AGSO

User's Guide to RTMAP Regolith Landform Mapping Database

By M.S. Hazell, S. Lenz & R.J. Ryburn

Record 1995/22

AGSO
AUSTRALIAN
GEOLOGICAL SURVEY
ORGANISATION

USERS' GUIDE TO RTMAP

REGOLITH LANDFORM MAPPING DATABASE

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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

CANBERRA

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. David Beddall, MP
Secretary: Greg Taylor

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Executive Director: Neil Williams

ISSN: 1039-0073
ISBN: 0 642 22339 4

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ABSTRACT

RTMAP, AGSO's Regolith Database, is a relational database which consists of two components - regolith field mapping site descriptions and regolith mapping unit descriptions. The database structure has been slightly modified from its original form (Lenz, 1991), based on experience gained from field mapping and integration with GIS. Extra authority tables have been added and provision made for the recording of additional attributes. RTMAP now also uses AGSO's corporate Sites table which standardises the way point locational information is recorded within AGSO.

Wherever possible data standards are controlled by authority tables. Many of the authority tables used by RTMAP belong to other database owners and are therefore made use of by other databases. It is important for data standards to be tightly controlled to ensure smooth operation of automated data analysis and display.

This guide presents an overview of the structure of RTMAP and describes in detail the screen menus and forms used to input and view data and the methods of navigating the forms. Detailed definitions of most database fields are given under descriptions of the screen forms. Several formatted reports have been prepared to provide users with an easy means of querying the database and producing hardcopy output. The operation and use of these reports is described together with some examples of output. The database schema, with all definitions of tables, views and indexes is contained in an appendix.

1 - INTRODUCTION

RTMAP is AGSO's regolith landform mapping database designed to store data generated in AGSO's regolith mapping program. The database uses the Oracle relational database management system (RDBMS) running on AGSO's corporate database server - a DG AViiON 6240 computer using UNIX System 5 Version 4 (see Lenz et al, 1993).

RTMAP consists of two components, a field site component and a mapping unit component. The sites component stores data relating to individual field sites. Site descriptions are recorded in the field in specially formatted notebooks and then entered into the database. RTMAP is one of a number of AGSO databases which use a common table, Sites, for storing locational information (Figure 1). The mapping unit component of the database contains descriptions of regolith landform mapping units. It has been designed to function as the attribute database for a GIS. Methods of mapping regolith landforms and recording field data for the database have been described in Pain, et al, (1991).

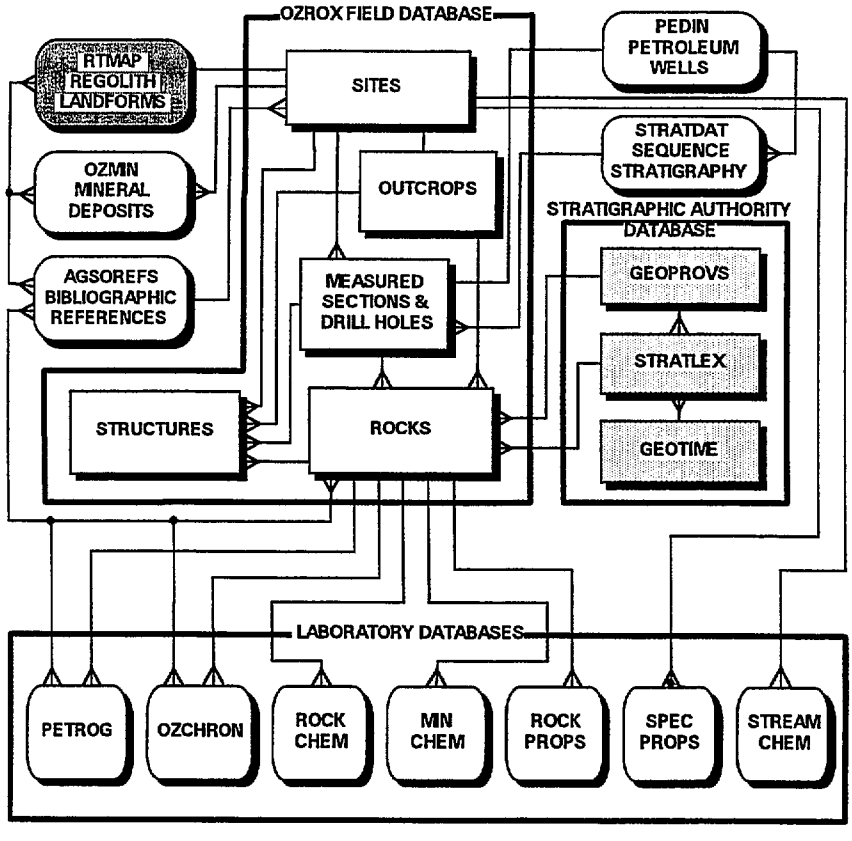

Figure 1. Simplified structure of AGSO's geological databases.

The RTMAP Database was initially designed in 1990 with the help of Information Systems Branch (see Lenz, 1991). It was the first attempt within AGSO to formulate a database, within a relational

database environment, for recording field site information and mapping unit attribute data. At the time AGSO's regolith landform mapping was in its infancy and few of the design team had much experience with regolith mapping. Deciding on how best to structure the database, which attributes to describe, and at the same time allow for future developments in regolith mapping, required much effort. Subsequent experience has shown that the hard work and time that went into designing the initial database structure was well spent. However certain adjustments to the table structure were required to allow for the use of additional attributes to cover the variation in emphasis required by different projects. Variations in the number and type of attributes being described was found to be greatest in the descriptions of field sites. The simple variation found between individual sites where, for example, sedimentological descriptors may be required at a site comprised of sediments but a totally different set of descriptors at another site comprised of saprolite, meant that database fields designed for descriptions of these attributes were often left empty. Also new mapping technologies, such as Gamma Ray Spectrometry, required new attributes to be described and as a consequence extra database fields to hold this data. The Zones table in the Sites Database was in danger of becoming very large with the addition of new fields which would not always have data. Keying past fields for which there was no data to enter would become very tiresome for geologists entering data. To overcome this problem an extendable attributes table was designed based on the OZROX Database (Ryburn, et al, 1993). In this way the database could meet changing needs without spawning large numbers of new fields or tables and thereby become inefficient and unwieldy. Adjustments to the Mapping Units component were also required to allow easier interaction with GIS.

This record describes the structure of the RTMAP Database as it now stands and how to access the database through AGSO's corporate menu system. The type and format of data which can be entered into each field is described together with any limitations on data entry. A series of reports have been written for easy extraction of data in hardcopy form. These have been described and examples of output included in an appendix.

2 - STRUCTURE OF THE RTMAP DATABASE

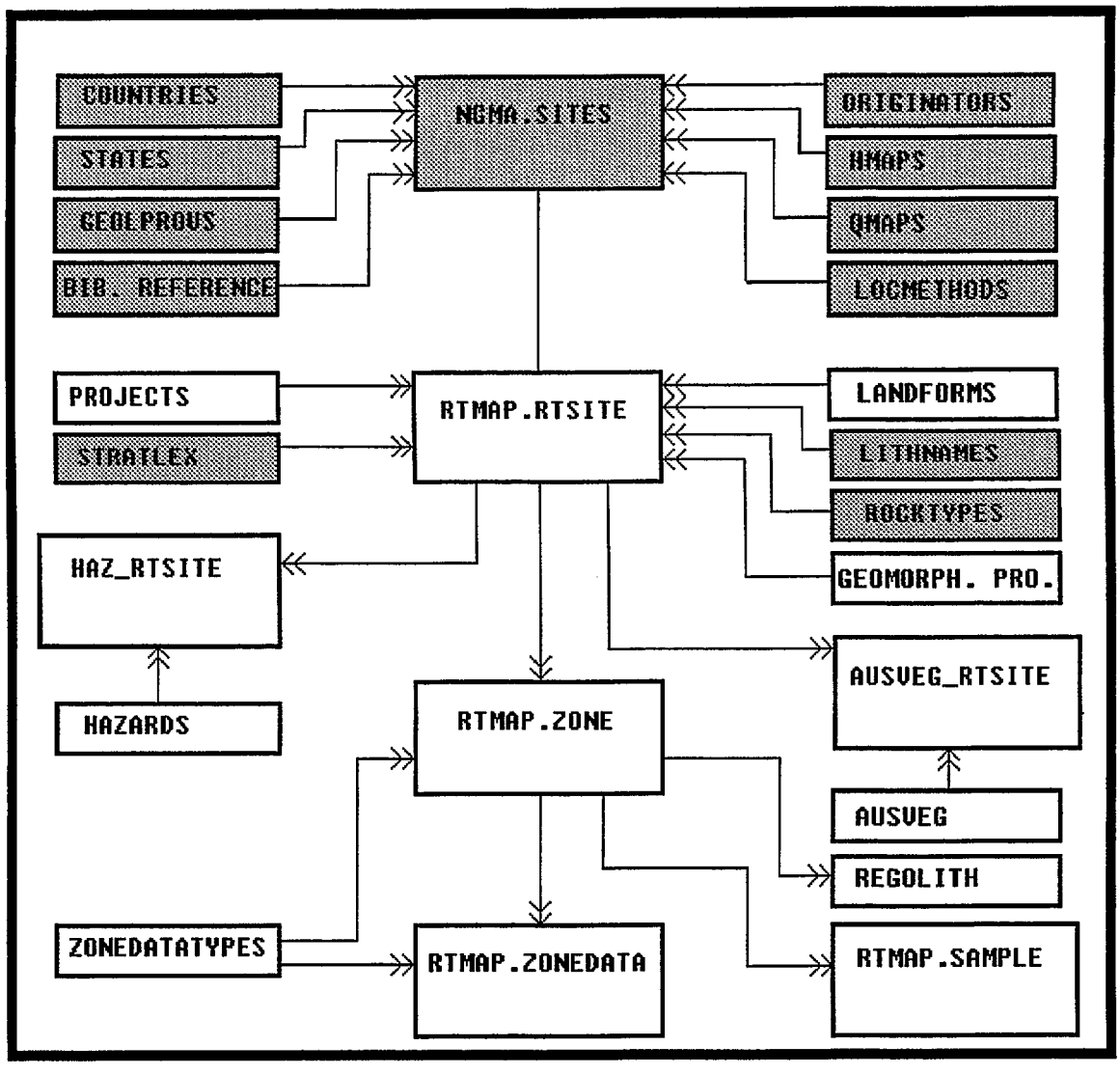

Figure 2. The structure of the RTMAP Field Site Database showing the relationship between tables with double arrow heads indicating the 'many' end of many-to-one links. Authority table labels emphasise function and are not necessarily actual table names. Shaded boxes indicate tables which do not have RTMAP as owner.

The RTMAP Database has been designed around two main entities; field site descriptions (Figure 2) and mapping unit descriptions (Figure 3). Neither entity is totally independent as they both share common authority tables. In addition the Sites Database is closely connected with the OZROX Field Mapping Database (Ryburn, et al, 1993). The Sites Database shares the OZROX Sites table (Figure 1) which was designed as the standard table for recording locational information in AGSO. RTMAP also makes use of authority tables from the OZROX Field Mapping Database and the Stratigraphic Authority Database.

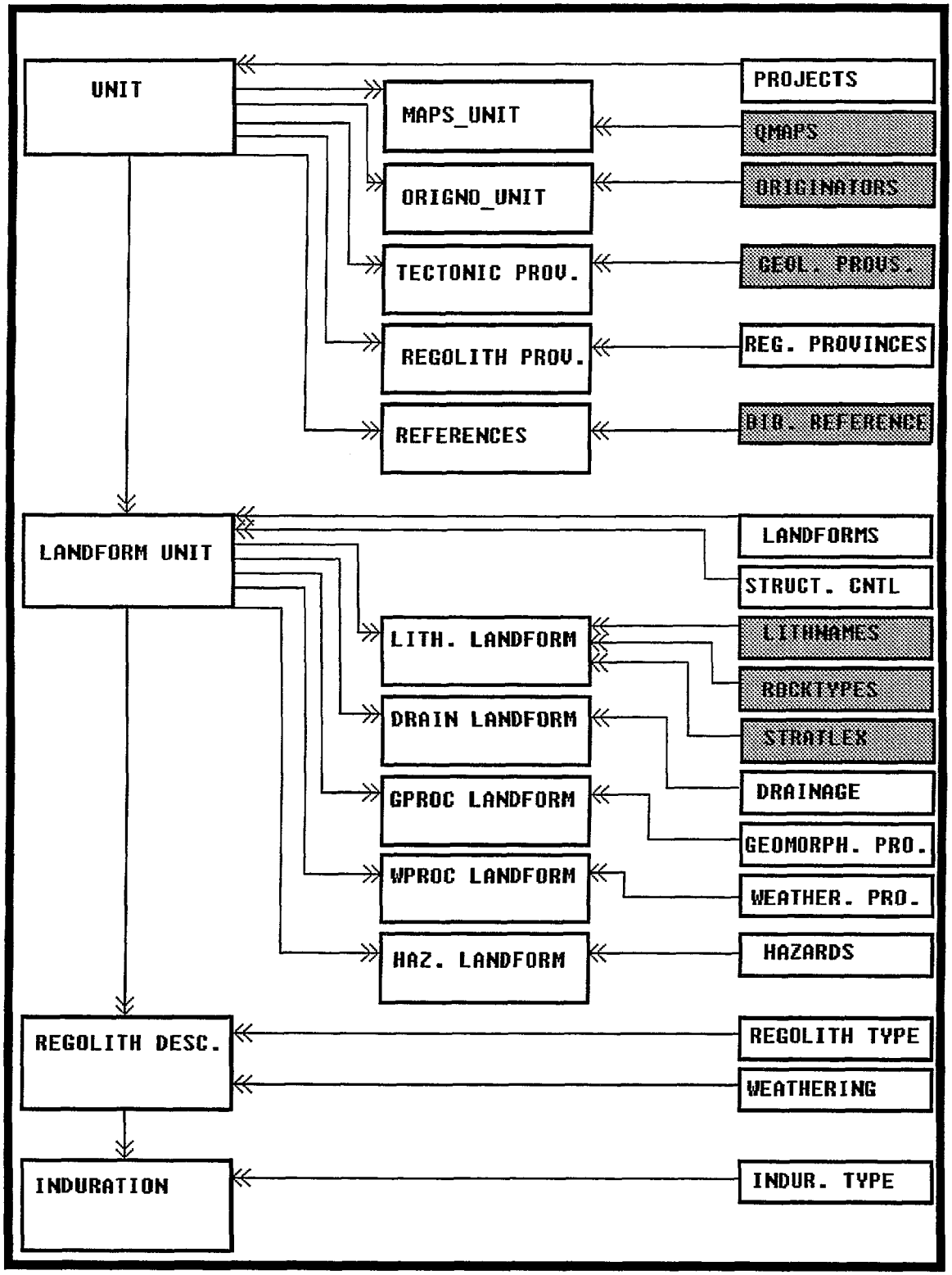

Figure 3. The structure of the RTMAP Mapping Unit Database showing the relationship between tables with double arrow heads indicating the 'many' end of many-to-one links. Authority table labels emphasise function and are not necessarily actual table names. Shaded boxes indicate tables which do not have RTMAP as owner.

The Sites Database has six main tables - SITES, RTSITE, ZONE, ZONEDATA, HAZ_RTSITE and SAMPLE. The SITES and RTSITES tables are the focus of the Sites Database, all other main tables having a many-to-one relationship with these two tables. The Units Database has three main tables - UNIT, LANDF_UNIT and REGT_LANDF. It also has 11 subsidiary tables which hold many-to-one attributes belonging to each of the main tables. The main tables in the RTMAP Database are listed below. Most are owned by the Oracle user called 'RTMAP'. The ownership of all tables is indicated in full table names by the name of the table owner occurring as a prefix in front of the full stop.

RTMAP SITES DATABASE TABLES

TABLE NAME	CONTENTS
NGMA.SITES	field site locational information, accuracy and lineage
RTMAP.RTSITE	description of the whole site
RTMAP.ZONE	regolith type, depth and thickness of each zone
RTMAP.ZONEDATA	extendable attributes for the ZONE table
RTMAP.HAZ_RTSITE	environmental hazards at a site
RTMAP.SAMPLE	samples collected at a site

RTMAP MAPPING UNITS DATABASE TABLES

TABLE NAME	CONTENTS
RTMAP.UNIT	summary information for the whole regolith mapping unit
RTMAP.QMAP_UNIT	the 1:250 000 maps on which a mapping unit occurs
RTMAP.ORIGNO_UNIT	the names of unit compilers
RTMAP. GEOPROV_UNIT	the tectonic provinces in which the mapping unit occurs
RTMAP.PROV_UNIT	the regolith provinces of which the mapping unit is a part
RTMAP.REFS_UNIT	references used in compiling the mapping unit
RTMAP.LANDF_UNIT	landform descriptions for each mapping unit
RTMAP.HAZ_LANDF	environmental hazards in each landform
RTMAP.LITH_LANDF	bedrock lithologies that occur in each landform
RTMAP.DRAIN_LANDF	drainage patterns found in each landform
RTMAP.GPROC_LANDF	geomorphic processes affecting each landform
RTMAP.WPROC_LANDF	weathering processes affecting each landform
RTMAP.REGT_LANDF	regolith types in each landform
RTMAP.IND_REGT	induration affecting each regolith type

In addition to the above tables there are a number of authority tables, not all of which belong to RTMAP. The authority tables validate entry into many of the fields in both databases. For these fields only attributes already in the authority tables may be entered. There are a number of

custodians for the authority tables. The custodians are the only people who may add new attributes to the authority tables. If you require new attributes see the custodians who are listed below beside each table.

