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CLASSIFICATION AND ATLAS OF REGOLITH-LANDFORM MAPPING UNITS

Exploration Perspectives for the Yilgarn Craton

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

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

P240: Laterite geochemistry for detecting concealed mineral deposits (1987-1991). Leader: Dr R.E. Smith.
Its scope was development of methods for sampling and interpretation of multi-element laterite geochemistry data and application of multi-element techniques to gold and polymetallic mineral exploration in weathered terrain. The project emphasised viewing laterite geochemical dispersion patterns in their regolith-landform context at local and district scales. It was supported by 30 companies.

P241: Gold and associated elements in the regolith - dispersion processes and implications for exploration (1987-1991). Leader: Dr C.R.M. Butt.
The project investigated the distribution of ore and indicator elements in the regolith. It included studies of the mineralogical and geochemical characteristics of weathered ore deposits and wall rocks, and the chemical controls on element dispersion and concentration during regolith evolution. This was to increase the effectiveness of geochemical exploration in weathered terrain through improved understanding of weathering processes. It was supported by 26 companies.

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

P240A: Geochemical exploration in complex lateritic environments of the Yilgarn Craton, Western Australia (1991-1993). Leaders: Drs R.E. Smith and R.R. Anand.
The approach of viewing geochemical dispersion within a well-controlled and well-understood regolith-landform and bedrock framework at detailed and district scales continued. In this extension, focus was particularly on areas of transported cover and on more complex lateritic environments typified by the Kalgoorlie regional study. This was supported by 17 companies.

P241A: Gold and associated elements in the regolith - dispersion processes and implications for exploration. Leader: Dr. C.R.M. Butt.
The significance of gold mobilisation under present-day conditions, particularly the important relationship with pedogenic carbonate, was investigated further. In addition, attention was focussed on the recognition of primary lithologies from their weathered equivalents. This project was supported by 14 companies.

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

This report (CRC LEME Open File Report 2) is a Second impression (second printing) of CSIRO, Division of Exploration Geoscience Restricted Report 440R, first issued in 1993, which formed part of the CSIRO/AMIRA Project P240A.

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PREFACE TO THE SECOND IMPRESSION
R. R. Anand and R.E. Smith, 12 November 1998.

In this second impression (second printing) of this Atlas, the authors made the decision to reproduce it as it was, except for a few minor corrections.

The readers' attention is directed to the following correlation of terms used for regolith-landform regimes developed in later work:

This Report		Terminology used in 1994 onwards
Residual regime As defined in Section 6.0, Open File Report 2	equivalent to:	*Relict regime* Anand and Smith (1993)

Comment on use of regolith-landform regimes

The first step is to make an objective map of the regolith-landform units present in an area, with little or no genetic bias. Such a factual map forms the basis of derivative or interpretative maps based on genetic grouping of the regolith and associated geomorphic features. It should also be pointed out that ferruginous materials have formed both in *in-situ* and transported materials. Laterite residuum, formed by residual enrichment in the weathering of parent rocks, is included with the relict regime. Iron cemented sands and gravels (ferricretes) are different because there is no direct genetic relationship between these ferricretes and the underlying bedrocks. Therefore, they are included with the depositional regime.

Although focus of this atlas is on the Yilgarn Craton of Western Australia and its periphery, the research findings may have wider application. Sponsors have used the research findings in other parts of Australia (Northern Territory and Queensland) and in appropriate terrain overseas, including western Africa, southern Asia and South America. It is hoped that the approaches found helpful in the Yilgarn may be translated generically and will be a guide to approaches that can be used in other lateritic terrains around the world.

Reference:

Anand, R.R. and Smith, R.E. (1993). Regolith distribution, stratigraphy and evolution of the Yilgarn Craton. In: P.R. Williams and J. A. Haldane (Compilers), An International Conference on Crustal Evolution, Metallogeny and Exploration of the Eastern Goldfields. Kalgoorlie 1993. Australian Geological Survey Record 1993/54. pp187-193.

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SUMMARY

For geochemical exploration, regolith units form the dominant sampling media in the initial stages of most programs. However, the regolith evolves in a complex fashion which results in a wide variety of regolith types at any particular site. Some of these are more appropriate for sampling than others. It is therefore important to have an understanding of the regolith in the region of interest in order to be able to devise effective sampling strategies and to interpret the geochemical data sensibly.

The *classification scheme and atlas* which is described in this report has been constructed with the explorationists in mind. The scheme and atlas should assist in the mapping of regolith-landform associations and subsequent selection of the sampling media. It also provides a standardized mode of description and classification of the diverse range of regolith-landform associations on the Yilgarn Craton. Such a standardized mode of description should allow mapping units from one region of the Yilgarn Craton to be compared with those from another region. These comparisons are particularly relevant when considering geochemical thresholds for different areas and in establishing the significance of geochemical anomalies.

The proposed classification and atlas is based on the examination of regolith-landform settings in a series of orientation districts across the Yilgarn Craton. The scheme is expandable, hierarchical and mnemonic. The results presented here form the basis of continuing work and are presented in a loose-leaf format so that findings from other areas can be incorporated.

The classification tables contain information on regolith-landform regimes, landforms and regolith materials. The latter are arranged vertically in order of regolith stratigraphy. Hierarchical mnemonic alpha-numeric codes are provided for all the designated regolith-landform mapping units. A system of map symbols for regolith-landform mapping units is proposed. Examples of coded maps from several orientation districts are presented.

Representative photographs of regolith materials and their positions in the landscape with accompanying descriptions (including geochemical data where available) are given in the atlas. The photos and data are arranged in the same order as those of classification tables. The codes provide link between the classification tables, and the photographs and their descriptions. The atlas should help exploration geologists, geochemists and geophysicists in recognising the nature of the regolith materials being mapped or sampled.

Future collaboration between Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian Geological Survey Organisation (AGSO), Geological Survey of Western Australia (GSWA), and Curtin University will link this atlas and its incorporated concepts, with regolith-landform mapping units for other regions of Australia.

PROJECT LEADERS' PREFACE
R.E. Smith and R.R. Anand, 8th November 1993

The AMIRA extension Project 240A *Yilgarn Lateritic Environments* has, as an objective, establishing a framework for classification of regolith-landform mapping units across the Yilgarn Craton - from a perspective of mineral exploration.

A workable scheme would have substantial implications in exploration. For example, it would allow:

a) transference of geochemical thresholds established for specific sample media, from one area to another,

b) prediction of exploration problems likely to be encountered,

c) optimum choice of exploration methods for an area and,

d) choice of which geochemical dispersion models apply in a particular exploration area.

Reasons, including these, led to the topic being set as a priority by sponsors of the project at the first project meeting in September 1991.

Classification of regolith-landform *mapping units* is a considerably more complex topic than classification of regolith *materials*, for example, as covered in "Laterite types and associated ferruginous materials, Yilgarn Block, terminology, classification, and atlas", CSIRO Division of Exploration Geoscience Restricted Report 60R. The present report is a companion volume to Report 60R and the two are fully compatible[1].

The report:

- classifies regolith-landform relationships in terms of four matrix tables, each having landforms as the horizontal axis and subdivisions of the regolith stratigraphy as the vertical;

- describes the approach used;

- sets out instructions for use and

- provides examples of maps and corresponding tables for selected orientation areas from the project.

The report should be of interest to exploration geologists, geochemists and geophysicists working in regolith terrains. It is intended to be used in the field at the project geologist level. Codes are provided for entry into digital databases and geographic information systems.

Cautionary note

The usefulness of this scheme will depend upon critical assessment of any proposed changes or expansion prior to their implementation and distribution. Comments, proposed changes and additions should be sent to R.R. Anand who will maintain the authoritative files that cover the classification tables, the glossary and definitions. Revisions will be done in consultation with other researchers.

---oOp---

[1] Report 60R is currently being revised for release as an Open File Report.

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1.0 INTRODUCTION

1.1 Background

Here in this report regolith is used as a general term for the entire cover, whether cemented or unconsolidated, that overlies unweathered bedrock, that has been formed by weathering, erosion, and sedimentary or chemical deposition. Regolith materials thus include residual weathered materials (e.g. saprolite, laterite, soils) and transported materials (e.g. colluvium, alluvium, evaporitic sediments, aeolian deposits).

The common presence of a thick and variable regolith is well recognised as a major impediment to mineral exploration in the Yilgarn Craton as well as in other important mineral provinces of Australia. The processes of deep weathering, residual accumulation, erosion and sedimentation have resulted in widespread concealment of bedrock sequences and included ore deposits. Commonly, the geological, geochemical and geophysical expression of ore deposits in the regolith is altered, weakened or buried. Regolith forming processes have led also to the formation of important secondary mineral deposits including lateritic and supergene gold, lateritic bauxite, nickel and cobalt deposits.

Besides tending to mask the appearance of most bedrock hosted mineral deposits, regolith forming processes can give rise to large, though often weak, dispersion patterns. Use of these dispersion patterns can provide great advantages in exploration for concealed ore deposits in regolith-dominated terrains by increasing the likelihood of success and, at the same time, substantially reducing exploration costs (Smith, *et al.*, 1992).

Weathering under prolonged conditions has resulted in widespread, deep weathering profiles over the Yilgarn Craton (Fig 1.1). Subsequent differential erosion and chemical modification has added complexity to the regolith. As a result, we now see a wide variety of regolith materials exposed on the land surface forming intricate relationships with the landforms (Fig 1.2). For geochemical exploration, regolith materials form the dominant sampling media in the initial stages of most programs. Some of these are more appropriate for sampling than others. Thus an understanding of the regolith-stratigraphic relationships and knowledge of the geochemical and mineralogical characteristics of the regolith are key ingredients for the effective exploration of regolith-dominated terrains. These factors govern the nature of the geochemical and geophysical expression of weathered or otherwise concealed ore deposits in such regions. An understanding of regolith-stratigraphic relationships allows: choice of appropriate exploration methods; design and execution of an optimal geochemical sampling program; sensible data interpretation and, soundly-based integration of exploration findings.

An adequate understanding of regolith-stratigraphic relationships can be achieved by the establishment of the regolith stratigraphy and by mapping. As a component of exploration, it is useful to be able to make comparisons between the regolith-landform mapping units of widely disparate areas. This is particularly relevant when considering geochemical thresholds for different areas and in establishing the relative importance of geochemical anomalies. Different geochemical thresholds usually apply to different sampling media and hence to different regolith-landform mapping units. One purpose in producing a regolith-landform map is to delineate areas within which data may be treated uniformly. If the variation in sample characteristics is too great, geochemical dispersion anomalies arising from ore deposits will be lost among the natural variations in sample characteristics, which are related to changes in regolith-landform settings. Regolith-landform maps also identify and delineate areas characterized by complex surficial relationships which may require more specialized exploration methods in contrast to areas in which a more straightforward approach such as soil sampling may be more appropriate.

1.2 Previous Work

Three major geoscience agencies (AGSO, CSIRO and GSWA) are involved in mapping regolith in the Yilgarn Craton of Western Australia both collaboratively and separately. A discussion paper (Craig *et al*, 1993) was produced for sponsors of Project P240A to facilitate an understanding of the co-operative process taking place between the various government and geoscience agencies involved in regolith mapping, and to put forward the major issues involved in moving towards an integrated regolith-landform mapping classification and nomenclature. This report proposes a classification scheme of regolith-landform mapping units for the Yilgarn Craton. The scheme presented in this report is designed from an exploration perspective, especially in relation to exploration geochemistry in the Yilgarn Craton. The intention is that collaboration will continue, contributing towards a future national scheme. However, this requires a time frame beyond project P240A.

1.3 Objective and Strategy

The objective of this *Classification and Atlas of Regolith-Landform Mapping Units* is to provide, from the perspective of mineral exploration, a standardized mode for the description and classification of the diverse range of regolith-landform associations that are mappable on the Yilgarn Craton.

The strategy adopted is :

- A classification and atlas should be designed to provide explorationists with a framework for planning and executing geochemical and geophysical surveys and interpreting the resultant data;

- The classification should be simple, factual , hierarchical and expandable. Map symbols should be kept as simple as possible. The scheme should be flexible such that it is possible to incorporate findings from other regions;

- Codes for the various attributes should be developed to provide a concise recording system for field use and for entry into computer databases;

- The atlas should help explorationists in recognising the nature and exploration significance of regolith materials being mapped and/or sampled; and

- It is important that any proposed scheme be adequately tested before release to sponsors, i.e. be robust to future change. Testing was carried out in each of the project orientation districts.

1.4 Purpose of this Report

The purpose of this report is to present a rationale for the proposed framework, to provide classification tables and a guide for use in exploration. The scheme and atlas should assist in the mapping of regolith-landform associations and subsequent selection of the sampling media. It is intended that this report will be a step towards establishing a common nomenclature so as to encourage more consistent observations. It should also help explorationists in recognising the various types of regolith materials. Furthermore, the suggested codes for the mapping units is intended to be a concise recording system for field use. This proposed classification should also assist in the development of digital databases incorporating detail on the regolith.

The classification of regolith-landform mapping units presented in this report is based on the examination of regolith-landform settings in a series of orientation districts across the Yilgarn Craton. It thus incorporates a wide range of regolith-landform settings rather than being focussed on isolated, idealized situations. Commonly occurring regolith-landform mapping units, relevant to geochemical exploration, are included in the *classification tables.* Representative photographs of materials and their positions in the landscape with accompanying descriptions (including geochemical data where available) are given in the atlas.

In this report the reader is first introduced to the general method of regolith mapping. Secondly, we show how to use the classification scheme which is presented as tables and as an atlas.

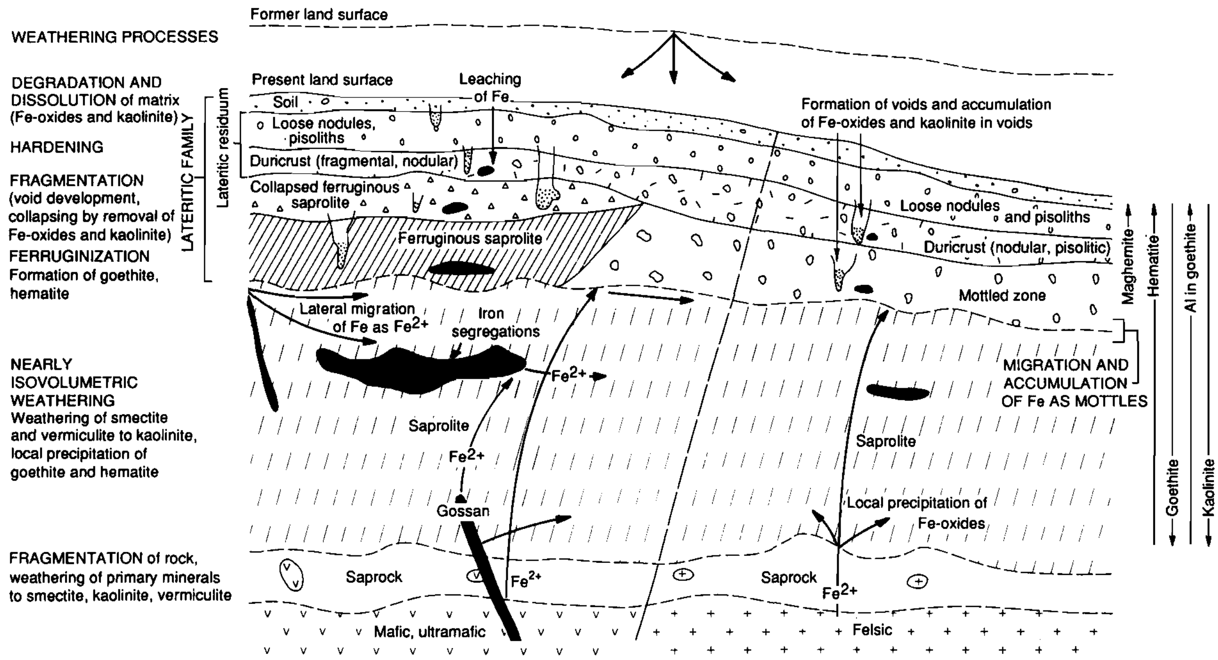


Figure 1.1. A schematic diagram of the differences in the nature of the weathering mantle developed from mafic, ultramafic and felsic bedrocks. This diagram is based on findings in the Darling Range and the Mt. Gibson, Lawlers, Mt McClure and Bottle Creek districts.

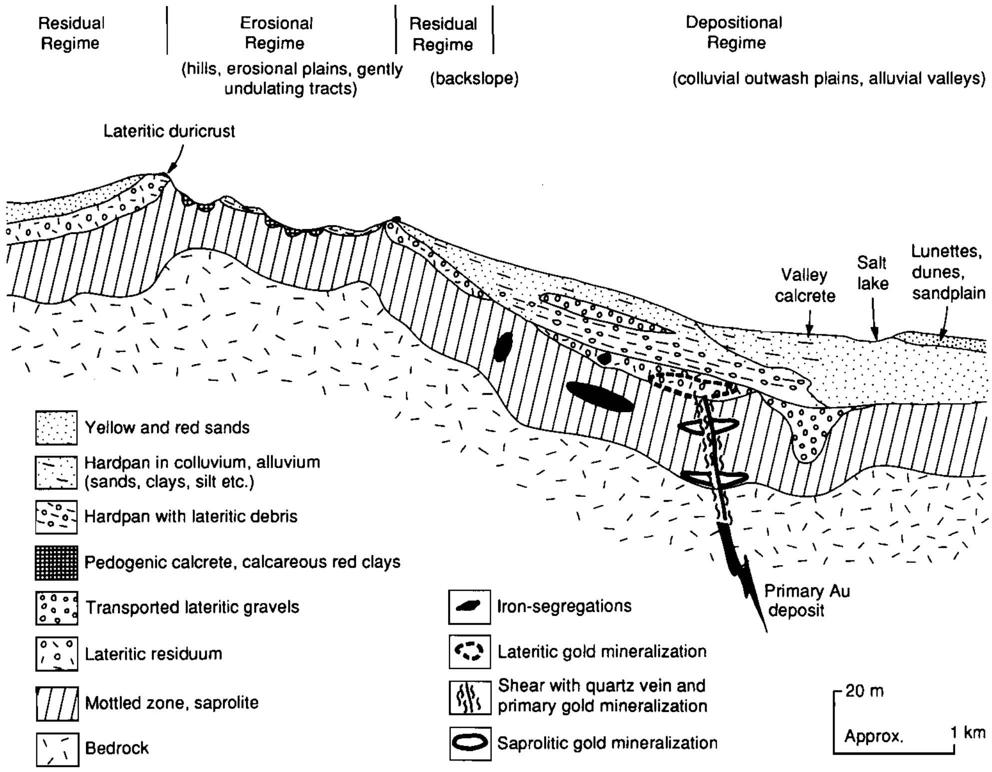


Figure 1.2. Generalized cross section showing regolith-landform relationships and regolith-stratigraphy in the Yilgarn Craton.

2.0 REGOLITH-LANDFORM MAPPING

2.1 Mapping Methods

In designing an approach to regolith-landform mapping, it is necessary to keep in mind the purpose of the mapping and the needs of the user of the resultant map. The explorationist needs information on the nature, distribution and genesis (residual vs. transported) of regolith types, the relationships between various regolith units across the landscape, and the association between the regolith and the underlying bedrock.

A general flow chart for carrying out detailed regolith-landform mapping for mineral exploration is shown in Fig 2.1. An adequate understanding of the regolith-dominated terrain is provided by carrying out regolith-landform mapping, establishing the regolith stratigraphy within these mapped units, and synthesizing regolith-landform models.

Regolith-landform mapping is essentially an integrated approach which enables identification of mapping units based upon discrete associations of landform, bedrock geology, regolith materials, and vegetation. The basic mapping unit is one where there is a recurring pattern of landform, bedrock, regolith materials, and vegetation. The recurring pattern is used as the basis for extrapolating site data because commonly only isolated occurrences of any one regolith-landform unit will be sampled. It is assumed that many land characteristics are inter-dependent and tend to occur in associations, and that attributes such as landform and vegetation observable on air-photos and remotely sensed images, can be used to predict the distribution of regolith material attributes which are observed at selected sites and traverses in the field.

An area may be mapped by delineating regolith-landform units based upon field traverses, inspection and interpretation of aerial photographs and multispectral remotely sensed imagery, and/or airborne geophysical data (e.g. radiometrics). An essential feature of regolith-landform mapping is the early development of models for mapping. These models form the basis of understanding of the distribution of regolith materials that, through their predictive qualities, leads to an efficient mapping program. For example, for many areas in the Yilgarn Craton, the premise has been made that the landscape was originally extensively mantled by a lateritic profile and that the present land surface is the result of long-continued differential stripping, movement and sorting of detritus, resulting in a complex array of variously weathered to unweathered materials forming the regolith.

A *regolith-landform mapping unit* is defined as an area delineated on a map, within which occur a particular association of regolith materials, bedrock geology and landforms. It may consist of multiples or sub-divisions of tones, textures, patterns and/or colours on airphotos or multispectral images. The interpretation of these patterns leads to the establishment of regolith-landform mapping units. A specific array of regolith materials can be related to particular landforms so that the recognition of the landforms is an essential part of regolith-landform mapping. This process is very similar to the toposequence concept used in soils mapping (See McDonald *et al.* 1990). A regolith toposequence is a group of regolith types which are linked by their regular association with particular landform types. Landforms may be identified by stereoscopic examination of aerial photographs.

Boundaries are drawn to indicate an area in which similar characteristics could be expected to occur. In GIS terminology this outline is referred to as a polygon. Beyond the polygon boundary a different set of characteristics would prevail. So, in general, a boundary should be placed on a regolith-landform map where the rate of change in characteristics is greatest.

The scale of airphotos or other imagery being used will influence the choice and definitions of regolith-landform units because of the practicalities of representing heterogenous assemblages at different scales. The more detailed the study becomes, the more the mapping units can be specifically related to regolith materials and not just the landforms.

An essential feature of regolith-landform mapping is the concurrent development of three dimensional regolith-landform models. Such models reflect an understanding of the distribution of regolith materials, in relation to landform and regolith stratigraphy. Their predictive qualities can lead to more efficient and effective mapping program.

