CHAPTER III

LITHOGEOCHEMICAL SURVEY

INTRODUCTION : Petrochemistry is increasingly been put to use not only to identify granite types but also to study genesis, source rock and their evolution. In recent years efforts by many geoscientist are made to identify ore bearing plutons using major oxides and trace elements constrains that reveals tectonic history of the area investigated, and to suggest possible metallogenic province within the pluton.

Among many geochemists Niglli (1920), Kleeman (1955), Barrukov (1957), Tuttle and Bowen (1958), Ivanova (1963), Sotnikov and Izyumova (1965), Sotllery et al. (1971), Flinter et al. (1972), Sheraton and Black (1973), Tauson and Kozlov (1973), Garret (1971, 1974), Tischendorf (1974), Chapple and White (1974), Ishihara (1977, 1981), Govett (1983), Tauson (1984), Ivanova and Navmov (1985), Govett and Atherden (1988), were the poineering workers who used major and minor elements for identification of ore potential of different rocks by interpreting their source and evolution.

In the present study, the author has made an attempt using petrochemistry in assessing the ore bearing potential of the granites from Koheda area of Karimnagar District in Andhra Pradesh. The petrochemical data is given in chapter II; and is presently discussed under three broad heading viz; major oxides, trace elements and major oxides in conjunction with trace elements. Such studies help in understanding the productive granites.

MAJOR OXIDES : As mentioned earlier the details of major oxides in various representative granites of Koheda area is given in Table 2.2 of chapter II. The Table 3.1 in this chapter indicates comprehensive statistical information of major oxides analysed. The Table 3.1 shows the range, average and standard deviation of major oxides of Koheda granites. The table also furnishes the average composition of the granites elsewhere in the world.

The Fig. 3.1 illustrates the relative enrichment or depletion of various elements with respective to the area average. It is noticed that the samples R3, R4, R8, R15, R17 and R20 are relatively enriched in SiO_2 and K_2O. These samples are collected from Kurella (R3, R4), Dharmasagarpalli (R8), Maisampalli (R15, R20) and Regonda (R17).

Groves (1972), Sherton and Black (1973) and Sheremote et al. (1973) stated that the productive intrusions are highly differentiated alkali rich granites with silica content ranging from 70% to 77% and low CaO and MgO. Tischendorf (1974), Dilles and Einaudi (1992), demonstrated that "Specialised Granites" have significantly high content of SiO_2 and K_2O and significantly low TiO_2, Fe_2O_3, MgO and CaO than normal granites. The specialised granites have granophilic elements - Sn, W, Mo, B, Nb, Ta, Cs, U, Th, REE - enriched and granophobic elements - Ni, Cr, Co, V, Sr, Ba - improverished compared to normal granites.

Table No. 3.1 : Shows a comprehensive statistical information of major oxides in granites from Koheda area.

Sr.No.	Oxides	Range (%)	Average (%)	Standard Deviation (%)	*World Average (%)
1	SiO_2	69.42 - 78.1	71.94	2.62	73.2
2	Al_2O_3	11.95 - 15.9	13.15	1.11	12.5
3	Fe_2O_3	0.20 - 2.16	0.86	0.51	1.9
4	FeO	0.31 - 3.52	1.84	0.74	1.3
5	MgO	0.30 - 2.10	0.78	0.57	0.2
6	CaO	0.23 - 3.24	1.63	0.87	0.5
7	Na_2O	1.79 - 4.10	2.61	0.62	4.6
8	K_2O	2.42 - 6.80	4.6	1.22	4.9
9	TiO_2	0.09 - 0.62	0.33	0.16	0.2
10	P_2O_5	0.03 - 0.42	0.17	0.11	Trace
11	MnO	0.02 - 0.65	0.29	0.26	0.1

*World average source - Wedepohl (1969)

