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Land of the ground sloths: Recent research at Cueva Chica, Ultima Esperanza, Chile

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ABSTRACT

Ultima Esperanza is a region known worldwide, where some of the best preserved remains of late Pleistocene ground sloths were found. Cueva del Milodón produced a large piece of *Mylodon darwini* skin in 1895 as well as extensive deposits of ground sloth dung that were sampled several times during the 20th Century. These deposits are dated within 13,500 and 10,200 radiocarbon years. At Cueva del Medio, not far from Cueva del Milodón, evidence of human exploitation of extinct fauna was discovered. Also, at nearby Dos Herraduras rockshelter, several ground sloth elements were found within a tephra layer regionally dated ca. 12,600 BP. This paper presents new data derived from stratigraphic work at Cueva Chica, a site located near Cueva del Milodón, which in spite of its obvious potential was not studied previously. The work revealed more than one layer of Late Pleistocene fauna, where remains of ground sloth, a large felid and other species were preserved. Radiocarbon studies produced some of the oldest evidence for the presence of *Mylodon* sp. in the region. The integration of these results within the context of the paleoecology of Late Pleistocene Ultima Esperanza is presented.

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1. Introduction

The Late Pleistocene interaction between humans and extinct faunas in the Cerro Benitez area, Ultima Esperanza, Chile (Fig. 1) is an issue debated for more than 100 years (Hauthal, 1899; Lehmann-Nitsche, 1899; Emperaire and Laming, 1954; Saxon, 1979). Most of this discussion was based on materials recovered at two sites, Cueva del Milodón and Cueva del Medio. Recently, a project was initiated focused on this subject that includes the study of previous archaeological and paleontological collections obtained at Cerro Benitez (Fig. 2), but also the intensive exploration of the area, new excavations at the classic sites and excavations of new sites. Cueva Chica was one of the neglected sites of the area, a condition that immediately led to its selection for excavation. In spite of its name (Cueva Chica means "Small Cave"), it is a site of considerable dimensions. The main chamber is ca. 38 × 17 m, and possess two large dark chambers in the back reaching a total length of ca. 70 m (Feruglio, 1950: 214; Fig. 3). A site of this size was attractive for human installation and the presence of dark chambers offers the opportunity to discuss the carnivore use of internal habitats.

The goal of this paper is to introduce the sequence of bones recovered at both the main and one of the dark chambers of Cueva Chica. A preliminary discussion of the implications of these findings will also be presented.

2. Antecedents

The area has been world-renowned since Herman Eberhardt discovered a large well preserved piece of *Mylodon darwini* skin in Cueva del Mylodon in 1895 (Martinic, 1996). This site was first excavated by E. Nordensjköld in March 1899 and by R. Hauthal in April of the same year (Hauthal, 1899; Roth, 1899, 1904; Lehmann-Nitsche, 1899, 1904; Moreno, 1899; Smith-Woodward, 1899, 1900; Nordenskjöld, 1996 [1990]). Later work by other researchers like Bird in 1937 (Bird, 1988), the French Mission in 1953 (Emperaire and Laming, 1954), Saxon in 1976 (Saxon, 1976, 1979), and Borrero in 1989 and 2000 (Borrero et al., 1988, 1991; Borrero and Martin, 2012) confirmed the importance of the locality. Different studies of the bones, hair and skin of ground sloths, as well as the

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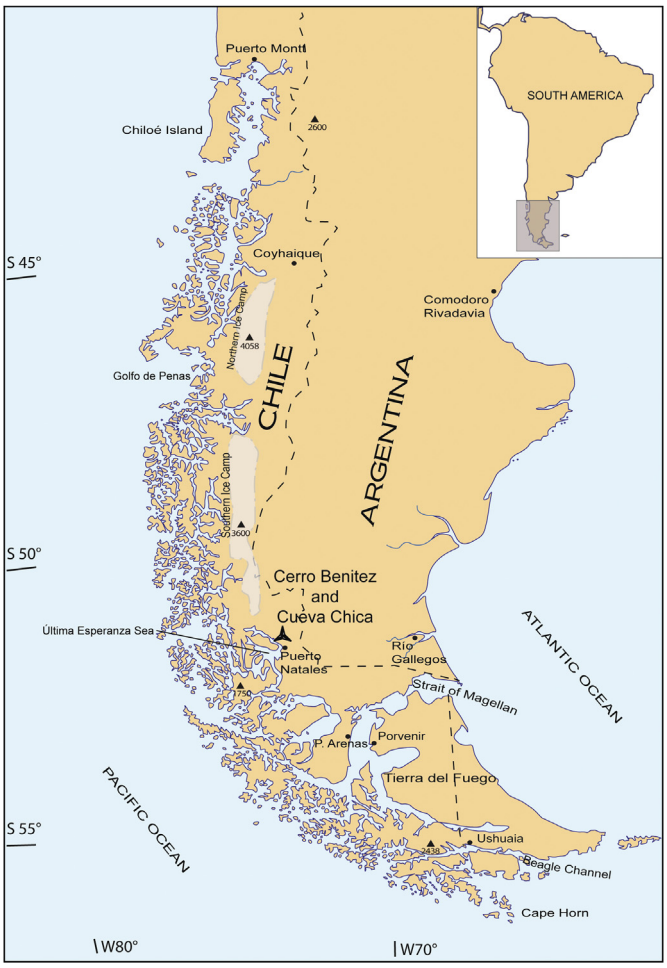


Fig. 1. Location map.

