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# PropBase Scoping Study - Murchison House

Urban Geosciences and Geological HazardsProgramme
Internal Report IR/06/089

BRITISH GEOLOGICAL SURVEY

URBAN GEOSCIENCES AND GEOLOGICAL HAZARDS PROGRAMME

INTERNAL REPORT IR/06/089

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# Foreword

This report is the published product of part of a scoping study, reported elsewhere (Shaw, 2006: IR/06/088) undertaken between September 2005 and July 2006 to define the scope of, and assess the priorities for, the PropBase project. The PropBase project is intended to provide information on physical, mechanical, chemical and mineralogical properties of the UK's rocks and soils, and their interrelationships to enable attribution of the 3D geological model and modelling of the properties themselves, and to obtain a better understanding of how these properties change as a result of geological processes. While one of the key drivers for PropBase is to allow 3D geological models to be attributed with property information there are other geoscience activities for which the availability of systematic rock property information is important. These include BGS projects such as the engineering properties of formations and hydrogeological properties database. Information in PropBase will be a key resource for a number of sectors including radioactive waste disposal studies and ongoing enhancement of GeoSure.

PropBase will not be just another corporate database. Primarily it will build on existing databases to enhance them where appropriate to meet its needs and additional databases will be proposed where there are gaps in corporate data coverage. The most important aspect of PropBase will be the development of a 'portal' that allows seamless access to and extraction from corporate rock property information and provision of tools to summarise these data for use in a range of project types, including attribution of 3D volumes in geological.

# Acknowledgements

In compiling this report, many individuals, including those listed below, were consulted as corporate data managers, potential non-corporate data holders, and for their opinions and insight regarding potential PropBase stakeholders and the priorities for PropBase. Their valuable comments, and enthusiasm and support for, the project are gratefully acknowledged.

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# Summary

This report is produced as part of a study (Shaw, 2006), to define the scope of, and assess the priorities for, the PropBase project. The PropBase project is intended to provide information on physical, mechanical, chemical and mineralogical properties of the UK's rocks and soils, and their interrelationships to enable attribution of the 3D geological model and modelling of the properties themselves, and to obtain a better understanding of how these properties change as a result of geological processes.

This reports describes a review, undertaken between March and July 2006, of BGS datasets held and maintained specifically within Murchison House, that may be of potential relevance to PropBase. The report also considers issues related to the potential integration of these datasets, future capture of data, particularly in accepted industry-wide electronic data recording and transfer formats (e.g. AGS and related formats), and the release of the data through PropBase to potential end-users, both internally and externally.

# 1 Introduction

PropBase will become a key component in providing the strategic geological and geo-environmental knowledge and the essential 3D geoscience baseline for the BGS Core Strategic Programme.

Specifically, PropBase will provide information on the physical, mechanical, chemical and mineralogical properties of the UK's rocks and soils, and their interrelationships. This will enable attribution of the 3D geological model, from which a better understanding of how these properties change as a result of geological processes.

PropBase will focus on formation properties, and materials in the 'zone of human interaction' in particular – i.e. the top few metres to tens of metres, and in particular on clays, mudrocks and superficial deposits (e.g. head, colluvium), and the weathered zone in general. PropBase will enable engineers and geologists to assess their site-specific data against agreed industry standards.

It is a major part of the current BGS strategy to develop a 3D spatial geological model of Britain. PropBase complements this strategic aim by providing the means to attribute the model with property information. As such, it relates to all of the eight Science Themes in the BGS 2005-10 Core Strategic Programme and addresses aspects of three of the Cross-cutting Themes (Climate change, Sustainable management of energy and natural resources and International development).

An important first step in the construction of PropBase is to identify relevant datasets to be incorporated within, or made accessible through, PropBase. This report specifically focuses on those datasets that are maintained solely within Murchison House and that may be of relevance to PropBase.

This report also:

- highlights datasets, and issues, relevant to Scottish legislation,
- identifies potential users/stakeholders of PropBase, both internally and externally, and their user requirements, and
- considers issues raised by individuals during its compilation that concern issues such as reliability of data, integration of data from disparate sources, and relevance of data.

## 1.1 OBJECTIVES

The overall objectives in establishing PropBase are:

1. to identify internal and external user needs for physical, mechanical, chemical and mineralogical property information and research'
2. to identify the data needed and where there are gaps: (a) where samples/data cannot be cross-correlated between different disciplinary datasets and, (b) where there are gaps across the board in all areas (i.e. no data available),
3. to determine the data basing requirements of PropBase, identify relevant existing databases and the links needed between them, and develop and implement a strategy for corporate databases of physical, mechanical and mineralogical property information,
4. to develop a strategy for attribution of Lithoframe/DigMap/Lexicon, including generic issues (e.g. uncertainty),

5. to identify and prioritise the collection and management of new property information, involving field and laboratory activities as necessary,
6. to develop new systems to capture data quality so that retrieved data are fit-for-purpose for the scale or function that they are required,
7. to identify research needs with regard to (a) inter-property relationships and (b) the relationship between properties and geological processes,
8. to develop methodologies for the 3D/4D modelling of property information,
9. to produce a medium to long-term strategy for PropBase covering (a) the 2005-10 BGS Programme and (b) the period to 2055 (fifty years) or as long as is deemed necessary),
10. to implement the data management and research strategies, and
11. to provide attributes for 3D/4D models.

## 1.2 PROPERTIES

Ground conditions at any site are the product of its entire geological and geomorphological history. Fookes (1997) refers to this history in terms of rock forming and rock modifying processes and environments. Therefore, in relation to the engineering properties of rocks and soils, the key physical, mechanical, chemical and mineralogical properties, and other properties such as structural, sedimentological, palaeontological, and those related to weathering, are the combined product of processes of

- formation, and
- modification, including responses to weathering processes.

Site-specific geological models are the 3D/4D basis for encapsulating these processes and mechanisms and the desk study is the first stage in their development. The mechanics used by geotechnical engineers are commonly applied to relatively simple models comprising isotropic homogenous continua (Davison et al., 2003) that may be assumed at an early stage. However, geological materials are more typically irregularly arranged and highly variable, so giving rise to uncertainty and increased risk for design assumptions. Potentially, risk can be reduced, and more productive ground investigation undertaken, if a more comprehensive geological model is developed at an early stage and continually refined. The ability to do so, and especially prior to costly ground investigation, depends to a large extent on the availability and accessibility of a wide range of reliable local and regional geological contextual (e.g. lithostratigraphic, regional structural etc.) and property data. Therefore, a wide range of properties need to be considered in populating a geological model.

In engineering use, rock cannot be broken down by hand into its constituent grains and can only be partially broken down by hand, depending on its weathered state. Rock material refers to the relatively strong cohesive assemblage of mineral particles that form the intact rock blocks between discontinuities in the rock mass, i.e. typically the scale at which hand specimens and recovered core are described. Rock mass refers to larger volumes and characteristics are particularly influenced by physical and mechanical properties (shear strength etc.), and are profoundly influenced by discontinuities (type, orientation, continuity, roughness, spacing etc. The distinction between material and mass characteristics depends on the size of the sample in relation to the typical spacing of the discontinuities and other aspects of the rock structure (Geotechnical Control Office, 1988). Chemical composition, grain size and the nature and extent of discontinuities are fundamental controls of the nature, rate and extent of weathering of rocks. Key descriptors of engineering rock, in addition to the rock name, therefore include strength, colour, texture/fabric, material weathering/alteration, structure, discontinuities and mass weathering.

The engineering behaviour of soils, including both naturally formed earth material and anthropogenic deposits (made ground), is fundamentally controlled by their particulate nature (particle size grading of the coarser particles and plasticity of finer particles) and soils can be broken down by hand into their constituent grains. The distinction between material properties (colour, composite soil type, particle shape and size and principle soil type) and mass properties (density/compactness/strength, discontinuities and bedding) of soils may be less clear than that for rocks, due to the changes that occur during soil formation (destruction or modification of rock characteristics, disturbance, remoulding etc.). The mass properties of soils are largely influenced by material characteristics (e.g. mineralogy, including grain size/shape, and physical properties including plasticity, density, etc.), but discontinuities, such as relict joints and other planar structures, also have an important effect on the behaviour of some soils. Key descriptors of engineering soil, in addition to the soil name, therefore include density/compactness/strength, discontinuities, structure (bedding etc), colour, particle shape, size and composition, and weathering.

Hence, the range of properties potentially encompassed by PropBase should include, amongst others, the following.

a) Physical properties, e.g.:

- porosity
- permeability
- density
- magnetic properties – including magnetic susceptibility
- natural radioactivity
- electrical properties such as conductivity, dielectric polarization, resistivity
- fluorescence

b.) Mechanical Properties, e.g.

- strength (compressive, shear)
- elasticity
- plasticity
- hardness

c.) Chemical Properties, e.g.:

- bulk composition, such as in terms of whole rock analyses, silicates, carbonates, phosphates, sulphates etc.
- composition of groundwaters
- reactivity, e.g. acids

d.) Mineralogical Properties, e.g.:

- mineralogy in hand specimen, thin section etc.
- texture
- hardness
- streak and lustre;
- cleavage and fracture
- refractive index

- colour
- etc.

Structural data are also considered below, given their relative importance, especially, but not exclusively, in relation to the characteristics of rock masses, as are data related to weathering. Palaeontological properties are also considered for completeness. Sedimentological data, however, are considered only as components of mineralogical and structural datasets.

### 1.3 MURCHISON HOUSE

Murchison House serves both important regional and national functions. In addition to being the regional hub for BGS's activities (geological mapping, hydrogeology and related regional and project specific datasets) in Scotland and the North of England, Murchison House, is the national hub for all activities related to seismology, magnetism, and the UK's offshore. As such, important national (corporate) databases are housed and maintained in Murchison House.

This report identifies and assesses databases and datasets (corporate and non-corporate) potentially relevant to PropBase that are maintained wholly within Murchison House. Data contributed from Murchison House to corporate datasets maintained in Keyworth are largely excluded from the report.

Murchison House maintains corporate datasets principally in relation to the following programmes:

- Geology and Landscape Northern Britain
- Marine, Coastal and Hydrocarbons
- Seismology and Geomagnetism
- Information Products/Management/Delivery

Discovery Metadata are held for these data sets, and details of these, together with additional comments (in red) on the current status, location and potential relevance to PropBase are provided in Appendix 1, and these datasets are described further in Chapter 2.

# 2 INTERNAL DATASETS (MURCHISON HOUSE)

### 2.1 CORPORATE DATASETS

Murchison House maintains corporate datasets principally in relation to the following programmes:

- Geology and Landscape Northern Britain
- Marine, Coastal and Hydrocarbons
- Seismology and Geomagnetism

Various aspects of these, and some other non-corporate datasets held in Murchison House, including their content, format, current status, location and relevance to PropBase are discussed

in the following sections. Further information on each of the corporate datasets is contained in Appendix 1.

### 2.1.1 Information Products/Management/Delivery - Onshore Physical, Mechanical and Geochemical Data

#### 2.1.1.1 SITE INVESTIGATION DATA

a.) A large proportion of the physical and mechanical data, and to a lesser extent chemical data, held in Murchison House are in the site and ground investigation records, and associated laboratory test results in the Site Investigation Records: Scotland & Northern England. (Appendix 1). This collection of over 19,000 site investigation reports for Scotland and Northern England consists of records of boreholes, trial pits, geotechnical results and interpretative reports. These are for SIs concentrated mainly in areas of urban development and along major roads and other infrastructure, and the data have been acquired from various sources. Borehole coverage in Scotland is patchy, and disproportionately concentrated in the Midland Valley, where the greater part of the population resides.

Only the factual parts of non-confidential reports are available for users and the SI reports are also available for consultation on microfilm. They are being systematically scanned also.

Recent acquisitions have included a geotechnical dataset from Sunderland University representing extensive SI data, collected up to about 2002, from the Tyne and Weir area. These data are being integrated in corporate datasets (SI reports registered, boreholes coded and included in SOBI) but contain extensive geotechnical data in hard copy. However, BGS is generally proactive in acquiring SI reports from local authorities etc. only if it is actively working (mapping etc.) in a particular area. Otherwise, it is more dependent on the particular local authority, or their consulting engineers, forwarding the reports, under a long-standing directive from the Scottish Executive (formerly Office), or not. Although operation of the directive has been haphazard, the data are now subject to free access under the Freedom of Information Act.

At present, the reports are received almost exclusively in hard copy form and are scanned in their entirety. The boreholes are then incorporated in SOBI and are available as hyperlinked scans on the GDI However, in Scotland, a large proportion of the boreholes are not yet indexed so can not be retrieved through the GDI.

With regard to the key data contained in the borehole reports, NGR Grid references may not be provided, and start heights for boreholes may be inaccurate, or not provided. Also, in the case of older borehole data, the site may have been modified so that the topography may no longer be that same as that at the time the borehole was drilled. Reliability and quality of the borehole information are uncertain and often doubtful, and the data contained in the reports are highly variable. For example, superficial deposits are often not logged and older reports usually only hold limited data on lithology.

Older reports for Northern England are held in the Shallow Borehole File (SB), now no longer added to. All SI reports (except SB files) are indexed on the Land Survey Record Index Database (LSRI); Scotland And Northern England. and all boreholes and trial pits contained in the reports (those with adequate site plans) are indexed on the Single Onshore Borehole Index (SOBI). The older reports often contain no geotechnical information, and are mainly lithological logs.

Selected borehole information have been extracted for key projects (e.g. Clyde Basin Environmental Project – see below) for Scotland and Northern England. However, interval data from the scanned face of onshore borehole logs are being captured generally under the National Borehole Information Capture Project. The captured text is then being converted to BGS

standards using the Thorleifson method (http://pubs.usgs.gov/of/2003/of03-471/thorleifson/index.html).

The range of test data provided, which may or may not be UKAS accredited or necessarily carried out according to BS 1377 1-9:1990 (British Standards Institution, 1999) unless specifically stated, largely reflects the nature of the project for which the data have been acquired. For example the recent SI for a bridge crossing at Kincardine included a very comprehensive range of soil and rock testing. The soil tests include for example:

- Moisture content
- Atterberg limits
- Particle Size Distribution
- Specific Gravity
- Bulk Density
- Undrained triaxial compression
- Consolidated undrained triaxial compression with monitoring pore water pressure
- pH and sulphate content
- Organic content
- Oedometer consolidation
- Moisture condition value
- California Bearing Ratio
- Moisture content versus dry density

Other SIs may include for example void ratio and %saturation amongst others but more typically the range of test data would be more limited.

Rock testing may include:

- Moisture content
- Unconfined compressive strength
- Point load index test
- Unconfined consolidated undrained triaxial compression testing with pore water pressure measurement
- Consolidation properties in hydraulic cell,
- etc.

In situ test data is likely to include SPT data. In situ vane test and hand vane test may also be provided. Instrumentation on site may include standpipe piezometers etc.

b.) The Altnabreac Site Investigation.
is a separate dataset maintained in Keyworth, although it relates to a ground investigation in Scotland and many of the documents are held as hard copies in Murchison House, is the These boreholes have been logged in considerable detail and the logs include lithological descriptions, a fracture log, RQDs, water levels, analysed water samples (pH, $CO_3$), core photographs and there are references to petrography and geophysical logging.

c.) AGS format data.

With the development by the Association of Geotechnical and Geoenvironmental Specialists of industry-wide standards for the format of geotechnical data – the so-called AGS format

(Appendix 2-1 to 2-3), and more recently for monitoring data also (the AGS-M format – Appendix 2-4), BGS advertises its capability of accepting data in AGS format. To date, no AGS format data have been received in Murchison House for inclusion within the Site Investigation Report, and there is no mechanism yet to do so in Scotland. Any data required for further projects (e.g. Glasgow Project) are then extracted manually and entered to a corporate database. The problem of data gathering is exacerbated by knowledge that Local Authorities commonly dispose of such reports without keeping any alternative records, after the required retention period (seven years), at which stage the data are probably be lost.

However, some AGS format data have been provided by Glasgow City Council (GCC) for use in the Clyde Basin Environmental Project. These data are those for which GCC has direct ownership. GCC also retains other AGS format data, and many other borehole records in hardcopy form, that have formed parts of submissions relating to Building Warrants and other approval mechanisms. There is as yet uncertainty over whether GCC is entitled to enable access to these data although the situation is under review. This may be seen as an important 'test case' for acquiring substantial volumes of AGS format data, and indeed other site investigation records in hard copy, from local authorities in Scotland. However, although it is believed that substantial quantities of AGS data are held by various external bodies/consultants/contractors, the extent of such data needs to be established through a survey of potential data holders.

A list of consultants and contractors who have registered their AGS format document with the Association of Geotechnical and Geoenvironmental Specialists in the UK is contained in Appendix 2. This list contains many of the leading geotechnical and geoenvironmental companies operating in the UK, and who currently provide ground investigation and laboratory data to BGS.

#### 2.1.1.2 MINES, QUARRIES AND MINERAL RESOURCES

a.) An index of records of mining and opencast sites from the National Coal Board and related bodies is available on the GDI (based on the Land Survey Records Index). However, the original mine data, both coal and non-coal related, are held mostly in the form of plans:

Plans Of Abandoned Mines (Coal & Oil Shale) For Scotland Held On Microfilm.

Plans Of Abandoned Mines (Other Than Coal & Shale): Scotland.

Plans Of Abandoned Mines (Other Than Coal): Cumbria.

These contain some useful structural information, but little or no physical, mechanical, chemical or mineralogical data, so are of limited relevance to PropBase.

b.) The Opencast Coal Records: Scotland & Northern England. consist of borehole drill logs, site plans, borehole location plans, geological plans and completion plans for opencast coal sites in Scotland and Northern England. They contain potentially useful information therefore, but some of the borehole data are confidential. The cored boreholes are indexed in SOBI.

c.) The Scottish Quarries Database, contains site and rock type information of working and disused hard rock quarries in Scotland, covering all mainland Scotland and major Scottish islands. The database is available at (\\mhsan\Store\GeoReports\Quarries_Scotland\. The dataset contains c. 16000records, though with many duplicates for some sites. The data have been collated in an EXCEL spreadsheet for Historic Scotland and this includes unique ID, quarry name, GR, status (active or not) basic rock type, the Operator and the data source. However, the dataset includes little physical or mechanical data, or structural data, relating to the quarrying process, so is of limited relevance to PropBase.

There is a move to update, validate and modify it for inclusion into the BritPits index (maintained in Keyworth) and recording active, ceased, inactive, restored and historic quarries in

the UK. A report is currently being prepared (by A.A. McMillan) to formulate a methodology for selecting and cataloguing Scottish quarries from the information held in BGS records. The data are of relevance to Historic Scotland who are interested in indigenous sourcing of building stone.

d.) The Archival Card Index Of Quarries In England And Wales. is an old card index of quarries in England, Wales and Scotland dating mostly from 1939 to 1963: each referring to one quarry. Scottish cards are arranged by county and may indicate county, geol-sheet, rock type, name, grid ref., locality, owner, date of record and cross references to BGS samples. However, although the index includes data on Scottish Quarries, this dataset is maintained from Keyworth and is not considered further.

e.) The Sand And Gravel Resources Assessment Records: Scotland. comprise c.3,000 records in hard copy of the former Industrial Minerals Assessment Unit (IMAU) relating to sand and gravel assessment projects in Scotland, 1978-88. The data include useful physical (borehole and trial pit records and measured sections), and mineralogical property data of relevance to PropBase, including grading and resource assessment data and aggregate tests. These records represent the original project data, subsequently captured in published reports.

f.) The Mineral Resource Records (Mr); Scotland & Northern England. (MRR) comprises c.6,000 records, including reports and data relating to geochemical sampling, geophysics, drilling and field mapping deposited by mineral exploration companies dating from c.1960 onwards. Major accessions include records of Mineral Exploration Incentive Grant Act (MEIGA) and reports and plans of Exploration Ventures Ltd (EVL) relating to NE Scotland. Indexed in Land Survey Record Index Database (LSRI). Although in hard copy, this dataset is potentially relevant to PropBase in terms of the extensive physical, geochemical and mineralogical data that it contains, Geophysical results include a wide range of data from various types of survey including IP, magnetic, VLF, self potential, radiometric data, seismic data, EM, resistivity, EM etc. Other types of analyses include soil geochemistry, stream geochemistry, petrographic studies, spectrographic analyses, mineral identification, assays, rock geochemistry analyses of panned concentrates (e.g. Au, Ag, As, Hf, U, Th, Mo, Na) etc. However, all of these data suffer from the variable quality of their description of with respect to the techniques used and precisions of data obtained (metadata).

The MRR superseded the earlier Mineral Resources Archive (Mra): Scotland & Northern England. which comprises c.5,000 items relating to economic mineral exploration and exploitation in Scotland (with some records for Northern England) pre c.1960, including some geo-physical and geochemical data from surveys for metals (Mo, Pb, Ag, Zn, Ba, Ni, Sr, Cr, Co, $Fe_2O_3$, Cu, Mn), but these are of lesser value to PropBase given their vintage.

g.) The Additional Information (AI): Scotland And Northern England., was the predecessor of the Land Survey Archives. There is no index available for this hard copy archive, and although the archive includes structural and mineralogical property data, mine plans, mine sections, shaft sections, borehole logs, trial pit logs and some geophysical records they are poorly accessible, and so, given their vintage also, they are of limited relevance to PropBase.

h.) Hydro-Electric Records (He) These records related to the ground investigation and construction of hydroelectric schemes in Scotland, mostly in the 1950s and early 1960s. The records comprise 1:250K maps with outlines of schemes and a card index indicating the project and site but no specific data. Some borehole logs may have been captured but not all of the shallow boreholes and horizontal boreholes that are contained in the reports. The data also include tunnel logs and other measured sections, with structural measurements and lithologies which may be of some relevance to PropBase but the data are from the 1950s-60s and contain few physical and mechanical data.

These and other tunnel data in general provide a very valuable opportunity for verification of physical and other data at depth. Equivalent to horizontal boreholes, these are not adequately catered for in existing databases (SOBI etc.).

## 2.2 GEOLOGY AND LANDSCAPE NORTHERN BRITAIN (GLN) – CORPORATE AND NON-CORPORATE DATASETS

The most important corporate, and non-corporate project-based, datasets related to recent and current GLN activity include:

- land survey (general)
- whole rock (bulk) and mineral geochemical data,
- structural data
- physical data, principally magnetic susceptibility data
- mineralogical (petrographic) descriptive data

The data are held by various individuals and the digital data are held in various locations, including the W: drive, individual N: drive folders and in a few instances in personal C: drives. The hard copies are generally retained by the individuals who worked with the data in the first place. Where those individuals have left BGS, others have taken over the data in some instances (e.g. John Mendum retains a limited amount of field-related data from the late Steve Robertson, and from Brett Beddoe-Stephens and Donald Smith) but some data have probably been lost already in this way over the years.

### 2.2.1 Land Survey (General)

The Land Survey Record Index Database (LSRI); Scotland And Northern England.is the corporate ORACLE database index that links the Land Survey corporate records, now accessible through the GDI , including:

a.) Land Survey Records (LSR): Scotland And Northern England. which comprises hardcopy records (numbered sequentially as per accession rather than sheet based) that are the modern equivalent of the Additional Information files, i.e. comprising miscellaneous MRP reports, locality details, Quaternary geology reports, cross sections, plans etc. SI reports in this archive are not the originals. These contain some data that are of relevance to PropBase, but the hard copy only data are not readily accessible.

b.) Land Survey Archives (LSA): Scotland & Northern England. which comprises >7000 items of field notebooks, field observations and reports, files, photographs, etc. and includes archival material deposited by outside individuals/organisations. These include NCB borehole geophysical logs, neutron logs, sonic logs, dipmeter analysis logs, coal quality logs, coal lithology logs, seam thickness logs, borehole logs, coal analyses etc. Survey archival material for Northern England will be incorporated. Some 380 accessions held amounting to over 7,000 items. The data include horizontal boreholes that will not have been captured in SOBI These archive contains data that are potentially relevant to PropBase, especially the borehole geophysical and mineralogical data, but there is no index of the data and they are all in hard copy, so making them hard to capture.

c.) Land Survey Plans (LSP) which comprises c.1,520 largely mine plans, and 492 non-coal mine plans deposited by the National Coal Board 1984-87, copies of mine plans derived from various research reductions, and c.500 miscellaneous plans from other survey records. These are of limited relevance to PropBase, other than the structural data that they contain.

### 2.2.2 Geochemical Data – Rocks

Few geochemical data are maintained in corporate databases in Murchison House. However, very large numbers of project/sheet-based whole rock and mineral analyses are retained in digital and hard copy form in Murchison House, which do not appear to have been captured in corporate databases. The data have been acquired from various sources and are generally more than 5 years old, some dating back to the 1980s. Typically, the data usually comprise whole rock (or bulk rock) major element oxides and trace elements, and in some cases rare earth elements and isotopes. These data, held by various individuals, are mainly in EXCEL spreadsheets, but there are also some in Access tables and others in hard copy, generally retained by the individuals who worked with the data in the first place. The digital data are held in the W: drive, individual N: drive folders and occasionally in personal C: drives. The data sets also include data provided by external collaborators and data extracted from external publications, unpublished theses etc.. In addition, geochemical data are presented in various internal reports and external publications (particularly memoirs).

