8-5 Demarcation of mineralized zone and ore reserves estimation

The inferred geological ore reserved of REE ore, associated with the carbonatite body in Buru Hill, were estimated based on the results of geological research and ore grade estimations of the elements by diamond drill cores by two years works, in accordance with the estimations of three-dimensional configuration of the ore body on east-west and north-south directional cross sections, Figs. II-8-8 to II-8-11.

Ore grade grouping were established by paying a remark on the content of La+Ce+Nd, the grade of which was determined by the high-accuracy analysis techniques on a more chemically reliable order of Ore Grade Level-percentage unit-, meanwhile, the remaining elements were chemically analysed on the order of Geochemistry Level - parts per million unit- with less reliability than the former.

It is estimated by the examinations of grade distribution on the east-west directional cross sections that the high grade ore zone is observed in upper portion of the carbonatite body, demarcated by the ground water table on 1,295 metres high above sea level, which is however variable in each drill hole, and is considered that an elucidation of zonal distribution of ore grade in the carbonatite body is uneasy due to a showing of irregular grade distribution in both of upper and lower portions of the body. The contents of REE and Nb in the reduction zone in lower part of the carbonatite body are low, what is estimated to be less economical.

The inferred geological ore reserves of the REE minerals, associated with Buru Hill carbonatite body in oxydized zone, are estimated to be of 10,700,000 tonnes of crude ore, having average grades of 2.07 percent of LREE (La+Ce+Nd), 370 ppm of MREE (Sm+Eu+Tb) and 38 ppm of MREE (Yb+Lu), and are re-calculated to be having 280,000 tonnes of Total RE Oxide (TREO), average-graded by 2.63 percent of TREO.

The current estimation of the geological ore reserves on the Buru Hill carbonatite, therefore, confinedly includes the ore block in the oxydation zone, meanwhile, the portion occupied by unweathered carbonatite, in the vicinity of Drill Holes BRL-3 and BR-1, is omitted from the estimation.

The measurement of specific gravity value of the carbonatite was not made by the current work, however, the value of 1.70 was empirically applied for the estimation. It is mainly based on the porous character of rock in oxydized zone and also on wide-spread occurrences of cavities observed in drill cores of carbonatite body.

Table II-8-2 shows the weighted average values of elements in weathered zone, Table II-8-3 shows that in fresh zone and Table II-8-4 shows the results of ore reserves estimation.

8-6 Results of petrological and mineralogical tests

Microscopic examinations of rock samples by thin sections, those of ore samples by polished thin sections, whole rock chemical analyses, mineralogical identifications by electron probe microanalyzer, absolute age determinations of rocks by potash-argon method, chemical analyses of ore minerals and mineral size distribution tests, and measurements of oxygen isotope ratio for the drill core samples were implemented by the current work.

The results of whole rock chemical analyses are shown in Apx. 1, those of potash-argon dating are in Apx. 2, those of oxygen isotope ratio determination are in Apx. 3 and those of electron probe microanalyser are in Apx. 4, respectively.

Table II-8-2 Average Values of Elements, Weathered Zone

Component	Unit	No. of sample	Maximum	Minimum	Mean(m)	Total length Analyzed(m)
BA	PPM	228	126000	5700	44906.0	676.90
SR	PPM	228	7780	226	1654.3	676.90
NB	PPM	228	4950	70	1037.7	676.90
Y	PPM	228	1950	105	724.6	676.90
U	PPM	228	429	1	48.6	676.90
TH	PPM	228	2084	81	918.7	676.90
LA	PPM	228	23100	400	7959.0	676.90
CE	PPM	228	24400	1000	10043.7	676.90
ND	PPM	228	8000	300	2716.4	676.90
SM	PPM	228	494.0	42.0	267.05	676.90
EU	PPM	228	198.0	10.9	80.19	676.90
TB	PPM	228	77.6	2.6	27.22	676.90
YB	PPM	228	82.1	4.8	32.88	676.90
LU	PPM	228	16.5	1.1	5.21	676.90

Table II-8-3 Average Values of Elements, Fresh Zone

Component	Unit	No. of sample	Maximum	Minimum	Mean(m)	Total length Analyzed(m)
BA	PPM	89	90600	4800	33800.1	316.50
SR	PPM	89	29600	850	2932.8	316.50
NB	PPM	89	3100	125	810.0	316.50
Y	PPM	89	980	225	521.5	316.50
U	PPM	89	124	1	13.8	316.50
TH	PPM	89	1545	225	618.5	316.50
LA	PPM	89	22600	690	5601.4	316.50
CE	PPM	89	20400	1900	7282.0	316.50
ND	PPM	89	6200	500	2152.0	316.50
SM	PPM	89	633.5	83.3	210.97	316.50
EU	PPM	89	169.4	23.5	61.16	316.50
TB	PPM	89	38.2	3.2	18.09	316.50
YB	PPM	89	41.8	6.3	25.42	316.50
LU	PPM	89	6.7	1.5	4.04	316.50

Table II–8–4　Ore Reserves and Grade of the Buru Hill Deposit

Reserves (Ton)		La (%)	Ce (%)	Pr*1 (%)	Nd (%)	Sm (ppm)	Eu (ppm)	Tb (ppm)	Yb (ppm)	Lu (ppm)	Y (ppm)
Crude Ore	10,700,000	0.796	1.004	0.09	0.272	261	80	27	33	5.2	724
TRe_2O_3	280,000	0.931	1.235*2	0.107	0.318	310	93	31	38	6.0	919
		2.59 %				478 ppm					919
Total Re_2O_3 grade		2.63 %									

Other elements : Nb_2O_5 : 0.14 %
P_2O_5 : 1.32 %

*1 : Estimated value from average content in bastnäsite
*2 : CeO_2 ,

LEGEND

Nb (ppm)	Th (ppm)	Y (ppm)	L La+Ce+Nd (ppm)	M Sm+Eu+Tb (ppm)	H Yb+Lu (ppm)
Above 1800	Above 1600	Above 1300	Above 36000	Above 540	Above 50
1600 - 1800	1600 - 1800	1050 - 1300	32000 - 36000	480 - 540	45 - 50
1400 - 1600	1400 - 1600	900 - 1050	28000 - 32000	420 - 480	40 - 45
1200 - 1400	1200 - 1400	750 - 900	24000 - 28000	360 - 420	35 - 40
1000 - 1200	1000 - 1200	600 - 750	20000 - 24000	300 - 360	30 - 35
800 - 1000	800 - 1000	450 - 600	16000 - 20000	240 - 300	25 - 30
600 - 800	600 - 800	300 - 450	12000 - 16000	180 - 240	20 - 25
400 - 600	400 - 600	150 - 300	8000 - 12000	120 - 180	15 - 20
Below 400	Below 400	Below 150	Below 8000	Below 120	Below 15

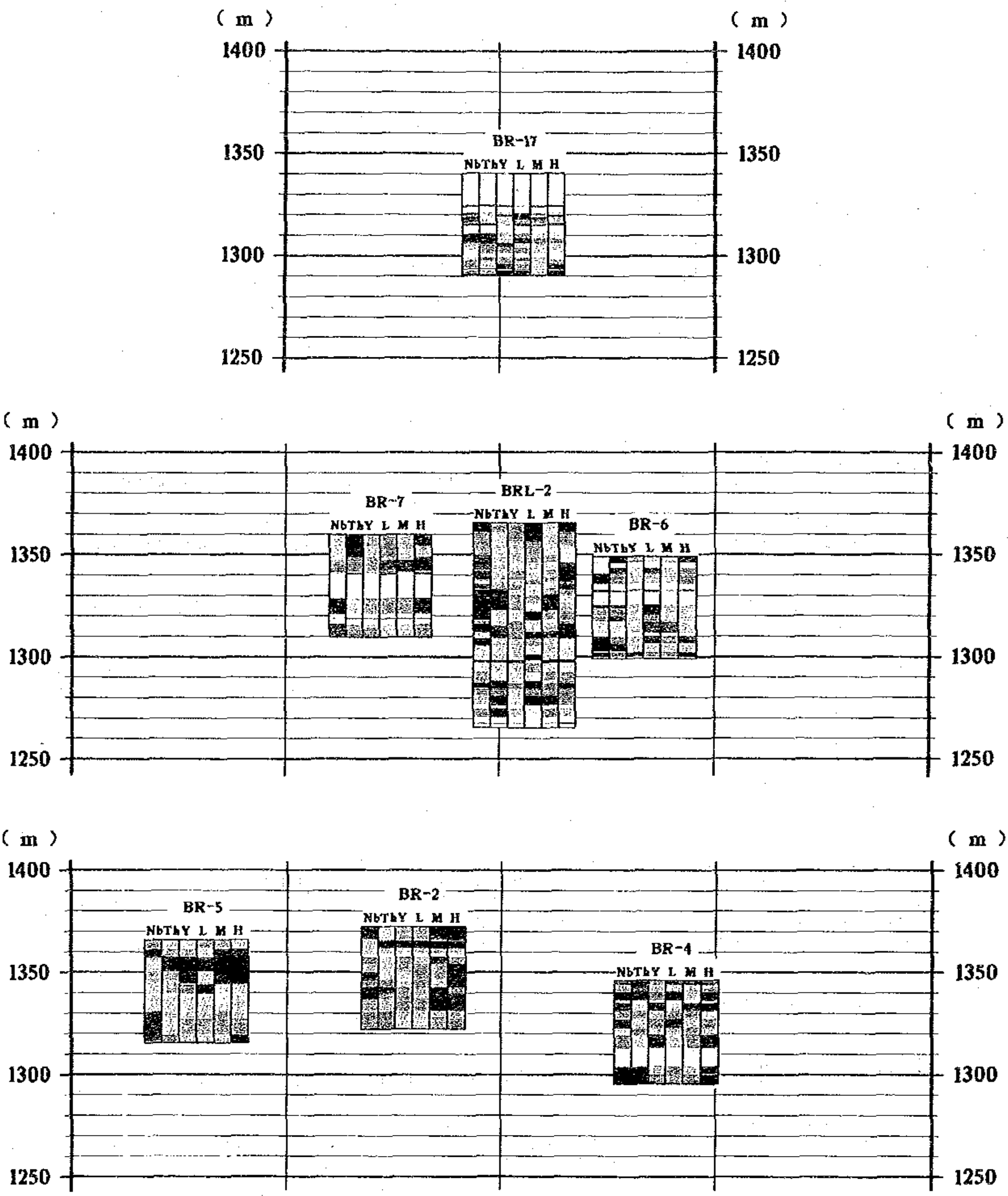
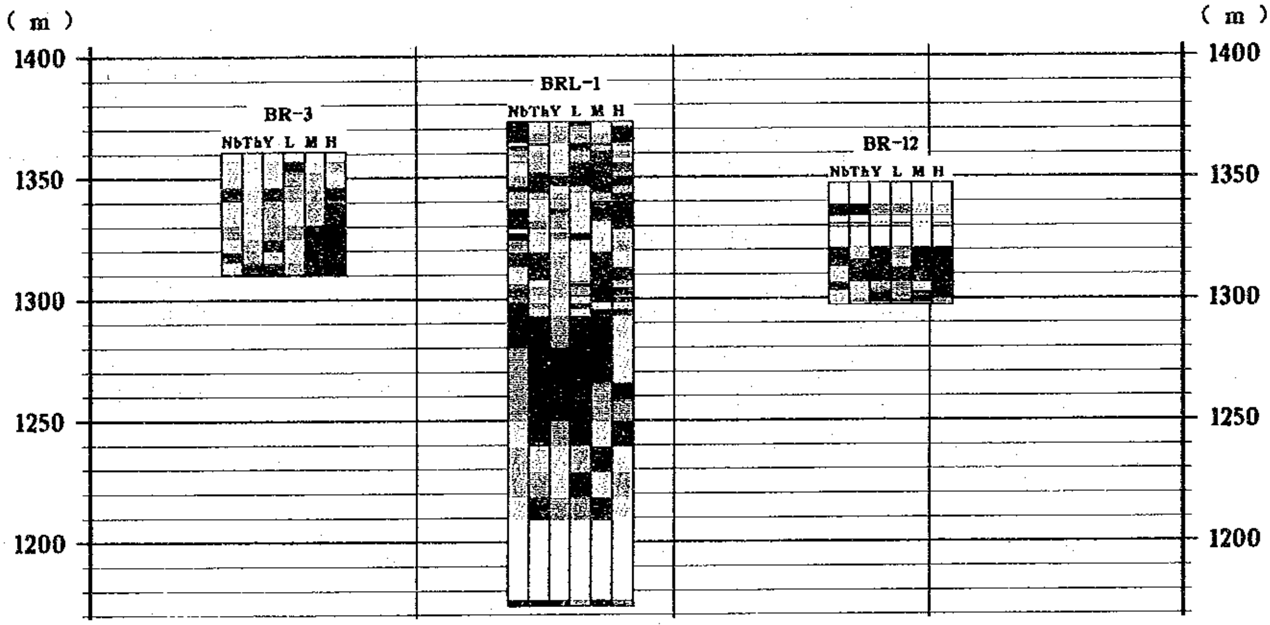


