

THE MOABI SYNCLINE : THE WEST CONGOLIAN OF GABON AND ITS TECTONIC SIGNIFICANCE ¹

by

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(5 figures)

ABSTRACT.- The West Congolian belt of Gabon is considered as the failed arm or aulocogen of the Pan African orogenic system, which closed early in the Pan African history before closure of the major Pan African belts. The structure consists of a large asymmetric NW trending synclinal zone. Deformation increases in intensity to the SW side of this syncline where basement granites and gneisses were thrust over overturned West Congolian sediments. The thrust folds and cleavage were later back-folded by SW verging structures.

RESUME.- La ceinture Ouest-Congolienne du Gabon est considérée comme le bras manqué ou aulocogen du système orogénique panafricain, lequel s'est fermé tôt dans l'histoire panafricaine, avant la fermeture des autres ceintures panafricaines principales. La structure tectonique consiste en un grand synclinal asymétrique aligné vers le NW. La déformation s'accroît en intensité vers le flanc SW de ce synclinal où les massifs de granites et gneisses ont été charriés sur les sédiments renversés Ouest-Congolien. Le charriage, les plis et la schistosité ont été retrocharriés et plissés par les structures déversées vers le SW.

INTRODUCTION

The Moabi syncline of Gabon forms the northern part of the West Congolian mobile belt, a zone of late Pre-cambrian folding which can be traced for over 1300 km from Gabon through the Congo to Angola (fig. 1 and 2). The West Congolian succession consists of a thick sequence of psammites, pelites and calcareous sediments with mixtites of possible glacial origin at the base (Schermerhorn and Stanton 1963 ; Kroner, 1977 a). Volcanic rocks are rare with only restricted occurrences of basalts and andesites in Zaire and northern Angola (De Paepe *et al.*, 1976). Basement gneisses to the west of the belt are similar to those to the east of the belt and hence Kroner (1977 b) considered the belt to be ensialic without any ocean consumption. Recent U/Pb geochronology of zircons from a West Congolian granite in the Zaire/Angolian border has yielded an age of 752 ± 12 my while closure of an Rb/Sr system in a migmatite in Zaire has given an age of 612 my (Cahen *et al.*, 1976). Mineral ages of 450 my (Cahen and Snelling, 1966) are posttectonic, possibly cooling ages. The West Congolian belt is thus part of the Pan African mobile belt system.

The aim of this paper is to examine the structure of the northern part of the West Congolian belt in Gabon and discuss its significance in terms of Pan African tectonics.

STRATIGRAPHY

The West Congolian beds are a sequence of arenaceous and pelitic sediments (the Schists Greseux) underlain by calcareous rocks and pelites (the Schisto Calcaire) underlain by variable, locally pebbly, schists. In the Toulougaba area (fig. 2) there are at least two horizons of pebbly schist and similar horizons may be found to the south in the Congo and Zaire. Pebbles or cobbles are present in a poorly sorted clastic sediment. The pebbly schists were originally considered as glacial mixtites (Dadet, 1969) though Schermerhorn and Stanton (1963) and Cohen and Leperstone (1977) consider them to be mudflows.

Devigné (1960) considered the West Congolian beds to be unconformably overlain by sediments of the Mayumbian and Mont Bamba formations. He recognised several unconformities from the overlap of the different formations. However Scolari and Van Daalhoff (1965) have cast doubt on the existence of these unconformities. In Gabon no evidence has been found for the presence of unconformities in the lower schists ;

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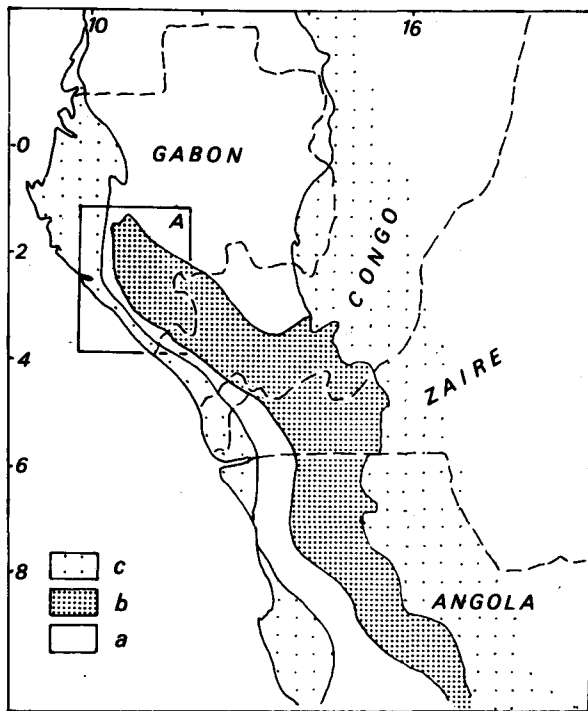


Figure 1.— Map of Equatorial West Africa showing the position of the West Congolian sediments (b), their basement (a) and late cover sediments (c)

