

The Miocene Kaikomagatake granitoid pluton in the Izu collision zone, central Japan: its petrogenesis, emplacement depth and exhumation history

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The Miocene Kaikomagatake pluton is one of the Neogene granitoid plutons exposed in the Izu collision zone, where the juvenile Izu-Bonin oceanic arc is colliding against the mature Honshu arc. The pluton intrudes discordantly into the Cretaceous to Paleogene Shimanto accretionary complex of the Honshu arc along the Itoigawa-Shizuoka Tectonic Line, which is the collisional boundary between the two arcs. The pluton consists mainly of hornblende–biotite-bearing granodiorites and biotite-bearing granite. Zircon U-Pb age of 13.8–12.4 Ma were reported (Sueoka et al., 2017), interpreted as the crystallization age of the pluton.

The Kaikomagatake pluton has SiO₂ contents of 68–75 wt%. It has high-K series compositions and its incompatible element abundances are comparable to the average upper continental crust. Major and trace element compositions of the pluton show well defined chemical trends. The trends can be interpreted with a crystal fractionation model involving the removal of plagioclase, biotite, hornblende, quartz, apatite and zircon from a potential parent magma with a composition of ~68 wt% SiO₂. The Sr isotopic compositions, together with the partial melting modeling results, suggest that the parent magma is derived by ~53 % melting of a hybrid lower crustal source comprising ~70 % K-enriched basaltic rocks of the Izu-Bonin arc and ~30 % Shimanto metasedimentary rocks of the Honshu arc. The petrogenetic model of the Kaikomagatake pluton suggests that the contribution of the metasedimentary component is required to produce incompatible element-rich granitoid magma with compositions comparable to the average upper continental crust (Saito et al., 2012).

The emplacement depth of the Kaikomagatake pluton estimated by the Al-in-hornblende geobarometer is ~2.2–2.4 kbar (Watanabe et al., under revision). Combined with low-temperature thermochronological data reported by Sueoka et al. (2017), the magma emplaced and solidified at the upper to middle crustal depth (~9–8 km depth) at 14–12 Ma and is situated at the depth for a period of ~10 million years, and then uplifts rapidly after ~3.3 Ma with the exhumation rate of ~4 mm/year. The early stage of the collision between the Izu-Bonin and the Honshu arcs contributed little to exhumation of the collision zone crust at the Kaikomagatake pluton area.

References:

Saito et al. (2012) *Contributions to Mineralogy and Petrology*, 163, 611–629.

Sueoka et al. (2017) *Journal of Geophysical Research: Solid Earth*, 122, doi:10.1002/2017JB014320.

Watanabe et al. (under revision) Submitted to *Journal of Metamorphic and Petrological Sciences*.

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