Fig. II-8-8 Assay Cross Section, E-W - (1)

LEGEND

Nb (ppm)	Th (ppm)	Y (ppm)	L: La+Ce+Nd (ppm)	M: Sm+Eu+Tb (ppm)	H: Yb+Lu (ppm)
Above 1800	Above 1800	Above 1300	Above 36000	Above 540	Above 50
1600 ~ 1800	1600 ~ 1800	1050 ~ 1300	32000 ~ 36000	480 ~ 540	45 ~ 50
1400 ~ 1600	1400 ~ 1600	900 ~ 1050	28000 ~ 32000	420 ~ 480	40 ~ 45
1200 ~ 1400	1200 ~ 1400	750 ~ 900	24000 ~ 28000	360 ~ 420	35 ~ 40
1000 ~ 1200	1000 ~ 1200	600 ~ 750	20000 ~ 24000	300 ~ 360	30 ~ 35
800 ~ 1000	800 ~ 1000	450 ~ 600	16000 ~ 20000	240 ~ 300	25 ~ 30
600 ~ 800	600 ~ 800	300 ~ 450	12000 ~ 16000	180 ~ 240	20 ~ 25
400 ~ 600	400 ~ 600	150 ~ 300	8000 ~ 12000	120 ~ 180	15 ~ 20
Below 400	Below 400	Below 150	Below 8000	Below 120	Below 15



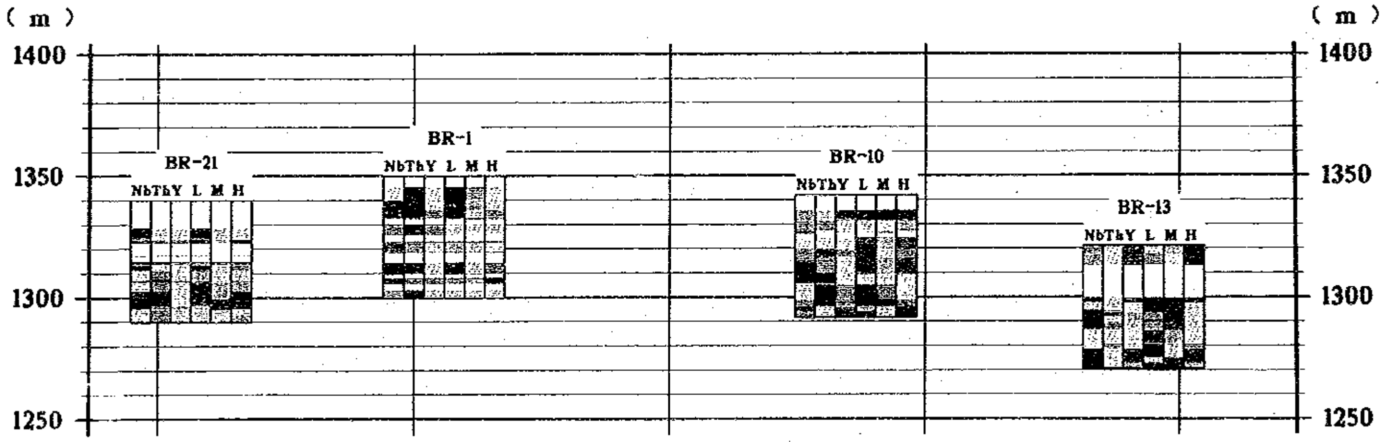


Fig. II-8-9　　Assay Cross Section, E-W - (2)

LEGEND

Nb (ppm)		Th (ppm)		Y (ppm)		L La+Ce+Nd (ppm)		M Sm+Eu+Tb (ppm)		H Yb+Lu (ppm)	
Above	1800	Above	1800	Above	1300	Above	36000	Above	540	Above	50
1600 -	1800	1600 -	1800	1050 -	1300	32000 -	36000	480 -	540	45 -	50
1400 -	1600	1400 -	1600	900 -	1050	28000 -	32000	420 -	480	40 -	45
1200 -	1400	1200 -	1400	750 -	900	24000 -	28000	360 -	420	35 -	40
1000 -	1200	1000 -	1200	600 -	750	20000 -	24000	300 -	360	30 -	35
800 -	1000	800 -	1000	450 -	600	16000 -	20000	240 -	300	25 -	30
600 -	800	600 -	800	300 -	450	12000 -	16000	180 -	240	20 -	25
400 -	600	400 -	600	150 -	300	8000 -	12000	120 -	180	15 -	20
Below	400	Below	400	Below	150	Below	8000	Below	120	Below	15

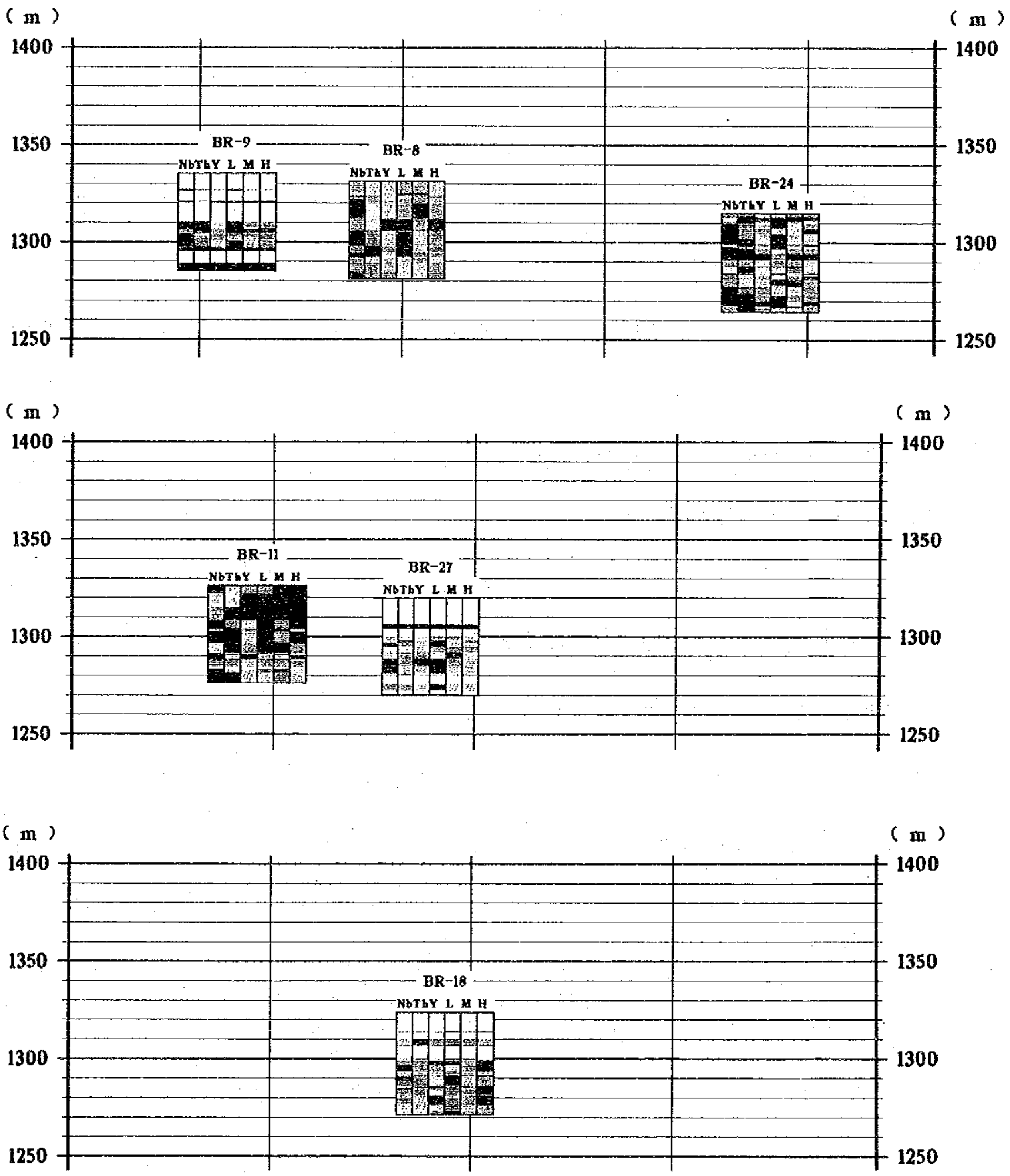


Fig. II-8-10 Assay Cross Section, E-W - (3)

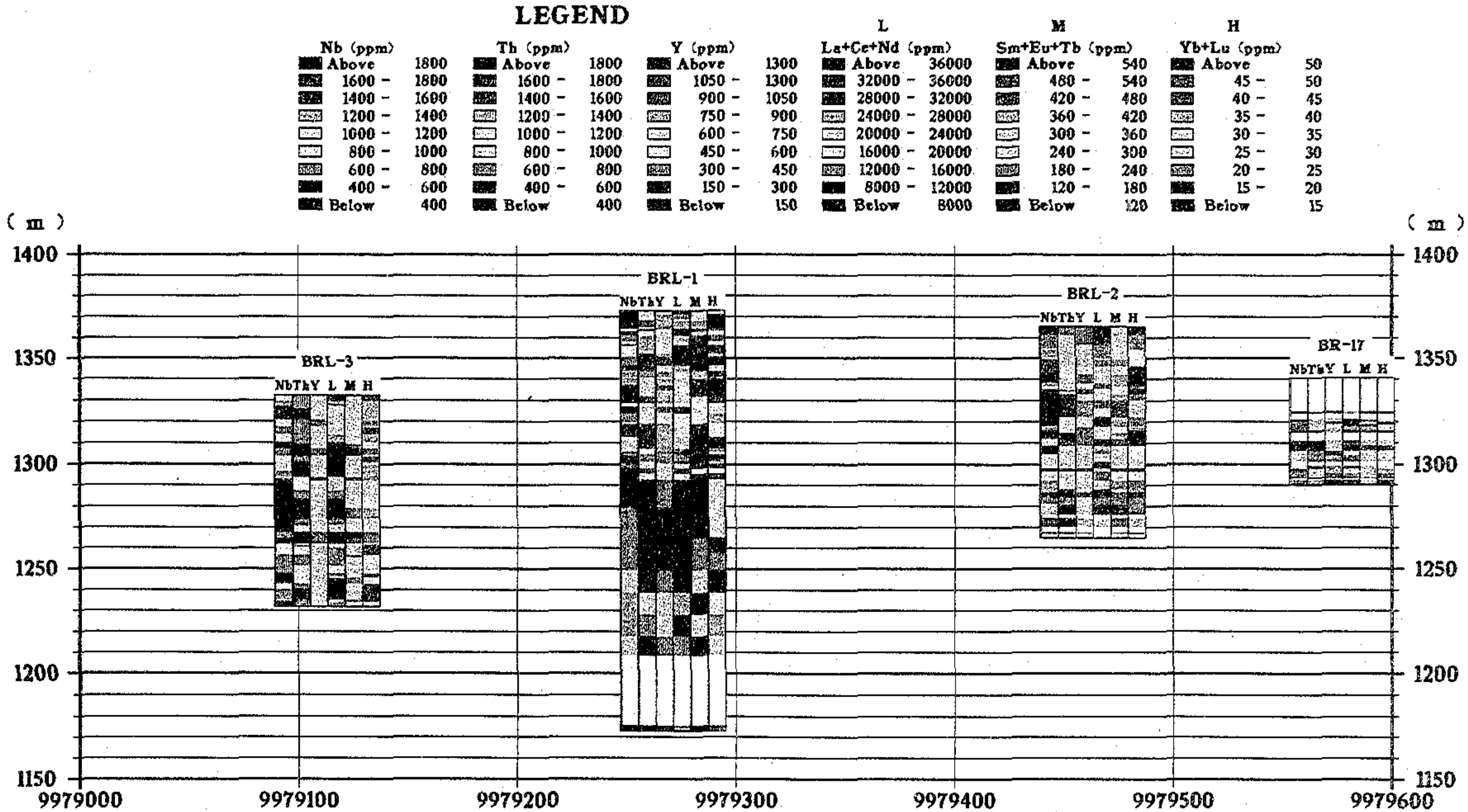


Fig. II-8-11 Assay Cross Section, N-S

CHAPTER 9 LEGETET HILL AREA

9-1 General geology

The Legetet Hill is a parasitic hill of the Tindret Volcano, one of large scale stratovolcanos in western Kenya, and is located in the south-western piedmont of the Tindret volcano.

