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Tempo of Magmatic Activity recorded in a Neoproterozoic Oceanic Arc System (Anti-Atlas, Morocco)

Antoine Triantafyllou (1), Julien Berger (2), Jean-Marc Baele (3), Nadine Mattielli (4), Olivier Bruguier (5), Scott Samson (6), Arnaud Watlet (7), Herve Diot (1), Christophe Monnier (1), Nasser Ennih (8), and Sara Vandycke (3)

(1) Laboratory of Planetology and Geodynamics, University of Nantes, Nantes, France (antoine.triantafyllou@univ-nantes.fr), (2) Géosciences Environnement Toulouse (GET), Observatoire de Midi-Pyrénées, CNRS, IRD, Université de Paul Sabatier, UMR-CNRS 5563, Toulouse, France, (3) Department of Fundamental and Applied Geology – Mining Geology, Université de Mons, Belgium, (4) G-Time, Dept. Earth and Environmental Sciences, Université Libre Bruxelles ULB, Belgium, (5) Géosciences Montpellier, Université de Montpellier 2, UMR-CNRS 5243, Montpellier-Cedex, France, (6) Department of Earth Sciences, Syracuse University, Syracuse, NY, USA, (7) Seismology-Gravimetry, Royal Observatory of Belgium, (8) EGGPG, Département de Géologie, Faculté des Sciences, Université Chouaïb Doukkali, 24000 El Jadida, Morocco

The Pan-African belt of North and West Africa exposes world-class remnants of oceanic and continental arcs along the northern and eastern sutures of the West African Craton (WAC). In the Anti-Atlas domain (southern Morocco), ocean-ocean subduction was active between 760 and 640 Ma, witnessed within two inliers (Bou Azzer and Sirwa) by a tectonic patchwork made of back-arc ophiolitic sequences to the north thrusted onto accreted arc complexes to the south. These arc-related magmatic rocks recorded 120 Ma of magmatic activity, cadenced by three successive flare-ups (IGN1-2-3: centered at 750, 700 and 650 Ma respectively) interspersed with periods of magmatic lull and/or intra-oceanic crustal shortening.

The oldest meta-igneous units belonging to the arc complexes (i.e. Tachakoucht, Tazigzaout and Bougmane complexes) are made of granodioritic/andesitic gneisses and amphibolites with typical oceanic arc signature ([La/Sm]N $\sim$ 2.4 ; εNd: +4.0 to +8.8). Their igneous ages (U-Pb zircons) range from 750 to 730 Ma (IGN1). These magmatic rocks were buried, deformed and metamorphosed under MP-MT conditions in Tachakoucht and Tazigzaout (ca. 700°C - 8 kbar) and HP-MT in Bougmane (ca. 750-800°C - 10 kbar). These events occurred prior to two magmatic pulses dated between 705-690 Ma (IGN2) and between 660-640 Ma (IGN3) respectively and represented by hydrous mafic to intermediate rocks (i.e. chilled hornblende gabbros, hornblendite cumulates and quartz-diorites) with typical oceanic arc fingerprints ([La/Sm]N $\sim$1.5; εNd: +5.0 to +6.7 for IGN2- and [La/Sm]N $\sim$1.9; εNd: +4.4 to +7.4 for IGN3-related arc rocks respectively). Both 700 and 650 Ma magmatic pulses strongly perturbed the thermal and physical structure of the arc locally leading to the granulitization (and garnetisation) of the middle and lower crust and to the genesis of intermediate to felsic magmas (tonalitic, granodioritic and granitic) with adakitic signature. The latter formed by dehydration melting of older or sub-contemporaneous hydrous mafic/intermediate rocks.

These results suggest that the mechanisms of Neoproterozoic oceanic arc growth and crustal thickening (ca. 30 km thick) consist of a combination of discrete, periodic but drastic phases of magmatic accretion at different levels of the crust but also by shortening tectonic regime leading to intra-arc stacking deformation (D1). These results suggest that the mechanisms of Neoproterozoic oceanic arc growth may locally differ from those governing the building of Phanerozoic counterparts.