G-BASE Trials of SIGMA Digital Field Data Capture; Feedback and Recommendations

Digital Geoscience Spatial Model

Internal Report IR/05/015

SYSTEM FOR INTEGRATED GEOSPATIAL MAPPING

BRITISH GEOLOGICAL SURVEY

DIGITAL GEOSCIENCE SPATIAL MODEL

INTERNAL REPORT IR/05/015

G-BASE Trials of SIGMA Digital Field Data Capture; Feedback and Recommendations

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Front cover

Cover picture shows regional soil sampling in East Anglia, G-BASE 2004.

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1 Introduction

One of the aims of SIGMA (System for Integrated Geospatial Mapping) is to evaluate current methods of field data collection and mapping in an attempt to increase efficiency where possible (Jordan et al. 2002). The G-BASE programme is one of several across BGS that was supplied with 'digital notebooks' (i.e. PDAs [Personal Digital Assistants] running customised software) and accessories such as GPS (Global Positioning Systems) and digital cameras in order to assess the impacts of digital field data capture on their fieldwork. This report provides feedback to the ongoing SIGMA Toolkit testing programme from the 2004 G-BASE field season.

The capture of digital field data and the transfer of data into a desktop database was carried out in two testing phases: firstly within the scope of the G-BASE regional and urban sampling campaign of 2004 in East Anglia and secondly in Keyworth in December 2004.

Due to heavy workloads and extremely tight schedules before the field season, an introduction and formal training to operate the HP iPAQ hardware and customised ArcPad software was not held and operators only had a brief overview of the system before commencing their work in the field. Therefore it took longer for G-BASE staff to become familiar with the devices during the 2004 field campaign and so trials under real field sampling conditions were limited. The devices were, however, handed out to experienced volunteer workers who carried out the sampling and digital recording of field observations.

To supplement this rather limited testing, a second trial was carried out at BGS Keyworth after the field season to gain additional information about the application of the digital devices. Andreas Scheib carried out trials in Keyworth with support from Paul Turner and Emma Bee. After both field trials were complete, the captured data was successfully transferred into the G-BASE field database.

2 Field data capture: Application and experiences

2.1 EQUIPMENT OVERVIEW

During the G-BASE field campaign and further tests at Keyworth, two SIGMA ‘toolkits’ (1 and 2) were used. Each SIGMA toolkit came in a padded toolbox case and contained one iPAQ with a pen, 4 spare AA and AAA rechargeable batteries with charger, one Bluetooth GPS receiver (Fortuna GPSmart), a media card reader, protection cases (AquaPac or HP rugged case), a backup powerpack and a digital camera. The toolbox case with the padding is absolutely sufficient for the protection and transport of the devices and all accessories (see Photograph 1)

Photograph 1: Example of a complete SIGMA toolkit in padded toolbox case used in the G-BASE field season 2004.

2.2 HARDWARE ISSUES

Operating the devices in the field showed that the handheld iPAQs are compact in size and have screens with very good resolution and visibility. Compared with the standard G-BASE equipment (Filofax, GPS, pens etc.) carried by the students each day, the SIGMA equipment (GPS, iPAQ, camera and spare batteries), was similar in size and weight.

