Holocene dust record in a NW European peat bog: A multiproxy approach

MOHAMMED ALLAN*[1], GAËL LE ROUX[2,3], SOPHIE VERHEYDEN[4], NADINE MATTIELLI[5], JÉRÉMIE BEGHIN[6], NATALIA PIOTROWSKA[7] AND NATHALIE FAGEL[1]

[1] AGEs, Département de Géologie, Université de Liège, Allée du 6 Août, B18 Sart Tilman B-4000, Liège, Belgium, (mallan@doct.ulg.ac.be; nathaliefagel@ulg.ac.be)

[2]Université de Toulouse ; INP, UPS; EcoLab (Laboratoire Ecologie Fonctionnelle et Environnement) ; ENSAT, Avenue de l'Agrobiopole, 31326 Castanet Tolosan, France,

[3]CNRS; EcoLab; 31326 Castanet Tolosan, France, (gael.leroux@ensat.fr)

[4]Royal Belgian Institute of Natural Sciences, Jenner straat 13, B-1000 Brussels, Belgium (Sophie.verheyden@naturalsciences.be)

[5]Université Libre de Bruxelles, Avenue FD. Roosevelt 50, B-1050 Bruxelles, Belgium (nmattiel@ulb.ac.be)

[6]Palaeobiogeology-Palaeobotany-Palaeopalynology, Department of Geology, University of Liege, Belgium

[7]Department of Radioisotopes, GADAM Centre of Excellence, Institute of Physics, Silesian University of Technology, Gliwice, Poland (natalia.piotrowska@polsl.pl)

Dust deposition in southern Belgium is estimated from the geochemical signature of an ombrotrophic bog. The analyses of Rare Earth Elements (REE) and lithogenic element concentrations as well as Nd isotopes were performed by HR-ICP-MS and MC-ICP-MS respectively, in a ~ 6 m peat section representing 5300 years, from 30 BC to 5300 BC dated by the ^{14}C method. REE concentration variations in peat samples were used as a dust proxy and the Nd isotopes to trace the sources. Peat humification and testate amoebae were used to evaluate hydroclimatic conditions. The range of dust deposition varied from 0.03 to 4 g m^{-2} yr^{-1}. The highest dust fluxes were observed from 800 to 600 BC, and from 3200 to 2800 BC and correspond to cold periods. The εNd values show large variability, between -5 and –13, identifying three major sources of dust: local soils, distal volcanic and desert particles. By comparing our results with the dust recorded in other peat bogs and ice cores from different latitudes, we evidence that the Misten peat is a valid archive for dust deposition.

CO_2 emissions from arc volcanism: sources, rates and uncertainties

P. ALLARD

IPGP-Sorbonne Cité, UMR7154 CNRS, 75005 Paris, France (pallard@ipgp.fr)

Arc volcanism is one key geological manifestation of chemical exchanges bewteen the Earth's mantle and surface reservoirs through plate subduction processes. Global quantification of the deep carbon cycle, in particular, requires improved knowledge of the CO_2 output from arc volcanoes, of respective carbon contributions from subducted slabs, mantle degassing and arc crusts, and hence of the porportion of total subducted carbon recycled back into deeper mantle. Here I present an updated review of theses different aspects and their uncertainties.

Chemical and isotopic data for high-temperature (450-1040°C) volcanic gases from various subduction zones worldwide, combined with melt inclusion data, provide the most pristine information on magmatic arc volatiles. High $CO_2/^3He$ ratios in these gases compared to MOR fluids evidence systematic addition of crustal-derived carbon whose origin (sudbucted sediments, altered oceanic slab, or arc crust) can be discriminated from the $\delta^{13}C$ vs $CO_2/^3He$ relationship and other geochemical tracers. In most cases, slab-derived carbon is the prevalent (70-95%) component of CO_2 emitted by arc volcanoes, except at a few documented volcanoes in continental arcs (e.g. Italy) where magma-carbonate crustal interaction is a significant to important source.

Published estimates of the global CO_2 output from arc volcanism, assessed from different proxies (fluxes of S, ^3He, ^{210}Po or/and magma supply rates), vary within an order of magnitude and, over time, tend to increase with increasing data for volcanic plume emissions but also crater lakes, hydothermal systems and soil degassing. When compared to global budgets for subducted carbon, the current figures suggest a carbon recycling efficiency of between ~50 and 100% through arc volcanism, with obvioulsy contrasted implications for the deep carbon cycle. Hence, measuring CO_2 fluxes and $\delta^{13}C$ vs $CO_2/^3He$ at much more numerous arc volcanoes worldwide is badly needed in order to better constrain this important aspect. This is one key objective of the international DECADE project sponsored by the Deep Carbon Observatory (DCO).

DOI:10.1180/minmag.2013.077.5.1