

## Several factors controlling the chemical composition of the hydrothermal solution in the hydrothermal system

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In order to elucidate the geochemical behavior of alkali and alkali earth elements and heavy metals in submarine hydrothermal system, we performed a series of water-rock reaction experiments using artificial seawater (ASW) and several types of igneous rock.

There are positive correlations between K, Ca, Rb, Sr and Pb contents in initial rocks and those concentrations in reacted solutions, indicating that the hydrothermal solutions interacted with the rocks containing large amounts of K, Ca, Rb, Sr and Pb tend to contain higher concentration of these ions.

On the other hand, there are no correlations between Cu and Zn contents in initial rocks and these concentrations in reacted solutions. In order to elucidate the controlling factors of the dissolution of such ions, we investigated the effect of oxidation-reduction condition on the mobility of such ions.

Cu, Zn and Pb, especially Zn and Pb more easily dissolve from the rocks to the reacted solution in more oxidation condition. Generally, two-valent iron is contained more in basaltic and andesitic rocks than acidic rocks, indicating that the oxidation condition of solutions interacted with acidic rocks are higher than with basic rocks. Although the Cu and Zn contents in initial acidic rocks are low, these ions are concentrated in reacted rocks. On the other hand, even though basalt contains large amounts of those metals, those are not concentrated in the reacted solution which interacted with basalt. Pb is strikingly concentrated in the reacted solution with acidic rocks compared with the reacted solution with the other rocks. This is the reason why not only the Pb contents in initial rocks but also the oxidation-reduction condition control Pb concentration in the reacted solution.

## Origin of the plagioclase-controlled trend of an extremely low alkali tholeiite: Aogashima Volcano, in the Izu Arc

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Aogashima Volcano, located at the volcanic front of the Izu arc, is characterized by the occurrence of low-alkali tholeiite. The volcano is also peculiar in its differentiation trend exhibiting an L-shaped trend in  $\text{SiO}_2$ - $\text{Al}_2\text{O}_3$  diagram, which has been called plagioclase accumulation or plagioclase-controlled trend. The L-shaped trend is not common in other arc basalts. Because of these somewhat extreme features, Aogashima Volcano is a suitable target to investigate the origin of arc tholeiite and its differentiation process.

Basalts on the plagioclase-controlled trend can be divided into highly plagioclase-phyric basalt (HPP), aphyric basalt, and moderately plagioclase-phyric basalt (MPP). The groundmass composition of HPP is nearly the same as whole-rock composition of aphyric basalt. The FeO contents of aphyric basalt are extremely high (~14wt%) compared with other arc basalts. The chemical compositions of plagioclase and olivine phenocrysts in HPP are correlated with FeO/MgO of the groundmass, suggesting an intimate genetic relation between phenocrysts and their groundmass. The least differentiated composition of Aogashima Volcano belongs to MPP and it is similar to that from other Izu arc volcanoes showing a gradual decrease in  $\text{Al}_2\text{O}_3$  with an increase in  $\text{SiO}_2$  (Hachijo-jima-Higashiyama trend=HHJ). A melt of the whole-rock MPP composition can differentiate to the aphyric basalt by fractionating only plagioclase at 0.1GPa and with 1.5wt% water content. The HHJ trend can be explained by fractional crystallization of cpx, plagioclase, and olivine at 0.1GPa 2.7wt% water content.

In order to explain above conditions of Aogashima Volcano, the following magma chamber process is proposed. Two stages of crystallization are required: crystallization of plagioclase from enormous liquid of MPP formed a crystal mush near beneath the roof of a magma chamber by either boundary layer crystallization or plagioclase floatation. The interstitial liquid was isolated from the main body and extensive crystallization of plagioclase drove the interstitial melt to very low- $\text{Al}_2\text{O}_3$  and high-FeO composition. The mush with various amounts of interstitial melt erupted, and it became HPP basalt. The differentiated liquid was expelled from the mush and erupted, to be the aphyric basalt.

The L-shaped trend is inferred to have derived from a parental magma common to the HHJ-type. The two contrasting trends starting from the common parental melt is probably due to the difference in water contents. At Aogashima volcano low water content condition must have archived during the second stage of crystallization.