Geophysical Research Abstracts
Vol. 15, EGU2013-7260-4, 2013
EGU General Assembly 2013

Paleoenvironmental reconstruction of Lake Azul (Azores archipelago, Portugal) and its implications for the NAO signal.

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Azores archipelago lies in the southern area of the dipole that defines the North Atlantic Oscillation (NAO). During the negative phase of the NAO, the Azores high pressure is displaced southwards allowing the storms to cross the islands increasing the precipitation in this area and also in southern Europe. This fact makes them excellent key places to perform accurate high-resolution climate reconstructions. Lake Azul (37^o 52' 21"N - 37^{o}52'21"W) is a monomictic lake infilling the volcanic complex of Sete Cidades which is located in São Miguel island. This monomictic and eutrophic lake was formed around 22000 cal. years B.P. by consecutive collapses of the underneath volcanic caldera. The last eruption of the Sete Cidades crater complex was radiocarbon-dated at 500-650 cal years B.P. At present, macrophytes are restricted to the lake shore and consist mainly of *Potamogeton spp., Myriophyllum alterniflorum, Ceratophyllum demersum, Nymphaea alba, and, Chara fragilis*. Moreover, this crater complex has steep borders mainly covered by exotic plant species, such *Cryptomeria japonica, Pittosporum undulatum and Hedychium gardnerianum*. Antropogenic changes in the catchment have occurred in the last centuries including deforestation, permanent pastures (around 31%), production forest (57%) and the human settlements.

In September 2011, fourteen sediment cores, up to 2.5 m long, were collected using a gravity corer from a UWITEC raft. A multiproxy characterization of these cores was carried out including smear slides, X-Ray Fluorescence, X-Ray diffraction, magnetic properties, diatom content, and bulk organic matter (d13C, d15N, TN, TOC). The chronological model was obtained by plant remains and pollen concentrates radiocarbon-dating. From base to top, three lithological units have been established from the retrieved cores: volcaniclastic rocks (lapilli), light grey laminated mud, and poor laminated light brown mud with frequent dark layers rich in plant debris. The radiocarbon date at the base of this fine mixture manifests the record for the last ca 650 cal. years B.P., which corresponds to the last recorded eruption. The dark brown layers are dominated by organic matter (low XRF signal and almost no diatoms) whereas light brown facies are mainly made up of terrigenous particles (high XRF signal and high content of benthic diatoms) and vascular plant macroremains. Bulk organic matter analyses have revealed that algae constitute the main compound of the organic fraction. However, the organic matter in the dark layers is composed by C3 plants, coherent with the clastic nature of this facies deposited during flood events.

Increase of precipitation, ruled by the negative phase of the NAO, together with the steep borders of the Sete Cidades crater prompts a substantial increase in the erosion of the catchment and hence an enhancement of runoff that reaches Azul Lake and the occurrence of the flood events. Therefore, identifying, characterizing and counting the dark layers would allow to reconstruct the intensity and periodicity of the negative phase of the NAO climate mode.