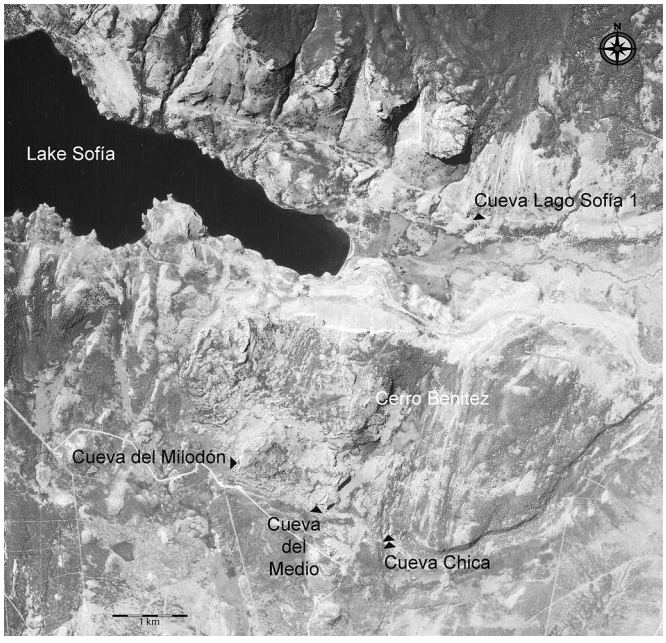


Fig. 2. Aerial photograph of the Cerro Benitez región.

sediments of the caves, were published (Salmi, 1955; Ringuelet, 1957; Moore, 1978; Markgraf, 1985; Simonetti and Rau, 1989; Heusser et al., 1992-1993; Nami, 1995; Esteban, 1996; Favier Dubois and Borrero, 1997; Alberdi and Prieto, 2000; Mol et al., 2003; Barnett et al., 2005; Clack et al., 2012; among others). It was only near the end of the 20th Century that systematic research was focused at other sites in Cerro Benitez and the nearby area (Nami, 1987; Borrero et al., 1988; Prieto, 1991). Cueva del Medio, the most important archaeological site in the locality, was poorly known until the 1980s. Excavations at that site started at the end of the 19th Century and produced interesting archaeological and paleontological evidence (Hauthal, 1899; Roth, 1899, 1904; Lehmann-Nitsche, 1899, 1904; Nordenskjöld, 1996 [1990]), but its significance for the peopling of Fuego-Patagonia was only recognized with the work of Hugo Nami (Nami, 1985-1986; Martinic, 1996; Martin, 2011). His work uncovered hearths, projectile points, scrapers and extinct and modern fauna bones dated ca. 11,000–10,000 BP (Nami, 1985-1986, 1987; Nami and Menegaz, 1991; Nami and Nakamura, 1995).

In this regional context, the information from a new site in the Cerro Benitez locality is important. Located at 2.48 km from Cueva del Milodón, Cueva Chica is a large, attractive and unexplored cave. With the exception of two bones (Camelidae, Rodentia), *Hippocamelus bisulcus* fibres and one fragment of *Mytilus* sp. recovered by Nordensjköld in 1899 (Nordenskjöld, 1996 [1990]) and a small test pit dug by Donald Jackson in 1993 (Jackson, 1993; Martinic, 1996), this site was never systematically excavated. That work produced a fragment of a young *Mylodontinae humerus* (Martin, 2011). It was recovered at 60–70 cm, in a yellow-grey sandy deposit, under a layer of conglomerate clasts (Jackson, 1993: 19). Prieto and Cárdenas (pers. comm.) recently found a human rib on the surface of the cave (Moraga et al., 2009). Observations of the contemporary floor of the cave clearly indicate that there was some vandalism but, comparatively speaking, this evidence is less important than that recorded at Cueva del Milodón or Cueva del Medio.

3. Location and methodology

Cueva Chica is located between 160 and 165 masl [51° 34′ 23.9″ S, 72° 35′ 09.7″ W] and opens on the conglomerate conforming the south side of Cerro Benitez (556 masl). Cerro Benitez is located near the Eberhard fyord, Almirante Montt Gulf. The conglomerate on which the cave was formed belongs to the Cerro Toro Formation (Upper Cretaceous), and lies in a landscape heavily modified by glacial forces.

The formation of the cave is similar to that of nearby Cueva del Milodón (Wellman, 1972; Prieto Véliz, 1992, 1993). According to Prieto Véliz (1992) the erosion of the 2.5 m- thick medium-coarse size sandstone, intercalated with conglomerates, is the main cause of formation of the cave, with weathering enlarging the cave. The action of water from a former paleolake was also invoked to explain the formation of the cave (Feruglio, 1950).

The entrance of the cave is 24 m wide, and it is oriented toward the south. Large boulders near the entrance indicate that its size and morphology were different in the past. The huge accumulation of debris under the dripline is several meters thick and forms a double talus (Feruglio, 1950: 214) (Fig. 4). There is evidence of gravitational displacements of small clasts resulting from the degradation of the conglomerate. Precipitation water also circulates toward the interior. Isolated individuals of *Nothofagus antarctica* ("ñires") dominate the entrance area. The floor is littered with leaves and branches, but no bones are visible.

In July 2010, several test pits were excavated in order to assess the potential of the cave. The initial test pit, a 1 × 1 m square (53 N), was located at the center of the main chamber, some 26 m from the

