

1978/23  
44  
DEPARTMENT OF  
~~NATIONAL RESOURCES~~  
NATIONAL DEVELOPMENT



BUREAU OF MINERAL RESOURCES,  
GEOLOGY AND GEOPHYSICS

067203

BMR Record 1978/23



Progress report on Georgina Basin geochemistry - results from  
1975, 1976 field seasons

by

J.J. Draper

The information contained in this report has been obtained by the Department of National Resources as part of the policy of the Australian Government to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus or statement the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

BMR  
Record  
1978/23  
c.4

BMR Record 1978/23

Progress report on Georgina Basin geochemistry - results from  
1975, 1976 field seasons

by

J.J. Draper

## CONTENTS

|                        | <u>Page Nos.</u> |
|------------------------|------------------|
| SUMMARY                |                  |
| INTRODUCTION           | 1                |
| General                |                  |
| Aims                   | 1                |
| This report            | 1                |
| Analytical methods     | 1                |
| Acknowledgements       | 2                |
| ARRINTHRUNGA FORMATION | 2                |
| HCl-soluble fraction   | 2                |
| Whole-rock fraction    | 3                |
| Element associations   | 3                |
| GEORGINA LIMESTONE     | 5                |
| HCl-soluble fraction   | 6                |
| Whole-rock fraction    | 6                |
| Element association    | 6                |
| NINMAROO FORMATION     | 9                |
| HCl-soluble fraction   | 9                |
| Whole-rock fraction    | 9                |
| Element association    | 9                |
| KELLY CREEK FORMATION  | 12               |
| HCl-soluble fraction   | 12               |
| Whole-rock fraction    | 12               |
| Element association    | 12               |
| COOLIBAH FORMATION     | 14               |
| HCl-soluble fraction   | 14               |
| Whole-rock fraction    | 15               |
| Element association    | 15               |

|                                        | <u>Page Nos.</u> |
|----------------------------------------|------------------|
| NORA FORMATION                         | 16               |
| HCl-soluble fraction                   | 17               |
| Whole-rock fraction                    | 17               |
| Element associations                   | 17               |
| VARIATIONS BETWEEN UNITS               | 19               |
| SUBSURFACE SAMPLES                     | 21               |
| (a) Boulia No. 9                       | 21               |
| (b) Pb-Zn analyses from various wells  | 24               |
| General                                | 24               |
| BMR Huckitta No. 1                     | 24               |
| " Elkedra No. 3A                       |                  |
| " Elkedra No. 4                        | 25               |
| " Elkedra No. 5                        | 26               |
| " Huckitta No. 7                       | 26               |
| " Huckitta No. 8                       | 27               |
| " Urandangi No. 9                      | 28               |
| " Tobermory No. 11                     | 28               |
| " Tobermory No. 12                     | 29               |
| Phillips-Sunray Black Mountain No. 1   | 29               |
| "       "       Beantree No. 1         | 30               |
| Alliance Mulga No. 1                   | 30               |
| Other minor analyses                   |                  |
| Discussion                             |                  |
| PROSPECTS FOR LEAD-ZINC MINERALISATION | 32               |
| CONCLUSIONS                            | 41               |
| REFERENCES                             | 42               |
| APPENDIXES                             | 46               |

1. Histograms of discriminant functions.



(iii)

2. Analytical results - Copy of results obtained by Australian Aquitaine Petroleum Project of a geochemical study carried out on three wells in the Georgina Basin.
3. Analytical results used in this report (Microfiche).

#### LIST OF FIGURES

1. Distribution and generalised stratigraphy of major units discussed in this report.
2. Histograms - Arrinthrunga Formation.
3. R-mode cluster analysis - Arrinthrunga Formation.
4. Correlation matrix-Arrinthrunga Formation.
5. Histograms - Georgina Limestone.
6. R-mode cluster analyses Georgina Limestone.
7. Correlation matrix - Georgina Limestone.
8. Histograms -- Ninmaroo Formation (TOKO).
9. R-mode cluster analysis - Ninmaroo Formation (TOKO).
10. Correlation matrix - Ninmaroo Formation (TOKO).
11. Histograms - Kelly Creek Formation.
12. R-mode cluster analysis - Kelly Creek Formation.
13. Correlation matrix - Kelly Creek Formation.
14. Histograms - Coolibah Formation.
15. R-mode cluster analysis - Coolibah Formation.
16. Correlation matrix - Coolibah Formation.
17. Histograms - Nora Formation.
18. R-mode cluster analysis - Nora Formation.
19. Correlation matrix - Nora Formation.
20. Summary of discriminant analysis.
21. Plot of elements against depth - Boulia No. 9.
22. Locality of stratigraphic holes in which Pb-Zn values measured.
23. Depth plot - Huckitta No. 1 (GRG1).
24. Depth plot - Elkedra 4 (GRG4).

- 25. Depth plot - Elkedra 5 (GRG5).
- 26. Depth plot - Huckitta 7 (GRG7)
- 27. Depth plot - Huckitta 8 (GRG8).
- 28. Depth plot - Urandangi 9 (GRG9).
- 29. Depth plot - Tobermory 11 (GRG11).
- 30. Depth plot - Tobermory 12 (GRG12).
- 31. Depth plot - Black Mountain No. 1.
- 32. Depth plot - Beantree No. 1.
- 33. Depth plot - Mulga No. 1.
- 34. Depth plot - Ammaroo No. 1.

LIST OF TABLES

- 1. Summary of analyses - Arrinthrunga Formation.
- 2. Summary of analyses - Georgina Limestone.
- 3. Summary of analyses - Ninmaroo Formation (TOKO).
- 4. Summary of analyses - Kelly Creek Formation.
- 5. Summary of analyses - Coolibah Formation.
- 6. Summary of analyses - Nora Formation.
- 7. Elemental means for various units.
- 8. Analytical results - Boulia No. 9.

## SUMMARY

In 1974, a multidisciplinary study of the Georgina Basin began; the geochemistry of the carbonate rocks is part of this study. The chemical composition of samples collected in 1974 and preliminary interpretations have been reported previously. This report is concerned with results from samples collected in 1975 and 1976 from the Arrinthrunga Formation, Georgina Limestone, Ninmaroo Formation, and in the Toko Syncline region, the Kelly Creek Formation, Coolibah Formation and Nora Formation. In addition chemical analyses of core material from BMR Boulia No. 9 are presented, as is a discussion on Pb-Zn values for cores and cuttings from a number of stratigraphic holes within the basin. A brief outline of prospectivity of the basin for Pb-Zn deposits in carbonate rocks is included.

A number of element associations are apparent, the most important of which are Ca-Sr, Fe-Mn(-Mg), P-F (-Acid Insoluble) and Ba-Mn. The first three are well known but the last (Ba-Mn) is unusual and requires further investigation.

Examination of differences between stratigraphic units indicate that carbonate fraction elements are useful but, apart from organic whole-rock elements are of little value for distinguishing between units.

Sphalerite was present in BMR Boulia No. 9 where it replaced a clast. Zn values in the core do not reflect the presence of sphalerite.

Pb and Zn values in stratigraphic wells show considerable variance in some stratigraphic units, but not in others. Anomalous Zn values in BMR Huckitta No. 7 and 8 reflect the presence of disseminated sphalerite associated with stylolites.

Examination of existing data indicates that the upper part of the Arrinthrunga Formation and Meeta Beds may be enriched in Pb, Zn and Ba, and that this stratigraphic level and the contact between these units and overlying units may be a prospective for Pb-Zn mineralisation. Another area worthy of particular attention is the unconformity below the basal Mesozoic sediments.

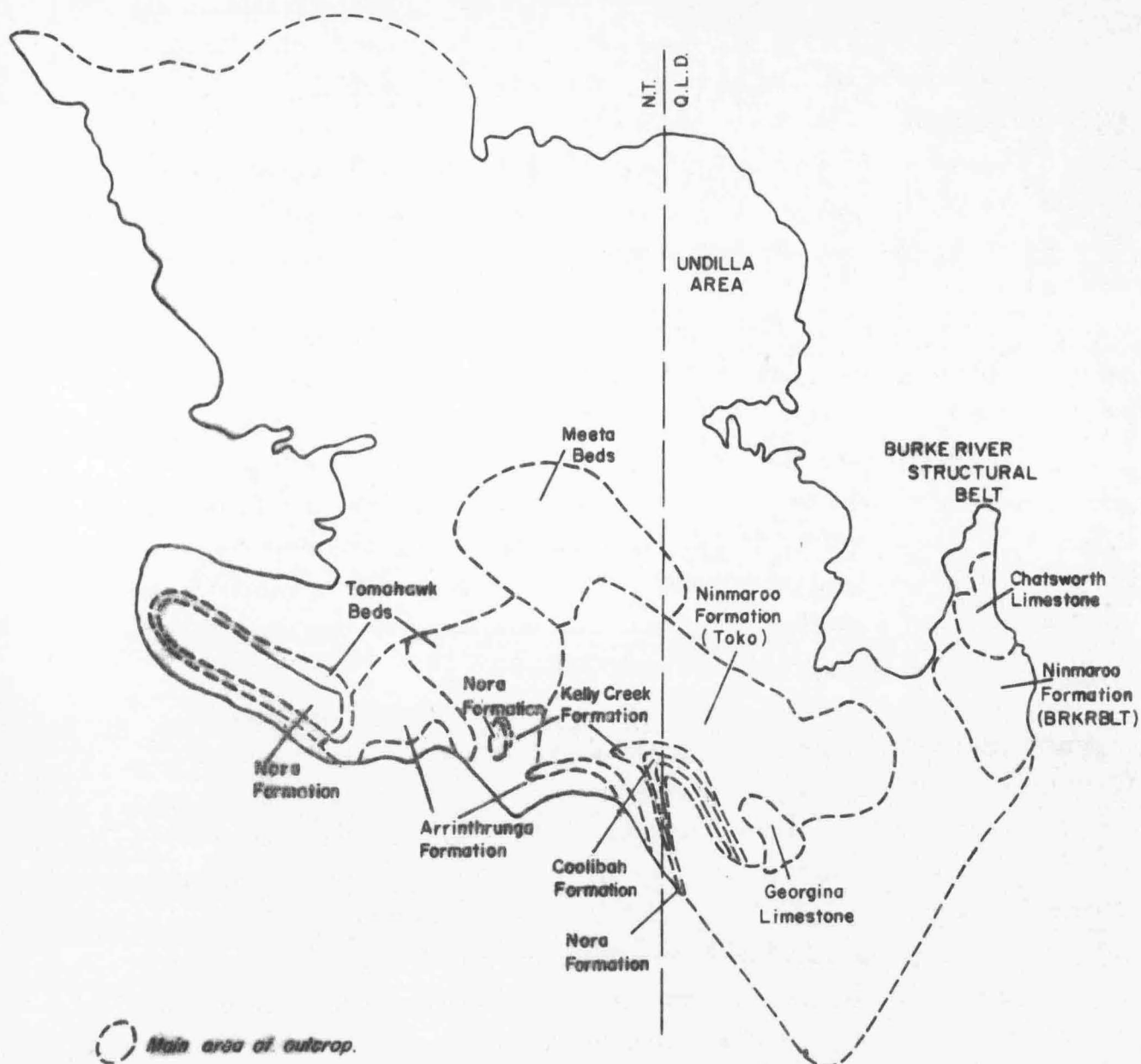
The data in this further preliminary report will be refined and subjected to more detailed interpretation in a planned publication on the geochemistry of carbonates in the Georgina Basin.

|                  |                           |                       |                |
|------------------|---------------------------|-----------------------|----------------|
| Lower Ordovician | Nora Formation            |                       |                |
|                  | Coolibah Formation        |                       |                |
|                  | Tomahawk Beds             | Kelly Creek Formation | *              |
| Upper Cambrian   | Ninmaroo Formation (Toko) |                       | ***            |
|                  | Arrinthrunga Fm **        | Georgina Lst.         | Chatsworth Lst |

\*\* Meete Beds are partly laterally equivalent.

\* There is a diastem within the Kelly Creek Formation  
\*\*\* See P II for explanation of division

0 150 km



Record 1976/23

AUS1/816

Figure. 1. Distribution and generalised stratigraphy of major units discussed in this report.



## INTRODUCTION

### Preamble

In 1974, a multidisciplinary study of the Georgina Basin was commenced (Druce, 1974). As part of this study, carbonate rocks from the Burke River Structural Belt were sampled in 1974 (Draper, 1976), and from the southern portion of the basin in 1975-76.

### Aims

- (a) to establish the geochemical character of various rock units, and from this extract maximum environmental information;
- (b) to establish regional background values for Cu, Pb, Zn, Ba, F, and P. In addition to this, some analyses have been carried out on iron and manganese weathering concentrations to examine their value as mineralisation indicators.

### This report

This report presents data collected during the 1975 and 1976 field seasons. Background values are listed, and the preliminary interpretations of the geochemistry of the Arrinthrunga, Ninmaroo, Kelly Creek, Coolibah and Nora Formations and the Georgina Limestone (Fig. 1) discussed. In addition, data from BMR Boulia No. 9, and analyses for Pb and Zn carried out by Broken Hill Proprietary Ltd on subsurface samples from material held in the BMR Core and Cuttings Laboratory, are discussed. A brief discussion on prospects for Pb and Zn mineralisation is included. It is emphasised that all discussions and conclusions are preliminary; that results will be reinterpreted and refined and incorporated with petrological data at a later stage.

### Analytical methods

The geochemistry has been split into two groups: (a) carbonate fraction and (b) whole-rock fraction. Analyses were carried out by Australian Mineral Development Laboratory, Adelaide:

(a) Carbonate fraction. To study the carbonate geochemistry, determinations were made for Ca, Mg, Sr, Fe, Mn and acid insoluble fraction on samples dissolved in 10 percent HCl. Ca, Mg, Fe, Mn, and Sr were analysed by AAS. Acid insolubles were determined using gravimetric analysis.

(b) Whole-rock fraction. Cu, Pb, and Zn were determined on HF-soluble fractions using AAS. Ba was determined by XRF, organic C by gravimetric methods, and F by specific ion electrode. Phosphorus was determined by a colorimetric method.

#### Acknowledgements

Sampling was carried out by Dr E.C. Druce, B. Radke, J. Kennard and the author. E.G. Smith and K. Heighway supervised the data processing with some assistance from R. McDuff. Drs E.C. Druce and J.F. Truswell made valuable editorial comments.

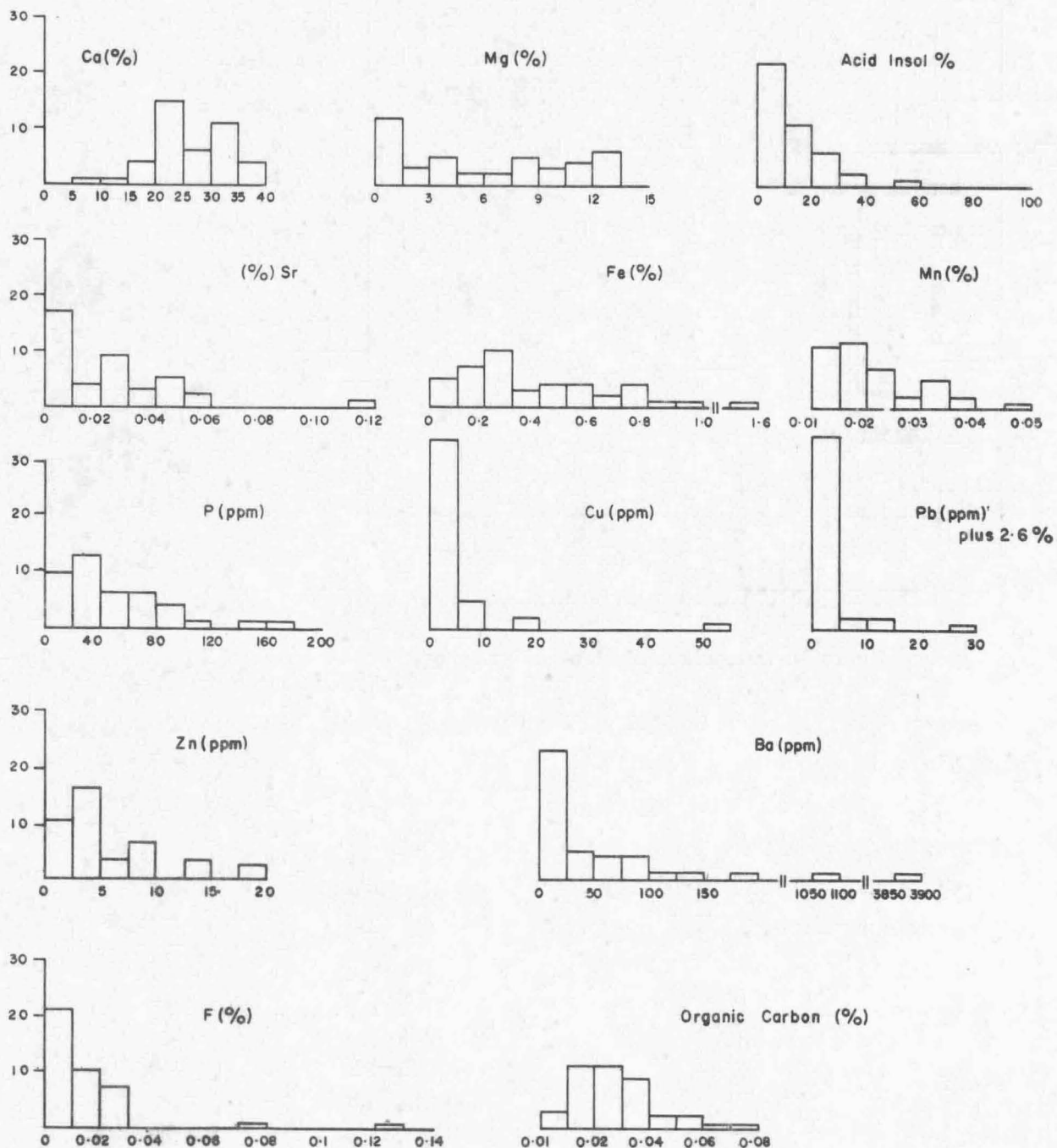
#### ARRINTHRUNGA FORMATION

The Late Cambrian Arrinthrunga Formation (Smith, 1964) is a sequence of crystalline dolomite, algal dolomite, oolitic and peloidal limestone, and dolomite with siltstone and sandstone interbeds.

42 samples from the Huckitta area have been analysed. They are all surface samples; a further 190 subsurface samples are currently being analysed. The results are summarised in Table 1 and Figure 2, and listed in Appendix 3 (microfiche).

#### Carbonate fraction

Both limestone and dolomite samples were analysed and this is reflected in the Ca and Mg values, which show wide variance. The Sr values also reflect the mineralogy. Fe values also show wide variance, but Mn values are more consistent.



Record 1978/23

AUS 1/17

Figure 2. Histograms - Arrinthunga Formation



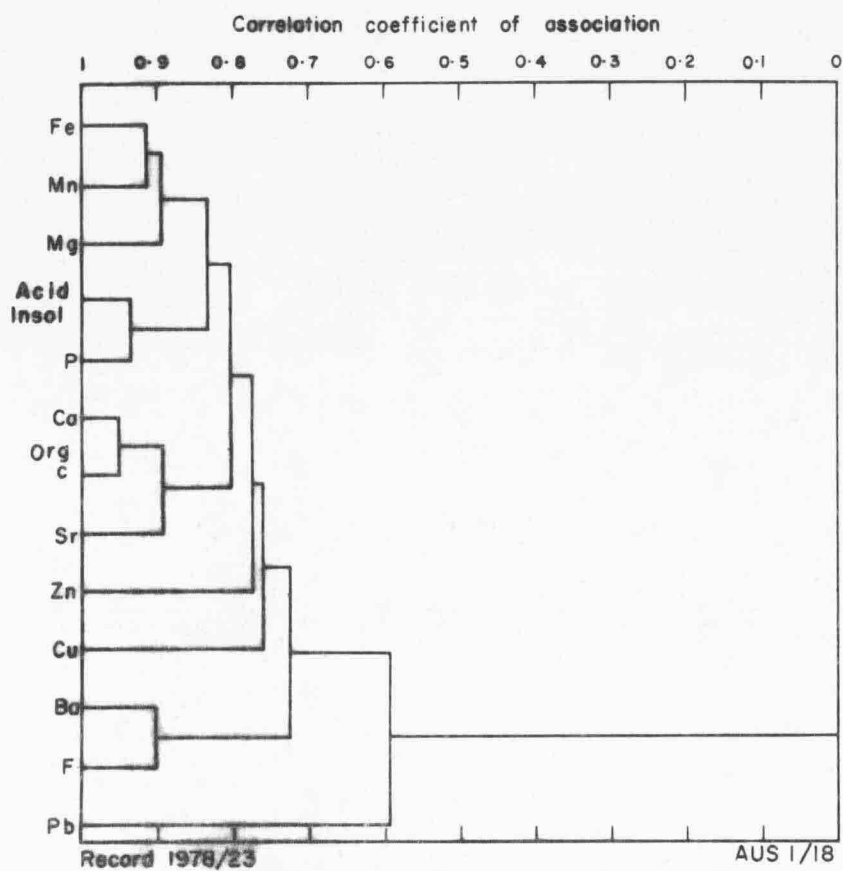


Figure 3. R-mode-Arrinthrunga Formation

### Whole-rock fraction

Cu, Pb, and Zn values are low, with no noticeably anomalous values. Ba shows the wide variance which appears typical for this element in carbonate rocks (Draper, 1976). P values are low, and show little variance. F values are also low, although there are several anomalously high values which correspond to the presence of fluorite. Organic C values are low, and relatively uniform.

### Element associations

(a) R-mode cluster analysis was carried out on the data and the resulting dendrogram is shown in Figure 3.

The effect of anomalous values on the clustering, noted by Draper (1976), is apparent here. Pb has one very high anomalous value and shows little association with other elements. Ba and F have little association with other elements, but show a strong association between themselves. Whether this reflects minor Ba-F mineralisation or is a sampling function is not known. Cu and Zn, which have some minor anomalous values, also form separate groups. The classification to date has been on the basis of anomalous value, but two major groupings with equal weighting remain.

Ca, organic C, and Sr form one grouping. The association between Sr and Ca results from the ease with which Sr substitutes for Ca in the crystal lattice. The reason for the association of organic C with Sr and Ca is not clear, but may result from the fact that Sr and organic C have similar standard deviations and means, i.e. the association is mathematical rather than a real one. Alternatively, it could indicate that organic C is derived in situ from carbonate precipitating or trapping organisms.

The remaining group can be divided into two subgroups, namely P-Acid Insol and Fe-Mn-Mg. Since little P occurs in carbonates it is logical for the P to show a strong association with the acid-insoluble fraction. Fe and Mn have similar chemical properties, and their association with Mg suggests that their distribution is influenced by dolomitisation.

(b) Correlation coefficients were calculated and tested for significance. The results are summarised in Figure 4.

Ca has a highly significant positive correlation with Sr. This results from the ease with which Sr substitutes for Ca in carbonate minerals. Highly significant inverse relationships with Mg and acid insoluble are the result of mutual exclusiveness. The significant, inverse relationship with P probably results from P being confined to the acid insoluble fraction. The significant, inverse relationship with Fe and Mn may indicate that Fe and Mn are strongly affected by dolomitisation or weathering.

Mg has a highly significant inverse relationship with Sr. The loss of Sr as dolomitisation proceeds is well known (Bathurst, 1975). The significant positive correlation with Mn suggests an association between Mn content and dolomitisation. The significant inverse relationship with organic carbon may result from destruction of organic C as dolomitisation occurs.

Sr, besides the correlations already discussed, has a negative, probably significant, correlation with Mn - the relationship probably results from the strong correlation between Mn-Mg and Sr-Mg.

The acid insoluble fraction has a highly significant positive correlation with P, indicating that P is associated with the non-carbonate fraction of the rocks.

Fe and Mn are strongly positively correlated, reflecting the similar chemical properties of these two elements. Fe has highly significant positive correlations with Ba and F, and probably significant correlations with Zn and organic C. Mn has highly significant positive correlations with Pb and Zn. The reason for these correlations is unclear, but may be related to remobilisation during dolomitisation.

Cu has a highly significant positive correlation with organic carbon, resulting from the strong complexing of Cu and organic molecules.

Ba has a highly significant positive correlation with F and organic C, and F has a significant positive correlation with organic C. Ba and F may be sorbed on clays, the lithological fraction with which organic C is normally associated. Some Ba and F may be associated with very minor mineralisation.

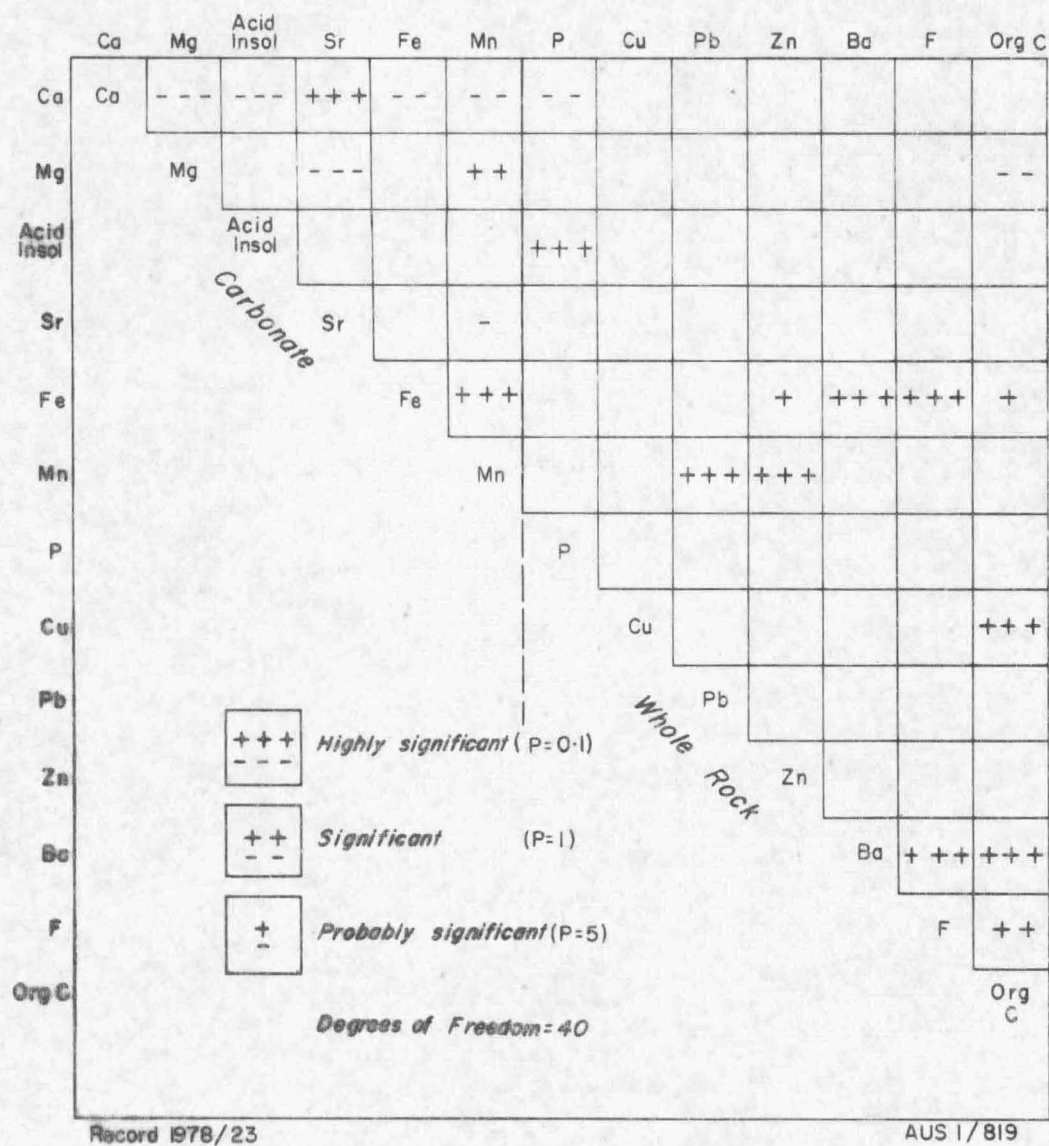


Figure 4. Correlation matrix-Arrinthrunga Formation.

(c) Comparison of (a) and (b). Although the R-mode cluster is strongly influenced by anomalous values, some of the associations found are similar to those indicated by correlation coefficients. Ca-Sr, Acid Insoluble-P, Fe-Mn and Ba-F associations are common to both analyses. An association between Fe/Mn and Mg is also suggested by both analyses.

Table 1. Summary of analyses - Arrinthrunga Formation

| Element | Range         | Mean    | Std Dev. |
|---------|---------------|---------|----------|
| Ca      | 9.6 - 36.8    | 26.0%   | 6.9      |
| Mg      | 0.12 - 12.7   | 5.8%    | 4.5      |
| Insol   | 3.2 - 58.7    | 13.2%   | 11.3     |
| Sr      | 0.002 - 0.12  | 0.022%  | 0.022    |
| Fe      | 0.056 - 1.59  | 0.396%  | 0.303    |
| Mn      | 0.011 - 0.048 | 0.025%  | 0.018    |
| P       | 10 - 180      | 52 ppm  | 39       |
| Cu      | 1 - 55        | 5 ppm   | 9        |
| Pb*     | 2 - 26        | 4 ppm   | 4        |
| Zn      | 1 - 19        | 8 ppm   | 11       |
| Ba**    | 20 - 3900     | 160 ppm | 614      |
| F       | 0.002 - 0.13  | 0.015%  | 0.022    |
| Org C   | 0.01 - 0.08   | 0.03%   | 0.02     |

n = 42

\* One value of 2.6% Pb from Box Hole deposit not used

\*\* 15 values 20 ppm used as 20 ppm in calculation

#### GEORGINA LIMESTONE

The Georgina Limestone (Ogilvie in Whitehouse, 1931; Opik 1956 p.22; amended Opik, 1960 p. 100, 1963 p. 14; Henderson, 1976) comprises flaggy, sandy limestone with breccia interbeds in the upper part, and dark bituminous limestone and pale aphanitic limestone in the lower part.



Twenty samples of surface material were analysed. Results are summarised in Table 2 and Figure 5, and tabled in Appendix 3.

#### Carbonate fraction

The samples analysed are relatively pure limestones (except for one sample of chert and limestone) with resulting low Mg and acid insoluble values. Sr and Fe values are somewhat similar, and Mn values relatively low.

#### Whole-rock fraction

P values are generally low with occasional high values. Cu and Zn show a spread of values within a narrow range. Pb values are very low except for one anomalous value. Ba shows a wide spread of values, and F a narrow spread. Organic C shows a bimodal distribution with the majority of values being 0.05 percent, but with a second group spread about 0.1 percent - probably reflecting the presence of rocks with a petroliferous odour.

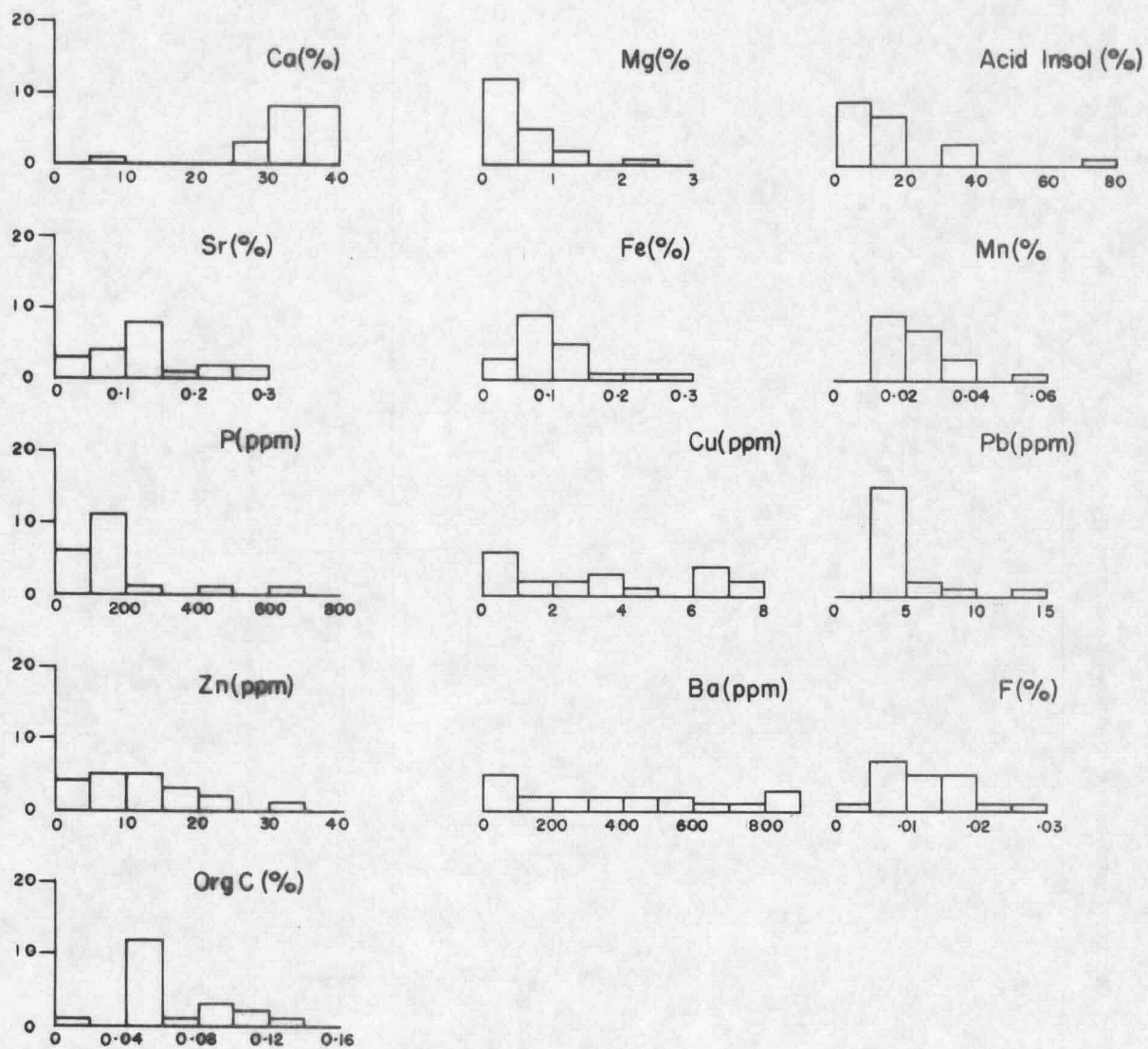
#### Element associations

(a) R-mode cluster analyses are summarised in the dendrogram in Figure 6.

Pb forms a separate group as a result of the anomalous values. The remaining elements show strong inter-relationships and can be divided into two main groupings; a Ca-Sr-Ba group and a Mn-F-P-Fe-organic C-Mg-Acid Insol-Cu-Zn group.

The Ca-Sr-Ba group reflects the similarity between Ca and Sr in carbonate lattices but the association of Ba with Ca and Sr is difficult to explain.

The Mn-F-P-Fe-organic C-Mg-Acid insoluble-Cu-Zn grouping can be divided into four subgroups: (i) Mn-F-P subgroup. The P-F part of this relationship can probably be attributed to the presence of apatite, but the association between P and F and Mn is perplexing; (ii) Fe-organic



Record 1978/23

AUS 1/820

Figure 5 Histograms- Georgina Limestone.

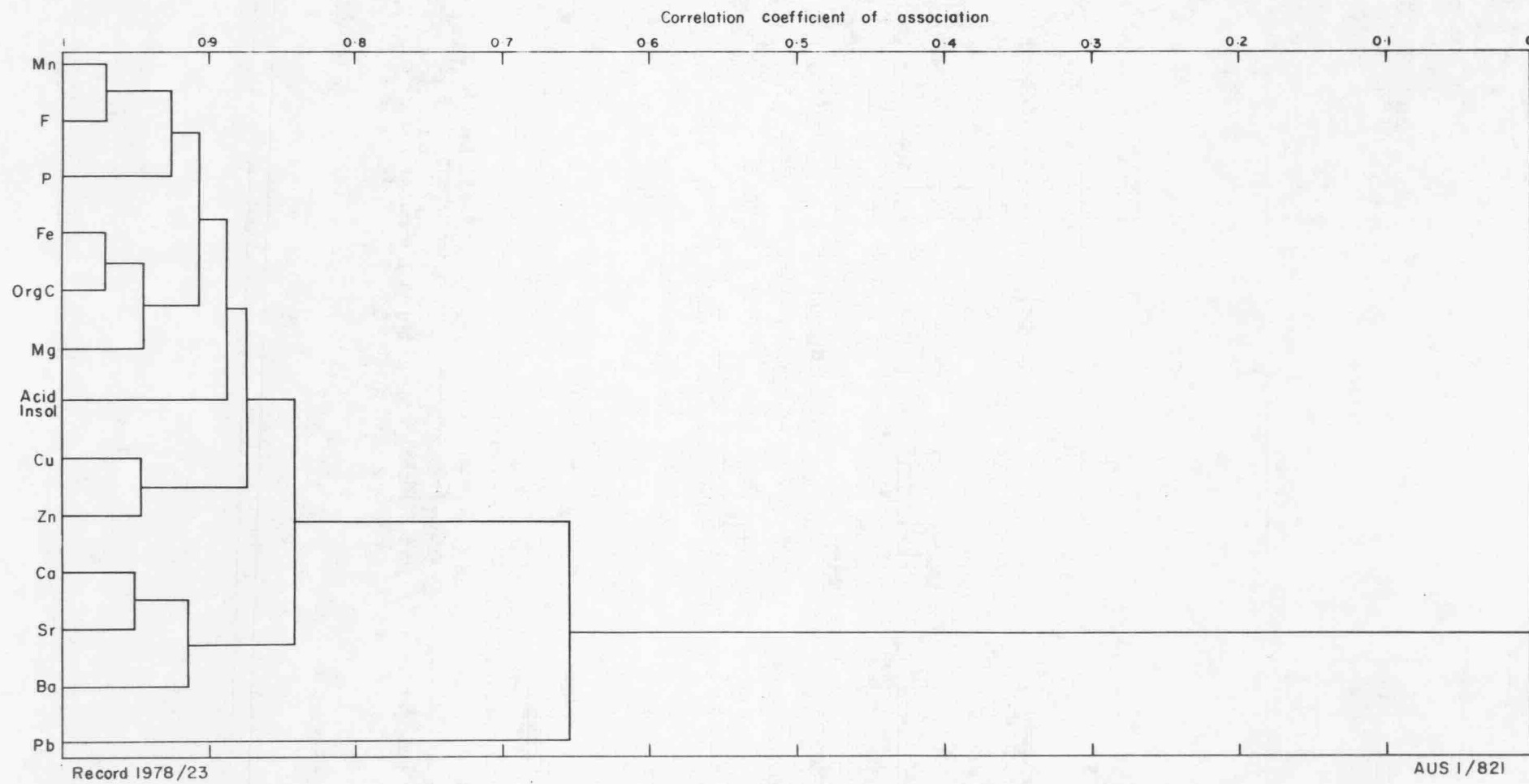


Figure 6. R-mode cluster analysis, Georgina limestone

| Ca | Mg | Acid Insol | Sr | Fe | Mn | P | Cu | Pb | Zn | Ba | F | Org C |
|----|----|------------|----|----|----|---|----|----|----|----|---|-------|
| Ca | -- | (-.99)     | +  | -- |    | - |    |    |    |    |   |       |
|    | Mg | +          |    | +  | +  |   |    |    |    |    |   | +     |
|    |    | Acid Insol | -  | +  | +  | + |    |    |    |    |   |       |
|    |    |            | Sr |    |    |   |    |    |    |    |   |       |
|    |    |            |    | Fe | +  | + |    |    |    |    |   | ++++  |
|    |    |            |    |    | Mr | + | +  |    |    |    | + | +     |
|    |    |            |    |    |    | P |    |    |    |    |   |       |
|    |    |            |    |    |    |   | Cu |    | +  | +  |   |       |
|    |    |            |    |    |    |   |    | Pb |    |    | + |       |
|    |    |            |    |    |    |   |    |    | Zn |    |   |       |
|    |    |            |    |    |    |   |    |    |    | Ba |   |       |
|    |    |            |    |    |    |   |    |    |    |    | F |       |
|    |    |            |    |    |    |   |    |    |    |    |   | Org C |

+++  
---

Highly significant

++  
--

Significant

+  
-

Probably significant

Record 1978/23

AUS 1/822

Figure 7 Correlation matrix - Georgina Limestone

C-Mg group. The association of Fe and Mg suggests that a ferroan magnesium-rich carbonate phase, possibly a cement, may be present. The association of organic C with these elements may indicate an association between dolomitic carbonate and organic matter; (iii) The acid-insoluble fraction is isolated, but is associated relatively strongly with subgroups (i) and (ii), probably because of the presence of P, F, and Org C in those subgroups; (iv) Cu-Zn are associated and are probably sorbed on clays.

(b) Correlation coefficients were calculated and tested for significance. The results are summarised in Figure 7.

Ca has a highly significant negative correlation with acid insoluble, and a significant inverse relationship with Mg. The reasons for these correlations have been explained previously. A significant negative correlation with Fe results from the correlation between Mg and Fe. The probably significant positive correlation with Sr is as expected. The probably inverse relationship with P indicates that P is in the acid insoluble fraction.

Mg has a significant positive correlation with Fe. This may indicate that the magnesium carbonate fraction is ferroan. A probably significant positive correlation with acid insoluble and organic C indicates an association between dolomitic carbonate and noncarbonate fraction, but the association is as yet not clear.

Acid insoluble fraction has a predictable probably significant correlation with Sr(-) and P(+). The positive significant correlation with Fe may indicate that some of the Fe in the carbonate phase was derived from the non-carbonate phase.

Fe has a highly significant positive correlation with organic C. The Fe associated with Mg may be obtained during diagenetic processes from pyrite, the quantity of which may have been controlled by the amount of organic matter present. The probably significant positive correlation with Mn is as would be predicted. The probably significant positive correlation with P reflects the correlation of both these elements with the acid insoluble fraction.



Mn has positive significant correlations with P and F, suggesting an unknown association between phosphate and Mn in the carbonate phase; perhaps Eh-pH conditions are the controlling factor.

Cu has a positive significant correlation with Zn - both are probably sorbed on clays.

Pb has a positive probably significant correlation with F-which may result from either minor mineralisation, or an association of both with clays.

Comparison between (a) and (b). A number of associations are common to both methods - Mn-F-P, Fe-organic C-Mg, Cu-Zn and Ca-Sr associations. Ba shows no correlation with any element and its linking with Ca-Sr in the R-mode cluster may be mathematical rather than real.

Table 2. Summary of statistics - Georgina Limestone.

| Element     | Range         | Mean    | Std Dev. |
|-------------|---------------|---------|----------|
| Ca          | 6.9 - 39.0    | 32.6%   | 7.0      |
| Mg          | 0.18 - 2.11   | 0.61%   | 0.45     |
| Acid Insol. | 0.72 - 73.0   | 15.6%   | 16.5     |
| Sr          | 0.016 - 0.26  | 0.124%  | 0.075    |
| Fe          | 0.030 - 0.26  | 0.105%  | 0.061    |
| Mn          | 0.012 - 0.054 | 0.024%  | 0.010    |
| P           | 30 - 660      | 181 ppm | 147      |
| Cu          | 1 - 8         | 4 ppm   | 3        |
| Pb          | 4 - 220       | 16 ppm  | 48       |
| Zn          | 2 - 31        | 13 ppm  | 7        |
| Ba          | 20 - 880      | 393 ppm | 291      |
| F           | 0.005 - 0.027 | 0.0133% | 0.0065   |
| Org. C      | 0.02 - 0.13   | 0.07%   | 0.03     |

n = 20

### NINMAROO FORMATION

The Ninmaroo Formation (Casey and others, 1960) covers a large area of the southern portion of the Georgina Basin. The geochemistry of this Upper Cambrian-Lower Ordovician Formation in the Burke River Structural Belt was discussed by Draper (1976). In this report the Ninmaroo Formation in the Glenormiston-Toko Syncline region is discussed and is identified as Ninmaroo Formation (TOKO). Ninmaroo Formation in the Burke River Structural Belt is referred to as Ninmaroo Formation (BRKRBLT). The Ninmaroo Formation (TOKO) is subdividable into four members (Pritchard, 1960), but the subdivisions are not used in this report. Ninmaroo Formation (TOKO) consists of dolarenite, dolomitic sandstone, sandy dolomite, stromatolitic beds, ooid and peloidal grainstone (limestone) and calcareous sandstone.

A total of 114 samples were analysed - the results are summarised in Table 3 and Figure 8, and tabled in Appendix 3.

#### Carbonate fraction

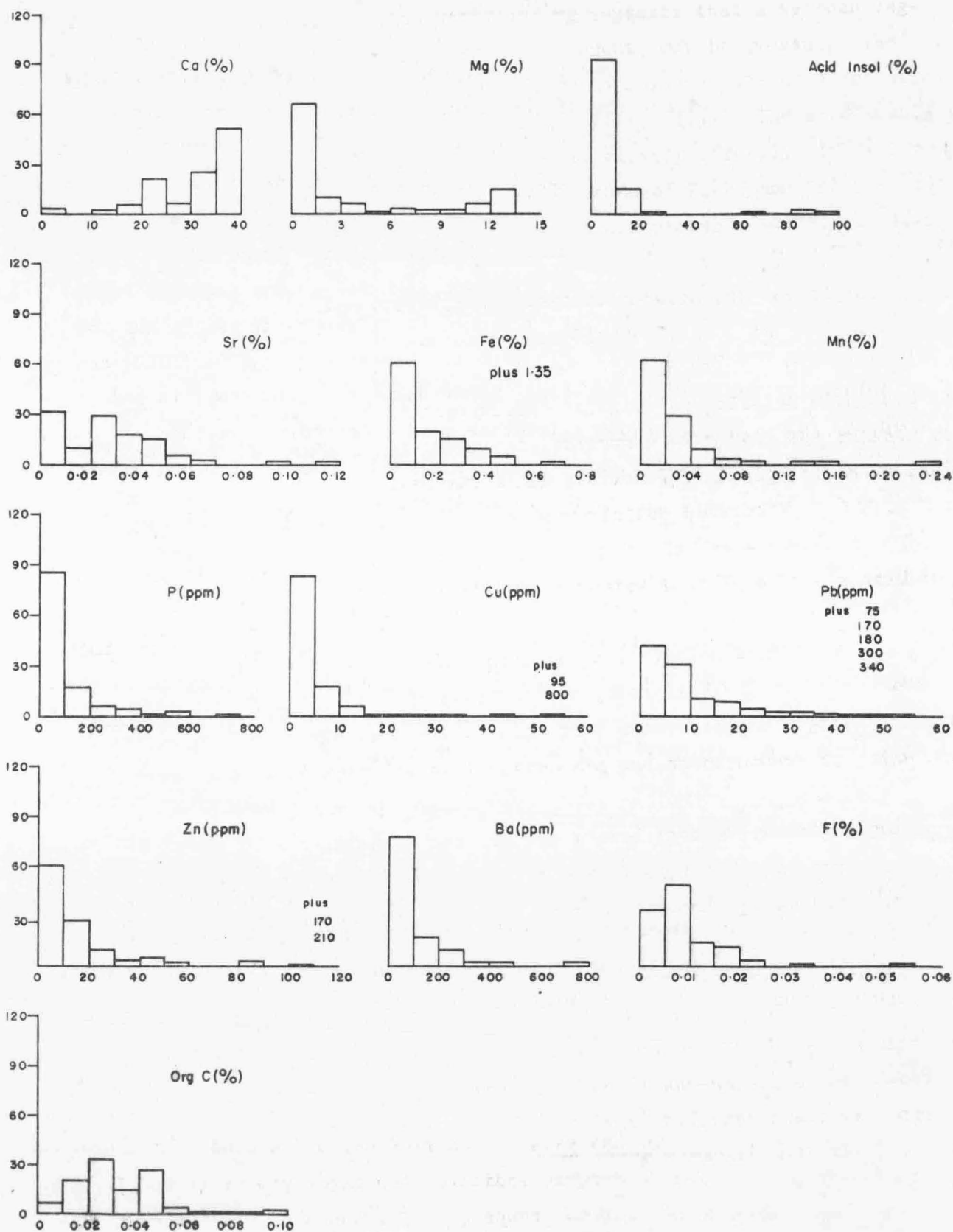
The samples consist largely of relatively pure carbonate (both limestone and dolomite). Limestone is more numerous than dolomite in the samples taken. Sr values reflect the Ca content. Fe and Mn values are relatively high, and have considerable variance.

