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British Geological Survey

TECHNICAL REPORT WA/97/83

Geology of the Brewood area

1:10 000 sheet **SJ 80 NE**
Part of 1:50 000 sheet 153 (Wolverhampton)

E HOUGH

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1. INTRODUCTION

This report describes the geology of 1:10 000 sheet SJ 80 NE (Brewood) which is included in 1:50 000 Geological Sheet 153 (Wolverhampton) (Figure 1). The sheet area (hereafter referred to as the 'district') was first geologically surveyed at the 1:10 560 scale by H. Dewey, E. E. L. Dixon and R. L. Sherlock between 1915 and 1921, and published on Staffordshire County Series sheets 49SE, 50SW, 55NE, 55SE, 56NW and 56SW. The one-inch Geological Sheet 153 (Wolverhampton) was published in 1929, and the accompanying sheet memoir (Whitehead *et al.*) dates from 1928. The district was resurveyed by E. Hough at the 1:10 000 scale in 1997.

The district lies within South Staffordshire, with the small town of Brewood the main centre of population. The countryside around Brewood is rural, and largely given over to agriculture. The east-west-trending M54, which is the principal road between the West Midlands and Shropshire, traverses part of the south of the district. The River Penk flows northwards along a shallow valley across the south-eastern and north-eastern corners of the district. The Shropshire Union Canal flows from Shut Green in the north of the district to The Hattons in the south.

The district is underlain by Triassic rocks forming part of the sedimentary fill to the Stafford Basin. The Brewood Fault, one of the major basin-bounding faults at the eastern margin of the Stafford Basin, trends north-eastwards across the district. This fault throws the Bromsgrove Sandstone Formation against the siltstones and claystones of the Mercia Mudstone Group.

Much of the district is covered by a mantle of glacial deposits. Till, which is widespread, is typically less than 5 m thick. A series of kames and irregular low mounds of Glacial Sand and Gravel, which are thickest at Brewood, locally overlie the Till, and form part of the southern extension of the so called 'Newport Esker Chain' (Whitehead *et al.* 1928). Glaciofluvial Sheet Deposits form low terraces along much of the Penk.

All National Grid references in this report lie within 100 km grid square SJ, and are given as eight figure numbers with square brackets. All borehole depths are given in metres below ground level.

Reports covering contiguous 1:10 000 sheets are:-

			BGS Technical report no.
SJ81SE	(Lapley and Stretton)	E. Hough	WA/96/45
SJ90NW	(Geology of the district between Wolverhampton and Penkridge)	D. McC Bridge	WA/96/82
SJ80SE	(Codsall)	R. S. Lawley	WA/93/105
SJ80NW	(Bishop's Wood)	D. McC Bridge	WA/97/26

