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Solihull and Knowle

Part of 1:50 000 Sheets 168 (Birmingham)
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Geological Survey of England and Wales

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CENTRE

**Geological notes and local details
for 1:10 000 sheets SP 17 NE
Solihull and Knowle**

Part of 1:50 000 Sheets 168 (Birmingham) and 183 (Redditch)

R. A. Old

centre

Bibliographic reference

OLD R. A. 1982.
Geological notes and local details
for 1:10 000 sheets SP 17 NE
(Solihull and Knowle).
(Keyworth: Institute of Geological
Sciences.)

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A further Open-file report 'Old, R. A., 1982. Quaternary deposits of SP17 and 27W Solihull and Balsall Common', covers this area, and gives special emphasis to the sand and gravel deposits.

Production of this report was supported by the Department of the Environment

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KEYWORD INSTITUTE OF GEOLOGICAL SCIENCES 1982

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INTRODUCTION

This report describes the geology of 1:10 000 Sheet SP 17 NE (Solihull and Knowle) which is included in One Inch Geological Sheet 168 (Birmingham) and 1:50 000 Sheet 183 (Redditch).

South of National Grid line 765 the only previous geological survey was that of Old Series One Inch Sheet 54 NE surveyed by H H Howell on the one-inch scale, and published in 1855. North of National Grid line 765 the primary six-inch survey was carried out by T E Eastwood in 1915, and a brief description of that area is included in Eastwood et al (1925). The whole sheet was surveyed on the 1:10 000 scale by R A Old in 1980 under the direction of G W Green, District Geologist: the fossils were identified by Dr H Ivimey-Cook, the work was funded by the Department of the Environment. An assessment of the sand and gravel resources of this sheet has been carried out by the Institute (Cannell, in prep.), but at the time of writing the results are held Commercial in Confidence.

Black and white copies of the map can be ordered from the Bookstall, Exhibition Road, London.

The area includes the centre of Solihull in the NW, and the towns of Knowle and part of Dorridge in the centre and south. Up to a third of the area is built over or is devoted to leisure activities and services. The rest is given over to farming and horticulture. The whole area lies within the catchment of the River Blythe which crosses it in a broad northerly convex arc.

The Mercia Mudstone Group underlies most of the area. Within it, the Arden Sandstone is an important mappable member, forming a 25 m high SE-facing scarp at Knowle. The Penarth Group and the Lower Lias are preserved in a fault trough extending eastwards from Copt Heath.

Much of the solid outcrop is obscured by glacial and younger drift deposits. The glacial drift masks an irregular rock head. It is confined mainly to the interfluves, but extends locally to the present-day valley floors. In the western half of the area the glacial drift forms a partly dissected plateau, with a surface at 120 to 135 m OD. Further east, the glacial drift has been subject to more erosion, and there is a greater variation in topography, the maximum relief being c. 40 m. Later drifts are confined to solifluction deposits (Head), terrace deposits and alluvium.

GEOLOGICAL SEQUENCE

The following geological formations occur on the sheet:

DRIFT

QUATERNARY

Alluvium
First River Terrace Deposits
Head

	Boulder Clay Sand and Gravel))	Glacial Deposits
SOLID			
JURASSIC	Lower Lias		
TRIASSIC	Penarth Group		
	Langport Member (not exposed)		
	Cotham Member (not exposed)		
	Westbury Formation		
	Mercia Mudstone Group		
	including:		
	Blue Anchor Formation (Tea Green Marl)		
	Tutbury Gypsum (not exposed)		
	Arden Sandstone		

SOLID GEOLOGY

MERCIA MUDSTONE GROUP

Much of the Mercia Mudstone is composed of red structureless mudstones. Despite the considerable area of outcrop, the only noteworthy exposures of these mudstones occur within one metre of the Arden Sandstone. The full thickness of the Group presented at outcrop is uncertain, because the exact position of the Arden Sandstone Member below the Penarth Group is uncertain. The nearest place where there is an unfaulted sequence from the Penarth Group to the Arden Sandstone is 20 km south of this sheet near Aston Cantlow. There it is estimated that the Arden Sandstone is 60 m beneath the Penarth Group. Within the area, the Knowle borehole [1883 7777] has penetrated 115 m below the Penarth Group without encountering the Arden Sandstone. This is probably because the latter was not reached; it is, however, possible that the Arden Sandstone has passed into the red mudstone in the vicinity of the borehole. In the former case at least 145 m of Mercia Mudstone crop out in the area, because at least 30 m of red mudstone crop beneath the Arden Sandstone. In the latter case the Knowle Borehole proves about the maximum thickness (115 m) preserved at outcrop. A log of the Knowle borehole is given in the appendix.