#### Whole-rock fraction

P values are low with few high values. Cu, Pb and Zn all show wide variance. Ba values are low with moderate spread. Several high values of F correspond to the presence of fluorite. Organic C shows considerable spread and several populations.

#### Element associations

(a) R-mode cluster analysis was carried out and a dendrogram constructed (Fig. 9). The dendrogram indicates two major groups (I and II) with Group I containing four subgroups (a, b, c and d). Group I contains



Record 1978/23

AUS 1/823

Figure 8. Histograms—Ninmároo Formation (Toko).

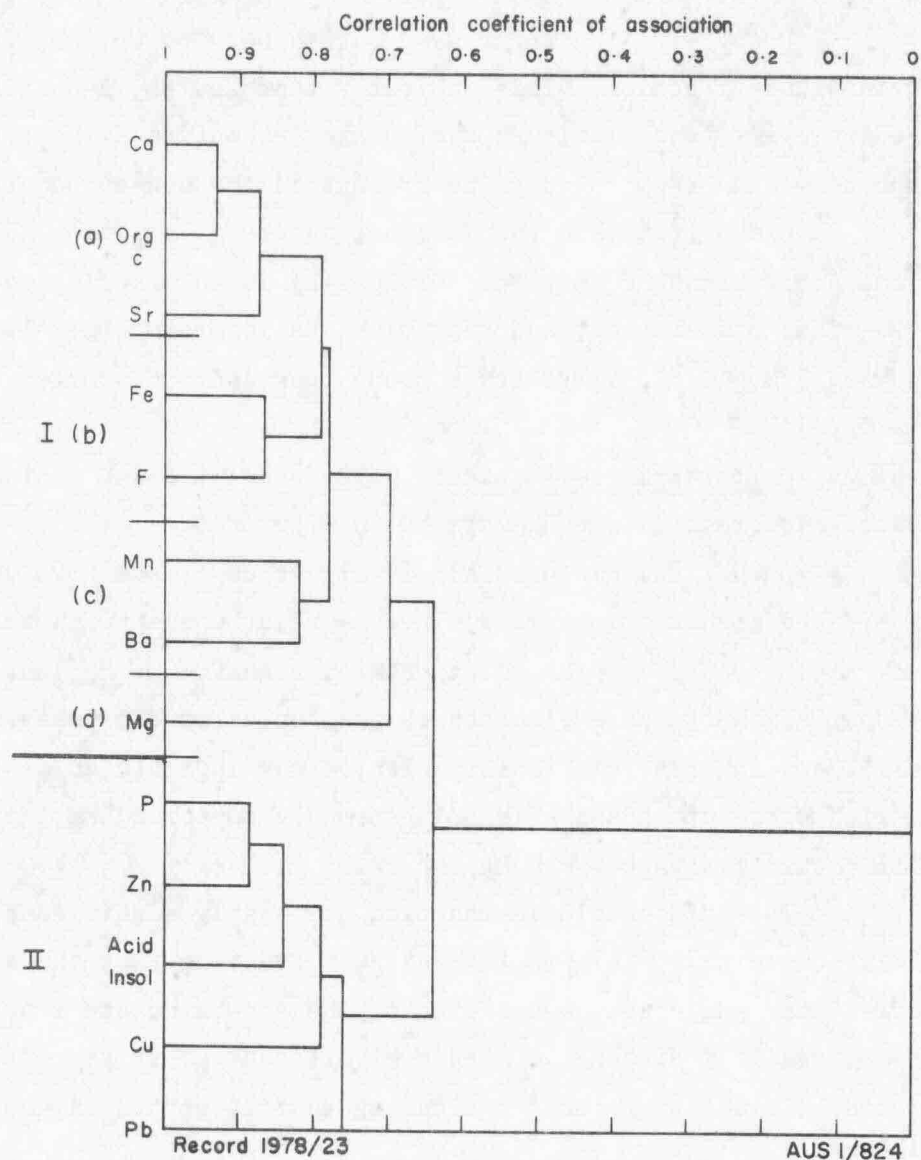


Figure 9 R-mode cluster analysis, Ninmaroo Formation (Toko)

a mixture of carbonate elements and whole rock elements whereas Group II contains non-carbonate elements only.

Group II is an inter-association between Cu, Pb, Zn and P and acid insoluble fraction. This indicates that Cu, Pb, and Zn are probably sorbed on clays, and little Pb and Zn are present in Carbonate minerals. Phosphate would be expected to be present in the non-carbonate phase.

Group I(a) show the Ca-Sr-organic C association noted previously for the Arrinthrunga Formation. Group I(b) is an association between Fe and F. This association, and that of Mn-Ba in Group I(c), is difficult to explain. Group I(d) is Mg; this group represents dolomites.

(b) Correlation coefficients were calculated and tested for significance. The results are summarised in Figure 10.

Ca has the expected highly significant, positive correlation with Sr, and highly significant, inverse relationship with acid insoluble. Highly significant, inverse relationships with P, Cu, Pb, Zn, and F indicate the restriction of these elements to the non-carbonate phase. The highly significant, inverse relationship with Fe may indicate an association with a Mg-rich carbonate phase - this is strongly supported by the significant positive correlation between Mg and Fe.

The acid insoluble fraction has highly significant, positive correlations with P, Cu, Pb, Zn, and F, suggesting that these elements are as previously suggested, restricted to the non-carbonate fraction of the rocks. Organic C also has a highly significant positive correlation with the acid-insoluble fraction, indicating that it occurs in the non-carbonate phase also.

Sr has a highly significant inverse relationship with Fe as a result of the highly significant positive and inverse correlations of Ca with Sr and Fe respectively.

Fe has a highly significant positive correlation with P and F, indicating an association between Fe content of the carbonate phase and phosphate. The nature of this association is unclear, but may be controlled by both Eh and pH. Fe has a significant, positive correlation with Mn, reflecting the similar chemical character of these elements.



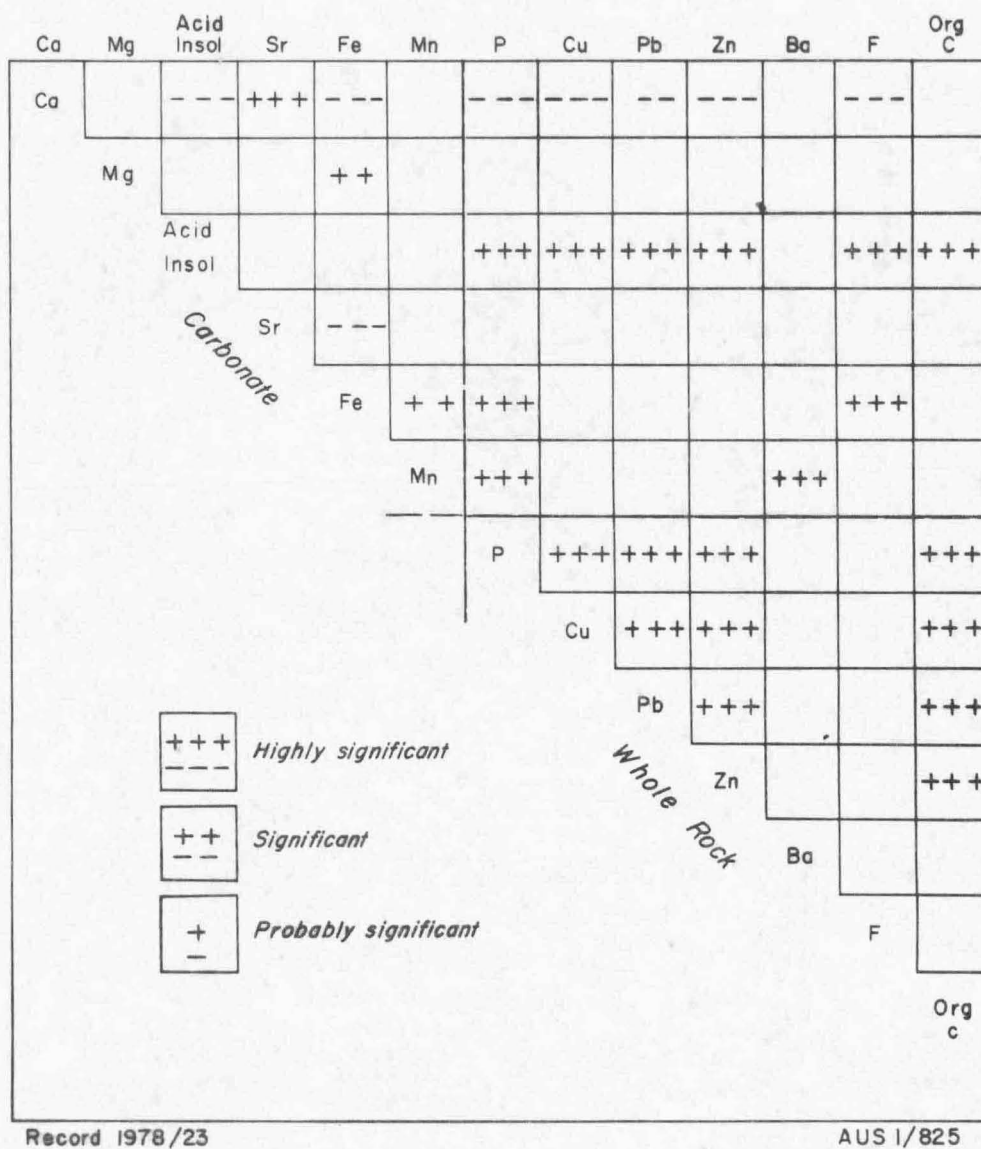


Figure 10. Correlation matrix-Ninmaroo Formation (Toko Province).

Mn has a highly significant positive correlation with P. As with the similar association between Fe and P, little can be said at this stage. Mn has a highly significant, positive correlation with Ba, the nature of which is unclear.

P, Cu, Pb, Zn and organic C all show highly significant, positive intercorrelations as shown previously, in their negative correlations with Ca and positive with acid insoluble.

(c) Comparison between (a) and (b). The association between acid insoluble-P-Cu-Zn-Pb is common to both methods as is the Ca-Sr relationship. The Fe-F, Mn-Ba relationships are shown in both methods also.

Table 3. Summary of statistics - Ninmaroo Formation (TOKO)

| Element     | Range         | Mean    | Std Dev. |
|-------------|---------------|---------|----------|
| Ca          | 0.64 - 39.6   | 30.5%   | 9.2      |
| Mg          | 0.02 - 13.3   | 4.2%    | 7.5      |
| Acid Insol. | 0.5 - 93.6    | 10.5%   | 18.0     |
| Sr          | 0.002 - 0.22  | 0.028%  | 0.027    |
| Fe          | 0.030 - 1.35  | 0.165%  | 0.168    |
| Mn          | 0.005 - 0.24  | 0.030%  | 0.035    |
| P           | 5 - 760       | 107 ppm | 120      |
| Cu          | 1 - 800       | 13 ppm  | 75       |
| Pb          | 4 - 340       | 20 ppm  | 47       |
| Zn          | 2 - 210       | 19 ppm  | 30       |
| Ba          | 20 - 800      | 134 ppm | 149      |
| F           | 0.002 - 0.055 | 0.0096% | 0.0072   |
| org C       | 0.01 - 0.10   | 0.04%   | 0.02     |

n = 114

### KELLY CREEK FORMATION

The Kelly Creek Formation (Casey in Smith, 1965) is a sequence of sandstone, siltstone, dolomite, and silicified coquinite with chert lenses, and is of early Ordovician age.

35 samples were analysed. The results are summarised in Table 4 and Figure 11 and tabled in Appendix 3.

#### Carbonate fraction

The samples are predominantly dolomites, with some limestone and chert samples. This is reflected in the Ca, Mg and acid insoluble values. The low Sr values reflect the dolomitic nature of the rocks. Fe values show wide variance, but Mn values are quite consistent.

#### Whole-rock fraction

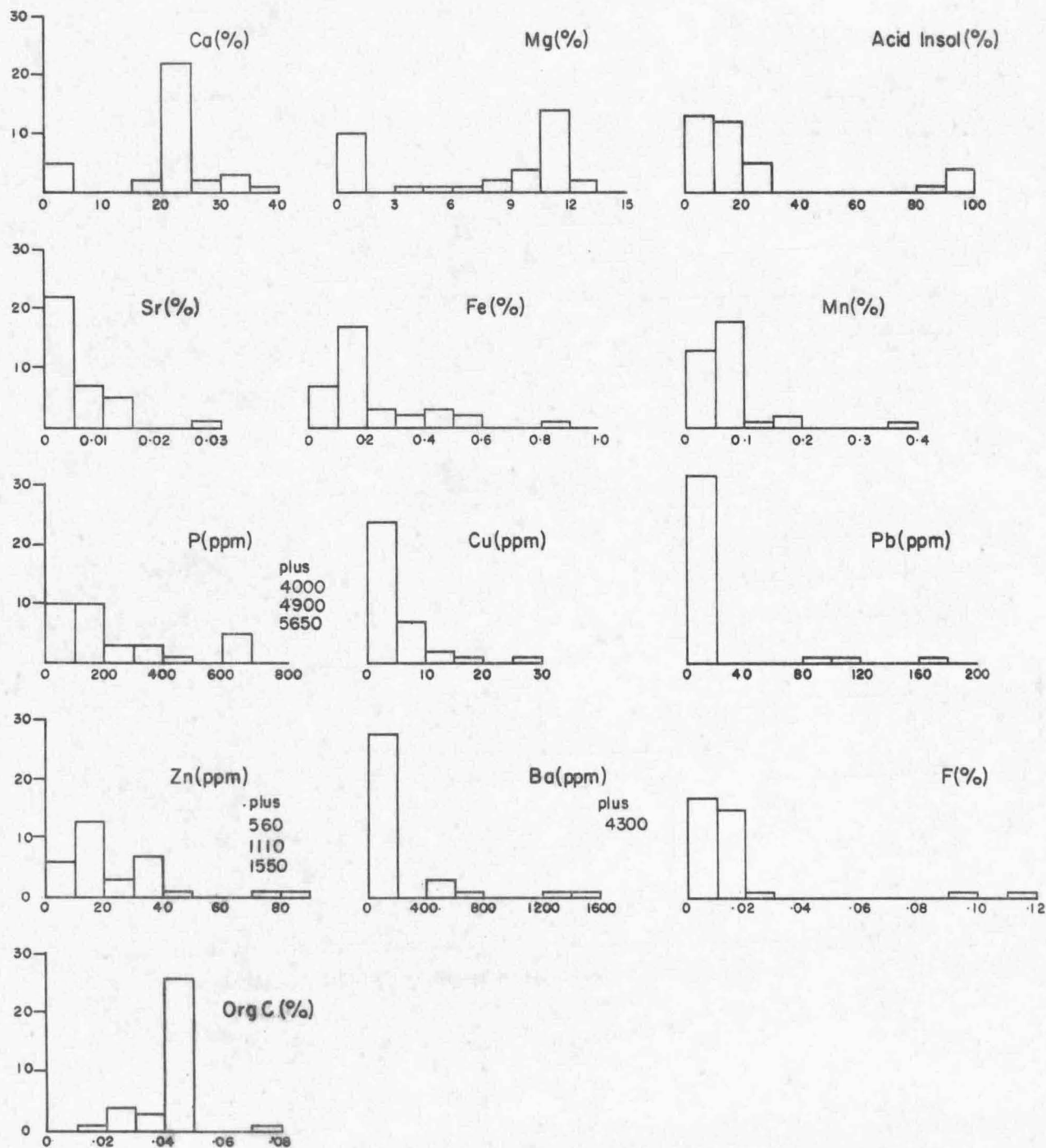
P values show wide spread, and reach high values (5650 ppm). Pb, Ba, and F have generally consistent values, but with several high values. Cu values are low and show little spread. Zn values show considerable variance. Organic C values are low and consistent.

#### Element association

(a) The R-mode cluster analysis dendrogram is shown in Figure 12. Two major groupings are apparent.

Group I contains Ca-organic C-Mg-Fe-Sr. Except for organic C these are all carbonate-phase elements, and indicate ferroan dolomite. Sr has less association with Ca than in other stratigraphic units examined. This is probably caused by the depletion of Sr as dolomites are formed.

Three subgroups are apparent in Group II. Group IIa links Mn-Ba-Cu, an association that is difficult to explain, but the Mn-Ba association was also present in the Ninmaroo Formation (TOKO). P-F-acid insoluble are associated in Group IIb, indicating that phosphate occurs in the non-carbonate phase. Group IIc shows an association between Pb and Zn elements which are often associated.



Record 1978/23

AUS 1/826

Figure II. Histograms - Kelly Creek Formation.

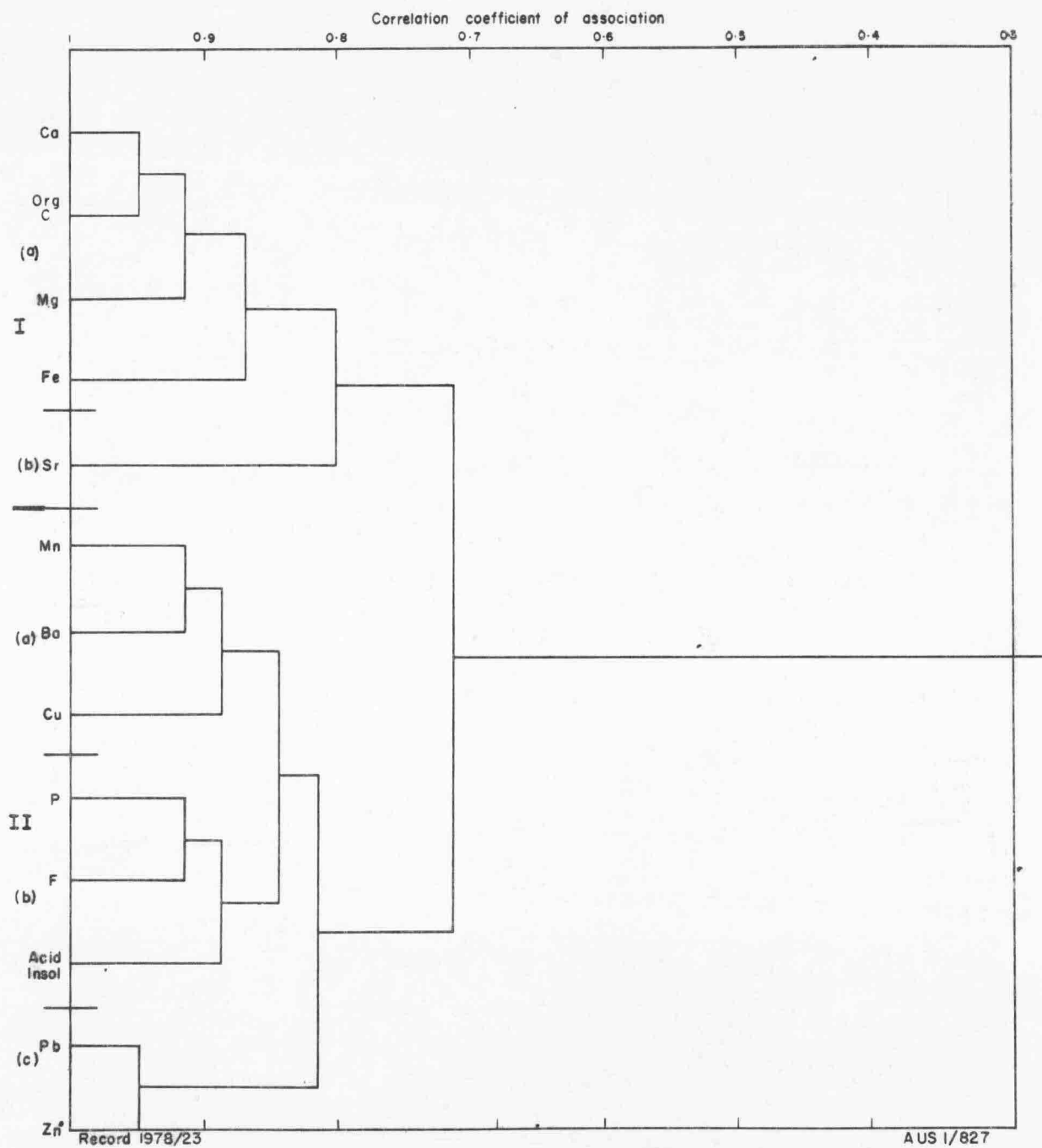


Figure 12. R-mode cluster analysis-Kelly Creek Formation

| Ca | Mg | Acid Insol | Sr | Fe | Mn | P   | Cu  | Pb  | Zn  | Ba  | F   | Org C |
|----|----|------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|
| Ca |    | ---        | ++ |    |    | --- | --  | --- | --- | --  | --  |       |
|    | Mg | ---        | -  |    |    | --  |     | --  | -   | --  | -   |       |
|    |    | Acid Insol |    |    |    | +++ | ++  | +++ | +++ | +++ | +++ |       |
|    |    |            | Sr |    | ++ |     |     |     |     |     |     |       |
|    |    |            |    | Fe |    |     |     |     |     |     |     |       |
|    |    |            |    |    | Mn |     | +++ |     |     | +++ | ++  | ++    |
|    |    |            |    |    |    | P   | +++ | ++  | +++ | ++  | +++ |       |
|    |    |            |    |    |    |     | Cu  | +++ | +++ | +++ | ++  | ++    |
|    |    |            |    |    |    |     |     | Pb  | +++ | ++  |     | +     |
|    |    |            |    |    |    |     |     |     | Zn  |     |     |       |
|    |    |            |    |    |    |     |     |     |     | Ba  | +++ | ++    |
|    |    |            |    |    |    |     |     |     |     |     | F   | +     |
|    |    |            |    |    |    |     |     |     |     |     |     | Org C |

+++  
---

Highly significant

++  
--

Significant

+  
-

Probably significant

Whole  
Rock

Record 1978/23

AUS 1/826

Figure 13. Correlation matrix - Kelly Creek Formation



(b) Correlation coefficients were calculated, tested for significance, and summarised in Figure 13.

Ca shows the expected inverse relationship and correlation with acid insoluble and Sr respectively. It also has significant or highly significant, inverse relationships with P, Cu, Pb, Zn, Ba, and F, suggesting that those elements occur in the non-carbonate phase of the rocks.

Mg has an inverse, highly significant relationship with acid insoluble. This correlation results from Mg being the dominant carbonate phase element, whereas Ca normally is. The inverse, probably significant relationship with Sr reflects the loss of Sr from the carbonate mineral as dolomitisation proceeds. Significant or probably significant inverse relationships with P, Pb, Zn, Ba, and F reflect the association of these elements with the non-carbonate phase.

The significant and highly significant positive correlation between acid insoluble and P, Cu, Pb, Zn, Ba, and F reinforces the suggestion discussed under Ca and Mg, that all these elements occur in the non-carbonate phase. This is further indicated by the correlations between these elements.

Sr correlates significantly with Mn (positive). This may indicate some loss of Mn during dolomitisation.

Mn has significant or highly significant positive correlations with Cu, Ba, F, and organic C. These correlations indicate once again that the non carbonate phase elements influence the behaviour of Mn in the carbonate phase.

Organic C correlates positively with Cu, Pb, Ba, and F-probably as a result of its association with the non-carbonate phase of the rocks.

(c) Comparison between (a) and (b). The association indicated in R-mode cluster are all reflected in the correlation coefficients, except for organic C-Fe-Ca-Mg.

Table 4. Summary of analyses - Kelly Creek Formation

| Element     | Range |         | Mean    | Std Dev. |
|-------------|-------|---------|---------|----------|
| Ca          | 0.36  | - 35.6  | 20.3%   | 9.0      |
| Mg          | 0.11  | - 12.2  | 7.3%    | 4.9      |
| Acid Insol. | 1.84  | - 96.9  | 22.9%   | 29.7     |
| Sr          | 0.001 | - 0.028 | 0.006%  | .0054    |
| Fe          | 0.043 | - 0.88  | 0.22%   | 0.19     |
| Mn          | 0.004 | - 0.38  | 0.067%  | 0.065    |
| P           | 20    | - 5650  | 633 ppm | 1339     |
| Cu          | 1     | - 26    | 5 ppm   | 5        |
| Pb          | 4     | - 165   | 18 ppm  | 35       |
| Zn          | 4     | - 1550  | 114 ppm | 322      |
| Ba          | 20    | - 4300  | 351 ppm | 772      |
| F           | 0.002 | - 0.120 | 0.017%  | 0.024    |
| Org C       | 0.02  | - 0.08  | 0.05%   | 0.01     |

n = 35

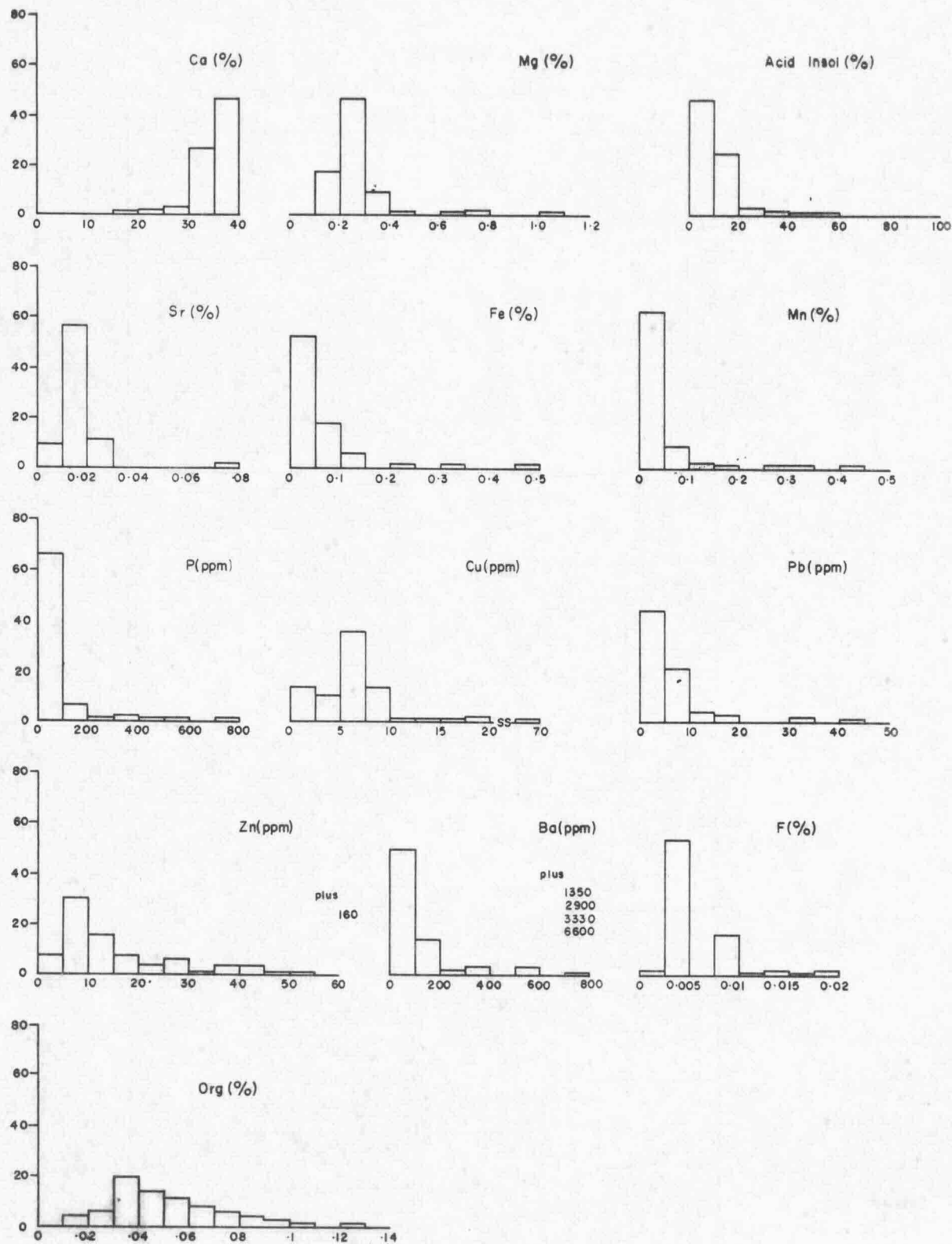
#### COOLIBAH FORMATION

The Coolibah Formation (Casey in Smith, 1965) consists of grey and white limestone, sandy limestone, dolomite, marl and lenses of chert. It is of Early Ordovician age.

Seventy-seven samples were analysed. The results are summarised in Table 5 and Figure 14, and tabled in Appendix 3.

#### Carbonate fraction

The samples are limestone, except for one calcareous siltstone. This is reflected in high Ca and low Mg values. Sr values are very consistent. Fe and Mn values are generally low, but several higher values are present.



Record 1978/23

AUS 1/829

Figure 14. Histograms - Coolibah Formation

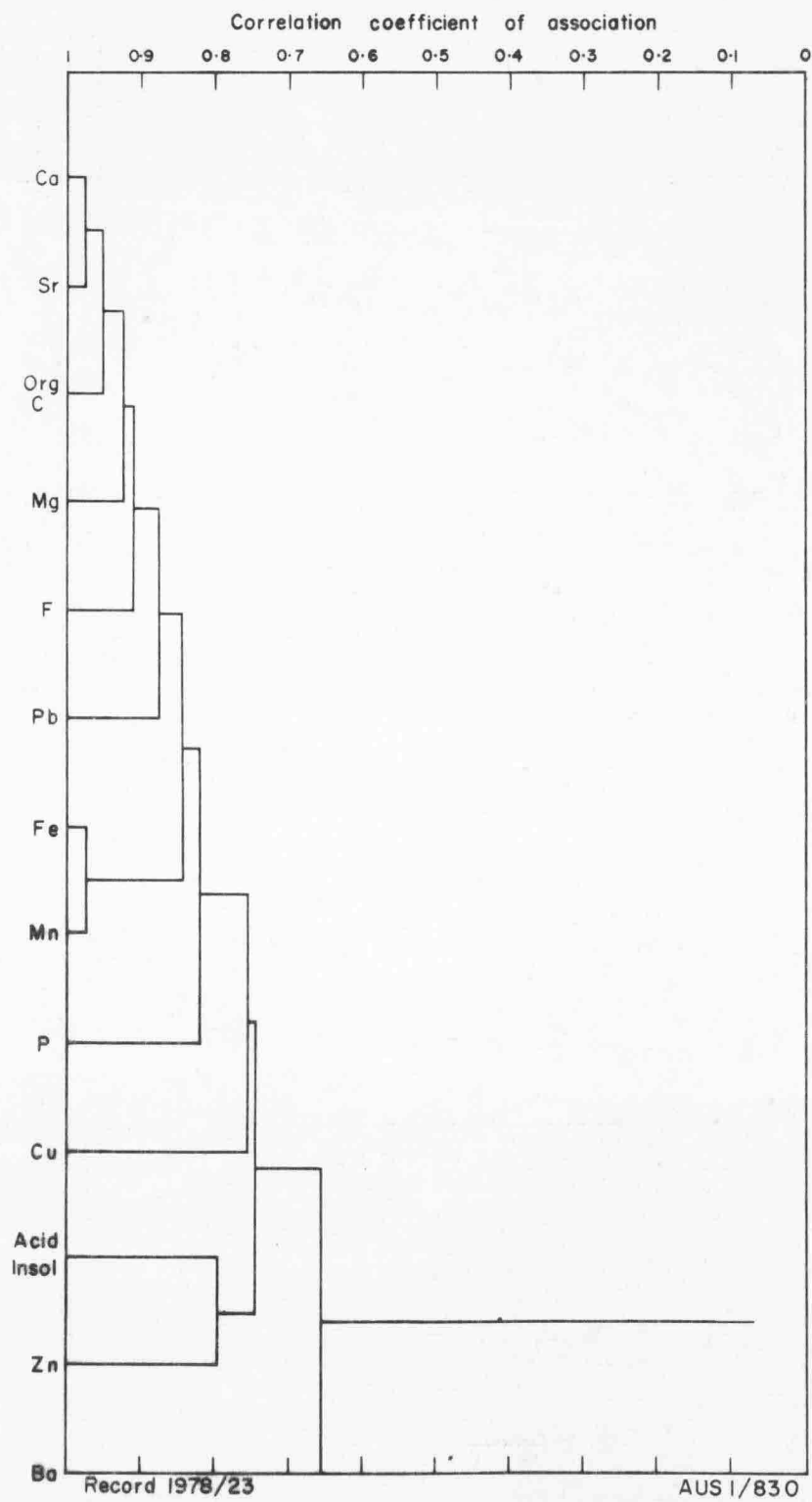


Figure 15. R-mode cluster analyses-Coolibah Formation

### Whole-rock fraction

P values tend to be very low, apart from a few anomalously high values. Cu, Pb, and Zn show a spread of values, as do Ba, F and Organic C.

### Element associations

(a) R-mode cluster analyses are summarised in a dendrogram (Fig. 15). The dendrogram shows a high degree of association, except for Ba which has some very high anomalous values.

Very close associations exist between Ca-Sr and Fe-Mn. Each of these groups contains elements with similar chemical properties. Organic C-Mg-F-Pb show some association with Ca-Sr and Fe-Mn. This may reflect little diagenetic alteration of a uniform primary environment. P and Cu, which have anomalous values, separate out from this tight association.

Acid insoluble and Zn separate out, and show a close association. Zn normally occurs in the acid-insoluble fraction, but the association is further strengthened by the occurrence of high Zn values in silicified ferruginised rocks.

(b) Correlation coefficients were calculated, tested for significance, and are summarised in Figure 16.

Ca has a highly significant, inverse relationship with acid insoluble, and expected correlation. Mg also shows an inverse relationship with acid insoluble.

Sr has a probably significant, positive correlation with Mn - indicating some similarity in behaviour with Mn in carbonate minerals. The lack of correlation between Sr and Ca indicates that Sr may be affected by diagenetic or weathering factors which have also affected Mn.

Fe has a highly significant, positive correlation with Mn, reflecting the similar chemical character of these elements. Highly significant, positive correlations also exist between P and F, a correlation previously noted for Georgina Limestone and Ninmaroo Formation (TOKO). Pb correlates positively with Fe.

AUS 1/831

**Figure 16. Correction matrix - Coolibah Formation**



Mn correlates with P and F in a manner similar to Fe. It also has a highly significant, positive correlation with Pb, perhaps caused by minor Pb mineralisation associated with a Fe-Mn rich carbonate cement.

P has an expected correlation with F, indicating that these elements are predominantly present as apatite.

Pb correlates with F, probably because of the association of F and Pb with Mn.

(c) Comparison of (a) and (b). The only association common to both methods is Mn-Fe.

Table 5. Summary of analyses - Coolibah Formation

| Element     | Range |         | Mean    | Std Dev. |
|-------------|-------|---------|---------|----------|
| Ca          | 18.5  | - 39.4  | 34.9%   | 3.8      |
| Mg          | 0.11  | - 1.08  | 0.27%   | 0.14     |
| Acid Insol. | 0.98  | - 52.5  | 11.0%   | 8.7      |
| Sr          | 0.01  | - 0.071 | 0.02%   | 0.007    |
| Fe          | 0.03  | - 0.48  | 0.065%  | 0.067    |
| Mn          | 0.01  | - 0.41  | 0.047%  | 0.067    |
| P           | 20    | - 750   | 86 ppm  | 124      |
| Cu          | 1     | - 70    | 7 ppm   | 8        |
| Pb          | 4     | - 45    | 8 ppm   | 7        |
| Zn          | 4     | - 160   | 18 ppm  | 20       |
| Ba          | 20    | - 6600  | 295 ppm | 895      |
| F           | 0.002 | - 0.02  | 0.0067% | 0.0037   |
| Org C       | 0.02  | - 0.13  | 0.06%   | 0.02     |

n = 77

#### NORA FORMATION

The Nora Formation (Casey in Smith, 1963) consists of a lower part of olive, grey, and brown sandstone and siltstone, with thin beds of grey limestone; a middle part of olive, grey, and brown limonitic limestone;

and an upper part of fine-grained yellow, grey and purple sandstone and white siltstone. The age is Arenigian (Early Ordovician).

57 samples were analysed and the results are summarised in Table 6 and Figure 17, and tabled in Appendix 3.

#### Carbonate fraction

The samples are a mixture of limestones and dolomites, some of which have high acid insoluble values. Sr values show considerable spread. Fe and Mn values show a wide spread of values.

#### Whole-rock fraction

P values are very variable, ranging from 90 to 30 500 ppm. Cu and Pb values show some variability, but Zn values are consistent. Ba and F values show wide variation. Organic C values are low and consistent.

#### Element associations

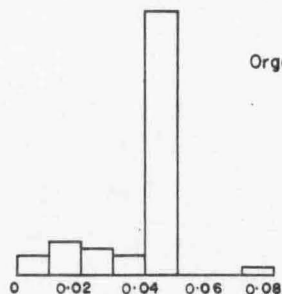
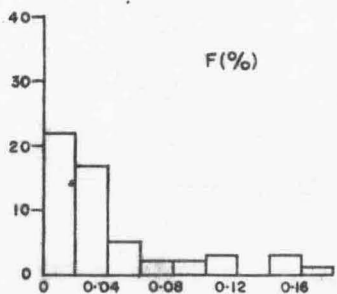
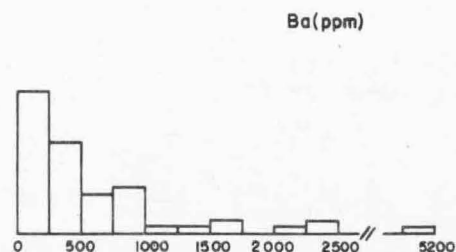
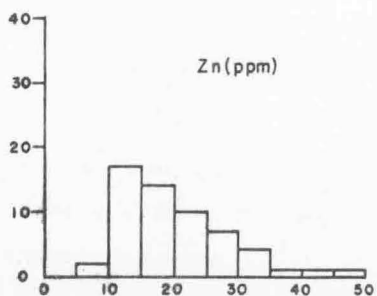
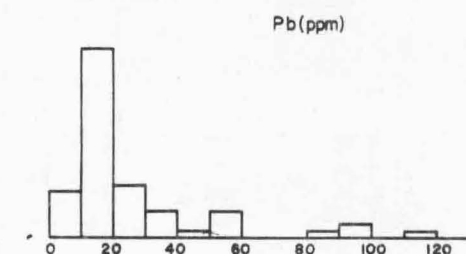
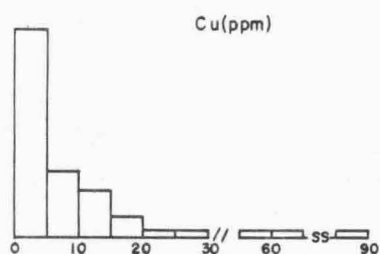
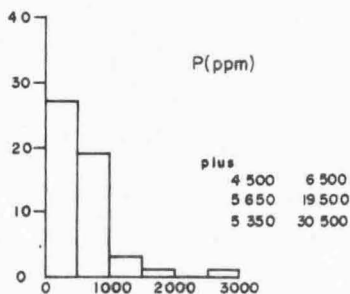
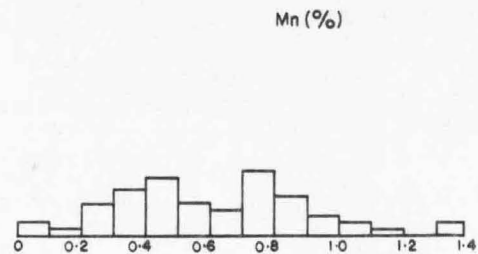
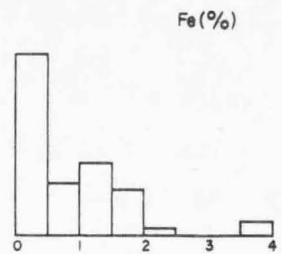
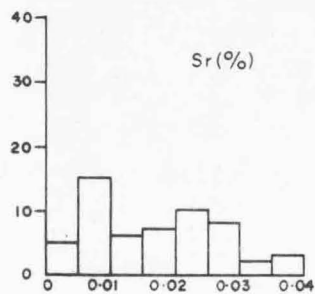
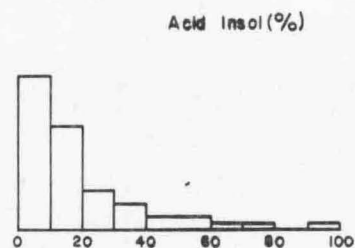
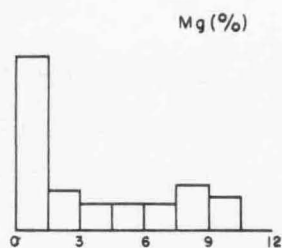
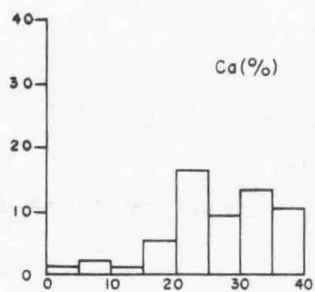
(a) R-mode cluster analysis results are shown in Figure 18. Two major groupings are apparent.

Group I shows a close association between Fe, Mn, and Mg-indicating that Fe and Mn are affected by dolomitisation. Cu and Ba form the remainder of the group, but close association is prevented by high anomalous values. Cu and Ba may be affected by dolomitisation.

Group II(a) shows the association between Ca-Sr-organic C noted for other units. In this case Zn is associated with the organic C. Group II(b) is Pb which is affected by several very anomalous values. Acid insoluble forms Group II(c) and P-F (apatite) make up Group II(d).

(b) Correlation coefficients were calculated, tested for significance and summarized in Figure 19.

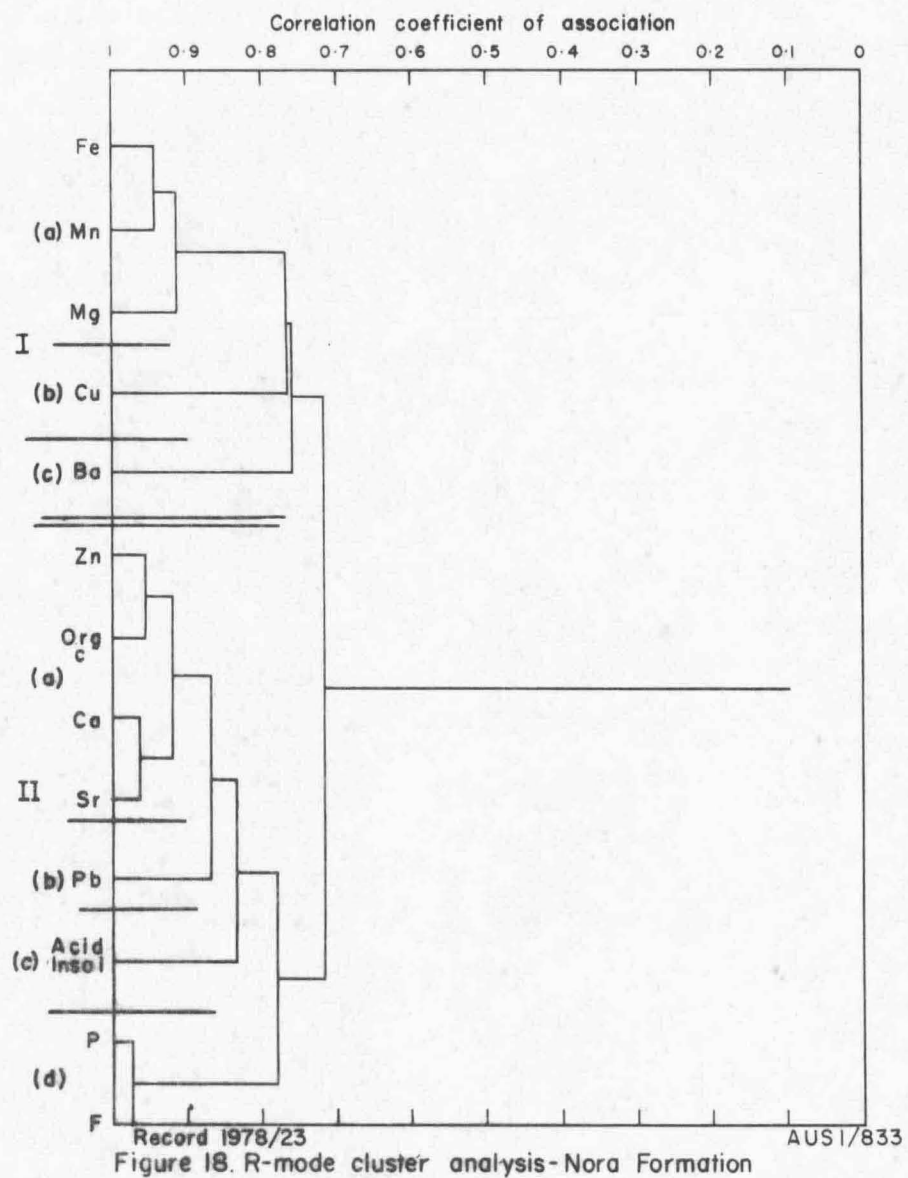
Ca has the expected correlations with Sr (positive) and acid insoluble (inverse). It also has highly significant, inverse relationship



Record 1978/23

Figure 17 Histograms - Noga Formation

AUS I/832



| Ca | Mg  | Acid Insol | Sr  | Fe  | Mn  | P  | Cu | Bb | Zn  | Ba | F             | Org C |
|----|-----|------------|-----|-----|-----|----|----|----|-----|----|---------------|-------|
| Ca | --- | ---        | +++ |     |     | -  |    |    | --- |    | -             |       |
|    | Mg  |            | --- | +++ | ++  |    |    | -  |     |    |               |       |
|    |     | Acid Insol |     | -   | --- | ++ |    | +  | ++  |    | ++            |       |
|    |     |            | Sr  | --- |     |    |    |    | --  |    |               | -     |
|    |     |            |     | Fe  | +++ |    |    |    |     |    |               |       |
|    |     |            |     |     | Mn  |    |    |    |     |    |               |       |
|    |     |            |     |     |     | P  |    |    |     |    | +++<br>(0.95) |       |
|    |     |            |     |     |     |    | Cu |    |     |    |               |       |
|    |     |            |     |     |     |    |    | Pb |     |    | +++           |       |
|    |     |            |     |     |     |    |    |    | Zn  |    |               |       |
|    |     |            |     |     |     |    |    |    |     | Ba |               |       |
|    |     |            |     |     |     |    |    |    |     |    | F             |       |
|    |     |            |     |     |     |    |    |    |     |    |               | Org C |

+++  
---

++  
--

+  
-

Highly significant

Significant

Probably significant

Record 1978/23

AUS 1/834

Figure 19. Correlation matrix - Nora Formation

with Mg reflecting the large amount of dolomite present. Inverse relationships with P-F and Zn probably reflect the presence of these three elements in the non-carbonate phase.

