
21 The Chalk of Flamborough Head

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Purpose

To examine the most northerly outcrop of late Cretaceous chalk in England at Flamborough Head, together with features of the Devensian glaciation, including the buried Cliff at Sewerby. The headland has S.S.S.I. status for its coastal scenery, geology and wildlife, being one of the most important coastal nesting sites in Europe.

Logistics

Access to the coast is easy; all the bays have adequate parking (Figure 21.1). Public transport is limited, especially in Winter with local 'Little Buses' from Bridlington to Flamborough and regular buses from Hull to Scarborough, via Bridlington. In Summer, a 'Little Train' service operates from Bridlington to Sewerby (www.eastriding.gov.uk).

*Note: **All locations must be visited on falling tides.*** Times are available from H.M. Coastguard on the harbour at Bridlington. **Safety helmets are recommended** as cliffs are subject to falls and mud slides. Suitable footwear is required as the foreshore rocks can be very slippery.

Maps

O.S. 1:25 000 Sheet TA 26/27 Flamborough; O.S. 1:50 000 Sheet 101 Scarborough & Bridlington; B.G.S. 1:63 360 Sheet 65 Bridlington.

Geological background

The chalk succession exposed between Sewerby and Bempton Cliffs, about 400 m thick, is subdivided on biostratigraphical and lithostratigraphical criteria (Figure 21.2). These criteria also distinguish the chalk of Flamborough Head from that of Southern Britain as Northern Province Chalk. The chalk represents slow deposition of carbonate material in a clear tropical ocean. Clastic material is at a minimum except for marl bands, which may represent air-borne ash falls associated with volcanic activity as the proto-Atlantic opened to the south. Within the middle chalk, flint is found as nodules and thicker beds, some of which can be used with the marl bands as marker horizons throughout Flamborough and the Yorkshire Wolds (Figure 15.1). In the upper chalk, large nodules of marcasite can be found, often converted to rusty masses of iron carbonate.

In late Cretaceous times, the chalk sea transgressed over the fault-controlled topography of the Market Weighton Block, and represents a contrast in depositional history to that displayed at Speeton. The earliest beds (Hunstanton Formation or Red Chalk) rest with marked unconformity on early Jurassic rocks in the Market Weighton area, with isolated patches of basal conglomerates and sands (see Excursion 15). The sea finally covered the block and deepened in the faulted basins to the north and south, with the chalk sections of the Wolds thinner than that on the coast. In the Tertiary, pressure from the east gently folded the chalk into a saucer-like basin, producing scarps in the west and north Wolds and reactivating the older marginal faults along the Howardian–Flamborough Fault System, resulting in a compressional/extensional fracture zone running east–west across the Wolds and exposed on the coast. The chalk was compressed and recrystallized to form the resistant Flamborough headland. Marine erosion has exploited the many minor faults associated with the crush belt, forming the magnificent coastal scenery of arches, stacks, caves and coves.

The chalk is covered by drift from the most recent Devensian ice-sheet that banked up against the headland to form the Flamborough Moraine, which contains exotic erratics from Northern England and Scandinavia.

Excursion details

Locality 1, Sewerby [TA 202 687]

Flamborough Chalk Formation (Sewerby Member), *Inoceramus lingua* Biozone (60 m). Reach Sewerby on a minor road off the B1255 from Bridlington. Park at Sewerby Park (Zoo and small Museum, with cafe and toilets), walk to the cliff edge and descend to the beach by the concrete Sewerby Steps, noting the rotational slipping of the Skipsea Till along a spring line. The beach is built of chalk boulders, many bored by modern bivalves, together with erratics and large blocks of calcrete, a post-glacial gravel cemented by calcium carbonate. The chalk is soft and flintless, with thin marly partings. Investigation is often prevented by rainwash from above, bringing down mudflows of drift, and by rock falls. In the past, the wave-cut platforms offered good collecting, especially from the Flamborough Sponge Bed that stretches from here almost to Danes Dyke, but it is better to collect from beach boulders. Fossils found include bivalves, echinoids, brachiopods, starfish plates, ammonites and well-preserved hexactinellid and lithistid sponges.

