

LORD OF BOWLAND TENTH  
ANNUAL LECTURE  
5<sup>th</sup> October 2021

*Maps, Mines, and Minerals: 25,000 Years of  
Bowland History*

by

Dr Nick Riley MBE, C. Geol.,

President of The Yorkshire Geological  
Society & Honorary Research Associate  
with the British Geological Survey

YORKSHIRE GEOLOGICAL  
SOCIETY



Spitzbergen today (*Hannes Grobe*)  
or NW England 25,000 years ago?





**COMPLEX MORAINES**

The York-Essex moraines span 90 km across the Vale of York, Yorkshire. They are pictured here in light brown on an elevation model. Photo: C. Clark

**ICE DAMMED LAKES**

The inferred extent of former lakes dammed by the ice sheet. Found by studying glacial lake sediments.

**CIRQUES**

Glacially-eroded armchair-shaped hollows cut into mountains. Also known as corries or cwms. Lines on map represent several cirques.

See in Gwynedd National Park, Wales. Photo: M. Hambray

**SUBGLACIAL RIBS**

Ridges formed at the base of the ice sheet, at right angles to flow direction. Closely related to drumlins. Lines on map record orientation, not length.

Elevation model of subglacial ribs, County Roscommon, central Ireland, spanning 50 km from east to west. Arrow indicates ice flow direction. Photo: C. Clark

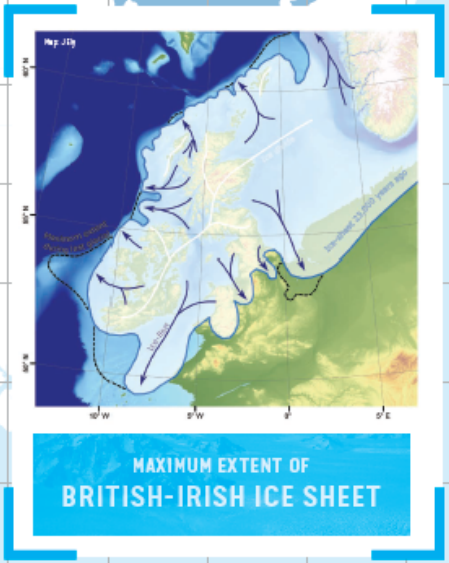
**ERRATICS**

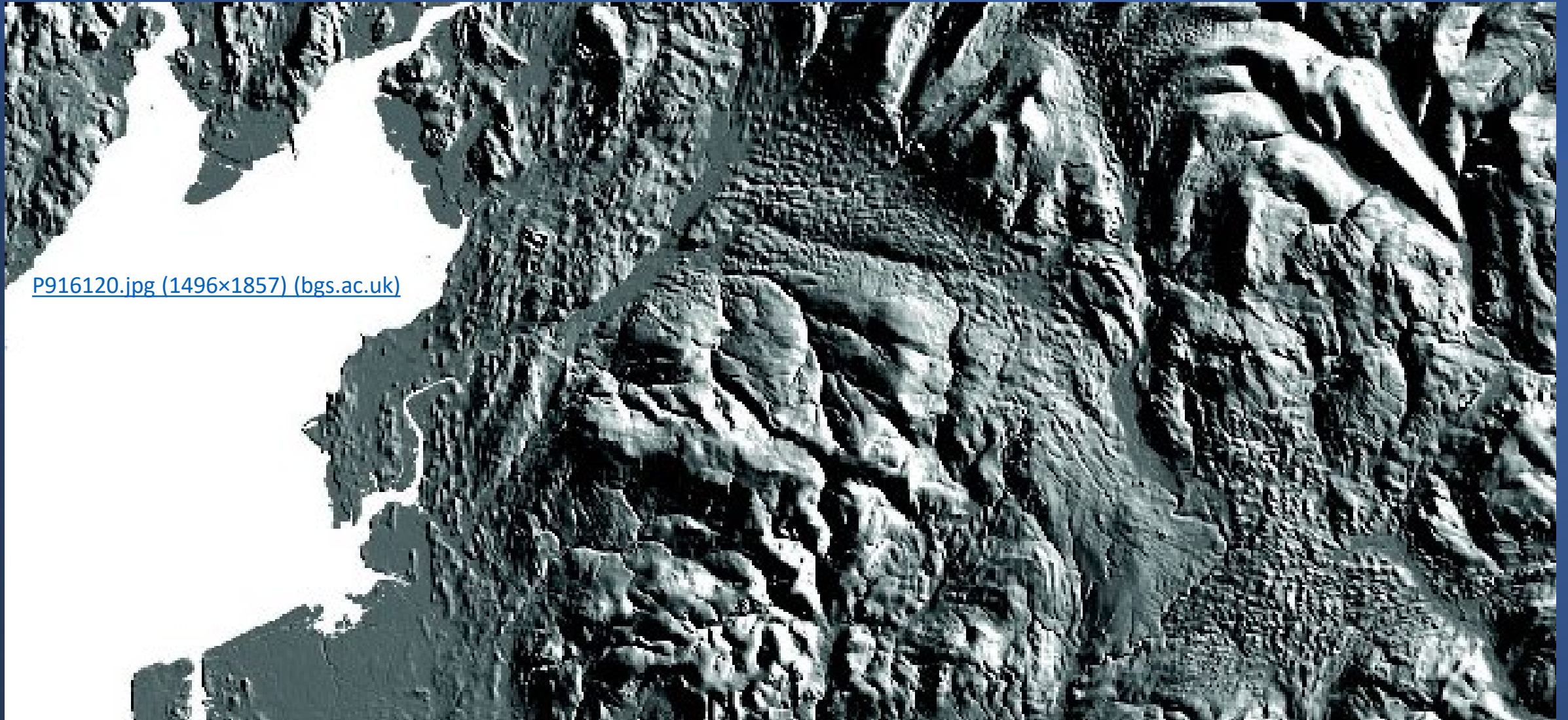
Erratics are rocks transported by the flow of ice so that they now lie in an area with a different geology.

**ERRATIC SOURCE AREA**

**ERRATIC PATHWAYS**

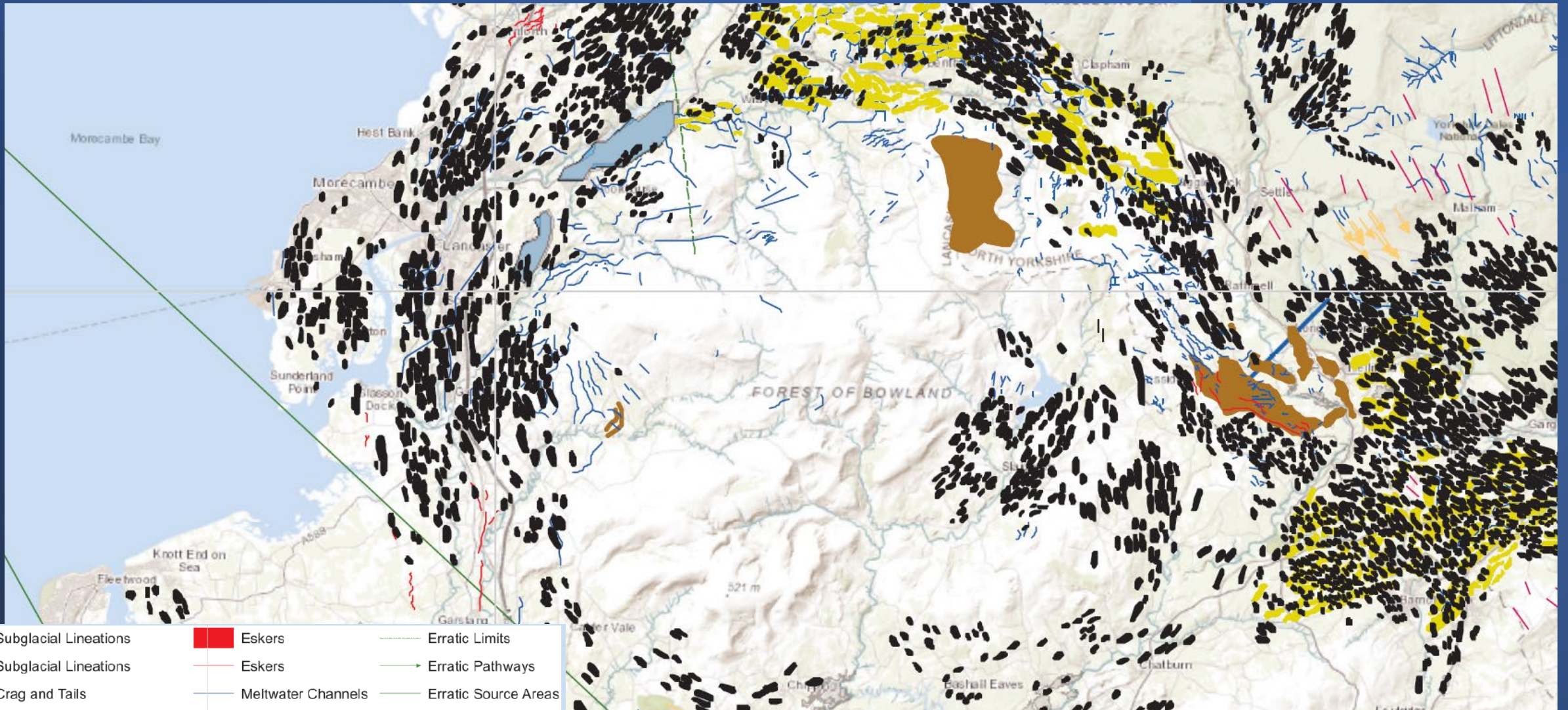
Shap granite erratic, Boppy Hole Beach, Yorkshire. Ice transported this boulder across the Pennines from near the Lake District. Photo: M. Baseman





