# Walton-On-The-Naze, Essex

[TM 266 234]–[TM 266 238]

## Highlights

One of the most important sections in UK Neogene stratigraphy, the cliff section at Walton-on-the-Naze is the type locality of the Waltonian stage and has yielded a marine fauna comprising hundreds of species.

## Introduction

The low coastal cliffs just north of Walton-on-the-Naze are one of the most frequently visited sites for the study of the Red Crag. Over 70 publications describe the section or record its fauna. In Crag research (Red and Coralline Crags) this number is exceeded only by the Coralline Crag section at Rockhall Wood, Sutton.

The presence of fossiliferous deposits at Walton-on-the-Naze was first noted by Dale (1704). Parkinson (1811) described the Crag section as being 'twenty or thirty feet' thick (6.1–9.1 m) and 'about 300 paces in length'. These dimensions are of the same order as for the section today but Parkinson may have included some of the overlying Pleistocene sediments within his estimate of the Crag thickness. The location is renowned for its mollusc fauna which was already attracting attention by 1812 (Sowerby, 1812). The site was visited by Charles Lyell in 1829 who made a collection of the molluscs and subsequently figured the sections in the first edition of *Principles of Geology* (Lyell, 1830–1833).

The Red Crag is exposed in natural cliff sections on the east side of The Naze (Figure 11.25), an area of high ground just north of the town where coastal erosion causes cliff recession of just over 0.5 m/year (Gray, 1988). The cliffs are fronted by numerous active slumps. The degree of exposure of the Red Crag is dependent on the extent of the frequent slumping. The section can change rapidly and features which are visible one year may be gone the next.

Wood (1859, p. 33) considered the sediments here to represent 'the type of the Red Crag' when compared to other localities which he regarded as 'disturbed', i.e. which contained a much higher proportion of reworked material. The section is the type locality for the 'Waltonian' stage of Harmer (1900a), the oldest of his three stages of the Red Crag and which showed a significantly warmer water fauna compared to that of localities further north.

In the mid-19th century, a shell of the bivalve *Glycymeris* with a crudely carved representation of a human face upon it was alleged to have been found *in situ* within the marine sediments of the Red Crag at Walton-on-the-Naze (Stopes, 1882). Although its authenticity and antiquity were later questioned (e.g. Christy, 1914) it played a part in the controversial debate over the antiquity of humans in the early part of the 20th century.

This site was also independently selected for its fossil plants, birds and Quaternary stratigraphy content, a more detailed account of which can be found elsewhere in the GCR series (*Mesozoic to Tertiary Palaeobotany of Great Britain* (Cleal and Thomas, in prep.); *Fossil Mammals and Birds of Great Britain* (Benton *et al.,* in prep.); *Quaternary of East Anglia and the Midlands* (Allen *et al.,* in prep.)).

The Palaeogene geology of this site is discussed in Chapter 3.

## Description

At Walton-on-the-Naze, Red Crag sediments are exposed for several hundred metres overlying the Eocene London Clay Formation (see Chapter 3) in low slumped cliffs. The thickness of the formation varies laterally from approximately 4 to 5 m at the south end of the exposed section to wedge out as the cliff height diminishes northwards. The thickness at the present time is thus comparable with the section of 15 feet 6 inches (4.72 m) seen in 1863 (Kendall, 1931). The basal contact of the Red Crag lies at approximately 15 m OD and is often marked by a prominent spring line in the cliff which is

largely responsible for the frequent slumping. The unconformity surface is also marked by a discontinuous conglomeratic lag deposit a few centimetres thick consisting mostly of small, rounded, polished phosphatic mudstone pebbles. Occasional 'boxstones' occur. The basal sediments have also yielded many well-preserved and articulated bivalves in the past. Bell (1911, 1912) placed this fauna within the Boytonian Stage, which together with the Gedgravian, constituted the time represented by Coralline Crag deposition. Therefore, Bell considered the fauna of the lowermost sediments of the Red Crag at Walton-on-the-Naze to be equivalent in age to part of the Coralline Crag. The Red Crag is overlain by up to 5 m of middle Pleistocene deposits (Figure 11.30). Compared to the Red Crag, these deposits have received relatively little attention. The deposits show periglacial involutions and ice wedges which may penetrate the Red Crag and be associated with diapirs of the underlying London Clay (Hails and White, 1970). These Pleistocene deposits are described in more detail by Bowden *et al.* (1995) and Allen *et al.* (in prep.).

