

Chromian spinel chemistry of basaltic rocks in the Izu-Bonin-Mariana arc

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The Izu-Bonin-Mariana arc is one of the typical oceanic arcs. The northern Izu-Bonin arc is topographically divided into four zones from east to west; Volcanic front, Active rift zone, back-arc knolls zone and back-arc seamount chain. In this study, we summarize chromian spinel compositions of basaltic magmas in the Izu-Bonin-Mariana arc. The back arc region has complex history such as repeated back arc rifting and resumption of arc volcanism. However, the regions of the volcanic front and active rift zone are presently active and have relatively simple histories. Therefore, we examined chromian spinel compositions from the volcanic front and active rift zone basalts. In the result, a spinel compositional field in the volcanic front basalts is obviously separated from that in the active rift samples on the diagram of $mg\#-Cr\#$, $Al_2O_3-TiO_2$ and $Cr\#-TiO_2$. The spinel chemistries can be divided into two types; volcanic front type (VF-type) and active rift type (AR-type). The compositional fields of the VF-type and AR-type spinels correspond with the fields of island-arc magmas and MORB in the $Al_2O_3-TiO_2$ discrimination diagram proposed by Kamenetsky et al. (2001), respectively. On the other hand, spinels of both types show oxygen fugacity equivalent to island-arc basalt proposed by Ballhaus et al. (1991). These results suggest that VF-type spinel could be precipitated from arc magmas and AR-type spinel could be precipitated from magmas produced by melting of MORB source affected by subduction, indicating that the VF-type is attributed to subduction-related arc magmas and the AR-type is attributed to rifting-related magmas. We applied the above chemical relationship of spinels to other locality samples such as the basement rocks of the Genroku and Manji seamounts in the back-arc seamount chain, the Horeki basalts in the back-arc knolls zones and the basalts in the northern end of Mariana Trough and so on. Spinel from the basement rocks of the Genroku and Manji seamounts and the basalts from the northern end of the Mariana Trough correspond to the AR-type. Spinel of the main body of the Horeki seamounts correspond to the VF-type and ones of the satellite cones and north-south trend ridges accompanied with the Horeki seamount correspond to the AR-type. Spinel in basalts from the Shin-Kurose monogenic volcano, which is newly found in the northern Izu-Bonin arc, does not correspond to VF-type but AR-type. These results indicate that magmatic setting and source might have spatially and temporally changed during growth of the Izu-Bonin-Mariana arc.