



Origin and control of the gravitational movements affecting the southern part of the Belledonne massif (French Alps)

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The Belledonne massif is located in the western Alps, North East of the Grenoble city. It belongs to the external crystalline massif which extends from the Aar massif in the North to the Argentera in the South. The Belledonne massif, which was affected by the Hercynian and Alpine orogenesis is divided by the N30° near-vertical Belledonne Middle Fault (BMF) which separates a block made of micaschists to the West from a block of amphibolites, gneisses and gabbros to the East. Recently, a 50 km long alignment of earthquakes, running in a N30° direction, was pointed out on the western flank of the Belledonne massif, suggesting the presence of an active seismic fault (called BBF: Belledonne Border Fault). In the Southern part of the Belledonne massif, the examination of satellite images and aerial photos reveals the presence of a significant number of active or past large slope movements concentrated on a surface of less than 30 km² in the micaschists. Most of these landslides are located along the Romanche River. Of major concern is the large Sechilienne landslide which affects the right south-facing bank of the Romanche river and whose active part (3.10⁶ m³) threatens to dam the valley. Upstream the Sechilienne landslide, the valley widens into a diamond-shape 1 km wide basin filled with loose river sediments. The valley suddenly narrows at the vicinity of the BMF which juxtaposes micaschists and amphibolites. South of the basin, the river sediments are covered by a quaternary alluvial fan which is cut by a linear 400 m long and 20 m high scarp of unknown origin. In order to better understand the relations between these morphological features, tectonics and slope activity, a multi-field study coupling geophysical experiments, geomorphology analysis and geological observations has been initiated in this area. A geophysical

campaign including electrical resistivity tomography profiles, seismic refraction and microtremor measurements, was performed in the basin and on the alluvial fan. The results showed that the near-vertical north oriented BMF crossing at right angle the Romanche valley is horizontally displaced by about 500 m in the basin with an apparent sinistral strike slip movement and that the sediment thickness increases in the basin comparing to the valley upstream. The fault responsible for this displacement, N110 oriented, does not show any sign of recent activity. The eastward shift of the amphibolites south of this fault explains the diamond shape and the greater thickness in the basin, which both probably result from the glacial erosion of the micaschists. The location of some of the slope movements suggests that they could be linked to the basin formation, although the influence of the BBF can not be discarded.