TECHNICAL REPORT

WA/88/36

Geological notes and local details for TM 18 NW,NE, TM 19 SW and SE

(Gissing,Pulham Market,Bunwell Street and Long Stratton)

Part of 1:50 000 Sheets 175 (Diss)

J.A. Zalasiewicz.

Natural Environment Research Council
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Onshore Geology Series

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Geological notes and local details for 1:10 000 sheets TM 18 NW, NE, TM 19 SW and SE (Gissing, Pulham Market, Bunwell Street and Long Stratton).

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1. INTRODUCTION

This report describes the geology of a group of four National Grid 1:10 000 sheet areas, TM 18 NW, NE, TM 19 SW and SE. These fall within the confines of the Diss (175) 1:50 000 Geological Sheet. The area was first surveyed on the one inch scale by W.H. Dalton in 1880-1883 as part of the Old Series One-Inch Geological Sheet 66, published in 1884. A descriptive memoir was published in 1884. The present 1:10 000 revision survey was conducted by S.J. Mathers and J. A. Zalasiewicz in 1985. Uncoloured dye-line copies of the 1:10 000 geological sheets may be obtained through the Map Sales Dept., British Geological Survey, Keyworth.

The 100 square kilometres of Norfolk described include the villages of Bunwell, Aslacton, Forncett St. Peter, Tharston, Long Stratton, Winfarthing, Gissing, Tivetshall St. Margaret and Pulham Market. One major north-eastwards flowing river, the Tas, dominates the drainage.

The land is almost entirely drift-covered, being in large part an almost flat expanse underlain by thick Till. Other deposits are almost entirely confined to the sides and bottoms of the Tas Valley and its minor tributary valleys (Fig. 1.). These comprise irregular spreads of Glacial Sand and Gravel, generally benched into the Till, and Head and Peat in the valley bottoms. The underlying solid (Upper Chalk) crops out near to the valley bottoms in the north-east of the area.

The land is largely arable, with a little pasture in the valley bottom "meadows". The flat nature of the higher ground led to a wartime airfield being established in the central part of the area.