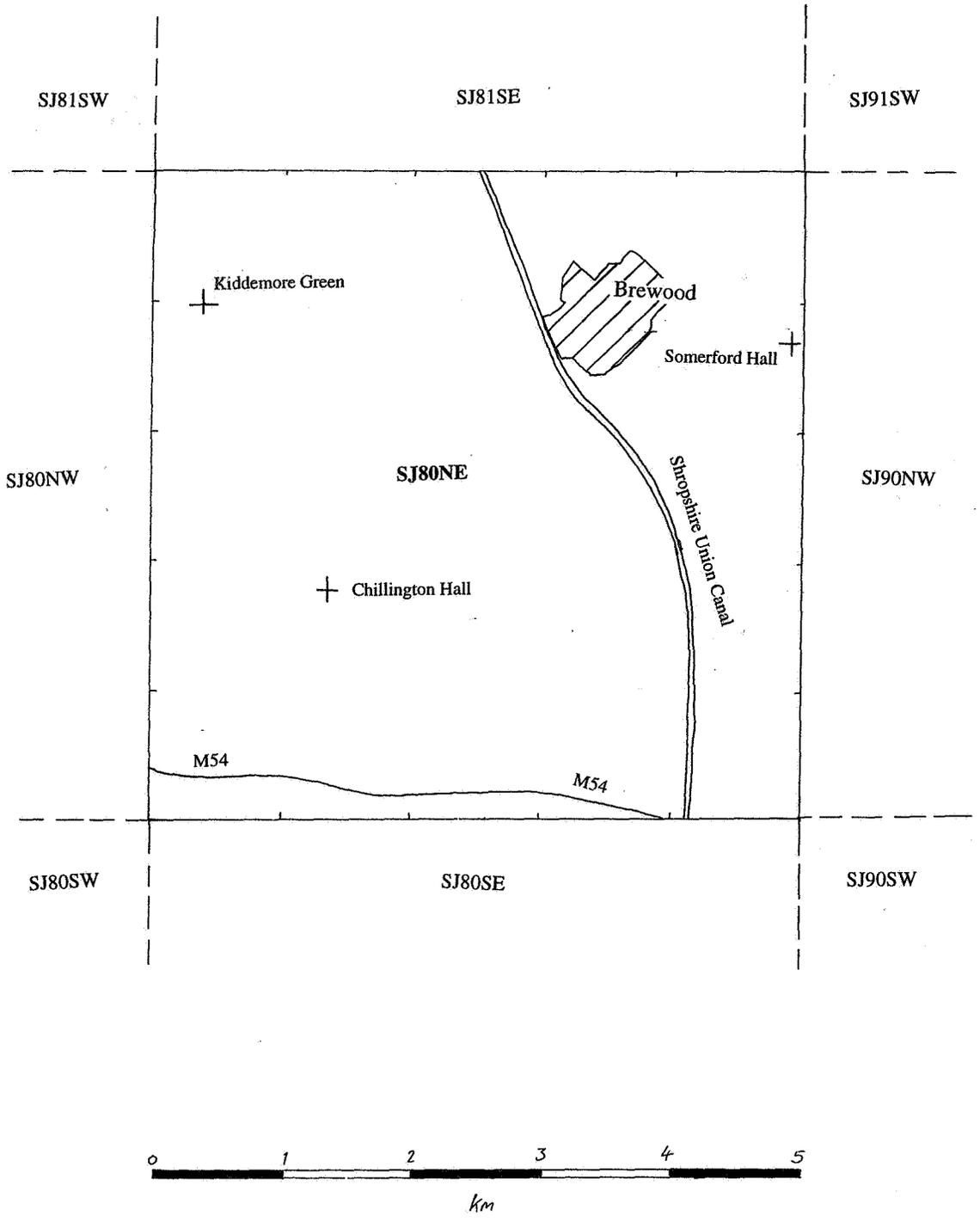


Figure 1: Location map of the district surveyed and adjoining 1:10 000 National Grid Sheets.

2. GEOLOGICAL SEQUENCE proved in the district

The Mercia Mudstone Group and beds in the upper part of the Bromsgrove Sandstone Formation crop out at surface. Older strata down to the Kidderminster Formation are proved by Somerford No. 1 Borehole, and strata down to the Wildmoor Sandstone Formation are proved by Somerford No. 2 Borehole; both boreholes were drilled at the Pumping Station at Somerford [8964 0933].

QUATERNARY (not necessarily in order of superposition)

Head

Alluvium

Glaciofluvial Sheet Deposits

Glaciofluvial Sand and Gravel

Till

TRIASSIC

Mercia Mudstone Group

Sherwood Sandstone Group
- Bromsgrove Sandstone Formation
- Wildmoor Sandstone Formation
- Kidderminster Formation

3. TRIASSIC

Strata of Triassic age underlie the entire district. The south and east of the district is underlain by the Bromsgrove Sandstone Formation, which is thrown against the Mercia Mudstone Group along the north-east striking Brewood Fault. This fault can be traced from Leper House in the south, to the north-eastern corner of the district. Age ranges for groups and formations are for lithologically correlatible units in adjacent areas.

3.1. Sherwood Sandstone Group

3.1.1 Kidderminster Formation (formerly 'Bunter Pebble Beds') Induan - ?Olenekian Stage

The Kidderminster Formation does not crop out within the district, but its presence at depth has been inferred from descriptions of water well core from Somerford No. 1 Borehole, the basal part of which is shown graphically in Figure 2.

