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NOTES BEING INCORPORATED INTO A REPORT ON LATERITE GEOCHEMISTRY FOR THE MOORA, PERTH, PINJARRA, COLLIE AND PEMBERTON 1:250 000 SHEETS

J. Innes, R.E. Smith and J.L. Perdrix

CRC LEME OPEN FILE REPORT 63

November 1998

(CSIRO Division of Minerals and Geochemistry Report Unnumbered, 1988.
Second impression 1998)

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RESEARCH ARISING FROM CSIRO/AMIRA REGOLITH GEOCHEMISTRY PROJECTS 1987-1993

In 1987, CSIRO commenced a series of multi-client research projects in regolith geology and geochemistry which were sponsored by companies in the Australian mining industry, through the Australian Mineral Industries Research Association Limited (AMIRA). The initial research program, "Exploration for concealed gold deposits, Yilgarn Block, Western Australia" (1987-1993) had the aim of developing improved geological, geochemical and geophysical methods for mineral exploration that would facilitate the location of blind, buried or deeply weathered gold deposits. The program included the following projects:

P240: Laterite geochemistry for detecting concealed mineral deposits (1987-1991). Leader: Dr R.E. Smith.

Its scope was development of methods for sampling and interpretation of multi-element laterite geochemistry data and application of multi-element techniques to gold and polymetallic mineral exploration in weathered terrain. The project emphasised viewing laterite geochemical dispersion patterns in their regolith-landform context at local and district scales. It was supported by 30 companies.

P241: Gold and associated elements in the regolith - dispersion processes and implications for exploration (1987-1991). Leader: Dr C.R.M. Butt.

The project investigated the distribution of ore and indicator elements in the regolith. It included studies of the mineralogical and geochemical characteristics of weathered ore deposits and wall rocks, and the chemical controls on element dispersion and concentration during regolith evolution. This was to increase the effectiveness of geochemical exploration in weathered terrain through improved understanding of weathering processes. It was supported by 26 companies.

These projects represented "an opportunity for the mineral industry to participate in a multi-disciplinary program of geoscience research aimed at developing new geological, geochemical and geophysical methods for exploration in deeply weathered Archaean terrains". This initiative recognised the unique opportunities, created by exploration and open-cut mining, to conduct detailed studies of the weathered zone, with particular emphasis on the near-surface expression of gold mineralisation. The skills of existing and specially recruited research staff from the Floreat Park and North Ryde laboratories (of the then Divisions of Minerals and Geochemistry, and Mineral Physics and Mineralogy, subsequently Exploration Geoscience and later Exploration and Mining) were integrated to form a task force with expertise in geology, mineralogy, geochemistry and geophysics. Several staff participated in more than one project. Following completion of the original projects, two continuation projects were developed.

P240A: Geochemical exploration in complex lateritic environments of the Yilgarn Craton, Western Australia (1991-1993). Leaders: Drs R.E. Smith and R.R. Anand.

The approach of viewing geochemical dispersion within a well-controlled and well-understood regolith-landform and bedrock framework at detailed and district scales continued. In this extension, focus was particularly on areas of transported cover and on more complex lateritic environments typified by the Kalgoorlie regional study. This was supported by 17 companies.

P241A: Gold and associated elements in the regolith - dispersion processes and implications for exploration. Leader: Dr. C.R.M. Butt.

The significance of gold mobilisation under present-day conditions, particularly the important relationship with pedogenic carbonate, was investigated further. In addition, attention was focussed on the recognition of primary lithologies from their weathered equivalents. This project was supported by 14 companies.

Although the confidentiality periods of the research reports have expired, the last in December 1994, they have not been made public until now. Publishing the reports through the CRC LEME Report Series is seen as an appropriate means of doing this. By making available the results of the research and the authors' interpretations, it is hoped that the reports will provide source data for future research and be useful for teaching. CRC LEME acknowledges the Australian Mineral Industries Research Association and CSIRO Division of Exploration and Mining for authorisation to publish these reports. It is intended that publication of the reports will be a substantial additional factor in transferring technology to aid the Australian Mineral Industry.

This report (CRC LEME Open File Report 63) is a Second impression (second printing) of CSIRO, Division of Minerals and Geochemistry Restricted Report Unnumbered, first issued in 1988, which formed part of the CSIRO/AMIRA Project P240.

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SUMMARY

These notes support the presentation of regional laterite geochemical coverage in part of the SW of the Yilgarn Block of Western Australia to sponsors of Project P240, on 11 April, 1988.

The geochemical results of some 2000 samples of lateritic duricrust materials are discussed. These represent: (a) all of the sampling within the five 1:250 000 sheets, Moora, Perth, Pinjarra, Collie and Pemberton, arising from research into laterite geochemistry sponsored by Greenbushes Ltd. from 1980 to 1983, Fig. 1; (b) with the addition of some sampling within these sheets arising from a second phase of research sponsored by Greenbushes in conjunction with St. Joe Minerals during 1983 and 1984, Fig. 2.

Accompanying these notes is a plot of the distribution of As in laterite at 1:1 M scale, and a floppy disk of the data.

INTRODUCTION

The concept of regional geochemical databases, based on the distribution of the chemical elements in stream sediments, for example, has been carried out by government instrumentalities on the scale of whole countries, so witnessed by the Wolfson Geochemical Atlas of England and Wales (Webb *et al.*, 1978) and the SAMINDABA coverage of the Republic of South Africa. Such surveys have also been carried out using lithochemical methods i.e. bedrock sampling. In both cases, the aim has been to define geochemical provinces in which the host rocks contain anomalous populations of particular elements; in other words, to define metallogenic provinces.

In the present example, the database was created by sampling and analysis of the laterite blanket which is extensively but variably developed to the east of the Darling Scarp in the south-western corner of Western Australia. This CSIRO project, commenced in November 1979 with orientation sampling of the lateritic cover in the Bridgetown/Greenbushes area. The study was then continued under sponsorship by Greenbushes Tin N.L. during the period 1980 to 1983, referred to as Project B. From July, 1983 until September, 1986 the project was sponsored by St. Joe Minerals together with Greenbushes, with regional coverage extending widely across the Yilgarn Block.

Concept and Scope

From the research point of view the objectives were:

- To provide further multi-element orientation information on dispersion from concealed ore deposits into lateritic duricrust - for example at the Greenbushes and Smithfield pegmatite fields, and over the Saddleback Greenstone Belt.
- To establish data on the type of variation in reality that occurs in laterite over various geological domains when one moves away from orientation situations.
- To test, and further develop, what was at that time an experimental approach to exploration, with emphasis on low-density multi-element laterite geochemistry. The programme was based upon first-pass sampling with 3 km spacing.

From the sponsor's point of view the exploration aspects were the most important activities of the programme.

Background to the Study

Smith *et al.* (1979) had already demonstrated the existence of kilometre-scale chalcophile element haloes in the pisolitic laterite cover associated with the Golden Grove Cu-Zn bodies. One of the objectives of Project B was to establish geochemical backgrounds for pisolitic laterite over a geographically extensive area in which laterite cover is developed under varied climatic regimes. These regimes range from the dissected cover in the hilly, well-watered and timbered terrain along the Darling Scarp to the more continuous but poorly exposed cover in the drier areas of the north-western wheatbelt area.

Around one-half of the samples comprising the database had been collected by May, 1981. By that time, sampling had covered major portions of the five 1:250 000 sheet areas: Moora, Perth, Pinjarra, Collie and Pemberton. Some data in these areas were collected under the subsequent Project C. Re-compilation and assessment of the data commenced in January, 1988 for presentation to the sponsors' group meeting, 11th April, 1988.

GEOMORPHOLOGY AND CLIMATE

Physiographically, the area covered is part of the Great Plateau (Jutson, 1934) and is underlain by the Western Gneiss Terrain of Gee (1979) and various supracrustal metamorphic belts and Phanerozoic sediments. In the west, the region is bounded by the eroded Darling Scarp separating the strongly lateritised and dissected Darling Plateau surface (at an average 300 metres a.m.s.l. elevation) from the Swan Coastal Plain, the latter being underlain by Phanerozoic sediments of the Perth Basin.