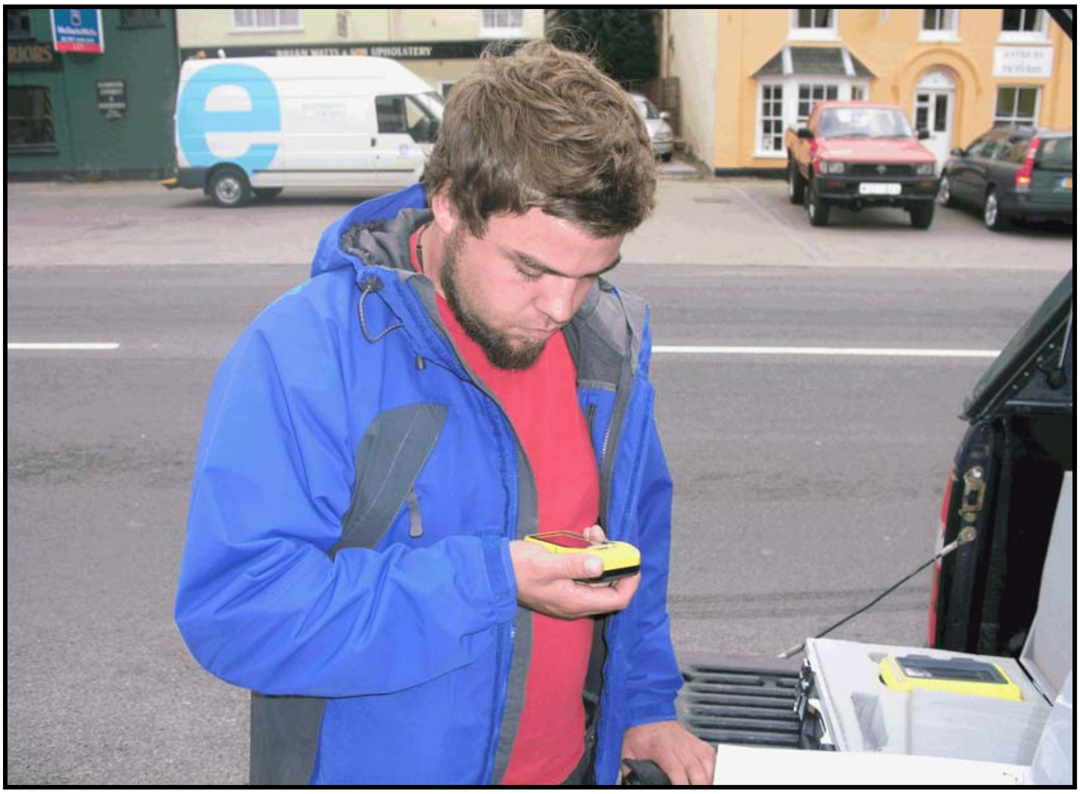
As field work is carried out under any weather conditions and the student Volunteer Worker (VW) always will be in contact with soil and stream water the devices have to be handled with care and need to be protected against dirt and water whilst used in the field. Both the HP case and the AquaPac are fully waterproof but the HP case does provide addition ruggedness. Therefore both options should be available within each Toolkit so that the appropriate case can be used to suit the conditions.

If charged properly, the iPAQs were fine to use for a whole day. Using the four spare rechargeable batteries in the powerpack with uncharged devices did not appear to work but this might be because the back-up batteries were not sufficiently charged.

The digital camera was a very useful tool to document, for example, contamination at stream sites, unusual finds in soils, bedrock outcrops, training sessions and sampling techniques, which then could also be used for reports and presentations.

The GPS units (GPSmart, by Fortuna) were not used during the G-BASE field campaign as we experienced problems with the Bluetooth. On the few occasions when the GPS unit was working and gave a location, the position for the sample site was inaccurate to approximately 100 meters east according to the map loaded into the iPAQ. Comparing the grid references between the GPS (Garmin), which is normally used by the G-BASE field teams, and the GPSmart (Fortuna) no deviation could be found. In this case the VWs had to enter the sample points by tapping on the screen at the location on the base map. Then they entered the exact grid reference from the GPS receiver (Garmin) into the data capture protocol. In the field this problem could not be solved but after reporting a recurring ‘Projection unknown’ error to the system developers the problem was identified and resolved.

The problems caused by the Bluetooth connections were resolved before testing continued at Keyworth. In preparation for the testing at BGS Keyworth the complete Bluetooth Manager set up was checked and a device search was run. Afterwards the iPAQ was clearly responding to the GPS receiver. During the data capture exercise at BGS Keyworth site the Bluetooth was working very accurately and the projection problems mentioned above did not reoccur.



Photograph 2: Preparation of the SIGMA kits for BBC filming, Long Melford 2004

2.3 SOFTWARE ISSUES

From the start of the trials difficulties appeared with the software. According to the descriptions in the manual, ArcPad should have been accessible through an icon in the “Start” pop-up menu. Instead ArcPad had to be opened via programs/file explorer/storage card.

There were two ways to open the existing project maps/files for the regional and urban G-BASE data capture. One option was to open those maps in ArcPad via "Open Map" or secondly to find and open projects that had previously been set up i.e. the files named ArcPadgbase2004 and ArcPadgbaseurban2004 under gbase2004/ArcPad on the storage card. However, neither of these ways worked so the project maps for capturing regional and urban field data had to be recreated. Therefore all necessary layers and toolbars had to be loaded. In doing so, ArcPad questioned with every layer, "The layer (e.g. fm24_25.sid) has no projection information. Do you want to assume it's British National Grid?". The question was answered with "yes". Then the newly generated project map was saved as one of the existing names above in folder: gbase2004 and location: storage card. Afterwards the newly created maps appeared under "Open Map" from "file" on the tool bar and could be opened without any problems.