TABLE NAME	CONTENTS	CUSTODIAN
RTMAP.LANDF	Australian landform classification	Colin Pain
RTMAP.GPROC	geomorphic process classification	Colin Pain
RTMAP.WPROC	weathering process classification	Colin Pain
RTMAP.DRAIN	drainage pattern classification	Colin Pain
RTMAP.PROV	Australian regolith landform provinces	Roslyn Chan
RTMAP.HAZARDS	environmental hazard classification	Colin Pain
RTMAP.STCNTL	landform structural controls	Colin Pain
RTMAP.ZONEDATATYPES	extendable regolith attributes	Colin Pain
RTMAP.PROJECT	mapping projects	Colin Pain
RTMAP.AUSVEG	Australian vegetation species names	Michael Craig
NGMA.ORIGINATORS	contributors of data	Murray Hazell
NGMA.AGSOCOUNTRIES	list of valid countries	Rod Ryburn
NGMA.AGSOSTATES	list of valid states	Rod Ryburn
NGMA.QMAPS	Australian 1:250 000 maps	Murray Hazell
NGMA.HMAPS	Australian 1:100 000 maps	Murray Hazell
NGMA.LOCMETHODS	spatial location methods	Richard Blewett
NGMA.ROCKTYPES	basic classification of rock types	Lesley Wyborn
NGMA.LITHNAMES	lithological names	Jan Knutson
NGMA.LITHDATATYPES	extendable attributes	P. Stuart-Smith
NGMA.AGSOMINERALS	mineral names	Morrie Duggan
NGMA.GEOREGIONS	Australian geological regions	Rod Ryburn
STRATA.STRATLEX	Australian stratigraphic names	Cathy Brown
STRATA.GEOPROVS	Geological provinces	David Palfreyman
BIBREF.AGSOREFS	AGSO's reference database	Rod Ryburn
QUATDB.VEGET	Australian vegetation classification	Geoff Hunt

3 - SECURITY AND ACCESS

RTMAP Sites Database

The Oracle production environment allows all users select-only access to the tables in the RTMAP Sites Database. Read-only versions of forms allow users to retrieve all data in the Sites Database. Insert, update and delete privileges are restricted to table owners or users who have been granted these rights by the table owners. Special views have been created to give all users insert, update and delete rights on their own records. All such views have the prefix 'U'. For example the view of the RTSITE table is called URTSITE. Views have been created with statements like the following -

```
CREATE VIEW URTSITE AS
    SELECT * FROM RTSITE WHERE ENTEREDBY = USER;
```

The word **USER** in the above statement is an Oracle function which returns the current username. All tables in the Sites Database have the field enteredby for the username of the person entering the data. This ensures that when in insert, update or delete mode users can see only their own records, and only they or the database custodians can alter or delete them.

SQL*Plus can also be used to select data from any of the tables in the database. When selecting from database tables the full names of the tables must be used. Full table names include the name of the table owner. For example the table RTSITE is owned by RTMAP and to select from this table the full table name RTMAP.RTSITE would be used.

The Mapping Units Database

All users have select access to the Mapping Units Database. Only users who have been given insert, update and delete access by the database owner, RTMAP, can add or alter records in the database. Unlike the Sites Database no special view for inserting, updating and deleting records in the Units Database has been created. All users, who have been granted the necessary privileges by the database owner, can see all the records in the database and insert, update and delete any record. With the small number of users entering new Unit records security should not be a problem, however care should still be exercised to ensure another person's record is not inadvertently altered or deleted.

The menu system provides only one form for viewing, inserting, updating and deleting Unit records. All users can query the Units database through this form regardless of insert, update or delete privileges.

4 - THE RTMAP MENU SYSTEM

Access to RTMAP is provided by the RTMAP menu system. All RTMAP forms, reports and SQL*Plus can be accessed through the menu. To access the RTMAP menu at the unix prompt type-

rtmap <ENTER>

From the opening menu (Figure 4) users can branch to the Sites Database, the Units Database, AGSO's reference database, AGSOREFS, the authority tables (lookup tables) or SQL*Plus. An option for generating laboratory sample submission reports for regolith samples is also available. Submenus give access to printed report facilities beyond each of the main Sites and Units menus.

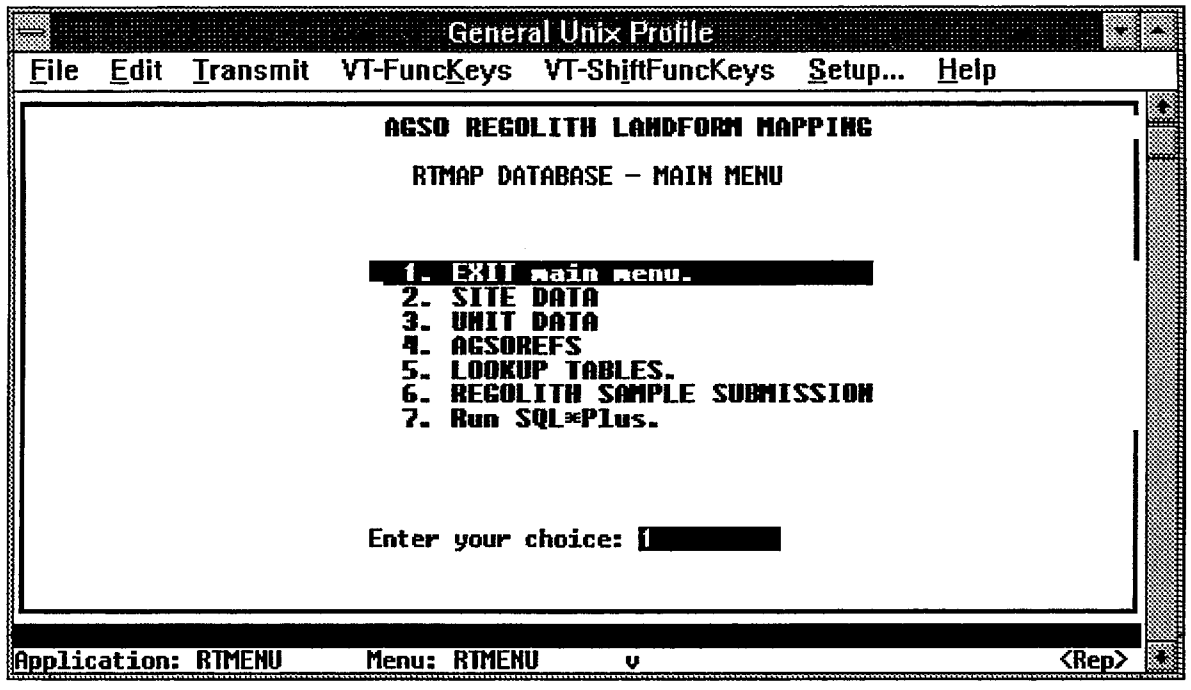

Figure 4. The main menu of the RTMAP Menu System. Users can branch from this menu to the Sites database, the Unit Database, AGSOREFS, the RTMAP authority tables, the laboratory sample submission report or SQL*Plus.

5 - THE SITES FORM

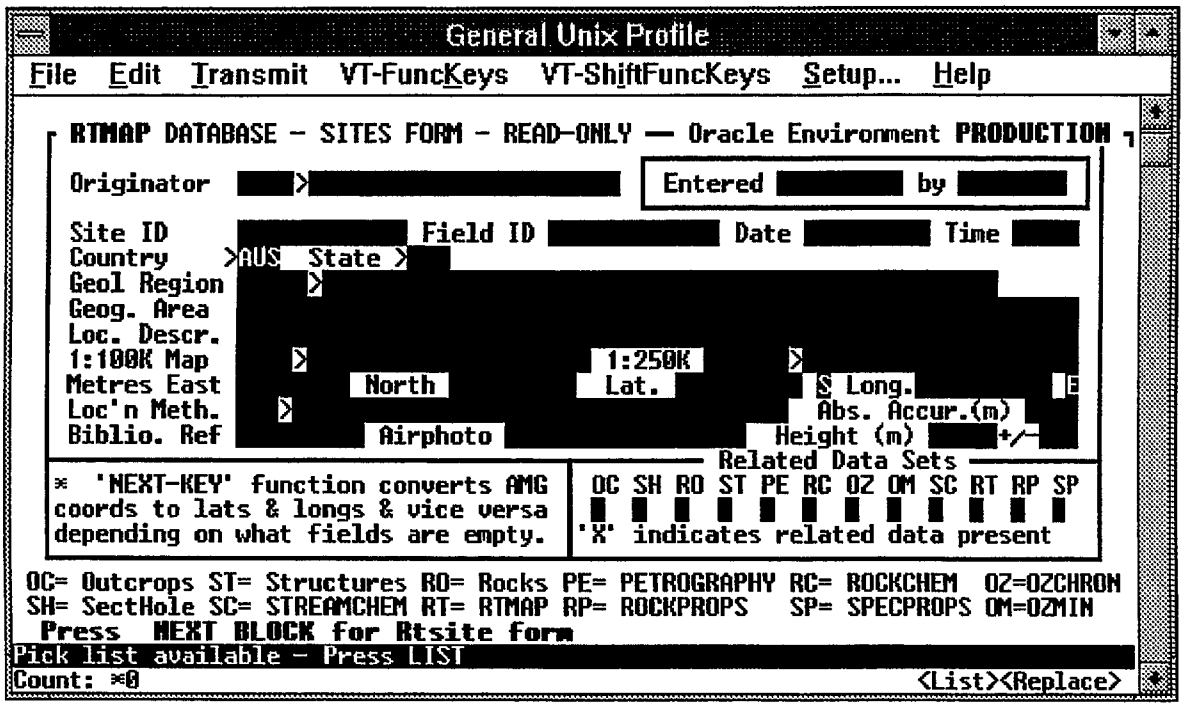

Figure 5. The Sites Database Sites Form.

The Sites Form standardises the recording of geographic point location data in AGSO's field databases. The form accesses the NGMA.SITES table, but also draws on standard terms from associated authority or lookup tables. A series of validation triggers built into the form ensures as much data integrity as possible. The Rtsite Form can be accessed directly from this form by pressing ***NEXT BLOCK***, the current originator number and site ID are then copied automatically into the Rtsite Form.

A 1:100 000 map sheet, geographic coordinates, method of location and accuracy of location method must be entered with each new record. Either AMG eastings and northings or decimal latitude and longitude are suitable geographic coordinates. A form trigger ensures the coordinates fall within the map sheet. The trigger will not detect an incorrect coordinate if it still falls within the given map sheet, however it will pick up gross errors. Mandatory fields record the accuracy of coordinates and the method of location. AMG coordinates can be converted to latitude and longitude and vice versa using the ***NEXT PRIMARY KEY*** key.

In the following field definitions the true database name of each field is given in brackets following the full name used in the form. For space reasons the field names in the forms are often abbreviated.

Originator - (ORIGNO) Mandatory integer of up to 5 digits which automatically retrieves the originator's name from the NGMA.ORIGINATORS table. Only the number of an originator already in the ORIGINATORS table may be entered. A pop-up list of originators and their

numbers may be viewed by pressing the ***LIST*** key. The originator is usually the person or organisation that collected the data at the site, and is also an indication of where to go for more information.

Entered - (ENTRYDATE) Mandatory date field for the date the current record was entered into the SITES table. This field is automatically inserted when the record is first committed. The cursor can be moved into this field only when the form is in query mode.

By - (ENTEREDBY) Mandatory field for the Oracle owner (user name) of the current record. This field is automatically inserted when the record is first committed. The cursor can be moved into this field only when the form is in query mode.

Site ID - (SITEID) Mandatory field of up to 16 characters for a user-supplied number or ID for the site. Any combination of numbers and letters may be used, but the Site ID must be unique to the originator. This is enforced by a unique index across both Originator number and Site ID, and attempts to enter duplicate Site IDs for the same Originator will result in the Oracle error 'duplicate value in index'. AGSO field parties should use the AGSO registered number system.

Field ID - (FIELDID) An optional field of up to 16 characters for an alternative site number or ID. In the past, some AGSO field parties used field numbering systems that were later translated in the office to AGSO registered numbers. The field numbers were marked on the back of airphotos. This field is not indexed and field numbers need not be unique.

Observation Date - (OBSDATE) The date that the field site was visited or observed - in the standard Oracle date format of DD-MMM-YY - e.g. '23-JUL-92'. This will not always be known for old sites, but should always be supplied with new site data.

Observation Time - (OBSTIME) The time that the field site was observed - in Oracle's 24-hour format of HH:MM - e.g. '14:47'. Although often not recorded, this field is essential for gravity and ground spectral measurements.

Country - (COUNTRYID) Mandatory 3 capital characters indicating the country or continent. Defaults to 'AUS' for Australia. Valid capital letters are those in the NGMA.AGSOCOUNTRIES table which can be viewed as a pop-up list. With a few minor additions, the countries and abbreviations used in this table are taken from Australian Standard 2632-1983 (Standards Association of Australia, 1983).

State - (STATE) Two or three capital letters indicating the State in Australia. A validation trigger in the form makes this field mandatory if the Country field is 'AUS' or null if some other country is given. A pop-up list of valid states is available.

Geol Region - (REGNO) An integer of up to 5 digits pointing to the Geological Region in the NGMA.GEOREGIONS authority table. Geological regions are based on Palfreyman's geological provinces (Palfreyman, 1984) and indicate the geographical region in which the field site is located. The bedrock unit at the site, therefore may not necessarily belong to the Geological Province of the same name. A pop-up list of valid geological regions is available. This field must be entered if the country is Australia.

Geographic Area - (GEOGAREA) An optional descriptive field of 64 characters for the geographic area (e.g. - valley, plain, mountain range) the site is in. Examples include 'Hay Plain', 'Tuggeranong Valley' and 'Selwyn Range'. This field is inherited from the old Samples table in the PetChem Database (Ryburn, 1990). It should not be used for the names of geological provinces or features - as has often happened in the past.

Location Description - (LOCDESC) An optional descriptive field of 64 characters for additional information relating to the site's location - e.g., '5 Km SE of Brown's Bore'. This kind of information is an aid to relocating a site in the field.

1:100 000 Map - (HMAPNO) A 4-digit integer identifying the 1:100 000 map sheet-area on which the site falls. Mandatory if the country is Australia, optional if PNG. Enter the map number and the map name is automatically displayed from the NGMA.HMAPS authority table. A pop-up list of valid 1:100 000 map sheets is available. A valid entry will automatically retrieve the corresponding 1:250 000 Map ID. A validation trigger ensures that the sheet number entered lies wholly or partly in the given state.

1:250 000 Map - (QMAPID) The 6-character ID of the 1:250 000 map sheet area on which the site falls - e.g., 'SF5402'. The field is automatically filled in when the 1:100 000 map is entered. The name is displayed from the NGMA.QMAPS authority table, and a pop-up list is available. Note that the first four characters identify the 1:1 000 000 map, and the first two letters in the ID give the 6° UTM zone. Essential if AMG coordinates are given.

Metres East - (EASTING) A 6-digit positive integer for the full AMG easting of the site in metres, but up to two decimal places may be entered (a precision of +/- 1.0 cm on the ground). Mandatory if the country is Australia and a longitude is not entered. A validation trigger ensures that the easting given lies within the given 100 000 map sheet area.

Metres North - (NORTHING) A 7-digit positive integer for the full AMG northing of the site in metres, but up to two decimal places may be entered (a precision of +/- 1.0 cm on the ground). Mandatory if the country is Australia and a latitude is not entered. A validation trigger ensures that the northing given lies within the given 100 000 map sheet area.

Decimal Latitude - (DLAT) A positive numeric field with up to 2 digits in front of the decimal point, and up to 6 digits after the decimal point. All latitudes and longitudes must be entered in decimal degrees and must not be negative. Mandatory if an AMG northing is not entered. A validation trigger ensures that the latitude given lies within the given 100 000 map sheet area.

N/S - (NS) A single-character field that can only take the values 'N' or 'S' and is only enterable if the Country ID does not equal Australia. The value in this field is automatically set to a capital 'S' when a latitude is entered. However if the latitude has been calculated from the AMG Northing then the default will be a lower case 's'. This field is needed because the SITES table has provision for locations in the northern hemisphere.

Decimal Longitude - (DLONG) A positive numeric field with up to 3 digits in front of the decimal point and up to 6 digits after the decimal point. Mandatory if an AMG easting is not entered. A validation trigger ensures that the longitude given lies within the given 100 000 map sheet area.

