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Research Paper

PETROLOGICAL AND GEOCHEMICAL STUDIES OF FELSITES AROUND MANDYA DISTRICT, WESTERN DHARWAR CRATON, SOUTH INDIA, KARNATAKA

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The Dharwar Craton in south India offers unique opportunity to study the natural cross-section of late Archaean continental crust. A preliminary attempt has been made in this study to understand the petrological and geochemical aspects of felsite dykes that are spread around Mandya district in south India. Geologically investigated area is made up of varied assemblages of rock types ranging from gneiss, ancient supracrustals of Sargur group, Peninsular gneiss, ultramafics, meta-ultramafites, amygdaloidal metabasalt and pillowed/BIF, granodorite, amphibolite and to younger intrusives of Neo-proterozoic age. Felsites in alternation with pegmatites are also exposed. Quartzo-feldspathic veins traverses the felsites at places and felsite with large phenocryst of feldspar are also found. At places felsites are highly jointed and the joint plane trend in E-W direction. Petrographic study shows that felsites are aphanitic and porphyritc in texture. The field and petrographic studies coupled with chemistry data suggest that the felsites dykes of the study area have evolved from a complex crystallization history and are formed in a volcanic arc granitic environment. The concentration of uranium up to 7.1 ppm indicates the potentiality of felsites for the occurrence of radioactive elements.

Keywords: Felsites, Western Dharwar Craton, Volcanic arc granitic, Aphanitic, Porphyritc

INTRODUCTION

Felsite is a fine grained igneous rock which occurs as veins or dykes in granites or nearby country rocks and it may or may not have phenocrysts. It is high in silica or felsic content, and consists of the minerals quartz, plagioclase feldspar and alkali feldspar. These rocks display either grey or pink colour as well a combination of both the colours. Generally they are highly jointed (Geological Survey of India, 2006). Felsite and porphyry dykes together form a composite series of intrusions varying from granodorite to tonalite and form syenite porphyry to granophyre in the Western Dharwar Craton (WDC). They show inclusions of older rocks and are much contaminated. Unlike the basic dykes which are generally narrow, the felsite and porphyry dykes are more massive and have developed a pronounced porphyritic texture (Radhakrishna and Vaidyanadhan, 1997).

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The Dharwar Craton preserves the geological history of one of the earliest continental crusts, covering a time span of over 3.3 Ga of earth history. The Dharwar Craton is divided into an eastern and a western domain with reference to N-S trending belt of granitoid intrusives known as "Closepet Granites" (Viswanatha and Ramakrishnan, 1981; Allen *et al,.*1986). The Western Dharwar Craton is occupied by vast areas of Peninsular Gneiss. Felsites in Western Dharwar Craton is found in association with granites. Felsite also occur as veins and they are only a few inches thick and they sometimes penetrate into the adjacent rocks. Felsite, aplites and pegmatite occurs as veins, dykes or sills in granites or nearly country rocks. There are a number of felsite and felsite porphyry dykes traversing the Peninsular Gneissic Complex (PGC) and schistose formations. Grey, pink and red felsite and felsite porphyries occurs as dykes and are exposed for several kilometres; these are confined to Mysore, Mandya and Bangalore districts in Dharwar Craton. A suite of alkaline dikes, also referred to as felsite and feldspar porphyry dikes has an age of 832±40 m.y, which correlates with the intrusion of the Chamundi Hill Granite and the feldspar porphyry dikes near Srirangapatnam. One of the alkaline dikes has a K-Ar age of 810±25 m.y., indicating absence of subsequent thermal events in the area (Mohammed Ikrammudin and Alan M Stueber, 1976). Petrological studies indicate the presence of uraninite at the peripheral part of a U-Ti complex in felsites from Papurna(Rajasthan). Part of the radioactivity in felsites is also contributed by monazite, zircon, xenotime, and goethite. In the feldspathic quartzites of Khetri, the U-Ti complex is enclosed within pyrite and is exclusively responsible for the radioactivity (Nagar *et al.,* 1995).

Geological Survey of India has worked out and found that dyke of both mafic and felsic composition and of various dimension and age criss-cross all the major litho types of Dharwar Craton, while the mafic dykes are ubiquitous, felsic varieties are confined to southern parts of the Dharwar Craton. These are the manifestations of the crustal extension and fractures along which these materials were emplaced.In chronological terms, these dykes could be grouped as:

i) Older metamorphosed varieties of >2600 million years old, mainly confined to the transitional zone between low grade greenschist terrain to the high grade granulite in southern Karnataka. These dolerites are rich with clouded feldspars which could be due to effects of regional thermal metamorphism.

ii) Younger unmetamorphosed dolerite to gabbroic dykes formed later to Dharwar event. Their general trend is ENE-WSW. Dyke swarms of this group are seen near Hunsur, Arsikere, Banavara, north of Chitradurga and around Kunigal.

iii) Felsite, alkaline and porphyry dykes are seen around Srirangapatna and Bidadi. These varieties are considered to be the youngest and related to plutonic activity of Chamundi Granite dating 800 million years.