[P916120.jpg \(1496x1857\) \(bgs.ac.uk\)](#)

Satellite image (digital terrain map- DTM) of the land surface



	Subglacial Lineations		Eskers		Erratic Limits
	Subglacial Lineations		Eskers		Erratic Pathways
	Crag and Tails		Meltwater Channels		Erratic Source Areas
	Crag and Tails		Wide Moraines		Lake Dams
	Subglacial Ribs		Narrow Moraines		Lake Deposits
	Subglacial Ribs		Cirques		Lake Levels
	Glacially Streamlined Bedrock		Fans		Trimlines
	Glacially Streamlined Bedrock		Erratic Source Areas		

**Acknowledgements**

We acknowledge the British Geological Survey for part funding the first BRITICE project. Support for this work came from the NERC consortium project BRITICE-CHRONO. [thematicmapping.org](http://thematicmapping.org) are thanked for their coastline data.

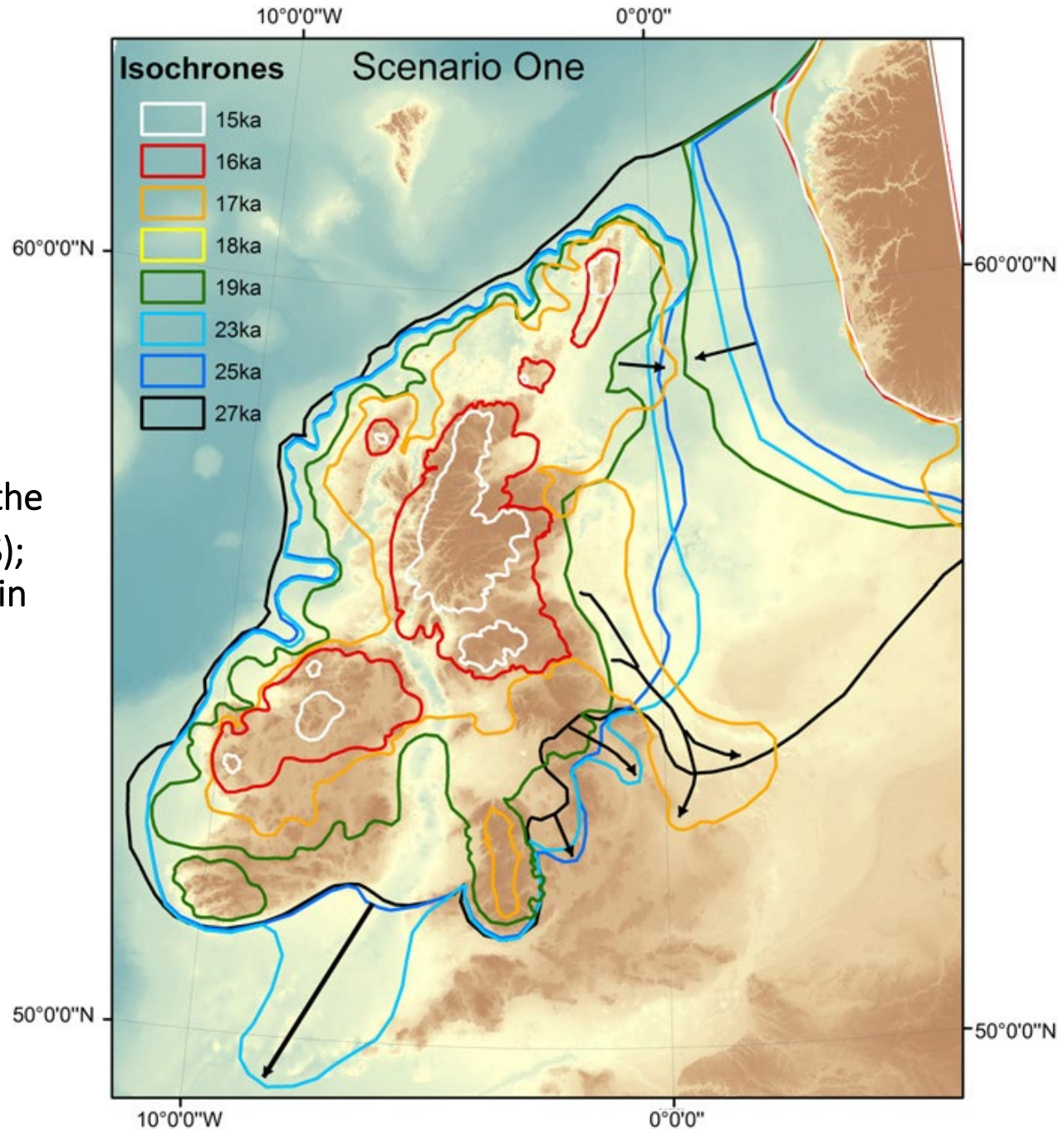


The University Of Sheffield.



**British Geological Survey**  
NATURAL ENVIRONMENT RESEARCH COUNCIL

Isochrones of ice retreat of the British & Irish Ice Sheet (BIIS); successive margin positions in years ka BP. (Clark *et al.*)



Meltwater canyon, Greenland (National Science Foundation)



