Hf isotopes and the rise and fall of the Gondwanan supermountains

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The East African Orogen [1] and its inferred extension into Antarctica [2] is a collisional orogenic belt that formed between 650 and 500 Ma during the assembly of the Gondwana supercontinent. It is widely believed to mark the site of one Earth's most substantial mountain chains that shed unprecedented volumes of sediment into fan systems that spread across the supercontinent [3] and has been linked to a rise in atmospheric oxygen and the the first appearance of animals on Earth [4]. The Cambro-Ordovician sedimentary sequences eroded from these inferred supernountains have characteristic "Gondwana" detrital zircon populations dominated by ~500-650 Ma (Pan-African) grains, with a secondary population of ~1000-1200 Ma (Grenvillian) grains, and various older grains. Comparison of published Hf isotope compositions in these zircons [5, 6 and others] reveal important spatial differences, most notably in the Grenvillian populations, which have dominantly positive εHf(t) values in southern regions (South Africa, Antarctica, Australia), but can extend to markedly negative values in the north (North Africa). These can in turn be linked to different Grenvillian-aged basement terranes reworked in southern and northern parts of the East-African–Antarctic Orogen, and suggest there is a fundamental geologic boundary along the Lurio Belt of Mozambique, with important implications both for the sequence of collisions that led to Gondwana assembly, and the sediment transport directions and distances away from these orogens.

[1] Stern (1994) *Ann. Rev. Earth Planet. Sci.* **22,** 319-351. [2] Jacobs *et al.* (1998) *J. Geol.* **106,** 385–406. [3] Squire *et al.* (2006) *Earth Planet. Sci. Lett.* **250,** 116-133. [4] Campbell and Squire (2010) *Geochim Cosmochim Acta* **74,** 4187-4206. [5] Morag *et al.* (2011) Geology **39,** 955–958. [6] Kristofferson *et al.* (in press) *J. Geol Soc. Lond.*