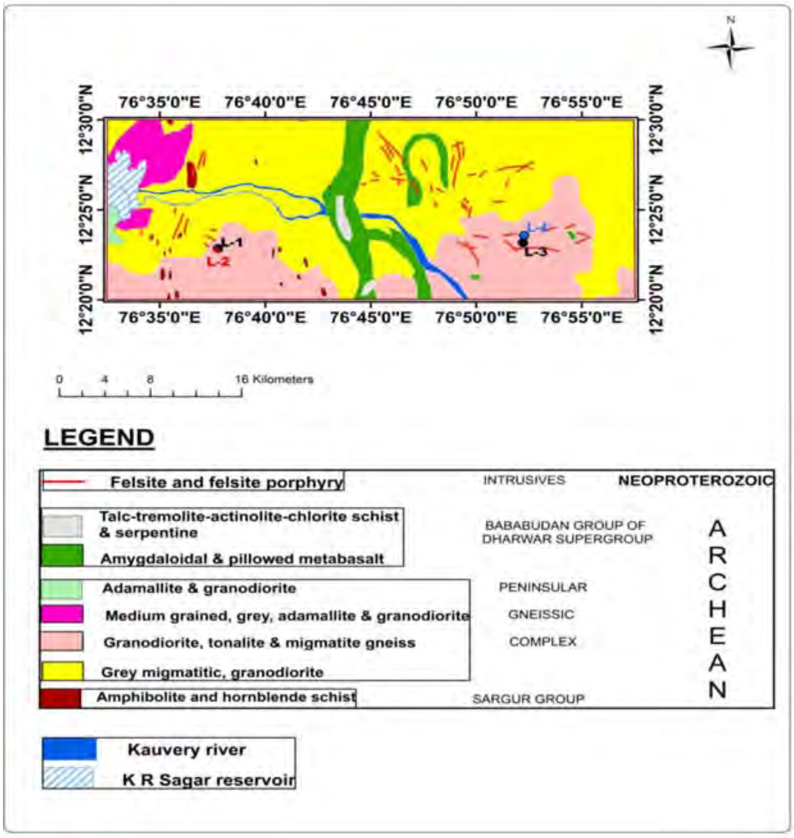
Karnataka state is the sole producer of felsite in India. According to mineral production in Karnataka for the year 2002-03 (excluding Atomic Minerals) felsite quantity was 1094 and value in '000 Rs. was 723. Large occurrences of these rocks are reported from Kirangur, Hosahalli in Srirangapatna taluk, Sadanhalli, Bannur and Mergalli in Mysore taluk of Mysore district and Malavalli and Maddur, Mandya district around Kanakapura, south of Channapatna, Satnur and

Bidadi, Bangalore district. Felsites can be cut to any required size, polished and used for decorative purposes. Only thin, small sized polished tiles for flooring and wall paneling can be manufactured from them (Geological Survey Of India, 2006).

GEOLOGICAL SETTING OF THE AREA

The study area lies between the latitude $12^0$20’N to $12^0$30’N and longitude $76^0$30’E to $76^0$60’E as shown in (Figure 1). It is in Mandya district in Karnataka state in southern India which covers parts of Mogarahalli and Margowdanahalli village. The major lithologies are gneiss, ancient supracrustals of Sargur group, Peninsular gneiss, ultramafics, meta ultramafites (Talc-tremolite-actinolite-chlorite schist and serpentine), amygdaloidal and pillowed metabasalt, granodorite, amphibolite and younger intrusive rocks of Paleoproterozoic and Neoproterozoic age. The Cauvery river is the main drainage course and the drainage pattern is trellis to dendritic. Unlike the basic dykes which are generally narrow, the felsite and porphyry dykes are more massive and have developed a pronounced porphyritic texture. Felsite dykes are pale green to dark grey in colour when fresh, but develop a pink crust on exposed surfaces. They have a compact felsitic texture (Radhakrishna and

Figure 1: Geological Map of the Study Area Showing Felsite Bodies, (Based Upon Mysore Quadrangle and District Resource Map of Mysore and Mandya First Edition 1965 After GSI, 2008)



Vaidyanadhan, 1997). Felsite and Porphyry dykes are found around Arakere in the Seringapatam taluk which consists of dykes of acid rocks, like felsites and porphyries. The disposition of the dykes in this region forms more or less a broad circle. These several dykes of acid rocks, cut across the granitic gneisses and also the younger Closepet granites, and therefore have been formed subsequent to the intrusion of the latter, though perhaps they belong to the same period of intrusion as the Closepet granites (Rama Rao, 1939).

MATERIALS AND METHODS

In order to understand the petrological and geochemical aspects of felsite rocks of the study area, field and laboratory investigations were carried out. Geological quadrangle maps of Mysore and District Resource maps of Mysore and Mandya were utilised in the study available at Geological Survey of India and toposheets (57D/11, 57D/15) were processed from Survey of India respectively. Samples from various locations have been collected and marked using GPS. Felsite samples were examined using Labor lux-Pol petrological microscope available in the Department of Studies in Earth science, University of Mysore, Manasagangotri, Mysore and geochemical analysis were performed using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) available at Shiva Analyticals (India) Private Limited, Bangalore for major oxides, trace and rare earth elements.

RESULTS AND DISCUSSION

Field Description and Petrography

Broadly in the area studied felsites are of two types, i.e. (1) Fine grained felsites; and (2) Porphyritic felsites. Fine grained felsites constitute the larger part of the study area and they are found to trend in NW-SE, E-W direction. At places fine grained felsites are traversed by E-W trending quartzo-feldspathic veins (Figure 5) and they are found associated with granites and gneiss. They show well developed E-W joints with steep dip (Figure 2). Its color index is leucocratic, shows aphanitic fabric and are massive. Felsite bodies trend in NW-SE and E-W directions.The fine grained felsites are greyish and reddish brown, pinkish in color and are composed mainly of K-feldspar, Na-feldspar and quartz. In some places felsites show dendritic patterns as dark patches which are nothing but pyrolusite dendritic formations in which pyrolusite have precipitated along the rock giving rise to the dendritic pattern (Figure 3).

