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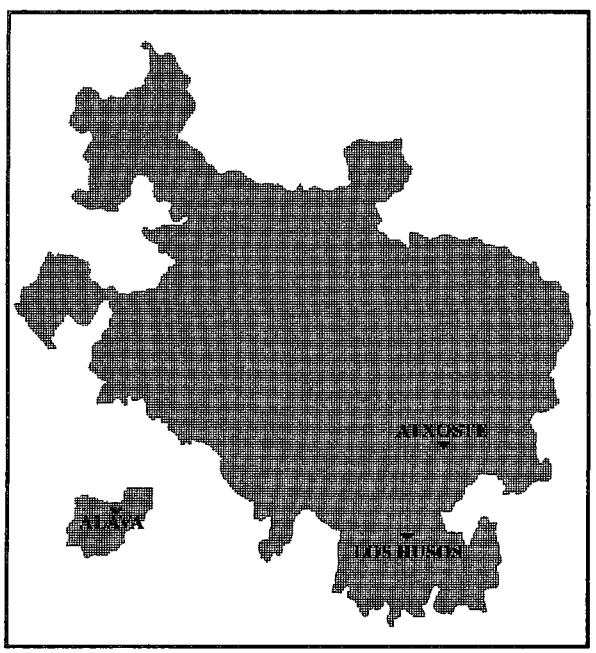
SOIL IN THE LATE PREHISTORY OF THE BASQUE COUNTRY : NEW DATA FROM ATXOSTE AND LOS HUSOS (ALAVA).

Javier Fernández Eraso, Alfonso Alday Ruiz and Iñaki Yusta Arnal*

I Introduction

There is a discussion regarding prehistory in the Iberian Peninsula relative to what is real and what is only apparent within the Holocene sedimentations. For example, some of the most classical Neolithic settlements of the Mediterranean front are being questioned because some alterations which have occurred later than the deposits were found. This problem is extended to most of the deposits which are contemporary to these. We will discuss here the common qualities which affect Mesolithic-Neolithic settlements in the Basque area, taking as an example the settlement of Atxoste (Virgala, Alava). During the advanced Neolithic and the Metal Age human groups tended to use open air habitats, they reserved the caves for specific uses. Los Husos (Elvillar, Alava) represents a good example of this new trend : it was used as a farm yard and this fact leads to a very peculiar sedimentation also found in other nearby places *(fig. 1)*.



Prehistorians value the knowledge of the genesis of the sediments for how much can be explained by the homogeneity of an archaeological deposit and the possibility of establishing internal partitions. Granulometric and morphoscopic analysis, chemical analysis of the soil, etc. help us and the results are compared with dating methods and typological systems. For this specific research we have put in common the work of prehistory specialists (J. Fernandez Eraso and A. Alday) and a soil analysis specialist (I.Yusta).

We are going to discuss here the sedimentation values of Atxoste and Los Husos noting that although they are geographically nearby they are situated in different ecological areas : the first one is between an oceanic and a Mediterranean area while the second emphasises the Mediterranean characteristics. Both places are being excavated at present and have provided large archaeological collections as well as evidence of old structures : a hut in Atxoste and a closed area for cattle in Los Husos. Both places share similar excavation techniques based on the Cartesian method. Although it was first published in the fifties (Laplace and Meroc 1954; Laplace 1971), we have used this method widely since 1918 when the excavations in the cave of Santimamiñe (Cortezubi- Vizczya) started (Aranzadi, Barandiaran and Eguren 1932).

II.1 Materials and methods

Biological phosphorous combines with Fe, Al and Ca giving insoluble phosphates which can be easily determined in archaeological sites to indicate human occupation. Several methods for phosphate analysis have been proposed in the literature, chiefly based on the extractable inorganic P using acid solutions (see Taboada *et al.*, 1993 and references therein), and characterized by their simplicity of use, low cost, but with different success of P recovery. X-ray fluorescence spectrometry (XRFS) is a widely accepted method for the quantitative chemical analysis of geological, archaeological and environmental samples. This technique gives total P data with very high precision and accuracy. Comparison studies on the performance of inductively coupled plasma (ICP) spectrometry and XRFS in determination Cu, Ni and Zn in contamined soils (Wilson *et al.*, 1995) gave similar results for both techniques, emphasizing the advantages of XRFS, *e.g.* simplicity of sample preparation, shorter measure-

* *University of the Basque Country. Vitoria and Lejona -Spain.*

ment time, multi-element determinations.

The XRFS technique is based on the measurement of the secondary radiation ("fluorescence" radiation) emitted by a sample when is excited by a primary beam of X-rays. The wavelength and intensity of the radiation emitted by a certain electron transition between two orbital levels depends on the elements present in the sample, the way they are bounded (mineralogical effect) and their mutual proportions. Nowadays, pressed powder pellets and fused glass discs are the most used procedures for sample preparation, the former method being very suitable for the determination of the heavier trace elements (like the ones usually analyzed in environmental samples), and the later for the accurate determination of major elements in geochemical samples.

In this study, all major (SiO_2, Al_2O_3, Fe_2O_3t, MnO, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5) and 25 trace elements (As, Ba, Co, Cr, Cs, Cu, F, Nb, Ni, Pb, Rb, S, Sn, Sr, V, Y, Zn, Zr, La, Ga, W, Hf, Th, Nd, Ce) were determined by wavelength dispersive X-ray Fluorescence (WD-XRF) using an automated PHILIPS PW1480 spectrometer at the Mineralogía Laboratory of the Basque Country University, Spain. In this paper we only present the results for major and some heavy metals (Fe, Mn, Ti, Zn, Pb, Cu, Ni, Cr, Co) and S, nevertheless the complete dataset can be obtained from the authors on diskette or as paper copies.

Major and trace element determinations were made on 40 mm diameter pressed powder pellets following the method of Zyl (1982) with few modifications (Yusta *et al.*, 1994). A subset of the whole population was analyzed using fused beads for controlling the accuracy in major elements, and also to check the suitability of the method for P analysis in high contents; note that a tipic soil ranges between 0.1 to 0.7 % wt P_2O_5, ultrabasic rocks may contain up to 1.0 % wt, and that an anthropogenically heavily influenced soil can reach 10.0% P_2O_5, which greatly exceeds the concentration range of the usual calibration standards.

Forty-two international reference samples (Certified Reference Materials, CRM's) were used to calibrate by regression the analytical lines. Coefficient of Variation for major and minor elements are usually below 1% with a detection limit for most trace elements on the order of 2 to 5 mg/kgr.

The spectrometer used for this study was a Philips PW1480 sequential X-ray spectrometer equipped with a Sc-Mo side-window tube, a 30 position automatic sample changer and under a vacuum path. The crystals used were LiF 200, LiF 220, Ge, PE and a multilayer PX1. Corrections factors were applied for line overlaps and matrix effects.

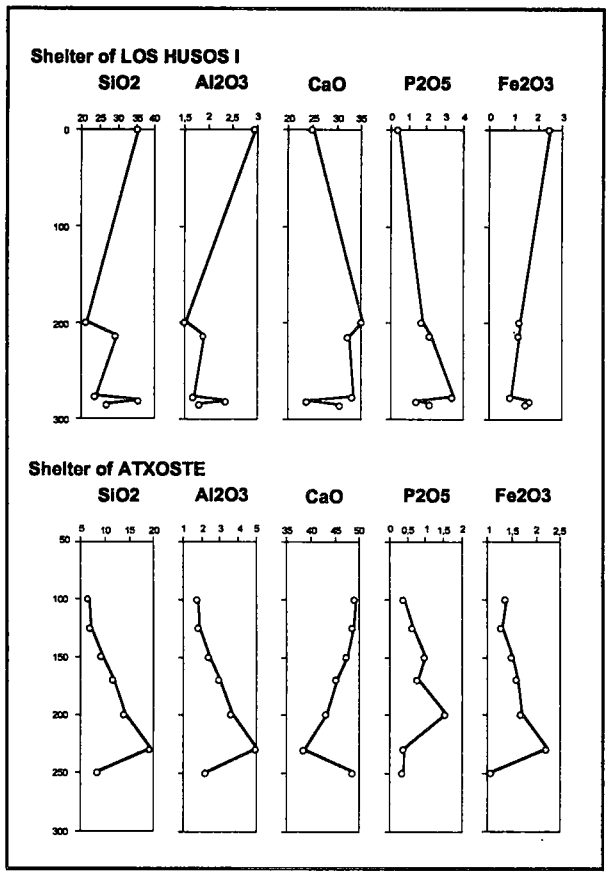
II.2 Results and discussion

Seven samples were taken from different levels of the shelter of Los Husos to characterize chemical composition of some brown carbonate deposits just above organic matter rich black soils (going downwards : levels G4, F4 and G2, respectevely) and to compare with P and Fe contents of the top soil and the shelters's enclosing rock.