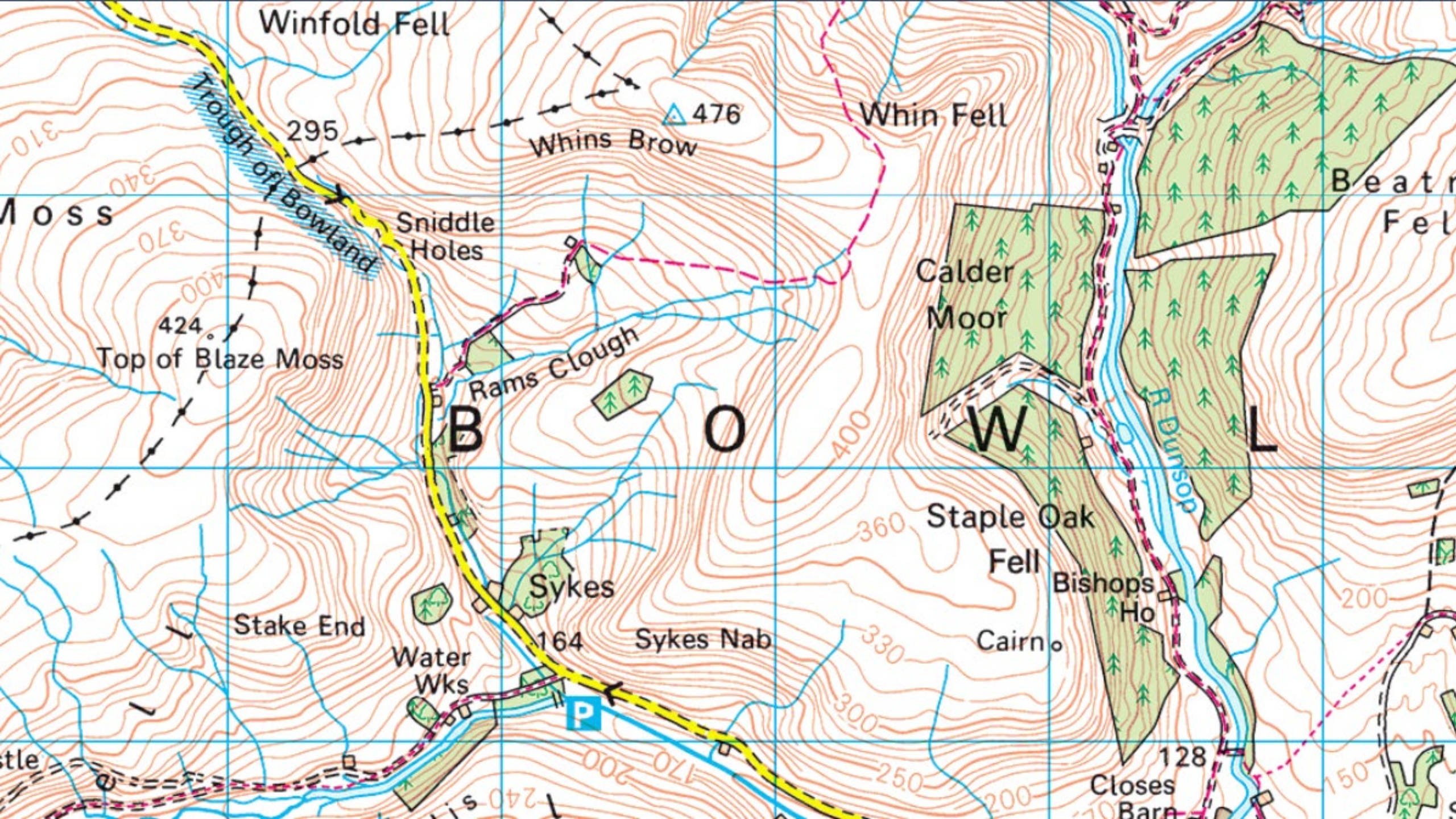
## Trough of Bowland-meltwater channel





Trough of Bowland-meltwater channel





Trough of Bowland-meltwater channel

Footholme  
Pumping Station

Penny Brook

Sykes

Trough of  
Bowland



2D





DISTRICT

Caton Moor

Cattle Grid

Winder

Ford

Cattle Grid

Kame

Crossgill

Hawes Ho

Deep Clough

Haylot Fm


The Cragg

Bellhill Fm

Littledale Hall

Field Head

Haylot Fell

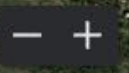


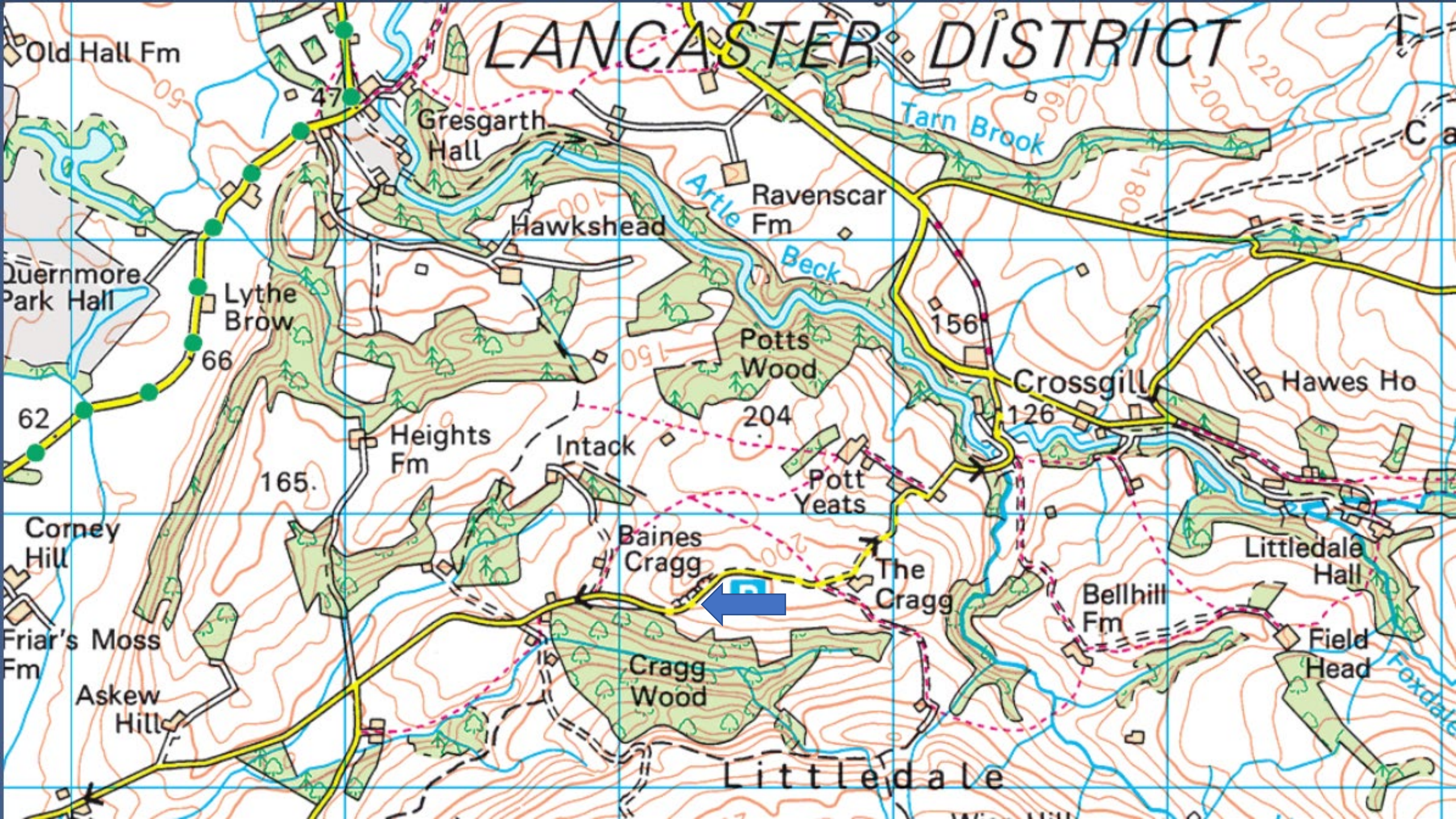
Kame deposited by melting ice



Kame

2D





# LANCASTER DISTRICT

Old Hall Fm

Gresgarth Hall

Tarn Brook

Hawkshead

Artle Beck

Ravenscar Fm

Quernmore Park Hall

Lythe Brow

62

66

Potts Wood

156

Crossgill

Hawes Ho

Heights Fm

Intack

204

Pott Yeats

126

Corney Hill

165.

Baines Cragg

The Cragg

Littledale Hall

Friar's Moss Fm

Askew Hill

Bellhill Fm

Field Head

Cragg Wood

Littledale

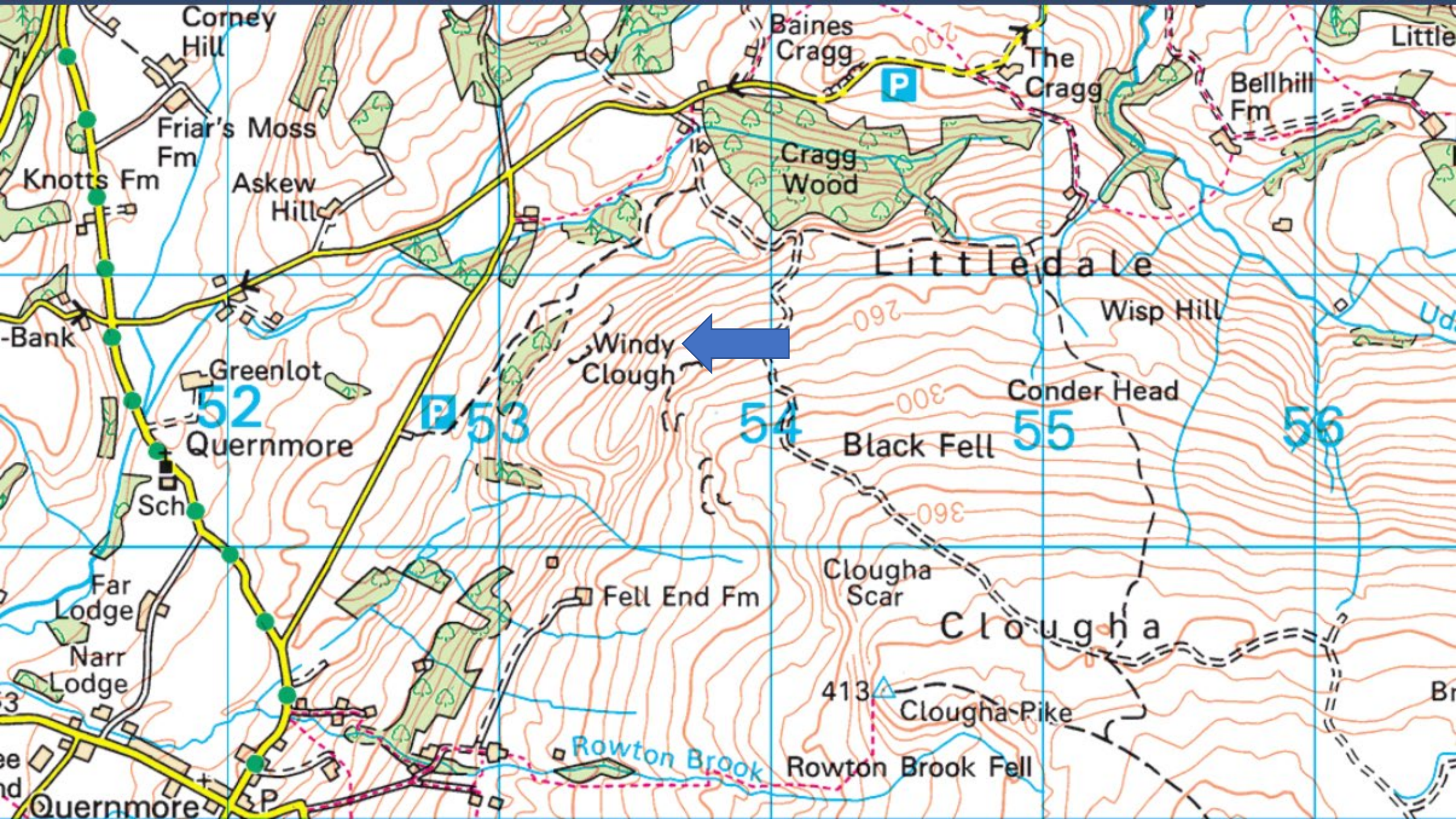
Foxdale

Wards Stone Sandstone.  
Ice plucked escarpment,  
shattered by periglacial  
freeze-thaw



Wards Stone Sandstone.  
Ice plucked escarpment,  
shattered by periglacial  
freeze-thaw





Wards Stone Sandstone. Ice plucked dip slope,  
shattered by periglacial freeze-thaw  
& destabilised by permafrost melt.



