

'ARE THERE SCHISTOSE ROCKS OLDER THAN DHARWARS'

A GROUP DISCUSSION

The Geological Society of India has been sponsoring group discussions on problems of current geological interest since the last two years. Two such discussions on 'the Geochemistry of the Precambrian Rocks of India' and 'the Peninsular gneissic complex of the South Indian Shield' have been held earlier (see Jour. Geol. Soc. Ind., Vol. 15, pp. 339-473 and Jour. Geol. Soc. Ind., Vol. 16, pp. 239-245.) These discussions have generated considerable interest among those engaged in the study of the Precambrians of India.

The earlier discussion on the Peninsular gneissic complex had highlighted the possibility of recognising a group of schistose rocks older than the gneisses and greatly affected by the latter through migmatisation. It was considered desirable to gather more information on such migmatised high grade schists in Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. The Department of Geology of Mysore University, Manasa Gangotri and Mineralogical Society of India came forward to organise a group discussion on this subject. A small group actively interested in the problem met at Mysore between the 12th and 14th of July. A full day excursion to some of the exposures of these older schists (Sargur type area) to the sw of Mysore was arranged which provided an opportunity to the visiting scientists to get an idea of the character of the rock types under consideration.

The Geological Survey of India another co-sponsor of the Group discussion extended its fullest co-operation, by deputing its officers from the different circles of the Southern region and by organising an exhibition of large scale geologic maps, specimens and photographs. What was more praiseworthy was the gift of the excellent collection of specimens representing the oldest rocks to the Geology Department of the Mysore University.

The discussion was inaugurated by Prof. C. S. Pichamuthu, President, Geological Society of India.

The arrangements made for holding the group discussion were excellent and the credit for the organisation should go largely to Prof. M. N. Viswanathiah and his group of young research assistants.

The important points made out during the course of the discussion are briefly summarised:

(1) The oldest rocks > 3000 m.y. that can be recognised in the Dharwar craton are mafic to ultramafic in character and occur as narrow belts and lenses completely surrounded by migmatites. Limited geochemical data points to a distinctive geochemical character to the older lavas. The older lavas and associated sediments are intruded by acidic rocks of tonalitic composition resulting in the widespread development of migmatitic gneisses. The bulk of the Dharwar schists are subsequent to this gneissic episode. There are thus two greenstone sequences, an older (Archaean) sequence, predominantly mafic and ultramafic with associated sediments and a younger

geosynclinal sequence (Proterozoic) with volcanic material at the base, followed by considerable thickness of mature sediments. It is considered desirable to distinguish the two greenstone successions by separate names. There is justification for the recognition of Sargur group representing an older group of high grade schistose rocks in the Precambrian succession of Karnataka (*B. P. Radhakrishna*).

(2) The Nilgiri and Eastern ghats charnockite khondalite belts represent the oldest rocks in the Peninsula. These are followed by a group of high grade schists which are more extensive and include besides the Sargur group of rocks, the schists of Nellore and Khammam in Andhra Pradesh, Bengpal in Bastar, and Deogarh-Pallahara-Mahagiri in Northern Orissa. The Dharwar greenstone belts are the youngest (*S. Narayanaswami*).

(3) Field and contact relations, basal character of conglomerates, structural history, nature of volcanogenic material, grade of metamorphism, nature of quartzofeldspathic injections are some of the criteria which should be used in establishing the stratigraphy of schist belts (*M. V. N. Murthy*).

(4) High grade schists forming narrow linear belts occurring as enclaves in gneisses throughout the craton should be separated from the Dharwars and given the status of a Supergroup (The Sargur Supergroup after Sargur in S. W. Karnataka where rocks of this group are well developed). The Sargur Supergroup consists of: quartzites and quartz schists interbedded with barytes at places; Pelitic schists with kyanite, sillimanite, cordierite, graphite, garnet, staurolite, fuchsite, corundum etc., calciphyres and crystalline limestones; metabasites, grunerite bearing magnetite-quartzites and ultramafic intrusions. The ubiquitous inclusions of ultramafic rocks in Peninsular gneissic complex are considered as remanant metamorphites which are possibly older than the high grade schists. (*M. N. Viswanatha*).

(5) The schists around Mavinhalli and Dodkanya (South of Mysore) are different from Dharwars and show similarity to the charnockite-khondalite group. The ultramafic rocks are younger and show inclusions of biotite gneisses. Mineral assemblages like olivine-orthopyroxene-carbonate-green spinel, and chromian tremolite-orthopyroxene-spinel are indicative of sagvandite affinities. The two pyroxene granulites and hornblendites have komatiitic chemistry. The marbles have a high manganese content. (*A. S. Janardhan and C. Srikantappa*).

