Detrital zircon populations in Ediacaran Period sediments distinguish active from passive continent margins even when metamorphosed and help resolve the Gondwana-Panotia supercontinent/megacontinent argument

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Great thicknesses of sand and greywacke were deposited on the margins of megacontinents during the Ediacaran Period (620–542 Ma). Zircon age populations in sediments with long deep-time flat profiles distinguish passive margin sedimentation from shorter humped zircon profiles characteristic of sediments derived from volcanic arcs and their feeder zones in active margins.

An example of a single hump detrital profile is given by an Ediacaran Period volcano present in the Charnian Supergroup in the Anglo-Brabant Massif of the East Avalonia terrane. This Gondwana fragment was originally part of the West Africa craton and was subsequently accreted to Laurentia. A volcanic complex with sediments carrying an Ediacaran biota is overlain by Triassic sediments. The main phase of eruption at c. 561 Ma provides a single hump zircon age histogram with a few pre-eruption zircon xenocrysts up to 40 Ma older.

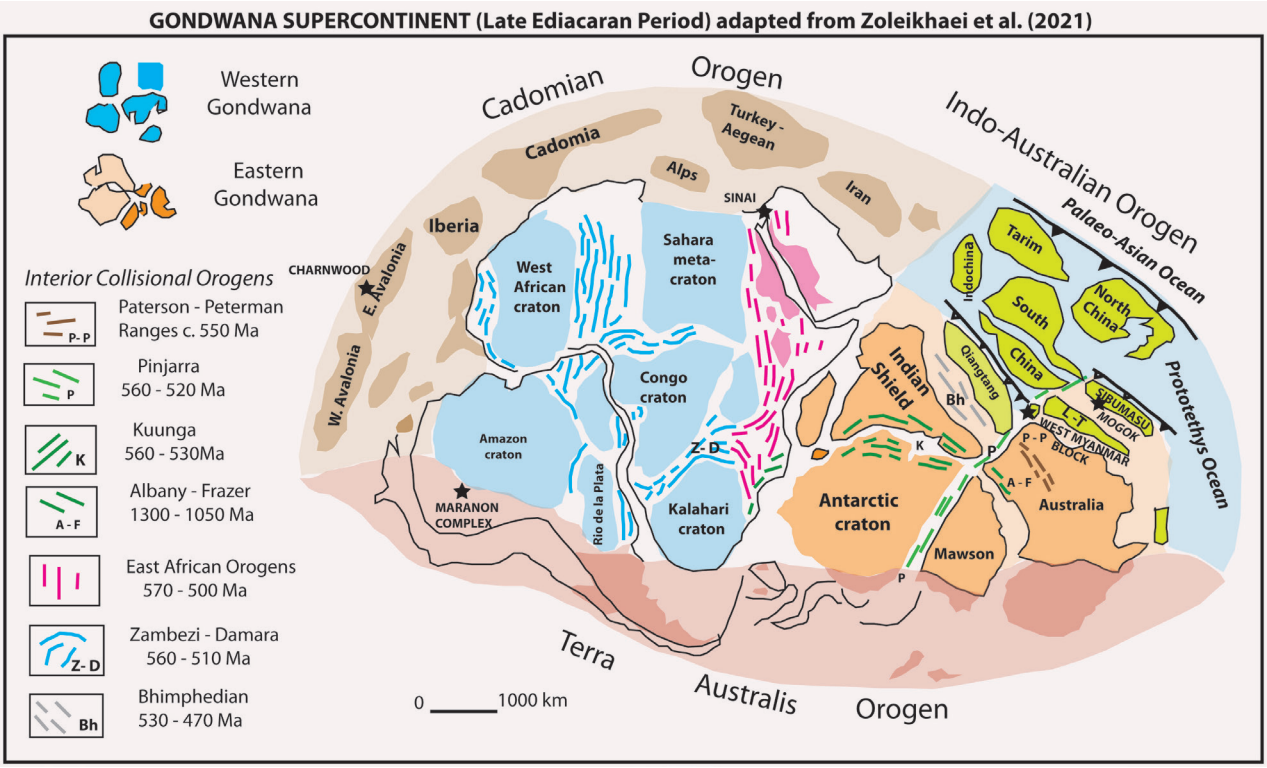

Fig. 1. Gondwana supercontinent (Late Ediacaran Period) (adapted from Zolekhaei *et al.*, 2021)

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There are many examples of successive episodes of volcanicity on the margin of Gondwana during the Neoproterozoic. In the Marañon Complex of Peru on the western Proto-Andean margin of the Amazonia block there were volcanic episodes between 880–750 Ma and 615–550 Ma. During the early Ediacaran Period Laurentia was attached briefly to Amazonia-Gondwana megacontinent to form the Panotia supercontinent. The time of the breakup is disputed but as eastern Laurentia had a passive margin until c. 600 Ma, it appears to have split from Amazonia-Gondwana c. 880 Ma, in a rift-drift scenario that resembles that in the Permian when Sibumasu broke from the Gondwana supercontinent.

In the Myanmar area of Sibumasu thick Ediacaran Period clastic sediments on the Shan Plateau are known as the Chaung Magyi Group which transitions into the Cambrian and also is present in both the high- and low-grade metamorphic zones of the Mogok Metamorphic Belt (MMB). In the granulite-facies area of the MMB detrital zircons are rare except in simple mineralogy metasediments like in a psammitic gneiss west of Mogok town. Detrital zircons of dacitic and granitic composition are preserved as nuclei to the c. 180–20 Ma metamorphic zircons. The youngest magmatic single zircon was 514 Ma together with zircons from magma suites of which the most numerous were 965–910 Ma and 1100 Ma in age. A few older xenocryst zircons which were either magmatic zircons derived from trans-crustal magma systems or zircons transported from the weathering of Proterozoic igneous rocks in the interior of East Gondwana. The Mogok magmatic zircon suites can be matched with granitic plutons in the area such as the c. 500 Ma Tawnpeng batholith from which K-Ar ages of c. 980 and c. 830 Ma are known indicating that trans-crustal magmatism was active during the Neoproterozoic in this part of the former Gondwana margin.

In the MMB of Myanmar the magmatism associated with the subduction of Prototethys ceased around c. 510 Ma when the South China megacontinent collided with Gondwana in the Indo-Australia accretion orogeny. Neoproterozoic zircon suites in sediments from Myanmar-Sibumasu, Lhasa-Tenchong and the Tethyan Himalaya indicate that terranes on the margins of East and West Gondwana had similar magmatic histories and the volcanic arcs were continuous rather than inboard of each other as has been suggested.

The recently described Ediacaran Period detrital zircon data from the West Myanmar Block place this small block on the Gondwana margin somewhere between Lhasa and Sibumasu. However the Cambrian metasediments in the Naga Metamorphics and in the Katha and Kumon ranges provide a challenge in interpretation. The Katha-Kumon area recently has been suggested either to be a part of the Tethyan Himalaya sequence of India that was thrust onto the West Myanmar Block or the Katha-Kumon Ranges are a faulted slice of Sibumasu. Examination of their detrital zircon profiles alternatively suggests that these Cambrian metasediments in fact are basal units in the West Myanmar Block sediment sequence.

Refrerences

Zoleikhaei Y., Mulder J.A. & Cawood P.A., 2021. Integrated detrital rutile and zircon provenance reveals multiple sources for Cambrian sandstones in North Gondwana. *Earth-Science Reviews*, 213: 103462. https://doi.org/10.1016/j.earscirev.2020.103462.