

Ⅲ 空中磁気探査資料の解析

第 1 章 総 説

本解析は、昭和55年度ブラジル連邦共和国アンタゴルダ地域資源開発協力基礎調査の一環として実施されたものである。

解析にさきだち、南西地区（A地区）6,750 km² について磁力変化図を数値化するとともに、北東地区（B地区）3,250 km² について磁気テープより磁力変化図を作成した。

数値化したA地区の磁力変化図に対して、フィルタ計算を行ない定性的解釈を施し、さらに定量解析を実施し、磁気異常岩体を帯磁率の面から分類し、岩石試料帯磁率との対比を行なうことにより、貫入岩体の分布が明らかとなった。また、A地区を支配する線状構造が把握された。

第 2 章 空 中 磁 気 探 査 概 要

2-1 調 査 地 域

本解析は、Fig. III-1 に示す地域の空中磁気探査資料について実施したものである。解析対象地域は、ブラジル連邦共和国サンパウロ、パラナ両境に位置し、面積は10,000km²であり、その境界の緯度、経度は下記の通りである。

	緯度(南緯)	経度(西経)
A	24°27'	48°55.6'
B	24°27'	49°15'
C	24°30'	49°15'
D	24°30'	49°30'
E	24°45'	49°30'
F	24°45'	49°45'
G	25°05'	49°45'
H	25°05'	48°52.5'
I	24°52'	48°38.7'
J	24°48.7'	48°40.5'
K	24°45'	48°37.5'
L	24°45'	48°15'
M	24°15'	48°15'
N	24°15'	48°45'

磁力変化図は南西部地区(A地区:A-B-C-D-E-F-G-H-I-J-A)でのみ作成されていたため、本年度は解析はA地区はついでのみ実施し、B地区(北東部地区:A-J-K-L-M-N-A)については磁力変化図を作成し、全地域の磁力変化図を編集することとした。

2-2 空 中 磁 気 探 査 測 定 の 概 要

本調査地域の空中磁気探査は、鉱山動力省鉱産局(Departamento Nacional da Produção Mineral, Ministério das Minas e Energia: DNPM)とCPRM(Companhia de Pesquisa de Recursos Minerais)によつて放射能探査等を含む総合空中物理探査事業の一環として実施されたものであるが、A、B両地区の調査名、調査仕様等は下記の通りである。

1) A 地 域

調 査 名 : Serra do Mar Sul 事業(データ収集)



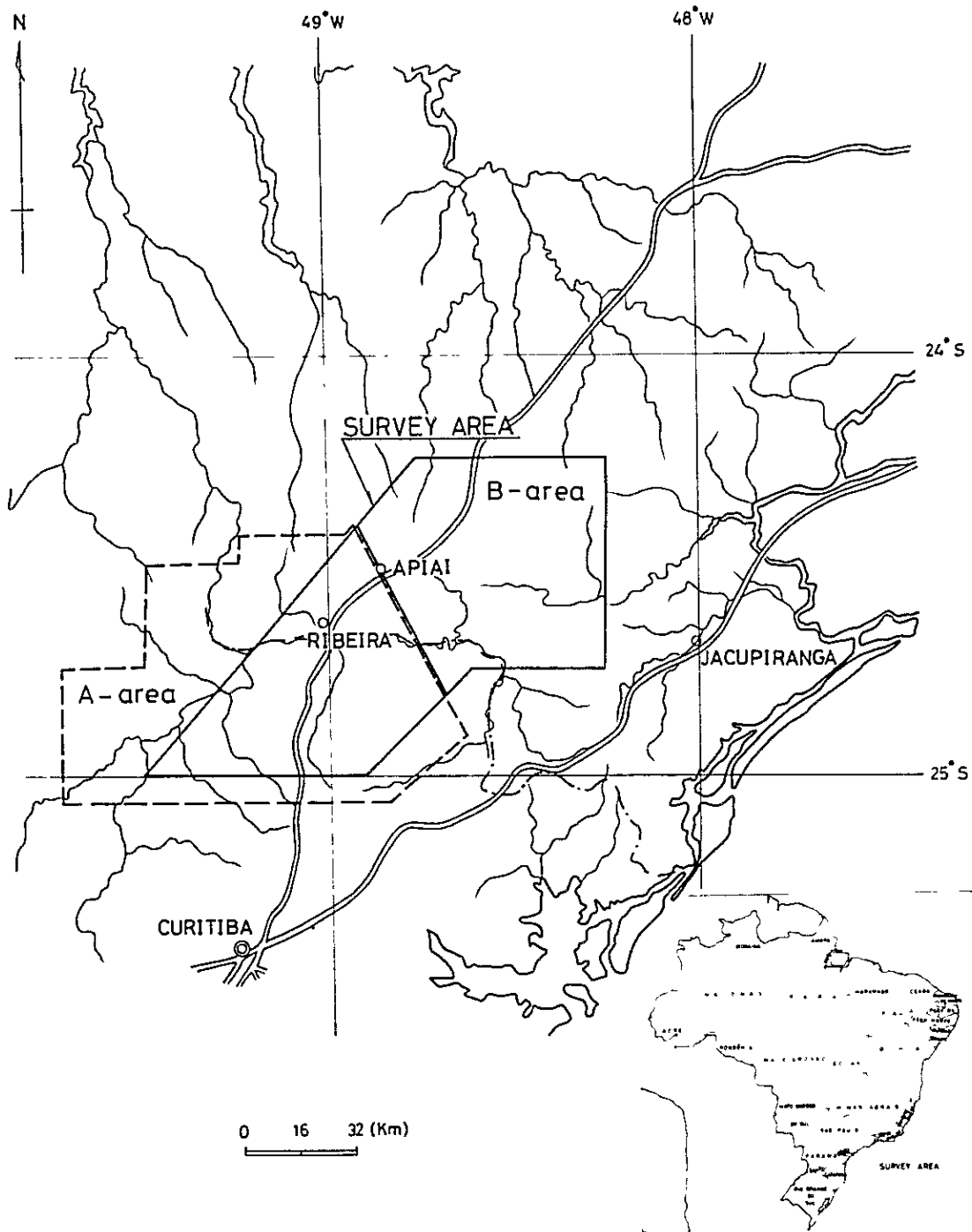


Fig. III-1 Location Map of Survey Area

— Santa・Catarina 州, Parana 州 Serra do Man 地域空中磁気・放射能
探査

調査期間：1975年8月

測線総延長：約80,000 line-km

主測線 交叉測線

測線間隔：1 km 20 km

飛行方向：N30°W N30°E

飛行高度：対地 105~165 m

地磁気伏角：26°S

地磁気偏角：N14°W

全磁力：23,500 γ

2) B 地区

調査名：São Paulo, Rio de Janeiro 地域空中物理探査事業 — 空中磁気・放射
能探査

調査期間：1975年6月~12月

測線総延長：約32,000 line-km

主測線 交叉測線

測線間隔：1 km 20 km

飛行方向：NS EW

飛行高度：対地 150 m

地磁気伏角：26°S

地磁気偏角：N14°W

全磁力：23,500 γ

2-3 解析方法

全磁力図上の磁力値から、地方的変化(Regional Variation)を除去するための国際標準地球磁場(IGRF)を差し引き、磁力変化図(Residual Map)が作成されている。この磁力変化図を基に解析を行なった。

空中磁気データを解析するには、定性的手法と定量的手法の2種類の方法がある。定性解析法は、磁気図に各種フィルタ処理を施し、或る範囲の波長の磁気異常を抽出または除去し、地下の磁気構造を定性的に推定する方法である。

定性解析に利用されるフィルタ処理としては、以下のものがある。

(1) 帯域フィルタ(Band Pass Filter)：任意の波長域の磁気異常を選択的に抽出する

フィルタ。

(2) 鉛直二次微分フィルタ (Second Vertical Derivative Filter) : 短波長域の磁気異常を強調するフィルタ。

(3) 上方または下方接続フィルタ (Upward or Downward Continuation Filter) : 観測磁気値から数学的に上方あるいは下方の磁力値を計算し、短波長の磁気異常を減衰または強調するフィルタ。

(4) 自己相関解析 (Auto-correlation Analysis) : 同規模の磁気異常を検出し、磁気特性の傾向を把握するフィルタ。

(5) スペクトル解析 (Spectrum Analysis) : 調査地域内の磁気異常群の波長特性を把握する方法。

(6) 擬似重力フィルタ (Reduction-to-pole Filter) : 数学的に極の磁気異常へ変換し、磁性岩体の形状を推定するためのフィルタ。

etc.

一方、定量解析法は、各磁気異常の平断面に対し、磁気異常を誘起する岩体の深度、形状及び帯磁率を求める方法であり、以下の方法が挙げられる。

(1) 特性点法 (Specific Point Method) : 磁気異常曲線の変曲点、曲率等を利用し磁性岩体の深度、幅を推定する方法。

(2) 曲線照合法 (Curve Matching Method) : 単純な形状の磁気異常 (標準曲線) との照合により、磁性岩体の深度、形状、帯磁率を求める方法。

(3) 特性曲線法 (Specific Curve Method) : 観測磁気異常の曲率から磁性岩体の深度または幅を推定する方法。

(4) 解析的方法 (Analytical Method) : 磁気断面をフーリエ級数展開し、ダイク状、断層状構造等によるスペクトル特性と比較し、各構造の深度、傾き、磁気特性を検出する方法。

etc

本地域の空中磁気探査は前述 (2-2) の如く、地表付近の磁気岩体を有効的に検出するために、対地 105~165m の包絡線飛行で実施されている。従って、調査地域内の深部磁気構造は、浅部磁気構造に覆われている可能性が考えられる。

本解析では、A 地区内のホウシャ、ペラウ両鉱山を含む 5.6km×3.2km の範囲に対し、2次元フーリエ級数によるエネルギー・スペクトル解析を行い、磁気異常群の波長特性を求めた。この結果から、2種類の波長帯域を選び、磁力変化図から帯域フィルタ図を得た。これら、2種の帯域フィルタ図および磁力変化図を定性解析の基本図とした。

一方、定量解析として、磁力変化図上の顕著な磁気異常に対して磁気断面を切り、曲線照合法による解析を行った。

本解析の解析法の概要を以下に記述する。また、Fig. III-2 に解析の流れ図を示す。

2-3-1 スペクトル解析

磁気図に表現された磁気異常群の波長特性を知ることにより、フィルタ処理を含めた種々の解析に対し有効な情報が得られるとともに、ポテンシャル論から平均磁気基盤深度を推定することも可能である。

1) エネルギースペクトル

点 (x, y) における磁気値 $F(x, y)$ は、2次元フーリエ級数により

$$F(x, y) = \int_0^{\infty} \int_0^{\infty} A_{mn} \exp(-2\pi j(m x/L_1 + n y/L_2)) dm dn$$

と表わされる。

フーリエ係数 A_{mn} は、

$$A_{mn} = \frac{4}{L_1 L_2} \int_0^{L_1} \int_0^{L_2} F(x, y) \exp(2\pi j(m x/L_1 + n y/L_2)) dx dy$$

と求められる。

エネルギースペクトルはフーリエ係数の絶対値の平方として表わされる。

即ち、 $E_{mn} = |A_{mn}|^2$

2) 平均磁気基盤構造深度

深度 H における磁気構造が白色スペクトルを有する場合、エネルギースペクトル E_{mn} と H との間にはポテンシャル論から

$$E_{mn} \propto e^{-4\pi H f}$$

の関係が成り立つことが知られている。

ただし、 f は波数（波長の逆数）であり、

$$f = \sqrt{(m/L_1)^2 + (n/L_2)^2} \text{ である。}$$

従って、横軸に波数 f 、縦軸に $\ln E$ をとり、各 E_{mn} をプロットし回帰直線を求めれば、この勾配から深度 H を推定することができる。

2-3-2 帯域フィルタ

帯域フィルタは、遮断周波数の異なる2個の低域通過 (low-pass) フィルタの差として表わされる。

2個の遮断周波数を w_1, w_2 ($w_1 > w_2$) とすれば、帯域フィルタの係数 f_{mn} は次のように求められる。

$$f_{00} = (w_1 - w_2) / \pi^2$$

$$f_{no} = f_{0n} = (w_1 / \pi) \cdot (\sin n w_1 s / n \pi s) - (w_2 / \pi) \cdot (\sin n w_2 s / n \pi s)$$

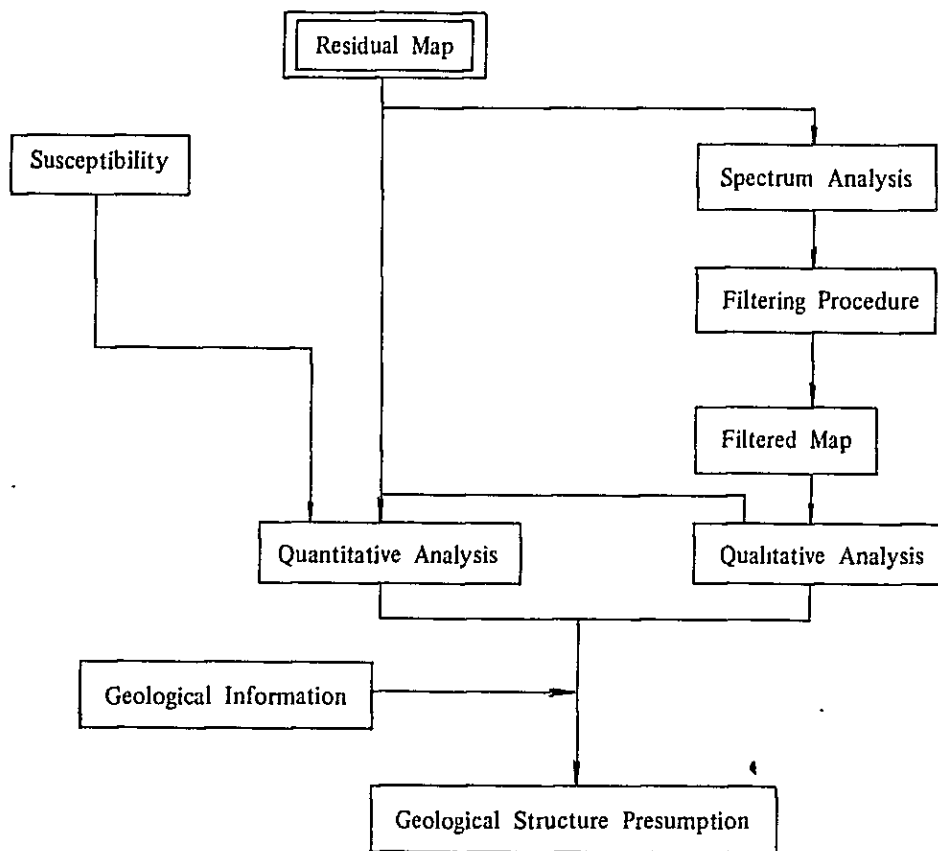


Fig. III-2 Flow Chart of Analysis

$$f_{mn} = (\sin m w_1 s / m\pi s)(\sin n w_1 s / n\pi s) - (\sin m w_2 s / m\pi s) \\ (\sin n w_2 s / n\pi s)$$

実際の計算では、磁力変化図を1 km格子で数値化した磁力値に対し上式で与えられる f_{mn} の値をとるフィルタを考え、磁力値と係数とのコンボリューション (Convolution) 積をとり、帯域フィルタ値を求める。

2-4 岩石磁性測定

岩石資料は PL. III-7 に示す位置から採取したものであり、全て地表の資料である。採取個数は56個であり、Bison製帯磁率計を用いて帯磁率を測定している。

測定結果を Table III-1 に示す。

帯磁率測定の結果、岩石別帯磁率の平均値は、帯磁率の高い順に並べると、斑レイ岩2854 (試料数1個)、輝緑岩1560 (2個)、閃長岩1400 (2個)、花崗岩467 (6個)、角閃岩122 (4個)、片麻岩82 (2個)、泥質岩類52 (16個)、砂質岩類51 (6個)、石灰岩48 (10個)である。

なお、各岩石帯磁率は 10^{-6} cgsemu/cc 単位で表わしている。

本調査地域の磁性岩体をランクA (強磁性岩体)、ランクB (中磁性岩体)、ランクC (弱磁性岩体)、ランクD (微弱磁性岩体) に分類すると、ランクAには、斑レイ岩、輝緑岩、閃長岩、ランクBには花崗岩、ランクCには角閃岩、片麻岩、ランクDには泥質岩類、砂質岩類、石灰岩がそれぞれに対応する。

帯磁率測定結果より、本地域の磁気異常の分布形態を推定するとランクA岩体分布地域では短波長かつ大振幅の磁気異常が卓越しているのに対し、他のランクの岩体が分布する地域では、小振幅の磁気異常が多数分布するものと考えられる。

Table III-1 Susceptibility of Rock Samples (1)

	Sample No.	Rock Name	Density (gr/cm ³)		Susceptibility (x10 ⁻⁶ cgsemu)	
				Average		Average
Gneiss	F-66	Gneiss	2.61	2.76	65	82
	F-105	Gneiss	2.84		98	
	F-290	Gneiss	2.84		(503)	
Pelitic Rocks	F-2	Phyllite	2.62	2.55 (16)	42	52
	F-5	Mica-schist	(2.83)		(1,877)	
	F-28	Phyllite	2.60		74	
	F-76	Phyllite	2.45		28	
	F-293	Mica-schist	2.52		69	
	F-294	Phyllite	2.57		38	
	F-300	Sericite-schist	2.64		73	
	S-13	Sericite-schist	2.38		54	
	S-20	Sericite-schist	2.55		70	
	S-24	Calcareous-schist	2.73		62	
	T-10	Mica-schist	2.69		50	
	T-13	Mica-schist	2.67		51	
	T-16	Mica-schist	2.65		38	
	T-20	Sericite-schist	2.55		27	
	T-35	Phyllite	2.50		56	
	T-47	Phyllite	2.05		32	
	K-252	Sericite-schist	2.59		73	
Psammitic Rocks	F-1	Quartzite	2.64	2.63 (6)	61	51
	F-67	Quartzite	2.62		38	
	T-9	Psammitic-schist (metasandstone)	2.73		71	
	K-195	Psammitic-schist (metasandstone)	2.62		59	
	K-258	Psammitic-schist (metasandstone)	2.53		30	
	K-263	Psammitic-schist (metasandstone)	2.62		49	
Green-schist	T-30	Green-schist	2.92	2.87 (2)	88	85
	K-340	Green-schist	2.81		81	

Table III-1 Susceptibility of Rock Samples (2)

