Proposed Studentship

Fault reactivation and evolution along the Madagascar-India conjugate margin

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Project Description

Madagascar occupied a central position within Gondwana by the time of the supercontinent's final construction in the Early Cambrian (e.g. Stern, 1994). A prolonged history of orogenesis, including end-Mesoproterozoic Rodinia amalgamation, subsequent break-up, and Neoproterozoic collisions (e.g. Li et al., 2008), led to a series of mobile belts that can be correlated between Madagascar's Gondwanan neighbours: Africa, India, Sri Lanka and Antarctica.

The trans-Gondwana mobile belts, including the East African- Antarctica Orogen (Jacobs and Thomas, 2004), mark the sites of subducted oceans, arc collision and micro-continental accretion (e.g. Collins, 2006). The belts experienced continued metamorphism and shearing into the Ordovician (Emmel et al 2006). A final phase of high temperature metamorphism affected the poly-deformed granulite terrane of South India and Madagascar between 600-450 Ma (e.g. Ghosh et al., 1998). The heterogeneous Gondwanan basement thus possessed lines of significant lithospheric weakness from the start of the Phanerozoic.

Basic and acid volcanism dated to ~ 88 Ma and related to the Marion hotspot signalled the separation of Madagascar from India (Acharyya, 2000) along the highly linear eastern margin of Madagascar, parallel to a number of inherited shear zones and cratonic slivers (Emmel et al 2004; Raval and Veeraswamy, 2003). A combination of weak, thin, warm and hydrous mobile belts and cold, thick and dry cratonic fragments ensured hotspot thermal effects and subsequent rifting were focussed along the mobile belts (Raval and Veeraswamy, 2003).

This PhD project aims to discover the kinematic history of faults along this margin since the Late Mesozoic break-up of Madagascar and India. The project will utilise targeted ^{40}Ar-^{39}Ar analysis of fault rocks to directly date the timing of reactivation since the break-up, and will involve analysis of 3-D fault geometries, fault propagation and fault linkage in the highly anisotropic lithosphere on both sides of the conjugate margin. It will be mainly based on data and samples collected in the field, and microstructural analysis, but may also utilise offshore seismic data where appropriate. The results of the project will have important implications for understanding how deformation is localised and partitioned along oblique continental rifts.

The successful student will be capable of undertaking detailed field mapping and structural analysis under difficult field conditions. An understanding of thermochronological methods and microtectonics would be an advantage, but training will be provided.

References

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Applicants are requested to send an additional copy of their CV directly to the lead supervisor of the project in which they are interested. Please also contact the supervisor if you have any questions about the project itself.