Chapter 4 - Geological Survey in Area "C"

4-1 OBJECTIVES and METHODOLOGY

4-1-1 Objectives

This survey is aimed at understanding the geological setting of area "C" (500 Km^2), in order to evaluate its potential for gold.

To accomplish the objectives above mentioned, the following steps were set to be achieved:

(1) Realize the distribution of rocks in the area, as well as confirm the lithostratigraphy;

(2) Comprehend the geological structure of this area;

(3) Understand the relationship between the existing mineralization and the country rock;

(4) Search for auriferous quartz veins and confirm their continuity;

(5) Realize the regional relationship between mineralization and the geological structure.

4-1-2 Methodology

Survey routes for field works were set aiming at covering uniformly the entire area with density higher than 0.8 Km/km^2. The routes were set mainly along the streams, because sampling of stream sediments as well as of pan concentrates were to be carried out concomitantly with the geological survey.

Topographic maps covering an area of approximately 530 Km^2, including the entire survey area, were produced in the scale of 1/50,000 from aerial photographs (1:60,000, taken in 1967). These maps were further enlarged to a scale of 1/25,000 to be used as the topographic base during the field works. The 1:50,000 topographic map was used as the base to produce the final geological map (Pl. II-4-1, Fig. II-4-1).

4-2 RESULTS

4-2-1 Geology

Rocks belonging to the Archaean Caico Complex, the Proterozoic Serido Group, and the Tertiary Serra dos Martins Formation crop out within the limits of area "C". The Serido Group is represented by the stratigraphically lower Equador Formation overlaid by the Serido Formation, while the Jucurutu Formation does not crop out in this area. In the same way as in previous Phases, the stratigraphic classification due to Jardim de Sa and Salim (1978) and Jardim de Sa (1982) is adopted (Fig. II-4-2).

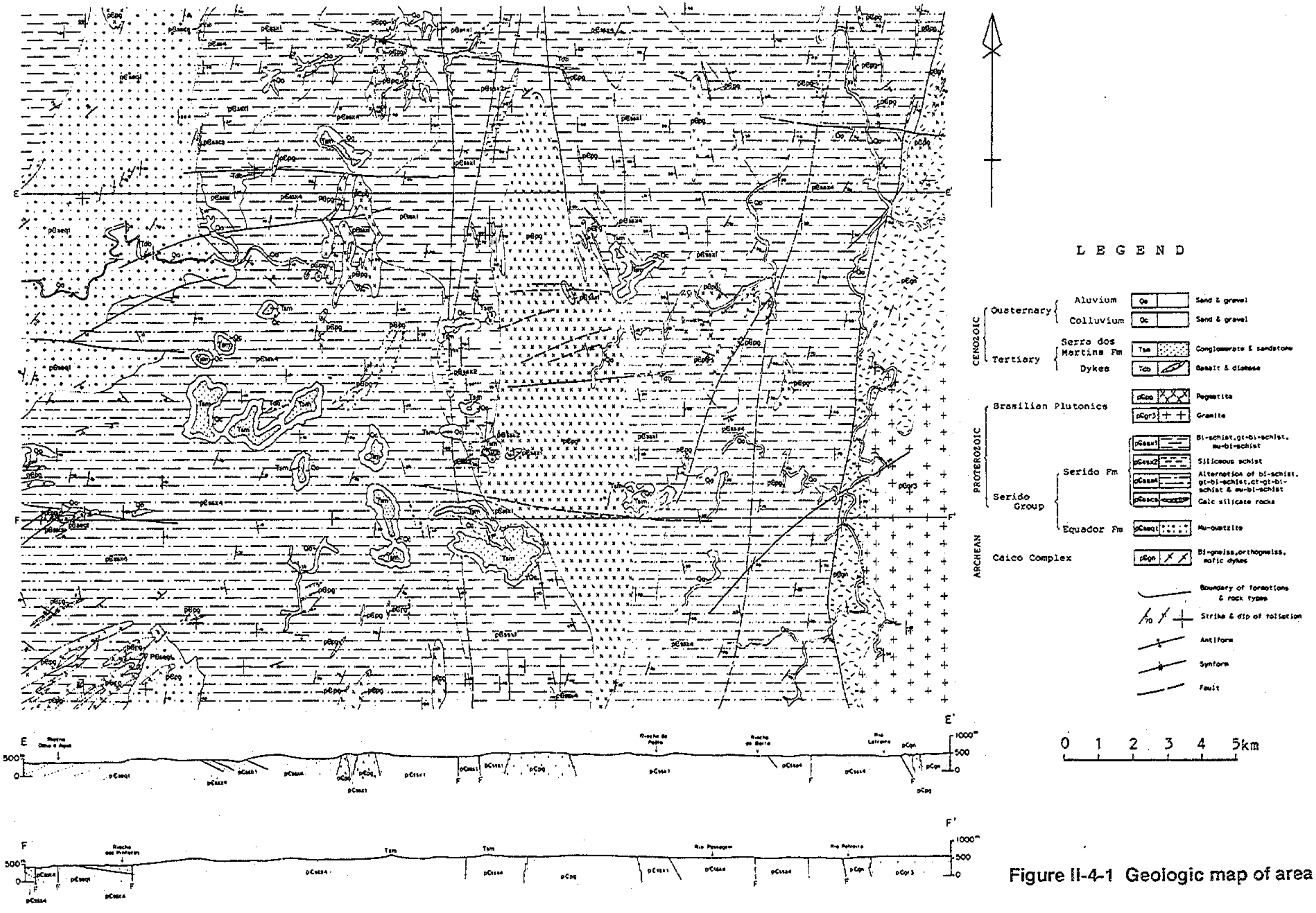


Figure II-4-1 Geologic map of area C

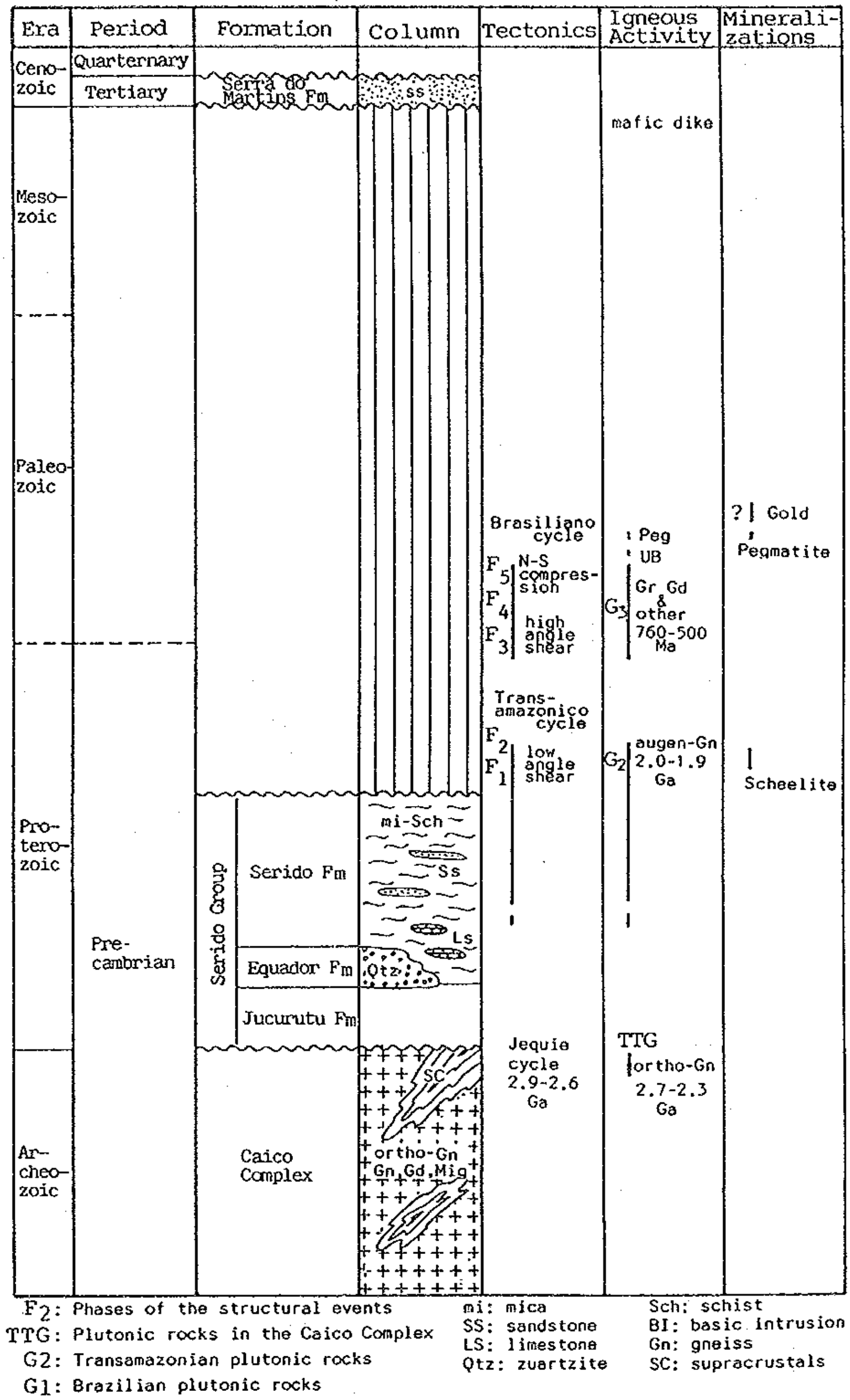


Figure II-4-2 Generalized columnar section of area C

(1) PRECAMBRIAN

(a) Caico Complex

1) Distribution

Rocks belonging to this complex crop out along the eastern border crossing through the entire area. Within this area, the western limit of this complex is in contact with the rocks belonging to the Serido Formation through the Picui fault, while to the east it is in contact with granites of Brasiliano age.

2) Lithology

This complex has been subdivided into two major units by Jardim de Sa (1987), based on their origin, igneous or sedimentary. The igneous unit is represented by basic ortho-gneisses with migmatite associated, which composition has been known as TTG (Tonalite-Trondhjemite-Granite). The meta-rsedimentary unit includes amphibolite, schist, quartzite, marble and basic rocks. Within the area being prospected this year, gneissic biotite granite (pCgn1), migmatites and meta-sedimentary rocks are complexly interfingering each other.

The following samples were collected within the outcropping area of this complex: two samples (C208, C209) in the northern portion, nearby the locality known as "Barra do Carrapato"; one sample (C202) in the central portion around "Barra do Onca", and 4 samples (C201, C203, C244, C245) in the southern portion, in the vinicity of "Tamandura" (Fig. II-4-3). These samples were analized chemically and petrographically (Tab. II-4-1, Tab. II-4-2). The results of the petrographic (thin section observations) descriptions are given below.

SAMPLE C208

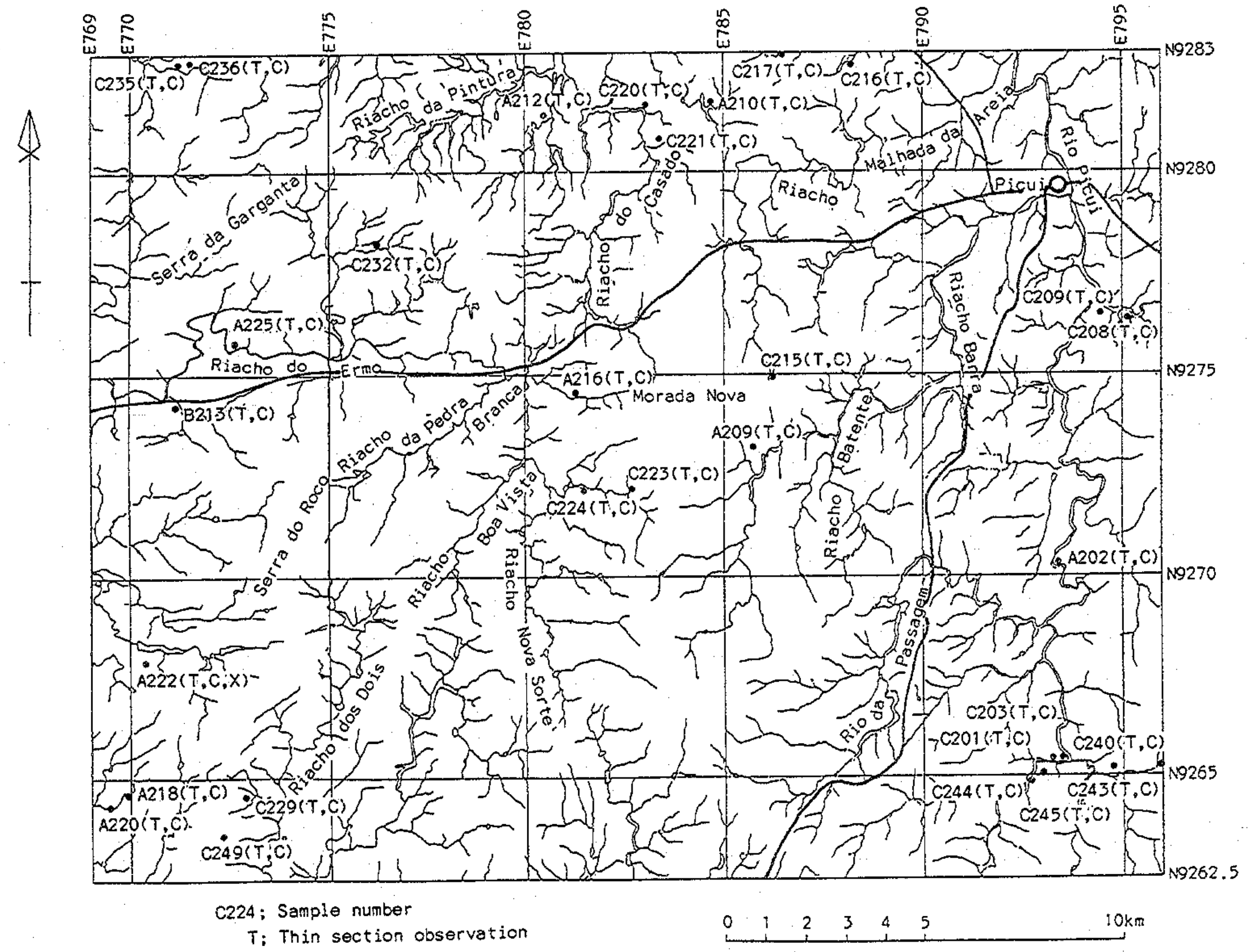
NAKED-EYE DESCRIPTION: pale gray, fine-grained, equigranular.
NAME: biotite-amphibole granite;
TEXTURE: granoblastic;
MINERAL COMPOSITION:

- MAJORS: quartz, plagioclase, alkali-feldspar, biotite, hornblende;
- MINORS: sphene, apatite, zircon, calcite;
- OPAQUES: present;
- SECONDARIES: chlorite, fine-grained muscovite, limonite.

SAMPLE C209

NAKED-EYE DESCRIPTION: pale gray, medium-grained, equigranular.
NAME: amphibolite;
TEXTURE: equigranular;
MINERAL COMPOSITION:

- MAJORS: hornblende, plagioclase, biotite;
- MINORS: sphene, zircon;
- OPAQUES: present;
- SECONDARIES: none.



C224; Sample number
T; Thin section observation
C; Chemical analyses
X; X-ray difractometry

Figure II-4-3 Location of samples for laboratory tests in area C

Table II-4-1 Analytical data of rock samples in area C

Sample No.	A202	A209	A210	A212	A216	A218	A220	A222	A225	B213	C201	C203	C208	C209	C215
Coordinates of location	E793.35 N9270.27	E785.70 N9273.00	E784.70 N9281.75	E780.55 N9281.34	E781.22 N9274.44	E769.96 N9264.68	E769.53 N9264.35	E770.40 N9267.83	E772.67 N9275.71	E771.28 N9274.22	E793.26 N9265.32	E793.58 N9265.41	E795.14 N9276.32	E794.45 N9276.50	E786.23 N9274.98
Lithology	bi-Gneiss	2-px Granulite	mu-bi Gneiss	bi Schist	mu-bi Schist	bi Sch	bi Sch	2-px Granulite	Dolerite	mu Quartz	bi Gneiss	Amphibolite	bi-hb Gnanite	Hornblen-dite	mu-bi-Sch
SiO2 %	73.00	54.97	70.27	70.73	69.30	69.21	67.99	46.62	42.41	80.02	68.24	57.56	65.22	57.99	64.10
TiO2 %	0.26	0.32	0.58	0.71	0.72	0.73	0.76	0.46	2.31	0.08	0.28	0.68	0.40	0.46	0.77
Al2O3 %	13.26	17.45	13.45	13.92	14.04	13.93	13.89	12.29	9.40	10.23	15.12	15.34	15.34	12.10	15.68
Fe2O3 %	1.03	2.23	0.51	0.73	0.71	1.23	1.44	3.09	3.97	0.71	0.92	2.44	1.56	1.63	2.92
FeO %	1.79	1.53	4.46	4.79	4.40	4.27	4.34	3.51	9.06	0.89	3.06	6.12	4.08	5.22	4.01
MnO %	0.04	0.09	0.08	0.11	0.08	0.12	0.12	0.25	0.21	0.02	0.07	0.14	0.11	0.15	0.20
MgO %	0.60	1.64	1.86	2.13	1.79	2.21	2.55	8.21	15.22	0.46	1.00	4.43	1.80	8.01	2.12
CaO %	1.36	7.44	1.75	1.63	1.81	1.44	1.98	17.82	9.50	0.50	3.20	7.25	4.00	7.72	2.54
Na2O %	2.69	6.53	3.52	2.97	3.37	2.91	3.11	0.49	2.94	1.36	3.43	3.19	3.14	4.08	3.85
K2O %	5.15	1.41	2.05	1.13	1.80	1.47	2.18	0.26	1.61	4.82	4.17	1.96	3.72	1.65	2.48
P2O5 %	0.10	0.06	0.21	0.23	0.33	0.17	0.24	0.18	0.78	0.04	0.21	0.22	0.20	0.12	0.31
LOI %	0.40	1.72	0.64	0.77	1.05	1.71	0.81	3.34	1.21	0.73	0.25	0.39	0.34	0.78	0.76
total %	99.68	95.39	99.58	99.85	99.40	99.40	99.41	96.52	98.62	99.86	99.95	99.72	99.91	99.91	99.74
Au ppb	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5	5	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5
Ag ppm	0.2	1.6	0.2	0.1	0.2	0.1	L 0.1	33.7	0.3	L 0.1	L 0.1	0.2	0.3	0.2	0.1
Fe %	2.11	2.75	3.90	4.23	3.92	4.18	4.38	4.89	9.82	1.19	3.02	6.47	4.26	5.20	5.16
Mn ppm	327.0	730	652	854	650	936	1941	1961	1619	166	545	1067	829	1152	1577
Mo ppm	2	20	1	1	L 1	1	L 1	432	12	3	1	L 1	1	L 1	1
W ppm	76	573	23	54	14	50	12	2030	1037	36	27	11	50	39	19
Sn ppm	6	5	6	3	6	4	3	4	6	2	L 2	7	4	5	9
Nb ppm	11	13	16	L 10	14	10	15	10	67	L 10	13	18	L 10	11	12
Ta ppm	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10
Be ppm	17.6	22.8	16.2	16.6	12.5	12.4	7.0	268.6	16.8	16.6	21.3	22.0	18.3	20.2	37.9
Li ppm	45	10	36	100	64	58	16	24	12	23	31	35	26	8	74
As ppm	L 1	1	2	L 1	1	L 1	L 1	L 1	2	L 1	1	1	1	L 1	1
Sb ppm	L 1	1	L 1	L 1	L 1	L 1	L 1	4	L 1	1	2	1	2	2	L 1

Table II-4-1 Analytical data of rock samples in area C (continued)

Sample No.	C216	C217	C220	C221	C223	C224	C229	C232	C235	C236	C240	C243	C244	C245	C249
Coordinates	E788.40	E786.43	E783.03	E783.40	E782.67	E781.51	E772.99	E776.23	E771.20	E771.55	E796.00	E794.73	E792.74	E793.13	E772.43
of location	N9282.74	N9282.97	N9281.65	N9280.79	N9272.06	N9272.08	N9264.60	N9278.18	N9282.70	N9282.71	N9265.25	N9265.14	N9264.97	N9265.07	N9263.52
Lithology	ms-bi-Sch	mu-bi Sch	mu-bi Sch	mu-bi Sch	mu-bi Sch	mu-bi Sch	Cortlandite	bi Sch	mu Quartz	Pegmatite	bi Granite	bi Granite	bi Gneiss	bi Gnanite	Skarn
SiO2 %	58.14	67.64	66.86	70.48	70.26	73.92	48.70	67.60	76.24	74.23	70.06	73.24	64.09	73.98	48.72
TiO2 %	0.73	0.54	0.86	0.47	0.60	0.42	0.29	0.82	0.15	0.02	0.37	0.14	0.43	0.12	0.86
Al2O3 %	20.46	15.54	13.92	13.86	13.93	12.66	7.81	14.28	12.04	13.95	13.95	13.23	16.41	13.37	18.37
Fe2O3 %	1.04	0.86	3.17	1.52	0.84	1.10	3.33	0.86	0.90	0.06	0.96	0.34	1.53	0.70	4.58
FeO %	7.27	4.34	3.51	2.61	3.25	2.87	3.45	4.91	1.21	1.40	2.74	1.92	3.13	1.40	3.45
MnO %	0.20	0.08	0.10	0.10	0.09	0.10	0.40	0.12	0.03	0.18	0.05	0.04	0.09	0.03	0.22
MgO %	4.05	2.13	2.26	0.65	1.57	0.71	10.72	2.10	0.61	0.09	0.66	0.24	1.91	0.15	4.75
CaO %	1.05	1.37	3.42	1.38	2.23	1.05	20.90	2.18	0.36	0.40	1.80	0.96	3.60	0.87	16.55
Na2O %	1.48	2.38	2.96	3.62	3.70	3.45	0.13	3.70	1.54	4.24	3.38	3.19	4.24	3.83	0.46
K2O %	2.04	2.17	1.86	4.32	1.96	2.69	0.06	2.04	5.49	4.74	5.28	5.95	3.23	5.21	0.31
P2O5 %	0.20	0.20	0.24	0.16	0.28	0.14	0.18	0.25	0.11	0.30	0.17	0.11	0.33	0.07	0.10
LOI %	1.89	1.63	0.51	0.35	0.36	0.56	2.74	0.72	0.78	0.20	0.47	0.35	0.34	0.26	1.37
total %	98.55	98.88	99.67	99.52	99.07	99.67	98.71	99.58	99.46	99.81	99.89	99.71	99.33	99.99	99.74
Au ppb	3	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5	L 0.5	0.9	0.6	L 0.5	L 0.5	6	L 0.5	L 0.5	15
Ag ppm	0.2	0.1	0.1	0.1	L 0.1	L 0.1	0.4	L 0.1	L 0.1	0.1	L 0.1	L 0.1	0.1	0.2	1.0
Fe %	6.38	3.97	4.95	3.09	3.12	3.00	5.01	4.42	1.57	1.13	2.8	1.73	3.50	1.58	5.88
Mn ppm	1511	596	810	764	659	775	3067	908	1381	233	375	282	674	230	1676
Mo ppm	2	1	L 1	1	L 1	L 1	4	1	3	2	3	12	2	4	22
W ppm	48	21	32	42	8	24	183	17	64	64	152	504	74	47	1150
Sn ppm	3	2	5	L 2	3	5	8	2	2	8	7	9	L 2	6	4
Nb ppm	11	L 10	11	18	16	42	L 10	L 10	L 10	30	32	21	18	L 10	16
Ta ppm	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10	L 10
Be ppm	35.9	17.7	28.0	17.1	22.3	22.2	272.4	13.3	24.1	9.8	30.8	19.9	29.6	20.3	42.3
Li ppm	109	30	31	41	33	34	11	22	50	15	24	24	64	25	22
As ppm	1	1	1	1	L 1	L 1	L 1	L 1	L 1	L 1	L 1	L 1	L 1	L 1	L 1
Sb ppm	L 1	L 1	L 1	L 1	L 1	1	2	L 1	2	2	3	L 1	L 1	2	L 1

Table II-4-2 Mineral assemblages of rock samples determined by thin section observation

Sample	Rock name determined by thin section observation	Structure (Texture)	Rock forming minerals																		Opaque minerals	Secondary minerals			Remarks
			Quartz	K-feldspar	Perthite	Plagioclase	Biotite	Muscovite	Hornblende	Pyroxene	Pyralspite	Cordierite	Sphene	Apatite	Zircon	Epidote	Calcite	Tourmaline	Sillimanite	Alanite		Finegrained muscovite	Limonite	Chlorite	
A202	bi Gneiss	Gneissose	○	∘		○	∘	·					·	·	·	·					·	·		·	Epidote : Secondary
A209	2-pyroxere Granulite	Granoblastic	·	·		◉				Opx ∘ Cpx ∘	∘		·	·			·				·	·		·	Calcite : Secondary
A210	mu-bi Gneiss	Schistose	○	∘	·	○	∘	·					·	·	·	·					·	·	·	·	Epidote : Secondary
A212	bi Schist	Schistose	◉	·		∘	∘				·	◉		·	·			·			·	·		·	
A216	mu-bi Schist	Schistose	○	·		○	∘	∘						·	·			·	·		·	·	·	·	
A218	bi Schist	Schistose	○	·		○	∘	·			·	(·)		·	·			·			·	·		·	Cordierite→Pinite
A220	bi Schist	Schistose	○	·		○	∘	·			·	(·)		·	·						·	·		·	Cordierite→Pinite
A222	2-pyroxere Granulite	Grano-blastic		·		∘			○	∘ (Opx) ○ (Cpx)			·	·	·	·					·	·		·	Epidote : Secondary
B213	mu Quartzite	Schistose	◉	∘		○	·	∘							·						·				
C201	bi Gneiss	Equi-granular	○	○	·	○	∘			·			·	·	·						·	·	·	·	Myraekyte included Pyroxeme : Salite
C203	Amphibolite	Grano-blastic	∘	·		◉	∘	∘					·	·	·						·		·		
C208	bi-hb Granite	Grano-blastic	○	∘		○	∘		∘				·	·	·		∘				·	·	·	·	
C209	Hornblendite	Equi-granular				∘	·		◉				·		·						·				
C215	mu-bi Schist	Schistose	○	·		○	∘	·						·	·						·	·		·	
C216	mu-bi Schist	Schistose	○			∘	∘	·				○		·	·			·			·	·		·	
C217	mu-bi Schist	Schistose	○	?		○	∘	·						·	·			·	·		·	·		·	
C220	mu-bi Schist	Schistose	○	?		◉	∘	·						·	·			·			·	·			
C221	mu-bi Schist	Schistose	○	∘		○	∘	·						·	·			·			·	·		·	
C223	mu-bi Schist	Schistose	◉			○	∘	·						·	·						·				
C224	mu-bi Schist	Schistose	◉	·		○	∘	∘						·	·						·		·		
C229	Cortlandite	Poikilitic				·			◉	(Aug) ∘			·	·	·		·				·	·			
C232	bi Schist	Schistose	◉			○	∘				·			·	·						·				
C235	mu Quartzite	Schistose	◉	○		∘	·	∘						·	·			·			·				
C236	Pegmatite	Allotrio-morphic granular	○	○		○	·	·										·		·		·			
C240	bi Granite	Equi-granular	○	○	·	○	∘	·						·	·						·	·		·	Calcite : fine, veinlet
C243	bi Granite	Equi-granular	○	○	·	○	∘	·					·	·	·		·				·	·		·	
C244	bi Gneiss	Gneissose	◉	∘		○	∘							·	·	·		·			·				
C245	bi Granite	Equi-granular	○	○	·	○	·	·													·	·		·	
C249	Skarn	Grani-blastic	∘			○			∘				·	·	·	○					·	·		·	
A225	Dolerite	Porphyritic	Phenocryst:Augite, Orthopyroxene:Groundmass:Plagioclase, Augite, Magnetite, Apatite, Calcite:Secondary minerals:Chlorite, fine grained Muscovite:Opaque minerals																						

◉> ○> ∘> ·
50 25 1

SAMPLE C202

NAKED-EYE DESCRIPTION: light brown, fine-grained, equigranular.

NAME: biotite gneiss;

TEXTURE: gneissic;

MINERAL COMPOSITION:

MAJORS: quartz, plagioclase, alkali-feldspar, biotite, muscovite;

MINORS: sphene, apatite, zircon;

OPAQUES: present;

SECONDARIES: chlorite, epidote, fine-grained muscovite.

SAMPLE C201

NAKED-EYE DESCRIPTION: light brown, fine-grained, equigranular, gneissic structure.

NAME: gneissic biotite granite;

TEXTURE: gneissic;

MINERAL COMPOSITION:

MAJORS: quartz, alkali-feldspar, plagioclase, biotite;

MINORS: salite, sphene, apatite, zircon;

OPAQUES: present;

SECONDARIES: chlorite, fine-grained muscovite, limonite.

SAMPLE C203

NAKED-EYE DESCRIPTION: greenish gray, medium-grained, equigranular, gneissic structure.

NAME: amphibolite;

TEXTURE: granoblastic;

MINERAL COMPOSITION:

MAJORS: plagioclase, hornblende, quartz, biotite, muscovite, alkali-feldspar;

MINORS: sphene, apatite, zircon;

OPAQUES: present;

SECONDARIES: limonite.

SAMPLE C244

NAKED-EYE DESCRIPTION: gray, medium-grained, equigranular, gneissic structure.

NAME: biotite gneiss;

TEXTURE: gneissic;

MINERAL COMPOSITION:

MAJORS: quartz, plagioclase, biotite, alkali-feldspar;

MINORS: apatite, zircon, epidote, tourmaline;

OPAQUES: present;

SECONDARIES: none.

SAMPLE C245

NAKED-EYE DESCRIPTION: light brown, medium-grained, equigranular.

NAME: granite

TEXTURE: equigranular

MINERAL COMPOSITION:

MAJORS: quartz, alkali-feldspar, plagioclase, biotite, muscovite;

MINORS: sphene, apatite, zircon, calcite;

OPAQUES: present;

SECONDARIES: chlorite, fine-grained muscovite.

