

Human occupations during recent prehistory in the granite caves of the western coast of Galicia

GROBA GONZÁLEZ, XAVIER¹ and MÉNDEZ QUINTAS, EDUARDO¹

(1) Clube Expeleolóxico Maíxo

Recibido: 1/11/2007

Revisado: 15/6/2008

Aceptado: 3/9/2008

Abstract

The granite caves known on the western coast of Galicia have prehistoric sites of all the Recent Prehistory in the northwest of the Iberian Peninsula: Neolithic, Copper and Bronze Age. However, for the time being it is very little the interest shown by archaeology when it comes to taking interest in the study of these subterranean areas. We contribute a view of synthesis and, thanks to the formal study of the artefacts, especially the metallic and ceramic ones, we dated each one of the sites. A significant number of granite caves show a specific type of artefact, Muíños Rupestres (“Rupestrian Mills”) that singularly characterise the same coastal territory in Galicia continuing in the north of Portugal.

Key words: granite caves, Galicia, Portugal, human occupation, Neolithic, Copper Age, Bronze Age

INTRODUCTION

Research on the Recent Prehistory in Galicia was traditionally focused on the megalithic world and on the phenomenon of outdoor Rock Art. The hut camps did not start to be studied until scarcely two decades ago. The caves and natural shelters, apart from exceptions that will be then detailed, were not considered by archaeologists as outstanding areas because most of them conceived that, in the Galician granite landscape, 80% of the territory, cavities could not exist.

The research on the Galician granite pseudokarst by C.E. Maúxo, since 1992, reveals the existence of a varied and extensive record of human occupation during all Recent Prehistory of this territory. The use of cavities on the Galician western coast chronologically covers all the traditional periods of Neolithic, Copper Age and the Bronze Age, which means a constant record between the IV and I millenniums B.C.

Moreover, a type of cave-dwelling site exclusive to the researched area is verified in this territory. They are called “Rupestrian Mills,” that is to say: non-transportable navicular mills as they are made over granite outcrops of the landscape. A significant number of cases is usually found in the inside of a cave or in the vicinity.

1. THE ARCHAEOLOGICAL CAVE SITES

Among the thirteen granite caves in which there is evidence of prehistoric occupation in their interior (Fig. 1), six of them are characterised by the presence of a substantial number of archaeological remains (ceramic, lithic and metallic). Due to the lack of archaeological works strictly speaking, and considering the complex stratigraphic context of the ones that were found, we find it complicated to provide a different perspective from the strictly typological viewpoint.

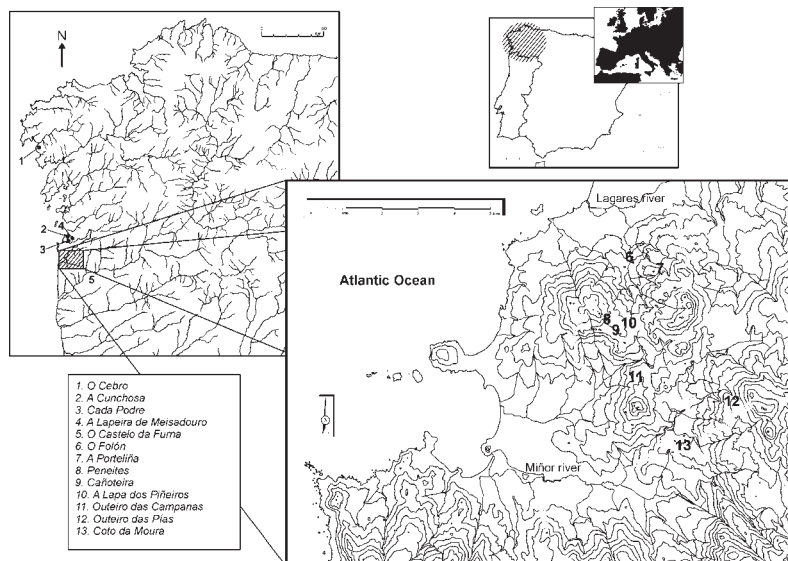


Fig. 1. Localisation map of the most site to name in the text.

1.1 The Cebro cave (O Pindo, Carnota)

The system of cavities of O Cebro is situated in the Pindo Mountain, in the vicinity of Cape Finisterre. It is a recently discovered cavity, unknown until a year ago with the preparation of this ICGC. The prehistoric

interest of the granite cavity is testified by the information of a significant number of ceramic fragments (Fig. 2). These fragments were observed on the surface of the cavity among the blocks and in the inside of the active fluvial course.

