PART Ⅱ. CONCLUSION AND RECOMMENDATION

PART III CONCLUSION AND RECOMMENDATION

1. Conclusion

1-1. Reional Survey Area

The result of the gelogical mapping is consistent with the previous geological maps and papers. The summary of the geology and mineralization in the area is as follows.

(1) Precambrian Systems

Precambrian Systems comprise, from the older to younger, Nyanzian System, Post-Nyanzian intrusive rocks, Kavirondian System, Post-Kavirondian intrusieve rocks, and Bukoban System.

Nyanzian System: It consists of volcanic and sedimentary rocks. The former include basalts, andesites, dacites, rhyolites etc. The basalts are thought to be equivalent to so-called Archean greenstone volcanic rocks, and show characteristically greenish colors.

Post-Nyanzian intrusives: The rocks distribute in the eastern and southern parts of the area as batholiths or stocks. They maily consist of granodiorites with some diorites and dolerites, and intrude Nyanzian rocks.

Kavirondian System: It distributes in the central part of the area, overlying both the Nyzian rocks and Post-Nyanzian intrusives. It is composed of conglomerates and sandostones.

Post-Kavirondian intrusives: The rocks widely ditribute in the eastern part of the area, but they also occur in the western part as the inlier of the Kaksingri volcano. They consist of granites, granodiorites etc.,and some parts are fenitized by the alkaline igneous activities in Tertiary.

Bukoban System: It distributes in the southeastern corner, overlying all the other Precambrian rocks mentined above, It mainly consists of basaltic volcanic rocks with some sedimentary rocks including quartzites. Soapstone, which is being extracted as a local speciality of the Kisii district, also belongs to the System. It is considered to be of the Proterozoic age.

(2) Tertiary to Quaternary rocks

The alkaline plutonism that started in the early Tertiary accompanied effusions, and continues to the Quaternary. In this area, most of the rocks that belong to the period are the products of this activity.

There are 5 nephelinite to phnolite volcanic centers, 6 ijolitic complexes, 8 subvolcanic carbonatite centers, and several areas where fenitization is developed. Major localities of these are; the Kaksingri volcanic center, the ijolite-carbonatite complex in the Wasaki Peninsula, the carbonatite center at Ruri Hills, the carbonatite-ijolite complex at Homa Mountain etc. All of these are distributed within the Kavirondo Rift, a side-shoot of the Kenya Rift(East Africa Rift Valley), to form a great carbonatites belt.

Kaksingri volcanic center: This is one of the largest stratovolcanos in the Western Kenya, which extruded nephelinitic volcanic rocks over an area more than 2,000 sq.km. The center of the volcano was collapsed to form a caldera, into which carbonatites intruded(Rangwa carbonatite center). Most of the western part of the project area are covered with the volcanic and pyroclastic rocks of the volcano.

Carbonatite-alkaline complexes in the Waski Peninsula,Ruri Hills, Homa Mountain etc: Different from the Kaksingri volcano, these are the carbonatite-alkaline complexes without a large scale eruption. It is also characteristic of these complexes that they often accompany cone-sheet shaped carbonatites. The carbonatites comprise alvikites, sovites, ferro-carbonatites etc.and the latter are relatively rich in rare earths. These will be menioned later in 1-2.

(3) Mineralization

4 small carbonatite dykes, 2 weak copper showings and 3 gold works were quickly visited during the present field works. The findings are summarized in TABLE III-1-1. The assay result of a handspecimen collected at a gold work some 3km SW of Wire Hill indicates 3.3g/t Au. The area is underlain by greenstone and is close to a granitic intrusive body, so that the area at least satisfies the minimum requirements of a favorable ground for gold mineralization. It might be expected to locate some small scale gold-bearing quartz veins, if a systematic exploration is carried out.

TABLE III-1-1 FINDINGS RELATED WITH METALLIC MINERALIZATION-REGINAL SURVEY AREA*1

Locality	Sample Number	Rock type/ Mineralization	Wd or Thkn	Length &/ or Area	Remarks
ca. 3km NW of Gwasi	WR-108	CARBONATITIC ROCKS	ca. 5m		Mt-bearing brown ALV & dark FCB intrude with IJL basement granites.
5km SE OF Sindo	RT-46		ca. 5m		Fenitized sovite intrudes schists & granites of basement.
WNW of Asego H.	RT-60				Brownish, fine, with weak foliation. ALV or meta-LS.
8km NE Homa Bay	RT-99		ca. 5m		Light brown, well-bedded sinter like ALV or Calcareous TF.
SE Kendu Bay	RT-83	Secondary Cu mineral			Disseminated & fracture-filling MALC in red QMZ on ridge.
Wire Hill prospect 4 to 5km NW of Oyugis		Volc.genc. massive sulfides		Limonit'zd OP over 30 m along Rd	Explored by UN Revolving Fund. (UN Revolving Fund:1978 Final Report).

GOLD MINERALIZATION					Au g/t	Ag g/t	Remarks
S of Wire Hill	RT-90	Quartz veins	5 ~ 10cm		3.3	2.0	Being mined. Occur in meta-BAS.
25km SSW of Oyugis	RT-105	Quratz veins	3.0m	OP & FL scattered over 5km	tr	1.0	Sample taken at RD side of A-1, S-end of a large QV
S Rongo OUTSIDE OF AREA	REFERECE SAMPLE	Electrum-bearing QV	??		849	59.0	Being mined. Within Migori Gold Field
Homa Mountain Area of SEMI-DETAILED SURVEY AREAS	100205G 100206G 100207G 100208G	Quartz veins with float zone	5m+	ca. 500m judged from float distribution.	2.0 31.3	5.0 4.0	2.5 ~ 3.3km E of Summit of Homa Mtn Aduralia-bearing white QV in Nyanzian meta-volcanic rocks.
	100209G	QV OP			0.7	1.0	
	100222G 100224G	QV FL QV FL	D=15cm D=20cm	?? ??	tr tr	1.0 1.0	Both are different veins from above.

*1 Gold localities include those from "Semi-deatailed areas" and outside of the the present project areas.

* ABBRIVIATION: ALV=alvikite. BAS=basalt. ca.=about. D=diameter. FCB=ferro-carbonatite. FL=foat. IJ=ijolite. Limonit'zd=limonitized. LS=limestone. MALC=malachite. MT=magnetite. OP=outcrop. RD=road. QMZ=quartz monzonite. QV=quartz vein. TF=tuff. Thk=thickness. Volc.genc.=volcanogenic. Wd.=width.

1-2. Semi-detailed Survey Areas

(1) Geological Mapping

Conclusion on geology of the 10 areas is summarized in TALBE III-1-2-1 together with the results of the geochemical survey and the assessment of exploration potential of these areas.

The exploration potential of an area is tentatively ranked as follows.
A; Further exploration is justified. B: Further study is required.
C: Necessity for further study is considered to be low.

(2) Geochemical Survey

(A) Univariate statistical analysis

As a result of the univariate analysis, following items of 5 major elements(Nb,Y,La,Ce,Nd) are summarized in TABLE III-1-1-2 by area:(i) The Highest value. (ii) Mean value. (iii) Number of samples of "ANOMALOUS VALUE"[>(M+1SD)], (iii) Number of samples of "HIGHLY ANOMALOUS VALUE"[>(M+2 SD)].

The major elements here mean those that have relatively high values and potential economical importance, and are well representative for the mineralization from the result of the principal component analysis.

The highest, mean, M+1SD and M+2SD of ALL AREAS, and the the highests and means of Buru Hill and Ndiru Hill are compared below. It is interesting that,except Nb, the means of Buru approximately coincide with "M+2SD" of ALL AREAS and those of Ndiru with M+1SD,respectively.

COMPARISON OF MAJOR 5 ELLEMENTS--ALL AREAS vs,BURU HILL vs,NDIRU HILL--

	All AREAS (1325 SAMPLES)				Buru Hill(47)		Ndiru Hill(90)	
	MAX. ppm)	MEAN (ppm)	m+1s	m+2s	MAX. (ppm)	MEAN (ppm)	MAX. (ppm)	MEAN (ppm)
Nb	12000	148	620	2600	4800	688	8200	368
Y	1360	63.9	148	344	3100	516	1700	159
La	14300	178	767	3300	19500	3150	14720	700
Ce	17700	283	1240	5460	20000	4960	20800	1370
Nd	3000	97.2	450	2090	2700	1330	1200	373

TABLE III-1-2-1 SUMMARY OF EXPLORATION RESULTS OF THE PHASE-1

AREA	RESULTS OF GEOLOGICAL SURVEY	RESULTS OF GEOCHEMICAL SURVEY	TARGET COMMODITIES	EXPLORATIOIN RANKING
Rangwa	* Carbonatites occur within an oval area(2.6kmx2.0km)(Carbonatite-CENTER). They consist mainly of massive alvikite, sovite , and carbonatitic breccia. * Ferro-carbonatites rarely occur.	* Most of ANOMALOUS VALUES of P,Ba,Sr,Nb,Y are distributed within CENTER. However, their numbers are small except P, and HIGHLY ANOMALOUS values are hardly observed. * Some 25% of the samples indicate ANOMALOUS, but very few show HIGHLY ANOMALOUS. * No prominet concentration is observed except Nb in soil samples from the CENTER. MEAN of Nb is 1010ppm.		C
Sagarume Nyangurka	* In Sagarume(NW part), only several narrow alvikite dykes that intrude ijolite are observed/ * In Nyamguruka(SE part), 2 small alvikite massive bodies and narrow dykes occur, but few ferro-cabonatites are observed. * A blind ijolite body is inferred to occur shallow in the area,from a wide distribution of fenitized zone. However, it is difficut to infer if there is any blind carbonatitic bodies underneath.	* No HIGHLY ANOMALOUS occurs except P, though some ANOMALOUS points of P and REE are in the vicinity of Nyamgurka. * The highest P throughout the whole areas is in this area(14.5%), but this is only a single point and does not form an ANOMALY. * No ANOMALOUS value was located in Sagarume. except 2 ijolite samples.		C
South Ruri	* There is a cylindrical massive cabonatite complex(diameter=2.5km), which is the largest single carbonatitic body in the Homa Bay area. * This comprises alvikite, sovite, cabonatitic breccia, and ferro-carbonatite. * Ferro-carbonatites occur as dykes in the peripheral zones of the complex.	* ANOMALOUS values are abundant in Sr and REE, whereas HIGHLY AHOMALOUS are abundant in Y,La,Ce. * Most of HIGHLY ANOMALOUS values of Y,La,and,Ce are in ferro-carbonatite area, and an ANOMALY is located some 1.5km ENE of South Ruri, where HIGHLY ANOMALOUS points are concentrated.	Y and REE	A
North Ruri	* A cone-sheet of carbonatites that lacks the SE part at the surface occurs. Basement rocks occur in the central part of the Hill. * The carbonatites comprises mainly alvikite with some carbonatitic breccia, sovite and ferro-carbonatite. * Ferrocarbonatite is mostly distributed in the peripheral zone of the complex as ring-dyke-like forms.	* The tendency is almost similar with South Ruri. * HIGHLY ANOMALOUS values of Y,La,and Ce are more frequently distributed in the peripheral zone of the cone-sheet. * 2 ANOMALIES are located some 0.8km N and 0.9km SW of the summit, where HIGHLY ANOMALOUS points are concentrated.	Y and REE	A
Kuge-Lwala	* A cabontite cone-sheet occurs at Kuge Hil(central to NW), close to which a ferro-carbonatite dyke occurs. The cone-sheet seems to express the top of an intrusive, so that a massive body may be expected at the depths. * The ferro-carbonatite dyke is 30 to 40m wide and 450m long in A N-S direction, dipping 30 to 40 deg.W . This is highly radioactive. * A ferruginous breccia zone that contains carbonatitic fragments is located at Lwala. It outcrops in an area of about 0.3 sq.km and is highly radioactive as well.	* Most of carbonatite samples from Kuge indicate ANOMALOUS values for Ba,Y, Th and REE. Of these, HIGHLY ANOMALOUS values of Ba,Y,Th, and Eu are concentrated in the ferro-carbonatite dyke. * The highest Th(2360 ppm) throughout all the areas is in this area. * The ferrugious breccia at Lwala shows HIGHLY ANOMALOUS values for Y,Th,and Yb.	Y- and REE	A
Ungou-Kuwor Area and Ugongo-Uyi Kiyanya-Sokolo Area	* A carbonatite complex occurs in an area including Sokolo point, and the area extends up to the NE shore. The complex comprises sovite,ferro-carbonatite, and alvikite. * A body at Sokolo is inferred to be a cylndrical with a diameter of some 600m. * Other than these, narrow ferro-carbonatite dykes are at SW and SE of Sokolo,and a small alvikite body is at NW part of Kuwor.	* ANOMALOUS values of 5 elements and REE are distributed in somewhat concentrated way. * Some are observed locally at SW and SE coast of Sokolo Area. * No ANOMALOUS values are located in Ungou-Kuwor Area. * HIGHLY ANOMALOUS values of La,Ce are only located locally at Sokolo Point, and those of Nb at the NE coast, respectively.		C
Homa Mountain	* A large number of carbonatite cone-sheets and dykes of various sizes occur in an oval-shaped area(6kmx5km), having the main carbonatite cone-sheet as a core. * Other than these, some carbonatite dykes occur in the southern part of the area as well. * Most of carbonatites occur as dyke-swarm aligned in cicular patterns. * There is very few sizable carbonatite body other than that at Ndiru Hill * Gold-bearing quartz veins are located some 3km E of the summit of Homa Mountain(Max. 31.3 g/t Au).	* 15 to 20% of samples show ANOMALOUS and 1 to 3% HIGHLY ANOMALOUS for the 5 ELEMENTS and REE. However, these are sporatically distributed over a wide area so that no ANOMALY is located. * Within this area, the highest samples for Sm(4920ppm), Nb(12,000ppm) etc. occur, so that the area is worth further watching . However, these are all single-point results and can not be classified as ANOMALIES.	Y, Nb REE (Au, Ag)	C (A)
Ndiru Hill Prospect in Homa Mountain Area	* This is a massive carnonatite complex (300mx500m) situated 2.5km of the summit of Homa Mountain. * It comprises sovite,alvikite and ferro-carbonatite and they intruded in this order.	* REE,Y,and Nb are concentrated along the periphery of the latest ferro-carbonatite. However, HIGHs of Nb occur a little outer from ferro-carbonatite * Y and REE are much lower than Buru Hill,though their means are in the same level of ANOMALOUS values of ALL AREAS. * Nb is concentrated only very locally, being controlled by fractures. * The depths seem not to be prospective, since mineraization of deeper facies has already been exposed at the surface, and no secondary enrichment can be expected.	Nb	B
Buru Hill	* The whol hillock of 500mx350m is mineralized and oxidized. Ores contain a great amount of limonite, forming a sort of leached capping. * Sovite is described to occur in old DDHs,though no carbonate was recognized during the present sampling. * 2ndary enrichment of Y, and Nb may be expected under the oxidized zone. * Superimposition of different stage mineralization may have occurred, as LREE and brecciated structures, both of which is thoght to be shallower facies, and deeper facies such as Nb-magnetite overlap at the surface.	* Means of most REE and Y are almost the same levels with HIGHLY ANOMALOUS values of ALL AREAS. * Averages(arithmetic average on antilog) and Maximum values of major 3 compositions are as follows: La+Ce+Nd: AV= 1.31 % Max= 3.98% Y : AV= 637ppm Max= 3100 ppm Nb: AV=1071ppm MAX= 4800 ppm	Y, Nb and REE	A
Legetet Hill	* Legetet Hill has been thought to be a parasitic volcano of the Tinderet volcano. However, there is a possibility that it might represent a preceeding activity, as a K-Ar dating of melanephelinite indicates 10.7MA. * At N and E foot, and a locality NE of the Hill, there occur carbonatitic rocks. They comprise pyroclstic rocks , lavas, sandy tuffs , representing effusive and redeposited facies of caarbonatite atcivity. They possibly preceeded the volcanic activity of Legetet Hill.	* ANOMALOUS and HIGHLY ANOMALOUS values are relatively abundant in Sr,Y,Yb, and Lu. These are limited only in the areas where carbonatitic rocks are distributed. * 2 samples that show HIGHLY ANOMALOUS values for Y,La,and Yb are located at the NE foot, where carbonatitic pyroclastic rocks occur. The locality seems to be one of the centers of the carbonatitic pyroclastics in this area. * Frequency of HIGHLY ANOMALOUS values are fewer compared with sample number		C