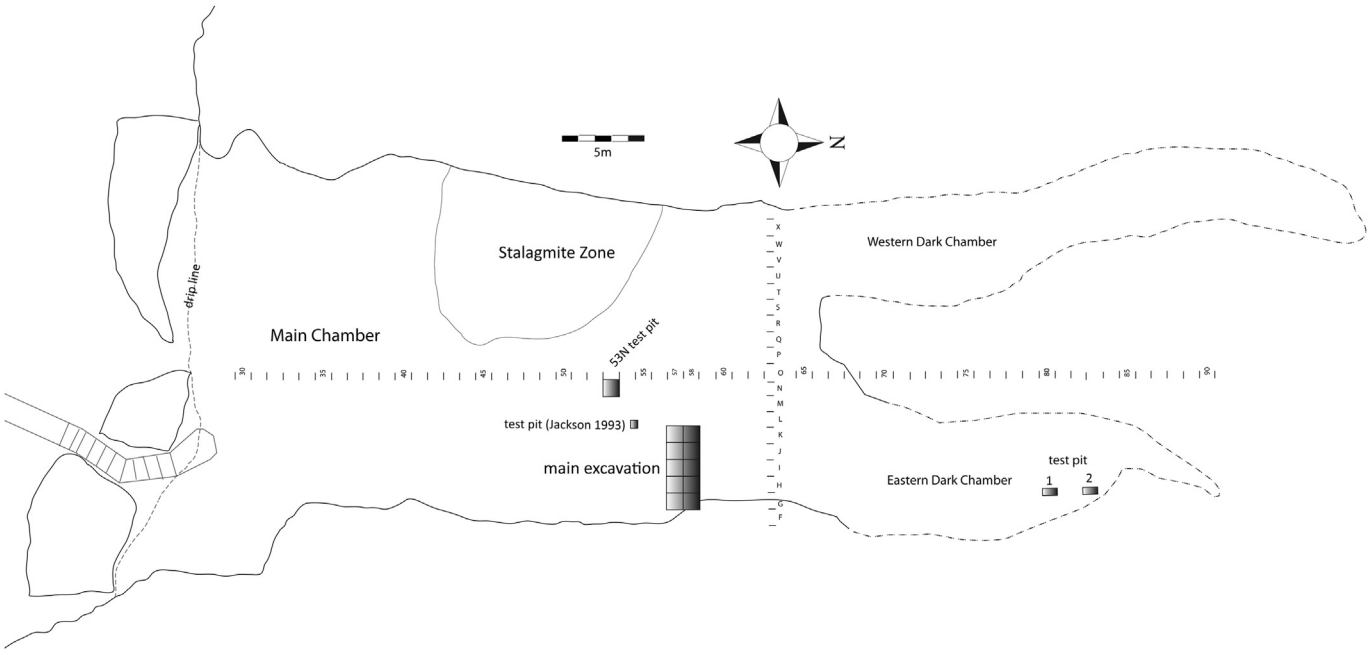


Fig. 3. Map of Cueva Chica.

mouth of the cave (Fig. 3). It reached a depth of 304 cm. Two 100 × 50 cm test pits (TP1 and TP2) were placed in the Eastern dark chamber, and reached depths of 120 and 91 cm respectively.

The excavations proceed by natural layers and using artificial units 10 cm thick. The sediments were dry sieved with a 2 mm mesh size.

The results of the test pits indicated the potential of the site for the study of Late Pleistocene faunas. On that basis, a larger excavation −5 × 2 m, subdivided in 1 × 1 squares- was located in the middle of the main chamber, near the east wall. The technique of excavation was similar to that used in the test pits. Starting at ca. 60 cm depth, the excavation was restricted to the eastern squares. The idea was to reach bedrock at a place relatively near the rock wall, expecting to find better bone preservation. The reasons behind this decision were that: a) that fissures near the wall are locations favored by carnivores (Martin and Borrero, 1997; de Ruiter and Berger, 2000, 2001) and are also places where hunter-gatherer activities produce highly visible accumulations (Binford, 1978; Thomas, 1983), and b) the existence of a slope toward the wall suggested potential accumulations of redeposited materials. Swift sedimentation expected in that sector might be associated with better preservation. The area near the wall was also selected to minimize the danger of a deep excavation with fragile profiles.



Fig. 4. Entrance to the cave. (Photo by D. Todisco, December 2011).



Fig. 5. Main Chamber. Excavation.

4. Results

4.1. Main chamber

Most of the work was concentrated in the main chamber (Fig. 5). Square 53 N produced a sequence of seven natural stratigraphic units. Bones in the upper 60 cm include Mammalia cf. Mylodontinae, Camelidae and Mammalia undetermined as well as a human clavicle of a young individual.

These upper layers are composed mostly of sands and rock debris from the roof ("rock meal", Wellman, 1972). Fallen stalactites are also abundant. Subrecent remains, including glass and fragments of modern textiles, were found associated with rodent remains.

Starting at ~60 cm, dark sediments are predominant. Most of the faunal bones were recovered here (Mammalia cf. Mylodontinae, Camelidae). Between 70 and 280 cm depth, there are no faunal findings. At ~250 cm, the sediment is very humid and plastic and is associated with large blocks, probably from the roof. Below at ~280 cm, two osteoderms (Mylodontinae) were found. They were sent for radiocarbon analysis, but no collagen was present. The maximal depth reached was 304 cm, where large rocks were found.

This excavation showed that there were significant sediment accumulations, preserving extinct faunal remains. The majority of the bones were in a bad state of preservation.

Stemming from this and other considerations, the main excavation was located northeast of 53 N (Fig. 3). The sequence of sediments is basically similar, and eight layers were recognized.