Electron microprobe data of mineral analyses are also held, although there are fewer of these. These are held both in EXCEL spreadsheets and in hard copy.

#### 2.2.2.1 DALRADIAN CARBONATE ROCK GEOCHEMISTRY DATABASE.

This corporate dataset comprises c.700 analyses for Dalradian and a few Moine limestones, mainly marbles. The data comprise a full range of analyses by XRF for major element oxides (although there is some variability) and a variable number of trace elements (maximum c.20) with later analyses in the series being more focussed for fewer elements. There are also REE data for less than 20 samples (analyses carried out by ICPAS at King's College, Univ. of London. There are also some electron microprobe analyses for calc silicates and limestones and whole carbonate isotope analyses (c.50) for O, C, S and Sr.

There are also some ion probe isotope analyses for 4 samples

The data are held in ACCESS tables on

cwt on 'mhsan\users' N:\ LSTCHEM\GEOCHEM

#### 2.2.2.2 KEY DATA HOLDERS AND DATASETS OF WHOLE ROCK (BULK ROCK) AND MINERAL GEOCHEMICAL DATA

Key data holders of non-corporate project-based datasets of whole rock and mineral geochemical data include the following (although the list is indicative rather than exhaustive):

1. Emrys Phillips who has accumulated c. 4000-5000 analyses over the last 16 years of whole rock (XRF and ICP-MS) analyses of major oxides, trace elements and some rare earth elements, mainly of igneous and metamorphic rocks from the Scottish Highlands (especially granites) the Midland Valley and the Southern Uplands. These also include some comparative data from outside the UK, not relevant to PropBase, and data gathered from publications and PhDs/MScs – whose use would be subject to copyright issues, which are potentially relevant to PropBase. Some isotope data are also held.

Many of the data are held in EXCEL spreadsheets in various folders at

erp on 'mhsan\users' N:\

The analyses are generally included in internal reports (all in Minpet Series and/or Technical Reports). The data are in various formats, as they largely pre-date standardisation since c. 2003-2004.

The analyses were carried out by various laboratories, including in-house, and University facilities. The results of the in-house analyses were provided in hard copy form and refer to analytical numbers rather sample numbers so could be hard to identify in BRITROCKS.

There are also microprobe data of mineral analyses. For example, there are analyses of garnet for $SiO_2$, $TiO_2$, $Al_2O_3$, $SiO_2$, FeO, MnO, MgO, CaO. The samples are identified by an S number and the grid references may also be given, although, this can be obtained separately from the BRITROCKS database.

2. Dave Millward oversees a large number of whole rock (bulk rock) analyses (c.500) and some mineral analyses) deriving from work in the Lake District (excluding NIREX-related data) over the last 20 years. These data are held in

\\mhsan\WorkSpace\GLN\NorthernEngland\Data\Lake_District_geochem_data\Geochem

and EXCEL spreadsheets therein. The data are all for Borrowdale Volcanic Group rocks and related intrusions Analyses include some carried out in-house and others at the Universities of Leicester and Nottingham and 52 microprobe analyses carried out at the University of Edinburgh on specimens from the Haweswater granite. The data also include analyses captured from other sources, including published data (Journal of the Geological Society etc), data provided by collaborators (Royal Holloway; data obtained by Webb and Brown for the Hot Dry Rock project, including analyses from borehole material for K, U and Th, and in house analyses by the late Nick Rock.)

A separate subset of whole rock (bulk rock) and some isotope data (Rb/Sr, Nd/Sm, Pb, Th, U) data for the Eycott Volcanic Group only are held in EXCEL spreadsheets at

dmill on 'mhsan\users' N:\

Radiometric data are held separately by NIGL.

3. Martin Gillespie holds the following datasets:

a.) Caledonian intrusions whole-rock geochemical database – an ACCESS database of c.2,000 whole-rock major and trace element analyses of samples from the Caledonian Igneous Supersuite. Original probably with former Highlands & Islands project legacy datasets; but may already be part of the corporate geochemical datasets. A full copy is held at:

mrg on 'mhsan\users' N:\

b.) Caledonian intrusions database - EXCEL spreadsheet comprising a wide range of field, geochemical, stable and radiogenic isotope, geochronological, and other petrological data for the Caledonian intrusions in Scotland. Held at:

\\mhsan\WorkSpace\GLN\GrampianHighlands\Data\MoineDalradian\Granites\

There is a more up-to-date version at

mrg on 'mhsan\users' N:\SB719 - M&D Basins

c.) Lithological and structural data from the Cairngorm Granite Pluton - EXCEL spreadsheets and ArcGIS comprising a range of observed and measured data from a comprehensive field survey of the Cairngorm pluton (~750 field stations), collected to assist interpretations of landscape evolution. Held at

\\mhsan\WorkSpace\GLN\GrampianHighlands\Archive\

d.) Petrological characteristics of Devonian sedimentary rock around Dounreay. Described in a report for UK Nirex Ltd and summarised in Word/Excel tables, comprising hand specimen and thin section descriptions, and heavy mineral ratios, of approximately 20 Devonian sandstone and conglomerate samples from within and around the Dounreay nuclear facility

In W:\GLN\Caithness, but a separate copy on

mrg on 'mhsan\users' N:\

e.) Cation exchange capacity (CEC) of selected lithologies from England, Wales and Scotland. Described in an Environment Agency R&D Technical Report, and summarised in Word/Excel tables, comprising reference CEC values (with accompanying details of location and lithology of analysed materials, and whole-rock XRD traces) for 30 lithologies in England, 4 in Wales, and 7 in Scotland, including most UK lithologies that are important in contemporary issues of groundwater pollution and contaminated land.

mrg on 'mhsan\users' N:\

4. Additional XRF datasets are held at various locations. The following list is indicative rather than exhaustive, e.g.:

\\mhsan\WorkSpace\GLN\NorthwestHighlands\Data\LEWISIAN\XRF data\

\\mhsan\WorkSpace\GLN\GrampianHighlands\Data\MoineDalradian\Geochem\EAP DATA\dalrad-all.xls

\\mhsan\WorkSpace\GLN\GrampianHighlands\Data\MoineDalradian\Geochem\EAP DATA\TABLE3.XLS etc.

some cosmogenic isotope data are held, e.g.:

\\mhsan\WorkSpace\GLN\GrampianHighlands\Data\Aviemore\Cosmogenic Methods\CHRIS-COSMO.XLS

and some Nd-Sm isotope data are contained in:

\\mhsan\WorkSpace\GLN\GrampianHighlands\Data\MoineDalradian\Granites\Scottish granite isotope data spreadsheet 2003.xls

Further data are held in hard copy by various individuals (e.g. Dave Stephenson holds analyses of metasedimentary amphibolites, some basic rocks from NE Scotland, basic igneous rocks of the Dalradian, Clyde Plateau basic lavas, and microprobe analyses of amphiboles), etc.

#### 2.2.2.3 KEY PROBLEMS

The key problem with integrating these data is the variable, and incompleteness or even absence of some of the metadata, particularly with respect to the analytical techniques, precisions, and explanations of the way in which the data are quoted (e.g. the basis for calculating Total Fe). Therefore, there are many issues to address in capturing and combining these data, including:

- variable formats in which the data are recorded (for data pre-dating standardisation)
- variable means of calculating and quoting data, for example Total Fe…..
- some data are presented as averages of groups of analyses rather than as the individual analyses
- some whole rock analyses have been recalculated to 100%
- different analytical techniques used and by different laboratories (despite reference to international standards), which may not be recorded
- different analytical precisions and errors, which may not be recorded

- copyright issues for data captured from published sources
- some data do not relate to the UK

There is some internal demand for access to such data, but external demand may be limited to a relatively small number of academics. However, in the case of the Lake District data, there may be demand in the future if NIREX reopen their interest in the area, in which case the data could be more relevant.

### 2.2.3 Geochemical Data – Soils and sediments

Data for Scotland and northern England are virtually all maintained within corporate datasets managed ultimately from Keyworth (G-BASE). However, some non-standard geochemical data requested by Glasgow City Council as part of the co-funded Clyde Basin project are maintained separately and include data for organics, asbestos and cyanide, for which there are no fields in the standard geochemical database. These data are maintained at present by Fiona Fordyce as part of the project-based dataset. Although the data are not regarded as confidential, joint permission (BGS and Glasgow City Council) is required for access.

These and other data from the project are of particular relevance to clients interested in the mobilization of contaminants.

Potential competitors in this field of data supply would include the MacAulay Land Use Research Institute, based in Aberdeen, who hold legacy data for soils across Scotland, but who currently lack a soil survey capability.

BGS is in a strong position for supplying baseline geochemical data, especially in combination with geological data to identify whether anomalies are/are not related to natural causes in the bedrock, and several local authorities have purchased data. Regulatory powers under the Environmental Protection Act are devolved to SEPA. However, implementation of the act is currently largely dealt with through the planning mechanism. Therefore, these data are of particular relevance to potential brownfield developments where the onus is on private developers to identify contamination and to propose effective mitigation strategies. At present, there is a lack of standards for assessing contaminated land and different laboratories use different methods to do so.

In Scotland, North Lanarkshire currently has the most contaminated land in terms of area, followed by Falkirk.

### 2.2.4 Structural Data

Structural data, including planar (bedding, foliation, joint, fracture etc.) and linear (lineations, plunges etc.) present a major challenge. Some more recent structural data are being captured within the corporate Structural Database, but there is a vast array of legacy data that are not. Considerable effort was made during the NIREX Contract work to acquire, database and manipulate structural data and a macro was developed to put data into a consistent format.

Planar feature/fabric data from outcrop and borehole are systematically collected as part of routine surveying. A brief review, by RP Barnes, of the types of structural data recorded, the environments in which they are recorded, and the formats in which they are/have been recorded, is reproduced in Appendix 3.

#### 2.2.4.1 STRUCTURAL DATASETS

*BGS SIGMA Project*

Development of structural data recording is being carried out under the BGS SIGMA Project which is testing a variety of hardware and software combinations in UK onshore surveys and abroad. The ongoing work in the Midland Valley and Strathmore Basin has taken the lead in this respect where much of the structural data is digitally captured, using tablet PCs (depending on availability) and transferred to populate an ACCESS table behind the map interpretation GIS. When insufficient tablet PCs are available (this is likely to be a temporary situation only), staff use field notecards and transfer structural data manually into ACCESS tables for incorporation with those obtained from the tablet PCs. It is considered that field notecards will cease to be used in the near future for this project. These Access Tables constitute in essence the BGS Structural database.

Tablet PCs are being used on an individual basis by other geologists in Scotland, and elsewhere, to record structural data. Others continue to use field notecards, and to transfer data, typically into EXCEL spreadsheets. For example, bedrock geologists working in the Scottish Highlands may record the majority of their field data on cards, as the numerical nature of their structural observations lends itself to such an approach, although elsewhere, notecards may not be used at all, with all data being recorded directly on to the map face, or in field notebooks.

*Scottish Highlands databases*

In the last 5-6 years, in the Scottish Highlands, there has been extensive development of project structural datasets in the form of EXCEL spreadsheets, but there is a backlog of vast quantities of structural data remaining in notecards, field notebooks, and on field slips.

The data in digital form, outwith the ACCESS tables are concentrated in two areas: the Grampian Highlands, and the Northwest Highlands. Theses data reside in EXCEL tables on the W: drive, including:

\\mhsan\WorkSpace\GLN\NorthwestHighlands\Data\Raw_Field-data\STRUCTURAL and files within

\\mhsan\WorkSpace\GLN\GrampianHighlands\Data\MoineDalradian

and files in sheet folders within.

The data include grid references and the azimuth and dip of various structural features including:

- bedding and inverted bedding
- Foliation; general, mylonitic, shear zone, igneous
- gneissosity
- joint
- fault, thrust and shear zone orientation
- dyke
- fold axis
- lineation
- glacial striation
- vergence, and

- younging

Together, the digital and notecard data are roughly estimated at c.100,000 individual measurements for the Grampian and Northwest Highlands areas combined. However, these data are probably peripheral to PropBase, their capture, especially of the data remaining on notecards would be very resource intensive. Given that there are likely to be limited users of the data, internally and externally in theses areas. Elsewhere, however, and chiefly in the Scottish Midland Valley, there may be greater demand for reliable structural data by external clients.

*The East Grampians Field Data.*

This corporate dataset comprises structural and related data contained in an ACCESS database at cwt on 'mhsan\users' N:\ ACCESS\PROJDATA\EGPROJ1.mdb

in several ACCESS tables including: Structural records (containing c. 23000 records) Field Sheet header records (c.12500 records), Sample records (c.3400 records etc.) and others.

The structural data list station number, number, structure trend (azimuth or strike), dip (or plunge), point, precision (scale of 1-3), way-up, way-up evidence and notes. However, the notecards contain more contextual information and although these have been used to some extent, there is no record of recent use of the structural database. Although the structural data are potentially relevant to PropBase, they are likely to lack internal consistency, having been collected by various individuals, and there has been no verification of the data, or QA of the dataset.

### 2.2.5 Magnetic Susceptibility Data

Non-corporate project-based magnetic susceptibility datasets comprising measurements taken using a hand-held kappameter on both outcrop and hand specimens, are held in various locations. Some have been included in tables in published memoirs and published papers (eg. Floyd and Trench, 1989; Floyd and Kimbell, 1995; Evans et al., 1991; Floyd and Rushton, 1993; Floyd, 1996; Floyd, 1999, table 2) The data are in SI units ($x10^{-3}$) and are typically quoted as means. Datasets from the Southern Uplands are retained on both W: and N: drives, and in the case of field measurements in field notebooks and on field slips, especially in relation to work carried out in the Southern Uplands and the Midland Valley.

\\mhsan\WorkSpace\GLN\MidValStrathBasin\Data\Midland_Valley\Magnetic_Susceptibility\Magnetic susceptibility from Rhins of Galloway to Irvine - Britrocks.xls

\\mhsan\users\jdf\ PETROL\SUSC.XLS

These files contain either single readings, or multiple readings on the same specimens with means calculated, for registered samples with S numbers and grid references.

### 2.2.6 Mineralogical (Petrographic) Data

Mineralogical data (excluding mineral geochemical data which are discussed separately above) are held in a various forms, much of it in hard copy (in reports and project notebooks), and are generally scattered amongst various locations/individuals/publications, poorly indexed and poorly accessible. The latter include a large number of the old style 'Pet Notes' held in the Land Survey archives in Murchison House. These are hand written and would need to be indexed before scanning.

The main types of information are field notes on exposures and measured sections, hand specimen descriptions, and thin section descriptions, including some quantitative descriptions (point counts, modal analyses etc.)
Some mineralogical data are held in EXCEL tables e.g.

\\mhsan\WorkSpace\GLN\GrampianHighlands\Data\MoineDalradian\Geochem\EAP DATA\MINERAL.XLS

Thin section descriptions are held by many of the geologists and are included in the Land Survey Archives. These are generally in hard copy, often hand written, or in text files, retained on individual's N:\ drives typically. Some representatives are contained in reports, including the old 'Min and Pet' Series, and more recently in the internal report series (Research Reports, Technical Reports) and memoirs held in the library (e.g.

However, all photomicrograph and other related images are registered separately in the corporate IMAGEBASE (maintained in Keyworth). There has been little systematic study of this type and the information is project/sheet mapping based. The data are not indexed and have been recorded in a wide variety of formats. These data could only reasonably be captured as scans.

No standards of description have been applied in the abundant legacy data. To expand coverage of this type would be very time consuming and would be unlikely to be justified by the limited demand for the information. However, systematic work is being carried out in relation to building stones, and cements and porosities in particular. Much of this work is carried out under contract to Glasgow City Council in relation to maintenance and preservation of the city's built heritage.

### 2.2.7 Miscellaneous project-related geotechnical data

a.) Compilations and Reviews of Geotchnical Data in Scotland

(i) Hobbs and Akhurst (2002) produced a useful compilation of quantitative results from site investigations on the geotechnical characteristics of the main solid and drift units in the Central Belt of Scotland. The results for a given geological unit were compiled and the characteristic value or range of values for each geotechnical property were evaluated and presented. The report was intended to be a broad guide to planners and geotechnical engineers, amongst others, as to the characteristic ground conditions that should be anticipated in the areas underlain by the main geological units, i.e. addressing a perceived external need for such data. However, the data were not site-specific.

This study was not intended to be comprehensive and so was necessarily selective in terms of the sources of data that were used, in part because of limitations of time and resources available to undertake the study. The study concentrated therefore on the south-western part of the Central Belt (Ayrshire and Lanarkshire) and six main site investigation reports (1313 geotechnical samples), related to road projects, were selected as the basis for the study. These were reports that were selected as they were considered by the authors to be likely to contain the most reliable and comprehensive geotechnical property data. However, the selection process was subjective. The test data were analysed statistically and graphically and the report reviewed test data (all subject where appropriate to BS 1377:1990) (British Standards Institution, 1999) for:

- water content,
- plasticity (Atterberg limits),
- particle size distribution,
- compaction (California Bearing Ratio),

- strength by a variety of methods
  - total strength for soils under various undrained conditions
  - effective strength parameters for soils from drained conditions or where pore pressure was measured,
  - total and effective triaxial, shear box and laboratory vane tests for rocks

(ii) Various reports which include geotechnical data were produced in the 1970s and early 1980s by the Engineering Geology Unit of IGS. These include a study of the Engineering Geology of the Upper Forth Estuary (Gostelow and Browne, 1981), and a similar study of the Cromarty Firth, and other studies related to foundation conditions (e.g. Lambert and Gostelow, 1978). These data are of potential relevance to PropBase but the resources required to extract the data are likely to outweigh its value.

b) Miscellaneous selected engineering data, including extracts from boreholes, SPT data, triaxial test data etc. for the M6 corridor in Cumbria and other locations, particularly colliery waste tips, in Northern England are retained in EXCEL spreadsheets at \\mhsan\WorkSpace\GLN\NorthernEngland\Data\Engineering

However, these data appear to be too selective to be of direct relevance to PropBase.

c) Miscellaneous selected data related to mining in North-east England, including some engineering data, is contained in various formats and files, mainly ARCGIS, but including some EXCEL spreadsheets, are contained in \\mhsan\WorkSpace\GLN\NEmining\Data and contain data for example on mine gas and groundwater. However, these selective project data appear of little direct relevance to PropBase

d) Mike Browne holds extensive data, including property data, relate to opencast sites in the Midland Valley of Scotland. Thee are all retained in hard copy.

### 2.2.8 Palaeontological datasets

Datasets of palaeontological properties appear to be of relatively low priority to PropBase but are included nevertheless. The principal corporate datasets mainted/held in Murchison House include the following.

#### 2.2.8.1 INDEX TO THE UK (NORTH) TYPE AND STRATIGRAPHICAL COLLECTION OF FOSSILS.

This hard copy dataset (GSE_SPECIMENS) is an index of the specimens and palaeontological slides held in the Type and Stratigraphical (T&S) Collection of Scotland and Northern England. This index along with GSE_REFERENCES (List Of Specimens From The UK (North) Type And Stratigraphical Collection And Related Publications) and to some extent SMITH_GSE are the digital equivalents of the analogue card index (held in BGS Edinburgh). The Stratigraphical Collection contains c.16000 records, of which perhaps 25% have been transcribed. The sporadically growing T&S Collection (which is derived from the Survey Collection) comprises some 16000 specimens. About 11000 are housed at BGS Keyworth and c.5000 remain at BGS Edinburgh. The specimens are individually registered in 5 leather bound volumes. These are held in BGS Keyworth, but equivalent information (microfilm and paper records) is held in BGS Edinburgh. For each specimen, the MS Access database MTD_GSE_SPECS provides a link with the Survey Collection, gives nomenclatural, taxonomical, geographical and stratigraphical information, an indication on where the fossil is housed, and any comments, perhaps on the state of preservation.

#### 2.2.8.2 List Of Specimens From The UK (North) Type And Stratigraphical Collection And Related Publications.

This dataset (GSE_REFERENCES) is a list of specimens held in the Type and Stratigraphical Collection of Scotland and Northern England, and the publications in which they are featured or illustrated. This database along with GSE_SPECIMENS (Index To The UK (North) Type And Stratigraphical Collection Of Fossils) and to some extent SMITH_GSE (Index To Specimens Transferred From The John Smith Collection To The UK (North) Type and Stratigraphical Collection) are the digital equivalents of the analogue card index (held in BGS Edinburgh).The latter contains c.16000 records, of which perhaps 25% have now been transcribed. The MS Access database BGS_GSE_REFS presently contains 431 records (but does not include specimens from the John Smith Collection). This represents an unknown, but probably small, proportion of the Type and Stratigraphical Collection of Scotland and Northern England featured in publications. The database links with GSE_SPECIMENS, and can also provide species, authors and nomenclatural status. Many of the publications referred to are held in an extensive paper reprint collection.

#### 2.2.8.3 Index To The UK (North) Survey Collection Of Fossils.

This dataset is an index of the Survey Collection of fossils for Scotland and Northern England. It is the digital equivalent of the analogue (card) index. The latter contains some 31000 records, c.70% of which has been transcribed. The continually growing Survey Collection comprises about 450,000 samples (including nearly 30000 specimens from the John Smith Collection), which are individually registered in c.150 leather bound volumes. The Oracle relational database BGS_FOSSLOC is a first step in ascertaining what registered fossil materials exist for certain areas, who collected them and when, their geographical and stratigraphical details, the type of collection (whether from boreholes or exposures), and any covering technical reports. It is also a pathway to an extensive and unique collection of paper graphic logs, some 18000 of which record annotated information on fossil occurrences and assemblages at certain stratigraphical levels (particularly in the Carboniferous) in Scotland and Northern England. FOSSLOC has been superseded by PALAEOSAURUS and is being merged with it, although not yet completed. The merging task is carried out in Keyworth. The record cards are not being added to but include taxonomic and limited stratigraphic data.

The dataset currently resides on the C: drive of Mark Dean, Murchison House at C:\databases\fosslocs_2000.mdb and see also

N:\FOSSLOCS\MURCHO.mdb (Fossloc)

#### 2.2.8.4 The BGS Edinburgh Palaeontological Slides Collection.

PALSLIDES_ED is the BGS Edinburgh Palaeontological Slides Collection. It comprises two registration series. The MIC series, which is added to sporadically, includes c.950 individually registered slides (each with up to 100 cells) of microfossils (mainly foraminifera and ostracods). The PS registration series, which has not been added to since 1987, comprises 4202 fossil thin sections and mounted slides, and includes various donated collections. Both the MIC register (10 volumes) and PS register (2 volumes) record the locality of each slide and any previous registration numbers. Stratigraphic information may also be given. Taxonomic information is not complete. There is, at present, no separate index (either analogue or digital) to the dataset, but it is included in FOSSLOC4. GSE_SPECIMENS and SMITH_GSE include those slides and thin sections transferred to the Type and Stratigraphical Collection from the Survey and John Smith collections.

#### 2.2.8.5 TAXONOMIC LISTING OF QUATERNARY, UPPER TERTIARY AND CARBONIFEROUS FOSSILS OF UK (NORTH).

This dataset is an taxonomic listing (various phyla and families) of Quaternary, Upper Tertiary and Carboniferous fossils relevant to the palaeontology of Scotland and Northern England. Species authors and some dates are given. The MS Access database MTD_TAXALIST presently contains 1169 records. It has provision for environmental interpretation, and publications in which the fossils are illustrated.

#### 2.2.8.6 INDEX TO SPECIMENS TRANSFERRED FROM THE JOHN SMITH COLLECTION TO THE UK (NORTH) TYPE AND STRATIGRAPHICAL COLLECTION

This index is a list of specimens and slides taken from the John Smith Collection and placed in the Type and Stratigraphical Collection of Scotland and Northern England (T&S). To some extent it is the digital equivalent to part of the T&S analogue card index which is held in BGS Edinburgh. The data, however, appear to have been derived from the 5 leather bound volumes of the T&S register. The latter are held in BGS Keyworth, but equivalent information (microfilm and paper records) is held in BGS Edinburgh. The MS Access database (BGS_SMITH_GSE) contains 1123 records, it links the T&S register with that of the John Smith Collection (8 bound volumes held at BGS Edinburgh) and provides limited information on taxonomy, nomenclatural status and chronostratigraphy. It also has provision for stating where the specimen is housed. The repository of BGS John Smith specimens is the Edinburgh office.

## 2.3 MARINE, COASTAL AND HYDROCARBONS

BGS has acquired a wide range of marine geological data over the last 35 years including seismic and acoustic, sediment particle size, geochemistry, geotechnical, gravity and magnetic data. BGS's interpretations of these data have produced digital images of, for example, sea-bed sediment distribution, bedrock geology, structure, stratigraphy, and potential field maps. These have all been used to develop the BGS Offshore GIS, which holds the offshore digital products that are available for licence. The BGS is also the national archive for a range of offshore data, including commercial site survey data.

The current programme of marine mapping is based on detailed multibeam sonar surveys and work is also focussing on estuaries, and the extent of estuarine contamination by organic and inorganic chemicals, and the coastal zone.

