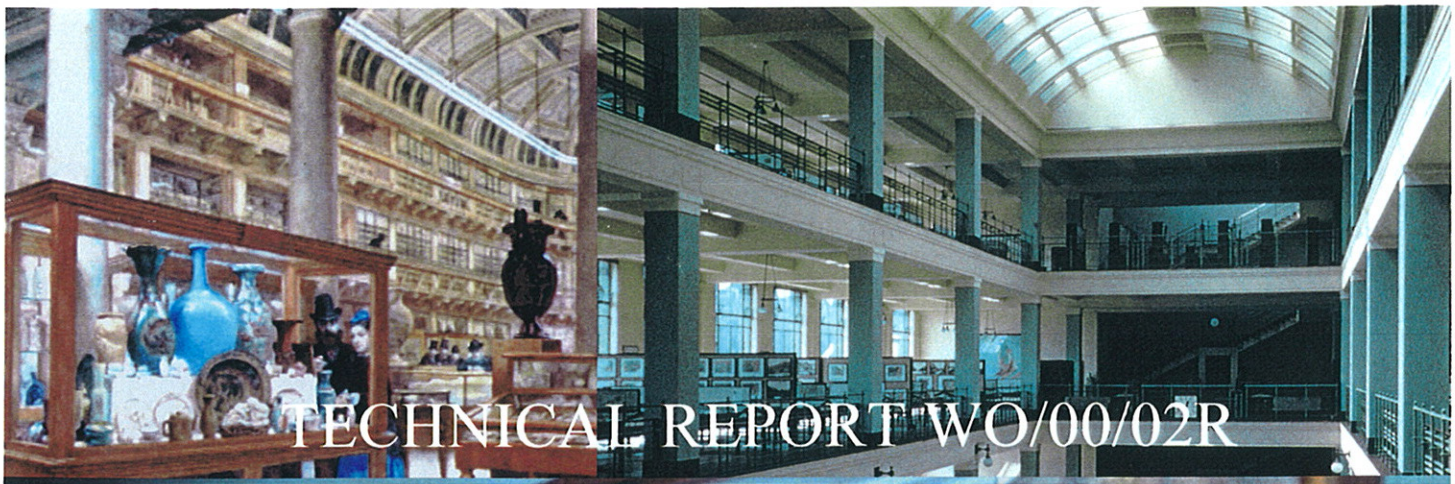
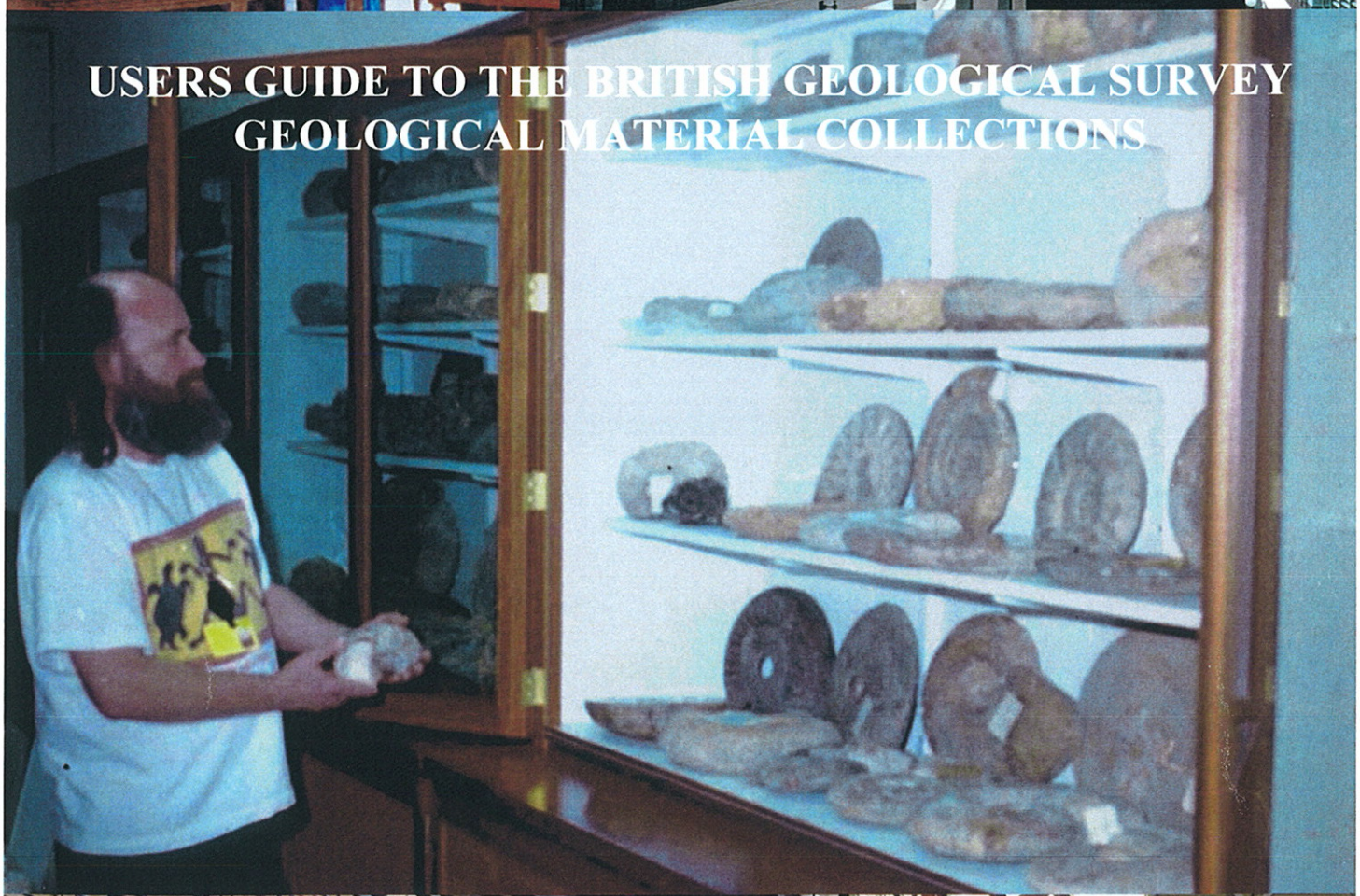
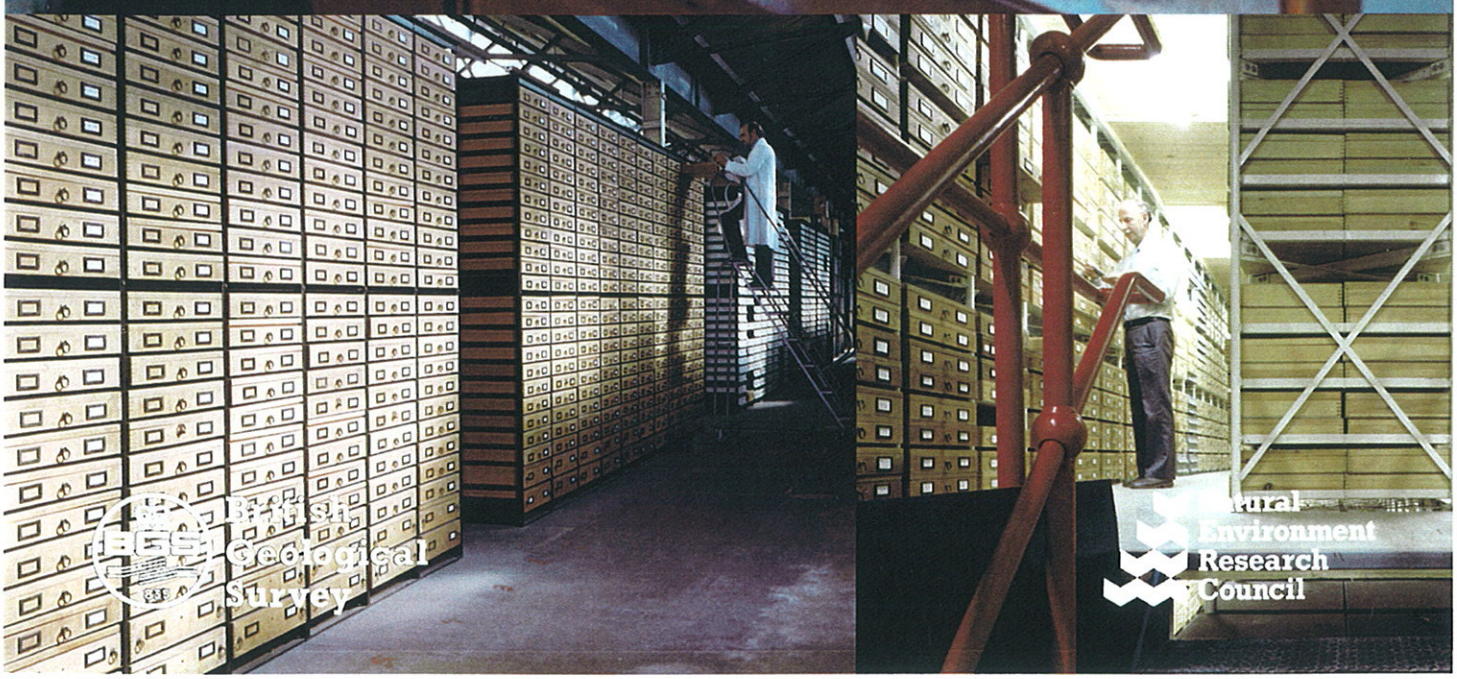


TECHNICAL REPORT WO/00/02R

USERS GUIDE TO THE BRITISH GEOLOGICAL SURVEY GEOLOGICAL MATERIAL COLLECTIONS





British Geological Survey

Natural Environment Research Council

Natural Environmental Research Council

British Geological Survey

TECHNICAL REPORT WO/00/02R

USERS GUIDE TO THE BRITISH GEOLOGICAL SURVEY GEOLOGICAL MATERIAL COLLECTIONS

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Cover Illustrations

Front Cover
Top Left: Museum of Practical Geology, Jermyn Street, London.
Top Right: Geological Museum, Exhibition Road, South Kensington London.
Bottom Left: Core Store, Gorst Road, Park Royal, London.
Bottom Right: Specimen tray storage, Keyworth
Centre: S.P. Tunnicliff and the Palaeontology Collection, Keyworth
Rear Cover
Main drillcore storage hall, Keyworth

Subject index
Geological, Collections

Bibliographic Reference
Hollyer S E, Wheatley C W. 2000. Users Guide To The British Geological Survey Geological Material Collections. British Geological Survey Technical Report WO/00/02R

Contents

1.Introduction.

1.1 General.

The Survey in all its guises as the national geological survey has, since its beginnings in 1835, included the gathering of geological material as one of its functions. Geologists are notorious magpies when it comes to geological specimens and this tendency has been indulged by the Survey, some would say to excess, so that today we need two large warehouses, the Keyworth storage hall and the Loanhead store in Edinburgh, plus specialist facilities, to contain the collections. A summary of the collections and their size is contained in Appendix 1a.

This course is intended to remove the veil of secrecy that often seems to surround and prevent access to the collections and by doing so encourage their use and exploitation. Each collection in BGS has a nominated manager responsible for the upkeep and development of the particular collection and they have produced the following guidance notes to the collections.

The intrinsic value of these collections in simple monetary terms is very limited - what is the price of a rock? However the value lies in the effort and costs in manpower terms collecting the material or in the drilling, the curation and storage costs plus maintaining and indexing the collections. Bear in mind that one metre of drilling may cost upward of £1K for some of the deeper boreholes. It has been estimated that to replace the drillcore alone would cost in the region of £100,000,000.

1.2 Simple guidelines in collection use.

1.2.1 Look first!

Before you consider any field collecting/drilling programme please look through the existing BGS collections. This is not simply to encourage you to use the collected material in place of new material but to help you refine and better focus your future collecting requirements. The BGS collections represent hundreds of years of collection and curation by staff and others and although much of the material held is of "museum" quality they are not museum but working collections. Please use them. The Collection Managers will always help you with access to the indexes and material.

1.2.2 Then collect!

If you do collect material as part of your work and wish to retain the material in one of the permanent collections always consult the relevant collection manager who will guide you in the requirements of the particular collection.

1.2.3. With your own number?

Avoid the duplication which can arise when you use an alpha-numeric symbol system of specimen identification when collecting. This is particularly relevant to biostratigraphical and petrological material but applies across the board. There is a database known as BGS.PREFIX_CODES where all current and passive prefix codes used are listed together with the user. The manager of this database is Susan Martin in NGRC who will advise you on which codes are available and will make up a sample code-book for your use.

1.2.4 Except for boreholes!

All the "B" symbols are reserved for **B**orehole material which, if registered in the borehole material collection as samples rather than continuous core, form part of a continuous symbol system.

1.3. Charging policy.

There is normally no charge for access to any of the collections if the work you are involved in is supported by Science Budget money. A charge may be levied if the work is associated with commercial contracts or if there is significant staff time involved in arranging access or processing material.

Also if you arrange access for a third party a charge may be levied. See Appendix 1b for current charges to material collections (item 2 in Summary of Charges). Note some external enquiry charges, especially for academic work, may be waived using the appropriate form (see Appendix 1c).

Appendix 1

a. Geological Material - broad statistics of the major collections.
b. Charges for information and advisory services.
c. Supporting statement for waiving charges.

Geological Material - broad statistics of the major collections

A) Material Held in Storage at Keyworth.

1) Onshore borehole material (*Stuart Hollyer).*
i. Registered borehole specimens in trays in the Borehole Collection.
Total of 570,000 individually registered specimens from 4,900 boreholes.
ii. Washed cuttings held in specimen trays.
Total of 1,500,000 samples from 1,448 boreholes
iii. Borehole material represented on pallets.
78,000m of drillcore from 1764 boreholes.
c150,000m of drilling represented by cuttings from 120 boreholes.
c15,000 metre boxes of samples and powders from c1400 boreholes.
Total number boreholes on pallets represented by one or a combination of the above is 2,934

2) Biostratigrahical material *(Steve Tunnicliff).*
i. Individually registered specimens in the Survey Collection.
1,250,000 specimens in 25,000 trays.
NOTE: this includes 345,400 specimens from a further 4,669 boreholes not included in 1)i. above.
ii. Specimens comprising the Type and Stratigraphic Collection.
200,000 specimens arranged stratigraphically and taxonomically.
iii. Prepared micro-palaeontological slides.
240,000 slides.

3) Petrological material *(Neil Fortey).*
i. England and Wales Sliced Rock Collection.
71,500 registered specimens (and associated thin sections held separately).
ii. Museum Reserve *36,335 High Value Specimen collection.*
106,500 registered specimens and associated thin sections.
ii. Other rock collections.
16,000 registered specimens generally not thin sectioned.

4) Offshore cores and samples *(Graham Tulloch).*
i. Northern UK Shelf:
a) Shallow bores.
8,500 one metre boxes from 520 sites
b) Vibrocore/gravity core samples

12,500 one metre boxes.
c) Surface samples. *15,000 samples*
d) Particle analysed samples. *40,000 samples (of which 14K have been analysed to half Phi fractions).*
ii. Southern UK Shelf:
iii. Reference Minerals *3,000 High Value Collection of Mineral Samples.*
iv. Other rock collections.
c. 68,700 miscellaneous specimens.

4) Coastal Geology Collection.*(Helen Glaves).*
310 Boreholes -215 on-shore (LOIS)
3,337 Vibrocores, 2,750 Gravity Cores, 10,000 other (Primary Grab) Samples.

5)NGRC Corporate Collection -ex Grays Inn Road *(Chris Wheatley).*
600,000 samples (powders, rocks, crushed samples) in 7,975 trays.

B) Material held in storage at Edinburgh (Murchison House and Loanhead)

1) Onshore borehole material, details held on the Murchison House VAX. *(Neil Halley).*
i. 24,750 registered specimens from 1,245 boreholes.
ii. 6,800m of continuous core from 146 boreholes.

2) Biostratigraphical material *(Mark Dean)*
i. Individually registered specimens in the Survey Collection
428,600 specimens in 5,300 trays.
ii. Specimens comprising the Type and Stratigraphical Collection.
4,800 specimens arranged stratigraphically and Taxonomically. Note: 10,570 specimens were transferred to Keyworth and 750 specimens are on loan to the Royal Museum of Scotland.
iii. Prepared micro-palaeontological slides
6,450 slides

3) Petrological material *(Roy Fakes).*
i. Scottish and Edinburgh Sliced Rock Collection
a)Shallow Boreholes. *2000 Boxes*
b)Vibrocore/Gravity Core/Surface Samples
3,800 Boxes
c)Particle Size Analysed Samples *6,500*
iii. Non-BGS material.
a) Hydrographic Office.*8,000 samples.*
b) Shallow commercial.*35,000 samples.*

C) Material stored at Wallingford
i.Tested samples from major UK aquifers. *12,600.*
ii.Tested samples from minor UK, Offshore and Overseas aquifers. *5,400.*

CHARGES FOR INFORMATION AND ADVISORY SERVICES

APRIL 2000

The British Geological Survey (BGS) is the custodian of extensive collections of records, materials and data pertaining to the geology and hydrogeology of the UK, its continental shelf and many countries overseas. Its staff are engaged on wide ranging survey and research activities and provide an unmatched reservoir of both scientific expertise and local geological knowledge. These resources are available for consultancy purposes, research studies and general advice, providing charges are met for specific services.

Charging policy

The charges covered by this leaflet are largely standard charges for one-off enquiries; consultancy rates are the subject of negotiations or quotes for more extensive staff involvement or use of resources. The rates are based on the cost of the staff time involved in retrieving, collating, copying and evaluating data. For information derived from collections, charges embody a levy as a contribution to maintenance costs.

In the main, charges are levied for the consultation or supply of copies of documents held in the archives, for the retrieval of published library material, for the inspection of borehole core, rock samples and fossil specimens in the reference collections and the supply of samples. There is a standard rate for the provision of geological or hydrogeological advice, bibliographic literature searches or the interpretation of data. This includes the supply of value-added information arising from the BGS's examination of material received from elsewhere.

No charge is made for dealing with simple enquiries about the availability of information, services and products. Specific requests, which involve much searching and retrieval of data from indexes or collections, are subject to charge.

A user ticket is available for commercial visitors wishing to access documentary collections held in the National Geological Records Centre and the Library at the Keyworth and Edinburgh Offices. No visitor charges will be levied on private researchers and academic staff entitled to waivers under the appropriate discretionary arrangements.

Whilst standard rates apply to all offices the overall charges may vary slightly for different collections, reflecting the different facilities or volumes of data.

SUMMARY OF CHARGES

1.Documentary collections

Commercial User Ticket

A combined day ticket for commercial visitors to the National Geological Records Centre (NGRC) and the Library is £50 (+VAT) and there is a £30 (+VAT) day ticket for visitors who only wish to use the Library. Frequent visitors can purchase an annual subscription at £250 (+VAT) for access to the NGRC and the Library, or £125 (+VAT) for use of the Library only. Further details can be provided on request.

Library

The user ticket entitles the commercial visitor to access to the Public Reading Room, retrievals from closed areas and expert staff assistance. Private researchers and academic users are entitled to free access to the Public Reading Room but charges will apply for the retrieval, inspection and copying of certain categories of material and conform to the standard BGS rates indicated below.

The Library also offers a premium service GEOSEARCH, which includes fee-based literature search services and a range of related services. A photograph enquiry service provides lists of available geological photographs for specific localities.

National Geological Records Centre (NGRC) & National Well Record Archive (NWRA)

The availability of information is readily determined from a computerised index. The initial data search and a standard written response is provided free of charge within three working days on a strict rota basis. For urgent enquiries a Premium Service is available providing a response within 24hrs for a charge of £15 (+ VAT).

Standard charges are made for the use of inspection facilities or the supply of data from the collections and are as follows :

a) Inspection fees. For the NGRC the user ticket covers inspection of the borehole logs and includes access to a set of relevant documents for one 5 km X 5 km area. A further charge of £17 (+ VAT) is payable for each additional set examined. The fees allow for data to be extracted from the records but if copies are requested they will be charged as below.

   For well records held in the NWRA similar fees are applied for assisted visits but overall charges are dependant on the staff time involved and area examined.

b) Supply of copies. A flat rate charge of £13 (+ VAT) is made for each copy of all borehole and well logs supplied with a minimum charge of £26 (+ VAT). Normal first class postage within the UK is included.

c) Value-added information. Where available, additional geological information or detailed classifications derived from BGS-examined borehole material may be provided at a charge of

£13(+ VAT) per 30 m depth.

d) Radon Protective Measures site reports (BRE guidance 211 (1999)) are available for £30 +VAT. A more detailed supplementary geological report is available at £100 + VAT (where a report takes more than one hour to produce additional staff time is charged @£40 (+ VAT) for each additional half-hour or part thereof).

e) Other data such as mine plans and field slips can be accessed. Details of charges are available on request.

f) For large or complex searches additional standard staff charges may be levied as set out below.

2. Material Collections

Borehole core and specimens

a) Inspection fee. A charge of £50 (+ VAT) is made per person per day plus £25 (+ VAT) for each pallet of boxed core examined or £10 (+ VAT) for each tray of selected material or cuttings retrieved from storage.

b) Samples. Subject to certain conditions, samples of borehole material may be taken away for analysis or testing, for which a charge of £12 (+ VAT) per sample is made to cover the cost of supervision, cutting, bagging and labelling. Despatch by post or carrier is extra.

Classified rock, mineral and fossil collections

Access to these reference collections, and loans of material from them, are subject to separate charges and conditions; details can be provided on request.

3. Advice, interpretation of data and literature searches

A comprehensive enquiry service is provided for the provision of site specific geological or hydrogeological advice, information or reports based on interpretative studies and literature searches. This is charged at the following standard rates for the specialist staff effort involved:

Standard Site Specific Geological Report - An initial charge of £80 (+ VAT) for the first hour of staff time plus £40 (+ VAT) for each additional half-hour or part thereof. A typical standard report will cost £120(+VAT) and will normally be completed within 3 working days. For a shorter response time there is an additional Premium Service charge of £80(+VAT). If borehole records are included in the report they may be charged at the standard rate (see 1b).

Hydrogeological Report - Most ad hoc enquiries on hydrogeological conditions or requests for advise on the possibility of developing ground water sources can be answered for the standard charge of £120 (+VAT). Contact the Hydrogeological Enquiries office at Wallingford for further details.

Bibliographic - The charge for most standard literature searches is £40 (+VAT) and covers the first half hour of staff time. Most larger searches can be answered for £120 (+VAT). Lengthy projects and certain on line searches are by arrangement.

Staff costs

Staff handling costs involved in retrieving, selecting and replacing documents may be charged at £27.00 (+VAT) per half hour.

Standard copying charges

Photocopies may be made of documents, subject to copyright regulations, at the following rates:

Up to A4 size 22p per sheet (+ VAT)
Up to A3 size 33p per sheet (+ VAT)

Charges for large plans, photographic or colour xerographic copies, microfilm prints or microfiche copies can be supplied on request.

Despatch of documents

Packages of documents sent through the post will be subject to postal charges in operation at the time. Next day recorded delivery or express parcel despatch is available on request and charged at cost. Copies of documents can be forwarded by facsimile transmission or e-mail at an additional charge of £1.30 (+ VAT) per A4 sheet.

Application of charges

Charges are effective from 1 April 2000 until further notice and are subject to VAT at the standard rate.

Customers may pay in advance by cheque or by approved credit/debit cards. Alternatively by prior agreement they may be invoiced for the charges incurred, subject to a minimum payment of at least £7.50 (+VAT). Settlement is required within one month of receipt.

Discretionary arrangements:
BGS is prepared to adjust charges for regulatory bodies or those undertaking bona fide academic research. All requests must also be sanctioned by the relevant BGS Collection Manager.

The deposit of data in the Survey's archives by other organisations is encouraged and BGS is prepared to consider waiving certain charges where a formal agreement for exchange of data would be of benefit to the national archive.

How to enquire and obtain data

Initial requests may be made to any of the BGS information points by telephone, facsimile transmission, e-mail or in writing. Enquiries dealing with particular localities should preferably be submitted in writing to the appropriate office (see the list of contacts), accompanied by a marked-up copy of a map or by 8-figure National Grid references defining the area in question. Order or request forms are available for most services to assist enquirers.

Study space is limited and in order to ensure that the material is available and made ready in advance, appointments should be made for visits to inspect reference collections. Normal opening hours are:

Monday-Thursday	9.00 -17.00	Note: Last admission times may vary
Friday	9.00- 16.30	

EXCLUSION OF WARRANTY

Use by the customer of information provided by the British Geological Survey is at the customer's own risk. In view of the disparate sources of information at the Survey's disposal, including much material donated to the Survey that the Survey accepts in good faith as being accurate, the Natural Environment Research Council (the Council) gives no warranty, expressed or implied, as to the quality or accuracy of information supplied by the Survey, or as to the information's suitability for any use. The Council accepts no liability whatever in respect of loss, damage, injury or other occurrence however caused.

Customers should be aware of the following factors that may affect the quality/accuracy of information supplied:

1. Geological observations are made according to the prevailing understanding of the subject at the time. The quality of such observations may be affected by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.

2. Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.

3. Detail clearly defined and accurately depicted on large-scale maps may be lost when small-scale maps are derived from them.

4. Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.

5. The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.

Principal offices and information points of the British Geological Survey

Information Points at some offices are highlighted with direct dial telephone numbers.
Internet address: http//www.bgs.ac.uk

Sir Kingsley Dunham Centre
Keyworth, Nottingham
NG12 5GG
Tel: 0115 9363100
Fax: 0115 9363200

Library/ Central Enquiries
Tel: 01159 363205/3143
Fax: 01159 363136
e-mail : enquiries@bgs.ac.uk
e-mail : library@bgs.ac.uk

National Geological Records Centre (South)
Tel: 01159 363109
Fax: 01159 363276
e-mail : ngrc@bgs.ac.uk

Main sales desk
Tel: 0115 9363241
e-mail : sales@bgs.ac.uk

Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire OXIO 8BB
Tel: 01491 838800
Fax: 01491 692345

Hydrogeological Enquiries & National Well Records Archive
Tel: 01491 692299
e-mail: hydro@bgs.ac.uk

Geological Survey of Northern Ireland
20 College Gardens
Belfast BT9 6BS
Tel: 01232 666595
Fax: 01232 662835

Forde House
Park Five Business Centre
Harrier Way, Sowton,
Exeter, Devon EX2 7HU

Geological and Records Enquiries South West England
Tel: 01392 278312
Fax: 01392 437505

Murchison House
West Mains Road, Edinburgh EH9 3LA
Tel: 0131 667 1000
Fax: 0131 668 2683

Library enquiries Tel: 0131 650 0322
e-mail : librarynh@bgs.ac.uk

National Geological Records Centre (North)
Tel: 0131 650 0307
Fax: 0131 667 2785
e-mail ngrcn@bgs.ac.uk

Geological Enquiries Scotland and Northern England
Tel: 0131 650 0300
Fax: 0131 667 2785
e-mail enquiry@bgs.ac.uk

London Information Office at the Natural History Museum Earth Galleries
Exhibition Road, South Kensington
London SW7 2DE

Information and sales orders
Tel: 0171 589 4090
Fax: 0171 584 8270
e-mail: sbr@bgs.ac.uk

Any queries regarding the charges and conditions applying to waivers should be directed to the nearest BGS office or forwarded directly to: The Manager, National Geosciences Information Service, British Geological Survey, Keyworth, Nottingham, NG12 5GG

British Geological Survey

Reference No: ...../ .....

SUPPORTING STATEMENT FOR WAIVING CHARGES

Academic Institution :

Departmental Address :

Name of Researcher :

1 Charges imposed by the British Geological Survey for the provision of scientific data and information may be waived* in circumstances where the request for such services is made in pursuance of academic studies. I herebyconfirm that the above-named person is engaged in bona-fide academic research, as described in the attached schedule, and that any material supplied to him/her will not be used for commercial purposes or utilised in anyway to attract payment from a third party. The material is for the sole use of the researcher and will not be passed, in any form whatsoever, to a third party.

2 I acknowledge that prepublication or draft copies of maps supplied by the Survey must not be released to a third party. I understand that the use of unpublished or open-file material in the preparation of published papers must first have the approval of BGS and due acknowledgement must be given to the source of the data. Also, I understand that the copyright of BGS's materials is vested in the Natural Environment Research Council (NERC) and materials must not be reproduced without the prior consent of BGS via the Copyright Manager. BGS would wish to receive copies of reports, scientific papers and theses based on information obtained through this waiver agreement, for inclusion in its publicly accessible archives.

3 If provided with samples for which charges have been waived, I undertake to ensure that the samples or unused portions thereof are returned, and copies of the research results or analytical data lodged with BGS, within a period of six months of the commencement of the loan. If the samples are retained for more than six months, the requirement for a charge will be met.

Signed : ..... Date : .....

SURNAME in block capitals : .....

State : Head of Department or Supervisor (Delete as appropriate) Other : .....

I confirm that I understand and will abide by the undertaking given above.

Signed : ..... Date : .....

(Researcher)

SURNAME in block capitals : .....

Signed : ..... Date : .....

(Collections Manager — on behalf of Director, BGS)

Failure to comply with these conditions will result in the full commercial rate being levied as set out in the current "Charges for Information and Advisory Service" leaflet. Future requests by the same organisation may also be refused academic status.

* With the exception of the costs of photocopying and postage.

2. The Borehole Materials Collection (Keyworth)

2.1. Introduction.

Staff of the Survey have been collecting material from boreholes since the Survey was established in 1835 and the oldest borehole material we hold was drilled in 1821 in Chatham Dockyard, Kent. We also hold the deepest onshore borehole drilled (Seal Sands at 13,670 feet), the first borehole drilled using a diamond crown (Sub-Wealden 1 drilled in 1875) and the borehole that proved marine Devonian beneath London (Meux Brewery borehole drilled in 1877 at the corner of Tottenham Court Road and Oxford Street).

The Survey only recognised the importance of organising its borehole material into a separate collection in the early 1950s by appointing a Mr Leo Morris to organise the material held in miscellaneous boxes into some sort of order. A collection of individually numbered hand specimens known as the Borings Department Collection was established in London, originally in the basement at Exhibition Road but transferred to the North Acton (Gorst Road) core store in 1968. At the time most borehole material was collected for its fossil content.

A Survey office was established in Leeds in 1964 which had two effects on the borehole collection. First all the Northern England borehole material was transferred from London into the Biostratigraphy Collection in Leeds (this material was kept in the Biostratigraphy collection for storage purposes on its transfer to Keyworth but is indexed in the borehole material database for ease of access.). Secondly the system of storing core in one metre length cardboard core boxes was established.

The current storage hall at Keyworth was commissioned in 1985 and 4.5K tonnes of core and specimens was transferred from London and Leeds in 1985/6.

2.2. Collection size and content.

The collection is restricted to onshore boreholes with material from England, Wales and Scotland.

The borehole material held by BGS comes from many sources. But as well as boreholes drilled by the Survey itself the majority of the material comes from boreholes drilled for commercial reasons such as coal, hydrocarbon, mineral or water exploitation/exploration boreholes. Access to much of this material by BGS is encompassed in two Acts of Parliament.

* Section 23 of the Mining Industry Act 1926 and Section 9 of the Petroleum (production) Act 1934. This entitles BGS staff access to the log and material of any borehole drilled for minerals (including hydrocarbons) over 30m in depth.

* Section 205 of the Water Resources Act 1991 allows the same access to boreholes drilled for water greater than 15 metres in depth.

It is important that staff should be familiar with these Acts and inform operators who may be

unaware of their obligations under the Acts. See **Appendix 2.a and 2.b** for details.

Most importantly the borehole collection includes all the material from the UK Onshore Hydrocarbon wells list released through the DTI (core and cuttings) plus individual donations from operators such as Candecca Resources, Cairn Energy, Edinburgh Oil and Gas, Kelt Petroleum and BP. In addition to the material covered by the above two acts many boreholes from site investigations and other drilling not covered are offered to the Survey on a regular basis.

Note; recent hydrocarbon boreholes which have not been released through the DTI are retained at the DTI Core Store at Gilmerton in Edinburgh (See Section 13) but are transferred to BGS Keyworth once released.

There are three sub-collections which form the borehole materials collection.

2.2.1 The registered specimen collection.

This comprises chosen representative hand specimens each of which has been given a unique identifying label. The label comprises a prefix and a number, for example BDY 6674. The series used to date are;
B 1 to 7,000
Ba to Bh 1 to 5,000
Bi to Bz 1 to 10,000 (Bu not used)
BDA to BDZ 1 to 10,000 (BDI and BDO not used)
BKA to BKH 1 to 10,000 (BKI not used)
BKJ 1 to 7637 (to date)
This gives a total of about 537,000 specimens from 4,900 boreholes.

Each set of specimens from a particular borehole are registered in depth order (top to base), for example the set of specimens from the Survey's Stowell Park borehole run from Bj 1 to 6508 and from 1 to 3,920 feet.

The amount of material collected from each borehole depends on the reason for drilling (and thus the cores taken), the collector and the state of knowledge at that time. Earlier collecting is not as comprehensive as today. The specimens are stored in standard BGS trays in series ordered as above, each tray having a label showing the tray contents for example Bj 4627-4658. To translate the specimen number to the depth of each specimen in a borehole there are borehole lists (see **Appendix 2.c**). These lists cross reference the registration number of the specimen to the depth. The lists are also used to record descriptions of the material or information such as fossil identifications and rock slice numbers for each particular specimen.

The series of registered specimens where the prefix starts from B to BKJ are those which formed part of the original London based collection but in addition there are borehole specimens that have been absorbed directly into the Biostratigraphy collection. This comprises about 345,400 specimens from an additional 4669 boreholes with information recorded in the Biostratigraphy registers. There is also borehole material in the Petrology collection.