Beds assigned to the Kidderminster Formation consist of red, grey and brown sandstones and pebbly

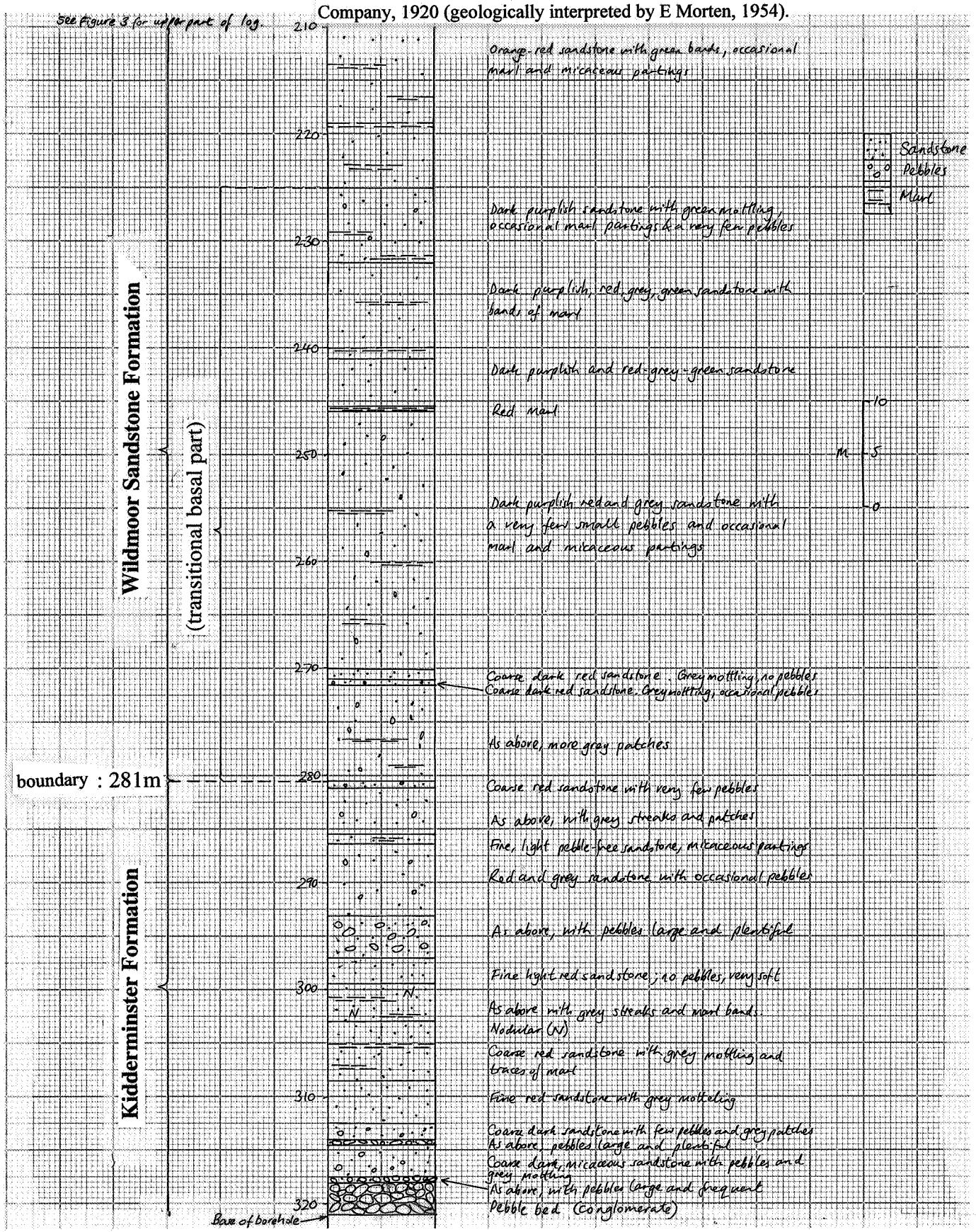


Figure 2: Graphic log of the basal part of Somerford No. 1 Borehole (SJ80NE 1a) [8964 0933]

sandstones with some thin marl and micaceous partings. Towards the base of the borehole, three conglomerate layers are present, at 314 m, 317 m and from 318 - 321 m. The top of the formation is transitional, grading into the Wildmoor Sandstone Formation as pebbles become less common. In Somerford No. 1 Borehole, the top has been taken at the point where pebbles become noticeably fewer in number, at 281 m, thus giving a proven unbottomed thickness of 40 m for the formation. The NCB Stretton Borehole, drilled approximately 500 m to the north of the district proved the total thickness of the formation, estimated from the geophysical log response, as 114 m (Hough, 1996).

The Kidderminster Formation has been interpreted as a series of stacked fluvial or sheetflood events (Warrington, 1980) within a braided river setting (Steel and Thompson, 1983).

