II-1-9 O-5 4393

THE ROLE OF THE AMAZON AND NW AFRICA CRATONS IN THE UPPER PROTEROZOIC ACRETION OF GONDWANA

Georg Robert SADOWSKI (Institute of Geosciences,Univ.São Paulo,Brasil)

The Amazon-NW Africa Craton was probably the major continental area of Western Gondwana during the Upper Proterozoic. Its present Eastern border is represented by a very extense guirdle of sutures underlined by ophiolites, gnaissic domes and extense thrusts and nappes. This system is represented by the Iforas-Gurupi-Tocantins and Paraguaia belts. The Eastern continental masses represented today by the Tuareg Shield, the Northeastern Brasil Massif, the Congo-São Francisco and Parana Cratons collided with this cratonic area, were consequently affected by intense lateral shearing and heating and, presently show extense milonitic belts of several hundreds of miles in extension.

The Western border of Gondwana showed a controversial evolution which evidences are obscured by the overprinting of later orogenies.

The Rokelides shear belt dislocated dextraly the Guayanan-NW African connection at the end of the Proterozoic.

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The Pan-African Ethiopia-Tanzania and the Kibaran Lurio-Mamama orogens of East Africa: abandonment of the "Mozambique Belt".

Raphael UNRUG (Dept. Geol. Sci., Wright State Univ., Dayton, Ohio, USA).

The Pan African orogen of East Africa south of the Arabian-Nubian shield extends across Ethiopia and Kenya where it is partly covered by Cenozoic volcanic rocks, and continues into northern Tanzania. Its southern termination has not been described. With the establishment of the Kibaran (1300-1000 Ma) age of the Lurio-Mamama orogen in Mozambique, southern Malawi and southern Tanzania, the term "Mozambique belt" for the Pan African orogen of East Africa became a source of confusion. The original definition of the Mozambique belt by A. Holmes in 1948 was established on c. 1300 Ma ages from Mozambique. L. Cahen in 1961 included the Mozambique belt of Holmes in the system of Late Precambrian to early Paleozoic orogens, that was subsequently named Pan-African by Kennedy in 1964. This was based upon the presence of intrusions and widespread Late Proterozoic to early Paleozoic radiometric ages that are now attributed to thermal rejuvenation.

It is proposed the name "Mozambique belt" be discontinued and replaced with the name "Ethiopia-Tanzania mobile belt". The "Mozambique province" as described by L.Cahen and N.J.Snelling in 1984 contains the Kibaran Lurio-Mamama mobile belt, and in Late Proterozoic time formed part of eastern Gondwana. The southern termination of the Ethiopia-Tanzania mobile belts is placed at the Schlesien-Mwembeshi-Climaliro dislocation zone extending between the São Francisco-Congo and the Kalahari cratons. This dislocation zone formed a major Late Proterozoic transform fault that controled the opening and closure of the ocean basin extending south from the Arabian-Nubian region. In Tanzania east of Lake Malawi, the Karoo Metangula and Luwega basins are superposed on the easternmost part of the dislocation zone. The recent aeromagnetic map of Tanzania clearly shows a change of trend of magnetic grains across a line in the basement of the Metangula and Luwega basins, that is interpreted as the easternmost segment of the transcontinental dislocation.

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Early Proterozoic assembly of "Ubendia" in Proto-West Gondwana (Equatorial and Southern Africa and adjacent parts of South America).

Sharad MASTER (Zimbabwe Mining Dev. Corp., Alaska, Zimbabwe).