	Sample No.	Rock Name	Density (gr/cm ³)		Susceptibility (x10 ⁻⁶ cgsemu)	
				Average		Average
Limestone	F-72	Limestone	2.78	2.77 (10)	24	48
	S-15	Limestone	2.72		30	
	S-86	Limestone	2.77		47	
	S-89	Limestone	2.75		59	
	S-94	Limestone	2.73		61	
	S-128	Limestone	2.71		36	
	S-129	Limestone	2.75		43	
	T-58	Limestone	2.66		46	
	T-85	Limestone	2.72		54	
Amphibolite	F-7	Amphibolite	2.97	2.95	108	122
	F-272	Amphibole -schist	2.92		109	
	S-93	Amphibolite	2.99		117	
	K-176	Amphibole -schist	2.83		(4,115)	
	K-178	Amphibolite	2.99		(1,390)	
	K-182	Amphibolite	3.00		155	
Granite	F-39	Granite	2.61	2.64	225	467
	F-57	Granite	2.62		593	
	F-242	Granite	2.62		154	
	S-49	Granite	2.68		890	
	S-91	Granite	2.64		80	
	K-184	Granite	2.64		860	
Syenite	F-21	Syenite	2.59		1,272	1,400
	F-87	Syenite	2.65		1,528	
Gabbro	S-33	Gabbro	2.93		2,854	2,854
Diabase	S-17	Diabase	3.02	2.96	2,331	1,560
	S-95	Diabase	2.90		796	
	F-4	Magnetite	3.67		54,970	

第3章 解析結果

本調査地域の空中磁気探査は、対地高度160mの包絡線飛行で行なわれているため、浅部磁気構造を反映した短波長磁気異常群が卓越し、深部磁気構造を示す長波長磁気異常が短波長磁気異常群によって覆われた磁気異常図が得られている。

3-1 残差図 (Residual Map)

残差図 PL. III-1 に表現される磁気異常から定性的に判断される本地域の磁気的特性は下記の通りである。

1) 本地域の南西部は、半波長1-3 km、振幅500ガンマ以上の短波長磁気異常が群集していることで特徴付けられる。これらの小規模磁気異常群は、北西-南東方向に配列する傾向が看取される。この磁気異常分布域をゾーンAと仮称するが、このゾーンには主として、前述(第2章2-4)のランクA磁性岩体(斑れい岩、輝緑岩、閃長岩)がかなり広範囲かつ複雑に分布していると推測される。

2) 本地域中央部から東部にかけての地域では、全体として磁力値の変化が小さく、ランクB、C、D磁性岩体が広く分布していると考えられる。この地区の北部及び南東部には、比較的まとまった形状の磁気異常が検出されており、ランクA磁性岩体の存在が考えられる。

本地域中央部から北東部にかけての地区は、比較的低磁力値を示しており、ゾーンBと仮称する。一方、南東部は比較的高い磁力値が優勢の地域であり、ゾーンCと仮称する。

3) 本地域北西部即ち、ゾーンA及びBの北側の地域では、北東-南西方向の等磁力線の傾向が卓越しており、低磁気異常が北東-南西方向に広く分布している。ゾーンDと仮称する。

顕著な磁気異常の分類には、磁気異常番号の頭に各異常が属する上記ゾーンの記号を冠した。

3-2 帯域フィルター図 (Band Pass Maps)

ゾーンB及びCを調査地域中央部の磁北方向(N14°W)56km、その直交方向(N76°E)32kmの地区(Fig. III-3)に対し、残差図の磁気異常をエネルギースペクトル解析した結果をFig. III-4に示す。エネルギースペクトル分布から、エネルギーは長波長域から短波長域になるに従い漸減の傾向を示している。

最小自乗法的に直線を引くと、波長(λ) = 2 km, λ = 4 km, λ = 16 kmを境界周波数とする2種類の波長帯域に分割される。

各波長帯域2~4 km, 4~16 kmについて最小自乗法的に決定された直線の勾配から、それぞれの磁気基盤面までの平均深度は、飛行高度から-2 km, -6 km程度の値が得られた。本調

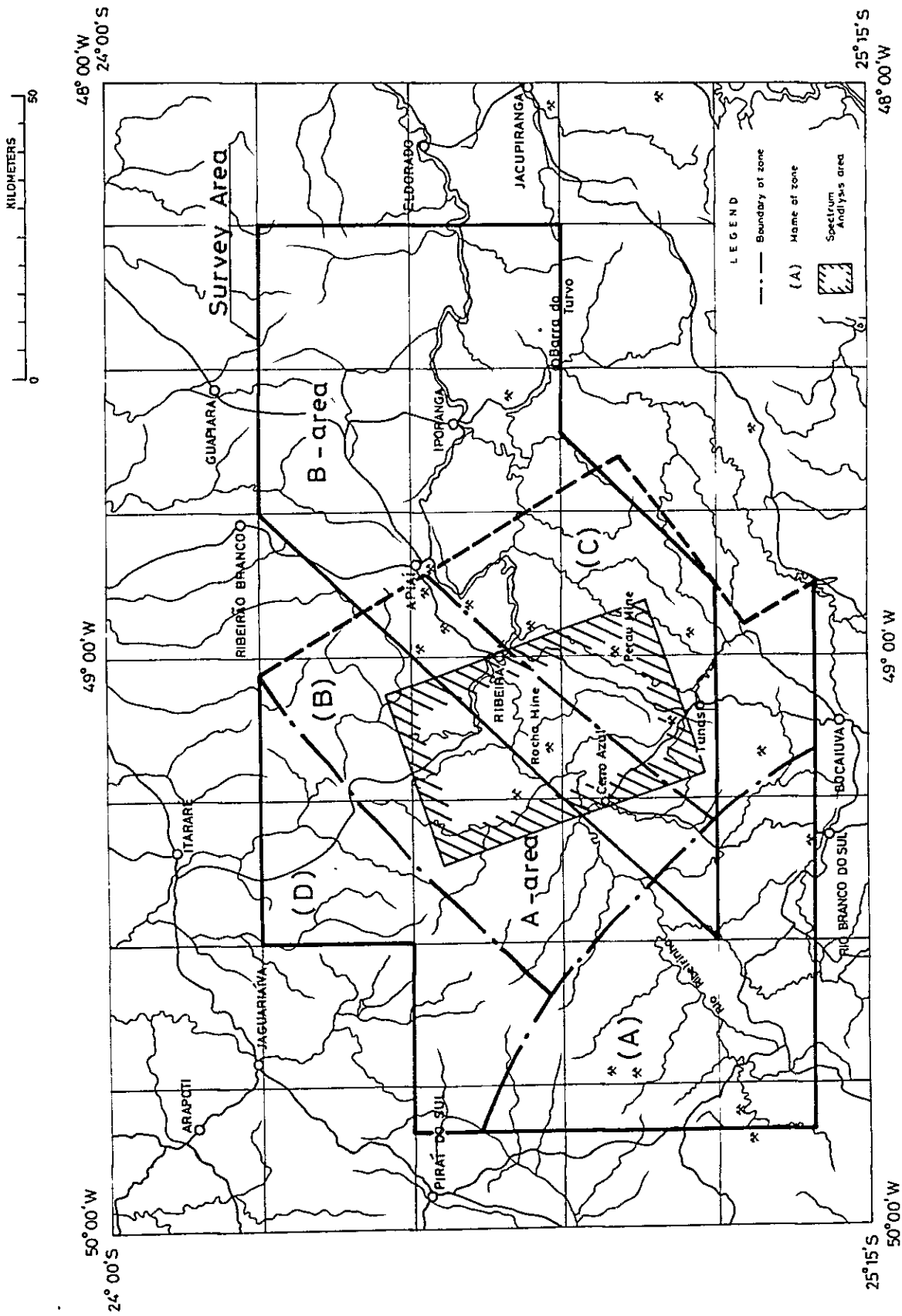


Fig. III-3 Index of Analyzed Area

査は、前述の如く（第2章2-2）包絡線飛行で行なわれているため、後者の波長帯域で得られた深度は見掛け上のものである可能性が大きい。

本調査地域内の磁性岩体の分布を規模別に把握することを目的として、下記の2種類の帯域フィルターを設計した。

1) BP-1 波長帯域2~4 kmの磁気異常を主として抽出する帯域フィルター。

2) BP-2 波長帯域4~16 kmの磁気異常を主として抽出する帯域フィルター。

上記2種類のフィルタを残差図に施して、帯域フィルタ図BP-1 (PL. III-2), BP-2 (PL. III-3)を得た。

以下に各フィルタ図から定性的に判断される磁気構造を列挙する。

3-2-1 帯域フィルタ図BP-1 (Band Pass Map BP-1)

残差図と類似の磁気異常分布であり、短波長成分が更に強調された形態を示している。残差図で分類した各ゾーンの磁気異常配列には連続性がみられる。即ち、ゾーンAでは、北西-南東方向の連続性が卓越し、ゾーンBでは、ゾーンC及びDとの境界付近では北東-南西方向の連続性が優勢であり、またゾーンB内ではこれと斜交または直交する方向の連続性も一部みられる。ゾーンC及びDでは、北東-南西方向の連続性が優勢である。

ゾーンA及び磁気異常番号を付した磁気異常群はいずれも500 γ を超える振幅を有しており、ランクA岩体の分布によるものと考えられるが、ゾーンB及びCの他の地域では振幅が小さく、ランクB及びCの岩体の分布が優勢であると推測される。

磁気異常分布から推定される磁気不連続構造は、岩石を帯磁率の観点から分類した場合の地下構造（岩体の境界、構造線等）を表現したものであり、磁気不連続構造が必ずしも地質学的な意味での構造線とは一致しない場合もある。このような事を留意して、BP-1図を定性的に解釈すると、以下の推定がなされる。

1) ゾーンAでは、主たる構造線の方向（北西-南東）に、小規模なランクAの岩体（斑レイ岩、輝緑岩）が多数分布している。

2) ゾーンBでは、主たる構造線は北東-南西であり北側のゾーンDと南側のゾーンCとほぼ並行して分布している。南側のゾーンCとの境界をなす構造線は、更に詳しくみると、Cerro Azul 付近から Itapirapua 東方5 km 付近までのびさらに北方へ続く構造線（B-a）、ホーンヤ鉱山から Ribeira 北方5 km 付近を通り、さらに北東方向へのびる構造線（B-b）及び Itapirapua 東方5 km から Ribeira 北方5 km へのびる北西-南東方向の構造線（B-c）からなる。

ゾーンBではランクBの磁性岩体（花崗岩）が主として分布しており、他の北西-南東方向の磁気不連続線とB-1, 2, 3, 4及び5の磁気異常群はランクA磁性岩体（輝緑岩、玄武岩等）によるものと考えられる。



3) ゾーンCでは、主たる磁気不連続の方向は北東-南西であるがゾーンAとの境界付近で消滅する。また、セロ・アスール東方10km付近からA地区東端のパネラス鉱山へ延びる構造線の存在が考えられる。ゾーンC内では磁力値の変化が小さいことから、ランクB, C, D(花崗岩, 角閃岩, 泥質岩類, 砂質岩類, 石灰岩)が広く分布する地域である。

一方、C-1, 2, 4の磁気異常は振幅が500 γ を超えることから、ランクA磁性岩体(斑レイ岩, 閃長岩, 輝緑岩)により誘起されるものである。

4) ゾーンDでは主たる構造線の方向は北東-南西であり、これに直交する磁気不連続線もみられる。ゾーンD全体としては、北西端を除いて磁気異常の振幅は200 γ 以下であり、ランクB, C, D磁気岩体(花崗岩, 角閃岩, 泥質岩類, 砂質岩類, 石灰岩)の分布する地域である。北西端の磁気異常は500 γ 以上であり、ランクAの磁気異常と考えられる。

3-2-2 帯域フィルタ図BP-2(Band Pass Map BP-2)

本図の磁気異常の傾向としては、東西方向にのびる振幅250 γ 程度、半波長10km前後の磁気異常が卓越している。

ゾーンAでは北西-南東方向の長波長磁気異常が配列し、前述(3-2-2)の磁気構造線の方向との一致がみられる。また、ゾーンDでも北東-南西方向に等磁力線が分布し、長波長の負異常がみられる。

一方、ゾーンB及びCでは、磁気異常B-1~4及びC-1~5が平滑化された分布となっており、前述(3-2-2)の構造線はみられず深部の構造を反映していると考えるのは困難である。従って、本図は見掛けの磁気異常を数学的に計算された結果として表現していると考えられる。

3-3 定量解析

残差図上の磁気異常群に対し断面線を設定し、角柱状モデル、ダイク状モデル等を仮定した断面解析を実施し、磁性岩体頂部の深度、見掛け帯磁率を求めた。得られた見掛け帯磁率をA, B, C, Dの4ランクに分類し、前述(第2章, 2-4)の磁性岩体に対応させた。

以上の定性、定量解析により総合的に判断される結果を総合解析図(磁気構造図)としてPL. III-4に示す。

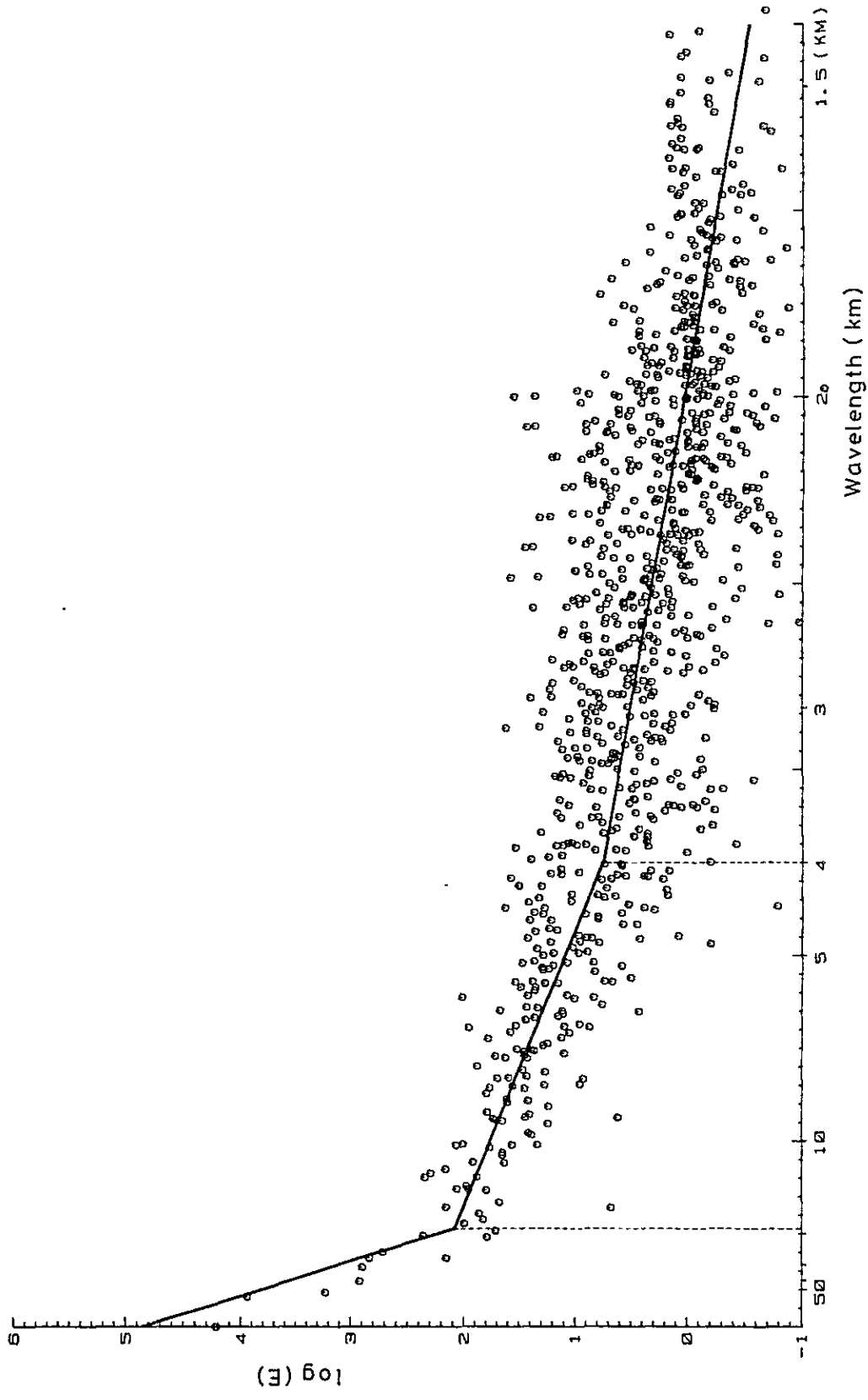


Fig. III-4 Energy Spectrum vs. Wavelength



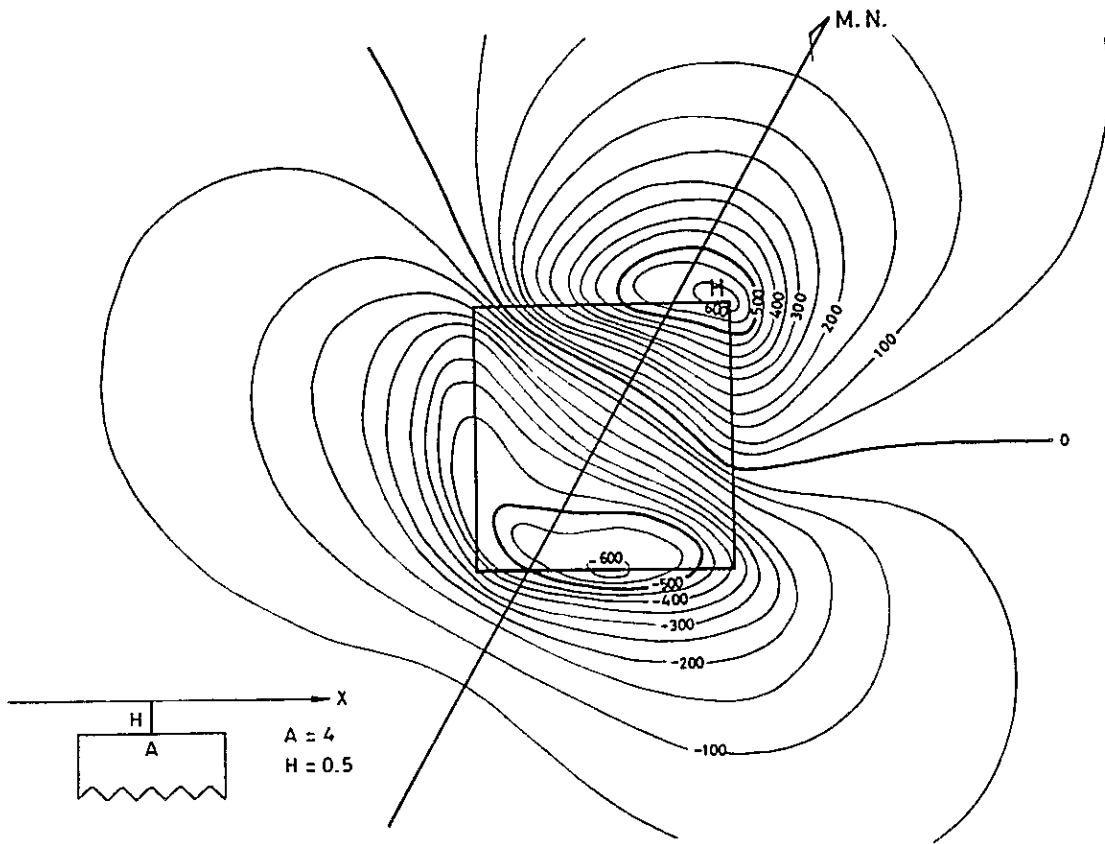


Fig. III-5 Magnetic Anomaly due to Prism Model
(Inclination $26^\circ S$)