The Tindret volcano is mostly composed of volcanic materials produced by basalt-nephelinite activities and belongs to the Kenya Rift valley type rather than to the carbonatite-nephelinite type. However, carbonatite nephelinite type volcanisms hav also taken place in a series of the Legetet Volcano, since that carbonatites are found in the Legetet Hill, the parasitic volcano.

9-2 Results of geological survey

(1) Geology

The geological plan and cross section in the area are presented in Fig. II-9-1. The geology of this area consists of gneissose rocks of Pre-cambrian basement, tuffs, carbonatitic volcanics and the Tindret Volcanics of Miocene, and Quarternary formations.

The carbonatitic volcanics are devided into carbonatitic pyroclastics (T-vfb), carbonatitic lavas (T-vc) and carbonatitic stratified tuffs (T-vfc).

(2) Geological Structures

Carbonatitic rocks in the Legetet Hill area, different from those in other areas for the semi-detailed survey, entirely show extrusive or post extrusion sedimentary facies. Melanephelinite overlies these carbonatitic rocks. The occurrence suggests that melanephelinite in the centre of the Legetet Hill might have formed a lava dome originally.

(3) K-Ar dating

The result of the K-Ar age determination of a melanephelinite sample, collected on the top of the Legetet Hill, indicates to be of 10.7 Ma, which is correlated to the early stage or a preceding stage to the Tindret Volcanism, in connection with the results of the K-Ar age determination ranging from 5.6 to 9.9 Ma according to Pickford et al. (1981).

9-3 Results of geochemical survey

(1) Sampling

The 116 rock samples were collected for geochemical purpose in the area. Among them, 61 samples are carbonatitic rocks, and other 55 include non-carbonatitic tuff and nephelinite-phonolitic rocks.

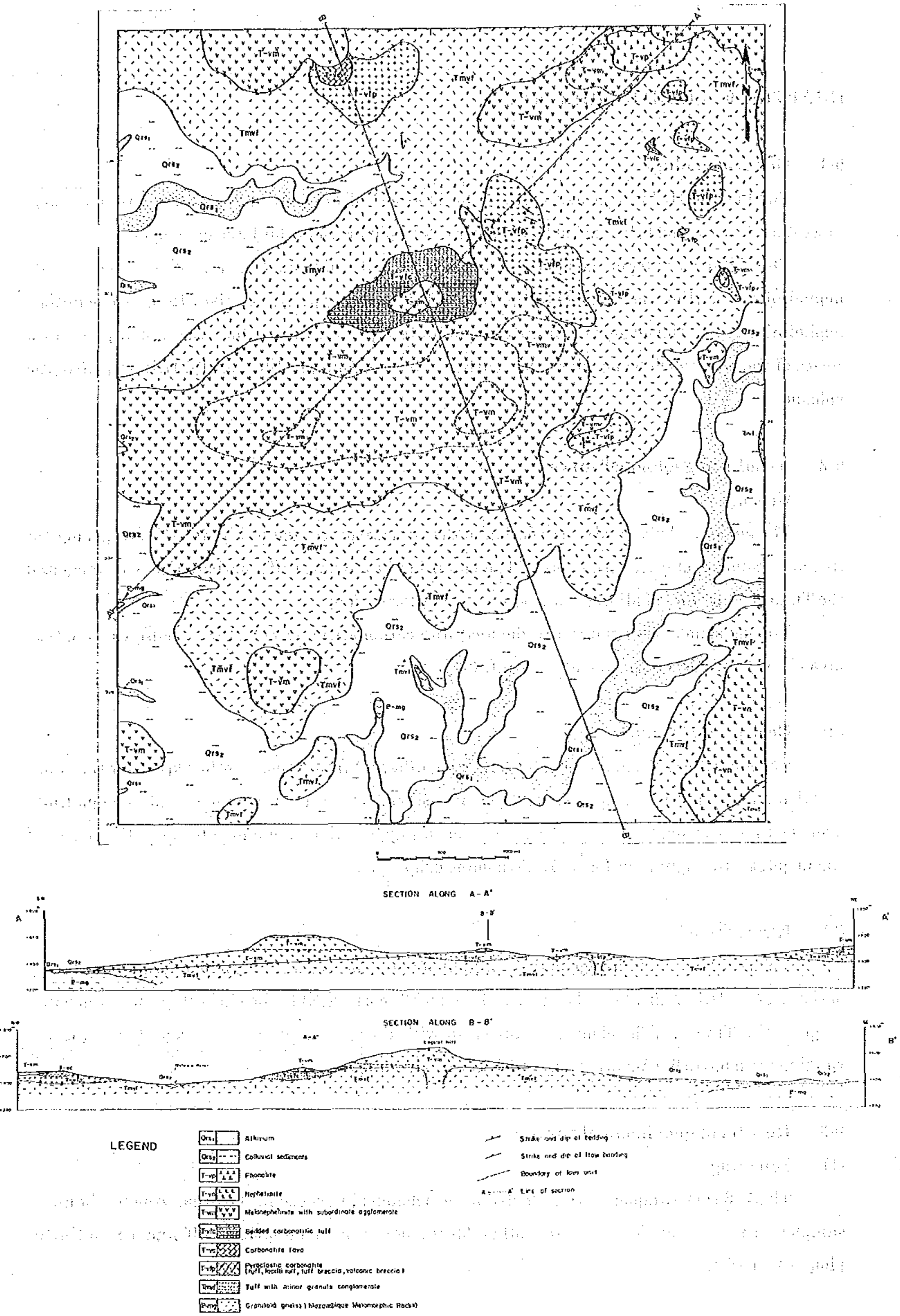
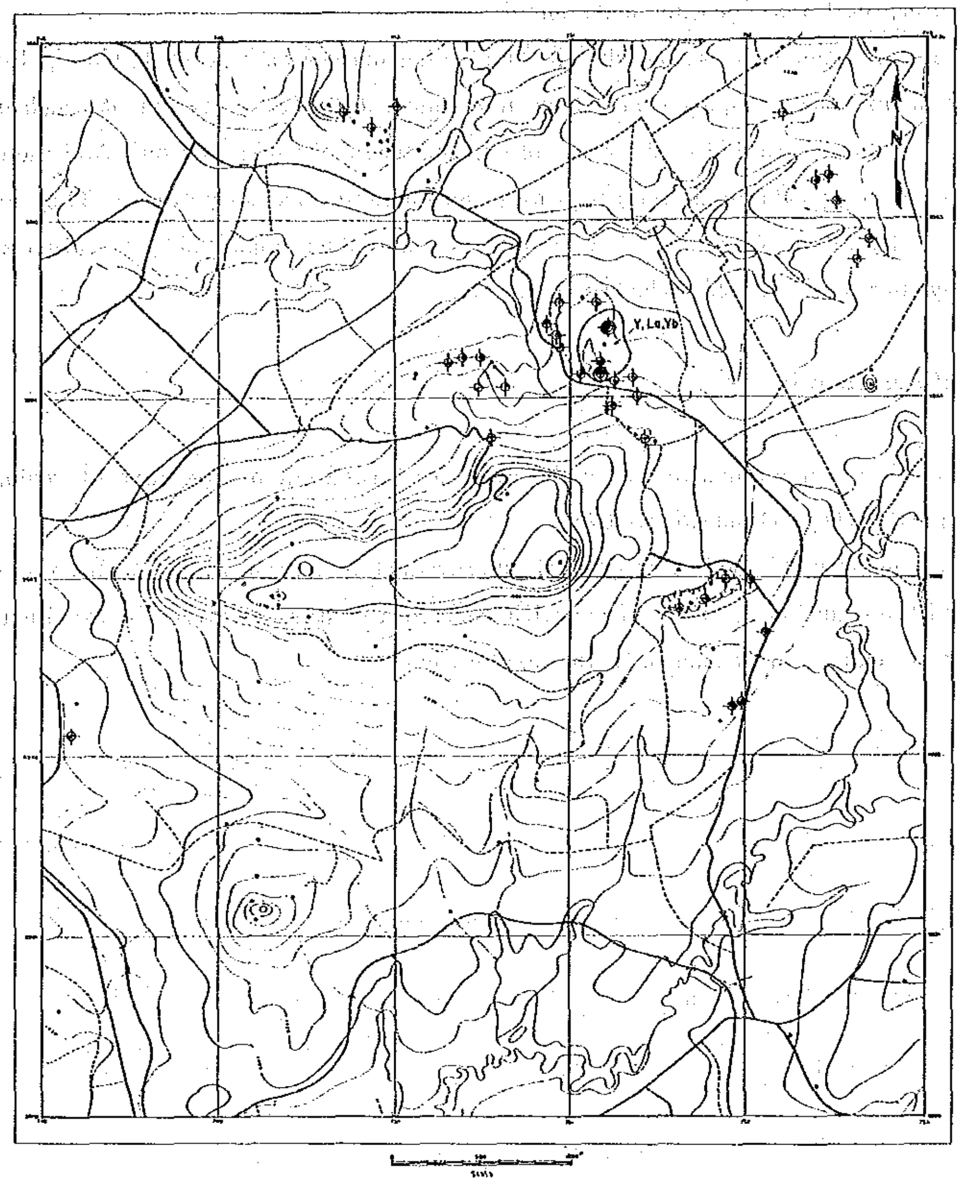


Fig. II–9–1 Geological Map of the Legetet Hill Area



LEGEND

- Non anomalous sample
- Anomalous sample (≧ m + 1S , < m + 2S)
- Highly anomalous sample (≧ m + 2S)
- Geochemicaly anomalous zone

Classification

Element	Anomalous, ≧ m+1S, <m+2S	Highly anomalous ≧ m + 2S
La ppm	≧ 767 , < 3,300	≧ 3,300
Y ppm	≧ 148 , < 344	≧ 344
Nb ppm	≧ 620 , < 2,600	≧ 2,600
P %	≧ 0.61 , < 2.17	≧ 2.17

m : mean , S : standard deviation

Figures are of 1325 rock samples from all the Semi-detailed Survey Areas other than the grid-sampled areas in the Buru and Ndiru Hills.

Fig. II-9-2 Geochemical Interpretation Map of the Legetet Hill Area

(2) Interpretations of geochemical anomaly

Interpretation results of geochemical anomalies in the area is presented in Fig. II-9-2.

The number of samples, which show anomalous values of certain elements, such as P, Sr, Y, Eu, Yb and Lu are limited in the areas of carbonatitic rocks distribution. And then samples, which show highly anomalous values of some elements are only three. They are highly anomalous for LREE-MREE and Y or Eu, but they are not accompanied by any other anomalous or highly anomalous samples to form an anomaly.