Some 250 m south, the gently dipping chalk cliffs end at the Sewerby Buried Cliff (Figure 21.3) which displays a section through glacial and interglacial deposits banked against and over the old cliff face. This feature can be traced southwards along the edge of the Yorkshire Wolds to Hessle and into Lincolnshire, and represents an interglacial cliffline of between 116 000 and 128 000 years ago. The exposure varies depending on the amount of slippage, but when it is clear the interglacial beach at the base can be seen resting on a planed wave-cut platform of chalk and Basement Till. From these deposits fragmented mammalian bones have been collected indicating an Ipswichian age. The interglacial beach is covered by rain wash, scree deposits, blown sands, and Chalk rubble with loess, capped with Skipsea Till, followed by glaciofluvial Sewerby Gravels containing mammoth teeth and human artifacts.

Return to Sewerby Steps and the car park or coastal path, or continue east along the beach to Danes Dyke, with many fossils, including sponges, to be found en route.

Locality 2, Danes Dyke [TA 231 692]

Flamborough Chalk Formation (Danes Dyke Member), *Marsupites testudinarius* (26 m) and *Uintacrinus socialis* (29 m) Biozones. There is a car park on the site of Danes Dyke House (with toilets and a small refreshment shop in summer). Walk through the woods to the beach noting the Iron Age earthwork which cuts across Flamborough Head to isolate its eastern end. The dyke is a deep ravine, now occupied by a small seasonal stream cutting into glacial deposits that filled a much larger glacial spillway. The ravine is cut along the Danes Dyke Fault that can be seen as highly fractured and contorted chalk in the cliff section to the west of the drainage pipe. Glacial deposits rest on the planed surface of the chalk. The fault can sometimes be traced across the beach in winter after severe storms have swept the beach clear of sand.

Walking west, the southerly dip brings down the upper part of the *Marsupites testudinarius* Biozone for about 200 m to a prominent group of four boulders on the beach. The thinly bedded, flintless marly chalk is full of the isolated calyx plates (see crinoid) of the index fossil, and their density increases upwards through the zone, with complete examples of the stemless calyxes not uncommon, especially along marl bands. Other fossils include echinoids, belemnites, brachiopods, and starfish ossicles from faecal pellets.

From Danes Dyke return to the car park or the coastal path, or else, *but only on a falling tide*, cross the Danes Dyke fault, which throws down to the south, and follow the shoreline eastwards out of the bay for 500 m to Hartendale Gutter [TA 221 692]

For about 200 m the more massive-bedded chalk, with bedding plane stylolites formed by loading and solution, is cut in the *Marsupites testudinarius* Biozone, but on approaching Hartendale Gutter, the calyx plates become fewer and the succession passes into the *Uintacrinus socialis* Biozone. This stemless crinoid is present locally and may have been (like *Marsupites*) a deeper-water species swept into the Northern Province, as these two fossils are common at this horizon throughout England. The section at Hartendale Gutter is one of the few British localities for complete specimens, but more commonly they are found as isolated calyx plates or groups of plates and arm ossicles, indicating individuals falling

into quiet conditions on the sea floor. Other fossils found include echinoids, brachiopods, corals, belemnites and sponges.

Return to Danes Dyke, or continue east to South Landing via the coastal path or beach (only on a falling tide.)

Locality 3, South Landing [TA 231 693]

Flamborough Chalk Formation (South Landing Member), *Hagenowia rostrata* Biozone (23 m).

Take Landings Road from Flamborough to South Landing where there are parking, picnic and toilet facilities. Descend to the beach along the road used for launching boats. The ravine is very similar to Danes Dyke and is probably formed along a fault line. The bay is cut in massive-bedded flintless chalk. The index fossil is very rare and the small echinoid *Hagenowia blackmorei* is found instead. Other fossils include echinoids, belemnites and sponges.

