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THE AGSO FIELD GEOLOGICAL NOTE BOOKS - A USER'S GUIDE

by
Richard Blewett

RECORD 1993/46

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

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The AGSO Field Geological Note Books — A Users Guide

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Richard Blewett

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. Michael Lee

Secretary: Greg Taylor

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

(formerly BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS)

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INTRODUCTION

The Australian Geological Survey Organisation (AGSO) field geological databases were developed by a combined working group between the Minerals and Land Use Program and the Information Services Branch of the Australian Geological Survey Organisation.

The AGSO field geological databases were largely developed and adapted from the Geological Survey of Queensland's Regmap Field Data Management System (Lang and others, 1987; Lang and others, 1990; Grimes and others, 1990; Withnall and others, 1992). Regmap is a very successful PC-based (dBase clone) system, however, it was found not suitable for AGSO's corporate requirements, and therefore adapted to the NGMA system using the Oracle database management system.

This record is designed to form a useful field summary of the more comprehensive user guide to the NGMA databases (see Ryburn and others, in preparation). The field guide accompanies the field notebooks that have been specially designed and printed to aid data recording in a format that is easily transferred into the Oracle databases.

The Record describes all the fields that are shown in the **field notebooks**, it includes a summary example of a page of field data. The important codes are listed in the Appendix. The Record is a supplement to the more complete users' guide (Ryburn and others, in preparation) to the AGSO Oracle databases as a whole.

NOTES ON NOTEBOOK ENTRY

- The note book is designed to fit into a standard plastic cover that can be obtained from most geological equipment suppliers. The inside cover contains space for instrument details. It is not essential that the designed note book be used for only correct symbols (codes) as it is possible to "translate" long hand writing straight into the Oracle forms but problems may occur if mandatory fields have not been recorded. It is also more difficult for someone other than the author, unfamiliar with the NGMA codes to enter data in this manner. The printed note books will make a contractor's or fieldhand's data entry more efficient.
- There are 50 pages in each book and most geologists would expect to fill between 10 and 15 books in an average 3 month field season.
- The pages of the notebook are broken down into sections for Sites, Outcrops, Rocks, Lithdata and Structures. These sections are specifically designed to allow easy data entry into the corresponding five Oracle databases (Rocks and Lithdata are combined into one Oracle "view" in the database). Mandatory fields are shown in bold on the note books.
- When fields are the same for the next site or sample, one simply ticks the respective field(s) to show the data entry person that the field is unchanged. This is useful in the form entry of the databases as entire views can be copied to fresh records and only the varying fields need be changed (e.g. the SITE ID and position) and therefore data entry is quite rapid. It is also recommended that the geologist "rings" a field that changes at the next site, (eg. hundred thousand sheet number or province fields) so that the change is easily noticed during data entry.
- *The system should not be restrictive, if you don't know the codes or formats etc. just write it out in full and "translate" it when you return to Base Camp or the office. This also applies to the right hand page of the Lithdata (sample) description.*

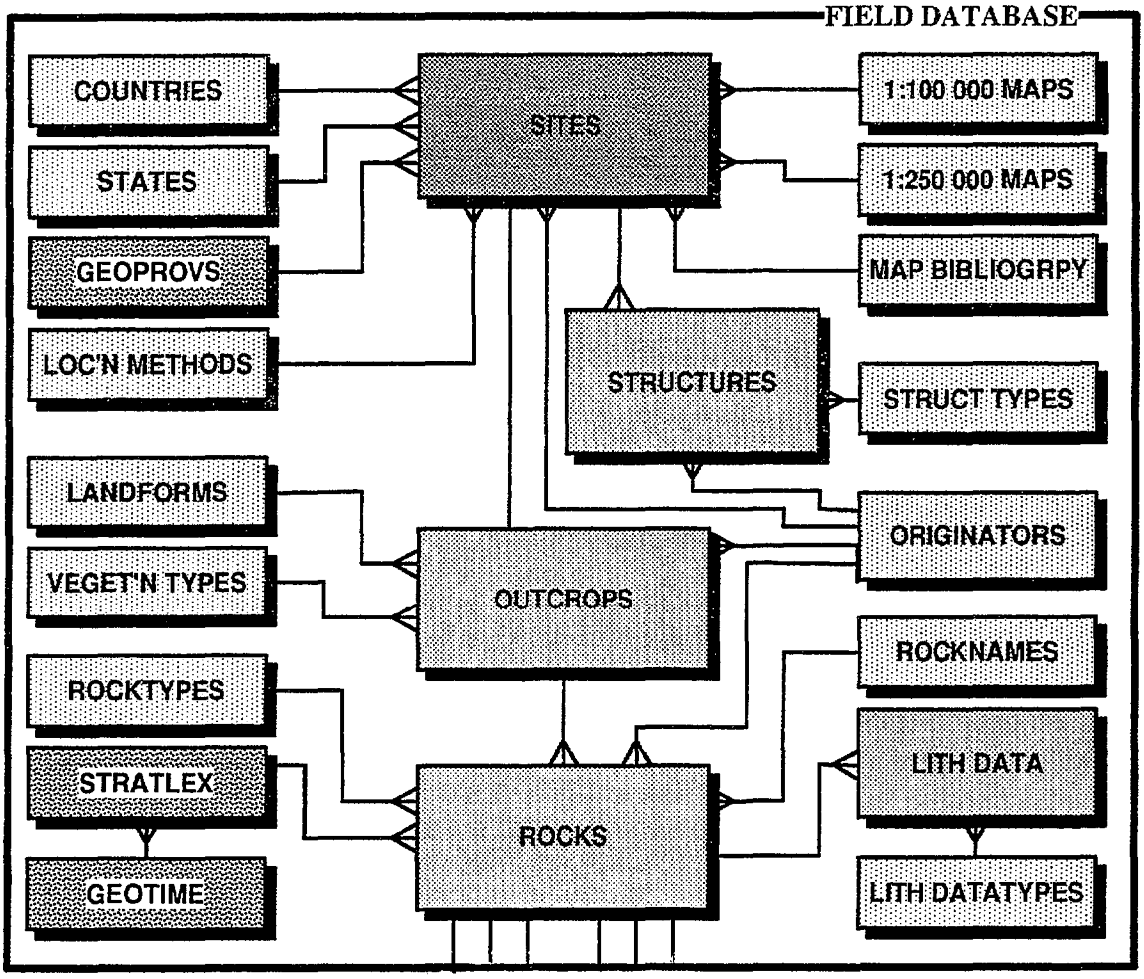


Figure 1 is an entity relationship diagram of the AGSO databases. The databases that concern the field geologist are SITES, OUTCROPS, ROCKS/LITHDATA and STRUCTURES. These databases are controlled by a number of look-up or authority tables.