Problems appeared when the gbase toolbars for entering field data weren't available in the "Options" menu. The paths to the Systems and the Applets files were subsequently found to be wrong. After changing the paths and resetting the device, the toolbars appeared. Some of these problems could have been alleviated through more thorough training or by a phone call back to one of the developers in Keyworth.

The problems noted above are a function of the way the memory of the iPAQs is designed. All data in the main memory (e.g. project files) are lost when the battery is allowed to run flat therefore it is recommended to store all data on the storage card, which is not wiped when all power is lost. This is noted in the instructions provided with the SIGMA Toolkit but should be stressed more.

During the trials under fieldwork conditions during summer 2004, one problem was mentioned by all students at each trial. The devices crashed after three to four sampling sites and therefore could not be used for the rest of the day. Students reported that the large data set (stored map layers) on the storage card could be responsible for the failure. They also noticed that the iPAQs were getting slower in processing and loading new images throughout the day. The reason for these problems could not be found, but it was suspected that it may be due to overloaded storage cards or poorly charged devices.

In preparation for the trials at BGS Keyworth, space had to be made on the storage card to save the layers for Keyworth and surroundings. Therefore all available layers of geological maps were deleted. None of the failures mentioned above occurred (crashes etc.) during tests supporting that the storage cards were to blame. It is recommended to provide larger storage cards or to trim the data on each card to that needed for a days or weeks work.

After correcting all software and set-up related problems the collection of field data was incredibly easy. With a perfectly working Bluetooth responding to the GPS receiver the data capture at BGS Keyworth was extremely successful.

The students reported that the use of ArcPad software was very easy. Entering the field data through tapping and tick-boxes is simple with the major advantage that data cannot be omitted as the software requires certain fields to be filled in. It was also noted that the stylus attached to the device is small and may be easy to lose but as the screen is pressure sensitive an ordinary pencil could be used in place of the stylus thereby circumventing this concern.

2.4 DATA TRANSFER

Data transfer into the field database was not tested in the field due to the problems experienced with data capture at sites and the large work load during the G-BASE field season. Instead the dataset captured at BGS Keyworth was used and, in cooperation with Paul Turner and Bob Lister, successfully transferred into the G-BASE field database.

The easiest and quickest way to download captured data from a day of fieldwork is to put the storage card into the card reader and connect it to the field laptop. During the day the captured field data of approximately 12 sites was saved on a generated .dbf file. The created .dbf file, e.g. XYfield2004urban_soil.dbf, was then copied from the storage card onto the hard drive of the field laptop. There, this file was renamed with a name less than nine characters, e.g. soils_urb.dbf. Then, to finally import this data into the Access field database, open the renamed file through File > Get External Data > Import. In the next window browse to the location of file and press ok to import. To complete the data transfer the new table will be joined in a query into the existing field data sheet.

3 Recommendations

The G-BASE MSAccess database has altered since the specifications were given to the SIGMA team therefore the following updates are required to the G-BASE tools in ArcPad: These updates will ensure accurate recording of field data and subsequent loading of those captured data into the main field database

- To record the bedrock geology of both urban and regional soil sites, two new tick boxes have to be created with a corresponding column with the title MAP_GEOL(1 and 2) along with the already existing CAT_GEOL and SITE_GEOL, because soil samples are not related to a certain catchment area (see Table 4 for details).
- Soil texture options should be changed to match those in the Geochemistry Database. Therefore textures like organic, made ground etc. have to be taken out, as they are not textures. See below a list of the updated soil texture codes.

Table 1: Recent soil texture codes for G-BASE field database

Code	Texture
CLAY	Clay
SACL	Sandy Clay
CLSA	Clayey Sand
SAND	Sand
SASI	Sandy Silt
SICL	Silty Clay
SILT	Silt
SISA	Silty Sand

- Another tick box should be added. Information about the slope at soil sample sites is required (Table 2). Recorded information will appear in column "RELIEF".

Table 2: Codes for slope at site

Code	Slope
1	Hill top
2	Gentle slope (5-20°)
3	Steep slope (>20°)
4	Foot slope base of valley side
5	Valley floor
6	Hollows with marsh or bog
7	Level field, flood plain

- A tick box for "Mineralization Style in Bedrock" needs to be added (Table 3). The corresponding column in the database is MINBED_STYLE.

