

West Midlands  
Regional Group of the  
Geological Society



Where was the Devensian Ice Margin  
in the West Midlands

# History of Observations

The notion that glacial ice had once covered much of Great Britain was generally accepted by the scientific community by the mid 19<sup>th</sup> century (the deposits left by former glaciers were not the result of Noah's flood). Observations by the Geological Survey and others by the end of the 19<sup>th</sup> century were able to divide the deposits into newer and older drift, on the basis of relatively fresh landforms left by the most recent (Devensian) glacial period (newer drift).

The extent of Devensian Ice into the West Midlands was reasonably well defined by mid 20<sup>th</sup> century geologists.

After an initial advance as far as Wolverhampton [hence the Wolverhampton Line], the ice margin then pulled back to the middle of the Shropshire/Cheshire Plain, where substantial end moraines were deposited (Wrexham - Barhill Moraine).

In the most recent BGS classification of Neogene and Quaternary deposits the deposits of the initial advance were classified as the Brewood Till Formation, and the deposits of the standstill phase were classified as the Stockport Formation. This distinction was recognised in the classification of the superficial deposits encountered by HS2 phase 2A

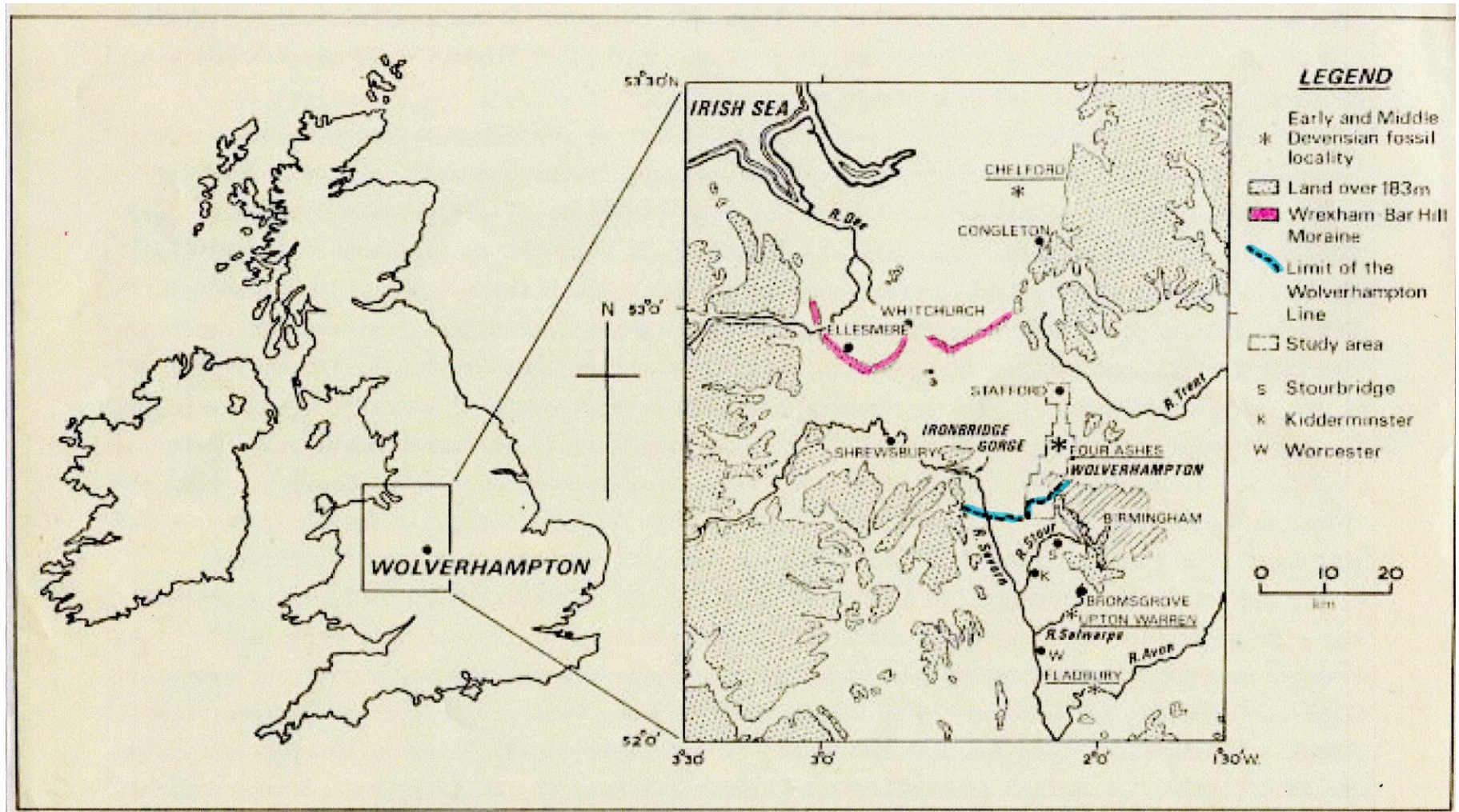
# A Word of Caution

A Quote from E A Francis in 1980.

The limit of the last glaciation may at first sight seem to be a topic which holds little potential for study, because this limit is relatively recent geologically and therefore may be thought to be self-evident. There are several reasons why we should not accept uncritically the limit as currently defined. We cannot be sure that the limit has been mapped correctly: the position is everywhere an inferred position, and the evidence in most places leaves a considerable margin of error or zone of uncertainty. In some cases, error has been introduced by the interpretation of features as marking the position of a terminal glacial feature, and further observations demonstrate that this is incorrect.



# The Wolverhampton Line



From A V Morgan 1973



# The Wolverhampton Line

Morgan was able to delineate the Devensian Ice margin (for a short section) across the West Midlands, and highlighted the importance of the Four Ashes Site

