ON THE OCCURRENCE OF PRIESKAITE FROM THE IRON STONE FORMATION, BABABUDAN HILLS

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ABSTRACT

A new variety of amphibole asbestos, prieskaite, has been observed in the iron stone formation of Doopadagiri area, Bababudan hills. The chemical composition corresponds to $(Ca_{1.85}\ Na_{0.08})\ (Mg_{0.87}\ Fe^{2+}_{2.55}\ Fe^{3+}_{0.46}\ Al_{0.37})\ SiO_{8.1}\ (OH)_{2.4}$. Prieskaite is formed by the intermixing of basic rocks with the ferruginous quartzites and subsequent metamorphic reactions.

TWO varieties of amphibole asbestos, crocidolite and amosite have been reported from the banded iron ore formations of Bababudans, chiefly confined to Attigundi and Doopadagiri area. Bands of prieskaite have been noticed by the present authors in place of amosite asbestos on the escarpment as well as the dip slopes near the Doopadagiri coffee estate, North Bababudans. The significance of this occurrence, and the mineral chemistry are reported in this communication.

Prieskaite, first discovered by Cilliers[2] in Koegas mine, South Africa, is ferroactinolite with high Fe/(Fe+Mg) ratio. Only a few such actinolite asbestos occurrences are known in the world. The cross fiber bands of prieskaite in iron stones of Doopadagiri vary in width from 0·2 to 0·5 cm (Fig. 1), set at close intervals. The asbestos is