2.2.2 The cuttings collection:

This discrete collection includes washed and dried cuttings mainly from commercial hydrocarbon boreholes. The samples of cuttings are contained in glass phials or small bags, each container being marked with the name of the borehole and the depth interval of the material contained. These are then stored in trays in depth order, each tray being numbered in sequence and in accession order. There are currently some 3,497 trays containing about 1,500,000 samples from 1448 boreholes. As almost all the material is from commercial sources the volume of material in each sample and the intervals over which the material was collected varies considerably. Most samples weigh between 25 and 50 grams and represent three to five feet or 3 metres of drilling depending on whether the original borehole was measured in feet or metres.

2.2.3 The drillcore collection:

The title of this collection is slightly misleading as it includes material other than drillcore. In essence it includes all borehole material stored on pallets in the storage hall and as well as drillcore it includes bulk samples (including powders), unwashed cuttings and core samples. All the material is stored in one metre long cardboard core boxes with the borehole name, the depth range and the way up of the drillcore marked on each box.

As well as the marking on the box it is a convention to mark the core with the "way up". This can be done on two ways. The core should be marked with arrows pointing UP the borehole. Alternatively two parallel lines are sometimes drawn on the core in two colours. For UK Nirex this was yellow and blue so that when looking at the core with the blue line on the left the core correctly orientated ie the top is at the top. On hydrocarbon core the lines may be red and blue just to confuse you but the blue should still be on the left.

The drillcore collection comprises some 106,000 one metre boxes holding material from 2,934 boreholes.

2.3. How to access the collection indexes.

It is important in collections of this size that not only is the collection managed in a structured way but that there are indexes which list the material available for inspection, examination and exploitation. There are two databases that allow you to search for the borehole material, BGS.BORE_SAMPLE and BGS.BGS_ONSHORE DRILLCORE. Both are Oracle tables mounted on KWDBASE and may be viewed and interrogated either directly in Oracle using SQL or by linking the tables through MS Access. Alternatively the MARS (Menu Aided Retrieval System) application provides a simple method of interrogating the tables and spatial searches using the GDI (Geoscience Data Index) can be carried out - contact Rod Bowie in the NGRC in N Block.

Both BGS.BORE_SAMPLE and BGS.BGS_ONSHORE_DRILLCORE will be demonstrated on the course.

2.3.1. BGS.BORE_SAMPLE

This oracle table mounted on KWDBASE gives you access to the registered specimen collection (2.2.1) and the washed and dried cuttings collection (2.2.2). The current database allows you to search by borehole name, the Ordnance Survey 1:10K sheet and any other fields or combination of the main fields which are:

LOCN	NOT NULL VARCHAR2(80) - name of borehole
QS	VARCHAR2(6) - OS quarter sheet
NUMB	NUMBER (5) - BGS borehole registration number
BSUFF	VARCHAR2(4) - suffix to borehole registration number
PURP	VARCHAR2(50) - why the borehole was drilled
YRWH	VARCHAR2(44) - when it was drilled and by whom
COMM	VARCHAR2(200) - comments!
COLLECTOR	NOT NULL VARCHAR2(20) - collector's symbol
TOP_SAMPLE	NOT NULL NUMBER(10) - first sample number
BASE_SAMPLE	NUMBER(10) - last sample number
TOP_SAMPLE_SUFFIX	VARCHAR2(2) - first sample prefix
BASE_SAMPLE_SUFFIX	VARCHAR2(2) - last sample prefix
TOP_DEPTH	NUMBER(10) - first sample depth
BASE_DEPTH	NUMBER(10) - last sample depth
UNITS	VARCHAR2(1) - depth units used (I=Imperial, M=Metric)

This table is accessible to all BGS staff. This may be achieved by using MS Access and forming a link to the table on the KWDBASE or directly by SQL. See **Appendix 2.d** for an example of a query on the database.

2.3.2. BGS.BGS_ONSHORE_DRILLCORE

This table includes all the material in 2.2.3 and is also mounted on the KWDBASE and may be viewed in the same way as BGS.BORE_SAMPLE. The table comprises the following fields which are the most useful for searches;

BOREHOLE	NOT NULL VARCHAR2(50) - name of borehole
QS	VARCHAR2(6) - OS quarter sheet
NUMB	NUMBER (5) - BGS borehole registration number
BSUFF	VARCHAR2(4) - suffix to borehole registration number
TOP_DEPTH_MET	NOT NULL NUMBER(7,1) - top depth of section in metres (converted if original measurement in feet)
LOWER_DEPTH_MET	NOT NULL NUMBER(7,1) - base depth of section in metres (as above)
TOP_DEPTH_IMP	NUMBER(7,1) - top depth of section in imperial (only if original measurement was in feet)
LOWER_DEPTH_IMP	NUMBER(7,1) - base depth of section in imperial (as above)
CORE_RUN	NUMBER(5) - core run number (mainly for hydrocarbon boreholes)
SAMPLES	NOT NULL VARCHAR2(30) - type of material stored (see dictionary below)
BOXES	NUMBER(5) - number of containers in section
COMMENTS	VARCHAR2(240) - comments!
BLITH_FLAG	VARCHAR2(1) - show to what stage the lithostratigraphy has been coded.
PALLET	NOT NULL VARCHAR2(10) - pallet location in the storage hall

See **Appendix 2.e** for an example of a query on the database.

As with BGS.BORE_SAMPLE any field or combination of fields may searched. The table below gives the dictionary codes used to describe the types of material stored.

MATERIAL_TYPE_CODE	MATERIAL_TYPE_DESC
SWCR	SIDEWALL CORE
BULK	BULK SAMPLE
UNKN	UNKNOWN
CRSM	CORE SAMPLE
DLCR	DRILLCORE
PWDR	POWDER
RGSP	REGISTERED SPECIMEN
TBSM	TUBE SAMPLE
CUTT	CUTTINGS
UWCT	UNWASHED CUTTINGS
WSCT	WASHED CUTTINGS
PLUG	CORED PLUG

THNS	THIN SECTION
RSDU	RESIDUE
PLET	PELLET
MCPS	MICRO-PAL SLIDE
WCSM	WAXED CORE SAMPLE
RMDC	RESIN MOUNTED DRILLCORE

2.3.3. Who to contact.

Once you have identified the material you would like to view or if you would like some further advice on how you may interrogate the tables to find what material is available you should contact the *National Geological Records Centre (NGRC)* staff in the Core Store who are:

Stuart Hollyer, Collections Administrator (extn 3105 or e_mail SEHO)
Chris Wheatley, data basing and enquiries (extn 3308 or e_mail CWW)
Sue Martin, data input and administration (extn 3179 or e_mail SMART)

Once you have identified the borehole you wish to examine contact one of the above members of staff with the name of the borehole (or its BGS Registration Number) plus the depth interval(s). The material can then be retrieved from the storage hall and laid out in the logging/viewing rooms. If you wish to view a large quantity of material it is advisable to book the logging/viewing rooms as far in advance as possible.

2.4. How the collection can be used.

2.4.1. Sampling.

Other than the above constraints the use of the collection is encouraged. It is not a museum collection but a working collection and should be used. This includes carrying out examination or testing, including destructive testing. There are guidelines for sampling but these are commonsense ones such as:

- registered specimens with identified fossils should not be destructively tested.
- use as little material as possible (note that for hydrocarbon cuttings, for each sample, at least 20 grams of material must be retained as a permanent record of the borehole).
- when sampling drillcore avoid removing complete sections.
- avoid repeating tests already carried out on the particular material.
- if you use acid or stain wash it off as soon as possible.
- avoid using a geological hammer if possible - small sampling saws are available.

2.4.2. Previous work.

It is always useful to look into what work has been carried out on a particular borehole before instigating further work:

- check with Mineralogy and Petrology to see if thin sections are available for a particular borehole and have been reported on.
- check with Basin Analysis and Stratigraphy to see if any palaeontological work has

been carried out and reported on (reports listed on BGS.BGS_unpub_reports on KWDBASE).

- check with NGRC (Core Store) to see what material has already been issued and for what purpose.

2.4.3. Material processing.

In addition to curating, indexing and storing geological samples and laying out material for inspection/sampling the Keyworth core store offers the following services.

* core and sample slicing
* core tube slicing - plastic U4 or triple barrel lining
* U4 extrusion
* core plugging from 6 to 65 mm in diameter plus end grinding
* core photography - specialist room available operated by Photographic Department staff

2.4.4. Charges.

Except for the core photography most of these services are free for Science Budget work unless a specific costing for the process has been included in the project. This is paticularly the case where extensive work is involved. **All commercial or commissioned work is charged for, including access to the logging and viewing areas.**

See **Apppendix 2.f** for the commercial rates for material processing and 1b for the current external enquiry charges.

2.4.5. Loans.

As well as being available to BGS staff most of the material in the borehole collection is also available to external enquirers, both academic and commercial. Some loans involve a complete suite of specimens or drillcore which may be removed from BGS for simple visual study purposes and such loans, for example to museums or universities, can be arranged as long as the borrower undertakes not to damage or process the material in any way.

The more common external loans are those where there is some processing of the material being loaned possibly resulting it the destruction of the material by chemical or mechanical means. In this case the loan has to be approved by various interested parties and there are strict conditions covering the return of the material in the processed form e.g. thin sections and any primary experimental data.

Details of the loan conditions are contained in **Appendix 2g**

2.4.6. Confidentiality of boreholes.

As a member of staff there is no restriction on the material that you can view. However it should be remembered that much of the material, even if not strictly confidential, may have some limitations placed upon its use. Thus caution must be exercised in the use of information gained from examining the core. Co-workers external to BGS should not have access to the confidential material without written permission of, for example, the operator of the well in the case of hydrocarbon material. Also information gained from confidential material should not be published or included in exclusive reports without permission of the operator.

See **Appendix 2h** for the current levels of confidentiality that applies to boreholes.

2.5. How to add new material to the collection.

2.5.1. General

It needs to be stressed that any borehole material may be collected and brought to the Keyworth Core Store for processing and examination. There is a **transit** area in which material may be stored on a temporary basis in the original containers, normally for a maximum of twelve months but extendable to the life of the particular project for which the material was collected. When material arrives for temporary or permanent storage, a **Drillcore Receipt Form** will be issued to the BGS staff member responsible for the acquisition; this needs to be completed and returned to the core store staff where it will be retained as a record of the material and entered on the BGS.CORE-IN-TRANSIT database. See **Appendix 2.i** for the form.

Once a project is completed or where material is collected for its value and is not part of a project the person responsible for the material has to decide on the future of the material. The main choices are:

- dispose of the material by throwing it out.
- return the material to the operator/customer in the case of contractual work.
- forward the material to a university
- retain and curate the material by adding it to the collection

2.5.2. Retention and curation.

In relation to the last option above the BGS operates an onshore borehole acquisition policy (see **Appendix 2.j**) and you should make yourself familiar with this policy. In particular for any material put forward for retention you should ensure:

- all meta data is available e.g. spatial reference, drilling details, ownership and confidentiality.
- a full suit of logs is available (including wire line logs where taken).
- that the donor of the material transfers the ownership of the material to BGS.
- that the material is fully and accurately marked with the depths and way up.

(Note that confidential borehole material should not be accepted from an external operator without some mechanism in place whereby the borehole may be release from confidentiality at some specified future date).

To help you decide what material should be retained you may consider the following criteria:

- Does the material represent a sequence not available in the current collection.
- Does the material represent a sequence not represented in a particular area.
- Does the quality of the material represent an improvement over the existing collection.
- Is there a legal (contractual?) obligation for BGS to retain the material.
- Is the material likely to attract commercial interest (and thus income for BGS) in the future.

Once you have decided that the material is a candidate for retention you need to complete an

Application to Curate form requesting the curation of the material and available through the Core Store staff listed above (see **Appendix 2.k**). The case will be presented to the Materials Collection Review Panel who will either endorse or reject the case for retention. It is usually best to talk to the Collections Administrator before you submit your case for retention so that the relevant points are included.

Finally, when approval for retention or permanent curation has been given you should discuss the best way to preserve/curate the material with the Collections Administrator, bearing in mind the three parts of the collection listed above.

2.5.3 The borehole record registration.

It is essential for the operation of the borehole materials databases that all boreholes which have material curated into the system, whether as specimens, cuttings or drillcore, should be given a BGS Borehole Registration Number. This is obtainable through the Borehole Records Sections at the Keyworth, Edinburgh or Exeter offices depending on the location of the borehole. Note that the Records Sections require full details of the borehole including a log to be deposited with them, even if the borehole is confidential. The index of boreholes in the various record sections are listed in BGS.SOBI (Single Onshore Borehole Index).

2.6. Future Developments.

2.6.1. Additional material.

The core store complex was opened in 1985 and at the time it was considered large enough to serve the requirements of BGS for the foreseeable future. However since 1985 the accession rate for borehole material has been such that the pallet racking in the storage hall is now 80% full of curated material. The major accessions have been, and will continue to be, hydrocarbon material donated to the BGS by oil companies including Cairn Energy, Edinburgh Oil and Gas, Kelt Petroleum, Candecca Resources and in the near future the total onshore collection from BP. These accessions are in addition to the material which comes to BGS via the DTI under the Mining Industry Act *(see 2.2 above)*.

2.6.2. Data basing.

Under the NERC "Seedcorn" monies a database (Borehole Materials Database) is in the latter stages of development which will improve the index to the material in the collection. Effort is being concentrated on the material at Keyworth but once the database is functional it is hoped that the borehole material held in Edinburgh will be included.

The Borehole Materials Database will add the litho-stratigraphy to the material from the boreholes held in Keyworth. To achieve this the litho-stratigraphy for over 5,000 boreholes has been coded and entered onto a table which will be incorporated into BGS.BOREHOLE_GEOLOGY. By using BGS.SOBI (**S**ingle **O**nshore **B**orehole **I**ndex) to search for the metadata and BGS.BOREHOLE_GEOLOGY to search for the litho-stratigraphy **plus** the two material depth databases (BGS.BORE_SAMPLE and BGS.BGS_ONSHORE_DRILLCORE) searches for material from litho_stratigraphical

Groups/Formations will be possible. Thus queries such as " what material do you have from boreholes that penetrate the Lias" which currently can only be answered by intensive manual searching will in future be answered in a flash - or so we hope!

2.6.3. Bar Coding.

Under the design of the Borehole Materials Database it was recommended that all the containers held on pallets in the Keyworth core store should be uniquely identified. This was investigated and eventually a system of bar coding was initiated which will identify each corebox, the pallet number and the pallet location in the corestore. The information on each core box is being remotely captured by a laser bar code reader which will transmit the corebox number, pallet number, pallet location, borehole name top depth, base depth and units of measurement to the transceiver which will populate the database. It is hoped to complete this exercise by March 2001.

On its completion attention will be turned to completing a similar exercise for the collection of registered borehole specimens held in trays.

Appendix 2.

2a. Mining Industry Act
2b. Water Act
2c. Example of a borehole specimen list
2d. Example of BGS.BORE_SAMPLE query result
2e. Example of BGS.BGS_ONSHORE_DRILLCORE query result
2f. List of commercial rate charges
2g. Loan conditions for external enquirers
2h. Confidentiality of boreholes
2i. Drillcore receipt form
2j .BGS borehole material acquisition policy
2k. Application to Curate form
2l. Users guide to material processing

Notification of intention to sink boreholes and shafts

Requirements under the provisions of the Mining Industry Act 1926

NOTIFICATION OF INTENTION TO SINK BOREHOLES AND SHAFTS

Mining Industry Act, 1926

The powers vested in the Committee of the Privy Council for Scientific and Industrial Research by the Mining Industry Act 1926 have been transferred to the Natural Environment Research Council by the Science and Technology Act 1965. The relevant sections of the Mining Industry Act 1926, and the Petroleum (Production) Act 1934, are reproduced in the Appendix (page 4).

The intention of these sections of the Acts is to ensure that all information obtained from the sinking of boreholes and shafts for minerals including petroleum is made available to the British Geological Survey. This information, together with that obtained from the surveys carried out by the staff of the Geological Survey, comprises a considerable volume of data on the geological structure of this country and the nature and extent of its mineral resources, This data is either published or held available for public inspection, except that information communicated as confidential is not divulged without consent.

1 Operations on which information is required

Any of the following operations carried out for the purpose of searching for or getting any minerals, whether onshore or within UK territorial waters:

(a) The sinking of a new borehole or shaft from the surface to a depth of more than 100 A (30 m);

(b) The sinking of a new borehole or shaft, commencing from sub-surface workings and intended to reach a depth of more than 100 ft (30 m) below the surface;

(c) The deepening of an existing borehole or shaft of less than 100 ft (30 m) so as to reach a depth of more than 100 ft (30 m) from the surface;

(d) The deepening of an existing borehole or shaft of more than 100 ft (30 m) in depth.

2 Duties of persons sinking boreholes and shafts for minerals

Any person carrying out any of the above operations is required to:

i/ Give written notification before operations begin of the intention to sink a borehole or shaft This notification should be sent to:

The Records Officer
National Geological Records Centre
British Geological Survey
Keyworth
Nottingham
NG12 5GG

The Records Officer
National Geological Records Centre
British Geological Survey
Murchison House
West Mains Road
Edinburgh EH9 3LA

ii/ Keep a record of the operations with details of the nature and thickness of the strata and the depth at which each bed was found. Standard record sheets are available.
iii/Retain specimens of the strata either as cores or fragments, for a period of at least six months
iv/Allow any properly authorised officer free access to all reasonable times to any such shaft, borehole or core to inspect and take copies of the records, to inspect all fragments obtained, and to take representative specimens of such cores or fragments.
v/ Allow, in underground workings, to any properly authorised officer, facilities similar to those in (iv) above; such officer to have the same rights as to the production and examination of plans and sections as are conferred on Inspectors of Mines.

Notification of intent to construct new wells and boreholes for water in England and Wales and the subsequent provision of Information

Water Resources Act 1991

Included within the Water Resources Act 1991 are the provisions of section 7 of the Water Act 1945 and certain subsequent legislation dealing with regulations concerning underground water. Section 198 requires that: (a) the Natural Environment Research Council be notified of the intention to sink new wells and boreholes for water to a depth of fifty feet (15 metres) or more in England and Wales; (b) that journals be kept of the programme of work, including measurements of any water levels and flow rates; (c) that these journals together with details of water levels and yields be provided to the Council at the following address:

The Records Section
Hydrogeology Group
British Geological Survey
Maclean Building
Crowmarsh Gifford
Wallingford
Oxon OX1 0 8BB

Section 205 of the Act provides for such information supplied under section 198 to be furnished in confidence if so required.

INSTITUTE OF GEOLOGICAL SCIENCES BOREHOLES AND SHAFTS

1st Map & Record No. 320

SPECIMENS

Name of Bore and Locality	"SUBWEALDEN EXPLORATION" Borehole 1, NETHERFIELD, SUSSEX Subsequently Known as MOUNTFIELD (1) (1873-4)		6" Map & Record No.
Notification No.	NGR: TQ 7194 1930		TQ 71 NW/2
Specimens collected by	Specimens ex Sedgwick Museum, Cambridge (previously unregistered), Geol. Soc. London and Borings Dept (Geol. Surv. G.B.).	O.D.	APPROX. 260' Metres

Registered No.	1¼in. core Description	Depth (ft) Metres	Horizon	Destination
BDS 5495	Cementstone silty textured with Liostrea sp. et al. small fragments	331	Upper Kimmeridge Clay	
5496	mudstone with small (1 cm) bivalves and fragments indet	388		
5497	calcareous mudstone with fragment of Camptonectes	396		
5498	calcareous mudstone silty textured with Thracia sp. + echinoid spine (Athorpe)	397		
5499	brownish, fissile mudstone with plaster of Protocardia Astarte and fragments of ?Modiolus subsinuatoensis (Coffeau) + shear surface with ?gypsum flakes	418		
5500	pale calcareous mudstone with incomplete impression of large Protocardia	428		
5501	pale, silty-textured calcareous mudstone with Thracia sp. et al. shell fragments indet	437		
5502	opt 5501	437		
5503	calcareous mudstone with shell fragments including Protocardia	453		
5504	very pale, highly calcareous mudstone with belemnite fragment	470		
5505	calcareous mudstone with Corbulamima?	471		
5506	calcareous mudstone with Protocardia morinica (de Loriol) + shell fragments including Camptonectes	496		
5507	mudstone with shell fragments + ? 'Lucina minuscula Blake'	526		
5508	calcareous mudstone, silty textured with myid ? Grandotia compressa (J de C. Sowerby)	526		
5509		535/6		formerly Borings Dept B948a
5510	cementstone, pale-medium grey, silty textured (0.18m)	535/9		
5511		536		
5512	see 5513/4	538		see over

IGS 1721-1000 9/76

BGS_BORE_SAMPLE Query

07/04/99

LOCN	QS	NUMB	BSUFF	TOP_DEPTH	BASE_DEPTH	UNITS	COLLECTOR	TOP_SAMPLE	BASE_SAMPLE
A259 BEXHILL BH 117	TQ71SW	33	.	11	30	M	BKH	9473	9493
A259 BEXHILL BH 127	TQ71SW	43	.	15	30	M	BKH	9494	9514
A259 BEXHILL BH 164	TQ71SE	205	.	13	40	M	BKH	9515	9549
A259 BEXHILL BH 165	TQ71SE	206	.	16	26	M	BKH	9550	9569
COMBE HAVEN C3	TQ71SE	1	.	53	53	I	SAM	7584	7584
GYPSUM MINES 1	TQ71NW	13	.	35	160	I	SEH	522	527
GYPSUM MINES 3	TQ71NW	15	.	260	362	I	BDY	1425	1518
GYPSUM MINES 3	TQ71NW	15	.	259	366	I	T	3066	3067
GYPSUM MINES 3	TQ71NW	15	.	175	370	I	Bs	9464	9670
GYPSUM MINES 4	TQ71NW	16	.	160	451	I	BDY	1519	1637
GYPSUM MINES 4	TQ71NW	16	.	160	451	I	T	3065	3065
GYPSUM MINES 4	TQ71NW	16	.	190	420	I	Bs	9671	9765
GYPSUM MINES 43	TQ71NW	50	.	625	701	I	Bi	4267	4283
GYPSUM MINES 44	TQ71NW	51	.	221	309	I	Bi	4284	4319
GYPSUM MINES 45	TQ71NW	52	.	520	644	I	Bi	4525	4549
GYPSUM MINES 46	TQ71NW	53	.	666	737	I	Bi	4550	4555
GYPSUM MINES 5	TQ71NW	17	.	125	299	I	Bs	9766	9999
NETHERFIELD PLACE 5	TQ71NW		.	890	925	I	SAM	224	297
NETHERFIELD PLACE 5	TQ71NW		.	919	1024	I	SAM	1799	1848
NETHERFIELD PLACE 3	TQ71NW	69	.	702	1094	I	SAM	298	433
NETHERFIELD PLACE 3	TQ71NW	69	.	703	1049	I	Bs	7874	8048
NETHERFIELD PLACE 5	TQ71NW		.	911	913	I	SAM	6933	6937
SUB-WEALDEN EXPLORATION	TQ71NW	2	.	331	1008	I	BDS	5495	5656
SUB-WEALDEN EXPLORATION	TQ71NW	2	.	536	990	I	B	948	952
SUB-WEALDEN EXPLORATION	TQ71NW	3	.	30	1879	I	BDS	5657	5829
SUB-WEALDEN EXPLORATION	TQ71NW	3	.	898	1785	I	B	600	616
SUB-WEALDEN EXPLORATION	TQ71NW	3	.	279	1541	I	Z	176	250
SUB-WEALDEN EXPLORATION	TQ71NW	3	.	471	1012	I	Z	251	268

BGS_BGS_ONSHORE_DRILLCORE Query1

07/04/99

BOREHOLE	QS	NUMB	BSUFF	TOP_DEPTH_MET	LOWER_DEPTH_MET	SAMPLES	BOXES
CHANNEL TUNNEL ITE 1	TR23NW	13	.	82.6	89.3	BULK	2
CHANNEL TUNNEL P000	TR34SW	24	.	43.9	77.1	DLCR	32
CHANNEL TUNNEL P000	TR34SW	24	.	77.1	107.3	DLCR	29
CHANNEL TUNNEL P000	TR34SW	24	.	107.4	147.2	BULK	8
CHANNEL TUNNEL P000	TR34SW	24	.	12.5	43.9	DLCR	32
CHANNEL TUNNEL P040	TR33NE	1	.	10	12	DLCR	3
CHANNEL TUNNEL P040	TR33NE	1	.	12	38	DLCR	32
CHANNEL TUNNEL P040	TR33NE	1	.	38	68	DLCR	30
CHANNEL TUNNEL R060	TR33NE	2	.	46.9	77.1	DLCR	33
CHANNEL TUNNEL R060	TR33NE	2	.	6.1	46.9	DLCR	42
CHANNEL TUNNEL R150	TR43SE	1	.	38.7	70.4	DLCR	32
CHANNEL TUNNEL R150	TR43SE	1	.	6.4	8.2	DLCR	2
CHANNEL TUNNEL R150	TR43SE	1	.	8.2	38.7	DLCR	32
CHANNEL TUNNEL R150	TR43SE	1	.	70.4	83.5	DLCR	12
CHANNEL TUNNEL RAIL LINK A2	TQ38SW	2212	.	10.5	37.4	DLCR	32
CHANNEL TUNNEL RAIL LINK A2	TQ38SW	2212	.	37.4	61.4	DLCR	28
CHANNEL TUNNEL RAIL LINK A4	TQ37NE	1790	.	19.8	29.3	DLCR	8
CHANNEL TUNNEL RAIL LINK A4	TQ37NE	1790	.	29.3	33.6	DLCR	7
CHANNEL TUNNEL RAIL LINK A6	TQ47SW	117	.	17.2	42.4	DLCR	16
CHANNEL TUNNEL RAIL LINK A6	TQ47SW	117	.	49.5	57	DLCR	4

BGS CORE STORAGE AND HANDLING SERVICES (at Keyworth)

The prices quoted below are for material supplied by the customer and do not include processing material forming part of the BGS archive collection.

PRICES FOR SERVICES OFFERED

Transitory storage of bore hole material

As delivered from drill site in original boxes for a period of up to 12 months.

For the first month per pallet (max weight 1,000 kg per pallet)	£35.00
For each subsequent month per pallet	£22.50

Long term storage

In one metre core boxes on pallets for a minimum of 12 months.

For each pallet per month	£28.00
For each 1m core box supplied by BGS	£2.25
To transfer drill core to 1m boxes per metre	£3.75

Retrieval from storage

From transitory storage per pallet	£6.50
From long term storage per pallet	£8.50

Use of core examination and logging room

For use of 50% of room per day	£50.00

Core Photography

Prices on application depending on individual requirements

Core Processing

The prices given below may vary according to the type of material presented for processing.

Longitudinal core slicing, per metre.	£18.60
Transverse or angled cuts, per cut	£8.00
25 & 38mm diameter core plugs, per plug	£8.95
End grinding 25/38mm core plugs, per plug	£5.90
50mm diameter core plugs, per plug	£15.00
End grinding 50mm core plugs, per plug	£16.50
Prices for other plug sizes on application	

All prices are ex VAT

March 2000

British Geological Survey

Application For Issue Of Rock Specimens From Landward Boreholes

Conditions

This application form must be used where rock specimens or samples in the care of the Survey from boreholes sunk by the Survey or by other organisations are requested by outside workers for purposes of research. The intention in to ensure that all information obtained from work on borehole material may be collated and stored at the Survey for the benefit of other workers. The following conditions must be observed:

1 The proposed investigations must offer results that will lead to a better understanding of the geology of the area.

2 The investigations shall not duplicate work already undertaken, even though they may be by a competitor company.

3 The factual results of the investigations shall be made available, on a shared-cost basis if necessary, to any enquirer who would otherwise need to obtain duplicate samples.

4 The passing on of material to a third party must be sanctioned by the Survey (via the Collections Administrator - Materials).

5 Biostratigraphy a complete suite of all fossils extracted, including all figured, described and cited specimens, and any residue of the samples, must be returned to the Collections Administrator (Materials).

6 Petrography *and* Geochemistry all material (or such as is agreed when the samples were issued) should be returned to the Collections Administrator; this to include thin sections, analysed material, other prepared material and any unused remnants

7 Copies of any report, article or work and related maps, drawings, analyses and photographs (including those intended for publication) which are produced from research utilising the issued material must be submitted to the Collections Administrator (Materials) (in the case of publications, before the date of publication so that the references to Survey material can be checked). In any publication referring to this material acknowledgement must be made that the Director, British Geological Survey, NERC gave permission to make use of the material, and a copy of offprint of the publication must be sent to the British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, NG12 5GG.

8 Application by a research student should be *through his* supervisor who will also signify his acceptance of these conditions.

9. Initially the loan period is for twelve months.
This may be extended on application to the Collections Administrator either at the time of the issue of the loan or during the first 12 months. On the expiry of the loan period the relevant material should be returned to BGS together with the results of the investigation.

On approval of the application the completed form will be placed, together with a receipt for the specimens, on the relevant borehole file. Photocopies will be issued to the applicant and the Head of Unit concerned The British Geological Survey (BGS) is the custodian of extensive collections of records, materials and data pertaining to the geology and hydrogeology of the UK, its continental shelf and many countries overseas. Its staff are engaged on wide ranging survey and research activities and provide an unmatched reservoir of both scientific expertise and local geological knowledge . These resources are available for consultancy purposes, research studies and general advice, providing charges are met for specific services.

Charging policy

The charges covered here are largely standard charges for one-off enquiries; consultancy rates are the subject of negotiations or quotes for more extensive staff involvement or use of resources. The rates are based on the cost of the staff time involved in retrieving, collating, copying and evaluating data. For information derived from collections, charges embody a levy as a contribution to maintenance costs.

In the main, charges are levied for the inspection of borehole core, rock samples and fossil specimens in the reference collections and the supply of samples. There is a standard rate for the provision of geological or hydrogeological advice, bibliographic literature searches or the interpretation of data. This includes the supply of value-added information arising from the BGS's examination of material received from elsewhere.

No charge is made for dealing with simple enquiries about the availability of information, services and products. Specific requests which involve much searching and retrieval of data from indexes or collections are subject to charge.

Material Collections

Borehole core and specimens

a) Inspection fee. A charge of £50 (+ VAT) is made per person per day plus £25 (+ VAT) for each pallet of boxed core examined or £10 (+ VAT) for each tray of selected material or cuttings retrieved from storage

b) Samples. Subject to certain conditions, samples of borehole material may be taken away for analysis or testing, for which a charge of £12 (+ VAT) per sample is made to cover the cost of supervision, cutting, bagging and labelling. Despatch by post or carrier is extra.

Charges, with the exception of photo-coping and postage, will be waived where the work carried is purely for academic purposes.

To be completed by applicant

Name of Borehole

BGS Registered Number of Borehole *(if known)*

Depth (or Range of Depth) of samples

Registered Number of Specimen (where the samples are taken from Registered Specimens)

Geological Formation or rock body represented by samples

Research topic and purpose of research (incl. Name of any sponsoring body)

To be completed by applicant

I apply for the samples, as detailed above, to be made available to me and I agree to all loan conditions. In the event of my being unable to carry out the research indicated I will discuss with BGS suitable disposal of the samples issued.

Name (block capitals)

Organisation

Address of Organisation

Position held in organisation

Signed **Date**

Supervisor's signature (where applicable)

Please return completed form to:

Collections Administrator
NGRC
BGS
Nicker Hill
Keyworth
Nottingham NG12 5GG

COMMERCIAL IN CONFIDENCE - FOR BGS INTERNAL USE ONLY

CONFIDENTIALITY OF BOREHOLE RECORDS AND SITE INVESTIGATION REPORTS

Please note: This is a guide to some of the major sets of data and should not be considered as a definitive listing.

All confidential records deposited in the National Geological Records Centre (NGRC) should be clearly marked 'Commercial-in-Confidence' and be accompanied by documentation showing the owner/donor and the release date. No data should be deposited in the NGRC with an unlimited confidential status. Leaflets are available for distribution to outside bodies which describe conditions of deposit and confidentiality. Ideally if records must be kept confidential then short periods should be negotiated. All the records kept in the Records Centre are treated as Public Records and will normally be released after 30 years. However, staff **must not** undertake to release data themselves. Any release must be carried out by NGRC staff using the correct procedures. When trying to obtain release of confidential data NGRC staff have on-line company search facilities that can help in contacting the originators.

Major data sets or company donations:

1. Hydrocarbon borehole logs (onshore):

- All current hydrocarbon (oil and gas) bores are drilled under the jurisdiction of the Department of Trade and Industry. Borehole data are normally released after 5 years unless further periods of confidentiality are requested. However a borehole is not released until it appears in listings produced by the DTI or ERICO Data Services who are their agents. The listings of released bores are held by the Records Section.

- Hydrocarbon boreholes drilled before 1966 are not covered by the same legislation and a large number are still partly or wholly confidential. These bores are released at the discretion of the companies concerned. Check with NGRC staff for details of individual bores.

2. Motorway and road investigations:

- All boreholes and related test data for Department of Transport/Highways Agency road schemes are released. This includes all trunk road schemes where local authorities are contracted to work on behalf of the Agency. The interpretative sections of the site investigation reports are held confidential for 10 years from the date of preparation of the report.

- All other site investigations for roads are treated individually.

3. British Coal/Coal Authority borehole and opencast records including those produced by licensees:

The following are **released**:

- All boreholes and shaft sections drilled prior to 31 December 1974.
- All boreholes and shaft sections drilled between 1 January 1975 and 30 October 1994 and which lie outside licence areas as at 30 October 1994.
- All boreholes and shaft sections drilled prior to 31 October 1994 which were released from confidentiality by agreement with British Coal i.e. all underground bores and shafts.
- All boreholes drilled from the surface to depths of less than 300m prior to 31 October 1994.
- Records of boreholes and shafts drilled on or after October 1994 provided by CA from sites which lie outside licence areas, unless otherwise directed by CA.
- Records of opencast borehole data provided by CA from sites which lie outside licence areas.

The following are confidential:

- Records of boreholes and shafts drilled on or after October 1994 from sites which lie inside current licence areas.
- Records of opencast borehole data provided by CA from sites which lie inside current licence areas.

Where the confidentiality status of a borehole is based on licence agreement areas NGRC staff will establish the confidentiality with the Coal Authority on an individual case by case basis.

