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Creation of the Till Thematic Layer

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Foreword

This report describes the content and application of the National Glacial Tills dataset produced by the British Geological Survey (BGS). The National Glacial Tills dataset provided the domains of the Glacial Tills at surface represented as member or formations as appropriate. For each domain the main and minor lithologies are also included.

Contents

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1 Introduction

The national glacial tills dataset is one of a series of GIS thematic layers designed to help environmental scientists, planners, consultants and contractors assess the characteristics of the 'near surface'. In particular, it focuses upon the material from which top soils and subsoils (A and B horizons) develop (i.e. from the base of the pedological soil down to approximately 3 m). According to DiGMapGB-50, Glacial Till covers approximately 30% of the land surface and makes up a majority of the Quaternary cover. It is known to be highly variable in its formation and in its particle size and lithological content.

1.1 WHAT IS A TILL?

Glacial Till is deposited directly by and may be deformed beneath or within a glacier and includes *lodgement, deformation, flow and melt-out tills* (McMillan et al., 1999). Their particle size is typically controlled by the type of till, the processes that formed it, the underlying deposits or bedrock, and subsequent weathering.

1.2 WHY PRODUCE THE DATASET?

The lithological content of tills varies in different areas. The generic description of till in the BGS lexicon is "Variable lithology, usually sandy, silty clay (possibly chalky in southeast England) with pebbles (gravel), but can contain gravel-rich, or laminated sand layers; varied colour and consistency". It is known that many tills do have a fine grained (silt or clay) matrix; however, others have a sand matrix. Some contain very coarse particles (cobble and boulders including rafts) whereas others do not contain any. Where the very coarse particles are a significant component, their rock type and characteristics are important; in some cases they are weak or weather to sand or smaller particles, in other cases they are strong, impeding site investigation and excavation. Also, as indicated by the generic description, deposits with contrasting physical characteristics also occur, including sand and gravel (glacifluvial) layers, and laminated clay and silt beds (glaciolacustrine).

The variability may be limited within one 1:50 000 map sheet, however, when compiled as a national map, as in DiGMapGB-50, the generic units must be used to describe the tills. This reduces the usefulness of the compilation as the true nature of the till may not be represented in its description within DiGMapGB-50. This generalisation then affects the downstream products such as GeoSure.

Tills are represented in DiGMapGB-50 (August 2009) in a number of ways, often depending on the date of the survey and the detail to which the Quaternary was mapped. Much of the till is represented by generic terms as:

a. Till undifferentiated (TILL)

or

b. Till deposited during the Pleistocene (TILMP)

or

c. Till deposited during the Devensian (TILLD)

In some areas specific till formations or members have been mapped and named, for instance the Lowestoft Formation, which covers much of East Anglia, is described in the BGS Lexicon as:

"An extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. The carbonate content of the till matrix is about 30%."

2 What the dataset shows

The till dataset comprises a spatial component (the GIS layer) and a database component. The database component comprises 17 fields of additional classification which are used to each till body. These fields are described below.

2.1 FIELD DESCRIPTIONS

Table 1 Field descriptions used to sub-classify the tills of Great Britain

Field name	Field description
Tillcode	Lex code of the Member or Formation (most detailed) or mixture of tills
Location	The extent of the till unit
Notes	Till content provided by the geologist
Facies	Facies classification mostly in accordance with Benn and Evans (1998) as supplied by the geologist
Litho_Code	Codes produced for this project by Jon Merritt
Colour	Colour or colours
Type	Description of the till unit
Clasts	Rock types of the gravel and very coarse clasts.
Lith_class	Classification of the description of the till
Cal_Carb	Estimated calcium carbonate content in %.
Cal_Class	The calcium carbonate content class.
Area	Geographical area of extent (as described by Merritt et al (2009)
Till_Unit	Name of the unit (Member or Formation)
Member	Member
Formation	Formation name
Subgroup	Lithostratigraphical Sub-Group
Group	Lithostratigraphical Group

2.2 TILL UNIT DESCRIPTIONS

Table 2 describes the till units shown in the dataset. It has been adapted from McMillan et al (2009).