River Conder

Wards Stone Sandstone. Ice plucked dip slope, shattered by periglacial freeze-thaw & destabilised by permafrost melt.

Rigg Lane Car Park



Trough Brook





Brennard Tarn

Threaphaw Fell

Winfold Fell

Trough of Bowland

Sniddle Holes

Top of Blaze Moss

Rams Clough

Brennard Fm

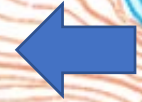
Whins Brow 476

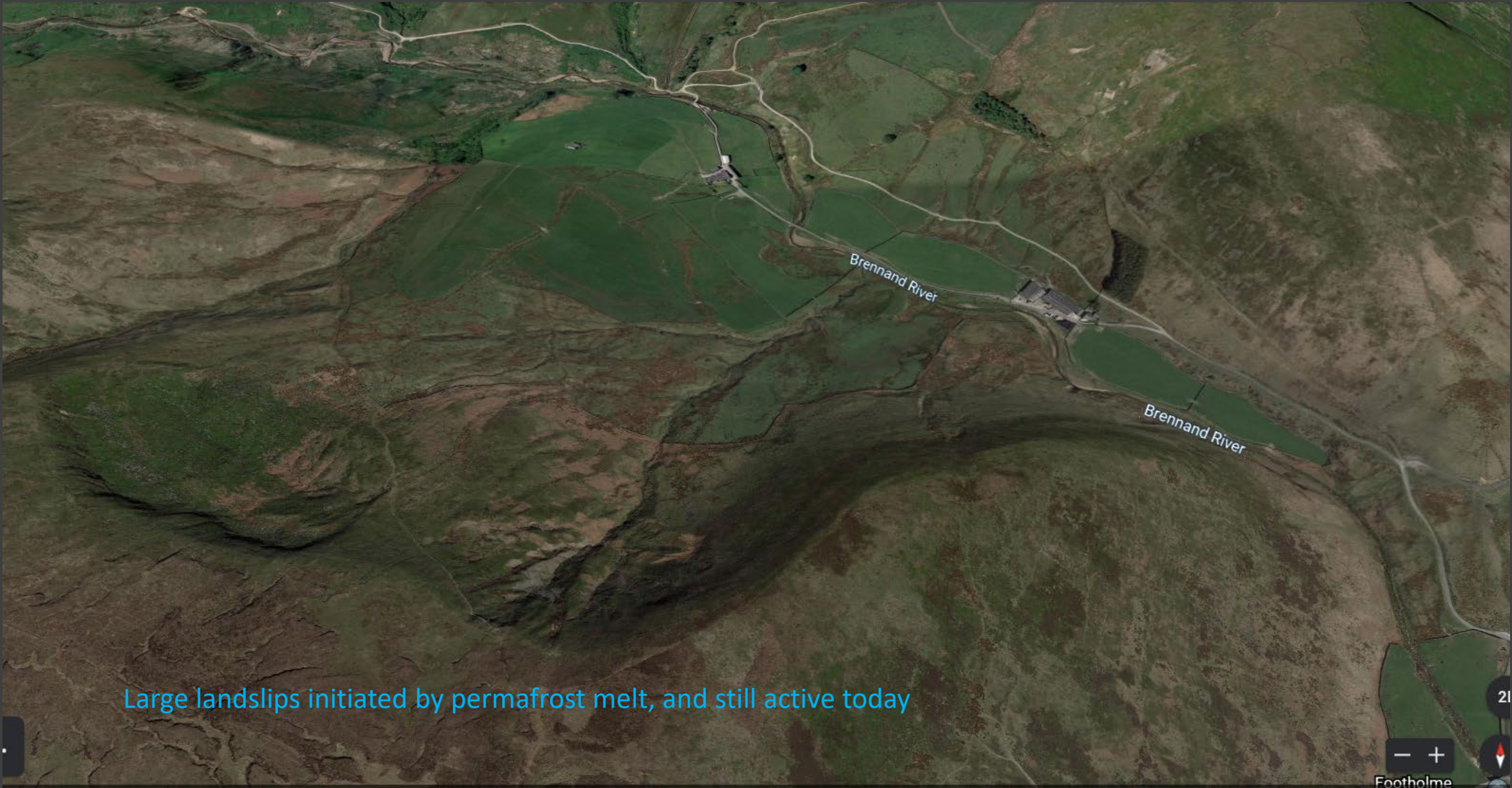
Whin Fell

Calder Moor

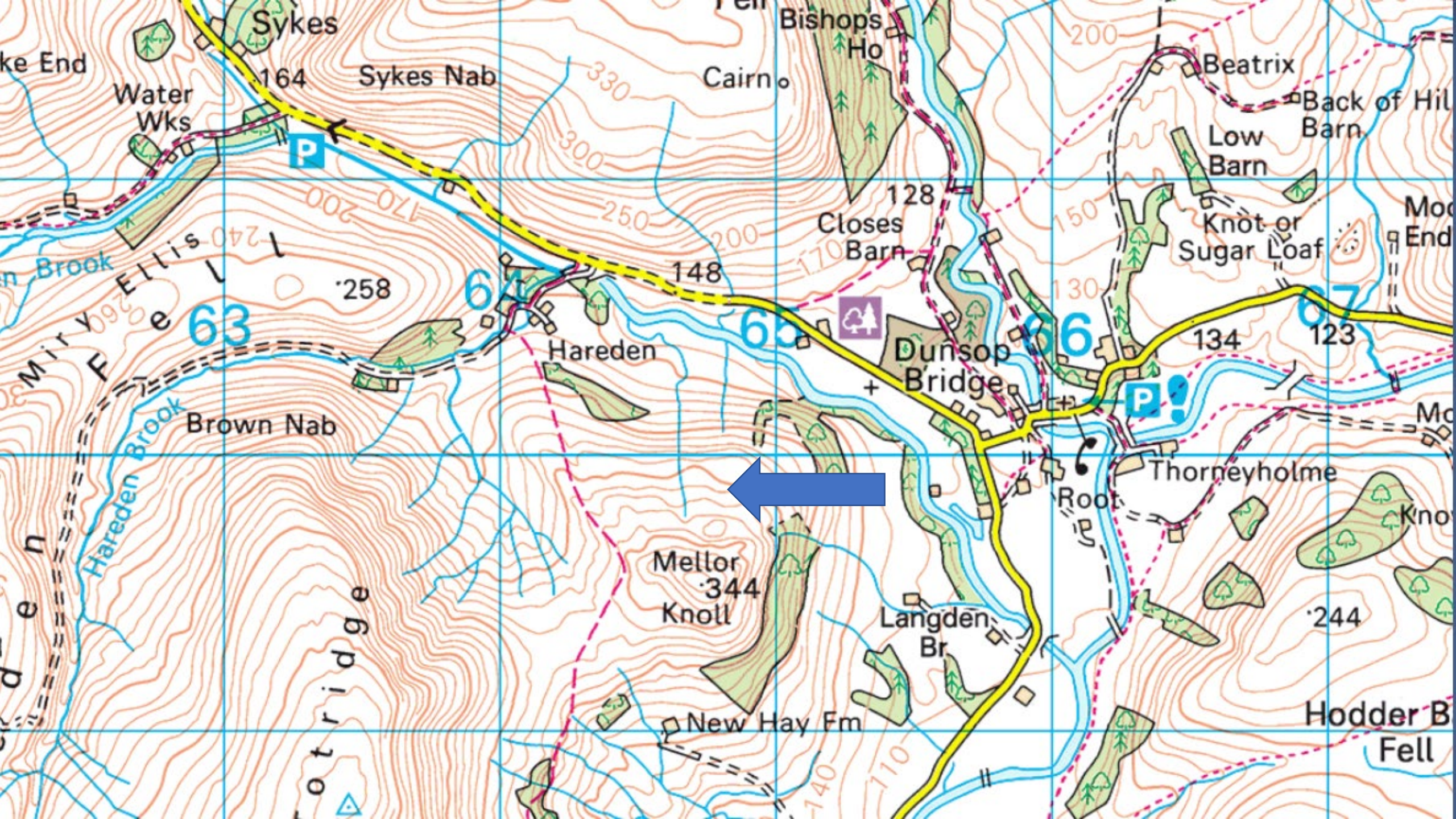
Middle Knoll 395

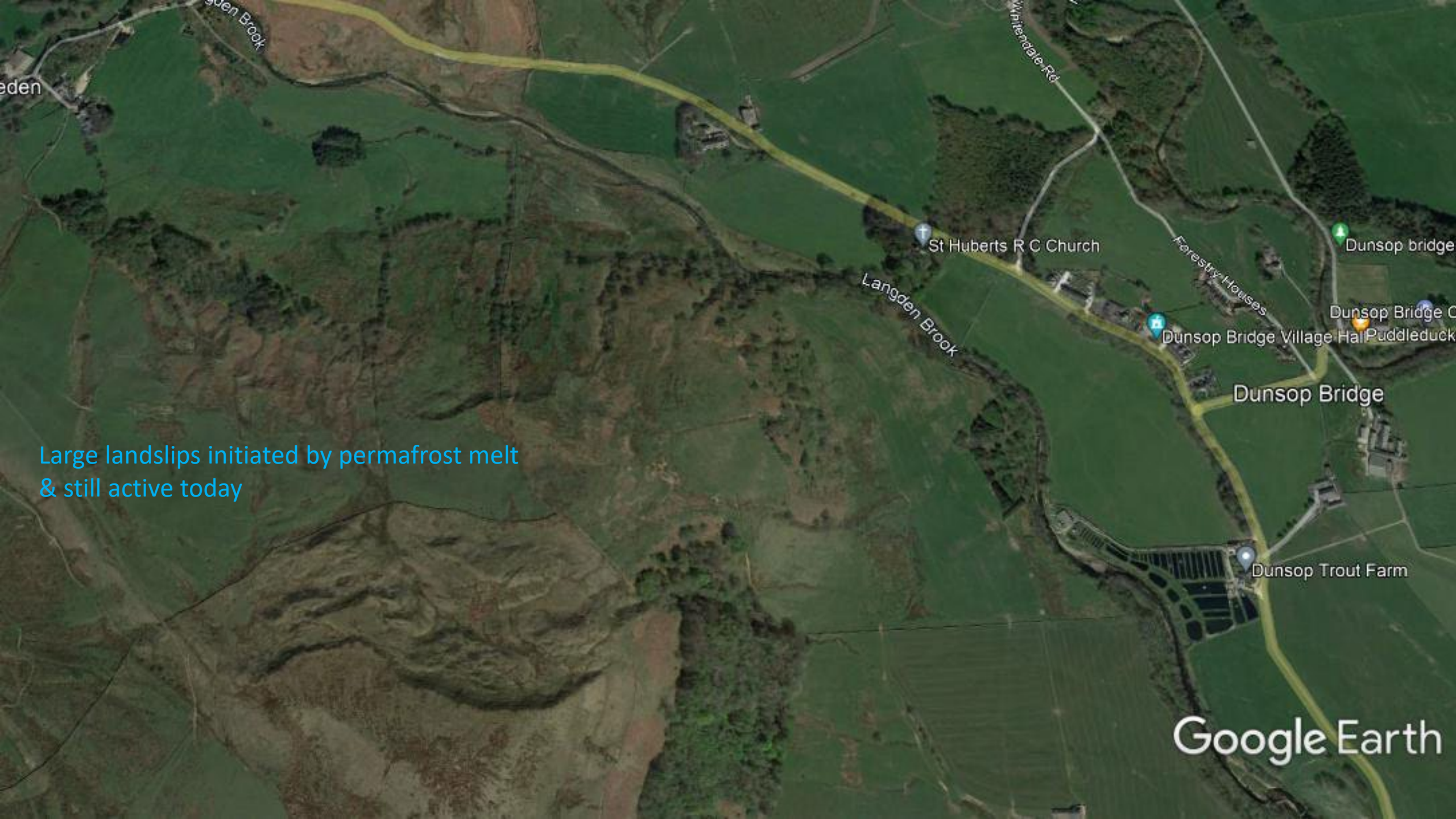
