Geofísica Internacional (2007), Vol. 46, Num. 1, pp. 85-87

Short Note

Human Footprints found in Central Mexico could be at least 40,000 years old

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Resumen

Uno de los grandes debates en las investigaciones antropológicas sobre América es la edad de la migración y poblamiento humano más temprano. Nosotros pensábamos que los primeros pobladores de América provenían del centro de Siberia, y que ellos habían migrado hacia el este y cruzado a través del estrecho de Bering hace 13000 AP. Sin embargo, estudios recientes de genética sobre poblaciones y el descubrimiento de nuevos sitios han desafiado este modelo y apuntan a que la primera migración humana al continente americano es más antigua. Los resultados de estudios paleomagnéticos sobre una ceniza volcánica cerca del Lago de Valsequillo (Puebla) muestran fuertes evidencias de un poblamiento más temprano del continente americano.

Palabras clave: Paleomagnetismo, Evolución humana, Valsequillo, Ceniza Volcánica.

Abstract

Recent studies from genetics of human populations and discoveries of new occupation sites have challenged the conventional model and earlier time framework of the earliest human migration into the American continent. Paleomagnetic analyses of a volcanic ash layer near Valsequillo, central Mexico, yields strong evidence of early arrival of humans in America.

Key words: Paleomagnetism, Human Evolution, Valsequillo, Volcanic Ash.

Introduction

Reports on human occupation in the American continent with dates considerably older than the Clovis sites have met with some skepticism. The Valsequillo site, south of Puebla, Mexico (1-3), contains what appear to be human and animal footprints in the upper bedding surface of the Xalnene volcanic ash layer (3). This layer has now been dated to 39 ka by means of optically stimulated luminescence analysis, in evidence that America was colonized earlier than was formerly believed. The same ash layer had been dated as 1.30 ± 0.03 Ma by Ar-Ar systematics (1). Paleomagnetic analysis of nine non-oriented samples (1) also showed that the ash is reversely magnetized, which is consistent with a date of 1.77 to about 1.07 Ma, or chron C1r.2r.

Figure 1 summarizes our recent results of detailed paleomagnetic and rock magnetic analysis of 16 samples of Xalnene ash collected at two different localities, and 8 standard paleomagnetic cores from nearby Toluquilla volcano. The Xalnene ash most probably originates from this volcano. These samples are oriented by both magnetic and sun compasses. The ash yields apparently stable univectorial magnetization carried by Ti-poor titanomagnetite, observed upon alternating field demagnetization and continuous susceptibility vs. temperature measurements. The ash layer which contains the footprints (18°55'21.8'' N and 98°09'21.5'' W) yields reasonably well-grouped mean paleomagnetic directions of Inc=17.8°, Dec=280.2°, a95=6.8°, k=52, N=10.

As the mechanism and nature of the remanent magnetization are controversial (4), we do not hazard a firm conclusion about the geomagnetic significance of the intermediate paleodirections. However, a nearby ash locality (18°55'23.8'' N and 98°09'22.3'' W) differs in lithology and lacks footprint evidence but yields rather similar paleodirections (Inc=13.0°, Dec=264.6° a95=6.4°, k=99, N=6). As for the Toluquilla lava, characteristic multicomponent magnetization was successfully isolated after applying a 20 mT peak alternating field. The site mean directions are Inc=-36.4°, Dec=189.5°, a95=5.8°,

