From Rodinia to Gondwana: Evidence for Breakup and Convergence of West and East Gondwana from Egypt and East Africa

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The development of the eastern margin of West-Gondwana before and during the Pan-African convergence in the Eastern Desert of Egypt is compared with Panafrican structures in East Africa. In Egypt, the orogenic cycle began at 800 Ma with rift-related tectonics during the breakup of Rodinia. Between 660 and 640 Ma plate convergence caused compressional tectonics. From 640 to 620 Ma the emplacement of ophiolitic nappes began. At 614 Ma a transpressional regime caused exhumation of the metamorphic cores and sinistral strike-slip shear zones at their margins. At 590 Ma orogen-parallel extension detached the ophiolitic cover from the basement. This development is compared with East Africa: In Voi area of southern Kenya three structural domains can be distinguished: (1) An easternmost domain (East Galana River) consists of metapelites and marbles of continental margin affinity. (2) A central domain (West Galana River) is composed of metatonalites and amphibolites of island arc and MORB affinity. It forms a very pronounced north-south trending wrench fault zone with left lateral displacement. (3) A westernmost domain (Taita Hills) exhibits flat foliation planes and southward thrusted nappe sheets, probably originating from an accretionary wedge. These observations might indicate that the eastern margin of West Gondwana might be localised in the Galana River profile and that this zone represents a prominent suture zone. Continental margin sediments and wrench fault structures can be traced into Central Tanzania. Age data obtained for granulite rocks reveal a complicated geological situation, Although many of the age data are very consistent over the Pan-African, some data differ significantly. These inconsistencies are explained by large strike-slip fault systems which juxtaposed different age domains. In Central Tanzania the structural style changes completely: Here structures are dominated by highly strained flat-lying mylonitic bands which show a well-developed top to the west shear sense, indicating nappe transport onto the Tanzanian Craton. The following model may can explain all these observations:

In contrary to the Eastern Desert of Egypt, where convergence only led to ocean-continent collision, the Mozambique Belt in southern Kenya and Tanzania is the result of continental collision tectonics. Remnants of island arcs occur at least in the Voi area and might be part of a suture zone. An oceanic domain between an eastern passive continental margin and a western terrane now represented by the Tanzanian granulite belt closed, incorporating island arc and accretionary wedge material. Oblique convergence is suggested by wrench tectonics. The age of convergent tectonics is 530 – 580 Ma, dated by Sm-Nd garnet-whole rock analysis. This is interpreted as the age of peak metamorphism. Pan-African major structures consist of: 1) Nappe stacking with NE-SW transport in S Kenya and northern Tanzania, characterised by high-temperature thrust emplacement within a deep crustal level. 2) Westward horizontal nappe transport onto the Tanzanian Craton in Central Tanzania. Since ages from the craton margin are not overprinted by Pan-African ages, this thrusting must have been relatively cold. The root of the these nappes is in the eastern part of Tanzania. 3) Major and minor strike-slip shear zones which juxtapose areas with different age domains (different mineral and cooling ages).