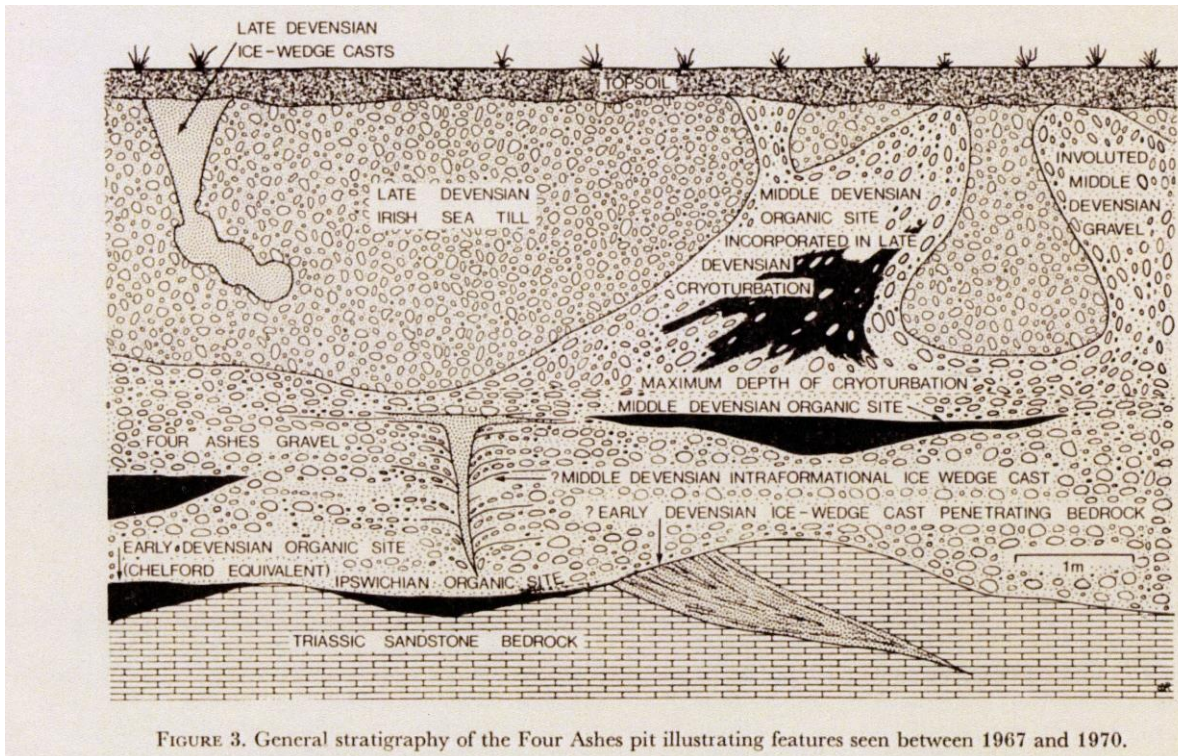


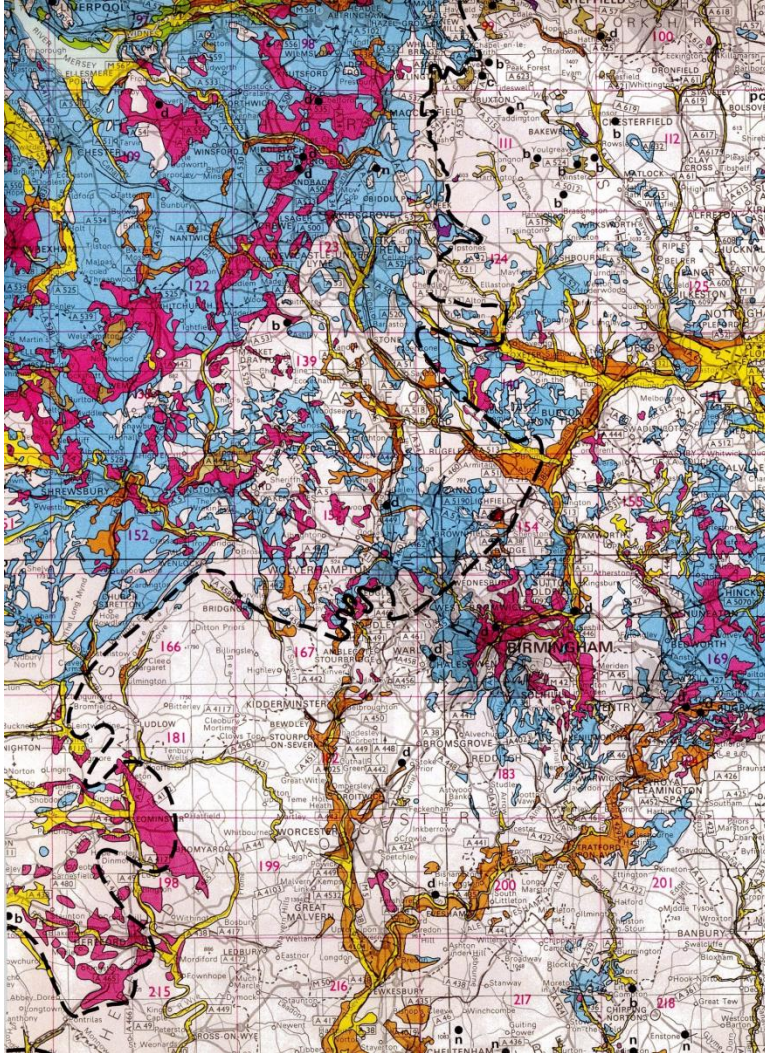
FIGURE 3. General stratigraphy of the Four Ashes pit illustrating features seen between 1967 and 1970.

This is now the type locality for the Devensian cold stage. But I do not think there is much visible today.

Note the intense periglacial disturbance of the Irish Sea Till (Brewood Till Formation). Some more about this at the end of the talk



# The Devensian Limit was depicted on the 1977 BGS 1:625 000 Quaternary Geological Map



That should be the end of the story, but more recent publications including the Britice Project is much less definitive

Why?



# The Wolverhampton Line – West into Shropshire

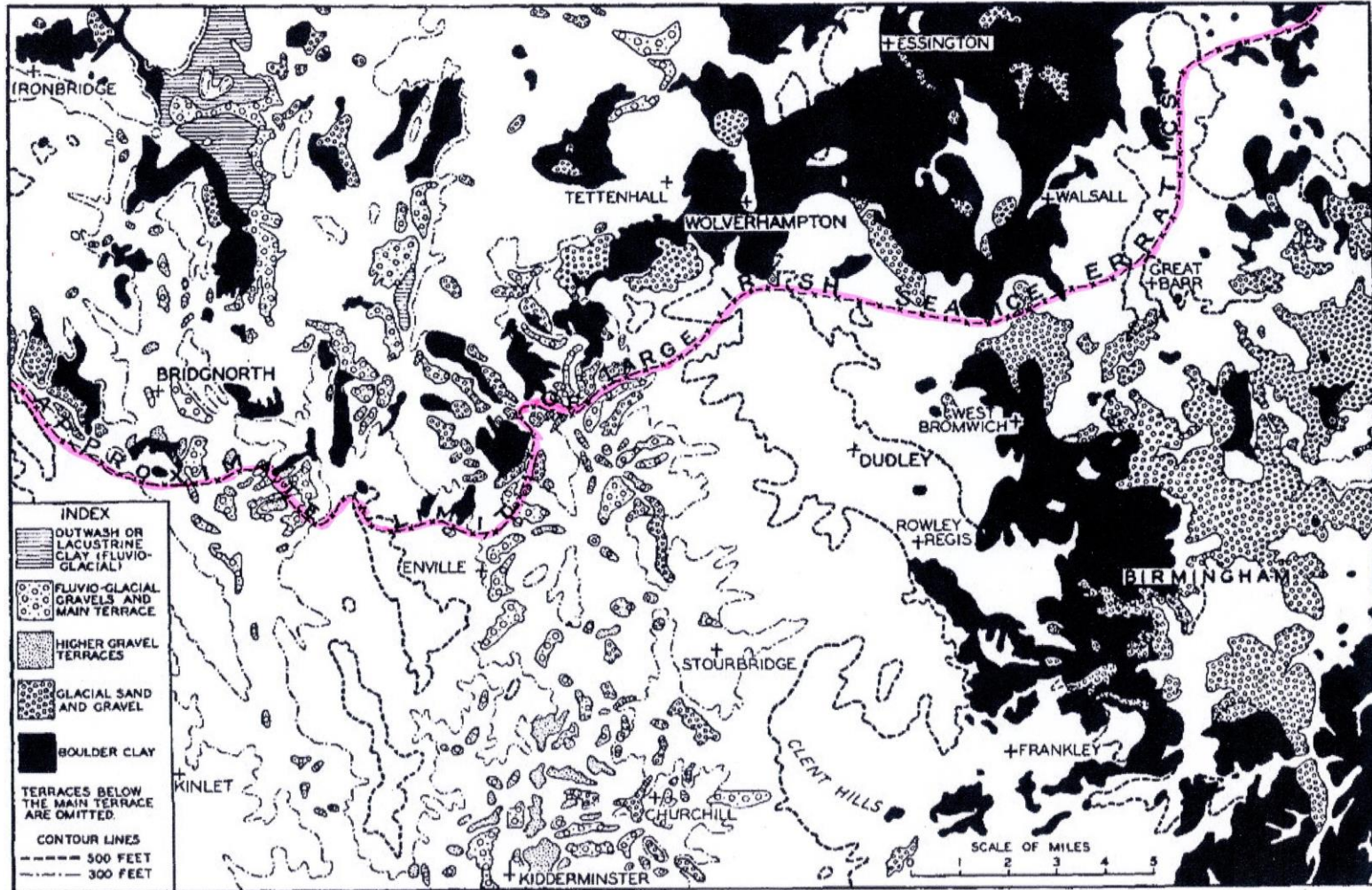


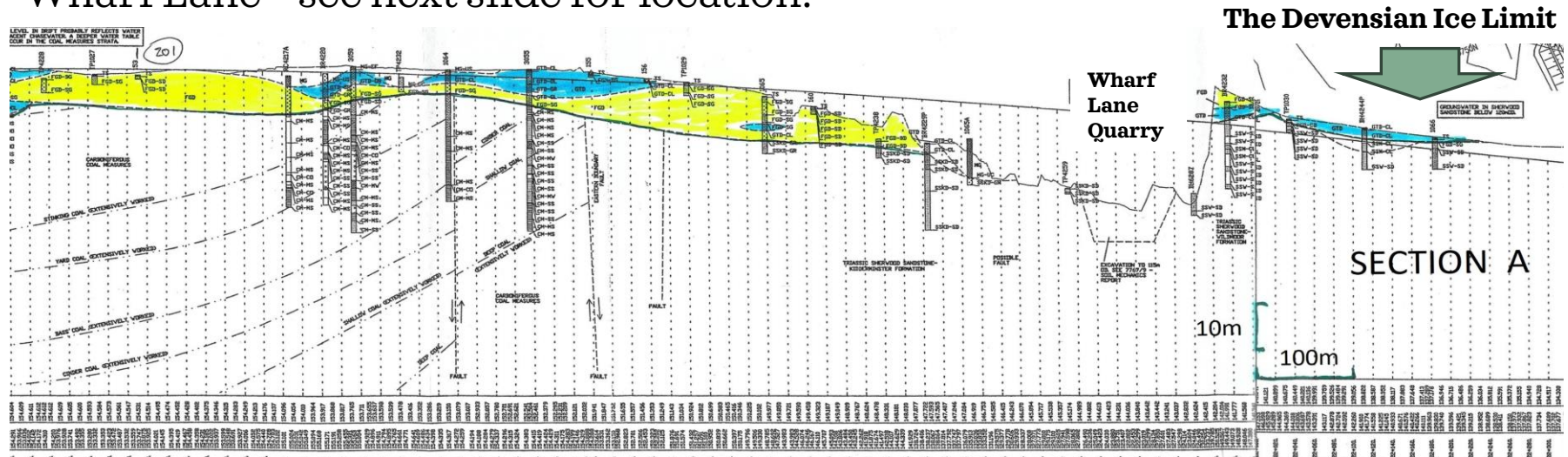
FIG. 18.—Generalized Map of the Glacial Deposits between Bridgnorth and Birmingham.

From Sheet 167 Memoir (1947). Note that it depicts 'Approximate limit of large Irish Sea Erratics', not the 'ice margin'.

# The Wolverhampton Line – East towards Cannock

The M6 toll alignment was expected to cross the Devensian Ice Margin near Chasewater, and give some confirmation on the BGS model.

The data from the boreholes was instructive. The Devensian glacial deposits formed a continuous layer of Glacial Till / Diamicton and Glaciofluvial deposits about 10m thick to the south of Chasewater. These deposits were observed to finish close of the location of Sherwood Sandstone Quarry at Wharf Lane – see next slide for location.

