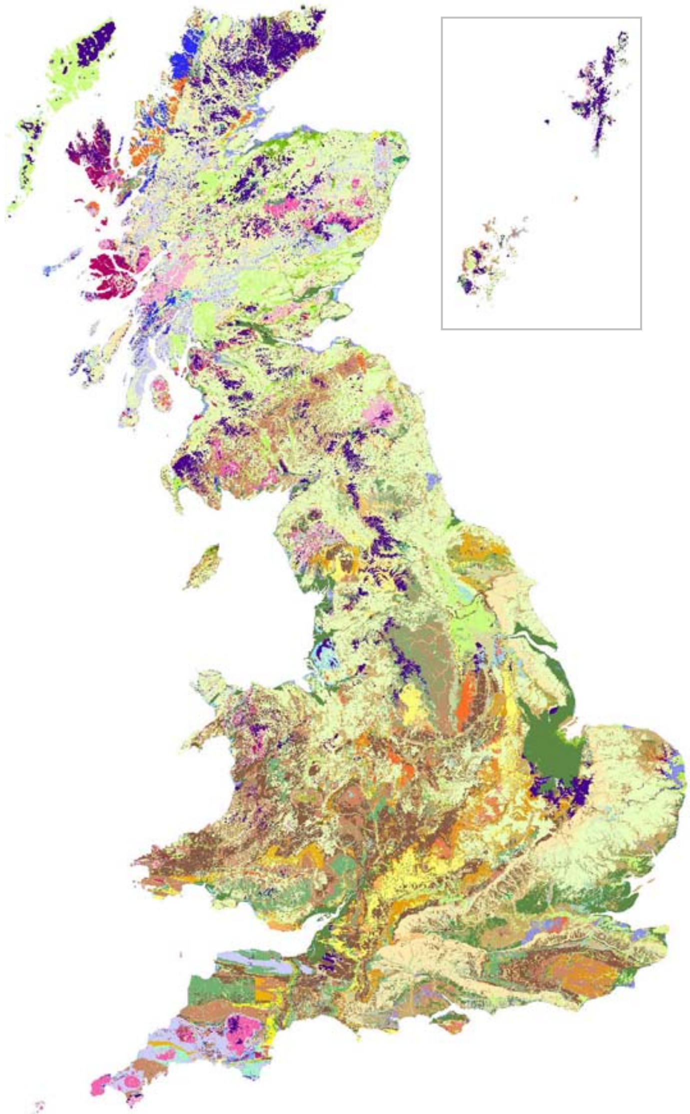
The Soil-Parent Material Database (SPM-v4): A User Guide.

Landuse and Development Programme and Information Products

Open Report OR/08/034



BRITISH GEOLOGICAL SURVEY
LANDUSE AND DEVELOPMENT PROGRAMME AND INFORMATION PRODUCTS
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The soil-parent material database: A User Guide.

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Foreword

This report is a user guide to the content and application of the National Soil-Parent Material database produced by the British Geological Survey (BGS). The National Soil-Parent Material database provides simplified descriptions of near-surface, geological materials and their overlying soils.

Acknowledgements

A large number of individuals in BGS have contributed to the project. 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 the local knowledge so important to the description of soil-parent materials. Key staff have helped to review draft chapters of this report. Of the many individuals who have contributed to the project we would particularly like to thank the following:

Prof B Smith (formerly of BGS),

Dr N S Jones (formerly of BGS).

The author would like to thank.

Ms F Billin

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1 Background

The soil-parent material (PM) database is part of a series of GIS maps designed to help environmental scientists and consultants assess the characteristics of the 'near-surface' weathered zone. In particular, the data focuses upon the material from which top soils and subsoils (A and B horizons) develop (i.e. from the base of pedological soil down to c. 3m).

1.1 WHAT IS A SOIL PARENT MATERIAL?

A 'soil parent material' is a geological deposit over, and within which, a soil develops. Typically, the parent material is the first recognisably geological deposit encountered when excavating beneath the soil layer. It represents the very-near-surface geology. In general, the geological deposits closer to the ground surface are the most weathered, whilst the deeper deposits are less so. The interface between soil and parent (geology) can vary from a sharp, clearly defined boundary, to a diffuse continuum with no distinctive point of transition.

"The major soil groups [in the UK]… are distinguished by broad differences in the composition or origin of the soil material" (Avery, 1979). Soil-parent materials play a vital role in determining soil-type. Typically, parent material characteristics control three primary characteristics of their overlying soils:

1. Texture
2. Chemistry
3. Permeability-Porosity (drainage).

All three characteristics are implicitly defined in the typical geological rock/deposit descriptions provided in BGS products. However, these characteristics are easier to use (by non-geologists) when explicitly defined, as they are in the soil-parent material database.

Most users will use the 'soil-parent material' data as their core data source to help them model and understand soil characteristics. Other datasets for terrain analysis, climate and landuse will help the user to build true digital soil models. BGS also supplies specific data for slope accumulation, wind-blown deposits cover, artificial deposits and geochemistry if users are particularly interested in thickened soil profiles, soil erosion/mobilisation, gleying or unusual soil-geochemical profiles.

The soil-parent material data has attributes for the following characteristics:

- Lithology
- Texture
- Mineralogy
- Strength
- Structure
- Colour
- Age
- Variability

1.2 TECHNICAL INFORMATION

1.2.1 Data scale and scope

The PM database is a synthesis of several national and regional databases held by BGS, primarily DiGMapGB-50 V4.16. The data provides national coverage for England, Scotland and Wales at a scale of 1:50,000. The PM database is a growing and developing database, which will extend its attribute content to hold enhanced and additional information on near-surface properties of rocks, superficial deposits and soils over time.

1.2.2 Data origin

The spatial content of the map is derived from the BGS 1:50,000 scale Geological Map of Great Britain, known as DiGMapGB-50 (British Geological Survey. 2007) with qualitative attribution derived from the BGS Rock Classification Scheme Volumes 1- 4 (Gillespie and Styles, 1999; Robertson, 1999; Hallsworth and Knox, 1999; McMillan and Powell, 1999) and additional soil texture data from the BGS GBASE survey (Ault and Mackenzie, 2006).

1.2.3 Data format

The data is supplied as vector GIS layers; either in Shape format (suitable for ESRI GIS systems) or TAB format (suitable for MapInfo GIS systems). Other formats are available on request. The data is also supplied with an example ESRI Map document (PM4.MXD file) or MapInfo workspace (PM4.WOR file) to help familiarise users with the data content and its potential use. These files can be opened in their respective GIS software and will provide a series of map images coloured and classified to highlight some of the data content.

1.3 WHO SHOULD USE THE SOIL PARENT MATERIAL DATASET?

Anyone working in the field of environmental science (from ground engineering to climate change impact assessment) can use the soil parent material dataset. The dataset has been designed for a diverse user-base and simply presents BGS' geological and pedological spatial data in a manner that is more flexible for GIS-aware environmental scientists. A basic understanding of geology and soils is recommended so that users can fully utilise the dataset but any user with a grasp of physical geography should be able to work with the dataset. The database sets out simplified, qualitative descriptions of PM characteristics. Drawing together these characteristics in a meaningful way will allow users to create maps of likely soil and ground/environment characteristics. More expert users will be able to integrate the parent material dataset into climate, land use and terrain data to create full digital soil models.

For background information on the relationship between soils and parent materials, and the use of environmental data in building digital soil models, please see Appendix 1.

1.4 USING THE PMM

The following sections outline the structure and content of the Soil-Parent Material (PM) database. For each of the attribute fields provided in the PM a brief description of the data is given. Attribute fields marked with an asterisk (*) also have a 'lookup' dictionary available in Appendix 2 to help users understand the meaning of codes or definitions.

The parent material database comprises a spatial layer (a map of polygons) with each map unit being described by fifty-three fields of attribute data. Most fields are populated with 'plain' text (simple text descriptions are used as they are considered more user friendly to non specialists) however some fields are populated with codes for ease of use within a GIS. The general structure of the attribute data is shown in Table 1 below.

Table 1. General attribute content of the PM database

Fields	Content
Fields 1- 2	ESRI shapefile identifiers (not applicable for non-ESRI formats)
Fields 3 – 10	Map Unit Descriptors (e.g. PM codes, unique id)
Fields 11 - 20	Lithological descriptors (e.g. parent rock type)
Fields 21 - 28	Texture descriptors (e.g. soil texture)
Fields 29 - 33	Mineralogical descriptors (e.g. CaCO3 content)
Fields 34 – 38	Strength and structure descriptors (e.g. Hardness)
Fields 39 - 40	Colour descriptors (e.g. fresh colour)
Fields 41	variability descriptor
Fields 42 - 47	Coded versions of selected descriptors (e.g. Agecode)
Fields 48 - 49	Alternate DiGMapGB-50 descriptors (e.g. alternative Lex_rock classification)
Fields 50 - 55	Map metadata (e.g. version number)

1.4.1 Parent material database: Map unit description

Each map unit (polygon) is described by eight fields detailing its parent material type and the near surface spatial context of the unit. The parent materials are described by a series of codes, each code representing a combination of physical characteristics.

