

論文 / 著書情報
Article / Book Information

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Title(English)	The tectonic history of Neoproterozoic and Paleoproterozoic subduction-related orogen
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種別(和文)	論文要旨
Type(English)	Summary

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論文要旨

THESIS SUMMARY

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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

The subduction-related orogeny on a convergent plate margin is key to understand the evolution of the Earth system including mantle dynamics, atmosphere, hydrosphere, and biospheres. The orogenic process principally forms three tectonic units; a batholith belt, a regional metamorphic belt, and an accretionary complex. At present, identification of orogens in ancient geological assemblages requires earnest geological, petrological, and geochronological studies. Unfortunately, instances of Precambrian subduction-related orogens are limited. In particular, the presence of accretionary complex before the Cambrian remains debatable due to the difficulty in constraining the age. The unavailability of such geochronological data has hampered the comprehension of a subduction-related orogeny during the Precambrian time. In this thesis, we focused on two famous regions of Anglesey-Lleyn (Neoproterozoic) and North Pole Dome (Paleoarchean). The objective of this study is to establish geotectonic frameworks of ancient subduction-related orogeny.

The Gwna Group in Anglesey-Lleyn area, Wales consists of a latest Proterozoic volcano-sedimentary trench mélangé, which has a complicated accretionary structure, and is poorly constrained by isotopic ages. Here, we reconstruct twelve columns of oceanic plate stratigraphies (OPs) by conducting a fieldwork. OPs accretionary timings are dated with the youngest U-Pb ages of detrital zircons. Our lithological description and chronological data means that there are two Gwna Groups that formed between the late Neoproterozoic and the Middle Cambrian. These Gwna Group formations are contemporaneous with a calc-alkaline arc magmatism and a regional metamorphism in the Anglesey-Lleyn complex, which leads to a conclusion that the Gwna Group is a geological assemblage of imbricated OPs that developed as an accretionary complex on the Avalonian suprasubduction zone.

For the better understanding of the Avalonian subduction-accretion system, we added the following geochronological data; U-Pb ages of detrital zircons in the Monian Supergroup, and K-Ar ages of phengites, and U-Pb ages of detrital zircons in the Blueschist unit, the Central Shear Zone (CSZ), and the New Harbour Group. Integration of new isotopic data with previously published ages enables a new interpretation of the accretionary history and tectonic evolution of the Anglesey-Lleyn orogen in terms of the subduction-related orogeny. Subduction of an oceanic plate already drove arc-related magmatism along the Avalonian margin by 711 Ma, and continued to 519 Ma. Formation of the Gwna Group had already begun by at least 578 Ma, and likely finished by 530Ma. Exhumations of the metamorphic units occurred at 578-530 Ma and 474 Ma. In a larger perspective, the Avalonian orogens in NW Wales and Central England formed by successive eastward subduction from 711 to 474 Ma.

In the Paleoarchean complex (Warrawoona Group) around the North Pole Dome area, age constraints are mainly based on zircon U-Pb geochronology. However, their age interpretation remains controversial due to metamictization of zircons, and contamination of the common Pb. In order to obviate such negative effects, we newly develop the LA-ICP-MS U-Pb zircon dating combined with a pre-ablation technique. This technique is a useful approach to in finding less-metamictized areas within a zircon grain. We succeeded in acquiring some concordant U-Pb data from radiation-damaged zircons. Two analyzed adamellites represent intrusive ages of 3454-3445 Ma, which constrains the minimum depositional age of the Warrawoona Group. The pre-ablation technique has potentials to yield more precise and accurate geochronological data from metamict zircons.

A geotectonic framework of the Warrawoona sequence provides a valuable finding in terms of the Archean plate tectonics. We tried to obtain new geochronological data based on the LA-ICP-MS U-Pb zircon dating combined with the pre-ablation technique, and quantitative geochemical data of the greenstones and felsic rocks. By integrating the previous data, we found that greenstone complex of the Warrawoona sequence intermittently formed at 3525-3434 Ma, and its chronostratigraphic data have an upward-younging trend. Based on our geochemical fingerprinting, a suprasubduction zone is most likely appropriate as the tectonic setting, which implies development of a subduction system before 3525 Ma. Moreover, the onset of plate tectonics dates back to pre-3752 Ma age.

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。

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