

## Cenozoic volcanisms and tectonic history of northern Kyushu

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Cenozoic western Pacific is characterized by numerous subduction volcanisms, opening of back arc basins, and within plate volcanisms in back arc regions, each timing of which is closely related to one another. These coupled phenomena suggest that some sort of thermal and material transportation within the upper mantle derives melting and eruption of magmas in the back arc region, and several mantle processes have been proposed for the origin of the magmatisms: diapiric active upwelling of a hot mantle, lithospheric extension inducing passive mantle upwelling, fluid flux melting, and large scale circulation of the mantle induced by a slab subduction. Since diverse modes of melting and upwelling are expected for each mechanism, it is important to clarify both the dynamics and physicochemical conditions of the mantle of the arc-back arc system. We will focus on Cenozoic back arc volcanisms and tectonics in northern Kyushu and will discuss dynamics of the upper mantle beneath back arc region.

The following tectonic histories around Japan Sea have been revealed from various approaches. Northern Kyushu, the Inner zone of southwestern Japan, is separated from southern Kyushu by east-west trending graben system in central Kyushu. Cenozoic basaltic volcanisms in northern Kyushu occurred mainly in Tertiary sedimentary basins formed between the basement of Cretaceous granitic rocks and the Nagasaki metamorphic rocks. Tertiary sedimentary basins are widely distributed not only in northern Kyushu but also along offshore San'in region, and show folded structure formed by extensive inversion mainly around the end of Miocene. In addition to the folded structures, many other lines of geological evidence such as orientation of dykes with age constraints and activity of thrust faults indicate compressional stress field of the northern Kyushu during late Miocene.

Cenozoic volcanisms of the Chugoku and northern Kyushu districts are characterized by eruptions of a number of alkaline volcanisms. Although the volcanisms were regarded as a large single volcanic province around the Japan Sea, volcanism of northern Kyushu is different from that of Chugoku district in several aspects: delayed initiation of volcanisms, extensive eruption volume of basaltic magmas, higher FeO content of the basalt at the same MgO content, and more isotopically depleted compositions. The most voluminous basaltic volcanism in southwestern Japan occurred in the Kita-Matsuura area, northwestern Kyushu, in the end of Miocene. Basaltic rocks from the Kita-Matsuura area are mostly hypersthene-normative and sub-alkalic, whereas rocks from the marginal area, such as North Kyushu, Goto Islands, and Unzen, are predominantly less norm hypersthene and alkalic. The initiation of basaltic activity propagated circumferentially from the Kita-Matsuura area to the outer part. We have made systematic geological, chronological, petrologic, and geochemical investigations on the volcanism in the Kita-Matsuura area active for ~2.5 Myr and 35km in horizontal scale. From spatial and temporal variation of generation conditions of mantle derived melts with careful evaluation of the effects of water content and source heterogeneity, we concluded that a chemically homogeneous hot mantle with potential temperature more than 1400°C actively upwelled beneath the Kita-Matsuura area at a rate ~2cm/year.

Although alkaline volcanisms in Chugoku district have been explained by flux melting of the upper mantle with low potential temperature or passive upwelling of asthenosphere associated with opening of the Japan Sea, results of this study together with tectonic stress field at that time strongly indicate that a sequence of Cenozoic basaltic magmatisms in northern Kyushu were derived from a number of hot small-scale active mantle upwelling irrespective of Japan Sea opening, probably from the mantle transition zone.