It is not recommended to continue further east on the beach towards Flamborough. The coastal path should be taken to Selwicks Bay.

Locality 4, Selwicks Bay [TA 255 708]

Flamborough and Burnham Chalk Formations, *Hagenowia rostrata* Biozone. Take the B1259 from Flamborough to the car park by the lighthouse (with cafe, gift shop and toilets), noting the older lighthouse on the golf course. Chalk does not make a good building stone and this is one of the few Flamborough buildings made of it. Walk to the top of the steps to view the bay. The vertical chalk cliffs contrast with the grass-covered slopes of the glacial drift, which support a great variety of animal and plant life, especially orchids. Walk down to the top of the new steps. At low tide the geology of the bay is well displayed, as are marine erosion features, especially the prominent stack (known locally as Adam).

Descend to the beach (best at low water). The chalk is cut by the Selwicks Bay Fault, downthrowing about 20 m to the north, and part of the Howardian–Flamborough Fault Zone that runs east–west across the Wolds and marks the reactivated edge of the Market Weighton Block. The main fault zone is marked by a large mass of fault breccia, cemented by crystalline calcite. The complex nature of the bay is best revealed on the wave-cut platform by walking north across the bay starting at the prominent brown flint band that marks the junction of the flintless Flamborough and flinty Burnham Formations. The fault breccia is a complex structure of fractured blocks with several stages of tension and compression indicated by cross-cutting calcite veins. On the north side of the bay the Flamborough Chalk Formation is steeply dipping away from the fault towards the small stream, where the beds are truncated by another, low-angle fault which can easily be traced across the wave-cut platform. On the south side of the bay, the Burnham Chalk Formation reappears in a cove known as Monk Hole. All around the bay, small faults and joints, with both horizontal and vertical slickensiding and calcite veins, criss-cross the chalk cliffs and beach, resulting from reactivated movement along the deep-seated faults. Within the chalk, compressional features can be seen, notably above the warning sign at the entrance to Monk Hole. Marine erosion has eroded along the weaker fault lines in the otherwise hard chalk to create a wide range of coastal features such as caves, coves, arches and stacks. *These should only be explored on a falling tide.* Fossils are uncommon in the hard crystalline chalk but include echinoids and belemnites.

The beach has many erratics, including semi-precious agates and cornelians. A purple sand often accumulates in patches and is largely composed of garnet.

Return to the car park or walk north along the cliff to Thornwick and North Landing. All cliff walks display magnificent coastal features, with a wide variety of nesting birds in spring and summer.

Locality 5, Thornwick Bay [TA 234 722]

Burnham and Welton Chalk Formations, *Stenotaxis planus* (38 m) and *Terebratulina lata* (60 m) Biozones. Take the B1255 from Flamborough to the Viking Hotel and then follow a rough road to the cafe. Descend the cliff path into Great Thornwick Bay which displays massive-bedded flinty chalk. The flint and marl bands form easily traced marker horizons around the bay and into Little Thornwick, for example the Feruginous Flint (easily recognized by its reddish colour). The

Ravendale Flint, 25 m above, is 1 m above the junction of the Welton and Burnham Chalk Formations, and the zonal boundary. Erosion features, excavated along faults and joints, are seen in both bays. Fossils are scarce in the hard recrystallized chalk but include echinoids, brachiopods and bivalves.

