LATE-HOLOCENE GEOMAGNETIC SECULAR VARIATION IN THE SOUTHERN ARGENTINA: TOWARDS THE CONSTRUCTION OF REGIONAL TYPE CURVES

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ABSTRACT

This work presents a high-resolution paleomagnetic and rock magnetic study of two cores collected at Laguna Carmen (Tierra del Fuego, Patagonia, Argentina). Palaeomagnetic and rock magnetic data show that the sample sequence is magnetically homogeneous. Rock magnetic data analysis suggests that the remanence signal is carried by titano(magnetite) grains in stable pseudo single domain (PSD) state. The sequence is characterised by well-defined paleomagnetic properties and can be used to reconstruct a continuous stratigraphic record that provides high-resolution paleosecular variation curves (PSV) for the period 1000-4200 years. The constructed PSV curves are in very good agreement with the available records of Southern Argentina, implying very promising results in the construction of curve patterns for the region.

**Keywords**: Paleosecular Variation, Southern Argentina

RESUMEN

En este trabajo se presentan los estudios de paleomagnetismo y magnetismo de rocas de dos testigos recolectados en la Laguna Carmen (Tierra del Fuego, Patagonia, Argentina). Los resultados muestran que la secuencia es homogénea desde el punto de vista magnético. Los estudios de magnetismo de rocas muestran que la remanencia la portan granos de (titano)magnetita de dominio pseudo-simple (DPS). La secuencia se caracteriza por propiedades paleomagnéticas bien definidas que pueden usarse para reconstruir un registro estratigráfico continuo que proporciona curvas paleoseculares (VPS) de alta resolución para el periodo 1000-4200 años. Las VPS se muestran en concordancia con los registros disponibles en el Sur de Argentina, lo que implica resultados muy prometedores en la construcción de curvas patrones para la región.

Palabras Claves: Variaciones Paleoseculares, Sur de Argentina

1. Location of the cores and sampling

Laguna Carmen (68.3167°W 53.6833°S) is a body of shallow water fed by short and temporary courses of water with pluvio-nival regime, located 29 m a.s.l. Its form is sub-circular, with a rectilinear extension of 1 km in N-W direction. The major axis is 1.74 km in N-S direction while the minor axis is 1.62 km in W-E direction. It has a perimeter of 7.13 km and an area of 1.97 km^2. It is the depocenter of a closed basin located in a mountain system with strong fluvial dissection and general slope towards the NE (Coronato *et al.*, 2017)

Two short cores were collected using a Livingstone piston corer during the 2011 Southern fall at a depth of 1.5 m below lake level (bll) some meters apart from each other (Fig. 1). The cores were named LCTF 1 and LCTF 2. Sediments were cored into plastic tubes, of 60 mm in inner diameter. After dividing the cores, each core section was sub-sampled for palaeomagnetic and rock magnetic measurements at the laboratory of the Institute of Andean Studies "Don Pablo Groeber" located in Buenos Aires city. Both cores were photographed and their lithology described.
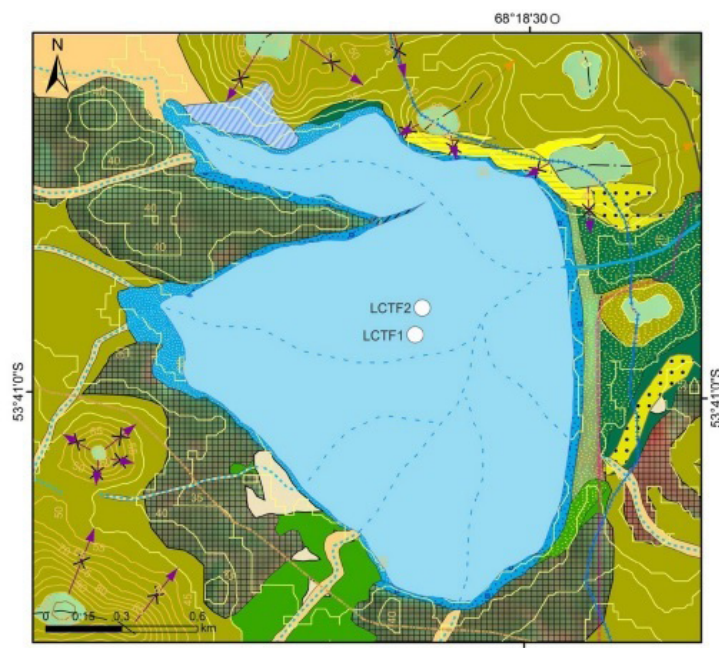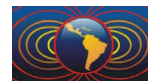
Figure 1. Locations of the analyzed cores are shown on the map (modified from Coronato *et al*., 2017).