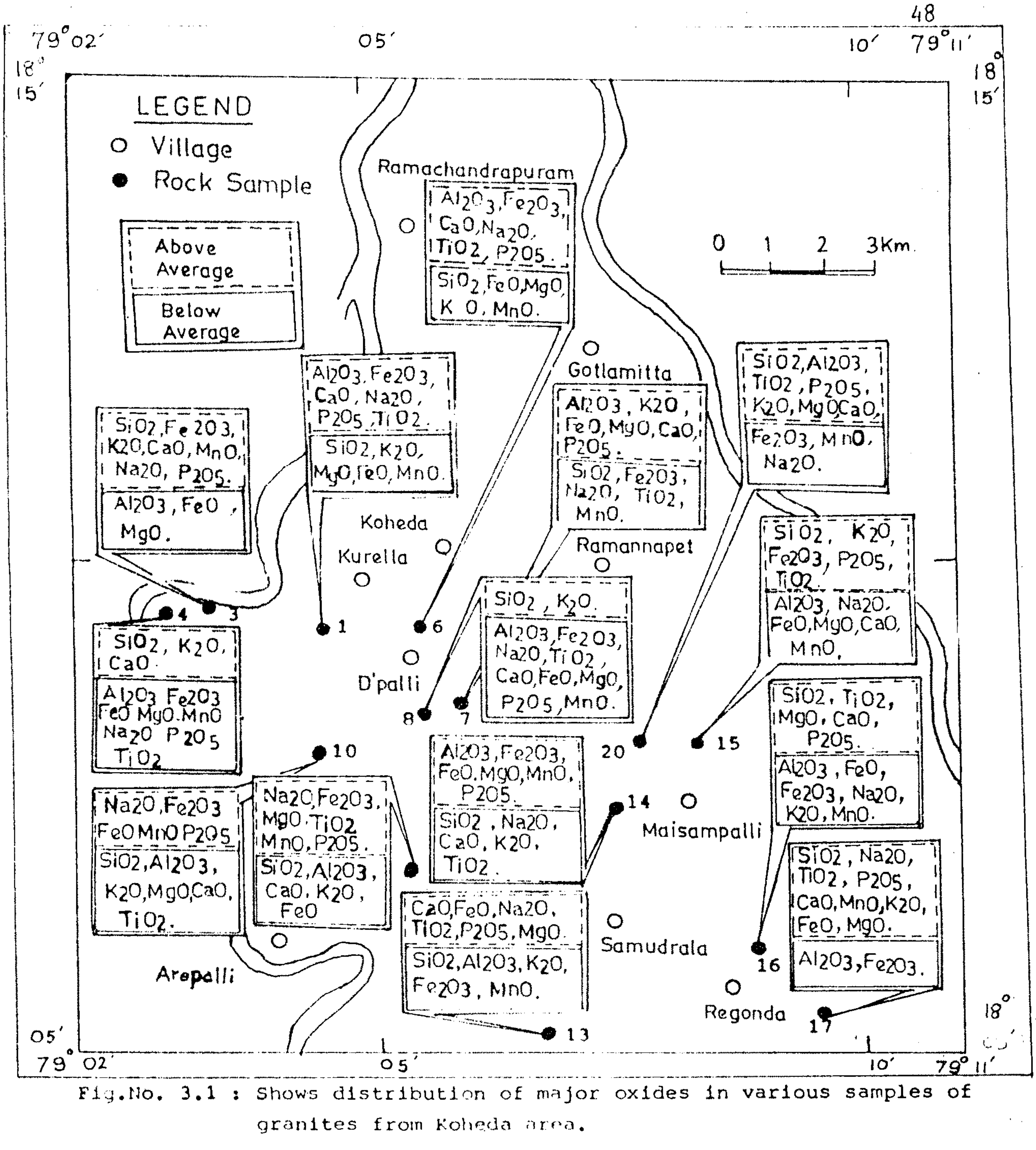


Fig.No. 3.1 : Shows distribution of major oxides in various samples of granites from Koheda area.

Olade and Flecther (1976), found that the porphyry copper deposits in their investigation is associated with potash rich zone and have marginal CaO rich zone. It is therefore reasonable to suspect that the sample and localities mentioned above in the present investigation represents a part of such porphyry copper system. Apart from silica and potash enrichment the samples that exhibit lime enrichment are R3, R4, R17 and R20. There are two samples which do not show CaO enrichment along with SiO_2 and K_2O are R8 and R15.

Lithogeochemical samples R3, R17 and R20 are found to have relatively higher content of total iron, TiO_2 'and P_2O_5. Sherton and Black (1973), who have stated about SiO_2 and K_2O enrichment have also observed relatively iron enrichment and this is reflected, in the present investigation, in samples R3, R17 and R20. This feature was also found by Taylor and Firyer (1983), who have shown that the granitoids of pre-alkaline affinity have diversity of mineral deposits in them. The most common are the porphyry copper and molybdenite deposits.

The sample R15 although not enriched in total iron, TiO_2 and P_2O_5, but show their values close to the average values of the area. The MgO content is found to be relatively higher in samples R17 and R20 only. These are collected from Regonda and Maisampalli, respectively. This indicates that the samples mentioned above are relatively depleted in MgO, which supports the investigation carried out by Sherton and Black (1973). The samples R1 and R6 show above area background in Al_2O_3 and Na_2O content, samples R1, R10 and R14 show Al_2O_3 and MnO enrichment.

The table 3.2 indicates in general the CIPW norm classification for the 14 representative granites collected from Koheda area. All the samples are persalic, prealuminous and peralkalic. In the persalic class salic normative minerals are extremely dominating over femic group of minerals. The salic / mafic ratio for the Koheda granites is of the range 8.01 to 50.43. The relative normative quartz and felspar for all the samples shows the dominance of felspar over quartz. These rocks range from quardofelic to perfelic. Clarks (1981), aluminium saturation index (ASI) of granites would reveal the genesis of the rocks. This ASI is calculated by taking the ratio of Al_2O_3 / CaO + K_2O + Na_2O. If the ASI value is greater than unity, the rocks are treated as prealuminous. If the ASI value is less than unity, the rocks are considered as metaluminous. The granites of the Koheda area are of the former type. The source material for prealuminous granites was discussed by Sarvothaman and Leelanandam (1992), who advocates that this rocks could have originated by partial melting of crustal igneous rocks such as Tonalite and Granodiorite rocks under H_2O excess condition or through fractionation from source material

Table No. 3.2 : Shows the CIPW norm classification for the granite samples from Koheda area.

Sr.No.	Rock Sample	Class	Order	Rang	Sub Rang
1	R 1	Per-salic	Quardofelic	Per-alkalic	Do pottassic
2	R 3	Per-salic	Quardofelic	Per-alkalic	Do pottassic
3	R 4	Per-salic	Feldoquaric	Per-alkalic	Per pottassic
4	R 6	Per-salic	Quardofelic	Per-alkalic	Do sodic
5	R 7	Per-salic	Perfelic	Per-alkalic	Per pottassic
6	R 8	Per-salic	Quardofelic	Per-alkalic	Per pottassic
7	R 10	Per-salic	Perfelic	Per-alkalic	Do sodic
8	R 13	Per-salic	Quardofelic	Per-alkalic	Do sodic
9	R 14	Per-salic	Quardofelic	Per-alkalic	Do sodic
10	R 15	Per-salic	Quardofelic	Per-alkalic	Per pottassic
11	R 16	Per-salic	Quardofelic	Per-alkalic	Sodi pottassic
12	R 17	Per-salic	Quardofelic	Per-alkalic	Per pottassic
13	R 20	Per-salic	Quardofelic	Per-alkalic	Per pottassic
14	R 22	Per-salic	Perfelic	Per-alkalic	Do sodic

compositions whose ASI straddle the unity.

The relative variation of alkalies in the Koheda area indicates that the samples range from perpotassic to dosodic. Of the 14 samples, 6 are perpotassic, 5 are dosodic, 2 are dopotassic and one belongs to sodic potassic (Table 3.2). The samples which exhibits perpotassic are R4, R7, R8, R15, R17 and R20. The samples R6, R10, R13, R14 and R22 are dosodic. Dopotassic samples are R1 and R3 and sodic potassic sample is R16. It may be recalled that all these samples are peralkaline and is in accordance with the productive granites investigated by Taylor and Fiyer (1983).

Interpretation of petrochemical data is made possible by using binary and ternary diagrams. Niggli (1920), states the source of magma generation can be inferred by calculating c/fm ratio. This ratio was calculated for Koheda granites which indicate eruptive nature of granites. Their ratio range is from 0.18 to 0.70. Chapell and White (1974), opined that porphyry - copper and associated molybdenite mineralisation are genetically related with magmatic granites. Therefore, in the present work the eruptive nature of Koheda granites could probably host Cu-Mo deposit.

