EXCURSION TO THE WHITBY AREA, YORKSHIRE

Leader:- Professor J.E. Hemingway — 9th - 11th June, 1967

Twenty-six members and friends took part in this excursion. Arrangements had been made to travel in private cars, the majority leaving Nottingham between 4.00 and 5.00 p.m. Most of the party assembled at the Beach Villa Hotel, Whitby (NZ 892115) in time for dinner. A brief business meeting was held on the Friday evening after which the leader gave an introductory talk on the geology of the area.

Table 1, below illustrates the sequence of formations of the Whitby area, which were to be investigated.

Middle Jurassic (in part)	Middle Deltaic Series Sands and Clays with fresh water and terrestrial flora and fauna. Variable thickness. Eller Beck Bed 12-20 feet of marine sandstones and shales rich in iron. Bedded ironstones are present, with many lamellibranchs and gastropods. Lower Deltaic Series Sandstones, siltstones, shales and clays with occasional thin coals and seatearths. Washout structures in the sandstones. Plant debris in most rocks. Freshwater fauna present. Approx. 100 feet. Dogger A poor quality sideritic ironstone, very variable. Up to 8 feet thick, it weathers characteristically brown, and is a good marker horizon.
Upper Lias	The Alum Shales Light grey shales with pyrites. The latter reacts with the clay minerals when the shales are burnt for the production of alum. Upper beds contain cementstone concretions. Fauna includes the ammonites Hildoceras, and Dactylioceras. Approx. 65 feet thick. Bituminous Shales Similar to the Alum Shales but containing a higher hydrocarbon content. Separated from them by shales containing ironstone concretions. About 66 feet thick. The Jet Rock Laminated shales, rather darker than the ones above and again rich in oil. The black jet, decomposed woody material, occurs in isolated lenses about 2 inches thick, and can be 10-15 feet long and 3-4 feet wide. The material is hard and capable of being polished. The thickness of this deposit is about 25 feet.

Upper Lias (continued)

Oil, at the rate of 20 gallons per ton, has been distilled from the shales.

Grey Shales

About 30 feet of silty grey shales with occasional belemnites.

Middle Lias

Ironstone Series

A series of ironstone beds with interbedded shales and sandy beds. Main Ironstone, sometimes in two layers, total thickness 6 feet 8 inches: Pecten Seam, sometimes in two or more more layers, total thickness 3 feet 7 inches: Two-foot Seam, 10 inches thick on the coast: Avicula Seam, also 10 inches thick.

The ironstone seams contain abundant lamellibranchs.

The Sandy Series

This is a typical shallow water succession of fine sandstones and siltstones with ripple marks and worm trace-fossils.

About 54 feet thick.

Glacial Features

The Whitby area is a classic region for the study of glacial deposits. There are boulder clays and sands filling the old river valleys up to 150 feet thick. Many of the topographical features inland are controlled by these deposits and there is evidence for drainage diversions.

Saturday, 10th June

From a point near Cook's monument on the West Cliff (NZ 897114) overlooking the harbour the succession of the East Cliff opposite was seen. From this view the succession from the Alum Shales at the foot of the cliff to the Eller Beck Bed, overlain by boulder clay, was displayed. A rapid transit was then made to the opposite cliff (NZ 901113) where the Upper Harbour could be seen and the profile of the West Cliff. The Upper Harbour widens out beyond the town, before narrowing again to form a gorge. The Upper Harbour marks the position of an early glacial channel for the River Esk which originally flowed to sea west of West Cliff before the channel was infilled. The present river channel is partly filled with peat and silt and the Old Town is built on a sand bank at river level. Excavations in the old town have shown that this sand bank has been covered and protected by an enormous cliff fall which compacted the sediments.

It was explained that there were differences in the geology of the east and west cliffs and that it was not possible to correlate the Lower Deltaic rocks directly from one side of the harbour to the other. It would seem that a fault runs through the centre of the harbour and out to sea and it is probable that the Esk followed the fault when it cut its present channel. In the harbour there is a sudden change of depth which can be traced out to sea, and which possibly marks the line of the fault.

Having been presented with the general geological picture of Whitby, the party then descended to the harbour and round to the East Cliff section (NZ 902114). Underfoot were Alum Shales, slippery and full of lime concretions. The cliffs show the upper part of these beds which are well jointed, vertically and obliquely, making them prone to rapid erosion. The wave cut platform exposes some of the lower beds of the Alum Shales and most members were able to obtain a good collection of the lamellibranch Nuculana ovum along with various pectens and ammonites.

The Deltaic Series forming the upper part of the cliffs show great lithological variation with alternating sands and clay beds, and sandy lenses indicating the positions of river channels. The lower parts of these lenses are gravelly and contained abundant plant debris.

Tracing these beds eastwards, the dip gradually brings the higher beds to cliff base until eventually one can examine the Dogger at a comfortable height. It was seen to contain many U-shaped worm tubes. The tubes were bored into an iron rich silt and were overlain by a pebble bed. Here also, were boulders of the Whitby Plant Bed, full of carbonised plant remains, mainly equisetids, which had fallen from the cliff of Lower Deltaic deposits above. Further east the direction of dip reverses and lower beds are encountered until the Jet Rock Series paves the beach at the low tide mark (NZ 917115) seaward of Saltwick Nab where the Bituminous Shales and Jet Rock could be examined. Despite diligent search however only small specimens of jet were collected.

