

New data on the wooden structures from the pile-dwelling of Palù di Livenza

PAOLO CORTI, NICOLETTA MARTINELLI, MAURO ROTTOLI,
ORAZIO TINAZZI & SERENA VITRI

ABSTRACT - The authors describe three different types of wooden structures found in the Late Neolithic pile-dwellings of Palù di Livenza (Northeastern Italy) during the researches carried out between 1983 and 1994. On the basis of dendrochronological investigations and C14 dating they should belong to different phases dated from 5720±130 BP (1s=4754-4402 cal. BC) to 4880±150 BP (1s=3775-3537 cal. BC), ascribed to Recent and Late Neolithic. Another C14 date confirms that the village lasted till Eneolithic.

KEY WORDS: Palù di Livenza, Friuli, Neolithic, Square Mouth Pottery Culture, Pile dwellings

PAROLE CHIAVE: Palù di Livenza, Friuli, Neolitico, Cultura VBQ, Insediamenti palafitticoli

Paolo Corti - via Strada della Piazza 13, I-22050 Abbadia Lariana (LC)

Nicoletta Martinelli & Orazio Tinazzi - DendroData s.a.s, via Cesiolo 18, I-37126 Verona

Mauro Rottoli - Laboratorio di Archeobiologia dei Musei Civici di Como, Piazza Medaglie d'Oro 1, I-22100 Como

Serena Vitri - Soprintendenza per i B.A.A.A.S. del Friuli Venezia Giulia, Piazza Libertà 7, I-34135 Trieste

1. THE STRUCTURES

Wooden remains of ancient settlement structures were discovered in different areas of the marshy basin on the Palù di Livenza archaeological site, where artefacts datable from the Upper Paleolithic through to the Roman Age were also recovered on different occasions and with the use of different methods (MONTAGNARI KOKELJ & VITRI, 1989).

A substantial part of the remains belonging to Late Neolithic pile-dwellings, well documented in literature (PERETTO & TAFFARELLI, 1973; VITRI, 1995), was found in the northern part of the peat-bog and was scattered over an area of about 60000 square metres. The documentation on this area was collected from sample excavations undertaken by the Soprintendenza Archeologica and the B.A.A.A.S. of Friuli Venezia Giulia in 1983 (sample tests I, II: GNESOTTO, *et al.*, 1984) and in 1987

(sample test IV: MARZATICO & VITRI, 1990) and from the timber structures at the bottom of a drainage ditch with a small perpendicular gully beneath it that came to light in a subsequent survey (1989, 1992-1994 excavations, Fig.1). Since then almost a thousand structural elements have been discovered and systematically documented in this area during the 1992-1994 campaigns. Among these about 700 elements were all used as samples for palaeoethnobotanical analysis. At the present time of research (1998), the type of wood used for 393 of these samples has been determined and dendrochronological analysis has been carried out on 65 samples.

Even though the documentation is abundant a precise interpretation is not possible. It is very difficult to reconstruct the building typologies, firstly because of the conditions of preservation of the remains¹, which were damaged mainly during the excavation of the trench and then by erosion and secondly because of the conditions in which the

research was carried out, adopting various methods in the presence of running water in ditches that were 5.5 metres wide at the most. It was difficult to interpret the findings as a large amount of elements were found without any apparent order; it was difficult to distinguish them stratigraphically, but they probably belonged to subsequent settlements.

Nevertheless, it was possible to distinguish at least three building typologies. Their different chronology is attested by the lack of dendrochronological synchronization of the structural elements (CORTI *et al.*, 1997) and by the results of the C14 radiometric dating.

1.1. Structure system I

This is attested in the area where the 1989 and 1992 investigations took place (Fig.2a-3) and precisely in the gully that was strongly eroded by the running water. It features anchorage structures formed by beams and small horizontal rafters placed at right angles forming a regular trellis girder.

