

## ON THE COEXISTENCE OF MAN AND EXTINCT PLEISTOCENE MEGAFUNA AT GRUTA DEL INDIO (ARGENTINA)

Alejandro García

CONICET—Departamento de Historia, Facultad de Filosofía, Humanidades y Artes, Universidad Nacional de San Juan, Ignacio de la Roza 230 (Oeste)—5400 San Juan, Argentina. Email: alegarcia@unsj.edu.ar or agarcia@logos.uncu.edu.ar.

**ABSTRACT.** New excavations and new  $^{14}\text{C}$  dates at the Gruta del Indio shelter in the central Argentinean Andes show that the dung layer of the site is much thicker towards the front of the site than near the rock wall. This yields a longer chronology for the dung deposit; thus, the upper boundary would date to about 9000  $^{14}\text{C}$  yr BP. The new measurements lengthen the possible time of the coexistence of man and extinct Pleistocene megafauna in the area, since ~1400 cal yr is much longer than previously thought (Long et al. 1998). Nevertheless, coexistence does not imply interaction, which still is not evident.

### INTRODUCTION

Gruta del Indio (34°45'S, 68°22'W) is a significant point of reference for the discussion of the features of the early human peopling of the central Argentinean Andes and the human relation to the extinction of Pleistocene megafauna (Long and Martin 1973; Lagiglia 1974; García 1999) and to the environmental changes (D'Antoni 1983; Dacar et al. 2001).

Despite the finding of lithic artifacts in the lower stratigraphic levels and of hearths dated to the final Pleistocene (Lagiglia 1956, 1968, 1979), a recent analysis of  $^{14}\text{C}$  dates on charcoal and dung samples (Long et al. 1998) from the right area of the shelter (Figure 1) suggests that the coexistence of man and extinct sloths is not certain and, at most, it would have been very short. In Long et al. (1998), a set of 10 dates from dung samples put these materials between  $9650 \pm 800$  and  $24,730 \pm 860$   $^{14}\text{C}$  yr BP. The calibration ( $2\sigma$ ) done by Long et al. (1998:696) for 5 dates with  $1\sigma$  counting errors less than 200 yr indicates maximal ages ranging from about 12,000 to 14,680 cal yr BP. Another set of 10 dates was obtained from charcoal samples with  $1\sigma$  counting errors less than 200 yr. Results span from  $8045 \pm 55$  to  $10,530 \pm 140$   $^{14}\text{C}$  yr BP, with calibrated ages ( $2\sigma$ ) between 8600 and 12,980 yr BP. The maximal possible overlap, based mainly on dates A-9493 (dung) and A-1638 (charcoal), is of 880 or 930 cal yr, depending on which calibration curve is used, from Burr et al. 1998 ( $12,880-12,000 = 880$ ) or from Hughen et al. 1998 ( $12,980-12,050 = 930$ ).

Otherwise, the probability range ( $2\sigma$ ) of a date from dermal ossicles (GrN 5772) overlaps or precedes those of 9 dates on charcoal (Long et al. 1998:Figures 4a and 4b). However, because of its origin, Long et al. (1998:698) consider the date on dermal ossicles to be anomalous.

On the basis of this information, the coexistence of man and extinct megafauna would not be clear. Recent excavations, carried out between 1997 and 2000, at the right area of the shelter and near the rain-drop line corresponding to the boundary of R8 and R9 squares (Figure 2), allow for a much broader chronological superposition. This proposal is based on a new series of dates from dung and charcoal samples as well as on stratigraphic observations.

### METHODOLOGY

Previous work at the site pointed out the presence of a layer containing extinct megafauna dung, ranging from about 0.15–0.30 m thick, although in some areas it could reach 0.40 m (Semper and Lagiglia 1968:133; Lagiglia 1974). Since these excavations were mainly in an area adjacent to the wall of the shelter (Figure 2), some seemingly anomalous dates (Lagiglia 1974), and the difficulty to determine the chronology of the layer are explained by its lesser width there.



