The Palaeo/Mesoproterozoic sedimentary basins of the São Francisco-Congo Craton: evolution and correlation

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Statherian taphrogenesis (1.8-1.6 Ga) produced a system of epicontinental basins on the São Francisco-Congo Craton. The volcanic and sedimentary rocks that fill these basins are collectively named Espinhaço Supergroup on the São Francisco Craton, whereas on the Congo Craton they comprise the Chela Group on the Angola-Kasai Shield, the Burundi, Rwanda and Mitwaba groups in the central African Kibaran Belt and the Muva Supergroup on the Bangweulu Block and within the Irumide Belt. New age and lithostratigraphical data reported for these successions allow a tentative test the original continuity of these basins across the entire São Francisco-Congo craton.

The Espinhaço Supergroup crops out in three domains in the central-eastern portion of Brazil: southern and northern Espinhaço range (SdEM and SdES) and Chapada Diamantina (ChDi). These basins were initially filled with continental sedimentary rocks (alluvial fans and aeolian dunes) and acid volcanic rocks during a rift phase, and then by continental and shallow marine sediments during transitional and flexural phases. Available geochronology suggests a long-lived nature for these repositories (ca. 600 Ma). Rhyolites at the base of the Espinhaço Supergroup were dated using the zircon U–Pb method at ca. 1770 Ma (SdEM), and ca. 1750, 1752 ± 4 and 1748 ± 1 Ma (Rio dos Remédios Group, ChDi). Minimum ages for the Espinhaço Supergroup are given by K–Ar on basic intrusions in SdEM at between 1.2 and 0.9 Ga. In ChDi a minimum age is given by a Pb/Pb isochron at 1140 ± 140 Ma in limestones close to the top of the Espinhaço Supergroup.

A depositional age of 1790 ± 17 Ma was reported for the Chela Group on the Angola-Kasai Shield in Angola, based on a zircon U–Pb age for a tuff in the basal Umpata Formation. This age supports previous work suggesting a correlation between the siliciclastic Chela Group and the basal formations of both the SdEM and ChDi. Further east on the Congo Craton, a zircon U–Pb crystallization age of 1780 ± 9 Ma for the Murore Tuff at the base of the Burundi/Rwanda group defines its depositional age in the NE Kibaran Belt. This group is dominated by siliciclastic shallow-water deposits, but also comprises turbiditic sequences attesting to deeper marine conditions. Detrital age data for quartzites from the NE Kibaran Belt (Rwanda and Burundi), indicate the existence of an older sedimentary succession with depositional age of ca. 1.78 Ga intruded by granitoids at ca. 1.38 Ga (minimum age), and a younger succession with maximum age of 1.41 Ga (youngest concordant zircon) for which no reliable minimum age constraint has yet been determined. A two-fold division is confirmed in the central part of the Kibaran Belt where an older sequence (Kiaora Group) unconformably overlies a Palaeoproterozoic basement complex and has been intruded by granitoids at ca. 1.38 Ga, while a younger succession (Nzilo and Hakansson groups) post-dates granitoid emplacement at 1.38 Ga and is intruded by Sn-bearing granites at ca. 1.0 Ga. Whereas in the NE Kibaran Belt no clear stratigraphic marker has been reported to delineate the two successions, in the central Kibaran Belt the two Groups are separated by a regional conglomerate (Kataba Conglomerate).

The Muva Supergroup of the Bangweulu Block and Irumide Belt comprises a sequence of largely undeformed aeolian, fluvial and lacustrine siliciclastic rocks on the Bangweulu Block (Mporokoso Group) and strongly deformed shallow-marine quartzite-pelite successions in the Irumide Belt (Manshya River/Kanona Group). A limited basin of very mature sandstones, termed the Kasama Formation, represents a second-cycle deposit derived from the Mporokoso Group. The Mporokoso Group of the Bangweulu Block unconformably overlies a plutono-volcanic basement dated using zircon U–Pb at 1.87–1.86 Ga. Tuff layers, associated with this basement occur within the basal parts of the Mporokoso Group, strongly suggesting a depositional age of ca. 1.86 Ga. Similar tuffs also occur within the Manshya River/Kanona Group succession of the Irumide Belt, and yielded zircon U–Pb ages of 1879 ± 13, 1871 ± 24 and 1856 ± 4 Ma, directly constraining ages of deposition for that group to be broadly coeval with deposition of the Mporokoso Group. The Kasama Formation quartzite is confirmed to be a younger succession, as it contains detrital zircon as young as 1434 Ma, while a close match between its detrital components and those in the Mporokoso Group supports its recycled nature. The data show that broadly coeval and sedimentologically similar epicontinental sedimentary basins occur on the São Francisco and Congo cratons, suggesting the possible existence of a large epicontinental shallow-water sea covering large extents of these cratons during Statherian times.