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Neoproterozoic DARCs in the Damara-Lufilian-Zambezi and Ubendian belts and the Western Rift Rise- relics of Rodinia fragmentation at 750 ± 50 Ma

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The Greater Congo Craton (GCC) was assembled by the late Mesoproterozoic, although whether or not it formed an integral part of Rodinia is still debated [1, 2]. Initial post-Irumide rifting of the GCC at c. 880 Ma resulted in the deposition of the Roan Gp of the Katanga Sgp, and the Nossib Gp of the Damara Sgp. A palaeopole for the 880 Ma Nchanga Granite, indicating a palaeolatitude of ~40 [3], supports reconstructions where GCC was part of Rodinia [1]. In both Sgps, a major unconformity marks the onset of rifting, uplift and ocean opening, when terrains to the south rifted away to form the Khomas Ocean, with development of an extensive Damaran-Katangan passive margin on the GCC. The rifting, which coincided with Rodinia breakup, occurred within the collage of Irumide accreted arc terranes [1], which extended from central Malawi and E. Zambia to central Namibia [4]. It may have been triggered by a mantle plume, which generated a triple junction (Damara and Zambezi rifts and Kundelungu Aulacogen) [4].

The rift succession is represented by c. 765-735 Ma mafic lavas and pyroclastics, olistostromes and breccias of the Mwashya Subgp, and 746 2 Ma ignimbrites and acid lavas of the Naupoort Fm (U. Nossib Gp) and 747 2 Ma rhyolites of the Ugab Subgp [4, 5]. In northern Namibia, deformed alkaline rocks and carbonatites (DARCs [6]- a Burkean acronym!) have similar ages to the rifting event. The Oas quartz syenite is dated at 756 2 Ma [5]. New dating of various intrusive phases of the Oas syenites has given U-Pb ages of 765 4.5 Ma (subvolcanic alkali granite) and 762 12 Ma (syenite) [7]. At Lofdal there are many carbonatite and nepheline syenite intrusions of similar age (762 2 Ma [7]; 765 16 Ma [8]). The Mwashya rifting event produced the 800m-thick Lwavu lavas (W. Zambia), tuffs and agglomerates of the Mwashya Subgp and the Kibambale volcanics flanking the Kibaran Belt NW of the Kundelungu Aulacogen. This rifting may have continued N towards the Western Rift Rise of the Kivu region of eastern DRC, where an alignment of c. 800-740 Ma DARCs, varying from alkaline granite to nepheline syenites to carbonatites, flanks deformed Neoproterozoic Itombwe Sgp rocks [9]. DARCs intruding and flanking the Ubendian Belt are also of this age- the Mbozi Ne-syenite, S. Tanzania (748 6 Ma); the Songwe syenite, N. Malawi (718 20 Ma), and the Nkombwa Hill carbonatite, N. Zambia (675 29 Ma) [4, 9, 10]. Coeval alkaline magmatism in the Ubendian Belt during the Kundelungu Aulacogen development means that the Bangweulu Block must have been rifting away from the Kasai Block, producing sinistral strike-slip reactivation of the Ubendian Belt. The rifting event has recently been recognised in central Malawi, where a deformed nepheline syenite gneiss contains zircons with cores dated at 730 4 Ma [9]; in eastern Zambia, where meta-rhyolites are dated at c. 750 Ma [Siegfried & Armstrong, unpubl., pers. comm.], and western Zambia, where there are 750 5 Ma subvolcanic porphyritic alkaline granites (Kasempa), and 749.5 3.4 Ma quartz syenites (Mwombezhi Dome) [7]. The DARCs were deformed during the Pan-African Damara-Lufilian-Zambezi Orogeny, at about 550-522 Ma, during the collision of the Congo and Kalahari cratons, coinciding with Gondwanaland assembly [4,11].