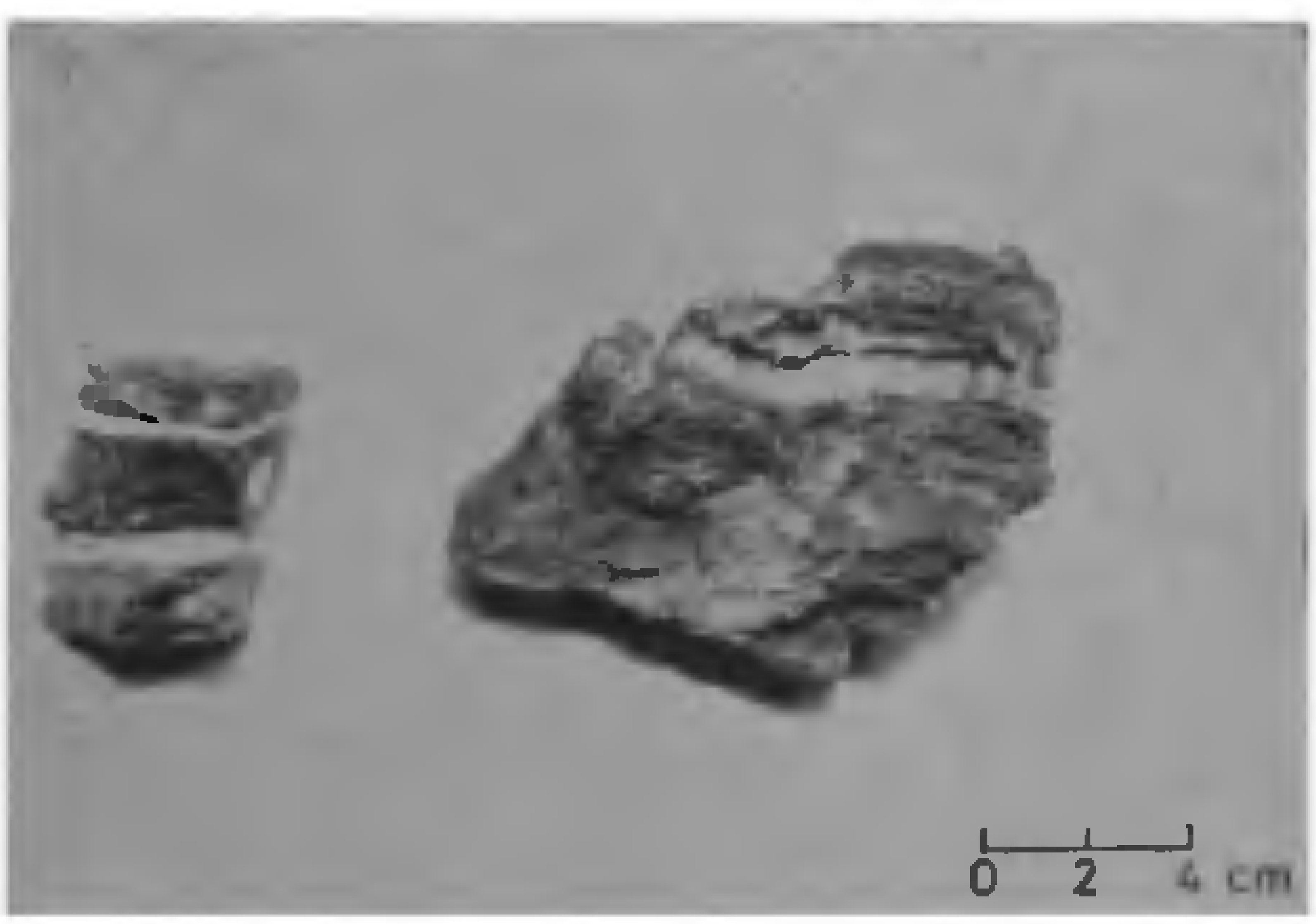

FIG. 1. Cross-fibers of prieskaite in ferruginous quartzite.

greenish white and has low to medium tensile strength. It is often interspersed in bands of quartz, with comb structure. In the banded iron ore formations, are clays, mostly ferrononttronite (Table I) derived from weathering of preexisting basaltic rock. Prieskaite asbestos is restricted to the bands spatially associated with basic rocks (metabasalts).

TABLE I

Chemical composition of minerals

	1	2	3	4
SiO_2	54·62	52·16	50·72	40·24
TiO_2	0·10	0·27	0·18	0·07
Al_2O_3	2·11	1·82	5·86	5·69
Fe_2O_3	4·12	3·91	0·43	29·78
FeO	20·46	21·38	13·28	0·12
MnO	0·16	0·20	0·09	0·03
MgO	3·86	5·92	15·91	0·64
C O	11·58	10·99	10·21	2·18
Na_2O	0·26	0·20	0·60	0·14
K_2O	0·10	..	0·16	0·06
H_2O^+	2·42	2·61	2·19	7·69
H_2O^-	0·12	0·18	0·44	13·21
Total	99·91	99·64	100·07	99·85

Number of ions calculated on the basis of 24 (O), 20 (O) *atoms and* 4 *(OH)*

Si	8·126	7·917	7·313	7·012
Al^4	..	0·084	0·687	0·988
Al^6	0·369	0·241	0·308	0·132
Ti	0·012	0·038	0·025	0·003
Fe^{3+}	0·461	0·446	0·047	3·291
Fe^{2+}	2·546	2·714	1·602	0·010
Mg	0·866	1·339	3·420	0·210
Mn	0·020	0·026	0·011	0·015
Ca	1·849	1·790	1·580	0·812
Na	0·075	0·059	0·168	0·030
K	0·019	..	0·029	0·007
(OH)	2·404	2·645	2·107	4·064

(1) Prieskaite; (2) Prieskaite; (3) Actinolitic hornblende; (4) Ferrononttronite.

Mineral Chemistry

The chemical formula of the prieskaite reported from Deep dagur is $(Ca_{1.85}Na_{0.08}Fe^{2+}_{2.5}Mg_{0.[illegible]}Fe^{3+}_{[illegible]}Al_{0.3[illegible]})Si_{8.[illegible]}O_{22}(OH)_{2.[illegible]}$ (Table II) indicating that it belongs to tremolite-actinolite series. In contrast, calcic amphiboles from the associated basic rocks have compositions intermediate between actinolite and hornblende with $Al^{4} = 0.684$ and total alkali = 0·197 atoms/formula. The 100 Fe/(Fe + Mg) ratio is much lower (around 33) than that of the prieskaite (71–78) which is suggestive of the chemistry of the host rocks.

Table II

Chemical composition of whole rocks

	1	2	3
SiO_2	32·12	53·01	43·16
TiO_2	0·21	0·18	0·23
Al_2O_3	0·76	10·79	8·91
Fe_2O_3	53·17	6·42	21·68
FeO	11·03	15·12	16·82
MnO	0·18	0·21	0·28
MgO	1·31	3·45	3·89
CaO	..	7·21	3·74
Na_2O	0·34	0·82	0·71
K_2O	0·11	0·27	0·18
H_2O^+	..	1·81	0·96
H_2O^-	0·10	0·28	0·12
Total	99·33	99·57	100·68