Table 3: Codes for mineralization style in bedrock

Code	Mineralisation style in bedrock
1	Vein
2	Fault
3	Pod
4	Lens
5	Stratiform
6	Joint or fracture
7	Disseminated
9	Staining or coating

- Tick boxes for soil moisture and OS map number (see figures 1 and 3) need to be added. They are corresponding to columns A_or S_MOIST and MAP_SCALE in the field database.
- New codes for recording land use, site geology, catchment geology and clast lithology can be found on Figures 1 to 4 in the Appendix.
- Another useful change would be to give the option to enter two or more collector's initials, as they work in pairs and for this reason both have to be mentioned. The possibility to enter volunteer's initials manually could also be helpful.
- Grid references (Easting/Northing) shouldn't appear with 5 or 6 decimal places. The software should round up or down to 6 digits, e.g. 614559.
- When importing data into Access, the column of comments should appear in the last column of the table.

For further information about recently changed codes see also internal report "The G-BASE field database" (Lister et al 2005) and also find tables and figures of recent codes and column headers attached in Appendix 1.

Listed below are a few more suggestions for changes in the ArcPad software and the hardware, which could improve the system:

- Geological maps such as superficial or bedrock are not necessarily required to be loaded on the iPAQs. If necessary, they could be loaded at field base individually onto the devices.
- Because of the problems experienced with the data transfer, it would be helpful if the generated dbf file could be named with less than 9 characters or even could include the sampling date for identification already.
- Both the card reader and the connection via USB cable are useful and easy for downloading data into the database. Unfortunately the software ActiveSync wasn't installed on the G-BASE laptop yet, so the iPAQs couldn't be found. The need for this software should be stressed further in the release notes.
- Symbols of sample sites should be changed to a dot. They came up on the screen as a "!".

- Currently ArcPad is creating two separate tables for soil and sediment data. It would be best if the generated dbf file could include both soil and drainage sample records.

4 Conclusions

Testing the iPAQs and its accessories under field sampling conditions during the G-BASE field campaign of 2004 and at BGS Keyworth led to the conclusion that the iPAQs could significantly improve the data collection in the field and allow easier transfer of captured data into the database. The main lesson learnt during the short trial phases of G-BASE fieldwork 2004 and further testing in Keyworth is that time will need to be allocated to BGS staff for sufficient training and practise before next year's field season, as they have to pass it on to students in an introduction and for further support during fieldwork.

The trials helped to find difficulties and problems with the devices, leading to an even more efficient way of using the iPAQs for the G-BASE field data capture. It is recommended that the SIGMA and G-BASE teams meet to discuss all updates and that these be made before the next field season.

Until we are confident that the iPAQ units can be used easily and efficiently in the field and that the data can always be safely downloaded without losing any data, the use of the iPAQs would still require the voluntary workers to fill in the G-BASE field cards as usual in next year's field campaign, and probably for the next few years, too.

A. Scheib has volunteered to be the lead G-BASE contact for digital field data capture and is willing to carry out further work with the iPAQ devices. The next opportunity for field trials would be the G-BASE/TELLUS staff-training week in May 2005 in Northern Ireland.

Appendix 1

Table 4: Example of field data in EXCEL format ready for loading to the Geochemistry Database with headers of each column (Lister et al., 2005).

Fieldname	*e.g. row 1*	*e.g. row 2*	*Comments*
PROJECT_CODE	42	42	
SITE_NUMBER	1	2	
SAMPLING_PROTOCOL			
CODE_VERSION			
DUPLICATE	FALSE	FALSE	
SAMP_C	C	C	
SAMP_P	P	P	
SAMP_W	W	W	
SAMP_A			
SAMP_S			
SAMP_STD			
EASTING	423310	424020	
NORTHING	338200	339140	
REF_MAP	128	128	
MAP_SCALE	1	1	field database to translate 1 to 50
COLLECTORS	SC/JC	JC/SC	
DATE	17/06/1997	17/06/1997	
REL_SAMP			
STM_ORDER	3	3	
DRAIN_TYPE	4	4	
DRAIN_COND	4	4	
WEATHER	3	4	
PPT_ORANGE			
PPT_BROWN	1	1	
PPT_BLACK	1	1	
SED_COLOUR	LB-O	LB-O	
SED_CLAY	1	1	
SED_ORGANIC	2	1	
CONTAM1	A1	B3	
CONTAM2	B0		
CONTAM3			
CONTAM4			
CONTAM5			
CONTAM6			
CONTAM7			
CONTAM8			
CONTAM9			
LAND_USE1	BAB0	BAB0	
LAND_USE2	AEAA	AC00	
LAND_USE3			
CLAST1	SDST	SDST	
CLAST2	SLMDST	MDST	
CLAST3	QZITE	QZITE	
CLAST4	SLMDST		
CLAST5	MDST		
CLAST6			
CLAST7			
CLAST8			
BEDROCK	1	1	
DRIFT1	C1	C1	
DRIFT2		E1	
DRIFT3			
DRIFT4			

