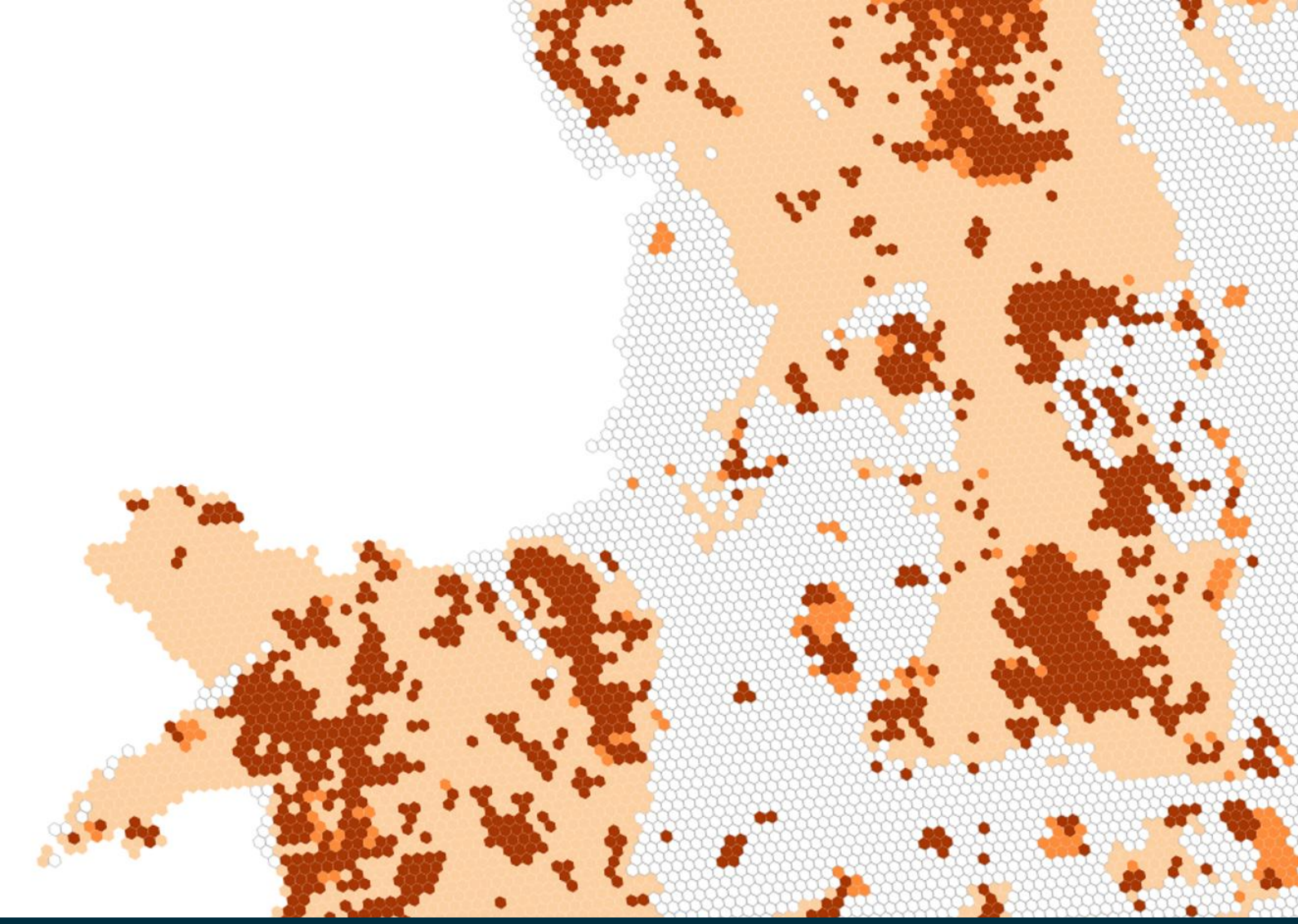

BGS INFORMATICS PROGRAMME

User Guide:

BGS Mining hazard (not including coal) GB Open V9

Open report OR/26/028

British Geological Survey

BRITISH GEOLOGICAL SURVEY

BGS INFORMATICS PROGRAMME

OPEN REPORT OR/26/028

User Guide: BGS Mining Hazard (not including coal) GB Open Version 9

British Geological Survey

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Keyworth, Nottingham British Geological Survey 2026

BRITISH GEOLOGICAL SURVEY

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The London Information Office also maintains a reference collection of BGS publications, including fossils, for consultation.