* ANOMALOUS > Mean + 1 Standard Deviation.
< Mean + 2 Standard Deviation.
* HIGHLY ANOMALOUS > Mean + 2 Standard Deviation.
* ALL AREAS : 1325 rock-chip samples excluding the grid-samples from Ndiru and Buru Hills
* EXPLORATION POTENTIAL RANKING:
A= Further exploration is justified. B= Further study is required. * C= Necessity for further study is considered to be low.

* ANOMALY: A place where more than 2 HIGHLY ANOMALOUS and several ANOMALOUS values are concentrated

TABLE III-1-2-2 SUMMARY OF MAJOR 5 ELEMENTS--BY AREA

Name of Area	No. samples	Item	Upper 2 lines ppm/Lower 2 number (pcs)					Samples that show the highest value of 1325 samples
			Nb	Y	La	Ce	Nd	
Rangwa	211	MAX.	1470	580	2300	3100	1210	
		Mean	211	51	110	130	37	
		>m+1s	10	3	10	10	12	
		>m+2s	0	1	0	0	0	
Saga-rume	76	MAX.	735	220	1690	2650	1180	P 14.5%
		Mean	32	43	68	136	52	
		>m+1s	1	3	7	8	12	
		>m+2s	0	0	0	0	0	
North and South Ruri Hills	258	Max.	2100	1360	14300	17700	2500	Tb 44ppm(in Ndiru 100). La:14300, Ce: 17700(in Ndiru H. 14720.20800). Y: 1360ppm(in Buru H. 3100ppm)
		Mean	127	69	206	364	116	
		>m+1s	19	28	34	45	55	
		>m+2s	0	15	17	15	1	
Kuge-Lwala	51	Max.	4150	680	3970	6750	2310	Th 2360ppm Yb 94ppm
		Mean	278	110	267	604	262	
		>m+1s	14	19	11	15	17	
		>m+2s	1	5	2	3	3	
Sokio-Ngou	109	Max.	5500	550	10000	10000	2120	Eu 163ppm. (in Ndiru Hill is a point that shows 170ppm)
		Mean	273	57	242	359	107	
		>m+1s	9	11	18	16	15	
		>m+2s	2	1	2	3	1	
Homa Mount.	*1 486	Max.	12000	910	10700	16100	2200	Ba 80700ppm Sr 11800ppm(in Ndiru H. is 12590ppm). Sm 4920ppm
		Mean	138	68	212	335	124	
		>m+1s	61	66	67	80	94	
		>m+2s	4	9	11	14	2	
Buru Hill	*2 18	Max.	3700	1100	13520	16700	2700	
		Mean	37	66	115	186	62	
		>m+1s	3	0	3	4	3	
		>m+2s	1	6	3	2	3	
Lege-tet H.	116	Max.	3800	750	3730	7190	1880	
		Mean	204	74	194	335	127	
		>m+1s	6	25	4	4	5	
		>m+2s	1	2	2	1	0	

* 1 : Excluding 90 grid samples from Ndiru Hill prospect.
* 2 : Including 6 samples from 49 grid samples at the Buru Hill prospect.

The geochemical anomalies and geological factors are correlated on the maps and the exploration potential is assessed for each area. The result is summarized in TALBE III-1-2-1 in the previous page.

4 areas,Buru Hill, Kuge-Lwala, and South and North Ruri areas are selected as targets for follow-ups in the 2nd Phase.

"Correlation analysis"

The result for 1325 rock-chips of ALL AREAS is shown in TABLE III-1-2-3. That for Buru Hill is presented in TABLE II-2-11-4 and that for Ndiru Hill in II-2-10-2, respectively.

Strong correlations are observed among REE,Y and Th in ALL AREAS and Ndiru Hill, whereas it is quite characteristic that only weak correlation is between LREE and Y in Buru Hill.

Some correlation is also discernible between gamma-ray and each of Th, Y,and middle(MREE) to heavy rare earths(HREE) such as Sm, Eu, Tb etc., so that the gamma-ray measurement will be a useful "tool" for REE exploration. especially in reconnaissance.

"Chondrite-normalized abundances of the REE"

The chondrite-normalized REE patterns are drawn for each of the averages of 43 rock types that were computed from all the 1509 samples.

The curves of sovite(SO), alvikite(AV) and ferro-carbonatite(FC) are plotted in Fig.III-1-1A, and those of ijolite(IJ), nephelinite(NE) and phonolite(PH) are in -B. The curves of the average of Ores from Buru Hill(OR) and IJ(as a representative of alkaline rocks) are plotted in the former for comparison.

Also comparison is made among averages of 8 areas, some Ores from Buru Hill, and carbonatites from Ndiru Hill(Fig.III-1-2).

Findings are as the followings.

i) In Fig.III-1-1, there is obviously a relationship as follows: OR> FC> AV> SO> IJ. IJ seems to be convex upward at Tb,compared with carbonatites. The difference between AV and FC apparently reduces at Tb.

ii) The three alkaline rock types are much lower than the carbonatite group. IJ is higher than other two at Tb.

iii) A fairly clear tendency is observed among carbonatites at Ndiru Hill: At the lightest La, the relationship is FC> AV> SO, but it changes at the heavier Yb, Lu, and Y, to AV> SO> FC, suggesting that LREE concentrates at later stage.

iv) The comparison among averages by area, obviously indicates the relationship of; Buru> Ndiru> Kuge> Ruri.

(B) Principal coponent analysis

The principal component analysis was tried for 3 groups, ALL AREAS, Buru Hill and Ndiru Hill, as it was thought to be useful for analyzing a large number of data comprising a lot of elements.

However, it has become obvious that the plots of the scores of the principal component analysis show almost the same tendency with those of elements themselves. One of the reasons must be the great chemical similarity of REEs. Therefore, the maps showing scores are omitted to attach.

The results up to the 4th principal component of ALL AREAS are shown in TABLE III-1-2-4, and those of Buru Hill and Ndiru Hill are presented in TABLE II-2-11-4 and II-2-10-3, respectively. The correlation of the results of these 3 is summarized in TABLE III-1-2-5.

TABLE III-1-2-3 CORRELATION COEFFICIENTS—1325 SAMPLES FROM ALL AREAS

	P	Ba	Sr	Nb	Y	Th	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu
P	1.000													
Ba	0.319	1.000												
Sr	0.513	0.407	1.000											
Nb	0.336	0.415	0.391	1.000										
Y	0.379	0.597	0.426	0.482	1.000									
Th	0.151	0.547	0.438	0.502	0.675	1.000								
La	0.419	0.643	0.675	0.470	0.695	0.694	1.000							
Ce	0.366	0.599	0.661	0.447	0.683	0.727	0.946	1.000						
Nd	0.354	0.575	0.640	0.426	0.670	0.731	0.894	0.923	1.000					
Sm	0.376	0.584	0.601	0.408	0.751	0.717	0.885	0.907	0.925	1.000				
Eu	0.375	0.550	0.607	0.438	0.754	0.725	0.853	0.876	0.892	0.935	1.000			
Tb	0.393	0.483	0.487	0.419	0.736	0.587	0.709	0.711	0.727	0.803	0.839	1.000		
Yb	0.300	0.383	0.342	0.353	0.760	0.560	0.500	0.492	0.488	0.567	0.588	0.606	1.000	
Lu	0.256	0.425	0.311	0.306	0.760	0.577	0.546	0.550	0.557	0.631	0.650	0.667	0.766	1.000

* 1325 rock-chip samples excluding grid-samples from Buru Hill and Ndiru Hill prospects.

TABLE III-1-2-4 SUMMARY OF PRINCIPAL COMPONENT ANALYSIS ——ALL AREAS ——

Prin-cipal Compo.	EIGEN Value	Cont-ribu-tion	Cumm. Cont-ribut.	Item	P	Ba	Sr	Nb	Y	Th	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu
1	8.804	0.629	0.629	Eigen vector	-0.158	-0.229	-0.227	-0.188	-0.288	-0.269	-0.309	-0.309	-0.307	-0.316	-0.315	-0.284	-0.235	-0.246
				Factor loading	-0.470	-0.680	-0.674	-0.559	-0.854	-0.797	-0.916	-0.917	-0.911	-0.937	-0.934	-0.843	-0.696	-0.731
				Contribution	0.221	0.463	0.455	0.312	0.729	0.635	0,840	0.841	0.829	0.878	0.873	0.711	0.484	0.534
2	1.219	0.087	0.716	Eigen vector	-0.359	-0.074	-0.446	-0.111	0.285	0.135	-0.196	-0.175	-0.151	-0.049	-0.016	0.113	0.470	0.476
				Factpr loading	-0.396	-0.083	-0.493	-0.122	0.315	0.149	-0.217	-0.193	-0.167	-0.054	-0.017	0.124	0.518	0.526
				Contribution	0.157	0.007	0.243	0.015	0.099	0.022	0.047	0.037	0.028	0.003	0.000	0.015	0.269	0.276
3	0.972	0.069	0.785	Eigen vector	0.701	0.019	0.134	0.318	0.165	-0.234	-0.153	-0.233	-0.253	-0.189	-0.146	0.044	0.292	0.144
				Factpr loading	0.691	0.002	0.133	0.314	0.163	-0.231	-0.151	-0.230	-0.250	-0.187	-0.144	0.044	0.288	0.142
				Contribution	0.478	0.000	0.018	0.098	0.026	0.053	0.023	0.053	0.062	0.034	0.020	0.002	0.083	0.020
4	0.796	0.057	0.842	Eigen vector	0.248	-0.377	0.153	-0.739	-0.049	-0.321	0.022	0.045	0.081	0.148	0.143	0.192	0.090	0.157
				Factpr loading	0.222	-0.336	0.136	-0.659	-0.044	-0.286	0.020	0.040	0.072	0.132	0.127	0.171	0.080	0.140
				Contribution	0.049	0.113	0.019	0.435	0.002	0.082	0.003	0.002	0.005	0.018	0.016	0.029	0.006	0.020