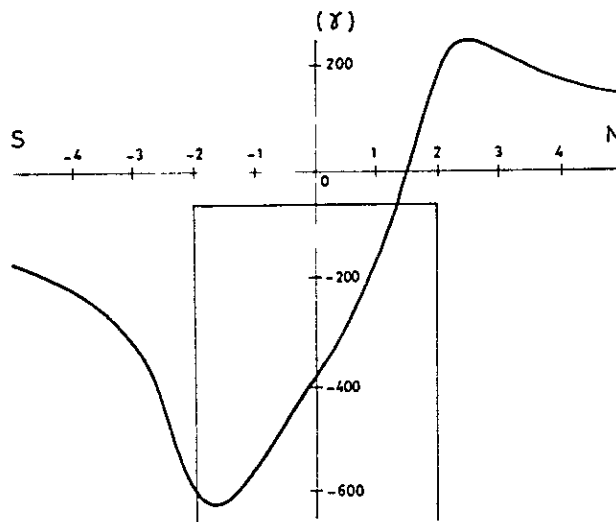


Fig. III-6 Magnetic Anomaly due to Dyke Model
(Inclination $26^\circ S$)

第4章 考察及び今後の問題点

調査地域の磁気異常はA, B, C, Dの4ランクに大別され各ランクの磁気異常はそれぞれランクA(強)磁性岩体, ランクB(中)磁性岩体, ランクC(弱)磁性岩体およびランクD(微弱)磁性岩体によって誘起された磁気異常と考えられる。岩石試料の帯磁率測定結果により, 斑レイ岩・輝緑岩・閃長岩はランクA, 花崗岩はランクB, 角閃岩・片麻岩はランクC, 泥質岩類, 砂質岩類, 石灰岩はランクDに対応すると判断された。

本解析で得られた結果に地質学的考察を加えて推察された事項を以下に列挙する。

1) 調査地域北東部から中央部にかけての幅約30kmの地域には北東-南西方向にランクB磁性岩体(花崗岩)が広く分布しており, その分布は両端の磁気不連続線により限られている。この岩体の北部及び中央部にはランクA磁性岩体(閃長岩, 輝緑岩)が貫入岩体として分布しており, 北部(B-1)中央部(B-3)では地表に露出しているが, B-2, B-4及びB-3周辺の小磁性岩体群がみられる地域では潜在している。また, ランクA磁性岩体の幅の狭い岩脈が北西-南東方向の磁気不連続線として表現されている。

2) 1)の地域の南西部には, 既存の地質調査結果によればランクB磁性岩体(花崗岩)が連続して分布しているが, 北西-南東方向に断続して多数分布するランクA磁性岩体(輝緑岩)のためにその分布を磁気図からは判断できない。調査地域南西部に多数検出された北西-南東方向の構造線はランクA磁性岩体の幅の狭い岩脈群を反映した結果と考えられる。

3) 調査地域南東部においては, ランクD岩体の分布が優勢であり, 北東-南西方向の構造線が卓越している。

ランクA岩体(斑レイ岩, 閃長岩)が, ホーシャ鉱山付近(B-5), ヒベイラ南方, (C-1) Tunas (C-4)及びベラウ鉱山東方約10km付近(C-2)に露出または潜在して検出されたが, これら貫入岩体と本地区に多数分布する鉱床との関連は明確ではない。

ランクC岩体(片麻岩, 角閃岩)は上記の構造線の方向に, ヒベイラ南方からTunas南西方約20km付近にかけて分布している。

以上の考察から, 本解析は次の様に結論される。

本調査地域A地区の主たる地質構造は, 北東-南西の方向性を有し, 磁気図から把握された構造線の方向に一致する。また, 花崗岩, 閃長岩, 斑レイ岩, 輝緑岩などの貫入岩体の分布が把握された。調査地域における鉱床はランクD磁性岩体中に分布し, ランクA及びB磁性岩体(斑レイ岩, 輝緑岩, 閃長岩, 花崗岩)との関係は明らかではない。

今後, 北東側のB地区の空中磁気探査資料を再解析し, 結果を併せて考察することにより鉱床に関連の深いランクD岩体の分布を把握し, かつ, ランクA, Bなどの貫入岩体との関係を明らかにすることが望まれる。

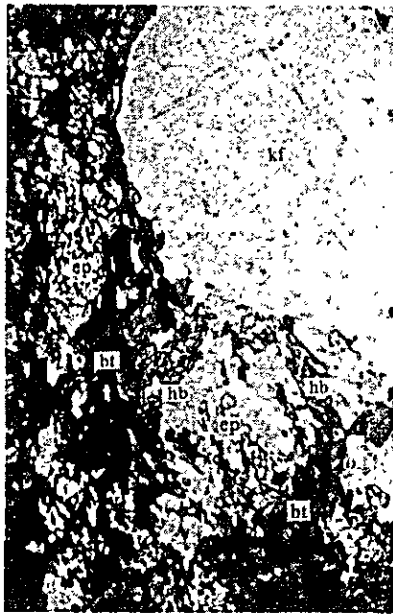
APPENDICES

Photo. A-1 Microphotograph of Thin Section

Abbreviations

q	:	quartz
pl	:	plagioclase
kf	:	potash feldspar
bt	:	biotite
mus	:	muscovite
hb	:	hornblende
tr	:	tremolite
au	:	augite
ae	:	aegirine
ga	:	garnet
op	:	opaque mineral
tor	:	tourmaline
ser	:	sericite
chl	:	chlorite
srp	:	serpentine
ep	:	epidote
cal	:	calcite
dol	:	dolomite

Sample No. : F-105
 Rock name : hornblende epidote biotite gneiss (Setuva F.)
 Location : Cerra do Cadeado

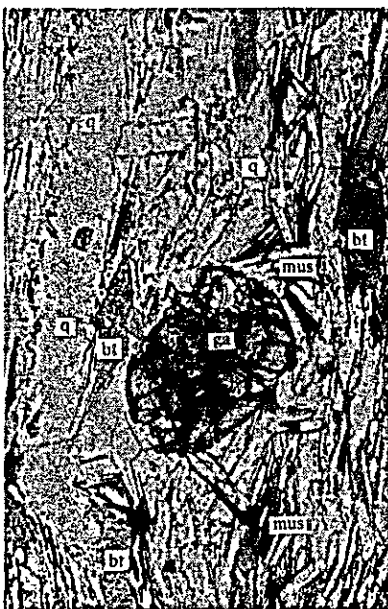


(only lower polar)



(crossed polars)

Sample No. : S-37
 Rock name : biotite muscovite schist (Açungui I F.)
 Location : Barrinha

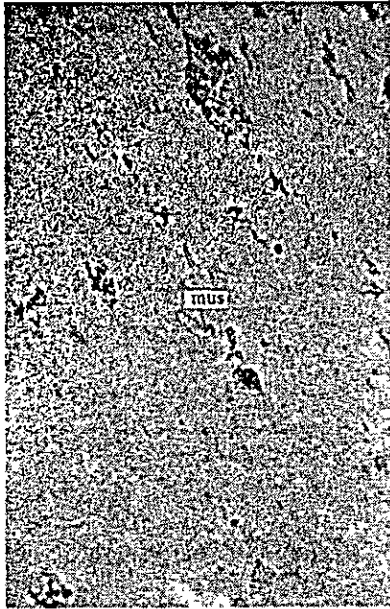


(only lower polar)



(crossed polars)

Sample No. : F-1
Rock name : quartzite (Açungui I F.)
Location : Perau Mine

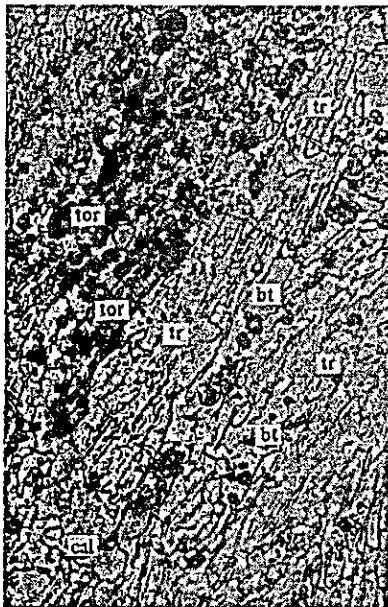


(only lower polar)

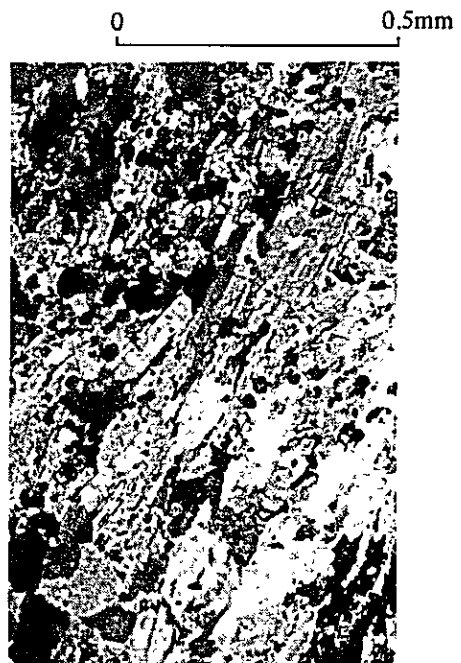


(crossed polars)

Sample No. : F-278
Rock name : calcareous muscovite tremolite schist (Açungui I F.)
Location : Perau Mine

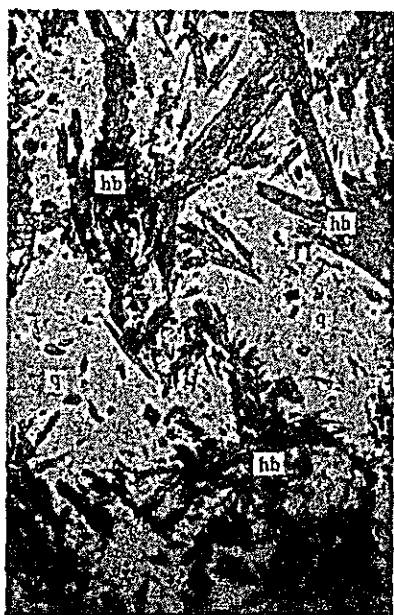


(only lower polar)



(crossed polars)

Sample No. : F-7
Rock name : amphibolite (Açungui I F.)
Location : Perau Mine

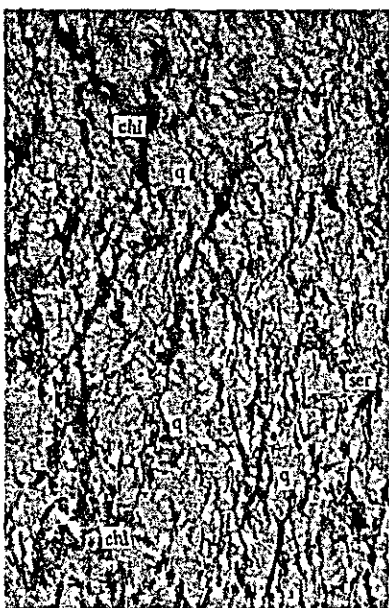


(only lower polar)



(crossed polars)

Sample No. : T-10
Rock name : chlorite sericite schist (Açungui II F.)
Location : Barra do Turvo



(only lower polar)



(crossed polars)

Sample No. : S-9
Rock name : sandstone (Açungui III F.)
Location : Adorianopolis



(only lower polar)



(crossed polars)

Sample No. : K-272
Rock name : sericite chlorite schist (Açungui III F.)
Location : Iporanga



(only lower polar)



(crossed polars)

Sample No. : S-126
Rock name : limestone (Açungui III F.)
Location : Rocha Mine

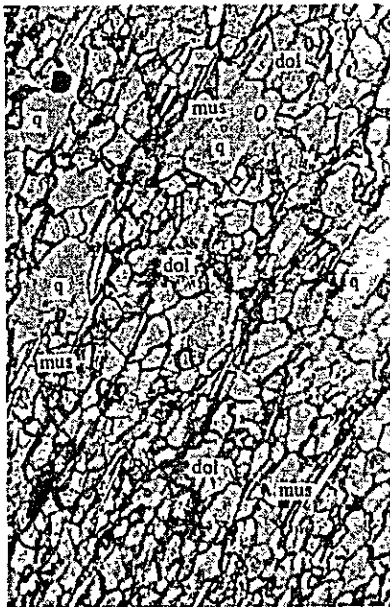


(only lower polar)

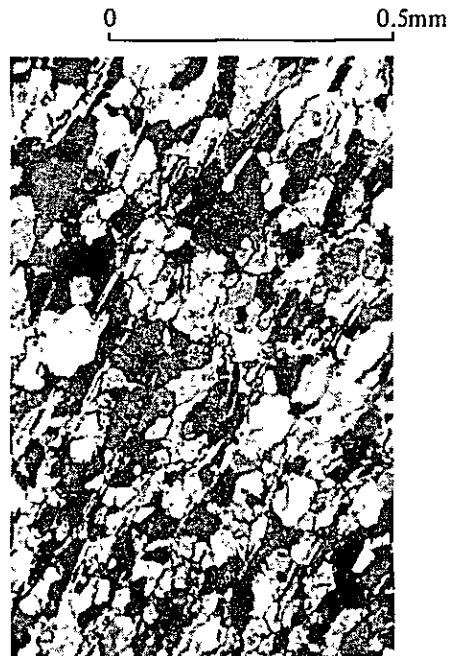


(crossed polars)

Sample No. : S-127
Rock name : dolomite (Açungui III F.)
Location : Rocha Mine



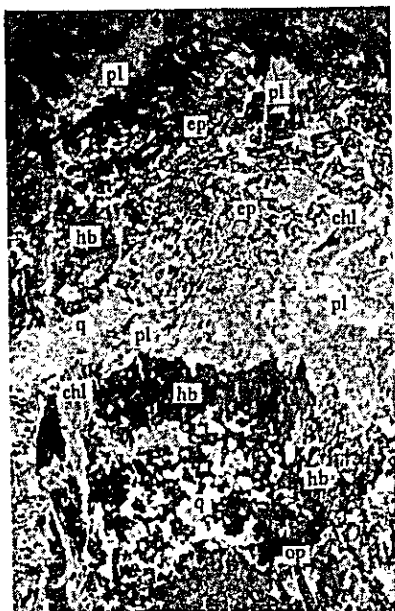
(only lower polar)



(crossed polars)

Sample No. : S-48
 Rock name : amphibolite (Açungui III F.)
 Location : Adrianopolis

0 1mm



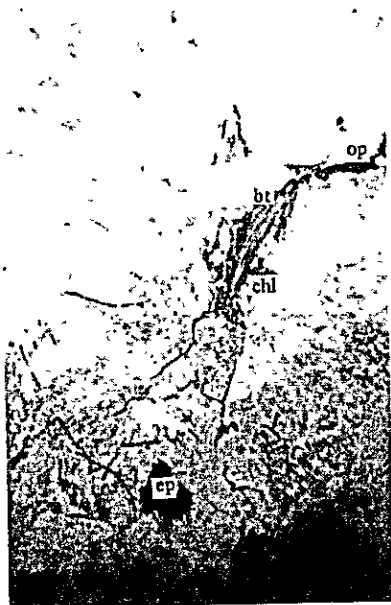
(only lower polar)



(crossed polars)

Sample No. : F-57
 Rock name : granite
 Location : Cerro Azul

0 1mm

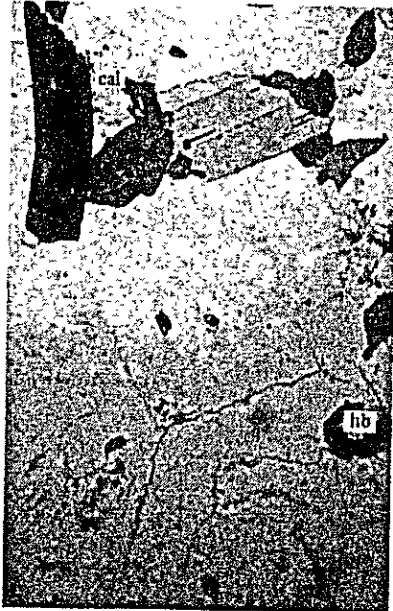


(only lower polar)



(crossed polars)

Sample No. : F-124
 Rock name : granite
 Location : Itaoca

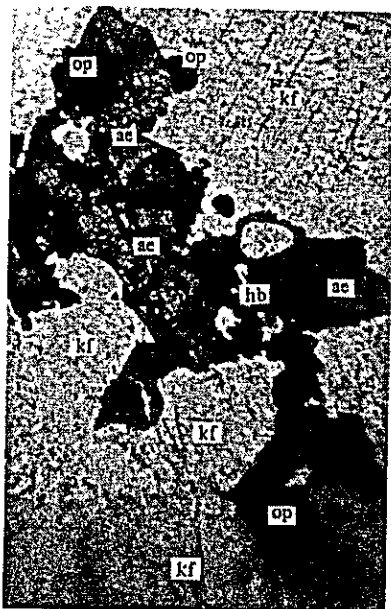


(only lower polar)

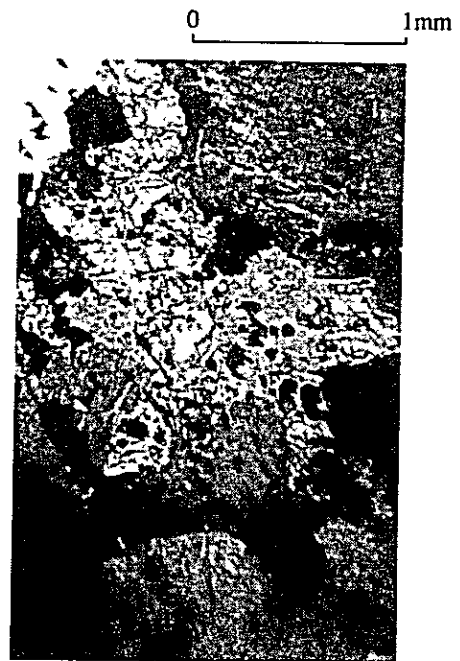


(crossed polars)

Sample No. : F-87
 Rock name : aegirin syenite
 Location : Tunas



(only lower polar)



(crossed polars)

Sample No. : F-9
 Rock name : diabase
 Location : Perau



(only lower polar)



(crossed polars)