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

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

The 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 geo-environmental 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 a digital dataset depicting susceptibility to mining related subsidence hazard for Great Britain.

Several individuals from the BGS have contributed to the project and this assistance has been received at all stages of the study. In addition to the collection of data, many individuals have freely given their advice and provided expert knowledge. Of the many individuals who have contributed to this project we would particularly like to thank Edd Lewis, Russell Lawley, Tom Bide, Isaac Watkins and Emma Raycraft.

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Summary

BGS Mining Hazard (not including coal) GB Open summarises the location and extent with an indication of the level of hazard associated with former and present underground mine workings.

The dataset covers Great Britain, and the content is derived from a range of data sources including, but not limited to the bedrock geology, extensive literature reviews of both published and unpublished documents, abandonment and mine plans, combined with a wealth of expert knowledge and experience. This content has been generalised to create an openly available version of the data.

The release of BGS Mining Hazard (not including coal) GB version 9 builds on the content of previously published versions. The coverage has been expanded with the inclusion of newly identified areas and drawing on data from the BGS published BGS BritPits and other resources.

The data have been compiled and presented in an easy-to-use format to provide a national overview of the country's mining legacy. Given the long and complex mining history of Great Britain, this dataset represents the best information available at the present time (October 2025). Work continues to develop this product, which will result in the release of ad hoc updates in the future.

NOTE: This dataset provides a generalised overview of the likelihood for mining to have occurred, derived from the premium data. It provides a national-scale summary of the presence of mining and an indication of the level of hazard associated with old workings. **It should not be used in site specific assessments, rather to identify regional and national overviews of mining hazard distribution to inform more detailed investigations of provide a broad scale overview.** Users seeking information about specific locations should consult the full resolution, licenced dataset here:

https://www.bgs.ac.uk/datasets/mining-hazard-not-including-coal/

The data is provided in vector GIS formats and is available to download from the BGS Mining Hazard (not including coal) GB Open webpage for use under the BGS Non-Commercial Use Licence (BGS-NCUL) v1.0.

The information provided in this User Guide is intended to provide a quick start guide to using and understanding this BGS data product. Users should not use the BGS Mining Hazard (not including coal) GB Open dataset without first reading this User Guide in full.

1 Introduction

1.1 BACKGROUND TO THE DATASET

The BGS Mining Hazard (not including coal) GB Open dataset identifies areas where past non-coal underground mining may have occurred, resulting in underground voids. Former underground workings, particularly where shallow, may collapse and consequently may cause surface settlement. Former coal mining areas are not included in the dataset as comprehensive data is available from the Mining Remediation Authority (formally The Coal Authority).

The defined mining areas are based on a combination of geological factors relating to the known distribution of mineral veins, bedded ores, building stones, chalk workings, oil shales, bedded ores and other commodities, which have been mined. The geological data has been supplemented by information (both published and unpublished) on known or suspected locations of workings. The study of the distribution of legacy non-coal mine workings across GB is an active area of scientific research and we are constantly updating and improving the accuracy of the dataset.

A 1:50 000 scale BGS Mining Hazard (not including coal) dataset is available to licence from the BGS (2026a). This provides information on the name, commodity that has or may have been extracted, a susceptibility to ground instability classification and description of what each class represents. A BGS User Guide (BGS, 2026b) provides further detail on this licenced, higher resolution dataset and can be accessed via the BGS product webpages here:

https://www.bgs.ac.uk/datasets/mining-hazard-not-including-coal/

This BGS Mining Hazard (not including coal) GB Open dataset is freely available, open, generalised version of the licenced dataset available for use under the BGS Non-Commercial Use Licence (BGS-NCUL) v1.0.