Beatr Fell





Large landslips initiated by permafrost melt, and still active today



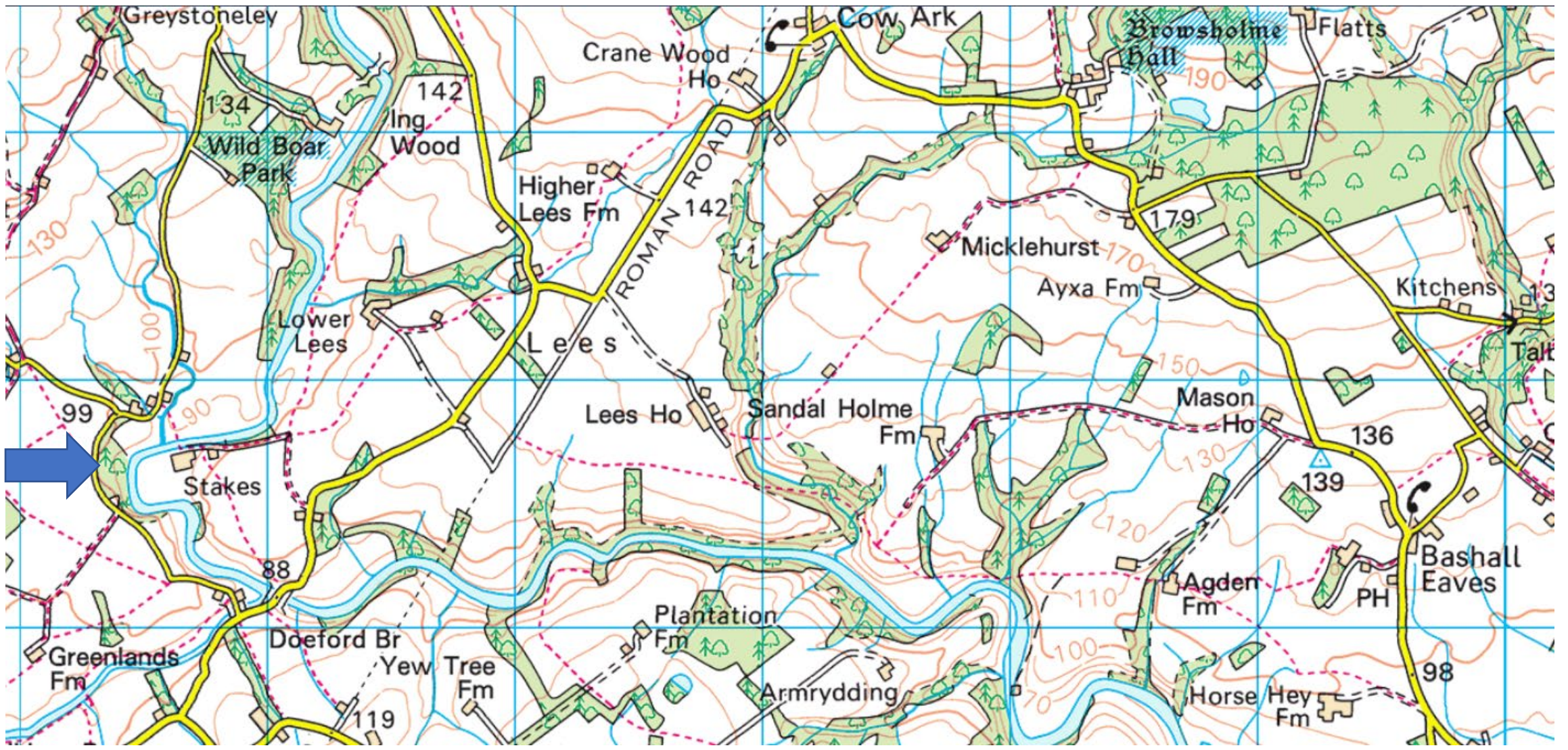


Large landslips initiated by permafrost melt  
& still active today



The depression is in the form of a one-kilometre-long gash up to 100 m deep, and growing, as a result of melting permafrost, in the East Siberian taiga, located 10km southeast of Bagatay, Russia





Diversion of the River Hodder due glacial blocking of the Loud Valley by Irish Sea Ice