Locality 6, North Landing [TA 238 720]

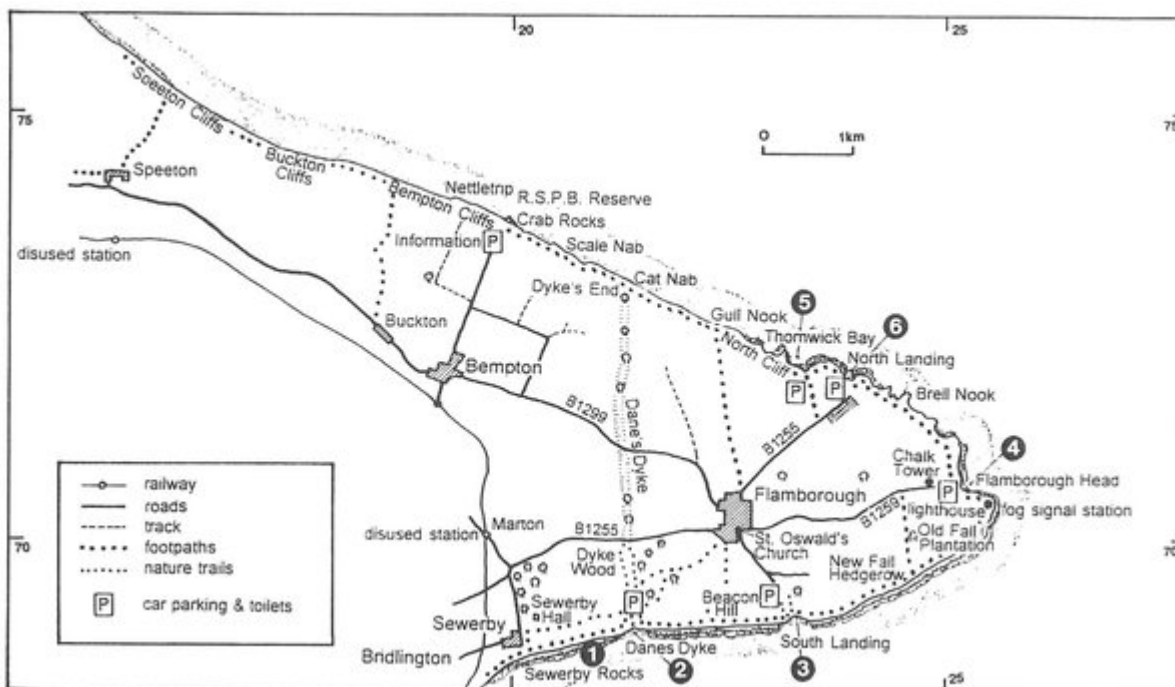
Burnham and Welton Chalk Formations, *Sternotaxis planus* and *Terebratulina lata* Biozones. Take the B1255 from Flamborough to the car park at North Landing (with cafe and toilets). Walk down to the beach via the slipway to the Lifeboat Station. North Landing is a very narrow bay and is probably fault controlled, with the back of the bay choked with till. In summer, boats frequently go out from here to view the birds and pass by the highly contorted chalk at Old Dor and Scale Nab [TA 205 736]

The chalk is massive and flinty, with a marl band forming a prominent ledge dipping into the bay and into the fault line cave on the north side. A band above it contains oysters, brachiopods and the index fossil, *Sternotaxis planus*. The flints are very prominent in the bay, especially the 'Paramoudra Flints', large masses up to 1 m length which appear to be original burrows expanded by overfilling with flint.

