Linking erosion rates and climatic variations in the Gulf of Lions, France: A geochemical approach

S. REVILLON[1,2], S. BERNE[1], G. BAYON[1], B. DENNIELOU[1] AND C. HEMOND[2]

[1]IFREMER Géosciences Marine, 29280, Plouzané, France (sidonie.revillon@ifremer.fr)
[2]IUEM Domaines océaniques, 29280, Plouzané, France

As a part of an integrated source-to-sink approach, we use geochemical tools to characterize the source of detrital sediments on continental margins and assess how variations in the sediment provenance during the past have been connected to global climate changes. We chose the deltaic margin of the Gulf of Lions because high sedimentation rates in this area allow accessing a high-resolution record of climate variability in Western Europe during the Late Quaternary period. During European project PROMESS 1, Hole PRGL1-4 was drilled on the continental slope of the Gulf of Lions in the Mediterranean Sea. ~ 300m of sediment cores were recovered covering the last five climatic cycles. Such a deep penetration allowed reconstructing climatic variations during the last 500 ka.

Here, we report geochemical results for sediment samples from Hole PRGL1-4 focussing on the last climatic cycle. Trace elements, Sr and Nd isotopic compositions were analysed on both silt and clay fractions. Mainly Sr and Nd isotopic compositions vary through time indicating a change in the composition of sediments deposited in the Gulf of Lions and a change in the sediment sources. This variability can be related to climatic forcing and, in particular correlate well with the imprint of so-called Heinrich events. During these cold episodes, $^{87}Sr/^{86}Sr$ ratios increase and εNd decrease toward more radiogenic values. These variations can be interpreted in term of changes in the contribution of detrital material from distinct sources. Our results suggest either, an increase of the Saharan particles contribution or a decrease in the sediment flux from the Rhône River during the same period or a combination of the two processes. These also suggest an increase in the aridity over the African continent in combination with a decrease in the erosion rates in the Rhone River catchments area.

Rheology of serpentines, seismicity and mass transfer in subduction zone

B. REYNARD[1], N. HILAIRET[1], I. DANIEL AND Y. WANG[2]

[1]Laboratoire des Sciences de la Terre, CNRS UMR 5570, Ecole normale superieure de Lyon, Universite Claude Bernard Lyon 1, 46 allee d'Italie 69364, Lyon cedex 07, 69364, France
[2]Center for Advanced Radiation Sources, The University of Chicago, 5640 S. Ellis Ave., Chicago, IL 60637, United States

Serpentinites have a lower density and lower viscosity than "dry" ultramafic rocks and it was proposed, based on numerical simulations, that they play a major role in mantle-slab decoupling, and in downward (sink) or upward (exhumation) motion of eclogites and ultra-high pressure (UHP) rocks in subduction zones. Rheological data on antigorite, the stable variety of serpentine in subduction zones, are obtained over a P-T range of 1-4 GPa and 200-500°C that cover most of its stability field. The experiments were carried out in a D-DIA apparatus installed at GSECARS on the 13-BM-D line of APS. The determined stress-strain curves were fitted to a power-law equation including both temperature and pressure dependence. The results confirm that serpentinites acts as a weak layer that allows significant mass transfer along the "serpentinized channel" and dynamic processes such as mantle slab decoupling, and mantle wedge convection. Regardless of the temperature, serpentinized mantle at the slab surface has a low viscosity that allows localizing the deformation and impeding stress build-up. It will limit the downdip propagation of large earthquakes, and allow viscous relaxation as an origin of post-seismic deformations and slow earthquakes. The low viscosity of serpentinized faults in the oceanic lithosphere makes them possible sites for subduction initiation. Models of growth and transport of a serpentinized channel using available kinetic and present rheological data explain high exhumation rates of eclogites and limited thickness of the channel at great depths ($\geq$ 50 km), and slower exhumation at in a thick hydrated mantle corner at shallower depths.