Geophysical Research Abstracts,
Vol. 11, EGU2009-8394, 2009
EGU General Assembly 2009

Hydrogen isotope ratios of higher plant waxes from surface sediments of lake, fjord and marine environments record rainfall variability in Chile

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Current knowledge suggests that the fractionation of hydrogen isotopes in plants is relatively constant, such that the dD values of leaf waxes derived from terrestrial plants, which obtain their hydrogen from meteoric water, have the potential to record changes in the isotopic composition of the hydrogen source. However, studies have shown that other factors, such as relative humidity and vegetation composition, may affect the dD values of leaf waxes (dDwax).

To test the use of dDwax as a proxy for changes in the hydrological cycle, we collected $\tilde{5}0$ surface sediment samples from marine, fjord and lake environments located along the Chilean coast between 22°S and 54°S. Chile provides good conditions for this proxy as the climate zones range from extremely arid in northern Chile (the Atacama Desert) through humid cool temperate to polar in southern Chile, where the rainfall amount exceeds 7000mm/year. We measured the hydrogen isotope ratios of odd-carbon-numbered, long-chain n-alkanes (C25 to C33 n-alkanes) and even-numbered, long-chain n-alkanoic acids (C22 to C30 n-alkanoic acids), which are the major lipid components of terrestrial plant epicuticular waxes. The dDwax values of both long-chain n-alkanes and n-alkanoic acids show a significant correlation with dD values of precipitation (dDp), respectively R2 = 0.74 and 0.71. This indicates that Dwax tracks overall dDp variation along the entire north-south transect independent of the type of environment and vegetation. Therefore, leaf-wax dD appears to be a valuable proxy to trace variability in the hydrological cycle in Chile.