Several systems for classifying parent material exist across the world; most classification systems are simplified subsets of geological descriptions of rock units. Many systems are flawed in that the PM classification relies on inconsistent grouping of certain geological characteristics. (i.e. some PM classification systems are based on rock genesis, others are based on knowledge of texture). The BGS PM classification is based upon the primary origin of the material, its dominant mineralogy and its generalised texture (grain size), see figure 1 below.

Most users will find the PM codes are sufficient to describe the parent materials and their likely soil characteristics. However, by using combinations of data held in the other attribute fields of the dataset, users can create a range of parent material maps varying in complexity from ‘simplistic’ to ‘detailed’ offering a number of classifications.

The PM database provides three key PM codes to describe each map objects these are: PM_CODE, A_PM_CODE and B_PM_CODE (see below for details). These codes are all four character ‘composite’ codes and all have the following structure:

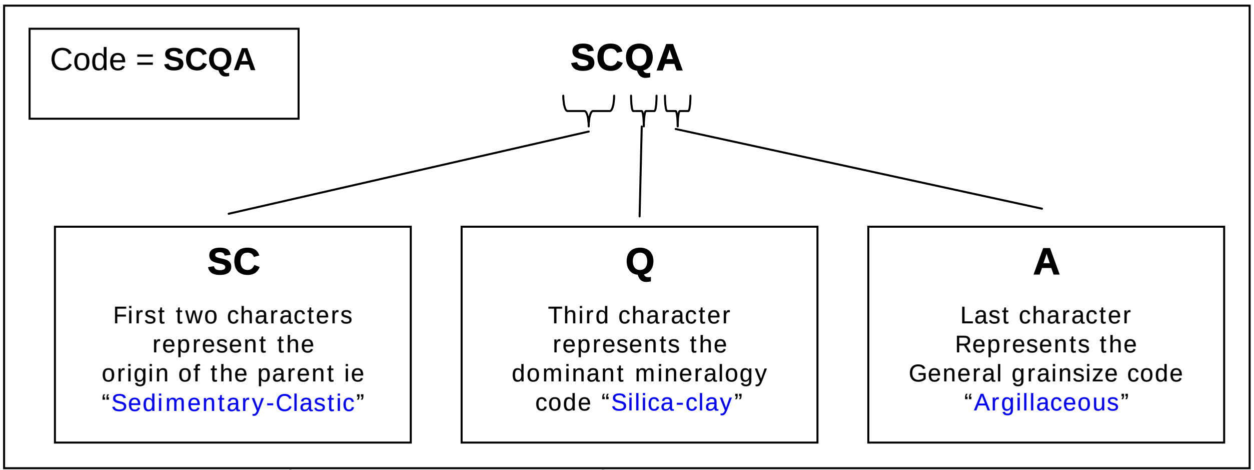

Figure 1 The structure of the 4 character PM classification codes used by the BGS

The combination of origin, mineralogy and grain size will broadly define the key parent material characteristics of any unit (and thus its overlying soil character). Further classification of parent material properties can be made by addition of additional codes from the other 52 fields held in the database. Typically the codes relating to age, hardness, engineering strength and minor mineralogy are useful in this respect, allowing the user to create flexible ‘alternative classification systems to describe their parent materials.

1.4.1.1 PM_CODE

The first (and most important) data field describes the primary **PM_CODE** of the unit. This primary PM code represents the MOST LIKELY parent-material type for that map polygon. i.e. the most likely parent material to be encountered at that location if the overlying soil was to be removed. In geological terms it is the uppermost geological layer of material. All the descriptions detailed in Fields 6- 50 relate to this primary PM code and its associated description of the geological unit present at surface, known as the LEX_ROCK code (see below).

1.4.1.2 A_PM_CODE

Near-surface geology can be locally complex, an ‘**A**lternative’ parent material code (A_PM_CODE) is provided for each map polygon to enable users to create variant models of soil types and to incorporate a degree of control over ‘thin’ units near the land surface. The A_PM_CODE can be used when the primary parent material is likely to be a thin ‘veneer’ of material (typically less than 1m thick) overlying a notably different rock type. For example, a thin layer of Peat (PM_code: UOOP) overlying a Glacial Till deposit will have the A_PM_CODE of the Till unit (PM_CODE: UGRX). Soils in this area could be derived from a combination of the two parent materials because they are related by their close vertical proximity.

1.4.1.3 B_PM_CODE

Similarly, the B_PM_CODE details the parent material code of any underlying **B**edrock units. This code can be used when the map unit is derived from a superficial deposit that is less than 5m thick (ie locally thin enough to be subject to influence from the characteristics of the underlying bedrock). The user can assess the thinness of the superficial deposits by referring to the ‘IS_VENEER’ field (see below).

1.4.1.4 ESB_CODE*

The ESB_Code field provides the ‘most applicable’ European Soil Bureau parent material code for the map unit. The ESB code is defined in the Georeferenced Soil database for Europe (Finke et al, 2001) and is summarised in Appendix 2. Codes with an imprecise correlation are marked with a suffix ‘x’. Multi lithic parent material (e.g. layered units) are represented by two or more codes separated by ‘_’. The ESB_Code is useful for users considering integration of this database into European soil/geology databases. See appendix 2a for its dictionary.

1.4.1.5 IS_SPRFCL

This field indicates whether the parent material for the map unit is derived from superficial deposits (T) or bedrock (F). In the UK, superficial deposits are the product of recent glacial, fluvial or aeolian activity and typically comprise unconsolidated materials.

1.4.1.6 OVR_BDROCK

This field indicates whether the map unit is a superficial unit directly overlying bedrock (T) or a series of layered superficial units near surface (F). In the UK it is common for superficial units to be layered deposits and several layers of material may exist between ground level and the bedrock at depth. Soils are typically developed from the topmost parent material, with subordinate influence from underlying geological units. This field may help users identify soil types indirectly influenced by underlying layers of superficial or bedrock units, not just the uppermost unit.

1.4.1.7 IS_VENEER

This field indicates whether the map unit is likely to be of a type that forms a thin 'veneer' (generally less than 1m thick) of material over the land surface (True) or of a type that locally thickens to a substantial body of material (False). This field may help users identify soil types over a parent material that may be "thin", and therefore subject to influence from the properties of the underlying 'associated' parent material; or subject to 'ploughing through' during tillage. This field is a synthesis of many field observations, and general theory of sedimentology. Typically deposits such as Peat, and loess will form a veneer, or blanket-like deposit, over the land surface, whereas alluvial or glacially derived deposits may form deep, irregular shaped channels, hollows or hills.

1.4.1.8 PMMID

This field is a unique integer to identify individual polygons.

1.4.2 Parent material database: Lithological descriptions

Map unit lithology is described in nine data fields by a series of hierarchical dictionaries. These dictionaries are described as follows:

1.4.2.1 SUBSTRATE*

This field defines whether the parent material is derived from Bedrock or Superficial deposits. There is an additional classification of 'Surficial' deposits denoting superficial units that have a thin, blanket-like morphology (veneer). This category of unit is important as soils form on the uppermost layers of geology, and so any thin laterally impersistent unit can have a significant effect on soil-type. The 'accumulated' materials layer should also be used in conjunction with parent materials of this type. Soils developed from bedrock units are classed as lithoskeletal soils. See appendix 2b for dictionary.

1.4.2.2 ORIGIN_PM*

This is the simplest descriptive term for each parent material type, and comprises Igneous, Metamorphic and Sedimentary classifications. i.e. the PM has a sedimentary origin. See appendix 2c for dictionary.

1.4.2.3 ROOT_PM*

This is the next simplest descriptive term for each parent material type, and comprises subdivisions of the Igneous, Metamorphic and Sedimentary classifications (e.g. Sedimentary Clastic, Sedimentary_carbonate). See appendix 2d for dictionary.

1.4.2.4 SUBROOT_LITHOLOGY

This is the next simplest level of lithological attribution for each parent material type and comprises a semi textural subclassification of the PM type. (e.g. Sedimentary_Carbonate_Limestone_argillic) This field is created by combining ROOT_PM with DOM_MNRL and GEN_GRAIN fields.

1.4.2.5 GENESIS*

This field provides a description of how the parent material was formed (e.g. Igneous intrusion). See appendix 2e for dictionary.

1.4.2.6 GEN_PMLITH

This is a simplified geological description of the parent material and is derived from the original DiGMapGB-50 database. In general the aim is to provide the user with as simplified a lithological description as possible.

1.4.2.7 LEX_ROCK

This field is the standard DiGMapGB-50 code that describes the geological units found in Great Britain. It provides the starting point for the parent material characterisation. It comprises a stratigraphic 'code' (LEX) and 'Lithology' code ROCK).

1.4.2.8 SYSTEM

This field is the standard DiGMapGB-50 stratigraphic 'SYSTEM' classification for the parent material denoting its geochronological age (e.g. Triassic, Jurassic)

1.4.2.9 STAGE

This field is the standard DiGMapGB-50 stratigraphic 'STAGE' classification for the parent material denoting its geochronological age (e.g. Toarcian, Bajocian)

Nb. The 'age' of the parent material has no direct influence on the soil type, however, it has been noted that material from certain geological eras possess soil-forming characteristics that are difficult to explicitly define. For example Triassic Mudstones weather in slightly different ways to Jurassic Mudstones. So even if there are no explicit characteristics we can extract from the parent material data, the 'age' fields can provide users with an additional factor by which to group or subdivide the parent material types.