3) Age

Since there is no direct measurement done in rocks from this area, these rocks were correlated to those belonging to the Caico Complex. According to Jardim de Sa (1984a), this complex was probably originated in Archaean ages.

4) Stratigraphic Relationship

In this area, these rocks represent the lowermost unit.

(b) Equador Formation

1) Distribution

Rocks belonging to this Formation are distributed over the western portion of this area. In the northwestern portion, these rocks are part of the southern extension of a belt-like outcropping area of this Formation which extends from area "B" up to the locality known as Areia da Cobra. Within this survey area, this Formation makes up a N-S belt like structure with a width ranging between 3 to 5 kilometers. Another small outcrop (100 m x 1 Km) of this Formation is found along the Pinturas river, some 3 kilometers south of the Areia da Cobra locality. Moreover, in the southwestern portion nearby the Quixaba locality, rocks belonging to the Equador Formation crop out making up a N-S structure some two kilometers wide, which extends outward the survey area.

In areas "A" and "B", which are located to the north of the present survey area, rocks of this Formation makes up a mountainous topography featuring deep valleys and mean altitude around 600 meters. However, by entering area "C", this mean altitude drops to around 400 meters, and they plunge below the Serido Formation at the southern edge of this outcropping area. In areas "A" and "B", the dip of these rocks are about 40°, decreasing considerably after entering area "C", and it drops to around 10° near the southern contact with the Serido Formation. The outcrop along the Pinturas river seems to be a result of an uplift due to a fault.

2) Thickness

Ebert (1968) has estimated the thickness of this Formation in 800^{+} meters for the mid-southern part of the Rio Grande do Norte state. In this area, however, though the upper limit with the Serido Formation does crop out, the lower limit is unknown, so that it was not possible to estimate the thickness for this area.

3) Lithology

Quartzite, muscovite quartzite and feldspathic muscovite quartzite constitute the main lithologic types of this Formation. In some places, biotite is present is small amounts, and biotite schists similar to those belonging to the Serido Formation can be found intercalated with the quartzites. These schists, however, are harder and more resistant to weathering than those of the Serido Formation. When hit with a hammer, they usually break down into centimeter-thick plates along the schistosity. Samples representing this Formation where taken from nearby the locality called Xique-Xique, and from a place north of Logradouro, in the western and northern part of the area, respectively (Fig. II-4-3). These two samples were analyzed chemically and petrographically (Tab. II-4-1, Tab. II-4-2). The petrographic (thin section observations) descriptions are given below.

SAMPLE B213
NAKED-EYE DESCRIPTION: light brown, fine-grained, equigranular, schistose structure;
NAME: psammytic schist;
TEXTURE: schistose;
MINERAL COMPOSITION:
MAJORS: quartz, plagioclase, alkali-feldspar, muscovite, biotite;
MINORS: zircon;
OPAQUES: present;
SECONDARIES: none.

SAMPLE C235
NAKED-EYE DESCRIPTION: pale brownish gray, medium-grained, equigranular, schistose structure;
NAME: psammytic schist;
TEXTURE: schistose;
MINERAL COMPOSITION:
MAJORS: quartz, alkali-feldspar, plagioclase, muscovite, biotite;
MINORS: apatite, zircon, tourmaline;
OPAQUES: present;
SECONDARIES: none.

4) Age

Although there is no absolute dating data on these rocks, from the stratigraphic relationship with other units, this Formation seems to have been formed during the lower Proterozoic.

5) Stratigraphic Relationship

The contact of this Formation with the stratigraphically low Jucurutu Formation does not outcrop in this area, but has been described as concordant in other areas.

6) Depositional Environment

Rocks of this formation have been described as deposited during pre-orogenetic periods.

(c) Serido Formation

1) Distribution

These rocks are distributed widely over the entire area. The predominant direction is N-S, even though it was NE-SW in area "A" and NNE-SSW in area "B".

2) Thickness

Unknown.

3) Lithology

This Formation is predominantly constituted of mica-schists, containing also psammytic schists and calc-silicate rocks.

In the same way as in previous years, the Serido Formation is subdivided in three main units (pCssx1, pCssx2, pCssx4). The pCssx1 unit crops out in the central and northwestern portions of the outcropping area of the Serido Formation. This unit is mainly composed by biotite-schists, including small occurrences of garnet-biotite schist and cordierite-biotite schist. The pCssx2 unit is harder and finer, contains less biotite and is more siliceous than the pCssx1. It crops out as small spots within the outcropping area of the pCssx1 unit, showing NNE-SSW or NNW-SSE directions, roughly in the central part of the survey area. The pCssx4 unit occupies large portions in the eastern and western portions of the outcropping area of the Serido Formation. It consists of alternating layers of biotite schist, garnet-biotite schist and cordierite-biotite schist, each of them making up layers 10 centimeters to 2 meters thick.

The rocks belonging to the pCssx2 unit outcrop in the central part of the survey area, making up a N-S zone of about 3 kilometers wide. This zone is the southern prolongation of the fold zone which cross through the area "B" and also through area "C". Within area "B", the units pCssx1 and pCssx4 do separate clearly from each other, dividing roughly the area in two parts. In area "C", however, their relationship is rather complex, not allowing such a simple description.

The calc-silicate rocks (pCsscs) constitute layers some tens of meters thick, and they are concentrated nearby the contact between the Serido and the Jucurutu Formations. In this area, these rocks crop out making up small outcrops some meters to tens of meters in size. In some places, amphibolite layers do also occur in contact or close to these calc-silicate rocks. These calc-silicate rocks as well as the amphibolites outcrop in the Garganta mountain range, along the Pinturas river and in the area west of the Quixaba locality. Within area "B", the pCsscs unit does occur concentrated to the east of the fold zone crossing through the central part of the area. In area "C", however, this fact was not observed.

In order to carry out chemical analyses as well as thin-section petrographic observations, 16 different (at naked-eye sight) samples were collected representing the Serido Formation. Among these, 7 are from the pCssx1 unit, 2 from the pCssx2 unit, 4 from the pCssx4 unit, and 3 from the pCsscs unit (Fig. II-4-3).

Chemical analyses results (Tab. II-4-1) were plotted on a ACF diagram (Fig. II-4-4), and all them do concentrate in the compositional field of pelitic graywacke. In comparison with similar plots obtained last year, it is clearly noticeable that the rocks belonging to the Serido Formation within area "C" area shifted toward the A-C base of the diagram, which means that they contain less FeO+MgO+MnO.

The samples belonging to the pCsscs unit fall all within the basic rock field in the ACF diagram (Fig. II-4-4). Even though these rocks were named as calc-silicate rocks during the field works, it seems likely that they are all originated from basic rocks. Samples A229 and C 249 contains Ag, W and Be in reasonable amounts, while sample A222 contains, in addition to these elements, Mo in high quantities. It seems likely that these anomalous values are due to some kind of mineralization.

Petrographic descriptions (thin section observations) of each sample from the Serido Forma-

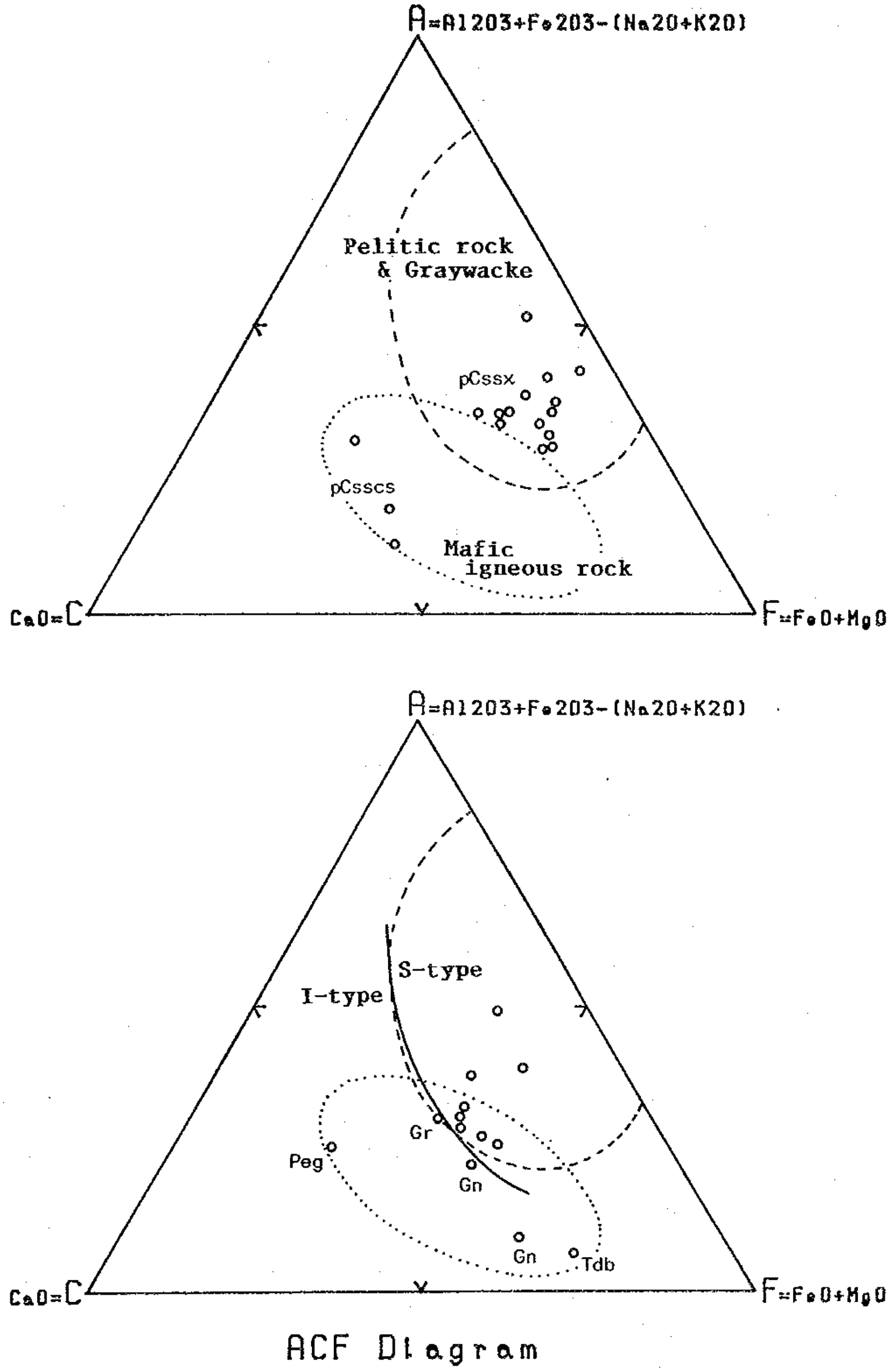


Figure II-4-4 ACF diagram drawn from the analytical data of rock samples in area C tion are given in Tab. II-2-2, and they were summarized as follow.

(1) Mica schist belonging to pCssx1 unit (A210, A216, A220, C215, C220, C223, C232);

NAKED-EYE DESCRIPTION: gray to dark gray, fine-to-medium grained, schistose structure;

NAME: muscovite-biotite schist, garnet-biotite schist;

TEXTURE: schistose;

MINERAL COMPOSITION:

MAJORS: quartz, plagioclase, biotite, (alkali-feldspar), (muscovite), (pinitized cordierite), (pyralspite);

MINORS: apatite, zircon, (sphene), (tourmaline), (sillimanite);

OPAQUES: present;

SECONDARIES: (fine-grained muscovite), (chlorite).

NOTES: brackets indicate those minerals that are not present in all samples.

(2) Mica schist belonging to pCssx2 unit (C221, C224);

NAKED-EYE DESCRIPTION: pale gray, fine-to-medium grained, schistose structure;

NAME: muscovite-biotite schist;

TEXTURE: schistose;

MINERAL COMPOSITION:

MAJORS: quartz, plagioclase, biotite, alkali-feldspar, muscovite;

MINORS: apatite, sphene;

OPAQUES: present;

SECONDARIES: (fine-grained muscovite), (chlorite).

NOTES: brackets indicate those minerals that are not present in all samples.

(3) Mica schist belonging to pCssx4 unit (A212, A218, C216, C217);

NAKED-EYE DESCRIPTION: gray to dark-gray, medium-to-coarse grained, generally contain large amount of biotite, and this mineral is found as inclusion in cordierite phenocrysts in sample C216;

NAME: garnet-cordierite-biotite schist, garnet-cordierite-biotite-muscovite schist, cordierite-biotite-muscovite schist, muscovite-biotite schist;

TEXTURE: schistose;

MINERAL COMPOSITION:

MAJORS: quartz, plagioclase, biotite, (alkali-feldspar), (muscovite), (pyralspite), (pinitized cordierite);

MINORS: zircon, apatite, (tourmaline), (sillimanite);

OPAQUES: present;

SECONDARIES: (fine-grained muscovite), (chlorite).

NOTES: brackets indicate those minerals that are not present in all samples.

(4) Calc-silicate rocks belonging to pCsscs unit (A222, C229, C249);

NAKED-EYE DESCRIPTION: greenish gray to dark green, fine-to-coarse grained, schistose structure, in sample A222 the presence of a green-colored copper mineral has been recognized;

NAME: two-pyroxenes granulite (A222), cortlandite (C229), skarn (C249);

TEXTURE: granoblastic, poikilitic;

MINERAL COMPOSITION:

MAJORS: [A222] hornblende, orthopyroxene, plagioclase, alkali-feldspar;
[C229] hornblende, augite, plagioclase;
[C249] plagioclase, quartz, hornblende;

MINORS: sphene, apatite, zircon, (epidote: C249), (calcite);

OPAQUES: present;

SECONDARIES: (chlorite), (fine-grained muscovite).

NOTES: brackets indicate those minerals that are not present in all samples.

Sample A222 was analyzed by X-ray diffractometry, and the results indicated that the clinopyroxene compositions vary from augite to diopside (Tab. II-4-3).

4) Age

According to Brito Neves (1983) these rocks were affected by the Transamazonico orogenic cycle (2200 to 1800 ma.). Based on such a consideration, these rocks can be concluded as being of lower Proterozoic age.

5) Stratigraphic Relationship

Rocks belonging to the Serido Formation overlay concordantly the Equador Formation. Interfingering between rocks of these two Formations can be observed in the eastern part of the Garganta mountain range as well as in the western part of the Gaviao mountain range. As previously mentioned, calc-silicate rocks and amphibolites do occur nearby the contact between the Serido and Equador Formations.

6) Sedimentary Environment

From their compositional characteristics, these rocks can be assumed as being originated from flysches composed of deep-ocean sediments like graywackes, argillites and turbidites.

(2) TERTIARY

(a) Serra dos Martins Formation

1) Distribution

Rocks belonging to this Formation crop out on mesas with altitude above 680 meters, mainly in the central part of the survey area. Each outcropping spot area is relatively small in size.

2) Thickness

In this area, even though thicknesses up to 50 meters have been confirmed, the actual thickness is unknown because the top of the mesas they support are always eroded.

3) Lithology

Within the present survey area, this Formation is mainly constituted by quartzose conglomerates, sandstones and argillaceous shales. These rocks frequently display a reddish coloration due to the presence of iron oxides.

One sample (A225) of this Formation has been collected from a place along the Elmo river, and it has been chemically and petrographically analyzed.

4) Age

Although no fossil has been found in rocks belonging to this Formation, the age of these

Table II-4-3 Mineral assemblages of samples determined by X ray diffraction

Number	Sumple number	Mineral names											
		Sericite/Montmolli Mixed layer	Sericite	Chlorite	Biotite	Quartz	Plagioclase	Augite ~Diopside	Actinolite	Epidote	Bravite	Hematite	Goethite
1	A−222						○	◎	o	o			
2	B−2642					◎						o	·
3	B−3040					◎					○		
4	B−3042			·		o					◎		
5	A−I−1, 81m		o	·		◎	○			○			
6	A−II−1, 41.7m			o	○	◎	○						
7	A−II−1, 46.3m			·	·	◎					○		
8	A−II−2, 68m	·				◎	◎						
9	A−II−3, 23m			·	○	◎	○						
10	A−II−3, 43m				○	◎	○						

◎>○>o>·

rocks is assumed as Tertiary from their relationship with other rocks in the neighborhood.

5) Stratigraphic Relationship

In this area, the Serra dos Martins Formation is laid discordantly on Proterozoic rocks.

6) Sedimentary Environment

According to Bigarella (1975, in Santos et al., 1984), these rocks have been deposited in a pediplain-type continental environment.

(3) INTRUSIVE ROCKS

Intrusive rocks in this area can be subdivide into those intruded during the Brasiliano orogenic cycle (pCgr3), those intruded in the post-Brasiliano times (Proterozoic to Palaeozoic) (pCpg) and those of Tertiary age (Tdb). The designation pCgr3 is due to Jardim de Sa (1981).

(a) pCgr3 Intrusives

These rocks are intruded in those belonging to the Caico Complex, and crop out in the south-eastern part of the present survey area, from the Capoeira do Luis to the Poco do Onca localities.

The dominant lithologic type consists of a gray to yellowish gray, fine to coarse grained, equigranular biotite granite.

Even though there is no absolute age determination for these rocks within the present survey area, based on petrographic characteristics they were considered as being Gr_3.

Samples C201, C240, C243 were collected from this intrusive body (Fig. II-2-3), and these samples were analyzed chemically as well as petrographically (Tab. II-4-1, Tab. II-4-2). A summarized description (thin section observation) is given below.

NAKED-EYE DESCRIPTION: gray to light brown, medium-to-coarse grained, equigranular.
Sample C201 is fine-grained and contains biotite in large amounts, showing many similarities with biotite schists of the Serido Formation;

NAME: biotite granite

TEXTURE: equigranular;

MINERAL COMPOSITION:

- MAJORS: quartz, alkali-feldspar, plagioclase, biotite, (muscovite);
- MINORS: (zircon), (sphene), (apatite), (epidote), (tourmaline);
- OPAQUES: present;
- SECONDARIES: (chlorite), (limonite).
- NOTES: brackets indicate those minerals that are not present in all samples.

(b) Pegmatites

Pegmatites in this area can be divided into those constituting dyke-like small scale bodies, and those which make up larger scale bodies. The biggest among the larger pegmatite bodies is located in the central part of the survey area, with an outcropping area 4 kilometers wide and 18 kilometers long. Other large pegmatite bodies are also found within this area, as that one to the west of this biggest pegmatite, where a large pegmatitic body extends from the state-road PB-288 to the Forte mountain range. Nearby the southwestern of the survey area, and around the Barra da Quixaba locality, situated between the biggest pegmatite body and the Picui city, two other large pegmatite bodies are found. One more large pegmatite body is found 2 kilometers east of the Picui city. Dyke-like pegmatites are found scattered all over the area. The orientation of these pegmatites are, in the northern and in the eastern parts of the survey area, almost parallel to the N-S foliation, while in the southwestern part they cross-cut the foliation in NE-SW direction. Moreover, around the large pegmatite body nearby the Barra da Quixaba locality, NNE=SSW oriented pegmatitic dykes can also be observed. The width of these dyke-like pegmatites ranges widely from some centimeters up to 10 meters. These pegmatites are generally short in length, reaching a maximum of approximately one kilometer. They dip generally at high-angles, but some with reasonably lower dip angles has also been observed.

These pegmatites are intruded in all units older than the Tertiary layers, but within the present survey area, pegmatites were not confirmed intruding the Gr_2 unit nor the Jucurutu Formation.

Several xenoliths including fragments of biotite schists are observed within the biggest pegmatite body in the central part of the survey area.

The major mineral constituents of these pegmatites are alkali-feldspar, quartz, plagioclase, muscovite, biotite, tourmaline and so forth. Other minerals like beryl and columbite-tantalite are also found in some bodies. Those bodies containing larger amounts of muscovite, columbite-tantalite and beryl have been frequently mined to a small scale.

The lower limit for the age of these rocks can be estimated, based on their relationship with the intruded rocks, as post-Brasiliano (orogenic cycle).

One sample of pegmatite (C236) and one of a xenolith within the pegmatite (A209) were collected and analyzed chemically as well as petrographically (Tab. II-4-1, Tab. II-4-2). Their petrographic descriptions (thin section observations) are given below.

A209: xenolith in pegmatite
NAKED-EYE DESCRIPTION: light brown, medium-to-coarse grained, equigranular.
NAME: two pyroxene granulite
TEXTURE: granoblastic;
MINERAL COMPOSITION:
- MAJORS: plagioclase, quartz, alkali-feldspar, ortho-pyroxene, pyralspite;
- MINORS: sphene, apatite;
- OPAQUES: present;
- SECONDARIES: chlorite, calcite, fine-grained muscovite;

A236: pegmatite
NAKED-EYE DESCRIPTION: light brown, coarse grained, inequigranular.
NAME: pegmatite
TEXTURE: inequigranular;
MINERAL COMPOSITION:
- MAJORS: quartz, plagioclase, alkali-feldspar, biotite, muscovite;
- MINORS: tourmaline;
- OPAQUES: none;
- SECONDARIES: fine-grained muscovite;

(c) Basalt

In the present survey area, these rocks are found intruding the Equador and the Serido Formations. They crop out in the western part of the survey area, northeast of the Xique-xique locality along the Elmo river; nearby Caicara and Serra Nova localities in the mid-northern part of the area; to the east of Olho dos Mendes locality in the mid-eastern part of the survey area. Their attitudes vary narrowly all over the area, from WNW-ESE to ENE-WSW, always dipping at high-angles. They are found frequently as concentration of small dykes some 10 centimeters to 2 meters wide.

One sample (A225) has been collected representing these basalts (Fig. II-4-3), and it was analyzed chemically as well as petrographically (Tab. II-4-1). Chemical results indicated a calc-alkaline composition for this sample. The petrographic (thin section observation) is summarized below.

A225: basalt
NAKED-EYE DESCRIPTION: dark-colored, fine-grained, massive;
NAME: dolerite
TEXTURE: porphyritic;
MINERAL COMPOSITION:
  PHENOCRYST: augite, ortho-pyroxene;
  MATRIX: plagioclase, augite, epidote, calcite, magnetite;
  OPAQUES: present;
  SECONDARIES: chlorite, fine-grained muscovite;

4-2-2 Geological Structure

(1) General Characteristics

The regional situating of area "C" has been discussed in previous (phase I and II) reports of this project, and also in Chapter 3 of Part I of this report. In the followings, therefore, the discussion will be restricted to those structures that occur within and/or are pertinent to area "C".

In areas "A" and "B", the general striking of layers are NNE-SSW, while in area "C", the Caico Complex in the eastern part as well as the Equador Formation in the western part are oriented close to N-S direction. Rocks belonging to the Serido Formation, on the other hand, do not show any characteristic striking. In this area, as in areas "A" and "B", pegmatites, faults and foliation show a strong structural control, striking mainly N-S in the northern half as well as in the eastern part, and predominantly NE-SW in the southwestern part of the area.

The Picui fault, which in the eastern part of the area makes up the contact between rocks belonging to the Caico Complex and those belonging to the Serido Formation, is a major east-dipping reverse fault constituting the division between the central and the oriental regional structural blocks. To the east of this regional reverse fault, some faults of smaller scale can be inferred. Also, in the central portion of the present survey area some small scale N-S faults were recognized. Among these, the westernmost faults seem to be prolongations of faults found in areas "A" and "B" that cross-cut the central part of the outcropping area of the Serido Formation, and mylonite zones have been recognized along some of them. In area "B", in some portions nearby the contact between the Equador and Serido Formations, NNE-SSW faults were observed, but no fault with similar characteristic has been found within area "C".

The above described faults are cut by WNW-ESE ~ N-S ~ ENE ^ WSW younger faults all over the area. Along some of these younger faults, Tertiary basalt dykes and quartz veins are intruded in some places. The faults these dykes and veins have intruded seem to be generally shorter in length than other similarly trending faults. In the western part of the survey area, the southern portion of a fault uplifted and led to repetition of rocks belonging to the Equador Formation. NE-SW faults were also recognized nearby the contact between the Caico Complex and the Serido Formation, as there have been observed in area "B".

The fold zone extending from that crossing through area "B" crosses also through the central part of the present survey area oriented in N-S direction. This zone shows a width of about three kilometers, and several smaller foldings oriented NNE-SSE ~ N-S ~ NNW-SSE are observed in its central portion. These smaller scale foldings are around one kilometer wide and 2 to 3 kilometers long. Moreover, a large pegmatite body is observed intruded along the eastern edge of this fold zone. Similarly to area "B", the pCssx2 unit crops out mainly within this fold zone, making up small outcrops. Small scale foldings are also found within the Equador Formation, which regionally show an anticlinal structure plunging southwards.

Concerning to the foliation, as above quoted, they are generally oriented parallel to the major structures, but their dip varies from about 30° in the eastern part of the area to smaller values westwards.

In the southwestern part of the present survey area, pegmatites show a somewhat different direction, being commonly oriented in NE-SW direction, cross-cutting the N-S foliation.

(2) Geological Structures and Mineralization

Apart from those related to pegmatites, no clearly defined mineralization has been recognized within the present survey area, so that it was not possible to draw any specific conclusion concerning to the relationship between mineralization and geological structures.

4-2-3 Mineralization and Metamorphic Alteration

(1) Mineralization within Area "C"

Tungsten associated to skarns, niobium-tantalum associated to pegmatites, alluvial gold and niobium-tantalum are the mineral deposits recognized within the present survey area. The main deposits are plotted in Fig. II-4-5.

Concerning to gold mineralization, there have been reports on occurrences of auriferous quartz veins (CPRM, 1980) in the mid-western part of the survey area, but they could not be confirmed during the field works. Reports on alluvial gold occurrences are all due to local small miners, and for the time being there is no deposit been mined. It was not possible, therefore, to obtain actual information on the size and contents on these occurrences.

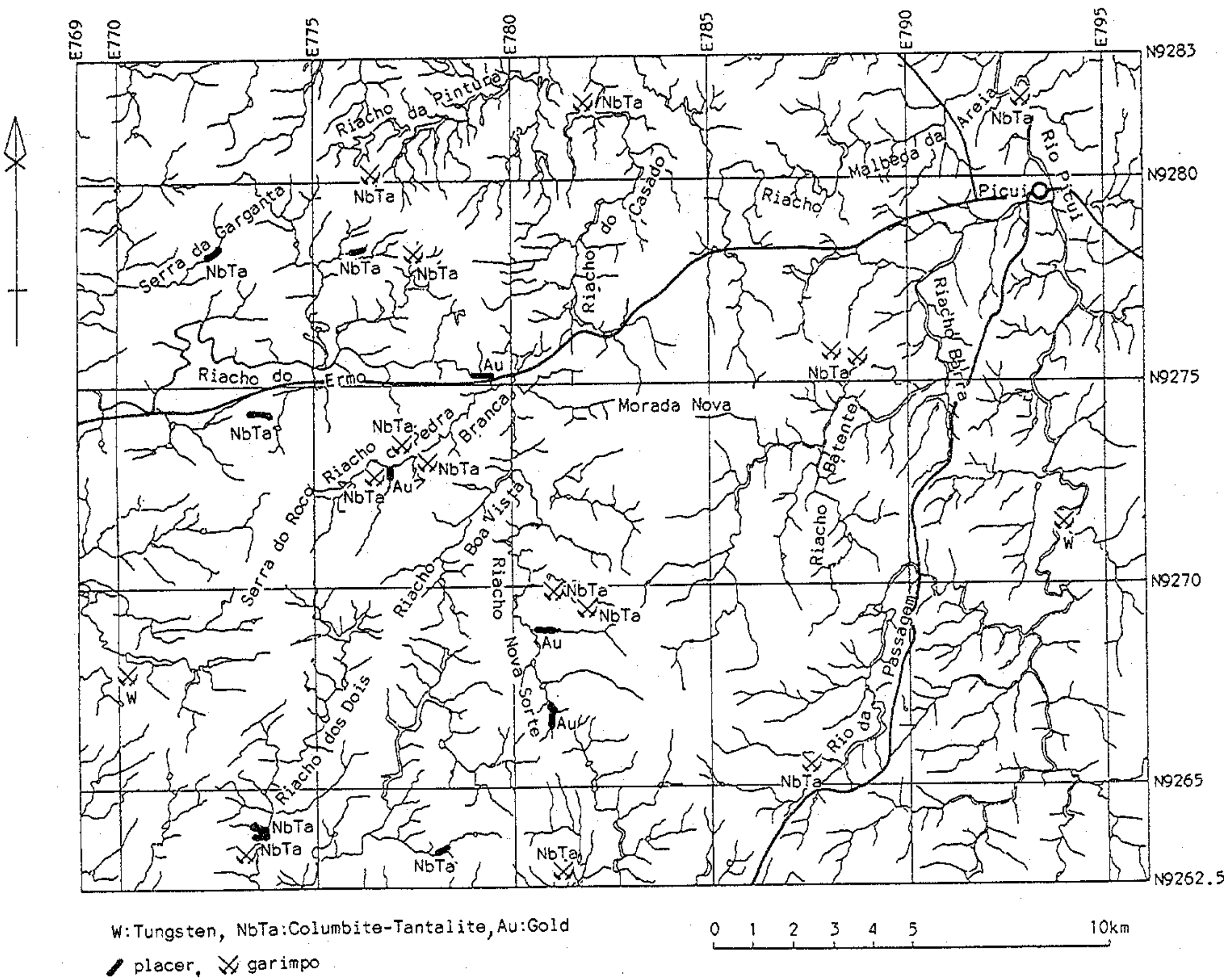


Figure II-4-5 Location of mines and mineral showings in area C

Tungsten deposits were recognized in the southwestern and in the mid-eastern parts of the survey area. The southwestern deposit is positioned within the Serido Formation, while the mid-eastern one is nested in the Caico Complex. The southwestern tungsten deposit is located within rocks belonging to the Serido Formation nearby the contact with the Equador Formation, and is associated with calc-silicate rocks. The mid-eastern tungsten deposit is found within gneiss containing amphibolites, and shows a vein-type structure oriented in N-S direction. Based on observations on excavated portions, the vein width is estimated to few centimeters, but no information on their concentration or quality could be obtained.

Niobium-tantalum deposits associated to pegmatites are scattered all over the entire area. Almost all these deposits have been and/or are being mined by small miners known as "garimpeiros", so that their locations can be easily identified. However, only few information is available concerning to the size and quality of these deposits.