Gondwanaland was ultimately assembled through the collision of West Gondwana (Africa and South America) with East Gondwana (India-Madagascar-Australia-Antarctica) in the Mozambique-Kirwanveggen Belt. West Gondwana was assembled in the late Proterozoic by the suturing of the composite Guiana-West African Shield ("Eburnia") with East-Central Africa and Eastern South America ("Ubendia") in the Pharusian Belt. Backstripping the Pan-African-Braziliano and Mozambique-Irumide-Kibaran events leads to the configuration of the eastern part of Proto-West Gondwana ("Ubendia") at c.1.8 Ga, when two Archaean mini-continents ("Sakongu" and "Tamazilika") had been sutured through collision events of the "Ubendian" cycle. "Tamazilika", consisting of Archaean shields of Tanzania, Malawi, Zimbabwe, Limpopo and Kaapvaal, together with the Grunehogna (W. Dronning Maud Land) and Pilbara (W. Australia) blocks, collided with "Sakongu", consisting of Sao Francisco, Angola, Kasai, Congo and Jebel Uweinat, after consumption of the intervening oceanic crust in an easterly-dipping subduction zone. The subduction (between 2.2-2.0 Ga) produced an Andean-type magmatic arc on the leading western edge of Tamazilika (represented by calc-alkaline plutonic and volcanic rocks [with some porphyry Cu-Mo deposits] of Tandilia, Richtersveld, Damara and Copperbelt basement, Mkushi, Bangweulu and Marungu). The magmatic arc was separated from Tamazilika by a back-arc basin, which was ensialic in the south (Kheis, Magondi, E.Zambia, Malawi), but may have opened into a small oceanic basin in the north (Ubendian and Ruzizian belts, Ruwenzori). Collision of the magmatic arc with Sakongu was accompanied by granulite facies metamorphism and the production of syn- and late-tectonic granitoids. In the south, the arc terrane overrode the back-arc basin, and the back-arc basin sequences were thrust with an easterly vergence onto their adjacent Archaean cratons of the Tamazilika mini-continent, in the Kheis and Magondi mobile belts. In the north, the oceanic back-arc basin closed with subduction directed towards the west, resulting in a c.1.8 Ga magmatic arc (Marungu Plateau, Bangweulu Block) being superposed on the earlier c.2.0 Ga magmatic arc. Collisional closure of the back-arc basin resulted in the high-grade accretionary terranes, including possible ophiolites, of the Ubendian-Ruzizian belts. The fundamental structural grain imposed on the African continent by the collision of Sakongu and Tamazilika was utilised in the Kibaran and Irumide belts, the Sinclair-Ghanzi and Damaran Pan-African belts, the Luangwa, Mid-Zambezi and Passarge Karoo rifts, and the western arm of the East African Rift System. Geochemical inheritance from the magmatic arc terrane resulted in the concentration in the later Kibaran-Irumide and Pan-African (Katangan-Damaran) sequences of those elements most associated with magmatic arcs (Cu, Sn, W, Au, Ag), eg. in the Central African Copperbelt, and in Kibaran and Damaran Sn-granites.

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Pan-African belts around the West African Craton : a review.

Michel VILLENEUVE (.Inst. Geodyn., CNRS, Valbonne ,France) and Jean J. CORNEE (URA 1208, Univ. Prov ., Marseille (France).

A network of Pan-african belts (1000 - 500 Ma) surrounds the West African craton in the Northwestern part of Africa . All of these belts produced by collisional process, did not arise in the same time . According to various and recent works, we distinguish three main tectonic events during the Pan-African cycle and consequently, three differents Pan-African belts. These tectonic events reflect generally the metamorphic phase linked to the collisional stage.

- The Pan-African I event (650 - 630 Ma) which occurs mainly in West Africa (Bassaride belt) and could be extended to the Mauritanides. The suture line shown by several main gravity anomalies may be linked to the Brunswick magnetic anomaly , in Georgia.

-The Dahomeyide event (620-600 Ma) which produced the Dahomeyide belt and which extends from the Benin to the Moroccan Anti-Atlas, through the Iforas and West Hoggar belts. This event may be extended to the Northeastern Brasil .

- The Panafrican II event (550 -530Ma) which occurs in Sierra Leone and Liberia (Rokelide belt) but not in North Africa. We think that the cryptic suture of Rokelides is linked to the Carolina slate belt island arc and may be a part of a Cambrian circum Gondwana tectonic belt. This panafrican event belt could also be extended to the Brasil .

The Panafrican network across the Northwestern Gondwana margin does not represent a single orogenic event but results from differents orogens which could be superimposed in any parts, for instance, in the Mauritanide belt .

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Late Protrerozoic to early Palaeozoic events in East Gondwanian crustal fragments

Masaru YOSHIDA (Dept. Geosci., Osaka City Univ., Japan).