Figure 1 General view of the new excavation at the right area of Gruta del Indio

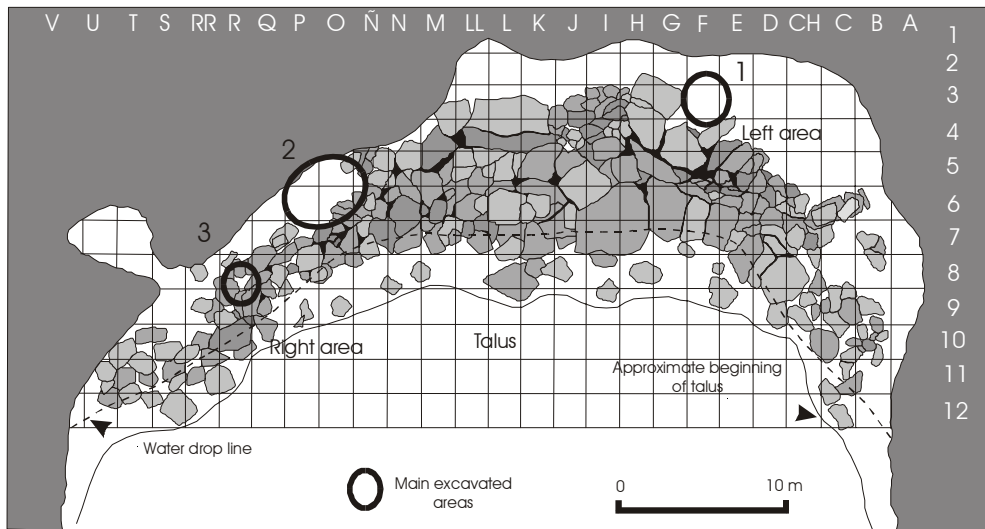


Figure 2 Plan of the site and main areas excavated, re-drawn from Lagiglia 1977: 1=Lagiglia/Semper; 2=Long/Lagiglia; 3=García/Lagiglia

In order to minimize disturbance of the site, the new excavation was carried out at a restricted area of some 2 m<sup>2</sup> cleared by partially removing two great rocks with a tackle. The results revealed that the layer including the megafauna dung is thicker towards the front of the shelter, at least in the area of squares R8 and R9 (García and Lagiglia 1999). The thickness of the layer reaches 0.9 m, allowing a better chronological control of the deposition periods. This wider stratigraphic distribution of the dung made it possible to obtain new dates that offer a very different view of the chronology of the

layer. The analyses were run by the Tritium and Radiocarbon Laboratory (Latyr) at the Universidad Nacional de La Plata and Beta Analytic, Inc. According to the results, a thin portion of that layer (0.10–0.30 m) would have been deposited during the Pleistocene–Holocene transition (Table 2, date #9), while the lower portion (about 0.60 m) would have laid between at least ~36,000 and ~24,000 yr BP (Table 2, #10–17).

Taking into account the small size of the recently analyzed dung balls (~80 mm), the probable presence of *Machrauchenia* sp. and *Hippidion* sp. (besides *Megatherium* sp. and *Myloodon* sp., see Semper and Lagiglia 1962–1968) in the record (Miotti, personal communication), and the morphological and dimensional similarity to that of actual equines, it is possible that the dung balls do not correspond to ground sloths.

For a better comparison of the results, all dates were calibrated using the Calib revision 4.3 program (Stuiver et al. 1998) and no subtractions to the conventional ages (in order to compensate eventual interhemispheric differences) were made (Figini 1999). To incorporate the date A–1351 to the comparison set, all dates with  $1\sigma$  counting errors  $\leq 210$  yr were included.

## RESULTS AND DISCUSSION

A date from a dung sample corresponding to the more recent depositions (close to the upper boundary of the layer) gave an approximate age for the end of the megaherbivores occupation at the site. The analyzed material (a single, 64-g dung ball) was taken at a distance of about 0.10–0.20 m from that boundary (Figure 3). The result was  $8990 \pm 90$   $^{14}\text{C}$  yr BP (LP 925). From the same level of LP 925, we recovered some 60 little fragments of bones presumably belonging to megafauna and a small (13 mm) flake of rhyolite, probably dispersed vertically by postdepositional disturbance agents (García and Lagiglia 1999b).

