The architecture of the "Betsimisaraka Suture Zone"; a record of oceanic arcs and associated metasedimentary successions between the "Indian" and "African" parts of Madagascar.

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Madagascar is made up of three Archaean crustal fragments; the 2.5 Ga-old Antananarivo Domain in the west, and the 3.2+2.5 Ga-old Antongil and Masora Domains in the east. During the late Neoproterozoic East African Antarctic Orogen, a series of Neoproterozoic terrains were juxtaposed with these cratonic assemblages; in the north the ~750-720 Ma-old Bemarivo Domain docked with the Antongil and Antananarivo Domains, while to the south a series of late-Neoproterozoic Domains (Vohibory, Ondroyen, Anoysen) were accreted to the Antananarivo Domain. The accretion of the Bemarivo Domain against both the Antananarivo and Antongil Domains shows that these latter two domains were juxtaposed by ~520 Ma, the timing of peak metamorphism related to the docking event (e.g. Buchwaldt et al. 2003).

In between the Antongil-Masora and Antananarivo Domains, a series of granulite-grade graphite-bearing metasedimentary units and intrusives occur, in which abundant small pods of mafic and ultramafic rocks are recognised (e.g. Collins, 2006 and Raharimahefa & Kusky, 2009). The graphitic nature and presence of mafic-ultramafic pods, broadly aligned along a north-south trend within the metasedimentary units prompted various authors to interpret these units as part of a suture zone, the Betsimisaraka Suture Zone (see Collins, 2006 and references therein). However, this interpretation was underpinned only by the interpretation of these granulite-facies lithological assemblages to comprise an ophiolitic melange, and by detrital zircon U-Pb SHRIMP data on two samples, one collected south of the Masora Domain (one zircon analysis with age 811 Ma) and one just south of the Antongil Domain (seven analyses between 832 and 709 Ma, Collins et al., 2003).

In this paper we present additional detrital zircon U-Pb Laser Ablation Multi-Collector Inductively Couple Plasma Mass Spectrometry and detrital zircon U-Pb Sensitive High Resolution Ion MicroProbe data for twelve samples of metasedimentary units between the Antananarivo and Antongil-Masora Domains.

The **Manampotsy Group** occurs to the west and north of the Masora Domain. It is comprised of a series of paragneiss sequences making up six formations, broadly from south to north the Ampasary, Perinet, Sakanila, Ambatondrazaka, Sasomanangana and Bealanana Formations. The relative position of these within the group is ambiguous due to the intense deformation, and it is therefore possible that several of those are laterally equivalent. We collected data for three of those Formations, the Ampasary, Perinet and Bealanana Formations. The Manampotsy Group is dominated by quartzofeldspathic gneisses, interpreted to have been derived from felsic volcanoclastic protoliths, but also contains mafic paragneisses with biotite, hornblende, garnet, graphite and sillimanite as well as minor calc-silicate units. Lenticular pods of mafic and ultramafic rocks are a characteristic feature of the group, and its outcrop pattern largely overlaps with the Betsimisaraka Suture Zone.

Three samples from the **Ampasary Formation** immediately west of the Masora Domain show a dominant contribution from Mesoarchaean sources (3.2-3.0 Ga) with minor modes at 2.7 and 2.5 Ga. The maximum age of deposition is given by the youngest analysis at ~780 Ma, which is in agreement with the sparse data from Collins et al. (2003).

Two felsic metavolcanic units from the **Perinet Formation** north of the Masora Domain yielded ages of 800 and 790 Ma, while one paragneiss gave a near-unimodal population at 840 Ma, interpreted to reflect a dominant volcanic mode. No zircons older than 840 Ma were recognised suggesting that the Perinet Formation was deposited aside an oceanic arc. Ages on orthogneiss units within the Perinet Formation overlap with the maximum depositional age bracket of 840-790 Ma, suggesting that they form part of the base of these oceanic arcs. Metamorphic zircon rims at 560 Ma provide a minimum depositional age for the Perinet Formation.

One quartzite and three paragneisses were dated of the **Bealanana Formation** west of the Antongil Domain, and all show near-unimodal age distributions indicating derivation from active arcs with ages between 830 and 770 Ma, similar to the age range observed for the Perinet Formation. As was the case for other units of the Manampotsy Group, no older zircons were recognised, in keeping with the interpretation that the Bealanana Group, too, represents the volcaniclastic product of active oceanic arcs. Metamorphic zircon rims in the Bealanana Formation are dated at ~510 Ma, giving a slightly younger minimum depositional age than the successions further south.

The **Ambatolampy Group** is a patchily preserved supracrustal package that rests tectonically on rocks of the Antananarivo Domain. It occurs to the west of the Manampotsy Group, from which appears to always be separated by Archaean orthogneisses of the Antananarivo Domain. The Ambatolampy Group is, however, lithologically quite similar to the Manampotsy Group, and is comprised of various felsic and mafic paragneisses and quartzites.

Three quartzites of the Ambatolampy Group gave detrital age patterns dominated by modes at 2.7 and 2.5 Ga, suggesting source terranes within the Antananarivo Craton. One sample yielded an additional important mode at 1060 Ma, corresponding to the age of the regionally restricted Dabolava Suite further west (e.g. Tucker et al., 2007). The youngest zircon has an age of 1056 Ma, providing the maximum age of deposition of the group. Abundant metamorphic (high U) zircon rims indicate an overprint at 560-540 Ma, providing a minimum age estimate.

The detrital age data obtained as part of this study indicate the deposition of sedimentary and volcaniclastic successions along the margins of the Antongil-Masora and Antananarivo Domains, as well as deposition of volcaniclastic-dominated successions alongside oceanic arcs well away from these Archaean crustal domains. The detrital age modes in the Ampasary Formation clearly show derivation from the Masora Domain, but going west, this Archaean contribution disappears, to give way to zircon exclusively derived from active volcanic arcs between 840 and 770 Ma. These Neoproterozoic oceanic arc successions can be recognised along a NS-oriented belt corresponding to the Betsimisaraka Suture Zone, and which is decorated with lenses of mafic-ultramafic rocks, which could represent preserved parts of an ophiolitic melange. To the west of this, the Ambatolampy Group contains detrital zircons only reflecting source terrains from the Antananarivo Domain. The metasedimentary successions of central Madagascar therefore present a compressed cross sectional view of the ocean that existed between the Indian and African blocks prior to the assembly of Gondwana.

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