Meeting the UK's geospatial data requirements in geoscience

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British Geological Survey
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Topics for discussion

• What is OpenGeoscience?
• Technical methods of implementation
• The need for OpenGeoscience and the Freemium model for knowledge exchange
• Benefits of OpenGeoscience and how the service meets user community needs
• Impact of OpenGeoscience
• Plans for the future
OpenGeoscience — Free data!

What is OpenGeoscience?

A free service where you can view maps, download photographs and other information.

Use OpenGeoscience material free-of-charge for non-commercial private study, research and educational activities.

Explore the six OpenGeoscience sections: Data, Education, Maps, Pictures, Reports and Software.

Who can use OpenGeoscience?

We encourage non-commercial users to use OpenGeoscience material with their own data. Contact us if you create something new and innovative that could benefit others: usingbgsdata@bgs.ac.uk

Maps
Pictures
Data
Education
Reports
Software
Geology of Britain viewer
Pan and zoom to an area of interest.
Click on the map to show the geology at that location.

Currently viewing: 1:50,000 scale geology
Full Transparency None

Bedrock Superficial

1:50,000 Geology details
BRANSCOMBE MUDSTONE FORMATION - MUDSTONE
What is Bedrock Geology?
Oblique aerial view looking north-east along the Great Glen from Banavie shows a linear fault-determined glen with glacial basins of Loch Oich, Loch Ness and U-shaped glacially scoured valley along the fault line. The Great Glen Fault Zone is one of the two most important fractures in Scotland (the other is the Highland Boundary Fault). It is a major transcurrent fault with a sinistral displacement of about 100 km. Note also the highly developed meandering river system with prominent gravel bars in the foreground. The fault has had a long and debated history, though the consensus is that the main phase of sinistral transcurrent movement occurred at the end of the Caledonian Orogeny (Silurian) with reactivation, mainly as a normal fault, during and after the deposition of the Old Red Sandstone.
### Index Limestone (Scotland)

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<thead>
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<th>Status Code:</th>
<th>FORMAL, LOCAL</th>
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<tr>
<td>Age or Age Range:</td>
<td>[ CE ] PENDLEIAN to [ ]</td>
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**Lithological Description:**
A pale to dark grey bioclastic (crinoidal) marine limestone, with algal nodules. The name is not geographical in origin, but indicates a marker bed for the Limestone Coal Formation coal seams below.

**Definition of Lower Boundary:**
Generally a conformable change from a marine mudstone almost at the top of the Limestone Coal Formation. The Index Limestone as it is usually called, forms the base of the Upper Limestone Formation.

**Definition of Upper Boundary:**
Generally a conformable change to a thick marine mudstone, which may also include the Huntershill Limestone, that passes up into deltaic arenaceous deposits of the Upper Limestone Formation.

**Thickness:**
From 0.6 m to 2.2 m in the Airdrie, Falkirk and Glasgow districts, and 3 m in the Irvine area of Ayrshire.

**Geographical Limits:**
Throughout most of the outcrop of the Upper Limestone Formation of the Midland Valley of Scotland, but locally absent in Ayrshire and Strathclyde on high parts created by the Clyde Plateau Volcanic Formation and poorly developed in central and east Fife because of an on-delta facies change.

<table>
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<tr>
<th>Parent Unit:</th>
<th>UPPER LIMESTONE FORMATION</th>
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<tr>
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<td>Parent Unit Code:</td>
<td>ULGS</td>
</tr>
<tr>
<td>Previous Code(s):</td>
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**Reference Section:**
The Monsneuk Borehole, BGS reg. no. NS88BE/204 south of Alloa, with a base at 770m depth, and 0.93m measured thickness.

