Metamorphism and U-P monazites dating of the SASCA domain (South-West of Ivory Coast)

Augustin Y. Koffi[1,*], Sagbrou C. Djro[1], Lenka Baratoux[2,3], Alain N. Kouamelan[1], Pavel Pitra[4], Olivier Vanderhaeghe[2], Sylvain Block[2], Hervé K. Fossou[1]

[1]UFHB Abidjan-Cocody, UFR STRM, 22 BP 582 Abidjan 22, Côte d'Ivoire, [2]Geosciences Environment Toulouse, Midi Pyrénées Observatory, IRD, 14 avenue E. Belin, 31400 Toulouse, France, [3]IFAN, Cheikh Anta Diop, Dakar, Senegal, [4]Geosciences Rennes, CNRS UMR6118, University of Rennes 1, 35042 Rennes Cedex, France

[*]E-mail: yaoaugustinkoffi@yahoo.fr

The Sassandra-Cavally (SASCA) domain (SW Ivory Coast) is located in the transition zone between the Paleoproterozoic and Archean domains (Fig. 1). It is characterized by the coexistence of high-grade and low-grade metamorphic units and the existence of Archean relics in the Birimian formations. Heterogeneous gneiss formations comprising migmatites, orthogneisses, garnet-cordierite-sillimanite-garnet metasediment and staurolite-bearing micaschists are affected by three main deformation phases (D_1-D_3). Thermobarometric calculations using Theriak-Domino (de Capitani, 1994) suggest a retrograde evolution from the granulite facies to the amphibolite facies, from Grand Bereby to Sassandra. The metamorphism in the paragneisses of Grand Bereby and in the orthogneisses of San-pedro with quartz-plagioclase-biotite-garnet-sillimanite-ilmenite and quartz-garnet-biotite-ilmenite partial fusion, respectively, evolves at the transition of granulite and amphibolite facies with a maximum pressure of 10 kbar and a temperature of 820°C. It seems to characterize a decompression period in the granulite facies followed by cooling to the amphibolite facies with an apparent geothermal gradient of 40°C/km. However, the evolution of staurolite-bearing micaschistes occurred mainly in amphibolite facies with PT conditions corresponding to 3.5-6.6 kbar and 550-620°C. During this evolution, two metamorphic stages are distinguished: a prograde stage and a retrograde stage. The prograde path evolves according to a gradient of 30°C/km up to a peak of metamorphism estimated at 6.6 kbar-620°C in the amphibolite facies for the sample of Kounoukou. This path would correspond to a burial comparable to a thickening of the crust up to about 14 km in depth under an apparent geothermal gradient of 39°C/km. At this P-T path, the rock passes through a cooling phase with low decompression evolving according to a geothermal gradient of 40°C/km. This decompression would be associated with a cooling phase recorded in staurolite-bearing micaschist. U-Pb in situ dating of monazites gives ages of 2044 ± 11 Ma, 2003 ± 11 Ma, 1973 ± 11 Ma in the orthogneiss to quartz-garnet-biotite-ilmenite and 2000 ± 10 Ma for staurolite-bearing micaschists. These ages correspond to metamorphic ages in the SASCA domain and their meaning will be further investigated.

Keywords: Metamorphism, U-Pb on monazite, Ivory Coast, Paleoproterozoic.

References

Papon, A., 1973. Géologie et minéralisation du Sud-Ouest de la Côte d'Ivoire (Synthèse des travaux de l'opération SASCA 1962-1968). Mém. B.R.G.M., Orléans, France, n° 80, 286 p.

de Capitani, C., 1994. Gleichgewichts-Phasendiagramme: Theorie und Software. Berichte der Deutschen Mineralogischen Gesellschaft, 6, 48.

