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Palaeoproterozoic high-pressure granulite overprint of the Archaean continental crust: evidence for homogeneous crustal thickening (Man Rise, Ivory Coast)

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The character of mountain building processes in the Palaeoproterozoic times is subject to much debate. The local observation of Barrovian-type assemblages and high-pressure granulite relics in the Man Rise (Côte d'Ivoire), led some authors to argue that Eburnean (Palaeoproterozoic) reworking of the Archaean basement was achieved by modern-style thrust-dominated tectonics (e.g., Feybesse & Milési, 1994). However, it has been suggested that crustal thickening and subsequent exhumation of high-pressure crustal rocks can be achieved by virtue of homogeneous, fold-dominated deformation of hot crustal domains even in Phanerozoic orogenic belts (e.g., Schulmann et al., 2002; 2008).

We describe a mafic granulite of the Kouibli area (Archaean part of the Man Rise, western Ivory Coast) that displays a primary assemblage (M1) containing garnet, diopsidic clinopyroxene, red-brown pargasitic amphibole, plagioclase (andesine), rutile, ilmenite and quartz. This assemblage is associated with a subvertical regional foliation. Symplectites that develop at the expense of the M1 assemblage contain orthopyroxene, clinopyroxene, plagioclase (bytownite), green pargasitic amphibole, ilmenite and magnetite (M2). Multiequilibrium thermobarometric calculations and P-T pseudosections calculated with THERMOCALC suggest granulite-facies conditions of ca. 13 kbar, 850°C and <7 kbar, 700-800°C for M1 and M2, respectively. In agreement with the qualitative information obtained from reaction textures and chemical zoning of minerals, this suggests an evolution dominated by decompression accompanied by moderate cooling. A Sm-Nd garnet - whole-rock age of 2.03 Ga determined on this sample indicates that this evolution occurred during the Palaeoproterozoic. We argue that from the geodynamic point of view the observed features are best explained by homogeneous thickening of the margin of the Archaean craton, re-heated and softened due to the accretion of hot, juvenile Palaeoproterozoic crust, as well as coeval intrusion of juvenile magmas. Crustal shortening was mainly accommodated by transpressive shear zones and by lateral crustal spreading rather than large-scale thrust systems. The occurrence of high-pressure granulites does not imply thrust-dominated tectonics.

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