Sample No. : F-38
 Rock name : gabbro
 Location : Morro Agudo

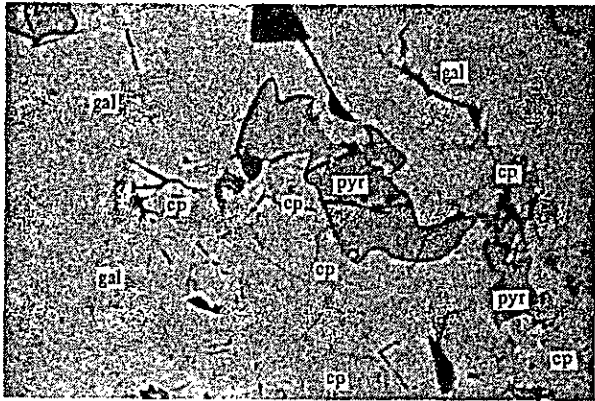


(only lower polar)



(crossed polars)

Photo. A-2 Microphotograph of Polished Section



Sample No. : F-204
Rock name : lead ore
Location : Panelas Mine

Reflected light
Only lower polar



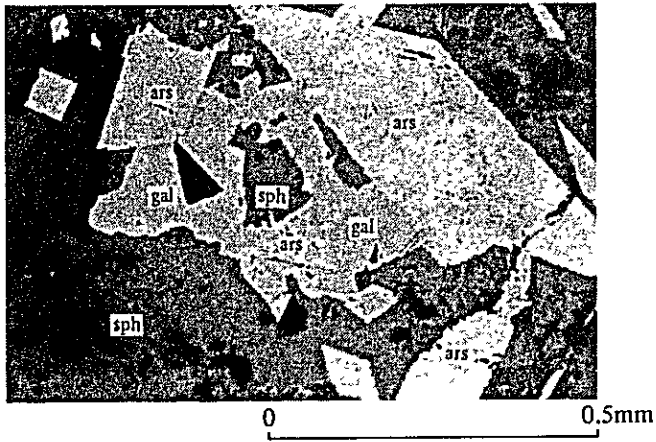
Sample No. : K-351A
Rock name : lead and zinc ore
Location : Lageado Mine

Reflected light
Only lower polar



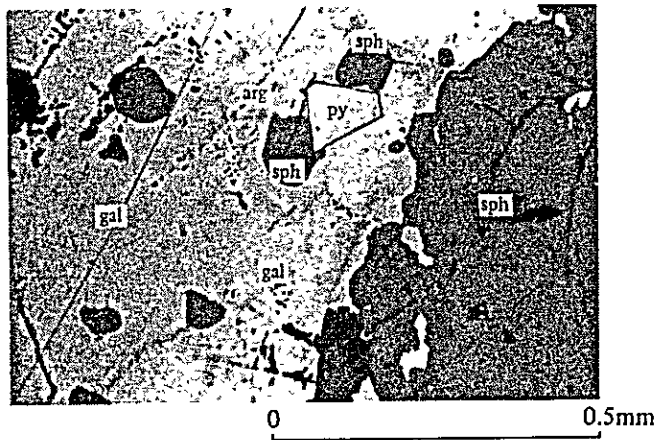
Sample No. : K-351C
Rock name : lead and zinc ore
Location : Lageado Mine

Reflected light
Only lower polar



Sample No. . T-81
 Rock name : lead and zinc ore
 Location : Furnas Mine, 500mL

Reflected light
 Only lower polar



Sample No. . T-83
 Rock name : lead and zinc ore
 Location : Furnas Mine,
 Santa Barbara II

Reflected light
 Only lower polar

Abbreviations

- py : pyrite
- cp : chalcopyrite
- ars : arsenopyrite
- pyr : pyrrhotite
- gal : galena
- sph : sphalerite
- arg : argentite

Table A-1 List of Mines and Showings

(1)

Ser. No.	Name of Mine	Kind of Ores	Type	Status Quo	Location	Host Rock	Ore Deposits				Grade (%)					Ore-Mineral	Remarks
							Strike & Dip	Lateral Extension	Longitudinal Extension	Average Width	Au	Ag	Cu	Pb	Zn		
1.	Espirito Santo	Pb	vein	closed	Estado São Paulo Município Iporanga	Açungui III F limestone	N80W~N80E 65~80N	m 20	m -	m 0.40	g/T -	g/T -	% -	% -	% -	Ga, Sp, Py, Cp	
2.	Maximinoiro	Pb, Ag	do	do	do	do	N40F 60S	100?	4	0.10	0	33	0.1	0.8	0.0	Ga, Q	
3.	Furnas	Pb, Ag	stratiform & vein	operating	do	do	N40~60W, 55N & E-W, 80S	100	300	0.20 0.20	0	200	0.1	12.0	8.0	Ga, Sp, Py, Cp, Cer, Lim	production (1981) 500T/M Pb:7% Ag:3,000g/T
4.	Lourenço Velho	Pb	vein	closed	do	do	N50E 80S	20~30	-	0.30	-	-	-	-	-	Ga, Lim, Cer	
5.	Santana Velha	Pb	do	do	do	do	N55E 75S	800	30	0.50	-	-	-	-	-	Ga, Lim	
6.	Santana Nova	Pb	do	do	do	do	N60E 75S	600	200	0.20	1	1,050	0.0	30.3	0.0	Ga	ore pocket 50m x 5m x 0.2m
7.	Mamangaba	Pb	do	do	do	do	N60E 60S	500	100	0.80	0	215	0.0	11.1	0.0	Ga, Sp, Py Cer, Lim	ore pocket 200m x 20m x 0.8m
8.	Porco de Mato	Pb	do	do	do	do	N70E 70S	-	-	0.30	-	-	-	-	-	Ga, Sp, Py	
9.	São Vicente	Pb	do	do	do	do	N40E 80S	-	-	0.30	0	1,210	0.3	30.2	0.2	Ga, Py, Sp, Lim	
10.	S. Rafael	Pb	do	do	do	do	N40E 60S	-	-	2.00	1	1	0.0	0.9	0.0	Ga, Py, Po, Cp, Lim	
11.	Jardim II	Pb	do	do	do	do	N40E 60S	200	5	-	0	1,130	0.3	29.8	0.1	Ga, Sp, Py	
12.	Bugios	Pb	do	do	do	do	N40E 70S	?	-	-	-	-	-	-	-	Ga	
13.	Coqueiro	Pb	do	do	do	do	N60E 80S	-	-	-	-	-	-	-	-	Ga	
14.	Rocha	Pb, Ag	do	operating	Estado Parana Município Adrianopolis	Açungui III F dolomite	N10~30W 60N,60S	180~400	150~300	0.10~2.00	1	130	0.5	18.0	0.4	Ga, Sp, Cp, Py	production (1981) 2,500T/M Pb:6.5% Ag:130g/T
15.	Barrinha	Pb, Ag	stratiform	under Exploration	do	Açungui III F limestone & calcareous shale	N50~70E 40~80N	50~70	70~200	0.50~14.00	1	150	0.1	30.6	0.0	Ga, Sp, Cp, Py Cer, Pyro	

Ser No.	Name of Mine	Kind of Ores	Type	Status Quo	Location	Host Rock	Ore Deposits				Grade (%)					Ore-Mineral	Remarks
							Strike & Dip	Lateral Extension	Longitudinal Extension	Average Width	Au	Ag	Cu	Pb	Zn		
16.	Paqueiro	Pb, Ag	vein & stratiform	closed	do	Açungui IIIF limestone	N50~60E 80N~80S	1~70	40	0.20~1.20	1	214	0.5	9.6	0.0	Ga, Sp, Cp, Py	total production 16,300T Pb:9%
17.	Bueno	Pb, Ag	do	do	do	do	N35E 50S	15	20	1.50	1	70	0.2	23.1	0.0	Ga, Py	total production 66T Pb:10.6%
18.	Diogo Lopes	Pb, Ag	do	do	do	do	N75~85E 50~70S	10	50	0.80	1	221	0.1	16.1	0.4	Ga, Py	total production 144T Pb:9.72%
19.	Onça II	Pb	vein	do	do	do	N45E	-	-	-	-	-	-	-	-	Ga	
20.	Quarenta Qitava	Pb	do	do	do	do	N45E	-	-	-	-	-	-	-	-	Ga	
21.	Braz	F	do	do	do	do	-	-	-	-	-	-	-	-	-	F, Ga, Py, Cp	
22.	Carumbe	Pb, Cu	do	do	do	do	-	-	-	-	-	-	-	-	-	Ga, Py, Cp, F	
23.	Cecrisa	Pb	stratiform	do	do	Açungui III F calcareous shale	E-W 60N	-	-	0.10~0.50	0	187	0.1	7.9	0.0	Ga, Cer	
24.	Laranjal	Pb	do	do	do	do	N70E 60N	-	-	0.50	1	223	0.6	17.4	0.1	Ga	
25.	Onça I	Pb	vein	do	do	Açungui III F limestone	-	-	0.30	-	-	-	-	-	-	Ga	
26.	Panelas	Pb	stratiform & vein	operating	do	do	N40E 50N	900	200	0.30	0	130	0.3	24.0	0.0	Ga, Sp, Py, Po	total production 1,200,000T Pb:7.0% production (1981) 2,500T/M Pb:5.8% Ag:100g/T
27.	Fluorita de Sete Barras	F	vein	closed	do	do	N80E	50+	20	0.50	nd	(F) 24.6	nd	nd	nd	F	
28.	Mater Empresa de Mineração	Cu	stratiform	do	do	Açungui II F calc-silicate rock	N80W 35N	60	60	0.50	1	10	0.4	0.2	0.7	Cp, Py, (Ga)	
29.	Pretinho	Ba	do	operating	do	Açungui I F calc-silicate rock	N40E 35S	1,000	100+	1.50	(BaSO ₄) 85	(S) 0.5	ppm 800	ppm 50	ppm 60	Ba	production (1980) 140T/Y
30.	Perau	Pb	do	do	do	do	N10E 30W	300+	200	0.50	0	120	0.2	18.7	2.0	Ga, Sp, Cp, Py	production (1981) 1,500T/M Pb:8.5% Ag:100g/T
31.	Água Clara	Cu	do	closed	do	Açungui I F dolomite	E-W 40S	10	50	0.20	0	8	0.8	0.0	0.0	Ga, Cp	

- no data

Ga : Galena Cer : Cerussite Py : Pyrite Ba : Barite
 Sp : Sphalerite Pyro : Pyromorphite Lim : Limonite
 Cp : Chalcopyrite Po : Pyrrhoite F : Fluorite

Table A-2 Microscopic Observations (Thin Section)

Abbreviations

Rock forming minerals

q	:	quartz
pl	:	plagioclase
kf	:	potash feldspar
bt	:	biotite
mus	:	muscovite
hb	:	hornblende
tr	:	tremolite
au	:	augite
ae	:	aegirine
cpx	:	clinopyroxene
ga	:	garnet
op	:	opaque mineral
tor	:	tourmaline
ap	:	apatite
zi	:	zircon
sph	:	sphene
ser	:	sericite
chl	:	chlorite
srp	:	serpentine
ep	:	epidote
cal	:	calcite
dol	:	dolomite

Rock name

gn	:	gneiss
sch	:	schist

Metamorphic Rocks

(1)

Formation	Sample No.	Location	Rock name	Texture	q	pl	kf	bt	mus	hb	tr	ga	op	tor	ap	zi	sph	ser	chl	ep	cal	dol	Remarks		
Setuva Formation	F- 66	Tunas	bt - ep - gn	porphyroblastic	⊙	•	○	•	•						•			•	•	•					
	F-105	Cerra do Cadeado	hb - ep - bt - gn	porphyroblastic	⊙		○	⊙		•										○	•		see photograph.		
	F-106	Cerra do Cadeado	bt - gn	porphyroblastic	⊙	○		⊙					•		•			○							
	F-290	Barra do Turvo	ep - hb - gn	nematoblastic	○	⊙	○				⊙		•	•				•		•	•				
Açungui Group	I Formation	F- 1	Perau Mine	quartzite	granoblastic	⊙		•										•					see photograph.		
		F- 7	Perau Mine	amphibolite	lepidoblastic	⊙	•				⊙					•								see photograph.	
		F- 67	Tunas	quartzite	lepidoblastic	⊙													•	•					
		F-115	Barrinha	bt - mus - sch	nematoblastic	⊙			○	⊙		•	•	•	•							•			
		F-278	Perau Mine	calcareous mus - tr - sch	lepidoblastic				○	•		⊙			•	○							○		see photograph.
		K-331	Lageado Mine	phyllite	fibroblastic	⊙				•										○					
		K-332	Lageado Mine	sandstone	blastopsammitic	⊙									•	•									
		K-357	Lageado Mine	chl - ser - sch	fibroblastic	○														⊙	⊙				
		K-359	Lageado Mine	ser - chl - sch	porphyroblastic	⊙														○	○				
		K-401	Rio des Pilões	chl - mus - sch	lepidoblastic	⊙			•	⊙											⊙				
	II Formation	S- 37	Barrinha	bt - mus - sch	nematoblastic	⊙			○	⊙			○											showing microfolding, see photograph.	
		S- 41	Barrinha	bt - mus - sch	nematoblastic	⊙			○	⊙			•	•							•				
		S- 93	Barrinha	amphibolite	nematoblastic	○						⊙								•					
		T- 30	Iporanga	calcareous green sch	lepidoblastic	○	•								•	•					⊙		○		
		T- 31	Iporanga	phyllite	fibroblastic	⊙															⊙				fine grained.
		T-170	Rio Pescaria	phyllite	fibroblastic	⊙															⊙				
		T-173	Rio Pescaria	green sch	granoblastic							○									⊙				
		T- 9	Barra do Turvo	ser - sch	lepidoblastic	⊙															⊙		•		
		T- 10	Barra do Turvo	chl - ser - sch	nematoblastic	⊙															⊙	○			see photograph.
		F-251	Adrianopolis	calcareous amphibolite	granoblastic								⊙										⊙		
K-151	Araçaba	chl - ser - sch	porphyroblastic	⊙	•	•		•											⊙	○					
K-161	Apiai	sandstone	blastopsammitic	⊙																					
K-192	Furnas	ser - chl - sch	lepidoblastic	⊙															○	⊙	⊙				

(2)

Formation	Sample No.	Location	Rock Name	Texture	q	pl	kf	bt	mus	hb	tr	ga	op	tor	ap	zi	sph	ser	chl	ep	cal	dol	Remarks	
III Formation	K-215	Furnas	calcareous sch	lepidoblastic	⊙								•					•			⊙			
	K-259	Iporanga	ser - chl - sch	porphyroblastic	⊙								○	•		•		⊙	⊙			•		
	K-272	Iporanga	ser - chl - sch	porphyroblastic	⊙								•	•				⊙						see photograph.
	S- 9	Adrianopolis	sandstone	blastopsammitic	⊙								○		•			○	•					see photograph.
	S- 13	Adrianopolis	chl - ser - sch	lepidoblastic	⊙								⊙	•				⊙	○					
	S- 18	Rocha	ser - sch	lepidoblastic	⊙								○	•		•		⊙	•					
	S- 45	Adrianopolis	calcareous chl - sch	porphyroblastic	⊙								○						⊙			⊙		
	S- 48	Adrianopolis	amphibolite	poikiloblastic	○	⊙					⊙			⊙	•				⊙	○				see photograph.
	S- 83	Barrinha Mine	calcareous chl - sch	lepidoblastic	⊙								⊙						○			⊙		
	S-126	Rocha Mine	limestone	granoblastic	•				•					•								⊙		see photograph.
	S-127	Rocha Mine	dolomite	lepidoblastic	○				•					•									⊙	see photograph.
	S-132	Espirito Santo	sandstone	blastopsammitic	⊙									•		•	•		○	•				
	S-135	Espirito Santo	sandstone	blastopsammitic	⊙									○	•		•		○	•				
	T- 87	Furnas Mine	limestone	granoblastic	•				•					○								⊙		
T-117	Furnas Mine	ser - sch	fibroblastic	⊙									•					⊙	○				showing microfolding.	

Sample No.	Location	Rock name	Texture	Phenocryst										Groundmass						Secondary mineral						Remarks									
				q	kf	pl	bt	mus	hb	au	ae	ap	op	q	kf	pl	bt	hb	cpx	mus	q	cal	ser	chl	ep		op	sph	srp	bt					
F- 33	Morro Agudo	granite	equigranular	○	•	⊙	○		•													•	•	•		•									
F- 57	Cerro Azul	granite	equigranular	⊙	⊙	⊙	•																•	•	•		•								kf is composed mainly of microcline. see photograph.
F-124	Itaoca	granite	equigranular	⊙	⊙	○	○		○													•					•								kf shows microcline and perthite structure. see photograph.
F-242	Itaoca	granite	equigranular	⊙	⊙	○	•															•	•	•	•	•	•								kf is composed mainly of microcline.
K-101	Ribeirão Branco	granite porphyry	porphyritic	○	○	○	•						⊙	○	○	○		○				•				•									ep forms veinlets.
K-102	Ribeirão Branco	granite porphyry	porphyritic	○	○	○	•						•	⊙	○	○	•		•			•			•	•									
K-106	Ribeirão Branco	granite porphyry	porphyritic	⊙	○	○							⊙	○	○			•				•		•	•	•									mafic min. altered to chl, containing garnet.
S- 28	Rocha	granite	equigranular	○	⊙	⊙		○														○	○	○		•									mafic min. altered to chl, kf shows perthite structure.
S- 36	Varginha	granite	mosaic	⊙	⊙	○	•																○	•	•										kf is composed mainly of microcline.
S- 50	Adorianopolis	granite	equigranular	⊙	⊙	⊙	⊙		•				•									•	•		•	•	•								containing garnet.
S-134	Espirito Santo	granite	equigranular	⊙	⊙	⊙	○		○														•	•	•		•								kf shows perthite structure.
F- 87	Tunas	aegirn syenite	equigranular		⊙	•			•		○		•										•			•	•								kf shows perthite structure. see photograph.
S- 90	Vinte e Sete	monzo-dionte	equigranular	•	⊙	⊙	○			○		•											•	•	•	•									
F- 9	Perau	diabase	doleritic			⊙				○				⊙				⊙				•	•	•											see photograph.
F- 38	Morro Agudo	gabbro	equigranular			⊙	•		•	⊙														•		○									see photograph.
K-157	Apiai	altered gabbro	equigranular	•		⊙				○												•			○		•								epidotized, silicified.
K-168	Apiai	diabase	doleritic			⊙				○				⊙				⊙						⊙		•									strongly chloritized.
K-169	Apiai	gabbro	ophitic			⊙				⊙												•		•	•										
S- 17	Rocha	gabbro	equigranular			⊙				⊙		•										•	•	•											

A-3 Microscopic Observations (Polished Section)

(1)

No.	Sample No.	Location	Names of Ore and Formation	Microscopic Observation	Remarks
1	F 4	Perau Mine outcrop	Magnetite (Açungui IF)	Magnetite-gangue (quartz) Hematite replaces magnetite in regular directions.	
2	F 11	Perau Mine G - I sublevel	Galena-Pyrite (Açungui IF)	It is mainly composed of pyrite and galena Galena fills fractures in pyrite. A small amount of sphalerite and chalcopyrite can be seen. Order of crystallization is pyrite, galena, sphalerite and chalcopyrite from an earlier stage.	
3	F 18	Perau Mine G 4	Galena-Sphalerite-Pyrite (Açungui IF)	Main components minerals are pyrite and sphalerite. Pyrite has an euhedral or subhedral form and has replaced by sphalerite. Galena is accompanied with sphalerite.	
4	F 121	Mater Empresa de Mineração Mine	Pyrite (Sphalerite) (Açungui IIF)	Pyrite crystals are crushed in various size (maximum 2mm ~ 0.1mm, average size : 0.8mm). A few sphalerite with galena fill the fractures Chalcopyrite grains are rarely observed in pyrite.	
5	F 204	Panelas Mine	Galena-Chalcopyrite-pyrrhotite (Açungui IIIF)	It is mainly composed of galena and pyrrhotite. Pyrrhotite after pyrite is in a xenomorphic granular form and enclosed by galena. Chalcopyrite and sphalerite are commonly accompanied with pyrrhotite.	see photograph
6	F 207	Panelas Mine	Galena-Pyrrhotite (Açungui IIIF)	Main components are xenomorphic granular pyrrhotite after pyrite and galena. A few chalcopyrite replace pyrrhotite and are accompanied with sphalerite.	
7	F 221	Panelas Mine	Galena-Pyrite (Açungui IIIF)	Granular pyrite crystals are in gangue. Very fine grained galena is scattered in pyrite and gangue. A few chalcopyrite with an irregular form and covellite are also found in them	
8	F 233	Panelas Mine	Galena-Pyrrhotite (Açungui IIIF)	Pyrrhotite after pyrite is enclosed by galena. Both of them are penetrated by gangue veins.	