Highly positive correlation between Si, Al and Fe; and inverse correlation with Ca show that the sampled soils are mainly composed by calcite (CaO up to 35% wt.) and clays. Iron contents covariate with Al indicating that their variation depends on the amount of clay in the sample. Moreover, the observed Fe percentages are similar or lower to those of present soil of the shelter (LH-0), so it could be concluded that no external supply of this metal has occurred (which could be the case for Fe enrichments in fire-places).

Phosphorous shows remarkable enrichments both in the carbonate levels and in the black non consolidated soil, when is compared to present day soils in the shelter (from 4 to 10 times higher, see *Table 1*).

Los HUSOS shelter															
Muestra	SiO2	Al2O3	Fe2O3t	MnO	MgO	CaO	Na2O	K2O	TiO2	P2O5	ppmP	prof	level	Pmgr/100gr	
LH–Rx	45,60	2,45	1,89	0,036	0,39	26,39	0,11	0,66	0,477	0,095	415			0,41	
LHpresent	35,00	2,95	2,46	0,054	0,49	24,81	0,13	0,78	0,436	0,335	1462	0	present	1,46	
G4–1carb	21,06	1,51	1,21	0,122	1,33	34,93	0,15	0,61	0,206	1,674	7306	200	III	7,31	
G4–1black	29,33	1,88	1,15	0,147	1,72	32,29	0,12	0,77	0,226	2,154	9401	215	IV	9,40	
LH1carbF4	23,62	1,67	0,83	0,123	1,24	32,94	0,19	0,74	0,265	3,415	14904	278	X	14,90	
LH1blackF4	35,46	2,34	1,62	0,126	1,72	23,72	0,19	0,91	0,287	1,398	6101	282	Xinf	6,10	
G2–3all	26,58	1,80	1,48	0,119	1,69	30,57	0,17	0,76	0,237	2,139	9335	286	X, Xinf	9,34	
mean (n=5)	27,21	1,84	1,258	0,127	1,54	30,89	0,164	0,758	0,244	2,156	9409			9,41	
ATXOSTE shelter															
AZ6.Z2.100	6,45	1,72	1,36	0,054	0,50	48,87	0,04	0,13	0,131	0,369	1610	100		1,61	
AZ6.Z2.125	6,83	1,80	1,27	0,062	0,48	48,39	0,03	0,15	0,141	0,621	2710	125		2,71	
AZ6.Z2.150	9,05	2,35	1,47	0,085	0,52	47,23	0,01	0,24	0,186	0,951	4150	150		4,15	
AZ6.Z2.170	11,55	2,91	1,59	0,072	0,58	45,00	0,02	0,34	0,220	0,754	3291	170		3,29	
AZ6.Z2.200	13,86	3,62	1,67	0,068	0,84	43,05	0,03	0,46	0,262	1,540	6721	200		6,72	
AZ6.Z2.230	19,19	4,96	2,20	0,070	1,03	38,31	0,07	0,56	0,348	0,357	1558	230		1,56	
AZ6.Z2.250	8,21	2,18	1,05	0,041	0,55	48,51	0,01	0,19	0,158	0,354	1545	250		1,54	
mean (n=7)	10,73	2,791	1,516	0,065	0,643	45,62	0,03	0,296	0,207	0,707	3084			3,08	



In the shelter of Atxoste the samples were taken at regular intervals of 25 cm because of the apparent homogeneity of the deposited sediments. Big clasts and snail shells were removed after crushing and grinding to avoid non-desirable dilution effects. Analyzed soils are mineralogically similar to those of Los Husos shelter, with interelement correlations more evident, but reacher in calcite (up to 49% wt. CaO). Phosphorous does not appear so much enriched as in Los Husos, but it still reveals high values (maximum of 1.54% wt. P_2O_5), denoting anthropogenic influence during the deposit.

These first observations of the chemistry of P and Fe in the studied shelters deserve further studies, necessary to evaluate the rate of P-enrichment in the Atxoste shelter (for example the determination of P in the present day sediment as in other parts of the cave), to correlate high P-contents with human or animal occupation, or to compare with fossil soils from other Holocene settlemnts in the Basque area.

III Shelter of Atxoste

III.1 Situation

The shelter of Atxoste is located in the municipality of Virgala (Alava, Spain). It is a small shelter with almost no roof situated in one of the usual limestone banks in the mountain pass of Azaceta which closes the diapire of Maestu on its north side. This mountain pass divides two geographic areas which are very different, the plain of Alava and the valley of Araya, it represents an obligatory traditional passage way between the two areas; we deduce from this the strategic position of this place.

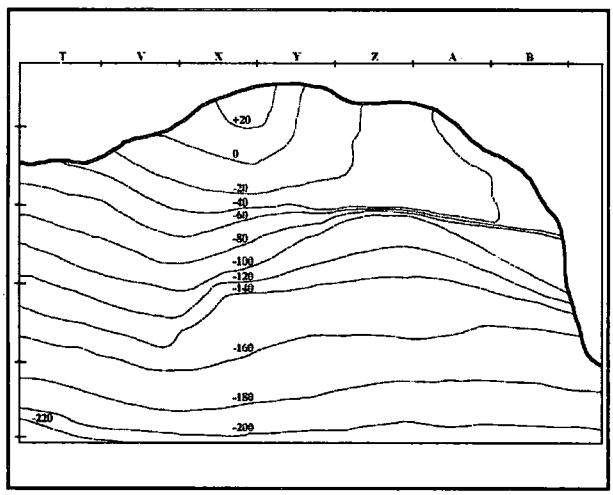
Nearby there are various shelters with similar characteristics, we have controlled through excavation the archaeological value of another two which reproduce with their own variations the same cultural sequences.

The river Berrón flows underneath the settlement, it rises nearby and goes through a vast valley before it reaches the Ega, one of the main tributaries which joins the river Ebro on its left side. Its coordinates UTM transferred to the S.G.E map page 139 (Eulate) on a scale 1:50.000 are : X= 543256; Y= 4734406; Z= 720.

In the valley of Arraya, geographical area of the shelter of Atxoste , there are various places of prehistorical interest : the Mesolithic/Neolithic settlements of Kanpanoste and Kanpanoste Goikoa; the Chalcolithic burial place of Arratiandi; the caves of Peña Rasgada or Los Moros which have doubtful graphic material; the hole shape deposit from the Iron Age called Bizkar. This list, including other less important findings, gives us the certainty that the valley of Araya has been continuously inhabited since 9500 BP at least. From Atxoste we can also find other accessible places within less than half a day walk, for instance the interesting settlements of Mendandia and La Peña de Marañon.

III.2 Background

The shelter of Atxoste has been mentioned during systematic explorations directed towards defining Meso-Neolithic habitats. On a small natural section in the soil we could collect in 1995 a few human bones and some fragments of ceramics and ophitas. We proposed starting excavations because of the special interest of the site and because it is close to the settlements of Kanpanoste and Kanpanoste Goikoa, the distance being a little over half a kilometre. The first stratigraphic analysis started in 1996 and has continued without interruption since then through successive excavation campaigns *(fig. 2)*.