THE COVER

AGSO

AUSTRALIAN
GEOLOGICAL SURVEY
ORGANISATION

AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

GPO BOX 378

CANBERRA CITY

ACT, 2601

MINERALS AND LAND USE PROGRAM FIELD NOTES

GEOLOGIST...

PROJECT...

DATE..

FIELD NUMBERS ....

LOCATION..

BOOK NUMBER ....

IF FOUND, PLEASE RETURN TO ABOVE ADDRESS.

Figure 2a is the cover with space for name (Geologist), project, date, field numbers, location, and book number. The AGSO address is also clearly shown and a note asking for the book to be returned if found.

Figure 2b (below) is situated on the inside front cover and is for the recording of instrument details.

INSTRUMENT DETAILS

GPS MAKE: [________________]

SPHEROID: [________________]

MAGNETIC SUS MAKE: [________________]

UNITS:[________]

SCINTILLOMETER MAKE: [________________]

UNITS:[________]

SPECTROMETER MAKE: [________________]

UNITS:[________]

NB. CHECK YOUR GPS SPHEROID AND BASE MAP YOU ARE COMPILING ON!

THE SITES FORM

```
ORIG[___] SITE ID[___________] DATE [__-____-__] STATE[_____]
PROV [___________] SPROV [_____________] DOMAIN [___________]
LOC DESCR [_________________________________________________]
[___________________________________________________________]
1:100K[_______] AMGEAST[__________] AMGNORTH [______________]
LOC METHOD [___] ABS ACC [___] AIRPHOTO[____________________]
```

Figure 2c is an example of the SITES section of the notebook.

ORIG – Mandatory integer of up to 4 digits that is unique to each geologist (it may also be used for an institution in some cases e.g. 'GSWA', 'RSES') from the ORIGINATORS table.

SITE ID – 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, however the Site ID must be unique to the originator. Most AGSO geologists use "AGSO" registered numbers for Site Id e.g. 93834000 - where 93 (year), 83 (project), 4000 (block of numbers allocated to R. Blewett 4000 -> 5999).

DATE – The date that the field site was visited or observed - in the standard Oracle date format of DD-MMM-YY - e.g. '23-JUL-93'.

Figure 2d (page 7) is an example field sheet where a single lithology is located at a site.

ORIG[119] SITE ID[93834000] DATE [03-JUN-93] STATE[QLD]

PROV [22] SPROV [ ] DOMAIN [ ]

LOC DESCR [10 KM W EBAGOOLA]

[ ]

1:100K[7568] AMGEAST[753309] AMGNORTH [8404600]

LOC METHOD [3] ABS ACC [50] AIRPHOTO[EBAGOOLA | 4 \ 326]

ROCK RELATIONS [GRANITE TORS]

[ ]

SKETCHES[ALIGNMENT OF KFS PORPS.]

[ ]

PHOTO [ ]

[ ]

VEG [526] LANDFORM [ER20]

STRAT UNIT[1342][ ]

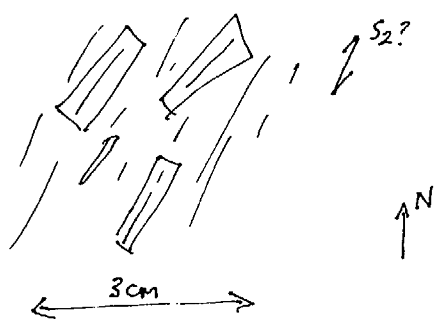
SMPLID [93834000] ROCK TYPE [2] L_QUAL[PORP]

LITHNAME CODE [GRT] LITH NAME[ ]

DESCR [Medium grained porphyritic biotite granite]

OTHER [ ]

SKETCH KFS PORP ALIGNMENT



TYPE	STYPE	DESCRIPTION
WEA	SW	
ALT	PY	
MI	QZ	2 mm
	KFS	ALIGNED NNE
	MS	< 5%
	BT	5% ALONG CRUDE FOLN
ITX	POR	
	XL	MAFIC ENCLAVES RARE
TEC	FO	WEAK - MOD // TO S_2 ?
	JO	WELL SPACED - CONJUGATE WITH SETS
		N-S + E-W . SUB VERT DIP.
COL	GY	
GS	M	
MAG	ME	20
	MAX	40
	MIN	5
RAD	TC	40
SP	IS	93834000
ST	RC	

TYPE	STYPE	AZ	INCL	DEFNO	DEFS	P
4	1	300	80			1
8	2	090	90			
8	2	360	90			

CARRY OVER [ ] SHEET [ ] OF [ ]

ORIG[✓] SITE ID[93834001] DATE [_-✓-_] STATE[✓]

PROV [✓] SPROV [ ] DOMAIN [ ]

LOC DESCR [✓]

[ ]

1:100K[✓] AMGEAST[753950] AMGNORTH [8405000]

LOC METHOD [✓] ABS ACC [✓] AIRPHOTO[✓]

ROCK RELATIONS [INTERBEDDED SCH / QZT]

[ ]

SKETCHES[ ]

[ ]

PHOTO [ ]

[ ]

VEG [ ] LANDFORM [ ]

STRAT UNIT[(INF)][DINGO CREEK SCHIST]

SMPLID [ ] ROCK TYPE [ ] L_QUAL[ ]

LITHNAME CODE [ ] LITH NAME[ ]

DESCR [ ]

OTHER [ ]

SKETCH

TYPE	STYPE	DESCRIPTION
93834001A		RT = 14 L = SCH
WEA	MW	
COL	BR	
GS	F	
MI	SIL	
	MS	
	BT	
	QZ	
TEC	CR	
	FO	
PH	S	93/1/3 — Fine sil needles in crenulated
		dingo ck schist.
	93834001B	RT = 14 Ø = CHY L = QZT
MAG	ME	35
RAD	TC	40
MTX	SA	GRANULAR TOWARDS TOP
TEC	FO	WEAK S2 FRACTURE CLEV.
SPH	SA	AT BASE
COL	WH	
GS	M	

	TYPE	STYPE	AZ	INCL	DEFNO	DEFS	P
B	1	1	028	30	0		1
A	3	1	100	80	2	0	

CARRY OVER [ ] SHEET [ ] OF [ ]

Figure 2e (page 8) is an example where more than one lithology is located at a site. This is explained later in the ROCKS section of the guide.

STATE - Mandatory if country is Australia. Two or three capital letters indicating the State in Australia (see Appendix).

