Assessment of aquifer vulnerability using statistical methods and GIS

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The purpose of the study for the development of the technologies of water quality monitoring and contamination protection at water resource aquifer is to secure the groundwater as potable water resources. The regional survey of groundwater quality for small potable water supply system were performed to know the effect of geology, soil properties, and land use for hydrochemistry at Nonsan area, Korea.

The geostatistical analysis, multivariate statistical methods, and GIS technique were used for the quantitative interpretation of groundwater chemistry. The monitoring results of groundwater in the study area showed that 13-21% of groundwater samples were exceeded the portable water guideline and the main causes were turbidity, bacteria, arsenic and nitrate-N. The high Cl, NO_3 and Na at granite area are caused by the high vulnerability of groundwater at granite region where the residential area and cultivated land are concentrated. The spatial distribution of components indicated the close relationships between groundwater quality and geology, land use, and topography. The results of principal component and discriminant analysis showed the close relationships between groundwater quality and geology (Fig. 1). From PCA, the three main variables explain 73% of the total variance and PC2 which is influecned by NO_3, Si, and HCO_3 is the major factors indicating geology induced factors. It is considered that the anomalous distribution of Arsenic is related to metasedimentry rock of Ogcheon belt with high contents of sulfide minerals.

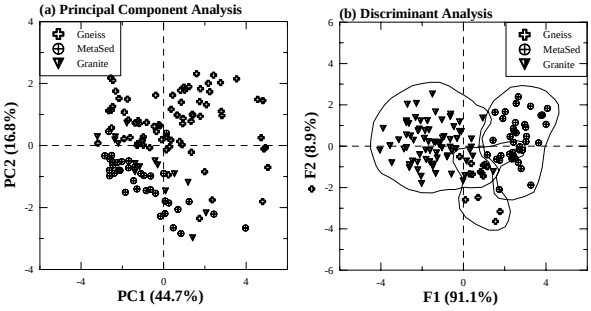

Figure 1. The results of multivariate statistical methods.

Raman and cathodoluminescence (CL) study of zircon inclusions derived from Gföhl felsic rocks in the Moldanubian Zone, Czech Republic

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Garnet peridotite and associated UHP eclogite, equilibrated at 4.5-5.0 GPa, occur as lenticular bodies surrounded by migmatitic gneiss at Nove Dvory area in the Moldanubian Zone, Czech Republic [1] [2]. This geological setting is similar to UHP rocks in Dabie-Sulu. It is important to identify the timing and mechanism when and how UHP rocks juxtaposed with Gföhl felsic rocks which have no HP/UHP evidence in their matrix, except for the occurrence of kyanite and show various kinds of partial melting structures. We report possible UHP evidence predated the partial melting of the felsic rocks identified from the zircon inclusions using the Raman spectroscopy and CL study.

The Raman spectroscopy for more than 1500 zircon separates from Gföhl felsic rocks at Nove Dvory area shows that the most of SiO_2 inclusions are quartz with clear and intense peaks at 464 and 393 cm^{-1}, and a few SiO_2 inclusion has a weak but clear peak at 521cm^{-1}, and a weaker peak at 179cm^{-1}, which are the most fundamental vibration of coesite, along with typical quartz vibration mentioned above. The Raman spectrum composed of the intense vibrations at 464 and 393 cm^{-1} of quartz and the weak vibrations at 521 and 179cm^{-1} of coesite were also obtained from the quartz proximal to relict coesite from the UHP rocks of the Dora Maira Massif. The similar Raman spectrum has been reported from quartz transformed from coesite in UHP rocks recovered from CCSD drillhole, eastern China [3]. Therefore, we propose that the SiO_2 phase showing the Raman spectrum with the weak vibrations at 521 and 179cm^{-1} was once coesite, along with the case of the Lanterman Range, Antarctica [4]. CL image observation of zircon grains displays that most zircon grains can be subdivided into two textural domains; the oscillatory zoned core and the rim separated by discontinuous CL pattern. All possible coesite inclusions are always detected from the core, although all SiO_2 inclusions in the rim were quartz.

These facts may suggest that the zircon of Gföhl felsic rocks at Nove Dvory once crystallized at UHP depths and most UHP evidence was obliterated by resorption and secondary growth of zircons during the exhumation stage.

Reference

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