Regional geological and local morphodynamic approaches to the Mont Blanc

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The field trip to the Brévent summit (2530 m a.s.l., Aiguilles Rouges massif) is a live introduction to the alpine landscape and the (geo)physical characteristic of the Mont Blanc massif. A twofold analysis of the relationships between geology and geomorphology of the massif will be proposed: a regional geological approach (RGA) and a local morphodynamic approach (LMA).

Application of the RGA analysis of large-scale, long-term geomorphological, lithological and structural features of the Aiguille Rouges and Mont Blanc Massif will start during the 1500 m ascent by cable car to the Brévent, when perceiving the high energy relief of the area and the powerful morphogenetic work occurred up to the present-day modeling of this imposing alpine landscape. The litho-structural units (Variscan polymetamorphic rocks, Mont Blanc Granite, Carboniferous schists, Dauphinois and Helvetic sedimentary covers), the km-wide Mont Blanc Shear Zone and other main tectonic discontinuities (thrusts and faults) will be described first as paleogeographic and tectonic markers of long-term evolutionary stages in the history of the external part of the Europe-verging Alpine chain. Therefore, lithological characters and general structure of the Massif (a series of listric wedges separated by steep fault zones) will be interpreted as general conditioning factors for modeling and stability of the mountain relief. In the long-term “geological” perspective, they represent independent variables, offering a “static” conditioning to the regional geomorphological system (e.g. constraints on hydrographic network, predisposition to natural instability as “internal” causes, lowering shear strength of slopes material).

Application of the LMA approach will follow, when describing the panoramic view of the NW side of the Mont Blanc massif. Some of its main summits over 4000 m in altitude (Aiguille Verte, Grandes Jorasses), the beautiful peaks of the Dru and the Aiguilles de Chamonix (Grands Charmoz, Blaitière, Plan), and other impressive landforms of the glacially sculpted massif will be observed. Remote recognition of local features (small scale heterogeneity of geomechanical properties, landforms indicating active geomorphological processes) will offer some relevant clues for: 1) understanding recent and present day mechanisms of relief evolution, 2) interpreting dynamic factors of natural instabilities (e.g. “external” causes of slope instability, increasing shear stress), and 3)contributing to process modelling and hazards assessment in this fragile high mountain environment, deeply affected by climate change.