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BACK TO THE POINT: NEW DATINGS FOR LA PEÑA DE CANDAMO CAVE ART (ASTURIAS)

De vuelta al punto de partida: nuevas dataciones del arte de la cueva de La Peña de Candamo (Asturias)

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Abstract: La Peña de Candamo was discovered by the scientific community in 1914, being one of the first known caves in the Cantabrian region, and declared a UNESCO World Heritage site in 2008. The only monographic study of its parietal art was led and published by E. Hernández Pacheco in 1919, showing exceptional complexity and graphic density. In 2007, a new research project was launched to update all the information related to the cave's parietal art from a multidisciplinary perspective. Within this context, and starting from the radiocarbon tests made by J. Fortea in the late 20th century, tests have been conducted at the Gif-sur-Yvette to date a series of black dots located on the 'Engraving's Wall'. The fact that the results are different to those published to date leads to the discussion as to which to accept based on the followed methodologies and protocols. Likewise, the implications of these results in the decorating of the cave and their place within the artistic production of the region during the Upper Palaeolithic period are also analysed.
Key words: Rock art. Upper Palaeolithic. Chronology. Radiocarbon. Cantabrian region.

Resumen: La cueva de La Peña de Candamo fue descubierta en 1914 para la comunidad científica, siendo una de las primeras conocidas en la región cantábrica y declarada Patrimonio de la Humanidad por la UNESCO en 2008. El único estudio monográfico de su arte parietal fue dirigido y publicado por E. Hernández Pacheco en 1919, evidenciando una complejidad y densidad gráfica excepcional. Desde 2007 se desarrolla un nuevo proyecto de investigación, que tiene como finalidad actualizar toda la información referente al arte parietal de la cavidad desde una perspectiva pluridisciplinar. En este contexto, y partiendo de las dataciones radiocarbónicas efectuadas por J. Fortea a finales del s. XX, se ha procedido a datar una serie de puntos negros del 'Muro de los Grabados' en el laboratorio de Gif-sur-Yvette. Los resultados obtenidos difieren de los publicados hasta el momento, por lo que se discute la pertinencia de aceptar unos u otros en función de los protocolos y metodologías seguidas. Se analiza igualmente la implicación de estos resultados en el proceso decorativo de la cavidad y su encaje dentro de la producción artística de la región durante el Paleolítico superior.
Palabras clave: Arte parietal. Paleolítico Superior. Cronología. Radiocarbono. Región cantábrica.

1. Introduction[1]

The cave is located near the top of La Peña de Candamo –226 metres–, in a rough and uneven landscape, approximately 4 kilometres away from the locality of San Román de Candamo (Asturias, N of Spain). This place, situated on the right riverbank, is an excellent nature observation area for the Nalón valley, approximately 12 km in a straight line away from the coast.

Up the river Nalón there is plenty of Palaeolithic evidence, all of it located on the right riverbank and on the river's lower basin (Fig. 1). Alongside La Peña cave, Covacho de Candamo yielded vestiges from the Early Solutrean period (Hernández Pacheco, 1919), as well as from the Upper Solutrean and Early Magdalenian periods. To the SE of La Peña cave is La Paloma cave (Hoyos *et al.*, 1980), a deposit with abundant Magdalenian and Azilian works of art. Upriver is another significant Magdalenian deposit containing works of art, Sofoxó cave (Corchón and Hoyos, 1973). Finally, at the very mouth of the river is Las Mestas cave, which preserves external cave art engravings and a wealth of archaeological sequences (González Morales, 1975). At about 10 kilometres upstream, there are even more Palaeolithic settlements, the most prominent being Las Caldas, La Viña, La Lluera I and Entrefoces. As regards cave art, the volume is equally significant: there are thirteen rock shelters with external cave art, and two cavities with interior engravings and paintings.

The cave of La Peña (Candamo, Asturias), discovered in the early 20th century (Hernández Pacheco, 1919), contains one of the most significant sets of Palaeolithic cave art of the Cantabrian region. Unfortunately, the cavity has undergone diverse processes of alteration due to its use as a shelter during the Spanish Civil War and to the aggressive preparation process it has undergone to host tourists.

In 2008 the cave was declared a UNESCO World Heritage site. That same year the integral study of its cave art was retaken under the direction of S. Corchón and D. Garate (HAR2010-17916 project). The thorough exploration of the cavity has allowed for the discovery of a significant amount of undocumented designs (Corchón and Garate, 2010). New three-dimensional documentation techniques based on laser-scanning and photogrammetry were also applied (Corchón *et al.*, 2011), as well as non-destructive analyses of the paintings using RAMAN and ERX (Olivares *et al.*, 2013).

One of the main goals of the project was to date the different decoration phases undergone by the cave. For this purpose, samples of black paint for AMS-C-14 analysis, and calcite samples for analysis through U/Th series were taken and processed at the Laboratoire des Sciences du Climat et l'Environnement, Gif-sur-Yvette. The results obtained are presented in this article[2].

2. Background

The introduction of accelerator mass spectrometry radiocarbon –AMS– allows for the radiocarbon dating of very small samples, and was thus the starting point of direct dating of parietal Palaeolithic art in the late 20th century. This possibility led to the development of an ambitious dating project focused on the expressions Palaeolithic art found in several caves in Aturias, La Peña Candamo among them. The late J. Fortea undertook a first radiocarbon dating programme in 1993, sampling parietal black pigments from several figures for AMS ^{14}C measurements in the LSCE –Gif-sur-Yvette, France– and after in 2001 for Geochron (Fortea, 2000/2001, 2002) (Fig. 2).

However, the panel showed various signs of important natural and anthropogenic damage (Fig. 3), which resulted in conflicting data from the dating

[1] The authors would like to acknowledge the assistance of the Culture and Tourism Department of the Government of Asturias, the Council of Grullos and the Centre of Interpretation of the San Román de Candamo cave, and also Georges Sauvet for his advice and input.