1. Banded ferruginous quartzite.
2. Basic rock.
3. Prieskaite bearing rock.

It is difficult to obtain the exact composition of the banded iron stones because of the varying width of the component bands. In general, they have higher oxides of iron (Fe_2O_3 + FeO = 40–60% by wt.) and SiO_2 (25–35% by wt.). When the bands contain magnesioriebeckite (bababudanite) and aegirine[3,4], alkali (3–6% by wt.) and magnesia (2–5% by wt.) contents are higher. The composition of the basic rock varies with its association. When plotted in MgO-total Fe-alkali diagram, the rock composition has affinity towards tholeiitic basalt with higher CaO, Al_2O_3, MgO and alkali. Composition of the host rock of prieskaite asbestos does not correspond to any of the known mafic rocks. It has lower CaO, Al_2O_3, MgO and alkali and very high iron. It is evident that prieskaite is a product derived by the contamination of the basic rock with iron stones.

The IR spectrum of prieskaite is given along with nonfibrous actinolite in Fig. 2. X-ray powder patterns were taken. The unit cell parameters obtained, $a = 9.87$ Å, $b = 18.13$ Å, $c = 5.29$ Å and $\beta = 104° 59'$, tally with the reported values for actinolites[5].

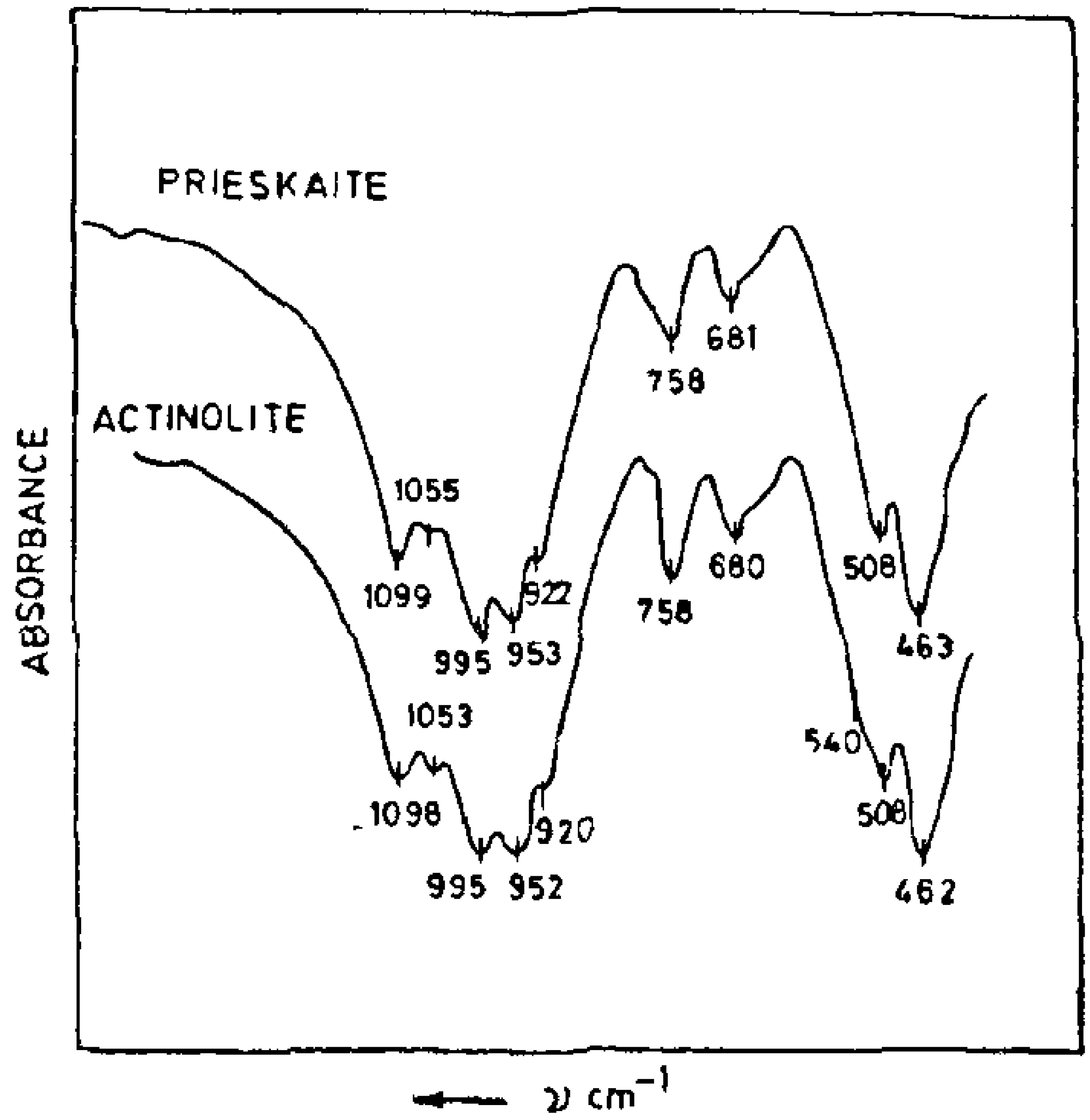

Fig. 2. IR spectra of prieskaite and actinolite.

Discussion

Controversial views are expressed on the mode of formation of iron stones of Karnataka craton; one view is that they are metamorphic products of the basic lava flows[6]. It has also been postulated that ferromagnesium minerals are of igneous parentage which by subsequent weathering and alteration gave rise to iron oxides and silica. A number of investigators[7,8] hold the alternative view that iron formations are of sedimentary origin, the constituents being derived from the land masses by the process of weathering, transportation and deposition in a basin. The basic flows and schists must have constituted the floor of the basin and subsequent diastrophism converted the iron formation into the crescent shaped ranges. However, the origin of magnetite and iron rich silicates in these banded iron ore formations is controversial. The variation in Na_2O, CaO contents of different horizons and formation of the three different amphibole asbestos are difficult to explain. There are a number of alternative explanations put forward for the source of Na_2O and origin of sodic amphiboles and amosite[9-11].

It is evident from the association that the prieskaite is formed in horizons where the basic rocks come in contact with ferruginous quartzites. Necessary calcium for its formation is derived from the basaltic rock. Prieskaite can be regarded as the product of metamorphic reaction such as