In the terminology of Finkl and Churchward (1973) the land surfaces are composed mainly of incipient lateritic etchplains to the immediate east of the Darling Scarp with semi-stripped (eroded) and partial lateritic etchplains further east. The lateritic etchplains are described as broadly undulating surfaces of generally low relief and smooth concavo-convex slopes in which lateritic duricrust is frequently overlain by unconsolidated Recent alluvial/colluvial materials.

In the partial lateritic etchplains, up to 50% of the lateritic cover has been removed by erosion. Saline lakes in the northern part of the Moora Sheet and breakaways are typical of this terrain. Semi-stripped etchplains have less than 15% of the duricrust remaining and bedrock outcrops are frequent. Breakaway scarps are common and remnants of duricrust occur along mesa cappings and along crests and spurs. These three etchplain types are incorporated in the Great Plateau of Jutson (op. cit.).

The area falls within a Mediterranean climatic regime with most rain falling during the winter months of May-September. Annual rainfall ranges from 300-600mm in the north to 600-1400mm in the extreme south of the area. Precipitation decreases markedly to the east of the Darling Scarp. Summer months are hot and dry with a transition towards a summer rainfall zone in the extreme north of the area.

Schlerophyll forest is typical of lateritic cover on the Darling Plateau in the south of the area changing to temperate savannah woodland further east. In the north of the area, most of the natural vegetation has been cleared to allow agricultural pursuits.

THE SAMPLING PROGRAMME

Sampling

A 3 km spaced triangular sampling grid was used over most of the sampled area, with limitations caused by the distribution of access roads, by the extent of erosional dissection of the laterite cover, by the extent of cover by younger alluvium/colluvium, and by the extent of mining and other land tenements. Various follow-up and fill-in samples were also

taken, usually closing the sample spacing to 1 km, in some cases to 330 m; the locations of follow-up sampling are obvious in 1:250 000 sample site plots.

The intention was to sample the cemented pisolitic laterite blanket [code CP(pisoliths) or CN(nodules)] or loose lateritic pisoliths (code LP) and nodules (code LN) which were released from duricrust. Lateritic nodules and pisoliths of 1 cm to 2 cm diameter were sought. Sampling in Project C was broadened to include additional sample types, appropriately catalogued, and one of the categories being ferricrete, a very iron-rich material. These ferricretes have different geochemical characteristics from the lateritic duricrust and require different data interpretation. Consequently, all data for materials logged as ferricrete have been excluded from the current database to ensure that morphologically similar sample types are being assessed. Generally, two samples each of 1 kg were collected at each site, averaged over an area of some 10 metres diameter. One sample was preserved in an untreated state as reference material while the other was crushed, split, milled and submitted for analysis.

Laterite samples were collected in situ where exposed. In soil covered areas useful samples were frequently obtained around the roots of uprooted trees, around the trunks of trees where pisolites and nodules are brought to the surface by soil heave, or by hand-picking of nodules/pisoliths from surface gravels.

Sample Preparation

In the initial stages of Project B, laterite samples were crushed in a tungsten carbide jaw crusher to minus 1mm followed by final milling to a nominal minus 250 μm in a motorized agate or alumina mortar and pestle. Tests showed that the WC crusher generally introduced around 10 ppm W and traces of Co into the samples, the actual amount varying with the hardness of the material and the operating conditions. Work on low-level W required that part of the reference sample be prepared using a W-free steel jaw crusher.

For later Project B samples, the procedure was modified to give a W-free product without the use of a separate preparation stream (Smith et al., 1983). Pisoliths/nodules up to 20 mm in diameter were fed directly into an alumina disc grinder/crusher. The disc clearance was then progressively diminished in successive sample passes until a minus 2 mm product is produced. Discs are examined and sand-blasted between samples to avoid cross-contamination. Oversize and cemented material was reduced in size by light tapping between hardened steel plates or by crushing between alumina plates in a hydraulic press. Approximately 30 grams of minus 2 mm material was then split and ground in a motorized agate mortar and pestle to a nominal minus 65 μm . This material formed the pulp for XRF and AAS trace element analysis.

Project C and subsequent laterite samples are subjected to the non-metallic sample preparation methods described by Smith (1987). Oversized material from the 1 kg sample is reduced to minus 8 mm by crushing between zirconia plates in an automated hydraulic press. The material is then fed to an epoxy-resin lined disc grinder with alumina plates and further reduced to minus 1 mm. Final milling is done in an agate or alumina mill. Cleaning of the equipment is performed by a combination of air- and sand-blasting and the passage of a quartz blank.

ANALYTICAL METHODS

Up to a total of 29 elements were analysed by AMDEL using the techniques and digestion methods given in Table I. The lower limits of detection are also indicated. In the early 1980s the reliability and sensitivity of Au analyses were inadequate from the testing done in this project and consideration of the 3 km-wide spacing, Au was therefore not analysed in first-pass sampling of Project B. Geochemical screening was first done on chalcophile elements with Au being analysed as part of the follow-up. Analytical performance later improved dramatically with lower limits of detection of 1 to 3 ppb being available, tests showing a fair degree of reliability above levels of 10 to 15 ppb levels. Analysis of Au was then routinely incorporated part way into Project C.

Because improved analytical and digestion methods were employed in the Project C samples as compared with those from Project B, it was necessary to manipulate part of the Project B data to enable a direct comparison with that from Project C. Where manipulation has been used, the conversion factors are given in Table II. The floppy disk and all statistical information of this report show only the Project B data as manipulated to be compatible with Project C data.

Analytical Quality Control

Three control samples of laterite covering a spectrum of multi-element values were submitted in a scrambled numerical sequence in each sizeable batch of samples submitted for analysis. These samples were also subjected to replicate analysis, both "in-house" and by an independent laboratory. From the results, a "favoured" value was selected for each element.

Between-batch variation could usually be detected by examination of the plotted locations of each sample in the batch. If any clustering or unusual pattern was noted, then the duplicate samples were submitted for assay. Several unusually high values of Ag and Cd were thus resolved as analytical artifices.

DATA HANDLING (after Perdrix, J.L., 1985)

The database for the south-western Yilgarn is part of a broader Yilgarn laterite database, currently comprising some 9000 samples, analysed for 27 to 35 elements, with the capacity for up to 130 information fields for each sample.

Information such as sample number, field number, locality (AMG reference grid coordinates), sample type (pisolith, nodule, ferricrete, etc.), collection date and gross bedrock geology are routinely entered by hand. Most analytical data for large sample batches are received on magnetic tape or floppy-disk and is transferred directly to the database.

The data are stored in a SAGE IV computer with a 40-Mb Winchester disk and back-up facilities. New programmes were developed "in-house" for data display and interpretation together with a data management system. Peripherals include a Hewlett-Packard 7580B plotter, a Facit 4540 printer, a Visual 550 monochrome graphics terminal with a Datasouth 220 printer for screen dumping, and three visual display units.

Between, 27 and 35 minor and trace elements are analysed routinely, either in-house or by an external laboratory. In-house ICP analysis expands this list to include additional major, minor and some trace elements. The different data sets resulting from differing analytical and digestion methods are all stored in the database.

Because of the size of the information field, data for various sub-areas of interest e.g. individual 1:250 000 sheet areas, are transferred to separate files in order to reduce data manipulation times. These files are erased at the end of an operational period and can be re-created from the updated database as required.

DATA TREATMENT AND PRESENTATION

Basic statistical parameters and percentiles were calculated from the south-west Yilgarn database, Table III.

The upper percentiles of the regional data set, (ca. 2000 samples) from the five 1:250 000 sheet areas were used to define threshold and anomalous values. The relatively large number (ca. 200) of highly anomalous orientation samples from the Greenbushes, Smithfield and Boddington areas was excluded from the regional data set for calculation of these percentiles to avoid skewing percentiles towards higher values. For geochemical maps for each element, abundance levels were colour coded for the 90th, 95th and 98th percentiles in blue, green and red, respectively and hand-contoured. Separate plots of sample site/number and the chalcophile index CHI-6 X have been incorporated into the folios.