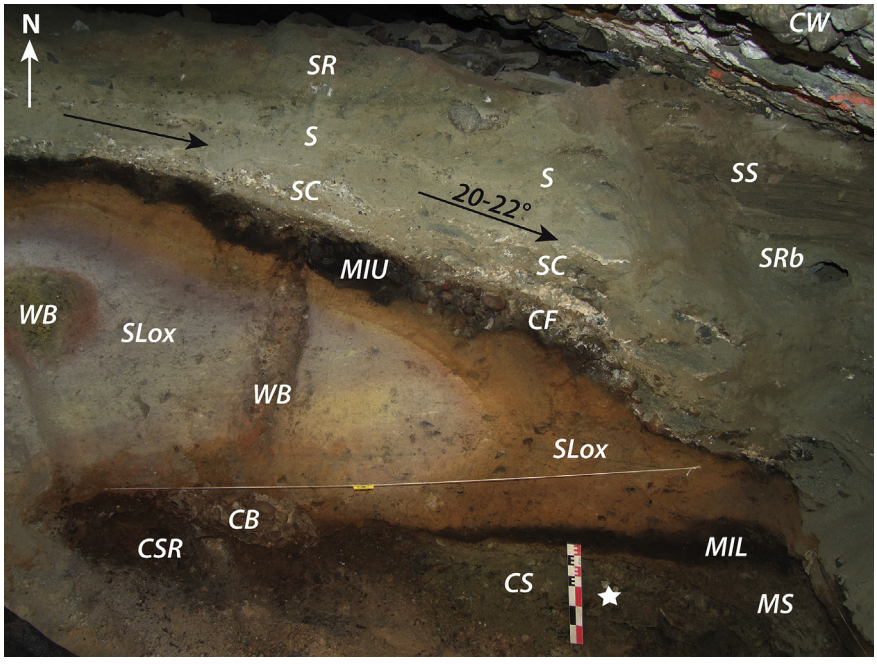


Fig. 6. Main Chamber. North wall of main excavation. Stratigraphic sequence (Table 1). (Photo by D. Todisco, December 2011).

Subrecent findings including glass fragments, matches, plastic, wire, textile and a sheep humerus were restricted to the upper layers. A few bird bones were found at the upper layer including one phalanx with a probable puncture, regurgitation pellets, and some feathers. Abundant and sometimes concentrated rodent bones, insect pupas, and fibers were also found.

Fig. 6 presents a simplified field stratigraphical description from top to bottom in the North wall as well as a preliminary interpretation of the stratigraphy (Table 1). Near the east wall, the sediment is more compact in comparison with the center of the cave, and is partially in contact with the roof. There are abundant blocks, with empty interstices in between. A relatively thin layer is present with variations in colour between very dusky red and black (MIU, Table 1). A Mylodontinae vertebra recovered at 68.5 cm depth was dated 10,780 ± 50 BP (Beta-288227).

Reddish sediment (SLox) that includes a sub-actual crotovina was detected, as well as charcoal spicles, probably fox faeces with beetles and rodent bones. A canid astragalus was recorded at ~169 cm depth.

A red layer, probably from oxidation with abundant blocks and round clasts produced no faunal remains except for bivalve shell fragments at 230 cm. Dark pockets resulting from decomposition of rocks were identified.

A black layer follows (MIL), below which clasts are dominant. A bone fragment among the clasts, a ground sloth rib, and one small undetermined bone fragment were recovered. Also, a bone ghost identified between clasts at 276 cm depth marks a significant decrease in bone preservation. A *Lama gracilis* phalanx was found among the clasts and selected for radiocarbon dating, but no collagen was found. However, pockets with well preserved bones also exist.

Table 1
Cueva Chica. Main Chamber. North wall of main excavation. Stratigraphic sequence (Fig. 6).

CW	Wall of the cave, conglomerate (Cerro Toro formation)
SS	Close to the conglomeratic wall; finely stratified recent sediment (subrecent/recent) including sandy, finely gravelly sand and silty layers; contain rare rodent bones; could be related to water and gravity action with alternating wet (silt) and dry (sand, gravel) sedimentary conditions
SRb	Bioturbated medium sand; recent animal burrow
SR	Medium sand with sparse conglomeratic fragments; grayish brown; recently anthropoturbated and probably bioturbated
S	Medium sand with crude stratification; sparse clastic elements including fine gravels, angular conglomeratic fragments (mudstones); brownish gray to grayish brown; sand and clastic elements could be related to gravity action with dry conditions of sedimentation along the slope; may have been anthropoturbated at the top
SC	Medium to coarse sand with crude stratification and calcite features including incipient calcite formation and indurations (speleothems); sparse clastic elements including fine gravels and conglomeratic fragments (mudstones); brownish gray to grayish brown; sand and clastic elements could be related to gravity action with dry conditions of sedimentation along the slope
MIU	Upper strongly impregnated clastic sediment (conglomeratic fragments: pebbles, angular mudstone fragments) with manganese and probably iron oxyhydroxides
MIL	Lower strongly impregnated clastic sediment (conglomeratic fragments: pebbles, angular mudstone fragments) with manganese and probably iron oxyhydroxides
CF	Clast-supported sediment including conglomeratic fragments (angular mudstone clasts, pebbles) with interclast calcite and medium sand; could be associated with debris fall
SLox	Matrix-dominated silty to sandy silt sediment with rare clastic elements (angular to sub-rounded conglomeratic fragments); massive (aeolian?) carbonated sediment with weathered conglomeratic blocks (WB); important redoximorphic features (iron oxyhydroxides) inducing variable coloration of the sediment: gray, weak red, reddish brown, or light yellowish brown; could be associated with periglacial solifluction
CB	Conglomeratic block with pebbles and mudstone clasts; could be related to debris fall
CSR	Clast-supported sediment including conglomeratic fragments (angular mudstone clasts) with a reddish sandy matrix; could be related to debris fall
CS	Clast-supported sediment including conglomeratic fragments (angular mudstone clasts, sandstone elements, pebbles) with a brownish gray sandy matrix (medium sand); could be related to debris fall; presence of bone fragments (star) = Mylodontinae?
MS	Matrix-supported sediment with sandy silt matrix; frequent clastic elements with angular (mudstone) to sub-rounded conglomeratic fragments (gravels, pebbles); could be associated with reworking debris fall by periglacial solifluction

Calcite is abundant between 100 and 130 cm, and was deposited below several rock blocks. Rodent remains are also found under some rocks. Bone fragments are abundant, and most of the faunal remains were found here (Mylodontinae, *Panthera*, Camelidae). A complete radius and bone fragments of a young *Mylodon* were found (Fig. 7). A fibula of *Panthera onca mesembrina* found at CF (Table 1) was dated 11,520 ± 50 BP (Beta-288228) recovered at 107 cm (Table 2).