(2) Minor Elements Contents

Rock samples previously described were analyzed for the same elements utilized in the geochemical survey. Results for Ta, Sn and Ag were all below the detection limit. Apart for sample C122, all other samples also yielded W contents below the detection limit (Tab. II-4-1). Except for 7.9 % obtained for a Tertiary basalt sample, all other Fe contents are within 2.0 and 5.8 %, showing no clear relationship with rock types. Sample C122 was collected from within the pCsscs unit in the northeastern part of the survey area, and according to the thin-section petrographic description, it constitutes a garnet amphibolite. As it can be concluded from the obtained analytical results discussed below, Sn, Be and Au contents of this sample are all higher than those found in other samples, indicating that this rock has been subjected to a kind of mineralizing process.

(a) Gold (Au)

Gold contents above the detection limit were obtained from biotite schists belonging to the Serido Formation (0.9 and 0.3 ppb), calc-silicate rocks (5 and 15 ppb), a quartzite belonging to the Equador Formation (0.6 ppb) and from a granite sample (G_3 (6 ppb). All other samples yielded contents below the detection limit of 0.5 ppb.

As described in the followings, the gold contents of the two calc-silicate rock samples (A222, C249) are not that high, but their contents of silver, molybdenum, tungsten, beryllium, etc. are all very high, indicating that these rocks were subject to some kind of mineralizing process.

Gold contents in biotite schist samples belonging to the Serido Formation are usually lower than those obtained for similar rocks in area "A" and "B", and most of samples yielded contents below the detection limit.

(b) Silver (Ag)

High silver contents (33.7 and 1.6 ppm) have been found in two samples, a calc-silicate rock (A-222) and a xenolith sample from within a pegmatite (A209), respectively, while all other samples yielded contents between 0.1 and 0.4 ppm. Compared with silver contents obtained in samples collected in areas prospected in Phases I and II (maximum of 0.2 ppm), these values are quite high, and possibly indicate that at least the two samples above mentioned were subjected to some kind of mineralization.

(c) Iron (Fe)

Iron contents ranged from 1.13 % to 9.82 %. The highest value of p.82 were obtained from a Tertiary basic dyke sample.

(d) Manganese (Mn)

Sample C229, a calc-silicate rock, yielded the maximum content of 3067 ppm, while other sample contents ranged from 100 to 2000 ppm. These results are in accordance with those obtained in Phases I and II, with manganese showing the highest concentration among the analyzed elements.

(e) Molybdenum (Mo)

Calc-silicate rock samples (A222, C249) yielded the highest values (432 and 22 ppm, respectively). Also, one granite sample (C243) and one sample of a xenolith within a pegmatite (A209) yielded 12 and 20 ppm, respectively. From these results, it can be inferred that the rocks represented by sample A222 were subjected to some kind of mineralization.

(f) Tungsten (W)

Samples A222 and C249 representing calc-silicate rocks yielded high contents of 2030 and 1150 ppm, respectively. These two rock samples seem to have been subject to a mineralizing process linked to skarnization. Sample A225, which were collected from a basic rock dyke, yielded also a high tungsten content of 1037 ppm, but does not show any other evidence of mineralization. The xenolith from within a pegmatite as well as a granite sample yielded contents of 573 and 504 ppm, respectively, and both seem to have been subjected to a mineralizing process.

(g) Tin (Sn)

All samples yielded low contents below 9 ppm. No correlation with rock types could be determined.

(h) Niobium (Nb)

Two somewhat high values were obtained from a biotite schist sample representing the Serido Formation, collected around the central part of the survey area (C224: 42 ppm), and from a basalt sample representing a basaltic dyke, collected in the northwestern part of the present survey area (A225: 67 ppm). Niobium shows no correlation with other elements.

(i) Tantalum (Ta)

All samples yielded tantalum contents below the detection limit.

(j) Beryllium (Be)

Obtained beryllium contents are generally lower than 2 ppm. Samples representing calc-silicate rocks (A222 and C249) show high contents of 268 and 272 ppm, respectively, indicating effects of some kind of mineralization. Pegmatite samples are usually expected to yield high beryllium contents, but sample C236 yielded a content of only 9.8 ppm. One possible explanation for this low content is based on the fact that beryllium in pegmatites does usually concentrate in some minerals like the beryl, which were not identified in sample C236.

(k) Lithium (Li)

As in areas prospected in previous phases (I and II) of this project, biotite schist yielded lithium contents higher than other rocks. Sample A212 and C216 yielded 100 and 109 ppm of lithium, respectively, in contrast with all other samples, which yielded contents lower than 80 ppm. These lithium contents seem to be reflecting the rock compositions themselves, rather than any kind of mineralization.

(l) Arsenic (As)

The majority of the results are lower than 1 ppm, with a maximum value of 2 ppm. Sample A222, which has been considered as representing mineralized rocks based on contents of other elements, does yield an arsenic content of 2 ppm only. It seems, therefore, that the mineralization which affected the rocks represented by this sample did not have arsenic associated.

(m) Antimony (Sb)

Most of the samples yielded contents lower than the detection limit of 1 ppm, and the maximum obtained value was 4 ppm. A calc-silicate rock sample (A222) and a granite sample (C240) yielded 4 and 3 ppm, respectively, but these values are quite low, and are probably not related to any mineralizing process.

4-3 DISCUSSION

4-3-1 Geology and Geological Structures

In the same way as in previous areas, the Serido Formation has been subdivided into pCssx1 and pCssx4 units as the boundary between these two units is clearly defined. In areas "A" and "B", this boundary was oriented roughly in N-S direction, and located in the central portion of the survey areas. In area "C", however, this boundary though clear is not that simple. That is, in areas "A" and "B", the pCssx4 was laid in the eastern portion while the pCssx1 was laid in the western, but in area "C", this "side-relationship" does not exist anymore. Moreover, in area "A" and "B", the pCsscs unit was frequently intercalated in rocks belonging to the western part of the pCssx4 unit, but this intercalation has not been recognized within area "C". Also, in the western parts of areas "A" and "B" nearby the contact between the Equador Formation and the pCssx1 unit of the Serido Formation, thin layers of the pCsscs unit mineralized to tungsten were frequently observed intercalated within the pCssx1 unit. In area "C", however, these mineralized pCsscs thin layers were observed intercalated within the pCssx4 unit. From these observations, it can be concluded that units pCssx1 and pCssx4, though formed in different environments, do not have a significant difference in age.

In the central portion of area "C", the N-S oriented pCssx1 unit shows an "finger" into the pCssx4 unit, which is probably related to the fact that this occur within the southern prolongation of the fold zone observed in area "B".

A major characteristic of this area is, without doubt, the occurrence of the big pegmatite body, which is intruded roughly in N-S direction along the eastern boundary of the fold zone above quoted. Other smaller pegmatite bodies are observed in areas to the west, southwest and east of this large pegmatite. Considering the orientation of these intrusive bodies, specially the smaller one located southwest of the big pegmatite body which is oriented in NE-SW direction, a different structural environment from those of area "A" and "B" seems to have prevailed in area "C".

Concerning to faults, two main sets have been recognized: NNE-SSW ~ N-S, WNW-ESE ~ ENE-WSW. The NNE-SSW to N-S set of faults are restricted to the eastern half of the survey area, while the other set occur throughout the entire area. The NNE-SSW ~ N-S set of faults seems to be prolongations of those observed in areas "A" and "B", and older than the other set. Basaltic dykes are intruded along some of the WNW-ESE ~ ENE-WSW faults.

Chemical analysis results indicated that few or almost no gold is included in rocks belonging to the Serido Formation outcropping within area "C", in contrast with results obtained for area "B" in previous Phase (1 to 9 ppb). Moreover, rocks belonging to the pCsscs unit could be inferred to contain large amounts of basic materials in addition to calcareous ones, and it could be concluded that these rocks contain gold and arsenic in much higher concentrations than other units of the Serido Formation. It is interesting that the NNE extension of the zone which contains large amounts of calc-silicate rocks coincides with that arsenic anomalous zone found within the area prospected last year.

4-3-2 Mineralization

Apart from the mineralizations related to pegmatites and tungsten deposits associated to the pCsscs unit of the Serido Formation, no other clear mineralization could be detected within area "C". Concerning to gold mineralization, although the locations were alluvial gold was dug out were known, no clear mineralization was recognized in neighboring areas.

As it will be referred to later, gold anomalies have also been recognized from stream sediment geochemical survey, but the anomalies in the present survey area are all relatively weak compared to those found in areas "A" and "B".

Chapter 5 - Geochemical Survey in Area "C"

5-1 STREAM SEDIMENT GEOCHEMICAL SURVEY

5-1-1 Objectives

The stream sediment geochemical survey in area "C" (500 Km^2), located on southern extension of the area prospected in Phase II, was aimed at selecting promising areas for auriferous deposits by understanding the distribution and behavior of mineralization-related elements.

5-1-2 Methodology

(1) Collection and Preparation of Samples

Altogether, 807 stream sediment samples were collected (Fig. II-5-1, Pl. II-5-2). The mean sampling density was around 1.6 samples/km^2, but samples were collected with somewhat lower density in the eastern granitic area, the western area where the Equador Formation crops out, and in the areas where pegmatitic rocks predominate.

The usual sample collection procedures were to collect stream sediment up to a depth of 10 centimeters from the bottom surface of the stream and sift it to separate materials under 80 mesh. The 80 mesh-under fraction was then quartered until a fraction of approximately 50 grams was obtained. Additionally to sample collection, information concerning to the surrounding geology, the stream magnitude, and the granulometry of sediments has also been recorded.

(2) Chemical Analysis

After roughly adjusting their weight, the samples were sent to the brazilian GEOSOL (Geologia e Sondagens Ltda) laboratory to be analyzed for the following 13 elements: Au, Ag, Fe, Mn, Mo, W, Sn, Nb, Ta, Be, Li, As and Sb. The analytical method together with its detection limit for each analyzed element are given in Tab. II-3-1, while the analytical results are listed in the Appendix 3. Comparing these results with those obtained in the area prospected last year, it is evident that the overall concentrations of the analyzed elements are higher in rocks of area "B" than those of area "C".

(3) Data Processing

Singlevariate Analysis: The analytical results were input in a HP-9000 series computer and statistically processed by using a software package developed by Bishimetal Exploration Co. Half of the detection limit value was used to input those values lower than the detection limit (in the case of Au, 0.2 ppb were input for samples with Au content lower than the detection limit of 0.5 ppb) in order to overcome practical problems. Basic statistical results as well as the correlation factor between each pair of elements are listed in Tab. II-5-1 and Tab. II-5-2, respectively. Silver and antimony analyses of more than 99.9 % of the samples yielded contents below the detection limit, so that the numbers shown in the tables are meaningless. Fe-Mn and Ta-Nb yielded high correlation factors of 0.74 and 0.567,

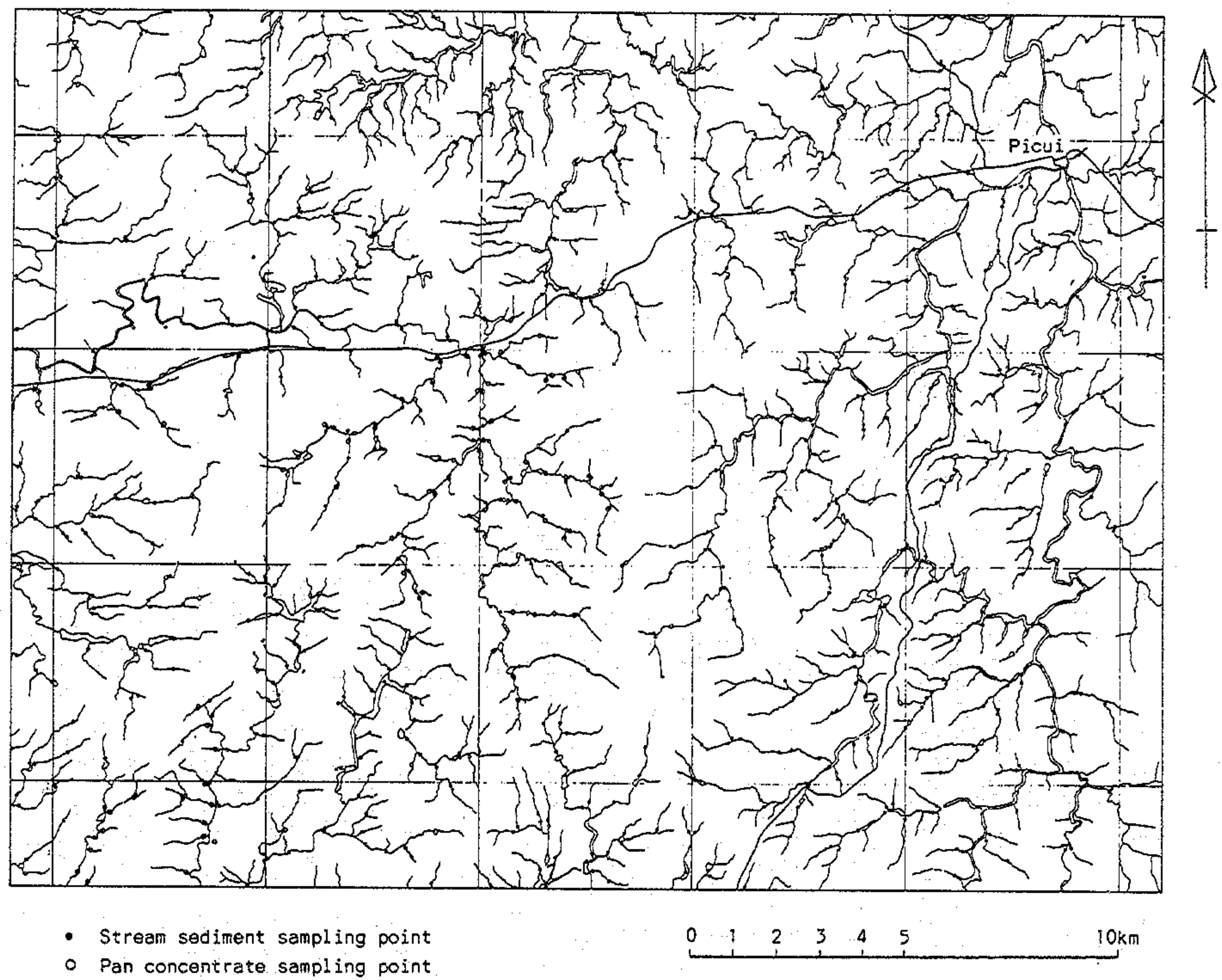


Figure II-5-1 Location of stream sediments and pan concentrates

Table II-5-1 Summary of statistical studies of stream sediment analytical data

Elements	Mean	Variance	Standard deviation	Minimum	Maximum	Below detection limit (%)
Au (ppb)	0.246	0.119	0.344	0.200	63.000	93.1
Ag (ppm)	0.100	0.000	0.021	0.100	0.400	99.9
Fe (%)	3.279	0.030	0.173	0.510	18.580	none
Mn (ppm)	1036.945	0.057	0.239	89.000	7386.010	none
Mo (ppm)	0.578	0.026	0.162	0.500	4.000	84.8
W (ppm)	5.246	0.016	0.125	5.000	268.000	96.5
Sn (ppm)	2.149	0.090	0.299	1.000	19.000	40.6
Nb (ppm)	23.147	0.140	0.374	5.000	680.000	11.8
Ta (ppm)	5.799	0.051	0.226	5.000	270.000	90.8
Be (ppm)	22.837	0.032	0.180	6.900	372.900	none
Li (ppm)	26.369	0.041	0.201	5.000	86.000	none
As (ppm)	1.381	0.054	0.233	0.500	4.000	15.5
Sb (ppm)	0.500	0.000	0.011	0.500	1.000	99.9

Table II-5-2 Correlation coefficient among thirteen elements in stream sediments

Elements	Au	Ag	Fe	Mn	Mo	W	Sn	Nb	Ta	Be	Li	As	Sb
Au	1.000												
Ag	-0.009	1.000											
Fe	0.030	0.035	1.000										
Mn	0.072	0.107	0.740	1.000									
Mo	0.026	-0.014	-0.178	-0.159	1.000								
W	0.044	-0.006	0.086	0.076	0.023	1.000							
Sn	-0.005	-0.039	0.085	-0.033	0.049	0.101	1.000						
Nb	0.052	-0.024	0.358	0.488	-0.001	0.162	0.198	1.000					
Ta	0.092	-0.010	0.209	0.313	-0.008	0.129	0.107	0.567	1.000				
Be	0.021	-0.032	0.097	0.012	0.066	0.127	0.316	0.318	0.233	1.000			
Li	0.024	0.024	0.443	0.220	-0.104	0.005	0.104	0.037	0.015	0.360	1.000		
As	0.018	0.024	-0.007	-0.033	-0.102	-0.093	-0.089	-0.104	-0.008	0.043	-0.029	1.000	
Sb	-0.009	-0.001	-0.018	0.001	0.052	-0.006	-0.039	0.000	-0.010	-0.010	0.007	-0.067	1.000

Table II-5-3 EDA analysis of stream sediment analytical data

Elements	Median	Lower fence	Lower wisker	Lower hinge	Upper hinge	Upper wisker	Upper fence	Upper fence or more (%)
Au (ppb)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	6.9
Ag (ppm)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0
Fe (%)	3.35	0.39	2.46	2.67	4.19	4.54	6.47	2.7
Mn (ppm)	1025	-307.5	669	735	1430	1598	2472.5	5.7
Mo (ppm)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	15.2
W (ppm)	5	5	5	5	5	5	5	3.5
Sn (ppm)	3	-3.5	1	1	4	4	8.5	1.2
Nb (ppm)	22	-18	13	15	37	45	70	10.0
Ta (ppm)	5	5	5	5	5	5	5	9.2
Be (ppm)	22.5	-2.05	15.8	17	29.7	32.5	48.75	2.6
Li (ppm)	27	-5.5	18	20	37	40	62.5	1.9
As (ppm)	2	-0.5	1	1	2	2	3.5	0.01
Sb (ppm)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0

Table II-5-4 Factor analysis of stream sediment analytical data

Elements	Factor 1	Factor 2	Factor 3	Factor 4	Communality
Au	-0.023	0.377	0.098	-0.522	0.4252
Ag					
Fe	0.823	0.173	0.210	0.113	0.7648
Mn	0.763	0.355	-0.057	0.192	0.7342
Mo	-0.226	0.050	0.027	0.133	0.0722
W					
Sn	-0.033	0.242	0.464	0.239	0.3318
Nb	0.226	0.729	0.129	0.310	0.6959
Ta	0.103	0.809	0.135	-0.167	0.7109
Be	-0.055	0.126	0.541	0.067	0.3157
Li	0.230	-0.089	0.486	-0.170	0.3263
As	-0.006	-0.027	-0.026	-0.142	0.0215
Sb					
Contributions	32.5%	35.4%	19.0%	13.1%	

respectively.

The boundary values to define anomalous areas were obtained by utilizing the EDA method (Exploratory Data Analysis, Lurzul, H. (1988)). A histogram and a boxplot were drawn for each analyzed element (Fig. II-5-2(1) ~ (4), Tab. II-5-3), and the upper fence value of this boxplot was taken as the boundary value to define anomalous areas.

Multivariate Analysis: Based on factor analysis, the relationship of each element with mineralization or with features of rocks outcropping in the surroundings has been examined. The factor axis of the initial factor loading matrix was rotated according to the Varimax method. This analysis was carried out for ten elements, namely Au, Fe, Mn, Mo, Sn, Nb, Ta, Be, Li and As. The other three elements (Ag, W and Sb) were not processed because the number of samples with contents lower than the detection limit exceeded 95 %.

Results of this multivariate analysis are listed in Tab. II-5-4 in the form of factor loading coefficients, communality and factor contribution coefficients. By examining the factor loading and contribution coefficient values, it can be concluded that the strength of contribution decreases in the order of the factors of Fe-Mn, Ta-Nb, Be-Li-(Sn) and Au. Moreover, factor scoring was calculated for each sample in relation to these four factors. The relationship of statistical results with geology and mineralization was then examined for those samples which yielded factor scoring higher than 1.

5-1-3 Results

(1) Anomalies of Each Element

Except for silver and antimony, geochemical anomaly maps were drawn for each of the analyzed elements, based on results of singlevariate analysis.

(a) Gold (Au)

Gold contents ranged between those lower than the detection limit of 0.5 ppb to a maximum of 63 ppb. Since 93.1 % of the samples yielded Au contents lower than the detection limit, all samples with Au contents above this limit should normally be considered anomalous, but in order to keep coherence with the results of previous phases, this lower boundary value was set to 1 ppb. Just three samples yielded gold contents between 0.5 and 1 ppb, so that there seems that no real loss of information did occur with this assumption. Also, only six samples yielded Au contents higher than 10 ppb (Appendix 2).

These anomalous values are quite scattered over the entire survey area, but they are somewhat concentrated in the following three topographic regions (Fig. II-5-3(1)).

1) The area enclosed by the Ermo and Casado streams, nearby the central part of the survey area. The streams within this area are originated in the same group of mountains. Pegmatites are largely distributed in higher portions of this group of mountains.

2) The southern portion of the Garganta range, in the northwestern part of the area. Although made up by only two anomalous points, they are located along the same stream. In the upstream, thin layers of calc-silicate rocks are observed in the vicinity of the contact between the Equador and Serido Formations.

3) Nearby the central part of the western limit of the survey area. This anomalous area is also defined by only two points, which are located along the same stream. Similarly to the previous area, in the upstream, thin layers of calc-silicate and amphibolitic rocks are observed near the contact between the Equador and Serido Formations.

The highest content of 63 ppb was obtained in a sample collected in the western portion of the Malhada da Areia stream, but no other anomalous point was observed in the surroundings. Moreover, nearby the southwestern limit of the survey area, one anomalous point stands alone, but gold grains have been observed in pan concentrates of sediments taken from an adjoining stream.

(b) Iron (Fe)

Fe contents ranged from 0.51 % to a maximum of 18.58 %. Based on statistical processing, the upper fence was set to 6.47 %. The anomalous points do not show any clear trend, being distributed rather scattered (Fig. II-5-3(2)). However, except for one point in the Ermo stream, all other anomalous points are located within the distribution area of rocks belonging to the Serido Formation. Among the analyzed elements, iron yielded the highest concentrations, a result that is more than obvious by considering that Fe is a major constituent element of rocks outcropping in this area. In the area "B" prospected last year, the iron anomalous zone showed a N-S oriented trend along the fold zone in the central part of that area, but no such a feature could be singled out in the present survey area.

(c) Manganese (Mn)

Mn contents ranged from 89 ppm to a maximum of 7386 ppm. The obtained upper fence value was 2472.5 ppm. The anomalous points do not concentrate within topographic zones, being distributed rather scattered (Fig. II-5-3(2)). However, it seems interesting that the distribution area of these manganese anomalous points are roughly coincident with the distribution of rocks belonging to the Serido Formation. These features seem to be reflecting the actual composition of rocks outcropping in this area (see Table II-4-1). For example, in the mid-southern part of the survey area, samples containing more than 5000 ppm of manganese are roughly concentrated, and cordierite-garnet-biotite schist is the only outcropping rock type. The correlation factor between iron and manganese is as high as 0.74, and this can also be observed in the overlapping distribution areas of their anomalies, except for the area to the northeast and southwest of the Morada Nova locality.

(d) Molybdenum (Mo)

Molybdenum contents ranged from those lower than the detection limit of 1 ppm to a maximum of 4 ppm. These results are, as a whole, lower than those obtained in area "B". Samples with Mo content lower than the detection limit amounted to 84.8 %, which is quite higher than that obtained for samples from area "B" (36.7 %). With high amount of samples with contents lower than the detection limit like this, an usual practice is to consider all samples with concentrations higher than the detection limit as anomalous. However, in the anomaly map for molybdenum, only those points with Mo contents higher than 2 ppm were plotted, in order to keep coherence with previous works. It should be emphasized, however, the plot which includes all points higher than 1 ppm shows the same features as the plot including only points higher than 2 ppm. According to these maps, the anomalous points do concentrate around the distribution area of pegmatites, particularly in the eastern portion (Fig. II-5-3(3)). Another anomaly is observed in the area south of the Picui city, but since in this area only rocks belonging to the Caico complex and to the Serido Formation are distributed, no clear correlation between country rock type and molybdenum anomaly can be advocated.

Tungsten (W)

96.5% of the analyzed samples yielded tungsten contents lower than the detection limit of 10 ppm, while the highest content observed reached 268 ppm, so that all values higher than the detection limit were taken as anomalous. Most of the anomalous points are distributed nearby the contact zone between the Serido Formation and the Caico complex, or within the outcropping area of rocks belonging to the Caico complex, in the eastern part of the survey area (Fig. II-5-3(3)). Some points do also scatter in the western part of the area. Among these western anomalous points, those located in the eastern and northeastern portions of the Garganta range do lay along the same drainage basin. In the upstream of this basin, calc-silicate rocks have been observed, and these results suggest that they should be mineralized. However, all high tungsten values (34, 57, 81 and 268 ppm) are located in the eastern anomalies, and the samples which yielded values of 57 and 268 ppm are both located on a stream originated on rocks belonging to the Caico complex. The high value of 81 ppm was obtained in a sample collected in the eastern portion of the Valente stream, but it was not observed any kind of rocks showing even traces of mineralization in this area or in the upstream.

Tin (Sn)

Tin contents ranged from those lower than the detection limit (2 ppm) to a maximum of 19 ppm. 40.6 % of these samples yielded contents lower than the detection limit. The upper fence value obtained from statistical processing was 8.5 ppm.

The anomalous points are concentrated in a zone around the Morada Nova locality, in the central part of the survey area. Pegmatites occur frequently in the surroundings (Fig. II-5-3(5)).

Niobium (Nb)

Niobium contents ranged from those lower than the detection limit (10 ppm) to a maximum of 680 ppm. Concentrations lower than the detection limit comprise 11.8 % of the obtained values. Statistical results indicated an upper fence of 70 ppm, and values higher than this lower boundary occur scattered throughout the survey area, except in the western part. Apart from the southwestern portion, the distribution area of anomalous points roughly overlaps that of pegmatites (Fig. II-5-3(4)). Although the close spacial relationship between niobium anomalies and pegmatite occurrences seems quite obvious, the southwestern portion is rich in pegmatites but shows no niobium anomaly. One possible explanation is related to the fact that the pegmatites in this southwestern portion have a somewhat different direction (NE-SW) compared to those occurring in other areas (N-S), meaning that they may not belong to the same generation, and so, may have different chemical compositions.

Moreover, N-S, NE-SW and NW-SE oriented pegmatites do occur nearby the eastern portion of the Batente stream, in the mid-eastern part of the survey area, but no anomaly has been recognized in the vicinity. As shown in table ??, niobium concentrations are much more higher than those of tantalum all over the, and this may probably be reflecting the actual composition of the original rocks.

(h) Tantalum (Ta)

Tantalum contents ranged from those lower than the detection limit of 10 ppm to a maximum of 270 ppm, and 90.8 % of these contents are below the detection limit. All values higher than the detection limit were therefore taken as anomalous.

The distribution of tantalum anomalies are almost identical to that of niobium anomalies (Fig. II-5-3(4)), a result that can be considered quite obvious given that, in the same way as niobium, tantalum-bearing minerals are closely associated to pegmatites.

(i) Beryllium (Be)

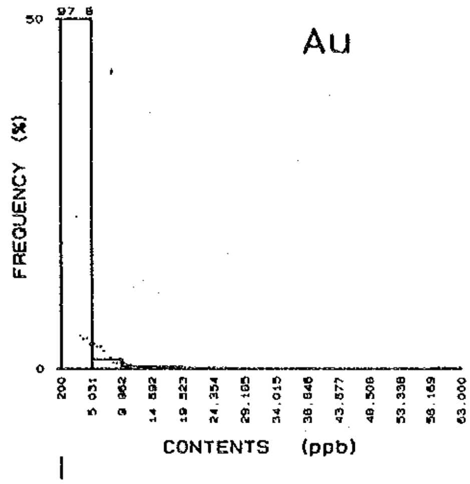
Beryllium contents ranged from 6.9 ppm to a maximum of 372.9 ppm. These values are quite high compared with those obtained for rocks collected last year in area "B", of which 35.9 % yielded contents lower than the detection limit with a maximum content of 78 ppm. In the present survey area, the calculated upper fence value was 48.75 ppm, and all samples with concentrations higher than this value were taken as anomalous. Some of these anomalous points do concentrate around the Morada Nova locality, while others are rather scattered (Fig. II-5-3(5)). In the area around the Morada Nova locality, as quoted previouly, pegmatites are quite frequently exposed, a fact that seems to be closely related to the occurrence of beryllium anomalous zones in the vicinity.

(j) Lithium (Li)

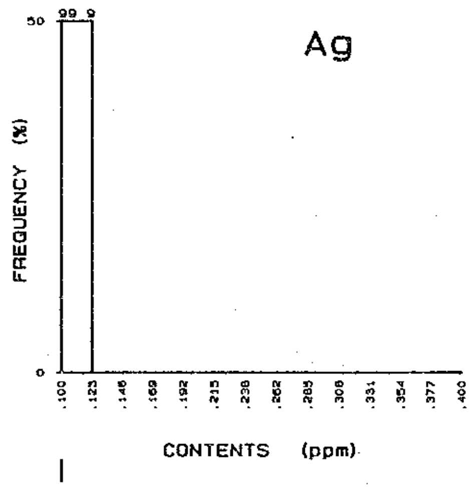
Lithium contents ranged from 5 ppm to a maximum of 86 ppm, which are very close to the range obtained in area "B". All values higher than the upper fence value (62.5 ppm) were taken as anomalous, and they do concentrate mainly in the northern half of the survey area. Anomalous points are specially concentrated in a zone northeast of the Picui city, which seems to be an extension of a similar zone found in area "B". These lithium anomalies seems to occur mainly in streams originating and/or crossing through gneisses belonging to the Caico complex, but apart from the anomalous zone nearby the Picui city, anomalous points are rather scattered (Fig. II-5-3(5)). Two anomalous points in the northern portion of the Casado stream are relatively close to each other, but the neighboring lithology is constituted mainly by rocks belonging to the Serido Formation. Lithium is known to be mainly concentrated in micas. Accordingly, rock analyses revealed that high lithium contents are mainly due to rocks belonging to the Serido Formation. Some high lithium contents were also found in granite samples collected in the southeastern part of the area, which may be related to some high lithium values found sparsely in stream sediments collected in the neighborhoods.

