Natural Environment Research Council

British Geological Survey

Onshore Geology Series

TECHNICAL REPORT WA/96/45

Geology of the Lapley and Stretton area

1:10 000 sheet **SJ 81 SE**
Part of 1:50 000 sheet 153 (Wolverhampton)

E HOUGH

Geographical index
UK, South Staffordshire, Stretton, Lapley

Subject index
Geology, Coal Measures,
Triassic, Quaternary

Bibliographical reference
HOUGH, E. 1996
Geology of the Lapley and Stretton District
British Geological Survey Technical
Report WA/96/45

BRITISH GEOLOGICAL SURVEY

The full range of Survey publications is available through the Sales Desks at Keyworth and at Murchison House, Edinburgh, and in the BGS London Information Office in the Natural History Museum Earth Galleries. The adjacent bookshop stocks the more popular books for sale over the counter. Most BGS books and reports are listed in HMSO's Sectional List 45, and can be bought from HMSO and through HMSO agents and retailers. Maps are listed in the BGS Map Catalogue, and can be bought from Ordnance Survey agents as well as from BGS.

The British Geological Survey carries out the geological survey of Great Britain and Northern Ireland (the latter as an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as its basic research projects. It also undertakes programmes of British technical aid in geology in developing countries as arranged by the Overseas Development Administration.

The British Geological Survey is a component body of the Natural Environment Research Council.

Parent Body

Natural Environment Research Council
Polaris House, North Star Avenue, Swindon, Wiltshire SN2 1EU.
Telephone 01793 411500
Telex 444293 ENVRE G
Fax 01793 411501

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG.
Telephone 0115 936 3100
Telex 378173 BGSKEY G
Fax 0115 936 3200

Murchison House, West Mains Road, Edinburgh EH9 3LA.
Telephone 0131 667 1000
Telex 727343 SEISED C
Fax 0131 668 2683

London Information Office at the Natural History Museum, Earth Galleries, Exhibition Road, South Kensington, London SW7 2DE.
Telephone 0171 589 4090
Telephone 0171 938 9056/57
Fax 0171 584 8270

19 Grange Terrace, Edinburgh EH9 2LF.
Telephone 0131 667 1000
Telex 727343 SEISED C

St Just, 30 Pennsylvania Road, Exeter EX4 6BX.
Telephone 01392 78312
Fax 01392 437505

Geological Survey of Northern Ireland,
20 College Gardens, Belfast BT9 6BS.
Telephone 01232 666595
Fax 01232 662835

Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB.
Telephone 01491 38800
Telex 849365 HYDROL G
Fax 01491 25338

CONTENTS

1. INTRODUCTION

This report describes the geology of 1:10 000 sheet SJ81SE (Lapley and Stretton) which is included in 1:50 000 Geological Sheet 153 (Wolverhampton) (Figure 1). The sheet area was first geologically surveyed at the 1: 10 560 scale by E E L Dixon and R L Sherlock between 1914 and 1919 and published on Staffordshire County Series sheets 49NE, 49SE, 50NW and 50SW. The one-inch Geological Sheet 153 (Wolverhampton) was published in 1929, and the accompanying sheet memoir (Whitehead *et al.)* in 1928. The district was resurveyed by E Hough at 1:10 000 scale in 1995.

The district lies within the county of Staffordshire, close to the small market town of Penkridge. It is entirely rural, with agriculture the mainstay of the local economy. The principal river is the Penk, which drains north-eastwards across the district, and has as its main tributaries Whiston Brook, Church Eaton Brook and Horse Brook, all of which occupy minor valleys. The district is also traversed by the A5 trunk road (Watling Street) and the north-west-trending Shropshire Union Canal.

The district is underlain by Triassic rocks forming part of the sedimentary fill to the Stafford Basin. The Sherwood Sandstone Group is exposed in a fault-block in the south-east of the district. Elsewhere younger rocks of the Mercia Mudstone Group form the local bedrock.

Most of the district is covered by glacial till, typically 1-3 m thick, but varying between 0 and about 10 m. In places, this till sheet is overlain by glaciofluvial sands and gravels, which are best developed along Whiston and Longnor brooks, and along the Penk valley. Alluvium occupies some valley floors.