For the sponsors' meeting the analytical data are displayed as a series of five map folios at 1:250,000 scale corresponding to each of the map sheets which this database covers.

For interpretation, the five 1:250,000 sheet areas have been divided into eight geological domains on the basis of gross differences in chemical composition, origin and to a lesser extent, geological age and overprinting relationships. The eight geological domains are:

- a) Gneisses and schists, notably the Chittering, Wongan Hills, Jimperding, Balingup Metamorphic Belts, (GS).
- b) Banded iron formations, (BIF).
- c) Migmatites, (MG).
- d) Clastic sediments e.g. Collie Coal Measures, Moora Formation, (SED).
- e) Felsic to intermediate volcanics ± pyroclastics ± sediments e.g. Wells Formation in Saddleback Group, (FIV).
- f) Mafic volcanics ± pyroclastics ± sediments, eg. Marradong Formation in Saddleback Group, (MV)
- g) Granitic supracrustal rocks with compositional ranges from granite through adamellite and monzonite to dioritic types, (GN).
- h) Mafic and ultramafic intrusive rocks, (MUI).

A gross geological designation (domain type) has been assigned as the substrate of each laterite sample according to the mapped distribution as published in the Geological Survey of Western Australia 1:250 000 series. It needs to be borne in mind that in the best developed lateritic terrain outcrop of bedrock is scarce and geological mapping thus extremely difficult. The standard statistics and percentiles were re-calculated for

each domain type. Use of these refined percentiles should enable a more subtle interpretation of the element plots.

SOME METHODS FOR DATA MANIPULATION

Many methods for data manipulation and interpretation are available. Comprehensive multivariate statistical procedures may be based upon customized software as used by Smith *et al.* (1984) or on general purpose scientific packages such as SPSS, BMDP, etc.

Smith *et al.* (1979) and Smith and Perdrix (1983) have shown that the geochemical dispersion from base-metal sulphide sources beneath lateritic cover is much more likely to be recognized when a suite of chalcophile elements is employed. A chalcophile index (Smith *et al.*, 1984) was shown to be an appropriate representation of the combined abundance levels of these chalcophile elements. Thus a single variable can be treated statistically and used as the basis for a contoured distribution map which highlights multi-element anomalies.

Two multi-element additive indices developed during the early stages of research in this region, based upon orientation situations, have proven very effective. The chalcophile index CHI-6 X provides a useful method for displaying chalcophile relationships either in map form or for listings of samples for ranking of anomalies. The formula for CHI-6*X is $As + (3 \times Sb) + (10 \times Bi) + (3 \times Mo) + (30 \times Ag) + (30 \times Sn_{XRF}) + (10 \times W) + (3 \times Se)$, where values for each element are in ppm.

A pegmatophile index PEG-4 with the formula $(0.09 \times As) + (1.33 \times Sb) + Sn + (0.6 \times Nb) + Ta$, with all values in ppm again, is useful for highlighting laterite covered pegmatite associations. It should be noted that As, Sb and Sn can be associates of both pegmatite and chalcophile situations. A follow-up screening that incorporates heavier weighting of Ta, Nb, and Li can be used to separate the two associations when close-spaced (1 km or less) sampling is used.

Many forms of simple data interrogation can be performed on the database by designing a "theme" for a specific deposit type. For example, levels for a selection of elements can be set from orientation data, or from expectations. The database can then be interrogated to list all samples satisfying this theme - and methods for ranking such samples are readily at hand.

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TABLE I	Analytical methods and lower limits of detection.
TABLE II	Adjustments made to Project B analytical data for merging with Project C data.
TABLE III	Statistical parameters for this database.
TABLE IV	Statistical parameters for the domain class "Gneisses & Schists".
TABLE V	Statistical parameters for the domain class "migmatites".
TABLE VI	Statistical parameters for the domain class "Clastic Sediments".
TABLE VII	Statistical parameters for the domain class "Felsic to Intermediate Volcanics.
TABLE VIII	Statistical parameters for the domain class "Mafic Volcanics".
TABLE IX	Statistical parameters for the domain class "Granitic Group".

FIGURE 1	The distribution of laterite samples within Project B.
FIGURE 2	The distribution of laterite samples arising from Project C sampling within the area covered.

TABLE I
ANALYTICAL METHODS AND LOWER LIMITS OF DETECTION
(Smith, R.E. and Perdrix, J.L., 1985)

PROJECT B			PROJECT C	
Element	Analytical Method	Lower Limit of Detection	Analytical Method	Lower Limit of Detection
Fe	AAS HC104 digestion	0.1%	AAS HF digestion	0.1%
Mn	AAS HC104 digestion	5	AAS HF digestion	5
Cr	-	-	XRF	5
V	-	-	XRF	10
Cu	AAS HC104 digestion	2	AAS HF digestion	2
Pb	XRF	4	XRF	2
Zn	AAS HC104 digestion	2	AAS HF digestion	2
Ni	AAS HC104 digestion	5	AAS HF digestion	5
Co	AAS HC104 digestion	5	AAS HF digestion	5
As	XRF	2	XRF	2
Sb	XRF	4	XRF	2
Bi	OES	1	OES	1
Bi	-	-	XRF extended count	1
Cd	AAS HC104 digestion	1	AAS HF digestion	1
In	OES	10	-	-
Mo	AAS HC104 digestion	1	XRF extended count	2
Ag	OES	0.1	OES	0.1
Sn	OES	1	OES	1
Sn	XRF	4	XRF extended count	1
Ge	OES	1	OES	1
Ga	OES	1	OES	1
W	XRF	10	XRF	10
Ba	XRF	10	-	-
Nb	XRF	3	XRF	3
Ta	XRF	10	XRF extended count	3
Se	XRF	4	XRF extended count	1
Te	XRF	10	-	-
Be	-	-	OES	1
Au	very few analysed		AAS Aqua Carbon Regia Furnace	0.001

Values in ppm except as indicated

TABLE II

ADJUSTMENTS MADE TO PROJECT B ANALYTICAL DATA
FOR MERGING WITH PROJECT C DATA

(Smith and Perdrix, 1985)

- a) The following elements were compatible and required no conversion:
Pb, As, Sb, Bi-OES, Cd, Ag, Sn-OES, Ge, Ga, W, Nb and Se.

- b) Conversion factors applied to HClO_4 /AAS analyses:

Project B data for Fe were multiplied by 1.18 to give compatible data

"	Mn	"	1.60	"
"	Cu	"	1.30	"
"	Zn	"	1.80	"
"	Ni	"	2.00	"
"	Co	"	1.80	"

- c) Conversion factors applied for other reasons:

Project B data for Mo were multiplied by 0.60 to give compatible data

"	Sn-XRF	0.78	"
"	Ta	0.20	"

- d) Compatible data for Bi-XRF analyses were generated from Project B data (Bi-OES analysis) using a calibration correction factor of x 1.5.

The above adjustments were made to allow computer treatment of the earlier data, from Project B, with the improved Project C data.

