Evidence from Deep Seismic Reflection and Seismic Refraction Study Across the Achan Kovil Shear Zone (AKS), South India , Reveal Deep Seated Nature of a Major Pan African Tectonic Event

B. RAJENDRA PRASAD[1] and G. KESAVA RAO [2]

1 *Emeritus Scientist, National Geophysical Research Institute (Council of Scientific and Industrial Research)*

2 Scientist-G, National Geophysical Research Institute, Hyderabad, India

The Southern Granulite Terrain (SGT) of south India is one of few terrains in the world that has preserved Achaean crust with extensive granulites essentially of lower crustal origin. The intervening shear zones between the highland granulite massifs might have acted as conduits for exhumation of these high pressure and temperature rocks to their present position probably during Pan-African rifting (~500 Ma). The SGT is divided into three major blocks. The northern granulite block occupies the area between Dharwar craton and Palghat-Cauvery Shear (PCS) zone and defines transition between low and high grade terrains. The region between PCS and Achan Kovil Shear Zone (AKS) zone is southern granulite block (0.5–0.7 Ga) including most of the highlands with amphibolites facies gneisses and supracrustal rocks in addition to charnockite, granulites and khondalites. The NW-SE trending AKS is more prominent toward southern end of SGT and indicates Proterozoic tectonic activity [Santosh et al., 2003]. The granulites were formed at average 7–10 kbar and 700–800 ^{0}C corresponding to burial depths of about 20–25 km (Rao et al., 2003).

To understand the complex geology and tectonic settings of SGT, a 220 km long N-S trending deep seismic

Reflection/refraction traverse was recorded from Vattalkundu to Kanyakumari in 2005-6 traversing across different shear zones. Deep seismic reflection data were acquired using a state of the art 240-channel, 24-bit Radio Frequency Telemetry System with all it's accessories for the first time, along the Vattalkundu-Kanyakumari. (Rajendra Prasad, et. al., 2007) Symmetric split spread geometry with 75/90 data channels on either side of the shot point was used for recording 24 s long seismic reflection data along the profile. A shot interval of 200 m and geophone group interval of 100 m were used to generate a nominal foldage of more than 30. Each receiver consisted of 20 geophone series string of 4.5 Hz natural frequency provided enough signal strength for recording the seismic events with high fidelity in a wide frequency band at 2ms sampling interval (4.5-250 Hz). The commands and data transfer were accomplished through a bidirectional and reliable

VHF radio link between remote units and the recording unit. The seismic source comprised of buried charge of 50 Kg in 25 m specially drilled shot hole. The seismic reflection data thus acquired is subjected to pre-processing for eliminating the coherent noises and standard crustal seismic data processing sequence to generate high resolution seismic reflection image of the region. The AKS shows up a series of south dipping, continuous parallel reflectors over an area of 30-40 km originating at mid-crustal levels In an independent effort the same reflection profile of 260 km is also covered with six shot points namely SP 77, 428, 808, 1271, 1953, 2269 with a receiver group interval of 100 m and a shot point interval ~ 45 km (Rajendra Prasad, et .al., 2006). The tomographic image from the data set clearly brings out the velocity variations across the AKS and the deep seated nature of the crustal scale shear zone complementing our seismic reflection fabric.

Key Words: Southern Granulite Terrain (SGT), Achan Kovil Shear Zone (AKS), Deep Seismic Reflection /Refraction study, Tomography

References

[1] Santosh and Collins, *Gondwana Research* 6, 911-918 (2003)

[2] Rajendra Prasad, et. al., *Precambrian research*, v. 153, pp.1–10 (2007)

[3] Rajendra Prasad, et. al., *Geophysical Research Letters*, v. 33, L14301 (2006)