Paper Number: 1824

Crustal evolution in Central and Eastern Africa, with Special References to the Granitoids associated with the Paleoproterozoic Ubendian belt: SE D.R. Congo, SW Tanzania and NE Zambia.

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The Ubendian belt together with its coeval Usagaran Belt, form a large Paleoproterozoic metamorphic zone at the western and southern edges of the Archean Tanzania Craton. This mobile belt, about 200 km wide, extends over 1000 km from Lake Malawi to Lake Tanganyika in Malawi and Tanzania into eastern the Marungu Plateau in D.R. Congo.

Structurally the Ubendian Belt represents a shear belt with a tectonic and magmatic evolution in 3 major phases spanning more than 2 Ga of Proterozoic activities. [1] [2] [3] [4]. The first phase of deformation in the granulitic facies is represented by the oldest Mbarali granite (2026±8 Ma) exposed in SW Tanzania. Its emplacement is related to the early Ubendian granulite facies phase metamorphism. The second phase comprises the Mpanda granite (1847±37 Ma), the Ufipa granite (1864±32 Ma), the Kate granite (1838±68 Ma) in W Tanzania and the Moba complex (1943±43 Ma, 1863±53 Ma) in D.R. Congo. The emplacement of these granitoids is thought to be synkinematic and associated with the second Ubendian ductile shear deformation NW-SE shear zones or late- syntectonic. This second shear phase is marked by, the coeval emplacement of synkinematic calc-alkaline batholiths and post-kinematic calc-alkaline granitoids (climax at ca 1700 Ma). It is also marked by a northwest-southeast gneissic foliation and mylonitic textures, linked to intrafolial folds and associated with an amphibolitic metamorphism and an east-west thrusting event. From 1700 Ma, the emplacement age of Lumono granitoids from Marungu Plateau in D.R. Congo, the Ubendian Belt was subject to reactivations that occurred episodically, and were accompanied by upper greenschist facies retrograde metamorphism. Northeast southwest open folds and shear zones, lower amphibolite-facies metamorphic overprint and intrusion of alkaline magmatic bodies mark this metamorphism. The third magmatic stage is represented by the granitoid complexes of Mambwe (1869±40 Ma), Luchewe (1824±145 Ma), Mansa (1833±18 Ma) in Northeast in Zambia), and those of Pepa-Lubumba (1861±28 Ma; 1820±200 Ma) and Lumono (1695±44 Ma) in D.R. Congo). They are late kinematic, non-deformed and the linear and planar fabrics do not reflect a tectonic control during the emplacement of the intrusive bodies.

The crystallization sequences deduced from textural relationship between minerals are characterized by early appearance of Fe-Ti oxides minerals followed by amphibole and/ or pyroxene, biotite and/or plagioclase, alkaline feldspars and quartz. These petrographical features are similar to those typifying calc-alkaline magmas crystallizing under high P_{H2O} and fo_2 conditions.

From geochemical point of view, the Ubendian granitoids display characteristics typical of Volcanic Arc Granites (VAG), and their emplacement is associated with the Palaeoproterozoic subduction in this part of the African plate. Their parent magmas could result from the mixing of two end-members, a mantle-derived magma and a crustal-derived one. On the whole, they reveal a complex geological history involving granitoids, which display space-time petrological and geochemical evolution. A petrogenetic model possibly explains the various types of granitoids within the evolution of the Ubendian belt is proposed.

Selected references

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