In thin sections(Figure 6), fine grained felsites shows aphanitic texture. However, individual minerals can be identified. They consists of quartz and K-feldspar as essential minerals. Quartz are anhedral and shows undulose extinction. K-feldspar occurs as tabular grains showing typical straight extinction and simple

Figure 2: Joints Trending in E-w Direction in Felsite In Mogarahalli

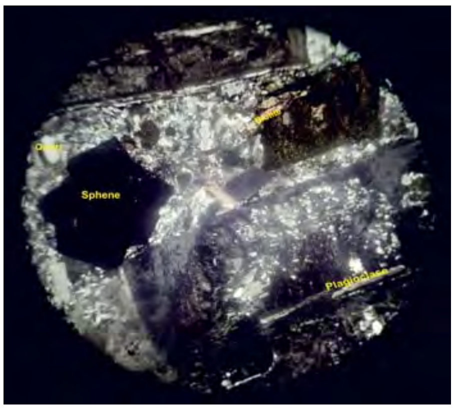
Figure 3: Exposure of Massive Felsite with Pyrolusiteformation Showing Dendritic Pattern in Mogarahalli

twinning. K-feldspar shows alteration to sericite/ muscovite and clay minerals and shows characteristic straight extinction. In addition, accessory minerals present are sphene and spinel. Sphene is brown in color pleochroic from dark brown to brown, wedge shaped and shows simple twinning. Spinel is brown in colour, subhedral and cleavage is absent. It is non-pleochroic and is isotropic. Irregular fractures are seen and are filled with mafic materials. Dark coloured isotropic grains of opaques are seen in the matrix which shows alteration to hydrous iron oxides. The porphyritic felsites (Figure 4) constitute smaller portion of the studied area. Felsites strikes in NW-SE, E-W direction. Foliation and cleavage are absent which attributes to their magmatic source and it shows typical porphyritic fabric and consists of phenocryst of K-feldspar and quartz in matrix. Some of the phenocryst, are of larger size and are embedded in the matrix. The color index of the rock is leucocratic. K-feldspar occur both as phenocryst and also groundmass.

Figure 4: Outcrop of Felsite Showing Porphyritic Fabric with Large Phenocryst of Feldspar Grains in Margowdanahalli

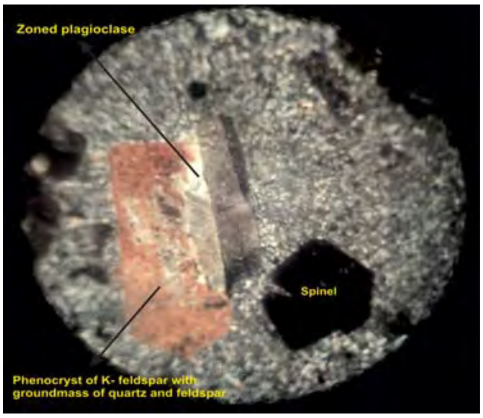
Figure 5: E-W Trending Quartzo-feldspathic Veins Traversing Felsite in Margowdanahalli

Figure 6: Photomicrographof Aphanitic Felsite with Phenocryst of Plagioclase Feldspar and Accessory Sphene Condensed in Fine Grained Matrix (Xpl). (Obj.10x)



In thin section, the rock shows porphyritic fabric (Figure 7). The essential minerals present are K-feldspar and quartz. They occur both in matrix and also as phenocryst. Phenocryst of K-feldspar are tabular and show alteration to sericite/ clay. Some of the grains of K-feldspar show simple twinning. Quartz are fine grained, anhedral, opaque and show typical wavy extinction. Spinel occurs as accesory mineral. They are green colored, anhedral and are isotropic. Intergrowth of quartz and feldspar grains are observed.

Figure 7: Felsite Showing Porphyritc Fabric With Phenocryst Of K-feldspar And Quartz Embedded In The Groundmass(xpl).(obj.10x)



WHOLE-ROCK GEOCHEMISTRY

Major and trace element analysis were performed on selected representative felsites samples. The results of the chemical analysis are given in Table 1, 2 and 3 respectively. The concentration of SiO_2 in the fine grained felsite (F1, F2, F3 and F4) samples varies from 69.18-75.08 wt% whereas in porphyritic felsites(K2-F, K3-PF, K3-F and K4-PF) SiO_2 value range from 61.86-69.53 wt% and Fe_2O_3 is 0.77-1.75 wt% for fine grained felsites and 1.72-3.10 wt% for porphyritic felsites. It indicate that the felsites are over saturated with silica (SiO_2 61.86 to 75.08 wt%). Alkali values range from 4.03 to 7.54 wt% for fine grained felsites and 4.06-8.69 wt% for porphyritic felsites and alumina values revolves around 13.93 to 16.33 wt% for fine grained felsites and 15.05-17.06 wt% for porphyritic felsites.

Rare earths are LREE rich and are dominated by La-27.2 ppm for fine grained felsites and La(26-118 ppm) for porphyritic felsites, Ce(0.6-52.2 ppm) for fine grained felsites and (44-140 ppm) for porphyritic felsites and among the trace elements, Uranium is enriched with 2.2-7.1 ppm for fine grained felsites and 5.7-6.7 ppm for porphyritic felsites, followed by Rb(280.9-315 ppm), Zr(65.9-413 ppm), Nb(8.4-12.8 ppm), Hf(4-10.9ppm), Th(0.8-33.3 ppm), Sr(163-175 ppm), Pb(36-89ppm), Zn(69- 410 ppm), Cu(7-9 ppm), Ta(0.4-0.5 ppm), Ga(28-29.5 ppm) and Li(8.3-9.7 ppm) for fine grained felsites and Rb(136-238 ppm), Zr(115-243 ppm), Nb(10-11 ppm), Hf(3.5-6 ppm), Th(8.4-27.8 ppm), Sr(810-1103 ppm), Pb(34-57 ppm), Zn(75-95 ppm), Cu(<5 ppm), Ta(<0.5 ppm), Ga(23.5-24-6 ppm) and Li(17-24 ppm) for porphyritic felsites.

