



Fossils from the boulder clay

About 450,000 years ago, during the coldest part of the Ice Age, Essex was situated at the southern edge of the Anglian Ice Sheet. The Anglian Ice Sheet was huge, up to 2 kilometres (over a mile) thick in places, and covering most of Britain. We know the extent of the ice sheet because it has left behind evidence of its existence in the form of a curious type of rock called boulder clay, or till.

As the ice moved it ground up and carried along pieces of the rocks over which it passed, just as glaciers and ice sheets do today, and when the ice melted an unsorted clayey residue called boulder clay was left behind, usually as debris 'lodged' at the base of the moving ice sheet. Boulder clay therefore contains rocks and even large boulders, known as glacial erratics, transported long distances by the ice. Some boulders are up to 2 metres (6 feet) in diameter and can be seen in prominent positions on the roadside in north Essex. Many erratic boulders show scratches that were received when the rocks passed over each other at the base of the ice sheet. By matching rock types with known outcrops in other parts of Britain geologists are able to establish the direction of ice movement across the country from its origins in Scotland or Scandinavia.

The Anglian ice sheet extended into Essex as far south as Chigwell, Hornchurch and Hanningfield, so that the area to the north of this line forms a boulder clay plateau which has been cut through by more recent rivers such as the Chelmer, Blackwater and Colne. The boulder clay is mostly between 10 and 15 metres (30 to 50 feet) thick but in some places in the north of Essex it can reach a thickness of over 40 metres (130 feet). The composition of boulder clay varies according to the rocks over which the ice passed. In Essex it usually contains much chalk but the lower part is often dark grey as it contains ground up Jurassic rocks from much further north. Many Jurassic fossils can be found in the boulder clay such as ammonites and belemnites; all of them brought to Essex from the Midlands. Jurassic fossils such as these can therefore be picked up from ploughed fields and gardens, especially after the soil has been washed by heavy rain. Many different species of fossils can be found but the following are the most common and distinctive:

Devil's toenails

The marine bivalve *Gryphaea arcuata* is a type of oyster commonly found as fossils throughout central England from Lyme Regis in Dorset up to Whitby in Yorkshire. Of Jurassic age (about 190 million years old), they are very distinctive fossils with one shell, or valve, much larger than the other and strongly curved as an adaptation to living on a muddy sea floor. In Scunthorpe, on Humberside, they were so abundant in the local ironstone quarries that illustrations of the fossil were incorporated in the town's coat of arms. Because of its shape, *Gryphaea* was known as the 'Devil's toenail' and formerly thought to have magical or health-giving properties.



Gryphaea arcuata or Devil's toenail
from Roxwell, near Chelmsford.
Photo: G. Lucy

In some parts of Britain, for example, possession of a specimen was once thought to guarantee a cure for arthritis. Another common species of *Gryphaea* that can be found in the Essex boulder clay is *Gryphaea dilatata* from the Jurassic Oxford Clay which is about 160 million years old.

Belemnites

The strange, bullet-shaped fossil found in rocks of the Jurassic and Cretaceous periods (190 to 65 million years ago) is the internal shell, or 'guard', of an extinct mollusc called a belemnite. Related to the cuttlefish and the squid, they were extremely common in the prehistoric seas, finally becoming extinct at the same time as the dinosaurs. Conical or pencil-shaped in form with the head and arms protruding from one end, they are thought to have darted about in the water with astonishing speed. In fact, the name originates from the Greek word for dart. The soft parts of these animals are hardly ever preserved leaving only the internal guards that consist of radiating crystals of the mineral calcite. Before anything was known about them, belemnites must have been puzzling objects. They were at one time known as 'thunderbolts', it being thought that they were formed by lightning striking the ground. Most of the belemnites found in the Essex boulder clay are from the Jurassic Oxford Clay and about 160 million years old.



Belemnites from temporary excavations in the boulder clay in north Essex.
Photo: G.Lucy

Ammonites

Ammonites are remarkably beautiful fossils that are extremely common in rocks of the Jurassic and Cretaceous periods (190 to 65 million years ago). They became extinct at the end of the Cretaceous period at the same time as the dinosaurs. The characteristic spiral shell of the ammonite is fossilised, with the soft body and feeding arms decomposing soon after burial in the mud on the sea floor. There seems to be an almost endless variety of shell shapes, each one adapted to different living conditions. The shell is composed of a number of chambers, the first containing the body and the others containing gas or water which was regulated to enable the ammonite to rise or fall in the water rather like a submarine. The walls separating the chambers have corrugated edges where they connect with the outer shell, an important strengthening feature to resist water pressure. These are visible as intricate patterns, called suture lines, on the surface of the fossil.



A magnificent example of an ammonite found in the boulder clay near Saffron Walden and on display in Saffron Walden Museum. Whole specimens like this are, however, extremely rare. Photo: G.Lucy

Further reading

Lucy, G. 1999. **Essex Rock : A look beneath the Essex landscape.**
Essex Rock and Mineral Society.

Natural History Museum. 1983 (sixth edition). **British Mesozoic Fossils.** HMSO.