Latest Miocene-Pliocene Arctic environmental conditions recorded in the stable isotope composition of (U-Th)/He-dated goethite from Axel Heiberg Island

CRAYTON J. YAPP[1]* AND DAVID L. SHUSTER[2]

[1]Dept. of Earth Sciences, SMU, Dallas, TX 75275-0395 (*correspondence: cjyapp@smu.edu)

[2]Berkeley Geochronology Center, 2455 Ridge Road, Berkeley, CA 94709

Goethite (Ax-2) in a sample from the middle Eocene (~45 Ma) Buchanan Lake formation of Axel Heiberg Island, Canada (~80°N latitude) replaces wood from an Eocene forest and preserves morphological characteristics of the wood at both hand sample and thin section scales. A preliminary (U-Th)/He age determination suggests that the goethite may have crystallized in the latest Miocene-early Pliocene (*ca*. 3 to 5.5 Ma) and thus is much younger than the host Buchanan Lake Formation. If so, the D/H and $^{18}O/^{16}O$ ratios of Ax-2 offer the possibility of assessing local non-marine temperatures and isotopic characteristics of meteoric waters on the margins of the Arctic Ocean prior to the onset of Pleistocene-style glaciations in the Northern Hemisphere. The non-exchangeable structural hydrogen in the goethite has a δD value of -221‰, which implies a water δD value of about -139‰. If waters present at the time of crystallization corresponded to a meteoric water array that was essentially the same as the GMWL, the $\delta^{18}O$ value of the water would have been -18.6‰. The inferred $\delta^{18}O$ value of the ancient water on Axel Heiberg contrasts with the modern $\delta^{18}O$ value of -31‰ measured by the IAEA for average annual precipitation at nearby Ellesmere Island (~82°N latitude) and is also more positive than the modern monthly average summer (J-J-A) precipitation value of -23‰. Combined oxygen isotope and yield measurements indicate a goethite $\delta^{18}O$ value of -9.6‰ and a goethite-water $^{18}O/^{16}O$ fractionation factor of 1.0092. This implies a crystallization temperature of about 3°C. The latter value is comparable to the warmest monthly average summer temperatures recorded by the IAEA on Ellesmere Island and is much warmer than the modern average annual T of about -18°C. The $\delta^{13}C$ value of the Fe $(CO_3)OH$ component in Ax-2 goethite is 6.7‰, and its abundance implies an ambient CO_2 concentration of about 28000 ppmV. These values hint at low organic productivity and an *in situ* CO_2 source that is suggestive of locally oxidizing siderite, which may mask any admixed ancient atmospheric CO_2 signal.

Statistical evaluation of seasonal variation of trace elements in soils and tea plants from the Çayeli Cu deposit (NE Turkey)

GÜLTEN YAYLALI-ABANUZ AND NECATI TÜYSÜZ

Karadeniz Technical University Department of Geology, 61080 Trabzon TURKEY (gultenyaylali@yahoo.com)

The Eastern Black Sea region with extensive Cu-Pb-Zn deposits is the largest metallogenic belt in Turkey. On this belt, there are a number of currently operated mines and several ore occurrences with a variety of size. Çayeli Cu deposit is one of the biggest deposits in the Eastern Black Sea region. Therefore, the host rocks in the study area contain high concentrations of various ore elements. Soils deriving from such kind of ore-containing rocks and tea plants growing on these soils may also contain high element concentrations.

In order to better understand the seasonal variations in the data, soil and tea leaf samples were collected during two seasons (April 2005, October 2005) and analyzed for major elements (Mn, Al, Fe, Na, Ca, K, Mg, and P), and trace elements (As, Cd, Co, Cu, Hg, Pb, and Zn). Linear discriminant analysis was performed on the soil and plant data of the study area. Mahalanobis generalized distance of both soil and plant samples showed that there was a large difference in the concentration level of two season's data.