TABLE III-1-2-5 COMPARISON OF PRINCIPAL COMPONENT ANALYSIS -ALL AREAS vs BURU HILL vs NDIRU HILL

	(A) ALL AREAS (1325 Rock-chip samples)	(B) BURU HILL PROSPECT (47 rock-chip grid samples)	(C) NDIRU HILL POSPECT (90 rock-chip grid samples)	REMARKS
1st PRINCIPAL COMPONENT (Z1)	* Contribution reaches as high as 62.9%. Th, and REE from La to Tb show factor loadings from -0.84 to -0.88, and Ba, Sr, Yb, and Lu show from -0.67 to -0.73 as well. This component seems to be related with carbonatite, especially with the distribution of ferro-carbonatite.	* Contribution is much lower(36.7%) compared with ALL AREAS. This component is strongly affected by Y(factor loading= 0.83) and MREE to HREE from Sm to Lu (0.75-0.88). * It is a prominent characteristics that Y and M-HREE indicate quite different behavior with LREE such as La and Ce here.	* Figure of contribution is between ALL ARES and Buru Hill (49%). Factor loadings of Ba, Th, and all the REE except Yb and Lu are remarkable(-0.72 ~-0.93). * This component may represent mineralization of pyrochlore group that may belong to a later stage mineralization.	* In (A) & (C) this may repr-epent a primary REE mineralization of a later stage.
2nd PRINCIPAL COMPONENT (Z2)	* Contribution shows 8.7%. Factor loadings of Sr (-0.49), Tb(0.52), Lu(0.53) etc. are relatively high.	* Contribution is 16.7% and is mainly affected by LREE, especially La(-0.88), Ce(-0.90), and Nd (-0.57). * This component may represent the supergene concentration of LREE in oxidized zone.	* Contribution is 11.5%, and factor loadings of P(-0.58), Sr(-0.53), Yb(-0.57) and Lu(-0.57) are relatively high.	* In (B) this may represent 2ndary concentrate of LREE
3rd(Z3) PRINCIPAL COMPONENT	* Contribution is 6.9%, and is mostly decided by P(0.69). * This may represent mineralization(?) of apatite	* Contribution is 13.5%, and decided mostly by P(-0.8) the same as ALL AREAS.	* Contribution is 8.6%. Factor loadings of gamma-ray (0.54) and Sr(0.64) show positive, whereas Nb(-0.62) shows a negative loading.	* In (A)&(B) this may represebt P min.
4th(Z4) PRINCIPAL COMPONENT	* Contribution is 5.7%, and is almost decided by Nb(-o.66).	* Contribtion is 8.5%, and decided mainly by magnetic susceptibility(0.57) and Nb(0.56). * May represent earlier mineralization of Nb.	* Contribution is 6.8%, and almost decided by gamma-ray(0.61) and Nb(0.52). This may represent earlier minerlization of Nb.	*In all 3, it may represent Nb-min. lztn.
CHARACTERISTICS etc.	* The result summarized above, indicate that the strong tie between the mineralization of REE, Y, Nb etc and carbonatite, especially with ferro-carbonatite.	* The mineralization in this prospect shows somewhat different features from other carbonatitic occurrences. This may be due to the effect of supergene alterration such as leaching and secondary enrichment.	* It is quite interesting Z4, which is inferred to represent earlier mineralization, and Z1, which is considered to represent later stage mineralization, have higer scores at almost the same position, implying superimposition of different stages.	

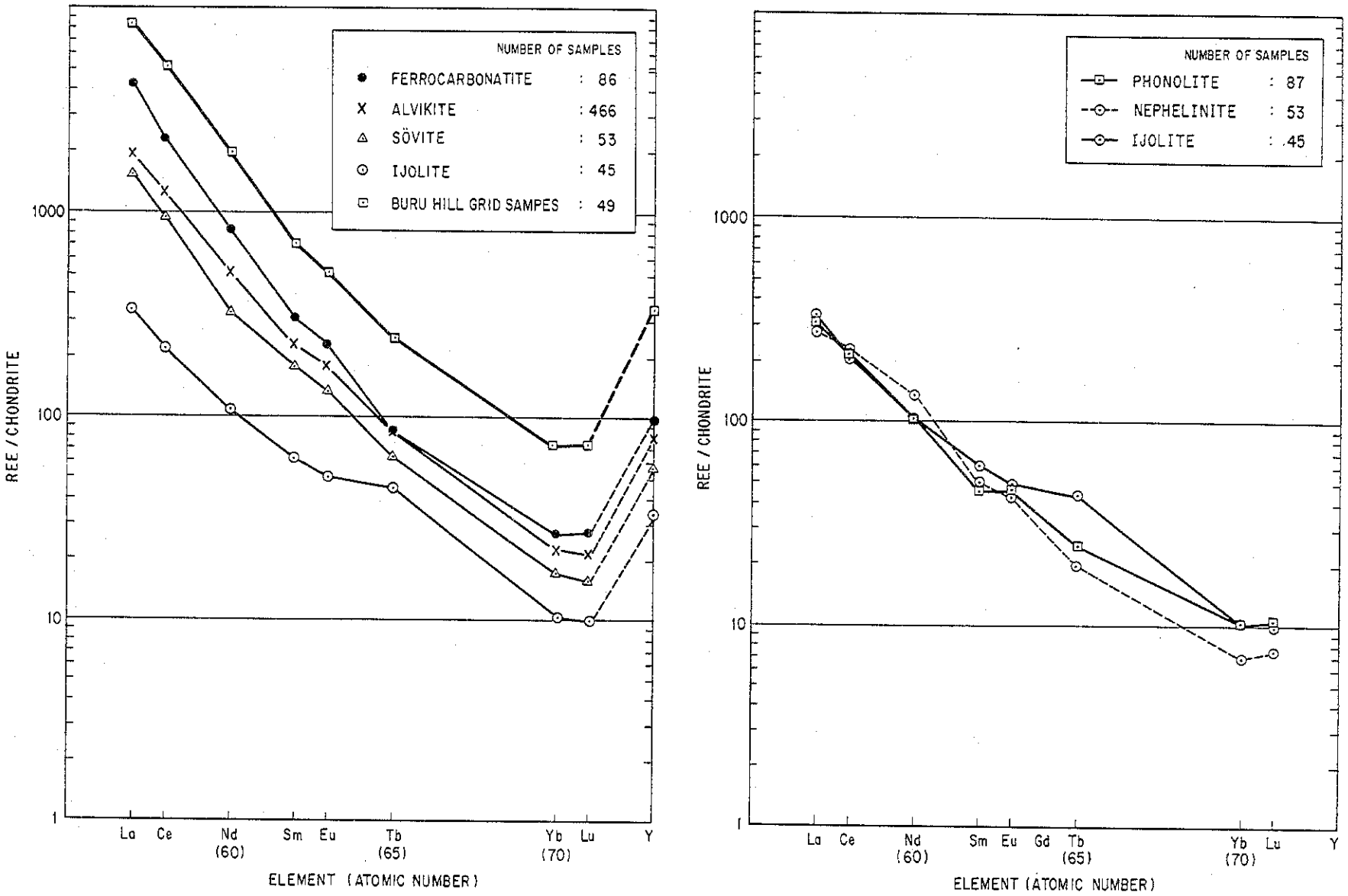

Fig. II1-1-1 Chondrite-normalized abundances of the REE: — Averages of Carbonatites & Alkaline Rocks in the Project Area

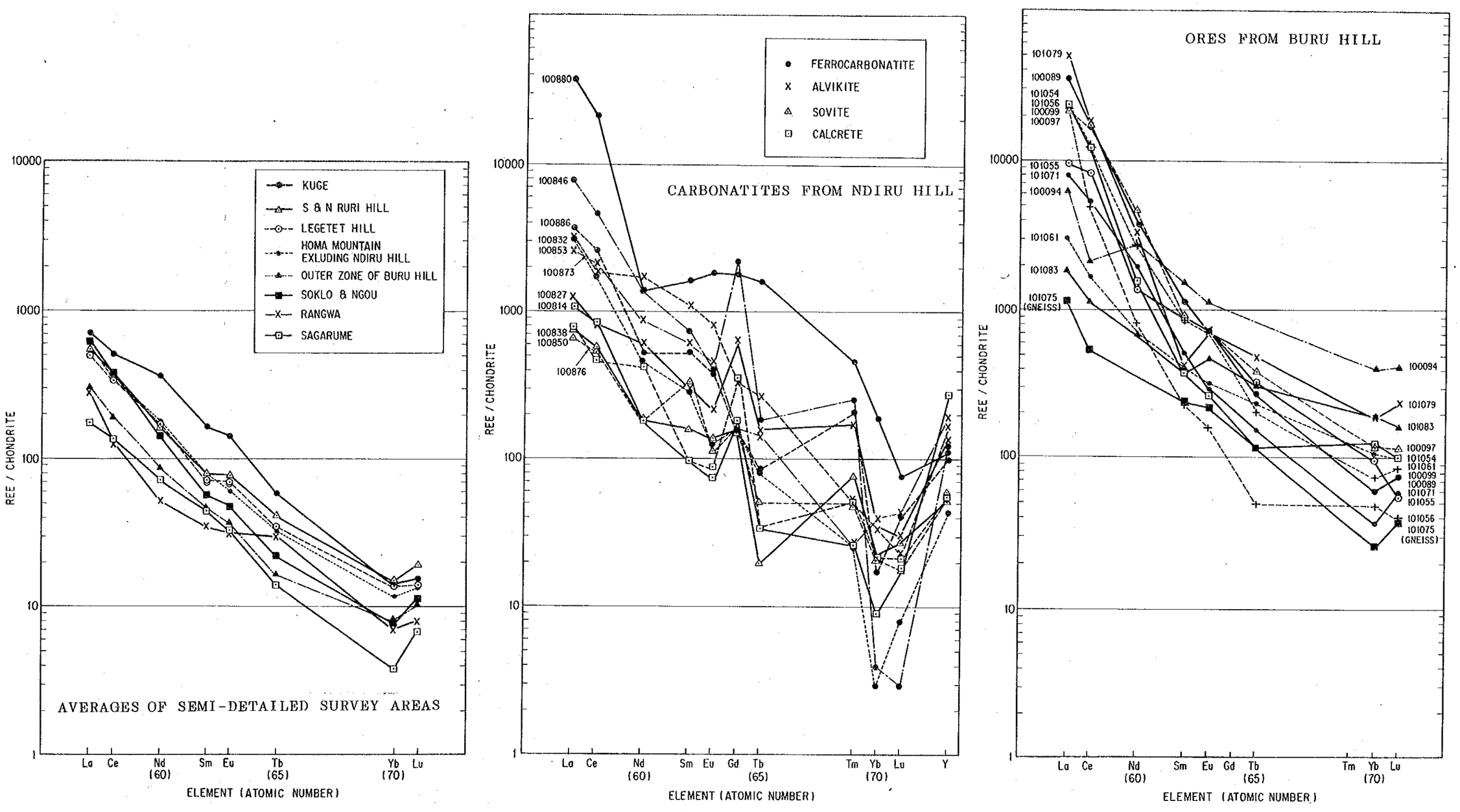

Fig. III-1-2 Chondrite-normalized abundances of the REE:— Comparison of Semi-detailed Areas & 2 Prospects

2. Recommendation for the 2nd Phase Prgramme

In this chapter, recommendation for each area is described in the order of the exploration priority of that area. For each area, only the major exploration methods are described.

It is necessary to select and combine some of auxiliary works in accor dance with major exploration methods adopted in that area.

The auxiliary works include;(a)preparation of topographical maps from air photos(1/2000 to 1/5000),(b)chaining of geochemical or geophysical cutting lines, pits, trenches, drill sites,(c) surveying of underground works after rehabilitation,(d)geological mapping and logging of the lines, pits, drill cores, undergroud works, adjacent areas etc..

It is recmmend to adopt radiometric survey along with other field works such as geological mapping, geeochemical sampling, and geophysical measurements.

2-1. Buru Hill area

(1) Diamond drilling

It is recommended to carry out surface drilling to anomlies of REE, Y, Nb etc. The purposes are as follows.

i) To explore the potential secondary enrichment zones of Y and Nb that are expected under the leached cappng.

ii) To explore the depths, where the vertical zoning of primary minerals might be expected.

iii) To know the shape and depths of the bottom of the oxidized zone.

iv) To explore a potential blind carbonatitic plug that might occur at the southern foot of the hillock.

(2) Geophysical survey

It is recommended to carry on detailed gravity and magnetic surveys in order to figure the geological structure at the depths. For, there is a possibility that the alteration zones at the southern foot of the hillock (the same as above) and in gneiss, which is located some 500m south of the hillock, might be the surficial expression of blind carbonatitic plugs.

(3) Pits and/or trenches

It is desirable to carry on pitting and trenching, in order to confirm the geolgy and mineralizaion in the soil-covered parts and to know the vertical distibtion of grades near the surface.

(4) Cleaning or rehabilitaion of inclined shaft

It is desirable to rehabilitate the old inclined shaft by NCGF(?), in order to investigate the mineralization at the depths and its occurrences 2-dimensionally. In relation with mining regulation etc., it may be appropriate to ask MGD to implement the work.

(5) Mineralogical and metallurgical tests

It is a matter of paramount importance for commodities such as REE, Y, Nb etc. to identify the constituent minerals and their occurrences, compared with other ordinary metal-commodities. This is as important as to determine their grades and reserves, so far as the feasibility of their extraction is concerned. Because, it is quite a common case that a material cannot be economical, even if its chemical grades reach the "ore grades", when its mineralogical features are unfaborable.