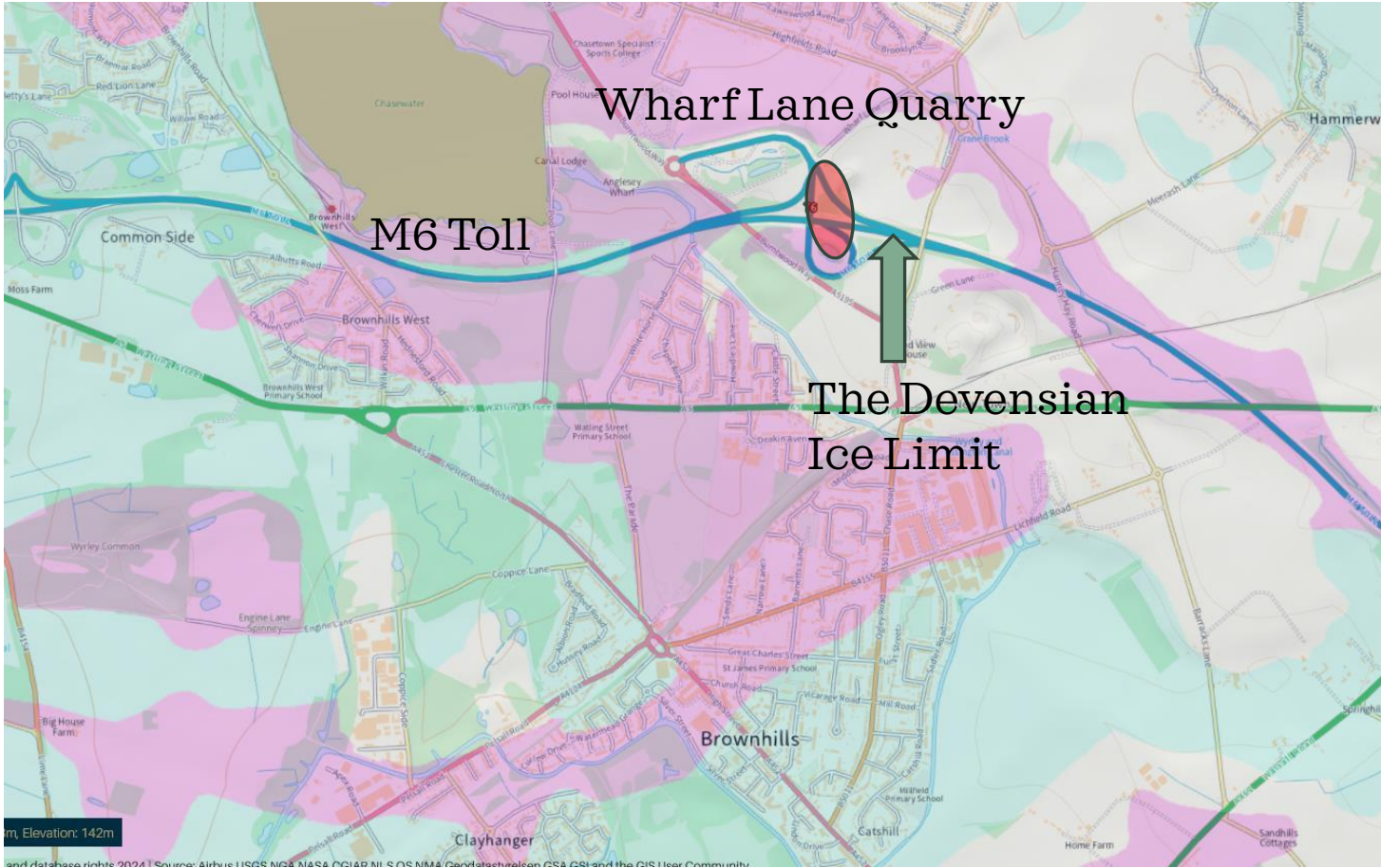


This information has been around for 25 years now, but (In my opinion) has not reached everybody in the scientific community eg the BGS.

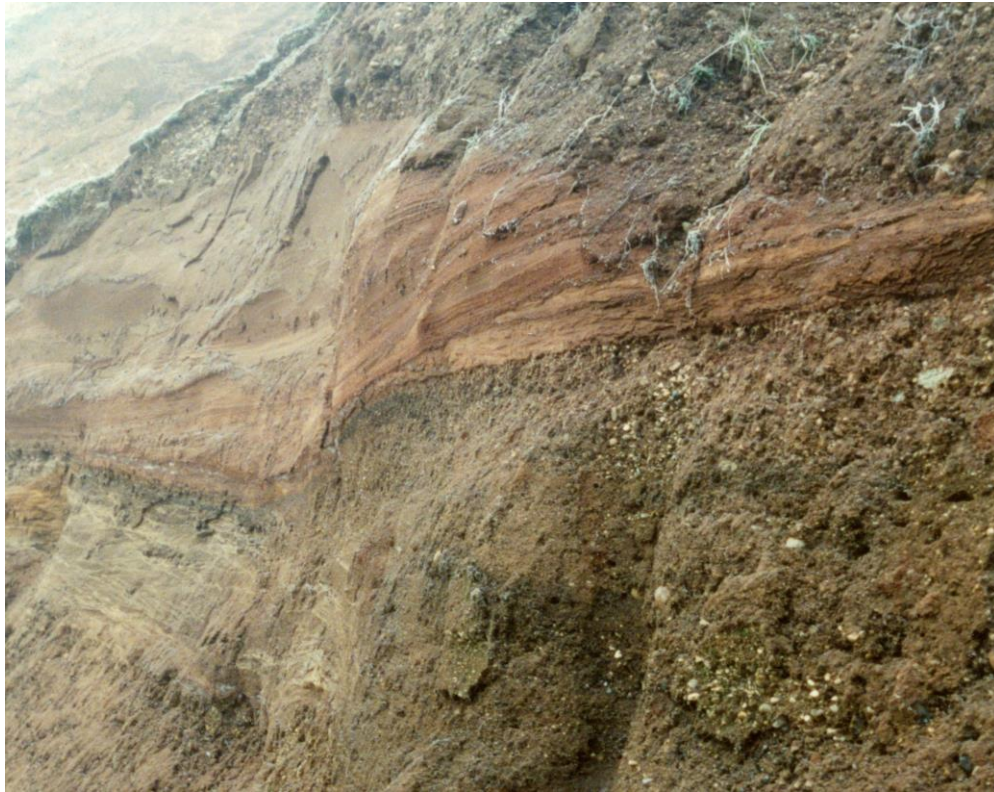


# The Wolverhampton Line - East towards Cannock

## M6 Toll and Wharf Lane Quarry - Location with BGS superficial deposits from Geology of Britain Viewer



# The Wharf Lane Quarry



This quarry face shows Devensian Brewood Till Formation Glaciofluvial deposits from close to the ice limit overlain by Brewood Till Formation Glacial till/Diamicton.

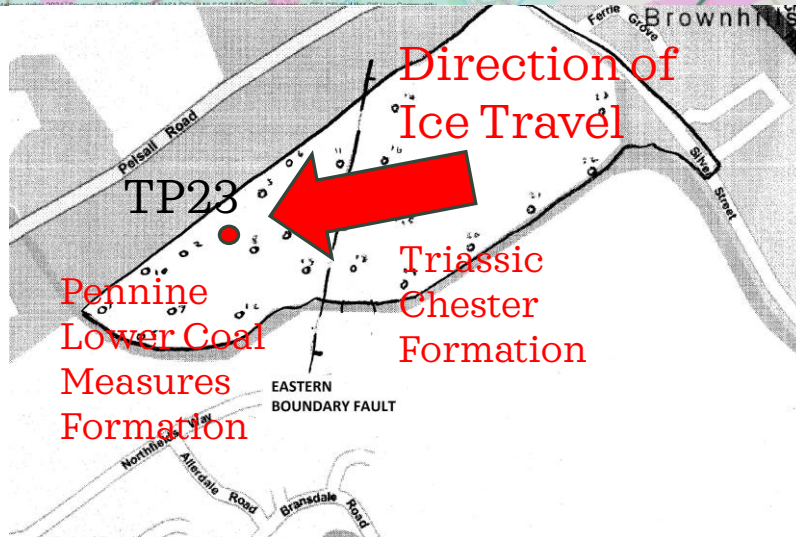
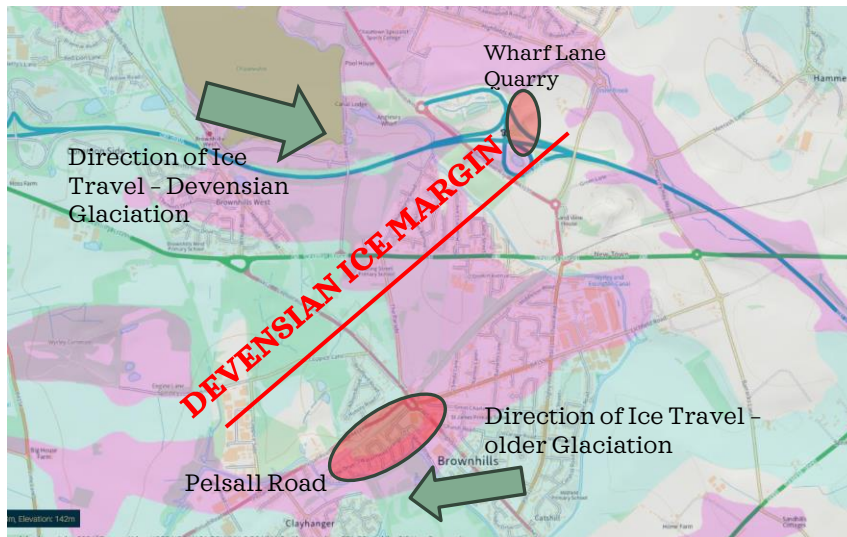
This may be a terminal moraine

