The importance of electron microprobe dating of monazite from some granites of northern Portugal

R. J. S. TEIXEIRA[1]*, A. M. R. NEIVA[2] AND M. E. P. GOMES[3]

[1, 3]Department of Geology, University of Trás-os-Montes e Alto Douro, Vila Real and Geosciences Centre, University of Coimbra, Portugal, rteixeir@utad.pt, mgomes@utad.pt (* presenting author)

[2]Department of Earth Sciences and Geosciences Centre, University of Coimbra, 3000-272 Coimbra, Portugal, neiva@dct.uc.pt

Ten Variscan S-type granites (G1 to G10) occur in Carrazeda de Ansiães region, northern Portugal, intruding Precambrian to Ordovician metasedimentary rocks. The U-Pb ID-TIMS data obtained in zircon and monazite from these granites yield crystallization ages comprised between 329.9 ± 0.8 Ma and 316.2 ± 0.7 Ma. The variation diagrams of these peraluminous granites and their minerals and the whole-rock REE patterns, whole-rock $\delta^{18}O$ values of 10.55 – 11.86 ‰, the different mean whole-rock values of $(^{87}Sr/^{86}Sr)_i$ and εNd_t for G1 (0.7097 ± 0.0000; -6.3), G2 (0.7149 ± 0.0008; -8.2), G4 (0.7112 ± 0.0006; -8.0), G5 (0.7124 ± 0.0007; -7.5), G7 (0.7156 ± 0.0005; -8.5) and G8 (0.7155 ± 0.0007; -8.4) point to the existence of distinct pulses of magmas, which were probably formed by the partial melting of heterogeneous metasedimentary rocks. Three differentiation series are distinguished: a) G2 and G3, b) G5 and G6 and c) G8, G9 and G10.

The zircon systematics are generally complex due to Pb loss and to the presence of inherited cores, but the latter can also affect some of the monazites. Therefore, the fast and low cost age determination on monazites, by electron microprobe, using the U-Th-Pb method [1], can be a useful tool in the interpretation of U-Pb ID-TIMS data. Its high spatial resolution can allow a detailed study of heterogeneities inside the same crystal, in areas with diameters as small as 5 µm. The monazite populations from the granites of the three differentiation series show ages similar to those from the ID-TIMS U-Pb results: 321 ± 6 Ma for G2, 318 ± 5 Ma for G3, 319 ± 7 Ma for G5, 319 ± 7 Ma for G6, 316 ± 7 Ma for G8, 315 ± 4 Ma for G9 and 315 ± 9 Ma for G10. However, in the rims of all monazite crystals and internal domains related to the rims, ages from 281 ± 8 Ma to 298 ± 9 Ma were also obtained, which should correspond to recrystallization events. On the other hand, in monazites from granites G6 and G9, inherited components were detected, presenting ages of 352 ± 7 Ma and 345 ± 5 Ma (Figure 1), which can explain the U-Pb age spreading of some concordant monazites in granite G9.

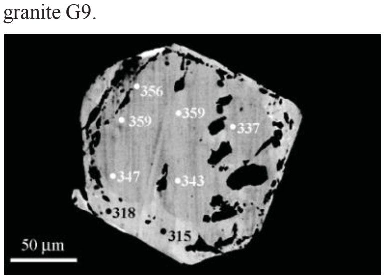

Figure 1: BSE image of a monazite from granite G9, with ages (in Ma) determined by electron microprobe.

[1] Montel (1996) Chemical Geology 131, 37-53.

Arsenic speciation and distribution controls throughout Murshidabad, West Bengal, India

KATHERINE TELFEYAN[1*], SANKAR M.S[2], SAUGATA DATTA[2], SOPHIA FORD[2], KAREN JOHANNESSON[1]

[1]Tulane University, New Orleans , LA, USA, ktelfeya@tulane.edu (* presenting author)

[1]Kansas State University, Manhattan, KS, USA, sdatta@ksu.edu

Over 2% of the world's population lives in the Bengal Delta, the world's largest fluvial-delta system. However, the rapid burial of Himalayan sediments has ultimately resulted in the release of arsenic (As) from sediment grains and tragically affected the health of millions of people [1]. In January 2012, field surveys of four blocks in the Murshidabad district of West Bengal, India were conducted, sampling tubewells, irrigation water, ponds, and sediment cores. Two sites, Beldanga and Hariharpara located east of the Ganges distributary, Bhāgirathi-Hooghly River, whereas Nabagram and Kandi are located to the west of the river. High As is associated with gray, reduced sediments, whereas low As is associated with orange-brown, oxidized sands [2]. Field test kits show total As concentrations ranging from less than 10 ppb to greater than 500 ppb. Eight groundwater samples were passed through ion exchange columns to separate As(III) from As (V) for analysis. Reductive dissolution of iron hydroxides is the primary cited cause of As mobilization. However, the source of the organic matter responsible for the reduction of iron and As is not fully understood. Previous studies have suggested human and animal waste, surface ponds, irrigation return-flow, and in situ organic matter at depth [3,4]. Analysis of dissolved organic carbon is discussed with regards to potential sources. In addition to organic matter, As concentrations are compared to those of other trace elements, such as Fe and Mn, that also vary as a function of redox conditions and pose health problems in Murshidabad.

[1] Mukherjee et al. (2009) *Journal of Asian Earth Sciences* **34** 228-244. [2] Neal (2010) *Master's Thesis Kansas State University*. [3] MacArthur et al. (2004) *Applied Geochemistry* **19** 1255-1293. [4] Harvey et al. (2006) *Chemical Geology* **228** 112-136.