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High-resolution Late Pleistocene paleomagnetic secular variation record from Laguna Potrok Aike, Southern Patagonia (Argentina): preliminary results from the ICDP-PASADO drilling

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Abstract

Here we present preliminary results of a high-resolution full vector paleomagnetic reconstruction from the southernmost continental scientific drilling site Laguna Potrok Aike, Argentina (52°S). Magnetic analyses of the long PASADO-ICDP composite record are currently underway at the Sedimentary paleomagnetism laboratory of the Institut des sciences de la mer de Rimouski (ISMER) and reveal high quality paleomagnetic data.

Introduction

High-resolution paleomagnetic reconstructions from sedimentary sequences are scarce in the Southern Hemisphere. Therefore, the millennial- to centennial-scale variability of the geomagnetic field is under-represented in the Southern Hemisphere relative to the Northern Hemisphere and the possible global nature of that variability cannot be assessed. Here we present the first high-resolution Late Pleistocene paleomagnetic secular variation (PSV) reconstruction from the continental archive Laguna Potrok Aike south of 42°S in South America. Laguna Potrok Aike (51°58'S, 70°23'W) is a maar lake located in the Pali Aike Volcanic Field in southern Patagonia (Argentina) (Figure 1). Previous studies revealed very high Holocene sedimentation rates (> 100 cm/ka; Haberzettl et al., 2007) in the center of the lake. Because of its geographic location in the mid-latitudes of the southern hemisphere and its high sedimentation rates, Laguna Potrok Aike is a key site for paleoenvironmental and paleomagnetic studies. During the austral spring 2008, the multi-national Potrok Aike maar lake Sediment Archive Drilling prOject (PASADO) science team successfully drilled two ~100 m holes under the framework of the International Continental scientific Drilling Program (ICDP) (Zolitschka et al., 2009).

Main

A preliminary Holocene age model of the PASADO-ICDP core based on comparison of magnetic susceptibility data from that core with a well-dated (radiocarbon-and tephra-based chronology) core located nearby in the center of the lake (PTA03-12; Haberzettl et al., 2007) indicates a deposition of ~19 m of lacustrine sediments since 16 ka cal BP. Hysteresis measurements using an alternating gradient force magnetometer were completed on 64 samples from the uppermost 25 m of the composite sequence. The results indicate a magnetic assemblage dominated by magnetite grains in the pseudo-single domain range. Principal component analysis (PCA) inclination and declination profiles were constructed from the stepwise alternating field demagnetization of the natural remanent magnetization (NRM) measured on u-channel samples at 1 cm intervals using a 2G Enterprises cryogenic magnetometer. The PCA inclinations vary around the expected geocentric axial dipole (GAD) inclination for the latitude of the coring site and the maximum angular deviation (MAD) values are generally lower than 5°, indicating high quality paleomagnetic data. Furthermore, the PASADO-ICDP paleosecular variation (PSV) record for the last 16 ka cal BP displays similar variations as the available records from marine sediments in the South Atlantic, South Pacific and Southern oceans, as well as from lacustrine sediments further north in Argentina. Altogether, the preliminary results indicate a genuine geomagnetic origin of the signal and indicate the great potential of the drilled core for further paleomagnetic investigations which will be accomplished within the next year.

These preliminary results are part of a PhD project with the following main scientific objectives: 1) reconstruct the full geomagnetic vector (inclination, declination and relative paleointensity) of the PASADO-ICDP composite profile (~106 m), 2) use magnetostratigraphy as a regional



chronostratigraphic tool for Laguna Potrok Aike, in addition to radiocarbon, luminescence, uranium isotopes series and tephrochronology dating approaches, 3) develop paleoenvironmental proxies of rapid climate changes using magnetic properties of the sediment.



Figure 1. Laguna Potrok Aike ($51^{\circ}58'S$, $70^{\circ}23'W$) is a maar lake located in the the Pali Aike Volcanic Field of southern Patagonia (Argentina). The maximum lake diameter is ~ 3.5 km and the maximum water depth is ~ 100 m. The picture was taken from a nearby scoria cone named the "Mexican hat". Typical volcanic rocks of this geologic structure are visible on the lower right.

References

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