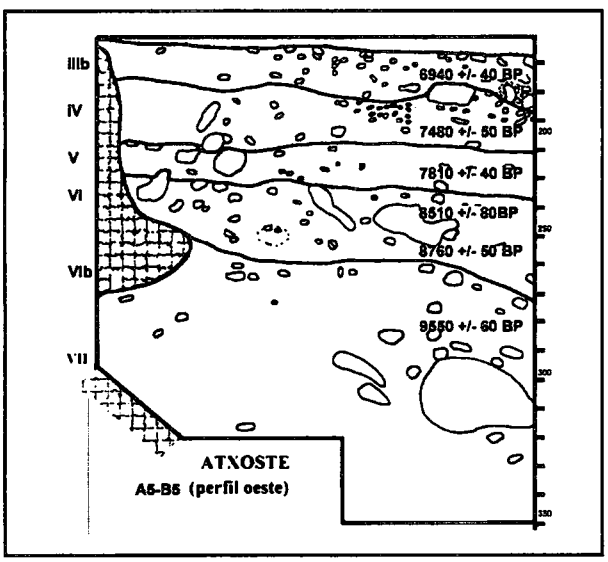
The excavation, which is not completed yet,

[1] *A follow up on the archaeological research and the cultural values that can be deduced is possible by referring to the publications Arkeoikuska (publications from 1995 up to now); Alday 1996,Alday and Diez 1998.*

reveals a stratigraphic sequence which is at least 350 centimetres thick, it could possibly be divided in smaller units combining sedimentary and archaeological data. This division is based on the radiocarbonic analysis. It includes, without interruption, various Mesolithic and Neolithic units which also involve burials from the Metal Age, in a cycle which spreads over no less than four millenniums. It provides a wide collection of lithic, ceramic and fauna materials which will be studied in detail when the excavations end[1]. The prehistoric dynamics revealed by the shelter as well as other information provided by other deposits with a similar aspect allow a more rigorous study of the cultural processes which happened at the beginning of the Holocene in the Ebro Basin.

III.3 Stratigraphy

The excavations are still open in the shelter of Atxoste, so the data that we provide is provisional and will be updated and varied in the future. There are two differentiated areas in the excavation : the central area, situated next to the wall of the shelter and partially protected by the roof; the occidental area, a three metre by one metre ditch which object was to limit the extension of the settlement. We have adopted different sequential nomenclatures to define the levels acknowledged in each one of them : in the future we will try to interrelate them. In this article we will use almost exclusively the data from the central area *(fig. 3)*.



The sedimentary levels are defined according to the presence of common characteristics along various semi sections relative to type of the soil, textures and coloration. The sublevels are defined according to minor differences or the progression of the archaeological materials. At first the layers are positioned perfectly horizontally with an east-west orientation but noticeably slanted, on a hillside with a north-south orientation. As a consequence the superior layers are not represented on the outside parts. The transversal sections show this peculiarity very well.

- **LEVEL I** : Its thickness depends fundamentally on the degree of development the vegetal layer has reached : more developed towards the North and West than towards the East and South. In some places it reaches up to a metre high and it was formed by a combination of mechanic and biogenetic processes with almost no human intervention. It is a muddy soil which is not compressed and has a granulated structure, its coloration varies from a light yellow in the protected areas to a light brown. Meteorization manifestations have provided abundant angular clasts which are very unevenly disposed on the settlement. A lot of small roots are found as soon as we move away from the walls but they do not disturb the nature of the sediment. In the final part which is in contact with level II we find some blocks which seem to correspond to an episode of ruin of the roof.

After the conditions of habitability were lost various inhumations were disposed under the vault. Most of the remains had lost their anatomic connection : we suspect that the bodies were just deposited there without any kind of covering rather than buried.

- **LEVEL II** : The layer is between 15 and 20 centimetres thick and has noticeably gained horizontality. The transition between this one and the layer which is superposed to it is more gradual towards the East of the settlement than towards the West. The soil is still muddy but it is finer and looser than before because the effect of the vegetal components is less important. The soil gets darker, the grey shades are dominant and they are more or less attenuated depending on the density of the archaeological material and of the washing of the soil. The number of angular clasts gets down and the contribution of the biggest fraction is not noticeable.

The burials of level I were inhumated directly on the residues left by the dwellers of this horizon : this is why human remains are mixed with lithic, ceramic and bone fragments.

- **LEVEL III** : This level is very important because it gets nearly one metre thick in some places. It is difficult to divide because of its homogeneity, despite this fact we distinguish three sub unities according to sedimentary values (IIIa and IIIb) and to archaeological ones (IIIb1 and IIIb2).

Sublevel IIIa reaches an average thickness of 20 centimetres, level II transforms into level IIIa without any drastic change. The biggest part of it is muddy soil but it has gained clay without losing it very loose structure. The coloration still has a tendency to get darker although it varies according to the anthropic actions : grey, dark brown and nearly black. The presence of clasts and blocks is less and less important and the participation of small roots is not noticeable. The excavation could isolate various pockets of earth snails, the majority colonies of *Helix nemoralis*, which would indicate a noticeable humidity in the atmosphere during the formation of the soils.

We have collected a very wide range of material remains : an impressive collection of pottery, a laminar industry with double bevel segments, retouched blades

sheets and abundant fauna remains.

It is not easy to set limits between sublevels IIIa and IIIb, the only place we can accept that there are a few changes - not without reserve - is on the most occidental section of Atxoste. The thickness of Level IIIb reaches up to 70 centimetres, it has a muddy-clayey soil which is more compact and more humid than before. The effect of fires makes it feel greasy and besides it gives this brown soil a black coloration. The biggest fraction is scarce and usually disturbed, and the pockets of molluscs are common.

The arguments used to differentiate IIIb1 and IIIb2 are basically archaeological. There are not many major changes between the prehistoric material of IIIa and IIIb1: abundant ceramic fragments, dense lithic collections with double bevel segments as a major characteristic, fauna, etc. In contrast, what is missing in IIIb2 are the ceramic elements and the segments are substituted by triangles and trapezes with abrupt retouch.

In IIIb2 it is interesting to note various stone structures : a row of bigger blocks and a hole for a pillar wedged with stones which are a reflection of an old hut *(fig. 4)*.

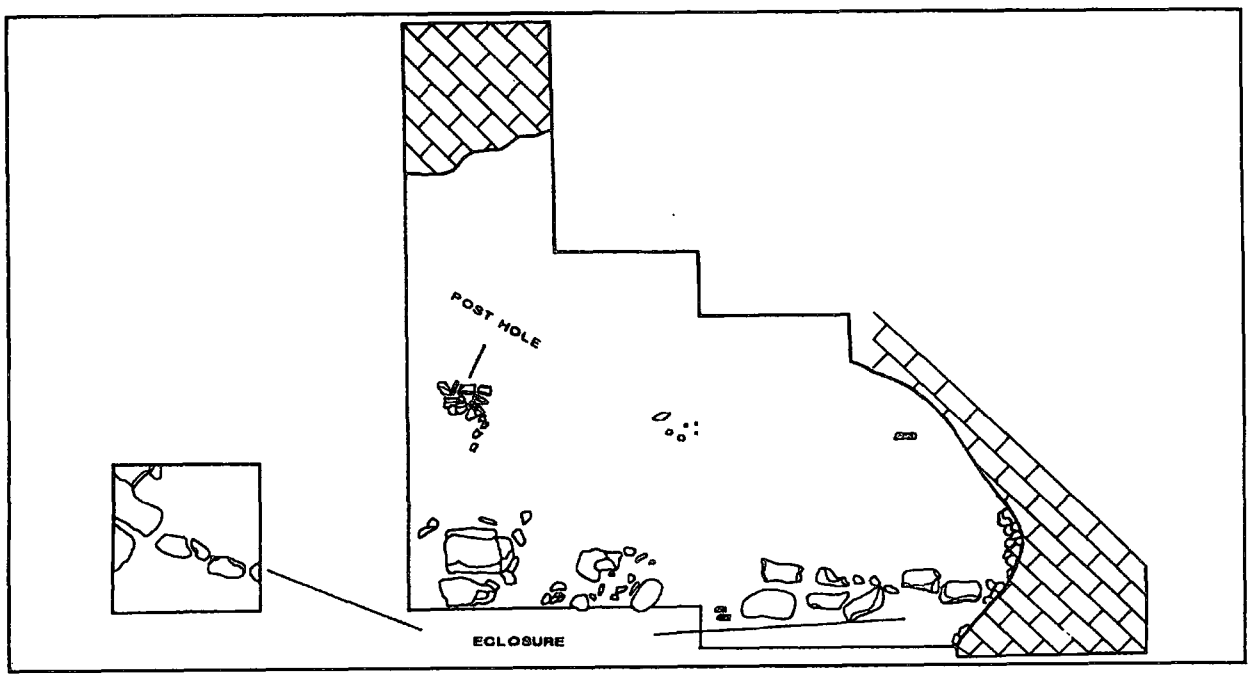
tions : dense lithic industry with geometrical armatures, scrapers, backeds, slots and denticles (those are partially found in V and VI).