TABLE III. Statistical Parameters for the Database

Element	Lab.	Method	l.l.d.*	Values	Percentiles							Min.	Max.	Mean	S.D.	Element
					25th	50th	75th	90th	95th	98th	99th					
Fe ₂ O ₃	Amdel	aa-hf	0.10%	1851	11.3	19.3	27.3	33.5	37.6	42.2	45.1	1.0	69.6	19.9	10.3	Fe ₂ O ₃
Mn	"	aa	5	1856	47	71	111	159	215	319	455	< 3	2359	92	103	Mn
Cu	"	aa-hf	2	1897	6	13	32	78	116	182	266	< 1	890	31	54	Cu
Pb	"	xrf	4/2	1898	17	26	40	55	70	85	100	< 1	180	30	20	Pb
Zn	"	aa-hf	2	1897	9	14	21	36	50	72	108	< 1	972	20	29	Zn
Ni	"	aa-hf	5	1886	10	25	40	70	90	140	170	< 2	660	33	39	Ni
Co	"	aa-hf	5	1886	2	2	9	18	36	45	54	< 2	180	7	12	Co
As	"	xrf	2	2159	11	16	25	44	70	130	190	< 1	640	25	38	As
Sb	"	xrf	4/2	1899	< 1	< 1	< 1	6	8	10	12	< 1	40	2	3	Sb
Bi	"	oes	1	1866	< 1	< 1	< 1	< 1	< 1	1	2	< 1	6	< 1	< 1	Bi
Cd	"	aa-hf	1	1814	< 1	< 1	< 1	< 1	< 1	1	2	< 1	40	< 1	1	Cd
Mo	"	xrf	2/1	1896	2	3	4	5	7	8	10	< 1	587	3	14	Mo
Ag	"	oes	0.10	1866	< 1.1.d.	< 1.1.d.	0.1	0.2	0.3	0.4	1	< 1.1.d.	5	< 1.1.d.	0.2	Ag
Sn	"	oes	1	1906	< 1	1	3	5	8	15	25	< 1	70	2	5	Sn
Sn	"	xrf	4/1	2119	< 1	4	6	9	12	15	17	< 1	109	4	5	Sn
Ge	"	oes	1	1851	< 1	< 1	< 1	< 1	1	1	2	< 1	6	< 1	< 1	Ge
Ga	"	oes	1	2020	20	25	30	46	60	70	80	< 1	150	28	14	Ga
W	"	xrf	10	2051	< 1.1.d.	< 1.1.d.	< 1.1.d.	15	20	25	35	< 10	170	6	8	W
Ba	"	xrf	10	1669	15	25	45	85	140	200	309	< 10	2250	43	87	Ba
Nb	"	xrf	3	2119	12	16	22	32	42	55	75	< 3	290	19	14	Nb
Ta	"	xrf	10/3	2108	1	1	1	3	4	5	6	< 3	15	1	1	Ta
Se	"	xrf	4/1	1828	1	1	3	5	7	8	9	1	16	2	2	Se
Te	"	xrf	10	1665	< 1.1.d.	< 1.1.d.	< 1.1.d.	< 1.1.d.	10	10	10	< 10	110	< 10	< 10	Te
Be	"	oes	1	200	< 1	< 1	1	1	2	2	2	< 1	4	< 1	< 1	Be
Au	analabs	aa-cf	.001	357	.002	.003	.004	.006	.010	.014	.019	<.001	.034	.003	.003	Au

* in ppm except where indicated otherwise.

Explanation l.l.d. column: for Ta 10/3 original l.l.d. was 10 ppm, later improved to 3 ppm.

TABLE IV
Statistical parameters for the domain class "Gneisses & Schists"

PROJECTS B & C Laterite data released 1988 April 11

filename : amiraBCdb

Date of last update : 1- 4-88

Number of records : 2379

Number of records tagged : 1103 GNEISSES & SCHISTS (GS)

Element	Lab.	Method	l1d	#values	25th	50th	75th	90th	95th	98th	99th	Min	Max	Mean	S.D.	Element
Fe wt%	amdel	aa-hf	0.10	814	11.9	20.3	28.3	34.42	38.39	42.416	44.8	2.2	55.5	20.781	10.325	Fe wt%
Mn ppm	amdel	aa-hf	10.00	934	47	79	127	175	239	486.68	639	1.667	2975	111.994	189.811	Mn ppm
Cr ppm	amdel	xrf	5.00	157	150	200	300	439.5	656.5	1011.18	1437.9	60	1500	282.204	236.439	Cr ppm
V ppm	amdel	xrf	10.00	157	200	400	600	858.5	1010.2	1212.74	1500	65	2500	457.49	336.321	V ppm
Cu ppm	amdel	aa-hf	2.00	965	7	18	41.75	91	123	201	294.45	0.333	890	37.042	63.031	Cu ppm
Pb ppm	amdel	xrf	4.00	965	16	26	40	60	80	100	142.8	0.667	200	32.089	25.065	Pb ppm
Zn ppm	amdel	aa-hf	2.00	965	9	14	27	39	54	90	120.15	0.667	972	21.513	37.615	Zn ppm
Ni ppm	amdel	aa-hf	5.00	964	10	30	60	100	138	187.2	203.6	1.667	660	44.712	50.051	Ni ppm
Co ppm	amdel	aa-hf	5.00	965	1.667	1.667	9	36	45	54	66.15	1.667	243	10.279	19.163	Co ppm
As ppm	amdel	xrf	2.00	1103	11	17	32	90	177.65	310	537.598	0.667	3050	46.786	136.082	As ppm
Sb ppm	amdel	xrf	2.00	950	1.333	1.333	1.333	6	10	12	17	0.667	75	2.848	4.755	Sb ppm
Bi ppm	amdel	oes	1.00	37	0.333	0.333	0.333	0.333	0.433	1	1	0.333	1	0.369	0.153	Bi ppm
Bi ppm	amdel	xrf	1.00	934	0.333	0.333	0.333	0.333	0.333	2	3	0.333	8	0.42	0.515	Bi ppm
Cd ppm	amdel	aa-hf	1.00	933	0.333	0.333	0.333	1	1	4	5	0.333	10	0.552	0.831	Cd ppm
In ppm	amdel	xrf	1.00	897	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	In ppm
Mo ppm	amdel	xrf	2.00	964	1	2	4	5	7	11	11	0.333	59	3.113	3.889	Mo ppm
Ag ppm	amdel	aa-hf	0.10	934	0.033	0.033	0.1	0.2	0.4	0.6	1	0.033	3	0.114	0.221	Ag ppm
Sn ppm	amdel	oes	1.00	979	0.333	1	3	6	10	60	100	0.333	1500	6.829	53.718	Sn ppm
Sn ppm	amdel	xrf	1.00	1099	1.333	1.333	6	9	14	31.16	109	0.333	3276	9.279	101.244	Sn ppm
Ge ppm	amdel	oes	1.00	934	0.333	0.333	0.333	0.333	1	1	2	0.333	4	0.394	0.276	Ge ppm
Ga ppm	amdel	oes	1.00	1067	20	25	36	50	60	80	100	0.333	150	30.668	16.485	Ga ppm
V ppm	amdel	xrf	10.00	1041	3.333	3.333	10	19.8	25	40.9	52.95	3.333	170	7.86	11.689	V ppm
Ba ppm	amdel	xrf	10.00	832	10	25	55	90	150	203.6	340.8	3.333	1050	44.794	79.274	Ba ppm
Nb ppm	amdel	xrf	3.00	1099	10	14	20	26	30	36	44.02	1.333	80	16.304	8.237	Nb ppm
Ta ppm	amdel	xrf	3.00	1099	3.333	3.333	3.333	3.333	4	6	9	1	15	3.314	1.175	Ta ppm
Se ppm	amdel	xrf	2.00	790	0.667	2	4	6	7	8	9	0.333	15	2.487	2.264	Se ppm
Te ppm	amdel	xrf	10.00	778	3.333	3.333	3.333	3.333	10	10	10	3.333	20	3.753	1.729	Te ppm
Be ppm	amdel	oes	1.00	92	0.333	0.333	0.333	1	5.8	15	15.4	0.333	20	1.261	3.418	Be ppm
Au ppb	amdel	aa-cr	1.00	101	1	2.5	3	5.9	10.75	14.96	15.99	0.333	34	3.215	4.24	Au ppb

TABLE V
Statistical parameters for the domain class "Migmatites"

PROJECTS B & C Laterite data released 1988 April 11

filename : amiraBCdb

Date of last update : 1- 4-88

Number of records : 2379

Number of records tagged : 194 MIGMATITES (MG)