E/W - (EW) A single-character field that can only take the values 'E' or 'W' and is only enterable if the Country ID does not equal Australia. The value in this field is automatically set to a capital 'E' when a latitude is entered. However if the latitude has been calculated from the AMG Northing then the default will be a lower case 'e'.

Location Method - (LOCMETHOD) A mandatory integer of up to 3 digits pointing to a record in the NGMA.LOCMETHODS table showing the method used to obtain the geographic coordinates of the site. In most cases an entry in this field will automatically insert a default estimate in the Absolute Accuracy field. If a standard series map is indicated it is assumed that the map used was the most up-to-date edition at the time the observation was made. The current standard series maps use the AMG-66 spheroid. If this is not the case then a specific map, report or publication can be referenced via the Bibliographic Reference field. A pop-up list of location methods is available. The LOCMETHODS table currently has the following entries -

Number	Description	Default Accuracy (+/-m)
0	unknown	50
1	GPS observation (WGS-84)	50
2	GPS observation (AMG-66)	50
3	GPS observation (AMG-84)	50
4	GPS observation (GDA-92)	50
5	astronomical observation	
6	surveyed from ground control	
7	published report	
8	unpublished report	
10	non-standard topographic map	
11	1:25 000 topographic map	25
12	1:50 000 topographic map	50
13	1:100 000 topographic map	100
14	1:250 000 topographic map	250
15	1:500 000 topographic map	500
16	1:1 000 000 topographic map	1000
20	non-standard geological map	
21	1:25 000 geological map	25
22	1:50 000 geological map	50
23	1:100 000 geological map	100
24	1:250 000 geological map	250
25	1:500 000 geological map	500
26	1:1 000 000 geological map	1000

Absolute Accuracy in metres - (ACCURACY) A mandatory field for the absolute accuracy of the given coordinates in metres on the ground. For example, points measured on a map at 1:100 000 scale are generally accurate to 1 mm on the face of the map or 100 metres on the ground. Estimates like this are automatically entered by the trigger in the Location Method field, but these may be refined by the user. This field is important for assessing whether a point in the SITES table can be plotted at particular scales - it provides the table with a degree of scale independence. GPS

measurements include accuracy figures and the map spheroid used should always be specified via the location method field.

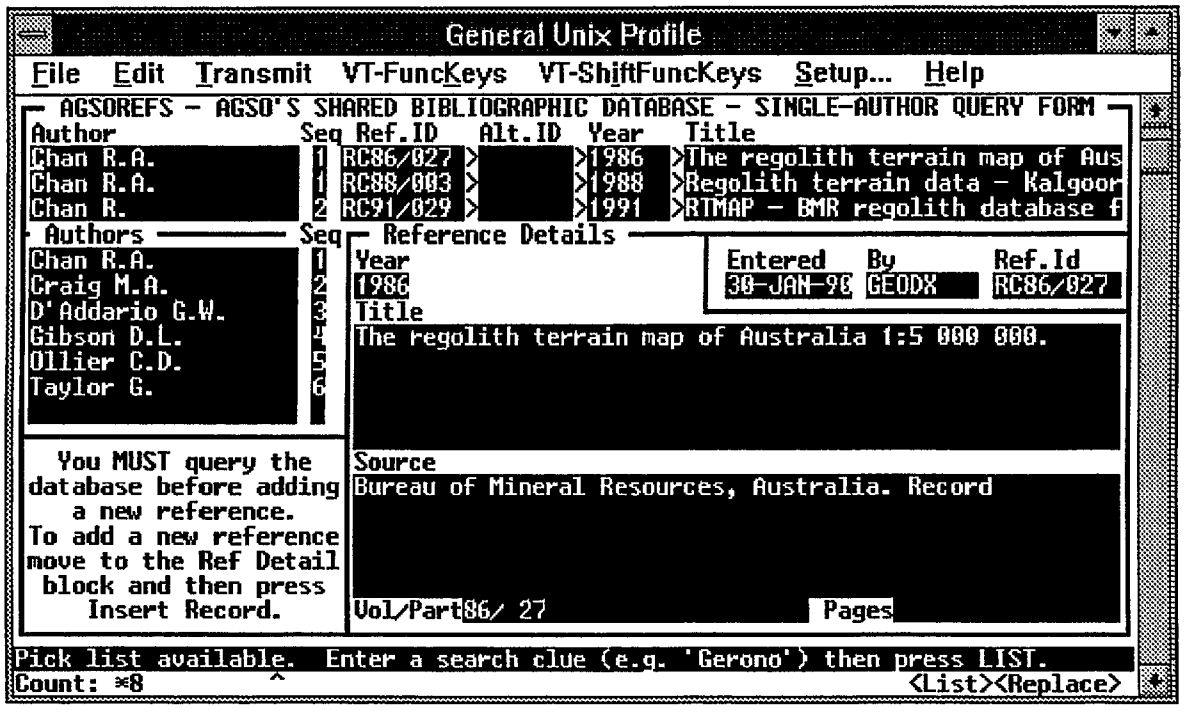

Figure 6. The AGSOREFS Single Author Query Form. This form must be queried before a new reference can be added. If the new reference is not returned by the query then it may be added by moving to the Reference Details block and pressing ***INSERT RECORD***. This form is accessed from the menu, the Bibref field in the Sites Form or the References block In the Unit Form.

Bibliographic Reference - (BIBREF) A 9-character field for the ID of a bibliographic reference in AGSO's Shared Bibliographic Reference Database (Ryburn, et al, 1995), AGSOREFS, that locates or refers to the site. The reference could be a locality diagram in a publication, a non-standard published map or a map from a PhD thesis or company report. This field is provided principally as a means of recording the lineage or provenance of data that has come from another source. Note that almost any map can be treated as a bibliographic reference using the standard 'Harvard-style' of reference notation. The GEODX IDs in AGSO's Reference Database are various - e.g. '79/20055', 'R156''GOLD239'. IDs of user-entered references are always a number with a '*' prefix - e.g. '*2156'. Available references can be accessed by pressing ***LIST VALUES***. This will display the Single-Author Query Form (Figure 6). If the reference is not returned by the query it may be added as a new reference by moving to the Reference Details block and pressing ***INSERT RECORD***. Full details on adding references to AGSO's Shared Bibliographic Database can be found in Ryburn, et al, 1995.

Airphoto - (AIRPHOTO) An optional field of 36 characters to identify the airphoto on which the site is located and/or was plotted. The field is for the name of the airphoto series, the run number and the photo number - e.g. 'Cloncurry 8/2134'. It is not intended to be a comprehensive reference

to a major airphoto database, as this is beyond any reasonable AGSO role at present. AGSO geologists often wish to re-locate and re-inspect airphotos on which sites occur.

Elevation in metres - (HEIGHT) An integer with up to 5 digits for the elevation of the site in metres above mean sea level. Can be negative. This information is not generally recorded, but it is essential for some purposes - e.g., gravity readings. The field is also needed for subsurface mine information and for cliff sections through subhorizontal strata.

Elevation accuracy - (HEIGHTACC) A positive integer of up to 3 digits for the absolute error in metres of the height entered in the previous field.

Related Data Sets - (OC, SH, RO, ST, MS, PE, RC, OZ, OM, SC, RT, RP, SP) Twelve single character fields that show what data sets join to the site. Only two values are allowed, null or capital 'X' - the 'X ' being placed in all fields with related data sets. The fields are as follows -

ID	Related Data Set
OC	OUTCROPS TABLE - Outcrop information
SH	SECTHOLES - Measured sections database
RO	ROCKS TABLE - Lithology and sample information
ST	STRUCTURE - Structural geology observations
MS	MEASURED SECTIONS AND DRILL HOLES
PE	PETROGRAPHY - Thin section database
RC	ROCKCHEM - Whole rock chemistry database
OZ	OZCHRON - Geochronology database
OM	OZMIN - Mineral deposits database
SC	STREAMCHEM - Geochemical database
RT	RTMAP - Regolith landform database
RP	ROCKPROPS - Geophysical properties database
SP	SPECPROPS - Spectral properties database

6 - THE RTSITE FORM

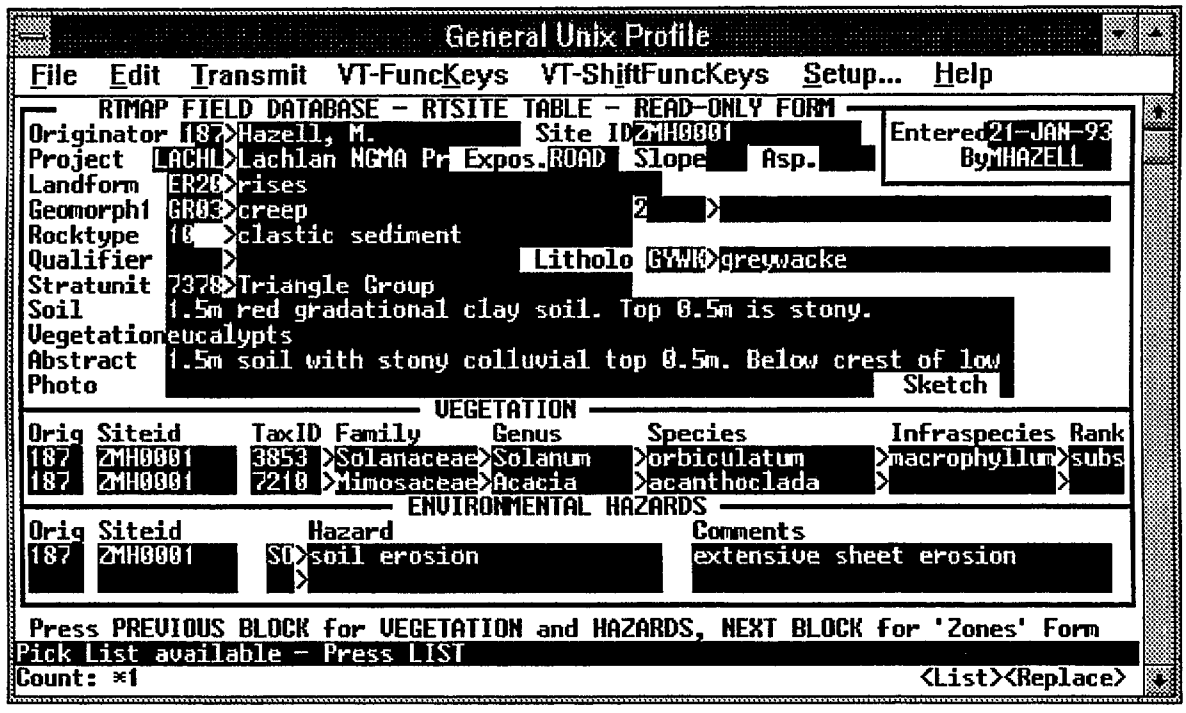

Figure 6. The Rtsite Form.

The Rtsite Form accesses the RTMAP.RTSITE table, the RTMAP.AUSVEG_RTSITE table and the RTMAP.HAZ_RTSITE table. It also draws on standard terms from authority or lookup tables. The RTSITE table records descriptive information about a single site. Therefore there is only one RTSITE record for each SITE record and a trigger ensures that a site record exists before a corresponding record can be entered into the RTSITE table. All features concerning a site should be summarised in this form. Users can proceed directly to the Zones Form by pressing ***NEXT BLOCK***.

The Vegetation Species and Environmental Hazards tables have a many-to-one relationship with the RSITE table allowing all the vegetation species and environmental hazards particular to a site to be recorded. These blocks can be accessed from the Rtsite block by pressing ***PREVIOUS BLOCK***, the originator number and site ID will then be copied automatically into these blocks from the Rtsite block. Users can proceed from either of these blocks directly to the Zones form by pressing ***NEXT BLOCK***.

Block 1 - Rtsite (RTSITE table)

Originator - (ORIGNO) As for the Sites Form.

Site ID - (SITEID) As for the Sites Form. A trigger ensures that only Originator-Site ID combinations that are already in the NGMA.SITES table can be entered.

Entered - (ENTRYDATE) As for the Sites Form.

By - (ENTEREDBY) As for the Sites Form.

Project - (PROJECT) A mandatory field for a 5-character abbreviation of the project name. Only project codes already in the RTMAP.PROJECT authority table may be entered. Project abbreviations used so far are -

Code	Project
KALG	Kalgoorlie 1:1 million Regolith Landform Map.
N.QLD	National Geoscience Mapping Accord North Queensland project.
LACHL	National Geoscience Mapping Accord Lachlan Foldbelt project.
WAGGA	Wagga Wagga 100 K Project.
SWBTA	Shoalwater Bay.
ARNH	Arnhem Land NGMA Project.
EGF	Eastern Goldfields NGMA Project.
KIM-A	Kimberly-Arunta NGMA Project.
LQAD	Liverpool Plains Aeolian Dust Project.

Exposure type - (EXPTYPE) A mandatory field of up to 5 characters for the type of exposure from which the site has been described. Only exposure types already in the RTMAP.EXPTYPES authority table can be entered. A pop-up list is available. Valid exposure types are -

Code	Exposure
AUGER	Auger hole (soil/otherwise)
CANAL	Canal
CLIFF	Cliff
CORE	Core
COST	Costean
CUTTI	Cuttings
DAM	Dam
FLOAT	Float
GRAVE	Gravel scrape
GULLY	Gully (for gullies/washouts)
MINE	Mine
OUTCR	Outcrop

PROSP	Prospect
QUARR	Quarry
RAILW	Railway
ROAD	Road/highway cutting
RUBBL	Rubble
SOIL	Soil
STREA	Stream (for creeks/rivers)
SURF	Surface
TRENC	Trench

Slope - (SLOPE) This is an optional two-digit integer for the slope angle at the site in degrees. Only numbers between 0 and 90 degrees can be entered.

Aspect - (ASPECT) This is an optional three-digit integer for the aspect of the site in degrees from magnetic north. Only numbers between 0 and 360 degrees can be entered.

Landform - (L_CODE) A mandatory four-character code for the landform in which the site is located. Only landforms already in the RTMAP.LANDFORMS authority table may be entered. A pop-up list is available.

Geomorphic Process 1 - (GP_CODE1) An optional 4-character field for the main geomorphic process at the site. Only geomorphic processes already in the RTMAP.GPROC authority table can be entered. A pop-up list is available.

Geomorphic Process 2 - (GP_CODE2) As for Geomorphic Process 1, but secondary geomorphic process.

Rock type - (ROCKNO) An optional one or two-digit integer that identifies the basic rock type at the site. This field is designed for a first pass coarse classification of rock types. Only rock types currently in the NGMA.ROCKTYPES authority table can be entered. A pop-up list is available. Currently the table looks like this -

No.	Rock type	No.	Rock type
1	unknown	10	clastic sediment
2	felsic intrusive	11	chemical sediment
3	intermediate intrusive	12	metabasite
4	mafic intrusive	13	felsic gneiss
5	felsic extrusive	14	metasediment
6	intermediate extrusive	15	metasomatite
7	mafic extrusive	16	ore
8	ultramafite		
9	alkaline igneous		

Lithology Qualifier - (QUALIFIER) A two or three-character code for any qualifying term before the lithology name which follows. The qualifying term provides an additional descriptive term for the lithology name. A pop-up list is available.

Lithology name - (LITHID) A field of up to 4 characters for the bedrock lithology name. Only names already in the NGMA.LITHNAMES authority table may be entered. A pop-up list is available.

Bedrock Stratigraphic Name - (STRATNO) An optional five-digit integer for the stratigraphic name of bedrock at the site. Only stratigraphic units already in the STRATA.STRATLEX authority table can be entered. A pop-up list is available.

Soil - (SOIL) An optional 240-character free-text field for describing the soil at the site. The amount of soil information that can be entered will depend to a large extent on the observer. Those with knowledge of soil classification (e.g. Northcote Key, Great Soil Groups, or the new Australian Soil Taxonomy) should use these. Others should note only the main morphological features of the soil.

Vegetation - (VEG) An optional field which can be used for a general description of the vegetation characteristics at a site. This field will accept either a code from the Quaternary Database's Vegetation Types table or up to 240 characters of free text. If a valid code from the Quaternary Database's Vegetation Types Table is entered then the form will insert the full vegetation description belonging to the code into this field. A pop-up list from the Quaternary Databases Vegetation Types table is available.

Abstract - (ABST) A 255-character field for a summary description of the site, including brief comments about the zones. This field is not mandatory but it should be completed in all cases, as retrieval of abstracts from the database provide quick summaries of the major features of the different sites.

Photos - (PHOTO) An optional 240-character field for details of photos taken at the site. If this field is too short for recording all photographic information extra information can be recorded in the RTMAP.ZONEDATA table which has the datatype PHO for photographic information.

Sketch - (SKETCH) Enter a Y here if a sketch was made of the site in the field book, or no if not. In the near future it will be possible to record sketches digitally and have them displayed with each database record.

Block 2 - Vegetation Species (AUSVEG_RTSITE table)

This block enables individual vegetation species to be recorded by their correct taxonomical name. Only users with a good knowledge of correct vegetation species names should use this table, all others should place their vegetation comments in the free-text field of the Rtsite Block. The Vegetation Species Block displays Taxonomic ID, Family name, Genus name, Species name, Infraspecies name and Infraspecies rank. Only the Taxonomic ID and the Species name field are

enterable in data entry mode, however queries can be performed on all fields in the block when in query mode.

