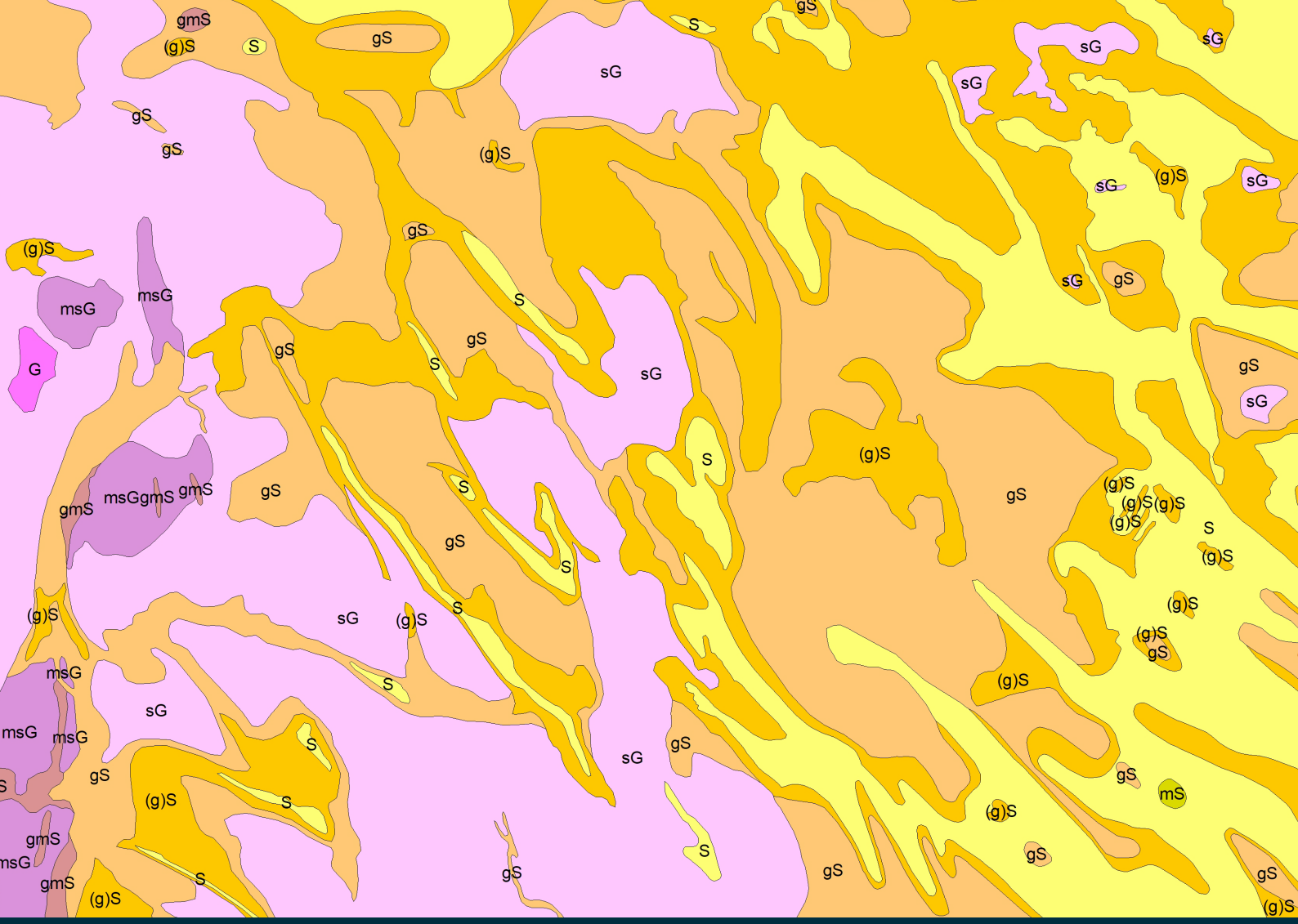

BGS INFORMATICS

User Guide: BGS Seabed Sediments 250k

Open report OR/21/010

British Geological Survey

BRITISH GEOLOGICAL SURVEY

BGS INFORMATICS

Open REPORT OR/21/010

User Guide: BGS Seabed Sediments 250k Dataset

British Geological Survey

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Marine Geology, Seabed, Sediments, Folk classification, Continental Shelf, Digital map

Front cover

Example of the BGS Seabed Sediments 250k dataset, from the southern North Sea.

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BRITISH GEOLOGICAL SURVEY

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We publish an annual catalogue of our maps and other publications; this catalogue is available online or from any of the BGS shops.

The British Geological Survey carries out the geological survey of Great Britain and Northern Ireland (the latter as an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as basic research projects. It also undertakes programmes of technical aid in geology in developing countries.

The British Geological Survey is a component body of UK Research and Innovation.

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Foreword

The British Geological Survey (BGS) is a world-leading geological survey, focusing on public-good science for government, and research to understand earth and environmental processes.

We are the UK's premier provider of objective and authoritative geoscientific data, information and knowledge to help society to:

- use its natural resources responsibly
- manage environmental change
- be resilient to environmental hazards

We provide expert services and impartial advice in all areas of geoscience. As a public sector organisation, we are responsible for advising the UK Government on all aspects of geoscience as well as providing impartial geological advice to industry, academia and the public. Our client base is drawn from the public and private sectors both in the UK and internationally.

The BGS is a component body of the Natural Environment Research Council (NERC), part of UK Research and Innovation (UKRI).

DATA PRODUCTS

BGS produces a wide range of data products that align to Government policy and stakeholder needs. These include baseline geological data, engineering properties and geohazards datasets. These products are developed using in-house scientific and digital expertise and are based on the outputs of our research programmes and substantial national data holdings.

Our products are supported by stakeholder focus groups, identification of gaps in current knowledge and policy assessments. They help to improve understanding and communication of the impact of geoenvironmental properties and hazards in Great Britain, thereby improving society's resilience and enabling people, businesses, and the government to make better-informed decisions.