(k) Arsenic (As)

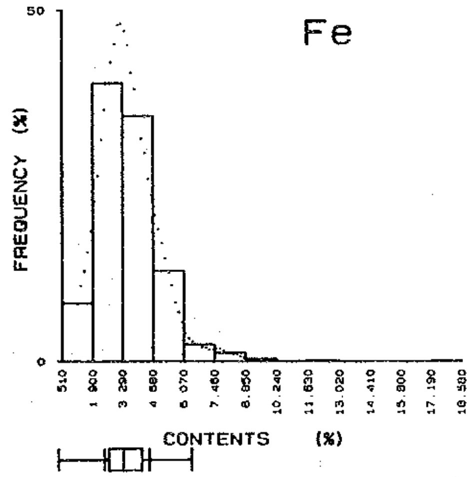
Arsenic contents ranged from those lower than the detection limit (1 ppm) to a maximum of 4 ppm. 15.5 % of the analyzed samples yielded contents lower than the detection limit. Given that 88.2



MEDIAN	:	.20
L.HINGE	:	.20
U.HINGE	:	.20
L.WHISKER	:	.20
U.WHISKER	:	.20
L.FENCE	:	.20
U.FENCE	:	.20

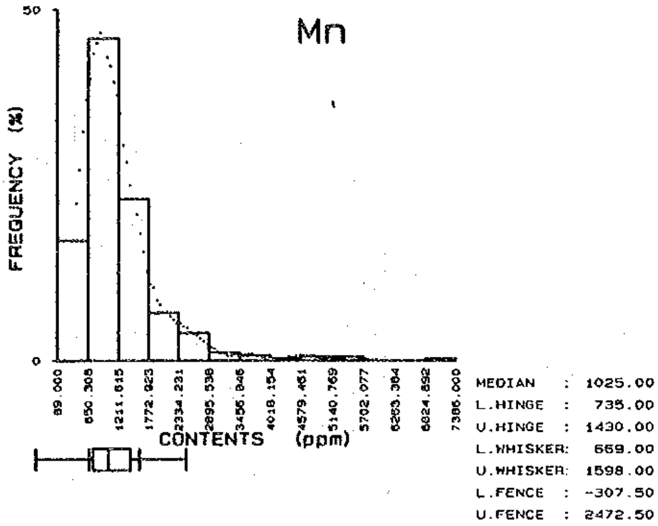


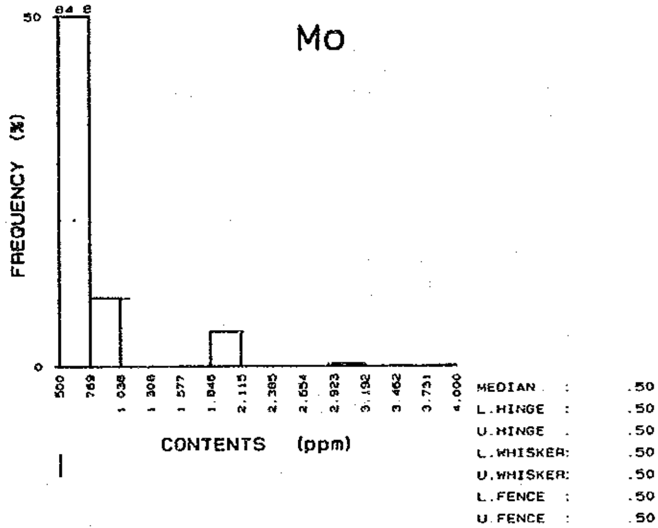
MEDIAN	:	.10
L.HINGE	:	.10
U.HINGE	:	.10
L.WHISKER	:	.10
U.WHISKER	:	.10
L.FENCE	:	.10
U.FENCE	:	.10



MEDIAN	:	3.35
L.HINGE	:	2.67
U.HINGE	:	4.19
L.WHISKER	:	2.46
U.WHISKER	:	4.54
L.FENCE	:	.39
U.FENCE	:	6.47

Figure II-5-2(1) Histograms and EDA boxplots for Au, Ag and Fe in stream sediments





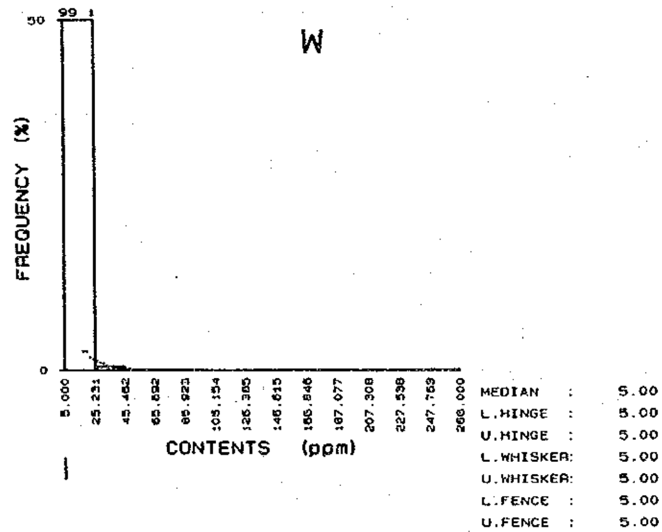


Figure II-5-2(2) Histograms and EDA boxplots for Mn, Mo and W in stream sediments

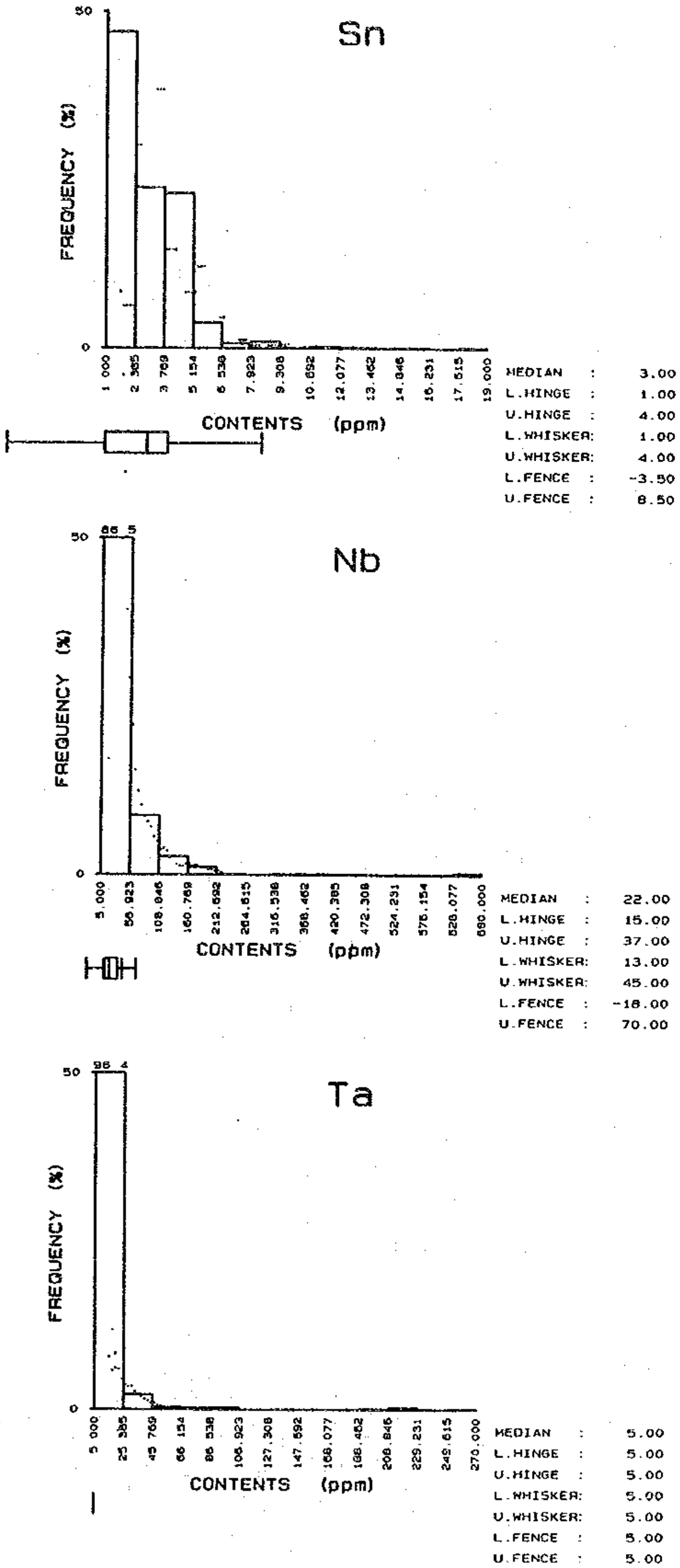
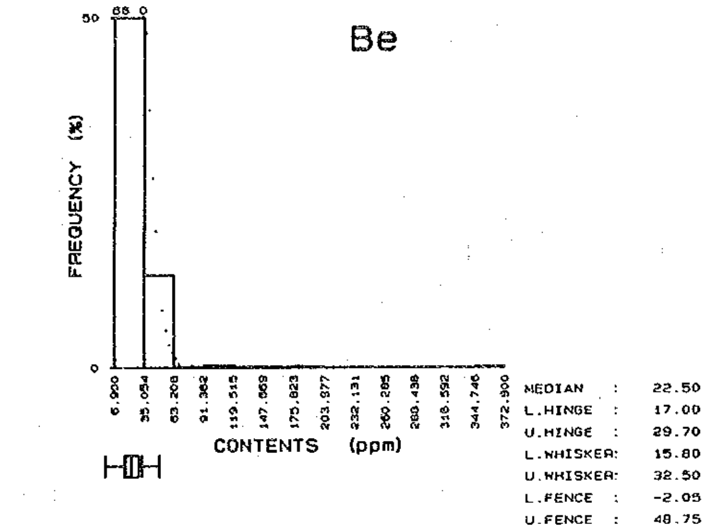
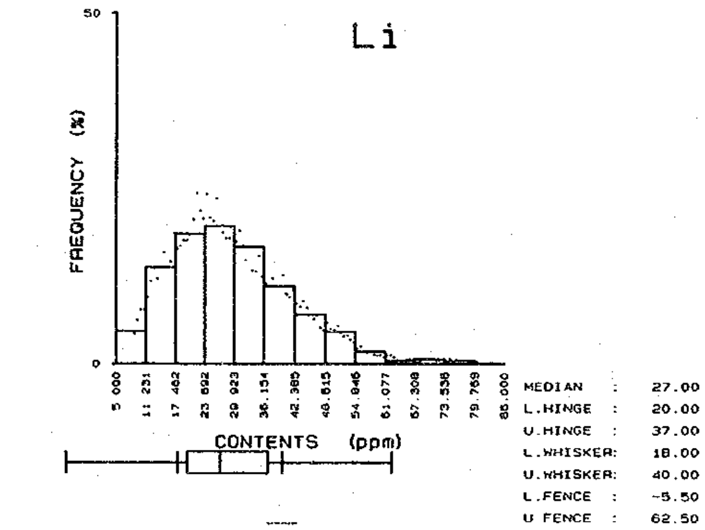


Figure II-5-2(3) Histograms and EDA boxplots for Sn, Nb and Ta in stream sediments





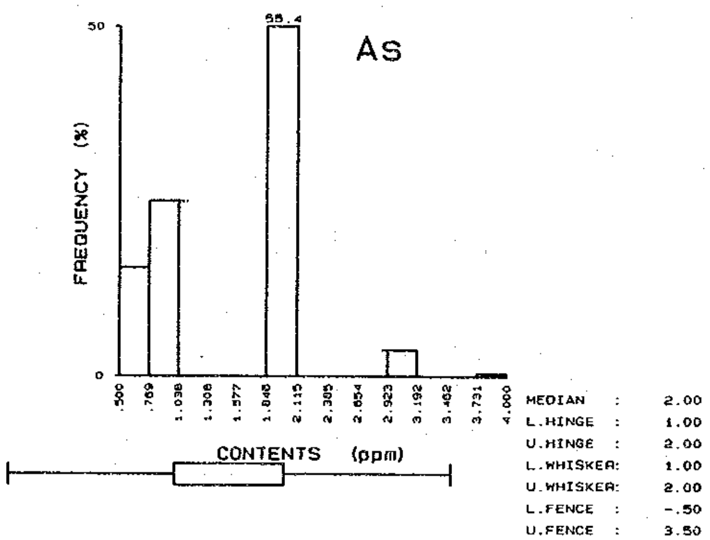


Figure II-5-2(4) Histograms and EDA boxplots for Be, Li and As in stream sediments

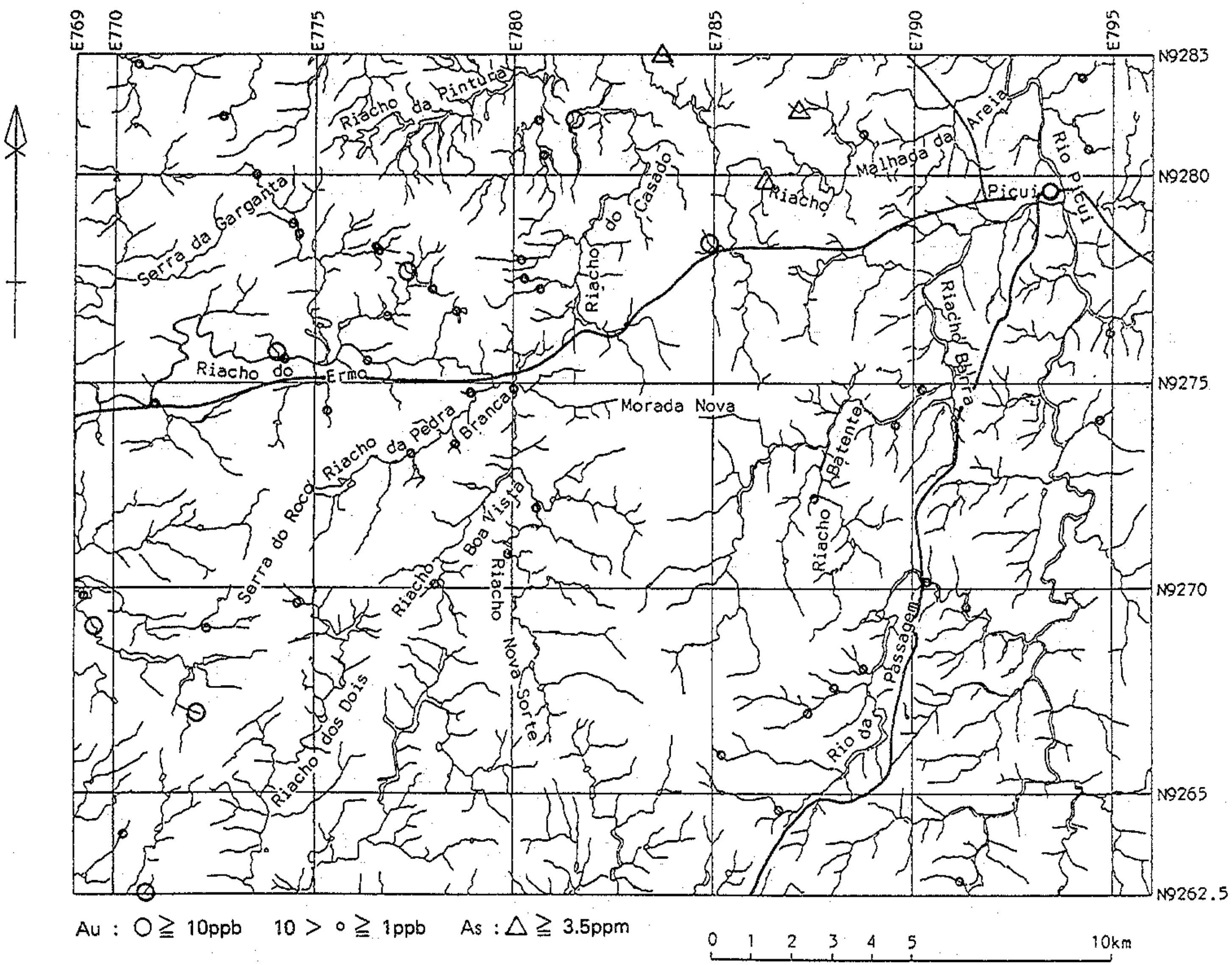


Figure II-5-3(1) Au and As anomalies in stream sediments

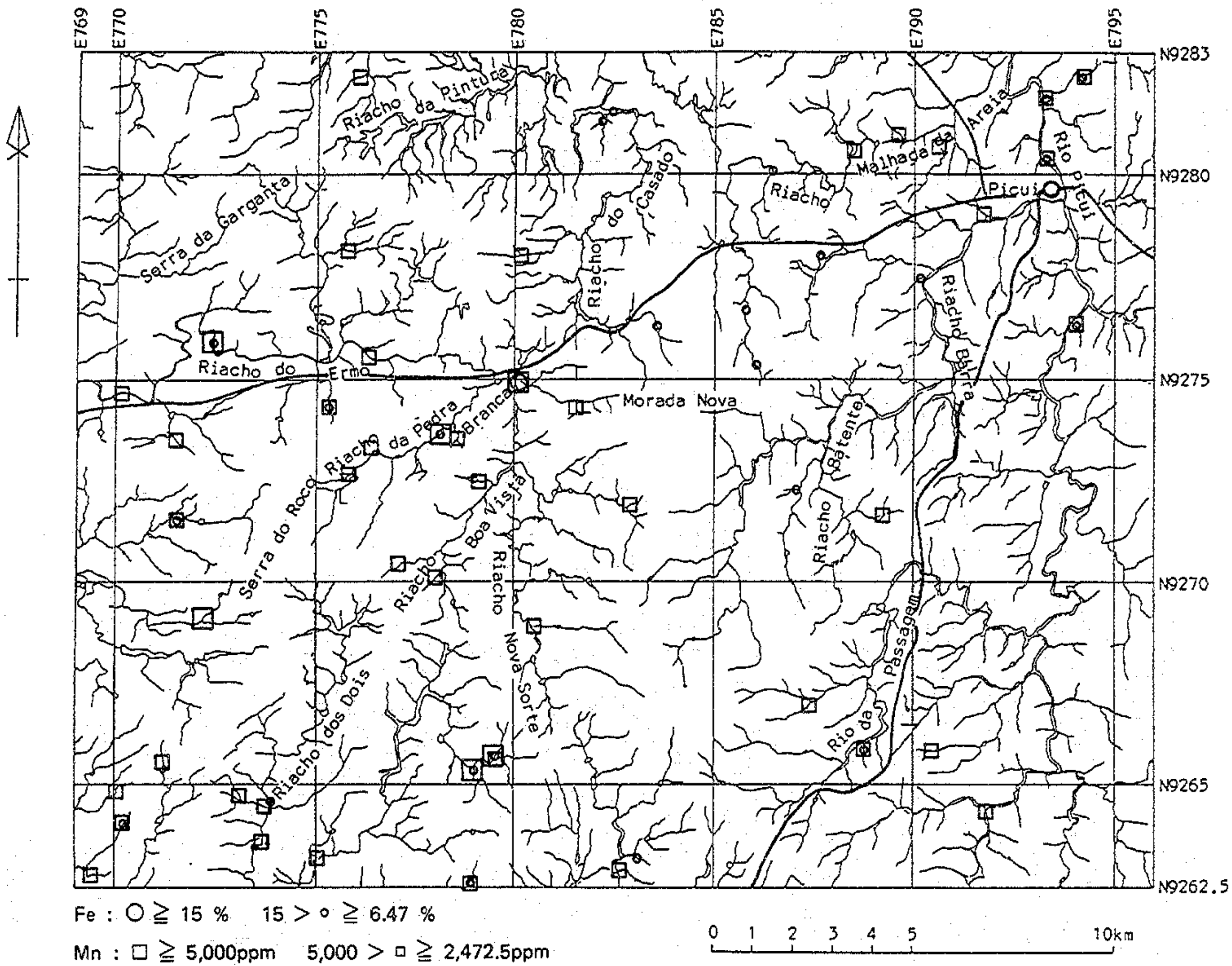


Figure II-5-3(2) Fe and Mn anomalies in stream sediments

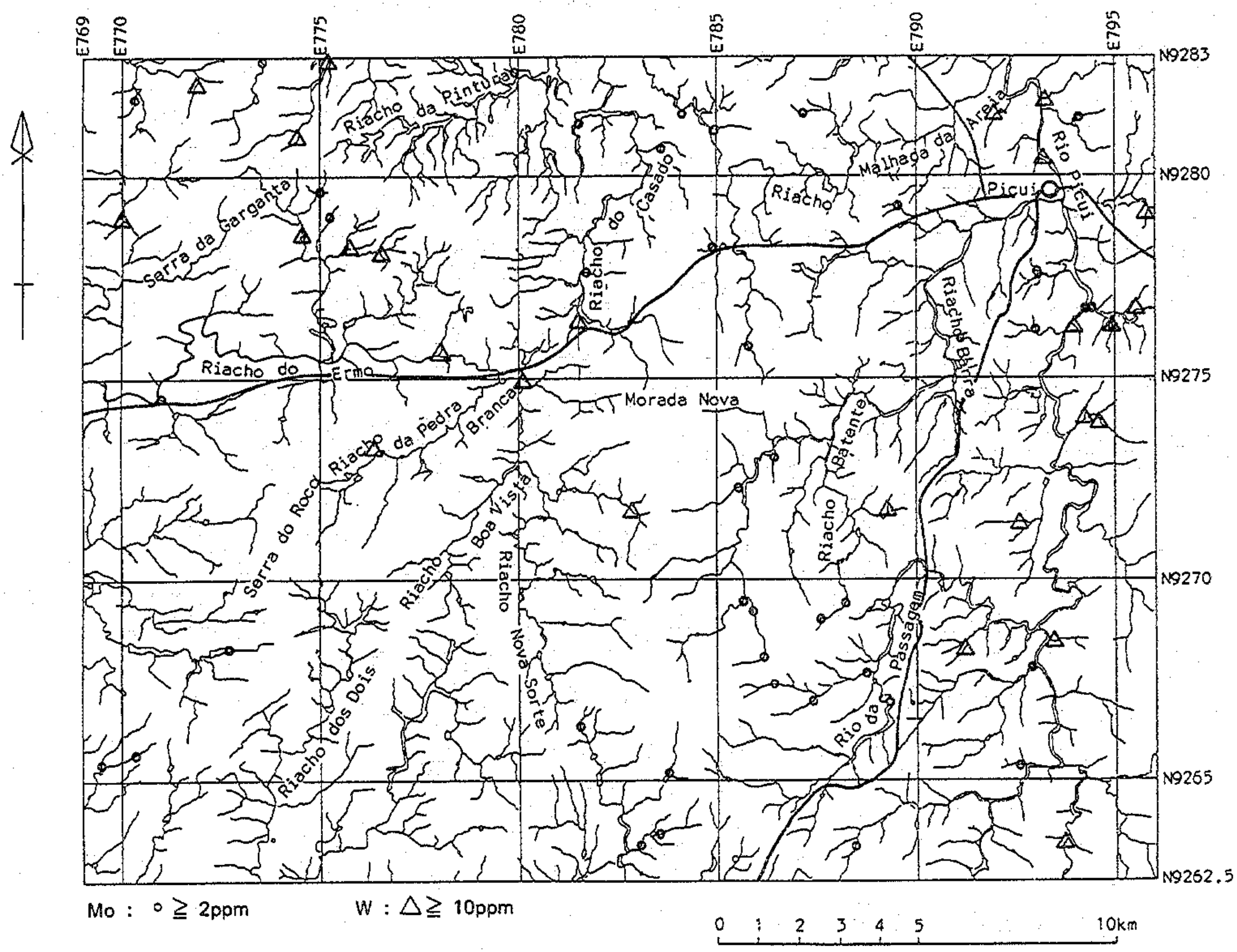


Figure II-5-3(3) Mo and W anomalies in stream sediments

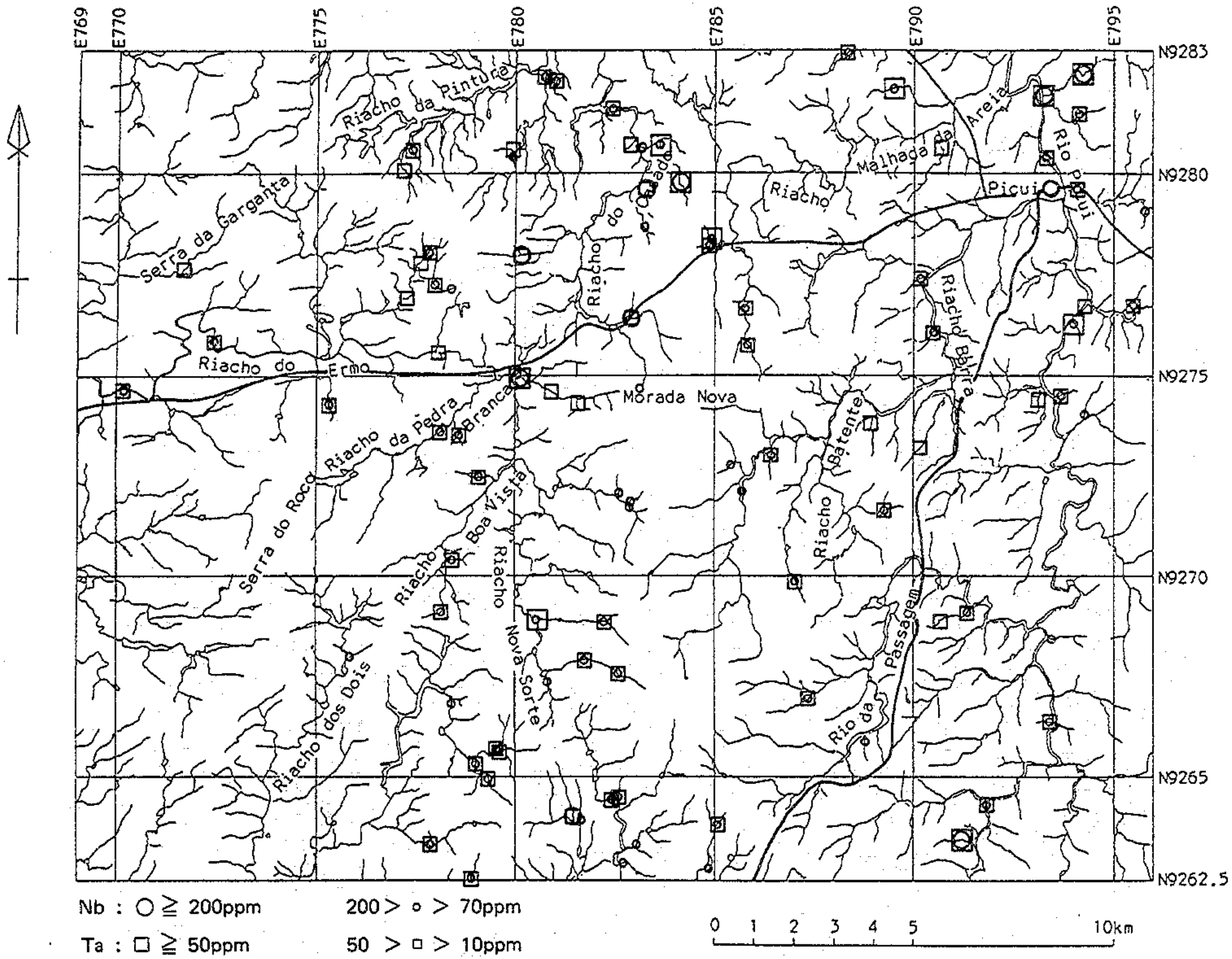


Figure II-5-3(4) Nb and Ta anomalies in stream sediments

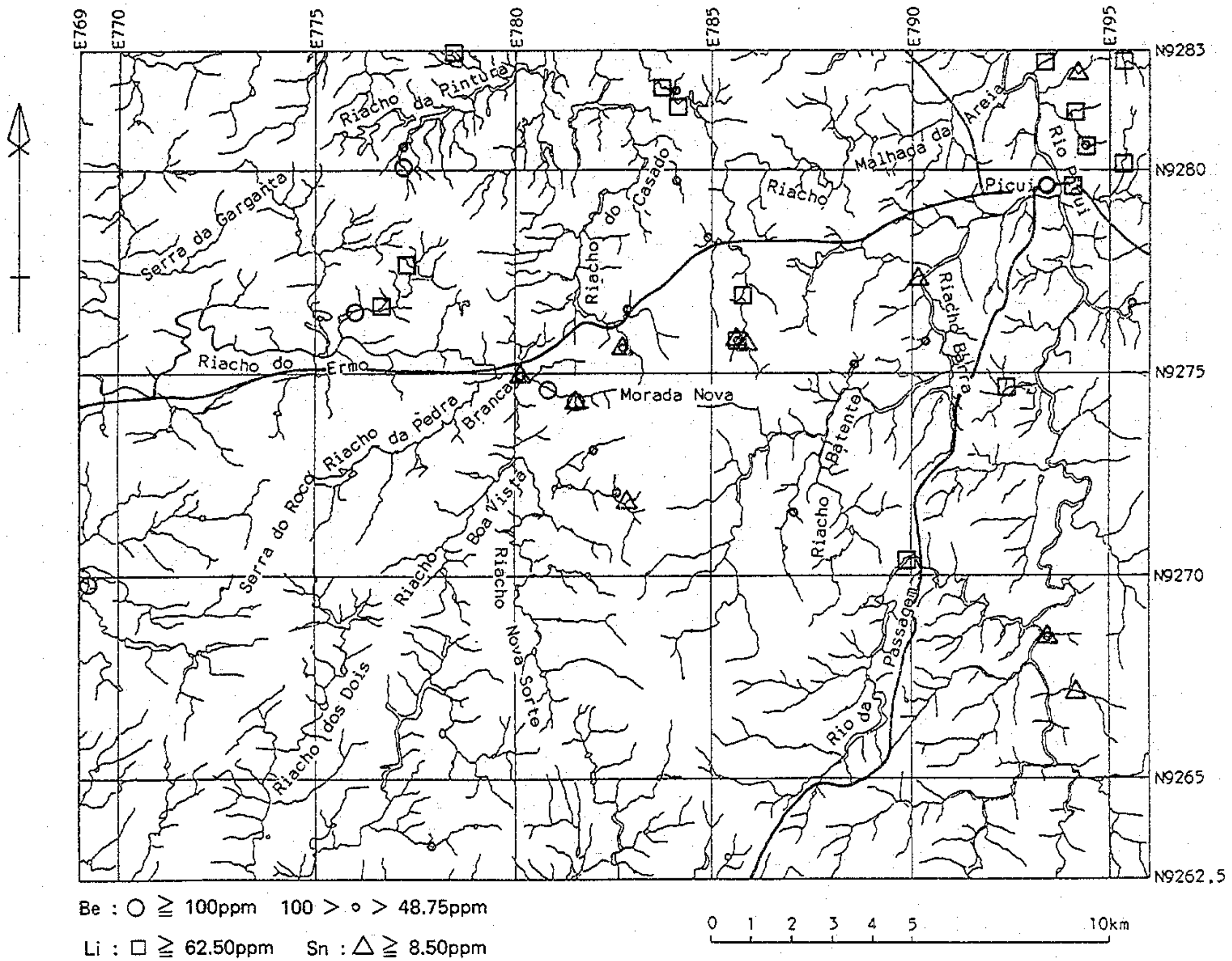


Figure II-5-3(5) Be, Li and Sn anomalies in stream sediments

% of samples from area "B" yielded arsenic contents lower than the detection limit, stream sediments in area "C" seems to be richer in this element than those in area "B", in spite of the fact that the maximum content found in area "B" (14 ppm) is higher than the highest found in the present area.