2.2 Establishing Regolith Stratigraphy

Neither airphoto nor multispectral image interpretation alone can provide adequate knowledge of the regolith stratigraphy of an area. This must be established by field mapping and detailed studies at strategically chosen sites using drilling, road cuttings, costeans, natural exposures or mine pits. This information enables an understanding of local regolith stratigraphy and evolution of weathering profile which can be presented as a series of regolith cross sections (Fig 2.2).

2.3 Genetic Regolith Maps

In lateritic terrain it is important to establish the presence or absence of lateritic residuum, and to delineate areas where there is substantial sedimentary cover. Two boundaries are, therefore, very important and need to be clearly delineated in regolith-landform mapping where possible. These are the boundaries which mark the base of the lateritic residuum and those which enclose areas of sedimentary cover. By identifying and delineating these boundaries, the regolith-landform relationships can be mapped in terms of residual, erosional and depositional regimes, where the focus is on evidence of preservation versus truncation of the lateritic residuum (Fig 2.3). These interpretative regimes are broader terms than the regolith-landform units described above.

Where these broad regolith-landform regimes are mapped in an area, it usually becomes clear which media should be preferred for geochemical sampling. For example, in erosional regimes, ferruginous saprolite or the soil should be sampled. However, in residual regimes the laterite should be sampled in preference to soils, because geochemical anomalies in laterite typically are relatively large and consistent relative to the corresponding ore-deposit source.

2.4 Regolith-Landform Models

Regolith-landform models are conceptual devices developed to represent three-dimensional regolith-landform relationships. They seek to have a predictive capability and often point to clear genetic interpretations. Regolith-landform models are used to design sampling strategies. They are commonly presented as cross-sections and block diagrams. These diagrams show (a) the main regolith-landform regimes, (b) the main units of the regolith stratigraphy, and (c) bedrock lithologies, where known. The vertical scale is usually exaggerated to show units of the regolith stratigraphy. It is useful to show individual regolith profiles linked with different regolith-landform regimes on a diagram, in effect expanding the vertical scale to show details of the regolith stratigraphy (Fig 2.4). By adding information about geochemical dispersion processes and patterns, regolith-landform diagrams become conceptual geochemical dispersion models (Fig 2.5).

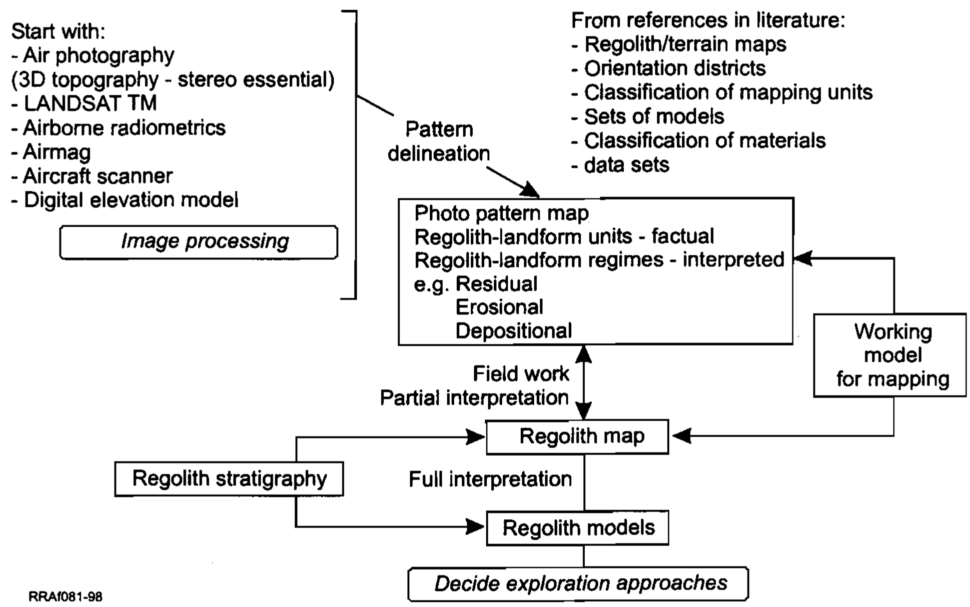


Figure 2.1. Flow chart for providing regolith-landform control in exploration geochemistry.

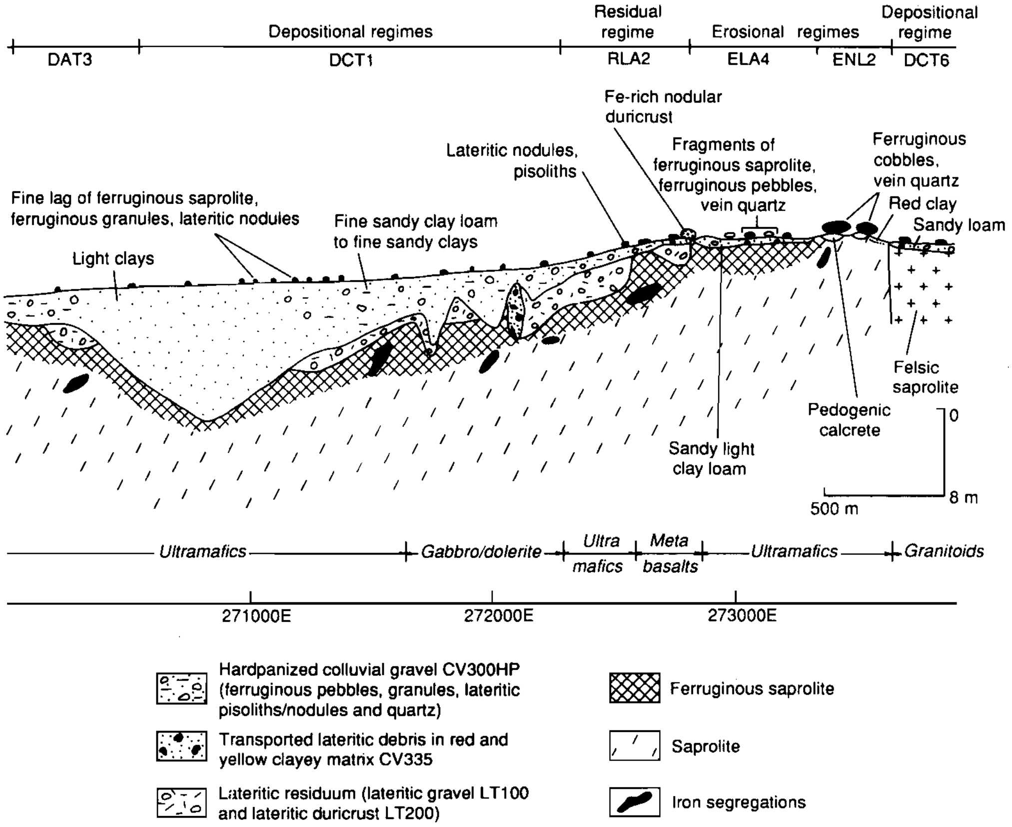


Figure 2.2. Cross section showing the regolith stratigraphy for line 6891600N, Meatoa area (after Anand, *et al.*, 1991). Codes for the regolith-landform mapping units are shown.

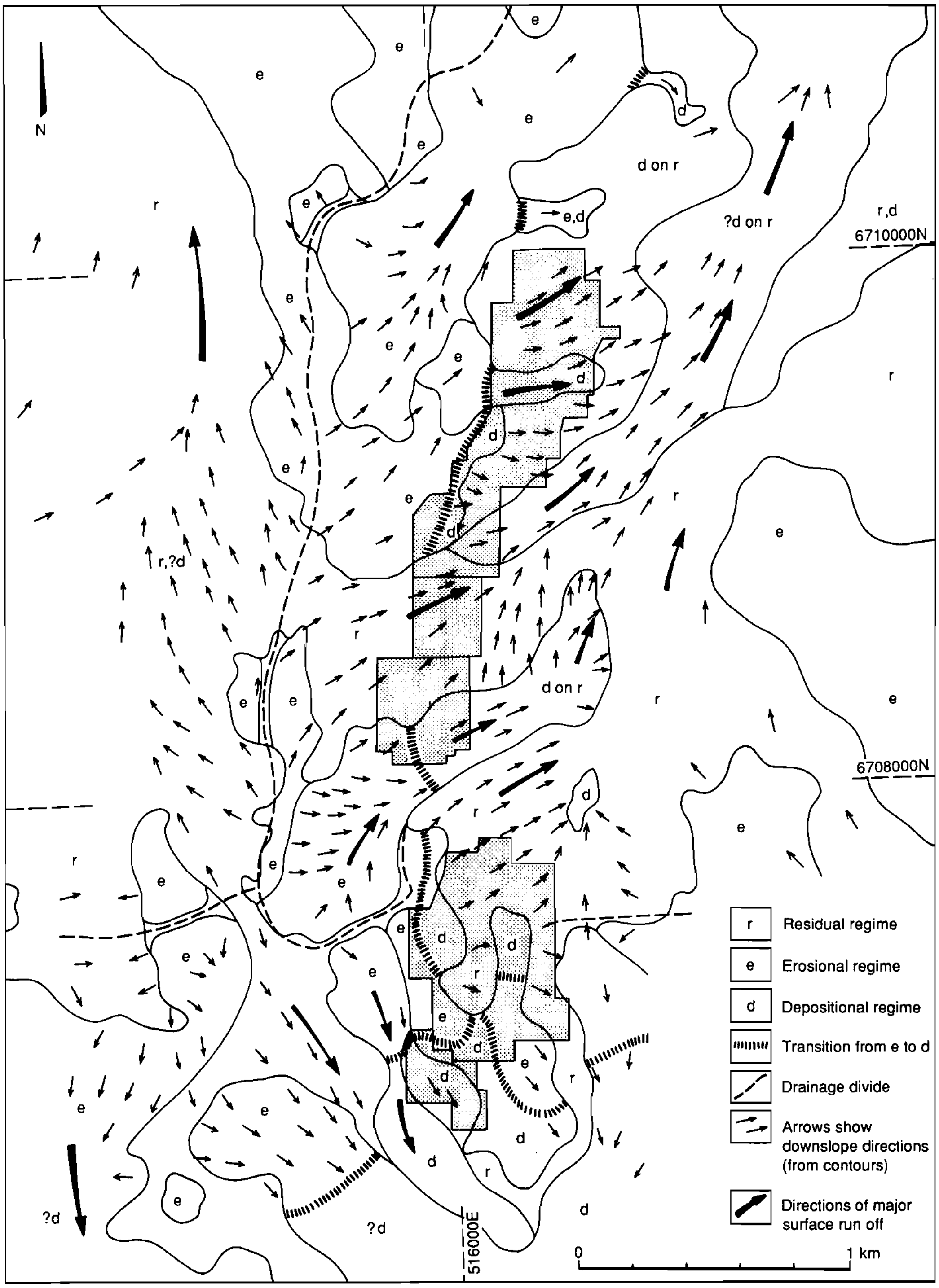


Figure 2.3. Genetic map of the Mt. Gibson detailed orientation area showing regolith-landform regimes and a synthesis of regolith-landform dynamics (after Anand *et al.*, March, 1989).

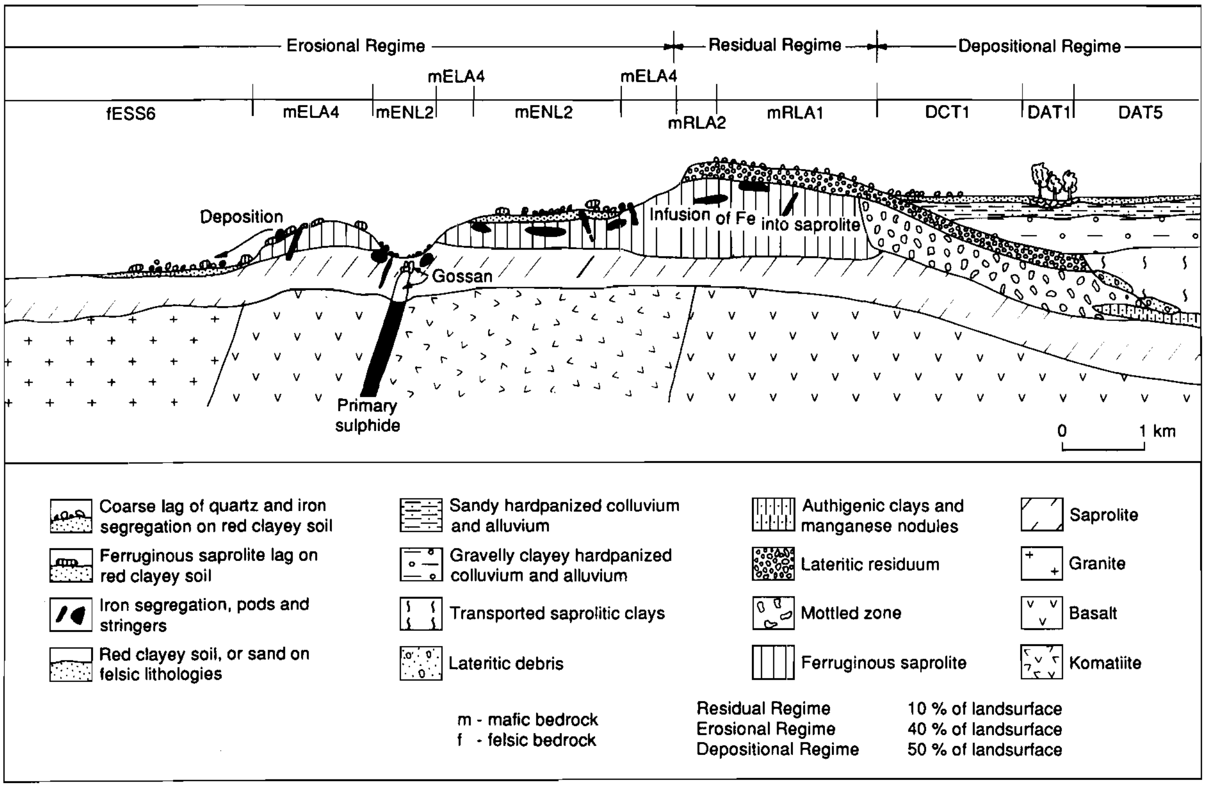


Figure 2.4. Schematic cross section for the Mt. McClure district showing the regolith stratigraphy and landforms (after Williamson et al., 1992). Codes for the regolith-landform mapping units are shown.

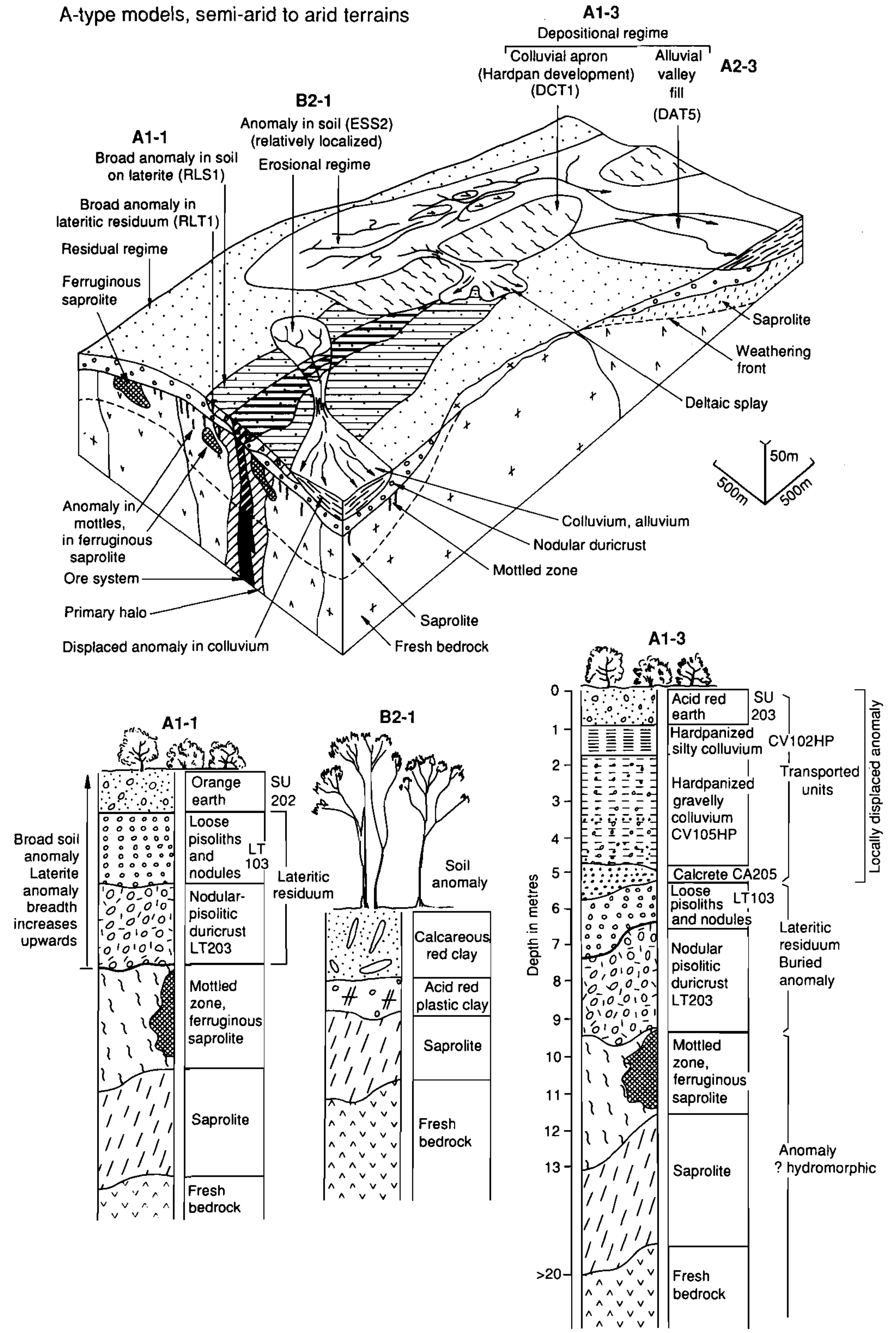


Figure 2.5. Geochemical dispersion model for the Mt. Gibson area, columns show regolith stratigraphy with classification codes for selected regolith materials (after Smith *et al.*, 1992). Codes for regolith-landform mapping units are also shown.

3.0 GUIDE FOR USE

The format of this classification and atlas is designed with two methods of entry. The intent is that an explorationist or researcher, faced with a field area of interest can decide which of the entry methods is more appropriate.

3.1 Entry via Classification Tables

Section 4.0 lists the classified regolith materials arranged vertically in a regolith stratigraphic order. The classification tables follow the same stratigraphic order.

The classification tables contain information about regolith-landform regimes, landforms and regolith materials, the latter are arranged vertically in order of the regolith stratigraphy. The system sets out to establish a hierarchical framework for identifying regolith-landform mapping units; that is, units which are defined in terms of various regolith and landform characteristics. The first level is the *regime*, that is residual, erosional or depositional- where the focus is on preservation and truncation of the lateritic residuum. The second level relates to specific *landforms,* for example, hills, crest, back slopes etc. These landforms are shown diagrammatically in Fig. 3.1 and are defined in glossary. The third level is concerned with the *regolith materials* themselves, for example, lags, soils. The relationships between members of the lateritic family are shown in Fig. 3.2. Each unit so identified has a mnemonic of at least four characters. If the information on bedrock (mafic, ultramafic, felsic, or sedimentary) is available, a supplementary code is added as a lower case prefix. An attempt is made to show the likely occurrence of various regolith types within each regolith-landform regime and its constituent landform categories.

Two versions of classification tables are given. These include (a) classification tables (1 to 4) with condensed codes (excluding landforms) and (b) classification tables (5 to 8) with extended codes (including landforms).

Entry by way of the tables enables the user to see at a glance all the terms in use, for a chosen regolith and landform type with their corresponding codes. The intent is that a close match be made with those regolith materials a user wishes to classify and map.

The alpha-numeric codes provide links between the photographs and descriptions, classification tables, example maps, and models.

3.2 Entry via the Atlas

Section 5.0 comprises a collection of representative photographs and accompanying descriptions of regolith-landform mapping units that with time can be expanded. They are arranged in the same order as those of the classification tables. The classification codes are shown on the right hand side of the photos. The intent is for a user to match the appearance and descriptions of these mapping units with those from an area being studied.

3.3 Steps to Follow

1. Interpretation of aerial photographs supplemented by multispectral remotely sensed imagery (such as Landsat, SPOT) and when available, airborne radiometrics data. This should lead to the preparation of a preliminary map which includes major regolith-landform regimes and landforms;

2. Field work should include mapping boundaries, traversing and collection of data on regolith materials, and the establishment of the regolith-stratigraphic relationships from drill holes, pits and costeans (if available). Extrapolation of site data using recurring regolith-landform patterns as a basis is appropriate;

3. If appropriate, information about regolith materials and landforms should be stored as a digital database such that the data can be manipulated for analysis and display by computer.

4. Symbol allocation to regolith-landform mapping units using the classification tables and atlas. Clearly there is a large body of information in the classification tables. In order to facilitate the more effective day to day use of these classification tables, priorities will have to be set up. Suggested priorities can be established in the following manner.

   In case of the residual and erosional regimes, priority should be given to lags of the ferruginous materials. Where ferruginous materials are rare, i.e. in the large areas of erosional regimes, soils and sub-crop and outcrop of bedrock/saprolite should form the basis of the mapping unit nomenclature. In the depositional regimes, substrate to the transported overburden is preferred. This may involve shallow drilling to establish the regolith stratigraphy.

   The symbols allocated to the mapping units comprise regolith-landform regime, and regolith material (e.g. RLA1). The information on the bedrock from which the regolith has been derived can be added as a prefix (e.g. mRLA1, where m indicates a mafic bedrock sequence). It seems that, for practicalities, information on landforms commonly has to be omitted because the symbolism becomes too cumbersome. However, if a user sees a need to include this information the suggested codes are shown in the extended classification tables (e.g. RCRLA1).

Example of coded maps from several orientation districts in the Yilgarn Craton are presented in Section 4.3.

