NEW RADIOCARBON AGES OF LUZIA WOMAN, LAPA VERMELHA IV SITE, LAGOA SANTA, MINAS GERAIS, BRAZIL

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ABSTRACT. Luzia woman is considered one of the oldest Paleoindian skeletons found in the Americas. Luzia was found at the Lapa Vermelha IV site (Lagoa Santa, Minas Gerais, Brazil) in 1975 by the archaeologist Annette Laming-Emperaire (1917–1977) who sent to the Gif laboratory charcoals collected in the vicinity of the skeleton for radiocarbon dating. Twenty-nine charcoal samples were dated from different levels of the stratigraphy of the cave (Délibrias et al. 1986). Recently, new charcoal samples were discovered within Laming-Emperaire's correspondence and were subsequently dated by the Saclay AMS laboratory. The new results confirm the age of Luzia; however, the ages correspond to the younger part of the interval: charcoals found near Luzia's skull give an age of 10,030 ± 60 ^{14}C yr BP (11,243–11,710 cal BP).

INTRODUCTION

For at least 50 years, the question of when the first humans arrived in the New World has been debated. Archaeological excavations have uncovered numerous old human settlements but few human bone remains for the late Pleistocene were found. Peter Wilhelm Lund (1842, 1844) first discovered human skeletons in the vicinity of Pleistocene extinct mammals remains in the Lagoa Santa region (Minas Gerais), suggesting an ancient human presence in the Americas. Despite the importance of these findings, it was more than a century later that excavations began again. In the same region, Hurt (1960) and Hurt and Blasi (1969) confirmed the evidence of old settlements at Cerca Grande (between 9 and 10 ka BP but no fossil bones were found during these investigations). Between 1973 and 1976, a French/Brazilian team supervised by Annette Laming-Emperaire excavated the large rockshelter Lapa Vermelha IV. Few artifacts were found, but the discovery of fossil mammal remains and bones belonging to a woman revived interest in this site. Numerous radiocarbon dates were obtained (Délibrias et al. 1986) bracketing the age of the skeleton between 10,200 ± 220 and 12,960 ± 300 ^{14}C yr BP. The unexpected death of Laming-Emperaire in 1977 brought the study to a halt again.

The skeleton belongs to a woman aged 20–25 yr, measuring 1.5 m and was called Luzia. At the time, she was the oldest known American but was joined later by other candidates for the title. A direct dating of Luzia's bones was attempted, but unfortunately no collagen was preserved and the organic residue (mainly the humic acids generally considered a contaminant) returned an age of 9330 ± 60 BP (Beta 84439) (Prous and Fogaça 1999; Araujo et al. 2005). The true age of the skeleton was believed to be older.

Although Laming-Emperaire believed that the human skull had been found *in situ*, Mello e Alvim (1977) pointed out that the bones of the skeleton are intrusive, since the skull, mandible, left tibia, and femur were found at 12.9, 10.45, 11.5, and between 10 and 10.2 m depth, respectively (Figure 2 from Laming-Emperaire et al. 1975). However, André Prous (in Hurt 1986) reported that the human skull and remains of a giant sloth (*Scelidotherium*) dated to 9580 ± 200 ^{14}C yr BP were both colored red, indicating that they belong to the same stratigraphic unit. All these uncertainties raised some doubts about the antiquity of Luzia, especially as detailed craniometric analyses suggested an African and/or Australian origin for this ancient population of the Lagoa Santa area (Neves et al. 1999). This interpretation is controversial; however, some new data about the chronology of the archaeological levels are likely to frame this new debate.

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Recently, a search in the Gif laboratory archives led to the discovery of several mail envelopes sent by Laming-Emperaire containing a few mg of charcoals found near the Luzia skeleton. We present here these new dating results.

MATERIAL AND METHODS

The rockshelter of Lapa Vermelha IV (19°40′S, 43°54′W) is located in Pedro Leopoldo county, Lagoa Santa region (Minas Gerais, central Brazil), and is part of a karstic complex of caves, shelters, and underground water channels (Laming-Emperaire et al. 1975). Descriptions and the results obtained from this site were published by Laming-Emperaire (1976, 1979), Laming-Emperaire et al. (1975), and Prous (1980).