2. Sedimentological studies

Sedimentology studies show that the sediment cores are composed mainly of massive silt with thin layers of silty sand. Both cores are divided in three units a, b and c (Coronato *et al*., 2017).

3. Methodology

The measurements of the natural remanent magnetization (NRM) of all samples were carried out at the laboratory of Paleomagnetism and Environmental Magnetism in Tandil (Buenos Aires, Argentina). Alternating Field (AF) demagnetisation and principal component analysis (Kirschvink, 1980) were applied to determine the characteristic stable inclinations and declinations of NRM. Stability of the magnetization was analyzed by alternating field (AF) demagnetisation. Samples were demagnetized successively at peak fields of from 5 to 100 mT. Rock magnetic measurements were performed to characterise the magnetic minerals contained within the sediments.

4. Paleomagnetic Curves

Typical examples of vector endpoint diagrams during progressive AF demagnetisation show a stable primary remanence pointing toward the origin after demagnetisation up to 100 mT. Paleomagnetic directions were calculated by fitting a linear regression line to minimise the Maximum Angular Deviation MAD. These values were generally smaller than 5°, providing evidence that the paleomagnetic directions are stable and well determined. Using the radiocarbon chronology, the stacked PSV of the characteristic remanent magnetization ChRM directions from LCTF were constructed (Fig. 2).

