Tectonic evolution of Sri Lanka based on isotope geochemistry of meta-carbonate rocks

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In this study, we deal with the meta-carbonate rocks in the Highland Complex (HC), which can help us in understanding the tectonic evolution of Sri Lanka. Pure carbonate samples that consist of calcite/ dolomite mineral or only with minor amounts of calc-silicate minerals were selected for this study.

The δ18O and δ13C values of pure meta-carbonate rocks are > 20 ‰ and range from -2.2 to 3 ‰, respectively, indicating preservation of possible Neoproterozoic marine carbonate values. In addition, these rocks show REE+Y patterns that are characteristic of platform carbonates. However, the initial 87Sr/86Sr ratios (850 Ma) show values that range from 0.704 to 0.706. These values when compared with the late Proterozoic Sr isotope chemostratigraphic curve of Halverson et al. (2010), suggest apparent depositional ages from late Tonian to early Cryogenian.

Many previous studies reported on tectonic evolution of Sri Lanka are based on the petrological and geochemical characteristics. One of these is a double-sided subduction model, during the Neoproterozoic, where the Wanni Complex (WC) to the west and the Vijayan Complex (VC) to the east were formed as continental-arcs. The subduction culminated in the collision with the HC during late Neoproterozoic to Cambrian (Santosh et al., 2014; He et al., 2016). Our estimated depositional ages of HC-WC side and HC-VC side indicate the former is older than the latter.

We compile the available strontium and neodymium isotopic data from all units in Sri Lanka and attempt to discuss on the tectonic evolution of Sri Lanka. Since neodymium isotopes in the oceans peripheral to continents are characteristic of local origin, the combination of Sr and Nd isotopes in carbonates are useful in understanding the tectonic environment of carbonate deposition (Otsuji et al. 2016). Accordingly, combining the radiogenic isotopic signature of igneous and meta-igneous rocks in the WC and VC with those of metacarbonate rocks from HC, we attempt to re-evaluate the tectonic interpretations of the crustal units of Sri Lanka.

Reference

Halverson et al. (2010), Precam. Res. 182, 337-350; He et al. (2016), Gondwana. Res. 32, 151-180.

Otsuji et al. (2016) Jour. Mineral. Petrol. Sci. 111, 170-180; Santosh et al. (2014), Precam. Res. 255, 1-29.