Tax ID - (TAXON_ID) This integer of up to five digits is unique to a particular species. The family, genus, species names will be displayed, and the infraspecies name and rank if applicable, in the adjoining fields. Only vegetation species already in the RTMAP.AUSVEG authority table may be entered. A pop-up list is available however, due to the large size of the authority table response time is slow. It is recommended that users list the authority table from the species field which is much quicker if the first few letters of the species name are entered first.

Species name - (SPECIES) A 20-character field for the species name. Only names already in the AUSVEG authority table may entered. A pop-up list is available which can be greatly speeded up by entering the first few letters of the species name prior to pressing the ***LIST VALUES*** key.

Block 3 - Environmental Hazards (HAZ_RTSITE table)

Hazard - (H_CODE) A two character code describing any environmental hazards at the site. Only hazards already in the RTMAP.HAZARDS table may be entered. A pop-up list is available.

Comments - (H_COMM) A 30-character free-text field for additional comments on each environmental hazard.

7 - ZONES AND SAMPLES FORM

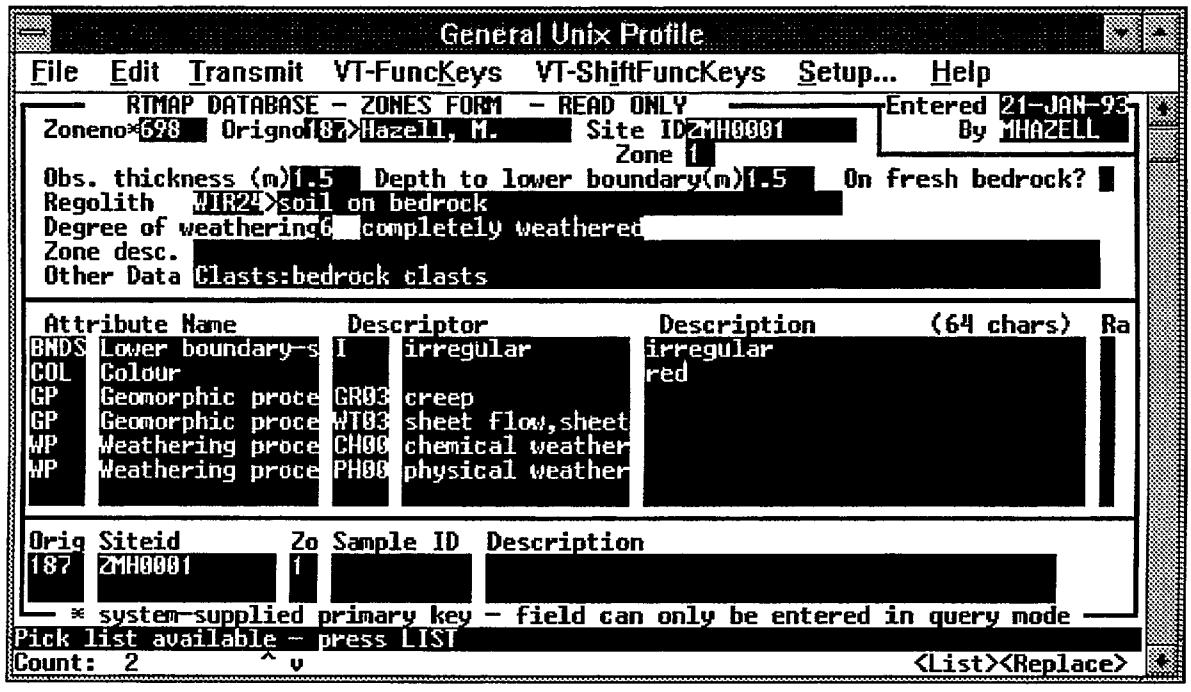

Figure 7. The Zones, Zonedata and Samples Form.

The Zones, Zonedata and Samples Form is for data on zones and samples, if any, taken at a site. The ZONES table has a many-to-one relationship with the RTSITE table as there can be many regolith zones at any one site. A zone is any package of regolith that can be described as a separate entity. The scale of zone descriptions may vary depending on the detail required. For example a package of alluvial sediment can be described as a single zone, or the individual layers within the sediment could be described as individual zones. Zones may be arranged vertically in a profile or they may be situated laterally to each other. The ZONEDATA table has a many-to-one relationship with the ZONES table. It functions as an extendable attributes table and as many attributes as needed can be entered.

The Samples table is linked to the Zones table to keep the relationship between each sample and the zone it belongs to. All samples taken must have a corresponding zone description in the Zones table.

Block 1 - Zones (ZONES table)

Zoneno - (ZONENO) This integer is the primary key for the ZONES table and links the ZONES table to the ZONEDATA table. The Zoneno is generated by the system when the record is committed. The field can only be entered in query mode.

Originator - (ORIGNO) As for the Sites Form.

Site ID - (SITEID) As for the Sites Form. A trigger ensures that only Originator-Site ID combinations that are already in the NGMA.SITES table can be entered.

Entered - (ENTRYDATE) As for the Sites Form.

By - (ENTEREDBY) As for the Sites Form.

Zone Number - (Z_NO) The zone number is a mandatory 2-digit number in the format 1, 2, 3 etc.,. If zones are arranged vertically then the zone numbering commences from the zone nearest the surface and increases with depth. When zones are situated laterally they should be numbered in order of increasing relative age, if this can be determined. In the latter case, a sketch showing the relationships should be provided in the notebook.

Thickness - (THICKNESS) A mandatory number field for the average thickness of the zone in metres. If the lower boundary of the zone cannot be seen then the observed average thickness should be recorded. Leaving the following depth field null indicates that the lower boundary of the zone was not observed. Up to three digits are allowed before and two digits after the decimal point so that thicknesses can be recorded to the nearest centimetre.

Depth to lower boundary - (DEPTH) An optional number field for the depth below the ground surface of the lower boundary of the zone in metres. If the lower boundary of the zone was not observed this should be left null. Up to three digits are allowed before and two digits after the decimal point so that thicknesses can be recorded to the nearest centimetre.

Bedrock - (BEDROCK) Enter a 'Y' if there is fresh bedrock immediately below this zone. As fresh bedrock would not be recorded as a zone this field allows the observer to indicate that there is fresh bedrock immediately below this zone. If the base of the last described regolith zone cannot be seen then a 'N' should be entered into this field.

Regolith - (REGT_CODE) A mandatory code for the main regolith type in the zone is entered in this field. The full name of the regolith type will then be displayed in the adjoining field. Only regolith codes already in the RTMAP.REGTYPE table can be entered. A pop-up list is available.

Degree of weathering - (REGT_WEATH) An optional single positive integer for the degree of weathering of the regolith type. If a regolith type displays a range of degrees of weathering then the dominant degree of weathering must be recorded here, any subsidiary degrees of weathering can be recorded in the ZONEDATA table. A pop-up list of valid codes is available. Current codes are listed below -

Code	Degree of Weathering
0	unknown
1	unweathered
2	slightly weathered
3	moderately weathered
4	highly weathered
5	very highly weathered
6	completely weathered

Zone description - (Z_COMMS) An optional 240-character field for comments on the zone which cannot be placed elsewhere.

Other data - (OTHERS) An additional 240-character text field. This field is a carry over from the old structure of the database and should only be used if absolutely necessary.

Block 2 - Zonedata (ZONEDATA table)

Records in the ZONEDATA table are linked with their parent record in the ZONE table via the Zoneno.

The Zonedata block allows a range of additional attributes to be recorded as needed. The attributes and descriptors are selected from the REGDATATYPES view, which is a union of the RTMAP.ZONEDATATYPES, NGMA.LITHDATATYPES and NGMA.AGSOMINERALS tables. If further attributes are required for these tables see the custodians listed below -

Table name	Custodian
RTMAP.ZONEDATATYPES	Colin Pain
NGMA.LITHDATATYPES	Peter Stuart-Smith
NGMA.AGSOMINERALS	Morrie Duggan

Attribute - (DATATYPE) A mandatory field of up to 4 characters identifying an attribute from the RTMAP.REGDATATYPES view. The attribute name is automatically displayed in the next field. The same attribute may be used more than once. A pop-up list is available. The REGDATATYPES view currently has the following attributes -

Abbrev.	Attribute Name	Abbrev.	Attribute Name
ALT	Alteration	MTX	Metamorphic Texture
BED	Bedding Thickness	PHO	Photodata
BNDS	Lower boundary-shape	RAD	Gamma Ray Spectrometry (cps)
BNDT	Lower boundary-type	REM	Remarks

BST	Bedrock structures	SEGA	Segregations-abundance
CFD	Coarse fragments	SEGC	Segregations-composition
CM	Common Mineral	SEGS	Segregations-size
COH	Coherence	SEGT	Segregations-type
COL	Colour	SEQ	Sequence Types
FOS	Fossil	SOR	Sorting
GP	Geomorphic processes	SP	Sample Provenance
GS	Grain Size	SPH	Sphericity
IN	Induration	SS	Sedimentary Structures
IS	Internal Stratification	ST	Sample Type
ITX	Igneous Texture	STX	Sedimentary Texture
MAG	Magnetic sus. (SI Units x 10-5)	TEC	Tectonic Features
MET	Metamorphic Grade	WEA	Weathering
MI	Mineral	WP	Weathering processes
MOTA	Mottles-abundance		
MOTS	Mottles-size		

Descriptor - (SUBTYPE) An optional field for an abbreviation of up to 4 characters which identifies an attribute descriptor from the REGDATATYPES view. A pop-up list is available for the attribute already entered. For example the Datatype "Lower boundary-type" currently has the following descriptors -

Abbrev.	**Datatype name**	**Abbrev.**	**Subtype Name**
BNDT	Lower boundary-type	A	abrupt
BNDT	Lower boundary-type	C	clear
BNDT	Lower boundary-type	D	diffuse
BNDT	Lower boundary-type	G	gradual
BNDT	Lower boundary-type	SH	sharp

The colour datatype (COL) offers a list of qualitative colour descriptors which are only of value for describing colours at a very general level. Munsell colours should be used for precise quantitative descriptions. The Munsell colour notation should be recorded in the free-text description field.

Description - (DESCRIPTION) An optional free-text field of 64 characters for descriptor values or any additional information relating to the Data Type/Subtype record. Though this field is free-text, values for instrument reading should be recorded as numbers only. This allows them to be easily retrieved for use in GIS. For example values for magnetic susceptibility or gamma-ray counts should be entered without any units or comments. The default units for magnetic susceptibility are S.I. units x 10^{-5} and for gamma-ray counts, counts per second. Additional comments, if any, relating to the readings should be recorded as a separate record using the comments datatype.

Rank - (RANK) An optional single-integer field for a number from 1 to 9. When a particular Data Type is used more than once the corresponding subtypes can be ranked in order of importance or dominance at the site. This is useful when interrogating the data with a GIS as it provides users with a method of identifying and displaying only the dominant subtype in a group of identical

datatypes. For example if more than one form of induration occurs within a zone then the various induration types can be ranked according to their dominance as in the following example -

Attribute		Descriptor	Rank
IN	induration	DC40 ferricrete	1
IN	induration	DM20 calcareous	2
IN	induration	DC62 silcrete pods	3

Block 3 - Samples (SAMPLE table)

Information on field samples taken are recorded in the RTMAP.SAMPLE table. This table links regolith site and zone information to geochemical analyses and dating information in the Rockchem and Ozchron Databases respectively.

Originator - (ORIGNO) As for the Sites Form.

Site ID - (SITEID) As for the Sites Form. A trigger ensures that only Originator-Site ID combinations that are already in the NGMA.SITES table can be entered.

Zone - (Z_NO) As for the Zones Block.

Sample ID - (SAMPLEID) AGSO users should only use AGSO registered numbers. AGSO registered numbers start with two numbers for the year, then two numbers for the project or group and then four numbers from 0001 to 9999, e.g., 94990123. It is current practice to use AGSO registered numbers as field site IDs and add successive capital letter suffixes to the registered number for any samples that were collected at the site. This method allows the connection between the samples and the field site ID to be easily recognised.

Description - (SAMP_DESC) A 40-character field for describing the sample or the reason for collecting the sample.

8 - THE UNIT FORM

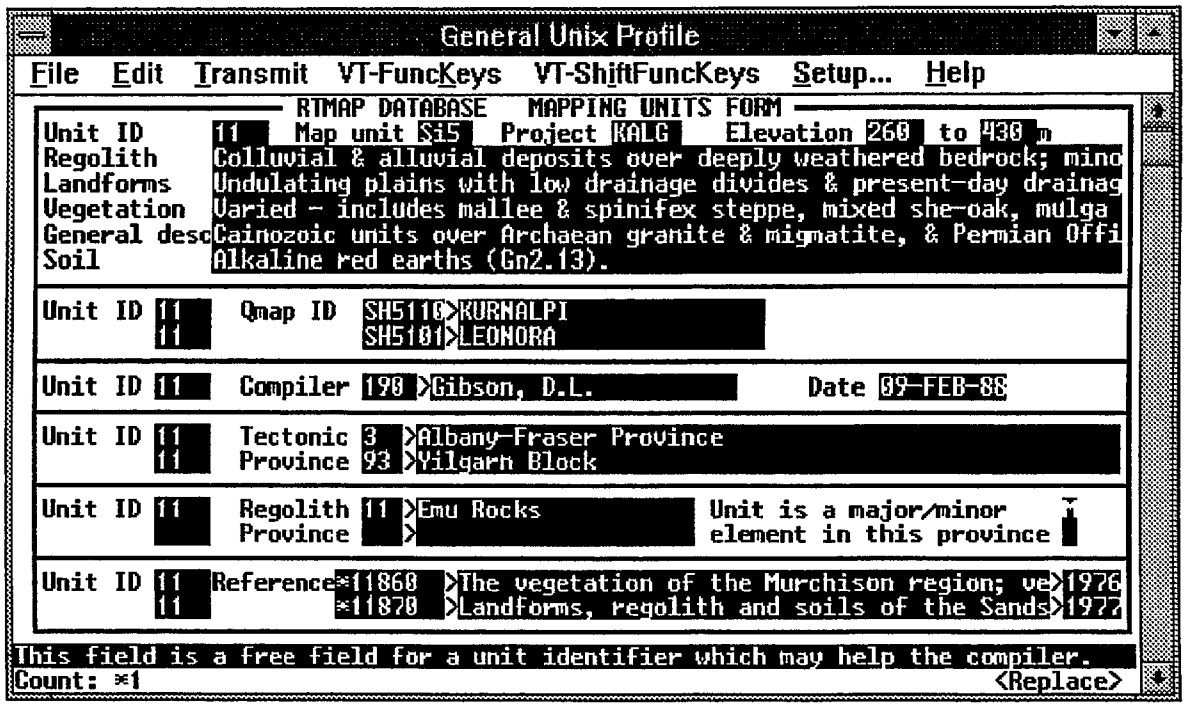

Figure 8. Screen 1 of the RTMAP Database Mapping Units Form.

The Unit Form records a range of attributes which describe regolith landform mapping units. The main tables which describe mapping units are UNIT, LANDF_UNIT and REGT_LANDF. The LANDF_UNIT table has a many-to-one relationship with the UNIT table and the REGT_LANDF table has a many-to-one relationship with the LANDF_UNIT table, reflecting the fact that a single regolith landform mapping unit may contain more than one landform and each landform may contain more than one regolith type. Other tables also have many-to-one relationships with each of these tables. The Unit Form has three screens each divided into several blocks. Data is entered into each block and then the ***NEXT BLOCK*** key pushed to move the cursor to the next block.

Block 1 - General Mapping Unit descriptions (UNIT table)

Block 1 contains fields for summarising the regolith, landforms, vegetation and soils for the whole mapping unit. The data in this block is a single record and is entered once only for each mapping unit. All following blocks have many-to-one relationships to the Unit block.

Unit ID - (U_ID) The Unit ID is a unique identifying number for each mapping unit description. Data which are spread across several tables in the database are linked by this key. The field is not

enterable, except in query mode. The form will automatically generate a sequential number when a new record is committed.

Map unit - (MAP_UNIT) This is an optional free-text field of up to 4 characters. Any combination of characters or numbers which may be useful to the map compiler during map compilation may be entered in this field.

Project - (PROJECT) A mandatory 5-character field for an abbreviation of the project name. The project codes used here are the same as those used in the RTSITE table. See the description of the RTSITE form for the current project codes. A pop-up list is available.

Elevation - (ELEV1 and ELEV2) Two fields for the minimum and maximum elevations, above sea level, of the mapping unit, in metres.

Regolith and Landform description - (REGOLITH AND TERRAIN) Two 255-character free-text fields for summary descriptions of landforms and regolith within the unit as a whole.

Vegetation description - (VEGETATION) 240-character free-text field for a summary description of the vegetation within the unit.

General Unit description - (U_COMMS) 240-character free-text field for any comments about the unit which cannot be entered elsewhere in the database.