[2] The research has been conducted as part of the project: *Aplicación de nuevas tecnologías al estudio del Arte paleolítico y su contexto social en el valle del Nalón (Asturias, España): 20000-12000 BP.* Ref. HAR2010-17916. Funded by the Ministry of Economy and Competitiveness (Spain). PI M.ª S. Corchón Rodríguez.

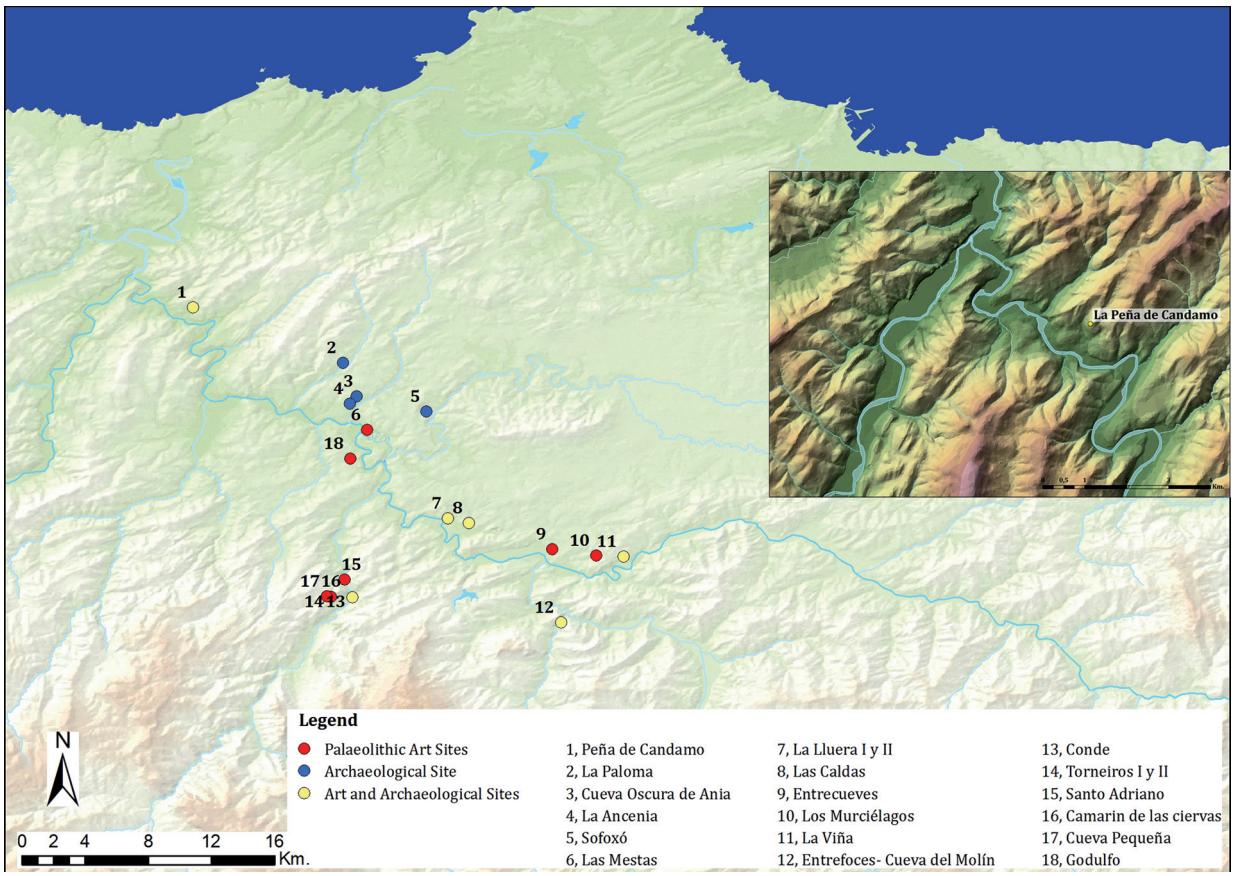


FIG. 1. *La Peña cave in the Nalón valley, Northern Spain.*

processes, leading to an ongoing wide-ranging discussion (Pettitt and Bahn, 2003; Valladas and Clottes, 2003; Alcolea and Balbín, 2007; Pettit and Pike, 2007; Combier and Jouve, 2012).

The data of this former dating analysis are given in Fig. 2. The datable carbon weight obtained after the chemical and thermal pre-treatment of the sample ranges between *c*. 0.3 and 1.54 mg (Valladas *et al.*, 2001; Valladas, 2003). The $\delta^{13}C$ values measured during the SMA analysis have an error of ± 3‰. They are taking into account the isotopic fractionations during the sample's processing –chemical treatment, oxidation in CO_2, graphitisation, AMS measurement– and are used to make the correction of fractionation on the ^{14}C activity (Stuiver and Pollach, 1977). They are quite different from the real isotopic composition of the organic sample and must not be used to speculate on carbon origin[3]. The ^{14}C results provided a wide chronological span that covered an extended time sequence in the panel's decoration, encompassing the whole Upper Palaeolithic period. Nevertheless, most of the dating analysis provided anomalous results that should be interpreted with caution. This is the case of deer no. 9 –CAN13– dated at 9150 ± 140 BP, a date that seems clearly underestimated and that can be explained by the small amount –only 260µg– of the dated carbon.

Likewise, some other ^{14}C results posed problems due to the large divergence between the pretreated

[3] Fontugne, M.; Shao, Q.; Frank, N.; Thi, F.; Guidon, N. and Boeda, E.: "Cross dating (Th/U-^{14}C) of calcite covering prehistoric paintings at Serra da Capivara National Park, Piaui, Brazil", *Radiocarbon*, in press.

