

Geochemical constraints on origin and evolution of the Vijayan Complex, Sri Lanka and its role in Gondwana formation

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The Precambrian crustal basement of Sri Lanka has been divided into four major litho-tectonic units as: the Wannu Complex (WC) to the west together with the Kadugannawa Complex (KC), the Highland Complex (HC) in the central region, and the Vijayan Complex (VC) to the east. This classification is largely adopted based on Nd-model age mapping and regional structural interpretations. Among the four units, HC is considered to represent the oldest and relatively deeper crustal rocks, and is interpreted to be a part of a supracrustal basin developed in a suture zone in the Mozambique Ocean during the Neoproterozoic Gondwana assembly. The WC is considered to represent a higher crustal level than that of the HC although there is no clear structural discontinuity between the rocks of the two complexes, and the contact between these two has been obliterated by later events. The boundary between the VC and the HC is well defined as a thrust/shear contact. The KC is interpreted as a layered intrusion within the WC and is regarded as a part of the WC or as a disrupted large magma chamber exposed at the eastern margin of the WC.

The existing geochronological and geochemical data support that the VC is predominantly a Grenville-aged (~1 Ga) magmatic arc, distinct from the metasedimentary dominated adjacent Highland Complex. Although the geochemical data support a subduction-related magmatic arc model, pervasive K-metasomatism has modified many of the gneisses that now have a granitic composition. This implies that the original rocks of the Vijayan Complex would have been more mafic and likely contained more tonalites and trondhjemites. The unique composition and age of the VC indicate that correlation of its geology with terrains in adjacent parts of Gondwana is difficult, although numerous attempts have been made. Recent studies have highlighted the importance of the Gondwana fragments in Sri Lanka in which only limited radiogenic isotope systematics (whole rock Sm-Nd and Lu-Hf in zircon) have been used to gain insights into continental growth in the Neoproterozoic Earth. However, these studies mainly focused in the HC, WC and KC and only very limited samples from the VC were investigated. These limited whole-rock Nd and Hf-in-zircon isotopic compositions of the VC are more variable than would be expected in an entirely juvenile terrain.

Hence, it is suspected that either unknown volumes of older continental material may have involved in the generation of the Vijayan rocks probably similar to modern island arcs such as Japan or large-scale involvement of trench sediments by subduction. Presently, there is no clear answer to this question, which creates difficulties and inconsistencies in correlating the Sri Lankan crustal terrains with the other Gondwana fragments. Therefore, in this study, we have undertaken a comprehensive geochemical study combining with high precision radiogenic isotopes on rocks of magmatic origin from the VC of Sri Lanka in order to establish the linkage with other Gondwana terrains, as a contribution to the global understanding of supercontinent growth.

Keywords: Vijayan Complex, Gondwana, Radiogenic isotopes, Geochronology, Sri Lanka