Below the base of the Blue Anchor Formation at 24.60 m, the Mercia Mudstone consists predominantly of blocky red brown mudstone unbottomed to 132.23 m. There are minor grey-green, dark grey and laminated beds. Gypsum is absent above a depth of 50.0 m. Below this, it occurs abundantly in nodules and, more rarely in thin beds. Between 65.56 m and 68.99 m, bedded gypsum/anhydrite predominates, and this bed lies at a similar position to the Tutbury Gypsum in the Burton upon Trent area (Stevenson and Mitchell 1955), with which it is tentatively correlated. Below the Tutbury Gypsum, nodular gypsum/anhydrite is common to 76.0 m and from 88.0 m to 101 m. Between 91.25 m and 101.05 m the predominant lithology is a bright red brown mudstone, crowded with small gypsum nodules, mainly below 1 cm in

diameter but ranging up to 10 cm in diameter. Low angle gypsum veins up to 2 cm thick form an irregular network, and many are cut and slightly offset by parallel, but thinner, ones.

Tutbury Gypsum

The Knowle Borehole proved bedded gypsum/anhydrite as follows, between 65.54 m and 68.99 m :-

	Thickness (m)	Depth (m)
Gypsum, white, massive, some anhydrite; gypsum veins and mudstone in basal 5 cm	0.20	65.74
Mudstone, red brown with abundant gypsum/anhydrite nodules	0.38	66.12
Gypsum, white, large nodules with interstitial mudstone patches	0.50	66.62
Mudstone, red brown with gypsum/anhydrite nodules	0.58	67.20
Gypsum, white, with minor mudstone bands and patches; grey, coarse grained in basal 15 cm	1.79	68.99

Around Buton upon Trent the Tutbury Gypsum lies some 46 m below the base of the Penarth Group (Stevenson and Mitchell 1955, p 35): the gypsum in the Knowle Borehole is 51 m below the Penarth Group so the two beds are tentatively correlated with one another.

Arden Sandstone Member

The Arden Sandstone comprises a distinctive unit of thinly bedded pale grey sandstone and siltstone, associated with green and red mudstone, that is up to 5 m in thickness and is set within the red mudstones. The most important outcrop forms a SE-facing scarp between Knowle Hall [194 763] and Dorridge [173 750]. The following section was seen in the west bank of the Grand Union Canal at Knowle

[1892 7637]:

	Thickness (m)
(Coarse, pale grey, thin bedded sandstone (with abundant green mudstone clasts	2.5
(Grey-green mudstone	0.8
ARDEN SANDSTONE (Interlaminated grey-green mudstone, silt- (stone and brown sandstone; 15 mm load- (casted sandstone at base	0.5
(Grey-green mudstone, 1 cm dark grey band (at base	0.4
Brown and red brown thin bedded siltstone with pale brown and green partings; green in basal 7 cm; passing down to	0.4
Red-brown, blocky, silty mudstone	0.3

The Arden Sandstone thins to 2.4 m at a road bridge, 150 m to the north. The section here, now obscured, has yielded fish remains and Estheria (Richards 1894, Matley 1912, p 257, Eastwood et al 1925, p 90). Similar thickness variations have been established by the mapping along the scarp east of Knowle.

Flaggy sandstone and green siltstone are exposed sporadically for 500 m along Purnell's Brook in Knowle Recreation Ground [175 767]. A red-brown mudstone, not exceeding 2 m in thickness, occurs above (to the east of the brook) and is overlain by green siltstone and mudstone forming a west-facing scarp along the east side of the Recreation Ground. The absence of Arden Sandstone west of Purnell's Brook has been interpreted as due to faulting, rather than to its having died out, as proposed by Eastwood et al (1925, p 90).

