

Geochemical study of chromian spinel bearing alkaline Matsue Basalt in the Shimane Prefecture, southwest Japan arc

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Introduction

Matsue city is 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 consists of 6 basic lavas and some of its pyroclastic deposit (sandstone and tuff) [1, 2]. The purpose of this study is clarifying geochemical characteristics of Matsue basalt. We here report the Bulk chemical composition, Mineral assemblage and mineral chemistry of Matsue Basalt. This is first report of systematic chemical study about Matsue Basalt. And we found chromian spinels in the many rock samples.

Results and Discussion

According to our result of bulk rock chemical compositions, Matsue Basalt is divided into 6 groups, which consist of 3 basalt groups (Chausuyama, Hanamagari and Agenogi groups), 2 basaltic andesite groups (Tsuda and Rakuzan groups) and 1 andesite group (Toukodai group). However it was clarified that it was chemically the same feature as Tsuda and Rakuzan groups among Matsue Basalt. That is, Matsue Basalt 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 [3, 4] proposed that Fo-Cr# relations depend on the tectonic setting, due to differing melting conditions (pressure, temperature and water vapor conditions). That is Chausuyama and Agenogi basalts of Matsue Basalt derived from the relatively depleted lherzolitic mantle.

[1] Miyajima *et al.* (1972) *Mem. Fac. Lit. & Sci., Shimane Univ., Nat. sci.* **5**, 131-138. [2] Tsubota *et al.* (2007) *Annual meeting of Japan Soc. of Earth Sci. Edu.* Abstract Vol. 46-47. [3] Arai (1987) *N. Jb. Miner. Mh.*, 347-354. [4] Arai (1994) *J. Volcanol. Geotherm. Res.* **59**, 279-294.

Quadruple Sulfur isotope analysis of ~2.9 Ga Pongola Supergroup

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Sulfur Mass-Independent-Fractionation (MIF) is observed only in geological records older than 2.0 Ga, but not in younger strata (e.g. [1]). This unique MIF signature is known to be caused by photochemical reactions of sulfurous gas, and thus suggests oxygen-poor atmosphere (i.e. weak UV shielding) before 2.0 Ga. However, recent investigations demonstrated that no large MIF has been observed in a period from 3.0 to 2.8 Ga [2, 3]. This implies a possibility that the oxygen content of the atmosphere may have increased tentatively at around 2.9 Ga [2, 3]. Alternatively, Farquhar *et al.* [4] interpreted that presence of "weak" MIF at 2.9 Ga do not imply oxygen rise, but change of atmospheric chemistry. In order to evaluate these scenarios, it is essential to extend multiple sulfur isotope data for geologically and petrographically well-characterized 3.0 to 2.8 Ga sedimentary rocks. Here, we report quadruple sulfur isotope analysis of wide range of lithotypes (conglomerate, sandstone, siltstone, dolomitic sandstone, arenaceous dolostone and stromatolitic dolostone) occurring in 2985-2837 Ma Nsuse and Mozaan Groups, South Africa. The $\Delta^{33}\text{S}$ values of sulfides of Mozaan Group and Nsuse Group are from -0.41 to 0.13‰ and -0.11 to 0.35‰ respectively. Examining $\Delta^{33}\text{S}/\Delta^{36}\text{S}$ relationships, it was found that 5 samples of Mozaan Group and 7 of Nsuse Group show small but clear MIF signature. Furthermore, isotope ratios of Nsuse and Mozaan sulfides exhibit two mutually distinctive areas in a plot of $\Delta^{33}\text{S}$ -vs- $\Delta^{36}\text{S}$ irrespective to their lithological variety, suggesting temporal (not geographical) change of chemistry responsible for these MIF. Our results do not conflict with "the oxygen poor atmosphere ($p\text{O}_2 < 10^{-5}\text{PAL}$) model". It is plausible that the sulfate concentration of 3.0-2.8 Ga seawater was low enough to remain MIF signatures. However, the $\Delta^{33}\text{S}$ and $\Delta^{36}\text{S}$ values of sulfides in carbonate of Nsuse Group are very similar to those of modern sulfate aerosols [5]. This implies Nsuse stage may represent a period of low but relatively rising atmospheric oxygen ($p\text{O}_2 > 10^{-5}\text{PAL}$).

[1] Farquhar & Wing (2003) [2] Ohmoto *et al.* (2006) [3] Ono *et al.* (2006a) [4] Farquhar *et al.* (2007) [5] Romeo & Thiemens (2003)