PROV – An optional integer of up to 5 digits pointing to the Geological Province in the GEOPROVS authority table. Either the number or the name may be entered. (see Appendix). Use letter suffixes (93834000A, 93834000B) for sites that are located on province boundaries (ie. faults and unconformities).

SPROV – Optional field as for Province, but the pointer must be to a Subprovince of an already-entered province. This is also controlled by an authority table.

DOMAIN – A division of a subprovince - e.g. structural domain and batholiths. Geographic Area is an additional free text field in the SITES table for informal location data. This is not given a space in the notebook.

LOC DESCR – 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'.

1:100K – A mandatory 4-digit integer identifying the 1:100 000 map sheet-area on which the site falls.

***AMGEAST** – A 6-digit positive integer for the full AMG easting of the site in metres. Mandatory if a decimal longitude is not entered.

***AMGNORTH** – A 7-digit positive integer for the full AMG northing of the site in metres. Mandatory if a decimal latitude is not entered.

**use the above fields if you are using Lats/Longs and make a note so as to later enter into correct fields. Be aware of your GPS spheroid and age of base map and compilation sheets when using AMG's.*

LOC METHOD – A mandatory integer of up to 3 digits pointing to a record in the LOCMETHODS table (Appendix) showing the method used to obtain the geographic coordinates of the site. A number of values are available for different spheroids when a locmethod is from a GPS (Appendix). 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. If this was not the case then a specific map can be referenced with the Bibliographic Reference field (not shown on SITES form of the notebooks).

ABS ACC – A mandatory numeric field for the absolute accuracy in metres for the measured coordinates. 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. 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. Most GPS units provide accuracy figures usually around 25-50 m. During data entry, this field is automatically entered via an Oracle trigger (the value being based on the location method). The automatic (prompt) value can be changed by the user.

AIRPHOTO – An optional field of 36 characters to identify the airphoto on which the site was located and/or plotted. The field is for the name of the airphoto series, the run number and the photo number - e.g. 'Ebagoola 8/2134'.

THE OUTCROPS FORM

The Outcrops Form covers the OUTCROPS table and is designed for descriptions of the outcrop as a whole and relationships between lithologies and structures in the outcrop. Information on individual lithologies, samples and structures belong in the ROCKS and STRUCTURES tables - both of which have a many-to-one relationship with OUTCROPS.

```
ROCK RELATIONS [____________________________________________]
[__________________________________________________________]
SKETCHES[__________________________________________________]
[__________________________________________________________]
PHOTO [____________________________________________________]
[__________________________________________________________]
VEG [______________________] LANDFORM [____________________]
```

Figure 2f is an example of the OUTCROPS section of the notebook.

ROCK RELATIONS – An optional field of 120 characters for a description of the rock relations in the outcrop.

SKETCHES – An optional field of 60 characters noting any sketches made at the outcrop.

PHOTO – An optional field of 60 characters noting any photos taken at the outcrop. For multiple photography or the need to link photographs to a rock or sample, use datatype = PH in the lithology datatypes section (see later).

VEG – An optional field of up to 4-characters for the vegetation type in the VEGTYPES or vegetation type table (Appendix). The database also has a free text field for vegetation.

LANDFORM – An optional field of up to 4 characters for the landform in the LANDF table (Appendix). The database also has a free text field for landform.

THE ROCKS FORM

The Rocks Form records data on lithologies and rock samples at a site, and is a two-block form covering the ROCKS and LITHDATA tables. The ROCKS table has a many-to-one relationship with the SITES table (and is linked by the sample ID) - and also with the OUTCROPS table if an outcrop record exists for a site.

```
STRAT UNIT[_____][____________________________________________]

SMPLID [________________] ROCK TYPE [__] L_QUAL[______________]

LITHNAME CODE [________] LITH NAME[___________________________]

DESCR [_______________________________________________________]

OTHER [_______________________________________________________]
```

Figure 2g is an example of the ROCKS section of the notebook.

If a sample exists a Sampleid (number) must be supplied, otherwise the record is regarded as a lithology observation without a sample having been taken. The sample ID or sample number can be the site number, or can be different, but it must be unique to the originator (i.e. no two samples should have the same number for a single originator). If the site number is used and several samples were taken, then the site number is typically modified by adding letters to represent each sample (e.g. 93834000A, 93834000B, 93834000C etc). This is the recommended system, as it ensures the connection between samples and sites is clear.

The way the database, and therefore the notebook are set up means that when more than one lithology type occurs at a site, a new page is needed (see Figure 2d). This is OK in the relational database, but is a waste of paper in the field (a compromise is possible). For example, if you have interbedded sandstone and siltstone, you might adopt a REGMAP (Withnall, 1992) strategy where the lithology type is recorded on the right hand page - describe one lithology, rule it off and describe the next lithology (Figure 2e). The two geological descriptions will obviously be entered into different ROCKS forms back in camp or office (they will share a common SITE and OUTCROP via Site ID and Originator number), but have unique sample ID numbers (generally suffixed by As and Bs).

STRAT UNIT – An optional positive integer of up to 5 digits that identifies the unit in AGSO's Stratigraphic Lexicon. Or, write out the unit in full in the space adjacent to STRAT UNIT. As it is not possible to include here all the stratigraphic units for the country, each project should obtain the codes and units from the Stratigraphic Lexicon for the Province that they are working in prior to fieldwork. It is also recommended that each project ensures that the Stratigraphic Lexicon contains the units that are needed and that there are not multiple entries for the same unit e.g. ABC beds and ABC Beds etc. It is important that the project decides on what Strat Unit code is used for each unit as this will be a powerful attribute for searching and analysis in Oracle or in the GIS. The ROCKS form also has fields for Informal name and Age (no separate space is provided for this in the notebooks). These allow the geologist to enter names that have not been formalised and therefore not in the Stratigraphic Lexicon. To indicate this in the notebook, write "inf" into the space for the StratUnit code and write out the informal name in the space provided to its right. (see Figure 2e).

SMPLID – An optional field of 16 characters for the ID of a sample. Must be entered if a sample exists, otherwise it is assumed that no sample was taken. It must be unique to the Originator. AGSO Originators should use AGSO registered numbers with letters appended if more than one sample exists at the one site.

ROCK TYPE – An optional positive integer of up to two digits that identifies the basic rock type from a look-up table of 17 possibilities (Appendix). This field is designed for a first-pass coarse classification of rock types.

L_QUAL – A 20-character optional field for the qualifying term, if any, before the Lithology Name field that follows. The qualifying term must be in the LITHNAMES authority table (Appendix).