Arden Sandstone, 2.9 m thick, was formerly exposed in the Sandal's Bridge Brick Works, Solihull [1645 7898]. The following section is based on Eastwood et al (1925, p 91):-

	<u>Thickness</u> (m)
Red Mudstone	0.9
(Grey mudstone, shaly and cuboidal	1.5
Arden Sandstone (Grey sandstone, soft, coarse and sandy (grey marl mottled red; base rather (irregular	1.4
Red sandy mudstone, not well stratified	5.5

Matley (1912, p 26) obtained fish scales from the sandstone at this locality.

Blue Anchor Formation (Tea Green Marl)

The Blue Anchor Formation, at the top of the Group, has a limited outcrop south of Waterfield Farm, Knowle [185 776], the base is marked by a strong feature. Pale greenish-grey mudstones are poorly exposed in both banks of the Grand Union Canal, and in a pit 270 m to the south-east [1893 7752]. Eastwood et al (1925, p 92) estimated the thickness of the formation to be 4.6 to 6.1 m, and the Knowle Borehole proved it to be 6.9 m (Appendix). In the Knowle Borehole the formation consists of medium grey green, slightly silty, blocky, very weakly bedded mudstones

PENARTH GROUP

Westbury Formation

The Westbury Formation occupies a small fault-bounded tract south of Waterfield Farm. Eastwood et al (1925, p 92) estimated the "black shales of the Rhaetic" (i.e. Westbury Formation) to be 6.1 to 7.6 m thick, and 6.0 m were proved in the Knowle Borehole (Appendix). In the Knowle Borehole the formation consists of dark grey or black fissile mudstone, with one 4 cm limestone band and a few bands

of micaceous siltstone up to 4 cm thick. There are rare poorly preserved casts of bivalves in the siltstone; these are probably of the same species as those found at outcrop by Brodie (1865, p 160), and described as "Pullastra arenicola". Fragments of black mudstone and rare yellow micaceous siltstone, dumped on the bank of the Grand Union Canal where it crosses the Westbury Formation outcrop [1870 7765] are all that can now be observed at surface.

Fossils found in the Knowle Borehole include Chlamys valoniensis, Eotrapezium concentricum, E. cf. germani, Lyriomyophoria postera, 'Natica' oppelii, Protocardia rhaetica, Rhaetavicula contorta, and fish scales including Gyrolepis alberti.

Cotham Member

At Knowle the Cotham Member is faulted out at the surface, and it has not previously been described from this area. In the Knowle Borehole, however, it was found to be 6.1 m thick, consisting mainly of pale to medium grey calcareous silty mudstone. At the junction with the Westbury Formation at 11.73 m there is a change in colour upwards from dark to pale grey over approximately 0.4 m, accompanied by a change from non-calcareous to calcareous mudstone. Slumped beds, and local dips of up to 20°, occur in this interval. At 10.30 m and 10.45 m there are bands of dark grey non-calcareous mudstone, 3 cm and 7 cm thick, respectively, dipping at 15°. Just above are fragments of dark grey mudstone. This basal sequence suggests local channelling and erosion at the base of the Cotham Member. Scattered bivalve fragments, including Rhaetavicula contorta found in this part of the sequence, mainly in the dark grey mudstone, are probably derived from the Westbury Formation. The rest of the Cotham Member was unfossiliferous.

Langport Member

Above the Cotham Member at 5.63 m in the Knowle Borehole is a 13 cm bed of limestone which has been referred to the Langport Member by Dr H Ivimey-Cook. The limestone is fissured and has erosion surfaces at 5.54 and 5.55 m respectively (Appendix). The bivalve Pteromya, including P. cf. tatei (juv.) occurred in limestone.

LOWER LIAS

The Lower Lias has a fault-bounded outcrop extending east from Copt Heath to the limit of the area. Exposures are few, and the complete sequence is not known in detail. An estimated maximum of 25 m of beds are preserved, of Planorbis Zone and probably Liasicus Zone age. Where not obscured by drift, much of the outcrop is dotted with shallow pits dug for limestone, and many of the fields are strewn with fragments of limestone and paper shale.