Element	Lab.	Method	l1d	#values	25th	50th	75th	90th	95th	98th	99th	Min	Max	Mean	S.D.	Element
Fe wt%	amdel	aa-hf	0.10	191	9.375	17.25	25.475	31.48	34.2	40.616	44.458	1.8	50.7	18.37	10.117	Fe wt%
Mn ppm	amdel	aa-hf	10.00	191	47	71	105	151	199	259.959	353.16	5	463	84.817	64.462	Mn ppm
Cr ppm	amdel	xrf	5.00	6	175.5	334	419.5	686.8	823.9	906.16	933.58	116	961	414.167	296.916	Cr ppm
V ppm	amdel	xrf	10.00	6	123.5	174	593	1047.2	1217.6	1319.84	1353.92	123	1388	499.167	509.642	V ppm
Cu ppm	amdel	aa-hf	2.00	191	6	13	23	58	96.85	166.68	250.14	0.667	409	25.632	47.424	Cu ppm
Pb ppm	amdel	xrf	4.00	191	17	26	42	55	70	79.5	101.8	4	120	31.351	19.819	Pb ppm
Zn ppm	amdel	aa-hf	2.00	191	9	14	18	32	50	55.62	81	0.667	216	17.845	19.401	Zn ppm
Ni ppm	amdel	aa-hf	5.00	191	10	20	50	80	90	110	120	1.667	180	32.531	30.654	Ni ppm
Co ppm	amdel	aa-hf	5.00	191	1.667	1.667	9	17.1	18	36	36	1.667	36	5.935	7.513	Co ppm
As ppm	amdel	xrf	2.00	194	9	13	18.5	26	36	55.6	90.3	0.667	130	16.046	14.891	As ppm
Sb ppm	amdel	xrf	2.00	194	1.333	1.333	1.333	5.2	6	8.24	10.12	0.667	12	2.234	2.05	Sb ppm
Bi ppm	amdel	oes	1.00	6	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333		Bi ppm
Bi ppm	amdel	xrf	1.00	191	0.333	0.333	0.333	0.333	0.333	0.333	2	0.333	8	0.44	0.697	Bi ppm
Cd ppm	amdel	aa-hf	1.00	191	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	1	0.337	0.048	Cd ppm
In ppm	amdel	xrf	1.00	185	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333		In ppm
Mo ppm	amdel	xrf	2.00	191	2	2	4	5	5.45	7	7.09	0.333	9	2.792	1.621	Mo ppm
Ag ppm	amdel	aa-hf	0.10	191	0.033	0.033	0.1	0.2	0.3	0.508	2	0.033	5	0.14	0.417	Ag ppm
Sn ppm	amdel	oes	1.00	184	1	1	2	4	5	7.96	10	0.333	10	1.768	1.823	Sn ppm
Sn ppm	amdel	xrf	1.00	194	1.333	1.333	4	7	8.3	10	12	1.333	12	3.259	2.511	Sn ppm
Ge ppm	amdel	oes	1.00	191	0.333	0.333	0.333	0.333	0.633	1	1	0.333	3	0.379	0.238	Ge ppm
Ga ppm	amdel	oes	1.00	194	20	25	30	50	60	61.2	70.6	6	80	29.799	13.609	Ga ppm
V ppm	amdel	xrf	10.00	194	3.333	3.333	3.333	15	20	25	25.3	3.333	35	6.091	5.645	V ppm
Ba ppm	amdel	xrf	10.00	185	15	25	45	80	115	183	196	3.333	330	38.216	42.783	Ba ppm
Nb ppm	amdel	xrf	3.00	194	11	16	22	28	34.6	42	48.42	1.333	55	17.558	8.965	Nb ppm
Ta ppm	amdel	xrf	3.00	194	3.333	3.333	3.333	3.333	4	5.12	6	1	7	3.204	0.76	Ta ppm
Se ppm	amdel	xrf	2.00	190	0.667	0.667	3	5	7	10	12.1	0.333	16	2.23	2.486	Se ppm
Te ppm	amdel	xrf	10.00	185	3.333	3.333	3.333	3.333	3.333	10	10.75	3.333	15	3.64	1.61	Te ppm
Be ppm	amdel	oes	1.00	6	0.333	0.333	1	1	1	1	1	0.333	1	0.667	0.365	Be ppm
Au ppb	amdel	aa-cr	1.00	21	1	1.5	3	4	4	4.58	4.79	0.333	5	1.968	1.433	Au ppb

TABLE VI
Statistical parameters for the domain class "Clastic Sediments"

PROJECTS B & C Laterite data released 1988 April 11

filename : amiraBCdb

Date of last update : 1- 4-88

Number of records : 2379

Number of records tagged : 69

CLASTIC SEDIMENTS (SED)

Element	Lab.	Method	l1d	#values	25th	50th	75th	90th	95th	98th	99th	Min	Max	Mean	S.D.	Element
Fe wt%	amdel	aa-hf	0.10	33	8.125	14.1	23.5	29.56	31.075	33.176	33.638	1.6	34.1	16.561	9.421	Fe wt%
Mn ppm	amdel	aa-hf	10.00	33	31	55	79	122.2	154.2	175	175	10	175	64.788	43.457	Mn ppm
Cu ppm	amdel	aa-hf	2.00	33	2	4.5	13	15	26.7	42.62	56.81	0.667	71	8.949	13.152	Cu ppm
Pb ppm	amdel	xrf	4.00	33	11	17	22	47.6	51.75	61.8	68.4	4	75	21.364	16.13	Pb ppm
Zn ppm	amdel	aa-hf	2.00	33	5	9	14	27	27	28.7	30.35	0.667	32	12.051	9.046	Zn ppm
Ni ppm	amdel	aa-hf	5.00	33	1.667	1.667	20	30	43.5	53.4	56.7	1.667	60	12.424	15.568	Ni ppm
Co ppm	amdel	aa-hf	5.00	33	1.667	1.667	1.667	1.667	1.667	4.16	6.58	1.667	9	1.889	1.277	Co ppm
As ppm	amdel	xrf	2.00	69	24	37	70	110	135.5	218.2	263.1	2	270	55.522	50.494	As ppm
Sb ppm	amdel	xrf	2.00	33	1.333	1.333	1.333	1.333	7.4	10.68	11.34	1.333	12	2.061	2.457	Sb ppm
Bi ppm	amdel	xrf	1.00	33	0.333	0.333	0.333	0.333	0.333	0.56	0.78	0.333	1	0.354	0.116	Bi ppm
Cd ppm	amdel	aa-hf	1.00	33	0.333	0.333	0.333	0.333	0.333	0.56	0.78	0.333	1	0.354	0.116	Cd ppm
In ppm	amdel	xrf	1.00	33	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	In ppm
Mo ppm	amdel	xrf	2.00	33	1	2	3	4	4	4	4	1	4	2.121	1.219	Mo ppm
Ag ppm	amdel	aa-hf	0.10	33	0.033	0.067	0.175	0.2	0.335	0.4	0.4	0.033	0.4	0.11	0.104	Ag ppm
Sn ppm	amdel	oes	1.00	33	0.5	1	2	2.7	4.35	6.02	7.01	0.333	8	1.505	1.573	Sn ppm
Sn ppm	amdel	xrf	1.00	33	1.333	1.333	1.333	6.7	13.05	15.68	16.34	1.333	17	3.101	4.024	Sn ppm
Ge ppm	amdel	oes	1.00	33	0.333	0.333	0.333	0.333	0.333	0.9	1.45	0.333	2	0.384	0.29	Ge ppm
Ga ppm	amdel	oes	1.00	33	20	25	30	37	53.5	66.8	73.4	10	80	27.727	13.641	Ga ppm
V ppm	amdel	xrf	10.00	33	3.333	3.333	8.333	15	15	16.7	18.35	3.333	20	6.061	4.856	V ppm
Ba ppm	amdel	xrf	10.00	33	25	35	45	53.5	70.25	93.6	106.8	3.333	120	37.525	21.95	Ba ppm
Nb ppm	amdel	xrf	3.00	33	14	16	21.5	26.8	30.1	36.04	38.02	8	40	18.424	6.96	Nb ppm
Ta ppm	amdel	xrf	3.00	33	3.333	3.333	3.333	3.333	3.333	3.56	3.78	2	4	3.253	0.354	Ta ppm
Se ppm	amdel	xrf	2.00	33	0.667	2	3	4	4.35	5.68	6.34	0.667	7	2.162	1.62	Se ppm
Te ppm	amdel	xrf	10.00	33	3.333	3.333	3.333	3.333	5.667	10	10	3.333	10	3.737	1.615	Te ppm
Au ppb	amdel	aa-cr	1.00	41	2	2	3	4	4.95	5.36	6.18	0.333	7	2.537	1.337	Au ppb