- **LEVEL V** : This layer is 15-20 centimetres thick and does not present a drastic change, it is quite easy to separate. The soil is muddy and fine, slightly compact with a brown pigmentation in the process of getting lighter : the decomposition of the main component besides giving the base a red colour also gives it a rough texture. We can recognize combustion structures which are slightly disturbed.

The change of orientation of the lithic industry is significant, now there is a preference for flake-blanks and the fabrication of slots and denticulates; the laminar components and the microlithic character disappear.

- **LEVEL VI** : This horizon has only been excavated on a small surface, no less than 25 centimetres thick. Taking into account chromatic graduations which seem to be the result of human activities we propose to divide it in three smaller units.

Level VIa is not very different from the previous one : it is more compact and it emphasises decomposition



- **LEVEL IV** : The change between horizon IV and horizon IIIb2 is gradual. Its mass which has a thickness of 20/25 centimetres is composed by loose muddy-clayey soil but it is more humid. There are fewer clasts as well as blocks and the soil is less greasy : the exhumation of the semi sections presents a smooth surface only interrupted by combustion structures. The most noticeable aspect is the pigmentation : the sediment gets lighter going from brown to a greyish colour with some isolated blackish stains due to the fires. Although there are less of them we still find colonies of snails, in fact a big part of the base is composed by countless pieces from the shells of the snails.

In level IIIb2 there are no archaeological variaphenomenon. The base gets more granulated and rough but the presence of medium and big fractions is not very important except in specific areas. We can recognize various combustion structures as well as groupings of coal. The presence of *Helix cepaea menoralis* is residual and not very homogeneous.

Level VIb1 is characterized by the dark colouring of its soil due to a dense human activity and because it feels greasy and creamy. It is frequent to find coal pieces, they are often of quite big dimensions, as well as combustion architectures forming a tumulus shape or limited circles. The wall is not a horizontal surface but presents pockets.

Level VIb2 is actually a transition layer between

the previous one and the following one, it is not always present - sometimes instead of it we can find the pockets mentioned before. Now, the soil is much lighter in its colouration and much more humid, this factor increases the degree of decomposition of the limestone.

There are no significant variations relative to the archaeological materials in the whole of layer VI. The differences between this layer and layer V are only questions of details, actually we found in both layers the same carving techniques and the same collection of objects.

- **LEVEL VII** : excavated on just over a square metre and not completely so, its stratigraphic potential is surprising; it is over a metre thick. The change in the sedimentation when compared to the upper sequence is also surprising. The base is clayey and has a light yellow colouration, the soil is compact and clean and the main component is scarce : unevenly distributed blocks.

It certainly has not provided an extensive material collection but it is significant due to the fact that it is really old : laminar collection with a preference for scrapers, backeds and also remains of fauna.

III.4 Habitat Holocene stratigraphies : shelters beneath a rock

Atxoste is a good example of one of the best known models for the beginnings of the Holocene in the Ebro basin : the shelters beneath a rock. It refers to small habitats prepared to shelter a portion of the group which has split from the rest, the aim is to take advantage of the cygenetic capacities of the environment. This is why they are situated in highly strategic places. The material collections found in those shelters provide abundant fauna residues, including various species and a lithic industry on flint brought from other places, specialised.

These settlements are "entrance-exit" places which means they are used for short but repetitive stays which are cyclic. Generally, during those stays repetitive actions are accomplished : setting limits to combustion areas, flintknapping (the preliminary tasks of eroding and pre-shaping were usually performed elsewhere), cooking, maybe treating animal skins, etc. As a result we find thick stratigraphies because of an accumulation of remains where it is difficult to establish internal subdivisions due to the important effect that repetitive anthropic actions have on the sedimentation. As we have seen in the case of Atxoste, in the day to day excavation archaeologists have to look for nuances to help them divide a whole part into smaller units and/or use the help of the seriation of the prehistoric instruments. Logically, the radiocarbon analysis is a good help.

In Atxoste- and this is extensible to a good number of the deposits- the levels are characterised according to their physical qualities, as follows :

- They are practically horizontal or slightly curved in the centre.
- They present regular surfaces which are only interrupted by intentional stone structures or accumulations of stones in specific places or by edges which have fallen off walls or roofs.
- They present a neat aspect where in occasions we can isolate units which are generally independent of a series of characters; they usually give the sensation of a non interrupted deposition.
- The soil usually has a dark colouration. On the sections we can observe a continuous chromatic graduation, on the surface the contrasts are bigger because the pigmentations are directly related to the use humans gave to the places. A peculiar depositional phenomenon- colonies of gasteropods , decompositions- colour the sediment with various stains.
- The base is, depending on each case, more or less greasy, creamy and its aspect is sometimes similar to ashes.
- The materials are rich enough, they are composed fundamentally by lithic residues, remains of fauna and, entering the Neolithic, ceramics.
- There are no parts which are archaeologically sterile. In the periods in between the visits, natural floors do not get formed and often, from the last occupation to present days, although various millenniums have gone by, the superficial layer is weak or inexistent.

The chemical composition is characterised as follows[2] :

- Presence of phosphorus in high proportions : its participation increases progressively from 3.5% at -100 to 15.4% at -200, at that moment it goes down suddenly. In the future we will be able to offer the relation between the density of human activity (through the inventory of objects) and the concentration of phosphorus and to check if there is a direct relation between the two factors.
- There is an important presence of iron whose curve follows a pattern similar to the phosphorus one : progressive increase up to -230 and decrease in the last portion studied. Fire making , a phenomenon which affects the quantities of iron we can detect, is constant all through the sequence.
- The calcic carbonate stabilises around 48%, values which are a little below what we had expected. This fact could be explained by the elimination of the major fractions and the snail shells from the sample as well as by the high percentage of phosphate and silica (SiO2) which react in opposite ways.

In conclusion, the physical characteristics of the stratigraphy of Atxoste reveals a continuity where it will be difficult to try some internal partitions. We try to do this combining litostratigraphic and archaeological considerations. Various chemical values seem to also hint at a progression in the components of the soil but we do not

[2] In this research we present the results of the chemical analysis of the soil of Atxoste and Los Husos. We have to note the impossibility of having lineal readings due to : a) the procedures of execution were different. In the samples from Atxoste given the fact that the soil was loose, we eliminated the major fraction- limestone edges- and the components that could disturb- bones, earth snails....- In Los Husos the base was compact which did not allow removing such elements. We had to grind all the sample without discriminating any element: b) in theory each sample can only represent itself and is not useful for the qualification of all the layer, this circumstance is more understandable in the places were we could establish differences in the use of the distinct areas of the settlement.

think it can allow a lineal reading of the data. The granulomatric dynamics which gives a saw teeth shape graph, lets us understand the importance of human intervention in carrying the medium-big fractions.

III.5 Chronology

For the chronological contextualization of the shelter of Atxoste we have been collecting during the excavation various bone samples which undergone a carbon 14 control. We took the samples to a specialised laboratory-Isotech (Groningen) making sure that : the samples always came from one same surface of the settlement as if it was a column analysis; we chose big bones rather than smaller fragments to avoid getting them mixed up.

We have at least one date for every level and the laboratory has not indicated noticeable changes. As for the chronological range involved Atxoste has the widest sequence C-14 in the initial Holocene in our territory. It does not show noticeable blanks except in layers VII and VI, this fact reinforces the hypothesis of a continuity in the dwelling which we relate to the sedimentary continuity we have described above- :

- The inferior level of the sequence, layer VII, is dated around the middle of the tenth millennium B.P, which corresponds to the laminar Mesolithic.
- Two dates help us situate episode VI between the middle and the first third of the ninth millennium B.P, it has a typical industry of the Mesolithic with slots and denticles.
- The next horizon, layer V, is not different from the previous one for its industry although the carbon 14 places us now in the first third of the seventh millennium B.P.
- Two radiocarbon references date with precision the geometric Mesolithic industry which develops during the formation of layer IV, this process must have happened between the middle and the third third of the seventh millennium.
- The same industrial factors remain in portion IIIb2, without any big time lap : we are in the transition between the seventh and the sixth millennium B.P
- We have been able to date the old Neolithic twice in Atxoste as we have seen in layer IIIb1: its inferior portion belonged to 6200 B.P, the superior portion is two centuries younger.
- We still have to date the last moments of the occupation of the shelter, the inhumations from the Bronze Age are really very late.