Table 2 Description of the Till units of Great Britain

Code	*Till Unit*	*Member*	*Formation*	*Subgroup*	*Group*
BWTI	**Burrier Wick Member**	Burrier Wick Member	Shetland Formation of Sutherland	Shetland Glacigenic Subgroup	Caledonia Glacigenic Group
LEWTI	**Lewis Till Formation**		Lewis Till Formation	Western Isles Glacigenic Subgroup	
PBTI	**Port Beag Till Formation**		Port Beag Till Formation		
ASTI	**Assynt Till Formation**		Assynt Till Formation	Northwest Highland Glacigenic Subgroup	
THTI	**Thormaid Till Member**	Thormaid Till Member	Reay Burn Till Formation		

REDR	**Reisgill Burn Till Formation**		Reisgill Burn Till Formation	Banffshire Coast and Caithness Glacigenic Subgroup
ESTI	**Essie Till Formation**		Essie Till Formation	
FINT	**Finglack Till Formation**		Finglack Till Formation	Inverness Glacigenic Subgroup
BATI	**Banchory Till Formation**		Banchory Till Formation	East Grampian Glacigenic
HATT	**Hatton Till Formation**		Hatton Till Formation	Logie - Buchan Glacigenic Subgroup
ARDT	**Ardverikie Till Formation**		Ardverikie Till Formation	Central Grampian Glacigenic Subgroup
BUTI	**Beinn an Uain Till Formation**		Beinn an Uain Till Formation	
GATI	**Gartocharn Till Formation**		**Gartocharn Till Formation**	
MFT	**Mill of Forest Till Formation**		**Mill of Forest Till Formation**	Mearns Glacigenic Subgroup
WITI	**Wilderness Till Formation**		**Wilderness Till Formation**	Midland Valley Glacigenic Subgroup
NMTI	**Norham Till Formation**		**Norham Till Formation**	Borders Glacigenic Subgroup
LHTI	**Langholm Till Formation**		**Langholm Till Formation**	Southern Uplands Glacigenic Subgroup
NATI	**New Abbey Till Member**	**New Abbey Till Member**		
JURBY	**Jurby Formation**		**Jurby Formation**	Irish Sea Coast Glacigenic Subgroup
GRET	**Gretna Till Formation**		**Gretna Till Formation**	
GOGL	**Gosforth Glacigenic Formation**		**Gosforth Glacigenic Formation**	
KMGL	**Kirkham Till Member**	**Kirkham Till Member**	**Stockport Glacigenic Formation**	
STPTG	**Stockport Glacigenic Formation**			
BDTI	**Brewood Till Formation**		**Brewood Till Formation**	
LLEYN	**Lleyn Till Member**	**Lleyn Till Member**	St Asaph Glacigenic Formation	
EDTI	**Edenside Till Member**	**Edenside Till Member**	Greystoke Till Formation	Central Cumbria Glacigenic Subgroup
GYTI	**Greystoke Till Formation**			
TKTI	**Threlkeld Till Formation**		**Threlkeld Till Formation**	
BLGL	**Blengdale Glacigenic Formation**		**Blengdale Glacigenic Formation**	
KLTI	**Kendal Till Member**	**Kendal Till Member**		
KWTI	**Kale Water Till Formation**		**Kale Water Till Formation**	Cheviot Glacigenic Subgroup
ANTI	**Acklinton Till Formation**		**Aklinton Till Formation**	North Pennine Glacigenic Subgroup
WETI	**Wear Till Formation**		**Wear Till Formation**	
BUTTI	**Butterby Till Member**	**Butterby Till Member**		
VYORK	**Vale of York Formation**		**Vale of York Formation**	
VYORKS	**Vale of York Formation (Sand Facies)**			
SFTI	**Stainmore Forest Till Formation**		**Stainmore Forest Till Formation**	
YDTI	**Yorkshire Dales Till Formation**		**Yorkshire Dales Till Formation**	
HGTI_YDTI	**Harrogate Till Formation and Yorkshire Dales Till Formation**			
HNTI	**Horden Till Formation**		**Horden Till Formation**	North Sea Coast Glacigenic Subgroup
HOLD	**Holderness Formation**		**Holderness Formation**	
HOTI	**Holkham Till Member**	**Holkham Till Member**		
SKTI	**Skipsea Till Member**	**Skipsea Till Member**		
WSTI	**Withernsea Till Member**	**Withernsea Till Member**		