Reports covering contiguous 1:10 000 sheets are:-

SJ91SW (Penkridge)	D McC Bridge (*in prep.*)
SJ81SW (Weston-under-Lizard)	D McC Bridge (*in prep.*)

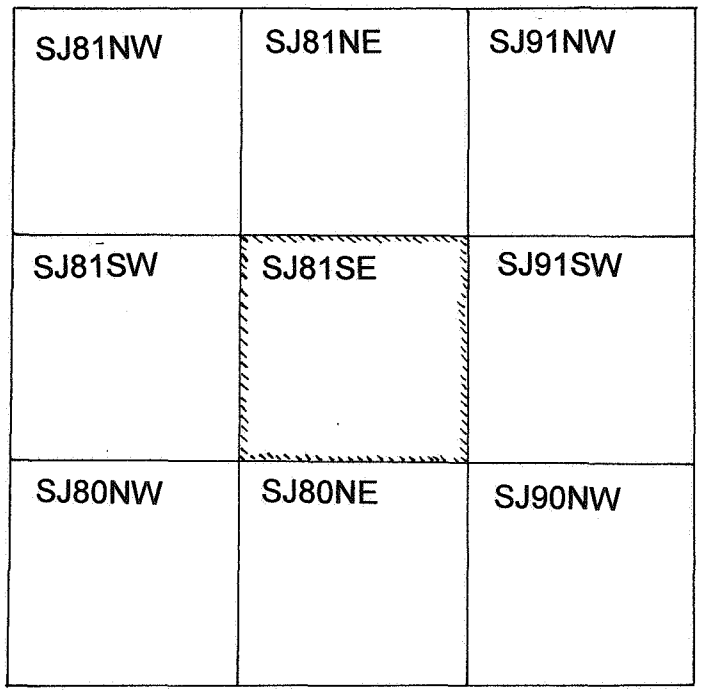

Figure 1: Location map showing district surveyed and adjoining 1: 10 000 National Grid Sheets.

2. GEOLOGICAL SEQUENCE

QUATERNARY

Alluvium

Glaciofluvial Sand and Gravel

Till

TRIASSIC

Mercia Mudstone Group

Sherwood Sandstone Group
Bromsgrove Sandstone Formation
Wildmoor Sandstone Formation
Kidderminster Formation

PERMIAN

Bridgnorth Sandstone Formation

CARBONIFEROUS

Salop Formation
Halesowen Formation
?Etruria Formation
Coal Measures
Middle Coal Measures
Lower Coal Measures

LOWER CARBONIFEROUS OR DEVONIAN

Knowledge of the pre-Triassic succession comes mainly from the NCB Stretton borehole, drilled in 1978 to a depth of 1220 m 1 km to the south-west of the village of Stretton, [8751 1041]. All depths quoted are in metres below ground level (below 108 m OD).

3. DEVONIAN OR LOWER CARBONIFEROUS

The basal 53 m of strata proved in the Stretton borehole may be divided into three units.

The lowest unit (below 1210 m) is dominated by sandstones with subordinate, poorly sorted siltstones. The sandstones are pale green to cream and are medium- to fine-grained. Poorly defined bedding is displayed in places. At a depth of 1220 m, borehole samples show a thin, clast-supported conglomerate within a sandstone.

Conformable on the lowest unit lie 18 m of green laminated mudstone. This unit exhibits wavy bedding and water-escape structures. In places, the rock is composed of an aggregate of well- cemented mudstone fragments of similar composition to the laminated strata.

An uppermost sandstone unit occurs between 1192 m and 1167 m. This unit is distinguished from the lowermost sandstone unit by the presence of mm-scale red mottles, which account for approximately 2% of the unit.

The age of these rocks remains uncertain. The upper 32 m of strata have yielded spores and a fish scale. Specimens of the spores *Florinites pumicosus* (Ibrahim) and *Rugospora* sp. were recovered from a depth range of 1208 m to 1204 m. These are common components of Namurian A and B sediments, although there is a strong possibility that they are re-worked from an older deposit (White, internal BGS comm., 1979). A poorly preserved fish scale from 1207 m is best regarded as a crossopterygian scale, the age of which could be Middle Devonian to Upper Carboniferous (White, internal BGS comm., 1979). Dipmeter readings show a change in dip (from 35° to 7°) across the junction with the overlying Coal Measures, suggesting the presence of an unconformity at this level. The absence of coalfield plant debris, and resemblance of beds to Devonian strata of the Downtonian Gornal Sandstone (White, internal BGS comm., 1979), suggests an Upper Devonian age for the unit. The balance of evidence favours an Upper Devonian age, when considered with the geophysical log evidence from the dipmeter log.