Four parallel oak beams (width 20-22.5cm, thickness 7-10cm), 1.70-2 metres apart, came to light in a space of about 8x5 metres (sector I-II-III-IV) facing E-W, supported by smaller perpendicular oak rafters, 1.20-1.50 metres apart, with no traces of joints or bindings. Two of the beams found in 1989 and later damaged by erosion, were fixed with vertical poles inserted in rectangular holes. These were inserted at regular intervals (1.20 metres) in the longer better-preserved beam. None of the structure elements found were intact: the maximum length of the beams was 4 metres (T.20/1989 = ES 31+143).

This structure system represents the earliest building technique adopted at Palù as it was dated (ES 32) back to 5720±130 BP (1s=4754-4402 cal. BC)².

What appears to be a similar structure was brought to light in a limited sector, 3m SE of the first one but facing a different direction (NE-SW), made of poplar/willow beams (T.25, 29/1989, sect. II-III), at regular intervals of 1 metre. This was associated with a thick network of poles and small rafters with traces of combustion, including ES 79, dated 5305±90 (1s=4246-3991 cal. BC).

1.2. Structure system II

This features horizontal elements - planks, beams, rafters and poles - found in zone 2, corresponding to the 1993-1994 excavations (Fig.2b).

These were made from various types of wood³; the horizontal rafters and poles were at right angles, while the wider planks were mainly placed alongside each other, along a NNE-SSW axis.

These are probably the remains of a flooring made of different layers of rafters and branches covered by boarding, which was very popular in Neolithic pile-dwellings in the Alpine area (BILAMBOZ & SCHLICHTERLE, 1982).

We do not know the exact purpose of the many poles, mainly made of hazelnut wood, with a diameter of less than 9cm, fixed vertically into the mud. It is impossible to know exactly what they belonged to even though we can assume they were used either for tamping the ground, as was hypothesized for the vertical poles found under the boarding of the dwellings in Fimon-Molino Casarotto, or as supports for walls (CORTI *et al.*, 1997). The date obtained for element ES 415 of this structure is 5230±95 BP (1s=4221-3959 cal. BC).

1.3. Structure System III

It was only thanks to dendrochronological analysis that it was possible to locate this system, which is also part of structure 1 and has already been introduced in CORTI *et al.* (1997). In fact, it is in the same zone 2 of the 1994 excavation area with structure system II flooring. Through dendrochronological analysis it was possible to identify a few large vertical oak poles used as a support to build upon, perhaps as hanging structures. It was possible to distinguish part of the perimeter of one of these structures (Fig.2b), with the highest parts more or less corresponding to the cardinal points and compare the difference between its orientation and that of structure II of the same area. The dating of this structure obtained from the analysis of element ES 373 is 4880±150 BP (1s=3775-3537 cal. BC).

Recent unpublished dendrochronological surveys have confirmed that this type of pole supports covered the whole of the 1994 excavation area, from sector IV to sector VII.

The different dating of the three different building techniques identified at Palù suggests that these might have had different functions or were subject to swings of the water level, but that the structures were nevertheless on shores with shallow water⁴.

The structures were probably dwellings and this can be confirmed by the presence of clay daubing with traces of wicker work in all the sectors taken into consideration.

As for dwelling structure I, the vast number

of flax seeds found in the area (US 9) suggests that plants were worked and retted.

2 THE WOOD SPECIES

The xylotomic research of the timber structures, carried out on a limited amount of samples from the areas excavated in 1989 and 1992 and more extensively in most of zone 2 (1993-1994 excavations), proved that oak was mainly used in the oldest structure system (structure system I) and other different types of species were used in the area where structure systems II and III overlap (Fig.2c). The horizontal structures in this area, which are more difficult to interpret, are mainly made of hazelnut wood (*Corylus avellana*, 148 elements) and of oak (*Quercus* sp. sez. *Robur*, 102); alder (*Alnus glutinosa/incana*, 26), maple (*Acer* sp., 21), beech wood (*Fagus sylvatica*, 18), willow (*Salix* sp., 12), ash (*Fraxinus* sp., 10), pomoidae (*Pomoideae*, 7), poplar (*Populus* sp., 2), lime tree (*Tilia* sp., 2), elm (*Ulmus* sp., 2) were occasionally used. An element made of holm-oak (*Quercus* sp. sez. *Suber*) and one of green alder (*Alnus* cf. *viridis*) would seem to be more recent.