The status of records for a site shall be changed from confidential to open file on relinquishment of the licence, subject to agreement of the licensee.

4. The data from all PSA boreholes are released, however the reports are all currently still held confidential.

5. All bores drilled for British Gypsum and the CEGB or its successors (National Grid, PowerGen etc.) are confidential.

6. British Steel ironstone bores in Northamptonshire, Leicestershire, Warwickshire, Rutland and Lincolnshire are released. Other areas should be treated individually.

7. All data from Exploration Associates is confidential unless released by their clients.

8. All data from the following site investigation companies HJT Solmek, MD Joyce, May Guerney and Johnson Poole & Bloomer should be treated as confidential.

9. The interpretations and recommendations contained in site investigation reports are normally not released because the copyright is considered to belong to the authors of the report.

10. All other records are dealt with on an individual basis.

Any problems or queries on the confidentiality of data should be referred to the Records Officer.

R.C.Bowie Records Officer, NGRC 8 April, 1999

NGRC Drillcore Receipt Form

DRF No.

Officer Respossible to complete Section A; Core Store Staff to complete Section B

Section A

Officer Responsible

Ext. No.

Borehole Name

QS/Num/Bsuff

Grid. Ref./ Lat.Long.

Depth Range

Units

Date Drilled / /

Confidential Y / N

Comments (incl. Donating Co.)

Section B

Material Type	Container Type / No.					
	Single	Double	Multiple	Tubes	Bags	Other
Core						
Cuttings						
Bulk						
U4						
Sample						
Other						

Storage Location

Date Received / /

Comments

Database Updated / /

By

Please return completed form to Chris Wheatley (N023)

BGS BOREHOLE MATERIAL ACQUISITION POLICY

1 MISSION STATEMENT

The British Geological Survey (BGS) undertakes to carry out the following:

- To assemble for permanent retention a representative collection of borehole material
- To maintain the collection in good order, under secure conditions
- To allow access to the collection by any bona fide enquirer (subject to confidentiality)
- To allow the removal of material from the collection (subject to availability) for the purpose of carrying out further investigations
- To maintain up-to-date indexes to the data held.

2 GENERAL

The BGS has been acquiring borehole material for over 150 years and the present collection represents a unique national resource. The material has been acquired through three routes:

- Boreholes drilled by the BGS in furtherance of its investigations into the geology of the UK
- Boreholes to which BGS has right of access by Acts of Parliament
- Boreholes drilled by outside organisations and donated to BGS.

3 POLICY

3.1 Temporary Custody

BGS will consider having temporary custody of borehole material where, for the purpose of a contract or project, an ability to examine, log or sample this material on BGS premises would be beneficial (scientifically and/or financially) to BGS. Normally, temporary storage is subject to a maximum holding period of 12 months.

BGS may also rent out space in its storage facilities on terms agreed to cover the costs of storage and the use of other facilities. The terms of such storage will also cover access, removal, disposal or transfer of ownership to BGS after a specified time of the stored material.

3.2 Permanent Custody

3.2.1 General

Material offered for permanent custody must offer a contribution to the geological knowledge of the UK. All material offered to BGS will be subject to consideration by the BGS Borehole Material Review Panel (BMRP) who have executive powers over the choice of material to be retained. The exception to this is material recovered from boreholes drilled for hydrocarbon exploration/extraction which is the subject of automatic retention.

3.2.2 Data

Any material offered for permanent custody must be accompanied by full documentation relating to the material. This will include:

- full spatial reference
- full suite of the available logs
- administrative details e.g. date drilled, operator, inclination, azimuth etc.

In addition, the material itself must be marked with depth intervals from a specified datum point.

3.2.3 Ownership

All borehole material supplied becomes the property of BGS once the operator has agreed that the BGS should become permanent custodian of the material.

3.2.4 Confidentiality

BGS will encourage the release of all material donated for permanent retention. Where the release of such material is not in the immediate commercial interests of the operator a mutually agreed date for the release will be negotiated. However, this must be for a maximum of ten (10) years from the date the material is donated to BGS. Open-ended confidentiality is not acceptable. The exception to the 10 year limit is material covered by legislation; e.g. hydrocarbon boreholes.

Individual BGS geologists may not enter into agreements without reference to the BMRP.

3.3 Disposal of Material

3.3.1 Newly donated core

If the BMRP rejects the material for permanent curation or accepts specific intervals only, the BGS will inform the operator and agree a procedure for disposal of the excess material.

3.3.2 Core in permanent storage

If material in permanent storage is to be disposed of (either through being poorly documented or being replaced by new acquisition) the BGS will, where possible, contact the original operator to agree on the disposal of the unwanted material.

3.3.3 Aid to teaching/research

Core that is not accepted for permanent retention or is being removed from permanent storage may, with the agreement of the operator, be offered as teaching/research aid to educational or academic organisations.

3.4 Access to Material

All material held as non-confidential will be available to any bona fide research or commercial body.

For material held on a confidential basis BGS staff and the original owner **only** will be allowed access while the material is confidential.

However, all organisations will be charged for the use of BGS viewing and sampling facilities, the rates dependent on the nature of the organisation and the investigation being carried out.

Reference No.

APPLICATION FOR CURATION OF DRILLCORE/BOREHOLE DERIVED MATERIAL.

This form should be completed by the person requesting curation and the appropriate group manager, and then returned to the Collections Administrator.

Borehole name:

NGR: 100km Square: Easting Northing

Latitude & longitude Lat. Long.

BGS Registration Number: Quarter Sheet Number Suffix

Depth range of material: Top / Base / Metres (✓) Feet

Date Drilled: / / (Day / Month / Year)

Ordnance Datum: Log available (✓) Yes No

Confidentiality (✓): 0 1 3 5 7 8 9

Officer Requesting Curation:

Extension number: Group:

Give reasons for retaining this material:

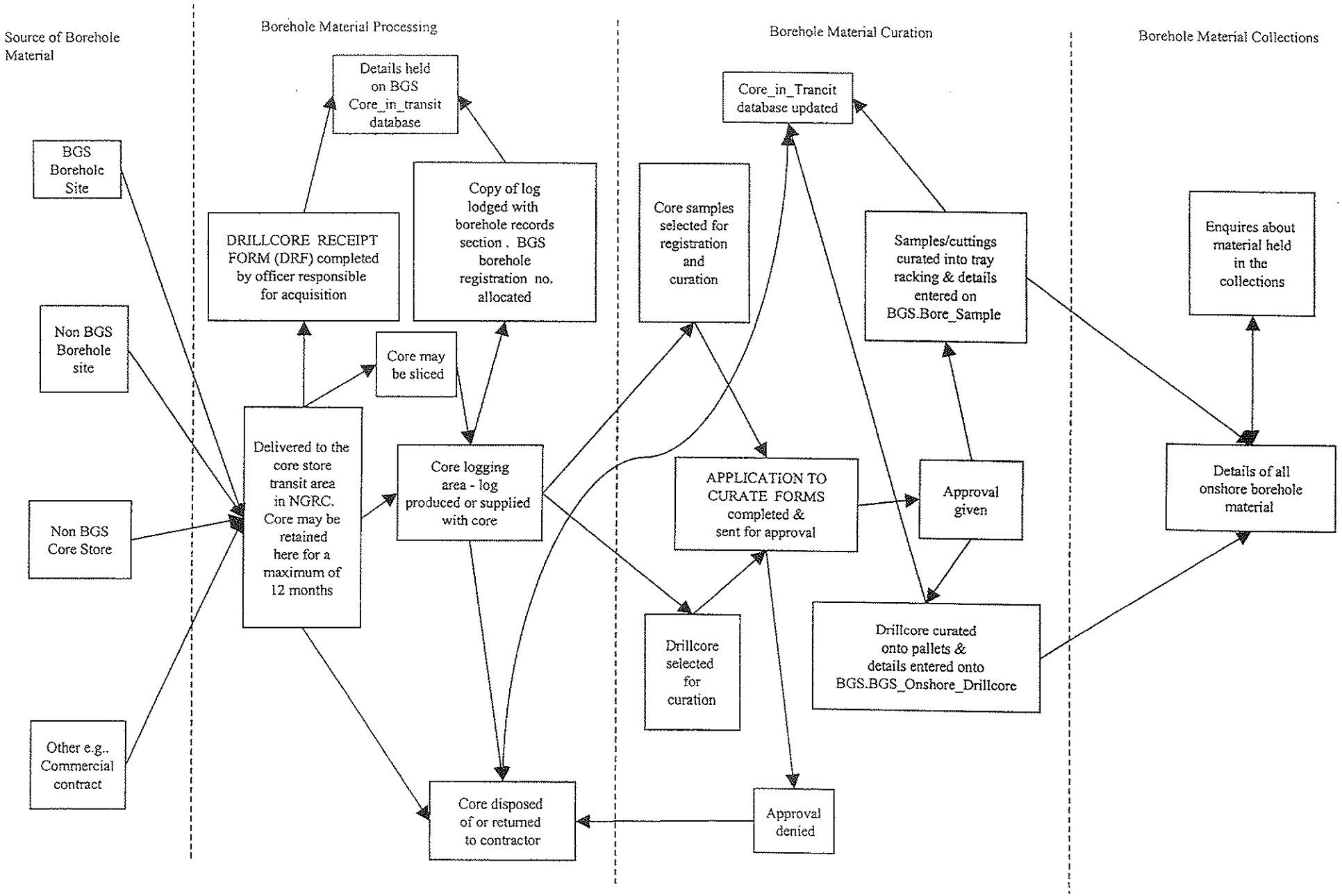
Please continue on a separate sheet if necessary

Group manager's signature:

Collections manager's comments:

Curation approved

Date: / /



Users guide to borehole Material Processing

3. The Palaeontological Collections (Keyworth)

3.1 Introduction

The BGS Palaeontological Collections are arguably the most important collection of British fossils in the world. While they are not as numerically large as those of the Natural History Museum, London, they are almost exclusively British and because of their integral association with the Survey's 160-year-plus history of mapping British geology they are the fundamental biostratigraphic basis for the geological maps which provide the framework for almost every geological endeavour in Britain. Further, unlike many collections, because of the way they are registered and stored, they retain a sense of the total assemblages collected at a locality and so provide an insight into the palaeoecology as well as the biostratigraphy.

The first collector on the staff was Richard Gibbs who joined in 1843. The following year saw the appointment of Edward Forbes as the first to bear the title Palaeontologist, even though the famous John Phillips was already in post at that time. Gibbs collected many thousands of specimens in the course of his 29 years of service and was followed by a succession of collectors about whom we know very little and can only admire their diligence. Forbes himself was followed by a list of eminent palaeontologists including John Salter, T.H.Huxley (Darwin's Bulldog), Robert Etheridge, and latterly C.J.Stubblefield.

However, because the collection has been amassed though donations as well as by the Survey's own efforts, some parts of it predate the Survey itself For instance, of the many important collections which have been absorbed, the thousands of British Fossils from the Geological Society of London Collection, received in 1911, include many of the specimens figured and described by Murchison in his *Silurian System,* published in 1839, but clearly collected before the Survey's founding in 1835.

The collections include tens of thousands of type, figured and cited specimens of international scientific importance. As a result they attract a steady flow of visiting palaeontologists from both home and abroad, and a constant flow of enquiries and requests for the loan of specimens for comparative purposes.

Palaeontological collections must have existed when the Survey was based at King's Court, but the first well documented arrangement was when they were housed in the Museum of Practical

Geology, Jermyn Street, London, from about 1849 until the building of the Geological Museum in London in the 1930s. Meanwhile parallel collections were housed in Edinburgh and in Dublin by the Scottish and Irish Surveys and with the establishment of the Leeds office in the 1960s much of the Carboniferous was transferred from London to Leeds. As a result, while following a general scheme, each office developed an idiosyncratic approach to the registration and storage of the collections which is reflected in the collections now at Keyworth and Edinburgh. The Irish Survey collection has, for the most part, passed to the Geological Survey of Ireland in Dublin although type material long-recognised as part of the Museum of Practical Geology Collections has remained with the BGS Collections to avoid confusion.

It is important to remember that the collections at Keyworth include some material from Scotland, and that the collections held in Edinburgh similarly include material from England and Wales, especially from the northern counties of England.

3.2 Collection size and content.
The collections at Keyworth, while effectively aspects of a whole, are stored in three areas. It must be remembered that these three parts of the collection are intimately related.

3.2.1 The Type and Stratigraphic Collection is housed in P block. It comprises approximately a quarter of a million mainly macro-palaeontological specimens of museum quality. Many thousands of these are type, figured or cited specimens of international taxonomic importance, the remainder are specimens selected for their quality as comparative material or for some other character such as an unusual occurrence. The specimens are stored in 195 cabinets which are arranged stratigraphically, the Palaeozoic being on the ground floor and the Mesozoic and Tertiary on the first floor. Within each cabinet, specimens are arranged taxonomically wherever possible in accordance with the Treatise on Invertebrate Paleontology. However, the approach to this arrangement is flexible so that, for instance, the Pleistocene is arranged by county and then by locality because this suits Pleistocene workers. Every specimen is accompanied by a series of labels giving details of its locality, stratigraphy and history.
This is the collection from which palaeontological material was selected in the past for exhibition in the Geological Museum in London and for that reason it is still sometimes known as the Museum Reserve or MR. For this reason also, it includes specimens which we would not now consider accepting into the collection: large vertebrate specimens, for instance, which are of comparatively little biostratigraphic use and which require specialist curation and conservation but which were essential to museum displays in the past.
Several years ago, about two-thirds of the Scottish equivalent of this collection were transferred to Keyworth and are now housed alongside the London-Leeds collections, but remain separate. The other third, largely one particular donation, is still housed in Edinburgh. Significant palaeontological specimens selected from the Borings Collection are incorporated into the Type and Stratigraphic Collection.

3.2.2 The Survey Collection, some two million specimens collected during mapping, is stored in about 30,000 trays on the upper two levels of the Core Store racking area. It is arranged and indexed by specimen number. Specimens are closely packed in the numbered trays, but because specimens from a particular collection made at a particular locality are registered consecutively,

a suite displaying a collected assemblage can be quickly retrieved for examination. The first trays in the numerical series happen to contain specimens collected by Richard Gibbs, the first collector, in 1864, close by are specimens collected by Gibbs with another early collector, J.C.Gapper, in 1854.
Many specimens in this collection are equal in quality to those in the Type and Stratigraphic collection, but would add nothing to that collection by their inclusion. Many localities which are no longer accessible are represented by suits of specimens in this part of the collection.

3.3.3The micro-palaeontological part of the collections, in excess of 200,000 slides, is mostly housed in cabinets in H block. There are many type, figured and cited specimens within this part of the collection. Registration and retrieval are similar to the macropalaeontological collections.

3.3 How to access the collection.
The key to accessing any part of the collection is the unique alpha-numeric number which each specimen, slide or sample bears. A summary of this is included as Appendix 3.x.
Armed with the specimen number, it should be a matter of only a few minutes work to find the register entry with all the known detail of the specimen, and to locate the specimen irrespective of which part of the collection it resides in.
The collections are indexed by locality, that being historically the unit of prime importance in mapping. Several generations of locality index cards are stored with the Type and Stratigraphic Collection in P block, but these are gradually being transferred to a database, Oracle table BGS.NEW_REGISTRATION stored on the Keyworth Oracle server, KWDB. Newly registered material is entered onto this database as a matter of course and no new cards are being made. An entry in the database will tell the enquirer most of the basic information about a suite of fossils: locality, horizon, where in the registers to find the details, who collected the material etc. Every specimen should be covered, even if only in enough detail to guide the user to the appropriate register. The register remains the prime record because it includes the identification of the specimens and often detailed conclusions which can at best be summarised in the database.

Because of the history of the collections, several sets of registers exist. The original London registers tend to have a stratigraphic arrangement so that any particular register is more likely to be Palaeozoic or Mesozoic in content, for instance. Once the Leeds office was established, a new set of registers was initiated there based on the geological one-inch sheet number (now 1:50k, of course). In consequence, some specimens are actually recorded in more than one register, and additional details may not have been added to all, so it may be important to check all possible entries. The database will guide the user to these.

The tray storage in the Core Store is indexed in the Oracle table BGS.PAL_TRAYS on KWDB, a simple listing of tray contents against tray numbers.

Conclusions already derived from the collections will be summarised in the WH series Technical Reports (previously Pal. Reports) generated successively by the Palaeontology Dept., Biostratigraphy Group and latterly the Basin Analysis and Stratigraphy Group. These should be listed in the various library and NGRC databases and both sequential and sheet-organised sets are retained with the paleontologists whatever their current group name.

The simplest way to access the collections is to ask a palaeontologist, usually the Curator (currently Steve Tunnicliff, who will be familiar with the complexities of the system.

3.4 How the collection can be used

The collections provide a valuable biostratigraphic resource for any new or proceeding project. It is recommended that a Survey field geologist embarking on a new mapping project should ascertain with the palaeontologists' help, what has previously been collected in an area. As long as the data has been entered, the spread of existing collections in an area can be usefully summarised on a map generated from the database: appendix 3.xx. If the data has yet to be entered it can be made a priority as part of the project.

Once it is clear that there is material in the collection from a mapping area, the collections can provide a useful insight into the likely fossils and fossiliferous lithologies which will be encountered and whether it will be worth the mapper making further collections or asking the palaeontologist to do so. This can help focus palaeontological and biostratigraphic efforts in problem areas: there is little point recollecting where adequate collections already exist.

Members of staff are urged to become aware of the potential of the collections and are encouraged to make as much use of them as possible. Comparatively little in the macro-fossil collections is of a confidential nature and access to the micro-palaeontological collections, which do include some confidential material, will be controlled by a contact within Basin Analysis and Stratigraphy.

3.5 How to add new material to the collection

Survey palaeontologists will not normally identify and report on material which is not registered into the Surveys collections, or into some other recognised institutional collection. The only way to ensure that results can be checked is to be able to find and re-examine the specimens. Any fossil specimens collected in the course of an officers duty are effectively BGS property and if of any significance should be registered and stored as part of the Palaeontological Collections.

Each officer should be issued with a unique three-letter collecting symbol and a book of numbers up to 10,000 to be used exclusively for fossil material. These symbols and books are allocated by Sue Martin (NGRC) to ensure that there is no duplication of specimen numbers between different collections: so although an officer may hold two symbols, one for fossils and one for rocks, these should be different and no two specimens within BUS should bear the same number. When the symbol is issued, a book of collecting sheets (sometimes referred to as Blue Sheets for historical reasons; appendix 3c) will also be issued with a set of instructions (appendix 3d). Before any specimen or sample is accepted into the Palaeontology Collections, it must be numbered by fixing the paper number from the number book directly to the specimen or to the sample container using an appropriate adhesive normally a PVA based adhesive. If in doubt about the adhesive to use, or the procedure to follow, an officer should seek advice. Every specimen should be numbered: the number relates to a specimen, not a locality or collection. If several specimens are submitted under one number, the collection will be rejected and returned to the officer for correct numbering. All the necessary detail should be filled in on a collecting

sheet. Only specimens from one 1:50k geological sheet should be entered on a sheet; if the collection covers more than one map, then extra collecting sheets should be started.

The minimum detail required is as follows: the first and last specimen numbers in a suite, a precise verbal description of the locality, the county, the geological 1:50k sheet number, the national grid reference, preferably to at least eight figures after the preceding two-letter code (e.g. 5K 1234 5678) and the Ordnance Survey 1:10k sheet (e.g. SKI5NW). Any known stratigraphy should be included, but it is accepted that this may be why the specimen has been collected and that this detail may therefore be limited. Finally, and importantly, a project code should be included with a project leaders signature or initials. The time taken to register and store your specimens will be charged to your project as well as the time a paleontologist takes to determine the fossils and to report on them. If no project code is included, it is likely that the specimens will be returned to you.

On receipt the fossils will be registered in one of the current registration volumes (appendix 3e). The specimens will be frayed in numerical order and stored in the Core Store until called for by the palaeontologist for examination and after use will be returned there for permanent storage.

3.6 Future developments

The most important future developments are likely to be in the area of databasing. Eventually it should be possible to find details of every individual specimen in greater detail than it generally is now but the backlog of data to be entered is such that this goal is still many years off. In the sorter term, the complete transfer of the card locality index should enable swift retrieval of essential information on what material exists. Increasingly this data will be linked to other biostratigraphic and geological databases.

Appendix 3

3a

BUS Palaeontological Collections numbering system

3b

Fossil localities printed upon a geological and topographical background for Sheet 1:50k 204 (Biggleswade). Generated from the database table BGS.NEW_REGISTRATION.

3c

A collecting sheet or "Blue sheet"

3d

Instructions to collectors

3e

A page from a recent register

Palaeontology Collections

Procedure to be followed before fossils are handed in to the Palaeontological Collections.

1 A number book will be supplied for each collecting symbol. These numbers must be used *for fossils only.*

2 If the pre-printed number cannot be used for some reason, the symbol and number should be written on archival paper in *black Indian ink* NOT with "Biro" or felt-tipped pen because these can smudge or fade.

3 Each individual specimen or sample should bear a separate number which should be affixed, where possible, so that no part of the fossil is obscured; it is helpful if counterparts of the same fossil are given adjacent numbers. A PVA based adhesive is recommended; if in doubt, please consult the Curator. Small specimens should be placed **in** corked tubes or lidded containers, the number being loose within the tube or container, not attached to the lid. Suitable containers are available from the Curator on request.

4 Microfossil samples should be placed in clean plastic bags, sealed and then treated as macrofossils. Where a sequence (e.g. peat samples) is being collected, the specialist palaeontologist should be consulted on the size and frequency of samples and other factors, such as whether the sample should be allowed to dry.

5 A specialist palaeontologist will always be glad to advise on the numbering of friable and difficult material.

6 The collecting sheets, which for historical reasons are known as "blue sheets', should be submitted (see attached example) with the fossils and should be filled in bearing the following in mind:

(a) The nature of the exposure (e.g. quarry, cliff-section) must be specified and temporary exposures (e.g. post-holes, opencast mines) specified as such, if specimens are collected loose, this must be clearly noted. If possible, relate the collection to a "marker" horizon as the apparent tops and bases of sections and quarries may change with time. An eight figure National Grid reference plus the index letters should be given wherever possible (otherwise a six-figure reference) together with the compass bearing and distance in meters from some permanent feature *named* on the Ordnance Survey 1:50,000 map (e.g. a trig point on a named hill, or a farm). It is helpful if the point of reference is on the same Ordnance Survey 1:10,000(6-inch) sheet. In some areas a note of the parish is useful. With small, temporary sections two such references, with an angle of intersection as close to 90 degrees as possible, are desirable. *It is important that the permanent feature used to describe the position of the locality be a fixed point marked on the 1:50,000 map as this is used in indexing Localities so that data can be retrieved later.*

(b) Geological Survey sheet number.

(c) Ordnance Survey 1:10,000(6-inch) sheet number and the name of the county in which the locality lies must be supplied. If the locality lies in a different county to that of the feature from which bearings are taken, this must be made plain.

(d) Material from different Geological Survey 1:50,000 sheets must be entered on separate pages.

(e) All specimens from a single locality should be numbered in one consecutive sequence of numbers. If fossils are collected from several horizons or beds in an exposure, the numbering of the specimens should begin with those from the lowest bed and so on upwards. If possible, please give a measured section with lithostratigraphic detail and indicate any "marker" horizons.

(f) All specimens from boreholes should be submitted to the Borings Collections NOT the Palaeontology Collections, and Borings Collections numbers should be used. Borehole material should only be submitted to the Palaeontology Collections if the collector is advised to do so by the Borings Collection administrators. In that event, specimens should be numbered conventionally in order from the topmost cores downwards and the depths recorded on the collecting sheet.

(g) Distance from shaft bottom or adit entrance should accompany fossils collected underground.

(h) It is not necessary to use a separate line on the collecting sheet for each of a group of specimens from the same locality; the first and last of a sequence can be shown thus:
DJ 419 1-4232.

(I) Collecting sheets must be signed by the Project Manager before they are handed with the specimens to the palaeontologist or biostratigrapher. The Project Manager should indicate whether this represents a request for (a) identification and reporting or (b) that the collection is for registration and storage only. He should also record the project number. N.B. Time spent registering the collection will be recorded against that project.

7 The collecting sheets are the permanent primary documents for reference in case of doubt or difficulty, and the specimen number is the key to the information they contain. Every care should be therefore be taken when they are filled in to ensure that they are accurate, clear and legible. More detail is better than scant information and sketch maps may be included. The information on the collecting sheet will be transferred to Palaeontology Collection registers, and to the databases and other indexes, but the person doing that job may not be as familiar with an area or its geology as the collector: a few extra moments taken in filling in the sheet may save much time and thus improve the service which the biostratigraphers can provide.

8 Collections and collecting sheets which are inadequately documented or which have not been approved by a Project manager may, at the discretion of the Manager of Basin Analysis and Stratigraphy Group, be returned to the collector.

The Biostratigraphers in Basin Analysis and Stratigraphy Group would be glad to discuss the most useful material to collect and would welcome the opportunity to show collectors relevant material already in our collections and to demonstrate how the information supplied by collectors is processed.

Steve Tunnicliff
Curator, Palaeontology Collections
British Geological Survey

10th May. 1999

BIOSTRATIGRAPHY AT BCS
NOTES FOR NEW TMOS PERSONNEL

Biostratigraphy Staff

The BGS biostratigraphers are accommodated at Keyworth on the ground and first floors of N block, and on the ground and first floors of P block. The current staff (part of the Basin Analysis & Stratigraphy Group) and their specialisms (in stratigraphical order) are as follows:

Mark Williams (P008)
Lower Palaeozoic macro- and micropalaeontology

Stewart Molyneux (H115)
Lower Palaeozoic palynology

Nick Riley (H114)
Carboniferous macro- and micropalaeontology (and Manager of the Basin Analysis and Stratigraphy Group)

Mike Stephenson(H109)
Upper Palaeozoic palynology

Ian Wilkinson (H105)
Upper Palaeozoic, Mesozoic and Cainozoic calcareous micropalaeontology

Geoff Warrington (H103)
Triassic palynology

Mark Woods (P107)
Cretaceous macropalaeontology

Jim Riding (H119)
Mesozoic and Cainozoic palynology

Steve Tunnicliff(P009)
Curator of the Palaeontology Collections

Kerry Johnson, Jane Kyffin-Hughes and *Pauline Taylor* undertake the necessary micropalaeontological and palynological sample preparations, and assist with curation, as required.

Through their traditional role of identifying and providing stratigraphical interpretations for fossil material collected by TMOS personnel during field mapping etc, the biostratigraphers have considerable experience of working with rocks of a particular age from all parts of Britain; they

are therefore well equipped to advise on more general problems of classification and correlation within the range of their stratigraphical specialism. Advice concerning parts of the stratigraphical column or fossil groups not covered by the above list should be directed to the Group Manager *(Nick Riley; ext. 3431).* NB BUS-collected fossil material should not be sent to outside workers without consultation with him.

Starting work on a new project

When starting work on a new project, it is recommended that new TMOS personnel should introduce themselves to the relevant biostratigrapher, and establish a working relationship early on. Although staff time for biostratigraphers has to be paid for out of project funds, this should not preclude any preliminary discussions about possible involvement/assistance/advice. Funding for staff time will have to be negotiated between the TMOS project leader, TMOS group manager and the biostratigraphers' group manager (Nick *Riley; ext. 343!)* to whom all bids for staff time should be directed.

Sample collecting forms

You will be issued with a book of sample collecting forms, a book of specimen numbers, and an advice sheet about how they should be used for fossil material. These will be issued by the Collections Administration Officer N.G.D.C, but any queries concerning these in relation to Biostratigraphy should be directed to *Steve Tunnicliff (ext 3517).*

What to collect and why

The main requirements are to collect only as much material as is needed to establish the identity of a particular stratum where there is doubt, and to ensure that there is enough material in the **BUS** collections (bearing in mind any material in the old collections) to support the stratal interpretation shown on the map. For example, there is no need to collect large numbers of brachiopods from a stratum that is already palaeontologically well characterised and whose brachiopod fauna is well known. However, at palaeontologically poorly known horizons, a comprehensive collection would be appropriate. Of course, there will be exceptions, and it is best to discuss individual collecting needs/requirements with the relevant biostratigrapher.

Biostratigranhv Collections

All fossil material collected by officers of the Survey since 1835, as well as donated material, is cared for by the BUS biostratigraphers, together with the associated paper archive. The Type & Stratigraphical collection of macrofossils is housed in museum-type accommodation in P block. This collection includes all the BUS type, figured and cited specimens as well **as** other

representative fossils, arranged stratigraphically. You may find it useful to browse through the drawers of specimens ~n order to gain some insight before starting work in a new area or on an unfamiliar part of the stratigraphical column. All other macrofossil specimens (the so-called Survey Collection) are housed in the NGRC. Microfossil specimens and palynology slides are housed in H block. All enquiries concerning the macrofossil collections should be directed to *Steve Tunnicliff (ext. 3517)* or the relevant specialist; all enquiries concerning the microfossil/palynology collections should be directed to *Nick Riley (ext. 3431)* or the relevant specialist.

7/99

Additional notes

Registers etc.:
London Registers, Leeds/I: 50k Registers etc. etc. housed in H-block
GSM, USE, GSL Registers housed in P-block
Oeol. Soc. Registers housed in P-block
Purchase & Donation Books in H-block
Old Survey Registers housed in H-block (some currently in SPT's room)
MPG 1865, 1878 and MS catalogues in P-block
Loans data is generally in P-block, but should also be databased.
Notes on Curation Procedures (i.e. the correct way to do things!) etc in lower drawer of two-drawer filing cabinet on bench just inside Curator's Room, P-block.
Many and various old documents, letter books, notebooks, catalogues etc. In Curators Room P-block.
There should be no need to resort to the card/paper symbol indexes which are both now out of date having been superseded by the digital version (see above).
There should, in theory, now be no need to add anything to the card locality index all should be being databased.

Useful References:
Guidelines to the Curation of Geological Materials; Geol. Soc. Misc. Pap. 17, 1985
Conservation of Geological Collections, ed. R.E.Child, Nat. Mus. Wales, 1994
The State & Status of Geology in LX Museums; Geol. Soc, Misc. Pap. 13, 1981
Standards in the Care of Geological Collections; Museums & Galleries Commission, 1993
Directory of British Geological Museums; Geol. Soc. Misc. Pap. 18, 1994
The Value & Valuation of Natural Science Collections ed Nudds & Pettit; Geol. Soc. 1997
The Geological Curator *passim*
Coprolite *passim*
Where is the Collection? Sherborne, 1940
World Palaeontological Collections; Cleevely, 1983

Remember:
The Kidston Collection is housed separately and is in its own set of catalogues in P-block. The specimens carry Kidston numbers with no prefix.
There are still some 1500 specimens on loan to Nat. Hist. Mus. mainly for use in their Earth Lab exhibit: details of these exist as paper and digital records.
If you can't find something but you know it exists, it is almost certainly because someone m the past was sloppy and took shortcuts or was careless. 100 years hence, people will bless you for taking the time to do the job properly, though no one will thank you now.
There are various unregistered but nevertheless important collections lurking in the store: you can only really learn, what and where by going and looking although many are databased in the tray storage system and registration database using cryptic V symbols, not to be confused with Z, Za, Zb etc

There may be other things but they don't spring readily to mind.

The following was added by the Curator who wrote the above. It was written after BGS Management decided that the expertise, experience and dedication was not needed to administer a collection of International importance and made the curator redundant. Time will tell!
Stuart Hollyer
Wednesday, January 26, 2000

These notes were prepared in June-July 1999 as part of a training course intended for new recruits to BGS, it is still essentially a draft and was not aimed at members of the group, but it gives most of the facts.[with additional notes appended at end 29.9.99]
Bear in mind that these systems are tried and tested over 160 years: tamper at your peril, it was done in Leeds and we have been picking up the pieces ever since.
Bear also in mind that a new Collections Supremo may think he/she knows better and insist on changes

BGS Palaeontological collections numbering system.

Every specimen should bear a unique alpha-numeric number and each has a register entry.

There are several series of numbers:

"Survey Collections" numbers usually appear thus on a white or blue rectangular label:
SPT 1234. Scottish Collections may appear thus: 16E 1234.

"Museum Collections" numbers are usually on an oval white label thus:
GSM 12345, GSL 12345, GSE 12345
If only a number appears on a white oval label, assume the prefix "GSM"
NB that GSM 12345, GSL 12345, GSE 12345 are three different specimens NOT different ways of referring to the same specimen.