TABLE VII

Statistical parameters for the domain class "Felsic to Intermediate Volcanics"

PROJECTS B & C Laterite data released 1988 April 11

filename : amiraBCdb

Date of last update : 1- 4-88

Number of records : 2379

Number of records tagged : 34 FELSIC TO INTERMEDIATE VOLCANICS (FIV)

Element	Lab.	Method	l1d	#values	25th	50th	75th	90th	95th	98th	99th	Min	Max	Mean	S.D.	Element
Fe wt%	amdel	aa-hf	0.10	34	23.8	27.8	32.1	35.06	38.55	41.872	44.286	9.6	46.7	27.991	7.109	Fe wt%
Mn ppm	amdel	aa-hf	10.00	34	55	79	147	202.2	395	481.56	484.28	23	487	123.941	113.069	Mn ppm
Cu ppm	amdel	aa-hf	2.00	34	10	15	24.5	49.2	52	64.48	77.74	3	91	21.735	18.864	Cu ppm
Pb ppm	amdel	xrf	4.00	34	11.5	19	27	36	45.9	56.6	58.3	3	60	21.882	13.186	Pb ppm
Zn ppm	amdel	aa-hf	2.00	34	9	14	18	32	59.4	80.64	89.82	9	99	20.647	19.27	Zn ppm
Ni ppm	amdel	aa-hf	5.00	34	10	30	40	66	73	96	113	1.667	130	32.745	26.996	Ni ppm
Co ppm	amdel	aa-hf	5.00	34	1.667	1.667	1.667	14.4	36	41.76	47.88	1.667	54	6.137	12.049	Co ppm
As ppm	amdel	xrf	2.00	34	15	34	48	132	170.5	350.2	515.1	9	680	63.118	117.79	As ppm
Sb ppm	amdel	xrf	2.00	34	1.333	1.333	5	9.2	11.2	19.12	24.56	1.333	30	4.118	5.584	Sb ppm
Bi ppm	amdel	xrf	1.00	34	0.333	0.333	0.333	0.333	1.3	2	2	0.333	2	0.451	0.409	Bi ppm
Cd ppm	amdel	aa-hf	1.00	34	0.333	0.333	0.333	0.333	0.333	0.547	0.773	0.333	1	0.353	0.114	Cd ppm
In ppm	amdel	xrf	1.00	34	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333		In ppm
Mo ppm	amdel	xrf	2.00	34	2	4	4	5.6	7	38.04	71.02	1	104	6.265	17.346	Mo ppm
Ag ppm	amdel	aa-hf	0.10	34	0.033	0.033	0.033	0.033	0.16	0.311	0.322	0.033	0.333	0.052	0.068	Ag ppm
Sn ppm	amdel	oes	1.00	34	1	3	5	10	10	19.6	29.8	0.333	40	4.784	6.911	Sn ppm
Sn ppm	amdel	xrf	1.00	34	4	10	14	16.2	18	21.52	25.26	1.333	29	9.853	6.529	Sn ppm
Ge ppm	amdel	oes	1.00	34	0.333	0.333	0.333	0.333	0.333	0.547	0.773	0.333	1	0.353	0.114	Ge ppm
Ga ppm	amdel	oes	1.00	34	25	30	50	80	80	86.4	93.2	10	100	40.294	23.547	Ga ppm
V ppm	amdel	xrf	10.00	34	3.333	3.333	10	23	33	65.6	92.8	3.333	120	11.667	20.994	V ppm
Ba ppm	amdel	xrf	10.00	34	10	30	52.5	100	133	207.2	278.6	1.667	350	48.578	63.521	Ba ppm
Nb ppm	amdel	xrf	3.00	34	14	18	25	28.4	32.6	36.56	39.28	6	42	19.353	7.765	Nb ppm
Ta ppm	amdel	xrf	3.00	34	3.333	3.333	3.333	3.333	5.033	9.32	9.66	2	10	3.608	1.534	Ta ppm
Se ppm	amdel	xrf	2.00	34	0.667	0.667	2	3	4	4.32	4.66	0.667	5	1.471	1.204	Se ppm
Te ppm	amdel	xrf	10.00	34	3.333	3.333	3.333	7.333	10	13.2	16.6	3.333	20	4.412	3.356	Te ppm

TABLE VIII

Statistical parameters for the domain class "Mafic Volcanics"

PROJECTS B & C Laterite data released 1988 April 11

filename : amiraBCdb

Date of last update : 1- 4-88

Number of records : 2379

Number of records tagged : 54

MAFIC VOLCANICS (MV)

Element	Lab.	Method	ltd	#values	25th	50th	75th	90th	95th	98th	99th	Min	Max	Mean	S.D.	Element
Fe wt%	amdel	aa-hf	0.10	54	24.4	29.4	32.75	36.66	40.89	47.928	51.666	6.5	55.5	28.891	8.48	Fe wt%
Mn ppm	amdel	aa-hf	10.00	54	75	95	151	227.8	273.4	337.88	401.88	10	471	127.537	84.369	Mn ppm
Cr ppm	amdel	xrf	5.00	2	301	602	814.5	942	984.5	1010	1018.5	602	1027	814.5	300.52	Cr ppm
V ppm	amdel	xrf	10.00	2	479.5	959	1198.5	1342.2	1390.1	1418.84	1428.42	959	1438	1198.5	338.704	V ppm
Cu ppm	amdel	aa-hf	2.00	54	15	23	56.5	81.6	119.9	154.96	188.66	2	227	40.352	42.545	Cu ppm
Pb ppm	amdel	xrf	4.00	54	11.5	18	27	41.6	80	98.4	113.8	0.667	130	23.994	23.798	Pb ppm
Zn ppm	amdel	aa-hf	2.00	54	16	18	27	37.8	45	45	90.54	0.667	144	23.29	19.407	Zn ppm
Ni ppm	amdel	aa-hf	5.00	54	10	30	50	86	116	176	189.2	1.667	200	38.858	41.847	Ni ppm
Co ppm	amdel	aa-hf	5.00	54	1.667	1.667	9	18	20.7	27	27	1.667	27	6.204	7.218	Co ppm
As ppm	amdel	xrf	2.00	54	11.5	22	41	65	120.2	149.52	214.4	7	290	36.481	46.664	As ppm
Sb ppm	amdel	xrf	2.00	54	1.333	1.333	5	9.2	10.6	12	12	0.667	12	3.407	3.293	Sb ppm
Bi ppm	amdel	oes	1.00	2	0.167	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333		Bi ppm
Bi ppm	amdel	xrf	1.00	54	0.333	0.333	0.333	1	3	5.76	12.44	0.333	20	0.951	2.796	Bi ppm
Cd ppm	amdel	aa-hf	1.00	54	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333		Cd ppm
In ppm	amdel	xrf	1.00	52	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333		In ppm
Mo ppm	amdel	xrf	2.00	54	2	4	5	8	10	10	10.92	1	12	4.296	2.492	Mo ppm
Ag ppm	amdel	aa-hf	0.10	54	0.033	0.033	0.067	0.28	0.353	0.4	0.492	0.033	0.6	0.09	0.122	Ag ppm
Sn ppm	amdel	oes	1.00	51	1	2.5	5	9.8	10	10	19.8	0.333	30	4.013	4.649	Sn ppm
Sn ppm	amdel	xrf	1.00	54	4	9	14	16.2	17.9	20.92	22.38	1.333	24	8.895	5.902	Sn ppm
Ge ppm	amdel	oes	1.00	54	0.333	0.333	0.333	0.333	0.333	0.333	0.64	0.333	1	0.346	0.091	Ge ppm
Ga ppm	amdel	oes	1.00	54	25	25	30	56	60	78.4	80	6	80	31.222	15.075	Ga ppm
V ppm	amdel	xrf	10.00	54	3.333	10	15	28	40	40	44.6	3.333	50	11.364	11.618	V ppm
Ba ppm	amdel	xrf	10.00	52	15	25	40	60	72	99	104.8	3.333	110	31.41	23.615	Ba ppm
Nb ppm	amdel	xrf	3.00	54	11	16	20	27.2	32.6	46.88	48	4	48	17.5	9.119	Nb ppm
Ta ppm	amdel	xrf	3.00	54	3.333	3.333	3.333	3.733	4	4.92	5.92	1	7	3.309	0.806	Ta ppm
Se ppm	amdel	xrf	2.00	54	0.667	0.667	2	3	5.3	6	6.46	0.667	7	1.531	1.529	Se ppm
Te ppm	amdel	xrf	10.00	52	3.333	3.333	3.333	3.333	3.333	9.733	10	3.333	10	3.59	1.295	Te ppm
Be ppm	amdel	oes	1.00	2	0.167	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333		Be ppm
Au ppb	amdel	aa-cr	1.00	5	3.25	9.5	18	19.5	19.75	19.9	19.95	3	20	12.2	8.167	Au ppb