1.2 WHAT THE DATASET INCLUDES

This version of the dataset summarises susceptibility to ground instability information via spatial statistics (zonal statistics) on the basis of a regular hexagon grid distributed across the surface of Great Britain. The hexagon grid utilises the H3 standard global grid system which provides a hierarchical geospatial indexing system that partitions the globe into hexagonal cells. This system is widely adopted by providers of open, geospatial data and therefore supports users in integrating BGS data with other H3 formatted datasets.

For more information, please consult the H3 user documentation: https://h3geo.org/docs

1.3 WHY THE DATASET IS USEFUL

This dataset is for users who are seeking summary information about areas susceptible to ground instability caused by non-coal mine workings across Great Britain. Identifying areas most likely to be affected by historic mining hazards and understanding where infrastructure such as road networks is most susceptible to subsidence, enables informed prioritisation and proactive planning of repairs before damage occurs.

This dataset provides a generalised overview of the likelihood for mining to have occurred. It provides a national-scale summary of the presence of mining and an indication of the level of hazard associated with old workings. It can be used by national and regional organisations to determine the distribution of non-coal mining hazard across their areas of responsibility and interest to inform the prioritisation of more detailed assessments.

It should not be used in site specific assessments, rather to identify regional and national overviews of mining hazard distribution to inform more detailed investigations of provide a broad scale overview. Users seeking information about specific locations should consult the full resolution, licenced dataset here:

https://www.bgs.ac.uk/datasets/mining-hazard-not-including-coal/

2 Methodology

This section outlines the procedures taken to generalise the BGS Mining Hazard (not including coal) GB V9 dataset to the H3 hexagonal grid. It does not provide information on how the BGS Mining Hazard (not including coal) GB V9 dataset has been derived. For information on the methodology used to produce the BGS Mining Hazard (not including coal) GB V9 dataset, please consult the BGS User Guide report OR/25/073 (BGS, 2026).

2.1 SOURCE DATA OVERVIEW

2.1.1 BGS Mining Hazard (not including coal) GB V9

The dataset draws together published information and expert knowledge, combined with details of the underlying geology. It identifies locations where mining is known or is likely to have occurred. The dataset summarises Great Britain's long and complex mining history. Inputs include:

- BGS Geology 50k v9: bedrock polygons and linear features
- BGS BritPits v3 underground workings
- Mine plans and mine abandonment plans from various sources, published and unpublished
- References to non-coal mineral workings from published and unpublished literature

2.1.2 H3 hexagonal grid

The H3 hexagonal grid is generated via implementation of an open source code library which identifies the H3 hexagonal cell a spatial point intersects and generates the hexagonal geometry for that particular cell, with the attribution of the original point attached. H3 is a hierarchical system therefore there are multiple cell resolutions available, and each resolution can be related to either its parent hexagonal cell or it's seven child hexagonal cells. Figure 1 – Illustration of the hierarchical nature of the H3 hexagonal gridding. Source: ESRI

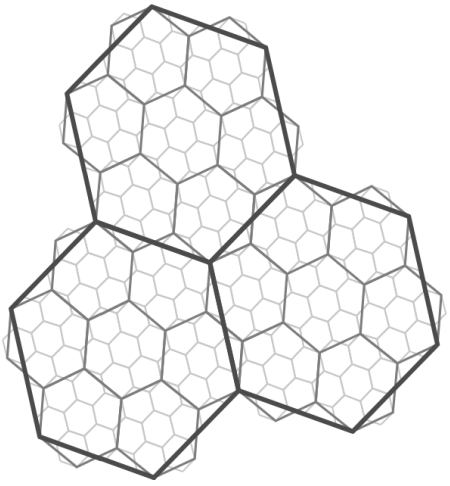


Figure 1 – Illustration of the hierarchical nature of the H3 hexagonal gridding. Source: ESRI

Figure 2 – A) shows the Mining Hazard (not including coal) premium data overlain with the Mining Hazard (not including coal) Open hexagonal grid.**Figure 1**, demonstrates this hierarchy with three resolutions of hexagons, the largest cells being parents to the intermediate cell size which are in turn parents to the smallest cell size. H3 is a global system therefore the spatial reference system of the grids is Word Geodesic System (WGS84).