9-4 Mineralization

So-called "calcareous rocks" in the area are turned out by the current geological and geochemical survey to be of carbonatite.

An anomaly of Y and LREE-MREE was revealed in an area, which has been considered to be one of the eruption centre of carbonatitic rocks in the area, however, the areal extent is too small to form an anomaly zone for further exploration.

PART III CONCLUSION AND RECOMMENDATION

CHAPTER 1 REGIONAL SURVEY AREA

1-1 Conclusion

Regional Survey of the Homa Bay Project was implemented as the first-year programme in 1987, for the purpose to elucidate the general geology in the carbonatite-bearing zone, including known carbonatite localities, which covers an area of 2750 square kilometres approximately.

The results of the survey are summarized to be that the regional geology of the area was found to be conformable with the existing geological informations, however, small carbonatite bodies were newly located, meanwhile, the existing geological maps were revised in some details. Copper showings were noted in several localities, however, were of limited extents and indicated weak mineralization. Gold occurrences were found in some localities and in some of these, local people have small-scale operations.

1-2 Recommendation

The regional geological survey area is located in the Nyanzian greenstone belt and Greenstone Belts are known world-wide to be associated with gold fields. Migori Gold Field is in the proximity to the south of the survey area. There may be a possibility of locating new gold potential areas by carrying out systematic exploration works in the area, especially the northeastern and southwestern parts of the survey area, including the Homa Mountain gold showings.

CHAPTER 2 RANGWA AREA

Through the geological and geochemical works, Rangwa carbonatite body is considered to be eroded more deeply than that in Ruri Hills and Homa Mountain. Consequently, highly concentrated contents of elements, such as Nb and P, are considered to represent that those are derived from a deeper section of intrusive carbonatite body.

Rock and Soil geochemistry in Rangwa Area provide a limited number of highly anomalous values that form an anomaly zone, therefore, the exploration target for future considerations in the area is estimated to be unlikely selected by the current works.

CHAPTER 3 SAGARUME-NYAMGURKA AREA

Through geological survey, it turnes out that this area provides very minor occurrence of carbonatite, especially ferrocarbonatite which is considered to have a close relation with mineralization of REE.

Through geochemical survey, inversely, none of anomaly was found in this area, however, there are a few alvikite which has anomalous values of P, Y and REE.

Samples of ijolites and fenites, which are frequently observed in this area, do not show any anomalous value, other than only one sample, which is highly anomalous for P.

Consequently, it is presumed that a further detailed work in the area is unlikely warranted.

CHAPTER 4 NORTH RURI HILL AREA and SOUTH RURI HILL AREA

The three sectors where geological survey and geochemical exploration were conducted are situated in the marginal parts and in the peripheries of the carbonatite complexes of Ruri Hill, and the geology comprises basement Nyanzian metabasalt and carbonatitic rocks which have intruded the former. From geochemical explorations, it has turned out that REE and Y concentrate in ferrocarbonatite, inversely, high values of Nb are randomly spread in the sectors and are independently distributed to any particular type of rock of carbonatites.

North Ruri Hill North Sector

The body of ferrocarbonatitic breccia is distributed in the center of sector, occupying an area of 0.03 km^2 trending E-W direction. The rocks are heterogeneous in chemical contents and strongly weathered. Geochemically anomalous zones of REE and Y are distriuted mostly in the same area covering the body and the immediate periphery. The anomalous zone has low contents parts of these elements, by what a hetergeneous character of the body is suggested. The small size of the anomalous zone and the heteogeneous character of the rocks unlikely warrant any further exploration.

North Ruri Hill South Sector

Ferrocarbonatites are mainly distributed in the south of sector in an area of 0.03 km^2 as dyke swarms, size of which are usually several centimetres to 1 m in width and several to several tens of metres in length.

Major geochemically anomalous zones are of Y, Th. and La+Ce+Nd, covering the zone of dyke-swarms of ferrocarbonatite and trending in E-W direction. The anomalous zone has an area of 0.06 km^2.

From the results of geology and geochemistry, the anomalous zone is unlikely of a potential target area for REE and Y, even though the area is larger than other two sectors.

South Ruri Hill Sector

Ferrocarbonatites in the sector occur as dykes or small dyke swarms and the majority occurs in the central to northwest part of the sector.

Major geochemically anomalous zone of the sector is observed only for La+Ce+Nd, covering the zone of dyke swarms of ferrocarbonatite.

Results of geological and geochemical explorations likely show a limited potentiality for a concentration of REE and Y in the sector.

CHAPTER 5 KUGE-LWALA AREA

5-1 Conclusion

Geological and geochemical research works, and diamond drill operations of six (6) holes, with total depths of 360 metres for a 1989-programmes, were implemented during the term 1987 to 1989 as a part of the Homa Bay Project, Nyanza Province, Republic of Kenya.

In accordance with the results of the above works, the Buru Hill area is geologically elucidated to be majorly composed of the dykes of ferrocarbonatite and carbonatite, which as an intermediate petrological character of ferrocarbonatite and alvikite. The general occurrence of the dykes in the area is observed in an extension of 600 metres long, 30 metres to 40 metres wide in average, 60 metres in maximum, and is extended north-southerly, dips 60 degrees to 80 degrees westerly. The results of diamund drill works by the current programme show that the oxydation zone in Kuge Hill area is insufficiently developed, resultant in that the concentration of REE minerals, associated with carbonititec dykes, is very limitedly formed. In accordance with the chemical research works of drill cores by the current works, the average grade of ore in the area shows 1.57 percent of La+Ce+Nd, which is approximate to that of the primarily mineralized zone in Buru Hill, that is 1.5 percent. The Kuge Hill ore body is with a limited quantity and quality, which are with less extension and less high concentration of REE. Consequently, it is to be concluded that the REE mineralization in Kuge Hill area is less economical for a future consideration.

5-2 Recommendation

Future examinations of exploration programming for an industrial/economical development of the REE minerals in Kuge Hill area are to be unlikely warranted in accordance with the conclusion, the above.

CHAPTER 6 NGOU-KUWOR AREA and UGONGO-UYI-KINANYA-SOKOLO AREA

None of distinct anomaly in the area was revealed by geological and geochemical survey, however, several samples of carbonatites or fenite have highly anomalous values of LREE or Nb.

The area is unlikely estimated to warrant a further exploration programme.

CHAPTER 7 HOMA MOUNTAIN AREA

The carbonatite complex of the Homa Mountain is one of the largest carbonatite complexies in the entire survey areas.

Carbonatites in the area occur mainly in the forms massive body (Ndiru Hill), dyke, veinlet network, small massive alvikite and rarely as ferrocarbonatite.

Through the geochemical survey, a prominent anomaly deserved to furhter exploration is unlikely revealed.

The area, where gold bearing quartz veins occur, is estimated to be warranted for the follow-up survey.

CHAPTER 8 BURU HILL AREA

1-1 Conclusion

Geological and geochemical research works, and diamond drill operations of thirty (30) holes, with total depths of 1,750 metres for two-year programmes, were implemented during the term from 1987 to 1989 as a part of the Homa Bay Project, Nyanza Province, Republic of Kenya.

In accordance with the results of the above works, the Buru Hill area is geologically elucidated to be majorly composed of massive intrusive carbonatite bodies, associated with the REE minerals, and is to be surrounded by granitoid gneiss of the basement rock in the area. The carbonatite itself is zonally divided to two zone; i.e., the upper zone of oxydized-weathered part and the lower zone of reduction part.

Concentrations of REE minerals by the supergene enrichment form an ore body in upper zone of the carbonatite body. The REE ore body is mainly mineralogically composed of bastnaésite.

The inferred geological ore reserves are estimated to be of 10,700,000 tonnes of crude ore, the average grade is La + Ce + Nd: 2.07 percent, Sm + Eu + Tb: 370 parts per million, Yb + Lu: 38 parts per million, to be re-calculated to be of Total REO: 2.63 percent, and 280,000 tonnes of Total Rare Earths Oxides.

The mineral contents in the Buru Hill ore body is inevitably estimated to be low-graded for the industrial/economical production under the current economical backgrounds in world-wide comparisons with other REE mines in operations. However, the Buru Hill ore body is with a favourable configuration for a facile applicability of open pit mining operation and with a favourable accessibility. It is also presumed that the ore body should be warrantedly examined with some economical possibility in a future when sufficient ore reserves and ore-grade values for the mining operation will be ameliorated by additional exploration activities and when an industrially favourable extration technology of REE minerals will be developed.

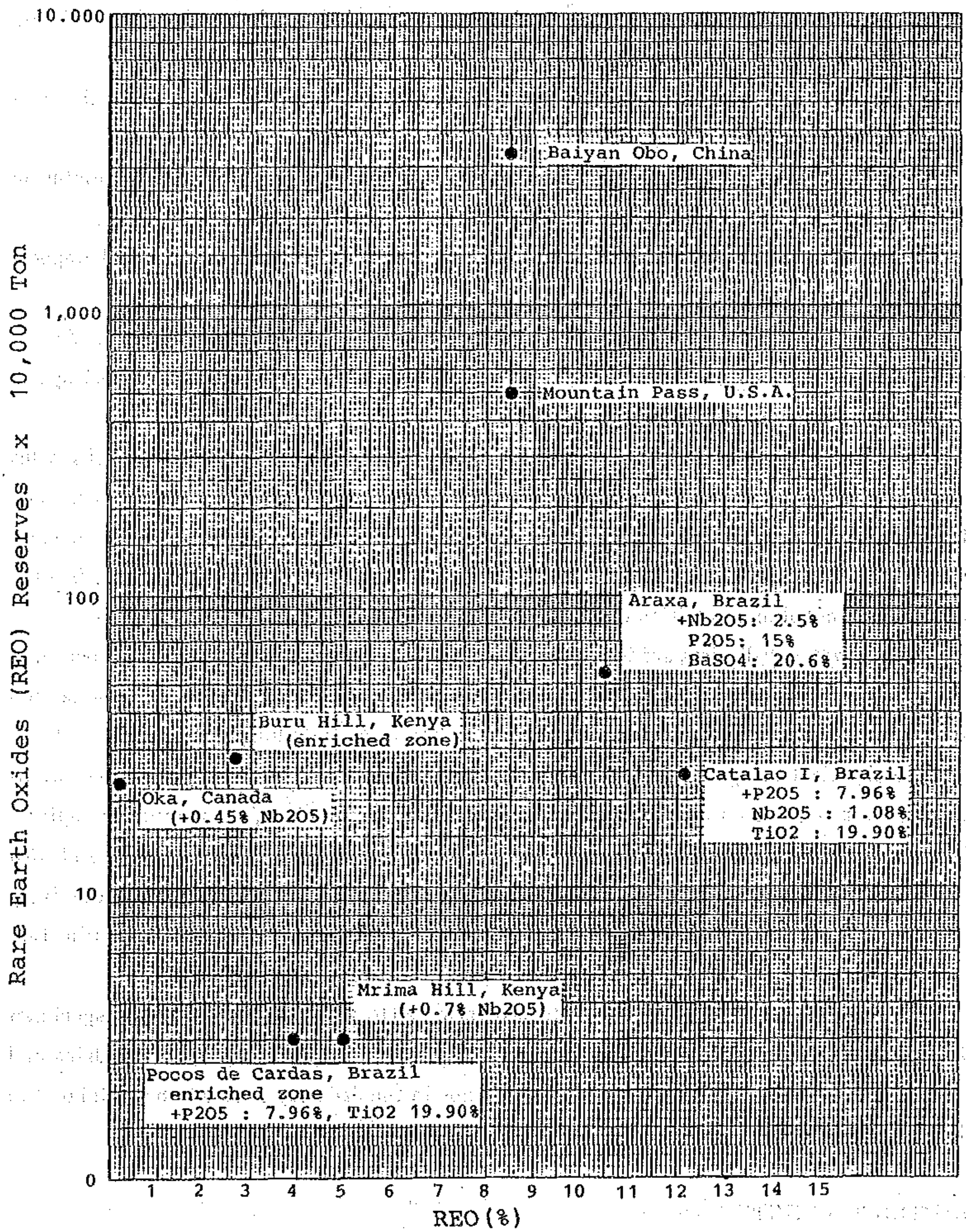


Fig. III–1–1 Grade – Reserve Plots of World – Rare Earths Deposits

1-2 Recommendation

It should be pointed out that the followings are the major factors to be examined in compliance with a future consideration to establish an industrial/economical estimation of economical possibility of the mining development of Buru Hill ore body, those are;

1) To establish a more reliable estimation of ore reserves and ore grade based on the results by sufficient quantities of diamond drills.
2) To establish a favourable extraction technology of REE minerals by feasible crushing and metallurgical tests.
3) To estimate reasonable capital and operation costs based on the programmes related to mine development, plant construction and mining/mineral processing operations.
4) To establish infrastructural and environmental researches related to the social impacts and associated terms.