The large amounts of hazelnut wood as well as the presumed interpretation of the structures suggest the introduction of a building technique, which is common not only at Palù but also at Fimon and in other central European sites of the same epoch.

The wide use of hazelnut wood, which corresponds to the increased amount of carbon of the same species in the dry sites of the Full and Late Neolithic in Northern Italy, would seem to be a result of the division of the forest development due to the increase in anthropic activities and at the same time results in a consistent change of the forest environment and therefore in a more conscious use of the forest. There are no comparisons during the Bronze Age even though, on the basis of recent data, the massive use of hazelnut wood for minor structures or for land reclamation seems to decrease and more alder or other groups of species are randomly used.

3. RADIOMETRIC DATING

On this occasion we would like to present the radiometric dating obtained for the archaeo-

logical area of Palù di Livenza (Tab.1). Eleven dates were obtained between 1987 and 1997, eight of which refer to structures or anthropic levels in pile-dwelling settlements. Dating regarding n.7 relative to US6 (1992 excavations) refers either to a disrupted anthropic level or to a more recent formation, even though it was identified in the area of the gully (VITRI, 1995). The dates regarding n.8-11 refer to levels or structures distinguished in surveys carried out in various places of the settlement area; dates n.8-9 refer to peat bog levels above the Late Neolithic deposit; dates 10 and 11 refer respectively to the anthropic level (sample test I/1983, a few metres East of the drainage ditch) and a pole (sample test II/1983, carried out about a hundred metres to the North) discovered in an area with little archaeological material, probably marginal, characterized by the exclusive presence of vertical poles (GNESOTTO *et al.*, 1984).

Dates 1-6 relative to the central part of the dwelling, in the ample chronological range between 5720 BP (1s=4754-4402 cal. BC)⁵ and 4880 BP (1s=3775-3537 cal. BC), suggest that there were various episodes of settlements in this area from half way through the V millennium to the first centuries of the IV millennium BC in calibrated chronology.

Dates n.10-11 obtained in 1987, previously considered as unreliable, are now of great interest because n.10 can be easily connected to n.4 and this allows to create a link between structure system III and the dense group of oak poles found in sample I; n.11 (1s=3333-2884 cal. BC) would seem to close the set of dates confirming that the settlement lasted at least up until the Eneolithic (MONTAGNARI KOKELJ & VITRI, 1989).

Apart from n.11, these dates are similar to other radiometric dates from other sites in Northern Italy attributed to different aspects of the Recent-Late Neolithic, and precisely the contexts referring to the various aspects of phase III of the Square Mouth Vase Culture, the Lagozza Culture and in particular, the aspects referring to the Late Neolithic phases in Trentino at Isera 1-3⁶. Of particular interest is the comparison between the older dating of Palù and the recent results obtained from the nearby site of Bannia-Palazzine di Sopra, ascribed to an ancient period of phase III of the Square Mouth Vase Culture (TASCA & VISENTINI, 1997:471).

The recent publications referring the Bannia and Isera sites do in fact throw new light on the dates obtained at Palù, proving the importance of this site in the study of the late phases of the Neolithic in Northern Italy.

On the basis of these dates it will be possible

to undertake systematic analysis on the consistent archaeological material found in the past, even though there are no precise stratigraphic references, contrarily to the results of the first analysis that had initially suggested a certain homogeneity⁷ (CORTI *et al.*, 1997) and an investigation can be programmed in the settlement area.

NOTES

1 - The top of all the vertical poles, for example, were cut by the dredging.

2 - The STUIVER & PEARSON calibration curve (1993) was used for the calibrated radiometric dating.

3 - Maple, beech tree, ash, hazelnut, alder, pomoidae, poplar, oak, willow and elm are present.

4 - The sedimentological analysis that are being re-

elaborated and re-examined at the present time by M. Bassetti suggest that the deposits refer to the lake shore, subject to swings of the water level.

5 - The STUIVER & PEARSON calibration curve (1993) was used for the calibrated radiometric dating.