Ref. figure	Ref. Lab	Ref. analysis	$\delta^{13}C$	datable C (mg)	C-14 Age (year BP)	Error
Bison (n.º 29)	CAN8	GifA 98171	-28.6	0.4	22590	280
Deer (n.º 2)	CAN9	GifA 98172	-21.7	0.69	13870	120
Auroch (n.º 11)	CAN10	GifA 96137	-25.7	0.97	10810	100
Auroch (n.º 11)	*FH (CAN10)*	*GifA 96150*	*-24.9*	*0.37*	*17180*	*310*
Bison (n.º 27)	CAN11	GifA 98195	-25	0.72	12260	100
Dots	CAN12	GifA 96138	-21.7	1.54	32310	690
Dots	CAN12	GifA 96139	-18.1	0.46	33910	840
Hind (n.° 9)	CAN13	GifA 98194	-15	0.26	9150	140
Dots	CAN14	GifA 98193	-8.6	0.33	16470	280
Dots	CAN3	GX-27841-AMS	-27.2	0.28	15160	90
Dots	CAN4	GX-27842-AMS	-27	0.29	15870	90

FIG. 2. *^{14}C results obtained on black parietal samples collected in 1993 and 2001 by Prof. Fortea.*

charcoal and the 'humic fraction' obtained during the basic treatment –aurochs no. 11 dated at 10810 ± 100, and humic fraction dated at 17180 ± 310 BP–.

In parallel, the result of the dating conducted by the LSCE of the black spots on yellow aurochs no. 15 and 16 was 33910 ± 840 and 32310 ± 690 BP respectively on a same sample recovered in 1993 from several black spots on each aurochs, which was subsequently mixed. In 2001, a new sample was taken from the presumed same spots. Their dating was conducted at Geochron without mixing those on one and the other aurochs, and they yielded much later dates: 15870 ± 90 and 15160 ± 90 BP (Fortea, 2000-2001).

In 1997, another sampling was made from the same previously dated spots to analyse the pigment through a SEM –scanning electron microscope– and determine its nature. The analysis was carried out by M. Hoyos and the results were published in parallel with the datings (Fortea, 2000-2001).

The results obtained from the analyses present several inconsistencies. Stated briefly, the dating results obtained by Geochron are consistent with each other, presenting $\delta^{13}C$ values, which are not the result of the mixture of two different sets of spots, even though the dating tests were based on a very small sample of matter –only 280µg and 290µg–. In the case of the analyses performed by the LSCE, despite the issue of the mixture of different spots, the dates obtained are equally coherent, although they are based on a single sample. The delta 13 values do not provide accurate data; however, the dating tests were performed on larger samples, and one of them presented unusual resistance to strong –acidic and basic– chemical and thermal pre-treatment that is unusual in the case of wood and bone charcoal that could be a result of the presence of graphite. Nevertheless, the SEM analysis carried out by M. Hoyos showed the presence of bone charcoal, and the absence of lignite and antracite, in the right sample (Fortea, 2000-2001: 195).

The data show that there is inconsistency among all the analyses. Fortea proposed several hypotheses such an ages variability but it remains impossible to favour one of them: the lateness of the dates obtained at Geochron due to recent contamination; the earlier dates presented by Gif-sur-Yvette due to contamination by bacteria, according to M. Hoyos; and, finally, the possibility that the spots studied were different or painted in two phases, which would explain the presence of bone charcoal and charcoal in the samples (Fortea, 2000-2001: 13).

Scientists immediately reported on the problems posed by the results of ^{14}C dating from the Peña de Candamo cave. Some of them stressed the possibility of contamination by microorganisms that could cause the analysis to yield earlier dates, and the need to establish a strict protocol for the identification of possible anomalies (Pettitt and Bahn, 2003). On the other hand, there is a theory that spots sampled and dated at each laboratory were not the same ones and that, therefore, both results would be valid, or that some of them were affected by contamination (Valladas and Clottes, 2003). Subsequent chronological assessments of

Fig. 3. *Main panel of the cave (P. Saura). The yellow aurochs and the black dots can be seen on the right.*

Palaeolithic art also mention these results, questioning whether the different laboratories follow homogeneous sample processing procedures (Alcolea and Balbín, 2007), or raising the issue of the inconsistency of the values resulting from the delta 13 tests (Combier and Jouvé, 2012).

The impossibility of solving the chronological issue related to the spots, in the light of the foregoing dates, led to a new physical-sample drawing with dating purposes within the framework of ongoing research.

3. Methodology

Our current project, whose purpose is a thorough study of the cavity, provides an opportunity to retake the chronological study of the Palaeolithic decoration of the cave. The first step of the work was to look carefully at the great panel where J. Fortea sampled, to find possible explanations for the previous ^{14}C results scattering. This examination revealed that four of the five dated animal representations were severely damaged and almost totally erased –engraved and painted deer, horse, bison, aurochs and hind–. This situation obliged J. Fortea to sample in several distant –till 2 meters– parts of each painting. Such situation prevented any reliable direct dating and would explain the first results scattering and incoherence. All the black dots located in front of and behind the yellow aurochs were also already severely damaged and most of them presented cracks and scratch marks. However, there was still enough pigment on some of them to attempt ^{14}C dating again, and therefore we sampled the dots that were best preserved (Fig. 4).

In December 2011, four black dots superimposed to the two yellow aurochs already studied were sampled for the analysis of their chemical composition –C2RMF, Paris– and for AMS ^{14}C measurements. Unfortunately, microscope and infrared analyses failed to identify the nature of the organic compound present in the black pigment. Previous *in situ* RAMAN analyses of the dots had detected amorphous carbon, and the absence of Raman signatures at 960 cm^{-1} –stretching vibration of PO_4^{3-}– excluded the presence of ivory or bone charcoal obtained when heating materials composed by hydroxyapatite (*Olivares et al.*, 2013). Around the same time several speleothems were sampled using the U/Th method.

The samples taken for ^{14}C (4) and U/Th (2) are the following (Fig. 5):

CAN-25: Two adjacent dots from the far right side of the row of black dots superimposed on engraved aurochs no. 13.

