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RESEARCH NOTE

CARBONATITE AROUND AJJIPURAM, KOLLEGAL TALUK, KARNATAKA

Abstract : Several lensoid bodies of carbonatite occur within a wide zone of fenitisation in the granulite terrain of Kollegal taluk, Karnataka. These are emplaced along deep NNE-SSW fracture system and are associated with pyroxenite, talc-tremolite schist showing varying degree of fenitisation. The sövite and beforsite varieties show high percentage of SiO_2 due to contamination during emplacement. The Fe_2O_3, MnO and MgO values of Ajjipuram carbonatites broadly compare with the Koratti carbonatites occurring on the eastern part of the mobile belt with similar tectonic history.

Keywords : Carbonatites, Kollegal taluk, Karnataka

Introduction: The occurrence of carbonatite complex along a system of deep faults in the granulite terrain has been reported from the adjoining Tamil Nadu (Grady, 1971). This includes carbonatite complex from Koratti, Samalpatti and Hogenakal areas, nepheline syenites from Piccili and syenite from Elagiri hills (Fig.1). The carbonatite occurrence of Hogenakal falls in Karnataka was described by Ramakrishnan *et al.* (1973) and in the adjoining Tamil Nadu by Srinivasan (1973, 1977). This complex has been dated to be 2.0

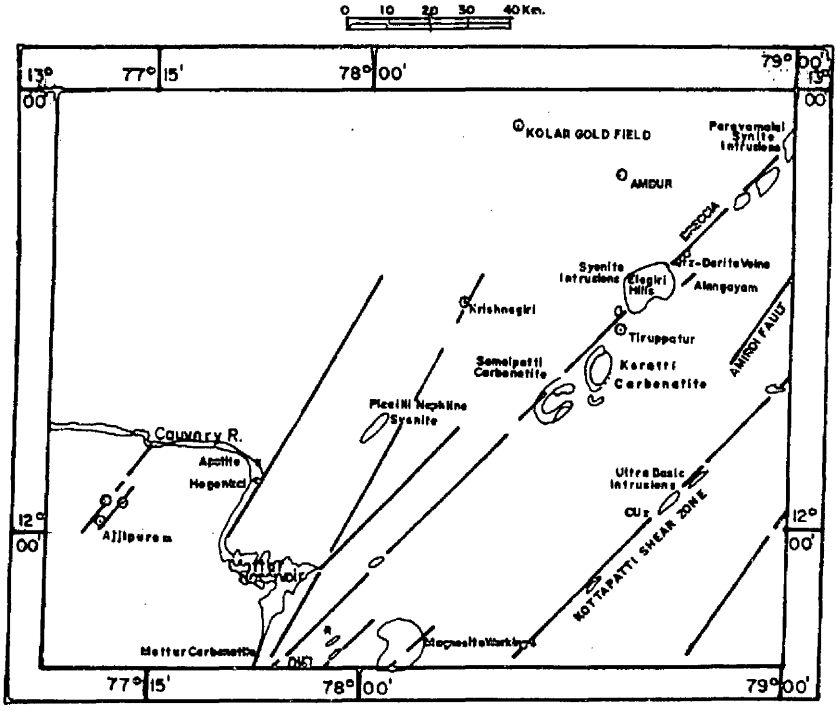

Fig.1. Carbonatites and associated lineaments of Kollegal area, Karnataka and adjoining Tamil Nadu. (Modified after Grady, 1971).

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Ga by Natarajan *et al.* (1994). A detailed account of carbonatite occurrence of Koratti in the granulite terrain of Tamil Nadu has been given by Borodin *et al.* (1971).

Geology: The area between Hanur and Malemahadeswara hills exposes granulitic facies rocks of intermediate to high pressure charnockite (Srikantappa and Hensen, 1992), with two pyroxene granulite, ultramafic talc-chlorite schist, sillimanite gneiss, calc-granulite and pink migmatite. Younger igneous activity is marked by pink porphyritic granite of Closepet type and basic intrusives include dolerite, norite and lamprophyre (vogesite at Mambetta). For the first time, a 10 km wide zone of fenitisation has been delineated within the granulite between Hanur and Kaudalli (Fig.2).