Mg has positive correlations with Fe and Mn, indicating that dolomitisation effects these elements. The inverse relationship with Sr results from depletion of Sr during dolomitisation. The probably significant inverse relationship with Pb may indicate that Pb is affected by dolomitization, or that Pb is in the non-carbonate phase.

Acid insoluble has positive correlations with P-F-Pb-Zn, showing the association of these elements with the non-carbonate phase. Inverse relationships with Fe and Mn probably result from Fe and Mn being in the carbonate phase.

Sr has an inverse relationship with Fe. As seen above, Sr decreases as dolomitisation proceeds so the inference from this correlation, and the positive correlation between Mg-Fe, is that Fe increases with dolomitisation. Sr has inverse relationships with Zn (in the non-carbonate phase) and organic C.

Fe and Mn, chemically similar, correlate strongly; as do P and F, which must be present as apatite.

Pb and F correlate strongly, suggesting that phosphates may be enriched in Pb.

(c) Comparison of (a) and (b). The following associations are common: Fe-Mn-Mg; Ca-Sr; and P-F.

Table 6. Summary of analyses - Nora Formation

| Element     | Range |         | Mean     | Std Dev. |
|-------------|-------|---------|----------|----------|
| Ca          | 0.86  | - 37.2  | 26.5%    | 8.1      |
| Mg          | 0.12  | - 10.1  | 3.4%     | 3.5      |
| Acid Insol. | 2.50  | - 94.8  | 19.2%    | 18.9     |
| Sr          | 0.001 | - 0.039 | 0.0172%  | 0.0096   |
| Fe          | 0.12  | - 3.88  | 0.89%    | 0.77     |
| Mn          | 0.028 | - 1.35  | 0.61%    | 0.29     |
| P           | 90    | - 30500 | 1789 ppm | 4782     |
| Cu          | 1     | - 90    | 10 ppm   | 16       |
| Pb          | 4     | - 115   | 26 ppm   | 25       |
| Zn          | 7     | - 47    | 21 ppm   | 8        |
| Ba          | 20    | - 5200  | 605 ppm  | 850      |
| F           | 0.005 | - 0.77  | 0.063%   | 0.115    |
| Org C       | 0.01  | - 0.08  | 0.04%    | 0.01     |



### VARIATION BETWEEN UNITS

The mean values of elements for each stratigraphic unit are listed in Table 7; differences between means are apparent. However, to test the difference between units, discriminant function analyses were carried out on the data using Program BMD04M (Mayo & Long, 1976). Whilst the data do not entirely satisfy the requirement for discriminant analyses (in terms of unimodality and normal distribution) it was felt that the method was adequate for a preliminary examination of the data and would give an indication of the major differences between units. Histograms were prepared from the results (Appendix 1). F(Discriminant Function) values and percentage contributed to variance by each element are also shown. Significant differences were found between all units, although, as can be seen from the histograms, the degree of significance varies. (The histogram for Chatsworth Limestone and Ninmaroo Formation (BRKRBLT) differs from that in Draper (1976), because of the addition of more dolomite samples to Ninmaroo Formation (BRKRBLT). However, apart from the increased importance of Mg, the results are not greatly different).

The results from the discriminant analyses are summarised in Figure 20. Lines joining units indicate that the particular element contributes more than 10 percent (an arbitrary cutoff figure) to the variance between units. Barred lines show that the percentage variance is greater than 50 percent. The results indicate that the HCl-soluble elements are most important in distinguishing between units, and the whole rock elements, with the notable exception of organic C, are of minor importance or of no value.

Ca and Mg plots reflect differences between limestone, dolomitic limestone and dolomite units. The acid insoluble plot shows a difference between Kelly Creek Formation and most other units; this is a function of the higher clastic component of the Kelly Creek Formation.

Sr, Fe, and Mn plots suggest that these elements are very important. Although the behaviour of these elements with dolomitisation explains part of the difference, it is apparent that other factors enter into the differences (e.g., dolomitic units differ from one another as do limestone units). It is intended that the relationship between these elements, and their relationship to mineralogy and facies, be examined further.

Table 7. Elemental means for various units.

| No. of Samples | 379    | 193    | 114    | 58    | 42    | 77     | 57     | 35    | 20    |        |
|----------------|--------|--------|--------|-------|-------|--------|--------|-------|-------|--------|
| Ca %           | 30.2   | 31.1   | 30.5   | 33.2  | 26.0  | 34.9   | 26.5   | 20.3  | 32.5  | -      |
| Mg %           | 3.23   | 2.58   | 4.2    | 0.43  | 5.8   | 0.27   | 3.4    | 7.3   | 0.61  | -      |
| Acid Insol %   | 12.4   | 12.1   | 10.5   | 15.3  | 13.2  | 11.0   | 19.2   | 22.9  | 15.6  | -      |
| Sr %           | 0.028  | 0.029  | 0.028  | 0.066 | 0.022 | 0.02   | 0.0172 | 0.006 | 0.124 | 0.0475 |
| Fe %           | 0.15   | 0.133  | 0.165  | 0.090 | 0.396 | 0.065  | 0.89   | 0.22  | 0.105 | -      |
| Mn %           | 0.032  | .035   | 0.030  | 0.042 | 0.025 | 0.047  | 0.61   | 0.067 | 0.024 | 0.05   |
| P ppm          | 153    | 192    | 107    | 456   | 52    | 86     | 1789   | 633   | 180   | -      |
| Cu ppm         | 8      | 6      | 13     | 3     | 5     | 7      | 10     | 5     | 4     | 14     |
| Pb ppm         | *282   | 537    | 20     | 5     | 4     | 8      | 26     | 18    | 16    | 8      |
| Zn ppm         | 24     | 26     | 19     | 7     | 8     | 18     | 21     | 114   | 13    | 26     |
| Ba ppm         | 274    | 327    | 134    | 233   | 160   | 295    | 605    | 351   | 393   | 150    |
| Org C %        | 0.05   | 0.06   | 0.04   | 0.05  | 0.03  | 0.06   | 0.04   | 0.05  | 0.07  | 0.24*  |
| F %            | 0.0305 | 0.0198 | 0.0096 | 0.017 | 0.015 | 0.0067 | 0.063  | 0.017 | 0.013 | 0.032  |

Total  
Ninmaroo Formation

Ninmaroo Formation (ENKRBLT)

Ninmaroo Formation (TOKO)

Chatsworth Limestone

Arrinthrunga Formation

Coolibah Formation

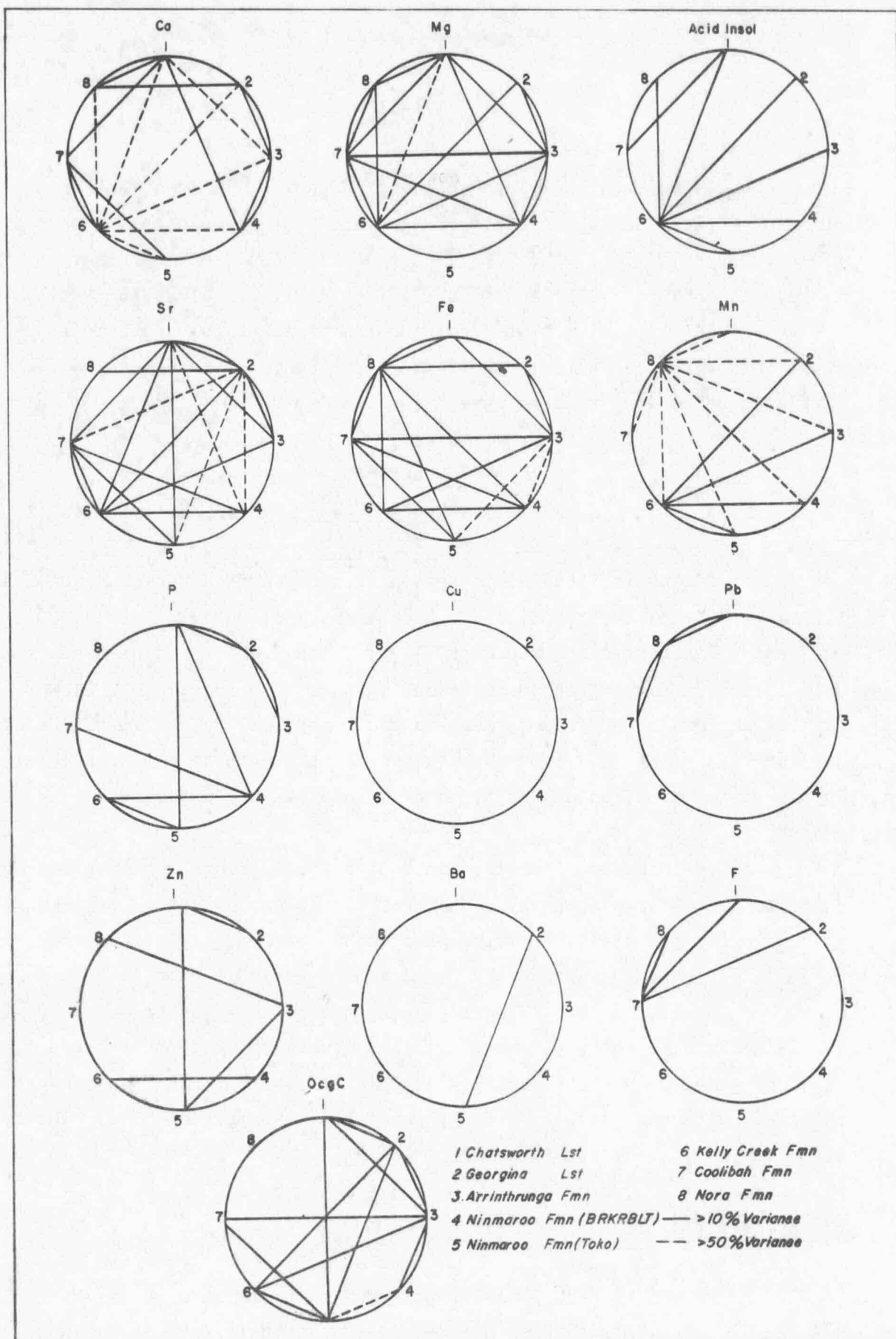
Nora Formation

Kelly Creek Formation

Georgina Limestone

Average for carbonates  
(Graf, 1960)

\*Gehman, 1962



Record 1978/23

AUS 1/835

Figure 20. Summary of discriminant analyses

Organic carbon plots show that organic C is important in distinguishing between units, in spite of the fact that organic carbon is strongly affected by oxidation. The main factor would appear to be whether the unit is dolomitic or not, limestones have slightly higher values than dolomites.

The remaining plots indicate that, except for specific cases, the whole-rock elements, whilst important constituents of the rocks, differ little in value from unit to unit.

#### SUBSURFACE SAMPLES

##### (a) Boulia No. 9

During the 1974 field season in the Georgina Basin, a number of stratigraphic holes were drilled. Geochemistry of Duchess 13 and Boulia 5, 6, 7 and 8 was described by Draper (1976). These holes had been continuously cored. In addition to these holes one further hole (Boulia No. 9) was drilled at Boulia Showground (Kennard and Draper, 1972). Ninmaroo Formation was intersected at 85.7 metres and a two-metre length of core was obtained. The Ninmaroo Formation was overlain by Mesozoic and younger rocks and sediments.

The Ninmaroo Formation in Boulia No. 9 is a slightly calcareous dolomite, with stylolites and some vugs. It is predominantly a grainstone with some rounded clasts. Pyrite is present. Sedimentary structures consist of laminae, cross lamination and compaction banding.

Sphalerite was found replacing one of the clasts. Consequently it was decided to carry out more detailed geochemistry on this core. The core was sampled over its entirety at 10 cm intervals. 18 samples were obtained. The analyses carried out were as in the introduction. The results are shown in Table 8 and Figure 21.

#### HCl-Soluble fraction

Ca and Mg show a strong positive correlation with one another and a strong inverse relationship with the acid-insoluble fraction. These correlations are what would be expected.

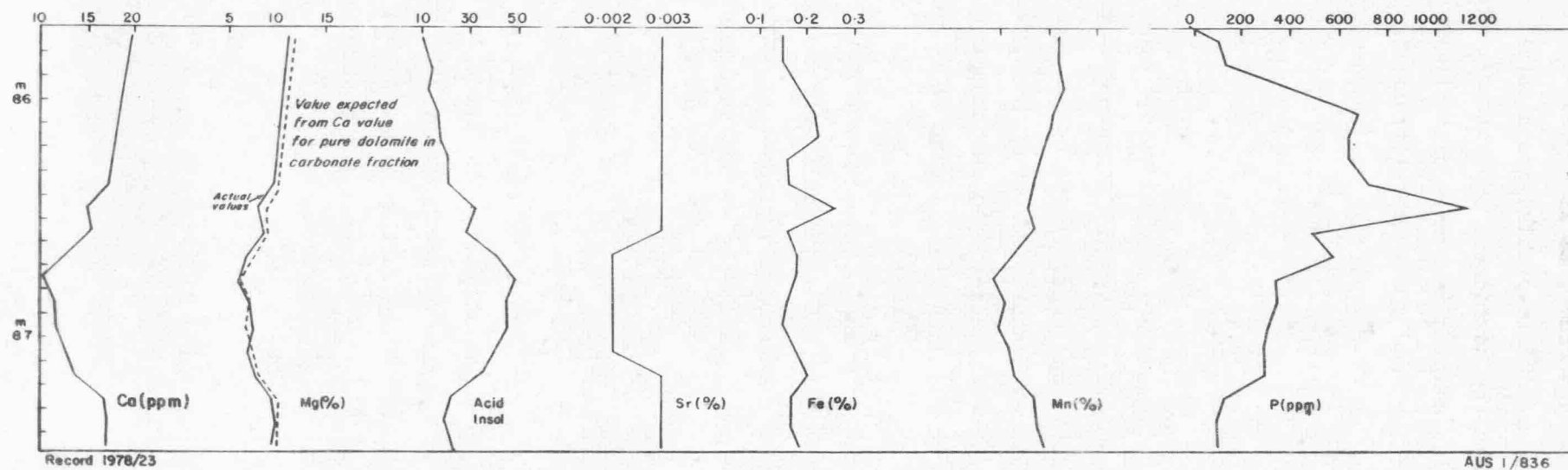
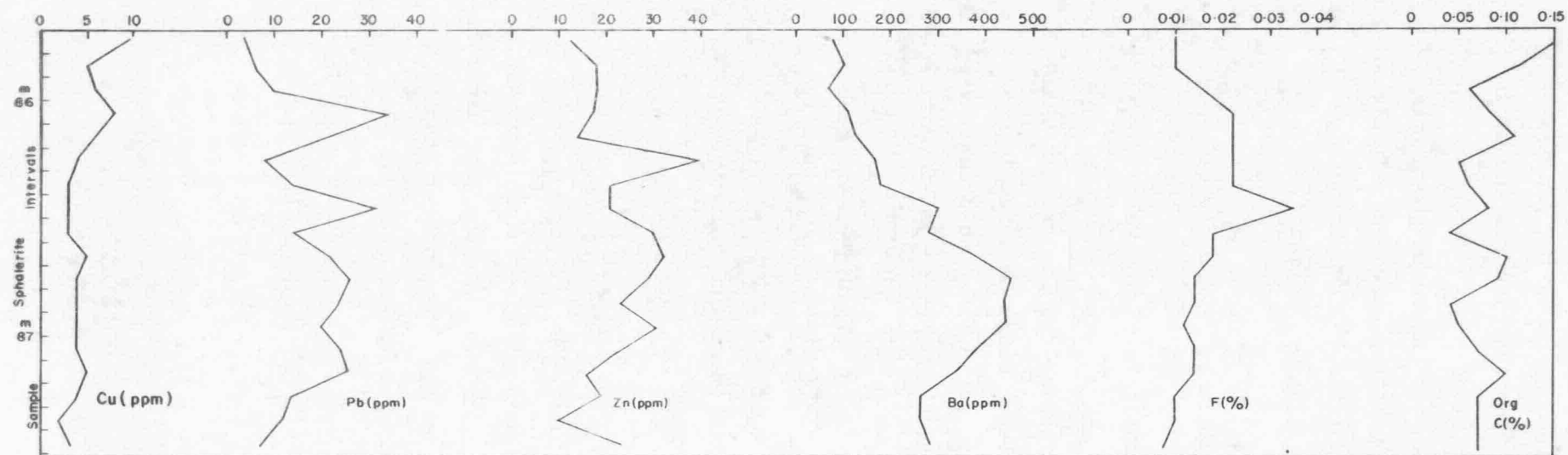


Fig. 21 Plot of elements against depth Bouliia No. 9.

Record 1978/23

AUS 1/836

Sr values, as is typical for dolomites, are very low and are lowest when acid insolubles are highest, suggesting that most of the Sr is present in the carbonate. Mn values correlate strongly with Ca and Mg, indicating that Mn is evenly distributed in the main carbonate phase. Fe on the other hand shows no relationship with any of the carbonate soluble elements. This suggests it may be present in cements, or was effected by weathering prior to deposition of the overlying clastic sediments.

#### Whole-rock fraction

Cu values are relatively constant, while Pb and Zn values vary. The values are average for Ninmaroo Formation, and show no indication of the presence of sphalerite in the core. The Zn value for the interval in which sphalerite is found is not even the highest value. Since this sample was taken only centimetres from the sphalerite it indicates that no primary dispersion at all exists around the sphalerite, which appears to be of replacement origin.

Ba values show a good correlation with the acid-insoluble fraction suggesting that Ba is probably sorbed on clays. P and F show good correlation and are undoubtedly present as apatite. Organic C values are relatively constant, and similar to values in other Ninmaroo Formation dolomites (Draper, 1976).

#### Discussion

The results indicate that, as no primary dispersion pattern exists around the mineralization, the detection of similar near-surface zinc mineralization by geochemical methods would be very dependent on secondary dispersion patterns. It would further suggest that in using cores or cuttings, one needs to actually intersect the mineralisation.



| SAMPLE   | FORM-<br>ATION                    | LITH-<br>OLOGY | Ca<br>% | Mg<br>% | Insol<br>% | Sr<br>% | Fe<br>% | Mn<br>% | P<br>ppm | Cu<br>ppm | Pb<br>ppm | Zn<br>ppm | Ba<br>ppm | F<br>% | Org<br>C % |
|----------|-----------------------------------|----------------|---------|---------|------------|---------|---------|---------|----------|-----------|-----------|-----------|-----------|--------|------------|
| 74715232 | NINMAROO FORMATION - BOULIA NO. 9 | DOLOMITE       | 19.9    | 11.3    | 10.8       | 0.003   | 0.15    | 0.032   | 100      | 9         | 4         | 13        | 80        | 0.010  | 0.15       |
| 3        |                                   |                | 19.3    | 10.9    | 14.3       | 0.003   | 0.15    | 0.032   | 130      | 5         | 6         | 18        | 100       | 0.010  | 0.11       |
| 4        |                                   |                | 18.9    | 10.8    | 13.1       | 0.003   | 0.18    | 0.033   | 400      | 6         | 10        | 18        | 70        | 0.016  | 0.06       |
| 5        |                                   |                | 18.5    | 10.5    | 16.6       | 0.003   | 0.21    | 0.031   | 680      | 8         | 34        | 17        | 110       | 0.022  | 0.08       |
| 6        |                                   |                | 18.0    | 10.4    | 17.5       | 0.003   | 0.22    | 0.030   | 640      | 6         | 20        | 14        | 130       | 0.022  | 0.11       |
| 7        |                                   |                | 17.5    | 10.1    | 21.2       | 0.003   | 0.16    | 0.028   | 640      | 4         | 8         | 40        | 170       | 0.022  | 0.05       |
| 8        |                                   |                | 17.4    | 9.75    | 21.6       | 0.003   | 0.16    | 0.027   | 720      | 3         | 14        | 21        | 180       | 0.022  | 0.06       |
| 9        |                                   |                | 15.2    | 8.4     | 32.3       | 0.003   | 0.26    | 0.026   | 1140     | 3         | 32        | 21        | 300       | 0.035  | 0.08       |
| 40       |                                   |                | 15.5    | 8.95    | 29.2       | 0.003   | 0.16    | 0.027   | 500      | 3         | 14        | 30        | 280       | 0.018  | 0.04       |
| 1        |                                   |                | 12.8    | 7.35    | 41.6       | 0.002   | 0.18    | 0.023   | 570      | 5         | 22        | 32        | 380       | 0.018  | 0.10       |
| 2        |                                   |                | 10.7    | 6.4     | 49.9       | 0.002   | 0.18    | 0.019   | 340      | 4         | 26        | 29        | 460       | 0.014  | 0.09       |
| 3        |                                   |                | 11.8    | 7.15    | 45.6       | 0.002   | 0.16    | 0.021   | 350      | 4         | 24        | 23        | 440       | 0.014  | 0.04       |
| 4        |                                   |                | 11.7    | 7.6     | 46.0       | 0.002   | 0.15    | 0.020   | 320      | 4         | 20        | 31        | 440       | 0.012  | 0.05       |
| 5        |                                   |                | 12.9    | 7.25    | 41.6       | 0.002   | 0.18    | 0.022   | 290      | 4         | 24        | 23        | 380       | 0.014  | 0.07       |
| 6        |                                   |                | 13.9    | 7.8     | 35.9       | 0.003   | 0.20    | 0.023   | 300      | 5         | 26        | 16        | 340       | 0.014  | 0.10       |
| 7        |                                   |                | 17.2    | 9.6     | 23.1       | 0.003   | 0.17    | 0.027   | 130      | 4         | 14        | 19        | 170       | 0.010  | 0.07       |
| 8        |                                   |                | 17.3    | 10.0    | 20.7       | 0.003   | 0.17    | 0.028   | 100      | 2         | 12        | 10        | 160       | 0.010  | 0.07       |
| 9        |                                   |                | 17.2    | 9.6     | 22.7       | 0.003   | 0.18    | 0.029   | 100      | 3         | 8         | 23        | 180       | 0.003  | 0.07       |

Table 8. Analytical results - Boulia No. 9.

(b) Pb and Zn from various wells

General

In 1974 as part of a review of potential of the Georgina Basin for Mississippi Valley Type (MVT) mineralisation, The Broken Hill Proprietary Company Limited carried out Pb and Zn analyses on cores and cuttings of the carbonate intervals from a number of wells in the Georgina Basin. These cores and cuttings were from a number of BMR drill holes, and some wells subsidised under the Petroleum Search Subsidy Act; they were sampled at BMR Core and Cuttings Laboratory, Fyshwick, ACT. A copy of the results was forwarded to BMR on 12 December 1974, the results being confidential until 15 March 1975.

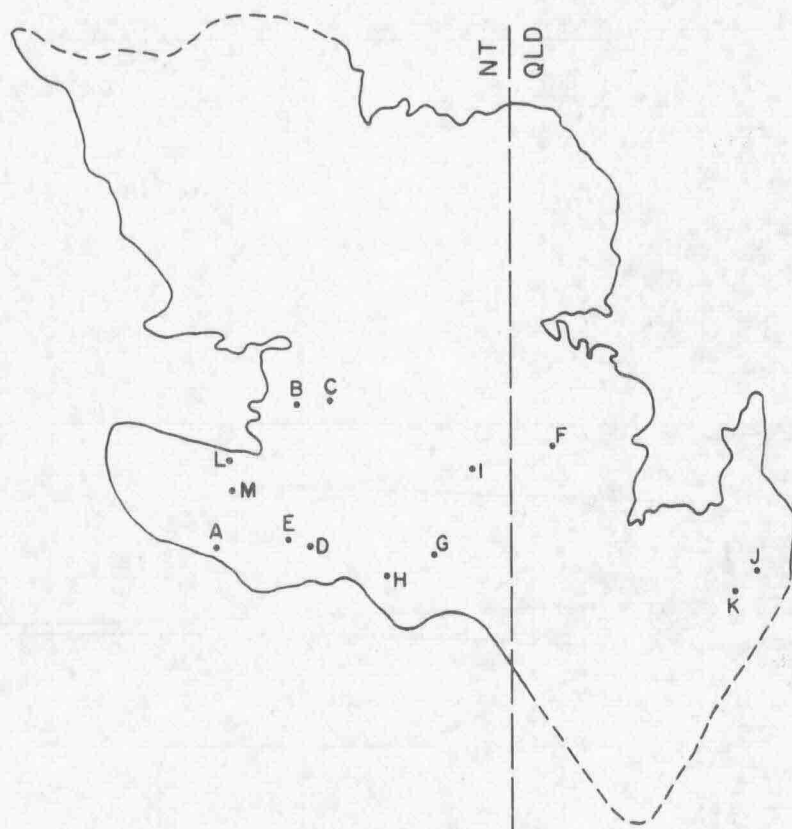
The analyses were carried out by Geochemical and Mineralogical Laboratories at Belmont, WA. The samples were leached by perchloric acid at 180°F for one hour and the values determined by Atomic Absorption Spectroscopy. The precision of the method was quoted by BHP as  $\pm 10$  percent and a detection limit of better than 5 ppm for lead and zinc.

In this report, each hole will be described and discussed. The results have been plotted against depth for each hole, using a moving average, smoothing technique, to make comparisons easier. The localities of the holes are shown in Figure 22. The BMR drill hole logs and descriptions are in Milligan (1963). The various rock units discussed are described in Smith (1972).

BMR HUCKITTA No. 1 (formerly GRG 1)

The interval between 36 metres and 64 metres were sampled over intervals ranging from 2 cm to 30 cm at spacings of approximately 30 m. The results are plotted against depth in Figure 23.

The lithological unit present was divided into three subunits by Milligan (1963). The interval 36-47.5 m contains grey, green, and red sandstone interbedded with grey, green, and pink siltstone. The interval 47.5-56.4 m comprises sandstone and green and grey siltstone, interbedded with



|   |     |                                |          |          |
|---|-----|--------------------------------|----------|----------|
| A | BMR | HUCKITTA                       | No 1     | (GRG 1)  |
| B | "   | ELKEDRA                        | No 3A    | (GRG 3A) |
| C | "   | ELKEDRA                        | No 4     | (GRG 4)  |
| D | "   | HUCKITTA                       | No 7     | (GRG 7)  |
| E | "   | HUCKITTA                       | No 18    | (GRG 8)  |
| F | "   | URANDANGI                      | No 9     | (GRG 9)  |
| G | "   | TOBERMORY                      | No 11    | (GRG 11) |
| H | "   | TOBERMORY                      | No 12    | (GRG 12) |
| I |     | ALLIANCE MULGA                 | No 1     |          |
| J |     | PHILLIPS-SUNRAY BLACK MOUNTAIN | No 1     |          |
| K | "   | "                              | BEANTREE | No 1     |
| L |     | AMAROO                         | No 1     |          |
| M | BMR | ELKEDRA                        | No 5     | (GRG 5)  |

0 150 km

Record 1978/23

AUS 1/837

Fig22. Locality of stratigraphic holes in which Pb-Zn values measured.

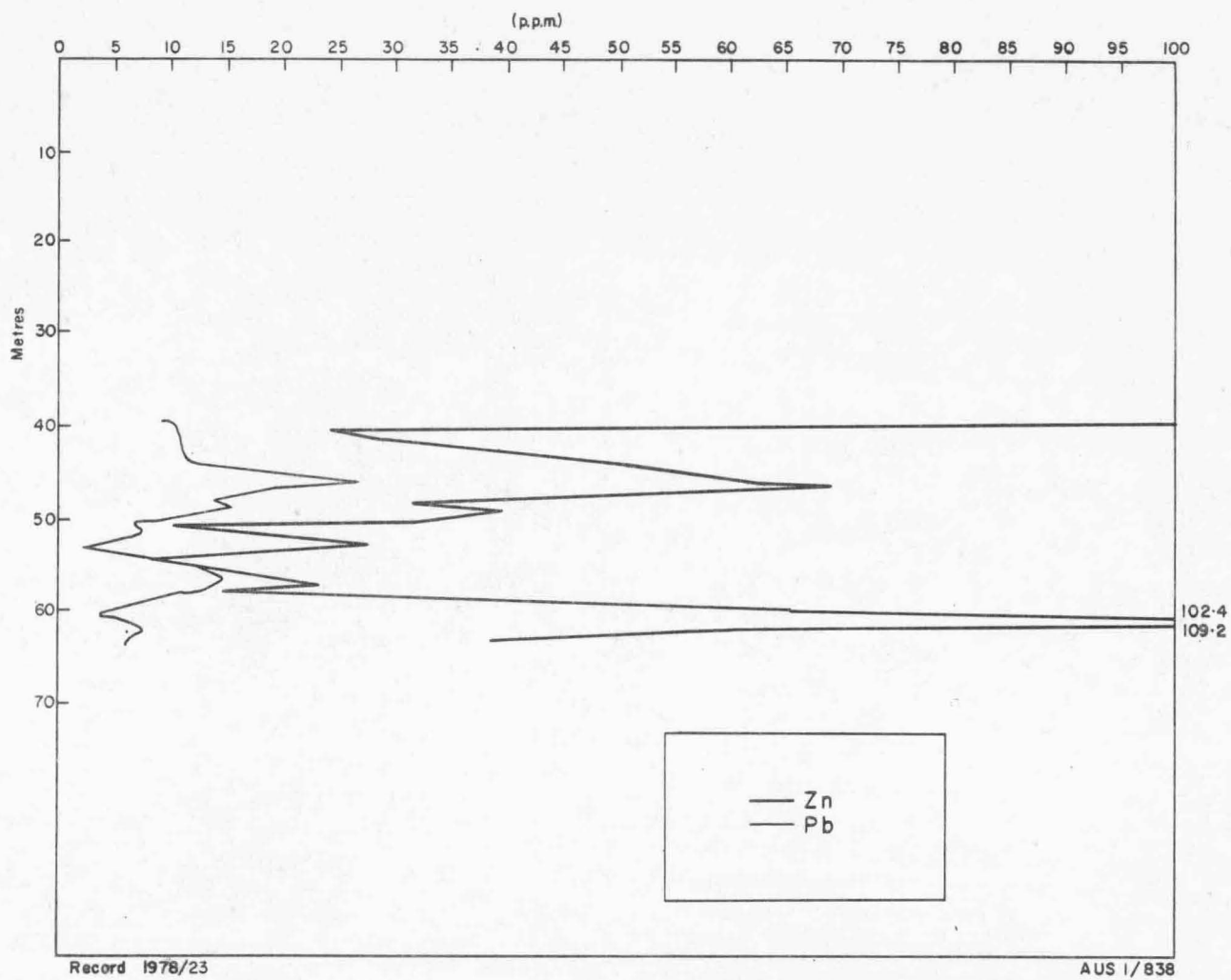


Fig 23 Depth plot Huckitta No.(GRGI)

green grey limestone containing ooids. The interval 56.4-64 m comprises grey, brown, and red oolitic limestone with grey, brown, and green siltstone. A phosphatic brachiopod at 63.4 m gives the unit an age of no older than Late Cambrian (Milligan, op. cit.) and is tentatively correlated with the Arrinthrunga Formation. Smith (1972) considers that the unit could correspond to either the Arrinthrunga Formation or Tomahawk Beds.

Pb and Zn values show wide variation in values, Zn values being greater and more variable than Pb values. The Pb and Zn values do not reflect the lithological subunits. Since siltstone is common to all three subunits, it is possible that the majority of the Pb and Zn present is sorbed on clays and organic matter.

BMR ELKEDRA No. 4 (formerly GRG 4)

A carbonate sequence was intersected at 27.7 m and the hole was completed at 225 m. The sequence was included in the Arrinthrunga Formation by Milligan (1963), but subsequently the sequence was included in the Meeta Beds (Smith, 1972), which is correlated in part with the Arrinthrunga Formation. Four separate subunits were recognised in the sequence (Milligan, 1963). From 27.7-110 m, green-grey pellet dolomite is present, with interbeds of red and green lutites, and interformational breccia. From 110-163 m, pink and white porous dololutites with pellet dolomite and intraformational breccia are present, with interbeds of red and green lutites. Light and dark grey limestone with green, grey, and black lutite interbeds are present between 163-189 m. Light and dark grey aphanitic dolomite is present between 189-225m, with interbedded dark green, grey, and black lutites.

Pb and Zn values (Fig. 24) are similar and show little variation, with Zn values more variable than Pb. The geochemistry does not reflect the lithological division. Since lutite is common to all subunits, and the values unaffected by whether dolomite or limestone present, the Pb and Zn would appear to be associated with fine-grained material.



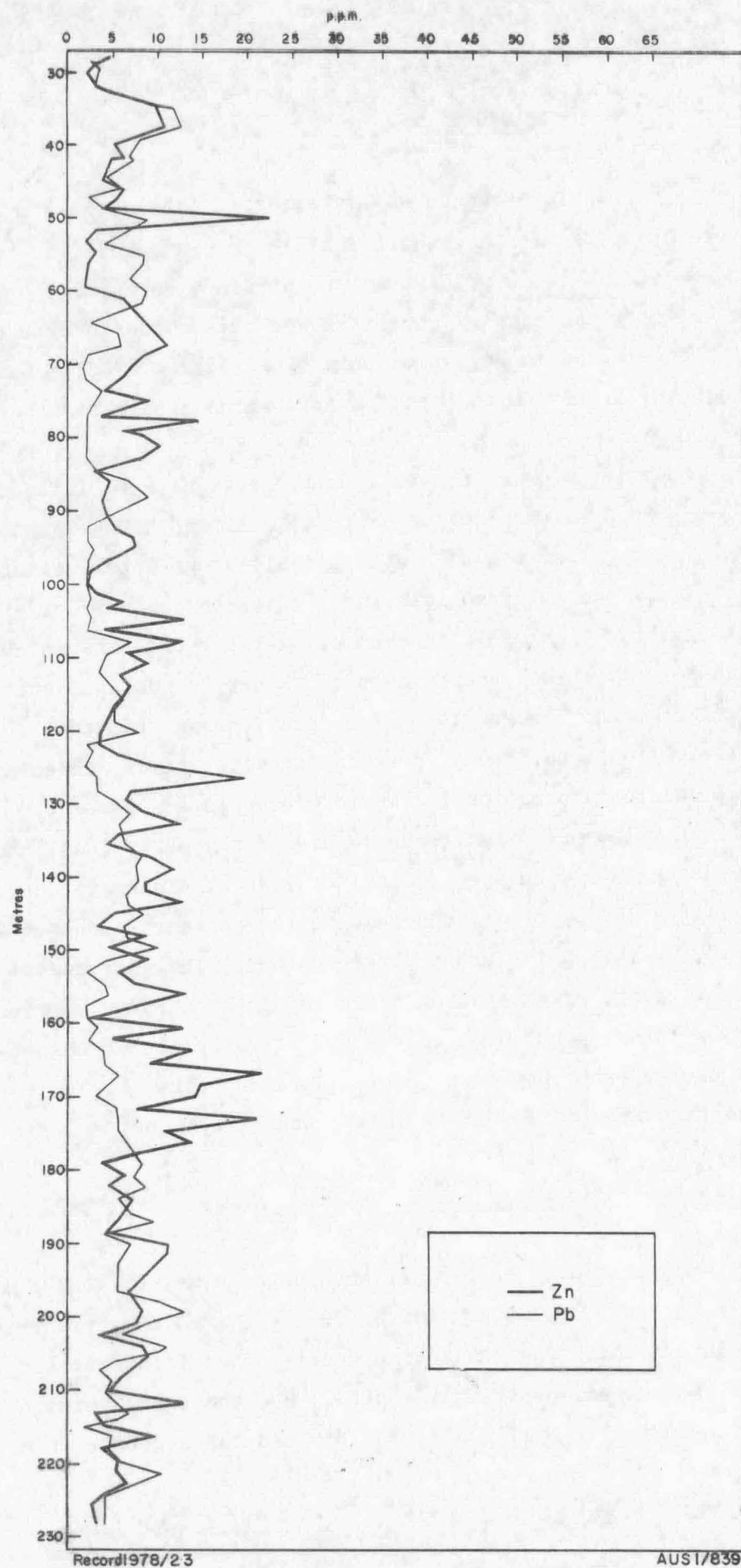


Fig 24 Depth plot, Elkedra 4(GRG4)



ELKEDRA No. 5 (formerly GRG 5)

A carbonate sequence was intersected between 52.7 m and the base of the hole at 137.2 m. On the original log the sequence was correlated with the Adelaidean to Lower Cambrian Grant Bluff Formation, but the identification of Late Cambrian trilobites showed this to be incorrect. The sequence was not referred to any named unit by Milligan (1963). Smith (1972) recognised similarities with both the Arrinthrunga Formation and Tomahawk Beds.

Four lithologic subdivisions are recognised (Milligan, 1963). From 52.7 m - 80.8 m, the rock consists of pink and blue limestone and chocolate, green, grey, red, brown, and purple siltstone interlaminated with calcarenite. Limestone, grey oolitic sandy calcarenite, buff or green sandstone and black and blue black siltstone comprise the rocks between 80.8-112.8 m. From 112.8-131 m the rock comprises buff to grey sandstone, and silty oolitic chocolate limestone. From 131-137.2 m, grey, brown, two-tone (grey and pink) oolitic limestone, brown, grey calcarenite, sandy, chocolate, red siltstone, and intraformational limestone breccia are present.

Zn values are significantly higher than Pb values, and are more variable. Both Pb and Zn show a distinct zone of higher values from 80.8-91 m. Milligan (1963) places the base of the weathered zone at 80.8 m. The rocks below this point are a darker colour. The increase of values at this point suggests precipitation of Pb and Zn at a Eh/pH barrier. Zn values below this zone of high values are slightly higher than those above; Pb values on the other hand are lower. This suggests slight depletion of Zn and slight concentration of Pb in the weathered zone.

BMR HUCKITTA No. 7 (formerly GRG 7)

Huckitta No. 7 entered Arrinthrunga Formation at 1.8 m and bottomed in the unit at 230 m. Smith (1972) divided the Arrinthrunga Formation into 4 units and considered Huckitta No. 7 intersected the lower portion of the second lowest unit (Unit 2) and the upper portion of the lowest unit (Unit 1). Milligan (1963) divided the sequence intersected

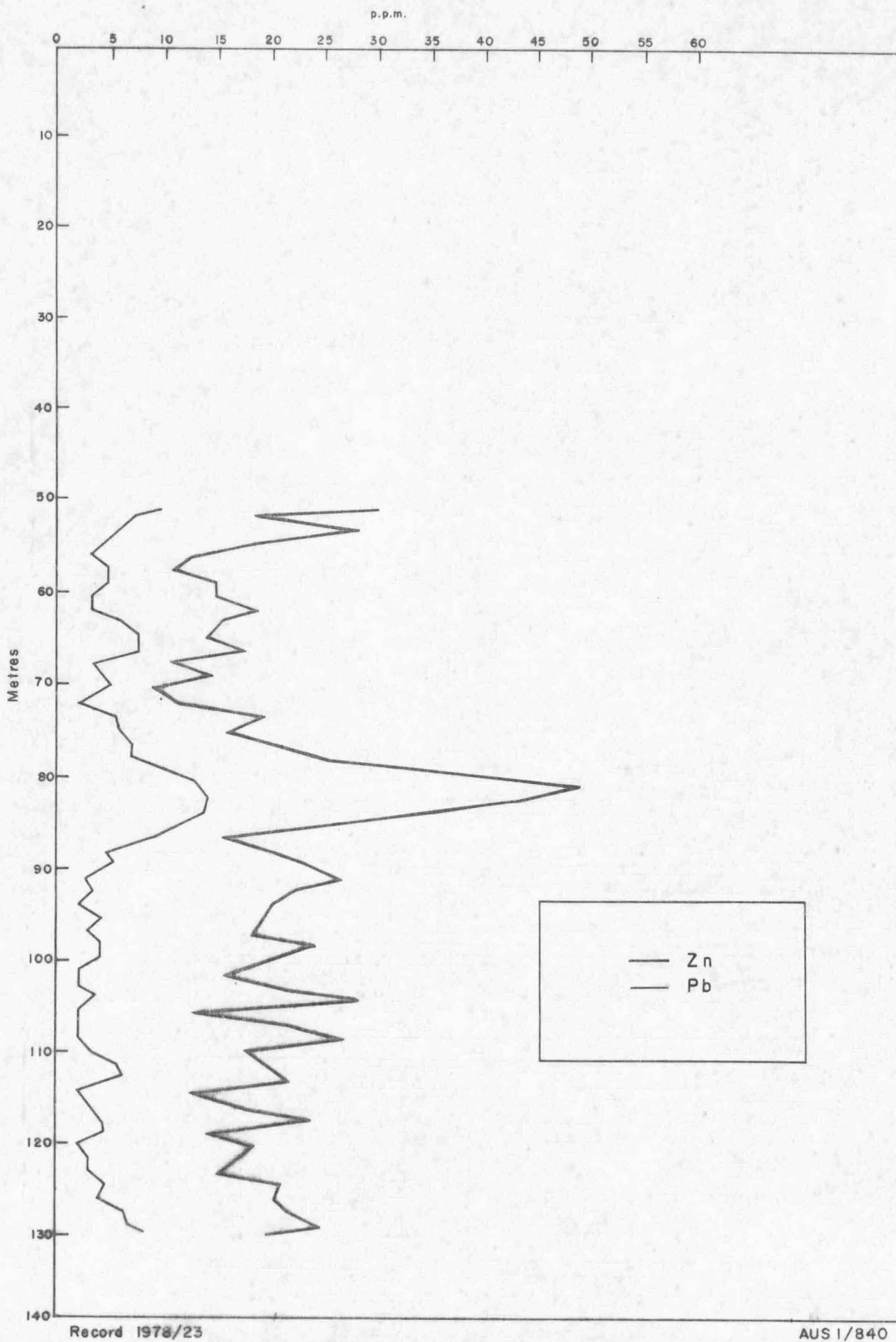


Fig 25 Depth plot - Elkedra 5 (GRG5)

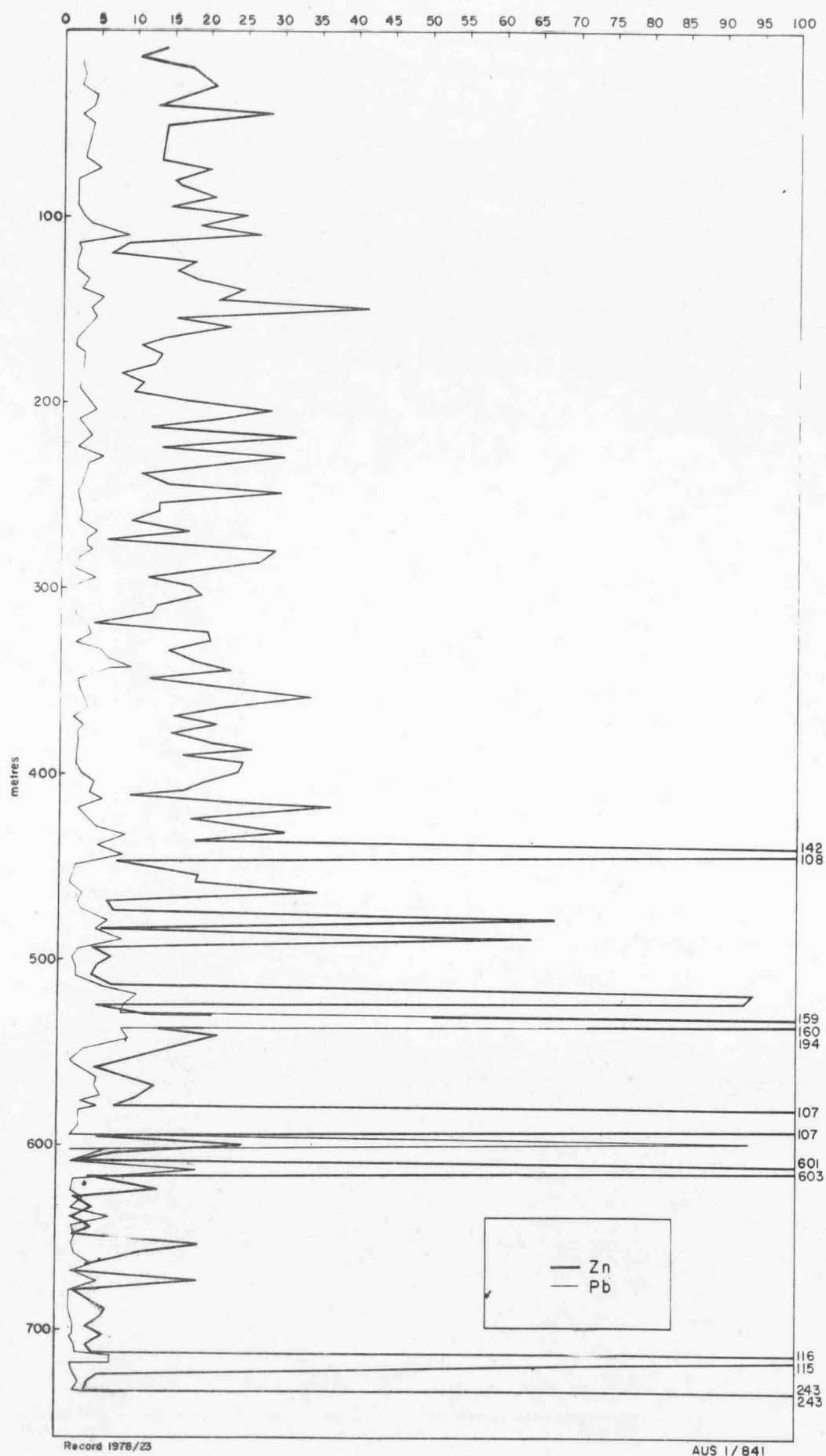


Fig 26 Depth plot-Huckitta 7(GRG7)

into three subunits. From 1.8-141.7 m, the rocks consist of equal amounts of bedded limestone and siltstone which grade into one another. The limestone is aphanitic to silty and grey, brown or green in colour. The grey, green grey, blue grey, brown, red and chocolate siltstone is calcareous to very calcareous. Intraformational breccia is infrequently present, as well as minor sandstone beds. Aphanitic to crystalline, grey and brown dolomite, which is often silty characterises the interval 141.7-158.5 m. Minor black siltstone is also present. Dolomite of a similar nature to that between 141.7-158.5 m is also present between 158.5 and 230 m, but is associated with dolarenite and pelletal dolomite.