CAN-26: Last dot of the far right side of the row of black dots on the back of yellow aurochs no. 15.

CAN-27: First dot on the left of the vertical column of spots on yellow aurochs no. 16.

CAN-32: Third dot of the lowest row of dots on yellow aurochs no. 15.

CAN-30: Calcite layer that originally covered the yellow aurochs and black dots completely and that was partially removed in the early 20th century.

CAN-31: Fragment from the calcite ledge that runs across the right side of the panel –below the paintings–. This sample was taken at the level of yellow aurochs no. 16.

Each pigment sample used for ^{14}C measurements –CAN 25-27, 32– was scraped off with a scalpel blade –HV– from a limited area –a few square mm– of the four black dots (Fig. 5). They weight was *c.* 10 mg –CAN 32–, 16 mg –CAN 25– and 35 mg –CAN 26 and 27– respectively. Microscope examination revealed that they were made of black material mixed with numerous grains of wall calcite. Wood structures were only observed in sample CAN 27, which, like CAN 25, was collected from above and below the smallest yellow aurochs located on the left and situated in front of the biggest one. These two samples were within sight and reach of visitors to the cavity. On the other hand, samples 26 and 32, collected from the back of the biggest aurochs, were hidden in a narrow recess of the wall and were not visible from the room thus, they were less exposed to human deterioration than the other two samples which are located in an area severely damaged by the cave visitors and the XXth century restorations.

The sample pre-processing method used to date these black dots has been described elsewhere (Valladas *et al.*, 2001; Valladas, 2003). The intensity of the treatment varies in accordance with the sample's size. The smallest samples

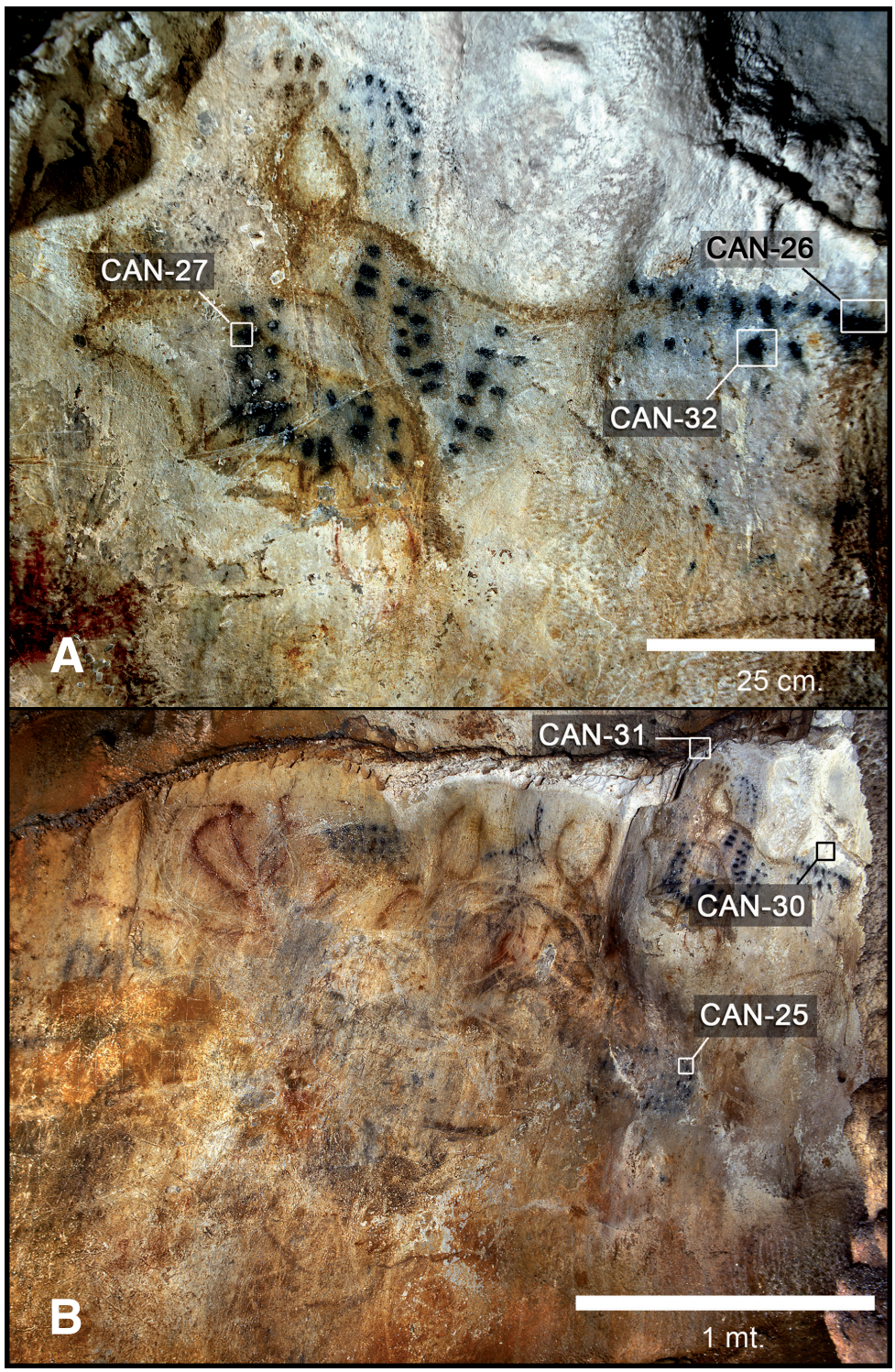


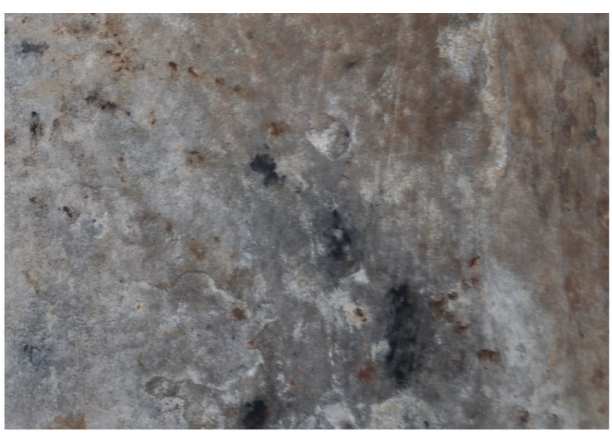
FIG. 4. *Dots sampled for C-14 and calcite for U/Th dating (© P. Saura). A: samples* CAN-26, CAN-27 *and* CAN-32. *B: samples* CAN-25, CAN-30 *and* CAN-31.