Data on geology and tectonothermal events during ca 1000 Ma to 400 Ma are assessed to obtain a geotectonic evolution of Gondwana during this period. A mobile belt having a tectonothermal culmination epoch of ca 1000 Ma is identified to develop continuously along almost all coastal areas of East Antarctica, and is designated as the Circum East Antarctic Mobile Belt (CEAMB). This belt is found to be composed mostly of granulites, and in the areas from Lutzow-Holm Bay to Pryds Bay, the granulites are mostly of young supracrustal origin in the central zone and of reworked older crust at marginal zones of the mobile belt. This mobile belt is considered to represent a past convergent plate boundaries judging from structural, petrological and petrochemical characteristics, and of metamorphic PTt paths characterized mostly by isothermal decompression. Some convergent models recently obtained from LHB and Sor Rondane Mountains are evaluated to give a realistic figure of tectonics of this belt. Thus CEAMB is interpreted to have resulted from the tectonic process directly related to the birth of East Gondwana.

Tectonothermal events of ca 700 Ma and 500 Ma having taken place throughout East Antarctic coastal areas as well as along Eastern Ghats and southwestern Australia involve activities of charnockite, granulite, pegmatite, and/or migmatite, or thermal rejuvenization, and do not involve the accumulation of supracrustal rocks. This is a sharp contrast to the dominant development of sedimentary-volcanic piles including some ophiolitic members in the Mozanbique Belt of east Africa. The tectonothermal events detected along the boundaries of crustal fragments of India-Australia, and Antarctica are found to become intense towards East Africa. This is explained in that the ca 700 Ma and 500 Ma events within East Gondwana are basically thermal events along principal weak zones within East Gondwana caused by the great collisional event of West and East Gndwanian mega continents during the Pan African times.

II-1-9 P-1 265

Geological evolution of the Proterozoic of southern Ethiopia.

Amenti ABRAHAM, Nassir HASSEN, Tesfaye YEMANE, Woldegabriel GENZEBU,Getahun SEYID, Kiros MEHARI, Tadesse ALEMU (Eth. Inst. Geol. Surveys, Addis Ababa, Ethiopia)

The Proterozoic geology of the Agere Maryam area (37° 30' to 39° E, 5° to 6° N) and adjacent localities, totalling about 20,000 sq km, is summarized as folows. Most of the area is underlain by high grade gneisses and associated plutons. The narrow Adola belt of low grade metamorphic rocks, 5 to 10 km wide and over 100 km long, runs N-S just west of 39° E. These rocks are mostly amphibolites and greenschists overlain by phyllites, metasilstones and metasandstones, and with associated serpentinite and mafic plutons. The earliest structural feature seen in the high grade rocks is a gneissic layering. This was folded during D1, forming rare mesoscopic intrafolial recumbent folds with E-W axes. D2 produced macroscopic to mesoscopic, generally upright folds with subhorizontal N-S axes, these being the main folds in the high grade terrane. During D3 a major N-S trending dextral strike-slip shear zone developed between 38° 30' and 40° E, its width at 6° N being about 170 km. This zone emerges from under Cenozoic volcanic cover at about 6° 30' N and continues south to the Ethio-Kenyan border, a distance of 350 km. D3 dextral shearing appears to have led to the formation of the basin in which the Adola low grade rocks were deposited. These rocks were folded into macroscopic to mesoscopic, generally upright N-S trending folds with subhorizontal axes during D4, probably at about 765 Ma. Accompanying metamorphism was of low grade. The Adola rocks were variably refolded by moderately to steeply plunging S-folds and cut by N-S sinistral strike-slip shears during D5, which probably ended about 710 Ma with the intrusion of late tectonic granites. D4 and D5 are interpreted as being due to N-S sinistral strike-slip movement of the high grade blocks bounding the Adola low grade belt to east and west. This sinistral shearing took place over the full length of the D3 shear zone. N-S sinistral shears marked by retrograde metamorphism and probably of D5 age cut the high grade terrane as well. Uplift of the area probably took place at about 630 Ma, with late granites being intruded at 555 to 530 Ma.

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