

## Geochemical evidence for extensive carbonate assimilation by CAMP tholeiites from Algarve (S Portugal)

L. MARTINS<sup>1</sup>, J. MUNHA<sup>1</sup>, J. MADEIRA<sup>2</sup>, N. YOUBI<sup>3</sup>,  
J. MATA<sup>1</sup> AND R. KERRICH<sup>4</sup>

<sup>1</sup>CeGUL, Faculdade de Ciências da Universidade de Lisboa;  
(lmartins@fc.ul.pt; jmunha@fc.ul.pt; jmata@fc.ul.pt)

<sup>2</sup>LATTEX, Faculdade de Ciências da Universidade de Lisboa;  
Portugal; (jmadeira@fc.ul.pt)

<sup>3</sup>Departement de Géologie; Univ. Cadi Ayyad, Marrakech,  
Maroc; (youbi@ucam.ac.ma)

<sup>4</sup>Dept. of Geological Sciences, Univ. of Saskatchewan;  
Canada; (robert.kerrich@usask.ca)

In the Algarve Basin (S Portugal), Lower Jurassic volcanic successions from CAMP include tholeiitic flows, pyroclasts, rare dikes, peperites and volcanic derived sediments. Fine-grained porphyritic carbonate-contaminated lavas coexist in the same sequences with ophitic uncontaminated flows. Carbonate contamination is expressed by low SiO<sub>2</sub> (45.67 to 50.00 wt%), high CaO, Sr contents (12.5 to 20.4 wt% and 235 to 1337 ppm, respectively), and (<sup>87</sup>Sr/<sup>86</sup>Sr)<sub>0</sub> isotope ratios (0.70665 to 0.70746) relative to those parameters in the uncontaminated rocks (SiO<sub>2</sub> = 50 - 53 wt%; CaO = 9 - 12 wt%; Sr = 149 - 233 ppm; (<sup>87</sup>Sr/<sup>86</sup>Sr)<sub>0</sub> = 0.70539 - 0.70634). High-CaO rocks also display distinct mineral assemblages, including An-rich plagioclase (An<sub>81</sub>), olivine (Fo<sub>62</sub>) and high-Al clinopyroxene (Al<sub>2</sub>O<sub>3</sub> up to 9.1 wt%). Enrichment of Al<sub>2</sub>O<sub>3</sub> in clinopyroxenes (reflecting extensive incorporation of Ca-Tschermak component) correlates with increasing CaO contents of the host rocks, consistent with the mineralogical/geochemical data which indicate a significant decrease of melt silica activity in the high-CaO domains relatively to the typical SiO<sub>2</sub> saturated character of the dominant tholeiitic magmas.

Binary mixing models (SiO<sub>2</sub>/CaO vs. 1/CaO; <sup>87</sup>Sr/<sup>86</sup>Sr vs. δ<sup>18</sup>O/Sr; <sup>87</sup>Sr/<sup>86</sup>Sr vs. SiO<sub>2</sub>/CaO; <sup>87</sup>Sr/<sup>86</sup>Sr vs. Sr ppm) indicate that contamination resulted from variable degrees of assimilation of 2-10% of an almost pure Ca-carbonate component. The contaminant component should have had high Sr contents (Sr ~ 6200 ppm) and relatively high δ<sup>18</sup>O (~ +23‰ to +25‰) and (<sup>87</sup>Sr/<sup>86</sup>Sr)<sub>0</sub> (~ 0.70771) isotope ratios, consistent with the chemical characteristics of Visean platform marine carbonates such as those present in the underlying Palaeozoic basement. Significant undercooling by CO<sub>2</sub> loss may have increased crystal nucleation rates, producing the fine-grained texture that characterizes the carbonate-contaminated rocks.

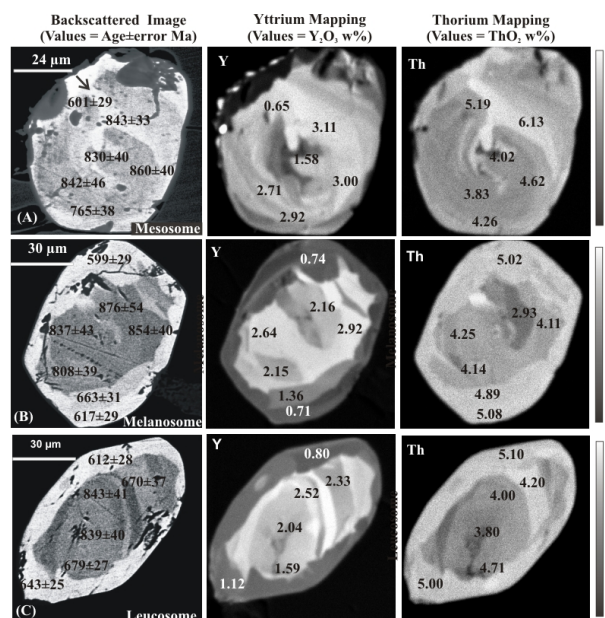
Clinopyroxene-liquid geobarometry indicates that the main fractionation occurred at an average depth of 26 ± 4 km, reflecting extensive magma underplating at the Lower Jurassic SW Iberia crust/mantle boundary (promoting assimilation of Visean carbonate basement) during the initial stages of the Atlantic opening.

## Monazite preservation and formation during anatexis: An example from garnet-bearing migmatite, Brazil

L. MARTINS, V.A. JANASI AND S.R.F. VLACH

Geosciences Institute, Universidade de São Paulo, São Paulo, Brazil (lucemart@usp.br, vajanasi@usp.br and srfvlach@usp.br)

Backscattered images, Y and Th mapping and U-Th-Pb<sub>(total)</sub> electron microprobe dating reveal complex compositional and age zonings of monazite crystals from a garnet-bearing migmatite (Fig. 1).



**Figure 1:** Backscattered images and compositional mappings (Y and Th) of monazite (mz) from garnet-bearing migmatite. (A) mz from mesosome (included in garnet), (B) mz from melanosome (included in quartz) and (C) mz from leucosome (included in quartz)

Monazite chemistry reflects in part its textural position: late interstitial crystals are Y+HREE-poor and Th+LREE-rich, while crystals included in garnet and biotite are Y+HREE-rich. Cores of leucosome monazite have high Y and HREE, and are similar to mesosome monazite, suggesting that they are inherited, and were not dissolved during the melting reactions because of their textural position. Associated to compositional zones, at least two main age domains (±827 Ma and 645 Ma) could be recognized through *in situ* U-Th-Pb<sub>(total)</sub> electron microprobe dating (147 analyses). Monazite cores or Y-rich zones correspond to the oldest ages (827 Ma). Some monazite rims or Y-poor and Th-rich zones can be interpreted as products of anatectic melt precipitation at 600-610 Ma, the age of a well-recognized regional metamorphic event (750°C and 5 kbar). The meaning of some portions with intermediate dates (~670 Ma) and chemical contents is unclear (Fig. 1), and could record partly resettled monazite or reprecipitated domains that incorporated some Pb from the anatectic melt.