It is not difficult to find places which, according to what we have indicated, can be approximately contemporary to Atxoste. Besides, they also share similar industries, the same kind of management and similar stratigraphic problems. Referring to the immediate geographical territory- Basque Country and High-Medium Ebro basin- we will find up to around fifty references.

The places, in caves or shelters, of Abauntz, Arenaza, Berniollo, Ekain, Forcas I, Mendandia, Zatoya for the laminar Mesolithic episode coincide with level VII in Atxoste. Although most of the dates tend to concentrate around the middle of the tenth millennium, a couple of them are quite distant : Mendandia, 8500, Zatoya 8200/8100. In any case it shows that with the start of the Holocene, territories which were seldom visited begin to get interesting and are used by humans as a fixed residency even sooner than we had expected.

Grouping horizons VI and V of Atxoste because they both belong to the Mesolithic complex of slots and denticles, we will find parallel characteristics in the shelter of El Angel, Forcas II, Kanpanoste Goikoa and Mendandia. Obviously, they do not provide a wide catalogue which would be helpful to characterise an industrial complex which is not very well known yet. They have the advantage of being located over a small period : 8200-8000 for El Angel, 8000-7800 for Atxoste V, 7800-7700 for Mendandia, 7800-7600 for Kanpanoste Goikoa. The dates of Atxoste VI would be the earliest of this complex (8700-8500).

The register which involves settlements from the geometric Mesolithic increases a little : Aizpea, Botiquería dels Moros, Costalena, Forcas II, Fuente Hoz, Kanpanoste Goikoa, Mendandia, Peña de Marañon and Pontet. These settlements are interesting thanks to the fact that they cover almost all the chronological range which involves such settlements : from 8100 in Fuente Hoz or from 7890 in Peña de Marañon, up to 6360 in Kanpanoste Goikoa which get close to Neolithic characteristics.

In our opinion the dates of the old Neolithic belonging to Atxoste are interesting because they confirm what other similar complexes situated in the Basque area made us expect : the introduction of the Neolithic in the region was not a late phenomenon , its rhythm does not varies from what seems common to other peninsular areas. Focussing only on the geographical environment we have mentioned before, the data of Atxoste coincides with the data from Aizpea, Arenaza, Cueva Lóbrega, Costalena, Chaves, Fuente Hoz, Herriko Barra, Peña Larga, Pontet, Zatoya.

In conclusion, Atxoste is situated in a region which starts to be inhabited with density from the beginning of the Holocene, setting up a cultural process, a long term cycle, which takes up the whole Mesolithic and the first forms of the Neolithic. The "new times" offered by the economic system of production lead to refocusing the habitat preferences, the interest for shelters of the type of Atxoste decreases.

III.6 Discussion, process of formation.

The sedimentary characteristics relative to the formation and the problematic described in Atxoste, far from being unique to this settlement are found repeatedly in quite a few contemporary places. It might be convenient to think about its internal dynamics as a general reflection for the rest of the places, noting in every case the peculiarities as they arise.

Due to the fact that the shelters are seen as "entrance-exit" places, the populations have a real net of settlements which they use simultaneously : Because of

that the elements of formation and the dynamics of the stratigraphic horizons are common to all those places. If we think of the small size of those shelters it seems that they were not able to hold a big group : in Atxoste the part which is covered by the roof does not seem to be more than three square metres big; in the nearby shelter of Kanpanoste Goikoa we estimate that the roof did not cover over twenty square metres, Kanpanoste was even smaller; for the rest of the deposits we would get to similar estimations. In order to improve the conditions of living there must have been some kind of added structure probably made with such light materials that we can hardly detect them. In Atxoste we have found an example of this type of architecture, which we will shortly refer to.

We have established a direct relation between the sedimentary characteristics of Atxoste with the human activities, this fact has been repeated in all the places we know in detail. In Atxoste, due to its location, the natural sedimentation has included aeolian elements and vegetal actions and it was complemented by medium and big blocks which had fallen off the wall or the vault of the shelter and in other occasions- with some reserves- it could have been complemented by some soil coming from the erosion of the moorlands of Atxoste. But we want to emphasise the importance of the anthropic interventions : as a fact, between each one of the prehistoric occupations there was no floor formation and the formation which took place after the last visit to the deposit is very weak. We do not find archaeologically sterile horizons but in contrast there are transition semi sections. The phenomenon is repeated with its own nuances in Kanpanoste, Kanpanoste Goikoa, Peña de Marañon- here the falling off of flat stone is the most relevant depositary phenomenon- or in Mendandia- where not even the least sedimentary unit has been developed over the last six thousand years.

The chromatic heterogeneities within a horizon, where the general colour is interrupted by more or less dark stains, the greasiness, the intentional adding of blocks, the accumulation of residues of fauna which has been consumed, the fires, remains of carvings and configured elements, etc. are due to human actions which are repeated in every visit. Peculiar phenomena such as concentrations of snails which are usually associated to dark colorations add their own characteristics.

In Atxoste, between -165/-175 in relation with the 0 line, which corresponds to level IIIb2, we have found remains of what must have been a hut leaning right on the shelter : this must have improved the habitability conditions of the place. Although we do not really know it, it is very probable that other similar constructions were built in other periods in which the shelter was used : besides, given the peculiarities of the following shelters we suspect that similar architectures were built in Kanpanoste, Kanpanoste Goikoa (here there is a latent structure), Montico de Charratu and La Peña de Marañon.We can also suspect the existence of works to put in a high structure in El Pontet- we could find holes made to put in pillars- and Els Secans -there we could find a closing wall.

The habitat would have had small dimensions, around thirteen square metres, and would have been surrounded by a small wall sub parallel to the wall of the shelter. This wall, according to what has been conserved was formed by a simple or double row of blocks selected for their size : in the case of double rows there in a space in between them. We suppose that either this support or the space between the rows were used as a base for an elemental wood skeleton (pillars) covered by vegetal or skin elements. Inside, we have found a hole which was used to put in a pillar : the hole was limited by a row of stones driven in the ground which would help keep the pillar up straight. We could maybe interpret the space in the middle of the settlement which has no stones as the entrance of the hut.

We have arranged the archaeological materials found inside the hut to see if they would provide some type of information about the different uses of the indoor spaces. The results are not definite yet because we have not excavated extensively all the surface of the hut. Besides, we have to note that a good part of the daily activity was probably performed outside the settlement as such, for instance we could not find fire structures inside. The major part of the materials seem to be concentrated in two zones : towards the back of the shelter-the closer to the wall we get the more residues there are- and towards the East, where the concavity of the shelter is bigger. What we think would be the entrance of the construction as well as the zone right near pillar provide less objects. If we only focussed on the scattering of the fauna remains we would immediately see a substantial modification of the evidence : although they still seem more abundant at the back of the hut than at the front they gather mainly on two squares (Z2; B3-B1). As for the lithic objects they have a more uniform pattern getting gradually more abundant from the outside towards the inner part of the hut.

We want to note here that it seems obvious that- for the floor as well than for other zones- the uneven distribution of the elements (as a whole and each group in particular) has a direct effect on the lack of homogeneity of the sediment : at least for characteristics such as coloration, texture, greasiness. So we have to emphasise two facts : how important anthopic actions are for the stratigraphic units and the sense of continuity we get due to the repetition of the actions and of the added sedimentary elements.

