

Chlorine geochemistry of volcanic rocks in Hokusatu district, Kagoshima, Japan

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The volcanic rocks of bimodal chemical composition (mainly andesite) are widely distributed in the Hokusatsu district, Kagoshima. This district is characterized by the numerous gold mineralization. The age of these volcanic eruption and associated mineralization becomes younger from west toward eastern volcanic front (Izawa, 1992). That is, contrary to the present volcanic front, the activities of magmatism and mineralization in the area close to the East China Sea gushed in the late Miocene (approximately 9Ma). This tendency might be extended toward more western side (the Koshikijima granitic rocks of 13Ma).

In this research, spatial variation concerning the main and trace element (especially, REE) of the volcanic rocks in the district are inspected, using XRF and ICP-MS.

The volcanic rocks are of tholeiite or calc-alkaline rock without significant geochemical features over whole area. The rock-forming Fe oxide minerals are magnetite and ilmenite, implying oxidized type volcanism. However, the distinct geochemical zonation is recognized in this district. The enrichment of incompatible elements such as K, Cl, and Rb are recognized in some areas. Those areas are elongated to NNE-SSW direction, parallel to the present volcanic front line. The zonation might be corresponding to this transitional change from the front to back arc system in Northeast Japan (Tatsumi, 1995), although the tendency are obscure. The important point is that the transitional changes repeat in this district to form zonal structure. The width of the zoning is rather narrow (20 to 30 km), compared to NE Japan. These evidences suggest that the transitional set has skipped intermittently from western end toward the present volcanic front, which might have occurred during discontinuous movement of subducted slab toward the ocean side.

In this zonation, gold mineralization distributes in the zones enriched in Cl and other incompatible elements; such as Hishikari-Ohra-Ohnoyama-Yamagano area and Kushikino-Iriki-Fuke-Oguchi area. And a typical example is observed in the Hishikari gold mining area. The volcanisms in this area are characterized by bimodal compositions (andesite and dacite). The phenocrysts of apatite, biotite (phlogopite) and hornblende of these volcanic rocks are rich in Cl and show high Cl/OH ratio. Geobarometer indicates that the dacitic magma reservoir might be emplaced into about 2km depth, and was almost saturated in water. These evidences suggest that gold hydrothermal fluid was discharged from dacitic magma as chloro-complex. However, the Hishikari hydrothermal ore solution is poor in Cl. It suggests that Au was converted from chloro-complex to bisulfide complex in reduced country rock (Accretion carbonaceous greywacke; Shimanto Supergroup), and that Au was precipitated when the bisulfide complex was decomposed in the volcanic rocks of oxidized type, or by mixing with oxidized meteoric water.