(5) Area E (Fig. 2-4-17)

This area is located at the eastern margin of Viti Levu. The geology consists of andesite lava and pyroclastics (Bna) and basalt lava and pyroclastics (Bnk) of Ba Volcanic Group.

[A semi-caldera opening east-northeastward have been extracted in this area.]

The semi-caldera is located at the southern end of medium-wavelength gravity high extending in the NW-SE direction. This medium-wavelength gravity high is on the extension of the NE-SW trending Wainimala Group and Colo Plutonics. And thus it is believed to reflect the rise of the Wainimala or the Colo rocks. There is, however, another possibility of high density rock mass such as solidified magma chamber in the deeper parts affecting the gravity from the distribution of Ba Volcanic Group and the existence of inffered volcanic center.

A relatively strong short-wavelength gravity high is extracted in the central part of the medium-wavelength gravity high, the measurement of this area is not sufficient for understanding the gravity features in detail. Therefore, the relation of this short-wavelength gravity high and the semi-caldera is not clear.

(6) Area F (Fig. 2-4-18)

This is located to the southeast of Monasavu Dam in the central part of Viti Levu. The surface geology consists of basaltic to dacitic pyroclastics (Wnu) of Wainimala Group and tonalite of the Colo Plutonic suite.

[An anuular structure and a caldera surrounding the former have been extracted in the area. These structures both have almost perfectly circular shape and thus intrusion of cone-shaped magma body is inferred as a possible process of genesis. The structure is relatively clear and is considered to be young.]

Medium-wavelength gravity map shows that high anomaly extends into this area from the northeast and bends westward at the western part of the area. Regarding short-wavelength gravity anomalies, a low anomaly has been extracted in the northeast and highs in the south and northwestern margin.

The elongation of the medium-wavelength high gravity zone coincides well with the distribution of the tonalite. The annular and caldera structures occur on the ridge of the medium-wavelength high gravity zone and coincide with the short-wavelength gravity low. Although the number of gravity station is not necessarily sufficient, this short-wavelength gravity low have been observed in several locations and the data is considered to be reliable.

The annular and caldera structures are believed to have formed by the intrusion of igneous bodies with cone-shaped top. If this is applicable in this area, this intrusive body has low gravity and is considered to be a felsic body with density lower than tonalite.

(7) Area G (Fig. 2-4-18)

This area is located at Namosi in the southeastern part of Viti Levu. The surface geology consists of basaltic to dacitic pyroclastics (Wnu) of Wainimala Group in the northeast to north-west, and andesitic pyroclastics (Mnm) and mudstone-sandstone of Medrausucu Group occur in other parts.

[An annular, semi-caldera opening southeastward, and two dome structures have been extracted. Andesite and porphyry complex of the Medrausucu Group occur in the area and volcanic center is inferred to have existed. The above SLAR structures are most probably volcanic in nature.]

Medium-wavelength gravity map shows that this area is situated at the southwestern edge of the low anomaly zone which extends in the NE-SW direction. Regarding short-wavelength gravity anomalies, there is a low to the northeast of Waivaka and a high in southwest.

The gravity gradient of the medium-wavelength low anomaly is generally gentle in this area. And it is inferred that low density formations (Medrausucu Group) gradually thickens toward the center of low anomaly. Corresponding short-wavelength gravity anomalies have not been found for the annular, semi-caldera structures and the dome on the northeast side. The dome structure on the southwest partially overlap the short-wavelength gravity high. The location of the dome and the anomaly do not coincide very well, but gravity station is lacking at the center of the dome - west of the short-wavelength gravity high -. If there were a station there, the short-wavelength gravity high may extend westward and may overlap the dome completely.

The number of gravity measurements in this area is small and the reliability of short-wavelength gravity features is low. Therefore, detailed correlation is not possible, but the short-wavelength gravity high overlapping the dome on the southwest side could be caused by blind intrusion. The density contrast between the country rock, namely the Namosi andesite or Wainimala

Group, and the porphyry related to mineralization is very small and short-wavelength anomalies indicating the shape of the porphry do not occur.

(8) Area H (Fig. 2-4-20)

This area is located to the northwest of Nadrau in the central part of Viti Levu. The surface geology consists of basalt lava and pyroclastics (Bnk), shoshonite, basalt (Bnu) of Mba Volcanic Group.

[Small scale annular structure has been extracted in this area. The location of this structure coincides with that of the syncline. Thus it is considered to be non-volcanic and to reflect the difference of resistance of the constituent rocks to erosion.]

Medium-wavelength gravity map shows that an annular structure is situated on the periphery of a large scale low anomaly with its center to northwest of Nanoko. The number of station is very small and no notable short-wavelength anomaly is observed in this area.

The reliability of the short-wavelength gravity features of this area is low and it is not possible to examine the details of the above annular structure.

(9) Area I (Fig. 2-4-20)

This area is located to the west of Nanoko in the central part of Viti Levu. The surface geology consists of basalt lava and pyroclastics (Bnk), sandstone (Bvk) of Ba Volcanic Group, shoshonitic pyroclastics (Ks), and sandstone (NdII) of Nadi Sedimentary Group.

[Small semi-annular structure has been extracted in this area. The inner part of this structure is depressed. In this depression, synclinal structure and a group of faults inferred to be a part of the annular fractures are observed. Thus it is probably of volcanic origin.]

Medium-wavelength gravity map shows that a semi-annular structure is located almost at the center of large scale low anomaly. This indicates the existence of thick low density sedimentary units below the semi-annular structure. A short-wavelength gravity low is found to the south of the semi-annular feature, but its relation with the structure is not clear because gravity measurements here are insufficient for detailed consideration.

(10) Area J (Fig. 2-4-18)

This area is located in the catchment of the Sigatoka River in central Viti Levu. Surface geology consists of basaltic propylite and pyroclastics, sandstone, limestone (Wnm, Wnu) of Wainimala Group, tonalite of Colo Plutonic Suite, sandstone, mudstone (Nvs) of Navosa Sedimentary Group, sandstone (Bvk) and monzonite stock(Bmv)of Ba Volcanic Group.

[A semi-caldera, and dome structures in two localities have been extracted in this area. Andesite stocks occur in the western dome and monzonite intrusive bodies occur in the eastern dome. Also the attitudes are disordered and fractures are developed in the peripheral parts. The possibility of volcanic block uplift is considered.]

Medium-wavelength gravity map shows that the semi-caldera and the dome structure in the west occur on the Verevere - Sigatoka Line which has a steep gravity gradient. Also the eastern dome is situated on the ridge of the high gravity branching northwestward from the center of medium-wavelength gravity high. But there is no gravity station here, and the gravity features are not very accurate. There is no short-wavelength anomaly corresponding to the semi-caldera and the western dome structures. The eastern dome corresponds to a short-wavelength gravity high. There is, however, no gravity station in this high zone, and the reliability of the data is low. Gravity data are insufficient to discuss the genesis of these structures.

(11) Area K (Fig. 2-4-21)

This area is located at northwestern Viti Levu. The surface geology consists mainly of shoshonite lava and pyroclastics (Ks), micro-monzonite-latite complex (Knv) of Koroimavua Volcanic Group, and shoshonite pyroclastics (Bky) of Ba Volcanic Group.

[The following structures have been extracted in this area. A dome, a caldera surrounding the said dome, and an aerial photographic semi-caldera opening southwestward. The genesis of the SLAR structures is not clear because of the lack of geological data. But the aerial photographic semi-caldera is considered to be an erosion caldera derived from either a volcanic crater or a collapsed structure, because a micro monzonite-latite complex body occur in the central part and this is considered to have been a volcanic center.]

Medium-wavelength gravity map shows that this area is situated from the center to the periphery of a large scale g ravity high. Dome and caldera structures occur where the gravity gradient becomes steep. The semi-caldera structure from aerial photograph is situated almost at the center of medium-wavelength gravity high. The short-wavelength anomalies do not correspond to the SLAR dome and caldera structures, but there is good correlation between a marked short-wavelength gravity high and the semi-caldera extracted from aerial photographs. This strong short-wavelength gravity high coincides well with the distribution of the micro-monzonite-latite complex which the anomaly most probably reflects.

The marked short-wavelength gravity high at the center of the aerial photo semi-caldera is situated also at the center of the large medium-wavelength gravity high. This is the indication of close relationship between the micro-monzonite-latite complex and the geologic structure of deep zones, because the igneous complex caused the short-wavelength high and the deep structure the medium-wavelength gravity high. Although there is a difference of high and low in the short-wavelength gravity, similar relation is observed at Areas A and C. The Kingston Mine is situated at the center of medium-wavelength gravity high and also the center of short-wavelength gravity high.

(12) Area L (Fig. 2-4-21)

This area is located at northwest Viti Levu and is adjacent to and west of Area K. The surface geology consists mostly of sandstone (NdII) of Nadi Sedimentary Group, volcanic rocks (Ks) and monzonite (Knv), sandstone (Kv) of Koroimavua Volcanic Group, and volcanic rocks (Bky) of Ba Volcanic Group.

[A semi-annular and semi-caldera structures opening northward have been extracted in the western part, and semi-caldera opening southward in the eastern part of this area.

Evidences for collapsed structure are not observed for the western semi-annular structure, but there is a semi-caldera considered to be a part of an erosion caldera occurs in the vicinity. Thus there is a possibility of old caldera structure in this area.

In the eastern semi-caldera, there is an igneous complex body (Knv) in the southern part and this is believed to have been a volcanic center. Thus this structure is considered to be a part of an erosion caldera derived from a volcanic crater or a collapsed caldera.]

Medium-wavelength gravity map shows that both semi-annular and semi-caldera structures are situated on the ridge of the high gravity zone projecting westward from the center of the large gravity high in the east. It appears that the westward projection of the medium-wavelength gravity high coincides with the distribution of the shoshonitic lava and pyroclastics (KS). The western semi-annular and semi-caldera structures partly overlap with short-wavelength high gravity zone exceeding 2 mgal, but the direction and the extent are not harmonious. The eastern semi-caldera overlaps the short-wavelength gravity low under -2 mgal extending from the north, but gravity was not measured here and the reliability is low. The SLAR structures and the short-wavelength features are generally not harmonious in this area.

(13) Area M (Fig. 2-4-21)

This area is located in northwest Viti Levu and is adjacent to and north of Area K. The surface geology consists of volcanic rocks (Ks) of the Ba Volcanic Group, volcanic rocks (Bky) and sandstone, conglomerate (Bs), and monzonite (Bnd) of the Ba Volcanic Group.