4. CARBONIFEROUS

The total thickness of Carboniferous rocks indicated by the Stretton borehole is 508 m. The Carboniferous succession is divided into the Productive Coal Measures (165 m thick; Figure 2) and an overlying sequence dominated by redbeds, referred to as the Barren Measures.

PRODUCTIVE COAL MEASURES

4.1. Lower Coal Measures

In the Stretton borehole, the Lower Coal Measures consist of 105 m of buff to grey siltstone and mudstone with rare, grey sandstone beds. The latter are locally carbonaceous and are more common towards the base of the sequence. Nine thin coals (the thickest of which, the Best Coal, is 0.51 m), are present within the sequence (Figure 2). They are distributed throughout, but occur more frequently towards the top of the unit. Plant and mussel fragments are found within the siltier and muddier lithologies above 1105 m.

4.2. Middle Coal Measures

About 47 m of Middle Coal Measures strata are proved by the Stretton borehole. The base of the unit is defined by the Vanderbeckei Marine Band, at a depth of 1062 m. The top is normally taken at the base of the incoming of redbeds of Etruria facies, or where these are absent as is partially the case in the Stretton Borehole, beneath the overlying basal sandstones of the Halesowen Formation. The unit is characterised by cyclic sequences of green-grey,

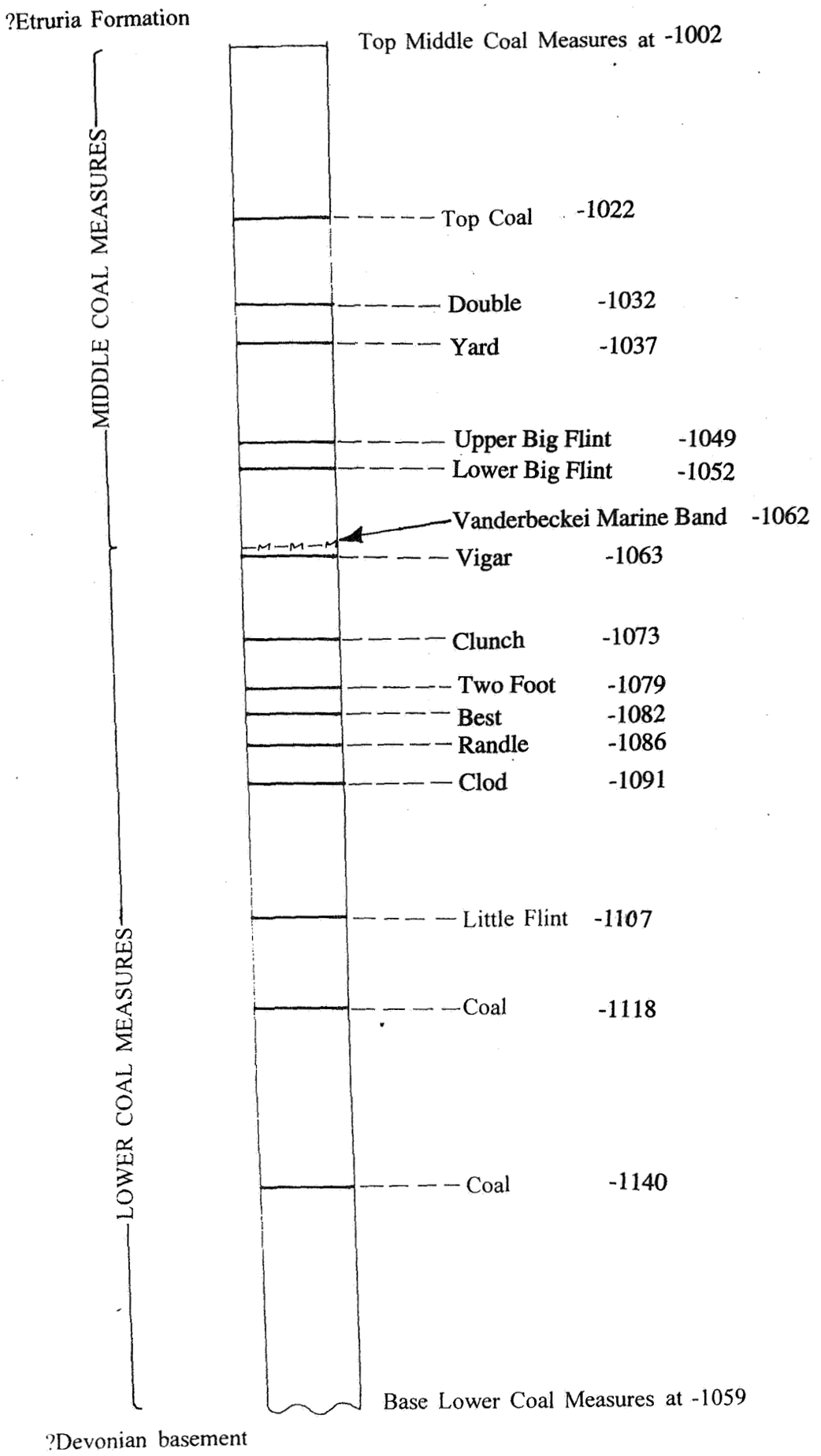

Figure 2: Positions of coals in the Stretton Borehole (SJ 38751 31041) (all depths are below ground level (108 m OD)). Scale 1: 700

fine-grained massive sandstone and siltstone, and dark grey mudstone. Five coals occur between 1048 m and 1022 m (Figure 2), the thickest being the Double seam (0.96 m thick). Marine and non-marine fossils are more abundant in the Middle Coal Measures than in the Lower Coal Measures.

BARREN MEASURES

4.3. ?Etruria Formation

Though it is uncertain whether the Etruria Formation is preserved above the Coal Measures in the Stretton borehole, it is presumed that this formation is present beneath parts of the sheet area. The characteristic lithologies are purple-grey sandstone, mudstone and conglomerate.

4.4. Halesowen Formation

