Paleomagnetic secular variation and environmental magnetic records for the last 600 years from Lake Petexbatun sediments in Maya lowlands

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Laguna Petexbatun is located in Maya lowlands where the Mesoamerican civilization developed prior to the 16 Century. As a part of the research project titled “Comparative Studies on Ancient American Civilizations,” several core samples were recovered for paleoenvironmental analysis mainly from a depression of about 40 m deep in the lake bottom. The sediments in the depression consist of grey mud with relatively thick annual varves, which are utilized for core-to-core correlation and construction of a composite depth scale of about 7.5 m long. AMS radiocarbon dates of fossil leaf fragments and varve counting indicate that the composite section covers the time period for the last 600 years. We made magnetic measurement of LL-channel samples from two long piston cores and additional short cores containing surficial sediments in order to investigate paleomagnetic secular variation (PSV) records and variations of magnetic properties reflecting environmental changes. Characteristic components of remanent magnetization obtained through principal component analysis of stepwise AF demagnetization show gradual increase of inclination values from about A.D. 1600 to the present. This variation is concordant with the global PSV models such as gufm1 and pfm9k.1a, and with the IGRF12 in the topmost part. Magnetic concentration parameters, including low-field magnetic susceptibility, anhysteretic magnetization, isothermal remanent magnetization (IRM) at 1 T, and high coercivity (0.3-1.0 T) component of IRM (HIRM), show consistent variation among the cores, suggesting decadal to centennial changes of magnetic mineral flux into the lake bottom. Particularly, the variations of IRM at 1T and HIRM can be well correlated to the yearly mean and monthly smoothed sunspot number record since A.D. 1700 characterized by 11-year and 88-year cycles. Thus magnetic properties of the Lake Petexbatun sediments provide geological evidence that the Mesoamerican climate has been modulated by the solar activity.

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