Zn values (Fig. 26) are higher than Pb; both show considerable variation. Zn values, however, do reflect the change from limestone to dolomite at 141.7 m where Zn values change to consistently lower background values. From 15 m above, and for all rock below 141.7 m, maximum Zn values are higher. Re-examination of the core (Jennard, personal communication, 1977) and verification by XRD proved the presence of sphalerite in the region of anomalous zinc values.

#### BMR HUCKITTA No. 8 (formerly GRG 8)

Huckitta No. 8 passed through Arrinthunga Formation from 3.6 m to the base of the hole at 89.9 m. This sequence is higher stratigraphically than that in Huckitta No. 7. Milligan (1963) recognised two subunits within the sequence. Between 3.6-26.8 m. the main lithology is silty grey to pink limestone and calcilutite with some green and grey siltstone. The remainder of the sequence is similar to the above, but contains sandy and oolitic pink and grey calcarenite.

Zn values (Fig. 27) are higher than Pb values, and both show some variance. The subunits recognised by Milligan (1963) are very similar and geochemistry fails to distinguish them. Sphalerite is present in the core just below where the anomalous sample was taken (J. Kennard, personal communication, 1977).

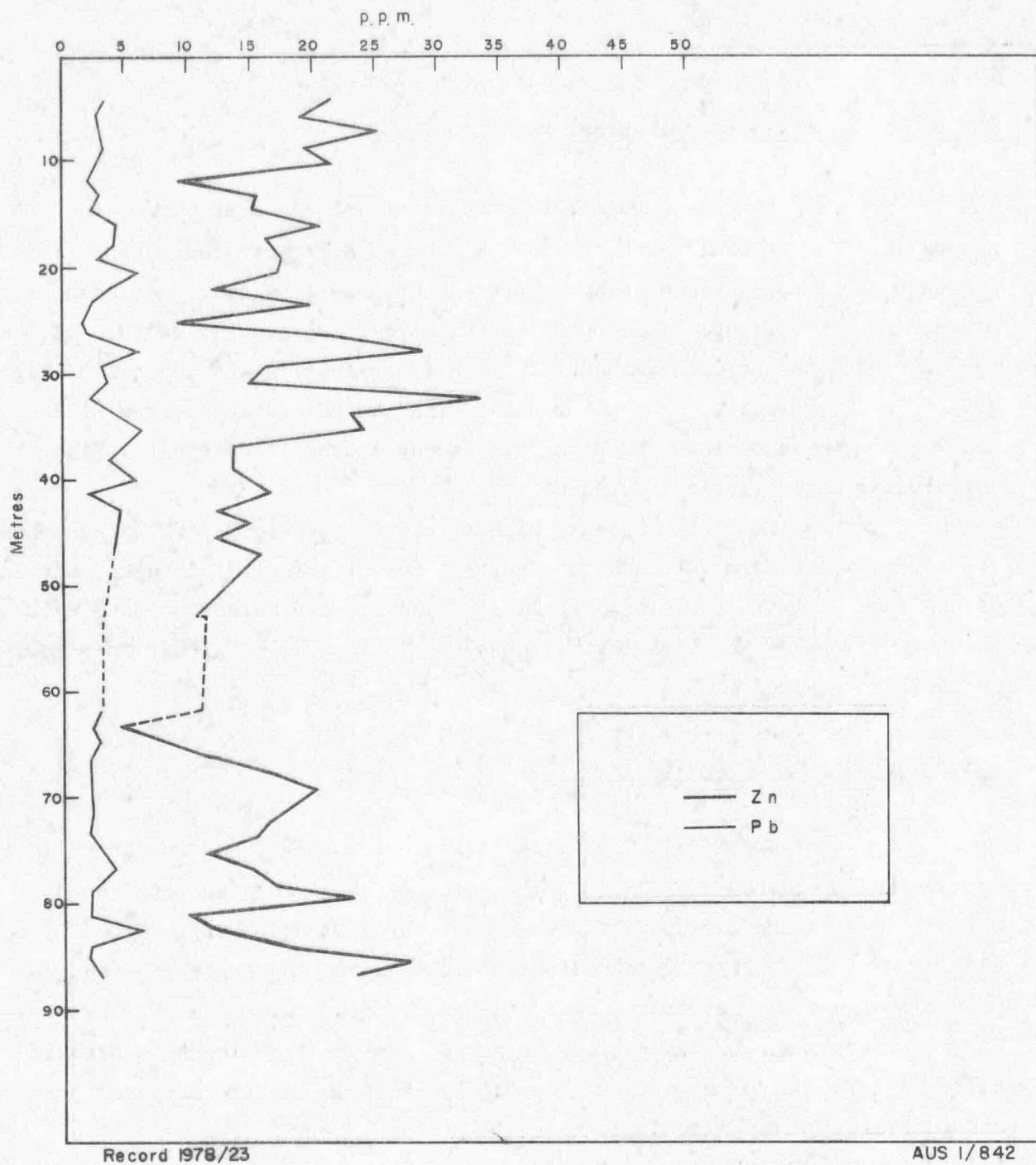


Fig 27 Depth plot Huckitta 8(GRG8)



BMR URANDANGI No. 9 (formerly GRG 9)

Urundangi No. 9 penetrated a dolomite sequence at 0.6 m, and continued in it to a total depth of 113.7 m. No fossils were found, and the sequence is tentatively correlated with the Camooweal Dolomite. It can be divided into two lithological subunits (Milligan, 1963). Between 0.6-82.3 m, the sequence consists predominantly of finely crystalline to aphanitic, light grey to white dolomite, with minor dolarenite and dololutite. From 82.3-113.7 m light grey dololutite with rare, sandy lenses is dominant. Minor intraformational breccia is present.

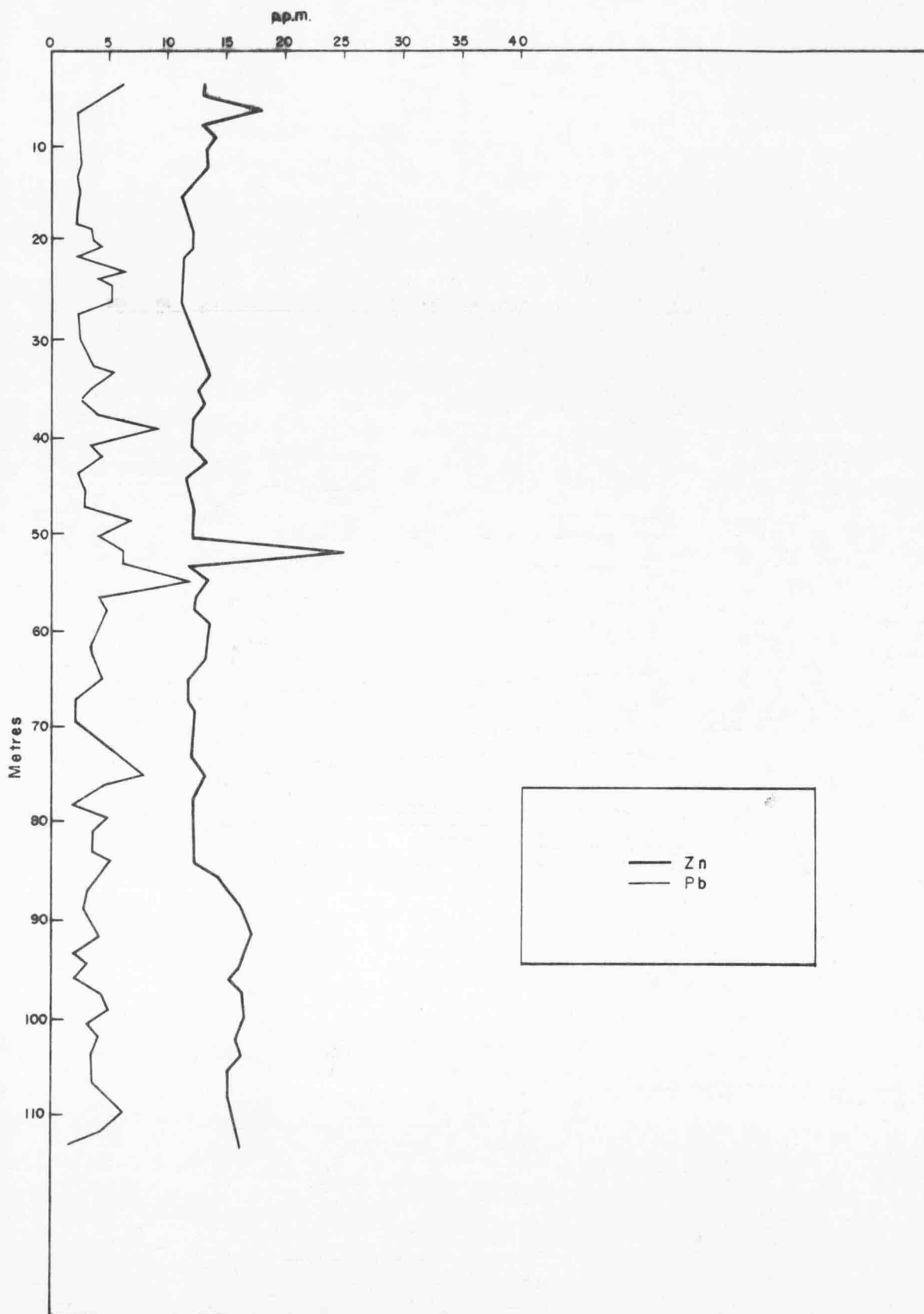
Zn values (Fig. 28) are higher than Pb values, but Pb values show greater variance. Pb values do not reflect the lithological changes, but Zn values show a distinct increase in minimum and average values at 85.3 m, which is 3 m below the lithological change. This suggests higher Zn values in the fine-grained rocks.

BMR TOBERMORY No. 11 (formerly GRG 11)

Tobermory No. 11 penetrated dolomite at 7.3 m, and continued in it to the base of the hole at 139 m. The sequence is correlated with the Ninmaroo Formation and divided into two subunits (Milligan, 1963). From 7.3 m to 82 m, aphanitic to crystalline dolomite with a small and scattered sand component is present. Between 82 m and 139 m dolomite similar to that between 73-82 m is present, but is pelley in parts. Dolarenite, which is occasionally oolitic and contains rare glauconite, and some intraformational breccia and conglomerate are also present.

Pb and Zn values (Fig. 29) are of the same order. Two major geochemical subdivisions are recognised corresponding to the lithological subdivision. The reason for such an abrupt change is not evident from the lithology, but may reflect a decrease in the fine-grained terrigenous component, and an increase in coarser carbonate content. The sequence is very cavernous and vuggy, and the numerous very high values of Pb and Zn above 82 m are associated with a cavernous zone. There are other variations apparent, but examinations of the core will be necessary to determine significance.





Record 1978/23

AUS I/843

Fig 28 Depth plot, Urandangie 9 (GRG9)

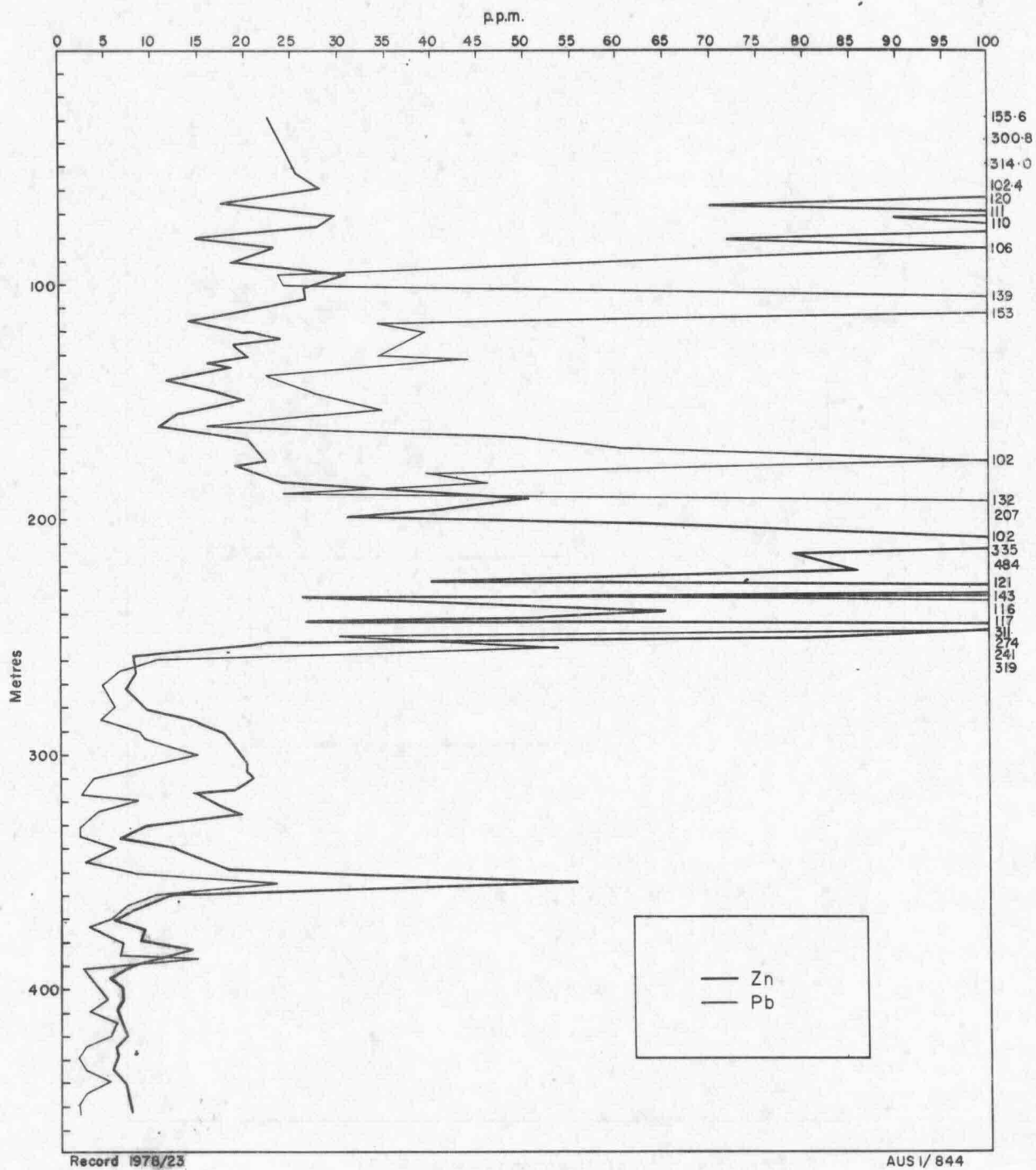


Fig 29 Depth plots, Tobermory II (GRG.II)

BMR TOBERMORY No. 12 (formerly GRG 12)

The sequence sampled in Tobermory No. 12 is from 99 m to the base of the hole at 230 m, and is correlated with the Tomahawk Beds (Milligan, 1963). Four lithological divisions are recognised (Milligan, 1963). Between 99 and 137.2 m the rock is chiefly coarse crystalline dolomite with some glauconites and ooids. Mirror dolarenite and intraformational conglomerate is present. From 137.2-164.6 m grey dolomitic sandstone is present. The interval 164.6-190.5 m contains dolomite, while from 190.5-230 m interbedded sandstone and siltstone are present with minor dolomite, dolarenite and intraformational conglomerate. Glauconite is present in this last subunit.

Pb and Zn values (Fig. 30) are similar, and show considerable variance. The intervals 99-137.2 m and 137.2-164.6 m are geochemically similar, but the top half of the underlying division (164.6-190.5 m) shows less variance in Pb and Zn. The lower half of the interval is geochemically similar to the upper intervals. The basal division (190.5-230 m) shows overall reduced variance. The zones of lower variance correspond to areas of high sand content.

PHILLIPS-SUNRAY BLACK MOUNTAIN No. 1

The interval 6 - 920 m was sampled in Black Mountain No. 1 (Phillips Petroleum Company, 1963) 6 - 180 m, the Chatsworth Limestone (6 - 180 m) comprises light grey, grey, to buff limestone which is crypto-microcrystalline. The limestone is argillaceous and silty in part, and contains some glauconite. Interbeds of grey to dark grey, micaceous, calcareous shale are present. The O'Hara Shale between 180-230 m comprises dark grey shale which is very micaceous, silty, and slightly calcareous. Fine laminations of brownish grey calcareous siltstone occur. Silty limestone between 230-478 m is correlated with the Pomegranate Limestone. The remaining rock (478-920 m) is tentatively assigned to the Inca Shale and comprises light grey, buff to dark grey-brown, crypto to microcrystalline limestone. The limestone is argillaceous and silty in part, and interbedded with grey to dark grey to black shale which is calcareous and micaceous in part. Pyrite, glauconite, and calcite veining are present.

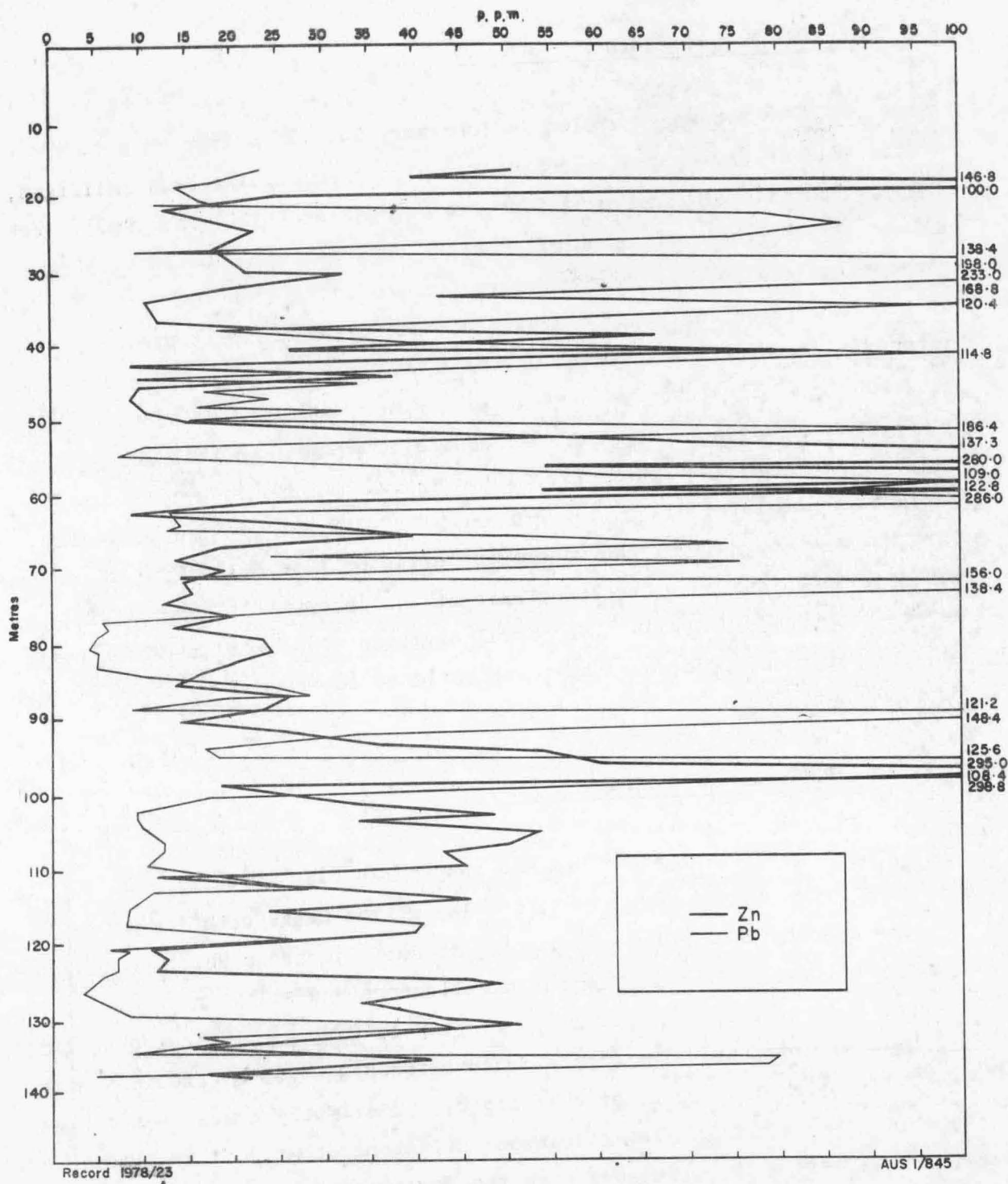


Fig 30 Depth plot Tobermory 12 (GRG12)

Zn values (Fig. 31) are generally higher than Pb values by a factor of 2, but variance is similar. The geochemistry does not reflect the formation changes. The Zn values increase significantly at 730 m. This corresponds to presence of a limestone although the values are even higher in the underlying shale.

PHILLIPS-SUNRAY BEANTREE No. 1

The interval sampled (92.4-488.9 m) is correlated with the Pomegranate Limestone (Phillips Petroleum Company, 1963). It is overlain unconformably by Lower Cretaceous strata and underlain by Middle Cambrian. The well bottomed in metamorphic and igneous basement. The lithology, consists of light grey, hard, dense microcrystalline limestone. The limestone is thinly interbedded with medium grey, hard, slightly calcareous siltstone containing fine-grained mica. Fossils include brachiopods and trilobites, mainly Late Cambrian although the base of the sequence may be late Middle Cambrian. Porosity is low.

Zn values are greater than Pb values (Fig. 32) by a factor of 2, and show greater variance. The variance is similar to that expected for interbedded limestone and siltstone. The zone of less variance from 122-244 m may reflect the low sampling density.

ALLIANCE MULGA No. 1

Mulga No. 1 (Laing, 1965) intersected Ninmaroo Formation Arrinthunga Formation and Marqua Beds. The sampling interval is too wide for any comparative purposes and is confined to the Ninmaroo Formation and upper Meeta Beds. However, all elements show a considerable variation (Fig. 33) with a distinct band of higher Pb values in the lower part of the sampled interval. Australian Aquitaine Petroleum Pty Ltd had also carried out analyses on this hole, and, combining their results (Appendix 2) with those obtained by BHP, it is apparent that there is a zone of anomalous Pb values in the upper part of the Meeta Beds with lesser anomalies of Zn and Ba.

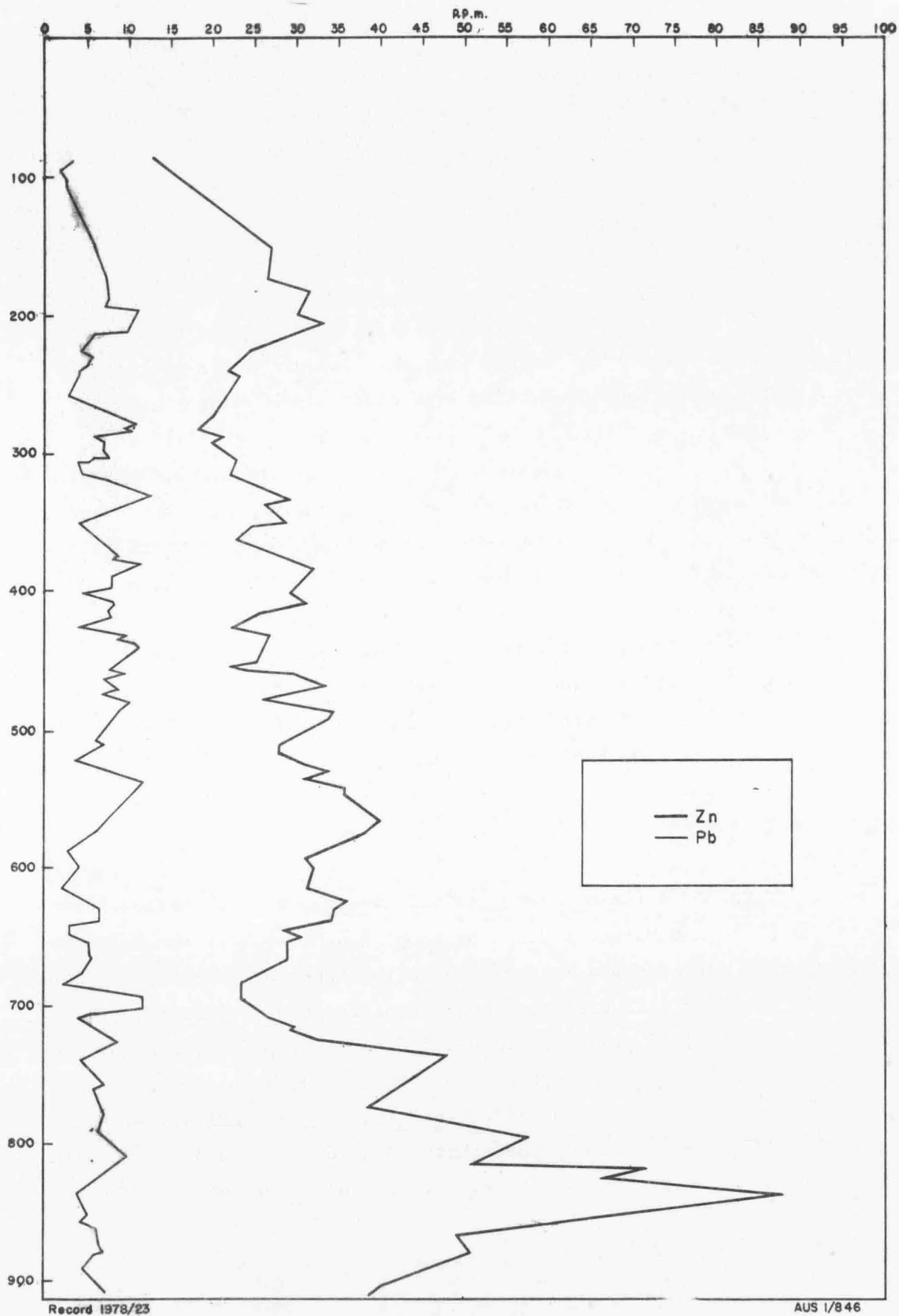


Fig 31 Depth plot, Black Mountain No. 1



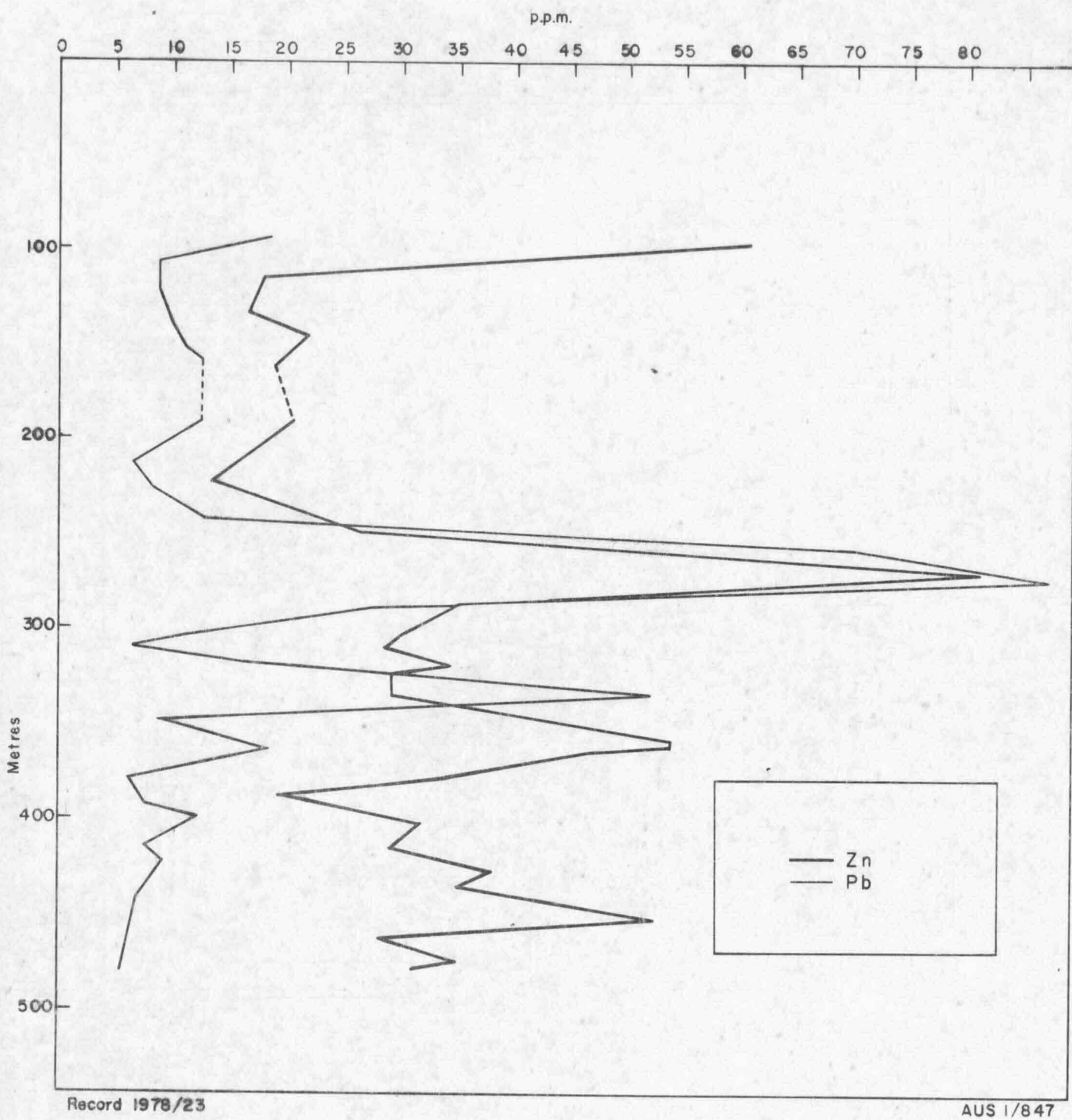


Fig 32 Depth plot, Beatree No. 1.

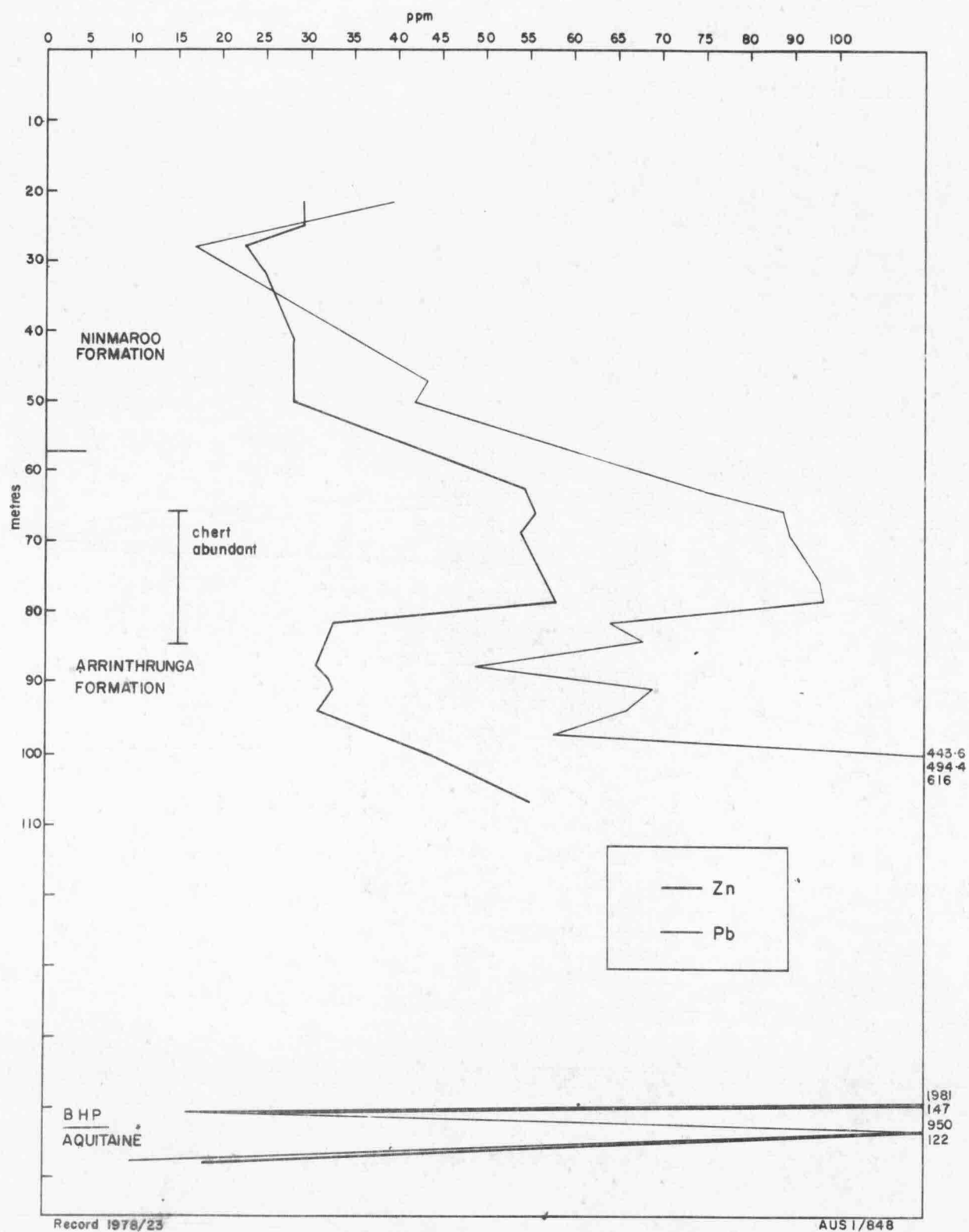


Fig. 33 Depth plot, Mulga No. 1

AMMAROO No. 1

167 m of fine-grained limestone and shale of the Sandover Beds were intersected by Ammaroo No. 1. Geochemistry sample intervals were too widely spaced to be useful for comparison. Zn values (Fig. 34) show much variation.

GRG 3A, 15A, 16, 17, 18

Only narrow intervals were sampled and the results are of little value.

Discussion

A number of wells, BMR Huckitta No. 1, No. 7, No. 8, No. 3A, BMR Elkedra No. 4 and No. 5 and Alliance Mulga No. 1, examined intersect the Arrinthrunga Formation and Meeta Beds. Pb and Zn, particularly Zn, have a wide range of values probably reflecting lithological variations. Anomalous values of Zn in Huckitta Nos. 7 and 8 are associated with sphalerite. Anomalous Zn values are also present in Huckitta No. 1 and Alliance Mulga No. 1, neither of which has been examined in detail. However Laing (1965) mentions a green crystalline mineral occurring in the vicinity of anomalous Zn values in Mulga No. 1.

There are few anomalous Pb values, except in Mulga No. 1 where most of the upper part of the Arrinthrunga Formation (referred by Smith (1972) to Meeta Beds) has values well in excess of 100 ppm (Fig. 32). This zone of anomalous values is also shown by analyses done for Australian Aquitaine Petroleum Pty Ltd in 1972 (see Appendix 2). Values of over 1000 ppm (0.1 percent) are present. The nature of the occurrence is not clear, although a Ba (and minor Zn) anomaly may also be present. Aquitaine suggested that the dark nature of the rocks in the zone indicates reducing conditions and postulated that the anomaly resulted from secondary (epigenetic) mineralisation. The stratigraphic level at which this anomaly occurs is approximately the same level at which mineralisation occurs at Box Hole (Smith, 1972). The

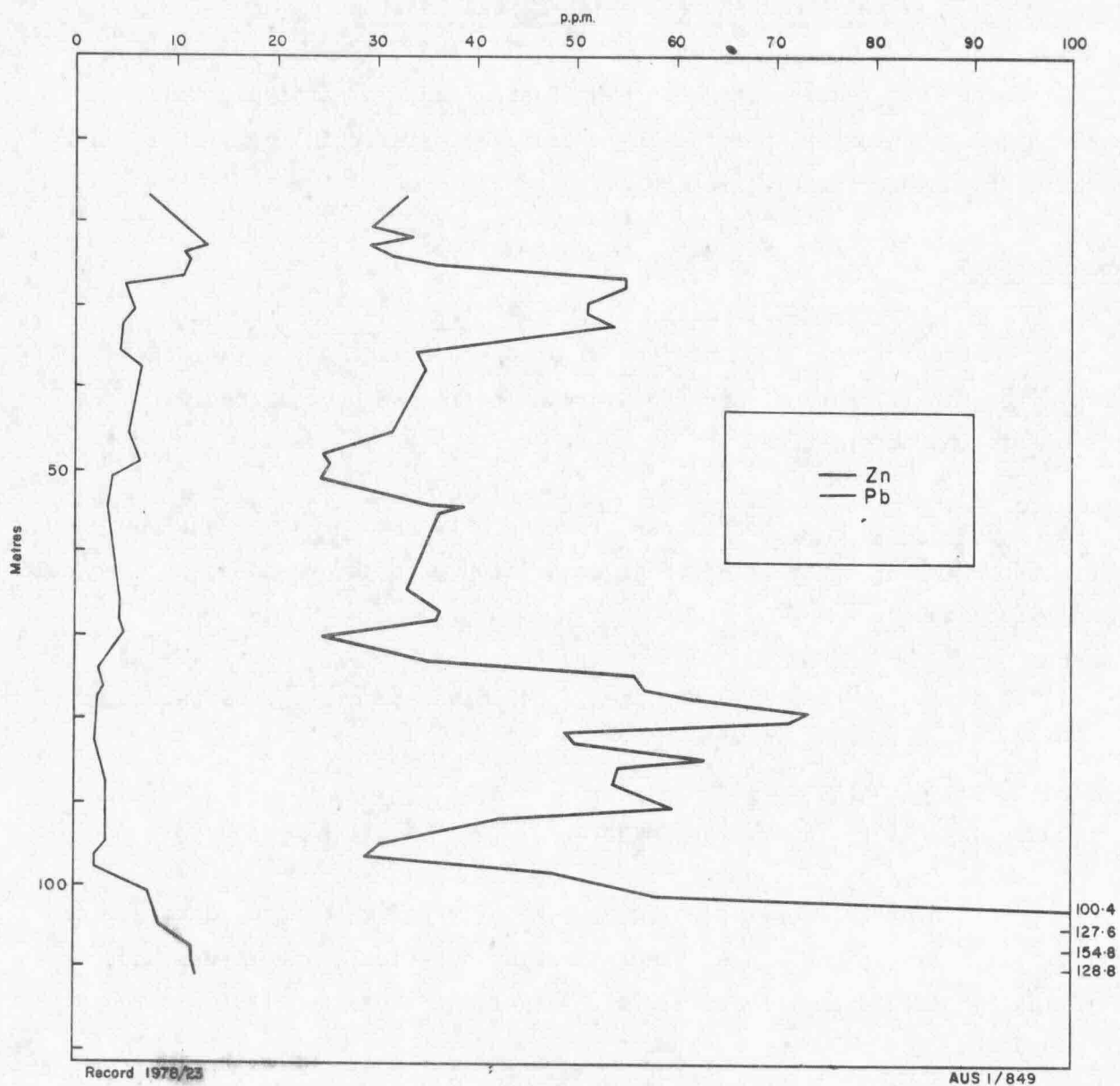


Fig 34 Depth plots-Amaro No. 1

mineralisation at Box Hole consists of galena, with minor sphalerite and barite. Syngenetic, early and late diagenetic origins have been proposed for the mineralisation. The upper part of the Arrinthrunga Formation (and Meeta Beds) would appear to have some prospectivity, particularly for lead.

#### PROSPECTS FOR LEAD-ZINC MINERALISATION

In this section, the Georgina Basin (and, in particular the southern and southeastern portions) are examined briefly in terms of a general model for Pb-Zn-Ba-F mineralisation in carbonate rocks.

##### General model

Snyder (1968) outlined the major characteristics of the Mississippi Valley Type mineralisation, and the Georgina Basin can be examined with respect to his characteristics.

(a) Host rocks. The host rocks are generally transgressive shallow water carbonates or impure sandstones associated with the carbonates. Typical lithologies include:

- (1) sand-size clastic carbonates (intraclasts, ooids, skeletal carbonates);
- (2) algal carbonates;
- (3) organic reefs and reef debris.

Within the Georgina Basin, the majority of carbonate rocks are of shallow water origin and range through shallow sub-tidal, intertidal and supratidal (Shergold and others, 1976). Algal and sandsize clastic carbonates are abundant.

(b) Basinal position. The most favoured basinal positions are basin margins (associated with shorelines) or over topographic highs within the basin. Deposits also occur on the flanks of topographic highs.



Most of the known Pb-Zn mineralisation within the Georgina Basin is associated with possible basement highs. The delineation of basement topography of the basin is important in selecting target areas for exploration. Phosphate deposits in the basin are also associated with basement highs.

(c) Unconformities. Unconformities are extremely important in the formation of Mississippi Valley Type deposits. Callahan (1964) suggests that the study of palaeophysiography is the best means of exploring for such deposits. Unconformities are important for 3 reasons:

- (1) the surface of the underlying beds has been subjected to erosion and possible formation of cave and collapse breccias which are important ore loci;
- (2) the unconformity helps to control the facies distribution of the overlying beds, i.e. it may provide stratigraphic traps;
- (3) the unconformity acts as a conduit for mineralising solutions.

Major unconformities or disconformities in the Georgina Basin are:

- (1) Proterozoic-Vendian
- (2) Vendian - Lower Cambrian
- (3) Upper Cambrian
- (4) Lower Ordovician within Kelly Creek Formation
- (5) Middle Ordovician
- (6) Middle - Upper Devonian
- (7) Cretaceous

However there are probably a large number of local disconformities and diastems which may also act as loci for mineralisation.

(d) Limestone-dolomite relationships. Ore is often localised at or near the limestone-dolomite interface. Little mineralisation occurs in the limestone and is rare in dolomitised areas.



Dolomitisation is widespread throughout the basin, and both early and late diagenetic dolomites can be recognised. The units particularly affected by dolomitisation are Ninmaroo Formation, Camooweal Dolomite, Arrinthrunga Formation, Age Creek Formation, Nora Formation, Tomahawk Beds, Arthur Creek Beds and Kelly Creek Formation.

(e) Stratigraphic distribution. Although production is restricted to certain stratigraphic horizons, mineralisation is present over a wide stratigraphic interval.

Mineralisation (Pb, Ba, Zn) occurs at Box Hole in the upper part of the Arrinthrunga Formation, and anomalous values of the same elements occur at a similar level in the Meeta Beds (Arrinthrunga Formation) in Alliance Mulga No. 1. Sphalerite is spasmodically distributed throughout the lower part of the Arrinthrunga Formation, as seen in BMR Huckitta Nos. 7 & 8.

Very minor mineralisation consisting of galena, fluorite, barite, and sphalerite occurs at a number of localities throughout the basin (Druce, 1976) and in a number of units. Galena is disseminated over a wide area in the Undilla area in the vicinity of Tott's Creek, where it appears to be confined to the interdigitating contact between the Camooweal Dolomite and the Age Creek Formation.

(f) Depth of occurrence. The only depth limitation appears to be the thickness of sediments. Mineralisation has been observed to 3000 m. However economic factors would restrict mining to much shallower depths, particularly in isolated areas such as the Georgina Basin.

(g) Major faults. Major faults are generally not mineralised, are tight, and characterised by dense gouge and breccia.

Major faults are present in the southern part of the Georgina Basin e.g. Toomba Fault, Sun Hill Fault. Near Signal Hill lead mineralisation occurs along a major fault.

(h) Minor fracturing and ground preparation. Minor faults do play a role in the physical localization of ore. However, their main role is in ground preparation - development of conduits for mineralizing solutions.

Within the Georgina Basin, numerous minor faults and areas of intense jointing occur (e.g. at Digby Peaks and around Mulga No. 1).

(i) Ground preparation through subsidence. Solution collapse breccias and similar features are important in increasing porosity in the rocks.

In the Digby Peaks, Swift Hills, and Black Mountain area collapse breccias dominate the uppermost Ninmaroo Formation and the Swift Formation. Collapse breccias may be present in other units in the basin. Mesozoic sediments fill karstic depressions in the Glenormiston area.

(j) Associated vein systems. In the classical areas the initial ore was mined from vein deposits. The geographic relationship of these deposits with stratabound deposits suggests a genetic relationship which is not yet appreciated.

(k) Stratigraphic traps. Stratigraphic traps include pinchout of beds against the flank of an underlying high, thinning of beds over a high, and lateral facies variations. Differential compaction effects as a result of facies variation is also important.

Lateral facies variations are extremely common within the Georgina Basin carbonates, but insufficient work has been done to enable stratigraphic traps to be detected. However, it is extremely unlikely that they would not exist in the basin.

(l) Reefs and associated structures. Reefs provide a rigid porous core around which finer grained, less competent carbonates are deposited. During tectonic activity reefs may fracture more rapidly than surrounding rocks.

No large reefs are known in the Georgina Basin and they are unlikely to occur. However numerous boundstones and small algal patch reefs are present in most units.

(m) Breccias. Four types of breccias have been recognised in the classical Mississippi Valley Type deposits:

- (1) submarine slide breccias;
- (2) collapse breccias as a result of solution;
- (3) pseudobreccia - in situ formation due to differential dissolution;
- (4) fracture breccia.

In the Georgina Basin, the three latter types are present in many units, although not to any great extent.

(n) Fissures. Fissures resulting from joints and minor faults act as ore loci in many areas.

Fissures are present in the Georgina Basin.

(o) Size of ore body. The size of the ore body is dependent on the size of the entrapping structure. In exploration, the size of the potential trap and the grouping of potential traps into subdistricts is important.

More detailed geophysical work is required in the Georgina Basin to delineate suitable areas and structures.

(p) Elements present. Ore minerals are generally sulphides, sulphates and halides; complex minerals are rare. Zn, Pb, Cu and Fe are invariably present. Either zinc or lead may be predominant. Barite and fluorite are often present and may be the major ore minerals in some cases. Co, Ni, Cd, Ge, and Hg are usually but not invariably present.

Galena (PbS), sphalerite (ZnS), barite (BaSO<sub>4</sub>) and fluorite (CaF<sub>2</sub>) are the main minerals observed in the Georgina Basin. Chalcopyrite (CuFeS<sub>2</sub>) is present at Box Hole (see below). Little work has been done on element associations.

(q) Isotopic character of lead. Lead present is generally of the radiogenic J-type. A wide range of values is generally found, although a systematic pattern can be recognised in many areas. The data is open to a number of interpretations but does indicate deposition over a long time period and tends to rule out a syngenetic origin.

(r) Isotopic character of sulphur. Biogenic source of sulphur is suggested by Snyder (1968). Heyl and others (1974) suggest a crustal origin, but are unable to decide on a specific source from within the crust.

No isotopic data is available for the Georgina Basin.

(s) Paragenesis. Mineralisation covers a long period of time, and it would appear that during deposition there are changes in composition of the depositing solution and the conditions of deposition.

