SHORTER COMMUNICATIONS

A NOTE ON THE GEOLOGY AND FAULT SYSTEMS OF KRISHNAGIRI AREA

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Introduction: A preliminary geological mapping was carried out in the Krishnagiri area which forms a portion of the project area, covered in parts of topo sheets Nos. 57 L/2, L/3, L/6 and L/7 of the Survey of India. The mapping was done mainly with a view to bring out a picture of the fault systems of the area. The area covered is a hilly terrain surrounded by many mountains with numerous streams. The streams are widely distributed and the drainage system shows a dendritic pattern.

Geology: The area is mainly occupied by metamorphic and igneous rocks such as amphibolite, pyroxenite, gneisses, granites and charnockites traversed by pegmatite veins, basic dykes and quartz veins.

The principal rock types of the area can be classified into three groups:

1. Dharwar rocks
2. Peninsular gneisses
3. Charnockites.

1. *Dharwar rocks:* The southern branch of Precambrian Dharwar eastern belt (Narayanaswamy, 1963) extending to Virupasandiram village is located and some lenses and patches of Dharwar rocks are observed to the west, east and northeast of Krishnagiri. The structure of the southern branch of the Kolar-Dharwar belt seems to be a tight-folded, steeply dipping, isoclinal syncline plunging to the north. Both the western and eastern flanks of the syncline appear to be faulted, and along the flanks there are numerous veins of white granite and aplite, some of them cutting the Dharwar rocks as well as biotite gneiss, grey granodiorites and migmatites of Krishnagiri type.

2. *Peninsular gneisses:* Rocks belonging to this group are the most widespread in the area. As pointed out by M. S. Krishnan (1968, page 93) they consist of a very heterogeneous mixture of different types of granites intrusive into the schistose rocks. The granitic rocks of Krishnagiri area could be divided into three types:

(i) Grey granite and granodiorite (Krishnagiri type)
(ii) White granite,
(iii) Pink granite (Closepet type)

Further divisions within the main rock types could be distinguished. Three such subdivisions are recognised in each rock type on the basis of the intensity of migmatisation (i) more or less pure granites usually the most massive in structure and definite in colour; (ii) the migmatites of the same granites composed of lenses, patches and bands of rocks of different composition; and (iii) patches and xenoliths of metamorphic rocks of basement with significant quantity of granitic materials.

Grey granite and Pink granite: The grey granite and pink granite are found to be uniform in their characters throughout the area.

White granite: The white granites of the area are not uniform in their character. Two varieties could be recognised on the basis of mineralogical composition. The first is biotite or hornblende-biotite variety mostly seen to the west of Krishnagiri. The second variety is white granite with hornblende or pyroxene-hornblende granite, seen east of Krishnagiri.

The results of the analyses of heavy concentrates, collected in this area, have shown that zircon is one of the most widely distributed minerals. It is also observed that the quantity of zircon in heavy concentrates and the frequency of occurrence of high zircon content in stream sediments are remarkably more in area of white and pink granites and migmatites.

Charnockites: Within the charnockite group, two types could be recognised in the field.

(i) Banded basic charnockite, and

(ii) Acid charnockite.

Field observations done mainly to the southwest from Krishnagiri seems to support the conclusion drawn by Subramaniam (1959) that the basic charnockites are essentially pyroxene granulites and variants, and the acid charnockites are an igneous suite.

Faults systems of the area: The fault zones observed in the area were mapped and studied in detail (Figure 1). The calculation of the length of different faults were carried out (Table I) and the azimuthal frequency diagram based on the data obtained is shown (Figure 2).

TABLE I

	Northwest		Northeast	
	Length in c.m.	Percentage	Length in c.m.	Percentage
0 - 10	15.5	4.3	81.2	22.5
10 - 20	2.3	0.4	—	0.0
20 - 30	26.3	7.3	34.2	9.5
30 - 40	65.2	18.2	32.3	8.9
40 - 50	15.4	4.3	—	0.0
50 - 60	—	0.0	0.3	0.0
60 - 70	5.7	1.3	—	0.0
70 - 80	17.6	4.1	—	0.0
80 - 90	47.2	13.2	19.2	5.3

Total length 362.4 c.m. = 100%

It can be easily seen that the faults observed can be grouped into four systems:

(i) NW–SE faults

(ii) N–S faults

(iii) E–W faults

(iv) NE–SW faults

Among these four systems, the NW–SE faults are the predominant in the area. The following are the criteria based on which the faults are identified in the field.