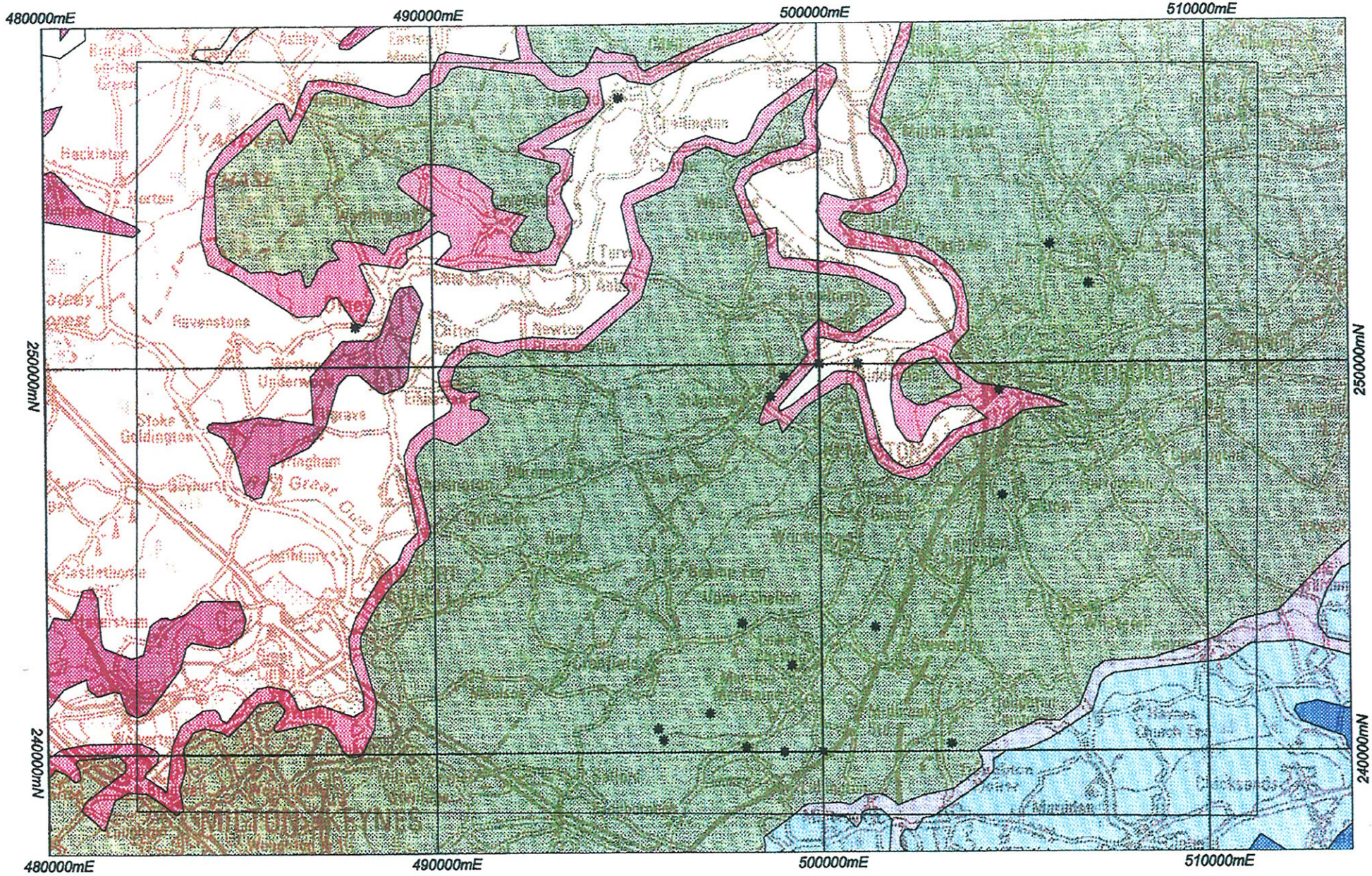
Geological Society Collection specimens are usually labelled thus: Geol. Soc. Coll. 1234. There are further series of Geological Society Collection specimens which carry the prefix GSa, Gsb etc.

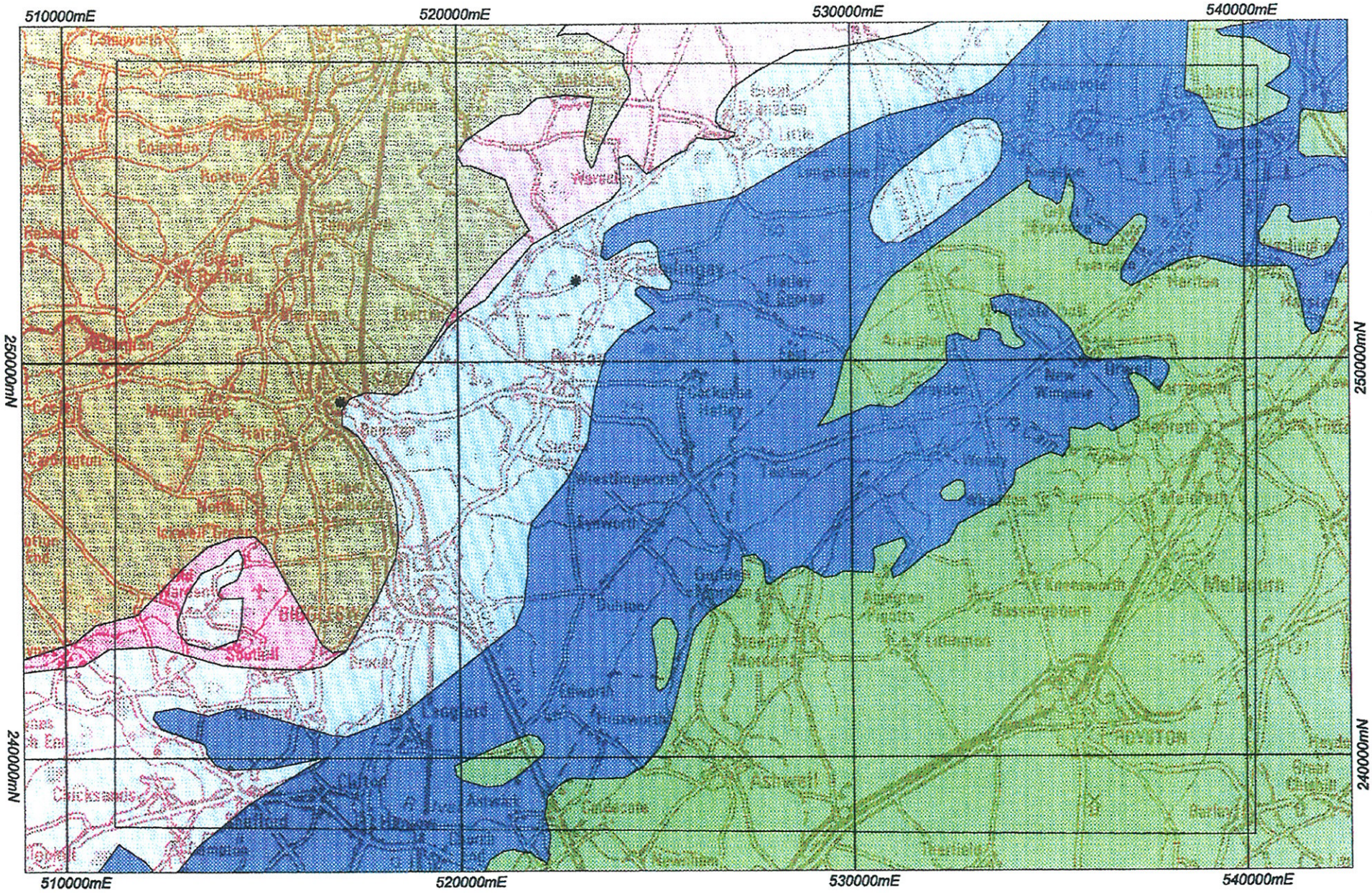
If a specimen still has only an old tablet number with it (e.g. VI 6/3 or similar) please ask for a new number to be allocated before referring to the specimen in print.

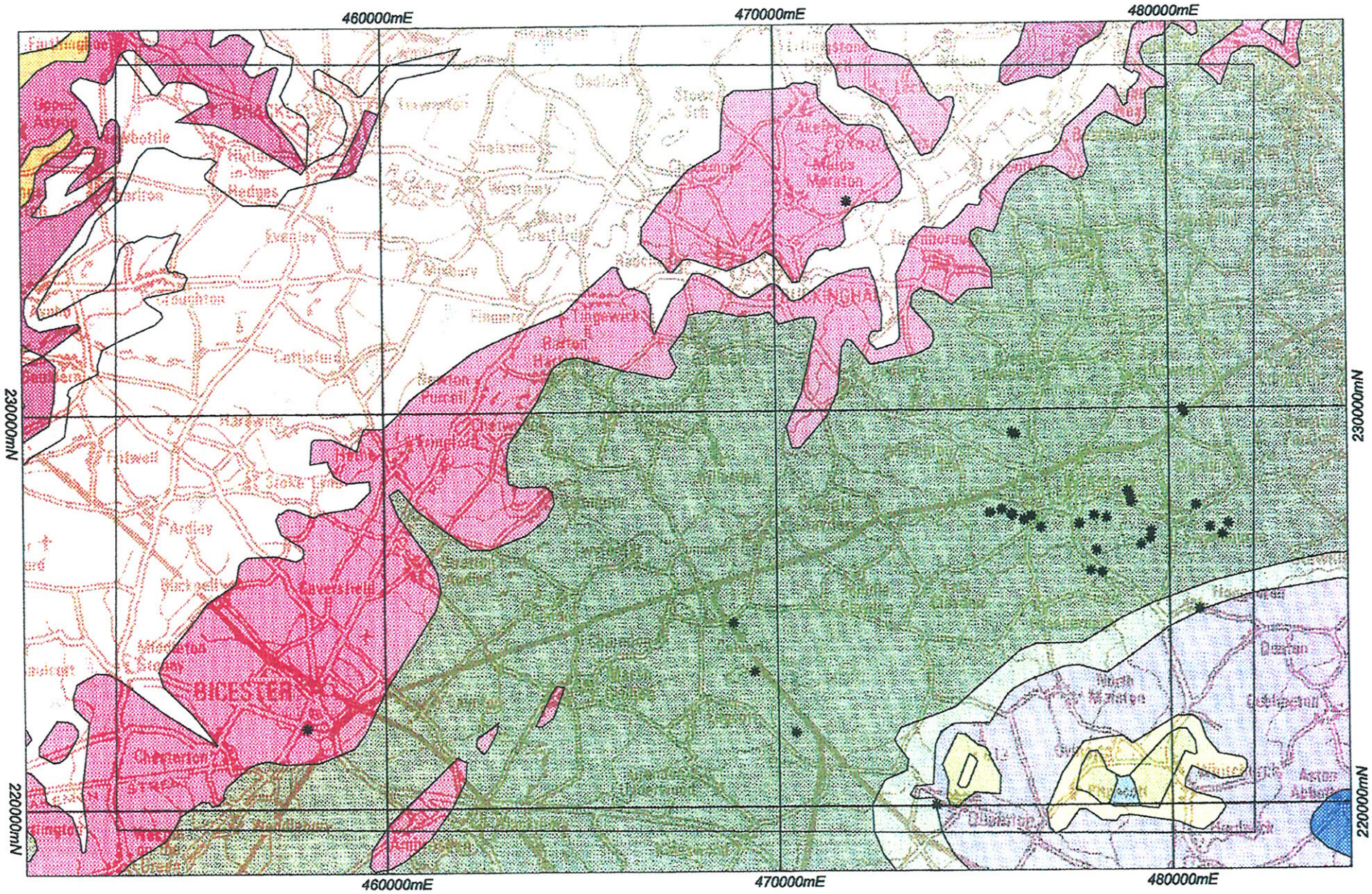
In publications, the preferred format for referring to BGS specimens would be:

BGS SPT 1234, BGS 16E 1234
BGS GSM 12345, BGS GSL 12345, BGS GSE 12345
BGS Geol. Soc. Coll. 1234, BGS Geol. Soc. Coll. GSa 1234

Following these guidelines should ensure no ambiguity of numbering.







British Geological Survey

Sample collecting form

For official use

Date (database/SRO) ....

Date (group/unit) ....

Sample destination

Biostratigraphy ☐ Min and Pet ☐

Other (please specify) ....

Submission date .... 1:50 k Geological map ....

Collector's name .... County/country ....

Project code .... Confidential ☐ Yes ☐ No Confidential samples must be recorded on a separate sheet

Fields indicated by shading must be completed

Original sample number		Additional sample number	Original sample type	Retained sample		NGR 100 km square	National Grid Reference		Precision	Sample elevation/ depth	Datum	Locality information	Geological description
Prefix	Number			Type	Stored location		Easting	Northing					

2
2451

GEOLOGICAL SURVEY FOSSILS

Collected by RA Waters JR Davies & JA Zalasiewicz Dec 1990

No.	NAME 24617	Destination	LOCALITY	FORMATION	
8694	Climacograptus normalis ; ?? Cl. cf. persculptus				D9 contd
8695	" " chapt.				
8696	Cl. cf. normalis frag.		✓		
	Coll'd JA Zalasiewicz Dec 1990				
J2 8697	?? Climacogr. normalis		Crag exposure immediately above	PD 90/392	D1
8698	Cl. normalis.		"upper leaf" of Carreg Gwynion Grits	Cwmere Fm	
8699	? Climacogr. sp.		480 m at 126° from Ciloerwynt Fm,		
8700	"		which is 10 km SW of Rhayader, Powys.		
8701	cf. Cl. normalis		1" - 179 6" - SN 86 SE (NE)		
8702	?? Cl. persculptus s.l.		NGR SN 8865 6268.		
8703	indet diplogr.		✓		
8704.	Cl. cf. normalis ?				
J2 8705	Dist Cl. normalis w1.3 2TRD 2.2		Crag exposure between the two 'leaves' of Carreg Gwynion Grit, 570 m at 131°	PD 90/392.	D2
8706	? frag C. cf. persculptus sensu Williams '83		from Ciloerwynt Fm, which is	Cwmere Fm	
8707	prox Cl. normalis w0.75 2TRD 1.6 (1.5')		1" - 179 6" - SN 86 SE (NE) NGR SN 8864 6260		
			✓		
J2 8708	? Cl. cf. persculptus		Roadside exposure ~ 10 m S of small roadside quarry, and 430 m	PD 90/392	P3
8709	" (prox)		at 137° from Ciloerwynt Fm,	Cwmere Fm	
8710	Cl. cf. normalis		which is ..... 1" - 179 6" - SN 86 SE (NE)		
8711	Gl. cf. persculptus sensu Williams		NGR SN 8853 6266		
8712	Climacogr. normalis		✓		
8713	? Climacogr. sp.				
8714	Glyptogr. cf. persculptus sensu Williams				
8715	" " ?				
J2 8716	??? monograptid fragment.		Crag exposure ~ 35 m south of base of main conglomerate scarp, 900 m at 040°	PD 90/392	D6A
8717	diplograptid frag		from Pen-car(-mawr), which is 5 km NE of Abergwesyn, Powys.	Cwmere Fm	
8718	cf. Atavograptus sp. w0.7 2TRD 3.0 cf. A. atavus.		1" - 196 - 5" - SN 85 NE (SE) NGR SN 9000 5640		

4. The Petrological Collection (Keyworth)

4.1 Introduction

This workshop aims to provide an introduction to the BGS petrological collection housed at Keyworth. These once formed an active part of the onshore mapping programme and other BGS activities, but have recently been little used. Nevertheless, they remain as a major corporate resource that, with the development of the petrological collections database (Britrocks), may provide an integral part of future Core activities as well as becoming readily available to external clients.

Since its foundation in 1835, to the present day, the British Geological Survey has built up extensive collections of petrological samples (rocks, minerals, thin sections). These were from the start intended to serve the dual purposes of preserving samples collected during active geological surveying and providing reference specimens of economic and academic importance. For this purpose, the Survey had its own museum. The original Jermyn Street museum, opened in 1848, was superseded in 1933 by the Museum of Practical Geology, South Kensington, London, where the collections were preserved and displayed.

In 1985, the BGS moved from its premises in the Museum of Practical Geology to a new base at Keyworth, near Nottingham, while the museum itself passed into the ownership of the Natural History Museum (NHM) and now houses the NMH's Earth Science galleries. Some of the former BGS collections remained with the museum and form part of the NHM collections. As a result, the Survey 'gave up' its valuable collections of economic specimens, gemstones, minerals and building stones. However, all was not lost. The BGS retained major reference collections which now hold more than 200,000 specimens. They are housed at the BGS offices at Keyworth and at Murchison House, Edinburgh, together with smaller collections at the Exeter office and under the care of the Geological Survey of Northern Ireland.

The BGS petrological collections are kept both for reference and as a resource for future investigations. They remain as active repositories available to samples from all BGS activities and also for donations of high quality samples. They provide a basis for detailed petrology studies and characterisation of the UK landmass, in that they represent the solid evidence for the BGS's maps. Material from surface outcrop in all parts of the country is supplemented by samples from boreholes and quarries. Many of the sites are no longer accessible. There are in addition collections of samples from BGS work overseas and on the continental shelf.

The first part of this presentation will be a brief outline of the principle collections at Keyworth:

- England and Wales Sliced Rocks
- The Reference Minerals
- The Museum Reserve Collection
- The Keyworth Building Stones Collection
- Miscellaneous private collections

There will be an introduction to accessing the collections via paper records and, in more detail, via the index-level database 'Britrocks'. This was set up in 1987, and is being populated to allow efficient curation and access to the collections. The presentation will discuss aspects of data standards relating to the collecting and registration of petrological samples in BGS as well as the process of registering new samples and retrieving material from the collections. Finally, there will be discussions of how to use the collections, how to register new material and the future development of the petrological collections.

4.2 Collection size and contents

In reality, there is no single petrological collection at Keyworth. Rather, there is a suite of collections as shown in Table 4.1.

Table 4.1. Petrological collections housed at Keyworth.

Collection	Number of samples	Sample code	Description	Thin section	Active	Form of database
England & Wales sliced rock	73,000	E	Rock samples collected during mapping	Yes	Yes	Paper registers and Britrocks
Foreign sliced rocks	10,000	F	Rock samples collected during overseas projects	Yes	No	Paper registers
Continental shelf	uncertain	C	Sample from seabed and boreholes	Some	No	Paper register
Reference Minerals	3,500	RC	Mineral samples	No	Yes	Card index and Britrocks
Museum Reserve	36,000	MR	Rock and mineral samples of special interest or quality; 1830s to present	Few	Yes	Paper registers and Britrocks
Keyworth Building Stones	400	KBC, MR	Rock samples from currently active workings	Few	Yes	Britrocks, Building Stones Database
One-inch collection	N x 1000	-	Rock samples collected during mapping and not sectioned - pre 1985	No	No	
Enquiry collection	N x 1000	-	Museum enquiries pre 1985	No	No	Some paper records
Miscellaneous collections	Unknown (many 1000s)	Various	Diverse redundant corporate collections, also project, donated and 'private' collections	Some	Some	Paper records mostly

4.2.1 Sliced Rock Collection

The greater part of the petrological collections at Keyworth consists of coupled thin sections and offcut hand specimens that make up the Sliced Rock Collection. This is divided into the:

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4.2.1 Sliced Rock Collection

The greater part of the petrological collections at Keyworth consists of coupled thin sections and offcut hand specimens that make up the Sliced Rock Collection. This is divided into the:

- England & Wales sliced rocks
- Foreigh collection
- Continental shelf collection

England & Wales sliced rocks (the 'E' collection) - This collection currently stands at about 72,100 thin sections and corresponding off-cut hand specimens. It consists of samples taken by BGS field surveyors, as part of their work, for thin section preparation and systematic petrographic characterisation; many are cited in individual sheet Memoirs. Coverage varies following changes in degree of rock exposure and geological complexity, so that much of south eastern England is only thinly represented whereas large parts of Wales and the Palaeozoic rocks of England have been intensely sampled.

Prior to the move out of the Geological Museum, the practice was for the identity of rocks collected by the field geologists to be confirmed by the Petrographic Department by examining a thin section. The Petrographic Department also undertook registration, curation and storage of the samples. After 1985, the Petrographic Departments of the Exhibition Road and Leeds offices were succeeded by the Mineralogy & Petrology Group (MPG), which continues to the present day. Routine examination by the petrographers of Core Programme samples and thin sections no longer takes place, although more focussed Core Programme investigations continue to be undertaken by MPG. The registration and curation of the 'sliced rocks' has continued to be done by MPG. At Keyworth, this was managed by Dick Merriman up to 1991, thereafter by Neil Fortey, with much of the curatorial work done by Kamal Siddiqui.

The samples were (and are) registered and stored in accession order. When the thin section was made, each sample was given a unique registered number, which had the prefix 'E', and was applied both to the thin section and the corresponding offcut sub-sample. This number was used in BGS reports and memoirs to make reference to specific samples. Up to 1985, sample details were recorded in a set of hand-written ledgers. Subsequently, samples have been recorded on a proforma known as the Sample Collection Sheet, two versions of which remain in use. These forms are kept by the Mineralogy & Petrology Group, filed according to the collector's name. Significantly, about 70% of these samples have also been loaded into the Britrocks database. The thin sections are stored in cabinets in room P104A and the corresponding offcut hand specimens are stored in the top floor of the racking in the NGRC building.

The geographical sampling location is recorded using the UK National Grid, usually to 10 metres precision, and also by a brief written description of the distance and direction to a fixed reference point. The records also include the 1 50k geological sheet, county and a brief description of the sample. In addition, it has become the practice to include codes drawn from the chronostratigraphic and lithostratigraphic lexicons, when possible, as well as petrological and mineral codes. At present, the petrological codes are drawn from the 1970 rock and mineral classification (Harrison & Sabine 1970), though this can be expected to be superseded by the new BGS Rock Classification codes. The mineral codes that are used are based on the International Mineralogical Association list of accepted minerals (Nickel & Nichols, 1991). Implementation of mineral codes from the new BGS Rock Classification may be brought in in future.

Note that there are also some 101,000 Scottish Sliced Rocks samples, which have an 'S' or, recently, and 'N' prefix rather than an 'E' prefix. These are stored at the BGS Murchison House office, Edinburgh, along with other collections of Scottish petrological material, under the care of Brett Beddoe-Stephens and Roy Fakes. In addition, there are some 5,000 specimens of rocks from Northern Ireland at the Belfast office and an older (pre-1920) archival collection of Irish samples that is still at Keyworth.

Foreign sliced rocks (the 'F' collection) - about 10,000 specimens, cited by their 'F' numbers. These include material archived from recent overseas projects and much collected late last century or earlier this century from regions within what was then the British Empire. It also includes 'exotic' materials donated to the Survey in its earlier years. Its coverage is varied, although there is a predominance of African material. Until recently, it had received no attention for several years, but it remains open for the registration of overseas material. None of this collection is currently loaded into the Britrocks database.

Continental Shelf - sediments and rocks from the UK continental shelf form a separate collection of some 5000 strong. It is not active at present. None of this collection is currently loaded into the Britrocks database.

4.2.2 Reference Minerals Collection (the 'RC' collection)

Housed at Keyworth, this collection now contains more than 3,000 specimens including many rare species. It was assembled by selection by David Morgan from material collected by the former Overseas Geological Survey and Atomic Energy Division, supplemented by recent additions including a large international suite of asbestos minerals. The collection was stored at the old BGS Geochemical Division office at Gray's Inn Road, London, until 1987, for which reason it was not ceded to the NHM. Specimens from mines and mineral deposits all over the world, especially in Africa and the Indian Subcontinent, were augmented by U and Th minerals collected during the era of uranium reconnaissance in the 1950's, 60's and early 70's.

Samples have numbers with the prefix 'RC'. The collection is stored in a locked area of the NGRC racking. It is backed up by a card index held by MPG and all samples have now been added to the Britrocks database.

Though by no means as extensive or renowned as the former BGS Geological Museum mineral collection, now incorporated into the Natural History Museum, it remains a valuable asset to the BGS, providing reference material for a variety of studies. A few years ago, a worldwide collection of more than 400 samples of asbestos minerals was donated, even though there are Health & Safety restrictions on handling it.

4.2.3 The Museum Reserve Collection (the 'MR' collection)

This collection, as its name implies, was assembled at the BGS Geological Museum to provide an archive of display quality hand specimens that could be drawn upon in mounting exhibits. Over 36000 samples are included. They are stored in cabinets on the top floor of the NGRC racking. The

samples were numbered, with the prefix 'MR', in accession order. A minority of the samples have thin sections, which are registered in the 'E' or 'F' collection as appropriate.

A major part of the MR collection consists of representative samples of many of the rock formations of the British Isles. This collection provides additional coverage of many of the poorly-exposed 'soft' rocks of southern England that are poorly represented in the E-collection. Moreover, at least a third (*c.*12000) is made up of worked stones and other commodities from quarries and mines, almost all abandoned and many no longer accessible. One example is a suite of >100 samples from the old bauxite mines of Antrim.

A further 5000 samples are of material donated from overseas localities, including a great deal of scientific or historic interest. Examples include more than 200 samples of volcanic rocks from the Galapagos Islands, Reunion and Ascension Island donated by Charles Darwin in the 1840's, some of which still retain the original labels written in the collector's hand. Of more topical interest are samples of early 20th century ashes, volcanic rocks and artifacts from the Caribbean, not to mention a sample of Krakatoa ash collected from the deck of a ship sailing some distance off shore. Another suite of 253 rocks was collected between 1857 and 1871 from the Mont Cenis (Fréjus) railway tunnel between Modane, France and Bardonecchia, Italy. This was the first great alpine tunnel, 13 km long, where the use of dynamite was first used for rock blasting, and the first major tunnel built from both ends and without ventilation shafts. One of the most curious specimens consists of a collection of pebbles from the stomach of a walrus shot (presumably for food) on July 11th 1897 off Cape Flora, Franz Josef Land, by members of the Jackson-Harmsworth Expedition.

Though unused for several years, the MR collection has recently come back into use as a repository for good quality samples that fall outside the scope of the Sliced Rocks collection. Aone recent addition is a set of samples of minerals and wallrocks from South Crofty tine mine, Cornwall.

4.2.4 Keyworth Building Stones Collection (the 'KBC' collection)

Among the smaller collections held at Keyworth is BGS's newest, the Keyworth Building Stones Collection. Intended to replace some of the former BGS Building Stones collection, now with the NHM, it is made up of samples collected recently from working quarries in many parts of the country. It currently contains more than 300 samples, all collected within the 1990's from working quarries. Samples are given a number with the prefix 'KBC', in accession order. They are also registered as part of the MR collection and thus also have MR numbers.

A display specimen is cut from each original sample, and remaining material is kept in reserve for further testing. The display offcuts are stored in under-bench drawer units in the NGRC core examination bays, while the reserve sub-samples are in trays on the ground floor of the NGRC racking. In many cases, a large-area, blue-dye impregnated thin section has also been prepared for petrographical examination and matching.

4.2.5 Miscellaneous and 'Private' Collections

Besides the main collections already mentioned, there are many other rock collections at Keyworth. They include the following:

One-inch sheet collection - Samples collected by Survey geologists but which were not sectioned used to be placed in this separate collection, where they were stored according to the 1-inch geological sheet. The collection is no longer in use, but is still present in the NGRC racking.

Enquiries collection - The old Petrographic Department used to answer enquiries from the general public, and the samples submitted by enquirers were kept in this collection. The collection is no longer in use, but is still present in the NGRC racking.

'Tank' collection - This is made up of 'private' collections of hand specimens provided by individual geologists, some dating back to the 19th century including Murchison, Geikie and Teall. The collection is no longer in use, but is still present in the NGRC racking.

Donated collections - When the BGS Geological Museum was operating, several individuals elected to donate suites of samples to the Survey for safe keeping. This continues to take place, as with the asbestos samples in the RC collection. Examples from the early years of this century include the Lindsey Collection - Samples donated by Lindsey, and the Hall Collection - Samples of Korean rocks donated by CT Hall.

Schools collection - a small collection of material culled from the other collections and deemed to be surplus to requirements was set aside for use in educational work, either as donations to individual schools or for use in classes given by BGS staff. Some of this is still present in the NGRC racking.

'Private' collections - These consist of collections kept by individual members of staff for their own reference. Many are kept in the individual's office while others have been deposited ('dumped') in the racking of the NGRC. They may be project-based or may result from many years of putting things on one side. They contain a great deal of good material. During the duration of a project, they are fully justified. However, once the project that generated them has finished, they become a problem. This is because they are not registered and often are poorly documented. Their locations are not recorded. Staff may transfer or retire, and their collections become useless even if their existence is known about. Yet these collections are accumulated during BGS work and should be seen as belonging the Survey, not to the individual concerned. It seems obvious that once a 'private' collection is no longer in use, it should be registered into the corporate collections, as appropriate, if the material is worth keeping. Otherwise, it should be disposed of. However, the reality is that these collections continue to exist and there is neither the resources nor the corporate will to do much about it, for the present, in spite of the good intentions of Stuart Hollyer and the other collection managers. With the adoption of Quality Control, it will be necessary to adopt a more regulated approach, which will have benefits in terms of accountability and long term availability of samples.

Borehole samples collection - This collection, maintained by the NGRC staff lead by Stuart Hollyer, contains much petrological material and is mentioned here for completeness.

4.3 How to access the collection

Collectively, the collections consist of solid samples of rocks and minerals as well as a collection of thin sections. Without discussing why they might be used, it is worth first considering how to gain access to them. There are perhaps three questions here. Where are the collections? How are they administered? How can they be searched?

Where is the petrological collection? - The 'sliced rock' and MR hand specimens are located on the top deck of the racking within the NGRC building. Most are in the drawers of an impressive series of purpose built cabinets that was rescued from the Geological Museum, with a small amount of overspill in loose drawers in the metal racking. The reference minerals are in racking in the ground level of the NGRC. Because there are uranium minerals and asbestos, this area is locked and can only be entered by permission of the NGRC manager. The building stones are divided into two: small offcut hand specimen are in underbench drawers in the first of the NGRC examination bays, while the corresponding larger reserve samples are in drawers in the ground level of the NGRC racking backing onto (but not within) the restricted area. All access to the NGRC storage areas is under the supervision of the NGRC manager. However, the thin sections are kept separately, in another suite of purpose built ex-museum cabinets within room P104A on the first floor of P-Block under the management of the Mineralogy & Petrology Group. Please contact Neil Fortey or George Strong when you decide to delve into them.

How is the petrological collection administered? - The petrological collection is a corporate BGS resource. Historically, it was administered by the specialists of the old Petrography Department. Now the responsibilities are shared between the Mineralogy & Petrology Group (Collection Manager -Neil Fortey, also George Strong, Hubert Murphy & colleagues) and the NGRC.

4.3.1 Sample registers

Although great efforts have been made to construct a computer database of the petrological collection, this is far from completed (will it ever be?). Therefore, users should be aware that the old hand-written registers and card index are still available via Neil Fortey for the sliced rocks, MR and reference mineral collections. In the case of the sliced rocks, entries are arranged by 50k geological sheet and accession order within that sheet. The sliced rock registers cover the period up to 1985, after which the paper Collection Sheet provided the paper record. These sheets are filed by the sender rather than the geological sheet, and their data has been entered into the Britrocks database (see below). The MR collection has a complete set of paper registers. The reference minerals have a card index. The building stones are managed by Graham Lott (Part 7 of this workshop). For the other collections, sample registration is very variable and gneralisations are not possible.

4.3.2 'Britrocks' Database

Although the collections are accompanied by their original hand-written registers and card indices, a computer-based database index is essential in order to 'navigate' collections of this size. In 1987 a start was made on transferring sample records into a database called Petmin. This was in the form of a single Oracle table in which all sample details were recorded in a single row of the table. This worked well. Although inefficient by database purist standards, it was simple and sufficiently robust to allow over 100 000 records to be loaded from the 'E' and 'S' series of samples.

"If it aint bust, don't fix it". In the early 1990s, it was argued that Petmin was in need of a major design overhaul because, being a flat-field design, it was regarded as inefficient in the way it stored information while at the same time its structure imposed a rigidity that made it difficult to adapt. Also, there was little validation of entries. So the decision was taken to re-design the database and to transfer all data from Petmin into the new database. This was carried out by Tony Killin, resulting in a new database called 'Britrocks'. This database was set up in Oracle on the BGS database server as a set of tables owned by BGS. As such, these tables are open to be read by anyone with a network PC and an Oracle password.

Figure 4.1 shows the data model that was employed in Britrocks. The boxes depict the actual tables and the connecting symbols depict the links between them. Most sample details go into table 'Sample' which is shown at the centre of the model. However, some data where there may be one or several entries for any one sample, go into the subsidiary tables 'Sample Sender', 'Collection Number', 'Report Reference', 'Petrological Code' and 'Mineral Code'. The other tables contain dictionaries that control what can be entered in the tables to which they are attached. Many of these are corporate dictionaries including the BGS chronostratigraphic and lithostratigraphic lexicon tables as well as the 'PETMIN' petrological code table set up by Harrison and Sabine in 1970. The table called 'Person' contains a list of sample collectors together with the two or three character code allocated to them for use in numbering their samples. It is important that anyone that collects samples under the Core Programme onshore UK mapping must have such a code - contact June Wright if you do not yet have one.

The database now contains data for more than 70 % of the total 180,000 samples of the entire Sliced Rock Collection ('E', 'S' and 'N' samples) as well as the Minerals Collection and much of the Museum Reserve Collection. The Oracle tables hold all the data, but are not in themselves easy to use. To meet this end, a user front-end was set up by Alan Mackenzie and has now been running for at least four years. This runs in Access 97 and connects to the Oracle tables by ODBC (Oracle DataBase Connectivity software). It runs in Microsoft Access 97, and is intended to be accessible from PCs on the BGS network (**Figure 4.2**). It is an ambitious product that has been slowly improved by trial and error. It is by no means perfected, but continued use and comments from users will provide the impetus to make modifications and improvements that meet users needs.

The Britrocks interface is constructed as a set of screen forms that fall into four sections (**Figures 4.3, 4.4**), which allow:

4.3.2.1 Entering a sample record - Called the *Collector's Form* (**Figure 4.5**), this part of the interface allows information about new samples to be placed into a separate Oracle table, one at a time. Entries are automatically validated against dictionary tables as far as is practical. Records are tagged with the Oracle-id of the person entering the data, and the interface only allows a user to see his or her own records. In effect, this means that each user has their personal sample record entry table. When a batch of sample records has been entered, they can be exported to be appended to the main database by the curator. Once a record has been appended, this is flagged in the Collector's Form.

4.3.2.2 Appending new sample records to the database - Called the *Curator's Form* (**Figure 4.6**), and accessible only to the Britrocks curator, this form is used to import sets of records from the Collector's Form and append them to Britrocks itself. The idea is that many users should be able to enter their own sample records (on the Collector's Form), but the curator has the job of verifying them and adding them to the database itself. If there are problems with the records, the curator may be able to make corrections or may have to ask the original inputter to correct the records and re-export them. In any event, the records undergo a series of validation checks during the append-records operation similar to those already carried out within the Collector's Form.

In some circumstances, curators can import records from a suitably configured Excel spreadsheet. The validation checks within the Curator's Form are invaluable here, because this route by-passes the Collector's Form. There are more possibilities of incorrect data being accepted.