The Red Crag sediments consist of marine, shelly, quartz-rich sands conspicuously stained with iron oxides from which the Red Crag takes its name. Small pebbles including phosphatic nodules and clasts of London Clay may be common within the Red Crag sediments in some parts of the section. Phosphatic pebbles washed out of the Red Crag were occasionally exploited from the beach during the 19th century (Whitaker, 1877). The sediments are often cross-bedded (Figure 11.26), indicating deposition by submarine sandwaves, with the foresets dipping predominantly to the south-west. Smaller scale cross-bedding with dip directions opposed to the main foreset dip direction can be seen comparable to that at Bawdsey and probably representing deposition from the subordinate tidal current. In contrast to Bawdsey, however, the dominant direction represented by the large-scale cross-bedding at Walton-on-the-Naze is southwards and is thus similar to the subordinate direction shown by the smaller-scale cross-bedding at Bawdsey. The foresets at Walton-on-the-Naze show evidence of cyclic deposition which may reflect tidal rhythms (Figure 11.27).

The uppermost metre or so of the Red Crag sequence may be completely devoid of carbonate due to post-depositional leaching. The undulose lower boundary of this leached zone often cuts across the cross sets and other sedimentary structures (Figure 11.26). This dissolution contrasts with that seen in the Coralline Crag in which only aragonite has been dissolved. Carbonate cements are rare but occasional patches of sediment with a coarse calcite spar cement may be associated with narrow joint fissures.

The Red Crag at Walton-on-the-Naze is well known for its diverse and well-preserved fauna, particularly of molluscs. The first list of molluscs from this site was produced by Wood (1866) with 118 species. The list was progressively increased by Prestwich (1871b), Bell and Bell (1872), Whitaker (1877) and Reid (1890), until Kendall (1931) had recorded almost 300 species of mollusc. Perhaps the most conspicuous species are the large shells of *Glycymeris glycymeris,* sometimes found in a convex-upward orientation, in distinct layers (Figure 11.28), and the sinistral gastropod *Neptunea contraria.* Other common mollusc species include *Spisula ovalis, Spisula arcuata, Aequipecten opercularis, Pholas cylindrica, Cerastoderma* spp., *Hinia reticosa, Hinia granulata* and *Natica* spp. Other fossils include the solitary coral *Balanophyllia* and the small irregular echinoid *Echinocyamus pusillis.* An extensive list of the fauna from this locality was given by Whitaker (1877) and Kendall (1931). Trace fossils found here include small *Skolithos* and occasional very large vertical burrows, sometimes up to 2.5 m long (Figure 11.29), ascribed to the ichnogenus *Psilonichnus* by Humphreys and Balson (1988). Terrestrial mollusc shells, which are extremely rare in the Red Crag, have been recorded at Walton (Bell, 1884; Kennard and Woodward, 1900).

The majority of the section at Walton-on-the-Naze consists of subtidal cross-bedded shell sands deposited by migrating sandwaves. Water depth was interpreted as 20–30 m by Dixon (1979). Strong tidal currents were able to transport large shell fragments and small pebbles. In-situ fauna is rare, as in the case of the cross-bedded Coralline Crag at Crag Farm (see Chapter 10), although some units are extensively burrowed. The abundance of the benthic foraminifer *Pararotalia serrata* indicates warm temperate conditions (Funnell and West, 1977). Dinoflagellates such as *Tectatodinium pellitum* also suggest temperatures warmer than the present North Sea (Hunt, 1989).

Pollen has been obtained from some relatively unoxidized sediments at Walton-on-the-Naze. The assemblage is dominated by tree pollen but there is evidence of nearby coastal saltmarsh (Hunt, 1989).