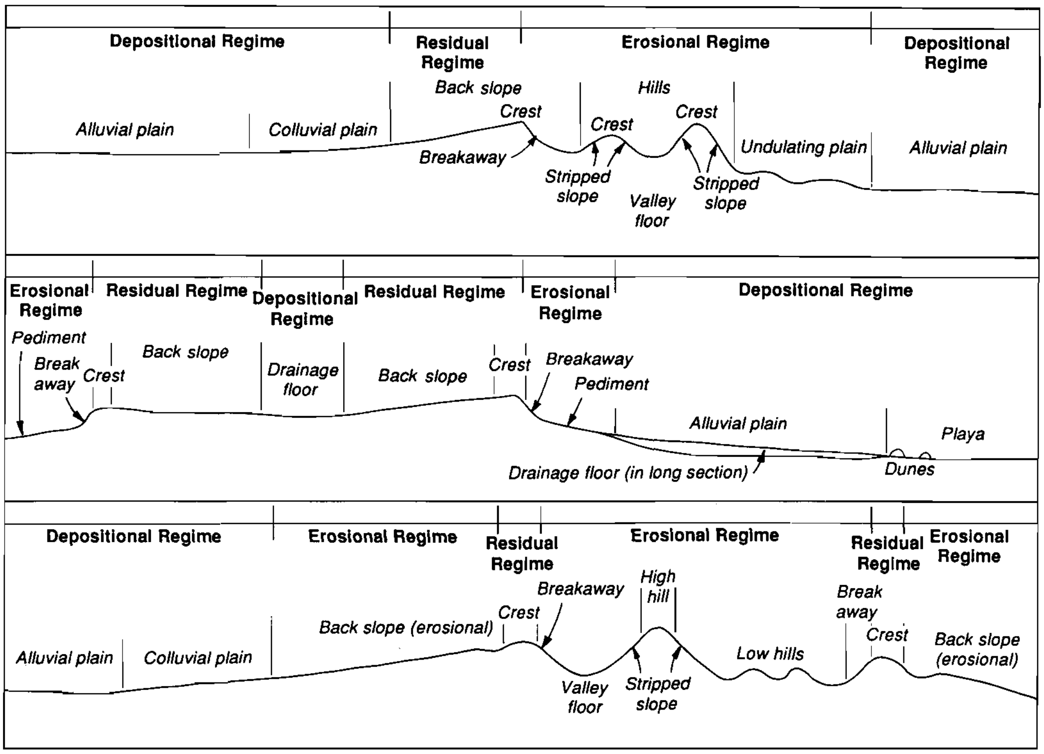


Figure 3.1. Schematic diagram showing the relationships between the landforms.

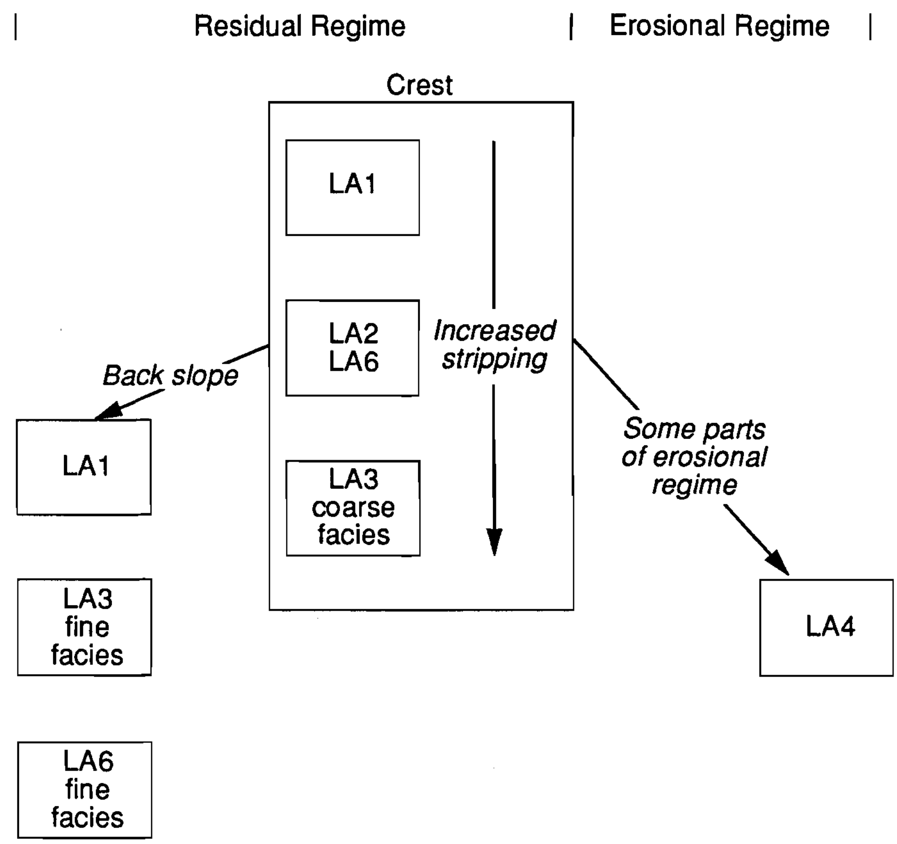


Figure 3.2. Schematic diagram showing the relationships between the members of the lateritic family.

4.0 CLASSIFICATION TABLES

4.1 Condensed Form (landforms excluded from codes)

LAGS

SOILS

UNITS OF WEATHERING PROFILE

SUBSTRATE TO TRANSPORTED OVERBURDEN

4.2 Extended Form (landforms included in codes)

LAGS

SOILS

UNITS OF WEATHERING PROFILE

SUBSTRATE TO TRANSPORTED OVERBURDEN

4.3 Examples of Coded Maps with Supporting Tables from some Project Study Areas

Classification Table 1 — LAGS

Group	Family	Clasts	Code	Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
				Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Clasts	***Code***	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
FERRUGINOUS	LATERITIC FAMILY **LA**	Lateritic nodules, pisoliths	LA1	RLA1	RLA1																
		Lateritic nodules, pisoliths, fragments of lateritic duricrust, Fe-saprolite, mottles	LA2		RLA2																
		Lateritic nodules, pisoliths, mottles, Fe-saprolite	LA3	RLA3	RLA3																
		Mottled, Fe-saprolite fragments	LA4			ELA4	ELA4	ELA4			ELA4		ELA4								
		Lateritic nodules, pisoliths, fragments of black Fe-rich duricrust, Fe-saprolite	LA5		RLA5																
		Black lateritic nodules, pisoliths, Fe-saprolite	LA6	RLA6	RLA6																
	NON-LATERITIC FAMILY **NL**	Gossan fragments	NL1				ENL1			ENL1	ENL1										
		Iron segregations	NL2								ENL2		ENL2								
		Fe-lithic fragments	NL3				ENL3	ENL3		ENL3	ENL3		ENL3	ENL3							
		Iron segregations, Fe-lithic fragments	NL4				ENL4				ENL4		ENL4	ENL4							
		Ferruginous granules	NL5									ENL5		ENL5							
NON-FERRUGINOUS	LITHIC FAMILY **LI**	Saprolite fragments	LI1					ELI1			ELI1		ELI1	ELI1							
		Saprock fragments	LI2				ELI2			ELI2	ELI2	ELI2	ELI2	ELI2							
		Bedrock fragments	LI3							ELI3	ELI3	ELI3									
		Quartz fragments	LI4						ELI4		ELI4										
		Bedrock, saprock, quartz fragments	LI5				ELI5					ELI5									
	MIXED (Lateritic + Non-lateritic + Lithic) **MI**	Brown ferruginous granules, quartz	MI1												DMI1	DMI1					
		Black ferruginous granules, quartz	MI2												DMI2	DMI2					
		Iron segregations, lithic fragments, lateritic nodules, pisoliths, quartz	MI3												DMI3	DMI3	DMI3	DMI3	DMI3		
		Lateritic nodules, pisoliths, fragments of Fe-saprolite, iron segregations, quartz	MI4												DMI4	DMI4	DMI4	DMI4	DMI4		
		Quartz, lateritic nodules, pisoliths	MI5												DMI5	DMI5	DMI5	DMI5	DMI5		

Fe=Ferruginous

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Table 2

SOILS

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
Soils derived from lateritic residuum **LS**	Gravelly orange sandy clay	LS1	RLS1	RLS1																
	Gravelly red-brown sandy clay	LS2	RLS2	RLS2																
	Yellow brown sandy gravels	LS3	RLS3	RLS3																
	Gravelly yellow sand	LS4	RLS4	RLS4																
	Gravelly red sand	LS5	RLS5	RLS5																
Soils derived from saprolite and bedrock **SS**	Red clay	SS1				ESS1			ESS1	ESS1	ESS1	ESS1	ESS1							
	Calcareous red clay	SS2				ESS2			ESS2	ESS2	ESS2	ESS2	ESS2							
	Calcareous grey-brown clay	SS3				ESS3	ESS3			ESS3			ESS3							
	Cracking clays	SS4											ESS4			DSS4		DSS4		
	Stony soils	SS5							ESS5											
	Sandy soils	SS6									ESS6	ESS6								
Soils developed in colluvium **CS**	Red clay	CS1												DCS1						
	Calcareous red clay	CS2												DCS2						
	Yellow sands	CS3												DCS3						
	Red sands	CS4												DCS4						
Soils developed in alluvium **AS**	Red clay	AS1													DAS1	DAS1	DAS1	DAS1		
	Calcareous red clay	AS2													DAS2	DAS2	DAS2	DAS2		
	Saline brown soil	AS3																	DAS3	
	Saline calcareous earth	AS4																	DAS4	
	Cracking clays	AS5													DAS5					
Soils developed in eolian sediments **ES**	Yellow sands	ES1																		DES1
	Red sands	ES2																		DES2

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Table 3 — UNITS OF WEATHERING PROFILE

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back Slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plains	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
LATERITIC RESIDUUM **LT**	Lateritic gravel	LT1	RLT1	RLT1																
	Lateritic duricrust	LT2	RLT2	RLT2																
	Fe-rich duricrust	LT3		RLT3																
MOTTLED ZONE **MZ**	Pisolitic-nodular mottled zone	MZ1				EMZ1	EMZ1													
	Mega-mottled zone	MZ2					EMZ2													
SAPROLITE **SP**	Mottled saprolite	SP1				ESP1	ESP1			ESP1										
	Fe-saprolite	SP2				ESP2	ESP2			ESP2										
	Collapsed Fe-saprolite	SP3				ESP3				ESP3										
	Clay rich saprolite	SP4					ESP4			ESP4		ESP4	ESP4							
	Silicified saprolite	SP5								ESP5										
SAPROCK **SR**	Fe-saprock	SR1				ESR1				ESR1										
	saprock	SR2							ESR2	ESR2	ESR2		ESR2							
BEDROCK **BR**	Fe-bedrock	BR1				EBR1				EBR1										
	Silicified bedrock	BR2							EBR2											
	Fresh bedrock	BR3						EBR3	EBR3	EBR3	EBR3									

Fe=Ferruginous

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Table 4

SUBSTRATE TO TRANSPORTED OVERBURDEN

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
COLLUVIAL SEDIMENTS **CT**	Lateritic residuum present beneath colluvial sediments	CT1												DCT1				DCT1		
	Mottled zone present beneath colluvial sediments	CT2												DCT2				DCT2		
	Ferruginous saprolite present beneath colluvial sediments	CT3												DCT3				DCT3		
	Clay zone present beneath colluvial sediments	CT4												DCT4				DCT4		
	Saprolite present beneath colluvial sediments	CT5												DCT5				DCT5		
	Bedrock present beneath colluvial sediments	CT6												DCT6				DCT6		
	Not known	CT7												DCT7				DCT7		
ALLUVIAL SEDIMENTS **AT**	Lateritic residuum present beneath alluvial sediments	AT1													DAT1	DAT1	DAT1	DAT1		
	Mottled zone present beneath alluvial sediments	AT2													DAT2	DAT2	DAT2	DAT2		
	Ferruginous saprolite present beneath alluvial sediments	AT3													DAT3	DAT3	DAT3	DAT3		
	Clay zone present beneath alluvial sediments	AT4													DAT4	DAT4	DAT4	DAT4		
	Saprolite present beneath alluvial sediments	AT5													DAT5	DAT5	DAT5	DAT5		
	Bedrock present beneath alluvial sediments	AT6													DAT6	DAT6	DAT6	DAT6		
	Not known	AT7													DAT7	DAT7	DAT7	DAT7		
EOLIAN SEDIMENTS **ET**	Lateritic residuum present beneath eolian sediments	ET1																		DET1
	Mottled zone present beneath eolian sediments	ET2																		DET2
	Ferruginous saprolite present beneath eolian sediments	ET3																		DET3
	Clay zone present beneath eolian sediments	ET4																		DET4
	Saprolite present beneath eolian sediments	ET5																		DET5
	Bedrock present beneath eolian sediments	ET6																		DET6
	Not known	ET7																		DET7

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Table 5 — LAGS

		Clasts	Code	Residual regimes(R): Back slopes BS	Residual regimes(R): Crests CR	Erosional regimes (E): Back slopes BS	Crests CR	Break away BK	Ridges RG	High hills HH	Low hills LH	Stripped Slopes SS	Pedi-ments PD	Undulat-ing plain UP	Depositional regimes (D): Colluvial plains CP	Alluvial plains AP	Major drainage floors MD	Small drainage floors SD	Valley floors VF	Playas PY	Dunes DU
FERRUGINOUS	LATERITIC FAMILY LA	Lateritic nodules, pisoliths	LA1	RBSLA1	RCRLA1																
		Lateritic nodules, pisoliths, fragments of lateritic duricrust, Fe-saprolite, mottles	LA2		RCRLA2																
		Lateritic nodules, pisoliths, mottles, Fe-saprolite	LA3	RBSLA3	RCRLA3																
		Mottled, Fe-saprolite fragments	LA4			EBSLA4	ECRLA4	EBKLA4			ELHLA4		EPDLA4								
		Lateritic nodules, pisoliths, fragments of black Fe-rich duricrust, Fe-saprolite	LA5		RCRLA5																
		Black lateritic nodules, pisoliths, Fe-saprolite	LA6	RBSLA6	RCRLA6																
	NON-LATERITIC FAMILY NL	Gossan fragments	NL1				ECRNL1			EHHNL1	ELHNL1										
		Iron segregations	NL2								ELHNL2		EPDNL2								
		Fe-lithic fragments	NL3				ECRNL3	EBKNL3		EHHNL3	ELHNL3		EPDNL3	EUPNL3							
		Iron segregations, Fe-lithic fragments	NL4				ECRNL4				ELHNL4		EPDNL4	EUPNL4							
		Ferruginous granules	NL5									ESSNL5		EUPNL5							
NON-FERRUGINOUS	LITHIC FAMILY LI	Saprolite fragments	LI1					EBKLI1			ELHLI1		EPDLI1	EUPLI1							
		Saprock fragments	LI2				ECRLI2			EHHLI2	ELHLI2	ESSLI2	EPDLI2	EUPLI2							
		Bedrock fragments	LI3							EHHLI3	ELHLI3	ESSLI3									
		Quartz fragments	LI4						ERGLI4		ELHLI4										
		Bedrock, saprock, quartz fragments	LI5				ECRLI5					ESSLI5									
	MIXED (Lateritic + Non-lateritic + Lithic) MI	Brown ferruginous granules, quartz	MI1												DCPMI1	DAPMI1					
		Black ferruginous granules, quartz	MI2												DCPMI2	DAPMI2					
		Iron segregations, lithic fragments, lateritic nodules, pisoliths, quartz	MI3												DCPMI3	DAPMI3	DMDMI3	DSDMI3	DVFMI3		
		Lateritic nodules, pisoliths, fragments of Fe-saprolite, iron segregations, quartz	MI4												DCPMI4	DAPMI4	DMDMI4	DSDMI4	DVFMI4		
		Quartz, lateritic nodules, pisoliths	MI5												DCPMI5	DAPMI5	DMDMI5	DSDMI5	DVFMI5		

Fe=Ferruginous

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Table 6 **SOILS**

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
Soils derived from lateritic residuum **LS**	Gravelly orange sandy clay	LS1	RBSLS1	RCRLS1																
	Gravelly red-brown sandy clay	LS2	RBSLS2	RCRLS2																
	Yellow brown sandy gravels	LS3	RBSLS3	RCRLS3																
	Gravelly yellow sand	LS4	RBSLS4	RCRLS4																
	Gravelly red sand	LS5	RBSLS5	RCRLS5																
Soils derived from saprolite and bedrock **SS**	Red clay	SS1				ECRSS1			EHHSS1	ELHSS1	ESSSS1	EPDSS1	EUPSS1							
	Calcareous red clay	SS2				ECRSS2			EHHSS2	ELHSS2	ESSSS2	EPDSS2	EUPSS2							
	Calcareous grey-brown clay	SS3				ECRSS3	EBKSS3			ELHSS3			EUPSS3							
	Cracking clays	SS4											EUPSS4			DMDSS4		DVFSS4		
	Stony soils	SS5							EHHSS5											
	Sandy soils	SS6									ESSSS6	EPDSS6								
Soils developed in colluvium **CS**	Red clay	CS1												DCPCS1						
	Calcareous red clay	CS2												DCPCS2						
	Yellow sands	CS3												DCPCS6						
	Red sands	CS4												DCPCS7						
Soils developed in alluvium **AS**	Red clay	AS1													DAPAS1	DMDAS1	DSDAS1	DVFAS1		
	Calcareous red clay	AS2													DAPAS2	DMDAS2	DSDAS2	DVFAS2		
	Saline brown soil	AS3																	DPYAS3	
	Saline calcareous earth	AS4																	DPYAS4	
	Cracking clays	AS5													DAPAS5					
Soils developed in eolian sediments **ES**	Yellow sands	ES1																		DDUES1
	Red sands	ES2																		DDUES2

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Table 7 — UNITS OF WEATHERING PROFILE

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back Slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plains	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
LATERITIC RESIDUUM	Lateritic gravel	LT1	RBSLT1	RCRLT1																
	Lateritic duricrust	LT2	RBSLT2	RCRLT2																
LT	Fe-rich duricrust	LT3		RCRLT3																
MOTTLED ZONE	Pisolitic-nodular mottled zone	MZ1				ECRMZ1	EBKMZ1													
MZ	Mega-mottled zone	MZ2					EBKMZ2													
	Mottled saprolite	SP1				ECRSP1	EBKSP1			ELHSP1										
	Fe-saprolite	SP2				ECRSP2	EBKSP2			ELHSP2										
SAPROLITE	Collapsed Fe-saprolite	SP3				ECRSP3				ELHSP3										
SP	Clay rich saprolite	SP4					EBKSP4			ELHSP4		EPDSP4	EUPSP4							
	Silicified saprolite	SP5								ELHSP5										
SAPROCK	Fe-saprock	SR1				ECRSR1				ELHSR1										
SR	saprock	SR2							EHHSR2	ELHSR2	ESSSR2		EUPSR2							
BEDROCK	Fe-bedrock	BR1				ECRBR1				ELHBR1										
BR	Silicified bedrock	BR2							EHHBR2											
	Fresh bedrock	BR3						ERGBR3	EHHBR3	ELHBR3	ESSBR3									

Fe=Ferruginous

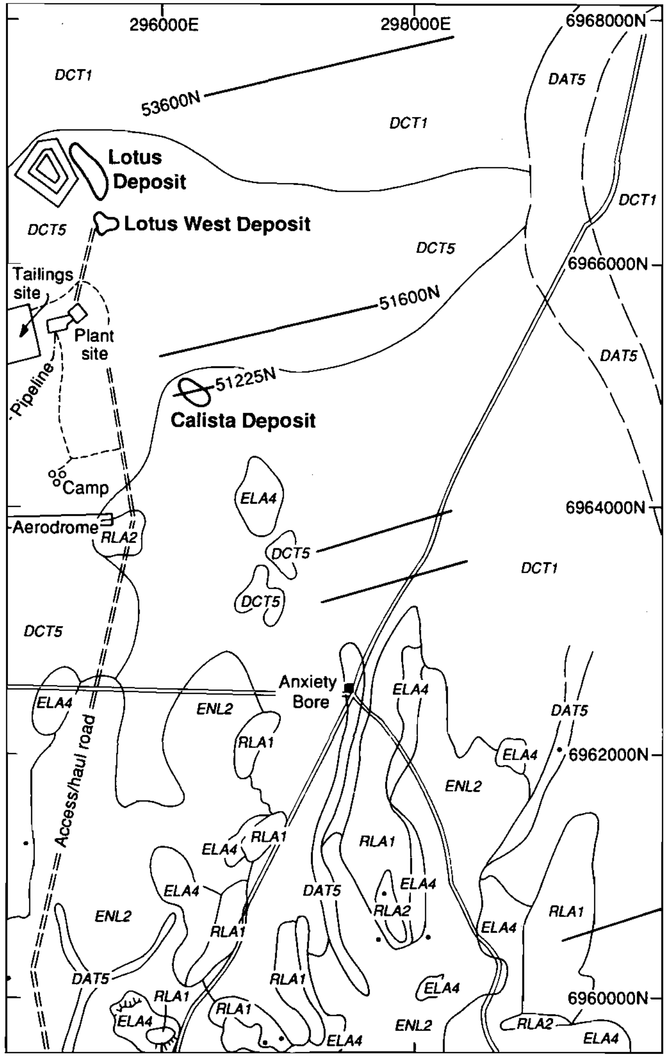
Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Table 8 — SUBSTRATE TO TRANSPORTED OVERBURDEN

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
COLLUVIAL SEDIMENTS **CT**	Lateritic residuum present beneath colluvial sediments	CT1												DCPCT1				DVFCT1		
	Mottled zone present beneath colluvial sediments	CT2												DCPCT2				DVFCT2		
	Ferruginous saprolite present beneath colluvial sediments	CT3												DCPCT3				DVFCT3		
	Clay zone present beneath colluvial sediments	CT4												DCPCT4				DVFCT4		
	Saprolite present beneath colluvial sediments	CT5												DCPCT5				DVFCT5		
	Bedrock present beneath colluvial sediments	CT6												DCPCT6				DVFCT6		
	Not known	CT7												DCPCT7				DVFCT7		
ALLUVIAL SEDIMENTS **AT**	Lateritic residuum present beneath alluvial sediments	AT1													DAPAT1	DMDAT1	DSDAT1	DVFAT1		
	Mottled zone present beneath alluvial sediments	AT2													DAPAT2	DMDAT2	DSDAT2	DVFAT2		
	Ferruginous saprolite present beneath alluvial sediments	AT3													DAPAT3	DMDAT3	DSDAT3	DVFAT3		
	Clay zone present beneath alluvial sediments	AT4													DAPAT4	DMDAT4	DSDAT4	DVFAT4		
	Saprolite present beneath alluvial sediments	AT5													DAPAT5	DMDAT5	DSDAT5	DVFAT5		
	Bedrock present beneath alluvial sediments	AT6													DAPAT6	DMDAT6	DSDAT6	DVFAT6		
	Not known	AT7													DAPAT7	DMDAT7	DSDAT7	DVFAT7		
EOLIAN SEDIMENTS **ET**	Lateritic residuum present beneath eolian sediments	ET1																		DDUET1
	Mottled zone present beneath eolian sediments	ET2																		DDUET2
	Ferruginous saprolite present beneath eolian sediments	ET3																		DDUET3
	Clay zone present beneath eolian sediments	ET4																		DDUET4
	Saprolite present beneath eolian sediments	ET5																		DDUET5
	Bedrock present beneath eolian sediments	ET6																		DDUET6
	Not known	ET7																		DDUET7

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Examples of the coded maps, using the classification scheme, for the MT. McClure, Lawlers, MT. Gibson, Bottle Creek and Wombola districts. Shaded areas in the corresponding classification tables show the distribution of regolith-landform mapping units present in each area.



