Cenomanian, Turonian, Senonian, Maastrichtian (CEN-MAA)

Block Description

Visit https://jncc.gov.uk/gcr-site-list, for more information on GCR blocks and sites
For Mesozoic-Tertiary Stratigraphy GCR block descriptions and GCR site lists, visit https://jncc.gov.uk/gcr-blocks-mesozoic-tertiary-stratigraphy

Introduction

The GCR sites selected for this GCR Block represent the British geological record of Earth history from about 100 to 65 million years ago (Ma). This interval comprises the six ages of the Late Cretaceous Epoch. Rocks that formed during the Late Cretaceous Epoch constitute the Upper Cretaceous Series, which is in turn part of the Cretaceous System.

It is from the white Chalk of the Anglo-Paris Basin that the 'Cretaceous System' takes its name (creta = Latin for chalk), introduced by the Belgian geologist, Omalius d'Halloy in the early nineteenth century.It was not until the late 20th century, however, that a Lower and Upper division was formalized at the base of the Chalk (strictly, at the base of the Cenomanian Stage).

Outcrop pattern

Upper Cretaceous rocks, primarily Chalk, cover a vast area of England forming the Downs and Wolds as well as the spectacular chalk cliffs from Flamborough Head to south-east Devon. In south-east Devon and the Inner Hebrides of north-west Scotland, white chalk rests on greensands, calcareous sands and commercially important quartz sandstones.

Palaeogeographical setting

During the Late Cretaceous times, the super continents of Laurasia and Gondwanaland were breaking up and sea levels reached their maximum for the whole of the last 600 Ma, leading to chalk deposits forming on many continental regions of the world, including the British Isles.The causes of these geological events have been related to (i) bulging ocean basins (Late Cretaceous super-plume), expelling sea water onto continents; (ii) carbon dioxide levels about four times greater than today, keeping continental interiors and polar regions much warmer during winter and (iii) little or no water trapped as polar ice, contributing to high sea levels.

A combination of high sea levels and warm, less oxygenated sea water compared to the present day also gave rise to three periods of black shale formation in the Cretaceous known as oceanic anoxic events (OAE). Two of these OAEs occurred in the Late Cretaceous Epoch, the first at the Cenomanian–Turonian (C/T) boundary, resulting in the Plenus Marls and Black Band lithologies 93.5 million years ago.

By the close of the Cretaceous Period, over a very short time period of perhaps only 200 000 years, huge changes had taken place on Earth that led to the disappearance of many fossil groups including the dinosaurs, ammonites, belemnites, inoceramid and rudistid bivalves and many of the chalk-forming calcareous nannoplankton. This extinction event marked the end ofthe Secondary Era, the Mesozoic. The suggested causes of these cataclysmic changes are controversial, and include inferred meteorite impact(s) in the Yucatan peninsula, Mexico (Chicxulub Crater) and Bombay area, India (Shiva Crater), preceded and followed by exceptional volcanic activity (Deccan Traps), leading to a 'nuclear-winter'.Until now, the Late Cretaceous rocks of Britain contributed little to the arguments because all of the sedimentary evidence at the Cretaceous–Palaeogene (K/P) boundary, at the time the meteorite impact is believed to have occurred, was thought to have been removed by erosion. It is possible, however, that the small remnants of rock beneath the basalts in the Inner Hebrides at Gribun (Mull) and Beinn Iadain (Morvern) may preserve the evidence at the boundary.Of particular interest would be the presence of an iridium anomaly, a key index of the K/P boundary, which is used as evidence for a bolide impact.

GCR site selection

For the purposes of site evaluation and selection, the GCR sites can be grouped into four themes or 'networks', reflecting depositional province. The networks are:

- Southern Province
- Transitional Province

• Northern Province

• Inner Hebrides Group

Although the relatively common invertebrate fossils do not have a separate selection category in the GCR in their own right, the scientific importance of many stratigraphy sites lies in their fossil content. Therefore, some of the GCR sites are selected specifically for their fossil fauna, which facilitates stratal correlation and enables the interpretation of the environments in which the animals lived. Moreover, some sites have international significance because they have yielded fossils that are the 'type' material for a taxonomic group.

Palaeontology, fauna and flora

The traditional means of subdividing the Cretaceous System is by means of ammonites, abundant and diverse nektonic cephalopod molluscs that, because of their rapid evolution, prove to be almost ideal 'zone fossils', enabling the correlation and division of the rocks into relative ages by way of a distinct fossil 'signature'. However, other key biostratigraphical indicators for 'The Chalk' include belemnites, inoceramid bivalves, brachipods, echinoids (sea urchins), crinoids (sea lilies) and microfossils such as foraminifera.

Other invertebrate faunas of the time included simple and compound corals, calcareous sponges and bryozoa, abundant bivalve molluscs, such as oysters, smooth terebratulid and ribbed rhynchonellid brachiopods, gastropods (snails) and asteroids (starfish).

Lobster- and shrimp-like crustaceans often produced burrows within sediments, preserved as trace fossils.

Belemnites, relatives of the ammonites, were abundant and along with fish were probably the main food of the aquatic reptiles, which were the largest vertebrate animals in the sea. These included ichthyosaurs, plesiosaurs, pliosaurs, crocodiles and turtles. The fish included both holostean and teleostean bony fishes, and sharks and rays.

On land, dinosaurs were advanced; mammals formed a minor but increasingly important part of the fauna. Land plants of particular prominence were the gymnosperms, notably conifers, cycads, ginkgoes, ferns and horsetails. Insect life included dragonflies.

In contrast to the manner in which most invertebrate fossils are represented in the GCR, fossils of vertebrates, arthropods (except trilobites) and terrestrial plants do have their own dedicated selection categories, owing to the relative rarity of the fossil material.

See Arthropoda (APD); Jurassic - Cretaceous Reptilia (JUR-CRE-RP); Mesozoic Mammalia (MES-MAM); Mesozoic Palaeobotany (MES-PALBOT); Mesozoic - Tertiary Fish/Amphibia (MZ-TR-FI-A); Palaeoentomology (PALENT).