Paleomagnetic Results from the Urupez Paleoindian Site, Maldonado Department, Uruguay

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The Urupez site (34° 49′ 15″ S, 55° 19′ 02″ W) is located in the Tarariras Creek basin, ca. 300 m north of the Río de la Plata (Maldonado department, Republic of Uruguay, Figure 1A). Archaeological excavations yielded a remarkable buried Paleoindian record in a deposit with two stratigraphic levels named "I" and "II," which belong to the same soil formation horizon (Figure 1B). Level I is dark gray homogeneous, compact, and plastic silty sand, and level II is yellowish brown highly compacted silty clay (Bossi 1983; Meneghin 2004). The Paleoindian level is ca. 5 cm thick and covers more than 100 m^2 at the base of level I in contact with level II. The Paleoindian record is composed of lithic artifacts—mostly debitage—and diverse unifacial and bifacial flaked tools. Among them are two projectile points, one of which is a typical "fishtail" specimen (cf. Nami 2007:Fig. 7b–c). Two charcoal samples recovered 50 m distant from each other yielded the following AMS uncalibrated dates: 10,680 ± 60 (Beta-165076) and 11,690 ± 80 (Beta-211938) RCYBP (Meneghin 2004, 2006).

A vertical paleomagnetic sampling (n = 13) was performed to study the geomagnetic field (GMF) directions in the deposit. To collect samples, cylindrical plastic containers 2.5 cm long and 2 cm diameter were carefully pushed into levels I (samples 1 to 7) and II (8 to 13 [8 to 11 belong to the Paleoindian level]), overlapping each other by about 50 percent. Their strike and dip were

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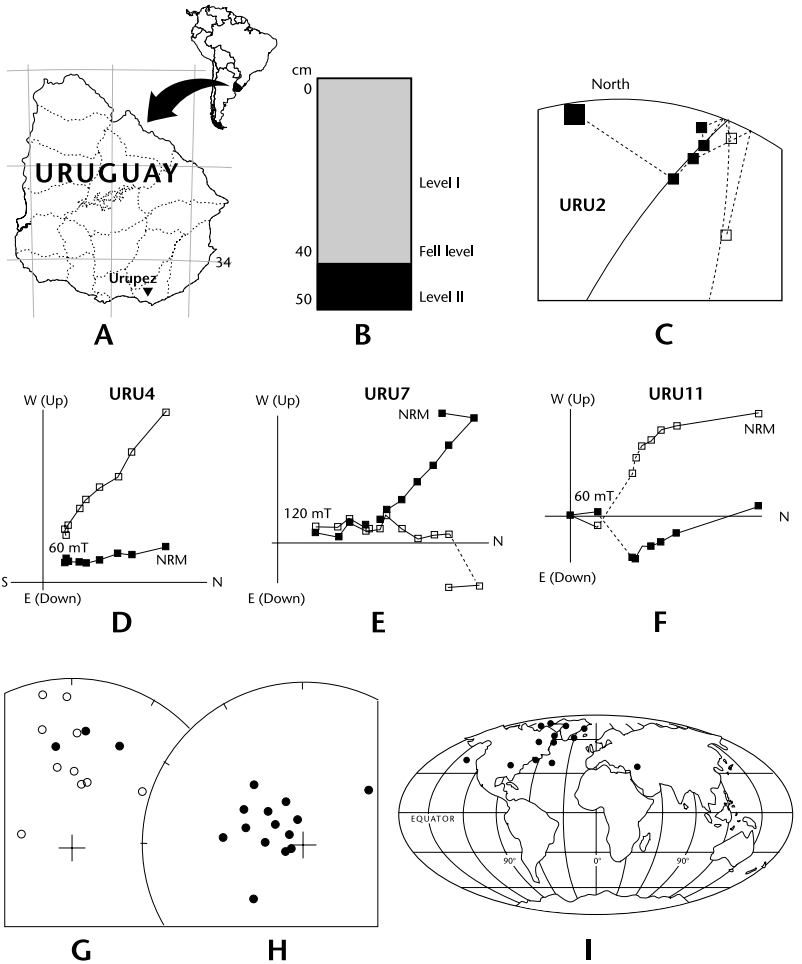

Figure 1. **A,** Location of Urupez site; **B,** schematic stratigraphic profile showing levels I and II; **C,** great circle observed during demagnetization process; **D–F,** typical Zijderveld diagrams of the samples (solid and open symbols correspond to the projection onto the horizontal and vertical planes respectively); **G,** stereoplot with the directional data (solid and open circles represent positive and negative values, respectively); **H–I,** stereoplot and world map showing the VGPs location.

measured using a Brunton compass and inclinometer; they were consolidated with sodium silicate after removal and numbered from top to bottom. All samples were subjected to progressive AF demagnetization in steps of 3, 6, 9, 12, 15, 20, 25, 30, 40 and 60 mT in a 3-axis static degausser attached to a 2G cryogenic magnetometer. Additional steps from 80 to 120 mT were used in some samples (Figure 1E). In most specimens, less than 30 percent of the NRM remained at fields of 60 mT (Figure 1D, F). Some cores showed positive and negative inclination moving in a great circle (Figure 1C). Characteristic

remnant magnetization (ChRM) was calculated using principal-components analysis (Kirschvink 1980), with the best-fitting line going to the origin in the Zijderveld diagrams (Figure 1D–F). Maximum angular deviations were generally within low values (≤ 10 degrees). Some samples had univectorial behavior (Figure 1D), while some showed two or three components (Figure 1E, F). ChRM shows either high (Figure 1D) or low negative inclinations (Figure 1F); a few showed westerly and northeasterly directions. The stereoplot (Figure 1G) shows that some directions with positive inclination values are far from the present GMF, especially those from the archaeological level. Similar results were obtained in nearby late-Pleistocene/Holocene records from northeastern Argentina. Comparable directions were observed at Arroyo Yarará (Misiones province), Barranca Pelada, San Juan, Santa Lucía (Corrientes province), and Lomas del Mirador (Buenos Aires province) (Nami 1999, 2006, in prep.). Virtual geomagnetic pole positions (VGP) calculated from the declination and inclination data are located in the Northern Hemisphere between 90° and 30° latitude, mainly in North America and Greenland (Figure 1H–I). These positions coincide with VGPs previously isolated in a number of latest-Pleistocene and Holocene sections (Mena and Nami 2002; Nami 1995, 1999, 2006, in prep.).

In summary, data from Urupez showed paleomagnetic directions similar to other latest-Pleistocene/Holocene sections in the southern cone of South America. In this sense, paleomagnetic research at this site shows that at ca. 11,000 RCYBP there were intermediate directions of magnetism. This sampling, therefore, is an additional record of GMF behavior in southeastern South America from the terminal Pleistocene to very recent times.

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