The lower 1.5 m depth of cave fill are dominated by lutite clasts and blocks of conglomerate. Degradation of the roof is seen also in the presence of fossils, probably *Inoceramus* sp. (Feruglio, 1950: 213). This sediment is a grey dust, resulting from the degradation of lutite. Between 294 and 304 cm, the accumulation of clasts is notable, with occasional invertebrate fossils. The presence of a few bone fragments was noted.

Table 2
Cueva Chica. Radiocarbon dates. Pant = *Panthera*, Mylo = Mylodontinae.

Square	Layer	Depth (cm)	Taxa	Sample	Date (BP)	2 Sigma calibration	Lab
57i	3	107	Pant	Fibule	11,520 ± 50	Cal BP 13,440–13,270	Beta-288228
Test pit 2	50–60	58	Pant	Rib	12,890 ± 60	Cal BP 15,540–15,130	Beta-284439
East profile		65	Pant	2nd phalange	11,470 ± 50	Cal BP 13400–13,260	Beta-319537
Test pit 2	30–40	32	Mylo	nasal	13,970 ± 70	Cal BP 17,130–16,900	Beta-284437
57H		301	Mylo	Vertebra	14,240 ± 60	Cal BP 17,150–16,840	Beta-288230
57K	3	68.5	Mylo	Vertebra	10,780 ± 50	Cal BP 12,860–12,780	Beta-288227
57H-57G-58H-58G	325–375	375	L. gracilis	Astragale	14,870 ± 70	Cal BP 18,500–17,930	Beta-288231



Fig. 7. Radio juvenile *Mylodon* with scoring and furrows.

The final part of the excavation was restricted to some sectors in squares 58 H–57 H and 58G-57G (338–355 cm depth) due to the technical difficulties and the potential danger of a deep excavation with friable walls. Near the base of the excavation there was a large lutite block, under which yellowish clay was found, locally in the shape of clay balls. A radiocarbon date of 14,240 ± 60 BP (Beta-288230) on a fragment of Mammalia cf. Mylodontinae vertebrae recovered at 301 cm (Table 2) was also obtained. A bone trace was recorded at 362 cm. Bone fragments and a *L. gracilis* astragalus dated 14,870 ± 70 BP (Beta-288231) were recovered ca. 375 cm (Table 2). Several bone splinters were found both at depths of 375 cm and 400 cm respectively. Below, only clasts and weathered rocks (mostly lutite) were found. A deposit of gravel was found at a depth of 411 cm where the excavation stopped. Fig. 8 shows a simplified field stratigraphical description from top to bottom as well as initial interpretations of the East wall is presented (Table 3). An incomplete posterior autopodium of *P. onca mesembrina* recovered on the East profile (SI) at a depth of 65 cm was radiocarbon dated 11,470 ± 50 BP (Beta-319537) (Fig. 9, Table 4).

Table 3
Cueva Chica. Main Chamber. East wall of main excavation. Stratigraphic sequence (Fig. 8).

CW	Wall of the cave, conglomerate (Cerro Toro formation)
SS	Near the conglomerate; finely stratified recent sediment (subrecent/recent) including sandy, finely gravelly sand and silty layers; contain rare rodent bones; could be related to water and gravity action with alternating wet (silt) and dry (sand, gravel) conditions of sedimentation
SR	Medium sand with sparse conglomeratic fragments; grayish brown; probably anthropoturbated and bioturbated; presence of modern wood remains
S	Medium sand; sparse clastic elements including fine gravels, angular conglomeratic fragments (mudstone) and pebbles; brownish gray to grayish brown; may have been anthropoturbated and bioturbated
SC	Medium sand with crude stratification and calcite features including incipient calcite formation and indurations (speleothems); calcite indurations tend to slope in both North and East directions; sparse clastic elements including fine gravels and conglomeratic fragments (mudstone); brownish gray to grayish brown; sand and clastic elements could be related to gravity action with dry conditions of sedimentation along the slope
SI	Brownish gray silty sand to sandy silt with calcite features; contains *Panthera* bones (white star); may be related to water action and wet condition of sedimentation
CSC	Clast-supported sediment including conglomerate fragments (pebbles, angular mudstone clasts) with interclast calcite (including crystals) and sand to silty sand; contains guanaco bones (black star); could be associated with debris fall
CSM	Clast-supported sediment rich in angular mudstone clasts with interclast soft calcite (moonmilk ?) and sand; could be associated with debris fall
MIU	Upper strongly impregnated clastic sediment (silty to sandy silt) with manganese and probably iron oxyhydroxides
SLox	Matrix-dominated silty to sandy silt sediment with rare clastic elements (angular to sub-rounded conglomeratic fragments); reddish brown massive (aeolian?) carbonated sediment; important redoximorphic features (iron oxyhydroxides) with vertical black manganese impregnations (Sm); could be associated with periglacial solifluction
MIL	Lower strongly impregnated clastic sediment (silt with conglomeratic fragments: gravels, pebbles; angular mudstone fragments) with manganese and probably iron oxyhydroxides
CB	Conglomerate block; could be related to debris fall
MS	Matrix-supported sediment with sandy silt matrix; frequent clastic elements with angular (mudstone) to sub-rounded conglomeratic fragments (gravels, pebbles); could be associated with reworking debris fall by periglacial solifluction
CS	Clast-supported sediment including conglomeratic fragments (angular mudstone clasts, sandstone elements, pebbles) with a brownish gray sandy matrix (medium sand); could be related to debris fall

Table 4
Cueva Chica. Main Chamber. East wall of main excavation. Location of *Panthera* bone (Fig. 9).