Acknowledgements

This report is the published product of a study by the British Geological Survey (BGS) to produce digital datasets depicting the distribution of seabed substrate types of the UK Continental Shelf. The methods used to derive the data were determined by a team of specialists with a broad range of expertise involved in data acquisition, interpretation, mapping and publication of the first seabed geology paper maps during the BGS Offshore Mapping Programme (1970s-1980s) supported by the then Department of Energy. Their work was central to the creation of this dataset.

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Summary

The BGS Seabed Sediments 250k dataset is a digital geological map portraying the distribution of seabed substrate types of the UK Continental Shelf at a scale of 1:250 000. This comprehensive product provides a digital compilation of the original paper maps published by BGS at the same scale with additional re-interpretation from regional geological studies.

The seabed is typically covered by sediments that form a veneer or thicker superficial layer of unconsolidated material over the bedrock. These sediments are classified by their grain size, partly reflecting the environment in which were deposited. This information is important to a range of stakeholders, including marine habitat mappers, marine spatial planners and offshore industries (in particular, the dredging and aggregate industries).

This dataset covers most of the UK Exclusive Economic Zone (EEZ) and some of its adjacent waters. It was primarily based on seabed grab samples of the top 0.1 m, combined with cores, dredge samples and side-scan sonar data acquired during mapping surveys since the early 1970s. The variations in data density will be reflected in the detail of the mapping.

This dataset can be used in conjunction with the other small-scale BGS offshore geological datasets:

- BGS Offshore Bedrock 250k dataset
- BGS Seabed Hard Substrate dataset

This user guide provides the information required to enable the reader to understand and use this BGS data product.

1 Introduction

1.1 WHAT THE DATA SHOW

The BGS Seabed Sediments 250k dataset (BGS, 2021a) portrays the distribution of seabed substrate types of the United Kingdom Continental Shelf (UKCS) and is part of the British Geological Survey collection of offshore digital maps at that scale, including the BGS Offshore Bedrock 250k dataset (BGS, 2021b).

The sediment of the seabed comprises numerous deposits with varying physical properties, such as grain size, mineral composition, texture, colour and layering, depending on the processes that formed them or that may have affected them since their formation. This digital map delineates the principal characteristics as a set of attributed polygons.

1.2 BACKGROUND TO THE DATASET

The seabed is generally covered by sediments that form a veneer or thicker superficial layer of unconsolidated material above the bedrock. These sediments can be classified based on their grain size reflecting the environment in which were deposited. In this dataset, the sediments are classified according to the BGS modified Folk classification that divides sediments, into 15 classes according to the proportions of Gravel, Sand and Mud. However, there are also areas of the seabed where sediments are absent or undifferentiated, these areas are also delineated and described within this dataset. An example of the data can be seen in Figure 1.

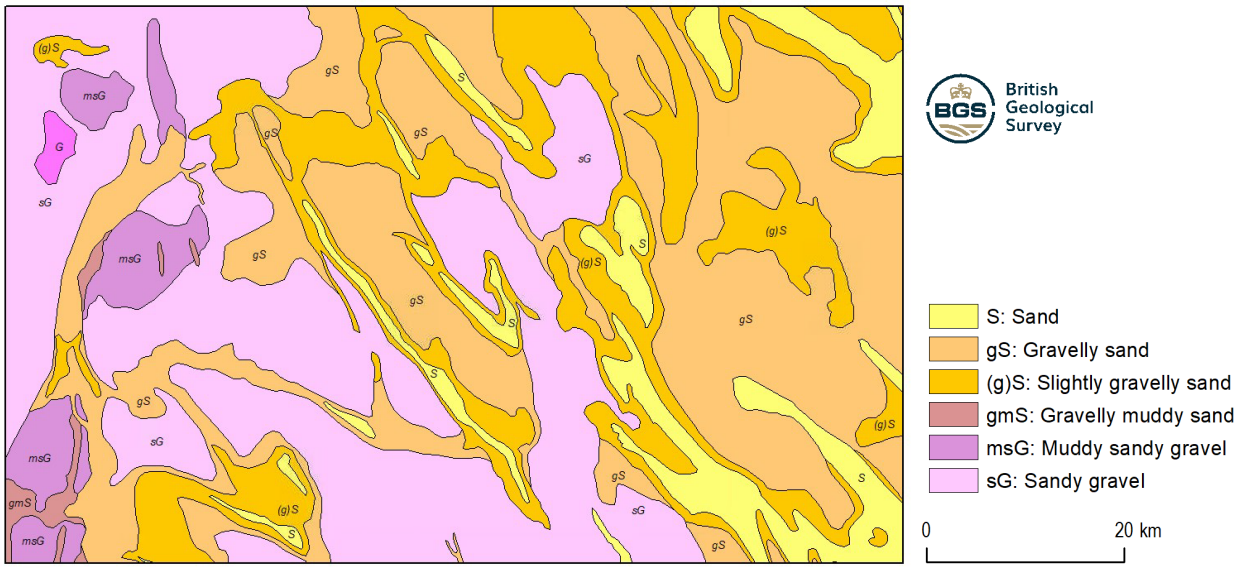

Figure 1 Example of the BGS Seabed Sediments 250k dataset.

The BGS Seabed Sediments 250k dataset has been compiled by digitising existing the BGS Offshore 1:250 000 geological map series, as well as incorporating additional re-interpretation from regional geological studies. The BGS Offshore 1:250 000 geological map series was published between 1977 and 2000, with additional 'special' sheets being published until 2009. The seabed sediment maps of that series were primarily based on seabed grab samples of the top 0.1 m of seafloor deposits, combined with shallow cores, dredge samples and side-scan sonar acquired during the BGS Offshore Mapping Programme of the 1970's – 1980's (funded by the then Department of Energy).

1.3 WHO MIGHT REQUIRE THE DATA?

The distribution of seabed sediments is important to a range of stakeholders connected to sea fisheries, shipping, aquaculture, renewable energy (wind, wave and tidal power), marine communications, dredging, and aggregate industry. Sediment grain size is a particularly important characteristic in determining the distribution of different habitats, especially for those organisms living on the seabed. The BGS Seabed Sediments 250k dataset, therefore, provides valuable information enabling the creation of seabed habitat maps and supporting marine management plans and assessments of the environmental status within most of the UK Exclusive Economic Zone (EEZ) and some of its adjacent waters (see Figure 4).

