The Neoproterozoic Iriri complex (Moroccan Anti-Atlas): insights into igneous, metamorphic and tectonic evolution of a middle oceanic arc crust

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The Iriri Neoproterozoic intra-oceanic arc complex in the Pan-African Anti-Atlas belt marks an oceanic suture zone together with back-arc related ophiolitic remnants. The andesitic precursor of gneisses from the complex has been dated at 743±14 Ma but also recorded a metamorphic event dated at 663 ± 13 Ma (U-Pb on zircon rims) [1].

The arc sequence comprises two units: I. the Tachakoucht formation consisting of plagioclase-quartz-biotite (and locally, garnet + tourmaline) porphyroclastic gneisses. It is thought to represent the superficial volcano-sedimentary deposits of the arc [1]. II. To the North, Iriri formation consists of hornblende-gabbros and coarse-grained hornblendites intruding the Tachakoucht gneisses in the middle crust of the arc. The transition between these two formations is marked by a migmatization of the Tachakoucht rocks and by a gradual increase of metabasaltic dykes and veins.

Phase diagram calculations and thermobarometry show that the intermediate, garnet-bearing Tachakoucht gneisses registered medium pressure, amphibolite grade conditions (~700°C, 5-8 kbars) and subsequently recorded retrograde P-T path up to greenschist facies. This result indicates that Tachakoucht protolith dived up to middle crust pressures before intrusion of the Iriri metabasic rocks.

The arc complex didn't accommodate all the deformation events similarly. Even so, the whole arc complex is marked by metamorphic foliations (F1) striking from N090 (E-W) to N130 (~NW-SE) and subvertical dipping. In these F1 foliations, two populations of stretching lineations have been observed: a down-dip lineation (L1) and a second one, subhorizontal plunging slightly to the ESE (L2).

However, Tachakoucht gneisses also underwent specific deformation before the intrusions of Iriri basaltic rocks. It has preferentially been affected by two intense folding events (P1 and P2). P1 population is marked by recumbent folds, with subhorizontal axis trending from N120 to N140. This fold population and F1 foliations are consistent with a southwestward vergence, regionally attributed to dominant compression direction during Pan-African Orogeny [2]. The second folding event (P2) is characterized by asymmetrical buckled folds with subvertical axis, generally showing dextral movement in Tachakoucht gneisses. Dextral shearing is also supported by sigma-shapes around garnet porphyroclasts and S-C structures mainly highlighted by micas. Nevertheless, folded metabasalt-gneiss contacts and snatched enclaves argue that this shearing event was already acting during and after intrusion of basaltic rocks and then, persisting during retro-metamorphism down to greenschist facies conditions.

The intra-oceanic arc has thus been affected by a first compressive southwest verging tectonic event (P1, F1 and L1) associated to the closure of the neoproterozoic paleo-ocean. This event is marked by burial of the shallow Tachakoucht volcano-sedimentary formation to middle crust

depth and southward thrusting of back-arc ophiolite. A possible flip in subduction polarity caused the intrusion of Iriri metabasaltic rocks into the Tachakoucht gneisses. Then, the arc complex docking along WAC induced a transcurrent component, changing primary motion into dextral transpressive regime. We assume that this tectonic regime was favorable to the development of extrusional tectonics, simultaneously recording retrograde metamorphic conditions (L2).

[1] Thomas *et al*. (2002)
[2] El Hadi *et al.* (2010)