It is considered very important to carry on mineralogical studies including EPMA, X-ray diffraction, microscopical observation etc.,after sufficient preparatory procedures such as separation and/or concentration of a target mineral, and resolution of impurities have been completed.

It is advisable to execute metallurgical/concentration tests some time in an earlier stage of the project.

2-2. Kuge-Lwala area

(1) Diamond drilling

It is recommended to carry on dilling for following purposes.

i) To explore a ferro-carbonatite dyke at the depths, in which an a combined anomaly of REE, Y, Th and gamma ray has been located by the present study.
ii) To explore the ferruginous breccia at the depths, which resembles the Ores of Buru Hill

(2) Geochemical survey(grid sampling)

It isrecommended to carry out it including pits and trenches.

2-3. South Ruri and Noth Ruri areas

It is recommended to follow up the anomalies of REE and Y which have been located by the present study. The follow up includes geochemical grid sampling and detailed geological mapping as well as pitting and trenching.

REFERENCES

REFERENCES

Alviola, R., Kortman, C., Githinji, I., Mulaha, T., and Nzau, K. (1985): Report on cement raw materials investigations in the Koru and Songhor areas, Western Kenya. Geological Survey of Finland.

Binge, F.W. (1962): Geology of the Kericho Area. Geological Serevey of Kenya.

Cluver, A. F. (1958): Buru Hill E.P.L. 110, Kericho District, Kenya. Unpublished internal report of New Consolidated Gold Fields Limited, Johannesburg.

Deans, T. (1966): Economic Mineralogy of African Carbonatites. p. 385-413 in Carbonatites. (ed) Tuttle, O. F. and Gittins, J.

DuBois, C. G. B. and Walsh, J. (1970): Minerals of Kenya. Bull. Geol. Surv. Kenya. No. 11.

Geological Survey of Japan(1987): Research on Mineral Deposits associated with carbonatite in Brazil. Report of International Research and Development Coorperation. IIIT Projects No. 8316.

Geological Survey of Kenya(1962a): Geological Map of Kenya.

——————————— (1962b): Mineral Map of Kenya.

Haskin, L. A., Frey, F. A., Wildeman, T. R. (1968): Relative and absolute terretrial abundances of the rare earths. In: Origin and distribution of the elements (Ahrens, L. H. ed.). Pergamon Int. Ser. Monogr. Earth Sci. 30, 889-912. New York, USA.

Heinrich, E. W. (1866): The Geology of Carbonaties. Rand McNally & Co., Chicago, USA.

Idman, H. and Mulaha, T. (1986): Report on an assesment for phosphates and niobium in carbonatitic and alkaline silicate complexes in Western Kenya, South Nyanza District. Geological Survey of Finland.

Kamitani, M. (1984): Carbonatite deposits in Brazil (1)(in Japanese). Geological News. No. 362, p. 24-33.

——— , Hirano, H. (1985): Carbonaite deposits in Brazil (2)(in Japanese). Geological News No. 372, p. 6-16.

——— (1986): Niobium--Study on rare metal resources(in Japanese)p. 100-120. Geol. Surv. of Japan.

——— , and Hirano, H. (1987): Important carbonatite-alkaline/alkaline complex and related resources in the world. In Research on Mineral Deposits associated with carbonatite in Brazil. p. 116-129. Geological Survey of Japan.

Kano, T., Yanagida, H. (ed.) (1989): Rare earths ; its physical property and application. (in Japanese). Gihodo-shuppan Ltd.

King, B. C. and Sutherland, D. S. (1966): The carbonatite complexes of Eastern Uganda. p. 73-126 in Carbonatites(1966) (ed) Tuttle O. F. and Gittins, J. Interscience Publisheers, N. Y., USA

Metal Mining Agency of Japan (1981): Reort of Study on Development of Exploration Technology(in Japanese).

LeBas, M.J. (1977): Carbonatite-Nephelinite Volcanism--an African Case History. John Wiley & Sons.

Masuda, A., Nakamura, N., and Tanaka, T. (1973): Fine structures of mutually normalized rare earth patterns of chondrites. Geochim. Cosmochim. Acta, 37, p. 239-248.

McCall, G.J.H. (1958): Geology of the Gwasi Area. Geological Survey of Kenya.

Mulaha, T.O. (1986): Report on the assessment of phosphorous and niobium in the Ndiru Hill carbonatite complex, South Nyanza District. Geological Survey of Finland.

Ohde, S., Suwa, K., and Kitano, Y. (1979a): Trace element geochemistry of carbonatites from Homa mountain, Kenya. 4th prelim. Rept. Afr. Studies, Nagoya Univ., 169-174.

Ohde, S., Suwa, K., Yusa, Y. and Kitano, Y. (1979b): Rare earth element geochemistry of carbonatites from the Kangankunde Mine, Malawi. 4th Prelim. Rept. Afr. Studies, Nagoya Univ., 175-179.

Okano, T. (1981): New metal resources(in Japanese). Mining Geol. Japan 31, 407-414.

Pulfrey, W. and Walsh. J. (1969): The geology and mineral resources of Kenya. Bull. Geol. Surv. Kenya No. 9.

Sakamaki, Y., Kamitani, M. (1986): Study of assessment of rare earths resources(in Japanese) P. 121-154. Geol. Surv. of Japan.

Suwa, K. (1981): Petrolgy of carbonatites. Mining Geol. Japan, 31, 457-465.

— , K., Oana, S., Wada, H. and Osaki, S. (1975): Isotope geochemistry and petrology of African carbonatites. Phys. Chem. Earth, Pergamon, 9, 735-746.

Sato, T. et al. (1985): Research on mineral deposits containing carbonatite in Brazil. The Japan Industrial & Technological Bulletin. 12, 10, 7-8, JETRO.

Takenouchi, S. (1973a): Carbonatite deposits (I)(in Japanese)Mining Geol. Japan. 23, 367-382.

———— (1973b): Carbonatite deposits (II)(in Japanese)Mining Geol. Japan. 23, 437-451.

———— (1981): Carbonatite deposits(in Japanese). Mining Geol. Japan. 31, 415-42 0.

Tanaka, T. (1981): Rare-earth behavior in magmatism and genesis of carbonatite. (in Japanese) Mining Geol. 31, 6, 467-478.

Tatsumi, I. (1965): Ore deposits associated with carbonatite and alkaline complex(in Japanese) Bull. Geogr. Soc. Tokto. 74, 1, 744.

Tuttle, O.F. and Gittins, J. (ed) (1966): Carbonatites. Interscience Publishers. N.Y., USA

United Nations Revolving Fund for Natural Resources Exploration(1978): Mineral Exploration in Western Kenya--Final Report. DP/KEN-NR-78-00.

APPENDIXES

APPENDIX-1 LIST OF SAMPLES TESTED

Area	Sample Number	Rock Type	1/50,000 Topo. map Sheet Name	Location X	Location Y	Thin Sect.	Polished Sect.	Assay Silc. *1	Assay Carb. *2	K-Ar Age Date	X-ray Diffract	Remarks
	RN-126	mic.sch	Gwasi	24+	38+	X						
	RN-139	amp.sch	Gwasi	23+	39+	X						
	RN-230	granite	Oyugis	79+	37+	X						
Regional	RN-284	diorite	Oyugis	86+	42+	X						
	RP-79	nephel.	Rusinga	36+	47+	X		X		X		
Mapping	RT-38	nephel.	Gwasi	24+	25+	X		X		X		
	RT-46	fen-sov	Gwasi	35+	38+	X						
Area	RT-77	rhyol.	Kendu Bay	91+	47+	X		X				
	WR-108	alvik.	Gwasi	25+	34+	X						
	WR-122	phonol.	Madiany	55+	46+	X						
	WR-136	ijolite	Madiany	55+	43+	X		X		X		
	RN-54	ijolite	Gwasi	29+	35+	X		X				
Rangwa	RO-2	alvik.	Gwasi	28+	37+	X			X			
	40929E	carb-br	Gwasi	28+	35+	X			X		X	
*3	99685G	fenite	Gwasi	32+	41+	X		X				
Sagarume	99712G	ijolite	Gwasi	29+	43+	X		X		X		
	99729G	alvik.	Gwasi	33+	40+	X			X			
South	99502G	Fe-carb	Homa Bay	53+	39+	X	X					
Ruri	100111G	Fe-carb	Homa Bay	51+	37+	X			X		X	
	100152G	sovite	Homa Bay	53+	38+	X			X		X	
North	99543G	alvik.	Homa Bay	52+	41+	X			X			
Ruri	100127G	sovite	Homa Bay	52+	41+	X			X			
	100132G	nep-sye	Homa Bay	52+	41+	X		X				
*4	100051G	alvik.	Madiany	51+	45+	X			X			
Kuge	100053G	Fe-carb	Madiany	51+	45+	X	X		X		X	
Ngour *5	100389G	alvik.	Madiany	52+	49+	X			X			
	100303G	Fe-carb	Madiany	56+	48+	X			X			
Soklo *6	100320G	black V	Madiany	56+	49+	X	X				X	in sovite
	100323G	fenite	Madiany	56+	49+	X		X			X	
	100324G	bi-sov.	Madanyy	56+	48+	X			X			
	99599G	Fe-carb	Madiany	66+	59+	X			X			
Homa	99961G	Fe ore	Kendu Bay	69+	52+	X	X					
Mountain	100233G	ijolite	Madiany	66+	56+	X		X				
	100490G	Fe-carb	Madiany	66+	60+	X	X		X			
	100827G	alvik.	Madiany	66+	55+	X	X		X			Locations
	100832G	Fe-carb	Madiany	66+	55+	X			X			are not so
Ndiru	100838G	sovite	Madiany	66+	55+	X			X			accurate,
Hill	100846G	Fe-carb	Kendu Bay	67+	55+	X	X		X		X	as Area
	100850G	sovite	Kendu Bay	67+	54+	X			X			straddles
	100853G	alvik.	Kendu Bay	67+	54+	X	X		X			two map
	100873G	Fe-carb	Madiany	66+	54+	X						sheets
	100089G	min.op	Muhoroni	40+	79+	X		X				min.
	100094G	min.op	Muhoroni	40+	79+		X	X				=minera-
	100097G	min.op	Muhoroni	40+	79+		X	X			X	lized
	100099G	min.op	Muhoroni	40+	79+	X						op=outcrop
	101054G	min.op	Muhoroni	40+	79+	X						
Buru	101055G	min.op	Muhoroni	40+	79+		X	X			X	
Hill	101056G	min.op	Muhoroni	41+	79+	X		X				
	101061G	min.op	Muhoroni	40+	79+	X	X	X				
	101071G	min.op	Muhoroni	40+	79+	X	X	X				
	101075G	gneiss	Muhoroni	40+	79+	X		X				
	101079G	min.op	Muhoroni	40+	79+	X	X	X			X	
	101083G	min.op	Muhoroni	40+	79+			X				
	RN-401	black V	Muhoroni	40+	79+		X				X	
Legetet	99743G	nephel.	Lumbwa	50+	83+	X		X		X		
Hill	99759G	carb-tf	Lumbwa	52+	84+	X			X			gray
	101047G	carb-tf	Lumbwa	50+	84+	X			X			black
TOTAL NUMBER OF SAMPLES TESTED						52	15	21	22	5	11	

*1 Silicate rocks and mineralized materials: SiO_2, TiO_2, FeO, Fe_2O_3, MnO, MgO, CaO, K_2O, Na_2O, Al_2O_3, P_2O_5, H_2O+, LOI. (13 elements).

*2 Carbonatitic rocks: SiO_2, TiO_2, FeO, Fe_2O_3, MnO, MgO, CaO, K_2O, Na_2O, Al_2O_3, P_2O_5, H_2O+, LOI, CO_2(14)
U, Th, La, Ce, Nd, Sm, Eu, Gd, Tb, Tm, Yb, Lu(12 elements).
Nb, Sr, Y, Ba(4 elements).

*3 Sagarume: Sagarume-Nyamgurka. *4 Kuge: Kuge, Lwala. *5 Ngou: Ngou, Kwor.

*6 Soklo: Ugongo, Uyi, Kiyanya, Soklo.

NOTE: UTM Grid in the map sheet is used to indicate approximate location.
*e.g.: X=41+ in Muhoroni Map sheet indicates between 741 and 742.