SHREW	**Shrewsbury Glacigenic Formation**		**Shrewsbury Glacigenic Formation**		
MNTI	**Merion Till Member**	**Merion Till Member**	Plynlimon Glacigenic Formation		
RBNTI	**Ruabon Till Member**	**Ruabon Till Member**			
ERYG	**Eryri Glacigenic Formation**		**Eryri Glacigenic Formation**	Wales Glacigenic Subgroup	
ELTI	**Elenid Till Member**	**Elenid Till Member**	Plynlimon Glacigenic Formation		
HDTI	**Hereford Till Member**	**Hereford Till Member**	Brecknockshire Glacigenic Formation		
LDTI	**Langland Till Member**	**Langland Till Member**			
GLGL	**Glamorgan Glacigenic Formation**		**Glamorgan Glacigenic Formation**		
SNAEF	**Snaefell Formation**		**Snaefell Formation**	Manx Glacigenic Subgroup	
LITI	**Llanddewi Glacigenic Formation**		**Llanddewi Glacigenic Formation**		Albion Glacigenic Group
POTI	**Penfro Till Formation**		**Penfro Till Formation**		
BKTI	**Bakewell Till Formation**		**Bakewell Till Formation**		
PKTI	**Pickering Till Formation**		**Pickering Till Formation**		
HGTI	**Harrogate Till Formation**		**Harrogate Till Formation**		
HPTI	**Happisburgh Till Member**	**Happisburgh Till Member**	Happisburgh Glacigenic Formation		
LOFT	**Lowestoft Formation**		**Lowestoft Formation**		
WATI	**Walcott Till Member**	**Walcott Till Member**			
BGTI	**Bacton Green Till Member**	**Bacton Green Till Member**	Sheringham Cliffs Formation		
RUTI	**Runton Till Member**	**Runton Till Member**			
WTTI	**Weybourne Town Till Member**	**Weybourne Town Till Member**			
WOLS	**Wolston Glacigenic Formation**		**Wolston Glacigenic Formation**		
WOLSS	**Wolston Glacigenic Formation (Sand Facies)**				
THT	**Thrussington Till Member**	**Thrussington Till Member**			
MTON	**Moreton Member**	**Moreton Member**			
ODT	**Oadby till Member**	**Oadby till Member**			
ODTL	**Oadby till Member (lias rich)**				
ODTT	**Oadby till Member (Triassic Facies)**				
BOZE	**Bozeat Till**				
NURS	**Nurseries Glacigenic Formation**		**Nurseries Glacigenic Formation**		
CODT	**Coddington Till Member**	**Coddington Till Member**	Risbury Glacigenic Formation		
BDTITHT	**Brewood Till Formation and Thrussington Till Formation**				

3 How the dataset was created

The Tills database is a compilation of the inputs by regional geologists and the classification of the proposed Devensian Till stratigraphy by the BGS (McMillan and Merritt, in preparation). Domains for each till unit were drawn from line work created by geologists, either from paper copies or .shp files (lines) provided in ArcGIS. Successions of two or more till units occur in some domains. This occurs where geological mapping has not differentiated between different

till units. For example, in parts of the East Midlands the GDI shows the till as TILMP, whereas the more recently mapped areas differentiate between the Oadby Till (ODT, ODTL and ODTT) and Thrussington Till (THT) members. This GIS shows the undifferentiated TILMP areas as ODT_THT, that is Oadby Till Member over Thrussington Till Member. It shows Oadby Till Member (ODT), Oadby Till Member (Triassic facies) (ODTT) and Thrussington Till Member (THT) as separated units in areas of recent mapping.

The names of the tills are established, and provided by the geologist or taken from Bowen (1999). However, in some cases they have currently not been adopted by The Stratigraphy Commission of the Geological Society of London.

3.1 SOURCES OF DATA

This section describes the various source or data and information that have been used in the compilation of the till thematic layer.

3.1.1 Domains

Although not part of the identification of a till unit, the Quaternary domains were used as they identified different provinces and domains. Each has its particular geological characteristics. There are two provinces – Non glaciated, laying to the south of the Anglian glaciation, and glaciated to the north. The glaciated province is sub divided into Upland and lowland. The provinces are further divided into domains based on the geomorphological features, assemblages of superficial deposits and on genetic linkages to surface processes that formed them as given below. These are presented in Figure 1.