Nockold and Allen (1953), have used the ternary plot of AFM to identify calc-alkaline and theoleeitic trends for different rocks. Granites generally fall under calc-alkaline trend. This is true even in the case of Koheda rocks and it is depicted in the Fig. 3.2a. The normative Qtz - Ab - Or plot used by Tuttle and Bowen (1958), helps in identifying the rock types falling in the granite field. Similar studies for Koheda rocks indicate their granitic nature (Fig. 3.2b).

$Na_2O + K_2O$ versus SiO_2 binary discrimanation plot Fig. 3.2c prepared after Irvine and Baragar (1971), shows the lithounits collected from Koheda area are subalkaline in their nature.

The chemical data of Koheda granites when plotted in to CaO - Na_2O - K_2O diagram (After Condie and Hunter 1976) shows these rocks are of granite and quartz monzonite nature (see Fig. 3.3a). Bolter and AL-Shaieb (1971), while investigation base-metal mineralisation found that quartz-monzonite are favourable for ore deposition. Similarly, Garrett (1971a and b, 1973, 1974) and Dilles and Einaudi (1992), assessed the ore potential of plutons and found that vast majority of ore deposits are associated with plutons of granite, granodiorite and quartz-monzonite. Wolfe (1974), have noticed porphyry copper and associated molybdenite mineralisation in granite, granodiorite and quartz-monzonites. The rocks of Koheda area being granite and quartz-monzonite type the possibility of hosting molybdenite and porphyry copper deposit can not be ruled out.

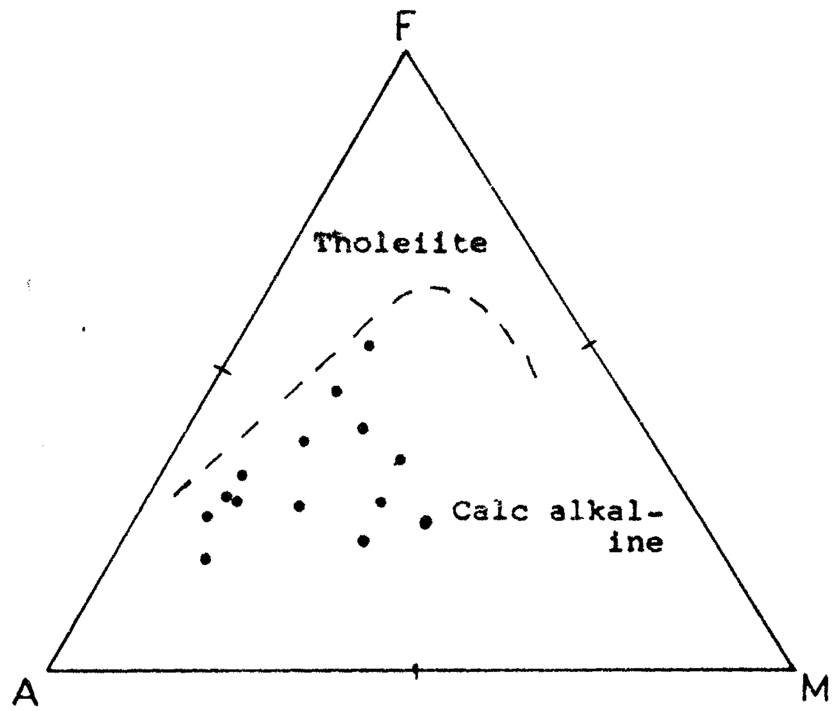


Fig.No. 3.2a : Shows AFM diagram for Koheda granites having calc-alkaline trend (after Nockold and Allen 1953).

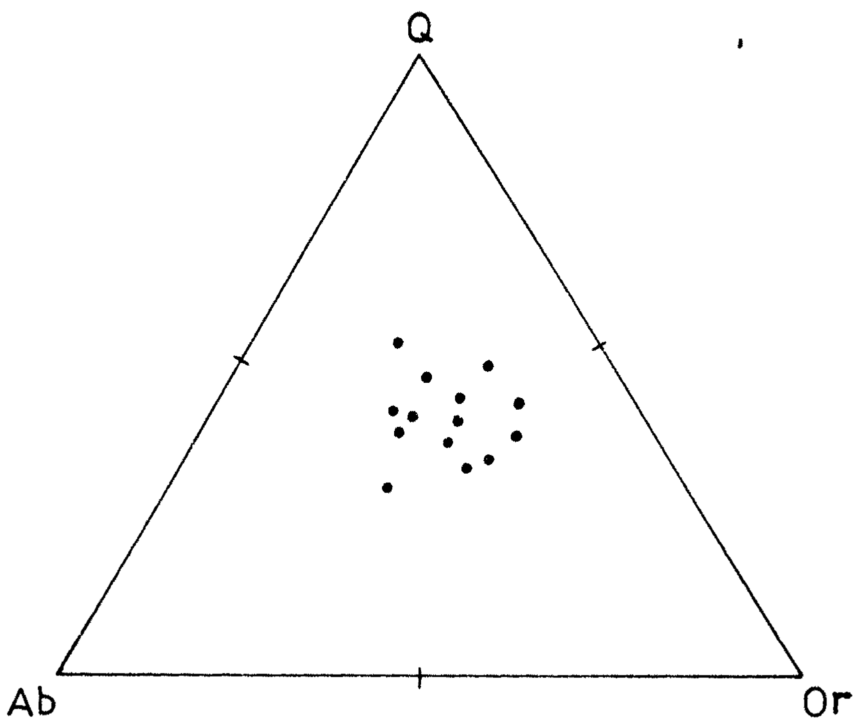


Fig.No. 3.2b : Shows Qtz-Ab-Or plot for Koheda rocks which fall in granite field (after Tuttle and Bowen 1958).

