Revisiting Hornos de La Peña 100 years after

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Abstract:

The cave of Hornos de la Peña contained one of the most relevant stratigraphic sequences for the study of the Middle and Upper Paleolithic in the Cantabrian Region, northern Iberia, as well as an important group of Paleolithic rock art. The site was discovered in 1903 and excavated during 1909-1910. Those excavations did not take place in the main hall of the cave because it was already emptied for modern phosphate extraction. At that time, in the preserved deposits, the archaeological excavations revealed an interesting sequence with Mousterian, Early Upper Paleolithic, Solutrean and Magdalenian cultural remains. Since then, the site has received little attention owing to the difficulties of interpreting the sequence and the biased nature of the preserved collections. In 2016 and 2017 a limited area of the preserved section was excavated to document its archaeological sequence, obtain samples for dating and achieve some insights about the cultural attribution of the identified units and their correlation with Obermaier's sequence. The results show that there is a coarse correlation between both sequences. More interestingly, this work has revealed the good preservation and interest of the Mousterian occupation, the presence of Early Upper Paleolithic, the indefinite nature of the Solutrean and the existence of a Middle Magdalenian occupation. These results provide new insights about the human presence at the site and allow to incorporate it into the new debates about the Middle and Upper Paleolithic in the Cantabrian Region.

Key words: Paleolithic, Archaeological Sequence, Mousterian, Magdalenian, Early Upper Paleolithic.

1. Introduction.

The site of Hornos de la Peña (San Felices de Buelna, Cantabria, Spain) was first discovered by Alcalde del Rio in 1903. He published the first interpretation of the Paleolithic rock art in 1906, and shortly after, in 1911, presented a complete study of the cave engravings with H. Breuil and L. Sierra (Alcalde del Río, Breuil and Sierra, 1911). In parallel with the discovery and study of the rock art, the archaeological deposit was excavated by H. Obermaier during 1909-10. The results from this excavation were succinctly published in Breuil and Obermaier's book (1912). Since then, the site has remained almost forgotten, and only a few attempts to obtain new information have been carried out (Bernaldo de Quirós, 1982; Carrión, 2002). There are several major handicaps for the site such as the lack of definition on its archeological sequence, the bias created by the old excavation methods, the difficulties in attributing specific artefacts to the archeological units described by Obermaier (see for example the case of the engraved horse frontal- Tejero et al. 2008) and the absence of a reliable chronology for the human occupations (see Soto-Barreiro 2003).

Despite these handicaps the site must be considered of relevance firstly, because it contains an important rock-art assemblage (Alcalde del Río, Breuil and Sierra, 1911), including typical Pre-Magdalenian and Magdalenian depictions (Rivero and Garate 2013) and secondly, because Mousterian and Aurignacian occupations have been identified there which makes it an ideal location to investigate the Middle to Upper Paleolithic transition in the region. Besides, the Solutrean and Magdalenian occupations at the site are relevant to understand the Late Glacial Maximum (LGM) and Late Glacial occupations in the mountainous region of the upper part of the Besaya valley. Unfortunately, the site has suffered from severe alterations due to phosphate exploitation previous to Obermaier's excavation, its use as a shelter during the Spanish Civil War between 1936-1939 (Ontañón, 2009), and the civil works carried out at the site to close the cave and facilitate tourist visits in the 1950s. All these modern alterations and previous archaeological works left only a few unaltered stratigraphic sections available for the re-evaluation of its archaeological sequence.

In 2016 and 2017, in the framework of a reanalysis of the rock-art assemblage led by O. Rivero, one of the stratigraphic sections left by H. Obermaier and situated in the entrance hallway (just after the first hall of the cave) was cleaned, revealing a complex sequence comparable to the descriptions made by Obermaier. The results reveal a long sequence that covers most of the cultural stages of the Late Pleistocene in the region (Mousterian, Early Upper Paleolithic, Solutrean and Magdalenian), confirming the initial observations made by H. Obermaier.

In this paper, the preliminary results of this new research are presented. Their relevance, not only for the comprehension of the Paleolithic occupations at the site, but also its role played in the major debates about the Paleolithic in the Cantabrian Region are discussed.

2. Archaeological setting:

The cave of Hornos de la Peña is located in the Besaya basin, Cantabria, Northern Iberian Peninsula ca. 20 km from the current coastline (Figure 1). The River Besaya rises in the Campoo area, in the Cantabrian Cordillera, at 870 m.a.s.l. At this point, situated ca. 25 km from the cave, after crossing an altitude <850 m.a.s.l., it is possible to access the Ebro Valley. The cave itself is in the Aptian limestones of Reocín Fm., at 210 m.a.s.l, and 50 meters above the Barranco de las Tejas. This Barranco links Anieva Valley with the Buelna Valley, a rather flat area of 13 km² filled by Quaternary deposits. The Buelna Valley also connects with the Pas basin across the Collado de Trescampo (291 m.a.s.l) and the Trelampo stream that runs below the famous Monte Castillo.