1.4 POLICY DRIVERS

Policies such as the Marine Strategy Framework Directive (MSFD; 2008/56/EC) and the Marine Spatial Planning Directive (MSPD; 2014/89/EU) highlight the importance governments place on protecting and sustainably managing the marine environment. The MSFD (European Union 2008) defines a list of 11 descriptors of environmental status for which 'good' status must be achieved, one of these descriptors is seafloor integrity. The integrity of the sea floor reflects the physical, chemical and biological characteristics of the seabed. Sediment grain size is a particularly important characteristic that can constrain the distribution of different habitats, especially for benthic organisms (those living on the seabed). Therefore, the information provided by this broad-scale mapping can contribute to assessing the environmental status of the UKCS and assist in the selection of sites that require special protection.

2 Case study: assessing and reporting the status of European seas

2.1 THE PROBLEM

Seabed habitat maps are an important tool that can support marine spatial planning, promote sustainable development of the seafloor (referred to as "Blue Growth"), and convey knowledge of the ecological status of the seabed. The BGS Seabed Sediments 250k dataset has been used in the development of the European-wide Seabed Habitat map (EUSeaMap). EUSeaMap enables the impacts and effects of human activity (Blue Growth) in the European marine environment, to be considered in a contiguous manner.

2.2 THE CHALLENGE

The marine environment is under increasing pressure from human activity. The European Marine Strategy Framework Directive (MSFD), adopted in June 2008 (European Union, 2008), aims to protect the marine environment across Europe. To support this aim, the MSFD called for multi-resolution full-coverage mapping data including bathymetry, geology and habitats, for all European seas.

To achieve sustainable development of our seas, marine spatial planners and policymakers need to be informed by the best available data on marine species, habitats and ecosystems. A prerequisite for informed decision-making and management is the availability of seabed habitat maps. However, such maps are reliant on surveys of the seafloor using sonar equipment, sampling and imagery of the seabed, therefore costly and time-consuming to produce. In contrast, broad-scale maps of the seabed substrate, when combined with modelling techniques that classify habitats, provide a lower cost and faster solution to developing a full-coverage habitat map.

2.3 THE SOLUTION

In 2012, as part of the EMODnet Seabed Habitats project (EMODnet, 2021), the first broad-scale seabed habitat map for Europe, also known as EUSeaMap, was created. EUSeaMap is a broad-scale predictive map of physical habitats covering European waters consistently. The predictive map was built by applying statistical analysis techniques to a combination of proxy measurements including:

- Environmental variables (*e.g.* salinity, temperature, water transparency, current-induced energy),
- Bathymetry (used to create biological zones), and
- Seabed substrate (including the BGS seabed sediments mapping)

The compiled seabed substrate data forms a critical component used in the generation of EUSeaMap and can be clearly detected in the final EUSeaMap outputs (Figure 2).

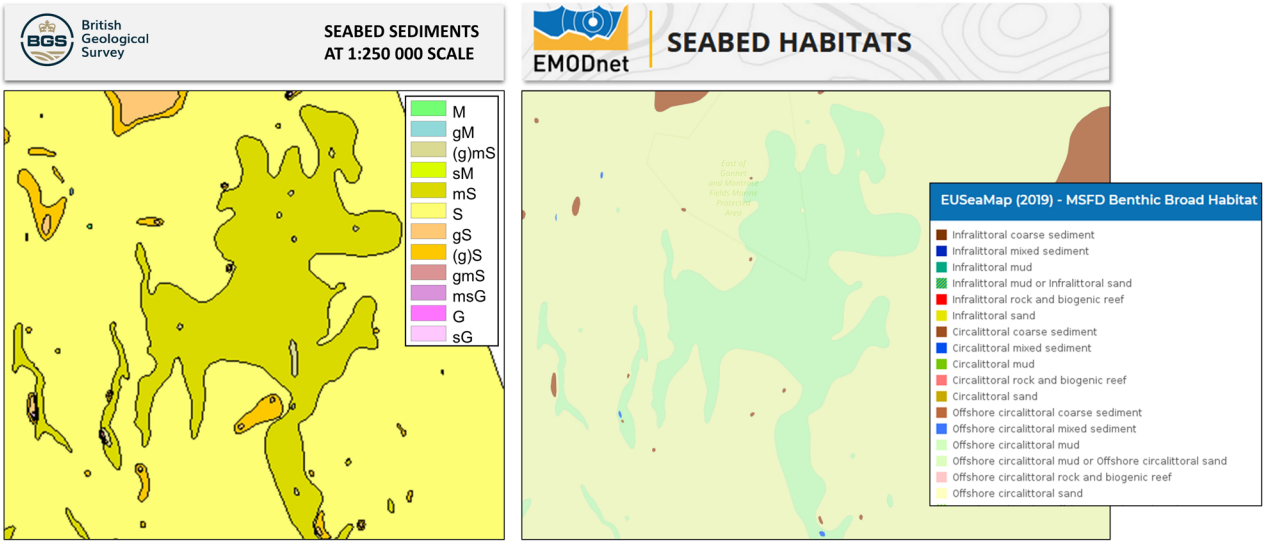

Figure 2 Comparison between the BGS Seabed Sediments 250k mapping (left) and the EUSeaMap (2019) – MSFD Benthic Broad Habitat Types mapping as displayed at the EMODnet portal (right).

2.4 WHAT WERE THE OUTCOMES?

EUSeaMap products have been used for assessing and reporting the status of European seas, designing ecologically coherent Marine Protected Area networks, establishing monitoring programs for seabed habitats and informing marine planning. The knowledge gained from implementing the European Marine Strategy Framework Directive was a driving force leading to the adoption of the Single-use Plastics Directive.

2.5 THE PRODUCTS USED

The BGS dataset used in this example was the BGS Seabed Sediments 250k (BGS 2010a). Under licence, this dataset was used to create the EUSeaMap broad-scale predictive model, produced by EMODnet Seabed Habitats.

