Tracking deep-water rock-interactions in the Critical Zone: Evidence from geochemical and isotopic data of borehole waters from elementary watersheds (Ringelbach CZO - France).

F. CHABAUX, C. BOSIA, Y. LUCAS.

[1] Laboratoire d'Hydrologie et de Géochimie de Strasbourg (LHyGeS), Université de Strasbourg, CNRS, 1 rue Blessig, 67084 Strasbourg Cedex, France (fchabaux@unistra.fr).

The study of the diversity of flow paths and of associated water-rock interactions in Critical Zone, is a prerequisite for correctly describing, modeling and predicting its evolution in response to environmental modifications due to natural and anthropogenic forcings. It requires first the recognition and the investigation of the different hydrological compartments involved in the water circulations, especially in the deeper part of the Critical Zone.

We proposed here to highlight the geochemical and isotopic (Sr, Nd, U-series nuclides) studies on rock and water samples collected in boreholes drilled down to 100m depth in elementary granitic watersheds, in particular in the Ringelbach watershed in the Vosges Mountains (Eastern France): (a) for constraining the nature of the alteration processes involved in the deeper part of the Critical Zone, and (b) for determining their time constants. Our data indicate that in such mountainous granitic watersheds deep-water circulations occur in networks of more or less independent conduits, which could extend over several tens to hundreds of meters deep. The data also point to contrasted geochemical characteristics but also contrasted residence times between surface and subsurface waters feeding the springs emerging on the watershed, vs. the deeper waters collected in the boreholes. All together, the data indicate a fairly high physical disconnection between the water circulation networks feeding the springs and the stream of the watershed and those feeding the boreholes (Schaffhauser et al., 2014). They clearly confirm relatively deep alteration processes, whose role in the functioning of the Critical Zone will have to be properly taken into account in future studies, especially in mountainous areas.

Schaffhauser et al., 2014. Chemical Geology, 374-375, 117-127.