Aluminum Saturation Index (ASI), (Al_2O_3/ $CaO+Na_2O+K_2O$ vs Al_2O_3/Na_2O+K_2O) as given in Figure 8.(Maniar and Piccolli, 1989) showing plots for felsites which indicate that both fine grained and porphyritic felsites are peraluminous in nature. On SiO_2 vs. $Na_2O + K_2O$ plot (LaBas *et al*.,1986) felsites fall in alkaline and subalkaline fields as shown in Figure 9. Plot of $Log_{10}K_2O$/Mgo ratio vs. SiO_2 content.(Rogers and Greenberg, 1981) in Figure10 shows fine grained felsites(F2 and F4) and porphyritic felsites (K3-PF) fall in the field of calcalkaline granite field and fine grained felsites(F1 and F3) samples fall in the field of A-type and calc-alkaline granites and porphyritic felsites(K2-F, K3-F and K4-PF) fall in A-type

Table 1: Major Oxides of Felsites in Weight Percentage

	F1	F2	F3	F4	K2-F	K3-PF	K3-F	K4-PF
SiO_2	75.08	69.18	74.82	70.04	61.86	69.53	68.72	67.24
Al_2O_3	13.93	16.33	14.06	15.06	17.06	15.05	14.07	16.16
Na_2O	4.75	4.31	4.74	4.51	4.16	4.75	4.24	4.71
K_2O	4.03	7.54	4.06	6.54	8.69	4.06	6.05	5.54
Fe_2O_3	0.77	1.75	0.76	1.86	3.1	1.72	0.66	1.57
CaO	0.44	0.2	0.44	0.3	2.2	1.77	0.74	0.4
SO_3	0.06	0.06	0.05	0.04	0	0	0	0
MnO	0.05	0.07	0.05	0.08	0.16	0.08	0.39	0.09
MgO	0.04	0.04	0.04	0.09	0.27	0.25	0.03	0.08
TiO_2	0.02	0.08	0.02	0.05	0.26	0.16	0.06	0.06
BaO	0.01	0.03	0.01	0.07	0.5	0.14	0.04	0.08
P_2O_5	0.01	0.03	0.01	0.05	0.15	0.07	0.09	0.04
LOI	0.45	0.7	0.46	0.53	1.2	1.53	1.54	1.35
Total	99.64	99.69	99.06	99.22	99.61	99.11	96.63	97.32

Table 2: Rare Earth Elements of Felsites in ppm

	F1	F2	F3	F4	K2-F	K3-PF	K3-F	K4-PF
La	<0.5	27.2	<0.5	<0.5	118	26	30	41.4
Ce	0.6	52.2	0.6	0.8	140	44	55.12	77.05
Pr	<0.5	6.2	<0.5	2.03	24	5	16	12.08
Nd	0.7	20.3	0.7	16.08	87	18	43	36.23
Sm	<0.5	2.2	<0.5	<0.5	16	3	11.03	14.67
Eu	<0.5	0.7	<0.5	<0.5	5	1.3	3.34	4.02
Gd	<0.5	2.3	<0.5	<0.5	14	3.1	6.51	11.07
Tb	<0.5	<0.5	<0.5	<0.5	2.1	<0.5	<0.5	1.87
Dy	<0.5	1.4	<0.5	<0.5	10	2	7	5.09
Ho	<0.5	<0.5	<0.5	<0.5	2	<0.5	1.08	0.34
Er	<0.5	1.1	<0.5	<0.5	5.5	1.4	2.86	3.76
Tm	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	0.3	0.52
Yb	<0.5	0.8	<0.5	<0.5	5.2	1.6	2.4	4.06
Lu	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	0.5	0.5
Sc	0.5	3.9	0.59	2.4	3	1.9	2.54	1.34
Y	1.1	7.2	1.13	1.4	54	13	22.03	16.07

Table 3: Trace Elements of Felsites in ppm

	F1	F2	F3	F4	K2-F	K3-PF	K3-F	K4-PF
Li	9.7	8.3	9.59	7.45	24	17	11.59	23.72
Be	5.6	1.9	5.63	4.67	4.8	5.8	6.67	4.45
Co	<0.5	1.8	<0.5	1.03	2.4	1.5	<0.5	<0.5
Ga	28	29.5	27.92	28.34	24.6	23.5	24.78	22.28
Ge	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Rb	315.4	280.9	314.96	305.07	238	136	217.76	163.4
Zr	65.9	413.2	65.88	66.34	243	115	66.89	112.92
Nb	12.8	8.4	12.81	9.65	11	10	11.65	10.8
Mo	0.5	1.5	0.55	1.34	<0.5	<0.5	<0.57	<0.5
Ag	<0.5	0.7	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
Cd	<0.5	<0.5	<0.5	<0.5	0.8	0.7	0.5	0.9
In	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sn	0.8	<0.5	0.98	<0.5	1.9	1	0.93	0.6
Sb	<0.5	0.6	<0.5	0.7	<0.5	<0.5	<0.5	<0.5
Te	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cs	16.5	1.9	16.52	7.08	6.7	5.6	4.56	17.5
Hf	4	10.9	4.14	6.78	6	3.5	4.13	3.4
Ta	0.5	0.4	0.53	0.54	<0.5	<0.5	<0.5	<0.5
W	0.5	1.9	0.55	0.9	<0.5	<0.5	<0.5	<0.5
Tl	2.1	1.9	2.01	1.3	2	1.7	1.09	1.1
Bi	0.6	<0.5	0.61	0.2	<0.5	<0.5	0.51	0.4
Th	0.8	33.3	0.81	0.98	27.8	8.4	3.85	4.6
U	2.2	7.1	2.13	3.67	6.7	5.7	2.34	3.1
Sr	163	175	164.01	172.45	1103	810	774.01	916.3
Pb	89	36	88.99	77.64	34	57	38.96	44.07
Cu	7	9	7.12	8.71	<5	<5	<5	<5
Zn	69	410	69.02	78.56	95	75	79.65	89.81
Ni	<5	<5	<5	<5	<5	<5	<5	<5