6 - We must however underline that the exact provenance of the sample of the wooden structural element was examined only in dating n.4-6, thus confirming the external rings (FASANI & MARTINELLI, 1994). Only these oak wood elements could be used as samples for the C14, using the outer rings of alburnum, thus obtaining the radiometric age of the last rings formed on the original trunk and therefore obtaining a possible date of when the trees were felled and when the pole was erected.

7 - "...the atypical characteristics and/or the long life of most of the material makes it difficult to identify the chronological phases suggested by the rather divergent results of the dendrochronological analysis and the C14 dating along with the various building techniques of the structures" (CORTI *et al.* 1997:271).

SUMMARY - The study of the wooden elements found in the Late Neolithic pile-dwellings of Palù met with many difficulties because of the peculiar methodology of research and the particular condition of preservation of the wooden remains, even though this allowed to recognize the presence of at least three types of structures. These related to different building phases on the basis of the dendrochronological results and C14 dating. We found the earliest type of building technique (structure I) in the area of the excavations of 1989 and 1992. It is a sort of fastening system made of horizontal oak boards disposed at right angles at regular distances, dated at 5720 ± 130 BP ($1s = 4754-4402$ cal. BC). Some other horizontal wooden elements (structure II) - boards and beams made of different species of wood belong to a later phase, dated 5230 ± 95 BP ($1s = 4221-3959$ cal. BC). These were found in zone 2, in the area of the excavations carried out in 1994. They probably represent the remains of a floor made of some overlapping layers of rafters and branches, covered by planking. By means of dendrochronological analysis it was possible to recognize a later structure (III), dated 4880 ± 105 BP ($1s = 3775-3537$ BP cal. BC), built on strong oak piles and to reconstruct a part of its plan. This building is oriented in a slanting direction in respect to the structure II, although they are both located in the same area. Between 1987 and 1997, eleven C14 dates were obtained from samples collected at Palù; eight of them are related to the pile-dwelling. The dates n.1-6, coming from the investigated area in the (middle) core of the Neolithic settlement, between 5720 and 4880 BP, seem to suggest a long life village with different building phases, that stood between the middle of the V millennium and the first half of the IV millennium BC. Another C14 date, made in 1987, refers to the beginning of the III millennium BC and confirms that the village lasted till the Eneolithic. These dates are comparable with other ones from Recent and Late Neolithic sites in Northern Italy (that is the levels related to the III phase of Square Mouth Vase Culture and to the Lagozza Culture), and especially those related to the Late Neolithic phases of Isera 1-3 in the Trentino region. Very interesting is the comparison between the older dates from Palù and the results coming from the nearby site of Bannia-Palazzine di Sopra, ascribed to an ancient period of the Square Mouth Vase Culture - III phase.