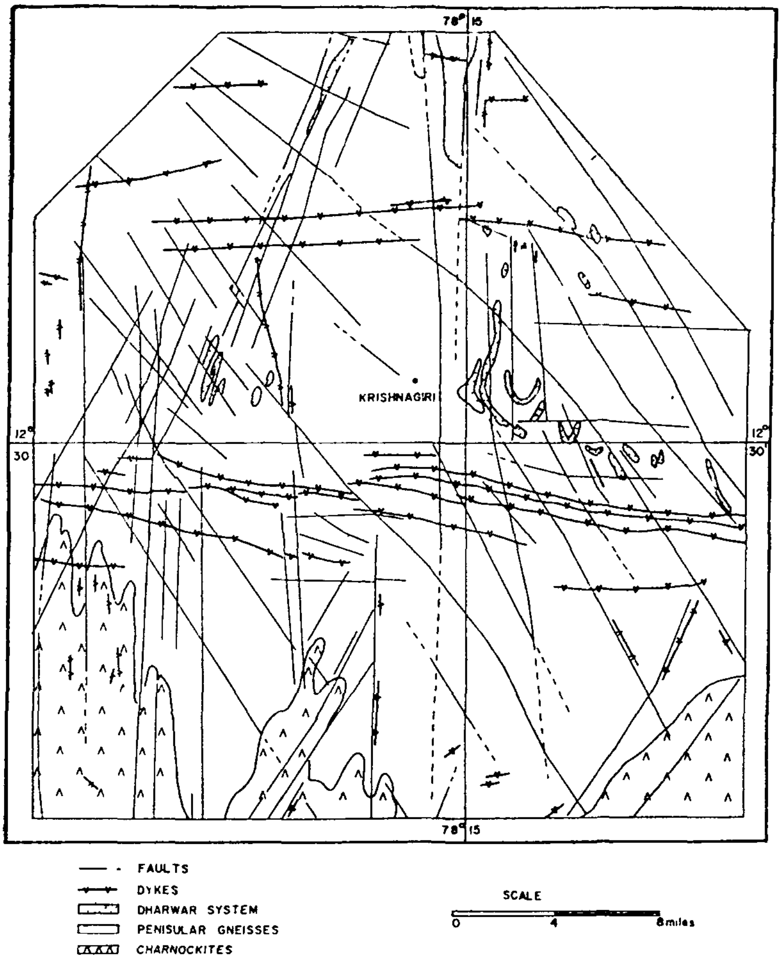

Figure 1. Geological map of the Krishnagiri area showing fault systems.

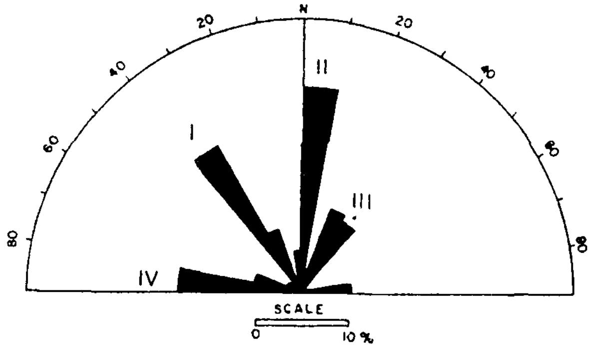

Figure 2. Azimuthal frequency diagram for entire structural (faults and dykes) data of Krishnagiri area.

1. presence of mylonites.
2. presence of sheared rocks & epidotisation.
3. elongation of hill masses.
4. drainage pattern, and
5. basic dykes.

However, no clear cut evidences as to the relative age of the fault systems could be noted. The basic dykes and pegmatites may be of use in the case of a few faults.

NW–SE Faults: The most predominant faults observed in the area are the faults which traverse the rocks in a NW–SE direction. These faults extend to a maximum of 33 miles in length. Crushed rocks and epidotisation are found in evidence of these faults; mylonites are also found along a river course east of Krishnagiri. Dislocation of a basic dyke and a zone of sulphide mineralisation due to the NW–SE faults are also observed in some places. On a general apprehension the drainage pattern seems to follow the NW–SE fault lines mostly. As regards mineralisation, these faults are found to be mostly barren.