The Stretton borehole proved 166 m of micaceous sandstone and red-brown-purple mudstone, lying unconformably on older Carboniferous rocks. The base of the unit is here recognised by a change in dip from between 5° and 7° in the underlying strata to 3° in the Halesowen Formation, and by the presence of a marked negative pick on the density geophysical log. The base of the formation is defined by Besley and Cleal (*in prep.*) at the first appearance of mudstones with a well ordered illite and kaolinite clay composition or at the incoming of sublitharenitic sandstones, rich in metasediment clasts. The top of the unit is defined as the top of the highest metasediment-dominated sandstone.

The unit is carbonaceous in places, with two thin coals in the lower 35 m. The lower 104 m is composed of sandstone and mudstone in fairly equal proportions, but above 912m the sequence becomes mudstone dominated (the 'Palustrine unit' of Besley and Cleal).

4.5. Salop Formation

Resting conformably on the Halesowen Formation are about 181 m of redbeds assigned to the Salop Formation. This formation is composed of brown, red and lilac, fine-grained sandstone with interbedded mudstone. A lower member (the Alveley Member) includes intraformational marl-pellet breccias and caliche-rich mudstones. This is overlain by a more arenaceous unit (the Enville Member), which is characterised by subordinate lenticular beds of conglomerate, with extraformational clasts.

5. PERMIAN

5.1. Bridgnorth Sandstone Formation

The Bridgnorth Sandstone Formation is not exposed in the district. Elsewhere in the region, the formation consists of fine- to medium-grained red-brown sandstones with thin brown mudstone partings. The formation lies unconformably on the Salop Formation and is 86 m thick in the Stretton borehole.

6. TRIASSIC

6.1. Sherwood Sandstone Group

6.1.1. Kidderminster Formation

The estimated thickness of the Kidderminster Formation, based on its geophysical signature in the Stretton borehole, is 114 m, the base being at 576 m. The formation is not exposed in the district, but in adjacent areas it comprises red to red-brown, well- to poorly-sorted sandstones. Pebbly horizons occur throughout the formation. The base is marked by a pebble conglomerate which has a distinctive low velocity signature on sonic logs. The top is transitional, and is defined in older well records at the change from pebbly to non-pebbly sandstones.

6.1.2. Wildmoor Sandstone Formation

The Wildmoor Sandstone Formation is composed of brown-red sandstones with some grey mottling. Beds are mostly fine- to medium-grained with sub-angular to sub-rounded grains. Some thin mudstone beds also occur. The Stretton borehole proved a thickness of 153 m.

