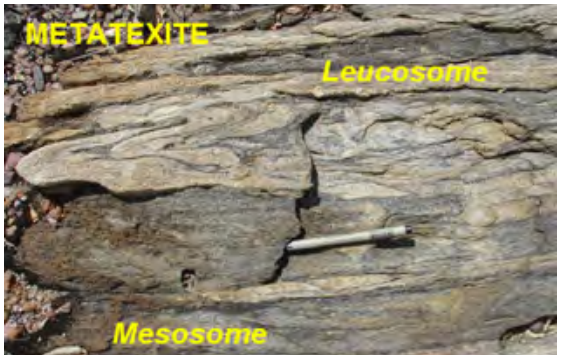
Evidence of crustal melting: insights from the Banabuiú gneiss-migmatitic complex (Central Ceará, Brasil)

F. Martins[1], M.R. Azevedo[1], B. Valle Aguado[1]

Migmatites are highly heterogeneous partially molten crustal rocks, typically found in continental terranes where the roots of ancient mountain belts (orogens) are exposed. In the deep parts of orogenic belts formed in response to plate convergence, the metamorphic conditions (P and T) may be high enough to melt the crust and generate migmatites. At low degrees of partial melting, melt-residuum separation produces metatexite migmatites, characterized by a conspicuous, centimeter-to decimeter-scale, compositional layering. The melted portion is light coloured (leucosome) and may constitute patches, layers and/or veins within the darker unmelted material (mesosome). As the temperature rises and melting becomes more extensive, the physical nature of the partially molten rock changes from solid-dominated to melt-dominated, magma flow occurs and pre-migmatization structures are destroyed leading to the formation of diatexite migmatites. Diatexite migmatites have a granitic appearance and enclose, in some cases, disrupted fragments of the host rock.

The Banabuiú region, located in Central Ceará (Brasil), represents a segment of the Brasiliano /Pan-African orogen, a deeply eroded mountain belt formed during the Late Neoproterozoic amalgamation of the West Gondwana supercontinent (ca. 600 million years ago) through the collision of the Congo-São Francisco and São Luís-West African cratons.

Spectacular outcrops of metatexites and diatexites occur in the area providing a unique opportunity to study the relationships between deformation, metamorphism and crustal melting processes. Field, structural, petrographic and geochemical evidence show that the large amounts of melts hosted in these terrains were produced at mid-crustal levels by partial melting of fertile metasediments, over a temperature range of 700-800°C, at the peak of Brasiliano contractional deformation and high-grade metamorphism. Migration and multiple injection of melts into the present exposure level was a deformation-assisted process, linked to the development of a structurally controlled network of conduits in the last stages of the Brasiliano /Pan-African Orogeny.



1 — Department of Geosciences & GEOBIOTEC, University of Aveiro

FIGURE 1
Assembly of the West Gondwana supercontinent at c.a. 600 Ma.

FIGURE 2
Metatexite showing veins of leucosome (melted fraction) within unmelted material (mesosome).

FIGURE3
Diatexite migmatite produced by high degrees of partial melting, enclosing disrupted fragments of the host rock.