SLox	Silt to sandy silt with redoximorphic features (iron oxyhydroxides)
MI	Strongly impregnated clastic sediment with manganese and probably iron oxyhydroxides
CG	Clast-supported sediment including conglomerate fragments (pebbles, angular mudstone clasts) with interclast calcite (including crystals) and sand to silty sand; contains **guanaco bones (G)**
SC	Medium sand with crude stratification and calcite indurations (arrows)
SI	Silty sand to sandy silt with calcite features; contains ***Panthera*** bones **(P)**

4.2. Eastern dark chamber

Excavations at the dark chamber (Fig. 10) were limited to two test pits of 100 × 50 cm located near the end of the chamber, and separated by 2 m. Sedimentary successions are shorter than in the main chamber. A calcium carbonate layer, sometimes pulverized was recorded on the upper layers. There are markers of disturbance, large blocks and stalactites fallen from the roof, as well as calcite slabs. They appear discontinuously along the sequence. Subrecent torches and glass fragments were recorded on the surface, and glass and plastic were recovered down to ~70 cm.

At Test Pit 1 (TP1), the sediments are basically alternating light brown and grey clays with abundant clasts. The grey sediments of the lower part of the sequence are very humid. Between 27 and 50 cm charcoal, small burnt branches, probably from subrecent torches, and rodents are present. A fragment of an undetermined rib was found. Bedrock was found at 120 cm depth.

Test Pit 2 (TP2) is located 2 m north of TP1. The sediment sequence is similar and partially sealed by a 2–3 m thick calcite crust at ca. 32 cm. A potent brown-grey layer, very low in clasts, is found below the calcite. Disturbance markers, including glass, paper and matches, were found only in the upper 20 cm. Charcoal and burnt branches as well as fox faeces were recorded. Blocks from the roof and calcite are less abundant. A fragment of Mylodontinae skull (nasal) at 32 cm depth was radiocarbon dated 13,970 ± 70 ^{14}C BP (Beta-284437) (Table 2). The sediment is more plastic, with no clasts or calcite deposits.

At 58 cm a *P. onca mesembrina* rib was found (Fig. 11), dated 12,890 ± 60 BP (Beta-284439). Only one osteoderm and a fragment of unfused vertebral epyphysis of undetermined Mammalia below 80 cm were found near the bottom. The maximum depth was 91 cm.

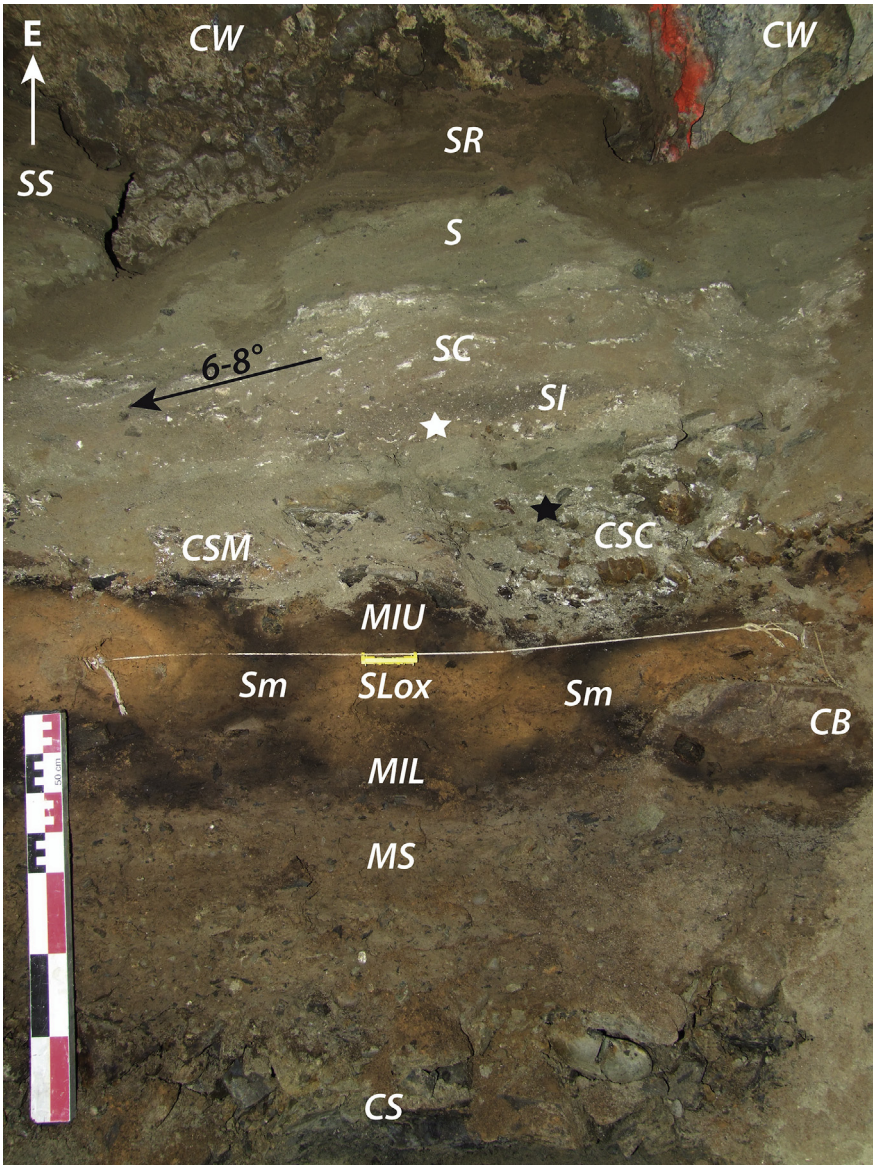


Fig. 8. Main Chamber. East wall of main excavation. Stratigraphic sequence (Table 3). (Photo by D. Todisco, December 2011).

5. Discussion and conclusions

5.1. Faunal remains

The magnitude of human disturbance in the excavated areas is not high. Some of the cultural remains of the upper layers were deposited within the last 100 years or so, and are accompanied by rodent and bird bones, but are restricted to the top 20–30 cm. Subrecent remains were only found below 30 cm at TP1, in the Eastern Dark Chamber. The activities of canids, probably foxes, are indicated on some of the bone remains recovered in this part of the cave, particularly bird bones, and deposited scats. Graffiti going back to at least 1944 are found on the walls of the Eastern Dark Chamber, a time at which visits to the cave are documented (Ernesto Helmer, pers. comm., M.L. Iglesias Alvarez, pers. comm.).

