Play of Plate Tectonics in SE India: Clues from Petrological and Geochemical Studies

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Petrological templates and geochemical signatures serve as valuable guides for evaluating the tectonic settings of the Precambrian terrains in a regional geodynamic framework, and hence act (together with geochronological measurements) as powerful tools for understanding the play of Precambrian plate tectonics. As far as SE India is concerned, our "play" has just begun!

Precambrian suture zones are often repeatedly modified, at different times, by a variety of complex petrotectonic processes. The presently exposed lower structural levels of the deeply eroded old orogens are not expected to bear any similarities with the top levels of young Phanerozoic mountain belts. Identification of Precambrian sutures is a daunting task and a vexatious venture. However, the welcome feature is that many Precambrian rock sequences exhibit trace element signatures almost identical to those found in Phanerozoic plate tectonic environments, thereby strongly suggesting their formation in an analogous setting.

The boundary/margin between the Dharwar-Bastar cratonic region and Eastern Ghats Belt (EGB) is frequently interpreted as a collision zone or as an easterly dipping crustal-scale thrust or a cryptic suture. Though this boundary is long speculated as a suture zone, convincing substantiation has come up only in recent years. The southern EGB provides, rather perfectly, several key products of the Precambrian plate tectonic activity.

DARCs (deformed alkaline rocks and carbonatites) represent the products of two well-defined parts (initial rift setting and subsequent collisional setting) of the Wilson cycle, and mark the places where vanished oceans have opened and then closed. Hence, the distribution of over 25 discrete occurrences of DARCs, all along the ca.1000 km long collision zone between the cratonic region and the EGB, sketches the surface trace of the suture. This is the most robust petrological evidence ever put forth for authentication of the suture.

The ca.500 km long west-vergent Nellore-Khammam Schist Belt (NKSB) is sandwiched between the Dharwar craton towards the west and EGB towards the east. Parts of the northern segment of this belt manifest two contrasting (oceanic island arc and continental margin island arc) tectonic environs, while a part of the southern segment is assigned a back-arc or marginal basin palaeotectonic setting. An Archaean layered-type anorthosite complex (? reminiscent of Archaean ophiolite assemblage) occurs at Chimalpahad in the northern segment, while a proven ophiolite complex (with two most diagnostic hall-mark constituents-sheeted dykes and plagiogranite) occurs at Kandra in the southern segment. These two complexes are of utmost significance, as the presence of ophiolites is considered as a key indicator for the operation of the Wilson cycle.

At Kondapalli in the EGB, the felsic granulites unequivocally represent basal portions of a subduction related magmatic arc, and the layered complex conforms to a plutonic core of an arc-root of the present day Andeantype setting. The general sequence of significant events in continent formation – subduction, island arc development, accretion and continental arc magmatism – is virtually the same in both Precambrian and Phanerozoic times.

Finally, we emphasize that the tectonic evolution of SE India is relevant to the formation and break-up of three supercontinents of Columbia, Rodinia and Gondwana.

Keywords: Eastern Ghats; suture zone; ophiolite; supercontinents