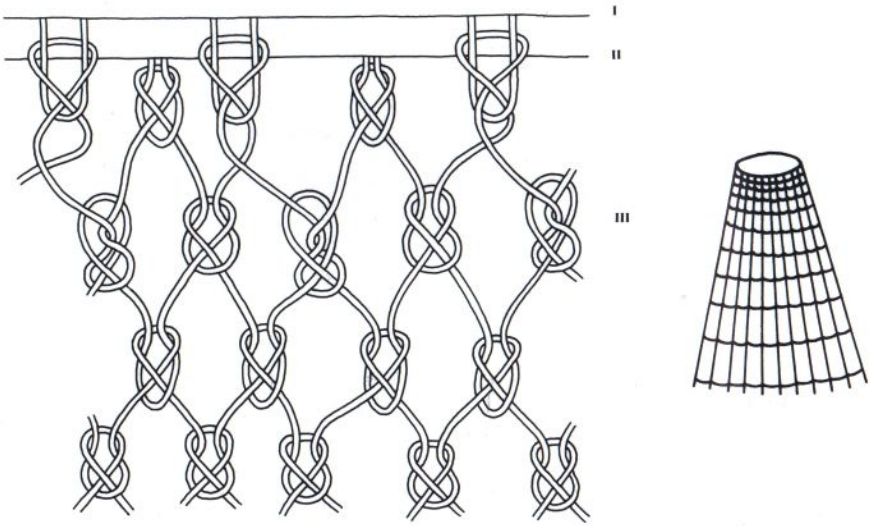

Figure 7B

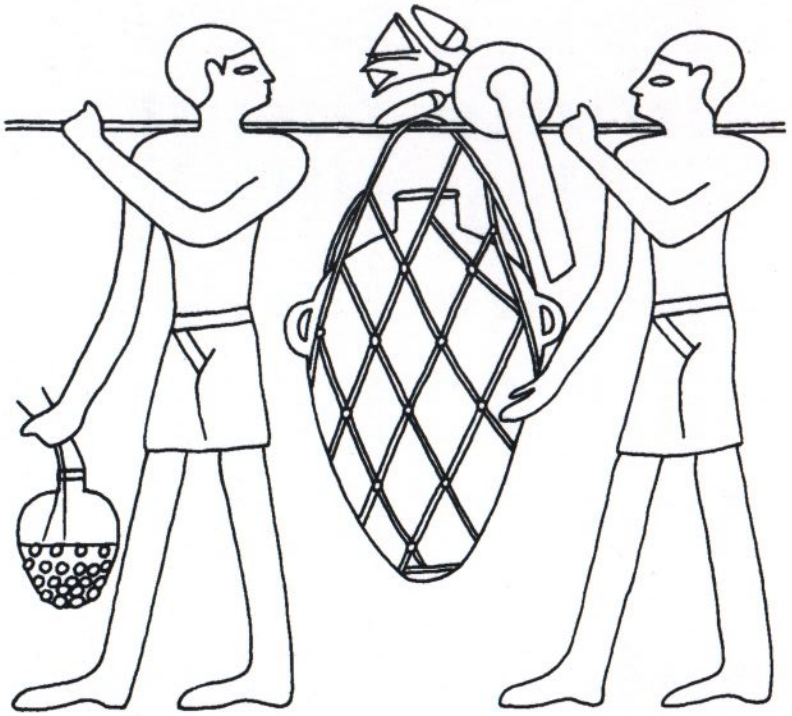

Figure 8

ENTRE PÁGS. 24 Y 25 VAN LAS PRIMERAS 8 P. DEL PLIEGO (1)

TABLE 1

context & PB	identification	number/size	composition	diameter yarn/ply	CIP	material	knot	mesh circum-ference	opening mesh (circ./pi)
BE94/95-1.031 52*	0466-H-9035	1/270x370	zS_2	1.7/2.7	-	flax	mesh	110.4	35.1
BE95-3.006 14	0306-h-0469	10/20x40-60x290	sZ_3	1.0/1.5	-	soft fibre	reef	30.8	9.8
BE96/97-13.002 22	2676-h-2303	4/65x60-70x210	zS_2	2.7/4.1	51	palm	reef	-	-
BE99-29.007 06	0532-h-3365	several/-	zS_2	2.9/3.7	70	det.grass	reef	-	-
BE99-29.007 06	0532-h-3366	several/-	zS_2	2.2/3.5	55	det.grass	reef	-	-
BE99-29.006 07	0529-h-3396	1/-	zS_2	1.2/2.3	57	det.grass	reef	38.0	12.1
BE99-29.007 06	0554-h-3892	1/290x370	zS_2	2.7/3.9	67	det.grass	reef	111.2	35.4
BE99-31.006 16	3050-h-3058	2/90,115	zS_2	3.5/5.1	70	grass	half	--	
BE99-31.007 13	2887-h-3081	2/90x110-110x120	zS_2	2.6/4.7	56	grass	half	88.4	28.1
BE99-31.007 13	2887-h-3082	3/160	zS_2	2.4/3.4	62	grass	mesh	-	-
BE99-31.007 09	2602-h-3154	6/40x140	zS_2	2.3/4.4	53	grass	reef	-	-
BE99-31.007 10	3300-h-3397	4/-	zS_2	2.5/3.8	59	det.grass	reef	84.0	26.7
BE99-31.ebc 38	4214-h-3878	5/-	zS_2	3.0/4.4	-	det.grass	reef	-	-
BE99-31.007 13	2887-h-3888	1/580x1060	zS_2	1.6/3.3	50	grass	mesh	72.0	22.9
BE99-31.007 13	2887-h-3889	1/200x330	zS_2	2.9/4.1	71	grass	half	98.9	31.2
BE99-31.sbc 33	3957-h-3891	3/-	zS_2	2.2/3.7	54	grass	mesh	82.0/95.2	26.1/30.3
BE99-31.007 13	2887-h-3894	1/75x150	zS_2	2.9/4.1	71	grass	half	-	-
BE99-31.ebc -	…-h-7279	2/180x1070-510x770	zS_2	2.1/3.8	47	grass	reef	104.0	33.1
BE01-48.001 15	1399-h-7205	1/210x300	zS_2	1.7/3.2	52	grass	mesh	130.0	41.4
BE01-48.019 43	3411-h-7246	5/-	zS_2	2.4/3.1	67	grass	half	-	-