…continue Table 4

Fieldname	*e.g. row 1*	*e.g. row 2*	*Comments*
RELIEF			
SITE_GEOL1			
SITE_GEOL2			
CAT_GEOL1	3D00	3D00	always taken from map
CAT_GEOL2	3S00	3S00	always taken from map
MAP_GEOL1			always taken from map for soils
MAP_GEOL2			always taken from map soils
PAN_MIN1	7D31	7E11	
PAN_MIN2	7T26	7T26	
PAN_MIN3	7E11	7B41	
PAN_MIN4			
PAN_MIN5			
PAN_MIN6			
MIN_BED1		7D11	
MIN_BED2			
MIN_BED3			
MIN_CLAST1			
MIN_CLAST2			
MIN_CLAST3			
MINBED_STYLE			
WAT_COLOUR	Y	Y	
SUSP_SOLID	1	1	
SOILA_COLOUR			
SOILS_COLOUR			
SOILa_TEXT			
SOILS_TEXT			
DEPTH_A			
DEPTH_S			
ORGANIC_A			
ORGANIC_S			
A_CLAST1			
A_CLAST2			
A_CLAST3			
A_CLAST4			
A_CLAST5			
A_CLAST6			
S_CLAST1			
S_CLAST2			
S_CLAST3			
S_CLAST4			
S_CLAST5			
S_CLAST6			
A_MOIST			
S_MOIST			
pH	7.87	7.99	
CONDUCT	563	550	
TOT_ALKALI	147	135	
BICARB			= TOT_ALKALI * 0.8303
COMMENTS	168 BARBEI	167 RED BR	free text

G-Base Regional drainage field card guidance overlay for card version 2005.2

SAMPLE TYPE (110-112)
C Stream sediment
P Panned Concentrate
W Water

EASTING (113-118) GPS reading
NORTHING (119-125) GPS reading

OS MAP NUMBER (127-129)
Printed number on cover of field map
MAP SCALE (130)
1 1:50,000 (1:50K)
2 1:25,000 (1:25K)
3 1:10,000 (1:10K)

COLLECTORS (131-136)
Collectors initials, person filling in card first. Max 3 characters each

PROTOCOL (108-109)
Fieldwork protocol number that applies to field season

WEATHER (150)
2 rain heavy within 12 hours
4 rain heavy within 24 hours
6 rain heavy within 48 hours
7 rain heavy 2-7 days
8 no rain within a week

LAND USE (151-166)
AEBB Mature Coniferous Forest
AEBA Recent Coniferous Forest
AEAB Mature Deciduous Forest
AEAA Recent Deciduous Forest
AC00 Rough Grazing
ABB0 Heather Moor
BD00 Arable
BAB0 Pasture
C000 Port areas and airfields
DD00 Recreational
DAC0 Urban Open Space
E000 Industrial
EAC0 Metal Manufacture
EB00 Extractive

WATER COLOUR (169-171)
CL Clear
YE Yellow
BR Brown

SUSPENDED SOLIDS (172)
1 Light
2 Moderate
3 Abundant

OBSERVED BEDROCK (301)
Within 100m of site
0 No outcrop
1 Minor outcrop
2 Moderate outcrop
3 Abundant outcrop

DRIFT (302-307)
Drift types at site and in adjacent and upstream areas

A1 Blown Sands
A4 Raised Beach
A5 Estuarine
B2 Alluvium
B3 Coarse Gravel
C1 Soil
C2 Marsh
C3 Peat Bog
D1 Clay with Flints
D3 Scree
E0 Glacial
E1 Till
E2 Moraine
E3 Fluvioglacial
F0 Made ground

SITE GEOLOGY (309-319)
Enter in order of decreasing abundance using RCS codes overleaf.

CATCHMENT GEOLOGY (321-331)
Enter in order of decreasing abundance using RCS codes overleaf

PAN MINERALS (333)
Enter 1 if minerals of interest present. List minerals and describe abundance, form, weathering etc in field data comments.