[FIGURE 1]

Few archaeological sites have been identified in the middle part of the Besaya basin. One of the most remarkable is the almost destroyed Sovilla cave, which preserved some rock-art engravings and lithic and bone tools attributed to the late Magdalenian (González Sainz et al. 1994). Additionally, the cave of Gurugú II, which has not been excavated, has yielded a rich assemblage of Middle Paleolithic materials, including Levallois flakes, denticulates, etc. (Muñoz et al. 1988, pp. 241-242). Finally, there are some informations about a small cave situated close to Hornos de la Peña, named Cueva de los Hornucos, with a rich (sic.) Paleolithic site (Muñoz et al. 1988, pp. 115), and the possible Acheulean site of San Felices de Buelna, cited by H. Obermaier (1925, pp. 226). At Monte Castillo, located in the mid-part of the Pas valley, there are important sites such as Castillo, La Flecha, Chimeneas, Monedas and Pasiega, with sequences covering basically the Upper Pleistocene, starting from the Late Acheulean, and including Mousterian, Aurignacian, Gravettian, Solutrean and Magdalenian.Also, renowned examples of paleolithic rock artare found at Monte Castillo caves (Alcalde del Río, Breuil and Sierra, 1911; Cabrera Valdés, 1984; Ripoll Perelló, 1972; González Echegaray, 1974; Straus, 1975; Sánchez-Fernández and Bernaldo de Quirós, 2008; Wood et al., 2016; among others).

In 1903 when H. Alcalde del Río discovered the site, made a short description of the Paleolithic rock art (Alcalde del Río, 1906). In 1909 the first archeological excavation was accomplished with the patronage of the *Institut de Paléontologie Humaine*, under the direction of H. Obermaier and J. Bouyssonie. The second campaign during 1910 was directed by H. Obermaier and H. Alcalde del Río. Those excavations took place in the first gallery, immediately after the cave vestibule as this emptied before the discovery. It is presumed that the cave vestibule probably contained the most important archaeological deposits in the cave (Breuil and Obermaier, 1912, Obermaier, 1925). Those initial excavations defined the site stratigraphy still in use (Figure 2) (Table 3)

[FIGURE 2]

That stratigraphy was roughtly confirmed by the authorswho reviewed the site long after H. Obermaier's excavations,Since 1960's the Mousterian (Freeman, 1964, Carrión, 2002), Aurignacian and Gravettian (Bernaldo de Quirós, 1982; Ríos-Garaizar et al. 2013), Solutrean (Straus, 1983, with some doubts about the integrity of the level), Magdalenian (Utrilla, 1981), portable art collections (Corchón, 1986, Tejero et al., 2008, Rivero, 2010) and the faunal assemblages (Yravedra, 2010) have been revisited. During the 1980s, K. Butzer made an independent analysis of the stratigraphy in an uncertain place of the cave, proposing a division of seven units covering more than 2.5 m. In that division, the Magdalenian is limited to the upper part of the sequence (Unit 6, 10 cm), while the Solutrean (Unit 5, 80 cm), Aurignacian (Unit 4, 20-40 cm) and the Mousterian units (Units 3b, 5-55 cm, and 3a, 75 cm) covered most of the sequence (Butzer, 1981: 171).

Beside the stratigraphy, the chronology of the deposit has been also the subject of different controversies in the last decades. The radiocarbon results of four samples submitted by V. Cabrera and F. Bernaldo de Quirós to the British Museum were published in 1982 (Burleigh et al., 1982) and corrected a few years later (Table 1, Bowman et al., 1990). The exact provenance of those samples is unknown, but according to the results and their apparent order, they were attributed to the Magdalenian and Solutrean levels (Soto Barreiro, 2003, Burleigh et al., 1980: 284).

3. Materials and methods

In 2016, a section of Obermaier's excavation situated in the sector between the entrance chamber and the main passage within the cave was cleaned (Figure 3). This section was previously affected by the civil works achieved to facilitate the cave access in the 1950s. Due to the reduced extension of the unaltered preserved sections, and given the brechified nature of the first units identified in the section previous to the excavation, a methodology adapted to the irregular nature of the preserved section was adopted. The objective was to excavate a minimum surface of the exposed section, only to recover material and select samples for dating. It was expected to find some preserved sediments corresponding to the Mousterian-Aurignacian in the sediment bank at the base of the section, therefore those sediments were also excavated.

[FIGURE 3]

The archeo-stratigraphic units, defined by changes in the sediments, were excavated in extension without following the rigid limits of a grid system. All the archaeological remains bigger than 1 cm, and all the lithic remains identified during the excavation, were coordinated using a topographic total station, and situated in an artificial coordinate system. Small bone finds recovered from irregular areas of ca. 25 cm of diameter were grouped into 'general bone' bags, and a coordinate was given in the center of these irregular areas. The sediment recovered from these ca. 25 cm diameter irregular areas was also kept, and its spatial position was recorded with a single coordinate taken also in the center of the excavated area. Each sediment bag contains an average of three liters of sediment. In total 0.4 m^3 of sediment were excavated in a maximum area of 0.65 m^2. In 2017 the orientation and inclination of the elongated materials bigger than 2 cm were also recorded. During the excavation it was very difficult to distinguish between units 12 to 7, also because they were excavated in a very small surface. Some materials with coordinates coming from these units were assigned to particular levels after the excavation. The sediment was water sieved with a one mm mesh. Additionally, two micromorphology samples were obtained for optical microscopy study. Sample named m2 was obtained from Unit 11, while sample m1 covers the contact between Units 11 and 12, Other units were not sampled due to the abundance of clasts or their breccified condition. Samples from Units 12, 13 and 14 will be obtained at the end of 2019 field season.

