

Magma evolution toward a caldera-forming eruption at Kikai Caldera; a study of submarine cores

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Magma evolution from a caldera-forming eruption toward the next caldera-forming eruption has been studied by analyzing submarine cores sampled near Kikai Caldera, southern Japan, during the R/V Chikyu cruise. The approximately 100 m submarine cores have recorded two caldera-forming eruptions at 95 and 7.3 ka and small eruptions during the inter-caldera stage. Based on lithophile element composition of volcanic fragments and minerals, we discovered small amount of mafic glass fragments among felsic ones that predominates the 95-ka eruption deposits. This implies the involvement of mafic magma in felsic magma-driven caldera-forming eruption. Inter-caldera volcanic activity resumed with binary mafic and felsic magma extrusions at 43 ka but then shifted to eruptions predominated by felsic magmas. However, the most felsic composition, similar to the rhyolitic magma that erupted during the 7.3-ka caldera-forming eruption, did not appear in glass fragments after 16 ka. We suggest that this period was the phase of felsic melt accumulation to grow a magma reservoir toward the next 7.3-ka caldera-forming eruption.

Volatile composition in mineral-hosted melt inclusions demonstrates that most melt inclusions are likely saturated with H₂O because of low CO₂ content. The H₂O content in melt inclusions in the inter-caldera stage samples suggests the pressure range equivalent to the 3 km depth or shallower. In particular, the melt inclusions with SiO₂ > 70 wt% tend to have low H₂O content, implying formation of stratified magma chambers with more felsic magma at shallower depth during the inter-caldera stage. The melt inclusions of the caldera-forming eruptions show higher H₂O content than those of the inter-caldera stage samples. Notably, difference in the range of H₂O content between the two caldera-forming eruptions at 95 and 7.3 ka suggests the presence of large magma chambers at different depths; the magma chamber extended to the deeper level up to ~10 km prior to the 95-ka caldera-forming eruptions.