MT. McCLURE DISTRICT

RESIDUAL REGIME

RLA1 Lateritic nodules and pisoliths

RLA2 Fragments of duricrust, lateritic pisoliths and nodules

EROSIONAL REGIME

ELA4 Fe-saprolite fragments

ENL2 Iron segregations

DEPOSITIONAL REGIME

DCT1 Lateritic residuum present beneath colluvial sediments

DCT5 Saprolite present beneath colluvial sediments

DAT5 Saprolite present beneath alluvial sediments

RAB line used for stratigraphic purposes

• Sample and/or photograph location

N

0 1 km

Classification Tables

MT.McCLURE DISTRICT-LAGS

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
	Clasts	***Code***	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
FERRUGINOUS — LATERITIC FAMILY **LA**	Lateritic nodules, pisoliths	LA1	**RLA1**	RLA1																
	Lateritic nodules, pisoliths, fragments of lateritic duricrust, Fe-saprolite, mottles	LA2		**RLA2**																
	Lateritic nodules, pisoliths, mottles, Fe-saprolite	LA3	RLA3	RLA3																
	Mottled, Fe-saprolite fragments	LA4			ELA4	ELA4	ELA4			ELA4		**ELA4**								
	Lateritic nodules, pisoliths, fragments of black Fe-rich duricrust, Fe-saprolite	LA5		RLA5																
	Black lateritic nodules, pisoliths, Fe-saprolite	LA6	RLA6	RLA6																
NON-LATERITIC FAMILY **NL**	Gossan fragments	NL1				ENL1			ENL1	ENL1										
	Iron segregations	NL2								**ENL2**		ENL2								
	Fe-lithic fragments	NL3				ENL3	ENL3		ENL3	ENL3		ENL3	ENL3							
	Iron segregations, Fe-lithic fragments	NL4				ENL4				ENL4		ENL4	ENL4							
	Ferruginous granules	NL5									ENL5		ENL5							
NON-FERRUGINOUS — LITHIC FAMILY **LI**	Saprolite fragments	LI1					ELI1			ELI1		ELI1	ELI1							
	Saprock fragments	LI2				ELI2			ELI2	ELI2	ELI2	ELI2	ELI2							
	Bedrock fragments	LI3							ELI3	ELI3	ELI3									
	Quartz fragments	LI4						ELI4		ELI4										
	Bedrock, saprock, quartz fragments	LI5				ELI5					ELI5									
MIXED (Lateritic + Non-lateritic + Lithic) **MI**	Brown ferruginous granules, quartz	MI1												DMI1	DMI1					
	Black ferruginous granules, quartz	MI2												DMI2	DMI2					
	Iron segregations, lithic fragments, lateritic nodules, pisoliths, quartz	MI3												DMI3	DMI3	DMI3	DMI3	DMI3		
	Lateritic nodules, pisoliths, fragments of Fe-saprolite, iron segregations, quartz	MI4												DMI4	DMI4	DMI4	DMI4	DMI4		
	Quartz, lateritic nodules, pisoliths	MI5												DMI5	DMI5	DMI5	DMI5	DMI5		

See following table for codes of depositional regimes

Fe=Ferruginous

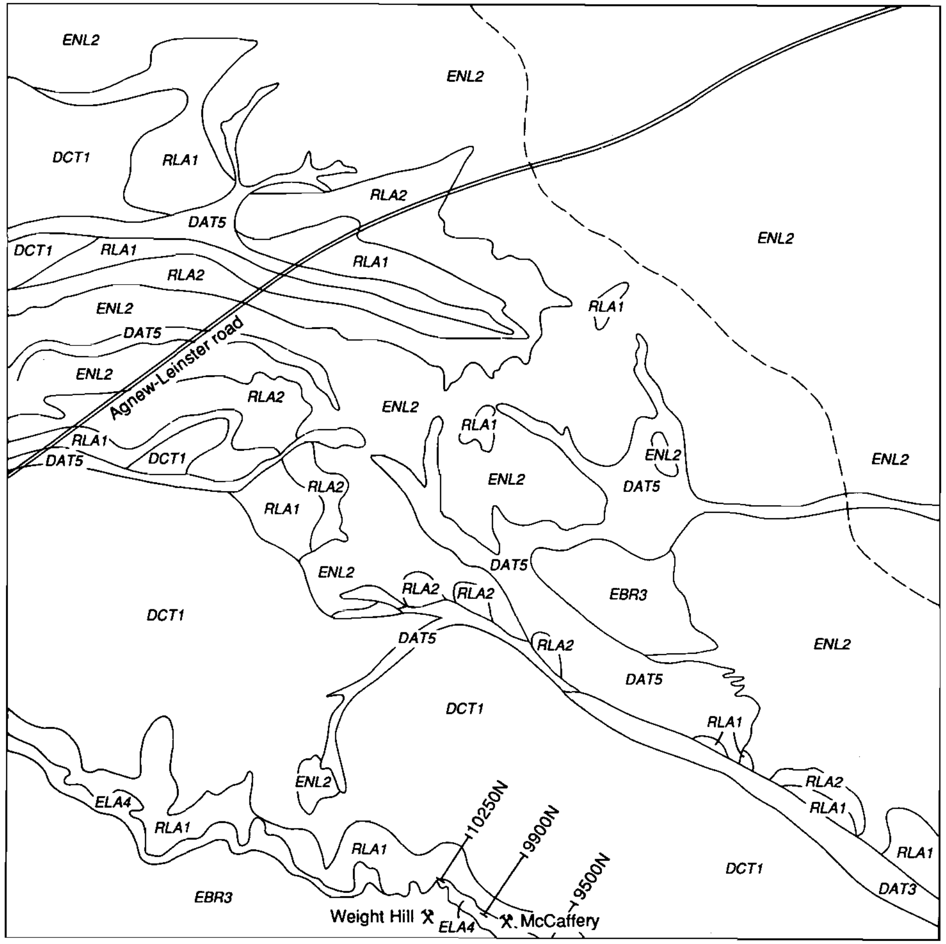
Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Tables

MT.McCLURE DISTRICT-
SUBSTRATE TO TRANSPORTED OVERBURDEN

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)							
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
COLLUVIAL SEDIMENTS CT	Lateritic residuum present beneath colluvial sediments	CT1												**DCT1**				DCT1		
	Mottled zone present beneath colluvial sediments	CT2												DCT2				DCT2		
	Ferruginous saprolite present beneath colluvial sediments	CT3												DCT3				DCT3		
	Clay zone present beneath colluvial sediments	CT4												DCT4				DCT4		
	Saprolite present beneath colluvial sediments	CT5												**DCT5**				DCT5		
	Bedrock present beneath colluvial sediments	CT6												DCT6				DCT6		
	Not known	CT7												DCT7				DCT7		
ALLUVIAL SEDIMENTS AT	Lateritic residuum present beneath alluvial sediments	AT1													DAT1	DAT1	DAT1	DAT1		
	Mottled zone present beneath alluvial sediments	AT2													DAT2	DAT2	DAT2	DAT2		
	Ferruginous saprolite present beneath alluvial sediments	AT3													DAT3	DAT3	DAT3	DAT3		
	Clay zone present beneath alluvial sediments	AT4													DAT4	DAT4	DAT4	DAT4		
	Saprolite present beneath alluvial sediments	AT5													DAT5	**DAT5**	DAT5	DAT5		
	Bedrock present beneath alluvial sediments	AT6													DAT6	DAT6	DAT6	DAT6		
	Not known	AT7													DAT7	DAT7	DAT7	DAT7		
EOLIAN SEDIMENTS ET	Lateritic residuum present beneath eolian sediments	ET1																		DET1
	Mottled zone present beneath eolian sediments	ET2																		DET2
	Ferruginous saprolite present beneath eolian sediments	ET3																		DET3
	Clay zone present beneath eolian sediments	ET4																		DET4
	Saprolite present beneath eolian sediments	ET5																		DET5
	Bedrock present beneath eolian sediments	ET6																		DET6
	Not known	ET7																		DET7

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks



LAWLERS DISTRICT

RESIDUAL REGIME

RLA1 Lateritic nodules and pisoliths

RLA2 Fragments of duricrust, lateritic pisoliths and nodules

EROSIONAL REGIME

ELA4 Fe-saprolite fragments

ENL2 Iron segregations

EBR3 Bedrock

DEPOSITIONAL REGIME

DCT1 Lateritic residuum present beneath colluvial sediments

DAT3 Fe-saprolite present beneath alluvial sediments

DAT5 Saprolite present beneath alluvial sediments

N

0 1 km

				Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
				Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Clasts	***Code***	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
FERRUGINOUS	LATERITIC FAMILY **LA**	Lateritic nodules, pisoliths	LA1	***RLA1***	RLA1																
		Lateritic nodules, pisoliths, fragments of lateritic duricrust, Fe-saprolite, mottles	LA2		***RLA2***																
		Lateritic nodules, pisoliths, mottles, Fe-saprolite	LA3	RLA3	RLA3																
		Mottled, Fe-saprolite fragments	LA4			ELA4	ELA4	***ELA4***			ELA4		ELA4								
		Lateritic nodules, pisoliths, fragments of black Fe-rich duricrust, *Fe-saprolite*	LA5		RLA5																
		Black lateritic nodules, pisoliths, Fe-saprolite	LA6	RLA6	RLA6																
	NON-LATERITIC FAMILY **NL**	Gossan fragments	NL1				ENL1			ENL1	ENL1										
		Iron segregations	NL2								***ENL2***		ENL2								
		Fe-lithic fragments	NL3				ENL3	ENL3		ENL3	ENL3		ENL3	ENL3							
		Iron segregations, Fe-lithic fragments	NL4				ENL4				ENL4		ENL4	ENL4							
		Ferruginous granules	NL5									ENL5		ENL5							
NON-FERRUGINOUS	LITHIC FAMILY **LI**	Saprolite fragments	LI1					ELI1			ELI1		ELI1	ELI1							
		Saprock fragments	LI2				ELI2			ELI2	ELI2	ELI2	ELI2	ELI2							
		Bedrock fragments	LI3							ELI3	ELI3	ELI3									
		Quartz fragments	LI4						ELI4		ELI4										
		Bedrock, saprock, quartz fragments	LI5				ELI5					ELI5									
	MIXED (Lateritic + Non-lateritic + Lithic) **MI**	Brown ferruginous granules, quartz	MI1												DMI1	DMI1					
		Black ferruginous granules, quartz	MI2												DMI2	DMI2					
		Iron segregations, lithic fragments, lateritic nodules, pisoliths, quartz	MI3												DMI3	DMI3	DMI3	DMI3	DMI3		
		Lateritic nodules, pisoliths, fragments of Fe-saprolite, iron segregations, quartz	MI4												DMI4	DMI4	DMI4	DMI4	DMI4		
		Quartz, lateritic nodules, pisoliths	MI5												DMI5	DMI5	DMI5	DMI5	DMI5		

See following table for codes of depositional regimes

Fe=Ferruginous

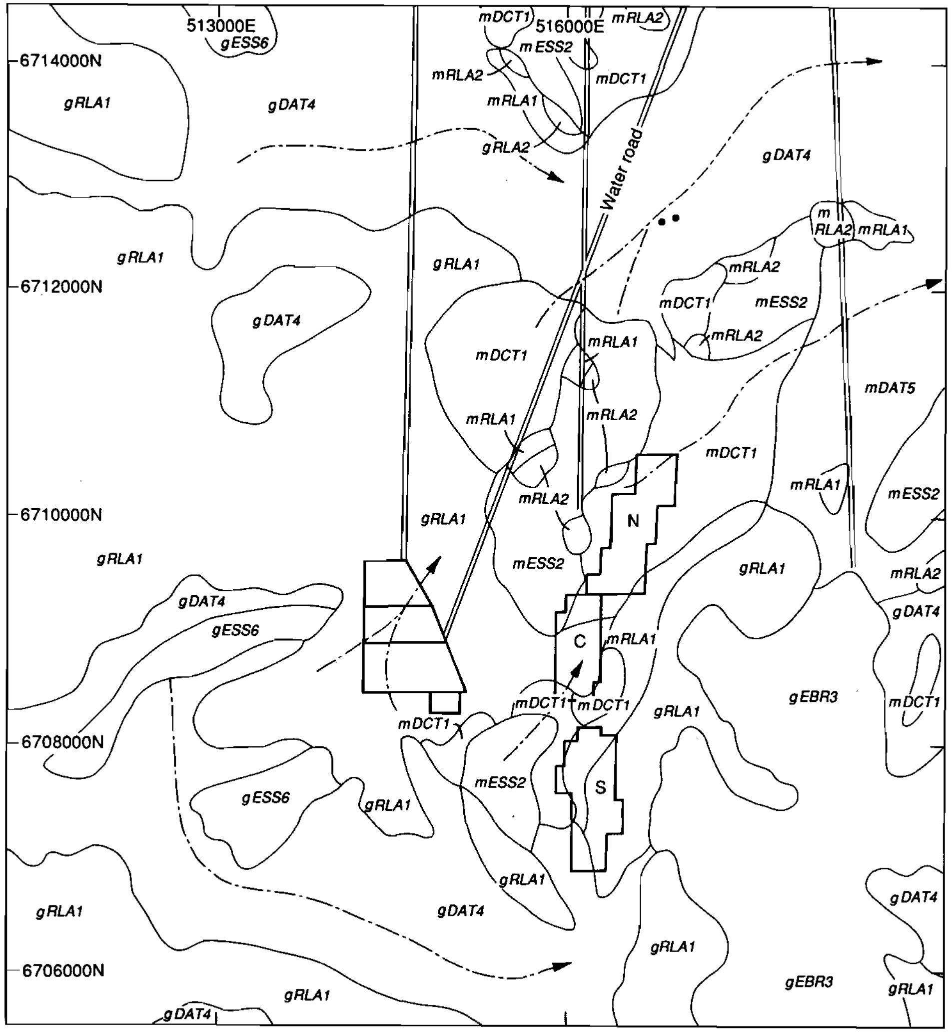
Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Tables

LAWLERS DISTRICT- SUBSTRATE TO TRANSPORTED OVERBURDEN

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
COLLUVIAL SEDIMENTS **CT**	Lateritic residuum present beneath colluvial sediments	CT1												***DCT1***				DCT1		
	Mottled zone present beneath colluvial sediments	CT2												DCT2				DCT2		
	Ferruginous saprolite present beneath colluvial sediments	CT3												DCT3				DCT3		
	Clay zone present beneath colluvial sediments	CT4												DCT4				DCT4		
	Saprolite present beneath colluvial sediments	CT5												DCT5				DCT5		
	Bedrock present beneath colluvial sediments	CT6												DCT6				DCT6		
	Not known	CT7												DCT7				DCT7		
ALLUVIAL SEDIMENTS **AT**	Lateritic residuum present beneath alluvial sediments	AT1													DAT1	DAT1	DAT1	DAT1		
	Mottled zone present beneath alluvial sediments	AT2													DAT2	DAT2	DAT2	DAT2		
	Ferruginous saprolite present beneath alluvial sediments	AT3													DAT3	***DAT3***	DAT3	DAT3		
	Clay zone present beneath alluvial sediments	AT4													DAT4	DAT4	DAT4	DAT4		
	Saprolite present beneath alluvial sediments	AT5													DAT5	DAT5	***DAT5***	DAT5		
	Bedrock present beneath alluvial sediments	AT6													DAT6	DAT6	DAT6	DAT6		
	Not known	AT7													DAT7	DAT7	DAT7	DAT7		
EOLIAN SEDIMENTS **ET**	Lateritic residuum present beneath eolian sediments	ET1																		DET1
	Mottled zone present beneath eolian sediments	ET2																		DET2
	Ferruginous saprolite present beneath eolian sediments	ET3																		DET3
	Clay zone present beneath eolian sediments	ET4																		DET4
	Saprolite present beneath eolian sediments	ET5																		DET5
	Bedrock present beneath eolian sediments	ET6																		DET6
	Not known	ET7																		DET7

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks



MT. GIBSON DISTRICT

RESIDUAL REGIME

RLA1 Lateritic nodules and pisoliths

RLA2 Fragments of duricrust, lateritic pisoliths and nodules

EROSIONAL REGIME

ESS2 Calcareous red clay

ESS6 Sandy soils

EBR3 Bedrock

DEPOSITIONAL REGIME

DCT1 Lateritic residuum present beneath colluvial sediments

DAT4 Clay zone present beneath alluvial sediments

DAT5 Saprolite present beneath alluvial sediments

m Regolith derived from mafic bedrock

g Regolith derived from granite bedrock

N

0 1 km

				Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
				Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Clasts	***Code***	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
FERRUGINOUS	LATERITIC FAMILY **LA**	Lateritic nodules, pisoliths	LA1	***RLA1***	RLA1																
		Lateritic nodules, pisoliths, fragments of lateritic duricrust, Fe-saprolite, mottles	LA2		***RLA2***																
		Lateritic nodules, pisoliths, mottles, Fe-saprolite	LA3	RLA3	RLA3																
		Mottled, Fe-saprolite fragments	LA4			ELA4	ELA4	ELA4			ELA4		ELA4								
		Lateritic nodules, pisoliths, fragments of black Fe-rich duricrust, Fe-saprolite	LA5		RLA5																
		Black lateritic nodules, pisoliths, Fe-saprolite	LA6	RLA6	RLA6																
	NON-LATERITIC FAMILY **NL**	Gossan fragments	NL1				ENL1			ENL1	ENL1										
		Iron segregations	NL2								ENL2		ENL2								
		Fe-lithic fragments	NL3				ENL3	ENL3		ENL3	ENL3		ENL3	ENL3							
		Iron segregations, Fe-lithic fragments	NL4				ENL4				ENL4		ENL4	ENL4							
		Ferruginous granules	NL5									ENL5		ENL5							
NON-FERRUGINOUS	LITHIC FAMILY **LI**	Saprolite fragments	LI1					ELI1			ELI1		ELI1	ELI1							
		Saprock fragments	LI2				ELI2			ELI2	ELI2	ELI2	ELI2	ELI2							
		Bedrock fragments	LI3							ELI3	ELI3	ELI3									
		Quartz fragments	LI4						ELI4		ELI4										
		Bedrock, saprock, quartz fragments	LI5				ELI5					ELI5									
	MIXED (Lateritic + Non-lateritic + Lithic) **MI**	Brown ferruginous granules, quartz	MI1												DMI1	DMI1					
		Black ferruginous granules, quartz	MI2												DMI2	DMI2					
		Iron segregations, lithic fragments, lateritic nodules, pisoliths, quartz	MI3												DMI3	DMI3	DMI3	DMI3	DMI3		
		Lateritic nodules, pisoliths, fragments of Fe-saprolite, iron segregations, quartz	MI4												DMI4	DMI4	DMI4	DMI4	DMI4		
		Quartz, lateritic nodules, pisoliths	MI5												DMI5	DMI5	DMI5	DMI5	DMI5		

See following table for codes of depositional regimes

Fe=Ferruginous

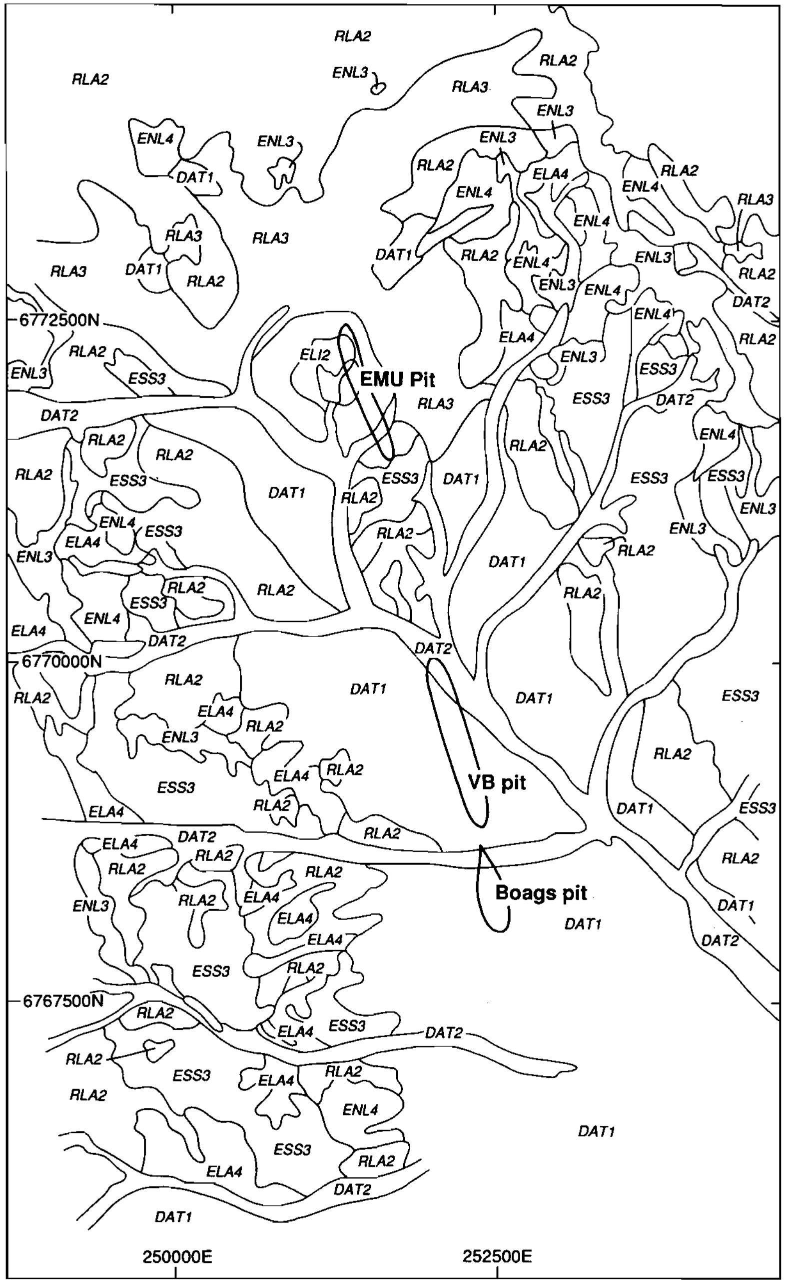
Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