3.1.2. Wildmoor Sandstone Formation (formerly 'Upper Mottled Sandstone') ?Induan - Olenekian Stage

The written logs for both of the Somerford Boreholes are of a poor descriptive quality. They do, however, allow the formation to be divided into a lower, pebbly, transitional part and an upper, pebble-free part.

Transitional Part

The basal, slightly pebbly part of the formation, is 55.4 m thick in Somerford No. 1 Borehole, and is composed of dark purplish red and grey sandstones with 'a very few pebbles' (Figure 2). The lower part of Somerford No. 2 Borehole proved 2.2 m of 'red and grey calcareous sandstone with small pebbles' resting on 8.5 m of pebble free calcareous sandstone. When compared to the provings from Somerford No. 1 Borehole, it is most likely that Somerford No. 2 bottoms out in the lower, transitional part of the Wildmoor Sandstone, and does not penetrate the Kidderminster Formation.

Strata above the Transitional Part

Pebble-free Wildmoor Sandstone is described in borehole logs from Somerford Nos. 1 and 2 Boreholes as a soft red-grey or orange-green silty sandstone with subordinate harder grey calcareous sandstone beds. Pebbles are not recorded in either borehole within strata above the transitional part. Somerford No. 1 Borehole proves 91.2 m of pebble free Wildmoor Sandstone, and Somerford No. 2 Borehole between 96.6 and 98.8 m.

In all, 146.6 m of the formation are proved by Somerford No. 1. This is slightly less than the provings from the Stretton Borehole, where 153 m of the formation is indicated by geophysical logs (Hough, 1996).

The logs from Somerford describe facies typical of the formation. The environment of deposition is consistent with a transitional setting between braided and low sinuosity fluvial (Hough, 1998). The marl bands noted in logs would be the result of local ponding of water in lakes and channels; an absence of desiccation features shows these were probably perennial features in the basin, although their limited thicknesses indicate they were fairly short lived.

3.1.3. Bromsgrove Sandstone Formation (formerly 'Lower Keuper Sandstone') Anisian Stage

The Bromsgrove Sandstone Formation comes to crop in the north and east of the district, east of the Brewood Fault. West of the Brewood Fault, the formation is present under a cover of about 150 m of mudstones and siltstones belonging to the Mercia Mudstone Group. The formation is composed of brown and green fine- to coarse-grained trough cross-bedded sandstones with subordinate reddish-brown siltstone and claystone beds. The sandstones are pebbly in part, and commonly micaceous. The base of the formation is not exposed in the district (but proved by boreholes); further to the east it is disconformable on the Wildmoor Sandstone Formation.

Somerford No. 1 Borehole proved 134.1 m of the formation (Figure 3). The borehole log shows the Bromsgrove Sandstone is dominated by coarse red sandstone, in units up to 11.2 m thick, interspersed with thinner siltstone ('marl') and sandy siltstone partings. The base of a 4.5 m 'red sandy marl' unit, at a depth of 9.75 m (80 m above OD), was taken previously as the base of the Mercia Mudstone Group (Whitehead *et al.* 1928). Regional mapping suggests the upper part of the borehole is more likely to be within siltier beds of the Bromsgrove Sandstone Formation; the position of the borehole, 250 m east of the Brewood Fault, and 12 m below a major sandstone feature, supports this conclusion.

Somerford No. 2 Borehole proved 136.6 m of red and grey sandstone and pebbly sandstone, with marl and sandy marl partings. In general, pebbly sandstones occur towards the base of the sequence, and marl is commoner, in thicker beds up to 4.9 m thick, towards the top. The unit previously taken as the base of the Mercia Mudstone Group by Whitehead *et al.* (1928) in Somerford No. 1 Borehole is identifiable as a 'red shaley marl' from 3.8 m to 7.6 m in Somerford No. 2 Borehole. Sub vertical gypsum veins within 'hard red sandstone' are noted between 11.4 and 12.3 m. Gypsum is also noted between 7.6 m and 7.9 m. Comparisons can be drawn with the Stretton Borehole [SJ81SE 13] which proved a full thickness for the formation of 132 m. This suggests a slight thickening of the formation occurs southwards.