This key location was destroyed when the M6 Toll was built, but a small section remains at the back of a depot north of the highway



# The Wolverhampton Line - East towards Cannock

## Data from Pelsall Road Brownhills



Data from a site in Brownhills is instructive, particularly the record from TP 23  
GL - 0.35m Topsoil  
0.35 - 1.9m Dense orange brown slightly clayey fine to coarse rounded SAND & GRAVEL with occasional cobbles. Below 1.8m becoming clayey [Glacial Sand & Gravel - Triassic derived]  
1.9 - 2.4m Stiff red brown gravelly CLAY [Glacial Till/Diamicton]

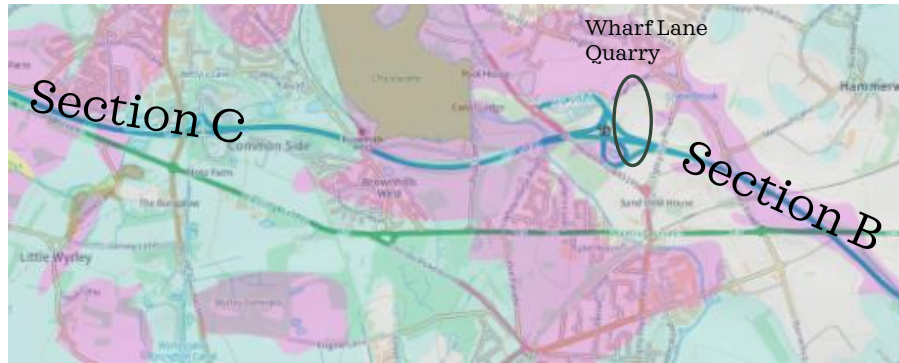
The Triassic derived till occurred at a location to the west of the eastern boundary fault, indicating derivation from the east / north east.

As the Devensian Glacier, as indicated from the M6 Toll data, advanced from the west / north west these deposits are likely to be from an earlier (Pre Devensian) glaciation.

This location appears to be south of the Devensian Ice Margin, and gives further information of the location of the Devensian Ice Margin.

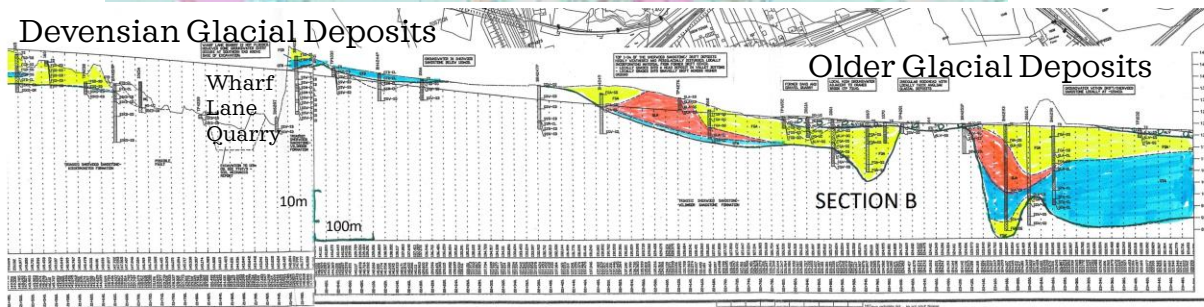
This is similar to that depicted on the BGS 1977 Map

# M6 Toll - Older Glacial Deposits



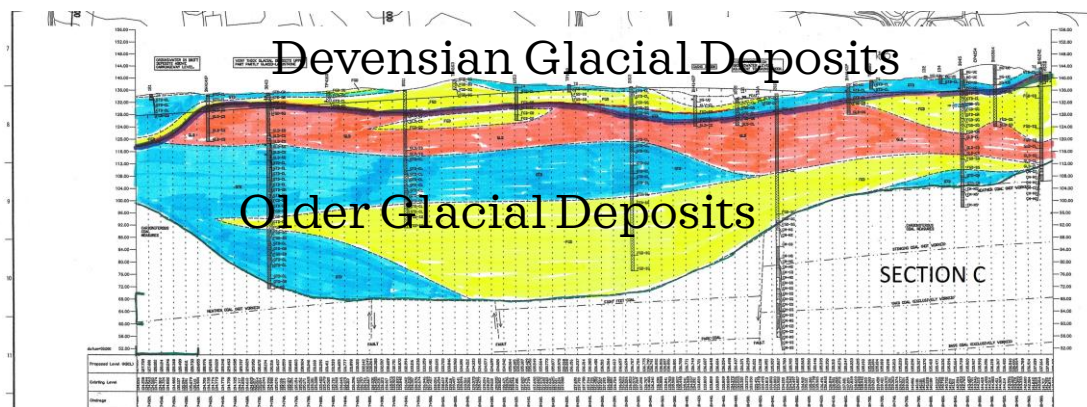
The Data from the M6 Toll indicates the occurrence of Older Glacial Deposits - probably of Wolstonian Age. They have a different character from the Devensian Deposits. The older Glacial Deposits are thicker in places, have an irregular base in places and contain deposits of a glaciolacustrine aspect (red in section), and may contain Flint.

In contrast, the relative thinness of the Devensian Glacial Deposits appears to be a feature of the Brewood Till Formation deposits north of the Wolverhampton Line.



Boreholes for the i54 site north of Wolverhampton showed a thin and in places discontinuous cover of Brewood Till Formation Glacial Deposits overlying Triassic strata.

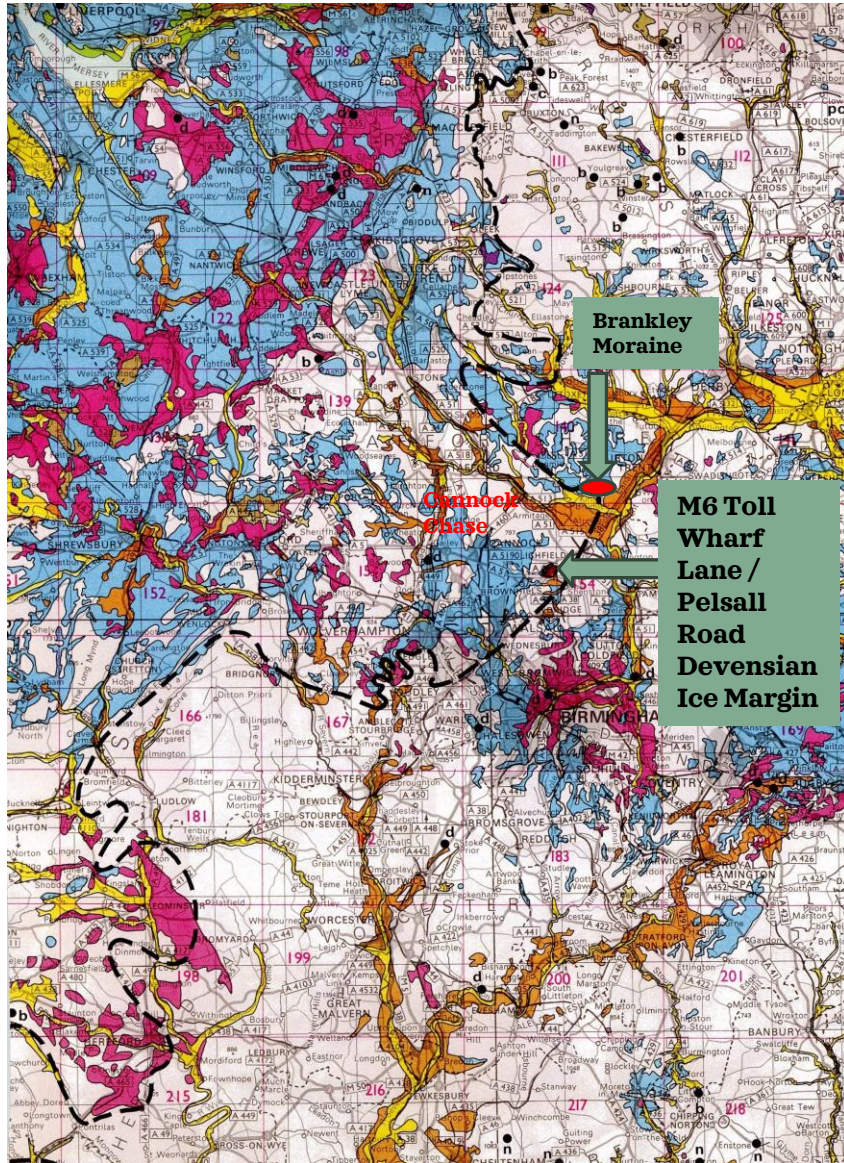
The thick Glacial Deposits to the west of Walsall are likely to be mainly of Older (Wolsonian) age with only the top 10m or so of Devensian Glacial Till Formation.