Figure 8: Aluminum Saturation Index (ASI) (Al_2O_3/$CaO+Na_2O+K_2O$ vs Al_2O_3/Na_2O+K_2O), the plotting coordinates are extracted from (Maniar and Piccolli, 1989) showing plots for felsites,

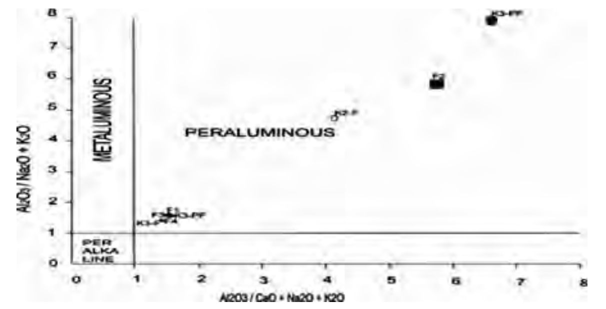


Figure 9: SiO_2 vs Na_2O+K_2O diagram showing alkaline and subalkaline condition of felsites. The plotting coordinates are extracted from LaBas et al., 1986

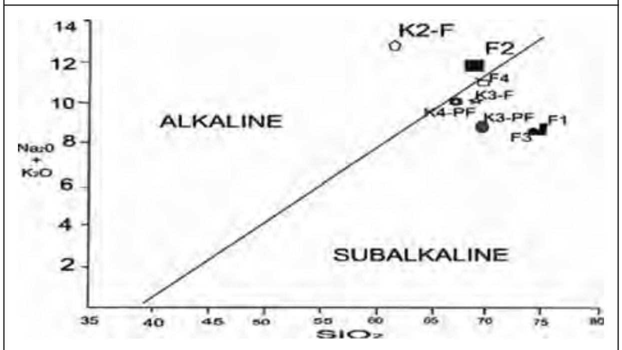


Figure 10: Plot of Log_{10} K_2O / Mgo ratio vs SiO_2content in weight percent characterizing felsites. The field of A-type granites and calcalkaline granites are extracted from Rogers& Greenberg,1981.

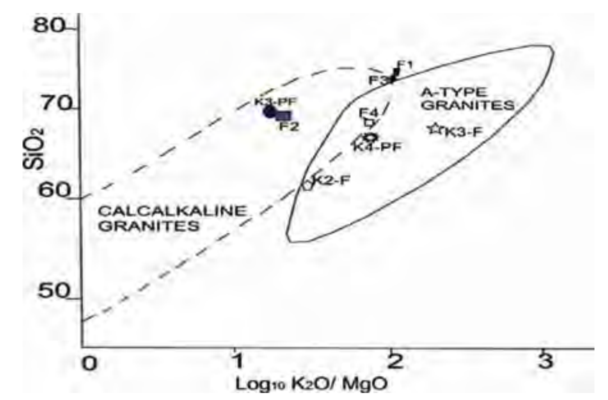


Figure 11: SiO_2vs AgapiticIndex(AI) diagram(Liegeois and Black,1987) characterising felsites.The post-collision granite(PCG) field is from Kuster and Harms(1998).

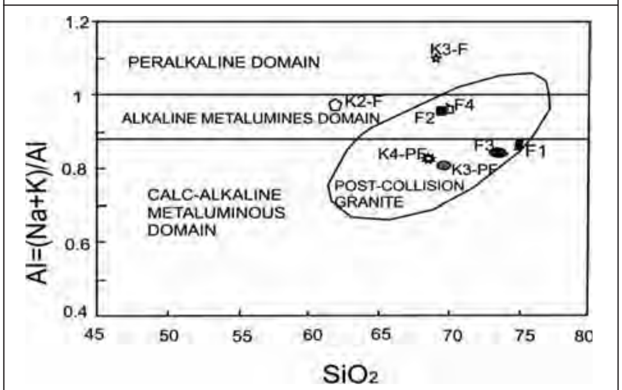


Figure 12: Na_2O-K_2O-CaO(wt%)ternary diagram of granite(Hassan and Hashad, 1990) showing fields of felsites. The trondhjemitic(TR) and calc-alkaline(CA) trends are from Barker and Arth(1976)

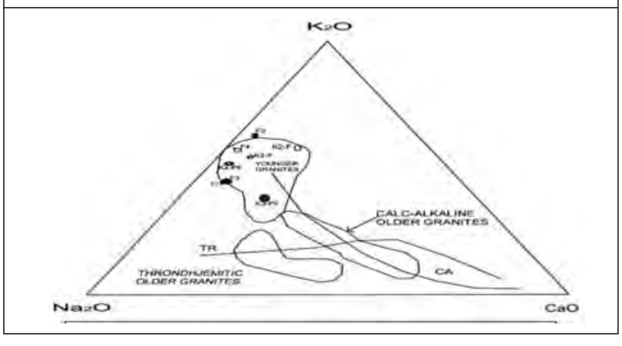


Figure 13: R1-R2 cationic classification diagram of De la Roche et al. (1980)

