Fig.2-1-1, teeth are drawn to indicate the sharp scarp).

The features indicating dome structures are ③ zones raised relative to the adjoining areas with circular or oval periphery and outward radial drainage pattern.

## 1-2 Results of Interpretation

### 1-2-1 Delineation of geologic units

From the combination of the factors mentioned in the previous section, the geology of the survey area was divided into four unit groups, A, B, C and I, then B and I were further subdivided to a total of ten geological units (henceforth units) as shown in Figure 2-1-1. An alphabetical symbol is given to each unit in the order of age from older to younger and I was given to a unit which was inferred to be an intrusive body.

The photo-characteristics and morphological expression of the units are shown in Table 2-1-1, the distribution and the photogeological characteristics of the units are as follows.

The geological map (1:250,000) of Viti Levu prepared on the basis of the work carried out last year was referred to during the classification.

(1) Unit A

This unit is distributed in the southern part of the survey area.

The tone is light to dark and the texture is medium to coarse. The drainage pattern is dense dendritic, and the resistance and the relief are both variable from low to high.

The photogeologic characteristics of this unit indicate massive rock bodies and it is inferred to consist of volcanic rocks. It will be called Karawa* Volcanics in this report. This is correlated to the Koroimavua Volcanic Group of the first phase survey. The units will be named after a locality of their respective distribution.

* Mt. Karawa (elevation 827.2m).

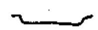
(2) Unit $B_{1-1}$

This unit is distributed in the central to southern part of the survey area. It occurs surrounding Unit A in fan-like fashion, and also as three small domes (1 - 1.5km in diameter) within Unit A.

The tone is dark to light and the texture coarse. The drainage pattern is dendritic and it is the most dense pattern in the survey area. The resistance and the relief are both very high.

This unit is inferred to consist of volcanic rocks composed

Table 2-1-1 Photogeological Interpretation Chart of the Mba-west Area

| Geologic Units | | | Photo-characteristics: Tone | Photo-characteristics: Texture | Morphological expression: Drainage: Pattern | Morphological expression: Drainage: Density | Morphological expression: Resistance | Morphological expression: Cross section | Morphological expression: Bedding | Morphological expression: Lineament | Conclusions | | Previous Geologic Map (1 : 250,000, 1991) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | | | medium to light | very fine (mosaic) | meandering | partly high and low | very low |  | none | none | Alluvium | | Alluvium | |
| B | $B_2$ | $B_{2-3}$ | light and dark | medium | dendritic, outward and inward radial | medium | very high |  | none | poor | Koroivunatoto Volcanics | | Ba volcanic Group | Nakorotubu Basalt |
| | | $B_{2-2}$ | light to dark | medium | dendritic, inward radial | high | high to low |  | poor | medium | Rakiraki Volcanics | | | Karavi Volcanics |
| | | $B_{2-1}$ | dark | medium | dendritic, outward and inward radial | high | very high |  | none | high | Nalawelo Volcanics | | | Namosau Volcanics |
| | $B_1$ | $B_{1-3}$ | medium | very fine (mosaic) | subdendritic and subparallel | high | low |  | poor | poor | fine-grained detrital or pyroclastic r. | Koroyanitu Volcanics | | Koroyanitu Breccia |
| | | $B_{1-2}$ | medium to dark | medium | subdendritic and subparallel | medium | low to medium |  | poor | poor | medium-grained pyroclastic r. | | | |
| | | $B_{1-1}$ | dark to light | coarse | mostly dendritic, partly parallel | very high | very high |  | none | medium | volcanic rocks | | | |
| A | | | light to dark | medium to coarse | dendritic | high | low to high |  | none | medium | Karawa Volcanics Volcanic Group | | Koroimavua | |
| I | $I_2$ | | medium | medium | none | none | very high |  | none | none | Dykes | | Dykes | |
| | $I_1$ | | light | medium | dendritic | high | low |  | none | poor | Navilawa Intrusive Rocks | | Intrusive | |

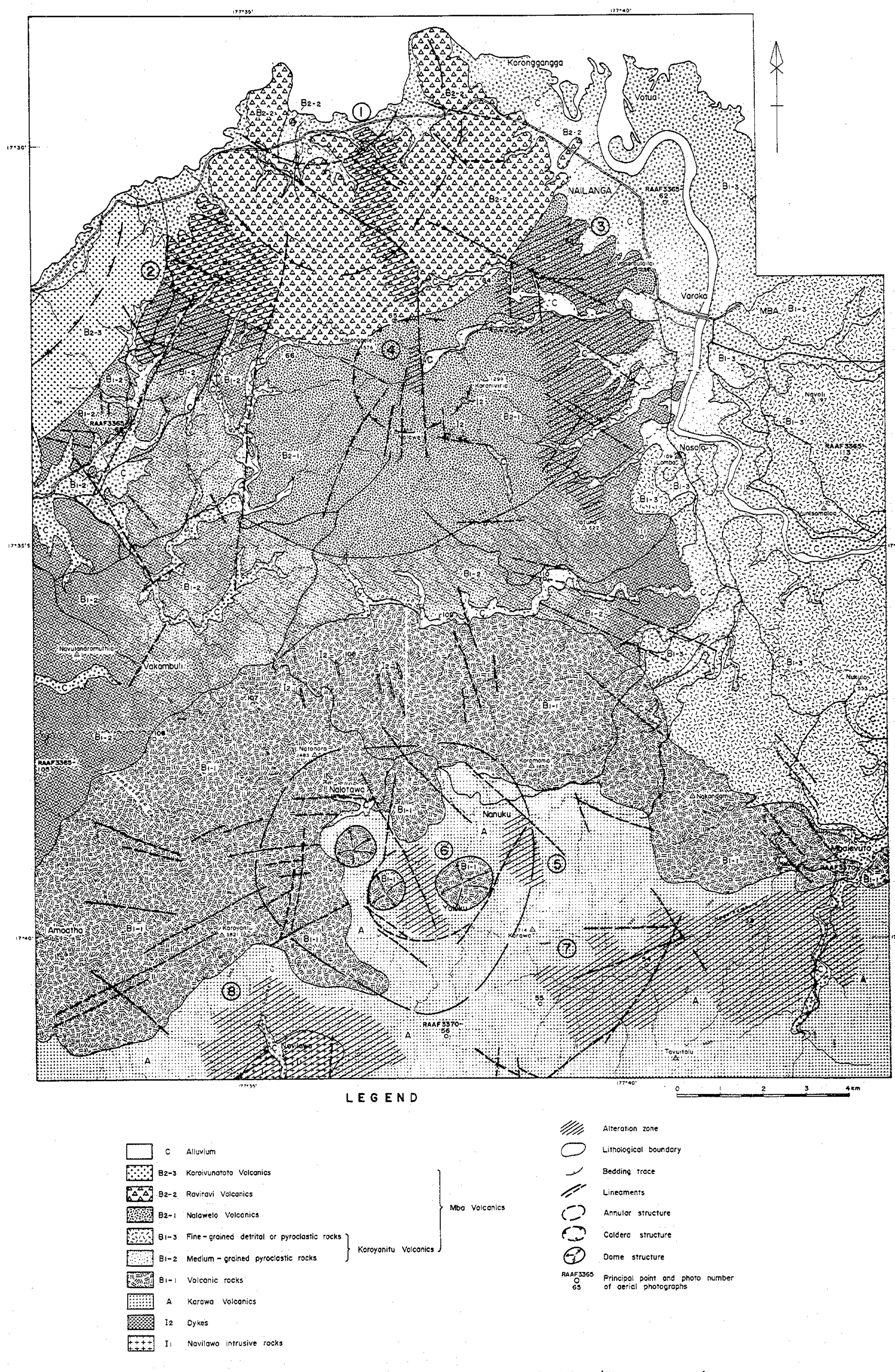



Fig.2-1-1 Aerial Photogeological Interpretation Map (Mba-west Area)

mostly of lava. It will be called Koroyanitu* Volcanics in this report. It is correlated to the Koroyanitu Breccia, the lowermost unit of the Ba Volcanic Group of first the phase survey.

* Mt. Koroyanitu (elevation 1,164.6m).

(3) Unit $B_{1-2}$

This unit is distributed in the central to the western part of the survey area and it overlies Unit $B_{1-1}$.

The tone is medium to dark and the texture also medium. The drainage pattern is of low to medium density and is sub-dendritic to sub-parallel. The resistance and relief are both low to medium.

Bedding with low northwestward dip is observed near the boundary with Unit $B_{1-1}$. It is inferred to consist of medium-grained pyroclastic rocks. The lithology is similar to the middle to upper Koroyanitu Volcanics. It is correlated to the Koroyanitu Breccia of the first phase survey.

(4) Unit $B_{1-3}$

This unit is distributed in the central to the eastern part of the survey area and overlies Unit $B_{1-1}$.

The tone is medium. The texture is very fine and the structure of the particle is mostly mosaic. The drainage pattern is dense and is sub-dendritic to sub-parallel. The resistance and the relief are both low.

This unit is inferred to consist of fine-grained detrital or pyroclastic rocks. It is correlated to the Upper Vuda Beds of the Koroyanitu Breccia in the 1:50,000 Lautoka geological sheet (Rao,1983).

The mosaic texture of the particle is interpreted as farm area composed mostly of sugar cane plantations.

(5) Unit $B_{2-1}$

This unit is distributed in the central part of the survey area.

The tone is dark and the texture is medium. The drainage pattern is dense and dendritic, outward and inwardly radial. The resistance and relief are both very high.

It is inferred to consist of volcanics composed mostly of lava. It will be called Nalawelo* Volcanics in this report. This unit is correlated to the Namosau Volcanics of the Ba Volcanic Group of the first phase survey.

* Mt. Nalawelo (elevation 538.9m).

(6) Unit $B_{2-2}$

This unit is distributed in the northernmost part of the survey area.

The tone is light to dark and the texture is medium. The drainage pattern is dense and dendritic to inward radial. Resistance and relief are both variable from high to low. Bedding with low southeasterly dip is observed in parts of the ridge.

This unit is inferred to consist of volanics composed mostly of lava. It will be called Raviravi* Volcanics in this report. It is correlated to the Karavi Volcanics of the Ba Volcanic Group of the first phase survey.

* Raviravi Creek.

(7) Unit $B_{2-3}$

This unit is distributed in the northwestern part of the survey area.

The tone is light to dark, and the photo-characteristics and morphological expression are the same as those of Unit $B_{2-1}$.

It is inferred to consist of volcanics composed mostly of lava and will be called Koroivunatoto* Volcanics. It is correlated to Nakorotubu Basalt of the first phase survey.

* Mt. Koroivunatoto (elevation 225.6m).

(8) Unit C

This unit is distributed relatively widely along the Mba River and in the low areas along the coast.

The tone is medium to light. The texture is very fine and the structure of the particle is mosaic. The drainage is characterized by meandering pattern. The resistance is very low.

This unit is inferred to be alluvium and its distribution corresponds to that of the Pleistocene flood plain sediments and also to the Late Pleistocene to Holocene(?) alluvium in the 1:50,000 Lautoka geological sheet (Rao,1983).

(9) Unit $I_1$

This unit is distributed in a small scale in the southern end of the survey area.

The tone is medium and the texture is medium. The drainage pattern is very dense and is dendritic. Both the resistance and the relief are very low.

This unit is inferred to consist of massive intrusive rocks and will be called Navilawa Intrusives in this report.

It corresponds to Navilawa Stock of the first phase survey.

(10) Unit $I_2$

This unit occurs as linear or spotty bodies within Units $B_{1-1}$ and $B_{2-1}$.

The resistance is very high and the unit is characterized by the unique linear and spotty distribution.

This unit is inferred, from its occurrence, to be dykes.

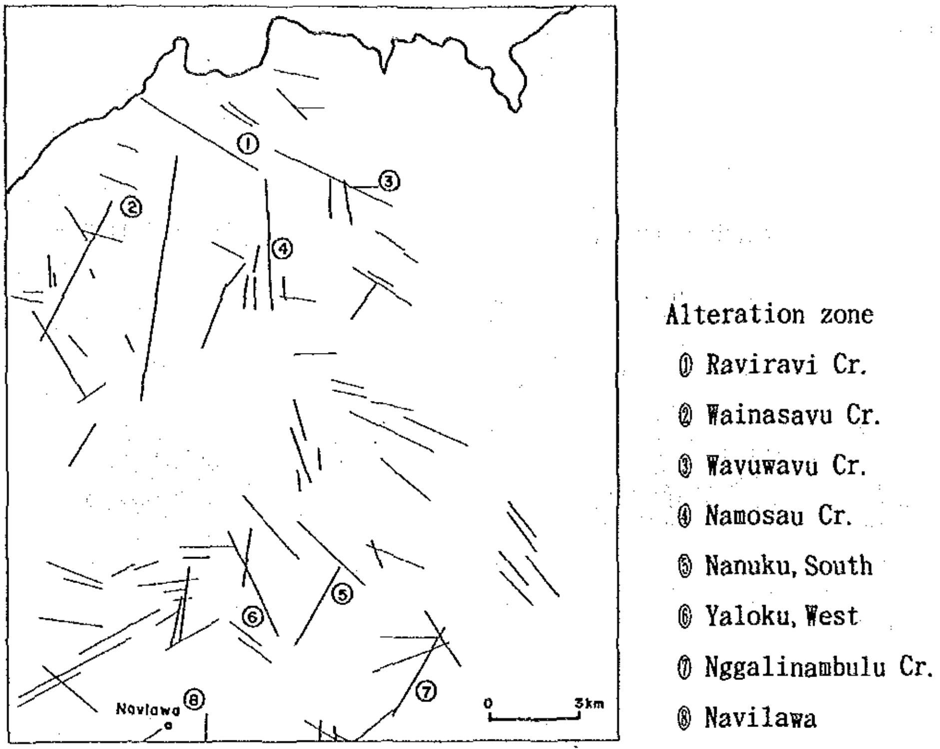



Fig. 2-1-2 Lineament Map Interpreted from Aerial Photographs (Mba-west Area)

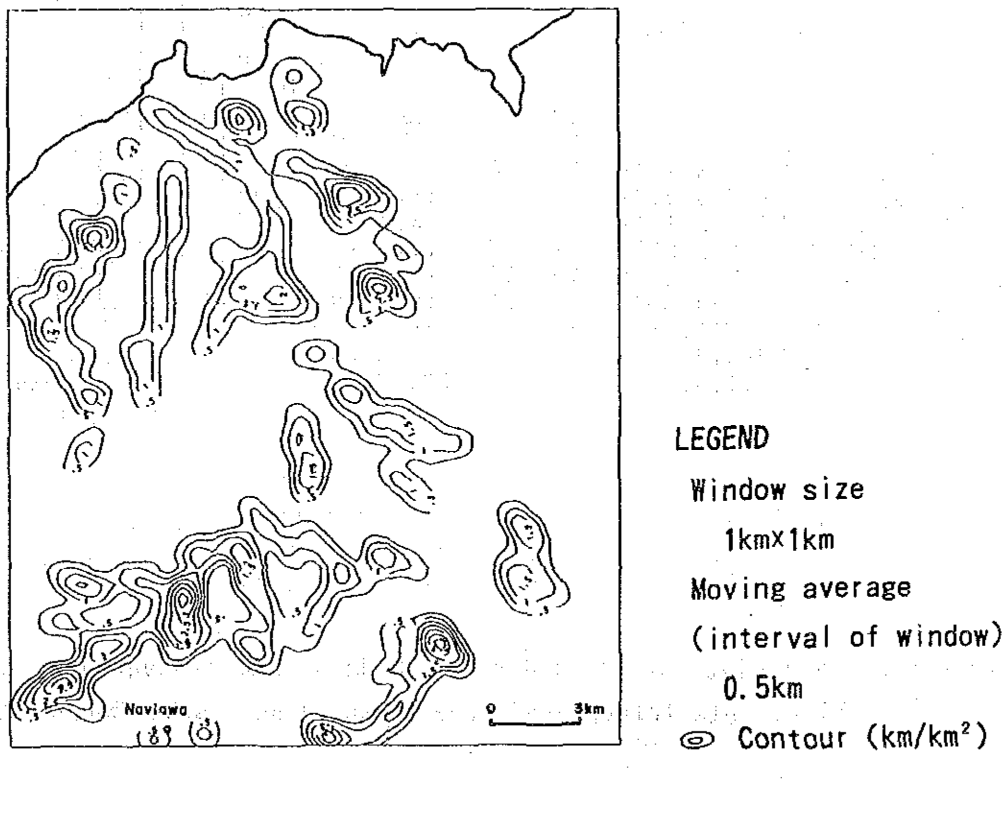
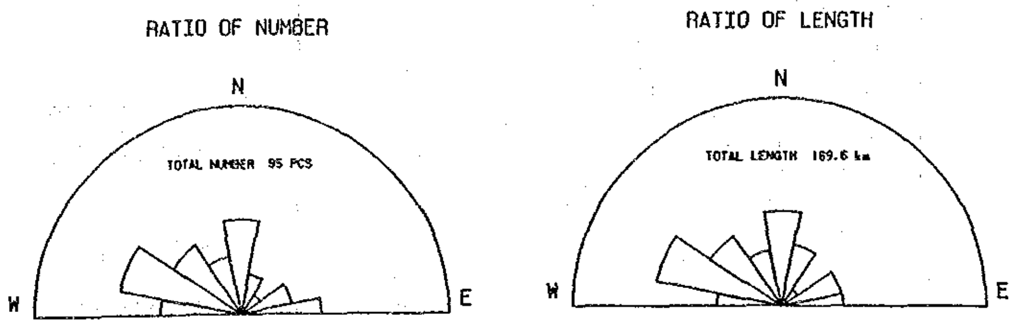



Fig. 2-1-3 Lineament-density Map Interpreted from Aerial Photographs (Mba-west Area)




| DIRECTIONS | | NUMBER PCS | NUMBER % | LENGTH km | LENGTH % |
|---|---|---|---|---|---|
| E | S78.75°E-N78.75°E | 14 | 15 | 18.8 | 11 |
| ENE | N78.75°E-N56.25°E | 9 | 9 | 18.5 | 11 |
| NE | N56.25°E-N33.75°E | 4 | 4 | 5.8 | 3 |
| NNE | N33.75°E-N11.25°E | 7 | 7 | 18.7 | 11 |
| N | N11.25°E-N11.25°W | 16 | 17 | 28.4 | 17 |
| NNW | N11.25°W-N33.75°W | 10 | 11 | 16.9 | 10 |
| NW | N33.75°W-N56.25°W | 14 | 15 | 25.2 | 15 |
| WNW | N56.25°W-N78.75°W | 21 | 22 | 37.3 | 22 |
| | TOTAL | 95 | | 169.6 | |

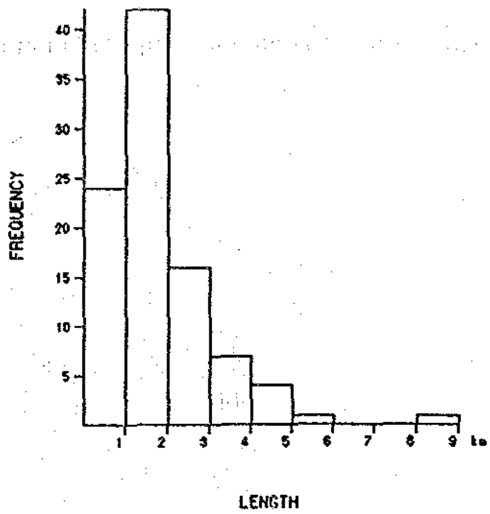



**Fig.2-1-4 Rose Diagrams of Number and Length, and Histogram of Length of Lineaments Interpreted from Aerial Photographs (Mba-west Area)**

### 1-2-2 Structural characteristics

(1) Folds

As mentioned in the earlier section, bedding is observed in Units $B_{1-1}$ and $B_{2-2}$. These dip southward in the northern and northward in the southern part of the area. The bedding in the north occurs very locally. This information is not sufficient to understand the general structure of the survey area, but combined with the distribution of the units, it is believed that the overall structure is gently dipping northward. There is, however, a possibility of localized fold structures.