The vertical distribution of faunal remains in the Main Chamber is not homogeneous. Findings at square 53 M are concentrated between 62–74 and 280–304 cm depth and at the main trench between 52–107 cm and 165–362 cm. The degree of disarticulation and fragmentation of the material suggest that these bones are either transported or redeposited assemblages.

The radiocarbon dates from the Main Chamber can be separated into two periods of 14,870–14,240 and 11,520–10,780 BP respectively, while the occupation of the Eastern Dark Chamber is dated 13,970–12,890 BP, that is between those two periods (Fig. 12). When calibrated at two sigma, there is an overlap between the dates of 13,970 and 14,240 BP. This pattern suggests the possibility of an alternation in the location of the occupations.

The bone findings are not abundant but interesting, including several carnivore remains. Not only do they confirm the presence of the species already recorded at other caves in the region, but add to the discussion of their age (see below).

The presence of carnivores, foxes and panthers, at the dark chamber (TP 2), and panthers at the main chamber confirms the importance of the site for carnivores. On the basis of chronology (Table 2), the presence of at least two panthers can be sustained. Beyond that presence, one complete Mylodontinae radius and a rib recovered at Cueva Chica show carnivore marks. The radius

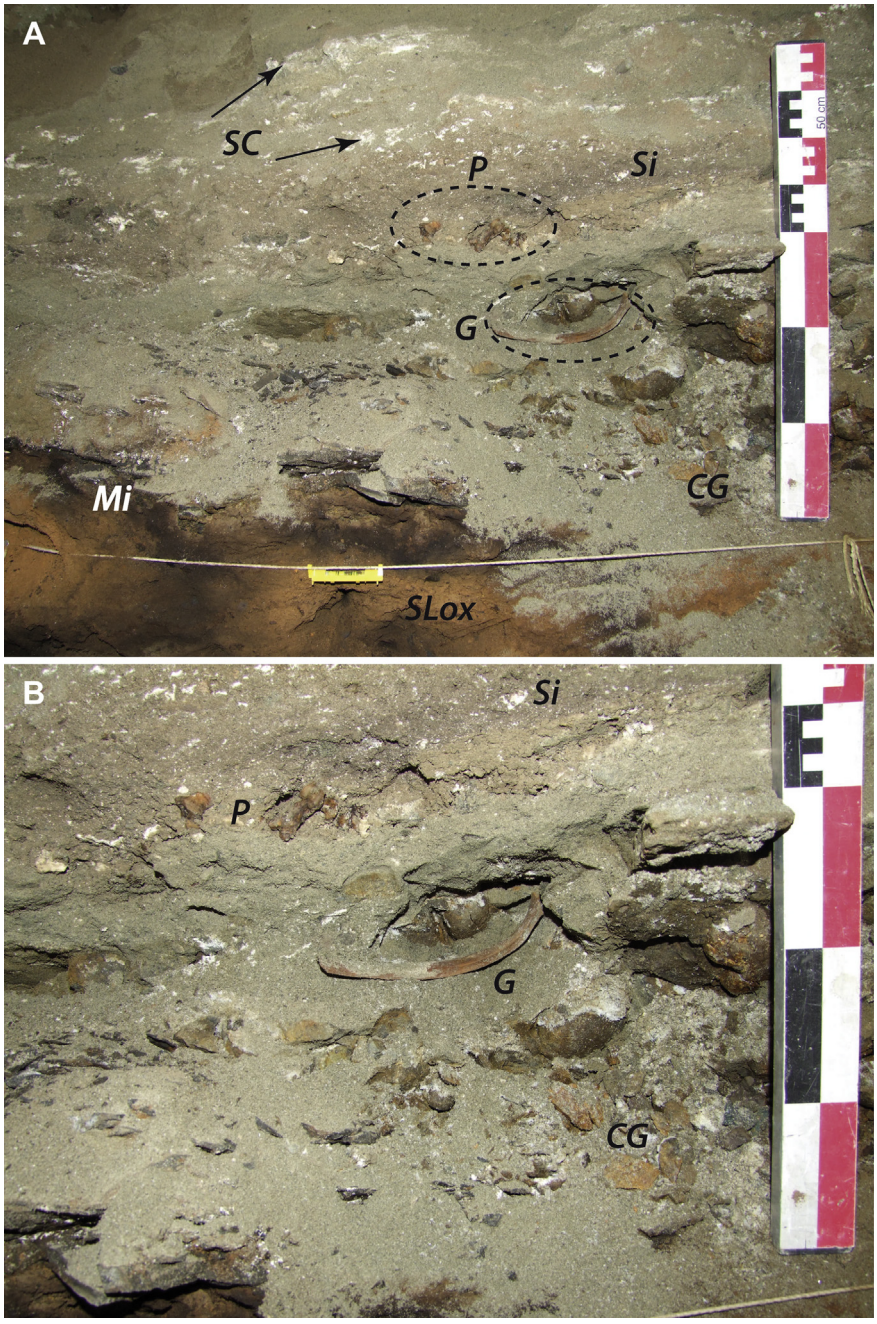


Fig. 9. Main Chamber. East wall of main excavation. Location of *Panthera* bone (Table 4). (Photo by D. Todisco, December 2011).

presents coarse tooth scores all around the diaphysis, as well as punctures and furrows (Fig. 7). Other bones also display carnivore marks. This evidence is enough to establish intensive carnivore activity on megafauna. The bone evidence from the dark chamber can be considered mainly as the result of carnivore activities. Therefore, previous inferences that suggested that dark chambers were used by carnivores are confirmed (Borrero et al., 1997; Martin, 2011).