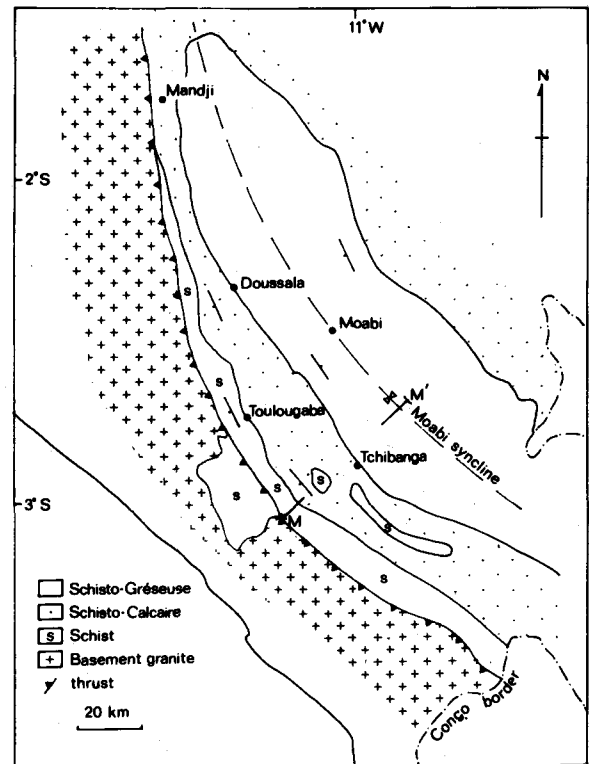


Figure 2.— Map of West Congolian belt in Gabon (area A of Fig. 1).

deformation is intense and any apparent oversteps on maps may be a result of tectonics.

Pre-Mayumbian rocks include granites, migmatites and amphibolites which show several deformation phases. The structures generally trend N-S to NE-SW though there are later NNE trending shear zones, possibly of Pan African age. A strip of basement gneiss outcrops west of the West Congolian rocks along the Atlantic coast from Gabon to Angola. In Zaire the gneisses have been dated at between 2125 - 2150 my by Rb/Sr isochron methods (Cahen and Snelling, 1966 ; Cahen, 1978) though some rocks give ages back to 2930 my.

STRUCTURE

There are two dominant fold and cleavage forming deformation phases (F_1 and F_2) which make up the Moabi syncline in Gabon. A slaty cleavage is associated with eastward verging folds and thrusts (F_1) and a locally intense crenulation cleavage is associated with later westward verging folds (F_2). There are occasional

later crenulation cleavages and in the west near the basement contact there is an earlier (F_0) cleavage parallel to bedding.

The F_1 phase.

This phase formed the major structures and cleavage. The West Congolian sediments were deformed into a large asymmetric fold (fig. 3 and 4). The basement gneisses and granites are undeformed except in the shear zones while the adjacent West Congolian sediments show an intense schistosity. The contact therefore must be tectonic, of thrust type. Mineral lineations and fibre growths indicate a transport direction to $040-045^\circ$. Fold hinges are horizontal on the F_1 cleavage and trend towards 140° . No evidence was found for hinges parallel to the transport direction.

The deformation intensity decreases to the east and the Schist Gréseux show little cleavage and folds of chevron, to kink band shape. This concentric form suggests the presence of a decoupling horizon at depth, possibly near the top of the Schisto Calcaire where there are local talc rich zones.

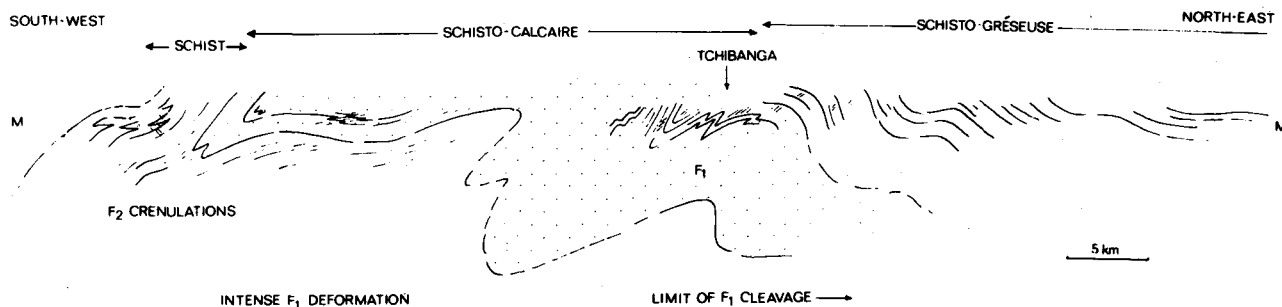


Figure 3.— Section through the West Congolian belt in the Tchibanga area (section line M-M' of Fig. 2). The Schisto-calcaire shown stippled.