(t) Composition of fluid inclusions. Saline water, probably of connate origin, appears to be the vehicle for transport of the metal. Na-Ca-Cl brines have been detected in fluid inclusions, and this strengthens the contention of many authors that there is a close association between hydrocarbon formation, transport and entrapment and metal transport and entrapment. It is likely that the metal and sulphur are derived from different sources and mixed.

Saline water is present in the deeper parts of the Toko Syncline. Anhydrite and gypsum pseudomorphs are present in the Ninmaroo Formation and Arrinthrunga Formation. Preliminary work suggests that part of the Arrinthrunga Formation is deposited in a sabkha environment (J. Kennard, personal communication, 1977) and hence brines would be present. The Ninmaroo Formation (B. Radke, personal communication, 1977) and some of the units in the Undilla area may also contain sabkha-like environments.

(u) Temperature of deposition. Temperature data indicates a temperature range of 75-150°C.

No data is available for the Georgina Basin.

(v) Silicification. The amount of silica in the ore appears to be closely related to the amount of silica contained in the host rock.

Silicification is associated with mineralisation at Tott's Creek and Box Hole.

#### Known mineralisation in Georgina Basin

##### Box Hole

Box Hole (or Turkey Creek) is the best studied Pb-Zn mineral occurrence within the Georgina Basin. In the late 1950's galena was identified by W.H. King within silicified dolomites. The mineralisation could be traced for 3 km on the eastern limb of a syncline. He mined 15 tons of 65-70% lead ore. In 1960 King and Enterprise Exploration N/L carried out a diamond drilling program which revealed that the mineralisation was strata-bound, and cut off by faulting. The major control of mineralisation was considered to be stratigraphic, with minor structural control. Woolley & Rowchow (1960) examined the locality for BMR, and suggested a syngenetic origin with subsequent supergene enrichment and redistribution. Central Pacific carried out drilling investigations in 1971 with poor results. Bege of CRA Ltd (in Reid, 1975) considered the deposit to be a late diagenetic accumulation derived from syngenetic dispersed sulphides. Anglo American Australia Ltd (Reid, op. cit.) carried out a detailed survey in 1974, consisting of geological mapping, gravity surveys and geochemical sampling but failed to disclose significant mineralisation. The deposit is currently under investigation by BHP Co. Ltd.

##### Other occurrences

Tott's Creek deposit near Camooweal has been examined by both Utah and Aquitaine Australia. Galena mineralisation appears to be restricted to the contact between the Camooweal Dolomite and the Age Creek Formation, and consists of scattered crystals and nuggets and as vug and joint filling in dolomite. The mineralisation although widespread is of low grade.



A minor occurrence of galena occurs near Noranside (Smith, 1972) and consists of blebs and patches of crystalline galena in a travertine-like dolomite gangue. It is associated with major faulting.

#### Methods of prospecting

Although it would appear that the Georgina Basin has many favourable attributes for Pb-Zn mineralisation, no major deposits have been discovered to date. However only small areas of the basin have been examined in detail, and much is obscured by alluvium, sand or younger rocks.

In the initial stages of exploration, detailed geological knowledge is a prime requirement. Of the attributes outlined in the model only a few are important in preliminary exploration.

- (a) host rock
- (b) basinal position
- (c) unconformities
- (d) limestone-dolomite relationship
- (e) stratigraphic distribution
- (f) structural setting, and ground preparation through subsidence.

Geophysical techniques, such as detailed aeromagnetics and gravity would be extremely useful in delineating basement configuration. Geochemical methods are probably of little value in the initial stages. Stream-sediment surveys carried out by companies in the basin have been difficult to interpret and are very much influenced by scavenging affects of iron and manganese oxides. Whole rock geochemistry may also be of limited value. Sangster (1968) in a study of three deposits in Canada (including Pine Point) found that primary dispersion was minimal, being less than 65 m for "larger deposits" and less than 25 m for "smaller occurrences". The data for the Georgina Basin is somewhat variable. Sphalerite was detected in core by geochemistry on some occasions but not on others. Draper (1976) indicated that the Noranside lead occurrence could be detected at a distance of 700 m



but this deposit may not be typical of Pb-Zn deposits in carbonate rocks. It is possible however, that geochemistry may be useful in delineating favourable stratigraphic horizons on which to focus exploration.

On current geological knowledge, the Arrinthrunga Formation could be worthy of investigation. The geochemistry presented in this report suggests that the uppermost part of the Arrinthrunga Formation and Meeta Beds may be enriched in Pb, Zn and Ba. The known mineral occurrence and anomaly are associated with an apparent basement ridge and high respectively. The prospect near Trackrider Base in the base of the overlying Tomahawk Beds is also associated with an apparent basement dome. The carbonates in the unit are of shallow water origin (intertidal to supratidal), and both limestones and dolomites are present. The sabkha type environment of part of the Arrinthrunga Formation (J. Kennard, personal communication, 1977) would indicate that suitable brines may have been present. Hydrocarbons are present in the unit (Draper, Shergold and Heighway, in press). Gypsum is present in the unit as are pseudomorphs after gypsum and anhydrite.

One unconformity worthy of investigation is the post-Devonian to Cretaceous karstic surface. The long period of ground preparation should have resulted in conduits for ore transport and traps of the type discussed by Callahan (1964). Cubic pseudomorphs of limonite after pyrite have been found associated with the unconformity at a number of localities in the basin. Barite is present in the base of the Cretaceous near Momedah Anticline on the Burke River Structural Belt (Casey and others 1960). High fluorite values in bore water in the same general area are also reported (op. cit.).

Possible source of lead and zinc for subsequent redeposition would be the carbonate rocks themselves plus the interbedded siltstones and shales, leaching from mineralized basement rocks, or a combination of sources. On the present karstic surface manganese and iron oxide weathering products are concentrating zinc (up to 6 500 ppm Zn) and barium (up to 1.14%). This may be a suitable mechanism for preconcentrating elements deposited in karst prepared traps in previous geological ages.

### CONCLUSIONS

1. Significant geochemical differences exist between units with the carbonate fraction elements and organic carbon being most important in outlining the differences. The whole rock elements show little variance between units.

2. The uppermost part of the Arrinthrunga Formation/Meeta Beds would appear to be a favourable stratigraphic horizon for lead mineralization. Scattered sphalerite occurrences in the lower part of the Arrinthrunga Formation are associated with stylolites and compaction features. These sphalerite occurrences are reflected by the geochemistry.

3. An occurrence of sphalerite in the Ninmaroo Formation in BMR Boulia No. 9 has no geochemical imprint in samples taken only centimetres away.

4. The extreme variance of Pb and Zn in some units and the possibility of little primary dispersion of these elements, suggest that whole rock geochemistry is of limited value in delineating deposits but may be useful in outlining favourable stratigraphic horizons.

5. Examination of correlations and R-mode clustering shows some interesting associations:

Ca-Sr : a reflection of the ability of Sr to substitute for Ca;

Fe-Mn : a reflection of the similar chemical behaviour of these elements. They are often associated with Mg indicating that they are affected by dolomitization;

P-F-Acid Insoluble: indicates phosphate present as apatite and is present in the non carbonate fraction;

Ba-Mn : difficult to explain but may indicate that the insoluble fraction exercises some control over the Mn content of the carbonate phase. The nature of this control is uncertain at present.

Fe and Mn - P and F : difficult to explain but may be related to pH and Eh conditions.

#### REFERENCES

- BATHURST, R.C., 1975. Carbonate Sediments and their diagenesis. Developments in Sedimentology 12, Elsevier.
- CALLAHAN, W.A., 1964. Paleogeographic premises for prospecting for strata-bound base metal deposits in carbonate rocks. CENTO Symposium on Mining geology, Ankara, Turkey, 191-248.
- CASEY, J.N., REYNOLDS, M.A., DOW, D.B., PRITCHARD, P.W., VINE, R.R., & PATEN, R.J., 1960. The geology of the Boulia area, western Queensland. Bureau of Mineral Resources Australia Record 1960/12 (unpublished).
- DRAPER, J.J., 1976. Progress report on Georgina Basin geochemistry. Results of 1974 field season. Bureau of Mineral Resources Australia Record 1976/57 (unpublished).
- DRAPER, J.J., SHERGOLD, J.H., & HEIGHWAY, K.A., in press. A review of petroleum exploration and prospects in the Georgina Basin. Bureau of Mineral Resources Australia Record 1978/10 (unpublished).
- DRUCE, E.C., 1974. Georgina Basin project 1974-1980, a proposal. Bureau of Mineral Resources Australia Record 1974/44 (unpublished).

- DRUCE, E.C., 1976. Georgina Basin. In Geological Branch Annual Summary of Activities. Bureau of Mineral Resources Australia Report.
- GEHMAN, H.M., 1962. Organic matter in limestones. Geochemica et Cosmochimica Acta 26, 855-867.
- GRAF, D.L., 1960. Geochemistry of carbonate sediments and sedimentary carbonate rocks. Illinois Geological Survey Circular 297.
- HENDERSON, R.A., 1976. Stratigraphy of the Georgina Limestone and a revised zonation for the early Upper Cambrian Idamean Stage. Journal of Geological Society of Australia 23(4), 423-433.
- HEYL, A.V., LANDIS, G.P., & ZARTMAN, R.E., 1974. Isotopic evidence for the origin of Mississippi Valley-Type mineral deposits: a review. Economic Geology, 69, 992-1006.
- KENNARD, J.M., & DRAPER, J.J., 1977. BMR stratigraphic drilling in the Burke River Structural Belt, southeast Georgina Basin, 1974. Bureau of Mineral Resources Australia Record 1977/19 (unpublished).
- MAYO, W., & LONG, K.A., 1976. Documentation of BMR Geological Branch computer programs. Bureau of Mineral Resources Australia Record 1976/82 Microfiche MF4.
- MILLIGAN, E.N., 1963. The BMR Georgina Basin core drilling programme. Bureau of Mineral Resources Australia Record 1963/86 (unpublished).
- OPIK, A.A., 1956. Cambrian geology of Queensland. In El Sistema Cambrico, su Paleogeografia y el Problema du su Base. International Geological Congress, 20th Session Mexico, 2, 239-284.

- OPIK, A.A., 1960. Cambrian and Ordovician geology (of Queensland). Journal Geological Society Australia, 7, 91-103.
- OPIK, A.A., 1963. Early Upper Cambrian fossils from Queensland. Bureau of Mineral Resources Australia Bulletin 64, 133 pp.
- PHILLIPS PETROLEUM CO. LTD. 1963. Phillips-Sunray stratigraphic drilling ATP, 54P, Queensland. Unpublished company report.
- PRITCHARD, P.W., 1960. The Ordovician section of the Toko Range. Journal Geological Society Australia 7, 110-4.
- REID, E., 1975. Huckitta project exploration licence 987. Final report to Department of Mines, Northern Territory, by Australian Anglo American Limited (unpublished).
- SANGSTER, D.F., 1968. Some chemical features of lead-zinc deposits in carbonate rocks. Geological Survey of Canada Paper 68-39.
- SHERGOLD, J.H., DRUCE, E.C., RADKE, B.M., & DRAPER, J.J., 1976. Cambrian and Ordovician stratigraphy of the eastern portion of the Georgina Basin, Queensland, and eastern Northern Territory. 25th International Geological Congress (Sydney) Guidebook 4C.
- SYNDER, F.G., 1968. Geology and mineral deposits, Midcontinental United States. In Rydge, J.D. (Ed.) Ore Deposits in the United States 1933-1967. Vol. 1, 257-286, A.I.M.E. and P.E.
- SMITH, K.G., 1963. Hay River, N.T. - 1:250 000 Geological Series. Bureau of Mineral Resources Australia Explanatory Notes SF53/16.
- SMITH, K.G., 1964. Progress report on the geology of the Huckitta 1:250 000 Sheet Northern Territory. Bureau Mineral Resources Australia Report 67.



SMITH, K.G., 1965. Tobermory, N.T. - 1:250 000 Geological Series. Bureau of Mineral Resources Australia Explanatory Notes SF/53-12.

SMITH, K.G., 1972. Stratigraphy of the Georgina Basin. Bureau of Mineral Resources Australia Bulletin 111.

WHITEHOUSE, F.W., 1931. Report of the Palaeontologist. Annual Report Department of Mines Queensland (1930), 1-142.

WOOLLEY, D.R., & ROCHOW, K.A., 1961. The occurrence of lead near Box Hole Bore, central Australia. Bureau of Mineral Resources Australia Record 1961/42.



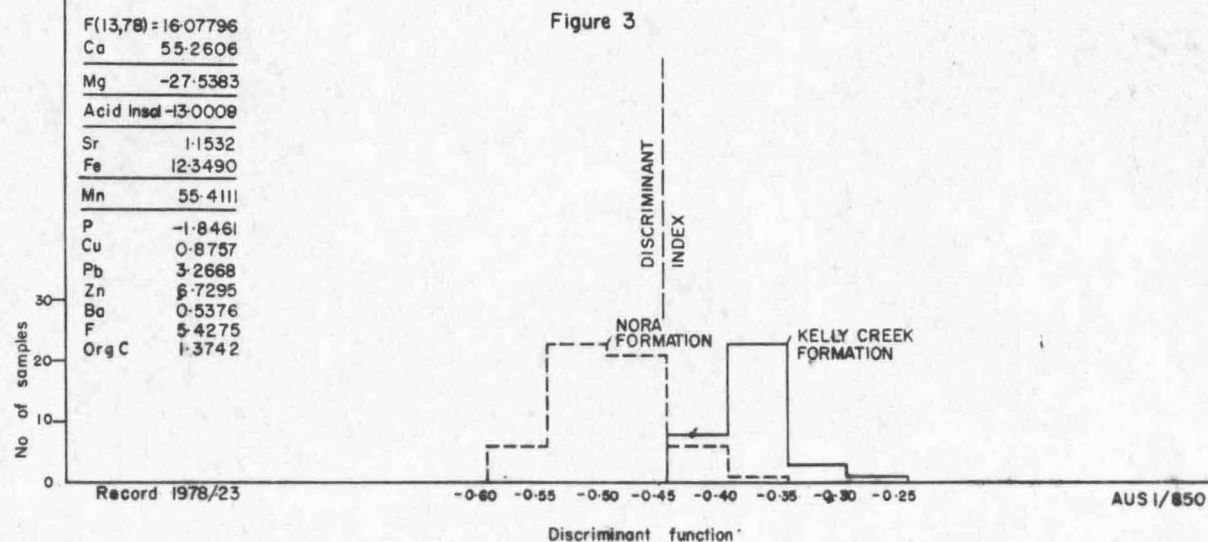
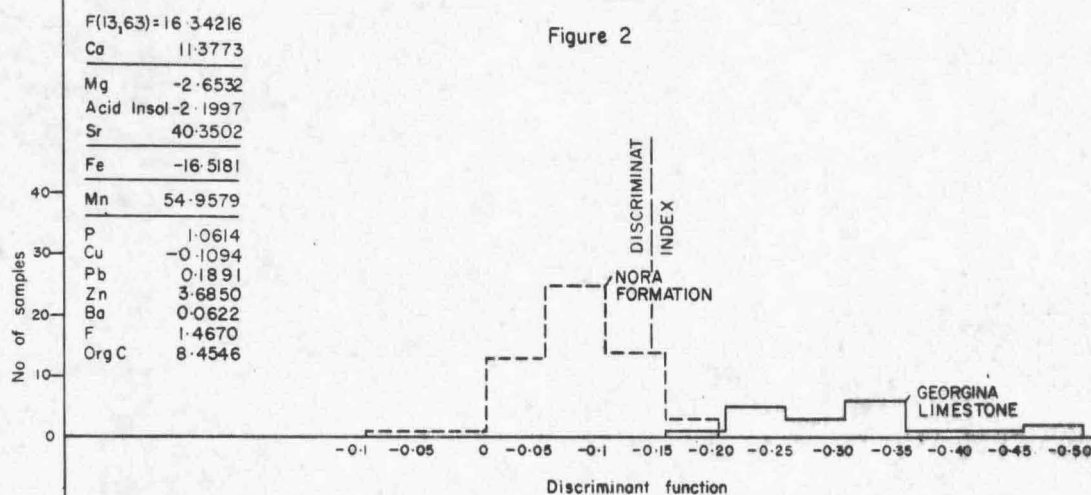
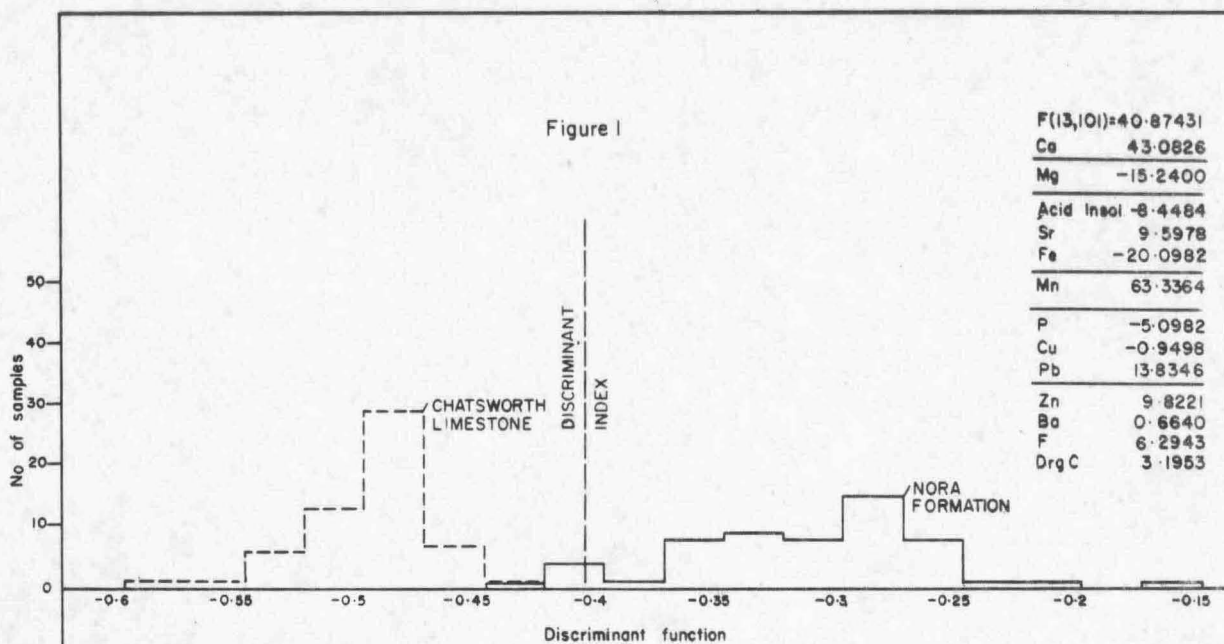
APPENDIX 1

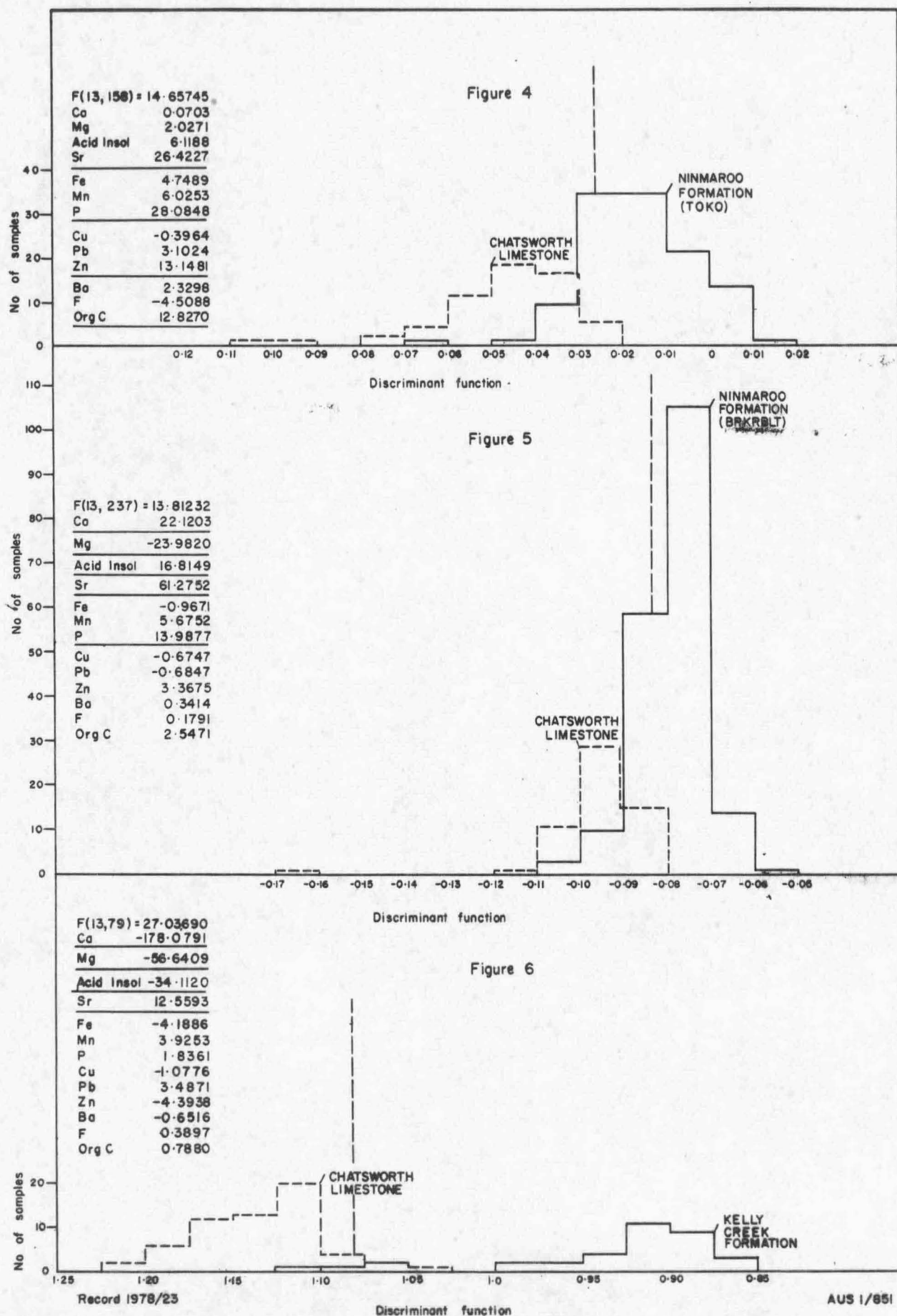
Histograms of Discriminant Functions  
(F-values and % variance added are also shown).

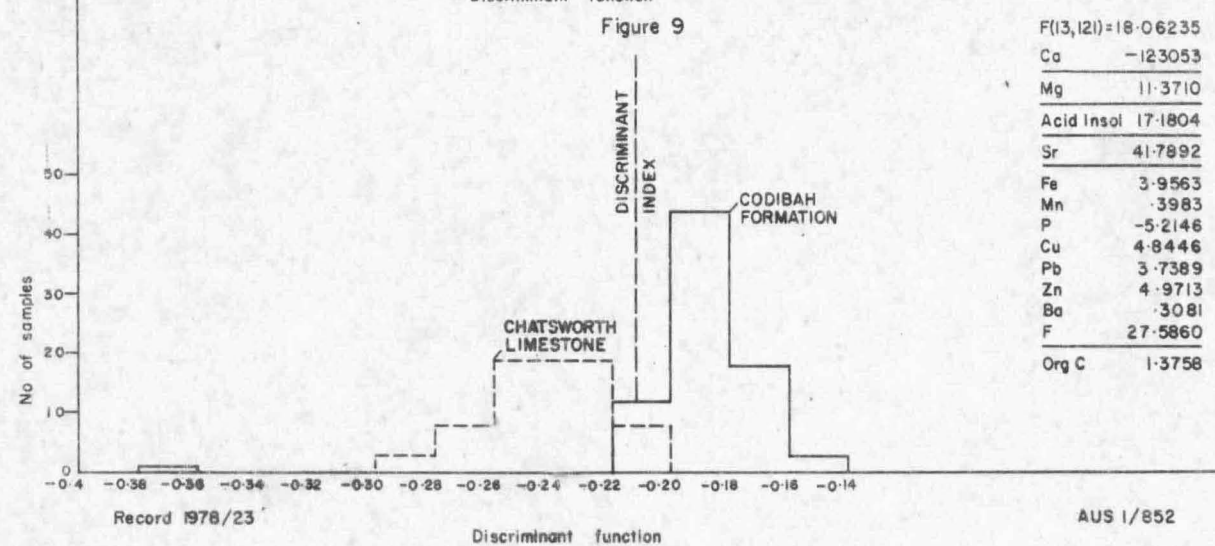
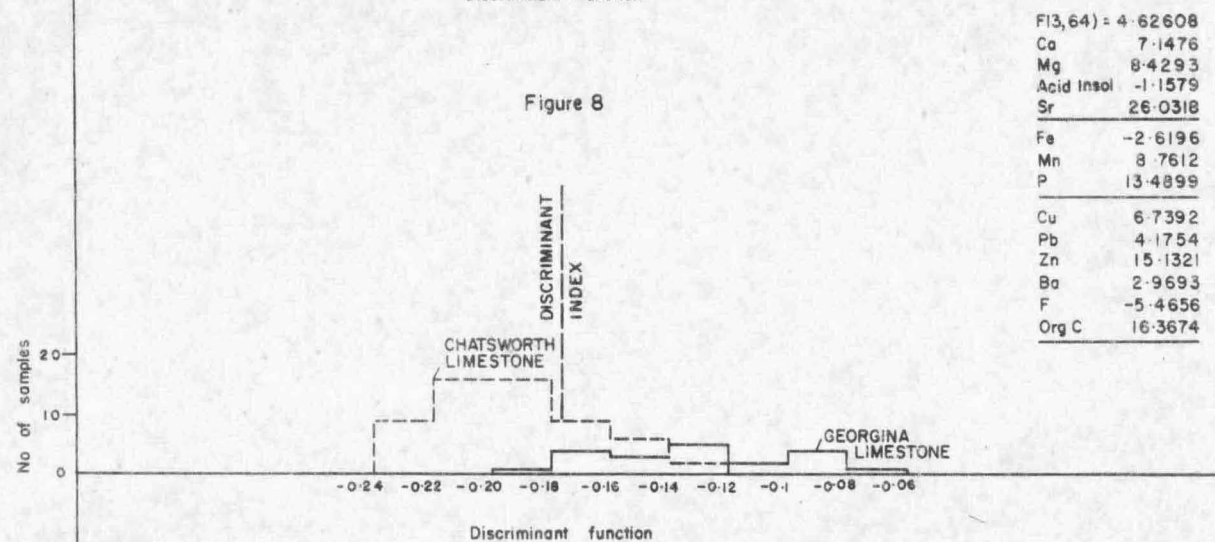
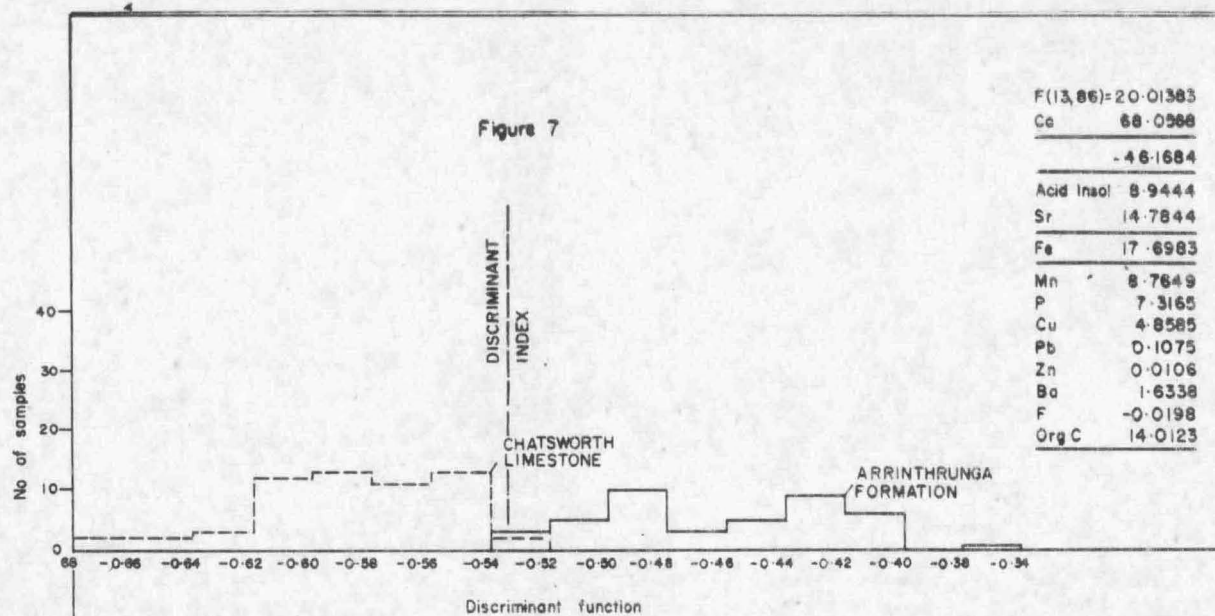
Histograms of Discriminant Functions

| Figure No. | Units                                                   |
|------------|---------------------------------------------------------|
| 1          | Chatsworth Limestone - Nora Formation.                  |
| 2          | Nora Formation - Georgina Limestone.                    |
| 3          | Nora Formation - Kelly Creek Formation.                 |
| 4          | Chatsworth Limestone - Ninmaroo Formation<br>(TOKO).    |
| 5          | Chatsworth Limestone - Ninmaroo Formation<br>(BRKRBLT). |
| 6          | Chatsworth Limestone - Kelly Creek<br>Formation.        |
| 7          | Chatsworth Limestone - Arrinthrunga<br>Formation.       |
| 8          | Chatsworth Limestone - Georgina Limestone.              |
| 9          | Chatsworth Limestone - Coolibah Formation.              |
| 10         | Nora Formation - Arrinthrunga Formation.                |
| 11         | Nora Formation - Coolibah Formation.                    |
| 12         | Georgina Limestone - Ninmaroo Formation.<br>(TOKO).     |
| 13         | Nora Formation - Ninmaroo Formation<br>(BRKRBLT).       |
| 14         | Nora Formation - Ninmaroo Formation (TOKO).             |
| 15         | Kelly Creek Formation - Ninmaroo Formation<br>(TOKO).   |
| 16         | Georgina Limestone - Ninmaroo Formation<br>(BRKRBLT).   |
| 17         | Georgina Limestone - Coolibah Formation.                |

- 18 Arrinthrunga Formation - Coolibah  
Formation.
- 19 Kelly Creek Formation - Coolibah Formation.
- 20 Kelly Creek Formation - Arrinthrunga  
Formation.
- 21 Georgina Limestone - Arrinthrunga Formation.
- 22 Arrinthrunga Formation - Ninmaroo Formation  
(TOKO).
- 23 Kelly Creek Formation - Ninmaroo Formation.  
(BRKRBLT).
- 24 Arrinthrunga Formation - Ninmaroo  
Formation (BRKRBLT).
- 25 Coolibah Formation - Ninmaroo Formation  
(BRKRBLT).
- 26 Georgina Limestone - Kelly Creek Formation.
- 27 Coolibah Formation - Ninmaroo Formation  
(TOKO).
- 28 Ninmaroo Formation (TOKO) - Ninmaroo  
Formation (BRKRBLT).







AUS 1/852

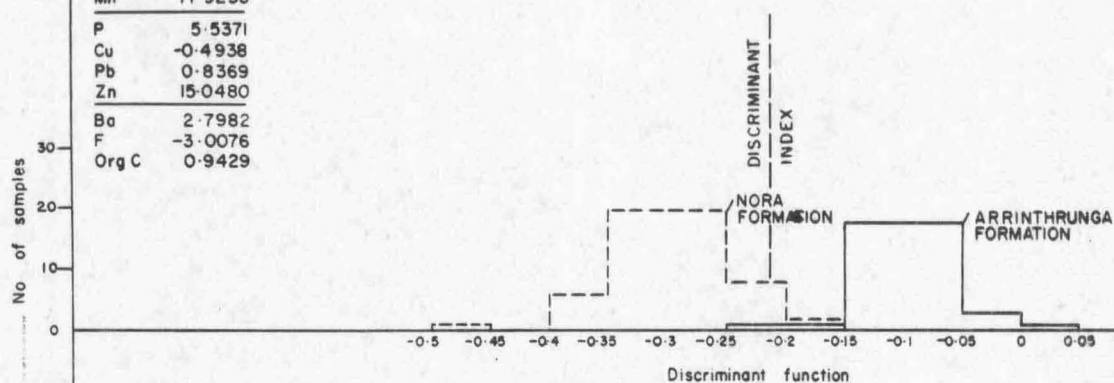


F(13,85)=31.42333

Ca 0.8777  
Mg 3.0887  
Acid Insol 6.0470  
Sr 3.7036  
Fe -7.3020  
Mn 71.9233

P 5.5371  
Cu -0.4938  
Pb 0.8369  
Zn 15.0480  
Ba 2.7982  
F -3.0076  
Org C 0.9429

Figure 10

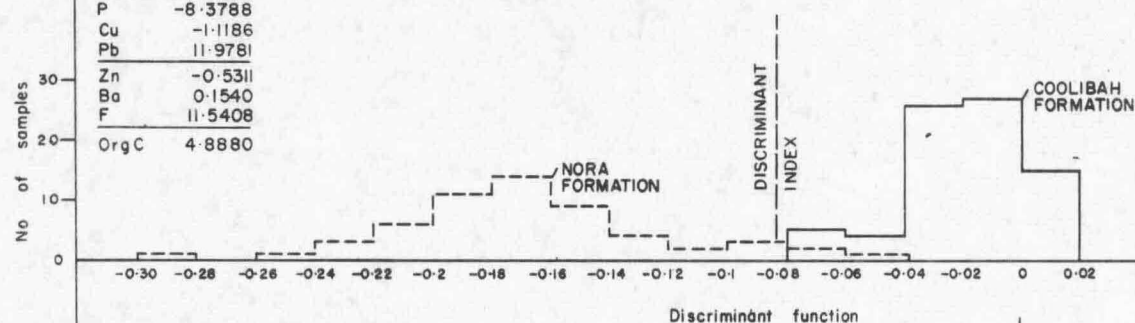


F(13,120)=44.44351

Ca -4.0799  
Mg 20.1412  
Acid Insol 8.9555  
Sr 0.1064  
Fe -18.5588

Mn 74.9034  
P -8.3788  
Cu -1.1186  
Pb 11.9781  
Zn -0.5311  
Ba 0.1540  
F 11.5408  
Org C 4.8880

Figure 11

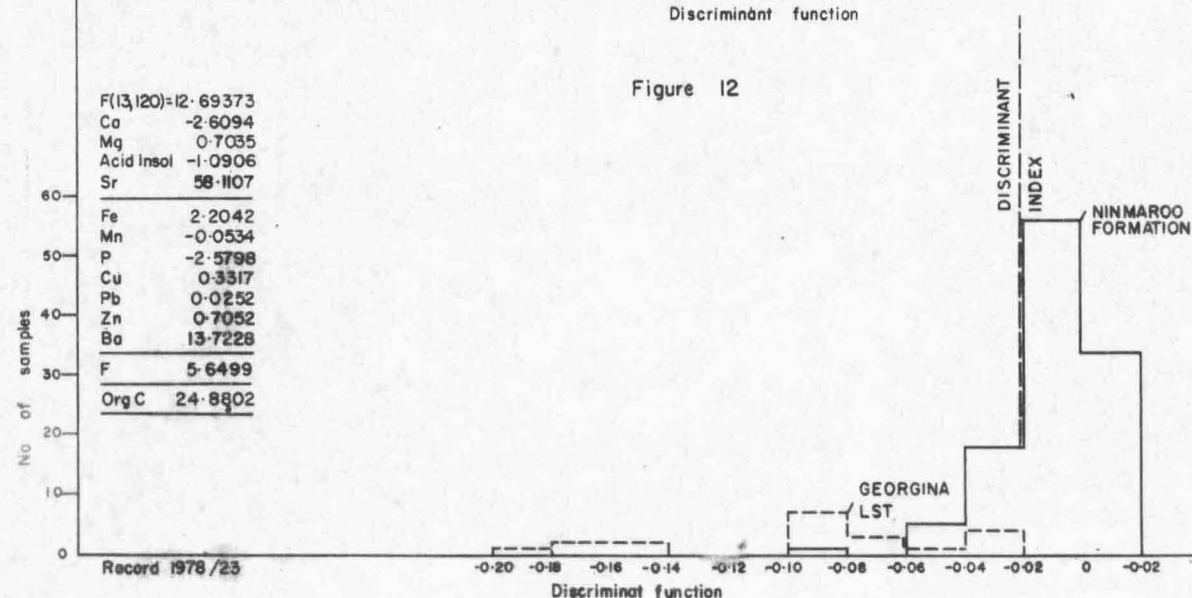


F(13,120)=12.69373

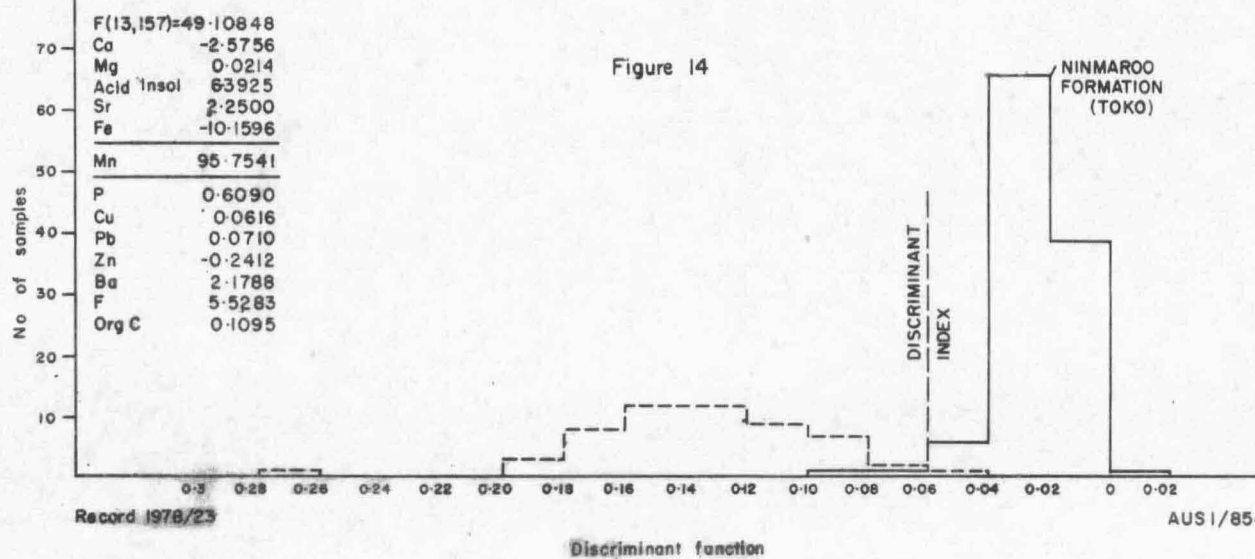
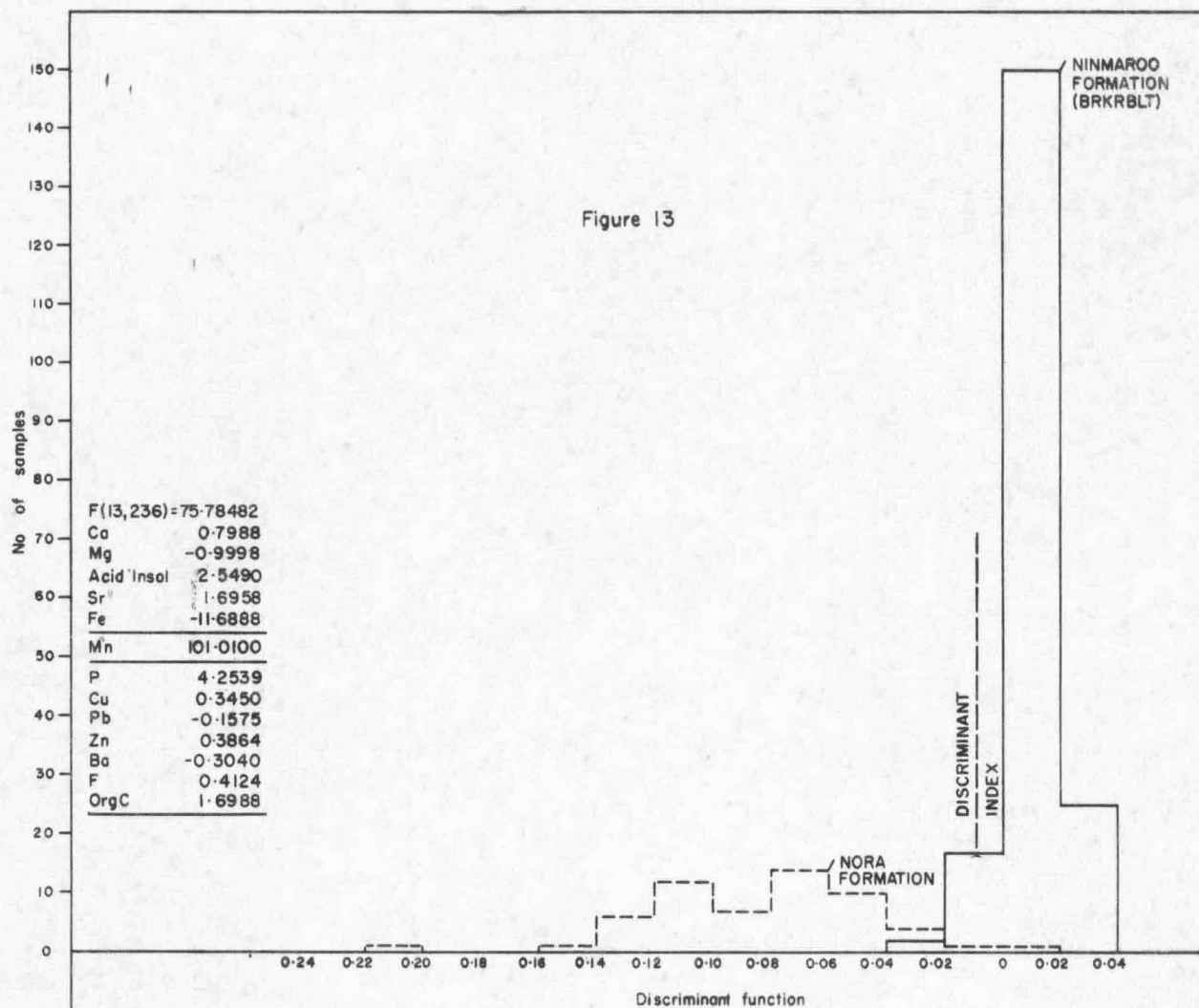
Ca -2.6094  
Mg 0.7035  
Acid Insol -1.0906  
Sr 58.1107

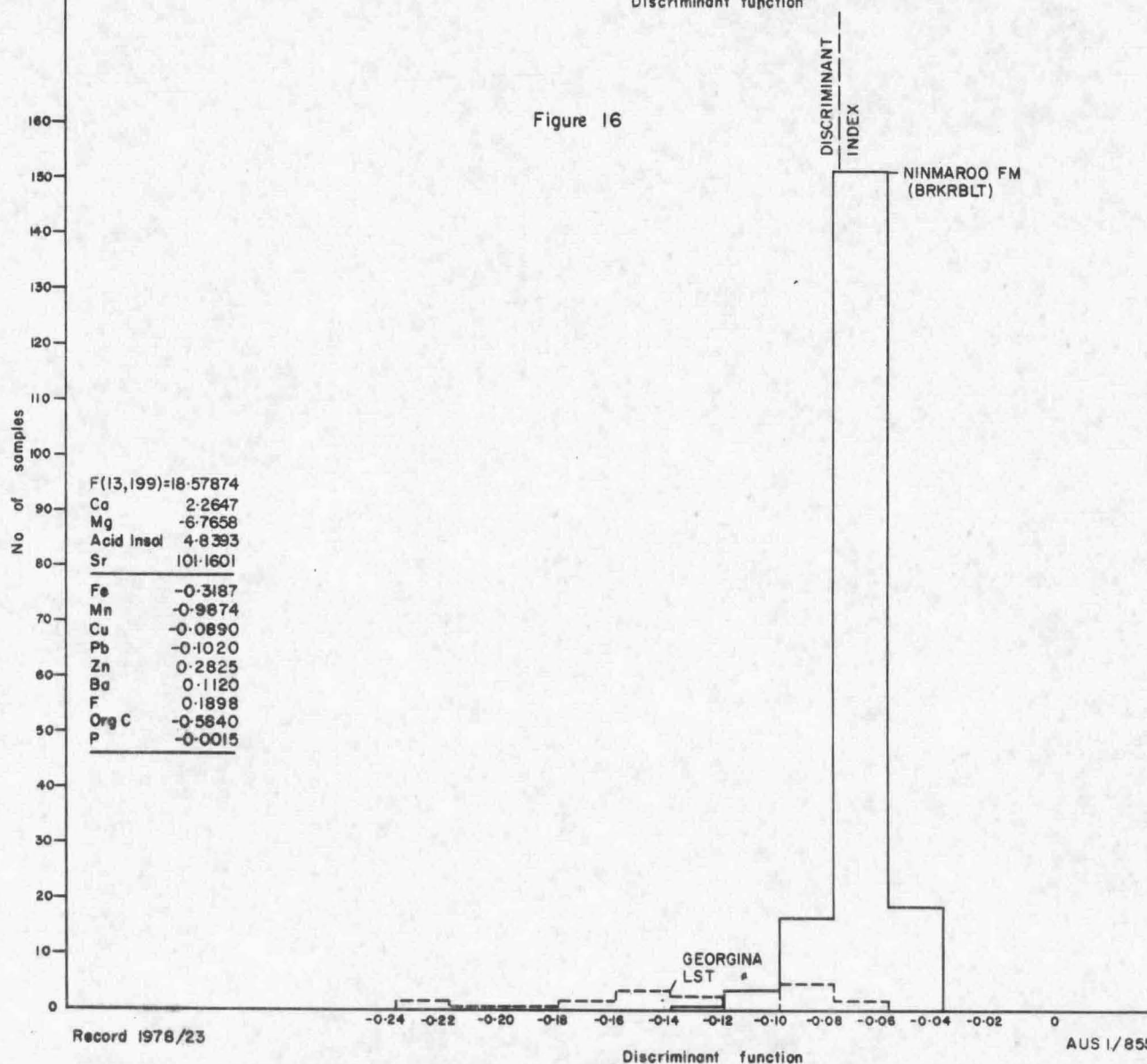
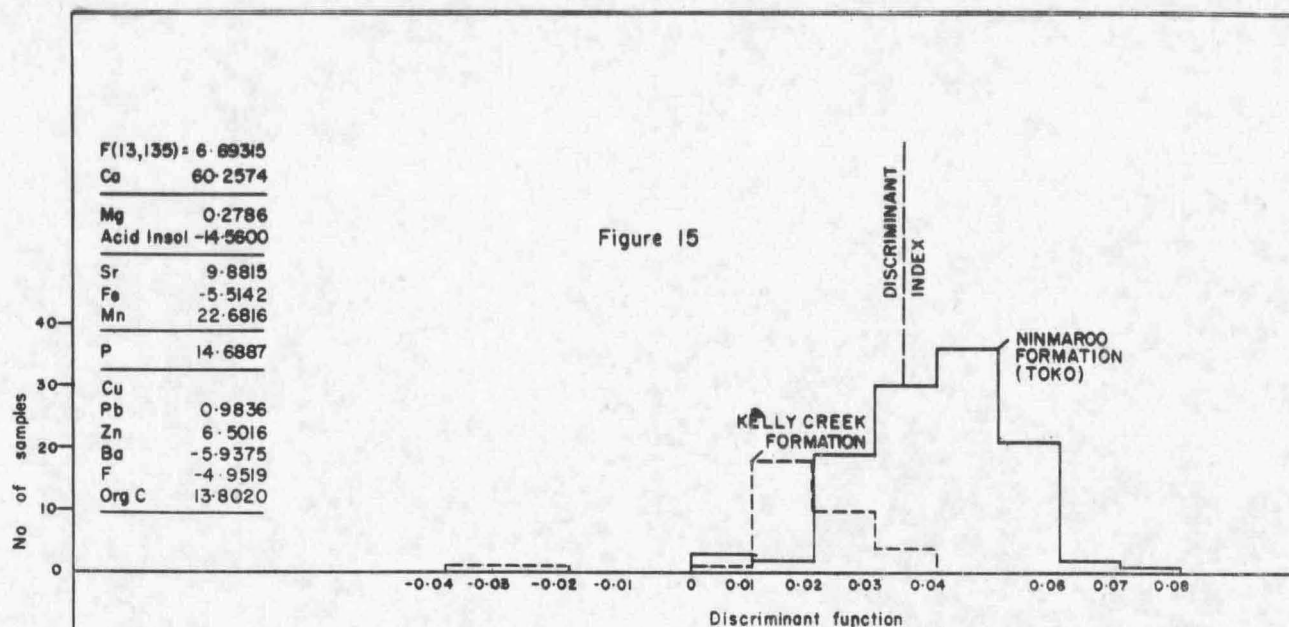
Fe 2.2042  
Mn -0.0534  
P -2.5798  
Cu 0.3317  
Pb 0.0252  
Zn 0.7052  
Ba 13.7228  
F 5.6499  
Org C 24.8802