TABLE IX

Statistical parameters for the domain class "Granitic Group"

PROJECTS B & C Laterite data released 1988 April 11

filename : amiraBCdb

Date of last update : 1- 4-88

Number of records : 2379

Number of records tagged : 920

GRANITIC GROUP (GN)

Element	Lab.	Method	l1d	#values	25th	50th	75th	90th	95th	98th	99th	Min	Max	Mean	S.D.	Element
Fe wt%	amdel	aa-hf	0.10	820	10.9	18.4	26.1	32.9	36	39.92	43.78	1	69.6	19.351	10.072	Fe wt%
Mn ppm	amdel	aa-hf	10.00	821	45.5	70.5	103	151	191	279.86	333.32	5	519	83.289	62.667	Mn ppm
Cr ppm	amdel	xrf	5.00	141	223	287.5	365.75	542.1	779.2	1113.599	1214.36	112	2503	355.319	268.547	Cr ppm
V ppm	amdel	xrf	10.00	141	237.25	335	532.25	819	1013.5	1282.12	1501.749	58	1981	431.993	302.207	V ppm
Cu ppm	amdel	aa-hf	2.00	831	6	13	26	65	97	162	186.14	0.667	351	25.844	38.119	Cu ppm
Pb ppm	amdel	xrf	4.00	832	19	28	42	55	68.8	85	96.36	0.667	180	32.105	19.598	Pb ppm
Zn ppm	amdel	aa-hf	2.00	831	9	14	21	28	39	54	69.52	0.667	261	17.394	15.582	Zn ppm
Ni ppm	amdel	aa-hf	5.00	821	10	20	40	60	70	90	137.9	1.667	550	29.743	30.818	Ni ppm
Co ppm	amdel	aa-hf	5.00	820	1.667	1.667	9	9	18	18	27	1.667	63	5.154	5.684	Co ppm
As ppm	amdel	xrf	2.00	920	11	17	26	38	55	98	150	0.667	300	23.317	26.752	As ppm
Sb ppm	amdel	xrf	2.00	849	1.333	1.333	1.333	6	8	10	11.02	0.667	18	2.211	2.258	Sb ppm
Bi ppm	amdel	oes	1.00	141	0.333	0.333	0.333	0.333	0.333	2	2	0.333	6	0.414	0.534	Bi ppm
Bi ppm	amdel	xrf	1.00	832	0.333	0.333	0.333	0.333	1	2	3	0.333	7	0.43	0.494	Bi ppm
Cd ppm	amdel	aa-hf	1.00	821	0.333	0.333	0.333	0.333	0.333	2	3	0.333	40	0.441	1.441	Cd ppm
In ppm	amdel	xrf	1.00	681	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333	3.333		In ppm
Mo ppm	amdel	xrf	2.00	831	2	3	4	6	7	10	15.69	0.333	587	4.135	20.459	Mo ppm
Ag ppm	amdel	aa-hf	0.10	831	0.033	0.033	0.1	0.2	0.3	0.4	0.738	0.033	2	0.083	0.135	Ag ppm
Sn ppm	amdel	oes	1.00	819	1	1	3	6	10	20	38.1	0.333	60	2.954	5.768	Sn ppm
Sn ppm	amdel	xrf	1.00	920	1.333	4	7	10	14	15	18	0.333	50	4.783	4.591	Sn ppm
Ge ppm	amdel	oes	1.00	816	0.333	0.333	0.333	0.333	1	1	2	0.333	6	0.415	0.353	Ge ppm
Ga ppm	amdel	oes	1.00	853	20	25	30	40	50	60	80	0.333	100	27.395	13.113	Ga ppm
V ppm	amdel	xrf	10.00	909	3.333	3.333	3.333	15	20	25	35	3.333	90	6.448	7.646	V ppm
Ba ppm	amdel	xrf	10.00	681	10	25	45	85	130	203.8	291.4	3.333	2250	43.551	102.842	Ba ppm
Nb ppm	amdel	xrf	3.00	920	14	18	26	42	55	78	99	1.333	290	23.42	19.073	Nb ppm
Ta ppm	amdel	xrf	3.00	909	3	3.333	3.333	3.333	3.333	5	5	1	10	2.903	0.975	Ta ppm
Se ppm	amdel	xrf	2.00	822	0.667	0.667	3	5	6	8	9	0.333	12	2.07	2.006	Se ppm
Te ppm	amdel	xrf	10.00	679	3.333	3.333	3.333	3.333	10	10	10	3.333	110	3.878	4.451	Te ppm
Be ppm	amdel	oes	1.00	153	0.333	0.333	1	1.7	2	2	2.47	0.333	4	0.71	0.609	Be ppm
Au ppb	amdel	aa-cr	1.00	190	0.333	2	4	6	9.5	11	13.6	0.333	26	2.867	3.3	Au ppb

