CHAPTER II

MATERIALS, METHODS AND ANALYTICAL DATA

INTRODUCTION : Prospecting geochemistry involves the practical application of the principles governing the distribution and migration of elements in geochemical environments. Development in geochemical investigations involves development of new analytical methods and interpretation of data derived from the chemical analysis of the earth's material. With the increase in cost of present day explorations and field operations, cost oriented and most effective prospecting methods are to developed at every stage prior to the exploration. The estimated cost for collection and analysis per sample in geochemical prospecting is less than the cost of 5 feet of subsurface drilling (Barnes 1964). Thus when used in conjunction ,with usual geological mapping and drilling program, routine geochemical evaluation of trace metal distribution can increase effectiveness and decrease the cost of prospecting for ore deposits. Sample devoid of visible mineralisation instead of providing a simple negative bit of information can now be used quantitatively as indicator of proximity to mineralisation (Barnes, 1964).

Apart from cost and logistic problems the choice of which particular type of survey is to be exployed is influenced by scale and stage of exploration and aim of the investigation. Most important factor that influences the type of survey is the type of ore being sought, the type of availibility of outcrops, climatic conditions, weathering and dispersion charecteristic in the area. At this juncture it is mandatory to mention some types of geochemical survey which Hawkes and Webb (1962) and later Rose, et al. (1979), gave a review of geochemical surveys and classified under two broad divisions, namely

1. Primary environment studies and
2. Secondary environment studies

The primary environment is deep-seated one which extends downward from the lowest levels reached by circulating ground water to the deepest level at which the rocks can form. Magmatic and metamorphic processes predominate in this environment. James, (1967) advocates that the term primary dispersion pattern should only be used to describe the distribution of chemical elements in the unweathered rocks.

The secondary environments encompasses weathering, erosion and sedimentation at the surface of the earth. The geochemical prospecting types in the secondary environment makes use of weathered rocks, soils, sediments (Lake and Stream), waters, etc.

Geochemical surveys are classified as regional survey and detail surveys. Regional survey identifies areas where mineral deposits are most likely to occur. At detail scale survey, specific deposits are delineated.

Regional surveys identifies metallogenic province within which a variety of deposit types and metals are most likely to be found. This when followed by detail survey individual anomalous areas are identified which reflect local conditions of mineralisation (Theobald et al. 1991).

Areas of tens to thousands of sq.km. are evaluated during regional surveys, often with no more than one sample per 1 sq.km. to 100 sq.km. In the detail survey a relatively close sample spacing of one meter to 100 mts. is usually required. This helps in clearly defining the proximity to ore deposits.

PRIMARY ENVIRONMENT : As stated earlier primary dispersion was defined by James, (1967) to describe the distribution of elements in unweathered rocks - weather the mineral deposits is epigenetic or syngenetic - this term include the distribution of elements in rock that has arisen through ore forming or rock forming process. Investigation of this kind is made possible by systematic collection of rocks such that the elemental distribution often has a reflection of mineralisation.

ROCK SAMPLING : The method for selection of sample sites was in an unbiased fashion. Representative samples from different granite outcrops were collected. The samples were collected with the purpose of recognising the productive granites. Care was excercised to collect unweathered rocks representing the complete area of investigation. Rock samples were broken from the outcrop with the help of hammer. Thereafter, they were packed in cloth bags. Figure 2.1 shows the location of the rock samples from the Koheda area. The total number of rock samples collected are 25, out of which 14 representative samples were selected for the analysis.

SECONDARY ENVIRONMENT : Minerals and rocks that are stable in primary environment are often unstable in the secondary environment. This environment has attained prime importance in geochemical exploration. This is because the secondary dispersion haloes are generally larger than those in the primary environment.

Soil Sampling : In the present investigation soil samples were collected in a grid pattern covering the complete area of investigation. The soils were sampled from a depth of 30 cms. using soil 'Auger'. It was noticed that this depth represents higher clay content ('B' horizon). The samples were packed in polythene bags and labled. Figure 2.2 shows the location of soil samples from the area of investigation. The soil sampling were carried out in one season to maintain uniformity. The total number of soils samples collected are fifty.