## Interpretation and evaluation

The section of Red Crag at Walton-on-the-Naze is extremely important in the study of UK Neogene stratigraphy. The site gave its name to the Walton Crag of Wood (1866) and the Waltonian Stage of Harmer (1900a) which later became synonymous with the Red Crag Formation (Mitchell *et al.,* 1973b). As a stratotype, the section at Walton-on-the-Naze leaves much to be desired. Firstly, the basal part of the sequence has formerly been assigned to another stage, the controversial Boytonian (Bell, 1911, 1912). Secondly, the sequence is dominated by large-scale cross-stratified sets which result from the migration of large marine bedforms. Evidence from the rhythmic bedding which may reflect tidal cyclicity indicates that deposition took place rapidly and therefore a single cross-stratified set represents only a few months or years of deposition as the bedform migrated laterally at rates of several tens of metres per year. Superposition by the next cross-stratified set may not have taken place immediately but it is likely that the entire sequence represents no more than a few decades of deposition.

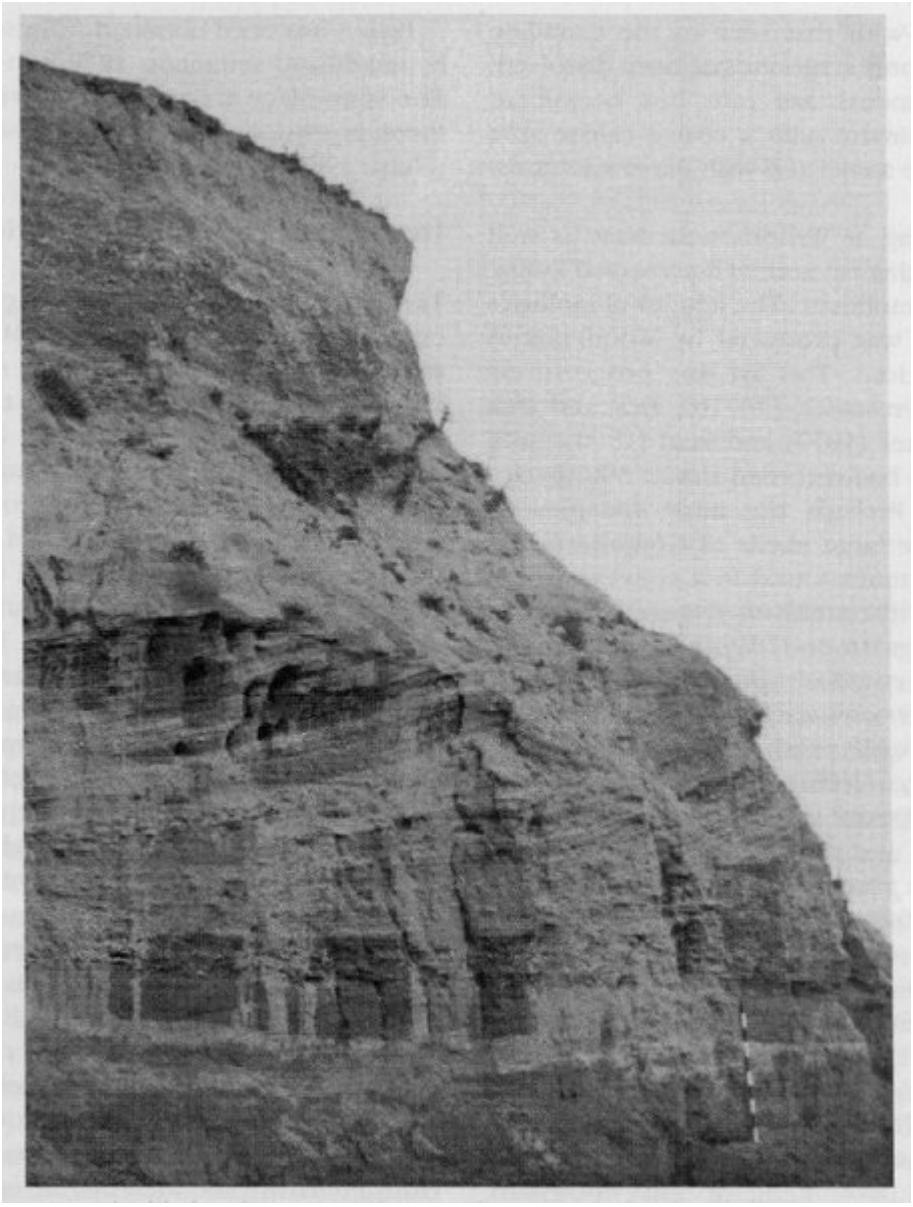
Pollen is extremely rare in the Coralline and Red Crags because of their generally sandy and oxidized nature and their marine facies. The discovery of pollen and other organic walled micro-fossils at Walton-on-the Naze is thus especially important. The pollen assemblage is closely comparable with the Late Pliocene Reuverian 'C' assemblages of the Netherlands (Hunt, 1989).

