

# A GLACIAL CHANNEL AT SPROXTON, LEICESTERSHIRE

by

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## Summary

A channel, incised into the solid rocks and first encountered during the working of an ironstone pit, is described, and an account given of the contents. A plan and measured sections of the channel are presented; recognition of the channel by a resistivity anomaly is established; its topographic setting is summarized and some suggestions are made as to its origin.

## Introduction

In 1961, the opencast working of the Northampton Sand ironstone at Sproxton in Leicestershire intersected a channel filled with unconsolidated sand, gravel, and clay. The pit ceased working but remained open until 1965, when it was backfilled and the land reinstated. While it was open, the visible parts of the channel were mapped by a project party of the East Midlands Geological Society led by the author; samples were taken, and sketches and some geophysical measurements were made, mostly during the summer of 1964. This paper assembles the information on the channel, partly on the basis of observations made by the quarry owners at the time of excavation, and partly from observations made by the project party.

## Location and Solid Geology

The site of the channel lies in Sheet SK 82 of the 1:25,000 map of the Ordnance Survey. Map references of the known ends of the channel are 854255 and 874254, between which it follows a slightly sinuous course. The village of Sproxton (pronounced to rhyme with 'roasten') lies about 1 km. to the south of the site and Saltby about 1 km. north-west of it.

The solid geology of the site is as indicated in the following table:

Lincolnshire Limestone, mostly below the horizon of the Crossi Bed	34 - 36 ft.
Lower Deltaic clays and silts	22 ft.
Northampton Sand ironstone	about 25 ft.
	(base not seen)

