
Metamorphism in the West African Craton: geodynamic implications

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Résumé

In the Paleoproterozoic domain of the West African Craton (WAC), most volcanic and sedimentary rocks were metamorphosed during the Eburnean orogeny between c. 2.13 and 1.9 Ga. Amphibolite facies conditions have been considered by some authors to be the result of contact metamorphism; however, a growing number of metamorphic studies provide evidence for the regional character of amphibolite-to-granulite facies metamorphism in Ghana, in Côte d'Ivoire, in Burkina Faso and in the Kédougou-Kéniéba Inlier (KKI) in Senegal.

The P-T trajectories of the high-grade rocks indicate a clockwise character, starting with apparent geothermal gradients as cold as 10-20°C/km at early metamorphic stages reaching greenschist, blueschist, amphibolite and granulite facies. The peak-stage thermal gradients vary between 20 and 30°C/km and reach greenschist, amphibolite and granulite facies conditions. Subsequent metamorphic stages are characterized by decompression, sometimes accompanied by heating, leading in places to partial melting and the abundant presence of migmatites. The final stages are generally marked by further decompression and cooling under greenschist facies conditions.

The oldest metamorphic U-Pb ages of monazite dating the peak of metamorphic conditions in northwestern Ghana yield 2137 ± 8 Ma for the early metamorphic stages and 2127 ± 7 Ma for the decompression/heating phase. A younger period of regional metamorphism has been documented in the KKI at c. 2095-2085 Ma for peak P stages and c. 2060-2050 Ma for decompression/heating stages (U-Pb on monazite, Sm-Nd on garnet). Similar metamorphic ages have been found in Ghana, ranging from 2095 ± 34 Ma to 2063 ± 9 Ma. The youngest

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U-Pb monazite metamorphic ages have been reported in western and southwestern Côte d'Ivoire, where they show several age peaks at 2050-2030 Ma, 2000 Ma and 1900-2000 Ma, corresponding to later prograde and retrograde metamorphic events. Metamorphic units from different locations in the craton show similar clockwise P-T paths. However, the timing of metamorphism demonstrates a diachronic character with ages spreading between c. 2130 and 1900 Ma. Such type of metamorphism is consistent with tectonic burial and differential exhumation during collisional stages of the Eburnean orogeny, which occurred at different time periods across the craton.

Mots-Clés: Paleoproterozoic, West African Craton, Geodynamics, Eburnean orogeny, Metamorphism, Continental collision