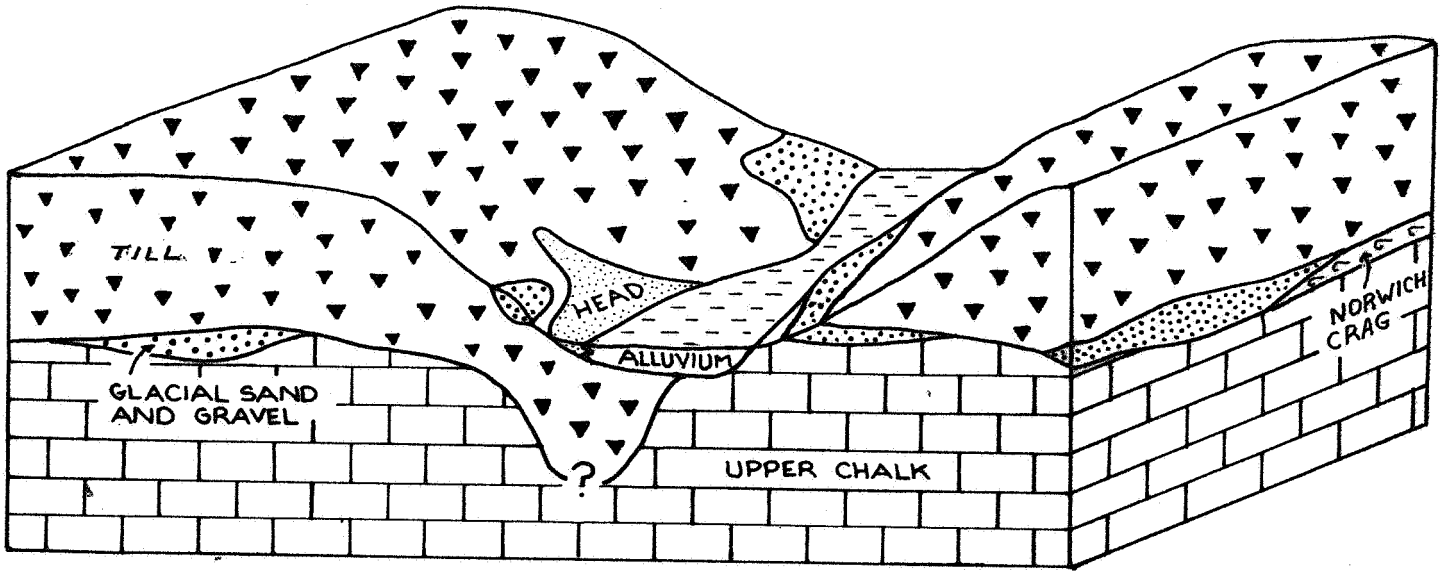


Fig. 1. Idealised diagram showing relationships between the main lithostratigraphical units. Not to scale.

2. GEOLOGICAL SEQUENCE.

The geological sequence is shown in Table 1.

3. SOLID FORMATIONS.

The only solid formation proved at outcrop is the Upper Chalk. The Old Series map shows Norwich Crag at outcrop in the north-east of the area, but that was not substantiated in the recent survey. Crag deposits are, however, present in the south-east of the area, beneath a thick drift cover.

3.1. Upper Chalk

Chalk underlies the greater part of the area (Fig. 2.) and is about 300 m thick (Whitaker, 1985). It is probably the Gonioteuthis and basal Belemnitella mucronota Zones of the Upper Chalk (Middle and Upper Senonian) which occur at outcrop and directly beneath the Drift (Peake and Hancock, 1961). The regional eastward dip is of the order of half a degree. The Upper Chalk is a pure white coccolith limestone with flints. The upper few metres are commonly weathered and softened.

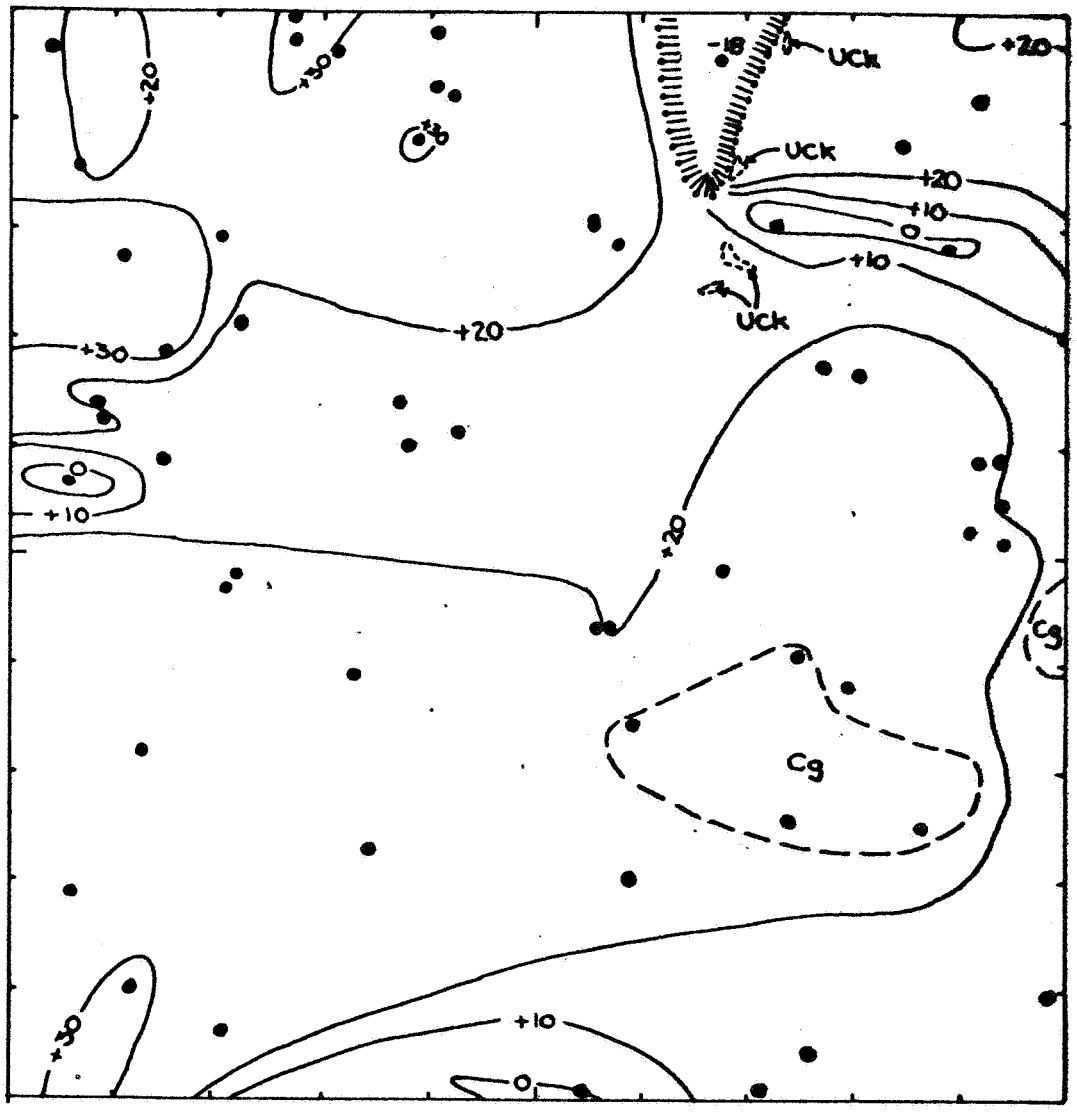
Small outcrops of Upper Chalk extend northwards from Orchard House (1665 9257) along the east side of the Tas valley. Minor outcrops are also present in the lower slopes of a small tributary of the Tas east of Tharston, near the extreme north-east of the area. There are no exposures within the area.