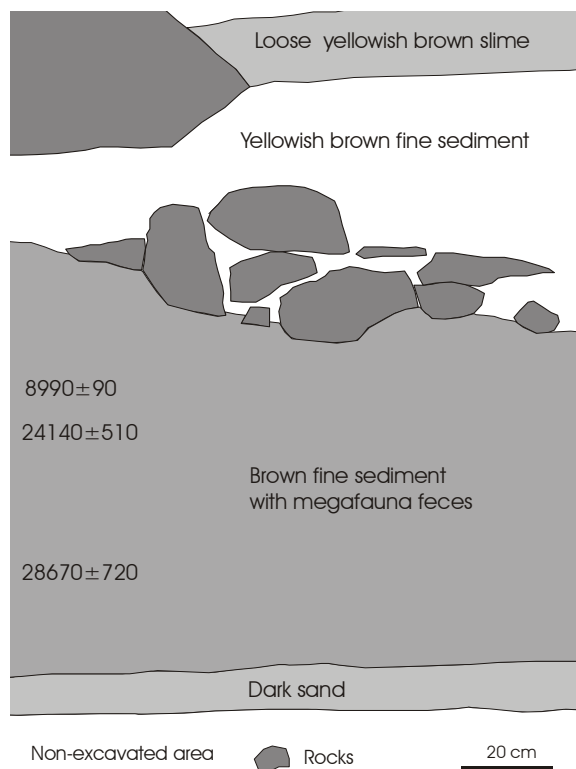


Figure 3 Pit wall at the R8/R9 boundary

Moreover, new dates on charcoal samples from previous and present work at squares Ñ4, O5, Q7 and RR9 (Lagiglia, personal communication) have been recently obtained. Results range between  $7430 \pm 90$  and  $9700 \pm 110$   $^{14}\text{C}$  BP, with calibrated ages ( $2\sigma$ ) between 8030–8390 and 10,690–11,260 BP.

Tables 1 and 2 show the calibrated dates ( $2\sigma$ ) only with  $1\sigma$  counting errors less than 200 yr from Long et al. (1998) and the new dates mentioned above. Even if the date on dermal ossicles rejected by Long et al. (1998) is removed, a difference of about 1420 cal yr (11,780–10,360 = 1420 cal yr) is recorded between the more conservative possibility of the date—corresponding to the older charcoal sample (A-1638, Table 1, #2)—and the oldest possible age of the more recent one, corresponding to the younger dung sample (LP-925, Table 2, #9). Considering  $1\sigma$ , the lesser possible difference between the calibrated ages for A-1638 (12,180–12,890) and LP-925 (9920–10,220) is about 1960 cal yr. Finally, the maximal possible difference between the cal ages for both samples ( $2\sigma$ ) is 3160 cal yr (12,950–9790 cal yr).

Taking into account the presence of more recent dung (because of its stratigraphic position, see Figure 3), the difference between the ages for the oldest charcoal and the youngest dung could be even greater.

Table 1 Dates with standard deviations  $\leq 210$  yr from Long et al. (1998:696)

Nr	Material <sup>a</sup>	Lab. nr	Coll. <sup>b</sup>	Origin	Date	Cal $2\sigma$ Stuiver et al. 1998
1	Ch	GrN 5394	HAL	RR9, 0.7 m	$8045 \pm 55$	8720 (9005) 9230
2	Ch	A-1638	AL	F3, 2.2 m	$10530 \pm 140$	11780 (12429, 12455, 12361) 12950
3	Ch	A-9486	AL	P6-O5, 0.8 m	$10135 \pm 95$	11260 (11696, 11723, 11726) 12340
4	Ch	A-9489	AL	O5	$9905 \pm 140$	10890 (11240, 11246, 11255) 11950
5	Ch	A-9491	AL	O5	$9770 \pm 85$	10810 (11186) 11330
6	Ch	A-9492	AL	Fogón 3	$9825 \pm 95/90$	11110 (11202) 11550
7	Ch	A-9495	AL	O5	$9890 \pm 75$	11170 (11232) 11550
8	Ch	A-9496	AL	O5	$9990 \pm 75$	11200 (11303, 11315, 11339, 11396, 11519, 11539) 11940
9	Ch	A-9497	AL	O5	$10195 \pm 80$	11360 (11767, 11806, 11927) 12360
10	Ch	A-9498	AL	O5	$10170 \pm 70$	11360 (11755, 11818, 11909) 12340
11	D	GrN 5558	HAL	RR8, 1.1 m	$10950 \pm 60$	12650 (12980) 13160
12	D	A-1351	HAL	Q7-7, 0.7–0.8 m	$10610 \pm 210$	11760 (12656, 12728, 12804) 13120
13	D	A-1371	HAL	Q7-8, 0.8–0.9 m	$11820 \pm 180$	13420 (13826) 15250
14	D	A-9571	AL	P6, >0.6m	$12375 \pm 115$	14100 (14325) 15510
15	D	A-9570	AL	P6, >0.6m	$11040 \pm 130$	12660 (13013) 13370
16	D	A-9493	AL	P6, >0.6m	$10900 \pm 185$	12390 (12944) 13190
17	B	GrN 5772	HAL	RR-9-7, 0.7 m	$9560 \pm 90$	10580 (10767, 10832, 10837, 10957, 11006, 11017, 11059) 11180

