

Chemical and isotopic variations of surface waters at a small catchment scale, lithological vs biological controls (the Strengbach case).

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The accurate determination of parameters controlling the chemical composition of surface waters is important for a correct modelling of the future evolution of the ecosystems in response to external forcing such as climate and human activities. Among these parameters, vegetation plays an important role in affecting movement, cycling and fractionation of elements.

In this general framework, a detailed study of the geochemical variability of the surface waters of the Strengbach catchment was carried out. The catchment is a small-forested watershed, about 80ha in surface area, in the Vosges Mountain, France (Observatoire Hydro-Géochimique de l'Environnement; <http://ohge.u-strasbg.fr>). It is located on a Hercynian granite, which was more or less hydrothermally altered.

During two hydrologic cycles (2004-2006), the stream at the outlet of the watershed, as well as all springs welling up located at different altitudes from various hillsides, were regularly sampled. Major and trace element (Sr, Rb, Ba, U) concentrations and Sr isotope ratios on the dissolved load of the water samples were determined.

The data highlight the large spatial variability of the chemical and isotopic composition of the surface waters of the Strengbach watershed. The variations of the mineralogical characteristics of bedrocks and soils, which are especially related to the more or less hydrothermalized character of the bedrock, can account for the spatial geochemical variations observed among the different springs of the watershed.

The data also outline an important time variation of the chemical and isotopic composition of water samples within each spring. It can be shown by using mixing diagrams, such as $^{87}\text{Sr}/^{86}\text{Sr}$ vs. Ca/Sr, that rain contribution is not a important parameter explaining the time variation. In addition, a simple binary mixing model between two water end-members, even with variable contribution versus time, cannot account for the observed geochemical variations. The latter imply the occurrence of specific chemical fractionations unrelated to lithological parameters, but probably induced by chemical recycling through the vegetation.

The results of our spatial and time variability study of surface waters at a small watershed scale point out how such a geochemical approach can help understanding the quantification of vegetation impact on the geochemical budget.

Processes and sources during late Variscan dioritic-tonalitic magmatism (Gęsiniec Intrusion, Bohemian Massif)

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Tonalitic-dioritic intrusions are common in orogenic settings. Two groups occur, emplaced at different stages of orogenic development: syn-collisional, pre-dating the main granite emplacement stage and post-collisional, contemporaneous with or post dating granite magmatism. Diorites and tonalites together with basaltic-andesitic volcanics are often the most mafic rocks present in orogenic and are often taken as end members that interacted with crust to produce a range of more felsic magmas and/or as the heat source for melting of the crust. However, dioritic-tonalitic intrusions are often characterised by variable isotopic and trace element compositions suggesting that they themselves underwent differentiation and contamination.

The Gęsiniec Intrusion (GI, 294-307 Ma, Bohemian Massif) represents a post collisional Variscan dioritic-tonalitic intrusion, generated during lower crust and lithospheric mantle delamination. Similar incompatible element ratios suggest a common source for the tonalitic – dioritic rocks in the GI, this source is distinct from that of earlier Variscan diorite-tonalite magmatism (syn-collisional, 340-350 Ma) in the Bohemian Massif. The parental magmas for the post-collisional GI were probably tholeiitic, water-undersaturated basalts derived from unmetasomatized mantle that interacted with crust. Parental magmas for 340-350 Ma dioritic-tonalitic magmatism were basalts derived from subduction-modified mantle (e.g. Janoušek *et al.* 2000).

In situ Sr isotope and trace element analyses of the GI plagioclase yield a range of 0.7069-0.7091, greater than that of whole rocks (0.7069-0.7084). Trace element and isotopic compositions of plagioclase suggest that different samples represent different processes of magma evolution from assimilation of wall rock by crystal mush at the magma chamber boundary, to interaction with water-rich magmas. The main differentiation recorded in plagioclase is thought to have occurred in the lower crust, below the level of emplacement of the GI and was followed by decompression and extensive resorption of plagioclase. The GI represents therefore an assembly of magmas derived from similar sources, but having undergone separate differentiation processes before final emplacement.

Reference

Janoušek V., Bowes D.R., Rogers G., Farrow C.M. and Jelinek E. (2000). *J. Petrol.* 41, 511-543.