6.1.3. Bromsgrove Sandstone Formation

Rocks of the Bromsgrove Sandstone Formation only crop out in the south-east corner of the district, where they form a well marked feature faulted against the Mercia Mudstone Group. The Bromsgrove Sandstone is distinguished from the Wildmoor Sandstone by the occurrence of breccias and conglomerates in the lower part, its deeper brown colour, and a greater proportion of mudstones. Deposition is thought to be cyclical (Warrington *et al*, 1980) with breccias and conglomerates becoming rarer towards the top of the formation. The formation is characterised in the Stretton borehole log by a serrated gamma log signature, which contrasts markedly with the smoother response given by the Wildmoor Sandstone Formation. Mudstone partings in the formation are picked out on the density geophysical logs by their higher readings.

East of Engleton Hall [8985 1010], the formation augers up as a chocolate coloured, medium- to fine-grained sand. The junction with the Mercia Mudstone Group is faulted along the Brewood Fault. Elsewhere, the formation has a transitional top with the overlying strata. Evidence from the Stretton borehole indicates 132 m of the formation are present beneath the Mercia Mudstone in the south of the district.

6.2. Mercia Mudstone Group

Most of the district is underlain by mudstones and subordinate sandstones of the Mercia Mudstone Group. These lithologies give rise to an essentially featureless landscape of rounded hills and valleys. Typically, exposure is limited to a metre or so of red weathered mudstone. Fresh exposures are confined to sections along Whiston Brook, and temporary exposures in recent ditches and pits. Subdivision of the group is difficult due to lack of

exposure and the absence of detailed work concerning the stratigraphy of the group in this region. However, the geophysical logs from the Stretton borehole indicate the presence of a lower sandstone-rich unit, about 70 m thick, which probably equates with the Maer Formation, defined from the northern part of the Stafford Basin by Rees and Wilson (*in prep.*). The succeeding beds are dominated by mudstone with subordinate sandstone and skerries. The latter unit which crops out throughout the sheet area, may be a correlative of the Gunthorpe Formation of the Nottingham area.

A 2.5 m section of red and green mudstone with thin calcareous sandstone beds is exposed along Whiston Brook [8856 1451]. The sandstones show evidence of loading, and are ripple-laminated with wavelengths of 1 cm and amplitudes of 1-2 mm. Ripples are asymmetric, and indicate depositional flow to the west.

South of Whiston [8932 1381], a temporary exposure in a recent clay pit shows a 0.9 m horizontally bedded fine-grained green sandstone bed within red mudstone.

7. QUATERNARY

The schematic interrelationships of drift in the district are shown in Figure 3.

7.1. Till

A widespread but generally thin till sheet (typically 1-3 m) covers most of the bedrock. A shallow borehole recorded a maximum thickness of 9.5 m at Leasowes Farm [8619 1100]; in some places (eg. north of Longnor Farm, [8705 1433]), till is absent.

Till rests directly on the Mercia Mudstone Group or Sherwood Sandstone Group, and is derived mainly from the local bedrock (Morgan, 1973). It is typically a red-brown pebbly sandy clay, but also includes pebble-free, brown-red laminated clays and more sandy or gravelly deposits with only a minor clay content. Distribution of till in the district is not topographically controlled, but extends as a sheet infilling valleys (Longnor Brook, [1423 8707]) and covering hill-tops (Beacon Hill [8970 1300]).

Seen in exposure in disused clay pits, the till is red-brown in colour (with rarer yellow and grey patches). Pebbles of rounded quartzite, re-worked from the Kidderminster Formation, are ubiquitous (Whitehead *et al*, 1928; Morgan 1973), as well as considerable numbers of 'exotics', including vein quartz, brown flints, black cherts and leuco- and mesogranites. The last two named have been assigned two distinct origins: North Wales and Ireland (Whitehead *et al*, 1928).

Cryptocrystalline silicates resembling pale green and turquoise-blue agate fragments were found between Bickford Grange and the Shropshire Union Canal. Their occurrence, predominantly along tracks, indicates a man-made rather than a glacial origin, and they are thought to be furnace slag. This assumption is supported by the vesicular appearance of some outer surfaces.