[Dome and semi-caldera structures have been extracted in the central part and an annular and caldera structures in the southwestern part of the area. Geologic data regarding the central dome are scarce and the geologic nature is not clear. The southwestern annular structure is considered to be related to volcanism because radial dykes and monzonite plug occur nearby and volcanic center possibly existed in the vicinity.]

Medium-wavelength gravity map shows that the southwestern annular and caldera structures are situated near the center of a large scale high anomaly while the dome and demi-caldera structures in the central part are at the flank of the gravity high where the gravity gradient is steep. In the short-wavelength gravity map all of the above structures coincide with neither the high gravity zones exceeding 2 mgal nor the low under -2 mgal, but occur in-between these anomalies. Thus the SLAR structures and the short-wavelength gravity features are completely unharmonious. The southeastern short-wavelength gravity high and the northeastern gravity low coincide well with the distribution of the andesite-basalt lava/pyroclastics (ks) and the sandstone/conglomerate (Bs) respectively.

(14) Area N (Fig. 2-4-21)

This area is located in northwest Viti Levu and is adjacent to and north of Area M. The surface geology consists of basaltic and andesitic volcanic rocks (Bnm, Bka, Bnk) of the Ba Volcanic Group.

[Semi-annular and semi-caldera structures have been extracted in the western part, a semi-caldera opening northwestward in the northeastern part, and a small caldera was identified in the southeast. The western semi-annular structure is a depression, but geologic data regarding collapsed structure are not found. The existence of volcanic dome is suggested in the western semi-caldera by the occurrence of radial dykes and geologic semi-dome structure. The semi-annular structure is situated in the center of a geologic dome and the possibility of volcanic crater of collapsed caldera is considered. The southeastern caldera is in geologic environment similar to that of the western caldera. The northeastern semi-caldera is strongly eroded and the geologic structure is not clear, but it is probably older than the structures in the west and southeast.]

Medium-wavelength gravity map shows that this area is situated at the transition zone between the high anomaly ridge protruding northward from the large southern gravity high and the inferred large gravity low in the north. The western semi-annular, semi-caldera, the northeastern semi-caldera, and the southeastern caldera structures are all correlated to short-wavelength gravity highs. The gravity high correlated to the western semi-caldera structure coincide well with the distribution of the basalt lava/pyroclastics of Ba Volcanic Group. The very high value of 7 mgal at the center of this anomaly indicates the existence of very thick high density body. This is inferred to have formed either by a high density lava pouring into deep collapsed structure or by solidification of a magma chamber in relatively shallow zones.

The southeastern and northeastern short-wavelength gravity highs are all located in the central part of lava and/or pyroclastics and there is a possibility of semi-caldera structure similar to that in the west.

(15) Area O (Fig. 2-4-15)

This area is located in the northern end of Viti Levu, and is adjacent to and northwest of Area A. The surface geology consists mainly of pyroxene andesite lava/pyroclastics and silt (Bvt) of Ba Volcanic Group.

[A dome structure has been extracted in this area. Geologic dome has not been found, but there are andesite plugs to the west and northeast of this structure. And the center of the structure lies on the line joining the two plugs. Thus, block uplift of volcanic nature is inferred.]

Medium-wavelength gravity map shows that this area is situated at the boundary zone between the high and low gravity area, and the gravity gradient is steep. A short-wavelength gravity high with good coincidence with the dome structure is extracted. This short-wavelength gravity high may support the volcanic block uplift in this locality.

The dome is situated at a steep medium-wavelength gravity gradient zone and this probably indicates a marked subsurface density boundary such as faults.

4-3-2 Relation between gravity, geology and SLAR images in Sigatoka area

Gravity survey was carried out in Sigatoka area in southwest Viti Levu with a large number of densely spaced gravity stations. The relation between the gravity data, geology and SLAR geologic structures was examined. The geological map, SLAR image analysis map, medium-wavelength gravity map and short-wavelength gravity map are shown in Figure 2-4-22.

In this area, the geology consists mostly of; volcanic rocks and limestone (Yv) of the Yavuna Group - the basement of Viti Levu - distributed in the north; pyroclastics (Wta), volcanic (Wka), limestone and volcanics (Wnb), and basalt (Wd) of Wainimala Group, and tonalite and other intrusives (Ct) of Colo Plutonic Suite in the northwest, central to southeastern parts; detrital sediments (Tt, Tc) of the Tuva Group and detrital sediments (Nvv, Nvs, Nvt) of Navosa Group in the northeast to east, and rocks of the Cuvu Sedimentary Group in the south to southwest.

SLAR analysis revealed the existence of lineaments, anticlinal and synclinal structures, but annular, caldera, and dome structures were not extracted.

Medium-wavelength gravity map shows that there are high gravity zones exceeding 0 mgal in the north, southwestern edge to western edge, and southeastern end of the area. There are wide zones from the east, central to northwestern parts of the area with low gravity under 0 mgal. The centers of the low gravity zone are at the east and western bank of the Sigatoka River, and the Bouguer anomaly decreases to the east and northeast. The steep gravity gradient zone in the southeast corresponds to the Verevere - Sigatoka Line.

The distribution of the Yavuna Group coincides with the northern anomaly of the three high gravity zones exceeding 0 mgal. The Wainimala Group which immediately overlies the Yavuna Group, is distributed in an area with gravity values ranging from -20 mgal to +10 mgal. The major reason for the wide range of Bouguer anomaly values in the Wainimala area is considered to be caused mainly by the depression and rise of the Yavuna Group in the low gravity zones and in the high gravity zones respectively. Of course, it may be partly caused by the large density variation in Wainimala Group. Average dendities of Wainimala Group are 2.65± g/cm^3 for the volcanic rocks and 2.45± g/cm^3 for the sedimentary rocks.

It is seen from the profile analysis (C-D section) that the Maximum depth of the Yavuna Group in this area is 7,000 m under the assumption of $\Delta\rho$ =0.30 g/cm^3 density difference from the upper layers.

The occurrence of the southeastern tonalite of the Colo Plutonic Suite coincides with the high gravity zone over 0 mgal, but this plutonic suite do not show notable anomalies to the west of Sigatoka. This probably is because of small density contrast between the plutonic rocks and the host Wainimala Group.

The distribution of the Tuva and the Navosa Groups which consists of relatively low density material, corresponds to the low gravity area under 0 mgal.

Density data on the rocks of Cuvu Sedimentary Group are insufficient for detailed discussions, but they partly show low anomaly in the short-wavelength gravity map which will be mentioned later, and thus is considered to belong to lower density group of rocks. These Cuvu rocks hardly show anomalies in the medium-wavelength gravity map, they probably were not sufficiently thick to produce anomalies.

The direction of the NE-SW trending faults in the southeastern part of the medium-wavelength gravity map agrees with that of the contour of the map. Other faults intersect the contours at oblique angles. It is inferred that the above faults in the southeast extends to deeper subsurface parts because of its coincidence with the medium-wavelength gravity contours. Also the location of these faults coincides approximately with the Verevere - Sigatoka Line.

The following SLAR lineaments coincide well with the direction of the contours of the medium-wavelength gravity map; N-S lineaments in the northwest (east-southeast of Momi), NW-SE lineaments in the southwest (east of Vusama), NE-SW lineaments in the southeast. There are also lineaments which intersect contours at right angles occur to the east of Vusama and along the north bank of the Sigatoka River in the northeast. These lineaments may reflect the deep-seated structures.

In the short-wavelength gravity map, marked anomalies exceeding +5 mgal or under -5 mgal are not observed, +2 to 3 mgal high and -2 to -3 mgal low anomalies are observed at about ten localities each. The relatively gentle short-wavelength gravity features is interpreted to be the reflection of the lack of notable density variation in shallow subsurface zones. Most of the short-wavelength anomalies do not correspond to the distribution of particular geologic units. The only exception is that in the north of Vusama which coincides with the distribution of the Cuvu Sedimentary Group.

Regarding the relation of the short-wavelength anomalies with faults, there is high gravity zone on the Yavuna Group side and low on the Wainimala side along the fault which separates the two groups. This reflects the difference of density on both sides of the fault. Along the southeast fault corresponding to the Verevere - Sigatoka Line, several high and low anomalies are observed on both sides, but the relation with the fault and the anomalies is not clear.

Concerning the relation between the short-wavelength anomalies and the SLAR lineaments, clear correlation cannot be made except for the lineament in the north which coincides with the NW-SE trending fault separating Yavuna and Wainimala Groups.

It is seen from the above that the cause of the majority of the short-wavelength anomalies in this area is not clear. Also all of the mines and mineral showings on the SLAR image analysis map are located in zones not exceeding +2 to -2 mgal short-wavelength anomalies, in other words, in areas with very small shallow density variation.

4-3-3 Prospective areas of Viti Levu

All relevant data concerning; altered zones, mines, mineral showings, various SLAR structures, high magnetic anomaly distribution, medium-wavelength gravity contours with 10 mgal intervals, short-wavelength gravity lows and highs and gravity faults of the whole Viti Levu Island were examined. The result was compiled in a integrated interpretation map (Fig. 2-4-23). This map was used as the basis for the following consideration on the prospectivity of Viti Levu.

The gravity pattern of Viti Levu is clearly divided by medium-wavelength gravity features into two areas by a line extending in the NE-SW direction joining Verevere in the northeast and Sigatoka in the southwest. Large scale g ravity highs occur isolated within a region of low gravity to the northwest of the line, while to the southeast, high and low anomalies occur as parallel belts with NE-SW trend. These two areas differ significantly not only in the pattern of gravity distribution, but also in the relation of the gravity features to the geologic structure, altered zones, and the SLAR structures. It will be described below.

In the area north of the above line, there are several localities where more than three of the following factors overlap; namely particular geologic formations, altered zones, SLAR structures, medium-wavelength gravity high, and short-wavelength gravity high/low. This is particularly notable in the central part of medium-wavelength gravity high.

A representative example would be the locality to the east of Vatukoula where the Emperor Deposit is located. There, annular, caldera structures, volcanic products of the Ba Volcanic Group, monzonite, acidic to intermediate altered zones, and circular short-wavelength gravity low occur overlapping each other. The deposit is situated in the periphery of the short-wavelength gravity low.

Similar overlap occurs in the central parts of the two medium-wavelength gravity highs to the southwest of Ba and to the west of Rakiraki. At the medium-wavelength anomaly to the southwest of Mba, caldera structure, micro monzonite complex of Koroimavua Volcanic Group, monzonite body of Ba Volcanic Group, acidic to intermediate altered zone, and marked short-wavelength gravity high are overlapping. The Kingston Deposit is situated at the center of the medium-wavelength gravity high. At the anomaly to the west of Rakiraki, dome structure, gabbro of Ba Volcanic Group, neutral altered zone (partly acidic), and marked short-wavelength gravity anomalies overlap.