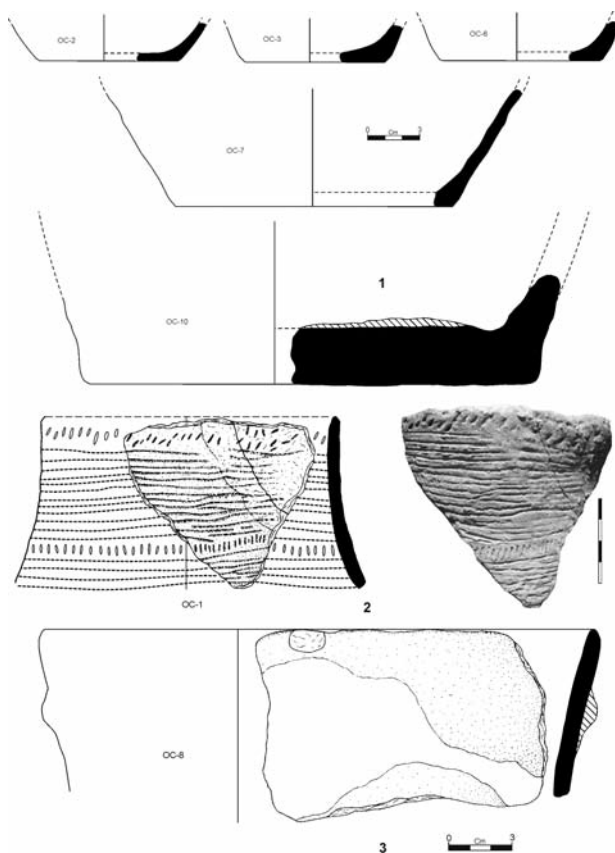


Fig. 2. Some pottery fragment of O Cebro System.

There are seven ceramic fragments representative of some other different receptacles. We are before handmade pots, with quartz and mica spot compact paste, in some cases of a good size. The colours range between the dark

ones, characteristic of reducing environments, and the reddish ones typical of oxidizing environments. Apart from several indeterminate fragments of the side, we have five fragments of recipients with a flat bottom (Fig. 2.1). Of

these, four belong to small and medium-sized containers (diameter of the bottom ranges from 80 mm to 160 mm) and they could be associated with buckled shapes with an “S” profile also known as “vases”. Next to these we find another one with a bigger bottom (261 mm of outside diameter) with a side 32 mm wide at the bottom that is easily assimilable with the big storage containers of a tronco-cone or buckled morphology. As a sample of these known types of containers we find a shard of a rim with a prominent morphology and a rounded lip with a considerable diameter (259 mm) characteristic of this type of shapes with a sinuous profile (Fig. 2.2).

A sole decorated ceramic fragment seems to relate to the bell-shaped tradition. We are before part of the neck of the pot in which it is not clearly identified whether it keeps the rim owing to the rolling it shows, even though it defines a marked buckled silhouette. The size of the original container is not very high, with a 130 mm diameter on its uppermost end. The decoration is divided into horizontal stripes, where stripes of parallel cut lines alternate with oblique imprints (Fig. 2.3).

The lack of a stratigraphic context for the materials makes it more difficult to state whether we are before a culturally homogeneous collection or, on the other hand, before the remains of temporarily scattered occupations. However, the technical and formal features of the pottery seem to indicate that we are before a homogeneous collection. They are deposited in the provincial museum of A Coruña. The formal and decorative features of the pottery of the Cebro Cave refer us to the Bronze Age, specifically to the initial stage with bell-shaped ceramic, characteristic of the first half of the IV millennium B.C.

1.2 The Cunchosa System (Beluso-Aldán, Bueu-Cangas)

The Cunchosa caves are situated in the western end of The Morrazo peninsula. We are before a range, or to be more precise,

before caves linked to fractures developed along major fracture planes that allow the easy circulation of water that conceals a large number of cavities, some of them of big dimensions (VAQUEIRO RODRÍGUEZ & VIDAL ROMANÍ, 2007).

The archaeological significance of these cavities is known since the late 70s, as inside this range numerous ceramic and lithic evidence of prehistoric occupation was discovered (SUÁREZ OTERO, 1997). The oldest one seems to date back to the Old Neolithic (end of the V millennium B.C.), represented by ceramic shapes like that of a “bottle” and containers with a cylindrical neck, decorated with imprints. These are associated with epical periods, typical of the southern-central area of Portugal. These would be therefore the first ceramic expressions of the Neolithic phenomenon in Galicia. A second period of occupation in these caves would be defined by the presence of ceramic shapes characteristic of an advanced period of the Bronze Age, where the presence of receptacles with buckled shapes and straight sides (cylindrical and tronco-cone) is usual.