LITHNAME CODE – Code of the lithology name without a qualifier e.g. GRT = granite (Appendix). We suggest that you extract the required code for your range of rock types and scribble them on to a crib sheet until they are familar *or*

LITH NAME – A 20-character optional field for a lithology name. Only names already in the LITHNAMES authority table may be used.

DESCR – A 64-character optional field for a description of the lithology. It is probably best not to use abbreviations here as it is a very useful field that is frequently used by other users.

OTHER – A 64-character optional field that may be used for any data not covered by the above fields that the user feels are relevant, such as general remarks.

THE LITHOLOGY DATA TYPES BLOCK (Right Page)

```
  TYPE     STYPE               DESCRIPTION
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
[______] [_______] [____________________________________________]
```

Figure 2h is an example of the LITHDATA section of the notebook.

TYPE – A mandatory field of up to 4 capital letters for an abbreviation pointing to a Data Type (attribute name) in the LITHDATA table. Only data types already in the LITHDATA table may be entered, but the same Data Type may be inserted more than once (e.g. – a sample may exhibit two types of alteration). See Appendix (also for lithname codes, make up a crib sheet of the codes you feel you will need - we hope you will quickly become familar with them). The LITHDATA table is transparent in the view that you see in the NGMA form menu and it is really linked to ROCKS by a hidden pointer called the Rockno. This field is generated automatically when one enters data via the forms and for most cases there is no need to worry about it, however one needs to be aware of it when using SQLLoader for batch entry.

STYPE – An optional field of up to 4 capital letters for an abbreviation pointing to a Subtype (value of an attribute) of a Data Type in the LITHDATA table (Appendix)

DESCRIPTION – An optional field of 64 characters for any additional descriptive information relating to the Data Type/Subtype record. For example, one may wish to comment on the mode of occurrence of a mineral in a sample. You can over run onto lines below - but only 64 characters can be stored on a single Oracle line. To get around this, just repeat the Data Type/Subtype and carry on writing.

In some cases, the *absence* of a feature might want to be emphasised or recorded. This is easily done by writing x in the description field (e.g. TEC FO X for a non foliated rock).

STRUCTURES

```
TYPE   STYPE    AZ      INCL   DEFNO    DEFS     P
[__]   [___]   [___]   [__]   [___]   [___]   [ ]
[__]   [___]   [___]   [__]   [___]   [___]   [ ]
[__]   [___]   [___]   [__]   [___]   [___]   [ ]
[__]   [___]   [___]   [__]   [___]   [___]   [ ]
[__]   [___]   [___]   [__]   [___]   [___]   [ ]
[__]   [___]   [___]   [__]   [___]   [___]   [ ]
                       CARRY OVER [_] SHEET [_] OF [_]
```

Figure 2i is an example of the STRUCTURES section of the notebook.

STRUCTURES are linked to SITES by the ORIGINO and SITE ID and are also linked to a particular ROCKS form by the Oracle-generated Rockno. This means that a structural observation can also be linked to a rock or sample rather than a site as a whole.

TYPE & SUBTYPE – Structural features are stored as a mandatory TYPE and an optional SUBTYPE (e.g. bedding that dips is TYPE 1 SUBTYPE 1). A full list of codes is given in the Appendix. If you don't know the codes then fill it in as you would REGMAP (Withnall, 1992) by using the Bell and Duncan terminology (i.e. S0, S1, F3, L5 etc). The problem with the latter system is that there are a number of possible symbols (on a map) that represent S2 - it could be a crenulation cleavage, slaty cleavage, schistosity etc.. Lineations that pitch on a plane need to be converted to an azimuth and inclination before entry. Write the value of the pitch next to the plane that contains the lineation, if you do not have a stereonet at the outcrop.

AZ – An AZIMUTH is a direction of dip between 0^o and 359^o, this is oriented 90^o to a strike. This is important as the plotting routines will rotate (place) the symbols in an incorrect orientation if one uses strike.

INCL – Inclinations are the amount of dip between 0^o and 90^o. The value provided will be placed along side the relevant symbol in the GIS plotting routines.

DEFNO – An optional field to store the deformation number or generation of a structure (e.g. bedding would be 0 and the first cleavage would be 1). It is particularly useful when the generation of a foliation or lineation is known (or inferred), for example F_3 would have a 3 in the DEFNO field.

DEFS – The deformed surface number is the generation of the surface that is deformed by a subsequent generation of structure (it is used in conjunction with DEFNO). For example, a third generation fold axis of an second generation surface (F_3^2) would be TYPE 3, SUBTYPE1, DEFNO 3, DEFS 2.

P – An optional field for a numeric plotting priority or rank. This allows maps to be made with a single structural symbol at a site despite more than one structural reading for that site.

For palaeocurrent data one may want to use a REGMAP style (Withnall, 1992) as this preserves original data, no provision is made for rotated (restored) data in the present schema of STRUCTURES. A palaeocurrent database may have to designed in the future.

In order to link multiple samples and their respective structures, simply write A,B,C etc to the left of the TYPE field (see Figure 2c). This will help the data entry person to assign the correct structural readings(s) to the correct sample when more than one sample has been described on a single page.

And finally the Carry Over is for those really great sites, where you get your teeth into!!! The LITHDATA table has no limits on the number of records for each Siteid/Sampleid and the limit of the page is one that should be sufficient for most sites.

ACKNOWLEDGEMENTS

I am very grateful to the MLUP and ISB Database Working Group for their time and effort in getting the databases off the ground and up and running. I would also like to thank our working partners in GSQ, especially Ian Withnall, Ken Grimes, Mark Thornton, and Simon Lang for introducing me to the benefits of digital field data management (Regmap) and to Ian Withnall, Mark Thornton and Bill Whitaker for a useful review of this manuscript.

I would particulary like to thank Drs. Rod Ryburn and Peter Stuart-Smith for their help in preparing this field guide. The working group was chaired by Richard Blewett and included Rod Ryburn, Lesley Wyborn, Mark Rattenbury, Morrie Duggan, John Sheraton and Jan Knutson.

REFERENCES

Ryburn, R.J., Blewett, R.S., Stuart-Smith, P.G., and Williams, P.R. in prep. The users guide to the NGMA field databases. Australian Geological Survey Organisation, Record 1993/49.

Lang, S.C., Murphy, P.R., Grimes, K.G. & Withnall, I.W. 1987. Regional Mapping Field Data Management System (REGMAP) – report on the trial period and the recommendations for full implementation. Geological Survey of Queensland, Record, 1987/13.

Lang, S.C., Withnall, I.W. & Grimes, K.G. 1990. Regional Mapping Field Data Management System (REGMAP) – guide to data collection and entry. Department of Resource Industries, Queensland, Geological Mapping Manual 2.