CAN-27

CAN-32

CAN-26

CAN-31



CAN-25

CAN-30

FIG. 5. *Details of black points sampled for C-14 and calcite sampled for U/Th.*

–CAN 25 and 32– were only etched with hydrochloric acid –0,5N– to dissolve the carbonate grains from the limestone wall or ground water. On the other hand, CAN 26 and 27 were subjected to the succession of 'acid (0,5N) –base (diluted sodium hydroxide)– acid' treatments which first dissolve the carbonates, then the humic acids arising from the transformation of organic matter and, finally, bacteria and other living microorganisms. The remains of this process were oxidized to carbon dioxide, then reduced to graphite and compressed into pellets for the accelerator mass spectrometer Artemis –LMC-14, CEN de Saclay, France–. The purification process removed more than 90% of the original mass, resulting in pellets containing 0,06 –CAN27–, 0,14 –CAN 25–, 0,21 –CAN 32– and 0,30 mg –CAN 26– of carbon respectively.

Between 100 and 200 mg of powdered calcite were used for the U/Th analysis of CAN 30 and CAN 31 –U/Th separation and purification was performed following a process described in Douville *et al.*, 2010–. The U and Th isotopic composition was analysed on the Neptune Plus Plasma multi-collector inductively coupled plasma mass spectrometer –MC-ICP-MS– of the *Laboratoire des Sciences du Climat* (France). For the mass fractionation correction, we used the standard/sample bracketing method –the procedure for MC-ICP-MS analysis is detailed in Fontugne *et al.*, 2014–.

$^{238}U/^{230}Th$, $^{234}U/^{238}U$ –expressed as $\delta^{234}U$–, and $^{230}Th/^{232}Th$ activity ratios are reported in Fig. 6. Ages were derived from isotopic U and Th ratios through iterative calculation, based on the equations of Broecker *et al.* (1963).

4. Results

The four ^{14}C dates obtained range from 18020 ± 230 –CAN 27– to 22620 ± 260 BP –CAN 32–. The calendar intervals obtained by calibrating these dates are 25660-24140 –CAN 25–, 27770-26260 –CAN 26–, 22260-20580 –CAN 27– and 28050-26330 yr cal BP –CAN 32– respectively –ages calibrated with CALIB©, Stuiver and Reimer, 2010–. Samples CAN 26 and 32 fall into the same time interval –26200-28000 yr cal BP–, which is not so different from the calibrated age obtained for CAN 25. This last sample appears to be slightly more recent than the other two, a fact that might be explained as due to the possible presence of recent extraneous carbon contamination in CAN 25, which was not eliminated during the chemical pre-treatment, hence the underestimation of its age.

The same remark can be made for CAN 27, which is even more recent. Note that these last two samples were more exposed to organic contamination, which is not the case of CAN 26 and 32. Therefore, at this stage it seems reasonable to

Sample	Location	Reference	δ ^{13}C	Date 14C BP	Calibration BP 68.2%	Calibration BP 95.4%
CAN-26	Black dot on aurochs No. 15	GifA 11449/SacA26191	-24.8	22400 ± 210	27581-26731	27769-26260
CAN-27	Black dot on aurochs No. 16	GifA 11450/SacA 26192	-20.6	18020 ± 230	21958-21274	22259-20580
CAN-25	Black dot on aurochs No. 13	GifA 12091/SacA 28705	-37.8	20790 ± 270	25100-24435	25655-24144
CAN-32	Black dot on aurochs No. 15	GifA 12092/SacA28706	-34	22620 ± 260	27739-26933	28046-26330

FIG. 6. *New C-14 datings for the paintings in La Peña cave. The δ C-13 values were measured during the SMA analysis with an error of ± 3‰. Therefore they give not information on the origin of the dated carbon.*

accept the results obtained for these two samples, since they are synchronous. Likewise, they are within the range of the age obtained 22600 ± 280 BP, GifA98171; 28,026-26,304yr cal BP, for the bison drawing located 3 meters above the ground (Fortea, 2000-2001).

Therefore, dates are grouped into three time periods set within a frame of approximately four millennia. Considering these results, the dots on the far side of the panel were probably traced in an advanced stage of the Gravettian technocomplex, possibly with later additions if we take into account the most recent dates obtained on CAN 25 and CAN 27. It should also be noted that, in the same cave, although in a different part called Batiscias gallery, charcoal remains and a bone found above the ground have yielded three dates corresponding to the Late Solutrean period[4], highly present in the Nalón valley.

On the other hand, U/Th dating of a whitish calcite layer has also been carried out. This layer covers part of yellow aurochs and black dots on the far left side of the panel, and was partially removed in the early 20th century. The result obtained, 12400 ± 400 after being corrected for the detritic thorium is 11400 ± 900, which corresponds to the late Upper Palaeolithic. This age corresponds to a growth episode of calcite in relation with climatic warming at the end of the glacial period. It represents *a terminus ante quem* for the painting and it is not contradictory with direct ^{14}C dating of black pigments. The basal layer of calcite, located below the paintings and engravings, is beyond the method's dating limits –over 500 ky–.

