



The groundwater system of Livigno area (north Lombardy – Italy): first results

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In the last few years, a progressive impoverishment of water resources took place in the mountain; this is due to the increase of anthropic activity and to the change in the precipitation regime. In this context, the preservation of every aquifer will acquire great importance. In particular, the mountain fissured aquifers could play a relevant role in the water supply for the mountain people, although they have a limited productivity. These aquifers, in fact, represent the main alimentation source for mountain people. However, they are made vulnerable by external factors such as the climate change and the pollution, because these springs are near to their recharge areas, therefore their circuits are short and swift. A good knowledge of the mountain hydro-geological circuits allows either their safeguard or a better exploitation. In the mountain environment, for a better reconstruction of groundwater system is suggested the multidisciplinary approach, because it permit to maximize the merit of both methods. The Livigno area represents a good test for the groundwater system reconstruction in the mountain environment because it has a complex geological and tectonical setting and because, in this area, the density of population varies greatly during the year and this generate a shortage of water in some seasons. In order to characterize this aquifer, a multidisciplinary approach, based on lithological, geochemical, hydro-geological and geo-structural methods, has been adopted. Mostly, the geo-structural methods allow to determinate the rock permeability and the hydraulic conductivity tensor, whereas the geochemical method permit to reconstruction of groundwater system.

The Livigno area is located at 1800 m s.l.m. in the central Alps (northern Lombardy – Italy). For the tectonic setting this area is comprise between the Err Bernina system (Lower Australpine) and the Ortles-Quaternals system (Upper Austroalpine). The most important regional fault is represented by Zebraù fault. This fault divides the sedimentary rocks constituted by Fraele and Monte Motto limestone (Lias) to crystalline basement, which is constituted by “Bormio phyllades” and “Punta Rossa Formation”. To the north of Zebraù fault system the Alpisella fault system outcrops and divides the Monte Motto limestone by Triassic dolomites and limestones.

The first results of geo-structural method show a general high permeability of fissured rocks. This is due the high tectonic activity, which caused by a high rock fracturation, and due the glacial tensioning, which produced an high aperture of fractures. This phenomenon is particularly evident in proximity of the ridges. This permeability values permit a high water infiltration and a deepening of water circuits.

The first results of geochemical analysis in 34 springs and rivers confirms the relative depth circuits suggested by geo-structural method. The high conductivity value of some water samples, in fact, indicates a relative depth circuit. The chemical data processing shows three groups of water: i) Ca+ Mg and SO₄ enrich water; ii) Ca+ Mg and HCO₃ enrich water; iii) a intermediate group between the first and the second group.

The next steps of work are an increase of geo-structural stations to enhance the data set for calculating the permeability tensor and to continue the geochemical analysis of springs and river associated to flow measurements for determine the groundwater system.