APPENDIX-2 SUMMARY OF MICROSCOPICAL OBSERVATION--THIN SECTIONS

	Sample Number (Rock-type)	FELSIC MINERALS				MAFIC MINERALS					ALTERATION SILICATE MINERALS				MINERALS CHARACTERISTIC IN CARBONATITE					UNIDENTIFEID		REMARKS
		quartz calced	K-spar	plagio clase	feldspathoid	clino-pyrox	ortho-pyrox	hornb-lende	bio-tite	musco-vite	seri-cite	chlo-rite	zoi-cite	zeol-ite	Ti-min Zr-min	barite	fluo-rite	apat-ite	carbon ates	opaque minl	uniden tified	
REGIONAL SURVEY AREA	RN-126 (M.sch)	◎ 40%		◎ 30%					○ 15%	○ 15%					△ zircon			△				tourm. zircon
	RN-139 (ampsch)	△		◎ 50%				◎ 45%												magne?	brown	
	RN-230 (granit)	◎ 35%		◎ 35% perth.					+		△ 2ndary											
	RN-284 (Q-dior)	◎ 25%		◎ 60%				○ 10%			△ 2ndary	△ 2ndary	△ 2ndary					+	+ 2ndary	?		*tremolite with chlorite
	RP-79 (nephel)				○ 15% melili + nephel	+									+ perovs			+		○ 5% mag		
	RT-38 (nephel)				○ 15% melili	+						+			+ perovs					○ 5% mag ?		
	RT-46 (sovite)		+micr ocline									+						+	◎ 100%		yellow clay	calcite & dol?
	RT-77 (ss?)	◎ 85%									○ 10%									hemat?	brown	
	WR-108 (alv)															○10%		○<3%	◎70%	<20%		
	WR-122 (phono)		○10% sanid.		◎ 25% nephel	○15% aegir?									△ sph perovs							spinel
	WR-136 (ij)				◎ 50% nephel	◎ 30% aegir?								○ 5% natro?				○ 5%				spinel
RANGWA	40929E (CBbrec)										+				+ sph perovs				◎90%	△5% magne?	Hin(1)	garnet or spinel?
	RN-54 (ij)				◎30% melil ◎30% nephel				◎20%						○ 5% perovs			+		○10% magne?		
	RO-2 (alv)																		◎ 90%		Hin(2)	
SAGARUME	99685G (fentizd granite)	◎40%	◎40%	○15% ab-rich		△5% aegir																
	99712G (ij)		○		◎30% nephel	◎20% aegir ○ 5% augite	△5%			△2%								○	○10% calc.		xenoth ime?	◎20% spinel
	99729G (alv)	○5%	?								+					△		△	◎80% calc.			
S. RURI	99502G (FCB)																		◎70%	◎20% brown ○10%	AP? pr barite	
	100111G (FCB)		+ sanid?			◎30% aegir					+	+						○10%	◎60% calc.			
	100152G (sovite)	△5%											◎20% zoisit								K-spar ?	
N. RURI	99543G (alV)					◎15% aegir												△ 5%	◎ 65%	◎15% ?	MIN(1)	pyrochlore?
	100127G (sovite)					◎20% aegir												○ 10%	◎ 70%		biot?	
	100132G (ne-sye)		◎ 40% orthcl		◎ 40% nephel	◎30% aegir								○ 10% natro? & anal							natro? anal?	
KUGE	100051G (alv)																	+	◎ 90%	MIN-1 MIN-2	*	*barite?, xenotime?, sphene?
	100053G (FCB)														+ ruti polish	+ X-ray	+ X-ray		○ 10%	◎ 90% goeth	X-ray: maghem bar.fl	Polish:goe>pyr >hem>X
NGOU & SOKOLO	100389G (alv ?)										+							△ 5%	◎ 75%	○ 10%	○ 10% brown	
	100303G (fcb)											+						+	◎ 90%	△ 5%	brown flaky	
	100320G carb v.								+									△ 5%	◎ 85%	○ 10% brown		
	100323G (nephel)		◎ by X-ray		◎ 70% nephel	◎ 20% aegir			+										○<20%	○ 10%		
	100324G (sov)								○ 10%									○ 10%	◎ 80%		MIN(2)	spiner or garnet ?
HOHA HIN	99599G (fcb)														sphene ?				◎ 95%		MIN(2)	sphene ?
	99961G (massove Fe-ore)								?											◎ 70%	◎ 20%	Polish:mag>hem >UNKOWN-b
	100233G (ij)				◎ 65% nephel	○ 20% aegir + minor			+	+								+	+			○ 10% spinel
	100490G (fcb)										+	+						△<3%	◎ 50% dol>ca	◎ 50%	MIN(2)	spinel or garnet ?
NDIRU HILL	100827G (alv)									+		+						△<10%	◎ 70%	△ 5%		◎ 20%:brown matter. *MIN(2):spinel or gar *xenotime(?)
	100832G (fcb)														?=1% BaO= 1.62%				◎ 65% = A ◎ 20% = B	△ 5%		○ 10%:brown matter. * gamma-ray=2050cps
	100838G (SOV)								alt ?									△ 5%	◎ 95%			alt. biot.?
	100846G (fcb)															+		+	◎ 35% = A ◎ 35% = B	△ 5%		A:siderite or ankerite B:calcite? ◎: 30% Brown matter
	100850G (alv)																		◎ 90%			△: 5% Brown matter * colorless mineral * MIN(2):spinel or gar
	100853G (alv)															?< 3%		△<5%	◎ 80%			◎: 20% Brown matter * barite ?
	100873G (fcb)											+							◎ 80%	+ ◎ 30%		◎: 40%: Brown matter * MIN(2):spinel or gar
BURU HILL	100089G (ore)								△<10%							○ 10%	◎ 20%	+				◎: 40%:Reddish brown matter
	100099G (ore)	△<5%														◎ 30%				◎ 40%		◎: 30%:Yellow matter
	101054G (ore)	35% calced														△ <5%		△ <3%		◎ 30%		◎: 35%: Brown matter.
	101056G (ore)	◎ 70% +calcd															+	+		○ 10%		◎: 20%: Brown matter.
	101061G (ore)																? (30%)			◎ 20%		◎: 30%: Light brown matter-fluorite ?. ◎: 20%: Brown matter.
	101071G (ore)															(◎) BaO11%	◎ 30%	+		◎ 30% magnet		◎:10 ～20%: Vesicle. ○:10%: Brown matter.
	101075G (gneiss)	◎ 40%		◎ 20%							◎ 20%								+ <1%	+		
	101079G (ore)														△<3%	△ 5%	◎ 55%		△<3% dolom	○ 10% maghem		* bastnaesite & maghem identified by X-ray
LEGETET HILL	99743G (mela-ne-phelin)		+ sanid.		◎ 70% nephel ? in G.mass	◎ 25%								△<5% analc?	△ 5% perovs			+		○ 10%		* analcite ?
	99759G (cb-tf)																	△ 5%	◎ 90%	○ 10%		
	101047G (cb-tf)																		◎ 90%			○:10%: Brown matter.

◎ : abundant say≧20%. ○: say ≧10% △ say severa to 10% +: Minor amount

* Unidentified minerals : MIN(1)= Cubic, dark yellow. May be pyrocholore from X-tal form. MIN(2)= Cubic, colorless to pale yellowixh to greenich. May be spinel or garnet.

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS--1 REGIONAL SURVEY AREA-1

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major results of other tests and/or Remarks
				Opaque minerals	transparent min.	
RN-126	Mica schist	* Dark grey, compact and hard. * Schistose structure is conspicuous. * Quartz crystals predominate with some plagioclse. Mica crystals are agrranged parallel to schistosity plane.	* Quartz: Approx. 40%. Granular; 0.1-0.2mm. * Plagioclase: Approx. 30%. Granular; 0.1-0.2mm. * Muscovite: Approx. 15%. Flaky; 0.1-2mm. Some parts comprise aggregate of sericite. * Biotite: Approx. 15%. Flaky; 0.1-0.3mm. * Apatite: Minr amount: Euhedral to subhedral; <0.1mm. * Tourmaline : -. Euhedral to sub- h edral; <0.08mm. * Zircon : -. Euhedral; <0.04mm.			
RN-139	Amphibole schist	* Brownish due to limonite stain. Compact, hard. * Compositional bandings of hornblende and plagioclase occur alternately. * Schistosity is also observed. * Veinlets of opaque mineral crosscut the schistosity in places.	* Hornblende : Approx. 45%. Euhedral; long prismatic to acicular. Pleochroism; dark green to yellow. * Plagioclse : Appox. 50%. Granular ; 0.1mm. * Quartz : Minor amount.	* Magnetite?: 5% Euhedral to subhedral.	* Brownish min.: (secondary). microgranular and irregular, crosscutting schistosity.	
RN-230	Granite	* Pink colored, compact and hard. Medium grained. Mafic mineral is scarce. * Typically granitic both in texture and mineral composition. * Hand-specimen tested is penetrated by a fine grained greenish veinlet , which may possibly contain Fe-rich chlorite.	* Quartz : Approx. 35%. 0.5-1mm. * Perthite : Approx. 35%. 1-2mm. 2ndary sericite is scattered in some crystals. * Plagioclase: Approx. 30%. 0.5-1mm. * Biotite : Very small amount. * No mafic mineral other than biotite is observed.			
RN-284	Quartz-diorite	* Grey, compact, hard, medium grained. * Quartz is interstitial to the crystals of plagioclase and hornblende. * Peripheries of hornblende grains are fringed with tremolite(?) in places.	* Plagioclase: Approx. 60%. Euhedral granular; 0.5-2mm. A mumber of crystals are saussuritised to form sericite. * Hornblende : Apporox. 15%. Outlines are obscured by fibrous tremolite(?), though hornblende might have originally been euhedral. * Quartz: Approx. 25%. Anhedal, filling interstitially grain boundaries of Pl. &/or Hb. Myrmekite is formed in places. * Chlorite: Associated with tremolite. * Sericite: As altered product. * Apatite: Long prismatic. * Epidote & Zoisite: As Fine granular aggregate. * Carbonate: Very small amount & occurs in irregular aggregates.	* Opaque mineral ?		

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS--2 REGIONAL SURVEY AREA-2

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major results of other tests and /or Remarks
				Opaque minerals	transparent min.	
RP-79	Nephelinite	* Porphyritic with melilite and clinopyroxene phenocrysts.	PHENOCRYSTS * Melilite: Approx. 15%. Euhedral; 1-3mm. This occasioinally includes euhedral crystals of clinopyroxene of about 0.4mm long. * Nepheline: Small amount. Anhedral. * Clinopyroxene: Euhedral; 1-5mm. Colorless. c ∧ Z=ca. 50°. * Magnetite: Approx. 10%. Euhedral to subhedral up to 2mm. * Perovskite: Small amount. Euhedral to subhedral. Occurs as inclusions of melilite & nepheline+phenocrysts. * Apatite: Small amount. Long prismatic & as inclusions of melilite & nepheline. GROUNDMASS: 60%, with minor amount of secondary chlorite.			*K-Ar dating: 4.5±0.5MA *Bulk chemical analysis: SiO2=35.32%. Al2O3=6.48%. Total iron as Fe2O3=16.92%. CaO=18.31%. *NORM Plot: in field.
RT-38	Nephelinite	* Porphyritic with phenocrysts of melilite and opaque minerals. Similar to RP-79, but finer grained.	PHENOCRYSTS * Melilite: Approx. 15%. Euhedral; 0.2-1mm. * Clinopyroxene: Minor amount. 0.1-0.2mm. * Perovskite: Minor amount. Polysynthetic twinning is often observed. GROUNDMASS: 80%. 0.01mm. Probably consists of melilite, clinopyroxene and opaque minerals, with a minor amount of chlorite.	* Magnetite?: 5%. Cube; <0.05 mm. As phenocrsts as well as inclusions in melilite phenocrysts.		* K-Ar Dating: 14.4±0.8 MA. * Bulk chemical analysis: SiO2=34.58. Al2O3=8.72%. Fe2O3=15.01%.(Total) *NORM plot: in field.
RT-46	Sovite	* Holocrystalline. * Aggregate of coarse and fine grained carbonates with finer grained carbonate bandings of later stage. * Crystals of coarser grained brown carbonate include microcrystals of apatite and microcline.	* Carbonate(calcite?): Coarse grained(1mm). * Carbonate(dolomite?): Fine grained(0.1mm). * Carbonate: Comprises bandings. Total three types of cabonates=100% * Apatite: Minor amount. Granular; <0.2mm. * Chlorite: Fine grained. * Microcline: Anhedral; <0.2mm.		* Yellowish clay mineral(Fe-rich chlorite?): With green pleochroism.	
RT-77	Altered sandstone or rhyolitic tuff	* White, siliceous, compact and hard. Stained with hematite. * Aggregate of irregularly arranged equigranular fine quartz(0.1mm) with fine micaceous matters.	* Quartz: AppoX. 85%. Granular; 0.1-0.2mm. * Sericite(?): Approx. 10%.	* Opaque mineral (hematite?) :5% .Irregularly shaped.	* Brown mineral: Irregularly shaped, very fine grained. Scattered throughout	* Bulk chemical analysis SiO2=81.86%. Al2O3=10.35% K2O=2.32% * NORM plot: in "Quartz-rich granitoid" field.