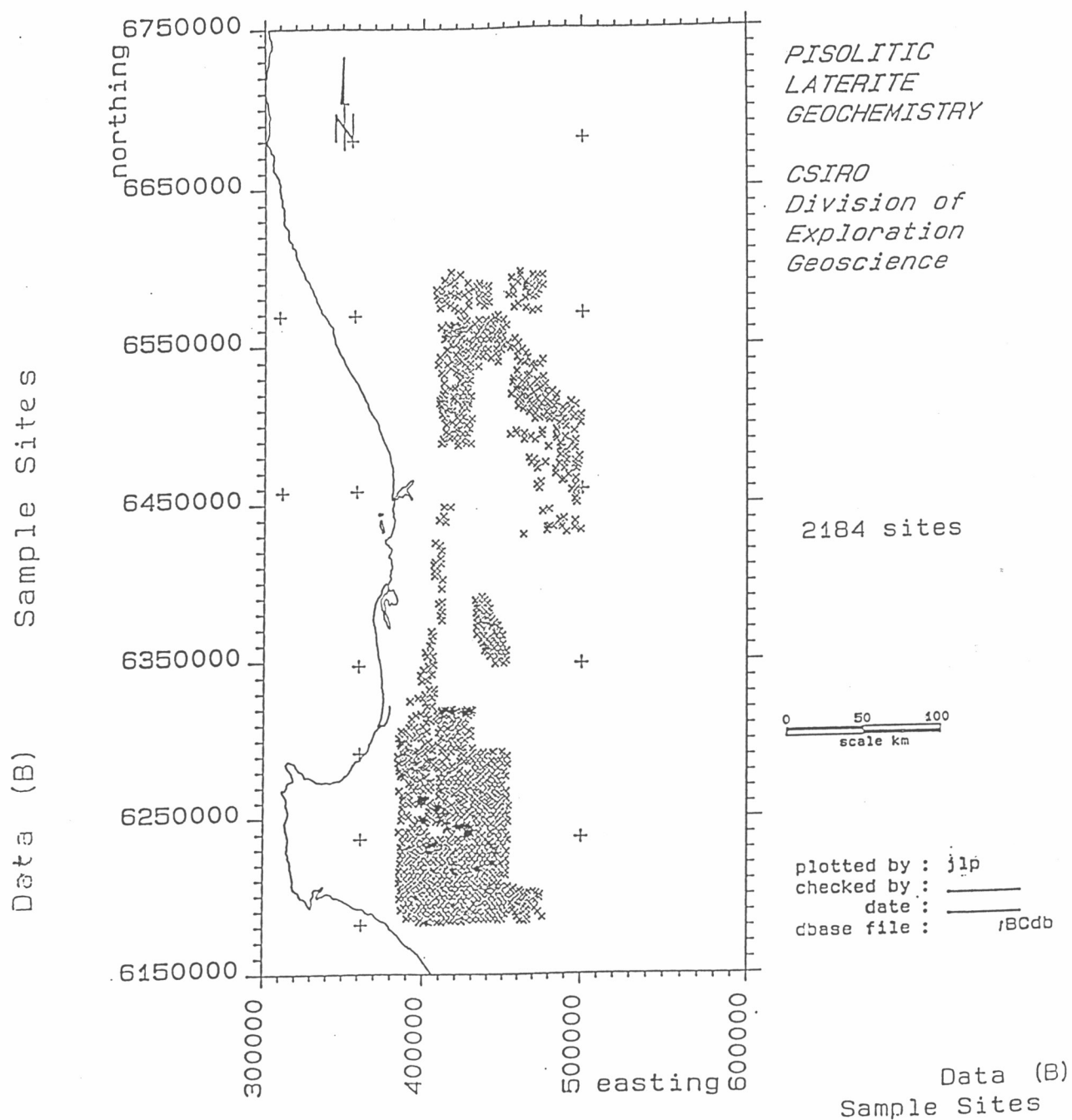


Figure 1. The distribution of laterite samples within Project B.

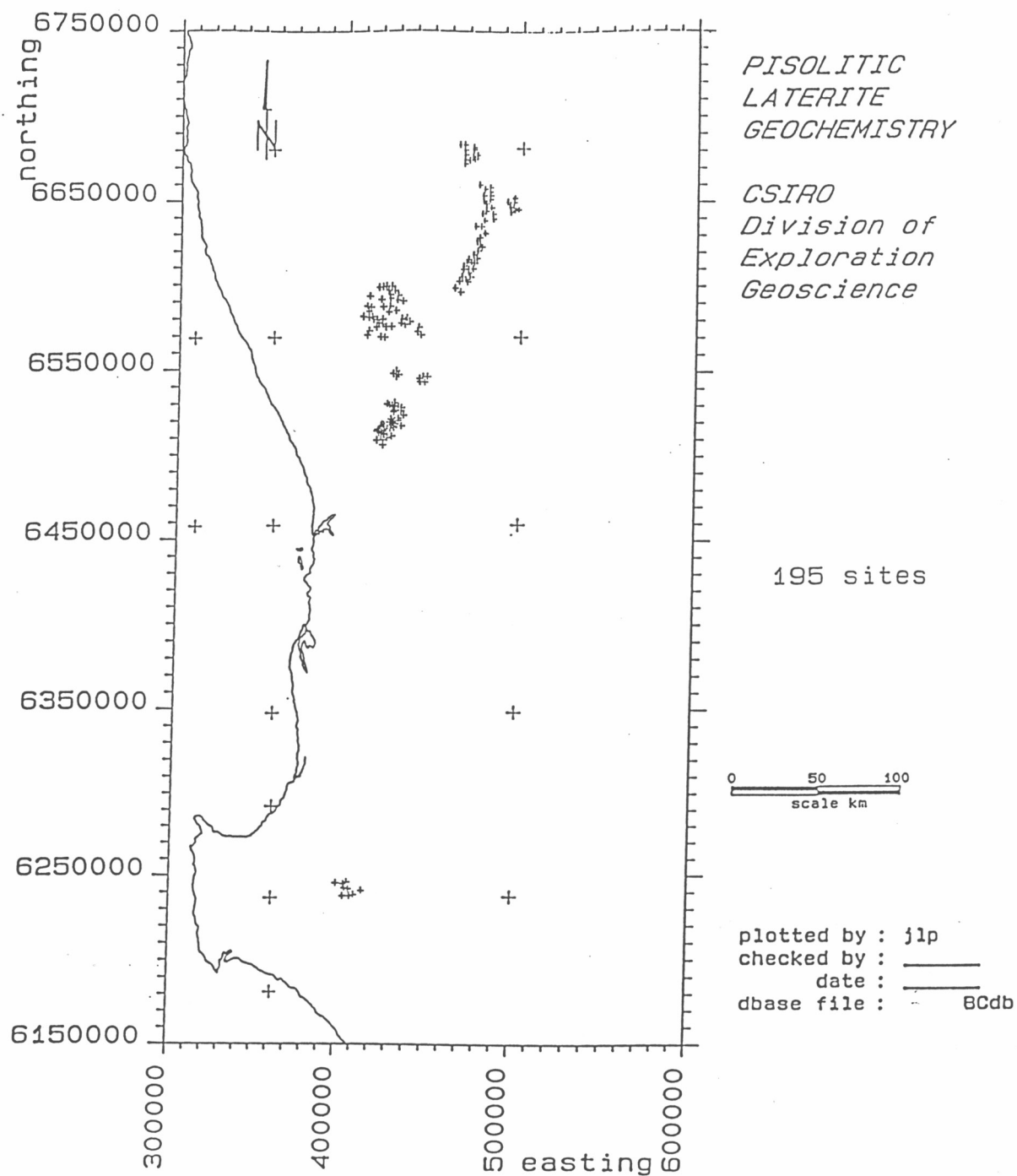


Figure 2. The distribution of laterite samples arising from Project C sampling within the area covered.

type|readme.txt

```
*****
*
*               PROJECTS B & C - DATA RELEASE APRIL 1988
*
*****
```

DATA FORMAT:

[datafiles: AMIRA1-1.SDF]
[AMIRA1-2.SDF]

Sample number - character 7
AMG Eastng - integer 6
AMG Northing - integer 7
map reference - character 8
Geology code - character 5 - codes explained in report
Sample type - character 5 - codes explained in report

Fe - real f5.1 - wt%
Mn - integer 5 - ppm
Cr - integer 6 - ppm
V - integer 6 - ppm
Cu - integer 5 - ppm
Pb - integer 5 - ppm
Zn - integer 5 - ppm
Ni - integer 5 - ppm
Co - integer 5 - ppm
As - integer 5 - ppm
Sb - integer 5 - ppm
Bi-OES - integer 5 - ppm
Bi-XRF - integer 5 - ppm
Cd - integer 5 - ppm
In - integer 5 - ppm
Mo - integer 5 - ppm
Ag - real f5.1 - ppm
Sn-OES - integer 5 - ppm
Sn-XRF - integer 5 - ppm
Ge - integer 5 - ppm
Ga - integer 5 - ppm
W - integer 5 - ppm
Ba - integer 5 - ppm
Nb - integer 5 - ppm
Ta - integer 5 - ppm
Se - integer 5 - ppm
Te - integer 5 - ppm
Be - integer 5 - ppm
Au - integer 5 - ppb

Negative values indicate less than detection limit
and zero values indicate no analyses.

Example read statement - Fortran 77

```
      read(input,100)sampno,easting,northing,mapref,grsgeo,samptype,  
+ Fe2O3,Mn,Cr,V,Cu,Pb,Zn,Ni,Co,As,Sb,BiO,BiX,  
+ Cd,In,Mo,Ag,SnO,SnX,Ge,Ga,W,Ba,Nb,Ta,Se,Te,Be,Au
```

```
100   format(a7,i6,i7,a8,a5,a5,f5.1,i5,2i6,12i5,f5.1,12i5)
```

end of file

A>