



Hettangian, Sinemurian and Pliensbachian (HET-PBN)

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 200 to 184 million years ago (Ma). This interval is the first part of the Jurassic Period; together with the succeeding Toarcian Age this age range constitutes the Early Jurassic Epoch. Rocks that formed during the Early Jurassic Epoch (part of the Jurassic Period) constitute the Lower Jurassic Series (part of the Jurassic System).

The Hettangian (200–197 Ma), Sinemurian (197–192 Ma) and Pliensbachian (192–184 Ma) strata are included in one GCR Block together because they are geologically commonly closely associated –over much of southern England they approximately equate with the lithostratigraphically defined terms, ‘Lower Lias’ and ‘Middle Lias’, (the Toarcian Stage being equated to the ‘Upper Lias’).

With few exceptions these deposits are fully marine and mark a striking contrast with the predominantly terrestrial deposits of the preceding Triassic System. They encompass a broad range of facies representing a correspondingly diverse range of environments. Most of these facies are fossiliferous, sometimes richly so, occasionally yielding exceptionally preserved material.

Outcrop pattern

The main outcrop of the Lower Jurassic Series in Britain forms an almost unbroken strip of varying width extending from the east Devon and the west Dorset coast, NNE through Somerset, Gloucestershire, the east Midlands and Humberside, to the coast of Cleveland and North Yorkshire. Significant outliers occur on either side of the Bristol Channel, in the Hebrides and adjacent west coast of Scotland, and in north-east Scotland, with others around Prees in Shropshire and Carlisle in southern Scotland.

Palaeoenvironment and palaeogeography

Britain lay between 30° and 40° north of the equator during early Jurassic times and occupied a key position in an epeiric seaway extending south-east into Tethys and north-east towards the Arctic. Although the break-up of Pangaea had commenced in Middle Triassic times, about 230 Ma, with rifting already well advanced by the start of the Jurassic Period, true ocean crust did not start forming in the north Atlantic until Toarcian times, about 180 Ma. Hence throughout early Jurassic times the major landmasses of North America and Greenland never lay far to the north and west, with further extensive areas of land present to the north-east in Scandinavia. These may have formed a source of some of the terrestrial elements of the biota, such as plants, insects and dinosaurs, which are found occasionally in these marine sediments, though many may have originated from the various minor islands which must have dotted this shallow seaway.

In a reconstruction of the palaeogeography during early Jurassic times published in 1992, it was considered that much of Scotland, the London Platform and the extreme south-west of England were land areas. The Mendip Hills and south-west Wales were considered to have been land for part of early Jurassic times but had become submerged by Toarcian times.

GCR site selection

For the purposes of site evaluation and selection, the GCR sites can be grouped into three main themes or ‘networks’, reflecting regional setting, within which sites were selected to represent the lithostratigraphical formations. The networks are:

- Southern England and Wales

Beacon Limestone Formation

Blue Lias Formation

Charmouth Mudstone Formation

Dyrham Formation

Marlstone Rock Formation

- Northern England

Cleveland Ironstone Formation

Redcar Mudstone Formation

Scunthorpe Mudstone Formation

Staithes Sandstone Formation

- Scotland (Hebrides Basin only)

Ardnish Formation

Blue Lias Formation

Breaknish Formation

Pabay Shale Formation

Scalpay Sandstone Formation

Stornoway Formation

The GCR sites selected include representatives from the main outcrop and from the main outliers, with the exception of the Carlisle and Prees outliers where there are no permanent exposures.

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 Jurassic 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'.

The many different depositional environments that developed in Britain during Early Jurassic times mean that the fossil record is rich and varied. Invertebrate faunas included simple and compound corals, calcareous sponges and bryozoa, abundant bivalve molluscs, such as oysters, smooth terebratulid and ribbed rhynchonellid brachiopods, gastropods (snails), asteroids (starfish), echinoids (sea urchins) and crinoids (sea lilies). The brachiopods occurred in an abundance that was never repeated on such a scale in later geological times. Microscopic organisms included foraminifera, ostracods and phytoplankton (dinoflagellates and coccolithophorid algae).

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 had already become established in Mid Jurassic times; primitive mammals formed a minor but 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).