(6) Chromite bearing ultramafic rocks with komatiite chemistry were emplacements in the Pre-Dharwar platforms. The high grade schists of south Mysore and Coorg, being closely associated with charnockites probably represent the 'Khondalites' of Karnataka. (*R. Srinivasan and B. L. Sreenivas*).

(7) The high grade schists occur either as isolated bands away from the greenstone belts or close to the latter's margins. There is a stratigraphic, structural and metamorphic discontinuity between them and the greenstone belts. The high grade schists are predominantly in the migmatitic amphibolite facies. There is no gradational contact between the high grade schists and greenstones.

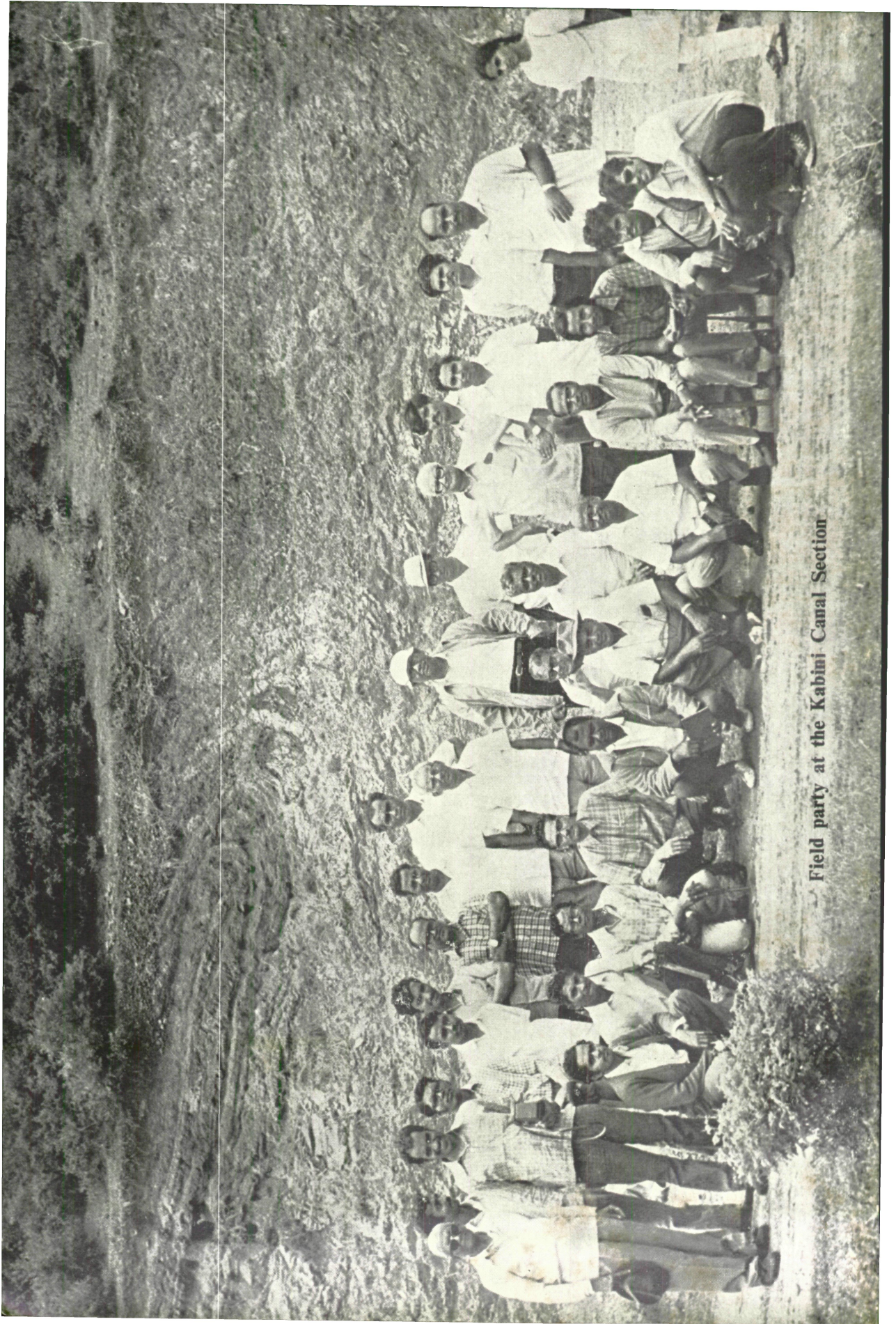
The Dharwar craton is divisible into two geotectonic blocks namely the Western



Participants in the Group discussion at the Department of Geology, Manasa Gangotri, Mysore

Field trip to Sargur





Field party at the Kabini Canal Section

and the Eastern, the former representing intermediate pressure and the latter low pressure facies series. The eastern block is dominated by volcanic belts, while the western block is characterised by volcanic sedimentary belts.