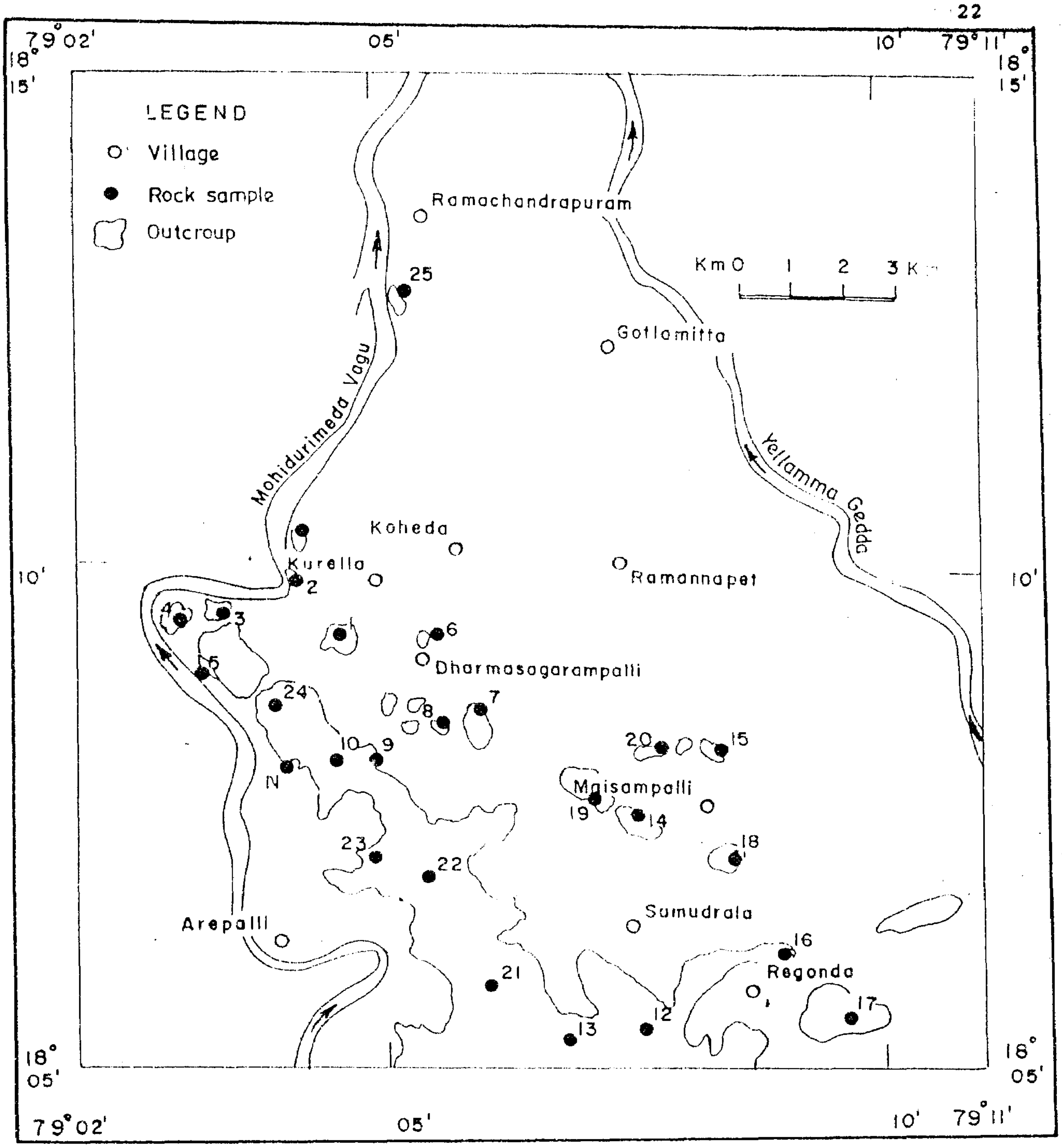

FIG NO.2.1:MAP SHOWING LOCATION OF ROCK SAMPLES

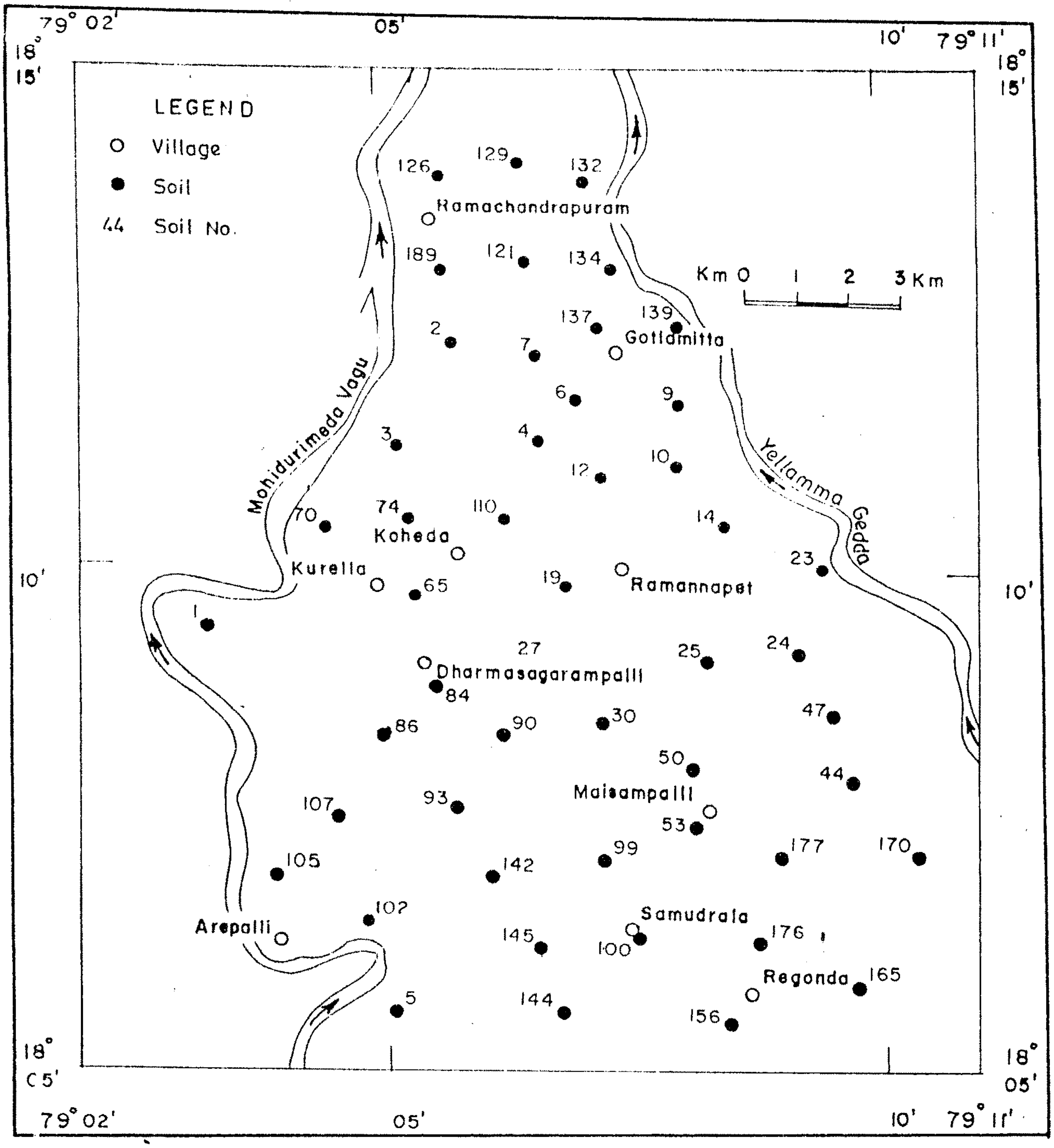

FIG. NO. 2.2 : MAP SHOWING LOCATION OF SOIL SAMPLES.

Lake Sediment Sampling : In the present investigation active lake sediment samples were collected from all the lakes of the investigated area. The samples were obtained at the point of streams confluencing with the lakes. Figure 2.3 shows the location of lake sediment samples from the area. A total of 103 lake sediment samples were collected.

SAMPLE PREPARATION : The analysis of rocks, soil and lake sediment involves three major stages. They are sample preparation, digestion or extraction and finally determination of elemental concentration. The first stage involves drying, crushing, grinding, seiving and lastly coning and quartering. These are carried out to obtain a truely representative and homogeneous samples.

Rock samples collected were subjected to jaw crushing and were powdered to minus 300 mesh (B.S.S.) size by tungsten - carbide ring mill.

Fletcher (1981) and Beeson (1984) used minus 80 mesh fraction of soils and sediments in geochemical exploration to obtain good anomaly - background contrast. The same has been applied in the present investigation. Soil and lake sediments samples were hand crushed to the size of natural grain size and sieved to obtain minus 80 (B.S.S.). Considerable amount of caution has been taken in the preparation of rock, soil and lake sediment samples to avoid any degree of contamination.