A flowstone coming from the base of the sequence was dated in the Xi'an Jiaotong University (RPC) by U/Th following the methodology described in Cheng et al. (2013) (Table 2).The powder extraction was performed using tungsten carbide drill burrs (width = 0.5 mm) at 10,000 rpm following the lamination of the speleothem growth (100 mg sample). The sampling was done under a laminar flow cabin to avoid contamination and with clean drills (purified using HCl 0.6M and ethanol).

Four animal bones were selected from units 4, 5, 6 and 8 for dating. Collagen extraction and analysis for radiocarbon dating were undertaken at the Oxford Radiocarbon Accelerator Unit (ORAU). Collagen was obtained following the method detailed by Brock et al., 2010, which involves the demineralisation of the mineral component (and any exogenous carbonates) of drilled bone power using 0.5M HCL at 5°C overnight, before removal of organics and humic acid using 0.1M NaOH solution for 30 minutes at room temperate (RT), and a final wash in 0.5M HCL for 1 hour at RT. The collagen was gelatinised in a 0.001M HCL solution for 20 hours at 70°C. EZEE™ biological filters (45–90 µm) were used to remove smaller soluble components, before ultrafiltration using cleaned 30 kDa MWCO Vivaspin™ 15 ultrafilters. Combustion of the collagen using an elemental analyser (ANCA-GSL), linked to an isotope ratio-mass spectrometer (Sercon 20–20) produced Carbon and Nitrogen stable isotope data, and samples were dated using an Accelerator Mass Spectrometer following conversion of excess CO_2 into graphite using an iron catalyst (Bronk et al., 2004).

Traces of prehistoric activity in Hornos de la Peña Cave are not limited to the most external cave areas. In fact, during the early 1900s excavations, the authors mention the location of paleontological and archaeological remains in the inner cave rooms, specifically bear bones and lithic pieces (Alcalde del Río *et al*. 1911). The methodology for the study of the internal archaeological context has included the division of the cave space in sectors according to geomorphology, the detailed surface examination (working with portable microscopes Dino-lite® 10x-460x), the cataloging of different archaeological remains, their geolocation, their photographic documentation and the sampling of the superficial remains (Garate et al., 2015, Medina-Alcaide et al., 2018).

4. Results

During the 2016-2017's campaigns, the archaeological sequence excavated from bottom to top is shown in Figures 4 and 5. The sedimentological description of this new sequence is describe as follows.

[FIGURE 4]

[FIGURE 5]

4.1 Basal flowstone: It has an irregular surface with inclination towards the inner part of the cave. There is evidence that it was damaged by Breuil and Obermaier's excavation, as the latter mentions it in his field notes. This flowstone was dated by U/Th to the MIS7 (222,920 ± 10,090, JRG-11.17) (Table 2).

4.2 Unit 15: Yellow silty sediment that fills the irregular surface of the basal flowstone. Completely sterile.

4.3 Unit 14: Orange silty-clayey unit with signs of oxidation and manganese. It covers the irregular surface of the basal flowstone creating and is inclined towards the inner cave. It contains few limestone clasts, some limonite pebbles (<10 mm), fragments of flowstone and iron crust. It yielded few lithic and faunal remains.

4.3 Unit 13: 20-5 cm thick, light brown silty-clayey unit with eboulis at the top, abundant centimetric limestone clasts and flowstone fragments. It covers the basal flowstone and Unit 14. The surface of the unit was reached after cleaning the reworked sediments over it, and probably the upper part of the unit was excavated by H. Obermaier. In the upper part, the position of the materials is sub-horizontal and not oriented. It contained a black charcoal feature associated with small charcoal fragments, burnt bones and two burnt limestone clasts, probably corresponding to an altered hearth. Some small burrows (1-2 cm wide) may have altered the unit integrity. At the bottom of this unit, some lithic remains and bones had significant inclinations, probably due to the irregular surface of the underlying unit.

Lithic and faunal remains are abundant. The lithic assemblage is characterized by a similar proportion of quartzite/orthoquartzite (probably local) and flint (basically Monte Picota and Flysch varieties) (Table 4). The abundance of sandstone and the lack of flint were noted in the previous analysis of Obermaier's Mousterian assemblage (Carrión 2002). Probably some of the pieces classified in this research as quartzite are, in fact, quartzarenite or orthoquartzite (Prieto et al. 2018), which can easily be mistaken for sandstone. Also, the lack of flint pieces in Obermaier's collection can be explained as the result of a bias in the collection. In fact, the flint remains from Unit 13 are usually small.

The technological characteristics of Unit 13 assemblage (discoid technology, abundance of quartzite/orthoquartzite, relative abundance of side scrapers and pseudo-levallois points) suggest a Middle Paleolithic attribution (Figure 6) (Tables 5-6). The presence of bladelets and elongated chips, some of them belonging clearly to the Upper Paleolithic must also be noted. Furthermore, two of those bladelets exhibited retouching on the ventral surface and have been classified as atypical Dufour bladelets. The presence of such pieces can be explained by admixture caused either by burrowing or by incorrect cleaning of the reworked sediments that were deposited directly over Unit 13. On the other hand, the presence of bladelet production has been identified in sites such as El Castillo and Cueva Morín (Maillo Fernández, 2001, Pastoors and Tafelmaier, 2010; Sánchez-Fernández &Maillo Fernández, 2007), and more recently in El Cuco Level X (Rios-Garaizar, in press). Besides, some elongated chips or even bladelet-like blanks are regularly obtained when retouching Quina sidescrapers (Rios-Garaizar 2004).

