

The Chemical compositions and textures for magma series at the “Green Tuff” Formation in the Katakai region, Niigata, Japan

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Elucidating the style and history of subaqueous volcanic activity related to the “Green Tuff” formation is not only important in understanding the island arc formation processes but also contributes to the understanding of subaqueous volcanism. We will present a geochemical analyzes of the volcanic rocks obtained from the boreholes in the Katakai region of Niigata Prefecture's Chuetsu district, Japan, and discuss the geochemical characteristic and magma genesis.

Electroconductivity measurements of boreholes and petrographic observations of core and rock chip samples were utilized to reconstruct subaqueous felsic lava domes, cryptodomes, and pyroclastic rocks, and mafic lavas and intrusive rocks. Volcanic and intrusive rocks were classified based on the geochemical characteristics.

Dolerite shows subophitic or intergranular textures and has low La/Yb ratios ($(La/Yb)_n=1.1\sim 1.2$) and flat rare earth element (REE) patterns (FLAT-type). Basalt lava has an intersertal or hyaloophitic texture and shows middle La/Yb ratio ($(La/Yb)_n=1.5\sim 1.7$) and linear decreases in REE patterns from light to heavy REEs (LINEAR-type). Gabbro has severely depleted REEs with a high La/Yb ratio ($(La/Yb)_n=2.9$) and a significant decrease from light to medium REEs (CA-type).

The felsic rocks can also be distinguished by their textures and are classified by REE patterns into three types; Vitric tuff has middle La/Yb ratios ($(La/Yb)_n=1.7\sim 1.9$) and depleted light REEs with flat patterns from middle to heavy REEs (L-F-type). Andesite has an intersertal or pilotaxitic texture and shows concave upward REE patterns with moderate La/Yb ratios ($(La/Yb)_n=1.4\sim 1.7$) (CONCAVE-type). Rhyodacites has an hyaloophitic texture and flat REE patterns with low La/Yb ratios ($(La/Yb)_n=1.1\sim 1.4$) and large negative europium anomalies (U-type).

The geochemical features in Katakai region are consistent with tectonics, volcanism and basin development of Miocene in Northeast Japan. Mid-ocean ridge basalt (MORB)-like magma (FLAT-type) erupted in the early stage of the back-arc basin extension. Slightly enriched magma (LINEAR-type) erupted as Graben-Fill Basalt (GFB) in syn-rift stage with active submarine volcanism. Simultaneously, the felsic magmas with a variety of REE patterns (L-F-type, CONCAVE-type, U-type) erupted and formed felsic lava domes, cryptodomes, and pyroclastic rocks. Finally, highly enriched magma (CA-type) supplied gabbro in sedimentary rocks at post-rift stage accompanied by regional subsidence.

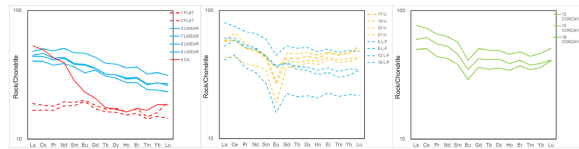


Figure. Representative trace element compositions of volcanic rocks from the Green Tuff formations Chondrite-normalized REE patterns. Normalizing factors are after Sun and McDonough (1989).