Grimes, K.G., Withnall, I.W., Lang, S.C., Murphy, P.R., and Thornton, M.P. 1990. Regional Mapping Field Data Management System (REGMAP) data release for the Ebagoola 1:250 000 Sheet area, Coen Inlier, Cape York Peninsula, 1990-2. Queensland Resource Industries, Record 1992/3.

Withnall, I.W. 1992. REGMAP as a model for geological field data management. In: Geographic Information Systems, Cartographic and Data Standards, Bureau of Mineral Resources, Geology and Geophysics, Record 1992/27, pp.181-198.

APPENDICES

STATES

Code	State	Code	State
ACT	Australian Capital Territory	SA	South Australia
NSW	New South Wales	TAS	Tasmania
NT	Northern Territory	VIC	Victoria
QLD	Queensland	WA	Western Australia

LOCATION METHOD

No.	Description	No.	Description
0	unknown	13	1:100 000 topographic map
1	GPS observation (WGS-84)	14	1:25 000 topographic map
2	GPS observation (AMG-66)	15	1:1 000 000 topographic map
3	GPS observation (AMG-84)	16	1:1 000 000 topographic map
4	GPS observation (GDA-92)	20	non-standard geological map
5	astronomical observation	21	1:25 000 geological map
6	surveyed from ground control	22	1:50 000 geological map
7	published report	23	1:100 000 geological map
8	unpublished report	24	1:250 000 geological map
10	non-standard topographic map	25	1:1 000 000 geological map
11	1:25 000 topographic map	26	1:1 000 000 geological map
12	1:50 000 topographic map		

PROVINCES

1	Adavale Basin	48	Laura Basin
2	Adelaide Fold Belt	49	Leeuwin Block
3	Albany-Fraser Province	50	Litchfield Block
4	Amadeus Basin	51	Maryborough Basin
5	Arafura Basin	52	McArthur Basin
6	Arckaringa Basin	53	Money Shoal Basin
7	Arnhem Block	54	Mount Isa Inlier
8	Arrowie Basin	55	Mount Painter Block
9	Arunta Block	56	Murphy Inlier
10	Bancannia Trough	57	Murray Basin
11	Bangemall Basin	58	Musgrave Block
12	Birrindudu Basin	59	Nabberu Basin
13	Bonaparte Basin	60	New England Fold Belt
14	Bowen Basin	61	Ngalia Basin
15	Bremer Basin	62	Northampton Block
16	Broken Hill Block	63	Oaklands Basin
17	Canning Basin	64	Officer Basin
18	Cape York-Oriomo Inlier	65	Ord Basin
19	Carnarvon Basin	66	Otway Basin
20	Carpentaria Basin	67	Paterson Province
21	Clarence-Moreton Basin	68	Pedirka Basin
22	Coen Block	69	Perth Basin
23	Cooper Basin	70	Pilbara Block
24	Daly River Basin	71	Pine Creek Geosyncline
25	Darling Basin	72	Polda Basin
26	Davenport Geosyncline	73	Rocky Cape Block
27	Denison Block	74	Rum Jungle Block
28	Drummond Basin	75	South Nicholson Basin
29	Duaringa Basin	95	Southern Cross Province
30	Dundas Trough	78	St Vincent Basin
31	Eromanga Basin	76	Stansbury Basin
32	Esk Trough	77	Stuart Shelf
33	Eucla Basin	79	Styx Basin
34	Galilee Basin	80	Surat Basin
35	Gascoyne Block	81	Sydney Basin
36	Gawler Block	82	Sylvania Dome
37	Georgetown Block	83	Tasmania Basin
38	Georgina Basin	84	Tennant Creek Block
39	Gippsland Basin	86	Torrens Basin
85	Granites-Tanami Block	87	Tyenna Block
40	Halls Creek Province	88	Victoria River Basin
41	Hamersley Basin	89	Warburton Basin
42	Hillsborough Basin	90	Wiso Basin
43	Hodgkinson Fold Belt	91	Wonominta Block
44	Kanmantoo Fold Belt	92	Yambo Block
45	Karumba Basin	93	Yilgarn Block
46	Kimberley Basin	94	Eastern Goldfields Prov
47	Lachlan Fold Belt		

LANDFORM

CO00	coastal lands	AL14	covered plain
CO01	beach ridge plain	AL30	stagnant alluvial plain
CO02	chenier plain	AL40	terraced land
CO03	coral reef	AL20	alluvial terrace
CO04	marine plain	VO00	volcano
CO05	tidal flat	VO01	caldera
CO06	coastal dunes	VO02	cone (volcanic)
DE00	delta	VO03	lava plain
DU00	dunefield	VO04	ash plain
ER00	erosional landforms	PT00	plateau
ER10	erosional plain	KA00	karst
ER11	pediment	MA00	made land
ER12	pediplain	ME00	meteor crater
ER13	peneplain	ER50	mountains
ER20	rises	ER60	escarpment
ER30	low hills	ER70	badlands
ER40	hills	AL15	meander plain
FA00	fan	ER14	etchplain
FA01	alluvial fan	PL04	sand plain
FA02	colluvial fan	AL50	alluvial swamp
FA03	sheet-flood fan	DU01	longitudinal dune field
PL00	plain	ER80	drainage depression
PL01	depositional plain	ER21	residual rise
PL02	lacustrine plain	ER31	residual low hill
PL03	playa plain	PT01	plateau edge
AL00	alluvial landforms	PT02	plateau surface
AL10	alluvial plain	CO07	coastal plain
AL11	flood plain	AL16	floodout
AL12	anastomatic plain	VO05	lava flow
AL13	bar plain		

VEGETATION

S2G	tall shrubland with tussock grasses
S2F	tall shrubland with other herbaceous plants
S1Z	tall open shrubland with low shrubs
S1H	tall open shrubland with hummock grasses
S1G	tall open shrubland with tussock grasses
Z4	closed heath
Z3	open heath
Z3G	open heath with tussock grasses
Z2G	low shrubland with tussock grasses and graminoids
Z2F	low shrubland with other herbaceous plants
Z2	low shrubland with no significant lower stratum
Z1H	low open shrubland with hummock grasses
Z1G	low open shrubland with tussock grasses
Z1F	low open shrubland with other herbaceous plants
Z1	low open shrubland with no significant lower stratum
H2	hummock grassland
G4	closed tussock grassland or sedgeland
G3	tussock grassland or sedgeland
G2	open tussock grassland
G1	sparse open tussock grassland
F1	sparse open herbfield
NIL	no significant vegetation
T4	tall closed forest
T3M	tall open forest with medium trees
T3L	tall open forest with low trees
T3S	tall open forest with tall shrubs
M4	closed forest
M3L	open forest with low trees
M3S	open forest with tall shrubs
M3Z	open forest with low shrubs
M3G	open forest with tussock grasses and graminoids
M3	open forest with no significant lower stratum
M2L	woodland with low trees
M2S	woodland with tall shrubs
M2Z	woodland with low shrubs
M2H	woodland with hummock grasses
M2G	woodland with tussock grasses
M1L	woodland with low trees
M1S	woodland with tall shrubs
M1H	woodland with hummock grasses
M1G	woodland with tussock grasses
L4	low closed forest