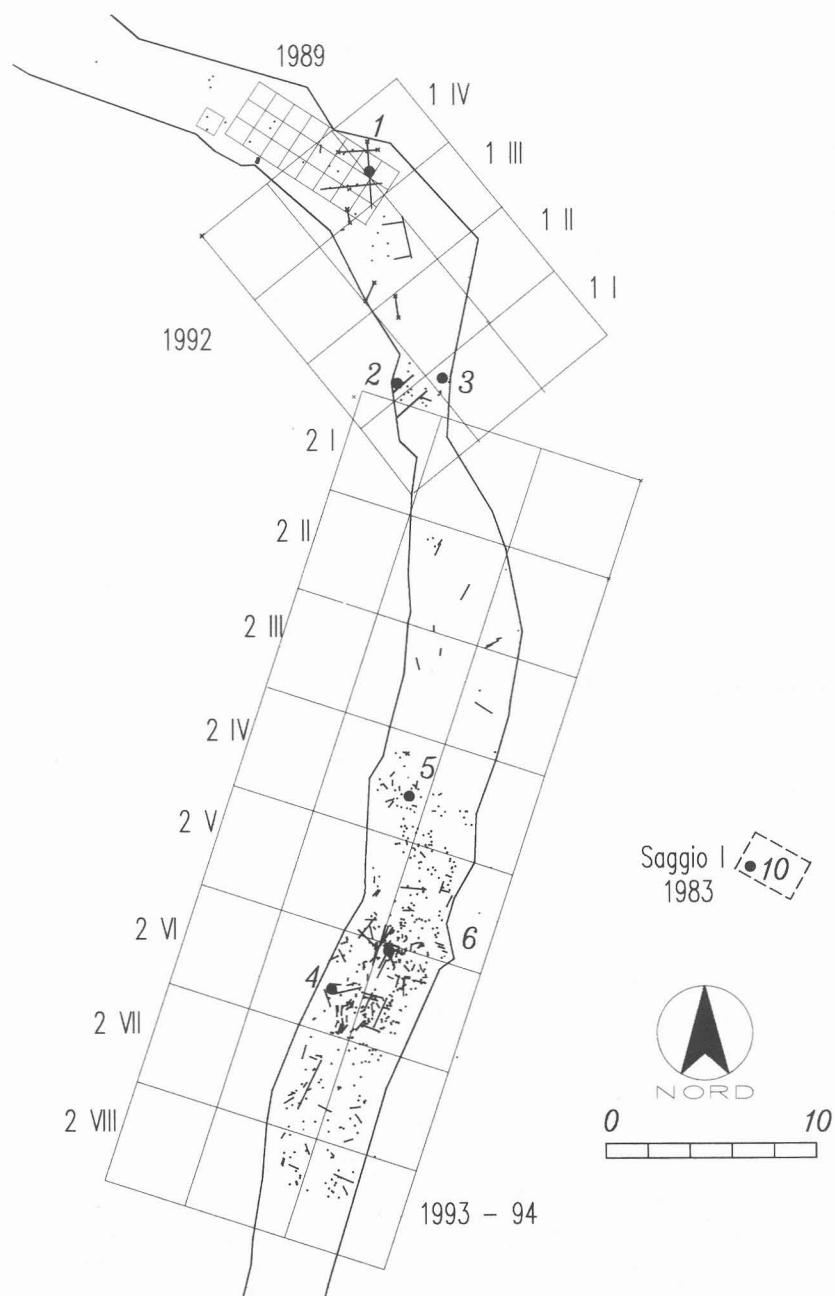
RIASSUNTO - Dallo studio degli elementi lignei dell'abitato palafitticolo tardoneolitico di Palù, nonostante le difficoltà di interpretazione dovute alle particolari condizioni della ricerca e di conservazione dei resti, sembra comunque possibile individuare l'uso di almeno tre diverse tipologie costruttive, pertinenti a fasi insediative diverse. La diversa attribuzione cronologica è attestata dalla mancanza di sincronizzazioni dendrocronologiche fra gli elementi strutturali ed è confermata dai risultati delle datazioni radiometriche col ¹⁴C. La più antica delle tecniche costruttive impiegate a Palù è attestata nell'area degli scavi 1989 e 1992. Essa è rappresentata da un sistema di ancoraggio costituito da assi di quercia orizzontali disposte ortogonalmente a formare una sorta di reticolo a maglie regolari, datato al 5720 ± 130 BP ($1 s = 4754 - 4402$ cal. BC). Ad una fase più tarda, datata al 5230 ± 95 BP ($1 s = 4221 - 3959$ BC cal.), risalgono gli elementi strutturali orizzontali - assi, travi, travetti - rinvenuti nella zona 2