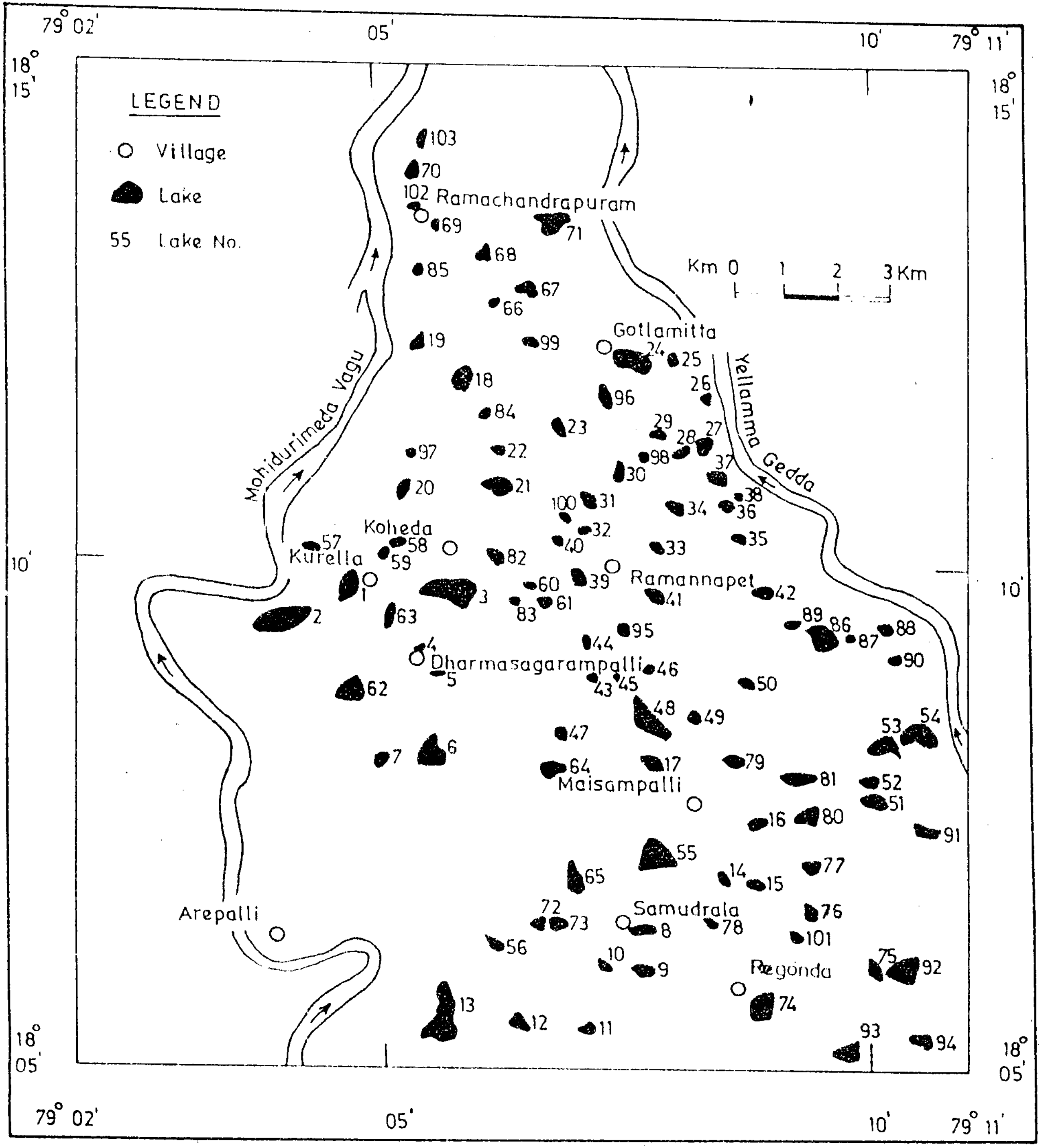

FIG. NO.2.3: MAP SHOWING LOCATION OF LAKE SEDIMENT SAMPLES

SAMPLE DECOMPOSITION AND ANALYTICAL PROCEDURE : The procedure of decomposition falls in two broad groups. Strong decomposition capable of breaking crystal lattice and releasing of the total constituents from the minerals. The second type of digestion is partial or weak decomposition intended to remove only weakly bond elements, those associated with a particular fraction of sample. In the present investigation samples were subjected to hot extraction by mixture of acids.

Table 2.1 shows a comprehensive scheme of sample digestion and analysis for the rocks, soils and lake sediments collected from Koheda area.

ROCK DECOMPOSITION : Lithogeochemical analysis of 14 representative granite samples were carried out by using different analytical procedures. The determination of silica and alumina was carried out on spectrophotometer and the digestion of these samples were made involving the use of NaOH flux as suggested by Shapiro and Brannock (1962).

Walsh (1987) suggested the use of HF + $HClO_4$ for the estimation of major and trace elements on AAS and ICP. The same was adopted for the 14 granite samples from Koheda area. The geochemical results are given in Table 2.2.

The advantage of hot acid over alkali fusion is that the method is simple, rapid and does not cause clogging of

Table No. 2.1 : Shows a comprehensive scheme of sample digestion and analysis for rocks, soils and lake-sediments collected from Koheda area.