3 Methodology

3.1 ORIGINAL SURVEY

This dataset is the result of digitising the existing BGS Offshore 1:250 000 scale Seabed Sediment map series. These are paper-based maps showing the broad-scale distribution of sediments, based on grab samples of the top 0.1 m of seabed deposits, combined with cored material, dredge samples and side-scan sonar data. Most of the data was acquired in the 1970s and 1980s, during the BGS Offshore Mapping Programme at this time. The locations of the geophysical data and seabed samples used are available on the BGS Offshore GeoIndex (BGS 2021c) and the original paper map series can be accessed (in a scanned format) from the BGS Map portal (BGS 2021d).

3.2 DIGITAL CAPTURE

The 1960s and 1970s BGS Offshore Mapping Programme was principally conducted at a reconnaissance level. The individual data sources, therefore, could often be several kilometres apart. Consequently, the interpretations are the result of extrapolation between sparsely distributed information. To improve the interpretation of the seabed sediment distribution, wherever possible, BGS geologists also made use of information provided by offshore infrastructure industries, such as site investigation reports for pipelines. In recent years, the increased availability of multibeam bathymetry and backscatter data has allowed an improvement of sediment boundary delineation in some mapping areas. The combination of data from legacy core sampling (sparse) and modern geophysical sensing systems (high density) can create data density variations that are reflected in the detail of the resultant geological map.

The sediment divisions on the map are primarily based on particle-size analysis of both surface sediment samples and the uppermost sediments taken from shallow cores. Sediments are classified according to the modified Folk classification (1954). The Folk classification divides sediments into 15 classes, according to the proportions of Gravel - particles with an average diameter larger than 2 mm; Sand - particles with an average diameter between 2 mm and 63 µm, and Mud - particles with an average diameter smaller than 63 µm.

The modified Folk diagram and classification used by BGS (Figure 3; Table 1) differs from that created by Folk (1954) in that the boundary between “no gravel” and “slightly gravelly” is changed from trace (0.05%) to 1% weight of particles coarser than 2 mm. The boundaries between sediment types are delineated using sample station particle size analyses and descriptions, seafloor topography derived from shallow geophysical data and, where available, multibeam bathymetry, backscatter and side-scan sonar profiles.

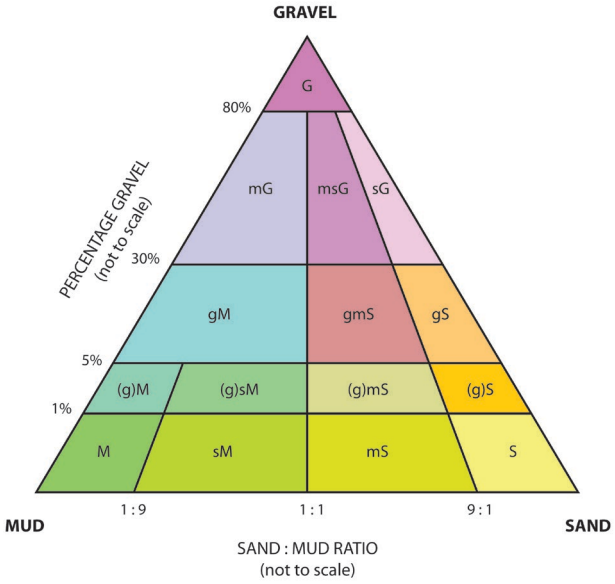

Figure 3 Modified Folk classification scheme adopted by the BGS to define the sediment classes used to portray the seabed sediment distribution in the BGS Seabed Sediments 250k dataset. For key to abbreviations see Table 1.

There are also areas where seabed sediments are absent or undifferentiated and areas where other sediment classification schemes have been adopted (non-UK waters) as listed (Table 2).

Table 1 Modified Folk classification and sediments composition used in the BGS Seabed Sediments 250k dataset.

Class	Code	Sand : Mud ratio	Gravel percentage
Mud	M	<1:9	<1 %
Sandy mud	sM	1:9 to 1:1	<1 %
Muddy sand	mS	1:1 to 9:1	<1 %
Sand	S	>9:1	<1 %
Slightly gravelly mud	(g)M	<1:9	1-5 %
Slightly gravelly sandy mud	(g)sM	1:9 to 1:1	1-5 %
Slightly gravelly muddy sand	(g)mS	1:1 to 9:1	1-5 %
Slightly gravelly sand	(g)S	>9:1	1-5 %
Gravelly mud	gM	<1:1	5-30 %
Gravelly muddy sand	gmS	1:1 to 9:1	5-30 %
Gravelly sand	gS	>9:1	5-30 %
Muddy gravel	mG	<1:1	30-80 %
Muddy sandy gravel	msG	1:1 to 9:1	30-80 %
Sandy gravel	sG	>9:1	30-80 %
Gravel	G	all ratios	>80 %

Table 2 Additional classifications used in the BGS Seabed Sediments 250k dataset.

Class	Comment
Clay and sand	Pre-Holocene deposit

Diamicton	Pre-Holocene deposit
Gravel, sand and silt	Undifferentiated
Undifferentiated mud	Undifferentiated
Rock and sediment	Undifferentiated
Rock and diamicton	Pre-Holocene
Mussel deposit	Biological
Gravel (G)	French classification
Gravelly sand (gS)	French classification
Sand (S)	French classification
Sandy gravel (sG)	French classification

4 Technical Information

4.1 SCALE

This dataset is produced for use at 1:250 000 scale. This scale data should not be relied on for local or site-specific geology, or navigation. The British Geological Survey should be contacted if more details are required as additional geological information may be available in BGS files, or we may be able to direct enquirers to other bodies or third parties.

4.2 COVERAGE

The BGS Seabed Sediments 250k dataset covers the majority of the UK Exclusive Economic Zone (EEZ) and some of the adjacent waters (Figure 4.)