In the Knowle Borehole (Appendix). the basal 2.5 m of the Lower Lias was

proved, and comprised dark grey mudstone with thin siltstone bands. Paper shale from near the base of the Lower Lias forms brash 200 m northeast of Waterfield Farm [1904 7789]. Fossils in the shale include diadematoïd fragments and spines, Modiolus minimus, Pteromya tatei, Psiloceras planorbis and fish fragments.

A trench, 200 m southeast of Grove Farm [1788 7806], exposed up to 4 m of thinly bedded grey mudstone with a few small limestone nodules. Abundant fossils were preserved on some bedding planes, and these included Eodiadema minutum, diademopsid? spines, Cardinia ovalis, Plagiostoma, sp., Pseudolimea hettangienensis,

and ostracods. Dr Ivimey-Cook comments "C. ovalis is most abundant in the Liasicus Zone but does occur earlier". Blocks of blue grey argillaceous limestone were found along a back-filled portion of the trench [1792 7802].

Fine grained, blue grey, flaggy limestone is exposed to 0.5 m in the south bank of the Grand Union Canal [1856 7793], and loose blocks of darker coarser limestone occur nearby. Liostrea hisingeri, Modiolus hillanoides (juv), and Placunopsis sp. were found in these limestones.

Limestone was formerly worked from three shafts at Copt Heath [1808 7808, 1814 7807 and 1805 7798], all of which were abandoned before 1857 (Brodie 1865, p 160). One shaft is reported to have a depth of 18.3 m (Eastwood et al, 1925, p 93). Brodie (1865, p 160, 1874, p 748) records 'Ammonites planorbis' from spoil around the limestone shafts.

The other results of Brodie's research at Knowle are summarised by Eastwood et al (1925, p 93). In particular Brodie demonstrated that the 'Insect Limestone', well known from the Wilmcote area north of Stratford on Avon within 5 m of the base of the Lower Lias, occurs at Knowle.

DRIFT DEPOSITS

GLACIAL SAND AND GRAVEL

The Glacial sand and gravel was laid down upon an uneven topography. The oldest deposits occur in the southeast, around Heronfield [194 751], and are terraced remnants of the infilling of a glacial channel. They are contiguous with others farther west along the Blythe Valley (see sheet SP 27 NW). At least 3 m of sand and gravel are present, and the deposit probably underlies the adjoining alluvium.

The base of the gravel between Eastcote [195 787] and Berry Hall Lane [182 796] also descends below the floor of the Blythe Valley. Two borehole [1836 7920; 1876 7978] prove the base of the gravel at 104.3 m OD and 104.6 m OD respectively.

Most of the southeast part of Solihull lies on a gravel plateau with a surface level of about 130 m OD. Drilling in the Solihull area [1519 7965; 1535 7993; 1619 7999] suggests a general easterly thickening of the gravel to a maximum thickness of 15 m. The base of the gravel lies between 120 m and 125 m OD between Solihull Municipal Offices [191 794] and Henwood Lane [179 796], but to the east descends below the valley floor (see above). An outlier of this gravel

forms the higher ground around Malvern Park Farm [154 785]. Its base slopes gently from about 132 m OD in the west to 125 m OD in the east. A gravel channel is intersected by the railway cutting NW of Widney Manor Station [1535 7800], where the base of the gravel descends below the base of the cutting (c. 125 m OD). At the southern end of the cutting 4 m of gravel with beds of sand are poorly exposed [1543 7783], while 150 m to the north [1536 7795] the basal 1 m of the deposit is soft silt.

The central part of the area is underlain by extensive flat topped sand and gravel deposits whose base shows an overall gentle fall from about 130 m OD in the west down to 115 m OD in the east. Locally the base of the gravel slopes more steeply, for example near Knowle Grove [177 753].

No clear exposures were seen in any of the above deposits. Small diggings revealed Bunter quartzite gravel with varying amounts of sand.

BOULDER CLAY

Boulder Clay is largely confined to the southwest quadrant of the area. The principal outcrop east of Dorridge [centred around 160 755] forms a featureless spread characterised by very gentle slopes. The relationship of the Boulder Clay to the Glacial Sand and Gravel is not everywhere clear. Around The Chase [1630 7710], and also 300 m north of Little Monkspath Wood [7600 1501], gravel underlies boulder clay. Between Tile Cross House [1640 7664] and Four Ashes Road [1620 7583] there is often no change of level at the contact of the two but it is assumed that the Boulder Clay is the younger, and either fills channels cut in the sand and gravel or is banked against it. Between Knowle Grove [176 752] and Norton Green Farm [184 751] Boulder Clay and Sand and Gravel occur in a 25 m deep channel, with the former occupying the deepest parts of the channel.

