Geophysical Research Abstracts
Vol. 14, EGU2012-**PREVIEW**, 2012
EGU General Assembly 2012

Oligocene – early Miocene evolution of the Western Alps drainage divide: constraints from multidisciplinary provenance analysis

S. P. Jourdan, M.B. Bernet, T.D. Dumont, S.G. Guillot, S.S. Schwartz, and P.T. Tricart
Université de Grenoble, ISTERRE, Grenoble, France (sebastien.p.jourdan@gmail.com)

The uplift of the Western Alps mountain range since the Oligocene is driven by the collision between the Apulian and European plates. The corresponding exhumation history was often reconstructed by considering detrital thermochronology data alone. Here we present the results of a multidisciplinary approach for constraining the position of the drainage divide in the southern Western Alps during the early Oligocene to early Miocene. We traced sediment provenance and exhumation rates preserved in the pro-side (Montmaur and Barrême) and retro-side (Torino hills) foreland basins, using geochemical and petrological analyses, and detrital geo-thermochronology (U-Pb and fission-track analyses).

Major and trace-element analyses of basalt pebbles, as well as Raman spectroscopy of serpentinite sand grains and pebbles, allow the identification of potential source lithologies in the internal Western Alps, which are not easily detected with detrital thermochronology. Lower Oligocene sediments of the pro-side foreland basin contain numerous basalt pebbles that share strong geochemical similarities with the Chenaillet obducted ophiolite. Raman analysis on serpentine from the pro and retro-side foreland basin deposits documents a systematic trend from antigorite (high-grade metamorphic conditions) to lizardite (low-grade metamorphic conditions) from the early Oligocene to the early Miocene. This trend is attributed to a shift in the location of the drainage divide in the Western Alps. Ophiolite erosion and drainage divide shift strongly constrain any reconstruction of the topographic evolution of the Western Alps.
Fission-track analysis on detrital zircon and apatite from pro-side samples show that these grains were mainly derived from the internal Alps. Some zircons have fission-track cooling ages close to their depositional age, which could be related either to very fast exhumation of the source zone during the Rupelian, or to the contribution of zircons from contemporary andesitic volcanism. Fission-track/U-Pb double-dating of individual zircons allows identifying the volcanic contribution, as volcanic zircons having Oligocene U-Pb crystallization and fission-track cooling ages. This contribution is small, so that the signal of exhumation at a rate of 1.4 to 2.7 km/Myr of the internal Western Alps during the Oligocene to Miocene is persistent.

Recent numerical model show that slab retreat can be consecutive to a slab break off and permit asthenospheric inflow above sudbucting plate. We propose that in Western Alps Oligocene slab break off generate the Oligocene andesitic volcanism then slab retreat. Slab retreat allows the emplacement of the Ivrea body above the European slab. Slab retreat can also cause a diminution of strain in the Western Alps. Erosion and incision of the uplifted surface of the internal Western Alps was probably controlled by fast exhumation in front of the Ivrea mantle indenter. The rapid uplift recorded in the Oligo-Miocene sediments can be interpreted as the consequence of the vertical and forward indentation of the Ivrea mantle sliver.