Formation. No relation between the rock and Serido Formation is observed.

(iii-4)Tertiary Basalt

(a)Distribution (see Pl.II-3-1 and Fig.II-3-1)

All of this unit is exposed as dikes and distribute in the all over the surveyed area. Each of them strikes WNW-ESE. The largest is situated in the Serido Formation in the westnorthwest of the Sao Francisco mine, it extends from Balas Grosso to Belo Horizonte. Its total extension is about 3.5km long. The next largest is located in the Serra do Cabocla in the central eastern part of the surveyed area. Its extension is about 2.5km long.

(b)Lithology

It is dark grayish in color and is fine-grained and compact. It is sometimes constructed by aggregated several dikes. Its width is as much as 0.3 to 1m.

3-2-2 Structure

(1)Regional Geological Structure

As mentioned previously in the section II chapter 1, this surveyed area is situated in the fold belt in the Precambrian system and suffered several times of orogenic movements (TableII-1-1). The majorities of the structures observed present day are the result of the mainly of F3 and F4 orogenic activities. The structured caused by the F1 and F2 orogenies are not distinguish the surveyed area. The stratigraphic column with respect to the geological structures are presented in Fig.II-3-4.

As obvious in the geological map (Pl.II-3-1 and Fig.II-3-1), the trend striking NNE-SSW appears intensively in the various geological elements through the surveyed area. It appears as the geological distribution, controlling faults, and schistosity, and so on.

In the northern half of the surveyed area, the distribution of Caico Complex and Serido Formation is NNE-SSW trending topographic high and low, respectively. Thus, Caico Complex represents topographic high and Serido Formation does Topographic low. The relationships between the block of Caico Complex (+ Jucurutu Formation) and the block of Serido Formation are usually the fault contact. While the normal/reverse direction of the fault is not clear, almost of them are supposed to be normal fault if the dips of the fault were similar to the those of the schistosity.

NNE-SSW trending fault system is predominated. The fault through the Sao Francisco mine in the central part of the surveyed area is separated into the two faults in the south. These are apparent as the surface hydrography south of the National way BR-226 and

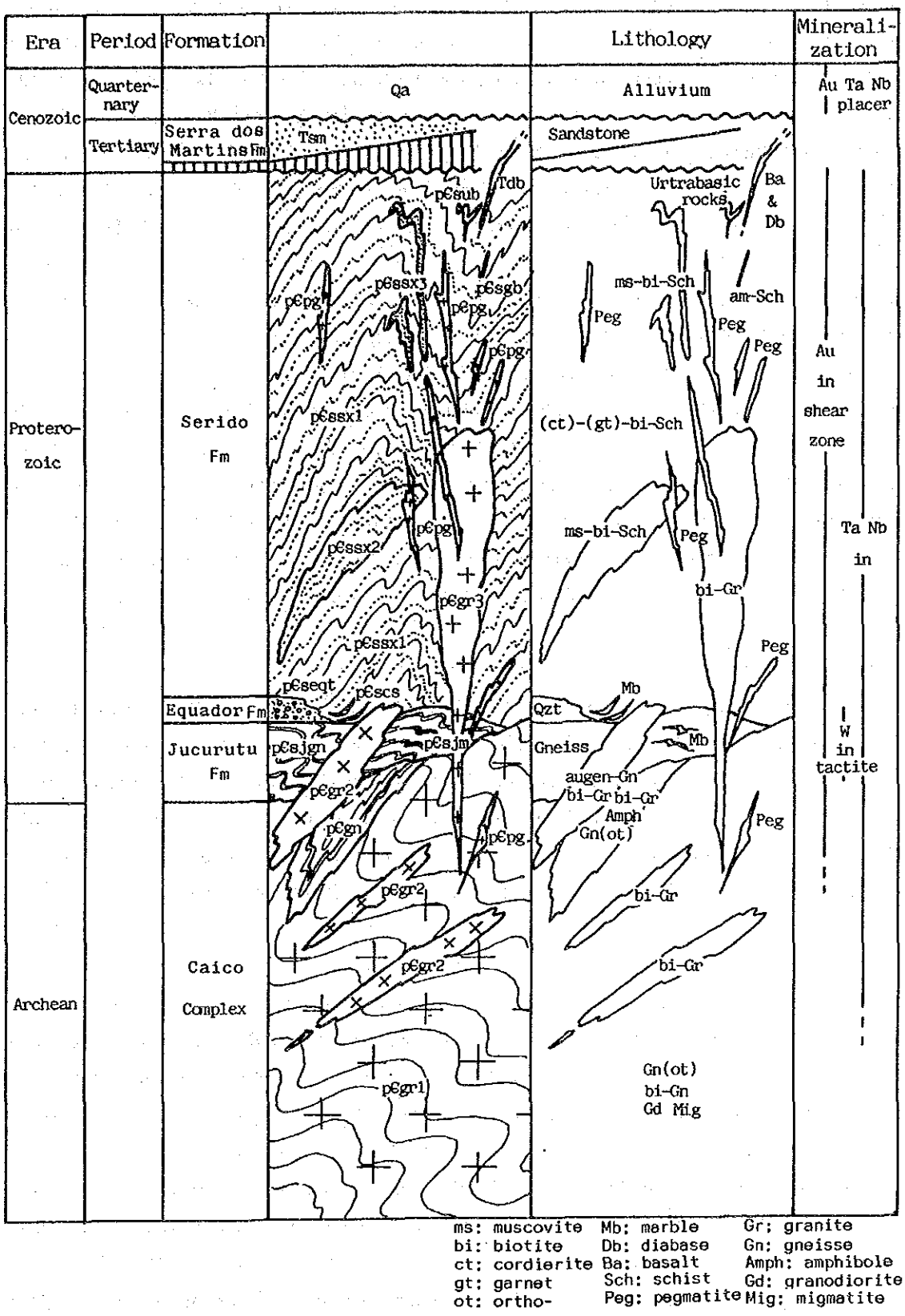

Fig. II-3-4 Tectono-stratigrafic section of the survey area

supposed to extend southward. This fault is not so clear around 5km north of the Minas Sao Francisco mine, but it is supposed to extend northward to continue the above mentioned fault between Caico Complex and Serido Formation. This fault strike N30°E in Serido Formation in the south of the Sao Francisco mine , and it separates into two faults trending N40°E and N20°E in the north of the nmine. Another fault system is striking WNW-ESE, and appears in Serido Formation in the central southern part of the surveyed area. The southern limit of Serido Formation (pCssx2) in the central western part of the surveyed area, ie.
the NW-SE trending boundary, is supposed to be the northwestward extension of the faults which strikes NW-SE in the southeastern part of the surveyed area.

The dips of the beds are not observed due to the folding structure by tectonic activities and to the intensive schistosities by metamorphism. The facing determination method of Laing et al.,(1978) (the method based on that the mineral composition should be affected by the original rock structure after the metamorphism if the original rocks consisted of the repeated sequences of the each individually graded bed) was not able to be applied since the compositionally banded distribution of the minerals were not observed.

The WNW-ESE trending basic dikes of Tertiary age is noted as young structure.

(2)Micro structure

The schistosity trending NNE-SSW are intensive and it is locally disturbed. This disturbance of the schistosity is observed 3km northeast of the Sao Francisco mine, and it strikes there N60°E and N75°E and so on. The direction of dips of the schistosity varies but it dips steeply in general. Thus the existence of open - gentle fold with the axial-plane trending NNE-SSW, branching steeply, through the area is supposed.

The above mentioned schistosity is cut by the major faults with low angle.

(3)Relationships between the mineralization and the structure

Gold deposit at the Sao Francisco mine is situated in Serido Formation and located around where the both of the faults systems striking NNE-SSW and WNW-ESE are crossing to be frequent. Since the strikes of the schistosity of Serido Formation is ENE-WSW around the north of the deposit, whereas it is NNE-SSW in general in the other area, the structural disturbance is supposed to have occurred during the tectonic movement.

Garimpo at the west of Sao Tome is situated in Caico Complex, where the strike of the fault forming the boundary between Caico Complex and Serido Formation changes from N30°E in the south to N10°E in the north.

Thus the gold prospects are regarded to be situated at the sites where the geological structures are disturbed such where the different trending faults are concentrated and

where the strike of the fault kinks. Consequently, the gold mineralization is supposed to have been genetically related to the structural disturbance due to faulting.

3-2-3 Mineralization and alteration

Distribution of the major mineral deposits in the surveyed area is shown in the Fig.II-3-5 and Tab.II-3-3. The prospects of gold are described here.

The gold prospects are the two sites that the one is the deposit at the Sao Francisco mine and the other is the Garimpo at the 7km west of Sao Tome Placer gold is digged and panned around and at the west of the Sao Francisco mone. The gold mineralization and the alteration at these prospects without placer gold are discussed here.

Ore analyses and X-ray diffractive analysis of the quartz vein samples, and X-ray diffraction analysis of the host rock of vein quartz and the clays associated with the vein are carried out to reveal the intensity of the mineralization and the characteristics of the alteration distributedat the Sao Francisco deposit and at the Garimpo.

To discover the virgin prospect, samples mainly of quartz vein have been collected from the area where any mineral prospects have not been known, and on which the ore analysis and X-ray diffractive analysis were exerted. The quartz vein associated with sulfides and oxides converted from the sulfides are selected to be collected.

Trace elements have been analyzed simultaneously with the whole rock chemical analysis to investigated the geochemical relationships between the rocks and ore deposits distributed in the surveyed area (TableII-3-1). The analyzed trace elements are the same as those of the geochemical survey of the stream sediments.

(1)The Sao Francisco deposit

This deposits is summarized as follows through the results of the this year's survey combined with Ferran,A.(1988) and Cassedane,J.P.(1973).

(i)Type of the deposit

According to the above mentioned two previous research, the two parallel mineralized belts form this ore deposit, both of which extend striking NNE-SSW. The main mineralizations of the both of the systems occurred as quartz vein and in the recrystallized meta-chert bed, and minor mineralization is observed in the country rock of schists. The width of the individual quartz vein and the meta-chert bed in the mineralized belt ranges 10-20cm and up to 50cm at most, and the total width of the mineralized belt is more than 50m and extend in kilometers order long. The gold grade in the mineralized belt is 6.6g/t Au of averaged value and locally up to 100g/t Au, and 3g/t Au of averaged value are obtained from the Sao Francisco Trend and from the Mojo Pelad Trend, respectively. The

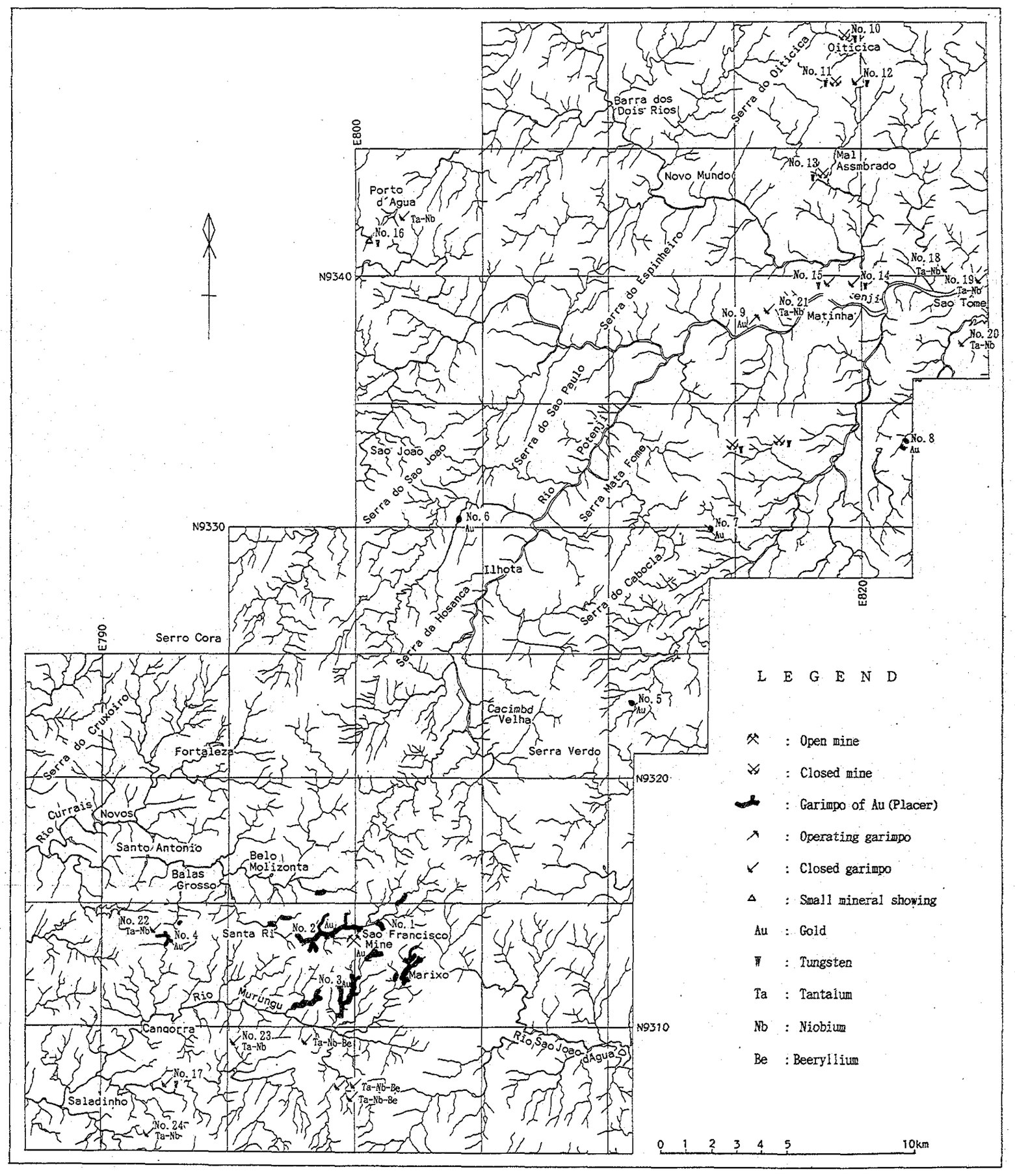

Fig. II-3-5 Location of mines and mineral showings in the survey area

Table II-3-3 List of mines and mineral showings.

No.	Name of mineral showing	Coordinate X	Coordinate Y	Host Rock	Description: Occurrrence	Description: Size	Description: Type	Description: Alteration	Remarks
1	Sao Francisco Mine	800.00	9,313.30	Serido F., gt-bi schist, bi schist	Chalcopyrite-bonite-malachite-azulite-pyrite-limonite, network/dissemination in quartz	50m x 1,200m	Au bearing quartz vein	silicificarion, argillization	
2	——— (Western lower reach of Sao Francisco Mine)	799.00	9,313.80	———	———	3km length along river	Au placer	———	more 5 small small garimpo
3	——— (South part of S.F.M.)	799.50	9,310.90	———	———	3 places of 2kmalong river	do.	———	more 2 small garimpo
4	——— (7 km westof S.F.M.)	792.60	9,313.50	———	———	500m along river	do.	———	
5	———	811.00	9,323.00	———	———	100m along river	do.	———	
6	———	804.05	9,330.40	———	———	200m along river	do.	———	
7	———	814.10	9,324.90	———	———	150m along river	do.	———	
8	———	821.60	9,333.40	———	———	2 place of 150m along river	do.	———	
9	Roca	815.70	9,338.30	bi-mu gneiss	pyrite-limonite-clay network in quartz vein	2m x 100m	Au bearing quartz vein	argillization	
10	Oiticica	819.40	9,349.50	bi-gneiss	———	———	W skarn	———	
11	Gpiara	819.00	9,347.60	do.	———	———	do.	———	
12	Riacho Fechado	820.00	9,347.80	do.	———	———	do.	———	
13	Morada Nova	818.40	9,343.90	do.	———	———	do.	———	
14	———	819.60	9,339.95	calc-silicate rock in gneiss	sheelite-garnet-epidote-diopside-carbonates spots	10m in diameter 5m in depth	do.	carbonitization, silicification	
15	———	818.70	9,339.70	do. in amphibolite	do.	5m in diameter 1m in depth	do.	do.	
16	———	800.50	9,341.50	calk-silicate rock	———	———	do.	do.	
17	———	792.50	9,302.80	do.	do.	———	do.	do.	
18	———	823.50	9,340.50	pegmatite	columbite in pegmatite	———	Nb,Ta massive		
19	———	824.80	9,339.80	do.	do.	1m x 30m	Nb,Ta vein	———	
20	———	824.25	9,337.40	do.	do.	———	———	———	
21	———	816.50	9,338.90	do.	do.			———	
22	———	792.30	9,313.90	do.	do.	5m x 50m	Nb,Ra vein	———	
23	———	785.50	9,309.10	do.	do.	———	———	———	
24	———	792.10	9,305.50	do.	do.	———	———	———	

total amount of metallic gold is 2,745kg.

Ferran,A.(1988) regarded this deposit as the exhalative-sedimentary deposit, whereas Cassedane,J.P.(1973) supposed this deposits as the metamorphic-genic with no relationships with any plutonic rocks.

As mentioned below, this deposit is supposed to be a hydrothermal vein type deposit in this present survey.

(ii)Ore hosting horizon

While garnet biotite-schist of Serido Formation has been reported to be the ore hosting bed in the above mentioned previous works, garnet-muscovite-biotite schist and muscovite-biotite schist are known to host the ore deposit besides the above mentioned garnet-biotite schist (Fig.II-3-6).

(iii)Geological structure control

Ferran,A(1988) reported the two trend of meta-chert bed which was suffered by the mineralization. They are the Sao Francisco trend and the Mojo Pelad trend. The Sao Francisco trend includes two meta-chert beds, both of which trending NNE-SSW and dipping SE45°. The extension along the striking direction reaches up to kilometers order long. The mineralized part in the meta-chert bed is to be concordant with the lineation of the host rocks and is to be plunged by 12° in SW direction on the bedding plane of the meta-chert bed. In the Mojo Pelad trend thin bed of the meta-chert repeated and the total thickness of the repeated chert bed reaches up to 50m. The strikes and dips of the bed at the surface is to be the same as those of the Sao Francisco trend.

This year's field survey was limited only at the Mojo Pelad trend due to the mining operation.

The conducted survey in the pit of the mine reveals that the gold mineralization is recognized in the both of the quartz veins and the host rock, and that those quartz veins are found in the mylonitized sheared zone and in the open fracture (Fig.II-3-6).
The strikes and the dips of the gold-bearing quartz veins in the sheared zone are similar to those of the schistosity of the schists in general, whereas some of quartz veinlets filling the open fracture cut the schitosity.

(iv)Ore minerals and alteration minerals

Gold occurs as free gold and associated with sulfide minerals (pyrite, pyrrhotite, galena, molybdenite) in the Sao Francisco trend, whereas it occurs in the similar manner as the Sao Francisco trend but galena and molybdenite are not found in the Mojo Pelad trend (Ferran,A.,1988). Cassedane,J.P. et al.(1973) reported accompanying minerals such as

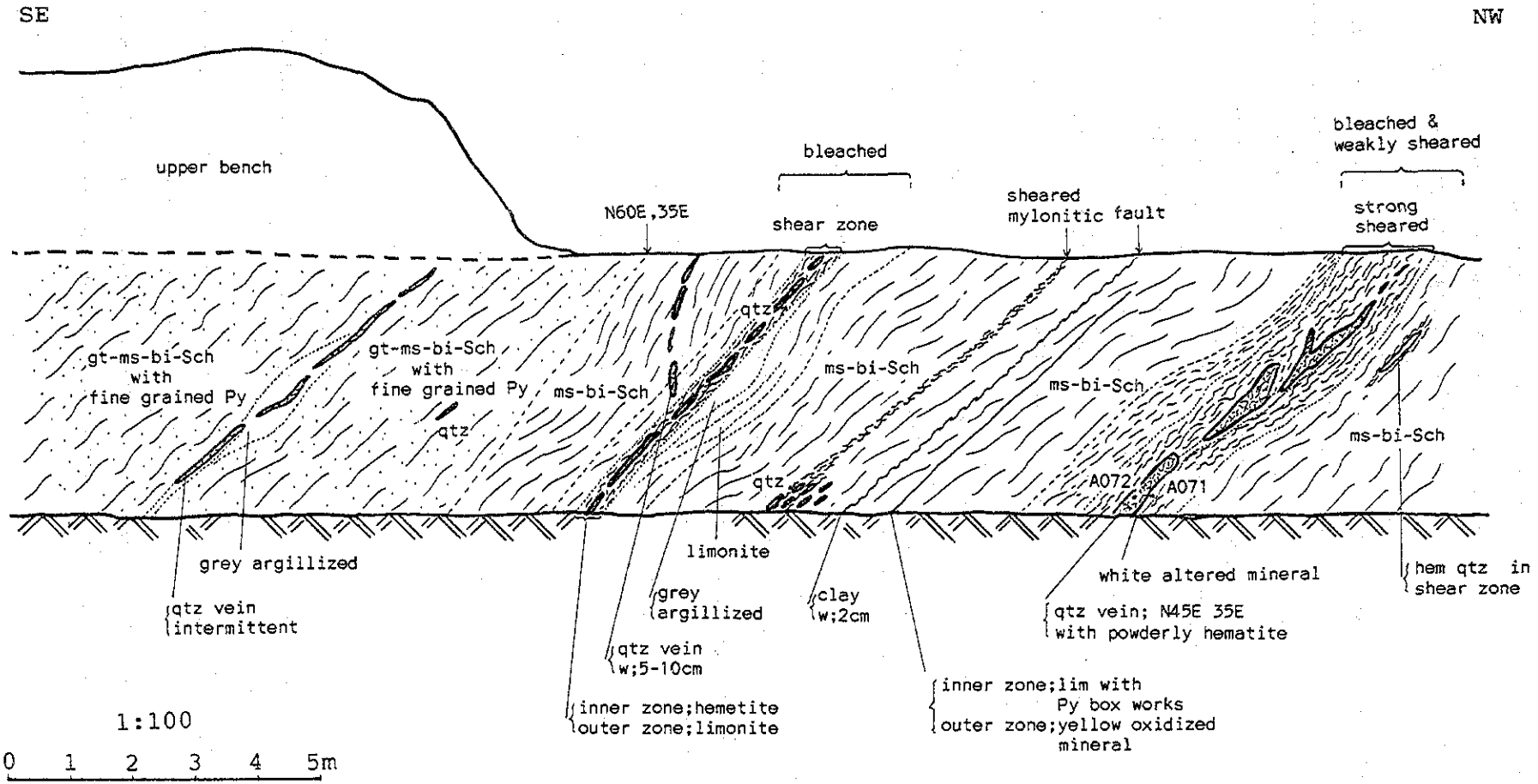

Fig. Ⅱ-3-6 Sketch of the bench side of the Sao Francisco Mine, facing southeast

melnicovite-pyrite, marcasite, arsenopyrite, chalcopyrite, bornite, covellite, chalcocite, sphalerite, hematite, manganese-oxide, goethite, iron and magnesium sulfate, scorodite, native sulfur, angelellite and cerussite, and calcite and dolomite have been reported as gangue minerals.