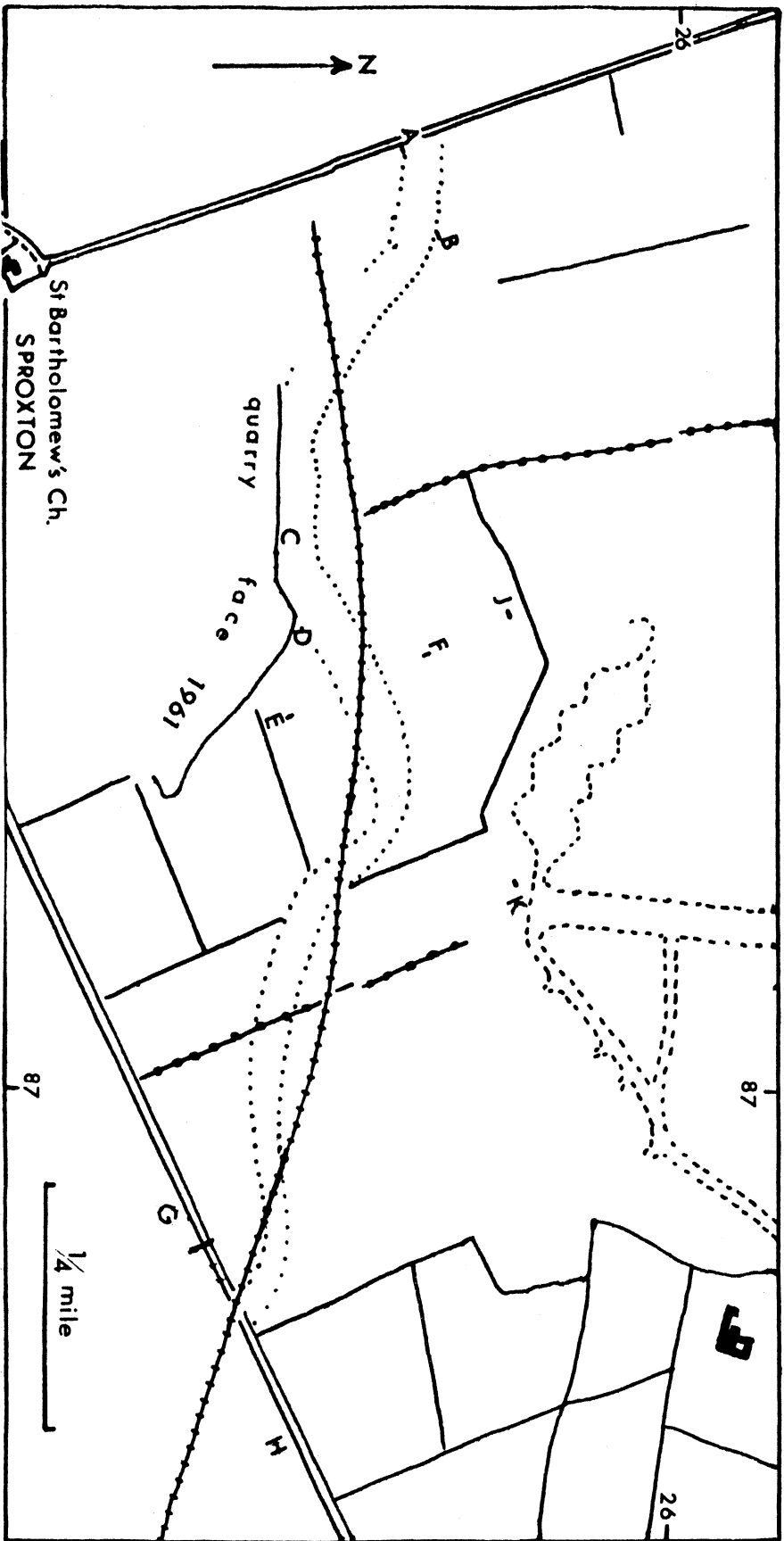


Fig. 1. Plan of the Sproxton channel, showing positions of Sections A-B, C-D, and Geophysical Traverses E-F, G-H, and J-K

These rocks are patchily covered by spreads of brown and grey boulder clay, and form a plateau departing little from 500 feet.

The solid rocks dip east at a low angle; some normal faulting, of a few feet throw, has both been encountered in the quarries and mapped by the Geological Survey.

#### The Channel in Plan

When first encountered, the channel was located by the quarry owners by means of a large number of boreholes; its course, as plotted in Text-fig. 1, is derived from their maps. The normally well-bedded Lincolnshire Limestone was seen to be replaced by a poorly-bedded sequence of coarse sand, rounded limestone pebbles and boulders, and a cover of grey and brown boulder clay. A line of boreholes about 10 metres apart was drilled along a hedge line, on a bearing of about 080 deg. True, from 855255 to and beyond the site of the old Sproxton windmill. The hedge line and the mill no longer exist, but are shown on old maps. The smaller section (A-B) in Text-fig. 3 has been constructed from the borehole records, which, though indefinite and incomplete, indicate the possible depth and width of the channel.

The channel then appears to pass under the existing office and workshop buildings and was next seen in a small access cutting to the north of the western end of the 1961 quarry face, indicated in Text-fig. 1. Here the visible channel filling consists of about 10 ft. of brown crumbly clay with patches of grey clay, groups of rounded limestone boulders and irregular beds of coarse sand. Because both sides of the channel, where the filling is in contact with undisturbed limestone, are obscured or have been removed, the exact width is not measurable, but it is not much in excess of 200 ft. The south side of the channel was exposed in the quarry face from C to D as shown in Text-figs. 1, 2, and 3. The line of trees shown in the sketch (Text-fig. 2) and in the Plate also appears on Text-fig. 1. In 1964, the section C-D, then considerably deteriorated, was measured and sampled, and appeared as in Text-fig. 3 C-D. The course of the channel from here to the East was traced by shallow boreholes drilled by the quarry owners. Its course was apparent to the 1964 party because the normally angular Lincolnshire Limestone 'brash' was replaced above the course of the channel by rounded stones.

The channel was also located crossing the two electrical resistivity traverse lines E-F and G-H in Text-fig. 1. Along these lines, a series of electrical depth probes was taken, using electrode separations up to 90 ft. in the Wenner four-electrode configuration, and read on an Evershed 'Megger' Earth Resistivity meter. The anomalies discovered on traverse E-F are illustrated in Text-fig. 4. The disturbed ground that they represent lies in the position postulated for the channel. Similar anomalies were observed in the channel position between G and H. Traversing between J and K to the north of the channel showed no such anomalies, and, at least in this direction, the channel appears unbranched.

The project party was able to show that rounded boulders of limestone outcrop in fields near 852256, where the ground falls away rapidly towards the Eye Brook; no continuation of the channel on the west side of this stream, where a thick cover of boulder clay is present, could be found. The far east end of the channel similarly runs out into falling ground near 874252, and it cannot be located beyond this point.

#### The Channel in Section

The oblique cross-section at A-B (Text-fig. 3) gives the general dimensions of the channel, i. e. from 150 to 200 ft. wide and with its floor more than 50 ft. below the present ground surface. It would appear from this section that the margins of the channel are quite steep and that the limestone close to the channel sides is shattered.