4.3.2.3 Retrieval of sample records - The *Data Retrieval Form* consists of a menu that allows selection from a set of separate forms that allow:

(a) Area Based Search (Figure 4.7) - This allows records to be retrieved by two levels of criteria. The first allows the user to stipulate a National Grid range in which to search. This can be defined in one of three optional ways:

- By typing in maximum and minimum easting and northing values (use full six-figure format).
- By typing in the easting and northing of a central point and the length in metres of the side of a square centred on that point.
- By selecting a single 1 to 50k geological sheet.

The second (optional) level allows the search to be constrained by a combination of lithostratigraphic code, chronostratigraphic code and petrological code.

In addition, retrievals can be set to include:

- 'Basic' subset of data for each sample retrieved - this is presented as a data table similar to a spreadsheet, and is fairly quick
- Full data for each sample retrieved - this is also presented as a data table similar to a spreadsheet, but tends to be slow, especially if a large number of samples is involved.
- A printed (A4) report of all data for each sample retrieved - records are formatted one to a page and this retrieval tends to be even slower, especially if a large number of samples is involved.
- A printed (A3) spreadsheet-like report of all samples for a selected geological sheet, also slow.

In general, it is quicker, and less wasteful of the world's forests, to export records retrieved as an Excel table rather than print them out.

(b) Sample Number Based Search **(Figure 4.8)** - This requires that the user types in a code that indicates which sample number series is to be used, then the number itself. There are many number series in Britrocks (and many more in BGS as a whole). The topic of sample numbering has become a corporate mess, with no standardisation and no over-arching policy. One consequence of this is that it is not possible to determine from the format of a sample number which series is being used. Numbers are not unique. Britrocks tries to accept as many number series as possible, provided that it is clear which is being used. The main ones used in Britrocks are listed below, but there are many others that are accepted and additional ones can be added to the list as necessary:

- Collector's Number (COLLNO), which is the number used by geologists when they first collect a sample. These consist of a collector's code, which is a code given to an individual to use for all their samples, unless superseded by a project based number. The codes are issued by June Wright and are recorded in an Oracle table that is used in Britrocks to validate collector's numbers.
- Sliced Rock Collection Number (E, S, N or F), which is a serial number given to a sample when it goes through the thin section laboratory.
- Mineral Reference Collection Number (MR).

Having entered the correct number series code, the user enters a sample number. Ranges are not permitted, but can be obtained by using wildcard symbols. The reason why ranges are not permitted is because sample numbers are stored as character strings, and this is because historically numbering has been anarchic in terms of the mixing of numerals and letters, so that it proved impossible to separate the code from the number for all records.

Searches can be for basic data, full data or an A4 print out of full data, though beware! the print option can be very slow and may lock your computer up for a long time.

(c) Geopolitical Area Search - This simply asks the user to select a county or country from a pull down menu, and then retrieves records for samples registered as coming from the chosen area.

4.3.2.4 Modify main database - This form (**Figure 4.9**) is similar to the retrieval by sample numbers form, but in this case all data about each record is presented as a screen form (**Figure 4.10**) that can be modified (edited) by the curator. The purpose of this is to allow records to be updated as new results become available or errors are discovered. It is also useful for validating that a particular sample record is on the database or, by selecting using wildcards, which out of a set of samples is recorded on the database.

4.3.2.5 Database standards - Table 2 lists (most of) the available fields in Britrocks. Mandatory fields have been kept to a minimum in recognition of the fact that many items of information may be unavailable for some samples. Nevertheless, it is clear that the usefulness of a system such as Britrocks is seriously limited if the data is of poor quality. It is stressed that the petrological collections are a corporate BGS resource as is the Britrocks database. The database is aimed at

allowing samples to be located and used in future work as well as providing the means of verifying statements made in BGS reports. If it is necessary to retrieve records for a particular geological sheet, this can only be done if the sheet is correctly recorded. The same goes for all items of data that are included in sample records, and it is up to the geologists that collect the samples to provide as complete and accurate a sample record as possible. Corrections and additions can be made later, but in practice this is laborious and expensive.

At present, there is not (as far as I know) a BGS QC Procedure that covers sample collection and registration within BGS, but this may come in. The present paper Sample Collecting Form proforma (**Figure 4.11**) needs to be updated. However, a better option would be for collectors to record details direct from their personal sample register or field note book on to the Britrocks Collector's Form or to record them as an Excel spreadsheet that can be e-mailed to the Britrocks curator. An Excel template can be provided for this purpose.

Table 4.2. Britrocks data fields.

Field Title	Description	Example	Validation	Mandatory
COLLECTION_NAME	Name of number series	COLLNO	Yes (LUT)	Yes
COLLECTION_CODE	Sample number prefix	CT	Yes (LUT)	Yes
COLLECTION_NO1	Sample number	1001	No	Yes
DUPLICATE	Duplicate sample suffix default	+	1 character only	Yes
PERSON_ID	Who collected the sample	ERJ	Yes (LUT)	No
PETROLOGICAL_CODE	Petrology code for sandstone	3D00	Yes (LUT)	No
MINERAL_CODE	Glauconite code - MPG system	M850520	Yes (LUT)	No
COUNTY_CODE	Code from BGS system	GLOUCS	Yes (LUT)	Yes
COUNTRY_CODE	Code from BGS system	ENG	Yes (LUT)	Yes
SHEET_CODE	E or S	E	Yes (LUT)	Yes
SHEET_NO	Number of 50k geol sheet	217	Yes (LUT)	Yes
LOCALITY_DETAILS	Free text note	..... Text	No	No
GRIDSQUARE_CODE	OS 100 km square code	SP	Yes (LUT)	Yes
EASTING	6 figure format - always	419870	Yes (6 char's)	Yes
NORTHING	6 figure format - always	205360	Yes (6 char's)	Yes
GRID_ACCURACY_CODE	5 = precise to 10 metres	5	Yes (LUT)	Yes
SIX_SHEET:	1 10k OS topog sheet	SP10NE	No	No
LAT_DEGREE	Optional - alternative to NGR		No	No
LAT_MINUTE	Optional - alternative to NGR		No	No
LAT_SECOND	Optional - alternative to NGR		No	No
LAT_DIRECTION	Optional - alternative to NGR		No	No
LONG_DEGREE	Optional - alternative to NGR		No	No
LONG_MINUTE	Optional - alternative to NGR		No	No
LONG_SECOND	Optional - alternative to NGR		No	No
LONG_DIRECTION	Optional - alternative to NGR		No	No
LAT_LONG_CONVERTED	NGR calculated from lat/long		Yes/no flag	Auto
COMMENTS	Free text sample description	Friable sandstone	No	No
LITHOSTRAT_OLD:	Name of lithostrastigraphic unit	Lower Greensand	No	No
CHRONOSTRAT_OLD:	Name of chronostrat. unit	Cretaceous	No	No
LITHOSTRAT_CODE	Code of lithostrat. unit	LGS	Yes	No
CHRONOSTRAT_CODE:	Code of chronostrat. unit	K	Yes	No
YEAR_COLLECTED:	Year when sample collected	1995	No	No
ROCKNAME_OLD:	Name of principal lithology	Limestone	No	No
WORKED_BODY_NO	Cross ref. To Britpits database	Not yet used	No	No
COMMODITY_CODE	Cross ref. To Britpits database	Not yet used	No	No
TRAY_NO1	Registered storage tray	Not yet used	No	No
USER_ENTERED	Who entered data to database	Njf	network ID	Yes
DATE_ENTERED	When entered	3/11/99	system date	Yes
BORENAME	Name of borehole		Yes (BH index)	No
OFFSHORE_BORE_ID	ID of offshore borehole		No	No
CORE_BOTTOM_FEET	Top depth of sample - feet		No	No
CORE_BOTTOM_INCHES	Top depth of sample - inches		No	No
CORE_BOTTOM_METRES	Top depth of sample - metres		No	No
CORE_TOP_FEET	Base depth of sample - feet		No	No
CORE_TOP_INCHES	Base depth of sample - inches		No	No
CORE_TOP_METRES	Base depth of sample - metres		No	No

4.3.2.6 GIS and Britrocks - Though not part of the present course, users should be aware that the sample records in Britrocks are geospatial information, in that the sampling site is recorded as a National Grid Reference or as latitude and longitude. The present version of the Geoscience Data Index (GDI) contains a Britrocks theme that allows locations of Britrocks samples to plotted with reference to the 625k geology of the British Isles and to all the other themes within the GDI. In die course, Britocks samples will be incorporated into the Digital Map and Geospatial Model.

4.4 How the collection can be used

The petrological collection can form a valuable resource for new investigations or map revision. Staff ought to assess the material and information available prior to undertaking new or follow-up investigations that may involve sample collection. The cost of sample collection and thin section preparation can be significant. Moreover, many samples in the collections are derived from exposures no longer accessible and thus could provide a more extensive coverage than could be obtained by a collection programme today.

4.4.1 Thin sections

Thin sections from the petrological collection are available for examination by BGS staff. High quality petrological microscopes in the Mineralogy & Petrology Group can be used on application to the Group Manager.

4.4.2 Rock samples

Rock samples and minerals are available for examination. Laboratory space and microscopes in the Mineralogy & Petrology Group can be used on application to the Group Manager. Where a thin section is missing or degraded, the hand specimen can be used to make a new one subject to agreement by the petrology collection manager, although the user will have to bear the cost. Similarly, mineral specimens can be provided for use in investigations subject to agreement.

4.4.3 Internal loans

When a sample is first sectioned and returned to the sender, it can be regarded as being loaned for the duration of the project concerned. At the end of the project, or when no longer needed, it must be placed into the collections so that it can be made available to other projects/users. At a later stage, members of staff may wish to take a set of samples to their office to examine them in their own time. This must be done in agreement with the collection manager, who will keep a record of the loan. In the past, loan material has not been returned for a long period, if at all. As a result, there are a number of gaps in the collection, in particular the 'sliced rocks' thin sections, that prevent others from making use of the collection. Some have disappeared, even though a database has been maintained recording the whereabouts of material. Inevitably, this is regretted and users must ensure that it does not happen in future. *It is important that material on loan to BGS staff is not passed on to other staff and in particular external collaborators without informing the curator.*

4.4.4 External loans

Use of the collection outside BGS is acceptable provided that it does not interfere with our own use. External loans are at the discretion of the collection manager and subject to an agreed duration. For commercial use, an appropriate fee will be charged, but this is waived for academic researchers. It may also be necessary to take a deposit to cover costs of damage or loss of materials on loan although, again, it is possible to waive this for trusted academic researchers.

Material can also be issued on loan to external bodies or organisations. In this case a fixed period is designated and signed requisitions are required. Past loans have been to trusted academic bodies and have not been subject to charges. Nevertheless, it must be realised that they remain BGS property and are expensive to replace. Recipients of loans are responsible for the safe keeping of the materials and any costs of repair or replacement that may become necessary. They are also repsonsible for ensuring the safe return of loaned material to BGS. Commercial charges will be made for loans to commercial organisations or where commercial work is involved.

4.4.5 Exhibitions

Rock samples are provided for displays and exhibitions. These may be for the general public, as in National Science Week, for visiting VIPs, for educational purposes or other purposes. As an example, Lawrence Donnolly had a loan set of Caribbean volcanics that he used when giving talks to groups of school children. In other cases, groups of rock samples deemed to be little future use to BGS have been given to local schools.

As with loans, this is at the discretion of the collection manager, and are treated as a loan. The borrower is responsible for the safekeeping and return of the samples. Such material should not be passed to a third party without authorisation. Use of materials for commercial purposes such as advertisements must be subject to BGS charges and copyright.

4.4.6 Searching the collections

Location of samples using the paper registers is possible but time consuming and severely limited. For the sliced rocks, the only way is to select a 50k geological sheet and search the samples in it in accession order. Even this breaks down for samples collected post-1985. For the MR, searching is strictly in accession order. The case for a computer database searchable on a range of criteria is overwhelming. Without it, the collection would be completely moribund. The only exception is the reference minerals, whose card index allows searching by species as well as accession order.

The BritRocks database can be accessed via a desktop PC via the customized MS Access application. This allows a user to retrieve sample data on the basis of area (BGS 50k map sheet or National Grid Reference), collection code or registered number.

For users that are familiar with Microsoft Access + ODBC or with Oracle-Forms, it is possible to develop their own front end, remembering that the Oracle tables themselves are owned by BGS and therefore open for read-access by all BGS staff with an Oracle password. This can be worth persevering with if specific queries or retrievals are going to be made repetitively. Microsoft Access training is, of course, provided by BGS.

Otherwise, access to material or sample information can be made through the curator, who can search the database and also has available the paper registers (which contain information not yet in the database). This is especially easy if you can provide him or her with some project time to carry out the search and report the results. For instance, the results of a Britrocks search can be exported and e-mailed as an Excel file to the enquirer.

4.5 How to add new material to the collection

Though not the immediate business of the collection manager or curator, it is clear that many of the samples collected by the geologists are destined for the corporate collection once their original purpose has been served. The collection is only as good as the samples placed in it and the information provided by the collector. Garbage in, garbage out!

Table 2 shows most of the data domains in Britrocks. Many are not mandatory as far as entering a sample record is concerned, although the database is only as good as the data placed in it. If there is no indication of rock type, then a search on rock type will not retrieve the sample.

- *Sample numbers* - ensure that you use your correct prefix code, then a numerical code, then if necessary a suffix of no more than one letter. Ensure that you do not duplicate a sample number.
- *Map sheet* - indicate the map number and whether this forms part of the England and Wales (E) series of the Scotland (S) series.
- *County and country* - indicate the county and country (the record may be entered by someone whose geographical knowledge is not as good as yours).
- *Grid reference* - although it has not been Land Survey practice, a plea must be made for using the full six-figure NGR format. This is used in Britrocks because it states the distance in metres from the grid origin and is thus suited to GIS location. In fact, Britrocks also asks for the letter-code of the 100 km square for user's convenience and to allow the data manager to convert conventional 4-figure grid references to six-figure numerical format, but this takes time and is prone to mistakes. It also requires a precision code in the form: 6 = precise to 1 metre, 5 = precise to 10 metres, 4 = precise to 100 km and 3 = precise to 1 km.
- *Location* - give a brief written description that can be used to corroborate the grid reference, such as "200 m on 60° bearing from Nelson's Column".
- *Rock description* - include a rock name, even a generalised one if that is all that is warranted, and mention any important or unusual mineral that is present.
- *Chronostratigraphy and lithostratigraphy* - though not specified on the Collection Form, these provide important search criteria and should be included where possible.

Finally, have pity on the poor old curator and please write legibly, especially where uncommon names or terms are used.

As an alternative, you can:

- Have the Britrocks interface set up on your desktop PC and then enter your own samples on to the Britrocks Collector's Form instead of using the paper Sample Collecting Form.
- Use an Excel spreadsheet - I can supply a template that reproduces the Sample Collecting Form. Once filled in it can be e-mailed to me and I can re-arrange it and enter the data onto Britrocks.

In either case, you will save yourself filling in the paper form, validate your own spellings and grid references, and save me some time.

The curator or thin section supervisor then enters the information you provide into the BritRocks database and files the paper copy (printing it from the spreadsheet if necessary). At the same time he issues the appropriate E numbers.

Material not requiring sectioning can be entered in the MR collection if the collection manager and the geologist agree the sample(s) justify this. Otherwise, subject to limitation of space, samples can be maintained as a personal collection within the rock store. In the event of the member of staff leaving or retiring, paper records (i.e. collector's personal sampling register) relating to non-registered samples **must** be deposited with the curator.

4.6 Future Development

Although the petrological collections continue to function, they leave a lot to be desired in terms of the services that could be offered, the inconvenience of their storage and examination facilities and the lack of resources that are provided to support them. Since the move of the BGS to Keyworth the collections have in effect been managed on a care and maintenance basis, and their future has received little consideration. Hopefully, this will change with the move to a coherent BGS Data Policy (Lowe & McKenzie, 1998).

Several areas of potential development can be mentioned here:

Facilities - The present separation of the storage of rocks and thin sections from places where they can be laid out and examined under the microscope is not acceptable. Potential users are discouraged. External users can not browse the collections. Retrieval by MPG staff is time-consuming and expensive. A museum area is badly needed where a selected reference subset of the total collection can be stored alongside bench space and petrological equipment.

Quality Control - Formal procedures are needed to ensure that submission, registration and provision of loans from the collection.

Numbering - The subject of sample numbering in BGS could fill a workshop on its own. Many numbering systems are in use, with extensive confusion and duplication between them. In the writer's view, the situation is chaotic and a corporate embarassment. A rational policy is needed.

IT - As already outlined, the collections database provides the means to link samples to GeoIDS and digital geological maps. It is hoped that this will be enhanced by identifying the lithostratigraphy of petrological samples. This will allow the creation of a suite of reference collection drawn from the petrological collection to represent the units displayed on the geological map.

Digital archives - Digital imaging using a digital camera offers the prospect of attaching a library of hand specimen and thin section images. All the necessary tools are readily available (cameras, downloading software, high volume storage, etc.). These could be linked to the digital map. Click on the sample point and up comes a digital photomicrograph and explanation. Such imaging could also preserve some of the oldest thin sections, an archive of the history of geology whose condition is deteriorating. Samples selected by a database query could be provided as a set of images on CD to be placed with a report or sold to the customer.

Internet and Intranet - Use of these media could change radically the use made of the collection. A library of digital images could form part of a 'Virtual Museum of UK Geology', accessible worldwide even though BGS has few museum facilities in the traditional sense. A more comprehensive version could be available over the intranet as a reference tool.

In looking to the future, it is important to emphasis that the petrological collections are a corporate resource. They are not the private reserve of the Mineralogy & Petrology Group. Their future depends on their value to BGS as a whole, for servicing its own work and also for providing information to its customers. They will become integrated into the BGS GeoIDS framework. Although the collections managers can produce endless ideas about how they could be developed, there is the need for ideas and initiatives to come from wider sources.

References

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Appendix 4 a Principal contacts:

English and Welsh Sliced Rocks, Minerals, Miscellaneous Rocks

Neil Fortey	extension 3408	n.fortey@bgs.ac.uk
Vicky Hards	extension 3336	v.hards@bgs.ac.uk

Keyworth Building Stones

Graham Lott	extension 3594	g.lott@bgs.ac.uk

Scottish Sliced Rocks, Scottish Miscellaneous Rocks, Scottish Building Stones

Brett Beddoe-Stephens, (MH) 0131 650 0385 (direct); b.beddoe-stephens@bgs.ac.uk

5. The Corporate Collection (Keyworth)

5.1. Introduction.

Over the history of BGS a large number of sample collections, both Group and Project based, have been instigated and later abandoned either due to the disbanding of the Group or the conclusion of the project. Interrogating these collections is at present difficult as the material is housed in the NGRC tray racking, second level, and their indexes are distributed widely around the Keyworth site. It was therefore decided that incorporating a number of these collections would be advantageous to BGS. The NGRC Corporate (NC) Collection was established to incorporate a number of these passive collections together with the Geochemical Sample Archive (GBase) and the Mineral Reconnaissance Program Collection, both of which are still active. The collection also covers a number of small private collections, which belonged to members of staff who have now retired (e.g. a collection of granites from S. E. Asia gathered by Dr. J.Cobbin). Description of the main collections and their indexes, and the location of these indexes, follows.

5.2 Collection Size and Content.

As already stated the Corporate Collection consists of the GBase Sample Archive and the Mineral Reconnaissance Program Collection plus a number of smaller now passive collections.
The combined size of the collection is in the order of 600K samples. Descriptions of each collection are set out below.

5.2.1 The GBase Sample Archive.

This is a collection of analysed soils and stream sediments from the UK and Northern Ireland, and is still an active collection. The material is stored in both prepared and unprepared form and curated in trays, which have both a tray number and the Lab. Number of the material enclosed on them. Miss D. Flight (Analytical & Regional Geochemistry Group) administers the index to the material. The original index is in the form of a register, which gives Geochemical Unit Project Code, File Number, Lab. Number, Original Sample Numbers, Number of Samples, Sender, Date Registered, Analysis Required, Analytical results, BGS Project Code, Locality of Collection. The collection is indexed by Lab. Number, The register contains numbers 1 – 5244 (a Lab Number can contain more that one original sample). This register is now passive as a new computerised indexing system (the Geochemistry Database) was implemented in 1998. Details from the paper register have also been entered onto the computerised database.
The current size of the collection is in the region of 120K samples and the annual increase is approximately 4.5K a year.

5.2.2 Mineral Reconnaissance Program Collection.

A collection of material collected as part of the Mineral Reconnaissance Program, which is stored in both prepared and unprepared form. The collection is still active, however the addition of new material is at a low level. Dr.D.C. Cooper (Minerals Group) holds an index to the material as an Excel spread sheet. This index records the Sample Number, Collector and Material Description and has 1040 entries. Each entry generally consists of a number of different samples, which have been collected from localities world wide.

5.2.3 UG (Uranium Minerals) Collection.

The collection was populated in the 1960s and 1970s by material collected as part of the Survey's Uranium Survey. The collection is now passive with the material housed on level 2 and, if exhibiting a certain level of radioactivity, in the radioactive caged area on level one of the NGRC tray racking. The original index in the form of a loose-leaf register is housed with the Mineralogy & Petrology Unit in P Block. The index records the UG number, the Senders Code, a Description of the material, Locality of collection (including Country), Remarks and Date Received, UM and UF numbers. The collection holds around 12K samples. The material and details are also incorporated in the Radioactive and Metaliferous Mineral Unit Collection and index, descriptions of which follows.

5.2.4 R collection.

This is now also a passive collection. Each tray in the collection is numbered (the number being prefixed by 'R') and also shows the samples contained. The card index for the collection is now housed on level 4 of Core Store Tray Racking. The index contains 1679 cards giving in part comprehensive details; Tray number (R number), Sample number (RMMU number), Nature of Sample (e.g. rock), Locality, Sender, File number, Date (no indication of whether date collected or date incorporated into collection); some cards however only give Tray number and Sample number.

5.2.5 Colonial and Overseas Collections

A collection of rock specimens which have been analysed and were collected from countries world wide, originally from countries which were part of the British Empire. The first 60 trays still identified by tray number and country of origin of material (countries' old colonial name e.g. Ceylon used). Following this most trays are only identified by tray number and Lab. number/s relating to specimens enclosed, in some cases though country of origin is also noted on tray. The collection is now passive and its index, which is in the form of a card index, is housed on Core Store Tray Racking level 4. Records are indexed by Lab. number (AAA1 – ZRA43). The cards give details of Lab.

number, Tray number and Locality (country of origin). There is no index by Tray number The collection contains some specimens of hazardous nature (e.g. Asbestos) although any radioactive specimens should have been transferred to the radioactive caged area (situated on level one)

5.2.6 Mineralogy & Petrology 1 Inch Geological Sheet Collection

The collection, which is now passive, was set up to be a reference set of rock specimens in addition to the sliced rock collection in the Leeds office. The collect is housed in 900+ trays and is ordered by 1 Inch sheet number. There appears to be no register for the collection. It is planned to sort though the collection and incorporate any identifiable material into the Mineralogy and Petrology Unit Museum Reserve (MR) Collection

5.3 How to access the collection.

In their present state any beneficial use of the passive collections is almost impossible, as the people responsible for setting up the collections are no longer with BGS and present staff do not know their contents. The two active collections do not pose this problem although their present indexes only show the relationship between the material and its sample number or tray number and not its storage location. A table (NC_TRAYS) has been designed to accommodate the collection details so that interrogation of contents of all the constituent collections can be carried out. A description of this table can be found in appendix A. This table is primarily an index for finding where material is stored within the collection, to find analytical details will however still need examination of their original indexes. Interrogation of the data can give such information as what material is available from a certain location.
The table has been placed on KWDBASE so that all staff can access it though Access.

5.4 How the collection can be used.

Uses of the collections can fall into either of two categories

5.4.1 Sampling.

Examination of the collections to ascertain what material has already been collected from a certain area or certain rock type could reduce the amount of sampling required for a specific project or even eliminate the need for sampling altogether. This being beneficial to BGS both in term of cost and time. This can be most advantageous where foreign material is concerned as travel cost here is greater and it may now be impossible to actually visit countries.

5.4.2 Previous work.

It is always useful to look into what work has already been carried out in a certain area. This again could reduce or eliminate the need for sampling. Any material, which has been analysed for a certain suite of minerals, could be analysed a second time for a different suite, also original analysis data could be used as a reference to compare with new data in determining any change (e.g. pre and post Chernobyl)

5.5 How to add new material to the collection.

New material will only be added to the two active collections, the Mineral Reconnaissance Program Collection and the Gbase Sample Archive. New material being added to these will only be authorised by the collection manager within the respective group.

5.6 Future Development.

It is planned that the contents of each tray, non-analytical data related to it and the tray number will be entered into the NC_trays database. This will enable the location of any known sample to be found and also what, if any, material the collection holds from a given locality. To find any analytical data it will still be necessary to interrogate the separate collection indexes. There are however a number of problems with the data gathering from the various collections for inclusion in the table

a) The card indexes do not in some cases gives complete details of a tray's contents.
b) Certain paper records appear to have been misplaced or even disposed of in their movement from the 'U' block records room.
c) In some cases the contents indicated on tray label does not correspond with the trays actual contents. This means that for correct data each tray must be opened to ascertain its exact contents, which itself poses a problem with the hazardous contents of some trays (e.g. Asbestos).

At present there are 4768 entries on the database, which represents data taken from 2109 trays. The process of data gathering is at present in abeyance as the build up of dust on the tops of trays, in particular the top tray of each stack, has posed a health problem. A deep clean of the facility is planned and the job will re-commence once this has been carried out.

Appendix 5a

Description of NC_trays table

Field	Type	Description
Sample_number	Text	Original sample registration number, collector number
Secondary_Sample _number	Text	as above
Stored_Location	Text	NC Collection Tray Number
Locality	Text	Where the sample was collected
Supplementary_Tray	Text	Original unit tray Number
Comments	Text	Any additional information (material type, collector etc)
Comments2	Text	as above
Tray_Location	Text	Where tray is stored in the NGRC

The Offshore/Coastal Collection (Keyworth)

6.1 Introduction.

The basis of this collection was the material held in the Kippax Core Store administered by the Continental Shelf Southern Unit based at the BGS Leeds Office. On the closure of the Leeds Office and associated Kippax store in 1986 the material was transferred to Keyworth.

The collection comprised material south of latitude 56 degrees in the North Sea and south of latitude 54 degrees in the Irish Sea and included the Western Approaches and English Channel. There were some minor exceptions to this such as all offshore hydrocarbon related material, which was held in Edinburgh for all latitudes.

In the early 1990's a new corestore was opened at Loanhead near Edinburgh at which time it was decided to transfer the majority of the offshore collection held at Keyworth to the new Loanhead store.

6.2 Collection size and contents.

The collection transferred to Keyworth in 1986 comprised 3,337 vibrocores, 2,750 gravity cores and approximately 10,000 grab samples most of which had been collected by BGS. The majority of this materal has now been amalgamated into a single offshore collection held at Loanhead and which may be accessed via the Loanhead offshore system.

The collection which now resides at Keyworth includes all of the material collected as part of the Land Ocean Interaction Study (LOIS) comprising 207 cores, all of which are from the North Sea. In addition the collection also contains other BGS offshore material which is being studied as part of ongoing projects being undertaken at Keyworth and offshore material which has been collected as part of current programmes.

6.3 How to access the collection.

The Offshore/Coastal Collection held at Keyworth can be accessed by contacting Helen Glaves, BGS Keyworth (hmg@bgs.ac.uk).

6.4 How the collection can be used.

The LOIS material and material collected as part of current programmes may be accessed for study, however, the level is sampling permitted outside these programmes is restricted. There are also detailed logs and photographs available for all of the LOIS material. Use of the pre-existing BGS material held in this collection is subject to the same restrictions as other offshore material.

6.5 How to add new material to the collection.

Material can only be added to this collection as part of programmes that come under the Coastal Geoscience and Global Change Impacts Programme. Any material to be added to the collection should be done via the Programme.

7. The Building Stone Collection at Keyworth and Edinburgh

7.1 Introduction.
A major building stone collection including examples from most of the UK building stones is held by the Natural History Museum in London. This collection began life following a nation wide survey of available building stones in the 1830s. The survey was carried out following the fire at the Palace of Westminster in 1834 to identify a building stone suitable for its subsequent rebuild to Barry's design in 1840 to 1852. The collection later developed with the inclusion of overseas material as well as UK based building stones and now numbers some 20,000 specimens.

Originally, when our organisation was "The Geological Survey of Great Britain incorporating the Museum of Practical Geology" the collection came under the auspices of the Museum Department of the Survey. However when the decision was made in 1985 to transfer the Geological Museum, its collections and staff to the Natural History Museum (NHM) this included leaving the building stone collection in London at the Geological Museum where it still resides.

However despite this BGS on its transfer to Keyworth continued to receive a constant trickle of enquiries concerning building stones. These include suitability and availability of natural stone for new buildings and enquiries requiring the identification and possible sources of replacement stone for old structures suffering erosion and decay. This has included enquiries about Salisbury Cathedral,

7.2 Building stones at Keyworth (Stuart Hollyer)

The origin of the "KBC" (**K**eyworth **B**uilding stone **C**ollection) runs curiously in parallel to the origin of the original NHM held collection described above. In the late eighties/early nineties BGS was asked to collect and test for strength and durability red sandstone from working quarries for use in cladding the new parliament building opposite Barry's Houses of Parliament in Westminster. Theses building stones formed the embryo of the Keyworth collection that currently numbers some 466 building stone specimens. An index to this collection is available on KWDBASE under JLWR.KEYWORTH_BUILDING_STONES2 but details are also contained in the Petrological Collection Database (Britrocks).

The collection comprises a viewing set registered as "KBC" specimens (**K**eyworth **B**uilding stone **C**ollection) which is retained in room N022 plus a smaller set registered in the MR section of the Petrological Collection. See also section 4.2.4. In addition to the KBC material the Petrological MR Collection contains samples of other building stones, many from filled in or abandoned and lost quarries.

The only way in which the collection can expand is for staff to contribute to it. Thus any member of staff who comes across a working stone quarry while carrying out a survey is asked to collect from the quarry. The specimens together with the data including rock description, location, quarry name etc should be deposited with the collections administrator who will ensure it is incorporated into the KBC and MR collections.

The contacts for information are Neil Fortey or Graham Lott.

7.3 Building stones in Edinburgh (Andrew Macmillan)

For enquiry work and petrographical studies, a limited collection of hand specimens and thin sections of building stones is held by the Mineralogy & Petrology Group. Contacts are Dr Brett Beddoe Stephens, Dr Emrys Phillips and Roy Fakes. In recent years, the collection has been augmented by material collected from both working and disused quarries by field geologists in the course of re-survey.

An additional collection of building sandstone from Scotland and northern England, maintained by Andrew McMillan and Richard Gillanders on behalf of the Edinburgh Geological Society, is housed in the Mineralogy and Petrology Rock Store. These stones have not been systematically thin sectioned. A selection of these used in Edinburgh's buildings is on permanent display in Murchison house. These stones, some of which are large cladding slabs from former buildings, provide a valuable reference collection representative of both working quarries and some of the famous old quarries which are no longer accessible. As such the collection is useful for enquiry work involving the matching the colour and texture of stone from old sources with material available from modern quarries.

8. The Borehole Collections (Edinburgh): *Neil Halley*

8.1 Introduction

Although the Survey started work in Scotland in 1867 the first borehole samples were not entered in the BO (BOrehole) collection until 1927.The Mining Industry Act of 1926 which gave the Survey access to all mineral borings over 100ft deep may have provided the incentive. The nearly all early specimens collected were from bores for coal and to this day the Scottish collections are biased towards the coalfield areas. Small individually labeled specimens were collected at this time. The concept of curating runs of core or even entire bores seems only to have started when MEIGA (Mineral Exploration and Investment Grants Act) was introduced in 1972. Several commercial drilling programmes for metalliferous minerals came about as a result of this scheme and formed the basis of the continuous core collection.

The BO collection eventually became the SBO (Scottish BOreholes). When this reached 9999 specimens it was followed by BEA (Boreholes, Edinburgh, and A) and eventually BEB. In addition to these collections there is much material from bores in the collections of the Edinburgh Petrology and Palaeontology Departments.

8.2 Collection size and content

The SBO, BEA and BEB collections now contain a total of 24,750 specimens. They are still biased towards the coalfield areas but the more recently acquired material, particularly from Survey bores, has altered the balance a little.

The continuous core collection contains approximately 6,800 metres of core from 146 boreholes. This is almost entirely igneous and metamorphic material from mineral exploration bores.

8.3 How to access the collection

When borehole material was first curated in the Edinburgh office it was kept in brown paper parcels tied up with string. It was catalogued by 1 inch to the mile map and borehole name. In the best Victorian tradition details were entered in a leather-bound ledger. The specimens were safe but virtually lost to researchers because of the difficulty of access and the poor search facilities. In the 1960's the parcels were replaced by trays and in 1982 - 4 much of the information available for each specimen in the SBO, BEA, and BEB collections was put on a Mimer database, BGS.CORE which has since been transferred to the Oracle system. By linking this to the borehole database tables searches can now be done by grid reference, depth, lithology and many other parameters or combinations of them.

The continuous core collection is also on an Oracle table, MTD.LOANHEAD but this is far from complete and the search facilities are at present less comprehensive.

All members of staff have access to these Oracle tables and to the samples. To see material from the Edinburgh collections at present staff should contact Neil Halley in

Murchison House. These collections are about to be moved to the Keyworth core store as part of a policy of concentrating offshore material at the Loanhead and onshore material at Keyworth. When the move is complete staff at the National Geological Records Centre in the Keyworth core store should be contacted for access to the material. Much of the material in the Scottish continuous core collection is held as 'commercial in confidence' and permission to publish information gained from it may have to be obtained from the originator.

The guidelines for sampling are the same as for the Keyworth collections.

In addition to the borehole collection there is a great deal of borehole material in the Petrology and Palaeontology Departments in Edinburgh. Most of it is not cross-referenced to the borehole collections and staff should always check with these departments when searching for existing material.