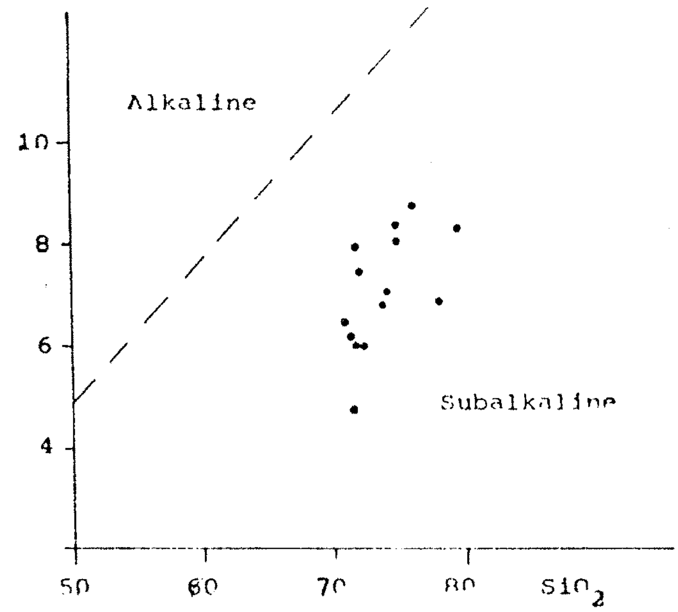


Fig.No. 3.2c : Shows alkali - Silica plot for the granites of Koheda granites indicate their sub-alkaline nature(after Iruine and Baragar 1971).

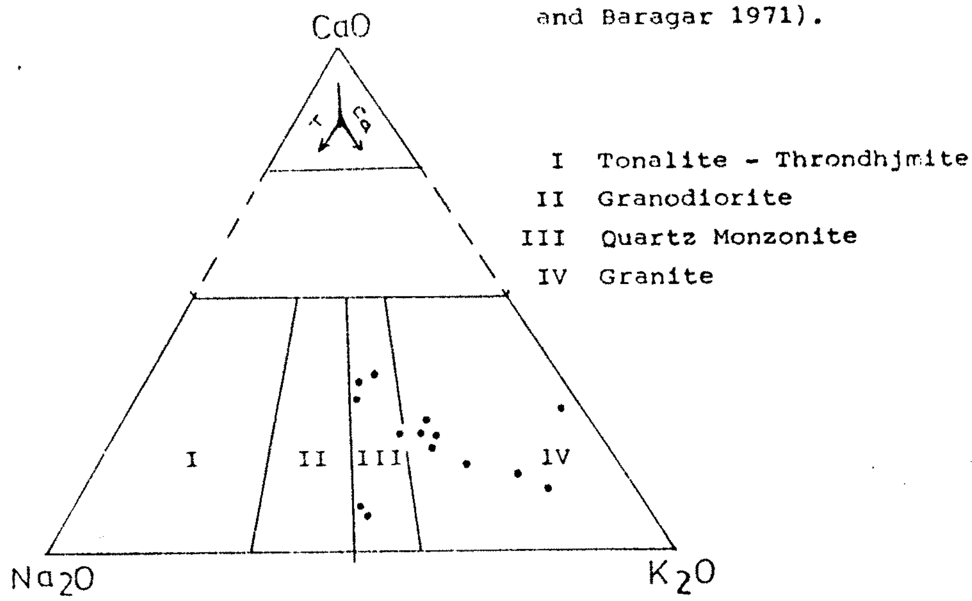
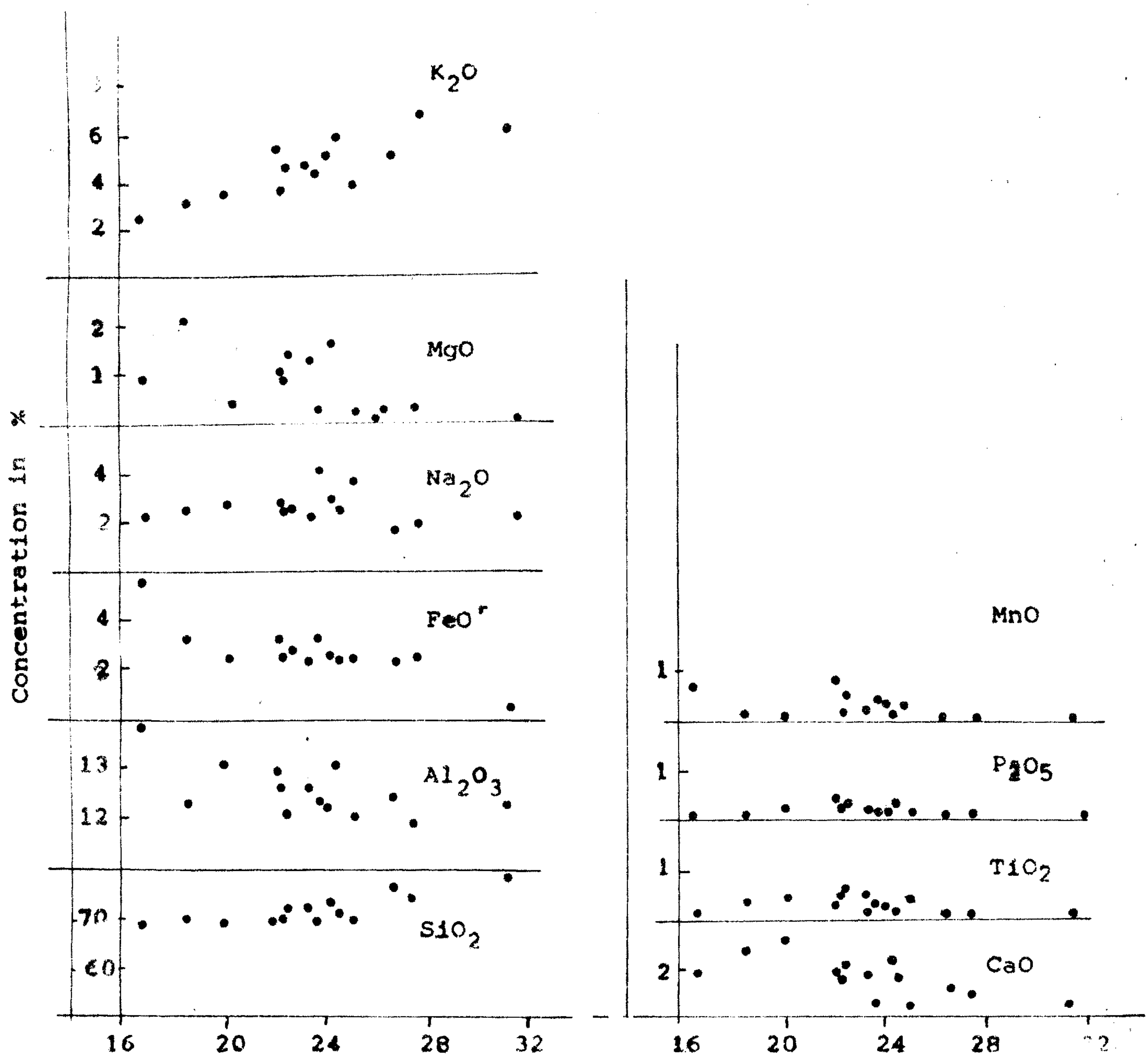


Fig.No. 3.3a : Shows CaO-Na_2O-K_2O diagram showing the distribution of compositions of granitic rocks from Koheda area. Rocks from Koheda fall under granite and quartz monzonite nature. (After Condie and Hunter 1976).