The part of the channel exposed by quarrying (between C and D in Text-fig. 1 and figured in Text-figs. 2 and 3 and in the Plate) was the only part available to general examination; as can be seen

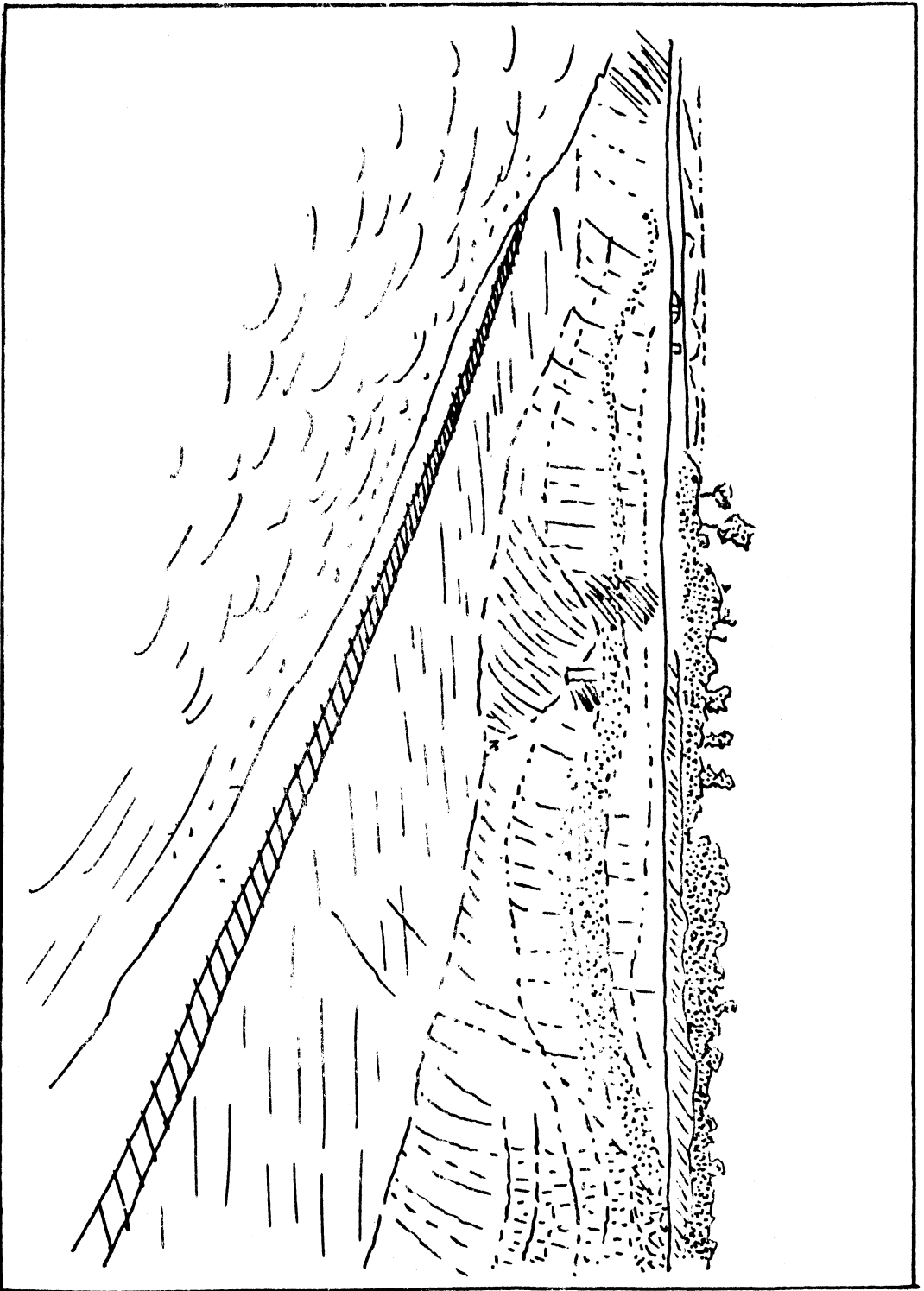


Fig. 2. View of the Section C-D in 1961, compiled from the photographs shown in the Plate. Compare Fig. 3

from Text-fig. 1, it was a section almost parallel with the channel length. The deposits presumably lie in sheets along the length of the channel and slightly concave upward. Any section almost parallel with the channel length will encounter the edges of beds, the apparent height of which will be dependent on the relative positions of the face and the channel centre. The rises and falls in the beds may therefore be due to sinuosities in the face or in the channel rather than to actual longitudinal inclinations in the beds.

In 1964, the lowest exposed part of the section, about 44 ft. below ground surface, consisted of rather ill-sorted rounded gravel and sand, the gravel not being over 3 ins. in diameter. The 1961 view shows material below this level which does not appear substantially different; but clays, possibly varved, have been mentioned to the writer in this position. The gravel and sand continued upward for about 16 ft. with little change in character, when they were replaced by a bed of soft sand without pebbles about 2 ft. thick. Above this band, which appeared discontinuous, about 6 ft. of gravel was again seen, becoming very coarse with particles up to 18 inches in diameter and, for the uppermost three or four feet, firmly cemented with calcite. This cemented band could be followed along the exposed section for nearly 350 ft. Its apparent change in level could be accounted for by the oblique section of the channel, as indicated above.