MT.GIBSON DISTRICT-
SUBSTRATE TO TRANSPORTED OVERBURDEN

Classification Tables

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
COLLUVIAL SEDIMENTS **CT**	Lateritic residuum present beneath colluvial sediments	CT1												**DCT1**				DCT1		
	Mottled zone present beneath colluvial sediments	CT2												DCT2				DCT2		
	Ferruginous saprolite present beneath colluvial sediments	CT3												DCT3				DCT3		
	Clay zone present beneath colluvial sediments	CT4												DCT4				DCT4		
	Saprolite present beneath colluvial sediments	CT5												DCT5				DCT5		
	Bedrock present beneath colluvial sediments	CT6												DCT6				DCT6		
	Not known	CT7												DCT7				DCT7		
ALLUVIAL SEDIMENTS **AT**	Lateritic residuum present beneath alluvial sediments	AT1													DAT1	DAT1	DAT1	DAT1		
	Mottled zone present beneath alluvial sediments	AT2													DAT2	DAT2	DAT2	DAT2		
	Ferruginous saprolite present beneath alluvial sediments	AT3													DAT3	DAT3	DAT3	DAT3		
	Clay zone present beneath alluvial sediments	AT4													DAT4	**DAT4**	DAT4	DAT4		
	Saprolite present beneath alluvial sediments	AT5													**DAT5**	DAT5	DAT5	DAT5		
	Bedrock present beneath alluvial sediments	AT6													DAT6	DAT6	DAT6	DAT6		
	Not known	AT7													DAT7	DAT7	DAT7	DAT7		
EOLIAN SEDIMENTS **ET**	Lateritic residuum present beneath eolian sediments	ET1																		DET1
	Mottled zone present beneath eolian sediments	ET2																		DET2
	Ferruginous saprolite present beneath eolian sediments	ET3																		DET3
	Clay zone present beneath eolian sediments	ET4																		DET4
	Saprolite present beneath eolian sediments	ET5																		DET5
	Bedrock present beneath eolian sediments	ET6																		DET6
	Not known	ET7																		DET7

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks



BOTTLE CREEK DISTRICT

RESIDUAL REGIME

RLA2 Fragments of duricrust and Fe-saprolite

RLA3 Lateritic pisoliths, nodules and Fe-saprolite fragments

EROSIONAL REGIME

ELA4 Fe-saprolite fragments

ENL3 Fe-lithic fragments

ENL4 Iron segregations and Fe-lithic fragments

ESS3 Calcareous grey brown clays

DEPOSITIONAL REGIME

DAT1 Lateritic residuum present beneath alluvial sediments

DAT2 Mottled zone present beneath alluvial sediments

N

0 1 km

Classification Tables

BOTTLE CREEK DISTRICT-LAGS

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)							
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Clasts	Code	BS	CR	BS	CR	BK	RG	HH	LH	SS	PD	UP	CP	AP	MD	SD	VF	PY	DU
FERRUGINOUS	LATERITIC FAMILY LA	Lateritic nodules, pisoliths	LA1	RLA1	RLA1																
		Lateritic nodules, pisoliths, fragments of lateritic duricrust, Fe-saprolite, mottles	LA2		**RLA2**																
		Lateritic nodules, pisoliths, mottles, Fe-saprolite	LA3	**RLA3**	RLA3																
		Mottled, Fe-saprolite fragments	LA4			ELA4	ELA4	ELA4			ELA4		**ELA4**								
		Lateritic nodules, pisoliths, fragments of black Fe-rich duricrust, Fe-saprolite	LA5		RLA5																
		Black lateritic nodules, pisoliths, Fe-saprolite	LA6	RLA6	RLA6																
	NON-LATERITIC FAMILY NL	Gossan fragments	NL1				ENL1			ENL1	ENL1										
		Iron segregations	NL2								ENL2		ENL2								
		Fe-lithic fragments	NL3				ENL3	**ENL3**		ENL3	ENL3		ENL3	ENL3							
		Iron segregations, Fe-lithic fragments	NL4				ENL4				ENL4		**ENL4**	ENL4							
		Ferruginous granules	NL5									ENL5		ENL5							
NON-FERRUGINOUS	LITHIC FAMILY LI	Saprolite fragments	LI1					ELI1			ELI1		ELI1	ELI1							
		Saprock fragments	LI2				ELI2			ELI2	ELI2	ELI2	ELI2	ELI2							
		Bedrock fragments	LI3							ELI3	ELI3	ELI3									
		Quartz fragments	LI4						ELI4		ELI4										
		Bedrock, saprock, quartz fragments	LI5				ELI5					ELI5									
	MIXED (Lateritic + Non-lateritic + Lithic) MI	Brown ferruginous granules, quartz	MI1												DMI1	DMI1					
		Black ferruginous granules, quartz	MI2												DMI2	DMI2					
		Iron segregations, lithic fragments, lateritic nodules, pisoliths, quartz	MI3												DMI3	DMI3	DMI3	DMI3	DMI3		
		Lateritic nodules, pisoliths, fragments of Fe-saprolite, iron segregations, quartz	MI4												DMI4	DMI4	DMI4	DMI4	DMI4		
		Quartz, lateritic nodules, pisoliths	MI5												DMI5	DMI5	DMI5	DMI5	DMI5		

See following table for codes of depositional regimes

Fe=Ferruginous

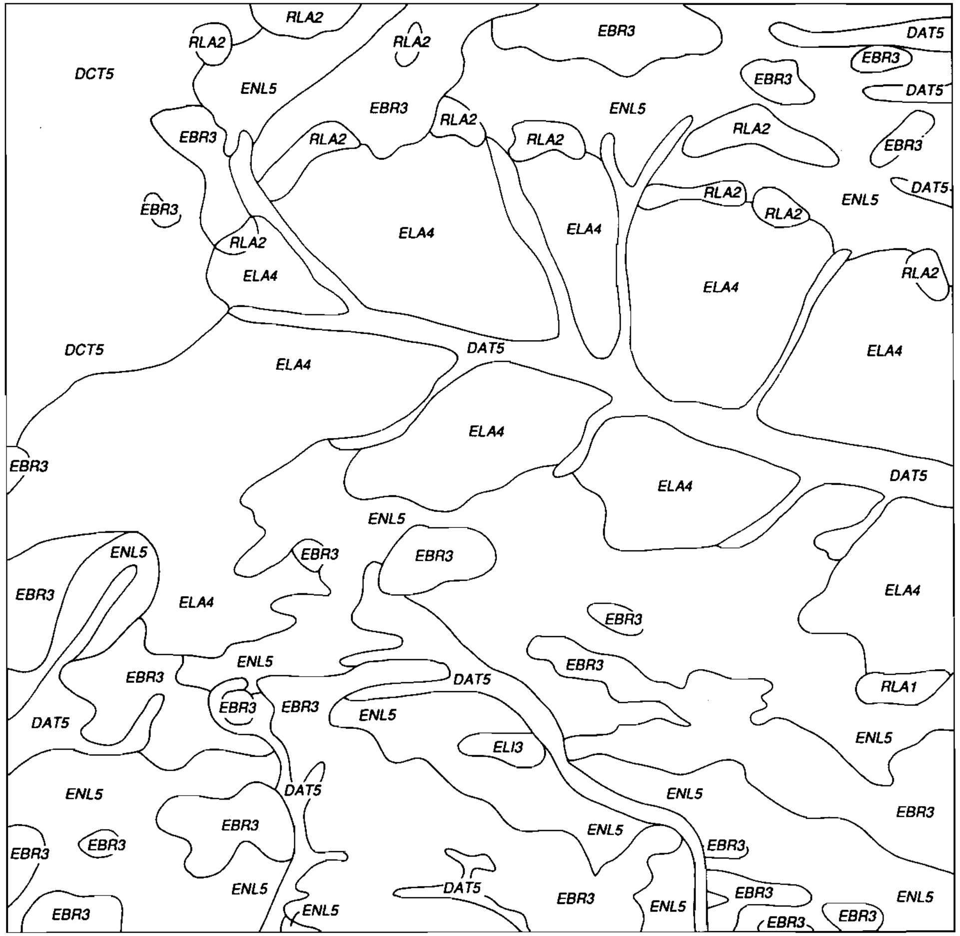
Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Tables

BOTTLE CREEK DISTRICT- SUBSTRATE TO TRANSPORTED OVERBURDEN

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
COLLUVIAL SEDIMENTS **CT**	Lateritic residuum present beneath colluvial sediments	CT1												DCT1				DCT1		
	Mottled zone present beneath colluvial sediments	CT2												DCT2				DCT2		
	Ferruginous saprolite present beneath colluvial sediments	CT3												DCT3				DCT3		
	Clay zone present beneath colluvial sediments	CT4												DCT4				DCT4		
	Saprolite present beneath colluvial sediments	CT5												DCT5				DCT5		
	Bedrock present beneath colluvial sediments	CT6												DCT6				DCT6		
	Not known	CT7												DCT7				DCT7		
ALLUVIAL SEDIMENTS **AT**	Lateritic residuum present beneath alluvial sediments	AT1													***DAT1***	DAT1	DAT1	DAT1		
	Mottled zone present beneath alluvial sediments	AT2													DAT2	***DAT2***	DAT2	DAT2		
	Ferruginous saprolite present beneath alluvial sediments	AT3													DAT3	DAT3	DAT3	DAT3		
	Clay zone present beneath alluvial sediments	AT4													DAT4	DAT4	DAT4	DAT4		
	Saprolite present beneath alluvial sediments	AT5													DAT5	DAT5	DAT5	DAT5		
	Bedrock present beneath alluvial sediments	AT6													DAT6	DAT6	DAT6	DAT6		
	Not known	AT7													DAT7	DAT7	DAT7	DAT7		
EOLIAN SEDIMENTS **ET**	Lateritic residuum present beneath eolian sediments	ET1																		DET1
	Mottled zone present beneath eolian sediments	ET2																		DET2
	Ferruginous saprolite present beneath eolian sediments	ET3																		DET3
	Clay zone present beneath eolian sediments	ET4																		DET4
	Saprolite present beneath eolian sediments	ET5																		DET5
	Bedrock present beneath eolian sediments	ET6																		DET6
	Not known	ET7																		DET7

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks



WOMBOLA DISTRICT

RESIDUAL REGIME

RLA2 Fragments of duricrust, lateritic pisoliths and nodules

EROSIONAL REGIME

ELA4 Mottled and Fe-saprolite fragments

ENL5 Black Fe-granules

EBR3 Bedrock

DEPOSITIONAL REGIME

DCT5 Saprolite present beneath colluvial sediments

DAT5 Saprolite present beneath alluvial sediments

N

0 1 km

Approximate scale due to distortion from aerial photography

Classification Tables

WOMBOLA DISTRICT-LAGS

		Clasts	Code	Residual regimes(R) Back slopes BS	Residual regimes(R) Crests CR	Erosional regimes (E) Back slopes BS	Crests CR	Break away BK	Ridges RG	High hills HH	Low hills LH	Stripped Slopes SS	Pedi-ments PD	Undulat-ing plain UP	Depositional regimes (D) Colluvial plains CP	Alluvial plains AP	Major drainage floors MD	Small drainage floors SD	Valley floors VF	Playas PY	Dunes DU
FERRUGINOUS	LATERITIC FAMILY **LA**	Lateritic nodules, pisoliths	LA1	RLA1	RLA1																
		Lateritic nodules, pisoliths, fragments of lateritic duricrust, Fe-saprolite, mottles	LA2		***RLA2***																
		Lateritic nodules, pisoliths, mottles, Fe-saprolite	LA3	RLA3	RLA3																
		Mottled, Fe-saprolite fragments	LA4			ELA4	***ELA4***	ELA4			ELA4		ELA4								
		Lateritic nodules, pisoliths, fragments of black Fe-rich duricrust, Fe-saprolite	LA5		RLA5																
		Black lateritic nodules, pisoliths, Fe-saprolite	LA6	RLA6	RLA6																
	NON-LATERITIC FAMILY **NL**	Gossan fragments	NL1				ENL1			ENL1	ENL1										
		Iron segregations	NL2								ENL2		ENL2								
		Fe-lithic fragments	NL3				ENL3	ENL3		ENL3	ENL3		ENL3	ENL3							
		Iron segregations, Fe-lithic fragments	NL4				ENL4				ENL4		ENL4	ENL4							
		Ferruginous granules	NL5									ENL5		***ENL5***							
NON-FERRUGINOUS	LITHIC FAMILY **LI**	Saprolite fragments	LI1					ELI1			ELI1		ELI1	ELI1							
		Saprock fragments	LI2				ELI2			ELI2	ELI2	ELI2	ELI2	ELI2							
		Bedrock fragments	LI3							ELI3	ELI3	ELI3									
		Quartz fragments	LI4						ELI4		ELI4										
		Bedrock, saprock, quartz fragments	LI5				ELI5					ELI5									
	MIXED (Lateritic + Non-lateritic + Lithic) **MI**	Brown ferruginous granules, quartz	MI1												DMI1	DMI1					
		Black ferruginous granules, quartz	MI2												DMI2	DMI2					
		Iron segregations, lithic fragments, lateritic nodules, pisoliths, quartz	MI3												DMI3	DMI3	DMI3	DMI3	DMI3		
		Lateritic nodules, pisoliths, fragments of Fe-saprolite, iron segregations, quartz	MI4												DMI4	DMI4	DMI4	DMI4	DMI4		
		Quartz, lateritic nodules, pisoliths	MI5												DMI5	DMI5	DMI5	DMI5	DMI5		

See following table for codes of depositional regimes

Fe=Ferruginous

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

Classification Tables

WOMBOLA DISTRICT-
SUBSTRATE TO TRANSPORTED OVERBURDEN

			Residual regimes(R)		Erosional regimes (E)									Depositional regimes (D)						
			Back slopes	Crests	Back slopes	Crests	Break away	Ridges	High hills	Low hills	Stripped Slopes	Pedi-ments	Undulat-ing plain	Colluvial plains	Alluvial plains	Major drainage floors	Small drainage floors	Valley floors	Playas	Dunes
		Code	*BS*	*CR*	*BS*	*CR*	*BK*	*RG*	*HH*	*LH*	*SS*	*PD*	*UP*	*CP*	*AP*	*MD*	*SD*	*VF*	*PY*	*DU*
COLLUVIAL SEDIMENTS **CT**	Lateritic residuum present beneath colluvial sediments	CT1												DCT1				DCT1		
	Mottled zone present beneath colluvial sediments	CT2												DCT2				DCT2		
	Ferruginous saprolite present beneath colluvial sediments	CT3												DCT3				DCT3		
	Clay zone present beneath colluvial sediments	CT4												DCT4				DCT4		
	Saprolite present beneath colluvial sediments	CT5												***DCT5***				DCT5		
	Bedrock present beneath colluvial sediments	CT6												DCT6				DCT6		
	Not known	CT7												DCT7				DCT7		
ALLUVIAL SEDIMENTS **AT**	Lateritic residuum present beneath alluvial sediments	AT1													DAT1	DAT1	DAT1	DAT1		
	Mottled zone present beneath alluvial sediments	AT2													DAT2	DAT2	DAT2	DAT2		
	Ferruginous saprolite present beneath alluvial sediments	AT3													DAT3	DAT3	DAT3	DAT3		
	Clay zone present beneath alluvial sediments	AT4													DAT4	DAT4	DAT4	DAT4		
	Saprolite present beneath alluvial sediments	AT5													DAT5	***DAT5***	DAT5	DAT5		
	Bedrock present beneath alluvial sediments	AT6													DAT6	DAT6	DAT6	DAT6		
	Not known	AT7													DAT7	DAT7	DAT7	DAT7		
EOLIAN SEDIMENTS **ET**	Lateritic residuum present beneath eolian sediments	ET1																		DET1
	Mottled zone present beneath eolian sediments	ET2																		DET2
	Ferruginous saprolite present beneath eolian sediments	ET3																		DET3
	Clay zone present beneath eolian sediments	ET4																		DET4
	Saprolite present beneath eolian sediments	ET5																		DET5
	Bedrock present beneath eolian sediments	ET6																		DET6
	Not known	ET7																		DET7

Prefix: m=mafic; um=ultramafic; f=felsic in greenstone; g=granite; s=sedimentary rocks

5.0 ATLAS OF REGOLITH-LANDFORM MAPPING UNITS

In this section field photographs of regolith-landform mapping units are arranged in the same order as that of the classification tables.

Descriptions corresponding to each photograph are located opposite for ease of reference. The alpha-numeric codes provide links with the photographs and descriptions.

umRLA1- LATERITIC NODULES AND PISOLITHS- AGNEW AREA, LAWLERS DISTRICT

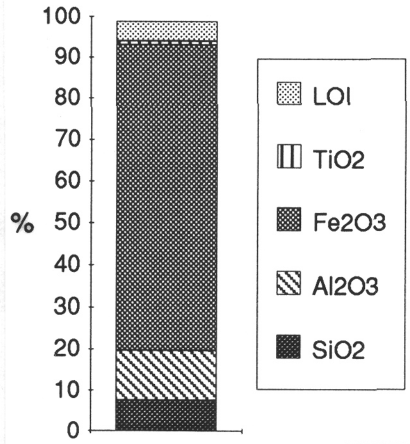
This residual unit, lateritic nodules and pisoliths derived from the weathering of ultramafic rock, occurs on a crest. The lag is dominated by medium to coarse (5-20 mm diameter), reddish brown lateritic nodules and pisoliths with occasional fragments of Fe-saprolite. The lags are underlain by a shallow, 20-40 cm, thick soil. The shallow soil is a gravelly, light brown, very friable, fine sandy loam on a substrate of pisolitic-nodular lateritic residuum. Pisolitic-nodular lateritic residuum in which hardpan has developed, occurs at a depth of about 50 cm.

Nodules and pisoliths have black or reddish brown cores with 1-2 mm thick, yellowish brown goethite-kaolinite-rich cutans. The occurrence of cutans with yellowish brown/greenish outer surfaces is typical of residual pisoliths and nodules. The nodules and pisoliths are comprised mainly of hematite, goethite, kaolinite and maghemite with small amounts of talc.

Lateritic nodules and pisoliths developed from the weathering of ultramafic bedrock have the mean chemical composition (N=3):

SiO2 7.6%	*Al2O3* 12.2%,	*Fe2O3* 73.2%	*MgO* 0.28%	*CaO* 0.36%
Na2O 0.01%	*K2O* <0.06%	*TiO2* 1.01%	*LOI* 4.82%	

Mn 336ppm	*Cr* 16930ppm	*V* 970ppm	*Cu* 26ppm	*Pb* 31ppm
Zn 38ppm	*Ni* 373ppm	*Co* 30ppm	*As* 68ppm	*Sb* 5ppm
Bi 5ppm	*Mo* 4ppm	*Sn* 3ppm	*Ga* 54ppm	*W* 6ppm
Ba 17ppm	*Zr* 138ppm	*Nb* 4ppm	*Au* <1ppb	



RLA1- LATERITIC NODULES AND PISOLITHS - BOTTLE CREEK DISTRICT

This example of lateritic nodules and pisoliths occurs on upper backslopes. The lag is dominated by fine to medium (3-10 mm), yellowish brown pisoliths and nodules. These nodules and pisoliths have reddish brown cores with 1-2 mm thick, goethite and kaolinite-rich cutans. The nodules and pisoliths are dominated by kaolinite, hematite and goethite.

LAGS

umRLA1

RLA1

mRLA2- FRAGMENTS OF LATERITIC DURICRUST, LATERITIC NODULES, PISOLITHS AND FERRUGINOUS SAPROLITE FRAGMENTS- BARDOC QUARRY, KALGOORLIE REGION

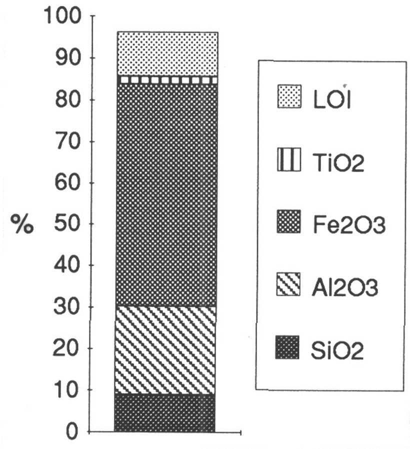
Lateritic nodules and pisoliths, along with some scattered fragments of nodular duricrust occur on a broad, smooth convex crest. This lag is derived from the weathering of gabbro and is dominated by fine to medium (generally <10 mm, with some reaching 20 mm), reddish brown pisoliths and nodules. Goethite, kaolinite and hematite are the major minerals comprising the nodules and pisoliths.

The soil is red, calcareous, gravelly, friable, fine sand clay loam, with moderate, fine pisoliths and nodules. This nodular and pisolitic material relates closely to the underlying calcified lateritic residuum.