Through the microscopic observation of the polished section of the ore samples collected from the pit in this year's survey, pyrite, chalcopyrite, pyrrhotite, chalcocite, covellite, cuprite and goethite are found as ore minerals and quartz and carbonates are found as gangue minerals (TableII-3-4). The results of the X-ray diffractometry revealed the occurrences of pyrite, goethite, malachite and atacamite (TableII-3-6). Under the microscopy, the ore minerals are found to have been intensively oxidized and thus chalcopyrite, covellite, chalcocite and cuprite are observed in the outward direction, and goethite was formed surrounding the pyrite. Ore minerals both of sulfides and oxides are seen to have not been influenced by the any dynamic and thermal metamorphic effects.

No gold grain was observed in the polished sections prepared in this survey. According to the oral communication of the mining engineer of the Sao Francisco mine, the gold grain large enough to be found by the naked eyes is very rare.

Ore samples from the pit of the mine both of quartz veins and host rocks were analyzed to examine the gold content in the ore deposit (TableII-3-5). The majority of the results range Au: 0.1-3.7ppm, Ag:0.8-57.3ppm. Au/Ag ratio is less than 1/8. All of the samples contain arsenic and A074 gave an high concentration of arsenic especially.

Furthermore, the X-ray diffraction analysis was exerted on the samples of quartz veins, clays and ore minerals and so on from the vicinity of the deposit, to examine the existence or not of the mineralization and, the type of the deposit (TableII-3-6). Sericite and trace amount of kaolinite, which characterize the hydrothermal alteration, were recognized in the clay samples. Samples A070 and A071 could be related to the gold mineralization since they are the clays directly contacted with the gold bearing quartz veins.

(v)Ore genesis

Cassedane,J.P.(1973) regarded this deposits as a deposit in the metamorphic rock, which was not related with the plutonic rocks, and pointed out the possibility of the rework of the previous deposits.

Ferran,A.(1988) supposed this deposit to be a exhalative sedimentary deposit, based on the continuity of the meta-chert bed and paragenesis with sulfides.

This present survey concludes that this deposit of quartz vein is hydrothermal origin since they are found to have been controlled by the shear zone and open fractures and the

Table Ⅱ-3-4 Mineral assemblages of ores determined by polished section observation

Sample	Occurrence	Minerals										Remarks
		pyrite	chalcopyrite	sphalerite	pyrrhotite	chalcocite	covellite	cuprite	malachite azurite	limonite	gangue minerals	
B11A	cp-py Dissemination	•	•			•	•				◎	qtz v ;garimpo, W of Sao Tome
B11B	cp-py Dissemination	•	•			•	•				◎	ditto
C051	cp-py-qtz Vein	◎	○	•	•						◎	from Sao Francisco Mine
C052	cp-py-po-qtz Vein	○	○	•	○						◎	ditto
C053	py-qtz Vein	◎	•							○	◎	ditto
C054	second enrich Cu Ore	•	◎			○	○	○	•	○	◎	ditto
C055	second enrich Cu Ore	•	○			○	○	○	•	○	◎	ditto

◎>○> ○> •

Table Ⅱ-3-5 Assay data of ore samples from the survey area

Sample	Location		Au	Ag	Sb	As	Hg	Remarks
	E	N	(ppm)	(ppm)	(ppm)	(ppm)	(ppb)	
A067	800.20	9313.65	0.7	6.9	L 3	7	22	qtz v from S F Mine
A072	800.20	9313.65	0.6	57.3	L 3	2	27	ditto
A073	800.20	9313.65	0.1	0.8	L 3	2	20	ditto
A074	800.20	9313.65	3.7	28.5	L 3	23	24	ditto
B001	815.70	9338.15	5.1	2.8	L 3	L 1	23	qtz v ;garimpo, W of Sao Tome
B002	815.70	9338.15	Tr	Tr	L 3	2	25	ditto
B003	815.70	9338.15	Tr	Tr	3	L 1	27	ditto
C003	801.20	9334.70	Tr	Tr	L 3	L 1	28	qtz v in bi-Sch
C007	789.60	9303.95	Tr	Tr	L 3	L 1	24	ditto
C009	791.85	9303.30	Tr	Tr	3	L 1	27	qtz with Cu in bi-Sch
C014	792.60	9313.65	Tr	Tr	12	L 1	33	qtz v from garimpo
C016	790.80	9313.85	Tr	Tr	L 3	2	28	qtz v with lim boxwork
C050	815.70	9338.15	9.7	4.5	L 3	L 1	28	qtz v ;garimpo, W of Sao Tome
D037	811.10	9323.05	Tr	Tr	8	L 1	17	limonitized sil-rock
E014	801.95	9312.20	Tr	Tr	L 3	6	18	qtz.v from garimpo

L: lower than

Table II-3-6 Mineral assemblages of samples determined by X-ray diffraction

Sample No	Coordinates of sample Location		Rock or Ore	R F M				C M				S/M	O A M				Sc		Fe M		Cu M			Remarks
	E	N		qtz	pg	K-fel	bi	kl	sc	mm	ch	sc/mm	tk	ja	nja	a.l.c.m.	gros	dr	py	lm	cp	mal	at	
A021	804.70	9326.00	qtz v	◎	◎		○		•		•								?					green mineral
A070	800.35	9318.95	clay	◎	○			○	◎															Sao Francisco M.
A071	800.35	9318.95	clay	○	◎	○			○					○										Sao Francisco M.
B001	815.70	9338.15	qtz v	◎	○	◎			○												?			north garimpo
B002	815.70	9338.15	qtz v	◎	◎	◎			○												?			north garimpo
B003	815.70	9338.15	qtz v	◎	◎	◎			○											?				north garimpo
C003	801.20	9334.70	qtz v	◎	○				•	•												•		green mineral
C007	789.60	9309.95	qtz v	◎	?				○	?	•								○					green mineral
C009	791.85	9309.30	qtz v	◎	◎		○		?		•											•		green mineral
C010	790.15	9309.15	qtz v	◎					•				•				◎							green mineral
C014	792.60	9313.65	qtz v	◎	◎				•	?	•													
C016	790.80	9313.85	qtz v	◎	○	○			○	•						○								with lm boxwork
C050	815.70	9338.15	qtz v	◎	○				•		•		•						•					north garimpo
C052	800.20	9313.65	ore	◎					•										○					Sao Francisco M.
C056	800.20	9313.65	ore	◎															○					Sao Francisco M.
C057	800.20	9313.65	ore	◎															○		?			Sao Francisco M.
C058	800.20	9313.65	ore	◎					•	?	•								○	•				Sao Francisco M.
C059	800.20	9313.65	gossan	○							•		•		○	○				•		•	◎	Sao Francisco M.
D037	811.10	9323.05	rock	◎	?							•												lm-silicified rock
E014	801.95	9312.20	qtz v	◎	◎				○		○									○				py-lm-clay in qtz

◎>○>○>• ?:uncertain

R F M : rock forming minerals
C M : clay minerals
S/M : sericitemont-morillonite mixed-lyer mineral
O A M : other altered minerals
Sc M : scarn minerals
Fe M : Fe minerals
Cu M : Cu minerals

qtz : quartz
pg : plagioclase
K-fel : K-feldspar
bi : biotite
kl : kaolinite
sc: sericite
mm : montmorillonite
ch : chlorite
sc/mm : sericite-montmorillonite
tk : talc
ja : jarosite
nja : natrojarosite
a.l.c.m. : amorphous low crystalline minerals
gro : grossular
dr : dravite
py : pyrite
lm : limonite
cp : chalcopyrite
ma : malachite
at : atacamite

alteration minerals such as sericite occur. Thus this deposit is concluded the fissure filling type hydrothermal deposit. The formation age of the mineralization is supposed to be post dated the tectonic activities especially the F4, since the ore minerals have not been affected by the metamorphism.

(2)The Garimpo at the west of Sao Tome

(i)Locality

It is situated at the site 7km west of Sao Tome, about 400m south of the latitudinal road RN-203, and located at the coordination E815.7, N9338.2 on the geological map grid.

(ii)Operation status

The operation status in the past years are uncertain. The present status are shown in the Fig.II-3-7. The entire trench is shown at the lower bottom corner of the figure.

(iii)Type of the deposit

The main mineralization occurs in the quartz veins. These gold bearing quartz veins are small scale, the width is less than 10cm in average, and their extension is about 60m at most even though the sum of the intermittent ones (Fig.II-3-7). Gold bearing quartz veins and their host rocks were chemically analyzed (TableII-3-5). The gold contents in the quartz veins are higher than those of the Sao Francisco deposit, thus which of the Garimpo are 5.1ppm and 9.1ppm. Silver contents in those veins are 2.8ppm and 4.5ppm. Au/Ag ratio is about twice, different from those value of the Sap Francisco deposit. Arsenic concentration is very low in the mineralized samples rich in gold.

(iv)Ore hosting horizon

Quartz veins occur in the biotite paragneiss of Caico Complex (Fig.II-3-5).

(v)Geological structure control

This deposit is situated at the site where the strike of the fault which extends along the boundary between Caico Complex and Serido Formation changes from N30°E in the south to N10°E in the north. Quartz veins are trendin N30°E and are dipping 50°E. The southward extension of the quartz veins are uncertain, while they does not extend northward so much and there the various trending and dipping quartz veins occur.

(iv)Ore minerals and the alteration minerals

Under the micro scopic observation of the polished sections of the samples collected

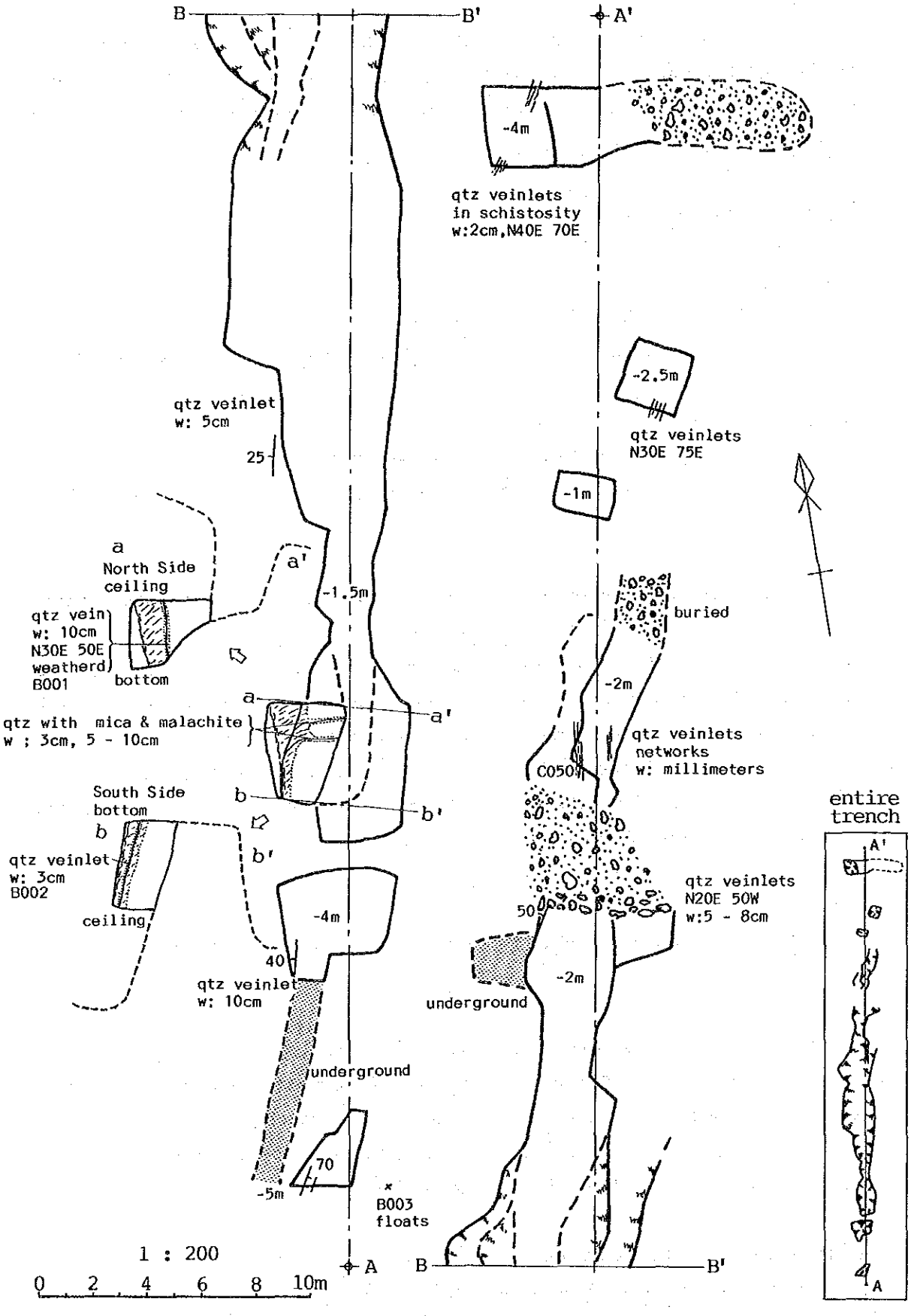

Fig. II-3-7 Sketch of the garimpo, located to the west of Sao Tome

from inside the pit, pyrite, chalcopyrite, chalcocite, and covellite were found, whereas each of them were trace amount (Table.II-3-4)

X-ray diffraction analysis of the quartz veins collected in the pit were carried out to examine the characteristics of the mineralization and the alteration (TableII-3-6). Pyrite and chalcopyrite(?) are recognized as ore minerals and sericite which are characteristic minerals as hydrothermal alteration product and trace amount of chlorite are recognized as alteration minerals. The considerable amount of the sericite is the case of the Sao
Francisco deposit. The ore genesis of this deposit is supposed to be similar as that of the Sao Francisco deposit.

(3)Trace elements in the rocks

Trace elements same as those used in the geochemical survey were chemically analyzed. Characteristic elements are mentioned below. Since number of rock samples is fewer than kind of lithology, the chemical composional tandercies of the rocks could not been discussed in detail.

(i)Gold

With only one exception of 635ppb of sample C060, the gold contents in the micaschist of Serido Formation are higher than those of Caico Complex by several ppb. The sample C060 is the host rock of the mineralized quartz vein at the Sao Francisco deposit, and it is obvious to have been mineralized. Those of the amphibolite, granite of Caico Complex, and G2 granite are lower than those of the micaschist of serido Formation.

(ii)Iron

Its concentration represent the bulk composition of the rock and is high in the amphibolite. In general, it is high in the micaschist of Serido Formation and is less in Caico Complex. This is suggested from containing Fe and Mg in cordierite of Serido Formation.

(iii)Manganese

It is enriched in Serido Formation and in the amphibolite than in Caico Complex. Its concentration is high especially in the sample C019 of calc-silicate rock and the
sample C060 of the host rock of the Sao Francisco deposit. As the sample C019 is skarnized and the sample C060 is associated with gold mineralization, the fact which these rocks consist of high content of Mn is supposed to indivatte the relation with any mineralization. It is considerably low in the samples B010, B011, E064 and E068 of Caico

complex. The
samples B010 and B011 are the host rocks of the Garimpo at the west of Sao Tome.

(iv)Molybdenum

Its concentration is higher in the Serido Formation than in Caico Complex in general. Although molybdenum mineralization is generally accompanied by acidic plutonic rocks, no evidence is recognized in the area.

(v)Tin

It is slightly enriched in the samples B010, B011 and C065. All of the three is of the muscovite-biotite gneiss and biotite gneiss of Caico Complex. As the rocks are not though to be origenated from granite, the tin concentration may not associate with mineralization.

(vi)Niobium

It is enriched in the samples B010, B011 and C065, which are those enriched in tin.

(vii)Beryllium

Its concentration is a little high in the samples E013 and E22B. Each rock is of the garnet-cordierito-biotite schist of Serido formation. Since beryllium seem to be contained in beryllium minerals of pegmatite in general, the reason why the element is high in Serido Formation is not clear.

(viii)Lithium

Its concentration is higher in the Serido Formation than in the Caico Complex, especially high in those enriched in Beryllium. Since lithium is ordonarily included in mica, it is supposed that lithium is high in Serido Formation containing remarkable mica.

(ix)Arsenic

It is enriched especially in the calc-silicate rocks (the sample C019) of Serido Formation. The containing arsenic is thought to be associated with mineralization because the rock is skarnized.

Thus it is concluded that metals concentrations without tin and niobium are higher in Serido Formation than in Caico Complex in general. Especially, the fact which the contents of gold are high in Serido Formation shows much interest in a though of gold mineralization.

3-3 Discussion

Gold mineralization is recognized at the two sites in the surveyed area. They are the Sao Francisco deposit and the Garimpo at the west of Sao Tome. The characteristics and the environment of these mineralization are discussed.

Gold is enclosed in the quartz vein generally in the Sao Francisco deposit and it is contained in the host rocks in trace amount. The quartz vein is accompanied with sulfide minerals such as pyrite, chalcopyrite and pyrrhotite, and trace amount of carbonate gangue minerals are also associated. Sericite and kaolinite were formed along the margin of the quartz vein as alteration minerals.

On the other hand, occurrence of gold is confirmed only in the quartz vein in the Garimpo at the west of Sao Tome. This quartz vein is weakly disseminated by the fine-grained pyrite and chalcopyrite. Mica minerals occur in the quartz vein contacted with the above mentioned sulfides. Sericite is found in the quartz vein as a alteration mineral.

These characteristics suggest that these mineralization are correlated as epithermal to mesothermal system.

The results of the chemical analysis of the quartz veins from these two gold deposit suggest that the chemistry of the ore fluid responsible for these two gold mineralization is different since the Au/Ag concentration ratio of the Sao Francisco deposit is less than 1/8 while the value of the Garimpo is about twice.

These quartz veins occur in Caico Complex and in Serido Formation in the surveyed area, and it is to occur in the Jucurutu Formation according to the previous paper, thus it is concluded that the occurrence of the mineralized quartz vein are not restricted in a certain horizon.

Each of the mineralized belts is consistent with the intensively developed faults and with the structures such as foliation, and is extend trending NNE-SSW. Thus it indicates that the ore formation should have been related to the tectonic activity that decide the orientation.

The above mentioned sericite was formed after the metamorphism since it is never formed in the amphibolite facies metamorphic grade that was reached during the Brazilian cycle orogeny. Furthermore, since it is not observed in the country rocks such as micaschist and gneiss under microscopic observation of thin sections, it is surely not the product of the retrograde metamorphism. Thus the sericite is concluded to be the hydrothermal origin.

However, since no igneous rock which might have been responsible for the mineralization as a heat source is found nearby the mineral deposit, the heat source is supposed to be the remaining heat of the metamorphism. The igneous source rock of gold

which should be rich in gold is not found. The gold concentration is higher in the mica-schist of Serido Formation than in the igneous rocks in the surveyed area, that is,the mica-schist of Serido Formation might have been the source of gold. The further discussion is required with respect to the origin of gold and the origin of the hydrothermal fluid which had transported gold.

