Geometry, kinematics and P-T paths of the Money window (Western Alps): lower-pressure rocks overthrusted by higher-pressure ones?

Ballèvre, M.[1], Manzotti, P.[1], Le Bayon, B.[2], Le Carlier de Veslud, C.[1] & Pitra, P.[1]

[1] Géosciences Rennes, UMR-CNRS 6118, Université de Rennes 1, 35042 Rennes Cedex, France (michel.ballevre@univ-rennes1.fr)
[2] BRGM, 3, Avenue Claude-Guillemin, BP 36009 – 45060 Orléans Cedex 2, France

In the Western Alps, the polycyclic, eclogite-bearing units of the Gran Paradiso and Dora-Maira are thrusted over monocyclic, lower-grade units that contain as a diagnostic suite a sequence of graphite-rich sequences long ago thought to derive from Carboniferous sediments (Money and Pinerolo, respectively).

In detail, the Money window exposes in the Valnontey valley (Gran Paradiso massif, Western Alps) a sequence of clastic sediments and volcanics that are intruded by a granitoid body (Erfaulet metagranite). Two types of clastic sequences have been recognized. The first one essentially consists of greyish (i.e. graphite-rich) micaschists and polygenic metaconglomerates, reworking quartz veins, granitoids and some mud clasts. The second one is made of monogenic conglomerates (consisting essentially of quartz veins, with rare granitic pebbles), with a few interbedded graphite-rich micaschists. The two sequences are separated by fine-grained biotite-amphibole gneisses that display alkaline chemistry, and by albite-bearing gneisses and amphibolites. Although still uncertain, the few observed polarity criteria (graded bedding in the former conglomerate layers) are consistent with sequence 1 being older than sequence 2. In addition, this would be coherent with the transition from essentially polygenic to monogenic conglomerates (implying closer sources and /or higher relief for sequence 1 with respect to sequence 2) and a transition from graphite-rich to graphite-poor sediments (recording the climate change at the Carboniferous to Permian boundary). La-ICPMS U-Pb geochronology on detrital zircon grains and on the volcanics will be performed in order to test this hypothesis.

Detailed mapping and structural analysis has been made within the Money window, allowing recognizing four main stages of Alpine deformation. The first one is only identified as relic foliation (S1) in the cores of albite and garnet porphyroblasts, defined by the alignment of quartz, chloritoid and rutile. The second one is associated to a pervasive foliation (S2) that is parallel to the main lithological boundaries. This foliation is defined by garnet-chloritoid-white mica-rutile, and testifies to an early high-pressure event. The stretching lineation (L2) associated to this event has an E-W trend.

The third one is associated to a large-scale folding (F3) of the volcano-sedimentary sequence, and it is characterized by flat-lying axial plane with nearly E-W fold axes. The S2 schistosity is microfolded (crenulated) in the weaker lithologies, i.e. in the two clastic sequences, where a new mica-chlorite-ilmenite foliation develops. Because the F3 fold axes have a nearly E-W trend, they are almost parallel with the L2 stretching lineation. However, a minor angle is observed between the L2 stretching and the F3 fold axes, suggesting that the folds are non-cylindrical at a kilometer scale. 3D modeling of the geometry within the Money window will be displayed.

The thrust contact that separates the Money Unit from the overlying Gran Paradiso Unit predates this F3 folding event, because the mylonites at the base of the Gran Paradiso Unit are folded. Detailed petrological models will be performed in order to check the pressure difference between the hangingwall (Gran Paradiso Unit) with respect to its footwall (Money Unit). The consequences of these data with respect to existing models for the Alpine collision will be discussed.