In spite of the importance of this site, it was never excavated archaeologically but sacked repeatedly. The archaeological materials, including those published, are still in private hands nowadays.

1.3 Cada Podre Cave (Hío, Cangas)

This cave is known in the Galician archaeological bibliography since 1913 (Ruiz Galvez, 1979). It is a cave of small dimensions associated caves associated with fields of residual or protoclastic blocks. Inside the cave, Wenceslao Requejo found an important deposit of bronze tools hidden, known as “Hío deposit,” deposited in the provincial museum of Pontevedra.

The batch of material found is made up of six heel axes with a ring, a tubular axe, two bronze bracelets, a chisel, three spearheads, a sword, hooks and several fragments of a rivet-

ed cauldron. The features of this collection, especially the shapes of the sword and the axes, refer to an advanced period of the Bronze Age (late II millennium and early I millennium B.C.). This type of metallic objects is common in the whole European Atlantic coast and taken as proof that contact among the various communities that dwelled in the area was frequent.

1.4 The Porteliña System (Valadares, Vigo)

The Porteliña cave is situated on the same river as O Folón, some hundred metres upstream in one of the rising springs of the Rega River. We are before a range similar to that of A Cunchosa, just of smaller size: horizontal development of 83 metres and a difference in level of -7.2 metres (CLUB ESPELEOLÓXICO MAÚXO, 1997).

During the course of the potholing works, members of the club identified carved and polished lithic industry by chance, as well as a decorated ceramic fragment. The carved lithic industry is represented by a two-sided quartz nucleus with a series of adjacent extractions. We also possess a small quartzite boulder that shows a very intense degree of polishing. The ceramic fragment is more interesting; it is a piece of the belly that shows a decoration consisting of a cut line framed by two printed dotted lines (POTHOLING CLUB MAÚXO, 1997). Two parallel short cut strokes are added to this. We are before an original decorative sketch, with no precise parallelism in the Galician prehistoric scene. They are deposited in the municipal museum "Quiñones de León", Vigo.

The chronology of the occupation is problematic because the materials recovered inside the cave do not provide relative and reliable dating elements. However, the features of the ceramic seem to refer it to an imprecise period of the Bronze Age.

1.5 The Folón System (Coruxo, Vigo)

The Folón cavity is a range or pseudocarstic cavity of transflowing that drains and

leads the Rega River through a subterranean net 234 metres long and with a -34 m difference in level. 905 metres of galleries and subterranean chambers have been topographed.

The prehistoric importance of the cave was established during the potholing works of the potholing club Maúxo when since 1995 an archaeological material has been gradually identified. It was necessary to recover fifty-three elements from it (POTHOLING CLUB MAÚXO, 1997; GROBA GONZÁLEZ, 2004; MÉNDEZ QUINTAS, in press). Successive deposits between 1996 and 1998 are in the "Quiñones de León" museum, Vigo.

The most abundant remains in the cave of O Folón are the ceramic ones with 40 elements followed by the lithic industry with 12 implements (between polished industry and carved industry), and an only metallic artefact made of iron and probably with an historical chronology. From the archaeological survey of the materials several periods of occupation can be distinguished in the cavity: one in the Copper Age (III millennium B.C.), another in the Bronze Age (II millennium B.C.) and some others in the historic period.

The archaeological materials were visually identified in the area inside the cave. Many of them appeared "stuffed" or "hanging" among the blocks that form the structure, in the fluvial sediments and in other sediments hanging from the cavity, which is an indication of their secondary position. The state of preservation is changeable. We sometimes found pieces virtually intact (situation not very usual when it comes to such old ceramics) next to other remains in bad condition. Most of the materials are big pieces and were found inside the chamber itself or collapsed gallery.

Some other ceramics (symptomatically many of the medieval ones), which got to the river, show rolling signs. For example, two ceramic fragments found outside the active course, in a sandy area +3.5 – 4 m height above sea level over the river course, present concretions (if there had been rolling, there

wouldn't be any concretions). So, the reading of the site is closely connected to the structural development of the cave itself, which changed outstandingly since the moment of the prehistoric occupation until the present time (VAQUEIRO RODRÍGUEZ 2003).

The Cooper Age occupation is defined by 14 ceramic fragments (Fig. 3). These are both decorated and plain shapes. Among the plain ones there are several pots with spherical and

globular shapes with convex bottoms. Their sizes are varied, although they hardly ever exceed 30 cm in diameter. The decorated ceramics are dominated by the inciso-metopado sketch such as the type "Penha," in which the horizontal cut stripes of parallel lines alternate with the vertical ones (Fig. 3.1). Next to these there appear closed spherical containers decorated with triangles, both printed and incised, filled with printed dots (Fig. 3.2).

