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Vertical structure of a caldera-filling pyroclastics and post-caldera granitic sill: the Middle Miocene Kumano Acidic Rocks emplaced in the Paleogene Shimanto accretionary complex, Japan

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A 600m all-core drilling penetrated a volcano–plutonic complex associated with middle Miocene Kumano caldera, Kii Peninsula, Southwest Japan. It shows us the vertical cross section of the caldera-filling pyroclastic deposit and granitic sill intruded inside the caldera. The drilling site is located in the southern rim of the north body of Kumano igneous complex.

The drilling core consists of the granite porphyry intrusion (Kumano Granite Porphyry) in the upper part (from surface to 464.3 m depth) and the welded tuff (Owase-Shirahama Pyroclastic Rocks) beneath them (464.3 and 600 m depth), which are associated with the caldera formation. The welded tuff in the core sample consists mainly of well-sorted coarse-grained volcanic ash of crystal fragments and lithic fragments. Subordinate amount of pumice fragment more than 10 cm across are scattered. Though most part of the welded tuff in the core sample is massive as observed in the surface outcrops, some parts show remarkable bedding structure. These structural characters suggest that the welded tuff is a pile of many flow units with several 10s meters thick each, which consists of basal pumice-concentrated bed, main massive tuff, and upper bedding part.

The lower intrusion boundary of the Kumano Granite Porphyry is exposed at 464.3 m deep, where the granite porphyry intrudes into the host welded tuff with about 10 m thick chilled margin, in which the granite porphyry has very-fine groundmass. The groundmass texture of the granite porphyry shows systematic variation with the distance from the intrusion contact. Within about 20 m from the contact, the groundmass consists of very-fine crystals and entirely shows volcanic rock texture. For 150 m above them, the groundmass consists mainly of quartz and plagioclase and shows equigranular texture. In the upper part (less than 300m deep), the groundmass shows graphic texture with quartz and alkali feldspar. The vertical variation of the groundmass texture indicates upward migration of interstitial vapor-rich fluid during the cooling of the sill from its basement. Mineralogically and geochemically, the Kumano Granite Porphyry is nearly homogeneous. The size and contents of phenocryst is almost constant through the drilling core sample. A lot of metasedimentary xenoliths and mafic magmatic enclaves are included in the Kumano Granite Porphyry. The mafic enclave consists mainly of porphyritic tonalite and quartz diorites. Gabbro is rare. The metasedimentary xenolith consists of pelitic-psammitic gneisses and nearly unmetamorphosed mud- and siltstones. Xenocrysts of cordierite, andalusite and garnet are observed.

The Kumano Acidic Rock and other Miocene acidic rocks in Southwest Japan are generated with a near-trench magmatism due to the subduction of a young hot Philippine Sea plate beneath the Southwest Japan arc. The S-type-like mineralogy and rather enriched isotopic character of the Kumano Acidic Rocks imply a magma source involving the component of the Shimanto accretionary complex.

Displacement of the basement of volcanic tuff layer suggests a subsidence of caldera floor during the igneous activity. At the bottom of the drill hole, about 500 m below sea level, the basement of the tuff layer did not expose, whereas basement of the tuff layer distributes almost flat at the ground surface 2 - 3 km south of the well about 400 -500 m a.s.l.. This relationship indicates more than 1000 m of vertical displacement of the tuff layer between these two areas. This displacement could be explained by the existence of caldera wall between two

areas, which associates the eruption of the welded tuff. No remarkable deformation is observed in the Kumano Granite Porphyry. The Kumano Granite Porphyry is a post-caldera intrusion possibly associated with the caldera resurgent activity.