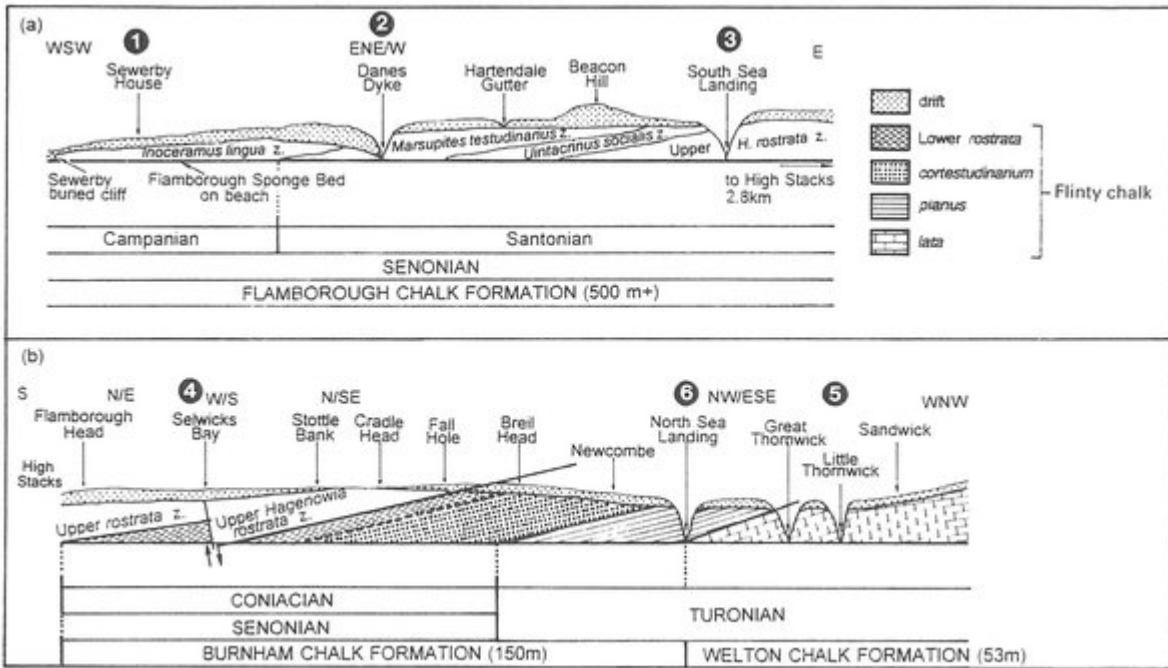
Return to the car park or take the coastal path back to Bridlington, or north to Speeton via the R.S.P.B. reserve at Bempton [TA 205 736]

None of the coastal sections below Bempton cliffs should be visited even at low tide.

