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AMS ^{14}C dating of early human occupation of southern South America

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ABSTRACT

The time of appearance of a persistent and demographically-viable hunter-gatherer population in late Pleistocene southern South America must be determined by evaluating evidence from as large as possible a sample of candidate archaeological sites in the region. We co-ordinated the AMS dating of multiple bone and charcoal samples from previously-excavated strata at the following sites: Arroyo Seco 2, Paso Otero 5, Piedra Museo, and Cueva Tres Tetas (all in Argentina), and Cueva del Lago Sofia 1 and Tres Arroyos (both in Chile). With one possible exception, we did not obtain new results to confirm earlier observations of pre-Clovis-age cultural activity at any of the sites considered in this study. The possible exception, Arroyo Seco 2, is considered in detail elsewhere [Politis G., Gutierrez M.A., Scabuzzo, C. (Eds), in press. Estado actual de las Investigaciones en el sitio 2 de Arroyo Seco (región pampeana, Argentina). Serie Monográfica INCUAPA 5. Olavarría]. However, our results for the samples which were the most preferred indicators of cultural events (hearth charcoal and cut-marked bone) confirm that people were in the southern cone of South America at or soon after 11,000 BP (13,000 cal BP). Considered alongside recent age estimates for the Clovis culture in North America, these results imply the contemporaneous emergence of a consistent and archaeologically-robust human occupation signal at widely-separated locations across the Western Hemisphere. Such findings suggest that Palaeoindian demic expansion may have involved more than one terminal Pleistocene dispersal episode.

1. Introduction

Dating the earliest human occupation of the Americas by archaeological means has often been contentious. By some recent criteria, the earliest accepted date for a site from the oldest generally-recognized archaeological culture in North America, the "Clovis" culture, dates to no earlier than 11,080 ± 40 BP (the Lange-Ferguson site; Waters and Stafford, 2007). However, claims are frequently made of earlier dates for sites at widely dispersed locations throughout the Americas. Following the attention given to the case for late Pleistocene human occupation at Monte Verde in south Chile (Dillehay, 1997), interest has turned to other possible late Pleistocene archaeological sites in this and in adjacent parts of South America.[1] Although such candidates exist, in many cases the actual age of the oldest cultural evidence is poorly resolved due to ambiguities in radiocarbon dating evidence.

In this paper we draw attention to some candidate sites for a late Pleistocene human occupation of southern South America. The immediate scientific objective of this study was to obtain precise and accurate dates for late Pleistocene occupation layers from recently-excavated archaeological sites in this region, by dating multiple specimens from the oldest artefact-bearing stratigraphic units. The ultimate objective is to refine our understanding of the chronology of human expansion into the Americas, in order to constrain demographic reconstructions of this process.

The requirements for diagnosing and dating past human activity at an archaeological location are that there should be undeniable traces of humans (artefacts or skeletons) in undisturbed geological deposits, with indisputable dates (Haynes, 1969; Dincauze, 1984). A more detailed recent specification stipulates the following standards of validity for early Palaeoindian sites: there should be a consistent series of accurate and statistically precise radiometric

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[1] We will not give further consideration to the Monte Verde site in this paper. At the time of publication of the second volume of the Monte Verde monograph (Dillehay, 1997) the repeatability of the observations and interpretations was assessed both through lab and site visits by an invited panel of external evaluators (Meltzer et al., 1997), and through public discussion of the completeness and accuracy of the published excavation records (Dillehay et al., 1999; Fiedel, 1999; Grayson, 2004). The monograph and its evaluations are in the public domain, and can be assessed independently by any archaeologically-competent investigator. In our view the most interesting scientific issue is that of the presence or absence of a persistent and demographically-viable hunter-gatherer population in southern South America during the late Pleistocene, and that issue is best addressed by evaluating evidence from as large as possible a sample of additional sites in this region.

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dates (error bars <300 years), based on taxonomically-identified single objects of carefully cleaned cultural carbon (which will be considered especially reliable if fruit/seed remains or purified amino acid fraction of bones/teeth of prey animals), found in primary stratigraphic association with artefacts, and with the results documented by peer-review publication (Roosevelt et al., 2002). Some scholars would further modify this to exclude samples with errors of more than ±1% of the mean age, in radiocarbon years.

Our specific objectives in this study were to reassess the age of the earliest cultural phases of a set of early archaeological sites in southern South America (Argentina and Chile). In each case, pre-existing radiocarbon dates suggested an age contemporary with or earlier than the North American Early Palaeoindian record. We wanted, in collaboration with these sites' investigators, to submit for AMS ^{14}C dating additional previously-excavated specimens from the same stratigraphic units. Our preference was for single pieces of hearth charcoal and for clearly cut-marked animal bones. Where such specimens were not available we also accepted burnt animal bone, and animal bone which was helically fractured by dynamic impact (although we were aware that such fracture patterns are not necessarily anthropogenic (Haynes, 1983, 1988) and that the argument for human agency must therefore be made from other aspects of the archaeological context). Finally, where no modified bone was available, we accepted specimens of unmodified animal bone; but we were aware that dates on such bone would be less reliable indicators of the age of human activity, because other taphonomic agents could have caused those bones to be present in the deposits. To control for potential error in interpreting ^{14}C measurements on bone and charcoal specimens (for example due to the burning of old wood, or to the difficulty of eliminating diagenetic contaminants from bone samples), a combination of both materials was selected where possible.