<sup>a</sup>Ch=charcoal; D=dung; B=bone

<sup>b</sup>Coll.=Collector: AL=Austin Long; HAL= Humberto Lagiglia

Table 2 Dates recently obtained for lower layer at Gruta del Indio

Nr	Material <sup>a</sup>	Lab. nr	Coll. <sup>b</sup>	Origin	Date	Cal 2 $\sigma$ Stuiver et al. 1998
1	Ch	LP-860	HAL	O5, 1 m	9590 $\pm$ 120	10560 (10794, 10795, 10809, 10823, 10860, 10940, 11068) 11230
2	Ch	LP-941	HAL	RR9, 0.7 m	9580 $\pm$ 100	10580 (10790, 10802, 10805, 10827, 10851, 10941, 11065) 11200
3	Ch	LP-991	HAL	Ñ4-1, 0.38-0.48 m	9510 $\pm$ 90	10510 (10740) 11160
4	Ch	LP-986	HAL	O5-2, 0.72-0.9 m	9160 $\pm$ 90	10180 (10242, 10352, 10355) 10580
5	Ch	LP-876	HAL	O5, 0.8-0.9 m	9700 $\pm$ 110	10690 (11165) 11260
6	Ch	LP-854	HAL	Q7-5, 0.5-0.6 m	8920 $\pm$ 110	9600 (9977, 9986, 10151) 10240
7	Ch	LP-873	HAL	Q7, 0.35-0.4 m	7430 $\pm$ 90	8030 (8195, 8296, 8278) 8390
8	Ch	LP-845	HAL	O5, 0.8 m	7860 $\pm$ 90	8420 (8606, 8620, 8628) 9010
9	D	LP-925	AG	R8/9	8990 $\pm$ 90	9790 (10190) 10360
10	D	LP-929	AG	R8/9	30200 $\pm$ 800	—
11	D	LP-918	AG	R8/9	30800 $\pm$ 700	—
12	D	LP-1072	AG	R8/9	28670 $\pm$ 720	—
13	D	LP-1075	AG	R8/9	24140 $\pm$ 510	—
14	D	Beta 152587	AG	R9	>37610	—
15	D	Beta 152588	AG	R9	29530 $\pm$ 540	—
16	D	Beta 152589	AG	R9	36400 $\pm$ 200	—

<sup>a</sup>Ch=charcoal; D=dung; B=bone

<sup>b</sup>Coll.=collector: HAL=Humberto Lagiglia; AG=Alejandro García

Also, date LP-925 is younger than 9 other dates from charcoal samples given by Long et al. (1998: Table 1, #2-10), and younger than 5 of the new results obtained by Lagiglia (Table 2, # 1-5).

According to the tables above and assuming that the age of the dung and the charcoal from the site constitutes an adequate instrument to solve the problem, the possible time of man and megafauna coexistence in the area of Gruta del Indio would be much greater than previously thought. This situation would not be rare given the available information for the early human peopling of the region, as indicated by the archaeological record of Agua de la Cueva rockshelter (200 km north) with an initial occupation dated to 10,950  $\pm$  190 <sup>14</sup>C yr BP (García et al. 1999).

