Petrological features of the Nohi Rhyolite and related granitoids: genesis of a large, Late Cretaceous, silicic magma system

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The Nohi Rhyolite formed one of the large silicic volcanic fields in the Southwest Japan Arc during the Late Cretaceous. The rhyolite consists mainly of intracaldera, crystal-rich, welded ash-flow sheets with a total volume of more than 5,000 km3. It has a close temporal and spatial relationship to hypabyssal intrusives and the batholithic Naegi-Agematsu Granite. The rhyolite and the granitoids have the following petrological features. (1) They are of dacitic to rhyolitic composition without any basalts or andesites. (2) The Nohi Rhyolite contains sodic to intermediate plagioclase without dusty zones and Fe-rich mafic silicates without reverse zoning. (3) The rhyolite and the granitoids belong to the high-K series. (4) The alumina saturation index of them is virtually under 1.1, which indicates they are I-type granites or the volcanic equivalents. (5) They contain no titanomagnetite, which means they belong to the ilmenite-series. (6) Most of them have the same REE pattern with a negative Eu anomaly becoming stronger with increasing SiO2 content, which indicates effective fractionation of plagioclase. (7) Most of them have high initial epsilon-Sr values (Terakado and Nakamura, 1984 etc.). These features suggest that the Nohi Rhyolite and the granitoids constitute a large silicic magma system. We propose a petrogenesis model for the silicic rocks as follows: Partial melts of low-K or medium-K mafic rocks in the lower crust rose through the crust and assimilated pelitic and psammitic materials with a high-K composition and high initial epsilon-Sr values in the upper crust. This process generated the parent high-K dacitic magma, which evolved to high-K rhyolitic magma with effective fractionation of plagioclase under reducing conditions. Thermal sources for the melting of the lower crust are assumed to be subduction-related mafic magmas, such as adakitic or high-Mg bajaitic basaltic-andesite found in the silicic volcanic field around the Nohi Rhyolite, although the volume of this is very small. The mafic magma effectively supplied heat only to the deep levels of the silicic magma system and did not contributed to shallow levels.