All samples with As contents higher than the calculated upper fence value (3.5 ppm) were taken as anomalous, and they are situated mainly in the northern and eastern portion of the Casado stream. Although somewhat scattered, these points seems to make up an anomalous zone, which in turn seems to be an extension of a similar zone defined in area "B". These zones show the peculiarity of being spatially associated to the fold zone (lay along the eastern border) that crosses through both survey areas in N-S direction (Fig. II-5-3(1)). It seems worth noting that in areas "A" and "B", calc-silicate rocks and amphibolites are frequently observed within this fold zone.

(2) Factor Analysis Results

First Factor: Fe-Mn

The distribution of samples with factor scores higher than 1.0 are shown in Fig. II-5-4(1).

Samples with high factor scores are distributed closely associated to rocks belonging to the Serido Formation, except in the central part of the survey area, nearby pegmatite occurrences; in the eastern part of the area dominated by outcrops of granites and rocks belonging to the Caico complex; and in the northwestern part of the area, dominated by outcrops of rocks belonging to the Equador Formation. This close relationship between iron and manganese seems to be, therefore, an inherent feature of the Serido Formation.

Second Factor: Ta-Nb

The distribution of samples with factor scores higher than 1.0 are shown in Fig. II-5-4(2).

These high score points are scattered over the entire area, except in the southern part, as do the anomalous areas of niobium and tantalum. They are specially concentrated in the central part of the survey area, within the distribution area of pegmatites. As previously quoted, apart from those pegmatites striking NE-SW, tantalum and niobium anomalies are closely related to the distribution of pegmatites.

Third Factor: Be-Li-(Sn)

The distribution of samples with factor scores higher than 1.0 are shown in Fig. II-5-4(3). The factor loading coefficients were respectively 0.541, 0.486 and 0.464, which are lower than those obtained for the first and second factors. Moreover, the factor contribution coefficient comprised only 19 % of the total, indicating how low is the correlation among these elements.

Samples with high factor scores are concentrated nearby and to the north of the Morada Nova locality, and also to the east of the Picui city. Pegmatites occur commonly in the area around the Morada Nova locality, and they also do occur in the area to the east of the Picui city, together with gneisses belonging to the Caico complex. Some samples with high scores are also scattered in the southern part of the Picui river, where the predominant lithology is constituted of granites. Other high

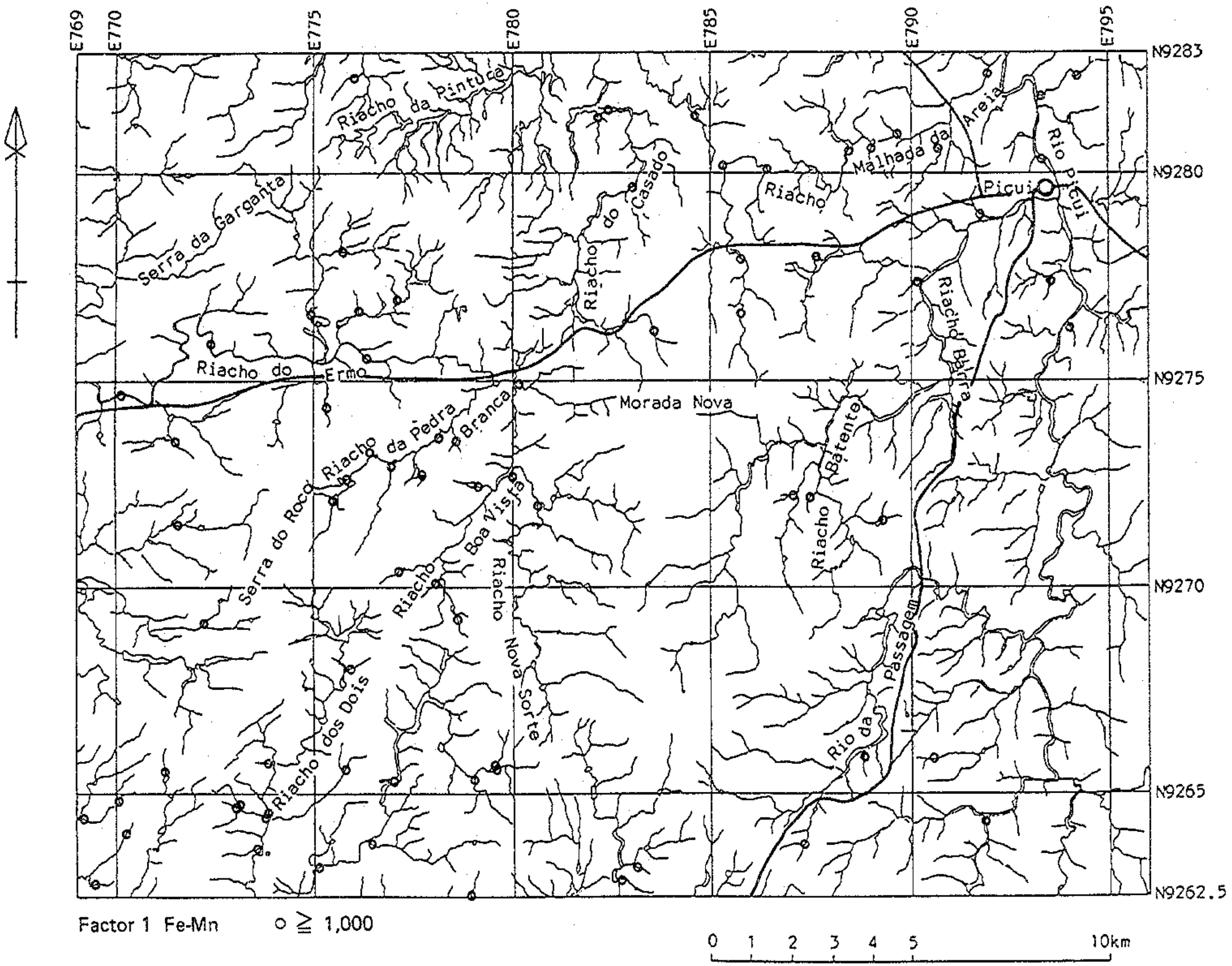


Figure II-5-4(1) Location of high factor score; Factor 1, Fe-Mn

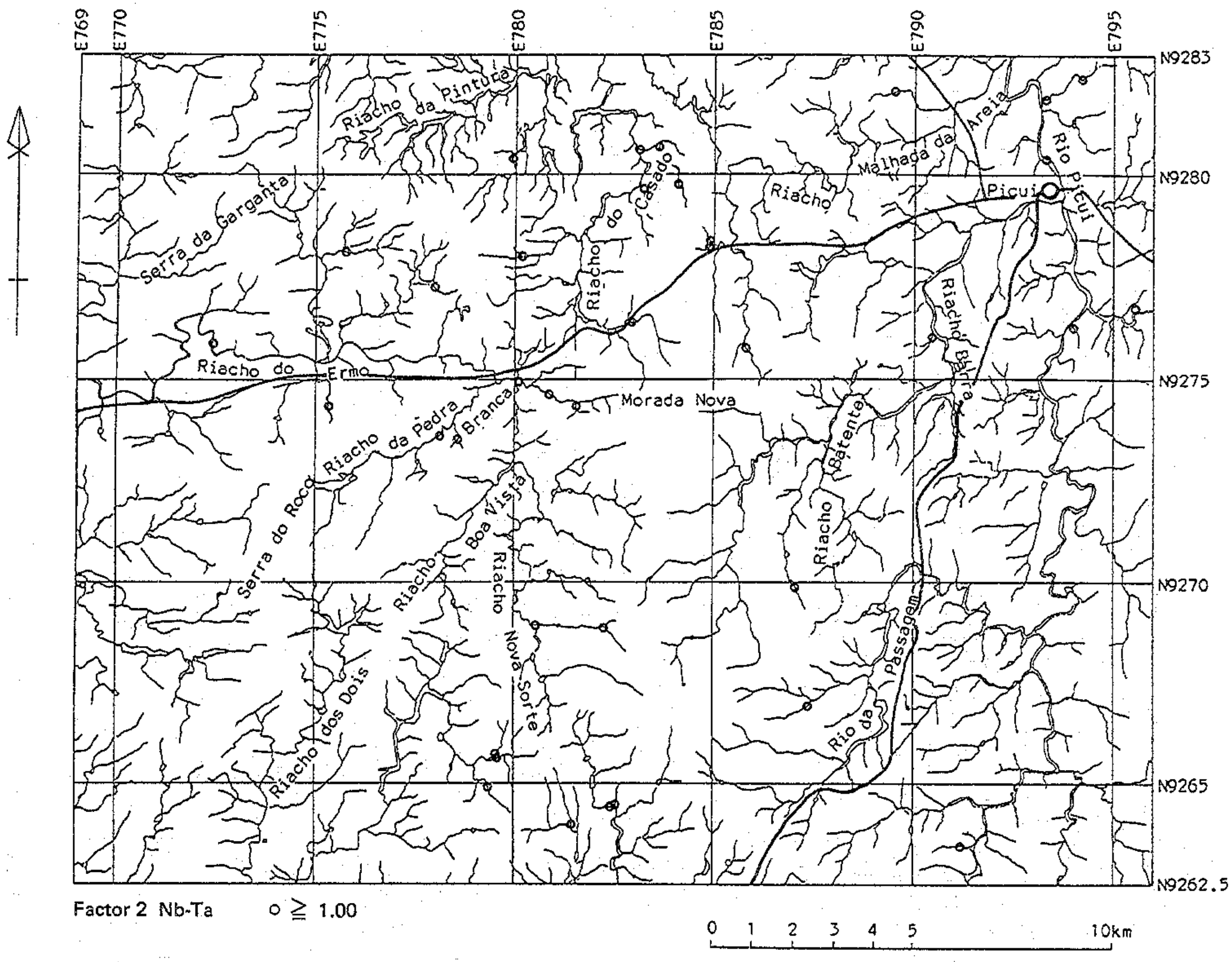


Figure II-5-4(2) Location of high factor score; Factor 2, Nb-Ta

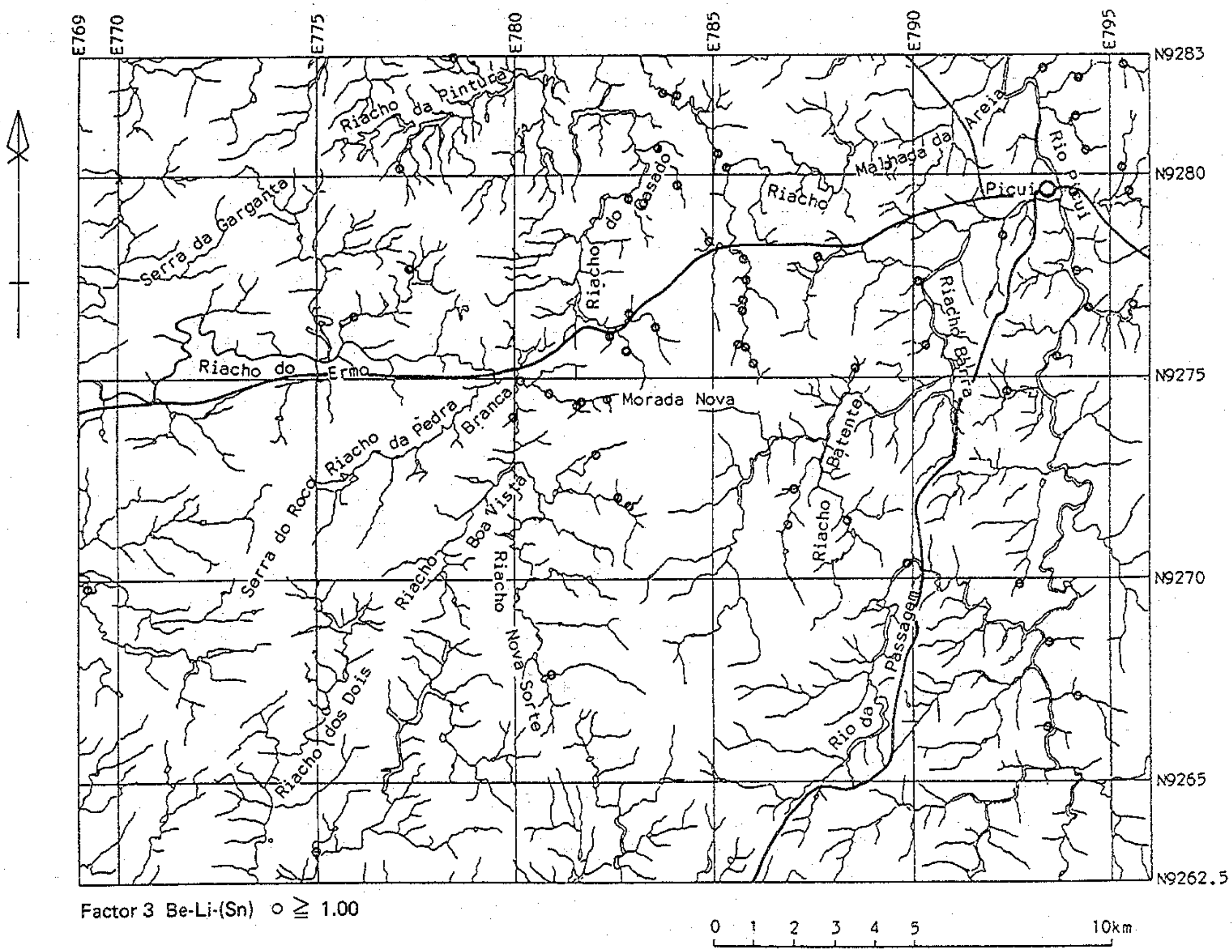


Figure II-5-4(3) Location of high factor score; Factor 3, Be-Li

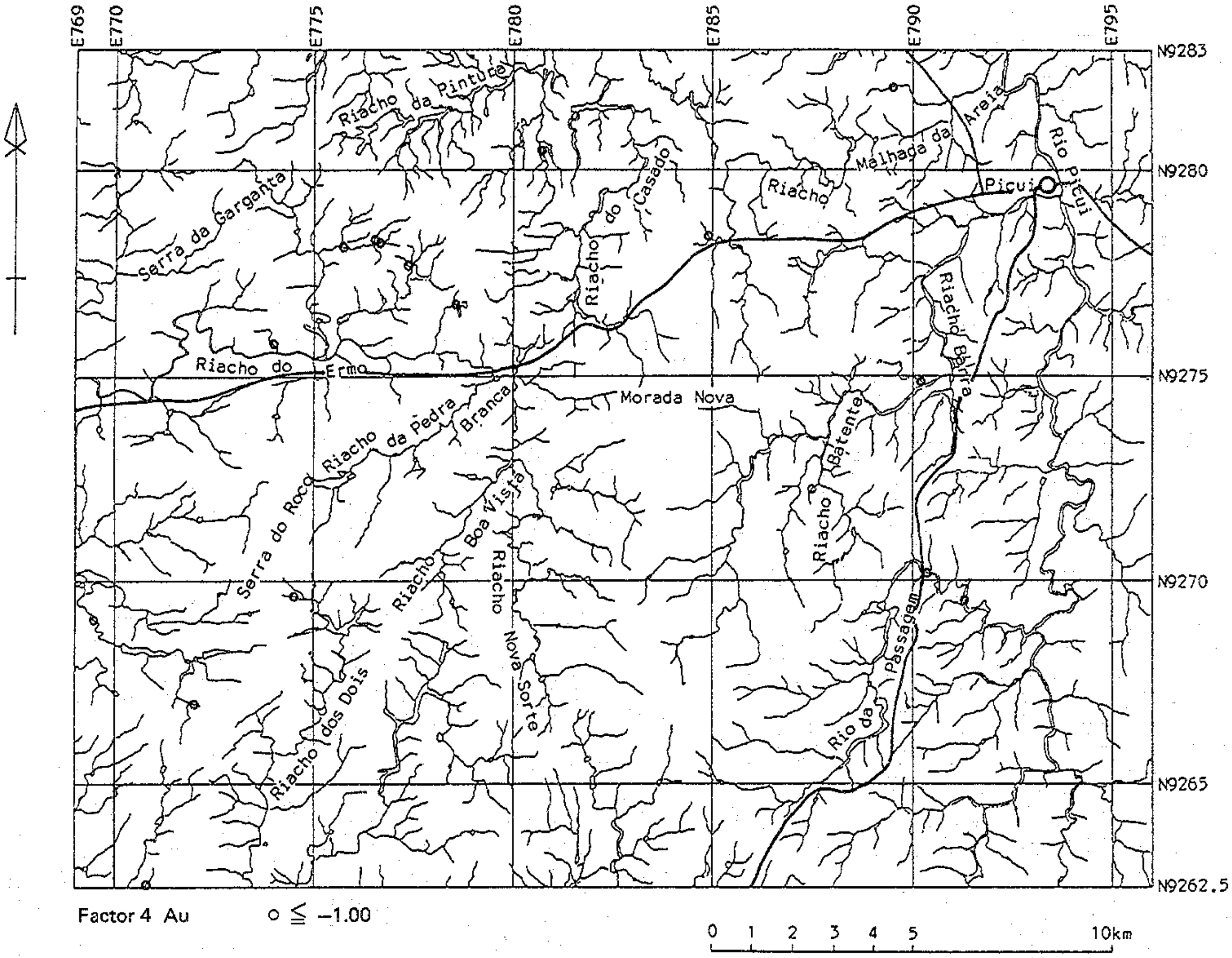


Figure II-5-4(4) Location of high factor score; Factor 4, Au score values are scattered throughout the area, without showing any special relationship with the surrounding lithology. From these results,it can be concluded that high scores of this third factor are mainly associated to the distribution of pegmatites and granites.

Fourth Factor: Au

The distribution of samples with factor scores higher than -1.0 are shown in Fig. II-5-4(4).

The obtained factor loading coefficient was as low as -0.522, and the factor contribution coefficient of 13.1 % was rather lower than those obtained for the third factor. These values seems to indicate a relationship with pegmatite mineralization.

Samples with factor scores lower than -1.0 are concentrated in the northern portion of the Ermo stream. These samples coincide with those yielding Au contents higher than 10 ppb.

5-2 PAN CONCENTRATE GEOCHEMICAL SURVEY

5-2-1 Objectives

This survey has been carried out with the following two objectives.

1) To investigate the distribution of the rocks and/or the dimensions of the drainage basins where gold grains have been reported in previous survey carried out by DNPN and CPRM teams.

2) Should Au-bearing quartz veins and/or gold grains in stream sediments be newly found in the survey area, this survey is to be carried out aiming at exploring the extension of the mineralization.

5-2-2 Methodology

(1) Collection and Preparation of Samples

The collection points were previously set on a 1:25,000 topographic map, but some of them were changed according to the access conditions. Problems related to transportation of the material to be panned were also taken into consideration in the selection of sampling locations (Pl. II-5-2, Fig. II-5-1). In the case of small streams, sampling points were set on the inner part of meanders, while in major ones, sediments were collected in the "shadow zone" of large blocks. The sampling depth varied according to the size of the stream, but as a general rule, sediments to be panned were taken from the portion right above the basement. In the case of deep sedimentation, where it was not possible to reach the basement, sediments were sampled in intermediary portions containing higher amounts of heavy minerals (Appendix 7).

The following steps were adopted during each sample collection: 40 ~ 50 Kg of sediments were firstly sift to separate approximately 20 Kg of the fraction under 4 millimeters. This fraction was then panned until a small concentrate containing mainly heavy minerals was obtained. During panning operation, special attention was paid as for the presence of gold grains. It should be emphasized that each sample was panned until the bottom of the pan was easily visible, in order to reduce as much as possible the sample size. However, given that the amount of heavy material does differ considerably from one sampling point to another, the sample size also differed considerably from each other.

(2) Chemical Analysis

Pan concentrate samples were all analyzed for Au, Ag, Mo, W, Sn, Ta, and Nb. The analytical method as well as the detection limit of each of these 7 elements are the same as previously mentioned for stream sediment samples. Chemical analyses were executed partly by the brazilian laboratory GEOSOL (Geologia e Sondagens Ltda.) and partly by the Earth Science Laboratory of the Bishimetal Exploration Co. Ltd.. Results are listed in the Appendix 6.

(3) Data Processing

As quoted above, the size of pan concentrate samples varied largely due to differences in heavy minerals contents of sediments, and also due to the obvious differences in panning techniques among the workers. Accordingly, it is almost meaningless to process statistically the analytical data of these samples. The following discussions are based, therefore, mainly on the relative contents of the analyzed elements, rather than in their absolute concentrations.

5-2-3 Results

(1) Naked-eye Appraisal of Samples

Pan concentrate samples were observed under a 20x lens to check for the presence of gold grains, and also to recognize the contained minerals. Gold grains were observed in three samples, all them collected in the southwestern part of the area (Fig. II-5-5(1)). The size of these grains are rather small, with a diameter of less than 0.2 millimeters (Appendix 6). Most frequently observed minerals include magnetite, columbite-tantalite and scheelite among others.

(2) Distribution of Each Element

(a) Gold (Au)

Gold contents ranged from those lower than the detection limit (0.5 ppb) to higher than 10,000 ppb. The sample with the highest concentration (>10,000 ppb) was the northernmost between the two samples that define the southwestern anomaly zone, and this is one of the samples in which the presence of gold grains has been confirmed. Fig. II-5-5(1) shows the locations of samples in which gold grains have been observed and of those that yielded contents equal or higher than 1,000 ppb. Among those samples containing more than 1,000 ppb of gold, two are located in the southwestern, two in the mid-western, and one in the central part of the survey area. Even though obvious, it seems worth noting that all samples in which gold grains have been observed yielded high gold contents. There have been reports of alluvial gold mining in the central part of the area, but none of the samples collected during this survey contained gold grains. Moreover, only few samples yielded high gold contents in this central area. Gold mineralization has also been reported in the mid-western part of the area, but this area is situated to the west where a sample with gold grain and high gold content has been collected. Within the southwestern anomalous zone, gold grains as well as high gold content has been found in the place indicated by previous reports. Nevertheless, gold mineralization has not been observed in country rocks in any of those locations.

(b) Silver (Ag)

Silver contents ranged from those lower than the detection limit (0.2 ppm) to a maximum of 0.6 ppm. The obtained contents were rather low, so that they were not plotted on a map. In spite of the low contents, however, some higher values of 2~6 ppm are situated along the Pedra stream, in the central part of the survey area.

(c) Molybdenum

Molybdenum contents ranged from those lower than the detection limit (1 ppm) to a maximum of 7 ppm. Compared with contents of similar samples of area "B", these values are rather low. Among samples with molybdenum contents higher than 5 ppm are located, one is located in the central part, two in the western, and two in the southwestern part of the survey area (Fig. II-5-5(2)). Between the two points in the western anomaly zone, one contained gold grains. The sole point in the central part of the survey area was collected within the area of pegmatite occurrences.

(d) Tungsten (W)

Tungsten contents ranged from 1 ppm to a maximum of 265 pm. These values, similarly to those of molybdenum, are lower than those obtained for similar samples of area "B". There have been no reports on scheelite mineralization in the survey area. In area "B", tungsten mineralizations were located mainly nearby the contact between the Equador and Serido Formations. Rocks belonging to the Equador Formation crop out in the mid-western as well as in the southwestern parts of the present survey area, but no tungsten anomaly has been recognized in these areas. High tungsten contents have been mainly observed in the central part of the survey area, mostly in drainages that cross through pegmatites as well as the fold zone within the Serido Formation (Fig. II-5-5(2)). Tungsten mineralization related to pegmatites are not known in areas "A" and "B", and are also unknown within area "C". Nevertheless, since anomalous tungsten contents in stream sediments have also been found in this central part, it seems conceivable that the pegmatites themselves and/or xenoliths within the pegmatites may be somewhat mineralized.

(e) Tin (Sn)

Tin contents ranged from those lower than the detection limit (2 ppm) to a maximum of 660 ppm. It is interesting that this highest value is higher than the maximum content observed in samples from area "B". The sample which yielded this highest tin content of 660 ppm yielded also a high content of tungsten, and as mentioned above, this sample was collected from a stream that cross through pegmatites and the fold zone within the Serido Formation. Other high tin values were obtained in samples collected from the same drainage system.

Stream sediment geochemical survey results indicated, as do the results of pan concentrates, that tin anomalies are distributed enclosing the distribution area of pegmatites in the central part of the survey area. It seems, therefore, that the pegmatites themselves or xenoliths within these pegmatites are mineralized to some extent.

(f) Tantalum (Ta)

Tantalum together with niobium anomalies in this area, as expected, are closely related to the occurrences of columbite-tantalite, and so, to the distribution of pegmatites, which are reasonably frequent in the present survey area. Moreover, tantalite-columbite are two closely associated high density minerals, so that they are frequently present in pan concentrates. These features are coherently reflected in the analytical results, with values ranging from 19 to 12,050 ppm. Samples which yielded contents higher than 10,000 ppm are all located in the central part of the survey area (Fig. II-5-5(3)). Tantalum anomalies have not been observed in stream sediment samples taken in the same places where these high-Ta pan concentrates were collected, but they have been confirmed downstream in the same drainage system, indicating that all this system constitutes a large tantalum anomaly zone.

Nevertheless, although pegmatite veins are observed in the western as well as in the southwestern parts of the survey area, no anomalous high tantalum contents have been observed. The same result has also been obtained from stream sediments, indicating that, as mentioned previously, these pegmatites may be of a different generation from those cropping out in the central part of the survey area.

(g) Niobium (Nb)

Niobium contents ranged from 69 ppm to 30,000 ppm. This element is highly concentrated in minerals like columbite and tantalite. Niobium contents are generally higher than those of tantalum in sediments as well as in rocks of this area. Samples which yielded contents higher than 10,000 ppm, as plotted in Fig. II-5-5(3), are concentrated in the central part of the area, and do not occur in the west nor in the southwestern part of the survey area.

5-3 DISCUSSION

Stream sediment geochemical results indicated that, excepting the pegmatite distribution area in the central part, the mid-southern part, and the eastern edge of the survey area, gold anomalies are rather scattered over the entire survey area. Apart from the fact that these gold anomalies are not related to pegmatites, no other relationship concerning to lithology or structure could be established.

A topographically closed anomalous area between the Ermo and Casado streams could be defined based on stream sediment geochemical results, where pegmatites crop out within rocks belonging to the Serido Formation (Fig. II-5-6).