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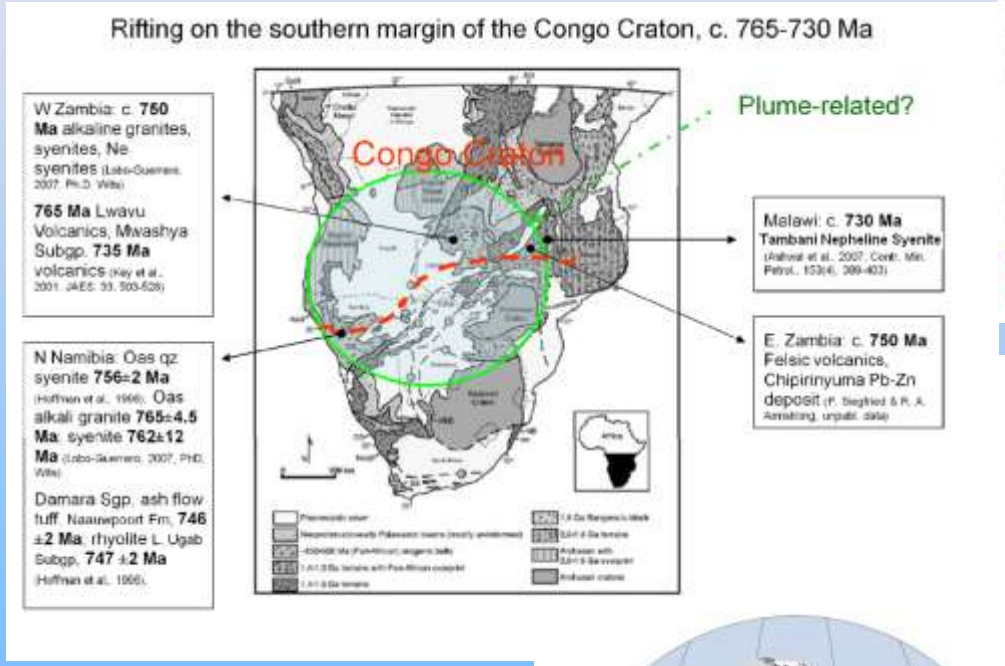

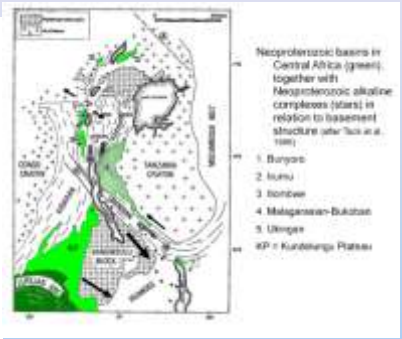

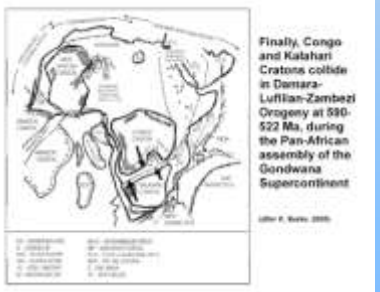

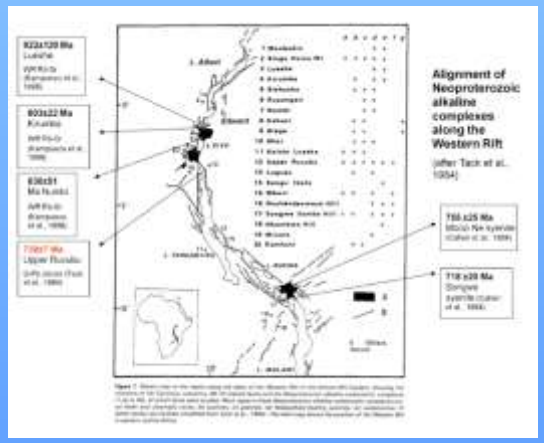

Greater Congo Craton in Rodinia (after Li et al., 2008)

What are DARCs?

"DARCs" is an acronym for "deformed alkaline rocks and carbonatites"

(Burke, Ashwal & Webb, 2003, Geology, 31, 391-394)