**Reference(s):**


Item matches "scotland geology"


Busby, Jon; Lewis, Melinda; Reeves, Helen; Lawley, Russell. 2009 Initial geological considerations before installing ground source heat pump systems. *Quarterly Journal of Engineering Geology and Hydrogeology*, 42 (3). 295-306. 10.1144/1470-9236/08-092


Mass balance, flow, and subglacial processes of a modelled Younger Dryas ice cap in Scotland

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   Email: n.gollledge@bgs.ac.uk
2 Institute of Geography, University of Edinburgh, Drummond Street, Edinburgh, EH8 9XP
3 Institute of Geography & Earth Sciences, The University of Wales, Aberystwyth, Ceredigion, SY23 3DB

ABSTRACT. We use an empirically validated high-resolution three-dimensional ice sheet model to investigate the mass balance regime, flow mechanisms, and subglacial characteristics of a simulated Younger Dryas stadial ice cap in Scotland, and compare the resulting model forecasts with geological evidence. Input data for the model are basal topography, a temperature forcing derived from GRIP δ18O fluctuations, and a precipitation distribution interpolated from modern data. The model employs a Positive Degree Day scheme to calculate net mass balance within a domain of 112500 km², which under the imposed climate gives rise to an elongate ice cap along the axis of the western Scottish Highlands. At its maximum, the ice cap is dynamically and thermally zoned, reflecting topographic and climatic controls respectively. In order to link these palaeoglaciological conditions to geological interpretations, we calculate the relative balance between sliding and creep within the simulated ice cap; forecast areas of the ice cap with the greatest capacity for basal erosion; and predict the likely pattern of subglacial drainage. We conclude that ice flow in central areas of the ice cap is a largely due to internal deformation, and is associated with geological evidence of landscape preservation. Conversely, the distribution of streamlined landforms is linked to faster-flowing ice whose velocity is predominantly the result of basal sliding. The geometry
GeoScholar is a set of free geological data - available in GIS format - for UK universities and the higher education sector, to support teaching and learning within the geosciences.

The dataset includes:

- digital geological map data from BGS
- aerial photos from Infoterra
- NEXTmap digital terrain model from Intermap Technologies
- borehole data and their corresponding logs
- several BGS geological map sheets

Each GeoScholar teaching package will include 12 different geographical regions, including Assynt, Coniston and South West Wales.

GeoScholar is available under free licence to academic institutions. Please note that only academic institutions can apply for a licence – GeoScholar data and licenses are not available to individual students.

The data is in ESRI ArcGIS format. Users must have an ESRI licence for ArcGIS 9.2 or higher to view the project files, although the data can be loaded individually in previous versions of ArcGIS or ArcView 3.X.

How do I get GeoScholar?

For a copy of the licence agreement or for further details e-mail enquiries@bgs.ac.uk

- GeoScholar v1.0 DVD contents
SECTION OF LAMLASH BAY, ARRAN
WATER BORE 1

Surface Level: O.D.

Communicated by Strathclyde Regional Council, Water Department

Date of boring or sinking: August 1979

Borer: Pettifer

One-inch Map: 2

Six-inch Map: 3

<table>
<thead>
<tr>
<th>Thickness from Surface</th>
<th>4</th>
<th>39</th>
<th>4</th>
<th>39</th>
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<tbody>
<tr>
<td>No core</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boulder clay: chocolate-brown, rather sandy. Few pebbles mostly 1-2 cm but up to 5 cm seen</td>
<td>1</td>
<td>12</td>
<td>5</td>
<td>51</td>
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<tr>
<td>Sandstone boulder</td>
<td>5</td>
<td>42</td>
<td>10</td>
<td>93</td>
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<tr>
<td>Greenish clay angular fragments (1 cm) of greenish mudstone</td>
<td>0</td>
<td>56</td>
<td>11</td>
<td>49</td>
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<tr>
<td>Fault gouge or weathered top</td>
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<tr>
<td>No core</td>
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<tr>
<td>Sandstone: pinkish-brown or purplish brown; coarse (0.5 mm). Coarse, cross-laminated. Finer band, darker, thinning upwards and downwards 17.70-18.07. Dip 15° to core length</td>
<td>4</td>
<td>47</td>
<td>15</td>
<td>96</td>
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<tr>
<td>Passing down into</td>
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<td></td>
</tr>
<tr>
<td>Sandstone: off white to grey; coarse (0.5 mm), cross-laminated. Some limonite staining. Elongate clasts of greenish and red mudstone up to 10 cm long. Parallel bedding 10-30 to base. Sharp base 10° to core length</td>
<td>2</td>
<td>26</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Sandstone/Grit: as above. Off white, coarse (1 mm) crosswandering down, coarse cross-laminated. Elongate red mudstone clasts and occasional angular pebbles of metagraywacke up to 1 cm. Limonite stains</td>
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<tr>
<td>Grit: off white with limonite stains (1-2 mm). Many clasts of red mudstone and quartzite. One red, rounded mudstone clast (10 x 4 mm)</td>
<td>0</td>
<td>70</td>
<td>21</td>
<td>70</td>
</tr>
<tr>
<td>Sandstone: red/off white; coarse (5 mm). Rounded grains. Well-laminated. Laminations (2-3 mm thick) at 30° to core length</td>
<td>0</td>
<td>50</td>
<td>22</td>
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<tr>
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<tr>
<td>Grit: off white; 1 mm, quartzite and mudstone clasts. Sharp base</td>
<td>0</td>
<td>65</td>
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An aim for OpenGeoscience