These three localities have "collapsed structure" or "photogeologic structure indicating collapsed structure - resurgent caldera" and plutonic bodies intruded into Ba Volcanic Group at about the same time. The medium-wavelength gravity highs at the three localities are located at inferred volcanic centers and have circular to oval shape. These facts are interpreted to reflect the existence of high density igneous bodies formed by the solidification of magma chambers. Convection cells are believed to be formed inside large magma chambers, and the crystallized minerals are deposited in the bottom of the convection cells and form mafic stratified igneous bodies. These bodies should have very high density. Basaltic activities were predominant in the Mba and Koroimavua Volcanic Groups which are widely distributed in the above three areas, but andesite became significant towards the latter part of the volcanism. This supports the view that magmatic differentiation occurred simultaneously with the basaltic volcanism and enriched SiO_2 in the upper parts of the magma chambers.

When the magma was in molten state, volcanism was most active at the surface immediately above the chamber. Volcano itself, collapsed structures, domes, and many fractures and fissures, which would later become the place of ore emplacement, were formed at that time. The Emperor Deposit is located at the margin of a collapsed structure and is emplaced in the fissures which most probably were formed by the volcanic process. It is, therefore, reasonable to consider the possibility of epithermal gold deposits, similar to those of the Emperor Mine, at the centers of the medium-wavelength gravity highs at the three localities. Considering the distribution of altered zones, medium-wavelength high gravity zone over 20 mgal would be the targets for all three localities.

Aside from the above three localities northwest of the Verevere - Sigatoka Line; altered zones, SLAR structures,and short-wavelength anomalies overlap at northwest of Ba and Sambeto south of Lautoka. Both localities are situated at the periphery of the medium-wavelength gravity high to the southwest of Ba and inferred volcanic center is in or near the structures. And the alteration and the SLAR structures are considered to be related to the activities of the small magma chambers which branched out from the large magma chamber inferred from the medium-wavelength gravity high to the southwest of Ba. Both localities have epithermal gold potentials.

The medium-wavelength gravity high to the southeast of Nadi which coincides with the distribution of the Yavuna Group is considered to be mainly caused by the rise of the basement Yavuna Group. This anomaly, however, is similar to that to the east of Vatukoula, and southwest of Ba, and west of Rakiraki in its size and shape, and the rocks of the Yabuna Group at the surface is basalt. Thus high density igneous body may possibly exist in the deeper parts as in the case of the three areas. There is a relatively large tonalite stock (more or less coincide with short-wavelength gravity low) in the central part of the medium-wavelength gravity high. It is inferred that small magma intrusion from the large magma chamber in the deep place occurred in the area. But since it is old, the porphyry copper type mineralized zone and epithermal mineralized zones are considered to have been eroded.

"Sigatoka" area is located to the northwest of the Verevere - Sigatoka Line, but this line may bend northwestward near Sigatoka and the "Sigatoka" area is located at the extension in that direction. Wainimala Group and Colo Plutonic Suite are predominant in the area and the geology is similar to that of southeast of the Line. The potential mineralization would be porphyry type associated with the Colo Plutonics and clarification of the morphology of the summit of the Colo Plutonic Suite is important for mineral exploration. The many mineral showings, however, do not show characteristic gravity anomalies. This is caused by the small density contrast between the rocks of the Colo Plutonics and the Wainimala Group. Therefore, gravity survey cannot play important roles for mineral exploration in this area.

The mineralization southeast of the above Line includes; volcanic type porphyry copper Namosi Deposit in Medrausucu Group, plutonic type porphyry mineralization in Colo Plutonics or vicinity, skarn mineralization in the contact between Colo Plutonics and limestone of the Wainimala Group, replacement mineralization in Wainimala Group near the Colo Plutonics, bedded manganese in stratified volcano-sedimentary formations of the Wainimala Group, and gold and iron placers. These, however, do not show characteristic gravity anomalies. This probably is due to the small density contrast between the andesite of Medrausucu Group and porphyries of Medrausucu Group and Wainimala Group or between Colo Plutonics and Wainimala Group. This is similar to the case of "Sigatoka" area. But the road network in this area is not well developed and the gravity stations could not be established at constant intervals, and consequently short-wavelength gravity anomalies have not been found sufficiently. This may be one of the reasons for the lack of characteristic short-wavelength anomaly pattern. Therefore, it is difficult to delineate promising zones from gravity data for area southeast of the Line.

However, the areas from north of Suva to the south of Monasavu Dam and east of Sigatoka should be considered for future mineral exploration because there are many short-wavelength anomalies of unknown origin, which could indicate the existence of blind intrusive bodies, collapsed structures and other relevant features. Thus it is recommended that when the access to this area is improved in the future, supplementary gravity stations should be established and detailed gravity features should be examined.

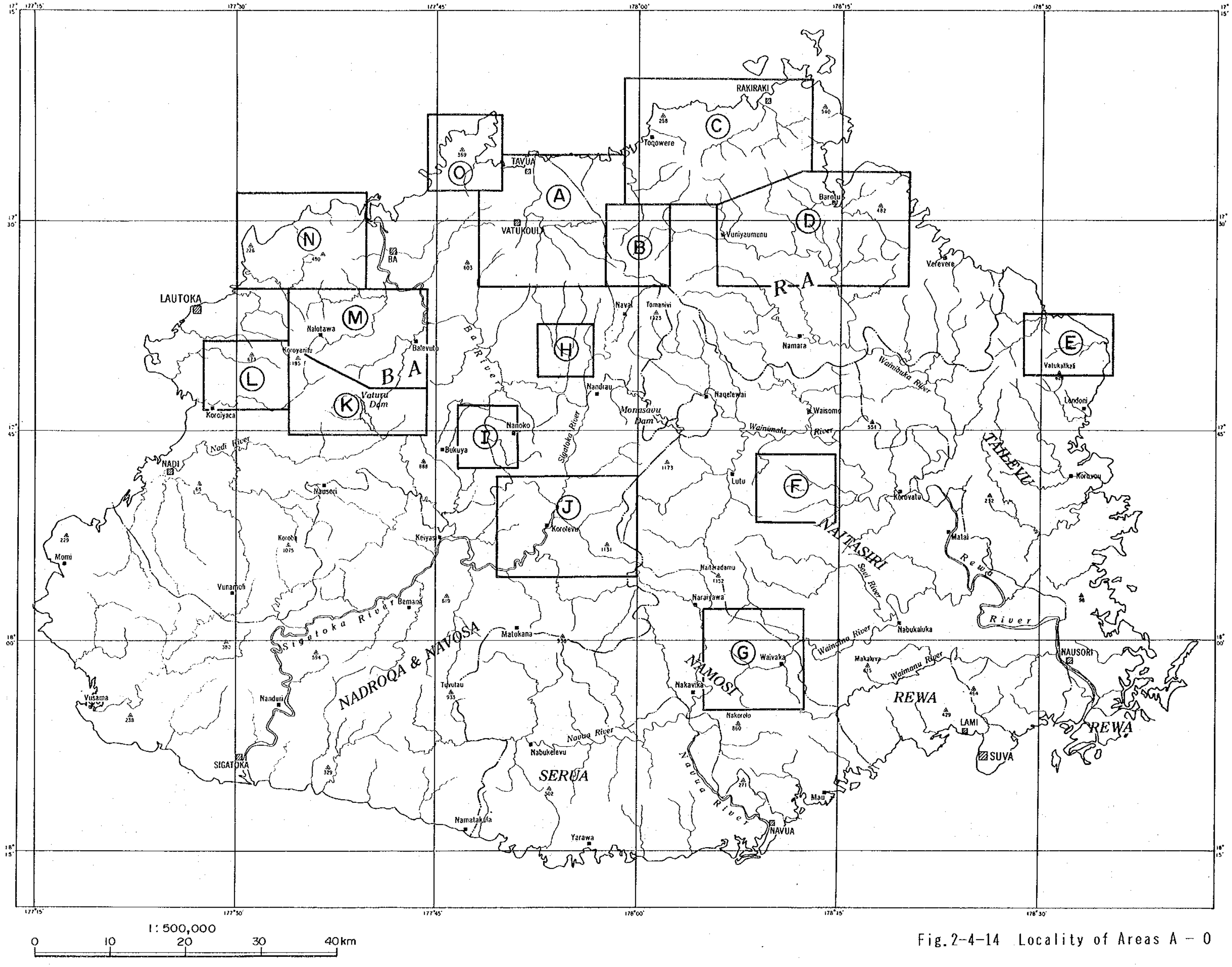


Fig. 2-4-14 Locality of Areas A - O

LEGEND

[Geology]