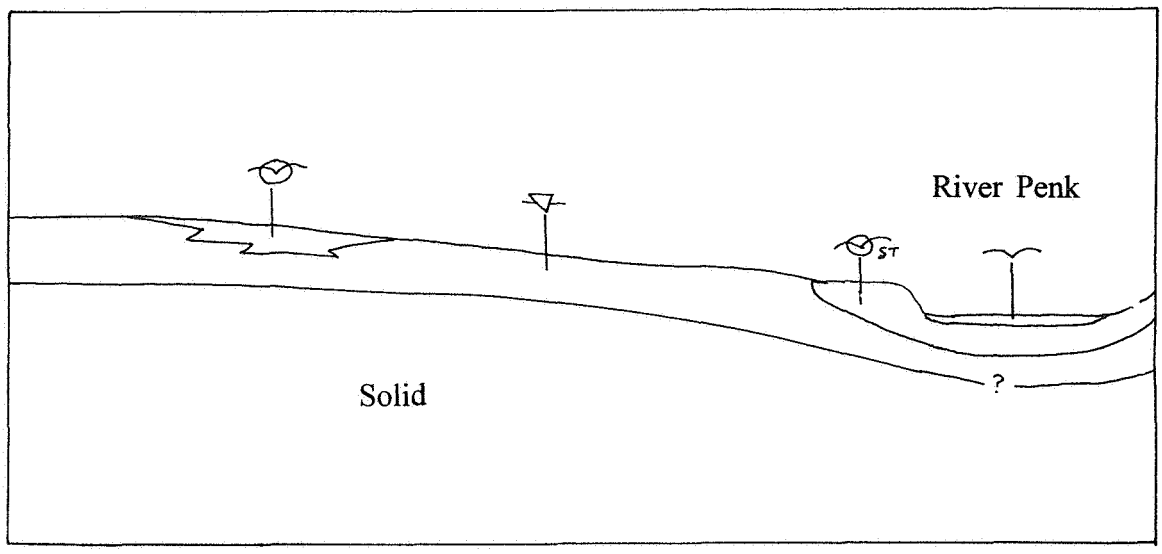

Figure 3: Schematic inter-relationships of drift deposits on sheet SJ81SE (not to scale)

Alluvium

Glaciofluvial Sand and Gravel (undifferentiated)

Glaciofluvial Sand and Gravel (Sheet Deposits)

Till

7.2. Glaciofluvial Sand and Gravel

Glaciofluvial sand and gravel deposits are found mainly along the modern alluvial valleys of the Longnor/Whiston Brook and the Penk, occurring up to 95 m AOD in the west of the district and falling to 85 m in the east. Outcrops of gravel in excess of 750 m border Whiston Brook at Bickford, with thicknesses of 5 m proved. North of Whiston Hall [8923 1449] the gravel deposits have a distinctive moundy form suggesting that they were probably deposited in close association with melting ice. Gravels along Longnor/Whiston Brook have a high sand content, with typically a yellow to orange colour, although some greener sand is also present.

Breaks in the continuity of the gravel bodies along the Longnor/Whiston Brook (to the south of Longnor Brook between [8629 1407] and [8695 1411], and to the north of Longnor Brook between [8688 1418] and [8779 1431]) are attributed to the seventh of possibly eighteen ice-margin standstills over the region (Whitehead *et al*,1928). The standstills, thought to be during the early stages of ice retreat, allowed greater volumes of gravel to be deposited in front of the ice-margin.

Along the Penk, the glaciofluvial gravels have a slightly undulatory top surface, but more closely resemble a terrace feature. The terrace flat remains at a fairly constant height of 86 m AOD. The Penk gravels attain a width of 250 m and a thickness of 6 m, and are exposed 200 m north-north-east of Stretton Mill [8982 1094]. The deposits are variable both laterally and vertically, but are matrix (sand) supported throughout. Discrete zones of 80% gravel lie adjacent to clay-rich sands with sparse gravel. Gravel clast types include a high proportion of quartzite clasts with minor quantities of limestone, vein quartz, flints (brown and grey), black cherts and igneous pebbles.

Sand and Gravel also occurs within the till sheet as featureless, ill defined patches, sometimes conspicuous by a sandy loam soil.