Lateritic nodules and pisoliths developed from the weathering of gabbro have the mean chemical composition (N=2) :

SiO2 9.0%	*Al2O3* 21.3%	*Fe2O3* 53.5%	*MgO* 0.10%	*CaO* 0.12%
Na2O 0.01%	*K2O* <0.06%	*TiO2* 1.85%	*LOI* 10.6%	

Mn 195ppm	*Cr* 1080ppm	*V* 875ppm	*Cu* 114ppm	*Pb* 2ppm
Zn 24ppm	*Ni* 82ppm	*Co* 12ppm	*As* 15ppm	*Sb* 2ppm
Bi <2ppm	*Mo* 2ppm	*Sn* 3ppm	*Ga* 46ppm	*W* <4ppm
Ba 60ppm	*Zr* 160ppm	*Nb* 4ppm	*Au* 13ppb	



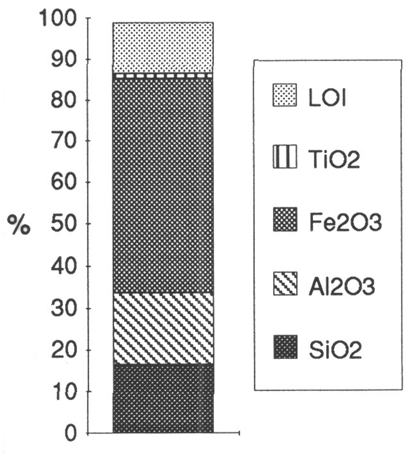
umELA4 - MOTTLED AND FERRUGINOUS SAPROLITE FRAGMENTS- LADY EVELYN AREA, KALGOORLIE REGION

This example of fragments of mottled and ferruginous saprolite occurs on a broad crest. Fragments of all these materials form a coarse lag (to < 40 mm) and are developed from the weathering of talc-chlorite-schist. The lag is underlain by a shallow, light brown, friable, calcareous sandy clay loam soil, containing like fragments. It overlies 1m thick, calcified ferruginous saprolite. Yellowish brown ferruginous saprolite fragments are goethite-kaolinite-rich, whereas reddish brown fragments are hematite-rich. Small amounts of talc are also present.

Mottled and ferruginous saprolite fragments derived from the weathering of talc-chlorite-schist have the chemical composition:

SiO2 16.5%	*Al2O3* 17.2%	*Fe2O3* 51.5%	*MgO* 0.21%	*CaO* 0.12%
Na2O 0.02%	*K2O* <0.06%	*TiO2* 1.20%	*LOI* 12.45%	

Mn 302ppm	*Cr* 11050ppm	*V* 692ppm	*Cu* 180ppm	*Pb* 2ppm
Zn 44ppm	*Ni* 930ppm	*Co* 72ppm	*As* 19ppm	*Sb* 2ppm
Bi <2ppm	*Mo* <2ppm	*Sn* 2ppm	*Ga* 26ppm	*W* <4ppm
Ba 75ppm	*Zr* 58ppm	*Nb* 2ppm	*Au* 3ppb	



LAGS

mRLA2

umELA4

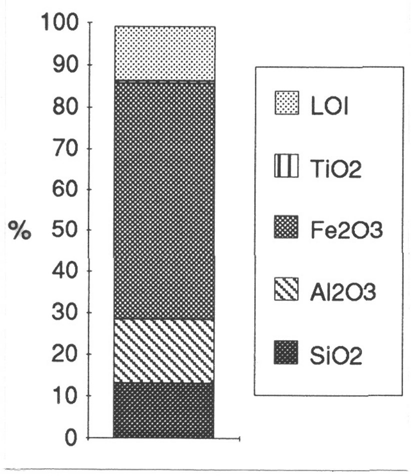
umELA4- MOTTLED AND FERRUGINOUS SAPROLITE FRAGMENTS - AGNEW AREA, LAWLERS DISTRICT

This unit, comprising mottled and ferruginous saprolite fragments, occupies pediments within an erosional regime. These fragments of ferruginous and mottled saprolite derived from the weathering of ultramafic bedrock are coarse (10-30 mm), irregular, yellowish brown to reddish brown and are non-magnetic. These fragments are comprised mainly of goethite and kaolinite, with small amounts of hematite. Maghemite is typically absent in ferruginous saprolite. The soils are acid, gravelly, sandy clay loam over ferruginous saprolite.

Ferruginous saprolite is an important sampling medium in areas where lateritic residuum is truncated. This has the mean chemical composition (N=3) :

SiO2 13.2%	*Al2O3* 15.3%	*Fe2O3* 57.1%	*MgO* 0.03%	*CaO* 0.03%
Na2O 0.01%	*K2O* <0.06%	*TiO2* 0.66%	*LOI* 12.90%	

Mn 227ppm	*Cr* 11050ppm	*V* 620ppm	*Cu* 160ppm	*Pb* 7ppm
Zn 42ppm	*Ni* 500ppm	*Co* 44ppm	*As* 17ppm	*Sb* 3ppm
Bi <2ppm	*Mo* <2ppm	*Sn* <2ppm	*Ga* 25ppm	*W* <4ppm
Ba 40ppm	*Zr* 78ppm	*Nb* <2ppm	*Au* 2ppb	



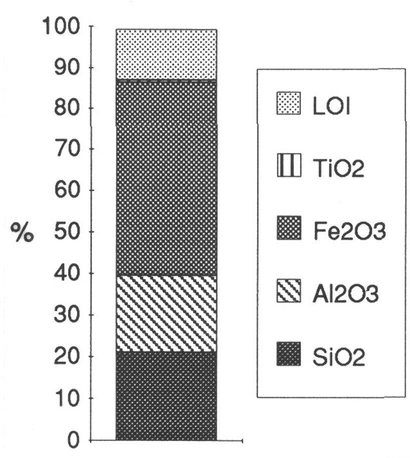
ELA4 - MOTTLED AND FERRUGINOUS SAPROLITE FRAGMENTS - MADOONGA DISTRICT

Fragments of ferruginous and mottled saprolite occurs on a crest and are derived from the weathering of mafic bedrock. The morphological characteristics of fragments of ferruginous saprolite are similar to those described above for the Lawlers district.

Fragments of ferruginous and mottled saprolite derived from the weathering of mafic bedrock have the chemical composition :

SiO2 21.1%	*Al2O3* 18.5%	*Fe2O3* 46.7%	*MgO* 0.10%	*CaO* 0.09%
Na2O 0.05%	*K2O* 0.06%	*TiO2* 0.58%	*LOI* 12.50%	

Mn 105ppm	*Cr* 1880ppm	*V* 913ppm	*Cu* 140ppm	*Pb* 2ppm
Zn 50ppm	*Ni* 90ppm	*Co* 25ppm	*As* 20ppm	*Sb* 7ppm
Bi <2ppm	*Mo* 3ppm	*Sn* 3ppm	*Ga* 35ppm	*W* 6ppm
Ba 64ppm	*Zr* 89ppm	*Nb* 4ppm	*Au* <1ppb	



LAGS

umELA4

ELA4

RLA5- FRAGMENTS OF BLACK FE-RICH DURICRUST, LATERITIC NODULES AND PISOLITHS - WOMBOLA DISTRICT, KALGOORLIE REGION

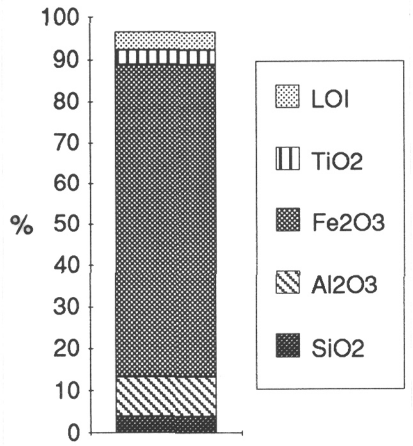
This unit, comprising fragments of Fe-rich duricrust and lateritic nodules, occurs on small, broad convex crest of a low rise. Fragments of duricrust and lateritic nodules are dark reddish brown to black and are developed from the weathering of the underlying mafic rock. Many nodules contain lithorelics and are dominated by hematite and maghemite. Kaolinite is absent. Nodules and pisoliths are magnetic because of the presence of maghemite, which may occur around the margins or within the cores of nodules and pisoliths.

The soils are acid, sandy clay loam, overlying a weakly developed hardpan at about 20 cm depth; although carbonates occur within 20 cm of the surface.

Fragments of lateritic duricrust and lateritic nodules derived from the weathering of mafic bedrock have the mean chemical composition (N=3):

SiO2	*Al2O3*	*Fe2O3*	*MgO*	*CaO*
3.9%	9.4%	75.6%	0.22%	0.28%
Na2O	*K2O*	*TiO2*	*LOI*	
0.01%	<0.06%	3.39%	4.21%	

Mn	*Cr*	*V*	*Cu*	*Pb*
632ppm	1110ppm	2350ppm	46ppm	<2ppm
Zn	*Ni*	*Co*	*As*	*Sb*
17ppm	33ppm	19ppm	19ppm	2ppm
Bi	*Mo*	*Sn*	*Ga*	*W*
2ppm	<2ppm	3ppm	85ppm	5ppm
Ba	*Zr*	Nb	*Au*	
32ppm	170ppm	8ppm	2ppb	



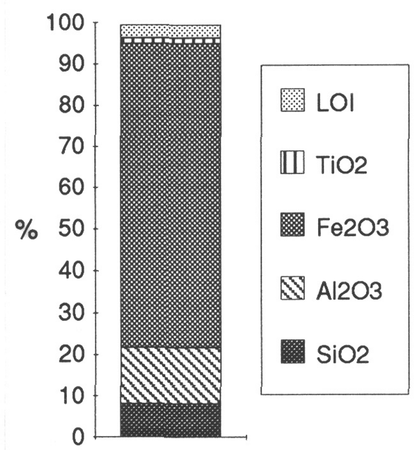
umRLA6- BLACK LATERITIC NODULES, PISOLITHS AND FERRUGINOUS SAPROLITE FRAGMENTS - CAWSE FIND, KALGOORLIE REGION

This unit, comprising black lateritic nodules and pisoliths and fragments of ferruginous saprolite derived from the weathering of ultramafic bedrock, occurs on a backslope. This lag overlies a calcareous, reddish brown, sandy clay loam soil. Mottled zone or saprolite is an extensive substrate to the soils. The lag is coarser upslope, on the fringes of the duricrust capped crusts, and become finer downslope. Nodules and pisolths are composed mainly of hematite, maghemite and kaolinite; goethite is present in very small amounts.

Black lateritic nodules and pisoliths derived from the weathering of ultramafic bedrock have the chemical composition :

SiO2	*Al2O3*	*Fe2O3*	*MgO*	*CaO*
8.1%	13.6%	73.1%	0.06%	0.06%
Na2O	*K2O*	*TiO2*	*LOI*	
0.01%	<0.06%	1.50%	3.15%	

Mn	*Cr*	*V*	*Cu*	*Pb*
228ppm	14200ppm	1065ppm	35ppm	24ppm
Zn	*Ni*	*Co*	*As*	*Sb*
13ppm	401ppm	22ppm	30ppm	2ppm
Bi	*Mo*	*Sn*	*Ga*	*W*
2ppm	<2ppm	2ppm	48ppm	4ppm
Ba	*Zr*	*Nb*	*Au*	
15ppm	125ppm	3ppm	6ppb	



LAGS

RLA5

umRLA6

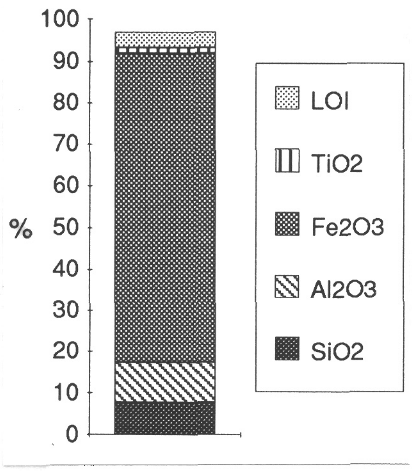
Close-up umRLA6

RLA6- BLACK LATERITIC NODULES AND PISOLITHS AND FERRUGINOUS SAPROLITE FRAGMENTS - WOMBOLA DISTRICT, KALGOORLIE REGION

This example of black lateritic nodules and pisoliths and ferruginous saprolite fragments occupy crest and upper slopes. The lag is underlain by a brown, sandy clay, calcareous soil. Saprolite is an extensive substrate to the soils. Microrelief (gilgai) is devoid of lag and is dominated by smectite-rich, calcareous soil. Black lateritic nodules and pisoliths are dominated by hematite, maghemite and goethite. These are characterized by:

SiO2 7.8%	*Al2O3* 9.6%	*Fe2O3* 74.6%	*MgO* 0.08%	*CaO* 0.25%
Na2O 0.01%	*K2O* <0.06%	*TiO2* 1.32%	*LOI* 3.62%	

Mn 590ppm	*Cr* 650ppm	*V* 1650ppm	*Cu* 47ppm	*Pb* 17ppm
Zn 21ppm	*Ni* 27ppm	*Co* 5ppm	*As* 26ppm	*Sb* <2ppm
Bi <2ppm	*Mo* <2ppm	*Sn* 1ppm	*Ga* 45ppm	*W* 9ppm
Ba 26ppm	*Zr* 177ppm	*Nb* 2ppm	*Au* <1ppb	



LAGS

RLA6

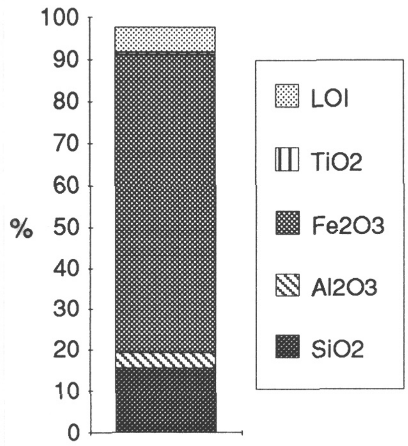
ENL2 - IRON SEGREGATIONS AND VEIN QUARTZ - MEATOA AREA, LAWLERS DISTRICT

This unit, comprising iron segregations and quartz, occurs on low hills. Patches of pedogenic carbonate related to mafic rocks occur within the unit. The fragments of the iron segregations are black and subrounded to subangular, and range in size from 20 to 200 mm. Fragments of iron segregations exceeding 100 mm are common. These iron segregations are typically non-magnetic and dense. It is significant that the iron segregations do not show any development of cutans. Iron segregations are dominated by goethite with small amounts of hematite.

The chemical composition of iron segregations is:

SiO2 15.5%	*Al2O3* 3.8%	*Fe2O3* 71.8%	*MgO* 0.16%	*CaO* 0.14%
Na2O 0.01%	*K2O* <0.06%	*TiO2* 0.61%	*LOI* 5.9%	

Mn 2640ppm	*Cr* 956ppm	*V* 394ppm	*Cu* 180ppm	*Pb* <2ppm
Zn 500ppm	*Ni* 740ppm	*Co* 210ppm	*As* 13ppm	*Sb* <2ppm
Bi <2ppm	*Mo* <2ppm	*Sn* <2ppm	*Ga* 18ppm	*W* 6ppm
Ba 203ppm	*Zr* 27ppm	*Nb* 3ppm	*Au* 1ppb	



ENL3 - FERRUGINOUS LITHIC FRAGMENTS - BOTTLE CREEK DISTRICT

Ferruginous lithic fragments occupy low hills from which the upper part of the weathering profile including lateritic residuum and saprolite have been removed by erosion. They are subangular to angular, reddish brown to black and are dominated by hematite, goethite and kaolinite. Petrographic examination reveals rock fabrics preserved within the fragment.

LAGS

ENL2

ENL3

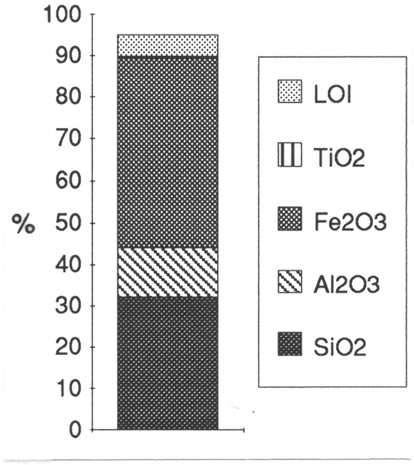
ENL3 - FERRUGINOUS LITHIC FRAGMENTS - GOLDEN RIDGE, KALGOORLIE REGION

Ferruginous lithic fragments are exposed on the face of the breakaway. Iron rich duricrust occurs on associated crest. The fragments are coarse, irregular and are dominated by goethite, hematite, quartz and kaolinite. Fragments preserve the mafic origin.

The chemical composition of this unit is:

SiO2 32.0%	*Al2O3* 12.2%	*Fe2O3* 45.2%	*MgO* 0.69%	*CaO* 0.60%
Na2O 0.05%	*K2O* 2.07%	*TiO2* 0.26%	*LOI* 5.38%	

Mn 128ppm	*Cr* 484ppm	*V* 66ppm	*Cu* 80ppm	*Pb* 16ppm
Zn 54ppm	*Ni* 25ppm	*Co* 15ppm	*As* 45ppm	*Sb* 2ppm
Bi <2ppm	*Mo* <2ppm	*Sn* 4ppm	*Ga* 24ppm	*W* 3ppm
Ba 75ppm	*Zr* 81ppm	*Nb* 4ppm	*Au* <1ppb	



LAGS

ENL3

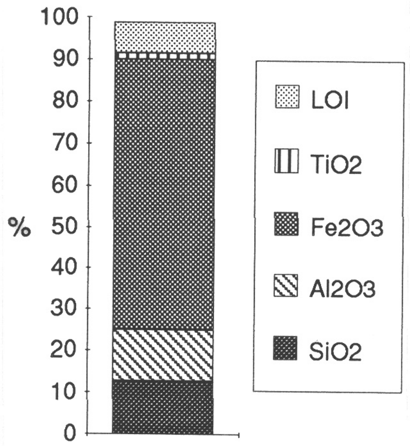
DMI1 - BROWN FERRUGINOUS GRANULES AND QUARTZ - MEATOA AREA, LAWLERS DISTRICT

This unit comprises a fine to coarse, (2 to 10 mm) polymictic lag, and occurs on colluvial outwash plains. This lag is very heterogenous containing fragments of lateritic nodules and pisoliths, ferruginous granules and quartz. Outer surfaces of the lag have a varnished appearance and lack cutan development. The variety of components in the lag indicate their diverse origins, with much material being derived upslope from the breakdown of lateritic residuum, from large fragments of ferruginous saprolite, and from iron segregations. This lag typically overlies a gravelly, red, sandy, light clay soil. Lateritic residuum containing abundant lateritic debris is buried beneath 3 metres of colluvium. Gravelly colluvium can easily be misidentified as being a residual laterite because of the abundance of lateritic pisoliths and nodules.

The brown lag has the mean chemical composition (N= 7) :

SiO2 12.8%	*Al2O3* 12.1%	*Fe2O3* 65.1%	*MgO* 0.05%	*CaO* 0.05%
Na2O 0.02%	*K2O* <0.06%	*TiO2* 1.55%	*LOI* 7.30%	

Mn 554ppm	*Cr* 6936ppm	*V* 1140ppm	*Cu* 106ppm	*Pb* 22ppm
Zn 111ppm	*Ni* 357ppm	*Co* 49ppm	*As* 36ppm	*Sb* <2ppm
Bi <2ppm	*Mo* <2ppm	*Sn* 2ppm	*Ga* 48ppm	*W* 5ppm
Ba 27ppm	*Zr* 103ppm	*Nb* 6ppm	*Au* 1ppb	



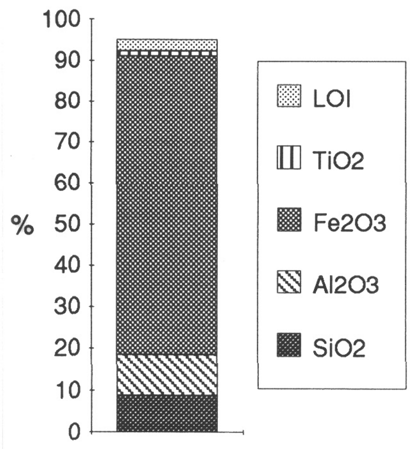
DMI2 - BLACK FERRUGINOUS GRANULES AND QUARTZ - WOMBOLA DISTRICT, KALGOORLIE REGION

This example of black ferruginous granules occurs on gently inclined plains that form a downslope continuum with backslopes. The plains are extensively mantled by the black ferruginous granules and this overlies acid, red, sandy clay loam soil. Quartz fragments are also present. Calcium carbonate appears at a depth of 15 cm and occurs in several forms. The calcareous soils are underlain by a zone of plastic, uniform red clays, 2m thick. Ferruginous granules are black, silver to earthy grey, sub to well rounded and vary in size from 0.5 to 10 mm. Typically the granules have an earthy to sub-metallic lustre and occasionally have thin, earthy cutans. They can be either magnetic or non-magnetic. The granules largely consist of hematite and maghemite, with variable quantities of goethite, kaolinite and quartz.