L3S	low open forest with tall shrubs
L3Z	low open forest with low shrubs
L3G	low open forest with tussock grasses
L3	low open forest with no significant lower stratum
L2S	low woodland with tall shrubs
L2H	low woodland with hummock grasses
L2G	low woodland with tussock grasses
L2	low woodland with no significant lower stratum
L1S	low open woodland with tall shrubs
L1Z	low open woodland with low shrubs
L1H	low open woodland with hummock grasses
L1G	low open woodland with tussock grasses
L1F	low open woodland with other herbaceous plants
L1	low open woodland with no significant lower stratum
S3Z	open scrub with low shrubs
S3H	open scrub with hummock grasses
S3G	open scrub with tussock grasses or graminoids
S2Z	tall shrubland with low shrubs
S2H	tall shrubland with hummock grasses
L2Z	low woodland with low shrubs

ROCK TYPE

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	17	regolith
9	alkaline igneous		

LITHOLOGY (Q) QUALIFIER - CODE, DEFINITION

ADC	Q	adcumulate
ALK	Q	alkali
AMG	Q	amygdaloidal
ARE	Q	arenaceous
ARG	Q	argillic
BAS	Q	basic
BD	Q	bouldery
BXD	Q	brecciated
CS	Q	calc-silicate
CAL	Q	calcareous
CLC	Q	calcic
CAR	Q	carbonaceous
CHY	Q	cherty
CLT	Q	chloritic
CGC	Q	conglomeratic
XL	Q	crystal
CUM	Q	cumulate
DIA	Q	diapiric
DMT	Q	dolomitic
EUT	Q	eutaxitic
EXV	Q	extrusive
FEL	Q	feldspathic
FOI	Q	feldspathoidal
FLS	Q	felsic
FER	Q	ferruginous
FIA	Q	fiamme
GSY	Q	glassy
GPT	Q	graphitic
HK	Q	high-K
ITM	Q	intermediate
ITV	Q	intrusive
LAY	Q	layered
LCC	Q	leucocratic
LMN	Q	laminated
LPL	Q	lapilli
LTH	Q	lithic
LK	Q	low-K
MAF	Q	mafic
MDY	Q	muddy
MGS	Q	magnesian
MK	Q	medium-K
MCC	Q	melanocratic
MCL	Q	mesocumulate
MET	Q	meta
MIC	Q	micaceous
MYL	Q	mylonitic
ORT	Q	ortho
OCL	Q	orthocumulate
PAR	Q	para
PBY	Q	pebbly
PEL	Q	pelitic
PHC	Q	phosphatic
PCR	Q	picro
POR	Q	porous
PORP	Q	porphyritic
POT	Q	potassic
PRS	Q	poorly sorted
PSM	Q	psammitic
PYR	Q	pyritic
QF	Q	quartzo-feldspathic
RYM	Q	rhythmic-layered
SDY	Q	sandy
SER	Q	sericitic
SIL	Q	siliceous
SDC	Q	sodic
SLY	Q	silty
SUL	Q	sulphidic
TPI	Q	tephri
THL	Q	tholeiitic
TCY	Q	trachy
TFC	Q	tuffaceous
UB	Q	ultrabasic
UM	Q	ultramafic
UNW	Q	unwelded
VTR	Q	vitric
WEL	Q	welded

IGNEOUS (I) LITHOLOGIES - CODE, DEFINITION

ANT	I	andesite
ANS	I	anorthosite
APL	I	aplite
ASH	I	ash
BLT	I	basalt
BSN	I	basanite
BON	I	boninite
CBT	I	carbonatite
CHR	I	charnockite
CHT	I	chromitite
DAC	I	dacite
DRT	I	diorite
DLT	I	dolerite
DUN	I	dunite
EPC	I	epiclastic
FNT	I	fenite
FDT	I	foidite
FDL	I	foidolite
GAB	I	gabbro
GRT	I	granite
GRD	I	granodiorite
HZB	I	harzburgite
HBT	I	hornblendite
IGM	I	ignimbrite
IJL	I	ijolite
KBL	I	kimberlite
KTT	I	komatiite
LPR	I	lamproite
LPY	I	lamprophyre
LTT	I	latite
MCH	I	meimechite
MLT	I	melilitite
MLL	I	melilitolite
MZB	I	monzogabbro
MZG	I	monzogranite
MZT	I	monzonite
NLL	I	nephelinlite
NRT	I	norite
OBS	I	obsidian
OPL	I	ophiolite
PER	I	peridotite
PNT	I	phonolite
PCT	I	picrite
PHY	I	porphyry
PYC	I	pyroclastic
PRX	I	pyroxenite
QZG	I	quartz-rich granitoid
RHY	I	rhyolite
SPL	I	spillite
SYN	I	syenite
TPH	I	tephra
TPT	I	tephrite
TNL	I	tonalite
TYA	I	trachyandesite
TYB	I	trachybasalt
TRC	I	trachyte
TUF	I	tuff

METAMORPHIC (M) LITHOLOGIES — CODE, DEFINITION

AMP	M	amphibolite
EGL	M	eclogite
GNS	M	gneiss
GFL	M	granofels
GR	M	greisen
GRN	M	granulite
HFL	M	hornfels
MBL	M	marble
MIG	M	migmatite
MTS	M	metasomatite
MYL	M	mylonite
PHL	M	phyllite
QZC	M	quartzite
QZR	M	quartz rock
SCH	M	schist
SKN	M	skarn
SRP	M	serpentinite

