Fact sheet No. 3

Flint

Flint is a very peculiar rock. It looks as though it is the product of a volcano and has hardened from a molten state but it has, in fact, been formed entirely by a cold process beneath an ancient sea floor.

Flint was formed in soft, limy mud on the floor of the Chalk Sea some 80 million years ago. It is made of quartz, or silica, which came from the skeletons of tiny sponges that lived in this tropical sea. Their skeletons were dissolved in the seawater and therefore the mud on the sea floor contained silica in small amounts. At a shallow depth beneath the sea floor the chemical conditions were right for the silica to form into flint, which literally replaced the chalk, creating nodules of flint of odd shapes and sizes and sometimes in continuous layers. Some flint beds can be traced for hundreds of kilometres. Over millions of years this process continued and the white chalk mud, containing trillions of flint nodules, was slowly compacted to form a great thickness of over 200 metres (600 feet) of chalk that we now see in Essex.

The bizarre shapes of flint nodules, with spiky protrusions and holes, are thought to be due to flint replacing the chalk in the burrows of marine animals such as arthropods that were living beneath the Chalk Sea floor, and it was this connection with burrows that proved to be the key to how flint was formed. The process of flint formation was originally the subject of much argument and was only finally worked out in the 1980s when it was established that flint formed preferentially in burrows due to the presence of decaying organic matter, and also at the 'redox boundary', below which anaerobic, sulphate-reducing bacteria predominate. The shape of a flint nodule is therefore often the shape of an animal's burrow, with the surface often showing the burrowed fabric of the chalk it has replaced. The resemblance to bones, teeth or fossilised animals is purely coincidental. The positions of horizontal beds of flint nodules were also determined by climate cycles.

Flint nodules occasionally also contain a record of the animals that lived in this vanished Chalk Sea. Fossils such as a sea urchins or cockle shells are sometimes exquisitely preserved in flint and the cavities in flints are often the remains of a fossil sponge.

Flint is black but flint nodules have a white outer coating or patina (also called a cortex). This is due to an optical effect - the inside is dense and does not reflect

A natural flint nodule from Essex. The resemblance to a Henry Moore sculpture is no coincidence. Moore sometimes used flint nodules as inspiration in his Perry Green studios which were not far from the Essex border in East Hertfordshire. *(Photo: G.Lucy).*

GeoEssex Factsheet No 3
Compiled by Gerald Lucy
Revised 31 Dec 2009

light but the outside is porous and full of tiny cavities that reflect light back to the eye. Some flint has regular banding which sometimes resembles fossil wood. **Banded flint** is an enigma; perhaps the bands were formed because some of the original chalk that the flint replaced was layered by creatures backfilling their burrows. Another theory is that it could have been caused by the 'Liesegang ring' phenomenon, a complex and little understood chemical process that causes rhythmic banding of insoluble chemicals, in this case the rhythmic precipitation of silica (named after its discoverer, the 20th-century German chemist Raphael Eduard Liesegang).

After the Chalk Sea disappeared, around the time of the extinction of the dinosaurs, the Chalk was subjected to millions of years of erosion and countless numbers of flint nodules were ground down to sand and pebbles by the relentless pounding of the waves. Flint pebbles were redeposited as great thicknesses of gravel across Essex. Flint is therefore most familiar to us as pebbles and it is rare nowadays to encounter a nodule fresh from the Chalk. It is such a hard, tough, durable rock that it has survived many cycles of erosion and deposition, and as a result, in South East England almost every stone in the garden and almost every pebble on the beach is flint.

A fossil sea urchin, or echinoid, preserved in flint and on display in Saffron Walden Museum. This specimen is the classic heart-shaped echinoid Micraster. As a result of the movement of gravel during the Ice Age a specimen like this could turn up in the soil almost anywhere in Essex. *Photo: G.Lucy.*

Flint has not often been used as a building stone as it occurs in nodules of awkward shape but this has usually been overcome by 'knapping' flint to produce a flat face. Several fine flint buildings can be seen in Essex, usually in areas where chalk (and flint) occurs at the surface such as at Saffron Walden. A remarkable property of flint is that it breaks like glass yielding a smooth, lustrous surface with rippled, shell-like, or 'conchoidal' fracture planes having extremely sharp edges. This property was very useful to early humans and flint was extensively used for early tools such as hand-axes.

Knapped flints can be seen in the external walls of many Essex churches. This example is St.Mary's Church, Saffron Walden. *Photo: G. Lucy.*

Further reading

FORREST, A.J. 1983. **Masters of Flint.** Terence Dalton.

FORTEY, R. 1993. **The Hidden Landscape**. Jonathan Cape. (Pages 216-231).

GOODWIN, C. 1983. **Flint**. Norfolk Museums Service Information Sheet.

MASON, H.J. 1978. **Flint: the versatile stone**. Providence press.

HART, S. 2000. **Flint architecture of East Anglia**. Giles de la Mare.

SHEPHERD, W. 1972. **Flint: its origin, properties and uses**. Faber and Faber.

SMITH, A.B & BATTEN, D.J. 2002. **Fossils of the Chalk**. The Palaeontological Association. (Pages 10-11).