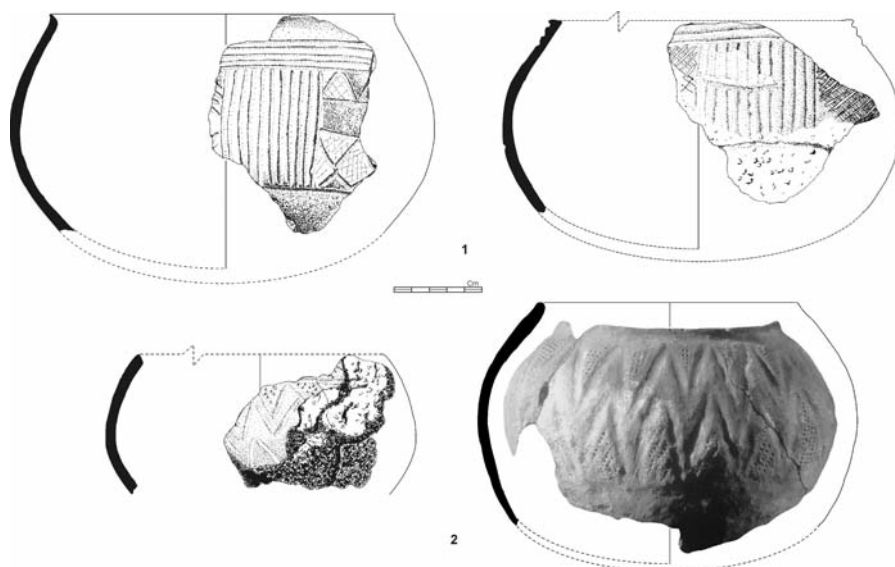


Fig. 3. Rock mills into the rock shelter (Castelo da Furna, Valença).

The occupation of the Bronze Age is defined by 13 fragments (Fig. 4). In this case the decorated containers are quantitatively less important than the plain ceramics and they are stylistically less complex regarding the former period. These show in general a greater variety of shapes and sizes. On the one hand there are receptacles with winding silhouettes, with an "S" profile in different sizes and in some cases

with decorations of vertical parallel fingerings on the neck area (Fig. 4.1-2). These containers vary in size between a bit over 10 cm. up to well over 30 cm. We have pots with cords decorated with fingerings that also have winding silhouettes although they seem to be larger (Fig. 4.3). In the other end we find receptacles with simple convex shapes, tronco-cone or with straight sides and flat bottoms.

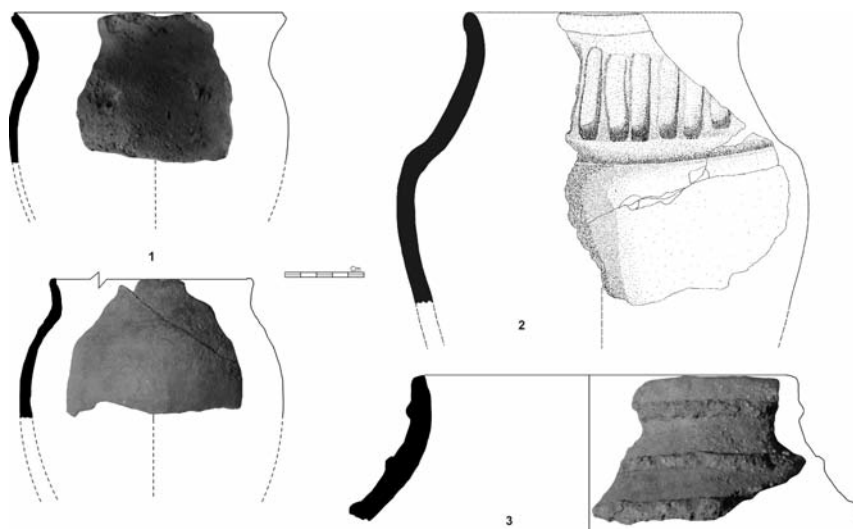


Fig. 4. Rock mill with a fragment of upper element from Peneites rock shelter.

1.6 The Castelo da Furna (Boivão, Valença)

The Castelo da Furna is an amazing granite outcrop affected by a complex network of faults and with a great number of natural cavities. The carried out Portuguese surveys have already demonstrated the prehistoric importance of the natural site. The references about the finding of archaeological materials in the area around the Castelo da Furna are old (BROCHADO DE ALMEIDA, et al. 1995; BRAZ MARTINS, 2003). The first archaeological news, towards 1910, mentions the finding of a menhir-statue from the Cooper Age in the Boulhosa mountain range, an orographic massif where the Castelo da Furna is located. Unfortunately, there is no proof that this sculpture was found inside the castle.

