Mechanisms of deep slab hydration and related geodynamical processes

MANUELE FACCENDA[1]*, TARAS V. GERYA[1], LUIGI BURLINI[2] AND DAVID MAINPRICE[3]

[1]Insitute of Geophysics, ETH Zürich, 8092 Zürich, CH (*correspondence: faccenda@erdw.ethz.ch)
[2]Institute of Geology, ETH Zürich, 8092 Zürich, CH
[3]Geoscience Montpellier, Université Montpellier II and CNRS, Montpellier, FR

In order to investigate hydration of the slab, we performed 2D numerical models of a spontaneously bending oceanic plate using I2ELVIS code that account for visco-elasto-plastic rheologies and where fluid flow is regulated by Darcy's law. At the outer rise, bending-related slab faulting occurs and provides a pathway for water percolation in the slab. Faults generally deep trenchward, but antithetic faults are also common. Downward deep fluid flow establishes during brittle extensional deformation at the trench outer rise producing strong variation of the tectonic pressure and causing sub-hydrostatic or even negative pressure gradients along bending-related normal faults through which fluids are pumped. The results of the numerical experiment indicate that water can be transported down and stored in the bending area via serpentinization of the normal faults which have important implications for the rheology, seismicity and structure of subducting slabs.

As the slab subducts, serpentinized faults acquire a vertical position. The coupled effect of well oriented, highly anisotropic hydrous minerals (serpentine, chlorite, mica) together with high aspect ratio, fluid filled cracks due to the de-hydration of the slab under the arc-forearc system produces significant seismic anisotropy detectable by long wavelength SKS waves. We found that the anisotropy measured above subduction zones seems to be related more to the spatial distribution of the serpentinized faults in the slab than to the flow in the upper mantle.

Biogenic origin of primary and secondary organic components in marine aerosol

M.C. FACCHINI[1]* AND C.D. O'DOWD[2]

[1]Institute of Atmospheric Sciences and Climate, National Research Council, Bologna (*correspondence: mc.facchini@isac.cnr.it)
[2]Department of Experimental Physics & Environmental Change Institute, National University of Ireland Galway, Galway, Ireland (colin.odowd@nuigalway.ie)

In this work we illustrate the link between marine organic aerosol production and oceanic biological activity and we show the distinguishing characteristics of primary and secondary organic components. The results were obtained in different experiments carried out in the North Atlantic ocean in the framework of the EC project MAP. Bubble-mediated experiments carried out during phytoplankton blooms revealed that organic carbon in nascent submicron spray particles was highly enriched in the finest fraction, constituting up to 77 % in mass of the aerosol in the 0.125-0.25 micrometer size range and was almost entirely water insoluble (WIOM up to 96 ± 2 %). Proton Nuclear Magnetic analysis (1HNMR) showed that WIOM in nascent marine aerosol forms from aggregation of lipopolysaccharides exuded by phytoplankton. The water soluble fraction (WSOC) was mainly accounted for by secondary organic aerosol components (SOA). The marine aerosol WSOC was dominated by MSA and two organic N species (ammonium salts of biogenic amines) and by several oxygenated species (mainly carboxylic acids and ketons).

The results also evidence the potential important contribution of organic nitrogen to marine SOA composition.