東南極セールロンダーネ山地における原生代末期の変成-流体イベント：U-Pb 年代および希土類元素からの制約

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Neoptroterozoic metamorphic and fluid events in Sør Rondane Mountains, East Antarctica: constraints from U-Pb age and REE chemistry

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Assembly of Gondwana supercontinent has been argued in numerous studies, and East Antarctic plays an inportant role for discussing Gondwana formation (Boger, 2011; and referecens therein). Generally the reported ages of Gondwana collision zones are in the range of 750-500 Ma, and recent studies imply that Gondwana supercontinent especially of its eastern part has been assembled at two-phases of age intervals such as ~750-620 Ma and 570-530 Ma for the separate regions (e.g., Meert, 2003). From Sor Rondane Mountains in East Antarctica, two-stages (640-630 Ma and 550-520 Ma) of metamorphic events are proposed (e.g., Shiraishi et al., 2008), and, hence, the region is of potential importance as a crossing zone of the above two-phase assemblies. It is, however, not yet fully understood the geographical and temporal relationships for these two age-events within and around the area. Northeastern-central part of the Sor Rondane Mountains consists mainly of highly-retrogressed granulite-facies and/or greenschist-amphibolite-facies metamorphic rocks along with multiple leucocratic veins and granitic intrusives (e.g., Shiraishi et al., 1991, 1997; Osanai et al., 1992).

We have analyzed U, Th, Pb and rare earth elements (REE) in zircon and monazite from highly-retrogressed garnet-sillimanite-biotite gneiss and three-generations of associated sub-concordant to discordant leucocratic felsic veins from Austkampane area in the central part of Sør Rondane Mountains, East Antarctica. The area is located within granulite-facies zone. The host garnet-sillimanite-biotite gneiss includes at least four zircon U-Pb age populations of >720Ma, c.700 Ma, 640-630 Ma and c.550 Ma. Chondrite-normalized REE pattern indicates 637±5 Ma as timing of metamorphic HREE-depleted zircon recrystallization in equilibrium with garnet. The earliest leucocratic vein which is partly intermingled with the host Grt-Sil-Bt gneiss and enclosing garnet-bearing pelitic enclaves includes a population of zircons with a crystallization age of 635±3 Ma, which is almost identical to the age found in the host pelitic gneiss. The second-generation leucocratic vein appears as sub-concordant veins with biotite-muscovite as characteristic minerals. This leucocratic vein has no zircon but monazite which yielded bimodal ~700Ma and 640-630 Ma ages. The third generation of pegmatitic vein which discordantly cut the host pelitic gneiss and the other leucocratic veins yields magmatic zircon ages of 550±2 Ma. These younger magmatic zircons shows HREE-enrichment typical of magmatic crystallization. Our data imply that the major high-grade metamorphic event, possibly in the granulite-facies, and the subsequent re-hydration events took place in the narrow age interval at ~635Ma. Another hydration event of which pegmatitic veins discordantly intruded and affected the pre-existing pelitic gneiss and other felsic veins at ~550 Ma.

These two age events discussed here are coeval with those proposed for the two-stages of Gondwana assemblies, and, hence, the investigations presented in this study can provide insights for the metamorphic-fluid regimes of these crossing of Neoproterozoic orogens. Systematic U-Th-Pb analyses combined with REE data suggest contrasting isotopic and chemical signatures, and such age-geochemical constraints combined with petrologic information enable us to discuss the temporal relationships of Neoproterozoic-Cambrian metamorphic-fluid-time regimes in this region.

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