Petrology and geochemistry of mafic and ultramafic metamagmatic rocks emplaced within the anatectic series of the middle crust of the Variscan Pyrenees: example of the Gavarnie-Heas dome, West Pyrenees

M. A. KILZI[1], M. GREGOIRE[1], M. BENOIT[1], P. DEBAT[1], M. ST. BLANQUAT[1] AND Y. DRIOUCH[2]

[1]Laboratoire de Géosciences Environnement Toulouse, Observatoire Midi Pyrénées, Université Paul-Sabatier, CNRS, IRD, *14*, Avenue Edouard Belin 31400 Toulouse michel.gregoire@get.obs-mip.fr
[2]Département de Géologie, Université de Fès, Maroc

Within the anatectic formations of the middle crust of the Variscan Pyrenees occur in some massifs (Alberes, Aston, Trois Seigneurs, Lesponne…) ultramafic and mafic rocks forming polymetric or plutons mileage enclaves. The most significant example is the Héas Gavarnie Dome in the Western Pyrenees. Within this dome of metasedimentary formations affected by a common anatexis (peak conditions at around 730 °C and 4.3 kb) the mafic and ultramafic series form three massifs: the Troumouse massif in the south, mostly made of diorites; the Aguila massif consisting of diorites which contains some hornblendite enclaves; the Gloriette massif, consisting of diorites and norites associated with ultramafic rocks (orthopyroxenites and hornblendites). All of these rocks are affected by variable degrees of metamorphism resulting in the development of secondary amphibole and biotite and cross cutted by a network of granitic bodies.

Petrological and geochemical studies show that theses rocks mostly correspond to a basic metamagmatic series with a calc-alkaline affinity and characterized by enriched REE (432 ppm) contents, and REE fractionation processes (La/Yb)N =7.5; (La/Sm) = 2.5 and (Gd/Yb) = 1). They have positive Eu anomalies (Eu/Eu* = 3.5) and the following trace element characteristics: (1) enrichments in U; (2) Nb and Sr depletion; and (3) large positive Pb anomalies. 87Sr/86Sr isotopic ratios of mafic and ultramafic rocks range from 0.7045 to 0.7117 and eNd from -5.2 to -10.5. These signatures are typically crustal and show that these rocks have preserved the isotopic fingerprints of lower crustal magmatic processes

Interpretation of hydrochemistry data using Bayesian statistical approaches to delineate groundwater contamination vulnerability

HO-RIM KIM[1], KYOUNG-HO KIM[1], KYUNG-GOO KANG[2], SOO-HYUNG MOON[2] AND SEONG-TAEK YUN[1]*

[1]Korea University, KU-KIST Green School and the Department of Earth and Environmental Sciences, South Korea, styun@korea.ac.kr (* correspondence)
[2]Jeju Special Self-Governing Province Development Corporation, Jeju, South Korea

Well understanding of the source(s) and landuse control of groundwater contamination is highly needed to better manage groundwater quality. In this context, we perfirmed the interpretation of hydrochemical data of groundwater using the Bayesian statistical method in conjunction with a GIS technique to produce a spatial map showing groundwater vulnerability to contamination. In particular, we used the Weight of Evidence (WofE) method (a Bayesian probabilistic model) and relevance vector machine (RVM) regression (a Bayesian machine learning technique) that was recently developed to find out the correlations among factors influencing the occurrence of groundwater contamination. Hydrochemistry data of 46 groundwater samples from the Pyosun watershed of Jeju volcanic island, South Korea were used, because the groundwater system has been considered to be highly susceptible to surface contamination (esp., agricultural pollution) because of the short residence time in permeable basaltic aquifer.

For the combined use of WofE and RVM, hydrochemistry data were evaluated using multivariate analyses to get the initial information whether a sample is contaminated or not. The results of Principal component analysis (PCA) and Hierarchical Cluster Analysis (HCA) showed a good spatial control of hydrochemistry data in relation to the topography within the watershed. In the next step, we estimated the correlation between topography data and the results of a binary classification from multivariate analyses. The results using Bayesian statistical techniques could predict the contamination vulnerability. Thus, the integrated method developed in this study can be successfully used for evaluating the groundwater vulnerability.