A few antler fragments and a shaped bone fragment in this unit suggest some bone tool production and use. This kind of behavior has been identified in other Middle Paleolithic assemblages (Mozota, 2014; Vila and Roebroeks, 2014).

[FIGURE 6]

4.4 Units 12-7: Succession of fluvial levels oriented towards the inner cave. They show changes in coloration from pale yellow to brown, and in the proportion of millimetric gravel, which is very abundant in Unit 12, even forming a lag. These units are quite poor in objects, with few bones and lithic remains. One bone point fragment was recovered in Unit 12 (Figure 9: 1). Unit 8, situated at the top of the sequence was dated in 25,120 ± 19 BP (OxA-36546) (Table 3). This fluvial sequence was eroded creating an irregular surface, exposing partially all the units. Unit 7 was only recognized after the excavation. It is a brown-clayey deposit (10 cm thick) filling a hollow delimited by a limestone crest and the eroded surface of Units 8-12 in the southern excavated area (Figure 5).

The petrographic analysis of samples m1 (Figure 7) and m2 (Figure 8) confirms the macroscopic description. Grains of quartz and quartzarenite, opaque particles consisting on metallic minerals, flint, sparitic grains from speleothems and bone fragments are the main components in m1 thin-section. The largest fragments are bones, quartz arenite and sparitic grains usually longer than 1 mm. Bone fragments are frequently covered by a coating, whose groundmass is darker than the surrounding one. Nevertheless, the most abundant component is quartz that varies in the range of fine sand and medium silt but there is also a smaller matrix of fine or very fine silt whose quantity is difficult to estimate. Furthermore, in m1 is visible the color change between Units 11 and 12 caused by the different abundance of opaque particles inside these units. A higher quantity of oxide particles in Unit 11 provokes an increase in the degree of oxidation and the staining of the groundmass, turning it darker. The size of the opaque particles is similar in both units, even a little larger in Unit 12, but the abundance is significantly much higher in Unit 11 and for this reason Unit 12 looks lighter.

[FIGURE 7]

Microscopic analysis of m2 sample in Unit 11 confirms the features described above and emphasizes that quartz and quartzarenite grains, flint, abundant opaque particles, limestone clasts, voids, bone shards and occasionally charcoal fragments are the main components. The largest clasts are limestone fragments (up to 1.5 mm) and bone shards (up to 1.7 mm) usually covered by dark coatings. Bone particles, as well as in the m1 sample, usually show pore infills rich in quartz and clay. The infill groundmass is lighter than the surrounding one and has similar optical properties as in Unit 12. Quartz grains are the most abundant component and size varies in the range of fine sand and medium silt. Grains show a rough sphericity and subangular shape. The micromorphological structure is not clear but, in some areas, it is possible to discern a complex microstructure of a crumbly and granular mixture.

[FIGURE 8]

4.5 Unit 6: Thick (20 cm) sandy-clayey brown unit with fewer clasts. Like Unit 5, it is also inclined towards the exterior. The contact with Units 7-11 is irregular. After the excavation two sub-units were distinguished, 6a and 6b, the latter presents a darker coloration. Unit 6 is also affected by burrowing. Lithic and faunal assemblages are not very abundant and not diagnostic. Among lithic materials, an increase in flakes and the use of local raw materials (quartzite and ophite) has been identified (Table 4). Retouched tools have been made on flint, with two splintered pieces, a denticulate and a combined borer-endscraper piece (Table 6). A distal fragment of a pointed tool and an ivory pendant have also been recovered. The ivory ornament imitates an atrophic red deer canine (Figure 9: 2). The piece has technical traces of shaping and a bidirectional perforation made by indirect percussion. The use of ivory and the shape of the pendant relates this object with similar pieces recovered from the Aurignacian levels at Gatzarria (Saenz de Buruaga, 1989), and also with another imitation of a red deer atrophic canine, in this occasion made from soap stone, in El Pendo Level VII, also Aurignacian (Barandiarán, 1973, fig. 70: 10-11). This level has been dated in 22,470 ± 140 (OxA-36545) (Table 3), and given the absence of diagnostic material, it cannot be clearly related with the Early Solutrean or Late Gravettian.

4.6 Unit 5: Thick colluvial deposit inclined towards the exterior. The matrix is formed by abundant decimetric angular limestone and sandstone clasts in chaotic distribution mixed with an organic matrix similar to Unit 4. The unit is topped by breccified limestone blocks that separate it from Unit 4. It yielded abundant charcoal and land snails. Lithic and faunal remains appeared in a chaotic position. Lithic assemblage (N=153) is formed by flint (basically Flysch and Treviño varieties), quartzite and rock crystal artifacts (Table 4). Most of the recovered remains are chips (N= 101), bladelets and flakes (Table 5). There are two bifacial re-sharpening flakes, but not a single foliate. Retouched tools are scarce, four backed bladelets and a notched flake (Table 6). The inventory of artifacts is completed by a meso-distal fragment of an antler point with a circular cross-section. It preserves several incisions that could have served for hafting in the area close to the proximal fracture. It also displays five notches on the distal end of the point (Figure 9: 3). Besides, in this unit another two antler fragments interpreted as technical waste have been identified. This unit has been dated in 13,315 ± 60 BP (OxA-36544) (Table 3), but given its reworked nature, it is difficult to propose a clear cultural attribution.