N–S Faults: Next to the NW–SE faults are the N–S faults. These faults can be traced up to a maximum distance of 28 miles. Mylonites and sheared rocks are found in these fault zones. Epidotisation is also found in some places. Dislocation of E–W basic dykes, in places, is observed in evidence of these faults. Some of the drainage pattern also follow these fault lines. These fault zones are more or less devoid of any mineralisation.

E–W Faults: The E–W faults of the area are mostly represented by the basic dykes which run to a maximum distance of 28 miles in an E–W direction. Epidotisation is also found, in places, in evidence of these fault zones. Mineralisation of sulphides is found to the east of Krishnagiri, and this shows clear evidence of hydrothermal action along the fault zone.

NE–SW Faults: The NE–SW faults can be seen NW, SE and SW of Krishnagiri. These faults extend up to a distance of 10 miles and more, and are parallel to the strike of the country rocks. The elongation of several hill masses in a NE–SW direction may be considered as an evidence for faulting. The Dharwarian schistose rocks are affected by these faults. This system of faults gains importance in areas south of Krishnagiri where some basic dykes are found to follow the fault lines and mineralisation of sulphides can be seen in some places.

Age relationship of the fault systems: An attempt to determine the age relationship of the fault systems is made using the available data. The NE–SW and N–S fault systems are probably the older ones, the E–W system younger and the NW–SE system the youngest. The age relationship between the NE–SW and NS fault systems could not be determined for want of adequate field evidences.

The NE–SW and N–S fault systems are considered the older ones as they follow mainly the general strike of rocks and of the granite-migmatite plutons. These faults are cut through by the later E–W basic dykes which are, in turn, disturbed by the NW–SE faults, the youngest.

However, it should be pointed out here that the E–W basic dykes are found dislocated by the N–S faults in places. This may be attributed to later tectonic movements of the area.

The E–W faults represented by basic dykes are younger to the NE–SW and N–S faults though in places it appears otherwise because of later tectonic movements. It seems possible that the E–W structures are upper Precambrian (Cuddapah) in age as they are filled mostly by basic dykes which are usually considered as related to the Cuddapah basic intrusions. It can also be suggested that the hydrothermal sulphide mineralisation located along the E–W faults is of the same age.

The NW–SE faults seem to be the youngest as they undoubtedly cut through the faults of the other systems. The NW–SE faults are most likely the youngest and are related to recent movements as the drainage pattern very often follows the fault lines.

Conclusion: 1. The following fault systems are determined in Krishnagiri area: NE–SW, N–S, E–W and NW–SE.

2. The age relations of the fault systems could be recognised as following: NE–SW and N–S faults the older ones, the E–W faults younger to them and the NW–SE the youngest.

3. The NW–SE and N–S fault zones are found to be devoid of any mineralisation. But the E–W and NE–SW fault zones have shown sulphide mineralisation and thereby evidences of hydrothermal activity.

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LINEAMENTS AND THEIR IMPORTANCE IN LANDFORM STUDIES

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Lineaments are geological or topographical alignments usually straight and occasionally arcuate which can be recognised on aerial photographs to consistently occur over a wide region. These have been variously named as 'fracture zones,' 'shear zones,' 'trend lines' and 'tectonic trends' (Auden, 1954; Eremenko, 1964; Sastry and Raiverman, 1968). Faults, joints, bedding, foliation and lineation in rocks seem to be related to some of the lineaments. Our interest in the lineaments in the Precambrian shield is mainly because the same do extend into the sedimentaries overlying them and these lineaments continue to exert their influence in the tectonic history of those younger formations. In India, lineaments or tectonic trends have been reported from some parts of the country based on stratigraphic, structural and geophysical data.

In the present study two regions in India (Fig. 1) have been taken one around the Iron Ore Region of Bihar and Orissa (Fig. 1A) and the other around the Nilgiri mountains (Fig. 1B) in South India. The main attempt is to see how far the lineaments, traced from aerial photographs of approximately 2 inches to a mile scale (1 : 31,680), control the nature of the landforms and drainage in the respective regions. There are a few more lineaments actually traced from the photographs than those shown in Figs. 1A and 1B. Close observation will show that the sets are parallel to sub-parallel and certain lineaments may have gradual variation in their direction of