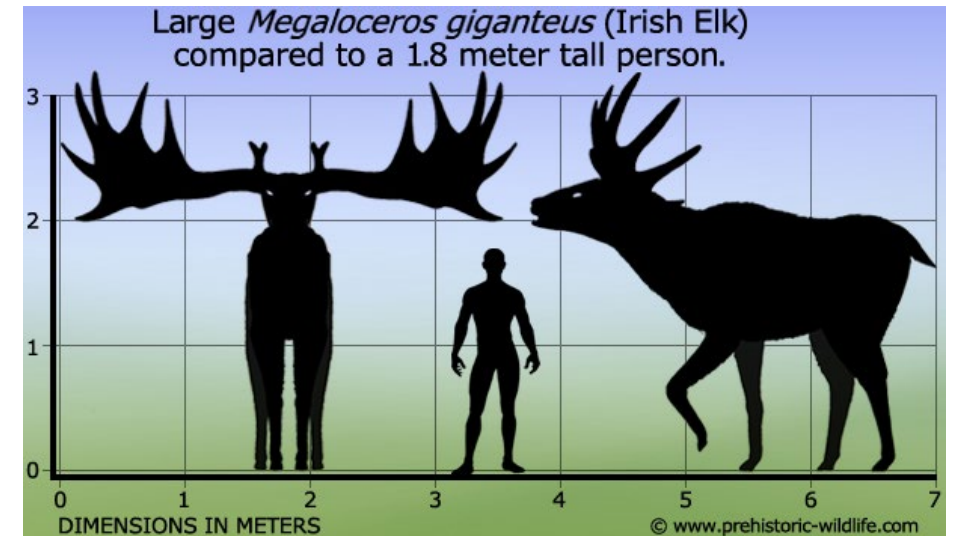
Approx age (Ka BP)	Chronostratigraphical stage		Marine isotope stage	Climate	Environment	Human cultures	Typical large herbivore fauna	Representative deposits	Characteristic features	Lithostratigraphy
	A	B								
11.7	LATE	Loch Lomond Stadial	2	Cold Local glaciation	Tundra - glacial	Late Upper Palaeolithic	Reindeer, bison, horse	Landslips, cover sands, head, screes, tufa, till, moraines	Cirque glaciers, screes Ice-wedge polygons Moraines Demise of large herbivores Initiation of modern drainage	Northern Uplands Glacigenic Subgroup
12.9		Windermere Interstadial		Warm continental	Birch forest	Elk, giant deer, aurochs	Kettlehole deposits, organic silts*			
14.7		Dimlington Stadial	Glaciation, dry polar desert	Arctic tundra grasses and sedges - glacial	Man absent	Mammoth, woolly rhino, steppe bison, horse	Extensive tills and other glacigenic deposits Head, screes	Kettleholes, till plains, meltwater channels, drumlins, eskers, end moraines, valley sandur	Southern Uplands and Irish Sea Coast Glacigenic subgroups	
29	MIDDLE	Upton Warren	3	Variable, generally cold	Open, treeless	Early Upper Palaeolithic	Mammoth			
40										
59	EARLY		4	Arctic	Tundra					No known deposits in the south of Scotland
70										
80		Brimpton	a	Continental temperate to polar desert	Pine, birch, spruce forest	Middle Palaeolithic	Reindeer, wolverine, steppe bison, woolly rhino			
90			b							
100		Chelford	c							
116		d	Cold	Open, treeless						
	IPSWICHIAN		5	e	Warm temperate	Mixed forest	Man absent	Hippo, straight-tusked elephant, narrow-nosed rhino, aurochs, red deer, fallow deer		
128										

# *Megaloceros giganteus*

---



- “This elk skeleton dates from the last ice age 13,500 years ago and was found in the village of Carleton near Poulton-le-Fylde. The injuries on its bones – and the weapons found with it – make it the earliest evidence of human habitation in Lancashire. (The Harris Museum Preston)”



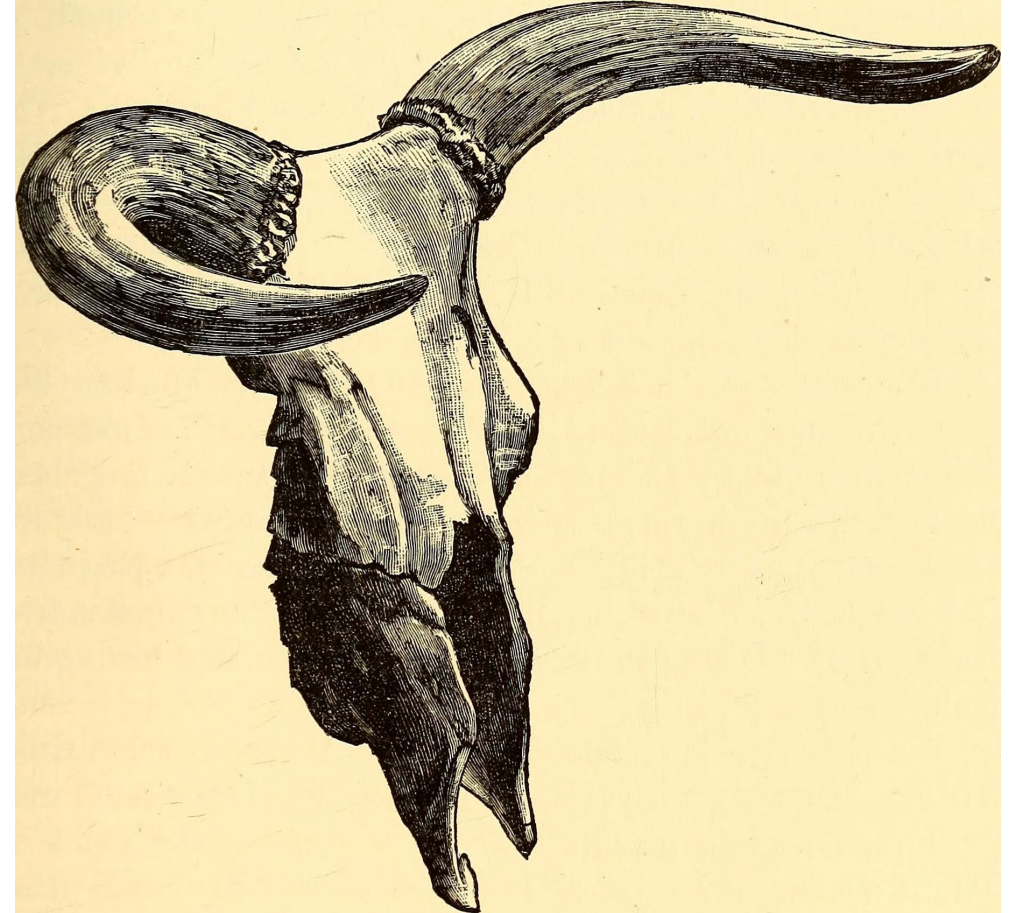
# Aurochs (*Bos primigenius*) – thought to be source of domesticated cattle



Artistic reconstruction of the Elba shepherdess (Spain), accompanied by the three aurochs found at the site, whose mitochondrial DNA has been analysed. "Specifically, these aurochs are more closely related to the aurochs of the British Isles than to the Central European specimens. British aurochs are more recent than those from Galicia. This may be related to the role of the Peninsula as a glacial refuge and the origin of the later recolonisation of the islands,"

Published: April 28, 2021

<https://doi.org/10.1371/journal.pone.0249537>



A vertebrate fauna of Lakeland including Cumberland & Westmorland with Lancashire north of the sands (Macpherson, 1892)

Approx age (Ka BP)	Chronostratigraphical stage		Marine isotope stage	Climate	Environment	Human cultures	Typical large herbivore fauna	Representative deposits	Characteristic features	Lithostratigraphy
	A	B								
1	Sub-Atlantic		1	Temperate	Mixed forest (alder, oak, elm, birch, beech)	Historical	Domestic animals	Made ground	Urbanisation Peat erosion	Britannia Catchments Group British Coastal Deposits Group Sou
2				Sub-Boreal	III	Temperate		Mixed forest (elm decline)		
3	Bronze Age									
4.3	Neolithic	Red deer					Tidal flat and coastal deposits		Tree clearance Sub-meandering rivers	
5.6	Atlantic	II		Temperate moist, relatively cold	Oak, elm, lime, alder forest	Aurochs	Peat accumulation*			
6.7							Boreal		Temperate, dry	
7.8	Pre-Boreal	I	Warm continental	Birch-pine forest	Aurochs					
8.7						10				
10	11.7									