(2) Lineaments

A total of 95 lineaments were extracted from this area (Fig. 2-1-2). Figure 2-1-3 is a lineament density map which shows the total length of lineations within a unit area. The window for this map is 1km × 1km, the moving average-interval is 0.5km and the contour interval is 1 km. This was prepared in order to obtain the general trend of the distribution of the lineaments.

The rose diagram of the lineaments and histogram of the length of the lineaments are laid out in Figure 2-1-4. In Figure 2-1-5, the directions of all lineaments of the survey area are divided into eight groups of 22.5° each and Figure 2-1-6 is the density map of the above.

The following features regarding the lineament distribution are observed from the above.

① Lineaments occur densely (over 1.5km contour) in the southern and northern parts in Units A and B.

② The dominant trends of the lineaments are WNW (22%), N (17%), NW (15%), E (15%) and the proportion of the lineaments trending NE is less than 4%.

③ Regarding the length of the lineaments, 1 - 2 km are most abundant, 42 lineaments, followed by shorter than 1km, 24, 2-3 km, 16, these amount to 86% of all lineaments.

④ The longest lineament extends for 8km in N-S direction. It is the border of $B_{1-2}$ and $B_{2-1}$.

(3) Annular structures, caldera structures and dome structures

One annular structure, three caldera structures and three dome structures were observed in the survey area. The relation between these structures and the geologic units are as follows.

① Annular structure: Occurs in an area covering Units A and $B_{1-1}$.

② Caldera structures: Observed in Units $B_{2-1}$, $B_{2-2}$ and $B_{2-3}$. That in $B_{2-1}$ has a closed circular shape while the latter two is arc shaped.

③ Dome structures: All occur within annular structure. They are in Unit $B_{1-1}$ and are surrounded by Unit A. The maximum diameter of the dome is 1.3km.

## 1-3 Discussions

### 1-3-1 Lithology and geologic structure

(1) The survey area is inferred to consist of volcanic rocks from; the existence of caldera and dome structures, various photogeologic characteristics and morphological features.

(2) These volcanic rocks are considered to have been formed by at least four volcanic activities. Unit $B_1$ by activities with the center near the annular or dome structures and Unit $B_2$ by independent volcanic activities with centers at each caldera structure. These activities probably migrated northward from the south.

(3) The overall geologic structure of the survey area is considered to be monoclinic with gentle northward dip. But gently southward dipping bedding is observed locally in the northern part and there is a possibility of local fold structure.

(4) There is a tendency for the lineations to develop in the vicinity of annular, caldera and dome structures. Thus the lineations are considered to be closely related to the formation of these structures.

(5) Lateral faults are inferred to occur where lineaments are arranged en echelon as in Figure 2-1-5. In this figure, the inferred lateral faults and their sense of movement are shown as well as the directions of the major maximum horizontal compressional stress axes. It is seen that there are two directions of the major stress axis, namely NNW to NNE and ENE to ESE.

Similar analysis was carried out in the first phase of this project which was conducted in 1990. It is now clear that the maximum horizontal compressional stress axes of ENE to ESE direction is predominant since Middle Pliocene and that NNW to NNE was the dominant direction from latest Miocene to Early Pliocene.

The major formations of the area with lineaments are of latest Miocene to Early Pliocene in age and the above two directions of the stress axes obtained this year is harmonious with the results of last year.

From the above, it is possible to estimate the age of some of the lineations. Namely, lineaments considered to have formed in Early Pliocene are distributed in the central and eastern part of southern Mba-west area, and those believed to have formed since Middle Pliocene occur in northwestern, central, and southwestern parts.

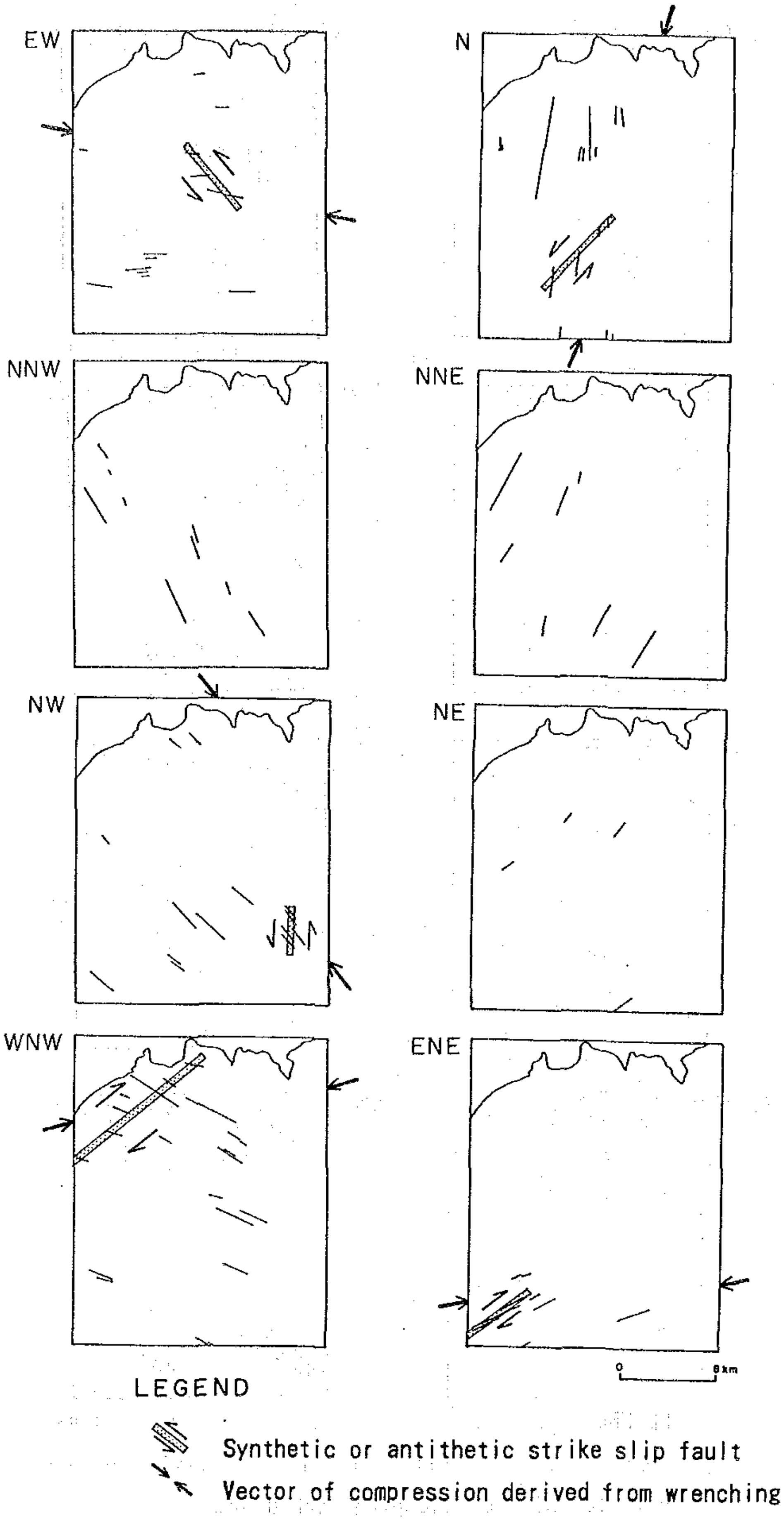
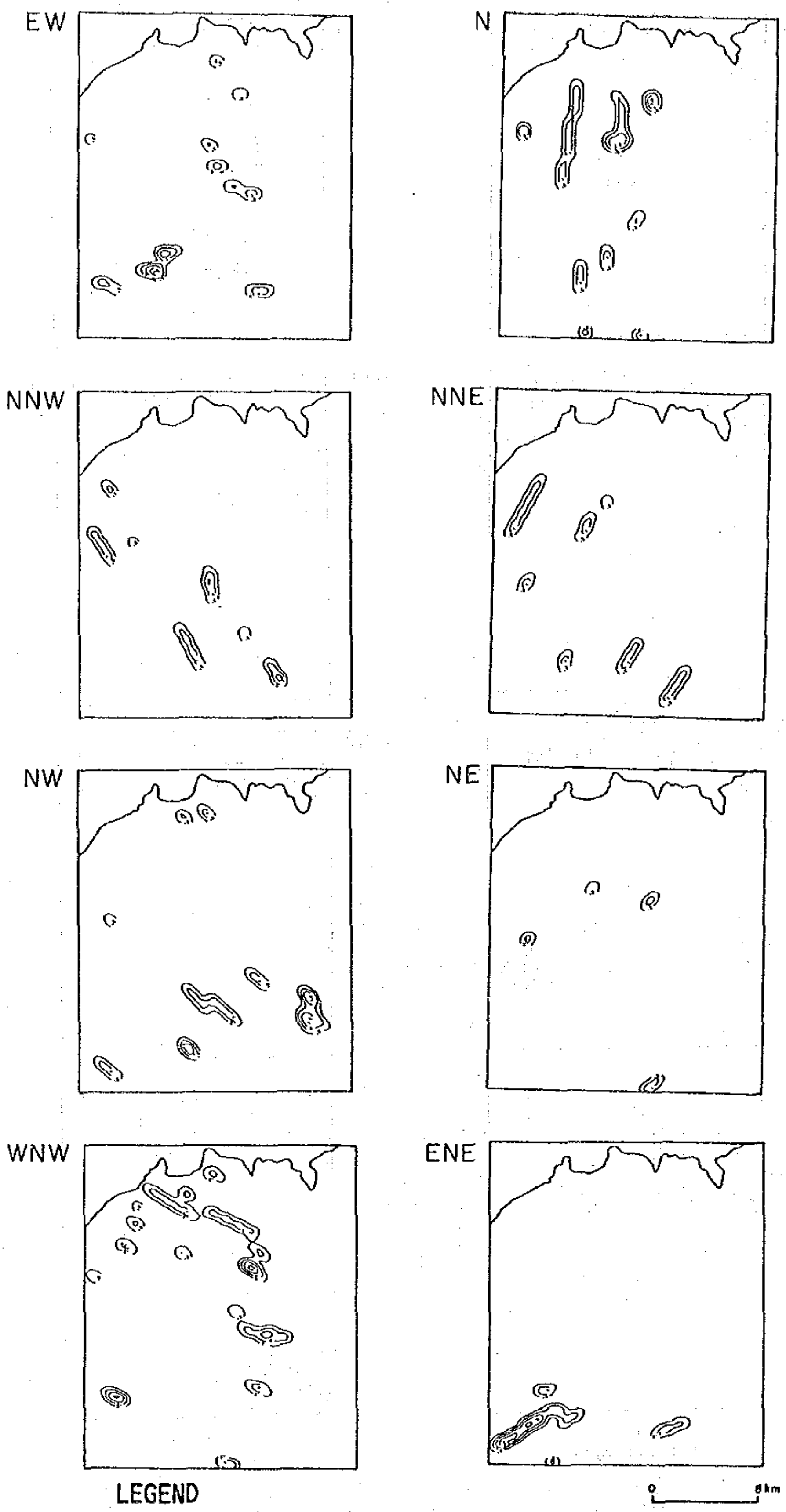



**Fig. 2-1-5 Lineament System Map Interpreted from Aerial Photographs (Mba-west Area)**




LEGEND

Contour of total length of the lineaments covered by a filter of 1km² stepping each 0.5km

**Fig.2-1-6 Lineament-density System Map Interpreted from Aerial Photographs (Mba-west Area)**

### 1-3-2 Alteration zones

Mineral showings in the north of Kingston Mine in the southern margin of the survey area and the Mbalevuto Mineral Showing in the southeastern part are known. These are high sulfidation (acid sulfate) type of epithermal vein, network and dissemination type gold mineralized zones. They occur in the alunite, kaolin and quartz

acidic alteration zones.

The photogeologic features which characterizes these alteration zones are the low resistance and the low relief.

The zones with photogeologic similarity with the above two alteration zones amount to eight (Fig. 2-1-1). They are listed below.

| Location | Size | Unit, Characteristics |
|---|---|---|
| 1 Raviravi Cr. | 4km(N-S)×1km(E-W) | $B_{2-2}$, mainly inside the caldera structure |
| 2 Wainasave Cr. | 4km(N-S)×3km(E-W) | $B_{2-2}$, $B_{1-2}$, outside the caldera structure |
| 3 Wavuwavu Cr. | 7km(N-S)×3km(E-W) | $B_{2-1}$, $B_{1-2}$ |
| 4 Namosau Cr. | 1.2km(N-S)×0.5km(E-W) | $B_{2-1}$, in the central part of the caldera structure |
| 5 S of Nanuku | 1.5km(N-S)×1km(E-W) | A, inside the annular structure |
| 6 W of Yaloku | 2km(N-S)×1km(E-W) | A, in the central part of the annular structure |
| 7 Nggalinambulu Cr. | 3km(N-S)×7km(E-W) | A, include Mbalevuto prospect |
| 8 Navilawa | 2.5km(N-S)×4.5km(E-W) | A, correlated to the prospect in the north of Kingstone Mine |

# Chapter 2 Mba-west

## 2-1 Method of Survey

Mba-west area was delineated, during the first phase survey of this project in 1990, as having high potential of epithermal gold discovery from the following characteristics. The area is relatively unexplored; there are alteration zones scattered throughout the area; there is the Mbalevuto Gold Prospect in the south; the possibility of the existence of volcanic depressions and domes in the southwest and north; and the gravity structure in the north is similar to that of the Tavua Caldera zone. Based on these conclusions of the previous year, the area was selected for conducting geological and geochemical surveys and drilling in the second phase.

The geological and geochemical work were conducted simultaneously along the streams and ridges. The sampling interval for the geochemical prospecting ranged from 100 to 200 m.

The geochemical orientation survey in the area east of the Emperor Mine, carried out during the first phase, showed that gold tend to concentrate more in the A soil horizon than in the B horizon. Since the geological environment of Mba-west has similarities to that of the above area, soil samples from A horizon were collected.

The drilling site for the present phase was selected during the surface survey. Therefore, the target was selected on the basis of the results of the field survey at that time, SLAR imagery interpretation ,and photogeological interpretation. The upper part of the Namosau Creek was chosen because a silicified zone with clear direction occur in the argillized zone.

The details of the methods used for this survey are laid out in the "OVERVIEW 1-3-3".

## 2-2 Geology

### 2-2-1 Outline of geology

The geology of this area consists of Miocene-Pliocene Series, Pliocene Series, Holocene Series, and intrusive bodies in the Pliocene formations. The stratigraphic classification is after Rodda (1989).