Thus, the gold deposit distributed in these two above mentioned sites are concluded to have been formed as a result that the ore solution passed through the fissures as the place of the pathway and the place of the deposition of the metal, which had been formed by the tectonic movement of the Brazilian cycle orogeny. Whereas these two deposits are located at 30km distance, they are regarded to be situated within the one continuous tectonic belt in the global point of view. Whether the tectonic movements in the surrounding area of the two ore deposits have been consistent or not is uncertain, because it is not discussed yet that the relationships between the direction of the tectonic movement of this tectonic belt and the formation of the vein fissures.

Gustafson(19889) pointed out that the scale of the tectonic belt and the long duration of its activity are the important points of view to consider the gold bearing tectonic belt. It follows him that the above mentioned tectonic belt is supposed to be a large scale one and have been active for long duration. The scale of this tectonic belt is said to be very large, since salite bearing amphibolite intruded along the fault at the northern margin of the surveyed area and granite (G3) have in the south. Thus it could be a good guidance to the exploration in future to explore the tectonic belt intruded by the younger intrusives.

Chapter 4 - Geochemical survey

4-1 Purpose and procedure

4-1-1 Purpose

The purpose of the geochemical survey is to comprehend the geochemical characteristics of the elements which are related to the mineral deposits in the selected area (1,000km^2)by means of the analysis of the previous researches and to extract the promising prospect of the ore deposit.

4-1-2 Procedure

(1)Sampling

Samples of 1,510 stream sediments and 155 panned stream sediments were collected for the geochemical survey, and 1,500 of stream sediments and 150 of pan concentrates were used for analysis. More than 50g per each samples have been stored in the storage of DNPM at Recife, in case the reanalyses of the samples may be required.

The stream sediments samples were collected at the print from the surface of stream to 10 cm in depth. The stream of under the 80 mesh were collected through the sieve. At the junction of the streams, sediments were collected upper stream of the each enough not to be influenced by each other. The location of the stream sediment samples are shown in the Pl.II-4-1(a)

Collection of the pan concentrates was limited to have been performed only around the known anomalous area of gold according to the previous reports. Additionally, the pan concentrates were collected in the vicinity of the prospect newly regarded during the present survey.

The location of the pan concentrates are shown in the Pl.II-4-1(b). Generally the pan concentrates were collected at the point where the heavy minerals were deposited and concentrated on the rock mass. And the depths of the points were described.

The existence of golds and their size and number were recognized (Appendix 3).

(2)Chemical analysis of the samples

Samples were roughly scaled at the site and were send to the GEOLOGIA E SONDAGENS LTDA (GEOSOL) in Brazil and were analyzed there. The analyzed elements are thirteen elements of Au, Ag, Fe, Mn, Mo, W, Sn, Nb, Ta, Be, Li, As and Sb for stream sediments and seven elements of Au, Ag, Mo, W, Sn, Ta and Nb for pan concentrates. These are regarded to be enough to represent the expected geochemical characteristics.

Table Ⅱ-4-1 Methods and detection limits of chemical analyses

Element	Method	Identification Limit
Au	Emission spectrochemical analysis	1 ppb
Ag	Atomic absorption analysis	0.2 ppm
Fe	X-ray fluorescence analysis	10 % (Upper limit)
Mn	X-ray fluorescence analysis	5 ppm
Mo	Emission spectrochemical analysis	1 ppm
W	X-ray fluorescence analysis	10 ppm
Sn	Emission spectrochemical analysis	2 ppm
Nb	Emission spectrochemical analysis	10 ppm
Ta	X-ray fluorescence analysis	10 ppm
Be	Emission spectrochemical analysis	0.5 ppm
Li	Atomic absorption analysis	1 ppm
As	Atomic absorption analysis	1 ppm
Sb	Atomic absorption analysis	1 ppm

The analytical method and detection limit of the each elements are listed in Table II-4-1. Mo, Sn, Be and Nb were analyzed by the method of emission spectrochemical analysis, Fe, Ta, W and Mn were of X-ray fluorescence analysis, Ag, Li, As and Sb were of atomic absorption analysis and Au was analyzed by the method of emission spectrochemical analysis after it was dissolved by the heated aqua regia (heated nitro-hydrochloric acid). The result of the analysis are presented in the appendix 1.

(3)Method of the analysis for geochemical survey

(i)Calculation of the statistical values

The analytical results of the stream sediment samples were statistically treated. These procedures were not exerted on the pan concentrates, which are collected in the different conditions for each and judged that these statistical treatment have no meaning.

Thus all of the below mentioned process and analysis of the statistical handling is only on the stream sediments samples.

The statistical treatment of the analytical data were done by the computer. The value of the half of the detection limit was available for the those below the detection limit, during the statistical calculations.

Correlation coefficients were computed to make clear the correlation among the elements.

(ii)Decision of the anomalous value

During the statistical treatment of the analytical data, the current procedure has been base on the classical statistics and hypothesis, such that distribution of the data have been referred to the regular distribution. Thus the arithmetic average "x" has been used as the central value of the distribution, and standard deviation "s" to represent the diversion. However, the actual analytical data often exhibit the distribution profile far away from the ideal distribution model, such as the case of the inconsistency of the data, bimodal distribution, and the existence of the jutted value. Nevertheless, the traditional statistical method has not been accounted such kind of the matter enough.

To compensate for such kind of fault, the statistical procedure is follow the method of Exploratory Data Analysis (denoted as the EDA method) in this year's data handling and interpretation. This method was applied to the data treatment during the geochemical survey by Kurzl,H.(1988) and is to be valid especially for the description and analysis of the data of the end component.

According to Kurzl,H.(1988), the following five comprise the EDA method.

(a)5-number summary

(b)boxplot

(c)density traces

(d)one-dimensional scatter plots

(e)quantile plot

Among them, (a)5-number summary and its graphic expression (b)boxplot are a little commented below. The others as (c), (d) and (e) are omitted since they are not enrolled in the present treatment.

(a)5-number summary

These five numbers shows the most important characteristics of the data sets. They are listed below in order of from high value to lower.

maximum

upper hinge (the value of 75%)

median (the value of 50%)

lower hinge (the value of 25%)

minimum

The range between the upper hinge and the lower hinge is called h-spread.

The relationships of these values are illustrated in the Fig. II-4-1.

(b)box plot

The box is the range surrounded by the upper hinge and the lower hinge, and the status around the box are expressed by whisker, step and fence. The relationships among them are illustrated in the Fig. II-4-2. Whisker is the range between the both of the hinge and the value of 25% outward toward the maximum and minimum values.

The values of the step and the fence are computed by the following algebraic expression.

step = 1.5*(h-spread)

lower fence = lower hinge - step

upper fence = upper hinge + step

In the present analysis, the values of 5-number summary were obtained from the frequency histogram and consequently the values of upper hinge, lower hinge, upper whisker and upper fence were obtained.

Values higher than the upper fence are to be the anomalous values.

(iii)Anomaly distribution map

The anomaly distribution maps were constructed by the plotting of the location of the anomalous value for each element through the above mentioned EDA method statistical

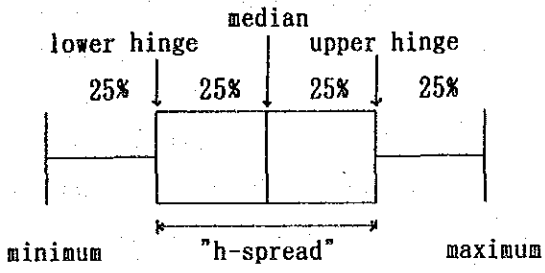

Fig. II-4-1 Definition of the boxplot in the Exploratory Data Analysis

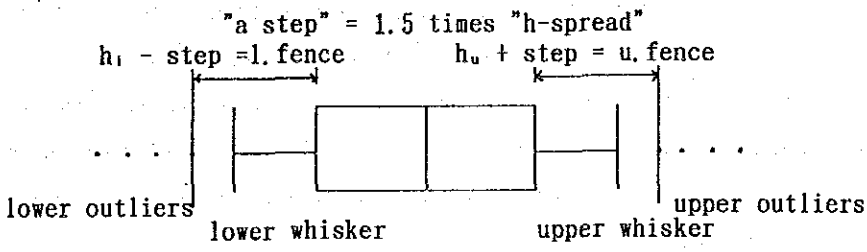

Fig. II-4-2 Principal terms used for the boxplot

treatment (Fig. II-4-6, Fig. II-4-7, Fig. II-4-8, Fig. II-4-9, Fig. II-4-10).

(iv)Multi variables analysis

The factor analysis were carried out as a multi variables analysis, following the Varimax method, which is to be the most valid to extract the latent factors behind the variables. This method is to rotate about the factor solution solved by the main factor method to obtain the factor structure called simple structure. The factor solution obtained by the main factor analysis were used in the present procedure. In general, the Varimax method are available in order to know the relevancy among 13 elements by using analytical data obtained and to find out the element related to gold as the object of this project. Among the extracted factors, those interpreted as significant were considered about the distribution of the factor scores on the topographic map (Fig. II-4-11, Fig. II-4-12, Fig. II-4-13, Fig. II-4-14).

4-2 Stream sediment survey

4-2-1 Statistical analysis of analytical data

The simplified statistical values of geochemical data for stream sediments are listed in the Table II-4-2. The maximum values of Au, Mn, Mo and Nb are shown to be more than 100 times as the minimum value of each. These concentration differences are supposed to have been caused been the material transportation including such kinds of elements due to the mineralization and the alteration, not only due to the original concentration variation in the different lithology. The averaged values of each elements are almost identical to the average crustal abundance of each elements.

As appear in the table, some sample show the minimum values below the detection limit for some of those elements such as Au, Ag, Mo, W, Sn, Nb, Ta, Be, Li, As and Sb. More than half of the samples have the lower values than the detection limits with regard to the each elements of Au, Ag, W, Sn, Ta and As.

4-2-2 Correlations between elements

Among the correlation coefficient between the given two elements, those values of the pair of Fe-Mn, Mn-Nb, Mo-Nb, Sn-Nb, Sn-Ta and Nb-Ta are higher than 0.500 as shown in the Table II-4-3. The intensive positive correlation is apparent between Fe-Mn as shown in the Fig. II-4-3. Since concentrations of Sn and Ta in the more than half of the samples are below the detection limits among the above listed elements, it is uncertain statistically whether the pairs of Sn-Nb, Sn-Ta and Nb-Ta are significantly positively correlated or

Table Ⅱ-4-2 Summary of statistical results of stream sediment analytical data

Elements	Mean	Var(LOG)	S.D. (LOG)	Minimum	Maximum
Au(ppb)	0.545	0.037	0.192	0.500	450.000
Ag(ppm)	0.102	0.006	0.076	0.100	1.000
Fe(%)	3.316	0.054	0.232	0.500	10.300
Mn(ppm)	886.703	0.042	0.204	100.000	12305.000
Mo(ppm)	1.562	0.108	0.329	0.500	101.000
W (ppm)	5.073	0.006	0.076	5.000	125.000
Sn(ppm)	1.672	0.150	0.387	1.000	68.000
Nb(ppm)	23.853	0.200	0.447	5.000	660.000
Ta(ppm)	5.394	0.023	0.151	5.000	89.000
Be(ppm)	1.849	0.121	0.348	0.200	74.000
Li(ppm)	4.053	0.068	0.261	0.500	20.000
As(ppm)	0.771	0.081	2.285	0.5000	25.000
Sb(ppm)	0.721	0.025	0.157	0.500	5.000

Var: variance, S.D.:standard deviation.

Table Ⅱ-4-3 Correlation matrix of thirteen elements from geochemical data.

	Au	Ag	Fe	Mn	Mo	W	Sn	Nb	Ta	Be	Li	As	Sb
Au	1.000												
Ag	-0.026	1.000											
Fe	-0.014	0.097	1.000										
Mn	0.049	0.052	0.629	1.000									
Mo	-0.023	0.089	0.425	0.304	1.000								
W	0.032	0.040	0.091	0.061	0.058	1.000							
Sn	-0.069	0.138	0.297	0.111	0.404	0.160	1.000						
Nb	-0.041	0.127	0.446	0.505	0.591	0.150	0.587	1.000					
Ta	-0.005	0.121	0.221	0.141	0.262	0.218	0.592	0.535	1.000				
Be	0.004	0.023	0.242	0.107	0.179	0.055	0.134	0.234	0.091	1.000			
Li	0.008	-0.009	0.332	0.216	-0.070	-0.035	-0.155	-0.187	-0.139	0.045	1.000		
As	0.184	0.022	0.016	0.090	-0.013	-0.003	-0.054	-0.088	-0.021	-0.054	0.142	1.000	
Sb	-0.039	0.043	0.167	0.021	0.185	0.057	0.229	0.220	0.152	0.032	-0.036	-0.030	1.000

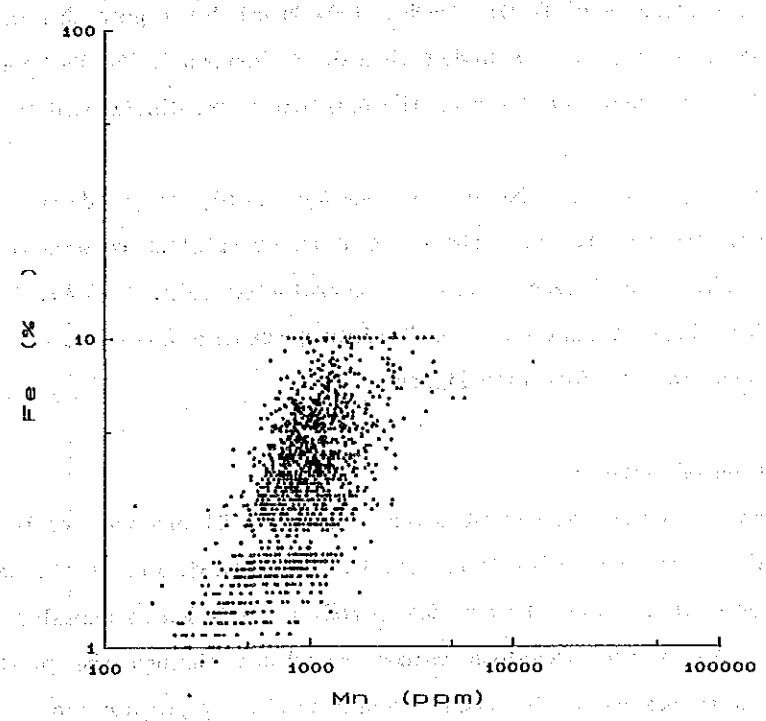

Fig. Ⅱ-4-3 Diagram showing correlations between Mn and Fe.

not.

The correlation coefficients of Fe-Mn, Fe-Nb and Mo-Sn ex hibiting higher than 0.400 show a specific characteristic of the rocks distributing on this survey area, because analytical data of Fe and Mn are high in amphibolites. As described previously, Sn-Nb is already known to be correlated in some of the rock of the Caico Complex.

Correlation coefficients of Fe-Mo, Fe-Nb and Mo-Sn exhibit higher than 0.400.

The good correlations of values higher than 0.500 between Fe-Mn, Mn-Nb and Mo-Nb are supposed to exhibit the characteristics of the original rocks distributed in the surveyed area.

The objective element in the present survey, gold, is said to exhibit good correlation between arsenic. However, the correlation coefficient between them is 0.184, and it does not exhibit an intensive positive correlation (Fig. II-4-4). But it is not concluded here that their correlation is bad, since concentrations of Au and As of 94% of the samples are less than the detection limits.

4-2-3 Concentration of elements

The frequency histogram were constructed (Fig. II-4-5) and the geochemical survey samples were analyzed by the combination with the EDA method. All of the values higher than the upper fence with respect to the EDA method are regarded as anomalous values, and the distribution map of the anomalous values are drawn through the plotting of the locations of the anomalous values for each elements on the topographic map.

Statistic values and distribution of the anomalous values for the each given elements are as follows.

Au

The concentration of gold ranges from the minimum less than 1ppb to the maximum up to 450ppb. The proportion of 94.3% of the samples exhibit the concentration less than the detection limit. The value of the upper fence is 0.5 and consequently the values higher than the detection limits are all anomalous value.

The high concentration area of higher than the upper fence value is illustrated in the Fig. II-4-6,

1)the area in the southern part of the surveyed area which extends from where approximately sited 2km north of Sao Sebastino, upper stream of the Rio Mulungu to where approximately sited 2km north of Santo Andre,

2)the vicinity around Cangorra at the lower stream of the Rio Mulungu,

3)the vicinity around at the site 4km south of Sao Sebastino,

4)the area which extends from Sao Migael at the upper stream of the Rio Currais Novas and

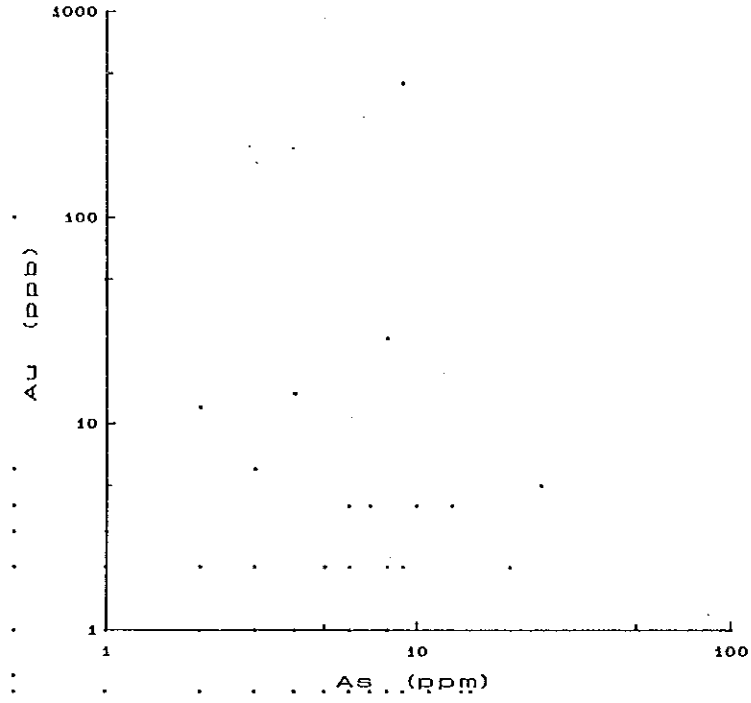

Fig. Ⅱ-4-4 Diagram showing correlations between As and Au.