MINERALISED BEDROCK (334)
Enter 1 if minerals of interest present. List minerals and describe abundance, weathering etc in field data comments.

MINERALISATION STYLE IN BEDROCK (335)
1 Vein
2 Fault
3 Pod
4 Lens
5 Stratiform
6 Joint or fracture
7 Disseminated
9 Staining or coating

MINERALISED CLASTS (336)
Enter 1 if minerals of interest present in clasts. List minerals and describe abundance, style, weathering etc in field data comments.

DRAINAGE TYPE (402)
1 Seepage or spring
2 Ditch
3 Drains, land drains
4 Small stream <3m wide
5 Stream 3-10m wide
6 Small river 10-33m wide

DRAINAGE CONDITION (403)
1 Dry
2 Ponded with dry sections
3 Low flow
4 Moderate flow-only boulders visible
5 Strong flow-large boulders visible
6 Channel filled bank to bank
7 Overflow –banks burst
8 Spate

Figure 1: Page one of drainage site coding information (Lister et al., 2005) showing marked boxes for codes need to be added or changed.

G-Base Regional drainage field card guidance overlay for card version 2005.2

CLAST PRECIPITATES (404-406)

COLOUR	ABUNDANCE
OR Orange	1 light
BR Brown	2 Moderate
BL Black	3 Heavy

SEDIMENT COLOUR (407-409)

GR	Grey
LB-O	Light Brown-orange
DB-BL	Dark brown-black

SEDIMENT COMPOSITION (410-415)

LC	Low clay
MC	Moderate clay
HC	High clay
LO	Low organics
MO	Moderate organics
HO	High organics

SITE CONTAMINATION (416-436)

A0	Manufactured Metal	E0	Rubber
A1	Iron, steel wire	F0	Chemical
A2	Galvanized iron	F1	Paint
A3	Copper		
A4	Lead	G0	Liquid effluent
A5	Zinc	G1	Farm effluent
A6	Brass	G2	Domestic effluent
A7	Aluminium	G3	Industrial effluent
B0	Ceramic	H0	Bulk industrial waste
B1	Pottery	H1	Metal mine tailings
B2	Tiles	H2	Coal tailings
B3	Bricks	H3	China clay tailings
B4	Glazed China	H4	Slag (furnace waste)
C0	Glass	I0	Agro-chemicals
C1	Clear glass	I1	Fertilizer
C2	Coloured glass	I2	Lime
D0	Plastic		
D1	Fertilizer sack		

MINERAL ABBREVIATIONS
(For use in description of pan minerals, clast mineralisation and bedrock mineralisation.)

AsFeS	Arsenopyrite	Mon	Monazite
Ba	Baryte	FeS	Pyrite
Born	Bornite	Pyrr	Pyrrhotite
Cal	Calcite	Qtz	Quartz
Cass	Cassiterite	AsS	Realgar
CuFeS	Chalcopyrite	Tiox	Rutile
Cr	Chromite	Schee	Scheelite
HgS	Cinnabar	ZnS	Sphalerite
Epi	Epidote	SbS	Stibnite
Fluor	Fluorite	Tour	Tourmaline
PbS	Galena	Wolf	Wolfram
Gt	Garnet	Zr	Zircon
Au	Gold	Coal	Coal
Hem	Hematite		
Ilm	Ilmenite		
Mag	Magnetite		
MoS	Molybdenite		

ROCK CLASSIFICATION SCHEME (RCS) For use in recording SITE GEOLOGY, CATCHMENT GEOLOGY or CLAST LITHOLOGY

IGRU	Igneous rock	BA	Basalt	SR	Sedimentary rock	CHLK	Chalk	METR	Metamorphic		
DOLR	Dolerite	GB	Gabbro	CONG	Conglomerate	LMST	Limestone	QZITE	Quartzite		
LMPY	Lamprophyre	MR	Mafic Rock	SDST	Sandstone	DLSD	Dolomite seds	PSAMM	Psammite		
PGGN	Pegmatite (granite)	DUN	Dunite	FAREN	Feldspathic arenite	FEST	Ironstone	PEL	Pelite		
PPHY	Porphyry	PDT	Peridotite	SLST	Siltstone	AGATE	Agate	PEPH	Pelite (Phyllitic)		
FELS	Felsite	SEPITE	Serpentinite	MDST	Mudstone	CHRT	Chert	SLTE	Slate		
GN	Granite	AGG	Agglomerate	OILS	Oil shale	FLNT	Flint	MARBLE	Marble		
GD	Granodiorite	TUFF	Tuff	CLAY	Clay	GYPS	Gypsum				
DI	Diorite	ASH	Ash (tephra)	CALSST	Marl	ANHY	Anhydrite				
RY	Rhyolite					COAL	Coal	SCH	Schist		
AND	Andesite					CMDST	Carbonaceous mudstone	GNSS	Gneiss		
DA	Dacite							MYL	Mylonite		

Figure 2: Page two of drainage site coding information (Lister et al., 2005) showing codes need to be added or changed.