The Miocene-Pliocene Series consists of Sabeto Volcanics of the Koroimavua Volcanic Group. It is composed of andesitic vol-

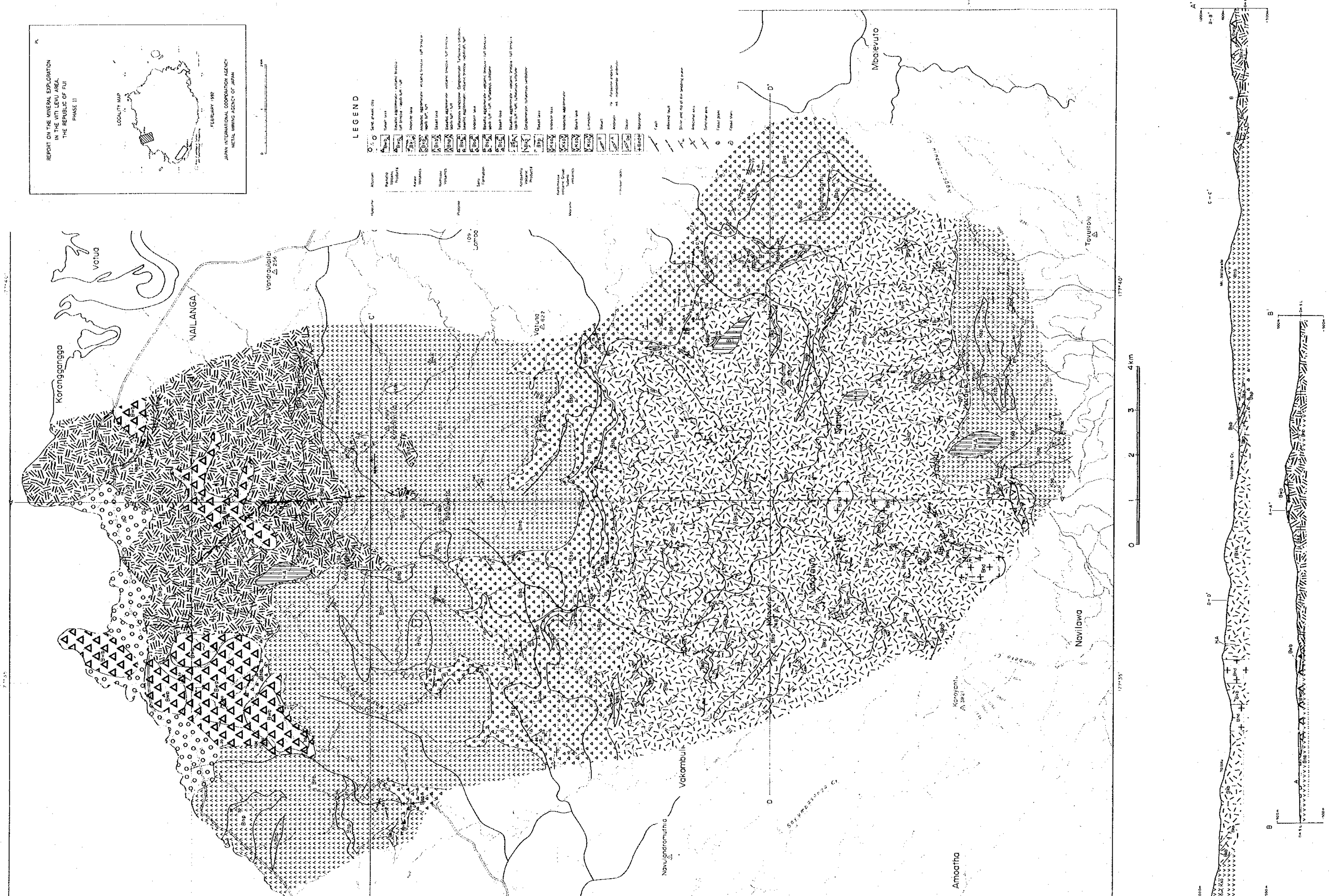



Fig.2-2-1 Geological Map with Geological Profiles of the Mba-west Area

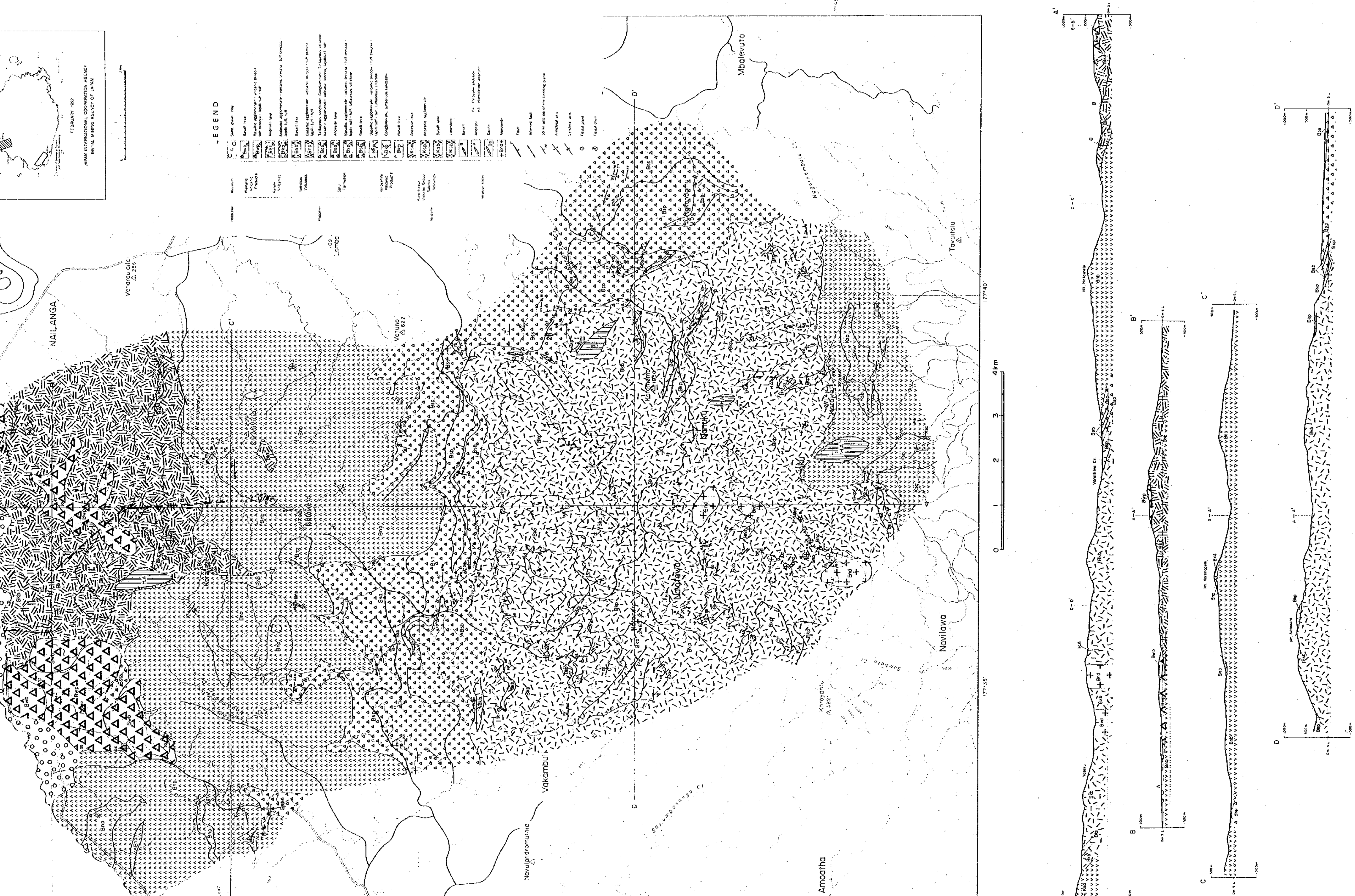


Fig.2-2-1 Geological Map with Geological Profiles of the Mba-west Area

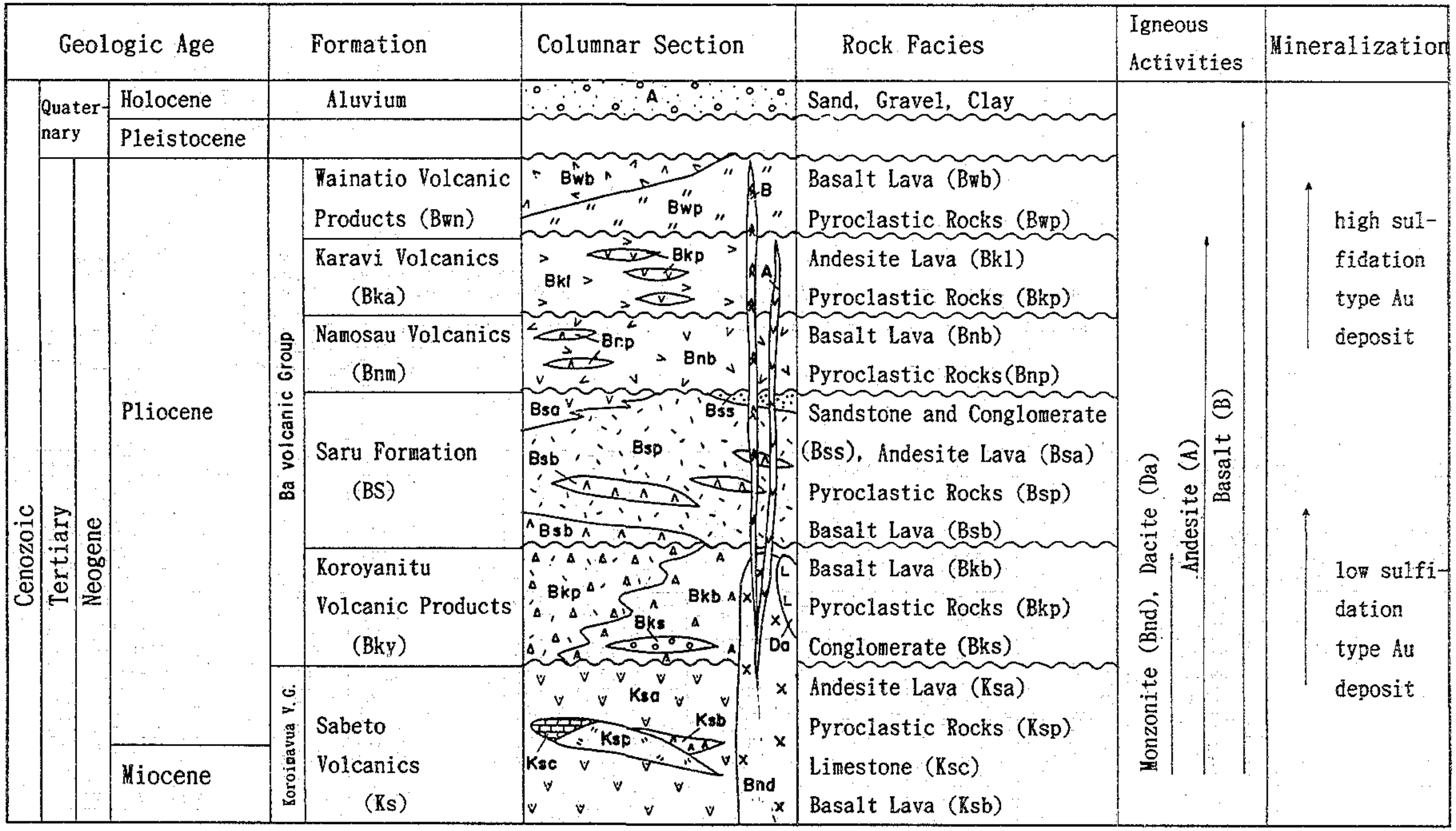



Fig.2-2-2 Schematic Stratigraphic Columns (Mba-west Area)

## Table 2-2-1 Results of Microscopic Observation of Thin Section (Mba-west Area)

| Sample No. | Locality | Rock Name | Formation | Texture | Phenocryst/ Crystal Fragment | | | | | | | | | Groundmass/ Matrix | | | | | | | | | | | Altered Mineral |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Qz | Kf | Pl | Bi | Hb | Au | Ol | Ap | Op | Si | Kf | Pl | Bi | Hb | Au | Hy | Ol | Op | Gl | Ap | |
| SM2-7 | N of Koronggele | Bs. | Dyke | Porph. | | | ◎ | | | ○ | | | △ | | | ○ | | | △ | | △ | | ○ | | Ca(Ol, Gl-p) |
| SM2-14 | N of Koroniviria | Ad. | Dyke | Porph. | | | ○ | | ○ | ◎ | | | △ | | | ○ | | △ | △ | | △ | | ◎ | | Id(Ol) Opa(Hb) |
| SM2-19 | S of Nalaweto | Bs. | Bnm | Porph. | | | ◎ | | | ○ | △ | | △ | | | ○ | | | △ | | △ | △ | ◎ | | Id(Ol) |
| SM2-28 | NE of Koromomo | Do. | Int. | Suboph. | | | △ | | | ○ | △ | | △ | | | ◎ | | | △ | | △ | △ | | | Mont(Au, Ol) |
| SM2-34 | E of Nanuku | Hb-Ad. | Bky | Porph. | | | ◎ | | ○ | ○ | | | △ | | | ◎ | | △ | △ | | | | ◎ | | Opa(Hb) |
| SM2-47 | N of Koronggele | Ad. | Int. | Porph. | | | ◎ | | △ | ○ | | | △ | | | ◎ | | △ | △ | | | △ | ◎ | | Opa(Hb) |
| AY2-14 | W of Nailanga | Ad. | Bka | Porph. | | | ○ | | ○ | △ | | | △ | | | ○ | | △ | △ | | | △ | ◎ | | Mont(Gl-p) Opa(Hb) |
| OK2-15 | NE of Koronggele | Bs. | Dyke | Porph. | | | ◎ | | | ○ | △ | | △ | | | ○ | | | △ | | △ | | ◎ | | Mont(Ol) Ca(Ol) |
| OK2-32 | SW of Nalaweto | Bs. | Bs | Porph. | | | ◎ | | | ○ | △ | | △ | | | ◎ | | | △ | | △ | | ◎ | | Mont(Ol, Gl) |
| OK2-34 | E of Vakambuli | Bs. | Bky | Porph. | | | ◎ | | | ○ | △ | | △ | | | ○ | | | ○ | | △ | | ◎ | | Mont(Ol, Gl-p, druse) |
| OK2-74 | W of Yaloku | Monz. | Int. | Suboph. | | | △ | | | ○ | | | △ | | △ | ◎ | ○ | | △ | | | △ | △ | | Ep(Gl, Au-p) Act(Au-p) Ca(Au-p) Chl(Gl) |
| KK2-57 | NW of Yaloku | Monz. | Int. | Suboph. | | | △ | | | ○ | | | △ | | △ | ◎ | ○ | | △ | | | △ | △ | | Act-Ca(Au-p) Ep(Gl, Au-p) Chl(Bi, Gl) Ab(Pl-p) |
| KK2-59 | NW of Yaloku | Bs. | Bky | Porph. | | | ○ | | | △ | | | △ | | | ◎ | | | △ | | | △ | ◎ | | Ca(Pl-p, Au) Chl(Pl-p, Au, Gl) Act(Au) |
| KK2-66 | Yaloku | Ad. | Ks | Porph. | | | ○ | | △ | ○ | | | △ | | | ◎ | | △ | △ | | | △ | ◎ | | Se(Pl-p) Ca(Pl-p, Au, Gl) Chl(Au) |

Abundance of minerals: ◎; abundant, ○; common, △; a few

Abbreviations
Texture: Porph; Porphyritic, Suboph; Subophitic
Mineral: Qz;Quartz, Kf;Alkali feldspar, Pl;Plagioclase, Bi;Biotite, Hb;Hornblende, Au;Augite, Ol;Olivine, Ap;Apatite, Op;Opaque mineral, Si;Silica mineral
By;Hypersthene, Gl;Glass
Ab;Albite, Act;Actinolite, Ca;Carbonate, Chl;Chlorite, Ep;Epidote, Id;Iddingsite, Mont;Montmorillonite, Opa;opasite, Se;Sericite, -p;partly
Rock : Ad;Andesite, Bs;Basalt, Do;Dolerite, Monz;Monzonite
Formation: Int.;Intrusive rock

canic products, basalt lava, and others.

The Pliocene Series consists of the following units from the lower horizon upward. Koroyanitu Volcanic Products, Saru Formation, Namosau Volcanics, Karavi Volcanics, and Wainatio Volcanic Products.

Koroyanitu Volcanic Products consists mostly of volcanic products of basaltic nature.

Saru Formation consists of basaltic volcanic products, andesite lava, and sandstone-conglomerate deposits.

Namosau Volcanics is composed of volcanic rocks of basaltic nature.

Karavi Volcanics consists of volcanic rocks of andesitic nature.

Wainatio Volcanic Products consists of volcanic rocks of basaltic nature.

Holocene Series consists of alluvium deposits comprising sand, pebbles and clay.

The intrusive rocks are; monzonite and dacite which intrude into Koroyanitu Volcanic Products, andesite dykes which intrude into Karavi Volcanics and basalt dykes which intrude into Wainatio Volcanic Products.

The formations of this area are generally superposed with gentle northward dip with local gentle fold structure.

**2-2-2 Geological description**

(1) Sabeto Volcanics

Distribution

The upper reaches of the Nggalinamblu Creek in the southern part of the area.

Lithology

Mainly andesite lava, andesitic pyroclastics, basalt lava and limestone.

Andesite lava is gray, often autobrecciated, and contain augite and biotite phenocrysts. This rock is often propylilitized. The andesitic pyroclastics comprises agglomerate, volcanic breccia, tuff breccia, and lapilli tuff. It is massive and strongly compacted, and the contained pebbles are augite andesite. Agglomerate often shows fractured lava form.

Basalt lava is compact, massive and contains small phenocrysts of augite.

Limestone is purplish gray, compact, hard, and contains irregular specks of several millimeters in size.

Stratigraphy

In this area, this formation is expressed as the undifferentiated Upper Miocene Koroimavua Volcanic Group in the 1/50,000 Lautoka geological sheet (Rao, 1983).

This formation is overlain unconformably by the Koroyanitu Volcanic Products, but the relation with the underlying strata is not clear. Andesitic pyroclastics, basaltic lava, and limestone are intercalated in andesitic lava.

The radiometric age (K-Ar) of a corresponding formation to the east of this area is reported to be 5.21± 0.07 Ma (First Phase Rpt).

(2) Koroyanitu Volcanic Products

Distribution

Area extending from Varathiva Creek to Yaloku Village in the south and the vicinity of Vakambuli Village in the west.

Lithology

The constituents are basalt lava, basaltic pyroclastics and conglomerate.

Basalt lava is black to gray, compact and hard. Its form ranges from massive, brecciated, to pillow. In places it is porous and also has amygdaloidal texture. A large amount of augite phenocrysts occur in this rock and their size varies from 1 mm to 8 mm. The rock along the Nandrou Creek east of Nanuku Village in the south, characteristically contain hornblende phenocrysts (5 mm). Those in the vicinity of Nalotawa and Nanuku Villages are often altered green.

Basaltic pyroclastics consists mainly of agglomerate and poorly sorted volcanic breccia with intercalations of tuff breccia, lapilli tuff, stratified tuff, and tuffaceous siltstone. The essential pebbles in the pyroclastics are basalt with augite phenocrysts. This pyroclastics show relatively strong compaction and often show the appearance of pillow lava. Agglomerate with augite-hornblende basalt pebbles and volcanic breccia with accidental pebbles of hornblende andesite are distributed along the Nandrou Creek.

Conglomerate occurs only in the southwestern margin of this area. This consists of small lapilli and calcareous matrix and contain shell fossils. This conglomerate gradually changes to tuffaceous sandstone in the west.

<u>Stratigraphy</u>

This formation overlies the Sabeto Volcanics unconformably and is overlain by the Saru Formation unconformably.

The basalt lava and basaltic pyroclastics of this formation interfinger with each other and the conglomerate is intercalated in basalt lava in the lowermost part of the formation.

(3) Saru Formation

<u>Distribution</u>

In a belt in the area from the southeastern part of the area through the Varathiva Creek catchment in the central part to the northwest.

<u>Lithology</u>

The constituent units are basalt lava, basaltic pyroclastics, andesite lava and sandstone-conglomerate.

Basalt lava is dark gray to black, compact, and massive to autobrecciated. It characteristically contains relatively large (3 mm) plagioclase phenocrysts and is porous in some places.

Basaltic pyroclastics consists of agglomerate, volcanic breccia, tuff breccia, lapilli tuff, tuff and tuffaceous siltstone. It is well sorted, and many of the volcanic pebbles are basalt with large plagioclase phenocrysts. The tuff and tuffaceous siltstone contain plant fossils. This rock in the northern part of the Mt. Koromomo and along the catchment of the Korotambu Creek in the southeastern part of the area, contains many accessory pebbles of dolerite and augite basalt, accidental pebbles of biotite dacite and andesite as well as porous basaltic volcanic bomb.