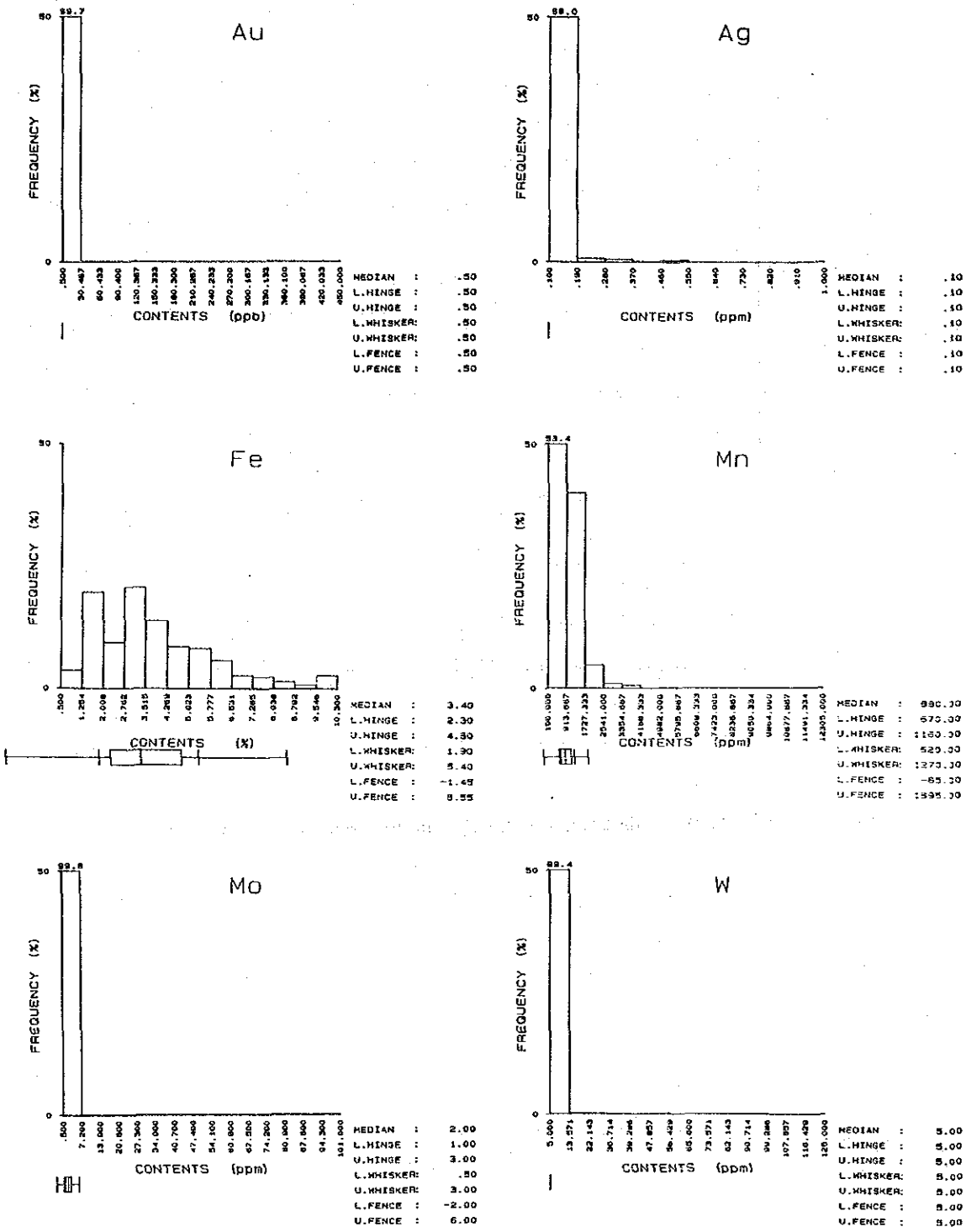

Fig. II-4-5 Histograms and boxplots for Au, Ag, Fe, Mn, Mo, W, Sn, Nb, Ta, Be, Li, As, Sb

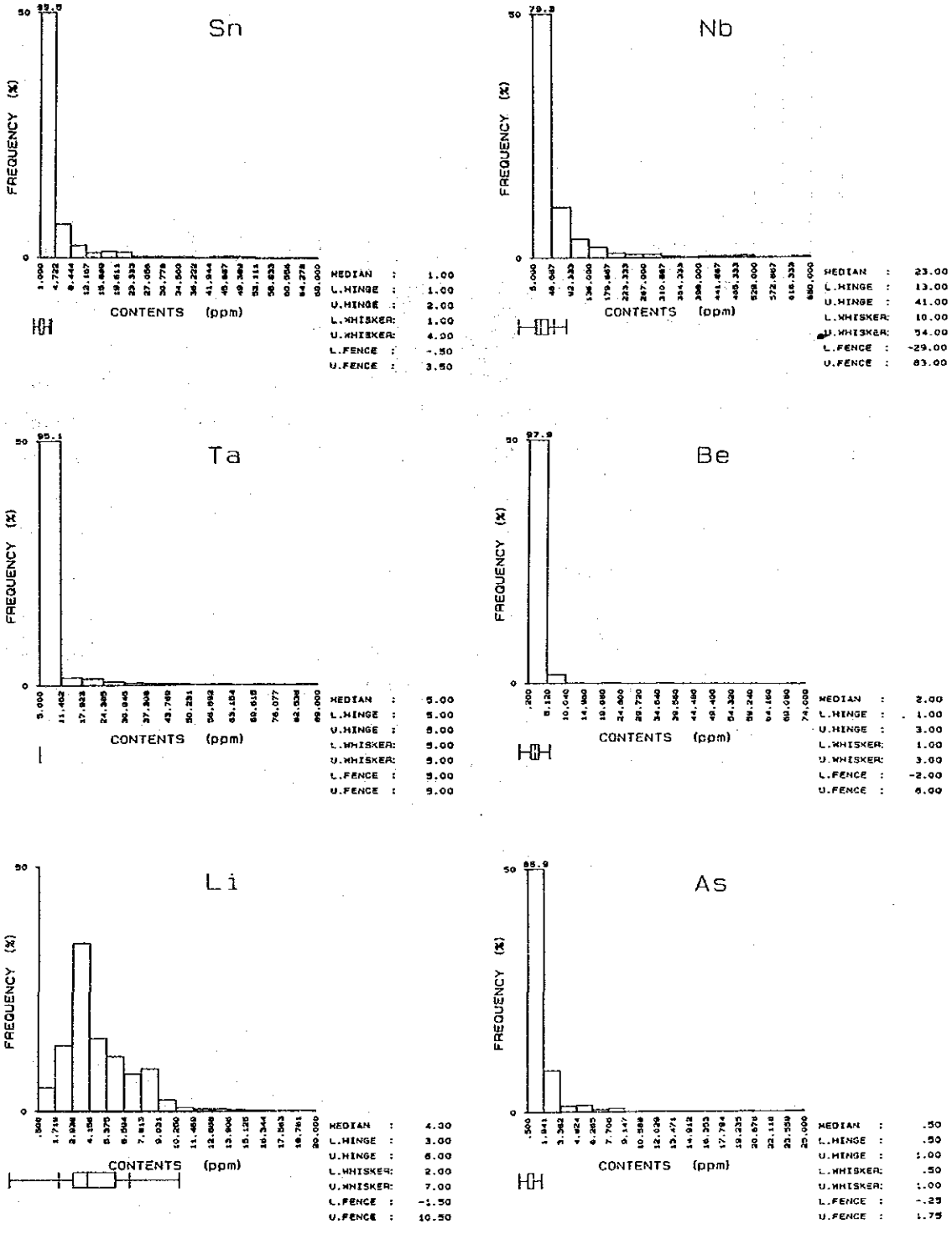

Fig. II-4-5 (continued.)

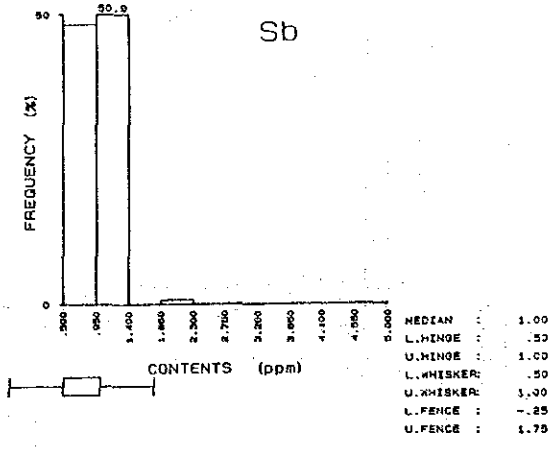

Fig. II-4-5 (continued.)

Table Ⅱ-4-4 Results of the EDA method analyses.

Element	Median	Lower Hinge	Upper Hinge	Lower Whisker	Upper Whisker	Lower Fence	Upper Fence
Au(ppb)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Ag(ppm)	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Fe(%)	3.40	2.30	4.80	1.90	5.40	-1.45	8.55
Mn(ppm)	880.00	670.00	1160.00	620.00	1270.00	-65.00	1895.00
Mo(ppm)	2.00	1.00	3.00	0.50	3.00	-2.00	5.00
W (ppm)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Sn(ppm)	1.00	1.00	2.00	1.00	4.00	-0.50	3.50
Nb(ppm)	23.00	13.00	41.00	10.00	54.00	-29.00	83.00
Ta(ppm)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Be(ppm)	2.00	1.00	3.00	1.00	3.00	-2.00	6.00
Li(ppm)	4.00	3.00	6.00	2.00	7.00	-1.50	10.50
As(ppm)	0.50	0.50	1.00	0.50	1.00	-0.25	1.75
Sb(ppm)	1.00	0.50	1.00	0.50	1.00	-0.25	1.75

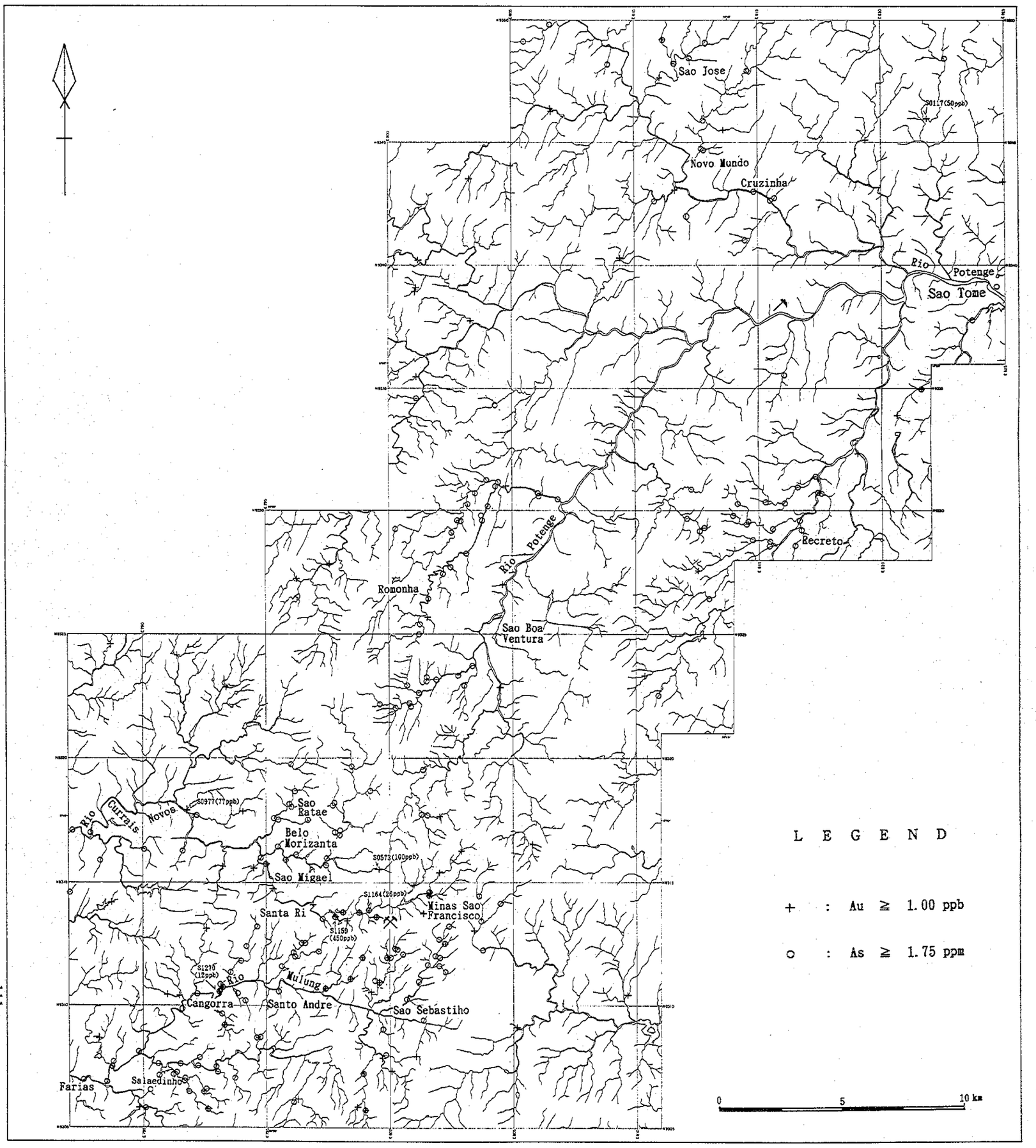

Fig. II-4-6 Stream sediment anomaries of Au and As.

to the Minas Sao Francisco.

Among them, the sites which exhibit high concentration of gold higher than 10ppb are the sample point S0117(50ppb), S0573(100ppb), S0977(77ppb), S1159(450ppb), S1169(26ppb) and S1270(12ppb). Especially, the anomalous sites of gold are concentrated in the vicinity around the Minas Sap Francisco situated in the southern part of the surveyed area. On the other hand, those appear only sporadically in the central to northern part of the surveyed area.

Ag

The concentration of silver ranges from the minimum value of less than 0.2ppm to the maximum 1.0ppm. As is the case of gold, the proportion of samples which exhibit the value less than the detection limit is very high to be 98.0%. The value of the upper fence is 0.10 and the all of the values higher than the detection limit is anomalous value.

The high concentration areas higher than the value of upper fence are four areas as illustrated in the Fig. II-4-7,

1)the area in the northeastern part of the surveyed area which extends from Santa Marra on the river Rcb da Quixaba au Caboeirinda to the site 3km southwest of Quixaba,

2)the area extends along the down to upper stream of the river Riacho das Minas in the central northwestern part of the surveyed area,

3)the area in the central western part of the surveyed area which extends from the site 5km northeast of Romonha to the vicinity of Sao Podco,

4)the vicinity of Sao Tome on the Rio Potengi situated in the northeastern part of the surveyed area.

Fe

The concentration of iron ranges from the minimum of less than 0.5% to the maximum of 10.30%. The value of the upper fence is 8.55.

The areas where the concentration is higher than the upper fence value are located at the four areas as shown in the Fig. II-4-8,

1)the area which extends from the site 2km west of Farias situated at the southwestern end of the surveyed area northward to Angico,

2)the area extends from the vicinity of Arara in the central western part of the surveyed area toward northwest about 5km long,

3)the area which extends between the sites of 2.5km west and of 4.0km west of Quixaba in the central eastern part of the surveyed area,

4)the Matinha area in the northeastern part of the surveyed area.

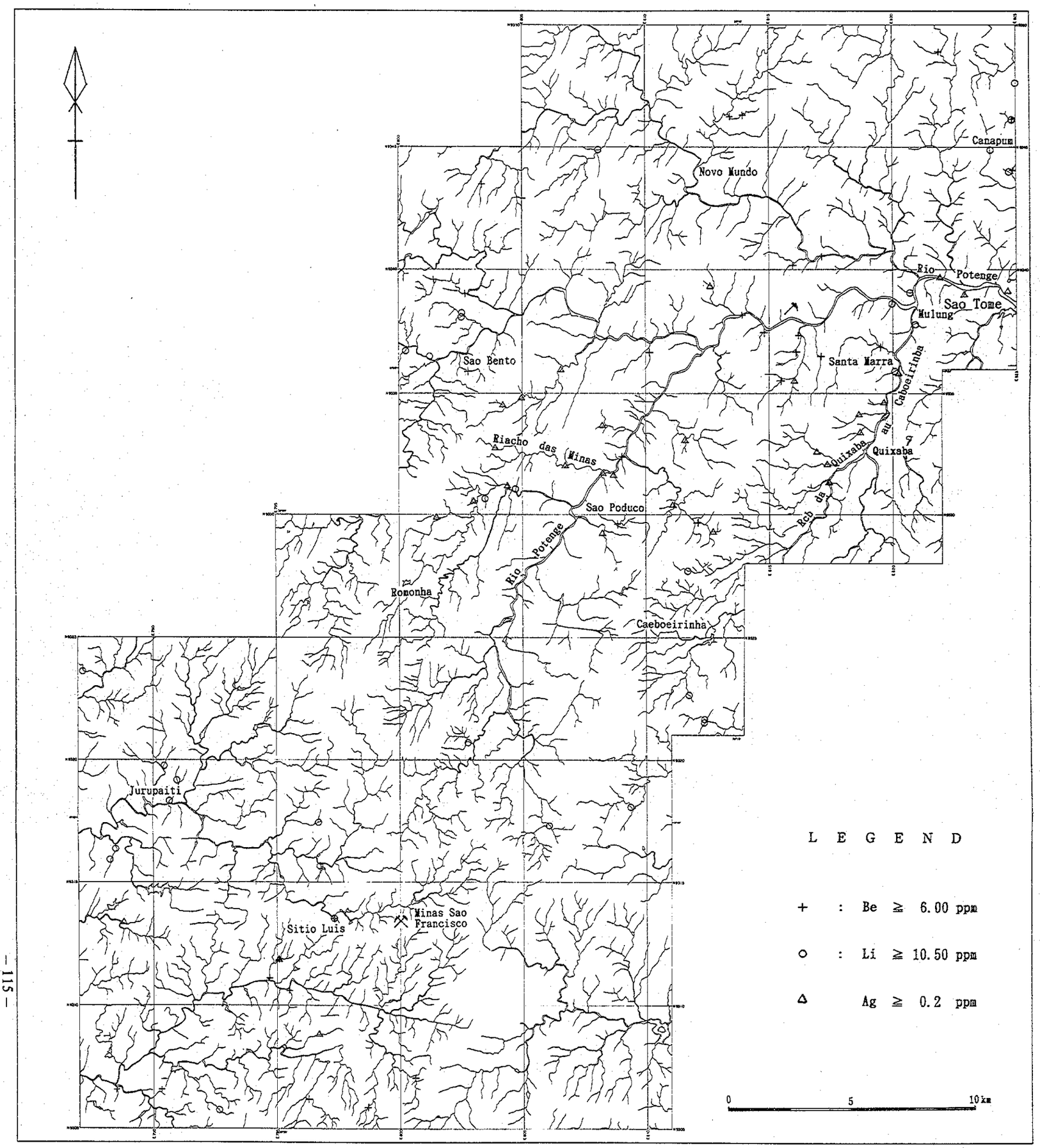

Fig. II-4-7 Stream sediment anomaries of Be, Li and Ag.

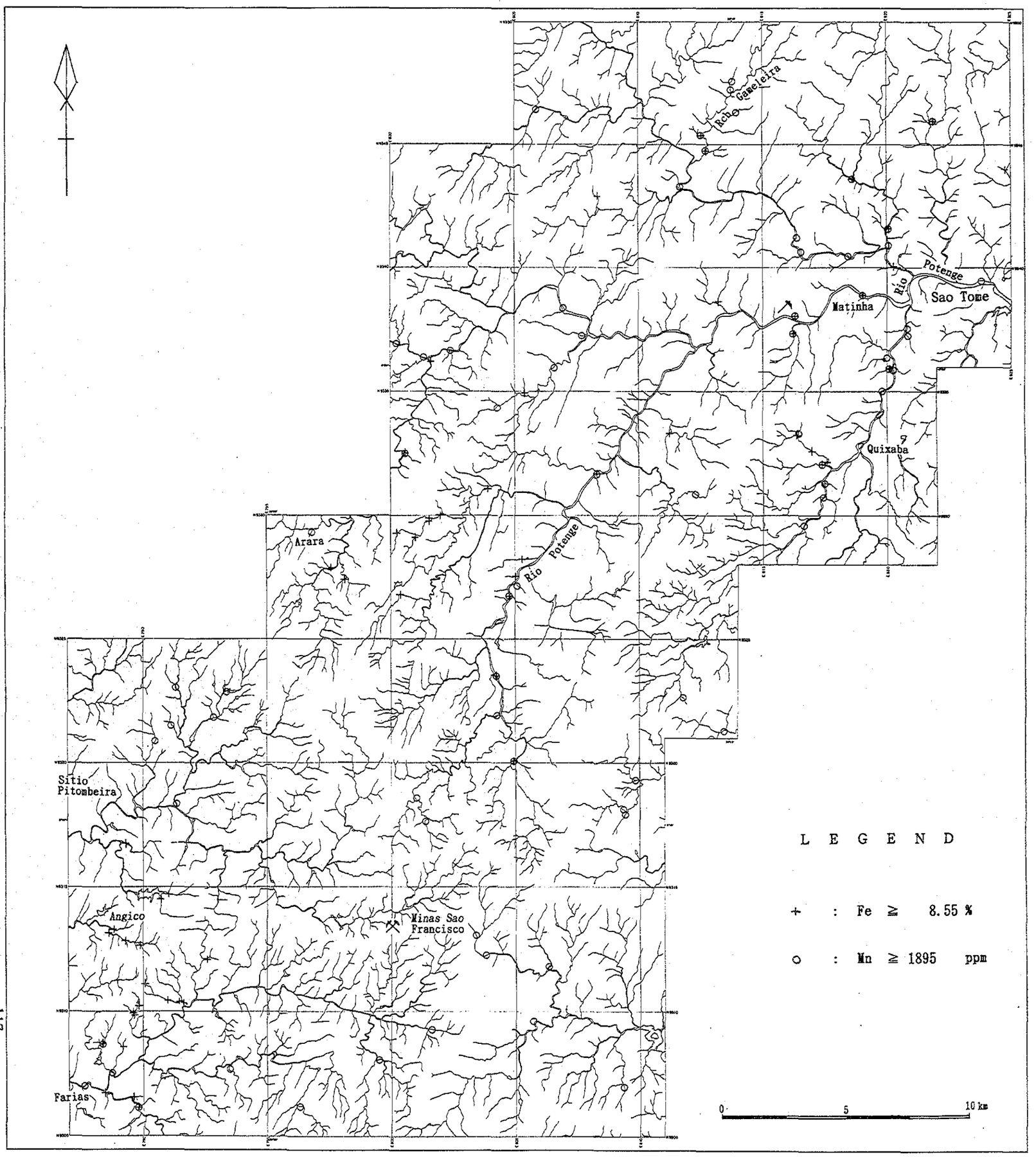

Fig. II-4-8 Stream sediment anomaries of Fe and Mn.

Mn

The concentration of manganese ranges from the minimum less than 100ppm to the maximum 12,305ppm. The value of the upper fence is 1895ppm.

As shown in the Fig. II-4-8, the high concentration area higher than the upper fence value are scattered randomly and the regional variation is not so clear,

1)the Matinha area and the area along the river Rcb da Quixaba au Caboeirinda SSW of Matinha, both in the northeastern part of the surveyed area,

2)the area along the river Rcb Gameleira at the northern margin of the surveyed area,

3)the areas the east and the northeast of Farias at the southwestern margin of the surveyed area and the vicinity of Sitio Pitombeira north of Farias.

Mo

The concentration of molybdenum ranges from the minimum less than 1ppm up to the maximum 101ppm. The upper fence value is 6ppm.