1.4.2.10MULTILITHIC

This field indicates if the parent material comprises two or more distinct lithologies. For example a unit described as sandstone with interbedded mudstone IS a multilithic unit (Y). This indicates that the overlying soils may vary significantly within the map polygon as they are derived from more than one possible parent.

1.4.3 Parent material database: Texture descriptions

Texture is described in eight data fields by a series of dictionaries. These dictionaries are described as follows

1.4.3.1 MIN_GRAIN*

This is a qualitative classification of the smallest grain size to be expected from the parent material. The terms used are clay, silt, mud (generic for clay or silt), sand, gravel, and boulder for sedimentary and metasedimentary rocks. Fine, medium and coarse for igneous and meta igneous rocks). The value is a estimation derived from geologist's descriptions of the finest-grained component of the parent material. See appendix 2f for dictionary.

1.4.3.2 MAX_GRAIN*

This is a qualitative classification of the largest grain size to be expected from the parent material. The value is a estimation derived from geologist's descriptions of the largest-grained component of the parent material. See appendix 2f for dictionary.

1.4.3.3 DOM_GRAIN*

This is a qualitative classification of the most common (dominant) grain size to be expected from the parent material. The value is a estimation derived from geologist's descriptions of the parent material, but for heterolithic or mixed lithologies this is difficult to estimate consistently and so is classified as a default 'unknown'. See appendix 2f for dictionary.

1.4.3.4 GEN_GRAIN*

A geological description and qualitative classification of the grain sizes expected for this parent material based upon the information in the minimum, maximum and dominant grain size fields. See appendix 2g for dictionary.

1.4.3.5 SOIL_TEXT*

This field provides a general pedological classification of soil texture from measured samples of soils overlying this parent material. Soil texture classes are based a UK classification of soil texture designed by The National Soil Research Institute (Hodgson, 1997). A ternary grainsize distribution chart, depicting the classes, is given in Appendix 3. Soil samples used to create this classification are derived from the BGS GBASE, IMAU and GTECH databases, and particle size distributions are derived by laser granulometry, wet and dry sieving, and sedimentation techniques. The soil parents are classified by the dominant texture indicated by the samples when plotted on a ternary diagram. Some soil-parent material types have no or few sample measurements. These soil-parent types are provided with an estimated classification, based upon the principle of textural similarity between parents of similar origins and texture. See appendix 2h for dictionary.

1.4.3.6 SOIL_GROUP*

This field provides a general description of the observed soil texture in terms of Heavy, Medium or Light soils as broadly defined in the Defra Cross Compliance Guidance for Soil Management (Defra, 2006). See appendix 2h for dictionary.

Additionally The parent material database stores information about gravel (stone/pebble) content. The presence of gravel can have a dramatic effect on soil characteristics, particularly drainage and water-storage:

1.4.3.7 GRV_CONTNT

This field is a logical flag (Y/N) to indicate that the parent material may contain gravel (‘stones’), or is capable of weathering into a soil that will contain gravel (e.g. a bed of quartzite will decompose into a soil that contains fragments of quartzite, where as a glaciolacustrine clay will not decompose into soil containing gravel).

1.4.3.8 GRVE_ABNDNC*

This field provides an estimate of the abundance of gravel in the soil-parent material. See appendix 2i for dictionary.

1.4.4 Parent material database: Mineralogy

The parent material database provides five fields of qualitative data for mineralogy, these are:

1.4.4.1 MINERALOGY

This is a free-format list of the main minerals to be found in the parent material.

1.4.4.2 DOM_MNRL*

This field is a very simplified classification of the dominant mineralogy of the parent material, dividing the parent into broad chemical groups. For example, silica-rich, carbonate-rich, acid (igneous), basic (Igneous). See appendix 2j for dictionary.

1.4.4.3 MNR_MNRL*

These are a free-format list of minerals observed in the parent that may affect soil chemistry; these include C (Carbonate), Py (Iron sulphides), P (Phosphate), F (Iron oxides), g (Glauconite), gy (Gypsum) etc. See appendix 2k for dictionary.

1.4.4.4 CACO3_RANK*

This field classifies all forms of carbonate content in each parent material (calcite, dolomite, siderite) as a simple ranking of: none, low, medium or high (with unknown or variable for heterolithic and multilithic parent units). As a general rule, soils forming over carbonate-rich rocks tend to have a high carbonate soil-chemistry and they are buffered for alkalinity by the underlying parent. See appendix 2l for dictionary.

1.4.4.5 CACO3_FORM*

This field details the form in which any carbonate is present in the parent material ranging from nodules, shells and clasts, to disseminated cements and beds. (Limestones and chalks are classified as 'host', signifying that the whole parent comprises carbonate material). The form of the carbonate is a useful indicator as to how-likely a soil will retain some carbonate content, a parent with a low, nodular carbonate content, may weather to a soil type with no residual carbonate. See appendix 2m for dictionary.

1.4.5 Parent material database: Strength and structure

The parent material database provides five fields of qualitative data for strength and structure.

The strength of the parent material will influence how easily it weathers to form a soil and whether the soil will contain gravel or be influenced by the 'fabric' of the underlying parent material. The structure of the deposit will provide indicators of how the unit will 'decompose' into constituent components.

1.4.5.1 HARDNESS*

This field is a very simple classification of the parent material into three categories soft, hard and very hard. As a general guide, soft materials will form soils by disaggregating into clay, silt or sand grade particles, Hard soils may also form sporadic gravel (and these will become abraded and rounded with time), Very Hard parent materials will form soils with abundant gravel and these may be angular. See appendix 2n for dictionary.

1.4.5.2 STRNGTH_MN*

This field provides classification of the minimum engineering strength of a map unit. See appendix 2o for dictionary.

1.4.5.3 STRNGTH_MX*

This field provides classification of the minimum engineering strength of a map unit. See appendix 2o for dictionary.

1.4.5.4 STRCTR_FRS *

This field provides a simple description of the structure of the parent material classifying the unit by its jointing, lamination or bedding in its freshest (least weathered) state. See appendix 2p for dictionary.

1.4.5.5 STRCTR_WTH*

The field provides a simple description of the structure of the parent material, providing an indication of the distribution of fine material versus coarse material in its weathered state.

The structure of a parent material (weathered or otherwise) influences its drainage and weathering characteristics as well as the drainage and fabric of the overlying soils. See appendix 2q for dictionary.

1.4.6 Parent material database: Colour

Two classified colour values are provided; parent material can impart a colour on overlying soils.

1.4.6.1 COLOR_FRSH

This field is a free-format description of parent material colour in its freshest (least weathered) state.

1.4.6.2 COLOR_WTH

This field is a free format description of parent material colour from samples that are considered to be in its weathered state.

1.4.7 Parent material database: Variability

A classification is provided to help the user assess the variability of a parent material. The spatial variability of a parent material will affect the likely soil characteristics that are derived from it. As a general rule, soil characteristics can naturally vary for any given parent type due to a range of environmental factors, such as rainfall, or land use. If the parent material characteristics vary widely, then the resulting overlying soils, will also have a very broad range of characteristics.

1.4.7.1 VARIABILITY*

This field provides a simple classification of high, medium and low. Low indicates that the parent is spatially uniform across a wide area (uniform over 100’s metres), medium indicates variability at a local scale (uniformity at 10’s of metres) whilst high variability suggests that the unit may vary at a metre scale. For example, some Jurassic rock sequences comprise weak mudstone with sporadic interbeds of hard limestone. The beds of limestone can often be only 20cm thick and range 1m to 20m apart, so overlying soils can be dominated by a layer of limestone or a layer of mudstone, depending upon how the soil has formed and the relative position of the rock layers in the landscape. The layering occurs at a scale we can estimate to be locally highly variable. See appendix 2r for dictionary.

1.4.8 Parent material database: Code-only versions of data

The following fields are code-only versions of fields provided elsewhere in a verbose form. These fields are of use to GIS users who wish to create simple, multi-field reclassifications of the database without building overly complex text legends.

1.4.8.1 ORIGIN_PM

This field is a coded version of the ORIGIN_PM field.

1.4.8.2 ROOT_PM

This field is a coded version of the Root_Lithology field.

1.4.8.3 D_MIN_CODE

This field is a coded version of the DOM_MNRL field.

1.4.8.4 G_GRN_CODE

This field is a coded version of the GEN_GRAIN field.

1.4.8.5 STAGECODE

This field is a coded version of the STAGE_PLUS field

1.4.8.6 AGECODE

This field is a coded version of the SYSTEM Field

1.4.9 Parent material database: Alternative DiGMapGB-50 Lex-rock descriptors

The parent material database provides two alternative parent material codes for each object in the database. These codes allow users to develop alternative ‘soil’ models based on the ‘thinness’ of near surface units.