Late? Pleistocene ~Holocene		Alluvium, beach sand, etc.,	Gravel, Sand, Clay
Pleistocene Holocene		Fluvial deposits	Gravel, Sand, Clay
Pleistocene		Ucuna Limestone	Reefal Limestone, Reef Detritus
Early Pliocene ~Earliest Pleistocene		Verata Sedimentary Group	
	Vnk	Nakasi beds	Sandstone, Siltstone
	Vnc	Nacua Sandstone	Sandstone, Siltstone, Pumiceous Lapilli Tuff
	Vk	Korovou Sandstone	Calcareous Sandstone
	Vw	Waidalici Conglomerate	Polymictic Conglomerate, Basaltic Conglomerate
Latest Miocene ~Earliest Late Pliocene		Ba Volcanic Group	
	Bb	Balevuto Sill	Olivine Monzonite
	TV	Tavua Volcanic Product	Shoshonite, Basalt, Andesite, Trachyandesite, Pyroclastic Rocks
	Bnk	Nakorotubu Basalt	Basalt, Pyroclastic Rocks
	ND	Namunamu Diorite	Microdiorite
	Bnr	Narewa Andesite	Andesite
	Br	Rokavukavu Basalt	Basalt
	Bvt	Vatia Andesite	Andesite, Pyroclastic Rocks
	Bt	Tova Andesite	Andesite, Pyroclastic Rocks
	Bnu	Nukunuku Lavas	Shoshonite, Basalt
	Bky	Koroyanitu Volcanic Products	Shoshonite, Pyroclastic Rocks
	TVM	Tavua Monzonite	Monzonite
	Bwn	Wainatio Volcanic Products	Basalt, Pyroclastic Rocks
	Bka	Karavi Volcanics	Bsalt, Andesite, Pyroclastic Rocks
	Bnm	Namosau Volcanics	Andesitic Pyroclastic Rocks
	Bw	Wainivoce Trachybasalt	Trachybasalt
	Bnc	Nacilau Volcanics	Basalt, Pyroclastic Rocks
	Bmv	Muanisavu Sill	Monzonite
	Bna	Naimasi Andesite	Hornblende Andesite
	Bns	Nasava Gabbro	Gabbro
	Bs	Saru Formation	Shoshonite
	Bnd	Nadrou Creek Intrusives	Olivine Monzonite
	Buv	Upper Vuda Beds	Sandstone
	Bvk	Vatukaro Greywacke	Greywacke, Sandstone
Latest Miocene ~Early Pliocene	Cu	Cuvu Sedimentary Group	
		Volivoli Limestone	Limestone, Marl
		Naevuevu Siltston	Siltstone
		Voua Sandstone	Sandstone
Latest Miocene ~Earliest Pliocene		Koroimavua Volcanic Group	
	Kv	Lower Vuda Beds	Sandstone, Conglomerate
	Ks	Sabeto Volcanics	Shoshonitic Pyroclastic Rocks, Basalt
	Knv	Navilawa Stock	Micromonzonite
	Knw	Nawainiu Intrusive Complex	Micromonzonite
Late Miocene		Navosa Sedimentary Group	
	Nvt	Tamanua Formation	Sandstone, Conglomerate
	QA	Qaravetuvetuku andesite	Andesite
	Nvs		Sandstone, Mudstone
	Nva		Andesitic Pyroclastic rocks
	Nvv	Vunamaoli Conglomerate	Conglomerate
Late Miocene		Nadi Sedimentary Group	
	Nb II		Sandstone
	Nd I		Andesitic Pyroclastic Rocks
Late Miocene		Ra Sedimentary Group	
	Rl	Likusavu Euxinites	Sandstone, Mudstone
	Rb	Barotu Sandstone	Sandstone
	Rw	Wailoa Conglomerate	Conglomerate, Sandstone
Late Miocene ~Early Pliocene		Medrausucu Group	
	Msm	Suva Marl	Marl, Sandstone, Limestone, Tuff
	Mw	Waidina Sandstone	Sandstone, Siltstone
	Mnv	Navua Mudstone	Mudstone, Sandstone
	Ml	Lami Limestone	Reef-Rubble Limestone
	NKB	Nakobalevu Basalt	Basalt
	Mnm	Namosi Andesite	Andesite, Pyroclastic Rocks
	Mm	Mau Andesite	Hornblende Andesite
	Mv	Voisari Sandstone	Andesitic Sandstone
	Mwk	Wainikaro Stock	Quartz Diorite
	Ms	Serua Conglomerate	Conglomerate
Mid Late Miocene		Tuva Group	
	Tt	Takaro Conglomerate	Conglomerate
	Tc	Cici Sandstone	Sandstone, Siltstone
	Ta	Koroleva Andesite	Hornblende Andesite
Middle ~Late Miocene		Colo Plutonic Suite	
	Ct		Tonalite, Diorite
	Cg		Gabbro
Early Miocene? ~Middle Miocene?		Savura Volcanic Group	
	Sv	Vago Volcanics	Basaltic~Andesite~Dacitic Pyroclastic Rocks
	Sn	Nasinu Basalt	Basalt
Late Oligocene ~Middle Miocene		Wainimala Group	
	Wnm	Namalavu Conglomerate	Conglomerate, Basalt, Pyroclastic Rocks, Limestone
	Wtt	Tuvutau Greywacke	Greywacke
	Wnu	Nubuonaboto Volcanics	Basaltic~Dacitic Pyroclastic Rocks
	Wko	Korobalavu Andesite	Andesite, Sandstone
	Wwk	Waikuru Basalt	Basalt
	Wta	Tari Formation	Basaltic~Andesitic Pyroclastic rocks, Limestone, Sandstone
	Wka	Kalata Dacite	Dacite, Pyroclastic rocks
	Wla	Lawalevu Sandstone	Sandstone, Dacitic Tuff, Basaltic Pyroclastic Rocks
	Wtu	Tawavatu Tuff	Basaltic and Dacitic Tuff
	Wwb	Wainibuka Trachyte	Trachyte, Pyroclastic Rocks, Limestone
	Wnd	Nadele Breccia	Basaltic Pyroclastic rocks, Basalt
	Wnb	Nabu Formation	Limemudstone, Dacite, Pyroclastic Rocks, Sandstone
	Wq	Qalimare Limestone	Limestone
	Wd	Dakadaka Basalt	Basalt
	Wm	Matawailevu Dacite	Dacite
	Wlo	Lokalevu Keratophyre	Dacite, Pyroclastic Rocks
Late Eocene ~Early Oligocene		Yavuna Group	
	Yvs	Yavuna Stock	Tonalite
	Yv	Yavuna Volcanics	Basalt, Dacite, Pyroclastic rocks, Limestone

: Fault

: Strike and Dip of Beds

: Anticlinal axis

: Synclinal axis

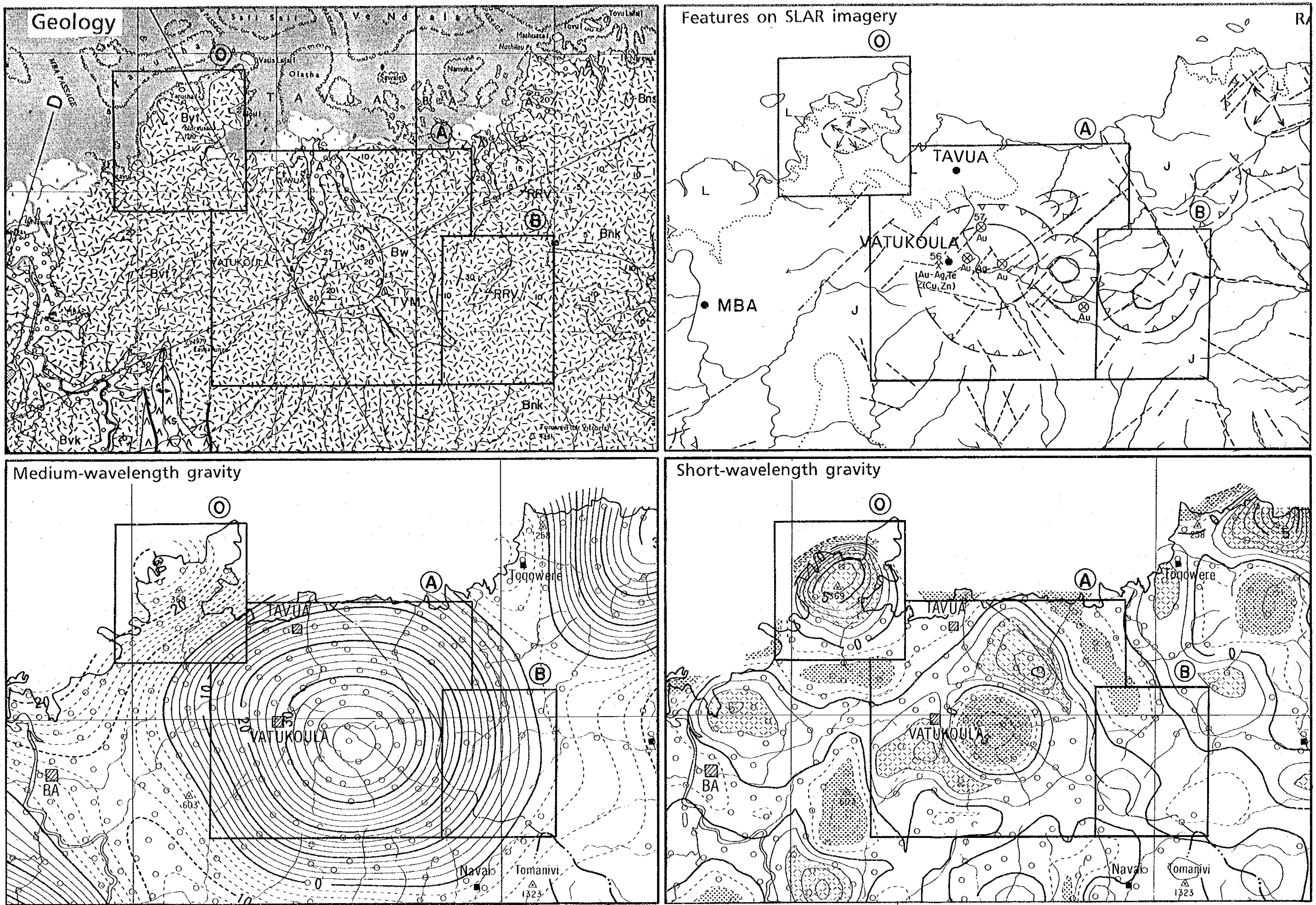
[Features on SLAR imagery]

A	Lithological boundary and unit
	Lineament (certain)
	Lineament (uncertain)
	Bedding
+	Horizontal bedding
	Strike and dip direction of bedding
	Anticline
	Syncline
	Annular structure (Morphological anomaly)
	Caldera structure (Morphological anomaly)
	Dome structure (Morphological anomaly)
	Working mine
	Closed mine
⊗	Prospect
1 ~ 63	Location Nos. denoted as the numbers in the list of the prospects and mines

[Features on short-wavelength gravity]

Gravity high(>2mgal)

Gravity low(<-2mgal)



1:250,000

0 5 10 15 20Km

Fig.2-4-15 Geology, SLAR Features, Med-, Short-wavelength Gravity (Areas A, B & O)