Three areas, where the sites of high molybdenum concentration higher than the upper fence value are distributed, are recognized as shown in the Fig. II-4-9,

1)the area which extends from Sao Tome to Roca in the northeastern part of the surveyed area,

2)the area extends from the site around the 5km east of Sao Poduco in the central part of the surveyed area to the upper stream of the river Rcb do Tigre in the north of Sao Paduco,

3)the area which extends from Cangorra to northeastward 2.5km in the southwestern part of the surveyed area.

W

The concentration of tungsten ranges from the minimum less than 10ppm up to the maximum of 125ppm. Almost samples as much as 99.0% samples exhibit the concentration below the detection limit. The upper fence value is 10ppm and all samples exhibit above the detection limit concentration are anomalous ones.

The four areas are recognized where the site of the concentration above the upper fence value as shown in the Fig. II-4-10,

1)the Oiticica area at the northern margin of the surveyed area,

2)the Mal Assombrado area south of Oiticica,

3)the vicinity of the site 2km southeast of Inga in the northwestern part of the surveyed area and the area extends between the sites of the 1km and of 4km southwest of Roca,

4)the vicinity around the sites of 2.5km west of Quixaba in the eastern part of the surveyed area.

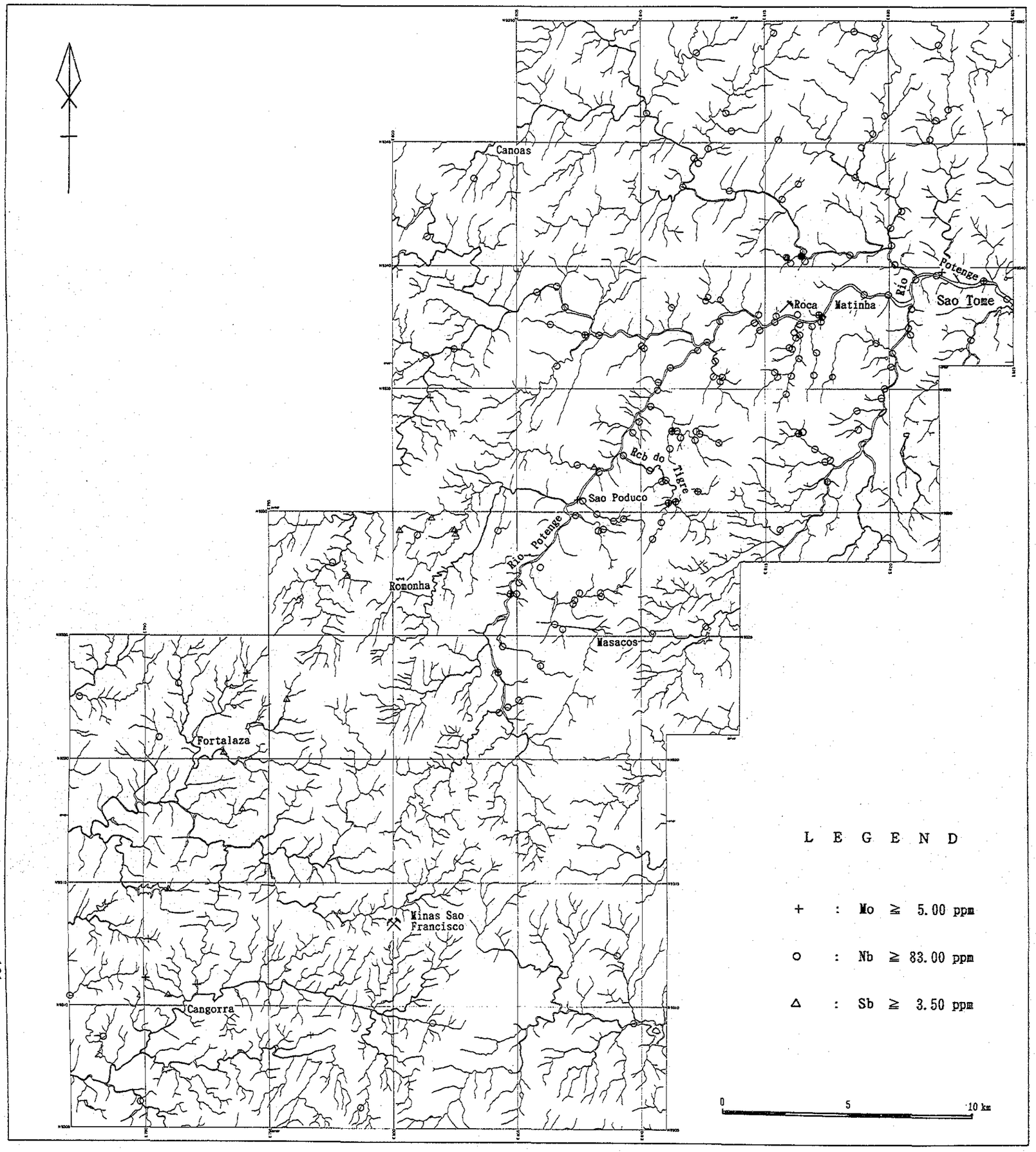

Fig. II-4-9 Stream sediment anomaries of Mo, Nb and Sb.

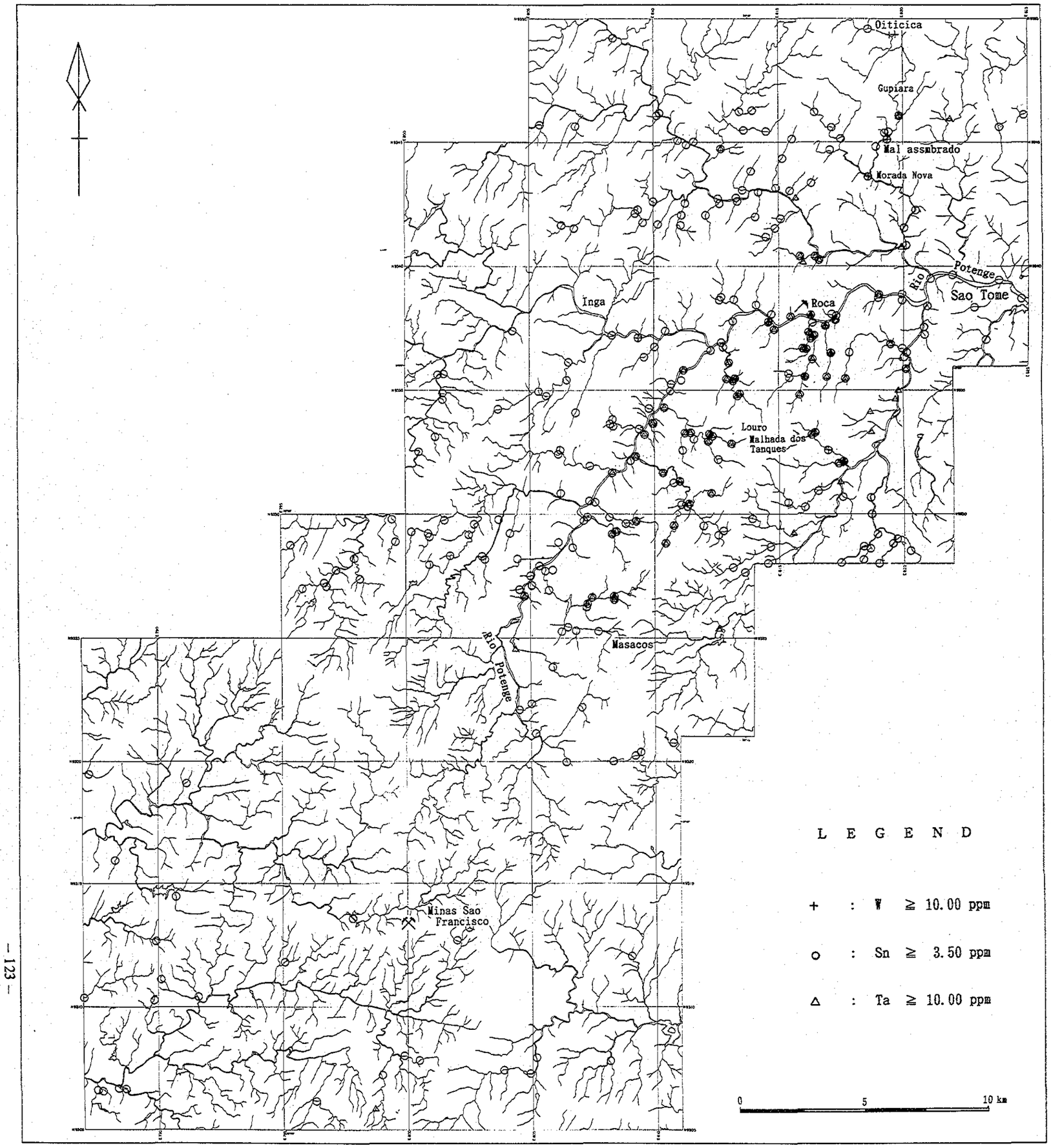

Fig. II-4-10 Stream sediment anomaries of W, Sn and Ta.

The known tungsten mines and the garimpos are situated in the above mentioned anomalous area except for the Quixaba area.

Sn

The concentration of tin ranges from the minimum below 2ppm to the maximum 68ppm. Many samples as much as 68.1% exhibit the concentration below the detection limit. The upper fence value is 3.50ppm.

The sites which exhibit the higher concentration above the upper fence value are widely scattered in the central to northern part of the surveyed area as shown in the Fig. II-4-10.

Nb

The concentration of niobium ranges from the minimum less than 10ppm to the maximum 660ppm. The upper fence value is 83.00ppm.

The sites of the values above the upper fence are widely distributed sporadically in the central to northern part of the surveyed area, and especially they area concentrated in the area which extends from Roca in the northern part of the surveyed area to the vicinity of Masacos in the central part of the surveyed area. This concentrated area is similar to the distribution of below mentioned tantalum. The anomalous values are recognized at the site 1km southwest of Canoas at the western margin of the surveyed area, where nearby a garimpo of Ta-Nb exists.

Ta

The concentration of tantalum ranges from the minimum below 10ppm up to the maximum 89ppm. Numerous samples as much as 94.9% exhibit the concentration less than the detection limit. The value of the upper fence is 10ppm and the all the value above the detection limit are the anomalous values.

The anomalous values higher than the upper fence are distributed as illustrated in the Fig. II-4-10, in the area which extends from Roca in the northern part of the surveyed area to the vicinity of Masacos in the central part of the surveyed area, especially concentrated in the area whose dimension of east-west 7km and north-south 20km (Fig. II-4-10).

This anomalous area is included in that of niobium.

Be

The concentration of beryllium ranges from the minimum below 0.5ppm to the maximum 74.00ppm. The upper fence value is 6.0ppm.

The area where the sites of high concentration above the upper fence are distributed are as shown in the Fig. II-4-7,

1)the vicinity of the site 1km southwest of Canoas in the northwestern part of the survey area,

2)the vicinity around the site 3km north of Novo Mundo, east of Canoas,

3)the vicinity around the site 2km south of Roca southeast of Novo Mundo,

4)the vicinity around the site 2km south of Sitio Luis in the southern part of the survey area,

5)the vicinity around the site 3-4km south of Sao Sebastinho, southeast of Sitio Luis.

The garimpos of Ta-Nb and Ta-Nb-Be are known in the vicinity of the site 1km southwest of Canoas in the northern part of the survey area and in the vicinity around the site 3-4km south of Sao Sebastinho in the southern part of the survey area.

Li

The concentration of lithium range from the minimum below 1ppm up to the maximum 20.00ppm. Theupper fence value is 10.50ppm.

The area where the sites of higher concentration above the upper fence are distributed are as shown in the Fig. II-4-7,

1)the vicinity around Mulungu in the northeastern part of the survey area,

2)the vicinity of Canapum northeast of Mulungu,

3)the vicinity of Sao Bento in the northwestern part of the survey area,

4)the vicinity around Jurupaiti in the southwestern part of the survey area,

5)the vicinity around the site 3km south of Caeboeirinha in the central eastern part of the survey area.

As

The concentration of arsenic ranges from the minimum less than 1ppm up to the maximum 25.00ppm. The proportion of the samples which exhibit concentrations below the detection limit is 59.2%. The upper fence value is 1.75ppm.

The areas where the sites exhibit the values above the upper fence are distributed are as presented in the Fig. II-4-6,

1)the vicinity around Sao Jose at the northern margin of the survey area and the area which extends from Novo Mundo southeast of Sao Jose to Cruzinha,

2)the vicinity around Recreto in the central eastern part of the survey area,

3)the area which extends from Romonha in the central western part of the survey area to 5km northeastward,

4)the vicinity of the site 3km southwest of Sao Boa Ventura in the central part of the survey area,

5)the area which extends from Belo Morizanta in the southern part of the survey area to Sao Ratae in the north of Belo Morizanta,

6)the area which extends from the Minas Sao Francisco to Sao Sebastinho to the south and to Santa Ri to the west of the mine,

7)the area which extends from Farias in the southwestern part of the survey area to the vicinity around the site 4km east of Salaedinho in the east of Farias. The anomalous areas of arsenic are not only restricted around the Minas Sao Francisco but also are sporadically concentrated in the central to the northern part of the survey area.

Sb

The concentration of antimony ranges from the minimum less than 1ppb up to the maximum 5.00ppm. The value of the upper fence is 1.75ppm.

The high concentration areas above the upper fence are as shown in the Fig. II-4-9,

1)the vicinity around the site 2.5km north of Matinha in the northeastern part of the survey area,

2)the vicinity of the site 2km north of Romonha in the central western part of the survey area,

3)the vicinity of the east of Fortaleza in the southern part of the survey area.

4-2-4 Multi-element analysis of analytical data

The results of the factor analysis after Varimax method extracted the six factors related to the elements marking higher than +/-4.00 as follows (Table II-4-5).

1)factor 1: Ta, Sn

2)factor 2: Li

3)factor 3: Au, As

4)factor 4: Mn, Fe, Nb, Mo

5)factor 5: Sn, Mo, Nb, Sn

6)factor 6: Be.

The elements marking higher than +/-1.000 factor point are summarized as a anomalous figure.

(1)Factor 1 (Fig. II-4-11)

The factor 1 which is that related to Ta and Sn, is possibly the factor related to the ore formation such as skarn deposit, considered in the addition of the values 0.357 of W and 0.353 of Nb. The contribution ratio of the factor is rather large as much as 18.56%.

Table Ⅱ-4-5 Results of factor analyses.

Element	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality
Au	0.038	-0.031	-0.425	0.007	0.088	0.035	0.1919
Ag	0.108	0.017	0.003	0.058	-0.165	-0.037	0.0439
Fe	0.131	0.324	0.013	0.655	-0.290	0.257	0.7009
Mn	0.093	0.159	-0.094	0.783	-0.016	0.048	0.6589
Mo	-0.008	-0.274	-0.025	0.444	-0.481	0.289	0.5581
W	0.357	0.004	-0.048	0.017	-0.016	0.096	0.1397
Sn	0.483	-0.199	0.100	0.151	-0.545	0.096	0.6118
Nb	0.353	-0.313	0.088	0.475	-0.430	0.227	0.6928
Ta	0.651	-0.177	0.020	0.144	-0.359	-0.006	0.6052
Be	0.102	0.032	0.048	0.116	-0.045	0.460	0.2409
Li	-0.100	0.566	-0.100	0.176	0.036	0.041	0.3741
As	-0.013	0.129	-0.422	0.035	-0.020	-0.095	0.2057
Sb	0.037	0.015	0.055	0.009	-0.408	0.049	0.1740
Contributions	18.56 %	13.64 %	7.73 %	29.81 %	21.67 %	8.58 %	

** Factor Lordings (Varimax Rotation) **

The order of Factor 1 to Factor 6 corresponds with it before varimax rotation.

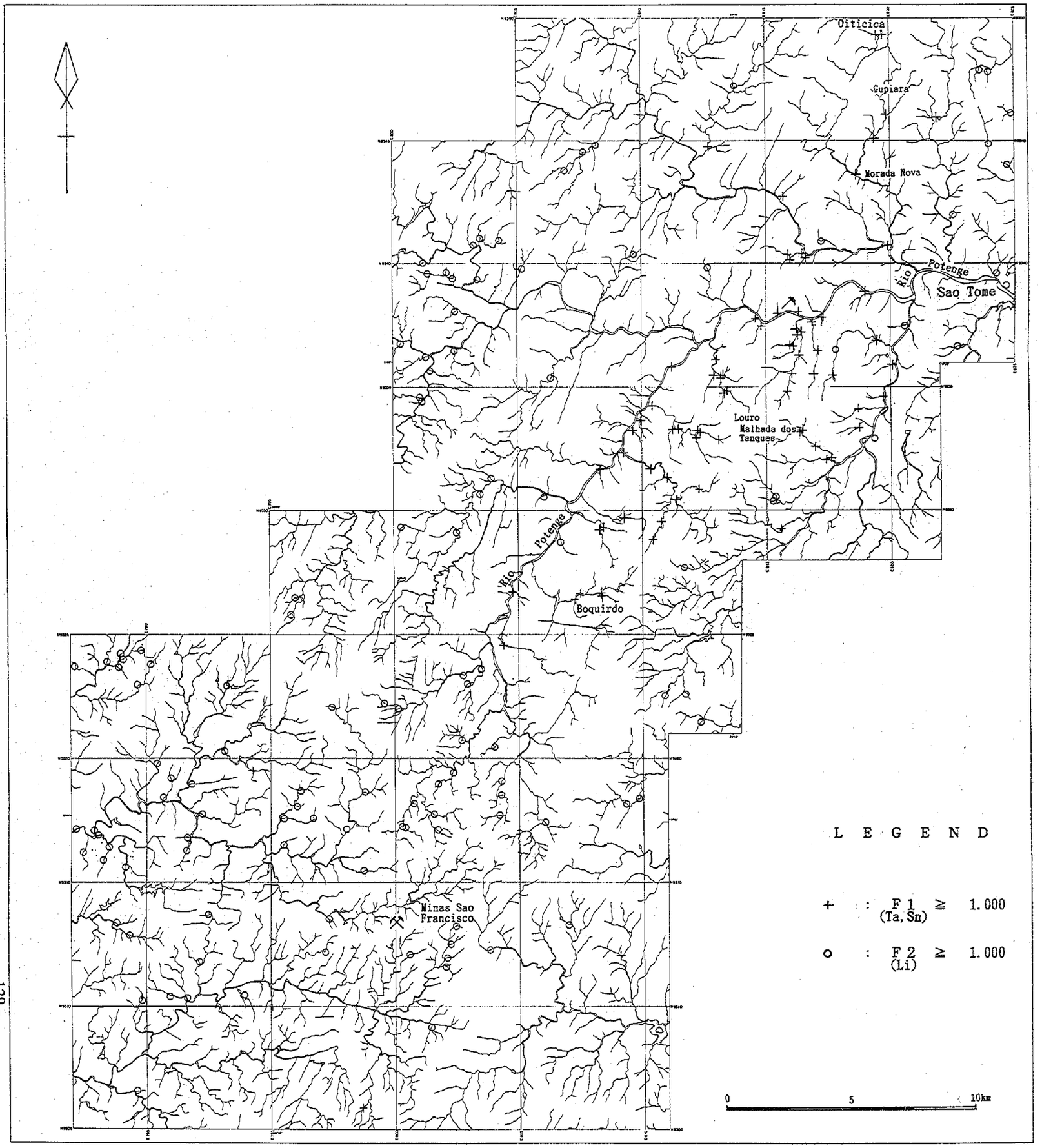

Fig. II-4-11 Anomaries from factor analysis: Factor 1 (Ta, Sn), Factor 2 (Li)

The area of the marks higher than +1.000 are distributed sporadically mainly in the area which extends from Oiticica in the northern part of the survey area to Boquirdo in the central part of the survey area as dimension of 25km long NNE-SSW and of 10km east-west. Other than the above, they are scarcely scattered in the central part of the survey area. Five tungsten deposits such as Oiticica, Gupiara, Mora do Nova, Louro and Malhada dos Tanques are known in the former area.

(2)Factor 2 (Fig. II-4-11)

The factor 2, which is related to Li, is possibly to be related to characteristic rocks including micas found commonly in the Serido Formation. The factor contribution ratio is rather small as much as 13.64%. The marks of the factor higher than +1.000 are widely distributed through the survey area from the north to the south. However, this factor is not distributed in the area where the factor 1 marks higher, and this is rarely distributed in the area, where both of the majorities of factor 1 and factor 5 which mark high scores are distributed, which extends from Oiticica in the northern part of the survey area to Boquirdo in the central part of the survey area with dimension of 25km NNE-SSW and 10km east-west.

(3)Factor 3 (Fig. II-4-12)

The factor 3, which is related to Au and As, is possible to be related to the gold mineralization. However, the factor contribution is as small as 7.73%. The area where the high marks less than -1.000 are distributed are significantly occurred as relatively concentrated areas and approximately extends southwestward of the Minas Sao Francisco,

1)the area which extends from the Minas Sao Francisco to Santa Ri in the southern part of the survey area,

2)the vicinity around the site 2km north of Santo Sebastinho,

3)the vicinity of Marixo,

4)the vicinity around the site 2km east of Cangorra,

5)the area which extends around the site 2km east of Salaedinho in the southwestern part of the survey area.