[FIGURE 9]

[FIGURE 10]

4.7 Unit 4: Black colored clayey-silty organic matrix with few clasts (7-10 cm). It is slightly carbonated. This unit has yielded relatively abundant, given the excavated extension, charcoal, faunal and lithic remains in normal position. The lithic remains comprise numerous bladelets, including a Dufour bladelet and a backed bladelet, a truncation and a sidescraper (Tables 5-6). The majority of the identified raw material is flint, and the identified varieties are Monte Picota, Flysch, Treviño and Urbasa (Table 4). This unit has been dated in 13,790 ± 60 BP (OxA-36543) (Table 3), which corresponds with a Middle Magdalenian chronology in the region.

4.8 Unit 3: Thick flowstone (6 cm.) Archaeologically sterile.

4.9 Unit 2: Breccified conglomerate of angular limestone clasts without sedimentary matrix (12 cm). It contains charcoal fragments, bones and a few non-diagnostic lithic remains. The cultural attribution of this unit remains undefined, but its position on the top of the sequence, above the Magdalenian, suggests a Late Pleistocene or initial Holocene chronology.

4.10 Unit 1: Thick flowstone (9 cm) with some floating charcoal fragments at the base and some captured centrimetric clasts. Archaeologically sterile.

4.11 Inner Archaeological context: The majority of the remains recovered are scattered pieces of charcoal left by torches and also a fireplace in a secondary position. Different species of plants including juniper wood, oak and legume have been identified. There are also a few ocher fragments and some lithic tools, including a single pressure blade core, which would correspond to post-Paleolithic visits to the cave. The identification of some imprints of fingers and objects in the the clay floor, along with fingerprints in the soft part of some walls, also evidence past human transit into the cave. Additionally, several scattered cave bear remains have been recovered from the cave surface.

5. Discussion

The fieldwork achieved during 2016 and 2017 in Hornos de la Peña Cave has allowed clarifying some relevant archaeological issues about this almost forgotten site. The sequence proposed by Obermaier, with a succession of Mousterian, Aurignacian, Solutrean and Magdalenian occupations, contrasts slightly with the reviewed sequence after cleaning Obermaier’s excavation section. However, a rough correlation between both sequences can be proposed. From the bottom to the top in the new excavated sequence,Units 14 and 13 probably correspond to Level III (Mousterian) in Obermaier’s excavation. Units 12 to 5 might correspond to Level II (Solutreo-Aurignacian), Units 12 to 7 to the base of level II, defined as ‘Aurignacian’ (*sensu lato*)and Units 5 and 6 to the Solutrean. Unit 4 corresponds to Level I (Magdalenian) and Units 1-3 with the ‘Eboulis moderne’ (Table 7).

[FIGURE 11]

This correlation between the initial and modern excavations serves to clarify some important aspects about the interpretation of the archaeological sequence at Hornos de la Peña. Level I, classified by Obermaier as Magdalenian, corresponds to the current Unit 4, dated during this research to the Middle Magdalenian. It is clear the position of the unit over a blockage and below a flowstone, with a characteristic black color, and its integrity suggest that it was relatively well-identified and isolated by Obermaier, and thus, materials attributed to Level I can be confidently correlated to current Unit 4.

Level II is far more problematic. Although it was excavated by Obermaier as a whole unit, he recognized two separate sedimentary units: the upper one corresponding to the Solutrean and the lower one to the ‘Aurignacian’. As proposed here, in fact, Level II is formed by eight different sedimentary units dating from the Magdalenian to the Gravettian. It is interesting to note that Obermaier mentions only a light brown-yellow sediment, but current sediment in Unit 5 is almost black. It is quite difficult to understand how Obermaier overlooked it. One possible explanation can be found in the very nature of Unit 5 that is a colluvial deposit, mixing probably Magdalenian and Solutrean materials, and it might have been quite limited in extension and thus, barely excavated by H. Obermaier. By accepting the latter, then Level II would be strictly related to Units 12 to 6. This would be coherent with the description of Level II made by Obermaier as it matches the characteristics of these units. According to this interpretation, Unit 6 (and 7?) would correspond to the ‘Solutrean’, and Units 12 to 8 to the ‘Aurignacian’. The date from Unit 6b situates the formation of this unit at the beginning of the regional Solutrean (22,470 ± 140 BP, OxA-36545) (Table 3), but serves as a *post quem* date for the Solutrean occupations. Having said that, the dates obtained in the 1980s from Obermaier’s materials (Straus, 1992) could easily correspond to these Solutrean occupations. Unfortunately, Unit 6 yielded few materials and not a single typical Solutrean tool.

On the one hand, the ivory bead that simulates an atrophic red deer canine, suggests an older chronology. At Cueva de Chufin, in a Solutrean level, a identical bead simulating an atrophic red deer canine, abandoned during its fabrication process, was found (Álvarez-Fernández, 2006, p. 264). Similar atrophic beads imitating red deer canines, but made with lithic materials have also been found in Magdalenian levels at Tito Bustillo and Praile Aitz (Álvarez-Fernández, 2006), suggesting that these imitations were made throughout the Upper Paleolithic. Following this argumentation, Units 12 to 7 would correspond to Obermaier’s ‘Aurignacian’. The date obtained from a red deer phalanx from Unit 8 situates the top of this sequence in the Gravettian, with a date very close to the dates obtained for Unit 12 at Cueva del Castillo (Bernaldo de Quirós et al., 2015), so there is place for the Aurignacian occupations in the units below it. Unfortunately, these units have been excavated in a very limited extension and only a few non-diagnostic materials have been recovered so far (Table 4). We should note the presence of a single Noailles burin, among the reworked materials, maybe linked with this possible Gravettian occupation. On the other hand, analysis of Obermaier’s lithic assemblage suggests a Late Aurignacian attribution for the base of Level II, which has any diagnostic Gravettian tool (Rios-Garaizar et al. 2013). However, our work opens the window to a possible Gravettian occupation at the site given the date of Unit 8 and the presence of some diagnostic materials on the excavation back-dirt. Nevertheless, further analyses are needed to confirm or refuse this possibility.