Ferruginous granules have the mean chemical composition (N=4):

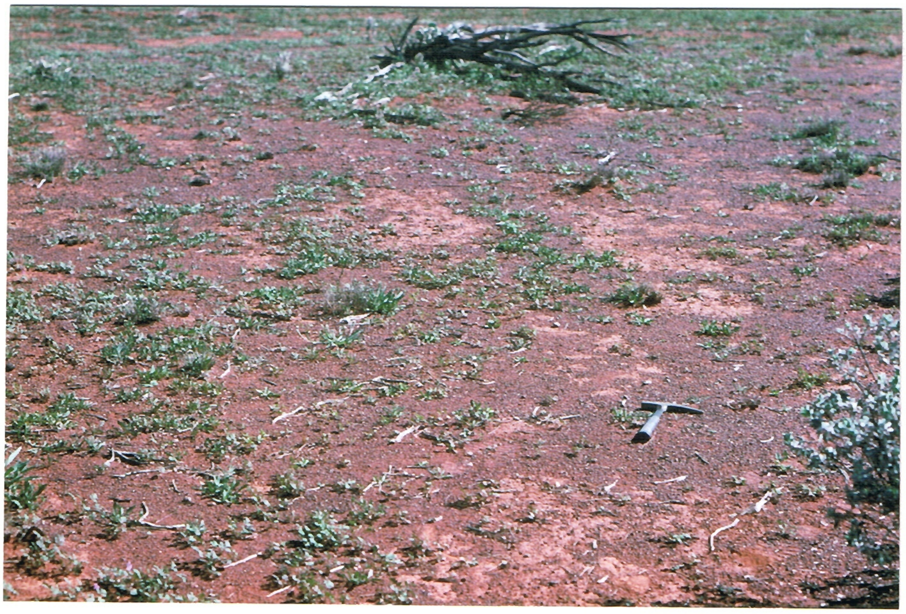
SiO2 8.8%	*Al2O3* 9.7%	*Fe2O3* 72.5%	*MgO* 0.24%	*CaO* 0.26%
Na2O <0.01%	*K2O* <0.06%	*TiO2* 1.26%	*LOI* 2.97%	

Mn 1600ppm	*Cr* 1290ppm	*V* 1550ppm	*Cu* 80ppm	*Pb* 18ppm
Zn 33ppm	*Ni* 140ppm	*Co* 18ppm	*As* 21ppm	*Sb* 3ppm
Bi 2ppm	*Mo* <2ppm	*Sn* <2ppm	*Ga* 42ppm	*W* 11ppm
Ba 220ppm	*Zr* 100ppm	*Nb* 2ppm	*Au* <1ppb	



LAGS

DMI1



DM12

Close up
DM12

DMI3 - IRON SEGREGATIONS, FERRUGINOUS LITHIC FRAGMENTS, LITHIC FRAGMENTS, LATERITIC NODULES AND QUARTZ - MADOONGA DISTRICT

This example of polymictic lag occurs on colluvial outwash plains. The components of the lag are transported and are not derived from the underlying regolith. Acid, red earths have developed in the colluvium, while extensive sheets (2 to 4 m thick) of pisolitic lateritic residuum form the principal substrate to the soils. Hardpan, developed in the soils at a depth of about 50 to 75 cm, continues for several metres within the underlying lateritic residuum.

DMI4 - LATERITIC NODULES, PISOLITHS, FRAGMENTS OF FERRUGINOUS SAPROLITE, IRON SEGREGATIONS AND QUARTZ - BOTTLE CREEK DISTRICT

This unit, comprising ferruginous saprolite, lateritic nodules and pisoliths (without cutans), iron segregations and quartz, occurs on plains. The soils are very friable, acid, red earths in a fine, sandy, light clay alluvium that contains some clasts similar to the overlying lags. The substrate is a pale saprolite, but there are scattered pockets of nodular-pisolitic lateritic residuum. Hardpan is extensive, generally occurring at a depth of about 1 to 2 m, within various substrates to the alluvium.

LAGS

DM13

DM14

RLS1- GRAVELLY ORANGE SANDY CLAY OVER LATERITIC RESIDUUM - MT. GIBSON DISTRICT

This example of residual soils occurs on the upper to mid-gentle slopes down from the crest, forming backslopes to breakaway. The soils are derived from the weathering of the underlying lateritic residuum. The soils are gravelly, acid, orange earths comprising very friable, sandy clay loam. Weakly indurated, nodular duricrust is an extensive substrate to the soils. The major minerals in this soil are kaolinite, quartz, hematite and goethite.

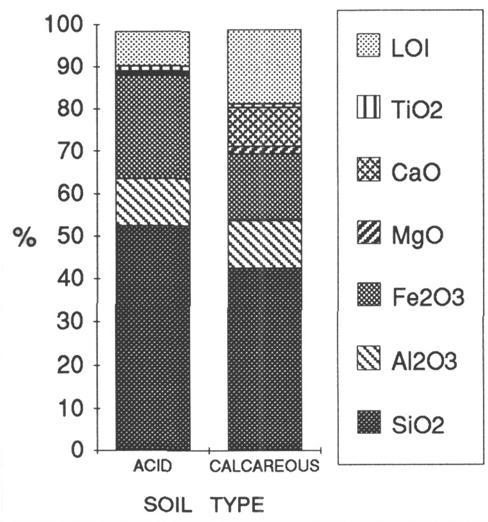
RLS2 - GRAVELLY RED-BROWN SANDY CLAY OVER LATERITIC RESIDUUM - GOLDEN RIDGE, KALGOORLIE REGION

This unit comprising gravelly, acid, sandy clay soils overlies calcareous soils which in turn overlies lateritic residuum. The major minerals in calcareous soils are kaolinite, calcite and quartz.

The chemical composition of an acid soil (< 2 mm) is :

SiO2 52.4%	*Al2O3* 11.3%	*Fe2O3* 24.3%	*MgO* 0.49%	*CaO* 0.42%
Na2O 0.36%	*K2O* 0.22%	*TiO2* 1.14%	*LOI* 8.34%	

Mn 738ppm	*Cr* 951ppm	*V* 446ppm	*Cu* 52ppm	*Pb* 13ppm
Zn 49ppm	*Ni* 116ppm	*Co* 18ppm	*As* 11ppm	*Sb* <2ppm
Bi <2ppm	Mo <2ppm	*Sn* 4ppm	*Ga* 21ppm	*W* 3ppm
Ba 156ppm	*Zr* 185ppm	*Nb* 7ppm	*Au* 16ppb	



The chemical composition of a calcareous soil (< 2 mm) is:

SiO2 42.4%	*Al2O3* 11.4%	*Fe2O3* 15.5%	*MgO* 1.75%	*CaO* 9.2%
Na2O 0.48%	*K2O* 0.18%	*TiO2* 0.85%	*LOI* 17.75%	

Mn 522ppm	*Cr* 551ppm	*V* 317ppm	*Cu* 50ppm	*Pb* 7ppm
Zn 33ppm	*Ni* 80ppm	*Co* 16ppm	*As* 6ppm	*Sb* 2ppm
Bi <2ppm	*Mo* 2ppm	*Sn* <2ppm	*Ga* 18ppm	*W* 4ppm
Ba 269ppm	*Zr* 134ppm	*Nb* 7ppm	*Au* 76ppb	

SOILS

RLS1

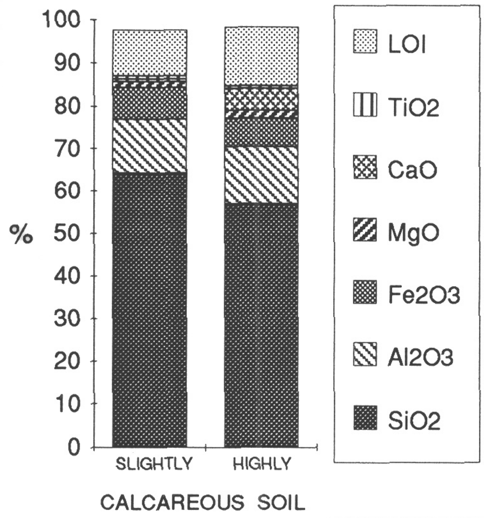
RLS2

ESS2 - CALCAREOUS RED CLAY SOILS OVER SAPROLITE - WOMBOLA DISTRICT, KALGOORLIE REGION

The residual calcareous, red clay soils are derived from the weathering of underlying rock. These soils are slightly calcareous at the surface, but become highly calcareous at 15 cm. Black granules are common in these soils. The major minerals in red clays are kaolinite and smectite with small amounts of goethite and hematite.
Slightly calcareous soils (<2 mm) have the chemical composition:

SiO2 64.3%	*Al2O3* 12.7%	*Fe2O3* 7.3%	*MgO* 1.28%	*CaO* 0.68%
Na2O 0.87%	*K2O* 0.41%	*TiO2* 0.76%	*LOI* 10.5%	

Mn 670ppm	*Cr* 478ppm	*V* 114ppm	*Cu* 55ppm	*Pb* 11ppm
Zn 61ppm	*Ni* 135ppm	*Co* 15ppm	*As* 5ppm	*Sb* <2ppm
Bi <2ppm	*Mo* 1ppm	*Sn* <2ppm	*Ga* 20ppm	*W* 3ppm
Ba 261ppm	*Zr* 197ppm	*Nb* 7ppm	*Au* 13ppb	



Highly calcareous soils (<2mm) have the chemical composition :

SiO2 57.0%	*Al2O3* 13.5%	*Fe2O3* 6.8%	*MgO* 1.7%	*CaO* 5.08%
Na2O 0.77%	*K2O* 0.46%	*TiO2* 0.67%	*LOI* 13.63%	

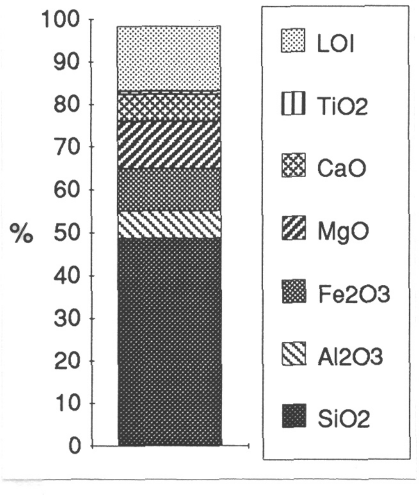
Mn 474ppm	*Cr* 477ppm	*V* 112ppm	*Cu* 58ppm	*Pb* 6ppm
Zn 52ppm	*Ni* 121ppm	*Co* 16ppm	*As* 5ppm	*Sb* <2ppm
Bi <2ppm	*Mo* <2ppm	*Sn* 3ppm	*Ga* 19ppm	*W* 2ppm
Ba 424ppm	*Zr* 182ppm	*Nb* 8ppm	*Au* 19ppb	

umESS3-CALCAREOUS BROWN SOILS OVER BEDROCK - WOMBOLA DISTRICT, KALGOORLIE REGION

This example of residual calcareous soils occurs on low hills. The soils are shallow, calcareous, brown clays, which are the product of the weathering of underlying ultramafic bedrock. The soils largely consist of kaolinite, smectite and calcite.
The chemical composition of calcareous soil (<2 mm) is :

SiO2 48.6%	*Al2O3* 6.4%	*Fe2O3* 9.8%	*MgO* 11.3%	*CaO* 6.4%
Na2O 0.45%	*K2O* 0.32%	*TiO2* 0.64%	*LOI* 15.20%	

Mn 786ppm	*Cr* 1730ppm	*V* 156ppm	*Cu* 57ppm	*Pb* 6ppm
Zn 82ppm	*Ni* 658ppm	*Co* 57ppm	*As* 15ppm	*Sb* 2ppm
Bi 2ppm	*Mo* <2ppm	*Sn* 2ppm	*Ga* 8ppm	*W* 2ppm
Ba 114ppm	*Zr* 95ppm	*Nb* 4ppm	*Au* 3ppb	



SOILS

ESS2

umESS3

DAS2 - CALCAREOUS RED CLAY SOILS IN ALLUVIUM - WOMBOLA DISTRICT, KALGOORLIE REGION

These soils are transported and are developed in alluvium. Lenses of quartz occur within soils, which are dominated by kaolinite, quartz, calcite and smectite.

SOILS

DAS2

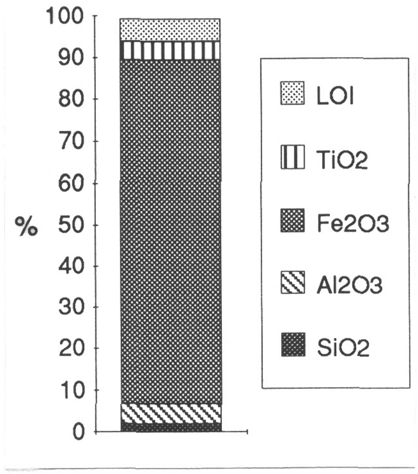
umRLT3 - BLACK FE-RICH DURICRUST - BRILLIANT AREA, LAWLERS DISTRICT

This unit comprising Fe-rich duricrust, developed by the weathering of ultramafic bedrock, occurs on a crest. It consists of abundant pisoliths and ooliths set in a fine grained, uniform, weak red hematite-goethite-rich matrix. Several types of ferruginous lithic fragments are in the matrix. Pseudomorphed wood fragments are a conspicuous feature of a polished sections and are set in a finely grained crystalline matrix of hematite and goethite. In the ooliths, many pieces of wood are replaced by Fe-oxides so completely, that in sections the cell structures can readily be seen. Hematite, goethite and maghemite are the major minerals present in duricrust. Small amounts of rutile and anatase are also present.

The Fe-rich duricrust, derived from the weathering of ultramafic bedrock have the chemical composition:

SiO2 2.0%	*Al2O3* 4.9%	*Fe2O3* 82.4%	*MgO* 0.05%	*CaO* 0.04%
Na2O 0.01%	*K2O* <0.06%	*TiO2* 4.42%	*LOI* 5.60%	

Mn 493ppm	*Cr* 10100ppm	*V* 1758ppm	*Cu* 15ppm	*Pb* 5ppm
Zn 60ppm	*Ni* 190ppm	*Co* 50ppm	*As* <2ppm	*Sb* <2ppm
Bi <2ppm	*Mo* <2ppm	*Sn* 7ppm	*Ga* 100ppm	*W* 4ppm
Ba 56ppm	*Zr* 26ppm	*Nb* 18ppm	*Au* <1ppb	



RLT3 - BLACK FE-RICH DURICRUST, MT. HOPE AREA

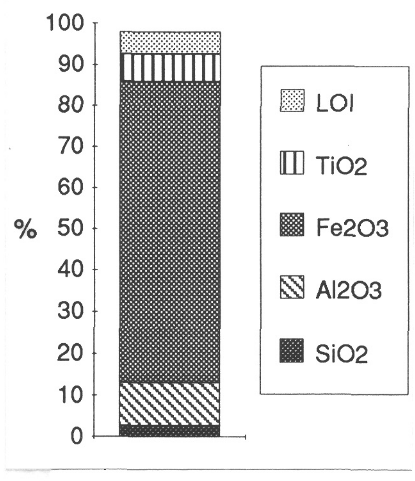
This example of Fe-rich duricrust typically occurs on a crest. The characteristics of the duricrust are similar to those described above for the Brilliant area.

mRLT3- BLACK FE-RICH DURICRUST - GRANTS PATCH AREA, KALGOORLIE REGION

This unit, developed by the weathering of mafic bedrock, occupies a crest. It is underlain by a 1 m thick ferruginous saprolite which in turn overlies saprolite. Black lateritic nodules derived from the breakdown of the duricrust, form a lag on the pediments. Hematite, goethite and maghemite are the major minerals present in the duricrust, with only minor kaolinite.
The Fe-rich duricrust have the chemical composition :

SiO2 2.7%	*Al2O3* 10.5%	*Fe2O3* 72.6%	*MgO* 0.08%	*CaO* 0.13%
Na2O 0.02%	*K2O* <0.06%	*TiO2* 6.82%	*LOI* 5.24%	

Mn 89ppm	*Cr* 4300ppm	*V* 2800ppm	*Cu* <2ppm	*Pb* <2ppm
Zn <2ppm	*Ni* 36ppm	*Co* 18ppm	*As* 10ppm	*Sb* <2ppm
Bi <2ppm	*Mo* 7ppm	*Sn* 9ppm	*Ga* 168ppm	*W* 12ppm
Ba 37ppm	*Zr* 269ppm	*Nb* 24ppm	*Au* 13ppb	



UNITS OF WEATHERING PROFILE

umRLT3

RLT3

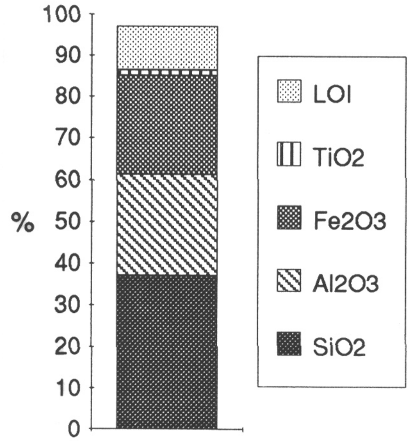
mRLT3

EMZ1 - MOTTLED ZONE - MT. GIBSON DISTRICT

This unit consisting of a pisolitic-nodular mottled zone, is exposed on breakaway. It comprises red, 5 to 10 mm mottles in a pale grey, kaolinite-rich matrix. Mottling is due to discrete, local accumulations of hematite cementing the clay matrix. The upper part of this zone lacks bedrock primary structures, but relict primary structures are recognizable at lower levels. The mottled zone largely consists of kaolinite, hematite, quartz and goethite.
Mottled zone is characterized by:

SiO2 37.1%	*Al2O3* 24.3%	*Fe2O3* 23.6%	*MgO* 0.28%	*CaO* 0.09%
Na2O 0.29%	*K2O* 0.12%	*TiO2* 1.38%	*LOI* 10.8%	

Mn 41ppm	*Cr* 618ppm	*V* 555ppm	*Cu* 35ppm	*Pb* 15ppm
Zn 14ppm	*Ni* 48ppm	*Co* 6ppm	*As* 18ppm	*Sb* <2ppm
Bi <2ppm	*Mo* 2ppm	*Sn* 2ppm	*Ga* 48ppm	*W* 3ppm
Ba 70ppm	*Zr* 77ppm	*Nb* 10ppm	*Au* 5ppb	

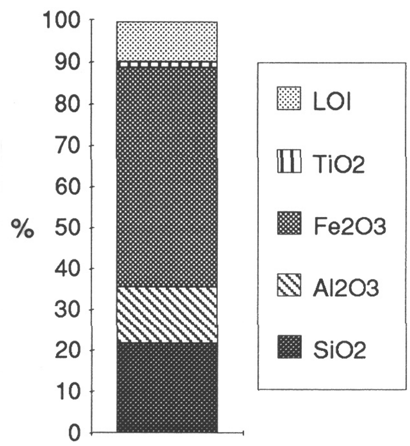


EMZ2 - MEGA-MOTTLED ZONE - BLACK FLAG, KALGOORLIE REGION

This example of a mega-mottled zone is exposed along the edges of the Black Flag lake and is underlain by bleached saprolite. The mega-mottles are reddish brown, irregular Fe-accumulations (up to several metres across) containing smaller (10 mm) sub-angular metallic granules. The mottles have a dull, earthy lustre and gradational to abrupt boundaries with the surrounding bleached clays. Root systems surrounded by a sheath of bleached clays are common and appear to show a close spatial relationship to zones of Fe-accumulation. Mega-mottles are characterized by kaolinite, hematite and goethite.
Mega-mottles have the chemical composition :

SiO2 21.7%	*Al2O3* 12.9%	*Fe2O3* 52.9%	*MgO* 0.22%	*CaO* 0.26%
Na2O 0.03%	*K2O* <0.06%	*TiO2* 1.46%	*LOI* 9.50%	

Mn 129ppm	*Cr* 463ppm	*V* 769ppm	*Cu* 64ppm	*Pb* 4ppm
Zn 5ppm	*Ni* 69ppm	*Co* 29ppm	*As* 39ppm	*Sb* 2ppm
Bi <2ppm	*Mo* 4ppm	*Sn* 2ppm	*Ga* 29ppm	*W* 3ppm
Ba 245ppm	*Zr* 109ppm	*Nb* 6ppm	*Au* <1ppb	



UNITS OF WEATHERING PROFILE

EMZI

EMZ2

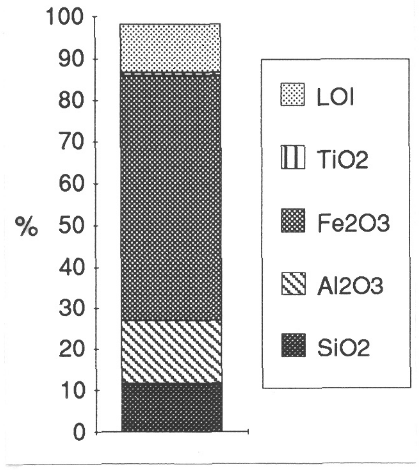
mESP2 - FERRUGINOUS SAPROLITE - AGNEW AREA, LAWLERS DISTRICT

This unit is characterized by yellowish brown ferruginous saprolite outcropping along breakaways; this which sheds as a coarse lag. The upper portion of a lateritic profile, the lateritic residuum, has been removed by erosion. A thick zone of saprolite underlies the ferruginous saprolite and there is very little soil. The fragments of ferruginous saprolite are coarse, yellowish brown and dominated by kaolinite, goethite and hematite.

Ferruginous saprolite developed from the weathering of mafic bedrock is characterized by :

SiO2	*Al2O3*	*Fe2O3*	*MgO*	*CaO*
11.6%	15.4%	58.8%	0.03%	0.03%
Na2O	*K2O*	*TiO2*	*LOI*	
0.01%	<0.06%	0.70%	11.60%	

Mn	*Cr*	*V*	*Cu*	*Pb*
243ppm	1010ppm	1436ppm	170ppm	12ppm
Zn	*Ni*	*Co*	*As*	*Sb*
74ppm	85ppm	28ppm	38ppm	<2ppm
Bi	*Mo*	*Sn*	*Ga*	*W*
<2ppm	2ppm	3ppm	38ppm	6ppm
Ba	*Zr*	*Nb*	*Au*	
28ppm	95ppm	3ppm	15ppb	

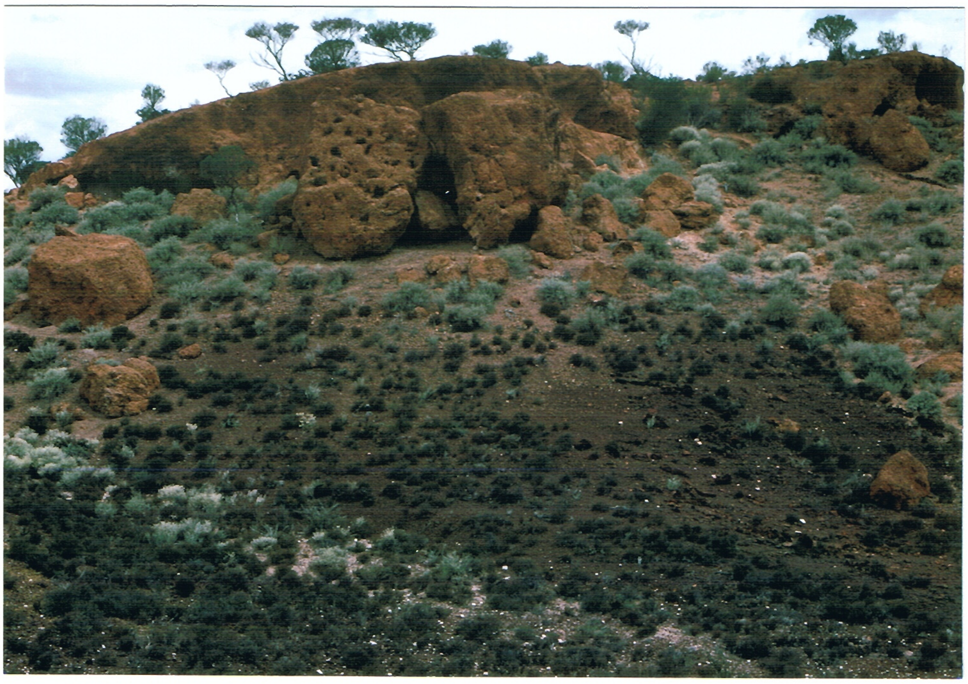


ESP2 - FERRUGINOUS SAPROLITE - BOTTLE CREEK DISTRICT

This unit, comprising ferruginous saprolite, occurs on breakaways. The characteristics of this unit are similar to those described for the Lawlers unit.