REFERENCES

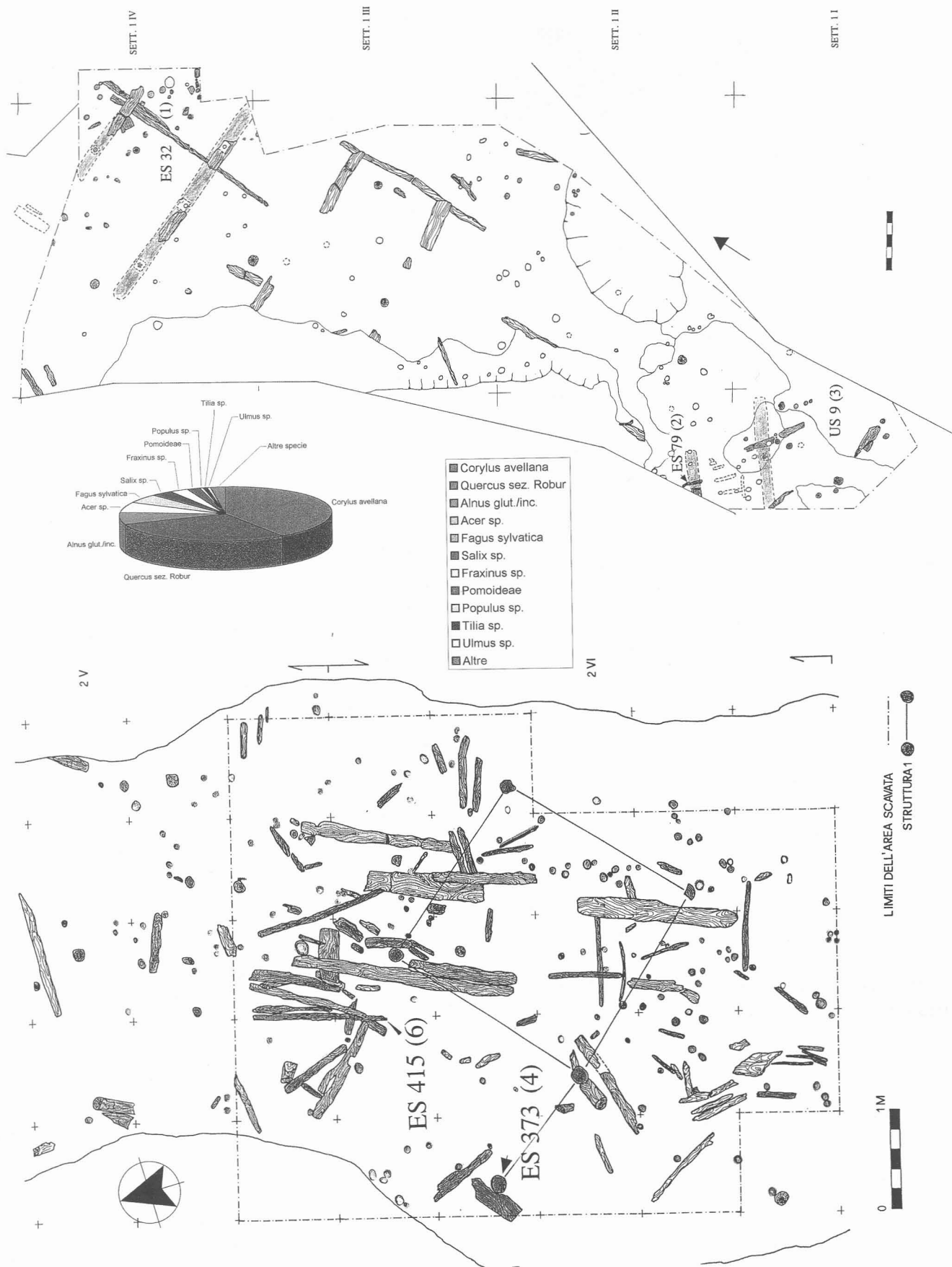
- BILLAMBOZ A. & SCHLICHTERLE H., 1982 - Das Holz der "Pfahlbausiedlungen". *Archaeodendrologie im Project Bodensee-Oberschwaben. Denkmalpflege in Baden-Wuerttemberg* 11,2:60-73
- CORTI P., MARTINELLI N., MICHELI R., MONTAGNARI KOKELJ E., PETRUCCI G., RIEDEL A., ROTTOLI M., VISENTINI P. & VITRI S., 1997 - Siti umidi tardoneolitici: nuovi dati da Palù di Livenza (Friuli Venezia Giulia, Italia). In: *Proceedings XIII UISPP Congress 1996*, vol.3:263- 275
- FASANI L. & MARTINELLI N., 1994 - Problemi relativi alle palafitte italiane alla luce della ricerca dendrocronologica. *Radiocarbon Dating and Italian Prehistory, Accordia Specialist Studies on Italy* 3:39-44
- GNESOTTO F., TONON M. & VITRI S., 1984 - Recenti sondaggi al Palù di Livenza (PN). In: *Atti "Preistoria del Caput Adriae"*, p.54-59
- MARZATICO F. & VITRI S., 1990 - Caneva-Polcenigo, loc. Palù di Livenza. *Relazioni della Soprintendenza per i beni ambientali, architettonici, archeologici, artistici e storici del Friuli Venezia Giulia* 8:169-173
- MONTAGNARI KOKELJ E., 1992 - Palù di Livenza. In: M.Tonon (ed), *Mammot* '8,9:190-194. Pordenone
- MONTAGNARI KOKELJ E. & VITRI S., 1989 - Palù di Livenza (Pordenone): abitato palafitticolo. *Aquileia Nostra* LX:383-390
- PEDROTTI A., 1996 - Un insediamento d'altura alla Torretta d'Isera (TN). In: U.Tecchiati (ed), *Archeologia del Comun Comunale Lagarino; Storia e Forme dell'Insediamento dalla Preistoria al Medio Evo*, p.71-86. Rovereto
- PERETTO C. & TAFFARELLI C., 1973 - Un insediamento del Neolitico Recente al Palù di Livenza (Pordenone). *Rivista di Scienze Preistoriche* XXVIII:235-260
- STUIVER M. & PEARSON G.W., 1993 - High-precision bidecadal calibration of the radiocarbon time scale. *Radiocarbon* 35,1:1-24
- TASCA G. & VISENTINI P., 1997 - Fiume Veneto, frazione Bannia, località Palazzine di Sopra: scavi 1997. *Aquileia Nostra* LXVIII:470-471
- VITRI S., 1995 - Palù di Livenza, Pordenone. In: *Guide archeologiche, Preistoria e Protostoria in Italia*, p.182-193. Forlì.