G-BASE soil field card guidance overlay for card version 2005.1

SAMPLE TYPE (110-111)
A Surface Soil
S Profile soil

COLLECTORS (130-135)
Collectors initials, person filling in card first. Max 3 characters each

WEATHER (149)
2 rain heavy within 12 hours
4 rain heavy within 24 hours
6 rain heavy within 48 hours
7 rain heavy 2-7 days
8 no rain within a week

EASTING (112-117) GPS reading
NORTHING (119-124) GPS reading

LAND USE (150-161)

AEBB	Mature Coniferous Forest	EAD0	Engineering, manufacturing, shipbuilding
AEBA	Recent Coniferous Forest	EAE0	Vehicle manufacture
AEAB	Mature Deciduous Forest	EAF0	Metal goods manufacture (not specified elsewhere)
AEAA	Recent Deciduous Forest	EAG0	Precision instruments manufacture, jewellery
AC00	Rough Grazing	EAH0	Textile manufacture
ABB0	Heather Moor	EAI0	Leather manufacture, leather goods, fur
BD00	Arable	EAJ0	Clothing manufacture
BAB0	Pasture	EAK0	Food manufacture, drink, tobacco
C000	Port areas and airfields	EAL0	Wood manufacture and cork
CB00	Major roads	EAM0	Paper manufacturing industries
CD00	Railways	EAN0	Other manufacturing industries
DD00	Recreational	EB00	Extractive
DAC0	Urban Open Space	EBA0	Quarry, mine (non metalliferous, non coal)
DACA	Urban open space tended but unproductive	EBB0	Quarry, mine, coal, lignite
DACB	Urban open space cleared, derelict	EBC0	Quarry, mine, metalliferous
DAA0	Commercial and residential	EC00	Tips
DC00	Caravan/Camp site	ECA0	Domestic urban wastes
E000	Industrial	ECB0	Industrial waste tip
EA00	Manufacturing	ED00	Utilities
EAA0	Treatment of non metalliferous mining products other than coal	EDA0	Water treatment works
		EDB0	Gas works
EAB0	Chemical and allied trades	EDC0	Electrical generation plant
EAC0	Metal Manufacture		

A SOIL TEXTURE (406 – 409)
S SOIL TEXTURE (441 – 444)

SAND	Sand
SILT	Silt
CLAY	Clay
SACL	Sandy clay
CLSA	Clayey sand
SICL	Silty clay
SASI	Sandy silt
SISA	Silty sand

A SOIL COLOUR (404 – 405)
S SOIL COLOUR (439 – 440)

BL	Black
DB	Dark brown
LB	Light brown
RE	Red
OR	Orange
YE	Yellow
GR	Green
GY	Grey

OS MAP NUMBER (126-128)
Printed number on cover of field map
MAP SCALE (129)
1 1:50,000 (1: 50K)
2 1:20,000 (1: 25K)
3 1:10,000 (1: 10K)

PROTOCOL (108-109)
Fieldwork protocol number that applies to field season

MINERALISED CLASTS (304)
Enter 1 if minerals of interest present in clasts. List minerals and describe abundance, style, weathering etc in field data comments.

MINERALISED BEDROCK (302)
Enter 1 if minerals of interest present. List minerals and describe abundance, weathering etc in field data comments.

OBSERVED BEDROCK (301)
Within 100m of site
0 No outcrop
1 Minor outcrop
2 Moderate outcrop
3 Abundant outcrop

A SOIL DEPTH (401 – 403)
Depth to base of surface soil sample in metres

S SOIL DEPTH (436 – 438)
Depth to base of profile soil sample in metres

MAPPED SITE GEOLOGY (305-314)
Enter in order of decreasing abundance using RCS codes overleaf.