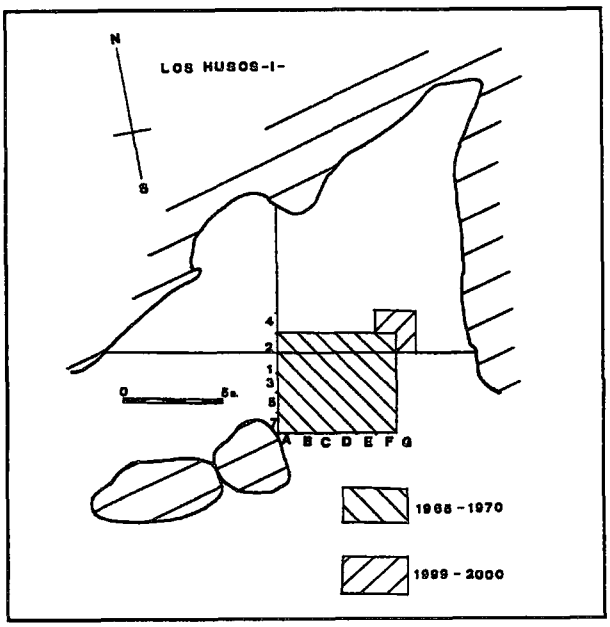
IV.Abrigo de Los Husos-I

IV.1 Situation

The shelter of Los Husos-I is located in the municipality of Elvillar (Alava-Spain) at the foot of the Sierra de Cantabria. It opens on some secondary conglomerated formations which reappear between the quaternary terraces of the river Ebro and the tertiary limy escarpment which form the Sierra.

Its opening approximately triangular has big dimensions, it is over seventeen metre high at its higher

point and it presents a South orientation. It is the biggest of a series of shelters located in the same formation. Los Husos I and Los Husos II are the only ones in which archaeological settlements can be found. A small spring rises in its inner part which does not stop flowing even in the driest months of the year and as we will see later on, it has a major importance when it comes to explaining the process of sediment formation *(fig. 5)*.



Its coordinates UTM, on the S.G.E map page 170 (Haro) on a 1:50.000 scale are : X=537026; Y=4717033; Z=829.

The Sierra de Cantabria forms the northern rocky outcrop of the Ebro river valley in the region of the Rioja Alavesa. A series of archaeological settlements chronologically similar to Los Husos-I are located in the Sierra de Cantabria : caves and shelters of Peña Larga, Burrubiel, Valanciego, San Cristobal, Peña Parda, Cueva del Payo Carrascajosa, etc. In the southern foothills of the sierra, on the terraces of the Ebro, are located the dolmens of Los Llanos, el Encinal, la Chabola de la Hechicera, el Alto de la Huesera, San Martin, el Sotillo, Layaza, la Cascaja, the burials of San Juan Ante Portam Latinam, the village of La Hoya and over a hundred other places on the surface and holes which show a very dense human presence in the zone during recent prehistory.

IV.2 Background

The settlement of Los Husos-I was excavated between 1965 and 1970 by J.M.Apellániz, he could recognize a stratigraphic sequence ranging from the Neolithic to the Roman age, its gets over five metres thick in some zones. In its exhumation remains of material culture were found as well as remains of fauna (they were studied by J. Altuna) and three dates could be fixed through C-14 analysis performed by the laboratory Teledyne Isotopes of New Jersey. All the results obtained were the subject of a monographic publication (Apellániz 1974).

The study of these materials was useful at the time to articulate the cultural scene of the prehistoric periods with ceramics in the Basque Country. Two different models of occupation and exploitation of the territory were established : the cost model using as a prototype the settlement of Santimamiñe in Vizcaya and the inland model we have seen in Los Husos-I. In spite of this, quite a few years ago, during the 80s, this apparent duality started to be questioned after realising that the settlement on the coast was probably not used as a permanent habitat and after starting to doubt the given value of the stratigraphy in Los Husos-I- But in recent publications on Spanish prehistory this dual thesis is still reproduced.

IV.3 Stratigraphy

In 1999 during the course of an investigation programme developed and subsidised by the University of the Basque Country[3], a new study of the stratigraphy of the shelter was proposed. The object was to work on aspects that were not studied during the previous excavations, three main objectives were proposed :

- To obtain a wide range of absolute dates through C-14.
- To make palinologic, carpologic and antrhacologic analysis.
- To extract a column of sediments to determine its origin and were they came from.

In our intervention we have respected the approach of the previous excavations. We have maintained the same squares and the same identification system, the new squares turn out to be an extension of the area excavated thirty years ago. We have worked on three contiguous squares, one square metre each, in a lateral zone relatively close to the wall of the shelter. We have removed the soil in layers using five centimetre sections as a standard maximum thickness measurement while adapting to the characteristics of the filling.

In the final publication we will set general characteristics for the levels, each one of these groupimg various layers. In the present publication we have preferred to keep the individualisation of each of the layer *(fig. 6, next page)*.

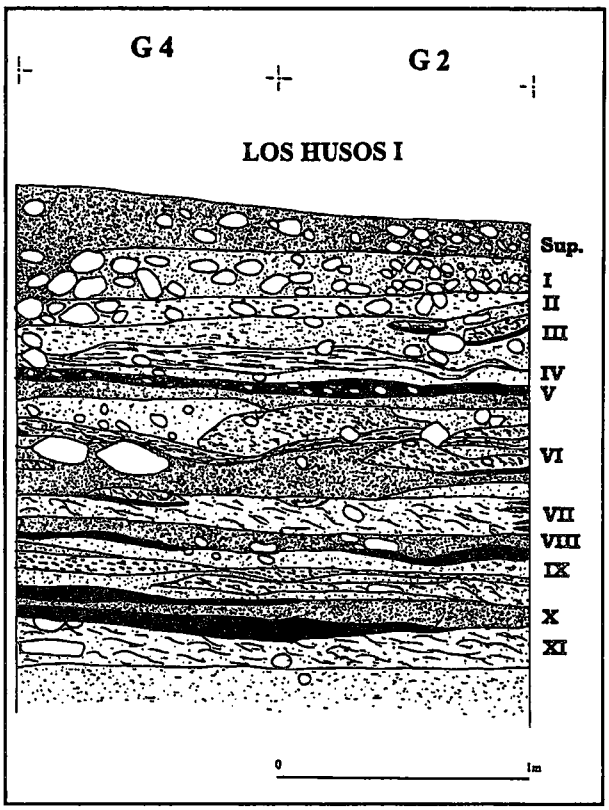
-Superficial layer- Between 14 and 24 centimetres thick. Very loose soil with abundant charcoal, roots and limestone clasts medium and small sizes, reddish brown (5YR4/4 and 5YR 3/4[4]). It contains reddish sandstone fragments which have fallen off the walls of the shelter and abundant boulders.

From its interior we could collect materials which had a modern age aspect as well as materials which had a prehistoric aspect all mixed together.

-Layer I.- Between 16 and 22 centimetres thick. Loose

[3] El poblamiento en la Sierra de Cantabria durante la Prehistoria Reciente: estudio bioclimatico y cultural del Holoceno en el extremo meridional del Pais Vasco (UPV/EHU 001550130-HAO70/98).

[4] The chromatic codes refer to MUNSELL, 1998.



dark reddish brown soil (5YE3/2) and dark greyish brown (10YR4/2) on the base with small light greyish stains (Hue 10YR7/2) which seem to have been carbonated by flooding.

We have collected fragments of late Terra Sigillata with decorations based of circular shapes as well as hand made ceramics, fragments of glass and fauna remains.

-**Layer II.**- Between 3 and 12 centimetres thick. Very loose soil with abundant roots and coal. The coloration ranges from a very dark grey (5YR3/1) to dark brown (7'5YR3/2). In its mass we can see a lot of medium size stones which tend to disappear towards its base and also sandstone fragments.

We also found in this layer ceramics fragments, hand made or made with a wheel, a fragment of iron and fauna remains.

-**Layer III.**- Between 33 and 15 centimetres thick. Generally compact muddy soil, yellowy brown (10YR5/4) with a lot of roots, coal and small clasts between 3 and 4 centimetres and very reddish sandstone fragments. There is a combination of abundant stains and big zones of greyish brown soil (10YR5/2), it feels very smooth, it has some boulders which size is inferior to one centimetre, those boulders are found on a red coloured base (2'5YR4/8) which feels very rough and scratchy. Inside the stains we could find some ceramics fragments.

This layer has abundant hand made ceramics residues, a flint nucleus which is exhausted and fauna bones.

-**Layer IV.**- It presents a narrow band of soil of variable thickness, between 2 and 5 centimetres, it has a very dark colour (5YR2'5/1-black) and is situated at the base of layer III underneath the stains. The soil is loose, very humid , with pieces of charcoal, small muddy clasts between 1 and 4 centimetres big, pieces of sandstones and very few roots.

It contains ceramics fragments and some bones.