For a further reliable establishment of the re-estimation of ore reserves and ore grade, the diamond drill operations on the modes of 50 metre-interval on grid-patterns covering the mineralized zone should be appropriately operated.

The Buru Hill mineralized zone has been intersected by twenty (20) diamond drill holes among thirty (30) on approximately 100 metres to 120 metres intervals by the current works. The drill exploration programme in future considerations, to be reached down to the lowermost elevation of the oxidized zone, some 1,295 metres high above sea level, are presumed to be fixed to an aim of an extent of some additional forty (40) holes, totaling 2,000 metres.

The recovered drill cores are to be quarter-splitted in every 2 metres to 3 metres section to produce the samples for tests as that the first quarter is to be for chemical assays, the second quarter is for a preservation for spare and a remaining half is for metallurgical test.

The chemical assay of ores and mineralized materials are to be made on 14 rare earths elements, such as, lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, telbium, dysprosium, holmium, erbium, thulium, ytterbium and lutecium, and with yttrium and thorium. Neutron activation analysis, X-ray fluorescene analysis and Inductively coupled plazma are usually recommended for the analysis technology and further an application of Inductively coupled plazma-Mass spectrometry of high accuracy is to be examined.

The value of specific gravity of ore is to be determined by using the representative specimen of drill cores of the ore body itself. The value is to be determined under the air-dried, dried and wet conditions. The distribution frequency of cavities in the ore body is also to be estimated to make a correction of the specific gravity value of ore in over-whole, if it is required.

CHAPTER 9 LEGETET AREA

So-called "calcareous rocks" in the area are turned out by the current geological and geochemical survey to be of carbonatite.

An anomaly of Y and LREE-MREE was revealed in an area, which has been considered to be one of the eruption centre of carbonatitic rocks in the area, however, the areal extent is too small to form an anomaly zone for further exploration.

Table III–1–1 Summary of the Mineral Exploration in the Homa Bay Area

Name of Area	Summary of Findings		
	Type	Location	Summary
Regional Survey Area	Carbonatite	1. To the NW of Mt. Gwasi	Alvikite and ferrocarbonatite dykes occur in granites with a small intrusion of ijolite. The width of dykes is about 5 m.
		2. To the SE of Sindo	A greenish white fenitic sövite occur as a dyke in schistosed granites. The width of dyke is about 5 m.
		3. To the WNW of Asego Hill	Floats of fine compact weakly foliated carbonatite.
		4. To the NE of Homa Bay	Sinter-like alvikite with calcareous tuff occur in a small area.
	Gold	5. To the SW of Wire Hill	A white quartz vein ranging from 5 to 10 cm in width occurs in the schistosed Nyanzian matavolcanics and are being mined in a small scale by local people
		6. To the SSE of Oyugis	Panning operation is observed and gold occurrence is unknown.
		7. To the South of Rangwe	Quartz veins about 5 cm in width occur in Nyanzian metabasalts and are being mined in a very small scale.
	Copper	8. To the SE of Kendu Bay	Green Cu-oxide stains, possibly malachite, occur along fractures in granite rich in K-feldspar. The Cu content is estimated less than 0.1%.
		9. Wire Hill	A massive Fe-oxide gossan occurs in rhyolitic rocks for a length of ca. 30 m in a road cut. UNRF concluded the occurrence to be of possible Kuroko type.

Semi-detailed and Detailed Survey Areas

Name of Area	Area of Survey	Number of Geochemical Samples	Summary of Geology	Summary of Geochemistry
Rangwa	26.50 km^2	238	An oval carbonatite body (2.6 x 2.6 km) comprises massive alvikite, sövite and carbonatite breccia.	Samples, having highly anomalous values to form an anomaly zone, were rare in this area.
Sagarume – Nyamgurka	9.75 km^2	76	Several narrow alvikite dykes and 2 small alvikite massive bodies occur at Sagarume and Nyamguruka, respectively.	No highly anomalous samples which form a anomaly was detected in the area.
North Ruri and South Ruri	Total 35.00 km^2	277	Shallow facies of carbonatite cone sheets are exposed in the both Ruri Hills. (North Ruri : 2 km, South Ruri 2.5 km diameter). Ferrocarbonatite are mainly distributed on marginal zones between the cone-sheets and basement rocks.	Highly anomalous values of REE are concentrated in three small areas. Grid sampling indicates that REE concentrations in ferrocarbonatitic rocks, but they are small in scale and low in contents.
	Detailed: 1.68 km^2	324		
Kuge-Lwala	6.25 km^2	51	A carbonatite cone-sheet (700 m x 500 m) occurs at Kuge Hill and a ferruginous breccia zone is located at Lwala.	Highly anomalous values of Ba, Y, Th and REE are concentrated in ferrocarbonatite dykes and ferruginous ores.
	Detailed Survey: 1.10 km^2	266	Ferrocarbonatite dykes at Kuge Hill form a body of 600 m long and 60 m wide in maximum. Ferruginous breccias at Lwala are of thin effusive facies of carbonatites.	Strong geochemical anomalies of REE are found in a zone covering the ferrocarbonatite dykes at Kuge Hill. Geochemical anomaly in the ferruginous zone at Lwala is limited in a small area.
	Detailed Survey: (Trenching) 4 localities, 320 m		The ore deposit of Kuge Hill consists of a number of ferro-carbonatite dykes and continues for about 600 m in the north-south direction with the maximum width of approximately 60 m or the average width of 30 to 40 m thinning out to the north and the south. The average grades are 1.567 % in light rare earth elements (La + Ce + Nd), 198 ppm in middle (Sm + Eu + Tb), 17 ppm in heavy (Yb + Lu) and 0.05 % in Nb, and are much lower than those of the Buru Hill Ore Deposit.	
	Detailed Survey: (Drilling Exploration) 6 Holes 360.6 m, 82 Samples			
Ngou-Kuwor	0.60 km^2	15	Several thin dykes and a small body of carbonatite occur in the NW of the area.	No distinct anomaly in the area was detected.
Ugongo-Uni-Kiyanya-Sokolo	8.40 km^2	94	A carbonatite body at Sokolo comprises sövite, ferrocarbonatite and alvikite, and is a cylindrical one with a diameter of 600 m.	Several samples have highly anomalous values for LREE or Nb, but no distinct anomaly was found by the survey.
Homa Mountain	69.80 km^2	581	A large number of carbonatite cone-sheets and dykes occur in an oval-shaped area (6 km x 5 km), aligned in circular patterns. A massive carbonatite complex (0.3 x 0.6 km) occurs at Ndiru Hill. Au-bearing quartz veins and porous iron ore zones are in the area.	Anomalous and highly anomalous samples for the analytical elements are sporadically distributed over a wide area so that no anomaly is located.
Buru Hill	4.00 km^2	61	The whole hillock of 0.2 km^2 is mineralized and oxidized, forming a sort of leached capping.	All samples from the mineralized zone shows highly anomalous values for REE and Nb.
	Detailed Survey: 0.96 km^2		The Buru Hill consists of a mass of carbonatite intrusion surrounded by gneisses of the basement. The carbonatite mass is rich in rare earth elements and can be vertically separated into two zones, the Upper Oxidized (or weathered) and the Lower Reduced (or primary) zones. The Upper Oxidized Zone is secondarily enriched in rare earth elements relative to the Lower Reduced Zone and form a rare earth ore body. The ore reserve is estimated at approximately 10.7 millions tonnes with average grades of 2.07 % in light rare earth elements (La + Ce + Nd), 390 ppm in middle (Sm+ Eu + Tb) and 38 ppm in heavy (Yb + Lu), or at approximately 280 thousands tonnes of contained total rare earth oxides (TREO) with the average grade of 2.63 % TREO.	
	Detailed Survey: (Trenching) 10 localities, 200 m (Pitting) 5 Holes			
	Detailed Survey: (Drilling Exploration) 30 Holes, 1,761.4 m, 372 Samples			
Legetet Hill	30.00 km^2	116	Effusive and redeposited facies of carbonatite occur in several small areas as pyroclastics, lavas and sandy tuffs.	Anomalous and highly anomalous values are relatively abundant in Sr and HREE, but they do not form any distinct anomaly.

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APPENDIXES

Apx. 1 Results of Whole Rock Analysis (1)

Sample Number	Area	Rock Type	SiO2 (%)	Al2O3 (%)	Fe2O3 (%)	MgO (%)	CaO (%)	Na2O (%)	K2O (%)	TiO2 (%)	P2O5 (%)	MnO (%)	BaO (%)	L.O.I. (%)	Total (%)	CO2 (%)	FeO (%)	+H2O (%)	-H2O (%)
40929E	Rangwa	CBB	7.91	2.51	8.73	2.13	40.66	0.22	0.27	3.33	0.10	0.10	0.02	30.40	96.39	28.80	2.42	0.63	0.65
99543G	N.RURI	ALV	2.30	0.49	8.95	0.32	45.90	0.30	<0.01	0.08	0.85	0.36	0.05	36.48	96.10	35.00	2.35	0.13	0.27
99599G	Homa Mtn	FCB	1.29	0.49	6.60	0.58	43.98	0.34	0.35	0.17	0.08	0.97	1.00	37.92	93.78	33.50	0.11	0.64	0.35
99729G	Sagarume	ALV	1.59	0.54	2.15	0.30	49.80	0.43	0.43	0.03	0.87	0.67	0.24	40.71	97.77	40.20	0.07	0.30	0.21
99759G	Legetet	CBTF	10.75	1.83	7.01	0.28	41.04	0.79	2.22	0.20	0.31	0.87	1.37	32.66	99.34	31.70	0.12	0.70	0.29
100051G	Kuge	ALV	1.57	0.57	2.26	0.46	52.69	0.25	0.13	0.06	0.33	0.56	0.38	41.30	100.57	41.20	0.13	0.11	0.18
100053G	Kuge	FCB	2.86	0.89	51.01	0.71	13.48	0.22	0.06	0.01	0.55	9.30	3.20	18.66	100.95	10.50	0.50	5.46	0.88
100111G	S.Ruri	FCB	17.83	5.24	9.79	1.41	30.01	1.38	1.20	0.30	2.96	0.82	0.35	24.00	95.30	20.10	0.53	1.97	1.32
100127G	N.Ruri	SOV	3.61	1.03	2.26	0.35	49.88	0.46	0.29	0.09	1.87	0.29	0.17	38.59	98.90	38.40	0.30	0.02	0.07
100152G	S.Ruri	SOV	36.14	3.98	1.74	0.14	33.02	0.19	<0.01	0.03	0.10	0.22	0.02	23.86	99.96	23.40	0.25	0.07	0.10
100303G	Soklo	FCB	14.90	4.84	6.89	1.12	34.23	0.36	3.51	0.49	1.86	0.79	1.00	25.71	95.71	23.60	1.60	0.50	0.30
100324G	Soklo	SOV	1.61	0.58	1.62	0.58	50.38	0.24	0.29	0.08	0.62	0.25	0.13	41.34	97.74	38.20	0.27	0.06	0.10
100389G	Ngour	SOV	4.07	1.02	3.53	0.67	50.96	0.25	0.22	0.20	1.76	0.50	0.24	37.61	101.04	31.60	0.06	0.46	0.77
100490G	Homa Mtn	FCB	1.07	0.66	19.67	11.71	24.71	0.28	<0.01	0.11	0.14	1.38	1.31	34.74	95.78	33.60	0.22	0.46	0.40
100827G	Ndiru H.	ALV	0.75	0.37	4.21	0.41	47.02	0.32	<0.01	0.15	4.21	0.53	1.07	36.58	95.64	33.50	0.16	0.46	0.22
100832G	Ndiru H.	FCB	1.25	0.64	8.32	0.59	45.21	0.20	<0.01	0.20	0.22	1.23	1.62	38.03	99.67	36.60	0.11	1.27	0.41
100838G	Ndiru H.	SOV	0.97	0.41	3.67	0.53	49.44	0.30	<0.01	0.04	1.54	0.49	0.41	40.11	97.93	39.40	0.13	0.45	0.17
100846G	Ndiru H.	FCB	2.09	0.71	12.90	0.50	39.33	0.22	<0.01	0.05	0.26	1.69	1.52	35.42	94.71	33.00	1.10	1.94	0.51
100850G	Ndiru H.	SOV	1.05	0.43	4.66	0.36	51.54	0.26	<0.01	0.04	0.37	0.39	0.17	41.23	100.52	39.40	0.15	0.48	0.20
100853G	Ndiru H.	ALV	0.90	0.37	2.04	0.28	53.52	0.22	<0.01	0.05	0.49	0.79	1.12	41.05	100.85	39.00	0.15	0.33	0.21
101047G	Legetet	CBTF	0.47	0.39	2.55	0.53	50.69	0.31	<0.01	0.03	0.90	1.12	0.47	39.90	97.38	39.30	0.18	0.05	0.10
RO-2	Rangwa	ALV	0.89	0.53	2.80	0.30	48.79	0.30	<0.01	0.06	1.88	0.59	0.52	39.37	96.05	38.20	0.08	0.29	0.15