No significant exposures of Boulder Clay were seen. Small diggings reveal brown clay with common Bunter quartzite pebbles. Brown silty clay is generally augered over the Boulder Clay outcrop.

HEAD

Two small patches of Head occur on steep slopes below outcrops of Glacial Sand and Gravel on the eastern margin of the area [1898 7630 and 1898 7530]. They consist of sand and gravel with an appreciable clay matrix, derived by solifluxion from the glacial deposits upslope.

FIRST RIVER TERRACE DEPOSITS

Terraces up to 1 m above the alluvium, and generally less than 200 m wide, border the flood plain of the River Blythe in many places. They consist predominantly of Bunter quartzite gravel, and are evidently largely derived from the Glacial

Sand and Gravel. Sand and gravel to 4.4 m overlying Mercia Mudstone was proved in Borehole SP 17 NE/71 [1860 7949].

The terrace deposits 500 m west of Blythe Hall [154 770] consist of greenish grey sandy pebbly clay in the north, and occupy an area mapped as Mercia Mudstone during the previous survey. In the south a borehole proved the following sequence:

SP 17 NE/8 [1540 7691]

Sand and gravel

to 2.0 m

Silty clay and gravel

to 3.5 m

Sand and gravel

to 4.0 m

Mercia Mudstone

to 5.5 m

ALLUVIUM

The River Blythe and its tributaries have continuous, but generally narrow, alluvial flood plains. River bank exposures usually reveal red brown loam up to 2 m thick overlying gravel. Two boreholes have penetrated the alluvium as follows:

SP 17 NE/10 [1550 7700]

Gravel and sandy clay

to 1.0 m

Very sandy silty clay

to 2.0 m

Mercia Mudstone

to 6.0 m

SP 17 NE/84 [1657 7913]

Brown grey very sandy clay

to 1.4 m

Sand and gravel

to 2.0 m

Mercia Mudstone (inc. Arden Sandstone)

to 24.5 m

An extensive alluvial flat comprising green brown clay and a little gravel has formed at the headwaters of Cuttle Brook [190-755]. The deposit has apparently been augmented by colluvial downwash from the Arden Sandstone escarpment to the north and west.

ECONOMIC GEOLOGY

BRICK CLAY

Disused brick pits in Mercia Mudstone at Mill Lane [166 766] and Riverside Drive [166 789] have been partly restored and the faces are totally obscured.

LIMESTONE

Much of the Lower Lias outcrop is covered by shallow pitting for limestone. Three shafts have been mentioned above (see Lower Lias). There was formerly a lime-works north of Waterfield Farm [1895-7805].

GLACIAL SAND AND GRAVEL

Despite their extensive outcrops the Glacial Sand and Gravel has been little worked. The only active working is a small pit at Brown's Lane [1653 7677]. This is now almost totally obscured, but clayey gravel (hoggin) is still occasionally dredged from beneath the water in the bottom of the 7 m deep pit. Pebbles on the stock piles are mainly Bunter quartzites and range up to 20 cm in diameter. Many pale brown and red brown flattened sandstone pebbles occur in the coarse fraction. The owner reports that the faces displayed 'wavy' bedding and that the gravel had a high clay matrix. The deposit is evidently in a local channel, for its base lies well below the base as mapped in nearby fields.

The most significant sand and gravel resource is in the gravel-filled channel between Eastcote and Berry Hall Lane where there is estimated to be 10 m to 15 m of gravel with no overburden. There are up to 7 m of gravel in the outlier at Henwood Hall Farm [181 787]. In the southeast corner of the area the terrace-like deposits of sand and gravel might prove to be over 8 m thick, as at the former 'Riley's Pit' on the adjacent ground to the west (SP 27 NW).