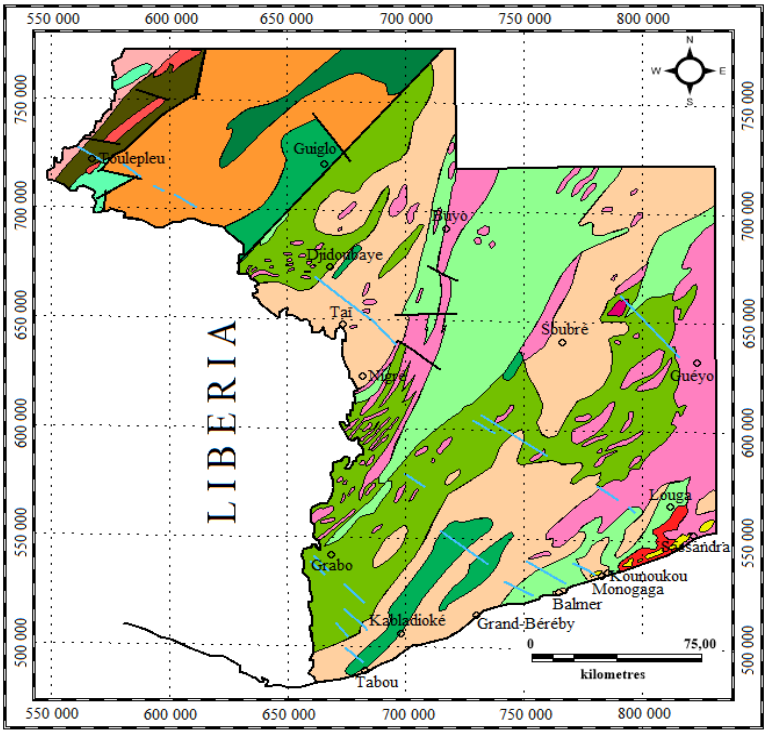

Figure 1: Geological map of the Southwest of Ivory Coast (modified after Papon, 1973)

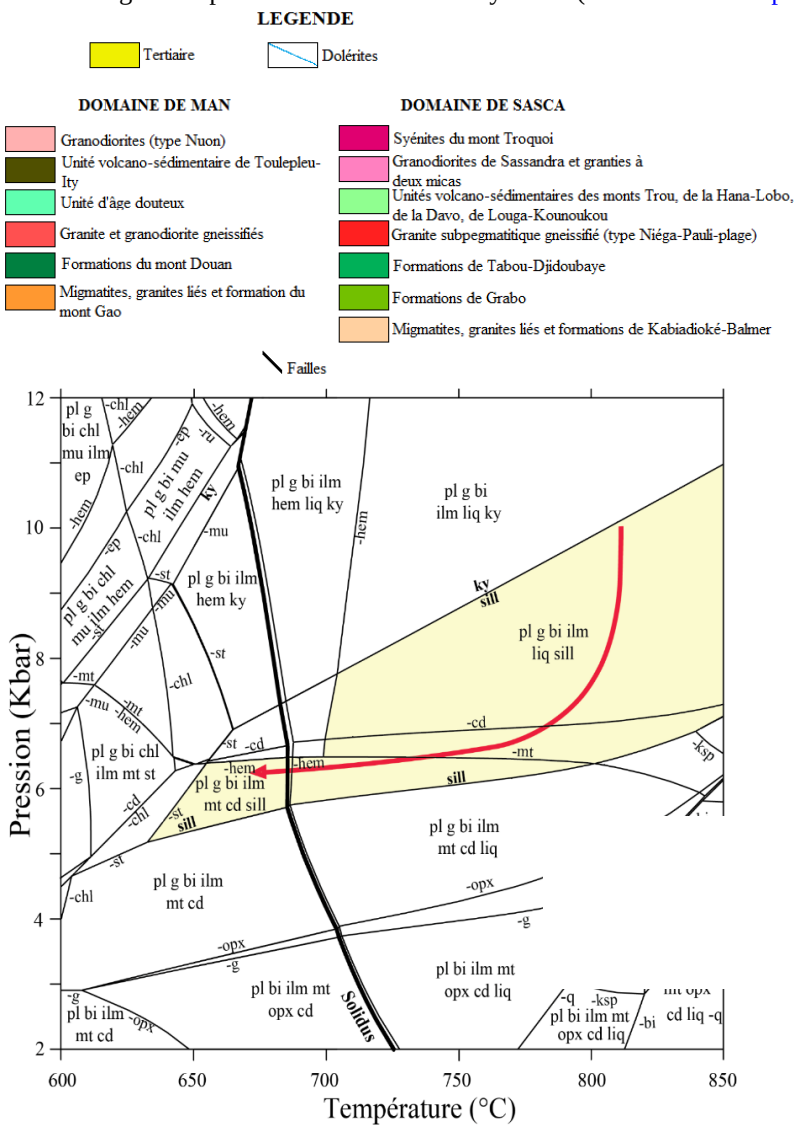

Figure 2: P-T Pseudo-section NCKFMASHTO showing the phases in equilibrium for the paragneiss of Grand Bereby. P-T path based on mineral assemblages of the studied sample is indicated in red.