Above the cemented gravel, there follows up to 12 ft. of grey boulder clay and then from 4 to 8 ft. of brown clay. Little or no soil is seen on this section since it was removed before the face was opened.

At D, where the channel deposits were seen in oblique contact with the limestone, a zone of shattering from 2 to 8 ft. in thickness was seen intervening between them. The solid limestone was itself cambered slightly towards the channel.

#### The Channel Sediments

The gravel and sand sample from the C-D section shows a range of grain sizes and its grading curve is shown in Text-fig. 5. The coarser parts of the gravel show a predominant oblate or equant shape, bladed shapes amounting to only 15%. Considerable variations in angularity were noted.

The fraction of the gravel above  $\frac{1}{2}$  inch in least dimension consists very largely (about 97% by weight) of material which matches very well with the local succession. A small part of this fraction consists of dark brown or reddish ferruginous sandstone which may be taken to represent the Northampton Sand, while the rest is Lincolnshire Limestone. The remaining 3%, mostly in the  $\frac{1}{2}$  inch to 1 inch fraction, consists of foreign material. Of this 3%,  $2\frac{1}{2}$ % is not difficult to match amongst the Bunter Pebbles of the Midlands, brown and yellow ironstained vein quartz and banded brown quartzites being present. The last  $\frac{1}{2}$ % consists of dark grey, fine-grained, hard, compact limestone for which a Carboniferous Limestone origin is suggested.

The Lincolnshire Limestone contribution appears in all shapes from very angular to well rounded, while the materials of more distant origin are now uniformly well rounded.

The cemented band in the gravel does not appear to differ in composition from the uncemented, the cementing being entirely secondary and possibly representing a period when the gravel formed the surface of the deposit.

The grey boulder clay of Text-fig. 3 is a hard, light-grey, compact material when dug, which tends to crumble into equidimensional grains from 1 to 10 mm. in diameter. The material is light grey on freshly broken surfaces, but older surfaces running through the mass and dividing the grains are light brown in colour.

Rather few large stones, up to 3 inch in diameter, form about 10% by weight of the boulder

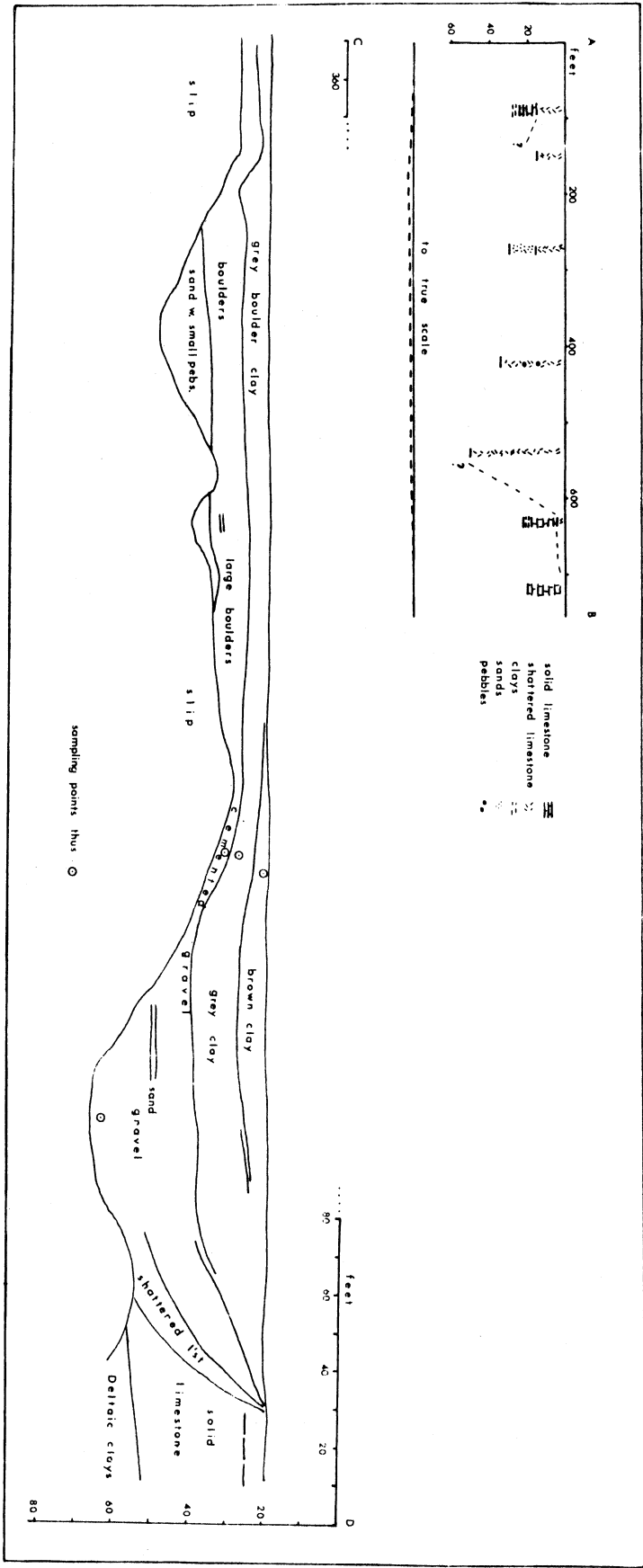


Fig. 3. Sections of the Spouton Channel. A-B from boreholes; C-D from measurement in 1964

