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Water isotopes in landslide research (WIsLaR)

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In the last decade, the scientific community is trying to integrate multidisciplinary approaches to gain further insights in the knowledge of landslide initiation and evolution. In particular, isotope geochemistry is a useful investigation tool to define landslide groundwater recharge origin, groundwater flow paths, mixing phenomena between different water bodies, type of aquifer, type of groundwater transfer processes (only pressure or pressure and mass).
This paper aims at pointing out the potentiality of stable and radiogenic isotopic analyses in the study of large and deep rock landslides located in north Apennines.
In the studied landslides, the continuous monitoring of groundwater levels, groundwater flow rate from springs or mitigation works, groundwater electrical conductivity and temperature are coupled with groundwater sampling followed by determination of major and tracers ions (such as: Na+, K+, Mg2+, Ca2+, Cl−, HCO−3, SO_2−4,Btot, Sr2+), and stable (∂18O, ∂2H,) and radiogenic isotopes (87Sr/86Sr, 3H).
In this study isotopic investigations are decisive to understand hydrological processes in landslide body. More in details ∂18O, ∂2H, 87Sr/86Sr and 3H allow to define subsurface architecture, groundwater origin, groundwater flow paths and mixing phenomena between different groundwater bodies. Recharge zones are identify by means of ∂18O and ∂2H isotopes. 3H gives information about groundwater age and allows to identify deep confined layer characterized by low circulation of water and to investigate subsurface transfer processes. In the current research 3H allows to identify a deep confined aquifer in which pressure transfer prevails on mass transfer. Subsurface layers with prevalent horizontal or vertical flux are identified by means simultaneous application of ∂18O, ∂2H and 3H. The simultaneous application of ∂18O, ∂2H, 3H and 87Sr/86Sr allows to recognize hydraulic connections between groundwater and surface water. Moreover, 87Sr/86Sr coupled with 3H allow to identify multilayer aquifer within the landslide body.