(2)

No.	Sample No.	Location	Names of Ore and Formation	Microscopic Observation	Remarks
9.	F-253	Panelas Mine	Galena-Pyrrhotite (Açungui IIIF)	Main components are pyrrhotite and galena. Both crystals are large in size. Chalcopyrite and sphalerite replace pyrrhotite along fractures and cleavages.	
10.	F-255	Panelas Mine	Galena-Pyrrhotite (Açungui IIIF)	It is mainly composed of pyrrhotite. Galena replace pyrrhotite irregularly. Euhedral pyrite grains partly replaced by galena and lath-shaped chalcopyrite are observed in pyrrhotite.	
11.	F-257	Perau Mine G-3	Galena-Sphalerite (Açungui IF)	Galena and sphalerite are main components. Sphalerite is granular in form (0.3 ~0.5mm) and embedded in galena. There are tiny dots of chalcopyrite with an orientation in sphalerite.	
12.	F-269	Galeria da Azurita	Oxidized Chalcopyrite (Açungui IF)	Chalcopyrite and gangue mineral. Chalcopyrite is oxidized into azurite along the fractures which are parallel to the bedding of dolomite.	
13.	F-276	Perau Mine G-1 Raise	Galena-Sphalerite (Açungui IF)	Galena streaks (0.2mm in width) are in host rock (calc-silicate rock). Galena replaces sphalerite and pyrite. No chalcopyrite can be seen.	
14.	F-280	Perau Mine G-3	Galena-Pyrite (Açungui IF)	It is mainly composed of pyrite and galena. Pyrite is granular in form (average size ~ 1mm) and enclosed in galena. There are a small amount of sphalerite in which exsolution dots of chalcopyrite exist.	
15.	F-307	Perau Mine	Galena-Chalcopyrite-Sphalerite (Açungui IF)	Granular pyrite and irregular chalcopyrite are in galena. Sphalerite has many oriented dots of chalcopyrite. A few pyrrhotite can be observed along the rims of sphalerite and chalcopyrite.	
16.	S-54	Bueno Mine 550mL	Galena-Chalcopyrite-Pyrite (Açungui IIIF)	Large crystals of pyrite (2mm in size) are penetrated by chalcopyrite-sphalerite-galena vein. Chalcopyrite is partly altered into covellite. Chalcopyrite dots are scattered in sphalerite.	

(3)

No.	Sample No.	Location	Names of Ore and Formation	Microscopic Observation	Remarks
17.	S-57	Paquero Mine Stockpile	Galena-Pyrite (Açungui IIIIF)	Cubic or granular pyrite grains are enclosed in galena. A few granular sphalerite are also accompanied. Chalcopyrite and galena dots are included in pyrite.	
18.	S-59	Paquero Mine 620mL	Galena (Açungui IIIIF)	Galena crystals with a few sphalerite No chalcopyrite occurs	
19.	S-76	Barrinha Mine	Galena	Galena with irregular form scatters in gangue and includes some dots of chalcopyrite.	
20.	S-77	Barrinha Mine	Galena (Açungui IIIIF)	Galena is penetrated by gangue minerals. Pyrite grains partly replaced by sphalerite are in galena. No chalcopyrite.	chemical analysis No. S-75
21.	S-79	Barrinha Mine Quatro	Galena-Pyrite (Açungui IIIIF)	Cubic or triangular pyrite and anhedral galena are main component minerals. In the pyrite a little amount of chalcopyrite and galena occur in the form of dot	
22.	S-81	Barrinha Mine G2	Galena-Pyrite (Açungui IIIIF)	Euhedral pyrite grains (partly crushed) are enclosed by galena. A few dots of chalcopyrite, galena and sphalerite are found in pyrite. Many gangue veinlets penetrate all of the ore minerals.	
23.	S-109	Rocha Mine 600mL	Galena (Açungui IIIIF)	Much galena with very few pyrite. Narrow gangue veins penetrate regularly.	
24.	S-114	Rocha Mine 308mL	Galena (Açungui IIIIF)	Galena occupies the most part of the field. Chalcopyrite occurs in an irregular form. No other minerals can be seen.	
25.	S-119	Rocha Mine 308mL	Galena-Pyrite (Açungui IIIIF)	Subhedral pyrite (1mm in size) are embedded in galena. Some pyrite crystals are crushed and penetrated by gangue or galena. A few granular sphalerite with chalcopyrite dots and chalcopyrite are observed in galena.	

(4)

No.	Sample No.	Location	Names of Ore and Formation	Microscopic Observation	Remarks
26.	S-122	Rocha Mine 403mL	Galena-Pyrite (Açungui IIIIF)	Fine grained anhedral pyrite crystals are replaced by galena. A few sphalerite and chalcopyrite are in galena.	
27.	S-124	do	Galena-Pyrite (Açungui IIIIF)	Same as S-122	
28	S-125	Rocha Mine 308mL	Galena-Pyrite (Açungui IIIIF)	Granular pyrite and irregular galena are main components. There are a few chalcopyrite and sphalerite in which oriented chalcopyrite dots can be seen.	
29.	S-136	do	Galena-Chalcopyrite-Pyrite (Açungui IIIIF)	A few granular pyrite (0.1~1mm in size), irregular sphalerite (max 2mm, average 0.3mm) and chalcopyrite (average 0.1mm in size) occur in galena. Dots of sphalerite and chalcopyrite are also included in pyrite.	
30.	K-188		Chalcopyrite-Pyrite (Açungui IIIIF)	Some amount of chalcopyrite in an irregular form, a few pyrite, few sphalerite and galena occur in gangue minerals. The maximum width of vein is 2mm.	
31.	K-238	Lageado Mine	Galena (Açungui IIIIF)	Galena irregularly fills cracks of host rock	
32.	K-309	Lageado Mine Santa Nava	Galena-Pyrite	Granular pyrite is in galena, both of which are penetrated by gangue minerals. Pyrite includes some prismatic chalcopyrite.	
33.	K-316	Lageado Mine Santa Nava	Galena-Pyrite (Açungui IIIIF)	Subhedral pyrite (some have intergrowth texture) are enclosed by galena. Very tinny dots of chalcopyrite are in pyrite.	
34.	K-322	Lageado Mine Mamangaba	Galena vein (Açungui IIIIF)	Galena partly altered into cerussite? vein. Some corroded pyrite are replaced by enclosing galena.	
35.	K-329	Lageado Mine Copper Mine	Pyrite-impregnation (Açungui IIIIF)	Pyrite-quartz veinlets and pyrite impregnation.	
36.	K-334	Lageado Mine São Vicente	Galena-Cerussite (Açungui IIIIF)	Galena is partially replaced by cerussite. Some cubic pyrite are altered to limonite.	

(5)

No.	Sample No	Location	Names of Ore and Formation	Microscopic Observation	Remarks
37.	K 336	Lageado Mine	Galena (Açungui IIIIF)	Massive galena is penetrated by irregular veins of gangue minerals. Galena is partially altered to cerussite and limonite.	
38.	K 338	Lageado Mine Jardim II	Galena vein (Açungui IIIIF)	Same as K 336	
39.	K 351A	Lageado Mine	Galena-Sphalerite-Pyrite (Açungui IIIIF)	Main components are pyrite, galena and sphalerite. Pyrite shows not only a framboidal texture but a dissemination in a cubic form. There is a faint zoning in the field viz 1) host rock 2) larger crystals of pyrite (0.1mm±), 3) fine grained framboidal pyrite (0.01mm±) 4) larger cubic pyrite (0.5~0.7mm) 5) anhedral galena and sphalerite.	see photograph
40	K 351B	Lageado Mine	Galena-Sphalerite-Pyrite (Açungui IIIIF)	Galena-sphalerite veinlets (0.3mm± in width) are in host rock. Pyrite with a cubic form is disseminated, and partially replaced by sphalerite	
41.	K 351C	Lageado Mine	Pyrite-Arsenopyrite (Açungui IIIIF)	Some prismatic or rhombic arsenopyrite crystals coexist with framboidal pyrite. A few sphalerite and galena can be seen around arsenopyrite	see photograph
42.	K 351D	Lageado Mine	Pyrite (Açungui IIIIF)	Aggregation of fine grained cubic pyrite. No replacement occur. A very few amount of galena with euhedral form exist.	
43	T 71	Furnas Mine 571mL	Galena-Pyrite (Açungui IIIIF)	Pyrite is replaced by galena. A few sphalerite can be seen. The order of crystallization is pyrite, sphalerite, chalcopyrite and galena from an earlier stage	
44.	T-81	Furnas Mine 500mL	Sphalerite-Galena-Pyrite (Açungui IIIIF)	Cubic pyrite partially corroded by sphalerite, chalcopyrite with an irregular form and large subhedral galena (2mm in size) are enclosed in sphalerite. There are a few rhombic arsenopyrite	see photograph

(6)

No.	Sample No.	Location	Names of Ore and Formation	Microscopic Observation	Remarks
45.	T-82	Furnas Mine Santa Barbara II	Sphalerite-Galena-Pyrite (Açungui IIIIF)	Same as T-81. The order of crystallization is pyrite, sphalerite, arsenopyrite and galena from an earlier stage	
46.	T-83	do Santa Barbara II	Galena-Sphalerite-Pyrite (Açungui IIIIF)	Galena and sphalerite are main components. Some cubic pyrite partially corroded are enclosed in galena and sphalerite. A very few argentite occur with or near sphalerite	see photograph
47.	T-84	do	Galena-Pyrite (Açungui IIIIF)	Cubic or granular pyrite (0.1 mm in size) and massive galena. Pyrite is partially replaced by enclosing galena. Few chalcopyrite and sphalerite are present	
48.	T-86	do	Galena-Sphalerite (Açungui IIIIF)	Mineral assemblage is same as T-82. A few chalcopyrite dots occur in pyrite. There are also triangular arsenopyrite.	
49.	T-103	Furnas Mine	Galena vein (Açungui IIIIF)	Galena veinlets (1~2mm in width) in host rock. Corroded pyrite is partially replaced by enclosing galena.	
50.	T-104	do	Galena-Pyrite (Açungui IIIIF)	Galena veinlet (1 cm in width) contains pyrite. Cubic or subhedral pyrite grains are scattered in galena. A few rhombic arsenopyrite crystals are present	
51.	T-113		Galena-Sphalerite (Açungui IIIIF)	Granular pyrite crystals and granular ~ irregular formed sphalerite are enclosed galena vein (5mm in width). Very fine grained chalcopyrite dots are recognized in pyrite.	

Table A-4 X-ray Diffractive Analysis

Smec	:	Smectite
Ch	:	Chlorite
Ver	:	Vermiculite
K	:	Kaolinite
Tc	:	Talc
Sp	:	Serpentine
M	:	Mica
		t : trioctahedral – Phlogopite ~ Biotite
		d : dioctahedral – Muscovite
Tr	:	Tremolite
Q	:	Quartz
Cc	:	Calcite
D	:	Dolomite
Pl(ab)	:	Plagioclase (Albite)
Goe	:	Goethite
Ch/M	:	Chlorite – illite
Dra	:	Dravite $(\text{Na, Ca})_{0.9} (\text{Mg, Fe})_{2.9} (\text{Al, Fe, Ti})_6 \text{B}_3\text{Si}_6\text{O}_{27}(\text{OH, F})_4$
Hem	:	Hematite
Gas	:	Gaspeite $(\text{Ni}_{0.49} \text{Mg}_{0.43} \text{Fe}_{0.08}) \text{CO}_3$
Pyro	:	Pyromorphite $\text{Pb}_5 (\text{PO}_4)_3 \text{Cl}$

No.	Sample No.	Rock Name	Location	Smec	Ch	Ver	K	Tc	Sp	M	Tr	Q	Cc	D	P(ab)	Goe	Others
1.	F-82	dolomite	Água Clara														
2.	F-216	fine, black limestone	Panelas Mine							t•	()						
3.	F-218	fine, grey limestone	do							t•	()						
4.	F-225	coarse, grey limestone	do							•?	()						
5.	I-228	fine, black limestone	do							t△	•						
6.	T-230	coarse, black limestone	do								•						
7.	I-231	fine, black limestone	do								•						
8.	I-232	coarse, white limestone	do							t△	∧						
9.	I-234	coarse, white limestone	do							t△	∧?						
10.	T-256A	banded limestone black part	do							t•	()						
11.	I-256B	banded limestone white part	do							t•	•						
12.	I-270	dolomite	do							t•?							
13.	S-60	clay (altered)	Paqueta Mine														
14.	S-61	clay (do)	do	∧	•?		•?			t•d•?						△	
15.	S-64	clay (do)	do							△							•
16.	S-69	ore	do				•?										△
17.	S-74	clay (altered)	Barrinha Mine				•?			○							
18.	S-80	oxide ore	do							•							Pyro
19.	S-120	clay (altered)	Rocha Mine							t△							
20.	S-126	dolomite	do							△							
21.	S-127	limestone	do							△							
22.	T-54	clay (altered)	Furnas Mine							•							
23.	T-62	clay (do)	do				△			○							
24.	T-63	clay (do)	do				•?			○							
25.	T-65	clay (do)	do							○							
26.	T-66	clay (do)	do							○							
27.	T-67	clay (do)	do							○							
28.	T-69	clay (do)	do		∧					○							ch/M
29.	T-70	clay (do)	do		△					○							ch/M
30.	T-77	clay (do)	do							○							
31.	T-88	clay (do)	do				•			○							
32.	T-91	clay (do)	do							○							
33.	T-105	clay (do)	do							○							
34.	T-111	clay (do)	do							○							
35.	T-113	clay (do)	do		△					○							
36.	K-101	granite	Ribeirão Branco							t△							
37.	K-121	green rock	do							t•	○						
38.	K-122	green rock	do				△			•							
39.	K-123	green rock	do				•			•							
40.	K-133	green rock	Aracaba		○					○							
41.	K-140	psammite schist	do					○		○							
42.	K-147	pelitic schist	do					△		○							
43.	K-186	green rock	Apiai							△							
44.	K-188	limestone	Apiai							•							
45.	K-192	calcareous schist	Apiai ~ Furnas		○					○							
46.	K-197	altered sandstone	Apiai ~ Furnas							○							
47.	K-291	trachyte*	Iporanga				•?			○							Dra
48.	K-308	clay (altered)	Lagoado Mine							○							He m
49.	K-314	dolomite	do		○					○							
50.	K-326	trachyte*	do							○							
51.	K-350	ore	do							•							Gas
52.	K-359	green rock	do		○					○							
53.	K-401	green rock	Rto Pilões		○					○							
54.	K-403	green rock	do		○					△							

Table A-5 Results of Chemical Analysis

Ore

(1)

No.	Sample No.	Location	Occurrence	Au g/T	Ag g/T	Cu %	Pb %	Zn %
1	F-10	Perau Mine	galena impregnation w:70	0.0	69.6	0.08	9.60	0.01
2	11	do	stratiform massive galena w:60	0.4	92.9	0.00	25.35	0.14
3	12	do	do w:35	0.1	79.6	0.44	7.42	0.70
4	14A	do	do w:30	0.3	148.6	0.05	18.12	0.01
5	14B	do	galena impregnation w:30	0.3	22.3	0.76	0.41	0.07
6	15	do	massive galena w:10	0.1	131.0	0.15	30.06	0.11
7	17	do	azulite (stockpile)	0.4	62.1	2.53	0.03	0.12
8	18	do	galena-pyrite-quartz vein w:20	0.0	4.5	0.04	6.68	9.21
9	81	Agua Clara Mine	chalcopryite-quartz vein w:20	0.0	8.4	0.81	0.01	0.01
10	121	Mater Empresa de Mineracao	stockpile	0.5	10.5	0.39	0.18	0.65
11	204	Panelas Mine	massive galena-pyrite w:30	0.1	287.0	0.36	30.45	0.01
12	207	do	galena-pyrrhotite w:10	0.0	0.9	0.20	24.46	0.04
13	211	do	galena-pyrrhotite w:10	0.3	134.3	0.26	15.36	0.00
14	221	do	stratiform galena-chalcopryite w:10	0.4	270.0	0.80	28.85	0.02
15	233	do	massive galena vein w:15	0.0	220.5	0.06	30.70	0.00
16	253	do	stratiform galena-pyrrhotite w:20	0.1	0.9	0.15	9.24	0.16
17	255	do	do w:50	0.7	0.6	0.11	26.11	0.02
18	257	Perau Mine	stratiform massive galena w:30	0.3	459.9	0.07	32.61	11.59
19	260	do	do w:15	0.0	207.6	0.03	22.55	4.07
20	265	do	do w:20	0.0	256.5	0.00	31.72	3.49
21	269	Galenta da Azurita	stratiform azulite w:10	0.3	116.2	29.90	0.04	0.09
22	276	Perau Mine	massive galena-pyrite w:60	0.1	115.2	0.02	14.84	3.13
23	280	do	massive galena w:35	0.2	23.3	0.87	27.80	0.30
24	281	do	galena impregnation w:30	0.0	83.3	0.02	7.35	0.52
25	302	Maximino Mine	galena-quartz vein	0.0	32.7	0.05	0.83	0.01
26	306	Perau Mine	coarse galena	0.3	235.2	0.06	33.29	3.64
27	307	do	fine galena	0.3	147.1	2.53	31.40	0.64
28	S-55	Bueno Mine	galena-pyrite vein	0.5	70.2	0.18	23.05	0.01

