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Triassic magmatism of Antarctic Peninsula and its implications for the southern Gondwanan margin: a revised tectonic evolution

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West Antarctica is considered to be composed of an amalgamation of several continental blocks, including the Antarctic Peninsula, which were originally dispersed along the southern margin of Gondwana. Prior to the Mesozoic disassembly of Gondwana, these blocks were located along the so-called Terra Australis margin, where proto-Pacific oceanic lithosphere was subducted beneath this pre-Mesozoic continental margin. Rifting of, among others, South America, Africa and East Antarctica drove crustal block rotations that subsequently led to the breakup of Gondwana and to the assembly of West Antarctica. Although there have been a series of recent improvements, there are still standing issues understanding the timing and geodynamic development of West Antarctica and the proto-Antarctic Peninsula during Paleozoic and early Mesozoic.

We present new geochronological (zircon U-Pb), geochemical (whole rock) and isotopic (whole rock Nd, Sr, Pb; zircon Hf) data acquired from Triassic igneous units exposed in the Antarctic Peninsula and along the Central and Eastern domains of Vaughan and Storey (2000).

Whole-rock geochemistry from a series of Late Triassic orthogneisses yielded high-K calc alkaline affinities with meta- and peraluminous compositions. The trace elements and Sr-Nd-Pb whole rock isotopes indicate a significant presence of subduction-derived components in their source, which suggests that the Late Triassic melts in both domains (Central and Eastern) were formed above an active subduction zone.

Zircon rims yielded Late Triassic concordant ages in the Central and Eastern domains, which constrain the timing of magmatism. Our data show a conspicuous presence of zircon xenocrystics cores with contrasting ages between both domains. While Paleozoic magmatic activity is recorded mostly in rocks from the Central Domain, a paucity of the Paleozoic magmatism is registered in the Eastern Domain.

We show that the paucity of Paleozoic magmatism in the xenocrystic zircons of the Eastern Domain might indicate that was located in an interior position within Pangea, distal from the axis of the arc magmatism. In contrast, the abundant presence of Paleozoic xenocrystic zircons of the Central Domain probably reveals the presence of an active margin during this period along this geological sub-province, which we equate with Terra Australis Margin of South America. Further, Lu-Hf model ages of the Paleozoic zircon cores yielded ages that suggests that the basement of the Antarctic Peninsula probably consist of a Paleozoic arc re-melted from Sunsas-aged rocks (ca. 1.2 – 0.9 Ga).

We suggest that the sinistral transtension prevailing along south-west Gondwana during the Triassic was also present in the sector of the proto-Antarctic Peninsula. These dynamics juxtaposed the Central and Eastern domains within the Late Triassic arc. Further, while the Eastern Domain was displaced from a foreland position to the margin axis, the Central Domain drifted relatively to the south. The data implies that the Antarctic Peninsula was probably formed by transtensional movements along the margin and support an in-situ margin evolution from, at least, the Late Triassic.

Vaughan and Storey. 2000. JGS 157, 1243-1256.