n. datazione	campione	codice laboratorio	età ^{14}C BP	data calibrata 1σ	data calibrata 2σ
	PALU' 1992-1994				
datazione 1	ES 32 elem. orizzontale (1992)	GX-18757	5.720 ± 130	4754-4402 BC	4899-4333 BC
datazione 2	ES 79 elem. orizzontale (1992)	GX-18756	5.305 ± 90	4246-3991 BC	4342-3955 BC
datazione 3	US 9 (1992)	GX-18758	5.395 ± 90	4341-4088 BC	4450-4421 BC 4395-3991 BC
datazione 4	ES 373 elem. verticale (1994)	GX-22103	4.880 ± 105	3775-3623 BC 3573-3537 BC	3942-3376 BC
datazione 5	ES 669 elem. verticale (1994)	GX-22104	5.130 ± 145	4211-4209 BC 4076-3775 BC	4319-3641 BC
datazione 6	ES 415 elem. orizzontale (1994)	GX-23010	5.230 ± 95	4221-3959 BC	4320-3799 BC
datazione 7	US 6 (1992)	GX-18759	3.210 ± 265	1750-1127 BC	2130 - 818 BC
	SONDAGGI				
datazione 8	S. IV campione 1 (1987)	CRG-887	1.860 ± 50	87-235 AD	65-321 AD
datazione 9	S. IV campione 2 (1987)	CRG-888	3.380 ± 65	1741-1531 BC	1873-1515 BC
datazione 10	S. I antropico B (1983)	CRG-930	4.487 ± 115	3757-3513 BC	3937 - 3861 BC 3817 - 3362 BC
datazione 11	S. II palo 2 (1983)	CRG-929	4.392 ± 140	3333-2884 BC	3497 - 3459 BC 3337 - 2618 BC