The bone assemblage is dominated by ground sloth remains. The young Mylodontinae radius marked by carnivores found in the main chamber and some vertebrae probably belong to the same individual recorded by Jackson (Jackson, 1993; Martin, 2011). The presence of an unborn or a newborn ground sloth at Cueva del Milodón (Tonni et al., 2003) points to caves being used by ground sloths as maternal dens. However, it remains possible that the remains of the young Mylodontinae recovered at Cueva Chica resulted from transport by carnivores.

The presence of very few camelid remains and the absence of *Hippidion saldiasi*, both usually abundant in Fuego-Patagonian Late Pleistocene bone assemblages, must be highlighted. For example, they are well represented in Late Pleistocene archaeological (Cueva del Medio, Cueva Lago Sofía 1) and paleontological sites of the region (Cueva del Milodón, Cueva Lago Sofía 4). The recovered camelid remains belong to *L. gracilis*. These bones are from the lower leg and an unfused radius fragment.

5.2. Human occupations

There is no evidence of human presence at the end of the Pleistocene at Cueva Chica. Humans are only represented by



Fig. 10. East dark chamber.

a couple of bones in the upper layers and on the surface. A few bivalve shell fragments recovered at a depth of ca. 230 cm in the main chamber cannot be used to argue for human transport, as birds appear as a more economic explanation for their presence.

The lack of archaeological evidence at Cueva Chica can be used to suggest that human occupation of caves was not intensive. This indicates either low human demography or a settlement not focused on caves. Only a few Late Holocene human bones were recovered at Cueva Chica. This is notable given that Alero Pedro Cárdenas, located only some 80 m from the mouth of Cueva Chica, displays relatively intense Holocene occupations (Nami, 1989-1990).

5.3. Paleoecological implications

Cueva Chica is located at ca. 160–165 masl, a relatively higher position than Cueva del Milodón and Cueva del Medio. For this reason, it was less exposed to the direct influence of the recently described paleolake that existed in the region at the end of the Pleistocene (Sagredo et al., 2011; Stern et al., 2011). Stern et al. (2011) comment that the proglacial lake was formed after 17.5 cal ka BP (14,520 ± 140 BP), "the closest minimum date of ice recession in the region as determined from the Vega Benitez core" (Stern et al., 2011: 12). That is also the date for local ice-free conditions near the summit of Cerro Benitez (Sagredo et al., 2011: 102–104). The new dates at the cave are confirmatory, as the area near the cave was not only free of ice by ca. 14,870 BP, but also was viable for the occupation of large mammals.

For Stern and coauthors, the tephra layer at nearby Alero Dos Herraduras suggests the proglacial lake level was below ~150 m before 12,825 ± 110 BP, because at this lake shore level Cerro



Fig. 11. *Panthera* rib and young Mylodontinae vertebra.

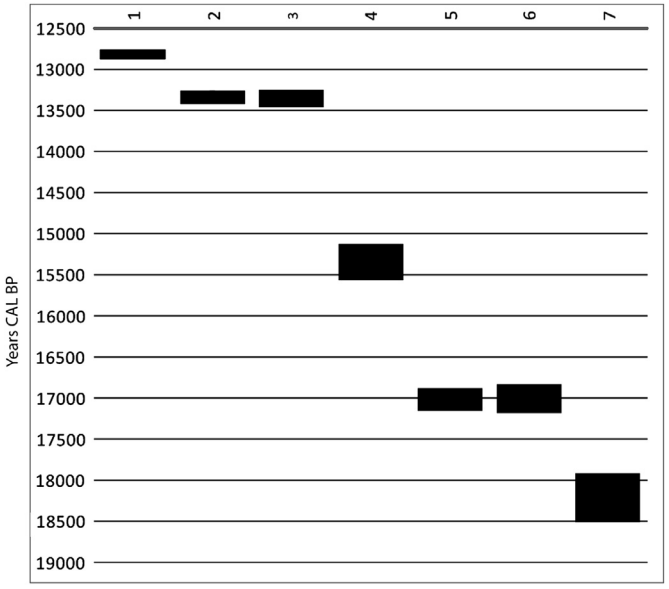


Fig. 12. Temporal distribution of calibrated radiocarbon dates.

Benitez had been isolated "from the mainland by water and the caves were inaccessible ... by land" (Stern et al., 2011: 8). The results of the present study indicate that this was happening well before that date. Stern et al. (2011) think that the lake was lowered to ~120 m "to connect these lake shore caves to the mainland", and they use a date of 13,560 ± 180 BP (from Cueva del Milodón) as the oldest date for the presence of large animals in the area. However, recent results at Cueva del Milodón produced older dates, reaching 13,630 ± 50 BP (Beta-164895)(Martin, 2011; Borrero and Martin, 2012) and the present study produced dates to 14,870 BP for Cueva Chica. All the available chronological evidence, and the published model (Stern et al., 2011), point to a previous date for the opening of a terrestrial connection between Cerro Benitez and the lands in the east.

6. Conclusions

Reasonably well-preserved and stratigraphically ordered Late Pleistocene bone remains were recorded in three different loci of Cueva Chica. The new records obtained at Cueva Chica site have provided a large range of information related to the length of occupation of Cerro Benitez by Late Pleistocene extinct faunas. The chronology of the animal occupation has a bearing on the interpretation of the evolution of the proglacial lake, particularly in terms of the opening of a terrestrial connection with the lands in the east.

The absence of *H. saldiasi* bones and the paucity of Camelidae bones are notable. Both taxa are usually abundant in Fuego-Patagonian Late Pleistocene bone assemblages. Given that intensive carnivore activity was recorded on some of the megamammal remains, this may be the result of carnivore prey selectivity.

Finally, in contrast with nearby Cueva del Medio, there is no evidence of Late Pleistocene human occupation at Cueva Chica. The presence of humans is limited to two human bones that were recovered in late Holocene contexts. A large cave apparently was not selected for human habitation. On the contrary, all the available evidence points to carnivores as the main agents of bone accumulation at the cave.

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