Andesite lava is compact and massive hornblende andesite lava and is porous in some places. Thin lapilli tuff containing plant fossils is intercalated in this lava.

Sandstone-conglomerate bed is composed mostly of alternation of tuffaceous sandstone, tuffaceous siltstone, tuff, lapilli tuff and conglomerate with thin intercalations of basaltic agglomerate and lapilli tuff. The tuffaceous sandstone and tuffaceous siltstone contain plant and shell fossils. Tuffaceous sandstone is medium- to coarse-grained medium- soft to soft rock with fine pebbles. It is relatively strongly compacted and is rich in pyroxene phenocrysts. Tuff is fine- to medium-grained crystalline tuff and contains plagioclase and pyroxene.

Stratigraphy

This formation overlies the Koroyanitu Volcanic Products unconformably and is overlain by the Namosau Volcanics also unconformably.

In the lower part of this formation, two sheets of basaltic lava is intercalated in pyroclastics, and in the upper part, andesite lava and sandstone-conglomerate overlie the pyroclastics. The distribution of the andesite lava and the sandstone-conglomerate differs and their relationship is not clear.

The basalt of this formation is correlated to the Saru Shoshonite of 1/50,000 Lautoka geological sheet (Rao, 1983) and of the first phase survey of this project. Also the sandstone-conglomerate of this formation was correlated to the Vatukoro Greywacke in the first phase survey, but if the Vatukoro Greywacke is the lowermost unit of the Ba Volcanic Group, this correlation is not correct.

(4) Namosau Volcanics

Distribution

The area from the catchment of Namosau Creek in the relatively northern part of Mba-west to the central part,and also in the northwest.

Lithology

The constituents are basalt lava and basaltic pyroclastics. The lava is black to dark green, compact and massive to brecciated, and in some places it is porous and amygdaloidal. Hyaloclastite occurs in the northwest. It is often rich in large augite phenocrysts (3-7 mm), and partly has greenish tint.

The pyroclastics is composed of agglomerate, lapilli tuff, tuff breccias, volcanic breccia and stratified tuff. Many of the volcanic pebbles are basalt with large augite phenocrysts, but there are some pale gray hornblende andesite pebbles. Matrix is mainly augite and plagioclase and is relatively compacted.

Stratigraphy

This unit overlies the Saru Formation unconformably and is overlain unconformably by Karavi Volcanics.

Small scale pyroclastics is intercalated in the basalt lava.

The radiometric age (K-Ar) is reported to be 4.48 ± 0.02 Ma, 5.05 ± 0.04 Ma, 4.22 ± 0.07 Ma (First Phase Rpt).

(5) Karavi Volcanics

Distribution

Catchment zones of Raviravi Creek and Nggalisavu Creek in the north.

Lithology

Constituents are andesite lava, and andesitic pyroclastics.

The lava is dark gray, compact and massive to brecciated hornblende andesite and augite andesite. It is pale green to dark blue gray and propylitized in some places.

The pyroclastics is composed of agglomerate, volcanic breccia, tuff breccia, lapilli tuff, crystal tuff and stratified tuff. Agglomerate is augite andesitic and is poorly sorted, while other pyroclastics are hornblende andesitic and well sorted. The matrix is relatively well compacted.

Stratigraphy

This volcanics overlies the Namosau Volcanics unconformably and is overlain unconformably by Wainatio Volcanic Products.

Pyroclastics are intercalated in andesite lava in this unit.

The radiometric age (K-Ar) of this unit is reported to be 4.55 ± 0.03 Ma (First Phase Rpt).

(6) Wainatio Volcanic Products

Distribution

Mainly in the vicinity of Wainatio Creek in the northwest and on the ridges north of Nggalisavu Creek.

Lithology

This unit consists of basalt lava and basaltic pyroclastics.

Basalt lava is black, compact, massive to brecciated and contains small augite (2 mm) phenocrysts.

Pyroclastics is composed of agglomerate, volcanic breccia, tuff breccia, lapilli tuff, and tuff. Agglomerate and tuff with good sorting are stratified with gentle dip on the ridges to the north of Nggalisavu Creek.

Stratigraphy

This overlies the Karavi Volcanics unconformably. In this unit, lava overlies the pyroclastics.

(7) Alluvium

Distribution

Northern coast and plains.

Lithology

It consists of unconsolidated sand, gravel and clay.

### 2-2-3 Intrusive rocks

(1) Monzonite

Distribution

As stocks near Yaloku Village in the south.

Lithology

Monzonite is grayish white to dark gray, compact, hard, and contains many augite phenocrysts (1-4 mm). It is, in some places micro-monzonitic, and also locally contains many basalt xenoliths. It is often altered green and pyritization and silicification are not uncommon.

Time of intrusion

This rock intrudes into the Koroyanitu Volcanic Products. The radiometric age (K-Ar) is reported to be 4.96 ± 0.03 Ma (First Phase Rpt).

(2) Dacite

Distribution

Very small distribution near Yaloku Village in the south.

Lithology

Grayish white biotite-dacite.

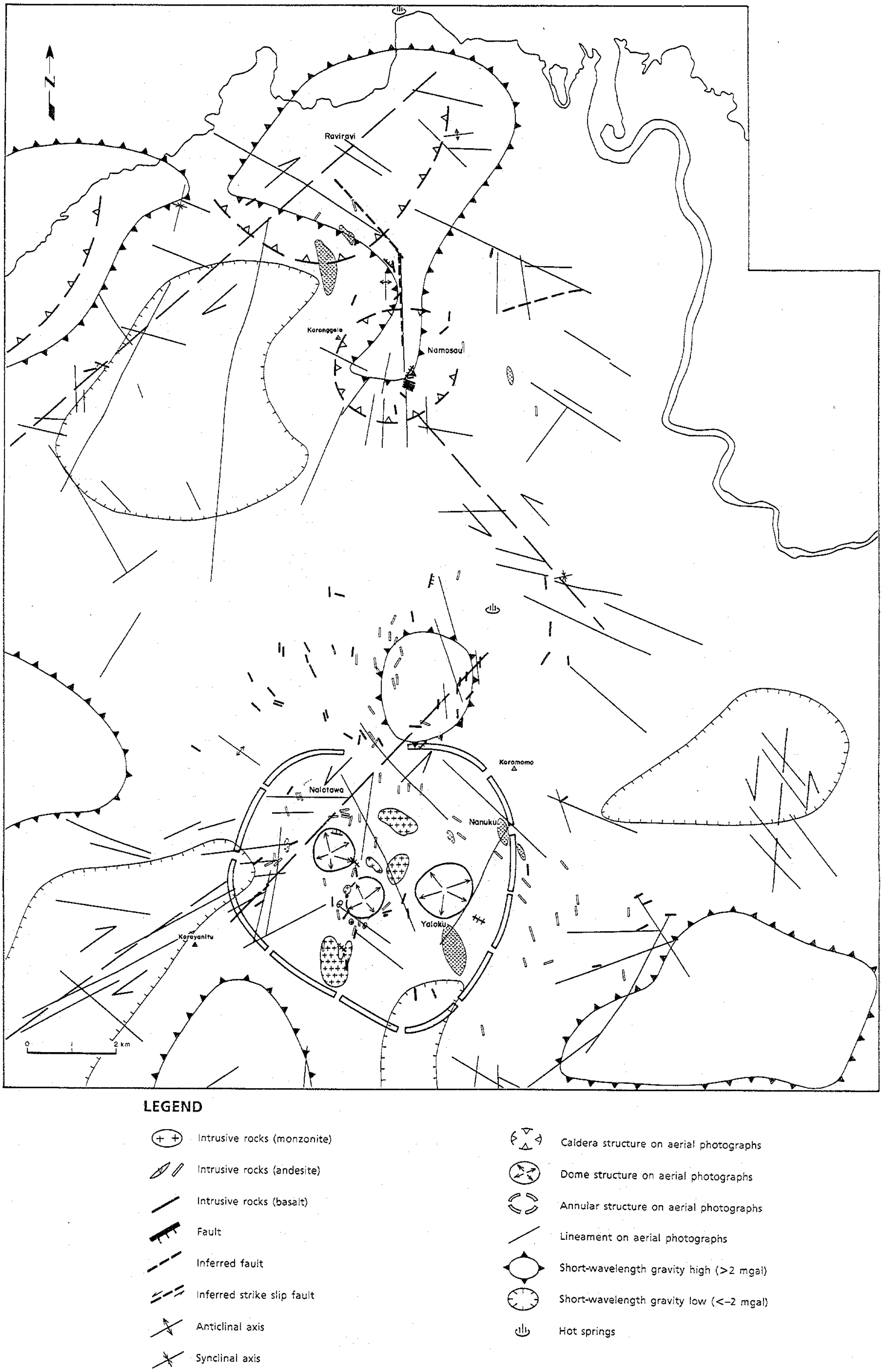



**Fig. 2-2-3 Structural Map (Mba-west Area)**

>PL66

Time of intrusion

Dacite intrudes into the Koroyanitu Volcanic Products.

(3) Hornblende andesite

Distribution

Widely distributed near Nalotawa, Nanuku, and Yaloku Villages in the south and also near Namosau Creek in the north.

Lithology

The rock is grayish white, compact, hard, and contains many phenocrysts of hornblende, augite, and plagioclase. The size of hornblende varies, but the largest attains 1 cm.

Time of intrusion

This rock intrudes into Sabeto Volcanics, Koroyanitu Volcanic Products, Namosau Volcanics, and Karavi Volcanics.

(4) Augite andesite

Distribution

Near Nalotawa, Nanuku, and Yaloku Villages in the south and also south of Varathiva Creek in the central part.

Lithology

The rock is dark gray, compact, hard, and contains phenocrysts of augite (1 mm) and plagioclase.

Time of intrusion

This rock intrudes into Sabeto Volcanics, Koroyanitu Volcanic Products, Saru Formation and Karavi Volcanics.

(5) Basalt

Distribution

South of Varathiva Creek, central, southern and northern part of the survey area.

Lithology

The rock is black, compact, hard, and contains phenocrysts of augite (1-2 mm) and plagioclase.

Time of intrusion

This rock intrudes into Sabeto Volcanics, Koroyanitu Volcanic Products, Saru Formation, Namosau Volcanics, Karavi Volcanics, and Wainatio Volcanic Products.

**2-2-4 Geologic structure**

The lowermost units of Mba-west area, Sabeto Volcanics are distributed in the southernmost part of this area. And the basement of Viti Levu, the Yavuna Group, occurs about 15 km further south.

The formations of this area is generally superimposed with gentle northward dip, and younger formations occur on the surface as we proceed northward.

The major components of all geological units of this area, with the exception of Saru Formation, are basaltic or andesitic volcanic products, and they are distributed with general E-W trend. The Saru Formation consists mainly of volcanic ejecta and sedimentary rocks and is distributed with E-W to NE-SE trend.

The following fault systems are estimated to exist in this area; N-S system in the northern upper reaches of Namosau Creek, NW-SE system in southern Raviravi Creek, and ENE-WSW system in the middle reaches of Namosau Creek. During the field survey, small faults were found to be scattered in many localities and they are predominant with NW-SE to WNW-ESE trend in the periphery of Yaloku Village.

Regarding the fold structure of this area; NW-SE trending anticlinal axis is developed in the Koroyanitu Volcanic Products in the southwest, E-W anticlinal axis in the Karavi Volcanics in the north, and NNE-SSW trending synclinal axis is developed in the Wainatio Volcanic Products.

The occurrence of the intrusive bodies will be briefly described below.

Monzonite is arranged in the NNE-SSW direction within the photogeologic annular structure (Fig.2-2-3) between Nalotawa and Yaloku Villages.

Andesite and basalt dykes mainly occur near Nalotawa and Yaloku Villages in the south and near the Namosau Creek in the north. They are predominant in the south.

Many of the dykes in the south occur in radial pattern from the eastern part of Nalotawa Village.

Of the dykes in the south, andesite mainly occur within the photogeologic annular structure and extends northward and southeastward. Basalt occurs in the periphery of the andesite bodies.

Within the photogeologic caldera structure in the upper reaches of Namosau Creek in the north, basalt dykes occur in semi-radial pattern.

Lineaments parallel to the gravity anomaly zones are developed in parts of the short-wavelength gravity anomaly zones (low gravity anomaly zone west of Yaloku, high gravity anomaly zone east of Yaloku, high gravity anomaly zone northeast of Nalotawa, low gravity anomaly zone west of Mt.Koronggele).

## 2-3 Mineralization and Alteration

### 2-3-1 Known mineral showings and past mineral exploration

The following mineral showings have been known in Mba-west and the following exploration activities have been carried out.

(1) Karavi Mineral Prospect

This is an alteration zone around the Raviravi Creek in the most northern part of the survey area. Airborne magnetics, geological survey, and geochemical prospecting (stream sediments, rocks) were carried out during 1986-1988 in the vicinity of silicified and argillized zones by Austpac Gold N.L.

(2) Namosau Creek Mineral Prospect

This is an alteration zone in the upper reches of the Namosau Creek in the northern part of the survey area. Austpac Gold carried out magnetic survey, geological survey, and geochemical prospecting (stream sediments, rocks) near the silicified and argillized zones in 1986-1987.

(3) Nalotawa-Nanuku Mineral Prospect

This is an alteration zone between the Nalotawa and the Nanuku Villages in the southern part of the survey area. Barringer Fiji Ltd., and Australian Anglo American Ltd., carried out stream sediment and soil geochemical prospecting in the surface altered zone in 1976. Also, Pacific Islands Gold (Fiji) Ltd., carried out stream sediment, rock, and soil geochemical prospecting in 1986.

(4) Karawa Mineral Prospect

This is an alteration zone in the southeastern edge of the survey area. Consolidated Gold Field (Fiji) Ltd., and Geopacific Services PTY Ltd., carried out geochemical prospecting (stream sediments, soil, and rocks) for the acidic altered zone in 1980-1981. Also Picon Exploration PTY Ltd., and others carried out airborne magnetics, geological survey, geochemical prospecting (stream sediments, rocks, soil) and drilling in 1988-1989.

Although not in the Mba-west area, the following prospects occur in the vicinity.

**Mbalevuto Mineral Prospect**

This is developed to the east of the Karawa Prospect. Limonite-quartz-alunite network veinlet group is developed in the white altered zone consisting of alunite, kaolinite, and pyrite.

**Ndrasa Ore Deposit**

This is located immediately to the northwest of this area and is a small bauxite deposit formed by the laterization of basaltic pyroclastics of the Ba Volcanic Group.

**Kingston Mine**

This is located to the southwest of the survey area. This is a porphyry copper type chalcopyrite network-dissemination in the periphery of complex plutonic plug (Navilawa Stock) related to a micro monzonite-latite volcanic activity. There are records of mining gold-silver copper veins.

**2-3-2 Mineralization and alteration**

Alteration zones were confirmed in the following five localities during the course of the present survey (Fig.2-2-4).

(1) Namosau Creek Alteration Zone

This zone was explored previously as Namosau Creek Prospect by Austpac Gold N.L. It is a propylitized and argillized zone developed in basalt lava and basaltic pyroclastics of the Namosau Volcanics belonging to the Ba Volcanic Group. In this zone, small ridges of silicification - alunite occur extensively in the N-S direction. The areal extent of the altered zone is 1 km E-W and 2 km N-S.

In this zone, X-ray diffraction analysis revealed the following concentric arrangement of altered minerals from the center outward. Namely, silicification-alunite subzone (Subzone I ) - kaolinite subzone (Subzone II ) - sericite subzone (Subzone III ) - mixed-layer minerals subzone (Subzone IV ) - smectite-chlorite subzone (Subzone V). It is seen that the mineral assemblage in the central part is relatively acidic which gradually becomes neutral toward the outside (Fig. 2-2-6).

The mineral assemblage of each subzone is laid out in Figure 2-2-5.

Silicification-alunite subzone (Subzone I ) is characterized by alunite, but is often associated with pyrophyllite and limonite.

Kaolinite subzone (Subzone II ) is characterized by kaolinite, but is also often accompanied by pyrophyllite or limonite.