Glaciated province: Uplands

- Ice-scoured montane domain **IM**
- Montane and valley domain **MV**
- Plateau and valley domain **PV**

Glaciated province: Lowlands

- Till dominant domain **TD**
- Dissected till domain **DT**
- Minimal Till domain **MT**
- Lowland Basin domain **LB**

Non-glaciated province

- Upland periglaciated domain **UP**
- Lowland periglaciated domain **LP**
- Coastal, estuarine and alluvial domain **CE**
- Fluvial domain **FP**

The domains give an immediate indication of the likely till cover in an area.

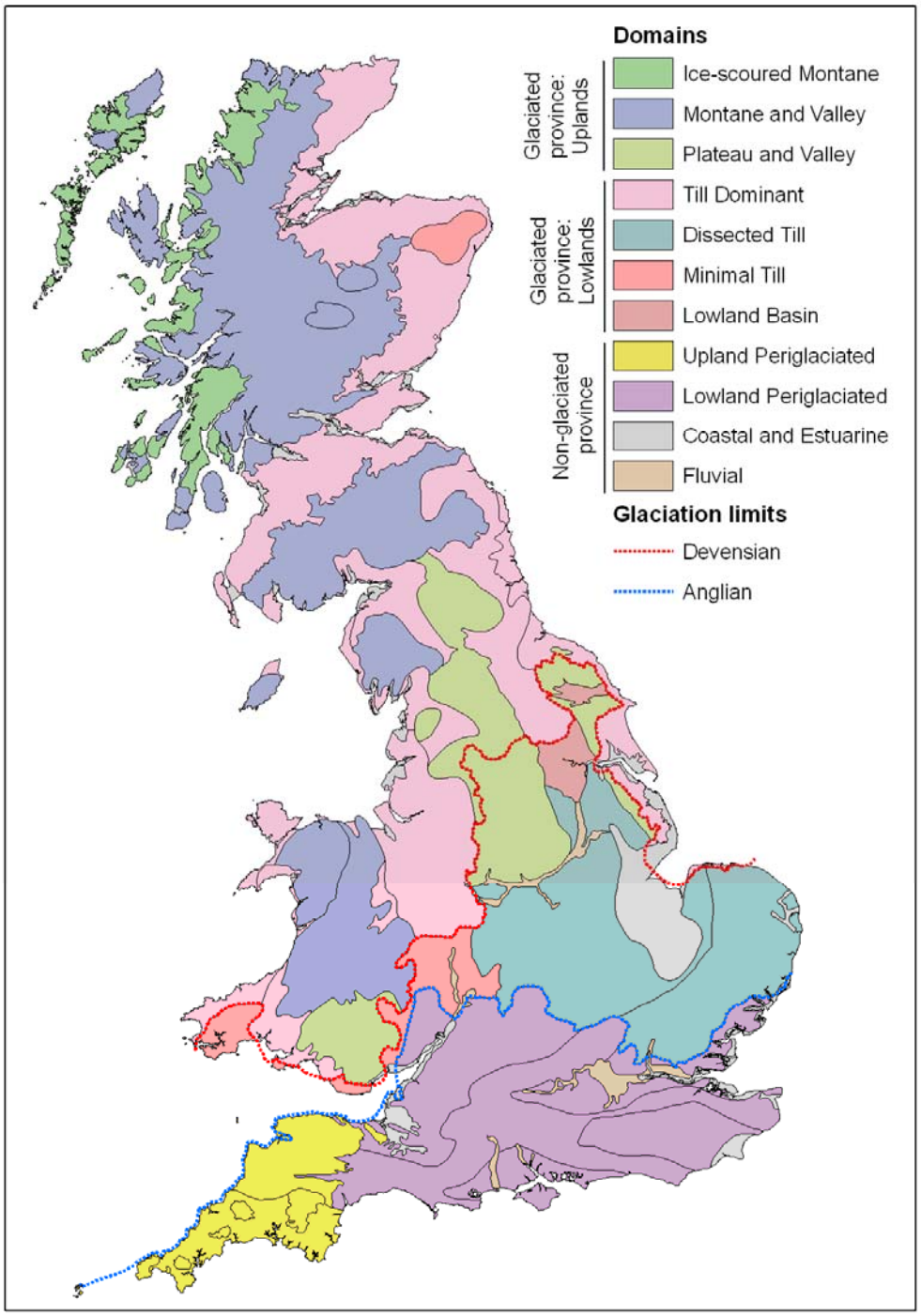

Figure 1. Quaternary domains and glaciation limits (Booth et al, 2007)

More information on Quaternary domains can be found in Chapter 2 of 'A guide to Quaternary Mapping in the United Kingdom' (Booth et al, 2007).

