



Hydro-geological characterization of the mine area of Servette-Chuc (Saint Marcel, Aosta Valley - Italy): permeability calculation and relationship with groundwater system.

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This study aims at characterize the groundwater system of the mine area of Servette-Chuc (Saint Marcel, Aosta Valley, Italy), correlating the fracture systems of the rock-mass and the aquifer with the identification of the areas with different permeability. This approach allows to determine the location of aquifer reservoir and presents a good environmental relevance for the safeguard of the water resources. The study area is located in the Saint Marcel Valley, in the middle Aosta Valley, and have an extension of 2 km². At the bottom of the study area there are a particular coloured spring and a coloured stream, known as Eva Verda (Lat. 45°42'11" - Long. 7°27'21") among the local inhabitants. This particular coloured water stimulated the interest of researchers since the end of the 17th century. The first description dates back to 1784, when the French count Saint Martin de La Motte performed the earliest chemical investigations. Its notoriety since the last two centuries is due to the characteristic light green colour of its bed. This stream is situated near to the abandoned mine of Chuc, downhill the Servette mine where a pyrite-chalcopyrite ore was cultivated until 1957. The geological setting of the Saint Marcel Valley is mainly carving into Piemontese nappe sequence, that include numerous mines and Cu-Fe, Fe and Mn mineralization. Serpentinite rock, metabasites and metasediments (micashists, quartzites) outcrop in the Saint Marcel Valley. The Saint Marcel Valley is oriented N-S along an important lineament. The regional schistosity is homogeneous and is oriented N290d40.

The right slope of the valley, where is located the Servette mine, is characterized by mainly down-slope orientation. The mainly systems in the Saint Marcel Valley are the N-S system and the Aosta-Ranzola fault system oriented E-W. In the study area we have done a permeability analysis in the unsaturated fissured zone, where the water movements are governed by gravity and by the infiltration into the discontinuity, and a permeability analysis in the saturated fissured zone, where the mainly water movements are horizontal. The permeability study have been done by a structural analysis. Analyzing the permeability in the unsaturated fissured zone we have individuated two zones: the zone near the Servette mine and the zone at the SE extremity of the study area with permeability value higher then the first zone. In the Servette mine zone the permeability values are between 10^{-6} and 10^{-1} , except for the Stop 1 (Lat. $45^{\circ}42'11''$ - Long. $7^{\circ}27'01''$) that have a permeability of $2,31E+00$ m/sec. The flux direction in the unsaturated zone has a general trend along the slope hydraulic gradient. There are small exception deriving by the error in the discontinuity aperture survey or by the tectonic control. The tectonic control of the study area and the surface flux is evident in the Servette mine zone and in the SE zone. In the both zones there are tendentially an high fracturation grade and the flux deviation by the mainly trend along the measured faults. We have obtained by the permeability analysis in the saturated zone, combined along the slope hydraulic gradient, the flow value of $35,8$ m³/s. This value represent maximum flux in the considered basin.