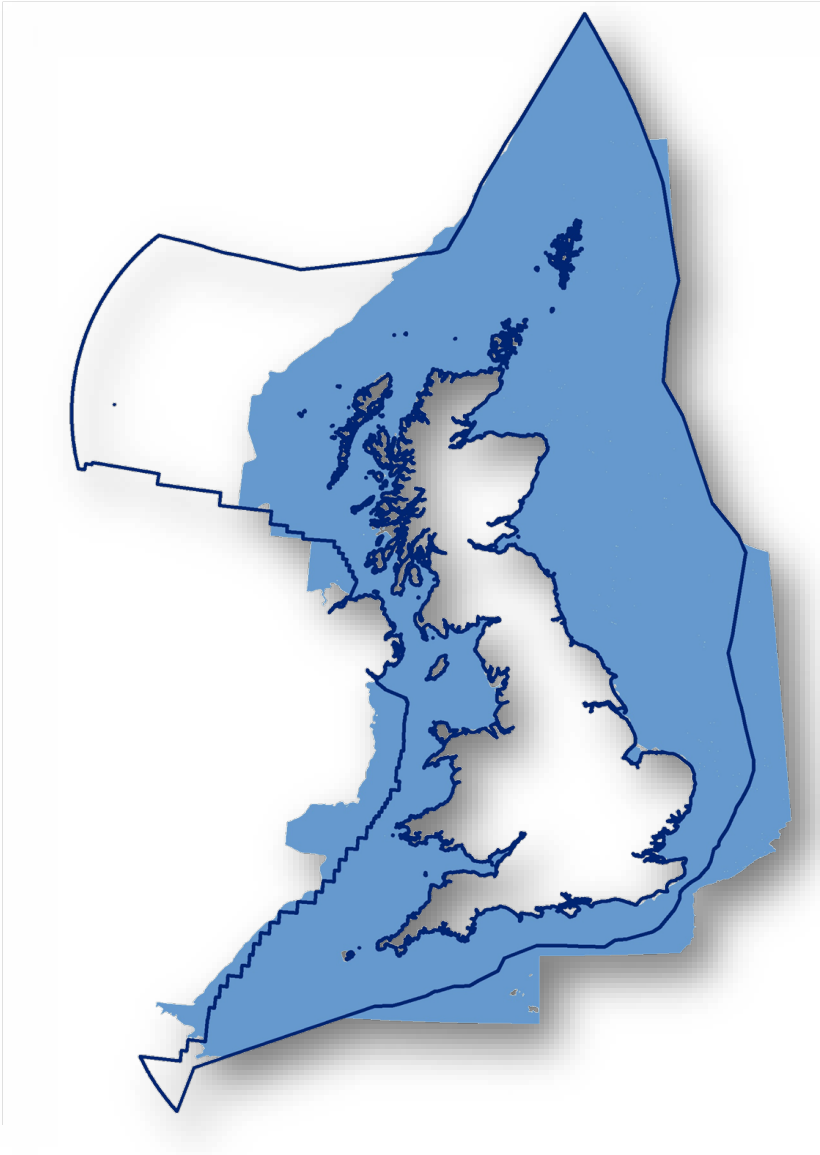

Figure 4 Coverage of BGS Seabed Sediments 250k dataset (shaded blue). UKEEZ boundary: United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, Jan 19, 2023, licensed under the Open Government Licence https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/. UK Coastline: Ordnance Survey data © Crown Copyright and database rights 2021.

4.3 ATTRIBUTE DESCRIPTION

Table 3 describes the fields (columns) in the attribute table associated with polygonal features in this dataset.

Table 3 Attribute table field names of the polygonal features and their descriptions.

Field name	Description
LEX	Lexicon (or LEX) code. First part of the LEX_ROCK label. Up to 5 characters (mostly letters). An abbreviation of the rock unit or deposit as listed in the BGS Lexicon of Named Rock Units: e.g. MSQH
LEX_D	Description of the Lexicon code above giving the name of the unit: e.g. Marine Sediments, Holocene is the full name of the unit coded as MSQH
LEX_RCS	The two-part code, LEX & RCS, used to label each polygon: e.g. MSQH-GV
RCS	The RCS code (or an abbreviation for the string of RCS codes given in full in RCS_X): *e.g.* GV - Gravel
RCS_X	RCS codes. An alternative code abbreviation (or a string of such codes joined by+ signs with square brackets used for subordinate types), each up to 6 characters, for the type of rock or lithology as based on the hierarchical BGS Rock Classification Scheme (RCS):
RCS_D	Description of the RCS code(s) above giving the lithology of the unit: e.g. GRAVEL (SEA BED SEDIMENT, BASED ON FOLK)
MAX_TIME_D	Maximum age of the unit, to the most accurate time (or geochronological) division possible: e.g. HOLOCENE
MIN_TIME_D	Minimum age of unit, to the most accurate time (or geochronological) division possible: e.g. HOLOCENE
MAX_TIME_Y	Maximum age, in years, of the oldest time division during which the geological unit was formed: e.g. 333800000
MIN_TIME_Y	Minimum age, in years, of the youngest time division during which the geological unit was formed: e.g. 320710000
MAX_INDEX	Maximum index. A number representing the maximum age (earliest time) of the unit: MAX_TIME_D field. Used for GIS querying and legend building: e.g. 1322120
MIN_INDEX	Minimum index. A number representing the minimum age (latest time) of the unit: MIN_TIME_D field. Used for GIS querying and legend building: e.g. 1321340
MAX_AGE	Maximum age. Name of the age of maximum geochronological time applicable: e.g. ASBIAN
MIN_AGE	Minimum age. Name of the age of minimum geochronological time applicable: e.g. ALPORTIAN
MAX_EPOCH	Maximum epoch. Name of the epoch of maximum geochronological time applicable: e.g. VISEAN
MIN_EPOCH	Minimum epoch. Name of the epoch of minimum geochronological time applicable: e.g. NAMURIAN
MAX_PERIOD	Maximum period. Name of the period of maximum geochronological time applicable: e.g. CARBONIFEROUS

