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Environmental magnetism from Zirahuen lake sediments, Michoacan, Mexico

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Rock magnetic analysis and geochemical non-magnetic parameters in sediments from Zirahuen lake (central Mexico) provide the basis for an interpretation of past environmental conditions for the Holocene and times short older. Geochemical analysis includes total organic and inorganic carbon (TOC, TIC), X ray fluorescence, carbon and nitrogen ratios.

Zirahuen lake is located at the center of the Trans Mexican Volcanic Belt (TMVB) (19˚ 26´ N, 101˚ 45´ W, 2,075 m asl). The area has a warm (12-18 ˚C), sub-humid (800-1200 mm/year) climate with a rainy season from June to October. Dominant vegetation is deciduous forest. Zirahuen is a tropical oligotrophic-monomictic lake, with maximum depth of ca. 48 m. Two sets of cores were recovered. One set of three parallel cores between 0.4 and 6 m long in the deepest central part, and a second set of three cores between 4 and 6.5 m long at the shallow littoral.

Sediments are characterized by alternated laminations and little strata (few millimeters to 7 cm). There have been identified three principal litostratigraphic units. The youngest, Unit 1, of dark brown clay (2003 AD – 2000 BC). Unit 2 is composed by brown silt, with white diatom oozes (2000 - 6800 BC); and the oldest, Unit 3, by brown fine-grained sandy silt (6800 – 9600 BC). Time scale was established by eleven 14-C dates in the deepest part core, and by nine in the littoral core. The age of bottom sediments yielded an age of ca. 10,020 yrs. B.P. (9590 BC) and 14,000 yrs BP (14800 BC).

Magnetic susceptibility (MS) has been a good tool for core correlations between the

central and littoral cores. MS shows two principal zones. The Unit 1 has high and variable concentration of magnetic minerals, and the units 2 and 3 have a very low magnetic concentration. In general, all the rock magnetic parameters measured in the sequences show differences following the stratigraphic units. Measurements of susceptibility vs. high temperature show that magnetite and Ti-magnetite are the main magnetic phase identified in most of the analyzed layers. The S_{300} ratio shows the presence of hard magnetic minerals at the base of both sequences. Hysteresis parameters indicate the presence of multidomain and superparamagnetic granis.

Results show that the main differences among each unit are in TIC and TOC content, in variations in the concentration of magnetic and superparamagnetic minerals, and in the particle-size distribution. These reflect differences in environmental conditions along the time. It has been possible to identify periods of wet and dry conditions for every defined unit in the sequence. These initial interpretations agree with parallel studies of pollen and diatom analysis.