1.4.9.1 A_LEX_ROCK

Near-surface geology can be locally complex, ‘alternative’ DiGMapGB-50 LEX-ROCK codes are provided for each map polygon to enable users to create variant models of geological deposits and to incorporate a degree of control over ‘thin’ units near the land surface. The **A_LEX_ROCK** code can be used when the LEX_ROCK code is likely to be a thin ‘veneer’ of material overlying a notably different rock type. For example, a thin layer of Peat (LEX-ROCK code P_PEAT) overlying a Glacial Till deposit will have the **A_LEX_ROCK** code of the Till unit (TILMP_DMTN). The deposits are ‘associated’ by their close proximity).

1.4.9.2 B_LEX_ROCK

Similarly, the B_LEX_ROCK code details the DiGMapGB-50 Lex-Rock code of any underlying Bedrock units. Where bedrock is at surface, the LEX_ROCK code will be the same as the A_LEX_ROCK and B_LEX_ROCK codes. However, for areas where the surface unit is a superficial unit and is potentially thin, or a veneer, this code can be used, to offer an alternative parent material type; (i.e. the superficial deposits are locally thin enough to be subject to influence from the characteristics of the underlying bedrock).

1.4.10 Parent material database: Metadata

The parent material database provides six fields of metadata associated with the scale and associated base mapping of each map object; these are:

1.4.10.1SHEET

This field provides the name and number of the 1:50,000 scale geological sheet that the map object was originally surveyed on.

1.4.10.2RELEASED

This field is the year of release of the geological sheet that the map object was originally surveyed on.

1.4.10.3NOM_SCALE

This field describes the nominal x-y spatial scale of the data. Most geological map data in the soil-parent material database is captured and presented at a scale of 1:50,000.

1.4.10.4NOM_BGS_YR

This field is the year of survey of the 1:50,000 scale geological sheet that the map object was originally surveyed on.

1.4.10.5VERSION

This field is the version number of DiGMapGB-50 data used to create the map object.

1.4.10.6OS_SHEET

This field is the Ordnance Survey 100km sheet name that underlies the map object.

1.5 DATA LIMITATIONS

The soil parent material dataset is derived from numerous geological maps, geochemical datasets and archives of textual material. It is a spatial dataset designed to be used at a working scale of 1:50,000. Most geological maps were originally fitted to a particular topographic base and care must be taken in interpretation, for example when the geological data are draped over a more recent topography. All spatial searches against the data should be done with a minimum 50 m buffer. Parent material maps, being derived from qualitative geological maps are by their nature, also subject to a degree of interpretation.

1.6 DATA HISTORY

This is the first published version of the Soil Parent Material Dataset. It was first released spring 2009.

2 Contact information

For all data and licensing enquiries please contact:

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Appendix 1: A brief overview of the relationship between Soils and parent materials

Soil formation is governed by a number of environmental parameters. These parameters were first identified in what is known as Jenny's equation (Jenny, 1941), or model of soil-forming factors:

$$Soil = f(Cl,O,R,P,T)$$

Where

Cl =Climate (precipitation)

O = Organic matter (Vegetation cover, Land use)

R = Relief (elevation, position in landscape)

P = parent material

T = Time

Modern databases of national scale exist for climate, land use and relief. The parent material database compliments these by providing information detailing the physical characteristics of the soil.

soil-parent materials control three key soil characteristics:

1. Texture
2. Mineralogy (and therefore Chemistry)
3. Permeability-Porosity (drainage).

All three characteristics are implicitly defined in geological rock/deposit descriptions, but are easier to use when explicitly defined, as in the soil-parent material database.

Texture is regarded as the most important factor. For many users it is important to determine soils that are likely to be clay-prone ('heavy') from sand-prone (Light); most productive soils tend to be 'loams' i.e. soils with a mixture of clay, silt and sand sized fractions. Gravel (stone/pebble) content is also a crucial factor in soil characterisation as gravel improves soil-drainage and occludes water. The soil-parent material database provides a range of texture classifications based upon the lithology of the parent as well as information about likely gravel content (derived from observations of gravel content within the parent, and the likelihood of the parent 'forming' gravel due to its hardness).

Mineralogy of parent materials plays a crucial role in soil formation, in terms of residual mineralogy during the weathering process and resultant soil-chemistry. Many soils are defined the presence of important, if relatively minor (volumetrically) mineral constituents. For example, soils derived from carbonate-rich parent materials generally have an alkaline chemistry; some parent materials create distinctive soils rich in glauconite or natural phosphate. The soil-parent material database has a series of classifications as well as specific data for classifying likely mineral content.

Drainage of soils is affected by parent material type in two ways: Firstly, the texture of the parent material type contributes to the soil-texture and thus porosity and permeability of the soil itself. Secondly, the drainage characteristics of the parent material controls the drainage characteristics of the overlying soil by limiting or enhance through-flow or sub-soil run off. For example, consider a soil developing over a sandstone. If the sandstone is porous and permeable, it will be freely draining, and the overlying soil is likely to be sandy and free draining (even possibly prone to drying out). However, if the underlying sandstone is well cemented, it may be poorly draining, causing the overlying soil to become seasonally waterlogged, gleyed or possibly peaty. Other factors such as slope play a role here, hence the importance of combining the parent material database with other national databases for the environment.

The soil-parent material database provides a spatial framework, and attribution to allow environmental scientists classify soil characteristics in bespoke digital soil models.

Appendix 2: Dictionaries used in the national soil parent material database

2A. EISB_CODE (EUROPEAN SOIL BUREAU CODES)

The list of parent materials given below has evolved from number of approximations, using experiences from several pilot projects. The current version includes for the first time a fourth level, i.e. that of the subtype. To facilitate the correlation of national geological data to the list below, the list of parent materials is preceded by a table that gives (for each of the four levels in the classification) the criteria used for subdivision. To allow for maximum informative value within the major classes, criteria for subdivision were different between some major classes.
Dictionary extracted from P.Finke et al. 2001.

Major Class		Group		Type		Subtype	
100	Consolidated clastic sedimentary rocks	110	psephite or rudite	111	conglomerate	1111	pudding stone
				112	breccia		
		120	psammite or arenite	121	sandstone	1211	calcareous sandstone
						1212	ferruginous sandstone
						1213	clayey sandstone
						1214	quartzitic sandstone / orthoquartzite
						1215	micaceous sandstone
						1216	feldspathic sandstone
				122	arkose		
				123	greywacke	1231	feldspathic greywacke
		130	pelite, agillite lutite or	131 132	claystone/ mudstonesiltst one	1311 1312	kaolinite bentonite
		140	facies rocks bound	141 142	flysch molasse	1411 1412 1413	sandy flysch clayey and silty flysch conglomeratic flysch
200	Sedimentary rocks (chemically precipitated, evaporated, or of organogenic or biogenic origin)	210	calcareous rocks	211	limestone	2111 2112 2113 2114 2115 2116	hard limestone soft limestone marly limestone chalky limestone detritial limestone carbonaceous limestone
						2117	lacustrine or freshwater limestone
						2118	travertine / calcareous sinter
						2119	cavernous limestone
				212	dolomite	2121	cavernous dolomite
						2122	calcareous dolomite

				213	marlstone		
				214	marl	2141	chalk marl
				215	chalk	2142	gypsiferous marl
		220	evaporites	221 222 223	gypsum anhydrite halite		
		230	siliceous rocks	231	chert, hornstone, flint		
				232	diatomite / radiolarite		
300	Igneous rocks	310	acid to intermediate plutonic rocks	311 312 313 314	granite granodiorite diorite syenite	3131 3132	quartz diorite gabbro diorite
		320	basic plutonic rocks	321	gabbro		
		330	ultrabasic plutonic rocks	331 332	peridotite pyroxenite		
		340	acid to intermediate volcanic rocks	341 342	rhyolite dacite	3411 3412	obsidian quartz porphyrite
				343 344 345	andesite phonolite trachyte	3431 3441	porphyrite (interm.) tephritic phonolite
		350	basic to ultrabasic volcanic rocks	351 352 353	basalt diabase pikrite		
		360	dike rocks	361 362 363	aplite pegmatite lamprophyre		
		370	pyroclastic rocks (tephra)	371 372 373 374	tuff / tuffstone tuffite volcanic scoria volcanic breccia	3711 3712 3713 3721 3722 3723	agglomoratic tuff block tuff lapilli tuff sandy tuffite silty tuffite clayey tuffite
				375	volcanic ash		
				376	ignimbrite pumice		
400	Metamorphic rocks	410	weakly metamorphic rocks	411 412	(meta-)shale / argillite slate	4121	graphitic slate
		420	acid regional metamorphic rocks	421 422 423 424 425 426	(meta-)quartzite phyllite mica schist gneiss granulite (sensu stricto) migmatite	4211	quartzite schist
		430	basic regional metamorphic rocks	431	greenschist	4311 4312 4313	prasinite chlorite schist talc schist

