PRESENT STATUS OF THE GEOCHRONOLOGY OF THE EARLY PRECAMBRIAN OF SOUTH INDIA.

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Available geochronological data, though scanty, indicates that sialic crust in the form of tonalitic gneisses developed in south India 3.3 to 3.4 Ga ago. These early gneisses so far recognised only in a few parts of western Karnataka are mainly migmatites. However, there is as yet no clear geochronological evidence that these gneisses were preceded by a supracrustal cycle. Recognisable supracrustal belts appear to have evolved either within or bordering this sialic crustal block.

The exposed Archaean supracrustal rocks have been divided into an older sequence (the Sargur Group, older greenstone belts) and an younger voluminous sequence (the Dharwar Supergroup subdivided into the Bababudan Group and the Chitradurga Group), the two being separated by a gneiss forming event at 3 Ga. In the absence of unambiguous and precise primary chronologies of the high grade Sargur assemblages and the low grade basal sections of the Dharwar Supergroup relative to themselves and to the 3.0 Ga gneiss, the separation of the supracrustals into the Dharwar and Sargur cycles remains debatable. The demonstrable lithological similarities between the basal sections of the Dharwar supracrustals and the Sargur assemblages have been used to argue for contemporaneous deposition of the two.

Whereas the ages of the intrusive granites and volcanics of the Chitradurga Group at about 2.6 Ga indicate that the Dharwar supracrustals are older than this, the possibility that at least the basal formations of the Dharwar Supergroup may be older than 3.0 Ga and in fact coeval with the Sargur rocks has not yet been ruled out. The time span for the development of the entire Dharwar sequence needs to be precisely determined, as this sequence has signatures which are rather unusual for the Archaean, but normal to the Proterozoic, such as distinction of stable and mobile zones of sedimentation, stability during the initial stages of development of supracrustal sequence, deposition of uraniferous conglomerates, large scale development of limestones, banded manganese and iron formations and stromatolites.

The third major granite-gneiss forming event occurred 2.5 to 2.6 Ga ago marking the close of the Dharwar tectonic cycle and remobilising the preexisting gneisses accompanied by large scale potash metasomatism. The Peninsular Gneissic complex with three distinct age components (3.4, 3.0 and 2.6 Ga) resulted by the close of this episode. The earliest granulite grade metamorphism so far recognised seems to be synchronous with this event. Evidence for 3.0 Ga and 2.6 Ga events have been found also in the granulite terrane including the Eastern Ghat belt. The relicts, if any, of the earlier 3.4 Ga event have not yet been picked up from the granulite province.

Geochronologically least constrained are the khondalites which resemble the Sargur supracrustals and may be high grade derivatives of the Bababudan Group and the Vanivilas Formation of the Chitradurga Group. Khondalites are known to have been intruded by charnockites in the Eastern Ghats. But whether these charnockites are as old as 2.6 Ga charnockites in the southern granulite zone or even older (3.0 Ga) needs to be assessed. In this context, it is to be noted that charnockites retrograde to gneisses and vice versa in several places. Charnockites retrograding to gneisses, but unconfined to later shear zones where such retrogression is common, could in fact belong to the older 3.0 Ga event.

One prevelant view is that the formation of potash granites of the Closepet suite occurred during the 2.6 Ga event in the upper crust coinciding with the charnockitization in the lower crust. Yet there are Rb-Sr ages as young as 2.1 Ga for some Closepet granites. Was the charnockitization in the lower crust and potash granite formation in the upper crust a protracted event lasting for nearly 500 Ma?

In summary, urgent and systematic geochronological studies should address the following first order questions on the temporal evolution of the south Indian crust.

1. Do the Sargur supracrustals predate the 3.4 Ga old gneissic components of the Peninsular Gneissic complex?

2. If not, are they older or only coeval with the lower Dharwar supracrustals and khondalites?

3. What is the time span for the development of the entire Dharwar supracrustal sequence?

4. What is the time relation between the 3.0 Ga old gneisses and the lower Dharwar supracrustals in the Craton and the khondalites in the Eastern Ghats?

5. Are there more than one generation of early Precambrian charnockites, just as there are more than one generation of gneisses?

6. Are the metamorphosed mafic dike swarms directly linked to the episodes of volcanism and plutonism in the early Precambiran of south India?