## Conclusions

In terms of number of species, the Red Crag at Walton-on-the-Naze is one of the most fossiliferous of all UK Neogene localities. One of the earliest recorded sections in the Red Crag, and often cited as the earliest formation in the British Quaternary, the cliff section at Walton-on-the-Naze is one of the most important Neogene sections in Europe.

**References**

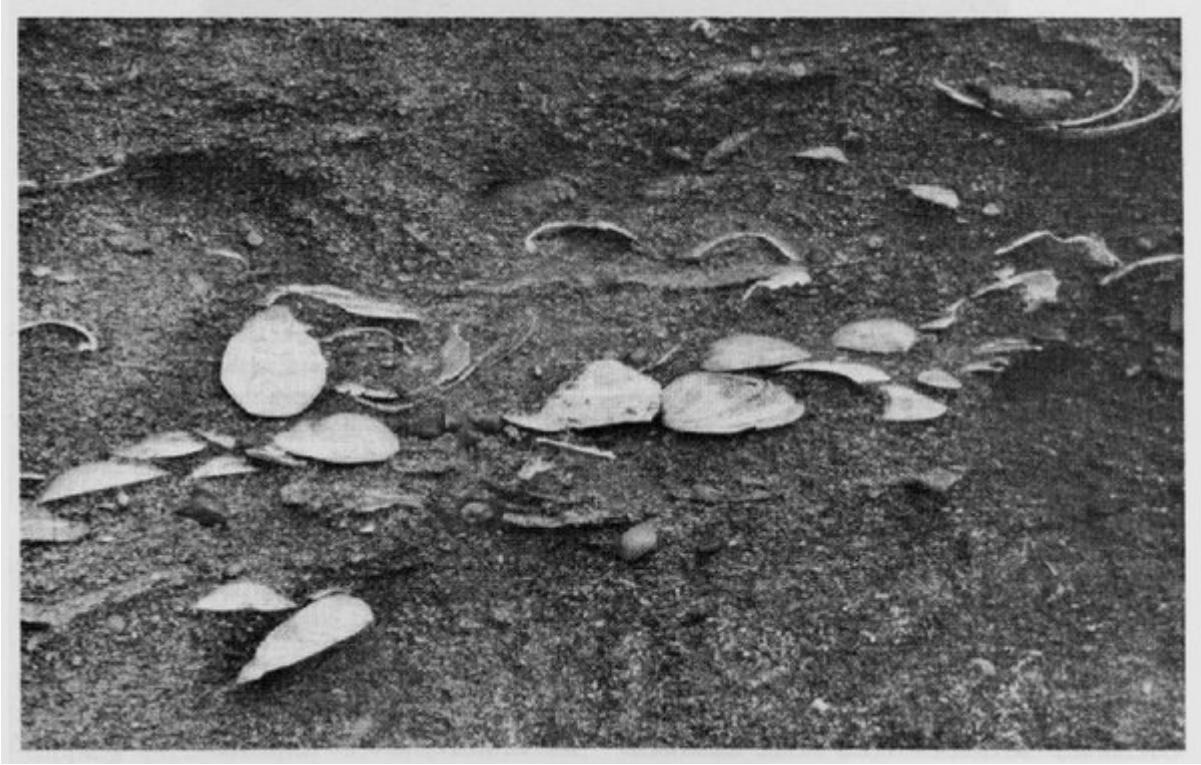
*(Figure 11.25) Walton-on-the-Naze. View looking north showing the slumped undercliff and low cliffs of Red Crag overlain by Pleistocene sands and gravels. (Photograph: P Balson.)*