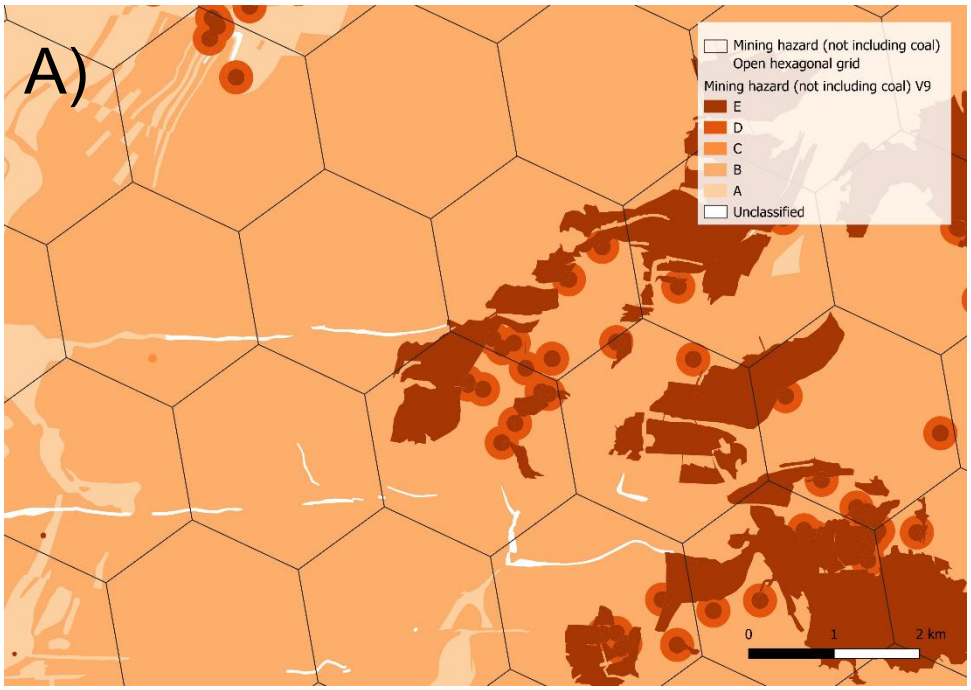
BGS has adopted H3 resolution 7 for the Mining Hazard (not including coal) Open dataset, with a cell area of c.5.16 km^2 and a cell length of c.1.4 km

2.2 BGS MINING HAZARD (NOT INCLUDING COAL) GB OPEN - CONSTRUCTION

The data are derived by spatially summarising the information held in the 1: 50 000 scale BGS Mining Hazard (not including coal) GB dataset. The original five classes have been rationalised to three ensuring that small scale mining features are not underestimated in the generalisation process.

Spatial statistics are used to determine the highest class (worst-case) present in the hexagon area. Each hexagon cell was then attributed with the highest (worse-case) class identified within the cell.

Section 3.3 provides further detail on data attribution. Figure 2 demonstrates how generalisation significantly reduces the spatial precision of the data and how the five premium classes are summarised into three open classes presenting the highest (worst-case) class per cell.