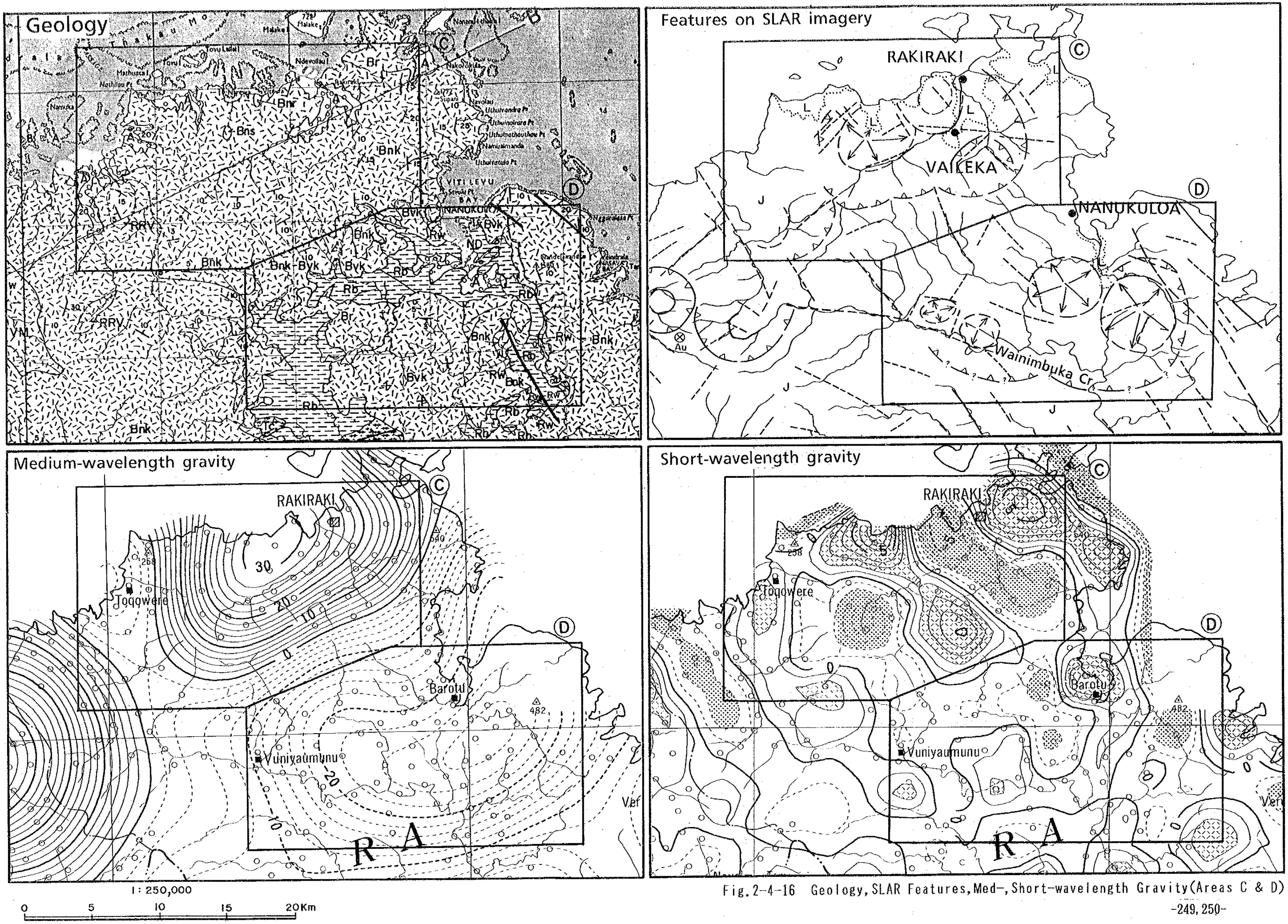


Fig.2-4-16 Geology, SLAR Features, Med-, Short-wavelength Gravity(Areas C & D)

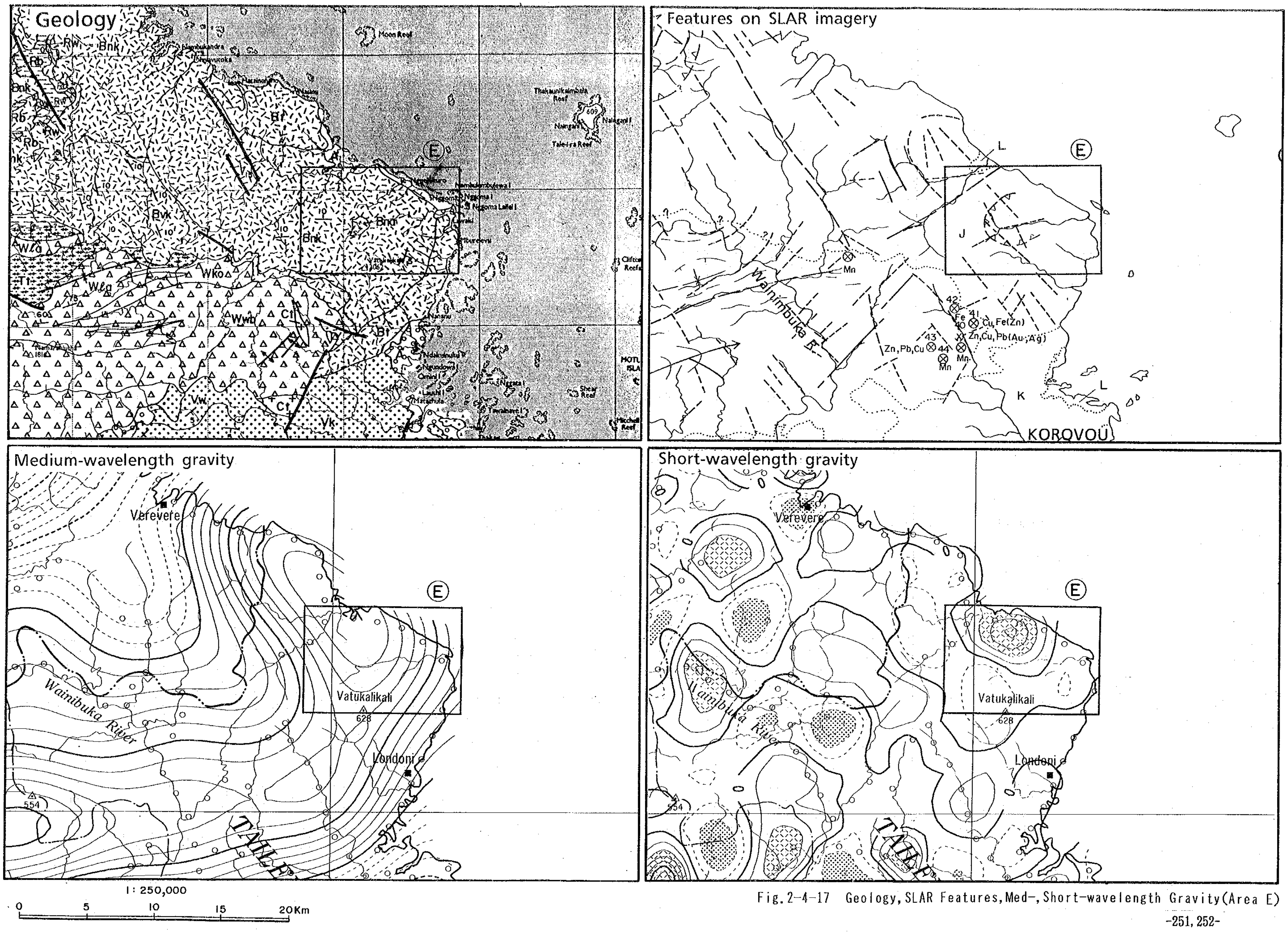


Fig.2-4-17 Geology, SLAR Features, Med-, Short-wavelength Gravity (Area E)

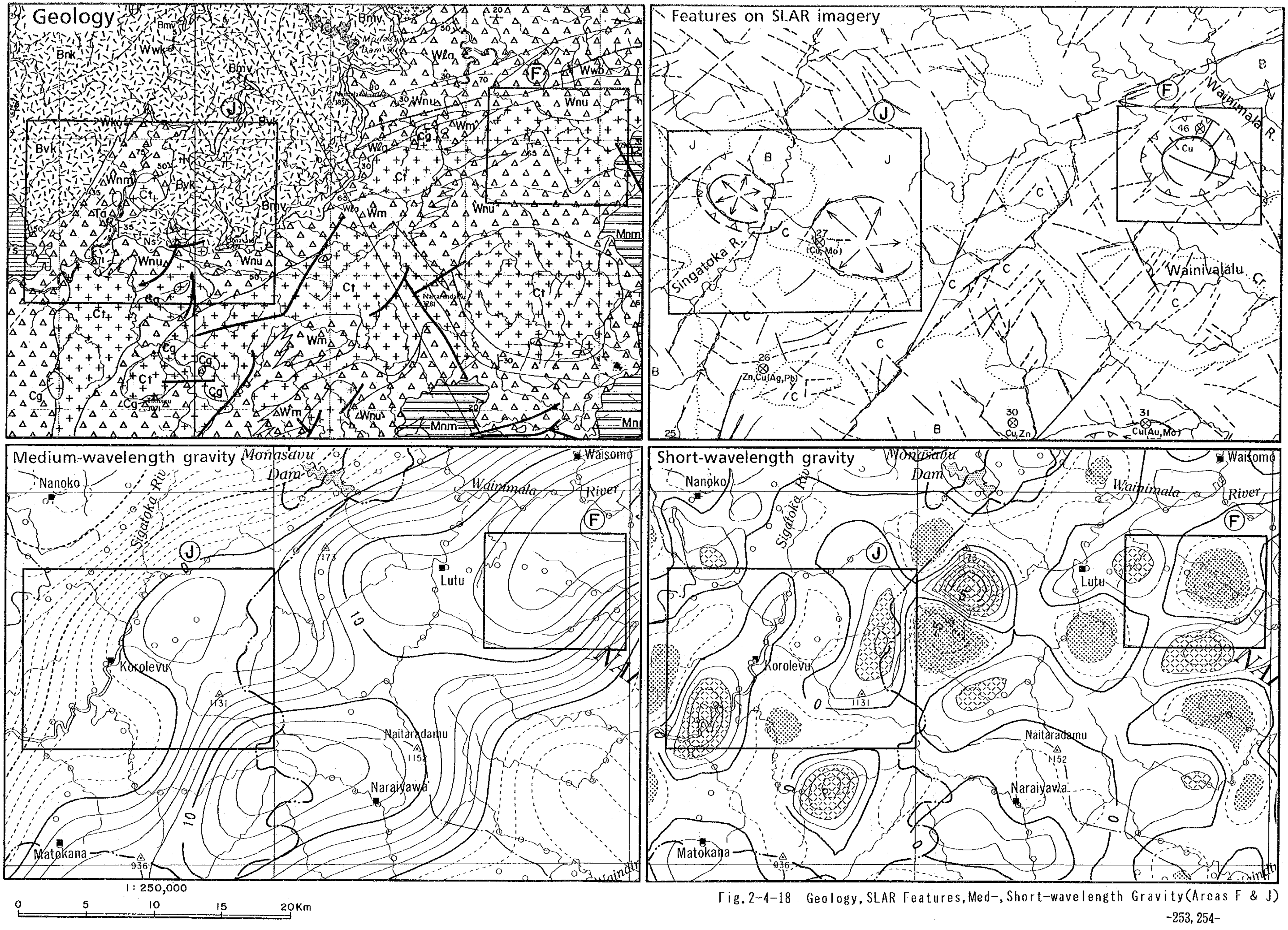


Fig. 2-4-18 Geology, SLAR Features, Med-, Short-wavelength Gravity (Areas F & J)

