Stratigraphy-dependence of the fluid-mobile element compositions of the Oman ophiolite magmas

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Fluid-mobile element compositions of the relict clinopyroxene phenocrysts collected from the volcanic rocks of the V1-Geotimes, V2-Lasail and V2-Alley of the Oman ophiolite are determined, and their equilibrated melt compositions are calculated using the clinopyroxene/melt distribution coefficients. In terms of the fluid-mobile element spectrum, the Oman ophiolite magmas can be subdivided into six types, that is, type A (tholeiite lacking enrichments in fluid mobile elements: V1-Geotimes), type B (tholeiite with high K/Pb but low Pb, Sr and Be), type C (tholeiite with high K, Pb and Sr but low Be), types D and E (tholeiite/calc-alkaline rocks with high K, Pb, Sr and Be) and type F (tholeiite/calc-alkaline rocks with high Pb/K but low Be). The tholeiitic V2-Lasail magmas belong to types B, C and D. On the other hand, the V2-Alley magmas contain types B, C, D, E and F, and both the tholeiitic and calc-alkaline magmas are observed. All of the calc-alkaline rocks in the V2-Alley are boninite and its differentiates that are characterized by V-shaped REE pattern.

The stratigraphy of the Oman ophiolite volcanic rocks suggests that after the magmatism at the spreading ridge (type A) ceased, the magmas of types B and C (tholeiite series) were erupted, and they precede the volcanism of the types D, E and F (tholeiite or boninite series). The unique fluid-mobile element characteristics of the type B magma can be explained if the magma was formed by partial melting of the mantle metasomatized by the hydrous fluid formed under the condition of greenschist-amphibolite facies, implying that the fluid involved in the magma genesis is unusually of shallow origin. The fluid-mobile element characteristics of the subsequent magmas (types D, E and F) apparently resemble those of the Izu-Mariana forearc boninites and island arc tholeiites, suggesting that these magmas were produced by partial melting of the mantle wedge in the relatively shallow subduction zone (but deeper than type B) which had been metasomatized by fluid or melt liberated from the slab of the amphibolite-eclogite facies.