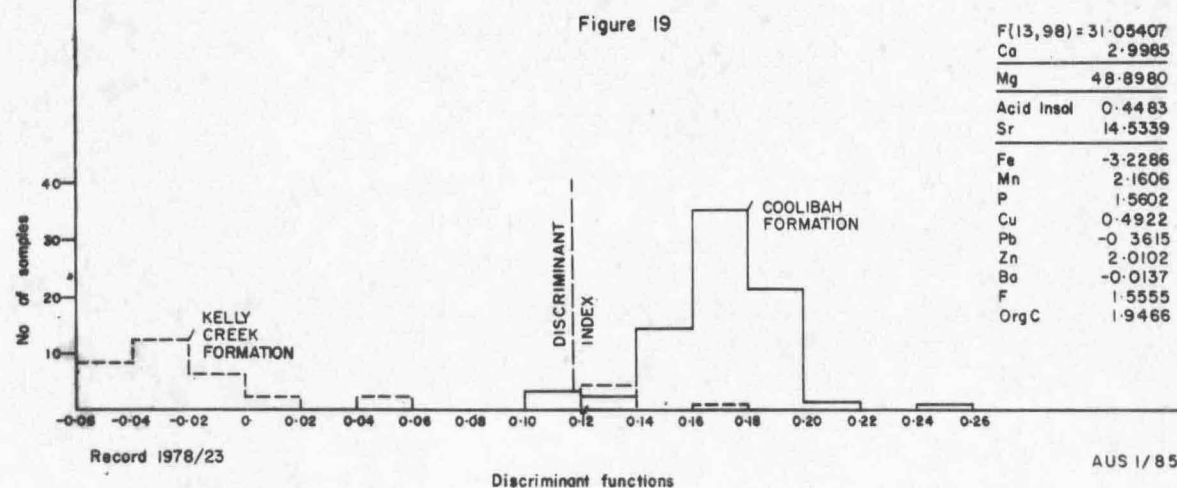
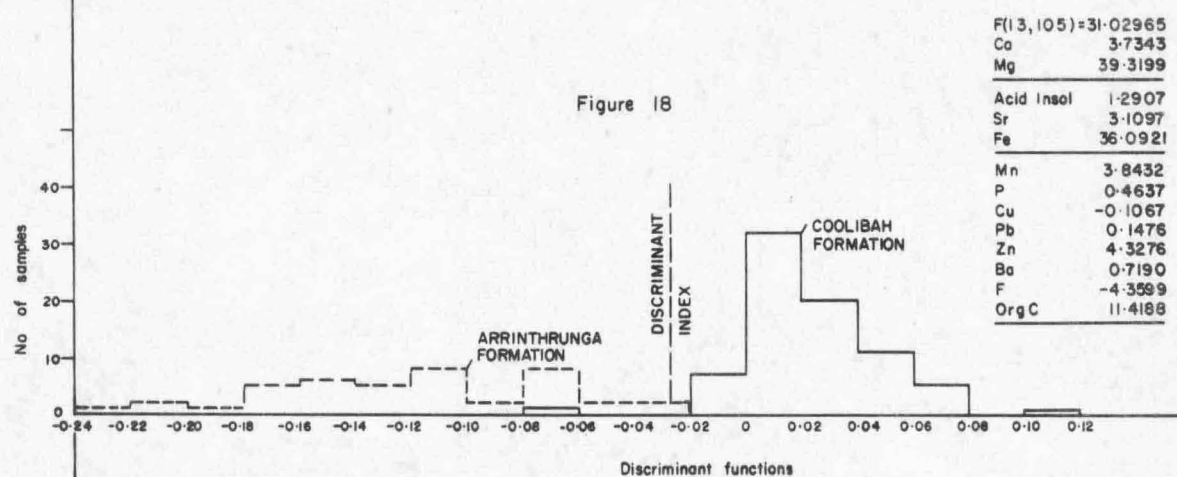
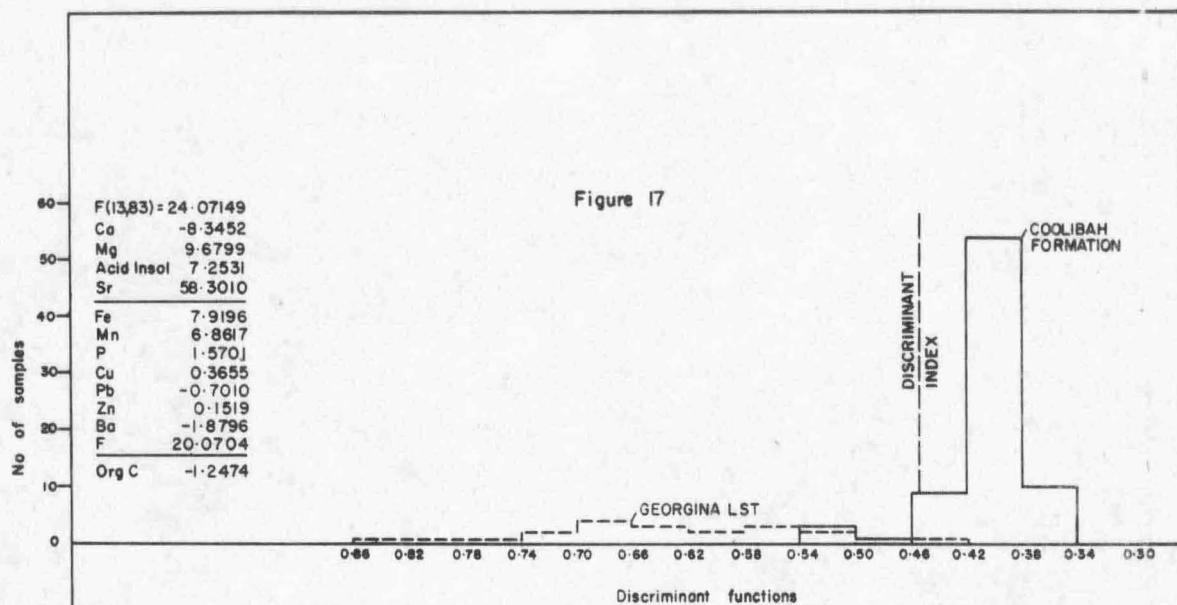
Figure 12











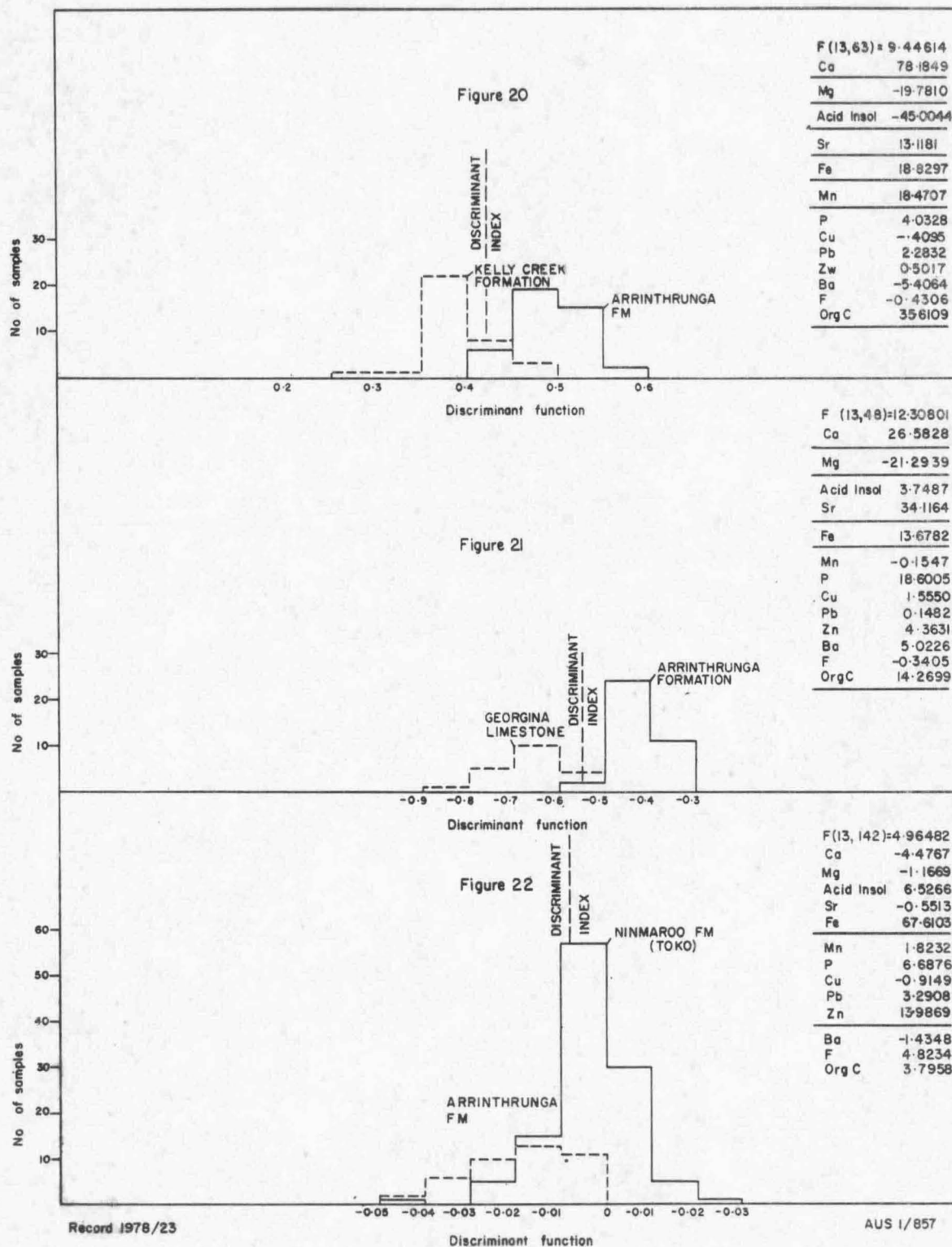


Figure 23

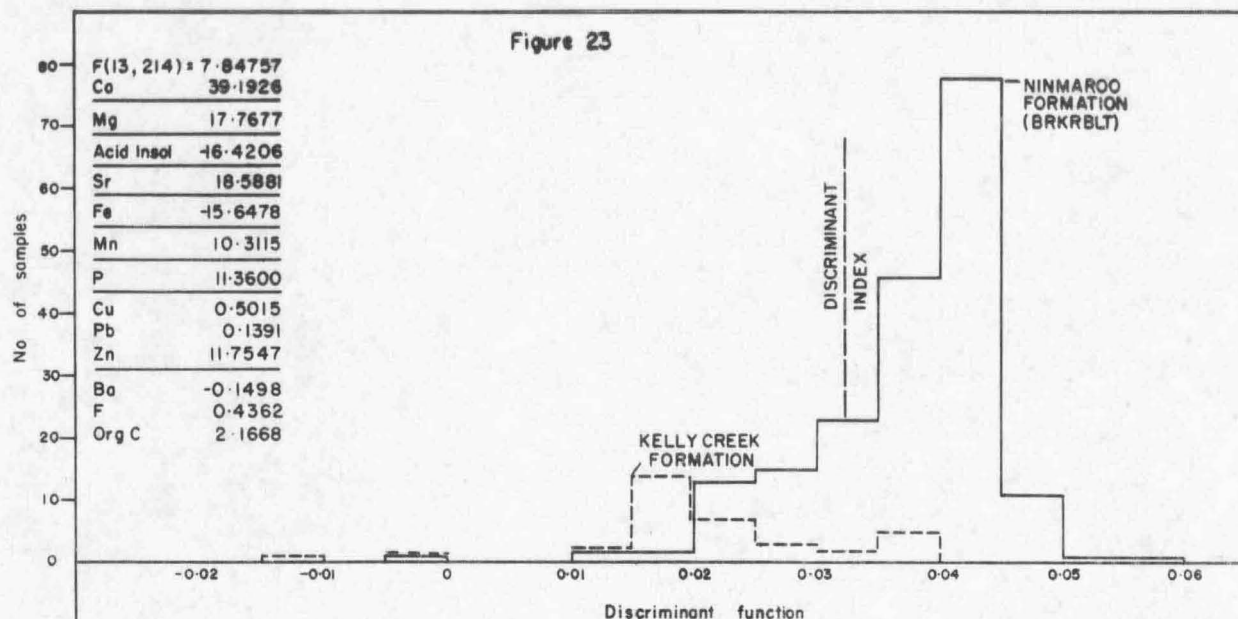


Figure 24

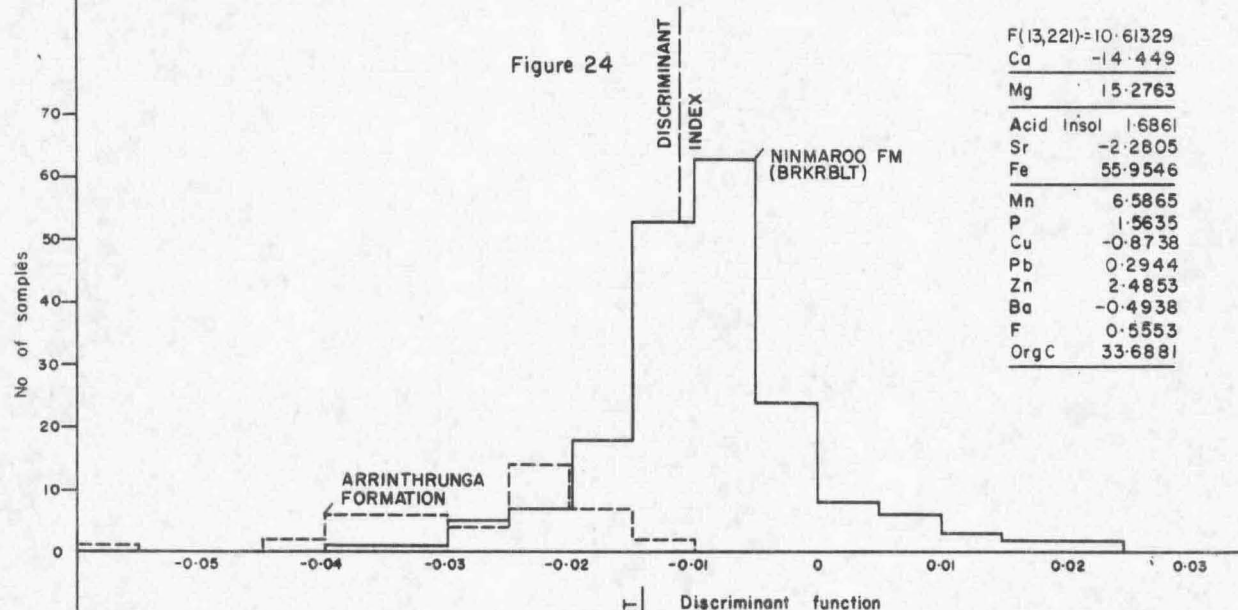
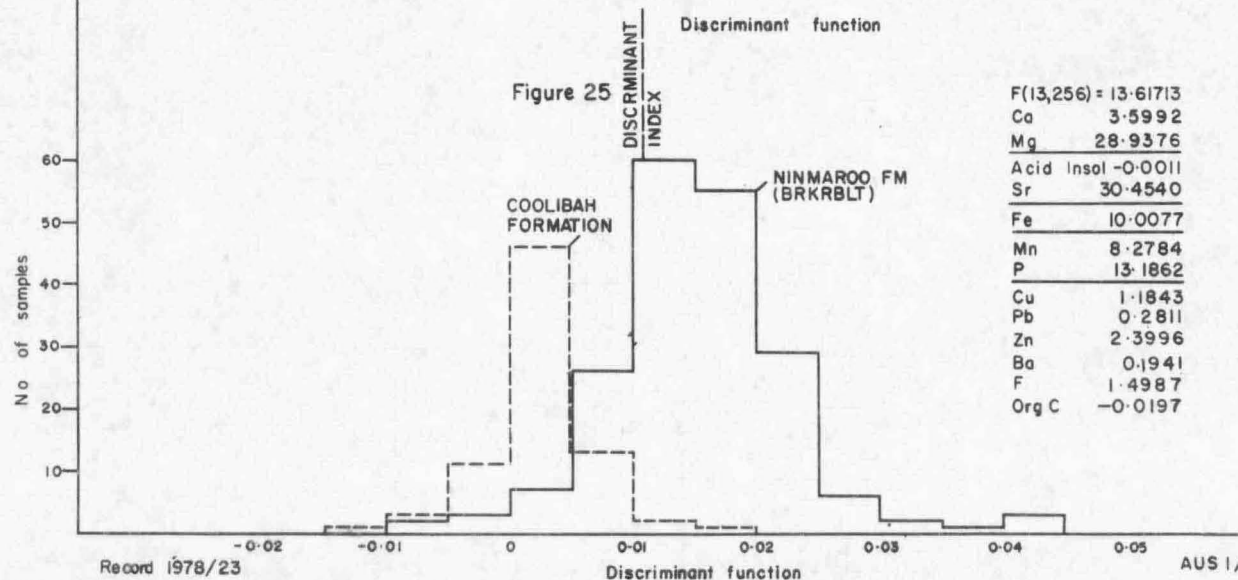
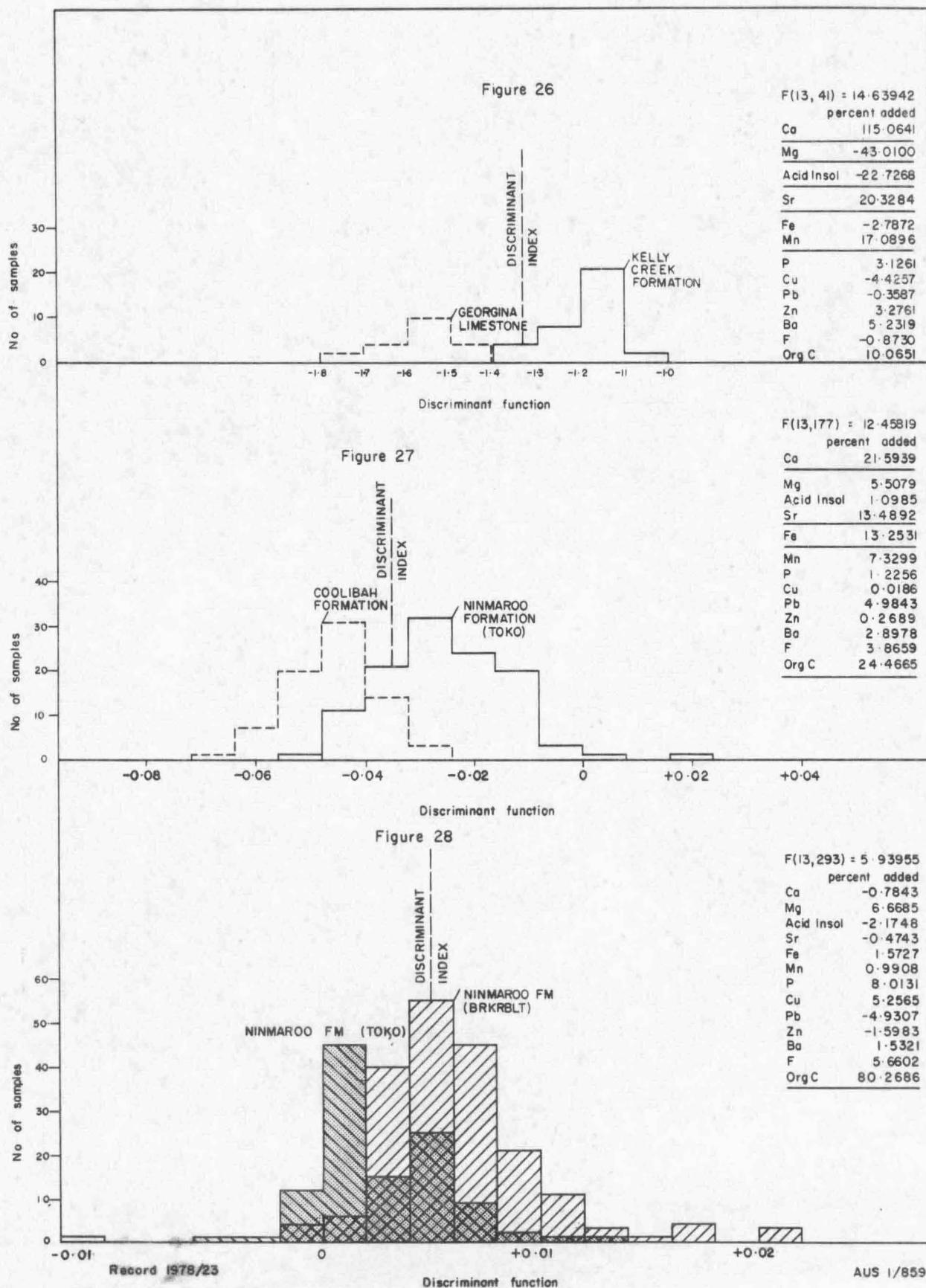


Figure 25







Histogram of Discriminant functions and percentage contribution by variables



APPENDIX 2

Copy of results obtained by Australian Aquitaine Petroleum Pty Ltd  
of a geochemical study carried out on three wells in the Georgina Basin.

MULGA I

| Depth       | Pb    | Zn  | Cu | Ba  |
|-------------|-------|-----|----|-----|
| 20 - 30     | 46    | 22  | 10 | 80  |
| 30 - 40     | 10    | 20  | 6  | 51  |
| 472 - 477   | 1,981 | 147 | 8  | 447 |
| 477 - 482   | 17    | 25  | 7  | 896 |
| 482 - 490   | 950   | 122 | 6  | 135 |
| 500 - 510   | 10    | 14  | 6  | 63  |
| 600 - 610   | 10    | 18  | 8  | 56  |
| 640 - 650   | 10    | 13  | 18 | 74  |
| 660 - 670   | 61    | 27  | 5  | 58  |
| 677         | 10    | 18  | 4  | 37  |
| 800 - 810   | 21    | 21  | 3  | 52  |
| 810 - 820   | 32    | 16  | 14 | 45  |
| 820 - 830   | 10    | 20  | 17 | 66  |
| 840 - 850   | 108   | 37  | 4  | 48  |
| 870 - 875   | 17    | 18  | 5  | 24  |
| 875 - 880   | 10    | 11  | 3  | 45  |
| 910 - 920   | 10    | 21  | 3  | 59  |
| 988         | 37    | 22  | 22 | 32  |
| 1100 - 1111 | 10    | 17  | 3  | 44  |
| 1496        | 21    | 13  | 3  | 22  |
| 1496        | 10    | 31  | 3  | 16  |
| 1505 - 1510 | 10    | 19  | 3  | 59  |
| 1520 - 1530 | 10    | 12  | 3  | 16  |
| 1920 - 1930 | 10    | 12  | 3  | 11  |
| 1930 - 1940 | 10    | 8   | 3  | 10  |
| 1940 - 1950 | 10    | 10  | 3  | 10  |
| 1950 - 1960 | 10    | 14  | 3  | 10  |
| 1980        | 24    | 16  | 10 | 12  |

All results are in ppm.

SANDOVER 14

| Depth | Pb | Sn | Cu | Ba  |
|-------|----|----|----|-----|
| 157'  | 10 | 30 | 10 | 60  |
| 159'  | 10 | 16 | 3  | 75  |
| 214'  | 10 | 19 | 6  | 112 |
| 215'  | 10 | 14 | 3  | 13  |
| 267'  | 10 | 17 | 3  | 68  |
| 272'  | 10 | 13 | 3  | 80  |
| 319'  | 10 | 29 | 8  | 37  |
| 326'  | 10 | 18 | 3  | 11  |
| 348'  | 10 | 26 | 10 | 13  |
| 354'6 | 10 | 18 | 3  | 18  |
| 390'6 | 10 | 16 | 8  | 15  |
| 566   | 10 | 5  | 3  | 10  |
| 570   | 10 | 49 | 14 | 26  |
| 570'5 | 10 | 15 | 9  | 20  |
| 633'  | 10 | 16 | 13 | 98  |
| 663'  | 10 | 84 | 3  | 42  |
| 666'  | 10 | 12 | 9  | 10  |
| 675'  | 10 | 15 | 3  | 13  |
| 680'  | 10 | 21 | 10 | 19  |
| 700'  | 10 | 71 | 4  | 29  |

All results in ppm.

LAKE NASH I

CORE SAMPLES

| Depth | Pb | Zn | Cu | Ba  |
|-------|----|----|----|-----|
| 293'  | 10 | 12 | 6  | 15  |
| 590   | 10 | 25 | 21 | 53  |
| 591'5 | 10 | 13 | 8  | 27  |
| 593   | 10 | 36 | 60 | 154 |
| 803'5 | 10 | 18 | 8  | 21  |
| 809'  | 10 | 13 | 3  | 10  |
| 1014' | 10 | 18 | 11 | 55  |

All results in ppm.

CUTTINGS

| Depth       | Pb | Zn  | Cu |
|-------------|----|-----|----|
| 240 - 250   | 18 | 20  | 7  |
| 308 - 320   | 25 | 18  | 10 |
| 370 - 350   | 24 | 7   | 7  |
| 410 - 350   | 19 | 11  | 6  |
| 440 - 450   | 19 | 9   | 4  |
| 460 - 470   | 13 | 7   | 8  |
| 560 - 570   | 74 | 8   | 7  |
| 610 - 620   | 64 | 14  | 13 |
| 640 - 650   | 60 | 20  | 10 |
| 670 - 680   | 19 | 18  | 10 |
| 710 - 720   | 95 | 18  | 9  |
| 820 - 830   | 43 | 14  | 7  |
| 870 - 880   | 43 | 14  | 7  |
| 930 - 940   | 19 | 17  | 7  |
| 980 - 990   | 20 | 10  | 7  |
| 1079 - 1084 | 6  | 118 | 8  |
| 1010 - 1128 | 23 | 20  | 8  |
| 1054 - 1060 | 14 | 15  | 14 |
| 1100 - 1110 | 14 | 24  | 10 |
| 1250 - 1260 | 5  | 6   | 5  |

All results in ppm.

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE   | MN   | P        | CU     | PB         | ZN     | BA       | F    | ORGC |
|----------------------|-------|--------|--------|------|------|------|----------|--------|------------|--------|----------|------|------|
| 74710001             | 21.70 | 9.400  | 7.800  | .004 | .503 | .083 | 80.000   | 3.000  | 100400.000 | 5.000  | 20.000   | .005 | .320 |
| 74710002             | 30.40 | .590   | 19.000 | .001 | .056 | .048 | 190.000  | 25.000 | 45.000     | 25.000 | 90.000   | .010 | .130 |
| 74710003             | 25.20 | 9.400  | 4.550  | .003 | .156 | .043 | 140.000  | 2.000  | 1260.000   | 6.000  | 20.000   | .010 | .090 |
| 74710004             | 21.90 | 11.500 | 5.350  | .004 | .293 | .005 | 110.000  | 3.000  | 6.000      | 4.000  | 20.000   | .010 | .060 |
| 74710005             | 30.00 | 6.000  | 6.400  | .112 | .390 | .110 | 380.000  | 5.000  | 95.000     | 12.000 | 130.000  | .010 | .060 |
| 74710007             | 35.50 | .620   | 7.100  | .029 | .045 | .012 | 80.000   | 2.000  | 2.000      | 5.000  | 10.000   | .010 | .060 |
| 74710008             | 36.00 | .230   | 6.100  | .037 | .028 | .010 | 50.000   | 1.000  | 15.000     | 3.000  | 50.000   | .005 | .050 |
| 74710009             | 37.30 | .320   | 4.250  | .075 | .035 | .007 | 20.000   | 1.000  | 5.000      | 4.000  | 10.000   | .005 | .060 |
| 74710010             | 35.70 | .350   | 6.800  | .053 | .038 | .026 | 40.000   | 4.000  | 5.000      | 8.000  | 90.000   | .010 | .080 |
| 74710011             | 30.40 | 3.450  | 12.700 | .023 | .087 | .012 | 90.000   | 3.000  | 5.000      | 8.000  | 180.000  | .015 | .060 |
| 74710012             | 37.00 | .320   | 2.450  | .033 | .028 | .009 | 20.000   | 1.000  | 5.000      | 4.000  | 10.000   | .005 | .060 |
| 74710013             | 34.60 | 1.170  | 10.200 | .031 | .059 | .011 | 178.000  | 3.000  | 5.000      | 20.000 | 190.000  | .015 | .030 |
| 74710014             | 36.90 | .300   | 6.000  | .019 | .028 | .015 | 50.000   | 2.000  | 5.000      | 25.000 | 40.000   | .011 | .050 |
| 74710022             | 36.10 | .330   | 5.600  | .055 | .041 | .010 | 50.000   | 2.000  | 5.000      | 15.000 | 3200.000 | .010 | .060 |
| 74710025             | 33.90 | .360   | 11.600 | .045 | .049 | .016 | 120.000  | 2.000  | 10.000     | 7.000  | 520.000  | .010 | .150 |
| 74710031             | 37.80 | .270   | 6.450  | .032 | .034 | .005 | 130.000  | 2.000  | 5.000      | 5.000  | 240.000  | .015 | .110 |
| 74710039             | 32.20 | .120   | 17.200 | .007 | .021 | .049 | 70.000   | 15.000 | 5.000      | 15.000 | 880.000  | .025 | .070 |
| 74710043             | 35.40 | .690   | 5.500  | .058 | .061 | .009 | 30.000   | 2.000  | 10.000     | 9.000  | 30.000   | .010 | .100 |
| 74710076             | 27.30 | .120   | 32.400 | .015 | .041 | .014 | 290.000  | 9.000  | 15.000     | 10.000 | 170.000  | .010 | .120 |
| 74710085             | 33.90 | .220   | 15.100 | .035 | .097 | .022 | 380.000  | 3.000  | 10.000     | 20.000 | 640.000  | .015 | .060 |
| 74710102             | 21.40 | .300   | 48.900 | .008 | .039 | .011 | 570.000  | 2.000  | 35.000     | 6.000  | 30.000   | .030 | .060 |
| 74710103             | 32.50 | .610   | 16.700 | .023 | .087 | .033 | 1400.000 | 3.000  | 5.000      | 25.000 | 50.000   | .030 | .050 |
| 74710104             | 31.70 | 1.050  | 17.300 | .024 | .085 | .023 | 340.000  | 3.000  | 5.000      | 9.000  | 30.000   | .015 | .080 |
| 74710114             | 36.80 | .380   | 5.950  | .046 | .081 | .012 | 70.000   | 3.000  | 15.000     | 4.000  | 60.000   | .005 | .060 |
| 74710115             | 37.60 | .350   | 5.600  | .040 | .078 | .010 | 60.000   | 3.000  | 5.000      | 5.000  | 80.000   | .010 | .070 |
| 74710138             | 29.60 | .160   | 24.100 | .035 | .071 | .033 | 910.000  | 4.000  | 5.000      | 3.000  | 40.000   | .025 | .050 |
| 74710139             | 27.90 | 6.350  | 7.400  | .005 | .240 | .072 | 380.000  | 3.000  | 5.000      | 10.000 | 580.000  | .020 | .050 |
| 74710155             | 26.50 | .370   | 33.100 | .029 | .057 | .011 | 100.000  | 2.000  | 5.000      | 10.000 | 1250.000 | .020 | .050 |
| 74710158             | 36.50 | .390   | 5.850  | .038 | .064 | .014 | 90.000   | 4.000  | 15.000     | 15.000 | 40.000   | .010 | .060 |
| 74710159             | 37.10 | .980   | 3.200  | .033 | .120 | .016 | 50.000   | 3.000  | 20.000     | 25.000 | 30.000   | .005 | .070 |
| 74710160             | 37.20 | .980   | 3.050  | .037 | .120 | .014 | 30.000   | 3.000  | 10.000     | 25.000 | 20.000   | .005 | .070 |
| 74710161             | 38.50 | .240   | 2.800  | .037 | .055 | .012 | 50.000   | 3.000  | 20.000     | 45.000 | 10.000   | .005 | .090 |
| 74710162             | 37.40 | .890   | 2.450  | .037 | .120 | .015 | 30.000   | 3.000  | 10.000     | 50.000 | 20.000   | .005 | .090 |
| 74710163             | 37.90 | .460   | 2.750  | .038 | .076 | .012 | 30.000   | 3.000  | 10.000     | 25.000 | 10.000   | .005 | .070 |
| 74710164             | 38.80 | .210   | 2.800  | .032 | .059 | .012 | 30.000   | 3.000  | 5.000      | 20.000 | 10.000   | .005 | .050 |
| 74710165             | 37.00 | .190   | 2.700  | .035 | .066 | .012 | 20.000   | 2.000  | 5.000      | 15.000 | 10.000   | .005 | .060 |
| 74710166             | 38.50 | .240   | 2.500  | .042 | .059 | .011 | 20.000   | 3.000  | 5.000      | 15.000 | 10.000   | .005 | .050 |
| 74710167             | 38.20 | .600   | 2.150  | .050 | .088 | .010 | 20.000   | 2.000  | 5.000      | 20.000 | 10.000   | .020 | .050 |
| 74710168             | 36.60 | .330   | 2.450  | .047 | .066 | .011 | 30.000   | 3.000  | 5.000      | 35.000 | 20.000   | .020 | .060 |
| 74710169             | 36.70 | .380   | 3.500  | .041 | .076 | .013 | 80.000   | 3.000  | 5.000      | 8.000  | 20.000   | .020 | .050 |
| 74710170             | 37.00 | .330   | 3.600  | .041 | .074 | .014 | 70.000   | 4.000  | 5.000      | 5.000  | 30.000   | .020 | .050 |
| 74710171             | 37.50 | .190   | 2.300  | .038 | .055 | .012 | 30.000   | 3.000  | 5.000      | 10.000 | 10.000   | .005 | .070 |
| 74710172             | 37.30 | .330   | 3.600  | .048 | .061 | .013 | 80.000   | 3.000  | 10.000     | 15.000 | 10.000   | .005 | .060 |
| 74710173             | 37.10 | .730   | 2.900  | .043 | .097 | .013 | 20.000   | 4.000  | 5.000      | 25.000 | 40.000   | .005 | .080 |
| 74710174             | 38.50 | .350   | 3.300  | .051 | .057 | .014 | 80.000   | 3.000  | 10.000     | 10.000 | 20.000   | .005 | .060 |
| 74710175             | 35.20 | .600   | 4.900  | .032 | .081 | .012 | 70.000   | 3.000  | 15.000     | 30.000 | 30.000   | .005 | .040 |
| 74710176             | 37.70 | .380   | 3.150  | .038 | .068 | .012 | 40.000   | 3.000  | 10.000     | 30.000 | 10.000   | .005 | .060 |
| 74710177             | 37.30 | .280   | 2.800  | .046 | .059 | .012 | 30.000   | 4.000  | 10.000     | 15.000 | 10.000   | .005 | .070 |
| 74710178             | 37.40 | .300   | 3.300  | .036 | .057 | .012 | 40.000   | 4.000  | 10.000     | 45.000 | 20.000   | .005 | .060 |
| 74710179             | 36.50 | .730   | 3.500  | .036 | .083 | .012 | 40.000   | 4.000  | 55.000     | 25.000 | 20.000   | .005 | .050 |
| 74710180             | 36.90 | .200   | 2.600  | .033 | .061 | .012 | 30.000   | 3.000  | 10.000     | 25.000 | 20.000   | .005 | .080 |
| 74710181             | 35.80 | .650   | 6.950  | .033 | .092 | .013 | 80.000   | 5.000  | 10.000     | 45.000 | 360.000  | .005 | .080 |

## GEOCHEMISTRY-NINMAROO BURKE RIVER BELT

PAGE 2

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE   | MN   | P        | CU     | PB     | ZN      | BA      | F    | ORGC |
|----------------------|-------|--------|--------|------|------|------|----------|--------|--------|---------|---------|------|------|
| 74711029             | 37.50 | .210   | 2.900  | .020 | .019 | .090 | 1500.000 | 1.000  | 5.000  | 20.000  | 130.000 | .035 | .060 |
| 74711032             | 37.20 | 1.150  | 2.500  | .019 | .019 | .094 | 1200.000 | 2.000  | 5.000  | 35.000  | 60.000  | .025 | .040 |
| 74711035             | 37.30 | 1.800  | 3.600  | .020 | .024 | .250 | 320.000  | 2.000  | 10.000 | 15.000  | 40.000  | .010 | .030 |
| 74711036             | 33.80 | 4.000  | 2.450  | .022 | .040 | .230 | 260.000  | 2.000  | 5.000  | 35.000  | 30.000  | .010 | .030 |
| 74711042             | 37.30 | .240   | 6.600  | .035 | .040 | .013 | 90.000   | 4.000  | 5.000  | 5.000   | 60.000  | .010 | .040 |
| 74711043             | 36.90 | .380   | 4.500  | .060 | .041 | .011 | 50.000   | 3.000  | 30.000 | 4.000   | 80.000  | .005 | .070 |
| 74711048             | 35.60 | .220   | 7.200  | .014 | .043 | .039 | 110.000  | 3.000  | 50.000 | 100.000 | 100.000 | .005 | .030 |
| 74711050             | 38.40 | .330   | 5.650  | .021 | .052 | .013 | 130.000  | 3.000  | 5.000  | 65.000  | 40.000  | .005 | .030 |
| 74711063             | 34.70 | .350   | 8.700  | .049 | .069 | .023 | 310.000  | 4.000  | 5.000  | 70.000  | 30.000  | .015 | .040 |
| 74711064             | 35.70 | .350   | 7.200  | .033 | .050 | .007 | 520.000  | 3.000  | 5.000  | 6.000   | 30.000  | .005 | .050 |
| 74711065             | 34.50 | .270   | 10.400 | .043 | .069 | .015 | 350.000  | 3.000  | 5.000  | 6.000   | 120.000 | .010 | .060 |
| 74711066             | 34.60 | .370   | 9.700  | .027 | .047 | .023 | 260.000  | 3.000  | 5.000  | 9.000   | 70.000  | .010 | .060 |
| 74711068             | 35.90 | .470   | 7.300  | .028 | .061 | .009 | 140.000  | 2.000  | 5.000  | 6.000   | 40.000  | .010 | .050 |
| 74711069             | 33.80 | .360   | 12.900 | .030 | .041 | .015 | 290.000  | 2.000  | 5.000  | 8.000   | 50.000  | .010 | .050 |
| 74711077             | 33.80 | 1.850  | 7.100  | .042 | .052 | .006 | 70.000   | 2.000  | 5.000  | 4.000   | 40.000  | .010 | .050 |
| 74711078             | 37.10 | .280   | 8.900  | .054 | .024 | .007 | 60.000   | 2.000  | 5.000  | 5.000   | 40.000  | .005 | .040 |
| 74711079             | 34.70 | 1.300  | 8.300  | .053 | .048 | .006 | 80.000   | 1.000  | 5.000  | 4.000   | 30.000  | .005 | .040 |
| 74711080             | 34.60 | .450   | 9.100  | .087 | .036 | .007 | 60.000   | 3.000  | 5.000  | 25.000  | 40.000  | .010 | .070 |
| 74711083             | 34.70 | 1.350  | 4.700  | .033 | .096 | .012 | 60.000   | 3.000  | 5.000  | 5.000   | 20.000  | .005 | .040 |
| 74711084             | 35.30 | .310   | 8.800  | .044 | .024 | .006 | 40.000   | 2.000  | 5.000  | 8.000   | 20.000  | .005 | .050 |
| 74711085             | 33.80 | .350   | 8.700  | .047 | .021 | .007 | 50.000   | 2.000  | 5.000  | 5.000   | 40.000  | .005 | .070 |
| 74711086             | 34.90 | .330   | 7.800  | .048 | .022 | .012 | 120.000  | 2.000  | 5.000  | 4.000   | 20.000  | .005 | .040 |
| 74711088             | 35.90 | .290   | 4.900  | .025 | .061 | .008 | 50.000   | 2.000  | 5.000  | 7.000   | 10.000  | .005 | .040 |
| 74711089             | 37.30 | .280   | 5.350  | .034 | .073 | .013 | 400.000  | 3.000  | 5.000  | 25.000  | 30.000  | .010 | .040 |
| 74711091             | 15.20 | .250   | 61.000 | .015 | .035 | .043 | 440.000  | 1.000  | 5.000  | 10.000  | 50.000  | .010 | .050 |
| 74711092             | 37.30 | .940   | 3.250  | .026 | .017 | .110 | 190.000  | 2.000  | 5.000  | 3.000   | 20.000  | .005 | .040 |
| 74711103             | 35.60 | .470   | 8.100  | .090 | .026 | .013 | 50.000   | 3.000  | 5.000  | 15.000  | 20.000  | .005 | .090 |
| 74711104             | 33.20 | .870   | 13.500 | .030 | .021 | .010 | 130.000  | 2.000  | 5.000  | 19.000  | 480.000 | .005 | .050 |
| 74711105             | 36.90 | .250   | 2.000  | .055 | .017 | .007 | 50.000   | 2.000  | 5.000  | 5.000   | 50.000  | .005 | .060 |
| 74711110             | 35.40 | .160   | 6.750  | .024 | .048 | .011 | 120.000  | 2.000  | 5.000  | 6.000   | 600.000 | .005 | .050 |
| 74711121             | 36.50 | .190   | 4.950  | .025 | .087 | .021 | 80.000   | 2.000  | 5.000  | 4.000   | 520.000 | .005 | .050 |
| 74711124             | 33.60 | .170   | 10.800 | .027 | .074 | .025 | 180.000  | 2.000  | 5.000  | 6.000   | 260.000 | .010 | .030 |
| 74711131             | 16.70 | .210   | 57.100 | .043 | .029 | .033 | 1750.000 | 3.000  | 5.000  | 23.000  | 80.000  | .030 | .100 |
| 74711132             | 36.20 | 2.000  | 3.850  | .019 | .026 | .052 | 740.000  | 1.000  | 5.000  | 10.000  | 20.000  | .020 | .040 |
| 74711133             | 23.60 | 11.000 | 5.300  | .005 | .048 | .090 | 840.000  | 1.000  | 5.000  | 5.000   | 20.000  | .025 | .030 |
| 74711134             | 21.40 | 10.700 | 9.750  | .004 | .170 | .055 | 180.000  | 3.000  | 5.000  | 27.000  | 50.000  | .015 | .050 |
| 74712026             | 36.50 | .150   | 4.800  | .021 | .035 | .013 | 130.000  | 2.000  | 5.000  | 2.000   | 60.000  | .005 | .070 |
| 74712027             | 37.80 | .330   | 4.100  | .053 | .026 | .004 | 20.000   | 2.000  | 5.000  | 3.000   | 10.000  | .015 | .040 |
| 74712028             | 37.90 | .300   | 2.100  | .048 | .026 | .004 | 10.000   | 2.000  | 5.000  | 2.000   | 40.000  | .005 | .040 |
| 74712029             | 37.30 | 1.200  | 2.100  | .047 | .035 | .006 | 20.000   | 2.000  | 5.000  | 2.000   | 10.000  | .005 | .050 |
| 74712030             | 37.30 | 1.080  | 2.450  | .044 | .043 | .007 | 10.000   | 2.000  | 5.000  | 1.000   | 20.000  | .005 | .070 |
| 74712031             | 36.90 | 1.900  | 3.550  | .045 | .090 | .007 | 30.000   | 2.000  | 5.000  | 1.000   | 10.000  | .005 | .040 |
| 74712032             | 37.80 | .390   | 6.550  | .041 | .038 | .007 | 20.000   | 2.000  | 5.000  | 1.000   | 30.000  | .005 | .080 |
| 74712033             | 37.70 | .410   | 4.550  | .045 | .036 | .008 | 60.000   | 3.000  | 5.000  | 3.000   | 40.000  | .005 | .060 |
| 74712034             | 30.80 | .300   | 11.500 | .064 | .035 | .012 | 60.000   | 2.000  | 5.000  | 9.000   | 60.000  | .010 | .060 |
| 74712035             | 38.30 | .150   | 3.350  | .035 | .016 | .007 | 30.000   | 3.000  | 5.000  | 6.000   | 60.000  | .010 | .040 |
| 74712037             | 35.20 | .320   | 11.400 | .041 | .078 | .014 | 190.000  | 2.000  | 5.000  | 2.000   | 80.000  | .005 | .030 |
| 74712038             | 34.90 | .320   | 9.900  | .033 | .180 | .025 | 330.000  | 15.000 | 25.000 | 6.000   | 50.000  | .020 | .040 |
| 74712039             | 36.50 | .220   | 8.000  | .040 | .078 | .014 | 400.000  | 2.000  | 5.000  | 25.000  | 30.000  | .010 | .080 |
| 74712040             | 35.60 | 1.700  | 4.300  | .035 | .081 | .040 | 290.000  | 50.000 | 5.000  | 3.000   | 40.000  | .015 | .030 |
| 74712072             | 35.70 | .230   | 8.750  | .024 | .021 | .009 | 100.000  | 2.000  | 5.000  | 10.000  | 40.000  | .005 | .050 |
| 74712077             | 35.80 | 1.140  | 6.150  | .047 | .024 | .014 | 70.000   | 2.000  | 10.000 | 15.000  | 20.000  | .005 | .030 |



| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE   | MN   | P        | CU     | PB      | ZN      | BA       | F    | ORGC |
|----------------------|-------|--------|--------|------|------|------|----------|--------|---------|---------|----------|------|------|
| 74712078             | 22.60 | 12.300 | 1.500  | .003 | .064 | .044 | 150.000  | 1.700  | 5.000   | 7.000   | 40.000   | .010 | .050 |
| 74712079             | 37.30 | .590   | 2.050  | .029 | .019 | .015 | 40.000   | 2.630  | 5.000   | 9.000   | 50.000   | .005 | .030 |
| 74712105             | 33.40 | .260   | 16.100 | .032 | .096 | .024 | 340.000  | 3.000  | 5.000   | 3.000   | 30.000   | .010 | .030 |
| 74712107             | 33.60 | .470   | 13.000 | .093 | .066 | .012 | 230.000  | 3.000  | 5.000   | 6.000   | 180.000  | .015 | .070 |
| 74712115             | 30.90 | 6.050  | 1.650  | .020 | .110 | .013 | 30.000   | 2.000  | 5.000   | 7.000   | 10.000   | .005 | .040 |
| 74712116             | 35.40 | 1.300  | 5.500  | .003 | .035 | .034 | 140.000  | 7.000  | 10.000  | 95.000  | 170.000  | .015 | .050 |
| 74712117             | 37.50 | .380   | 4.250  | .045 | .048 | .009 | 20.000   | 2.000  | 5.000   | 25.000  | 30.000   | .300 | .040 |
| 74712118             | 37.20 | .280   | 4.850  | .053 | .096 | .013 | 50.000   | 3.000  | 5.000   | 4.000   | 70.000   | .005 | .030 |
| 74712119             | 38.10 | .300   | 5.500  | .044 | .035 | .007 | 100.000  | 3.000  | 5.000   | 5.000   | 20.000   | .030 | .050 |
| 74712121             | 37.60 | .340   | 2.850  | .039 | .041 | .007 | 20.000   | 2.000  | 5.000   | 6.000   | 20.000   | .005 | .050 |
| 74712122             | 36.40 | .330   | 6.950  | .054 | .047 | .011 | 30.000   | 3.000  | 5.000   | 3.000   | 60.000   | .005 | .040 |
| 74712137             | 36.10 | .270   | 7.150  | .033 | .026 | .009 | 40.000   | 3.000  | 5.000   | 4.000   | 70.000   | .005 | .040 |
| 74712149             | 20.70 | 10.900 | 15.700 | .002 | .160 | .036 | 50.000   | 2.000  | 5.000   | 7.000   | 90.000   | .005 | .040 |
| 74712151             | 36.80 | .870   | 4.350  | .048 | .096 | .012 | 70.000   | 3.000  | 5.000   | 15.000  | 20.000   | .005 | .040 |
| 74712152             | 38.20 | .220   | 4.200  | .028 | .017 | .010 | 40.000   | 3.000  | 5.000   | 15.000  | 30.000   | .005 | .030 |
| 74712155             | 5.90  | .160   | 81.400 | .002 | .110 | .010 | 830.000  | 50.000 | 50.000  | 640.000 | 350.000  | .012 | .090 |
| 74712157             | 24.10 | 12.500 | 2.550  | .003 | .130 | .050 | 210.000  | 2.000  | 5.000   | 7.000   | 30.000   | .010 | .050 |
| 74712158             | 34.10 | 2.550  | 3.700  | .028 | .045 | .028 | 240.000  | 3.000  | 5.000   | 30.000  | 20.000   | .005 | .050 |
| 74712159             | 36.80 | 2.600  | 1.750  | .028 | .021 | .027 | 40.000   | 2.000  | 5.000   | 10.000  | 20.000   | .005 | .050 |
| 74712165             | 32.00 | 3.300  | 11.200 | .038 | .055 | .007 | 170.000  | 2.000  | 5.000   | 10.000  | 190.000  | .010 | .050 |
| 74712166             | 39.50 | .400   | 2.100  | .050 | .031 | .006 | 40.000   | 2.000  | 5.000   | 3.000   | 20.000   | .010 | .040 |
| 74712167             | 34.10 | 3.800  | 4.150  | .020 | .140 | .008 | 30.000   | 3.000  | 5.000   | 15.000  | 80.000   | .010 | .050 |
| 74712168             | 28.30 | 1.350  | 27.400 | .043 | .140 | .013 | 120.000  | 3.000  | 5.000   | 4.000   | 4000.000 | .010 | .080 |
| 74712169             | 22.20 | 11.500 | 8.200  | .004 | .270 | .042 | 70.000   | 4.000  | 10.000  | 25.000  | 50.000   | .010 | .080 |
| 74712192             | 36.20 | .370   | 7.800  | .042 | .076 | .014 | 70.000   | 2.000  | 5.000   | 2.000   | 140.000  | .010 | .050 |
| 74712193             | 34.70 | .370   | 10.300 | .042 | .073 | .014 | 140.000  | 3.000  | 5.000   | 3.000   | 260.000  | .010 | .060 |
| 74712194             | 34.90 | .340   | 12.300 | .040 | .074 | .010 | 80.000   | 2.000  | 5.000   | 3.000   | 110.000  | .010 | .070 |
| 74712195             | 36.90 | .380   | 5.700  | .047 | .069 | .012 | 140.000  | 3.000  | 5.000   | 2.000   | 60.000   | .010 | .050 |
| 74712196             | 37.50 | .310   | 3.900  | .057 | .074 | .011 | 40.000   | 3.000  | 5.000   | 2.000   | 30.000   | .035 | .060 |
| 74712199             | 36.90 | .160   | 6.300  | .029 | .043 | .013 | 30.000   | 2.000  | 5.000   | 55.000  | 50.000   | .005 | .050 |
| 74712200             | 36.60 | .300   | 7.050  | .049 | .080 | .015 | 470.000  | 13.000 | 5.000   | 10.000  | 30.000   | .010 | .050 |
| 74712204             | 34.90 | .190   | 15.300 | .028 | .069 | .021 | 390.000  | 3.000  | 5.000   | 65.000  | 160.000  | .010 | .050 |
| 74712219             | 33.00 | .300   | 15.100 | .007 | .029 | .031 | 290.000  | 5.000  | 5.000   | 180.000 | 1450.000 | .005 | .050 |
| 74712220             | 12.30 | .460   | 65.400 | .013 | .130 | .050 | 290.000  | 3.000  | 5.000   | 5.000   | 3200.000 | .030 | .120 |
| 74712222             | 38.10 | .750   | 4.500  | .040 | .045 | .017 | 20.000   | 3.000  | 5.000   | 20.000  | 70.000   | .005 | .060 |
| 74712223             | 37.20 | .330   | 7.100  | .040 | .035 | .012 | 220.000  | 3.000  | 5.000   | 20.000  | 30.000   | .005 | .040 |
| 74712226             | 35.10 | .340   | 11.200 | .051 | .029 | .005 | 30.000   | 2.000  | 5.000   | 5.000   | 50.000   | .005 | .060 |
| 74712227             | 35.70 | .480   | 7.200  | .040 | .040 | .024 | 60.000   | 2.000  | 18.000  | 7.000   | 40.000   | .008 | .060 |
| 74712229             | 38.10 | .380   | 4.400  | .041 | .033 | .012 | 40.000   | 3.000  | 5.000   | 2.000   | 20.000   | .010 | .050 |
| 74712234             | 22.60 | 11.400 | 3.900  | .004 | .550 | .130 | 10.000   | 2.000  | 55.000  | 15.000  | 20.000   | .005 | .070 |
| 74712235             | 35.60 | .200   | 8.300  | .007 | .019 | .062 | 40.000   | 4.000  | 5.000   | 70.000  | 4200.000 | .005 | .040 |
| 74712236             | 37.60 | .200   | 3.350  | .020 | .021 | .011 | 10.000   | 2.000  | 5.000   | 6.000   | 20.000   | .005 | .030 |
| 74712237             | 35.20 | .330   | 10.500 | .037 | .071 | .043 | 90.000   | 4.000  | 5.000   | 10.000  | 180.000  | .240 | .060 |
| 74712238             | 34.50 | .310   | 14.700 | .035 | .064 | .012 | 100.000  | 2.000  | 5.000   | 2.000   | 130.000  | .043 | .050 |
| 74712239             | 27.30 | 2.200  | 22.600 | .016 | .200 | .022 | 150.000  | 4.000  | 5.000   | 6.000   | 220.000  | .030 | .030 |
| 74712263             | 2.10  | .054   | 92.700 | .004 | .230 | .002 | 350.000  | 34.000 | 4.000   | 34.000  | 80.000   | .017 | .050 |
| 74712267             | 35.60 | .410   | 6.900  | .040 | .040 | .040 | 180.000  | 4.000  | 5.000   | 13.000  | 110.000  | .015 | .090 |
| 74712268             | 37.20 | 1.070  | 3.500  | .040 | .050 | .010 | 20.000   | 8.000  | 5.000   | 3.000   | 20.000   | .010 | .060 |
| 74712272             | 36.10 | .700   | 4.100  | .027 | .120 | .030 | 40.000   | 4.000  | 10.000  | 8.000   | 370.000  | .003 | .060 |
| 74712278             | 2.30  | 24.700 | 5.400  | .004 | .029 | .001 | 20.000   | 2.000  | 4.000   | 40.000  | 40.000   | .120 | .030 |
| 74712290             | 22.90 | 11.800 | 1.800  | .004 | .300 | .059 | 580.000  | 3.000  | 8.000   | 11.000  | 20.000   | .050 | .040 |
| 74712293             | 16.10 | 1.040  | 49.400 | .010 | .160 | .140 | 1350.000 | 24.000 | 270.000 | 210.000 | 2750.000 | .015 | .070 |

## GEOCHEMISTRY=NINMAROO BURKE RIVER BELT

PAGE 4

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE    | MN   | P        | CU      | PB     | ZN       | BA       | F    | ORGE |
|----------------------|-------|--------|--------|------|-------|------|----------|---------|--------|----------|----------|------|------|
| 74712296             | 31.20 | .410   | 21.000 | .110 | .043  | .009 | 140.000  | 3.000   | 8.000  | 7.000    | 120.000  | .034 | .060 |
| 74712304             | 17.70 | .270   | 50.100 | .010 | .140  | .020 | 320.000  | 18.000  | 10.000 | 28.000   | 320.000  | .040 | .090 |
| 74712310             | 23.60 | 3.550  | 26.200 | .006 | .053  | .150 | 320.000  | 24.000  | 46.000 | 105.000  | 1200.000 | .008 | .040 |
| 74712324             | 34.20 | .650   | 12.900 | .030 | .100  | .010 | 100.000  | 4.000   | 5.000  | 6.000    | 90.000   | .015 | .070 |
| 74712325             | 36.10 | .400   | 10.100 | .029 | .033  | .006 | 70.000   | 3.000   | 10.000 | 6.000    | 140.000  | .010 | .010 |
| 74712326             | 33.70 | .460   | 14.700 | .030 | .040  | .010 | 120.000  | 4.000   | 5.000  | 6.000    | 150.000  | .015 | .070 |
| 74712328             | 37.30 | .350   | 5.200  | .030 | .030  | .010 | 20.000   | 4.000   | 5.000  | 8.000    | 20.000   | .010 | .060 |
| 74712329             | 7.60  | .140   | 49.100 | .010 | .120  | .170 | 2800.000 | 320.000 | 10.000 | 1100.000 | 6300.000 | .025 | .130 |
| 74712399             | 14.20 | 8.000  | 36.900 | .005 | .200  | .019 | 110.000  | 7.000   | 8.000  | 7.000    | 90.000   | .011 | .040 |
| 74712400             | 22.80 | 7.250  | 39.800 | .010 | .091  | .009 | 80.000   | 16.000  | 18.000 | 10.000   | 200.000  | .034 | .020 |
| 74712401             | 20.40 | 11.800 | 6.800  | .004 | 1.180 | .180 | 45.000   | 3.000   | 6.000  | 6.000    | 40.000   | .008 | .010 |
| 74712403             | 27.60 | .600   | 28.700 | .002 | .083  | .085 | 130.000  | 8.000   | 8.000  | 55.000   | 220.000  | .006 | .030 |
| 74712404             | 12.90 | 5.300  | 47.300 | .002 | .170  | .036 | 260.000  | 11.000  | 32.000 | 87.000   | 70.000   | .010 | .040 |
| 74715030             | 17.40 | 8.950  | 24.500 | .005 | .470  | .050 | 350.000  | 7.000   | 10.000 | 16.000   | 200.000  | .030 | .060 |
| 74715031             | 19.20 | 10.200 | 12.600 | .004 | .600  | .073 | 140.000  | 4.000   | 10.000 | 17.000   | 100.000  | .035 | .060 |
| 74715032             | 14.00 | 7.300  | 36.200 | .004 | .510  | .063 | 160.000  | 2.000   | 10.000 | 8.000    | 240.000  | .035 | .030 |
| 74715033             | 21.80 | 11.800 | 1.950  | .003 | .600  | .094 | 20.000   | 2.000   | 5.000  | 8.000    | 210.000  | .025 | .060 |
| 74715034             | 22.00 | 11.300 | 4.300  | .005 | .660  | .110 | 60.000   | 2.000   | 5.000  | 12.000   | 40.000   | .035 | .040 |
| 74715035             | 11.40 | 6.350  | 44.400 | .003 | .530  | .082 | 360.000  | 4.000   | 5.000  | 14.000   | 480.000  | .035 | .040 |
| 74715036             | 19.70 | 10.100 | 10.600 | .005 | .560  | .075 | 200.000  | 4.000   | 10.000 | 40.000   | 80.000   | .035 | .010 |
| 74715037             | 17.90 | 9.000  | 22.500 | .005 | .370  | .094 | 90.000   | 4.000   | 5.000  | 15.000   | 240.000  | .035 | .030 |
| 74715038             | 21.20 | 10.700 | 8.900  | .003 | .440  | .034 | 90.000   | 2.000   | 5.000  | 10.000   | 70.000   | .030 | .030 |
| 74715039             | 21.40 | 10.900 | 6.400  | .005 | .460  | .055 | 80.000   | 3.000   | 5.000  | 8.000    | 50.000   | .030 | .050 |
| 74715040             | 14.90 | 7.900  | 33.300 | .003 | .480  | .087 | 180.000  | 6.000   | 5.000  | 12.000   | 300.000  | .035 | .040 |
| 74715041             | 19.60 | 10.200 | 12.700 | .004 | .610  | .100 | 90.000   | 4.000   | 10.000 | 7.000    | 70.000   | .030 | .040 |
| 74715042             | 18.80 | 9.650  | 15.100 | .003 | .720  | .110 | 70.000   | 4.000   | 5.000  | 12.000   | 100.000  | .030 | .030 |
| 74715043             | 18.40 | 9.650  | 17.300 | .003 | .540  | .074 | 60.000   | 4.000   | 10.000 | 12.000   | 170.000  | .025 | .040 |
| 74715044             | 17.90 | 9.650  | 17.300 | .003 | .470  | .100 | 170.000  | 8.000   | 10.000 | 16.000   | 100.000  | .030 | .040 |
| 74715045             | 19.70 | 10.200 | 12.100 | .004 | .480  | .042 | 70.000   | 9.000   | 5.000  | 15.000   | 480.000  | .030 | .040 |
| 74715046             | 19.30 | 9.500  | 16.300 | .005 | .650  | .130 | 200.000  | 4.000   | 10.000 | 40.000   | 110.000  | .035 | .030 |
| 74715047             | 19.00 | 9.500  | 15.600 | .005 | .500  | .067 | 170.000  | 4.000   | 10.000 | 12.000   | 70.000   | .025 | .050 |
| 74715048             | 20.40 | 10.500 | 9.500  | .005 | .680  | .140 | 50.000   | 4.000   | 10.000 | 13.000   | 50.000   | .030 | .060 |
| 74715049             | 20.50 | 10.700 | 8.400  | .003 | .770  | .045 | 50.000   | 3.000   | 5.000  | 5.000    | 50.000   | .030 | .040 |
| 74715050             | 20.00 | 10.800 | 7.200  | .004 | .360  | .046 | 60.000   | 6.000   | 5.000  | 8.000    | 30.000   | .025 | .050 |
| 74715104             | 30.90 | .340   | 19.800 | .030 | .043  | .015 | 190.000  | 4.000   | 5.000  | 34.000   | 170.000  | .020 | .070 |
| 74715105             | 15.10 | .150   | 56.500 | .013 | .034  | .012 | 470.000  | 1.000   | 10.000 | 13.000   | 530.000  | .015 | .040 |
| 74715106             | 17.00 | .160   | 52.600 | .016 | .035  | .012 | 490.000  | 1.000   | 10.000 | 11.000   | 500.000  | .015 | .050 |

## GEOCHEMISTRY=NINMAROO TOKO

PAGE 1

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE   | MN   | P       | CU      | PB      | ZN      | BA      | F    | ORGC |
|----------------------|-------|--------|--------|------|------|------|---------|---------|---------|---------|---------|------|------|
| 74711150             | 36.80 | .240   | 7.200  | .021 | .075 | .038 | 80.000  | 1.000   | 4.000   | 7.000   | 280.000 | .004 | .050 |
| 74711151             | 36.60 | .230   | 8.200  | .021 | .053 | .023 | 210.000 | 1.000   | 8.000   | 8.000   | 20.000  | .005 | .050 |
| 74711152             | 37.80 | .230   | 3.960  | .027 | .061 | .027 | 50.000  | 1.000   | 4.000   | 15.000  | 40.000  | .002 | .050 |
| 74711153             | 33.40 | 2.610  | 4.220  | .022 | .240 | .042 | 90.000  | 1.000   | 4.000   | 47.000  | 50.000  | .010 | .050 |
| 74711154             | 36.80 | .220   | 6.200  | .022 | .066 | .032 | 100.000 | 1.000   | 4.000   | 7.000   | 100.000 | .006 | .050 |
| 74711155             | 37.00 | .360   | 7.000  | .030 | .060 | .030 | 120.000 | 20.000  | 10.000  | 18.000  | 40.000  | .005 | .100 |
| 74711156             | 35.90 | .230   | 10.000 | .018 | .060 | .027 | 70.000  | 1.000   | 4.000   | 7.000   | 120.000 | .003 | .050 |
| 74711157             | 36.20 | .270   | 6.400  | .023 | .075 | .063 | 250.000 | 4.000   | 18.000  | 60.000  | 130.000 | .007 | .050 |
| 74711158             | 32.50 | 3.100  | 7.600  | .022 | .280 | .098 | 370.000 | 1.000   | 8.000   | 83.000  | 220.000 | .008 | .050 |
| 74711204             | 34.80 | .750   | 6.200  | .020 | .077 | .062 | 260.000 | 1.000   | 10.000  | 2.000   | 70.000  | .012 | .050 |
| 74711252             | 37.00 | .170   | 4.440  | .050 | .056 | .019 | 100.000 | 13.000  | 6.000   | 13.000  | 60.000  | .005 | .050 |
| 74711253             | 36.30 | .340   | 8.600  | .030 | .080 | .020 | 80.000  | 20.000  | 5.000   | 22.000  | 90.000  | .010 | .070 |
| 74711391             | 34.20 | .770   | 11.200 | .029 | .084 | .017 | 120.000 | 5.000   | 10.000  | 8.000   | 440.000 | .006 | .050 |
| 74711392             | 36.90 | .180   | 10.000 | .032 | .052 | .016 | 210.000 | 15.000  | 6.000   | 16.000  | 110.000 | .004 | .020 |
| 74711393             | 36.80 | .230   | 4.280  | .035 | .047 | .017 | 30.000  | 1.000   | 4.000   | 8.000   | 80.000  | .004 | .050 |
| 74711396             | 38.00 | .980   | 3.240  | .027 | .088 | .019 | 120.000 | 1.000   | 4.000   | 5.000   | 20.000  | .002 | .050 |
| 74711398             | 37.30 | .250   | 8.000  | .030 | .030 | .005 | 60.000  | 1.000   | 6.000   | 38.000  | 360.000 | .002 | .020 |
| 74711399             | 38.10 | .820   | 2.660  | .028 | .044 | .009 | 40.000  | 1.000   | 4.000   | 13.000  | 20.000  | .002 | .030 |
| 74711400             | 31.20 | 3.950  | 6.900  | .015 | .130 | .014 | 70.000  | 1.000   | 4.000   | 8.000   | 20.000  | .005 | .050 |
| 74711401             | 36.50 | .220   | 7.800  | .220 | .049 | .041 | 110.000 | 1.000   | 6.000   | 7.000   | 110.000 | .005 | .040 |
| 74711402             | 36.00 | .220   | 8.700  | .030 | .030 | .010 | 100.000 | 5.000   | 10.000  | 32.000  | 50.000  | .005 | .060 |
| 74711403             | 34.60 | 2.070  | 3.900  | .030 | .110 | .011 | 410.000 | 1.000   | 4.000   | 7.000   | 20.000  | .020 | .020 |
| 74711405             | 36.40 | .330   | 5.200  | .030 | .044 | .010 | 40.000  | 2.000   | 4.000   | 47.000  | 20.000  | .002 | .050 |
| 74711407             | 24.20 | 7.800  | 9.400  | .010 | .360 | .020 | 20.000  | 6.000   | 10.000  | 4.000   | 70.000  | .015 | .060 |
| 74711408             | 34.70 | 1.380  | 5.200  | .031 | .120 | .014 | 40.000  | 1.000   | 4.000   | 7.000   | 20.000  | .006 | .050 |
| 74711409             | 36.00 | .400   | 7.400  | .040 | .050 | .010 | 60.000  | 6.000   | 5.000   | 3.000   | 60.000  | .005 | .030 |
| 74711410             | 38.80 | .550   | 2.020  | .036 | .089 | .027 | 10.000  | 1.000   | 180.000 | 5.000   | 40.000  | .002 | .050 |
| 74711411             | 32.10 | 1.760  | 11.600 | .020 | .140 | .030 | 150.000 | 5.000   | 4.000   | 7.000   | 140.000 | .008 | .050 |
| 74711462             | 37.20 | .430   | 2.860  | .054 | .084 | .018 | 40.000  | 1.000   | 4.000   | 12.000  | 20.000  | .004 | .050 |
| 74712417             | 21.00 | 12.300 | 3.300  | .003 | .210 | .031 | 50.000  | 4.000   | 4.000   | 9.000   | 50.000  | .008 | .020 |
| 74712418             | 39.60 | .260   | 1.740  | .055 | .047 | .007 | 20.000  | 1.000   | 4.000   | 17.000  | 20.000  | .002 | .010 |
| 74712419             | 22.00 | 12.400 | 2.680  | .004 | .270 | .020 | 30.000  | 1.000   | 4.000   | 20.000  | 20.000  | .002 | .020 |
| 74712420             | 21.50 | 12.300 | 2.680  | .002 | .410 | .020 | 40.000  | 2.000   | 4.000   | 21.000  | 20.000  | .003 | .030 |
| 74712442             | 31.90 | .300   | 18.500 | .046 | .100 | .020 | 110.000 | 2.000   | 16.000  | 11.000  | 150.000 | .006 | .040 |
| 74712443             | 38.30 | 67.000 | 3.000  | .044 | .087 | .019 | 25.000  | 4.000   | 32.000  | 8.000   | 30.000  | .003 | .050 |
| 74712444             | 38.10 | .460   | 8.200  | .047 | .059 | .012 | 5.000   | 1.000   | 8.000   | 10.000  | 50.000  | .005 | .040 |
| 74712445             | 38.40 | .390   | 3.000  | .051 | .059 | .012 | 10.000  | 1.000   | 12.000  | 8.000   | 20.000  | .009 | .040 |
| 74712447             | 39.00 | .250   | 1.100  | .032 | .035 | .011 | 5.000   | 3.000   | 10.000  | 19.000  | 20.000  | .010 | .020 |
| 74712448             | 35.00 | 2.200  | 2.700  | .040 | .200 | .020 | 20.000  | 6.000   | 5.000   | 13.000  | 20.000  | .010 | .090 |
| 74712449             | 37.00 | .390   | 7.200  | .040 | .060 | .010 | 60.000  | 6.000   | 5.000   | 16.000  | 30.000  | .010 | .040 |
| 74712450             | 37.20 | .550   | 2.900  | .042 | .062 | .014 | 100.000 | 1.000   | 8.000   | 25.000  | 20.000  | .022 | .020 |
| 74712452             | 36.40 | .230   | 8.200  | .017 | .055 | .150 | 70.000  | 4.000   | 22.000  | 31.000  | 800.000 | .010 | .020 |
| 74712453             | 33.00 | .450   | 16.600 | .040 | .083 | .038 | 130.000 | 4.000   | 24.000  | 44.000  | 170.000 | .008 | .030 |
| 74712461             | 28.00 | 6.750  | 9.400  | .050 | .180 | .012 | 65.000  | 1.000   | 4.000   | 12.000  | 50.000  | .018 | .030 |
| 74712462             | 1.50  | .330   | 93.600 | .002 | .140 | .011 | 145.000 | 12.000  | 8.000   | 12.000  | 130.000 | .008 | .040 |
| 74712464             | 27.90 | 7.350  | 5.900  | .022 | .390 | .017 | 35.000  | 3.000   | 12.000  | 20.000  | 60.000  | .024 | .030 |
| 74712465             | 38.60 | .420   | 2.600  | .045 | .053 | .006 | 10.000  | 3.000   | 4.000   | 3.000   | 20.000  | .013 | .020 |
| 74712466             | 1.20  | .060   | 84.800 | .010 | .320 | .020 | 760.000 | 830.000 | 170.000 | 210.000 | 130.000 | .010 | .100 |
| 74712467             | .64   | .020   | 82.200 | .010 | .280 | .020 | 40.000  | 34.000  | 55.000  | 85.000  | 140.000 | .010 | .080 |
| 74712468             | 36.70 | 1.240  | 3.200  | .095 | .100 | .017 | 30.000  | 8.000   | 4.000   | 5.000   | 230.000 | .010 | .040 |
| 74712469             | 27.60 | 4.000  | 18.200 | .020 | .380 | .030 | 100.000 | 8.000   | 5.000   | 9.000   | 80.000  | .020 | .040 |
| 74712471             | 37.30 | .700   | 2.800  | .049 | .130 | .012 | 5.000   | 2.000   | 12.000  | 9.000   | 90.000  | .015 | .030 |

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE    | MN   | P        | CU     | PB      | ZN      | BA       | F    | ORGC |
|----------------------|-------|--------|--------|------|-------|------|----------|--------|---------|---------|----------|------|------|
| 74712472             | 28.70 | 4.600  | 11.400 | .037 | .350  | .021 | 10.000   | 1.000  | 8.000   | 12.000  | 40.000   | .013 | .030 |
| 74712473             | 55.00 | .790   | 6.600  | .052 | .380  | .099 | 140.000  | 3.000  | 12.000  | 4.000   | 470.000  | .017 | .030 |
| 74712476             | 22.30 | 12.700 | .500   | .004 | .140  | .027 | 10.000   | 2.000  | 4.000   | 13.000  | 40.000   | .017 | .020 |
| 74712477             | 19.10 | 12.500 | 6.900  | .010 | .240  | .130 | 40.000   | 6.000  | 5.000   | 26.000  | 30.000   | .010 | .050 |
| 74712478             | 26.60 | 6.150  | 9.800  | .005 | .130  | .074 | 85.000   | 24.000 | 8.000   | 39.000  | 300.000  | .005 | .020 |
| 74712480             | 36.60 | .280   | 11.600 | .046 | .060  | .019 | 25.000   | 2.000  | 4.000   | 10.000  | 80.000   | .019 | .020 |
| 74712481             | 28.80 | 3.830  | 13.000 | .017 | .270  | .028 | 20.000   | 2.000  | 16.000  | 5.000   | 230.000  | .020 | .030 |
| 74712482             | 39.50 | .230   | 2.200  | .068 | .051  | .009 | 25.000   | 5.000  | 4.000   | 3.000   | 20.000   | .011 | .030 |
| 74712483             | 34.30 | 2.460  | 5.500  | .042 | .190  | .029 | 20.000   | 5.000  | 26.000  | 10.000  | 50.000   | .004 | .030 |
| 74712484             | 38.80 | .240   | 3.100  | .027 | .043  | .007 | 5.000    | 2.000  | 6.000   | 4.000   | 60.000   | .005 | .030 |
| 74712485             | 21.80 | 11.400 | 4.200  | .005 | .400  | .028 | 40.000   | 7.000  | 4.000   | 8.000   | 50.000   | .007 | .020 |
| 74712486             | 23.10 | 11.800 | 1.900  | .005 | .220  | .054 | 55.000   | 5.000  | 14.000  | 6.000   | 20.000   | .008 | .010 |
| 74712488             | 20.00 | 11.200 | 10.000 | .005 | .240  | .048 | 310.000  | 6.000  | 14.000  | 23.000  | 190.000  | .018 | .020 |
| 74712490             | 33.60 | 1.890  | 10.700 | .027 | .120  | .015 | 60.000   | 1.000  | 4.000   | 24.000  | 140.000  | .005 | .030 |
| 74712491             | 1.38  | .210   | 92.700 | .003 | .100  | .010 | 2000.000 | 6.000  | 14.000  | 15.000  | 2150.000 | .055 | .040 |
| 74712493             | 21.00 | 12.200 | 2.500  | .002 | .190  | .038 | 10.000   | 2.000  | 6.000   | 3.000   | 60.000   | .010 | .030 |
| 74712495             | 18.90 | 10.800 | 12.500 | .003 | .280  | .042 | 155.000  | 1.000  | 4.000   | 11.000  | 120.000  | .007 | .030 |
| 74712497             | .60   | .060   | 87.500 | .010 | .400  | .030 | 520.000  | 95.000 | 340.000 | 170.000 | 100.000  | .010 | .100 |
| 74712498             | 33.10 | .430   | 14.000 | .023 | .070  | .065 | 130.000  | 1.000  | 8.000   | 28.000  | 320.000  | .006 | .020 |
| 74712500             | 34.00 | 2.400  | 6.600  | .022 | .080  | .009 | 60.000   | 1.000  | 4.000   | 15.000  | 320.000  | .005 | .020 |
| 74712501             | 34.00 | 1.280  | 7.400  | .024 | .087  | .014 | 30.000   | 7.000  | 20.000  | 5.000   | 440.000  | .012 | .050 |
| 74712502             | 35.50 | .230   | 12.200 | .035 | .036  | .006 | 35.000   | 8.000  | 8.000   | 1.000   | 200.000  | .003 | .020 |
| 74712514             | 20.50 | 12.800 | 4.600  | .010 | .310  | .030 | 20.000   | 2.000  | 20.000  | 6.000   | 20.000   | .010 | .050 |
| 74712516             | 21.20 | 12.800 | 2.200  | .002 | .300  | .021 | 5.000    | 3.000  | 14.000  | 4.000   | 30.000   | .008 | .010 |
| 74712517             | 21.80 | 12.600 | .800   | .002 | .190  | .019 | 5.000    | 1.000  | 4.000   | 6.000   | 20.000   | .006 | .010 |
| 74712518             | 21.30 | 13.000 | 4.300  | .003 | .280  | .014 | 5.000    | 1.000  | 8.000   | 3.000   | 50.000   | .009 | .010 |
| 74712519             | 22.00 | 11.800 | 2.300  | .003 | .410  | .021 | 15.000   | 1.000  | 6.000   | 5.000   | 20.000   | .013 | .030 |
| 74712520             | 20.70 | 12.500 | 3.400  | .004 | .470  | .032 | 5.000    | 2.000  | 6.000   | 4.000   | 160.000  | .015 | .050 |
| 74712521             | 22.50 | 10.700 | 5.400  | .009 | .620  | .026 | 15.000   | 2.000  | 10.000  | 3.000   | 80.000   | .017 | .020 |
| 74712522             | 37.90 | .290   | 3.200  | .120 | .050  | .010 | 20.000   | 6.000  | 5.000   | 3.000   | 240.000  | .010 | .030 |
| 74712524             | 38.10 | .370   | 5.200  | .050 | .055  | .007 | 5.000    | 1.000  | 8.000   | 4.000   | 780.000  | .007 | .030 |
| 74712527             | 35.00 | .440   | 9.200  | .030 | .110  | .010 | 80.000   | 4.000  | 5.000   | 4.000   | 90.000   | .010 | .060 |
| 74712529             | 34.00 | 1.900  | 7.000  | .020 | .200  | .020 | 20.000   | 4.000  | 5.000   | 8.000   | 40.000   | .010 | .030 |
| 74712530             | 36.40 | .850   | 5.200  | .033 | .100  | .009 | 5.000    | 2.000  | 8.000   | 3.000   | 40.000   | .009 | .050 |
| 74712531             | 35.00 | 1.700  | 6.200  | .030 | .140  | .010 | 20.000   | 6.000  | 5.000   | 6.000   | 30.000   | .010 | .030 |
| 74712532             | 33.70 | 3.000  | 5.100  | .030 | .220  | .010 | 20.000   | 2.000  | 5.000   | 4.000   | 20.000   | .010 | .040 |
| 74712536             | 34.10 | 3.550  | 2.600  | .030 | .320  | .026 | 10.000   | 1.000  | 10.000  | 14.000  | 20.000   | .007 | .020 |
| 74712537             | 37.60 | .300   | 4.200  | .040 | .093  | .021 | 80.000   | 2.000  | 8.000   | 6.000   | 50.000   | .007 | .040 |
| 74712539             | 37.10 | 1.070  | 5.100  | .019 | .080  | .017 | 75.000   | 3.000  | 20.000  | 27.000  | 30.000   | .020 | .030 |
| 74712542             | 35.90 | .270   | 8.800  | .030 | .120  | .043 | 105.000  | 2.000  | 14.000  | 8.000   | 80.000   | .007 | .030 |
| 74712544             | 38.40 | .460   | 5.000  | .038 | .057  | .014 | 110.000  | 7.000  | 40.000  | 11.000  | 20.000   | .008 | .060 |
| 74712545             | 36.00 | .250   | 11.500 | .029 | .063  | .029 | 10.000   | 2.000  | 24.000  | 5.000   | 100.000  | .005 | .030 |
| 74712546             | 23.20 | 9.300  | 8.000  | .010 | 1.350 | .140 | 560.000  | 55.000 | 5.000   | 14.000  | 90.000   | .025 | .050 |
| 74712547             | 32.40 | 3.300  | 5.800  | .002 | .260  | .160 | 335.000  | 5.000  | 20.000  | 11.000  | 780.000  | .022 | .040 |
| 74712552             | 35.40 | .320   | 7.300  | .037 | .058  | .012 | 10.000   | 1.000  | 300.000 | 3.000   | 300.000  | .002 | .030 |
| 74712553             | 36.30 | 1.360  | 5.200  | .039 | .099  | .008 | 25.000   | 4.000  | 18.000  | 8.000   | 20.000   | .006 | .030 |
| 74712554             | 38.10 | .400   | 3.500  | .044 | .034  | .009 | 10.000   | 2.000  | 38.000  | 50.000  | 20.000   | .002 | .040 |
| 74712557             | 12.60 | 1.310  | 63.800 | .013 | .140  | .012 | 90.000   | 7.000  | 30.000  | 21.000  | 70.000   | .034 | .030 |
| 74712558             | 37.20 | .370   | 6.400  | .037 | .057  | .011 | 40.000   | 4.000  | 34.000  | 105.000 | 20.000   | .007 | .040 |
| 74712559             | 32.70 | 3.080  | 5.900  | .031 | .066  | .240 | 120.000  | 1.000  | 4.000   | 82.000  | 20.000   | .007 | .030 |
| 74712560             | 38.70 | .140   | 1.800  | .028 | .032  | .009 | 60.000   | 44.000 | 42.000  | 46.000  | 230.000  | .006 | .020 |
| 74712561             | 28.10 | 7.200  | 6.700  | .005 | .450  | .043 | 20.000   | 2.000  | 28.000  | 3.000   | 60.000   | .017 | .010 |

## GEOCHEMISTRY=NINMAROO TOKO

PAGE 3

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE   | MN   | P       | CU     | PB     | ZN     | BA      | F    | ORGC |
|----------------------|-------|--------|--------|------|------|------|---------|--------|--------|--------|---------|------|------|
| 74712577             | 21.50 | 12.100 | 6.100  | .006 | .085 | .017 | 290.000 | 29.000 | 8.000  | 8.000  | 30.000  | .013 | .030 |
| 74712581             | 22.00 | 12.400 | 2.600  | .005 | .089 | .022 | 30.00   | 1.000  | 12.000 | 17.000 | 90.000  | .007 | .030 |
| 74712584             | 18.10 | 9.000  | 22.300 | .003 | .260 | .030 | 130.000 | 8.000  | 75.000 | 24.000 | 180.000 | .007 | .030 |
| 74712585             | 21.70 | 13.300 | 1.300  | .005 | .190 | .046 | 5.000   | 1.000  | 48.000 | 15.000 | 70.000  | .006 | .030 |
| 74712587             | 23.90 | 10.200 | 4.000  | .007 | .066 | .060 | 100.000 | 13.000 | 22.000 | 9.000  | 280.000 | .014 | .050 |
| 74712591             | 23.30 | 11.400 | 3.000  | .004 | .220 | .033 | 55.000  | 5.000  | 24.000 | 51.000 | 20.000  | .011 | .030 |
| 74712596             | 18.20 | 10.400 | 16.000 | .005 | .470 | .026 | 40.000  | 4.000  | 12.000 | 5.000  | 90.000  | .013 | .010 |
| 74712597             | 38.50 | .320   | 3.300  | .069 | .048 | .007 | 25.000  | 2.000  | 18.000 | 5.000  | 40.000  | .006 | .030 |
| 74712598             | 36.10 | 1.200  | 4.200  | .052 | .093 | .016 | 20.000  | 2.000  | 32.000 | 7.000  | 290.000 | .013 | .040 |
| 74712599             | 34.90 | .230   | 10.100 | .052 | .065 | .014 | 135.000 | 3.000  | 20.000 | 4.000  | 70.000  | .005 | .020 |

| REGISTERED<br>NUMBER | CA    | MG    | INSOL  | SR   | FE   | MN   | P       | CU     | PB     | ZN      | BA       | F    | ORGC |
|----------------------|-------|-------|--------|------|------|------|---------|--------|--------|---------|----------|------|------|
| 747110577            | 36.90 | .220  | 6.900  | .071 | .042 | .160 | 165.000 | 5.000  | 18.000 | 8.000   | 140.000  | .011 | .040 |
| 74711168             | 22.70 | 1.080 | 5.300  | .014 | .130 | .039 | 90.000  | 1.000  | 4.000  | 11.000  | 20.000   | .010 | .050 |
| 74711198             | 38.50 | .160  | 3.700  | .010 | .060 | .020 | 60.000  | 8.000  | 5.000  | 7.000   | 20.000   | .005 | .090 |
| 74711200             | 37.80 | .360  | 4.500  | .020 | .090 | .080 | 60.000  | 8.000  | 10.000 | 40.000  | 40.000   | .005 | .080 |
| 74711201             | 37.80 | .220  | 4.260  | .023 | .100 | .081 | 60.000  | 1.000  | 12.000 | 29.000  | 20.000   | .003 | .040 |
| 74711244             | 33.50 | .270  | 15.800 | .020 | .050 | .050 | 80.000  | 8.000  | 10.000 | 30.000  | 170.000  | .005 | .080 |
| 74711248             | 33.00 | .250  | 16.900 | .020 | .100 | .120 | 260.000 | 14.000 | 35.000 | 15.000  | 460.000  | .010 | .100 |
| 74711249             | 36.00 | .240  | 7.300  | .020 | .350 | .300 | 480.000 | 16.000 | 15.000 | 14.000  | 100.000  | .015 | .060 |
| 74711250             | 36.00 | .210  | 7.200  | .020 | .480 | .410 | 380.000 | 10.000 | 10.000 | 9.000   | 160.000  | .015 | .080 |
| 74711251             | 38.00 | .180  | 4.600  | .020 | .060 | .020 | 80.000  | 4.000  | 5.000  | 28.000  | 30.000   | .005 | .040 |
| 74711281             | 37.00 | .200  | 5.100  | .020 | .150 | .160 | 180.000 | 8.000  | 35.000 | 6.000   | 320.000  | .010 | .060 |
| 74711290             | 38.50 | .260  | 3.000  | .020 | .030 | .020 | 20.000  | 6.000  | 10.000 | 13.000  | 520.000  | .005 | .080 |
| 74711291             | 37.00 | .240  | 7.200  | .020 | .050 | .010 | 60.000  | 6.000  | 5.000  | 8.000   | 20.000   | .005 | .070 |
| 74711292             | 34.20 | .250  | 11.200 | .016 | .048 | .024 | 330.000 | 1.000  | 10.000 | 9.000   | 560.000  | .019 | .020 |
| 74711294             | 38.20 | .710  | 5.900  | .020 | .120 | .080 | 40.000  | 6.000  | 15.000 | 5.000   | 80.000   | .010 | .070 |
| 74711299             | 31.00 | .260  | 20.700 | .020 | .040 | .020 | 60.000  | 6.000  | 10.000 | 7.000   | 100.000  | .005 | .080 |
| 74711340             | 33.90 | .370  | 13.000 | .024 | .035 | .013 | 30.000  | 1.000  | 4.000  | 24.000  | 20.000   | .004 | .050 |
| 74711341             | 38.20 | .490  | 6.500  | .025 | .050 | .027 | 40.000  | 2.000  | 4.000  | 9.000   | 40.000   | .003 | .050 |
| 74711342             | 39.40 | .210  | 2.440  | .021 | .035 | .020 | 20.000  | 1.000  | 4.000  | 23.000  | 20.000   | .002 | .070 |
| 74711348             | 35.50 | .260  | 9.800  | .020 | .050 | .020 | 60.000  | 6.000  | 5.000  | 10.000  | 20.000   | .005 | .090 |
| 74711350             | 36.50 | .310  | 7.200  | .020 | .050 | .020 | 60.000  | 8.000  | 10.000 | 6.000   | 40.000   | .005 | .100 |
| 74711351             | 37.90 | .170  | 4.600  | .010 | .040 | .020 | 60.000  | 6.000  | 5.000  | 13.000  | 20.000   | .005 | .050 |
| 74711352             | 34.80 | .220  | 12.400 | .010 | .030 | .020 | 40.000  | 6.000  | 5.000  | 5.000   | 40.000   | .005 | .040 |
| 74711353             | 38.00 | .260  | 5.300  | .020 | .050 | .030 | 20.000  | 6.000  | 5.000  | 10.000  | 20.000   | .005 | .090 |
| 74711359             | 39.00 | .250  | 2.600  | .020 | .050 | .020 | 40.000  | 6.000  | 10.000 | 6.000   | 20.000   | .005 | .060 |
| 74711360             | 37.00 | .270  | 7.400  | .020 | .040 | .010 | 200.000 | 6.000  | 5.000  | 7.000   | 20.000   | .005 | .060 |
| 74711366             | 36.30 | .200  | 8.200  | .020 | .040 | .020 | 40.000  | 18.000 | 5.000  | 5.000   | 70.000   | .005 | .070 |
| 74711367             | 33.50 | .200  | 15.500 | .020 | .030 | .030 | 40.000  | 6.000  | 10.000 | 13.000  | 260.000  | .005 | .110 |
| 74711368             | 34.00 | .220  | 13.200 | .020 | .030 | .020 | 40.000  | 6.000  | 5.000  | 8.000   | 140.000  | .005 | .060 |
| 74711369             | 36.00 | .220  | 9.700  | .020 | .040 | .050 | 40.000  | 6.000  | 5.000  | 15.000  | 20.000   | .005 | .050 |
| 74711373             | 36.00 | .180  | 10.000 | .010 | .030 | .020 | 60.000  | 8.000  | 5.000  | 6.000   | 20.000   | .005 | .030 |
| 74711374             | 32.60 | .240  | 18.500 | .020 | .030 | .010 | 80.000  | 6.000  | 5.000  | 11.000  | 20.000   | .005 | .060 |
| 74711375             | 26.80 | .190  | 30.900 | .020 | .040 | .010 | 60.000  | 6.000  | 5.000  | 14.000  | 20.000   | .005 | .060 |
| 74711377             | 35.00 | .310  | 13.100 | .020 | .050 | .020 | 20.000  | 6.000  | 5.000  | 6.000   | 20.000   | .005 | .090 |
| 74711378             | 26.60 | .220  | 32.700 | .020 | .050 | .010 | 60.000  | 8.000  | 5.000  | 13.000  | 20.000   | .005 | .130 |
| 74711380             | 38.60 | .360  | .980   | .022 | .065 | .030 | 20.000  | 1.000  | 4.000  | 9.000   | 20.000   | .002 | .050 |
| 74711381             | 34.40 | .210  | 14.000 | .020 | .030 | .030 | 20.000  | 6.000  | 5.000  | 10.000  | 20.000   | .005 | .060 |
| 74711424             | 35.90 | .350  | 8.700  | .020 | .050 | .020 | 80.000  | 70.000 | 15.000 | 6.000   | 20.000   | .005 | .050 |
| 74711425             | 32.00 | .180  | 18.900 | .020 | .060 | .040 | 140.000 | 6.000  | 5.000  | 10.000  | 380.000  | .005 | .050 |
| 74711426             | 35.00 | .260  | 10.400 | .020 | .080 | .030 | 100.000 | 18.000 | 5.000  | 18.000  | 100.000  | .005 | .040 |
| 74711427             | 20.70 | .170  | 45.700 | .018 | .055 | .018 | 140.000 | 1.000  | 4.000  | 35.000  | 70.000   | .003 | .040 |
| 74711428             | 37.00 | .220  | 6.800  | .030 | .250 | .310 | 200.000 | 8.000  | 10.000 | 4.000   | 180.000  | .010 | .050 |
| 74711482             | 37.00 | .280  | 5.500  | .020 | .050 | .010 | 20.000  | 6.000  | 5.000  | 8.000   | 20.000   | .005 | .050 |
| 74711510             | 36.30 | .280  | 4.700  | .020 | .050 | .010 | 20.000  | 4.000  | 5.000  | 8.000   | 20.000   | .005 | .050 |
| 74711511             | 37.30 | .180  | 5.800  | .010 | .030 | .010 | 60.000  | 4.000  | 10.000 | 6.000   | 20.000   | .010 | .050 |
| 74711512             | 35.00 | .270  | 10.900 | .020 | .030 | .010 | 20.000  | 6.000  | 5.000  | 6.000   | 2900.000 | .010 | .060 |
| 74711513             | 34.00 | .270  | 13.200 | .020 | .040 | .030 | 40.000  | 6.000  | 5.000  | 13.000  | 1350.000 | .005 | .050 |
| 74711514             | 30.30 | .260  | 21.000 | .020 | .050 | .020 | 40.000  | 6.000  | 5.000  | 10.000  | 50.000   | .005 | .080 |
| 74711515             | 34.30 | .240  | 14.400 | .030 | .040 | .020 | 40.000  | 6.000  | 10.000 | 13.000  | 3330.000 | .010 | .070 |
| 74711516             | 32.00 | .230  | 16.400 | .020 | .030 | .020 | 40.000  | 6.000  | 10.000 | 160.000 | 150.000  | .010 | .060 |
| 74711517             | 18.50 | .110  | 52.500 | .010 | .050 | .010 | 40.000  | 4.000  | 5.000  | 4.000   | 400.000  | .005 | .070 |
| 74711518             | 36.80 | .220  | 7.400  | .020 | .040 | .030 | 20.000  | 12.000 | 5.000  | 18.000  | 200.000  | .005 | .040 |