I have no data on this, but using the M6 Toll and Pelsall Road template, it might be possible to distinguish in GI data, between the two ages of glacial deposits in the area west of Walsall, however this detail might be beyond what routine GI data is able to resolve. The BGS might have a view on this from the Lichfield Sheet remapping, but this remains frustratingly unpublished (I think).



# The Wolverhampton Line - Towards the Trent Valley



The Wharf Lane location provides a link between the classically defined ‘Wolverhampton Line’ in the Black Country and the Trent Valley, as shown on the 1977 BGS map.

The BGS on the Geological Map sheet 140, suggest that the Devensian Brewwood Till Formation Ice lobe extended down the Trent Valley to the north east of Cannock Chase as far as Yoxall, as shown on the 1977 BGS map.

This is controversial, as many recent publications, including the Britice Project dispute this. However, other sources such as the remapping for the National Forest project suggest that the Brewwood Till Formation extends across much of the Needwood Forest.



# The Devensian Ice Margin in the Trent Valley

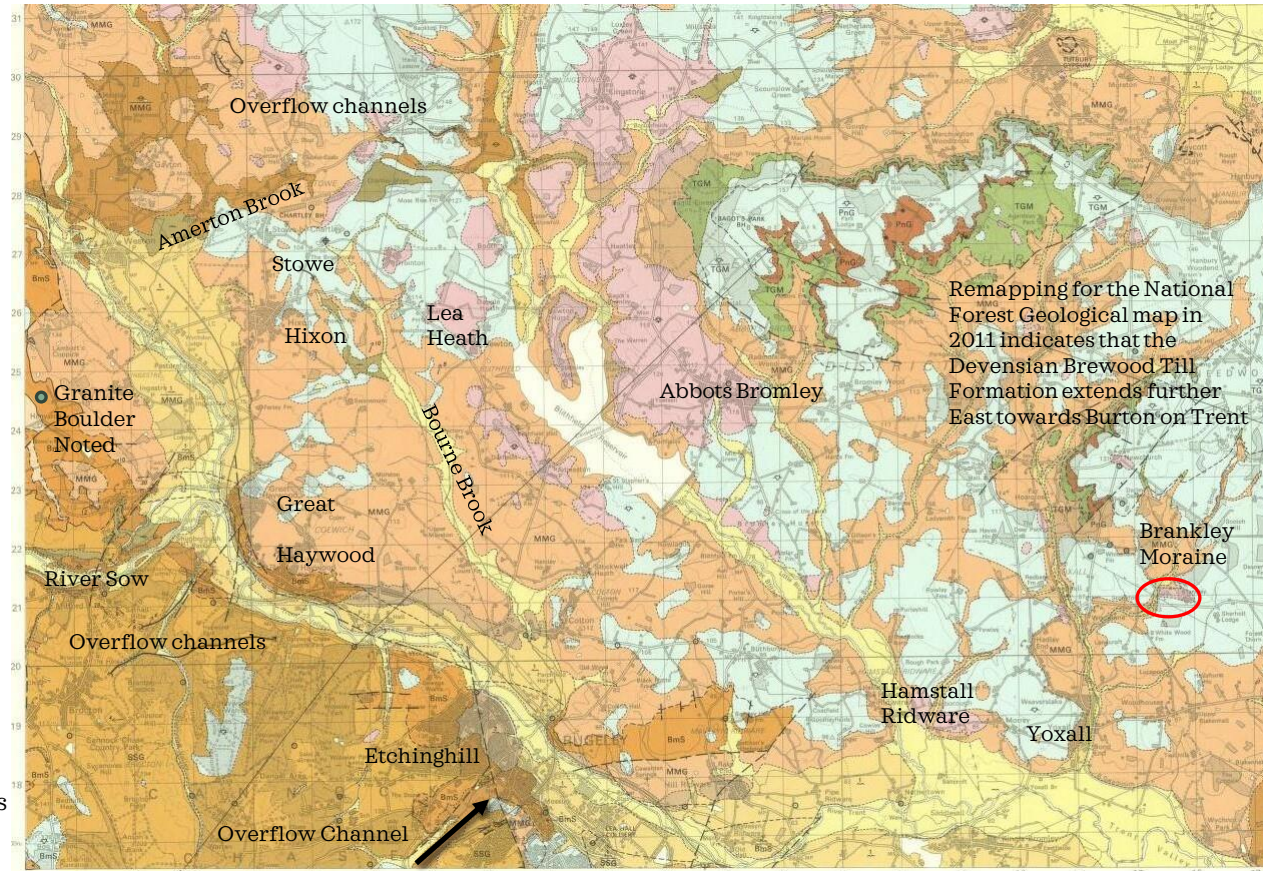
## Quotes from BGS Memoir for sheet 140

Late Irish Sea Drift- West of the great sweep of gravels at Abbots Bromley there are scattered patches of boulder clay and gravel and also of more significance a number of excellent overflow channels, which are not to be found in the area to the east. It seems certain that Irish Sea ice (Pocock 1927, Dixon 1928) banked up from the west against Cannock Chase, broke through into the area of the Trent drainage and deposited boulder clay and gravels in the ditrict around Great Haywood and Hixon. Round Hamstall Ridware and Yoxall the gravelly character of the drift, rich in quartzite pebbles, suggest that the Irish Sea ice may even even reached as far as these villages. Indeed, one of the few cases where the drift has the appearance of a moraine occurs at Brankley. [This location is used on the 1977 BGS map to define the Devensian Ice Limit and is only 8km north east of the M8 Toll limit]

### Overflow Channels.

That the Irish Sea ice penetrated into valley of the River Sow in some force is evident from the excellent series of overflow channels which cut across the northern slopes of Cannock Chase. The southernmost of this series is the conspicuous overflow channel now containing Rising Brook which starts at about 510ft at Hednesford , southwest of Rugeley and extends by way of Moors Gorse to a point about a mile and a half south west of Rugeley

Two further channels occur at the northern end of Cannock Chase. One starts just south of Oat Hill running nearly due east to Seven Springs (N W of Haywood Park, at right angles to the present direction of drainage. A little farther to the north close to the main road from Stafford to Rugeley , a similar channel runs north east into Shugborough Park

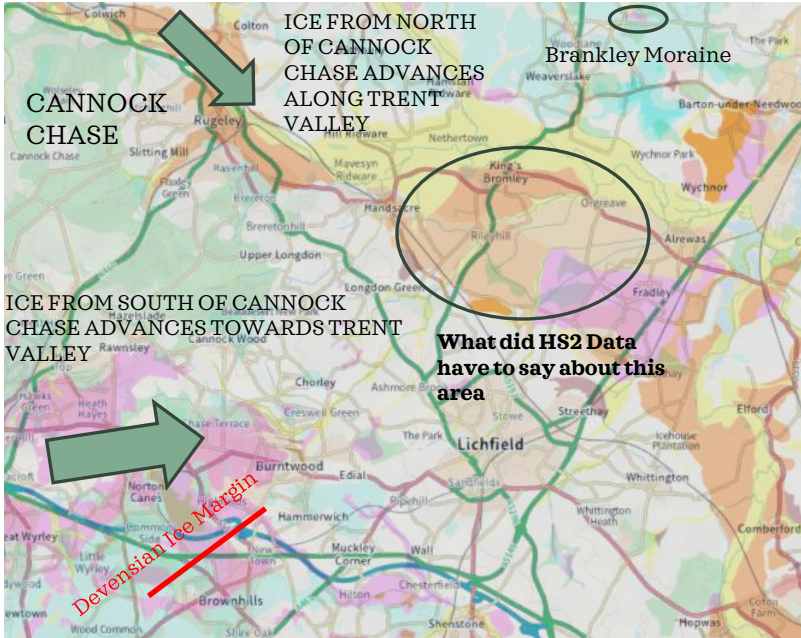


On the northern side of this lobe of ice, marginal drainage channels were developed a short distance south of Knowle Farm . Lea Heath. Small mounds on the floor of the valley running between the Trent and Bourne Brook, a mile south south east of Hixon may be of morainic origin, formed during the retreat of this ice. The presence of a mass of sand and gravel, showing an ice-contact slope, north east of Park House, west of Etchinghill shows that this ice-lobe either over-rode or flowed round the north eastern corner of Cannock Chase. A granite erratic noted by the Geological Survey is consistent with this

Between Stowe and Amerton the boulder clay descends into the Trent valley, and ice appears to have blocked the valley that now contains the Amerton Brook , causing the formation of a lake, whose waters cut two overflow channels across the watershed into the Blithe valley



# The Devensian Ice Margin in the Trent Valley

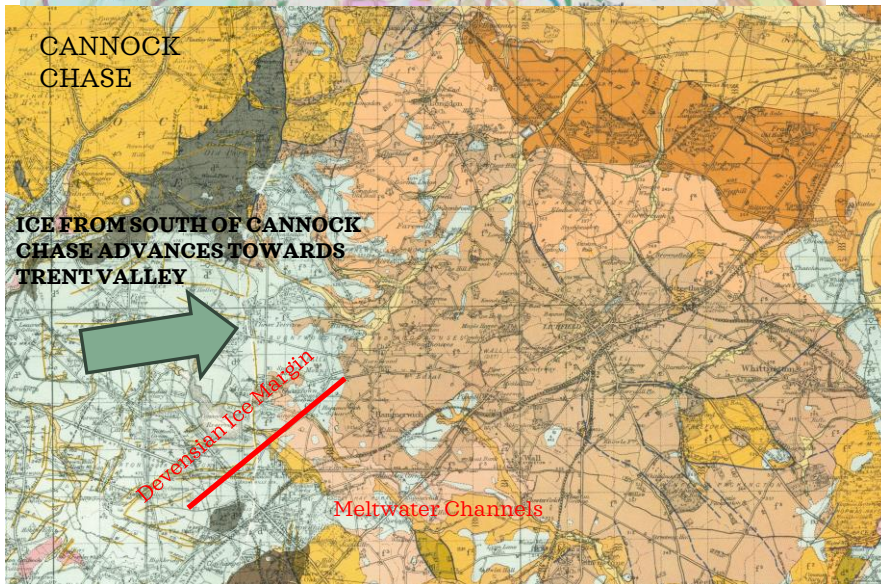


Apart from the M6 Toll /Wharf Lane location, details of the Devensian Ice Margin to the east of Cannock Chase are elusive.