5. Discussion

The new dates obtained for the black dots in La Peña de Candamo cave provide insight into the controversy generated by the former dates: as opposed to previous results obtained from two samples dated at 33000 BP and another two dated around 15400 BP, we now have two samples coherently dated at *circa* 22500 BP, and two more recent ones dated around 20800 and 18000 BP (Fig. 8).

For the current study we have chosen to sample the dots individually. Thus, the two coherent dates obtained from the row of dots on the back of yellow aurochs no. 15 come from two different dots and are two individualized samples, which contribute to certify the validity of the dates. In addition, each sample was dated using a different pre-treatment method. Since contamination would be removed to a greater or lesser extent by the different methods, the agreement of the dates seems a reasonable indication that contamination is not an issue for these samples. The other two results for the black dot from the series on yellow aurochs no. 16 and that on engraved aurochs no. 13 give more recent dates that do not overlap with the rest of dates obtained from the cave, which hampers the certification of their validity.

On the other hand, the results obtained for these dots on aurochs no. 15 are also completely coherent as regards black bison no. 29, dated at 22620 ± 260 BP –GifA98171–. This datum is particularly interesting, since it corresponds to a figure situated 3 meters above the ground that has remained less altered by the severe deterioration and contamination suffered by the main panel.

Sample Name	Labcode	^{238}U (µg/g)	$\delta^{234}Um$	($^{230}Th/^{232}Th$)	($^{230}Th/^{238}U$)	age (kyr)	$\delta^{234}U(0)$	age (kyr)*
Can 30	2616	0,405 ± 0,006	2,09 ± 1,00	17 ± 0,5	0,107 ± 0,003	12,4 ± 0,4	2,2 ± 1,0	11,4 ± 0,9
Can 31	2911	0,244 ± 0,001	2,68 ± 2,65	250 ± 0,7	1,020 ± 0,003	Out of limits		

FIG. 7. *Isotopic ratios, U content and U/Th ages. * Age corrected for detritical fraction using 230/232 = 1.5 ± 50%.*

[4] Corchón, M. S.; Garate, D.; Rivero, O.; Valladas, H.; Pons-Branchu, E.; Murelaga, X.; Ortega, P. and Hernando, C.: "The Batiscias gallery: U-series datings for a new decorated area in the Palaeolithic cave of Candamo (Asturies, Northern Spain)", in preparation.

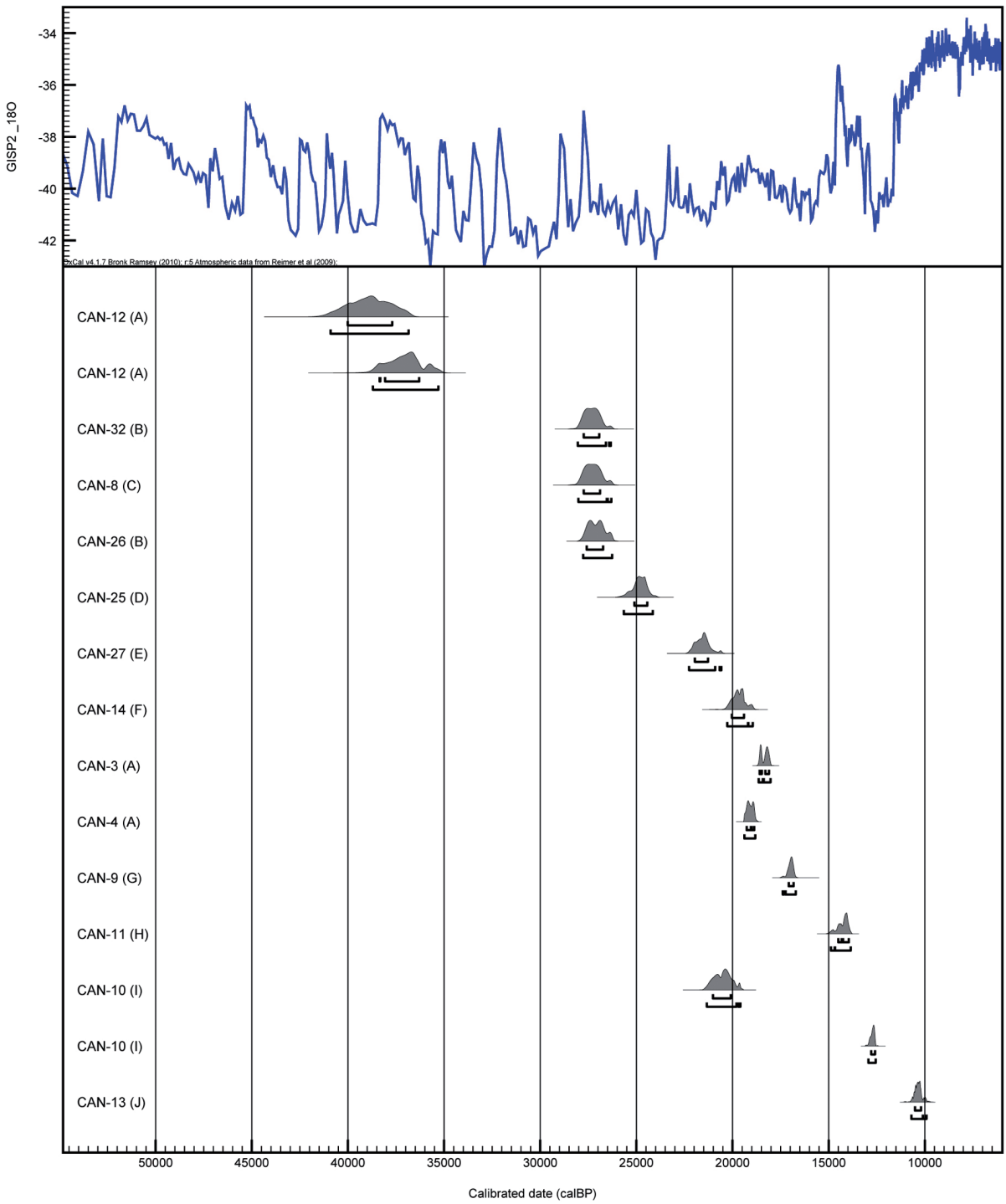


FIG. 8. *Calibrated ^{14}C datings from the cave. Dates published by J. Fortea (A. dots on aurochs no. 15 and no. 16; C. bison no. 29; F. black spots near hind no. 9; G. deer no. 2; H. bison no. 27; I. aurochs no. 11; J. hind no. 9). Current dates (B. dot on aurochs no. 15; D. two black dots on aurochs no. 13; E. black dot on aurochs no. 16).*