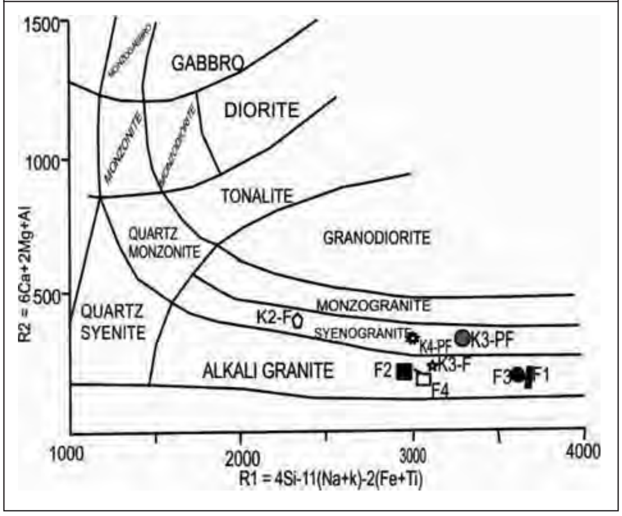


Figure 14: Molar. CaO / (Mgo+Fe_2O_3)vsAl_2O_3 / (MgO+Fe_2O_3), Showing plots of magmatic source of granites(field after Altherr et al.1986)showing fields of felsites.

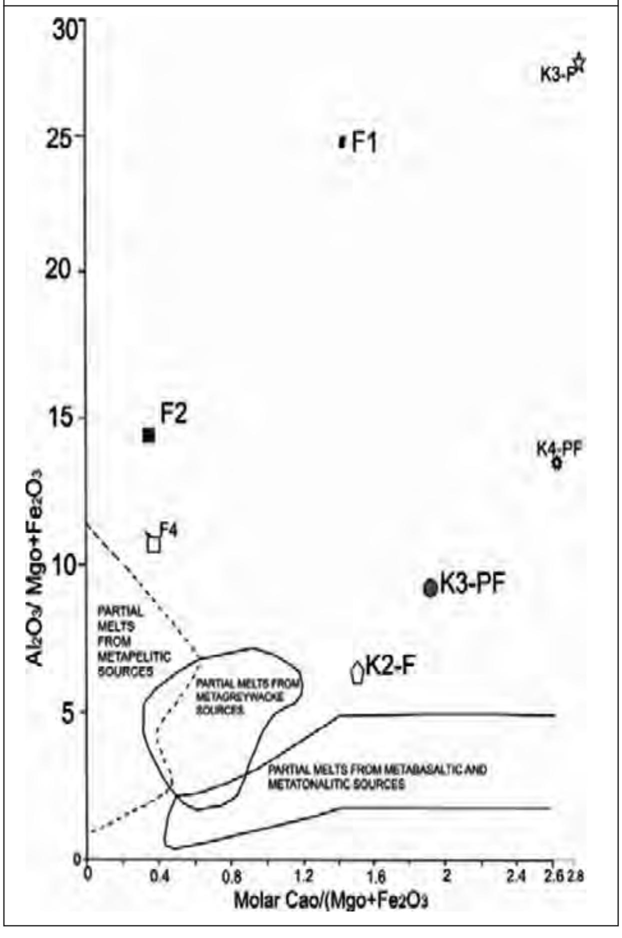


Figure 15: Binary Variation Diagram of Granite K_2O vs Na_2O (after Chappell and White, 1974)

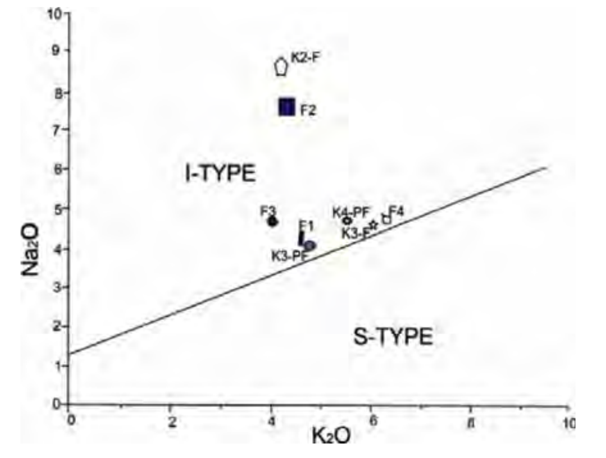
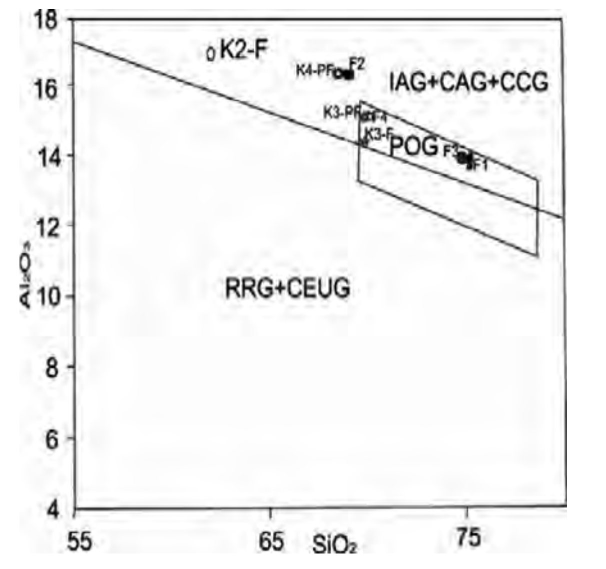


Figure 16: SiO_2 vs Al_2O_3 Diagram (Maniar and Piccoli, 1989). IAG= Island arc Granitoids, CAG = Continental arc Granitoids, CCG= Continental Collisional Granitoids, POG=Post Orogenic Granitoids, RRG= Rift Related Granitoids CEUG=Continental Epeirogenic uplift granitoids



granite. In Figure 11. SiO_2 vs. Agapitic Index (AI) diagram (Liegeois and Black,1987), fine grained felsites (F1 and F3), porphyritic felsites (K3-PF and K4-PF) fall in calc-alkaline metaluminous domain whereas fine grained felsites (F2 and F4) and porphyritic felsites (K2-F) in alkaline