Unit 13 has been excavated over a wider area. Its composition suggests a Mousterian attribution with a few intrusive Upper Paleolithic materials. Several of its characteristics, as the use of a discoid cordal system, relates it with Late Mousterian levels, for example El Castillo 20e (Sánchez-Fernández and Bernaldo de Quirós, 2007), Morín 11 (Maillo Fernández, 2005), Amalda VII (Rios-Garaizar 2010) and Esquilleu (Baena et al. 2012). Additionally, its stratigraphic position, immediately below the Initial Upper Paleolithic units, reinforces its attribution despite yet the lack of direct dating. More than 600 lithic artefacts, almost 200 excluding small chips and inform fragments have been recovered. This contrasts with the 286 remains preserved from Obermaier's excavations (Carrión, 2002), suggesting the biased nature of Obermaier's collection.Other aspects of interest are the presence of flint from far away, surely from the eastern region (Flysch, Treviño and Urbasa), but probably also from the western one. These catchment areas of raw material indicates that Neanderthal groups had wide networks covering the whole Cantabrian Region.

Unit 14 yielded some faunal materials suggesting a mostly paleontological unit, with almost no human presence. The chronology of this unit must be further investigated although it has been already established that it is probably no older than 222 kyrs according to the date obtained from the underlying flowstone.

In summary, from the obtained results several discussion points can be drawn. First, the observations made by Obermaier remain valid, despite the resolution problems of a early 1900s excavation. The major occupation periods identified by Obermaier, although with a more accurate resolution during the new excavations, remain. Thus, the cave was occupied during the Mousterian, Initial Upper Paleolithic (Aurignacian *sensu lato*), Solutrean and Magdalenian. Moreover, considering that the excavation made by Obermaier was achieved in a "marginal" area, because the main hall was already voided, the site might have probably contained a major Paleolithic sequence. Indeed, despite the very limited extension of the recent excavations, hundreds of lithic and faunal remains have been recovered, including also several bone tools and one ivory ornament. This evidences, somehow, the irreparable loss caused by the phosphate diggers in the cave entrance.

Consequently, the materials recovered by Obermaier, currently curated at the Museo Arqueológico Nacional and the Museo de Prehistoria y Arqueología de Cantabria, likely represent just a marginal part of the materials deposited in the cave during the successive Paleolithic occupations. Furthermore, these old collections are strongly biased by the excavation methods, the highly likely inter-unit admixture and the curation problems during the last century. These biases greatly limit the value of these collections for answering current issues in Cantabrian Paleolithic studies.

The current excavation project was forced to excavate the remnants left by the phosphate diggers, Obermaier and the road-menders. Only small patches of preserved sediments remained and, therefore, we endedmaking"archaeology of the archaeology". However, this high-resolution minimal intervention has been proved to be valid for solving questions such as the cave sequence definition, providing a chronological context and offering information about cultural and behavioral aspects. Currently, several projects in the Cantabrian Region are operating in a simlar way (i.e.; Lezetxiki, Axlor, Bolinkoba, Santimamiñe, Atxurra, Castillo, Morín and El Pendo) (Arrizabalaga, 2006; González Urquijo et al., 2006; Iriarte Chiapusso and Arrizabalaga, 2015; Montes and Sanguino, 2001) where renewed information concerning the cultural sequences has been recovered, even challenging previous assumptions. For example, the existence of pre-Magdalenian occupations in Santimamiñe (López Quintana et al., 2011) or the presence of Azilian in Atxurra (Rios-Garaizar et al., 2019).

Hornos de la Peña Cave has, in addition, an interest for the knowledge of prehistoric activities in the subterranean landscape. The work in the cave to ease tourist visits affected the conservation of the inner archaeological context. Today, the best-preserved paleofloors are located in a narrow strip following the cave's perimeter limit. However, remains related with the prehistoric lighting systems (a small ensemble of scattered charcoal associated with human transit carrying wood torches) and also, a hearth placed in a secondary position have been recently documented. Anthracological analysis determined that juniper, oak and legume wood were used for these activities. Besides other prehistoric activities have been identified including the finger imprints and objects in the clayfloor, along with fingerings on the clayed walls, lithic tools and ocher.

These evidences are probably related to the extensive chronological lapses of transit of the cavity, which covers the entire Prehistory. Already H. Alcalde del Río, H. Breuil and L Sierra (1911) pointed out the presence of mousterian industry in the floor along the cavity transit, and local testimony also indicates the finding of Neolithic polished axes still in the 70s.

All these data provide a more complete information about the site, showing that the parietal cave art ensemble, composed by 108 graphic units currently documented, was complemented by extensive human occupation located in the cave entrance throughout the Middle and Upper Paleolithic.

