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Deep Seismic Reflection Results from Lithospheric Analogues for Sri Lanka

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Sri Lanka represents unique opportunities for lithospheric study by geophysical techniques at various scales. Specific geological issues that could be addressed by future seismic experiments include: What is the lithospheric thickness of the Sri Lankan microcontinent? Does it have an effective lithospheric keel? Does that keel preserve fossil strain fabrics? What is the morphology of the Moho? Does that Moho represent a lithologic, tectonic or phase boundary? How is Moho thickness reconciled with surface metamorphic grade? Does the lower crust preserve tectonic fabrics distinct from surface geology? How substantial are igneous additions in the deep crust, and how are they manifest? What is the deep geometry of key surface faults and geological contacts? To what extent can these characteristics provide a fresh basis for re-evaluating geological reconstructions of Sri Lanka's position in the Gondwanaland reconstructions? A fundamental issue relevant to all of the above is whether the fingerprints of collisional tectonics resulting from the amalgamation of Gondwanaland can be distinguished from subsequent thermal/structural overprints associated with supercontinent breakup.

Experience with deep seismic reflection surveys in possible analogous terranes elsewhere in the world provides a basis not only for guiding expectations for future deep investigations in Sri Lanka, but for designing such surveys to be most informative. A review of the global database of deep reflection results suggests the following could be of particular relevance:

(a) Smoothed Moho topography that implies either thermal re-equilibration of orogenic structure by post-orogenic collapse, tectonic truncation of the lower crust by sub-horizontal decollement, or migration of phase transitions across lithologically heterogeneous lower crustal assemblages.

(b) Prominent dipping reflectors that extend from the lower crust well into the upper mantle which likely mark fossil subduction zones that may be laterally displaced from surficial geological suture zones

(c) Seismic bright spots that mark igneous emplacements in the crystalline crust.

(d) Lamination in the lower crust that seems to characterize mafic intrusion in extensional environments.

(e) Listricity in major crustal faults that link to detachments at deep crustal, and perhaps even upper mantle; depths. Such geometries can attest to large-scale lateral displacement of shallow crustal rocks from their lower crustal (mantle) roots.

(f) Dipping reflection fabrics that mark distributed strain zones formed under ductile conditions.

(g) Cross cutting fault/intrusion relationships that can "date" the sequence of buried tectonic events.

While deep reflection profiling remains perhaps the highest resolution geophysical technique for lithospheric studies, it is now commonly integrated with wide-angle refraction and passive seismic methods to provide a more complete view of lithospheric structure. The passive methods in particular allow linkage of crustal details observed from reflection profile to structure at sub-crustal and even mid-mantle depths. Such observations are essential in addressing issues related to lithospheric thickness and upper mantle strain.