Subsequently, the finding of a bronze cubical axe is mentioned, and this one was found in the Castelo da Furna itself. Its chronology could be set towards the end of the Bronze Age.

The latest references about the finding of prehistoric materials in the Castelo da Furna refer us to the middle of the 90s in the XX century, when after some improvement road-works in the access road to the place, the remains of two ditches dug in the altered granite substratum, which caused an archaeological conduct to control and to do research, came to view. The morphology of these ditches was ovoid and they were filled to the brim by sediments blended with organic materials (coal). Their function would be to store food. A vast amount of prehistoric ceramic associated with the pits was found (some 50 fragments belonging to different containers). Among the pieces several fragments of edges stand out, some of them decorated. Among them it was important to do research on a small decorated ceramic fragment in a bell-shaped tradition and a container with an “S” profile decorated with vertical cut lines on the neck. These materials, like the ditches themselves go back

to the Bronze Age (BROCHADO DE ALMEIDA et al., 1995).

The patrimonial wealth of the Castelo da Furna is not exclusively restricted to prehistory. During the High Middle Ages it played a key role in the history of the old Kingdom of Galiza being a part of the “Land of Turonio”, Tui. After the XII century, with its independence, it will be a part of the Portuguese Kingdom. The castle, jurisdictional head of the “Land of Fraião”, was located here and along with the territories of Caminha, Cerveira, Pena da Rainha and Valadares, they

organized and protected the people from Portugal in the XIII century (BRAZ MARTINS, 2003). It is not surprising then that in the Castelo da Furna signs and plentiful medieval ceramic material are observed.

During the preparation of this ICGC, the place provided the archaeological innovation of identifying a high concentration of prehistoric artefacts, better known in Galicia than in Portugal, called “Rupestrian Mills.” We know that in the Castelo da Furna there are 16 mills of this type distributed in 9 different groups (Fig. 5), and there are certainly more.

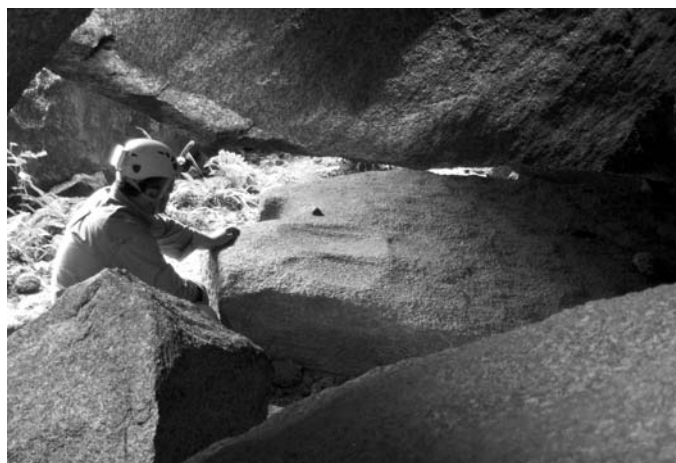


Fig. 5. Copper Age pottery of Folón System.

2. THE CAVES WITH RUPESTRIAN MILLS

A Rupestrian Mill is formally different from any other type of prehistoric navicular mill in that it is not mobile, but it is built in the area of the landscape rocky outcrops (Fig. 6). Furthermore, this type of base for grinding by hand is characterized by being able to have several components with different characteristics at your disposal (FERNÁNDEZ PINTOS, 1993; COSTAS GOBERNA, 1999). At least a rectangular sink with a navicular section, framed or not by one or two cavities with an

elliptic floor, smaller and with signs of direct percussion. In the sink, there are cases in which the marks resulting from the polishing caused by repeated activity can be easily seen.

These mills are restricted to the southwest coast of the Rías Baixas and to their Portuguese surrounding area, with an important novelty, such as the recent discovery of a station near Mountain Pindo, Carnota city council (CERNADAS SANDE, 2007). Its layout is not homogeneous coexisting areas with a large concentration of artefacts, mostly in Maúxo, Vigo and Nigrán, with other areas where, in vast territories, any stations

of rupestrian mills are hardly known. There are about 190 rupestrian mills distributed in over 80 groups. They preferably appear in groups and they are built over granite slabs protected in such a way that it is easy to find them in sheltered zones or inside a cave

(Table 1). On the contrary, there are exceptions as outstanding as those of two groups of rupestrian mills in As Penisas Pequenas, in Monteferro (Paxón, Nigrán) and in Fortiño beach (Saiás, Vigo) not sheltered at all nowadays.