The plot of SiO_2, Al_2O_3, FeO, MgO, Na_2O, K_2O, P_2O_5, TiO_2, CaO, MnO versus Larsen Index (1/3 SiO_2 + K_2O - CaO - MgO - Fe_2O_3 - FeO), illustrated in Fig. 3.3b, indicates that the Koheda granites show continuity in their trend for most of the oxides. The continuity suggest the magmatic origin by differentiation Taylor, et al. (1984). The Differentiation Index (D.I.) proposed by Thronton and Tuttle (1960), based on the normative minerals upon calculating for Koheda granites support the continuity of igneous trend as observed in the Larsen Index. The D.I. range from 81.54 to 96.73 for the Koheda granites which reveal that the rocks of Koheda have attained high degree of differentiation. Field evidences indicate the granites are of coarse grey-pink varities and granite pegmatites.

There is a general concensus among Flinter et al. (1972), Tauson (1984), and Hesp and Rigby (1974, 1975), that specialised granites hosting a mineral deposit are leucogr-anites with high D.I.. In the present investigation the samples with high D.I. could be those which can prove produ-ctive.

TRACE ELEMENTS : The availability of rapid and extremely sensitive analytical instruments for estimation of trace element content has prompted geochemist to analyse large number of samples. The use of AAS and ICP has heralded the



$^1/_3$ $SiO_2 + K_2O - CaO - MgO - FeO$ (Larsen Index)

FeO^+ = Total $FeO + Fe_2O_3$

Fig.No. 3.3b : Shows variation diagram for granitic rock of Koheda area. Weight % of oxides plotted against Larsen Index (adopted from Taylor et al 1984).

advantage of being rapid, sensitive, reproducible and relatively cost effective (Walsh 1987). It is a well established fact that the trace elemental data can be used in deciphering differentiation trends of igneous rocks and also in classification of the rock type (Tauson and Kozlov 1973).

In the present investigation the trace elemental analysis of the representative rock samples were carried out and is given in the chapter II. The trace content of the granites is presently assessed in terms of the ore bearing potentials of Koheda area. A comprehensive statistical information of the trace elements analysed is given in the Table 3.3. This table furnishes the range, average, standard deviation for the granite samples of Koheda area. It also gives the average trace content of granites analysed elsewhere in the world. The table indicates that the background values of Cu, Pb, Zn, Sn, W and Mo elements show higher concentration on comparision with the world average. This might indicate that the granites of the Koheda area are specialised type and detail geochemical surveys might prove the productivity of them.

The Fig. 3.4 illustrate samples either enriched or depleted in terms of trace constituents. In determining this, the area average has been used (see Table 3.3). It can be observed from the Fig. 3.4 that the samples R3, R8

Table No. 3.3 : Shows a comprehensive statistical information of trace elements in granites from Koheda area.

Sr.No.	Elements	Range (ppm)	Average (ppm)	Standard Deviation (ppm)	*World Average (ppm)
1	Cu	11 - 1182	160.00	300	12
2	Pb	14 - 165	54.79	40	20
3	Zn	60 - 960	244.93	230	50
4	Co	34 - 127	64.00	20	3
5	Cr	42 - 182	81.00	40	20
6	Ni	12 - 56	32.00	10	0.8
7	Mo	18 - 252	106.64	80	1.5
8	W	8 - 90	33.43	20	1.5
9	Rb	174 - 610	359.57	160	150
10	Sr	148 - 582	314.71	130	300
11	Ba	124 - 1687	671.36	480	700
12	Sn	2 - 24	11.79	10	3
13	As	2 - 24	8.71	10	1.5
14	Cl	64 - 230	199.00	290	200
15	F	788 - 1672	1145.36	300	800
16	Li	28 - 68	44.64	10	30

*World average source - Wedhpohl (1969)