The results of the recent remapping of the Lichfield Sheet would be useful to review, but this information is unpublished.

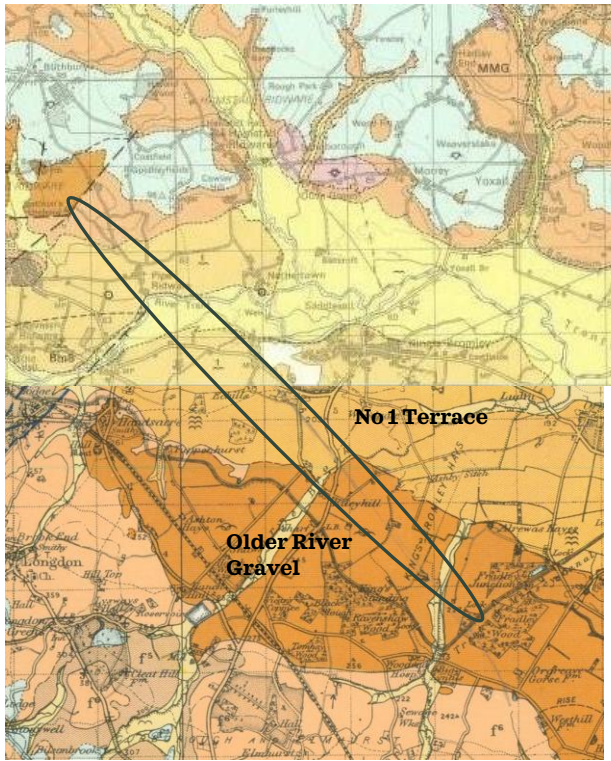
Surprisingly the extent of the Devensian Ice Sheet to the south of Cannock Chase, as demonstrated by the M6 Toll data, is more definitive on the early 20<sup>th</sup> century Geological Survey map, than is depicted on the Geology of Britain viewer, which incorporates the results of the resurvey.

The HS2 Phase 2A alignment crosses this area and should give some answers.

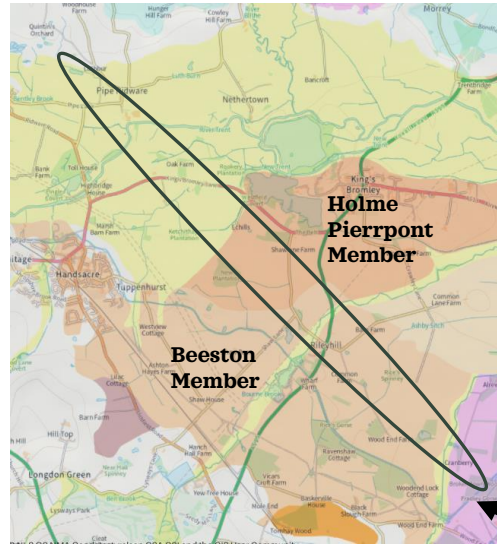


# The Devensian Ice Margin in the Trent Valley - Information from HS2 Phase 2A GI

## Setting the Scene



Information from published 1: 50 000 Geological Maps sheet 140 (1982) showing resurvey from the 1940s and sheet 154 (1971) showing resurvey information from 1910 - 1913.



Information from Geology of Britain viewer reflecting recent resurvey of sheet 154, and present day classification of the River Trent Quaternary Deposits (Trent Valley Formation) - see table to right

Old Nomenclature	Present Nomenclature	Age (generally Accepted)	Age if Wolston Formation is not <u>Anglian</u>	
	Trent Valley Formation	<u>Hemington Member</u>	Early Holocene	
		<u>Holme Pierrpont Member</u>	Devensian	
Beeston Terrace		Beeston Member	Early Devensian	Ipswichian
Hilton Terrace		<u>Egginton Common Member</u>	Late <u>Wolstonian</u>	Late <u>Wolstonian</u>
		<u>Etwell Member</u>	<u>Wolstonian</u>	
		<u>Eagle Moor Member</u>	Late Anglian	
	Wolston Formation	Anglian	<u>Wolstonian</u>	

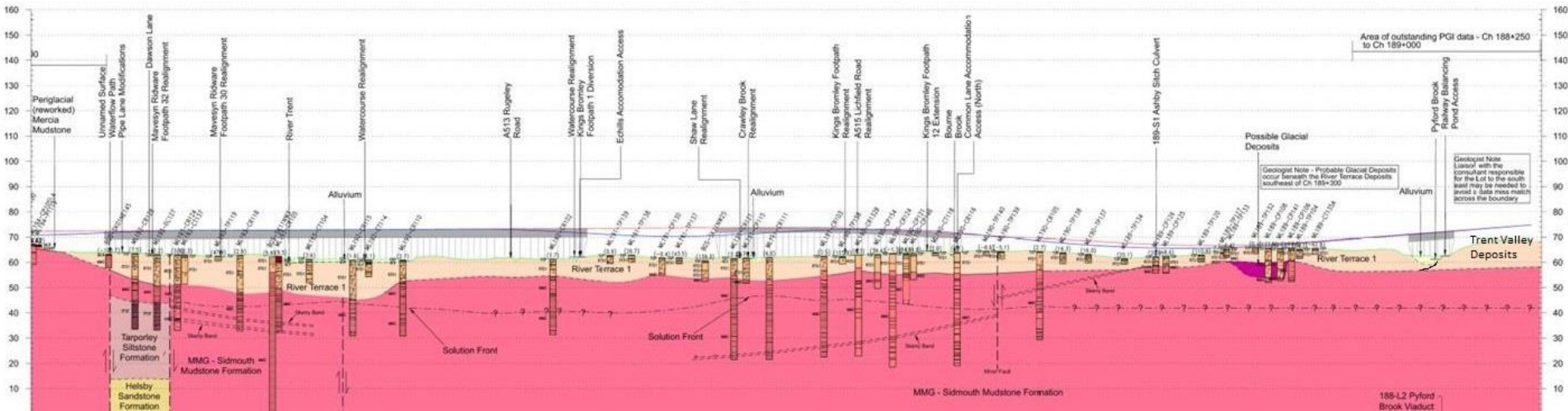
Trent Valley Formation - Glaciofluvial Sheet deposits. The Trent Valley formation member is not defined on Geology for Britain viewer.

This suggests uncertainty.

There is uncertainty on the age of the 'older' glacial deposits in the Trent Valley



