

A Detailed Record of Brunhes-Matuyama Geomagnetic Reversal in Tlalpan Paleosols (Central Mexico)

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Abstract: Barranca Tlalpan (19 ° 27'54" N, 98 ° 18'37.2 " W) belongs to the state of Tlaxcala in central Mexico . The studied profile contains a 15 m thick sequence of 7 consecutive paleosols separated by compacted tephra. The sequence is capped by a Holocene soil with remains of pre-Hispanic pottery and artifacts. Morphologically, the soils are grouped into three distinct units: Gray Unit (30-303 cm depth) below the modern floor, consisting of 2 Stagnic Luvisols P1 and P2. Two radiocarbon dates for the upper part of the sequence were obtained from humus of PD2 and an AMS dating of CaCO₃ concretions of PD1. The Brown Unit (303-1168 cm depth) , with three Haplic Luvisols and a Duric Network Unit with no dates because the lack of humus and carbonates. The Red Unit (1168-1528 cm depth) comprises 2 Chromic Luvisols P6 and P7. It is in the P6 (1238 to 1393 cm) paleosol where the change of polarity (Fig. 1) is observed. A K / Ar dating of 0.9 + / -0.3 Ma of underlying volcanic rocks of the paleosol P7 was obtained. The section was previously studied to obtain paleoclimate proxies (Sedov et al., 2009, Solís-Castillo, et al., 2012).

Oriented blocks were obtained from P5, P6 and P7. They were consolidated and subsampled every 2 cm in laboratory in order to get 8 cm³ cubic sample boxes. The samples were demagnetized by peak alternating fields up to 100 milliTesla and the characteristic magnetizations calculated by vectorial diagrams using principal component analysis.

The sequence begins at 1153 cm depth in P5 section and until 1301 shows a mean direction of 44.4 degrees of inclination and a declination of 344°, with $\alpha_{95}=4.2$ (Fig. 1). The green square corresponds to the beginning of inversion with variation in inclination from 44.4 to -5.1° and from 322.8 to 199.1° for declination. Between 1319 and 1436 cm (red square) a zone of intermediate polarity is observed, where the inclinations are both negative and positive. Then a stabilization of inclination values are observed reaching -24.8° (blue square). The sequence ends between 1505 to 1523 cm with a mean direction of -44° of inclination and 168° of declination with $\alpha_{95}=9.3$. These results are supported by positive reversal test. Judging from the stratigraphic context and radiometric age determinations, the

polarity transition observed most probably correspond to the Brunhes - Matuyama transitions. Some directional unstable fluctuations observed prior the transition may be interpreted as reversal precursor which seems to be a worldwide feature.

Keywords: paleosecular variation, polarity inversion, paleosols, rock magnetism

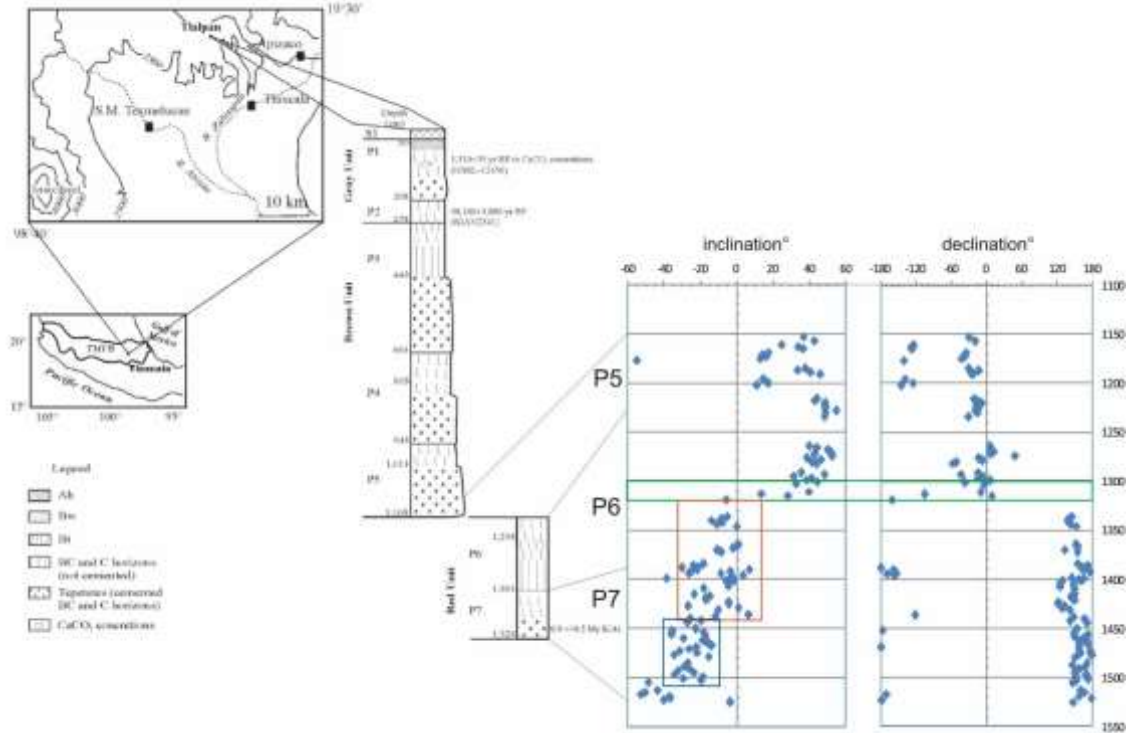


Figure 1: Location of pedostratigraphic units at Tlalpan together with mean paleomagnetic directions (Modified from Solís-Castillo et al., 2012)

References :

Sedov, S., Solleiro-Rebolledo, E., Terhorst, B., Solé, J., Flores Delgadillo, M.L., Werner, G. and Poetsch, T., 2009. The Tlaxcala basin paleosols sequence. A multiscale proxy of middle to late Quaternary environmental change in central Mexico. *Revista Mexicana de Ciencias Geológicas*, vol.26, no. 2, p. 448-465.

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