MIN_PERIOD	Minimum period. Name of the period of minimum geochronological time applicable: e.g. PERMIAN
MAX_ERA	Maximum era. Name of the era of maximum geochronological time applicable: e.g. PALAEOZOIC
MIN_ERA	Minimum era. Name of the era of minimum geochronological time applicable: e.g. MESOZOIC
MAX_EON	Maximum eon. Name of the eon of maximum geochronological time applicable: e.g. PROTEROZOIC
MIN_EON	Minimum eon. Name of the eon of minimum geochronological time applicable: e.g. PHANEROZOIC
PREV_NAME	Previous name(s) for the unit as listed in the BGS Lexicon of Named Rock Units
BGSTYPE	A brief description of the map theme: e.g. 250k_SUPERFICIAL
LEX_RCS_I	Concatenation of Lexicon and RCS codes, plus the maximum index number
LEX_RCS_D	Description of Lex_RCS above
VERSION	Version number and attribute level of the digital data: e.g. V4_16 is version 4, with attribute level 16. The version number is changed when a new dataset is released following major changes or periodic update. Data with the same attribute level have the same structure. As fields are added, renamed or removed so the attribute level is changed
RELEASED	Date released
NOM_SCALE	Nominal scale of the published (or compiled) information used to prepare the digital data: e.g. 250000 for 1:250 000
LEX_ROCK	A two-part code, LEX & ROCK, formerly used as the primary label for each polygon of DiGMapGB data and for creating map keys or legends
FOLK_D50	Folk class name: e.g. GRAVELLY MUDDY SAND
FOLK_S	Folk symbol text: e.g. gmS
BGS_ID	BGS feature unique identifier
SHAPE_LENG	The length of the polygon, measure in degrees
SHAPE_AREA	The area of the polygon, measure in degrees
BGSREF	BGS reference colour for the polygon based on the LEX_ROCK code pair, defined as a 3-digit number: *e.g.* 525

4.4 DATA FORMAT

This dataset is available as a vector GIS dataset comprised of one geospatial data layer, the Seabed Sediments layer (comprised of polygons). These are available in two GIS formats, including ESRI (.shp), and Geopackage (.gpkg). Other formats may be available but may incur additional processing costs. Please email BGS Enquiries (enquiries@bgs.ac.uk) to request further information.

4.5 DATASET HISTORY

The original version of BGS Seabed Sediments 250k published in 2000 (named at the time DiGSBS250k) was the result of digitising the existing BGS Offshore 1:250 000 geological map series. Sheets of this series were issued on a regular grid, with each map sheet covering an area of one degree of latitude by two degrees of longitude. Details of the printed map sheet names, numbers and publication dates are available from the BGS online catalogue, and the

printed maps are still available via the BGS Bookshop and are available to view from the BGS map portal (BGS, 2021c).

The second version of this dataset was released in 2007 (named at the time DiGSBS250k v.2). The principal objective of this revision was to improve the positional accuracy of the data in the dataset.

The third and current version of the BGS Seabed Sediments 250k dataset was released in 2011 (named DiGSBS250k v.3). In 2021, this dataset was renamed 'BGS Seabed Sediments 250k version 3.0' and a Digital Object Identifier (DOI) for the dataset published (BGS, 2021a). Over 3000 results of new particle size analysis from seabed samples have been sourced and used to develop existing interpretations. Increased availability of multibeam bathymetry and backscatter has allowed an improvement in sediment boundary delineation in some areas. Join-up issues between the various 'sheet' areas inherited from the sequentially published paper maps were removed, plus polygon linework was smoothed to improve cartographic appearance.

4.6 DISPLAYING THE DATA

It is recommended that the BGS Seabed Sediments 250k dataset should be displayed based on the "LEX_ROCK" field in the attribute table. This field provides an abbreviation of the rock unit or deposit as listed in the BGS Lexicon of Named Rock Units and the type of seabed substrate (based on Folk classification, when possible) according to the hierarchical BGS Rock Classification Scheme. Two alternative ESRI layer files are provided with the dataset.

5 Licencing the data

5.1 BGS LICENCE TERMS

The British Geological Survey does not sell its digital mapping data to external parties. Instead, BGS grants external parties a licence to use this data, subject to certain standard terms and conditions. In general, a licence fee will be payable based on the type and geographical extent of data, the number of users, and the duration (years) of a licence.

All recipients of a licence (potential licensees) are required to return a signed digital data licence document before authorisation for release of BGS digital data is given.

Please use the following acknowledgements when using BGS Seabed Sediments 250k Premium:

- **DATASET NAME** licenced data: 'Derived from BGS Digital Data under Licence (cite your licence number) British Geological Survey © UKRI. All rights reserved.'
- **DATASET NAME** data: 'Contains British Geological Survey materials © UKRI [year]'

Further details about licensing BGS data can be found on our web page https://www.bgs.ac.uk/information-hub/licensing/.

For more information on the availability of data or to obtain a quote for licensing the data, please email digitaldata@bgs.ac.uk. For any questions related to the licence agreement or to discuss your proposed usage of the data, please email iprdigital@bgs.ac.uk.

5.2 OPEN DATA

To encourage the use and re-use of this data we have made it available under the Open Government Licence www.nationalarchives.gov.uk/doc/open-government-licence/version/3/, subject to the following acknowledgement accompanying the reproduced BGS materials: "Contains British Geological Survey materials © UKRI [year]".

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This dataset falls under BGS' OpenGeoscience portfolio of datasets and services. OpenGeoscience provides a wide range of freely available geoscience information allowing users to view maps, download data, access web services and browse our archive of photos, maps and memoirs. The services available under OpenGeoscience include:

- Map viewers
- Apps
- Map data downloads
- Web services
- Photos and images
- Publications
- Scanned records
- Data collections
- Software

Please refer to OpenGeoscience, see www.bgs.ac.uk/Opengeoscience for more information and a full listing of datasets and services available under this service.