				432 433	amphibolite eclogite		
		440	ultrabasic regional metamorphic rocks	441	serpentinite	4411	greenstone
		450	calcareous regional metamorphic rocks	451 452	marble calcschist, skarn		
		460	rocks formed by contact metamorphism	461 462 463	contact slate hornfels calcsilicate rocks	4611	nodular slate
		470	tectogenetic metamorphic rocks or cataclastic metamorphism	471 472 473	tectonic breccia cataclasite mylonite		
500	Unconsolidated deposits (alluvium, weathering residuum and slope deposits)	510	marine and estuarine sands	511 512	pre-Quaternary sand Quaternary sand	5111 5121 5122	Tertiary sand Holocene coastal sand with shells delta sand
		520	marine and estuarine clays and silts	521 522	pre-Quaternary clay and silt Quaternary clay and silt	5211 5212 5221 5222	Tertiary clay Tertiary silt Holocene clay Holocene silt
		530	fluvial sands and gravels	531	river terrace sand	5311	river terrace sand
				532	or gravel flood plain sand or gravel	5312 5321 5322	river terrace gravel flood plain sand flood plain gravel
		540	fluvial clays, silts and loams	541	river clay and silt	5411 5412 5413	terrace clay and silt terrace loam floodplain clay and silt
				542	river loam		
				543	overbank deposits	5431 5432	floodplain clay and silt floodplain loam
		550	lake deposits	551 552 553	lake sand and delta sand lake marl, bog lime lake silt		
		560	residual and redeposited loams from silicate rocks	561	residual loam	5611 5612	stony loam clayey loam
				562	redeposited loam	5621	running-ground
		570	residual and redeposited clays from calcareous rocks	571	residual clay	5711 5712 5713 5714	clay with flints ferruginous residual clay calcareous clay non-calcareous clay

						5715	marly clay
				572	redeposited clay	5721	stony clay
		580	slope deposits	581	slope-wash alluvium		
				582	colluvial deposits		
				583	talus scree	5831	stratified slope deposit
600	Unconsolidated glacial deposits / glacial drift	610	morainic deposits	611	glacial till	6111	boulder clay
				612	glacial debris		
		620	glaciofluvial deposits	621	outwash sand, glacial sand		
				622	outwash gravel, glacial gravel		
		630	glaciolacustrine deposits	631	varves		
700	Eolian deposits	710	loess	711	loamy loess		
				712	sandy loess		
		720	eolian sands	721	dune sand		
				722	cover sand		
800	Organic materials	810	peat (mires)	811	rainwater fed moor peat (raised bog)	8111	folic peat
						8112	fibric peat
						8113	terric peat
				812	groundwater fed bog peat		
		820	slime and ooze deposits	821	gyttja, sapropel		
		830	carbonaceaous rocks (caustobiolite)	831	lignite (brown coal)		
				832	hard coal		
				833	anthracite		
900	Anthropogenic deposits	910	redeposited natural materials	911	sand and gravel fill		
				912	loamy fill		
		920	dump deposits	921	rubble / rubbish		
				922	industrial ashes and slag		
				923	industrial sludge		
				924	industrial waste		
		930	organic materials				

2b. SUBSTRATE

PM_DIC_SUBSTRATE	
SUBSTRATE	**DEFINITION**
BEDROCK	UNIT IS CLASSED AS BEDROCK
SUPERFICIAL	UNIT IS CLASSED AS A SUPERFICIAL DEPOSIT
SURFICIAL	UNIT IS CLASSED AS A SUPERFICIAL DEPOSIT WITH A THIN SURFICIAL FORM (VENEER)

2C. ORIGIN_PM

PM_DIC_CORE_LITHOTYPE	
CODE	**DEFINITION**
IGNEOUS	Rocks of igneous origin
METAMORPHIC	Rocks that have been metamorphosed
MIXED	Rocks of mixed origin
SEDIMENTARY	Rocks of sedimentary origin

2D. ROOT_PM

PM_DIC_ROOT_LITHOLOGY		
ROOTCODE	ROOT_LITHOLOGY	DEFINITION
AX	ANTHROPOGENIC	ARTIFICIAL DEPOSITS OR DISTURBED UNITS
IE	IGN_EXTRUSIVE	EXTRUDED IGNEOUS ROCK
II	IGN_INTRUSIVE	INTRUDED IGNEOUS ROCK
IM	IGN_MINERALISATION	INJECTED MINERALISATION ASSOCIATED WITH IGNEOUS ACTIVITY
IP	IGN_VOLCANOCLASTIC	PYROCLASTIC VOLCANOCLASTIC IGNEOUS ROCK
IT	IGN_VOLCANOCLASTIC	TUFFACEOUS VOLCANOCLASTIC IGNEOUS ROCK
IX	IGN_MIXED	IGNEOUS ROCK (MIXED GENESIS)
MC	META_SED_CLASTIC	METAMORPHOSED SEDIMENTARY CLASTIC ROCKS
ME	META_IGN_EXTRUSIVE	METAMORPHOSED IGNEOUS EXTRUSIVE ROCKS
MI	META_IGN_INTRUSIVE	METAMORPHOSED IGNEOUS INTRUSIVE ROCKS
MK	META_SED_CARBONATE_CLASTIC	METAMORPHOSED SEDIMENTARY CLASTIC AND CALCAREOUS ROCKS
ML	META_SED_CARBONATE	METAMORPHOSED SEDIMENTARY CALCAREOUS ROCKS
MP	META_SED_PRECIPITATE	METAMORPHOSED SEDIMENTARY PRECIPITATE ROCKS
MT	META_TECTONIC	METAMORPHOSED ROCKS WITH A STRONG TECTONIC FABRIC
MV	META_IGN_VOLCANOCLASTIC	METAMORPHOSED VOLCANOCLASTIC (IGNEOUS) ROCKS
MV	META_SED_VOLCANOCLASTIC	METAMORPHOSED VOLCANOCLASTIC (SEDIMENTARY) ROCKS
MX	META_MIXED	METAMORPHOSED ROCKS (MIXED IG-SED ORIGIN)
SC	SED_CLASTIC	LITHIFIED SEDIMENTARY CLASTIC ROCK
SK	SED_CARBONATE_CLASTIC	LITHIFIED SEDIMENTARY CLASTIC AND CALCAREOUS ROCKS
SL	SED_CARBONATE	LITHIFIED SEDIMENTARY CALCAREOUS ROCKS
SO	SED_ORGANIC	LITHIFIED SEDIMENTARY ORGANIC ROCKS (COALS)
SP	SED_PRECIPITATE	LITHIFIED SEDIMENTARY PRECIPITATE ROCKS
SV	SED_VOLCANOCLASTIC	LITHIFIED SEDIMENTARY VOLCANOCLASTIC ROCKS
SX	SED_MIXED	LITHIFIED SEDIMENTARY ROCKS (MIXED ORIGIN)
UA	UNCONSOLIDATED_AEOLIAN	UNCONSOLIDATED SEDIMENTARY CLASTIC ROCK (AEOLIAN)
UC	UNCONSOLIDATED_FLUVIAL	UNCONSOLIDATED SEDIMENTARY CLASTIC ROCK (FLUVIAL)
UF	UNCONSOLIDATED_GLACIOFLUVIAL	UNCONSOLIDATED SEDIMENTARY CLASTIC ROCK (GLACIO-FLUVIAL)
UG	UNCONSOLIDATED_GLACIGENIC	UNCONSOLIDATED SEDIMENTARY CLASTIC ROCK (ICE-LAIN)
UL	UNCONSOLIDATED_GLACIOLACUSTRINE	UNCONSOLIDATED SEDIMENTARY CLASTIC ROCK (GLACIO-LACUSTRINE)
UM	UNCONSOLIDATED_MARINE	UNCONSOLIDATED SEDIMENTARY CLASTIC ROCK (MARINE-ESTUARINE)
UO	UNCONSOLIDATED_ORGANIC	UNCONSOLIDATED SEDIMENTARY ORGANIC ROCKS (ACCUMULATION OF ORGANICS)
UR	UNCONSOLIDATED_RESIDUAL	UNCONSOLIDATED SEDIMENTARY CLASTIC ROCK (RESIDUAL)
UX	UNCONSOLIDATED_CLASTIC	UNCONSOLIDATED SEDIMENTARY ROCKS (MIXED ORIGIN)
XX	UNKNOWN	UNKNOWN
XX	MIXED_LITHOLOGIES	MIXED

