



A look at what happened to Tethyan mantle during closure of Neo-Tethys

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The mantle beneath the Indian Ocean has an isotopically distinct composition that is evident in present day Indian Ocean MORBs (mid-ocean-ridge-basalts) and some Tethys ophiolites preserved throughout the Himalayas (Mahoney et al., 1998). Intriguingly, evidence of the same composition existing in MORB-like samples from a 350 My ophiolite in SE China suggests that Indian Ocean-type mantle has occurred in the upper mantle since that time (Xu et al., 2002; Zhang et al., 2005). For the same distinct mantle chemistry to exist, requires that significant regions of the mantle must have remained isolated for 100's millions of years. And furthermore, its presence in the shallowmost mantle for at least 350 My contradicts whole mantle convection models and raises questions about what happens to the shallow mantle during ocean basin closure.

But was this isotopically distinct mantle pervasive beneath Neo-Tethys, as appears to be the case for the Indian Ocean? Or was the asthenosphere beneath Neo-Tethys more heterogeneous than that beneath the Indian Ocean? And was this isotopically distinct signature a characteristic of all the Tethyan mid-ocean ridge basalts, even at its margins?

To investigate the repeated presence of this distinct isotopic signature in the shallowmost mantle, we have combined high precision Hf-Nd isotope studies of Tethyan MORBs with 3D numerical spherical models run with Earth-like convective vigour, using TERRA. Unlike previous isotopic studies of Tethyan basalts, we have fingerprinted Tethyan MORBs using robust Hf-Nd isotopes, to avoid issues of element mobility relating to sea water alteration or low-temperature fluids. From this we can determine where and when Indian Ocean-type mantle was present within the shallow asthenosphere. We have coupled this with 3D geodynamic models for the past 120 Ma to investigate what happened within the shallowmost mantle between the time of Neo-Tethys and the present day. Using passive markers to track isotopically known portions of the crust and mantle we can investigate how Indian Ocean-type mantle persisted within the shallowmost asthenosphere despite the closure of one ocean basin and the opening of another. Here, we will present the initial findings of this study.

References

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