

Paleo-climate Changes in NE Taiwan since 6 Ka :

Environmental Magnetic Evidences from Lacustrine Core

MHL-5A of Mei-Hua Lake in Ilan

Tien-Yen Lin¹, Teh-Quei Lee², Shu-Kun Hsu¹

1. Department of Earth Sciences and Institute of Geophysics, National Central University

2. Institute of Earth Sciences, Academia Sinica

Abstract

MHL-5A core, taken from Mei-Hua Lake in the southern Lanyang plain was studied in order to investigate the characteristics of the variations of winter monsoon and the drought-precipitation conditions in the NE Taiwan by using environmental magnetic (EM) proxies. Based on the C-14 dating, this core of 28.52 meters provides the information for the last 6000 yrs approximately.

Magnetic parameters, reflecting the abundance, the grain size, and the kinds of magnetic minerals, contained in the lake sediments, could be applied to find the paleo-climate conditions. Three different trends could be major delimited. First, the values of S-ratio, ARM, ARM/ χ_{lf} , BIRM, SIRM, and SIRM/ χ_{lf} are generally high. This reveals the dominant input of fine-grained and low oxidized ferrimagnetic magnetic minerals. Most of them are magnetite probably. Sometimes the values of these proxies become lower, implying that the increased input of relative coarser-grained magnetite and/or high oxidized magnetic minerals. However these periods did not last very long time. We propose that the climate condition is generally wet as usual. Although there might have heavy rain fall to cause the floods to bring lots of sediments into the lake, but no or very few debris flows in general occurred. Second, S-ratio, ARM, ARM/ χ_{lf} , BIRM, SIRM, and SIRM/ χ_{lf} stay very low values and almost unchanged. It obviously indicated that very few input of magnetic minerals. Certainly, it represents that the climate was very dry. Third, the values of BIRM, HIRM, SIRM, and SIRM/ χ_{lf} increased gradually but then suddenly dropped. Meanwhile, ARM and ARM/ χ_{lf} were all very low. This could be the condition that sudden and heavy rain fall induced severe debris flow to bring large amount of very coarse-grained and large amount of high oxidized magnetic minerals from upstream to flood into the lake. This might represent a very long periods of dry climate condition.

According to the compilation of the used EM proxies of the core, the paleo-climate system at northeastern Taiwan could be major compartmentalized into

three periods for the last 6 ka: (I) 5330 ~ 4600 yr BP, (II) 4600 ~ 1450 yr BP, and (III) 1450 yr BP. In period I, there were no much sediments input into the lake, occasionally might have some. In period II, there appeared many very high spikes of χ_{lf} and high HIRM values, which probably suggest very significant inputs of the paramagnetic, the superparamagnetic and/or high oxidized magnetic minerals. Also SIRM and SIRM/ χ_{lf} values were very high, implying that many fine grained ferrimagnetic minerals inputted too, especially during 4600 ~ 2700 yr BP. This period, from 4600 to 2700 yr BP, just coincides with the duration of the weakening of Kuroshio current in Okinawa trough, possibly as a result of the intensified of winter monsoon. Period III could be subdivided into period III a (1450 ~ 600 yr BP) and III b (600 yr BP ~present). The variations of ARM, SIRM, SIRM/ χ_{lf} , ARM/ χ_{lf} are generally all very small in period III a but not in period III b. In addition, the peaks of HIRM in period III b are dominantly higher than those in period III a. High oxidation induced from dry condition in period III a, which might response the Medieval Warm Period (MWP) dominating the weakening of the NE winter monsoon. Furthermore, the results of this study proposed that the NE winter monsoon started to strengthen in the beginning of the period III b, about 600 yr BP, which is coincided with the beginning of the Little Ice Age (LIA).