Sr. No.	Sample Type	Digestion	Elements	Estimation	References
1.	ROCKS	NaOH flux	SiO_2, Al_2O_3	Spectrophotometer	Shapiro and Brannock (1962)
		HF + $HClO_4$	Na_2O, K_2O, CaO, MgO, FeO, Fe_2O_3, MnO, P_2O_5, TiO_2	AAS + ICP	Walsh (1987)
		HF + $HClO_4$	Cu, Pb, Zn, Ni, Cr, Co, Sr, Rb, Ba, As, Sn, Li	AAS + ICP	Walsh (1987)
		TISAB + CDTA buffer	F, Cl	Specific Ion Electrode	Flecther (1981)
		$NaCO_3$ + NaCl KNO_3 flux	Mo, W	Colourimetric	Levinson (1980)
2.	SOILS	Hot Aquaregia	Cu, Pb, Zn, Co, Ni, Cr, Fe, Mn	AAS	Warren and Delavault (1959) Chao, et.al.(1992)
		$NaCO_3$ + NaCl + KNO_3 flux	Mo, W	Colourimetric	Levinson (1980)
3.	LAKE SEDIMENTS	Hot Aquaregia	Cu, Pb, Zn, Co, Ni, Cr, Fe, Mn	AAS	Warren and Delavault (1959) Chao, et.al.(1992)
		$NaCO_3$ + NaCl KNO_3 flux	Mo, W	Colourimetric	Levinson (1980)

Table No. 2.2 : Shows the **oxides** concentration for the representative granite samples from Koheda area.

Sr. No.	Oxides %	R_1	R_3	R_4	R_6	R_7	R_8	R_{10}	R_{13}	R_{14}	R_{15}	R_{16}	R_{17}	R_{20}	R_{2}
1.	SiO_2	70.02	73.3	78.1	69.9	71.03	76.12	70.4	70.42	69.42	74.12	70.62	72.16	72.04	69.
2.	Al_2O_3	13.86	12.4	12.26	14.2	14.10	12.98	12.64	12.63	15.90	11.95	13.11	12.18	13.24	12.
3.	Fe_2O_3	0.32	1.1	0.2	0.88	0.4	0.73	1.1	0.81	2.16	0.92	0.56	0.71	0.6	1.
4.	FeO	0.86	1.6	0.31	1.58	1.9	1.64	1.3	2.4	3.52	1.6	1.8	1.98	1.6	1.
5.	MgO	0.99	0.4	0.11	0.43	01.2	0.35	0.25	2.1	0.92	0.33	0.86	1.42	1.26	0.
6.	CaO	1.98	2.21	0.23	2.24	1.6	1.12	0.44	2.8	1.98	1.03	1.64	2.16	1.8	0.
7.	Na_2O	2.71	2.9	2.23	2.71	2.4	1.79	3.6	2.88	2.32	1.98	2.4	2.42	2.2	4.
8.	K_2O	5.28	5.16	6.08	3.48	5.97	5.11	3.9	3.16	2.42	6.8	3.68	4.68	4.6	4.
9.	TiO_2	0.33	0.4	0.12	0.42	0.2	0.09	0.2	0.4	0.17	0.3	0.5	0.62	0.5	0.
10.	P_2O_5	0.42	0.1	0.09	0.2	0.3	0.03	0.1	0.1	0.12	0.1	0.2	0.3	0.2	0.
11.	MnO	0.85	0.3	0.02	0.1	0.1	0.02	0.3	0.2	0.71	0.06	0.18	0.5	0.2	0.

Table No. 2.2 : Shows the elemental concentration for the representative granite samples from Koheda area.

Sr. No.	Elements	R_1	R_3	R_4	R_6	R_7	R_8	R_{10}	R_{13}	R_{14}	R_{15}	R_{16}	R_{17}	R_{20}	R_{22}
1	Cu	183	128	68	28	72	1182	18	34	98	61	87	24	246	11
2	Pb	86	72	55	22	67	165	14	26	65	56	54	18	37	30
3	Zn	330	364	230	110	188	960	60	98	210	245	280	140	134	80
4	Co	49	96	53	75	57	127	45	34	76	54	58	65	51	56
5	Cr	13.0	7.6	9.0	8.7	7.5	10.9	6.7	4.6	18.2	4.2	4.2	5.4	6.0	7.
6	Ni	3.0	2.5	2.5	4.1	1.6	4.4	1.2	5.6	4.1	2.6	3.4	4.8	3.8	2.
7	Mo	120	48	180	252	206	86	32	32	26	240	46	126	81	18
8	W	28	16	40	58	72	30	14	18	12	90	12	46	24	8
9	Rb	447	494	528	218	610	521	226	190	244	566	224	316	276	174
10	Sr	148	214	178	456	198	240	314	418	470	160	328	582	340	360
11	Ba	210	237	253	1687	317	292	846	817	124	340	940	1232	1186	918
12	Sn	19	6	18	24	21	12	2	5	8	22	10	8	8	2
13	As	4	18	8	2	10	24	2	4	3	12	4	6	22	3
14	Cl	90	184	180	94	118	170	87	79	126	230	118	86	98	64
15	F	864	1672	1044	1035	990	1664	788	1214	1440	1311	1247	792	1118	856
16	Li	28	44	34	45	30	52	38	62	68	38	58	37	57	34

the AAS Burner unlike the fusion method (Ward et al. 1969 and Fletcher 1981).