SEDIMENTARY (S) LITHOLOGIES - CODE, DEFINITION

AGLS	S	algal limestone	GYWK	S	greywacke
ARNT	S	arenite	GUN	S	guano
AGLT	S	argillite	GYT	S	gyttja
ARKS	S	arkose	IRFM	S	iron formation
BIOC	S	biocarbonate	IRST	S	ironstone
BIOM	S	biomicrite	LMST	S	limestone
BIOS	S	biosparite	LOM	S	loam
BLD	S	boulder	LOS	S	loess
BDST	S	boundstone	MARL	S	marl
BX	S	breccia	MCRT	S	micrite
CBNR	S	carbonaceous rock	MXLL	S	microcrystallineLMST
CBRK	S	carbonate rock	MUD	S	mud
CRNL	S	carnieule	MDST	S	mudstone
CHLK	S	chalk	NVLT	S	novaculite
CHRK	S	chemical rock	OLTL	S	oolitic limestone
CHRT	S	chert	OOZ	S	ooze
CLRK	S	clastic rock	ORSD	S	organic sediment
SDMT	S	clastic sediment	PBL	S	pebble
CLY	S	clay	PELT	S	pelite
CLST	S	claystone	PHSP	S	phosphorite
CNGL	S	conglomerate	PCLN	S	porcellanite
CQNA	S	coquina	PSMT	S	psammite
DMCT	S	diamictite	RDLT	S	radiolarite
DTMT	S	diatomite	RCL	S	residual clay
DOLL	S	dolomitic limestone	SND	S	sand
DLST	S	dolostone	SDST	S	sandstone
DST	S	dust	SHLE	S	shale
EVPT	S	evaporite	SHG	S	shingle
FGLT	S	fanglomerate	SLST	S	silstone
FLNT	S	flint	SLT	S	silt
GYST	S	geyserite	SPGT	S	sparagmite
GNST	S	grainstone	TLL	S	till
GPST	S	grapestone	TRVN	S	travertine
GVL	S	gravel	TBDT	S	turbidite

REGOLITH (R) "LITHOLOGY" CODES, DEFINITION

BAU	R	bauxite	GOS	R	gossan
CLC	R	calcrete	LAT	R	laterite
FER	R	ferricrete	SIL	R	silcrete
GRU	R	grus			

DATATYPE MI (MINERAL)
COMMON ROCK FORMING MINERALS — SUBTYPE (CODE), DEFINITION

AB	Albite
ACT	Actinolite
ADS	Andesine
AEG	Aegirine
ALM	Almandine
ALN	Allanite
AMPH	Amphibole
AN	Anorthite
AND	Andalusite
ANH	Anhydrite
AP	Apatite
APY	Arsenopyrite
ARF	Arfvedsonite
AUG	Augite
AZ	Azurite
BN	Bornite
BRL	Beryl
BRT	Barite
BT	Biotite
CAL	Calcite
CARB	Carbonate
CC	Chalcocite
CCP	Chalcopyrite
CHR	Chromite
CIN	Cinnabar
CL	Chlorite
CLAY	Clay mineral
CLD	Chloritoid
COR	Corundum
CPX	Clinopyroxene
CRD	Cordierite
CRS	Cristobalite
CST	Cassiterite
CUM	Cummingtonite
CUP	Cuprite
CV	Covellite
CZO	Clinozoisite
DI	Diopside
DOL	Dolomite
EP	Epidote
FA	Fayalite
FS	Feldspar
FL	Fluorite
FSPD	Feldspathoid
GLN	Glaucophane
GLT	Glauconite
GN	Galena
GP	Gypsum
GR	Graphite
GRS	Grossular
GNT	Garnet
GT	Goethite
AU	Gold
HBL	Hornblende
HEM	Hematite
HL	Halite
ILL	Illite
ILM	Ilmenite
JD	Jadeite
KFS	K-feldspar
KLN	Kaolinite
KY	Kyanite
LAB	Labradorite
MAL	Malachite
MC	Microcline
MCS	Marcasite
MGS	Magnesite
MGT	Magnetite
MICA	Mica
MNT	Montmorillonite
MNZ	Monazite
MOL	Molybdenite
MS	Muscovite
NE	Nepheline
OAMP	Orthoamphibole
OGC	Oligoclase
OL	Olivine
OPL	Opal

OPQ	Opaque mineral	SERP	Serpentine
PGT	Pigeonite	SIL	Sillimanite
PHL	Phlogopite	SP	Sphalerite
PHOS	Phosphate	SPL	Spinel
PL	Plagioclase	SPS	Spessartine
PMP	Pumpellyite	SRL	Schorl
PO	Pyrrhotite	ST	Staurolite
PRH	Prehnite	STB	Stibnite
PRL	Pyrophyllite	SUL	Sulphur
PRP	Pyrope	TLC	Talc
PY	Pyrite	TOUR	Tourmaline
PYRX	Pyroxene	TOZ	Topaz
QZ	Quartz	TR	Tremolite
RBK	Riebedcite	TTN	Titanite
RT	Rutile	VES	Vesuvianite
SA	Sanidine	VRM	Vermiculite
SCH	Scheelite	WO	Wollastonite
SD	Siderite	ZEOL	Zeolite
SERC	Sericite	ZRN	Zircon

LITHOLOGY DATATYPES & SUBTYPES — CODES, DEFINITION

DATA	TYPEDESC	SUBT	SUBDESC
ALT	Alteration	AB	albitic
ALT		AL	alunitic
ALT		AR	argillic
ALT		CA	carbonate
ALT		GR	greisen
ALT		HM	hematitic
ALT		KA	kaolinitic
ALT		PO	potassic
ALT		PR	propylitic
ALT		PY	pyritic
ALT		SE	sericitic
ALT		SP	serpentinised
ALT		SI	silicified
ALT		SK	skarn
ALT		ZE	zeolitic
BED	bedding thickness	LA	laminated
BED		ME	medium
BED		TK	thick
BED		TN	thin

BED		VTK	very thick
BED		VTN	very thin
COH	coherence	CP	compact
COH		CON	consolidated
COH		FI	fissle
COH		FR	friable
COH		HD	hard
COH		IN	indurated
COH		PO	porous
COH		UN	unconsolidated
COL	Colour	BK	black
COL		BL	blue
COL		BR	brown
COL		BU	buff
COL		CH	chocolate
COL		CR	cream
COL		FA	fawn
COL		GR	green
COL		GY	grey
COL		IR	iridescent
COL		KH	khaki
COL		MA	maroon
COL		MO	mottled
COL		OL	olive
COL		OR	orange
COL		PI	pink
COL		PU	purple
COL		RE	red
COL		VC	varicoloured
COL		VG	variegated
COL		VI	violet
COL		WH	white
COL		YE	yellow
FOS	fossil	FI	fossil invertebrates
FOS		FP	fossil plants
FOS		FV	fossil vertebrates
FOS		FM	microfossils
FOS		FT	trace fossils
GS	grainsize	BM	bomb
GS		BO	boulder
GS		C	coarse
GS		CB	cobble
GS		F	fine