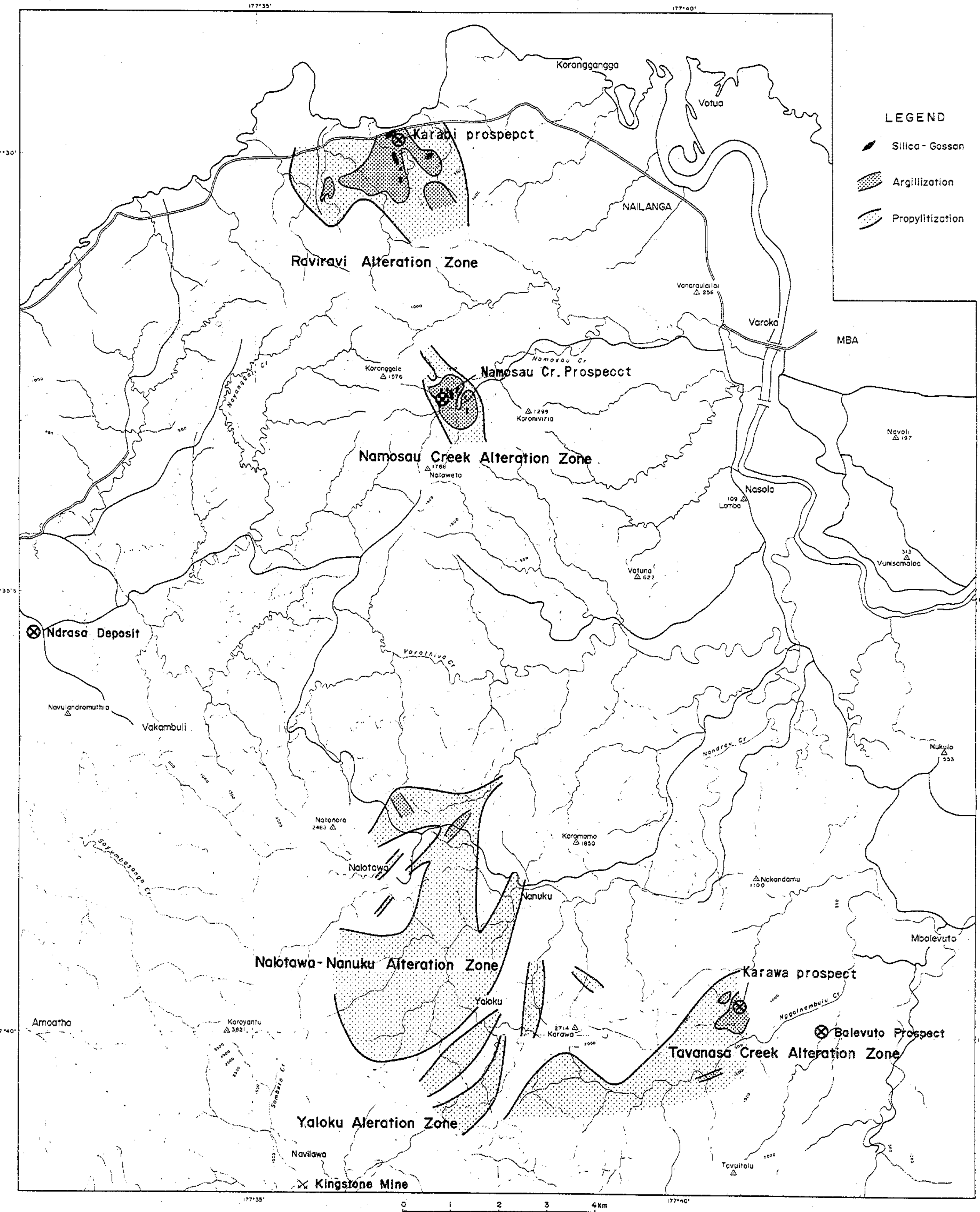



Fig.2-2-4 Distribution Map of Alteration Zone (Mba-west Area)

## Table 2-2-2 Results of X-Ray Diffraction Analysis (Namosau Cr)-1

| Sample | Clay minerals | | | | | | | | | | | | Silica m. | | | Feldspar | | Sulfates | | | Carbon. | | Oxides, Hydroxides | | | | | Sulfides | | | Others | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | SME | CHL | SER | KAO | HA | PYP | TAL | SRP | S/M | C/M | K/M | ZEO | QTZ | ACR | TRI | PLA | KFL | ALU | JAR | GYP | CAL | DOL | DIA | GB | GOE | HEM | MAG | MAR | PYR | SPH | OLI | AMP | PX |
| SM3 | | △? | | | | | | | | △ | | | ○ | | | ○ | | | | | | | | | | | | | ▲? | | | △ | |
| SM4 | | | △ | | | | | | △? | | | | ◎ | | | △? | | | | | | | | | △ | | | | | | | | |
| SM5 | | | ▲ | △ | | | | | | | | | ○ | | | | △? | | | | | | | | △? | | | | △? | | | | |
| SM101 | | | ▲ | | | △? | △? | | | | | | ◎ | | | | | | | | | | | | | | | | △ | | | | ▲ |
| SM102 | | | △ | | | | | | | | | | ◎ | | | | △? | | | | | | | | △? | | | | △ | | | | |
| SM103 | | | | △ | | △ | | | | | | | ○ | | | | | ○ | | | | | | | | | | | △ | | ▲? | | |
| SM104 | | | △ | | | | | | | | | | ◎ | | | | | ▲ | | | | | | | | | | | | | | | |
| SM105 | | | | | | | | △? | | | △ | | ○ | | | | | | | | | | | | △? | | | | △ | | | | |
| SM106 | | | | | ▲ | ○ | | | | | | | △ | | | | | | | | | | | | △ | | | | ▲ | | | | |
| SM107 | | | | | | | | | | | | | ◎ | | | | | ◎ | | | | | | | | | | | | | | | |
| SM108 | | | | | | | | ▲? | | | △ | | ○ | | | | | | | | | | | | △ | | | | | | | | |
| SM109 | | | | | | | | △? | | | △ | | ○ | | | | | | | | | | △ | | △ | | | | ▲? | | | | |
| KK4 | △ | | | ▲ | | | | | | | | | ▲ | △? | | ○ | | | | | | | | | | | | | | | | | ▲ |
| KK36 | | | | | | | | | | | △ | | ◎ | | | | ▲? | | | | | | | | | | | | ▲? | | | | |
| KK37 | | | ▲ | | | | | | | | ▲ | | ○ | | | ▲? | | | | | ▲ | | | | △ | | | | | | | | |
| KK38 | | | | ○ | | △ | | | | | | | ◎ | | | | | △ | | | | | | | △? | | | | ▲ | | | | |
| OK16 | | | △ | | | | | | | | ▲ | | ○ | | | | | | | | | | | | △ | ▲ | | | | | | | |
| OK17 | △ | △ | △ | | | | | | | | | | ○ | | | ○ | | | | | △ | | | | | | | | | | | | |
| OK18 | | | ▲ | ○ | | △ | | | | | | | ○ | | | | | ○ | | | | | ▲ | | △ | ▲? | | | △ | | | | |
| OK19 | | | △ | ▲ | | | | | | | | | ◎ | | | | △? | | | | | | | | ▲? | | | | △? | | | | |
| OK20 | | | △ | | | | | | | | | | ◎ | | | | △? | | | | | | | | ▲? | | | ▲? | ▲ | | | | |
| OK21 | | △ | | | | | | | | | | ▲ | ○ | | | ○ | | | | | ▲? | | | | | | | | ▲ | | | | ▲? |
| AY3 | △ | ▲? | | ▲? | | | | | | | | | △ | | | ○ | ○ | | | | | | | | | | | | △ | | | ▲? | △ |
| AY4 | △ | △ | | | | | | | | | | | ○ | | | ○ | | | | | | | | | | | | | △ | | | | |
| AY5 | ▲ | | | | | △ | | | | | | ▲ | ○ | | | ▲? | | | | △ | | | | | | | | | ○ | | | | |
| AY6 | △ | | | | | | | | ▲ | | | | ○ | | | ▲ | | | △ | | | | | | | | | | | | | | |
| AY8 | △ | | | | | | | | ▲? | | | | ○ | | | △ | | | ○ | | | | | | | | | | | | | | |
| AY9 | △ | △ | | | | | | | | | | △ | △ | | | ○ | | | | | △ | | | | | | | | ▲ | | | | |

Abbreviations:
◎:Abundant ○:Common △:Few ▲:Rare

SME:Smectite, CHL:Chlorite, SER:Sericite, KAO:Kaolinite, HA:Halloysite, PYP:pyrophyllite, TAL:Talc
SRP:Serpentine, MON:Montmorillonite, S/M:Ser/Mon mixed layer mineral, C/M:Chl/Mon mixed layer mineral,
K/M:Kao/Mon mixed layer mineral, ZEO:Zeolite, QTZ:Quartz, ACR: α-Cristobalite, TRI:Tridymite,
PLA:Plagioclase, KFL:Potassium feldspar, ALU:Alunite, JAR:Jarosite, GYP:Gypsum, CAL:Calcite,
DOL:Dolomite, DIA:Diaspore, GB:Gibbsite, GOE:Goethite, HEM:Hematite, MAG:Magnetite, MAR:Marcasite,
PYR:Pyrite, SPH:Sphalerite, OLI:Olivine, AMP:Amphibole, PX:Pyroxene

## Table 2-2-2 Results of X-Ray Diffraction Analysis (Namosau Cr)-2

| Sample | Clay minerals | | | | | | | | | | | | Silica m. | | | Feldspar | | Sulfates | | | Carbon. | | Oxides, Hydroxides | | | | | Sulfides | | | Others | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | SME | CHL | SER | KAO | HA | PYP | TAL | SRP | S/M | C/M | K/M | ZEO | QTZ | ACR | TRI | PLA | KFL | ALU | JAR | GYP | CAL | DOL | DIA | GB | GOE | HEM | MAG | MAR | PYR | SPH | OLI | AMP | PX |
| AY11 | ▲ | | | | | | | | | | ▲? | | △ | | | ○ | | | | | | | | | | | | | ▲ | | | ○ | △ |
| AY12 | | △ | | | | ▲? | | | | | | △ | ○ | | | ○ | | | | △? | | | | | | | | | △ | ○ | | | ▲ |
| AY13 | | | | | | | | | | | △ | | ○ | | | | | | | | | | | | | | | | ▲ | | | | |
| AY14 | | | ▲? | | | | | | | | ▲ | | ○ | | | | | | | | | | | | △? | | | | ▲ | | | | |
| AY15 | | | | ○ | | | | | | | | | ○ | | | | | | | | | | | | | | △? | | | | | | |
| AY16 | | | | | | | | △? | | | △ | | | | △ | | | | | | | | | | | | | △ | △ | | | | |
| AY17 | | | ▲? | | | | | ▲? | | | ▲ | | ○ | | | | | | | | | | | | | | | ▲ | | | | | |
| AY18 | | | | | ▲ | | | | | | △ | | ▲? | | △? | | | | | | | | | | | | △? | ▲ | ▲? | | | | |
| AY19 | | | | | | | | | | | △ | | ○ | | | | ▲? | | | | | | | | △? | ▲ | | ▲ | | | | | |
| AY20 | | | | | | | | △? | | | △ | | ○ | | | | | | | | | | | | | | | △? | | | | | |
| AY21 | | | △ | | | | | | | | △ | | ○ | | | | | | | | | | | | | | | | ▲? | | | | |
| AY22 | | | △ | | | | | ▲? | | | ▲ | | ○ | | | | | | | | | | | | | ▲? | | | ▲ | | | | |
| AY23 | ▲? | | | | | | △ | △? | | | △ | | △ | | | | ○ | | | | | | | | | | | | | | | | ▲ |
| AY24 | △ | ▲? | | | | | | ▲? | | | | | | △? | △ | △ | | | | | | | | | | | | ▲ | ▲ | | | | |
| AY26 | △ | △ | | | | | | | | | | | ▲? | | | | ○ | | | | | | | | | | | | | | | | △ |
| AY28 | | | | | | | | ▲? | | | ▲ | | | | △? | | ○ | △? | | | | | | | | | | | | | | | △ |
| AY4011 | | | | △ | | | | | | | | | ◎ | | | | | ○ | | | | | | | | ▲ | | | | | | | △? |

## Table 2-2-3 Results of X-Ray Diffraction Analysis (Raviravi)-1

| Sample | Clay minerals | | | | | | | | | | | | Silica m. | | | Feldspar | | Sulfates | | | Carbon. | | Oxides, Hydroxides | | | | | Sulfides | | | Others | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | SME | CHL | SER | KAO | HA | PYP | TAL | SRP | S/M | C/M | K/M | ZEO | QTZ | ACR | TRI | PLA | KFL | ALU | JAR | GYP | CAL | DOL | DIA | GB | GOE | HEM | MAG | MAR | PYR | SPH | OLI | AMP | PX |
| SM1 | ▲? | | | | | | | | | | △ | | | ▲? | | ○ | | | | | | | | | | | | | | | | | |
| KK23 | | | | ○ | | | | | | | | | ◎ | | | | | | | | | | | | | | | | | | | | |
| KK25 | | | | △ | | | | △? | | | | | ◎ | | | | | | | | | | | | | | | | | | | | |
| KK27 | | | △ | ▲? | | | | ▲? | | | | | ○ | | | | | | | | | | | | | | | | | | | | |
| KK28 | | | △ | △ | | | | | | | | | ○ | | | | | | | | | | | | | ▲? | | | | | | | |
| KK29 | | | | ○ | | | | | | | | △? | ◎ | | | | | | | | | | | | | | | | | | | | |
| KK31 | △ | ▲? | | ▲? | | | | | | | | | ▲ | | | ○ | | | | | | | | | | | | | | | | | |
| KK32 | | | △? | | | | | | | | △? | | ○ | | | | | | | | | | | | | | | | | | | | |
| KK33 | | | | | | | | | | | △ | | ◎ | | | ▲? | | | | | | | | | | | | | | | | | |
| KK34 | △ | | | | | | | | | | △? | | △ | | | | ○ | | | | | | | | | | | | | | | | △ |
| KK35 | | | ▲? | △ | | | | | ▲ | | | | ◎ | | | | △ | | | | | | | | | | | | | | | | |
| KK50 | △ | | | △ | | | ▲? | ▲? | | | | | △ | | | | △ | | | | | | | | | | | | | | | | ▲? |
| OK1 | | | ▲? | | | | | | | | ▲ | | ○ | | | | | | | | | | | | | | | | | | | | |
| OK2 | △ | | | △ | | | | | | | | | ○ | | | ○ | | | | | ○ | | | | | | | | | | | | |
| OK10 | ▲ | | | | | | | | | | △ | | ○ | | | △ | | | | | | | | | | | | | | | | | △ |
| OK11 | | | △ | | | | | | | | | | ○ | | | | △? | | | | | | | | | | | | | | | | |
| OK12 | ○ | | | | | | | | | | | | ○ | | | △? | | | | | | | | | | | | | | | | | |
| OK13 | △ | | | △ | | | | | | | | | ○ | | | ○ | | | | | | | | | | | | | △ | | | | |
| OK14 | △ | | | | | | | | | | ▲? | | ○ | | | ▲? | | | | | | | | | | | | | | | | | |
| OK15 | △ | | | △ | | | | | | | | | ○ | | | | | | | | | | | | | | | | | | | | |
| OK2008 | △ | | | ▲ | | | | | | | | △ | △? | | | ○ | | | | | | | | | | | | | | | | | ○ |
| AY52 | ▲? | | | | | | | | | | ▲? | △ | ○ | | | ○ | | | | | | | | | | | | | △? | | | | △ |
| AY53 | △ | △ | | | | | | | △ | | | △ | ○ | | | ○ | | | | | ◎ | | | | | | | | | | | | |
| AY54 | △ | △? | ▲ | | | | | | | | ▲? | | ○ | | | | | | | | | | | | | | | | | | | | |
| AY55 | ▲ | | ▲ | | | | | | △ | | | | △ | | | ▲ | | | | | | | | | △ | ▲ | | | ▲ | | | | |
| AY56 | | △ | ▲ | ▲? | | | | | | | | | ○ | | | | | | | | ▲? | | | | | | | | | | | | |
| AY57 | △ | △? | | △ | | | | | | | | | ○ | | | ○ | | | | | ○ | | | | | | | | | | | | ▲ |
| AY58 | | | | | | | | △? | | | △ | | △? | | △? | | | | | | | | | | | | | ▲ | | | | | |
| AY59 | ▲? | | | | | | | | | | ▲ | | ▲? | | | ○ | | | | | | | | | | | | | | | | | |

Abbreviations:
◎:Abundant ○:Common △:Few ▲:Rare

SME:Smectite, CHL:Chlorite, SER:Sericite, KAO:Kaolinite, HA:Halloysite, PYP:pyrophyllite, TAL:Talc
SRP:Serpentine, MON:Montmorillonite, S/M:Ser/Mon mixed layer mineral, C/M:Chl/Mon mixed layer mineral,
K/M:Kao/Mon mixed layer mineral, ZEO:Zeolite, QTZ:Quartz, ACR: $\alpha$ -Cristobalite, TRI:Tridymite,
PLA:Plagioclase, KFL:Potassium feldspar, ALU:Alunite, JAR:Jarosite, GYP:Gypsum, CAL:Calcite,
DOL:Dolomite, DIA:Diaspore, GB:Gibbsite, GOE:Goethite, HEM:Hematite, MAG:Magnetite, MAR:Marcasite,
PYR:Pyrite, SPH:Sphalerite, OLI:Olivine, AMP:Amphibole, PX:Pyroxene

## Table 2-2-3 Results of X-Ray Diffraction Analysis (Raviravi) -2

| Sample | Clay minerals | | | | | | | | | | | | Silica m. | | | Feldspar | | Sulfates | | | Carbon. | | Oxides, Hydroxides | | | | | Sulfides | | | Others | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | SME | CHL | SER | KAO | HA | PYP | TAL | SRP | S/M | C/M | K/M | ZEO | QTZ | ACR | TRI | PLA | KFL | ALU | JAR | GYP | CAL | DOL | DIA | GB | GOE | HEM | MAG | MAR | PYR | SPH | OLI | AMP | PX |
| AY60 | ○ | | | | | | | ▲? | | | | | | △? | △ | ○ | | | | | | | | | | | | | | | | | △ |
| AY61 | ▲ | | | | | | | | | | △ | | ○ | | | ▲? | | | | | | | | | △? | | | | | | | | |
| AY62 | | △ | | | | | | △? | | | | | | ○ | | | △ | | | | | | | | | | | | | | | | ▲ |
| ST1 | | | | ○ | | | | | | | | | ○ | | | | | | | | | | | | | ▲? | | | | | | | |
| ST2 | | | △ | | | | | | | | | | ◎ | | | | | | | | | | | | ▲ | | | | △? | | | | |
| ST3 | | | ▲ | △ | | | | | | | | | ◎ | | | | | | | | | | | | ▲ | | | | | | | | |
| ST4 | | | △ | △ | | | | | | | | ▲? | ◎ | | | | | | | | | | | | ▲ | | | | ▲? | | | | |
| ST5 | | | △ | | | | | | | | | | ○ | | | | △? | | | | | | | | △ | | | | | | | | ▲? |
| ST6 | | | △ | ○ | | | | | | | | | ○ | | | | ▲? | | | | | | | | △? | | | | | | | | |
| ST7 | ▲? | | | | | | | | | | △ | | ○ | | | | | | | | | | | | △? | | | | | | | | |
| ST8 | △? | | ▲ | | | | | | | | △ | | ○ | | | | | | | | | | | | △ | | | | | | | | |
| ST9 | ▲? | | | △ | | | | ▲? | | | | | ○ | | | | △ | | | | | | | | | | | | ▲? | | | | ▲ |
| ST10 | | | ▲ | ▲? | | | | | | | | | ◎ | | | | | | | | | | | | | | | | | | | | |
| ST11 | | | | | | △ | | | | | | △? | ◎ | | | | | | | | | | △ | | △ | | | | △ | | | | |
| ST12 | | | | ▲ | | | | | | | | | ◎ | | | | △? | | | | | | △ | | ▲ | | | | | | | | |
| ST15 | | | ○ | △ | | | | | | | | | ◎ | | | | | | | | | | | | | | | | | | | | ▲ |
| ST16 | | | △ | | | | | | | | ▲ | | ◎ | | | | △? | | | | ▲? | | | | | | | | | | | | |
| ST17 | △ | △ | | △ | | | | | | | | | △ | | | ○ | | | | | ○ | | | | | | | | △? | | | | ▲ |
| ST18 | ○ | | | | | | | | | | | | △ | | | ○ | | | | | | | | | | | | | | | | | ▲ |
| ST19 | | | ▲ | | | | | | | | △? | | ○ | | | | △? | | | | | | | | | | | | | | | | |
| ST20 | | | △ | △ | | | | | | | | | ○ | | | | ▲? | | | | | | | | | | | | | | | | |
| ST21 | | | △ | | | | | | | | | | ◎ | | | △? | | | | | | | | | △? | | | | | | | | △? |