SOIL AND LAKE SEDIMENT DECOMPOSITION : Boiling aquaregia extraction has been recommended as a general decomposition procedure for geological material from primary and secondary environment by a Ward, et al. (1969).

Dolezal, et al. (1968); Sullek, (1977); Reeves, et al. (1978); Flecther, (1981) and Chao, et al. (1992); have used aquaregia in most of their geochemical exploration programs and found that aquaregia is powerful oxidizing solvent for sulphides, selenides, tellurides, arsenides and sulfo - arsenides and decomposes to some extent silicates. Warren and Delavault (1959), suggested aquaregia as a sulphide selective attack for bed rock geochemistry.

It was shown by the Workers mentioned above that in geochemical exploration aquaregia can extract 90 % of the trace constituents on practical basis. Aquaregia which is a mixture of HNO_3 + HCl (ratio 1:3) has a much stronger oxydising and dissolving power then any single acid by virtue of the formation of nascent chlorine, when these two acid are mixed, (Chao, et al. 1992). With this in view-point, samples from secondary environment was thus subjected to hot aquaregia extraction. Half a gram of minus 80 (B.S.S.) fractions of soil and lake sediment samples were taken into test-tubes. To these 5 ml of concentrated aquaregia was added and the samples were boiled on a hot water bath for three hours with occasional shaking. Then the test-tubes were removed from the water-bath and allowed to cool over night. About 25 ml of deionised water was added and homogenised. The elements that were estimated in soils and lake sediments are Cu, Pb, Zn, Fe, Mn, Co, Ni and Cr, by using Atomic Absorption Spectrometer. Higher dilutions were used for estimating Cu, Zn, Fe and Mn such that the concentration of the samples fall within linear range of instrument.

The soil geochemical data is given in Table 2.3 and lake sediment geochemical data in Table 2.4.

Levinson, (1974) and Stanton, (1976) have proposed colourimetric determination of molybdenum and tungsten for the geological material from primary and secondary environment. This was necessary in order to overcome complex problems related to the detection limits and interferences by using AAS.

The colourimetric method involves fusion by alkali flux and using zinc dithiol which concentrate and seperate these important pathfinder elements in a complex geological material and make the determination nearly to the crustal abundance levels. Rao, (1971) opined that the colorimetric method is successful in geochemical exploration rather than estimating molybdenum and tungsten by AAS.

Table No. 2.3 : Shows the elemental concentration values in ppm with pH of soil samples from Koheda area.

Sr. No.	Soil No.	pH of Soil	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
1	1	6.8	115	46	349	14	86	42	29600	363	36	36
2	2	6.4	65	42	28	15	72	24	24800	150	10	12
3	3	8.4	145	349	180	24	219	110	28600	220	6	18
4	4	6.8	33	52	150	18	76	18	24800	210	8	12
5	5	7.5	56	67	120	8	69	48	26430	330	36	34
6	6	7.3	38	33	30	7	50	22	33000	338	10	12
7	7	5.3	30	36	49	14	78	28	62600	184	12	33
8	9	8.2	28	28	32	10	46	26	48300	190	24	30
9	10	8.3	34	46	50	12	74	52	31060	180	42	18
10	12	7.6	22	30	62	9	38	54	34460	262	10	16
11	14	8.3	1055	104	2700	16	54	414	68600	184	12	10
12	19	6.8	32	32	33	7	43	48	32680	144	8	28
13	23	7.5	24	37	46	6	56	56	29800	172	24	12

Sr. No.	Soil No.	pH of Soil	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
14	24	8.5	80	64	156	6	34	40	64600	150	54	14
15	25	8.3	40	48	28	22	66	46	24060	270	63	63
16	27	7.4	74	54	52	8	40	648	56300	144	36	28
17	30	8.5	86	50	180	16	74	36	42400	120	12	56
18	44	7.5	72	32	174	14	83	45	56400	380	10	18
19	47	7.3	80	80	150	24	117	48	68600	386	48	68
20	50	5.5	110	58	110	18	44	38	27600	222	66	65
21	53	7.3	130	54	120	16	63	26	28460	316	72	38
22	65	5.5	124	64	180	15	106	42	26300	150	54	24
23	70	6.6	1160	56	90	8	56	50	34600	230	68	28
24	74	7.1	84	110	114	12	54	54	36060	380	36	32
25	84	7.2	186	52	106	6	32	41	24300	115	33	36
26	86	8.5	210	48	115	8	66	38	26060	338	36	34