(2)

No.	Sample No.	Location	Occurrence	Au g/T	Ag g/T	Cu %	Pb %	Zn %
29	S- 57	Paqueiro Mine	massive galena (stockpile)	0.8	57.4	0.25	33.05	0.03
30	58	do	do	2.1	361.6	0.19	30.98	0.04
31	59	do	do	0.4	656.5	0.09	21.83	0.01
32	62	do	galena impregnation w:100	2.5	110.0	0.03	8.91	0.01
33	63	do	do w:20	0.1	6.4	0.01	1.61	0.45
34	65	do	galena vein w:20	0.1	84.5	0.06	5.95	0.01
35	66	Bueno Mine	galena pyrite vein	0.2	1.3	0.16	0.02	0.01
36	67	do	do w:80	1.0	53.3	0.20	5.99	0.61
37	68	do	massive galena vein w:50	0.9	424.9	0.07	31.83	0.38
38	70	do	galena impregnation w 10	0.2	6.1	0.01	0.29	0.01
39	71	do	do w 40	0.0	18.0	0.07	0.41	0.01
40	72	Barrinha Mine	galena-quartz-calcite w 50	0.7	199.5	0.26	15.20	0.05
41	75	do	do w:50	3.9	164.3	0.10	8.30	2.98
42	78	do	oxidized ore	0.0	153.3	0.08	30.61	0.04
43	82	do	stockpile	0.1	187.1	0.09	7.86	0.01
44	85	do	galena-quartz w 40	0.8	222.9	0.58	17.38	0.06
45	104	Rocha Mine	galena-pyrite vein chip	1.5	140.0	0.23	14.65	0.26
46	113	do	do w 80	1.8	470.1	0.49	26.95	0.02
47	115	do	do w 60	0.8	80.8	0.34	5.03	0.04
48	116	do	do w 40	0.4	63.1	0.35	3.62	0.15
49	117	do	do w 20	0.2	2126.0	5.07	30.61	0.30
50	118	do	do w:80	0.7	72.6	0.33	13.43	0.08
51	121	do	do chip	0.2	123.3	0.45	30.43	0.92
52	123	do	do chip	0.8	131.4	1.05	18.54	1.73
53	T - 52	Furnas Mine	oxidized ore w:40	0.0	29.8	0.00	13.65	15.91
54	53	do	do w 40	0.0	19.5	0.00	0.69	27.50
55	56	do	do w 200	0.0	24.0	0.03	0.28	19.42
56	57	do	do w 150	0.1	8.2	0.05	0.03	2.30
57	61	do	do w 10	0.0	8.7	0.15	3.43	2.80
58	71	do	galena-pyrite w 150	0.4	181.7	0.04	30.37	0.14

(3)

No	Sample No.	Location	Occurrence	Au g/T	Ag g/T	Cu %	Pb %	Zn %
59	T-72	Furunas Mine	oxidized ore w.150	0.1	27.0	0.08	1.95	2.52
60	80	do	do w.50	0.0	36.9	0.00	0.45	20.96
61	81	do	sphalerite-galena vein w:50	0.0	97.6	0.07	5.06	33.89
62	82	do	do w:50	0.3	5.9	0.03	9.56	21.01
63	83	do	galena-sphalerite vein w:40	0.0	311.9	0.07	17.26	27.31
64	84	do	galena vein w.10	0.0	2.2	0.06	29.51	0.31
65	89	do	oxidized ore vein w.200	0.0	5.7	0.05	0.96	4.32
66	99	do	do w 70	0.1	199.5	0.03	3.43	1.89
67	100	do	do w:40	0.1	26.1	0.08	18.81	2.19
68	102	do	do w 30	0.0	14.1	0.01	0.31	0.07
69	103	do	galena vein chip	0.1	1208.0	0.01	31.46	0.06
70	104	do	do chip	0.0	641.8	0.00	30.98	1.31
71	106	do	oxidized ore vein w 150	0.4	146.2	0.02	3.33	1.65
72	110	do	do w 10	0.2	450.8	0.06	30.73	2.15
73	113	do	galena w 10	0.2	1330.0	0.17	31.10	0.87
74	115	do	oxidized ore w:10	0.0	9.8	0.00	0.34	0.26
75	118	do	galena w.10	0.3	233.9	0.05	14.84	7.07
76	K-105	Ribeirão Branco	pyrite-quartz vein	0.0	1.5	0.00	0.03	0.03
77	138	Aracua	greenrock with pyrite	0.0	0.5	0.01	0.02	0.03
78	153	do	do	0.0	0.7	0.01	0.03	0.03
79	236	Lageado Mine	altered sandstone	0.0	0.9	0.00	0.02	0.01
80	238	do	limestone with pyrite	0.0	0.1	0.01	0.01	0.02
81	301	do	oxidized ore chip	1.8	232.4	0.11	19.71	0.30
82	303	do	do chip	1.7	265.5	0.03	21.71	0.02
83	307	do	galena, vein w:100	1.2	960.9	0.02	29.15	0.01
84	309	do	do chip	1.0	798.9	0.04	30.73	0.03
85	315	do	oxidized ore chip	0.5	4.5	0.01	0.10	0.02
86	316	do	galena-oxidized ore chip	0.1	1378.0	0.02	30.98	0.01
87	K-319	do	cerussite? chip	0.0	12.5	0.01	0.87	0.28
88	322	do	do Max w:150	0.6	630.8	0.13	32.32	0.02

(4)

No.	Sample No	Location	Occurrence	Au g/T	Ag g/T	Cu %	Pb %	Zn %
89	K-319	Lagoado Mine	oxidized ore vein w:10	0.0	7.4	0.00	0.21	0.09
90	328	do	pyrite-galena vein chip	1.4	27.3	1.60	0.46	3.47
91	329	do	pyrite impregnation chip	0.0	1.9	0.00	0.67	0.01
92	333	do	oxidized ore vein w 200	1.4	1.4	0.01	0.86	0.03
93	334	do	galena-oxidized ore vein w-40	0.4	1212.0	0.28	30.21	0.16
94	336	do	galena vein w 100	0.0	658.8	0.00	29.27	0.17
95	338	do	galena-oxidized ore vein Max w-200	0.1	1132.0	0.33	29.76	0.12
96	348	do	oxidized ore vein chip	0.0	595.5	0.00	29.88	0.02
97	350	do	do chip	0.0	68.0	0.02	4.24	31.82
98	351A	do	galena + pyrite vein chip	0.0	18.9	0.01	6.34	10.93
99	351B	do	do chip	0.0	26.1	0.02	8.44	1.67
100	351C	do	do chip	0.1	1.1	0.00	2.20	0.20
101	351D	do	do chip	0.0	59.3	0.00	3.57	0.28
102	353	do	galena vein chip	0.0	690.4	0.05	31.34	1.86
103	358	do	altered sandstone	0.0	3.2	0.00	0.13	0.02
104	403	Rio dos pilões	green rock with chalcopyrite	0.0	1.3	0.10	0.04	0.02

No	Sample No.	Location	Occurrence	BaSO ₄ %	S %	Cu ppm	Pb	Zn ppm
105	F-13	Perau Mine	thin bedded barite in schist	87.05	0.76	47	1.92 %	69
106	82	Agua Clara Mine	dolomite	0.34	0.24	29	63 ppm	26
107	113	Pretinho Mine	thick bedded barite (1~2m) in schist	85.48	0.51	812	54 ppm	61

No.	Sample No.	Location	Occurrence	F %
108	F-123	Fluorita de Sete Barras	network of fluorite in limestone	24.64

Rock

(S)

No.	Sample No.	Location	Occurrence	CaO%	MgO%	Al ₂ O ₃ %	Fe ₂ O ₃ %	C %	CO ₂ %	Insoluble Residue%
1	F- 216	Panelas Mine 150ML	limestone (black)	38.39	3.36	0.21	1.07	-	-	22.58
2	218	do	do (black)	15.39	5.27	0.48	1.76	-	-	58.52
3	225	do	do (grey)	44.40	8.85	0.02	0.14	-	-	1.06
4	228	do	do (grey)	42.92	2.96	0.17	0.61	-	-	15.62
5	230	do	do (black)	52.41	9.66	0.06	0.29	-	-	3.30
6	231	do	do (black)	45.16	1.21	0.08	0.56	0.76	30.20	15.22
7	232	do	do (grey)	31.79	4.34	0.56	2.70	-	-	29.76
8	234	do	do (grey)	52.00	1.15	0.06	0.66	0.01	34.09	3.76
9	256A	Outcrop	banded limestone (black)	45.11	0.96	0.12	1.19	0.02	13.84	14.44
10	256B	do	do (white)	50.67	0.76	0.08	0.94	0.03	21.05	4.84
11	S- 126	Rocha Mine 308ML	grey limestone	41.29	2.32	0.09	0.67	-	-	19.84
12	127	do	grey dolomite	25.13	16.72	0.44	1.32	-	-	16.56

Table A-6 Fossils

Formation	Sample No.	Rock	Location	Fossils	Remarks	
Açungui III F	S-26	Dolomitic Schist	Rocha Mine	None		
	S-89	Limestone	Diogo Lopes Mine	None		
	S-101	Limestone	Rocha Mine	None		
	S-129	Limestone	Espirito Santo	None		
	T-58	Limestone	Furnas Mine	None		
	T-85	Limestone	Furnas Mine	None		
	T-152	Limestone	Espirito Santo	None		
	Açungui I F	F-72	Dolomite	Southeast of Tunas	None	
		F-74	Dolomite	Southeast of Tunas	None	
F-75		Limestone	Southeast of Tunas (Quarry)	None		
F-82		Dolomite	Agua Clara Mine	None		

Table A-7. Metal Contents of Geochemical Samples approved for Interpretation

		Abbreviation
Sam No.	:	Sample No.
M	:	Multiple
Area	:	Drainage Area
Lith	:	Lithology
<ol style="list-style-type: none"> 1. Basic Complex 2. Granite 3. Açungui Group – chemical sequence 4. do – upper clastic sequence 5. do – middle clastic sequence 6. do – schist and amphibolite 7. do – metabasite and amphibolite 8. Quartzite 9. Setuva Formation 10. Crystalline Complex 		
*	:	Mean value of the rank

(3)

No	San No	Arealith	pH	Cu	Pb	Zn	No	San No	Arealith	pH	Cu	Pb	Zn	No	San No	Arealith	pH	Cu	Pb	Zn	
			Unit in ppm						Unit in ppm						Unit in ppm						
401	FA0106	5	5	5	3	30	22	80	451	AM0133	4	3	10	25	501	IP0381	10	1	5	55	42
402	FA0108	4	2	5	3	10	7	58	452	AM0134	18	2	10	30	502	IP0384	7	2	5	10	45
403	FA0112	9	2	5	3	14	7	30	453	AM0135	15	2	10	40	503	IP0386	2	4	5	10	50
404	FA0113	5	2	5	3	10	20	45	454	AM0136	14	2	10	35	504	IP0388	7	2	5	10	40
405	FA0123A	5	2	5	3	13	22	80	455	AM0137	3	3	10	35	505	IP0389	5	2	10	40	45
406	FA0126	8	2	5	3	4	22	40	456	AM0140	4	3	10	20	506	IP0390	4	2	10	40	45
407	FA0128	7	2	5	3	4	7	40	457	AM0150	5	3	10	30	507	IP0393	3	2	10	40	45
408	FA0166	6	9	5	3	8	7	4	458	AM0154	2	2	10	35	508	IP0394	3	2	10	40	45
409	FA0167	4	9	5	3	25	18	85	459	AM0227	4	10	25	20	509	IP0395	2	3	10	15	70
410	FA0169	7	9	5	3	12	22	65	460	AM0228	3	10	30	30	510	IP0396	2	2	10	15	70
411	FA0171	9	9	5	3	21	22	110	461	AM0229	2	10	25	10	511	IP0410	9	2	10	12	37
412	FA0173	11	10	5	3	25	22	75	462	AM0231	11	10	45	10	512	IP0411	4	3	10	15	60
413	FA0174	5	10	5	3	20	22	85	463	AM0234	11	5	15	5	513	IP0415	9	4	10	20	85
414	FA0176	3	10	5	3	14	22	70	464	AM0235	5	5	20	10	514	IP0414	2	2	10	25	80
415	FA0177	4	9	5	3	9	7	60	465	AM0260	5	10	17	7	515	IP0416	3	2	10	45	40
416	FA0182	3	5	5	3	19	22	45	466	IP0067	3	4	5	5	516	IP0418	3	2	10	5	40
417	FA0247	2	9	5	3	23	22	95	467	IP0068	5	2	5	5	517	IP0407	7	2	10	5	40
418	FA0249	7	9	5	3	23	22	75	468	IP0070	3	4	5	5	518	IP0409	4	3	10	7	52
419	FA0251	3	9	5	3	15	22	85	469	IP0104	5	4	10	5	519	IP0411	4	8	10	10	75
420	FA0252	7	4	5	3	13	7	35	470	IP0105	5	4	10	5	520	IP0415	3	1	10	5	50
421	FA0254	4	3	5	3	13	7	35	471	IP0129	4	2	10	35	521	IP0436	4	1	10	72	10
422	FA0255A	5	3	5	3	31	7	90	472	IP0134	8	2	10	35	522	IP0441	2	1	10	50	70
423	FA0256	7	4	5	3	37	7	120	473	IP0148	3	2	10	5	523	IP0442	15	2	10	52	42
424	AM0019	5	4	5	3	20	58	474	IP0135	5	4	5	10	524	IP0443	7	3	10	10	70	
425	AM0024	1	4	5	3	38	46	60	475	IP0177	6	2	5	10	525	IP0474	8	4	10	37	50
426	AM0030	4	4	6	2	75	1008	63	476	IP0131	5	2	7	20	526	IP0447	5	4	10	37	50
427	AM0032	4	5	5	3	29	11	55	477	IP0198	7	2	5	7	527	IP0486	7	3	10	42	7
428	AM0034	6	4	5	3	45	50	65	478	IP0200	3	4	5	10	528	IP0481	4	3	10	47	70
429	AM0037	6	3	5	3	20	22	45	479	IP0208	7	4	5	10	529	IP0483	2	3	10	47	70
430	AM0039	9	1	5	3	20	22	55	480	IP0210	7	4	15	10	530	IP0492	3	3	10	10	42
431	AM0041	5	4	5	3	23	55	98	481	IP0215	8	2	5	7	531	IP0493	2	3	10	10	42
432	AM0042A	5	4	5	3	75	7	55	482	IP0230	7	2	5	10	532	IP0504	1	4	10	30	35
433	AM0045	7	2	5	3	13	22	69	483	IP0303	9	2	5	5	533	IP0505	2	4	10	35	72
434	AM0046	6	2	5	3	7	22	45	484	IP0338	4	2	10	10	534	IP0503	6	3	10	42	80
435	AM0047	7	4	5	3	29	7	130	485	IP0339	6	2	25	10	535	IP0512	6	4	10	245	230
436	AM0048	6	4	5	3	24	7	60	486	IP0351	7	2	10	65	536	IP0512	6	4	10	20	70
437	AM0049	3	2	5	3	9	7	45	487	IP0355	1	2	5	10	537	IP0558	1	2	10	20	60
438	AM0050	4	3	6	2	30	7	58	488	IP0357	3	2	10	15	538	IP0580	3	2	10	20	60
439	AM0051	1	3	7	0	14	7	28	489	IP0358	4	2	7	7	539	IP0584	2	4	10	15	40
440	AM0052	8	2	5	3	23	22	50	490	IP0359	3	2	15	40	540	IP0586	5	3	10	12	32
441	AM0054	2	4	5	3	23	18	40	491	IP0360	3	2	15	10	541	IP0607	2	4	10	30	110
442	AM0055	7	6	5	3	18	8	35	492	IP0364	5	2	30	10	542	IP0608	2	4	10	110	100
443	AM0058	6	2	5	3	7	20	48	493	IP0367	2	2	40	45	543	IP0611	7	2	10	5	40
444	AM0069	6	4	5	3	12	7	17	494	IP0368	2	2	10	75	544	IP0613	7	2	10	50	50
445	AM0117	8	3	5	3	5	5	35	495	IP0369	6	2	5	35	545	IP0633	7	2	10	35	85
446	AM0123	4	3	5	3	10	5	38	496	IP0371	3	2	5	10	546	IP0639	6	2	15	30	85
447	AM0124	6	3	5	3	5	5	25	497	IP0372	4	2	25	15	547	IP0661	2	2	45	30	62
448	AM0125	5	3	5	3	5	5	15	498	IP0376	3	2	10	10	548	IP0689	2	3	7	15	40
449	AM0126	4	3	5	3	35	16	60	499	IP0377	2	2	5	5	549	IP0695	8	3	40	17	77
450	AM0128	2	3	5	3	10	5	30	500	IP0380	1	2	5	35	550	IP0696	2	4	60	25	65