That its provision of information in

• flexible,
• interoperable forms
• across the web

will enable the delivery of BGS information to

• new audiences
• a diverse range of media
• facilitating new, previously inconceivable uses
• stimulating wider use of our science information and knowledge

to benefit environmental analysis and decision making.
OpenGeoscience technology

• Spatial data services
  • ArcGIS Server for 1:50 000 scale data WMS
  • MapServer for smaller scale geology maps WMS. Provide an exemplar for the OneGeology project using Open Source software
  • GeoServer and Snowflake for WFS

• Viewing applications
  • The ArcGIS Server e.g. Javascript API, and its extension for Google Maps, are used to provide web-based map viewers
  • Asset Bank digital asset management system is used to provide the image delivery system
  • Adobe Coldfusion is used to provide search interfaces for non-spatial databases

• Data sources
  • Spatial data
    • spatially-enabled Oracle objects accessed directly and via ArcSDE
    • ESRI file-based geodatabases.
  • Non spatial data
    • Oracle and MS SQL Server
The need for OpenGeoscience

- Policies and drivers at EU and UK level are pushing the opening up of public sector data for reuse
  - EU legislation including INSPIRE
  - UK Government reports
  - Media campaigns (Guardian: ‘Free our data’)
- Tensions and potential conflicts exist
  - expectation to make more information available for free
  - rationale for commercial exploitation remains/increases
BGS commercial services

• BGS has successfully run commercial Knowledge Exchange services since 2000
• Our licensed data business is recognised by Office of Public Sector information as Best Practice against their Information Fair Trader Scheme
• GeoReports has previously been used by OPSI as a case study for successful exploitation of Public Sector Information

BGS GeoReports — your starting point for land investigations

"Don’t be surprised by geology – get a GeoReport"
Freemium model

- BGS has perhaps been less successful in delivering effective KE services to non-commercial sectors (including public, research & education)
- OpenGeoscience is partly about creating a balanced ('Freemium') model for our provision of information services
- Ordnance Survey – another high profile example in the UK
Freemium to INSPIRE SDI

'Value Added'

DATASET

‘Core’

OpenGeoscience

‘Business’ services

Non-Commercial

USE

Commercial

Download
Benefits for BGS

- OpenGeoscience has enabled us to greatly increase access to geological data and to increase the flexibility with which the information can be used.
- OpenGeoscience also provided us with the ‘brand’ we needed to pull together and clearly indentify in the user community the increasing amounts of open-access information we have been providing in recent years, and will be providing in coming years.
- Getting our information out on the web is a critical part of our future customer services. The self-service aspects of web map services reduce the need for BGS to run inefficient manual information provision services.
- OpenGeoscience allows BGS to reach out to the global information community and raise the profile of our related science and information work. It acts as a shop window through which a much wider user community can be attracted.
- Rapidly developing viewing platforms, such as the iPhone/iPad mean the public are hungry for more viewable maps. OpenGeoscience and its web map services have the capability to meet this demand.
- Testing and early adoption of INSPIRE compliant view services
Benefits for users

• Easily accessible geological information will aid national planning e.g. related to environmental change, disaster potential & sustainable use of resources
• Empowering the public to make more informed decisions based on better knowledge of their natural environment
• Beneficial to the research base by providing them with greater access to contextual spatial information
• Powerful boost to teaching sector through provision of highly useful materials on easily accessible web platforms
• Enabling the public and research base to view and mash-up environmental information for free will increase awareness of environmental issues and potentially enable new solutions to environmental problems to be devised.
• Encouraging business innovation can seed ideas for the next generation of online information services and into areas that may have not previously considered using geological information
Impact of OpenGeoscience