## Table 2-2-4 Results of X-Ray Diffraction Analysis (Nalotawa-Nanuku, Yaloku and Tavanasa Cr.)-1

| Sample | Clay minerals | | | | | | | | | | | | Silica m. | | | Feldspar | | Sulfates | | | Carbon. | | Oxides, Hydroxides | | | | | Sulfides | | | Others | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | SME | CHL | SER | KAO | HA | PYP | TAL | SRP | S/M | C/M | K/M | ZEO | QTZ | ACR | TRI | PLA | KFL | ALU | JAR | GYP | CAL | DOL | DIA | GB | GOE | HEM | MAG | MAR | PYR | SPH | OLI | AMP | PX |
| SM13 | △ | △? | | | | | | | | | | | △ | | | | ○ | | | | ○ | | | | | | | | ▲ | | | | |
| SM14 | | | | △ | | | | | | | | | ○ | | | ○ | | | | | △ | ○? | | | | | | | ▲? | | | | △ |
| SM2036 | △ | △ | | | | | | | | | | | △ | | | | | | | | ◎ | ○? | | | | | | | ▲ | | | | ▲? |
| KK2064 | ▲ | | | | | | | | | | | | △ | | | ◎ | | | | | | | | | | | | | ▲? | | | | △ |
| KK2073 | △ | | ▲ | | | | | | | | | | | | | ◎ | | | | | | | | | | | | | ▲? | | | | △ |
| OK2063 | | | | | | | | | | | | | | | | ◎ | | | | | | | | | | | | | | | | | △ |
| OK2064 | | | | | | | | | △ | | | | ○ | | | | ▲ | | | | | | | | | | | △ | | | | | |
| OK2065 | ▲ | ▲? | ○ | | | | | | | | | | △? | | | ○ | | △? | | | | | | | | | | | | | | | △ |
| OK2067 | ▲ | ▲ | ○ | | | | | | | | | | △ | | | ○ | | | | | | | | | | | | | | | | | △ |
| OK2070 | | | △ | | | | | | | | | | △? | | | ○ | | △? | | | | | | | | | | | | | | | △ |
| OK2071 | △ | ▲ | | | | | | | | | | | △ | | | ◎ | | | | | | | | | | | | | | | | | △ |
| OK2072 | ▲? | | | | | | | | | | | | △ | | | ○ | | | | | | | | △ | | | | | | | | | △ |
| OK2096 | △ | △ | | | | | | | | | | | △ | | | ○ | | | | | ○ | | | | | | | | ▲ | | | | |
| AY39 | △ | △ | | | | | | | | | | | ○ | | | ○ | | | | | | | | | | | | | ○ | | | | ▲ |
| AY40 | ○ | ▲ | | | | | | | | | | | ▲ | | | ○ | | | | | | | | | | | | | ▲ | | ▲? | | ▲ |
| AY42 | ○ | | | | | | | | | | | | | △? | | ○ | | | | | | | | | | | | | △ | | | | △ |
| AY43 | △ | △ | | | | | | | | | | | ○ | | | ○ | | | | | | | | | | | | | ▲ | | ▲? | | |
| AY44 | ▲ | △ | | | | | | | | | | | ○ | | | △ | | | | | ◎ | ◎? | | | ▲? | | | | △ | | | | |
| AY45 | ▲ | ▲ | | | | | | | ▲? | | | | ○ | | | △ | | | △ | | | | | | | | | | | | | | ▲ |
| AY2077 | ▲ | △ | | | | | | | | | | | ○ | | | ○ | | | | | ○ | | | | | | | | ▲ | | | | |
| AY2094 | | | | | | | | | | | | | △ | | | | | | | | ◎ | | | | | | | ▲ | ▲ | | | | |

Abbreviations:
◎:Abundant ○:Common △:Few ▲:Rare

SME:Smectite, CHL:Chlorite, SER:Sericite, KAO:Kaolinite, HA:Halloysite, PYP:pyrophyllite, TAL:Talc
SRP:Serpentine, MON:Montmorillonite, S/M:Ser/Mon mixed layer mineral, C/M:Chl/Mon mixed layer mineral,
K/M:Kao/Mon mixed layer mineral, ZEO:Zeolite, QTZ:Quartz, ACR: $\alpha$-Cristobalite, TRI:Tridymite,
PLA:Plagioclase, KFL:Potassium feldspar, ALU:Alunite, JAR:Jarosite, GYP:Gypsum, CAL:Calcite,
DOL:Dolomite, DIA:Diaspore, GB:Gibbsite, GOE:Goethite, HEM:Hematite, MAG:Magnetite, MAR:Marcasite,
PYR:Pyrite, SPH:Sphalerite, OLI:Olivine, AMP:Amphibole, PX:Pyroxene

## Table 2-2-4 Results of X-Ray Diffraction Analysis (Nalotawa-Nanuku, Yaloku and Tavanasa Cr.)-2

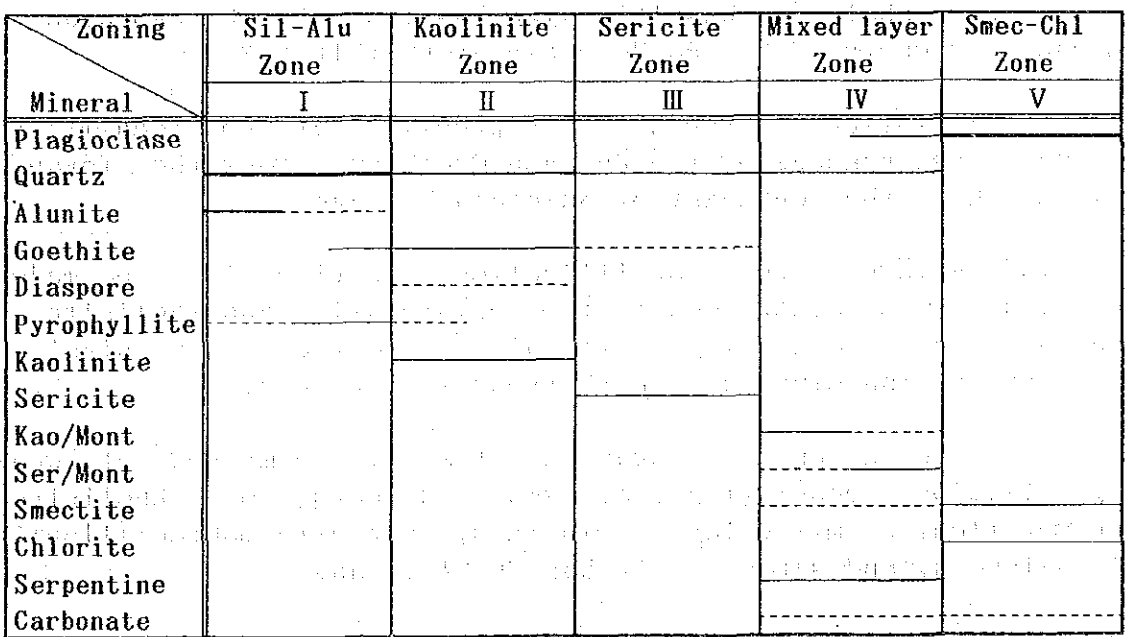
| Sample | Clay minerals | | | | | | | | | | | | Silica m. | | | Feldspar | | Sulfates | | | Carbon. | | Oxides, Hydroxides | | | | | Sulfides | | | Others | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | SME | CHL | SER | KAO | HA | PYP | TAL | SRP | S/M | C/M | K/M | ZEO | QTZ | ACR | TRI | PLA | KFL | ALU | JAR | GYP | CAL | DOL | DIA | GB | GOE | HEM | MAG | MAR | PYR | SPH | OLI | AMP | PX |
| SM6 | | | | | | | | | | | △ | ▲? | △ | ○ | | | | | | | | | | | | | ▲? | | | | | | |
| SM8 | △ | △ | △ | | | | | | | | | | ○ | | | ○ | | | | | ○ | | | | | | | | | | ▲? | | |
| SM9 | ○ | | | | | | | | | | | | | △ | ▲? | ◎ | | | | | △ | | | | | | | | △ | | | | |
| SM10 | △ | | | | | | | | | | | | ○ | ◎ | | | △? | | | | | | | | | | | | △ | | | | |
| SM11 | | △ | | | | | | | | | | | ○ | | | ◎ | | | | | ○ | | | | | | | | | | ▲? | | △ |
| SM12 | △ | ▲ | | | | | | | | | | ▲? | ○ | | | △? | | | | | ○ | ▲? | | | | | | | ○ | | | | |
| SM16 | | ▲ | ○ | | | | | | | | | | ○? | | | ◎ | | | | | | | | | | | | | | | | | ○ |
| SM2030 | ▲ | | | | | | | | | | | | △ | △ | | ◎ | | | | | △ | | | | | | | | | | | | ○ |
| SM2031 | ▲ | | | | | | | | | | | | △ | | | ◎ | | | | | | | | | | | | | | | | | △ |
| SM2038 | △ | △ | ▲? | | | | ▲? | | | | | | ▲? | △? | | ◎ | | | | | | | | | | | | | | | | | △ |
| KK7 | ○ | | | △ | | | | | | | | | ○ | | | ○ | | | | | ▲? | | | | | | | | | | | | ▲ |
| KK2042 | △ | | | | | | | | | | | ▲ | | | △ | ○ | | | | | | | | | | | | | | | △? | | △ |
| KK2043 | △ | ▲ | | | | | | | | | | ▲ | ○ | | | ◎ | | | | | △ | | | | | | | | ▲ | | | | |
| KK2044 | △ | | | | | | | ▲? | | | | | | | | ○ | ○ | | | | | | | | | | | | | | | | △ |
| OK5 | | | | | | | | | △ | | | | ○ | | | | △ | | | | | | | | | | | | | | | | |
| OK6 | | | ▲ | | | | | | | | ▲ | | ○ | | | | △ | | | | | | | | | | | | | | | | |
| OK7 | △ | | | | | | ▲ | | | | ▲ | | ○ | | | | ▲? | | | | | | | | △? | | | | | | | | |
| OK2045 | △ | ▲ | | | | | | | | | | ▲ | △ | | | ○ | | | | | △ | | | | | | | | ▲ | | | | △ |
| OK2049 | △ | | | | | | | | | | | | | △? | | ◎ | | | | | | | | | ▲ | | | | ▲? | | | | △ |
| SM17 | ○ | | | | | | | △ | | | | | ▲? | ○ | | △ | | | | | | | | | | | | | | | | | |
| SM18 | | | ▲ | | | | | | | | | | ○ | | | | | | ○ | | | | | | | | | | | | | | |
| SM19 | | | △ | | | | | ▲? | | | | | ◎ | | | △ | | | | | | | | | | | | | ▲ | | | | ▲ |
| SM20 | △ | △ | | | | | | | | | | | ○ | | | ○ | | | | | ○ | | | | | | | | | | | | △? |
| SM21 | △ | | ▲ | △ | | | | | | | | | ○ | | | △ | | | ○ | | | | | | | | | | | | | | |
| SM22 | | | | △ | | △ | | | | | | ▲ | ◎ | | | | | | | | | | ▲? | | | | | | | | | | |
| SM23 | | | | ○ | | ▲? | | | | | | | ◎ | ○ | | | | △? | | | | | | | | | | | ▲ | | | | |
| KK10 | △ | | ▲? | △ | | | | | | | | | ○ | | | ○ | | | | | ▲? | | | | | | | | △ | | | | ▲? |
| KK11 | △ | △? | | ▲ | | | | | △ | | | | ○ | | | | | | | | | | | | | | | | | | | | |
| KK12 | △ | ▲ | | ▲ | | | | | ▲ | | | | ○ | | | △ | | | | | | | | | | | | | △ | | | | |
| KK13 | △ | △? | | | | | | | | | | | ○ | | | ○ | | | | | | | | | | | | | ▲? | | | | |
| KK14 | | | | △ | | | | | | | | | △ | ◎ | | | | | | | | | | | | | | | | | | | |
| KK15 | △ | | | | | | | | | | | | △ | | | ○ | | | | | | | | | | | | | △ | | | | △ |
| KK2077 | △ | | | | | | | | | | | | | | | ◎ | | | | | | | | | | | | | | | | | ○ |
| KK2078 | △ | | ▲ | | | | | | | | | | | | △? | ○ | | | | | | | | | | | | | | | | | △ |
| OK9 | ▲? | | | | | | | | ▲ | | | | ◎ | | | | | | | | | | | | | | | | | | | | |

Sericite subzone (Subzone Ⅲ ) is characterized by sericite, but limonite is often associated.

Mixed-layer minerals subzone (Subzone Ⅳ ) is characterized by kaolinite-montmorillonite mixed-layer minerals and smectite. It is also associated with serpentinite, carbonates, and other minerals.

Smectite-chlorite subzone (Subzone Ⅴ ) is the so-called propylitized zone. The original rocks have been altered to smectite, chlorite, and calcite, but it is weak and plagioclase phenocrysts of the original rocks often remain.

Ethylene glycol, heating, and acid treatment were used for mineral identification when necessary. Montmorillonite and saponite were grouped together as smectite. Minerals identified as illite were included in the sericite group.




Abbreviation Sil:Silica, Alu:Alunite, Chl:Chlorite, Smec:Smectite,
Kao/Mont:Kaolinite/Montmorillonite mixed-layer mineral
Ser/Mont:Sericite/Montmorillonite mixed-layer mineral

**Fig.2-2-5 Alteration zoning by mineral assemblage (Raviravi and Namosau Cr)**

(2) Raviravi Alteration Zone

This corresponds to the Karavi Prospect of Austpac Gold N.L. It is a propylitized and argillized zone developed in the andesite lava and andesitic pyroclastics of the Karavi Volcanics which belong to the Ba Volcanic Group. In this zone, small leached silica-limonite gossans occurs with N-S trend. The areal extent of this zone is large at 3.5 km in the E-W and 2.5 km in the N-S direction.

The altered minerals of this zone form zonal arrangement similar to that of the Namosau Alteration Zone. But that corresponding to the silicification-alunite subzone (Subzone I) does not appear to occur, and four subzones from kaolinite to smectite-chlorite occur (Fig. 2-2-7).

Diaspore is observed in parts of kaolinite subzone (Subzone II).

In the mixed-layer minerals subzone (IV), sericite-montmorillonite mixed-layer minerals are identified as well as the kaolinite-montmorillonite group in the marginal parts.

(3) Nalotawa-Nanuku Alteration Zone

This is a propylitized zone (smectite-chlorite zone) developed widely near the Nalotawa and Nanuku Villages. The host rocks are basalt and basaltic pyroclastics of the Koroyanitu Volcanic Products of the Ba Volcanic Group (Fig.2-2-8).

Argillization is found in the propylite at two localities, the uppermost reaches of the Wainasa Creek and along the Toganivalu track to the northeast of Nalotawa Village.

The Wainasa Creek argillization, smectite is the major constituent with minor amount of α-cristobalite and kaolinite-montmorillonite mixed-layer minerals. Also there is a significant pyrite dissemination. NW-SE trend is inferred.

The one along the Toganivalu track is composed of weak argillization consisting of small amounts of kaolinite-montmorillonite mixed-layer minerals, sericite-montmorillonite mixed layers, and sericite. It has NE-SW trend.

(4) Yaloku Alteration zone

This is a propylitized zone (smectite-chlorite zone) to the south of the Yaloku Village (Fig.2-2-8). The host rocks are basalt and basaltic pyroclastics of the Koroyanitu Volcanic Products belonging to the Ba Volcanic Group. There are many quartz veinlets several to several tens of centimeters wide in this altered zone extending from the upstream part of the Nasala Creek to also the upstream part of the Ndavetalevu Creek. These veinlets have ENE-WSW trend. This will be called Nasala vein swarm. This swarm is developed in the propylite, but is not accompanied by significant argillization and alteration hardly occurs even at the contact with the veins.