Today, the recent excavations, as well as the analysis of the cave art and the internal archaeological context, provide relevant chronological data to assess the human occupation at the site. Thus, an ancient phase during the Upper Paleolithic (probably Gravettian) corresponds to the parietal art located not only in the cave entrance, but also in the interior (Rivero and Garate, 2013). This phase is complemented by the much better-known Magdalenian phase, with numerous graphic examples inside the cave, which can probably be ascribed to the Middle Magdalenian and the Upper Magdalenian.

6. Conclusion

The re-excavation of a section left by Obermaier in Hornos de la Peña Cave has served to re-evaluate the site stratigraphy and compare it with the sequence previously described, which has been referred in the last hundred years. The new results reveal that, in general, the sequence described by Obermaier was correct, but it is far more complex, including at least 15 stratigraphic units ranging from the Middle Pleistocene to the Holocene. Although the ongoing work has failed to identify clearly the position of the Solutrean and the Aurignacian, it has revealed the relevance of the Magdalenian, the presence of the Gravettian and the richness of the Mousterian. This work also highlights the necessity and the value of reviewing sequences, that were excavated long ago, and remarks the importance of applying update methodologies to relevant sites for including them in the current Paleolithic research debate.

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Tables:

Table 1: Previous radiocarbon dates achieved at Hornos de la Peña Cave

Numero de muestra	**Burleigh et al., 1982**	**Bowman et al., 1990**
1881	18,230 ± 510	18,450 ± 520
1882	19,950 ± 300	20,180 ± 310
1883	20,700 ± 350	20,930 ± 370
1884	24,120 ± 460	24,340 ± 470

Table 2: ^{230}Th dating results. The error is 2σ error. U decay constants: l238 = 1.55125x10-10 (Jaffey et al., 1971) and l234 = 2.82206x10-6 (Cheng et al., 2013). Th decay constant: l230 = 9.1705x10-6 (Cheng et al., 2013). *d234U = ([234U/238U] activity – 1) x1000. ** d234Uinitial was calculated based on 230Th age (T), i.e., d234Uinitial = d234Umeasured x el234xT. Corrected 230Th ages assume the initial 230Th/232Th atomic ratio of 4.4 ±2.2 x10-6. Those are the values for a material at secular equilibrium, with the bulk earth 232Th/238U value of 3.8. The errors are arbitrarily assumed to be 50%. ***B.P. stands for “Before Present” where the “Present” is defined as the year 1950 A.D.

Table 3. Radiocarbon dating. Ultrafiltration protocol was used for all the samples.

Number	**Unit**	**Cultural Attribution**	**Species**	**Anatomical element**	**Taphonomic modifications**	**OxA**	**Date (BP)**	**Error**	**d13C (‰ VPDB)**	**d15N (‰ AIR)**	**%C**	**C:N**	**% collagen yield**
HP.16.04.016	4	Middle Magdalenian	Large sized-mammal	Long bone diaphysis	Fresh fracture	OxA-36543	13790	60	-20.84	3.46	44	3.188	5.5
HP.16.05.020	5	Middle Magdalenian	*Capra pyrenaica*	Phalanx I	-	OxA-36544	13315	60	-23.15	-1.17	43.8	3.187	10.4
HP.16.06.016	6	Late Gravettian/ Early Solutrean	Large sized-mammal	Long bone diaphysis	Fresh fracture	OxA-36545	22470	140	-22.72	2.34	44.3	3.186	7.9
HP.16.08.na	8	Gravettian	*Cervus elaphus*	Phalanx I	Fresh fracture	OxA-36546	25120	190	-20.64	2.12	43.4	3.199	4.4

Table 4. Raw material classification of the material found during the 2016-2017 excavations

	Units								
	1-3	**4**	**5**	**6**	**7**	**13**	**14b**	**Reworked**	**Total**
Sandstone	0	0	2	0	2	5	0	2	**11**
Limestone	1	1	0	3	34	7	0	2	**48**
Rock Crystal	3	3	12	1	5	8		1	**33**
Quartz	1	2	1	3	7	33		9	**56**
Quartzite/Orthoquartzite	3	4	9	7	19	270	0	38	**350**
Mudstone					1	2			**3**
Ophite	1	0	4	10	30	15	0	4	**64**
Lidite/Radiolarite			1					1	**2**
Flint	9	23	124	20	41	264	2	82	**565**
Undetermined						2		2	**4**
Total	**18**	**33**	**153**	**44**	**139**	**606**	**2**	**141**	**1136**
Surface m^2	0.25	0.20	0.20	0.20	0.20	0.60	0.15	na	0.65
Depth m	0.23	0.23	0.25	0.32	0.20	0.25	0.03	na	1.59
Volume m^3	0.057	0.046	0.05	0.064	0.04	0.15	0.004	na	0.41
Density (artefacts/m^3)	315.8	717.4	3060	687.5	3475	4040	500		2770.7

Table 5. Technological classification of the lithic material found during the 2016-2017 excavations

	Units								
	1-3	**4**	**5**	**6**	**7-12**	**13**	**14b**	**Reworked**	**Total**
Cores	1	1	1		3	6	0	4	**16**
Cortical flakes	1	1	6	9	20	41	0	21	**99**
Flakes	1	5	10	7	41	66	0	48	**178**
Cortical blade			1		1	1	0	3	**6**
Blade byproducts	2	1	3	1	2	0	0	6	**15**
Blades	1		1	1	1	2	0	2	**8**