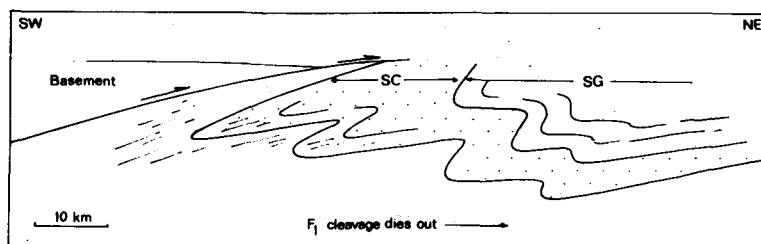


Figure 4.— Simplified section through the West Congolian belt removing the effects of F_2 deformation.

The metamorphic grade is low, of low amphibolite facies in the south west, anchizone in the Doussala-Toulougaba area. No evidence of metamorphism was found on the less deformed, NE limb, of the syncline.

The F_2 phase

This phase was one of back-folding, producing medium to small scale SW verging folds and a locally pronounced crenulation cleavage. The folds have nearly horizontal hinges which trend at 140° , coaxial with the F_1 folds. Together, the F_1 and F_2 structures make a strong linear fabric which plunges very gently to the NW or SE. No evidence was observed of metamorphic mineral growth during this phase.

DISCUSSION

Porada (1979) suggested that a major Pan African mobile belt could be traced along the western margin of Africa from the Cape to Gabon and that its pre-continental drift western margin could be seen in the Ribiero belt of South America. Porada (*op. cit*) interpreted this belt as the site of the proto-South Atlantic Ocean which closed in early Proterozoic times. The distribution of these Pan African belts is shown in fig. 5.

In Gabon, the full width of the Pan African - West Congolian Belt is observable ; the belt is not broken by later continental drift. The tectonic history involved large displacements on thrusts which moved to the NE. Basement rocks were involved in the deformation ; the structure was not due simply to gravity sliding. However there is no evidence for a suture zone ; there are no ophiolitic volcanics, no calc-alkaline intrusives or extrusives, no high pressure metamorphic rocks. The western basement appears to be part of the main Congolian craton.

The geochronological work of Cahen *et al* (1976) suggests that West Congolian deformation took place in the late Proterozoic. However deformation in the Damaran belt took place much later at between 550 - 500 my (Blaxland *et al*, 1979 ; Downing and Coward, in press), though in the Dahomeyan-Malian belt, Pan African dates of 645 - 570 my have been obtained (Bertrand and Davison, 1981 ; Black *et al*, 1979). Similarly the movement direction of the thrusts in the West Congolian belt is almost normal to the movements and overthrust directions of the Damaran belt (fig. 5, from Coward, in press). This suggests that the West Congolian belt is not part of the Cape - Damaran Pan African system.

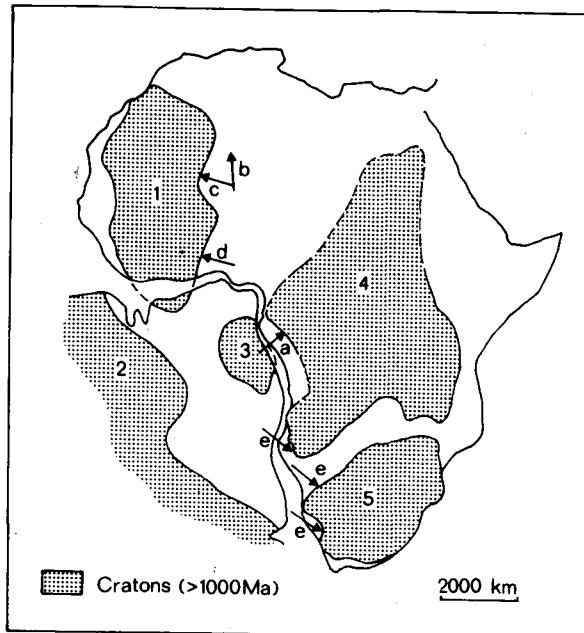


Figure 5.— The Pan African belts of Africa and NE Brazil and adjacent cratons.

1. West African Craton,
2. Guapore craton,
3. Sao Francisco craton,
4. Congo craton,
5. Kalahari craton.

Arrows indicate movement directions of major thrusts.

- a. west Congolian belt (this paper),
- b. and c. movements in the Hoggar (Boullier et al., 1979)
- d. Dahomeyan belt (Shackleton, 1977),
- e. Damaran belt (Coward, in prep.).

The sediments of the West Congolian belt are very thick with the boulder rich deposits, interpreted as mud flows, at the base. The preferred interpretation of the West Congolian belt therefore, is that it represents a failed arm or aulocogen of Pan African age. This arm closed early in Pan African history before the closure of the major belts. The West Congolian belt may thus represent a rift which joined on to the north-east fold belt of Brazil (the southern continuation of the Dahomeyan - Nigerian belt) and/or the Damara - Ribiera belt to the south. If the northern continuation of the Damaran belt involved ocean consumption the site of this proto-Atlantic suture is better placed in the Pan African belts of central Brazil where an ophiolitic rock is reported at intervals of nearly 1500 km along the eastern margin of the West Brazil (Guapore) Craton (Shackleton, 1977).

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