5.3 CONTACT INFORMATION

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NG12 5GG
Direct Tel: +44(0)115 936 3143
Email: digitaldata@bgs.ac.uk

6 Limitations

6.1 DATA CONTENT

The BGS Seabed Sediments 250k is a digital compilation from previously published and unpublished maps and archive information. The mapping, description and classification of the seabed substrate are based upon the interpretations and evidence available at the time of survey, or time of re-evaluation for modifications/correction. This dataset, therefore, represents data of different vintages and origins. This means that it may not always agree with more recently gathered observations (such as multibeam data).

6.2 SCALE

This digital map at 1:250 000 scale is generalised and the geological interpretation should be used only as a guide to the geology at a local level, not as a site-specific geological plan based on detailed site investigations. The data should not be over-enlarged; for example, do not use 1:250 000 nominal scale data at 1:50 000 working scale.

6.3 ACCURACY AND UNCERTAINTY

The mapping accuracy associated with this dataset is nominally +/-1 mm which equates to +/-250 m on the ground, at the true scale. This is only a measure of how faithfully the lines have

been captured from the original paper mapping, it is not a measure of the accuracy of the original geological survey.

Marine in situ measurement techniques (e.g. grabs, cores and underwater video footage) reveal detailed information about the sediment properties and provide, in general, an accurate representation of the local seabed. However, the seabed sampling that underpins this dataset was principally collected at a reconnaissance level and, therefore, the data could be several kilometres apart. Consequently, the interpretations are the result of extrapolation between quite widely and heterogeneous distributed sampling points and may not always be sufficient to represent the sediment heterogeneity.

The limits of some polygons may be affected by imprecisions in the position of the oldest seabed samples and geophysical data, that underpin the geological interpretations presented in this digital product. The position of the oldest data was determined using terrestrial-based radio navigation systems (e.g. Decca Mainchain in the 1970s and 1980s). Their accuracy would vary depending on several factors, e.g. the distance from the shore and time of the day but would normally be comparable to the map accuracy at 1:250 000 scale (+/- 250 metres).

The uncertainty associated with the use of a discrete classification system to portray the seabed sediment distribution will depend heavily on the relationship between the different seabed substrates being mapped. For example, a sharp boundary separating two contrasting sediment types is likely to be more accurately mapped, with greater certainty that a diffuse or gradational boundary between two similar seabed substrates.

Concerning the various factors of uncertainty referred to above, the user should also be aware that any seabed sediments map should be considered a “snapshot in time” of a transitory reality due to the high mobility of certain sedimentary deposits. Within the most dynamic areas, the spatial distribution of these deposits may change dramatically over time due to the local hydrodynamic regime, plus the seafloor may have been subjected to a range of anthropogenic disturbances (*e.g.* dredging).

6.4 ARTEFACTS

The BGS Seabed Sediments 250k data product is based on the BGS Offshore Mapping Programme data and therefore represents data from different times, origins and differing techniques used to map the seafloor over time (see 6.3).

6.5 DISCLAIMER

The use of any information provided by the British Geological Survey (‘BGS’) is at your own risk. Neither BGS nor the Natural Environment Research Council (NERC) nor UK Research and Innovation (UKRI) gives any warranty, condition or representation as to the quality, accuracy or completeness of the information or its suitability for any use or purpose. All implied conditions relating to the quality or suitability of the information, and all liabilities arising from the supply of the information (including any liability arising in negligence) are excluded to the fullest extent permitted by law. No advice or information given by BGS, NERC, UKRI or their respective employees or authorised agents shall create a warranty, condition or representation as to the quality, accuracy or completeness of the information or its suitability for any use or purpose.

7 Frequently asked questions

The questions and answers below have been provided to address any potential issues relating to how the product can be used or how it can be interpreted. If you have any additional questions, please contact digitaldata@bgs.ac.uk

Q: What does this dataset show?
A: The distribution of seabed substrate types of the UK Continental Shelf at a scale of 1:250 000. These sediments are classified based on their grain size, reflecting the environment in which were deposited.

Q: What are the different colours on the map for?
A: The different colours are to show differences in seabed substrate. Each colour will represent a type of seabed sediment type (based on the BGS modified Folk classification, when possible).

Q: How accurate is this dataset?
A: This data was principally collected at a reconnaissance level and, therefore, the individual data points could be several kilometres apart. Users must not consider this dataset at scales finer than 1:250 000. Certain marine environments can be highly dynamic and seabed sediment deposits are known to migrate across large distances, therefore the spatial distribution of deposits presented in this dataset may have changed with time.

Q: How often will this dataset be updated?
A: As this dataset is reviewed and updated, future versions of this dataset are likely. However, dates for new version releases are, as yet, undetermined. BGS will contact licence holders with information about future releases of this dataset once they become available.

Q: Where can I purchase paper maps?
A: Paper maps are available from the BGS online shop. You can also view our catalogue of 6000 digital scans of paper maps in the BGS maps portal (British Geological Survey 2021c)

Q: How can I obtain the digital data?
A: This dataset is licenced from BGS, subject to certain standard terms and conditions. However, an increasing number are available for viewing or download. Many products also offer sample data downloads and user guides to help you decide if the data is suitable for you.

Q: In what formats can these data be provided?
A: The dataset is provided as vector data in ArcGIS format (shapefiles). Other formats may be available but may incur additional processing costs. Please email BGS Enquiries (enquiries@bgs.ac.uk) to request further information.

Q: I don’t have a GIS. Can I still view the data?
A: Yes. The BGS Offshore GeoIndex Map Viewer is a good place to start. It is an online data and GIS service that covers a very wide range of marine geoscience research. The Seabed Sediments at 1:250 000 dataset is also available to view as a Web Map Service (WMS).

Q: Can I use this dataset as part of a commercial application?
A: Please refer to the licencing terms supplied alongside the dataset. For further queries regarding the licencing terms of our products, please contact digitaldata@bgs.ac.uk.

Q: I think the map might be incorrect. What can I do?
A: We make every effort to ensure that our digital data reflects our best understanding of the geology of the UK continental shelf. Sometimes our interpretations need to be revised as new evidence (such as new multibeam data) is obtained and simple errors sometimes get through our quality assurance procedures. We are currently working on a web service to improve notifications of errors that have been found and corrected; we hope to make this available soon. If you think you have spotted a problem with our datasets. Please contact digitaldata@bgs.ac.uk. to let us know.

