Classification of Groundwater from a Coastal Granitoidic Fracture Network

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Introduction

A groundwater classification system, using the distribution of the two groundwater conservative parameters Cl and $\delta^{18}O$ was developed at Äspö Hard Rock Laboratory (Äspö HRL).

Groundwater from boreholes was sampled during the years 1987-2009 from a total of 284 packed-off sections representing depths of 8 m to 984 m below the sea level. The groundwater classification system was based on the conceptual hydrological understanding of the region, including five end-members which, in ascending order with respect to their age, are: deep saline water of old age [1] but unknown origin (referred to as "old-saline water"), glacial melt water formed during the last Pleistocene glaciation, Littorina Sea water (mid-Holocene), current meteoric water and Baltic Sea water.

Results and Conclusions

Most of the samples in Fig 1 plot in the Mixed class indicating influences from several end-members. The Meteoric, Marine and Saline classes are also well represented by the samples. Few samples plot close to the Littorina and Glacial end-member indicating less influence in the sampled water."

The groundwater classification and results presented here are relevant for recognition of conditions of importance in terms of bedrock disposal of toxic waste materials as technical barriers may be influenced by hydrogeological and hydrochemical changes over time.

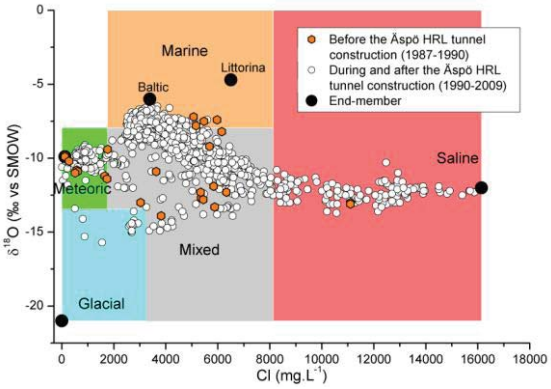

Fig. 1. Sampled groundwater plotted according to the established classes: Saline, Glacial, Marine, Meteoric and Mixed.

[1] Laaksoharju et al (2008) *Applied Geochemistry* **23**, 1921-1940.

Petolorogical diversity of chromian spinel bearing Matsue Basalt in Shimane Prefecture, Japan.

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Matsue Alkaline Basalt

Matsue city located in Japan Sea coast side of southwest Japan arc. There are many alkaline basic-intermediate lavas that we called "Matsue Basalts" in Matsue city area. The activity of the Matsue Basalt is about 10 Ma ago. Matsue basalt basically consist of 6 basic lavas and some it's pyroclastic deposite (sandstone and tuff) [1, 2]. The purpose of this study is clarifying geochemical characteristics of Matsue basalt. We here report the Bulk rock chemical composition, and mineral assemblage and chemistry of Matsue Basalt. And we classified Matsue basalt into five groups. And we found chromian spinels from two groups. This study adds a new data and idea to the Tsubota and Matsumoto (2008) [2].

Results and discussion

Bulk rock chemical compositions of Matsue Basalt are divided into 6 groups, which are 3 basalt groups (Chausuyama, Hanamagari and Agenogi groupes), 2 basaltic andesite groups (Tsuda and Rakuzan groups) and 1 andesite group (Toukodai groupe) based on their volcanic Stratigraphy. However, Tsuda and Rakuzan groups are show same chemical feature. That is Matsue Basalt is chemically consists of 5 groups. Chausuyama and Agenogi basalts show particularly with respect to their low FeO*/MgO ratios and high Cr content. And these two basalts have chromian spinels in and around olivine grains. Chromian spinels from Chausuyama and Agenogi basalts have Cr# (Cr/(Cr+Al) atomic ratio) of 0.16-0.40, and olivines from these basalts have Fo of 88-76. Arai (1987, 1994) proposed that Fo-Cr# relations depend on the tectonic setting, due to differing melting conditions (pressure, temperature and water vapour conditions) [3, 4]. That is Chausuyama and Agenogi basalts of Matsue Basalt derived from the relatively depleted lerzolitic mantle. Furthermore, above two basalts may be the different magma origins by Cr and Ni bulk rock chemical composition.

After 5 Ma of activity of Matsue basalt, eruption of adakite magam enters active time at the almost same location as Matsue basalt [5]. That is, it may be able to explain the chemical diversity of Matsu basalt in which it is related also with motion of a Philippine Sea Plate and activity of adakite magma in Japan sea coast side south west Japan arc.

[1] Miyajima et al. (1972) *Mem. Fac. Lit. & Sci., shimane Univ., Nat. sci.* **5**, 131-138. [2] Tsubota & Matsumoto (2008) *GCA*, Abstract Vol. **72**, A960. [3] Arai (1987) *N. Jb. Miner. Mh.* 347-354. [4] Arai (1994) *J. Volcanol. Geotherm. Res.* **59**, 279-294. [5] Sato *et al.* (2011) *Jour. Geol. Soc. Japan.* **117**, 439-450.