To attest the fidelity of the geomagnetic field records, we compared the stacked PSV curves obtained for cores LCTF1 and LCTF2, with the nearest available reference PSV curves (with a distance < 250 km) for Laguna Potrok Aike (51°58′S, 70°23′W; Gogorza *et al*., 2012) over the same time interval (Fig. 3). Following the strategy suggested by (Yang *et al*., 2012), both inclination and declination were used to correlate the records synchronously because the geomagnetic field is a vector. The PSV record of Laguna Carmen cores clearly show the major maxima and minima in inclination (i1–i5) and declination (d1–d5) as seen in PSV records of Laguna Potrok Aike, indicating the same sources of the Earth's magnetic field variation.
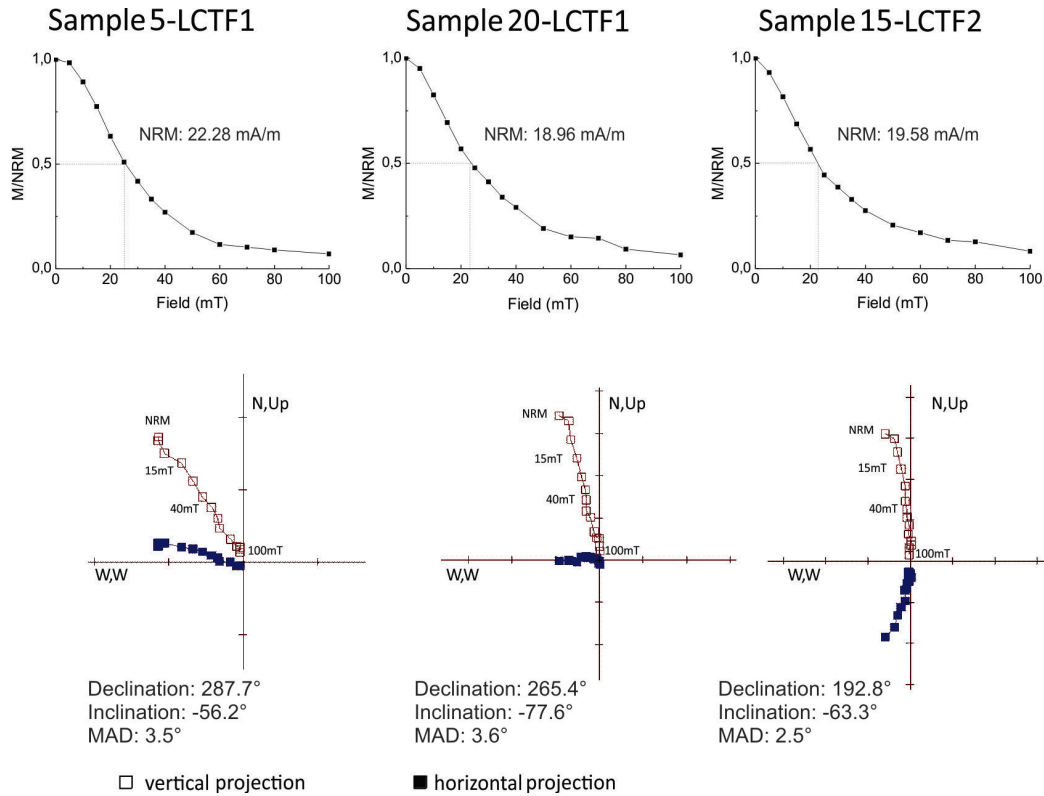
Figure 2. Normalized intensity decay curves and orthogonal vector plots for three pilot samples from LCTF1 and LCTF2 cores, produced by stepwise AF demagnetization at 5–10 mT steps, up to a maximum field of 100 mT.
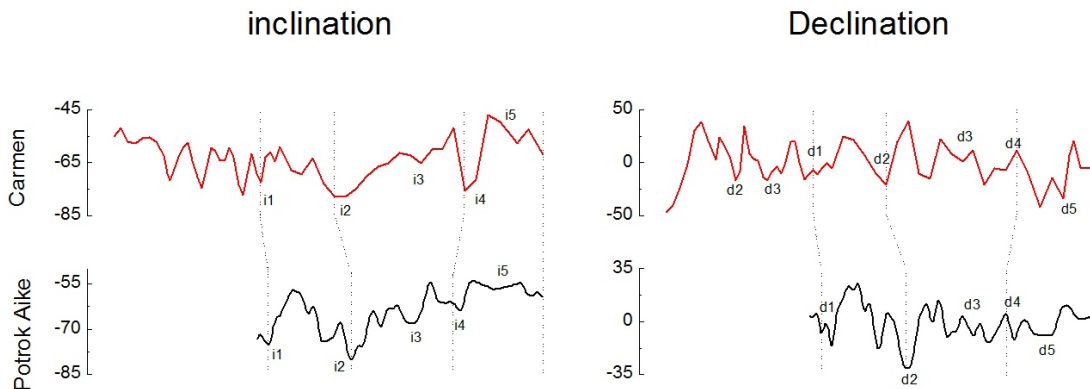
Figure 3. Plots of inclination and declination for Laguna Carmen and Laguna Potrok Aike.

5. Conclusions

The secular variations of the geomagnetic field derived from Laguna Carmen show a generally consistent pattern with the records from Laguna Potrok Aike within the age dating uncertainties. In particular, a series of peaks and lows were clearly defined in the inclination and declination curves in the period 1000-4200 years. The good coincidence between both records provides a promising approach to refining the chronology of the sediments and encourages us to deduce the general pattern for Southern Argentina.

Acknowledgements

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