3.1.2 Glaciation Limits

The Anglian and Devensian limits were used extensively to define boundaries between till units (see Figure 1 above). However, recent mapping indicates that tills of Anglian age occur north of the Devensian limit, and, in the Uttoxeter area, the Brewood Till Formation, a Devensian tills, is thought to occur south of the current Devensian limit. This indicates that in some areas the Devensian and Anglian limit may not be correct, or are possibly more spatially complex than previously thought.

3.1.3 Boreholes

Borehole logs are used to identify the uppermost till in areas where one till overlaps another and where the difference is easily identified by colour. For instance, in North Wales the Stockport Glacigenic Formation, which is typically red or reddish brown, can be differentiated from the Merion Till Member, which is usually grey to dark grey.

3.1.4 Geologist's knowledge

A number of geologists contributed to defining and describing the till units of Great Britain and detailed in Table 2.

Table 3 Geologists' areas

Area	Geologist
Scotland, Northern England and Isle of Man	Jon Merritt
Lancashire	Dick Crofts and Jon Merritt
Yorkshire	Tony Cooper and Jon Merritt
Wales	David Wilson and Jon Merritt
West Midlands	Keith Ambrose and Mark Barron (south)
East Midlands	Tony Morigi and John Carney
North East Anglia, Cambridgeshire, Huntingdon and Peterborough	Jon Lee
South East Anglia	Steve Mathers
South East Midlands	Tony Morigi and Mark Barron

- Jon Merritt provided linework outlining all the Devensian Till Domains with indication of end moraines and areas where tills over lap each other.
- The tills in Lancashire and part of Cheshire were sub divided by lithological and thickness by R Crofts.

3.1.5 Moraines and Eskers

Some moraine linework has been provided by geologists. These features represent either terminal or lateral moraines that may confine the till unit.

4 Technical Information

The till dataset has complete coverage of Great Britain for areas that have been subject to glaciation (i.e. north of the Anglian glaciations limit). The dataset is not dependant on DiGMapGB-50 linework and so will not be affected by minor changes to the spatial extent of till in DiGMap. However, the GIS will be edited where mapping provides changes in the differentiation between till units. It has been extended offshore by 1 km, to overcome any slight changes in mapping at the coastline.

It is intended that this dataset will be intersected with till from DiGMapGB-50, and any attributes from the till dataset transferred to the DiGMapGB-50 linework. Figure 2 below illustrates this.

The till dataset has been developed with the intention of using it in conjunction with 1:50 000 data, but that is not to say that it currently has 1:50 000 resolution, which will require further evidence and development in some areas.