Apx. 1 Results of Whole Rock Analysis (2)

	Area	Rock TYPE	SiO2 (%)	Al2O3 (%)	Fe2O3 (%)	MgO (%)	CaO (%)	Na2O (%)	K2O (%)	TiO2 (%)	P2O5 (%)	MnO (%)	BaO (%)	L.O.I. (%)	Total (%)	FeO (%)	+H2O (%)	-H2O (%)
99712G	Sagarume	IJ	39.23	17.32	6.65	1.95	15.81	8.46	3.49	1.90	0.60	0.16	0.04	2.36	97.98	1.94	0.15	0.14
99743G	Legetet	NEP	40.39	14.15	11.42	3.26	11.37	6.15	2.35	3.01	0.54	0.26	0.16	4.27	97.34	4.49	2.34	1.12
99865G	Sagarume	FEN	73.71	12.18	2.78	0.17	0.71	4.24	5.69	0.18	0.11	0.06	0.06	0.33	100.25	0.31	0.03	0.14
100089G	Buru H.	ORE	4.83	1.69	13.49	0.57	43.46	0.42	1.17	0.33	0.34	2.99	3.40	5.42	78.12	0.10	1.66	0.58
100094G	Buru H.	ORE	2.28	0.98	72.27	0.25	1.29	0.23	0.13	0.06	0.94	9.04	3.25	8.17	98.89	0.16	4.54	1.36
100097G	Buru H.	ORE	2.92	2.03	60.87	0.32	2.60	0.21	0.80	0.08	0.61	8.25	7.08	10.17	95.94	0.14	5.75	1.66
100132G	N.Ruri	SYN	47.58	17.16	8.22	0.74	5.52	8.48	7.05	0.61	0.15	0.44	0.44	2.79	99.19	1.21	1.23	0.60
100233G	Homa Mtn	IJ	40.11	19.50	5.46	1.92	12.95	9.58	5.08	0.67	0.51	0.20	0.07	2.65	98.71	1.49	0.34	0.17
100323G	Soklo	FEN	48.33	12.15	6.49	1.01	9.85	2.55	10.55	0.28	0.65	0.27	0.42	6.95	99.51	0.60	0.17	0.11
101055G	Buru H.	ORE	38.11	1.11	25.47	0.37	5.48	0.30	0.78	0.42	1.83	6.04	10.58	6.94	97.43	0.20	2.88	0.49
101056G	Buru H.	ORE	54.82	0.87	8.35	0.14	15.02	0.30	0.77	0.13	0.58	0.57	4.87	5.44	91.87	0.37	1.02	0.19
101061G	Buru H.	ORE	1.98	2.12	46.78	0.18	20.82	0.40	0.60	0.47	12.36	3.16	1.29	5.27	95.44	0.24	2.72	0.79
101071G	Buru H.	ORE	2.53	1.85	49.42	0.27	17.33	0.33	0.82	0.18	0.52	1.86	10.63	6.05	91.79	0.17	3.03	0.81
101075G	Buru H.	ORE	60.79	13.44	6.58	0.65	1.40	0.80	9.66	0.38	0.14	0.41	1.01	2.92	98.19	0.21	1.41	0.60
101079G	Buru H.	ORE	2.26	1.23	16.76	0.30	40.60	0.35	0.55	0.09	0.55	5.21	1.92	5.59	75.42	0.20	1.79	0.58
101083G	Buru H.	ORE	2.36	1.66	25.32	0.25	28.32	0.31	0.39	0.20	0.91	5.81	8.02	6.26	79.82	0.40	2.52	0.79
RN-54G	Rangwa	IJ	33.06	12.93	9.16	7.99	16.67	4.87	3.25	2.39	1.99	0.21	0.44	1.69	94.66	3.87	0.37	0.17
RP-79G	Region.S	NEP	35.32	6.48	16.92	8.75	18.31	1.23	0.82	3.73	0.43	0.23	0.12	3.03	95.38	7.76	2.51	0.89
RT-38G	Region.S	NEP	34.58	8.72	15.01	6.61	17.45	2.99	1.50	4.24	0.79	0.28	0.16	3.29	95.63	7.42	2.08	1.43
RT-77G	Region.S	MRHY	81.86	10.35	1.33	0.37	0.52	0.25	2.32	0.11	0.12	0.02	0.03	1.80	99.07	0.26	0.68	0.36
WR-136	Region S	IJ	40.47	20.07	6.80	3.24	11.02	9.41	3.55	1.53	0.76	0.15	0.02	0.74	97.77	2.38	0.35	0.25

Apx. 1 Results of Whole Rock Analysis (3)

Sample Description			SiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO	BaO	LOI	TOTAL	F
Number	Depth (m)	Rock Type	%	%	%	%	%	%	%	%	%	%	%	%	%	%
BR-1-A	9.50	Ferrocarbonatite	1.45	0.33	37.78	0.16	21.90	0.17	0.05	0.09	2.88	4.36	0.94	19.03	89.15	0.87
BR-1-B	12.40	Ferrocarbonatite	1.82	0.37	31.35	0.19	24.57	0.27	< 0.01	0.23	4.30	3.53	1.02	19.52	87.19	1.55
BR-1-C	20.20	Carbonatite	1.21	0.22	13.14	0.15	37.15	0.21	< 0.01	0.03	2.51	6.14	3.29	23.78	87.85	7.18
BR-1-D	27.50	Siliceous ore	12.06	2.98	28.91	1.02	16.88	0.22	1.91	0.47	1.39	4.79	3.79	17.61	92.04	2.13
BR-1-E	38.20	Carbonatite	1.42	0.31	17.55	0.31	29.97	0.36	< 0.01	0.27	6.55	5.86	5.61	18.94	87.17	4.19
BR-2-A	25.50	Ca-Fe-ore	2.47	0.63	43.60	0.25	14.96	0.14	< 0.01	0.05	0.56	7.20	1.65	12.26	83.79	10.60
BR-3-A	8.50	Ca-Fe-ore	1.61	1.17	41.65	0.25	13.11	0.12	< 0.01	0.23	0.96	6.22	6.58	10.51	82.43	9.20
BR-4-A	10.40	Siliceous ore	25.45	0.41	40.36	0.33	5.71	0.15	< 0.01	0.10	0.47	6.68	2.27	10.60	92.55	4.23
BR-4-B	17.00	Siliceous ore	36.62	0.30	25.45	0.13	14.50	0.27	< 0.01	0.22	0.55	3.83	1.22	11.07	94.18	10.10
BR-4-C	45.20	Carbonatite	3.49	0.21	17.26	0.29	31.90	0.23	< 0.01	0.14	1.68	4.47	6.92	22.89	89.50	4.88
BR-5-A	14.80	Mn-Fe ore	5.16	1.35	49.34	0.41	5.54	0.13	0.06	0.06	0.37	10.01	2.17	14.16	88.77	4.10
BR-5-B	31.90	Siliceous ore	34.58	1.49	39.67	0.38	0.88	0.11	0.44	0.36	0.38	0.42	1.39	9.22	89.33	0.89
BR-5-C	50.30	Siliceous ore	29.40	0.46	28.40	0.14	12.32	0.11	< 0.01	0.11	0.28	4.93	3.65	11.60	91.42	9.16
BR-6-A	10.50	Ca-Fe ore	1.36	0.99	43.82	0.27	11.54	0.13	< 0.01	0.01	0.16	10.06	2.58	11.97	82.91	8.46
BR-6-B	18.90	Mn-Fe ore	4.66	2.06	26.87	0.45	4.68	0.12	0.17	0.04	0.53	11.58	14.09	14.56	79.82	4.51
BR-6-C	30.80	Ca-Fe ore	2.57	0.58	46.98	0.24	16.20	0.17	0.24	0.09	0.14	3.06	3.27	6.17	79.72	11.80
BR-8-A	39.45	Ca-Fe ore	3.68	0.49	42.14	0.40	11.45	0.14	0.02	0.10	0.10	6.21	5.23	13.93	83.90	6.70
BR-8-B	45.70	Carbonatite	3.58	0.48	13.43	0.66	37.52	0.22	0.59	0.14	2.97	4.31	1.01	29.35	94.27	1.08
BR-9-A	29.20	Carbonatite	1.17	0.25	24.68	0.18	34.77	0.23	< 0.01	0.09	5.54	2.28	1.04	22.37	92.62	1.42
BR-9-B	35.20	Ferrocarbonatite	2.42	0.49	23.20	0.50	22.98	0.20	< 0.01	1.05	2.49	5.55	8.33	17.92	85.15	2.92
BR-10-A	26.10	Carbonatite	1.09	0.24	14.52	0.28	40.75	0.27	< 0.01	0.08	4.86	6.18	1.59	25.06	94.94	4.11
BR-10-B	49.80	Ferrocarbonatite	2.22	0.30	36.64	0.25	14.50	0.19	< 0.01	0.19	2.48	7.91	7.51	15.96	88.17	1.85
BR-11-A	38.50	Mn-Fe ore	1.38	0.33	60.02	0.21	0.71	0.12	< 0.01	0.01	0.09	10.08	7.99	9.48	90.44	0.20
BR-11-B	38.90	Carbonatite	0.89	0.13	10.53	0.30	41.10	0.23	< 0.01	0.02	3.53	4.86	2.43	29.58	93.62	1.92
BR-12-A	48.00	Carbonatite	2.49	0.28	12.62	0.27	35.46	0.14	< 0.01	0.09	0.43	4.42	2.98	29.60	88.80	2.92
BR-12-B	50.30	Ferrocarbonatite	2.84	0.45	38.23	0.42	14.01	0.12	< 0.01	0.37	0.19	4.94	7.10	13.31	82.00	4.72
BR-13-A	27.20	Mn-Fe ore	3.94	0.81	54.16	0.21	0.72	0.19	0.12	0.09	0.06	13.75	5.15	13.36	92.57	0.40
BR-13-B	32.80	Mn-Fe ore	1.62	0.37	51.11	0.36	5.01	0.10	< 0.01	0.05	0.05	11.24	9.10	13.00	92.01	0.42
BR-13-C	38.50	Carbonatite	2.79	0.18	14.31	0.19	29.49	0.21	< 0.01	0.69	2.84	5.19	9.72	15.04	80.67	9.84
BR-13-D	50.00	Carbonatite	0.98	0.26	32.34	1.11	19.91	0.19	< 0.01	0.17	0.63	6.71	3.67	29.43	95.42	1.93
BR-14-A	9.30	Carbonatite	4.16	0.22	14.78	0.62	27.55	0.13	< 0.01	0.14	0.10	4.77	10.06	24.42	86.97	2.51
BR-15-A	38.80	Mn-Fe ore	3.94	0.25	61.57	0.29	1.56	0.10	< 0.01	0.01	0.09	11.70	2.38	12.89	94.80	1.12
BR-15-B	42.80	Mn-Fe ore	3.85	0.27	55.57	0.79	4.51	0.11	< 0.01	0.01	0.04	11.25	1.56	15.13	93.11	1.13
BRL-1-A	68.10	Mn-Fe ore	1.83	0.26	58.73	0.20	5.39	0.06	< 0.01	0.01	0.26	12.60	1.32	13.17	93.87	0.32
BRL-1-B	74.10	Carbonatite	2.37	0.50	30.13	0.31	18.78	0.17	< 0.01	0.39	2.17	8.40	6.84	14.21	84.29	5.16
BRL-1-C	85.40	Carbonatite	1.29	0.24	33.15	1.07	21.37	0.27	0.11	0.33	3.09	3.43	1.38	25.23	90.97	1.64
BRL-1-E	113.90	Carbonatite	1.15	0.30	21.54	1.40	34.87	0.32	< 0.01	0.15	6.02	2.91	0.47	27.98	97.13	1.19
BRL-1-F	131.30	Carbonatite	1.01	0.23	19.98	1.10	32.21	0.20	< 0.01	0.05	0.12	3.02	1.39	33.25	92.58	3.32
BRL-1-H	198.10	Carbonatite	4.11	0.30	9.02	3.13	34.82	0.30	0.22	0.22	3.45	3.63	2.90	25.95	88.06	3.94
BRL-1-G	180.00	Nephelinite	41.28	11.41	9.25	3.18	11.00	2.49	2.05	1.28	1.23	0.27	2.75	11.02	97.22	0.34
	Number	Rock Type														
Average	15	Carbonatite	2.14	0.27	17.78	0.89	32.52	0.23	-	0.19	3.05	4.65	3.84	24.51	89.96	3.69
Value by	6	Ferrocarbonatite	1.96	0.37	33.31	0.44	19.64	0.19	-	0.35	2.16	5.50	4.76	19.20	87.85	2.31
rock type	5	Ca-Fe ore	2.34	0.77	43.64	0.28	13.45	0.14	-	0.10	0.19	6.55	3.86	10.96	82.55	9.35
(ore)	5	Siliceous ore	27.62	1.13	32.56	0.40	10.06	0.17	-	0.25	0.61	4.13	2.46	12.02	91.90	5.30
	8	Mn-Fe ore	3.30	0.71	52.17	0.37	3.52	0.12	-	0.04	0.19	11.53	5.47	13.22	90.67	1.52