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-3 REGIONAL SURVEY AREA-3

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	transparent min.	
WR-108	Alvikite (dyke facies)	* Stained with limonite. Light brown with dark brown irregular spots of goethite. Compact, hard, and fine-grained. * Aggregate of carbonate grains.	* Carbonate: Approx. 70%. Granulous; 0.1-0.5mm. * Barite : Apporx. 10%. Anhedral to subhedral ; <0.2mm. * Apatite : < 3%. Anhedral to subhedral.	* <20%. Filling interstitially carbonate grains		
WR-122	Phonolite (dyke facies)	* Greenish grey. porphyritic with large phenocrysts of alkaline feldspar(up to 10mm). * Compact , hard and fresh. * Phenocrysts; nepheline, sanidine, chromian diopside etc. * Flow structure is observed.	PHENOCRYSTS * Nepheline: Approx. 25%. Euhedral; <2mm. * Sanidine : Approx. 10%. Euhedral; up to 10mm. Optically (-). Twinning is observed. * Chromian diopside(aegirine?): Approx. 15%. Euhedral; <1-2mm. Optically biaxial(-). Some MIROPHENOCRYSTS * Spinel(Picotite): Brownish, anhedral to subhedral; <1.5mm. * Sphene: Subhedral to euhedral. * Perovskite: weakly brownish. Subhedral; <0.4 mm. High refractive indices. GROUNDMASS: 50%. Cryptocrystalline and may consist of nepheline and aegirine.			
WR-136	Ijolite	* Greenish grey and light brownish white. Coarse grained holocrystalline. Compact & hard. * Major constituent mieral is nepheline, associated with clinopyroxene(aegirine or chromian diopside).	* Nepheline: Approx. 50%. Subhedral to anhedral granular; 1-2mm. * Clinopyroxene(Aegirine): Approx. 30%. Euhedral to subhedral; 0.2-1.5mm. Pale green. Low birefringence, biaxial(-). c $\wedge$ z=30 ° $\pm$ * Spinel: Approx. 10%. Irregularly shaped, but some show hexagonal platy form; 0.1-0.3mm. Brownish to opaque. * Apatite: Appox. 5%. Granular or prismatic; <0.15mm. * Natrolite(?): Approx. 10%. Occurs as aggregates of very fine radiating crystals.			* Bulk assay , NORM plot in field. * K-Ar dating: 16.2 $\pm$0.8MA

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-4 SEMI-DETAILED SURVEY-(1) RANGWA

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	transparent minerals	
40929E	Carbonatite breccia	* Orange colored matrix with orange yellow breccia. Penetrated by reticular veinlets of green apatite and calcite.	* Carbonate: Approx.90%. Microgranular. * Opaque mineral(Magnetite): Approx.5%. Angular; 5mm. Brecciated fragments are filled with carbonate. * Perovskite: Approx.1%. Euhedral to subhedral or irregular in places;<0.7mm. Twinning is prominent. Browninsh, very high indices with low birefringence. * Sphene: Minor amount. Euhedral and fine. * Phengitic mica * Apatite: Not discernible in this section.	* Possible magnetite: As it is strongly magnetic. See left column.	* Mineral-(2) : Minor amount. <0.2mm. colorless. Cubic. High index. Garnet or spinel(?) * Mineral-(1) : Minor amount. Subhedral to Euhedral;<0.2mm Dark yellow & Cubic. Pyrochlore(?)	
RN-54	Ijolite	* Dark grey, compact and hard. Equigranular, holocrystalline and coarse. * Major consitituent minerals are melilite, nepheline and biotite, with fairly abundant magnetite and a small amount of perovskite. * Micaceous fine grained mineral is formed as a reaction rim at the contact between biotite and melilite or nepheline.	* Melilite: Approx.30%. 0.2-2mm. Yellowish. * Nepheline: Approx.30%. 0.2-2mm. Colorless. * Reaction rim: Approx. 5%. Fibrous. * Biotite: Approx.20%. 1-2mm. * Magnetite: Approx.10%. Perovsikite is formed surounding magnetite crystals. * Perovskite: Approx.5%. Hexaganal form. Polysynthetic twinning is prominet. * Apatite: Minor amounts. Euhedral. Twinning is observed, and cleavage is clear.			* Bulk assay. SiO2= 33.06% Al2O3=12.33% Total iron as Fe2O3=9.16% Na2O= 4.87% K2O= 3.25% * NORM plot in ____ field
RO-2	Alvikite	* Light brown, fine grained, compact and hard. * Dark brown long prismatic to irregularly shaped phenocrysts are arranged in a direction.	* Carbonate: Approx.90%. Granular; 0.1mm.	* Brown colored matter: Approx. 90%. Irregularly shaped, flaky in places, filling interstitially grain boundaries of carbonate.	* Prismatic colorless mineral in the brown colored matter. cf. Left column. Elongation positive. * Mineral-(2)(Spinel or garnet): Minor amount. Euhedral to subhedral;0.08-0.4mm Isotropic.	* Bulk assay Total Fe2O3=2.80% P2O5=1.88% La= 470ppm Ce=1200ppm Nd= 590ppm

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-5 SEMI-DETAILED SURVEY-(2) SAGARUME

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major results of other tests and /or Remarks
				Opaque minerals	transparent min.	
99685G	Fenitized granite	* Light grey to yellowish white with feldspar crystals up to 5mm. Penetrated by closely spaced reticular veinlets of aegirine. * Rich in quartz and K-spar. Quartz occurs in two groups in size;coarser and finer. K-spar occurs as coarse grains. * Micropegmatitic(graphic) texture by K-spar, quartz, and plagioclase is often observed. * Aegirine occurs as veinlets and filling interstitially grain boundaries of minerals mentioned above.	* Quartz: Approx. 40%. 0.1-0.2mm up to 1-2mm. * K-spar: Approx. 40%. Up to 5mm. * Plagioclase: Approx. 15%. Albite-molecule rich, as refrative indices are lower than quartz. Polysynthetic twinning is prominet. * Aegirine: Approx. 5%. Aggregate of microcrystals filling interstitially or forming veinlets, implying its secondary origin.			* Bulk assay SiO2= 73.71% Al2O3= 12.18% Total iron as Fe2O3= 2.78% CaO= 0.71% Na2O= 4.24% K2O= 5.69% * NORM plot in _____ field.
99712G	Ijolite	* In this thin section, mineral composition is fairly different in upper and lower halves; In the upper, large crystals of aegirine and nepheline are interstitially filled with carbonate, whereas in the lower only nepheline and spinel are present.	* Aegirine: Approx. 20%. Euhedral; up to 6mm. * Augite: Approx. 5%. Subhedral. * Orthopyroxene: Approx. 5%. Anhedral. * Muscovite: Approx. 2%. * Nepheline: Approx. 30%. Subhedral; 3-4mm. * Orthoclase: Approx. Subhedral; up to 4mm. * Calcite: Approx. 10%. Anhedral; 1-2mm. * Apatite: Abundant. Euhedral rounded. * Spinel(chromite or picotite): Approx. 20%. Subhedral to euhedral; 1-7mm.		* Xenotime(?) or sphene(?): Uniaxial. Not identified by X-ray diffraction.	* K-Ar dating: 25.8±1.3 MA * Bulk assay: SiO2= 39.23% Al2O3= 17.32% Total iron as Fe2O3= 6.65% MgO= 1.95% CaO= 15.81% NaO= 8.46% K2O= 3.49% * NORM plot in _____ field
99729G	Alvikite	* * Aggregate of coarse grained angular carbonate crystals, being interstitially filled with an opaque mineral and K-spar. * Euhedral quartz crystals are fringed with carbonate in places.	* Calcite: 80%. Euhedral rectangular to granular; Approx. 1mm. * Quartz: Approx. 5%. Fine grained; 0.3-0.7m. * Phengitic mica: Minor amount. * Barite: Minor amount. Anhedral. Associated with possible K-spar. * Apatite: The same as barite.	* Opaque mineral: Approx. 10%. Irregular, some show radiating needle-like feature.	* K-spar(?): Approx. 5%. Euhedral. Some occur as veinlets. Associated with barite and apatite. Not identifed by X-ray diffract.	* Bulk assay & minor elements analysis Nb= 490ppm Y= 210 La= 829 Ce=2110 Nd=1180 Sm= 244.5 Eu= 37.2

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-6 SEMI-DETAILED SURVEY-(3) S. Ruri

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major results of other tests and /or Remarks
				Opaque minerals	transparent min.	
99502G	Ferro-carbonatite (dyke facies)	* Aggregate of fine-grained carbonate and very fine black to brown opaque minerals.	* Carbonate: Approx.70%. Aggregate of fine-grained crystals.	* Brown matter: Approx.20%. Weathered product. * Black matter: Approx.10%. Filling interstitially.	* Apatite(?) and /or barite(?): <3%. High refractive indices.	* Polished section Goethite and two unidentified minerals.
100111G	Sovite or Ferrocarbonatite	* Aggregate of coarse- and fine-grained carbonate,and euhedral aegirine crystals. * Finer carbonate grains fairly predominates, but the texture is not porphyritic.	* Calcite: Approx.60%. Granular;irregular in size ranging 0.1-2mm. * Aegirine: Approx.30%. Euhedral; 2-3mm. * Apatite: Approx.10%. Granular; 0.1mm±. * Chlorite and mica: Minor amounts. * Orthoclase(sanidine?): Minor amount; Up to 0.9mm. Twinning is discernible.			* X-ray diffraction * Calcite: abundant * Carbonate-hydroxyl-apatite: scarce. * Maghemite: scarce. * No aegirine is identified in the tested sample. * Bulk assay and minor elements analysis SiO2= 17.83% Al2O3= 5.24% Fe2O3= 9.79% MgO= 1.41% CaO= 30.01% Nb and REEs are low.
100152G	Sovite	* Coarse-grained equigranular.*	* Carbonate(Mostly calcite): Approx.60%.Granular; 2-3mm. * Zoisite: Approx.20%. Euhedral;2-6mm. Colorless. High refractive indices & low birefringence. Biaxial(+) and small 2V.Elongation (-). * Quartz: Approx.5%. Filling interstices of large crystal grains of other minerals.		* K-spar(?): Approx.15%. 4mm. Very clear without dusty inclusions and resembles nepheline.	* X-ray diffraction Calcite: abundant Quartz: moderate Epidote: scarce No K-spar identified * Bulk assay and minor elements analysis SiO2= 36.14% Al2O3= 3.98% CaO= 33.02% Na2O= 0.19% K2O= <0.01% All REEs<5ppm

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-7 SEMI-DETAILED SURVEY-(4) N. RURI

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major results of other tests and /or Remarks
				Opaque minerals	transparent min.	
99543G	Alvikite	* Fine to medium grained. * Comprises carbonate that ranges from 0.1 to 0.2mm. Contains a small amount of apatite and altered aegirine.	* Carbonate: Approx.65%. Granular;0.1-0.2mm. * Apatite: Approx.5%. Long prismatic. Contans a fair amount of inclusion. * Aegirine: Approx.15%. Euhedral to subhedral; 2mm ±. Altered into brown to yellowish mineral with high birefringence and elongation positive.	* ?: Approx.15%. Hexagonal shaped ;0.5-2mm.	* Aegirine(?) * Mineral-1(Pyrochlore?): a small amount; <0.15mm. High refractive indices and cubic.	* Bulk assay and minor element analysis SiO2= 2.30% Total iron as Fe2O3= 8.95% CaO= 45.90% Nb= 1090ppm U= 130ppm Th= 140ppm
100127G	Sovite	* Comprises coarse-grained granular carbonate and euhedral aegirine phenocrysts with a minor amount of apatite.	* Carbonate: Approx.70%. Granular;0.5-3mm. * Aegirine: Approx.20%. Euhedral; 1-6mm. * Apatite: Approx. 10%. Long prismatic;<0.5mm.		* Biotite(?):	* Bulk assay and minor element analysis SiO2= 3.61% CaO= 49.88% Sr= 6390ppm
100132G	Nepheline Syenite	* Porphyritic with phenocrysts of nepheline, orthoclase, and aegirine. Groundmass consists of fine grains(0.1-0.2mm) of nepheline, aegirine and needle-like unkown mineral that fills interstitially.	PHENOCRYSTS * Nepheline: Approx.40%. Euhedral;1-1.5mm. Some include carbonate and a minor amount of aegirine, sphene and zircon at the core. * Orthoclase: Aprrox.20%. Euhedral;<2mm. * Aegirine: Approx. 30%. Euhedral;1-0.5mm. GROUNDMASS * Holocrystalline microgranular;consists of nepheline, aegirine, natrolite(?), analcite(?) and cancrinite(?).		* Clinopyroxene (chromian diopside?): Green. * Natrolite(?): Approx. 10%. Acicular;very fine. Colorless. High birefringence, straight extinction and optically positive. * Analcite(?): Minor.<5% Euhedral and isotropic. Colorless. * Cancrinite(?): As altered product.	* Bulk assay SiO2= 47.58% Al2O3= 17.16% Total iron as Fe2O3= 8.22% CaO= 5.52% Na2O= 8.48% K2O= 7.05% * NORM plot in _____ field.