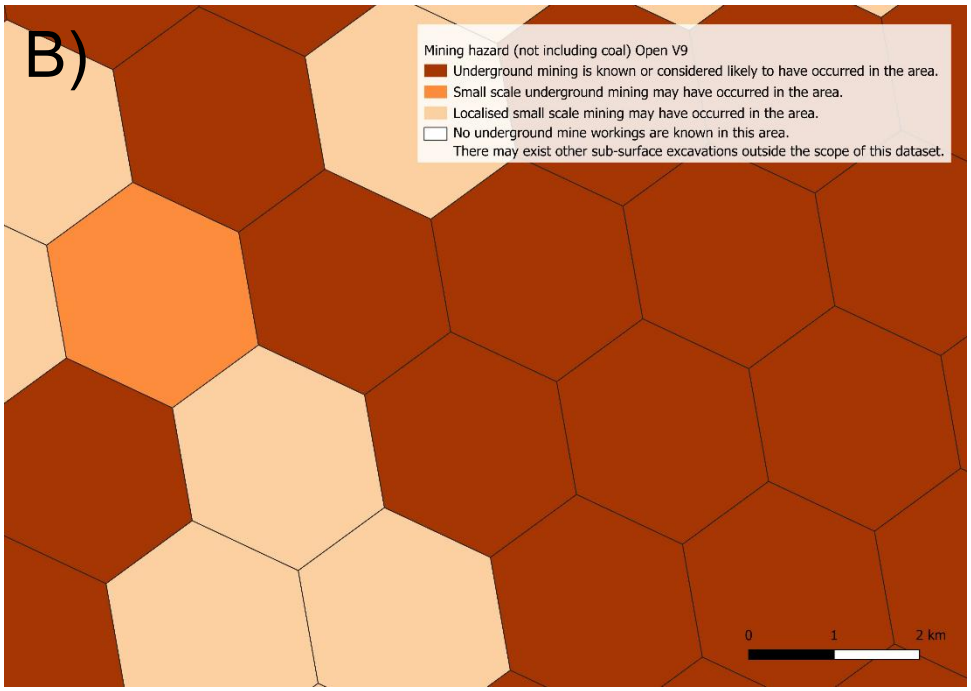


Figure 4 – A) shows the Mining Hazard (not including coal) premium data overlain with the Mining Hazard (not including coal) Open hexagonal grid.

B) shows the Mining Hazard (not including coal) Open

The generalisation of the Mining Hazard (not including coal) premium data in the Open dataset significantly reduces the spatial precision of the dataset making it unsuitable for anything other than assessing the national or regional trends in mining hazard

3 Technical information

The following sections provide all technical information relating to the BGS Mining Hazard (not including coal) GB Open dataset.

3.1 SCALE

The BGS Mining Hazard (not including coal) GB Open provides a generalised mining hazard assessment at a ground resolution of c. 5.16 km^2 per cell in Word Geodesic System (WGS84) spatial reference system in accordance with the H3 grid system.

3.2 COVERAGE

BGS Mining Hazard (not including coal) GB Open covers Great Britain in geographic coordinate system EPSG:4326, in line with H3 standards. Mining of non-coal minerals has occurred only in specific locations therefore susceptibility to the associated ground instability hazards is highly localised. Areas where no known mining activity is recorded are represented in the dataset by the 'NA' classification.

3.3 ATTRIBUTE DESCRIPTION

BGS Mining Hazard (not including coal) GB Open is provided as a vector GIS dataset containing the following attributes:

Table 1 – Summary of Mining Hazard (not including coal) Open attribution

Attribute	Description			
H3_IX	The H3 identifier per cell. This value can be used to join Mining hazard (not including coal) Open data to other H3 hexagonal grid datasets.			
CLASS	NA	Low	Moderate	Significant
LEGEND	No known record of mining activity.	Localised small-scale mining may have occurred in the area.	Small scale underground mining may have occurred in the area.	Underground mining is known or considered likely to have occurred in the area.
DATASET	Name of dataset - BGS Mining Hazard (not including coal) GB Open v9			

3.4 DATA FORMAT

The data is supplied as a shapefile (.shp) and geopackage (.gpkg) with accompanying symbology style files for ESRI (.lyrx) and QGIS (.qlr) GIS software. More specialised formats may be available but may incur additional processing costs. Files are provided in Word Geodesic System (WGS84) spatial reference system in accordance with the H3 grid system.

3.5 DISPLAYING THE DATA

The data is supplied with .lyrx .qlr and .qml style files for use in ESRI and QGIS GIS software respectively.