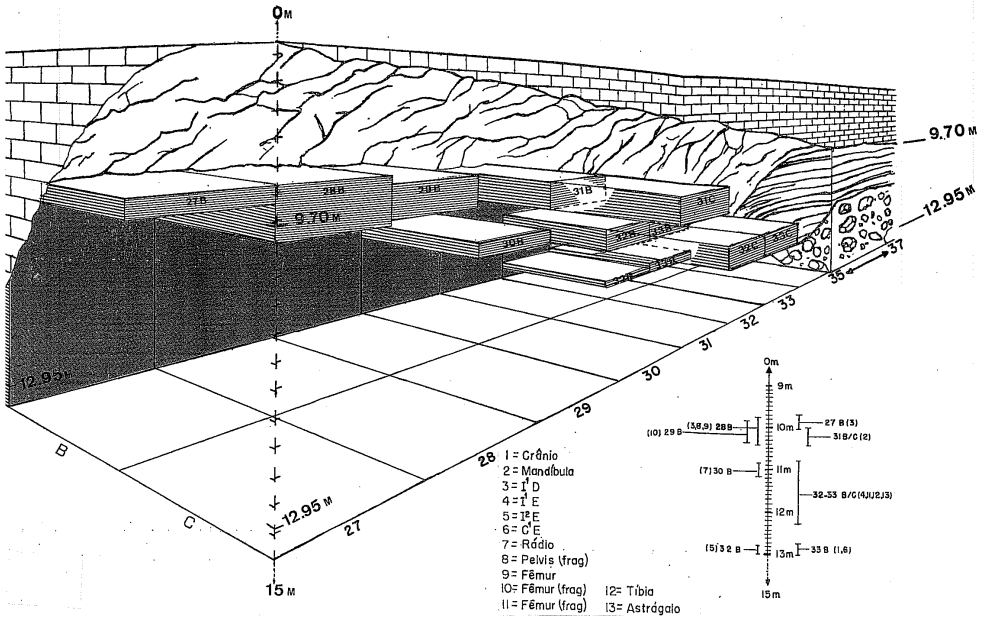

Figure 1 Schematic representation of the excavation of Lapa Vermelha Cave with the location of human bones marked (from Laming-Emperaire et al. 1975). The depths of the human remains in sector 30-33B are given in the lower part of the figure. The locations of the new samples are listed in Table 1.

Recently, James Feathers of the University of Washington asked for information concerning the Lapa Vermelha IV dates. This led to searching the Gif laboratory archives and the discovery of these forgotten samples in several envelopes mailed by Laming-Emperaire containing a few mg of charcoals certainly ignored at that time due to their quantity being far too low for beta counting. Four samples from the red sediment level were dated; their description, depth, and location within the stratigraphy are reported in Table 1. Sample reference 67 was collected near the skull in unit 33B.

Sample preparation followed the standard acid-alkali-acid (AAA) treatment: 1M HCl, 0.1M then 1M NaOH, and 0.1M and 1M HCl. All treatments were performed at room temperature either in an ultrasonic bath or under agitation. Rinsing with ultrapure water followed each step. About 1 mg of clean charcoal was then sealed in a quartz tube under vacuum with an excess of copper oxide and silver wire. Tubes were placed in an oven at 840 °C for 5 hr to transform the organic matter into CO_2. The evolved CO_2 was then reduced to obtain graphite targets prepared following the method

described by Arnold et al. (1987, 1989) and Hatté et al. (2003). Analyses were performed at the French National AMS facilities (LMC14) and results are expressed as conventional ages following Stuiver and Polach (1977). Calibrated ages are expressed as cal BP with a confidence level of 95.4% (2σ) following Stuiver and Reimer (1993) and Reimer et al. (2004).

RESULTS AND DISCUSSION

Results are reported in Table 1 and range from 3300 ± 30 to 11,100 ± 60 ^{14}C yr BP, in reasonable agreement with the stratigraphy. Sample 42 from units 27 to 29 at 11.7 m depth and sample 51 from units 32-33 at 12.6 m depth present ages similar to those obtained in the same sector of the excavations by Délibrias et al. (1986), for levels D to F and unit 32B (Gif-3907: 5400 ± 500 ^{14}C BP), respectively. Sample 91 (11,100 ± 60 ^{14}C BP) is significantly younger than sample 121 collected in the levels just below (Gif-3905: 15,300 ± 400 ^{14}C BP). These new results integrate well in the series published by Délibrias et al. (1986) and suggest that the stratigraphy of the deposits, in several sedimentary units of the cave, was disturbed or reworked as suggested by Hurt (1986) and Mello e Alvim (1977). Sample 67 of charcoal surrounding Luzia's skull gave an age of 10,030 ± 60 ^{14}C BP [11,243–11,710 cal BP, confidence level 95.4%] and confirms the antiquity of the skull as already supposed by the date of the bone organic fraction. Nevertheless, the age corresponds to the youngest estimates proposed for Luzia, who remains the oldest Brazilian paleoindian.

Table 1 References and ^{14}C ages of the charcoal samples. $\delta^{13}C$ is measured by AMS and is not representative of the carbon isotopic composition of the charcoal since it includes carbon isotope fractionation due to target preparation and fractionation within beams in the AMS. The $\delta^{13}C$ values provided by the Saclay facilities differ generally by ±3‰ from the IRMS $\delta^{13}C$ values ranging between –25‰ and –30‰ for tropical forest wood.

Lab code	Reference	Location	Depth (m)	Comments	^{14}C age BP	$\delta^{13}C$ (‰)
SacA17001/Gif-12419	42	LV-IV 27-28-29AB 17/04/75	11.70	Red sediment	3320 ± 30	–26.7
SacA17002/Gif-12420	51	LV-IV 32-33B 17/04/75 Code F26-28	12.60–12.70	Red sediment near the skull	4075 ± 35	–27.1
SacA17000/Gif-12418	67	LV-IV/33B 18/04/75	12.80–12.95	Red sediment, charcoal surrounding the skull	10,030 ± 60	–31.0
SacA17003/Gif-12421	91	LV-IV 32-33B 17/04/75 F26-28	13.15–13.55	Red sediment, similar to Gif-3905	11,100 ± 60	–21.2
Gif-3905 Délibrias et al. 1986	121	Unit 32-33 L.V.IV 75.121	13.55–14.5	Red sediment	15,300 ± 400	nd

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