Soils Comments - (SOIL) 240-character free-text field for summary information, at a general unit level, on the soil. If the information about soils is detailed enough, relate the soil type to the landform unit by using the soil field on the landform block. The amount of soil information that can be entered will depend to a large extent on the observer. Those with knowledge of soil classification (e.g. Northcote Key, Great Soil Groups, or the new Australian Soil Taxonomy) should use these. Others should note only the main morphological features of the soil.

Block 2 - 1:250 000 maps (MAPS_UNIT Table)

This is a multi-record block for recording all the 1:250 000 map sheets on which a unit occurs.

Qmap ID - (M_CODE) Standard 1:250 000 sheet numbers are entered in this field as 6-character codes. The full map name will then be displayed in the adjoining field. Data entry into this block is controlled by the NGMA.QMAPS authority table. A pop-up list of maps is available.

Block 3 - Compilers' names and dates (ORIGNO_UNIT Table)

A multi-record block for recording the compilers of the mapping unit description, and the date the unit was compiled.

Compiler's name - (ORIGNO) An integer field of up to 3 digits for the originators' numbers. Only codes already in the NGMA.ORIGINATORS Table can be entered. A pop-up list is available.

Date - (ODATE) The date field defaults to the system date. It can be altered if required by overwriting it.

Block 4 - Geological Provinces (GEOPROV_UNIT Table)

A multi-record block for recording the geological provinces in which the unit occurs.

Geological province code - (GEOPROVNO) Enter the number codes for geological provinces where the unit occurs. Only provinces in the STRATA.GEOPROVS Table and ranked 1 can be entered. A pop-up list is available.

Block 5 - Regolith Landform Provinces (PROV_UNIT Table)

A multi-record block for recording the Regolith Landform Provinces in which the unit occurs. Regolith Landform provinces have often not been decided on at the time mapping unit data is being entered into the database, and therefore will need to be entered at a later date.

Province name - (P_CODE) Enter the codes for Regolith Landform Provinces, of which the unit is a part. Only Regolith Landform Provinces listed in the RTMAP.PROVS table can be entered. A pop-up list is available.

Major/Subordinate - (MM_CODE) A single-character field for either an upper case M or S, signifying Major or Subordinate respectively. This code indicates if the unit is a major or subordinate component of the Regolith Landform Province.

Block 6 - References (REFS_UNIT Table)

This block is provided as a means of referencing data sources used in the compilation of the unit description.

Bibliographic Reference - (BIBREF) A 9 character field for the ID of a bibliographic reference in AGSO's Shared Bibliographic Reference Database (Ryburn, et al, 1995). The reference could be a publication, a PhD thesis a company report or a published map. Note that almost any map can be treated as a bibliographic reference using the standard 'Harvard-style' of reference notation. The GEODX IDs in AGSO's Reference Database are various - e.g. '79/20055', 'R156''GOLD239'. IDs of user-entered references are always a number with a '*' prefix - e.g. '*2156'. Available references can be accessed by pressing ***LIST VALUES***. This will display the Single-Author Query Form (Figure 6). If the reference is not returned by the query then it may be added, as a new reference, by moving to the Reference Details block and pressing ***INSERT RECORD***. Full details on adding references to AGSO's Shared Bibliographic Database can be found in Ryburn, et al, 1995.

The title and year of publication are displayed in the next two fields of the References Block when a reference ID has been entered.

LANDFORM INFORMATION

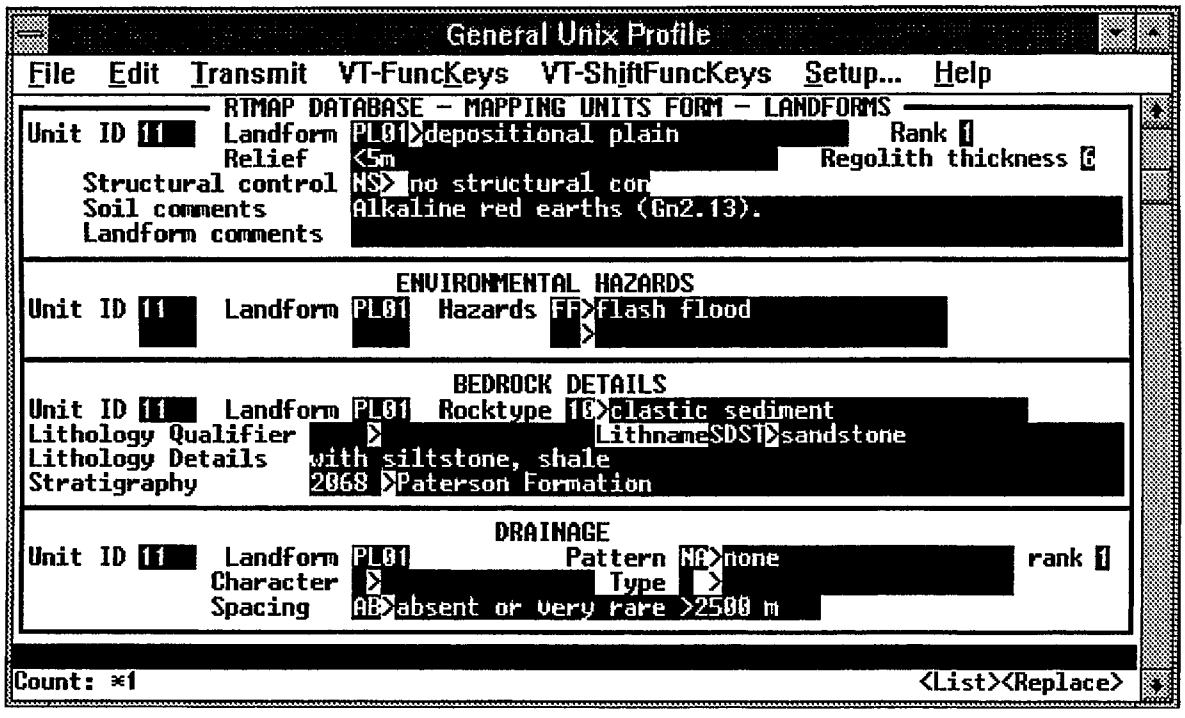

Figure 9. Screen 2 of the RTMAP Database Mapping Units Form.

Landforms are the major subdivision of a Regolith Landform Unit. A Regolith Landform Unit may be comprised of a single landform or it may have many. The top block of screen 2 of the RTMAP Database Mapping Units Form records the landform name and information relating to that landform. This block is attached to the LANDF_UNIT table. All blocks following this block describe further attributes which have a many-to-one relationship to the landform. These blocks are attached to the tables HAZ_LANDF, LITH_LANDF, DRAIN_LANDF, GPROC_LANDF, WPROC_LANDF and REGT_LANDF. All the attributes for each landform should be completed before commencing the description of the next landform.

Block 7 - Landforms (LANDF_UNIT Table)

Unit ID - (LANDF_UNIT.U_ID) The unit ID is automatically copied into this field from the unit block. This field is only enterable in query mode.

Landform - (L_CODE) This is a mandatory 4-character code. The full name of the landform is displayed in the adjoining field. Only landforms already in the RTMAP.LANDF table can be entered. A pop-up list is available.

Rank - (MM_CODE) A mandatory field. A single integer from 1 to 9 is entered in this field to indicate the relative importance of each landform within the Regolith Landform Unit. Ranking allows the dominant landform type in a mapping unit to be easily identified and retrieved. Maps of the main regolith and landforms can easily be generated when this field is filled. Always make sure the most common landform within a unit is equal to number 1.

Relief - (RELIEF) An optional 30-character field for the average relief, ie the difference in elevation between the highest and lowest parts of the landform. (This should not be confused with elevation, which is absolute height above sea level). Relief information must be recorded in metres.

Regolith Thickness - (REGT_TKNS) An optional single-integer field which indicates the probable maximum thickness of regolith in the landform. Regolith thickness over an entire landform is obviously impossible to determine, and usually varies dramatically, therefore this field gives a general indication of regolith thickness only. An arbitrary value of 2 m is used to distinguish between bedrock dominated landforms and weathering or sediment dominated landforms. Thus deep weathering is considered to be greater than 2 m. A code indicating regolith thickness can be selected from the RTMAP.ZONEDATATYPES table. A pop-up list is available. The following is a list of the available thickness codes -

Code	Thickness
0	unknown
1	< 0.5 m
2	< 2 m
3	> 2 m
4	> 5 m
5	> 15 m
6	> 50 m

Structural Controls - (STRUCT_CNTL) If any structural influence can be determined in the landform enter the relevant code in this field. Only codes already in the RTMAP.STCNTRL authority table may be used. A pop-up list is available.

Soil Comments - (SOIL) An optional 240-character free-text field. Use this field if the soil information can be related to the landform otherwise use the soil field in the unit block. The amount of soil information that can be entered will depend to a large extent on the observer. Those with knowledge of soil classification (e.g. Northcote Key, Great Soil Groups, or the new Australian Soil Taxonomy) should use these. Others should note only the main morphological features of the soil.

Comments on the Landform - (L_COMMS) An optional 240-character free-text field for describing features belonging to this landform. This could include depth and degree of dissection, if appropriate. This field can also be used for further describing any environmental hazards noted in the hazards block.

The following blocks have a many-to-one relationship with the landform. For each landform, complete each block as many times as necessary to cover the range of attributes.

Block 8 - Environmental Hazards (HAZ_LANDF Table)

Unit ID - (U_ID) The Unit ID is copied automatically from the Landform Block into this field and into all Unit ID fields in the following blocks. These fields are only enterable in query mode.

Landform Code (L_CODE) The landform code is copied automatically from the Landform Block into this field and into all Landform Code fields in the following blocks. These fields are only enterable in query mode.

Environmental hazards - (H_CODE) A 2-character code which refers to any environmental hazards to which the landform is susceptible. Only codes already in the RTMAP.HAZARDS table may be entered. A pop-up list is available.

Block 9 - Bedrock Details(LITH_LANDF table)

The fields in this block describe the bedrock underlying the landform. Only one record is displayed at a time, however pressing the ***NEXT RECORD*** key will step the user through all the lithology records belonging to the landform displayed in the Landform block.

Unit ID - As above.

Landform Code - As above

Rock type - (ROCKNO) A mandatory 1 or 2-digit integer that identifies the basic rock type. It serves as a first pass coarse classification of the bedrock lithology. Only rock types currently in the NGMA.ROCKTYPES authority table can be entered. A pop-up list is available. Currently the table looks like this -

No.	Rock type	No.	Rock type
1	unknown	9	alkaline igneous
2	felsic intrusive	10	clastic sediment
3	intermediate intrusive	11	chemical sediment
4	mafic intrusive	12	metabasite
5	felsic extrusive	13	felsic gniess
6	intermediate extrusive	14	metasediment
7	mafic extrusive	15	metasomatite
8	ultramafite	16	ore

Lithology Qualifier - (QUALIFIER) An optional 2 or 3-character code for any qualifying term before the Lithology Name which follows. The qualifying term must be in the

NGMA.LITHNAMES authority table. A pop-up list is available. The qualifying term provides an additional descriptive term for the lithology name.

Lithology name - (LITHID) An optional code of up to 4-characters identifying the lithology name. Only names already in the NGMA.LITHNAMES authority table may be entered. A pop-up list is available.

Lithology Details - (LI_COMM) An optional 30-character field which can be used for any comments about the bedrock.

Stratigraphic Unit - (STRATNO) An optional 5-digit integer for the stratigraphic name of bedrock at the site. Only stratigraphic units already in STRATA.STRATLEX authority table can be entered. A pop-up list is available.

Block 10 - Drainage (DRAIN_LANDF table)

The fields in this block describe the pattern, character, type and stream spacing of the drainage in the landform. Only one record is displayed at a time, pressing the ***NEXT RECORD*** key will step the user through all the drainage records belonging to the landform displayed in the Landform block..

Unit ID - As above.

Landform Code - As above.

Drainage pattern - (D_CODE) A 2-character code describing the drainage pattern. Only drainage patterns already in the RTMAP.DRAIN authority table can be selected. A pop-up list is available.

Rank - (MM_CODE) Each drainage pattern should be ordered from 1 to n. The drainage pattern covering the greatest area should be entered as number 1, other patterns can then be ordered according to decreasing area. This is an optional field, but it is strongly recommended that at least the major drainage pattern be given a rank.

Drainage Character - (D_CHAR) An optional single-character code describing the drainage character. Only drainage characters already in the RTMAP.DRAIN table may be entered. The following is a list of the available drainage characters:

Code	**Character**
D	dry
I	intermittent
P	perennial
T	tidal

Drainage Type - (D_TYPE) An optional single-character code describing the drainage type. Only drainage types already in the RTMAP.DRAIN table may be entered. The following is a list of the available drainage types:

Code	Type
A	antecedent
C	captured
D	diverted
N	normal
R	reversed
S	superimposed
U	underground

Stream Channel Spacing - (D_SPACE) An optional 2-character field describing the stream channel spacing. Only drainage spacings already in the RTMAP.DRAIN table may be entered. The following is a list of the available drainage spacings:

Code	Stream Channel Spacing	
AB	Absent or very rare	> 2500 m
SP	Sparse	1500 - 2500 m
VW	Very widely spaced	1000 - 1500 m
WS	Widely spaced	625 - 1000 m
MS	Moderately spaced	400 - 625 m
CS	Closely spaced	250 - 400 m
VC	Very closely spaced	150 - 250 m
NU	Numerous	< 150 m

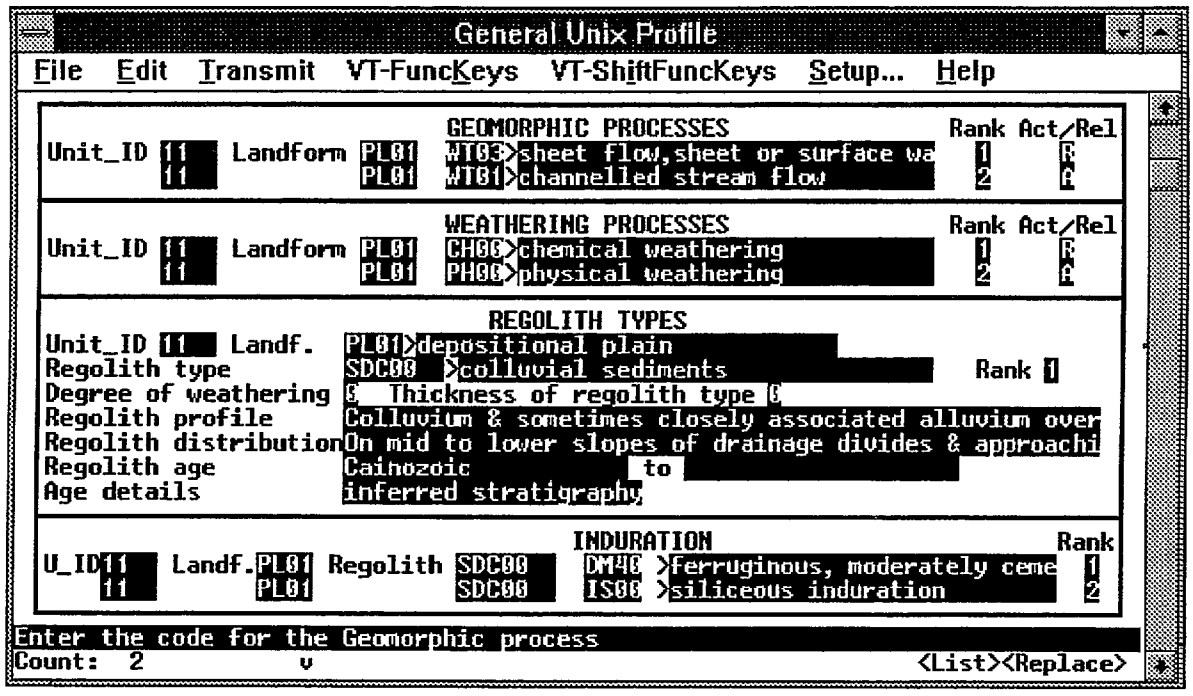

Figure 10. Screen 3 of the RTMAP Database Mapping Units Form.

Block 11 - Geomorphic Processes (GPROC_LANDF TABLE)

A multi-record block listing the geomorphic processes affecting a landform.

Unit ID - As above.

Landform Code - As above.

Geomorphic process - (GP_CODE) A mandatory 4-character field for the geomorphic process code. Only geomorphic processes already in the RTMAP.ZONEDATATYPES authority table may be entered. A pop-up list is available.

Rank - (MM_CODE) A mandatory single-integer field ranking the geomorphic processes in order of importance from 1 to n. The most important process should be number 1.

Active/relict - (AR_CODE) An optional single-character code allows present day processes (A) to be recorded, while the relict code (R) allows recognition of processes active in the past that were responsible for the origin of the landform.

Block 12 - Weathering Processes (WPROC_LANDF table)

A multi-record block for listing the weathering processes affecting a unit.

Unit ID - As above.

Landform Code - As above.

Weathering process - (WP_CODE) A mandatory 4-character code for the weathering processes. Only weathering processes already in the RTMAP.ZONEDATATYPES authority table may be entered. A pop-up list is available.