8.4 How to add new material to the collection

New borehole material from Scotland and the north of England will be brought to the Edinburgh core store in the first instance for logging and possible sub-sampling. If it is then decided to keep any material in addition to that collected for the petrology and palaeontology collections this will be forwarded to Keyworth when all the necessary rubric has been assembled. The same criteria will be used when deciding what to keep as is applied to material from the rest of the UK.

8.5 Future developments

As this is written (March 1999) the transfer of the Scottish borehole collections to Keyworth has started. When the transfer of specimens is complete it may be appropriate to combine the database tables for Scottish and all other collections. They should at least be sufficiently compatible to allow queries to be addressed to both.

Full independence for Scotland seems less and less unlikely as the months go by. It would presumably have a profound effect on the Survey and the collections. The implications are outside the scope of these notes but may well have to be addressed in a very few years time.

Appendix 8

a) An SQL search joining 2 tables, b g s.core and b g s .bindex
b) An SQL search of the continuous core collection, mtd.loanhead, showing the number of boxes of core held for the specified bores.

Appendix 8a

An SQL search joining two tables bgs.cors and bgs.bindex.

```
SQL> run
  1  select bname, depth, lith from bgs.bindex, bgs.core
  2  where east between 221900 and 228400
  3  and north between 0660100 and 0771800
  4* and qs = quad and numb = accn
```

BNAME	DEPTH	LITH
ADMIRALTY GREENOCK NO.7	5059	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.2	5029	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.2	5304	BASA FINE GRAIN AMYGDALOIDAL
ADMIRALTY GREENOCK NO.2	5456	BASA FINE GRAIN AMYGDALOIDAL
ADMIRALTY GREENOCK NO.2	5639	BASA FINE GRAIN AMYGDALOIDAL
ADMIRALTY GREENOCK NO.2	5913	BASA FINE GRAIN AMYGDALOIDAL
ADMIRALTY GREENOCK NO.2	6462	BASA AMYGDALOIDAL
ADMIRALTY GREENOCK NO.6	559	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	846	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	914	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	1158	BASA FINE GRAIN

BNAME	DEPTH	LITH
ADMIRALTY GREENOCK NO.6	1493	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	2134	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	3292	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	3779	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	3871	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	4983	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.6	5547	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.7	1829	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.7	3840	BASA FINE GRAIN
ADMIRALTY GREENOCK NO.2	213	BASA
ADMIRALTY GREENOCK NO.2	396	BASA

BNAME	DEPTH	LITH
ADMIRALTY GREENOCK NO.2	518	BASA
ADMIRALTY GREENOCK NO.2	701	BASA AMYGDALOIDAL FINE GRAIN
ADMIRALTY GREENOCK NO.2	792	BASA HARD FINE GRAIN
ADMIRALTY GREENOCK NO.2	792	BASA HARD
ADMIRALTY GREENOCK NO.2	1067	BASA AUTOBRECC CALCITE VEIN
ADMIRALTY GREENOCK NO.2	1707	BASA MACROPORPHYRITIC
ADMIRALTY GREENOCK NO.2	2301	BASA AMYGDALOIDAL
ADMIRALTY GREENOCK NO.2	2987	BASA MACROPORPHRITIC

```
29 rows selected.

SQL> spool off
```

Appendix 8b

An SQL search of the continuous core collection, mtd.loanhead showing the number of boxes held for specified boreholes.

```
SQL> run
  1  select count (*), borehole from mtd.loanhead
  2  where borehole like '%Aberfeldy%'
  3* group by borehole

  COUNT(*) BOREHOLE
---------- --------------------------------------------------------------------
         3 Aberfeldy No.1 BGS BH
        17 Aberfeldy No.10 BGS BH
        22 Aberfeldy No.11 BGS BH
         1 Aberfeldy No.2 BGS BH
         3 Aberfeldy No.3 BGS BH
         2 Aberfeldy No.4 BGS BH
         4 Aberfeldy No.5 BGS BH
        27 Aberfeldy No.6 BGS BH
        10 Aberfeldy No.7 BGS BH
        26 Aberfeldy No.8 BGS BH
        13 Aberfeldy No.9 BGS BH

11 rows selected.

SQL> spool off
```

9. The Biostratigraphy Collection (Edinburgh)

9.1 Introduction

The earliest fossil collectors included Arthur Macconochie (1850-1922) and James Bennie (1821-1901) whose first specimens were registered in 1869. Macconochie collected the great bulk of Silurian graptolites from southern Scotland which were described in the classic work of Peach and Horne (1899). He is also credited with establishing a Precambrian age for the Torridonian Sandstone of western Ross-shire.

John Smith (1846-1930) was a private collector, of mainly Carboniferous fossils, that have proved of particular importance to the Scottish Office of the BGS. He was a prolific and highly respected collector who presented his collection to us in 1930. The number of his specimens registered and catalogued by the BGS is almost 30,000 and more than half of these came from Ayrshire. His collections were used by many of the specialist palaeontologists of the day.

Since John Smith's time there have been many eminent collectors including W.Manson, R.Eckford, W.D.Fisher, J.McCall, W.E.Graham, and G.A.Goodlet, and in more recent times P.J.Brand, and D.K.Graham. These people have collected from both exposures and boreholes.

The earliest known collection from underground was by David Tait in 1905. The samples came from a shaft sinking near Castlecary Railway Station, Lanarkshire. The most prolific suppliers of borehole materials have been 'British Coal' (ex NCB) and BGS itself. The Archerbeck Geological Survey Borehole near Canonbie, Dumfriesshire was drilled in 1953 to a depth of 1403.30m. It provided 7520 samples. More recently, in 1999, the BGS Howgillside Borehole, Dumfriesshire was drilled to a depth of 145.71m and produced 3673 samples.

As part of todays Continuous Revision Project, D.N.Halley and P.M.Halpin collect fossil samples from boreholes to provide a consultancy service for developers. Site investigation started in earnest in the 1960s and continues today, but we tend to see less of the core. Mapping geologists may also collect from exposures or employ the palaeontologist to collect from larger sections. A recent example of this is the collection of 638 samples from Mootlaw Quarry, Northumberland by M.T.Dean in 1995.

9.2 Collection size and contents

The biostratigraphic material (c.451,100 items) is almost exclusively confined to exposures and boreholes from Scotland (c.448,100 items) and Northern England (c.3,000 items). It comes from a variety of sources (alluded to in the introduction above) and comprises 3 main collections – the Survey Collection (c.428,600 samples including 29,725 John Smith specimens), the Type and Stratigraphical Collection (c.16,000 specimens), and the Palaeontological Slides Collection (c.6,500 micropalaeontological

slides and fossil thin sections). Access to this material is largely unrestricted though some borehole material (for example that from the British Coal - Scottish Area 'deep mines') remains confidential.

9.2.1 The Survey Collection

Each sample or specimen has a unique registration number, comprising a prefixed registration series, a sequential number, and sometimes a suffix (for example: B1066; M1215a; JS1642; A1776; EG1914 and 11E1939). The registration numbers used to date are:

Registration Series	Registration Numbers	Suffix
B	1 – 5000	
B	1 – 5000	a – i (inclusive)
M	1 – 5000	
M	1 – 5000	a – n (inclusive; j not used)
V	1 – 5000	
V	1 – 5000	a – c (inclusive)
T	1 – 5000	
T	1 – 5000	a – i (inclusive)
JS	1 – 29,725	
A	1 – 2400	
E	1 – 9999	
EA – EW	1 – 9999 (ED - EF, EI, EO – EQ and ES not used in Edinburgh)	
2E – 16E	1 - 9999	
17E	1 – 386+	
DL	1875 – 4799	

Each set of specimens submitted is registered systematically by the palaeontologist. The registration series B, M, V and T were initiated by Bennie, Macconochie, McVey and Tait, and JS indicates the John Smith Collection. Manson continued using the letter M registering materials from both exposures and boreholes. For a while (1952 – 1974), boreholes and exposures were registered separately in the E to EW series. Numbered registration series started with 2E in 1975. 17E is currently being added to. The DL registers were inherited in 1986 and used after that date to sequentially register Northern England material. This series was discontinued in 1996 in favour of the Keyworth system of registration by collector.

The general information recorded in the registers includes at least a locality description, the 1:50,000 and 1:10,000 scale sheet numbers and any BGS Borehole or Site Exploration Registration Number. Significant exposures are logged (this information should be copied to the BGS Notebook Database) and the samples from each bed registered sequentially. Specimens from boreholes are registered in depth order (top to base), for example the set of specimens from the Archerbeck Geological Survey Borehole

(BGS Registration Number NY47NW/14) run from EA1 to 4999 and EC1 to 2521 and correspondingly from 17.45m to 1401.17m depth. Entries recording the names of the fossils identified on each sample are made against its registration number (in reality, however, much material still needs to be worked on).

The amount of material collected depends largely on the fossiliferous nature of the exposure or borehole. One or two past collectors are known to have been biased towards certain taxa. Occasionally the amount of collecting at natural exposures is restricted by conservation, and contractors may allow only minimum sampling of their core from sensitive developments. Time for collection can be an overriding factor. The specimens are stored in the Palaeontology Collections Store (room 2/41, Murchison House) in some 5,300 standard BGS trays in series ordered as above. Each tray has a label showing the tray contents (for example 16E2970 – 2862). Some large specimens are stored in racking, others that are particularly large or heavy are held at Loanhead.

9.2.2 The Type and Stratigraphical Collection

In general, every specimen in the T&S Collection has a unique registration number. This comprises the prefix GSE and a sequential number (from GSE1 to GSE15123). The collection is very largely derived from the Survey Collection. It comprises taxonomic types, which have been illustrated or cited in scientific publications. It also contains generally well-preserved fossils, useful for in-house comparative work that ensures consistency in naming.

The information recorded in the register includes at least the name of the species and its geographical locality. Published references are given, as may be chronostratigraphical or lithostratigraphical information. Cross reference is made to the Survey Collection registration number (and vice versa). The specimens themselves are boxed separately with a white label that records the T&S registration number, geographical and stratigraphical information. A blue label is also completed and placed with the specimen each time it is newly figured. A red spot is stuck to the fossil if it has been used as a type specimen. A green spot is adhered if it has been figured.

In 1993 the Scottish T&S Collection was split when about 10,750 mostly Lower Palaeozoic specimens were shipped to Keyworth and some 750 Silurian, Devonian and Carboniferous fish specimens were sent to the Royal Museum of Scotland, Edinburgh. The approximately 4,500 specimens that remain in Edinburgh reside in the museum area of the Paleontology Collections Store (Room 2/41, Murchison House) where they are arranged taxonomically in 157 alpha-numerically labeled drawers in 6 chronostratigraphically labeled wooden cabinets. Of these, Quaternary specimens (c.2,000) use 53 drawers, Carboniferous specimens (c.900) use 40 drawers, John Smith specimens (c.1,000) use 34 drawers, and the rest (c.600) use 30 drawers. Representative fossils from all the Phanerozoic systems still reside in Murchison House, but, apart from the Quaternary and perhaps the Carboniferous, they have been very impoverished by the split.

In 1994 the T&S Register (5 leather bound volumes) was transferred to Keyworth where new specimens sporadically added to the collection are kept. It is the general practice at that office not to give T&S GSE-prefixed numbers to new specimens, but merely to utilize the existing Survey Collection registration number. A microfilm of the T&S register has been provided for Edinburgh, and whilst it includes specimens GSE1 to 15123 that were registered up to 1994, it needs to be brought up to date.

9.2.3 The Palaeontological Slides Collection

Each slide has a unique registration number comprising a prefixed registration series and a sequential number (for example MIC1648; PS1848). The registration numbers used to date are:

Registration Series	Registration Number
MIC	1 – 944
PS	1 – 4202

The MIC series was started in 1938 by F.W.Anderson, and continues today. It is a collection of microfossils, mounted on cardboard slides with up to 100 numbered cells. The microfauna (mostly foraminifera and ostracoda) are largely derived from samples processed in the laboratory and from the Survey and John Smith collections.

The information recorded in the MIC register (10 volumes) includes a locality description, and the 1:10,000 and 1:50,000 scale sheet numbers. Microfaunas from boreholes are registered in depth order (top to base). Stratigraphic information may also be recorded. Any registration numbers from previous collections are noted. Entries are made recording the name of the microfossil in each cell under each registration number. However, this information is incomplete.

The PS series was started in 1954, and nothing has been added to it since 1987. It comprises fossil thin sections and mounted slides and includes collections donated by E.J.Garwood (algae), G.W.Lee (bryozoa), C.T.Clough (plants), and John Smith (corals, conodonts etc.) It also contains 666 thin sections of foraminifera and other microfossils from the calcareous beds of the Archerbeck Geological Survey Borehole.

The information recorded in the PS register (2 volumes) includes a locality description, and the 1:50,000 and 1:10,000 scale sheet numbers. Thin sections and slides from boreholes are registered in depth order (top to base), and lithostratigraphical information may be recorded from exposures. Any previous registration number (for example from the Survey or John Smith collection) is noted, as are any published references and types. Entries recording the names of the fossils are made against each registration number. However, this information is not fully complete.

The Palaeontological Slides Collection is stored in a wooden cabinet in the museum area of the Paleontology Collections Store (Room 2/41, Murchison House). Ordered by registration number, the MIC and PS series occupy 20 and 72 labeled drawers respectively. Some 160 MIC and 60 PS slides currently reside in Keyworth.

9.3 How to access the collections

There are 2 digital datasets associated with the biostratigraphic collections: FOSSLOC3 and GSE_SPECIMENS.

9.3.1 FOSSLOC3

FOSSLOC3 is an index of the Survey Collection of fossil samples and the Palaeontological Slides Collection for Scotland and Northern England. It is the digital equivalent of the analogue (card) index. The latter contains some 31,000 records, some 70% of which have now been transcribed. The Oracle table TMOS.FOSSLOC3 is the most up to date digital guide to 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 the pathway to an extensive and unique collection of paper graphic logs, some 18,000 of which record annotated information on fossil occurrences and assemblages at certain stratigraphical levels (particularly in the Carboniferous) in Scotland and Northern England. TMOS.FOSSLOC3 is accessible to all BGS staff, but the Data Manager should be contacted first. An MS Access front end to this database is also available, but currently is undergoing redevelopment. TMOS.FOSSLOC3 will be demonstrated on the course.

9.3.2 GSE_SPECIMENS

GSE_SPECIMENS is an index of the specimens and palaeontological slides held in the Type and Stratigraphical Collection of Scotland and Northern England. It is partly the digital equivalent of the analogue (card) index, which is held in Murchison House. The latter contains about 16,000 records, of which perhaps 25% have now been transcribed. For each specimen or slide, an MS Access table MTD_GSE_SPECS provides a link with the Survey Collection, gives nomenclatural, taxonomical, geographical and stratigraphical information, an indication of where the fossil or slide is housed, and any comments, perhaps on the state of preservation. MTD_GSE_SPECS is readily interrogated, but, at present is not accessible to all BGS staff (see 9.3.3 below). It will be demonstrated on the course.

9.3.3 Who to contact

If you wish to interrogate the databases (either digital or analogue) to find out what material is available you should contact the SNEG Field Palaeontologist who is:
Mark Dean, (extn 0354 or e_mail MTD)

9.4 How the collection can be used

The biostratigraphic collections form a unique database for future geological investigations and are extensively consulted by BGS staff, and academic and industrial workers from all over the world. The areas of interest and application include: palaeontological research; biostratigraphic support for the BGS Mapping and Continuous Revision projects; minerals exploration and the exploitation of natural resources; land use development, assessment of ground conditions, risk and hazard; environmental protection and conservation.

9.4.1 Policy on access to the collections (abridged)

The collections were developed primarily for BGS use, and viewing them by our staff is unrestricted. Their use, however, is limited, especially when they are being held in confidence. The analysis of samples and fossils is likely to require the services of a specialist palaeontologist, whose time should be bid for at the beginning of the financial year, or negotiated for during the year. The palaeontologist will also be able to advise on previously published information, BGS technical reports, the availability of information, and services and products. No charge is made for access to the collections by BGS staff, or persons with a *bona fide* academic interest, but charges will be levied for an enquiry or loan linked with any commercial interest.

The destruction of the collections (for example by destructive analysis or sub-sampling for microfossils) is strongly discouraged since the materials are finite and, in effect, irreplaceable. The enhancement of the collections (for example by expert developing of fossils) is accepted. The advice of the palaeontologist must always be sought.

9.4.2 Policy on loans (abridged)

Application for a loan (by anyone) of biostratigraphic materials should preferably be in writing giving adequate reason for the request. As a member of staff you will probably be invited to study the material in the Palaeontology Laboratory (room 2/35, Murchison House), but if you intend to take the materials away, you will have to complete a loan form.

The conditions of a loan place obligations on the borrower for the safe custody of all material; that it will not be altered, in any way, without the written permission of the Curator; and will be safely packed and returned with proper care by the loan return date (usually no more than 1 year after the loan form is issued – or a recall fee may be charged). Materials on loan must **not** be passed to another person or removed to another place, without written permission of the BGS Curator. If the materials are modified, all the products remain the property of BGS. We also request the borrower to inform us of fossil identifications and give us copies of papers (or parts of theses) in which our materials are cited or figured.

9.5 How to add new material to the collection

All biostratigraphic materials acquired by BGS Edinburgh are registered by the staff of the SNEG Paleontology Unit (at present the Field Palaeontologist and a part time assistant). The collections are laid out and examined in the Palaeontology Laboratory (room 2/35, Murchison House) and stored in the Paleontology Collections Store (room 2/41).

Acquisition rates to the primary Survey Collection over the past five years have averaged about 5,000 samples a year. New materials (samples from boreholes and natural exposures) are only accepted into the Survey Collection if they are known to be of actual or potential, scientific or commercial value – *potential* value since much material cannot be identified and analyzed immediately. Materials will generally not be accepted for permanent storage unless the following information is given:

Locality (the geographical name applied to the borehole or exposure)
Locality details (the topographic position, bearings or grid references of boreholes and exposures)
Collector
Date of collection
1:50,000 Sheet number
1:10,000 Sheet number
Borehole registration number)
Site exploration number) (as appropriate)
Field notebook location number)
Depths of specimens from boreholes
Measured position of specimens from exposures
Graphic log of borehole or exposure
Stratigraphic information

Disposal of biostratigraphic materials is strongly presumed against. The disposal of any significant registered specimens is the strict responsibility of the Director under the advice of professional curatorial staff outside BGS. In the case of material being rejected because it has no scientific or historic value (for example rock waste from specimens or cores, multiple specimens received from BGS collectors, and unidentifiable material) disposal may be undertaken by the in-house curator. Unregistered fossiliferous materials should be sorted, sampled and registered, any surplus being disposed of by the in-house curator with discretion.

9.6 Future developments

9.6.1 Additional Material

Over the years the Palaeontological Department in Murchison House has shrunk greatly, putting pressure on the remaining space for the storage of materials. All things remaining the same, and at current acquisition rates, the racking in the store will last about 30 years.

But who can tell the future? The pessimist would point out that contractors in Scotland can be a fickle bunch. They seem to be reticent to pay a fair price for a top quality consultancy service, and that BGS boreholes are at present drilled in-house, but that this facility is under threat. The optimist, however, would look forward to the effects of Scottish devolution - the rejuvination of site and minerals exploration, the revival of research in Scottish Universities, and the receiving back of the bulk of our Type and Stratigraphical Collection from Keyworth. Perhaps BGS Paleontology in Scotland is on the verge of renaissance!

9.6.2 Databasing

The biostratigraphical databases need to be fully populated (see 9.3.1 and 9.3.2 above). They need to be made compatible with other BGS databases (for example within the proposed BGS_geoIDS structure) and made publicly available (for example on the INTERNET). FOSSLOC3 also needs augmenting with detailed stratigraphic and taxonomic data, which would allow enquiries based on these criteria to be effectively dealt with. The most favourable approach to this would be the digitisation of the primary faunal identifications given by each individual register entry (140 volumes). A welcome, but ultimately far less cost-effective compromise would be the digital scanning of the faunally annotated paper graphic logs (c.18,000 records).

Several other databases exist with regard to the BGS Biostratigraphy Collections (Edinburgh). They are all in a state of flux, and none is presently accessible in an up-to-date form to BGS staff. They include:

BGS_GSE_REFS	(specimens held in the BGS (Edinburgh) T&S Collection, and the publications in which they are featured or illustrated. The database is very incomplete)
BGS_SMITH_GSE	(specimens and slides taken from the John Smith Collection and placed in the BGS (Edinburgh) T&S Collection)
BGS_ADDRESS_ED	(records the names and addresses of borrowers of materials from the BGS (Edinburgh) Biostratigraphy Collections)
BGS_SPECS_ED	(records the registration numbers of materials currently on loan from the BGS (Edinburgh) Biostratigraphy Collections)
MTD_TAXALIST	(a taxonomic listing (various phyla and families) of Quaternary, Upper Tertiary and Carboniferous fossils relevant to the palaeontology of Scotland and Northern England. Incomplete.)

The whole area of databasing the Scottish Biostratigraphy Collections needs to be examined holistically, as the relationships between the various collections of data held are complex. It is anticipated that GISG will address these problems in the financial year 1999/2000.

Appendix 9

9.a Example of an entry in the Survey Collection (Edinburgh) register
9.b A print-out from FOSSLOC3.MDB
9.c A print-out from MTD_GSE_SPECS
9.d BGS Charges for Information and Advisory Services leaflet

REGISTERED NUMBER	NAME	No. of Map (6" & 1")	LOCALITY	Remarks
15E 4381		040 E NT28NE	Seafield-Abden Shore (on shore between L & HWM c. 240m NNE of Seafield Tower in shales c. 1m below Middle Kinning Limestone) c. [NT 2802 8877] Coll: M T Dean	
4382				
4383		040 E NT28NE	Seafield-Abden Shore (on shore between L & HWM c. 240m NNE of Seafield Tower in Sst c. 4m below Middle Kinning Limestone) Coll: M T Dean c. [NT 2801 8877]	
4384		040 E NT28NE	Seafield-Abden Shore (In bank below path above HWM c. 220m SSW of Seafield Tower in Shales c. 1m above sst c. 4m below main post of Third Abden (Seafield Tower) Limestone Coll: M T Dean c. [NT 2790 8831]	
4385		040 E NT28NE	Seafield-Abden Shore (In bank below path above HWM c. 220m SSW of Seafield Tower in Shales c. 0-0.3m above sandstone c. 4m below main post of Third Abden (Seafield Tower) Limestone. Coll: M T Dean. c. [NT 2790 8831]	
4386				
4387				
4388				
4389				
4390	ostracods, pond (frag), pond spines, shell frags (indet.), brachiopod? (juv), algal halo	14E NS52NE/21	Blairmulloch Farm Bore (BGS) [NS 5604 2819] Coll. M T Dean (for S K Monro) (See also 15E 5808-6046; 15E 8914-16E 429)	2.16
4391	ostracods, shell frags (indet.), algal haloes, pond (frag.), pond spines			2.21
4392	ostracods, shell frags (indet.), pond frags & spines, algal haloes			2.26
4393	as 4392, crinoid columnals			2.29
4394	opt 4393, Sorentscus sp (poor), crinoid columnal			2.29
4395	ostracods, shell frags (indet.), pond frag? & spines, algal haloes, crinoid columnals			2.32

REGISTERED NUMBER	NAME	No. of Map (6" & 1")	LOCALITY	Remarks
ISE 6826			North Clarement Sht. BH1 (as before)	18.20
6827				39.65
6828	leaf (impression)	23E NS83SE	Craig Burn [NS8720 3308] & [NS8709 3320] Coll. MTDean (11&19/9/96)	
6829	cpt 6828		Exposures: 960m to 88° from Parkhall and 860m to 81° from Parkhall respectively)	
6830	carbonaceous streaks & rooty bioturbation (v. vague)		Measured Section:	
6831	carbonaceous streaks & patches, rooty bioturbation, plant frags (carbonised) (?megaspores)		Mudstone, pale grey orange weathering, silty with marine fossils [NS8709 3320] Specimens ISE 7060-7102 (008/36W at [NS8708 3322]) Craigburn Shell-bed c1·7m	
6832	rooty vugs & bioturbation, coaly patches		Sandstone, silty (see previous graphic) c. 2·0m	
6833	plant frags (?megaspores) (carbonised), rooty bioturbation		Seatearth with sandstone rib (") c. 4·6m	
6834	rooty vugs & bioturbation, plant frags (carbonised) (?megaspores), 'nodular' (after roots?)		Mudstone/siltstone, pale grey, sandy with minor gaps (continuation of seatearth above) c. 3·0m	
6835	plant frags & root traces (carbonised)		Gap c. 9·4m	
6836	cpt 6835		Mudstone, pale grey mottled orange, buff & mauve, silty, sandy in places, generally friable, very soft and hard in places (very soft & clayey at base), rooty (bioturbated) Poorly exposed in stream & SW bank (seatearth) c. 7·2m	
6837	vugy root traces		Gap with sporadic mudstone, red-brown mottled orange and buff, silty and sandy, soft to hard (seatearth) c. 6·5m	
6838	coaly plant frags		Siltstone, dull brown-red mottled pale grey;	
6839	rooty plant frags (carbonised)			
6840	Productus sp. (frags), Edmondia sp. (v poor), plant material (carbonised), shell frags (indet), ?fish material, Naticopsis variata ?(whorl frag.),			

FOSSLOC3

LOCALITY	LOCALITY_DETAILS	QS	EAST1
MONKLANDS HOSPITAL BORE 9		NS76NW	
M73 HAZARD WARNING BORE 12/2		NS76NW	
MONKLANDS HOSPITAL BORE 8		NS76NW	
SUNNYSIDE ROAD, COATBRIDGE BORE 4		NS76NW	
SUNNYSIDE ROAD, COATBRIDGE BORE 11		NS76NW	
SUNNYSIDE ROAD, COATBRIDGE BORE 1		NS76NW	
SUNNYSIDE ROAD, COATBRIDGE BORE 2		NS76NW	
SUNNYSIDE ROAD, COATBRIDGE BORE 3		NS76NW	
MUIRYHALL STREET COATBRIDGE BORE 4		NS76NW	
MUIRYHALL STREET COATBRIDGE BORE 1		NS76NW	
MUIRYHALL STREET COATBRIDGE BORE 2		NS76NW	
COLTSWOOD, COATBRIDGE, BH.1	SE14682	NS76NW	
COLTSWOOD, COATBRIDGE, BH.2	SE14682	NS76NW	
BURNLIP DIAMOND BORE 1	0.75ML SE OF GLENBOIG RLY STAT-2ML N OF CAOTBRIDGE	NS76NW	
AIRDRIE HOSPITAL BORE		NS76NW	
AIRDRIE HOSPITAL BORE		NS76NW	
AIRDRIE HOSPITAL BORE		NS76NW	
AIRDRIE HOSPITAL BORE		NS76NW	
AIRDRIE HOSPITAL BORE		NS76NW	
AIRDRIE LEAEND NEW SERIES BHS		NS76NW	
AIRDRIE LEAEND BORE		NS76NW	274920
AIRDRIE LEAEND BORE		NS76NW	274800
COATBRIDGE BORE 1967-1968		NS76NW	
COATBRIDGE BORE 1967-1968		NS76NW	
COATBRIDGE BORE		NS76NW	
AIRDRIE LEAEND BORE		NS76NW	274690
AIRDRIE LEAEND BORE		NS76NW	274700
MOSSIDE AIRDRIE BORE		NS76NW	
MOSSIDE AIRDRIE BORE		NS76NW	
BEDLAY COLLIERY NO2 BORE		NS76NW	
BEDLAY COLLIERY NO2 U/G BORE		NS76NW	
BEDLAY COLLIERY NO3 1963 U/G BORE		NS76NW	
BEDLAY COLLIERY 1/64 U/G DOWN BORE		NS76NW	
BURNLIP DIAMOND BORE 1	0.75ML SE OF GLENBOIG RLY STAT-2ML N OF COATBRIDGE	NS76NW	
BURNLIP DIAMOND BORE 1	0.75ML SE OF GLENBOIG RLY STAT-2ML N OF COATBRIDGE	NS76NW	

FOSSLOC3

NORTH1	EAST2	NORTH2	NGA	ONENO	REG_SERIES_NO	MIN_NO	MAX_NO	SUFFIX	RT	NUMB	BSUFF	PD_NUMBER	YEAR	RP_NUMB
				31W	14E	650	657	.	BJ	481	.			
				31W	13E	8650	8652	.	BJ	482	.			
				31W	14E	643	649	.	BJ	480	.			
				31W	15E	1264	1269	.	BJ	490	.			
				31W	15E	1347	1365	.	BJ	491	.			
				31W	15E	1247	1254	.	BJ	487	.			
				31W	15E	1255	1256	.	BJ	488	.			
				31W	15E	1257	1263	.	BJ	489	.			
				31W	15E	1663	1665	.	BJ	494	.			
				31W	15E	1651	1659	.	BJ	492	.			
				31W	15E	1660	1662	.	BJ	493	.			
				31W	15E	1676	1682	.	BJ	.	.			
				31W	15E	1683	1686	.	BJ	.	.			
				31W	T	3537	3542	b	BJ	140	.			
				31W	ET	2074	2081	.	BJ	263	.			
				31W	ET	2082	2086	.	BJ	268	.			
				31W	ET	2091	2092	.	BJ	270	.			
				31W	ET	1863	1866	.	BJ	266	.			
				31W	EV	5823	5847	.	BJ	318	.			
				31W	3E	6118	6121	.	BJ	352	.			
0665700				31W	2E	3149	3168	.	BJ	350	2			
0665670				31W	2E	3935	3950	.	BJ	350	4			
				31W	ET	1921	1927	.	BJ	285	.			
				31W	ET	1928	1932	.	BJ	288	.			
				31W	EN	1733	1738	.	BJ	203	.			
0665720				31W	2E	4774	4776	.	BJ	350	5			
0665620				31W	2E	4777	4783	.	BJ	350	6			
				31W	9E	1039	1053	.	BJ	407	.			
				31W	9E	1054	1057	.	BJ	408	.			
				31W	E	6371	6380	.	BJ	4	.			
				31W	EH	9930	9935	.	BJ	12	.			
				31W	EL	4947	4950	.	BJ	11	.			
				31W	EL	5326	5327	.	BJ	10	.			
				31W	T	3331	3414	b	BJ	140	.			
				31W	T	3435	3443	b	BJ	140	.			

FOSSLOC3

CHRONOSTRATIGRAPHICAL_AGE	LITHOSTRATIGRAPHICAL_AGE	USER_ENTERED	DATE_ENTERED	USER_UPDATED	DATE_UPDATED
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96
C		TMOS	06/02/97	KAH	13/12/96

MTD_GSE_SPECS

GSENUM	OLDNUM	ENT_DATE	GENUS	SUB_GENUS	SPECIES	SUB_SPECIES	SP_AUTHOR	SUBSP_AUTHOR	STATUS	TAX_GROUP
7		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
8		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
9		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
10		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
11		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
12		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
13		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
14		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
15		11/11/93	Euchasma		blumenbachi		Billings			Rostroconcha
683	M523d	11/11/93	Euchasma		sp.(4)					Rostroconch
5350	M4078d	11/11/93	Olenellus		reticulatus		Peach		syntype	trilobite
181		11/11/93	Diploplegma		cinctum				holotype & topo	
9958	M4036d	11/11/93	Ischadites		sp.					sponge?
14102A	9E5780a	11/11/93	Acrograptus		filiformis cf.					Graptolite
14993	13E4938	11/11/93	Pristiograptus		fragilis		J.E.Hutt			Graptolite
13844	8E8134a	11/11/93	Tetragraptus		s.l. kindlei					Graptolite
438		11/11/93	Diplograptus		rugosus		G.L.Elles & E.M.R.Wood			Graptolite
22		11/25/93	Euchasma		sp.(1)					Rostroconcha
23		11/25/93	Euchasma		sp.(1)					Rostroconcha
24		11/25/93	Euchasma		sp.(1)					Rostroconcha
25		11/25/93	Euchasma		sp.(1)					Rostroconcha
26		11/25/93	Euchasma		sp.(1)					Rostroconcha
27		11/25/93	Euchasma		sp.(1)					Rostroconcha
8073	M2344e	11/25/93	Orthoceras		mendax		Salter			Cephalopod
14649	T713e	11/25/93	Metabrograptus		scoticus		Strachan		Paratype	Graptolite
14102		11/30/93								
28		12/06/93	Euchasma		sp.(2)					Rostroconcha
29		12/06/93	Euchasma		sp.(2)					Rostroconcha
30		12/06/93	Euchasma		sp.(2)					Rostroconcha
31		12/06/93	Euchasma		sp.(2)					Rostroconcha
32		12/06/93	Euchasma		sp.(2)					Rostroconcha
33		12/06/93	Euchasma		sp.(2)					Rostroconcha
39		12/06/93	Euchasma		sp.(3)					Rostroconcha
40		12/06/93	Euchasma		sp.(3)					Rostroconcha
41		12/06/93	Euchasma		sp.(4)					Rostroconcha
42		12/06/93	Euchasma		sp.(4)					Rostroconcha
43		12/06/93	Euchasma		sp.(4)					Rostroconcha
44		12/06/93	Euchasma		sp.(4)					Rostroconcha
45		12/06/93	Euchasma		sp.(4)					Rostroconcha
46		12/06/93	Euchasma		sp.(5)					Rostroconcha

MTD_GSE_SPECS

GSENUM	OLDNUM	LOCALITY	LOCAL_DESC	SHEET	QS	EAST	NORTH	NGA
7		Durness						
8		Durness						
9		Durness						
10		Durness						
11		Durness						
12		Durness						
13		Durness						
14		Durness						
15		Durness						
683	M523d	An Garbh Eilean						
5350	M4078d	Meall a' Ghuibhais, Kinlochewe		92				
181		Abington or Hartree Hill						
9958	M4036d	Trochraigue Burn?	Small stream just below Trochraigue House and about 2mi NE of Girvan, Ayrshire	8				
14102A	9E5780a	Grey Hill	Roadside at 3010m at 243.5* from trig point at Grey Hill		NX	1382	9156	4
14993	13E4938	Glenswinton	Stream 650m E by N of Glenswinton north bank		NX	7073	7455	4
13844	8E8134a	Balcreuchan Port	800m at 309* from Little Bennane		NX	948	8737	4
438		Laggan Gill		15				
22		Durness						
23		Durness						
24		Durness						
25		Durness						
26		Durness						
27		Durness						
8073	M2344e	Loch Lonachan,Broadford,Skye	Exposures near Loch Lonachan	71				
14649	T713e	Corsewall Lighthouse	At arch on shore between Portpatrick and Corsewall Lighthouse	3	NW			
14102								
28		Durness						
29		Durness						
30		Durness						
31		Durness						
32		Durness						
33		Durness						
39		Durness						
40		Durness						
41		Durness						
42		Durness						
43		Durness						
44		Durness						
45		Durness						
46		Durness						

MTD_GSE_SPECS

GSENUM	OLDNUM	SYSTEM	HORIZON	DRAW_NUM	COMMENTS
7		Cambro-Ordovician		A9KW	
8		Cambro-Ordovician		A9KW	
9		Cambro-Ordovician		A9KW	
10		Cambro-Ordovician		A9KW	
11		Cambro-Ordovician		A9KW	
12		Cambro-Ordovician		A9KW	
13		Cambro-Ordovician		A9KW	
14		Cambro-Ordovician		A9KW	
15		Cambro-Ordovician		A9KW	
683	M523d	Cambro-Ordovician		A9KW	approaching Eopteria
5350	M4078d	Cambrian	Fucoid Beds, Cambrian	A14KW	
181		Ordovician			
9958	M4036d	Ordovician	Lower Caradoc	A64KW	
14102A	9E5780a	Ordovician		A47KW	Pyritised distal fragment tentatively referred to this species
14993	13E4938	Ordovician		A56KW	
13844	8E8134a	Ordovician		A57KW	Acrograptus?
438		Ordovician	Lower Caradoc		Missing
22		Cambro-Ordovician		A9KW	
23		Cambro-Ordovician		A9KW	
24		Cambro-Ordovician		A9KW	
25		Cambro-Ordovician		A9KW	
26		Cambro-Ordovician		A9KW	
27		Cambro-Ordovician		A9KW	
8073	M2344e	Cambrian	Durness Limestone	A12KW	
14649	T713e	Ordovician		A54KW	
14102					
28		Cambro-Ordovician		A9KW	
29		Cambro-Ordovician		A9KW	
30		Cambro-Ordovician		A9KW	
31		Cambro-Ordovician		A9KW	
32		Cambro-Ordovician		A9KW	
33		Cambro-Ordovician		A9KW	
39		Cambro-Ordovician		A9KW	
40		Cambro-Ordovician		A9KW	
41		Cambro-Ordovician		A9KW	approaching Eopteria
42		Cambro-Ordovician		A9KW	approaching Eopteria
43		Cambro-Ordovician		A9KW	approaching Eopteria
44		Cambro-Ordovician		A9KW	approaching Eopteria
45		Cambro-Ordovician		A9KW	approaching Eopteria
46		Cambro-Ordovician		A9KW	

10. The Petrological Collection (Edinburgh)

10.1 Introduction

The Edinburgh petrological collections comprise rock and mineral samples, primarily from outcrop, resulting from the onshore survey and related investigations within Scotland. They essentially mirror the England & Wales collections housed in Keyworth. The subdivision between the two collections is historical resulting from the original existence of an effectively separate Geological Survey of Scotland when the collections were initiated. It is only comparatively recently when the area of onshore responsibility within Murchison House extended south of the border; however, English samples are still registered within the Keyworth collections.