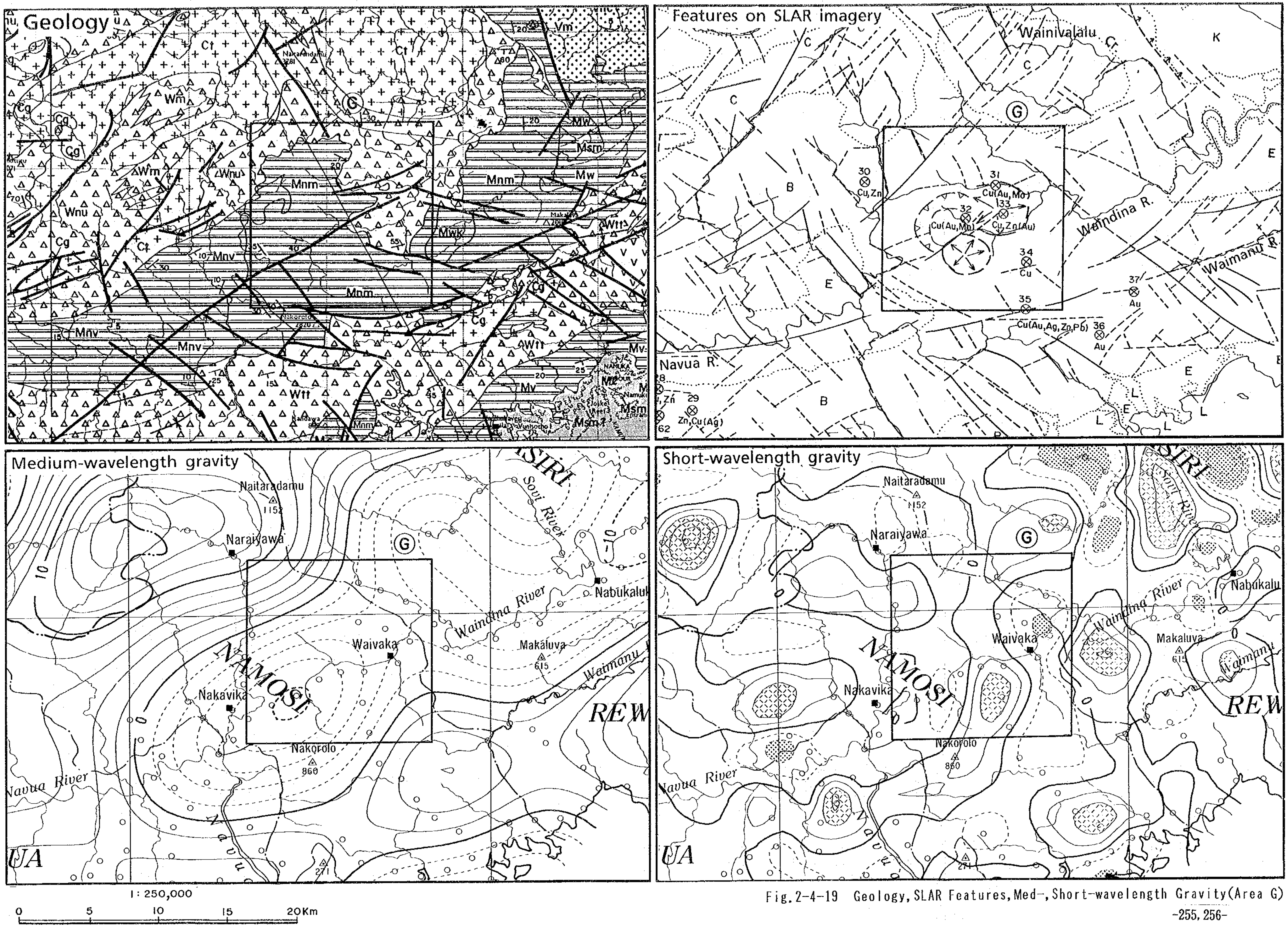


Fig. 2-4-19 Geology, SLAR Features, Med-, Short-wavelength Gravity (Area G)

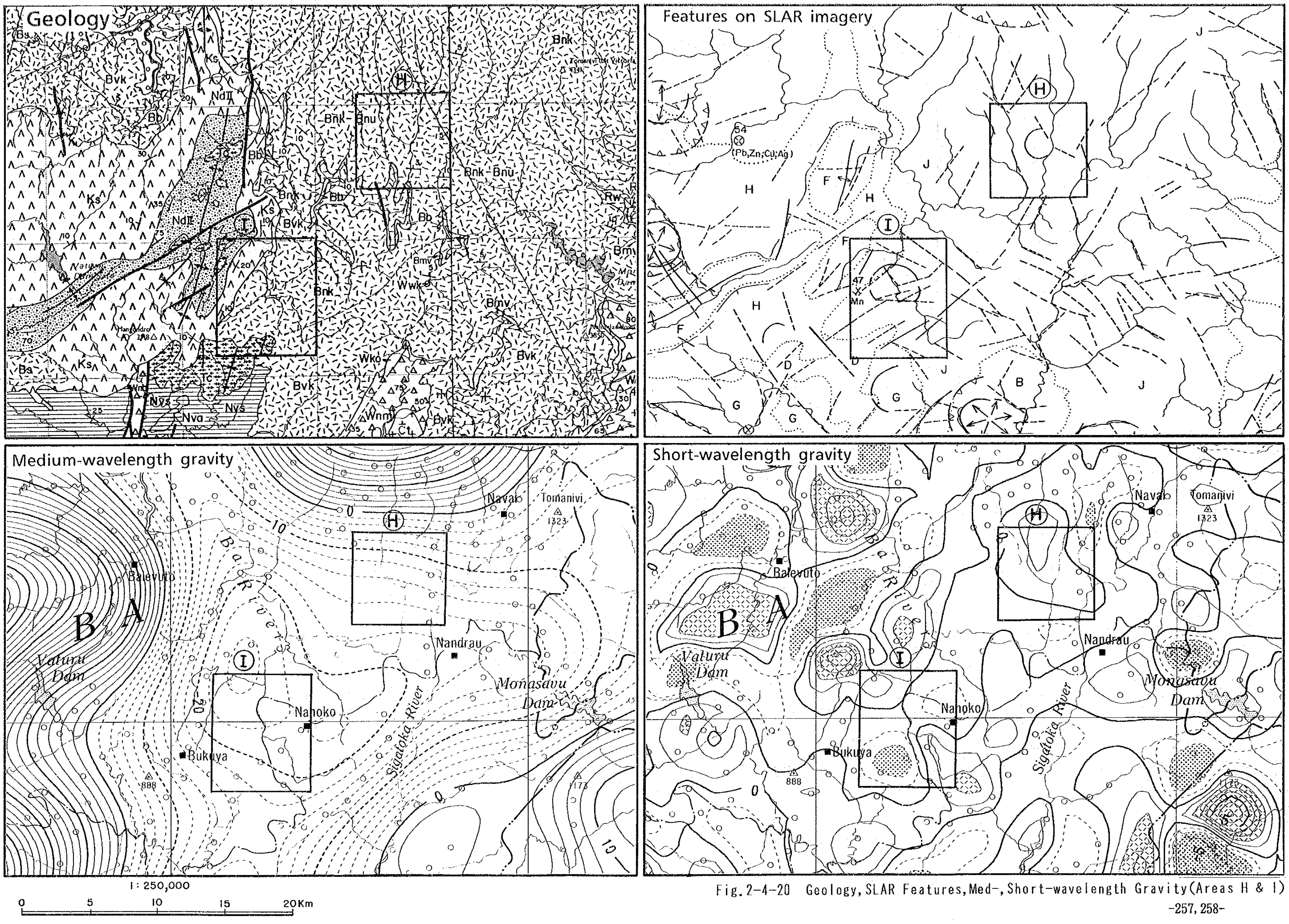
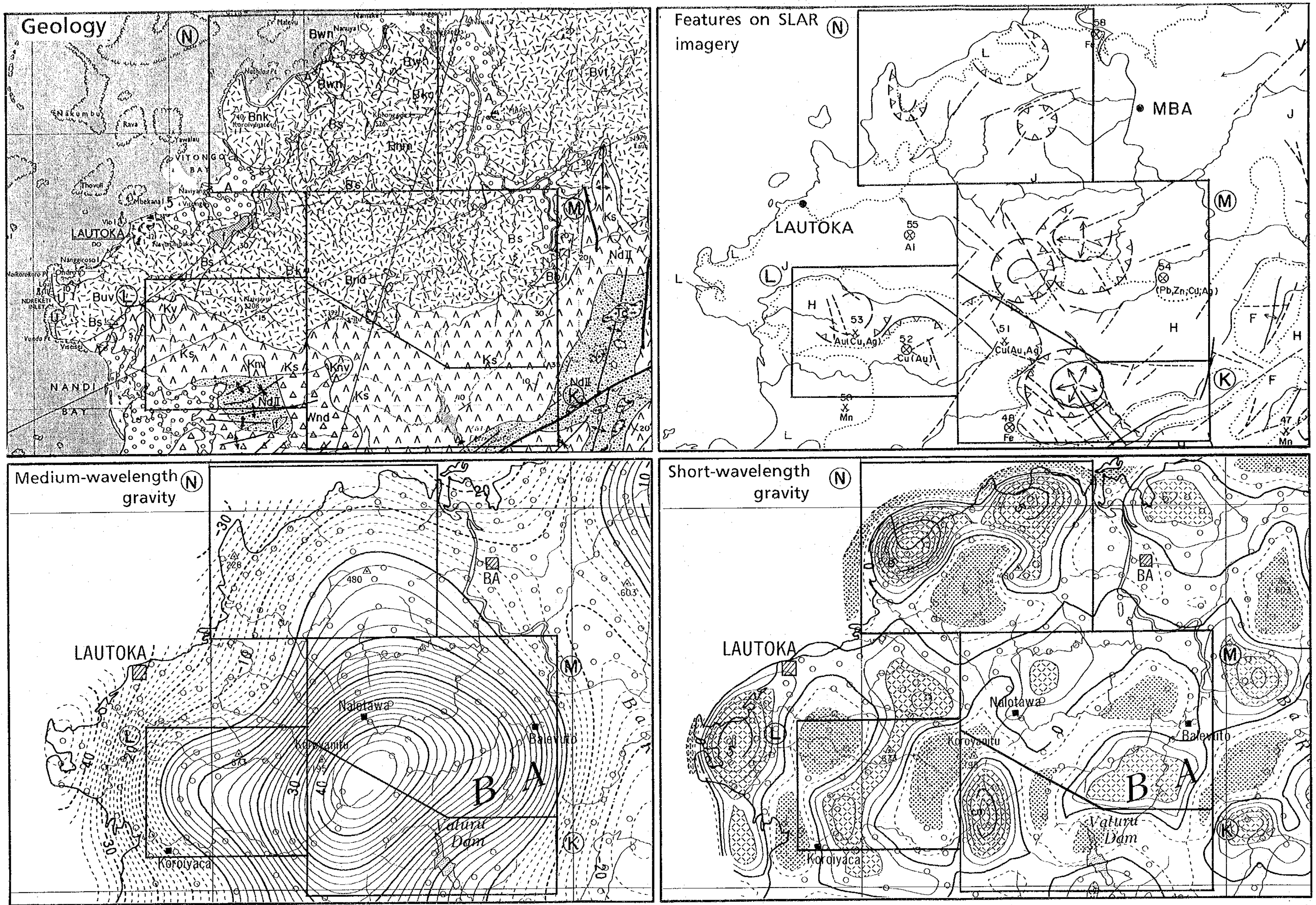