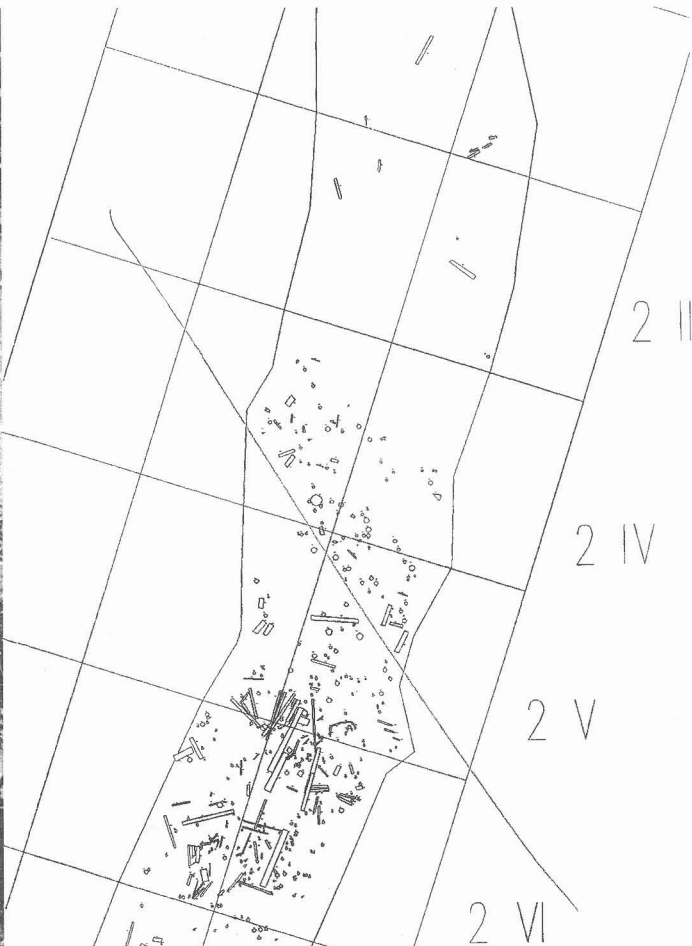
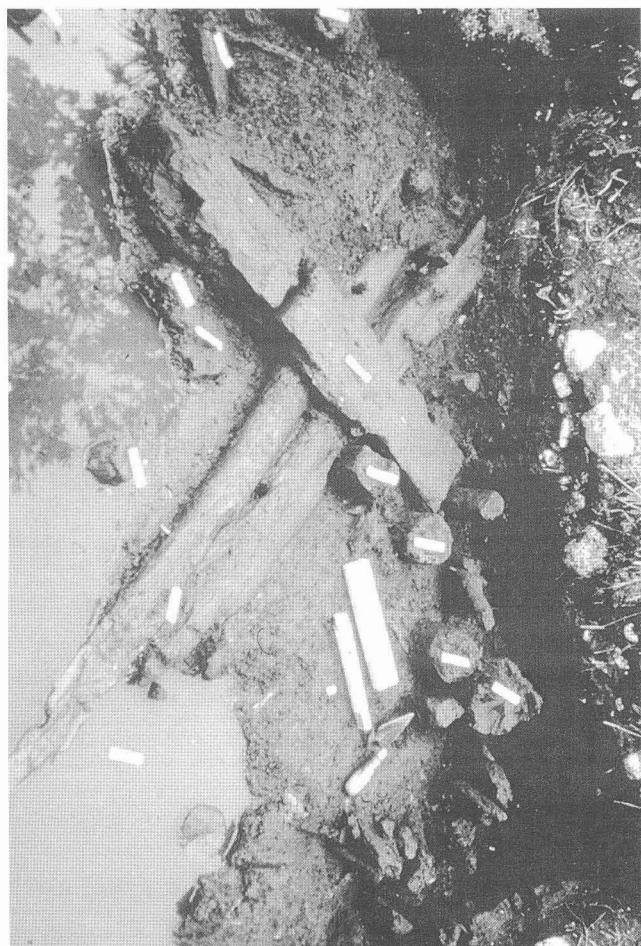
Tab. 1 - The results of the radiometric date undertaken on samples from Palù di Livenza; the years indicated in brackets refer to the date of excavation and collection of the samples.



1 - General relief of the investigated areas of the drainage ditch; the numbers refer to the samples for the radiometric dating (see Tab.1)



2 - a) Relief of the wooden elements located in the 1989 and 1992 excavation area; the timber elements (ES) and the anthropic levels (US) that underwent radiometric dating. The numbers are in brackets; b) Relief of the timber elements located in the 1993 and 1994 excavation area; the timber elements (ES) that underwent radiometric dating. The numbers are in brackets; 2) The percentage data of the wood species used for the timber structures



3 - Details of structure system I: timber elements ES 32, ES 41 and ES 92 (1992 excavations)