The Lützow-Holm Bay Suture Zone: A major crustal break in the Lützow-Holm Complex, East Antarctica

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Recent petrological and geochronological data from the Lützow-Holm Complex (LHC) in East Antarctica indicate that the complex can be subdivided into three major crustal units: (1) Neoproterozoic (ca. 1.0 Ga) magmatic arc in the northeastern part of the LHC, (2) Neoarchean (ca. 2.5 Ga) microcontinent in the southwestern part of the LHC (Shirase Microcontinent), and (3) a suture zone separating the two units (e.g., Tsunogae et al., 2014, 2015, 2016; Takahashi et al., 2018a; Takamura et al., 2018).

The northeastern part (Prince Olav Coast) and the northwestern margin (Innhovde and Hutatu-iwa) of the LHC are composed of various orthogneisses showing magmatic ages of 1.0 Ga to 850 Ma (e.g., Tsunogae et al., 2015; Kazami et al., 2016). The geochemical and geochronological characters of the orthogneisses are similar to those of the Vijayan Complex of Sri Lanka, although metasediments are less abundant in the Vijayan Complex, based on which we regard that the northern part of the LHC in Price Olav Coast and the Vijayan Complex might corresponds to a unified litho-unit (arc or composite arc) as "Prince Olav-Vijayan Arc" (POVA). The POVA possibly collided with the Wanni Complex of Sri Lanka during the latest Neoproterozoic, forming the Highland Complex as a suture zone (e.g., Santosh et al., 2014).

The southwestern part of the LHC is composed dominantly of orthogneisses (e.g., charnockite and biotite-hornblende gneiss) with magmatic crystallization ages of ca. 2.5 Ga (Dunkley et al., 2014; Tsunogae et al., 2014, 2016), suggesting that this unit might correspond to a Neoarchean continental fragment defined as "Shirase Microcontinent" (Takahashi et al., 2018a). Although the size and the extension of the microcontinent are not known, recent geophysical data (Fitsimons, personal communication) suggest that the ca. 2.5 Ga terrane is an isolated block of about 200 x 300 km in size, and not a part of the Ruker Craton.

The POVA and the Shirase Microcontinent probably collided during the latest Neoproterozoic (590-550 Ma), and the entire LHC was affected by regional high-grade metamorphism. The boundary between the two terranes is defined by a thick zone of abundant metasediments with remnants of exotic orthogneiss blocks with ca. 2.5 Ga (Sudare Rock), ca. 1.8 Ga (Skallevikshalsen, Telen, and Austhovde), and ca. 1.0 Ga (Langhovde) magmatic ages. The tectonic boundary is now re-defined as the E-W trending Lützow-Holm Bay Suture Zone (LHBSZ) formed by the closure of paleo-ocean present between ca. 1.0 Ga POVA and ca. 2.5 Ga Shirase Microcontinent. The occurrences of <850 Ma magmatic ages in the POVA suggest that the direction of subduction could have been toward north.

The boundary between the LHBSZ and the POVA is not known because it is covered by thick ice (possibly around Ongul). In contrast, the LHBSZ - Shirase Microcontinent boundary can be observed in Rundvågshetta region where high-strain gneisses with E-W-trending strong foliation can be observed in the northern part (Fig. 1), whereas the southern part of Rundvågshetta is composed of abundant orthogneisses (charnockite and mafic granulite) possibly corresponds to the northern margin of the 2.5 Ga Shirase Microcontinent. Along the LHBSZ-Shirase Microcontinent boundary, graphite/sulfide mineralization and high-temperature metasomatism associated with brine infiltration (Takahashi et al., 2018b) are commonly observed, suggesting the effect of fluid infiltration along the crustal-scale shear zone.

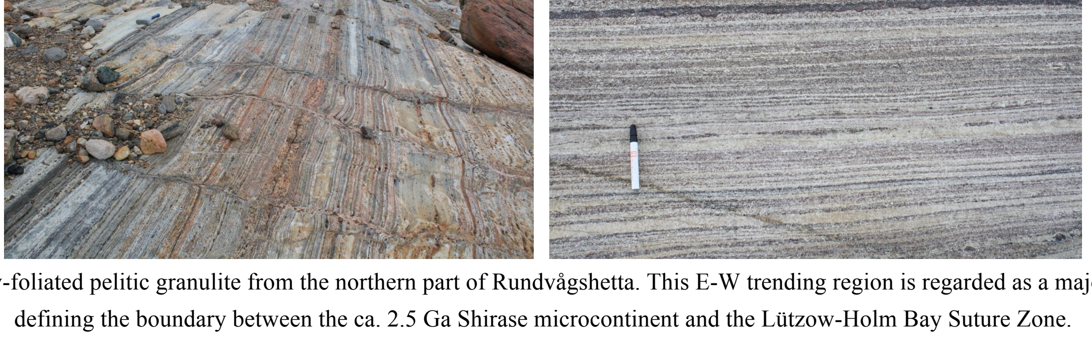

Fig. 1. Highly-foliated pelitic granulite from the northern part of Rundvågshetta. This E-W trending region is regarded as a major shear zone defining the boundary between the ca. 2.5 Ga Shirase microcontinent and the Lützow-Holm Bay Suture Zone.

Takamura et al. (2018) argued based on detrital zircon geochronology and lithological characters that the LHBSZ might continue to the Trivandrum Block in southern India. Although the eastern extension of the LHBSZ is not known, it might continue to the western Rayner Complex, and further east toward the terrane boundary between the Eastern Ghats Belt (India) and the Napier Complex.

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