2e. GENESIS

GENESIS	DEFINITION
ARTIFICIAL	DEPOSITS LAIDDOWN OR DISTURBED BY HUMANS
EXTRUSIVE	EXTRUDED IGNEOUS ROCK
INTRUSIVE	INTRUDED IGNEOUS ROCK
MINERALISATION	MINERALISATION BY FLUID OR CONTACT METAMORPHISM
VOLCANOCLASTIC	VOLCANOCLASTIC EJECTA
MET_GENERIC	REGIONAL/CONTACT METAMORPHISM
MET_EXTRUSIVE	METAMORPHOSED EXTRUDED IGNEOUS ROCK
MET_INTRUSIVE	METAMORPHOSED INTRUDED IGNEOUS ROCK
MET_VOLCANOCLASTIC	METAMORPHOSED VOLCANOCLASTIC EJECTA
MET_SED	REGIONAL/CONTACT METAMORPHISM
MULTIPLE	MIXED METHODS OF GENESIS
AEOLIAN	WIND BLOWN
AEOLIAN(LOESSIC)	WIND BLOWN (LOESS, NOT DUNE)
ALLUVIAL	FLUVIAL MATERIAL OF CURRENT OR RECENT ALLUVIAL TRACT
ALLUVIAL(FAN)	FLUVIAL FAN MATERIAL OF CURRENT OR RECENT ALLUVIAL TRACT
ALLUVIAL(LOESSIC - REWORKED)	REWORKED WIND BLOWN (LOESS, NOT DUNE)
ALLUVIAL(TERRACE)	FLUVIAL TERRACE MATERIAL OF CURRENT OR RECENT ALLUVIAL TRACT
FLUVIAL	FLUVIAL MATERIAL OF PREVIOUS OR ANCIENT ALLUVIAL TRACT
FLUVIAL(DELTAIC)	FLUVIAL-DELTAIC MATERIAL OF PREVIOUS OR ANCIENT ALLUVIAL TRACT
FLUVIAL(LACUSTRINE)	FLUVIAL-LACUSTRINE MATERIAL OF PREVIOUS OR ANCIENT ALLUVIAL TRACT
FLUVIAL_MARINE	FLUVIAL-ESTUARINE-MARINE MATERIAL OF CURRENT OR ANCIENT ALLUVIAL TRACT
SED_GENERIC	SEDIMENTARY GENESIS UNKNOWN
GLACIGENIC	ICE LAIN
GLACIOFLUVIAL	GLACIAL OUTWASH
GLACIOLACUSTRINE	GLACIAL LACUSTRINE OR PONDED
LACUSTRINE	FLUVIAL-LACUSTRINE MATERIAL OF CURRENT OR ANCIENT ALLUVIAL TRACT
LACUSTRINE	FLUVIAL-LACUSTRINE MATERIAL OF CURRENT OR ANCIENT ALLUVIAL TRACT
LAGOONAL_MARINE	LACUSTRINE-SHORELINE MATERIAL OF CURRENT OR ANCIENT COASTLINE
LITTORAL_MARINE	BEACH OR NEAR SHORE MARINE MATERIAL OF CURRENT OR ANCIENT COASTLINE
MARINE	OFFSHORE MARINE MATERIAL OF CURRENT OR ANCIENT COASTLINE
MIRE_OR_BOG	RAISED OR LOWLAND BOG
PEDOGENIC	PEDOGENIC
PERIGLACIAL	PERIGLACIAL
PERIGLACIAL(LOESSIC-REWORKED)	PERIGLACIALLY REWORKED LOESS
PRECIPITATION	CHEMICAL PRECIPITATION
PYROCLASTIC	SEDIMENTARY REWORKED VOLCANOCLASTIC EJECTA
WEATHERING	IN SITU WEATHERING (REGOLITH/SAPROLITE)
UNKNOWN	GENESIS NOT DETERMINED

2F. MIN_GRAIN, MAX_GRAIN, DOM_GRAIN

DOMINANT_GRAINSIZE	Particle Diameter (mm)
BOULDER	600 +
COARSE **	2.0 +
GRAVEL	2.0 - 600
MEDIUM **	0.25 > 2
SAND	0.06 - 2.0
FINE **	< 0.25
SILT	0.002 - 0.06
MUD	0 - 0.06
CLAY	0 - 0.002
UNKN	UNKNOWN

** Igneous rock crystal size.

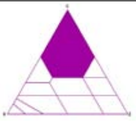
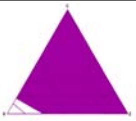
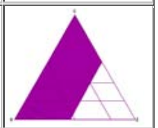
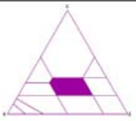
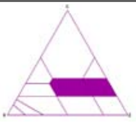
2G. GEN_GRAIN

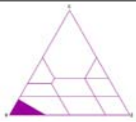
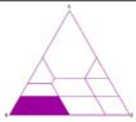
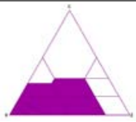
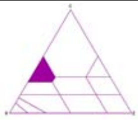
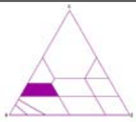
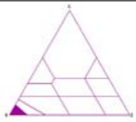
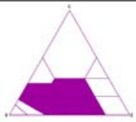
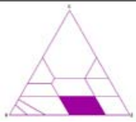
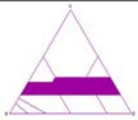
GRAINSIZE_CODE	GRAINSIZE_NAME	Particle Diameter (mm)
F	FINE	< 0.25
M	MEDIUM	0.25 > 2
C	COARSE	2.0 +
Z	SILT	0.002 - 0.06
S	SAND	0.06 - 2.0
P	PEAT	na-DUMMY CODE
V	GRAVEL	2.0 - 60
B	BOULDER	600 +
A	ARGILLACEOUS	< 0.06
N	ARENACEOUS	0.06 - 2.0
R	RUDACEOUS	2.0 +
O	ARGILLIC - ARENACEOUS	< 2.0
T	ARENACEOUS - RUDACEOUS	0.06 +
X	MIXED (ARGILLIC-RUDACEOUS)	ALL
L	COBBLE	60-600
D	CLAY	< 0.002

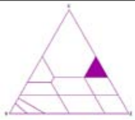
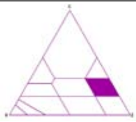
2H. SOIL_TEXT AND SOIL_GROUP

PM classification of soil sample textures and associated Defra classification of soil textures, based upon the NSRI (UK) Soil texture triangle (Hodgson, 1997). Images show the regions of texture triangle represented by the description. See Appendix 3 for enlarged ternary diagram.

The use of the prefix ‘e’ denotes that the database object has no specific texture data available, and so its soil texture has been estimated from similar parent material types. Eg a soil texture code of ‘eS_SL’ denotes that the parent material type has no observed data, but is of a type similar to other parent material that are coded as S_SL (Sand to Sandy Loam).

OBSERVED_SOIL_TEXTURE	OBSERVED_SOIL_TEXTURE DESCRIPTION	APPROXIMATE Defra CLASS	TEXTURE TRIANGLE
ALL	ALL	ALL	
C	CLAY	HEAVY SOILS	
C_L	CLAY AND LOAM SOILS (ALL TYPES EXCEPT SANDY)	HEAVY MEDIUM AND LIGHT (SILTY) SOILS	
C_MCL	CLAY, CLAYEY LOAM AND SILTY CLAY LOAM	HEAVY TO MEDIUM (SILTY) SOILS	
C_ML	CLAY, CLAYEY OR SILTY LOAM (LIMITED SAND IN THE LOAMS)	HEAVY, MEDIUM (SILTY) AND LIGHT (SILTY) SOILS	
C_S	CLAY, SAND, SANDY LOAMS, BUT GENERALLY LESS THAN 40% SILT)	HEAVY, MEDIUM (SANDY) AND LIGHT (SANDY) SOILS	
C_XCL	CLAYEY AND SANDY TO SILTY CLAY LOAMS	HEAVY TO MEDIUM SOILS	
CL	CLAY LOAM	MEDIUM SOILS	
L	LOAMY SOILS (ALL TYPES)	MEDIUM TO LIGHT (SILTY) SOILS	
MCL	CLAY LOAM TO SILTY CLAY LOAM	MEDIUM (SILTY) SOILS	
ML	CLAYEY TO SILTY LOAMS (LIMITED SAND)	MEDIUM (SILTY) TO LIGHT (SILTY) SOILS	

OBSERVED_SOIL_TEXTURE	OBSERVED_SOIL_TEXTURE DESCRIPTION	APPROXIMATE Defra CLASS	TEXTURE TRIANGLE
S	SANDY SOILS (SAND AND LOAMY SAND)	LIGHT (SANDY) SOILS	
S_L	SANDY AND LOAMY SOILS (LIMITED CLAY)	MEDIUM TO LIGHT SOILS	
S_SL	SANDY TO SANDY- LOAM SOIL	LIGHT (SANDY) SOILS	
S_SXL	SANDY TO SANDY- LOAM AND SANDY CLAY LOAM SOIL	MEDIUM (SANDY) TO LIGHT (SANDY) SOILS	
S_SXL_L	SANDY TO CLAYEY AND SILTY LOAM SOIL (LIMITED CLAY, MODERATE-HIGH SAND)	MEDIUM TO LIGHT SOILS	
S_XZL	SANDY AND SANDY-SILTY LOAMS (LITTLE CLAY)	LIGHT SOILS	
SC	SANDY CLAY	HEAVY (SANDY) SOILS	
SCL	SANDY CLAY LOAM	MEDIUM (SANDY) SOILS	
SX	SAND	LIGHT (SANDY) SOIL	
SXL	SANDY CLAY LOAM TO SANDY LOAM	MEDIUM (SANDY) TO LIGHT (SANDY) SOILS	
SXL_L	SANDY, CLAYEY AND SILTY LOAMS (MINIMUM 20%SAND)	MEDIUM TO LIGHT SOILS	
SZL	SANDY SILT LOAM	LIGHT (SILTY) SOILS	
XC	CLAYEY SOILS. SANDY CLAY, CLAY AND SILTY CLAY	HEAVY SOILS	
XCL	SANDY CLAY, CLAY AND SILTY CLAY LOAM	MEDIUM SOILS	
XZL	SANDY TO SILTY LOAM	LIGHT SOILS	