Sr. No.	Soil No.	pH of Soil	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
27	90	8.3	174	84	380	26	60	36	24000	230	33	32
28	93	7.4	180	90	240	28	102	38	78060	590	36	36
29	99	7.6	30	42	28	6	40	42	23660	180	6	12
30	100	8.6	52	32	30	6	46	40	28000	115	5	18
31	102	8.4	64	42	110	12	48	47	77400	260	12	34
32	105	6.8	68	52	115	24	56	48	82080	284	48	54
33	107	6.8	80	48	110	16	52	54	80460	240	33	30
34	110	6.8	36	32	54	14	37	42	33500	240	30	28
35	121	7.8	72	26	156	6	44	28	28600	110	10	12
36	126	5.4	110	46	140	14	82	36	76600	316	8	14
37	129	7.3	66	28	120	12	73	51	64800	269	8	10
38	132	7.5	63	34	48	8	64	57	58200	254	6	38
39	134	8.1	54	48	32	21	146	52	29400	486	10	16

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Sr. No.	Soil No.	pH of Soil	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
40	137	7.5	74	74	56	12	53	26	68400	180	6	14
41	139	8.3	46	45	62	8	49	55	48000	172	12	14
42	142	6.8	72	32	115	16	32	48	26680	110	10	30
43	144	8.4	60	68	120	12	72	42	28440	280	12	18
44	145	8.3	64	74	120	12	64	54	24600	370	12	18
45	156	7.5	56	36	140	14	86	58	22430	338	12	18
46	165	8.5	48	48	33	14	81	56	56200	370	48	80
47	170	6.3	41	28	30	12	65	48	46800	486	30	38
48	176	7.5	38	30	27	6	44	46	69800	160	12	36
49	177	7.5	66	34	64	6	34	38	58200	145	33	33
50	189	7.3	36	49	46	6	86	24	28660	172	10	12

Table No. 2.4 : Shows the elemental concentration for the lake sediment samples from Koheda area.

Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
1	1	58	45	75	7	42	13	9324	126	15	44
2	2	1404	121	954	13	119	338	31752	190	6	32
3	3	68	44	83	10	65	35	36540	208	27	48
4	4	74	27	97	21	109	53	43344	316	10	28
5	5	92	44	97	14	76	29	28728	284	5	22
6	6	96	45	133	13	75	21	31420	388	5	26
7	7	46	34	86	7	52	16	17388	158	5	30
8	8	53	54	61	11	91	19	16128	140	5	32
9	9	43	59	61	7	55	20	19872	360	5	28
10	10	49	68	79	8	109	20	19656	72	12	24
11	11	50	41	59	9	70	16	20160	101	20	60
12	12	114	34	180	10	89	15	38556	234	5	56
13	13	70	40	118	13	83	24	21168	445	15	48

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Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
14	14	71	38	148	20	193	40	68544	259	15	63
15	15	53	26	151	9	61	14	16416	154	5	36
16	16	64	36	133	13	92	19	47800	219	5	32
17	17	102	58	120	14	88	36	37800	229	30	38
18	18	62	38	101	14	99	19	30996	262	10	12
19	19	53	32	83	14	86	21	25704	194	10	14
20	20	52	38	47	8	60	21	13356	201	5	10
21	21	52	30	62	13	39	10	13356	201	10	38
22	22	55	43	94	11	85	33	45864	169	10	36
23	23	63	39	79	11	59	165	28224	234	2	18
24	24	59	50	76	11	71	32	37800	133	4	24
25	25	87	41	230	14	88	41	25956	309	5	28
26	26	52	42	79	13	69	40	53172	237	10	32

Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
27	27	77	32	130	8	55	37	110880	237	10	18
28	28	71	51	76	15	80	40	24192	291	10	24
29	29	83	47	94	22	92	53	38556	644	15	46
30	30	53	34	65	14	67	31	50652	302	15	36
31	31	78	61	83	26	113	70	59724	342	5	32
32	32	59	48	86	13	61	22	21168	158	3	18
33	33	58	68	68	10	71	26	19152	270	25	16
34	34	98	56	122	24	109	53	33264	644	12	14
35	35	62	50	97	13	82	28	34272	133	12	10
36	36	52	36	90	14	83	42	33264	133	12	18
37	37	67	45	104	19	83	141	26208	270	14	12
38	38	52	48	75	16	70	52	34272	270	12	14
39	39	52	43	79	10	71	20	35784	248	4	10

Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
40	40	52	36	104	10	109	22	33264	133	10	34
41	41	58	35	126	13	67	25	18396	245	20	14
42	42	72	49	75	10	60	22	29900	260	12	10
43	43	1213	126	936	15	97	323	1440	158	40	56
44	44	77	37	136	17	56	27	30240	310	15	54
45	45	88	55	280	26	119	36	42336	316	10	60
46	46	64	68	100	21	109	42	59724	493	5	34
47	47	90	59	205	24	116	62	61992	496	5	63
48	48	87	57	101	26	125	64	60480	277	6	38
49	49	91	64	154	26	130	66	59220	554	20	38
50	50	67	46	202	17	86	36	33768	428	15	48
51	51	97	68	108	28	126	69	59976	990	9	24
52	52	79	48	115	26	126	67	44100	446	10	18

Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
53	53	97	93	101	36	173	142	81144	673	10	10
54	54	83	52	111	24	95	67	52668	403	15	48
55	55	43	32	47	7	22	16	4032	139	2	34
56	56	76	110	219	29	142	43	47880	392	4	14
57	57	79	102	140	25	158	48	43768	376	6	12
58	58	62	62	79	12	73	26	26208	202	5	38
59	59	62	62	79	12	73	26	26208	202	5	38
60	60	83	61	158	26	114	65	59220	608	8	14
61	61	57	38	61	10	78	15	59724	136	12	10
62	62	57	46	136	14	80	35	38808	338	5	24
63	63	51	45	122	10	61	15	15876	219	3	26
64	64	68	185	67	20	96	44	43092	561	8	16
65	65	79	57	130	22	95	35	48132	500	5	10

Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
66	66	45	30	61	9	36	10	16128	136	5	28
67	67	53	35	133	8	28	7	6552	108	5	14
68	68	68	32	130	11	54	18	15120	172	3	12
69	69	65	37	79	25	80	37	31500	162	4	10
70	70	87	48	151	17	96	51	94500	316	2	18
71	71	68	25	64	10	47	20	13356	237	10	45
72	72	81	72	144	17	89	38	9324	370	14	18
73	73	81	72	144	17	89	38	9324	370	14	18
74	74	71	59	158	17	109	40	40100	472	5	32
75	75	73	64	1368	17	91	30	29484	529	15	50
76	76	52	23	79	18	50	8	9576	169	20	56
77	77	87	57	100	26	129	64	60480	277	10	38
78	78	52	35	64	10	50	53	15860	170	16	48

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Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
79	79	86	48	140	25	111	61	33768	518	5	12
80	80	82	61	151	21	109	53	38052	410	5	38
81	81	67	63	118	24	78	31	13860	295	4	18
82	82	52	36	66	10	52	13	16000	97	4	12
83	83	53	31	151	8	74	8	7812	94	5	36
84	84	52	34	75	7	92	26	41076	237	11	18
85	85	55	45	102	16	67	20	33516	410	3	16
86	86	79	55	72	7	39	12	14112	97	3	10
87	87	67	49	72	9	40	13	18000	92	5	36
88	88	57	36	50	8	34	13	5796	97	8	32
89	89	71	49	118	14	91	30	27720	309	6	12
90	90	53	36	50	7	76	18	33768	237	11	38
91	91	57	31	63	7	39	24	14112	93	4	18

Sr. No.	Lake No.	Cu	Pb	Zn	Co	Cr	Ni	Fe	Mn	Mo	W
92	92	55	33	56	6	40	21	16000	74	5	72
93	93	54	26	67	8	62	13	19660	160	5	38
94	94	51	23	60	8	56	17	18000	120	5	36
95	95	45	30	52	21	58	20	27300	240	18	32
96	96	51	24	63	7	66	22	15300	135	4	18
97	97	48	28	79	8	80	18	14600	250	5	16
98	98	52	45	63	10	86	38	33516	252	10	10
99	99	63	40	169	17	93	41	41076	263	4	34
100	100	60	43	72	6	120	18	38052	98	10	28
101	101	46	28	112	12	34	12	44100	97	18	48
102	102	61	63	72	10	90	42	40100	309	4	16
103	103	56	36	46	8	86	20	14112	80	5	14

In the present investigation molybdenum and tungsten estimation by colourimetric techniques is adopted in toto as proposed by Levinson (1974). The results of which are given in Table 2.2, 2.3 and 2.4 for rocks, soils and lake sediments, respectively.

CONCLUSIONS : The inferences drawn from this chapter is as follows :

* Extraction by mixture of acids (HF + $HClO_4$) for major and trace constituents in rocks for AAS and ICP estimations has proved good in the identification of geochemical signatures of mineralisation.

* Hot aquaregia extraction is cost effective in the investigation as it has given suitable results in soils and lake - sediments. The results so obtained helped in detection of anomalies related to the mineralisation.

* Estimation of Mo and W by alkali fusion for colourimetric method was helpful in recognising the anomalies caused by mineralisation.