Geochemical implications of basaltic products from Develidağ volcanic complex, Central Anatolia, Turkey

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Extensive magmatic activity was developed at Develidag volcanic complex which is situated at the southeastern part of Kayseri in central Anatolia. Volcanic complex is dominated mostly by Basalts, Basalticandesites, and associated with minor amount of Andesites. During the volcanic episodes, develidag has undergone different types of development processes.

Basaltic products of volcanic complex are represented by low LIL (Rb, K, Ba, Th) and high HFS (Nb,Zr,Hf,Y) element contents whereas andesites generally have high both LIL and HFS values except Nb and Zr. Variable amount of Pb (3.11-12.09) and U (0.36-2.64) is also observed associated with relatively high Ba content within the rocks suites. Although low Nb/La (0.6-0.7) and relatively high Ba/Nb ratios indicate the crustal involvement for the basalts, high Zr/Ba (0.5), Zr/Hf (42-47) relatively high Nb/U (27-32), Th/U (3.13-4.69) ratios imply the contributions from the asthenospheric source component. Furthermore, such a high values of Zr/Hf is the indicative of primitive mantle source. (>36, [1]) Primitive mantle normalised spidergrams exhibit that develidag basalts have similar trace element signature that those of the Columbia River Tholeiites(CRT), Steens Mountain Flood Basalts (USA), Rio Grande Rift Axis products and Lassen region calc-alkaline basalts for Cascades range. Andesites have similar trace element patterns that those of Central and Eastern Anatolian calk-alkaline products and Central American (El Salvador) basalts.

Zr/Hf, Zr/Ba, Nb/Th, Sr/Ce Th/U ratios indicate N-Type MORB mantle source for the generation of basaltic products. Basalts and basalticandesites seem to be derived from a spinel peridotite source via partial melting whereas andesites reflect subduction signature, Nb/La, Ba/Nb incompatible element ratios express more or less crustal involvement. Although the melting model that indicates generation from a spinel peridotite source (% 3-4 melting), is not the unique process responsible for the magma extraction, the ongoing effects of AFC process seem to be responsible for the relatively evolved product as well as the melting issue, in such a complex tectonic setting. Typical tholeiitic calk-alkaline associations are also observed among the volcanic products as a concequences of either melting process and crustal involment or changing of the rate of melting degree. Furthermore, the lack of akaline products that is conventionally observed at final stage of many central Anatolian volcanic centers, seems to be attributed to either the lack of extensional development or deficient extensional rate before the late miocene.

[1] Furman, T. & Graham, D. (1999) *Lithos* **48**, 237-262.

Experimental research of plagioclase -gas-water interaction at hydrothermal conditions caused by CO_2 sequestration

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Underground disposal of CO_2 have been proceded in the world, where a part of the CO_2 can be dissolved into brine and react with surrounding rocks to form carbonate minerals. The rates of this gas-water-rock(mineral) interaction are mainly controlled by temperature and the pH and salt concentrations of the brine. In this paper, plagioclase such as anorthite was reacted with CO_2 saturated water at hydrothermal temperature to examine the reaction rates of carbonate mineralization and to apply for CO_2 sequestration into relatively high temperature fields in Japan.

Outline of Experiments

The experiments have been performed with crushed anorthite (7g; grain size is 05 to 2mm) and Kyoto tap water (70ml). They were enclosed with CO_2 (10MPa) or N_2 gas after evacuating in a teflon reaction container and heated up to 150 in an electric furnace with rotation (1 rpm). After 1 to 15days, the solutions were analyzed for their chemical compositions and mineral surfaces were observed by SEM-EDS.

Results

The concentration of Ca in the solutions reacted with CO_2 quickly increases within 1 day and is ~50mg/L higher than those without CO_2 (with N_2 gas). The saturation index shows that the solutions with CO_2 are saturated with respect to carbonate such as calcite and aragonite during the reaction. In these samples, calcite was observed on the anorthite surfaces by SEM-EDS and other mineral such as kaolinite were not identified. These results indicate that Ca can be released from rocks (silicates) easily and might be removed as $CaCO_3$ during CO_2 sequestration into relatively high temperature (geothermal) fields. Also, Ca-rich plagioclase (anorthite) is a good potential of CO_2 fixation as carbonate.