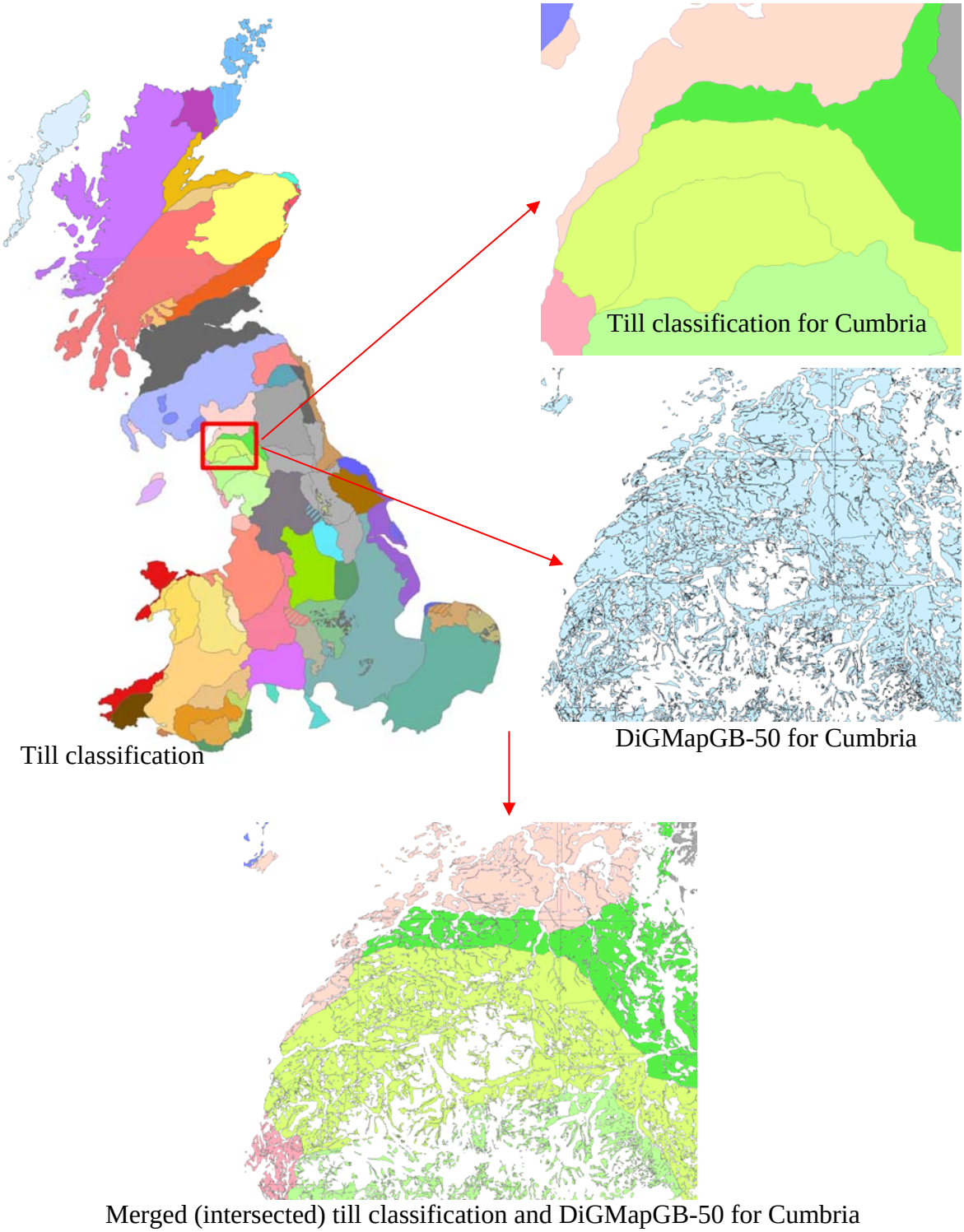

Figure 2. Intersecting the till dataset with DiGMapGB-50

5 Limitations

- The data is based on current knowledge of different till units and includes the proposed stratigraphy. Some of the names used are still to be ratified. The age of the till units in some areas require further research.

- The extent of the till domains is considered to be the till at surface. However, in some places, the proposed Devensian till (Merritt and MacMillan) and Anglian till stratigraphy includes domains that contain a sequence of till units, one over the other. The 3d complexity of the till is beyond the scope of this study but will be addressed in future work.
- In some areas differentiating between tills at surface is too complex, and the possible till units that may be present are described as a combined unit.
- In parts of the Pennines, north of the Devensian limit, currently two tills units are considered to be present, the Devensian till in the valleys and Anglian till on the hills. These different till units are not currently mapped as separate units but have been described together in the Harrogate area as the Harrogate Till Formation (Anglian) and the Yorkshire Dales Formation (Devensian). The relationship between the two ages of till are likely to occur in other parts of the Pennines and possibly elsewhere.
- There are still contentious areas, one of which has been identified in the Uttoxeter – Burton-upon-Trent area where the till may be of Anglian age (Thrussington Till Member) or Devensian age (Brewood Till Formation).
- The lithological types are based on information from geologists, memoirs and other publication. Each till unit domain contains only one lithological type. This may not be fully representative of all the till in that domain.
- This is a new dataset which will be updated as other information becomes available.

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.

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