(4)Factor 4 (Fig. II-4-13)

The factor 4 is that related to Mn, Fe, Nb and Mo. Among them, Mn and Fe marks as high as above 0.65. Marks of Nb and Mo are smaller than those of Mn and Fe, ranging 0.44 to 0.47. Fe and Mn are contained in the mafic minerals such as biotite which is occurred very much in the survey area, while relatively high marks of Nb and Mo are found in the acidic rocks. The anomalous values are distributed trending NNE-SSW, and is supposed to be

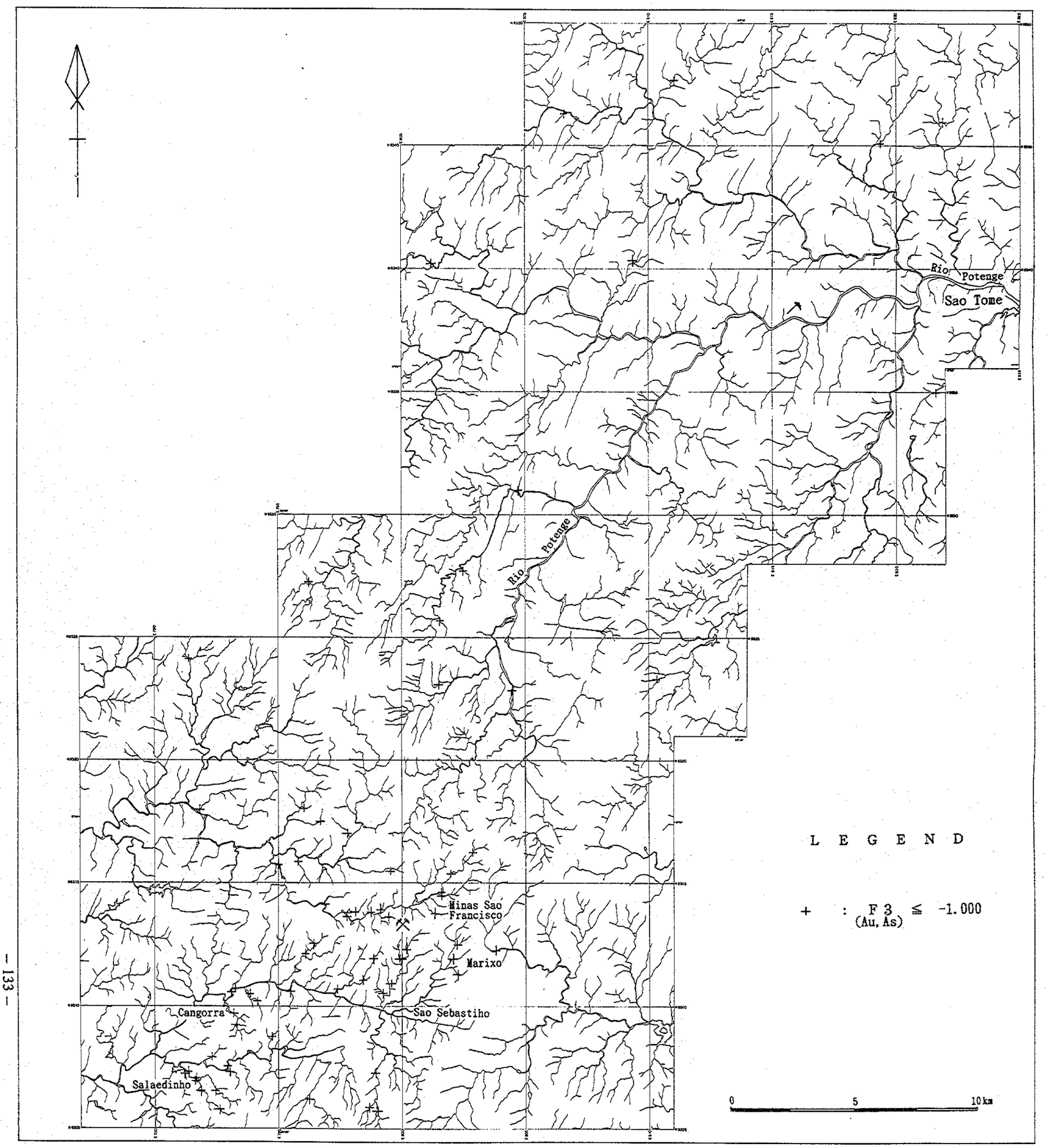

Fig. II-4-12 Anomaries from factor analysis: Factor 3 (Au, As)

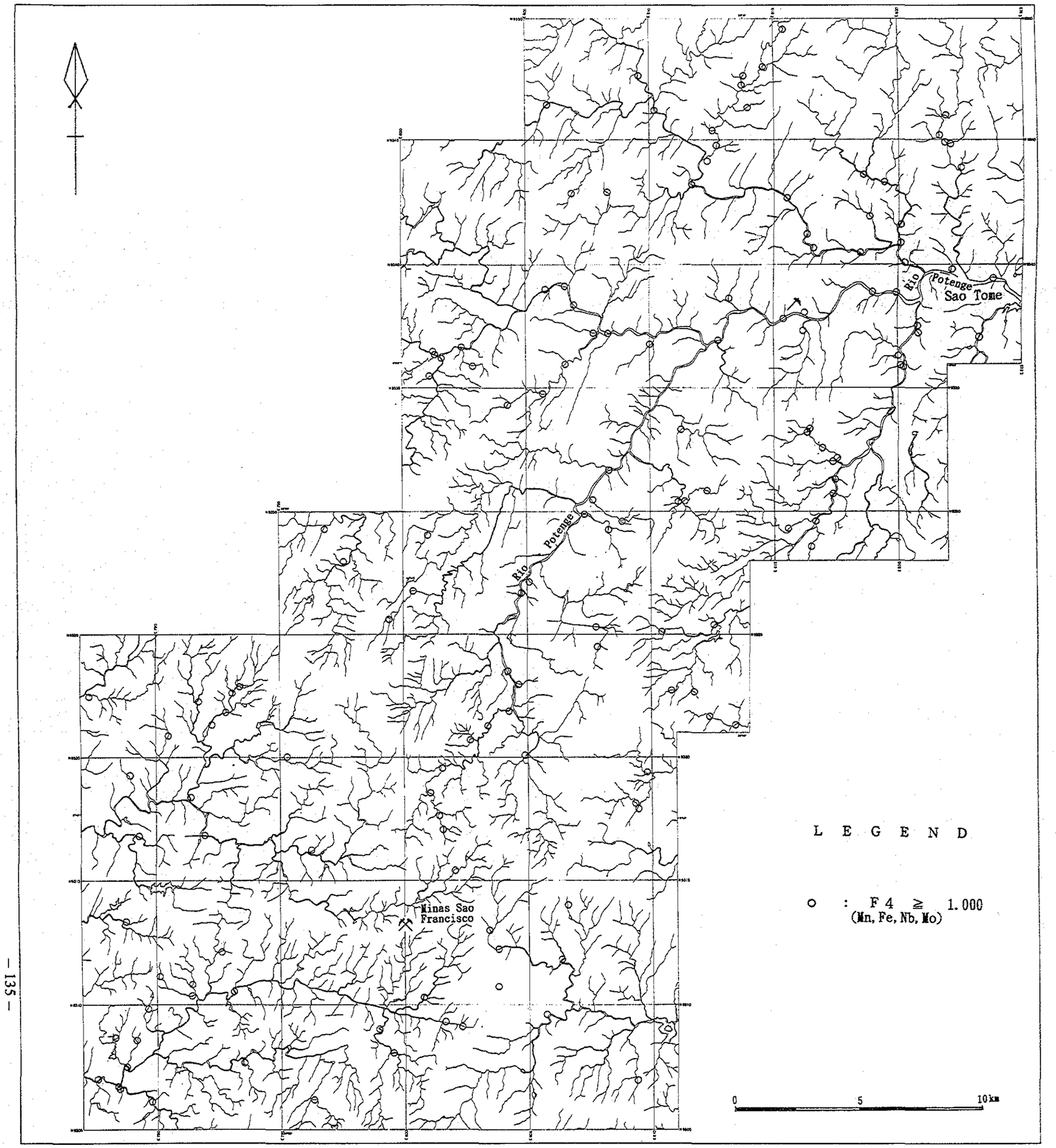

Fig. II-4-13 Anomaries from factor analysis: Factor 4 (Mn, Fe, Nb, Mo)

related to the regional geological structure striking NNE-SSW. Thus, this factor probably represent the characteristics of the acidic rocks intruded into the NNE-SSW trending geological structure.

The factor contribution ratio is as large as 29.81%. While the factor marking higher than +1.000 look to be distributed all throughout the area from the north to the south of the survey area, the continuity of the anomalous values are found to be aligned striking NNE-SSW sporadically.

(5)Factor 5 (Fig. II-4-14)

The factor 5, which is related to Sn, Mo, Nb and Sn, seems to be the factor related to the bulk composition of the original rock. The factor contribution ratio is as large as 1.1327. The factor marking higher than -1.000 are distributed to be concentrated in the area which extends from Pedra de Cima in the northern part of the survey area to Masacos in the central part of the survey area with dimension of 20km NNE-SSW and 10km east-west. they are also distributed in the area from Olho d'Agua to Tapuio at the central western margins of the survey area with the extension as long as 10km trending NNE-SSW. They are additionally rarely scattered at the western margin of the southern part of the survey area.

This high factor scores are distributed at a part of Caico Complex area. In general, Sn, Mo, Nb and so on appear with mineralization related to granites. It is not clear what this factor relate to.

(6)Factor 6 (Fig. II-4-14)

The factor 6, which is related to Be, is supposed to be correlated to the rocks related to the beryllium deposits, which exist related to pegmatites in this area. The factor contribution ratio is as small as 8.59%. The factor marking higher than +1.000 are scattered mainly in the central to the northern part of the survey area in general, and scattered at southwest of Sao Bento in the northwestern part of the survey area while it also distributed sporadically to be aligned between Mal Assombrado at the northern margin of the survey area and Acude Velho. At the western margin in the southern part of the survey area, it is aligned sporadically striking NNE-SSW significantly.

This factor relates to the rocks as pegmatite, because Bemineralizations related to pegmatite exist in the area where the high factor scores distribute. But this matter are not always corresponded to northwest part of this survey area, because there are few pegmatite at northwest part of this area. Thus, the five factors are pointed out to be related to the geological distribution, since each of them exhibit the anomaly trending NNE-SSW, except for the factor 2.

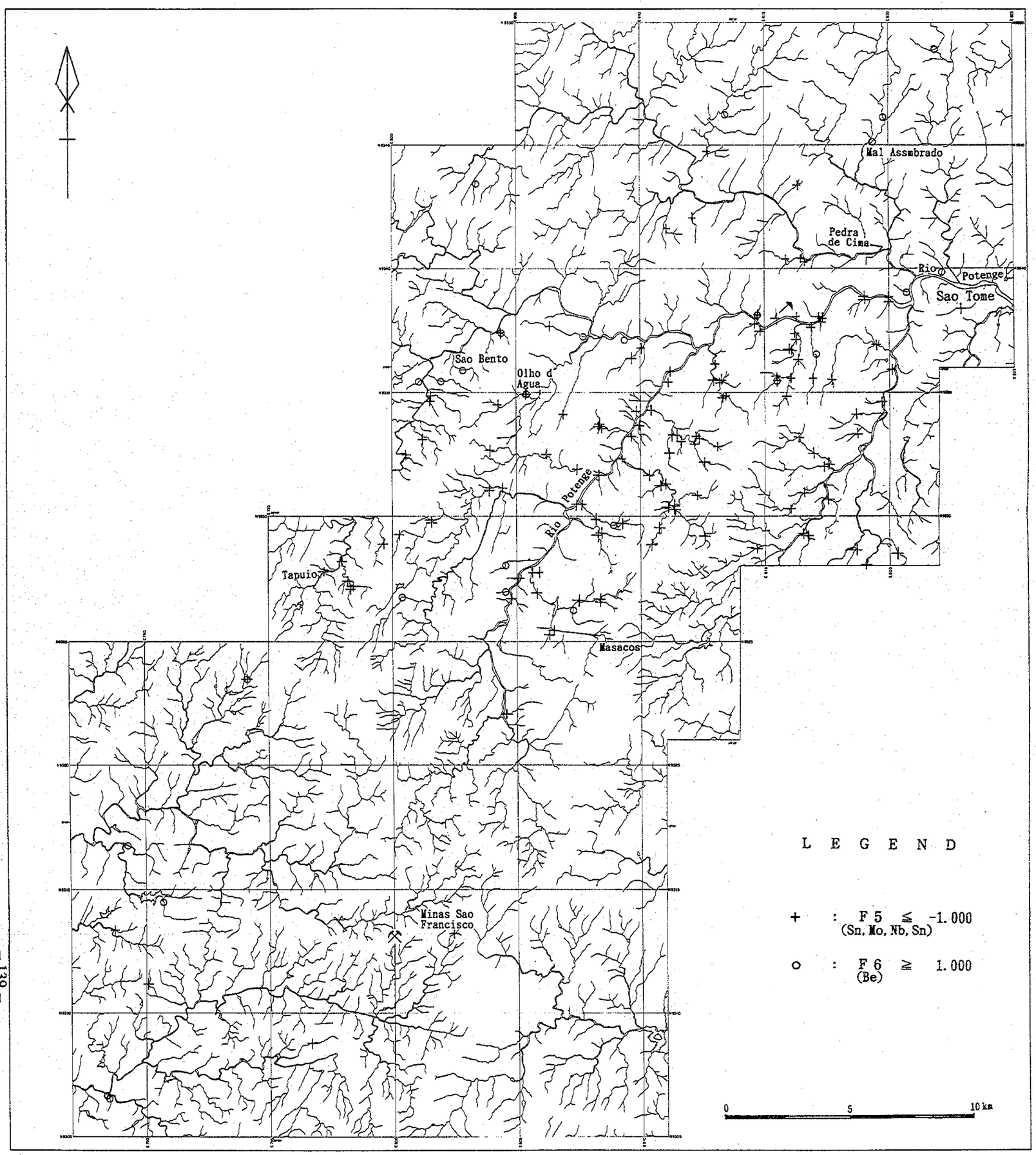

Fig. II-4-14 Anomaries from factor analysis: Factor 5 (Sn, Mo, Nb, Sn), Factor 6 (Be)

4-3 Pan concentrate survey

4-3-1 Sample location

Panned samples were collected for the known geochemical anomalies distributed in the survey area. The number of the sampling sites are 155. Seven elements such as Au, Ag, Mo, W, Sn, Ta and Nb were analyzed. The known geochemically anomalous areas are denoted by the number from the north to the south, to express the area as follows (Fig. II-4-15)

No.1 area: Barra dos Dois Rios Area
including the sites which exhibit geochemical anomalies of 0.1ppm and 0.25ppm

No.2 area: Mal Assombrado Area
including the sites which exhibit geochemical anomalies of 0.10ppm and 0.15ppm

No.3 area: Sao Tome Area
including the site which exhibits geochemical anomaly of 0.10ppm

No.4 area: Serra Agudo Area
including the site which exhibits geochemical anomaly of 0.10ppm

No.5 area: Sao Pedro Area
including the site which exhibits geochemical anomaly of 2.00ppm

No.6 area: Fortaleza to Santo Antonio Area
including the sites which exhibit geochemical anomalies of 0.25ppm, 2.50ppm and 0.85ppm

No.7 area: Machimera Area
including the site which exhibit geochemical anomaly of 2.00ppm

No.8 area: Santo Andre to Marixo Area
all the sites exhibiting geochemical anomalies

No.9 area: Sitio Luis Area
including the site which exhibits geochemical anomaly of 0.05ppm.

Consequently the advances of this year's field survey, the following areas were regarded to be added to consider the pan concentrates.

No.10 area: Morada Nove Area

No.11 area: Angico Area

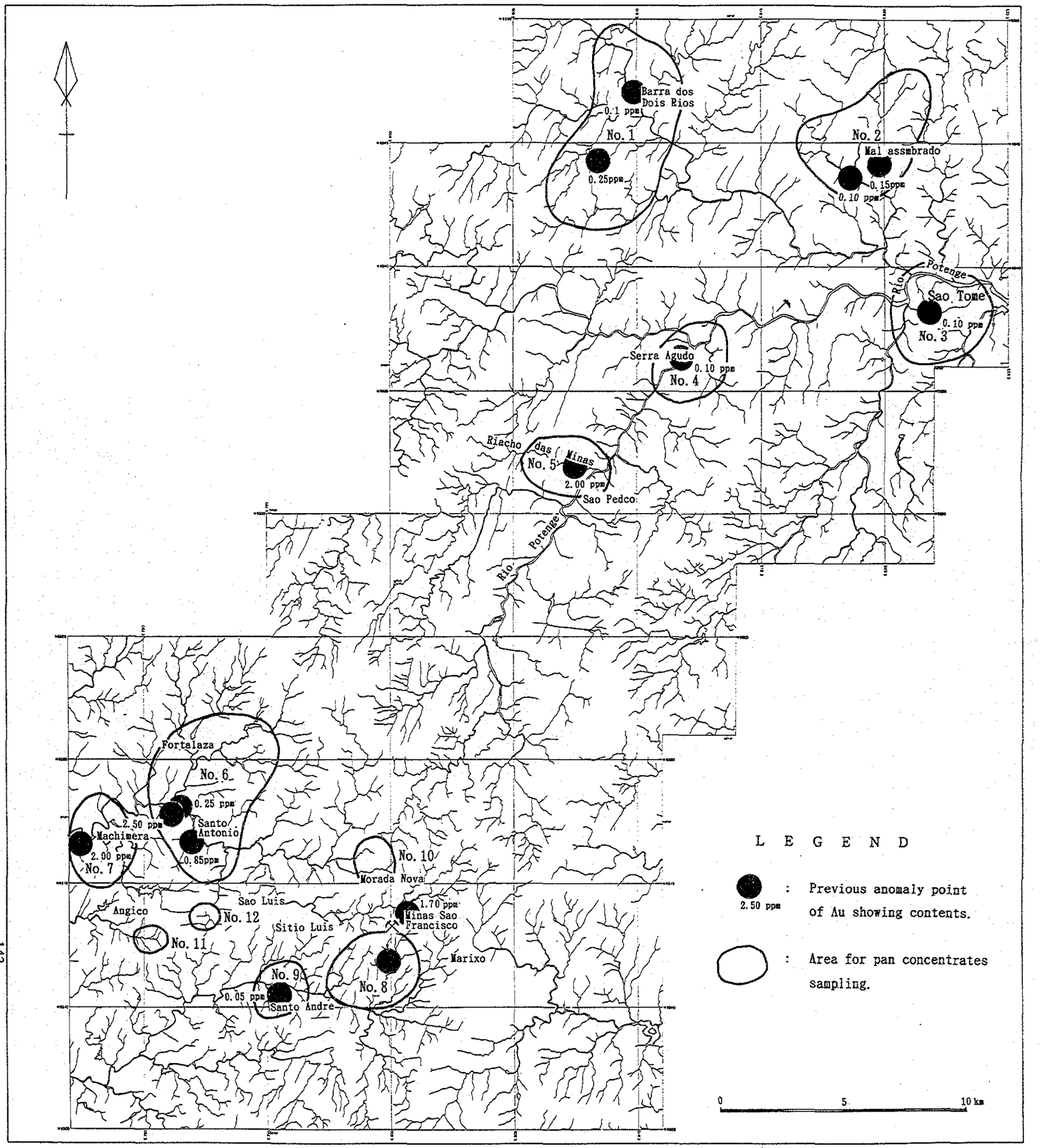

Fig. II-4-15 Areas for pan concentrate sampling

No.12 area: Sao Luis Area

4-3-2 Gold dust in Samples

At the status of the pan concentrate, the existence of the gold grain were examined. The result are listed in the appendix table. The site where the existence of the gold grain was confirmed are the site C025 in the central part of the Fortaleza to Santo Antonio Area and at the sites C041, C055, C060 and C139 in the central eastern part of the Santo Andre Area.

4-3-3 Concentrations of 7 analyzed elements

The assay results are listed in the appendix table.

The gold concentration of the pan concentrates which contain the gold grains are 539ppb at the site C025, below the detection limit at C041, 29,000ppb at C055, 3,270ppb at C060, 29,780ppb at C139. The considerably small values for the sites C025 and C041 are supposed to be due to that the gold grains have missed to remain in the samples prepared for the analysis through the sieve.

The simplified statistical values of the assay results of the pan concentrates are shown in the Table II-4-6. These values are shown only for the comparison, since those are not suitable for the statistical treatment due to that the sampling were done under the various conditions as mentioned previously. Through the comparison with the simplified statistical values of the stream sediments, the values of gold of pan concentrates are 30 to 40 times as the averaged value of the stream sediments, when the detection limit is assumed as 1ppb, which means the effect of the panning as the gold concentration procedure. The maximum value of the gold concentration is as high as 66,000ppb. The values of tungsten, tantalum and niobium exhibit 15 to 20 times as the averaged values of the stream sediments.