Table 2 contains colour codes and a visual of the colours for use with other GIS software. To ensure accessibility for individuals with visual impairments, a swatch of colours was sourced from the ColourBrewer 2.0 palette, which is suitable for colour-blind users.

Table 2 - Colour palette recommended for displaying the BGS Mining Hazard (not including coal) GB Open data.

Data Classification	RED	GREEN	BLUE	HEX	LOOKS LIKE
CLASS	This is the equivalent red channel colour	This is the equivalent green channel colour	This is the equivalent blue channel colour	This is the equivalent Hexadecimal value	This cell shows the colour as intended
NA	255	255	255	FFFFFF	
Low	253	208	162	FDD0A2	
Moderate	253	141	60	FD8D3C	
Significant	166	54	3	A63603	

3.6 DATA HISTORY

In line with BGS naming conventions relating to the use of the BGS Geology 1:50 000 scale data product, this dataset is known as the BGS Mining Hazard (not including coal) GB V9 Open. The 'V9' suffix refers to the version of the BGS Geology 1:50 000 scale data that the model is based on (version 9).

Since 2009, six versions of the licenced Mining Hazard (not including coal) dataset have been released. This is only the second generalised version produced by BGS, the first being for version 8.1.

The BGS Mining Hazard (not including coal) GB V9 updates the BGS Geology derived geometries to reflect the BGS Geology V9 digital geology maps released in October 2025. It also includes an updated selection of BGS BritPit underground working locations, notably an increased representation of iron ore workings which had previously been excluded as the commodity was extracted coincidently with coal. A number of previously identified errors have been corrected and the methodology for compiling the bedded ore and vein mineral commodities reviewed and updated.

The BGS Mining Hazard (not including coal) GB Open inherits all of the updates to the licenced dataset described above. Additionally, Mining Hazard (not including coal) Open V9 has adopted the H3 gridding system at resolution 7 which has a hexagonal coverage area c.5.16 km^2 with a cell side length of c.1.4 km. The previous version provided data in hexagonal cell format with an area c.2.6 km^2 and cell side length of c.1 km. This change has been made in order to align with the increasingly popular H3 open data format to improve the interoperability of BGS open data with other hexagonally gridded geospatial datasets. **Due to these updates users should not compare Mining Hazard (not including coal) Open V9 with previous versions, nor take any changes in susceptibility class values for a specific location as an indication of a real-world change in susceptibility to ground instability.**

4 Licencing the data

4.1 BGS LICENCE TERMS

To encourage the use and re-use of this data BGS has made it available under open, non-commercial, licence terms, subject to the following acknowledgement accompanying the reproduced BGS materials: "Contains British Geological Survey materials ©UKRI [year]".

This open Licence is a simple and straightforward licence that allows anyone – including individuals, charities and community groups - to re-use public sector information without having to pay or get permission, as long as that re-use is not for 'Commercial Purposes', as defined in the licence.

4.2 OPENGEOSCIENCE

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.

4.3 CONTACT INFORMATION

For all data and licensing enquiries please contact:
BGS Data Services
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5 Limitations

5.1 DATA CONTENT

Observations made in the production of the underlying source data are according to the prevailing understanding of the subject at the time. Subsequent advances in knowledge, improved interpretation methods and new information sources have not been included.

Summarising via spatial statistics may lead to over estimation of the extent of a hazard.

Conversion to a hexagon grid generalises the data altering perception of the spatial distribution. Results of any analysis and subsequent interpretation should be viewed with care.

Comparison with the underlying source data will reveal variations due to the generalisation process applied.

5.2 SCALE

Data has been generalised to c. 5.16 km^2 hexagon grid, it must not therefore be used at finer scales.

The BGS Mining Hazard (not including coal) GB Open provides a generalised mining hazard assessment at a ground resolution of c. 5.16 km^2 per cell in Word Geodesic System (WGS84) spatial reference system in accordance with the H3 grid system. It can be used by national and regional organisations to determine the distribution of non-coal mining hazard across their areas of responsibility and interest to inform the prioritisation of more detailed assessments.

