東南極セール・ロンダーネ山地に産する閃長岩マグマの起源

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Petrogenesis of syenite magma in the Sør Rondane Mountains, East Antarctica

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Syenitic rocks and related lamprophyres are thought to be important intrusive rocks 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 situated within the continental collision zone between the West and East Gondawana and the timing of collition is regarded as the late Proterozoic (650 to 600 Ma) (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 lamprophyre dikes intrude during the extensional stages in the Sør Rondane Mountains, eastern DML (Toyoshima et al., 2013). In this paper, we will address the petrography, mineralogy and geochemistry including isotopic studies of the syenite complex and related lamprophyre dikes, and then discuss the petrogenesis of the syenite magma.

The syenite complex occurring in the Lunckeryggen, the central part of the Sør Rondane Mountains, consists of a layered syenite and a melanosyenite dike. The complex has basically similar mineral assemblages in each layer but shows different modal abundances. The mineral assemblages are of K-feldspar, clinopyroxene, amphibole, biotite, titanite and apatite with small amounts of fluorite and calcite. Zircon is rare. The lamprophyre (576 Ma: zircon SHRIMP U-Pb age) possesses mineral assemblages similar to the melanocratic layer of the layered syenite. 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 high (4-15 wt%). Another important signature is that the bulk chemistry of lamprophyre is plotted on the chemical trends of the syenite complex. The syenite complex and related lamprophyre dikes geochemically form monotonous trends and have significant character with high-K ($K_2O/Na_2O>3$), high-LREE/HREE ratios and relatively enriched Sr-Nd isotopic compositions. Considering petrography, mineralogy and geochemistry, the chemical variations of the syenite complex can be explained by mainly fractionation and cumulate unmixing processes from a single parental magma. In other words, the syenite complex has been derived from the lamprophyre magma, and fractional crystallization and accumulation play an important role of formation of the layered structure. Therefore, the syenite complex corresponds to the plutonic facies of lamprophyre magma.

The geochemical studies including Sr-Nd isotopic compositions reveal that the lamprophyre magma is derived from the enriched mantle at the post-collision stage; 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). The present result demonstrate that the Sør Rondane Mountains underwent the extensional collapse with high-K magmatism similar to that observed in other part of the DML; *e.g.*, the syenite complex from the Yamato Mountains (Zhao et al., 1995).

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し，大陸衝突プロセスを解明する上で重要な地域であると考えられている．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ている．山地中央部には閃長岩（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の岩脈も産する．

本研究は閃長岩とランプロファイアーの岩石記載や化学組成を検討し，衝突帯における閃長岩質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．ランプロファイアー岩脈は，花崗岩を貫き，567Ma の U-Pb ジルコン SHRIMP 年代を示す．層状閃長岩は粗粒で、主にカリ長石の量比が異なる優黒質閃長岩、優白質閃長岩からなる．構成鉱物は，カリ長石，単斜輝石，角閃石，黒雲母，チタン石および燐灰石で，まれに蛍石と方解石を含む．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．閃長岩複合岩体に含まれるカリ長石と有色鉱物の量比は連続的に変化する．閃長岩は幅広い 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．層状閃長岩，優黒質閃長岩岩脈およびランプロファイアーは主要元素、微量元素共に一連の組成トレンドを形成する．さらに Sr-Nd 同位体比はやや肥沃的で，閃緑岩複合岩体とランプロファイアーは共に同じ組成を示す．

鉱物のモード組成や化学組成の検討から，層状閃長岩はランプロファイアーマグマを起源とし，そのマグマからの早期晶出鉱物と残液の混合作用によってと考えられる．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することを示す．その原因は，大陸衝突以前に存在した枯渇した島弧的マントルに対して，大陸衝突によって地殻物質が島弧的マントルへ付加であると推察される．このようなプロセスは東ドロンイングモードランドのやまと山脈に産する閃長岩体の成因と類似する．

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