6. Conclusions

The cave of La Peña has suffered several alterations since its discovery, which renders radiocarbon dating of the parietal representations very difficult due to possible contamination. The disagreement between the dates obtained at Gif-sur-Yvette –*c*. 32000 ^{14}C BP– and Geochron –*c*. 15000 ^{14}C BP– cannot be clarified. We have mentioned certain difficulties during the sampling process, such as the mixing of different pigments, the incoherence between MEB analysis and δ^{13}C, the anomalous reaction of some samples, or their sampling by people outside the research laboratories, thus altering the optimal conditions for obtaining good results.

This leads to the assumption that the most reliable results are those obtained from the most recent datings. They range from 18000 to 22600 BP. The most recent dates were obtained from a very small amount of carbon, although the possibility of slight contamination of these samples –CAN 25 and 27– by recent carbon, based on the position of the spots on the main panel, cannot be ruled out. The most reliable dates obtained are those –CAN 26 and 32– obtained from the black spots located on the back of the biggest aurochs, hidden in a narrow recess of the wall. They fall within the same time period as the age previously obtained from black bison –22600 ± 0,280 BP; 28026-26304 yr cal BP– located three meters above the ground.

These new dates for the black dots allow us to attempt a chronological arrangement of the decoration process of the main panel of La Peña de Candamo cave. They suggest a stage of decoration with black drawings around 22500 BP made up by a series of black dots and, at least, one bison. Parietal stratigraphy suggests that the yellow aurochs and deer are previous to the aforementioned stage and, likewise, that some of the red paintings also representing aurochs and deer would be even older. In any event, we lack the necessary data to establish the chronological distance between the aforementioned stages that, in any case, would correspond to the cavity's first decoration sequence, which corresponds to Gravettian or Aurignacian period. On the other hand, the series of engravings would belong to a later period than that corresponding to the aforementioned stages, since all the cases of overlapping consist of superimposition to the black dots and stylistically correspond to the models dated in the early and mid-stages of the Cantabrian Magdalenian Period (González Sainz, 2005a).

Finally, the results provided represent an important contribution to the knowledge of early graphic activity in the Cantabrian Region during the Upper Palaeolithic period (Fig. 9). Made up mainly of red figures and engravings, there are very few direct or indirect dates established for the mentioned period.

Except for the indirect data, 36500 ± 750 BP (Ly: 6390), regarding the Aurignacian occupation rate of the rock shelter of La Viña (Fortea, 2000-2001), most of the dates available are concentrated around the late Gravettian cultural stage. This is the case of a black line in Calero II, dated at 25185 ± 450 BP –AA 20046–, a modest set consisting mainly of rows of black and red dots (Muñoz Fernández and Morlote, 2000). And it is also the case of El Conde, where the engravings were already covered by a Gravettian layer dated at 23930 ± 180 BP –GX-25787-AMS– and 21920 ± 150 BP –GX-257889-AMS– (Fortea, 2000-2001); of the fireplaces at 22340 ± 510/480 BP –GrN 18574– and 22580 ± 100 BP and of a black handprint at 18200 ± 70 BP discovered in Fuente del Salín associated to negative and positive handprints and coupled lines (Moure and González Morales, 1992); and of the sunken bone at 23760 ± 110 BP –Beta-303671– associated to the red paintings of Askondo, with horses, a negative handprint, and coupled lines –Garate and Rios, 2012–. Direct dating of the horse of Castillo at 19140 BP –GifA98154– is less accurate, since this horse has also been dated as belonging to 16980 ± 180 BP –GifA98153– (Moure and González Sainz, 2000).

In short, there is a considerable wealth of ^{14}C dates that are concentrated around 22500 BP –27000 cal BP– and that, in addition, include very different styles. On the one hand, there are sets of external engravings such as El Conde, which appear to be no earlier than 29000 BP if we take into account the distance from the archaeological layers (Fernández Rey *et al.*, 2005). On the other hand, there are sets of red paintings where the dot technique can be observed, such as Askondo and

