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学位論文の要旨

Abstract of Thesis

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学位論文題目 Title of Thesis (学位論文題目が英語の場合は和訳を付記)

Geochemical and geochronological study of the Cenozoic Adakitic Lavas from SW Japan: Implications for the slab-Mantle interactions in a Hot subduction system
 西南日本の新生代アダカイトの地球化学的および年代学的研究：若く温かい沈み込み帯におけるスラブ・マントル相互作用

学位論文の要旨 Abstract of Thesis

Late Cenozoic magmatism in southwest Japan arc is characterized by voluminous eruptions of intermediate to felsic lavas and monogenetic mafic volcanisms. I present K-Ar ages, major- and trace-element abundances, and Pb isotope data for the intermediate to felsic volcanic rocks from the arc. My new results, together with published geological, geochronological, geochemical, and geophysical data, are used to evaluate the origin of various types of magmas and the role of subducting oceanic plate in the evolution of magmatism in a hot subduction system. The intermediate to felsic lavas show geochemical characteristics of magmas commonly referred to as “adakite”. The K-Ar dating on these lavas revealed that the eruption of adakites had occurred during the last 2 Myrs, concurrently with or following the eruption of mafic lavas in the adjacent (< 10 km) regions. The adakitic lavas show trace-element characteristics consistent with partial melting of basalt which consists of the subducting Shikoku Basin Plate. Major- and trace-elements, and Pb-isotopic compositions exhibit along-strike lateral variations. In east and west margins of this region (Kurayoshi and Aonoyama), the lavas are andesitic and poor in SiO₂. They also have lower Sr/Y, La/Yb, and less radiogenic Pb isotope compositions. In central part of this region, the adakitic lavas are dominated by SiO₂-rich dacitic rocks, and characterized by higher Sr/Y and La/Yb, and more radiogenic Pb isotopic compositions. The Pb isotope trends formed by adakitic lavas suggest the involvement of two end-member components. The origin of these two end-member components

is melting of oceanic crust of Shikoku Basin Plate and overlying sediment. Mass balance modeling involving trace-element and Pb-isotopic compositions suggests that the adakitic magma are the best explained by mixing of partial melts from oceanic crust ($F = 15\%$) and sediment ($F = 40\%$) at 99:1 to 95:5 ratios. The lateral variation in the flux of sediment is attributed to either (1) lateral variation in the amount of sediments supplied to the trench, (2) lateral difference in efficiency of sediment delivery to the depth, owing to topographic variety of subducting crust (e.g., presence of seamount), or (3) lateral transportation of sediment within the trench caused by subduction obliquity. The slab surface temperature, predicted by a numerical modeling, is too low to generate slab melt. The sub-arc mantle temperature, estimated from the mafic lavas to be 1280–1420 °C, is enough to bolster slab melting. The similarity of trace-element and isotopic compositions between adakitic and adjacent mafic lavas are suggestive of the mutual interaction. The thermochemical interaction also played a major role of melt infiltration in the mantle. A warm mantle facilitates melt transport without freezing, as the adakite-mantle reactant (pyroxinite) is expected to have a solidus lower than temperature of partially molten peridotite. The association of adakite-mafic magmas is coincident in space with seismic discontinuity on the slab, which is interpreted as tear zones. A hot and buoyant mantle could upwell adiabatically through tear from sub-slab depth, and bolster slab melting. Progressive interaction with decompression facilitates transport of felsic slab melt, as the mantle supplied heat to prevent solidification of adakite-mantle reactant within the sub-arc mantle.