Chemical composition and elemental behavior of spring water in and around the Tono Composite Pluton, the Kitakami Mountains

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A study of water-rock interaction is necessary in order to elucidate elemental circulation of earth environment. It is for the last purpose of this study to elucidate elemental behavior by water-rock interaction affecting weathering of rock generally. In this presentation, we investigated the chemical composition of spring water of the Tono composite pluton, and it was tried to make clear relation with geological feature and chemical composition of the water and a difference of elemental behavior with weathering.

The Tono pluton exists in the center of the Kitakami Mountains, and is 37 km from north to south and 23 km from east to west. This pluton is becoming more felsic from the outer part inward, showing a zoned pluton, and is accompanied with gabbro to west part. This pluton is divided into five facies (marginal facies, main facies, central facies and Arakawa type of granitic facies / gabbroic facies) by kinds of mafic mineral in rock. This pluton is next to the Kurihashi granite body and limestone of the Paleozoic.

The water quality was investigated for the end of September, 2001. The spot to sample was spring water and well spot of the Tono pluton, the Kurihashi pluton and limestone area. In addition, for comparison, the most recent rain was gathered more before than a sampled day. We measured water temperature, pH, electric conductivity and oxidation-reduction potential. Concentration of a major element, trace element and rare-earth element was measured with ion chromatography and ICP-MS.

The value of pH shows 5.8-7.9 in granite area, and limestone area shows 7.8-8.8. Because pH of rain which fell before the measurement was 4.3-5.1, we understood that rain reacted with rock, and pH rose.

characteristics of main contents of water are rich in order of sodium, calcium in granite area, and chlorine, magnesium are contained inconsiderably. In gabbro area, calcium is richer than sodium, and other characteristics are similar to granite. In limestone area, calcium is richer than sodium, and potassium and sulfuric acid are not included. Rain particularly includes chlorine and sodium a lot, and there are a few other elements.

Water type was classed by the Na/Ca chemical equivalent ratio. When the ratio is more than 1, it is classed in Na-type, and it is classed in intermediate-type in case of more than 0.5, and it is classed in Ca-type than 0.5 when small. In a granite area, water type almost agreed with rock facies, and central facies was almost classified in Na-type, and main and marginal facies was classified in an intermediate-type, and gabbroic area was classified in Ca-type. In a limestone area, it was classed in Ca-type.

According to the relation of dissolved Mg+Ca and Na+K, mafic facies is rich in dissolved Mg and Ca, and we think that a plagioclase or hornblende influence it.

In addition, we tried to examine which mineral influenced it in the Mg/Ca ratio and the Ca/Sr ratio. The plotted field is different from central facies which is hardly included of hornblende and other facies.

In addition, water type reflects composition of a plagioclase in rock well. From these things, as for water composition, influence of a plagioclase is big with central facies. In other rock facies, a mafic mineral as hornblende may influence it in addition to a plagioclase.

Furthermore, water samples were standardized with element concentration of fresh granite, and we argued with movement of a trace element to water. In granite zone, we understood that Sr which plagioclase included a lot and Sc and Mo were easy to dissolve in water. It became clear that Zr which zircon included a lot, Ni, Y and V were hard to dissolve in water. As for the rare-earth element, negative abnormality of Ce was watched, and generally this is reported.

According to the above-mentioned fact, factors deciding the water quality depend on differences of resistance for mineral weathering and differences of the mineral composition besides pH and redox state.