OBSERVED_SOIL_TEXTURE	OBSERVED_SOIL_TEXTURE DESCRIPTION	APPROXIMATE Defra CLASS	TEXTURE TRIANGLE
ZC	SILTY CLAY	HEAVY (SILTY) SOILS	
ZCL	SILTY CLAY LOAM	MEDIUM SOILS	
ZL	SILT LOAM	LIGHT (SILTY) SOILS	
ZXL	SILTY CLAY TO SILTY LOAM (LESS THAN 20% SAND)	MEDIUM TO LIGHT (SILTY) SOILS	

2I. GRV_ABNDNC

PM_DIC_STONE/CLAST_ABUNDANCE	
GRAVEL_ABUNDANCE	DEFINITION
ABUNDANT	>35% CLASTIC CONTENT IN HOST
NA	NO CLASTIC CONTENT IN HOST
FEW	
COMMON	5%>35% CLASTIC CONTENT IN HOST
UNKN	UNKNOWN
VARIABLE	CLASTIC CONTENT VARIES IN HOST

2J. DOM_MNRL

BULK mineralogy CODE	DOM mineralogy class	DOMINANT MINERALOGY DEFINITION
?	UNKNOWN	BULK MINERALOGY IS UNKNOWN
A	ACID	IGNEOUS ROCKS WITH HIGH SILICA (63%+)
B	BASIC	IGNEOUS ROCKS WITH LOW SILICA (45-52%)
C	CLAYS	DOMINANT CLAY MINERALS (90%+)
D	DOLOMITE	DOMINANT CaMgCO3 with SOME CaCO3
E	EVAPORITE	PREDOMINANTLY SULPHATES AND HALIDES
F	IRONSTONE	DOMINANT Fe/Ca/MgCO3 with SOME CaCO3
G	IRONSTONE_SILICA-CLAY	DOMINANT Fe/Ca/MgCO3 (60%+) SUBORDINATE SILICA-CLAY (40%-)
H	SILICA-CLAY_IRONSTONE	DOMINANT SILICA-CLAY (60%+) SUBORDINATE Fe/Ca/MgCO3 (40%-)
I	INTERMEDIATE	IGNEOUS ROCKS WITH MOD SILICA (52-63%)
K	CHALK	DOMINANT CaCO3 (90%)
L	LIMESTONE	DOMINANT CaCO3 with SOME CaMgCO3
M	CLAY_LIMESTONE	DOMINANT CLAYS (60%+) SUBORDINATE CaCO3 (40%-)
N	LIMESTONE_CLAY	DOMINANT CaCO3 (60%+) SUBORDINATE CLAY (40%-)
O	ORGANIC	DOMINANT ORGANIC MATERIAL (90%+)
P	DOLOMITE_SILICA-CLAY	DOMINANT MgCaCO3 (60%+) SUBORDINATE SILICA-CLAY (40%-)
Q	SILICA_CLAY	DOMINANT SILICA (60%+) SUBORDINATE CLAY (40%-)
R	CLAY_SILICA	DOMINANT CLAYS (60%+) SUBORDINATE SILICA (40%-)
S	SILICA	DOMINANT SILICA (90%+)
T	LIMESTONE_SILICA-CLAY	DOMINANT CaCO3 (60%+) SUBORDINATE SILICA-CLAY (40%-)
U	ULTRABASIC	IGNEOUS ROCKS WITH VERY LOW SILICA (45%-)
V	SILICA-CLAY_LIMESTONE	DOMINANT SILICA-CLAY (60%+) SUBORDINATE CaCO3 (40%-)
W	SILICA-CLAY_DOLOMITE	DOMINANT SILICA-CLAY (60%+) SUBORDINATE MgCaCO3 (40%-)
X	MIXED	BULK MINERALOGY IS VARIABLE DUE TO LITHOLOGY
Z	PHOSPHATE_SILICA-CLAY	DOMINANT PO4 (60%+) SUBORDINATE SILICA-CLAY (40%-)

2K. MNR_MNRL

CODE	DEFINITION
c	CALCITE CEMENT (CaCO3)
f	FERROAN CEMENTS (Fe/Ca/MgCO3)
p	PHOSHATIC CEMENT/MINERAL
gy	GYPSIFEROUS CEMENT/MINERAL
h	HALITE CEMENT/MINERAL
o	ORGANIC MATERIAL
g	GLAUCONITIC CEMENT/MINERAL
d	DOLOMITE CEMENT (CaMgCO3)

2L. CACO3_RANK

PM_DIC_CACO3_CONTENT	
CACO3_RANK	DEFINITION
HIGH	50%+ $CaCO_3$
LOW	<10% $CaCO_3$
MOD	10>50% $CaCO_3$
NA	NOT APPLICABLE
NONE	NONE
UNKN	UNKNOWN
VARIABLE	VARIABLE (HETEROGENOUS DISTRIBUTION OF $CaCO_3$)

2M. CAC03_FORM

PM_DIC_CACO3_FORM	
CACO3_FORM	**DEFINITION**
BED	Unit contains beds of calcareous material (limestone/ lime-sandstone or similar)
CEMENT	Carbonate present as an intergranular cement
CEMENT, CLASTS	Carbonate present as an intergranular cement and as detrital clasts
CLASTS	Carbonate present as detrital clasts of calcareous material
DETRITAL	Carbonate present as detrital material derived from underlying unit (altern8_pmm ranking)
HOST	Whole Unit is calcareous e.g. chalk
MATRIX	Unit comprises an argillic- matrix comprised of calcareous material
MINERAL	Carbonate present as crystals or veins of calcareous material within the host
NA	Not Applicable
NODULE	Carbonate present as nodules (calcrete) within the host
UNKN	Unknown

2N. HARDNESS

PM_DIC_HARDNESS	
CODE	DEFINITION
VHARD	BREAKS ONLY WITH HAMMER, FRACTURES ACROSS GRAINS (INDURATED)
VARIABLE	EXHIBITS VARYING HARDNESS DUE TO LITHOLOGICAL VARIABILITY
VSOFT	GRAINS FALL APART WITH SLIGHT PRESSURE BY HAND
SOFT	MODERATELY EASY TO BREAK OFF CHIPS BY HAND/PENKNIFE
HARD	NEED HAMMER TO BREAK ROCK, FRACTURES AROUND GRAINS
UNKN	UNKNOWN

2O. STRNGTH_MN AND STRNGTH_MX

	Term	Uniaxial Compressive Strength (MPa)	SPT N-values (blows/300mm penetration)	Strength Code
Rocks	Extremely Strong	>200	-	ESTR
	Very Strong	100 - 200	-	VSTR
	Strong	50 - 100	-	STRO
	Moderately Strong	12.5 - 50	-	MSTR
	Moderately Weak	5.0 - 12.5	-	MWEA
	Weak	1.25 - 5.0	-	WEAK
	Very weak rock / hard soil	0.60 - 1.25	>60	VWEA
Fine Soils	Very Stiff	0.30 - 0.60	30-60	VSTI
	Stiff	0.15 - 0.30	15 to 30	STIF
	Firm	0.08 - 0.15	8 to 15	FIRM
	Soft	0.04 - 0.08	4 to 8	SOFT
	Very soft	<0.04	<4	VSOF

2P. STRCTR_FRS

PM_DIC_STRUCTURE	
STRUCTURE	DEFINITION
BEDDED	Host exhibits bedding features (1cm +)
BEDDED_MASSIVE	Host exhibits a weak or discontinuous bedding or is locally structureless
CLEAVED_FOLIATED_BEDDED	host exhibits foliation and bedding features with cleavage
CLEAVED_LAMINATED_BEDDED	Host exhibits lamination and bedding features with cleavage
COMPLEX	Reserved for host where chemical/mineral growth/deformation within host forms complex physical structure
FIBROUS_BEDDED	Host (normally peat) forms beds of fibrous material
FOLIATED_BEDDED	Host exhibits foliation and bedding features (typically reflecting a layered, metamorphosed sequence)
FRACTURED	Dominant rock structure comprises fracture surfaces (subordinate structural features may also occur)
JOINTED_BEDDED	Host exhibits bedding features (1cm +) and jointing
JOINTED_BEDDED_MASSIVE	Host exhibits jointing of a weak/discontinuous bedding or locally massive unit
JOINTED_CLEAVED_FOLIATED	Host exhibits jointing and/or cleavage in a dominantly foliated unit
JOINTED_CLEAVED_FOLIATED_BEDDED	Host exhibits jointing and/or cleavage in a foliated and bedded unit
JOINTED_CLEAVED_FOLIATED_MASSIVE	Host exhibits jointing and/or cleavage of a weakly/discontinuously foliated or locally massive unit
JOINTED_CLEAVED_LAMINATED_BEDDED	Host exhibits jointing and/or cleavage in a laminated and bedded unit
JOINTED_FOLIATED	Host exhibits jointing of a dominantly foliated unit
JOINTED_FOLIATED_BEDDED	Host exhibits lamination and bedding features with jointing
JOINTED_FOLIATED_MASSIVE	Host exhibits jointing of a weakly/discontinuously foliated or locally massive unit
JOINTED_LAMINATED	Host exhibits dominant lamination features with jointing
JOINTED_LAMINATED_BEDDED	Host exhibits lamination and bedding features with jointing
JOINTED_MASSIVE	Host exhibits jointing of an otherwise massive unit
LAMINATED	Host exhibits lamination features (
LAMINATED_BEDDED	Host exhibits lamination and bedding features (typically reflecting a layered argillic/arenaceous sequence)
LAMINATED_MASSIVE	Host exhibits a weak or discontinuous lamination or is locally massive
UNKN	structure in unknow or lex rock unit too diverse