Figure 17: SiO_2 vs Fe_2O_3 / (Fe_2O_3 + MgO) diagram (Maniar and Piccoli, 1989) IAG= Island arc granitoids, CAG = Continental arc granitoids, CCG= Continental Collisional Granitoids, POG=Post Orogenic Granitoids, RRG= Rift Related Granitoids, CEUG= Continental Epeirogenic Uplift Granitoids

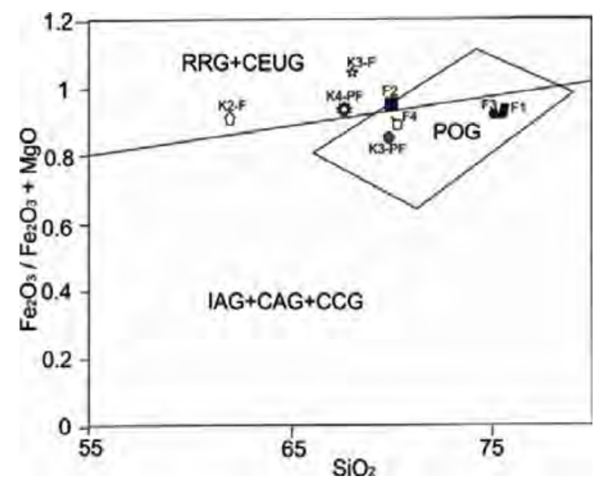
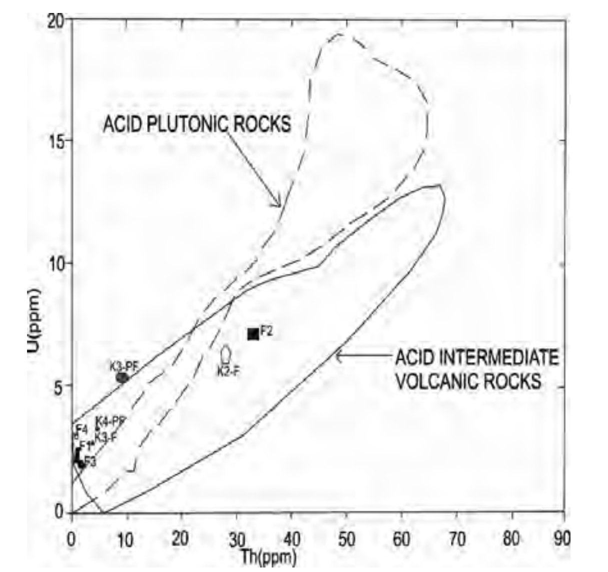


Figure 18: Th vs U Diagram (Wasserburg *et al.* 1984)



metalumines domain and both fine grained and porphyritic felsites fall in the field of post collision granite. As shown in Figure 12. Na_2O-K_2O-CaO (wt%) ternary diagram of granite (Hassan and Hashad,1990), both the felsites fall in the field of younger granites in the ternary diagram and have

Figure 19: SiO_2 vs Th/U Diagram (Taylor and Mc. Lennan, 1985)

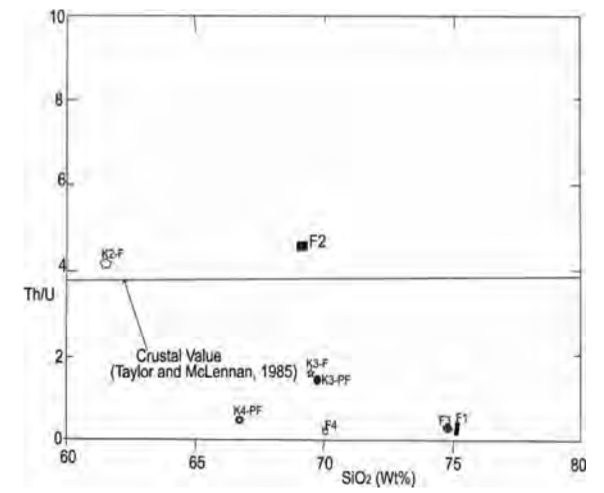


Figure 20: Differentiation Index(DI) vs Agapitic Index(AI)

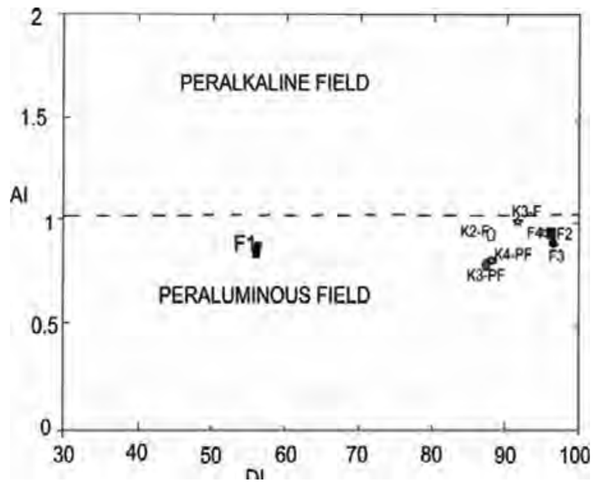


Figure 21: 10^4Ga/Al vsZr diagram for granite (Whalen et.al. 1987) indicating felsite samples in A-type granite