No. Sam No	Area/Lth	pH	Cu	Pb	Zn	No. Sam No	Area/Lth	pH	Cu	Pb	Zn	No. Sam No	Area/Lth	pH	Cu	Pb	Zn
(Unit in ppm)						(Unit in ppm)						(Unit in ppm)					
601	AG0076	3	5	3	25	651	AG0185	5	4	5	100	701	PP0044	5	4	5	3
602	AG0077	4	6	5	35	652	AG0186A	5	3	5	7	702	PP0051M	8	2	5	3
603	AG0078	5	5	5	47	653	AG0191	12	3	5	50	703	PP0052A	7	2	5	3
604	AG0085	3	9	5	23	654	AG0192	4	4	5	7	705	PP0054	3	2	5	0
605	AG0087	10	9	5	35	655	AG0193	2	4	5	26	706	PP0054	5	2	5	0
606	AG0088	3	6	5	26	656	AG0196	4	4	5	17	707	PP0056	5	2	5	5
607	AG0090M	2	4	5	35	657	AG0199	10	3	5	5	707	PP0057	7	2	5	0
608	AG0092	4	9	5	40	658	AG0200	3	4	5	8	708	PP0058	6	4	5	0
609	AG0093A	3	9	5	55	659	AG0205	5	4	5	7	709	PP0061	12	2	5	0
610	AG0095	2	9	5	21	660	AG0207	5	4	5	25	710	PP0062	10	2	5	0
611	AG0097	2	6	5	40	661	AG0208	7	4	5	5	711	PP0064	9	4	5	3
612	AG0098M	1	6	5	55	662	AG0216	7	4	5	22	712	PP0066	4	2	5	3
613	AG0099M	1	6	5	27	663	AG0254	12	4	5	5	713	PP0070	10	2	5	3
614	AG0100M	2	6	5	7	664	AG0261	5	4	5	6	714	PP0072	10	2	5	3
615	AG0102M	2	3	6	20	665	AG0269A	5	3	5	15	715	PP0073	9	2	5	3
616	AG0103M	2	6	5	7	666	AG0271	8	4	5	5	716	PP0075	7	2	5	3
617	AG0105M	2	6	5	27	667	AG0274	7	4	5	5	717	PP0079	10	2	5	3
618	AG0107	5	9	5	3	668	AG0275	9	4	5	35	718	PP0080	7	2	5	3
619	AG0109	6	4	5	27	669	AG0276	8	4	5	24	719	PP0084	5	4	5	7
620	AG0112	13	4	5	4	670	AG0279	5	5	5	4	720	PP0085	3	2	4	7
621	AG0114	8	8	5	40	671	AG0087	10	5	5	7	721	PP0086A	3	2	5	5
622	AG0116	3	8	5	50	672	AG0019	2	4	6	5	722	PP0088	11	4	5	0
623	AG0121	3	4	5	22	673	AG0021	2	4	5	8	723	PP0090	15	2	5	7
624	AG0122	9	5	5	45	674	PP0002	10	2	5	0	724	PP0091	9	2	5	0
625	AG0124	6	4	5	18	675	PP0004	9	2	5	3	725	PP0092	7	2	5	0
626	AG0126	2	4	5	158	676	PP0006	9	2	5	3	726	PP0093	7	2	5	7
627	AG0129	7	4	5	140	677	PP0008	12	2	5	0	727	PP0094M	3	2	5	5
628	AG0131M	1	2	5	13	678	PP0013M	7	2	5	0	728	PP0098	2	2	5	0
629	AG0132M	2	5	5	35	679	PP0014M	3	2	5	3	729	PP0100	3	2	-	-
630	AG0133	6	5	5	23	680	PP0017M	5	2	5	3	730	PP0102	2	4	-	-
631	AG0138M	11	2	5	4	681	PP0019	4	2	5	9	731	PP0109	5	2	-	-
632	AG0141M	1	4	5	28	682	PP0020	2	3	6	5	732	PP0110	4	2	-	-
633	AG0142	7	5	5	30	683	PP0021	6	3	6	2	733	PP0111	3	2	-	-
634	AG0145	8	5	5	14	684	PP0022	3	3	6	5	734	PP0114	4	2	-	-
635	AG0147	4	3	6	18	685	PP0023	3	4	6	5	735	PP0115	3	2	-	-
636	AG0148	5	3	5	30	686	PP0024M	3	2	5	5	736	PP0116	8	2	-	-
637	AG0149	6	3	6	2	687	PP0025M	4	2	5	3	737	PP0125	4	2	-	-
638	AG0152	3	3	3	8	688	PP0026	6	4	5	3	738	PP0127	2	2	-	-
639	AG0154A	9	9	5	3	689	PP0027M	3	2	5	5	739	PP0127	2	2	-	-
640	AG0156	6	9	5	75	690	PP0028	5	2	5	3	740	PP0223	8	10	-	-
641	AG0157	3	2	3	16	691	PP0029	6	3	5	0	741	PP0224	5	10	-	-
642	AG0159	12	9	5	3	692	PP0031	4	2	5	3	742	PP0224	5	10	-	-
643	AG0162	2	8	5	23	693	PP0034	3	3	5	5	741	PP0230	7	10	-	-
644	AG0163	5	4	5	26	694	PP0035	10	2	5	0						
645	AG0164	8	4	5	21	695	PP0036	10	2	5	3						
646	AG0166	7	4	5	95	696	PP0037M	9	2	5	0						
647	AG0178	4	4	6	35	697	PP0038	6	2	4	7						
648	AG0172	8	4	5	13	698	PP0037	5	4	5	0						
649	AG0181	4	4	5	28	699	PP0040	6	2	5	0						
650	AG0183	7	4	5	14	700	PP0042	9	4	5	7						



Table A-8. Results of Projeto Geoquímica no Vale do Ribeira (DNPM-CPRM) 1978

1.	TABELA	VIII	Cu-AA-Stream Sediment – Subarea Sudelpa – Summary of Data
2.		X	Matrix of Correlation X Number of Stream Sediment Samples – Subarea Sudelpa (Cu)
3.		XI	Pb-AA-Stream Sediment – Subarea Sudelpa – Summary of Data
4.		XIII	Matrix of Correlation X Number of Stream Sediment Samples – Subarea Sudelpa (Pb)
5.		XIV	Zn-AA-Stream Sediment – Subarea Sudelpa – Summary of Data
6.		XVI	Matrix of Correlation X Number of Stream Sediment Samples – Subarea Sudelpa (Zn)
7.		XXIX	Cu-AA-Stream Sediment – Regional Geochemical Prospection – Summary of Data
8.		XXXI	Matrix of Correlation X Number of Stream Sediment Samples – Regional Geochemical Prospection (Cu)
9.		XXXIII	Pb-AA-Stream Sediment – Regional Geochemical Prospection – Summary of Data
10.		XXXV	Matrix of Correlation X Number of Stream Sediment Samples – Regional Geochemical Prospection (Pb)
11.		XXXVII	Zn-AA-Stream Sediment – Regional Geochemical Prospection – Summary of Data
12.		XXXIX	Matrix of Correlation X Number of Stream Sediment Samples – Regional Geochemical Prospection (Zn)

TABELA VIII - COBRE-AA - SEDIMENTO DE CORRENTE - SUB-ÁREA SUDELPA-SUMÁRIO DOS ESTIMADORES										
POPULAÇÕES	NÚMERO DE AMOSTRAS	VÁLOR MÍNIMO	VÁLOR MÁXIMO	MÉDIA GEOMÉTRICA (MG)	DESVIO GEOMÉTRICO (DG)	COEFICIENTE DE VARIACÃO	GRAU DE DETECÇÃO	MG x DG	MG x DG ²	MG x DG ³
ÁREA TOTAL	256	2,5	120	12	2,787	1,364	235:257	35	96	268
AÇUNGUI GERAL	106	2,5	120	29	2,176	0,911	105:106	64	139	301
AÇUNGUI CLÁSTICO	61	10,0	120	40	1,711	0,578	61:61	68	116	199
AÇUNGUI QUÍMICO	19	5,0	85	28	1,968	0,763	19:19	54	108	211
AÇUNGUI INDIFERENCIADO	26	2,5	90	15	2,432	1,097	25:26	36	87	211
GRANITOS	151	2,5	90	7	2,004	0,788	130:151	14	27	54

OBSERVAÇÕES

- 1 - Dados expressos em p p m.
- 2 - MG e DG são geométricas, supondo-se a distribuição log-normal.
- 3 - Grau de detecção refere-se ao número de valores definidos e transformados em relação ao total de valores analisados.
- 4 - MG = Background.
- 5 - MG x DG a MG x DG² = Alto background.
- 6 - MG x DG² = Limiar.
- 7 - MG x DG² a MG x DG³ = Anomalia possível.
- 8 - \geq MG x DG³ = Anomalia provável.
- 9 - AA = Absorção atômica, S = Espectrografia.

TABELA X — MATRIZ DE CORRELAÇÃO X NÚMERO DE AMOSTRAS
 SEDIMENTO DE CORRENTE-SUBÁREA SUDELPA
 COBRE — ABSORÇÃO ATÔMICA

	ÁREA TOTAL		AÇUNGUI GERAL		AÇUNGUI CLÁSTICO		AÇUNGUI QUÍMICO		AÇUNGUI INDIFERENCIADO		GRANITOS	
	N	Cu-AA	N	Cu-AA	N	Cu-AA	N	Cu-AA	N	Cu-AA	N	Cu-AA
Fe-S	2 31	0	104	0	60	0	19	0	25	0	127	•
Mn-S	2 29	0	99	•	55	0	19	•	25	•	130	0
Co-S	2 22	0	101	0	58	0	18	0	25	0	121	0
Cu-S	2 12	0	102	0	59	0	19	0	24	0	110	0
Ni-S	2 33	0	104	0	60	0	19	0	25	0	129	0
Pb-S	2 07	(•)	81	•	51	0	13	(•)	17	•	126	(•)
Cu-AA		0		0		0		0		0		0
Pb-AA	2 31	0	101	0	61	•	18	0	22	0	130	0
Zn-AA	2 35	0	105	0	61	0	19	0	25	0	130	0

OBSERVAÇÕES :

- N - nº de amostras que entraram no cálculo
 S - espectrografia semi-quantitativa p/ 30 elementos
 AA- espectrofotometria de absorção atômica
 • - < 0,30
 0 - 0,30 a 0,59
 0 - 0,60 a 0,79
 0 - ≥ 0,80
 (•) - correlação negativa

TABELA XI - CHUMBO-AA - SEDIMENTO DE CORRENTE - SUB-ÁREA SUELPA-SUMÁRIO DOS ESTIMADORES										
POPULAÇÕES	NÚMERO DE AMOSTRAS	VALOR MÍNIMO	VALOR MÁXIMO	MÉDIA GEOMÉTRICA (MG)	DESVIO GEOMÉTRICO (DG)	COEFICIENTE DE VARIACÃO	GRAU DE DETECÇÃO	MG x DG	MG x DG ²	MG x DG ³
ÁREA TOTAL	257	2,5	280	12	2,060	0,828	251:257	26	53	110
AÇUNGUI GERAL	106	2,5	280	17	2,447	1,108	101:106	42	104	254
AÇUNGUI CLÁSTICO	61	5,0	280	24	2,082	0,844	61:61	50	104	217
AÇUNGUI QUÍMICO	19	2,5	110	14	2,260	0,972	18:19	32	72	163
AÇUNGUI INDIFERENCIADO	26	2,5	130	9	2,536	1,173	22:26	23	59	149
GRANITOS	151	2,5	35	10	1,583	0,485	150:151	16	25	40

OBSERVAÇÕES	
<p>1- Dados expressos em p p m.</p> <p>2- MG e DG são geométricos, supondo-se a distribuição log-normal.</p> <p>3- Grau de detecção refere-se ao número de valores definidos e transformados em relação ao total de valores analisados.</p> <p>4- MG = Background.</p> <p>5- MG x DG a MG x DG² = Alto background.</p>	<p>6- MG x DG² = Limlar.</p> <p>7- MG x DG² a MG x DG³ = Anomalia possível.</p> <p>8- \geq MG x DG³ = Anomalia provável.</p> <p>9- AA = Absorção atômica; S = Espectrografia.</p>

TABELA XIII — MATRIZ DE CORRELAÇÃO X NÚMERO DE AMOSTRAS
 SEDIMENTO DE CORRENTE-SUBÁREA SUDELPA
 CHUMBO — ABSORÇÃO ATÔMICA

	ÁREA TOTAL		AÇUNQUI GERAL		AÇUNQUI CLÁSTICO		AÇUNQUI QUÍMICO		AÇUNQUI INDIFERENCIADO		GRANITOS	
	N	Pb-AA	N	Pb-AA	N	Pb-AA	N	Pb-AA	N	Pb-AA	N	Pb-AA
Fe-S	247	•	100	○	60	•	18	•	22	○	147	•
Mn-S	245	•	95	(•)	55	•	18	(•)	22	(•)	150	•
Co-S	234	○	97	•	58	•	17	•	22	○	137	•
Cu-S	215	○	98	○	59	•	18	•	21	○	117	○
Ni-S	247	○	100	○	60	•	18	○	22	•	147	•
Pb-S	227	○	81	●	51	•	13	●	17	●	146	•
Cu-AA	231	○	101	○	61	•	18	○	22	○	130	○
Pb-AA		●		●		●		●		●		●
Zn-AA	251	●	101	●	61	○	18	○	22	○	150	○

OBSERVAÇÕES :

- N - nº de amostras que entraram no cálculo
 S - espectrografia semi-quantitativa p/ 30 elementos
 AA- espectrofotometria de absorção atômica
 • - < 0,30
 ○ - 0,30 a 0,59
 ● - 0,60 a 0,79
 ● - ≥ 0,80
 () - correlação negativa

TABELA XIV - ZINCO-AA - SEDIMENTO DE CORRENTE - SUB-ÁREA SUELPA-SUMÁRIO DOS ESTIMADORES

POPULAÇÕES	NÚMERO DE AMOSTRAS	VALOR MÍNIMO	VALOR MÁXIMO	MÉDIA GEOMÉTRICA (MG)	DESVIO GEOMÉTRICO (DG)	COEFICIENTE DE VARIACÃO	GRAU DE DETECÇÃO	MG x DG	MG x DG ²	MG x DG ³
ÁREA TOTAL	257	5,0	270	49	1,794	0,638	257:257	67	156	281
AÇUNGUI GERAL	106	5,0	270	67	1,843	0,673	106:106	123	228	420
AÇUNGUI CLÁSTICO	61	30,0	270	88	1,511	0,431	61:61	133	200	301
AÇUNGUI QUÍMICO	19	20,0	130	60	1,668	0,547	19:19	100	166	276
AÇUNGUI INDIFERENCIADO	26	5,0	130	39	1,989	0,777	26:26	78	153	305
GRANITOS	151	10,0	100	39	1,580	0,468	151:151	60	95	147

OBSE RVAÇÕES

- 1- Dados expressos em p p m.
- 2- MG e DG são geométricos, supondo-se a distribuição log-normal.
- 3- Grau de detecção refere-se ao número de valores definidos e transformados em relação ao total de valores analisados.
- 4- MG = Background.
- 5- MG x DG a MG x DG² = Alto background.
- 6- MG x DG² = Limiar.
- 7- MG x DG² a MG x DG³ = Anomalia possível.
- 8- \geq MG x DG³ = Anomalia provável.
- 9- AA = Absorção atômica; S = Espectrografia.

TABELA XVI — MATRIZ DE CORRELAÇÃO X NÚMERO DE AMOSTRAS
 SEDIMENTO DE CORRENTE-SUBÁREA SUDELPA
 ZINCO — ABSORÇÃO ATÔMICA

	ÁREA TOTAL		AÇUNQUI GERAL		AÇUNQUI CLÁSTICO		AÇUNQUI QUÍMICO		AÇUNQUI INDIFERENCIADO		GRANITOS	
	N	Zn-AA	N	Zn-AA	N	Zn-AA	N	Zn-AA	N	Zn-AA	N	Zn-AA
Fe-S	253	●	105	●	60	○	19	○	26	●	148	○
Mn-S	251	○	100	•	55	○	19	•	26	•	151	○
Co-S	239	○	102	●	58	○	18	●	26	○	137	○
Cu-S	219	●	102	●	59	○	19	●	24	●	117	○
Ni-S	252	○	104	●	60	○	19	●	25	●	148	○
Pb-S	228	•	81	○	51	●	13	○	17	○	147	(•)
Cu-AA	235	●	105	●	61	●	19	●	25	●	130	○
Pb-AA	251	●	101	●	61	○	18	○	22	○	150	○
Zn-AA		●		●		●		●		●		●

OBSERVAÇÕES :

- N - nº de amostras que entraram no cálculo
 S - espectrografia semi-quantitativa p/ 30 elementos
 AA- espectrofotometria de absorção atômica
 • - < 0,30
 ○ - 0,30 a 0,59
 ● - 0,60 a 0,79
 ● - ≥ 0,80
 () - correlação negativa

TABELA XXIX — COBRE -AA — SEDIMENTO DE CORRENTE — GEOQUÍMICA REGIONAL SUMÁRIO DOS ESTIMADORES										
POPULAÇÕES	NUMERO DE AMOSTRAS	VALOR MÍNIMO	VALOR MÁXIMO	MEDIA GEOMETRICA (MG)	DESVIO GEOMETRICO (DG)	COEFICIENTE DE VARIAÇÃO	GRAU DE DETECÇÃO	MG x DG	MG x DG ²	MG x DG ³
ÁREA TOTAL	1288	1,5	390	18	2,250	0,965	1288.1288	41	92	207
GRUPO AÇUNGUI	868	1,5	340	23	2,134	0,881	868.868	48	103	220
GRUPO AÇUNGUI (AD=20-40)	69	4,0	170	22	2,422	1,090	69:69	53	129	312
GRUPO AÇUNGUI (AD > 40)	22	3,0	100	20	2,247	0,962	22:22	45	101	228
AÇUNGUI SETUVA	197	3,0	150	26	1,904	0,717	197.197	49	92	176
AÇUNGUI SETUVA (AD < 5)	80	3,0	95	26	1,876	0,697	80.80	50	93	174
AÇUNGUI SETUVA (AD=5-10)	53	5,0	110	26	1,773	0,623	53:53	46	81	144
AÇUNGUI SETUVA (AD=10-20)	30	5,0	150	24	2,116	0,868	30.30	51	109	231
AÇUNGUI CLÁSTICO	509	3,0	340	23	2,151	0,893	509:509	49	105	225
AÇUNGUI CLÁSTICO (AD < 5)	147	4,0	150	26	2,002	0,787	147:147	52	103	206
AÇUNGUI CLÁSTICO (AD=5-10)	129	4,0	340	22	2,234	0,953	129:129	49	108	242
AÇUNGUI CLÁSTICO (AD=10-20)	70	3,0	100	19	2,177	0,912	70:70	42	92	200
AÇUNGUI QUÍMICO	176	1,5	190	18	2,395	1,069	176:176	43	104	248
AÇUNGUI QUÍMICO (AD < 5)	61	1,5	190	19	2,506	1,151	61:61	48	120	301
AÇUNGUI QUÍMICO (AD=5-10)	48	3,0	130	20	2,327	1,020	48.48	47	110	255
AÇUNGUI QUÍMICO (AD=10-20)	30	4,0	120	16	2,434	1,098	30:30	38	93	226
GRANITOS	345	1,5	120	11	1,976	0,768	345.345	22	43	85
GRANITOS (AD < 5)	47	3,0	55	11	2,029	0,806	47.47	23	46	94
GRANITOS (AD=5-10)	95	1,5	120	12	2,213	0,938	95:95	27	60	133
GRANITOS (AD=10-20)	65	3,0	65	11	1,965	0,761	65:65	21	41	81
GRANITOS (AD > 40)	13	4,0	23	8	1,568	0,474	13:13	12	19	30
COMPLEXO GN-MIGMATÍTICO	26	7,0	390	21	1,952	0,751	26.26	41	80	155
GRUPO TUBARÃO	27	3,0	80	11	2,083	0,844	27.27	23	48	99
FORMAÇÃO FURNAS	12	1,5	27	6	2,126	0,876	12.12	13	27	58

OBSERVAÇÕES	
1—Dados expressos em ppm	5— MG = Background
2—MG e DG são geométricos supondo-se a distribuição log-normal	6— MG x DG a MG x DG ² = Alto background
3—Grau de detecção refere-se ao número de valores deitados e transformados em relação ao total de valores analisados	7— MG x DG ² = Limiar
4— AD = Área de drenagem expressa em km ²	8— MG x DG ² a MG x DG ³ = Anomalia possível
	9— ≥ MG x DG = Anomalia provável