Although the offshore datasets are very substantial, the lack of common standards in the past, and the need for future data to conform to established standards, have been highlighted. Also, the spatial reference systems for the offshore databases are typically latitude and longitude, as opposed to the National Grid Reference (NGR) system used for onshore data. This means that there is an issue with co-ordinate systems that will need addressing. The DGSM project considered the issues relating to the conversion of national grid co-ordinates to latitude/longitude The issue is further complicated by the metadata for the offshore databases commonly indicating 'system not known' for the system of latitude/longitude used (e.g. the commonly used ED50 or WGS84 systems), the differences between systems can result in substantial differences in location. Work is in progress to try to resolve this issue for existing databases, and there are conversion packages built into both ArcGIS and ORACLE. Therefore, this should be further reviewed by PropBase and recommendations for how this issue is to be managed within the BGS made, and then appropriate conversion tools built.

### 2.3.1 National Hydrocarbons Data Archive and DEAL

The Department of Trade and Industry (DTI), together with the BGS, has established the National Hydrocarbon Data Archive (NHDA) to preserve the most valuable geoscience data

collected from the UK Continental Shelf and make this data available at low cost for public use. The NHDA is part of the NGDC. The DTI, BGS, UKOOA, and CDA are encouraging oil companies to deposit selected geoscientific data in the NHDA. In terms of data compilation, and downstream distribution, the National Hydrocarbons Data Archive (NHDA), and the associated DEAL system, contain some useful concepts that PropBase may be able to draw on.

NHDA and DEAL are intended to reduce costs, remove perpetual licence obligations, and increase data availability for future exploration. UK legislation requires all licensees in the UKCS to store most data in perpetuity (excluding cores and cuttings), even after licence relinquishment or sale or trade. DTI can request copies of the data, which should be provided in a modern format, at anytime. Obligations are borne jointly and severally by all parties to a licence and not by the operator of that licence alone. The NHDA will take on the obligation and store a subset of data f or the long-term benefit of the nation. The model includes options for licensees to transfer data to the NHDA at agreed events (for example at the time of licence relinquishment or at COP). Provision of a defined set of data to the NHDA will earn licensees permanent relief from their obligation to manage and maintain this data in perpetuity in return for an ‘endowment’ fee.

Although relief of obligation is granted for licences and licence data, the procedure will be flexible to allow partial relief of individual datasets that may be associated with more than one licence, such as regional seismic surveys, potential field data etc.

Data is selected in conjunction with the operator to provide a record of exploration and development, such that future exploration and redevelopment activities, for hydrocarbons, $CO_2$ sequestration, geothermal energy, or other geoscientific or commercial activities will be able to build on a summary of existing information.

The decision to archive is principally economic and would be taken collectively by all partners in a Licence Group. Once in the NHDA, data will be made available at low cost to the public, with a catalogue of data available through DEAL.

DEAL, (Digital Energy Atlas and Library), is a web-based GIS system which promotes and facilitates access to data and information relevant to offshore exploration and production of hydrocarbons on the United Kingdom Continental Shelf. As such, it is the definitive metadatabase for the UK’s oil industry and is the intended single virtual repository for UK data. Users can select data and be directed to the data vendor web site or e-mail contact. The DEAL site is the result of a commission to BGS from Common Data Access Ltd. (CDA).

DEAL is the definitive source of reliable basic data, including

- coastlines and international boundaries
- quadrants, blocks and licenses
- well location data
- 3D seismic outlines
- 2D seismic outlines
- filed outlines and surface infrastructure locations
- pipelines and other subsurface infrastructure

Where data are clearly in the public domain, users can download the data directly.

The DEAL site provides a comprehensive catalogue of geoscientific data on one site. Users can see the full extent of available well, seismic and other data for a given area, and be directed rapidly to the relevant data vendors.

DEAL is becoming the entry to a network of linked data repositories. Subscribers can use an entitlement and ordering system to obtain copies of data as required. This enables the industry and DTI to maintain one set of data and generate significant savings in the cost of data storage.

The eventual aim of DEAL is to provide as much data as possible, including well and seismic trace data, by electronic means.

BGS recently co-ordinated an EC-funded project to compile metadata for seismic and sonar information collected by European Geological Survey organisations. These data are available at the EU-SEASED website.

BGS is cooperating with a wide range of marine, government and industry organisations to maximise the benefit of marine data, including the UK Marine Information Council, Inter-agency Committee on Marine Science and Technology and the Marine Data and Information Partnership (MDIP).

### 2.3.2 Marine geoscience databases

These databases are managed mainly by Colin Graham (Databases), John McInnes (DEAL and NHDA) and Alan Stevenson (Coastal & Marine GIS/EU-SEASED). The Corporate collections – offshore archive is managed by Graham Tulloch

The BGS Corporate Collections Offshore Archive contains over 31 200 samples, collected since 1969. These comprise borehole, vibrocore, gravity core, rock drill and seabed samples. The Offshore Archive also contains over 53 000 non-BGS survey samples donated by other institutions, academia and industry. Relevant datasets are Offshore Borehole Cores.; Vibrocore Samples. ; Seabed Surface Samples.; Sample Station Location Maps.; Sample Station Data; Rock And Sediment; Core Sample Photographs And Negatives;

Property data are held in various forms:

1. ORACLE tables e.g. containing data on compressive strength, shear strength derived from instrumentation of core as collected, with some uninterpreted hand penetrometer and uncorrected hand shear vane test data,
2. EXCEL spreadsheets of selected borehole data, e.g. for downhole measurements and geochemical data for up to 32 single elements and some organic content analyses,
3. hard copies of Sample Station Data sheets, Sample Description Sheets and Sample Station Geology sheets (see below), e.g. as measurements of particle size analyses and $CO_3$ content for up to 40 000 sample stations for the 1:250 000-scale seabed maps. These data have not typically undergone any formal QA procedures and some, e.g. those gathered for the Rockall Consortium, are confidential, and
4. hard copy Technical Reports and site investigation reports.

### 2.3.3 Sample Station Data sheets, Sample Description Sheets and Sample Station Geology sheets

Sample Station Data provides access to the descriptive information of physical properties of relevance to PropBase.

- Sample Station data themselves are mainly scans of hard copies that include for given sample numbers by latitude and longitude, time date and water depth, summary sample descriptions (e.g. poorly sorted fine to coarse shell sand on very sort mud') geotechnical data comprising penetrometer and hand vane measurements both in raw form and as averages in kPa for given depth intervals. Some data on equipment type are provided.
- Sample description Sheets include for the given sample numbers more comprehensive descriptions of the lithologies logged, including some engineering geological property information (e.g. strength). There is also scope for geotechnical logging and sub-sampling data.
- Sample Station Geology sheets include for the given sample numbers depth interval data including Folk class, subordinate rock type, Munsell Colour, sorting, HCl reaction, sand fraction data (grain size range, roundness range, sphericity, %shell material), mud fraction data (hardness, plasticity), gravel fraction data (%shell material, maximum clast size, roundness range, sphericity) and additional characteristics may be included (basal contact, bedding, jointing, $H_2S$ odour, heavy minerals, mica, glauconite, fauna/fossils, presence of whole shells, foraminifera, plant remains, chronostratigraphy, lithostratigraphy, unit and additional comments. Descriptions for most parameters are restricted to short lists provided on the proforma.

Older data are held on 'IGS Continental Shelf Units' sheets, which include latitude and longitude, lithological descriptions, carbonate%, sand%, gravel%, silt and clay%, and other sampling information.

### 2.3.4 Marine and Coastal GIS

This is the repository for the many spatially referenced datasets and interpretations that have resulted from BGS offshore and coastal mapping projects. ArcGIS layer files and the Marine_Coastal_GIS.mxd are located in S:\GIStore\Offshore\Layers or S:\GDI\GDI9\Layers\Offshore and data from the GDI, DEAL, ESRI Geography Network etc. can be readily added. An ArcMap document called Marine_Coastal_GIS.mxd has also been created and is located in S:\GIStore\Offshore. This contains customised buttons to make it easier to extract and view information from BGS offshore datasets.

The BGS information tool, to be released in June 2006 (but currently available in the Marine and Coastal GIS by clicking on the 'BGS information' button) will enable a user to click on a BGS sample point to display a summary information form. The form includes a summary of data from the following layers:

- BGS Samples
- BGS Geochemical Data
- DigRock
- Bathymetry
- BGS Geotechnical Data
- Seabed sediment samples
- DigSed
- Various Offshore Reports

### 2.3.5 Key Datasets Relevant to PropBase

#### 2.3.5.1 ANALYSES OF MINERALS IN NORTH SEA RESERVOIR CORE SAMPLES

This completed hard copy dataset (Analyses Of Minerals In North Sea Reservoir Core Samples. ) is a compilation of mineral analysis data is for 1142 core samples assembled for Statoil and archived by BGS. Most records refer to carbonates, feldspars and clays analysed by electron microprobe. Further details are held in a variety of technical reports, unpublished BGS documents and PhD theses. Sample site locations are by borehole name/number and depth but are not present for some samples.

#### 2.3.5.2 ROCKALL SAMPLE STATION DATA

Rockall Sample Station Data is an ORACLE database records locations of gravity cores collected in 1994 and a few cores collected in 1998.

#### 2.3.5.3 GEOLOGICAL DESCRIPTIONS OF UNITS IN ROCKALL SHALLOW BOREHOLES

Geological Descriptions Of Units In Rockall Shallow Boreholes is an ORACLE database of data geological, geochemical and isotope data from 14 shallow, continuously-cored boreholes based on BGS high-resolution seismic data acquired for the Rockall Consortium and the results remain confidential to the consortium although some

#### 2.3.5.4 COMPOSITE LOGS OF BGS OFFSHORE SHALLOW BOREHOLES

This is a hard copy archive of composite borehole logs for BGS drilled offshore boreholes since 1969.(Composite Logs Of Bgs Offshore Shallow Boreholes.)

#### 2.3.5.5 GEOTECHNICAL DATA FROM OFFSHORE SAMPLES

This is an ORACLE dataset for data resulting from geotechnical analysis of BGS offshore core material. The main results are compressive and shear strength measurements made using hand vanes. (Geotechnical Data From Offshore Samples.)

#### 2.3.5.6 STRATIGRAPHIC SURFACES DATABASE

Stratigraphic Surfaces Database is an ORACLE database that stores down-hole stratigraphic data to complement the seismic surface picks stored in the LOCSEC database. Because these surfaces are chosen for their visibility on seismic data, they may not be directly equivalent to established BGS lithostratigraphic and/or choronstratigraphic divisions. However, the local coding system is based on and can relate to the BGS stratigraphic LEXICON. Stratigraphic picks are stored in terms of depth and seismic one-way travel time. Local borehole summary information (location, elevation, etc.) is used because both onshore and offshore boreholes are stored in this database. These data can be related to the BGS onshore borehole database by borehole registration, and to the offshore well database by DTI well-id. Additional tables (under development) provide information on hydrocarbon tests and their results.

#### 2.3.5.7 SHALLOW SEABED SAMPLE DESCRIPTION SHEETS

Shallow Seabed Sample Description Sheets comprises metadata for samples taken from sea areas around the UK since the late 1960s, including.hardcopy forms with a field description of the sample. The format and content of the forms has changed over time. For some sites, all data are contained in a single form, for others data is contained on many forms.

#### 2.3.5.8 ANALOGUE SHALLOW SEISMIC PROFILES

Analogue Shallow Seismic Profiles is a hardcopy dataset of BGS's seismic and sonar survey data for the sub-bottom and seabed ranging from low resolution but deep penetration airgun to high resolution but shallow penetration pinger. Navigation markers tie the data to position data stored digitally. The dataset contains well over 200,000 line kilometres of survey records.

#### 2.3.5.9 SAMPLE DESCRIPTION SHEETS FOR ROCKALL CONSORTIUM SEABED SAMPLES

Sample Descriptions Sheets For Rockall Consortium Seabed Samples is the hardcopy dataset of sample descriptions sheets for Rockall Consortium seabed samples.

#### 2.3.5.10 PARTICLE SIZE ANALYSES OF ROCKALL CONSORTIUM SAMPLES

Particle Size Analyses Of Rockall Consortium Samples is an ORACLE database of restricted access analyses are derived from the top few centimetres of gravity cores obtained in 1994.

#### 2.3.5.11 GEOTECHNICAL DATA FROM ROCKALL CONSORTIUM SAMPLES

Geotechnical Data From Rockall Consortium Samples is an ORACLE database of restricted access data derived from gravity cores, taken in 1994 and 1998 as part of a regional organic geochemical sampling programme.

#### 2.3.5.12 GEOCHEMICAL ANALYSES OF ROCKALL CONSORTIUM SAMPLES (RGEOCHEM)

Geochemical Analyses Of Rockall Consortium Samples. (Rgeochem) is an ORACLE database of restricted access organic and inorganic geochemical analyses of sub-samples of Rockall Consortium gravity cores for traces of hydrocarbons.

#### 2.3.5.13 ANALOGUE SEISMIC PROFILES AS PART OF ROCKALL CONSORTIUM PROJECT

Analogue Seismic Profiles Collected As Part Of Rockall Consortium Project. A hard copy dataset of seismic profiles.

#### 2.3.5.14 GEOCHEMICAL ANALYSES OF ROCKALL CONSORTIUM SAMPLES (RCKLGCANL)

Geochemical Analyses Of Rockall Consortium Samples. (Rcklgcanl) A hard copy dataset of organic analyses of Rockall Consortium organic and inorganic geochemical analyses Igneous rocks analysed for major, trace and REE data and isotopes i.e. inorganic. Sediments analysed for traces of hydrocarbons.

#### 2.3.5.15 ROCKALL CONSORTIUM DEEP SEISMIC PROFILES

Hard copies of Rockall Consortium deep seismic profiles with coincident gravity data. (Rockall Consortium Deep Seismic Profiles.)

#### 2.3.5.16 PARTICLE SIZE ANALYSES OF OFFSHORE SAMPLES

Particle Size Analyses Of Offshore Samples. An ORACLE database for particle size analyses of BGS offshore samples – mainly sea-bed sediments, including gravel, sand and mud fractions, carbonate content and phi/half phi analysis of the sand fraction.

#### 2.3.5.17 GEOCHEMICAL ANALYSES OF OFFSHORE SAMPLES

This comprises BGS offshore geochemical data, consisting of 38 elements, are available from sea-bed samples potentiall relevant to pollution control, fishing, natural resources, nature conservation, shipping, tourism, recreation, and waste disposal management. No data west of UK or south of 50' N. U data available only in the North Sea and the Inner Hebrides. Hg data available only in the North Sea. Sampling density variable but generally uniform. Clustering in some river estuaries such as the Forth and Clyde. (Geochemical Analyses Of Offshore Samples.)

#### 2.3.5.18 OFFSHORE DATABANK

This comprises an ORACLE database of geological and geophysical data, results of analyses, reports and indexes to archive material relating to the UKCS. (Offshore Databank)

#### 2.3.5.19 NON-CONFIDENTIAL DEEP SEISMIC PROFILES

This comprises hard copies of 8 BGS deep seismic surveys offshore – now superseded. (Non-Confidential Deep Seismic Profiles)

#### 2.3.5.20 MAGNETIC TAPES OF PROCESSED SEISMIC DATA

This comprises magnetic tapes of older multichannel seismic surveys. (Magnetic Tapes Of Processed Seismic Data)

#### 2.3.5.21 MAGNETIC TAPES OF DIGITAL NAVIGATION, FIELD AND PARTLY PROCESSED DATA

This comprises magnetic tapes resulting from multichannel seismic surveys. (Magnetic Tapes Of Digital Navigation, Field And Partly Processed Seismic Data )

#### 2.3.5.22 COASTAL AND ESTUARINE EVOLUTION DATABASE

An ORACLE database of borehole related data to be linked to SOBI. (Coastal & Estuarine Evolution Database.)

#### 2.3.5.23 COMPOSITE LOGS OF BGS SHALLOW BOREHOLES

Hard copy records of composite records of borehole logs of BGS boreholes since 1969 have been compiled in the field and also back in the office. (Composite Logs Of Bgs Offshore Shallow Boreholes.)

#### 2.3.5.24 ORIGINAL SEISMIC SEC TIONS

Hard copy datasets of original prints, on paper, sepia or film, of seismic reflection survey sections. Mostly UK onshore area; although there are some UK near-shore and offshore (North Sea, Irish Sea) and foreign data. C. 8500 sections. (Original Seismic Sections.)

#### 2.3.5.25 OFFSHORE TECHNICAL REPORTS

These hard copy reports result from BGS offshore activities. They vary from 'internal reports' which record survey operations, to results of geological interpretations generated for clients and contain some information of potential relevance to PropBase. However, extraction of the data would be time-consuming, and the data are in a variety of formats so integration would be problematic. (Offshore Technical Reports.)

2.3.5.26 OTHER MARINE-RELATED DATASETS

Index To Offshore Geophysical Surveys. ORACLE DATABASE
Index Of Internal And External Offshore Reports ORACLE DATABASE
Data Relating To The Western Frontiers Association Bibliography. CD bibliography

Non-Confidential Geophysical Track Charts. Hard copy
UK Hydrographic Office Charts Seabed bathymetry

Hydrographic Office Sidescan And Echo-Sounder Records Paper records of seabed bathymetry
Indexes To UK Hydrographic Office Maps And Records. ACCESS and ORACLE databases
Original Seismic Shotpoint Location Maps.

### 2.3.6 Differences between onshore and offshore data acquisition

In terms of geotechnical data, the range of data collected offshore is typically more restricted offshore than onshore, as in most cases the boreholes are not being drilled to establish foundation conditions. Therefore, for example, RQD data and Fracture indices are rarely collected, and there is no apparent market for such data.

The requirements from clients are also commonly restricted and in terms of geotechnical data, the following basic properties are considered sufficient by those dealing with offshore geotechnical data, and handling related enquiries, and can be considered as the main priorities for PropBase:

- Shear strength
- Compressive strength
- Moisture content
- Densities
- Atterberg limits

Mineralogical data are occasionally collected offshore, and in terms of chemistry, Eh and Ph, sulphate and carbonate data may be available but there is little interest in such data from commercial companies, and it is rarely requested.

### 2.3.7 Considerations

Amongst existing datasets, the following considerations have been highlighted.

1. There should be no obligation, and there is no commercial justification, to provide property data for the entire UK Continental Shelf. Currently, there is a focus of commercial interest on the West Coast of the UK and this could be given relative priority.
2. Currently, BGS provides data for, and guides clients in, planning site investigations. Unlike onshore site investigations, where the walkover survey is off critical importance, offshore site investigations are totally reliant on existing data to guide the planning of the ground investigation. Therefore, BGS's offshore data holdings have particular importance.
3. There is a need to resolve access to particle size data. Such data are considered particularly useful but currently they are held in many formats and like with like comparisons are not readily feasible at present. However, there may not be sufficient clients to justify the substantial input needed to resolve the existing problems.

### 2.4 SEISMOLOGY AND GEOMAGNETISM

Geomagnetic Survey Data. holds values of the geomagnetic elements measured at points on land, sea, in the air and from satellites, and is updated as data are received. There are no constraints on access and the original data are held in a delimited ASCII format. The magnetic survey data can be retrieved externally through the following form:

http://www.geomag.bgs.ac.uk/gifs/surveydata.html

This includes a search facility by year(s) during which the data were obtained, for specified latitude and longitude, and for data in various forms, including:

- one-off land survey data
- aeromagnetic data;
- three-component marine data
- satellite data
- marine total intensity data
- repeat station data
- observatory (variometer) station data

Data can be provided together with a map. However, these, and other geomagnetic datasets are probably of limited relevance to PropBase, other than for meeting possible demand from clients in relation to directional drilling. In addition, Data From Various Aeromagnetic Surveys In Offshore Petroleum Areas. contains over 22000 km of corrected aeromagnetic total intensity data from various offshore surveys, including overseas, collected to assist directional drilling. Line separation is 2 km and flight altitude is 80 m above sea level (a.s.l.) and navigation is by GPS. Other digital geomagnetic datasets of UK data include:

UK Geomagnetic Observatory One-Minute Mean Values. (ORACLE database)

UK Geomagnetic Observatory K-Indices. (ORACLE database)

UK Geomagnetic Observatory Hourly Mean Values. (ORACLE database)

Aa Indices. (various formats)

As with the offshore databases, the spatial reference system for the magnetic databases (where indicated in Discovery Metadata) is latitude and longitude, as opposed to the National Grid Reference (NGR) system used for onshore data. This means that there is an issue with co-ordinate systems that will need addressing. The issue is further complicated by the metadata for the magnetic databases typically indicating 'system not known' for the system of latitude/longitude used (e.g. the commonly used ED50 or WGS84 systems); the differences between systems can result in substantial differences in location.

# 3 External Datasets

## 3.1 KEY DATA HOLDERS

Many of the potential external clients of PropBase are also holders of geoscientific property data, which may be relevant to PropBase. The data are likely to comprise Site Investigation reports, including borehole records and laboratory test results for a wide range of geotechnical data, monitoring data, geochemical data (soils and groundwater). These include:

- statutory bodies such as SEPA and the local authorities,
- commercial consultants and contractors, and
- academic institutions

### 3.1.1 Statutory Bodies and Local Authorities in Scotland and Northern England

Many of the major councils in Scotland and the North of England have their own geotechnical units. For example, Glasgow, North Lanarkshire and Edinburgh, and Durham County Council, Gateshead Council, Newcastle City Council, Northumberland County Council, Cumbria etc. In Northern England, most data are believed to be held at the City/County council level, rather than at the District council level.

BGS already holds large numbers of site investigation data and related laboratory results acquired from statutory bodies and local authorities, and their consultants. However, it is known that many reports are not acquired for a variety of reasons. Chiefly amongst these appears to be the limitations of resources in local authorities for what they would regard as the low priority task of extracting and forwarding reports. The burden could be alleviated if the data were already available in digital form, e.g. AGS format data (see below) and could therefore be readily transmitted. This would also relieve the burden on the data holder of storage of the data.

Data reception from stakeholders in AGS Format would be likely to improve data capture overall due to reduced time and costs in handling, and would facilitate downstream usage and third party transfer.

### 3.1.2 Consultants and contractors

Geotechnical, engineering geological, environmental and hydrological/hydrogeological consultants are all likely to retain substantial databases of geoscientific property data. Such data, acquired on behalf of local authorities or statutory bodies may be accessible, with the compliance of the client body. However, those data deriving from work for private clients are less likely to become accessible, unless it can be demonstrated that collective ownership of such data is advantageous in terms of greater efficiency, or, as in the case of DEAL.

Using the DEAL model, BGS may be able to develop a system for PropBase whereby consultants/contractors and local authorities can discharge their legal obligation to retain Site Investigation etc. data (typically for seven years) by transferring them at a suitable time (end of works, settlement of any claims etc.) to a discrete framework within the NGDC, to be made accessible under license through PropBase.

It will be particularly important to test the extent to which consultants and contractors currently acquire/maintain geotechnical data in AGS format and to assess their willingness to submit data to BGS in this format. In this regard, the support of major clients (Section 3.1.1) who own the data, and especially the local authorities, statutory bodies and Scottish Executive, would be essential.

### 3.1.3 Academic Institutions

Some potentially relevant data are acquired and held by universities etc. However, if they are the owners of the data, the data are likely to be limited in number and localised in coverage, given the limitations of the universities in data gathering. If the data are not owned by the university, they should be obtained from the primary sources. Therefore, universities etc. are unlikely to be a major source of data relevant to PropBase.

### 3.1.4 Miscellaneous groups

Some potentially relevant material that may be useful to fill gaps in data sets may be held by miscellaneous groups. For example, information and samples collected from quarries and other localities are held externally by local RIGS (Regionally Important Geological and Geomorphological Sites) groups in Scotland and the North of England, e.g. Lothian and Borders RIGS group (http://www.edinburghgeolsoc.org/r_home.html) Strathclyde, Stirling, Tayside and Fife.

# 4 POTENTIAL CLIENTS

## 4.1 END-USERS OF/STAKEHOLDERS IN PROPBASE – ONSHORE

### 4.1.1 General

PropBase is broadly welcomed as an important means to expand the culture of corporate ownership of data within BGS and there is general support internally for its development.

### 4.1.2 Potential external clients in Scotland

The main external clients in Scotland are likely to be:

- The Scottish Executive, and its consultants,
- Local Authorities, and their consultants, especially engaged in
    - Planning
    - Environmental Assessments
- Scottish Environment Protection Agency (SEPA), and their consultants,
- Scottish Natural Heritage (SNH), and their consultants,
- Historic Scotland, and their consultants,
- NGOs, including those involved in conservation,
- commercial consultants, including
    - geotechnical
    - engineering geological
    - environmental consultants

- contractors, engaged on behalf of clients in the public and private sectors, in:
  - Planning and undertaking site investigation/Ground investigation
  - Geotechnical Assessments
  - Infrastructure development
  - Housing development
- Those involved in the minerals extractive industry, including both the planning and the extraction.

#### 4.1.2.1 CURRENT DEMAND FOR GEOSCIENTIFIC INFORMATION IN SCOTLAND

There is reasonable current demand in some parts of Scotland for reliable and up-to–date geoscientific analysis and information for the urban environment in particular, but not exclusively. This is mainly focussed in the urban areas of the Scottish Midland Valley.

