Thermochronological evidence for long-term elevated geothermal gradients in Ribeira Belt, SE Brazil

T. BENTO DOS SANTOS[1]; J. MUNHÁ[1]; C. TASSINARI[2], P. FONSECA[3] AND C. DIAS NETO[2]

[1]Centro/Departamento de Geologia, Universidade de Lisboa, Portugal (tmsantos@fc.ul.pt; jmunha@fc.ul.pt)

[2]Instituto de Geociências, Universidade de São Paulo, Brazil (ccgtassi@usp.br; coridias@usp.br)

[3]LATTEX, Universidade de Lisboa, Portugal (gpetfons@fc.ul.pt)

This study addresses petrological/thermochronological relations in the São Fidelis-Santo António de Pádua (SFSAP - N Rio de Janeiro State, Brazil) sector of the central segment of the Neoproterozoic collisional Ribeira Belt. SFSAP mainly comprises granitoid (orthogneissic) rocks, migmatites and granulites/charnockites. Following the earlier collisional stage at 630-600 Ma, main (thrusting) regional deformation was coeval with peak metamorphism (850 ± 50º C, 8.0 ± 1.0 kbar), lower crustal melting and widespread charnockite development at 565 ± 8.0 Ma (U/Pb-zircon); further high-grade metamorphism evolved (at P ≥ 4 kbar) to ~ 600º C, being followed by decompression and retrogradation (~ 350º C) during long-term transpressional shearing at the late stages of the Braziliano Orogeny (Biotite-WR Rb/Sr age = 455 ± 4.0 Ma). The overall average cooling rate was low (< 5º C / Ma from 850 to 350º C), but distinct cooling paths indicate differential uplift and complex mechanical/kinematics interactions among the distinct lithotypes. Although migmatites show a globally stable 3º C / Ma cooling rate, most charnockites remained at T > 650º C until 510 - 470 Ma (Garnet-WR Sm/Nd), being then rapidly exhumed/cooled (~ 30º C / Ma) during post-orogenic granite emplacement in the area at 491 ± 7.1 Ma (U/Pb-zircon). Both charnockite thermal evolution and extensive production of granitoid melts imply that high geothermal gradients must have been sustained for a long period of time (50 – 100 Ma) in the studied area. Crustal geotherms are sensitive to both mantle heat-flux input and the amount/distribution of heat producing elements (HPE). Collisional active mountain building should have been followed by gravitational collapse of the orogen, induced by thermal erosion and progressive thinning of the lithosphere. The timing for the onset of the resulting thermal anomaly seems to have started at ca. 570 - 550 Ma and reflect initial upwelling of asthenospheric mantle and magma underplating along the main axis of the Ribeira orogenic belt. This, coupled with long-term generation of (high-HPE) granitoids, should have sustained elevated crustal geotherms (relative to the pre-granite conductive geothermal regime) for almost 100 Ma, promoting widespread charnockitization at middle to lower crustal levels.

From planetesimals to planetary embryos

WILLY BENZ

Physikalisches Institut, University of Bern, Switzerland

We investigate the collisional growth of planetesimals by means of numerical simulations using an orbit-averaged Monte Carlo approach (Nyffenegger 2005) originally proposed by Hénon for the study of stellar clusters. Such an approach is situated between explicit N-body and statistical methods. Similar to statistical treatments, we assume an overall potential to determine the general motion of the bodies. Perturbations to this motion are then caused by local interactions between the bodies (collisions, close encounters, etc.) which account for the stochastic nature of the system. In this respect, the Monte Carlo technique resembles the N-body method but it allows the use of a much large number of bodies. In addition and again similarly to N-body simulations, the tracking of individual bodies over time is easily done. Therefore, the entire collisional history of planetary embryos can be reconstructed.

After presenting some tests of the method, we shall focus on the collisional evolution of a swarm of planetesimals in the terrestrial planet region. We derive some important characteristics of this evolution such as the typical formation time, collision frequency, impactor mass, etc. We then discuss the implications of these quantities focusing in particular on planetary differentiation and the constraints placed by the extra-solar planets.

Refernces

Hénon, M., 1971, Monte Carlo models of star clusters, in *Gravitational N-body problems*, IAU Colloq. 10, Ed. M. Lecar, Reidel publishing company.

Nyffenegger, O., 2005, Modelling Protoplanetary dics using an orbit-averaged Monte Carlo technique, PhD, University of Bern.