Exposures are limited within the district. Less than a metre of flat-lying, brown, fine-grained sandstone crops out in a drainage trench 350 m south of Brewood Road [8979 0733]. The beds exhibit current-bedding, and some bedding surfaces show poorly preserved ripples, the axes of which trend broadly east-west. A roadside exposure 80 m south of Straasfield House (formerly 'Stone' House), referred to by Whitehead *et al.* (1928) [8966 0770], consists of 0.3 m of dark brown, fine-grained micaceous sandstone.

The Bromsgrove Sandstone was deposited within a gently subsiding basin, in a semi-arid fluvial environment (Wills, 1970). The major pebbly sandstones, commoner in the lower part, formed in low sinuosity (?braided) channels (Warrington, 1970). The fine-grained sandstone and mudstone units more dominant within the upper part were deposited in channels of a higher sinuosity and lower flow, and have been interpreted as overbank and channel plug facies (Warrington, 1970).

3.2. Mercia Mudstone Group (undivided) (formerly 'Keuper Marl') Ladinian - ?Carnian Stage

This group consists of reddish-brown blocky siltstone and claystone with thin green and grey fine-grained sandstone beds. The Mercia Mudstone underlies the north and western parts of the district,

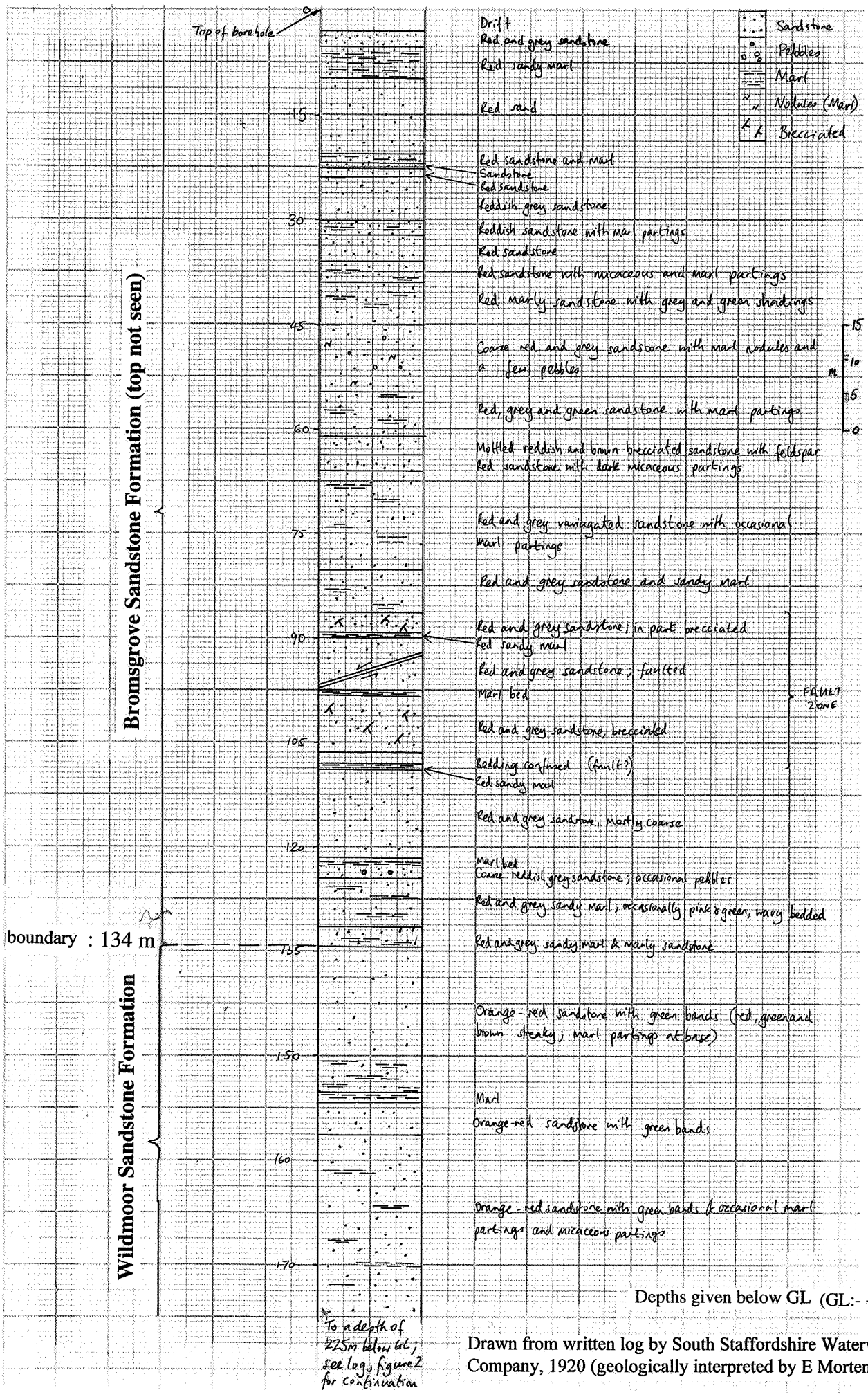


Figure 3: Log of the upper part of Somerford No. 1 Borehole (SJ80NE 1a) [8964 0933]

south-west of the Brewood Fault. The group gives rise to a gently undulating topography, ranging between 92 m AOD at the Penk to 145 m at Coldham. Exposures within the district are rare; auguring typically proves stiff red mudstone with sporadic fragments of pale greyish-green, fine-grained sandstone.

