

論文 / 著書情報
Article / Book Information

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Title(English)	Chronological and Geochemical Study on the Origin of Cretaceous to Paleogene Granitic Rocks, Southwest Japan
著者(和文)	飯田和也
Author(English)	Kazuya Iida
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Type(English)	Summary

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論文要旨

THESIS SUMMARY

専攻:	地球惑星科学	専攻
Department of		
学生氏名:	飯田和也	
Student's Name		

申請学位(専攻分野):	博士	(理学)
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指導教員(主):	岩森 光	
Academic Advisor(main)		
指導教員(副):	丸山 茂徳	
Academic Advisor(sub)		

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Granite is one of the main components of the continental upper crust, and is thought to provide key information on evolution of the continental crust yet the origin of granitoid remains enigmatic. In order to address this important and unresolved problem, I have studied the origin of the Cretaceous to Paleogene granitic rocks in SW Japan. I have especially focused on (1) spatial-temporal variations of the granitic rocks, (2) spatial-temporal variations of chemical signatures of the granitic rocks, (3) tectonic and dynamic settings that have created the observed spatial-temporal variations, based on the U-Pb zircon ages, whole rock chemistry especially for isotopic ratios, and numerical simulation for the thermal field of subduction zones. As a result, systematic spatial-temporal variations of magmatism and the spatial-temporal variations of petrological signatures in SW Japan have been observed. Numerical modeling suggests that ridge subduction model can explain spatio-temporal-compositional variations of granitic rocks in SW Japan. Based on these results, we discuss the origin of the granitic rocks.

U-Pb zircon age determination using LA-ICPMS has been performed on total 92 rock samples. The obtained ages range from 95 Ma to 30 Ma, with a possible temporal gap between 60 Ma and 50 Ma. During 95-60 Ma, the systematic migration of granitoid magmatism occurred from the south to the north. Systematic temporal variations are also observed: with time, (1) initial ratios of $^{206}\text{Pb}/^{204}\text{Pb}$, $^{207}\text{Pb}/^{204}\text{Pb}$, $^{208}\text{Pb}/^{204}\text{Pb}$ decrease from radiogenic characters to depleted ones, (2) initial ratios of $^{143}\text{Nd}/^{144}\text{Nd}$ isotopes increases from radiogenic compositions to less radiogenic ones, (3) initial ratios of $^{87}\text{Sr}/^{86}\text{Sr}$ isotopes slightly decrease from radiogenic compositions to depleted ones, and (4) rock types of the granitoids change from ilmenite-series to magnetite-series. In addition, across-arc variations of the geochemical-petrological signatures are also observed: (1) the $^{87}\text{Sr}/^{86}\text{Sr}$ initial ratios are depleted in the back-arc region (latitude 35.0° — 35.5°N) compared to the fore-arc region, and (latitude 34.5° — 35.0°N) (2) initial Pb and Nd ratios in the back-arc are more scattered than those in the fore-arc between 95 and 77Ma.

In order to investigate the mechanism of spatial-temporal variations of the petrological signatures, a ridge subduction model has been tested with numerical simulation, especially in terms of thermal impact of the subducted ridge as a function of subduction velocity and angle with or without slab window. The numerical results clarify the following points: (1) thermal impact of ridge subduction is large enough to explain the voluminous granitic magmatism as observed in the circum-Pacific orogenic belts, especially when the subduction velocity changes from high to low associated with creation of slab window, (2) after the ridge subduction, the melting region, mainly of slab melting, spreads extensively over the across-arc range, and then shrinks from the trench-side to the back-arc side, (3) the subduction angle and the subduction velocity are important to control the overall duration and spatial range of magmatism, and (4) slab melting of AOC occurs extensively, while comparable arc crustal melting also occurs if slab window is created, causing isotopic diversity of the magmas as a mixture from the multiple source materials.

Finally, the numerical results have been compared with the observed spatio-temporal-compositional variations of the granitic rocks in SW Japan. Calculated isotopic range cover the observed isotopic ratio. These numerical results suggest that the ridge subduction is likely to have been the primary cause of Cretaceous to Paleogene granitoid magmatism in SW Japan, and this model of ridge subduction may be applicable to other subduction zones and orogenic belts, such as Sierra Nevada, where systematic temporal migration is observed for magmatism.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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