Fig.2-4-20 Geology, SLAR Features, Med-, Short-wavelength Gravity (Areas H & I)



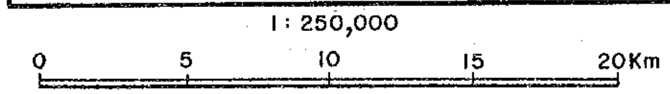


Fig.2-4-21 Geology, SLAR Features, Med-, Short-wavelength Gravity (Areas K, L, M & N)

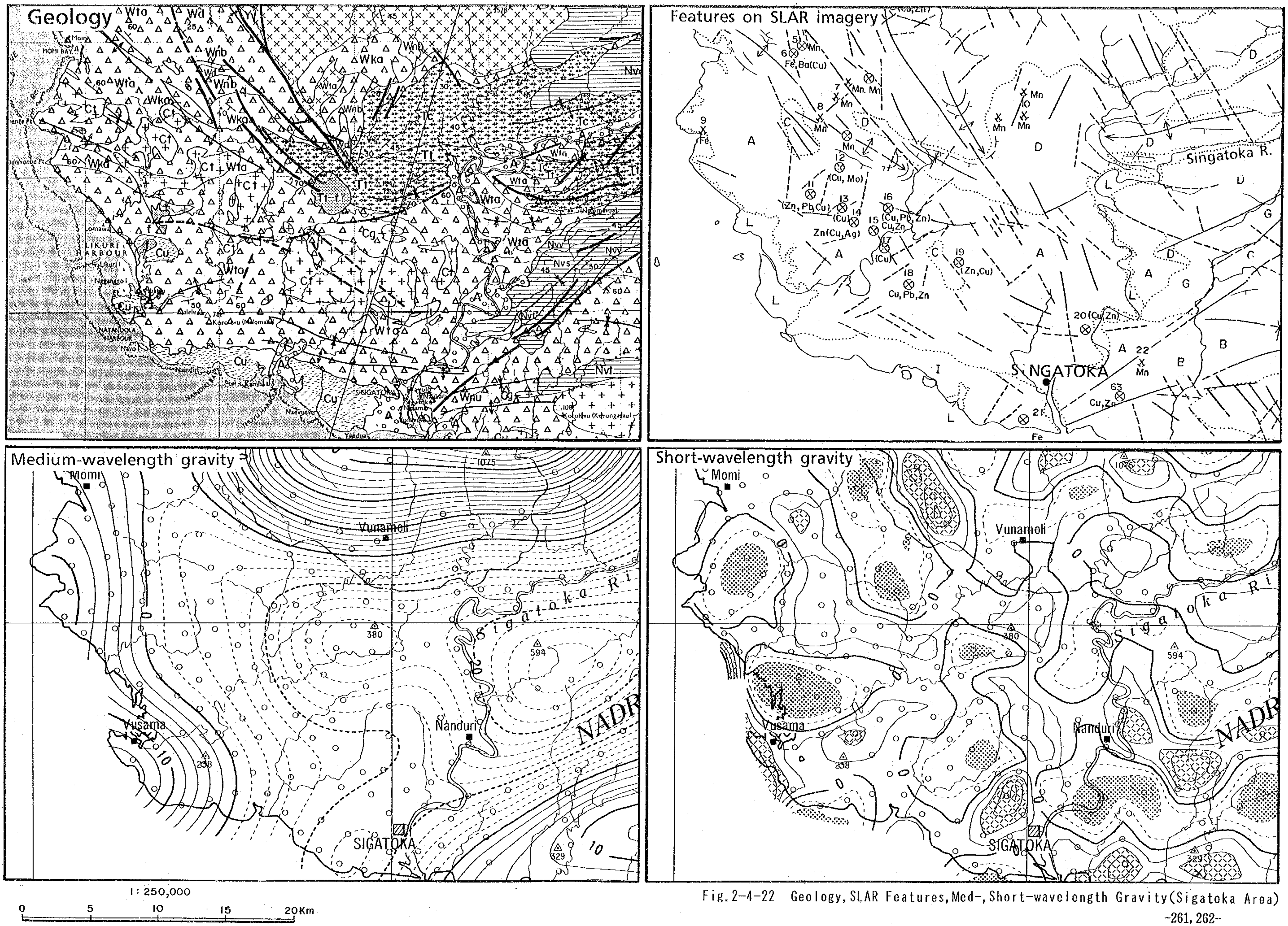


Fig.2-4-22 Geology, SLAR Features, Med-, Short-wavelength Gravity (Sigatoka Area)

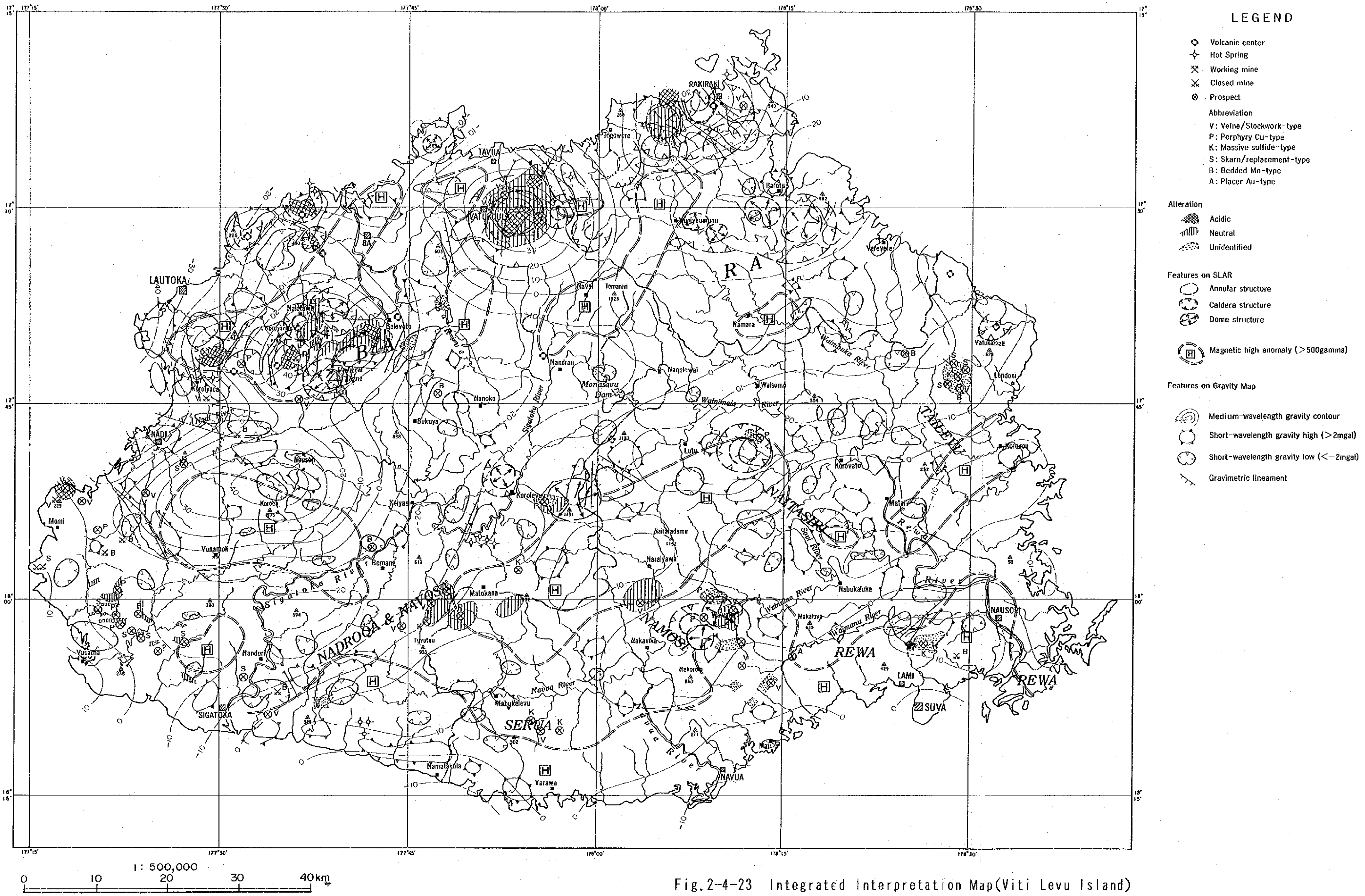


Fig. 2-4-23 Integrated Interpretation Map (Viti Levu Island)

PART Ⅲ CONCLUSIONS AND RECOMMENDATIONS

PART Ⅲ CONCLUSION AND RECOMMENDATION

CHAPTER 1 Conclusions

[Mba-west Area]

Photogeological analysis, geological survey, geochemical prospecting and drilling were carried out.

The following conclusions were obtained.

(1) The Mba-west area was photogeologically analyzed. The geology was classified into 10 units and gently northward dipping general structure was identified.

(2) Total of ninety five lineaments were extracted photogeologically in the Mba-west. Many of these are concentrated in the southern and northern parts of the area. The directions of the maximum horizontal compressional stress axes were inferred to be NNW to NNE and ENE to ESE from the en echelon arrangement of the lineaments.