TABELA XXXI — MATRIZ DE CORRELAÇÃO X NÚMERO DE AMOSTRAS
 SEDIMENTO DE CORRENTE-GEOQUÍMICA REGIONAL

COBRE — ABSORÇÃO ATÔMICA

		Cu-AA	Pb-AA	Zn-AA	Ag-AA	Co-AA	Ni-AA	Fe-AA	Mn-AA
ÁREA TOTAL	N		1288	1288	1288	1288	1288	1288	1288
	Cu-AA	●	○	○	•	○	○	○	○
GRUPO AÇUNGUI	N		868	868	868	868	868	868	868
	Cu-AA	●	○	○	•	●	●	●	○
GRUPO AÇUNGUI AD 20-40	N		69	69	69	69	69	69	69
	Cu-AA	●	○	●	(*)	●	●	●	○
AÇUNGUI SETUVA	N		197	197	197	197	197	197	197
	Cu-AA	●	•	○	•	○	○	○	○
AÇUNGUI SETUVA AD MENOR 5	N		80	80	80	80	80	80	80
	Cu-AA	●	•	○	•	○	○	○	○
AÇUNGUI SETUVA AD 5-10	N		53	53	53	53	53	53	53
	Cu-AA	●	•	○	•	○	○	○	○
AÇUNGUI SETUVA AD 10-20	N		30	30	30	30	30	30	30
	Cu-AA	●	(*)	○	○	○	○	○	○
AÇUNGUI CLÁSTICO	N		509	509	509	509	509	509	509
	Cu-AA	●	○	○	○	○	●	●	○
AÇUNGUI CLÁSTICO AD MENOR 5	N		147	147	147	147	147	147	147
	Cu-AA	●	○	○	•	○	●	●	○
AÇUNGUI CLÁSTICO AD 5-10	N		129	129	129	129	129	129	129
	Cu-AA	●	○	○	•	○	●	●	○
AÇUNGUI CLÁSTICO AD 10-20	N		70	70	70	70	70	70	70
	Cu-AA	●	○	○	•	●	●	●	○
AÇUNGUI QUÍMICO	N		176	176	176	176	176	176	176
	Cu-AA	●	○	○	○	●	●	●	○
AÇUNGUI QUÍMICO AD MENOR 5	N		61	61	61	61	61	61	61
	Cu-AA	●	○	○	○	○	●	●	○
AÇUNGUI QUÍMICO AD 5-10	N		48	48	48	48	48	48	48
	Cu-AA	●	○	○	○	●	●	●	○
AÇUNGUI QUÍMICO AD 10-20	N		30	30	30	30	30	30	30
	Cu-AA	●	○	○	•	●	●	○	○
GRANITOS	N		345	345	345	345	345	345	345
	Cu-AA	●	○	○	•	○	○	○	○
GRANITOS AD MENOR 5	N		47	47	47	47	47	47	47
	Cu-AA	●	○	○	•	○	○	○	○
GRANITOS AD 5-10	N		95	95	95	95	95	95	95
	Cu-AA	●	•	○	•	○	○	○	○
GRANITOS AD 10-20	N		65	65	65	65	65	65	65
	Cu-AA	●	○	○	○	○	○	○	○
COMPLEXO GNÁISSICO-MIGMATÍTICO	N		26	26	26	26	26	26	26
	Cu-AA	●	(*)	○	○	○	○	○	•
GRUPO TUBARÃO	N		27	27	27	27	27	27	27
	Cu-AA	●	○	○	•	○	○	○	○
FORMAÇÃO FURNAS	N		12	12	12	12	12	12	12
	Cu-AA	●	○	○	•	○	○	○	○

OBSERVAÇÕES

- N - nº de amostras que entraram no cálculo
 AA- espectrofotometria de absorção atômica
 (*) - correlação negativa
 • - < 0,30
 ○ - 0,30 a 0,59
 ○ - 0,60 a 0,79
 ● - ≥ 0,80
 AD- área de drenagem expressa em km²

TABELA XXXIII — CHUMBO-AA — SEDIMENTO DE CORRENTE — GEOQUÍMICA REGIONAL SUMÁRIO DOS ESTIMADORES										
POPULAÇÕES	NUMERO DE AMOSTRAS	VALOR MINIMO	VALOR MÁXIMO	MEDIA GEOMETRICA (MG)	DESVIO GEOMETRICO (DG)	COEFICIENTE DE VARIACÃO	GRAU DE DETECÇÃO	MG x DG	MG x DG ²	MG x DG ³
ÁREA TOTAL	1288	1,5	1300	16	1,904	0,717	1288:1288	30	56	108
GRUPO AÇUNGUI	868	1,5	1300	15	2,010	0,793	868:868	31	61	123
GRUPO AÇUNGUI(AD:20-40)	69	3,0	50	14	1,701	0,571	69:69	24	40	69
GRUPO AÇUNGUI (AD > 40)	22	5,0	50	16	1,800	0,642	22:22	29	52	94
AÇUNGUI SETUVA	197	4,0	380	12	1,773	0,623	197:197	19	32	53
AÇUNGUI SETUVA (AD < 5)	80	4,0	40	11	1,620	0,512	80:80	18	29	46
AÇUNGUI SETUVA (AD:5-10)	53	5,0	40	12	1,576	0,480	53:53	20	31	49
AÇUNGUI SETUVA (AD:10-20)	30	4,0	50	13	1,885	0,703	30:30	24	46	87
AÇUNGUI CLÁSTICO	509	3,0	1300	16	1,860	0,686	509:509	30	55	103
AÇUNGUI CLÁSTICO(AD < 5)	147	3,0	170	16	1,764	0,617	147:147	28	50	89
AÇUNGUI CLÁSTICO(AD:5-10)	129	4,0	210	15	1,861	0,686	129:129	29	53	99
AÇUNGUI CLÁSTICO(AD:10-20)	70	5,0	100	15	1,608	0,503	70:70	24	39	62
AÇUNGUI QUÍMICO	176	1,5	1300	19	2,561	1,192	176:176	49	125	319
AÇUNGUI QUÍMICO (AD < 5)	61	4,0	1300	20	2,654	1,262	61:61	53	144	382
AÇUNGUI QUÍMICO (AD:5-10)	48	1,5	1300	19	2,751	1,336	48:48	53	145	399
AÇUNGUI QUÍMICO(AD:10-20)	30	1,5	100	16	2,235	0,954	30:30	35	79	176
GRANITOS	345	4,0	100	17	1,636	0,524	345:345	27	45	73
GRANITOS (AD < 5)	47	4,0	40	16	1,618	0,510	47:47	25	41	67
GRANITOS (AD:5-10)	95	4,0	65	17	1,758	0,612	95:95	29	51	90
GRANITOS(AD:10-20)	65	7,0	100	18	1,620	0,512	65:65	29	48	77
GRANITOS (AD > 40)	13	8,0	20	14	1,393	0,341	13:13	19	27	38
COMPLEXO GN-MIGMATÍTICO	26	7,0	35	14	1,556	0,465	26:26	21	33	52
GRUPO TUBARÃO	27	6,0	60	13	1,716	0,582	27:27	22	38	66
FORMAÇÃO FURNAS	12	4,0	22	10	1,632	0,520	12:12	16	27	43
OBSERVAÇÕES										
1-Dados expressos em ppm					5- MG + Background					
2-MG e DG são geométricas supondo-se a distribuição log-normal					6- MG x DG a MG x DG ² = Alto background					
3-Grau de detecção refere-se ao número de valores detidos e transformados em relação ao total de valores analisados					7- MG x DG ² = Limiar					
4- AD= Área de drenagem expressa em km ²					8- MG x DG ² a MG x DG ³ = Anomalia possível.					
					9- ≥ MG x DG = Anomalia provável					

TABELA XXXV — MATRIZ DE CORRELAÇÃO X NÚMERO DE AMOSTRAS
SEDIMENTO DE CORRENTE-GEOQUÍMICA REGIONAL

CHUMBO — ABSORÇÃO ATÔMICA

ÁREA TOTAL	N	Cu-AA	Pb-AA	Zn-AA	Ag-AA	Co-AA	Ni-AA	Fe-AA	Mn-AA
		1288		1288	1288	1288	1288	1288	1288
GRUPO AÇUNGUI	N	868		868	868	868	868	868	868
	Pb-AA	O	●	O	O	O	•	O	O
GRUPO AÇUNGUI AD 20-40	N	69		69	69	69	69	69	69
	Pb-AA	O	●	●	•	●	O	●	●
AÇUNGUI SETUVA	N	197		197	197	197	197	197	197
	Pb-AA	•	●	O	O	O	•	•	•
AÇUNGUI SETUVA AD MENOR 5	N	80		80	80	80	80	80	80
	Pb-AA	•	●	O	O	O	•	O	•
AÇUNGUI SETUVA AD 5-10	N	53		53	53	53	53	53	53
	Pb-AA	•	●	O	●	O	•	O	•
AÇUNGUI SETUVA AD 10-20	N	30		30	30	30	30	30	30
	Pb-AA	(*)	●	•	•	•	(*)	(*)	•
AÇUNGUI CLÁSTICO	N	509		509	509	509	509	509	509
	Pb-AA	O	●	O	O	O	O	O	O
AÇUNGUI CLÁSTICO AD MENOR 5	N	147		147	147	147	147	147	147
	Pb-AA	O	●	O	O	O	O	O	•
AÇUNGUI CLÁSTICO AD 5-10	N	129		129	129	129	129	129	129
	Pb-AA	O	●	O	O	O	O	O	O
AÇUNGUI CLÁSTICO AD 10-20	N	70		70	70	70	70	70	70
	Pb-AA	O	●	O	O	O	O	●	•
AÇUNGUI QUÍMICO	N	176		176	176	176	176	176	176
	Pb-AA	O	●	●	O	O	O	O	O
AÇUNGUI QUÍMICO AD MENOR 5	N	61		61	61	61	61	61	61
	Pb-AA	O	●	O	O	O	O	O	O
AÇUNGUI QUÍMICO AD 5-10	N	48		48	48	48	48	48	48
	Pb-AA	●	●	●	●	O	●	O	•
AÇUNGUI QUÍMICO AD 10-20	N	30		30	30	30	30	30	30
	Pb-AA	O	●	O	•	O	O	•	O
GRANITOS	N	345		345	345	345	345	345	345
	Pb-AA	O	●	O	●	O	•	•	O
GRANITOS AD MENOR 5	N	47		47	47	47	47	47	47
	Pb-AA	O	●	O	O	O	•	O	O
GRANITOS AD 5-10	N	95		95	95	95	95	95	95
	Pb-AA	•	●	•	●	O	•	•	•
GRANITOS AD 10-20	N	65		65	65	65	65	65	65
	Pb-AA	O	●	O	●	O	O	O	•
COMPLEXO GNAISSICO-MIGMATÍTICO	N	26		26	26	26	26	26	26
	Pb-AA	(*)	●	•	O	•	•	•	O
GRUPO TUBARÃO	N	27		27	27	27	27	27	27
	Pb-AA	O	●	O	•	O	O	O	O
FORMAÇÃO FURNAS	N	12		12	12	12	12	12	12
	Pb-AA	O	●	O	●	O	●	●	O

OBSERVAÇÕES

N - nº de amostras que entraram no cálculo

AA- espectrofotometria de absorção atômica

(*) - correlação negativa

• - < 0,30

O - 0,30 a 0,59

● - 0,60 a 0,79

● - ≥ 0,80

AD- área de drenagem expressa em km²

TABELA XXXVII — ZINCO - AA — SEDIMENTO DE CORRENTE — GEOQUÍMICA REGIONAL
SUMÁRIO DOS ESTIMADORES

POPULAÇÕES	NÚMERO DE AMOSTRAS	VALOR MÍNIMO	VALOR MÁXIMO	MÉDIA GEOMÉTRICA (MG)	DESVIO GEOMÉTRICO (DG)	COEFICIENTE DE VARIACÃO	GRAU DE DETECÇÃO	MG x DG	MG x DG ²	MG x DG ³
ÁREA TOTAL	1288	3,0	710	47	1,847	0,676	1288:1288	68	162	299
GRUPO AÇUNGUI	868	4,0	710	52	1,865	0,689	868:868	98	182	340
GRUPO AÇUNGUI(AD>20-40)	69	7,0	140	46	1,986	0,775	69:69	92	183	364
GRUPO AÇUNGUI (AD> 40)	22	5,0	120	50	2,078	0,841	22:22	104	217	451
AÇUNGUI SETUVA	197	9,0	700	58	1,693	0,565	197:197	94	154	253
AÇUNGUI SETUVA (AD < 5)	80	12,0	180	55	1,743	0,601	80:80	96	167	290
AÇUNGUI SETUVA (AD=5-10)	53	9,0	110	61	1,576	0,480	53:53	97	153	241
AÇUNGUI SETUVA (AD=10-20)	30	25,0	120	57	1,570	0,475	30:30	90	141	221
AÇUNGUI CLÁSTICO	509	5,0	390	52	1,869	0,692	509:509	98	182	341
AÇUNGUI CLÁSTICO(AD < 5)	147	13,0	170	58	1,729	0,592	147:147	101	175	302
AÇUNGUI CLÁSTICO(AD=5-10)	129	12,0	170	50	1,879	0,699	129:129	94	177	333
AÇUNGUI CLÁSTICO(AD=10-20)	70	6,0	150	49	1,910	0,721	70:70	93	178	340
AÇUNGUI QUÍMICO	176	4,0	710	46	2,115	0,868	176:176	96	204	430
AÇUNGUI QUÍMICO (AD < 5)	61	4,0	150	43	2,061	0,829	61:61	89	183	377
AÇUNGUI QUÍMICO (AD=5-10)	48	9,0	710	52	2,363	1,046	48:48	124	292	689
AÇUNGUI QUÍMICO(AD=10-20)	30	13,0	120	44	1,852	0,680	30:30	82	152	282
GRANITOS	345	10,0	120	40	1,521	0,439	345:345	61	92	140
GRANITOS (AD < 5)	47	11,0	120	39	1,622	0,513	47:47	64	103	167
GRANITOS (AD=5-10)	95	13,0	110	41	1,505	0,426	95:95	61	92	138
GRANITOS(AD=10-20)	65	12,0	90	39	1,597	0,495	65:65	62	99	158
GRANITOS (AD > 40)	13	11,0	50	29	1,440	0,377	13:13	42	60	87
COMPLEXO GN-MIGMATÍTICO	26	40,0	240	69	1,526	0,442	26:26	105	160	244
GRUPO TUBARÃO	27	6,0	50	19	1,747	0,604	27:27	33	58	101
FORMAÇÃO FURNAS	12	3,0	90	14	2,577	1,205	12:12	36	93	239

OBSERVAÇÕES

- 1—Dados expressos em ppm
- 2—MG e DG são geométricas supondo-se a distribuição log-normal
- 3—Grau de detecção refere-se ao número de valores detidos e transformados em relação ao total de valores analisados
- 4—AD=Área de drenagem expressa em km²
- 5—MG= Background
- 6—MG x DG a MG x DG²= Alto background.
- 7—MG x DG²= Limiar.
- 8—MG x DG² a MG x DG³= Anomalia possível.
- 9— \geq MG x DG= Anomalia provável.

TABELA XXXIX — MATRIZ DE CORRELAÇÃO X NÚMERO DE AMOSTRAS
 SEDIMENTO DE CORRENTE-GEOQUÍMICA REGIONAL

ZINCO — ABSORÇÃO ATÔMICA

		Cu-AA	Pb-AA	Zn-AA	Ag-AA	Co-AA	Ni-AA	Fa-AA	Mn-AA
ÁREA TOTAL	N	1288	1288		1288	1288	1288	1288	1288
	Zn-AA	⊙	○	●	•	⊙	⊙	○	○
GRUPO AÇUNQUI	N	868	868		868	868	868	868	868
	Zn-AA	⊙	○	●	•	⊙	⊙	○	○
GRUPO AÇUNQUI AD 20-40	N	69	69		69	69	69	69	69
	Zn-AA	●	⊙	●	(•)	●	●	●	⊙
AÇUNQUI SETUVA	N	197	197		197	197	197	197	197
	Zn-AA	○	○	●	•	⊙	⊙	⊙	○
AÇUNQUI SETUVA AD MENOR 5	N	80	80		80	80	80	80	80
	Zn-AA	○	○	●	•	○	⊙	⊙	○
AÇUNQUI SETUVA AD 5-10	N	53	53		53	53	53	53	53
	Zn-AA	○	○	●	•	⊙	⊙	⊙	○
AÇUNQUI SETUVA AD 10-20	N	30	30		30	30	30	30	30
	Zn-AA	○	•	●	○	○	○	⊙	○
AÇUNQUI CLÁSTICO	N	509	509		509	509	509	509	509
	Zn-AA	⊙	○	●	•	⊙	●	⊙	○
AÇUNQUI CLÁSTICO AD MENOR 5	N	147	147		147	147	147	147	147
	Zn-AA	⊙	○	●	•	⊙	●	⊙	○
AÇUNQUI CLÁSTICO AD 5-10	N	129	129		129	129	129	129	129
	Zn-AA	⊙	○	●	•	⊙	●	⊙	○
AÇUNQUI CLÁSTICO AD 10-20	N	70	70		70	70	70	70	70
	Zn-AA	⊙	○	●	•	⊙	●	●	○
AÇUNQUI QUÍMICO	N	176	176		176	176	176	176	176
	Zn-AA	⊙	⊙	●	○	⊙	⊙	●	⊙
AÇUNQUI QUÍMICO AD MENOR 5	N	61	61		61	61	61	61	61
	Zn-AA	⊙	○	●	○	⊙	●	●	○
AÇUNQUI QUÍMICO AD 5-10	N	48	48		48	48	48	48	48
	Zn-AA	⊙	⊙	●	○	⊙	⊙	⊙	○
AÇUNQUI QUÍMICO AD 10-20	N	30	30		30	30	30	30	30
	Zn-AA	⊙	○	●	•	⊙	⊙	●	⊙
GRANITOS	N	345	345		345	345	345	345	345
	Zn-AA	⊙	○	●	•	⊙	⊙	⊙	○
GRANITOS AD MENOR 5	N	47	47		47	47	47	47	47
	Zn-AA	⊙	○	●	•	⊙	⊙	⊙	○
GRANITOS AD 5-10	N	95	95		95	95	95	95	95
	Zn-AA	⊙	•	●	•	⊙	⊙	⊙	⊙
GRANITOS AD 10-20	N	65	65		65	65	65	65	65
	Zn-AA	⊙	○	●	•	⊙	○	⊙	○
COMPLEXO GNAÍSSICO- MIGMATÍTICO	N	26	26		26	26	26	26	26
	Zn-AA	⊙	•	●	•	○	⊙	○	○
GRUPO TUBARÃO	N	27	27		27	27	27	27	27
	Zn-AA	⊙	○	●	•	●	●	⊙	⊙
FORMAÇÃO FURNAS	N	12	12		12	12	12	12	12
	Zn-AA	●	○	●	○	●	⊙	⊙	⊙

OBSERVAÇÕES

N - nº de amostras que entraram no cálculo

AA- espectrofotometria de absorção atômica

(•) - correlação negativa

• - < 0,30

○ - 0,30 a 0,59

⊙ - 0,60 a 0,79

● - ≥ 0,80

 AD- área de drenagem expressa em km²