Slabs of fine grained sandstone and siltstone from a quarry to the east of Brewood, now infilled [8876 0872] were described by Hull in 1869. He noted the presence of sand-infilled mudcracks, ripple marks, worm burrows and tracks, and footprints of the dinosaur 'Labyrinthodon'. The dinosaur footprints were also discussed by Beasley (1898). Mudcracks indicate the sediment was sometimes subject to aerial exposure, and the presence of worm burrows indicate periods of high moisture content or water saturation of the sediment.

The base of the group is not exposed, or proved by boreholes within the district. Further to the east, it is conformable on the Bromsgrove Sandstone Formation, with which it is transitional. Logs from the Stretton borehole prove up to 172 m of Mercia Mudstone rest on the Sherwood Sandstone Group.

4. QUATERNARY

The schematic inter-relationships of the drift in the district are shown in Figure 4.

4.1. Till

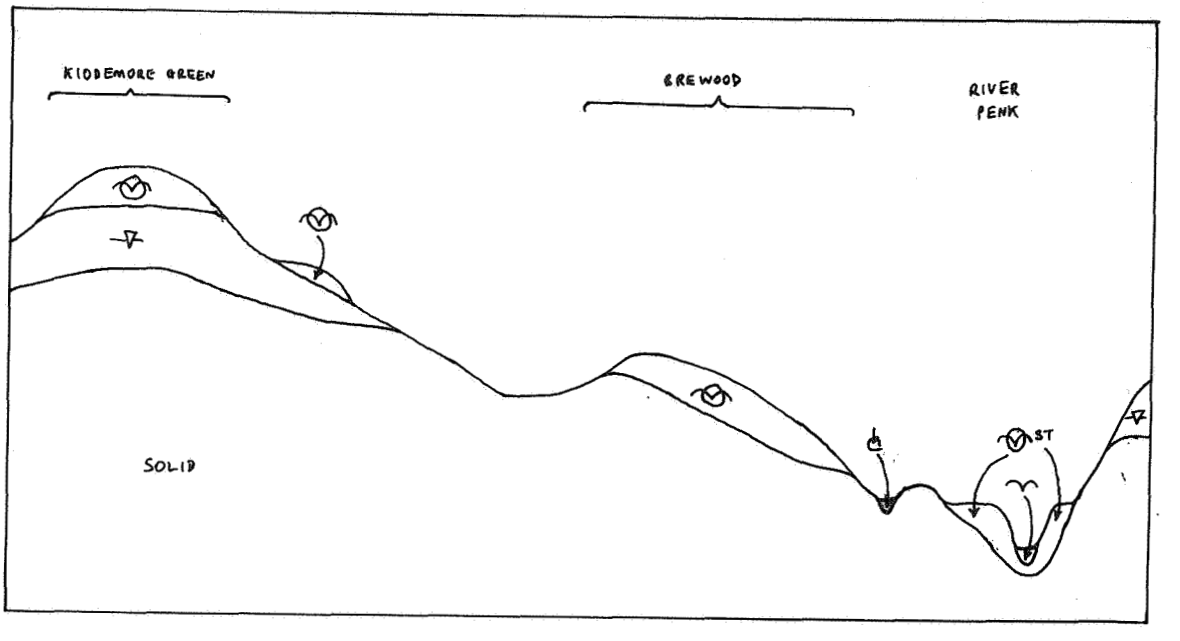
Although the district was covered by ice during the Late Devensian (Whitehead *et al.* 1928, Morgan, 1973), till cover is patchy, only becoming more consistent to the east. Boreholes along the M54 prove till is locally up to 6 m thick, and composed of stiff reddish-brown silty, sandy clay with sporadic gravel bands. The mapped junction between Till and bedrock is not normally feature-forming, although in places a slight concave break in slope may be developed. Erratics in the till include sandstone, brown chert, quartz, slate and granite, the last mentioned occurring as boulders up to 1 m in diameter. No good sections through till were seen at the time of resurvey.