MINERALISATION STYLE IN BEDROCK (303)
1 Vein
2 Fault
3 Pod
4 Lens
5 Stratiform
6 Joint or fracture
7 Disseminated
9 Staining or coating

SLOPE (170)
1 Hill top
2 Gentle slope (5 - 20°)
3 Steep slope (>20°)
4 Foot slope base of valley side
5 Valley floor
6 Hollows with marsh or bog
7 Level field, flood plain

A SOIL MOISTURE CONTENT (410)
S SOIL MOISTURE CONTENT (445)
1 Dry
2 Damp
3 Waterlogged

A SOIL ORGANIC CONTENT (411)
S SOIL ORGANIC CONTENT (446)
1 Low
2 Moderate
3 High

Figure 3: Page one of soil site coding information (Lister et al., 2005) showing codes need to be added or changed.

G-BASE soil field card guidance overlay for card version 2005.1

DRIFT (162-167)
Drift types at site and in adjacent and upstream areas

A1	Blown Sands
A4	Raised Beach
A5	Estuarine
B2	Alluvium
B3	Coarse Gravel
C1	Soil
C2	Marsh
C3	Peat Bog
D1	Clay with Flints
D3	Scree
E0	Glacial
E1	Till
E2	Moraine
E3	Fluvioglacial
F0	Made ground

SITE CONTAMINATION (315-335)

A0	Manufactured Metal	E0	Rubber
A1	Iron, steel wire	F0	Chemical
A2	Galvanized iron	F1	Paint
A3	Copper		
A4	Lead	G0	Liquid effluent
A5	Zinc	G1	Farm effluent
A6	Brass	G2	Domestic effluent
A7	Aluminium	G3	Industrial effluent
B0	Ceramic	H0	Bulk industrial waste
B1	Pottery	H1	Metal mine tailings
B2	Tiles	H2	Coal tailings
B3	Bricks	H3	China clay tailings
B4	Glazed China	H4	Slag (furnace waste)
C0	Glass	I0	Agro-chemicals
C1	Clear glass	I1	Fertilizer
C2	Coloured glass	I2	Lime
D0	Plastic		
D1	Fertilizer sack		

MINERAL ABBREVIATIONS
(For use in description of pan minerals, clast mineralisation and bedrock mineralisation.)

AsFeS	Arsenopyrite	Mon	Monazite
Ba	Baryte	FeS	Pyrite
Born	Bornite	Pyrr	Pyrrhotite
Cal	Calcite	Qtz	Quartz
Cass	Cassiterite	AsS	Realgar
CuFeS	Chalcopyrite	Tiox	Rutile
Cr	Chromite	Schee	Scheelite
HgS	Cinnabar	ZnS	Sphalerite
Epi	Epidote	SbS	Stibnite
Fluor	Fluorite	Tour	Tourmaline
PbS	Galena	Wolf	Wolfram
Gt	Garnet	Zr	Zircon
Au	Gold	Coal	Coal
Hem	Hematite		
Ilm	Ilmenite		
Mag	Magnetite		
MoS	Molybdenite		

ROCK CLASSIFICATION SCHEME (RCS) For use in recording MAPPED SITE GEOLOGY and A & S SOIL CLAST LITHOLOGY

IGRU	Igneous rock	BA	Basalt	SR	Sedimentary rock	CHLK	Chalk	METR	Metamorphic
DOLR	Dolerite	GB	Gabbro	CONG	Conglomerate	LMST	Limestone	QZITE	Quartzite
LMPY	Lamprophyre	MR	Mafic Rock	SDST	Sandstone	DLSD	Dolomite seds	PSAMM	Psammite
PGGN	Pegmatite (granite)	DUN	Dunite	FAREN	Feldspathic arenite	FEST	Ironstone	PEL	Pelite
PPHY	Porphyry	PDT	Peridotite	SLST	Siltstone	AGATE	Agate	PEPH	Pelite (Phyllitic)
FELS	Felsite	SEPITE	Serpentinite	MDST	Mudstone	CHRT	Chert	SLTE	Slate
GN	Granite	AGG	Agglomerate	OILS	Oil shale	FLNT	Flint	MARBLE	Marble
GD	Granodiorite	TUFF	Tuff	CLAY	Clay	GYPS	Gypsum		
DI	Diorite	ASH	Ash (tephra)	CALSST	Marl	ANHY	Anhydrite		
RY	Rhyolite					COAL	Coal	SCH	Schist
AND	Andesite					CMDST	Carbonaceous mudstone	GNSS	Gneiss
DA	Dacite							MYL	Mylonite

Figure 4: Page two of soil site coding information (Lister et al., 2005) showing codes need to be added or changed.

References

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