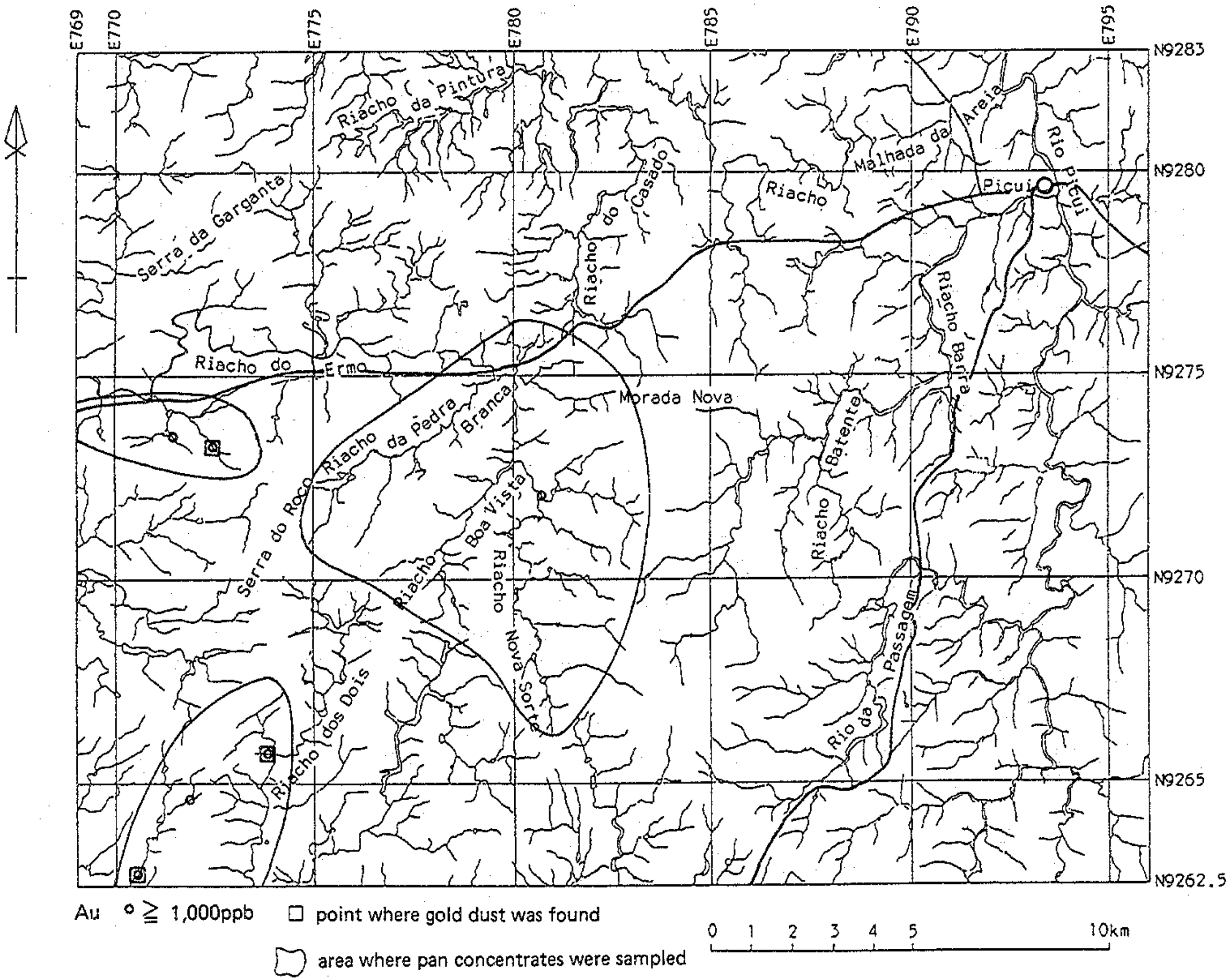


Figure II-5-5(1) Au concentration in pan concentrates

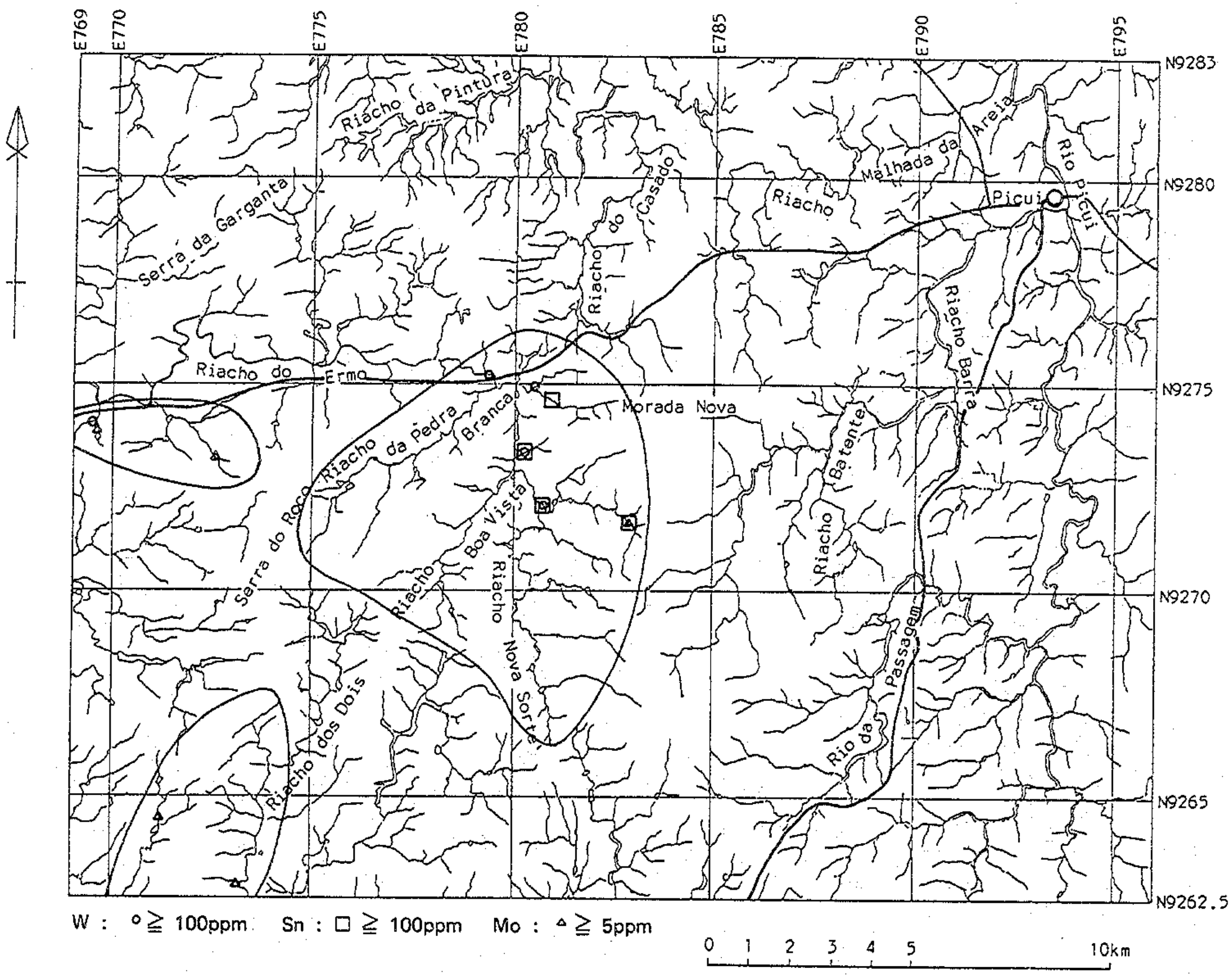
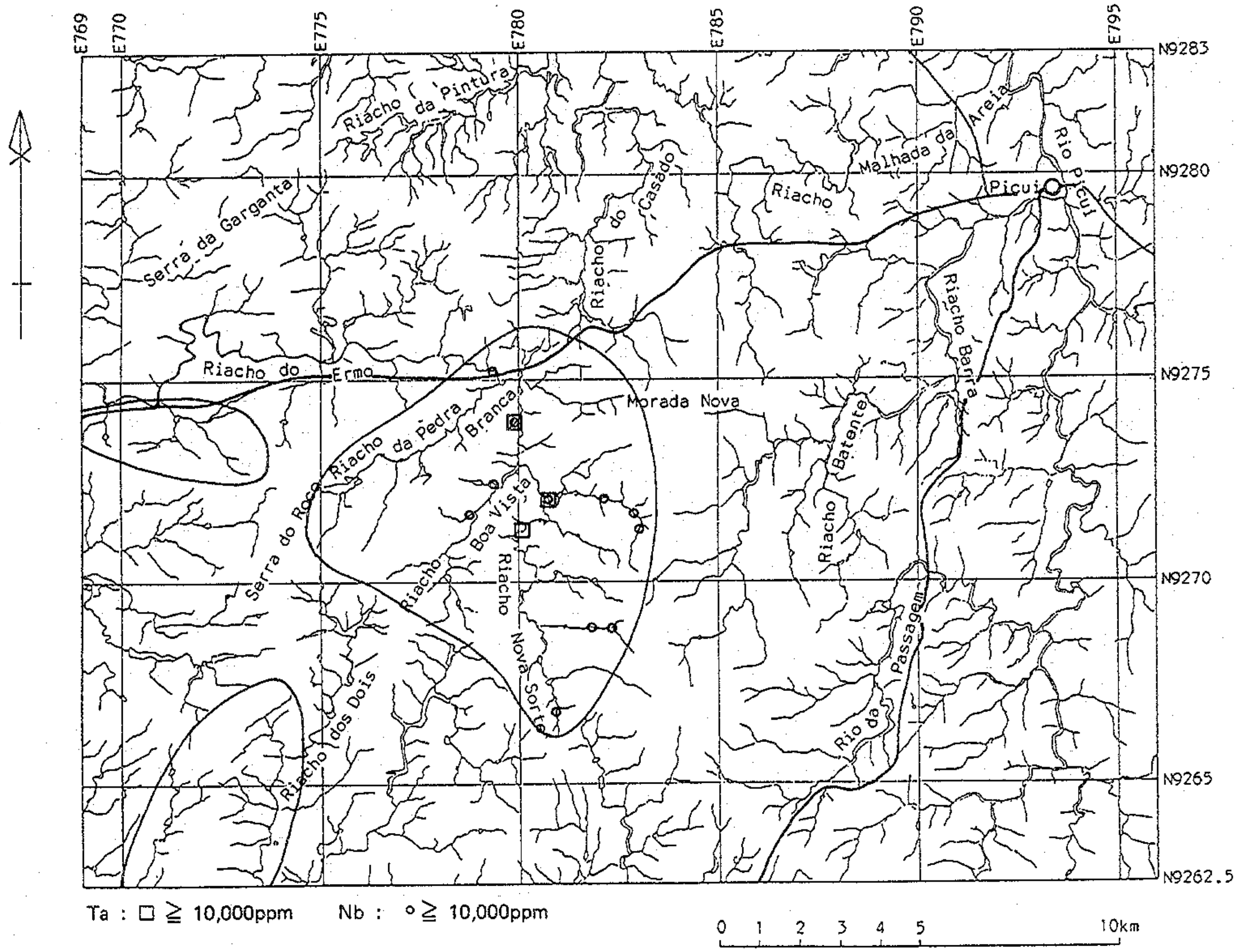
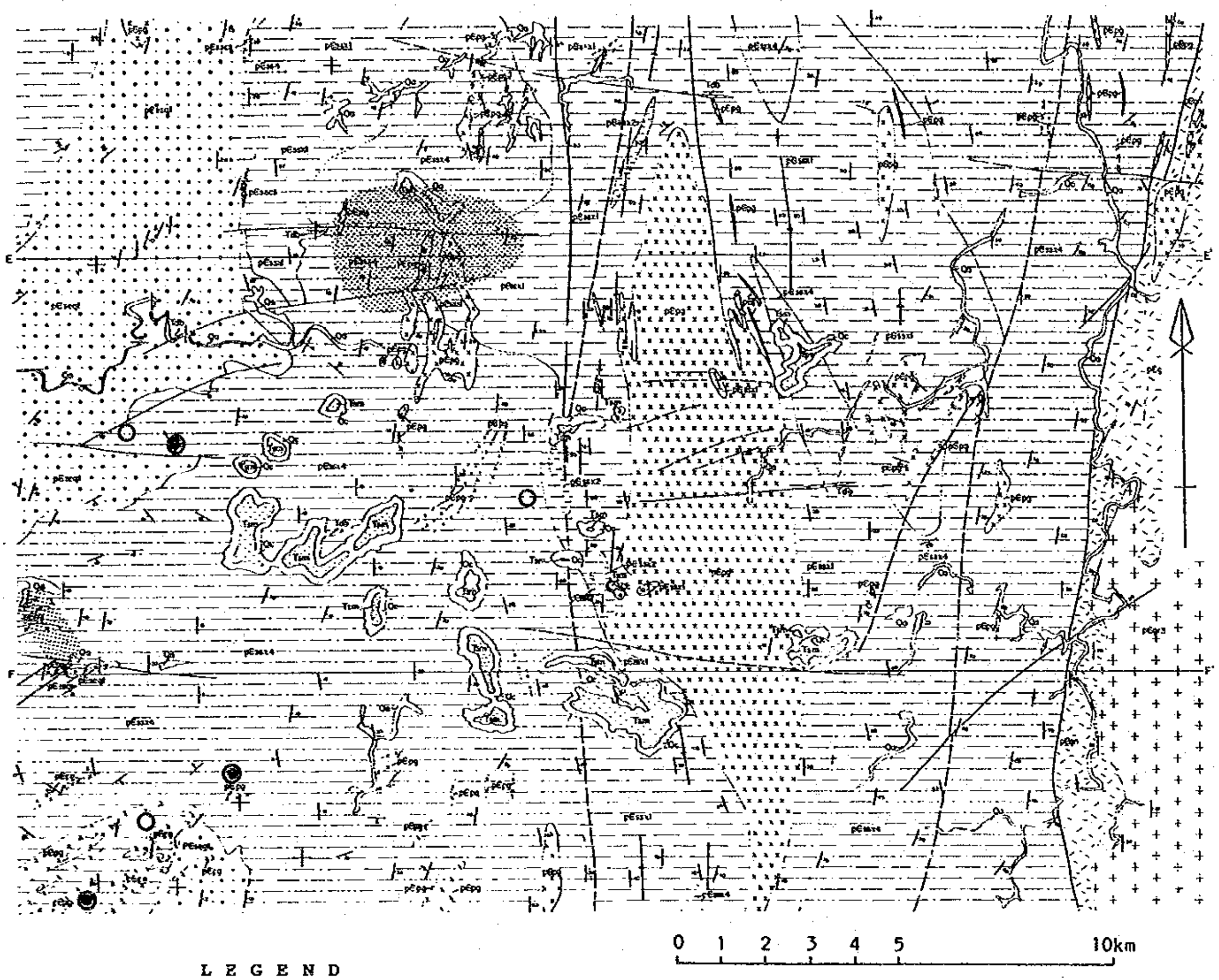


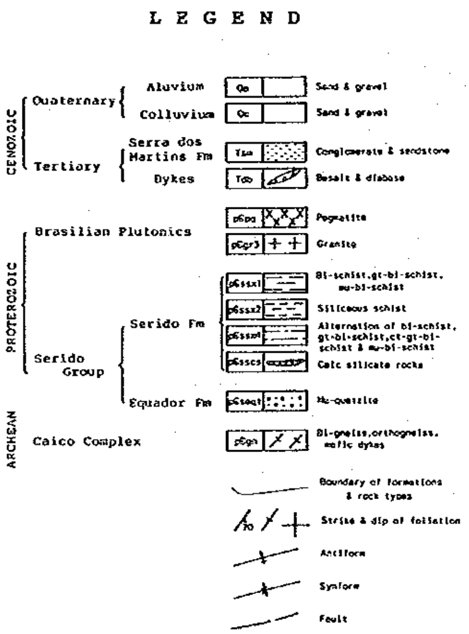
Figure II-5-5(2) W, Sn and Mo concentration in pan concentrates



Ta : □ ≧ 10,000ppm Nb : ○ ≧ 10,000ppm

Figure II-5-5(3) Nb and Ta concentration in pan concentrates





LEGEND

- Stream sediment Au anomalous area (Au ≧ 1ppb)
- ● Location of Au particles
- ○ High Au value in pan concentrate (Au ≧ 1,000ppb)

Figure II-5-6 Compilation of the survey results in area C

P A R T III

CONCLUSIONS

and

RECOMMENDATIONS

Chapter 1 - Conclusions

(1) AREA "A"

Trench surveys in area "A-I" did not confirm the anomalies defined by soil geochemical surveys. These results indicate that the possibility for existence of gold mineralization in this area is very low; no further prospecting works seems therefore necessary.

In area "A-II", a gold mineralization has been defined in an area 200 meters east of the Sao Francisco mine, where an overlap of geochemical and geophysical anomalies has been observed. This result indicates that gold mineralizations does also occur in areas outside the mineralized zone of the Sao Francisco mine. Moreover, geophysical results suggest that both mineralized zones are continuous up to the survey depth. However, biogeochemical as well as geophysical anomalies over this anomalous zone located 200 meters east of the Sao Francisco mine are mainly spot-shaped, suggesting a rather small scale mineralization. From these results, it can be concluded that, except for the Sao Francisco deposit, there is no other promising area for gold within area "A-II", so that no further prospecting works are needed.

Trench survey results indicated that the geophysical method utilized to prospect the present survey area is a valuable tool to obtain underground information on the distribution of quartz veins. On the other hand, soil geochemical survey did not yield satisfactory results for gold, probably due to the poor development of soils, typical of this area.

(2) AREA "B"

In area "B-I", soil geochemical survey were carried out by using Au, As and Sb as tracer elements. Sb results were all below detection limit, and even though Au and As did define some anomalous zones, no correlation between them has been obtained. It was concluded, therefore, that Au was the only reliable element to prospect for gold in this area.

Au anomalous points are rather scattered all over the area. In the northeastern part of the area, some anomalous points are somewhat concentrated along the western foothills of the Umburana Range, where sulfide-bearing quartz veins have also been observed. These points are located roughly on the extension of these veins in the direction of their strikes. In addition, sulfide-bearing auriferous quartz veins have been observed in the eastern foothills of the same mountain range, and these veins are only 300 meters far from those found in the western foothills. Tanking into consideration the overall spatial relationships, it seems possible that all these veins belong to a same stage, and that they are continuous at least up to the soil anomalies which lay on their extension.

However, considering that the size of these sulfide-bearing quartz veins are rather small, and the Au soil anomalies are quite low, the existence of larger scale mineralized veins seems to be very improbable. It is concluded, therefore, that there are only few possibilities to find an economically exploitable gold deposit in this neighborhood.

(3) AREA "C"

In area "C", Precambrian rocks are widely distributed, and are overlaid by small Tertiary and Quaternary coverings. Precambrian rocks are comprised by the Archaean Caico Complex and the Proterozoic Serido Group. The Serido Group is subdivided, from the bottom upwards, into Equador and Serido Formations. The Jucurutu Formation does not crop out in the present area. The Equador and Serido Formations are represented by quartzites and biotite schists, respectively. The distribution of these rocks within the survey area can be roughly described as follow. Rocks belonging to the Caico Complex are mainly exposed nearby the eastern margin, the quartzites belonging to the Equador Formation crop out mostly in the western part, while those rocks which make up the Serido Formation dominate the central part of the survey area. Large scale pegmatitic bodies are found within the Serido Formation. The contact between the Caico Complex and the Serido Formation are made up by the Picui fault. A N-S oriented fold zone has been observed crossing through the central part of the outcropping area of the Serido Formation, which is part of the fold zones found in areas "A" and "B". Concerning to rupturing structures, NE-SW ~ NNE-SSW and WNW-ESE ~ ENE-WSW are the directions of main faults observed in this area.

Concerning to mineralizations, apart from some Nb-Ta ones associated to pegmatites and small tungsten occurrences, no other clear mineralization could be defined.

Although 13 tracer elements were analyzed for the stream sediment geochemical survey, it was concluded that Au is the only reliable element for gold prospecting. Only few Au anomalies were obtained, and they did not concentrate within any topographically and/or hydrographically well defined area. Some anomalous Au points are somewhat clustered in the area enclosed by the Ermo and Casado streams, in the northwestern part of area "C". The highest Au content of 63 ppb was obtained from a sample collected in the central part of the area, but no other anomalous point was observed in the vicinity.

As above stated, Au contents in stream sediments in area "C" are quite low, and those samples with somewhat higher Au contents are rather scattered all over the area. Moreover, no vestige of mineralization has been found in basement rocks during the geological survey. It is concluded, therefore, that the potential for gold of this are is quite low.

Chapter 2 - Recommended Further Works

As emphasized above, the possibility of finding a large gold deposit within the project areas is rather small. If, however, further works are to be carried out in this area, the following surveys are suggested.

(1) AREA "A"

Valuable information about the southern extension of the Sao Francisco mine deposit was obtained by geophysical prospecting, but none of such data are available on the northern extension. Since this kind of information will enhance not only the knowledge about this specific deposit, but will be also useful in prospecting similar mineralizations, geophysical as well as trench survey are recommended to be carried out in the northern extension of the Sao Francisco mine deposit.

(2) AREA "B"

Detailed geological and geophysical (IP method) surveys along the Umburana Range seems to be worthy of consideration, in order to clarify the actual state of that mineralization.

REFERENCES

REFERENCES

(1) REPORTS

Almeida, F.E.M. and Hasui,Y.(1984): O Precambriano do Brasil, 378p. Editora Edgard Blucher Ltda.

Almeida, F.E.M. et al.(1988): Magmatismo pos-Paleozoico no Nordeste Oriental do Brasil, Rev. Bras. Geoc., vol.18, no.4, pp.451-462.

Angelim, L.A. de A.(1983): Prospecto Ouro de Encanto. Relatorio Final, Cprm, Recife, 15p.

Barbosa, A.J.(1989): Ensaio sobre a oportunidade de investimento no prospeccao de ouro Faixa Seri-do-Cachoeirinha-R. do Pontal. Curso de Metalogenia do Ouro. CPRM Sureg-Re.

Barbosa, O.(1968): Projeto Ouro, Pianco-PB. Recife, DNPM/PROSPEC, 13p.

Bowles, J.F.W.(1988): Mechanical and chemical modification of alluvial gold, Asian Mining '88 Conference held in Kuala Lumpur, pp.25-28.

Boyle, R.W.(1979): The geochemistry of gold and its deposits, Geological survey of Canada, Bulletine 280, p.584.

Brito Neves, B.B.de (1981): O Ciclo Brasiliano no Nordeste, Atas do X simposio de geologia do nordeste, Recife, pp.329-336, Recife, atas...SBG Recife.

Brito Neves, B.B. de (1983): O Mapa Geologico do Nordeste Oriental do Brasil, escala 1:1,000,000, Sao Paulo, 177p, (Teste de Livre Docencia, IGUSP)

Brooks, R.R.(1982): Biological methods of prospecting for gold, Journal of Geochemical Exploration, 17, 109-122.

Busche, F.D.(1989): Using plants as an exploration tool for gold, Journal of Geochemical Exploration, 32, 199-209.

Cassedane, J.P. et al.(1973): A Paragenese da Mina de Oro de Sao Francisco, Mineracao e Metalurgia, Rio de Janeiro, Vol. 37(343), pp.6-13.

Cerny, P. and Meintzer, R.E.(1988): Fertile granites in the Archean and Proterozoic field of rare-element pegmatites; crustal environment, geochemistry and petrogenetic relationships, in Recent Advances in the Geology of Granite-related Mineral Deposits, pp.170-207, CIM Special Vol.39, edited by R.P. Taylor and D.F.Strong.

CPRM (1980): Comite de Ouro, Reratorio final, vol.1, CPRM Racife.

Ebert, H.(1970): The Precambrian Geology of the Borborema Belt (States of Paraiba and Rio Grande do Norte, northeastern Brasil) and the Origin of Its Mineral Provinces, Geol. Rundschau, vol.59, no.3, pp.1299-1326.

Einaudi, M.T. et al.(1981): "Skarn Deposit" in Econ. Geol., 75th Aniv. Vol., pp.317-391.

Einaudi, M.T., Burt, D.M.(1982): Introduction-Terminology, Classification and Composition of Skarn Deposit, Econ.Geol., vol.77, No.4, pp.745-754.

Eisenlohr, B.N. et al.(1989): Crustal-scale shear zones and their significance to Archaean gold mineralization in Western Australia, Mineral. Deposita, 25, 1-8.

Ferina, M.(1977): Perspectivas Metalogeneticas de Alguns Granitos Pos-orogenicos do Nordeste Brasileiro, Atas do VIII Simposio Geologia do Nordeste, Campina Grande (PB), no.6, pp.122-129.

Ferrau, A.(1988): Mina de ouro de Sao Francisco, Currais Novos, Rio Grande do Norte, in Principais Depositos Minelais do Brasil, vol.3, Metais Basicos nao-Ferrosos, Ouro e Aluminio, pp.589-595, DNPM.

Gama Jr., T. and Albuquerque, C.A.R.(1985): Petrologia do Grupo Serido; Currais Novos-Parelhas (RN), Rev.Bras.Geoc., vol.15, no.2, pp.132-138.

Getsinger, J.S. et al.(1990): Gold exploration success along structural trends in the Sicker Group of Vancouver Island, British Columbia, CIM Bulletine, vol.83, no.935, pp.125-935.

Guilbert, J.M., Park, C.F.Jr.(1986): The Geology of Ore Deposits, p.985, W.H.Freeman and Company.

Gustafson, L.B.(1989): SEG Distinguished Lecture in Applied Geology; The importance of Structural Analysisin Gold Exploration, Economic Geology, Vol.84, No.4, pp.987-993.

Hama, M.(1980): Geocronologia da Regiao do Serido; Novas Datacoes Geocronologia para o Projeto Scheelita do Serido, Relatorio Tecnico, Sao Paulo, CPRM, 28p.

Hanspacker, P.C. and Legrand, J.M.(1989): Microstructural and Metamorphic Evolution of the Portalegre Shear Zone, Northeastern Brazil, Rev.Bras.Geoc., vol.19, no.1, pp.63-75.

Hayashi, I. and Numata, M.(1976): Structure and Succession of Caatinga Vegetation in the Brazilian Northeast, in Tokyo ageography Papers XX Reports on the 3rd FieldStudy of the Brazilian Northeast, Department of Geography, Tokyo Kyoiku Univ., pp.23-44.

Hinse, G.J. et al.(1986): On the origin of Archean vein-type gold deposits with reference to the Larder Lake "break" of Ontario and Quebec, Mineral. Deposita, 21, 216-227.

Hodges, K.V. and Spear, F.S.(1982): Geothermometry, geobarometry and the Al_2SiO_5-triple point at MT. Moosilauke, New Hampshire, American Mineralogist, vol.67, pp.1118-1134.

Hutchinson, R.W.(1987): Metallogeny of Precambrian Gold Deposits, Space and Time Relationships, Econ.Geol., Vol.82, pp.1993-2007.

Jardim de Sa, E.F.(1978): Revisao sobre a "Faixa Dobrado do Serido" e eventuais correlatos no Nordeste, Rev.Ciencia, Natal, pp.77-83.

Jardim de Sa, E.F.(1978): Evolusao Tectonica da Regiao do Serido; Sintese Preliminar, Problema e Impricacoes, in Ciclo de Estudos Sobre a Prospeccao de Scheelita no Nordeste, vol.1, Currais Novos, 14p.

Jardim de Sa, E.F. and Salim, J.(1980): Reavaliacao dos Conceitos Estratigraficos na Regiao do Serido, RN-PB, Min.Metal., Rio de Janeiro, vol.44, no.421, pp.16-29.

Jardim de Sa, E.F. et al.(1980): Estratigrafia de Rochas Granitoides na Regiao do Serido, RN-PB, CBG XXX Boletine no, Resumos das Comunicasoes, p.310.

Jardim de Sa, E.F.(1984): A Evalucao Proterozoica da Provincia Borborema, Atas do XI Simposio de Geologia do Nordeste, Natal, pp.297-316.

Jardim de Sa, E.F.(1984): Geologia da Regiao do Serido; Reavariacao de Dados, in Atas do XI Simposio do Geologia do Nordeste, Natal, pp.278-296.

Jardim de Sa, E.F. et al.(1986): Granitogenese Brasiliana no Serido; o Masico de Acari (RN), Rev.Bras.Geoc., vol.16, no.1, pp.95-105.

Jardim de Sa, E.F. and Sa, J.M.(1987): Proterozoic granitoids in a policyclic setting: A field excursion in the Serido Region, NE Brasil, ISGAM. Excursion guide, pp.33-46.

Jardim de Sa, E.F. et al.(1987): Proterozoic granitoids in a polycyclic setting: the Serido region, NE Brasil, ISGAM extended abstracts, pp.103-109.

Jardim de Sa, E.F.(1988): An update of the Precambrian geology of northeast Brazil, Benin-Nigeria Geotraverse-International Meeting on Proterozoic Geology and Tectonics of High Grade Terrains-Program and Lecture Series.

Jardim de Sa, E.F. et al.(1988): Geochronology of metaplutonics and the evolution of supracrustal belts in the Borborema Province, NE Brazil, Atas do VII Congresso Latino-Americao de Geologia, Belem, Para, V.1, pp.49-62.

Kurtz, H.(1988): Exploratory data analysis: recent advances for the interpretation of geochemical data, Jour.Geoc.Expl., vol.30, pp.309-322.

Laing, W.P. et al.(1978): Structure of the Broken Hill Mine area and its significance for the genesis of the ore bodies, Econ.Geol., vol.73, pp.1112-1136.

Lima, E. de A.M. et al.(1980): Projeto Scheelita do Serido, Relatorio Final, Recife, DNPM/CPRM, 35v.

Lima, E.S.(1986): Metamorphism and Tectonic Evolution in the Serido Region, Northeastern Brazil, 215p. (PhD Thesis UCLA).

Lima, E.S.(1987): Evolucao Termo-Barometrica das Rochas Metapiliticas da Regiao do Serido, Nordeste Brasileiro, Rev.Bras.Geol., vol.17, no.3, pp.315-323.

Lins, C.A.C.(1984): Mineralizacoes auriferas dos Estados de Pernambuco, Paraiba e Rio Grande do Norte, in Atas do XI Simposio de Geologia do Nordeste, Natal, 473p.(Boletin 9), pp.452-464.

Lins, C.A.C. et al.(1985): Projeto mapas metalogeneticos e de previsao de recursos auriferos, escala 1:1,000,000, texto e mapas, Folhas SB.24/SB.25, Jaguaribe/Natal, CPRM Recife.

Mallic, B.(1987): Geochemical Surveys - Care and common sense are needed to interpret complex data, E & MJ, July 1987, pp.44-47.

Maranhao, R.J.L.(1978): Os Sistemas de Prospeccao em Ocorrencias de Scheelita do Nordeste, in Ciclo de Estados Sobre a Prospeccao Scheelita do Nordeste, vol.1, Currais Novos, 10p. (patroc. DNPM, manuscripto inedito).

Maranhao, R. et al.(1986): A jazida de scheelita de Brejui/Barra Verde/Boca de Lage/Zangarelhas, Rio Grande do Norte, in Principais Depositos Minerais do Brasil, vol.II, pp.393-407.

Maron, M.A.C.(1988): Ouro, in Balanco Mineral Brasileiro, DNPM Brasilia, pp.211-230.

Masuda, F. et al.(1989): Elementtal partition among tree, soil and basement rocks in thorn scrub in Northeast Brazil: A preliminary note, in Ann.Rep., Inst.Geosci., Univ.Tsukuba, no.15, pp.88-91, Dec.25, 1-8.

Masuda, F. et al.(1990): Elemental partition among tree, soil and basement rocks in thorn scrub in Northeast Brazil: A preliminary note, Report of Inst.Geosci., Univ.Tsukuba, pp.71-83.

Meira Barbosa, R.L.(1988): Tungstenio, in Balanco Mineral Brasileiro, DNPM Brasilia, pp.299-306.

Mero, E.B.(1980): Excursao No.3 - Provincia scheelitifera do Nordeste Distritos de Currais Novos e Sao Tome. CBG XXX. Bol 2 Roteiro das Excursoes. pp.45-57.

Mont'Alverne, A.A.F. coodinacao (1984): Principais depositos minerais de Nordeste Oriental, Geologia Economica no.4, 437p., DNPM.

Moraes, J.F.S.(1989): Concideracoes geologico-ecomonicas sobre o Projeto Itapetim, CPRM.