In Murchison House, as at Keyworth, the collections are maintained and administered by the Mineralogy & Petrology Group (see Appendix) on behalf of the Collections Administration Group (part of Corporate Services and Business Development).

10.2 Collection size and content

The following table lists the main collections housed in the 'rock store' (room 2/1). Thin sections pertaining to these samples are housed in the adjacent room 2/4.

Collection	Number of samples	Sample code	Description	Thin section	Active	Form of database
Scottish sliced rock	99,999	S	Rock samples collected during mapping	Yes	No	Paper records and BritRocks
" (continued)	1,000	N	" "	Yes	Yes	" "
Murchison Collection	5,800	MC	Rock and mineral samples of special interest or quality	No	Yes	Predominantly paper records
Edinburgh collection	7,500	ED	Mainly rock samples resulting from ad hoc investigations	Yes	Yes	Predominantly paper records
Systematic collection	14,000	Various collector codes	Suites of representative samples arranged by 1" map sheet	No	No	Paper records

The Scottish sliced rock collection is the main collection used by BGS field staff and represents the main registration vehicle for samples submitted for thin sectioning and petrographical study as part of the mapping programme. This was initiated in about 1900, with sample S1 being a basalt from Arthur's Seat in Edinburgh. In 1997, when this collection reached 100,000 it was supplanted by the N collection, purely as numbers over 100000 become unwieldy and increasingly liable to error and misidentification. Samples are routinely registered in the corporate Oracle database BritRocks. S numbers (or corresponding E numbers for south of the border) are typically quoted in BGS publications, thus retention of material represents an essential backup whereby later generations of geologists can re-examine and re-interpret samples described by their forebears.

The Murchison Collection comprises a suite of samples including many of display quality, such as samples of building stones, quarry samples and vein or mineral material of economic interest. Although sample information is largely contained in paper registers all samples relating to quarried stone has been entered into a separate MS Access™ database as an aid to enquiry work etc.

The Edinburgh Collection is a receptacle for material not obviously relating to onshore geological surveying. Most of the samples have accompanying thin sections. For example, it may contain archaeological samples or building stone material resulting from ad hoc petrological investigations undertaken over the years.

The systematic collection was assembled many years ago (ca. 1935) from non-sectioned samples. The samples are well trimmed and of uniform size and are intended to provide a representative range of rock types from a given 1:63,360 map sheet. Although now deemed inactive it forms a useful tool to staff undertaking new investigations within a particular area. The material is referenced solely in geologists' collection registers.

In addition to these collections the Murchison House Rock Store contains collections of geologists personal material, donated collections (e.g. from Universities), mineral collections (e.g. the Knox collection).

10.3 How to access the collections

Information contained within the BritRocks Oracle databank can be accessed via a desktop PC. The front end for this database is a customised MS Access application. This allows a user to retrieve sample data on the basis of area (map sheet or grid referenced), collection code or registered number. It also enables users to enter data. More information can be supplied on request. Alternatively, the Oracle tables (on the server KWDBASE) can be accessed directly via SQL or linked to an Access database.

The Geoscience Data Index (an ArcView GIS application) can also be accessed from a desktop PC and BritRocks sample localities viewed together basic sample information.

Otherwise access to material or sample information can be made through the curator. For BGS staff thin sections or samples can be readily issued on long term loan, a database is maintained recording the whereabouts of material. Material can also be issued on loan to external bodies or organisations. In this case a fixed period is designated and signed requisitions are required. *It is important that material on loan to BGS staff is not passed on to other staff and in particular external collaborators without informing the curator.*

10.4 How the collections can be used

In addition, to providing an historical archive and registration system for samples and thin sections, the collections form a valuable resource for new investigations, sheet revisions or providing samples for further analysis. Staff therefore should assess the material and information available prior to undertaking new or follow-up investigations that may involve sample collection. The cost of sample collection and thin section preparation can be significant. Many samples in the collections may in fact be derived from exposures no longer

accessible and thus could provide a more extensive coverage than could be obtained by a collection programme today.

Samples and sections can be made available for study by external organisations, or loaned for display purposes. Academic or educational uses do not attract a charge, but availability of material to service commercial work should be charged accordingly.

10.5 How to add new material to the collections

Scottish samples submitted for thin sectioning are registered in the BritRocks database. Currently the main system is for collectors to submit sample details on a collector's sheet (Appendix). This includes collectors' number, location, sample type and rock/mineral identification. Although no specific requirement is indicated on the form for lithostratigraphical or chronostratigraphical information this should be supplied if known. The curator then enters this information into the BritRocks database and files the paper copy. At the same time he issues the appropriate N number.

Material not requiring sectioning can be entered in the MC or ED collections if the collections administrator and the geologist agree the sample(s) justify this. Otherwise, subject to limitation of space samples can be maintained as a personal collection within the rock store. In the event of the member of staff leaving or retiring paper records (i.e. collectors book or forms) relating to non-registered samples must be deposited with the curator.

10.6 Future developments

Future developments are primarily in the use of computer software in facilitating the storage, retrieval and use of sample data. Because of the length of time that the collections have been in existence there is wide range in the quality of the data held. Rock nomenclature has evolved and most critically the NGR system of location was not in existence during earlier years. Another consequence of the system as operated, both pre-electronically and since, is that basic data is entered into the archive and has not been modified significantly as a result of petrographical or other examination. So a desirable future development is to enable collector/geologist to enter and update his/her own data, and to use the BritRocks database as a personal resource. Although the BritRocks interface currently allows any user to enter data, only the curators can modify data.

The development of the Intranet is likely to be important in that BGS datasets will be easily accessible via this medium to all staff. GIS (e.g. ArcView) applications will allow the ready retrieval of sample locations and information.

Other developments are likely in the near future regarding sample registration protocols and material acquisition policy etc, to conform with corporate standards and QA requirements.

Appendix 10

10.a Key staff

Name	Function	Location	Email
B. Beddoe-Stephens	Petrological collections manager, Scotland	Room 2/5 Murchison House	BBE
R.D. Fakes	Collections curator and sample registration, Scotland	Room 2/4 Murchison House	RDF
A.C. Mackenzie	Manager BritRocks databank, UK	Keyworth	ACMA

10.b Example of collection form used by geologists to record samples. A copy of this is used to submit samples for thin sectioning and registration in the Petrological collections.

British Geological Survey

Sample collecting form

BGS REGISTERED NUMBER IF, AND WHEN ASSIGNED

TO INCLUDE GROUP, FORMATION OR MEMBER STATUS, IF KNOWN

For official use
Date (database/SRO) ....
Date (group/unit) ....

Sample destination	
Biostratigraphy ☐	Min and Pet ☐
Other (please specify)	

Submission date .... 1:50 k Geological map ....

Collector's name .... County/country ....

Project code .... Confidential ☐ Yes ☐ No Confidential samples must be recorded on a separate sheet

Fields indicated by shading must be completed

Original sample number		Additional sample number	Original sample type	Retained sample		NGR 100 km square	National Grid Reference		Precision	Sample elevation/ depth	Datum	Locality information	Geological description
Prefix	Number			Type	Stored location		Easting	Northing					

11. The Offshore Core and Sample Collection

11.1. Introduction

The marine sample collection is largely the result of the regional survey of the UK Continental Shelf carried out between 1968 and 1986, funded by the then Department of Energy.

The oldest BGS sample in the archive was collected on the 17th Aug 1967, sample number 54/-05 110 was collected at 2.45pm. The deepest BGS drilled borehole at 274m was completed on 8th September 1989.

Since 1986 the Marine Group has continued to add to the collection by attracting funding from a number of sources, working either as a partner or as a contractor to commercial companies.

Initially offshore samples were given prefixes of abbreviated ship names or general sea areas, Dogger Forties and Forth Approaches for example. However it was soon recognised that this system was too arbitrary and so the Latitude/Longitude system was adopted and continues today. Appendix 11.1 shows the sheet names and the maps produced by the marine groups.

We retain all samples collected, in perpetuity. The reason for this is two fold, cost and availability. Chartering a ship, mobilising and de-mobilising the equipment, transit time to and from the site, not to mention staff time makes re-sampling one site extremely expensive. Secondly, not every site is still accessible as cable and pipeline routes not to mention offshore structures installed after our sampling programmes have exclusion zones around them.

Although the collection is an archive it is not a museum and as such staff are encouraged to use it. This can be either for examination only or for sub-sampling. Not only BGS staff but also university students and staff and commercial companies are encouraged to utilise the samples.

Whilst it is the marine collection it should be remembered that the geology of the UK does not begin or end at the coast. Some of the samples or data held by the marine group could be of value to someone working onshore.

The National Core Store (North) is only 6 years old. Prior to 1993 the various collections were stored in a number of sites around Edinburgh and its suburbs. The marine collection was housed in an old army camp outside Dalkeith, south of Edinburgh. In the spring 1993 when we acquired the lease for the present building the various collections were brought together under the one roof at Loanhead. It took one month to move the marine collection but several months to plan.

11.2. Collection size and content

We not only have samples collected by BGS for our own purposes at Loanhead but also samples collected by us for clients, and samples donated by commercial companies carrying out site investigation work.

Exploration companies like Shell and B.P. or geotechnical companies such as Fugro and Alluvial Mining have donated samples to the offshore archive. Whilst these samples are not fully 'open shelf', they may be examined by anyone who has the written permission of the owner. We also have samples donated by academia.

Unlike the land survey there is no act of parliament covering sample donations. UKODA has made recommendations to its members that data should be donated to BGS, but often it comes down to contacts within companies.

11.2.1 Regional samples

This is the term used to distinguish between the shallow samples collected *by* BGS *for* BGS and other samples in the collection.
A total of 20 000 core samples have been collected from almost 23 500 sites occupied for sampling purposes and 23 500 surface samples from just over 24 000 occupied sites. Where possible each collection in the archive has been ordered by degree square commencing from the south western most area working east and then north or in the case of the boreholes sequentially within the year of drilling.

The collection is continually growing although not at the rate it did when the regional survey was at its height in the early 1980's.

11.2.1.1 Core and bottle samples

These samples are stored in the original containers they were collected in on the ship. They may have been cut longitudinally, in the case of cores, x-rayed, photographed or sub-sampled. But they are still essentially as they were collected, allowing for deterioration due to time.

11.2.1.2 Particle size analysis

Samples analysed to determine their grain size are stored separately from the 'original' samples. The majority of these are seabed samples although there are a few thousand samples from various depths down cores.

We have 33 000 samples sieved for major fraction particle size analysis in the collection. Of these
14 300 have been sieved to half phi divisions and 5 500 to phi.

11.2.2 Borehole collection

This is the collection of boreholes drilled for BGS. Between June 1969 and 1998 almost 600 offshore boreholes, 30km total length, have been drilled by BGS. Most

are open file however some, drilled under the direction of the Rockall project for example, have restrictions on them.

11.2.3 Non-BGS samples

Samples have been donated to BGS by various external bodies. The samples are stored in the non-BGS collection in anonymous, sequentially numbered boxes, no original numbers are visible. There are presently 54 500 sample sites in the non-BGS table and 8 000 boxes of samples in the collection with more being added all the time. As with other collections there is no hard and fast acquisition rate as we are dependent on the generosity of those who donate the material.

11.2.4 Hydrographic Office samples

The Hydrographic Office sample set are all surface samples collected for the compilation of their Admiralty Charts. Talks are currently being held to allow BGS to use the data for our own purposes. The sheets completed at the time of collection recording an abbreviated description of all samples and possible reasons for the unsuccessful occupation of a site are sent to BGS together with the samples.

Not all samples collected by the Hydrographic Office are retained, and so whilst we only have 8 000 samples in this set we hold descriptions for over 20 500 individual sample points.

11.2.5 Falkland Island samples

The most recent addition to the archive are the samples from the hydrocarbon exploration drilling in the south Atlantic Ocean around the Falkland Islands. As part of the contract awarded to BGS by the Falkland Islands Governments' we store the core and cuttings samples. This material is not open shelf and will remain confidential for at least the next 5 years.

11.3 How to access the collection indexes

There are a number of indexes relating to the marine samples. However, as with the other collections you may only examine a few of them. The tables are held on the database server and may be interrogated via SQL or MS Access. The tables are currently being scrutinised and the data allocated a quality code, essentially a confidence rating in the data held. The fields included in the tables allow samples to be searched for by degree square, number, old number or equipment type and in any combination.

11.3.1 Sample station data

Allows for information on each sample station to be retrieved, including either precise position or degree square, basal depth of sample and when the sample was collected, amongst others.

DGSQ	NOT NULL	Char (6)	Degree square (e.g. "+58+01")
NUM	NOT NULL	Number (5)	Sample station number
WHEN		Date	Date and time
SHIP		Char (2)	Ship code
CRUISE		Number (2)	Cruise number
DEPTH		Number (4)	Water depth
PFIX		Char (1)	Position fixing method
COMM		Char (1)	Comments flag
LAT		Number (10, 5)	Latitude
LON		Number (10, 5)	Longitude
OLDNUM		Char (6)	Old sample station number or borehole number
TD		Number (7,2)	Terminal depth
SUMMARY		Char (70)	Summary sample station description
SITE_QC		Char (2)	Site quality code

11.3.2 Sampling equipment data

When linked to the sample station data table this table adds the equipment type and success code to any query.

DGSQ	NOT NULL	Char (6)	Degree square (e.g. "+58+01)
NUM	NOT NULL	Number (5)	Sample station number
EQTYPE		Char (2)	Equipment type code (e.g. GS, VE)
SUCCESS		Number (1)	Success code (1 to 4)

11.3.3. Sample store

This table is one of the newest in the offshore database. It is continually being updated, as data from the ongoing validation programme becomes available. It defines what samples are available for a particular site, what condition the sample is in and where to find it in the store.

DGSQ	NOT NULL	Char (6)	Degree square (e.g. "+58+01)
NUM	NOT NULL	Number (5)	Sample station number
OLDNUM		Char (6)	Old sample station number or borehole number
EQTYPE		Char (2)	Equipment type code (e.g. GS, VE)
ACCN		Char (1)	Accession number
NO_CORES		Number (2)	Number of cores
NX		Char (1)	Core NX (Y or N)
CUT		Char (1)	Core cut (Y or N)
PHOTO		Char (20)	Negative number
XRAY		Char (1)	X-ray available (Y or N)
CORE_LOC		Char (2,3)	Core location
NO_BTLS		Number (2)	Number of bottle samples
NO_SHOE		Number (2)	Number of shoe samples

BTL_LOC	Char (2,3)	Bottle location
SAMP_QC	Char (2)	Sample quality code

11.3.4 Who to contact.

All enquiries relating to offshore samples should be directed, in the first instance, to the Core Store Manager. If you have an enquiry relating to records or reports held by the Petroleum and Marine Geology Group the Records Manager should be contacted. Other enquiries relating to the database should be directed to the Database Manager.

Database Manager	Colin Graham	extn. 398	email CCG
Records Manager	John McGuigan	extn. 383	email JMCG
Core Store Manager	Graham Tulloch	extn. 365	email GJT

Although the preferred option is for individuals to visit the store arrangements can be made for samples to be taken to Murchison House.

11.4 How the Collection can be used

As a member of staff there are no restrictions on access to BGS owned material, other than those imposed by the project leader or others working on any samples you may require. Non-BGS samples may have some restrictions placed on them by the owners, however restrictions are kept to a minimum as a term of acceptance for storage. If they will not allow BGS staff access to their samples we may refuse to accept them.

11.4.1 Previous work

Before any work is carried out on a sample in any of the marine collections the possibility of similar data existing from previous analysis should be investigated.

The Records Manager should be contacted to determine if there are any similar reports on file. The Core Store Manager will also check if there are any results expected from the sample(s) in question before signing an Authority to Remove/Work on Samples held in the BGS Core Store form, see Appendix 11.2.

If results from previous analyses are available these should be used in the first instance, even if it is merely to refine your own sampling regime.

11.4.2 Sampling

BGS staff may sub-sample material by arrangement of the Core Store Manager.

As with other BGS collections common sense should be used when sampling archive material.

- avoid repeating analyses if at all possible

- non-destructive testing carried out first
- use as little material as possible
- acid used on limited areas and washed after use
- individual fossils should not be destructively tested

Before sub-samples are removed an Agreement for the Loan of Material from the BGS Marine Store form must be signed and appended with sample numbers and depth intervals. If the samples are to be removed from the core store a Sample Issue and Receipt Voucher will be filled out to accompany the samples. See Appendix 11.3 and 11.4. These forms are an important part of our sample tracking procedures.

11.4.3 Material processing

Samples in the collection have already undergone various sampling regimes and if required more can be undertaken by PMGG laboratory staff or they can arrange for it to be carried out at an external laboratory if it cannot be done in-house.

- Cores cut longitudinally
- Photography
- X-ray photography
- Sub-samples can be taken for geotechnical analysis; Moisture content, plasticity etc.
- Whole samples may be removed for destructive testing if required.

11.4.4 Reporting

All results pertaining to borrowed samples should be copied to the Records Manager via the Core Store Manager. This allows accurate tracking of the movement of the samples to take place. Samples for which the agreed time limit for results to be lodged has expired will be pursued, either for the return of unused samples or related data if analysis has been carried out.

It is in everyone's interest that a tight control is maintained on sub-sampling the collection and the lodging of data, therefore enquirers are not given further access to the sample collection until either data or samples have been returned to BGS.

11.4.5 Charges

BGS staff can, obviously, access the collections free of charge. However, if Core Store staff are required to assist it will be necessary to provide a project code to cover the time involved.

Most charges to academic enquirers are waived on production of a letter from their Department Head stating that the research is for non-commercial purposes, see Appendix 11.5 for an example of the Supporting Statement for Waiving of Charges. Although, in line with other enquirers, researchers must pay for consumables.

Commercial non-BGS enquirers may access the collections for a small charge and the production of a letter of agreement from the owner of non-BGS samples. Charges are made to owners of non-BGS material who are examining their own samples.

Current charges are available on request.

11.5 How to add new material to the collection

New material may be donated to BGS and added to the offshore collection at any time by anyone.

The pre-requisites for BGS to accept marine samples are:

- Samples **must** have spatial data (for BGS staff in the form of completed Sample Data Sheets, as per Fyfe, 1986)
- Samples should be clearly labelled with sample reference numbers and orientation marks
- Details of previous sub-sampling carried out provided

See Appendix 11.7 – 11.9 for examples of standard BGS marine Sample Data Sheets.

If any of these prerequisites is not complied with the samples **will not** be accepted.

In addition, the following are also requested:

- Composite logs of core samples
- Reports generated from analyses

Samples are accepted with the caveat that if BGS no longer wishes to retain the samples, for whatever reason, they will be offered back to the owner prior to disposal.

Samples will be accepted if there is a contractual obligation for BGS to do so and may *not* be accepted if there are samples already in the archive that the new set does not add any value to.

The Core Store Manager must be informed that samples for retention are to be delivered to the Core Store at least one week in advance of expected delivery.

The points covered in paragraphs 11.4.1 to 11.4.4 and 11.5 are covered in greater detail in Tulloch (1998).

11.6 Future Developments

11.6.1 Additional material

Material from BGS projects like the Rockall Consortium continues to ensure that sample material is being added to the collection, not forgetting the Hydrographic Office and other non-BGS sources.

However the main influx of sample material to the National Core Store (North) in recent years, whilst not new to BGS, has been the marine samples relocated from Keyworth. Once this exercise is complete, hopefully within the current calendar year, there will be one store for all marine samples, housing in the region of 50 000 boxes of samples.

11.6.2 Databasing

When the move from the old store at Newbattle was completed it was recognised that the opportunity to validate the archive had presented itself. The sample collection had grown, year on year with little or no real check done on it. Did samples still exist after 30 years? And if so what condition were they in?

Every sample in every box will be examined for accuracy of labelling, condition and completeness. In addition the x-ray and conventional photographic collections will cross-reference with the samples and the position of the sample within the store will also be noted. See Appendix 1.10 for an example of validated samples. Appendix 11.10 lists the Quality Codes available to be assigned to the samples.

References

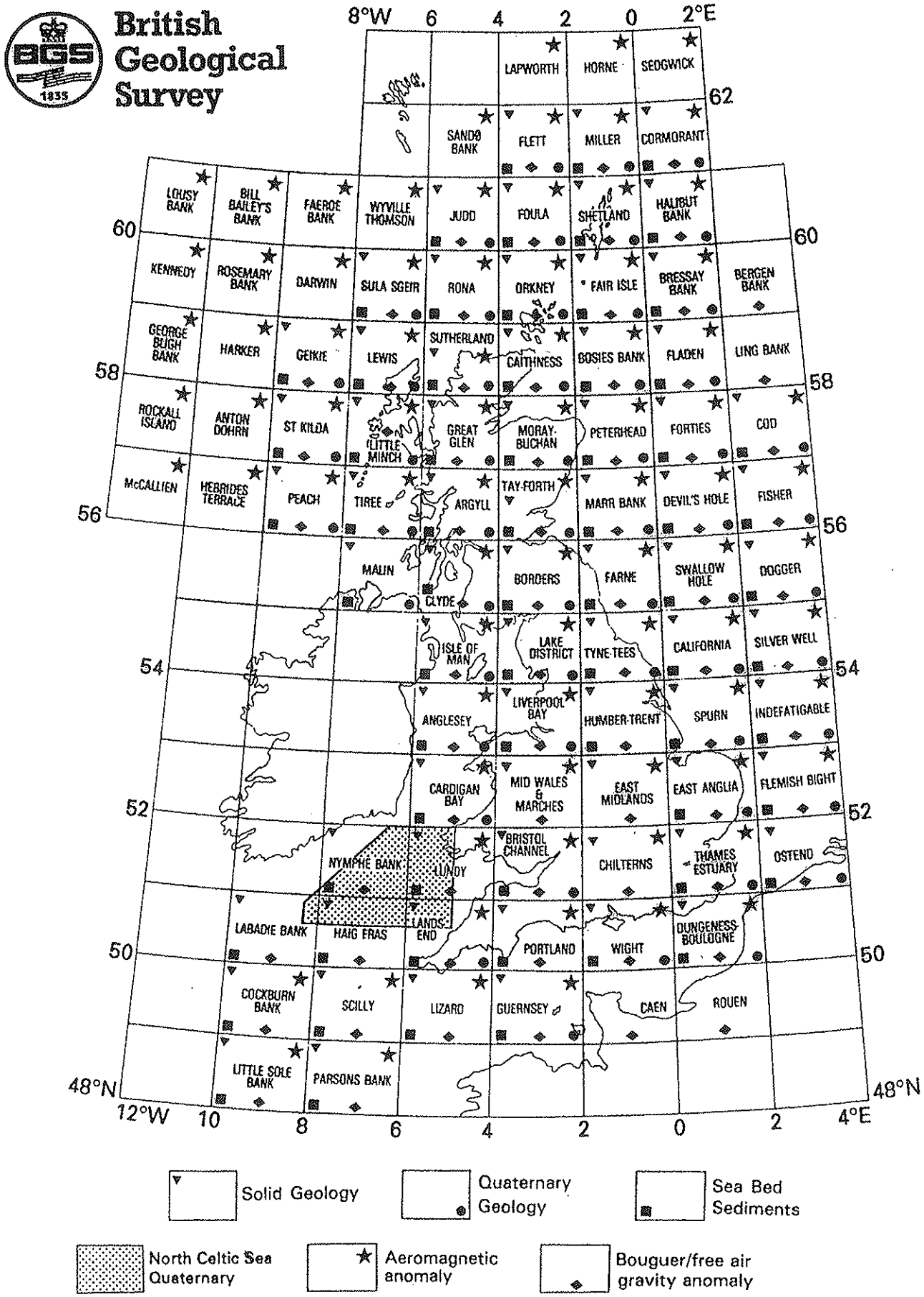
Fyfe, J.Alan, 1986. A guide to shipboard recording of sample station data. **BGS Technical Report WB/86/41, Marine Report Series.**

Tulloch, Graham J., 1998. Management of Sample Material within BGS Petroleum and Marine Geology Core Store and Laboratory. **BGS Technical Report WB/98/53, Marine Report Series.**

Appendix 11

a) Map sheet base map.
b) Authority to Remove/Work on Samples
c) Agreement for the Loan of Material
d) Samples Issue and Receipt Voucher
e) Supporting Statement for Waiving of Charges
f) Sample Station Data Sheet
g) Sample Station Geology Sheet
h) Sample Description Sheet
i) Example of validated samples
j) Sample Quality Codes

AVAILABILITY OF 1:250 000 SCALE UTM MAPS



British Geological Survey
Petroleum and MarineGeology Group
Murchison House
West Mains Road
Edinburgh
EH9 3LA
United Kingdom

Telephone +44 (0)131-667 1000
Fax +44 (0)131-668 4140

Enquiry No.....

Date .....

Authority to Remove/Work on Samples held in the BGS Marine Core Store

..... of ..... is authorised to *remove/work on samples held in the Marine Core Store.

*delete as appropriate

Nature of authorisation

A. Own material.

B. Permission granted by owner/donor of material (commercial-in-confidence data - attach permission).

C. Permission granted by Project co-ordinator.

D. Permission granted by Core Store Manager (BGS archived core only).

E. Other, please specify .....

Conditions pertaining to removal

A. For examination and return.

B. For subsampling - Loan Agreement also required.

C. Other, please specify .....

Approved **Samples/Comments**

.....

British Geological Survey

Petroleum and Marine Geology Group
Murchison House
West Mains Road
Edinburgh
EH9 3LA
United Kingdom

Tel +44 (0)131-667 1000
Fax +44 (0)131-668 4140

Enquiry No.....

Date .....

Agreement for the loan of material from the BGS Marine Core Store

Conditions of Loan

1. All factual results and reports obtained from these samples must be provided to BGS within ..... months of receiving the samples.

2. BGS will agree to hold these data in confidence for a period of ..... months, following which they will become part of the database available to other enquirers.

3. All materials not destroyed in the tests must be returned to BGS.

4. Palaeontology. A complete suite of all fossils extracted, including all figures, described and cited specimens, must be returned to BGS.

5. Petrography and Geochemistry. Representative fragments of all rocks sliced, and of all chemically analysed material must be returned to BGS.

6. If any of the information derived from these samples is to be used for any publication, prior permission must be sought from the Director, BGS, and a suitable acknowledgement made.

Undertaking

A list of samples to be loaned to you is given overleaf/on the attached list. Please sign below to indicate your agreement with the Loan Conditions outlined above.

Name (print) ..... Signature .....

Organisation ..... Position .....

Address .....

****

For BGS use

Approved by (print) ..... Signature .....

British Geological Survey
Petroleum and Marine Geology Group
Murchison House
West Mains Road
Edinburgh
EH9 3LA
United Kingdom

Tel +44 (0)131-667 1000
Fax +44 (0)131-668 4140

Enquiry No.....

Date .....

Agreement for the loan of material from the BGS Marine Core Store

Conditions of Loan

1. All factual results and reports obtained from these samples must be provided to BGS within ..... months of receiving the samples.

2. BGS will agree to hold these data in confidence for a period of ..... months, following which they will become part of the database available to other enquirers.

3. All materials not destroyed in the tests must be returned to BGS.

4. Palaeontology. A complete suite of all fossils extracted including all figures, described and cited specimens, must be returned to BGS.

5. Petrography and Geochemistry. Representative fragments of all rocks sliced, and of all chemically analysed material must be returned to BGS.

6. If any of the information derived from these samples is to be used for any publication, prior permission must be sought from the Director, BGS, and a suitable acknowledgement made.

Undertaking

A list of samples to be loaned to you is given overleaf/on the attached list. Please sign below to indicate your agreement with the Loan Conditions outlined above.

Name (print) ..... Signature .....

Organisation ..... Position .....

Address .....

****

For BGS use

Approved by (print) ..... Signature .....

British Geological Survey

Sample Issue and Receipt Voucher

Voucher No. .....

Consignor

Petroleum and Marine Geology Group
Murchison House
West Mains Road
Edinburgh
EH9 3LA
tel 44 (0)131 667 1000
fax 44 (0)131 668 4140

Consigee

.....
.....
.....
.....

Item No	Sample Number	Comment

Contents of delivery should be checked and a signed copy of this voucher returned to the sender

Issued by: .....

Date .....

Received by: .....

Date .....

British Geological Survey

British Geological Survey

Information and Advisory Service

Enquiry No.....

Date .....

Supporting statement for waiving of charges

Academic institution:

Departmental address:

Name or researcher: .....

1. On the understanding that charges imposed by the British Geological Survey for the provision of scientific data and information may be waived* in circumstances where the request for such services is made in pursuance of academic studies, I hereby confirm that the above-named person is engaged in bona-fide scientific research and that any material supplied to him/her will not subsequently be used for commercial purposes or utilised in such a way as to attract payment from a third party.

2. I acknowledge that the prepublication or draft copies of maps supplied by the Survey must not be released to a third party. I understand that the use of unpublished or open-file material in the preparation of published papers must first have the approval of the Survey and due acknowledgement must be given to the source of the data. Also, I understand that the Survey's own published maps and illustrative matter must not be reproduced in other publications without the prior consent of the Director.

3. If provided with samples for which a monetary deposit has been waived, I undertake to ensure that either the samples are returned, or copies of the research results or analytical data lodged with BGS, within a period of six months of the commencement of the loan. If the samples are retained for more than six months, the requirement for a deposit will be met.

Signed .....

(Surname in block letters .....)
Head of Department

*with the exception of the cost of photocopying and postage.