2Q. STRCTR_WTH

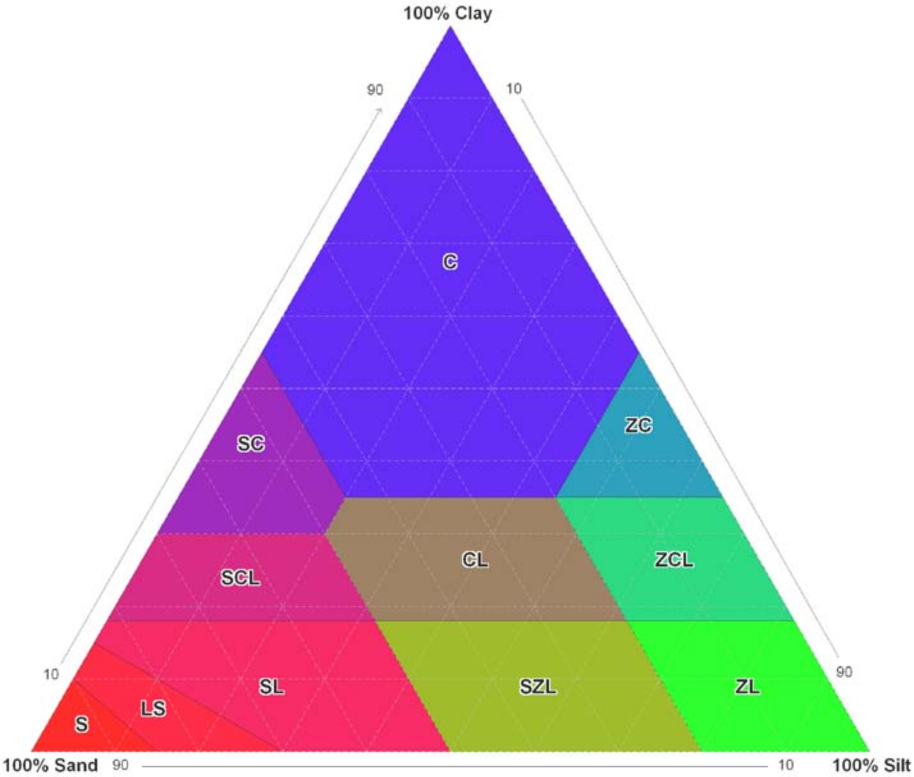
PM_DIC_WEATHERED_STRUCTURE	
CODE	DEFINITION
GRAVEL_(CLAST_SUPPORTED)	DISAGGREGATED GRAVEL 2.0 - 600MM IN DIAMETER, LITTLE INTERGRANULAR MATRIX
GRAVEL_(CLAY_MATRIX_SUPPORTED)	ROCK FRAGMENTS/STONES WITH SUBORDINATE ARGILLIC-MATRIX
GRAVEL_(SAND_MATRIX_SUPPORTED)	ROCK FRAGMENTS/STONES WITH SUBEQUAL ARENACOUS MATRIX
GRAVEL_(SAND_MUD_MATRIX_SUPPORTED)	ROCK FRAGMENTS/STONES WITH SUBORDINATE ARGILLIC TO ARENACEOUS MATRIX
MATRIX_CLASTIC_HETEROGENEOUS	HETEROGENOUS UNIT WITH VARYING ZONES OF MATRIC CLASTIC DOMINANCE
MUD_MATRIX(PLASTIC)	SOFT/PLASTIC ARGILLIC MATRIX (NO ROCK/STONE CONTENT)
MUD_MATRIX_WITH_GRAVEL	DOMINANT ARGILLIC-ARENACEOUS MATRIX WITH SUBORDINATE ROCK FRAGMENTS/STONES
ORGANIC_MATRIX	DOMINANT ORGANIC MATRIX (NO ROCK/STONE CONTENT)
SAND_MATRIX	ARENACEOUS MATRIX (NO ARGILLIC COMPONENT AND NO ROCK FRAGMENT OR STONE CONTENT)
SAND_MATRIX_WITH_GRAVEL	ARENACEOUS MATRIX (NO ARGILLIC COMPONENT) WITH A SUBORDINATE ROCK FRAGMENT OR STONE CONTENT)
SAND_MUD_MATRIX	DOMINANT ARGILLIC-ARENACEOUS MATRIX (NO ROCK FRAGMENTS)
SAND_MUD_MATRIX_WITH_GRAVEL	DOMINANT ARGILLIC-ARENACEOUS MATRIX (SOME ROCK/STONE CONTENT)
SAND_MUD_MATRIX_WITH_REMNANT_GRAVEL	DOMINANT ARGILLIC-ARENACEOUS MATRIX WITH VERY SUBORDINATE AND DEGRADED ROCK FRAGMENTS/STONES
UNKN	UNKNOWN

2R. VARIABILITY

PM_DIC_UNIT_VARIABILITY	
UNIT_VARIABILITY	DEFINITION
HIGH	UNIT IS HETEROLITHIC AT MAP OBJECT SCALE (OR IS A COLLECTION OF DIFFERENT ROCK UNITS)
LOW	UNIT IS HOMOGENOUS AT MAP OBJECT SCALE
MOD	UNIT HAS HETEROGENEITY AT MAP OBJECT SCALE (OR IS A COLLECTION OF SIMILAR ROCK UNITS)
UNKN	UNKNOWN

Appendix 3: Classification of soil texture

NATIONAL SOIL RESEARCH INSTITUTE (UK) Soil texture triangle (Hodgson, 1997).



Texture class	Texture name
C	CLAY
SC	SANDY CLAY
ZC	SILTY CLAY
SCL	SANDY CLAY LOAM
CL	CLAY LOAM
ZCL	SILTY CLAY LOAM
S	SAND
LS	LOAM SAND
SL	SANDY LOAM
SZL	SANDY SILT LOAM
ZL	SILTY LOAM

Some parent material types utilise combined codes to define their texture. So a parent material expected to create soils ranging from Sandy Clay Loam to Sandy Loam is denoted by a derivative code of SXL (covering SCL and SL).

Glossary

parent material The geological deposits which immediately underlie the layers commonly known as 'topsoil' and 'subsoil'.

Lex_rock: A code used within the BGS DiGMapGB-50 map database that denotes the stratigraphy (lex) and lithology (rock) of rocks and deposits across the UK.

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: http://geolib.bgs.ac.uk.

Ault, L, & Mackenzie, A. C., 2006. From LIMS to geochemistry database : GBASE samples analytical data: British Geological Survey report IR/06/075.

British Geological Survey. 2006. National Superficial Thickness Model of Great Britain 1:50 000 scale (DiGMapGB-50) data [CD-Rom]. Version 4.16. Keyworth, Nottingham: British Geological Survey.

British Geological Survey. 2007. Digital Geological Map of Great Britain 1:50 000 scale (DiGMapGB-50) data [CD-Rom]. Version 4.16. Keyworth, Nottingham: British Geological Survey.

FINKE, P., ET AL. 2001. GEOREFERENCED SOIL DATABASE FOR EUROPE: MANUAL OF PROCEDURES. VERSION 1.1

Gillespie, M & Styles, M., 1999. BGS rock classification scheme, Volume 1: Classification of igneous rocks [2nd ed]: British Geological Survey, Research Report RR/99/006 / M.R. Gillespie & M.T. Styles. - 2nd ed.

Hallsworth, C, & Knox, R.W.O'B., 1999. BGS rock classification scheme. Volume 3, classification of sediments and sedimentary rocks: British Geological Survey, Research Report RR/99/003.

Jenny, H. 1941. Factors of Soil Formation, a System of Quantitative Pedology. McGraw-Hill, New York, 281pp

McMillan, A, & Powell, J. H., 1999. BGS rock classification scheme. Volume 4, classification of artificial (man-made) ground and natural superficial deposits applications to geological maps and databases in the UK: British Geological Survey, Research Report RR/99/004.

Robertson, S., 1999. BGS rock classification scheme. Volume 2, classification of metamorphic rocks: British Geological Survey, Research Report RR/99/002.

Hodgson, J.M. 1997. Soil Survey field Handbook. Soil Survey Technical Monograph No. 5, Silsoe

Defra. 2006. Cross Compliance Guidance for Soil Management . Department for Farming and Rural Affairs. PB11160. http://www.rpa.gov.uk/rpa/index.nsf/vContentByTaxonomy/B0282EE0A3104193802570D1005AC787?OpenDocument