4.2. Glaciofluvial Sand and Gravel

4.2.1. Glaciofluvial Sand and Gravel (undifferentiated)

Kames of both well-featured sand bodies, forming upstanding mounds, and less well-featured deposits rest on till or bedrock throughout the district. These deposits were included within the 'Newport Esker Chain' by Whitehead *et al.* (1928). The phrase 'Newport Esker Chain' is a misnomer though, since very few of the deposits show the classic esker-type morphology. The deposits are thickest around Brewood, where they are estimated to be up to 12 m thick. The base of the deposits falls gradually eastwards across the district, from 140 m above OD at Coldham to 104 m above OD south east of Brewood.

Many kames are identifiable in the district (for example, at Giffard's Cross [8810 0745] and 400 m west of Long Birch Farm [8740 0590]). Their steep sides indicate that sand and gravel may have been deposited up against the ice margin. The Sand and Gravel bodies at Kiddemore Green and



Head

Alluvium

Glaciofluvial Deposits; undifferentiated

Glaciofluvial Sheet Deposits

Till

Figure 4: Schematic inter-relationships of the drift deposits on sheet SJ80NE (not to scale)

Brewood are, in contrast, flattish in profile. Auguring suggests silt and clay rich lenses within the Sand and Gravel are fairly common. In contrast, the deposit 800 m north-east of Long Birch Farm (known locally as 'gravel field') is notable for the apparently high gravel content at surface, which cannot be augured by hand.

4.2.2. Glaciofluvial Sand and Gravel (sheet deposits)

Glaciofluvial Sand and Gravel sheet deposits are found mainly along the Penk valley, generally below 90 m above OD in the north of the district, rising to about 98 m above OD east of The Old Hattons. The maximum outcrop width of gravel is 300 m south of Somerford Farm. The gravel deposits are terrace-like, with a distinctive undulose top. This irregular form suggests that they were probably deposited in a short space of time, in close association with melting ice. The Sand and Gravel deposit is estimated to be up to 6 m thick at Engleton Mill [8921 0988], based on the height of the top of the terrace feature above the modern alluvium.

4.3. Alluvium

Modern alluvial deposits are best developed along the Penk Valley, where they reach a maximum width of 180 m. Smaller streams in the district (notably an unnamed tributary of the Penk which drains east from Coldham, and Chillington Brook) have less well formed alluvial tracts. Generally, alluvium is a heterogeneous mixture of brown and black organic rich silt, with sand and gravel lenses towards the base.

4.4. Head

Head, consisting of dark and light brown silt, sand and clay, has been observed resting on Glacial Glaciofluvial Sand and Gravel, Till or Alluvium at [8501 0711], and along a dry valley trending north-east 50 m north of Brewood Hall Farm [8888 0875]. The thickness of the deposits is estimated to be no more than 2 m.

5. STRUCTURE

The Mercia Mudstone Group and Sherwood Sandstone Group together form part of the sedimentary fill to the South Staffordshire Basin, the depocentre of which lies to the north of the district. The Brewood Fault, traced at surface from Leper House [8690 0500] to the north-east of the district [8981 1000], has been identified as one of the major basin-bounding extensional faults (Bridge, 1997).

A seismic survey was carried out by Shell UK in 1984. This indicates the Brewood Fault dips steeply to the north-west and has an estimated throw down to the north-west of approximately 200 m. Several smaller faults are imaged on seismic sections but are not identifiable at surface; these have not been shown on the map face.

Strata at crop are near flat-lying throughout the district, although exposures proving this are limited. Steepening of strata may be expected in the vicinity of the Brewood Fault. The dip of strata in Somerford No. 1 is estimated to be 3° to the west (Whitehead *et al.* 1928).