-**Layer V.**- Its thickness varies greatly, between 24 and 16 centimetres. The soil is muddy-clayey and its coloration is light greyish (10YR4/2 and 7'5YR5/2), it is very humid and has abundant roots and very compact whitish stains.

We can find in it abundant hand made ceramic fragments and fauna residues.

-**Layer VI.**- Between 20 and 40 centimetres thick. Muddy-clayey soil feeling smooth, humid, loose in some occasions carbonated, with a lot of small and medium size stones y a lot of roots, the dominant colour is reddish brown (705 Yr4/2-4/2), it looks like the sediment was formed due to a bogging down over a short period of time. Reddish, yellowish or greyish stains are abundant and they contribute to give the layer-which is not uniform altogether- a chaotic aspect.

We could collect abundant hand made ceramic fragments.

-**Layer VII.**- It has an average thickness of around 17 centimetres. Muddy-clayey soil with a dark reddish coloration (5YR3/2 10YR3/2). In its mass we can see abundant stains which have a very rough soil, sandy very compact and dry with a very dark grey coloration (705YR3/1).

Hand made ceramic fragments are abundant and there are also fauna bones.

-**Layer VIII.**- Between 6 and 10 centimetres thick. Dark grey soil (705YR4/1), muddy-clayey, loose and compact depending on the zone, very humid, with roots and stones. Its mass contains stains made of very hard and compact crusts and with blackish stains on its base.

In this layer we found hand made ceramic fragments.

-**Layer IX.**- between 7 and 10 centimetres thick. Muddy-clayey soil, dry with a dark or very dark reddish brown colouration (5YR 2.5/1 and 2.5YR 2.5/1). With a noticeable quantity of small and medium size stones and roots.

From this layer a hole starts which gets to perforate a little over the surface of layer XII. In its base we could detect big stones, underneath one of them we could find a big fragment of a ceramic edge which has a rough texture, it is decorated with digitations and ungulations, we could also find a toad skeleton which is almost complete (*Bufo bufo*).

We have to emphasise that we also collected a maritime style bell beaker fragment.

-**Layer X.**- this layer was subdivided in two sections during the excavation :

*X superior, between 6 and 10 centimetres thick, very hard com-

pact soil, feeling scratchy, a little humid, with a colouration between pinkish grey and pink (5YR 7/2 and 5YR7/4). This crust is composed by extremely thin small layers which are separated by extremely thin and discontinuous layers of blackish soil.

We found here some ceramic fragments and bones.

*X inferior, with a thickness of 2/3 centimetres, formed by very black soil, plastic and very humid with a black coloration (7.5YR2.5/1).

In its mass we could collect some ceramic fragments and bones.

-**Layer XI.**- Between 17 and 31 centimetres thick. During the excavation we separated two units.

*The superior unit has a muddy-clayey soil, very compressed and humid, with small and medium size rounded stones with a light reddish brown coloration (5YR2.5/2). It includes some very compact greyish crusts with numerous rounded edges, little stones and bits of charcoal all of which are found on very thin layers of black, plastic and humid soil.

In this unit we could isolate four pillar holes and up to half a dozen small holes with a diameter no bigger than 1.5 centimetres.

*XI inferior formed by fine compact soil, very compressed and humid with small stones between 4 and 8 centimetres, its colouration is light reddish brown (5YR2.5/2) and in some zones even red (10YR 5/6).

We could collect here ceramic, flint and fauna elements and a fragment of a bone burin.

-**Layer XII.**- It has only been excavated in its first centimetres but it is not the base layer of the settlement because we know there are inferior units. Its soil is sandy, rough , its colouration is yellowish, it has a big quantity of sandstones, pebbles and stones, some of them are very big.

It has a large quantity of human bones, some ceramic fragments and flint instruments.

-IV.4 Description of the formation of the stall : the case of Los Husos-I

The sedimentary, physical and chemical data we have gathered in Los Husos-I allow us to discuss its use as a fold. As for the physical part the layers have the following characteristics :

- They are practically horizontal.
- They present an irregular surface with abundant holes and depressions.
- They have a anarchical aspect and small layers of different characteristics intermingle.
- There are groupings of very compact rough greyish crusts which are formed by a superposition of thin calcic carbonate layers which in some occasions hold thin layers of very plastic black soil. In its interior we can find small pieces of charcoal, small boulders and very eroded pieces of sandstones of different colours, some ceramic fragments and bones which are not brunt.
- Those crusts can be found on thin layers, maximum 3 to 4 centimetres thick, formed by very plastic clayey soil, with a very intense black colouring. In its interior we could not see clearly coal fragments. It contains some ceramic fragments and bones which are not burnt.
- The materials found in those formations is very poor and not very varied, it almost exclusively includes ceramic fragments. The fauna collected has mainly a domestic character.
- Finally, it is surprising to see the great thickness reached by those levels over a relatively short time span. Between layers V and IX, a thickness of around 0.80 metres, there are a little over three hundred years involved.

As for its chemical composition they have the following characteristics :

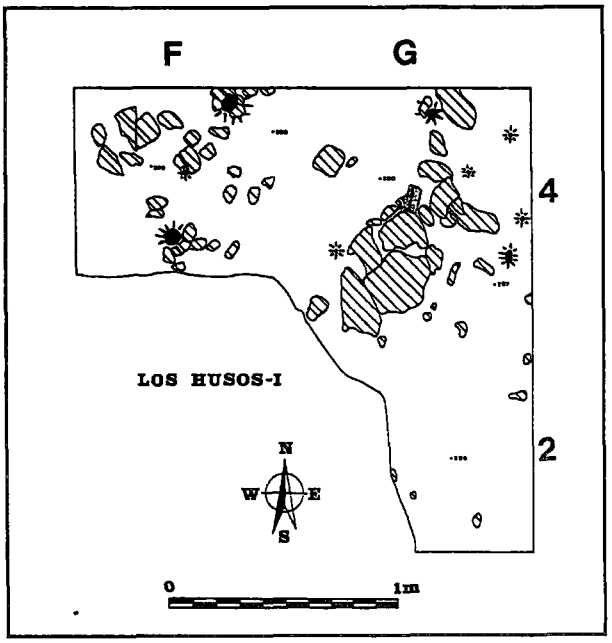
- Presence of phosphorus in high proportions (around 3%).
- Low participation of iron (Fe_2O_3t in percentages around 1%).
- High concentration of humic acid.
- The greyish crusts are composed by calcic carbonate CaO.

In Los Husos-I those physical-chemical characteristics are developed between layers III/IV and layer XI. This means the shelter was used as a fold from the Chalcolithic to at least the end of the Bronze Age or the beginning of the Iron Age. We have to mention that up to the middle of the XX century the shelter occasionally still had this function.

The layer which presents the most interest is with no doubt layer XI because it represents the floor on which the first fold was constructed. In its superior unit we located four pillar holes, three of them at the same depth and a fourth a little deeper covered by a sandstone block. Nearby we could find up to half a dozen small holes which diameter is no bigger than 1.5 centimetres. The base of the pillars, except for the one covered by a stone slab, were surrounded by a very compact lump of mud and stones. The holes have a circular shape with a diameter between 4 and 8 centimetres and they are between 17 and 20 centimetres deep, its base is wedge-shaped or pointed. The pillars, according to their diameters would be too weak to hold a roof, this fact combined with the presence of the small holes nearby leads us to think more of a fence to form a fold rather than of a construction which could be used as a hut *(fig. 7, next page)*.

In previous excavations similar structures to the ones described here were not located. In spite of this we do no doubt that they existed but we think that because of the dynamics of those interventions they were not noticed. So, we ignore the existence of intermediate elements to hold up a structure or other types of peripheric closing. We cannot define the morphology of the fold but, taking into account the floor of the shelter and the fact that the structures are close to the wall, we think there was a polygonal shaped fence which closed the wide opening of the shelter.

Above the layers which form the fold we have not located any other similar structure. To explain this fact we find various reasons : the residual character of our



excavations and the fact that they are not extensive, the fact that they do not focus on previous excavations or the possibility of those structures having been substituted by some other kind of closing, using different materials.