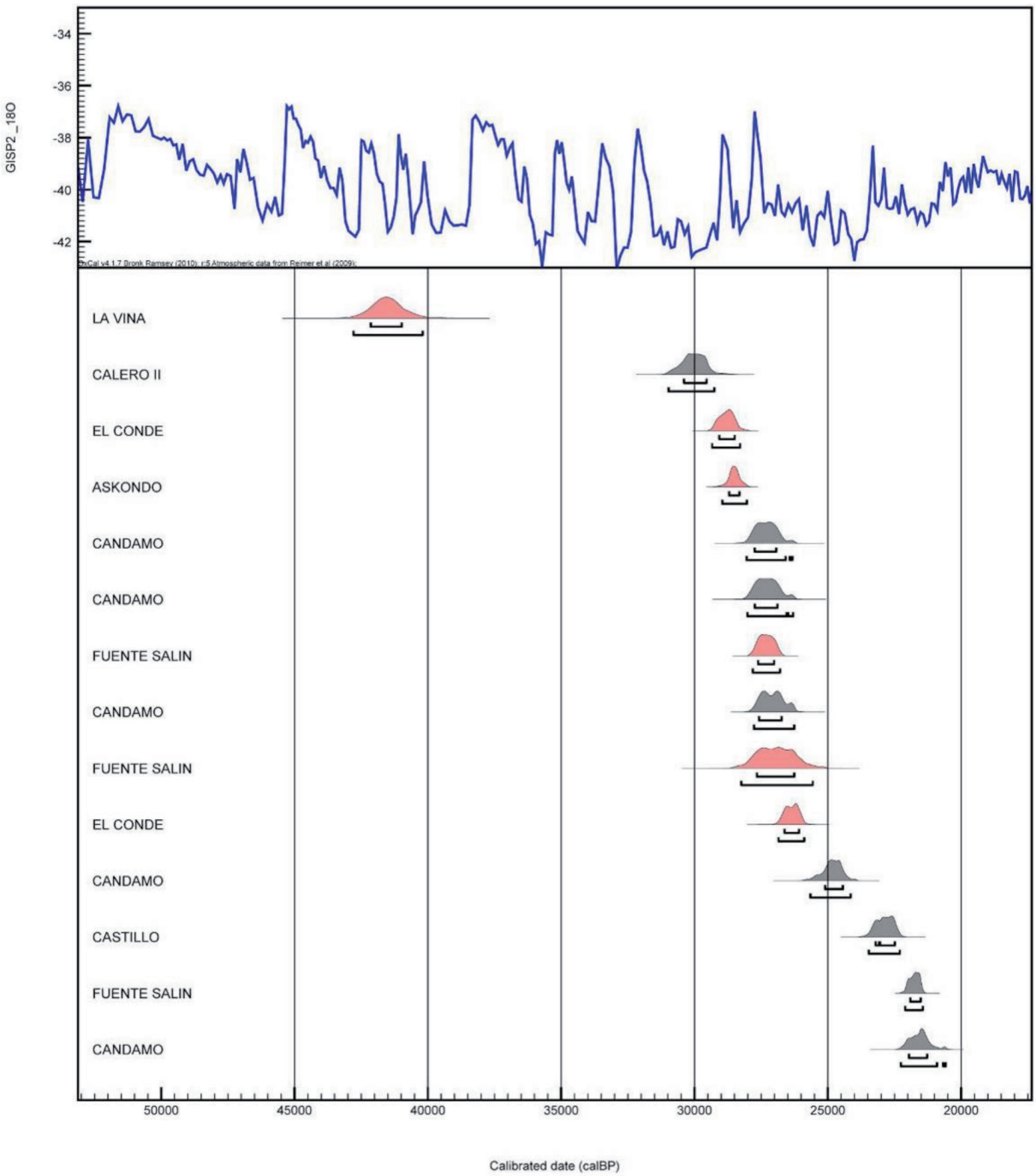


FIG. 9. *Calibrated ^{14}C datings of Pre-Magdalenian cave art from the Cantabrian coast. Direct dates appear in grey (Calero II: black line, Peña Candamo: black dot, Peña Candamo: black bison, Peña Candamo: black dot, Peña Candamo: black dot, Castillo: black horse, Fuente del Salín: black hand, Peña Candamo: black dot). Indirect dates appear in red (La Viña: archaeological layer, El Conde: archaeological layer, Askondo: bone sunk in the wall, Fuente del Salín: fireplace).*

Fuente del Salín, which are more handprint-centred, and Altamira, where recent dates for the stratigraphic sequence, around 22000 BP, have been related to the red paintings of horses with marginal dotting, handprints and coupled lines (Lasheras, 2010). And, last of all are the groups of black figures and rows of dots such as those in Calero II or Peña Candamo itself. This implies that cave art in the Cantabrian Gravettian cultural stage is characterized by a wide range of styles, techniques and topics that, in certain cases, could have even developed simultaneously.

The data obtained from the Thermoluminescence and U/Th dating of crusts, although not so accurate, support the aforementioned idea of a parietal artistic "meeting point". The former technique –TL– was employed in several cavities of the Asón river basin. In Venta Laperra, two crusts overlapping external engravings provide an *ante quem circa* 25700 date with a margin of error of around 2500 years (Arias *et al.*, 1998-1999). In the case of Pondra, a red spotted stag presents crusts both overlapping it and under it, and dating places the figure within a time frame ranging between 32946 ± 3440 and 26972 ± 2747 years, while the dating of an engraved horse places it as previous to 22595 ± 2338 and the date obtained for a red line is previous to 35750 ± 4730 (González Sainz and San Miguel, 2001). Other results, especially those obtained from La Garma cave, are either archaeologically incoherent, or they do not provide enough relevant information due to the recentness of the dated formations. U/Th dating was first employed in La Garma, obtaining an *ante quem* date of around 27000 years for the red goats of area IV and of 33000 ± 2000 for a red stain associated to an orange negative handprint (González Sainz, 2005b)[5]. Another series of dates has been recently published based on very small calcite samples (Pike *et al.*, 2012), that considerably push back the expected dates and even provide *ante quem* results relating to the Aurignacian period for a red anthropomorphic figure in Tito Bustillo, a red symbol in Altamira, a red disc and a handprint in El Castillo. But the validity of these results are difficult to evaluate without a further comparison with other laboratories and ^{14}C dates (Clottes, 2012)[6].

Consequently, the dating processes carried out in the Peña Candamo cave provide an alternative answer that is coherent with the most accurate results among those obtained from previous sampling carried out by J. Fortea. In addition, the new dates obtained allow us to establish a sequence in the decoration of the cavity's main panel. On the other hand, these new dates enrich the regional context of the Cantabrian Region, which displays a wealth of styles and techniques that, according to the different radiometric dating systems, are concentrated around the Gravettian period.

Nevertheless, maybe the main lesson that can be drawn from the 'affaire Candamo' is awareness of ^{14}C dating problems in cases of much deteriorated caves, such as the case here analysed, and the need, still to be accomplished, to establish a strict dating protocol to be followed by all laboratories.

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