During the financial year 2005-2006, based on information in the IDA, Records North dealt with 889 enquiries (compared with 3426 for the same period for Records South and 40 for Borehole records Southwest). The large majority of the enquiries (829) were from commercial interests (engineering, environmental, mining and hydrogeological consultancies, individual consultants, drilling contractors, structural engineers, water companies, the Coal Authority), with comparatively few (30) from academia and individuals (17). Public bodies also made a small number of enquiries. Only a very small number of enquiries (6) were directly from Central or Local Government but some of the enquiries from consultants would be on behalf of local authorities. Most of these were for direct data orders where the client confirmed in advance, following their own search of our website the specific data they require. The clients are supplied mainly with copies of borehole records, typically on CD-ROM in the form of .pdf files (not .tif files). Clients sometimes consult the SI reports on microfilm in person, but more commonly visitors inspect mine plans and maps.

Only the factual parts of non-confidential reports are available for users, although information regarding testing (procedures, techniques etc.) within the main body of the report is also provided on request. The standard charge is £13 (+VAT) per record supplied, and there is no additional charge for information relating to testing, unless this is very substantial.

Glasgow City Council is particularly proactive in seeking geoscientific information, licensing data and co-funding the Clyde Basin Environment Project (CBEP) (Project leader: Mike Browne). The CBEP provides a potentially useful template for linkage of physical, mechanical, geochemical and mineralogical data to state-of-the-art BGS GIS map development and 3D modelling onshore of the superficial deposits and bedrock. It is also a demonstration of client willingness to subscribe, and invest in advance, where high quality and relevant geoscientific data can be made readily available. The Scottish Environmental Protection Agency (SEPA) is also involved in the CBEP, and BGS hopes to involve the Scottish Executive, Enterprise bodies, surrounding local authorities, CEH and others in the project.

BGS's existing data holdings are being updated and maps revised in the Glasgow conurbation and Clyde valley. The intension is to deliver sustainable environmental geological information for the River Clyde catchment. It is also developing ways to present modern geological data relevant to the user community, including 3D models to define depths and thicknesses of strata and potentially areas at risk from collapse of old mine workings, digital databases, environmental geology themes and GIS layers. This project is linked currently to three supporting co-funding BGS projects and key components include

- enhancement of the BGS digital borehole metadatabase with the addition of scientific data on the Quaternary lithologies and Carboniferous lithostratigraphy leading to

- superficial deposits maps and 3D models
- bedrock/rockhead maps and 3D models
- The Clyde Estuary geochemistry and sediment study, combining offshore shallow drilling to obtain samples for geochemical analysis and grain size determination, in combination with seismic reflection data offshore, and an urban sediment geochemistry study across Glasgow to identify potentially contaminated sites for land management and environmental protection.

It is intended to add physical and mechanical properties (e.g. permeability, strength etc.) to the 3D model volumes for use in:

- Hydrogeology and hydrology studies of groundwater pollution, flooding etc.
- engineering geology

In addition, modelling will also encompass:

- geophysics
- minerals / aggregates

Currently, progress on the 3D modelling depends on expansion of the project borehole database. Data are manually extracted from hard copy borehole logs, and entered in an ACCESS database, which forms part of SOBI. In some cases, limited data have already been entered in SOBI for these boreholes. A significant number of cases already been previously interpreted and annotated by BGS staff, or by staff of the former National Coal Board, or by consultants. Otherwise data are largely taken on trust directly from the original logs. Key information is extracted including superficial deposits where available, (though these are often not recorded in any detail), rockhead (usually based on previous annotations which are usually taken on trust) lithologies, selected coal horizons and major stratigraphic divisions, mineral workings, made ground (using the 5-fold BGS classification where possible), colour, fossil content, faults, water levels/strikes (although many of the older records are considered to be unreliable if recorded at all), comments (the only option for expressing uncertainty), etc. Geotechnical data are not extracted as part of the data extraction in Murchison House. Start heights are generally considered reliable for recent boreholes, but many older boreholes have no start heights, in which case heights are estimated from current Ordnance Survey maps to within 5 metres. The process has no formal QA procedure for checking the data entry, although the data users occasionally identify anomalies, which result in corrections being made, and there is no system of indicating confidence/uncertainty. The only index of reliability is the interpreter's name. The rate of handling of data is very consistent at c. 6000 log lines entered per month by a very experienced handler fully familiar with the procedure and the local stratigraphy (Tony Irving), representing c. 20 boreholes per day.

It is generally considered that BGS's future business opportunities in Scotland are likely to remain focussed in the Clyde Basin in particular, and it is hoped that the beneficial influence of Glasgow City Council's proactive geotechnical engineers will extend to neighbouring Local Authorities.

PropBase can therefore provide the mechanism by which the current models of the Clyde Basin can be continually updated for these stakeholders and similar geotechnical, studies of ground conditions can be undertaken to support urban regeneration.

#### 4.1.2.2 POTENTIAL CLIENTS UNDER CURRENT SCOTTISH PLANNING AND ENVIRONMENTAL LEGISLATION

The Scottish Executive, Scottish Local Authorities and other statutory bodies have various legal obligations which require them to seek, obtain, assess and maintain data in relation to the planning process and environmental legislation. BGS holds, or could provide much of this data, at least in part, through PropBase. The following are relevant.

(i) Under the Planning etc. (Scotland) Bill, currently in progress, proposed legislation refers to "key agencies" that will provide baseline data in support of the planning process at national (National Strategic Framework) and local (Regional and Local Development Plans) levels. BGS should lobby to be seen as a key agency in relation to providing baseline data in relation to, and being consulted on, a wide range of geoscience topics (minerals extraction, contaminated land, landfill issues etc.). As a guide to what baseline data these are likely to be, and in which some overlap with PropBase is apparent, BGS is referred to as the (only) source, at 'Local' level, in the ODPM's Draft Practical Guide to the SEA Directive (2004) for data relating to "Minerals, unstable land, contaminated land, groundwater etc." Hence, The Scottish Executive, and the planning divisions within Scottish local authorities, are likely to be clients for, amongst others, such mineralogical, physical and chemical data, and data relating to ground stability, peat/bog bursts etc. and so will be stakeholders in PropBase.

(ii) Environmental Assessment (under the SEA Directive (2001/42/EC) and the EA (Scotland) Act 2005) is referred to in the Bill in relation to Development plans but not the National Strategic Framework – this is an issue where Consultative Authorities under EA legislation may not necessarily overlap with key agencies in relation to Planning. In Scotland, there are only two acknowledged Consultative Authorities under recently enacted Scottish EA legislation; the Scottish Environment Protection Agency (SEPA) and Scottish Natural Heritage (SNH). However, they, or their consultants, especially environmental consultants, will be likely to have to refer to BGS for the same types of data as are referred to above under Planning legislation, i.e. "Minerals, unstable land, contaminated land, groundwater etc.", so are potential PropBase stakeholders.

(iii) Under the Environment Protection Act 1990, (as amended by the Scotland Act, 1998), Part IIA Contaminated Land (see also Annex 4 of the Contaminated Land (Scotland) Regulations 2000)

- (3.1) each local authority has a duty to cause its area to be inspected from time to time for the purpose of identifying contaminated land, and
- (2.7) The local authority is also required to act in accordance with statutory guidance issued by The Scottish ministers in determining whether pollution of controlled waters is being, or is likely to be, caused

(iv) The **Environmental** Information (**Scotland**) Regulations 2004 implement Directive 2003/4/EC of the European Parliament and of the Council and

- provides for the making available of environmental information held by Scottish public authorities
- imposes a general duty on Scottish public authorities to take reasonable steps to organise and keep up to date environmental information relevant to their functions with a view to its active and systematic dissemination to the public.
- provides for a power to charge fees for making information available with exceptions
- obliges Scottish public authorities to provide advice and assistance to applicants and prospective applicants.

- makes provision for the transfer of requests or the provision of information about the holder when the Scottish public authority to which a request has been made does not hold the information.

Environmental Consultants particularly active in regard to assessment of contaminated land in Scotland include Enviros (who are dealing with the very large Ravenscraig site in North Lanarkshire), Environ (based in Edinburgh) and URS Corp (based in Manchester).

### 4.1.3 Potential clients in Northern England

The range of potential clients in Northern England are essentially the same as for other parts of England and would be substantially the same as those clients listed in section 4.1.1, except for that related to the devolved legislature.

The greatest demand for physical etc. data information would be likely to be in relation to the Tyne and Weir conurbation.

There may be an additional demand from NIREX in the wake of renewed interest in a possible subsurface radioactive waste repository.

### 4.1.4 Potential clients related to building stones

The present client demand for BGS expertise and data related to building stones in Scotland is strong, and there is considered to be good potential for expansion. Therefore, there is a perceived need for a UK Buildings Stones Resource Database to provide a digital resource for rapid access to data on UK (and other?) building stones, to enhance BGS's ability to answer enquiries and increase turnaround of GeoReports Building Stone Assessment.

PropBase could potentially provide much of this resource by linking the relevant data from various sources held both internally and externally into a single system. The following information are considered potentially relevant:

- petrographic descriptions, e.g. of Graham Lott, BGS Technical Reports/previous enquiry reports
- samples in BGS collections
- thin section images, as above
- hand specimen images, many of which are already available through Imagebase
- hand specimen description, although this may need to be developed from material in the existing collections
- Munsell colour, as above
- physical test data,
    - currently held by the Building Research Establishment/British Stone data but already available on the internet
    - data available from quarry operators.
- Link to BritRocks, for sample data

- Link to BritPits; BGS Directory of Mines & Quarries for information on quarry Details/suppliers

- Link to GeoReports data, for information on previous enquiries.

The potential commercial advantage of such a resource could include increased turnover of GeoReports Enquiries. The database would be a unique resource, bringing together data from a number of sources, and may be of considerable value to a broad range of clients (e.g. local authority planners, architects, developers etc.).

## 4.2 POTENTIAL CLIENTS OF PROPBASE – OFFSHORE

At present, enquiries for offshore property data come mainly from oil companies or consultants to the oil industry, and are typically related to the planning of offshore site investigations. They are generally borehole or area based and will request any geotechnical data that may be available. The data are typically either to help them plan their own survey, or to satisfy insurance or legislative requirements.

Potential growth areas in relation to demand for data are seen in relation to offshore wind farms and tidal power schemes, where foundation conditions would be the issue, and in relation to seabed trenching for powerlines etc..

The Clyde Basin Environmental Project has demonstrated a local authority demand for linkage of onshore soil geochemical data with sediment geochemistry in nearshore and estuarine environments. There is also a similar need apparent for linkage of geotechnical data in these environments also, for example in relation to the **Clyde** Waterfront **Regeneration** Plan and the related **Clyde Gateway** project.

## 4.3 POTENTIAL INTERNAL CLIENTS

### 4.3.1 Areas of application

The main internal clients of PropBase are considered likely to be in relation to:

- continuous revision mapping,
- urban mapping,
- engineering geology,
- geohazard evaluation,
- building stones,
- modelling seafloor changes and coastal erosion,
- attribution of hydrogeological, geotechnical , geophysical and mineralogical property information to LithoFrame, DigMap, and the BGS Lexicon,
- research into property information relationships and the effect of geo-processes, and
- 3D and 4D modelling of property information including research into statistical methods to summarise the data and to define uncertainty.

Internal usage in relation to marine geology, seismology and geomagnetism appears likely to be limited as access to relevant data is already provided to a substantial degree.

# 5 PROBLEMS TO ADDRESS

## 5.1 GENERAL

After 2010, following completion of the baseline geological map, continuous revision mode will predominate. This will link logically to PropBase, as the borehole and other data that it will link are the key data on which map revision is likely to depend. The integration of project areas (onshore and offshore) in terms of scales and consistent handling of data will also be essential.

It is vital in this context that PropBase is

- seen as a long-term infrastuctural project,
- is able capture efficiently new data,
- that these data are internally consistent (e.g. to BS 1377 1-9:1990 (British Standards Institution, 1990), BS 5930:1999 (British Standards Institution, 1999); UKAS accredited laboratories etc. ), and
- that they are in a form that can be readily incorporated, e.g. AGS Format data rather than hard copy and Mechanisms to resolve IPR issues efficiently,
    - to update existing maps (DigMap),
    - to upgrade existing 3-Dmodels, and

to develop other corporate datasets, including the LEXICON.

## 5.2 LEGACY DATA

Although the large volumes of legacy data identified in this report appear potentially useful to a wide range of end users, there are several overriding problems apparent in integrating these data sets, namely the lack of:

- common standards,
- consistent definitions,
- internal consistency,
- validation, and
- accessibility.

All of these problems, if unresolved, would significantly undermine the defensibility, and hence commercial viability, of the data, and so would limit the extent to which they could be used.

### 5.2.1 Standards

The metadata for most of the datasets described in this report are generally insufficient to resolve the uncertainties in terms of methodologies and equipment used to acquire the data, the levels of

precision attained, and definitions of the parameters quoted. However, in some instances, these uncertainties can be resolved by referring to published documents (in-house Technical Reports, Site Investigation Reports etc.) and files, and in others, the data quoted may have been acquired subject to a British or International Standard, or acquired by an organisation subject to the United Kingdom Accreditation Service, the sole national accreditation body recognised by government to assess, against internationally agreed standards, organisations that provide certification, testing, inspection and calibration services.

The issue of conversion between latitude/longitude and NGR coordinates has already been discussed (Section 2.3). In addition, the recording of XY coordinates must adhere to an agreed best practice, as outlined for example in Appendix 4.

### 5.2.2 Definitions

The issue of definitions is key to the linking and integration and expansion of datasets. Where different definitions are used for the same term in different datasets, their linkage potentially degrades the value of both, and will be masked by subsequent quantitative analysis. The problem of lack of definitions is also exacerbated by the lack of generally accepted definitions for some important concepts that are highly relevant to PropBase.

The classification of, and related definitions of superficial deposits, including the related classification of artificial deposits/made ground/derelict ground, have been addressed internally by McMillan and Powell (1999). McMillan et al. (2001) present useful definitions for engineering soils and engineering rock. However, they highlight a key issue in the lack of an accepted definition, and criteria for recognising, engineering rockhead, as opposed to the simpler concept of geological rockhead, which is precisely defined as the base of Quaternary deposits. For example, engineering rockhead is not specifically referred to in BS 5930:1999 (British Standards Institution, 1999) and there is some overlap with the term ‘bedrock’. Furthermore, engineering rockhead may be used differently by engineers, depending on the nature of the project being undertaken – for example in relation to foundation engineering, with possible requirements for minimum percentage recoveries of rock, as opposed to tunnel engineering, in which a minimum overburden of rock of particular weathering grade or better may be required, or where efficient TBM operation critically depends on transitions from rock to soil.

In broad terms, engineering rockhead is the upper surface of material that has the engineering properties of rock. This may be complicated by irregular transitions from soil to rock related to variations in rock type, structural control of weathering, the development of corestone-bearing profiles etc. Identification of the upper surface of ‘engineering rock’ influences in turn the way in which materials are described, and properties recorded, in borehole logs. In practice, this is commonly taken as the level, determined by the driller, at which rotary coring commenced in response to increased resistance to drilling by other methods (shell and auger, light cable percussion) following a change in material characteristics resulting. Alternatively, the boundary between ‘soil’ and ‘rock’ is frequently taken at an arbitrary uniaxial compressive strength of 1Mpa. However, recognition of rockhead in legacy borehole data will remain problematic and without a common basis for identifying rockhead, integrating property information from disparate sources will be subject to significant uncertainty.

For obtaining improved information on weathering profiles and an indication of engineering rockhead levels in particular, McMillan et al. (2001) suggest:

- adherence to BS 5930:1999 (British Standards Institution, 1999), and Section 6 in particular for engineering description of soils, for future BGS logging of weathered rock cores and exposures, and
- identifying and recording rotary coring depths on borehole logs (this parameter is recorded in the Geotechnical Database).

BGS's Urban geoscience projects follow the British Standard for lithological description as far as possible, so that data provided by the projects are interchangeable between most end-users. However, this would not necessarily be the case for other BGS lithological data, which since 1999 would generally conform to the BGS Rock Classification Scheme. The engineering properties of soils should be acquired by soil mechanics testing techniques (BS 1377:1990).

Colour in BGS's Urban geoscience projects is recorded using the widely-adopted Munsell soil or rock colour charts, but these are not used in all other areas of BGS's work, although they are used for example for projects relating to Building Stones.

Texture, discontinuities (fractures and joints) and weathering are again described in Urban geoscience projects using British Standard 5930:1999 (British Standards Institution, 1999) descriptors.

With regard to the in-house mineralogical data, these are largely descriptive (thin section, hand specimen and outcrop descriptions) and there have been no established corporate standards for such descriptions. However, by contrast, more recent GeoReports provide petrographic descriptions that conform to British and European standards.

### 5.2.3 Internal consistency

Some of the datasets are subject to considerable operator bias, therefore affecting the internal consistency. For example, the sets of structural data include data collected by many individuals, generally working independently. As a result, although definitions of features measured may be unambiguous, the identification of the measured features may not be.

The in-house mineralogical datasets are subject to substantial operator bias in terms of their accuracy and content. These largely descriptive data often reflect the particular skills and interests of the individual, and the project in relation to which the descriptions were made, and so can generally be regarded as partial descriptions only.

The geochemical datasets are amalgamations of data obtained from a variety of laboratories, using a wide range of equipment and analytical techniques with varying levels of analytical precision. Although individual sets of data would typically be calibrated to reference samples material, the calibration data are not readily available in many cases.

With respect to the physical and mechanical data, these are obtained from a very large number of external sources and even if they apparently conform to specified standards, there is likely to be inconsistency between different data providers. The problem is exacerbated where the data predate any effective data gathering standards.

### 5.2.4 Validation

There is little information available on validation of the datasets and it appears in many, if not most, instances, the datasets have been subject to little or no validation. With most of the older legacy data this would be impossible to do, and to do so at all retrospectively in other instances would require considerable resources.

Ultimately, with respect to the legacy data in particular, there will be many gaps in the datasets that can not be filled. Therefore, it will be important in such cases to acknowledge these gaps exist for one of the following:

- 'Not applicable', meaning 'Not applicable',
- 'Not available', meaning 'Applicable, but a value cannot be found despite a search, and
- 'Not entered', meaning 'a value has not yet been assigned (and it might not be applicable)'

### 5.2.5 Accessibility

The data are held in various hard copy, analogue (e.g. magnetic tape), and digital formats (spreadsheets, databases, relational databases) and there may be some issues of compatibility.

Many of the data are scattered within hard copy files and reports which may or may not be indexed, and the useful data are often hard to identify and labour intensive to retrieve and validate.

Some magnetic tapes (containing seismic reflection data) are in uncertain condition and retrieval may not be possible in all cases.

## 5.3 CURRENT DATA

Most of the problems associated with integrating legacy data also affect current data. Many of these problems are more readily overcome with current data, so that their overall quality is higher, their defensibility is more readily established, and their resulting commercial viability greater.

### 5.3.1 Common standards, definitions, internal consistency, validation and accessibility

#### 5.3.1.1 EXTERNAL ACQUISITION

Internationally accepted standards exist for acquiring, transmitting and validating many of the types of data that PropBase will integrate. PropBase can therefore focus on accessing those data externally:

- with adequate and up-to-date metadata,
- with appropriately defined terms,
- whose acquisition has been subject to an internationally accepted standard (e.g. British Standards Institution),
- which have been acquired and validated by an appropriately accredited organisation (e.g.UKAS), and
- which are held in a format that is internationally accepted and readily transmissible and captured (e.g. AGS format in the case of geotechnical data – Sections 3.1.1 and 3.1.2, Appendix 2-1 to 2-4, and potentially AGS XML format – Appendix 2-5, but see also Appendix 3).

The issue of terms lacking generally accepted definitions (referred to above) remains for some current data however, and needs to be resolved.

In acquiring data in AGS format, the essential support of major clients (Section 3.1.1 and 3.1.2) who own the data, and especially the local authorities, statutory bodies and Scottish Executive, has already been highlighted. Presently, in relation to acquisition of Site Investigation reports, the long-standing directive in Scotland of the Scottish Executive (formerly Scottish Office) is relevant (Section 2.1.1.1). The support of the Scottish Executive in relation to digital in Scotland, rather than hard copy data acquisition, would be key therefore. This could be greatly facilitated by development and promotion of a specifically Scottish subset of PropBase.

Potentially, however, the development of AGS XML (Appendix 2-5) or similar Geotechnical Markup Language (Appendix 3), a geotechnical engineering version of Extensible Markup Language (XML), could pose some threat to the long-term development of PropBase. It could

using XML become possible to search all geotechnical data available on the web in a structured way (not simply by keyword) so that the web could become an international repository of geotechnical information, potentially avoiding the need to establish national or international geotechnical/property databases.

#### 5.3.1.2 INTERNAL ACQUISITION

In-house recording and observation standards are equally needed to ensure internal consistency and effective integration of data. The four-volume BGS Rock Classification scheme provides the framework for recording and classification through recognised terms for description of the lithologies of all deposits:

- Volume 1 Igneous rocks
- Volume 2 Metamorphic rocks
- Volume 3 Sediments and sedimentary rocks
- Volume 4 Artificial man-made ground and natural superficial deposits

However, there are minor differences between this rock classification and that in the British Standards Code of Practice for Site Investigations (BS 5930:1999, British Standards Institution, 1999) with respect to sediment description and classification (Ellison et al., 2002). These have arisen because of differences between geological and engineering geological approaches to description. Ellison et al. 2002 therefore recommend that the British Standard be used in-house for logging weathered rock core and exposures.

# References

Most of the references listed below are held in the Library of the British Geological Survey at Keyworth, Nottingham. Copies of the references may be purchased from the Library subject to the current copyright legislation.

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# Appendix 1 Review of datasets maintained within Murchison House

The following tables are derived from the existing Discovery metadata held for BGS corporate datasets maintained wholly or partly within Murchison House. Additional comments on the content of these datasets, and their relevance to PropBase, are in red.