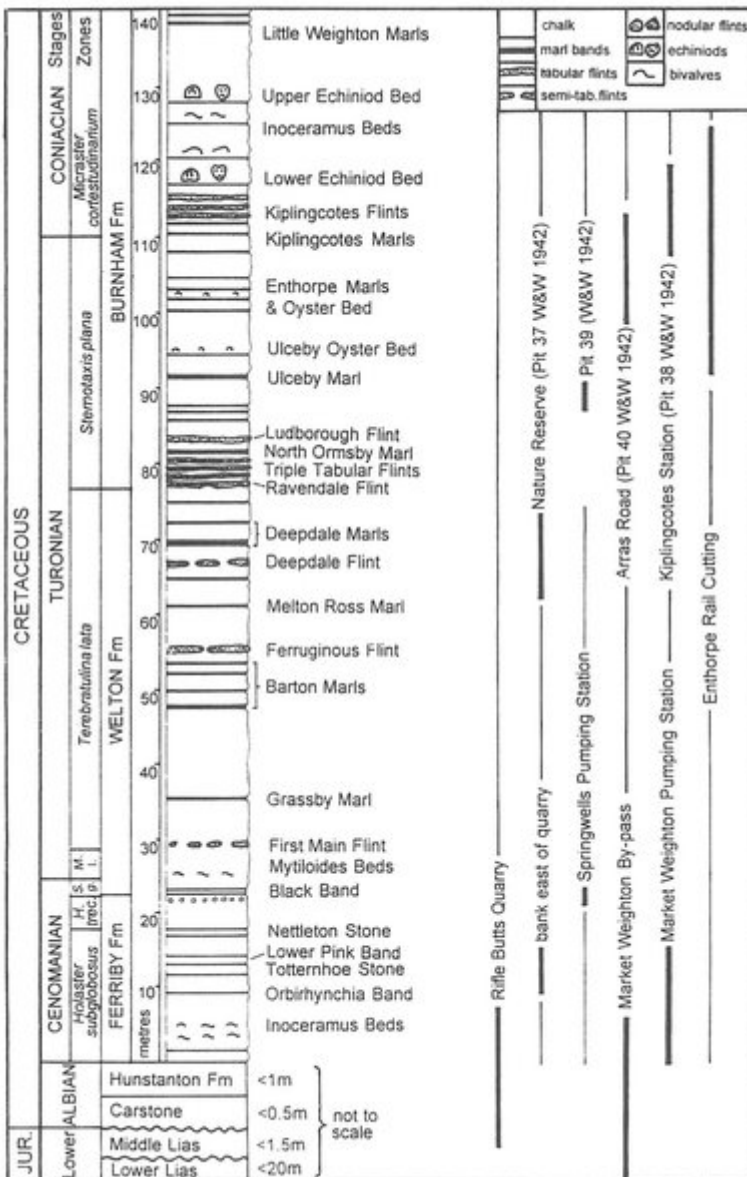
Bibliography



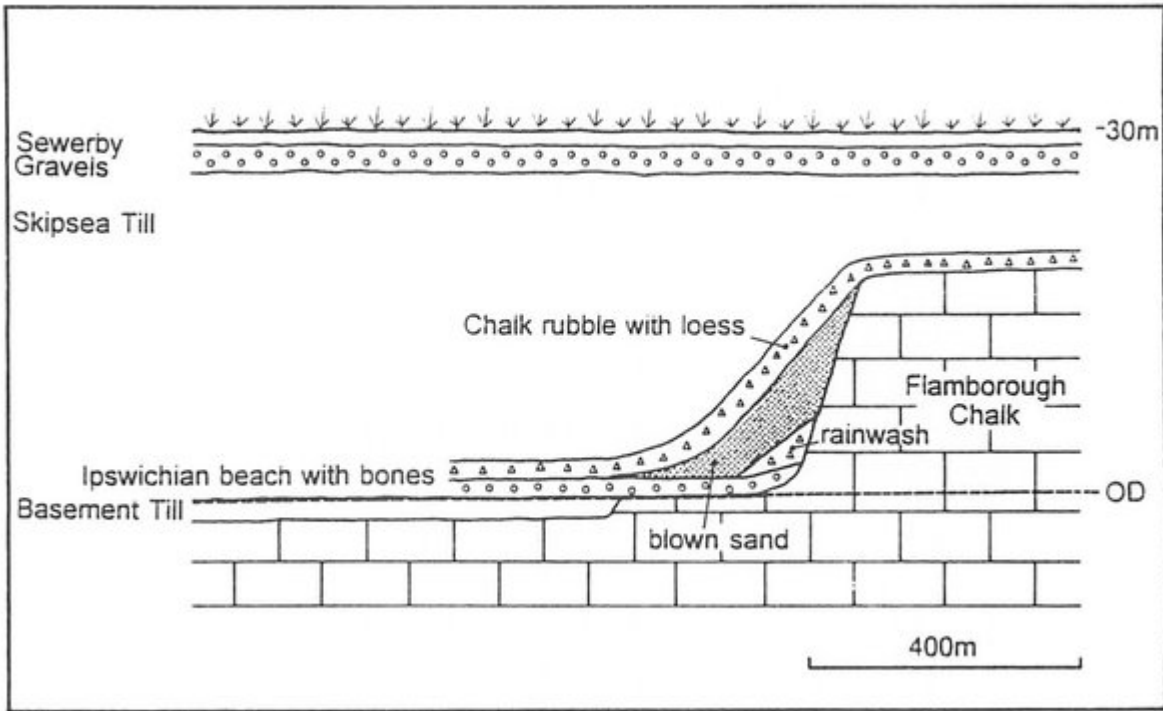
(Figure 21.1) Map of the Flamborough area indicating localities described in the text.



(Figure 21.2) Cliff profiles: (a) Bridlington to South Landing; (b) Flamborough Head to Thornwick Bay (based on Neale in Rayner & Hemingway, 1974).



(Figure 15.1) Geological succession in the Market Weighton–Kiplingcotes area.



(Figure 21.3) Profile of Sewerby buried cliff (based on Myerscough in Lewis, 1991).