8 Glossary

Terms	Explanation
ArcGIS	Geographic Information System (GIS) software for working with maps and geographic information maintained by the Environmental Systems Research Institute (ESRI).
Attribute	Named property of an entity. Descriptive information about features or elements of a database. For a database feature like a census tract, attributes might include many demographic facts including total population, average income, and age. In statistical parlance, an attribute is a variable, whereas the database feature represents an observation of the variable.
Backscatter data	Data that was acquired with a sonar system capable of measuring the intensity of the return acoustic signal (echo) backscattered by the seafloor. The intensity of the return signal results from a complex combination of acoustic and geophysical processes, accounting for both transmitting and recording electronics of the sonar and intricate physical phenomena occurring both in the water column and at the seafloor. New methods of analysing backscatter data have increased its potential for seabed characterisation.
Bathymetry	The measurement of the water depth in oceans, seas, or lakes. In other words, bathymetry is the underwater equivalent of topography.
Bedrock	The main mass of rocks forming the earth, laid down prior to 2.588 million years ago. Present everywhere, whether exposed at the surface in rocky outcrops or concealed beneath superficial deposits, artificial ground or water. Formerly called solid.
Continental Shelf	The section of the ocean floor that occurs between the shoreline and the continental slope (or, when there is no noticeable continental slope, a depth of 200 m).
Digitisation	The process of converting information into digital codes stored and processed by computers. In geographic applications, digitising usually means tracing map features into a computer using a digitising tablet, graphics tablet, mouse, or keyboard cursor.
Epoch	Geological unit of time during which a rock series is deposited. It is a subdivision of a geological period.
ESRI	Environmental Systems Research Institute (ESRI) is an international supplier of Geographic Information System (GIS) software, web GIS and geodatabase management applications.

Exclusive Economic Zone (EEZ)	An Exclusive Economic Zone is an area beyond and adjacent to the territorial sea, prescribed by the United Nations Convention on the Law of the Sea, over which a coastal state has special rights regarding the exploration and use of marine resources, including fishing, drilling, and other economic activities. The EEZ shall not extend beyond 200 nautical miles from the baselines of the territorial sea.
Geophysical data	Data that has been acquired by recording and analysing measurements of the Earth's physical properties, such as electrical, gravity, magnetic, radioactivity and seismic properties.
Geospatial data	Data that has a geographical component to it. This means that the records in a dataset have locational information directly linked to them, such as geographic data in the form of coordinates, addresses, cities, or postcodes.
Lexicon	Vocabulary defining rock names, the BGS Lexicon of Named Rock Units database provides BGS definitions of terms that appear on our maps and in our publications. https://www.bgs.ac.uk/lexicon/home.html
Lithological units	A rock identifiable by its general characteristics of appearance colour, texture and composition defined by the distinctive and dominant, easily mapped and recognizable petrographic or lithologic features that characterize it.
Lithology	Rocks may be defined in terms of their general characteristics of appearance: colour, texture and composition. Some lithologies may require a microscope or chemical analysis for the latter to be fully determined.
Lithostratigraphy	Age and lithology. Many rocks are deposited in layers or strata and the sequence of these strata can be correlated from place to place. These sequences of different rocks are used to establish the changing geological conditions or geological history of the area through time. The description, definition and naming of these layered or stratified rock sequences is termed lithostratigraphy (rock stratigraphy). Lithostratigraphy is fundamental to most geological studies. Rock units are described using their gross compositional or lithological characteristics and named according to their perceived rank (order) in a formal hierarchy. The main lithostratigraphic ranks in this hierarchy are Bed (lowest)>Member,>Formation>Subgroup>Group>Supergroup (highest). The units are usually named after a geographical locality, typically the place where exposures were first described.
Multibeam data	Data that was acquired with a multibeam echosounder. This type of sonar system emits sound waves in a fan shape. Multibeam systems acquire both bathymetry (depth) and

	backscatter (intensity) data. The amount of time taken for the sound waves to bounce off the seabed and return to a receiver is used to determine water depth. Whereas, the return intensity (i.e. how much of a transmitted acoustic signal is bounced back) reflects the nature of the seabed and can be used to determine the type of material or sediment on the seafloor.
Particle size	Particle size, also called grain size, means the diameter of individual grains of sediment, or the lithified particles in clastic rocks.
Polygon	Polygons are a representation of areas. A polygon is defined as a closed line or perimeter completely enclosing a contiguous space and is made up of one or more links.
Scale	The relation between the dimensions of features on a map and the geographic objects they represent on the Earth, commonly expressed as a fraction or a ratio. A map scale of 1/100 000 or 1:100 000 means that one unit of measure on the map equals 100 000 on the earth.
Sedimentary	Rocks that originated from the broken up or dissolved and re-precipitated particles of other rocks. Examples include clay, mudstone, siltstone, shale, sandstone, limestone and conglomerate. Sedimentary rocks cover more than two-thirds of the Earth's surface. They are formed from the weathering and erosion products of rock material, which have been transported (usually by water or wind), redeposited and later consolidated.
Sediments	A naturally occurring solid fragmental material originated from weathering of rocks or other matter, like biological material (*e.g.* shells), that was transported and deposited by water, wind, or ice. They tend to form deposits of loose, unconsolidated material. Sediment can be classified based on its grain size (*e.g.* sand, gravel) or composition.
Shapefile	The shapefile format is a geospatial vector data format for geographic information system software. It is developed and regulated by ESRI as a mostly open specification for data interoperability among ESRI and other GIS software products.
Superficial	The youngest geological deposits formed during the most recent period of geological time, the Quaternary. They date from about 2.6 million years ago to the present.
Vector	A representation of the spatial extent of geographic features using geometric elements (such as points, curves, and surfaces) in a coordinate space.

9 References

British Geological Survey holds most of the references listed below, and copies may be obtained via the library service subject to copyright legislation (contact libuser@bgs.ac.uk for details). The library catalogue is available at: https://envirolib.apps.nerc.ac.uk/olibcgi.

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