Nesbitt, B.E. and Muehlenbacks, K.(1988): Mesothermal Au ± Ag Deposits of the Canadian Cordillera: Evidence for meteoric water involvement in the genesis of methothermal Au deposits. in Bicentenial gold 88, pp.344-346, Geological Society of Australia Inc. Abstracts No.22, Melbourne, May 1988.

Neves, J.M.C. et al.(1986): A Provincia Pegmatitica Oriental do Brasil a Luz dos Conhecimentos Atuais, Rev.Bras.Geoc., vol.16, no.1, pp.106-118.

Oliveira e Silva, E.H.R.(1987): Carta Metalogenetica, Carta de Previsao de Recursos Minerais, Carta de Previsao de Acoes Govermentais (1:250,000), Natal Falha SB.25-V-C Regiao Nordeste, DNPM.

Pettijohn, E.J.(1975): Sedimentary rocks, Third edition, p.628, Harper & Row, Publishers.

Pulkkinen, E. et al.(1989): Geobotanical and biogeochemical exploration for gold in the Sattasvaara volcanic complex, Finnish Lapland, Journal of Geochemical Exploration, 32, 223-230.

Reading, K.A.L. et al.(1987): Biogeochemical Prospecting for Gold in the Canadian Arctic, Journal of Geochemical Exploration, 27, 143-155.

Salim, J., Aguiar, A.P. and Veiga, J.P.(1978): Mineralizacao de Tungstenio na Serra do Feticeiro, Lages, RN., UFRN Natal, Rev.Ciencia., vol.1, no.1, pp.59-67.

Salim, J.(1978): Ciclo de Estudos sobre a prospeccao Scheelitifera do Nordeste, Currais Novos (RN), (patroc. DNPM).

Salim, J.(1979): Geologia e Controles das Mineralizacoes Scheelitiferas da Regiao da Serra do Feiticeiro e Bonfim, 106p. (Teste de Mestrado, UNB).

Salim, J.(1988): Mapas metalogeneticos e de Previsao de Recursos Minerais (1:250,000), DNPM (Todas as folhas que englobem a Provincia Scheelitifera do Nordeste).

Schobbenhaus, C. et al. Coodinators (1984): Geologia do Brasil: Texto Explicado do Mapa Geologicco do Brasil e da Area Oceanica Adjacente incluindo Depositos Minerais, Escala 1:2,500,000, 501p., DNPM Brasilia.

Schobbenhaus, C. coodinator (1974): Carta Geologica do Brasil ao Milionesimo: Folha Jaguaribe (SB-24), Folha Fortaleza (SA-24), DNPM, Brasilia.

Sial, A.S.(1986): GRanite Types in Northeastern Brazil: Current Knowledge, Rev.Bras.Geoc., vol.16, no.1, pp.54-72.

Souza, Z.S. et al. (1986): Geologia e controle de mineralizacao aurifera entre Lages e Sao Tome, Regiao Serido/RN - Topicos Preliminares, in XII Simposio de Geologia do Nordeste - Joao Pessoa - PB de 01 a 04 de maio de 1986, pp.169-182.

Strong, D.F.(1988): A Review and Model for Granite-related Mineral Deposits, in Recent Advances in the Geology of Granite-Related Mineral Deposits, pp.424-445, CIM Special Vol.39, edited by R.P.Taylor and D.F.Strong.

Takahashi, M. et al.(1980): Magnetite-series/Ilmenite-series vs. I-Type/S-Type granitoides, Mining Geology Special Issue, No.8, pp.13-28, The Society of Mining Geologists of Japan.

Torres, H.F. et al.(1973): Projeto Tungstenio/Molibdenio, Recife, DNPM (Relat. Final).

Torres, H.F. et al.(1988): Mapas Metalogeneticos e de Previsao de Recursos Minerais (1:250,000), DNPM.

Tsuchiya, A.(1990): Hypertropic growth of trees of the Caatinga plant community and water balance, Latin American Studies, 11, 51-70.

Valenti, I. et al.(1986): Biogeochemical Exploration for Gold at a Site in the Cordillera Cantabrica, Spain, Journal fo Geochemical Exploration, 26, 249-258.

White, A.J.R. and Chapel, B.W.(1977): Ultrametamorphism and granitoid genesis, Tectonophysics, vol.43, pp.7-22.

Whitten, E.H.T.(1966): Structural Geology of Folded Rocks, 678p., Rand Mc.Nally & Co.

Willig, C.D.(1986): Geologia do Tungstenio, in Principais depositos minerais do Brasil, vol.2, DNPM, pp.387-391.

(2) MAPS

Amaral, C.A.(1987): Areia Branca/Mossoro, Falhas SB.24-X-B/D Regiao Nordeste, Carta metalogenetica, Cartade previsao de recursos minerais, Carta de previsao de acoes governamentais, escala 1:250,000, DNPM Brasilia.

CNEN/CPRM (1975): Mapa geologico, Projeto NE/203 - Currais Novos, escala 1:100,000.

CNEN/CPRM (1975): Mapa geologico, Projeto NE/204 - Jardim do Serido, escala 1:100,000.

CNEN/CPRM (1975): Mapa geologico, Projeto NE/205 - Picui, escala 1:100,000.

CPRM (1980): Mapa previsional do ouro supergenetico, detritico e quimico, 1:1,000,000.

CPRM (1980): Mapa previsional do ouro primario, 1:1,000,000.

CPRM (1980): Mapa tectono - geologico, 1:1,000,000.

CPRM (1980): Mapa metalogenetico do ouro, supergenetico detritico, Caico SB.24-Z-B-I, 1:100,000.

CPRM (1980): Mapa metalogenetico do ouro, supergenetico detritico, Pianco/Itaporanga, SB.24-Z-D-I, SB.24-Z-C-II, 1:100,000.

CPRM (1980): Mapa metalogenetico do ouro, supergenetico, Natal(SB.25), Jaguaribe(SB.24), Recife(SC.25), Aracaju(SC.24), 1:1,000,000.

CPRM (1980): Mapa metalogenetico do ouro, jazimentos primarios e secundarios, Natal(SB.25), Jaguaribe(SB.24), Recife(SC.25), Aracaju(SC.24), 1:1,000,000.

CPRM (1980): Mapa metalogenetico do ouro, jazimentos primarios e secundarios, Caico SB.24-Z-B-I, 1:100,000.

CPRM (1982): Projeto mapa metalogeneticos e de previsao de recursos minerais, Mapa Geocronologico, 1:250,000.

CPRM (1983): Projeto mapa metalogeneticos e de previsao de recursos auriferos, Carta metalogenetica dos recursos auriferos, Jaguaribe/Natal SB.24/SB.25, 1:1,000,000.

DNPM/CPRM (1980): Projeto scheelita do Serido, Mapa geologico integrado, 1:250,000.

DNPM/CPRM (1982): Projeto mapas metalogeneticos e de previsao de recursos minerais, Carta de previsao de recursos minerais, Areia Branca/Mossoro, Folha SB.24-X-B/SB.24-X-D, 1:250,000.

DNPM/CPRM (1982): Projeto mapas metalogeneticos e de previsao de recursos minerais, Carts de previsao de recursos minerais, Caico, Folha SB.24-Z-B, 1:250,000.

DNPM/CPRM (1982): Projeto mapas metalogeneticos e de previsao de recursos minerais, Mapa geo-

fisico, Caico, Folha SB.24-Z-B, 1:250,000.
DNPM/CPRM (1982): Projeto mapas metalogeneticos e de previsao de recursos minerais, Carts metalogenetica, Natal, Folha SB.25-V-C, 1:250,000.
MME/DNPM : Areas protocoliz. ate 30/09/88, Rotina CS 0636 0000 overlay 37 de 88/12/27.
MME/DNPM : Areas protocoliz. ate 30/09/88, Rotina CS 0636 0030 overlay 38 de 88/12/27.
MME/DNPM : Areas protocoliz. ate 31/07/88, Rotina CS 0636 0030 overlay 9 de 88/09/09.
MME/DNPM : Areas protocoliz. ate 31/07/88, Rotina CS 0536 3000 overlay 37 de 88/09/09.
MME/DNPM : Areas protocoliz. ate 31/07/88, Rotina 0636 3030 overlay 35 de 88/09/09.
UFRN (1986): Mapa geologico da Faixa Aurifera Sao Francisco, Currais Novos - RN, 1:10,000.

(3) DATA

Listagem das ocorrencias minerais.
MME-DNPM prosig sistema codigo de mineracao data 98/02/02. Listagem de dados essenciais, classificada por: ano/numero do processo referente a todo Brasil, Nordeste, NT - Inativo (Morto).
MME-DNPM prosig sistema codigo de mineracao data 98/02/02. Listagem de dadosessenciais, classificada por: ano/numero do processo referente a todo Brasil, Currais Novos - Inativo (Morto).
CPRM (1980): Comite de ouro, Relatorio Final vol.2.

TABLES

and

FIGURES

FIGURES

TABLES

PLATES

APPENDICES

APPENDICES

Appendix 1

Analytical data of soil samples.

List of Geochemical Analysis(1)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
1	B2456	42130	777.300	9286.000	.2	1.0	.5
2	B2457	42130	777.350	9286.000	.2	4.0	.5
3	B2458	42130	777.400	9286.000	.2	.5	.5
4	B2459	42130	777.450	9286.000	.2	.5	.5
5	B2460	42130	777.500	9286.000	.2	.5	.5
6	B2461	42130	777.550	9286.000	27.0	.5	.5
7	B2462	42130	777.600	9286.000	.2	.5	.5
8	B2463	42130	777.650	9286.000	.2	18.0	.5
9	B2464	42130	777.700	9286.000	.2	10.0	.5
10	B2465	42130	777.750	9286.000	.2	4.0	.5
11	B2466	42130	777.800	9286.000	.2	7.0	.5
12	B2467	42130	777.850	9286.000	.2	2.0	.5
13	B2468	42130	777.900	9286.000	.2	6.0	.5
14	B2469	42130	777.950	9286.000	.2	3.0	.5
15	B2470	42130	778.000	9286.000	.2	1.0	.5
16	B2471	42130	778.050	9286.000	.2	9.0	.5
17	B2472	42130	778.100	9286.000	.2	22.0	.5
18	B2473	42130	778.150	9286.000	.2	.5	.5
19	B2474	42130	778.200	9286.000	.2	.5	.5
20	B2475	42130	778.250	9286.000	.2	1.0	.5
21	B2476	42130	778.300	9286.000	.2	6.0	.5
22	B2477	42130	778.350	9286.000	.2	1.0	.5
23	B2478	42130	778.400	9286.000	.2	4.0	.5
24	B2479	42130	778.450	9286.000	.2	3.0	.5
25	B2480	42130	778.500	9286.000	.2	2.0	.5
26	B2481	42130	778.550	9286.000	12.0	3.0	.5
27	B2482	42130	778.600	9286.000	.2	4.0	.5
28	B2483	42130	778.650	9286.000	.2	1.0	.5
29	B2484	42130	778.700	9286.000	.2	4.0	.5
30	B2485	42130	778.750	9286.000	.2	.5	.5
31	B2486	42130	778.800	9286.000	.2	1.0	.5
32	B2487	42130	778.850	9286.000	.2	7.0	.5
33	B2488	42130	778.900	9286.000	.2	3.0	.5
34	B2489	42130	778.950	9286.000	.2	2.0	.5
35	B2490	42130	779.000	9286.000	.2	1.0	.5
36	B2491	42130	779.050	9286.000	.2	.5	.5
37	B2492	42130	779.100	9286.000	.2	1.0	.5
38	B2493	42130	779.150	9286.000	.2	8.0	.5
39	B2494	42130	779.200	9286.000	.2	9.0	.5
40	B2495	42130	779.250	9286.000	.2	7.0	.5
41	B2496	42130	779.300	9286.000	.2	10.0	.5
42	B2497	11400	777.300	9285.800	.2	1.0	.5
43	B2498	11450	777.350	9285.800	.2	.5	.5
44	B2499	42130	777.400	9285.800	.2	.5	.5
45	B2500	42130	777.450	9285.800	3.0	.5	.5
46	B2501	42130	777.500	9285.800	4.0	.5	.5
47	B2502	42130	777.550	9285.800	.2	.5	.5
48	B2503	42130	777.600	9285.800	.2	.5	.5
49	B2504	42130	777.650	9285.800	.2	.5	.5
50	B2505	42130	777.700	9285.800	.2	1.0	.5

List of Geochemical Analysis(2)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
51	B2506	42130	777.750	9285.800	.2	12.0	.5
52	B2507	42130	777.800	9285.800	.2	1.0	.5
53	B2508	42130	777.850	9285.800	.2	5.0	.5
54	B2509	42130	777.900	9285.800	.2	5.0	.5
55	B2510	42130	777.950	9285.800	.2	1.0	.5
56	B2511	42130	778.000	9285.800	7.0	1.0	.5
57	B2512	42130	778.050	9285.800	.2	12.0	.5
58	B2513	42130	778.100	9285.800	.2	3.0	.5
59	B2514	42130	778.150	9285.800	.2	3.0	.5
60	B2515	42130	778.200	9285.800	.2	1.0	.5
61	B2516	42130	778.250	9285.800	.2	10.0	.5
62	B2517	42130	778.300	9285.800	.2	3.0	.5
63	B2518	42130	778.350	9285.800	.2	1.0	.5
64	B2519	42130	778.400	9285.800	.2	5.0	.5
65	B2520	42130	778.450	9285.800	.2	2.0	.5
66	B2521	42130	778.500	9285.800	.2	1.0	.5
67	B2522	42130	778.550	9285.800	.2	.5	.5
68	B2523	42130	778.600	9285.800	.2	.5	.5
69	B2524	42130	778.650	9285.800	.2	.5	.5
70	B2525	42130	778.700	9285.800	.2	1.0	.5
71	B2526	42130	778.750	9285.800	.2	5.0	.5
72	B2527	42130	778.800	9285.800	.2	3.0	.5
73	B2528	42130	778.850	9285.800	3.0	1.0	.5
74	B2529	42130	778.900	9285.800	116.0	1.0	.5
75	B2530	42130	778.950	9285.800	.2	1.0	.5
76	B2531	42130	779.000	9285.800	.2	6.0	.5
77	B2532	42130	779.050	9285.800	.2	6.0	.5
78	B2533	42130	779.100	9285.800	.2	1.0	.5
79	B2534	42130	779.150	9285.800	.2	3.0	.5
80	B2535	42130	779.200	9285.800	.2	1.0	.5
81	B2536	42130	779.250	9285.800	.2	4.0	.5
82	B2537	42130	779.300	9285.800	.2	9.0	.5
83	B2538	42130	777.300	9285.600	.2	1.0	.5
84	B2539	42130	777.350	9285.600	.2	.5	.5
85	B2540	42130	777.400	9285.600	.2	.5	.5
86	B2541	42130	777.450	9285.600	.2	1.0	.5
87	B2542	42130	777.500	9285.600	4.0	.5	.5
88	B2543	42130	777.550	9285.600	6.0	1.0	.5
89	B2544	42130	777.600	9285.600	.2	2.0	.5
90	B2545	42130	777.650	9285.600	.2	.5	.5
91	B2546	42130	777.700	9285.600	.2	1.0	.5
92	B2547	42130	777.750	9285.600	.2	.5	.5
93	B2548	11400	777.800	9285.600	.2	.5	.5
94	B2549	42130	777.850	9285.600	.2	.5	.5
95	B2550	42130	777.900	9285.600	.2	.5	.5
96	B2551	42130	777.950	9285.600	.2	.5	.5
97	B2552	42130	778.000	9285.600	4.0	1.0	.5
98	B2553	42130	778.050	9285.600	.2	2.0	.5
99	B2554	42130	778.100	9285.600	.2	1.0	.5
100	B2555	42130	778.150	9285.600	.2	1.0	.5

List of Geochemical Analysis(3)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
101	B2556	42130	778.200	9285.600	.2	.5	.5
102	B2557	42130	778.250	9285.600	.2	.5	.5
103	B2558	42130	778.300	9285.600	.2	.5	.5
104	B2559	42130	778.350	9285.600	.2	.5	.5
105	B2560	42130	778.400	9285.600	.2	.5	.5
106	B2561	42130	778.450	9285.600	.2	.5	.5
107	B2562	42130	778.500	9285.600	.2	.5	.5
108	B2563	42130	778.550	9285.600	.2	1.0	.5
109	B2564	42130	778.600	9285.600	3.0	7.0	.5
110	B2565	42130	778.650	9285.600	10.0	1.0	.5
111	B2566	42130	778.700	9285.600	.2	.5	.5
112	B2567	42130	778.750	9285.600	.2	.5	.5
113	B2568	42130	778.800	9285.600	.2	.5	.5
114	B2569	42130	778.850	9285.600	.2	.5	.5
115	B2570	42130	778.900	9285.600	5.0	.5	.5
116	B2571	42130	778.950	9285.600	4.0	.5	.5
117	B2572	42130	779.000	9285.600	.2	.5	.5
118	B2573	42130	779.050	9285.600	.2	.5	.5
119	B2574	42130	779.100	9285.600	.2	5.0	.5
120	B2575	42130	779.150	9285.600	.2	2.0	.5
121	B2576	42130	779.200	9285.600	.2	1.0	.5
122	B2577	42130	779.250	9285.600	2.0	7.0	.5
123	B2578	42130	779.300	9285.600	.2	1.0	.5
124	B2579	42130	777.300	9285.400	.2	.5	.5
125	B2580	42130	777.350	9285.400	.2	.5	.5
126	B2581	42130	777.400	9285.400	.2	.5	.5
127	B2582	42130	777.450	9285.400	.2	.5	.5
128	B2583	42130	777.500	9285.400	.2	.5	.5
129	B2584	42130	777.550	9285.400	.2	.5	.5
130	B2585	42130	777.600	9285.400	.2	.5	.5
131	B2586	42130	777.650	9285.400	.2	.5	.5
132	B2587	42130	777.700	9285.400	.2	.5	.5
133	B2588	42130	777.750	9285.400	.2	2.0	.5
134	B2589	42130	777.800	9285.400	.2	1.0	.5
135	B2590	42130	777.850	9285.400	.2	.5	.5
136	B2591	42130	777.900	9285.400	.2	.5	.5
137	B2592	42130	777.950	9285.400	.2	.5	.5
138	B2593	42130	778.000	9285.400	.2	.5	.5
139	B2594	42130	778.050	9285.400	.2	.5	.5
140	B2595	42130	778.100	9285.400	.2	1.0	.5
141	B2596	42130	778.150	9285.400	.2	3.0	.5
142	B2597	42130	778.200	9285.400	.2	17.0	.5
143	B2598	42130	778.250	9285.400	.2	1.0	.5
144	B2599	42130	778.300	9285.400	.2	.5	.5
145	B2600	42130	778.350	9285.400	.2	.5	.5
146	B2601	42130	778.400	9285.400	.2	.5	.5
147	B2602	42130	778.450	9285.400	.2	1.0	.5
148	B2603	42130	778.500	9285.400	.2	3.0	.5
149	B2604	42130	778.550	9285.400	.2	16.0	.5
150	B2605	42130	778.600	9285.400	.2	8.0	.5

List of Geochemical Analysis(4)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
151	B2606	42130	778.650	9285.400	.2	1.0	.5
152	B2607	42130	778.700	9285.400	4.0	.5	.5
153	B2608	42130	778.750	9285.400	.2	.5	.5
154	B2609	42130	778.800	9285.400	.2	.5	.5
155	B2610	42130	778.850	9285.400	.2	.5	.5
156	B2611	42130	778.900	9285.400	.2	1.0	.5
157	B2612	42130	778.950	9285.400	.2	.5	.5
158	B2613	42130	779.000	9285.400	.2	.5	.5
159	B2614	42130	779.050	9285.400	.2	.5	.5
160	B2615	42130	779.100	9285.400	.2	1.0	.5
161	B2616	42130	779.150	9285.400	.2	6.0	.5
162	B2617	42130	779.200	9285.400	.2	37.0	.5
163	B2618	42130	779.250	9285.400	.2	10.0	.5
164	B2619	42130	779.300	9285.400	.2	9.0	.5
165	B2620	42130	777.300	9285.200	.2	.5	.5
166	B2621	42130	777.350	9285.200	.2	.5	.5
167	B2622	42130	777.400	9285.200	.2	.5	.5
168	B2623	42130	777.450	9285.200	.2	.5	.5
169	B2624	42130	777.500	9285.200	.2	.5	.5
170	B2625	42130	777.550	9285.200	.2	.5	.5
171	B2626	42130	777.600	9285.200	.2	.5	.5
172	B2627	42130	777.650	9285.200	.2	.5	.5
173	B2628	42130	777.700	9285.200	.2	2.0	.5
174	B2629	42130	777.750	9285.200	.2	2.0	.5
175	B2630	42130	777.800	9285.200	.2	1.0	.5
176	B2631	42130	777.850	9285.200	.2	.5	.5
177	B2632	42130	777.900	9285.200	.2	.5	.5
178	B2633	42130	777.950	9285.200	.2	.5	.5
179	B2634	42130	778.000	9285.200	.2	.5	.5
180	B2635	42130	778.050	9285.200	2.0	.5	.5
181	B2636	42130	778.100	9285.200	.2	1.0	.5
182	B2637	42130	778.150	9285.200	.2	5.0	.5
183	B2638	42130	778.200	9285.200	.2	.5	.5
184	B2639	42130	778.250	9285.200	.2	1.0	.5
185	B2640	42130	778.300	9285.200	.2	1.0	.5
186	B2641	42130	778.350	9285.200	.2	5.0	.5
187	B2642	42130	778.400	9285.200	.2	1.0	.5
188	B2643	42130	778.450	9285.200	.2	.5	.5
189	B2644	42130	778.500	9285.200	.2	7.0	.5
190	B2645	42130	778.550	9285.200	.2	.5	.5
191	B2646	42130	778.600	9285.200	.2	.5	.5
192	B2647	11400	778.650	9285.200	.2	1.0	.5
193	B2648	42130	778.700	9285.200	10.0	.5	.5
194	B2649	42130	778.750	9285.200	.2	.5	.5
195	B2650	42130	778.800	9285.200	.2	1.0	.5
196	B2651	42130	778.850	9285.200	.2	1.0	.5
197	B2652	42130	778.900	9285.200	9.0	2.0	.5
198	B2653	42130	778.950	9285.200	.2	9.0	.5
199	B2654	42130	779.000	9285.200	.2	4.0	.5
200	B2655	42130	779.050	9285.200	.2	5.0	.5

List of Geochemical Analysis(5)

Ser. No.	Sample No.	Geoi Unit	Location (km) X-coord	Y-coord	Au ppb	As ppm	Sb ppm
201	B2656	42130	779.100	9285.200	.2	.5	.5
202	B2657	42130	779.150	9285.200	6.0	.5	.5
203	B2658	42130	779.200	9285.200	.2	.5	.5
204	B2659	42130	779.250	9285.200	.2	.5	.5
205	B2660	42130	779.300	9285.200	.2	.5	.5
206	B2661	42130	777.300	9285.000	.2	1.0	.5
207	B2662	42130	777.350	9285.000	.2	5.0	.5
208	B2663	42130	777.400	9285.000	.2	.5	.5
209	B2664	42130	777.450	9285.000	.2	.5	.5
210	B2665	42130	777.500	9285.000	.2	1.0	.5
211	B2666	42130	777.550	9285.000	.2	2.0	.5
212	B2667	42130	777.600	9285.000	.2	1.0	.5
213	B2668	42130	777.650	9285.000	.2	1.0	.5
214	B2669	42130	777.700	9285.000	.2	.5	.5
215	B2670	42130	777.750	9285.000	.2	.5	.5
216	B2671	42130	777.800	9285.000	.2	.5	.5
217	B2672	42130	777.850	9285.000	.2	.5	.5
218	B2673	42130	777.900	9285.000	.2	.5	.5
219	B2674	42130	777.950	9285.000	.2	.5	.5
220	B2675	42130	778.000	9285.000	.2	.5	.5
221	B2676	11400	778.050	9285.000	.2	.5	.5
222	B2677	11400	778.100	9285.000	.2	.5	.5
223	B2678	42130	778.150	9285.000	.2	.5	.5
224	B2679	42130	778.200	9285.000	.2	2.0	.5
225	B2680	42130	778.250	9285.000	.2	2.0	.5
226	B2681	42130	778.300	9285.000	.2	1.0	.5
227	B2682	42130	778.350	9285.000	.2	.5	.5
228	B2683	42130	778.400	9285.000	.2	.5	.5
229	B2684	42130	778.450	9285.000	.2	.5	.5
230	B2685	42130	778.500	9285.000	.2	.5	.5
231	B2686	42130	778.550	9285.000	.2	1.0	.5
232	B2687	42130	778.600	9285.000	.2	8.0	.5
233	B2688	42130	778.650	9285.000	.2	2.0	.5
234	B2689	42130	778.700	9285.000	.2	1.0	.5
235	B2690	42130	778.750	9285.000	.2	2.0	.5
236	B2691	42130	778.800	9285.000	.2	2.0	.5
237	B2692	42130	778.850	9285.000	.2	1.0	.5
238	B2693	42130	778.900	9285.000	.2	2.0	.5
239	B2694	42130	778.950	9285.000	.2	6.0	.5
240	B2695	42130	779.000	9285.000	10.0	9.0	.5
241	B2696	42130	779.050	9285.000	.2	9.0	.5
242	B2697	42130	779.100	9285.000	.2	6.0	.5
243	B2698	42130	779.150	9285.000	.2	4.0	.5
244	B2699	42130	779.200	9285.000	.2	6.0	.5
245	B2700	42130	779.250	9285.000	.2	5.0	.5
246	B2701	42130	779.300	9285.000	.2	2.0	.5
247	B2702	42130	777.300	9284.800	.2	2.0	.5
248	B2703	42130	777.350	9284.800	.2	1.0	.5
249	B2704	42130	777.400	9284.800	.2	.5	.5
250	B2705	42130	777.450	9284.800	.2	.5	.5

List of Geochemical Analysis(6)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Y-coord	Au ppb	As ppm	Sb ppm
251	B2706	42130	777.500	9284.800	.2	.5	.5
252	B2707	42130	777.550	9284.800	.2	.5	.5
253	B2708	42130	777.600	9284.800	.2	1.0	.5
254	B2709	42130	777.650	9284.800	.2	1.0	.5
255	B2710	42130	777.700	9284.800	.2	1.0	.5
256	B2711	42130	777.750	9284.800	.2	1.0	.5
257	B2712	42130	777.800	9284.800	.2	6.0	.5
258	B2713	42130	777.850	9284.800	.2	1.0	.5
259	B2714	42130	777.900	9284.800	.2	.5	.5
260	B2715	42130	777.950	9284.800	.2	.5	.5
261	B2716	42130	778.000	9284.800	.2	.5	.5
262	B2717	42130	778.050	9284.800	.2	.5	.5
263	B2718	42130	778.100	9284.800	.2	.5	.5
264	B2719	42130	778.150	9284.800	.2	.5	.5
265	B2720	42130	778.200	9284.800	.2	.5	.5
266	B2721	42130	778.250	9284.800	.2	1.0	.5
267	B2722	42130	778.300	9284.800	.2	4.0	.5
268	B2723	42130	778.350	9284.800	.2	6.0	.5
269	B2724	11400	778.400	9284.800	.2	1.0	.5
270	B2725	42130	778.450	9284.800	.2	.5	.5
271	B2726	42130	778.500	9284.800	.2	.5	.5
272	B2727	42130	778.550	9284.800	.2	.5	.5
273	B2728	42130	778.600	9284.800	.2	.5	.5
274	B2729	42130	778.650	9284.800	.2	.5	.5
275	B2730	42130	778.700	9284.800	.2	1.0	.5
276	B2731	42130	778.750	9284.800	.2	5.0	.5
277	B2732	42130	778.800	9284.800	.2	.5	.5
278	B2733	42130	778.850	9284.800	1.0	.5	.5
279	B2734	42130	778.900	9284.800	.2	.5	.5
280	B2735	42130	778.950	9284.800	.2	.5	.5
281	B2736	42130	779.000	9284.800	.2	.5	.5
282	B2737	42130	779.050	9284.800	.2	.5	.5
283	B2738	42130	779.100	9284.800	.2	.5	.5
284	B2739	42130	779.150	9284.800	.2	8.0	.5
285	B2740	42130	779.200	9284.800	.2	6.0	.5
286	B2741	42130	779.250	9284.800	.2	8.0	.5
287	B2742	42130	779.300	9284.800	.2	1.0	.5
288	B2743	42130	777.300	9284.600	.2	.5	.5
289	B2744	42130	777.350	9284.600	.2	.5	.5
290	B2745	42130	777.400	9284.600	.2	.5	.5
291	B2746	42130	777.450	9284.600	.2	.5	.5
292	B2747	42130	777.500	9284.600	.2	.5	.5
293	B2748	42130	777.550	9284.600	.2	.5	.5
294	B2749	42130	777.600	9284.600	.2	.5	.5
295	B2750	42130	777.650	9284.600	.2	.5	.5
296	B2751	42130	777.700	9284.600	.2	.5	.5
297	B2752	42130	777.750	9284.600	.2	.5	.5
298	B2753	42130	777.800	9284.600	2.0	.5	.5
299	B2754	42130	777.850	9284.600	.2	.5	.5
300	B2755	42130	777.900	9284.600	.2	.5	.5

