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A geochronological U-Pb zircon La-ICPMS age and provenance study of Wanni, Highland and Vijayan Complexes of Sri Lanka and Proterozoic Pranhita Godavari Purana basin of India unveils origin of Sri Lanka.

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Chapter 4 - Charnockites of the Highland Complex and the Vijayan Complex of Sri Lanka show two different Geological Origins: LA-ICPMS U-Pb Zircon Geochronology.

Abstract

The island of Sri Lanka is the focus of Neoproterozoic super continent Gondwana. But the geological origin and paleotectonic position of Sri Lanka are least understood without knowing age and provenance of the four main crustal units, the Wanni Complex (WC), Highland Complex (HC), Vijayan Complex (VC) and the Kadugannawa Complex (KC). The study of age and provenance of metaquartzites of the WC and HC, leucosomes and paleosomes of migmatites of the WC, and charnockites of the HC and VC of Sri Lanka and sedimentary rocks of neighboring Proterozoic rift basins like Pranhita-Godavari basin of central India is significant in research on origin of Sri Lanka and also continental evolution to unravel the paleotectonic position of Sri Lanka before Gondwana being amalgamated in the Neoproterozoic. This study examined age of detrital zircon cores and metamorphic rims of metaquartzite, migmatite and charnockite samples along two west to east transects across the island of Sri Lanka as well as sedimentary rock samples from the Pranhita-Godavari rift basin of India using the LA-ICPMS method.

The U-Pb zircon isotopic data from metaquartzites of WC (near WC-HC boundary) and HC demonstrate dominant Mesoarchaean to Paleoproterozoic (2.0-2.8 Ga) detrital input into the metasedimentary make up and near boundary WC and HC metaquartzites were deposited between 2000 Ma and ~550 Ma with a maximum age of deposition ~ 2000 Ma, however a sample from the western WC was deposited in early Neoproterozpoic and mixed with Paleoproterozoic to Neoarchaean detritus indicating WC and HC terranes existed adjacent to each other since early Neoproterozoic and current WC-HC boundary is inaccurate and to be shifted westwards.

This study reveals that parent materials of leucosomes of WC migmatitic gneisses are metasedimentary and showing late Mesoproterozoic to Neoproterozoic provenance (0.70-1.15 Ga) with maximum age of deposition at ~700 Ma. But paleosomes of WC migmatites show metaigneous origin with older Mesoarchaean ages (2.85-3.0 Ga) and have been identified in this study as the Mesoarchaean reworked continental basement material of WC. The HC charnockites clearly show metaigneous origin and primary intrusion ages of ~1.82 to 1.85 Ga. whilst a sample from the VC shows metasedimentary origin. A weighted mean of all rim data of WC and HC yields an age of 545.1 ± 9.7 Ma, supporting the age of

Ediacaran-Cambrian metamorphism. Metaquartzite rocks of the HC of Sri Lanka are correlated with the Trivandrum Block and Northern Madurai Block of South India and the Itremo Group of Madagascar whilst metaquartzites of the western WC of Sri Lanka are correlated with the Southern Madurai Block of South India and the Molo Group of Madagascar and Sri Lankan metaquartzites were most probably sourced from east African igneous protolith sources. These differences in sedimentary provenance and maximum age of deposition prove and confirm that WC was a different crustal domain from the HC terrane.

All this strongly supports a double subduction and collisional geological origin for the island of Sri Lanka with 'HC orogeny' occurred when the Southern Madurai Block of India (SMB)-WC and VC Mesoarchaean continental blocks collided with the HC orogenic belt and the oceanic crust of deeper basin of HC had subducted underneath the SMB-WC and VC continental blocks when ancient south Mozambique ocean closed along WC-HC boundary and HC-VC boundary sutures. This study reveals that Sri Lanka's paleotectonic position could be south east of south India connecting Trivandrum Block to the HC and WC to the Southern Madurai Block. The study also reveals that the Pranhita-Godavari Basin was sourced from Eastern Ghats and Antarctica unlike Sri Lankan terranes were sourced from East Africa indicating Southern Granulite Terrane of India and Sri Lanka were not parts of mainland cratonic India until Ediacaran-Cambrian times.

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