3.2. Crag.

Crag has only been identified with certainty in one borehole (TM 18 NE 14) [1746 8914] which proved 4.3 m of grey shelly sand. Nearby, boreholes between Tivetshall Station (159 880) and Colegate End (192 879) record up to 10 m of sands and silts overlying the Chalk; these deposits have been interpreted provisionally as Norwich Crag. In addition a borehole at Wood

Geological classification and age					Maximum thickness
		FLANDRIAN	Peat	Variably sandy and clayey peat	5 m*
		?FLANDRIAN-DEVENSIAN	Head	Pebbly sandy clay and clayey sand and gravel	3 m*
DRIFT DEPOSITS	QUATER-NARY	Anglian (Lowestoft phase)	Glacial Silt	Laminated silts, clays and fine sands with sporadic pebbles	2 m*
			Till	Grey-black silty clay with numerous pebbles of flint, chalk and other erratics	46 m*
			Glacial Sand and Gravel	Flint-rich sands and gravels, locally chalky	23 m*
SOLID FORMAT-IONS	QUATER-NARY	?	Crag	Sands and clays, locally shelly	10 m*
	CRETA-CEOUS		Upper Chalk	White chalk with flint nodules	75 m*

Table 1. Geological sequence of the Gissing, Pulham Market, Bunwell Street and Long Stratton area.
(* - estimated thickness)



KEY

—+20— Contour on Chalk surface; heights are in metres relative to O.D.

(UCk) Chalk outcrop

(Cg) Extent of Crag deposits

• Borehole that reaches the Chalk surface

•-18 Borehole, giving level of Chalk surface relative to O.D.

Course of drift-filled buried channel

Fig. 2. Contour map of the eroded top surface of the Upper Chalk, showing also the distribution of the Crag. Derived from surface outcrops and boreholes (positions shown). Values in metres are above or below Ordnance Datum.

Farm (TM 18 NE/13) [1997 8941] proved 6.1 m of clay and sand with a pebbly base, which in this account is also referred to the Crag. The distribution of the Crag shown in Fig. 2. is conjectural.

The Crag in this area is provisionally assigned to the Norwich Crag (sensu Funnell and West, 1977). However, no sedimentological or palaeontological studies have been made to confirm this; so the presence of some Red Crag at the base of the sequence cannot be ruled out.