Rank - (MM_CODE) A mandatory single-integer field ranking the weathering processes in order of importance from 1 to n. The most important process should be number 1.

Active/relict - (AR_CODE) An optional single-character code which allows present day weathering processes (A) to be recorded, while the relict code (R) allows recognition of weathering processes active in the past.

Block 13 - Regolith Types (REGT_LANDF table)

A single record block describing the attributes and spatial and age relationships of the various regolith types within a landform. Only one regolith type description is displayed at a time, further records can be seen by pressing the ***NEXT RECORD*** key. For each regolith type enter all the information for the regolith type and, if applicable, any induration. Then return to the regolith type block and press ***CREATE RECORD*** to begin entering the information relating to the next regolith type. When all the regolith information pertaining to a landform has been entered, return to the landform block and commence entering the data belonging to the next landform, or return to the unit block and commence entering a new unit description.

Unit ID - As above.

Landform Code - As above, however the landform is displayed in the next field.

Regolith type - (REGT_CODE) A mandatory 5-character code for the regolith type. The full name of the regolith type will be displayed in the adjoining field. Only regolith types already in the RTMAP.REGTYPES table may entered. A pop-up list is available.

Rank - (MM_CODE) A mandatory single-integer field for ranking the regolith type in order of importance. The regolith type ranked number one is the main regolith type for the landform. Ranking the regolith type allows the main regolith type in the landform to be easily retrieved when interrogating the database from a GIS.

Degree of weathering - (REGT_WEATH) An optional single-integer code for the degree of weathering of the regolith type. The degree of weathering is selected from the RTMAP.ZONEDATATYPES table. The following is the list of weathering types currently available -

Code	Degree of weathering
0	unknown
1	unweathered
2	slightly weathered
3	moderately weathered
4	highly weathered
5	very highly weathered
6	completely weathered

Thickness - (REGT_TKNS) An optional single-integer code indicating the approximate thickness of the regolith type. Only codes already in the RTMAP.ZONEDATATYPES table may be entered. The following is a list of currently available thicknesses:

Code	Thickness
0	unknown
1	< 0.5 m
2	< 2 m
3	> 2 m
4	> 5 m
5	> 15 m
6	> 50 m

Regolith Profile - (REGT_PROF) This is an optional 240-character descriptive field for recording the total known gross profile characteristics of the regolith, including any truncation or covering that may have occurred.

Regolith Distribution - (REGT_DIST) This is an optional 240-character descriptive field for comments on the three-dimensional landscape position of the regolith type and its relationship with other regolith types in toposequences or otherwise.

Regolith Age - (REGT_AGE1 and REGT_AGE2) Two optional 20-character fields. The age fields are completed if the regolith type has been dated or a relative age inferred from the mapping or the literature. The first field is for an older age and the second for a younger age. If only one age is known enter this into the first field. Ages are entered as full names, e.g. Pliocene, or Cretaceous, and may include prefixes, e.g. early, middle etc. Only ages already in the STRATA.GEOTIME authority table may entered. Pop-up lists are available.

Age Details - (REGT_AGE3) This is an optional 20-character field for comments about the age. It can be used for details on how the age was obtained, whether it is a maximum or minimum age, and its accuracy.

Block 14 - Induration (IND_REGT table)

This is a multi-record block which has a many-to-one relationship with the regolith type. For each regolith type enter all the induration types which belong to it before entering the next regolith type. When all the information for each of the regolith types for the particular landform have been entered, return to the landform block and begin entering the information belonging to the next landform. If there are no further landforms, return to the unit block to begin entering the next unit description.

Unit ID - As above.

Landform Code - As above.

Induration - (IND_CODE) A 4-character code describing the induration type. Only induration types already in the RTMAP.ZONEDATATYPES table may be used. In the RTMAP Database it is not possible to enter an induration type in the regolith types block. Induration is considered to be a modifier of a pre-existing regolith type. Therefore, for example, ferricrete can not be entered as a regolith type. An attempt should be made to recognise the original identity of the indurated material and record this information in the regolith types block and the type of induration in the induration block. For the purposes of deciphering landscape and regolith development history it is more useful to know that a particular ferricrete is indurated alluvial sediments and record it as such rather than have it recorded as just ferricrete. If it is impossible to recognise the original identity of the indurated material the regolith type should be entered as either *weathered in situ bedrock (unknown origin)* or *weathered sediments (unknown origin)*, or if even this level of identification is impossible then it should be entered as *weathered material (unknown origin)*. A pop-up list of induration types is available.

Rank - (MM_CODE) A mandatory single-integer field for ranking the induration 1 to 9.

10 - THE ZONE DATA TYPES FORM

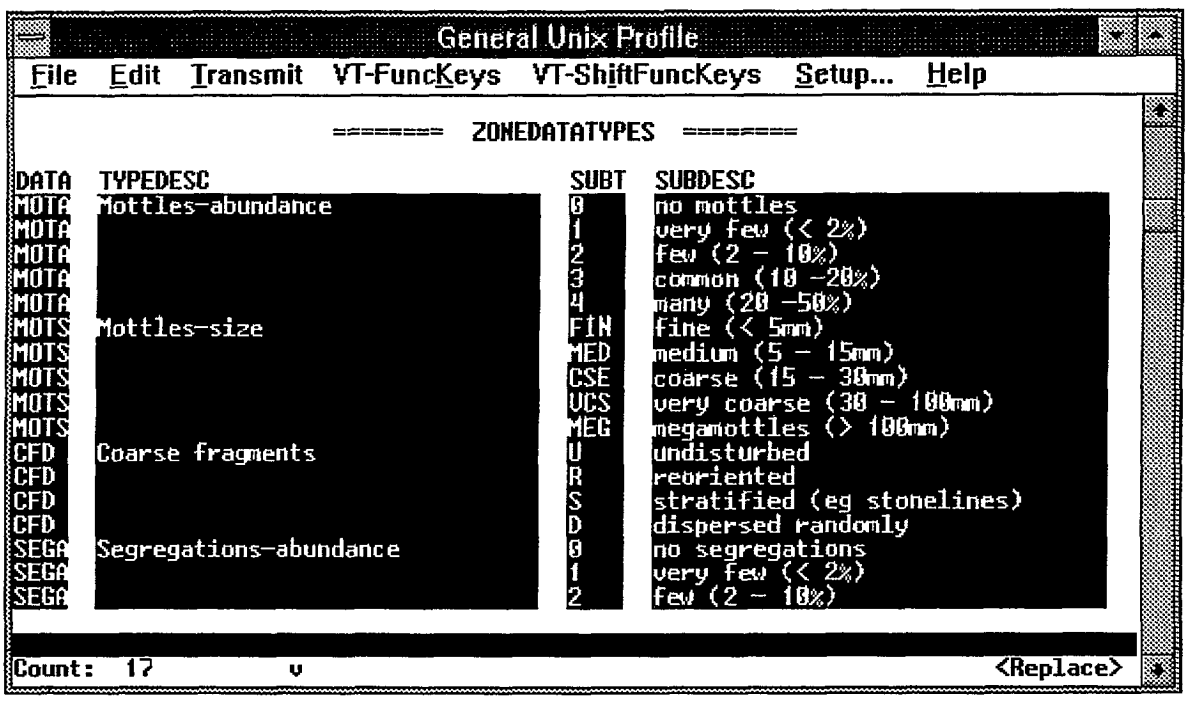

Figure 11 - The Zone Data Types Form.

The Zone Data Types Form covers the RTMAP.ZONEDATATYPES table and gives access to the list of attributes belonging to RTMAP which are used to validate entries into the RTMAP.ZONEDATA table. This table is joined in the RTMAP.REGDATATYPES view with the NGMA.LITHDATATYPES and NGMA.AGSOMINERALS tables to provide all the allowable attributes for the RTMAP.ZONEDATA table. It also provides validation for some fields in several other RTMAP tables. Users requiring additions to this authority table should see the custodian, Colin Pain.

Data - (DATATYPE) A mandatory field of up to 4 characters for an abbreviation of the datatype or attribute.

Description - (TYPEDESC) An optional field of up to 32 characters for a description of the datatype abbreviation. This description will appear in the Zonedata block of the Zones Form when users enter a datatype. The first letter of a description should be capitalised.

Subtype - (SUBTYPE) A mandatory field of up to 4 characters for an abbreviation of the data subtype or attribute value.

Subtype description - (SUBDESC) A mandatory field of up to 32 characters for a description of the subtype.

12 - DRAINAGE FORM

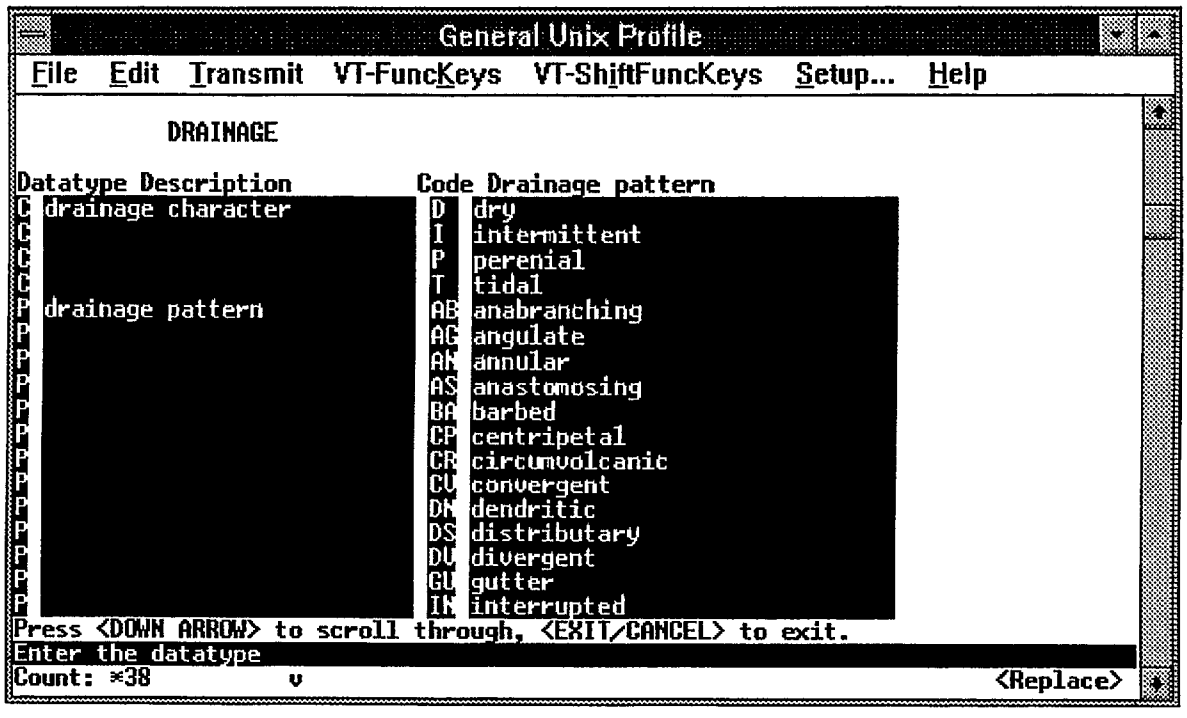

Figure 12 - The Drainage Types Form.

The Drainage Form covers the RTMAP.DRAIN table and gives access to the list of drainage attributes used by the RTMAP.DRAIN_LANDF table. The various fields in the RTMAP.DRAIN_LANDF table are validated by the datatypes in this table. Users requiring additions to this authority table should see the custodian, Colin Pain.

Datatype - (DATATYPE) A mandatory single character field identifying the drainage attribute being described.

Description - (DTYPE_DESC) An optional 25-character field for a description of the datatype.

Code - (D_CODE) A mandatory 2-character code for describing the drainage attribute.

Code description - (D_DESC) A field of up to 30 characters for the full name of the drainage code. This name is displayed in the Drain_landf block when the appropriate code is entered.

9 - REPORTS

A number of reports are available to allow users of the database to easily query and retrieve data. The easy to read formatted reports are output as flat ASCII files and can be viewed on the screen or retrieved to the user's hard disk and then printed on a laser printer, or used in a word processing document. The reports are formatted to fit on an A4 page, either portrait or landscape, depending on the report. Examples of the report outputs can be seen in Appendix 2.

Most of the reports are menu-driven and do not require a knowledge of SQL, however familiarity with SQL would be an advantage to perform more specific queries. Figure 11 is an example of a fully menu-driven report. Certain of the reports perform only simple queries and therefore have only limited flexibility in terms of querying the database. Users of these reports are prompted for responses on a series of simple questions which are usually map sheet specific.

Reports pertaining to unit descriptions are accessible through the Unit Forms Menu and reports for retrieving sites data are accessible through the Sites Forms Menu. The following reports are currently available -

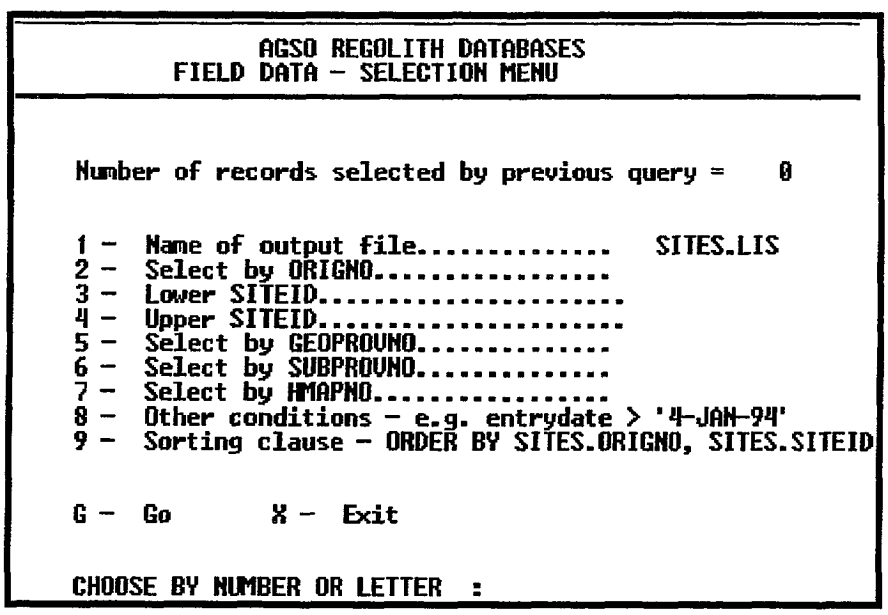

Figure 11 . Sites report menu. Other menu-driven reports have a similar appearance.

Sites Database Reports

Sites report - This is a fully menu-driven formatted report which returns all site information for each site selected by the query. Selection criteria are composed through a menu interface (Figure 11) which allows users to easily select data based on a variety of criteria.

Sites summary - This is a simple report which produces a brief summary of each site returned by the query. The fields selected are origno, siteid, exposure type, geomorphic processes and abstract. Data selections are based on 1:100 000 map sheets and originator numbers. Users are prompted by the report to enter a 1:100 000 map sheet number and an originator number.

Chemlab sample submission form - All samples submitted to the DRGM geochemical laboratories are required to have had information on their place of collection entered into the Sites Database, before any analyses will be done. This report produces a printout from the database showing that the data for the samples has been entered. The report prompts users for their originator number and the range of sample numbers being submitted.

Unit Database Reports

Unit Report - This is a fully menu-driven formatted report which returns all the unit information for each unit selected by the query. Selection criteria are composed through a menu interface, similar to the Sites Report (Figure 11), allowing users to easily select data based on a variety of criteria. The options available in the menu for this report are restricted to attributes available in the UNIT table. However it is possible to select units based on attributes in other tables by using subqueries. This can be done through option 5 in the menu but it does requires a basic knowledge of SQL syntax. An example of a subquery which can be used in option 5 is:

unit.u_id in (select u_id from rtmap.maps_unit where m_code = 'SH5512')

This subquery can be altered to retrieve data based on information in other tables. Further subqeries can be nested within this subquery allowing queries to be further refined by selecting units based on information residing in more than one table.

Summary of regolith, landform and lithology - A fully menu-driven summary report of all the landform and regolith data within a unit. The report retrieves the descriptive regolith and landform fields from the UNIT table and the names of all landforms in each unit together with information on relief and maximum regolith thickness for each landform. The bedrock types for each landform are listed with the regolith type codes and any induration. The menu for this report is the same as for the unit report menu above and therefore the method of operation noted for that report also applies for this report.

Main landform and regolith types ('One liner') - This is a simple report which provides a quick 'one line' summary of the main regolith type and landform type within a unit. The regolith and landform descriptive fields are retrieved from the UNIT table together with the main landform and regolith type names. Retrievals from the database are based on the 1:250 000 map sheet code and an originator number, which the user enters after the prompts.

10 - ACKNOWLEDGMENTS

The development of the RTMAP Database owes much to the inputs of Roslyn Chan, Julie Kamprad and Colin Pain formulating the original structure. Comments and suggestions from Colin Pain and other geologists involved in regolith mapping provided the impetus for making the adjustments to the database structure described in this record. The Record has benefited greatly from reviews by Colin Pain and Lynton Bond.