The log from Somerford No. 1 (Figure 3) indicates a fault zone between 86.5 m and 108.2 m. This fault is unlikely to be the Brewood Fault as Somerford Pumping Station lies 250 m within the footwall.

6. ECONOMIC GEOLOGY

6.1. Clay

Claystone and siltstone from the Mercia Mudstone Group has been dug from The Dingle [0550 0850]. Pits in mudstone beds from the Bromsgrove Sandstone Formation [8856 0730], and till (for example [8540 0787]) also supplied clay and pebbly clay to local industries. Clay from the district has been used for brick and tile making (Sherlock, 1915) and as a liner for the Shropshire Union Canal. No clay pits are presently active within the district.

6.2. Sand and Gravel

A pond 400 m to the east of The Old Hattons [8950 0520] appears to be a disused gravel pit, dug into part of the Glaciofluvial Sand and Gravel flanking The Penk. These deposits have also been worked 250 m to the north west of Somerford Hall [8985 0839]. The Barnfield Sand Pits [8842 0933] at Brewood were worked for Glacial Sand and Gravel, and were active earlier this century. Whitehead *et al.*(1928) suggest gravel was worked at Kiddemore Green, from a shallow pit at [8518 0903] (not shown on map face).

6.3. Building Stone

The Bromsgrove Sandstone was worked as a building stone during the 19th century and possibly into the early 20th century. The stone was used for many of the walls and buildings in Brewood. It is reputed that the quarry at [8877 0667] supplied stone for some of the bridges over the Shropshire Union Canal, including the ornate Avenue Bridge at Chillington (Whitehead *et al.* 1928).

7. MAN-MADE DEPOSITS

7.1. Made Ground

Made Ground deposits within the district are associated with either the Shropshire Union Canal or the M54. Canal embankments and spoil heaps are typically between 2m and 4m high, centred on [8775 0975], [8820 0841], [8871 0777], [8895 0737], [0915 0675] and [0915 0558]. They consist mainly of glacial till dug for the canal. Embankments for the M54 at Gunstone are up to 3 m high. A 6-7 m high landscaped mound 200 m south-east of The Pool [8595 0545] is spoil dug from the motorway cutting to the south of The Pool.

7.2. Worked Ground

There are several building stone quarries in the Bromsgrove Sandstone: at Brewood [8850 0865] and [8876 0872], Straasfield House [8964 0777] and Upper Cottages [8878 0666]. The Barnfield Sand

Pits, referred to in 6.2, are up to 5 m deep and cover an area in excess of 4 hectares. Small clay pits and reservoirs, typically a few metres deep and up to 120 m in diameter, are common across the district. The Canal [8661 0637] to [0580 0569], flowing west into The Pool, appears to be man made and dug to a depth not exceeding 3 m. More recent areas of Worked Ground have been dug along the M54, 300 m north-west of Long Birch Farm, and along the Shropshire Union Canal.

8. GEOLOGICAL HAZARDS

This section is intended as a summary of the principal geological hazards identified in the area at the last date of survey. It is not exhaustive and should not be used under any circumstances to replace any part of a geological investigation.

Gypsum veins and nodules are present at 7.8, 11.9 and 26.8 m below ground level in Somerford No. 2 borehole. They are in sandstone units up to 0.9 m thick from part of the uppermost beds of the Bromsgrove Sandstone Formation. Gypsum may be liable to dissolution. This could give rise to development of sub-surface cavities which could cause differential settlement of superposed structures.

Unconsolidated deposits in the area include **Head, Alluvium, Till, Glaciofluvial Sand and Gravel, and Made Ground.** Unconsolidated deposits are internally heterogeneous, and can be highly compressible compared with other drift deposits or bedrock, and may give rise to excessive or differential settlement of superposed structures. For this reason particular care should be taken in the siting of any construction on such deposits.

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10. APPENDIX

10.1. LIST OF BOREHOLES REFERRED TO IN TEXT

BGS ref. No.	Name	National Grid Reference	Starting Level (m above OD)	Total depth (m below OD)	Date Drilled
SJ80NE 1a	Somerford 1	[8964 0933]	90	321	1919
SJ80NE 1b	Somerford 2	[8964 0933]	90	244	1935
SJ80NE 3 - 31	M54 Boreholes	varies	varies	varies	1970-75
SJ80NE 43 - 51	M54 Boreholes	varies	varies	varies	1970-75
SJ81SE 13	Stretton	8770 1030	108	1220	1978