# The Devensian Ice Margin in the Trent Valley - Information from HS2 Phase 2A GI



## Elevation Section Across Trent Valley from HS2 Phase 2A GI

What was actually found

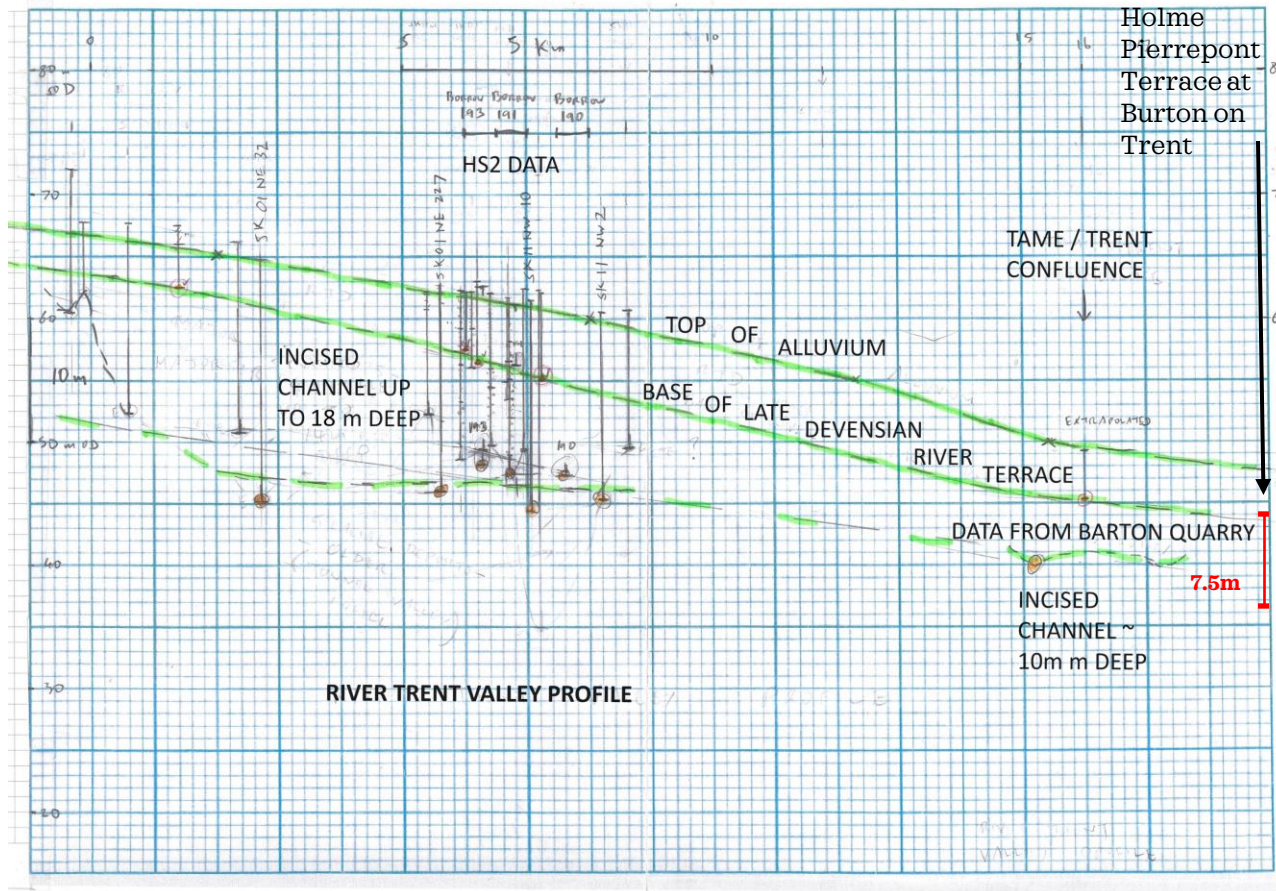
- 1) Along the HS2 corridor, a single River Terrace appeared to be present across the entire width of the valley bottom. The HS2 data Could not distinguish between the No 1 Terrace (Holme Pierrepont Member) and Older River Gravels (Beeston Member). The Beeston Member was probably not present!! However just to the south-west of the HS2 corridor a thinner and discontinuous gravelly deposit is present, just extending into the HS2 corridor where possible Glacial Deposits were noted. There are lots of uncertainties.
- 2) The Holme Pierrepont member has a narrow incised channel up to 18m deep.
- 3) The extent of the Alluvial deposits (Heminghton Member) corresponded with the older published geological maps and not the Geology for Britain viewer information.
- 4) The weathering profile in the Mercia Mudstone does not follow the base of the Holme Pierrepont Member, suggesting that this weathering profile it predates the Devensian erosion of the Trent Valley.

**There is no clear indication of an advance of Brewood formation ice across the area, from the HS2 data.**

**Some Glacial Deposits were noted but it is unclear whether these were Devensian (Brewood) or earlier.**

# The Devensian Ice Margin in the Trent Valley

Data from the HS2 GI - The Incised Channel below the Late Devensian Holme Pierrepont River Terrace Deposit.



The Incised channel is was a bit of a surprise, and could relate to the Brewood Till Formation Ice Advance into the Trent Valley.

However , in the HS2 phase 2A GI, the gravels infilling the channel could not be separated from the overlying River Terrace Deposit. This does not mean that the incision phase is not Brewood, but that the channel infilling and the lateral extension of the Late Devensian River Terrace braidplain were perhaps continuous in response to continuous sediment and meltwater input from the Ice Sea Ice Sheet to the north-west, especially during the Stockport Standstill.

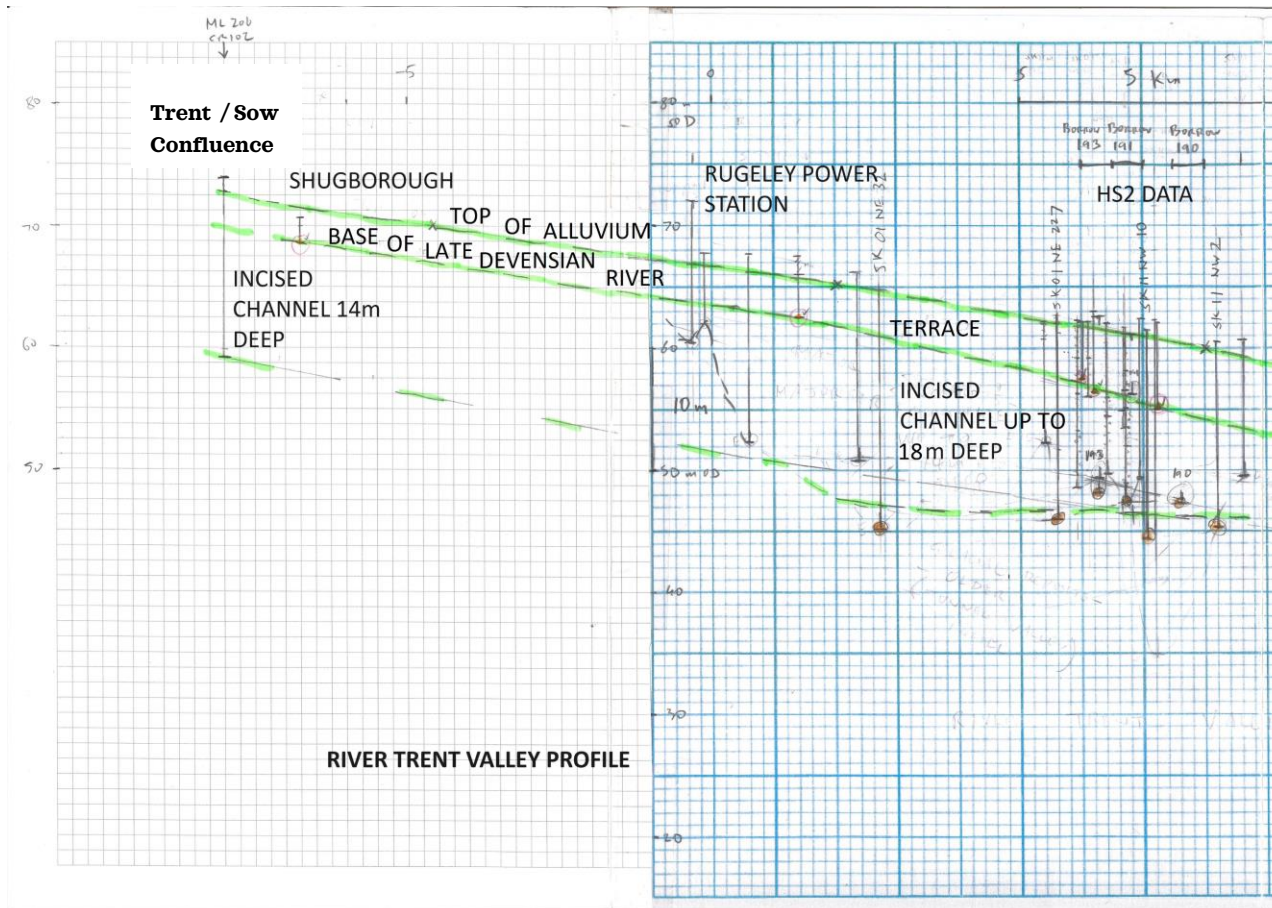
Below the Tame/Trent Confluence at Burton on Trent the Holme Pierrepont Terrace is still thick (7.5 - 8.0m) but there is no indication of an incised Devensian channel.

However, at Burton on Trent an incised channel from an earlier (Wolstonian) Glacial phase does exist (continuation of the Stretton Paleochannel), and this gravel infilled channel contributed significantly to the groundwater resource used by the Brewing Industry.



# The Devensian Ice Margin in the Trent Valley

Data from the HS2 GI - The Incised Channel below the Late Devensian River Terrace Deposit



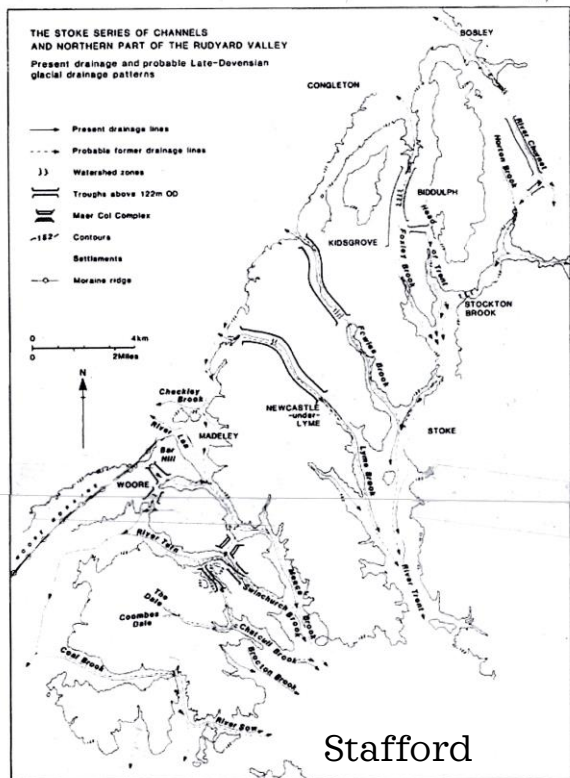
The incised channel extended to the Trent / Sow Confluence, where it was but not quite as deep as at Rugeley.

Incised Channels (Tunnel Valleys) associated with the Brewood Phase are present in the Stafford Area, but they are difficult to distinguish from the Stockport Phase, when copious meltwater crossed the area.