Fig. 6. Bronze Age pottery of Folón System.

SITES	Nº MILLS	RELATION TO ROCK ART
A Lapeira do Meisadouro	1	Rock Art in the in the vicinity
Peneites	2	Rock Art in the in the vicinity
A Cañoteira	3	Superposition of Rock Art
A Lapa do Piñeiro	3	Superposition of Rock Art
O Penedo das Pías	5	Rock Art in the in the vicinity
Outeiro das Campanas	1	Rock Art in the in the vicinity
O Coto da Moura	3	Superimposed Rock Art and more mills outside the cave
O Castelo da Furna	16	No research done here, but a few
A Igrexa Piñeira	Destroyed	

Table. 1. Stations with rock mills inside granite caves.

Currently, it is not known the type of product processed in these mills. In a recent study on the microremains (phytoliths) kept in the

active areas of five of these mills, it was determined the presence of plant leftovers among which is cited a case with *Hyoscyamus* sp

from Beleño and with narcotic properties (FÁBREGAS VALCARCE, 2001). Waiting for more conclusive data, we consider as most probable that these artefacts are related to an everyday diet, being used to grind some hard vegetable product (chestnuts, acorns, pine kernels) or some cereal, without ruling out completely the preparation of other non-organic substances.

Also, the chronology of this type of artefacts is presently very vague. In many cases the rupestrian mills share support with the known prehistoric art (COSTAS GOBERNA, 2001, GROBA GONZÁLEZ, 2004, in press). The associated engravings are always of an abstract type (circular combinations and groups of cups). This factor sets a relative chronology between the mills and the petroglyphs for the following reasons:

When they share a support, the engravings are usually in the marginal parts of the available space, the mills taking up the most favourable area of the slab for the grinding.

In a significant number of cases, the mills are integrated in the cave compositions that flood the support. The engravings respect the mills and are placed on top of the mills (for example, lines which link the side microcomponents or, more usual and symptomatic, cups engraved over the surface of the sink sealing them).

As it is inferred from these circumstances, the rupestrian mills were built before the rock art. We are not in a position to say how much time earlier or if what we see is an order of a “functional” nature in relatively short periods of time, or whether there is a longer difference in time between both expressions. Independently of this, the chronology of the rock art is also problematic, but it tends to be placed between the III and II millennium B.C. However, new information permits to put back a part of this type of engravings, at least about the IV millennium B.C., or even earlier. With this information, rupestrian mills would be prior to an important part of the cave art cycle, which could place them in the middle

of the Neolithic (COSTAS GOBERNA, 1999; GROBA GONZÁLEZ, 2004, in the press, MÉNDEZ QUINTAS, 2005).

DISCUSSION AND CONCLUSIONS

The number of archaeological sites associated to granite cavities is significant. If we take into account that until now never has an intensive archaeological study been made of these caves, we observe that the profitability of these activities is very high.

The geographical spreading of the caves with archaeological sites is also significant. It covers a wide coastal territory, from Mountain Pindo to the Castelo da Furna, meeting the coastal Galician area of the Rías Baixas. The uneven denseness of cases known with absolute certainty is due to the lack of more studies. Even so, we consider that the northern border of this culture is well-defined in the Pindo Mountain. In the East, inland, and mostly in the South, penetrating into Portuguese territory, this type of cave sites needs more data for us to be able to distinguish their geographical boundaries.

These pieces of research have to count on the involvement of archaeology, twin science of potholing and the only one that can go into the learning of how the Galician people in recent prehistory used the caves in their territory.

The archaeological materials recovered in these caves cover all the ages in Recent Prehistory. We can state that we have an enough constant occupation that provides evidence for the Recent Prehistory and that allows us to put together a diachronic sequence. The case of the Cunchosa cave, with the presence of ceramics typical of late periods in the Neolithic, is important. Ceramics type “Penha” like the ones we found in the Folón caves, are beautiful and good examples of the Copper Age, a stage better defined thanks to the data that are found out every time about the sites of coeval outdoor huts. This seems to have been a Copper Age

period in which the granite caves were frequented regularly, either as a place of occasional habitation, as burial areas, or as places to worship nature since the Galician caves, the same as fountains, trees and other natural phenomena in the region, were venerated in the past in Galicia. During the Bronze Age the use of caves is very frequent, because we testify to artefacts belonging to this period in almost all the cavities mentioned here.