11 - BIBLIOGRAPHY

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APPENDIX 1 - RTMAP DATABASE DEFINITIONS

```
rem     SCHEMA FOR RTMAP DATABASE


rem     The two most important entities within the regolith landform database
rem     RTMAP are the regolith landform mapping unit (UNIT) and the field site
rem     (RTSITE). The regolith landform mapping unit can combine horizontally
rem     more than one landform form and several regolith types.
rem     The field site occurs in one landform type and may have many regolith
rem     types in several zones vertically. Therefore the tables UNIT,
rem     LANDF_UNIT, REGT_LANDF, NGMA.SITES, RTSITE and ZONE are central to
rem     this database
rem     and all other tables relate directly or indirectly to these five.
rem     AGSO has developed a range of specialised databases each with their
rem     own lookup tables.
rem     RTMAP uses some of the specialised lookup tables developed for other
rem     databases. The lookup tables belonging to other databases are
rem     indentified in the schema by the custodian database name, which
rem     proceeds the databases name, eg STRATA.GEOPROVS.
rem
rem
rem     Begin creating the RTMAP Database.
rem

create table UNIT
                (u_id           number(4)       not null,
                 map_unit       varchar2(4),
                 project        varchar2(5),
                 elev1          number(4),
                 elev2          number(4),
                 u_comms        varchar2(240),
                 terrain        varchar2(255),
                 regolith       varchar2(255),
                 vegetation     varchar2(240),
                 soil           varchar2(240))
                      storage (initial 120K
                               next 40K);

create unique index UNIT1 on UNIT (u_id)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);


rem     This table contains topographic information on the regolith landform
rem     unit and descriptive information on landform, regolith and vegetation.
rem     The values of the unit identifier (u_id) are automatically created
rem     4-digit sequential numbers. Map_unit corresponds to the unit
rem     identifier on the map face.

rem     Locational information for each field site is held in
rem     NGMA database table "SITES". This table has a one
rem     to one relationship with RTMAP's RTSITE table. RTSITE is used for
```

```
rem     further description of the field site. The following create table
rem     statement describes the attributes of the NGMA.SITES table.


rem     create table SITES
rem              (origno          number(5)       not null,
rem               siteid          varchar2(16)    not null,
rem               fieldid         varchar2(16,
rem               obsdate         date,
rem               obstime         number(4,2),
rem               countryid       varchar2(3)     not null,
rem               state           varchar2(3),
rem               geoprovno       number(5),
rem               subprovno       number(5),
rem               domainno        number(5),
rem               geogarea        varchar2(64),
rem               locdesc         varchar2(64),
rem               hmapno          number(4),
rem               qmapid          varchar2(6),
rem               easting         number(6),
rem               northing        number(7),
rem               accuracy        number(4)       not null,
rem               height          number(5,0),
rem               heightacc       number(3,0),
rem               dlat            number(8,6),
rem               ns              varchar2(1),
rem               dlong           number(9,6),
rem               ew              varchar2(1),
rem               method          number(3)       not null,
rem               bibref          varchar2(9),
rem               airphoto        varchar2(36),
rem               oc              varchar2(1),
rem               ro              varchar2(1),
rem               st              varchar2(1),
rem               pe              varchar2(1),
rem               rc              varchar2(1),
rem               oz              varchar2(1),
rem               om              varchar2(1),
rem               sc              varchar2(1),
rem               rt              varchar2(1),
rem               rp              varchar2(1),
rem               sp              varchar2(1),
rem               sh              varchar2(1),
rem               enteredby       varchar2(16)    not null,
rem               entrydate       date            not null,
rem               lastupdate      date
rem               regno           number(5));


rem     create unique index sitesunique on SITES (origno,siteid);
rem     create        index sitesids    on SITES (siteid);
rem     create        index sitesusers  on SITES (enteredby);
rem     create        index sitesprovs  on SITES (geoprovno);
rem     create        index sitessubprovs on SITES (subprovno);
rem     create        index siteshmaps  on SITES (hmapno);
rem     create        index sitesqmaps  on SITES (qmapid);
rem     create        index sitesdlats  on SITES (dlats);
rem     create        index sitesdlongs on SITES (dlongs);
```

```
rem     create        index sitesstruc  on SITES (st);
rem     create        index sitesozmin  on SITES (oz);
rem     create        index sitesrtmap  on SITES (rt);

rem     grant select on sites to public;

rem     Origno and siteid are combined as unique identifiers for each site
rem     record. Origno is a number corresponding to the person, or
rem     organisation who collected the site information. Origno numbers are
rem     stored in the NGMA.ORIGINATORS table.


rem     create view USITES as select * from SITES where enteredby = user;

rem     grant select,insert,update,delete on USITES to public;

rem     USITES is the insert/update view of the SITES table.


create table RTSITE
                (siteid         varchar2(16)     not null,
                 origno         number(5)        not null,
                 project        varchar2(5)      not null,
                 exptype        varchar2(5),
                 slope          number(2),
                 aspect         number(3),
                 l_code         varchar2(4)      not null,
                 gp_code1       varchar2(4),
                 gp_code2       varchar2(4),
                 stratno        number(5),
                 rockno         number(2),
                 qualifier      varchar2(4),
                 lithid         varchar2(4),
                 sketch         varchar2(1),
                 xref           varchar2(40),
                 photo          varchar2(240),
                 soil           varchar2(240),
                 veg            varchar2(240),
                 abst           varchar2(240),
                 enteredby      varchar2(16) not null,
                 entrydate      date) not null
                        storage (initial 200K
                                 next 100K);


create unique index RTSITE1 on RTSITE (origno,siteid)
                    tablespace indxa
                    storage     (initial 16K
                                 next   10K);
create        index RTSITE2 on RTSITE (siteid)
                    tablespace indxa
                    storage     (initial 10K
                                 next 6K);
create        index RTSITE3 on RTSITE (enteredby)
                    tablespace indxa
                    storage     (initial 10K
                                 next 6K);
```

```
grant select on RTSITE to public;


rem     This table contains descriptive information on various aspects of
rem     the field site.
rem     The siteid is combined with the origno to make a unique identifier
rem     linking RTSITE to NGMA.SITES.


create view URTSITE as select * from RTSITE where enteredby = user;

grant select, insert, update, delete on URTSITE to public;

rem     URTSITE is the insert/update view of the RTSITE table


create table ZONE
                (siteid         varchar2(16)      not null,
                 origno          number(5)        not null,
                 zoneno          number(5)        not null,
                 z_no            number(2)        not null,
                 thickness       number(5,2),
                 depth           number(5,2),
                 bedrock         varchar2(1),
                 regt_code       varchar2(7),
                 weathering      number(1),
                 otherinfo       varchar2(240),
                 z_comms         varchar2(240),
                 enteredby       varchar2(16) not null,
                 entrydate       date) not null
                        storage (initial 200K
                                 next 100K);

create unique index ZONE2 on ZONE (origno,siteid,z_no)
                    tablespace indxa
                    storage (initial 40K next 10K);
create          index ZONE3 on ZONE (siteid)
                    tablespace indxa
                    storage (initial 30K next 10K);
create          index ZONE4 on ZONE (enteredby)
                    tablespace indxa
                    storage (initial 15K next 10K);

grant select on ZONE to public;


rem     This table contains information pertaining to a zone within a field
rem     site. Zoneno is a system generated unique number.
rem     The site identifier (siteid) comes out of table RTSITE. The zone
rem     number(z_no) is a 2-digit number in the format 1,2,3 etc.


create view UZONE as select * from ZONE where enteredby = user;

grant select, insert, update, delete on UZONE to public;


rem     UZONE is the insert/update view of the ZONE table
```

```
create table SAMPLE
                (siteid         varchar2(16)     not null,
                 z_no           number(2)        not null,
                 origno         number(5)        not null,
                 sampleid       varchar2(16)     not null,
                 samp_desc      varchar2(40))
                        storage         (initial 20K
                                         next 10K);

create unique index SAMPLE1 on SAMPLE (origno,sampleid)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);
create        index SAMPLE3 on SAMPLE (enteredby)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);

grant select on SAMPLE to public;


rem     This table contains all the samples taken in the field. The site
rem     identifier (siteid) and zone number (z_no) are carried over from
rem     table ZONE.


create view USAMPLE as select * from SAMPLE where enteredby = user;

grant select, insert, update, delete on USAMPLE to public;


rem     USAMPLE is the insert/update view of the SAMPLE table



create table DRAIN_LANDF
                (u_id           number(4)        not null,
                 l_code         varchar2(4)      not null,
                 d_code         varchar2(2)      not null,
                 d_char         varchar2(1),
                 d_type         varchar2(1),
                 d_space        varchar2(2),
                 mm_code        varchar2(1))
                        storage (initial 20K
                                 next 10K);

create index DRAIN_LANDF1 on DRAIN_LANDF (u_id,l_code)
                tablespace indxa
                storage (initial 6K
                         next   6K);
create index DRAIN_LANDF2 on DRAIN_LANDF (d_code)
                tablespace indxa
                storage (initial 6K
                         next   6K);

rem     This table relates units to drainage patterns. The values of drainage
rem     pattern, character, type and spacing come from the DRAIN table.
```

```
rem     The mm_code (major/minor code) is a number signifying the order of
rem     importance of the particular drainage pattern in the landform.


create table ORIGNO_UNIT
                (u_id            number(4)       not null,
                 origno          number(5)       not null,
                 odate           date            not null)
                        storage (initial 10240
                                 next 10240);

create unique index origno_unit1 on origno_unit (u_id,origno,odate)
        tablespace indxa storage (initial 6K next 6K);


rem     This table relates units to the originators of the unit data.


create table GEOPROV_UNIT
                (u_id            number(4)       not null,
                 geoprovno       number(5)       not null)
                        storage (initial 10240
                                 next 10240);

create unique index GEOPROV_UNIT1 on GEOPROV_UNIT (u_id,geoprovno)
                    tablespace indxa
                    storage     (initial 6K
                                 next    6K);
create        index GEOPROV_UNIT2 on GEOPROV_UNIT (geoprovno)
                    tablespace indxa
                    storage     (initial 6K
                                 next    6K);


rem     This table relates units to tectonic provinces.


create table LANDF_UNIT
                (u_id            number(4)       not null,
                 l_code          varchar2(4)     not null,
                 mm_code         varchar2(1)     not null,
                 struct_cntl     varchar2(2),
                 relief          varchar2(30),
                 l_comms         varchar2(240),
                 soil            varchar2(240),
                 regt_tkns       number(1))
                        storage (initial 40K
                                 next 20K);

create unique index LANDF_UNIT1 on LANDF_UNIT (u_id,l_code)
                    tablespace indxa
                    storage     (initial 10K
                                 next   10K);

create        index LANDF_UNIT2 on LANDF_UNIT (l_code)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);
```

```
create unique index LANDF_UNIT3 on LANDF_UNIT (u_id,l_code,mm_code)
                    tablespace indxa
                    storage     (initial 10K
                                 next   10K);


rem     This table relates units to landform types. Unit identifier (u_id) and
rem     landform code (l_code) come out of tables UNIT and LANDF.


create table    PROV_UNIT
                 (u_id           number(4)        not null,
                  p_code         number(3)        not null,
                  mm_code        varchar2(1)      not null)
                        storage (initial 10K next 10240);

create unique index PROV_UNIT1 on PROV_UNIT (u_id,p_code,mm_code)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);

rem     This table relates units to regolith landform provinces.


create table GPROC_LANDF
                (u_id           number(4)        not null,
                 l_code         varchar2(4)      not null,
                 gp_code        varchar2(4)      not null,
                 mm_code        varchar2(1)      not null,
                 ar_code        varchar2(1))
                        storage (initial 30K next 20K);

create          index GPROC_LANDF1 on GPROC_LANDF (u_id,l_code)
                      tablespace indxa
                      storage    (initial 10K
                                  next   10K);
create          index GPROC_LANDF3 on GPROC_LANDF (gp_code)
                      tablespace indxa
                      storage (initial 6K
                               next      6K);

rem     This table relates landforms within units to geomorphic processes.

create table WPROC_LANDF
                (u_id           number(4)        not null,
                 l_code         varchar2(4)      not null,
                 wp_code        varchar2(4)      not null,
                 mm_code        varchar2(1)      not null,
                 ar_code        varchar2(1))
                       storage (initial 20480
                                next 10240);

create          index WPROC_LANDF1 on WPROC_LANDF (u_id,l_code,wp_code)
                      tablespace indxa
                      storage   (initial 15K
                                 next   10K);
```

```
rem     This table relates weathering processes to landforms within a unit.


create table REGT_LANDF
                (u_id           number(4)       not null,
                 l_code         varchar2(4)     not null,
                 regt_code      varchar2(7)     not null,
                 mm_code        varchar2(1),
                 regt_weath     number(1),
                 regt_tkns      number(1),
                 regt_dist      varchar2(240),
                 regt_prof      varchar2(240),
                 regt_age1      varchar2(20),
                 regt_age2      varchar2(20),
                 regt_age3      varchar2(30))
                        storage (initial 150K
                                 next 50K);

create unique index REGT_LANDF1 on REGT_LANDF (u_id,l_code,regt_code)
                    tablespace indxa
                    storage     (initial 15K
                                 next   10K);
create        index REGT_LANDF2 on REGT_LANDF (l_code)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);
create unique index REGT_LANDF3 on REGT_LANDF (u_id,l_code,regt_code,mm_code)
                    tablespace indxa
                    storage     (initial 15K
                                 next   10K);

rem     This table relates regolith types to landforms within a unit.


create table IND_REGT
                (u_id           number(4)       not null,
                 l_code         varchar2(4)     not null,
                 regt_code      varchar2(7)     not null,
                 ind_code       varchar2(4)     not null,
                 mm_code        varchar2(1))
                        storage (initial 20480
                                 next 10240);

create unique index IND_REGT1 on IND_REGT(u_id,l_code,regt_code,ind_code)
                    tablespace indxa
                    storage (initial 10K
                             next 10K);
create        index IND_REGT2 on IND_REGT(regt_code)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);
create unique index IND_REGT3 on
IND_REGT(u_id,l_code,regt_code,ind_code,mm_code)
                    tablespace indxa
                    storage (initial 10K
                             next 10K);
```

```
rem     Table IND_REGT links induration types selected from INDTYPE to
rem     regolith types in REGT_LANDF.


create table LITH_LANDF
                (u_id           number(4)       not null,
                 l_code         varchar2(4)     not null,
                 rockno         varchar2(6)     not null,
                 qualifier      varchar2(4),
                 lithid         varchar2(4),
                 li_comm        varchar2(60),
                 stratno        number(5))
                       storage (initial 20480
                                next    10240);

create          index LITH_LANDF2 on LITH_LANDF (l_code)
                      tablespace indxa
                      storage    (initial 6K
                                  next   6K);

rem     This table relates lithology and stratigraphy to the landform type
rem     within the unit.


create table HAZ_LANDF
                (u_id            number(4)      not null,
                 l_code          varchar2(4)    not null,
                 h_code          varchar2(2)    not null,
                        storage (initial 10K
                                 next 10K);

create unique index HAZ_LANDF1 on HAZ_LANDF(u_id,l_code,h_code)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);
create          index HAZ_LANDF2 on HAZ_LANDF(l_code)
                      tablespace indxa
                      storage     (initial 6K
                                   next   6K);

rem     This table relates enviromental hazards for each landform. Hazards are
rem     taken from the HAZARDS table.


create table HAZ_RTSITE
                (siteid          varchar2(16)    not null,
                 origno          number(5)       not null,
                 h_code          varchar2(2)     not null,
                 h_comm          varchar2(30),
                 enteredby       varchar2(16) not null,
                 entrydate       date not null)
                        storage (initial 10K
                                 next 10K);

create unique index HAZ_RTSITE1 on HAZ_RTSITE(siteid,h_code)
                    tablespace indxa
                    storage     (initial 6K
                                 next   6K);
```

```
grant select on HAZ_RTSITE to public;

rem     This table relates enviromental hazards for each site. Hazards are
rem     taken from the HAZARDS table.

create view UHAZ_RTSITE as select * from HAZ_RTSITE where enteredby = user;

grant select, insert, update, delete on UHAZ_RTSITE to public;


rem     UHAZ_RTSITE is the insert/update view of the HAZ_RTSITE table


create table MAPS_UNIT
                (u_id           number(4)       not null,
                 m_code         varchar2(4)     not null)
                        storage (initial 20480
                                 next 10240);

create unique index MAPS_UNIT1 on MAPS_UNIT (u_id,m_code)
                    tablespace indxa
                    storage     (initial 15K
                                 next   10K);

rem     This table relates units to a 1:250K map.


create table REFS_UNIT
                (u_id           number(4)       not null,
                 r_no           number(4)       not null)
                        storage (initial 10240 next 10240);

create unique index REFS_UNIT1 on REFS_UNIT (u_id,r_no)
                    tablespace indxa
                    storage     (initial 10K
                                 next   6K);

rem     This table relates units to all other references. The values for u_id
rem     and r_no come out of tables UNIT and the AGSO Shared Bibliographic
rem     References Database.


create table DRAIN
                (datatype       varchar2(1)     not null,
                 dtype_desc     varchar2(25),
                 d_code         varchar2(2)     not null,
                 d_desc         varchar2(30)    not null)
                        storage (initial 6K next 6K);

rem     This table contains a list of drainage patterns.
rem     Datatypes are P, C, T, S. Dtype_desc describe the datatype and are
rem     drainage pattern, drainage character, drainage type and drainage
rem     spacing. The values of d_code relate to each subdata type.
rem     Field d_desc is for a full description of the subdata types.
rem     Source: Speight, J.G. 1984: Landform. In: Australian Soil and Land
rem     Survey Field Handbook, McDonald et al. (Eds), Inkarta Press, Mel-
rem     bourne. (Some additions).
```

```
create table LANDF
                (l_code          varchar2(4)      not null,
                 l_desc          varchar2(30)     not null,
                 map_code        varchar2(2))
                        storage (initial 6K next 6K);

rem     This table contains a list of landform patterns.
rem     Landform patterns are areas more than 600m across, and are made up of
rem     landform elements. Values for l_code are 2 upper case letters and 2
rem     digits.
rem     Source: Speight, J.G. 1984: Landform. In: Australian Soil and Land
rem     Survey Field Handbook, McDonald et al. (Eds), Inkarta Press,
rem     Melbourne. (Some additions).


create table PROJECT
                (prcode          varchar2(5)      not null,
                 project         varchar2(40)     not null)
                        storage (initial 6K
                                         next 6K);

create unique index PROJECT1 on PROJECT (prcode)
                    tablespace indxa
                    storage (initial 6K next 6K);

rem     This authority table lists valid project codes.


create table PROV
                (p_code          number(3)        not null,
                 p_name          varchar2(20)     not null)
                           storage (initial 6144
                                    next 6144);

rem     This table will list all the regolith landform provinces, 30 to begin
rem     with.


create table REGTYPE
                (regt_code       varchar2(7)      not null,
                 regt_desc       varchar2(40)     not null,
                 map_code        varchar2(2))
                        storage (initial 6K next 6K);


rem     These tables contain a list of regolith types.
rem     Source: Speight, J.G. and R.F. Isbell in press: Substrate Material.
rem     In: Australian Soil and Land Survey Field Handbook, 2nd Edition,
rem     McDonald et al. (Eds), Inkarta Press, Melbourne. (Some additions).
```

```
create table HAZARDS
                (h_code          varchar2(2)      not null,
                 h_desc          varchar2(25)     not null)
                        storage (initial 6144
                                 next 6144);

rem     This table contains a list of enviromental hazards


create table STCNTRL
                (s_code          varchar2(2)      not null,
                 s_desc          varchar2(22)     not null)
                        storage (initial 6144
                                 next 6144);

rem     This table contains a list of possible structural controls that may
        influence the landform.


create table MAXNOS
                (idmaxno          varchar2(16)    not null,
                 maxno            number(6)       not null)
                        storage (initial 6K next 6K);

rem     Sequential numbers for the zone table are generated in this table.
rem     Field idmaxno contains the table name, maxno the maximum sequential
rem     number for the table. Triggers to increment the values in maxseqno
rem     must be set up in the entry forms.
rem     The two-step pre-insert block trigger for sequential number generation
rem     in SQL*Forms is:
rem     1. update MAXNOS set maxno = maxno + 1 where idmaxno = 'ZONE'
rem     2. select maxno into :zoneno from MAXNOS where idmaxno = 'ZONE'


create table zonedatatypes (
                datatype     varchar2(4)  not null,
                typedesc     varchar2(32),
                subtype      varchar2(4),
                subdesc      varchar2(32),
                primary key (datatype,subtype) )
                  storage (initial 6K next 6K);


create unique index ZONEDATATYPE1 on ZONEDATATYPES (datatype,subtype)
                    tablespace indxa
                    storage (initial 6K next 6K);
create          index ZONEDATATYPE2 on ZONEDATATYPES (subtype,subdesc)
                    tablespace indxa
                    storage (initial 6K next 6K);


rem     ZONEDATATYPES is an authority table of regolith extendable attributes
```

```
create table zonedata
        (zoneno         number(5)     not null,
         datatype       varchar2(4)   not null,
         subtype        varchar2(4),
         description    varchar2(64),
         rank           number(1),
         enteredby      varchar2(8)   not null,
         entrydate      date          not null)
         storage (initial 200K next 100K);

create index ZONEDATA1 on ZONEDATA(zoneno)
             tablespace indxa
             storage (initial 15K next 10K);
create index ZONEDATA2 on ZONEDATA(enteredby)
             tablespace indxa
             storage (initial 15K next 10K):


rem     ZONEDATA is the extendable attributes table for the ZONE table.

create view UZONEDATA as select * from ZONEDATA where enteredby = user;

grant select, insert, update, delete on UZONEDATA to public;

rem     UZONEDATA is the insert/update view of the ZONEDATA table


create view regdatatypes as (
                    select datatype,typedesc,subtype,subdesc
                    from ngma.lithdatatypes
                    where datatype != 'WEA'
                  union
                    select 'CM','Common Mineral',minabbrev,minname
                    from ngma.agsominerals
                    where common = 'C'
                  union
                    select 'MI','Mineral',Minabbrev,minname
                    from ngma.agsominerals
                  union
                    select datatype,typedesc,subtype,subdesc
                    from rtmap.zonedatatypes);

grant select on regdatatypes to public;

rem     This view of NGMA.LITHDATATYPES, NGMA.AGSOMINERALS and
rem     RTMAP.REGDATATYPES is for use as a zonedata authority table.


create table ausveg (
                taxon_id        number(6)       not null,
                family          varchar2(20)    not null,
                genus           varchar2(20)    not null,
                species         varchar2(20)    not null,
                species_author  varchar2(60),
                infraspec_rank  varchar2(10),
                infraspecies    varchar2(20),
                infra_author    varchar2(60))
                        storage (initial 2000K next 200K);
```

```
create unique index ausveg1 on ausveg (taxon_id)
        tablespace indxa
                storage (initial 55K next 10K);
create index ausveg2 on ausveg (genus)
        tablespace indxa
                storage (initial 140K next 15K);
create index ausveg3 on ausveg (species)
        tablespace indxa
                storage (initial 180K next 20K);

grant select on ausveg to public;

rem     This table is an authority table of Australian vegetation family,
rem     genus, species and subspecies.  The data for this table was sourced
rem     from ERIN.

create table ausveg_rtsite (
                origno          number(5)       not null,
                siteid          varchar2(16)    not null,
                taxon_id        number(6)       not null,
                enteredby       varchar2(16)    not null,
                entrydate       date            not null)
                        storage (initial 15K next 10K);


create view uausveg_rtsite as select * from ausveg_rtsite
                                where enteredby = user;

grant select,insert,update,delete on uausveg_rtsite to public;

rem     uausveg_rtsite is the insert/update view of ausveg_rtsite.


create table exptype (
            exp_code    varchar2(5)         not null,
            exp_desc    varchar2(30)        not null)
                  storage(intial 7K next 7K);

rem     The table exptype is an authority table of exposure types.
```