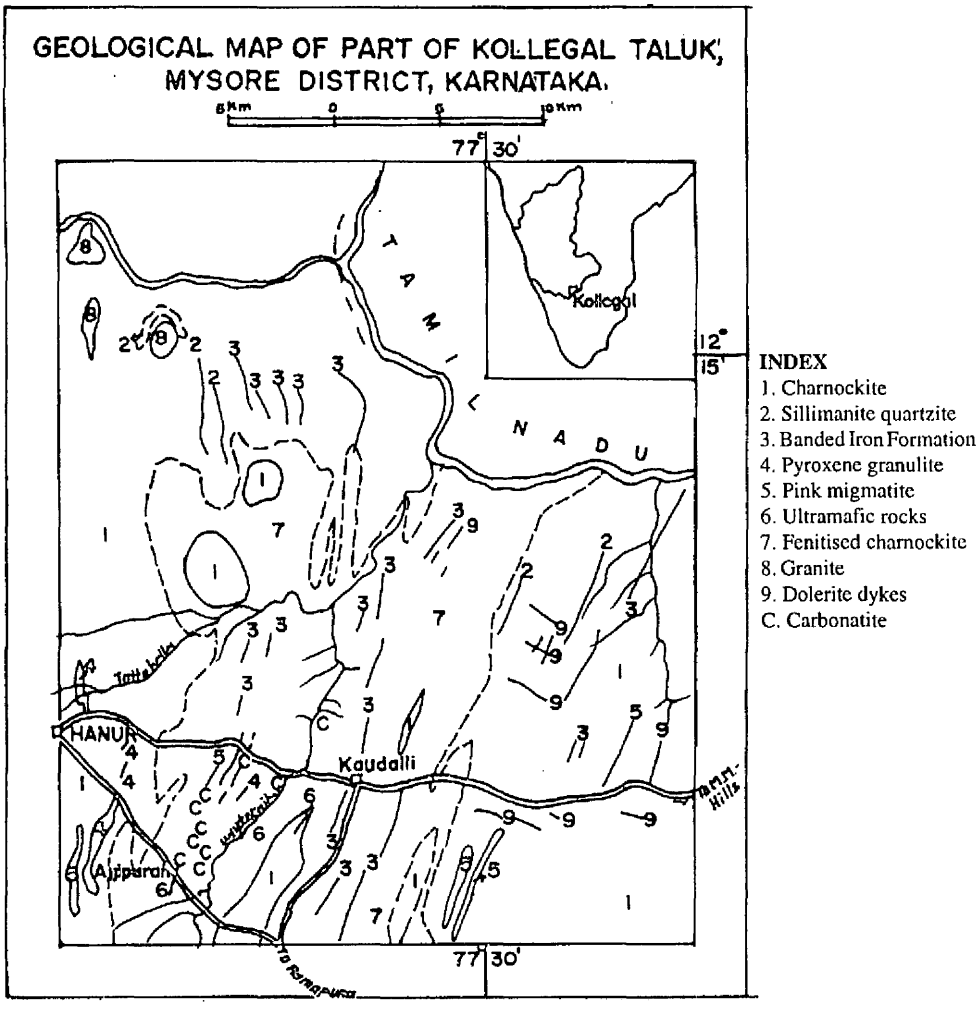

Fig.2. Geological map of part of Kollegal taluk, Mysore district, Karnataka.

Carbonatite Occurrence: A number of carbonatite bodies are noticed in the fenitised zone. Fenites are metasomatised *in situ* rocks formed as a result of emplacement of hyperalkaline igneous rocks including carbonatites (Le Bas, 1977) and form a distinct envelope around carbonatite bodies. The effect of alkali metasomatism on the charnockite and associated granulites of Kollegal area, is very extensive as seen by the development of soda-rich minerals such as aegirine, arfvedsonite, ferro-actinolite, clinozoisite and epidote.

A number of lensoid bodies of carbonatite of varying dimension are located in fenitised zone in many localities on either side of the Udutorai halla. They vary in width from a few centimetres to 30 metres. They are:-

1. To the east of Ajjipuram, over a length of 5 km as detached discontinuous and lenticular bodies.
2. 750 m east of Ellemalam, near Utehalla causeway.
3. East of Mallayanapura, for a length of 800 m on the eastern bank of Udutorai halla.
4. 1 km north of Budugunpe gudde as impersistent parallel bands.