2. Materials and methods

Six sites in Argentina and south Chile were selected for re-dating by AMS of potentially late Pleistocene occupation layers. Their investigators were invited to submit specimens (preferably charcoal and/or culturally-modified animal bone) from the basal cultural units. The site locations are shown in Fig. 1. The sites are summarized below, and the specimens are listed in Table 1.[2]

2.1. Site name: Arroyo Seco 2, Argentina (AS2)

2.1.1. Background

A multi-component open air site located on a low ridge between a creek and a lagoon (38°21′38″ S, 60°14′39″ W), near the town of Tres Arroyos in the Argentinean Pampas. The early component includes a lithic industry mostly composed of unifacial, marginally retouched quartzite artefacts associated with bone remains of extant (*Lama guanicoe*, *Ozotoceros bezoarticus*, *Rhea americana*) and extinct megamammals (*Megatherium americanum*, *Equus neogeus*, *Hippidion* sp., *Toxodon platensis*, *Glossotherium robustus.* and *Paleolama wedelli.*; Gutierrez, 2004; Salemme, in press). The stratum bearing these remains is, however, cut by human graves of early/mid-Holocene hunter-gatherers (dated between c. 7800 and 4500 BP; Scabuzzo and Politis, 2006; Politis et al., in press).

2.1.2. Pre-existing dates

Eleven radiocarbon dates had previously been obtained from animal bone from within the stratigraphic unit Y and S, all from specimens in close spatial and stratigraphic association with lithic artefacts, but with ages ranging from 12,240 ± 110 BP to 7320 ± 50 BP (see Politis and Steele, in press).

2.1.3. Specimens selected for this study

Four specimens of bone of extinct megamammals, in each case helically fractured through dynamic impact (see Table 1).

2.2. Site name: Cave 1, Cerro Tres Tetas, Argentina (C3T)

2.2.1. Background

Cave 1 of Cerro Tres Tetas (48°8′58″ S, 68°56′ W) is a multi-component site located in the Central Plateau of Santa Cruz Province, southern Patagonia (Argentina) at about 450 m above sea level, in a biogeographic zone characterized today by bush/shrub/steppe vegetation. The lower level of the site is characterized by the association of c. 500 lithics (including scrapers, side scrapers, bifacial tools, a chopper and a hammer) with scattered bones of *Lama guanicoe* (Paunero, 2003a).

2.2.2. Pre-existing dates

The oldest cultural deposit had previously been dated to 11,560 ± 140 BP (LP-525, a conventional ^{14}C date on hearth charcoal). The top of the basal cultural layer was dated by charcoal from a separate hearth feature to 10,260 ± 110 BP (LP-800), which gave a *terminus ante quem* for the underlying deposits.

2.2.3. Specimens selected for this study

A sample of the same large lump of charcoal which had previously been dated to 11,560 ± 140 BP, and another piece of charcoal from the same hearth (see Table 1).

2.3. Site name: Cueva del Lago Sofia 1, Chile (CLS)

2.3.1. Background

A cave (51°32′ S, 72°32′ W) located in the northern periphery of Lake Sofia, Ultima Esperanza province, Magallanes (south Chile), about 35 km from Mylodon Cave (Prieto, 1991). In the lower level a hearth was recovered which contains broken and burned bones of extinct fauna, bifacial and unifacial flakes, and bone tools (a retoucher and a bird bone awl).

2.3.2. Pre-existing dates

Two radiocarbon dates had previously been obtained from the earliest levels: 11,570 ± 60 B.P. (PITT-0684) and 12,990 ± 490 B.P. (PITT-0939) (Prieto, 1991). It is probable that the older of these dates, on unmodified animal bone (*Mylodon*) from Level 3, reflects the age of a palaeontological assemblage pre-dating human occupation (Jackson and Prieto, 2005).

2.3.3. Specimens selected for this study

Six bone specimens were submitted. The submitter's notes state that most of the specimens come from the surroundings of the Layer 2a hearth, and that they mostly bear cut-marks. However, this was not differentiated at the level of the individual specimens. The only specimen individually identified by the submitter as culturally-modified had been used as a tool, a bone retoucher (illustrated in Jackson Squella, (1989–90), figure 1c) (see Table 1).

2.4. Site name: Paso Otero 5, Argentina (PO5)

2.4.1. Background

An open air site on the bank of the Rio Quequen river in the Argentinean Pampas (38°12′08″ S, 59°06′58″ W) A single archaeological component on a palaeosol, located at the bottom of a 2.5 m-thick series of Holocene flood plain sediments

[2] We use the term "specimen" to denote the entity submitted by the investigator, and "sample" to denote the fraction of that entity which was used by an individual lab for the actual ^{14}C measurement.