List of Geochemical Analysis(7)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
301	B2756	42130	777.950	9284.600	.2	.5	.5
302	B2757	42130	778.000	9284.600	.2	.5	.5
303	B2758	42130	778.050	9284.600	.2	.5	.5
304	B2759	42130	778.100	9284.600	.2	4.0	.5
305	B2760	42130	778.150	9284.600	1.0	1.0	.5
306	B2761	42130	778.200	9284.600	.2	5.0	.5
307	B2762	42130	778.250	9284.600	.2	11.0	.5
308	B2763	42130	778.300	9284.600	.2	2.0	.5
309	B2764	42130	778.350	9284.600	.2	8.0	.5
310	B2765	42130	778.400	9284.600	.2	.5	.5
311	B2766	42130	778.450	9284.600	.2	.5	.5
312	B2767	42130	778.500	9284.600	.2	.5	.5
313	B2768	42130	778.550	9284.600	.2	.5	.5
314	B2769	42130	778.600	9284.600	.2	.5	.5
315	B2770	42130	778.650	9284.600	.2	.5	.5
316	B2771	42130	778.700	9284.600	.2	.5	.5
317	B2772	42130	778.750	9284.600	.2	.5	.5
318	B2773	42130	778.800	9284.600	.2	.5	.5
319	B2774	42130	778.850	9284.600	.2	.5	.5
320	B2775	42130	778.900	9284.600	.2	.5	.5
321	B2776	42130	778.950	9284.600	.2	.5	.5
322	B2777	42130	779.000	9284.600	.2	.5	.5
323	B2778	42130	779.050	9284.600	.2	.5	.5
324	B2779	42130	779.100	9284.600	.2	.5	.5
325	B2780	42130	779.150	9284.600	.2	5.0	.5
326	B2781	42130	779.200	9284.600	.2	1.0	.5
327	B2782	42130	779.250	9284.600	.2	.5	.5
328	B2783	42130	779.300	9284.600	.2	.5	.5
329	B2784	42130	777.300	9284.400	.2	.5	.5
330	B2785	42130	777.350	9284.400	.2	.5	.5
331	B2786	42130	777.400	9284.400	.2	.5	.5
332	B2787	42130	777.450	9284.400	.2	.5	.5
333	B2788	42130	777.500	9284.400	.2	.5	.5
334	B2789	42130	777.550	9284.400	.2	1.0	.5
335	B2790	42130	777.600	9284.400	.2	1.0	.5
336	B2791	42130	777.650	9284.400	.2	4.0	.5
337	B2792	42130	777.700	9284.400	.2	1.0	.5
338	B2793	11400	777.750	9284.400	.2	.5	.5
339	B2794	42130	777.800	9284.400	.2	.5	.5
340	B2795	42130	777.850	9284.400	.2	.5	.5
341	B2796	42130	777.900	9284.400	.2	.5	.5
342	B2797	42130	777.950	9284.400	.2	.5	.5
343	B2798	42130	778.000	9284.400	.2	1.0	.5
344	B2799	42130	778.050	9284.400	.2	1.0	.5
345	B2800	42130	778.100	9284.400	.2	.5	.5
346	B2801	42130	778.150	9284.400	.2	.5	.5
347	B2802	42130	778.200	9284.400	.2	.5	.5
348	B2803	42130	778.250	9284.400	4.0	.5	.5
349	B2804	42130	778.300	9284.400	.2	.5	.5
350	B2805	42130	778.350	9284.400	.2	.5	.5

List of Geochemical Analysis(8)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
351	B2806	42130	778.400	9284.400	.2	.5	.5
352	B2807	42130	778.450	9284.400	.2	.5	.5
353	B2808	42130	778.500	9284.400	.2	.5	.5
354	B2809	42130	778.550	9284.400	.2	.5	.5
355	B2810	42130	778.600	9284.400	.2	.5	.5
356	B2811	42130	778.650	9284.400	.2	.5	.5
357	B2812	42130	778.700	9284.400	.2	.5	.5
358	B2813	42130	778.750	9284.400	.2	.5	.5
359	B2814	42130	778.800	9284.400	.2	.5	.5
360	B2815	42130	778.850	9284.400	.2	.5	.5
361	B2816	42130	778.900	9284.400	.2	.5	.5
362	B2817	42130	778.950	9284.400	.2	.5	.5
363	B2818	42130	779.000	9284.400	.2	1.0	.5
364	B2819	42130	779.050	9284.400	.2	1.0	.5
365	B2820	42130	779.100	9284.400	.2	.5	.5
366	B2821	42130	779.150	9284.400	.2	.5	.5
367	B2822	11400	779.200	9284.400	.2	.5	.5
368	B2823	11400	779.250	9284.400	.2	.5	.5
369	B2824	11400	779.300	9284.400	.2	.5	.5
370	B2825	42130	777.300	9284.200	.2	.5	.5
371	B2826	42130	777.350	9284.200	.2	2.0	.5
372	B2827	42130	777.400	9284.200	.2	1.0	.5
373	B2828	42130	777.450	9284.200	.2	.5	.5
374	B2829	42130	777.500	9284.200	.9	.5	.5
375	B2830	42130	777.550	9284.200	.2	.5	.5
376	B2831	42130	777.600	9284.200	.2	.5	.5
377	B2832	42130	777.650	9284.200	.2	.5	.5
378	B2833	42130	777.700	9284.200	.2	.5	.5
379	B2834	42130	777.750	9284.200	.2	.5	.5
380	B2835	42130	777.800	9284.200	.2	.5	.5
381	B2836	42130	777.850	9284.200	.2	1.0	.5
382	B2837	42130	777.900	9284.200	.2	.5	.5
383	B2838	42130	777.950	9284.200	.2	1.0	.5
384	B2839	42130	778.000	9284.200	.2	.5	.5
385	B2840	42130	778.050	9284.200	2.0	.5	.5
386	B2841	11400	778.100	9284.200	.2	.5	.5
387	B2842	11400	778.150	9284.200	.2	1.0	.5
388	B2843	11400	778.200	9284.200	.2	1.0	.5
389	B2844	11400	778.250	9284.200	.2	.5	.5
390	B2845	11400	778.300	9284.200	.2	2.0	.5
391	B2846	42130	778.350	9284.200	.2	1.0	.5
392	B2847	42130	778.400	9284.200	.2	.5	.5
393	B2848	11400	778.450	9284.200	.2	.5	.5
394	B2849	11400	778.500	9284.200	.2	.5	.5
395	B2850	11400	778.550	9284.200	.2	1.0	.5
396	B2851	42130	778.600	9284.200	.2	16.0	.5
397	B2852	42130	778.650	9284.200	.2	1.0	.5
398	B2853	42130	778.700	9284.200	.2	.5	.5
399	B2854	42130	778.750	9284.200	.2	.5	.5
400	B2855	42130	778.800	9284.200	.2	.5	.5

List of Geochemical Analysis (9)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
401	B2856	42130	778.850	9284.200	.2	.5	.5
402	B2857	42130	778.900	9284.200	.2	.5	.5
403	B2858	42130	778.950	9284.200	.2	1.0	.5
404	B2859	42130	779.000	9284.200	.2	1.0	.5
405	B2860	42130	779.050	9284.200	.2	.5	.5
406	B2861	42130	779.100	9284.200	.2	.5	.5
407	B2962	42130	779.150	9284.200	18.0	.5	.5
408	B2863	42130	779.200	9284.200	.2	.5	.5
409	B2864	11400	779.250	9284.200	.2	.5	.5
410	B2865	11400	779.300	9284.200	.2	.5	.5
411	B2866	42130	777.300	9284.000	.2	.5	.5
412	B2867	42130	777.350	9284.000	.2	.5	.5
413	B2868	42130	777.400	9284.000	.2	.5	.5
414	B2869	42130	777.450	9284.000	.2	.5	.5
415	B2870	42130	777.500	9284.000	.2	.5	.5
416	B2871	42130	777.550	9284.000	.2	.5	.5
417	B2872	42130	777.600	9284.000	.2	.5	.5
418	B2873	42130	777.650	9284.000	.2	.5	.5
419	B2874	42130	777.700	9284.000	.2	.5	.5
420	B2875	42130	777.750	9284.000	.2	.5	.5
421	B2876	42130	777.800	9284.000	2.0	.5	.5
422	B2877	42130	777.850	9284.000	.2	.5	.5
423	B2878	42130	777.900	9284.000	.2	.5	.5
424	B2879	42130	777.950	9284.000	.2	.5	.5
425	B2880	42130	778.000	9284.000	.2	.5	.5
426	B2881	42130	778.050	9284.000	.2	.5	.5
427	B2883	42130	778.150	9284.000	.2	.5	.5
428	B2884	42130	778.200	9284.000	.2	.5	.5
429	B2885	42130	778.250	9284.000	.2	.5	.5
430	B2886	42130	778.300	9284.000	.2	.5	.5
431	B2887	42130	778.350	9284.000	.2	.5	.5
432	B2888	11400	778.400	9284.000	.2	.5	.5
433	B2889	11400	778.450	9284.000	.2	.5	.5
434	B2890	42130	778.500	9284.000	.2	.5	.5
435	B2891	42130	778.550	9284.000	.2	.5	.5
436	B2892	42130	778.600	9284.000	.2	.5	.5
437	B2893	42130	778.650	9284.000	.2	.5	.5
438	B2894	42130	778.700	9284.000	.2	.5	.5
439	B2895	42130	778.750	9284.000	.2	.5	.5
440	B2896	42130	778.800	9284.000	.2	.5	.5
441	B2897	42130	778.850	9284.000	.2	.5	.5
442	B2898	42130	778.900	9284.000	.2	.5	.5
443	B2899	42130	778.950	9284.000	.2	.5	.5
444	B2900	42130	779.000	9284.000	.2	.5	.5
445	B2901	42130	779.050	9284.000	.2	.5	.5
446	B2902	42130	779.100	9284.000	.2	.5	.5
447	B2903	42130	779.150	9284.000	.2	.5	.5
448	B2904	42130	779.200	9284.000	.2	.5	.5
449	B2905	11400	779.250	9284.000	.2	.5	.5
450	B2906	42130	779.300	9284.000	.2	.5	.5

List of Geochemical Analysis (10)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
451	B2907	42130	777.300	9283.800	.2	3.0	.5
452	B2908	42130	777.350	9283.800	.2	3.0	.5
453	B2909	42130	777.400	9283.800	.2	3.0	.5
454	B2910	42130	777.450	9283.800	.2	5.0	.5
455	B2911	42130	777.500	9283.800	.2	4.0	.5
456	B2912	42130	777.550	9283.800	.2	2.0	.5
457	B2913	42130	777.600	9283.800	.2	1.0	.5
458	B2914	42130	777.650	9283.800	2.0	.5	.5
459	B2915	42130	777.700	9283.800	.2	.5	.5
460	B2916	42130	777.750	9283.800	.2	.5	.5
461	B2917	11400	777.800	9283.800	.2	.5	.5
462	B2918	42130	777.850	9283.800	.2	3.0	.5
463	B2919	42130	777.900	9283.800	.2	1.0	.5
464	B2920	42130	777.950	9283.800	.2	.5	.5
465	B2921	42130	778.000	9283.800	.2	.5	.5
466	B2922	42130	778.050	9283.800	.2	.5	.5
467	B2923	42130	778.100	9283.800	.2	.5	.5
468	B2924	42130	778.150	9283.800	.2	.5	.5
469	B2925	42130	778.200	9283.800	.2	.5	.5
470	B2926	42130	778.250	9283.800	.2	.5	.5
471	B2927	42130	778.300	9283.800	.2	.5	.5
472	B2928	42130	778.350	9283.800	.2	.5	.5
473	B2929	42130	778.400	9283.800	.2	.5	.5
474	B2930	42130	778.450	9283.800	.2	.5	.5
475	B2931	42130	778.500	9283.800	.2	.5	.5
476	B2932	42130	778.550	9283.800	.6	.5	.5
477	B2933	42130	778.600	9283.800	.2	.5	.5
478	B2934	42130	778.650	9283.800	.2	.5	.5
479	B2935	11400	778.700	9283.800	.2	.5	.5
480	B2936	42130	778.750	9283.800	.2	.5	.5
481	B2937	42130	778.800	9283.800	.2	.5	.5
482	B2938	42130	778.850	9283.800	.2	.5	.5
483	B2939	42130	778.900	9283.800	.2	.5	.5
484	B2940	42130	778.950	9283.800	.2	.5	.5
485	B2941	42130	779.000	9283.800	.2	.5	.5
486	B2942	42130	779.050	9783.800	.2	.5	.5
487	B2943	42130	779.100	9283.800	.2	.5	.5
488	B2944	42130	779.150	9283.800	.2	.5	.5
489	B2945	42130	779.200	9283.800	.2	.5	.5
490	B2946	42130	779.250	9283.800	.2	.5	.5
491	B2947	11400	779.300	9283.800	.2	.5	.5
492	B2948	42130	777.300	9283.600	.2	1.0	.5
493	B2949	42130	777.350	9283.600	.2	2.0	.5
494	B2950	42130	777.400	9283.600	.2	2.0	.5
495	B2951	42130	777.450	9283.600	.2	1.0	.5
496	B2952	42130	777.500	9283.600	.2	2.0	.5
497	B2953	42130	777.550	9283.600	.2	1.0	.5
498	B2954	42130	777.600	9283.600	.2	.5	.5
499	B2955	42130	777.650	9283.600	.2	.5	.5
500	B2956	42130	777.700	9283.600	.2	1.0	.5

List of Geochemical Analysis(11)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
501	B2957	42130	777.750	9283.600	.2	1.0	.5
502	B2958	42130	777.800	9283.600	.2	.5	.5
503	B2959	42130	777.850	9283.600	.2	1.0	.5
504	B2960	42130	777.900	9283.600	.2	1.0	.5
505	B2961	42130	777.950	9283.600	.2	.5	.5
506	B2962	42130	778.000	9283.600	.2	1.0	.5
507	B2963	42130	778.050	9283.600	.2	.5	.5
508	B2964	42130	778.100	9283.600	.2	.5	.5
509	B2965	42130	778.150	9283.600	.2	.5	.5
510	B2966	42130	778.200	9283.600	.2	1.0	.5
511	B2967	42130	778.250	9283.600	.2	.5	.5
512	B2968	42130	778.300	9283.600	.2	1.0	.5
513	B2969	42130	778.350	9283.600	.2	.5	.5
514	B2970	42130	778.400	9283.600	.2	.5	.5
515	B2971	11400	778.450	9283.600	.2	1.0	.5
516	B2972	42130	778.500	9283.600	.2	.5	.5
517	B2973	42130	778.550	9283.600	.2	.5	.5
518	B2974	42130	778.600	9283.600	.2	1.0	.5
519	B2975	42130	778.650	9283.600	.2	1.0	.5
520	B2976	42130	778.700	9283.600	.2	.5	.5
521	B2977	42130	778.750	9283.600	.2	1.0	.5
522	B2978	11400	778.800	9283.600	.2	.5	.5
523	B2979	42130	778.850	9283.600	.2	.5	.5
524	B2980	11400	778.900	9283.600	.2	1.0	.5
525	B2981	42130	778.950	9283.600	.2	1.0	.5
526	B2982	42130	779.000	9283.600	.2	.5	.5
527	B2983	42130	779.050	9283.600	.2	.5	.5
528	B2984	42130	779.100	9283.600	.2	.5	.5
529	B2985	42130	779.150	9283.600	.2	.5	.5
530	B2986	42130	779.200	9283.600	.2	.5	.5
531	B2987	42130	779.250	9283.600	.2	.5	.5
532	B2988	42130	779.300	9283.600	.2	.5	.5
533	B2989	42130	777.300	9283.400	.2	5.0	.5
534	B2990	42130	777.350	9283.400	.2	1.0	.5
535	B2991	42130	777.400	9283.400	.2	1.0	.5
536	B2992	42130	777.450	9283.400	.2	1.0	.5
537	B2993	42130	777.500	9283.400	.2	9.0	.5
538	B2994	42130	777.550	9283.400	.2	5.0	.5
539	B2995	42130	777.600	9283.400	.2	3.0	.5
540	B2996	42130	777.650	9283.400	.2	1.0	.5
541	B2997	11400	777.700	9283.400	.2	1.0	.5
542	B2998	42130	777.750	9283.400	.2	.5	.5
543	B2999	42130	777.800	9283.400	.2	.5	.5
544	B3000	42130	777.850	9283.400	.2	.5	.5
545	B3001	42130	777.900	9283.400	.2	1.0	.5
546	B3002	42130	777.950	9283.400	.2	1.0	.5
547	B3003	42130	778.000	9283.400	4.0	1.0	.5
548	B3004	42130	778.050	9283.400	16.0	2.0	.5
549	B3005	42130	778.100	9283.400	.2	.5	.5
550	B3006	42130	778.150	9283.400	.2	.5	.5

List of Geochemical Analysis(12)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Location (km) Y-coord	Au ppb	As ppm	Sb ppm
551	B3007	42130	778.200	9283.400	.2	.5	.5
552	B3008	42130	778.250	9283.400	.2	.5	.5
553	B3009	42130	778.300	9283.400	.2	.5	.5
554	B3010	42130	778.350	9283.400	.2	.5	.5
555	B3011	42130	778.400	9283.400	.2	.5	.5
556	B3012	42130	778.450	9283.400	.2	.5	.5
557	B3013	42130	778.500	9283.400	.2	.5	.5
558	B3014	42130	778.550	9283.400	.2	.5	.5
559	B3015	42130	778.600	9283.400	.2	.5	.5
560	B3016	42130	778.650	9283.400	.2	.5	.5
561	B3017	42130	778.700	9283.400	.2	.5	.5
562	B3018	42130	778.750	9283.400	16.0	.5	.5
563	B3019	42130	778.800	9283.400	.2	.5	.5
564	B3020	42130	778.850	9283.400	.2	.5	.5
565	B3021	42130	778.900	9283.400	.2	.5	.5
566	B3022	42130	778.950	9283.400	.2	.5	.5
567	B3023	42130	779.000	9283.400	.2	.5	.5
568	B3024	42130	779.050	9283.400	.2	.5	.5
569	B3025	42130	779.100	9283.400	.2	.5	.5
570	B3026	42130	779.150	9283.400	.2	.5	.5
571	B3027	42130	779.200	9283.400	.2	.5	.5
572	B3028	42130	779.250	9283.400	.2	.5	.5
573	B3029	11400	779.300	9283.400	.2	.5	.5
574	B3030	42130	777.300	9283.200	.2	.5	.5
575	B3031	42130	777.350	9283.200	.2	.5	.5
576	B3032	42130	777.400	9283.200	.2	.5	.5
577	B3033	42130	777.450	9283.200	.2	1.0	.5
578	B3034	42130	777.500	9283.200	.2	1.0	.5
579	B3035	42130	777.550	9283.200	.2	.5	.5
580	B3036	42130	777.600	9283.200	.2	.5	.5
581	B3037	42130	777.650	9283.200	.2	.5	.5
582	B3038	42130	777.700	9283.200	.2	.5	.5
583	B3039	42130	777.750	9283.200	.2	.5	.5
584	B3040	42130	777.800	9283.200	.2	.5	.5
585	B3041	11400	777.850	9283.200	.2	.5	.5
586	B3042	42130	777.900	9283.200	.2	.5	.5
587	B3043	42130	777.950	9283.200	.2	.5	.5
588	B3044	42130	778.000	9283.200	.2	.5	.5
589	B3045	42130	778.050	9283.200	.2	.5	.5
590	B3046	42130	778.100	9283.200	.2	.5	.5
591	B3048	42130	778.200	9283.200	.2	.5	.5
592	B3049	42130	778.250	9283.200	.2	.5	.5
593	B3050	42130	778.300	9283.200	.2	.5	.5
594	B3051	42130	778.350	9283.200	.2	.5	.5
595	B3052	42130	778.400	9283.200	.2	.5	.5
596	B3053	42130	778.450	9283.200	.2	.5	.5
597	B3054	42130	778.500	9283.200	.2	.5	.5
598	B3055	42130	778.550	9283.200	.2	.5	.5
599	B3056	42130	778.600	9283.200	43.0	.5	.5
600	B3057	42130	778.650	9283.200	.2	.5	.5

List of Geochemical Analysis(13)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Y-coord	Au ppb	As ppm	Sb ppm
601	B3058	11400	778.700	9283.200	.2	.5	.5
602	B3059	42130	778.750	9283.200	.2	.5	.5
603	B3060	42130	778.800	9283.200	.2	.5	.5
604	B3061	42130	778.850	9283.200	.2	1.0	.5
605	B3062	42130	778.900	9283.200	.2	2.0	.5
606	B3063	42130	778.950	9283.200	.6	1.0	.5
607	B3064	42130	779.000	9283.200	.2	1.0	.5
608	B3065	42130	779.050	9283.200	.2	.5	.5
609	B3066	42130	779.100	9283.200	.2	.5	.5
610	B3067	42130	779.150	9283.200	.2	.5	.5
611	B3068	42130	779.200	9283.200	.2	.5	.5
612	B3069	42130	779.250	9283.200	.2	.5	.5
613	B3070	11400	779.300	9283.200	4.0	.5	.5
614	B3071	42130	777.300	9283.000	.8	1.0	.5
615	B3072	42130	777.350	9283.000	.2	1.0	.5
616	B3073	42130	777.400	9283.000	.2	1.0	.5
617	B3074	42130	777.450	9283.000	.5	1.0	.5
618	B3075	42130	777.500	9283.000	.2	3.0	.5
619	B3076	42130	777.550	9283.000	.7	1.0	.5
620	B3077	42130	777.600	9283.000	.2	1.0	.5
621	B3078	42130	777.650	9283.000	.2	.5	.5
622	B3079	42130	777.700	9283.000	.2	.5	.5
623	B3080	42130	777.750	9283.000	.2	1.0	.5
624	B3081	42130	777.800	9283.000	.2	.5	.5
625	B3082	11400	777.850	9283.000	.2	.5	.5
626	B3083	42130	777.900	9283.000	.2	.5	.5
627	B3084	42130	777.950	9283.000	.2	.5	.5
628	B3085	42130	778.000	9283.000	.2	.5	.5
629	B3086	42130	778.050	9283.000	.2	2.0	.5
630	B3087	42130	778.100	9283.000	.2	5.0	.5
631	B3088	11400	778.150	9283.000	.2	.5	.5
632	B3089	11400	778.200	9283.000	.2	.5	.5
633	B3090	11400	778.250	9283.000	.2	.5	.5
634	B3091	42130	778.300	9283.000	.2	.5	.5
635	B3092	42130	778.350	9283.000	.2	.5	.5
636	B3093	42130	778.400	9283.000	.2	.5	.5
637	B3094	42130	778.450	9283.000	.2	.5	.5
638	B3095	42130	778.500	9283.000	.2	.5	.5
639	B3096	42130	778.550	9283.000	.2	.5	.5
640	B3097	42130	778.600	9283.000	.2	.5	.5
641	B3098	42130	778.650	9283.000	.2	.5	.5
642	B3099	42130	778.700	9283.000	.2	.5	.5
643	B3100	42130	778.750	9283.000	.2	.5	.5
644	B3101	42130	778.800	9283.000	.2	.5	.5
645	B3102	42130	778.850	9283.000	.2	.5	.5
646	B3103	42130	778.900	9283.000	.2	.5	.5
647	B3104	42130	778.950	9283.000	.2	.5	.5
648	B3105	42130	779.000	9283.000	.2	.5	.5
649	B3106	42130	779.050	9283.000	.2	.5	.5
650	B3107	42130	779.100	9283.000	.2	.5	.5

List of Geochemical Analysis(14)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Y-coord	Au ppb	As ppm	Sb ppm
651	B3108	42130	779.150	9283.000	.2	.5	.5
652	B3109	42130	779.200	9283.000	.2	.5	.5
653	B3110	42130	779.250	9283.000	.2	.5	.5
654	B3111	42130	779.300	9283.000	.2	1.0	.5
655	B3112	42130	778.725	9284.800	.2	1.0	.5
656	B3113	42130	778.675	9284.800	.2	1.0	.5
657	B3114	42130	778.725	9284.800	.2	1.0	.5
658	B3115	42130	778.725	9284.600	.2	.5	.5
659	B3116	42130	778.775	9284.600	.2	1.0	.5
660	B3117	42130	778.825	9284.600	.2	.5	.5

Appendix 2

Analytical data of stream sediment samples.

List of Geochemical Analysis(1)

Ser. No.	Sample No.	Geol Unit	Location (km) X-coord	Y-coord	Au ppb	Ag ppm	Fe %	Mn ppm	Mo ppm	W ppm	Sn ppm	Nb ppm	Ta ppm	Be ppm	Li ppm	As ppm	Sb ppm
1	S2353	42130	770.503	9282.846	1.0	.1	1.51	671	.5	5	1	19	5	16.7	17	1.0	.5
2	S2354	42130	770.398	9282.716	.2	.1	1.18	393	.5	5	3	11	5	21.8	25	1.0	.5
3	S2355	42130	770.284	9282.251	.2	.1	2.84	856	.5	5	1	14	5	27.5	39	.5	.5
4	S2356	42130	770.374	9282.086	.2	.1	5.06	1424	2.0	5	1	28	5	32.0	37	1.0	.5
5	S2357	42130	770.474	9282.097	.2	.1	2.60	813	.5	5	1	22	5	23.2	23	2.0	.5
6	S2358	11110	771.947	9282.728	.2	.1	2.66	873	.5	5	5	26	5	16.8	16	2.0	.5
7	S2359	42400	772.087	9282.487	.2	.1	2.49	410	.5	5	5	16	5	25.2	23	2.0	.5
8	S2360	42400	771.992	9282.442	.2	.1	4.01	500	.5	18	6	22	5	23.5	25	2.0	.5
9	S2361	42400	773.620	9282.898	.2	.1	2.03	241	2.0	5	1	16	5	25.9	10	2.0	.5
10	S2363	42400	772.807	9281.468	2.0	.1	2.16	180	1.0	5	1	13	5	26.0	10	2.0	.5
11	S2364	42400	772.917	9281.458	.2	.1	2.98	292	.5	5	1	20	5	32.3	15	2.0	.5
12	S2365	42400	773.297	9280.659	.2	.1	2.83	385	.5	5	1	19	5	26.7	14	2.0	.5
13	S2366	42130	774.534	9282.239	.2	.1	1.76	452	.5	5	1	5	5	19.0	12	2.0	.5
14	S2367	42130	774.849	9281.869	.2	.1	1.44	733	.5	5	1	5	5	11.8	9	2.0	.5
15	S2368	42130	774.675	9281.609	.2	.1	2.16	658	.5	5	4	5	5	21.5	17	2.0	.5
16	S2369	42130	774.805	9281.500	.2	.1	4.13	1990	.5	5	4	16	5	23.4	17	2.0	.5
17	S2370	42130	774.345	9281.154	.2	.1	1.87	350	1.0	5	3	5	5	21.3	11	2.0	.5
18	S2371	42130	774.470	9280.965	.2	.1	3.52	1543	.5	11	4	14	5	24.0	15	2.0	.5
19	S2372	42130	775.248	9282.845	.2	.1	4.18	2174	.5	11	5	29	5	24.2	13	2.0	.5
20	S2373	42130	775.273	9282.620	.2	.1	3.47	1096	1.0	5	3	5	5	23.8	31	2.0	.5
21	S2374	42130	776.022	9282.405	.2	.1	4.50	2876	.5	5	3	18	5	26.1	20	3.0	.5
22	S2375	42130	776.447	9282.436	.2	.1	3.71	2129	1.0	5	1	22	5	27.2	19	2.0	.5
23	S2376	42130	776.397	9282.336	.2	.1	3.01	1036	.5	5	1	5	5	26.2	27	2.0	.5
24	S2377	42130	776.732	9282.366	.2	.1	4.00	1119	.5	5	1	10	5	31.1	36	2.0	.5
25	S2378	42130	776.078	9281.915	.2	.1	3.47	1020	.5	5	2	5	5	26.7	30	2.0	.5
26	S2379	42130	776.283	9281.865	.2	.1	3.61	984	1.0	5	1	10	5	32.9	37	2.0	.5
27	S2380	42130	778.085	9282.637	.2	.1	4.66	1660	.5	5	1	33	5	33.4	48	1.0	.5
28	S2381	42130	778.085	9282.787	.2	.1	3.86	1209	.5	5	1	26	5	33.4	49	1.0	.5
29	S2382	42130	778.419	9283.012	.2	.1	4.38	1144	.5	5	1	13	5	37.5	68	1.0	.5
30	S2383	42130	778.330	9282.896	.2	.1	3.71	1343	.5	5	1	11	5	36.7	50	1.0	.5
31	S2384	42130	778.824	9282.907	.2	.1	3.10	1528	.5	5	5	27	5	30.7	39	1.0	.5
32	S2385	42130	779.888	9282.628	.2	.1	2.37	1459	2.0	5	1	41	5	27.9	20	2.0	.5
33	S2386	42130	779.499	9282.508	.2	.1	3.80	1358	.5	5	1	14	5	29.3	42	2.0	.5
34	S2387	42130	779.389	9282.378	.2	.1	3.71	1336	.5	5	1	17	5	37.7	53	2.0	.5
35	S2388	42130	779.174	9282.083	.2	.1	2.41	1262	.5	5	4	37	5	26.8	23	1.0	.5
36	S2389	42130	779.364	9281.878	.2	.1	3.22	1604	.5	5	1	19	5	24.8	23	1.0	.5
37	S2390	42130	779.719	9281.979	.2	.1	4.05	1227	.5	5	1	20	5	37.7	44	2.0	.5
38	S2391	42130	778.355	9281.902	.2	.1	4.28	1603	.5	5	2	14	5	44.8	60	1.0	.5
39	S2392	42130	777.496	9281.656	.2	.1	2.65	887	.5	5	1	14	5	41.6	38	1.0	.5
40	S2393	42130	778.925	9281.628	.2	.1	4.15	1264	.5	5	1	34	5	32.0	55	2.0	.5
41	S2394	42130	778.685	9281.362	.2	.1	2.83	1049	.5	5	1	17	5	21.8	34	2.0	.5
42	S2395	42130	778.501	9280.697	.2	.1	3.35	1230	.5	5	1	33	5	28.3	37	2.0	.5
43	S2396	42130	778.151	9281.257	.2	.1	3.42	1087	.5	5	1	26	5	31.5	45	2.0	.5
44	S2397	42130	777.986	9281.217	.2	.1	3.24	1608	.5	5	5	22	5	31.3	37	1.0	.5
45	S2398	42130	777.147	9281.347	.2	.1	4.16	1001	.5	5	5	5	5	24.8	40	2.0	.5
46	S2399	42130	777.157	9281.121	.2	.1	4.22	1443	.5	5	4	12	5	24.4	36	2.0	.5
47	S2400	42130	777.397	9280.587	.2	.1	3.17	2124	.5	5	1	100	24	42.1	29	2.0	.5
48	S2401	42130	777.232	9280.616	.2	.1	2.83	1307	.5	5	1	22	5	92.7	21	2.0	.5
49	S2402	42130	777.138	9280.127	.2	.1	3.88	1223	.5	5	2	26	32	188.9	36	2.0	.5
50	S2403	42130	775.424	9280.865	.2	.1	3.28	1403	.5	5	1	12	5	11.5	21	1.0	.5