The obtained data were divided into the ranks and the concentration map for the elements were drawn.

The results are as follows.

Au (Fig. II-4-16)

The values of gold are divide into the four ranks divided at 100ppb, 1,000ppb and 10,000ppb. The highly concentrated areas above 1,000ppb are recognized at a site in the No.1 area, 10 sites in the No.6 area, a site in the No.7 area, 16sites in the No.8 area, a site in the No.10 area and a site in the No.12 area. The very much high value above 10,000ppb are situated in the No.6 area, in the No.8 area and in the No.10 area.

Table Ⅱ-4-6 Summary of statistical results of pan concentrate analytical data

Elements	Mean	Var(LOG)	S.D.(LOG)	Minimum	Maximum
Au(ppb)	36.147	2.074	1.440	0.500	66000.000
Ag(ppm)	0.100	0.000	0.000	0.100	0.100
Mo(ppm)	0.578	0.086	0.293	0.500	100.000
W (ppm)	93.818	0.381	0.617	5.000	9800.000
Sn(ppm)	1.759	0.213	0.461	1.000	310.000
Nb(ppm)	439.853	0.153	0.391	56.000	8800.000
Ta(ppm)	89.435	0.822	0.907	5.000	9000.000

Var: variance, S.D.:standard deviation.

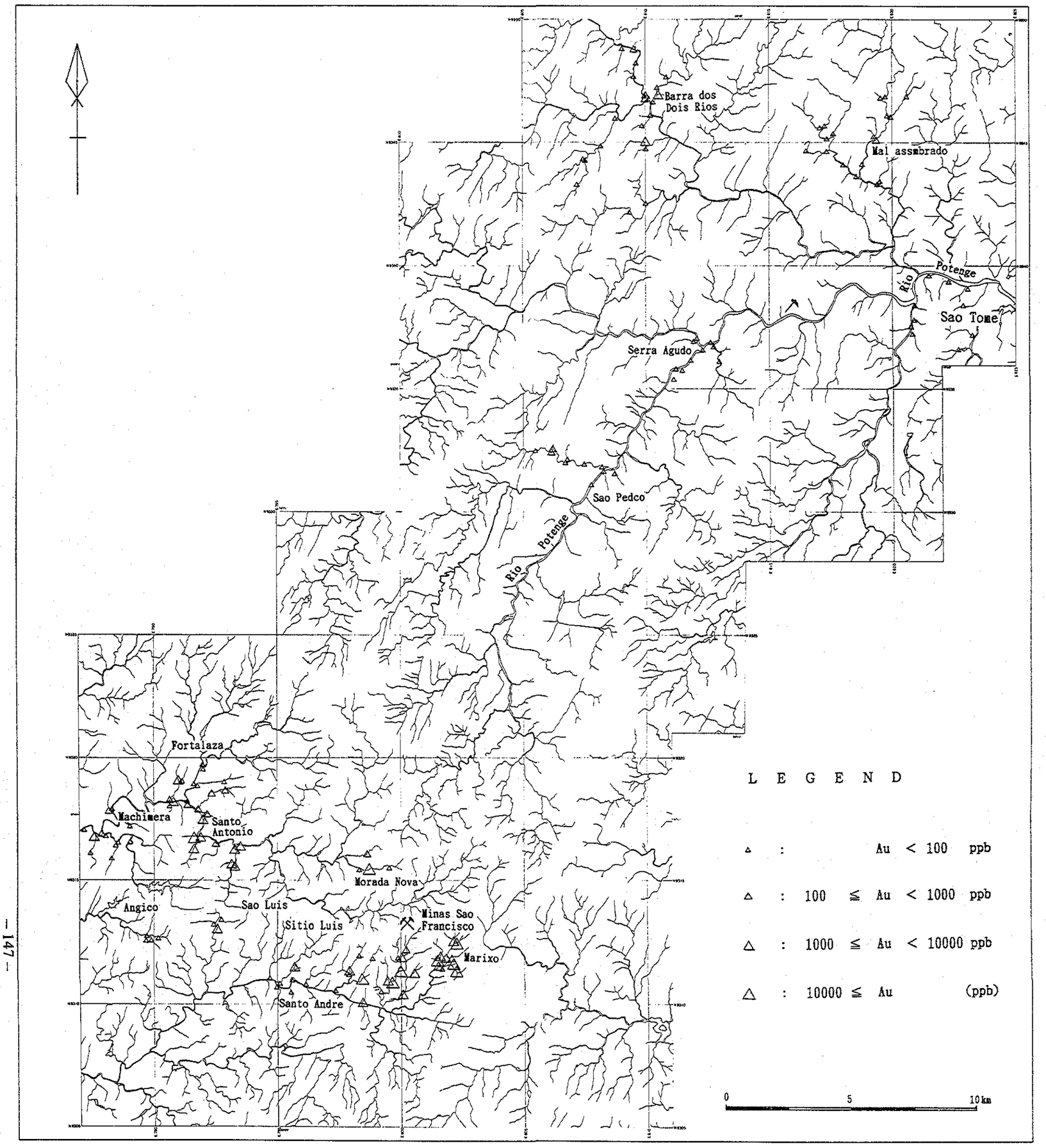

Fig. II-4-16 Au concentration in pan concentrates

Mo (Fig. II-4-17)

The values of molybdenum are divided into the four ranks divided at 1ppm, 10ppm and 100ppm. The maximum value of molybdenum was 100ppm. The concentrated sites higher than 10ppm are the two sites in the No.6 area.

W (Fig. II-4-18)

The values of tungsten are divided into the four ranks divided at 10ppm, 100ppm and 1,000ppm. The maximum value of tungsten was 9,800ppm. The highly concentrated sites are situated at a site in the No.1 area, a site in the No.6 area and 4 sites in the No.8 area.

Sn (Fig. II-4-19)

The values of tin are divided into the four ranks divided at 2ppm, 10ppm and 100ppm. The highest value of tin was 310ppm. The high values are situated at 2 sites in the No.2 area, 2 sites in the No.3 area, a site in the No.4 area, a site in the No.5 area, 2 sites in the No.6 area, 6 sites in the No.8 area and a site in the No.9 area.

Ta (Fig. II-4-20)

The values of tantalum are divided into the four ranks divided at 10ppm, 100ppm and 1,000ppm. The maximum value of tantalum was 9,000ppm. The highly concentrated sites above 1,000ppm are situated at a sites in the No.1 area, 3 sites in the No.2 area, 6 sites in the No.6 area, a site in the No.7 area, 9 sites in the No.8 area, a site in the No.9 area, 2 sites in the No.10 area and a site in the No.12 area.

Nb (Fig. II-4-21)

The values of niobium are classified into the three ranks divided at 100ppm and 1,000ppm. The highest value of niobium was 8,800ppm. The sites which exhibit higher than 1,000ppm are situated at 3 sites in the No.2 area, a site in the No.3 area, a site in the No.4 area, 2 sites in the No.5 area, 8 sites in the No.6 area. 3 sites in the No.7 area, 7 sites in the No.8 area, 2 sites in the No.9 area and 2 sites in the No.10 area.

Ag

The all of pan concentrates exhibit below the detection limit with respect to silver.