7.3. Alluvium

Well-formed alluvial flats exist along the Penk, Horse Brook and Church Eaton Brook, and also along part of an un-named tributary of Whiston Brook to the south of Wheaton Aston. Exposures and auger samples indicate a brown-black, organic-rich silt with intraformational sands and gravels.

8. STRUCTURE

The Mercia Mudstone Group and Sherwood Sandstone Group together form part of the sedimentary fill to the South Staffordshire Basin, whose depocentre lies to the north of the sheet area. The Brewood Fault, which cuts the south-east corner of the district, is a basin margin extensional fault, separating the Stafford Basin from the Heath Farm Block, composed of older Triassic strata (Smith, internal BGS comm.,1996).

A seismic survey, carried out by Shell UK in 1984, showed a series of north-east and north-west trending faults transect the district at depth. Most faults plot within the outcrop the

Mercia Mudstone. Stratal dips of up to 10° to the north (recorded by Whitehead *et al*, 1928, at [8848 1087]) suggest at least some of the faults come to crop, although there is no contemporary field evidence to back this up, and it is assumed most terminate at lower levels within the Triassic. The Brewood Fault, trending north-east, forms a steep bank where rocks of the Mercia Mudstone Group are thrown against the Bromsgrove Sandstone Formation. Throw on this fault in the district is estimated to be at least 60 m, down to the north-west.

9. ECONOMIC GEOLOGY

9.1. Coal

None of the coal seams proved at depth have been worked in the district.

9.2. Brick clay

Brick clay pits and shallow workings are common over the whole district. Although none is worked presently for clay, many disused pits (and some specially dug or over-deepened pits) are used to accommodate game birds.

Up until the early twentieth century, clay was extracted from the Mercia Mudstone Group and overlying till to manufacture bricks, floor and roofing tiles, drainpipes and coping (R L Sherlock, 1915).

Clay was presumably used in the 1830s to line the Shropshire Union Canal; The Pool at Stretton is also lined.

9.3. Sand and Gravel

The extensive sand and gravel deposits along Whiston/Longnor Brook are fairly well washed, and heterogeneous. They are used locally for concrete and shallow foundations of small buildings. Their location close to well established routes of transport make them the district's main economic resource. Areas of gravel are currently being considered for licensing and extraction.

10. MAN-MADE DEPOSITS

10.1. Made Ground

Most of the areas mapped as Made Ground in the district are canal and reservoir embankments. A heap of spoil from a recent clay pit is also present at [8932 1381]. The largest Made Ground deposits by volume are those along the Shropshire Union Canal, locally known as the Lapley and Stretton Spoil Banks. Spoil mounds up to 3.5 m high flank canal banks, and consist of Mercia Mudstone and till dug during construction of the canal. Belvide Reservoir, in the south of the district, is part impounded by an embankment of Mercia Mudstone up to about 6 m high along the eastern margin of the reservoir.

10.2. Made Ground and Worked Ground

Approximately 3 hectares of Made and Worked Ground are present in the district. The majority of this occurs at Bickford [8826 1421] where three ponds have been constructed for recreational fishing.

10.3. Disturbed Ground

Two areas of disturbed ground have been mapped:

- A Roman villa site [8953 1019] west of Engleton Hall.

- A series of earthworks [8723 1301] north of Lapley Manor, of unknown age.

11. REFERENCES

BESLEY, B M, and CLEAL, C J. *In prep.* Upper Carboniferous lithostratigraphy of the West Midlands (UK), revised in the light of borehole geophysical logs.

MORGAN, A V. 1973. The Pleistocene geology of the area north and west of Wolverhampton, Staffordshire, England. *Philosophical Transactions of the Royal Society of London*, B, Vol. 265, 233-297.

REES, J G, and WILSON, A A. *In prep.* Geology of the country around Stoke. *Memoir of the British Geological Survey*, Sheet 123 (England and Wales).

SHERLOCK, R L. 1915. 1: 10 560 BGS fieldslip 13245 (Staffordshire county sheet 50 W, part).

WARRINGTON, G, and eight others. 1980. A correlation of Triassic Rocks in the British Isles. *Special Report of the Geological Society of London*, No.13.

WHITEHEAD, T H, ROBERTSON, T, POCOCK, R W and DIXON, E E L. 1928. The country between Wolverhampton and Oakengates. *Memoir of the Geological Survey of Great Britain*, Sheet 153 (England and Wales).