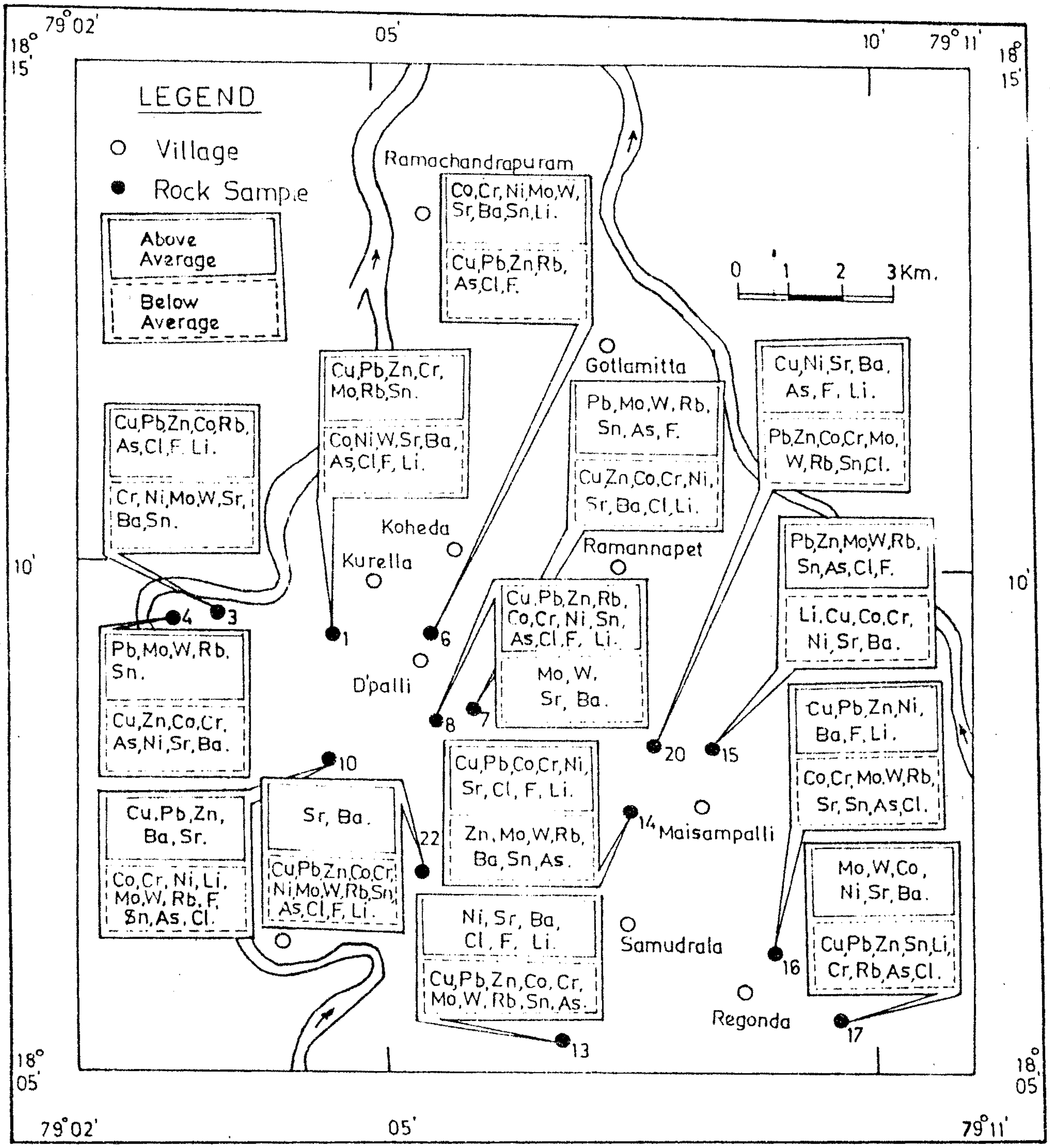


FIG. NO. 3.4: MAP SHOWING DISTRIBUTION OF VARIOUS ELEMENTS IN ROCK SAMPLES.

and R20 are relatively enriched in Cu, As, F and Li. Apart from these elements, the samples R3 and R8 indicate higher then average values for Rb and Cl. Further, it is noticed that samples R3 and R8 are having above background concentrations of Co and Pb, Zn, Sn, Cr and Li respectively. These samples have been collected from Kurella (R3), Dharmasagarpalli (R8) and Maisampalli (R20).

The Fig. 3.4 also illustrates that the samples R4, R15 and R17 collected from Kurella, Maisampalli and Regonda. respectively, indicate enrichment in Mo and W. Further R4 and R15 have enriched amounts of Sn, Rb and Pb. It can also be seen that R15 has enhanced values for Zn, As, Cl and F. Sample R17 is found to have above background concentration for elements Co, Ni, Sr and Ba.

Investigation of Holland et al. (1972), Garrett (1973) and Barnes and Czamanske (1967), in identifying productive granites opined that elements such as Cu, Pb, Zn, As, Sn, W, Mo, Cl, F and Rb are normally enriched in rocks associated with ore deposits. It was observed by Helgeson (1964), Krauskopf (1964), Barnes and Czamanske (1967), that the Halogen elements (Cl, F) are best transporting agents for metal ions in ore fluids. They leave geochemical signatures in the form of relative enrichment compared to barren rocks. Thus in the Koheda area the samples collected from Kurella, Dharmasagarpalli and Maisampalli are enriched in the said elements and have geochemical imprints of mineralisation.

The samples R1, R10 and R16 show above average concentration for Cu, Pb and Zn. Apart from these elemental enrichment, R16 has higher than background value for Ni, Li, F and Ba. Enrichment of Sn, W and Mo is noticed in samples R6 and R7. However, R6 has additionally higher than average concentration of Co, Cr, Ni and Li. Sample R7 has higher than background values of Pb, As, Rb and F. Barium and Strontium are relatively enriched in samples R1, R6, R10, R13 and R22. The samples R13 and R14 collected from Samudralla and Maisampalli, respectively, have Ni, Li, F and Cl enrichment. The sample R14 also exhibits higher than average values of Cu, Pb, Co, Cr and Sr. The rest of the elements analysed in the samples show tendency of depletion.

Chaffe (1976), investigated the zoning patterns of various elements associated with copper - molybdenite deposits. He found that there are two principle zones - 1)Ore zone and 2)Hallow zone. He further observed that elements with anomalously high concentration in ore zone are Cu, Mo, Co, K etc. and elements with low concentration in ore zone are Pb, Zn, Mn etc. While in the second zone termed as hallow zone, high concentration of Cu, Zn, Pb and Fe were found and in the same zone Ni, Na, Te etc. are impoverished. In light of this, in Koheda area, the samples collected from Kurella (R3, R4), Dharmasagarpalli (R7, R8) and Maisampalli (R15, R20), have fairly high concentrations of target elements Cu, Mo, Co and K and is conjectured to represent the ore zone. The other samples collected from Kurella (R1), Dharmasagarpalli (R6) and Maisampalli (R14), have higher concentrations of analysed hallow zone elements mentioned above. This could represent a complex episode of mineralisation. Hence, a detail exploration programme by means of drilling can prove the above said localities as productive areas for base metal and associated molybdenite deposits.

The Fig. 3.5 depicts the trace elemental relationship with Larsen Index. It is noticed that the elements Cu, Zn, Mo and Rb show increasing concentrations with increasing Larsen Index. The element Sr show depletion trend with increasing Larsen Index. The K_2O behaviour with respect to Larsen Index is similar to the behaviour of Cu, Zn, Mo and Rb. The CaO concentration with respect to Larsen Index is similar to Sr. The other elements do not exhibit any significant relationship.