4. DRIFT DEPOSITS

4.1. Anglian Glacial Deposits (Lowestoft phase)

The glacial deposits of the area are all referred to the Lowestoft phase of the Anglian glaciation (Baden-Powell, 1948; Mitchell et al., 1973). No deposits belonging to the preceding North Sea Drift phase of the Anglian glaciation have been recognised. However, representatives of this earlier phase may be present, for Clarke and Auton (1982) described a possible correlative of the Norwich Brickearth (North Sea Drift) directly beneath the Lowestoft Till, a few kilometres to the south-west; and Wyatt (1981) noted a similar deposit filling a channel cut into the Norwich Crag at Morningthorpe Gravel Pit [TM 2206 9445], 2km ENE of Stratton St. Michael.

The glacial deposits of the area comprise (Lowestoft) Till, Glacial Sand and Gravel, and Glacial Silt and Clay. Till is the dominant element, outcrops of Glacial Sand and Gravel and Glacial Silt and Clay being confined to the Tas valley and its main tributary.

The base of the glacial deposits appears to be more or less planar over most of the area, as indicated both by available borehole information and by recent geophysical studies (M. Raines, J. Cornwell, pers. comm.). The only major observed departure from this trend is a possible channel filled with Till, some 50 m deep, underlying the western side of the Tas valley (Figs. 1., 2); the presence of this channel is indicated by a single borehole record showing an anomalously thick Drift sequence (TM 19 SE/14; 1674 9461).

4.1.1. Glacial Silt and Clay.

A small outcrop of Glacial Silt and Clay is present (TM 1685 9485) in the Tas valley, north of Forncett St. Mary. It consists of 1.5 m+ of pale grey silty clay, finely interlaminated with silt and fine sand (Fig. 3.). This deposit may form part of the fill of a buried channel thought to underlie the Tas valley in this vicinity.

4.1.2. (Lowestoft) Till.

Till underlies the greater part of the area, and attains thicknesses of more than 30 m over the higher, flat-lying ground.

The Till is a fairly uniform deposit consisting of numerous chalk granules and pebbles, together with pebbles, cobbles and boulders of flint, quartz, quartzite and other lithologies, set in a stiff, blue-grey sandy clay matrix which is in large part derived from the Kimmeridge Clay. There is little lithological variation. Both geological surveying and geophysical soundings (M. Raines, J. Cornwell, pers. comm.) indicated that the lower 5-10 m may include more arenaceous material and, throughout, there are scattered irregular pods of Till with a cream-coloured matrix, apparently the result of partial disaggregation of chalk. The Till is weathered, commonly to a depth of 1-3 metres; the weathered material is softer than the parent till, being pale grey, buff and ochreous mottled, and in part decalcified.

The deposit is the Lowestoft Till as described by Perrin, Rose and Davies (1979). It was probably laid down by lodgement processes (Rose and Allen, 1977) beneath the south-eastwards flowing Anglian (Lowestoft phase) ice-sheet.

4.1.3. Glacial Sand and Gravel.

Glacial Sand and Gravel is present in two main situations. Firstly, it occurs as lenses of variable thickness underneath the Till over much of the area. Borehole records show that commonly it reaches thicknesses of a