It should not be used in site specific assessments, rather to identify regional and national overviews of mining hazard distribution to inform more detailed investigations of provide a broad scale overview. Users seeking information about specific locations should consult the full resolution, licenced dataset here:

https://www.bgs.ac.uk/datasets/mining-hazard-not-including-coal/

5.3 ACCURACY AND UNCERTAINTY

Details on the accuracy and uncertainty of the 1:50,000 scale, Mining hazard (not including coal) Premium dataset from which this dataset has been generalised can be found in the BGS user guide available to download here:

https://www.bgs.ac.uk/datasets/mining-hazard-not-including-coal/

5.4 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) or 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.

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6 Frequently asked questions

These questions and answers 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 the BGS Mining hazard (not including coal) Open Dataset show?
A: This dataset shows a generalised version of the BGS Mining hazard (not including coal) Premium dataset which dataset summarises susceptibility to ground instability information via spatial statistics (zonal statistics) on the basis of a regular hexagon grid distributed across the surface of Great Britain. The hexagon grid utilises the H3 standard global grid system which provides a hierarchical geospatial indexing system that partitions the globe into hexagonal cells. This system is widely adopted by providers of open, geospatial data and therefore supports users in integrating BGS data with other H3 formatted datasets.

Q: What areas does the BGS Mining hazard (not including coal) Open Dataset cover?
A: This dataset covers covers Great Britain in geographic coordinate system EPSG:4326, in line with H3 standards. Mining of non-coal minerals has occurred only in specific locations therefore susceptibility to the associated ground instability hazards is highly localised. Areas where no known mining activity is recorded are represented in the dataset by the 'NA' classification.

Q: In what data formats can the BGS Mining hazard (not including coal) Open Dataset be provided?
A: The data is supplied as a shapefile (.shp) and geopackage (.gpkg) with accompanying symbology style files for ESRI (.lyrx) and QGIS (.qml) GIS software. More specialised formats may be available but may incur additional processing costs. Files are provided in Word Geodesic System (WGS84) spatial reference system in accordance with the H3 grid system.

Q: At what map scale is the BGS Mining hazard (not including coal) Open Dataset provided?
A: The dataset provides summary statistics at a ground resolution of c. 5.16 km^2 per cell in Word Geodesic System (WGS84) spatial reference system in accordance with the H3 grid system. This dataset provides a summarises susceptibility to ground instability information via spatial statistics (zonal statistics). It should not be used in site specific assessments. It is only intended to provide regional and national overviews of mining hazard distribution to inform more detailed investigations of provide a broad scale overview. Users seeking information about specific locations should consult the full resolution, licenced dataset here:

https://www.bgs.ac.uk/datasets/mining-hazard-not-including-coal/

Q: How often will the BGS Mining hazard (not including coal) Open Dataset be updated?
A: This dataset is not routinely updated. The dataset is revised on an ad hoc basis, as and when there are significant changes in its source data, and/ or it is prioritised for update.

Q: Can I use the BGS Mining hazard (not including coal) Open Dataset as part of a commercial application?
A: To encourage the use and re-use of this data BGS has made it available under open, non-commercial, licence terms, subject to the following acknowledgement accompanying the reproduced BGS materials: "Contains British Geological Survey materials ©UKRI [year]".

This open licence is a simple and straightforward licence that allows anyone – including individuals, charities and community groups - to re-use public sector information without having to pay or get permission, as long as that re-use is not for 'Commercial Purposes', as defined in the licence.