FIRST RIVER TERRACE GRAVELS

Most of the deposits of the First Terrace have a high gravel content. They are thickest between Eastcote and Berry Hall Lane, where up to 4.4 m of gravel have been proved (see above). They could possibly be worked in conjunction with the Glacial Sand and Gravel.

REFERENCES

- BRODIE, P.B., 1865. On the Lias outliers at Knowle and Wootton Wawen in South Warwickshire, and on the presence of the Lias or Rhaetic bone-bed at Copt Heath, its furthest northern extension hitherto recognised in that county. Q. Jour. Geol. Soc., 21, 159-161.
1874. Notes on a railway section of the Lower Lias and Rhaetics between Stratford on Avon and Fenny Compton, on the occurrence of the Rhaetics near Kineton, and the Insect-beds near Knowle in Warwickshire, and on the recent discovery of the Rhaetics near Leicester. Q. Jour. Geol. Soc., 30, 746-749.
- CANNELL, B. (in preparation). The Sand and Gravel Resources of the Country East of Solihull, Warwickshire. Description of parts of 1:25 000 sheets SP 17, 18, 27 and 28. Miner. Assess. Rep. Inst. Geol. Sci.
- EASTWOOD, T., WHITEHEAD, T.H., and ROBERTSON, T., 1925. The Geology of the Country around Birmingham. Mem. Geol. Surv.

<p>MATLEY, C.A., 1912. The Upper Keuper (or Arden) Sandstone Group and associated rocks of Warwickshire.</p>	<p><u>Q. Jour. Geol. Soc.</u>, 68. 252-280.</p>
<p>RICHARDS, E.P., 1894. On researches in the newly discovered "Acrodus Bed" in the green gritty marls of the Upper Keuper at Shrewley, Warwickshire. Chiefly upon its extension.</p>	<p><u>Proc. Warwickshire Nat. Field Club</u> (1893), 54-57.</p>
<p>STEVENSON, I.P. and MITCHELL, G.H. 1955.</p>	<p><u>Geology of the Country between Burton upon Trent, Rugeley and Uttoxeter.</u> Mem. Geol. Surv.</p>

APPENDIX

KNOWLE BOREHOLE (1981)

~~Site: 450 m NE of Grimshaw Hall [1883-7777]~~

IGS Registered Number: SP 17 NE/184

Abbreviated Log

	<u>Thickness</u> (m)	<u>Depth</u> (m)
Drift Glacial sand and gravel	3.00	3.00
Lower Lias Mudstone, dark grey, fissile, thin siltstone bands; many shells and echinoid spines	2.5	5.50
?Langport Member Limestone pale buff and grey, fissured; prominent erosion surfaces at 5.54 and 5.55 m	0.13	5.63
Cotham Beds Mudstone, pale to medium grey, calcareous, with frequent silty laminae, passes down to	6.10	11.73
Westbury Formation Mudstone, dark grey, fissile, silty laminae common in parts, abundant bivalves, including <u>Rhaetavicula contorta</u> ; 4 cm limestone at 13.44 m; 15 cm siltstone at 16.60 m; sharp base	6.02	17.75
Blue Anchor Formation (Tea Green Marl) Mudstone, medium grey green, blocky, very poorly bedded; sharp base	6.85	24.60
Mercia Mudstone Mudstone, red brown, blocky, generally slightly silty; a few thin green bands; many fish remains for 10 cm at 30.00; scattered 'fish eyes' and desiccation cracks	25.40	50.00
Mudstone, red brown, smooth, blocky, abundant gypsum nodules and veins, many desiccation cracks 52.00 m to 56.00 m	15.54	65.54
Gypsum (Tutbury Gypsum)(see detailed log, p 3)	3.45	68.99
Mudstone, red brown, smooth, blocky, many gypsum/ anhydrite nodules and veins	6.68	75.67
Mudstone, red brown, blocky, slightly silty, gypsum nodules and veins common in basal 3 m	15.58	91.25
Mudstone, bright red brown, brown, crowded with small gypsum nodules and a network of thin gypsum veins	9.80	101.05

<p>Mudstone, dull red brown, blocky, smooth, many gypsum veins and a few anhydrite nodules; dark grey for 23 cm at 129.38 m and 26 cm at 130.80 m</p>	<p>31.18 132.23</p>
<p>(bottom of borehole)</p>	