The greenstone belts (Dharwar Supergroup) and the high grade schists (Sargur Supergroup) are distinct separate cycles and not one and the same unit metamorphosed at different levels. (*M. Ramakrishnan*).

(8) A palynological probe of samples of limestones and quartzite from the Sargur schist belt has revealed certain ellipsoidal and spherical microstructures which are identical with those described from the Onverwacht Group of South Africa (*M. N. Viswanthiah, V. Venkatachalapathy and A. P. Mahalakshamma*).

(9) In northern parts of North Arcot and Coimbatore districts, several linear bands of high grade schists and gneisses interbanded with metasedimentary assemblages are seen in close association with charnockites. These have been involved in different episodes of deformation and migmatization unlike the Dharwars. These have close comparison with the Sargur group of Karnataka and the Wynad group of Kerala and are named the *Satyamangalam group* of Tamil Nadu, a group quite distinct from the Dharwars (*K. Gopalakrishnan, E. B. Sugavanam & V. Venkata Rao*).

(10) High grade schists of Sargur continue westwards in the Kuthuparamba-Iratty-Manantoddy region, Cannanore district. Rocks consist of biotite-muscovite schists with or without kyanite; quartzites (fuchsite bearing); quartz-feldspar-biotite gneisses; and garnetiferous gneisses with or without sillimanite, and amphibolites. The basement rocks are biotite hornblende and hypersthene gneisses partly migmatized and charnockites. Near Kuthuparamba a polymict conglomerate is noticed at the base of the biotite schists. (*M. N. Nair, K. T. Vidyadharan, S. D. Pawar, P. V. Sukumaran and Y. G. K. Murthy*).

(11) MnO/TiO₂ ratios of Precambrian basalts decrease with time, being greater than 0.30 in metabasalts older than 3200 m.y. and less than 0.30 in younger basalts. The Kolar basalts, using this criterion are much older than their homotaxial equivalents in other Dharwar schist belts. (*S. Viswanathan*).

(12) The long, narrow, elongated belt of Nellore consists of two distinct suite of rocks separated by a fault and an oligomict conglomerate. The western half exposes a predominantly greenstone suite (chlorite schist, chlorite phyllites, meta-basalts etc.) metamorphosed under the green schist facies, equivalent to the Dharwar Supergroup of rocks. The eastern half shows high grade schists (kyanite-staurolite-sillimanite schists, calc-silicate rocks, hornblende and biotite granulites) which have undergone almandine-amphibolite to lower granulite facies of metamorphism. These high grade schists affected by later migmatization are older than the greenstones and are equivalent to the Sargur group of rocks of Karnataka. (*D. Vasudevan and T. M. Rao*).

(13) A group of high grade schists trending NE-SW occurs to the east of Khammam, Andhra Pradesh. Quartz-biotite schists, garnetiferous biotite schists, garnet-kyanite-muscovite schists, calc-silicate rocks, banded magnetite quartzite and

quartzites are the rock types forming the schist belt. A gabbro-anorthosite complex at Chimalpad has been syntectonically emplaced within the schists and gneisses. The lithological assemblages and the intrusion of the gabbro anorthosite complex suggest similarities with the Sargur group of rocks of Karnataka. (*M. Subba Raju*).

The object of holding the group discussion was to bring the active workers on the problem together to enable them in a cooperative spirit to separate facts from hypothesis and to identify points of agreement and areas of disagreement.

The following is the consensus which emerged after a field trip to the Sargur area and the two full day free and frank discussion of the different aspects of the problem:

There is a group of high grade schistose rocks distinct from the Dharwar greenstones and widely affected by a subsequent migmatization episode. Such rocks are not restricted only to Karnataka but have been recognised over a wide region at Nellore and Khammam in Andhra Pradesh, Satyamangalam in Tamil Nadu and Wynad and Manantoddy in Kerala.

Information on the stratigraphy, structure, geochronology and geochemistry on these rocks at present is fragmentary to arrive at any firm conclusion as to their classification into a separate Supergroup.

Detailed geological, geochemical and geochronological studies have to be pursued on these high grade rocks. Particular emphasis is to be laid on the study of structural styles of the two groups of schistose rocks—Dharwar and Sargur, as they are believed to belong to distinct tectonic domains.

In order to view the problem in its correct perspective it is felt necessary to have a clear understanding of the high grade granulite terrain. A group discussion should be organised on the Archaean high grade terrains of Peninsular India preferably in the early part of 1976 at Madras. Field trips should be arranged to critical areas.

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