Apx. 1 Results of Whole Rock Analysis (4)

SAMPLE DESCRIPTION		SiO_2 %	Al_2O_3 %	Fe_2O_3 %	MgO %	CaO %	Na_2O %	K_2O %	TiO_2 %	P_2O_5 %	MnO %	BaO %	LOI %	TOTAL %	F %	CO_2 % inorg	FeO %
BR-17-A	16.10m	4.67	1.24	63.64	0.19	6.71	0.17	0.20	0.12	0.18	6.36	1.84	12.62	97.95	4.58	0.5	0.08
BR-17-B	25.50m	1.52	1.32	67.12	0.36	0.43	0.07	0.19	0.01	0.32	15.23	1.56	10.67	98.81	0.27	< 0.2	0.06
BR-18-B	6.60m	40.17	10.31	24.21	0.17	0.61	0.30	8.89	0.49	0.30	3.27	3.33	5.91	97.97	0.23	< 0.2	0.09
BR-18-D	29.90m	44.78	5.81	28.67	0.23	0.48	0.21	4.40	0.46	0.88	2.54	2.56	6.48	97.50	< 0.10	0.6	0.11
BR-21-A	25.30m	11.18	1.82	43.15	0.37	7.12	0.17	1.03	0.11	0.38	10.27	8.13	15.76	99.50	4.58	< 0.2	0.09
BR-24-B	36.70m	4.47	0.50	51.17	0.48	8.17	0.10	0.18	0.09	0.16	12.92	4.41	14.65	97.30	5.34	0.7	0.06
BRL-2-B	17.10m	4.05	1.09	44.26	0.16	17.02	0.13	0.34	0.66	0.35	3.54	6.18	13.71	91.47	10.90	< 0.2	0.08
BRL-2-C	22.10m	1.92	1.26	61.63	0.37	4.61	0.07	0.18	1.02	0.16	11.70	1.65	11.85	96.42	3.36	0.3	0.08
BRL-2-E	42.00m	2.50	0.93	51.98	0.47	5.98	0.09	0.36	0.66	0.61	12.11	6.70	11.60	93.97	4.58	0.5	0.06
BRL-3-H	66.40m	14.70	3.29	27.45	1.54	10.76	0.64	1.90	0.47	0.85	6.48	9.16	17.61	94.85	3.36	12.0	0.07
KG-3-D	8.00m	4.37	1.15	27.26	1.01	25.80	0.09	0.72	0.27	0.24	4.06	5.21	24.66	94.85	0.61	22.1	0.05
KG-3-E	24.60m	4.17	1.02	27.35	0.78	25.37	0.09	0.59	0.15	0.91	5.46	2.93	26.12	94.94	0.34	20.9	0.05

Description of samples

BR-17-A Weathered brown amorphous iron ore
BR-17-B Weathered black porous MN-FE ore
BR-18-B Weathered brecciated granitic gneiss cemented by goethite rich matrix
BR-18-D Strongly brecciated gneiss filled with khaki goethite rich matrix
BR-21-A Weathered brown iron ore (possibly ferrocarbonatite dyke)
BR-24-B Weathered dark brown porous ferrocarbonatite
BRL-2-B Laterite (weathered fine porous carbonatite)
BRL-2-C Weathered fine porous ore (MN_FE ore)
BRL-2-E Weathered black porous MN-FE ore
BRL-3-H Fresh pale grey carbonatite breccia rich in chlorite matrix

KG-3-D Pale grey slightly banded carbonatite (transitional facies to ferrocarb.
KG-3-E Brown massive ferrocarbonatite

Apx. 2 Results of K–Ar Dating

Sample Number	99712G	99743G	RP-79	RT-38	WR-136	BRL-1–I
Area Rock type	Sagarume ijolite	Legetet H. nephelin.	Regional Survey nephelin.	Regional Survey nephelin.	Regional Survey ijolite	Buru Hill Boring Core Carbonatite
Material Analyzed	All the samples analyzed are "whole rock"					biotite
Isotopic Age (Ma)	25.8±1.3	10.7±0.6	4.5±0.5	14.4±0.8	16.2±0.8	22.2±1.1
^{40}Ar (sec/gm × 10^{-5})	0.323 0.316 0.307	0.055 0.058	0.016 0.016	0.103 0.102	0.208 0.203	0.537 0.526 0.525
% ^{40}Ar	81.8 54.7 76.0	36.1 54.8	20.5 23.2	35.0 64.9	75.8 61.9	40.4 47.0 61.6
% K	3.11 3.13	1.36 1.36	0.91 0.90	1.81 1.84	3.24 3.27	6.10 6.08

Apx. 3 Results of Oxygen Isotope Data of the Buru Hill Carbonatite Complex

Sample Number	Location (Depth:m)	Sample Description	Type	$\delta^{18}O$ (SMOW) (0/00)
BRL–1–G*	180.00	Greenish grey altered nephelinite subjected to strong carbonitization	WR	+11.5
BRL–1–H*	198.10	Dark grey medium-grained magnetite rich ferro-carbonatite	WR	+10.1
BRL–1–J*	76.00	Black small calcite crystals in a drose of weathered carbonatite	Cal	+25.9
BRL–2–F	83.50	Pale grey to white banded fine-grained carbonatite	WR	+13.7
BRL–3–G	57.40	Pale grey to white banded fine-grained carbonatite rich in magnetite	WR	+10.8
BRL–3–J	84.50	Pale grey carbonatite breccia rich in chlorite	WR	+10.3
BR–04–A*	10.40	Dark grey compact very fine-grained siliceous iron ore	WR	+11.0
BR–13–B*	32.80	Dark grey ferrocarbonatite subjected to oxidation by weathering	WR	+5.8
BR–16–A*	30.00	Pale grey biotite bearing granitic gneiss	WR	+8.6
BR–23–B	20.50	Pale grey granitic gneiss rich in porphyroclast of K-feldsper	WR	+7.6

* Samples taken from Phase II boring, Others are from Phase III boring.
WR: whole rock, Cal: calcite

Apx. 4 Summary of EPMA Test (1)

Sample Number	Minerals	Results (weight %)				
		Components	1	2	3	Average
BR-1-A	Unknown ; probably Ba-rich Rancieite	MnO	57.96	52.64	58.08	56.23
		(MnO_2)	(70.71)	(64.22)	(70.86)	(68.60)
		BaO	13.26	12.00	12.75	12.67
		FeO	2.46	7.78	2.74	4.33
		CaO	2.55	1.86	1.89	2.10
		Total	(88.98)	(85.86)	(88.24)	(87.69)
BR-1-E	Bastnäesite	Ce_2O_3	34.27	33.56	33.60	33.81
		La_2O_3	26.47	25.17	25.07	25.57
		Nd_2O_3	2.71	4.20	2.57	3.16
		SrO	1.69	1.54	1.49	1.57
		CaO	4.19	4.88	4.75	4.61
		Total	69.33	69.35	67.48	68.72
	Barite	BaO	65.93	66.72	66.80	66.48
		SO_3	33.40	33.04	33.60	33.35
		CaO	0.50	0.35	0.32	0.39
		FeO	0.31	0.13	0.17	0.20
		SrO	0.43	1.40	1.09	0.97
		Total	100.57	101.64	101.98	101.40
BR-9-A	Pyrochlore	Nb_2O_5	61.96	61.09	60.64	61.23
		Ta_2O_5	8.25	10.06	9.71	9.34
		TiO_2	5.14	5.00	4.64	4.93
		Fe_2O_3	1.56	1.08	1.81	1.48
		CaO	14.32	13.89	14.00	14.07
		Na_2O	8.24	9.06	7.08	8.13
		Total	99.47	101.18	99.88	100.18
BR-10-A	Parisite	CaO	8.82	8.94	9.05	8.94
		Ce_2O_3	30.07	29.02	29.01	29.37
		La_2O_3	22.30	22.10	22.30	22.23
		Nd_2O_3	2.24	2.35	2.69	2.43
		SrO	1.17	1.26	1.56	1.33
		Total	64.60	63.67	64.61	64.29
BR-12-B	Bastnäesite (aggregate)	Ce_2O_3	36.05	34.20	34.72	34.99
		La_2O_3	19.33	19.30	19.34	19.32
		Nd_2O_3	8.36	7.45	7.97	7.93
		SrO	1.38	1.49	1.48	1.45
		CaO	2.49	2.28	2.39	2.39
		Y_2O_3	0.45	0.33	0.00	0.26
		Total	68.06	65.05	65.90	66.34
	Barite	BaO	67.38	66.16	66.55	66.70
		SO_3	34.27	34.36	34.21	34.28
		CaO	0.00	0.00	0.00	0.00
		FeO	0.43	0.36	0.39	0.39
		SrO	0.30	0.58	0.42	0.43
		Total	102.38	101.46	101.57	101.80