APPENDIX 2 - EXAMPLES OF REPORT OUTPUT FROM THE RTMAP DATABASE

1 - Example of full regolith field site formatted report.

```
------------------------------------------------------------------
                    REGOLITH FIELD SITE RECORD
------------------------------------------------------------------

ORIGINATOR: Hazell, M.              SITEID: ZMH0001
COUNTRY...: Australia               STATE.: NSW
GEO PROV..: Lachlan Fold Belt
LOC DESC..: 3 km along Jaunter Road.
100K MAP..: OBERON                  LAT: 33.98898   LONGS: 149.8758
250K MAP..: BATHURST                EASTING: 765600 NORTHING: 6235200
LOC METH..: 1:100 000 topographic map
ACCURACY..: 100  AIRPHOTO:
ELEVATION.: 1140                    RT  RC
                                     X
   ---------------------------------------------------------------

PROJECT..: LACHL     EXPOSURE: ROAD   SLOPE:      ASPECT:
LANDFORM.: rises
GPROC....: creep
STRATUNIT: Triangle Group
BEDROCK..: clastic sediment
QUAL:                               LITHOLOGY: greywacke
SOIL:  1.5m red gradational clay soil. Top 0.5m is stony.
VEG:   eucalypts
ABST:  1.5m soil with stony colluvial top 0.5m. Below crest of low
       rise.
PHOTO:
SKETCH:
   ---------------------------------------------------------------

                              ZONES
                             -------


ZONE: 1   THICKNESS: 1.5   DEPTH: 1.5     ON FRESH BEDROCK?:

REG TYPE: soil on bedrock
D OF W..: completely weathered
ZONE COMMENTS:
OTHER INFO: Clasts:bedrock clasts
   ---------------------------------------------------------------

DATATYPE  SUBTYPE              DESCRIPTION                      RANK
--------  -------------------  -------------------------------- ----
BNDS      irregular            irregular
GP        creep
GP        sheet flow,sheet or
          surface wash
```

2 - Example of full regolith mapping unit formatted report.

```
**************************************************************
                REGOLITH TERRAIN MAPPING UNIT DATA

                    MAP UNIT: Bs1        UNIT ID: 1
**************************************************************
                  GENERAL MAP UNIT DESCRIPTION
                Elevation of Unit: from 280m to 380m

Regolith Description.: Shallow, often stoney soils on bedrock;
                       minor colluvium and alluvium.
Terrain Description..: Prominent linear rocky ridges. Trending east
                       north east in west, north east in east.
Vegetation...........: Eucalypt woodland and tall shrubland.
General Unit Comments:
Soil.................: Shallow calcareous loams (Um5.11) and other
                       Um soils in western areas, shallow stony
                       sands and sandy loams (Uc1,43) in east.
250K Maps:
                      WIDGIEMOOLTHA
                      ZANTHUS

Tectonic Elements:
                      Albany-Fraser Province
                      Eastern Goldfields Province

Regolith Province:
                      1   Fraser Range

**************************************************************

                       LANDFORM DESCRIPTIONS

LANDFORM..: hills                          Rank: 1

Relief...............: 120m
Structural control....: dyke/sill
Max regolith thickness: unknown
Soil in the landform..: See unit soil description.
General Comments......: Minimal regolith. Outcropping bedrock. Most
                        of unit has < 0.5 m regolith thickness.

  ENVIRONMENTAL HAZARDS

                      no recognised hazards

  BEDROCK LITHOLOGY

Rocktype.............: felsic gneiss
Lithology............: gneiss
Lithology details.....:
Stratigraphy.........: Fraser Complex;

A = Active, R = Relict geomorphic or weathering process
```

```
****************************************************************
                REGOLITH TERRAIN MAPPING UNIT DATA

                    MAP UNIT: Bs1        UNIT ID: 1
****************************************************************


Rocktype.............: metabasite
Lithology............: meta gabbro
Lithology details.....:
Stratigraphy.........: Fraser Complex;

Rocktype.............: metasediment
Lithology............: granulite
Lithology details.....: basic granulite
Stratigraphy.........: Fraser Complex;

  DRAINAGE

Pattern...: dendritic                      Rank: 1
Character............: intermittent
Spacing..............: sparse, 1500-2500m
Type.................: normal

  GEOMORPHIC PROCESSES
                        1    A    creep
                        2    A    sheet flow,sheet or surface wash
                        3    A    wind erosion (deflation)
                        4    A    channelled stream flow

  WEATHERING PROCESSES
                        1    A    physical weathering
                        2    A    chemical weathering

  REGOLITH DESCRIPTIONS

Regolith type.: soil on bedrock                        Rank: 1
Thickness............: <0.5 m
Degree of weathering.: unknown
Age..................:  to
Age details..........:
Regolith Profile.....: Skeletal soils on bedrock.
Regolith Distribution: Summit and slopes.
Induration...........:


Regolith type.: colluvial sediments                    Rank: 2
Thickness............: unknown
Degree of weathering.: unknown
Age..................:  to
Age details..........:
Regolith Profile.....: Colluvium interfingering with alluvium on
                       bedrock.
Regolith Distribution: Lower slopes.
Induration...........:

      A = Active, R = Relict geomorphic or weathering process
                                3
```

****

REGOLITH TERRAIN MAPPING UNIT DATA

MAP UNIT: Bs1 UNIT ID: 1

****

Regolith type.: channel deposits Rank: 3
Thickness.....: unknown
Degree of weathering.: unknown
Age.....: to
Age details.....:
Regolith Profile.....: Alluvium interfingering with colluvium on bedrock.
Regolith Distribution: In channels between hills.
Induration.....:

****

DATE, COMPILER

01-JAN-88, Gibson, D.L.
10-DEC-90, Chan, R.A.
14-DEC-90, Hazell, M.

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A = Active, R = Relict geomorphic or weathering process

3 - Example of database report of summary field site data.

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RTMAP SUMMARY SITE INFORMATION

ORIGNO	SITEID	EXP_T	LANDFORM	GP_PROCESS1	GP2	ABSTRACT
187	94990001	ROAD	erosional plain			
187	ZMH0001	ROAD	rises	creep		1.5m soil with stony colluvial top 0.5m. Below crest of low rise.
187	ZMH0002	ROAD	rises			Mudstone, greywacke outcrop and subcrop on rises. Colluvial mantle shedding off outcrop and covering deeply weathered flanks of rises. Low rise above wide alluvial flats. Relief increasing due to proximity to deeply incised terrain.
187	ZMH0003	ROAD	rises	sheet flow,sheet or surfa	GR03	Outcrop of shales and greywackes upslope associated with shallow red gradational soil. Downslope in slight concave depression grades to yellow then bleached white with no bedrock visible. On gentle slope
187	ZMH0004	ROAD	alluvial terrace	channelled stream flow	GR03	3 terrace levels including present flood plain. Highest terrace 5m above creek; with mixed cobble and pebble lithologies 1m thick, red earth and thin colluvial mantle. Steep rocky slope on east. Gentler slope with terraces on west.
187	ZMH0007	ROAD	low hills			Alternating beds of very hard medium grained sandstone and shales. Shales usually very weathered. Rounded hill form with 80 m wide alluvial flats.

4 - Summary report ('one liner')of the main regolith and landform for each mapping unit.

U_ID	UNIT	REGOLITH DESCRIPTION	LANDFORMS DESCRIPTION	MAIN REGOLITH TYPE	MAIN LANDFORM
670	1a	Silt sand gravel and cobbles layers up to 2m of prairie and alluvial soils on flood plain. Some buried paleosols on terrace remnants.	Flood plains from 100m up to 1000m wide on the Macquarie, relict channels and oxbows on the Macquarie. Smaller streams in deep gullies. Small remnant terraces along reaches of some smaller rivers.	alluvial sediments	flood plain
672	1c	Well rounded cobbles up to 10cm diameter. Iron staining.	Strath terraces 10 to 15m high flanking upper Fish and Duckmaloi rivers.	alluvial sediments	rises
671	1b	Alluvial sediments consisting of poorly sorted sandy clay, well rounded gravel and well rounded cobble beds. Scatter of rounded river cobbles on surface. Alluvial sediments overlay highly weathered granite saprolite.	A least two alluvial terrace levels above the present flood plain of the Macquarie River. The terraces have been dissected and degraded by erosion to varying degrees.	alluvial sediments	terraced land
681	3a	Extensive sandy and gravelly granite derived colluvium/alluvium. Large granite tors on ridges are a significant feature. Detritus is coarser close to outcrop. Highly weathered saprolite underlies much of the colluvium.	NNE trending ridges and spurs. Unit separates lower granites of the Bathust plains from the high Oberon Plateau to the south and the higher elevation unit 2 granites. Slopes are generally steep.	colluvial sediments	hills

5 - Summary report of all landform, bedrock, regolith and induration for each mapping unit.

Unit	Regolith description	Terrain description	Landforms	Bedrock lithology	Regolith/Indur	
1	Shallow, often stoney soils on bedrock; minor colluvium and alluvium.	Prominent linear rocky ridges. Trending east north east in west, north east in east.	hills unknown thickness 120m	*felsic gneiss *mafic intrusive *mafic intrusive *metabasite *metasediment	WIR24 SDC00 SDA10	
1	Shallow, often stoney soils on bedrock; minor colluvium and alluvium.	Prominent linear rocky ridges. Trending east north east in west, north east in east.	hills unknown thickness 120m	*felsic gneiss *mafic intrusive *mafic intrusive *metabasite *metasediment	WIR24 SDC00 SDA10	
2	Rises with <0.5m residual calcareous loams & earths on bedrock; abundant large lmst frags; some calcrete nodules. 1-3m colluvial calcareous clay in depressions on bedrock; lmst & calcrete cobbles; rare lmst. outcrop; often gilgai structure.	Flat to gently undulating plain with rises & depressions. Parellel chains of elongated or circular hummocky clay flats in sth. Large shallow depressions (dongas) & numerous small scattered claypans in nth. Some rock holes & blow holes.	etchplain < 0.5m thick 6m occasionally 9m karst > 2m thick 3m max in northern dongas.	*clastic sediment *chemical sediment *clastic sediment	WIR21 WIR11 SDC00 WIR21	DC20 DC20