MAJOR OXIDES IN CONJUNCTION WITH TRACE ELEMENTS : The relationship among two or more elements in a group of samples may carry considerable information not expressed by any single element. A variety of statistical methods are currently employed for interpretation of relationship involving multiple element data. The simplist of them is computation of

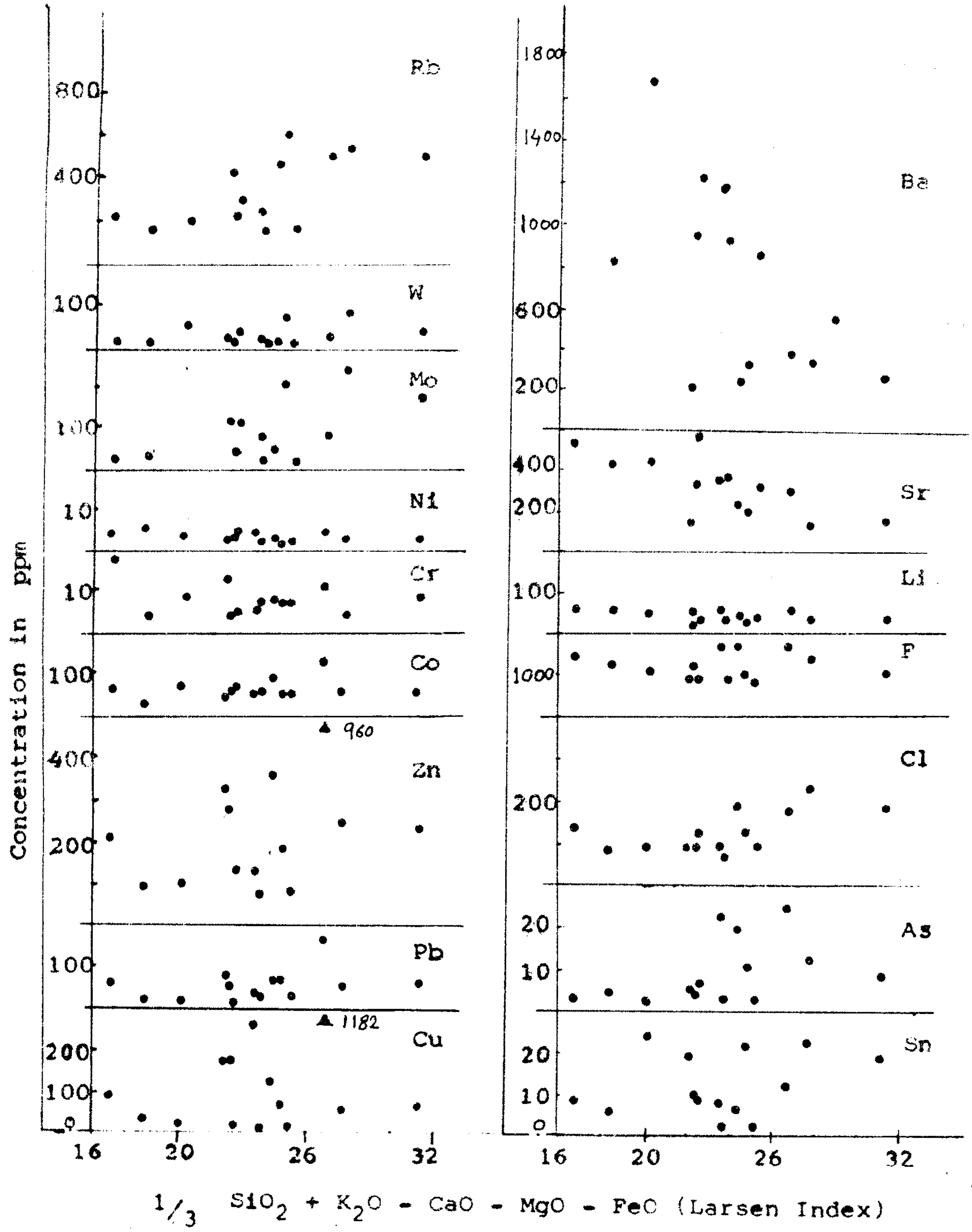


Fig.No. 3.5 : Shows variation diagram of trace constituents for Koheda granites plotted against Larsen Index (adopted from Taylor et al 1984).

correlation coefficient of the multivariate data. The correlation coefficient matrix helps in deciphering the association of elements in the environment under consideration. Studies of such kind with lithogeochemical data helps in understanding the association of elements during the magmatic or hydrothermal episode. It also facilitates in deciding the pathfinder element or group of elements for the recognition of productive granites.

To determine the elemental association with base-metal and molybdenite mineralisation from Koheda area, correlation coefficients were computed from the lithogeochemical data given in Table 2.2. The correlation coefficient matrix so obtained is given in Table 3.4.

The correlations between elements in taken to be significant if it is plus 0.5 or more. On the basis of their association all the elements which are significantly correlating are grouped under the following classes - 1) SiO_2 - K_2O - Rb 2) SiO_2 - Cu - Pb - Zn - As 3) K_2O - Mo - W - Sn - Rb 4) Al_2O_3 - FeO - Cr 5) Pb - Zn - Rb 6) Cu - Pb - Zn - Co - As - F 7) W - Cl 8) Rb - As 9) Rb - Cl 10) Ni - Sr 11) Ni - Li 12) F - Li 13) TiO_2 - Sr - Ba 14) Sr - Ba 15) P_2O_5 - MnO and 16) MnO - Cr.

It is inferred that the elements in each group having above 0.5 positive correlation amongst themselves could have their similar behaviour in the primary environment. Thus when the elemental contents with high inter correlationship in each group are plotted as combination map and compared, a close similarity of their dispersion patterns will be noticed (Solovov et al. 1971). Their similarity is either in the form of enrichment or depletion with respect to potentially productive and nonproductive granites of Koheda area. This aspect was discussed in some detail in the preceeding pages.

The high inter correlationship between SiO_2 Vs K_2O and K_2O Vs Rb is found in the localities from were samples R3, R4, R8, R15, R17 and R20 have been collected. All these samples show SiO_2, K_2O and Rb enrichment. This factor indicates that the granites have attained higher degree of differentiation which would facilitate in the formation of specialised pluton. Such studies coroborates with Olade and Flecther (1976) and Dillies and Einaudi (1992), who have found that potash and rubidium are geochemically coherent and base-metal mineralisation within granites are associated with potash rich zones. Therefore, the granites of Koheda area with samples from Kurella, Dharmasagarpalli, Maisampalli and Regonda exhibit relatively enhanced concentrations of SiO_2, K_2O and Rb. The field evidences show the presence of chalcopyrite, pyrite and molybdenite in the samples. This may indicate proximity to a buried mineralisation.

Higher base-metal concentration is accompanied by above average content of cobalt and arsenic in samples R3, R8 and R20. This is due to their chalcophilic affinity. These samples indicate associated silicification with mineralisation. Hence, high coefficients among the above mentioned elements.