Bladelets/Elongated chips	1	10	14	3	12	35	0	19	**94**
Resharpening flakes			3	2	1	27	0	4	**37**
Bifacial shaping flakes			2			0	0	0	**2**
Burin spalls	2	1	2		1	2	0	2	**10**
Splints	3	4	7	3	6	9	0	8	**40**
Inform fragments		1	2		5	14	0	7	**29**
Chips	6	9	101	18	46	403	2	17	**602**
Total	**18**	**33**	**153**	**44**	**139**	**606**	**2**	**141**	**1136**

Table 6. Typology of the lithic material found during the 2016-2017 excavations

				Units				
	1-3	**4**	**5**	**6**	**7**	**13**	**Reworked**	**Total**
Pseudo-levallois point						5	4	**9**
Sidescraper		1			2	4	6	**13**
Borer/Bec						2	7	**9**
Raclette							1	**1**
Notch			2		1	1	1	**5**
Denticulate				1	1	6	5	**13**
Retouched flakes					1	5	5	**11**
Endscraper							1	**1**
Atypical endscraper						2		**2**
Nucleiform endscraper							1	**1**
Endscraper/Burin						1		**1**
Endscraper/Borer				1				**1**
Burin							1	**1**
Noailles burin							1	**1**
Truncation		1			1			**2**
Retouched blade							1	**1**
Splintered piece	1		1	2	1			**5**
Backed bladelet		1	3			2		**6**
Denticulated bladelet							1	**1**
Notched bladelet							1	**1**
Dufour bladelet		1			1		1	**3**
Atypical Dufour bladelet						2		**2**
Diverse	1				9	3	13	**26**
Total	**2**	**4**	**6**	**4**	**17**	**33**	**50**	**116**

750

Table 7: Correlation between Obermaier's excavation levels and 2016-1017 excavations archeo-stratigraphic units.

2016-1017 excavations	**Obermaier's excavation**
Units 1-3	Eboulis moderne'.
Unit 4	Level I (Magdalenian)
Units 5 to 12	Level II (Solutreo-Aurignacian)

Units 14 and 13	Level III (Mousterian)

Figure Captions:

Figure 1: Location of Paleolithic sites mentioned along the text. Base map made with QGIS 2.18.17 using Jarvis A., H.I. Reuter, A. Nelson, E. Guevara, 2008, Hole-filled seamless SRTM data V4, International Centre for Tropical Agriculture (CIAT), available from http://srtm.csi.cgiar.org. Bathymetry and Europe Map made with data from Natural Earth.

Figure 2: Frontal section of the H. Obermaier' excavation in Hornos de la Peña (Inventory Number 57/37/6/1/1/1/1/7, Archive MAN).

Figure 3: Zoomed plan of the cave entrance with the position of the excavations achieved during 2016-2017 (in red), and the nearby paleolithic rock-art panels (in blue).

Figure 4: Frontal and sagital view of the stratigraphy. The stars mark the position of the samples used for radiocarbon dating.

Figure 5: Detail of the stratigraphical sequence between Units 5 and 13 excavated during 2016-2017.

Figure 6. Lithic artifacts from Unit 13. 1-3 Quartzite side-scrapers; 4-6 Discoid flakes (Pseudolevallois points), 4 and 5 in Quartzite, 6 in lutite; 7-8 Denticulates on quartzite.

Figure 7: a-b: Example of a speleothem fragment (npp: parallel nichols, nx: cross nichols). In nx large fibrous sparitic crystals are visible; c-d: Contact between Units 11 and 12 (npp). The abundance of opaque metallic particles is higher in Unit 11 (upper part of the image) provoking a more intense oxidation and a darker staining of the ground amass. In Unit 12 (lower part of the image) opaque particles are common and similar in size, but deposited in a lower proportion; e-d General view of the components (npp and nx); g: Bone fragment covered by a darker coating that includes quartz crystals (npp); h: Bone fragment with pore infill (npp).

Figure 8: a-b General view of the main components (npp: parallel nichols, nx: cross nichols): bones, opaque particles, quartz, voids and ground mass. A fine or very fine silty matrix of quartz crystals is visible; c: Bone fragment with a fine grained coating which consists of quartz grains and clay (npp); d: Bone fragments; e-f Bone infill that mainly consists of quartz cristals, opaque particles, dark brown rock fragment and a groundmass which is clearer than the one that is surrounding the bone (npp and nx). The groundmass inside the bone shows similar optical properties than in Unit 12; g-h General view of the components: bone fragments in yellow pale (npp), subangular quartz crystals, grain of quartzarenite, flint and plane voids.

Figure 9: 1: Bone point from Unit 12; 2: Ivory pearl from Unit 6; 3: Antler point from Unit 5.

Figure 10: 1: Flint bladelet core from reworked sediments; 2: Retouched blade found in the Inner context; 3-5: Splintered pieces (3: Unit 5, 4: Inner Context; 5: Unit 6); 6-7 notches (6: Unit 6, 7: Unit 5); 8. Atypical Noailles Burin from reworked sediments; 9-11 Dufour bladelets (9: reworked; 10: Unit 4; 11: Unit 7). 12-13. Backed bladelts (12: Unit 5, 13: Unit 4); 14: Notched bladelet from Unit 5; 15: Borer from Unit 6; 16: Side-scraper Unit 7.

Figure 11: Correlation between the current sequence (on the left) and Obermaier's one. Both images are on shown with the same scale.