IV.5 Chronology

We have already mentioned that one of the motivation of our investigation is getting together a good and complete sequence of radiocarbon dates for the settlement. To achieve this we have collected bone samples and a seed (of layer I) of each one of the individualised units. We could not extract samples from layers IV and X. The results are shown in the following chart :

Layer	Dates BP	2 Sigma calibrated result (95%)	Laboratory Number
I	1560±60	390-630 AD	Beta-136037
I	1760±50	135-405 AD	Beta-136038
II	1550±50	410-625 AD	Beta-136039
II	1600±40	390-550 AD	Beta-137897
III	2970±50	1375-1020 BC	Beta-136040
V	3360±50	1750-1520 BC	Beta-136041
VI	3410±40	1770-1620 BC	Beta-148055
VII	3400±40	1760-1610 BC	Beta-149399
VIII	3630±40	2130-2080 BC-2060-1890 BC	Beta-148057
IX	3710±40	2210-1970 BC	Beta-148058
XI	3190±40	1520-1400 BC	Beta-149400
XII	3980±40	2580-2430 BC	Beta-148061

According to these results we define five cultural levels in the amaterial we have exhumed :

- Layers I and II correspond with a Roman period phase well characterised by the late Sigillata ceramics it provides.
- Layers III and IV (it actually is the same geological-sedimentary unit) fits in the last moment of the Final Bronze or the beginning of the Iron Age.
- Layers V, VI and VII are situated in the Medium Bronze.
- Layer VIII is in the Initial Bronze.
- Layers IX, X, XI and XII provide dates characteristic of the Chalcolithic : the oldest was used as a burial place, the next ones were used as folds.

It is easy to find in the nearby environment of Los Husos-I settlements with similar chronologies and a similar problematic. The settlement of Peña Larga located no more than two kilometres away, on the same side of the Sierra, has a Chalcolithic level of burial dated in 4470±160 BP. There is another one, superimposed, with important bell beaber ceramic remains and another one from the Initial Bronze, with sediments with similar characteristics than the one described in Los Husos-I- (Fernandez Eraso 1977).

On the northern side of the same mountain range the well know funerary deposit of La Yurdinas (Sáenz de Buruaga *et al.*, 1992; Alday *et al.* 1993; Fernández Eraso 2000) is situated in the Chalcolithic due to the fact that it provides dates C-14 between 4390±80 BP and 4290±40 BP. In the dolmen of Los Llanos, at the foot of the same mountain range, and very close to Peña Larga, we obtained dates between 4660±200 BP and 4080±170 BP. The burial place of San Juan Ante Portam Latinam about ten kilometres away from Los Husos also belonging to the Chalcolithic provides dates ranging between 4570±70 BP and 4460±70 BP. The dates of Cueva Lóbrega would be similar, it is forty kilometres away in a straight line, it is dated in 4480±60 BP. (Barrios Gil *et al.*1992). More to the north we will find other places with a similar chronology : Kanpanoste Goikoa level II (Alday 1998) from 4350±60 BP; Peña de Marañon between 3710±60 BP and 3610±60 BP. (Beguiristain and Cava 1985). In the Rioja Alavesa, the important prehistoric village of La Hoya has provided, for its inferior level, the following dates : 3410±90 BP and 3220±100 BP. (Mariezkurrena 1990).

As a result we deduce that the shelter of Los Husos-I is situated in an area with a dense human presence during recent prehistory, it offers a system of territorial management that should be studied in a general way, trying to explain the relationship which links the settlements.

IV.6 Discussion, process of formation.

After having described the sedimentary characteristics of the levels of the prehistoric stalls exhumated in Los Husos-I we have to consider their process of formation in order to define them better and to be able to compare them with what we have seen on other places classified as folds.

During the last years various articles were published in which stall (or founiers) type deposits are examined , so this question is well documented (Brochier 1983, 1991 and 1992; Badal 1991 and 1999; Bergada 1995).They discuss the practice of burning the stalls in order to clean them up, this would explain the peculiar formations. This habit seems to be well represented in various zones of the Mediterranean area up to not long ago. But this explanation does not satisfy us completely when we try to apply it to the case of Los Husos-I.

A fire that would burn important quantities of manure should produce easily noticeable residues at a physical level : abundant charcoal remains, stones and sandstones with rubefaction stigmas , marks of fire on the

ceramic fragments we have collected, roasted bones or bones with marks of combustion on the surface, thick and extensive layers of ashes, burnt pieces belonging to the pillars used to close the settlement, etc. None of these characteristics have been recognised in Los Husos-I.

Referring to fires is less justifiable when we analyse the chemical components of the soil. One of the elements which is always present when there has been animal occupation is phosphorus. An unusual concentration of this chemical element reveals the passing or the permanency of two legged or four legged animals. In the samples from Los Husos the percentages of phosphorus are high. Taking into account this element only we could affirm that there have been animals in the shelter and due to the materials we have collected, not many but manufactured, we could get to the conclusion that it was a human occupation.

On the other hand, iron is a decisive element and is always present in the places where there has been fire. At a temperature superior to 400° C the particles of iron existing in the clay of the soil are attracted by the effect of the thermoremanent magnetism and they concentrate. We should think that if there had been combustion actions in Los Husos the analysis would provide a high concentration of iron. But this is not what happens in this case. Affirming that when manure burns it does not reach high temperatures is not a viable explanation because when such materials burn they do so slowly but constantly reaching temperatures which are certainly high.

Contrasting what we have observed - and already described- during the excavation with the chemical composition analysis of the soil we are trying to look for an alternative to the generally admitted explanation of the genesis of these sediments, which would be valid for our case.

The small extension we are exhuming presents the shape of a small bucket where a spring flows, this spring rises from the bottom of the shelter in a continuous way. Its different courses, along the stratigraphic filling have been conveniently individualised and studied during the excavations and we came to the conclusion that the zone must have got frequently flooded. The excrements and urine of the animals kept in the settlement would get deposited in the course of the spring increasing the levels of acidity of the soil. The Beta Radiocarbon laboratory has warned us that the bones sent for dating belonging to layer XI were highly polluted by acids which made the dating more recent. Besides, the process of putrefaction of the organic materials contained in the soil must have been constant, as a result the temperature increased but without reaching as it is logical the temperature that a fire would reach.

The roof of the shelter is formed by a conglomerate of sandstones with a coloration that varies from red to yellow, supported by a natural cement of calcareous composition. Even nowadays pieces of the walls and the vault fall off frequently. The greyish layers or crusts we have detected are probably a consequence of the falling off of these fragments. Falling in an acid and flooded environment these pieces would disintegrate floating and concentrating in the lower areas. This is the reason why we find little pieces of rounded sandstones in the interior of the crusts, they have been corroded. This phenomenon would explain the reddish, pinkish or yellowish coloration that some of those crusts present, as well as the succession of small layers super positioned.

The thin black layers which are systematically deposited under the crusts make sense because of the concentration of organic elements in a humid environment.

On the other hand the fact that the mud lumps around the holes as well as the soil around them are more compact than the soil being excavated could be due to the precipitation o carbonates which soak and slightly harden the soil beneath them.

It seems obvious to us that the formation of the stall layers in the shelter of Los Husos-I is related to chemical processes which usually take place in flooded and acid environments and that it can not be explained by the effects of fire.

V Conclusion

Having described the fundamental sedimentation characteristics in shelters of the type of Atxoste and Los Husos, we can indicate various ways in which the research must continue :

- The verification of a noticeable change in the functionality of the archaeological settlements. The shelters belonging culturally to the Mesoneolithic are specifically used as dwelling places only used for hunting. The model of dwelling in those shelters is recurrent nomadism. As the Neolithic moves on those shelters loose interest or are used for funerary purposes. Other shelters, usually bigger, sometimes having Neolithic and funerary phases antecedents will be used during the advanced Chalcolithic and the Bronze Age as folds to shelter the cattle. For the first case we have referred to Atxoste and for the second to Los Husos.
- The shelters used as habitat produce a continuous sedimentation where it is difficult to see minor units : repetitive human actions on a along term basis give the sensation that the stratigraphy is continuous. Here the physical phenomenon are of capital importance. On the other hand, in the stall layers we can observe important stratigraphic discontinuities. They must have their origin in chemical processes which are more important than the physical elements, at least in Los Husos : for instance the burning of the manure produced by the animals kept in the shelter.
- As the long radio chronological list shows, the settlements analysed range over an extensive period of recent prehistory : from the tenth millennium BP to the Roman Times. They are thus helpful as threads which show us the cultural dynamics of those moments.

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