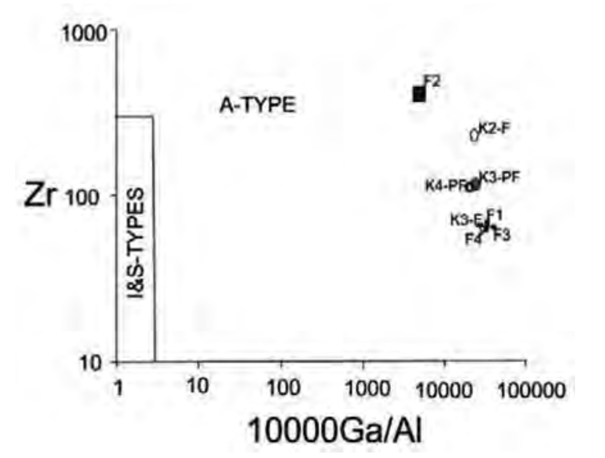
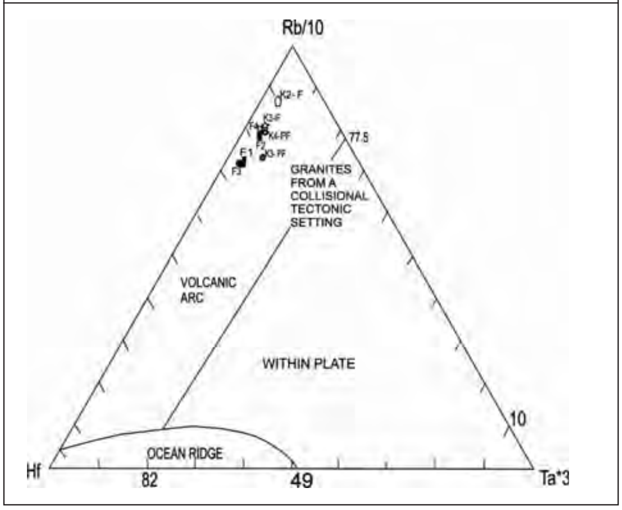


Figure 22: The Hf -Rb/10- -Ta*3 discrimation diagram for granites showing the fields of volcanic arc granites, within plate granites and ocean-ridge granites characterising felsites. The plotting coordinates are extracted from Harris et al., (1986).



higher Na_2O and K_2O content and lower CaO content. In R1-R2 cationic classification diagram of De la Roche *et al.* (1980) (Figure 13) fine grained felsites (F1, F2, F3 and F4) and porphyritic felsites (K3-PF) fall on alkali granite field and porphyritic felsites (K2-F, K4-PF and K3-PF), fall on syenogranite field. Figure 14. Molar $CaO/(MgO+Fe_2O_3)$ vs $Al_2O_3/(MgO+Fe_2O_3)$ shows the plots of magmatic field of felsites (field after Altherr *et al*.1986) and indicates the magmatic origin of felsites. In Figure15 the binary variation diagram of granite, K_2O vs. Na_2O (After Chappell and White, 1974) shows I- & S- type fields of granite. In the present study, both fine grained and porphyritic felsites fall in I-type granite fields.On both SiO_2 vs. Al_2O_3 wt% and SiO_2 vs. $Fe_2O_3/(Fe_2O_3+MgO)$ wt% diagram (Maniar and Piccoli, 1989) in Figure 16 and Figure 17 respectively, fine grained felsites (F1, F3, F3 and

F4) and porphyritic felsites (K3-PF) fall in the field of post orogenic granitoids and porphyritic felsites (K2-F, K3-F and K4-PF) fall on IAG+CAG+CCG and RRG + CEUG field (IAG = Island Arc Granitoids, CAG= Continental Arc Granitoids, CCG=Continental Collisional Granitoids, POG=Post Orogenic Granitoids, RRG= Rift Related Granitoids; CEUG=Continental Epeirogenic Uplift Granitoids).

From the plots of Th vs U diagram (Wasserburg *et al.,* 1984) (Figure 18) it is clear that felsites are acid intermediate volcanic rocks and on SiO_2 vs. Th/U diagram (Figure 19), it falls both above and below the crustal value as given by Taylor and Mc. Lennan (1985). In Figure 20, on Differentiation Index (DI) vs. Agapitic Index (AI) diagram for both fine grained and porphyritic felsites indicates peraluminous nature. The plots of 10^4 Ga/Al vs. Zr diagram for granite (Whalen *et al*.,1987) on Figure 21 shows both fine grained and porphyritic felsites fall in the field of A-type field which suggest that there is high concentration of Zr. Ga/Al ratio measures the alkanity of rocks and the solubility of zircon will increase with increase in alkanity index. To evaluate the tectonic setting of felsites, the analysis were plotted on discrimination diagram such as ternary plot Rb/10-Hf-Ta*3 (Figure 22) (after Harris *et al.,* 1986), felsites fall in the field of volcanic arc granites which indicates that the felsites of the present study are volcanic arc granite type.

CONCLUSION

Field setting and petrographic study of the acidic dykes found in the form of felsite around Mogarahalli and Margowdanahalli around Mandya district in Western Dharwar Craton can be classified into (1) Fine grained felsites; and (2) Porphyritic felsites. These felsite bodies are intrusive into schists, peninsular gneiss and granites. The geological age of felsites (832 ± 40 m.y.)are in coeval with the age of younger Chamundigranite (800 m.y.) in the Western Dharwar Craton. Major element chemistry suggest that the felsites are peraluminous, alkaline to calc-alkaline A-type younger granites. They are syenogranite to alkali granite in composition. Trace element and REE chemistry indicate that the felsites are acid intermediate A-type granitic in composition with lower Th/U crustal values. Whole rock chemistry suggests that Mogarahalli and Margowdanahalli felsite dykes are igneous in origin and are formed due to post orogenic process. This aspect correlates with the field observation. Concentration of Uranium upto 7.1 ppm in the felsites of the study area indicates the possible potentiality of occurrence of radioactive elements in these acidic intrusives in the Western Dharwar Craton.

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