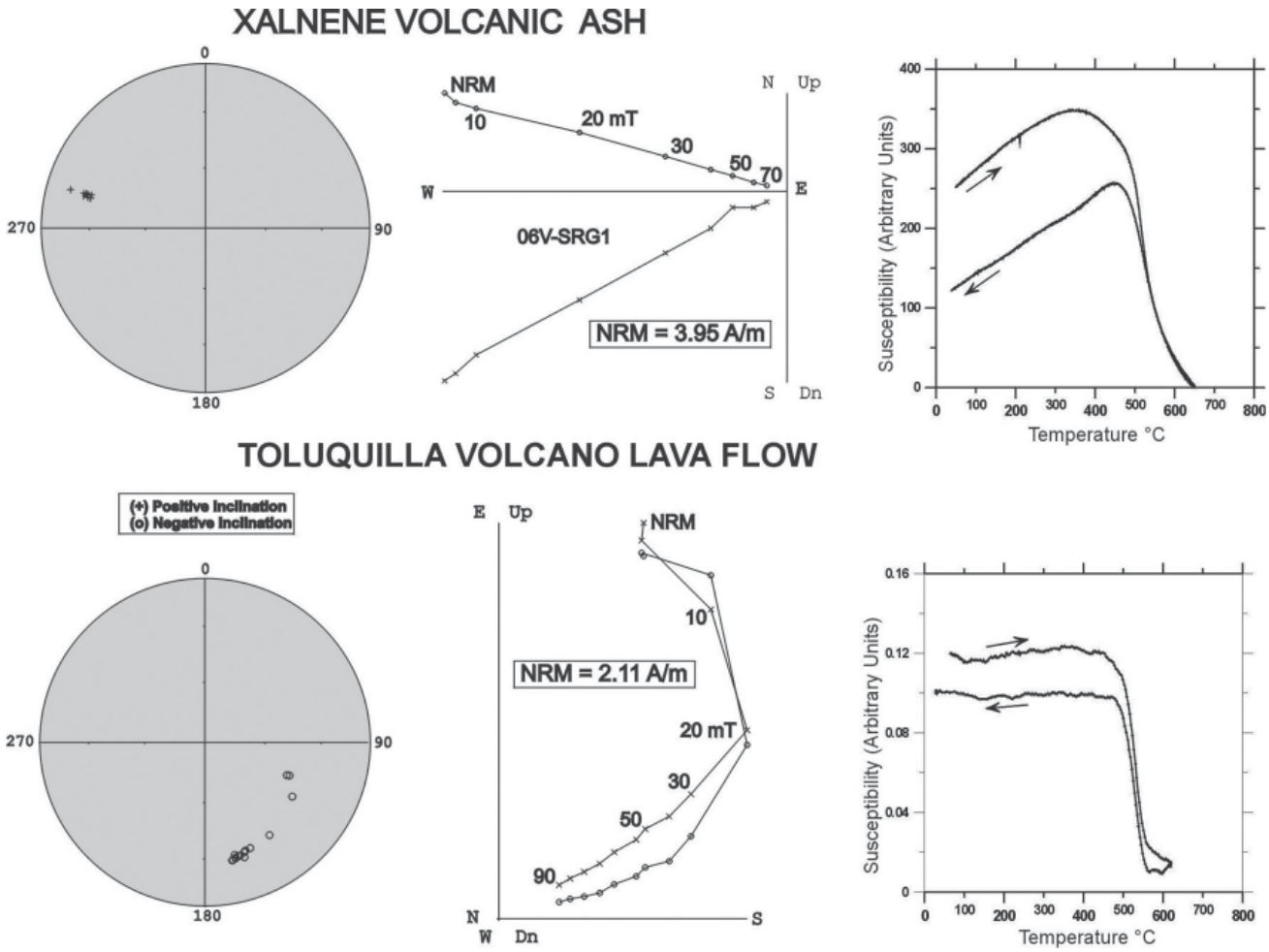

Fig. 1. Equal area diagrams and orthogonal vector plots of stepwise alternating field demagnetization (stratigraphic coordinates). The numbers refer to peak alternating fields in mT. o – projections into the horizontal plane, x – projections into the vertical plane. NRM – natural remanent magnetization. Also shown are susceptibility vs. temperature curves. The arrows indicate the heating and cooling curves.

k=101, N=8 with a mean absolute paleointensity of 17.7 ± 0.7. Note that this value is less than half of the present-day geomagnetic field strength in central Mexico. It might correspond to the transitional geomagnetic field regime.

In summary, our paleomagnetic investigation yields an intermediate magnetic polarity for the Xalnene ash deposits while nearby Toluquilla volcano is reversely magnetized. Moreover, the absolute geomagnetic paleointensity is significantly reduced. The previous interpretation based on a supposed reverse polarity of the Xalnene ash layer plus the age determination of 1.3 Ma made a human origin of the footprints very unlikely. No evidence of an intermediate field exists within chron C1r.2r. As hominid tracks as old as 1.3 Ma seems remote on the American continent, an alternative interpretation suggests that the intermediate polarity of the Xalnene ash and the reverse polarity of the volcanic lava both originated during the Laschamp geomagnetic event, 45 ka to about 39 ka ago. The Laschamp geomagnetic excursion was first discovered in the Massif Central, France, in the 1960s (5). It remains one of the best-documented recent geomagnetic excursions and has worldwide expression (6). Our interpretation would suggest that Valsequillo is one of the earliest sites of human occupation in America and that it represents significant evidence of early arrival of humans. The origins, the timing, and the route followed by the first colonizers of the American continent remain one of the important topics in human evolution (7-8).

Acknowledgements

This study was supported by UNAM-DGAPA project IN102007.

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