Ajjipuram carbonatite: East of Ajjipuram, a prominent occurrence of small lensoid carbonatite body with a strike length of 375 m in NE-SW direction and a width of 30 m is delineated (Fig.3). It is located along the NNE-SSW fracture plane occupied by Udutorai

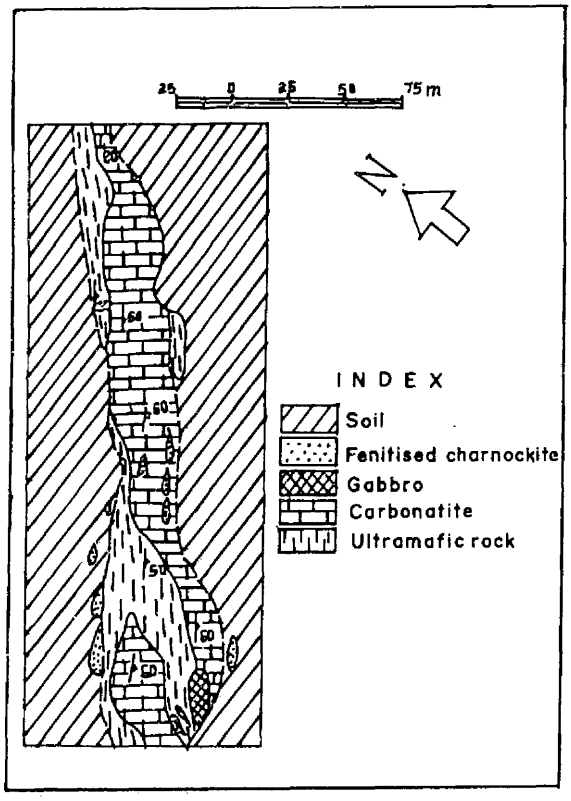

Fig.3. Large scale map of the carbonatite body east of Ajjipuram.

halla, which shows extensive development of cataclasites and mylonites. Here, the carbonatite is associated with ultramafic bodies, represented by talc-tremolite schist and gabbro in a fenitised charnockite terrain.

Compositionally, the carbonatite bodies around Ajjipuram fall into two categories. The main one occurring extensively in this area is beforsite rich in magnesite and iron carbonates and the other one is a pure calcic variety - sövite.

Mineralogy: In the field, the carbonatite bodies exhibit typical pale brown colour, hard and compact with ribbed weathering. They are closely associated with ultramfics, showing varying degree of carbonatisation. The sövite occurs within charnockite and has a distinct metamorphic aureole. Microscopic and X-ray diffraction studies (Table I) show medium to fine grains of dolomite/calcite and quartz with minor amounts of talc, chlorite, sericite, apatite, rutile and ilmenite which is often altered to leucoxene.

Table I. X-ray diffractometry of carbonatite samples from Kollegal taluk, Karnataka.

Sl. No.	Sample No.	Mineral phase
1.	K/C/5	Dolomite (S) Biotite (W) Quartz (S) Chlorite (M) Apatite (W)
2.	K/C/6	Dolomite (S) Quartz (S) Chlorite (S) Plagioclase (M) Apatite (W)

S: Strong, M: Medium, W: Weak-represent intensity of reflections. Samples studied by diffractometry, on Phillips XRD, Pet. Lab., AMSE, GSI, Bangalore.

Geochemistry: Four samples of carbonatites from Ajjipuram and nearby areas (Table II) were analysed by XRF and spectrographic method for major and minor elements.

Table II. Chemical analyses of Carbonatites around Ajjipuram.