The shore section ended at the west side of Saltwick Bay and access to the cliff top (NZ 916107) through the remnants of old workings being relatively easy, the party walked back to their cars passing close to the ruins of Whitby Abbey (NZ 902112). It was decided to travel the short distance along the River Esk to Sleights before lunch was taken (NZ 866073).

The afternoon was spent on the moors above Whitby. The party left the transport at Goathland (NZ 833012) and walked to the type section of the Eller Beck Bed (NZ 832022) to examine this marine horizon in the Middle Jurassic sediments and to collect its fauna. The lower surfaces of many beds showed casts of spectacular ripple marks.

The excursion then continued towards Egton Bridge. On the way, various features of glacial deposition were pointed out and a stop was made at Castle Hill (NZ 808030) to see the striking double channel, probably the result of subglacial erosion.

Eventually Egton Bridge was reached and after a short walk along the River Esk (NZ 797053) an exposure in the Cleveland Dyke was examined. The full width of the dyke could be seen, although the north contact was best displayed. The rock is a medium grained andesite becoming very fine at the margins. Alteration of Upper Lias country rock at this point consequent upon the intrusion of the dyke, was displayed.

After dinner, the leader took the Society out again to examine the West Cliff section (NZ 898115), to see sedimentary structures developed in the Lower Deltaic sandstones and silts.

Sunday, 11th June

This day's excursion was centred on Staithes (NZ 782188), to the north of Whitby. The cars were parked in the abandoned railway station and before descending into Staithes, the general topographical features were explained by Professor Hemingway. The region is capped by boulder clay but is without the usual hummocks and ridges. There is a general flatness here and westwards towards Boulby (NZ 760190) with a topographical level of about 190 feet. It has been suggested that there was a marine pleneplanation after the retreat of the ice with subsequent uplift.

Sandy beds of the Sandy Series were exposed in the road cutting and on the opposite side of the little valley leading down to the harbour there were more extensive outcrops. The party descended down to the harbour (NZ 783189) to study the cliff and foreshore sections in an easterly direction. The west promontory of the harbour, Colborn Nab displayed a fine sequence of the sandy beds of the upper part of the Lower Lias. The cliffs were gashed by little gullies formed where faults had shattered the rock and there was much evidence of active shore erosion. Well developed potholes were seen in the rocks on the shore at the foot of Penny Nab (NZ 787190).

The section at Penny Nab, begins with the Sandy Series at the base of the Middle Lias. The variable nature of these beds is well demonstrated with laminated sandstones and clays. Some of the sandstones contain iron carbonate and are fossiliferous, including Protocardium and rhynchonellids. In this cliff, the ironstones of the Ironstone Series (see Table 1), could be seen, and also the Grey Shales and the Jet Rock Series of the Upper Lias. The whole succession is capped with boulder clay.

Eastwards, the dip of the beds gradually brings the higher beds down to sea level where they were examined. It was seen that in this section the Pecten Seam comprised 5 or 6 separate ironstones. The final part of the section examined was the Grey Shales and Jet Rock Series, containing much oil. They have been known to ignite in dry weather. Further opportunity was given to add to the collection of Upper Liassic fossils and samples of jet. The party climbed the steep cliffs at Rosedale Wyke (Old Nab NZ 796175) and walked back to Staithes along the cliff top.

The afternoon was again spent on the moors. The party was led in convoy through Easington (NZ 745180) to Danby (NZ 707084) making a traverse to the west of the road taken in the morning and the previous afternoon. Several halts were made to observe the topography of Cleveland Dome, from which the river valleys radiate. A marked break in the slopes marks the position of the Dogger with Lower Deltaic Series above and Alum Shales below. The drainage was established before the Ice Age and when the ice approached from the coast the rivers were dammed. The River Esk spread out to form Lake Eskdale and fingers of the Lake ran up each of the tributary valleys. There are sands and laminated clays on the site of the lake but the original flat area is now dissected. In general the soil is acid and forms moorland, but where boulder clays occur the land is cultivated.

The party followed Castleton Rigg (NZ 6805), a long ridge between Danby Dale and Westerdale to Rosedale Head and the last halt was made at Ralph Cross (NZ 674019) the highest point. From here the leader pointed out the Yorkshire Wolds of the East Riding. All around was the generally plane surface of the gently warped Tertiary peneplain.

The chosen route continued along Blakey Ridge (SE 6896) through Hutton-le-Hole (SE 704900) where the Cornbrash was examined, and across the Corallian by Kirkby Mills (SE 705860) to Helmsley (SE 613838). In the Market Place the President moved a vote of thanks to Professor Hemingway for the most interesting and instructive excursion which he had led.

Cars then proceeded homewards independently.

D.M.M.

REFERENCES

HEMINGWAY, J.E. 1958. The Geology of the Whitby area reprinted from A survey of the Whitby and surrounding area University of Newcastle, Newcastle-on-Tyne.