• Clear increase in access to BGS information due to the release of OpenGeoscience

_Demonstrates that there is a world of ‘digital natives’ out there who are hungry for rapid online access to information about their ‘place’_

FACT: We are surrounded by “digital natives” (Prof. Hulme, Leics Uni, 2009), who have grown up surrounded by computers, phones & games
E.g. 75% of 16-24 year olds “can’t live without the web” (YouthNet 2009)

_The web is the place to be!_
What did visitors click on?

OpenGeoscience — Free data!

What is OpenGeoscience?

Map

View the geology of Great Britain from your web browser, a geobrowser (Google Earth) or GIS systems (MapInfo or ArcGIS).

Simple view

Pan and zoom to where you live, click on an area of interest and reveal the rocks beneath your feet.

Explore the Geology of Britain in your web browser.

Intermediate view

View the geology layers or recent earthquakes in Google Earth or Google Maps — at small scale 625k using KML.

Advanced data (625k) and view (50k)

MapInfo or ArcGIS users can download the complete small scale 625k data in in ESR® and MapInfo® formats.

Users of these and other systems can also view medium scale 50k data using our Web Map Service (WMS).

UK academic users at subscribing institutions can also access DiGMapGB-50 from the EDINA Geology Digimap service which provides online mapping and data download services.

Pictures

Data

Education

Reports

Software
OpenGeoscience mashups

- A key aim of OpenGeoscience was to allow people to ‘mash-up’ BGS data with their own information.
- The user community is already taking advantage of the web map services available within OpenGeoscience and a number of “mashups” have already been created.

Map data mash-ups gallery | OpenGeoscience

Mash-ups reuse, repurpose and combine existing data, art or content to create something new, or add value in some way. We encourage non-commercial users to mash-up OpenGeoscience material with their own data in new and innovative ways by adding new functionality or interfaces. We can draw inspiration and know-how from mash-ups from the developer community to help us develop robust new products for the benefit of society. Contact us if you create something new and innovative that could benefit others: using BGS data

Example Mash-ups

Gallery below of mash-ups using geological map data at different scales and applications such as: ArcGIS Explorer, ArcGIS Server, ArcWatch, Google Maps, KML, Mapinfo and Ordnance Survey OpenSpace.
- BGS developers
- our research partners
- developer community
Land cover and surface geology of East Anglia

Subsidy & Land Cover Correlation, East Anglia Fenlands after Darby (1969, 1974) & O.S. OpenData
Bracknell Caving Club
Ordnance Survey OpenSpace
OneGeology Portal
Feedback from the GI world

- Jack Dangermond (President ESRI inc.) has taken a personal interest
- Michael Jones (GoogleEarth’s TCO) used OpenGeoscience in his welcome to launch an OGC conference at Google HQ

Feedback from universities

- “Literally putting geosciences 'on the map'. It will become a kind of 'GoogleRock' ” - Open University
- “Capacity to transform the way in which geosciences are taught in universities” - Birmingham University
Feedback in the blogosphere

• Positive and interested audience engaging with OpenGeoscience through social media – blogs, Twitter, YouTube etc
What’s next for OpenGeoscience?
**SECTION OF LAVASHAL BAY, AHRAH WATER ROSE #1**

Surface Level: O.D.

Communicated by Strathclyde Regional Council, Water Department

Date of boring or sinking: August 1979

Borer: Pettifer

One-inch Map: 21

Six-inch Map: N5 3.5 w

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**No core**

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**Sandstone boulder**

**Greenish clay** angular fragments (1 cm) of greenish mudstone

**Fault gouge or weathered top**

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**Passing down into**

**Grill:** off white; 1 mm, quartzite and mudstone clasts. Sharpy base

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Better support for mobile devices
Map scan delivery
Extension of API provision to BGS data
Tell us what you think!

• Jonathan Amos, BBC correspondent said: *OpenGeoscience was so popular because it actually gave people something “to play with”*

• We encourage you to go and do just that and tell us what you think!

www.bgs.ac.uk/opengeoscience

pdbe@bgs.ac.uk