Previous periods typical of the Paleolithic cannot be discarded, and, as a matter of fact, this can be an interesting line of work to follow since the lack of knowledge about the retrospective stages of the paleolithic period in our region is very significant. The darkest time, in which this type of cavities seems not to prove any significant cultural importance, oddly enough is focused during the Castrexa Culture. The Galician natives in the second half of the I millennium B.C., even romanized, did not leave any indications at sight in any of the caves documented. Later historical periods are documented, and it is significant the case of the cave of the Folón with testimonies from medieval, modern and contemporary times.

Something very important and at the same time complex to be specific about is that of the nature of the prehistoric occupations of these granite cavities. There is a case, such as that of Cada Podre, in which it is frequent the use of the buried space to conceal, storing up valuable possessions, metals in that case. The caves with rupestrian mills and those where it is standard practice to have collections characterized by ceramics and lithic industry (O Cebro, A Cunchosa, O Folón ...) seem to refer us to domestic contexts (The Castelo da Furna without doubt) or maybe funerary (O Folón, The Cebro cave ??), hypotheses that only archaeological works will be able to confirm or discard in the future. All in all, we consider it probable that the use of the granite caves did

not always correspond to the same motives and/or functions. During the long Recent Prehistory, even in a given cultural time, it is possible that there were different types of use and/or temporary occupation of the buried space.

Anyway, future attempts to state an interpretive hypothesis on the nature of cave occupation will have to be formulated taking into account that the current archaeological record is understood in its particular geological context. For example, O Folón, Porteliña, O Cebro ... are caves that show unequivocal signs of a recent structural collapse which means that the space in the cave is not today as it was before and, as we indicated, this helps to understand the context itself where a significant part of the archaeological material appeared.

To sum up, we consider that it can be stated that during the Recent Prehistory of this territory, natural cavities were appreciated, known and frequently used and, therefore, the local archaeology will have to take an interest in the finding and research of this type of sites in the same way it takes interest in megalithic monuments, cave art and the coeval outdoor sites already taken into consideration.

ACKNOWLEDGEMENTS

This would not be possible with the group work of the Clube Espeleolóxico Maúxo; and among our colleagues and friends of the club, we wish to show explicit recognition for the expertise of José Bernardino Costas Goberna on prehistoric matters. We would also like to thank for what we shared and learned about these issues Xosé María Bouzón, Xulio Carballo Arceo, José Cernadas Sande, Xulio Fernández Pintos, Carlos Gómez Costas, Manuel Ledo Bernárdez, Tiago A. Loureiro Lobato, Antonio de la Peña, Juan Ramón Vidal Romaní and Xosé Lois Vilar Pedreira.

BIBLIOGRAPHY

- BRAZ MARTINS, C. M (2003). Contributo para o estudo do monte do Castelo de Fraião, Boivão, Valença". *Portugalia Nova Serie*, Vol XXIV: 81-94.
- BROCHADO DE ALMEIDA, C.A, SOEIRO, T. and BARROCA, M.J. (1995). "Estação arqueológica do Castelos de Fraião (Boivão, Valença)". *Portugalia Nova Serie*, Vol XVI: 311-322.
- CERNADAS SANDE, J. (2007). *Gravados Rupestres nos montes de Carnota*. TresCtres Editores. Sta. Comba, A Coruña.
- CLUBE ESPELEOLÓXICO MAÚXO (1997). "Os sistemas de cavidades do Folón e Porteliña. Contexto prehistórico e relevancia da zona espeleolóxica G/PO-I. Maúxo, Vigo-Nigrán". *Castrelos* 9-10: 37-54.
- COSTAS GOBERNA, J.B. (2001). "Cavidades Naturais e Insculturas Rupestres no Suroeste Galego". *Congreso Internacional de Arte Rupestre Europea*, Vigo, 1999. Actas en CD-ROM.
- FÁBREGAS VALCARCE, R. (2001). Los Petroglifos y su contexto: Un ejemplo de la Galicia Meridional, *Revista do Instituto de Estudos Viqueses*, Vigo.
- FERNÁNDEZ PINTOS, J (1993). "Asociaciones de Combinaciones Circulares a Equipos de Molienda Rupestre en el NO Peninsular". Actas do VI Coloquio Portense de Arqueología (1987).
- LUCERNA. *Cadernos de Arqueología do Centro de Estudos Humanísticos*, Segunda Serie, Vol. III, Porto: 75-93.
- GROBA GONZÁLEZ, X. (2004). "Patrimonio arqueolóxico asociado". En VV. AA.: O Folón (Coruxo) e as outras covas do sur de Vigo. Informe anexo ás solicitudes de catalogación dos recursos patrimoniais existentes entre os concellos de Vigo e Nigrán (Galicia): 27-52.
- GROBA GONZÁLEZ, X. (in press). "Relevancia prehistórica das covas graníticas no N-NE do Val Miñor". *I Congreso Galego de Espeleoloxía*. O Barco de Valdeorras 2006. Ed. Federación Galega de Espeleoloxía.
- MÉNDEZ QUINTAS, E. (2005). "Cavidades entre a Idade do Bronce e o Paleolítico". En VV.AA: *As Covas de Vincios. Comunidade de Montes en Man Común de Vincios*: 189-210.
- MÉNDEZ QUINTAS, E. (in press). "Contextualización das ocupacións prehistóricas nas cavidades de O Folón (Coruxo, Vigo)" *I Congreso Galego de Espeleoloxía*. O Barco de Valdeorras 2006. Ed. Federación Galega de Espeleoloxía.
- OLIVEIRA JORGE, V. and OLIVEIRA JORGE, S. (1990). "Satues-menhirs et stèles du Nord du Portugal, *Revista da Facultade de Letras da Universidade de Porto* 7: 299-325.
- RUIZ GALVEZ PRIEGO, M^a. (1979). "El depósito de Hio (Pontevedra) y el final de la Edad del Bronce en la fachada atlántica peninsular", *El Museo de Pontevedra*, XXXIII.
- SUÁREZ OTERO, X. (1997). "Del yacimien-to de A Cunchosa al Neolítico en Galicia", *O Neolítico Atlántico e as Orixes do Megalitismo*, Universidade de Santiago de Compostela: 485-506.
- VAQUEIRO RODRÍGUEZ, M. (2003). "Caracterización de cavidades de bloques graníticos y cuevas estruturais en Vigo-Tui (Galicia, España). Análisis morfo-estructurales del sistema del Folón. *Cadernos do Laboratorio Xeolóxico de Laxe*, nº 28, A Coruña: 213-230.
- VIDAL ROMANÍ J. R. and VAQUEIRO M. (2007). Types of granite cavities and associated speleothems: genesis and evolution. *Nature Conservation* 63, 127-132.