clay. The stones consist of fine grained limestones of Lias aspect, micaceous sandstones and broken fossils (Gryphaea sp.).

Smaller stones no larger than  $\frac{3}{4}$  in. are contained in the clay, forming perhaps 5%. Of these, the most obvious are particles of chalk, but soft ferruginous sandstone, small limestone pebbles, and small iron-stained quartzes, comparable with those in the gravel, are present. No materials related to the Lincolnshire Limestone are seen, although the clay contains a considerable fine carbonate content, as is evident from the effervescence with dilute hydrochloric acid.

The brown boulder clay overlies the grey clay and is divided from it by a well defined line. The clay shows a similar granular structure when dry and grades up into the surface soil. It is differentiated from the grey clay by a different suite of contained stones, and a complete absence of any carbonate material, fine or otherwise.

The contained stones constitute about 10% by weight of the whole; they divide almost equally into Bunter material and rocks for which no immediate origin is obvious. These consist of medium grained, iron- and silica-cemented sandstones reminiscent of Millstone Grit, white cherts, yellow siliceous siltstones, pink cherts, and occasional igneous rocks. Some of these stones are notably angular when compared with either the Bunter material contained in the brown clay, or with the stones contained in the grey clay. The brown clay has a higher sand content than the grey clay.

The boulder clays only exist within the channel in the immediate neighbourhood. The 'banks' of the channel consist of Lincolnshire Limestone not covered by clay.

#### The Topographic Setting

As the channel was seen to end both ways in falling ground, its topographic setting suggested itself as an additional study.

This is summarized in Text-fig. 6, where areas over 500 ft. are shown dotted and the modern watershed lines separating the Wreake, Trent, and Witham drainages are drawn in. That the position of the Sproxton channel is anomalous is very apparent, if it were taken to have any close connection with the modern drainage, since a modern col lies about a mile to the south and almost 100 ft. lower. It can only be supposed that the channel predates the modern pattern of drainage; this supposition is confirmed by the position of the channel deposits, lying under a local representative of the Gipping or Great Chalky Boulder Clay.

#### Conclusions

The general nature of the Sproxton channel reminds one of the Thistleton channel described by Rice (1962), but on closer examination significant differences are apparent. The Thistleton channel is much larger, its length being measured in miles rather than hundreds of yards; and, unlike the Sproxton channel, it is covered by a spread of clay wider than the channel. Its deposits also seem to consist largely of clay, gravels and sand being poorly represented. The Sproxton channel is reasonably straight and certainly far from showing a meander pattern, as is shown for a small stream in Rice (1965). Equally, it gives rise to little or no surface relief, whereas both the Thistleton channel and smaller drift-filled valleys mentioned by Lamplugh (1909) are still represented by notches or low ground. The Sproxton channel cuts across the watershed, not at a col, but at one of the highest points in the area.

Its waterlaid deposits, in spite of their rounding, do not appear to have travelled far; they owe their rounding to violent transport rather than distance. The foreign stones in the gravel can be related to the nearby presence of boulder clays. The channel gravels were later overrun by ice which laid down