4-4 Discussion

(1)Compilation of geochemical survey

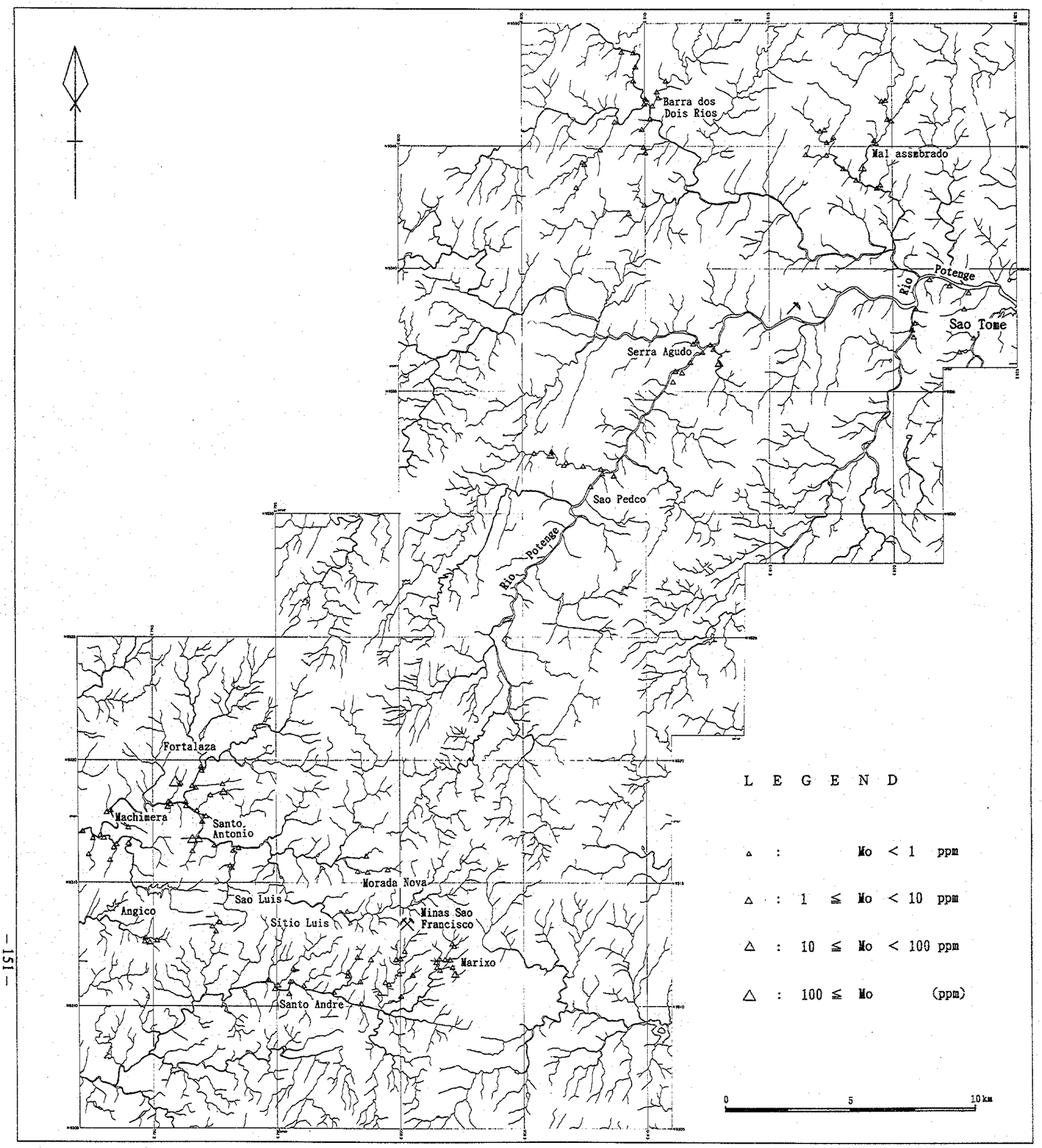

Fig. II-4-17 Mo concentration in pan concentrates

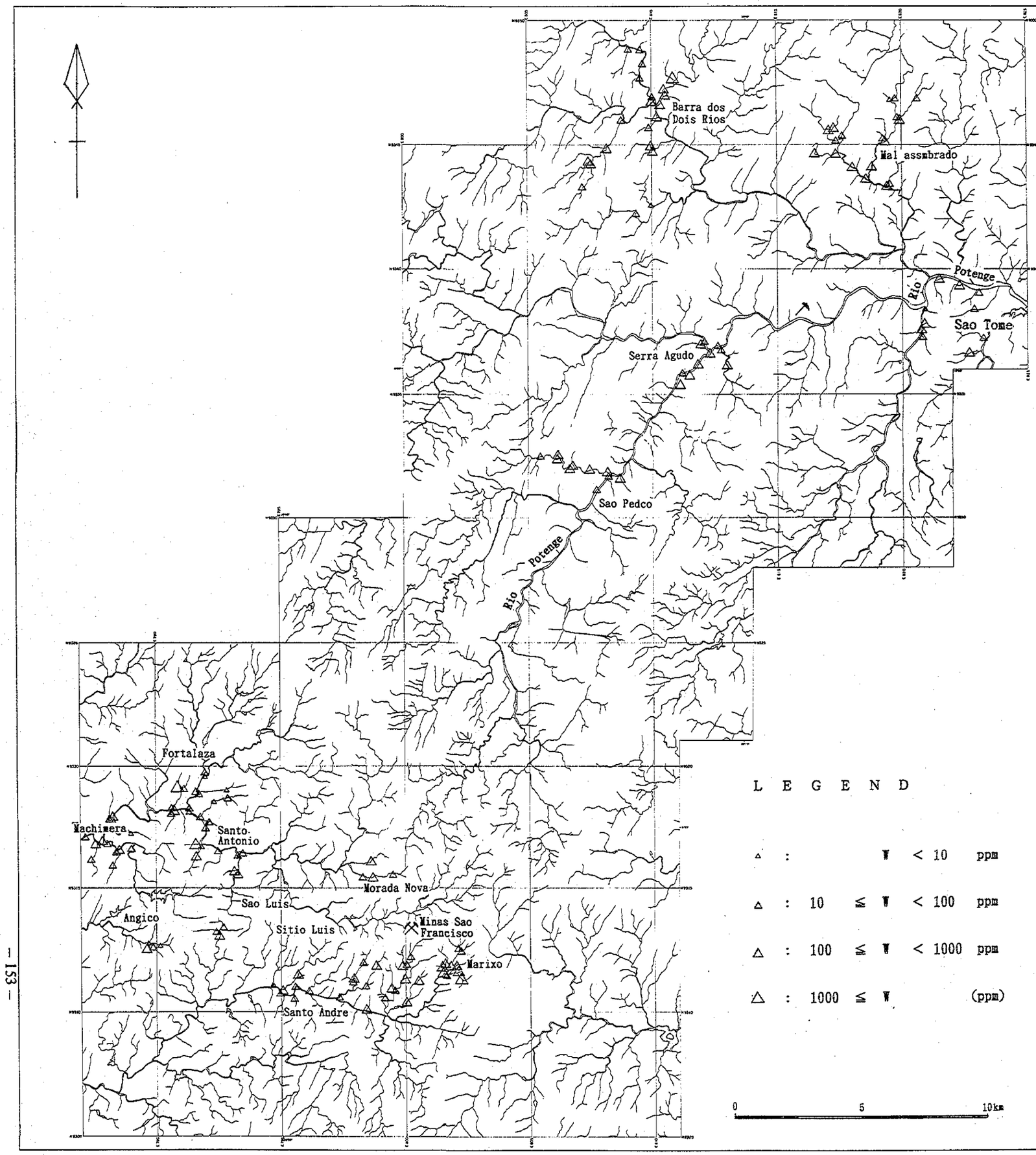

Fig. II-4-18 W concentration in pan concentrates

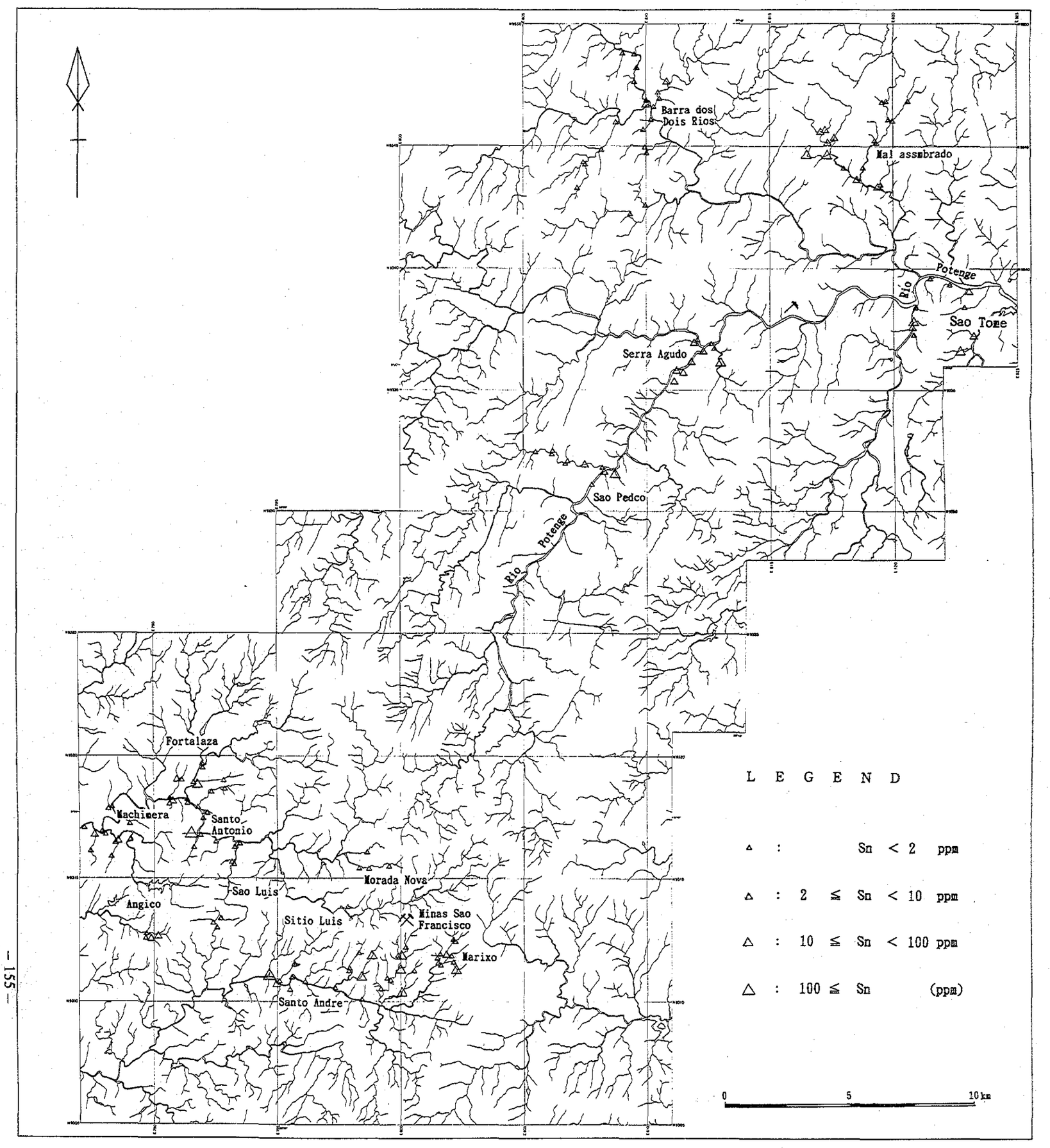

Fig. II-4-19 Sn concentration in pan concentrates

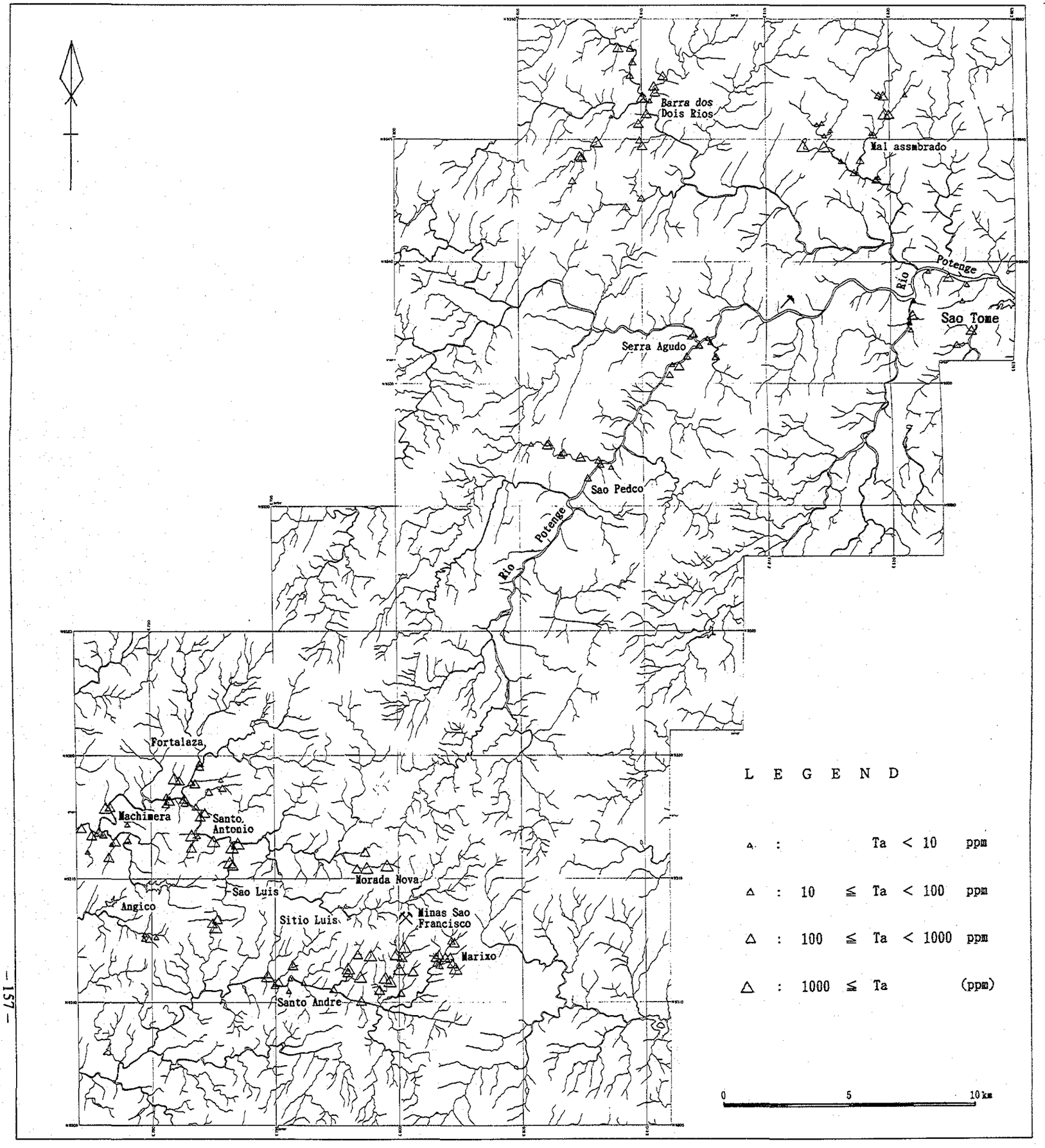

Fig. II-4-20 Ta concentration in pan concentrates

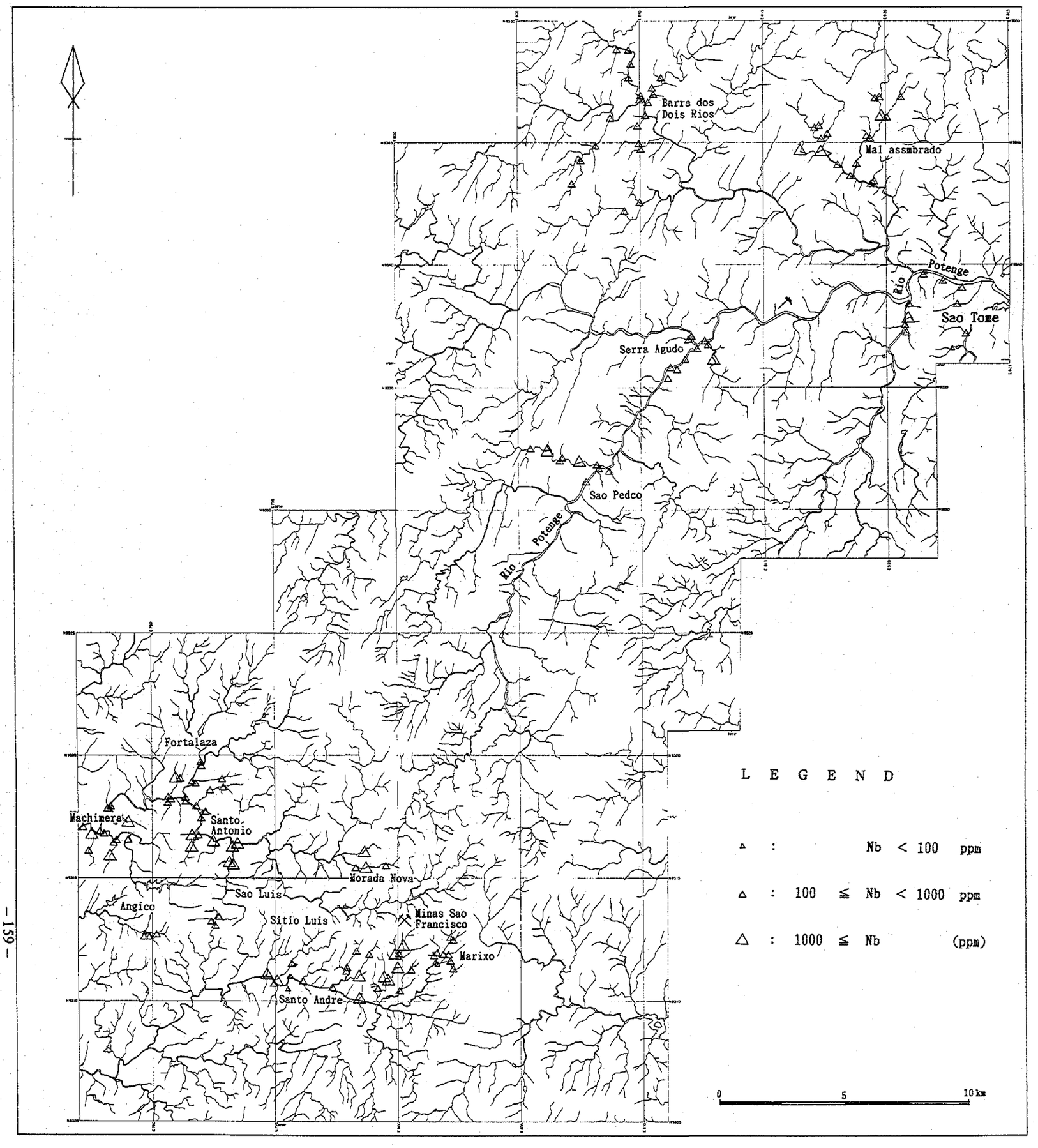

Fig. II-4-21 Nb concentration in pan concentrates

The assays of thirteen elements were exerted on the 1,500 stream sediments and the results were statistically treated to be analyzed to extract the promising prospect of the mineral deposit in this year's surveyed area. The analytical results are summarized with respect to gold which is the main objectives in this report.

The factors correlated with gold which is the objective of the present survey were extracted using multi-valuables analysis. The factor is represented as the factor 3 comprised by gold and arsenic.

The gold high concentration anomalous areas are as illustrated in the Fig. II-4-22,

1)the area which extends from the site 2km north of Santa Sebastinho at the upper stream of the river Rio Mulungu in the southern part of the surveyed area to the site 2km north of Sao Andre,

2)the vicinity of Cangorra at the down stream of the river Rio Mulungu,

3)the vicinity of the sites 4km south of sao Sebastinho,

4)the area which extends from Sao Migael to the Minas Sao Francisco.

The sites which exhibit the values higher than 10ppb are the site S0117(50ppb), S0573(100ppb), S0977(77ppb), S1159(450ppb), S1164(26ppb) and S1270(12ppb).

The highly concentrated anomalous area of arsenic are

1)the vicinity around Sao Jose at the northern margin of the survey area and the area which extends from Novo Mundo southeast of Sao Jose to Cruzinha,

2)the vicinity around Recreto in the central eastern part of the survey area,

3)the area which extends from Romonha in the central western part of the survey area to 5km northeastward,

4)the vicinity of the site 3km southwest of Sao Boa Ventura in the central part of the survey area,

5)the area which extends from Belo Morizanta in the southern part of the survey area to Sao Ratae in the north of Belo Morizanta,

6)the area which extends from the Minas Sao Francisco to Sao Sebastinho to the south and to Santa Ri to the west of the mine,

7)the area which extends from Farias in the southwestern part of the survey area to the vicinity around the site 4km east of Salaedinho in the east of Farias.

The areas of the factor 3 (Au, As) of the factor analysis of thirteen elements marking higher scores are significantly distributed as relatively concentrated area at,

1)the area which extends from the Minas Sao Francisco to Santa Ri in the southern part of the survey area,

2)the vicinity around the site 2km north of Santo Sebastinho,

3)the vicinity of Marixo,

4)the vicinity around the site 2km east of Cangorra,

5)the area which extends around the site 2km east of Salaedinho in the southwestern part of the survey area.

As the results of assay analysis of the pan concentrates, the highly concentrated sites above 1,000ppb are recognized at,

1)a site in the Barra dos Dois Rios Area,

2)10 sites in the Fortaleza to Santo Antonio Area,

3)a site in the Machimera Area,

4)16 sites in the Santo Andre to Marixo Area,

5)a site in the Morada Nove Area,

6)and a site in the Sao Luis Area.

The concentrated sites of gold above 1,000ppb in the pan concentrates overlapping the anomalous area of gold and arsenic concentrations in the stream sediments and thus the anomalous areas of their factor 3 are the two areas as (4)the Santo Andre to Marixo Area and (5)the Morada Nove Area. The anomalies have not been detected in the Fortaleza to Santo Antonio Area which includes the 10 sites where gold is concentrated in the pan concentrates. However, it is very much suggestive that many of the highly concentrated sites are found in the Santo Andre Area south of the Minas Sao Francisco in the southern part of the survey area and in the Fortaleza to Santo Antonio Area of northwest of the mine.

The results as mentioned above are summarized in the Fig. II-4-22.

(2) Discussion

The anomaly areas of gold according to the previous reports are summarized as the 9 areas as shown in the Fig. II-4-15. These are divided into the two, one of those is the northern district including the Sao Tome area, and the other is the southern district including the Minas Sao Francisco, globally. Ferran,A.(1988) reported about the southern district.

The results of the assays of the pan concentrates collected in the above mentioned known gold anomaly areas exhibit that the highly concentrated sites above 1,000ppb are situated at a site in the No.1 area, 10 sites in the No.6 area, a site in the No.7 area, 16sites in the No.8 area, a site in the No.10 area and a site in the No.12 area. As a whole, the majority of the high gold concentration sites are found in the southern district (Fig. II-4-16).

Especially, many points of high concentration of gold concentrate on No.6 area and No.8 area.

As No.8 area belongs to the known mineralized area extending to southwest part of Sao

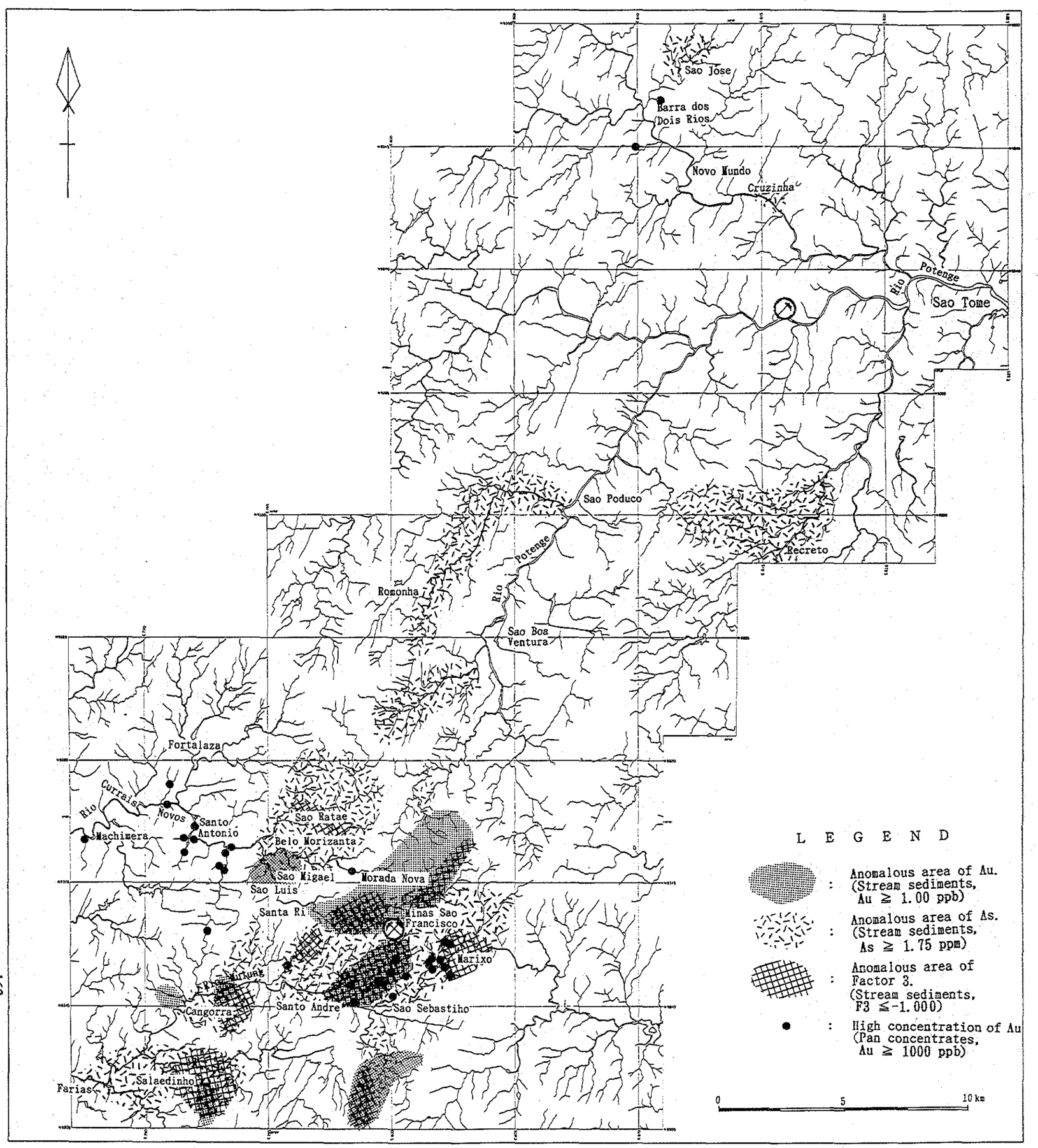

Fig. II-4-22 Compilation of geochemical anomalies related to Au

Frasisco mine. The gold detected on this area seems to be derived from mineralization related Sao Fransisco ore deposits.

No.6 area is located 10km west feom Sao Fransisco mine and belongs to the lower reaches of river Rio Murungu where the mine is located.

But as the point of high concentration of gold locate in a tributary of Rio Murungu the gold detected in this area derived from another mineralized area not to be related the known gold mineralized area as Sao Fransisco mine. But anomalous area of gold from the result of geochemical survey by stream sediments could not be extracted in this area. And it is not clear what this anomalous area of gold is related to.

Through the analysis of the assay data of the stream sediments, the factor comprised by gold and arsenic were extracted by means of factor analysis. These two elements behave in a similar manner during the ore formation in general.

The distribution of the anomalous area of gold in the stream sediments are concentrated mainly around the Minas Sao Francisco in the southern part of the survey area. On the other hand, the anomalous areas are rare and are scattered sporadically in the central to the northern part of the surveyed area (Fig. II-4-6).

The distribution of the anomalous areas of arsenic concentration are also condensed around mainly of the Minas Sao Francisco in the southern part of the surveyed area. And the extension of the western margin of its distribution reaches up to Sao Podco about 25km northward. The anomalous areas are also concentrated at Recreto in the eastern part of the surveyed area in the dimension of 5km east-west and 2km north-south. The anomalous area of arsenic is rare and sporadically scattered in the northern part of the surveyed area (Fig. II-4-6).

The anomalous areas both of gold and arsenic are overlapped in the vicinity around the Minas Sao Francisco in the southern part of the surveyed area, in the Belo Morizanta area at northwest of the mine, in the Cangorra area, the Salaedinho area and Sao Sebastinho area, those at south of the mine (Fig. II-4-22).

From the global points of view, the anomalous areas in term of the gold, arsenic and the factor 3 of the stream sediments are distributed where which extends from the south to the central part of the surveyed area striking NNE-SSW, and further, the two anomalous belts seem to Br exist as the one which extend over ten kilometers through the Minas Sao Francisco trending NNE-SSW, and the other which extends about 25km from Salaedinho to the site 5km NNE of Romonha.

In these areas, the widely spread Serido Formation of the Serido Group and the intruding dikes of pegmatite are exposed.

This area is situated in the large tectonic belt. The NNE-SSW trending weak structures are supposed since the NNE-SSW striking numerous intrusives of small scale

pegmatite, which are to small to be mapped, have been developed.

As a summary, the gold mineralization occurred in the Sao Francisco area in the southern part of thesurveyed area is supposed to have been more intense than in the central to the northern part (including the Rages-Sao Tome area) in the survey area.

Three recommended areas including Sao Fransisco mine were harrowed down to the following,

1)the area including Sao Fransisco mine, which extents from Santo Andre to the site 3km north of Morada Nova, 4km EW and 8Km NNE-SSW.

2)the area which is located west side of Sao Fransisco mine and extents from Sao Atarre to Salaedinho, 3km EW and 15km NNE-SSW.

3)the area which located east side of Sao Fransisco mine and extents from the site 5km south of Sao Sebastinho to Marixo, 3km EW and 10km NNE-SSW.

PART III CONCLUSIONS AND RECOMMENDATIONS

Chapter 1 - Conclusions

The survey area is underlaid by Archaean Caico Complex, Proterozoic Jucurutu, Equador and Serido Formations, and by Tertiary and Quaternary Formations. The mineralizations of gold seems to have no stratigraphic control, in spite of the fact that the Serido Formation was found to have higher contents of gold than the rocks of the Caico Complex.

Mining works related to gold in the survey area are restricted to the Sao Francisco mine, a small "garimpo" about 7 Km west of Sao Tome, and mining of some small placers.

Calculated ore reserves of the Sao Francisco deposit amounts to 587,646 tons, containing 1,750 Kg of gold. The reserve of the gold occurrence in the neighborhoods of Sao Tome has not been calculated yet, due to the lack of detailed data. The ore in both deposits consists mainly of sulfide-bearing quartz veins, so that the mineralization has been considered as being of hydrothermal type.

Mineralized zones in this area are invariably associated to structural (shear) zones trending NNE, suggesting that the ore genesis is strongly related with the geologic structure. The Sao Francisco deposit is situated in an area where faults and fractures trending WNW cross-cut the NNE trending shear zone. On the other hand, the gold occurrence around Sao Tome is located in a bending point of the NNE structural zone.

Anomalous areas for Nb, Ta, Sn, As and Au have been disclosed by a geochemical survey of stream sediments. The anomalous areas for Nb and Ta have both an elongate form trending NNE, and overlap each other. These anomalous areas are situated in an area approximately 10 Km north to northeast of the Sao Francisco mine, and cover partially the exposures of the Caico Complex. The anomalous area for Sn, on the other hand, covers widely the northern half of the area under survey.

Au anomalies in conjunction with As ones were identified in the following three areas: west to southwest (WSW) and south to southeast (SSE) of the Sao Francisco mine, and around this mine. The anomalous area in the WSW of the mine trends NNE and is in conformity with the local geologic structure. This anomaly, therefore, is presumed to be structurally controlled. On the other hand, the anomaly in the SSE of the mine do not show, in its distribution, a clear relationship with the geologic structure.

The mineralization in the Sao Francisco gold deposit is considered to be strongly controlled by the geologic structure. Taking into account this characteristic, the anomalous area in the WSW of the Sao Francisco mine can be pointed out as having higher potential for gold mineralization than that one in the SSE of the mine.

Moreover, the WSW area possibly extends further to the south outward of the present survey area. Based on the fact that this high potential area is situated in the southernmost part of the survey area, faults trending NNE nearly the Sao Francisco deposit possibly

extend southwards. Also, faults trending WNW is typically present in the area of the Sao Francisco deposit, and their extension to the south is suggested by the interpretation of LANDSAT TM images.

The interpretation of analyses of pan concentrates of stream sediments revealed that anomalous areas for gold are concentrated in the neighborhood of the Sao Francisco gold deposit, and also in the area situated 7 to 10 Km WNW of the Sao Francisco mine. The anomalies found in areas around this deposit are thought to be derived from the deposit. The origin of gold in the other area, however, is not well known, and only further detailed studies will allow to shed some light on its origin.

Chapter 2 - Recommendations for phase II survey

Based on the results of the survey in the phases I of this project, the following areas are recommended for further detailed surveying:

1) The area situated WSW of the Sao Francisco mine, where stream sediment anomalies were concentrated. In this area, the following survey methods are suggested:

a) Trenching, following the WNW direction, in order to delineate possible mineralizations;

b) Geophysical survey, in order to uncover underground structures and to identify potential faults and fractures associated with the gold mineralization. One recommended geophysical method is the magnetic survey, since this methodology has been successfully applied, by a Brazilian team, to disclose structural features in the southern area of this project .

2) The area to the south of the phase I area. It is suggested the employment of the following survey methods:

a) Geological traversing and geochemical survey to discover potential areas for gold mineralization;

b) Geophysical survey to define structures such as faults and fractures. It is also recommended to program the surveying to maximize resolution for NNE and WNW structural trends.

3) The anomalous area for gold from pan concentrates situated about 7 to 10 Km WNW of the Sao Francisco mine. The methods recommended to be applied are

a) Geophysical survey to reveal geologic structures that could be associated to the mineralization. The magnetic survey seems to be the most suitable, following the reasoning described above.

b) Trenching in the WNW direction, in order to delineate potential mineralizations.

4) The anomalous area in the stream sediment survey, situated to the WSW of the Sao Francisco mine. The following survey methods are recommended:

a) Geophysical survey to reveal geologic structures that could be associated to the mineralization. The magnetic survey seems to be the most suitable, following the reasoning described above.

b) Trenching in the WNW direction, in order to delineate potential mineralizations.

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