Glossary

Term	Explanation
Bedded ore	Bedded ore refers to an ore deposit that is formed in a tabular or layered form, typically lying horizontally or slightly inclined to the horizontal. It is commonly found in sedimentary rocks and is parallel to the stratification of the surrounding rock.
BGS Geology	The suite of digital BGS geological maps. https://www.bgs.ac.uk/datasets/bgs-geology-50k-digmapgb/
BritPits	An abbreviation of British Pits, and the word 'pits' is used here to include both surface and underground mineral workings. The BGS BritPits database holds information on names of mines, quarries, oil wells, gas wells, ash and desulphogypsum plants; geographic location; address; operator; mineral planning authority; geology; mineral commodities produced; end-uses where known.
Building stone	Building stone refers to naturally occurring igneous, sedimentary or metamorphic rocks that are sufficiently strong and cohesive to be quarried and worked into blocks or slabs for use in construction, including walling, paving and roofing. Principal building stones include igneous rocks such as granite, massive, bedded sandstones, limestones, and metamorphic rocks such as marble and slate. Building stone is also commonly referred to as Dimension stone.
Chalk	A sedimentary rock formed from the accumulation up of the shells marine microorganism comprised of calcium carbonate.
EPSG:4326	EPSG:4326 refers to the WGS 84 projection, which is the default geographic coordinate system used for latitude and longitude and the standard coordinate system used for H3 grids.
ESRI	Environmental Systems Research Institute (ESRI) is an international supplier of geographic information system (GIS) software, web GIS and geodatabase management applications.
Evaporite	A sedimentary rock composed mainly of minerals produced by evaporation, normally from an enclosed body of seawater or a salt lake. Minerals formed in this way include gypsum, rock salt, and various nitrates and borates.
Geographic Information System	Geographic Information Systems (GIS) provides accurate information, assistance, support, and maintains and creates information to aid in the development of maps and data analysis.
Geohazard	Geological and environmental conditions, involving long and short-term processes which may lead to widespread damage. There are many different types of geohazard with different natural and artificial processes causing them to occur. All have the potential to create problems for development of the human environment and threats to the safety and well-being of people. Geohazards can develop quickly (seconds or minutes) in response to the processes that drive them, or take tens, hundreds, or thousands of years to develop to a point where they pose a danger. They are found in most parts of the world, including marine and fluvial environments.
Geopackage (.gpkg)	A GeoPackage is an open, non-proprietary, platform-independent data format for geographic information systems (GIS). It is based on SQLite, allowing for efficient storage and management of geospatial data.
Geospatial data	Data describing anything with spatial extent, i.e. size, shape or position. In addition to describing things that are positioned relative to the Earth,

	spatial data may also describe things using other coordinate systems that are not related to position on the Earth, such as the size, shape and positions of cellular and sub-cellular Spatial Things described using the 2D or 3D Cartesian coordinate system of a specific tissue sample.
H3	A discrete global grid system for indexing geographies into a hexagonal grid, developed at Uber. Please visit the H3 webpages for more information. https://h3geo.org/
.lryx	ArcGIS Pro layer file that stores the symbology, labelling, and other properties of map layers, enabling consistent visualisation. The .lyrx file is pre-linked to the Mining hazard GIS files and can be added to ArcGIS Pro project to display the data with the symbology pre-applied.
Mineral veins	A distinct sheetlike body of crystallised minerals within a rock which often have economic value.
Oil shale	Oil shale is an organic-rich fine-grained sedimentary rock containing kerogen from which liquid hydrocarbons can be produced.
Other commodities	All other non-coal commodities which have been worked and do not fall within one of the other six BGS Mining hazard (not including coal) commodity groups.
QGIS	A free and open-source cross-platform desktop geographic information system (GIS) application that supports viewing, editing, and analysis of geospatial data. QGIS was until 2013 known as Quantum GIS.
.qlr	QGIS file that stores the symbology, labelling, and other properties of a specific GIS file. The .qlr file is pre-linked to the Mining hazard GIS files and can be added to QGIS project to display the data with the symbology pre-applied.
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.
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.
Vector	A representation of the spatial extent of geographic features using geometric elements (such as point, curve, and surface) in a coordinate space.
Workings	The current or past underground or surface openings and tunnels of a mine. More specifically, the area where the ore has been extracted.

References

The British Geological Survey holds most of the references listed 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://ukrinerc.on.worldcat.org/discovery

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