## SITE INVESTIGATION

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| 1 | Site Investigation Records: Scotland & Northern England.<br><br>ONGOING<br><br>(RG) | Site Investigation Records: Scotland & Northern England.<br><br>Records are requested and retrieved from Local Authorities (LAs). Some are proactive but others less so and it proves hard to obtain records from some. The LAs retain the records only for 7 years, prior to destroying them. There appears to be no mandatory requirement for contractors to supply the raw SI/GI information to the Las as client. Contractors/consultants are likely to hold more extensive records of GI/SI than some Las and will in addition hold records for private work for which there is no mandatory requirement to forward results to BGS.<br><br>The data are held in hard copy. I incoming records have been, and continue to be, scanned in |

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| | | their entirety (Keyworth has recently adopted this procedure rather than the selective scanning previously carried out) to maintain integrity of the data. All past records are also on microfilm and the microfilms have been scanned but these .tif files are not readily accessible at present.<br><br>All records are indexed in the ORACLE table BGS.BGS_SI and the Borehole Index Scotland (BINDEX) is available through the GDI from the ORACLE table BGS.BINDEX on MHDBASE.<br><br>No reports in AGS format have been yet been received into the SI records in Scotland although some data are being used on a project basis.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The collection of over 19,000 site investigation reports for Scotland and Northern England consists of records of boreholes, trial pits, geotechnical results and interpretative reports acquired from various sources. The collection started c.1960 to cater for the increasing amount of post-war shallow drilling for building and road construction which was kept separately by the Survey from the Borehole Journal collection reserved for deeper geologist examined mineral bores. The SI reports are available for consultation on microfilm. Only the factual parts of reports are available for public inspection.<br><br>Reports for Northern England are held in the Shallow Borehole File (SB), now no longer added to. All SI reports (except SB files) are indexed on the Land Survey Record Index (LSRI) and all boreholes and trial pits contained in the reports (those with adequate site plans) are indexed on the Single Onshore Borehole Index (SOBI).<br><br>All non-confidential data held by NGRC(N) is available to users. Concentrated mainly in areas of urban development and major roads.<br><br>Constraints: Some SI reports commercial-in-confidence. Interpretative parts of reports not available to public.<br><br>Associated dataset(s)<br>○Single Onshore Borehole Index<br><br>Paper records |
| 2 | Altnabreac Site Investigation. COMPLETED 1982<br><br>(Keyworth) | Altnabreac Site Investigation.<br><br>This dataset is an anomaly in having been maintained as a separate entity. The point of contact for the dataset is in Keyworth even though it relates to a ground investigation in Scotland and many of the documents are held in Murchison House. The boreholes have been logged in considerable detail and the logs include lithological descriptions, a fracture log, RQDs, water levels, analysed water samples (pH, CO3), core photographs and there are references to petrography and geophysical logging<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>Surface and borehole information for a nuclear waste site investigation programme at Altnabreac, Northern Scotland. Dataset includes geological mapping, surface geophysics, borehole information, borehole geophysics and spring survey geochemistry.<br><br>Dataset completed 1982. DATASET_COMPLETENESS = All existing data are available to all users.# SPATIAL_DETAIL_LEVEL = CM'S TO KM'S# DATASET_LOGICAL_CONSISTENCY = Logical for each project.<br><br>Constraints: None.<br><br>Associated dataset(s)<br>○Hydrotesting in boreholes.<br><br>Paper |

## MINERALS, INCLUDING COAL

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| 3 | Sand And Gravel Resources Assessment Records: Scotland.<br>COMPLETED 1988<br>(RG) | Sand and Gravel Resources Assessment Records: Scotland.<br>These IMAU records represent the original project data, but it is likely that all significant data have already been captured in the published reports. The dataset was recently reviewed by Jon Merritt and rationalised.<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>Dataset description<br>"Archive" collection of c.3,000 records of the former Industrial Minerals Assessment Unit (IMAU) relating to sand and gravel assessment projects in Scotland, 1978-88. Includes borehole and trial pit records, grading and resource assessment data and aggregate tests.<br>Published BGS Mineral Assessment Reports. All non-confidential data held by NGRC(N) is available to users. Mainly areas of sand & gravel deposits.<br>Constraints<br>Financial<br>Associated dataset(s)<br>Single Onshore Borehole Index<br>Paper |
| 4 | Scottish Quarries Database<br>ONGOING<br>(AM) | Scottish quarries Database<br>The Scottish Quarries database, including locations is available (held in the GeoReports folder in the S drive \\mhsan\Store\GeoReports\Quarries_Scotland\XYX-QUARRI.dbf,). This is not currently a corporate database but there is a move to update, validate and modify it for inclusion into the BritPits index (maintained in Keyworth) and recording active, ceased, inactive, restored and historic quarries n the UK. A report is currently being prepared (by A. McMillan) to formulate a methodology for selecting and cataloguing Scottish quarries from the information held in BGS records. The dataset contains c. 16000records, though with many duplicates for the same sites, this does not represent such a large number of quarries. Data from this dataset has been collated in an EXCEL spreadsheet for Historic Scotland and includes unique ID, quarry name, GR, status (active or not)basic rock type, the Operator and the data source.<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>Dataset description<br>Contains the site and rock type information of working and disused hard rock quarries in Scotland, covering all mainland Scotland and major Scottish islands.<br>Database was initiated in the spring of 1997. Various stages of completeness in the dataset according to information received, quarries not documented will not be recorded. Quarry site data is given as point data (centre 2D XY data), at the point there is a quarry. Areal extent is not recorded. DATASET_LOGICAL_CONSISTENCY = where the rock type is known the information is recorded.<br>Constraints: Legal<br>Literature, Maps, MS Access Database, Paper |
| 5 | Archival Card Index Of Quarries In England And Wales.<br>ONGOING<br>(Keyworth) | Archival card index of quarries in England and Wales.<br>Though including data on Scottish Quarries, this dataset is maintained from Keyworth.<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>Old card index of quarries in England, Wales and Scotland dating mostly from 1939 to 1963: |

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| | | about 7000 cards, each referring to one quarry. England & Wales cards are arranged by BGS 1-inch (now 50 k scale) geological sheet, Scottish cards by county. At best, cards indicate county, geol-sheet, rock type, name, grid ref., locality, owner, date of record and cross references to BGS samples.<br><br>Constraints: Examination at BGS Keyworth office by arrangement only<br><br>Work planned on this index to link the dataset with BritPits. Card Index kept in D102 (As of 2005).<br><br>Cards |
| 6 | Opencast Coal Records: Scotland & Northern England.<br><br>ONGOING<br><br>(RG) | Opencast Coal Records: Scotland & Northern England.<br><br>Few data have been received recently. Some completion plans may go to Keyworth instead. Keyworth have taken on all British Coal data for open cast sites.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Data holdings relate to coalfield areas.<br><br>Dataset description<br>The collection consists of borehole drill logs, site plans, borehole location plans, geological plans and completion plans for opencast coal sites in Scotland and Northern England. It includes records deposited by the Directorate of Opencast Coal Production (DOCP) and its successors, National Coal Board (NCB), British Coal and numerous private and licensed opencast mine.<br><br>The NCB Scottish Area records are arranged by the NCB opencast site number. Many records of cored "diamond" boreholes are held in the BGS Scottish Borehole Journal records.<br><br>Northern England opencast records are mainly held with the ex-Newcastle Borehole Records. Copies of completion plans for Scotland are also held in the Coal Mine Abandonment Plan collection available on microfilm aperture cards. Opencast sites are indexed in the Land Survey Record Index (LSRI) database. The cored "diamond" boreholes are indexed on Single Onshore Borehole Index (SOBI).<br><br>Constraints: Boreholes within Coal Authority license areas may be confidential.<br><br>Associated dataset(s)<br>○Land survey Record Index Database (LSRI); Scotland and Northern England.<br>○Single Onshore Borehole Index<br><br>Paper Record |
| 7 | Plans Of Abandoned Mines (Coal & Oil Shale) For Scotland Held On Microfilm.<br>ONGOING<br><br>(RG) | Plans of abandoned mines (coal & oil shale) for Scotland held on Microfilm.<br><br>As described - Duplicate microfilm collection of originals held by Coal Authority. Little more data likely to be received.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The collection includes colour microfilm aperture card copies of 7,170 plans of mine workings for coal and oil shale dating from 1872 onwards deposited on abandonment of a mine in compliance with the Coal Mines Regulation Act. An additional c.5,000 coal "working" plans, mostly pre-dating 1872, formerly belonging to British Coal, have been added to the abandonment plan collection. The latter are held as black & white microfilm aperture cards. The collection includes plans of workings for other minerals, notably ironstone, where worked with coal. The microfilms are held on behalf of the Coal Authority who hold the original plans on behalf of the Health & Safety Executive (HSE). Original plans are held by the Coal Authority, Mansfield. No complete digital index held by BGS. An up to date finding aid is provided by the Coal Authority's paper "Catalogue of Plans of Abandoned Mines".<br><br>Constraints: None<br><br>Mine abandonment plan collection started c.1872. COAL AUTHORITY: Catalogue of Plans of Abandoned Mines. (unpublished.) MINES DEPARTMENT, 1931. Catalogue of Plans of |

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| | | Abandoned Mines, Vol. V, Scotland. HMSO.<br><br>Associated dataset(s)<br>○Land Survey Plans (LSP)<br>○Plans of Abandoned mines (other than Coal & Shale): Scotland.<br><br>Microfilm Aperture Cards |
| 8 | Plans Of Abandoned Mines (Other Than Coal & Shale): Scotland.<br><br>ONGOING<br><br>(RG) | Plans of Abandoned mines (other than Coal & Shale): Scotland.<br><br>As described – we hold plans on behalf of a consortium comprising the H&SE, Coal Authority, National Archives and Camborne School of Mines. The plans are being scanned (likely to take c. 1 year to complete) as part of programme under Jenny Walsby.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The collection comprises plans of mine workings for ironstone, fireclay, limestone, baryte and metalliferous minerals for Scotland dating from 1872 onwards deposited on abandonment of a mine in compliance with the coal and metalliferous mines regulation acts. The plans are held on behalf of the Health & Safety Executive (HSE) and total about 610 plans. Indexed in the BGS Plans Database Index.<br><br>Constraints: Post 1974 plans cannot be copied without the written consent of the mine owner.<br><br>Collection started c.1872. Coal Authority/Health & Safety Executive: Catalogue of Plans of Abandoned Mines. (unpublished.) PUBLICATION: THE BRITISH GEOLOGICAL SURVEY MINE PLANS DATABASE AND ITS COMPUTER APPLICATIONS. BRITISH GEOLOGICAL SURVEY TECHNICAL REPORT WO/90/3. MINES DEPARTMENT, 1931. Catalogue of Plans of Abandoned Mines, Vol. V, Scotland. HMSO<br><br>Associated dataset(s)<br>○Plans of abandoned mines (coal & oil shale) for Scotland held on Microfilm.<br>○Land Survey Plans (LSP)<br>○Mineral Resources Archive (MRA): Scotland & Northern England.<br><br>Collection, plans |
| 9 | Plans Of Abandoned Mines (Other Than Coal): Cumbria.<br><br>ONGOING<br><br>(RG) | Plans of abandoned Mines (other than Coal): Cumbria.<br><br>Anomalous set of plans originally held by BGS on behalf of Cumbria Record Office, when original plans dispersed by H&SE to local authorities, Cumbria were unable to accept plans for their area. However, the originals have now been handed over to Cumbria and BGS only retains 35mm transparencies and black and white half plate negatives of the plans.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The collection comprises photographic half plate black & white negative and 35mm colour transparency copies of plans of mine workings for haematite, gypsum, limestone, baryte and metalliferous minerals for Cumbria dating from 1872 onwards. The plans were originally deposited in compliance with the Coal and Metalliferous Mines Regulation acts. The original plans are currently held by Cumbria County Record Office on behalf of the Health & Safety Executive (HSE) and total about 1240 plans. No digital index is available but a paper catalogue is provided by the Health & Safety Executive.<br><br>Constraints<br>Post 1974 cannot be copied without the written consent of the mine owner.<br><br>Collection started c.1872. HEALTH & SAFETY EXECUTIVE: Catalogue of Plans of Abandoned Mines for Cumbria. (unpublished)<br><br>Collection, plans |
| 10 | Mineral Resource Records (Mr); Scotland & Northern | Mineral Resource Records (MR); Scotland & Northern England.<br><br>Current and semi-current exploration records and miscellaneous reports (MEIGA etc) – remaining 'commercial in confidence'. Nothing added recently. Geophysical results include a |

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| | England.<br>ONGOING<br>(RG) | wide range of data from various types of survey including IP, magnetic, VLF, self potential, radiometric data, seismic data, EM orientation, resistivity, EM etc. Other types of analyses include soil/overburden geochemistry, stream geochemistry, petrographic studies, spectrographic analyses, mineral identification, assays, rock geochemistry analyses of panned concentrates (e.g. Au, Ag, As, Hf, U, Th, Mo, Na) etc. However, all of these data suffer from the variable quality of their description of with respect to the techniques used and precisions of data obtained (metadata).. The boreholes have probably been captured in SOBI.<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>Dataset description<br>The collection, amounting to c.6,000 records, consists of reports and data relating to geochemical sampling, geophysics, drilling and field mapping deposited by mineral exploration companies dating from c.1960 onwards. Major accessions include records of Mineral Exploration Incentive Grant Act (MEIGA) and reports and plans of Exploration Ventures Ltd (EVL) relating to NE Scotland. Indexed in Land Survey Record Index Database (LSRI).<br>Constraints: Some "commercial-in-confidence" records. Access subject to NGRC conditions and regulations.<br>Associated dataset(s)<br>○Land Survey Plans (LSP)<br>○Mineral Resources Archive (MRA): Scotland & Northern England.<br>Paper records |
| 11 | Mineral Resources Archive (Mra): Scotland & Northern England.<br>ONGOING<br>(RG) | Mineral Resources Archive (MRA): Scotland & Northern England.<br>Originally filed by commodity then latterly by accession number. Index held on an ACCESS database, much data dating back to WWII.<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>Dataset description<br>Collection of c.5,000 items relating to economic mineral exploration and exploitation in Scotland (with some records for Northern England) pre c.1960. Incorporates Non-Ferrous Metallic Ores Committee and Mineral Development Committee records. Collection originally arranged by mineral commodity, but new data is added in accession order.<br>Constraints: Access subject to NGRC conditions and regulations relating to archives.<br>PUBLICATION: MINISTRY OF FUEL & POWER, 1949. REPORT OF THE MINERAL DEVELOPMENT COMMITTEE. HMSO.<br>Associated dataset(s)<br>○Land Survey Plans (LSP)<br>○Mineral Resource Records (MR); Scotland & Northern England.<br>○Plans of Abandoned mines (other than Coal & Shale): Scotland.<br>Paper records |

## LAND SURVEY RECORDS

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| 12 | Land Survey Record Index Database (LSRI); Scotland And Northern England.<br>ONGOING<br>(RG) | Land survey Record index Database (LSRI); Scotland and Northern England.<br>ORACLE database index to the Land Survey Records, which are now accessible through the GDI:<br>Site Investigation (Scotland) subset of BGS_LSR on MHDBASE<br>Archives (Scotland) subset of BGS_LSR on MHDBASE<br>Enquiries (Scotland) subset of BGS_LSR on MHDBASE<br>Exploration (Scotland) subset of BGS_LSR on MHDBASE |

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| | | Mineral Resources (Scotland) subset of BGS_LSR on MHDBASE<br>Opencast Plans (Scotland) subset of BGS_LSR on MHDBASE<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The Land Survey Record Index was set up c.1980 to provide a digital database index to records and archives held by the Land Survey in Scotland and Northern England and contains over 46,600 records. Finding aid to the following record groups/data sets, is provided through a application query interface: Site Investigation Records (SE); Land Survey Archives (LSA); Land Survey Records (LSR); Mineral Resource Records (MR); Additional Information Files (AI); Enquiry Record Files (EE; EN); Opencast Coal Sites (OC). Table name: BGS.LSR<br><br>Constraints: Subject to the usual BGS terms and conditions.<br><br>http://www.bgs.ac.uk/bgs/w3/cust/publications/publ.html (links to listings of all BGS publications) Mineral Resource Archive not yet indexed; index to Additional Information Files not complete.<br><br>Associated dataset(s)<br>○Additional Information (AI): Scotland and Northern England.<br>○Enquiry Records/Archives: Scotland and Northern England.<br>○Hydro-Electric Records (HE)<br>○Land Survey Plans (LSP)<br>○Opencast Coal Records: Scotland & Northern England.<br>○Single Onshore Borehole Index<br><br>Relational Database |
| 13 | Land Survey Records (LSR): Scotland And Northern England.<br><br>ONGOING<br><br>(RG) | Land Survey Records (LSR): Scotland and Northern England.<br><br>All hardcopy records. The modern equivalent of the Additional Information files comprising miscellanea. Numbered sequentially as per accession rather than sheet based. Including MRP reports, locality details, Quaternary geology reports, cross sections, plans etc. SI reports in this archive are not the originals.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>Miscellaneous geological records of current or semi-current interest filed in order of accession. Some 65 accessions held which will be subject to review for permanent retention/destruction. Indexed on Land Survey Record Index Database.<br><br>Constraints: Some items may be held on a "commercial-in confidence" basis.<br><br>Associated dataset(s)<br>○Additional Information (AI): Scotland and Northern England.<br>○Land Survey Plans (LSP)<br><br>Paper Records, Photographs |
| 14 | Land Survey Archives (LSA): Scotland & Northern England.<br><br>ONGOING<br><br>(RG) | Land Survey Archives (LSA): Scotland & Northern England.<br><br>Murchison House archives relating to land survey activity. Data generally more than 30 years old. Including structural and lithological information etc. in notebooks. These include NCB borehole geophysical logs, neutron logs, sonic logs, dipmeter analysis logs, coal quality logs, coal lithology logs, and seam thickness logs, borehole logs, coal analyses (moisture, ash content etc.). Also including underground boreholes, so not captured in SOBI.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The Land Survey Archives consists of records of the Geological Survey in Scotland for permanent retention dating from 1860s onwards. The collection comprises geologists" field notebooks, miscellaneous field observations and reports, historical and biographical material, correspondence files, photographs, etc. Includes archival material deposited by outside individuals and organisations, e.g. NCB Bore Book Collection. Survey archival material for |

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| | | Northern England will be incorporated. Some 380 accessions held amounting to over 7,000 items. Indexed at collection level in Land Survey Record Index (LSRI). Plans abstracted and held separately in Land Survey Plans Collection.<br><br>Constraints: Access subject to NGRC conditions and regulations relating to consultation of archival material.<br><br>Associated dataset(s)<br>○Land Survey Plans (LSP)<br><br>Paper Records, Photographs |
| 15 | Land Survey Plans (LSP)<br><br>ONGOING<br><br>RG and Rod Bowie, Keyworth) | Land Survey Plans (LSP)<br><br>Now indexed in BGS.ALL_PLANS_NEW on MHDBASE, this collection of plans is jointly maintained by Keyworth and Murchison House.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The Land Survey Plans collection of c.1,520 plans consists largely of mine plans acquired by the Survey, including 492 non-coal mine plans deposited by the National Coal Board 1984-87, and copies of mine plans derived from various sources including "6-inch reductions". The collection also contains about 500 miscellaneous plans extracted from other Land Survey records in order to benefit from specialised systems of archival storage. The Survey's collection of Northern England mine plans are being added to the LSP collection. The collection supplements the Plans Of Abandoned Mines (Other than Coal & Oil Shale) in Scotland (NONCOALPLANSCO) providing an index to plans other than coal and oil shale for Scotland. Indexed on BGS Plans Database Index.<br><br>Constraints: None.<br><br>Additional information available from COAL AUTHORITY. Catalogue of Plans of Abandoned Mines. (Unpublished) PUBLICATION: THE BRITISH GEOLOGICAL SURVEY MINE PLANS DATABASE AND ITS COMPUTER APPLICATIONS. BRITISH GEOLOGICAL SURVEY TECHNICAL REPORT WO/90/3. MINES DEPARTMENT, 1931. Plans of Abandoned Mines, vol. 5, (Scotland). HMSO.<br><br>Associated dataset(s)<br>○Plans of abandoned mines (coal & oil shale) for Scotland held on Microfilm.<br>○Land Survey Archives (LSA): Scotland & Northern England.<br>○Land Survey Records (LSR): Scotland and Northern England.<br>○Land survey Record index Database (LSRI); Scotland and Northern England.<br>○Mineral Resources Archive (MRA): Scotland & Northern England.<br>○Mineral Resource Records (MR); Scotland & Northern England.<br>○Plans of abandoned Mines (other than Coal):Cumbria.<br>○Plans of Abandoned mines (other than Coal & Shale): Scotland.<br><br>Collection, Plans |
| 16 | East Grampians Field Data.<br><br>LAPSED1992<br><br>(CT) | East Grampians Field Data.<br><br>Geochemical data now form part of the Dalradian carbonate geochemistry database<br><br>Structural and related data are contained in an ACCESS database which now resides at cwt on 'mhsan\users' N:\ ACCESS\PROJDATA\EGPROJ1.mdb in several ACCESS tables including: Structural records (containing c. 23000 records) Field Sheet header records (c.12500 records), Sample records (c.3400 records etc.) and others.<br><br>The structural data list station number, number, structure trend (azimuth or strike), dip (or plunge), point, precision (scale of 1-3), way-up, way-up evidence and notes. However, the notecards contain more contextual information and although these have been used to some extent, there is no recent useage of the structural database. The data are likely to lack internal consistency, having been collected by various individuals, and there has been no verification of the data, or QA of the dataset. |

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| | | **Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>Field notebook observations including structural observations and sample locations.<br><br>Constraints**:** Restricted use.<br><br>Data entry lapsed after 1992.<br><br>Associated dataset(s)<br>○Dalradian carbonate rock geochemistry database.<br><br>MS Access database |

## HYDROLOGY, ENQUIRIES AND MISCELLANEOUS

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| 17 | Scottish Water Well Records.<br><br>ONGOING<br><br>(RG) | Scottish Water Well Records.<br><br>These records are being transferred to WELLMASTER. Paper records are retained in Murchison House, and have not yet been scanned.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>The collection consists of records for c.5000 wells and springs in Scotland mostly lodged by drillers in compliance with the Water Act. These include data on well construction, water yields, water levels, water chemistry and well lithology. The collection is organised on the One-Inch Geological Sheet basis. Catalogues for wells in Central Scotland were published between 1963 and 1969. SOBI provides a partial digital index to the records.<br><br>Water Supply Papers of the Geological Survey of Great Britain: Well Catalogue Series - Scotland. (1963-69). Mainly relate to industrial areas of central Scotland.<br><br>Constraints: Some records are held on a "commercial-in-confidence" basis.<br><br>Associated dataset(s)<br>○Single Onshore Borehole Index<br><br>Collection and Paper records |
| 18 | Hydro-Electric Records (He)<br><br>COMPLETED<br><br>(RG) | Hydro-Electric Records (HE)<br><br>Comprising a set of 1:250K maps with outlines of schemes and a card index indicating project and site but no specific data. Some borehole logs may have been captured but not all shallow boreholes and horizontal boreholes in the reports. The data include tunnel logs, with structural measurements, lithologies.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>Archive of reports, correspondence, records of tunnel and dam site examinations, borehole records relating to the North of Scotland Hydro-Electric Board's schemes in the Scottish Highlands c.1945-1970. Arranged by hydro-electric scheme.<br><br>All data held by NGRC(N) is available to BGS users.<br><br>Constraints: Some records confidential to Scottish Hydro-Electric plc.<br><br>Associated dataset(s) |

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| | | ○Land Survey Record index Database (LSRI); Scotland and Northern England.<br>○Single Onshore Borehole Index<br>Paper Record |
| 19 | Enquiry Records/Archives: Scotland And Northern England.<br>ONGOING<br>(RG) | Enquiry Records/Archives: Scotland and Northern England.<br>As described – little relevance to PropBase<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>Dataset description<br>The collection consists of records of enquiries answered by the Land Survey from c.1939 to 1970, with a small number of earlier records. Pre c.1960 files relate mainly to economic mineral enquiries while files after that year relate increasingly to enquiries on geological site conditions. Enquiry records of former Leeds and Newcastle offices, relevant to UK(N), are held for c.1950 to 1992. Edinburgh Office enquiry files dated up to 1970 have been reviewed for retention/destruction and those of continuing informational or historical value have been retained as archives. Post 1970 files are confidential to BGS staff. Indexed on Land Survey Record Index (LSRI). Edinburgh enquiry files are referenced EE, (ex-Newcastle Office enquiries, EN).<br>Collection is added to as semi-current files are reviewed. SPATIAL_DETAIL_LEVEL = Mainly areas of urban development.<br>Constraints: Post 1970 files are confidential to BGS staff.<br>Associated dataset(s)<br>○Land survey Record index Database (LSRI); Scotland and Northern England.<br>Paper records |
| 20 | Additional Information (AI): Scotland And Northern England.<br>ONGOING<br>(RG) | Additional Information (AI): Scotland and Northern England.<br>Predecessor of the Land Survey Archives. No index available. Being transferred to the Land Survey Archives but much work remains to be done. The data includes structural and mineralogical data, mine plans, mine sections, shaft sections, borehole logs, trial pit logs and some geophysical records<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>Dataset description<br>Collections of miscellaneous items mainly of semi-current value, including some field observations supplementary to 1:10560/1:10K mapping, arranged on 1:10K or One-Inch sheet basis. Records of archival value for permanent retention being transferred to Land Survey Archives (LSA). Indexed in the Land Survey Record Index (LSRI).<br>Constraints: None.<br>Associated dataset(s)<br>○Land Survey Records (LSR): Scotland and Northern England.<br>○Land survey Record index Database (LSRI); Scotland and Northern England.<br>Collection, Paper Records |
| 21 | Dalradian Carbonate Rock Geochemistry Database.<br>COMPLETED<br>(CT) | Dalradian carbonate rock geochemistry database.<br>This dataset comprises c.700 analyses for Dalradian and a few Moine limestones, mainly marbles. The data comprise a full range of analyses by XRF for major element oxides (although there is some variability) and a variable number of trace elements (maximum c.20) with later analyses in the series being more focussed for fewer elements.<br>There are also REE data for less than 20 samples (analyses carried out by ICPAS at King's College, Univ. of London.<br>There are also some electron microprobe analyses for calc silicates and limestones and whole carbonate isotope analyses (c.50) for O, C, S and Sr.<br>There are also some ion probe isotope analyses for 4 samples<br>The data are held in ACCESS tables on the N: drive of Chris Thomas, |

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| | | cwt on 'mhsan\users' N:\ LSTCHEM\GEOCHEM<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>Database of whole-rock, major and trace element data, together with some REE, Sr, C, O and S isotope data of various sorts. Electron microprobe data for calc-silicate and carbonate rocks from the Dalradian.<br><br>Part of East Grampians project initially, now Dalradian-wide, including Northern Ireland.<br><br>Constraints: Other - Undefined. Contact Supplier for further information<br><br>Associated dataset(s)<br>East Grampians Field Data.<br><br>MS Access database |

## GEOMAGNETISM

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| 21 | Geomagnetic Survey Data.<br>ONGOING<br>(SM) | Geomagnetic Survey Data.<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Values of the geomagnetic elements measured at points on land, sea, in the air and from satellites.<br><br>Updated as data are received. http://www.geomag.bgs.ac.uk/gifs/surveydata.html<br><br>Constraints: None<br><br>Associated dataset(s)<br>Geomagnetic observatory Annual Means.<br><br>Delimited ASCII |
| 22 | Geomagnetic Observatory Year Books.<br>ONGOING<br>(SM) | Geomagnetic observatory year books.<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Collection of annual publications from the global network of magnetic observatories. They typically contain tabulations of hourly, monthly and annual mean values of the geomagnetic elements.<br><br>http://www.geomag.bgs.ac.uk Various organisations around the World that run magnetic observatories supplied the data.<br><br>Constraints: None<br><br>Paper |
| 23 | UK Geomagnetic Observatory One-Minute Mean Values.<br>ONGOING<br>(EC) | UK Geomagnetic Observatory One-minute mean values.<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Digital one-minute mean values of the Geomagnetic field elements from Lerwick, Eskdalemuir and Harland observatories.<br><br>DATASET_COMPLETENESS = Contains all available values. SPATIAL_DETAIL_LEVEL = 3 UK locations.<br><br>Constraints: A fee applies for any commercial use of data. |