Nevertheless, this is not a proof for the interaction between man and megafauna. On the contrary, the signals are scarce (Semper and Lagiglia 1962-1968; Lagiglia 1979) and eventually suggest a very sporadic presence of man at the site during the Pleistocene-Holocene transition. Otherwise, although attention has been focused on the overlap of dates from dung and charcoal samples, better proof is still needed for the cultural origin of that charcoal. The absence of burnt dung in the area of R8/9 suggests that no natural fires expanding throughout the site would have occurred, so the charcoal recorded could have a cultural origin. Notwithstanding, recent observations point out marked

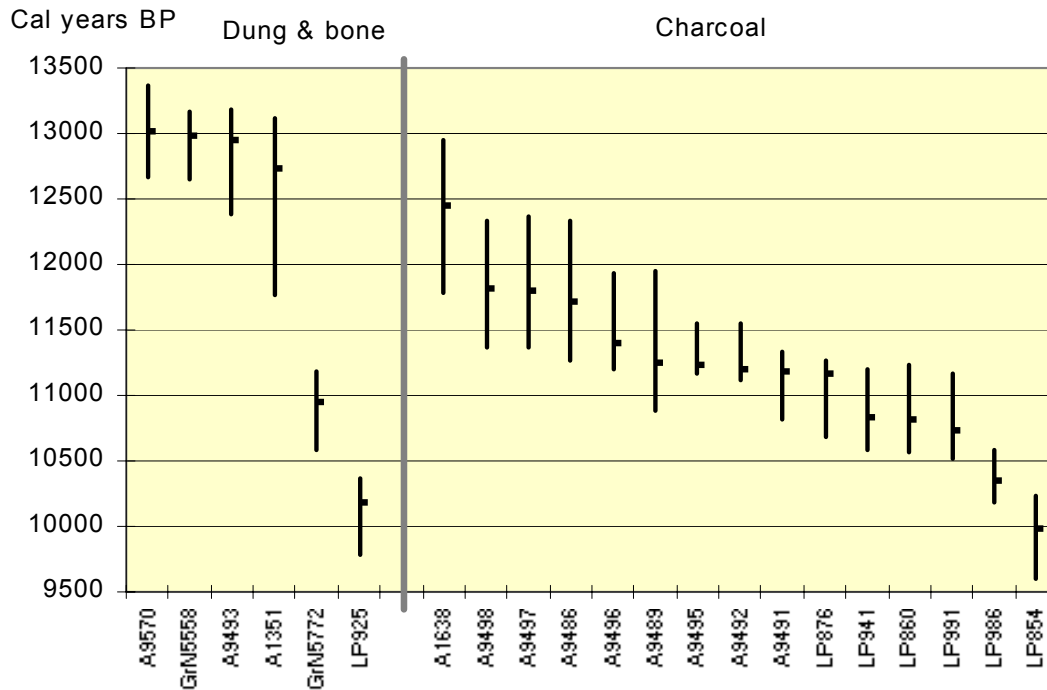


Figure 4 Overlap of probability ranges of calibrated dates ( $2\sigma$ )

stratigraphic differences at neighboring areas of the site (García 2001), whereas the sole presence of definite charcoal patches or lines does not imply a cultural origin (García and Zárata 1999).

Due to the scarcity of lithic artifacts (Lagiglia 1979) and their lack of direct association with the charcoal and megafauna items (Borrero 2002), the most fruitful way to prove the interaction of man and Pleistocene megafauna (not considering new excavations in the central area of the site) seems to be the study of the osseous material showing probable cultural marks, discovered at the right area of the shelter (Semper and Lagiglia 1962–1968; García and Lagiglia 1999).

## CONCLUSIONS

The  $^{14}\text{C}$  dates from Gruta del Indio indicate that several episodes of charcoal burning occurred during at least the last 1400 cal yr of existence of the Pleistocene megafauna around the site. If the cultural character of that charcoal is accepted (Long et al. 1998) and an effective interaction is assumed (Lagiglia 1974), the time of coexistence between man and Pleistocene megafauna in the area could be so prolonged as to allow interaction and the incidence of the former to the extinction. However, to prove that interaction, firmer, more solid evidence is still required, which could come from the future discovery of cultural artifacts and megafauna items in direct association or from the analysis of use-traces and fractures on the archaeofaunistic material presently available.

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