(3) The photogeological characteristics of the known mineral prospects of Mba-west were identified to be low resistance and low relief. Eight localities with these features were delineated.

(4) The geology of Mba-west consists mostly of; Miocene-Pliocene andesitic/basaltic volcanic products and limestone; Pliocene basaltic/andesitic volcanic products, sandstone, and conglomerates; Holocene alluvium; and intrusive rocks (monzonite, dacite, andesite, basalt) penetrating the Pliocene formations. The Miocene and Pliocene formations largely dip northward at low angles and are superposed. Thus the strata become younger northward.

(5) The following characteristics are noted in the intrusive bodies of Mba-west.

Monzonite is arranged in the NNE-SSW direction within the photogeological annular structures in the southern part.

Andesite and basalt dykes occur mostly in the south and north. They are particularly dominant in the south.

Many of the dykes in the south and some of the northern dykes are arranged radially.

In the south, andesite is distributed mainly within the photogeological annular structures and extend northward and southeastward from these structures. Basalt is distributed in the periphery of the andesite area.

(6) Marked Au, As, Te geochemical anomaly zones which coincide

with the altered/mineralized zones on the surface were extracted at four localities in Mba-west area. Aside from the above, small geochemical anomalies not associated with alteration/mineralization were confirmed at several localities and blind buried altered/mineralized zones were anticipated to occur in shallow subsurface parts.

(7) Two holes drilled in Mba-west area penetrated through basalt lava and basaltic pyroclastics of the Pliocene Namosau Volcanics and confirmed wide argillized zone accompanied by pyrite dissemination, but promising Au mineralization could not be confirmed.

(8) The circular depression extracted in southern Mba-west as photogeological annular structure is believed to have been the center of volcanic activity from the distribution of the volcanic products and intrusive bodies. A large scale medium-wavelength gravity high is distributed throughout this area. This gravity high is believed to reflect high density rock bodies (deep-seated bedded basic intrusive bodies) formed by the solidification of the magma chamber which supplied the volcanic products of this area. The above annular structure is located near the center of this high gravity anomaly.

(9) There is a photogeological dome structure. Plutonic monzonite and the dome occur within the annular structure in southern Mba-west, this is considered to be the evidence of uplift of the structure after the effusion of the volcanic products. The process of formation of this structure is inferred as follows. First, volcanic collapsed structure was formed in relation to the effusion of volcanic material. Subsequently the depressed structure was uplifted by the rise of magma, resulting in the extinction of the clear collapsed structure.

(10) Monzonite and andesite intruded into basaltic volcanic products near the above annular structure in southern Mba-west. This is believed to indicate the differentiation from basaltic to andesitic magma in the magma chamber after the effusion of the volcanic products.

(11) The monzonite bodies are arranged in the NNE-SSW direction in southern Mba-west, and thus it is inferred that, at the time of the intrusion (4.96 ± 0.30 Ma), extensional deep fractures were formed in that direction by maximum horizontal compressional stress. This inferred stress field coincides with that of Pliocene obtained by photogeological analysis.

(12) Many lineaments of Mba-west are developed near the inferred volcanic centers in north and south, also lineaments with various

trends are developed within the photogeologic annular structures.

Also in short-wavelength low gravity zones and in parts of the short-wavelength high gravity zones, lineaments parallel to the elongation of the zones are developed in and near the zones. This is interpreted as reflecting fractures which were developed as the result of the vertical block movement accompanying the rise of magma.

(13) Propylitized zones and sericitized zones are developed near the southern photogeological annular structures, and geochemical anomalies related to Au mineralization and auriferous quartz veins occur overlapping some of these altered zones. These features regarding geologic structure and mineralization/alteration are very similar to those of the Emperor Mine area. It is anticipated that low sulfidation epithermal gold mineralization akin to that of the Emperor Mine would exist in this area.

(14) Photogeological caldera structures are extracted at three localities in northern Mba-west and volcanic products are distributed in the vicinity. These calderas all occur in short-wavelength high gravity zones. This reflects the fact that these calderas are crater and/or volcanic collapsed structures and that the short-wavelength highs are caused by shallow high density rocks. These shallow bodies are considered to be small magma chambers formed as offshoots of the large, deeper chamber whose existence is inferred from medium-wavelength gravity high.

(15) Acidic alteration zones accompanied by silicification are developed in some of the photogeological calderas in northern Mba-west. Geochemical anomalies related to Au mineralization occur overlapping these altered zones. This is of the high sulfidation epithermal gold mineralization. This type is considered to form under shallower environment than the low sulfidation type. The results of drilling at Namosau Alteration Zone of this year, showed that the deposits could have been eroded out. But the conditions of the lower parts of the Raviravi Alteration Zone is not clear, and the possibility of the occurrence of gold deposits has not died.

The high sulfidation type mineralization/alteration also occur in short-wavelength high gravity zone at the southeastern border of Mba-west.

(16) The mineralization of Mba-west was brought about by hydrothermal activities related to Pliocene volcanism. And it is considered that high sulfidation type epithermal gold mineralization occurred above the shallow small magma chamber while low sulfidation type occurred near the volcanic center in the central part of the deep and large scale chamber.

[Sigatoka Area]

Gravity survey, geological survey and geochemical prospecting were carried out.

The following conclusions were obtained.

(1) The geology of Sigatoka consists of; Miocene basaltic and/or andesitic volcanic products, and detrital sediments; Pleistocene (?) fluviatile sediments; and intrusive bodies (granodiorite-porphyry-diorite porphyry bodies, granodiorite, diorite, diorite porphyry, quartz porphyry, aplite, basalt, andesite, dacite, and rhyolite) penetrating Miocene Series. The Miocene units largely dip southwestward are superposed.

(2) The major faults of Sigatoka area have trends (E-W to WNW-ESE) similar to the direction of the arrangement of the Colo Plutonic Suite (WNW-ESE), and there are a few which intersect them at oblique angles. The major faults transect the relatively old porphyry bodies (10.1 ± 1.6 Ma) of Colo Plutonic Suite bodies, and, in turn, is transected by younger plutonic bodies (8.1 ± 0.3 Ma). This indicates that the activities of the fault and the Colo Plutonism overlap.

To the south of Colo Plutonic Suite, dykes are arranged en echelon in the NW-SE to E-W direction and the existence of right lateral faults are inferred.

(3) The trends of the SLAR lineaments of Sigatoka are NW-SE, WNW-ESE, and NE-SW. There are Colo Plutonic Suite bodies with elongation similar to these lineaments in respective areas.

(4) Most of the mineralized/altered zones occur in either near the above faults, near the Colo Plutonic Suite bodies, near the SLAR lineaments, and near the en echelon dykes. Also some of them occur within the Colo Plutonic Suite bodies.

(5) Four large geochemical anomalous zones were extracted in the Sigatoka area. These four zones coincide with the surface mineralized/altered zones, and many other small anomalies were also extracted. These are believed to be anomalies related to the activities of the Colo Plutonic Suite which occur extensively below.

(6) The mineralization of the Sigatoka area is closely related to the activities of the Colo Plutonic Suite and they are emplaced in fractured zones in the vicinity of the plutonic and porphyry

bodies, thus, it is considered that the mineralization took the form of veins, replacement, porphyry, and other types of meso- to hypothermal activity.

(7) The intensity of the mineralization/alteration is weak with some exceptions. The intensity of the geochemical anomalies is also generally low. Many of the altered zones and anomalies have been drilled without significant success. There are two undrilled localities where multi-component anomalies are noted. If large deposits are to be anticipated, the weak surface manifestation indicates deep occurrences.

[Gravity Survey]

Gravity survey was conducted in the southern part of Viti Levu Island, and analysis was carried out from the data of the first and second phase surveys.
The following conclusions are obtained.

(1) Medium-wavelength gravity features indicate that to the north of the NE-SW trending line joining Verevere in the north-east and Sigatoka in the southwest, large scale gravity highs with circular to oval shape occur isolated in a generally low gravity area, while to the southeast of the line, high and low anomalies elongated in the NE-SW direction in belt-form are distributed alternating each other. Thus the gravity features of the two areas are clearly different. The westernmost high anomaly southeast of Nadi in the northwestern part coincides well with the distribution of the Yavuna Group, but the other three highs cannot be correlated with surface geology. The zonal distribution of the high and low anomalies in the southeast more or less coincides with the distribution of the "Wainimala Group - Colo Plutonic Suite" and "Medrausucu Group - Verata Sedimentary Group".

(2) There are large medium-wavelength gravity high at three localities, southwest of Mba, east of Vatukoula, and west of Rakiraki. Annular, caldera, dome structures identified photo-geologically and collapsed structures ,intrusive bodies, altered zones, and marked short-wavelength gravity anomalies are concentrated in the centers of these medium-wavelength gravity highs. The gravity gradient of the peripheral parts of these medium-wavelength highs is steep and the shape of these anomalies is circular to oval. These are considered to indicate the existence of subsurface high density igneous body and is inferred that there was a large magma chamber in the deeper parts.

(3) The Emperor Mine is situated at the periphery of the collapsed structure in the center of the medium-wavelength gravity high to the east of Vatukoula, the Kingston Mine in the center of the medium-wavelength gravity high to the southwest of Mba. Together with the high west of Rakiraki, the centers of these three medium-wavelength gravity highs are considered to be the localities where active volcanism occurred repeatedly. Therefore, these are listed as promising for epithermal gold exploration. The anomalies in the northern Mba-west are on the northern extension of the medium-wavelength gravity high to the southwest of Mba, and with the coincidence of SLAR annular and caldera structures and the short-wavelength gravity highs, it is believed that the northern Mba-west was the place of activity of small magma branched out from large magma chamber. The area is listed as a promising for epithermal gold deposit occurrence.

Chapter 2 Recommendations for the Third Phase Survey

It is recommended that the following activities be undertaken for the third phase survey.

(1) Drilling at Yaloku and Nalotawa-Nanuku Alteration Zones in south Mba-west in order to confirm the conditions related to low sulfidation epithermal gold mineralization. These zones are located near the photogeological annular structures in south Mba-west.

(2) Drilling at Raviravi Alteration Zone in north Mba-west in order to confirm the conditions related to high sulfidation epithermal gold mineralization.

(3) Geophysical surveys in order to clarify the conditions of subsurface mineralization/alteration at several localities where small geochemical anomalies not related to surface mineralization/alteration. And drilling if the above geophysical survey provides promising results.