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| | | Oracle, Various |
| 24 | UK Magnetic Observatory Magnetograms. COMPLETED 1986 (EC) | UK Magnetic Observatory Magnetograms.<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset Description<br>Original Paper magnetograms as recorded at Kew, Greenwich, Abinger, Hartland, Eskdalemuir and Lerwick Observatories.<br>CAPTURE_END_DATE = 01-DEC-1986 END_DATE_ACCURACY = YEAR END_DATE_COMMENT = Accurate to a day. DATASET_COMPLETENESS = All available originals. SPATIAL_DETAIL_LEVEL = Several UK locations.<br>Paper Magnetograms |
| 25 | UK Geomagnetic Observatory K-Indices. ONGOING (EC) | UK Geomagnetic Observatory K-Indices.<br>Dataset description<br>A time series of 3-hourly K-Indices from Lerwick, Eskdalemuir, Greenwich, Abinger and Hartland Magnetic Observatories.<br>**Spatial Reference System:** No information provided in metadata<br>DATASET_COMPLETENESS = Abinger & Hartland - all available values. Not available digitally - Greenwich 1841-1867, Lerwick 1923-1953 and Eskdalemuir 1911-1953. SPATIAL_DETAIL_LEVEL = 5 Uk Locations.<br>Constraints: None.<br>Oracle, Various |
| 26 | UK Geomagnetic Observatory Hourly Mean Values. ONGOING (EC) | UK Geomagnetic Observatory Hourly mean values.<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>Digital hourly mean values of the Geomagnetic field elements from Lerwick, Eskdalemuir, Abinger and Hartland Observatories.<br>Final values updated annually DATASET_COMPLETENESS = Contains all available values. SPATIAL_DETAIL_LEVEL = 4 UK locations.<br>Constraints: A fee applies for any commercial use of data.<br>Oracle |
| 27 | Geomagnetic Observatory Annual Means. ONGOING (SM) | Geomagnetic observatory Annual Means.<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>Annual Means of the geomagnetic field elements from observatories from around the world.<br>Constraints: None<br>Delimited ASCII |
| 28 | Aa Indices. ONGOING (EC) | Aa Indices.<br>**Spatial Reference System:** No information provided in metadata<br>Dataset description<br>The 3-hourly aa indices and daily mean Aa values -A time series of Global Geomagnetic activity indices from 1868.<br>DATASET_COMPLETENESS = Yes - Complete time Series. SPATIAL_DETAIL_LEVEL = |

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| | | Global: Derived from 2 Antipodal Locations.<br><br>Constraints: None.<br>Various storage formats |

## PALAEONTOLOGY

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| 29 | Macrofossils Identified During The Hartfell Project-Scottish 1" Sheet 16<br><br>COMPLETED<br><br>(Paul Shepherd, Keyworth, | Macrofossils identified during the Hartfell Project-Scottish 1" sheet 16<br><br>This is maintained from Keyworth although it relates to fossils collected in Scotland<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>**Spatial Reference System:** BNG map sheet or quadrant number [] |
| 30 | Index To The UK (North) Type And Stratigraphical Collection Of Fossils.<br><br>ONGOING<br><br>(MD) | Index to the northern UK Type and Stratigraphical Collection of fossils.<br><br>The Card Index system in Murchison House has not changed since these metadata<br>Refer also to mtd on 'mhsan\users'(N:) N:\FOSSLOCS\MURCHO.mdb (2 versions of GSE specimens)<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>GSE_SPECIMENS is an index of the specimens and palaeontological slides held in the Type and Stratigraphical (T and S) Collection of Scotland and Northern England. It, GSE_REFERENCES and to some extent SMITH_GSE are the digital equivalents of the analogue card index (held in BGS Edinburgh). The latter contains c.16k records, of which perhaps 20% have been transcribed. The sporadically growing T and S Collection (which is derived from the Survey Collection) comprises some 16k specimens. About 11k are housed at BGS Keyworth and c.5k remain at BGS Edinburgh. The specimens are individually registered in leather bound volumes. These are held in BGS Keyworth, but an equivalent microfilm is held in BGS Edinburgh. For each specimen, the MS Access database MTD_GSE_SPECS provides a link with the Survey Collection, gives nomenclatural, taxonomical, geographical and stratigraphical information, an indication on where the fossil is housed, and any comments, perhaps on the state of preservation.<br><br>Data capture started on 11 November 1993, subject to revision. Old and current records entered irregularly. Data to be included in Palaeosaurus. GSE_SPECIMENS then to be considered a legacy dataset. About 25% of index cards digitised. As accurate as the information on the index cards. DATASET_LOGICAL_CONSISTENCY = Varies according to time and source of supply.<br><br>Constraints: Restricted, conditions.<br><br>Associated dataset(s)<br>○Index to the northern UK Survey collection of Fossils.<br>○<br>List of specimens from the northern UK Type and Stratigraphical Collection and related publications.<br>○<br>Record of borrowers of specimens and slides from the Survey and Type and Stratigraphical collections<br>○The BGS Edinburgh Palaeontological Slides Collection.<br>○Index to specimens transferred from the J.S. Smith collection<br><br>Analogue, Card, Paper, Collection, Registers, Specimens, Microfische |
| 31 | List Of Specimens | List of specimens from the northern UK Type and Stratigraphical Collection and related |

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| | From The UK (North) Type And Stratigraphical Collection And Related Publications.<br>ONGOING<br>(MD) | publications.<br>As was reported here. File index cards maintained in Murchison House provide locality. taxonomic and stratigraphic information<br>Refer also to mtd on 'mhsan\users'(N:) N:\FOSSLOCS\MURCHO.mdb (GSE refs)<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>GSE_REFERENCES is a list of specimens held in the Type and Stratigraphical Collection of Scotland and Northern England, and the publications in which they are featured or illustrated. GSE_REFERENCES, GSE_SPECIMENS and to some extent SMITH_GSE are the digital equivalents of the analogue card index, which is held in Edinburgh. The latter contains c.16k records, of which perhaps 20% have now been transcribed. The MS Access database BGS_GSE_REFS presently contains 431 records (but does not include specimens from the John Smith Collection). This represents an unknown, but probably small, proportion of the Type and Stratigraphical Collection of Scotland and Northern England featured in publications. The database links with GSE_SPECIMENS, and can also provide species, authors and nomenclatural status. Many of the publications referred to are held in an extensive paper reprint collection.<br><br>Start date of capture strictly not known (?possibly 1993). Subject to revision. Old and current records entered irregularly. DATASET_COMPLETENESS = Incomplete, not added to since 1993. SPATIAL_DETAIL_LEVEL = As accurate as the information on the index cards. DATASET_LOGICAL_CONSISTENCY = Varies according to time and source of supply.<br><br>Constraints: Legal.<br><br>Associated dataset(s)<br>○Index to the northern UK Survey collection of Fossils.<br>○Index to the northern UK Type and Stratigraphical Collection of fossils.<br>○<br>Record of borrowers of specimens and slides from the Survey and Type and Stratigraphical colle ctions<br>○Index to specimens transferred from the J.S. Smith collection |
| 32 | Index To The UK (North) Survey Collection Of Fossils.<br>COMPLETED<br>(MD) | Index to the northern UK Survey collection of Fossils.<br>FOSSLOC has been superseded by PALAEOSAURUS and is being merged with it, although not yet completed. The merging task is carried out in Keyworth. The record cards are not being added to but include taxonomic and limited stratigraphic data.<br>Currently resides on the C: drive of M.T. Dean, Murchison House. C:\databases\fosslocs_2000.mdb<br>Refer also to mtd on 'mhsan\users'(N:) N:\FOSSLOCS\MURCHO.mdb (Fossloc)<br>Fossil locality information is available in the GDI through joined ORACLE tables BGS.NEW_REGISTRATION and BGS.NGR_CODES<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>BGS_FOSSLOC is an index of the Survey Collection of fossils for Scotland and Northern England. It is the digital equivalent of the analogue (card) index. The latter contains some 31k records, c.70% of which has now been transcribed. The continually growing Survey Collection comprises about 425k samples (including nearly 30k specimens from the John Smith Collection) which are individually registered in 147 leather bound volumes. The Oracle Relational database BGS_FOSSLOC is a first step in ascertaining what registered fossil materials exist for certain areas, who collected them and when, their geographical and stratigraphical details, the type of collection (whether from boreholes or exposures), and any covering technical reports. It is also a pathway to an extensive and unique collection of paper graphic logs, some 18k of which record annotated information on fossil occurrences and assemblages at certain stratigraphical levels (particularly in the Carboniferous) in Scotland and Northern England.<br><br>Data capture started mid-eighties, FOSSLOC started 1997. Subject to revision. DATASET_COMPLETENESS = Digitisation of all index cards. SPATIAL_DETAIL_LEVEL = As accurate as the information on the index cards. DATASET_LOGICAL_CONSISTENCY = |

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| | | Varies according to time and source of supply.<br><br>Constraints: Restricted, conditions.<br><br>Associated dataset(s)<br>○List of specimens from the northern UK Type and Stratigraphical Collection and related publications.<br>○Index to the northern UK Type and Stratigraphical Collection of fossils.<br>○Index to specimens transferred from the J.S. Smith collection<br><br>Analogue, Cards, Charts, Digital, Paper, Registers, Relational Database, Specimens |
| 33 | The BGS Edinburgh Palaeontological Slides Collection.<br><br>ONGOING<br><br>(MD) | The BGS Edinburgh Palaeontological Slides Collection.<br><br>As reported here. No separate card index is available but they are included in the FOSSLOC card index.<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>PALSLIDES_ED is the BGS Edinburgh Palaeontological Slides Collection. It comprises two registration series. The MIC series, which is added to sporadically, includes c.950 individually registered slides (each with up to 100 cells) of microfossils (mainly foraminifera and ostracods). The PS registration series, which has not been added to since 1987, comprises 4202 fossil thin sections and mounted slides, and includes various donated collections. Both the MIC register (10 volumes) and PS register (2 volumes) record the locality of each slide and any previous registration numbers. Stratigraphic information may also be given. Taxonomic information is not complete. There is, at present, no separate index (either analogue or digital) to the dataset, but it is included in FOSSLOC4. GSE_SPECIMENS and SMITH_GSE include those slides and thin sections transferred to the Type and Stratigraphical Collection from the Survey and John Smith collections.<br><br>START_DATE_COMMENT = MIC series 1938; PS series 1954.<br>DATASET_COMPLETENESS = No separate index (indexed as part of FOSSLOC4).<br>SPATIAL_DETAIL_LEVEL = As accurate as the information in the registers.<br>DATASET_LOGICAL_CONSISTENCY = Varies according to time and source of data.<br><br>Constraints: Legal.<br><br>Associated dataset(s)<br>○Index to the northern UK Type and Stratigraphical Collection of fossils.<br>○Index to specimens transferred from the J.S. Smith collection<br><br>Collection, Paper, Slides, Specimens, Thin Sections |
| 34 | Scottish Samples Collected For Carboniferous Foraminifera.<br><br>COMPLETED | Scottish samples collected for Carboniferous Foraminifera.<br><br>This is maintained from Keyworth although it relates to fossils collected in Scotland<br><br>**Spatial Reference System:** BNG map sheet or quadrant number [] |
| 35 | Taxonomic Listing Of Quaternary, Upper Tertiary and Carboniferous Fossils Of UK (North).<br><br>ONGOING<br><br>(MD) | Taxonomic listing of Quaternary, Upper Tertiary & Carboniferous Fossils of Northern UK.<br><br>Nothing added since 1993.<br><br>Data transferred to an ACCESS database.<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>TAXALIST is an taxonomic listing (various phyla and families) of Quaternary, Upper Tertiary and Carboniferous fossils relevant to the palaeontology of Scotland and Northern England. Species, authors and some dates are given. The MS Access database MTD_TAXALIST presently contains 1169 records. It has provision for environmental interpretation, and publications in which the fossils are illustrated. |

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| | | Data capture may have started in the 1980s. TAXALIST started 1992. Subject to revision. New records entered irregularly. 1169 digital records to date (ongoing). Not added to since 1992. As accurate as data format of data. Most dates of first description missing.<br>DATASET_LOGICAL_CONSISTENCY = Varies according to time and source of supply.<br><br>Constraints: Legal.<br><br>Books, Cards, Collections, Journals, Monographs, Memoirs, Papers, Registers, Relational Database, Specimens |
| 36 | Index To Specimens Transferred From The John Smith Collection To The UK (North) Type and Stratigraphical Collection<br><br>COMPLETED<br><br>(MD) | Index to specimens transferred from the J.S. Smith collection<br><br>Card index system of material included in the Working Collection, with a separate card index of material in the Type and Stratigraphical collection.<br><br>Refer also to mtd on 'mhsan\users'(N:) N:\FOSSLOCS\MURCHO.mdb (Smith_GSE)<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br><br>Dataset description<br>SMITH_GSE is a list of specimens and slides taken from the John Smith Collection and placed in the Type and Stratigraphical Collection of Scotland and Northern England (T and S). To some extent it is the digital equivalent to part of the T and S analogue card index which is held in BGS Edinburgh. The data, however, appears to have been derived from the 5 leather bound volumes of the T and S register. The latter are held in BGS Keyworth, but an equivalent microfilm is held in BGS Edinburgh. The MS Access database BGS_SMITH_GSE contains 1123 records, it links the T and S register with that of the John Smith Collection (8 bound volumes held at BGS Edinburgh) and provides limited information on taxonomy, nomenclatural status and chronostratigraphy. It also has provision for stating where the specimen is housed. The repository of BGS John Smith specimens is the Edinburgh office.<br><br>Start date of data capture strictly not known (?possibly 1993). Subject to revision. Old and current records entered irregularly. About 85% 0f specimens digitised. Not added to since 1993. As accurate as the information in the register. Data is to be incorporated into Palaeosaurus.<br>DATASET_LOGICAL_CONSISTENCY = Varies according to time and source of supply.<br><br>Constraints<br>Legal constraint.<br><br>Associated dataset(s)<br>Index to the northern UK Survey collection of Fossils.<br>List of specimens from the northern UK Type and Stratigraphical Collection and related publications.<br>Index to the northern UK Type and Stratigraphical Collection of fossils.<br>Record of borrowers of specimens and slides from the Survey and Type and Stratigraphical collections<br>The BGS Edinburgh Palaeontological Slides Collection.<br><br>Cards, Collection, Microfische, MS Access Database, Paper, Registers, Slides, Specimens |

**OFFSHORE**

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| Vibrocore Samples.<br><br>?ONGOING<br><br>(CG) | Vibrocore samples.<br><br>Of indirect relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>The core material was collected by BGS from the sea areas around the UK during vibratory coring operations to a maximum penetration of 6m.<br><br>Updates depend on new survey programmes being funded. All core material retained for use. Some core material may not exist due to past subsampling. Data located as accurately as |

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| | possible based on varying types of navigation throughout the period of collection. Varies from radar ranging to differential GPS. Data are stored to a high standard.<br><br>Constraints<br>Material may be subsampled and analysed, results must be lodged with BGS.<br><br>Associated dataset(s)<br>○Rock and sediment core sample photographs and negatives.<br><br>Core material |
| Analyses Of Minerals In North Sea Reservoir Core Samples.<br><br>COMPLETED 1990<br><br>(CG) | Analyses of minerals in North Sea reservoir core samples.<br><br>Mineral analyses of relevance to PropBase, but the data are held in a variety of formats, much of which is hard copy, so extraction of some of the data would be time-consuming, and integration of the data would be problematic given the variety of formats and sources of the data.<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Compilation of mineral analysis data for some 1142 core samples assembled for Statoil and archived by BGS. Most records refer to carbonates, feldspars and clays analysed by electron microprobe. Further details are held in a variety of technical reports, unpublished BGS documents and PhD theses. Sample site locations are by borehole name/number and depth but are not present for some samples.<br><br>Dataset closed as of 1990. DATASET_COMPLETENESS = Variable: analyses are complete but supporting data is often incomplete, relying on availability in the related documents refer to in the database. Borehole depth is often quoted, but not the borehole position.<br><br>Constraints<br>The data are jointly owned by BGS and Statoil: Access is normally restricted to certain individuals<br><br>Digital, PhD these, technical reports, paper records |
| Rockall Sample Station Data.<br><br>COMPLETED 1999<br><br>(CG) | Rockall sample station data.<br><br>Of indirect relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Locations of gravity cores collected in 1994 and a few cores collected in 1998.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1994# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-1999# END_DATE_ACCURACY = YEAR# New information depends on more work being commissioned by the Rockall Consortium. PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. FINAL GEOLOGICAL REPORT (5 VOLUMES). BGS TECHNICAL REPORT WB/95/11C Data confidential to BGS and Rockall Consortium. Sea-bed location of gravity corer not known relative to ship.<br><br>Constraints<br>Reproduction restrictions.<br><br>Associated dataset(s)<br>○Geochemical analyses of Rockall Consortium samples.<br>○Geotechnical data from Rockall Consortium samples.<br>○Particle Size Analyses of Rockall Consortium Samples.<br>○Geological descriptions of units in Rockall shallow boreholes.<br>○Sample descriptions sheets for Rockall Consortium seabed samples.<br><br>Relational database |
| Geological | Geological descriptions of units in Rockall shallow boreholes. |

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| Descriptions Of Units In Rockall Shallow Boreholes.<br>LAST INPUT 2000<br>(CG) | Potentially relevant to PropBase but the results are confidential to the Rockall Consortium.<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>On behalf of the Rockall Consortium, BGS has chartered the dynamically-positioned drillship MV Bucentaur on two occasions (in 1994 and 1999) in order to drill a number of shallow, continuously-cored boreholes. Seven boreholes were completed in each drilling programme. BGS uses some of its own equipment, personnel and techniques to maximise core recovery from this type of vessel. The locations of the boreholes are decided by the Management Steering Committee and are generally based on BGS high-resolution seismic data acquired for the consortium. In 1994 the boreholes were located on the western margin of the Rockall Trough. In 1999 two were drilled on Hatton Bank and the remainder in the greater West Shetland/Faroese area. The deepest borehole penetrated 209.65m below seabed and the deepest water in which the ship has operated for the consortium is 1500m. BGS organises the analyses on the core recovered and has produced the relevant operational and geological drilling reports. The results remain confidential to the Rockall Consortium although a limited amount of information has been used in publications: Stoker, M.S. 1997. Mid- to late Cenozoic sedimentation on the continental margin off NW Britain. Journal of the Geological Society, London 154, 509-515. Hitchen, K. et al. 1997. Geological implications from geochemical and isotopic studies of Upper Cretaceous and Lower Tertiary igneous rocks around the northern Rockall Trough. Journal of the Geological Society, London<br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1994# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-2000# END_DATE_ACCURACY = YEAR# UPDATE_FREQUENCY_COMMENT = More data acquired at the discretion of the Rockall Consortium.# ADDITIONAL_INFO 1 = Publication. PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. FINAL GEOLOGICAL REPORT (5 VOLUMES). BGS TECHNICAL REPORT WB/95/11C# PUBLICATION: ROCKALL CONTENENTAL MARGIN PROJECT. SHALLOW BOREHOLE DRILLING PROGRAMME 1999. GEOLOGICAL REPORT. WB/95/11C. DATASET_COMPLETENESS = Data confidential to BGS and Rockall Consortium.<br>Associated dataset(s)<br>○Rockall sample station data.<br>Relational database |
| Offshore Borehole Cores.<br>?ONGOING<br>(CG) | Offshore borehole cores.<br>The borehole core material is collected by BGS from the sea areas around the UK during wireline drilling operations.<br>Of indirect relevance to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 04-JUN-1969# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 10-JUN-1990# END_DATE_ACCURACY = YEAR# Updates depend on new drilling programmes being funded. All core material retained for use. Some core material may not exist due to past subsampling. Data located as accurately as possible based on varying types of navigation throughout the period of collection. Ranges from radar ranging to differential GPS. Data are stored to a high standard.<br>Constraints<br>Material may be subsampled and analysed, results must be lodged with BGS.<br>Associated dataset(s)<br>○Geological descriptions of offshore cores.<br>○Rock and sediment core sample photographs and negatives.<br>Drillcore |
| Composite Logs Of Bgs Offshore Shallow | Composite logs of BGS offshore shallow boreholes. Data are of relevance to PropBase but as |

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| Boreholes.<br>ONGOING<br>(CG) | the data are in hard copy format, extraction would be time-consuming.<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>BGS has drilled offshore boreholes since 1969. Borehole logs have been compiled in the field and also back in the office. This dataset comprises the composite borehole logs plus associated paperwork.<br>**Constraints**<br>Reproduction restrictions/fees/acknowledgements.<br>Associated dataset(s)<br>○Sample station data.<br>Paper record |

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| Offshore Technical Reports.<br>ONGOING<br>(CG) | Offshore technical reports.<br>Contain data of some relevance to PropBase but extraction of the data would be time-consuming and the variety of the formats of the data would make integration problematic.<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>These reports are the product of BGS offshore activities. They vary from 'internal reports' which record survey operations, to results of geological interpretations generated for clients.<br>START_DATE_STATUS = NOT KNOWN<br>Constraints<br>Restricted conditions.<br>Associated dataset(s)<br>○Offshore BGS and NON-BGS technical reports.<br>○Index of internal and external offshore reports<br>Reports |
| Geotechnical Data From Offshore Samples.<br>COMPLETED<br>(CG) | Geotechnical data from offshore samples.<br>Of direct relevance to PropBase but the index is not comprehensive<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>This dataset results from geotechnical analysis of BGS offshore core material. The main results are compressive and shear strength measurements made using hand vanes. Expert advice is required in the use of the data.<br>Updates depend on new survey programmes being funded. Not all geotechnical data are held in the index. Check for other information held in reports.<br>Constraints<br>Restricted conditions.<br>Associated dataset(s)<br>○Shallow seabed sample description sheets<br>Relational database |

## MARINE GEOLOGY

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| Data Relating To The Western Frontiers Association | Data relating to the Western Frontiers Association Bibliography.<br>Of indirect relevance to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known [] |

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| Bibliography.<br>ONGOING<br>**(CG)** | **Spatial Reference System:** UKCS LICENCE QUADRANTS/BLOCKS []<br><br>Dataset description<br>An interactive bibliography originally supplied as analogue now digitally on CD to members of the Western Frontiers Association. The bibliography contains published and unpublished papers, reports, theses concerning the Upper Cenozoic sequence and environment west and north of Scotland extending from the UK/Ireland median line to the UK/Norway median line. The principal focus of the bibliography is the identification of potential geohazards.<br><br>A new version is produced every year. DATASET_LOGICAL_CONSISTENCY = Samples analysed by various appropriate methods<br><br>Constraints<br>None.<br><br>Relational database |
| Seabed Surface Samples.<br>ONGOING<br>(CG) | Seabed surface samples.<br><br>Not of direct relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>The samples were collected by BGS from the sea areas around the UK during sampling operations.<br><br>START_DATE_COMMENT = Start date available from the records.# Updates depend on new survey programmes being funded. All core material retained for use. Some core material may not exist due to past subsampling. Data located as accurately as possible based on varying types of navigation throughout the period of collection. Varies from radar ranging to differential GPS. Data are stored to a high standard.<br><br>Constraints<br>Material may be subsampled and analysed, results must be lodged with BGS.<br><br>Associated dataset(s)<br>Rock and sediment core sample photographs and negatives.<br><br>Material |
| Stratigraphic Surfaces Database.<br>ONGOING<br>(John Rowley, Keyworth)) | Stratigraphic Surfaces Database.<br><br>Hydrocarbon-related dataset – of little relevance to PropBase<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>**Spatial Reference System:** TM65 / Irish National Grid [29900]<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>This database stores down-hole stratigraphic data to complement the seismic surface picks stored in the LOCSEC database. Because these surfaces are chosen for their visibility on seismic data, they may not be directly equivalent to established BGS lithostratigraphic and/or chronostratigraphic divisions. However, the local coding system is based on and can relate to the BGS stratigraphic LEXICON. Stratigraphic picks are stored in terms of depth and seismic one-way travel time. Local borehole summary information (location, elevation, etc.) is used because both onshore and offshore boreholes are stored in this database. These data can be related to the BGS onshore borehole database by borehole registration, and to the offshore well database by DTI well-id. Additional tables (under development) provide information on hydrocarbon tests and their results.<br><br>Data added during interpretation projects. Backlog from old projects input as time permits. Incomplete: Only data from recent and selected older projects input. Mostly concentrated in areas prospective for coal, oil and gas. |

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| | Constraints<br>Legal Restrictions.<br><br>Associated dataset(s)<br>Copy Borehole Logs.<br>Seismic Locations and Sections Database<br><br>Relational database |
| Sample Station Location Maps.<br><br>COMPLETED<br><br>(CG but jointly maintained with Keyworth) | Sample station location maps.<br><br>Of indirect relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>The maps show the locations of sample stations collected by BGS in the sea areas around the UK. In many cases, summary sample descriptions are displayed at the margin of the map. The maps are no longer updated as they have been superseded by digital storage and GIS display.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 17-NOV-1960# START_DATE_ACCURACY = DAY# The maps are no longer updated. The maps are no longer maintained. Maps stopped being maintained in the mid 1990's, although in many areas, no additional data are available. Data are located as accurately as possible based on varying types of navigation throughout the period of collection. Data are presented to a consistent standard.<br><br>Constraints<br>Restricted conditions.<br><br>Associated dataset(s)<br>Sample station data.<br><br>Paper records |
| Shallow Seabed Sample Description Sheets<br>ONGOING<br><br>(CG) | Shallow seabed sample description sheets<br><br>Potentially relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Samples taken from the sea areas around the UK since the late 1960s. For each sample collected, metadata was entered on a form, and a field description of the sample was made. This dataset comprises the field forms. The format and content of the forms has changed over time. For some sites, all the data is contained in a single form, for others data is contained on many forms.<br><br>START_DATE_COMMENT = Accurately timed survey navigation. At most 1 or 2 updates per year. All existing data available to users providing access conditions met. SPATIAL_DETAIL_LEVEL = Variable quality depending on when a sample was collected. General improvement from oldest to most recent. The records are paper sheets ranging in age from late 1960's to 1990's.<br><br>Constraints<br>Reproduction restrictions/fees/acknowledgements.<br><br>Associated dataset(s)<br>Geotechnical data from offshore samples.<br>Particle size analyses of offshore samples.<br>Sample station data.<br><br>Paper records |
| Analogue Shallow Seismic Profiles. | Analogue Shallow Seismic Profiles.<br><br>Not of direct relevance to PropBase |