$$\begin{array}{l} Ca\,(Mg,Fe)\,Si_2O_6 + 2Fe_3O_4 + 6SiO_2 + H_2O \\ \quad cpx \quad\quad + \; mt \; + \; qz \; + Water \\ = (CaFeMg)_7\,Si_8O_{22}\,(OH)_2, \text{ Prieskaite.} \end{array}$$

This reaction suggests that clinopyroxene (cpx) of original basic rock reacted with the constituents of iron stones under appropriate fluid pressures resulting in the formation of prieskaite. The iron-rich phase is considered as Fe_3O_4; however the equation may be rewritten in terms of Fe_2O_3 as well, assuming appropriate oxygen fugacity. This reaction can take place under P–T conditions of green schist facies.

The development of asbestiform morphology may be attributed to the role of shearing stress, directive pressures or to minor chemical impurities. The formation of cross fibers of prieskaite may as well be related to the control exerted by the parallel surfaces in individual seams during crystallization[12].

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SOME REPRODUCTIVE ANOMALIES IN THE INDIAN RUFUS HORSE SHOE BAT, *RHINOLOPHUS ROUXI* (TEMMINCK)

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Abstract

The female genitalia of the bat, Rhinolophus rouxi, exhibits pronounced physiological asymmetry, the right ovary normally releasing the ovum during each cycle and the right uterine cornu carrying the pregnancy. Among 285 pregnant females examined for the present study two presented unique features. One female had monozygotic twin embryos at the unilaminar blastocyst stage of development in the right uterine cornu. In another specimen both ovaries had a corpus luteum each, and there was an embryo in each uterine cornu, but the embryo in the right cornu was more advanced in development than the one in the left cornu. It is suggested that the retarded growth of the embryo in the left cornu is due to the development of this embryo in an abnormal environment with deficient hormonal and nutritional levels.

Introduction

THE uterus is bicornuate and the two cornua are morphologically bilaterally symmetrical in all the bats except in the members belonging to the family Phyllostomatidae which have simplex uterus. However, from a physiological point of view the bats possessing bicornuate uterus can be recognized into three major categories: (1) Those in which ovulation normally occurs from both the ovaries and pregnancy is carried in both the uterine cornua as in several vespertilionids[1-8]. (2) Those in which only one ovary normally releases a single ovum during each cycle and the embryo is carried in the ipsilateral uterine cornu, but the two sides of the genitalia alternate in releasing the ovum and in carrying pregnancy in successive cycles as in *Desmodus rotundus murinus*[9], *Taphozous longimanus*[10, 11] and *Rousettus leschenaulti*[12, 13]. (3) Those in which, although the two sides of the genitalia