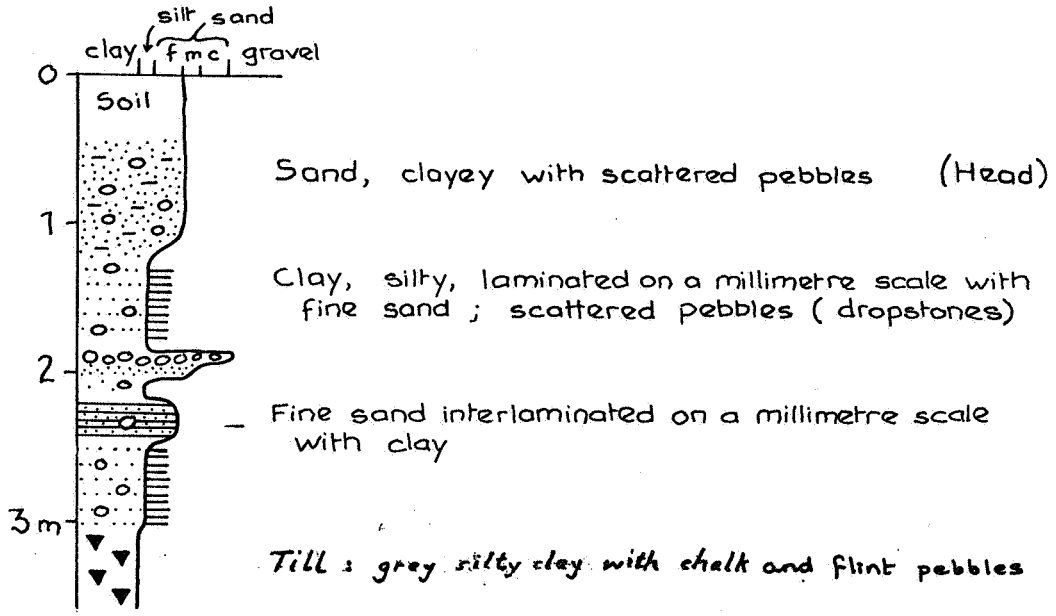


Fig. 3. Graphic lithological log of an extendable auger-hole (TM 1683 9485) showing the lithology of the Glacial Silt and Clay.

10-15 m, except in the south-west of the area, where it rarely exceeds 5 m. The maximum thickness proved is 22.6 m (TM 19 SW/16; 1316 9469), west of Tacolneston. Hand-auger sampling of this sand and gravel shows it to be flint-rich, fine to coarse gravel, with subsidiary sands. While these deposits are all referred to the Anglian Glaciation in this account, it is possible that representatives of earlier deposits such as the Kesgrave Sands and Gravels (Rose and Allen, 1977) are present.

Secondly, Glacial Sand and Gravel is also present within and above the Till. A thick lens of Glacial Sand and Gravel interdigitates with the Till north of Tharston (185 945), and there are irregular low-lying outcrops overlying the Till along the Tas Valley. Exposures show a medium to coarse flint, quartz and quartzite-rich gravel, interbedded with pebbly sand (Fig. 4; pebble counts are shown in Table 2.). One small outcrop (TM 1695 9425) east of Old Hall Farm shows coarse angular and nodular flint at surface.

The Glacial Sand and Gravel which underlies the Till is likely to have been deposited as a proglacial sandar. The Glacial Sand and Gravel which overlies the Till and is benched into the valey sides may have been laid down as small kames or fan-deltas during deglaciation; the limited distribution of these deposits makes it unlikely that they are the eroded remnants of a formerley extensive fluvioglacial terrace system.

4.2. Head.

Head is present in the base of some of the minor valleys and locally fringes the Peat of the larger valleys. It is a variable pebbly clayey sand, rarely exceeding two metres in thickness. It is largely structureless, though the pebbles tend to be concentrated near the base of the deposit. It appears to have formed as the result of a mixture of solifluxion, hillwash and aeolian processes.