UNITS OF WEATHERING PROFILE

mESP2



ESP2

EBR1 - FERRUGINOUS BEDROCK - BOTTLE CREEK DISTRICT

This unit, an indurated ferruginous bedrock occurs on low hills. The bedrock was ferruginized during the post-laterisation period.

This is characterized by goethite and hematite. There is very little soil.

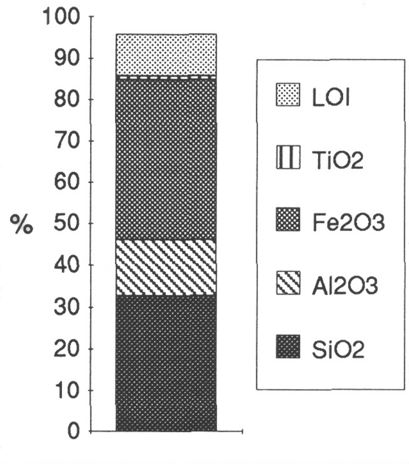
EBR1 - FERRUGINOUS BEDROCK - MADOONGA DISTRICT

This unit, ferruginous bedrock, occurs on high hills. Much of the BIF fabric is preserved.

Ferruginous rock is characterized by :

SiO2 32.8%	*Al2O3* 13.3%	*Fe2O3* 38.6%	*MgO* 1.46%	*CaO* 1.67%
Na2O 0.09%	*K2O* 0.11%	*TiO2* 0.97%	*LOI* 10..20%	

Mn 226ppm	*Cr* 1180ppm	*V* 897ppm	*Cu* 70ppm	*Pb* 20ppm
Zn 45ppm	*Ni* 80ppm	*Co* 20ppm	*As* 37ppm	*Sb* 6ppm
Bi <2ppm	*Mo* <2ppm	*Sn* 3ppm	*Ga* 34ppm	*W* <4ppm
Ba 106ppm	*Zr* 160ppm	*Nb* 4ppm	*Au* <1ppb	



UNITS OF WEATHERING PROFILE

EBR1

EBR1

DCT1 - LATERITIC RESIDUUM PRESENT BENEATH SEDIMENTS -WAROONGA DEPOSIT, LAWLERS DISTRICT

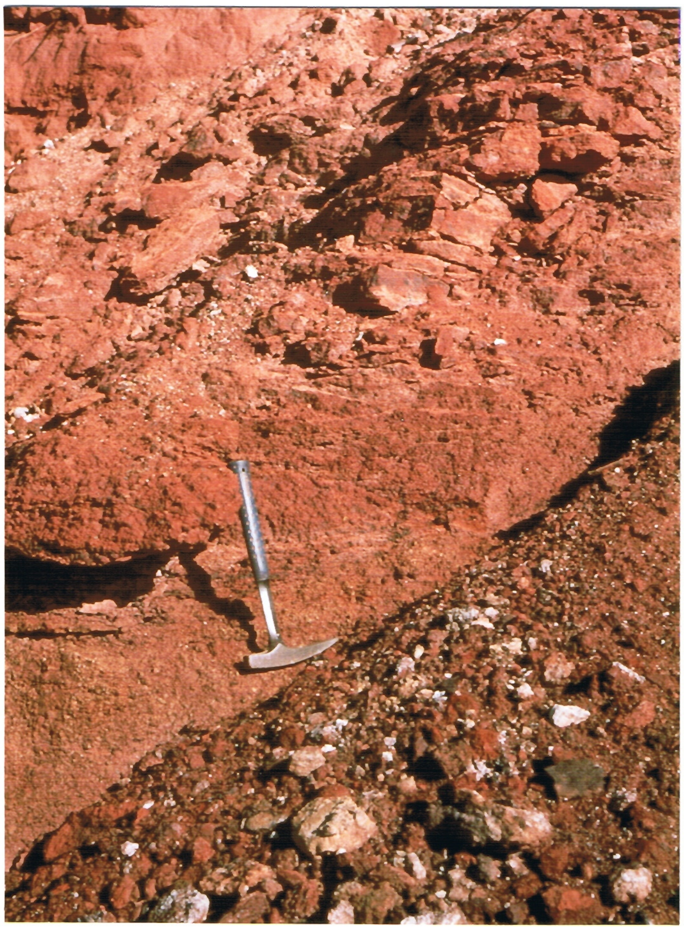
This unit occurs on colluvial outwash plains. Here lateritic residuum developed by the weathering of metasedimentary rocks, is buried beneath 7 m thick, transported regolith. The transported regolith comprises of 4.5 m thick hardpanized colluvium underlain by a 2.5 m thick, red clay layer. Hardpanisation has also affected the lateritic residuum. At depth, the lateritic residuum merges into the mottled zone with the appearance of large grey to red mottles in a clayey mass.

DCT1 - LATERITIC RESIDUUM PRESENT BENEATH SEDIMENTS - MIDWAY NORTH, MT. GIBSON DISTRICT

This example occurs on the long gentle slopes. Here, the hardpanized colluvium overlies pisolitic-nodular lateritic residuum which is present as an almost continuous horizon, varying from 2 to 4 m thick. The introduction of silica cement has modified the lateritic residuum resulting in a coarsely laminated appearance. Lateritic residuum merges at depth with a mottled zone (2-4 m), thence to a clay-rich saprolite, which in turn merges into fresh mafic bedrock.

SUBSTRATE TO TRANSPORTED OVERBURDEN

DCT1



DCT1

DCT1 - LATERITIC RESIDUUM PRESENT BENEATH SEDIMENTS - MEATOA AREA, LAWLERS DISTRICT

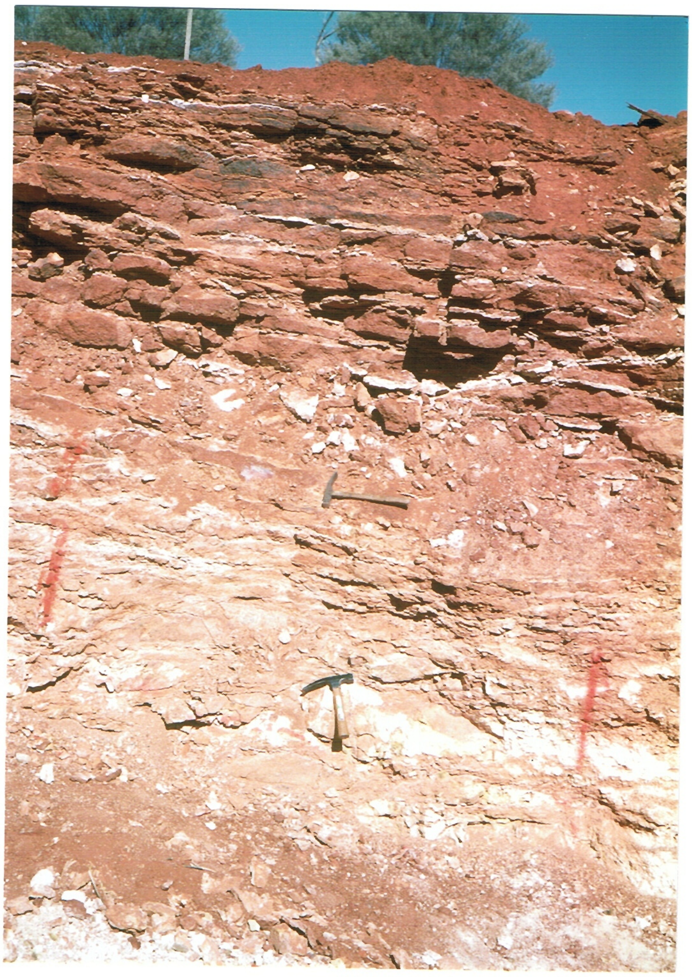
This example occurs on colluvial outwash plain. The lateritic residuum occurs at a depth of 5m, forming an almost continuous layer. Typically, ferruginous saprolite underlies the residual laterite and this in turn overlies bleached saprolite derived from mafic rock.

DAT5 - SAPROLITE PRESENT BENEATH SEDIMENTS - BOTTLE CREEK DISTRICT

This unit occurs on alluvial plains. Here lateritic residuum is truncated and hardpanized alluvium directly overlies hardpanized saprolite.

SUBSTRATE TO TRANSPORTED OVERBURDEN

DCT1



DAT5

6.0 GLOSSARY

In this section important terms used in the regolith-landform mapping process are defined. The definitions are arranged in alphabetical order. Terms used to describe regolith units of the weathering profile in detail are given in *Terminology and classification of laterites and associated ferruginous materials* (Anand *et al.*, August 1989) and in the Summary Report 236R (Smith *et al.*, 1992) for project P240.

Alluvium

A general term for clay, silt, sand, and gravel deposited as a sorted or semi-sorted sediment during comparatively recent geological time on the bed or flood plain of a river or stream.

Back slopes

Smooth gentle slopes extending down from and at the back of breakaway crests. They are usually mantled by colluvium that overlies an extensive lateritic residuum, at a shallow depth.

Back slopes (erosional)

Smooth gentle slopes extending down from and at the back of breakaways. Usually mantled by colluvium but with a substrate stripped to saprolite, saprock or fresh rock.

Breakaways

Erosional scarps usually capped indurated and subindurated parts of the weathered mantle. Breakaways can mark the limits of the erosional destruction of a deeply weathered land surface.

Clasts

This term is used here in a general manner for fragments of a rock mass or hardened regolith material, particularly in the granule, pebble or cobble size range. It includes fragments of ferruginous saprolite, hardened mottles, ferruginous lithic fragments, iron segregations, as well as lateritic nodules and pisoliths.

Clay Zone

This zone generally occurs above the pedoplasmation front but may be absent. It consists of massive clays, commonly with a mesoscopically-homogenous clay fabric. The loss of lithic fabric is caused by solution and authigenesis of saprolitic kaolinitic clays and mechanical processes such as shrinking and swelling of clays.

Colluvium

A general term for recent sedimentary deposits on slopes or at the base of slopes transported chiefly by rainwash, sheetwash, or slow continuous downslope creep.

Crests

These landform facets are subdivided into those associated with residual regimes and those with erosional. Crests in residual regimes can be mantled by lateritic residuum and by soils derived from it. These crests can however be mildly eroded so that a wider range of materials from the weathered mantle can contribute to the lag and the soils on the crest. Crests in erosional regimes are of a more diverse nature and extensively stripped. As a general rule the soils are shallow and the lags often related to the underlying rocks, to outcropping quartz veins and to bodies of Fe-segregations.

Depositional Regimes

These regimes are characterized by widespread sediments which can be many metres thick. The boundary between residual and depositional regimes can be gradational or sharp. The substrate can range from stripped surfaces to complete weathering profiles.

Drainage Floors

Flat alluvial tracts having little, if any, stream incision. Major floors are to 0.5km wide. Small floors are <0.2km wide.

Dunes

Ridges and hummocks resulting from aeolian working of sand.

Erosional Regimes

Erosional regimes are characterized by erosion and removal of the lateritic residuum to a level where the mottled zone, clay zone, saprolite, or fresh bedrock are either exposed, or concealed beneath soil, or a thin mantle of locally-derived, associated sediments.

Ferruginous Granules

Fragments of Fe-rich (hematite, goethite, and maghemite) material, somewhat rounded, between 2 and 4 mm in diameter, generally having no cutans, and comprised of a mixture of magnetic and nonmagnetic iron oxides. Commonly occur in soils or as surface lag.

Ferruginous Saprolite

Ferruginous saprolite is formed by the infusion of clay-rich saprolite with goethite, and is firm to hard, massive to mottled, and is dominated by goethite and kaolinite. Fragments of ferruginous saprolite are yellowish-brown to reddish-brown, non-magnetic, and may have an incipient nodular structure. Ferruginous saprolite may form a continuous blanket and is generally overlain by collapsed ferruginous saprolite where soft, soluble, less ferruginized material has been removed by leaching, causing the whole structure to collapse.

Ferruginous Lithic Fragments

Lithic fragments enriched in Fe-oxides. These are generally yellowish brown through reddish brown to black and commonly have relict textures. Some may have matt to glossy surface, generally referred to as varnish. The ferruginous lithic fragments are derived from the ferruginization of the lower part of the saprolite, saprock and bedrock.

Hardened Mottles

Iron-rich (hematite, goethite) irregular-shaped lateritic mottles, occurring as surface lag on truncated landscapes from which the lateritic residuum has been stripped exposing the mottled zone. Commonly occurring in the pebble-size range, 4 to 64 mm.

Hill (high)

Landform pattern of high relief (>5m) with gentle to moderate slopes.

Hill (Low)

Landform pattern of low relief (<5m) with gentle slopes.

Iron Segregations

Various forms of iron enrichments (iron segregations) occur within the ferruginous saprolite and the upper part of the saprolite. These iron segregations occur as pods, lenses, and large slabs. They are black, non-magnetic and are goethite rich. Fragments of iron segregations are subrounded to subangular and commonly range in size from 20 to 200 mm. It is significant that iron segregations do not have cutans. Cutan here refers to an outer layer, surface coating, or skin (Anand *et al.*, August 1989).

Lag

Lag covers much of the surface in the Yilgarn and consists of a variety of clast types, including lithic fragments, ferruginous granules, pebbles and cobbles, lateritic pisoliths, nodules, and quartz clasts. Lag reaches the surface by deflation of the soil by wind and water, by root plucking and by eluviation. The various clast types are commonly mixed but their distribution may be related to source material, such as regolith substrate, and to the regolith-landform framework.

Lateritic Duricrust

Lateritic duricrust is indurated lateritic residuum, consisting of various secondary structures such as nodules, pisoliths, and ooliths, set in a matrix of kaolinite and Fe-oxides. Both magnetic and non-magnetic varieties of nodules and pisoliths occur in lateritic duricrust. The magnetic properties are due to maghemite.

Lateritic Family

The lateritic family results from ferruginization and residual accumulation of Fe in the upper lateritic profile. A large part of their Fe is derived from the weathering of underlying bedrocks. These materials are yellowish brown to dark reddish brown and largely consist of kaolinite, hematite, goethite and maghemite. The original rock texture may be partly preserved or completely destroyed. The lateritic family includes lateritic duricrust, lateritic nodules and pisoliths, mottled and ferruginous saprolite.

Lateritic Gravels

Lateritic gravels consist of loose lateritic nodules, pisoliths, and hardened mottles. Lateritic pisoliths and nodules typically have 1-2 mm thick, yellowish-brown to greenish cutans around hematite-rich, black to red nuclei. Both lithic and non-lithic nodules are common in this unit.

Lateritic Nodule

A ferruginous lateritic particle with an irregular shape, usually with rounded edges, in the 2 to 64-mm diameter range, and which may have a cutan around a nucleus or core. As sphericity increases, the term pisolith becomes appropriate. The core can be of a variety of materials, such as hardened, variably ferruginized sandy grit, lithorelics, etc. Lateritic nodules commonly occur as loose aggregates, as a lag, in soil, and in lateritic duricrusts.

Lateritic Pisolith

A ferruginous lateritic particle resembling a pea in shape, by definition of 2 mm or more in diameter. Pisoliths can have a concentric internal structure, but concentric lamination is not diagnostic; however, most pisoliths have a cutan. Lateritic pisoliths and nodules commonly occur together, but the former rarely exceed 20 mm in diameter.

Lateritic Residuum

Lateritic residuum is a collective term for certain ferruginous units of the laterite profile. It is formed by weathering, precipitation of minerals, and residual accumulation in the upper part of a lateritic weathering profile. Lateritic residuum includes units consisting of loose lateritic pisoliths and nodules (forming lateritic gravel) as well as lateritic duricrust. The colour of this regolith unit varies from yellowish-brown, through dark reddish-brown to very dark brown. The mineralogy is mainly kaolinite, hematite, goethite, with or without subordinate and variable amounts of gibbsite, quartz, maghemite, muscovite, zircon, ilmenite, and anatase. Lateritic residuum may occur at surface or subsurface when the weathering profile has been buried.

Lithic Family

The lithic family includes materials which contain very little or no Fe and are derived from the lower part of a weathering profile. Generally the fabric of the rock is preserved in these materials. The materials include saprolite, saprock and bedrock and fragments derived from them.

Mottled Zone

The mottled zone represents the lower part of the ferruginous zone of the weathering profile and differs from the lateritic residuum above by lesser accumulation of Fe-oxides and lacks induration. The mottled zone has contrasting kaolinite-rich bleached domains and Fe-mottles, which may be distinguished easily in outcrops and in samples on a centimetre scale.

Non-lateritic Family

The very diverse non-lateritic family results from extreme ferruginization and has developed predominantly within the upper part of saprolite. Its members are not confined to a single unit of regolith stratigraphy. Their Fe is derived from a variety of sources, including weathering of Fe-rich lithologies, gossans, etc., and leaching from upper horizons and upland areas. The non-lateritic family includes iron segregations, ferruginized lithic fragments and gossans.

Pediments

Smooth gentle broadly concave to linear slopes extending down from breakaways. These slopes are mantled by colluvium (pedisediment) which overlies saprolite /saprock at a shallow depth.

Plains-Colluvial, Alluvial

These types can merge, one into the other. The term **colluvial plains** is generally used when referring to those plains that are continuous with, and down slope from, back slopes and hill units. They can occupy tributary valleys as well. In general this term tends to be used when referring to transported materials occupying sites that are proximal to possible source areas. Some may be associated with coarse lag, others, particularly when associated with downslope extensions of back slopes, can have granular to fine gravel lag, much of which can be pisolitic. **Alluvial plains** are generally more distal from source and lags which are generally finer may not be a significant feature of these areas. Alluvial plains occupy the main valleys and some of the tributaries.

Playas

Bare saline tracts (lake floors) generally occupying broad zones along major valley floors.

Regolith-Landform Mapping Unit

These are areas delineated on a map, within which occur a particular association of regolith materials, bedrock geology and landforms. Regolith-landform mapping units may consist of multiples or sub-divisions of airphoto patterns. The interpretation of these patterns leads to the establishment of regolith-landform mapping units.

Regolith-Landform Regimes

These are broad genetic groupings of the landform and associated regoliths. They often form the basis of regolith-landform models, particularly for weathered terrain. In these models, the development of an extensive deeply-weathered mantle is proposed as the first stage, and this is subsequently modified by erosion and deposition. In broad terms, three major regimes are perceived as being widely applicable in lateritic terrain, namely, residual, erosional, and depositional.

Regolith Stratigraphy

This term refers, collectively, to units of weathering profiles as well as to those of the Cainozoic sedimentary succession. The use of the term stratigraphy, when dealing with regolith materials, is compatible with the International Stratigraphic Guide (Hedberg, 1976). A lithostratigraphic approach is used, namely systematic organization of rocks (in this case weathered rocks) and sediments based upon certain unifying characteristics, or attributes that distinguish each from the other layers.

Regolith Unit

Regolith units are subdivisions of regolith stratigraphy as used in P240 and P240A reports. They include zones or horizons of weathering profiles such as soil, lateritic duricrust, lateritic gravel, mottled zone, saprolite, etc., as well as the subdivisions of the associated sedimentary sequences. These are units of the regolith stratigraphy. Each regolith unit can vary spatially and changes can be gradual or sharp.

Residual Regimes

Residual regimes are mappable areas characterized by widespread preservation of lateritic residuum. Conceptually, they are relics of an ancient weathered land surface.

Saprock

Saprock is a compact, slightly-weathered rock of low porosity, with less than 20% of the weatherable minerals altered. The boundary between bedrock and saprock is not generally a plane, but is very irregular and corestones of fresh rock may occur in the saprock and saprolite.

Saprolite

Saprolite is weathered rock that retains much of the fabric and structure of the parent bedrock. Saprolite can be firm (rather than hard), soft, or friable. Isovolumetric weathering is commonly envisaged. Saprolite may become more massive upwards as the proportion of clay increases and cementation by secondary silica, carbonates, and especially Fe-oxides is common. Saprolite is lighter in colour than the overlying mottled zone and lateritic residuum. Its mineralogy is variable, depending upon the nature of the parent bedrock.

Stripped Slopes

Slopes flanking hills in erosional regimes. These slopes can have much rock exposed and/or a shallow mantle of stony colluvium. It should be noted that this focus on the details of the landform, such as individual slopes and not on hills, *in toto,* allow the investigator to record information concerning the regolith if it is necessary and, the scale is adequate.

Transported Overburden

General term referring to material of exotic or redistributed origin such as alluvium, colluvium and aeolian that blanket fresh or weathered bedrock. It may be friable or partially or wholly consolidated, cemented by Fe-oxides, silica, carbonates, gypsum or clays.

Undulating Plain

Slightly undulating tracts of low relief (<3m) comprising an association of broad smooth crests and broad shallow concavities. These areas are generally dominated by erosional regimes but locally may contain some deposits of transported materials.

Valley Floors

This is applied to valley bottoms when the site, in question, is not on other features that might be present within the valley, such as alluvial or colluvial plains.

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