Karsts in sandstones and quartzites of Minas Gerais, Brazil

LUC WILLEMS,¹ LUC¹; JOËL RODET,² JOËL²; ANDRÉ POUCKET, ANDRÉ³;
SERGIO MELO,⁴ SERGIO⁴; RODET, MARIA JACQUELINE RODET⁵; PH.
COMPÈRE,⁶ PH.⁶; F. HATERT,⁷ F.⁷, and AUGUSTO S. AULER,⁸ AUGUSTO S.⁸

(1) Dr. Luc Willems, EuReKarst, Pétrologie sédimentaire, B20, University of Liège, Sart-Tilman, B-4000 Liège, Belgium.

(2) Dr. Joël Rodet, EuReKarst, UMR 6143 CNRS, Continental and Coastal Morphodynamics, Laboratory of Geology, University of Rouen, 76821 Mont Saint Aignan Cedex, France.

(3) Prof. André Pouclet EuReKarst, ISTO, Earth Sciences Institute, University of Orleans, France.

(4) Sergio Melo, CPMTC – Instituto de Geociências, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil.

(5) Dr. Maria Jacqueline Rodet, Museu de História Natural Jardim Botânico – MHNJB, Belo Horizonte, Brazil.

(6) Dr. Philippe Compère, Laboratory of Ultrastructural Morphology, Department of Sciences and Management of the Environment, allée de la Chimie, 3, University of Liège, B-4000 Liège 1, Belgium.

(7) Dr. Frédéric Hatert, Laboratory of Mineralogy, Dpt. Geology, B18 Minéralogie et cristallographie, bd du Rectorat, 17, University of Liège, B-4000 Liège 1, Belgium.

(8) Dr. Augusto Auler, Carste Consultores Associados. Rua Kleper, 385/04 – Sta. Lúcia/CEP: 30360-240/ Belo Horizonte MG, Brazil.

Corresponding author: Dr Luc Willems – LucWillems65@versateladsl.be, 2 Thier du Marnave, 4550 Villers-le-Temple, Belgium

Recibido: 1/11/2007

Revisado: 7/8/2008

Aceptado: 18/10/2008

Abstract

The state of Minas Gerais (Brazil) is characterized by significant karst regions, which develop in both sandstone and quartzite terrains and display complex suites of underground and surface forms. In the Espinhaço Ridge, Central Minas Gerais, several caves of up to a few hundred metres long, occur in the surroundings of the town of Diamantina. Some of these caves, such as Salitre actually consist of swallow-holes. Other horizontal caves are characterized by corrosion forms generated in the phreatic zone. In some places, such as in the Rio Preto area, these phreatic forms are overprinted by ceiling tubes, suggesting a polyphase karst evolution, prior