論文 / 著書情報
Article / Book Information

題目(和文)	「ジルコンの酸素同位体比および微量元素組成に基づいた花崗岩の成因の推定」要約
Title(English)	Summary of "Petrogenesis of Granitoids in view of Oxygen Isotope Ratio and Trace Element Geochemistry in Zircons"
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出典(和文)	学位:博士（理学）, 学位授与機関:東京工業大学, 報告番号:甲第9720号, 授与年月日:2015年3月26日, 学位の種別:課程博士, 審査員:丸山　茂徳,横山　哲也,高橋　栄一,綱川　秀夫,上野　雄一郎
Citation(English)	Degree:, Conferring organization: Tokyo Institute of Technology, Report number:甲第9720号, Conferred date:2015/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	要約
Type(English)	Outline

Summary of

"Petrogenesis of Granitoids in view of Oxygen Isotope Ratio and Trace Element Geochemistry in Zircons"

Kazue Suzuki

Understanding of formation process of granite is essential to unveil history of the Earth. In this thesis, I focused on geochemistry of zircon to constrain genesis of granite. Two main projects were conducted in this study: constraints of composition and formation age of continental lower crust, and establishment of new index to unravel formation process of granites.

Investigation into continental lower crust was carried out on young (4-9 Ma) Tanzawa Tonalite using mafic enclave and host tonalite (Chapter 2 and 3). In Chapter 2, it is suggested that arc lower crust beneath the Tanzawa Tonalite was formed at >43 Ma based on LA-ICP-MS U-Pb dating and trace element analysis for zircons from mafic enclaves. In Chapter 3, oxygen isotope ratios of zircons from the Tanzawa Tonalite are obtained by SIMS analysis. The lower oxygen isotope range of the Tanzawa zircons than mantle value suggest that the arc lower crust included former oceanic crust at the timing of generation of the Tanzawa Tonalite (4-9 Ma).

The investigation method for mafic enclave in Chapter 2 is applied to mafic enclave and host TTG in the Archean Pilbara craton, western Australia (Chapter 4). Mafic enclaves in the Pilbara TTG are surmicacesous enclave, biotite-gneiss xenolith and amphibolite xenolith with angular shape, in contrast to mafic enclaves in the Tanzaw Tonalite which show magmatic

appearance and doleritic texture (Chapter 2). The difference between enclaves in the Archean Pilbara TTG (2.8-3.5 Ga) and the modern Tanzawa Tonalite (4-9 Ma) may reflect difference between Archean and modern granitic magma generation process.

In Chapter 5, in order to explain formation process of the Caledonian granitoids, concept of Pacific-type orogeny is applied to the Caledonian orogeny which have been believed to be typical Collision-type orogeny. Based on age relationship among new zircon U-Pb ages in Caledonian granitoids, metamorphic age of Barrovian metamorphic belt and formation age of accretionary complex, it is suggested that most of the Caledonian orogenic belt was formed by Pacific-type orogeny following after arc-continent Collision-type orogeny.

Finally, new discrimination diagrams are formed using trace element composition in zircons from young granites (<10 Ma) formed at well-understood tectonic setting (the Tanzawa Tonalite and the Taitao Granite; Chapter 6 and 7). Combined with trace element data in zircons from Archean granite (Chapter 4), I-type granite and S-type granite from previous studies, combinations of Sm/Yb, U/Yb and Ce/Ce* ratios show broad correlations with amount of sedimentary component in granites. The correlations suggest that these trace elements ratios in zircons can be indicators of sedimentary component in granite. Using the new indicators together with oxygen isotope ratio in zircons, discrimination of formation process of the granite would become possible. In this thesis, possibility to unveil formation process of granites through the whole Earth history is provided using oxygen isotope ratio and trace element geochemistry in zircons.