## GEOCHEMISTRY-COOLIBAH

PAGE 2

| REGISTERED<br>NUMBER | CA    | MG   | INSOL  | SR   | FE   | MN   | P       | CU    | PB     | ZN     | BA       | F    | ORGC |
|----------------------|-------|------|--------|------|------|------|---------|-------|--------|--------|----------|------|------|
| 74711519             | 32.80 | .210 | 17.700 | .020 | .040 | .020 | 20.000  | 4.000 | 5.000  | 20.000 | 200.000  | .020 | .040 |
| 74711520             | 35.00 | .210 | 12.400 | .020 | .040 | .030 | 40.000  | 6.000 | 5.000  | 28.000 | 120.000  | .005 | .030 |
| 74711521             | 36.70 | .360 | 7.000  | .027 | .052 | .032 | 40.000  | 9.000 | 6.000  | 41.000 | 20.000   | .003 | .040 |
| 74711522             | 36.00 | .240 | 10.100 | .020 | .050 | .050 | 40.000  | 4.000 | 5.000  | 50.000 | 90.000   | .005 | .040 |
| 74711523             | 37.60 | .300 | 5.500  | .020 | .060 | .060 | 20.000  | 6.000 | 5.000  | 42.000 | 190.000  | .010 | .040 |
| 74711525             | 30.00 | .170 | 22.100 | .017 | .056 | .022 | 750.000 | 1.000 | 6.000  | 12.000 | 20.000   | .017 | .040 |
| 74711538             | 35.80 | .260 | 8.400  | .020 | .060 | .060 | 40.000  | 4.000 | 5.000  | 14.000 | 200.000  | .010 | .100 |
| 74711543             | 37.30 | .640 | 4.300  | .020 | .060 | .040 | 540.000 | 6.000 | 5.000  | 6.000  | 6600.000 | .005 | .040 |
| 74711545             | 35.80 | .200 | 10.000 | .010 | .040 | .020 | 60.000  | 8.000 | 5.000  | 8.000  | 280.000  | .005 | .070 |
| 74711546             | 36.00 | .240 | 9.500  | .020 | .040 | .030 | 40.000  | 8.000 | 5.000  | 44.000 | 760.000  | .010 | .030 |
| 74711547             | 35.20 | .790 | 9.000  | .020 | .110 | .060 | 40.000  | 8.000 | 5.000  | 6.000  | 20.000   | .005 | .040 |
| 74711549             | 35.00 | .350 | 12.200 | .020 | .040 | .030 | 40.000  | 6.000 | 5.000  | 28.000 | 40.000   | .005 | .050 |
| 74711550             | 35.00 | .220 | 10.700 | .026 | .042 | .025 | 40.000  | 1.000 | 6.000  | 39.000 | 20.000   | .002 | .030 |
| 74711552             | 34.60 | .230 | 13.100 | .010 | .040 | .020 | 60.000  | 6.000 | 5.000  | 16.000 | 20.000   | .010 | .040 |
| 74711553             | 36.00 | .300 | 8.600  | .020 | .040 | .020 | 40.000  | 6.000 | 5.000  | 6.000  | 110.000  | .005 | .040 |
| 74711554             | 37.00 | .180 | 4.800  | .020 | .060 | .090 | 40.000  | 6.000 | 45.000 | 55.000 | 560.000  | .010 | .020 |
| 74711555             | 34.00 | .230 | 13.400 | .020 | .030 | .030 | 40.000  | 6.000 | 10.000 | 26.000 | 30.000   | .010 | .030 |
| 74711556             | 38.10 | .200 | 3.600  | .020 | .050 | .050 | 40.000  | 6.000 | 10.000 | 22.000 | 150.000  | .005 | .020 |
| 74711557             | 38.50 | .210 | 2.100  | .010 | .060 | .030 | 40.000  | 6.000 | 10.000 | 9.000  | 20.000   | .005 | .040 |
| 74711558             | 35.00 | .330 | 12.500 | .020 | .050 | .030 | 20.000  | 6.000 | 10.000 | 4.000  | 20.000   | .010 | .060 |
| 74711559             | 36.00 | .220 | 5.200  | .020 | .110 | .080 | 20.000  | 4.000 | 20.000 | 16.000 | 20.000   | .005 | .050 |
| 74711560             | 36.30 | .300 | 5.200  | .020 | .080 | .080 | 20.000  | 4.000 | 20.000 | 20.000 | 20.000   | .005 | .070 |
| 74712043             | 37.50 | .260 | 7.300  | .021 | .050 | .014 | 20.000  | 2.000 | 5.000  | 4.000  | 50.000   | .005 | .070 |
| 74712044             | 36.90 | .250 | 7.300  | .025 | .031 | .021 | 90.000  | 2.000 | 5.000  | 20.000 | 140.000  | .005 | .040 |
| 74712045             | 32.60 | .190 | 15.800 | .018 | .041 | .025 | 30.000  | 2.000 | 10.000 | 40.000 | 80.000   | .005 | .030 |

## GEOCHEMISTRY-ARR IN THRUNGA

PAGE 1

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE    | MN   | P       | CU     | PB        | ZN     | GA       | F    | ORGC |
|----------------------|-------|--------|--------|------|-------|------|---------|--------|-----------|--------|----------|------|------|
| 74712367             | 15.20 | 8.600  | 25.400 | .004 | .560  | .088 | 30.000  | 8.000  | 26000.000 | 23.000 | 110.000  | .005 | .030 |
| 74712368             | 21.60 | 12.200 | 4.800  | .004 | .920  | .100 | 55.000  | 5.000  | 46.000    | 69.000 | 40.000   | .013 | .030 |
| 74718002             | 21.20 | .120   | 15.500 | .052 | 1.590 | .040 | 60.000  | 19.000 | 7.000     | 13.000 | 3900.000 | .130 | .080 |
| 74718003             | 31.00 | .470   | 20.800 | .050 | .190  | .013 | 90.000  | 55.000 | 12.000    | 19.000 | 120.000  | .011 | .070 |
| 74718007             | 32.10 | 1.450  | 14.800 | .044 | .310  | .017 | 30.000  | 6.000  | 4.000     | 4.000  | 80.000   | .005 | .060 |
| 74718012             | 29.60 | .370   | 21.800 | .036 | .160  | .014 | 70.000  | 6.000  | 3.000     | 4.000  | 80.000   | .007 | .050 |
| 74718019             | 30.00 | 5.800  | 6.450  | .024 | .510  | .023 | 90.000  | 6.000  | 3.000     | 4.000  | 1100.000 | .012 | .040 |
| 74718022             | 17.90 | 6.280  | 32.900 | .009 | .690  | .031 | 40.000  | 17.000 | 5.000     | 6.000  | 20.000   | .022 | .030 |
| 74718026             | 22.00 | 5.650  | 17.000 | .009 | .820  | .026 | 90.000  | 5.000  | 4.000     | 9.000  | 50.000   | .021 | .050 |
| 74718028             | 9.60  | 4.680  | 58.700 | .003 | .250  | .038 | 80.000  | 2.000  | 2.000     | 3.000  | 70.000   | .010 | .030 |
| 74718032             | 33.80 | 3.100  | 4.750  | .026 | .230  | .015 | 10.000  | 1.000  | 3.000     | 3.000  | 20.000   | .004 | .040 |
| 74718038             | 30.40 | 3.280  | 9.750  | .014 | .300  | .019 | 40.000  | 6.000  | 6.000     | 2.000  | 20.000   | .004 | .040 |
| 74718040             | 36.70 | .620   | 3.850  | .029 | .093  | .011 | 10.000  | 5.000  | 2.000     | 3.000  | 20.000   | .002 | .040 |
| 74718042             | 22.40 | 10.300 | 7.900  | .005 | .540  | .021 | 40.000  | 3.000  | 26.000    | 5.000  | 20.000   | .010 | .040 |
| 74718047             | 22.30 | 12.200 | 3.850  | .003 | .800  | .033 | 30.000  | 3.000  | 4.000     | 1.000  | 20.000   | .008 | .040 |
| 74718049             | 21.80 | 12.100 | 3.700  | .002 | .750  | .034 | 80.000  | 4.000  | 2.000     | 1.000  | 20.000   | .005 | .010 |
| 74718050             | 21.90 | 12.300 | 4.000  | .003 | .710  | .034 | 40.000  | 1.000  | 2.000     | 3.000  | 20.000   | .005 | .020 |
| 74718051             | 17.50 | 10.100 | 21.600 | .003 | .250  | .017 | 60.000  | 2.000  | 2.000     | 2.000  | 20.000   | .004 | .030 |
| 74718052             | 21.80 | 12.400 | 5.350  | .004 | .170  | .015 | 30.000  | 3.000  | 2.000     | 1.000  | 20.000   | .005 | .020 |
| 74718054             | 22.30 | 12.700 | 1.000  | .005 | .210  | .022 | 10.000  | 1.000  | 3.000     | 8.000  | 20.000   | .005 | .020 |
| 74718056             | 28.60 | 6.200  | 5.050  | .012 | .410  | .021 | 20.000  | 2.000  | 4.000     | 1.000  | 20.000   | .010 | .030 |
| 74718067             | 21.00 | 11.200 | 9.900  | .009 | .160  | .020 | 30.000  | 3.000  | 2.000     | 8.000  | 30.000   | .023 | .020 |
| 74718073             | 21.80 | 11.900 | 4.300  | .009 | .220  | .048 | 30.000  | 4.000  | 3.000     | 5.000  | 80.000   | .021 | .020 |
| 74718080             | 21.30 | 11.200 | 10.400 | .008 | .410  | .022 | 10.000  | 2.000  | 2.000     | 4.000  | 20.000   | .015 | .010 |
| 74718086             | 21.00 | 11.000 | 9.650  | .009 | .460  | .020 | 50.000  | 2.000  | 3.000     | 4.000  | 20.000   | .017 | .020 |
| 74718089             | 14.30 | 7.600  | 38.500 | .008 | .240  | .019 | 180.000 | 3.000  | 3.000     | 4.000  | 100.000  | .026 | .020 |
| 74718092             | 22.40 | 10.300 | 8.350  | .009 | .300  | .033 | 40.000  | 3.000  | 2.000     | 13.000 | 20.000   | .020 | .020 |
| 74718097             | 33.10 | 2.420  | 6.650  | .021 | .290  | .026 | 10.000  | 4.000  | 2.000     | 6.000  | 20.000   | .010 | .020 |
| 74718102             | 30.60 | 2.410  | 12.100 | .037 | .190  | .015 | 60.000  | 7.000  | 2.000     | 6.000  | 40.000   | .024 | .060 |
| 74718109             | 34.90 | .580   | 6.600  | .030 | .076  | .016 | 30.000  | 4.000  | 3.000     | 2.000  | 20.000   | .004 | .030 |
| 74718110             | 20.30 | 8.380  | 22.600 | .042 | .340  | .011 | 100.000 | 5.000  | 2.000     | 14.000 | 150.000  | .079 | .040 |
| 74718114             | 30.80 | 1.400  | 17.100 | .031 | .100  | .019 | 80.000  | 2.000  | 2.000     | 8.000  | 50.000   | .016 | .020 |
| 74718120             | 35.40 | .340   | 4.400  | .120 | .056  | .011 | 20.000  | 4.000  | 2.000     | 4.000  | 20.000   | .011 | .020 |
| 74718123             | 36.80 | .380   | 4.900  | .029 | .068  | .017 | 20.000  | 4.000  | 2.000     | 3.000  | 20.000   | .004 | .010 |
| 74718130             | 36.00 | .220   | 10.700 | .055 | .150  | .019 | 40.000  | 2.000  | 4.000     | 5.000  | 20.000   | .005 | .030 |
| 74718131             | 29.30 | 4.380  | 10.400 | .021 | .700  | .025 | 50.000  | 3.000  | 2.000     | 5.000  | 20.000   | .013 | .040 |
| 74718135             | 35.00 | .500   | 5.000  | .041 | .120  | .011 | 10.000  | 1.000  | 3.000     | 3.000  | 20.000   | .005 | .030 |
| 74718138             | 27.80 | 3.970  | 19.200 | .019 | .550  | .019 | 70.000  | 3.000  | 2.000     | 8.000  | 70.000   | .013 | .030 |
| 74718144             | 27.20 | 3.550  | 19.600 | .018 | .480  | .019 | 70.000  | 3.000  | 3.000     | 8.000  | 70.000   | .012 | .040 |
| 74718147             | 18.20 | 7.940  | 26.700 | .007 | .720  | .025 | 60.000  | 1.000  | 2.000     | 5.000  | 70.000   | .021 | .040 |
| 74718150             | 31.80 | .750   | 16.200 | .028 | .220  | .015 | 110.000 | 2.000  | 6.000     | 5.000  | 50.000   | .007 | .030 |
| 74718151             | 34.80 | 2.610  | 3.200  | .030 | .310  | .015 | 10.000  | 1.000  | 4.000     | 18.000 | 20.000   | .009 | .030 |

## GEOCHEMISTRY-KELLY CREEK

PAGE 1

| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE   | MN   | P        | CU     | PB      | ZN       | BA       | F    | ORGC |
|----------------------|-------|--------|--------|------|------|------|----------|--------|---------|----------|----------|------|------|
| 74710265             | 1.14  | .110   | 88.200 | .014 | .140 | .380 | 4000.000 | 26.000 | 120.000 | 560.000  | 4300.000 | .098 | .080 |
| 74711163             | 24.90 | 10.600 | 3.080  | .006 | .150 | .056 | 100.000  | 5.000  | 10.000  | 85.000   | 30.000   | .009 | .050 |
| 74711167             | 21.10 | 11.000 | 10.000 | .012 | .099 | .027 | 40.000   | 2.000  | 4.000   | 24.000   | 90.000   | .010 | .050 |
| 74711195             | 24.40 | 5.300  | 20.300 | .004 | .083 | .044 | 190.000  | 7.000  | 6.000   | 19.000   | 190.000  | .007 | .050 |
| 74711196             | 20.90 | 10.600 | 12.800 | .005 | .140 | .052 | 120.000  | 5.000  | 10.000  | 33.000   | 90.000   | .011 | .050 |
| 74711235             | 22.40 | 12.200 | 3.460  | .002 | .140 | .035 | 60.000   | 2.000  | 10.000  | 9.000    | 20.000   | .011 | .050 |
| 74711236             | 21.30 | 8.600  | 18.800 | .004 | .130 | .060 | 260.000  | 2.000  | 20.000  | 37.000   | 190.000  | .009 | .050 |
| 74711237             | 20.10 | 10.600 | 14.800 | .008 | .110 | .029 | 100.000  | 2.000  | 6.000   | 19.000   | 200.000  | .009 | .050 |
| 74711238             | 20.50 | 11.200 | 11.100 | .003 | .360 | .068 | 90.000   | 8.000  | 6.000   | 17.000   | 30.000   | .006 | .050 |
| 74711239             | 21.00 | 11.800 | 6.300  | .003 | .120 | .060 | 60.000   | 5.000  | 8.000   | 19.000   | 60.000   | .008 | .050 |
| 74711240             | 20.10 | 11.400 | 10.200 | .005 | .230 | .085 | 70.000   | 2.000  | 4.000   | 17.000   | 110.000  | .012 | .050 |
| 74711243             | 24.80 | 6.300  | 14.500 | .009 | .140 | .180 | 640.000  | 5.000  | 6.000   | 27.000   | 1600.000 | .030 | .050 |
| 74711254             | 20.30 | 10.700 | 11.500 | .003 | .580 | .061 | 200.000  | 5.000  | 6.000   | 16.000   | 150.000  | .008 | .050 |
| 74711255             | 21.30 | 11.600 | 5.500  | .003 | .410 | .061 | 640.000  | 7.000  | 10.000  | 80.000   | 20.000   | .020 | .040 |
| 74711259             | 21.80 | 12.100 | 4.260  | .003 | .600 | .071 | 70.000   | 2.000  | 4.000   | 33.000   | 20.000   | .005 | .050 |
| 74711262             | 21.50 | 11.900 | 5.300  | .002 | .180 | .054 | 300.000  | 4.000  | 4.000   | 36.000   | 20.000   | .010 | .050 |
| 74711288             | 20.20 | 10.300 | 15.000 | .003 | .130 | .074 | 350.000  | 8.000  | 12.000  | 39.000   | 190.000  | .013 | .050 |
| 74711349             | 30.20 | .280   | 22.600 | .012 | .062 | .031 | 110.000  | 2.000  | 4.000   | 16.000   | 50.000   | .006 | .040 |
| 74711356             | 21.60 | 9.800  | 13.500 | .008 | .130 | .065 | 160.000  | 8.000  | 4.000   | 12.000   | 40.000   | .012 | .050 |
| 74711357             | 31.90 | .360   | 1.840  | .003 | .043 | .040 | 150.000  | 5.000  | 8.000   | 12.000   | 680.000  | .007 | .050 |
| 74711384             | 21.20 | 11.300 | 7.000  | .005 | .880 | .049 | 130.000  | 2.000  | 12.000  | 7.000    | 60.000   | .011 | .040 |
| 74711385             | 19.40 | 10.900 | 15.400 | .003 | .120 | .061 | 380.000  | 1.000  | 6.000   | 20.000   | 160.000  | .015 | .050 |
| 74711386             | .36   | .038   | 92.500 | .001 | .380 | .004 | 4900.000 | 16.000 | 100.000 | 1550.000 | 420.000  | .002 | .050 |
| 74711387             | .60   | .160   | 92.600 | .002 | .450 | .015 | 610.000  | 11.000 | 165.000 | 1110.000 | 460.000  | .018 | .050 |
| 74711394             | 18.20 | 9.600  | 20.500 | .003 | .480 | .033 | 170.000  | 5.000  | 4.000   | 4.000    | 150.000  | .010 | .030 |
| 74711422             | 1.66  | .030   | 94.600 | .002 | .150 | .016 | 5650.000 | 7.000  | 8.000   | 12.000   | 560.000  | .120 | .050 |
| 74711423             | 28.30 | 4.000  | 14.300 | .008 | .058 | .110 | 240.000  | 5.000  | 4.000   | 11.000   | 170.000  | .015 | .030 |
| 74711453             | 24.80 | 9.800  | 3.420  | .009 | .130 | .065 | 130.000  | 12.000 | 16.000  | 32.000   | 50.000   | .010 | .050 |
| 74711491             | .43   | .120   | 96.900 | .001 | .078 | .034 | 610.000  | 1.000  | 16.000  | 35.000   | 1400.000 | .008 | .030 |
| 74711496             | 35.60 | .300   | 5.900  | .028 | .220 | .160 | 640.000  | 4.000  | 6.000   | 9.000    | 170.000  | .017 | .050 |
| 74711497             | 32.20 | .200   | 20.200 | .015 | .082 | .074 | 310.000  | 2.000  | 4.000   | 7.000    | 200.000  | .014 | .050 |
| 74711503             | 21.80 | 11.600 | 2.480  | .006 | .270 | .054 | 445.000  | 2.000  | 4.000   | 23.000   | 50.000   | .017 | .030 |
| 74711504             | 23.40 | 11.800 | 1.460  | .004 | .170 | .040 | 40.000   | 2.000  | 4.000   | 7.000    | 20.000   | .006 | .050 |
| 74711508             | 29.00 | .180   | 25.300 | .013 | .075 | .028 | 20.000   | 1.000  | 8.000   | 11.000   | 150.000  | .005 | .050 |
| 74711542             | 21.00 | 8.700  | 17.000 | .005 | .120 | .062 | 160.000  | 9.000  | 8.000   | 44.000   | 190.000  | .012 | .020 |

| REGISTERED<br>NUMBER | CA    | MG    | INSOL  | SR   | FE   | MN   | P        | CU    | PB     | ZN     | BA       | F    | ORGC |
|----------------------|-------|-------|--------|------|------|------|----------|-------|--------|--------|----------|------|------|
| 74711137             | 36.50 | .530  | 4.500  | .070 | .074 | .047 | 260.000  | 5.000 | 10.000 | 4.000  | 40.000   | .010 | .060 |
| 74711138             | 38.20 | .370  | 3.700  | .090 | .061 | .080 | 180.000  | 2.000 | 5.000  | 2.000  | 340.000  | .010 | .050 |
| 74711139             | 37.50 | .440  | 5.100  | .060 | .120 | .120 | 170.000  | 3.000 | 5.000  | 6.000  | 260.000  | .010 | .040 |
| 74711141             | 34.30 | .640  | 13.400 | .065 | .110 | .050 | 620.000  | 3.000 | 5.000  | 5.000  | 90.000   | .020 | .080 |
| 74711142             | 35.90 | 1.300 | 4.650  | .065 | .140 | .120 | 210.000  | 2.000 | 5.000  | 6.000  | 20.000   | .010 | .050 |
| 74711143             | 36.80 | .590  | 6.200  | .044 | .026 | .130 | 280.000  | 2.000 | 5.000  | 3.000  | 440.000  | .015 | .060 |
| 74711144             | 37.70 | .520  | 4.750  | .041 | .040 | .140 | 140.000  | 2.000 | 5.000  | 4.000  | 45.000   | .015 | .090 |
| 74711145             | 36.30 | .400  | 6.350  | .042 | .090 | .055 | 130.000  | 4.000 | 5.000  | 9.000  | 130.000  | .010 | .040 |
| 74712001             | 32.10 | .300  | 15.500 | .059 | .085 | .031 | 2000.000 | 3.000 | 5.000  | 4.000  | 130.000  | .055 | .040 |
| 74712002             | 35.10 | .320  | 6.800  | .110 | .040 | .027 | 80.000   | 2.000 | 5.000  | 4.000  | 40.000   | .010 | .090 |
| 74712003             | 34.10 | .340  | 8.200  | .110 | .085 | .010 | 90.000   | 3.000 | 5.000  | 4.000  | 150.000  | .010 | .050 |
| 74712004             | 27.40 | .330  | 33.200 | .059 | .010 | .018 | 810.000  | 2.000 | 5.000  | 5.000  | 130.000  | .020 | .050 |
| 74712005             | 33.20 | .350  | 15.400 | .082 | .085 | .027 | 1450.000 | 2.000 | 5.000  | 10.000 | 170.000  | .050 | .060 |
| 74712006             | 29.40 | .220  | 28.700 | .052 | .070 | .016 | 410.000  | 4.000 | 5.000  | 17.000 | 200.000  | .020 | .060 |
| 74712007             | 37.50 | .450  | 3.300  | .150 | .071 | .011 | 100.000  | 2.000 | 5.000  | 2.000  | 20.000   | .010 | .070 |
| 74712008             | 36.30 | .300  | 10.400 | .071 | .085 | .019 | 190.000  | 4.000 | 5.000  | 4.000  | 140.000  | .010 | .040 |
| 74712009             | 28.80 | .310  | 28.600 | .039 | .078 | .016 | 310.000  | 5.000 | 5.000  | 5.000  | 120.000  | .020 | .040 |
| 74712010             | 24.20 | .270  | 39.400 | .034 | .094 | .012 | 250.000  | 2.000 | 5.000  | 4.000  | 130.000  | .020 | .050 |
| 74712011             | 23.20 | 1.950 | 35.400 | .014 | .200 | .020 | 170.000  | 2.000 | 5.000  | 4.000  | 170.000  | .010 | .030 |
| 74712012             | 31.00 | .260  | 19.000 | .330 | .080 | .016 | 540.000  | 2.000 | 5.000  | 5.000  | 100.000  | .015 | .040 |
| 74712013             | 29.30 | .300  | 27.700 | .035 | .080 | .017 | 1100.000 | 3.000 | 5.000  | 6.000  | 120.000  | .020 | .040 |
| 74712014             | 34.30 | .320  | 12.800 | .049 | .066 | .036 | 240.000  | 3.000 | 5.000  | 4.000  | 50.000   | .010 | .040 |
| 74712015             | 30.30 | .250  | 22.800 | .046 | .068 | .041 | 210.000  | 2.000 | 5.000  | 5.000  | 90.000   | .010 | .060 |
| 74712016             | 35.50 | .280  | 8.650  | .053 | .081 | .043 | 250.000  | 3.000 | 5.000  | 10.000 | 340.000  | .010 | .050 |
| 74712017             | 29.20 | .310  | 25.400 | .053 | .081 | .022 | 440.000  | 2.000 | 5.000  | 6.000  | 240.000  | .020 | .040 |
| 74712018             | 33.00 | .330  | 15.300 | .049 | .094 | .016 | 340.000  | 2.000 | 5.000  | 15.000 | 120.000  | .010 | .050 |
| 74712019             | 24.10 | .140  | 40.600 | .028 | .066 | .016 | 160.000  | 2.000 | 5.000  | 20.000 | 140.000  | .010 | .070 |
| 74712052             | 32.80 | .530  | 13.700 | .110 | .043 | .010 | 120.000  | 2.000 | 5.000  | 2.000  | 120.000  | .005 | .040 |
| 74712059             | 31.00 | .630  | 18.300 | .047 | .160 | .052 | 240.000  | 1.000 | 5.000  | 3.000  | 150.000  | .010 | .030 |
| 74712069             | 33.20 | .220  | 16.400 | .038 | .071 | .014 | 120.000  | 3.000 | 5.000  | 2.000  | 80.000   | .005 | .040 |
| 74712071             | 23.30 | .200  | 41.200 | .039 | .059 | .017 | 260.000  | 2.000 | 5.000  | 4.000  | 220.000  | .030 | .060 |
| 74712081             | 29.10 | .290  | 27.100 | .045 | .120 | .026 | 2900.000 | 2.000 | 5.000  | 15.000 | 840.000  | .060 | .050 |
| 74712082             | 33.20 | .270  | 14.500 | .090 | .048 | .013 | 390.000  | 3.000 | 5.000  | 5.000  | 1900.000 | .020 | .050 |
| 74712162             | 36.00 | .210  | 13.200 | .087 | .071 | .017 | 110.000  | 3.000 | 5.000  | 6.000  | 140.000  | .010 | .050 |
| 74712163             | 30.10 | .200  | 26.700 | .071 | .047 | .025 | 150.000  | 5.000 | 5.000  | 6.000  | 800.000  | .010 | .040 |
| 74712170             | 35.70 | .350  | 11.600 | .100 | .120 | .024 | 190.000  | 3.000 | 5.000  | 10.000 | 260.000  | .010 | .070 |
| 74712171             | 35.20 | .440  | 14.300 | .095 | .130 | .028 | 170.000  | 4.000 | 5.000  | 30.000 | 160.000  | .010 | .040 |
| 74712172             | 37.20 | .260  | 4.700  | .092 | .066 | .028 | 60.000   | 2.000 | 5.000  | 3.000  | 120.000  | .005 | .070 |
| 74712173             | 38.40 | .270  | 3.900  | .059 | .055 | .070 | 1850.000 | 3.000 | 5.000  | 10.000 | 30.000   | .045 | .040 |
| 74712175             | 26.60 | .090  | 32.000 | .022 | .160 | .087 | 420.000  | 7.000 | 5.000  | 7.000  | 520.000  | .010 | .090 |
| 74712176             | 26.30 | .200  | 33.900 | .048 | .120 | .019 | 420.000  | 3.000 | 5.000  | 4.000  | 220.000  | .010 | .060 |
| 74712178             | 31.00 | .250  | 19.700 | .069 | .170 | .033 | 280.000  | 5.000 | 5.000  | 20.000 | 320.000  | .025 | .050 |
| 74712180             | 37.50 | .320  | 4.150  | .042 | .087 | .120 | 310.000  | 3.000 | 5.000  | 6.000  | 100.000  | .010 | .040 |
| 74712183             | 36.00 | .340  | 6.700  | .047 | .096 | .025 | 570.000  | 3.000 | 10.000 | 10.000 | 340.000  | .020 | .060 |
| 74712186             | 37.30 | .360  | 4.100  | .072 | .120 | .043 | 40.000   | 2.000 | 5.000  | 4.000  | 30.000   | .005 | .050 |
| 74712187             | 36.30 | .340  | 5.000  | .053 | .110 | .075 | 590.000  | 2.000 | 5.000  | 7.000  | 120.000  | .020 | .030 |
| 74712188             | 37.80 | .450  | 3.250  | .120 | .210 | .065 | 230.000  | 3.000 | 5.000  | 4.000  | 480.000  | .010 | .060 |
| 74712190             | 35.10 | .410  | 10.900 | .071 | .120 | .018 | 170.000  | 3.000 | 5.000  | 5.000  | 90.000   | .010 | .050 |
| 74712191             | 32.80 | .300  | 18.100 | .049 | .090 | .027 | 2100.000 | 3.000 | 5.000  | 15.000 | 150.000  | .055 | .050 |
| 74712240             | 32.40 | .330  | 18.700 | .029 | .096 | .024 | 440.000  | 2.000 | 5.000  | 3.000  | 70.000   | .015 | .050 |
| 74712241             | 30.40 | .260  | 23.500 | .033 | .087 | .021 | 660.000  | 2.000 | 5.000  | 6.000  | 90.000   | .020 | .030 |
| 74713004             | 34.10 | .410  | 13.600 | .063 | .055 | .017 | 190.000  | 4.000 | 5.000  | 5.000  | 70.000   | .030 | .050 |

## GEOCHEMISTRY=CHATSWORTH

PAGE 2

| REGISTERED<br>NUMBER | CA    | MG    | INSOL  | SR   | FE   | MN   | P        | CU    | PB    | ZN     | BA       | F    | ORGC |
|----------------------|-------|-------|--------|------|------|------|----------|-------|-------|--------|----------|------|------|
| 74713006             | 36.30 | .970  | 6.050  | .074 | .047 | .014 | 60.000   | 3.000 | 5.000 | 15.000 | 40.000   | .010 | .040 |
| 74713007             | 33.40 | .450  | 13.100 | .047 | .054 | .087 | 90.000   | 4.000 | 5.000 | 30.000 | 90.000   | .005 | .040 |
| 74713008             | 37.40 | .380  | 2.650  | .053 | .045 | .067 | 1500.000 | 3.000 | 5.000 | 3.000  | 40.000   | .055 | .050 |
| 74713009             | 36.70 | 1.450 | 3.300  | .053 | .180 | .074 | 50.000   | 2.000 | 5.000 | 3.000  | 30.000   | .005 | .040 |
| 74713012             | 35.70 | .430  | 11.000 | .055 | .054 | .038 | 600.000  | 4.000 | 5.000 | 30.000 | 1900.000 | .020 | .040 |
| 74713013             | 37.50 | .950  | 4.200  | .059 | .140 | .057 | 50.000   | 2.000 | 5.000 | 2.000  | 60.000   | .005 | .030 |

## GEOCHEMISTRY=GEORGINA LIMESTONE

PAGE 1

| REGISTERED<br>NUMBER | CA    | MG    | INSOL  | SR   | FE   | MN   | P       | CU    | PB      | ZN     | BA       | F    | ORGC |
|----------------------|-------|-------|--------|------|------|------|---------|-------|---------|--------|----------|------|------|
| 74711432             | 34.20 | .514  | 10.900 | .140 | .080 | .019 | 160.000 | 1.000 | 4.000   | 2.000  | 540.000  | .012 | .050 |
| 74711433             | 39.00 | .29   | .720   | .230 | .058 | .020 | 150.000 | 1.000 | 4.000   | 13.000 | 1750.000 | .006 | .060 |
| 74711434             | 35.00 | 1.170 | 4.000  | .226 | .230 | .031 | 150.000 | 1.000 | 4.000   | 13.000 | 880.000  | .007 | .100 |
| 74711435             | 37.00 | .450  | 4.540  | .260 | .085 | .018 | 130.000 | 5.000 | 4.000   | 7.000  | 1100.000 | .009 | .110 |
| 74711438             | 36.70 | .480  | 4.440  | .140 | .061 | .022 | 100.000 | 1.000 | 4.000   | 9.000  | 860.000  | .006 | .050 |
| 74711439             | 31.80 | 1.130 | 16.100 | .130 | .076 | .019 | 170.000 | 2.000 | 4.000   | 11.000 | 1100.000 | .013 | .050 |
| 74711441             | 27.40 | .360  | 30.400 | .160 | .120 | .025 | 170.000 | 2.000 | 4.000   | 15.000 | 3850.000 | .020 | .050 |
| 74711444             | 26.80 | .460  | 31.900 | .140 | .150 | .039 | 150.000 | 1.000 | 4.000   | 8.000  | 660.000  | .020 | .050 |
| 74711446             | 36.80 | .910  | 5.900  | .260 | .160 | .022 | 90.000  | 4.000 | 4.000   | 9.000  | 340.000  | .008 | .110 |
| 74711448             | 33.00 | .320  | 17.100 | .037 | .110 | .023 | 80.000  | 7.000 | 4.000   | 24.000 | 280.000  | .011 | .050 |
| 74711449             | 32.70 | .390  | 14.800 | .056 | .150 | .054 | 660.000 | 7.000 | 4.000   | 17.000 | 1050.000 | .025 | .100 |
| 74711450             | 35.80 | .330  | 9.700  | .110 | .130 | .023 | 90.000  | 7.000 | 4.000   | 20.000 | 540.000  | .011 | .100 |
| 74711452             | 33.30 | .330  | 15.900 | .110 | .075 | .027 | 140.000 | 8.000 | 4.000   | 21.000 | 460.000  | .017 | .050 |
| 74712024             | 35.70 | .340  | 5.950  | .150 | .043 | .012 | 160.000 | 4.000 | 5.000   | 4.000  | 200.000  | .010 | .070 |
| 74712025             | 38.50 | .360  | 3.600  | .049 | .047 | .017 | 30.000  | 3.000 | 5.000   | 5.000  | 60.000   | .005 | .050 |
| 74712422             | 34.20 | .540  | 11.100 | .060 | .030 | .017 | 70.000  | 3.000 | 6.000   | 5.000  | 20.000   | .019 | .050 |
| 74712423             | 27.10 | .180  | 32.100 | .036 | .095 | .015 | 200.000 | 8.000 | 10.000  | 31.000 | 500.000  | .019 | .050 |
| 74712424             | 33.60 | .590  | 13.700 | .060 | .066 | .019 | 300.000 | 1.000 | 6.000   | 19.000 | 150.000  | .008 | .050 |
| 74712592             | 35.50 | .900  | 5.500  | .120 | .081 | .032 | 130.000 | 4.000 | 220.000 | 12.000 | 310.000  | .027 | .020 |
| 74712593             | 6.90  | 2.110 | 73.000 | .016 | .260 | .024 | 480.000 | 7.000 | 14.000  | 9.000  | 210.000  | .012 | .130 |



| REGISTERED<br>NUMBER | CA    | MG     | INSOL  | SR   | FE    | MN    | P        | CU     | PB      | ZN     | BA       | F    | ORCC |
|----------------------|-------|--------|--------|------|-------|-------|----------|--------|---------|--------|----------|------|------|
| 74711170             | 24.90 | 7.900  | 7.700  | .009 | 1.730 | .710  | 8.0.000  | 4.000  | 20.000  | 29.000 | 260.000  | .030 | .030 |
| 74711172             | 35.40 | .860   | 7.500  | .015 | .460  | .330  | 960.000  | 1.000  | 28.000  | 11.000 | 50.000   | .020 | .050 |
| 74711173             | 20.30 | 9.300  | 14.400 | .005 | 1.390 | .740  | 790.000  | 12.000 | 20.000  | 27.000 | 180.000  | .035 | .050 |
| 74711178             | 35.90 | .150   | 8.500  | .020 | .360  | .380  | 1290.000 | 2.000  | 6.000   | 9.000  | 260.000  | .040 | .030 |
| 74711193             | 31.90 | .600   | 15.700 | .023 | .600  | .370  | 1170.000 | 8.000  | 100.000 | 23.000 | 80.000   | .035 | .050 |
| 74711202             | 17.80 | 8.500  | 25.600 | .011 | 1.050 | .400  | 5650.000 | 7.000  | 8.000   | 15.000 | 2150.000 | .150 | .050 |
| 74711203             | 21.90 | 10.100 | 7.800  | .006 | 1.010 | .490  | 930.000  | 20.000 | 14.000  | 19.000 | 220.000  | .030 | .050 |
| 74711207             | 7.70  | 3.660  | 66.800 | .008 | .240  | .250  | 660.000  | 24.000 | 14.000  | 31.000 | 640.000  | .030 | .050 |
| 74711214             | 24.20 | .120   | 38.000 | .027 | .410  | .320  | 1000.000 | 4.000  | 26.000  | 47.000 | 220.000  | .060 | .020 |
| 74711216             | 35.60 | .220   | 9.100  | .037 | .450  | .490  | 210.000  | 1.000  | 20.000  | 15.000 | 70.000   | .020 | .050 |
| 74711219             | 33.20 | 1.190  | 9.800  | .030 | .480  | .500  | 230.000  | 5.000  | 14.000  | 19.000 | 110.000  | .025 | .050 |
| 74711220             | 31.70 | .800   | 16.500 | .022 | .420  | .520  | 270.000  | 2.000  | 20.000  | 16.000 | 320.000  | .080 | .050 |
| 74711221             | 31.70 | .590   | 17.900 | .023 | .470  | .490  | 310.000  | 5.000  | 14.000  | 19.000 | 190.000  | .120 | .050 |
| 74711222             | 30.00 | 3.810  | 8.000  | .018 | 1.470 | .920  | 80.000   | 4.000  | 14.000  | 31.000 | 240.000  | .175 | .050 |
| 74711223             | 6.80  | 2.500  | 71.700 | .009 | .630  | .430  | 1270.000 | 20.000 | 18.000  | 36.000 | 1350.000 | .105 | .050 |
| 74711227             | 18.40 | .310   | 52.800 | .011 | .320  | .310  | 700.000  | 15.000 | 16.000  | 28.000 | 860.000  | .145 | .050 |
| 74711228             | 30.90 | .170   | 15.000 | .027 | .410  | 1.350 | 140.000  | 5.000  | 12.000  | 15.000 | 620.000  | .050 | .050 |
| 74711272             | 37.20 | .210   | 4.720  | .032 | .410  | .730  | 90.000   | 2.000  | 18.000  | 11.000 | 340.000  | .008 | .050 |
| 74711273             | 30.00 | .410   | 20.900 | .022 | .230  | .460  | 420.000  | 8.000  | 46.000  | 20.000 | 1700.000 | .080 | .050 |
| 74711284             | 15.50 | 8.200  | 32.500 | .003 | .120  | .049  | 460.000  | 4.000  | 20.000  | 31.000 | 260.000  | .017 | .050 |
| 74711296             | 34.80 | .250   | 7.000  | .031 | .410  | .670  | 190.000  | 7.000  | 14.000  | 15.000 | 1000.000 | .014 | .050 |
| 74711298             | 36.50 | .230   | 3.080  | .026 | .390  | .300  | 200.000  | 2.000  | 4.000   | 7.000  | 140.000  | .008 | .050 |
| 74711301             | 33.70 | .130   | 13.600 | .008 | .120  | .110  | 780.000  | 4.000  | 32.000  | 14.000 | 360.000  | .020 | .050 |
| 74711309             | 21.20 | .270   | 46.400 | .012 | .230  | .410  | 700.000  | 2.000  | 22.000  | 16.000 | 800.000  | .020 | .050 |
| 74711311             | 30.20 | 1.610  | 15.300 | .021 | .810  | .510  | 1000.000 | 7.000  | 55.000  | 20.000 | 160.000  | .030 | .010 |
| 74711312             | 32.80 | 1.990  | 10.900 | .020 | .510  | .710  | 190.000  | 2.000  | 20.000  | 12.000 | 150.000  | .035 | .050 |
| 74711314             | 30.80 | 2.700  | 10.900 | .018 | .850  | .790  | 200.000  | 5.000  | 20.000  | 21.000 | 160.000  | .017 | .050 |
| 74711315             | 26.10 | 4.910  | 13.000 | .017 | 1.620 | 1.050 | 170.000  | 2.000  | 14.000  | 23.000 | 110.000  | .013 | .050 |
| 74711316             | 24.80 | 7.700  | 3.720  | .006 | 3.880 | 1.350 | 140.000  | 1.000  | 4.000   | 24.000 | 20.000   | .005 | .050 |
| 74711317             | 23.10 | 7.300  | 9.500  | .005 | 3.600 | 1.200 | 150.000  | 4.000  | 8.000   | 29.000 | 100.000  | .008 | .050 |
| 74711318             | .86   | .270   | 94.800 | .001 | .170  | .028  | 550.000  | 5.000  | 14.000  | 13.000 | 520.000  | .014 | .020 |
| 74711326             | 32.90 | .600   | 16.600 | .018 | .470  | .740  | 500.000  | 7.000  | 60.000  | 16.000 | 360.000  | .012 | .050 |
| 74711334             | 32.20 | 2.080  | 9.400  | .023 | .340  | .840  | 170.000  | 2.000  | 18.000  | 15.000 | 1000.000 | .015 | .050 |
| 74711336             | 25.30 | 5.200  | 16.500 | .018 | 1.150 | .850  | 300.000  | 4.000  | 14.000  | 20.000 | 2450.000 | .030 | .050 |
| 74711460             | 29.90 | .300   | 22.100 | .021 | .240  | .600  | 270.000  | 2.000  | 85.000  | 16.000 | 520.000  | .013 | .050 |
| 74711468             | 28.90 | .190   | 26.200 | .024 | .220  | .410  | 2600.000 | 1.000  | 16.000  | 15.000 | 280.000  | .060 | .010 |
| 74711473             | 26.80 | .160   | 30.500 | .026 | .460  | .720  | 6500.000 | 56.000 | 60.000  | 23.000 | 1050.000 | .160 | .050 |
| 74711474             | 36.80 | .200   | 5.100  | .039 | .470  | .810  | 290.000  | 15.000 | 12.000  | 13.000 | 260.000  | .014 | .020 |
| 74711476             | 36.80 | .200   | 5.900  | .037 | .580  | .800  | 450.000  | 13.000 | 24.000  | 11.000 | 160.000  | .020 | .020 |
| 74711478             | 35.20 | .150   | 7.500  | .024 | .280  | .830  | 160.000  | 7.000  | 28.000  | 15.000 | 900.000  | .010 | .040 |
| 74711483             | 20.60 | 8.000  | 17.300 | .010 | 1.670 | .970  | 300.000  | 90.000 | 26.000  | 17.000 | 660.000  | .035 | .050 |
| 74711484             | 22.40 | 8.200  | 11.900 | .008 | 1.700 | .970  | 970.000  | 4.000  | 14.000  | 15.000 | 190.000  | .025 | .050 |
| 74711527             | 22.70 | 6.300  | 20.400 | .004 | 1.070 | .490  | 4500.000 | 15.000 | 14.000  | 25.000 | 360.000  | .120 | .050 |
| 74711528             | 25.90 | 5.800  | 12.700 | .015 | 1.400 | .730  | 760.000  | 63.000 | 20.000  | 24.000 | 1700.000 | .085 | .050 |
| 74711529             | 22.60 | 9.100  | 6.200  | .008 | .710  | .780  | 380.000  | 16.000 | 4.000   | 31.000 | 620.000  | .030 | .050 |
| 74711530             | 22.30 | 5.700  | 21.800 | .009 | 1.410 | .620  | 780.000  | 30.000 | 32.000  | 21.000 | 2500.000 | .030 | .050 |
| 74711532             | 21.30 | 10.000 | 5.200  | .005 | 2.230 | 1.070 | 410.000  | 1.000  | 12.000  | 23.000 | 160.000  | .013 | .020 |
| 74711533             | 35.10 | .410   | 6.600  | .027 | .560  | .380  | 850.000  | 9.000  | 28.000  | 19.000 | 360.000  | .030 | .040 |
| 74711534             | 37.30 | .320   | 3.060  | .028 | .560  | .260  | 1950.000 | 2.000  | 12.000  | 15.000 | 100.000  | .060 | .010 |
| 74711535             | 25.30 | 6.900  | 8.900  | .009 | 1.730 | .880  | 520.000  | 5.000  | 22.000  | 17.000 | 260.000  | .019 | .050 |
| 74711536             | 23.50 | 7.200  | 12.600 | .009 | 1.760 | .920  | 730.000  | 5.000  | 38.000  | 12.000 | 120.000  | .035 | .050 |
| 74711561             | 31.30 | 4.500  | 2.500  | .010 | .830  | .560  | 130.000  | 5.000  | 4.000   | 16.000 | 40.000   | .013 | .050 |

## GEOCHEMISTRY=NORA

PAGE 2

| REGISTERED<br>NUMBER | CA    | MG    | INSOL  | SR   | FE    | MN   | P         | CU     | PB      | ZN     | BA       | F    | ORGC |
|----------------------|-------|-------|--------|------|-------|------|-----------|--------|---------|--------|----------|------|------|
| 74711562             | 24.10 | 9.400 | 5.700  | .010 | 1.370 | .700 | 360.000   | 1.000  | 8.000   | 28.000 | 140.000  | .045 | .050 |
| 74711563             | 24.80 | 7.700 | 6.900  | .012 | 1.310 | .670 | 970.000   | 5.000  | 12.000  | 28.000 | 5200.000 | .030 | .050 |
| 74711564             | 17.60 | 2.900 | 41.300 | .008 | .420  | .260 | 5350.000  | 15.000 | 115.000 | 43.000 | 340.000  | .085 | .080 |
| 74711566             | 18.50 | 4.340 | 35.700 | .021 | 1.280 | .510 | 19500.000 | 11.000 | 55.000  | 24.000 | 480.000  | .410 | .030 |
| 74711567             | 12.90 | 1.150 | 58.800 | .030 | .490  | .260 | 30500.000 | 9.000  | 105.000 | 29.000 | 620.000  | .770 | .040 |

# INDEX

| LOC | CONTENT | LOC | CONTENT | LOC | CONTENT | LOC | CONTENT |
|-----|---------|-----|---------|-----|---------|-----|---------|
| 801 |         |     |         |     |         |     |         |
| 001 |         |     |         |     |         |     |         |
| 001 |         |     |         |     |         |     |         |
| 601 |         |     |         |     |         |     |         |
| 601 |         |     |         |     |         |     |         |
| 001 |         |     |         |     |         |     |         |
| 401 |         |     |         |     |         |     |         |
| 101 |         |     |         |     |         |     |         |
| 101 |         |     |         |     |         |     |         |
| 401 |         |     |         |     |         |     |         |
| 101 |         |     |         |     |         |     |         |
| 401 |         |     |         |     |         |     |         |
| 401 |         |     |         |     |         |     |         |
| 001 |         |     |         |     |         |     |         |
| 001 |         |     |         |     |         |     |         |
| 901 |         |     |         |     |         |     |         |
| 901 |         |     |         |     |         |     |         |