# The Devensian Ice Margin, Brewwood Stage, Paleochannels



Stockport Meltwater Pathways

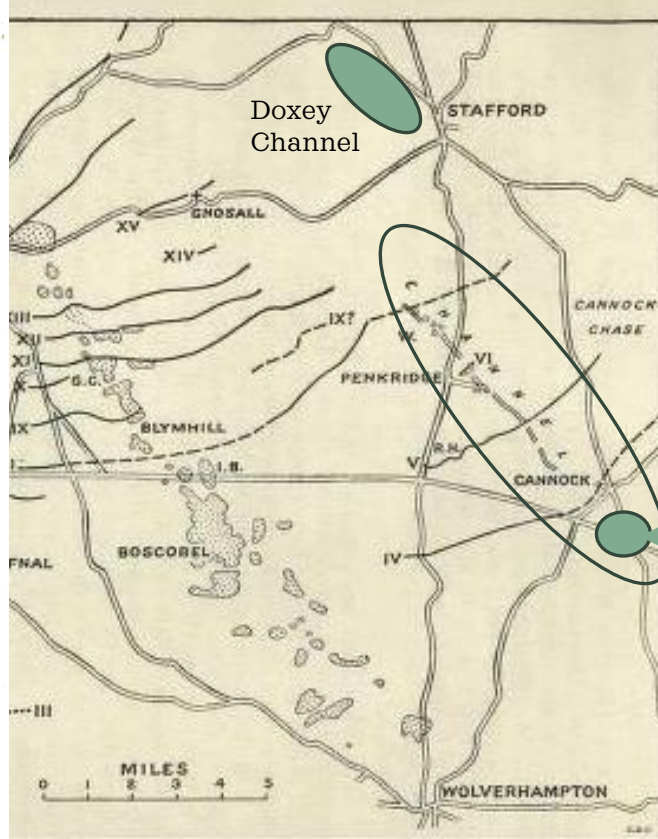


FIG. 9.—Sketch-map of Ice-stands between Wolverhampton and Newport. (The stippled areas indicate the Newport esker-chain and the Penkridge esker).

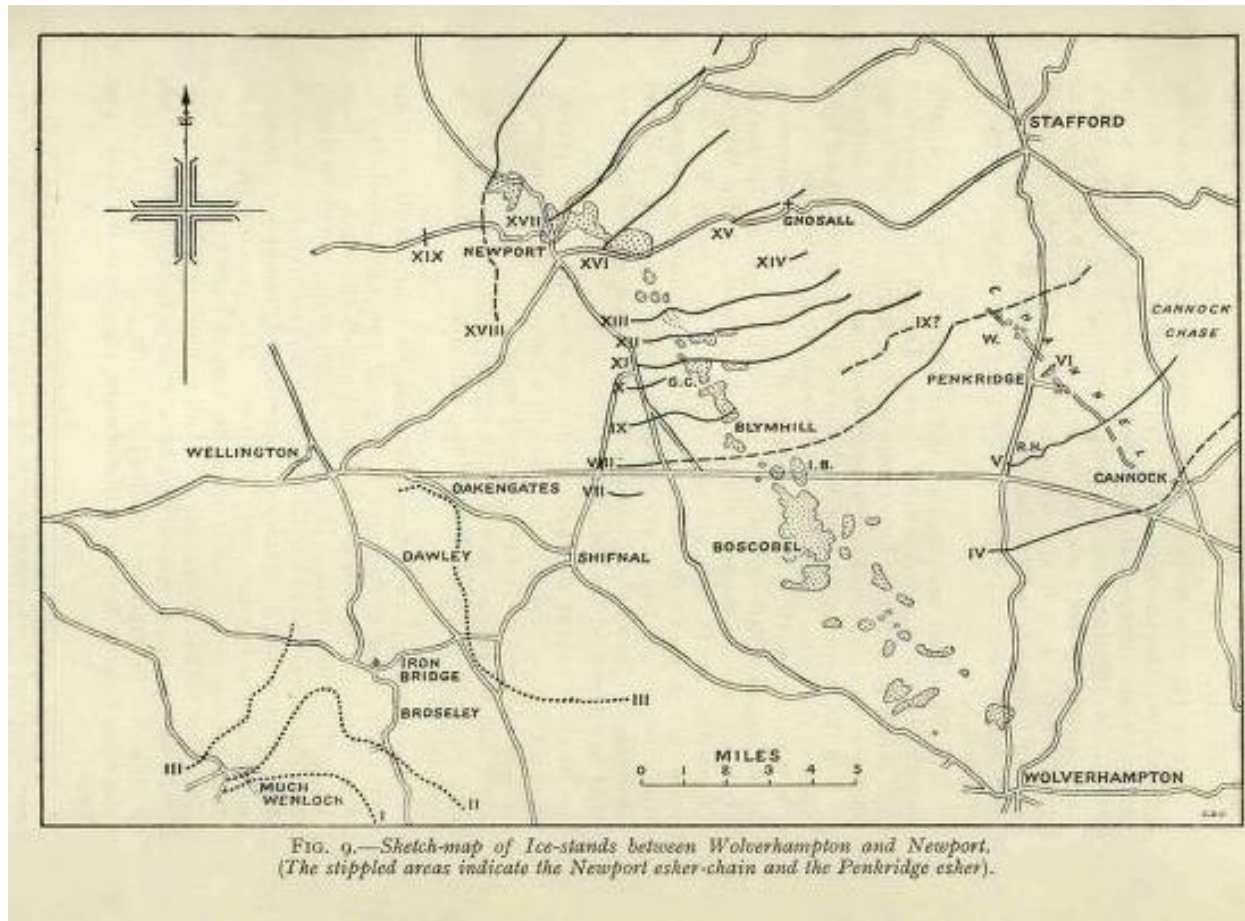
From Morgan 1973

Several Paleochannels associated with the Brewwood Phase are noted in the Stafford area. The Doxey channel was encountered by boreholes for the M6. The Channel noted by Morgan (1973) was encountered by boreholes for the M6 Toll. A further channel was noted in HS2 borehole north of Stafford. The record is complicated by ongoing meltwater discharge along these pathways during the Stockport phase. However, the Cannock Channel in the M6 Toll boreholes did not appear to have been modified during the Stockport Phase.

# The Devensian Ice Margin in the West Midlands

Why are features related to the Wolverhampton Line advance so poorly observed?

Some do exist as noted by Morgan 1973

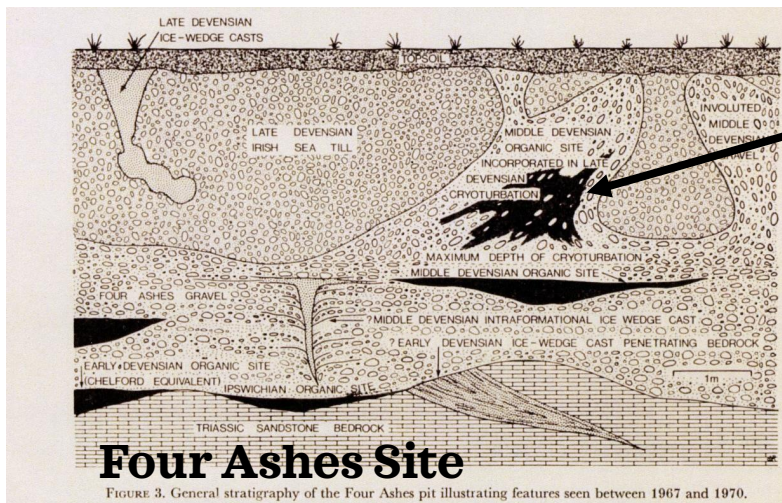




# The Devensian Ice Margin in the West Midlands

Key observations from the HS2 Phase 2A GI.

The HS2 Phase 2A GI covered an area to the east, north and northwest of Stafford, an area affected by the Brewood Phase / Wolverhampton Line ice sheet. This data showed a discontinuous and intensely periglacially disturbed covering of Devensian Glacial deposits. It is indicated that after the retreat of the Brewood Phase Glacier during the Stockport Phase when Ice still occupied the Cheshire Plain, rigorous periglacial conditions existed to the south east of the ice margin, which eroded and reworked the superficial deposits left by the Brewood Phase. This included any terminal moraine features that might have been left by the Brewood Advance., Although as noted some retreat features are present to the north west of Wolverhampton.



Periglacial reworking was noted affecting the Brewood Phase deposits at the Four Ashes site

Footnote...

HS2 data indicated intense periglacial degradation of the landscape left, after the retreat of the Stockport Glacier

# The Devensian Ice Margin in the West Midlands

## **CONCLUSIONS**

The limit of the Devensian Ice to the north east of Wolverhampton, apart from the M6 Toll Data, remains poorly defined.

Short lived lobes of Ice advanced along the Trent Valley to the north east of Cannock Chase, and to the south of Cannock Chase (M6 Toll)

The HS2 data has not clarified the matter, where the alignment corridor crossed the Trent Valley south west of Kings Bromley . There is some evidence of older glacial deposits but no clear imprint from the Brewood Phase, apart from the incised channel at the base of the Holme Pierrepont member of the Trent Valley Formation.

After the retreat of the Brewood Phase there was a prolonged period of intense periglacial degradation of the landscape and reworking of the Brewood Glacial Deposits. This appears to have degraded features related to the 'Wolverhampton Line' advance.