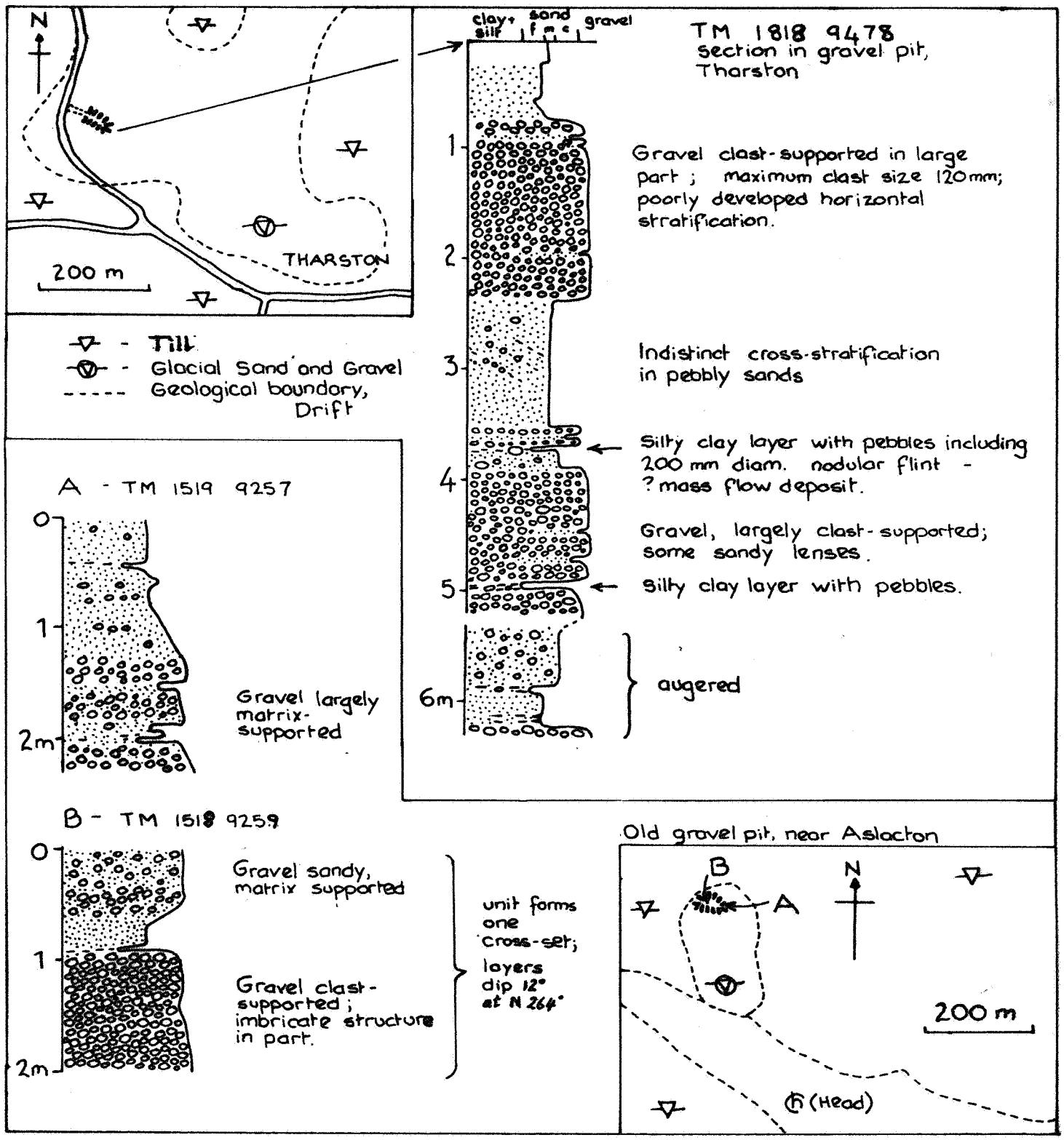


Fig. 4. Graphic lithological logs of sections through the Glacial Sand and Gravel.

TABLE 2 COMPOSITION OF THE + 8 - 16mm GRAVEL FRACTION OF THE GLACIAL SAND AND GRAVEL

SAMPLE	Old Gravel pit, near Aslacton (see Fig. 4) B; 10-20	Gravel pit, Tharston (see Fig. 4); 40-50
% FLINT	53	54
% QUARTZ	24	22
% QUARTZITE	17	16
% CHALK	--	2
% IRON-CEMENTED SANDSTONE	2	2
% SEDIMENTARY, OTHERS	3	2
% IGNEOUS AND METAMORPHIC	1	2
NUMBER OF PEBBLES COUNTED	472	398

4.3. Peat.

Peat has accumulated in the bottoms of some of the valleys, notably that of the Tas. Thicknesses of up to 3 m have been observed in newly scraped ditches. The deposit is dark brown to black, variably clayey and commonly includes the remains of freshwater molluscs.

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