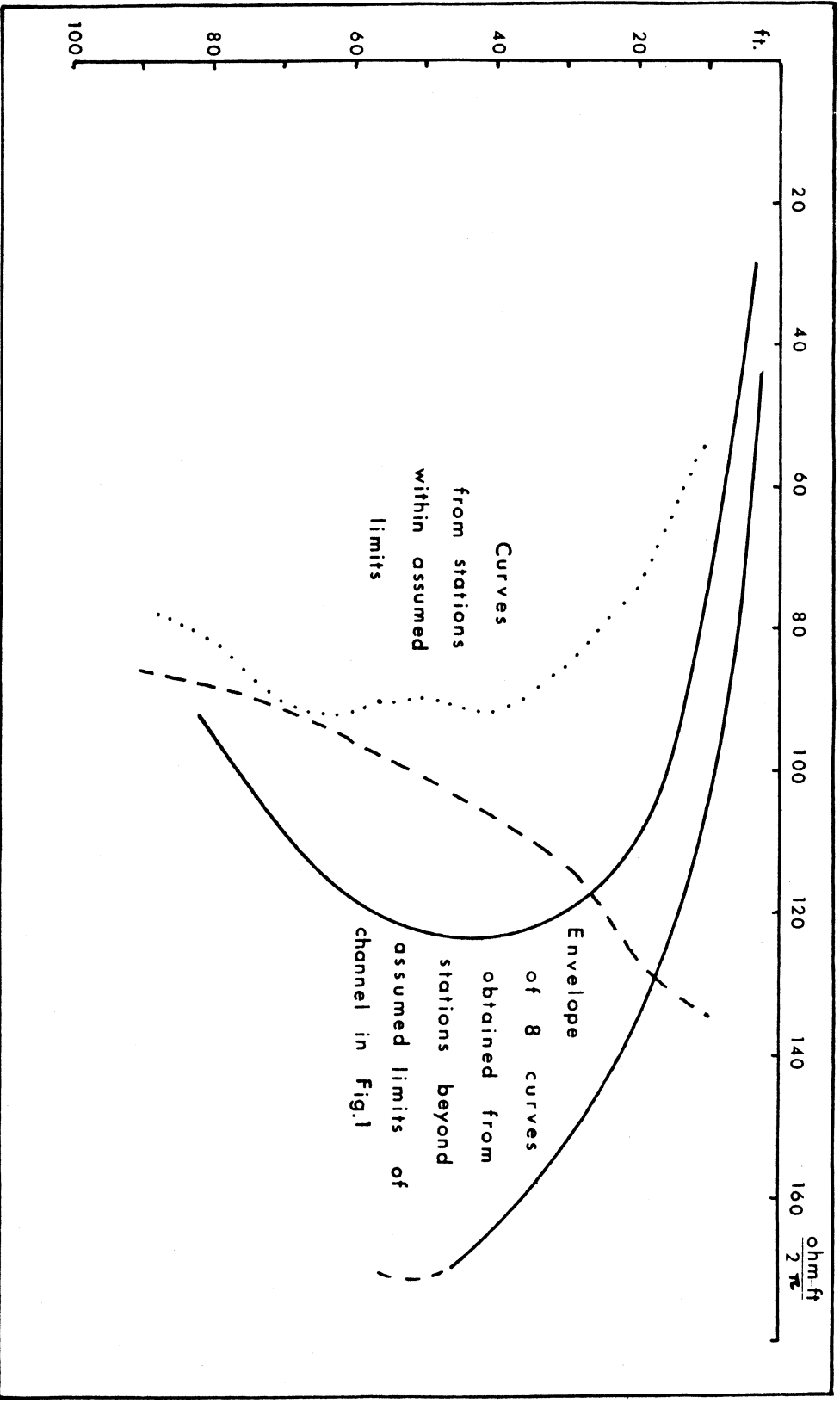


Fig. 4. Curves of Apparent Resistivity v. Electrode Separation obtained from stations along Traverse E-F