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-8 SEMI-DETAILED SURVEY-(5) KUGE & NGOU

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major results of other tests and /or Remarks
				Opaque minerals	transparent min.	
100051G (Kuge)	Alvikite	* Banded * Anhedral carbonate fills interstices of euhedral rhombic grains of carbonate.	* Carbonate: Approx.90%. Euhdral showing rhombic outline;0.3-1mm. Some are anhedral filling interstices of the former;0.2-0.3mm. * Apatite: Very minor amount in irregular form	* Opaque min-1 : (Granular) * Opaque min-2 : (Acicular radiating): Total 5%	* Barite(?): Irregular;minor amount. * Xenotime(?) or sphene(?): Scattered;0.01-0.05 mm.High indices	* Bulk assay and minor element analysis SiO2= 1.57% CaO= 52.69% Nb= 715ppm Y= 185ppm La= 434ppm Ce= 909ppm
100053G (Kuge)	Ferrocarbonatite	* Aggregate of euhedral opaque mineral,being filled intersitially by carbonate.	* Opaque mineral: Approx.90%. Euhedral,rectangular to rhombic;0.1-0.5mm. Some part seems to be goethite. * Carbonate: Approx.10%. Micogranular filling interstices of opaque mineral grains.	* Opaque mineral See left column and X-ray,polish and chemical analysis results	* Apatite(?): Anhedral fine-grained. Colorless	* Gamma-ray: 9355cps * Polished section: goethite>pyrochlore>hematite>unkown-i>unknown-j>rutile. * X-ray diffraction: calcite,barite,fluorite maghemite,hematite * Bulk assay and minor element analysis: Fe2O3= 51.01% CaO= 13.48% MnO= 9.30% BaO= 3.20% Y= 240ppm Th= 2357ppm Sm= 283ppm Eu= 74.9ppm
100389G (Ngou)	Alvikite (lava?)	* Shows a unique texture similar to"intersertal"of andesitic rocks.	* Carbonate: Approx.75%.Lath-shaped or granular;0.1-0.3mm. * Apatite: Approx.5%. Granular or long prismatic;0.1-0.2mm. * Phengitic maica: A minor amount;0.5-1.0mm.	* Opaque min.: Approx.10%. 0.1-0.2mm.	* Brown matter: Approx.10%.	* Bulk assay and minor element analysis: SiO2= 4.07% Fe2O3= 3.53% CaO= 50.96% P2O5= 1.76% Nb= 225ppm Y= 77ppm La= 270ppm Ce= 450ppm Nd= 200ppm

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-9 SEMI-DETAILED SURVEY-(6) SOKLO

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major results of other tests and /or Remarks
				Opaque minerals	transparent min.	
100303G	Fine ferro-carbonatite	* Aggregate of equigranular fine-grained carbonate. Fine opaque mineral and brown matter occur interstitially. Some "eye-like" carbonate grains of 2-3mm are observed in places.	* Carbonate: Approx.90%. Granular;0.1mm. * Apatite: Minor amount. * Chlorite:	* Opaque min.: Approx.5%.	* Brown flaky matter: Approx. 5%.Brown to dark brown;0.01mm±. May include some chlorite.	* Bulk assay and minor elements analysis SiO2= 14.90% Fe2O3= 6.89% CaO= 34.23% P2O5= 1.86%
100320G	Carbonate vein in sovite(2-7mm)	* Aggregate of carbonate granules of 0.1-0.2mm Brown mineral occurs along grain boundaries of carbonate. Apatite veinlets are observed in places.	* Calcite: Approx.85%. Granular;0.1-0.2mm. * Apatite: Approx.5%. 0.1-0.2mm. Low birefringence. * Biotite: Very minor amount. Euhedral,hexagonal platy;<0.1mm.		* Brown mineral: Approx.10%.	* Gamma-ray radiation: 2213cps * X-ray diffraction: cacite:abundant carbonate-hydroxyl apatite: scarce * Polished section: Unkown-e and -j>>magnetite
100323G	Fenitized rock or nephelinite	* Porphyritic with eye-like nepheline phenocrysts of about 1mm. Groundmass is fine grained holocrystalline.	* Nepheline: Approx.70%.Euhedral to subhedral; 0.5-1.0mm. * Aegirine: Approx.20%. Irregular aggregates of fine granules of about 0.01mm. * Biotite: Very small amount. * Carbonate: <20%. Irregular shaped;veinlets of <0.1mm and granules of 0.1-0.4mm. Both are associated with aegirine and fill interstices of nepheline crystals.	* Amorphous matter: Approx.10%. microgranules filling interstitially. Limonite(?)		* X-ray diffraction: calcite and K-spar are abundant. * Bulk assay: SiO2= 48.33% Al2O3= 12.15% Fe2O3= 6.49% Na2= 2.55% K2O= 10.55% * NORM plot in _____ field
100324G	Biotite-sovite	* Coarse grained carbonatite with large crystals of biotite and some round apatite.	* Carbonate: Approx.80%. Granular ;1-2mm up to 2-6mm in places. * Biotite: Approx.10%. Sometimes reaches 8mm. * Apatite: Approx.10%. Rounded granular ;0.1-0.5mm.		* Mineral-2 (spinel or garnet ?): Approx.<1 %.Subhedral to euhedral;0.1-0.2 mm.	

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-10 SEMI-DETAILED SURVEY-(7) HOMA MTN.

Sample Number	Rock type	Macrosopical features and microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	transparent min.	
99599G	Ferrocarbonatite	* Aggregate of rounded granules of carbonate with opaque matter filling interstitially.	* Carbonate: Approx.95%. Rounded granulous;0.4-1.0mm.	* Opaque mineral :Approx.5%. Irregular shaped.	* Mineral-2(spinel or garnet?): Approx.<3%.0.1-0.5mm. Cubic. * Sphene(?): Minor amount.High birefringence * Acicular crystal:Colorless.	* Bulk assay and minor elements analysis: Fe2O3= 6.60% CaO= 43.98% La= 1017ppm Ce= 1964ppm Nd= 766ppm
99961G	Massive iron ore	* Black, massive.compact and hard with strong magnetism. * Almost all the part consists of opaque mineral. Dark reddish brown mineral is observed in places. A minor amount of possible biotite(?) also observed occasionally.		* Opaque mineral (magnetite): Approx.70%.	* Reddish brown mineral:Approx. 20%. Irregular shaped. * Biotite(?): Approx.10%	* Polished section: magnetite>hematite>unknown mineral-b
100233G	Ijolite	* Coarse-grained plutonic rock with euhedral nepheline.anhedral to subhedral aegirine, and other minerals. A small amount of carbonate also obseved.	* Nepheline: Approx.65%. Euhedral;5-10mm. * Aegirine: Approx.20%. Subhedral to anhedral; 5-10mm. Contains biotite inclusions.Green. * Clinopyroxene: A minor amount. Colorless.Biaxial(+).small 2V, oblique extinction,elongation negaive. * Spinel: Approx.10%. Anhedral;2-5mm.Brown,zoning observed. * Carbonat: Minor amount and interstitil. * Muscovit: Minor amount. * Biotite: Minor amount of microcrystals as inclusions in aegirine sites. * Apatite: Minor amount. Rounded long prismatic euhedral. As inclusions of larger phenocrysts.	* Opaque mineral		* Bulk assay: SiO2= 40.11% Al2O3= 19.50% Fe2O3= 5.46% MgO= 1.92% CaO= 12.95% Na2O= 9.58% K2O= 5.08% * NORM plot in _____ field
100490G	Ferrocarbonatite rich in hematite	* Aggregate of carbonate and opaque matter with minor amount of possible apatite in places.	* Dolomite>>calcite: Approx.50%. Small euhedral and large enhedral. * Apatite: Approx.<3%. 0.1mm. Colorless. * Mica(phengic): Approx.<1%. 0.03mm. * Chlorite: Approx. <1%.	* Opaque mineral : Approx.50%. Irregular and amorphous.	* Mineral-2 (Spinel or garnet?):<1%. Euhedral;0.03-0.08mm. Cubic with high index. Colorless	* Polished section: magnetite>hematite>>unknown-j. * Bulk assay and minor elements analysis: Fe2O3= 19.67% MgO= 11.71% CaO= 24.71% Nb=2200ppm, Y= 170ppm La= 880ppm. Ce=1804ppm Sm= 88.4ppm. Eu= 24.5ppm

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-11 SEMI-DETAILED SURVEY-(8)NDIRU HILL-1

Sample Number	Rock type	Macrosopical feature/ microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	Transparent min.	
100827G	Alvikite with black unidentified mineral	* Stained with limonite to brown. Irregular black specks. * Comosed of mostly fine-grained rounded carbonate. * Irregular shaped brown matter and opaque mineral occur interstitially. * Transparent matter(apatite) fills interstices of all these mentioned above.	* Calcite: Approx. 70%. Rounded granules; 0.02mm * Apatite: Apoprox. <10%. Irregular shaped; very fine-grained. Filling interstitially calcite and other matters. * Chlorite and mica: Minor amount.	* Opaque mineral: Approx. 5%. Irregular shaped; micro-granules.	* Brown matter: Approx. 20%. Irregular shaped; micro-granules. * Mineral-2(spinel or garnet?): Euhedral to subhedral; 0.05-0.1mm. Often with a round hole at core. Yellowish green. * Xenotime(?): Very high index & birefringence. Elongation (+). 0.1mm	* Gamma-ray radiation: 1400cps at the site of sampling. *Polished section: Two unidentified minerals are observed. * Bulk assay and minor elements analysis: Fe2O3= 4.21% (total iron) CaO= 47.02% P2O5= 4.21% BaO= 1.07% Nb= 550ppm La= 470ppm Y = 180ppm Ce= 810ppm Th= 290ppm Nd= 430ppm Gd= 200ppm
100832G	Ferrocarbonatite with black unidentified mineral	* Dark brown to black; penetrated by white calcite veinlets. Black spots possibly after magnetite are abundantly occur. * Composed of fine-grained carbonate of two types. One is euhedral to subhedral, showing angular to rhombic shapes. Another is anhedral, filling interstitially grain boundaries of the former.	* Carbonate A: Approx. 65%. Euhedral, rectangular to rhombic in shape; 0.2mm. Colorless & contains abndant inclusions. * Carbonate B: Approx. 20%. Anhedral; Very fine. Colorless, but contains less inclusion & clear	* Opaque mineral: Approx. 5%. Irregular shaped; 0.02mm.	* Brown matter: Approx. 10%. Irregular shaped. Concentrated along grain boundaries of carbonate. grains. * Barite(?): Approx. 1%. Anhedral. Colorless.	* Gamma-ray radiation: 2050cps at the sampling site. * Bulk assay and minor elements analysis: Fe2O3= 8.32% (total iron) CaO= 45.21% P2O5= 0.22% BaO= 1.62% Nb= 240ppm La=1200ppm Y = 67ppm Ce=1700ppm Th= 290ppm Nd= 330ppm Gd= <50ppm
100838G	Sovite with dark grey to black veinlets	* Light brownish, penetrated by dark grey veinlets./ * Coarse grained carbonate crystals are surrounded by altered biotite(?).	* Carbonate: Approx. 95%. Granular ; 2-10mm. * Apatite: Approx. 5%. Granular ; 0.1mm. With abundant inclusions, especially at the core of a crystal.		* Altered biotite (?): Surrounding carbonate grains.	* Gamma-ray radiation: 2400cps at the sampling site. * Bulk assay and minor elements analysis: Fe2O3= 3.67% (total iron) CaO= 49.44% P2O5= 1.54% BaO= 0.41% Nb= 65ppm La= 280ppm Y = 81ppm Ce= 570ppm Th= 56ppm Nd= 130ppm

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-12 SEMI-DETAILED SURVEY-(9)NDIRU HILL-2

Sample Number	Rock type	Macrosopical feature/ microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	Transparent min.	
100846G	Rare-earths-Nb bearing ferro-carbonatite with barite and hematite	* Brown colored weathered rock ;stained with limonite and dustered with a fine dark mineral. * Composed of brown euhedral (rectangular) carbonate and colorless carbonate that fills interstially the grains of the former. Grains of an euhedral colorless mineral(possibly barite) are scattered throughout.	* Carbonate-1: Approx.35%. Euhedral, rectangular; 0.1mm±. Siderite or ankerite(?). * Carbonate-2: Approx.30%. * Barite: Small amount. Anhedral. Low birefringence. As veinlets in places. * Apatite:	* Opaque mineral: Approx.5%. Scattered throughout.	* Brown matter: Approx.30%.Irregularly filling interstices of carbonate grains.	* Gamma-ray radiation: 6800cps at the sampling site, which is the highest in this prospect. * X-ray diffraction:Calcite;abundant . Barite and hematite;scarce * Polished section: hematite>>unidentified-a and -b. * Bulk assay and minor elements analysis: Fe2O3= 12.90% P2O5= 0.26% CaO= 39.33% BaO= 1.52% Nb= 310ppm Th= 410ppm Nd= 1100ppm Y= 185ppm La= 3200ppm Sm= 170ppm U= 26ppm Ce= 4800ppm Gd= 680ppm
100850G	Sovite or alvikite?	* Moderately stained with limonite to brownish color. * Seams and veinlets of carbonate and limonite occur./ * Aggregate of fine grained carbonate, being filled interstitially by brown matter and / or micrograins of colorless minereal.	* Carbonate: Approx.90%. Subhedral;0.1-1.0mm. Abundantly contains very fine inclusions.		* Brown matter: Approx.5%. Ore mineral? * Colorless min.: Approx. 5%. <0.1mm. Low birefringence and resembles nepheline. * Mineral-2(spinel or garnet?): <1%. Euhedral;0.1-0.2 mm. Isotropic and high refractive index.	* Gamma-ray radiation: 1287 cps at the site of sampling. * Bulk assay and minor elements analysis: Fe2O3= 4.66% P2O5= 0.37% CaO=51.54% BaO= 0.17% Nb= 450ppm Th= 130ppm Nd= 130ppm Y= 87ppm La= 250ppm Sm= 31ppm U= 19ppm Ce= 550ppm Gd= <50ppm
100853G	Alvikite	* Brownish grey, fine grained. * Aggregate of carbonate of about 0.1mm; containing abundantly irregular shaped brown matter. Coarse carbonate crystals of about 2mm occur as veinlets or bandings.	* Carbonate: Approx.80%. Equigranular;<0.1mm. Coarser grained(up to 2mm) one in veinlets. * Apatite: Approx.<5%. Irregular shaped.		* Brown matter: Approx.20% Irregular shaped. Partly opaque. * Barite(?): <3%.	* Gamma-ray radiation: 1300cps at the sampling site. * Bulk assay and minor elements analysis: Fe2O3= 2.04% P2O5= 0.49% CaO=53.52% BaO= 1.12% Nb= 105ppm Th= 130ppm Nd= 640ppm Y= 300ppm La=1000ppm Sm= 140ppm U= <1ppm Ce=2000ppm Gd= <50ppm