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| ONGOING<br>(CG) | **Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>BGS operates a range of seismic and sonar survey equipment to image the sub-bottom and seabed. This ranges from low resolution but deep penetration airgun to high resolution but shallow penetration pinger. The source, receiver and recording technology has changed throughout the time covered by this dataset. The main output from the surveys are analogue paper chart recordings on a variety of fan-folded or rolled chart media. There are navigation markers on the records which tie the data to position data stored digitally. Collection is ongoing at the rate of 1-2 surveys per year, although increasingly the data are being stored digitally on a variety of tape media. Currently the dataset contains well over 200,000 line kilometres of survey records.<br><br>Average 1 or 2 updates per year. PUBLICATION: OFFSHORE INVESTIGATIONS 1966-1987, BGS TECHNICAL REPORT WB/89/2. The data consists of folded or rolled paper records of variable width and length. The printing devices are a variety of chart recorders using a variety of printing technologies. Copies of the original records can be provided as continuous xerox paper records. All existing data available to users providing access conditions met. Variable quality depending on when a survey was undertaken. General improvement from oldest to most recent. The records are chart recordings printed using a variety of print technologies from 1960's to 1990's.<br><br>Constraints<br>Reproduction restrictions/fees/acknowledgements.<br><br>Associated dataset(s)<br>○Index to offshore geophysical surveys.<br><br>Paper records |
| Sample Descriptions Sheets For Rockall Consortium Seabed Samples.<br><br>?COMPLETED<br><br>(CG) | Sample descriptions sheets for Rockall Consortium seabed samples.<br><br>Potentially relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Sample description sheets were completed for gravity cores collected in 1994 and 1998.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JUN-1994# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JUL-1998# END_DATE_ACCURACY = YEAR# New data will be acquired only if commissioned by the Rockall Consortium Management Steering Committee. PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. FINAL GEOLOGICAL REPORT (5 VOLUMES). BGS TECHNICAL REPORT WB/95/11C Data confidential to BGS and Rockall Consortium.<br><br>Constraints<br>Reproduction restrictions/acknowledgements.<br><br>Associated dataset(s)<br>○Rockall Consortium deep seismic profiles.<br>○Analogue seismic profiles collected as part of Rockall Consortium project.<br>○Rockall sample station data.<br><br>Paper records |
| Particle Size Analyses Of Rockall Consortium Samples.<br><br>?COMPLETED<br><br>(CG) | Particle Size Analyses of Rockall Consortium Samples.<br><br>Relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Analyses are derived from the top few centimetres of gravity cores obtained in 1994.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JUN-1994# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# |

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| | CAPTURE_END_DATE = 01-JUL-1994# END_DATE_ACCURACY = YEAR All data available to BGS and members of Rockall Consortium. Seabed location of rockdrill known to 10m. All analyses to same standard.<br><br>Constraints<br>Reproduction restrictions.<br><br>Associated dataset(s)<br>Geotechnical data from Rockall Consortium samples.<br>Rockall sample station data.<br><br>Relational database |
| Geotechnical Data From Rockall Consortium Samples.<br><br>COMPLETED<br><br>(CG) | Geotechnical data from Rockall Consortium samples.<br><br>Relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Data derived from gravity cores, taken in 1994 and 1998 as part of a regional organic geochemical sampling programme.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1994# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-1999# END_DATE_ACCURACY = YEAR# New data only if commissioned by Rockall Consortium. Position of gravity corer relative to ship unknown.<br><br>Constraints<br>Reproduction restrictions.<br><br>Associated dataset(s)<br>Geochemical analyses of Rockall Consortium samples.<br>Particle Size Analyses of Rockall Consortium Samples.<br>Rockall sample station data.<br><br>Relational database |
| Geochemical Analyses Of Rockall Consortium Samples. (Rgeochem)<br><br>?COMPLETED<br><br>(CG) | Geochemical analyses of Rockall Consortium samples.<br><br>Relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Organic geochemical analyses of sub-samples of Rockall Consortium gravity cores collected in 1994 were carried out to look for traces of hydrocarbons. Inorganic geochemical analyses of Rockall Consortium igneous rocks collected in 1994 to 1999 were also carried out.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1994# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-2000# END_DATE_ACCURACY = YEAR# UPDATE_FREQUENCY_COMMENT = New data will only be acquired if commissioned by the Rockall Consortium.# DATASET_COMPLETENESS = Data confidential to BGS and Rockall Consortium.# SPATIAL_DETAIL_LEVEL = Organic geochemistry : sea-bed location of gravity corer relative to ship unknown. Inorganic geochemistry : sea-bed location of rockdrill known to +10m.# DATASET_LOGICAL_CONSISTENCY = Organic geochemistry : sediments analysed for traces of hydrocarbons. Inorganic geochemistry : igneous rocks analysed for major, trace and REE data, and some isotopes. PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. FINAL GEOLOGICAL REPORT (5 VOLUMES). BGS TECHNICAL REPORT WB/95/11C<br><br>Constraints<br>Reproduction restrictions/ fees /acknowledgements.<br><br>Associated dataset(s)<br>Geochemical analyses of Rockall Consortium samples. |

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| | ○Geotechnical data from Rockall Consortium samples.<br>○Rockall sample station data.<br><br>Relational database |
| Analogue Seismic Profiles Collected As Part Of Rockall Consortium Project.<br><br>COMPLETED<br><br>(CG) | Analogue seismic profiles collected as part of Rockall Consortium project.<br><br>Not of direct relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Includes 1992 and 1998 shot paper data.<br><br>New data acquired only if commissioned by Rockall Consortium. PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. FINAL GEOLOGICAL REPORT (5 VOLUMES). BGS TECHNICAL REPORT WB/95/11C# Data confidential to BGS and Rockall Consortium for two years. Vertical and horizontal scales vary. Equipment varies.<br><br>Constraints<br>Reproduction restrictions/acknowledgements.<br><br>Associated dataset(s)<br>○Rockall Consortium deep seismic profiles.<br>○Location data for Rockall Consortium shallow and deep seismic surveys.<br>○Sample descriptions sheets for Rockall Consortium seabed samples.<br><br>Paper records |
| Geochemical Analyses Of Rockall Consortium Samples. (Rcklgcanl)<br><br>?COMPLETED<br><br>(CG) | Geochemical analyses of Rockall Consortium samples.<br><br>Relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Organic analyses of Rockall Consortium sub-samples of gravity cores collected in 1994 were carried out to look for traces of hydrocarbons. Inorganic analyses of Rockall Consortium igneous rocks collected in 1994 and 1999 were also carried out.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1994# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-2000# END_DATE_ACCURACY = YEAR# UPDATE_FREQUENCY_COMMENT = New data will only be acquired if commissioned by the Rockall Consortium.# ADDITIONAL_INFO 1 = Publication. PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. FINAL GEOLOGICAL REPORT (5 VOLUMES). BGS TECHNICAL REPORT WB/95/11C# ADDITIONAL_INFO 2 = Publication. PUBLICATION: LATE CRETACEOUS TO EARLY TERTIARY IGNEOUS ACTIVITY AROUND THE NORTHERN ROCKALL TROUGH. BGS TECHNICAL REPORT WH/97/48C.# ADDITIONAL_INFO 3 = Hitchen, K., Morton, A.C., Mearns, E.W., Whitehouse, M., Stoker, M.S. 1997. Geological implications from geochemical and isotopic studies of Upper Cretaceous and Lower Tertiary igneous rocks around the Northern Rockall Trough. Journal of the Geological Society London 154, 517-521<br><br>Constraints<br>Reproduction restrictions/fees/acknowledgements.<br><br>Associated dataset(s)<br>○Geochemical analyses of Rockall Consortium samples.<br><br>Diagrams/figures, text |
| Rockall Consortium Deep Seismic Profiles.<br>COMPLETED<br><br>(CG) | Rockall Consortium deep seismic profiles.<br><br>Not of direct relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description |

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| | Rockall consortium deep seismic profiles were recorded in 1993 by Digicon. Grid area c.1050 km. Record length 10s. Grid area c.650 km. Record length 18s. Source 6360 ins3. Processed by Simon Petroleum Technology. Some lines reprocessed by BiPs. Line C reprocessed to the same specification as BIRPS WESTLINE. Lines have coincident gravity data. Some lines coincident with 1992 high-resolution data.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 11-JUL-1993# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-AUG-1993# END_DATE_ACCURACY = YEAR# New data will be acquired only if commissioned by the Rockall Consortium Management Steering Committee. PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. FINAL GEOLOGICAL REPORT (5 VOLUMES). BGS TECHNICAL REPORT WB/95/11C PUBLICATION: ROCKALL CONTINENTAL MARGIN PROJECT. OPERATIONS REPORT: DEEP SEISMIC SURVEY. WB/93/28C. Digital Exploration Ltd 1993. Rockall Continental Margin Project, North Atlantic Ocean. 2-D seismic survey for BGS and BIRPS. Data confidential to BGS and Rockall Consortium. Shot-point interval : 25m on 10s TWT data. Shot-point interval : 50m on 18s TWT data. Some lines recorded with 6360ins3 airgun array and recorded to 10s TWT. Some lines recorded with 9390ins3 airgun array and recorded to 18s TWT. Cable length 6kms in both cases.<br><br>Constraints<br>Reproduction restrictions/fee/acknowledgements.<br><br>Associated dataset(s)<br>○Analogue seismic profiles collected as part of Rockall Consortium project.<br>○Location data for Rockall Consortium shallow and deep seismic surveys.<br>○Sample descriptions sheets for Rockall Consortium seabed samples.<br><br>Transparent film |
| Rock And Sediment Core Sample Photographs And Negatives.<br><br>ONGOING<br><br>(CG) | Rock and sediment core sample photographs and negatives.<br><br>Contains photographs of split core, mainly digital, but not properly indexed. Potentially relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>The photographic negative collection contains a mixed format of negatives mainly of sediment and rock core samples but also includes frames from Pisces and Consub dives. The collection dates back from 1969 to present day and therefore captures the advances in offshore sampling equipment. A selection of seismic sections have been photographed as have a number of published maps for display purposes.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1969# START_DATE_ACCURACY = YEAR# PUBLICATION: NEGATIVE COLLECTION, FILE LISTING. BGS TECHNICAL REPORT WB/86/35. PUBLICATION: NEGATIVE COLLECTION, EQUIPMENT LISTING. BGS TECHNICAL REPORT WB/86/36. PUBLICATION: CORE NEGATIVE COLLECTION, FILE LISTING. BGS TECHNICAL REPORT WB/86/37. Available to users subject to reproduction charge and intellectual property and copyright constraints. Core negatives defined by BGS nomenclature, others by short description of content.<br><br>Constraints<br>Reproduction restrictions.<br><br>Associated dataset(s)<br>○Offshore borehole cores.<br>○Gravity core samples.<br>○Seabed surface samples.<br>○Vibrocore samples.<br><br>Photographs, negatives |
| Sample Station Data. | Sample station data.<br><br>Provides access to descriptive information of physical properties of relevance to PropBase. |

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| ONGOING<br>(CG) | • Sample Station data themselves are mainly scans of hard copies that include for given sample numbers by latitude and longitude, time date and water depth, summary sample descriptions (e.g. poorly sorted fine to coarse shell sand on very sort mud') geotechnical data comprising penetrometer and hand vane measurements both in raw form and as averages in kPa for given depth intervals. Some data on equipment type are provided.<br>• Sample description Sheets include for the given sample numbers more comprehensive descriptions of the lithologies logged, including some engineering geological property information (e.g. strength). There is also scope for geotechnical logging and sub-sampling data.<br>• Sample Station Geology sheets include for the given sample numbers depth interval data including Folk class, subordinate rock type, Munsell Colour, sorting, HCl reaction, sand fraction data (grain size range, roundness range, sphericity, %shell material), mud fraction data (hardness, plasticity), gravel fraction data (%shell material, maximum clast size, roundness range, sphericity) and additional characteristics may be included (basal contact, bedding, jointing, H2S odour, heavy minerals, mica, glauconite, fauna/fossils, presence of whole shells, foraminifera, plant remains, chronostratigraphy, lithostratigraphy, unit and additional comments. Descriptions for most parameters are restricted to short lists provided on the proforma<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>This is an index to sample station data gathered by BGS during offshore survey operations.<br><br>START_DATE_COMMENT = Start date available from the records.<br>END_DATE_COMMENT = End date available from the records. Updates depend on new survey programmes being funded. All BGS samples are indexed. Data located as accurately as possible based on varying types of navigation throughout the period of collection. Varies from radar ranging to differential GPS. Data are stored to a high standard.<br><br>Constraints<br>Restricted conditions.<br><br>Associated dataset(s)<br>○Composite logs of BGS offshore shallow boreholes.<br>○Offshore borehole records<br>○Shallow seabed sample description sheets<br>○Sample station location maps.<br><br>Relational database |
| Index To Offshore Geophysical Surveys.<br>ONGOING<br>(CG) | Index to offshore geophysical surveys.<br>Of little direct relevance to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>This dataset is an index to BGS geophysical surveys conducted in the sea areas around the UK. It contains all the relevant survey line navigation data.<br><br>Updates depend on new survey programmes being funded. All geophysical surveys are indexed.<br><br>Constraints<br>Restricted conditions apply.<br><br>Associated dataset(s)<br>○Non-confidential geophysical track charts.<br>○Analogue Shallow Seismic Profiles.<br><br>Relational Database |

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| Index Of Internal And External Offshore Reports<br>ONGOING<br>(CG) | Index of internal and external offshore reports<br>Of indirect relevance to PropBase in terms of the data contained in the reports, but these data would be time-consuming to identify and extract.<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>The archive consists of an index to petroleum and marine geology reports, specialist reports and commercial well site investigation reports.<br>Constraints<br>Reproduction restrictions<br>Associated dataset(s)<br>Site investigation Reports for the UK offshore<br>Offshore technical reports.<br>Relational Database |
| Particle Size Analyses Of Offshore Samples.<br>ONGOING<br>(CG) | Particle size analyses of offshore samples.<br>Relevant to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>This dataset results from particle size analysis of BGS offshore samples. The bulk of the data are derived from analysis of sea-bed sediments. Analysed fractions are retained for further examination and analysis. The dataset includes gravel, sand and mud fractions, carbonate content and phi/half phi analysis of the sand fraction.<br>The archive is updated as reports are received. PUBLICATION: CATALOGUE OF AVAILABLE BGS MARINE REPORTS AND PUBLICATIONS WITH CONFIDENTIAL TITLES, BGS TECHNICAL REPORT<br>Constraints<br>Restricted conditions.<br>Associated dataset(s)<br>Analysed fractions of sea-bed samples.<br>Geochemical analyses of offshore samples.<br>Shallow seabed sample description sheets<br>Relational database |
| Geochemical Analyses Of Offshore Samples.<br>COMPLETED<br>(CG) | Geochemical analyses of offshore samples.<br>Relevant to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br>Dataset description<br>The sea area around the United Kingdom is used for a wide range of human activities, all of which have a significant impact on the marine environment. The naturally-occurring concentrations of chemical elements in sea-bed sediments may be enhanced by contaminants introduced by input from rivers and the atmosphere and by more localised sources arising from shipping operations, exploitation of oil and gas, and by direct discharges from drainage systems, sewage outfalls, effluents from industry and waste disposal at sea. It is therefore important to identify components of sea-floor sediments that are due to the rocks or older sediments from which they are derived, and those that are introduced into the environment. BGS offshore geochemical data, consisting of 38 elements, are available from sea-bed samples collected from a variety of sediment types occurring in a wide range of environments. Samples have been collected offshore of the eastern coast of the UK where major river systems which drain heavily populated and industrialised catchment areas, such as the Thames, Humber and Tyne, flow into the North Sea. In contrast, samples are also available from the shelf west of Scotland where man's activities have had much less impact. The data provide a baseline for chemical element concentrations in sea-bed sediments against which future work may be assessed. It should |

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| | therefore be of significance to a diverse range of interests including pollution control, fishing, natural resources, nature conservation, shipping, tourism, recreation, and waste disposal management. In addition the information derived from the data will be of use to geologists in identifying the source of sea-bed sediments and the underlying glacial deposits.<br><br>END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 31-MAR-1992# END_DATE_ACCURACY = DAY# DATASET_LOGICAL_CONSISTENCY = Data are presented to a consistent standard. PUBLICATION: THE GEOCHEMISTRY OF SEABED SEDIMENTS OF THE UNITED KINGDOM CONTINENTAL SHELF, THE NORTH SEA, HEBRIDES AND WEST SHETLAND SHELVES, AND THE MALIN-HEBRIDES SEA AREA. BRITISH GEOLOGICAL SURVEY TECHNICAL REPORT WB/95/28C. AUTHORS: STEVENSON, A. G., TAIT, B. A. R., RICHARDSON, A. E., SMITH, R. T., NICHOLSON, R. A. AND STEWART, R. 1995.<br><br>Constraints<br>Reproduction restrictions.<br><br>Associated dataset(s)<br>○Particle size analyses of offshore samples.<br><br>Relational database |
| Offshore Databank<br>ONGOING<br><br>(CG) | Offshore Databank<br><br>Indirectly relevant to PropBase and a mast dataset<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>The Offshore databank contains geological and geophysical data, results of analyses, reports and indexes to archive material relating to the UKCS.<br><br>Updates depend on new survey programmes being funded. All data are indexed. Data located as accurately as possible based on varying types of navigation throughout the period of collection, varies from radar ranging to differential GPS. Data are stored to a high standard.<br><br>Constraints<br>No information<br><br>Relational database |
| Non-Confidential Geophysical Track Charts.<br>ONGOING<br><br>(CG) | Non-confidential geophysical track charts.<br><br>Of little direct relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>These maps are track charts showing the locations of the survey lines run by BGS during survey operations in the sea areas around the UK. The information on the maps allows the seismic records to be tied into the locational data.<br><br>Constraints<br>Restricted conditions apply.<br><br>Associated dataset(s)<br>○Index to offshore geophysical surveys.<br><br>Maps |
| Non-Confidential Deep Seismic Profiles<br><br>ONGOING<br><br>(CG) | Non-confidential deep seismic profiles<br><br>Of little direct relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>BGS has commissioned or acquired six deep seismic surveys offshore around the UK |

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| | between 1968 and 1979. In addition, two surveys were commissioned jointly by BGS and IOS. Funding was provided by either NERC or Department of Energy. After processing, the data were plotted on a variety of fan-folded or rolled paper and film media. The technology used in the acquisition and processing is now dated, and, in many cases, more modern data has been acquired commercially.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 12-OCT-1960# START_DATE_ACCURACY = YEAR# START_DATE_COMMENT = Charts compiled from accurately timed survey navigation. Data located as accurately as possible based on varying types of navigation throughout the period of collection. Data are presented to a consistent standard.<br><br>Constraints<br>Reproduction restrictions/fees/acknowledgement<br><br>Film, Paper Records |
| Magnetic Tapes Of Processed Seismic Data<br><br>ONGOING<br><br>(CG) | Magnetic tapes of processed seismic data<br><br>Of little direct relevance to PropBase<br><br>Dataset description<br>The magnetic tapes result from multichannel seismic surveys conducted by BGS, BIRPS and other organisations. There are a variety of tape formats and the condition of the older tapes is unknown.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-MAY-1968# START_DATE_ACCURACY = MONTH# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-1997# END_DATE_ACCURACY = YEAR# Updates depend on data being donated to or commissioned by funding consortia. SPATIAL_REFERENCE_SYSTEM = VARIOUS (UNDIFF) Older tapes may not be readable. All tapes archived.# SPATIAL_DETAIL_LEVEL = Data located as accurately as possible based on varying types of navigation throughout the period of collection. Ranges from radio navigation to differential GPS.# DATASET_LOGICAL_CONSISTENCY = Data are stored to a high standard.<br><br>Constraints<br>Data range from publicly available to commercial-in-confidence.<br><br>Digital |
| Magnetic Tapes Of Digital Navigation, Field And Partly Processed Seismic Data<br><br>?ONGOING<br><br>(CG) | Magnetic tapes of digital navigation, field and partly processed seismic data<br><br>Of little direct relevance to PropBase<br><br>Dataset description<br>The magnetic tapes result from multichannel seismic surveys conducted by BGS, BIRPS and other organisations. There are a variety of tape formats and the condition of the older tapes is unknown.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-MAY-1968# START_DATE_ACCURACY = YEAR# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-1997# END_DATE_ACCURACY = YEAR# UPDATE_FREQUENCY_COMMENT = Updates depend on data being donated to or commissioned by funding consortia.# SPATIAL_REFERENCE_SYSTEM = VARIOUS (UNDIFF) DATASET_COMPLETENESS = Older tapes may not be readable. All tapes archived.# SPATIAL_DETAIL_LEVEL = Data located as accurately as possible based on varying types of navigation throughout the period of collection. Ranges from radio navigation to differential GPS.# DATASET_LOGICAL_CONSISTENCY = Data are stored to a high standard.<br><br>Constraints<br>Data range from publicly available to commercial-in-confidence.<br><br>Digital |
| Coastal & Estuarine | Coastal & Estuarine Evolution Database. |

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| Evolution Database.<br>ONGOING<br>(CG but maintained in Keyworth) | Relevant to PropBase<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Database initiated as part of NERC Land-Ocean Interaction Study. Will be linked to SOBI when project ends in March 2000.<br><br>Data capture began in 1992 when Land-Ocean Interaction Study commenced The database is now being updated as part of the Coastal & Engineering Geology Groups core-funded Coastal & Estuarine Evolution Project. Database developed using LBMS System Tools.<br><br>Constraints<br>Restricted conditions. Other users can obtain access to the data via the Coastal Data Manager.<br><br>Associated dataset(s)<br>○Single Onshore Borehole Index<br><br>Relational database |
| UK Hydrographic Office Charts<br>ONGOING<br>(CG) | UK Hydrographic Office charts<br><br>Of indirect relevance to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>Survey charts supplied to BGS by the UK Hydrographic Office. The charts denote spot bathymetric depths and contours, sediment texture and bedforms, and ship's tracks.<br><br>Constraints<br>Data owned by the UK Hydrographic Office. Permission required.<br><br>Associated dataset(s)<br>○Indexes to UK Hydrographic Office maps and records.<br>○Hydrographic Office sidescan and echo-sounder records<br><br>Paper records |
| Gravity Core Samples.<br>ONGOING<br>(CG) | Gravity core samples.<br><br>Of limited direct relevance to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>The core material was collected by BGS from the sea areas around the UK during gravity coring operations.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1960# START_DATE_ACCURACY = YEAR# START_DATE_COMMENT = Accurate start date probably available in the records.# END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-1987# END_DATE_ACCURACY = YEAR# END_DATE_COMMENT = 1987 is the most recent year of survey data held by BGS.# UPDATE_FREQUENCY_COMMENT = No updates for 2 years.# ADDITIONAL_INFO 1 = UK Hydrographic Office, Admiralty Way, Taunton, Somerset TA1 2DN<br><br>Constraints<br>Material may be subsampled and analysed, results must be lodged with BGS.<br><br>Associated dataset(s)<br>○Rock and sediment core sample photographs and negatives.<br><br>Samples |
| Hydrographic Office Sidescan And Echo- | Hydrographic Office sidescan and echo-sounder records |

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| Sounder Records<br>ONGOING<br>(CG) | Of little direct relevance to PropBase<br>**Spatial Reference System:** No data provided in the metadata<br><br>Dataset description<br>The Hydrographic Office conduct high-resolution bathymetric surveys of the sea areas around the UK. The seabed texture is also mapped using side-scan sonar. The survey records gathered in the years 1960 onwards are archived (excluding restricted datasets) by BGS. The data are provided 10 years after collection. The records consist of the original echo-sounder rolls, side-scan records, navigational printouts plus assorted field notebooks and charts.<br><br>BGS receives data from the Hydrographic Office approximately once per year. UK Hydrographic Office, Admiralty Way, Taunton, Somerset TA1 2DN All existing data available to users providing access conditions met. Variable quality depending on when a survey was undertaken. General improvement from oldest to most recent. The records are chart recordings printed using a variety of print technologies from 1960's to 1980's.<br><br>Constraints<br>Viewing and use needs permission from the Hydrographic Office.<br><br>Associated dataset(s)<br>Indexes to UK Hydrographic Office maps and records.<br>UK Hydrographic Office charts<br><br>Paper records |
| Indexes To UK Hydrographic Office Maps And Records.<br><br>ONGOING<br>(CG) | Indexes to UK Hydrographic Office maps and records.<br><br>Of little direct relevance to PropBase<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>UK Hydrographic Office survey data are archived by BGS. The data consists of survey charts and survey records. Indexes have been created to catalogue the holdings.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1960# START_DATE_ACCURACY = YEAR# START_DATE_COMMENT = Accurate start date probably available in the records. END_DATE_STATUS = KNOWN# CAPTURE_END_DATE = 01-JAN-1987# END_DATE_ACCURACY = YEAR# 1987 is the most recent year of survey data held by BGS. UK Hydrographic Office, Admiralty Way, Taunton, Somerset TA1 2DN<br><br>Constraints<br>Data owned by the UK Hydrographic Office. Permission required.<br><br>Associated dataset(s)<br>Hydrographic Office sidescan and echo-sounder records<br>UK Hydrographic Office charts<br><br>MS Access database, relational database |
| Microfossils From The Continental Shelf - Value Added Data<br>COMPLETED | Microfossils from the continental shelf - value added data<br><br>This is maintained from Keyworth although it relates to fossils collected offshore<br><br>**Spatial Reference System:** Latitude and Longitude; system not known [] |
| Microfossils From The Continental Shelf - Raw Data<br>COMPLETED | Microfossils from the continental shelf - raw data<br><br>This is maintained from Keyworth although it relates to fossils collected offshore<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>**Spatial Reference System:** Latitude and Longitude; system not known [] |