The high coefficient between elements of the group Sn - W - Mo is due to their geochemical affinities. This feature is accompanied by higher K_2O and SiO_2. Extreme fractionation of productive pluton would result in enhanced values of elements Mo - W apart from other traces of granophile and associated silica and potash enrichment, (Garett 1973). This inference could hold true in the present studies.

In Koheda area, granite and granite-pegmatites host base-metal and molybdenite mineralisation separately. Rose et al. (1979), found that specialised plutons can be recognised when they are associated with lithophilic elements but this is not so in the case of plutons associated with base-metal mineralisation. This feature indicates that lithophilic group of elements including Sn - W - Mo and chalcophilic group of elements including Cu - Pb - Zn show some degree of separation. Such phenomena is partly reflected in higher correlation between Cu, Pb, Zn, Co, As and F in Koheda area. Whereas, the other group consist Sn - W - Mo with higher inter correlation coefficients. The base metal concentration is noticed in samples R3, R8 and R20. Whereas, Sn - W and Mo is evident in R4 and R15.

The Table 2.2 of chapter II reflects, Mo values relatively on the higher side of average accompanied by higher concentrations of Sn and W for samples R4, R6, R7, R15 and R17. The said elements exhibit significant coefficient values (see Table 3.4). It may be recalled that these samples which show higher concentration of Sn, W and Mo also have enrichment of SiO_2, K_2O and Rb. The net result is significant relationship between SiO_2 and K_2O and K_2O with Mo, Sn and W.

The above mentioned elements are of acidic differentiates and higher correlations amongst them is due to their geochemical affinity in the process of magmatic differentiation (Govett and Atherdens, 1988). Higher the differentiation, greater shall be their coefficient values.

In contrast to acidic differentiates, elements that are concentrated at the early stage of magmatic process are Mg, Sr, Ca, Mn, Cr, Ti, P and Ba. In the present study it is observed that samples which are relatively enriched with the above mentioned elements are those which are impoverished in K_2O. This is due to their antipathic nature. Higher coefficient values are found between TiO_2 Vs Sr and Ba, P_2O_5 Vs MnO and MnO Vs Cr. This is shown in the Table 3.4.

Halogen elements are considered to be best transporters of metals in ore fluids (Garrett 1973; Parry and Jackobs 1975; Kesler et al. 1975; Helgeson 1964; Krauskopf 1964; Barnes and Czamanske 1967). The ore bearing fluids invariably get concentrated in the final phase of magmatic process. The correlation of W, Li and Rb with halogen elements (F, Cl) is high for Koheda granites.

As stated in the chapter I, Tauson and Kozlov (1973), have classified granites into five types and they have also advocated the genesis of five granite varities based on elemental ratio. The K/Na, K/Rb, Ba/Rb and F/Li ratios range for Koheda granites are 0.95 - 3.52; 97.86 - 183.90; 0.469 - 7.73 and 19.56 - 38, respectively. The average values of the ratios are 1.94 (K/Na), 136.70 (K/Rb), 2.64 (Ba/Rb) and 26.51 (F/Li). These values for Koheda granites indicate that they are close to plumasitic and other normal granites. The plumasitic granite series are those which have formed by late magmatic differentiation and possibily concentrate Sn, W, Mo etc. to form specialised granites.

The Table 3.5 shows the average concentration of various trace constituents in different sub-rangs of peralkalic rang. On careful examination of the table it is evident that the perpotassic rocks show highest average concentrations for Cu, As, Mo, W, Rb and Cl. It may be recalled the work of Flinter et al. (1972); Tauson (1984);

Table No. 3.5 : Shows the average concentration of various trace elements in different sub-range of pre alkalic rang of Koheda granites.

Sr.No.	Element	Per Pottassic	Do Pottassic	Sodi Pottassic	Do Sodic
1	Cu	274.5	155.5	87.00	47.25
2	Pb	62.33	79	54	31.4
3	Zn	316.16	347	280	111.6
4	Co	67.83	72.5	58	57.2
5	Cr	7.166	10.3	4.2	9.12
6	Ni	3.283	2.75	3.4	3.44
7	Mo	153.16	84	46	72
8	W	50	22	12	22
9	Rb	469.5	470	224	210
10	Sr	283	181	328	403.6
11	Ba	603.3	223.5	940	878.4
12	Sn	14.8	12.5	10	8.2
13	As	13.6	11	4	2.8
14	Cl	147	137	118	90
15	F	1153	1268	1247	1066.6
16	Li	41.33	36	58	49

Grooves (1972); Sharemote et al. (1973) and Sharaton and Black (1973), that the higher differentiation index would result in ore bearing fluids. Later, they may result in mineralisation. This holds good for per potassic granites of Koheda area. The average concentration of Pb, Zn and F appear to be highest in dopotassic rocks and Cr, Ni, Sr and Ba show highest values in dosodic rocks. However, it may be mentioned with caution that in subrang dosodic consist only one sample. The other elements analysed do not throw any meaningful information. It may be infered that the productive granites are those of perpotassic and barren could be dosodic.

CONCLUSIONS : The lithogeochemical survey carried out in the Koheda area reveals the following aspects.

* The major oxide petrochemistry of the rocks indicate the presence of granite and quartz monzonite in the area. These rocks are peralkaline, peraluminous and perpotassic to dosodic in nature. They represent high degree of differentiation.

* The rocks collected from Kurella (R3, R4), Dharmasagar-palli (R8), Maisampalli (R15, R20) and Regonda (R17) show silica and potash enrichment.

* The rocks which are relatively enriched with the target elements (Cu, Pb, Zn, Mo, W, Sn) are perpotassic.

* The Tauson's classification for the granites based on the elemental ratio, indicate that the mineralised samples from the Koheda area are close to plumasatic granite and the barren ones are normal type of granites.
* The trace elemental configuration of the samples R3, R8 and R20 representing Kurella, Dharmasagarpalli and Maisampalli indicate chalcophilic elements (Cu, As) enrichment. The granophilic elements (Mo, Sn, W) are above regional background in the samples R4, R15 and R17. These samples are from the above mentioned localities.
* From the statement mentioned above, it appears that the granites hosts base metal and molybdenite mineralisation separately or represent complex elemental zoning.
* The field observations at Maisampalli, Dharmasagarpalli, Regonda and Kurella reveal the presence of chalcopyrite, pyrite and molybdenite specks in granites. Thus the petrochemistry corroborates with these observations and might prove drilling targets for productive granites.