**Fig. 2-2-6 Distribution of Alteration Zones (Namosau Cr.)**

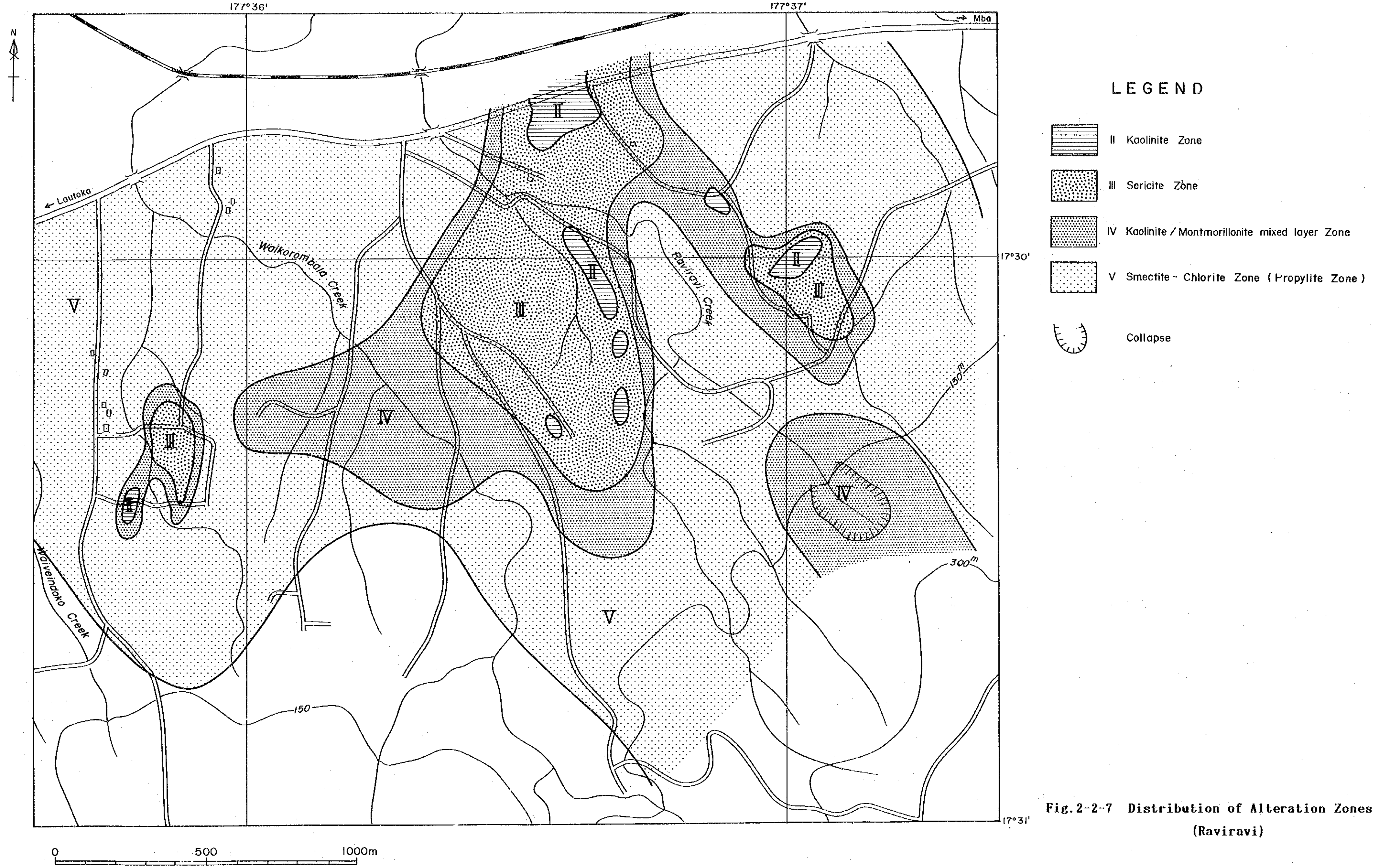



Fig. 2-2-7 Distribution of Alteration Zones
(Raviravi)

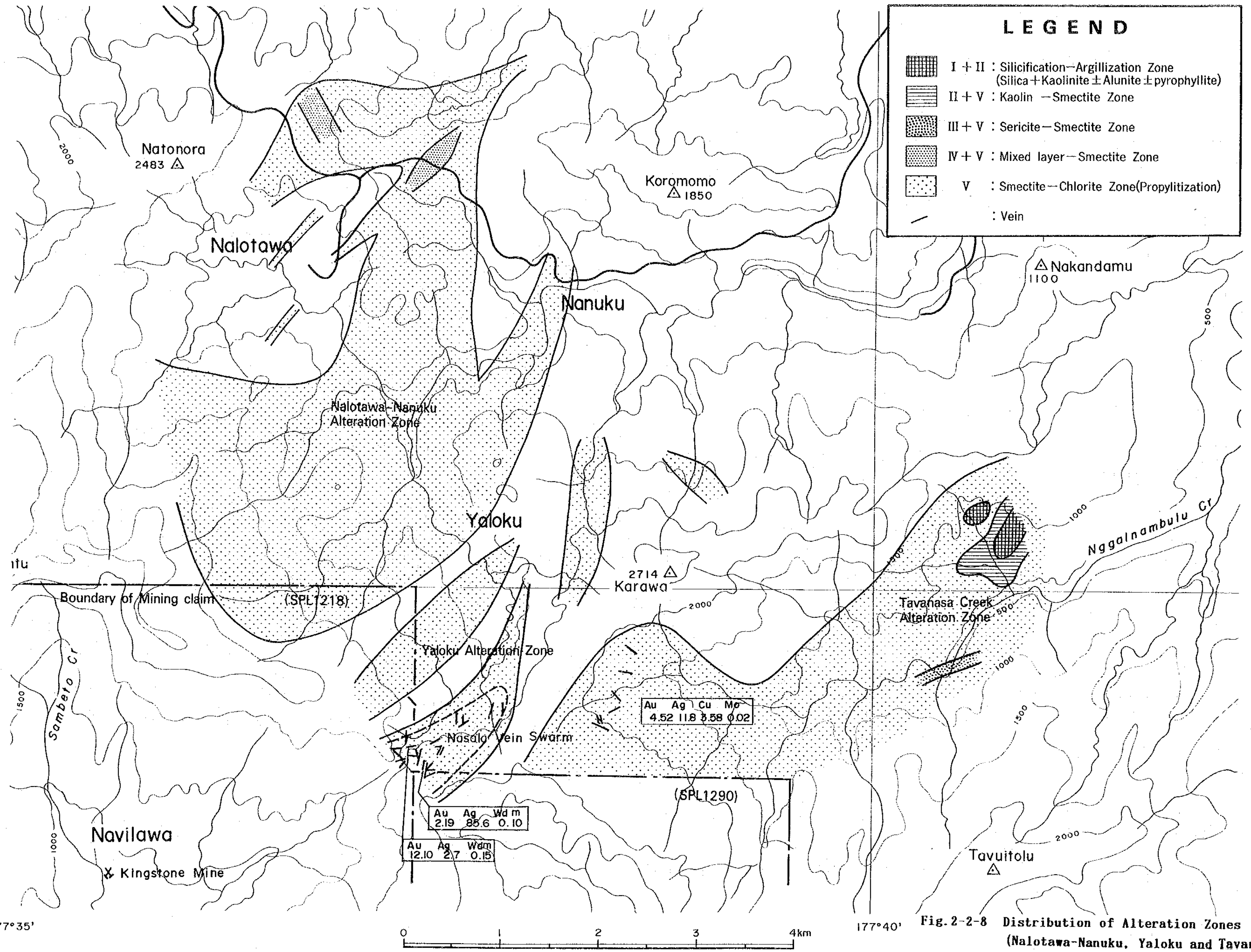



Fig. 2-2-8 Distribution of Alteration Zones (Nalotawa-Nanuku, Yaloku and Tavanasa Cr.)

(5) Tavanasa Creek Alteration Zone

This zone occurs widely from Tavanasa Creek which is the tributary of Nggalinambulu Creek to the south of the Karawa Triangulation Station (Fig.2-2-8). The host rocks are andesite and andesitic pyroclastics of the Sabeto Volcanics belonging to the Koroimavua Volcanic Group. The major alteration of this zone is propylitization (smectite-chlorite), but small strong silicification and argillization occurs at the Kawara Prospect in the eastern end of Mba-west. Silica and kaolinite are the major constituents of this zone with minor content of alunite and pyrophyllite, and is considered to be an acidic alteration overlapping Subzones I and II of Figure 2-2-5. This acidic alteration is surrounded by weakly argillized zone composed of kaolinite-smectite. This latter is considered to be an overlap of acidic Subzone II over Subzone V.

**2-3-3 Discussions regarding mineralization and alteration**

Twenty six (26) samples (include accidentals) collected from quartz veins and silicified rocks were analyzed at the Chemex Labs Ltd., in Canada. Total of seven elements; Au, Ag, Cu, Pb, Zn, Mo, and Te were analyzed. The results are shown in Table2-2-2.

The samples from Raviravi Alteration Zone, Namosau Creek Alteration Zone, Nalotawa-Nanuku Alteration Zone, and Tavanasa Creek Alteration Zone did not contain the metals in any notable amounts, but three samples in the 14 from the quartz veins of the Nasala vein swarm contained relatively high Au, Ag (OK-10,Au 12.10 g/t,Ag 2.7g/t,Cu 0.03 % ; OK-12,Au 2.19 g/t,Ag 85.6 g/t,Cu 0.03 % ; OK-18,Au 4.52 g/t,Ag 11.8 g/t,Cu 3.58 %).

There are high grade Au-Ag-Cu veins in the Kingston Deposit to the southwest of the Nasala vein swarm. They both could have been formed by the same type of mineralization.

Epithermal gold deposits are classified into the adularia-sericite type formed by neutral hydrothermal solution, and the acid sulfate type formed by acidic hydrothermal solution. In recent years, the former type is often called low sulfidation type, and the latter high sulfidation type (Hedenquist, 1987).
In Fiji, Emperor Deposit of Viti Levu is considered to belong to the low sulfidation type and the Mt. Kasi Deposit of Vanua Levu is of the high sulfidation type.

Representative deposits of the high sulfidation type are Goldfield in Nevada USA, Summitville in Colorado USA, Chinkuashih in Taiwan, Nansatsu type in Japan and others.

Table 2-2-5 Results of Chemical Analysis of Ore Samples (Mba-west Area)

| Sample No. | Location | Descriptipn | Dip-strike | Width (cm) | Ore Grade Au g/t | Ag g/t | Cu % | Pb % | Zn % | Mo % | Te % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OK1 | Raviravi | Qtz vein | N6°W ,60°W | 1 | <0.07 | <0.5 | <0.01 | <0.01 | 0.06 | 0.001 | <0.001 |
| KK16 | " | Silica-Gossan | | | <0.07 | <0.5 | 0.02 | <0.01 | 0.01 | <0.001 | <0.001 |
| KK17 | " | Silica-Gossan | | | <0.07 | <0.5 | 0.02 | <0.01 | <0.01 | <0.001 | <0.001 |
| ST5 | " | Silica-Gossan | | | <0.07 | <0.5 | 0.01 | <0.01 | <0.01 | <0.001 | <0.001 |
| ST1 | Namosau Creek | Silica-Gossan | | | <0.07 | <0.5 | 0.01 | <0.01 | <0.01 | <0.001 | <0.001 |
| SM2 | " | Qtz-Alu vein | N27°W,90° | 5 | <0.07 | <0.5 | 0.04 | <0.01 | <0.01 | <0.001 | <0.001 |
| SM4 | " | Qtz-Alu vein | N35°W,70°E | 200 | <0.07 | <0.5 | 0.04 | <0.01 | 0.01 | <0.001 | <0.001 |
| SM101 | " | Gossan float | | | <0.07 | 0.5 | 0.01 | <0.01 | <0.01 | <0.001 | <0.001 |
| SM102 | " | Silicified rock | N10°E,90° | 50 | <0.07 | <0.5 | 0.01 | <0.01 | 0.01 | <0.001 | <0.001 |
| SM104 | " | Silicified rock | N5°E ,90° | 170 | <0.07 | <0.5 | 0.01 | <0.01 | <0.01 | <0.001 | <0.001 |
| SM8 | Nalotawa | Lim. network | | | <0.07 | <0.5 | 0.01 | <0.01 | 0.01 | <0.001 | <0.001 |
| SM19 | Tavanasa Creek | Qtz-Alu float | | | <0.07 | <0.5 | 0.01 | <0.01 | <0.01 | <0.001 | <0.001 |
| SM11 | Yaloku | Qtz vein | N73°E,60°S | 15 | <0.07 | <0.5 | 0.02 | <0.01 | <0.01 | <0.001 | <0.001 |
| OK2 | " | Qtz vein | N40°W,35°W | 15 | <0.07 | 2.0 | 0.05 | 0.05 | 0.01 | <0.001 | <0.001 |
| OK4 | " | Qtz vein | N77°W,60°S | 25 | <0.07 | 1.0 | 0.04 | 0.02 | 0.01 | <0.001 | <0.001 |
| OK7 | " | Qtz vein | N13°E,60°E | 2 | <0.07 | 1.0 | 0.04 | <0.01 | 0.01 | <0.001 | <0.001 |
| OK10 | " | Qtz vein | NS ,80°E | 15 | 12.10 | 2.7 | 0.03 | 0.02 | 0.01 | <0.001 | <0.001 |
| OK12 | " | Qtz vein | N88°E,70°S | 10 | 2.19 | 85.6 | 0.08 | 0.24 | 0.01 | <0.001 | <0.001 |
| OK16 | " | Qtz vein | N17°W,80°W | 5 | <0.07 | 0.9 | <0.01 | <0.01 | <0.01 | <0.001 | <0.001 |
| OK18 | " | Qtz vein | N30°W,70°W | 3 | 4.52 | 11.8 | 3.58 | <0.01 | 0.01 | 0.020 | <0.001 |
| KK7 | " | Qtz vein | NS ,84°W | 5 | <0.07 | <0.5 | 0.01 | <0.01 | 0.01 | <0.001 | <0.001 |
| AY9 | " | Qtz vein | N47°W,80°S | 5 | <0.07 | <0.5 | 0.10 | <0.01 | 0.01 | <0.001 | <0.001 |
| AY10 | " | Qtz vein | N75°W,80°N | 3 | <0.07 | <0.5 | 0.08 | <0.01 | 0.01 | <0.001 | <0.001 |
| ST2 | " | Qtz vein | N84°E,75°S | 2 | <0.07 | <0.5 | 0.01 | <0.01 | 0.01 | <0.001 | <0.001 |
| ST3 | " | Qtz vein | N10°W,80°E | 3 | <0.07 | <0.5 | 0.07 | <0.01 | 0.01 | <0.001 | <0.001 |
| ST4 | " | Qtz vein | N10°W,80°E | 15 | <0.07 | <0.5 | 0.04 | <0.01 | 0.01 | <0.001 | <0.001 |

Abbreviation Qtz:Quartz,Alu:Alunite,Lim:Limonite

Of the high sulfidation gold deposits, Summitville Deposit has been most exhaustively studied regarding the time - space relation of the gold mineralization and alteration (Steven and Ratte, 1960; Stoffregen, 1987; etc.).

The Summitville is a pipe or pod-shaped Au-Ag-Cu deposit replacing quartz latite lava dome within a caldera. It continues 400 m vertically.

There is a very clear zonal arrangement of altered minerals as seen in Figure 2-2-9 (Steven and Ratte, 1960). When considered that the illite rock of this figure corresponds to the sericite subzone (Subzone Ⅲ), this arrangement agrees well with those of the Raviravi and Namosau Creek Alteration Zones.

This similarity indicates the fact that the alteration zones of the Raviravi and Namosau Creek were formed by the high sulfidation type mineralizing fluid. However, it is not clear how the deposits were developed. There are various types of deposits formed by high sulfidated fluids such as; veins (El Indio:Chile), pods (Summitville), stockwork (Nansatsu), dissemination (Temora:Australia). The shape of the deposits and the space-time relation with the acidic alteration would be strongly controlled by the development of the fissures, intensity of fracturing, existence of porous rocks and other factors related to the permeability of the host rocks.

Both Raviravi and Namosau Alteration Zones occur in the caldera structures extracted by photogeological analysis and they are controlled by the vertical fissure system formed during the caldera formation and pipe-shaped deposits similar to the Summitville Deposit are believed to have been formed.

It has been confirmed that below the silica-alunite and kaolinite subzones of Namosau Creek, smectite-chlorite alteration is widely developed associated with some alunite veins, kaolinite veins, and sericite veins. It is highly possible that the lowermost part of the Summitville type alteration is exposed. If this is the case, the ore deposit itself is eroded out and the possibility of further exploration is poor. This will be mentioned in the section on drilling results.

Regarding the Raviravi Alteration Zone, the correlation between the surface altered zone of Raviravi and the Summitville zones is not clear. It will be necessary to confirm the conditions of the mineralization and alteration for clarifying the total features of the mineralization in order to evaluate the mineral potential of this zone.

A

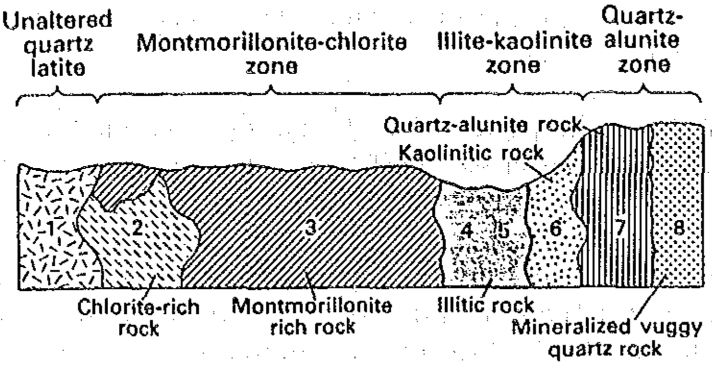
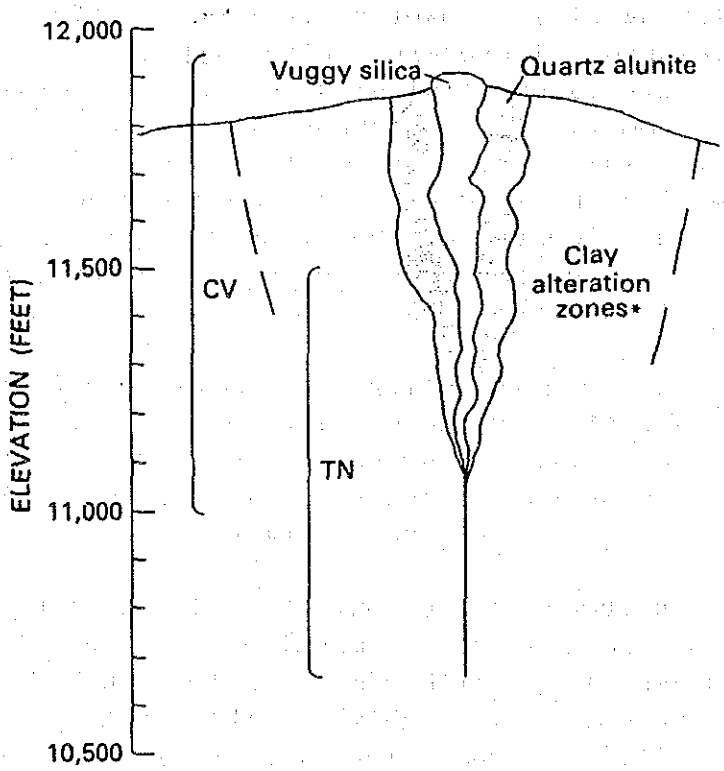



Diagram showing hydrothermal alteration pattern in the Summitville district adapted from Steven and Rattè (1960 ).

B




Schematic cross section of the alteration patterns and mineral zonation of the Summitville deposit. The clay alteration zones refer to zones 3-6 in the above figure. CV—covellite, luzonite, enargite, pyrite, marcasite, chalcopyrite, trace sphalerite, sulfur, and gold assemblage; TN—chalcopyrite, tennantite, pyrite, plus minor sphalerite and trace galena assemblage.

**Fig. 2-2-9 Hydrothermal Alteration Pattern in the Summitville District.**

The alteration zones of Nalotawa-Nanuku and Yaloku are considered to be of the low sulfidation type alteration because; 1: only the weakly argillized zone consisting of sericite and mixed-layer minerals is developed in the smectite-chlorite altered subzone (propylite subzone) and acidic altered minerals are not found, 2: auriferous quartz veinlet swarm (Nasala vein swarm) is developed in the Yaloku Alteration zone.

Small acidic alteration occurs in the eastern edge of the Tavanasa Creek Alteration Zone. But it is mostly propylite consisting of smectite-chlorite and thus is considered to be of low sulfidation alteration. It is known that acidic alteration can occur near the surface by the concentration of steam even when the mineralizing fluid is chemically neutral. This process is a possible cause of the small acidic altered zone mentioned above, and also it could be the western edge of the large acidic alteration zone in the Mbalevuto Prospect adjacent to the east.