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| Composite Logs Of Bgs Offshore Shallow Boreholes.<br><br>ONGOING<br><br>(CG) | Composite logs of BGS offshore shallow boreholes.<br><br>Contains material descriptions, all in analogue records, without any scans; of direct relevance to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>BGS has drilled offshore boreholes since 1969. Borehole logs have been compiled in the field and also back in the office. This dataset comprises the composite borehole logs plus associated paperwork.<br><br>Accurate start time recorded but not required for this dataset. Data sufficient. At most 1 update per year. PUBLICATION: OFFSHORE INVESTIGATIONS 1966-1987, BGS TECHNICAL REPORT WB/89/2 All data available to users provided confidentiality restrictions are met. Variable quality of data from hand-drawn to computer drawn logs. SPATIAL_DETAIL_LEVEL = Variable quality depending on when a borehole was drilled. General improvement from oldest to most recent. The data are in various formats of paper records. No attempt has been made to standardise.<br><br>Constraints<br>Reproduction restrictions/fees/acknowledgements.<br><br>Associated dataset(s)<br>○Sample station data.<br><br>Paper records |
| Analysed Fractions Of Sea-Bed Samples.<br><br>ONGOING<br><br>(CG) | Analysed fractions of sea-bed samples.<br><br>Relevant to PropBase<br><br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset description<br>The data consist of analysed fractions retained as the result of Particle Size analyses (PSA) of marine samples, mainly of the sea-bed sediments.<br><br>Updated as new data are analysed.<br><br>Constraints<br>Restricted, conditions.<br><br>Associated dataset(s)<br>○Particle size analyses of offshore samples.<br><br>Samples |

## GEOPHYSICS

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| Original Seismic Shotpoint Location Maps.<br><br>ONGOING<br><br>(Simon Flower) | Original Seismic Shotpoint Location Maps.<br><br>Of little relevance to PropBase<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>**Spatial Reference System:** TM65 / Irish National Grid [29900]<br>**Spatial Reference System:** Latitude and Longitude; system not known []<br><br>Dataset **description**<br>This document data set contains original prints, on paper, sepia or film, of seismic reflection survey location (navigation) maps. These provide the location data for the seismic sections of the ORIGSEISECS and COPYSEISECS datasets. Almost all data are within the UK onshore area; although there are some UK near-shore and offshore (North Sea, Irish Sea) and foreign data. Most data were acquired for commercial hydrocarbon exploration and subsequently provided to BGS for use on specific projects. Some data were acquired by BGS and other |

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| | public-sector bodies, e.g. BIRPS, for academic research. All maps are digitised upon receipt (see LOCSEC database) and then archived in this data set. (Copies used to be used for interpretation purposes but this is no longer the case.) Documents stored rolled in tubes. Approx 800 maps.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1960# START_DATE_ACCURACY = DECADE# START_DATE_COMMENT = Earliest surveys made in 1960s.# END_DATE_COMMENT = Acquisition continues.# Data added whenever BGS is able to acquire it. Incomplete: No information about extent of completeness as BGS does not have information on the total amount of seismic acquisition. There are some duplicate data. SPATIAL_DETAIL_LEVEL = Variable, mostly concentrated in areas prospective for coal, oil and gas.<br><br>**Constraints**<br>Legal Restrictions.<br><br>**Associated dataset(s)**<br>○Seismic Line Index (SLI).<br>○Copy Seismic Sections.<br>○Digital Seismic Sections.<br>○Digital Seismic Shotpoint Location Maps.<br>○Seismic LOCations and SECtions Database<br>○Original Seismic Sections. |
| Original Seismic Sections.<br><br>ONGOING<br><br>(Simon Flower) | Original Seismic Sections.<br><br>Of little direct relevance to PropBase<br><br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700] **Spatial Reference System:** TM65 / Irish National Grid [29900] **Spatial Reference System:** Latitude and Longitude; system not known []<br><br>This document dataset contains original prints, on paper, sepia or film, of seismic reflection survey sections. Most data are within the UK onshore area; although there are some UK near-shore and offshore (North Sea, Irish Sea) and foreign data. Most data were acquired for commercial hydrocarbon exploration and subsequently provided to BGS for use on specific projects. Some data were acquired by BGS and other public-sector bodies, e.g. BIRPS, for academic research. This data set is a master set; copies must be used for interpretation purposes - see: COPYSEISECS data set. Documents stored rolled in tubes, approx 10 sections per tube, approx 850 tubes.<br><br>START_DATE_STATUS = KNOWN# CAPTURE_START_DATE = 01-JAN-1960# START_DATE_ACCURACY = DECADE# Earliest surveys made in 1960s. Data added whenever BGS is able to acquire it. SPATIAL_REFERENCE_SYSTEM = UNIVERSAL TRANSVERSE MERCATOR Incomplete: No information about extent of completeness as BGS does not have information on the total amount of seismic acquisition. There are some duplicate data. SPATIAL_DETAIL_LEVEL = Variable, mostly concentrated in areas prospective for coal, oil and gas.<br><br>Constraints<br>Legal Restrictions.<br><br>Associated dataset(s)<br>○Seismic Line Index (SLI).<br>○Copy Seismic Sections.<br>○Digital Seismic Sections.<br>○Digital Seismic Shotpoint Location Maps.<br>○Seismic LOCations and SECtions Database<br>○Original Seismic Shotpoint Location Maps.<br><br>Paper records, film |

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| Data From Various Aeromagnetic Surveys In Offshore Petroleum Areas.<br><br>ONGOING<br>(SM) | Data from various aeromagnetic surveys in offshore petroleum areas.<br>Of indirect relevance to PropBase<br>**Spatial Reference System:** WGS 84 [4326]<br>Over 22000 km of corrected aeromagnetic total intensity data from various surveys in offshore petroleum areas in UKCS and overseas collected to assist directional drilling. Line separation is 2 km and flight altitude is 80 m above sea level (a.s.l.) and navigation is by GPS<br>Discrete surveys within area specified. All referenced to the International Geomagnetic Reference Field.<br>**Constraints**<br>Diverse<br>Delimited ASCII |

**NIREX**

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| Nirex Analogue (Paper) Records<br><br>ONGOING<br>(RS) | Nirex Analogue (paper) records<br>Although maintained from Keyworth, a large number of unarchived paper records are held in Murchison House. These include a wide range of document types, many of which are of little or no value to PropBase, including draft documents, and project management information, but some of which is in the form of field notes, annotated borehole logs, reports etc. and includes data of potential relevance to PropBase. However, these data would be time consuming to identify and to extract.<br>**Spatial Reference System:** OSGB 1936 / British National Grid [27700]<br>**Dataset description**<br>The paper archives comprise a set of the factual and interpretative reports that document the investigations carried out by Nirex and its contractors. In total there are in excess of 2,250 individual volumes. It is the availability of this paper archive of results and interpretation that makes the Nirex geological archives of rock cores and samples unique.<br>UPDATE_FREQUENCY_COMMENT = Additional reports may be added to the archive from time to time. DATASET_COMPLETENESS = Nearly all of Nirex factual reports on their deep boreholes are held by the BGS. Some volumes are missing. SPATIAL_DETAIL_LEVEL = Complete DATASET_LOGICAL_CONSISTENCY = Reports are as supplied by Nirex<br>**Constraints**<br>A fee may be payable to the British Geological Survey for access to the data.<br>Paper records |

# Appendix 2 AGS and related data formats for transferring geotechnical and geo-environmental data

The following information is substantially based on information contained on the website of the Association of Geotechnical and Geoenvvironmental Specialists (http://www.ags.org.uk/).

## AGS FORMAT

Development of the AGS Format for the Electronic Transfer of Geotechnical and Geoenvironmental Data has been a major advance in geotechnical data management in the last fifteen years. The standard format enables the geotechnical and geoenvironmental information to be transferred readily. The format was developed by the Association of Geotechnical and Geoenvironmental Specialists (AGS) in the United Kingdom. The Format continues to develop following the First Edition in 1992, the Second Edition in 1994, and the Third Edition in 1999, published on the AGS web site (http://www.ags.org.uk/). Further versions are being tailored to national requirements.

The AGS format defines data groups and fields to ensure reliability and consistency for data transfer. It is now widely used amongst contractors, consultants and clients for communicating data in the UK. The AGS format is also used outside the UK, and most notably in Hong Kong, where its use has been required by the Government in all of its geotechnical contracts and consultancies for more than 10 years.

Standard software tools (from simple spreadsheets to complete database systems with data translation modules) have been developed to read and write the data file, which uses the American Standard Code for Information Interchange (ASCII). The AGS Format file is a text file, based on a 'data dictionary' approach, and contains tables of geotechnical data derived from site investigation. The format is readily expanded as required, but only key data (e.g. as required by BS 5930) are to be included, with no derived/interpreted data. See http://www.ags.org.uk/ for further information on data file rules. However, the files are intended to accompany, rather than replace, printed reports.

## SOFTWARE COMPATIBLE WITH AGS DATA

The following commercial software programs are listed as being compatible with the AGS Data Interchange Format (from the Geotechnical and Geoenvironmental Software Directory ).

AGS File Manager - Data validation; ALF - Data validation; Contam Data System - Geoenvironmental database systems; CPT-pro - Insitu testing; DataSystem 7 - Laboratory testing (soil); GEODASY - Database systems (with log production); GeoSmart II - Borehole log production; GEOVIEW - Geographical information systems; gINT LogWRITER+ - Database systems (with log production); gINT Professional - Database systems (with log production); HoleBASE III - Database systems (with log production); INCLI-pro – Instrumentation; KeyAGS - Data validation; KeyGeoView - Geographical information systems; KeyHOLE - Database systems (general); KeyLAB - Laboratory testing (soil); MonitoringPoint – Instrumentation; PocketSI - Field data collection; SID - Database systems (with log production); Smart Lab - Laboratory testing (soil); Smart-M – Instrumentation; TECHBASE - Database systems (with log production)

## COMPANIES WITH A REGISTERED AGS FORMAT DOCUMENT

Companies on the list below have registered their AGS format document with the Association of Geotechnical and Geoenvironmental Specialists. These include many of the leading ground investigation contractors and geotechnical and geoenvironmental consultants in the UK, and many of the organisations that provide geotechnical data to BGS's NGDC.

Advanced Investigation Systems Ltd; Amec Group Ltd; Andrews Survey; Arcadis Geraghty & Miller International Inc; Arup Geotechnics; Balfour Beatty Major Projects; Bechtel; Black & Veatch Ltd; Boxwood Laboratories Ltd; British Waterways; Buro Happold, Ground

Engineering; C Tech Development Corporation; Cambridge Insitu; Casella Stanger; China Geo-Engineering Corporation; Concept Site Investigations; Costain Geotechnical Services; DrilTech Ground Engineering Ltd; EarthSoft, Inc; Eclipse Voelcker Science; Ed Wilkins Pty; Edafomichaniki S.A.; EDGE Consultants UK Ltd; Entec UK Ltd; Environmental Analysis; FaberMaunsell; Ferroday Ltd; Fugro Engineering Services Limited; Fugro Middle East; GeoData Consult; GeoDelft Environmental; Geoffrey Walton Practice; Geolabs Ltd; Geotechnical Consulting Group; Geotechnical Developments (UK) Ltd; Geotechnical Engineering Ltd; Geotechnics Ltd; gINT Software; Glover Site Investigations Ltd; Gold Ram Engineering & Development Ltd; Golder Associates; Halcrow Group Ltd; Harrison Group Environmental Ltd; Hugh Samuel; Integral Geotechniques (Wales) Ltd; Intrafor Hong Kong Limited; Jacobs Babtie; John Barnett & Associates; Jones & Wagener; K4 Soils Laboratory; Kent Geotechnics; Keynetix Ltd; Klohn-Crippen; LBH Wembley Geotechnical & Environmental; Leeke Associates; MateriaLab Ltd; Monitor-Pro Ltd; Mott MacDonald; Mouchel Parkman Services Ltd; Mowlem Environmental Sciences Group; MWH MWH; MZ Associates; Norfolk County Laboratory; Norwest Holst Soil Engineering Ltd; Parsons Brinckerhoff Ltd; Pell Frischmann; Portsmouth University; Quantum (GB) Ltd; RPS Planning Transport & Environment; Scott Wilson Ltd; Seacore Limited; Soil Mechanics Limited; Solum Eng. E Geol. Ltda; Southern Testing Laboratories; Spea Ingegneria Europea spa; Stanger Asia Ltd; STL Midlands; Structural Soils Ltd; Terraform-FGS Ltd; The Environmental Company; Tree Technology Ltd; UKAEA; Vibro (HK) Ltd; W S Atkins Consultants; Wardell Armstrong; Weeks Technical Services plc; WSP Environmental

## AGS-M FORMAT FOR ELECTRONIC TRANSFER OF MONITORING DATA

The Association of Geotechnical and Geoenvironmental Specialists (AGS) is also developing a module, the so-called AGS-M Format, to use with the 3rd Edition of the AGS Format (and its compliant software), or as a stand-alone, for transferring monitoring data (e.g. geotechnical, structural and geochemical, and including automatically logged, real-time instruments). The AGGS envisage that most users will import and export data files using available commercial programs, without the need to understand the file structure.

## AGS XML DATA FORMAT

The AGGS is also developing, through the AGS XML working group, of which BGS is a member, alignment of the AGS Format with Extensible Mark-up Language (XML) (but see also Appendix 4) - the global standard for web-based data transfer. The intention is to preserve compatibility, as far as possible, with the existing AGS Format by extending the scope of AGS (3rd Edition). Output will either be conventional text-based, or in XML format (using the identical data dictionary, but with different rules).

The first version of the proposed AGSML data format has been released for consultation on the download section of http://www.ags.org.uk/ and an international version s in preparation.

# Appendix 3 A review of types of, and environments and formats in which, structural data are/have been recorded by R P Barnes (5.04.2006)

## ORIENTATION MEASUREMENT IN OUTCROP

### Planar features

There is no BGS standard and the main forms in which the orientation of planar features (bedding/cleavage/foliation/fracture) is/have been recorded use one of three conventions:

(i) Dip amount (0-90°) and dip azimuth (0-360°) (e.g. 60/045; 75/220)

(ii) Strike (0-360°) and dip amount (0-90°) (the 'right hand rule' (e.g. 315/60; 130/75)

(iii) Strike (0-180°), dip amount (0-90°) and dip direction (e.g. 135/60NE; 130/75SW)

(i) and (ii) are useful for digital applications, (i) being conceptually the simplest, but with moderate to steeply dipping rocks in the field, it is more convenient (hence often more accurate) to measure strike and dip in which case conversion to (i), and application of (ii), require some thought, whereas (iii) is simple and therefore commonly used. It may make little difference, however, which convention is used for note taking, as long as it is clear which one it is, and that it is used consistently. When transferring data to a digital record (spreadsheet/GIS) convention (i) is preferable.

Provision needs to be made for records with no dip value as primary survey maps commonly show symbols for dip or strike/dip without a dip value. A null value in the dip field is not acceptable as zero is a possible dip value. In tables, a dummy value of 99 in the dip field may be used to denote no value.

### Linear features

Such features (e.g. lineations, fold axes, glacial striae) are/have been simply recorded by orientation of the line (0-360° in the direction of the plunge) and a plunge (angle from horizontal in the vertical plane containing the feature, 0-90°).

For linear features on steeply dipping surfaces, pitch (angle from horizontal within the surface) and pitch direction (NW, S etc) are/have been commonly used, allied to the measurement of the planar surface. Such measurements are difficult to database and would be best converted to plunge orientations.

Some features (e.g. palaeocurrent data) may require an additional field for direction.

Some features are commonly recorded without plunge (e.g. glacial striae) in which case it may be sensible to use a dummy value in the field to denote no value

## ORIENTATION MEASUREMENT IN BOREHOLES

Planar feature data may be interpreted from borehole wall imagery, acquired by various wireline techniques that include directional information; interpretation typically produces data in dip/dip azimuth format. Data may also be recorded from core but dip relative to core axis and azimuth (if recorded) relative to some arbitrary line of reference; 'true' orientations of features in core may be obtained by a borehole trajectory survey to correct dip and (more difficult) orientation of reference line on each intact stick of core by, e.g. correlation of two or more core logged features with imagery interpreted features.

## OTHER PARAMETERS

### Primary planar structures

(i) Type of structure

- sedimentary (e.g. bedding/lamination),
- igneous (e.g. boundaries to igneous units, flow lamination, pre-full crystallisation fabric), and
- tectonic (e.g. fracture, foliation/cleavage)

(ii) Sub-type within class, e.g.:

bedding – important to distinguish surfaces that approximate to the palaeo-horizontal (e.g. planar bedding surfaces in turbidites) and those that do not (e.g. deltaic foreset beds; internal lamination in dune bedded sandstone)

### Secondary planar structures

Type – fracture, foliation/cleavage, fold axial surface …

Sub-type within class, e.g.:

foliation/cleavage type (fracture, slaty, schistose/gneissose), generation (S1, S2 etc), spacing …

fracture – bedding parallel, joint, fault, stylolite etc

### Other details, e.g.:

bedding - way up (unknown, right way up, inverted) – can be difficult to record with vertical bedding as right way up/inverted are meaningless but in ArcView, for example, vertical bedding may be recorded as a younging direction 0-360°/dip 90°/right way up (as opposed to way up unknown, in which case the 'dip direction' is 0-180°); basis of way up determination (e.g. sole structures, graded bedding, rippled top etc)

fracture – a wide range of possible parameters (e.g. Nirex database for borehole observations, sample outcrop scan-line and trace map tables attached) – A BGS classification of discontinuities is under preparation at present by Martin Gillespie (Murchison House.

### Primary linear structures

Type - e.g. primary current lineations (PCL), linear sole structures, directional indicators such as flute casts, ripple crests/cross-lamination (although orientation of ripple crests if recorded needs to be clearly distinguished from inferred palaeocurrent direction at 90°)

### Secondary linear structures

Type – glacial striae, structural lineation, fold axis, slickenslide.

Further information/sub-class may be needed, e.g. generation of fold axis, type of lineation, nature of intersection lineation.

The division into primary and secondary structures may not be helpful from a database point of view beyond keeping menus to reasonable length if used.

# Appendix 4 Geotechnical Markup Language

The following has been modified from information extracted from the University of Durham's Geo-engineering website (http://www.dur.ac.uk/~des0www4/geotechml/).

## INTRODUCTION

Geotechnical Markup Language is a geotechnical engineering version of Extensible Markup Language (XML), allowing simple text files to be marked with tags that can be recognised by an XML compliant web browser. It is intended that using GeotechML, geotechnical data on the web will be searched searched in a structured way. Hence, it is argued that the World Wide Web could become the international repository of geotechnical information, available to all, and so potentially avoiding the need to establish national or international geotechnical databases.

GeotechML files for a variety of applications (e.g. ground investigation (borehole) data, raft foundation, retaining walls etc.) have been developed at the University of Durham:

http://www.dur.ac.uk/~des0www4/geotechml/):

## SOME RELATED PUBLICATIONS

Toll, D.G. and Cubitt, A.C. 2003. *Representing Geotechnical Entities on the World Wide Web*, in *Advances in Engineering Software*, 34, 11–12, 729–736

Toll, D.G. 2001. *Computers and Geotechnical Engineering: A Review*, 433–458 in *Civil and Structural Engineering Computing*: 2001, B.H.V. Topping (editor) (Stirling, Scotland: Saxe-Coburg Publications.)

## OTHER GEOTECHNICAL XML PROJECTS

**GML** (http://www.ejge.com/GML/) The first proposal for a geotechnical version of XML by W3G. (*GML is now used for Geography Mark-up Language*)
**SlopesML** (http://www.ins.itu.edu.tr/bulent/slopesml/) Representing slope stability case histories at Istanbul Technical University
**AGSML** (http://ags.org.uk/agsml/) Representing ground investigation (borehole) data - XML version of the AGS data format
**COSMOS** (http://geoinfo.usc.edu/gvdc/) Creating a Geotechnical Virtual Data Center for California
**eEarth** (http://eearth.nitg.tno.nl/) European eContent project for making borehole data available from national geodatabases

## DISCUSSION GROUP

A discussion group concerning GeotechML is available at
http://groups.yahoo.com/group/GeotechML/
mail: *David Toll* (*d.g.toll@durham.ac.uk*)

# Appendix 5 Storage of Geographic Coordinates in Oracle - Best Practice – by K A Holmes (19.07.2006)

## BACKGROUND

Over the years, geographic coordinates and references have been stored in a variety of different ways in Oracle – and often in ways that have made them difficult to use in GIS and other applications.

The introduction of Oracle 10g to BGS, coupled with the widespread use of GIS, gives us an opportunity to take advantage of the power of such software to make the use, conversion and transformation of geographic coordinates much easier, as well as reduce the maintenance and development costs of databases and applications. In order to do this we need a convention for storing geographic coordinates.

This Best Practice will change as new requirements are identified and new facilities become available, but is designed to be flexible enough to take accommodate many of these.

## BOUNDARIES

This Best Practice applies to all tables held in the corporate BGS (or other corporate) schemas.

The introduction of this Best Practice does not mean that:

a specific coordinate system has to be used,

a grid reference (such as NT 0263 8657) or a lat/long (such as 6° 11′ 0.43″ W, 49° 33′ 30.02″ N) cannot be displayed or entered when using applications.

This Best Practice is solely concerned with the names and fields used within Oracle tables.

It does not deal with heights.

## CONVENTIONS

| Column Name | Definition | Description | Example |
|---|---|---|---|
| X | Number, not null | The X coordinate. Coordinates west of the origin are negative (except when using very rare coordinate systems that not applicable to the UK). | The X value of the grid reference NT 0263 8657 is 302630.<br>The X value of the Longitude 6° 11′ 0.43″ W is -6.1834528 |

| Column Name | Definition | Description | Example |
|---|---|---|---|
| Y | Number, not null | The Y coordinate. Coordinates south of the origin are negative (except when using very rare coordinate systems that not applicable to the UK). | The Y value of the grid reference NT 0263 8657 is 686570.<br>The Y value of the Latitude 49° 33′ 30.02″ N is 49.55834 |
| EPSG_CODE | Varchar2 (10), not null<br>Constrained against the field NAME in the table BGS.DIC_ADD_HORIZ_CS<br>KAH: This may not be the correct table – I don't think there is a table in BGS yet | The International Association of Oil & Gas Producers (OGP)[1] codes for coordinate reference systems. | '27700' for British National Grid<br>'4230' for ED50-UK |
| XA | Number, not null<br>It should be constrained to ensure it is greater than 0.<br>Use 0 if the accuracy is unknown | The estimated accuracy of the X value. | If the easting is quoted as 302630 and known to within 5 metres, the EASTING_ACCURACY is 5.<br>If the easting is quoted as –6.1834528 and known to the nearest second, the EASTING_ACCURACY is 0.0002778 (1/3600). |
| YA | Number, not null<br>It should be constrained to ensure it is greater than 0.<br>Use 0 if the accuracy is unknown | The estimated accuracy of the Y value. | If the easting is quoted as 686570 and known to within 10 metres, the EASTING_ACCURACY is 10.<br>If the easting is quoted as –and known to the nearest 2 seconds, the 49.55834 EASTING_ACCURACY is 0.0005556 (2/3600) |

## RESPONSIBILITIES

The Data Architect has responsibility for operating this Best Practice. Part or all of this responsibility may be delegated.

The Data Architect may, for practical reasons, decide that this Best Practice need not apply in specific instances; the Data Architect will document such exceptions within the BGS Technical Metadata.

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[1] Although the OGP Surveying and Positioning Committee has absorbed the now-defunct European Petroleum Survey Group (EPSG), these codes are likely to remain widely known as EPSG codes.

The full EPSG Geodetic Parameter Dataset is a repository of parameters required to:

> *identify coordinates such that those coordinates describe position unambiguously. This is through a coordinate reference system (CRS) definition,*
>
> *define transformations and conversions that allow coordinates to be changed from one CRS to another CRS. Transformations and conversions are collectively called coordinate operations.*

These parameters are also available within Oracle, GIS and other software so are unlikely to be used directly by BGS staff – but access to them is available if needed.

All Database Developers have a responsibility to consult with, and follow the advice of, the Data Architect on the application of this Best Practice.

Keith Holmes

19 Jul 2006