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-13 SEMI-DETAILED SURVEY(10) NDIRU & BURU

Sample Number	Rock type	Macrosopical feature/ microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	Transparent min.	
100873G (Ndiru Hill)	Alvikite or ferrocarbonatite	* Moderately limonite-stained orange-brown, compact rock. / * Composed of fine carboate with veinlets of coarser carbonate crystals. Very fine brown matter is widely scattered throughout.	* Carbonate: Approx. 60%. Anhedral; Mostly fine grained, but coarser one occurs in veinlets. * Chlorite: Minor amount. Scattered as aggregates of microcrystals. Colorless.	* Opaque mineral: Minor amount	* Brown matter: Approx. 40%. Dusty microgranules, some parts are yellowish. * Mineral-2(spinel or garnet?): Isotropic with high refractive index. Shows shagreen texture.	* Gamma-ray radiation: 3000 cps at the sampling site.
Buru Hill 100089G	Weathered, limonitized ore (Rare-earths bearing barite-fluorite-goethite-hematite-magnetite ore)	* Orange brown, comparct, hard rock with abundant irregular network veinlets and dissemination of magnetite and its derivatives. /	* Fluorite: Approx. 20%. Occurs filling interstices of grain boundaries of opaque minerals and reddish brown matter. * Barite: Approx. 10%. Micogranulous. * Apatite: Only a grain is observed. Cleavage is developed and finely fragmented. Colorless * Biotite: <10%. Yellow to dark green.	* Opaque mineral: Approx. 30%.	* Reddish brown matter: Approx. 40% Irregularly rounded ones are predominant.	* Gamma-ray radiation: 2602 cps at the sampling site. * Magnetic susceptibility: 31.18 10-3 SIU at the sampling site. * Bulk assay: SiO2 : 4.83% P2O5: 0.34% Fe2O3: 13.49% MnO : 2.99% CaO : 43.46 BaO : 3.40% * Minor elements(in ppm): Nb: 810 La: 13520 Sm: 260 Y : 560 Ce: 16700 Eu: 63 Th: 400 Nd: 2700
100099G	Weathered, limonitized ore (Rare-earths bearing quartz-barite-goethite rock)	* Dark brownish grey. Flow or foliation structure with angular fragments. Altered gneiss? * Comprises opaque and yellow matters with colorless minerals filling interstitially.	* Barite: Approx. 30%. Filling interstices of other minerals and as veins ; Fine <1mm. Colorless. Quartz: Approx. <5%.	* Opaque mineral: Approx. 40%. Irregularly shaped.	* Yellow matter: Approx. 30%. Irregular shaped aggregates; cryptocrystalline to amorphous.	* Gamma-ray radiation: 7606 cps at the sampling site. * Magnetic susceptibility: 0.37 10-3 SIU at the sampling site. Nb= 680 Y=480 Th=530 La=8330 Ce=12300 Nd=2000 Sm=200 Eu=52
101054G	Weathered, limonitized ore (Rare-earths bearing chalcedony-barite-goethite rock)	* Grey-brown with fragments. / * Euhedral crystals of an opaque mineral are surrounded by brown amorphous matter, and acicular radiating chalcedony that fills interstices.	* Chacedony: Approx. 35%. Radiating aggregates. Elongation (-). Straight extinction. * Barite: APPROX. <5%. Anhedral to subhedral. * Apatite: Approx. <3%. Anhedral and colorless.	* Opaque mineral: Approx. 30%. Euhedral; 0.1mm.	* Brown matter: Approx. 35%. Irregular shaped microcystalline aggregates.	* Gamma-ray radiation: 3100 cps at the sampling site. * Magnetic susceptibility: 2.70 10-3 SIU at the sampling site. Nb=1410 Y=670 Th=100 La=8920 Ce=12300 Nd=1100 Sm= 85 Eu=23

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-14 SEMI-DETAILED SURVEY-(11) BURU HILL-2

Sample Number	Rock type	Macrosopical feature/ microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	Transparent min.	
101056G	Weakly weathered Bastnaesite(?)-bearing siliceous rock(?) (as high La-Ce with low P2O5)	* Light brown, siliceous. Penetrated by chalcedonic quartz veinltes and disseminated with black minerals./ * Aggregate of fine-grained minerals with amorphous brown matter and an opaque mineral. * The latter two occur both as interstitial filler and veinlets. * Quartz seems to be secondary origin.	* Quartz: Approx. 70%. Fine grained(<0.1mm) and some as veinlets. * Chalcedony + opal: Small amount. Acicular radiating crystals associated with quartz veinlets. Pale brownish, elongation(-). * Apatite: Small amount. Some occur as rounded crystals. * Fluorite: Small amount. Isotropic.	* Opaque mineral: Approx. 10%. Irregular; microgranular	* Brown matter: Approx. 20%. Irregular; microgranular	* Gamma-ray radiation: 3174 cps at the sampling site. * Magnetic susceptibility: 1.01 10-3 SIU at the sampling site. * Bulk assay: SiO2 :54.82% P2O5: 0.58% Fe2O3: 8.35% MnO : 0.57% CaO :15.02% BaO : 4.87% * Minor elements(in ppm): Nb: 240 La: 8990 Sm: 53 Y : 210 Ce: 4800 Eu: 14 Th: <40 Nd: 5900
101061G	Moderately weathered, limonitized ore	* Light yellow, stained to reddish brown to purple. * Penetrated by magnetite and/ or hematite veinlets and disseminated by the same./ * Interstices of opaque mineral-grains are filled by amorphous matter. No carbonate is discernible.	* Colorless vesicules(?): Approx. 30%. Circular; 0.1-0.3mm.	* Opaque mineral: Approx. 20%. Some grains are euhedral; 0.2-0.4mm. * Minor elements(in ppm): Nb:1355 Y : 610 Th: 300 La:1200	*Pale brown matter (Fluorite?): Approx 30%. Irregular; Microgranular to cryptocrystalline * Brown matter: Approx. 20%. Irregular; microgranular.	* Gamma-ray radiation: 4362 cps at the sampling site. * Magnetic susceptibility: 1.26 10-3 SIU at the sampling site. * Polished sections: magnetite>unidentified-d>-a>-g>>-e * Bulk assay: SiO2 : 1.98% P2O5:12.36% Fe2O3:46.78% MnO : 3.16% CaO :20.82% BaO : 1.29% Ce:1700 Nd:500 Sm: 93 Eu:28
101071G	Gold-pyrochlore-fluorite-barite bearing massive magnetite ore	* Black, compact and hard. * Highest magnetic susceptibility and lowest gamma-ray readings in this prospect. * Aggregate of fine grained opaque mineral(magnetite) and irregular shaped amorphous(?) matter, being filled interstitially by fluorite and barite.	* Fluorite: Approx. 30%. Interstitially filling spaces around magnetite and brown matter; microgranulous, including apatite and barite * Barite: Only identified as inclusion in fluorite sites. However, more should be present, being judged from assay result. * Apatite: Occurs as inclusion in fluorite sites. * Vesicles: Approx. 10-20%.	* Opaque mineral (Magnetite): Approx. 30%. From the high magnetic susceptibility and observation of polished section, most of the opaque part are to be magnetite.	* Brown matter: Approx. 10%. Irregularly shaped. Barite might be hidden in this matter(?).	* Gamma-ray radiation: 997cps at the sampling site. * Magnetic susceptibility: 181 10-3 SIU at the sampling site. * Polished sections: magnetite>>pyrochlore>unidentified-a>-c>electrum * Bulk assay: SiO2 : 2.53% P2O5: 0.52% Fe2O3:49.42% MnO : 1.85% CaO :17.33% BaO :10.63% * Minor elements(in ppm): Nb: 1070 La: 3300 Sm: 120 Y : 280 Ce: 5600 Eu: 25 Th: 350 Nd: 1600

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-15 SEMI-DETAILED SURVEY-(12) BURU HILL-3

Sample Number	Rock type	Macrosopical feature/ microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	Transparent min.	
101075G	Altered gneiss	* Greyish white and gneissose with dark colored banding. Fairly sheared. * Very fine opaque mineral and colorless minerals occur showing a banding structure * Some albitic porphyroclasts are present. * Carbonate is very little.	* Quartz: Approx. 40%. Fine -grained. * Sericite: Approx. 20%. Microgranulous. * Plagioclase: Approx. 20%. Euhedral, rectangular; 0.5mm. No zoning is observed. Polysynthetic twinning is prominent. * Carbonate: <1%. Irregular. May be secondary.	* Opaque mineral: Forms compositinal bands with sericite. * Minor elements(in ppm): Nb: 515 La: 430 Sm: 54 Y : 150 Ce: 530 Eu: 19 Th: 380 Nd: 250		* Gamma-ray radiation: 2409 cps at the samplin site. * Magnetic susceptibility: 0.04 10-3 SIU at the sampling site. * Bulk assay: SiO2 :60.79% K2O : 9.68% Fe2O3: 6.58% TiO2: 0.38% CaO : 1.40% BaO : 1.01% * NORM plot in Qz-Or-(Ab-An): In Quartz syenite field close to Granite field.
101079G	Weathere, limonitized ore Maghemite-magnetite-goethite-fluorite-barite-bastnaesite ore	* Dark brown- yellowish white mixture. Rough surfaced and relatively porous. * Penetrated by abundant goethite veihlets. * Macroscopically intergrowth of transluecent yellowish white mineral and transparent greyish white mineral is observed.	* Fluorite: Approx. 55%. Irregularly shaped; fine-grained. Contains microcrystals of unitdentified mineral. * Barite: Approx. 5%. Some are radiating. Clear crystals with cleavage and without twinning and zoning. Low birefringence and possibly biaxial (+). * Apatite: <3%. Anhdra to subhedral long prismatic; very fine. * Vesicle: Approx. 30%. * Dolomite: <3%. Irregularly shaped secondary mineral.	* Opaque mineral Approx. 10%. Irregularly shaped. Mircrogranuous.		* Gamma-ray radiation: 6126cps at the sampling site. * Magnetic susceptibility: 0.16 10-3 SIU at the sampling site. * X-ray diffraction: Fluorite, bastnaesite and maghemite are identified. * Polishted section: maghemite>magnetite>geothite>rutile>unidentified-a * Bulk assay: SiO2 : 2.26% P2O5: 0.55% Fe2O3:16.76% MnO : 5.21% CaO :40.32% BaO : 1.92% ◎ No assay for F. Total of assayed elements is only 75.42%. * Minor elements(in ppm): Nb: 175 La:19500 Sm: 100 Y : 730 Ce:17900 Eu: 61 Th:1200 Nd: 2400

APPENDIX-3 MICROSCOPICAL OBSERVATION OF THIN SECTIONS-16 SEMI-DETAILED SURVEY(13) LEGETET HILL

Sample Number	Rock type	Macrosopical feature/ microscopical texture and structure	Identified minerals	Unidentified minerals		Major result of other tests and /or Remarks
				Opaque minerals	Transparent min.	
99743G	Melanephelinite	* A volcanic rock with abundant phenocrysts of pyroxene, showing intersertal texture. Groundmass comprises pyroxene and a colorless mineral(nepheline?).	PHENOCRYSTS * Clinopyroxene: Approx.25%. Euhedral;0.1-0.5mm Pale yellow and virtually no pleochroism. Some part shows greenish color. Biaxial(+). * Perovskite: Approx.5%. 0.1mm.Brown, zoning, twinning, and shagreen texture are observed. * Sanidine: Minor amount;0.7mm * Apatite: Minor amount. Euhedral, subhedral & Anhedral;0.7mm. GROUNDMASS * Clinopyroxene and nepheline(?):Approx.70%. Mirogranular.	* Opaque mineral: Approx.10%.0.1%.	* Analcite(?):<5%. Euhedral;0.03-0.2 mm. Colorless.	* K-Ar dating 10.7±0.6 MA
99759G	Carbonatitic tuff	* Sandstone-like aggregate of carbonate grains. Apatite crystals are scattered.	* Carbonate: Approx.90%. Granular ;0.1-0.2mm. * Apatite: Aprrox.5%. Irregulr, rounded and long prismatic;0.1mm.	* Opaque mineral: Approx.10%. Locally concentrated & fills interstitially. May be altered product of ore mineral.		* Bulk assay: SiO2 :10.75% P2O5: 0.31% Fe2O3: 7.01% MnO : 0.67% CaO :41.04% BaO : 1.37% * Minor elements(in ppm): Nb: 480 La: 585 Sm: 41.6 Y : 175 Ce: 902 Eu: 14.0 Th: 51 Nd: 315
101047G	Carbonatitic tuff	* Aggregate of rounded and rectangular grains carbonate of about 0.1-0.2mm, showing sandstone-like texture. Grains are cemented by opaque or amourphous matters.	* Carbonate: Approx.90%. Granular to angular; 0.1-0.2mm.		* Brown matter: Approx.10%. Occurs surrounding carbonate grains. May be alteration product of some mineral.	* Bulk assay: SiO2 : 0.47% P2O5: 0.90% Fe2O3: 2.55% MnO : 1.12% CaO :50.69% BaO : 0.47% * Minor elements(in ppm): Nb: 520 La: 777 Sm: 56.6 Y : 210 Ce: 1244 Eu: 18.1 Th: 72 Nd: 406