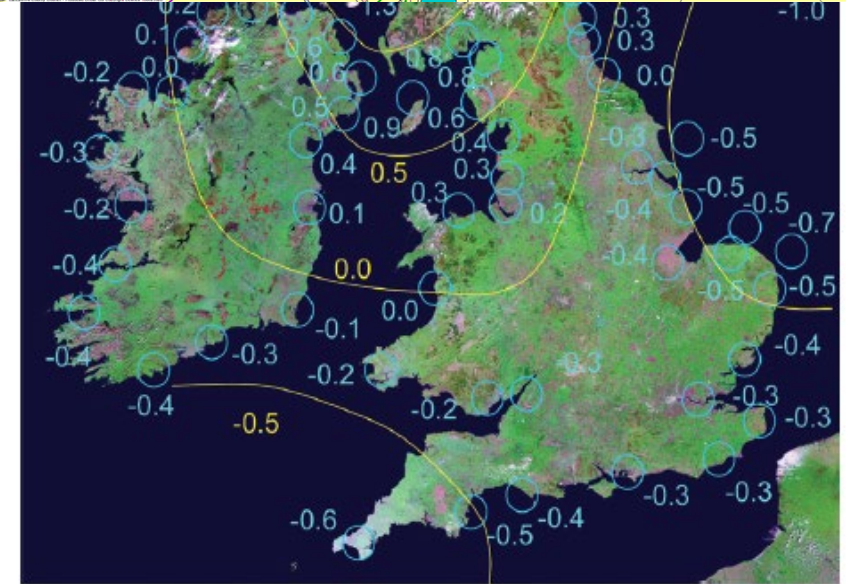
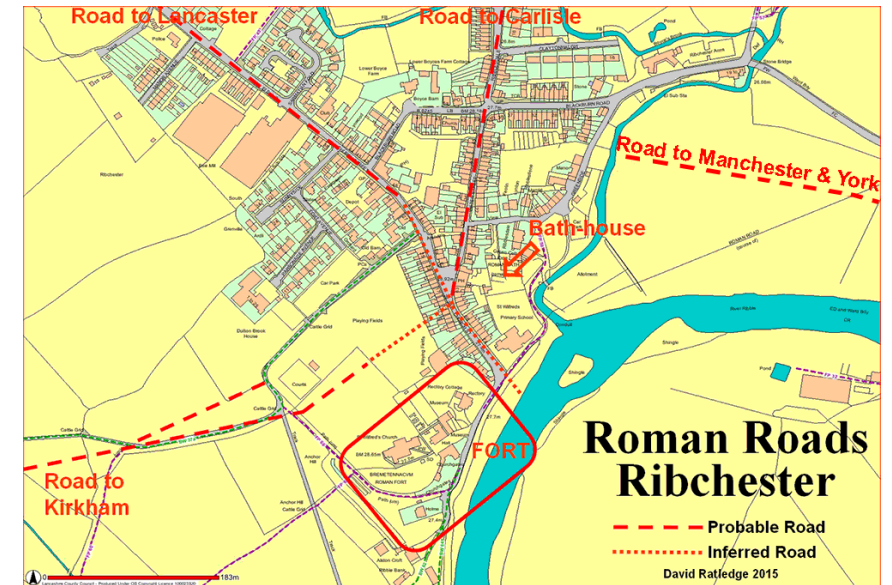
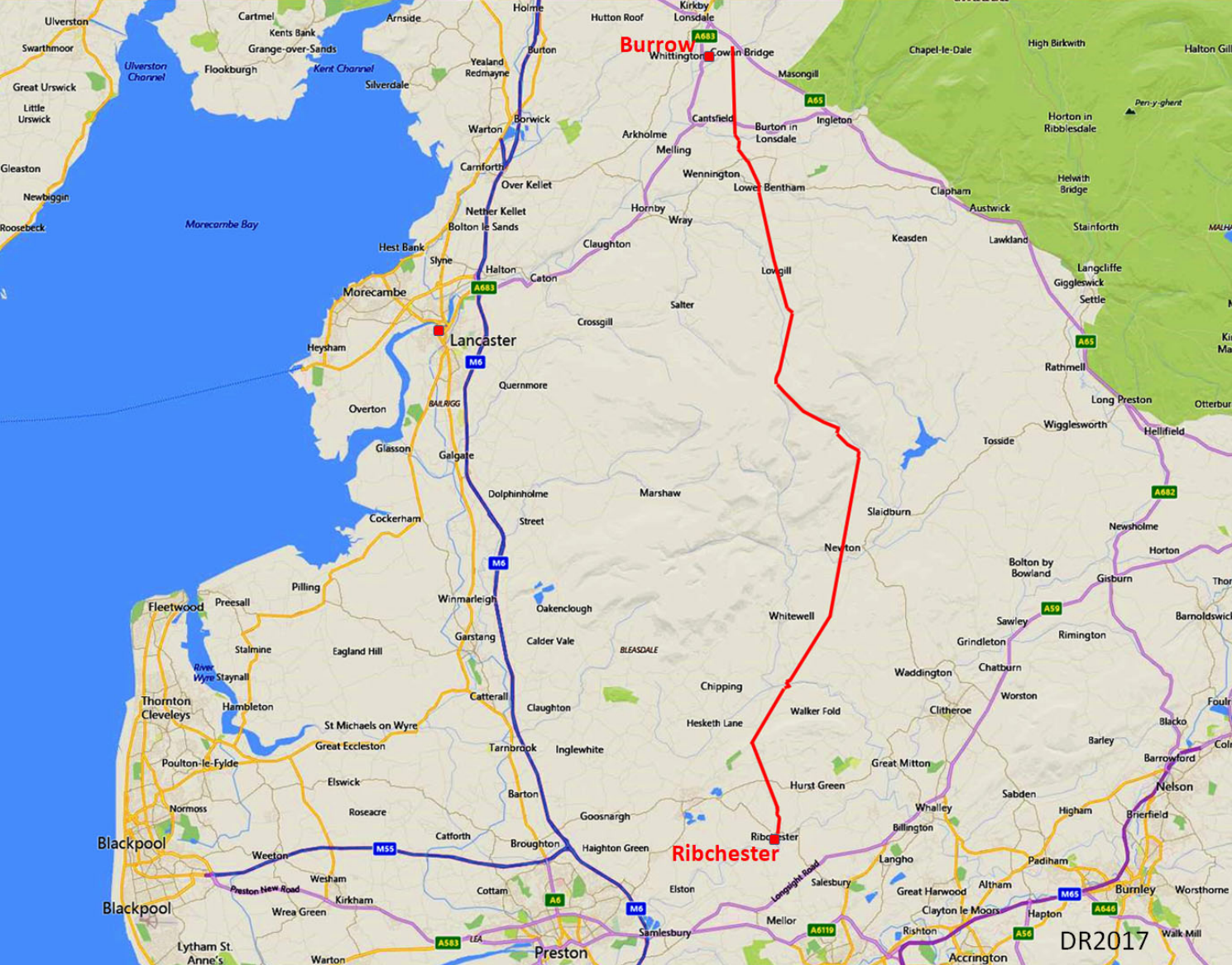
- 
- This is the skull of a man who lived in the North West of England around 5,500 years ago. He was about 40 years old when he died – but we don't know how he died. Stone Age people like him lived nomadic lifestyles hunting animals and gathering wild foods. They used stone and flint tools and wore clothes made from animal skins.
  - This is one of 23 human skulls in the Harris collection which were found during excavations for Preston Dock. Other Stone Age collections include flints from the Bann Culture in Northern Ireland, stone axes and arrow heads (The Harris Museum, Preston).



- 
- These urns were found in the centre of the Bleasdale Circle – one of the most important Bronze Age sites in Lancashire. They contained pieces of charcoal, bone and linen consistent with cremation which have been dated to 4000 years old. They are part of small collection of Bleasdale finds which include timber posts. The Harris holds a small collection of other Bronze Age items including axeheads and spears (Harris Museum, Preston).







<http://www.romanroads.org/gazetteer/lancspages.html>

It is likely that in Roman times Ribchester was reached by high spring tides. Due to glacial rebound the land has risen & tides no longer reach so far.

Figure 1. Current rate of relative land- and sea-level change in the British Isles in mm a<sup>-1</sup>, showing relative land uplift as positive and relative subsidence as negative. Image is ~900 x 1300 km, courtesy of the NASA Scientific Data Purchase Program.



Roman Road from Ribchester to Burrow passes over & close to lead-zinc mineral deposits in the Whitewell & Ashnott area