Sample No.	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	MnO	P_2O_5	S	Cr_2O_3	NiO	BaO	LOI
K/C/5	40.74	4.38	5.59	15.07	10.92	0.06	0.04	0.17	0.12	0.05	0.04	0.36	0.00	0.00	21.91
K/C/6	43.54	7.21	8.58	12.21	8.08	1.25	0.18	0.33	0.15	0.04	0.00	0.20	0.00	0.00	16.62
K/C/5A	49.73	15.35	8.40	1.35	7.05	2.93	3.45	1.53	0.09	1.34	0.03	0.02	0.00	0.18	6.07
C/18	59.83	15.36	3.68	1.84	4.58	4.08	3.08	0.44	0.00	0.23	0.03	0.02	0.00	0.04	7.41

Trace Elements

	Cu	Ni	Co	W	Zr	Ag	Cr	V	Ba	Sr	Ga	Y	La	Nb
K/C/5	∠10	400	20	30	∠30	1	2000	50	10	150	10	∠10	∠30	∠10
K/C/5A	150	15	30	∠30	200	2	40	150	1500	600	10	80	150	10
K/C/6	10	150	80	80	30	2	2000	180	10	200	5	10	∠30	∠10
C/18	15	15	10	∠30	30	∠1	30	80	500	300	10	∠10	∠30	∠10

Major oxide analysis by PW 1410 Phillips X-ray Spectrometer, Pet. Lab., AMSE, GSI, Bangalore (values in wt. %).

Trace elements analysed by semi-quantitative spectrographic analysis from AMSE Wing, GSI, Bangalore (values in ppm).

The analytical results show that beforsite has high MgO, Fe_2O_3 and low SiO_2 compared to sovite due to the presence of dolomite, ankerite and siderite. The effect of fenitisation on beforsite seems to be less and is reflected in low concentration of alkalis when compared to sövit. The sövite carbonatite is typically surrounded by Na-rich aureole suggesting enrichment of alkalis in the parent magma (Le Bas, 1989). However, alumina appears to be almost immobile during fenitisation (Rubie and Gunter, 1983).

The high SiO_2 (40.74% to 59.83%) in these carbonatites could be due to contamination of the carbonatite melt with the adjacent country rock during emplacement. It may also indicate that it might have been derived from melt formed at shallower depths (Ratnakar and Leelanandam, 1989).

The presence of P_2O_5 in both the varieties is accounted by the presence of apatite. High concentration of barium and strontium (up to 1500 ppm of Ba and 600 ppm of Sr) may indicate late stages of fractionation, as Ba concentration increases with potash feldspar fractionation during differentiation (Ratnakar and Leelanandam, 1989). The presence of high chromium (up to 2000 ppm), vanadium (up to 160 ppm) and nickel (up to 400 ppm) indicate the contamination of the carbonatites by associated ultramafic rocks. Y, La and Nb values are generally low with a lone exception.

Comparison with other occurrences: Carbonatites of Ajjipuram, Kollegal taluk, compare well with those of Hogenakal and Koratti occurrences of Tamil Nadu in terms of geological set up, paragenesis and mode of emplacement. A comparative account is given below:

Table III. Comparitive geological set up of carbonatite occurrences in the adjoining areas.

	Ajjipuram	Hogenakal	Koratti
1.	Sövite and beforsite	Sövite	Sövite, pure ankerite and dolomitic carbonatite (beforsite)
2.	Lensoid bodies associated with meta-pyroxenite, talc-chlorite schist and syenite	Long sinuous lenses with linear bands (dykes) of mixed rock of meta-pyroxenite and syenite	Arcuate outcrops associated with pyroxenite and syenite.
3.	Rich in apatite	Rich in apatite, low in magnetite	Rich in apatite, magnetite and pyrochlore
4.	Shows feniti-sation with development of sodic minerals in surrounding country rock	Little or no fenitisation (atypical)	Little fenitisation but strong development of biotite, phlogopite and vermiculite in pyroxenite due to intrusion of syenite and carbonatite
5.	Associated with NNE-SSW faults	Associated with NNE-SSW faults	Associated with NE-SW faults

Conclusions: Geology and the mode of emplacement of carbonatites of Ajjipuram, clearly indicate that they compare well with the carbonatite occurrences from Hogenakal and Koratti

areas of Tamil Nadu. The development of a wide zone of fenitisation is characteristic of Ajjipuram carbonatite. The NNE-SSW fracture system along which they are emplaced, form a part of the regional fracture system found in southern part of India. Since the carbonatites of Ajjipuram are over-saturated, they may have been emplaced along shallow fracture planes.

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