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東南極セール・ロンダーネ，後衝突期閃長岩の活動時期とマグマ組成

大和田正明[1]、梶川歩美[1]、先山　徹[2]、亀井淳志[3]、小山内康人[4]、中野伸彦[4]、足立達朗[4]、堀江憲路[5]、外田智千[5]
[1] *山口大学*
[2] *兵庫県立大学*
[3] *島根大学*
[4] *九州大学*
[5] *国立極地研究所*

U-Pb Zircon Age and Magma Compositions of Post-Collisional Syenite, Sør Rondane Mountains, East Antarctica

M. Owada[1], A. Kajikawa[1], T. Sakiyama[2], A. Kamei[3], Y. Osanai[4], N. Nakano[4], T. Adachi[4], K. Horie[5], T. Hokada[5]
[1]*Yamaguchi University*
[2]*Hyogo Pref. University*
[3]*Shimane University*
[4]*Kyushu University*
[5]*National Institute of Polar Research*

Syenites and related intrusive rocks are important to understand the process of collision zone magmatism in Dronning Maud Land (DML), East Antarctica, because DML is situated within the continental collision orogen between the West and East Gondwana (Mikhalsky et al., 2006). The Sør Rondane Mountains is located in the eastern part of DML. According to the previous results, the timing of continental collision is regarded as the late Proterozoic (650 to 600 Ma) in the Sør Rondane Mountains (Shiraishi et al., 2008, Baba et al., 2013, Hokada et al., 2013, Osanai et al., 2013). Undeformed (post-kinematic) granite stocks, a syenite complex and lamprophyres intrude during the extensional stages in the Sør Rondane Mountains (Toyoshima et al., 2013). In this paper, we address the geochronological and geochemical studies of the syenite complex and lamprophyres, and then discuss the timing of intrusion and the origin of syenite magma.

The syenite complex occurring in the Lunckeryggen, the central part of the Sør Rondane Mountains, consists of a layered syenite, melanosyenite dikes and quartz syenite dikes. The syenite complex and the Lunckeryggen granite that is K-feldspar-rich alkaline granite are coeval intrusive rocks. The boundary between them is not clear and shows mingling structure. The lamprophyre locally intrudes the granite as a syn-plutonic dike. The U-Pb zircon dating used for the SHRIMP-II installed at NIPR gives ages of 559.4 ± 1.6 Ma, 550.0 ± 1.7 Ma, 548.8 ± 3.4 Ma for the layered syenite, the granite and the melanosyenite dike, respectively. The recalculated Pb-Pb age of the lamprophyre (M09010802A, published in Owada et al., 2013) shows 557.5 ± 4.8 Ma. Considering the field relationships and the zircon SHRIMP dating, the syenite complex, granite and lamprophyre would, therefore, intrude into this suture zone during the same magmatic stage.

The layered syenite has basically similar mineral assemblages in each layer but shows different modal abundances. The mineral assemblages are of K-feldspar, clinopyroxene, amphibole, biotite, epidote, titanite, ilmenite and apatite with small amounts of fluorite, calcite and zircon. The lamprophyre possesses mineral assemblages similar to the melanocratic layer of the layered syenite but poor in clinopyroxene. Bulk chemical compositions of the syenite complex form monotonous trends on the variation diagrams. SiO_2 contents of the syenite complex show a wide range (44-62 wt%) and total alkaline (Na_2O+K_2O) contents are as high as 4-15 wt%. The syenite complex and the lamprophyre have significant character with high-K ($K_2O/Na_2O>3$), high-LREE/HREE ratios and relatively enriched Sr-Nd isotopic compositions. The chondrite-normalized REE patterns of clinopyroxenes from the melanocratic part of layered syenite and lamprophyre show the concaved upward between LREE and MREE with HREE depletion. Considering petrography, mineralogy and geochemistry, the syenite complex has been derived from the lamprophyre magma, and fractional crystallization and accumulation played an important role of formation of the layered structure. Therefore, the syenite complex corresponds to the plutonic facies of the lamprophyre magma.

The lamprophyre possessing primitive compositions includes phenocrysts of Mg- and Cr-rich phlogopite. The P-T conditions of the lamprophyre magma are estimated by the biotite-liquid equilibrium relations (Righter and Carmichael, 1996). The calculated P-T conditions for the formation of lamprophyre magma are up to 1150 ˚C and 1.6 GPa that is equivalent to 60 km depth. The geochemical studies including Sr-Nd isotopic compositions reveal that the lamprophyre magma is derived from the enriched mantle; probably is formed by interaction between the depleted mantle and the enriched materials (*e.g.*, slab-derived fluids, melting product of subducted crustal rocks, or reaction with fossil wedge mantle) (Owada et al., 2013).

ゴンドワナ超大陸は西ゴンドワナ大陸と東ゴンドワナ大陸の衝突によって原生代末〜古生代初頭にかけて成立した．東南極セール・ロンダーネ山地は衝突帯の中心部に位置する．カリウムに富む岩石（閃長岩やランプロファイアー）は大陸衝突帯における火成作用を理解する上で重要な岩石とされ，後衝突期火成岩としてセール・ロンダーネ山地を含む東南極ドロンイングモードランドに広く分布している．山地中央部には閃長岩体（ルンケリッゲン閃長岩）が分布するほか，ランプロファイアー岩脈も散点的に広く産する．本研究は閃長岩とランプロファイアーのジルコン U-Pb 年代や化学組成を検討し，衝突帯における閃長岩質マグマの貫入時期とマグマの起源を議論する．

閃長岩は複合岩体として高度変成岩類を貫くストック状の層状岩体とそれを貫く優黒質な閃長岩岩脈から構成される．岩体の南側には，閃長岩複合岩体と同時期に活動した花崗岩が分布する．層状閃長岩と花崗岩のジルコン U-Pb 年代は，それぞれ 559.4 ± 1.6 Ma と 550.0 ± 1.7 Ma で，層状閃長岩を貫く優黒質閃長岩岩脈の年代は 548.8 ± 3.4 Ma を示す．また，ランプロファイアーの Pb-Pb 年代は 557.5 ± 4.8 Ma である．層状閃長岩の構成鉱物は，カリ長石，単斜輝石，角閃石，黒雲母，チタン石，チタン鉄鉱，緑簾石および燐灰石で，まれに蛍石，方解石，ジルコンを含む．ランプロファイアーの構成鉱物も基本的に優黒質閃長岩の組み合わせと類似する．閃長岩複合岩体は幅広い SiO_2 含有量(44-62%)を示し，高い Na_2O+K_2O 含有量(4-15%)や K_2O/Na_2O 比，そして LREE/HREE 比を示す．優黒質閃長岩とランプロファイアーの単斜輝石は，共に同じ REE パターンを示す．また，閃緑岩複合岩体とランプロファイアーは共に Sr-Nd 同位体比はやや肥沃的で，同じ同位体組成を示す．初生的な全岩化学組成を示すランプロファイアーには，高 Mg-, Cr-黒雲母斑晶が含まれる．この黒雲母組成と平衡なマグマの組成を考慮すると，ランプロファイアーマグマは地下 60km 付近のマントルから分離・上昇してきたと考えられる．また，Sr-Nd 同位体比の特徴は，このランプロファイアーマグマがやや肥沃なマントルに由来したことを示す．このようなマントルは，衝突以前の島弧的な枯渇マントルへ肥沃な物質が付加されたことによると推察される．

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