

Rediscovery of a major alpine thrust : the Helvetic Basal Decollement

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Since two centuries the European Alps are a natural laboratory to study continental lithosphere deformation during mountain building. Since the early studies a constant question has been to evaluate the importance of vertical versus horizontal displacements in the building of reliefs. Whilst the occurrence of large thrust sheets, as initially proposed from field observations, are now well explained in the frame of plate tectonics, controversies still arise on the precise geometry, amount and timing of major thrusting during the orogeny.

We present a new detailed 3D structural study of the cover / basement relationships in the Chamonix synclinorium in between the Mont-Blanc (MB) and Aiguilles Rouges (AR) ranges, two of the main external basement ranges of the western Alps, that allows to decipher the area structural history : the Mesozoic sedimentary cover has been thrust at least 10km NW above the Helvetic Basal Décollement (HBD) prior to be offset by late steep thrusts during exhumation in the Miocene.

Such interpretation fundamentally diverges from the classical view of the sedimentary cover of the Chamonix synclinorium being expelled from a former graben during a single deformation phase, and implies that a major thrust phase lasting ~10 Ma has been overlooked. Our observations show that the HBD was a major thrust system active between ~30 and ~20 Ma, possibly until 15 Ma, with a shortening of more than 10km in the south to 20km in the north. It extends below most of the subalpine ranges and emerges in front of the Bauges and within the Chartreuse and Vercors massifs, and was rooted east of the External Crystalline Massifs (Mt-Blanc and Belledonne). During the Miocene, the HBD was cut by steep reverse faults and uplifted above the basement culmination of the ECM obscuring its continuity and precluding its recognition as a major structure even if it was previously described at several localities.

Mots-Clés : Structural Geology, Alps, 3D model, thrusting