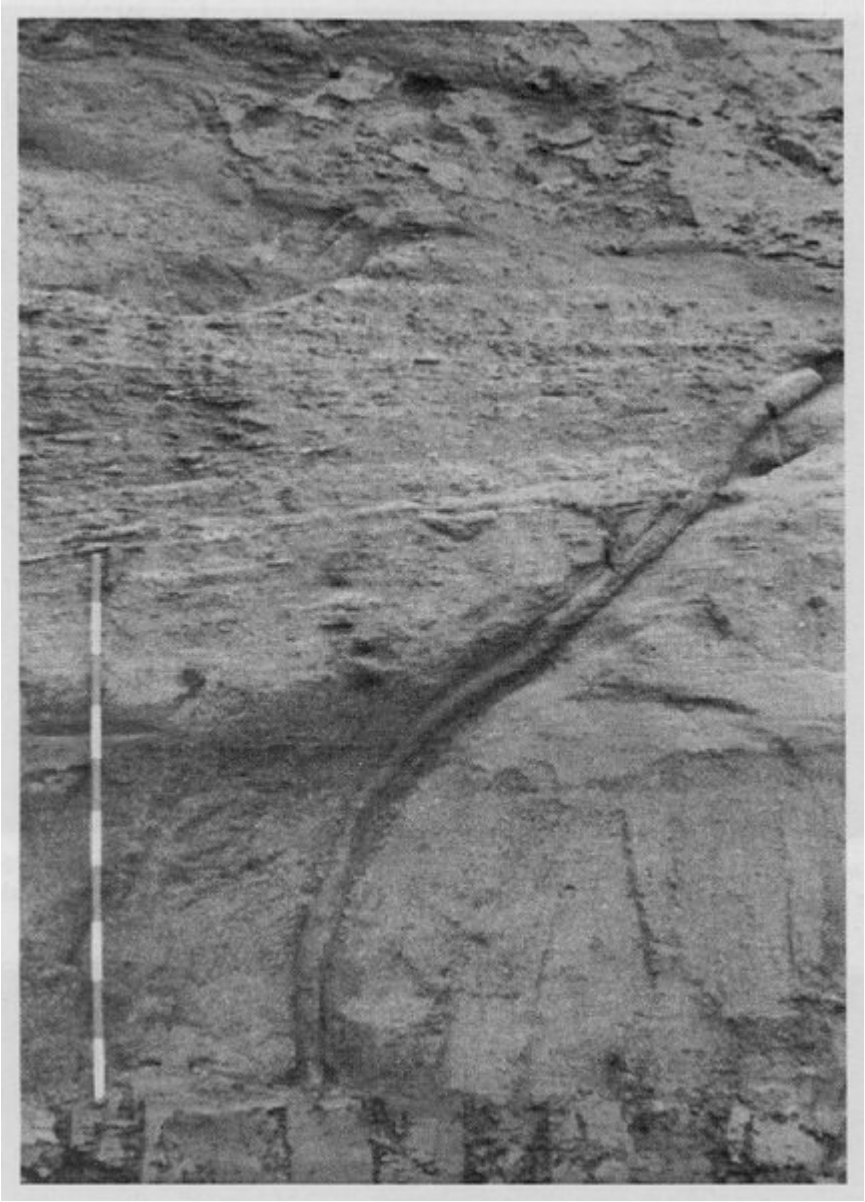
*(Figure 11.30) Cross-bedded Red Crag at Walton-on-the-Naze overlain by Pleistocene sands and gravels. Scale is 1 m long. (Photograph: P. Balson.)*

*(Figure 11.26) Cross-bedded Red Crag sediments, Walton-on-the-Naze. Lower limit of decalcification is arrowed. Graduations on scale = 10 cm. (Photograph: P Balson.)*

*(Figure 11.27) Small-scale cross-bedding reflecting migration of smaller bedforms (possibly ebb-oriented) up the face of a larger sandwave. Graduations on the scale = 10 cm. (Photograph: P Balson.)*



*(Figure 11.28) Shell layer in Red Crag showing characteristic convex-upward orientation of bivalve shells. Coin is 30 mm in diameter. (Photograph: P. Balson.)*



*(Figure 11.29) Very large trace fossil ascribed to Psilonichnus by Humphreys and Balson (1988). Scale is 1 m long. (Photograph: P Balson.)*