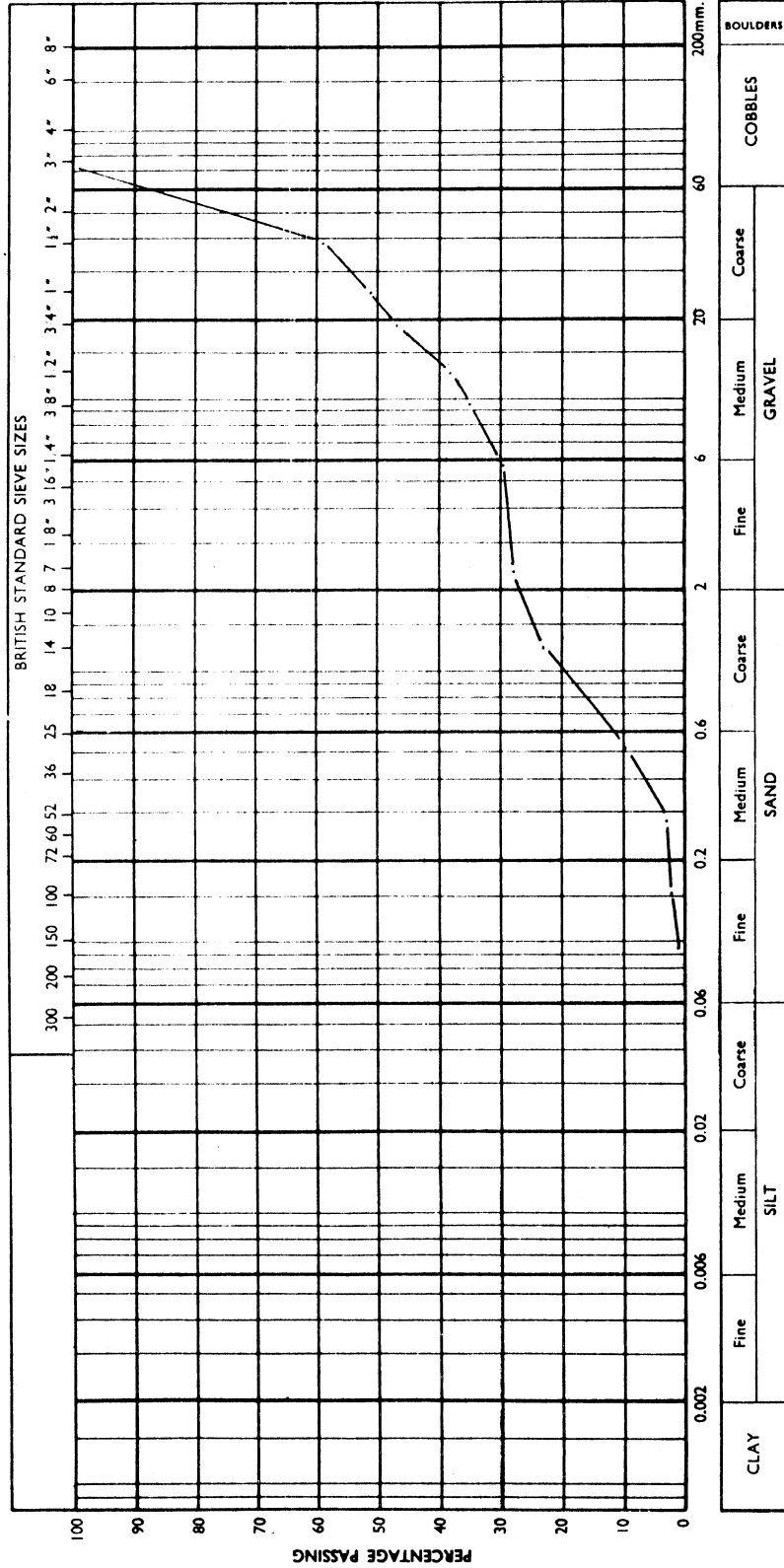
PARTICLE SIZE DISTRIBUTION

LOCATION No. **SPROXTON**  
 DATE OF TEST **26-11-64**

BORE HOLE No. —  
 DESCRIPTION **GRAVEL & SAND**

SAMPLE No. —

PRETREATMENT DETAILS  
 LOSS ON PRETREATMENT — %



the grey and brown boulder clays, though these latter do not differ much in their state of weathering and therefore not much in age. Between these two events, the channel gravels had become strongly cemented at the top, indicating the occurrence of a temporarily warmer climate.

A tentative suggestion may therefore be made of the history of the channel. The channel was cut by the violent release of water from local melting ice, as if by the rupture of an ice dam. The hill-top position of the channel today may mean little in terms of subglacial topography; the channel might have been cut subglacially, though this was not necessarily the case. The channel filling is therefore mainly of local material, with a slight contamination of material introduced by the ice. A warmer interval would cause the cementing of the gravels; the hollow left by the channel would trap some of the subsequent thin boulder clay cover, which has otherwise been almost entirely removed from the immediately surrounding plateau.

The channel bears no relation to the modern drainage, but was a feature controlled by the presence of ice and was abandoned as soon as lower levels were exposed by the melting. Any continuation it had at either end was cut either through into ice or into topography which has since been removed by modern erosion.

The writer feels sure that other channels remain to be discovered in the Lincolnshire limestone plateau, for instance at Hungerton, where possibly a similar feature exists in an ironstone pit. Until a greater number are known, their nature will remain unclear.

#### Acknowledgements

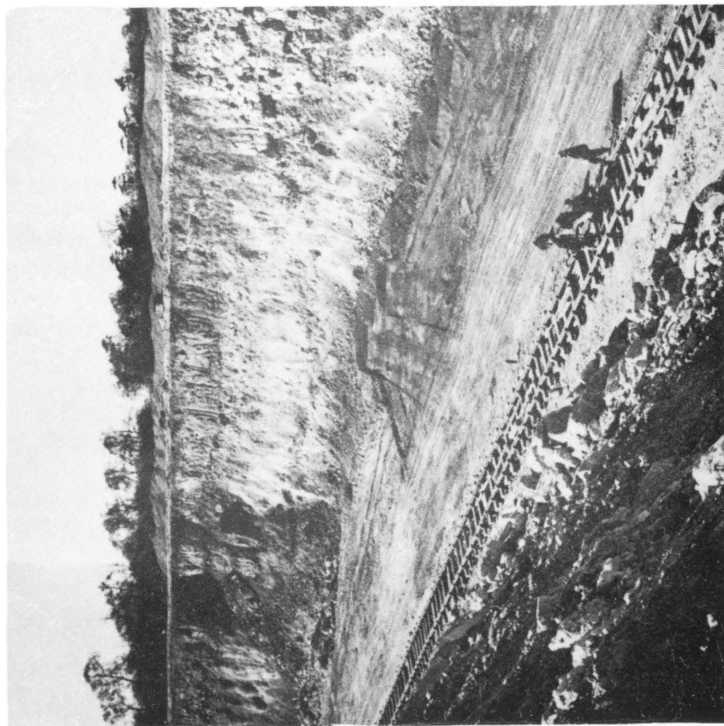
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Views of the Sproxton Channel as excavated in 1961



