New paleomagnetic data on dykes to assess the accretions of West African Craton to Columbia and Rodinia

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A new Apparent Polar Wander Path has been calculated for the West African Craton (WAC) using paleomagnetic data obtained on the Yetti-Eglab intrusions and stromatolite-bearing formations. As no contact test was available, the magnetic stability of carriers was demonstrated thanks to rock magnetic measurements. One, two or three magnetization components on 159 oriented specimens (14 sites) have been isolated using principal component analysis or great circles technique, mainly on doleritic dykes. High and low unblocking temperature components were isolated in six dykes but also in four sites of the well dated Hank stromatolite-bearing formation (875-890 Ma). For the two kinds of rocks, the main components show stable remanent magnetization mainly carried by magnetite (or titanomagnetite) as described using thermomagnetic or Isothermal Remanent magnetization curves, where no significant mineralogical transformation occurred at high temperatures.

Five groups of paleopoles have been calculated: they witness the existence of a large circum-terrestrial loop with a drift from the high latitudes of the lower hemisphere to the high southern latitudes of the upper hemisphere followed by a re-entry in the high latitudes of the lower hemisphere. This is in agreement with the previous loop computed by Sabaté and Lomax (1975) between 2.1 Ga and 1.7 Ga. The Yetti and Eglab blocks amalgamated around 1.9 Ga and participated to the formation of Columbia Supercontinent. The paleopole computed for the stromatolite-bearing formation corresponds with the location of Rodinia Supercontinent at its early stages of amalgamation.

The geodynamic evolution of the WAC respect with that of Columbia and Rodinia Supercontinents suggests that the Eglab and Yetti were clearly separated by a large oceanic crust before 1.9 Ga. A volcanic arc developed during the subduction of this ocean followed by crustal thickening which generated an intrusive suite (Aftout granites) when it was at the northern low latitudes. Fennoscandia and Rio de la Plata Cratons were close to the WAC after 1.7 Ga. Fennoscandia probably followed the same loop as the WAC between 1.7 and 0.9 Ga. In Africa, the collapse of the Birimian orogen was probably contemporaneous with the fragmentation of Columbia. At 0.9 Ga, Fennoscandia was probably not attached together with the WAC since the latter was not affected by the Grenvilian orogen, so did not necessarily have the same loop.

Keywords: West African Craton, dykes, Columbia, Rodinia, Paleomagnetism, Rock magnetism, Apparent Polar Wander Path.

Reference

Sabaté, P., Lomax, K., 1975. Données stratigraphiques et paléomagnétiques de la région Yetti-Eglab (Sahara occidental algérien). *Bulletin du B.R.G.M.* (deuxième série), section II, 4, 293-311.