2D



04 October 2021

Monday

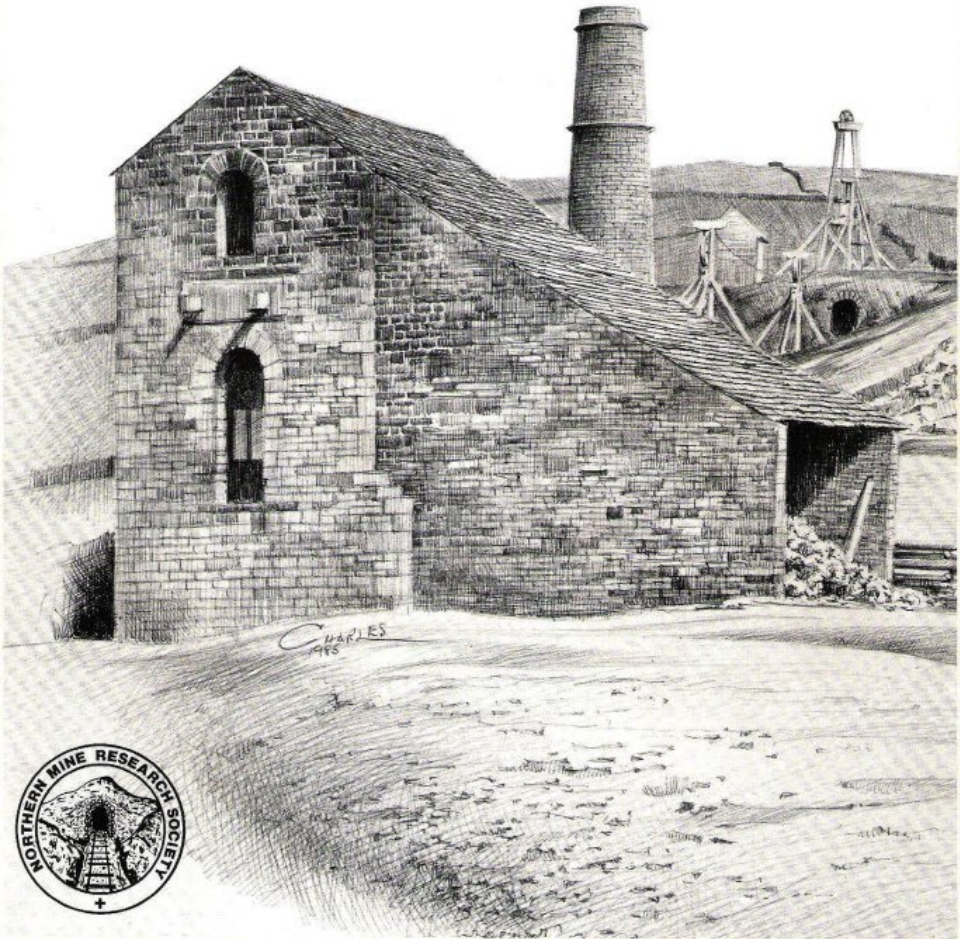
289 m



Ashnott

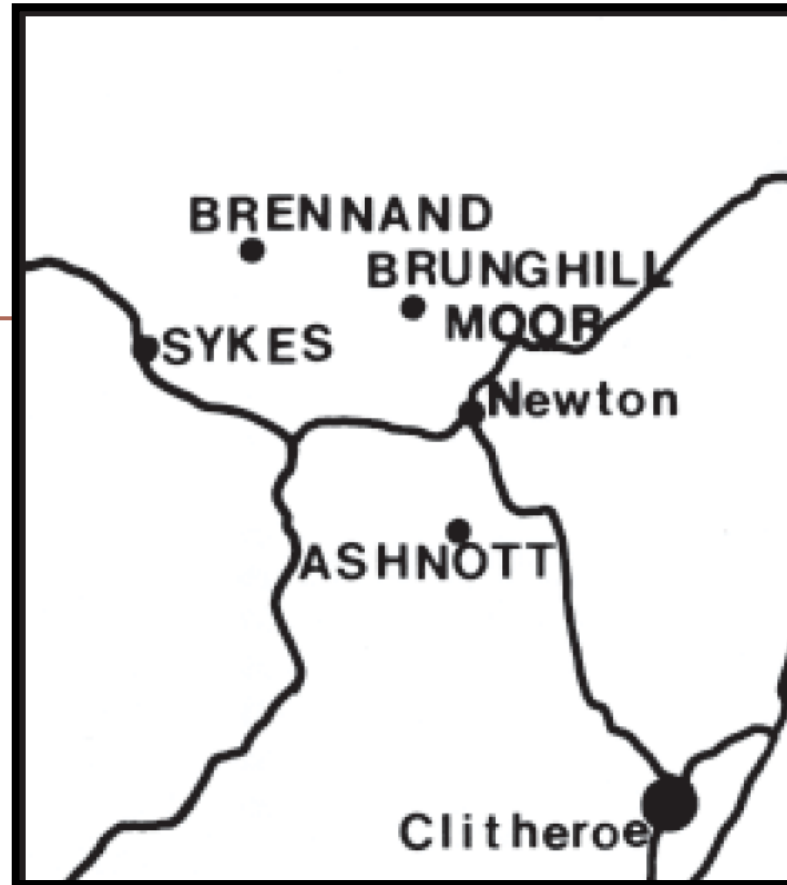


# THE YORKSHIRE AND LANCASHIRE LEAD MINES



A study of Lead Mining in the South Craven  
and Rossendale Districts

by  
M.C. GILL.



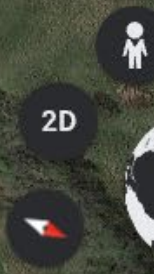
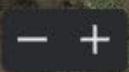
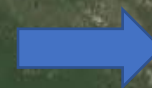
- [British Mining No 33 - The Yorkshire & Lancashire Lead Mines - Northern Mine Research Society \(nmrs.org.uk\)](http://nmrs.org.uk)

Calamine (zinc carbonate) mines, hosted in reef limestone



Dinkling Green Brook

Calamine (zinc carbonate) mines, hosted in reef limestone



Sykes Mine, lead, zinc & copper ores are hosted in the  
Hetton Beck Limestone in the core of the Sykes Anticline



## Welcome to Langden

Back in the 1800s, Lancashire's booming industrial towns were thirsty for water and these remote and beautiful hills were literally a lifesaver.

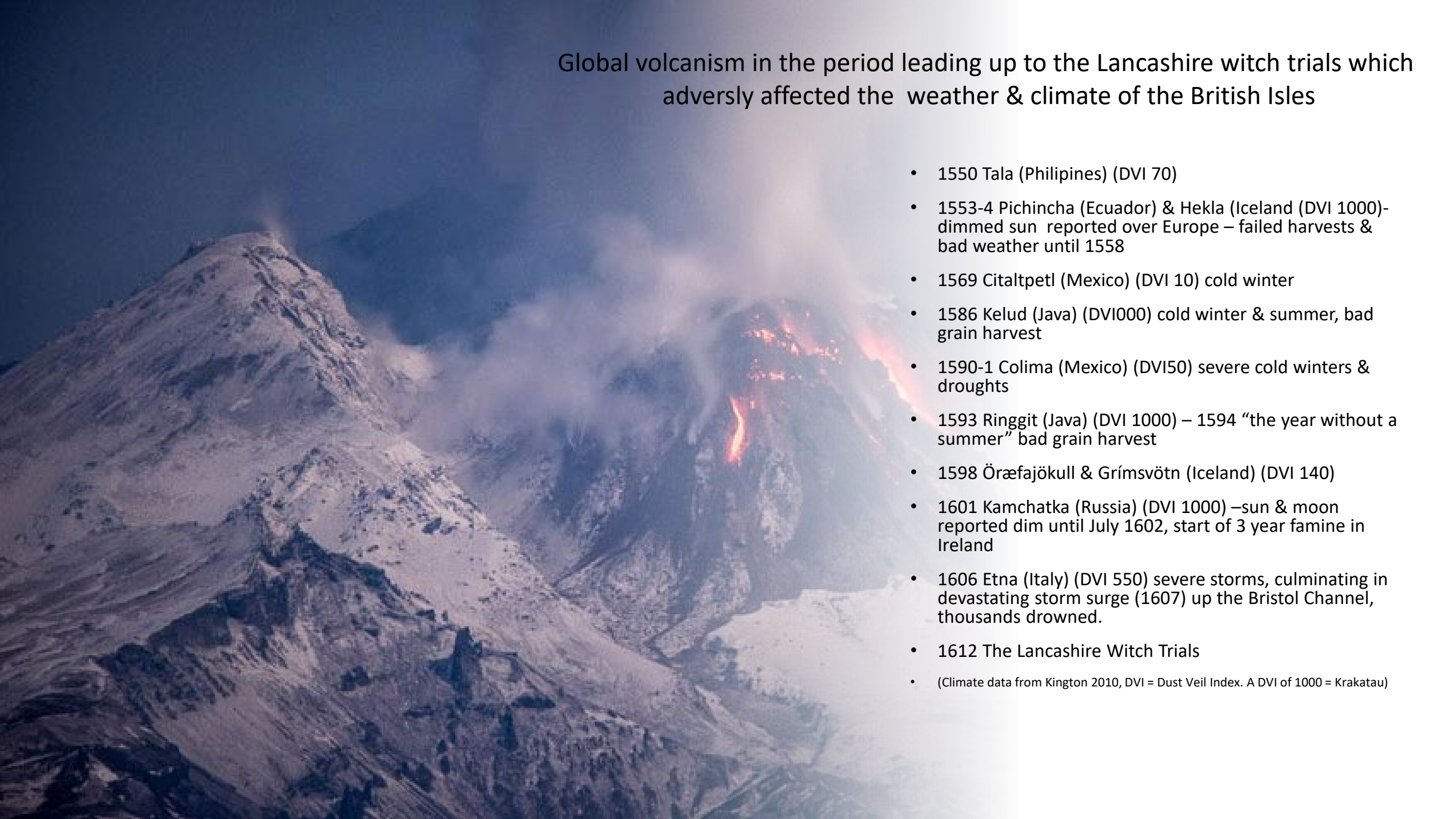
It was Preston's city fathers who, battling against disease and shocking sanitation, first spotted the potential in the clear running waters of Langden and Hareden brooks.

In 1871 they built intakes on both brooks. intakes are small dams which collect water and channel it along pipes. Over the following 80 years the intakes were improved and expanded until nowadays six separate river intakes make up the Langden system.

Together they supply 110 million litres of lovely water - that's about 24 million gallons - into Preston and beyond. It's already some of the best water in Europe and, here at United Utilities, we're hoping to make it even better.







## Global volcanism in the period leading up to the Lancashire witch trials which adversely affected the weather & climate of the British Isles

- 1550 Tala (Philippines) (DVI 70)
- 1553-4 Pichincha (Ecuador) & Hekla (Iceland (DVI 1000)- dimmed sun reported over Europe – failed harvests & bad weather until 1558
- 1569 Citaltepetl (Mexico) (DVI 10) cold winter
- 1586 Kelud (Java) (DVI 1000) cold winter & summer, bad grain harvest
- 1590-1 Colima (Mexico) (DVI 150) severe cold winters & droughts
- 1593 Ringgit (Java) (DVI 1000) – 1594 “the year without a summer” bad grain harvest
- 1598 Öraefajökull & Grímsvötn (Iceland) (DVI 140)
- 1601 Kamchatka (Russia) (DVI 1000) – sun & moon reported dim until July 1602, start of 3 year famine in Ireland
- 1606 Etna (Italy) (DVI 550) severe storms, culminating in devastating storm surge (1607) up the Bristol Channel, thousands drowned.
- 1612 The Lancashire Witch Trials
- (Climate data from Kington 2010, DVI = Dust Veil Index. A DVI of 1000 = Krakatau)



The next major glaciation is expected @ 170-180ky from now!

Thankyou for your attention!  
Any Questions?