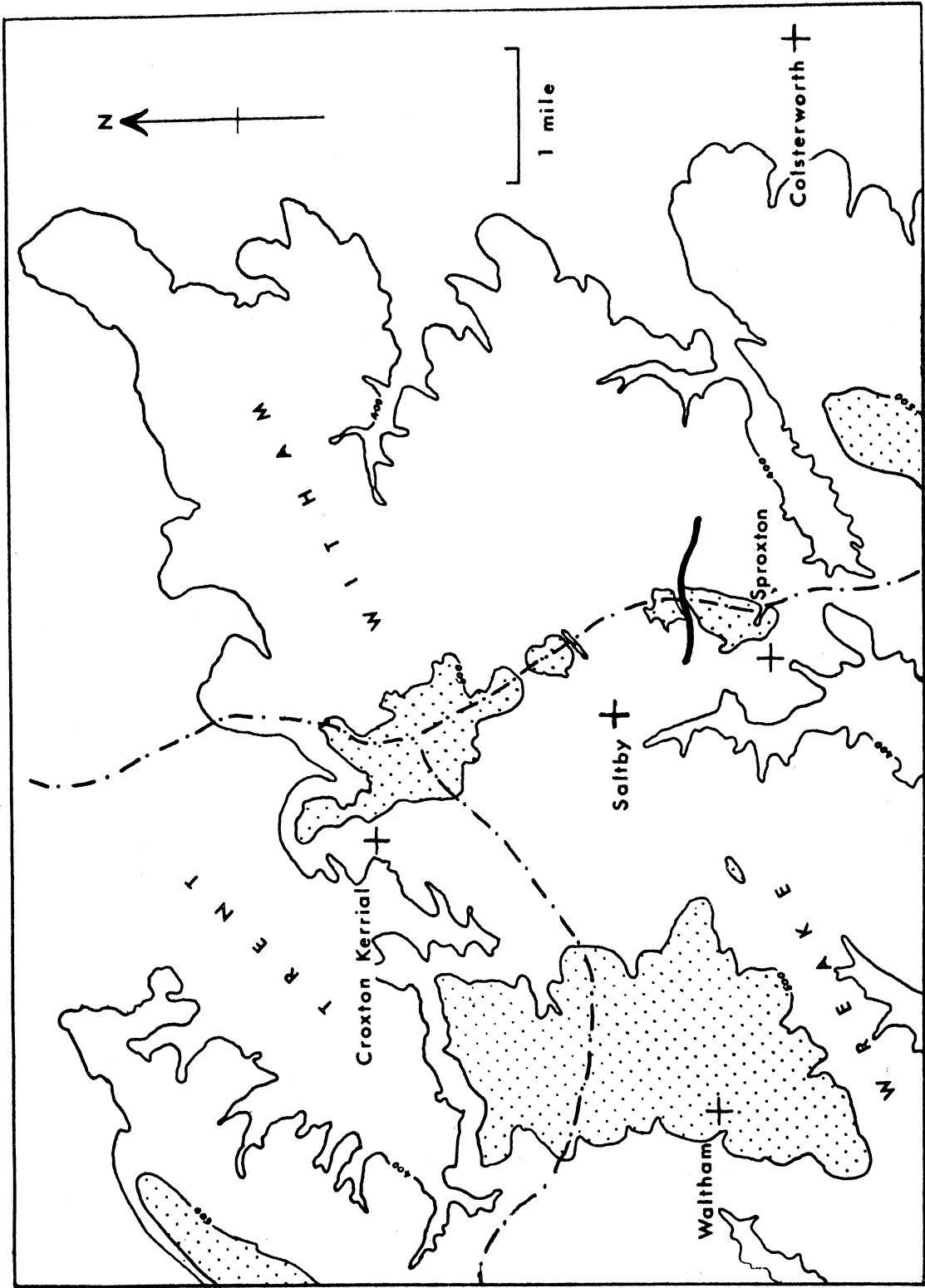


Fig. 6. The topographic setting of the Sproxton channel

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