SAMPLE STATION DATA

INSTITUTE OF GEOLOGICAL SCIENCES - MARINE GEOLOGY UNIT

F (1) SAMPLE NO. ± lat ± long no. 11

CRUISE NO. year : ship : no 18

DATE mnth : day 22

TIME (local) hrs : mins 26

WATER DEPTH metres 30

POSITION FIXING METHOD

COMMENT 32

NAVIGATIONAL READINGS (tick lanes with best intersection)

CHAIN RED GREEN PURPLE 55

POSITION

LATITUDE ± degs : mins (decimal) 63

LONGITUDE ± degs : mins (decimal) 71

ADDITIONAL INFORMATION :

EQUIPMENT TYPE: 1 = sample recovered; 2 = no sample (geological reasons); 3 = no sample (equipment failure); 4 = no sample (undifferentiated)

G (1) dup cols 2-11 GS VE CS CR DM DR BH SD RD SU PS DI BS OC OG (12 22 32)

T.D. metres 50 55

SUMMARY SAMPLE DESCRIPTION : (Free text - max. 69 characters)

H (1) dup cols 2-11 (12 20 30 40 50 60 70 80)

GEOTECHNICAL DATA :

RAW DATA

PENETROMETER Head Readings

HAND VANE Head Readings

AVERAGED DATA

DEPTH PENETROMETER (KPa) HAND VANE (KPa)

I (1) dup cols 2-11 (14 18 22 / 25 29 33 / 36 40 44 / 47 51 55 / 58 62 66 / 69 73 77)

I (1) dup cols 2-11 (14 18 22 / 25 29 33 / 36 40 44 / 47 51 55 / 58 62 66 / 69 73 77)

SAMPLE STATION GEOLOGY

GEOLOGIST

SAMPLE NUMBER K

K dup columns 2–11

DEPTH INTERVAL (m) upper | lower

SEDIMENT (Folk class) or main rock type | subordinate rock type | MUNSELL COLOUR | Sorting | HCl Reaction

SAND: Grain Size Range | Roundness Range | Sphericity | % Shell Material

MUD: Hardness | Plasticity

GRAVEL: % Shell Material | Max.Clast Size mm | Roundness Range | Sphericity

Basal Contact | Bedding | Jointing | H_2S Odour | Heavy Minerals | Mica | Glauconite | Fauna/Fossils: Whole Shells | Forams | Plant Remains

Chronostrat | Lithostrat | Unit

Comments

12 21 30 40 48 52 61 ABUNDANCE SCALE 80

L dup columns 2–11

DEPTH INTERVAL (m) upper | lower

label | ADDITIONAL COMMENTS (FREE TEXT)

12 21 30 40 50 60 70 80

SORTING OF TOTAL SAMPLE	HCl REACTION	SAND GRAIN SIZE	ROUNDNESS	SPHERICITY	MUD HARDNESS	MUD PLASTICITY	BASAL CONTACT	BEDDING	JOINTING	H_2S ODOUR	ABUNDANCE SCALE	LITHOSTRAT UNIT	COMMENTS
V=very poorly sorted P=poorly sorted M=moderately sorted W=well sorted X=very well sorted	N=no reaction W=weak M=moderate S=strong	S=silt V=very fine F=fine M=medium C=coarse K=very coarse	V=very angular A=angular S=subangular U=subrounded R=rounded W=well rounded	L=low H=high	V=very soft S=soft F=firm T=stiff Y=very stiff H=hard	N=non-plastic L=low plasticity I=intermediate H=highly plastic	G=gradational S=sharp E=erosive U=unconformity	F=flat lamination R=ripple lamination X=cross-bedded D=disturbed C=colour banded G=graded bedding	J=prominent joints D=prominent discontinuities F=fissuring	W=weak M=moderate S=strong A=induced by acid	R=rare C=common A=abundant	G=group F=formation M=member B=bed I=informal	C=additional comments below 1,2etc=label if more than one comment

SHEET _____ OF _____

SAMPLE DESCRIPTION SHEET

INSTITUTE OF GEOLOGICAL SCIENCES - MARINE GEOLOGY UNIT

SAMPLE NO.

SURFACE SAMPLE	Equipment Used:	Seabed Photo: Yes/No	Stored in: Jars, Bags.

CORE SAMPLE	Equipment Used:	Stored in: Cut Cores, Uncut Cores, Jars, Bags.

Depth	Log	Description	Core Photo: Yes/No	Sub Samples	Geotechnical Log

(m)

1

2

3

4

5

6

o shear strength Δ compressive strength

DGSQ	NUM	OLDNUM	EQTYPE	ACCN	NO_CORES	NX	CUT	PHOTO	XRAY	CORE_LOC	NO_BTLS	NO_SHOE	BOTL_LOC	SAMP_QC
+57+00	279	SF 143	GS	.							1		4-82	1A
+57+00	279	SF 143	VE	.	2	N	Y	6x63.7.11-12	N	4-47	2	1	4-82	1B
+57+00	280	SF 144	CS	.	1	Y	Y	6x63.8.1	N	4-47				1B
+57+00	280	SF 144	GS	.										2A
+57+00	280	SF 144	TC	.							1		4-82	1A
+57+00	281	SF 145	CS	.	1	Y	Y	6x63.8.3	N	4-47		1	4-82	1B
+57+00	281	SF 145	GS	.										2A
+57+00	281	SF 145	TC	.										2A
+57+01	218	SF 119	CS	.	1	Y	Y	6x63.4.4	N	4-98		1	4-112	1B
+57+01	218	SF 119	GS	.										2A
+57+01	218	SF 119	TC	.							1		4-112	1A
+57+01	219	SF 120	CS	.	1	Y	Y	6x63.4.5	N	4-98				3B
+57+01	219	SF 120	GS	.										2A
+57+01	219	SF 120	TC	.							1		4-112	1A
+59+00	187		GS	.							1		5-87	1A
+59+00	187		VE	.	6	N	Y	Y	N	5-81		1	5-87	1B
+59+00	188		GS	.										2A
+59+00	188		VE	.	2	N	Y	Y	N	5-81	1		5-87	1B
+59+00	189		GS	.							1		5-87	1A
+59+00	189		VE	.	4	N	Y	Y	N	5-81		1	5-87	1B
+59+00	190		CS	.							2		5-87	1C
+59+00	190		GS	.							1		5-87	1A
+59-05	61		GS	.										2A
+59-05	61		VE	.	2	N	Y	Y	Y	5-22		2	5-25	1B
+59-05	62		VE	.	1	N	Y	Y	N	5-22		1	5-25	1B
+59-05	63		GS	.										2A
+59-05	64		GS	.										2A
+59-05	64		VE	.							1	1	5-26	1C
+59-05	65		CS	.										2B
+59-05	65		GS	.							1		5-26	1A
+61-04	34		CS	.	3	N	Y	35mm1.89.17	N	5-242		1	5-244	1B
+61-04	35		VE	.	5	N	Y	35mm3.1.8	N	5-242				3B
+61-04	36		VE	.	6	N	Y	35mm3.1.6	Y	5-242		1	5-244	3B

BOTTLE SAMPLES

1.	Remainder	A.	Enough to analyse
		B.	Not enough to analyse
2.	No Remainder	A.	Consumed by earlier analysis
		B.	Not retained
		C.	Missing from archive

CORE SAMPLES

1.	Remainder	A.	Whole core - suitable for visual inspection
		B.	Whole core - not suitable for visual inspection
		C.	Bottle sample only
2.	No Remainder	A.	Consumed by earlier analysis
		B.	Not retained
		C.	Missing from archive
3.	Incomplete remainder	A.	Section missing - core continuous from the seabed
		B.	Section missing - core discontinuous from the seabed
		C.	All core missing: Bottle sample only

PSA SPLITS

1.	All splits	A.	High confidence
		B.	Low confidence
2.	No Split	A.	Missing from archive
		B.	Too small to analyse
3.	Incomplete split		

PHI DATA

1.	Analysis	A.	High confidence
		B.	Low confidence

HALF PHI DATA

1.	Analysis	A.	High confidence
		B.	Low confidence

12. The Hydrogeological materials collection (Wallingford)

12.1 Introduction

The hydrogeological materials collection at Wallingford is held in the Aquifer Properties Laboratory of the Hydrogeology Group. The collection is an integral part of the Laboratory and has grown over the years as a result of a variety of studies undertaken in the Laboratory.

The Aquifer Properties Laboratory was originally set up by P. Lovelock in 1965 when the Hydrogeology Group occupied offices at Exhibition Road, South Kensington, London. The Laboratory and the hydrogeological materials collection were transferred to their present location at Wallingford in 1978. M. Price took over the management of the laboratories and collection in 1974, and was succeeded by D.Allen in 1990. John Bloomfield has been laboratory co-ordinator since 1997.

The laboratory was set up to investigate the extent to which core analysis studies could be used to improve our knowledge of the aquifer properties of consolidated granular water-bearing formations, initially with a particular focus on the Permo-Triassic Sandstones of the UK (Lovelock, 1972; 1976). To enable core analysis to be undertaken, samples, usually right-cylindrical plugs c. 24.5 mm in diameter and between 25 and 35 mm in length, were prepared either from whole cores or from rock obtained at surface exposures. It is samples such as these that form the basis of the present hydrogeological materials collection.

A variety of measurements have been made on the core plugs in the collection. These include, porosity, gas and liquid permeability, pore-throat size distribution, formation factor, centrifuge specific yield, diffusion coefficient, tracer breakthrough and immiscible phase residual saturation. Only the porosity and gas permeability measurements are performed as standard tests.

The value of the collection is due to the combination of the material and associated data holdings.

The main customers of the laboratory have been the Department of Trade and Industry (DTI), formerly the Department of Energy (DEn), who commissioned core analysis work between 1970 and 1993, and NIREX UK who commissioned core analysis work between 1991 and 1996. This work primarily involved routine core analysis, but the DEn work also included special core analysis. However, the data resulting from both these projects is either confidential or of restricted classification and the core has not been included in the collection.

The majority of the core in the collection is the result of various CR projects not managed by Laboratory staff and SB projects managed within and without the Laboratory. Examples of such work include the UK Geothermal Project (CR), the Nitrate Project (CR), various overseas projects (CR) and investigations related to the current National Groundwater Survey (SB). The laboratory now functions primarily

as a research laboratory as well as acting as a support facility for projects throughout BGS. The following section outlines the size and content of the collection.

12.2 Collection size and contents

To date over 18,000 samples have been tested, most of these have been included in the collection, and most of the results have been put on a database. The majority of the samples are from the major aquifers of England and Wales. There is additional material from the minor aquifers of England and Wales and a limited number of samples from Scotland and Northern Ireland, from offshore UK, and from overseas. Although there is a sample register, there is neither a current comprehensive nor concise overview of all the core holdings. However, a recent study of the physical properties of the major aquifers of England and Wales (Allen et al. 1997) reviewed the data holdings for these aquifers. This review gives an indication of the contents of the collection.

Table 1 summarizes the distribution of core analysis data held in the Aquifer Properties database as a function of each of the major UK aquifers, giving the number of sites and number of samples tested. Although there may be corresponding samples for most of these measurements there will not necessarily samples for all measurements.

Table 1. Distribution of core analysis data held in the Aquifer Properties database for the major UK aquifers (figures in bold are totals for the aquifer). Table taken from Allen et al. (1997).

Aquifer	Number of sites	Number of samples
Permo-Triassic Sandstones	**523**	**8933**
Sherwood Sandstone		5205
Permian sandstones		3342
Permo-Triassic (undiff.)		386
Chalk	**97**	**2270**
Upper Chalk		722
Middle Chalk		513
Lower Chalk		241
Undifferentiated		794
Jurassic (lst and sst)	**50**	**931**
Lower Greensand	**43**	**340**
Magnesian Limestone	**14**	**140**
TOTALS	**727**	**12,614**

The difference between the total number of samples detailed in Table 1 and the estimated 18,000 samples in the collection is made up by samples from the minor UK aquifers, from offshore UK, and from overseas.

12.3 How to access the collection

At the present it is not easy for a member of BGS outside the Aquifer Properties Laboratory to access directly either the sample collection or the associated database of physical properties core data (see section 12.6 for proposed future developments).

This is principally due to the following reasons,

- The Aquifer Properties sample registration system is independent of other sample registration systems within BGS. Samples from a borehole or outcrop are given an (consecutive) Aquifer Properties identification number followed by a unique sample number. The latter includes information on sample orientation. Full details of the sample numbering system can be found in the BGS Quality System Manual, Section AQP1.1.

- Due to the nature of many of the hydrogeological investigations that have given rise to the core collection, the stratigraphic position of many of the samples is poorly defined. Appendix A.1 gives examples of the broad lithostratigraphic classes that are used for classification in the card index to the collection. These classifications were refined for the review of major aquifer properties (see Allen et al. 1997 for more details and data summaries).

- Physical properties data relating to the sample collection is held in three formats. A card index and dBase IV file that was last systematically updated in 1993, and a subset of that data (containing only core data for the major and minor aquifers of England and Wales) in a Microsoft Access database (last updated winter 1998). An example of a typical entry on the card index is given in the appendix A.2.

Currently, the easiest way to access the collection is by contacting either the Laboratory co-ordinator, John Bloomfield (tel. 01491 692310 or e-mail jpb@bgs.ac.uk), or the Hydrogeological enquiries desk at Wallingford (tel. 01491 692301). If anyone were interested in accessing the sample collection or database it would be helpful if they could provide any or all of the following information;

- geographical area of interest (defined by national grid co-ordinates),
- broad lithostratigraphic category,
- borehole name(s) if related to a known previous BGS study or investigation, type of data or information required.

It should be re-emphasized that even if we hold data for a sample we may not necessarily have the sample in the collection. Additionally, some of the samples are over thirty years old and some of those from more poorly consolidated and friable lithologies may have disaggregated.

For staff specifically interested in samples and data from the major aquifers of England and Wales (Chalk, Upper and Lower Greensand, Jurassic limestones, Permo-Triassic sandstones, Magnesian and Carboniferous Limestone), Allen et al. (1997) contains a CD-ROM giving summary physical properties data for these samples.

12.4 How the collection can be used

Samples are available for hand specimen inspection and for non-destructive testing, including standard or special physical properties testing. These tests may be required to verify old data or to augment old data with complementary new data such as liquid permeability, formation factor or saturation-capillary pressure measurements. If enough material is available from a given sampling interval then it may be possible to use some core material to undertake destructive procedures or tests, such as pore-throat size distribution measurements, thin section preparation or whole rock chemistry. However, generally there is only limited core available at each sampled point and destructive tests are rarely possible.

The following brief examples of previous studies using samples and associated data from the hydrogeological collection provide an indication of how the collection has been used and could be used in the future.

Example 1. Hydraulic conductivity data, core v field

Price et al. (1982) combined core analysis with field hydraulic tests to investigate the relative contributions of fracture flow and matrix flow in the Permo-Triassic Sandstone at Cliburn [NY 585 260], Vale of Eden, Cumbria. Field hydraulic conductivity data generally showed good correspondence with core data from the laboratory with the exception of two intervals, one interval near the water table and one interval at the base of the borehole where the field hydraulic conductivity was significantly higher. Geophysical logging, including flow logs, suggested that water was entering the borehole via the single major fracture near the water table and leaving via the fracture at the base of the borehole (see Figure A.4.1 in the appendix).

Example 2. Statistical analysis of regional trends in matrix properties

Bloomfield et al. (1995) used data from the Aquifer Properties database to investigate systematic variations in the matrix porosity and dry bulk density of the Chalk of England. Table A.4.1 is a summary of the results.

Example 3. Influence of diagenesis on aquifer development

Bloomfield (1997) investigated the influence of diagenesis on the development of the Chalk aquifer at Fair Cross [SU 6974 6326], Berkshire. He used porosity and gas permeability profiles in combination with lithological descriptions and whole rock and pore water chemistry to infer a transition from predominantly mechanical compaction to predominantly chemical (pressure solution) compaction near the base of the Seaford Chalk (see Figure A.4.2 in the appendix). Contemporary groundwater circulation was inferred to be restricted to the interval that had not undergone significant chemical compaction.

Example 4. Physical and chemical controls on contaminant movement

A current project within the Laboratory, funded by the Engineering and Physical Sciences Research Council (EPSRC), is an investigation of the physical and chemical

controls on the movement of dense non-aqueous phase liquids, DNAPLs (specifically chlorinated solvents), in the matrix of the Permo-Triassic Sandstone aquifer in the UK. A central aim of the study is to characterise relationships between pore-throat size distributions, solvent pore entry pressure, and residual saturation (see Figure A.4.3 in the appendix). Samples are being selected from a range of representative Permo-Triassic lithotypes, and with a wide geographical spread.

12.5 How to add to the collection

Samples are added to the collection following physical properties testing (there is a list of currently available tests in the appendix, A.3). Staff wishing to have samples tested should contact the Laboratory co-ordinator. Samples can be prepared at Wallingford from whole core or blocks, or supplied pre-prepared by the customer.

12.6 Future developments

There are three main tasks that have to be completed if BGS is to obtain the maximum benefit from the hydrogeological sample collection and associated database. These are as follows,

- Update the database to include all physical properties records, not just those for the major and minor aquifers of England and Wales. As part of this exercise all samples in the collection should be checked and, where appropriate, their condition noted.
- Records in the aquifer properties database should be in a format consistent with other BGS data holdings, e.g. common borehole identification codes, common lithostratigraphic nomenclature.
- Make information available to BGS through appropriate organisation-wide data dissemination structures.

These tasks will not be trivial and appropriate sources of funding will have to be identified if significant progress is to be made on any of these tasks.

References

Allen, D. J., Brewerton, L. J., Coleby, L. M., Gibbs, B. R., Lewis, M. A., MacDonald, A. M., Wagstaff, S. J. and Williams, A. T. 1997. The Physical Properties of Major Aquifers in England and Wales. *British Geological Survey Technical Report* WD/97/34. 312 pp.

Bloomfield, J. P. 1997. The role of diagenesis in the hydrogeological stratification of carbonate aquifers: an example from the Chalk at Fair Cross, Berkshire, UK. *Hydrogeology & Earth System Sciences*, 1, 19-34.

Bloomfield, J. P., Brewerton, L. J. and Allen, D. J. 1995. Regional trends in matrix porosity and dry density of the Chalk of England. *Quarterly Journal of Engineering Geology*, 28, S131-S142.

Lovelock, P. E. R. 1972. *The Aquifer properties of the Permo-Triassic sandstones of the United Kingdom*. Ph.D. Thesis, University of London. [Unpublished].

Lovelock, P. E. R. 1976. Aquifer properties of the Permo-Triassic Sandstones in the United Kingdom. *Bull. Geol. Surv. G.B.*, No. 56.

Price, M., Morris, B. and Robertson, A. 1982. A study of permeability variations in the Chalk and Permian aquifers using double packers. *Journal of Hydrology*, 54, 401-423.

Appendix 12

a) A1 Major lithostratigraphic classes used for sample classification in the card index to the collection.
b) A2 Example of data record from the Aquifer Properties Laboratory card index.
c) A3 Tests currently available in the Aquifer Properties Laboratory, Wallingford
d) A4 Figures & test results.

APPENDIX

A.1 Major lithostratigraphic classes used for sample classification in the card index to the collection

A more refined lithostratigraphic classification was adopted for the review of major aquifer properties (see Allen et al. 1997 for more details and data summaries).

Pre-Cambrian	Old Red Sandstone
Upper Devonian	Lower Carboniferous
Millstone Grit	Lower Coal Measures
Middle Coal Measures	Upper Coal Measures
Scottish & Northern Irish Permian	Devon & Midlands Permian
Penrith sandstone	Magnesian & Permian Marls
Lower Mottled Sandstone	Bunter Pebble Beds
Upper Mottled Sandstone	St. Bees, Annan & Kirklinton sandstones
Devon Triassic sandstones	Undivided Bunter Sandstone
Northern Irish Bunter Sandstone	Keuper Sandstone & Conglomerate
Keuper Waterstones	Northern Irish Keuper Sandstones
Lower Jurassic	Middle Jurassic
Lower Cretaceous	Upper Cretaceous
Lower Chalk	Middle Chalk
Upper Chalk	Undifferentiated Chalk

Appendix 12/a

A.2 Example of data record from the Aquifer Properties Laboratory card index

NY 5836 2605 NGR or co-ords	11·93-11·99 depth	30 1" sheet	3G reg no	MARCH 1978 date	U.K. country	1089-22 lab ref no
CLIBURN NO. 4 BH., nr PENRITH, CUMBRIA. locality				PENRITH SANDSTONE formation		

Plug	ρB	ρS	ρG	α(%)	WD(k) (md)	WP(k) (μm²)	WK(K) (m/d)	Laboratory methods: porosity/density	Laboratory methods: permeability
V	1·857	2·156	2·649	29·89	739·7	0·73	0·476	LS with DW	BP Fancher A (N)
H	1·856	2·156	2·651	29·96	3131	3·09	2·01	LS with brine	Ruska G A N
								LS with	Ruska L
								GEP	

drilling method	drilling fluid	sample type		CSD	Syc / Plug / Coated/unc	Remarks (incl MC and AWCP)	MICP No.
HYDRAULIC ROTARY.	(air)	(core)	uncon				
	water	block	bag				
	Formation water	(rotary core)		D_{10} μm	Time		
	Bent/Gel	drive core		D_{50} μm	Temp		
		cylinder		D_{90} μm	App tension		
				UC		Lithology	

A.3 Tests currently available in the Aquifer Properties Laboratory, Wallingford

A.3.1 Interconnected porosity by liquid resaturation
A.3.2 Interconnected porosity by helium gas expansion
A.3.3 Interconnected porosity by mercury injection (MICP)
A.3.4 Bulk density by liquid resaturation
A.3.5 Grain density by liquid resaturation
A.3.6 Pore-throat size distribution by mercury injection (MICP)
A.3.7 Gas permeability (including empirical correction to give liquid permeability)
A.3.8 Liquid permeability
A.3.9 Aqueous phase diffusion co-efficents
A.3.10 Air-water capillary pressure-saturation curves
A.3.11 Immiscible phase (liquid-liquid) capillary pressure saturation curves
A.3.12 Immiscible phase pore entry pressure
A.3.13 Immiscible phase residual saturation
A.3.13 Centrifuge specific yield

A.4 Figures and Tables

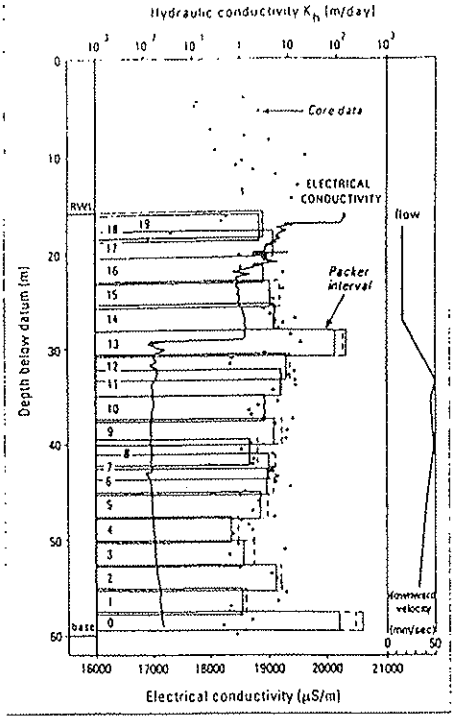


Figure A.4.1 Comparison of core hydraulic conductivity, packer test hydrualic conductivity, electrical conductance and flow logging in the Penrith Sandstone (after Price et al. 1982)

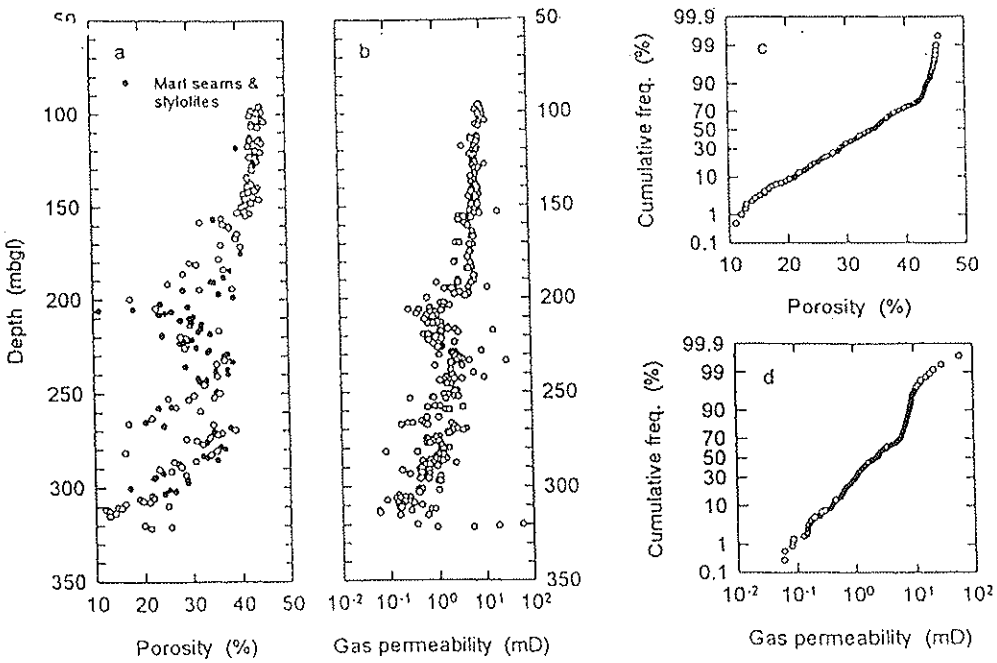


Figure A.4.2 Matrix porosity and gas permeability profiles at Fair Cross. Chemical compaction has been inferred to be significant below about 155 mbgl. Marl seams and stylolites are much more prevalent below this depth (after Bloomfield 1997)

Table A.4.1 Figure showing Chalk porosity and dry density statistics on a region by region basis

	All Regions	Northern England Upper Chalk	Northern England Middle Chalk	East Anglian Upper Chalk	East Anglian Middle & Lower Chalk	Thames & Chilterns Middle Chalk	Thames & Chilterns Lower Chalk	Southern / T & C Upper Chalk	Southern Middle Chalk	Southern Lower Chalk
Porosity (%)										
n	2045	191	62	127	281	356	158	724	34	112
mean	34.0	35.4	18.9	38.4	34.3	31.4	26.6	38.8	28.4	22.9
s.d.	8.3	6.8	4.6	7.7	5.7	6.6	6.6	5.8	4.2	7.7
sk.	−0.61	−1.39	0.39	0.05	0.14	−0.37	−0.32	−1.45	0.06	0.53
min	3.3	3.3	6.7	24.1	18.4	9.5	11.6	5.6	20.5	9.7
max	55.5	45.3	31.4	55.5	47.8	52.6	39.5	48.9	35.9	46.5
10%	22.8	23.8	13.7	29.4	27.4	24.0	16.3	31.7	22.3	13.3
50%	35.1	38.0	18.0	37.1	33.6	31.8	27.0	39.8	28.3	22.9
90%	43.7	41.2	24.7	48.1	42.4	39.5	35.5	44.7	35.0	34.2
Dry density (kg/m^3)										
n	2003	149	62	127	281	356	158	724	34	112
mean	1790	1780	2190	1670	1770	1850	1970	1650	1910	2080
s.d.	220	190	120	210	150	180	160	150	100	200
sk.	0.56	1.05	−0.59	−0.08	−0.15	0.47	0.13	1.40	−0.33	−0.59
min	1210	1530	1850	1210	1410	1280	1640	1380	1730	1430
max	2510	2510	2430	2040	2190	2460	2330	2430	2100	2450
10%	1520	1610	2040	1390	1560	1630	1740	1500	1740	1780
50%	1760	1700	2220	1710	1800	1830	1970	1630	1920	2090
90%	2090	2080	2340	1920	1960	2050	2230	1840	2030	2330

KEY: *n*, number of samples; mean, arithmetic mean; s.d., population standard deviation; sk., distribution skewness; min, value of minimum observation; max, value of maximum observation; 10%, value of ten percentile in cumulative distribution; 50%, value of fifty percentile in cumulative distribution; 90%, value of ninety percentile in cumulative distribution.

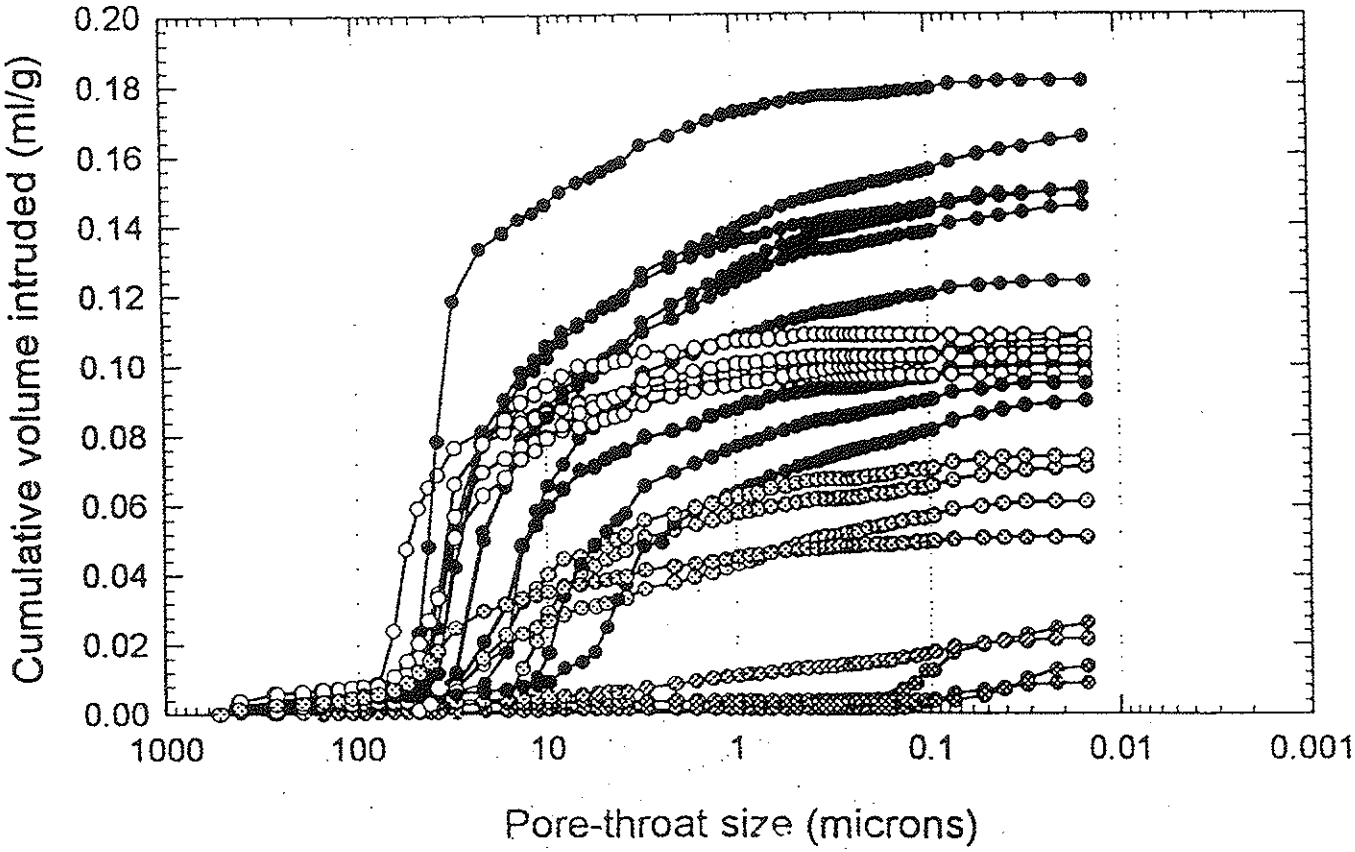


Figure A.4.3 Suite of pore-throat size distributions illustrating the variability of the matrix properties of the Permo-Triassic Sandstone aquifer. Contaminant transport properties in the matrix of the aquifer, such as pore entry pressure and residual saturation, are highly sensitive to small changes in the pore structure of the sandstones

13. The DTI Core Store (Gilmerton)

13.1 Introduction

The DTI owned Core Store at Gilmerton, Edinburgh is a national archive for core and cutting samples obtained during drilling for hydrocarbons within the UK and UK Continental Shelf. Hays Information Management (HIM) under contract to the DTI manages the Core Store. HIM is responsible for core curation and managing visitor bookings; all queries should be referred to the Core Store Site Manager (HIM).

Among the facilities offered are;

- 3 core inspection laboratories, each with full spectrum lighting, water, 10% HCL, petrographic microscope, space to lay out up to 200m of core per lab. Labs can be opened up into one very large room for core workshops etc. (up to 600m of core may be viewed at one time).
- Microfiche viewing room, with microfiche of well logs from all released wells (no copying of fiche permitted)
- Photographic laboratory
- Collection of thin sections and palynology slides, petrological microscopes
- Spacious conference room with presentation facilities (overhead and slide projectors, TV/Video)
- Visitors kitchen (fridge, microwave oven, instant hot water boiler for drinks, free instant coffee/tea)
- Free parking

13.2 Collection size and contents.

The material stored at Gilmerton comprises the cores and cuttings (some 280km of core and over 5 million cuttings samples) from wells drilled on the UK Continental Shelf. Under current licenses there is an obligation on behalf of the operators to supply the DTI Oil and Gas Directorate with a portion of the core and a suite of the cuttings taken during drilling operations.

In addition to the material originating from the UKCS material from onshore boreholes drilled in the UK is retained at Gilmerton until the boreholes are released from confidentiality when the material is transferred to the BGS Core Store at Keyworth.

The core is generally a 1/3 to 1/2 slice, or a 1/4 wedge-shaped cut and samples are available for the entire length of every core cut, with segments up to 10 cm in length commonly missing due to sub-sampling.

13.3 How to access the collection

BGS staff has full access to all **released** material, including onshore and offshore core, cuttings, microfiche of well logs and thin sections. Sub-sampling is permitted only following consultation with the Core Store Site Manager.

BGS staff may also access **unreleased** material, e.g. onshore borehole material still not released, provided that the operator has given permission. BGS staff should write to the operator(s) involved, asking them to send written/faxed permission to the **Core Store Site Manager**.

There may be charges associated with access to the core store and BGS staff engaged in commercial contract work are charged at the same rate as industry: £150 + VAT per laboratory per day. BGS staff engaged in research/non-commercial activities may use the facilities free of charge, but must write to **John Brooks at the DTI** for permission. Access to the microfiche data only is free of charge to all.

For bookings and further information on the core store contact:

Core Store Site Manager:

Mr Richard Sutherland (or Mrs Irene Gunner)
Hays Information Management
DTI Core Store
376 Gilmerton Road
EDINBURGH
EH17 7QS
Tel 0131 664 7330
Fax 0131 664 8394

For other information e.g. policy on the DTI operations and commercial access contact:

DTI:

Mr. J R V Brooks CBE
Oil and Gas Directorate
Department of Trade and Industry
1 Victoria St
LONDON
SW1H 0ET
Tel: 0171 215 5061
Fax 0171 215 5070