The most promising prospect found by the present survey is the Nasala vein swarm of the Yaloku Alteration Zone. This vein swarm has a general trend of ENE-WSW and to the WSW outside of Mba-west is the Kingston Mine. The veins reported at the Kingston Deposit and some of the quartz veins of the Nasala vein swarm contain Au, Ag, Cu and the nature of mineralization is similar, but the Kingston Deposit is of porphyry copper type and that of the Nasala vein swarm is of low sulfidation type epithermal deposit. The relation between the two deposits is not known.

## 2-4 Geochemical Prospecting

### 2-4-1 Methods employed

Geochemical prospecting using A soil horizon samples was carried out over an area of 206 km² in order to extract promising mineral prospects.

The collected soil samples were dried naturally under the sun, sieved to -80 mesh, and chemically analyzed at Chemex Labs Ltd., of Canada.

A total of 3,005 samples were collected and the contents of six elements, Au, Ag, As, Sb, Hg, Te were analyzed. The analytical methods for each element and the limit of detection are as follows.

Analytical Procedures (Mba-west Area)

| Element | Method | Detection Limit | Upper Limit |
|---|---|---|---|
| Au | Fuse, FA-AAS | 5ppb | 10,000ppb |
| Ag | $HNO_3$/Aqua Regia digestion, AAS | 0.2ppm | 100.0ppm |
| As | $HNO_3$/Aqua Regia digestion, AAS | 1ppm | 10,000ppm |
| Sb | $HCl/KClO_3$ digestion, extraction, AAS | 0.2ppm | 1,000ppm |
| Hg | $HNO_3/HCl$ digestion, AAS | 10ppb | 100,000ppb |
| Te | $HBr-Br_2$ digestion, extraction, AAS | 0.05ppm | 100.0ppm |

**FA : Fire Assay**

**AAS : Atomic Absorption Spectrometrys**

### 2-4-2 Results of analysis

The analytical results are laid out in Appendix 1.

The contents of heavy metals are generally low. Of the total of 3,005 samples; Au content was below the detection limit in 2,966 samples (98.7%), Ag in 3,005 samples (100%), As in 1,924 samples (64.0%), Sb in 2,899 samples (96.5%), Te in 2,719 samples (90.5%). Only Hg content was over the limit of detection in all samples.

### 2-4-3 Statistical treatment

(1) Method of statistical treatment

The statistical treatment of geochemical data usually involve multivariate analysis such as principal component analysis with the assumption that correlation exists among each component and also that each component show log-normal distribution. With the geochemical data of this area, however, correlation scarcely exists among the components and the statistical distribution is not clear. Therefore, it was concluded that multivariate analysis of these data would not produce meaningful results.

Therefore, threshold values were set for each component, and geologic structure, mineralization, alteration, relation with the results of gravity survey, and other relevant factors were examined for anomalous zones extracted from the iso-grade contour maps.

Also, anti-logarithm was used for the following analysis rather than natural logarithm used in statistical treatment of these data. The data on Ag whose content was below the detection limit in all samples were excluded from this process.

Basic statistic values are shown below.

Table 2-2-6 Basic statistics (Mba-west Area)

| | Au | Ag | As | Sb | Hg | Te |
|---|---|---|---|---|---|---|
| Average (m) | ppb 2.$^{7}$ | ppm - | ppm 1.$^{0}$ | ppm 0.1 | ppb 50 | ppm 0.0$^{4}$ |
| Standard deviation (σ) | 4.$^{4}$ | - | 1.$^{2}$ | 0.0$^{4}$ | 35 | 0.0$^{9}$ |
| Maximum | 180 | <0.2 | 30 | 1.0 | 580 | 3.1 |
| Minimum | <5 | <0.2 | <1 | <0.2 | 10 | <0.0$^{5}$ |
| Detection limit | 5 | - | 1 | 0.2 | 10 | 0.0$^{5}$ |
| m+σ | 7 | - | 2 | 0.1 | 85 | 0.1$^{3}$ |
| m+2σ | 12 | - | 3 | 0.2 | 119 | 0.2$^{2}$ |
| Threshold | 12 | - | 3 | 0.2 | 119 | 0.20 |

(2) Correlation of components

One half (1/2) of the detection limit values were used as the contents of the components existing in amounts less than the limit of detection. Since there are many such samples, the correlation among individual components is very low, and only some correlation can be observed between As and Te (correlation coefficient: 0.4432).

Correlation Coefficients of Soil Assay (Mba-west Area)

| | Au | Ag | As | Sb | Hg | Te |
|---|---|---|---|---|---|---|
| Au | 1.0000 | 0.0000 | 0.1122 | -0.0078 | -0.0013 | 0.0901 |
| Ag | | 1.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| As | | | 1.0000 | 0.1143 | 0.1964 | 0.4432 |
| Sb | | | | 1.0000 | 0.0396 | 0.0522 |
| Hg | | | | | 1.0000 | 0.0335 |
| Te | | | | | | 1.0000 |

(3) Distribution pattern of geochemical data

The statistical distribution of homogeneous population generally approximate normal or lognormal distribution. But it is said that the distribution of the composite population, consisting of more than two constituent populations such as the "background" and "geochemical anomalies due to mineralization", often is not normal distribution (Otsu et al., 1983).

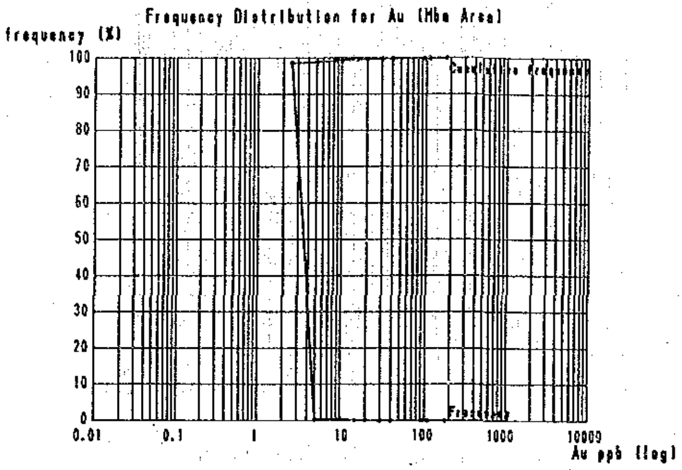
Logarithmic frequency distribution diagrams for each component were prepared in order to clarify the statistical distribution type of the geochemical data of this area (Fig.2-2-10). It is seen that only Hg show lognormal distribution. The statistical distribution of other components could not be determined because of the low content of the elements. The results of the soil geochemical prospecting of Tavua Caldera area (adjoining Emperor Mine to the east) conducted in 1990 by MMAJ (First Phase Survey Rpt., 1991) indicated non-normal distribution for Au, Sb, Te, and composite population type for As. The data of the present area are considered not to have a single normal type distribution, but a non-normal population, or a composite population of several normal distribution for the four components, Au, As, Sb, Te.

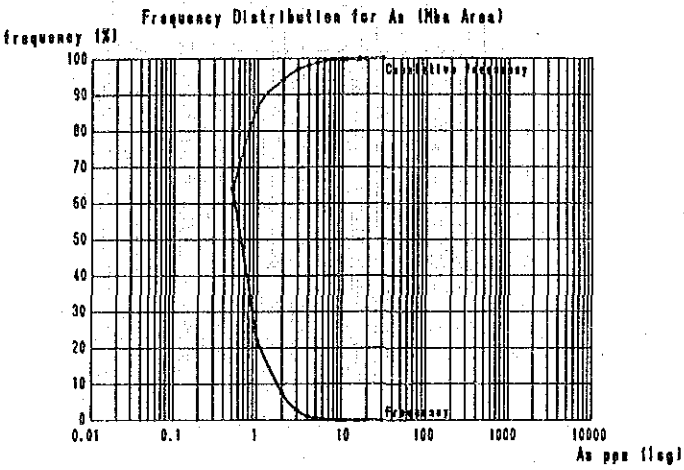
(4) Determination of threshold values

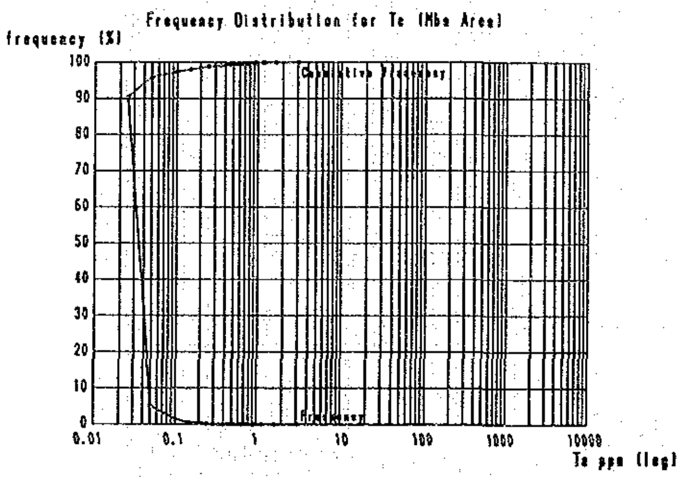
The cumulative frequency distribution method of Lepeltier (1969) was applied in order to determine the threshold and to extract the "anomalous" population from the composite population.

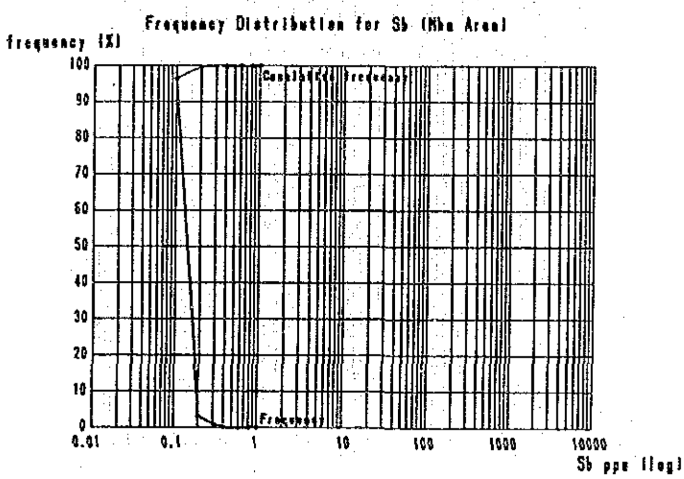
Cumulative frequency distribution diagram for each component was drawn on logarithmic probability graph paper (Fig.2-2-11). Significant breaking points or inflection points which would indicate the difference of population could not be extracted. The breaking points in very low probability parts are formed by few singular values and do not reflect the difference of population. The diagram for Hg has a breaking point near 1 % probability (Hg 150 ppm), but the change of inclination is very small and does not reflect the difference of population.

As it was not possible to determine the threshold values from the cumulative frequency distribution diagram, average + standard deviation × 2 ( $m + 2\sigma$ ) was used as the threshold value. The $m + 2\sigma$ value is actually the threshold value for extracting the higher 2.5 % of lognormal distribution (Hawkes and Webb, 1962; Lepeltier, 1969). And it cannot be applied with accuracy to the data of the present area whose statistical distribution type is not clear, but it is used as a simple value for selecting the high anomalies.



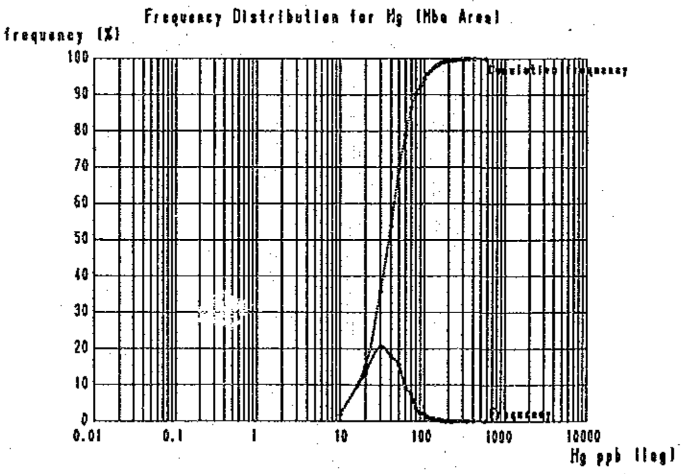
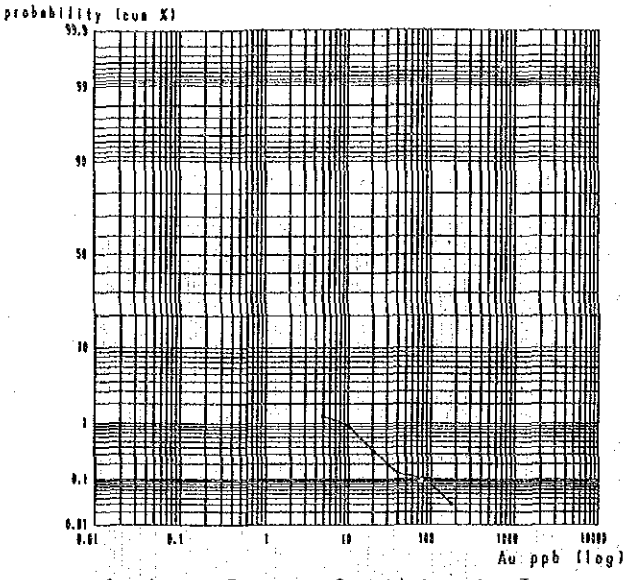
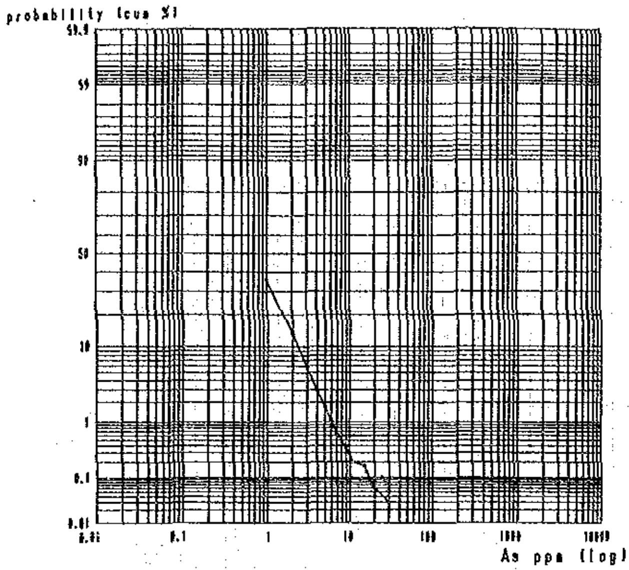




**Fig. 2-2-10 Frequency Distribution and Cumulative Frequency Distribution of Soil Assey (Mba-west Area)**

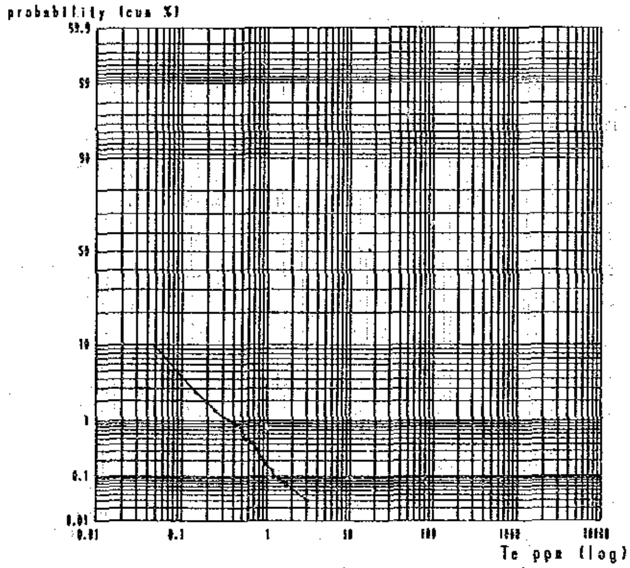
Cumulative Frequency Distribution for Au



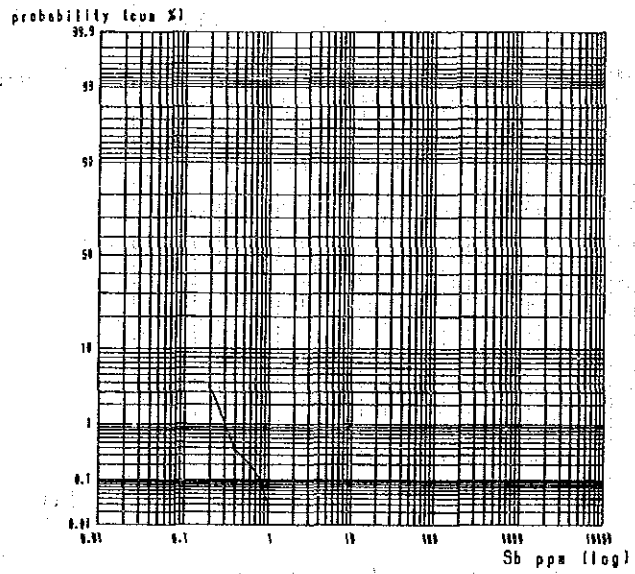

Cumulative Frequency Distribution for As




Cumulative Frequency Distribution for Te




Cumulative Frequency Distribution for Sb




Cumulative Frequency Distribution for Hg

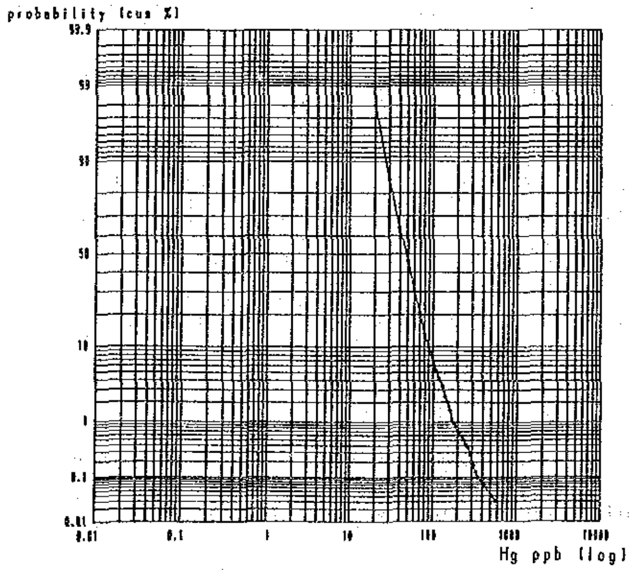



**Fig.2-2-11 Cumulative Frequency Distribution on Logarithmic Probability Paper (Mba-west Area)**