Sample Number	Minerals	Results (weight %)				
		Components	1	2	3	Average
BR-14-A	Barite	BaO	67.18	66.80	67.91	67.30
		SO_3	34.65	34.48	34.88	34.64
		SrO	0.17	0.46	0.21	0.28
		FeO	0.51	0.40	0.48	0.46
		Total	102.51	102.14	103.48	102.71
	Rancieite	MnO_2	71.00	72.67	72.07	71.91
		BaO	12.63	13.01	13.25	12.96
		CaO	1.45	1.43	1.46	1.45
		SrO	0.56	0.76	0.58	0.63
		FeO	0.40	0.62	0.82	0.61
		Total	86.04	88.49	88.18	87.57
	Bastnäesite	Ce_2O_3	33.44	32.56	31.94	32.64
		La_2O_3	22.77	22.11	22.04	22.31
		Nd_2O_3	2.84	1.18	3.53	2.52
		SrO	1.07	0.74	1.09	0.96
		CaO	6.77	6.59	7.73	7.03
		Total	66.89	63.18	66.33	65.47
BRL-1-A	Synchysite	CaO	14.29	15.08	15.01	14.79
		SrO	1.49	1.34	1.56	1.46
		BaO	1.18	0.23	1.47	0.96
		Ce_2O_3	24.80	24.25	25.42	24.82
		La_2O_3	7.00	4.70	6.70	6.13
		Nd_2O_3	10.53	11.64	10.73	10.97
		Total	59.29	57.24	60.89	59.14
BRL-1-D	Barite	SO_3	33.56	34.45	32.85	33.62
		BaO	66.82	66.59	66.48	66.63
		CaO	0.42	0.13	0.08	0.21
		FeO	0.36	0.40	0.46	0.41
		SrO	0.48	0.31	0.27	0.35
		Total	101.64	101.88	100.14	101.22
BRL-1-F	Pyrochlore	Nb_2O_5	61.06	61.34	59.78	60.73
		Ta_2O_5	9.27	9.88	10.23	9.79
		TiO_2	4.82	4.41	4.56	4.60
		Fe_2O_3	0.77	0.62	0.70	0.70
		CaO	13.98	14.45	13.97	14.13
		Na_2O	8.48	7.30	9.54	8.44
		Total	98.38	98.00	98.78	98.38
BRL-1-H	Strontianite	SrO	62.16	65.94	66.72	64.94
		CaO	8.09	5.90	4.69	6.23
		Total	70.25	71.84	71.41	71.17
	Huanghoite – Synchysite	CaO	4.34	8.35	6.77	6.49
		SrO	4.22	3.06	3.84	3.71
		BaO	14.95	8.55	11.93	11.81
		Ce_2O_3	20.74	21.58	20.80	21.04
		La_2O_3	21.58	22.43	21.03	21.68
		Nd_2O_3	2.02	2.01	1.87	1.97
		Total	67.85	65.98	66.24	66.69

Apx. 4 Summary of EPMA Test (2)

Sample Number	Minerals	Components	Results(weight %)			Average
BRL-2-F	Barite		1	2	3	
		BaO	65.65	66.17	66.58	66.47
		SO_3	33.25	31.74	32.89	32.63
		CaO	0.24	0.18	0.18	0.20
		Fe_2O_3	0.02	0.10	0.18	0.10
		SrO	1.22	0.42	0.05	0.56
		Total	101.38	98.61	99.88	99.96
	Pyrochlore		4	5	6	
		Nb_2O_5	65.50	65.65	65.39	65.18
		Ta_2O_5	6.89	6.41	6.92	6.74
		TiO_2	2.91	2.72	2.67	2.77
		Fe_2O_3	1.95	1.39	1.00	1.45
		CaO	11.12	11.37	11.09	11.19
		Na_2O	11.36	11.10	11.86	11.44
		Total	98.73	98.64	98.93	98.77
	Bastnaesite		7	8	9	
		CeO_2	29.47	26.02	27.06	27.52
		La_2O_3	24.06	21.39	22.10	22.52
		Nd_2O_3	5.93	5.92	5.87	5.91
		SrO	2.55	1.86	2.56	2.31
		CaO	6.27	6.03	6.09	6.13
		Fe_2O_3	1.10	5.33	1.27	2.57
		MnO	0.12	0.31	0.10	0.18
		Total	69.50	66.86	65.05	67.14
BRL-3-B	Barite		1	2	3	
		BaO	67.05	65.55	65.51	66.04
		SO_3	34.65	33.74	33.10	33.83
		CaO	0.34	0.48	0.47	0.43
		Fe_2O_3	0.03	0.00	0.04	0.02
		SrO	0.31	0.29	0.25	0.28
		Total	102.38	100.06	99.37	100.60
	Pyrochlore		4	5	6	
		Nb_2O_5	65.17	66.03	64.82	65.34
		Ta_2O_5	7.30	6.63	7.52	7.15
		TiO_2	3.56	3.49	3.66	3.57
		Fe_2O_3	1.10	0.70	0.51	0.77
		MnO	0.43	0.60	0.16	0.40
		CaO	11.96	11.98	12.33	12.09
		Na_2O	9.48	8.94	9.10	9.17
		Total	99.00	98.37	98.10	98.47
BRL-3-D	Barite		1	2	3	
		BaO	67.04	65.90	66.50	66.48
		SO_3	32.98	33.76	33.23	33.32
		CaO	0.01	0.19	0.18	0.13
		Fe_2O_3	0.00	0.00	0.00	0.00
		SrO	0.20	1.40	0.74	0.78
		Total	100.23	101.25	100.65	100.71
	REE-rich Carbonate Mineral		4	5	6	
		CeO_2	11.76	12.70	11.29	11.92
		La_2O_3	6.15	7.07	6.47	6.56
		Nd_2O_3	7.51	6.61	6.27	6.80
		BaO	4.44	4.41	6.34	5.06
		SrO	0.95	1.21	1.16	1.11
		CaO	8.52	8.63	7.56	8.24
		Fe_2O_3	3.56	1.62	1.98	2.39
		MnO	25.70	25.05	20.23	23.66
		Total	68.59	67.30	61.30	65.73
BR-17-D	Rancieite		1	2	3	
		BaO	16.33	15.91	15.32	15.85
		SrO	0.06	0.44	0.26	0.25
		CaO	0.84	0.61	1.16	0.87
		Fe_2O_3	2.05	1.88	2.24	2.06
		MnO	59.21	59.85	58.53	59.20
		Total	78.49	78.69	77.51	78.23
	Barite		4	5	6	
		BaO	66.02	67.07	67.25	66.78
		SO_3	32.47	33.19	32.99	32.88
		CaO	0.02	0.40	0.25	0.67
		Fe_2O_3	0.00	0.21	0.00	0.22
		SrO	0.33	0.70	0.00	0.34
		Total	98.84	101.57	100.49	100.30
BR-2A-A	Pyrochlore		1	2	3	
		Nb_2O_5	67.18	66.12	66.29	66.53
		Ta_2O_5	10.66	10.01	9.54	10.07
		TiO_2	4.85	4.16	4.40	4.47
		Fe_2O_3	1.84	1.86	1.19	1.63
		CaO	11.85	11.54	11.86	11.74
		Na_2O	3.39	1.86	2.26	2.50
		MnO	0.16	0.40	0.16	0.24
		Total	99.93	95.95	95.70	97.20
	Rancieite		4	5	6	
		BaO	15.64	15.52	16.03	15.73
		CaO	4.81	4.66	5.02	4.83
		Fe_2O_3	3.53	4.60	3.31	3.81
		SrO	0.50	0.40	0.55	0.48
		MnO	55.12	53.07	54.30	54.16
		Total	79.60	78.25	79.21	79.02
BR-24-A	Bastnaesite		7	8	9	
		CaO	9.73	7.79	7.21	8.24
		Fe_2O_3	0.21	3.48	2.52	2.07
		SrO	1.22	1.58	2.14	1.65
		CeO_2	26.33	28.51	29.36	28.07
		La_2O_3	4.23	5.35	6.10	5.23
		Nd_2O_3	16.15	14.02	15.44	15.20
		Total	57.87	60.73	62.77	60.46
BR-24-B	Barite		1	2	3	
		BaO	67.07	66.06	66.51	66.55
		SO_3	33.20	33.24	33.72	33.39
		CaO	0.47	0.23	0.08	0.26
		Fe_2O_3	0.34	0.51	0.69	0.51
		SrO	0.50	0.21	0.39	0.37
		Total	101.58	100.25	101.39	101.07
KG-2-A	Pyrochlore		1	2	3	
		Nb_2O_5	66.67	66.10	67.40	66.72
		Ta_2O_5	6.13	6.46	5.91	6.17
		TiO_2	3.92	4.08	4.25	4.08
		Fe_2O_3	0.57	0.78	0.57	0.64
		CaO	13.84	13.74	14.37	13.98
		Na_2O	6.97	8.01	7.80	7.59
		MnO	0.09	0.05	0.20	0.08
		Total	98.19	99.22	100.50	99.30
	Rancieite		4	5	6	
		BaO	15.91	16.35	16.70	16.32
		CaO	0.61	0.65	0.57	0.61
		Fe_2O_3	4.48	5.79	2.82	4.36
		MnO	59.11	57.15	61.01	59.09
		SrO	0.45	0.47	0.52	0.48
		Total	80.56	80.41	81.62	80.86
	Bastnaesite		7	8	9	
		BaO	3.62	2.71	3.74	3.36
		CaO	9.55	7.52	5.81	7.63
		SrO	2.67	2.21	2.40	2.43
		CeO_2	18.78	20.58	21.53	20.30
		La_2O_3	19.41	22.02	24.58	22.00
		Nd_2O_3	3.68	3.50	4.82	4.00
		Total	57.71	58.55	62.88	59.71
KG-3-A	Barite		1	2	3	
		BaO	65.95	65.49	64.68	65.37
		SO_3	33.24	33.48	32.85	33.19
		CaO	0.39	0.55	0.20	0.38
		Fe_2O_3	0.17	0.22	0.03	0.14
		MnO	0.08	0.10	0.15	0.11
		SrO	0.44	0.56	1.03	0.68
		Total	100.27	100.40	98.94	99.87
	Bastnaesite		4	5	6	
		CaO	4.92	4.64	3.49	4.35
		CeO_2	30.70	30.29	30.37	30.45
		La_2O_3	23.73	22.84	23.55	23.37
		Nd_2O_3	6.01	5.45	5.33	5.60
		Fe_2O_3	0.03	0.10	0.25	0.13
		MnO	0.42	0.22	0.00	0.21
		SrO	1.57	1.41	1.66	1.55
		Total	67.38	64.95	64.65	65.66
KG-5-B	Barite		1	2	3	
		BaO	66.10	66.50	65.15	65.92
		SO_3	33.48	33.31	32.76	33.18
		CaO	0.22	0.14	0.39	0.25
		Fe_2O_3	0.71	0.35	0.28	0.45
		MnO	0.20	0.12	0.03	0.12
		SrO	0.99	0.39	0.66	0.68
		Total	101.70	100.81	99.27	100.59
	Rancieite		4	5	6	
		MnO	58.74	58.64	58.64	58.01
		BaO	13.70	14.24	14.24	14.24
		Fe_2O_3	3.74	4.20	5.18	4.37
		CaO	0.78	0.69	1.01	0.83
		SrO	0.90	0.92	0.91	0.91
		Total	77.86	78.69	80.31	78.95
KG-6-A	Barite		1	2	3	
		BaO	66.83	65.95	66.29	66.36
		SO_3	33.54	33.39	33.57	33.50
		CaO	0.12	0.12	0.26	0.17
		Fe_2O_3	0.10	0.05	0.06	0.07
		MnO	0.08	0.05	0.08	0.07
		SrO	0.25	0.54	0.47	0.42
		Total	100.92	100.10	100.73	100.58

* Numbers on analytical results show analysed points in X-ray Images.

FLOW CHART OF THE HOMA BAY PROJECT