GS		GL	granule
GS		GV	gravel
GS		GT	grit
GS		LA	lapilli
GS		M	medium
GS		MX	microcrystalline
GS		MUD	mud
GS		PB	pebble
GS		PEG	pegmatitic
GS		SLT	silt
GS		VC	very coarse
GS		VF	very fine
IS	internal stratification	CV	convolute
IS		XB	cross-bedded
IS		XL	cross-laminated
IS		FL	flasers
IS		HO	horizontal
IS		HPL	horiz. ‖ laminae
IS		HX	hummocky cross bed
IS		LA	lamination (intrabed)
IS		LEN	lenticular bedding
IS		LPX	low-angle planar cross bedding
IS		LTX	low-angle trough cross bedding
IS		MAS	massive
IS		GR	normal grading
IS		PI	pillowed
IS		RG	reverse grading
IS		RXL	ripple cross laminae
IS		WB	wavey bedding
ITX	texture (igneous)	AM	amorphous
ITX		AMY	amygdaloidal
ITX		APH	aphanitic
ITX		APHY	aphyric
ITX		AB	autobrecciated
ITX		CON	conchoidal
ITX		CX	cryptocrystalline
ITX		DV	devitrified
ITX		EQ	equigranular
ITX		EU	eutaxitic
ITX		FR	fragmental
ITX		MX	microcrystalline
ITX		POR	porphyritic
ITX		SPH	spherulitic

ITX		VE	vesicular
ITX		VI	vitric
ITX		VU	vuggy
ITX		XC	xenocrystic
ITX		XL	xenolithic
MAG	Magnetic Sus. 10^{-5}	ME	mean
MAG		MAX	maximum
MAG		MIN	minimum
MTX	texture (metamorphic)	BA	banded
MTX		BR	brecciated
MTX		BK	broken
MTX		GN	gneissic
MTX		MIG	migmatitic
MTX		POB	porphyroblastic
MTX		PS	pseudomorph
MTX		RX	recrystallised
MTX		SA	saccharoidal
MTX		SCH	schistose
PH	Photographic Info	S	35mm slide
PH		CP	colour print
PH		BW	black and white
RAD	Gamma Ray Spec.	TC	Total Count
RAD		U	uranium
RAD		TH	thorium
RAD		K	potassium
SEQ	sequence types	CU	coarsening upward sequence
SEQ		FU	fining upward sequence
SEQ		TKU	thickening upward
SEQ		TNU	thinning upward
SOR	sorting	M	moderate
SOR		P	poor
SOR		W	well
SP	Sample Provenance	AD	aeolian detritus
SP		CV	colluvium
SP		DB	displaced block (near situ)
SP		GE	glacial erratic
SP		IS	in situ
SP		RB	river detritus
SP		UN	unknown
SP		VD	volcanic ejectamenta
SPH	sphericity	ANG	angular
SPH		RO	rounded
SPH		SA	sub-angular

SPH		SR	sub-rounded
SPH		VA	very angular
SPH		WR	well-rounded
SS	sedimentary structures	BP	ball-and-pillow
SS		BIO	bioturbated
SS		BU	burrows
SS		CL	clast
SS		ES	erosive structures
SS		FS	flame structures
SS		IM	imbricated
SS		LC	load casts
SS		MC	mud cracks
SS		PA	parting
SS		PL	parting lineation
SS		RUC	rip-up-clasts
SS		RM	ripple marks
SS		SD	sandstone dykes
SS		SSD	soft sedim. deform.
SS		SM	sole markings
SS		TR	trails
ST	Sample Type	AS	assay
ST		GC	geochronology
ST		HS	hand specimen
ST		HM	heavy mineral conc.
ST		PA	macropaleontology
ST		MP	micropaleontology
ST		PM	palaeomagnetic
ST		RP	rock properties
ST		SC	soil chemistry
ST		SS	stream sed chemistry
ST		TS	thin section
ST		UN	unknown
ST		RC	whole-rock chemistry
STX	texture (sedimentary)	CEM	cemented
STX		GP	geopetal
STX		MIC	micritic
STX		ON	oncolitic
STX		OO	oolitic
STX		PE	peloidal
STX		PIS	pisolitic
TEC	tectonic features	BOU	boudinaged
TEC		BR	brecciated
TEC		CAT	cataclastic

TEC		CLV	cleaved
TEC		CT	contorted
TEC		CR	crenulated
TEC		FD	folded
TEC		FO	foliated
TEC		FR	fractured
TEC		JO	joint
TEC		KI	kink
TEC		MY	mylonitic
TEC		SL	slickensided
TEC		ST	stylolitised
TEC		VN	vein
WEA	weathering	FR	fresh
WEA		HW	heavily weathered
WEA		MW	moderately weathered
WEA		SW	slightly weathered

STRUCTURE CODES

TYPE	SUBTYPE LEGEND
1	1 Bedding (gen. dipping)
1	2 Bedding (gen. vertical)
1	3 Bedding gen. horizontal
1	4 Bedding gen. overturned
1	11 Bedding(facing definite)
1	12 Bedding vertical
1	13 Bedding horizontal
1	14 Bedding overturned
1	15 Bedding horizontal invert
1	21 Bedding (facing unknown)
1	22 Bedding unknown vertical
1	23 Bedding unknown horizontal
2	1 Cleavage dipping
2	2 Cleavage vertical
2	3 Cleavage horizontal
2	11 Crenulation cleavage
2	12 Crenulation cleavage vert
2	13 Crenulation cleavage hori
3	1 Foliation dipping
3	2 Foliation vertical
3	3 Foliation horizontal
4	1 Igneous layering dipping

4	2 Igneous layering vertical
4	3 Igneous layering horizont
5	1 Axial surface dipping
5	2 Axial surface vertical
5	3 Axial surface horizontal
6	1 Fault dipping
6	2 Fault vertical
6	3 Fault horizontal
7	1 Vein quartz
7	2 Vein porphyry
7	3 Vein dolerite
7	4 Vein granite
7	5 Vein lamprophyre
7	6 Vein pegmatite
7	7 Vein rodingite
7	8 Vein aplite
7	9 Vein microgranite
7	10 Vein syenite
8	1 Joint dipping
8	2 Joint vertical
8	3 Joint horizontal
20	1 Fold hinge
21	1 Mineral elongation
21	2 Stretching lineation
21	3 Intersection lineation
21	4 Crenulation lineation
21	5 Slickenside
21	6 Mullion
22	1 Palaeocurrent
23	1 Boudin axis
31	1 Kink band
32	1 Shearing direction
35	1 C plane
35	2 S plane