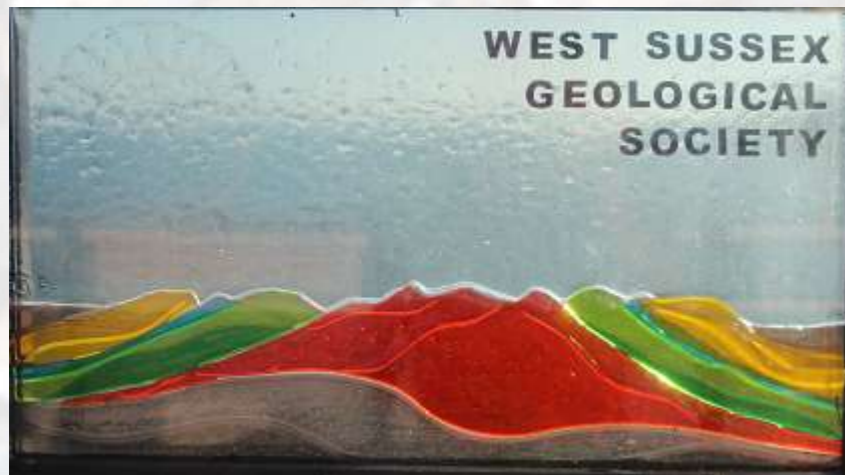




STONE TRAIL FIVE

PEBBLES ON THE BEACH

Explore our shingle beaches to discover the huge variety of pebbles, their history, the formation of flint that makes up much of the local beaches and the variety of fossils within it. Exotic rocks from Ice Age erratics, ships' ballast, and sea defences add a different dimension to the story.



Our stained-glass window on Worthing Pier

This leaflet has been produced to accompany the stained-glass window showing a geological cross-section through the Weald. Placed on Worthing Pier in Spring 2019 by the West Sussex Geological Society and generously supported by the Curry Fund of the Geologists' Association.



The Pavilion and pebble beach, Worthing Pier

Local Geology

The coast of Sussex lies on the southern slopes of the Wealden anticline. This is a large upturned boat-shaped geological formation, formed by deep crustal uplift starting about 50 million years ago. Since then the Weald has been eroded to the form shown in cross section in our stained-glass window.

Erosion was hugely increased during the climatic extremes of the Ice Ages during the last 1.5 million years. Although no ice sheets reached Sussex, the tundra-like conditions of severe winter cold and summer thaws led to the removal of vast quantities of rock. Erosion of the Chalk that forms the South Downs has left a residue of flints, naturally occurring nodules that formed millions of years ago. Today, these form extensive deposits of gravel (shingle) on our beaches.

The shingle also includes a variety of non-local 'exotic' rocks, such as granite. Some of these are fragments of stone from sea defences, others may be pieces of discarded ships' ballast whilst some may be erratics. These were carried here, trapped in icebergs, by ocean currents during the Ice Ages. As the ice melted, they fell to the sea floor and were subsequently incorporated into the modern beach.

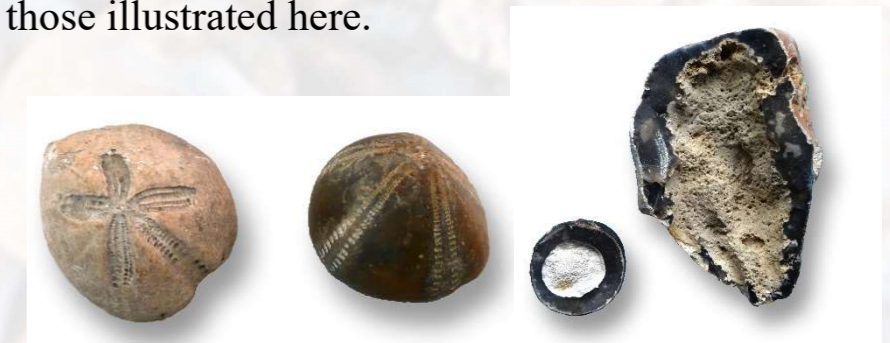
The beach is still being moved westwards by longshore drift, as can be seen by looking at the

groynes and sea walls, where the beach is higher to the west of any barrier to movement.

What is Flint

Flint began as the silica skeletons of sponges and other marine organisms, such as tiny diatoms, which lived between 90 and 65 million years ago as the Chalk was being deposited. After death, the silica slowly dissolved but subsequently, under the right conditions, solidified to form nodules or inside fossils of sponges and sea urchins. The nodules often replace burrows of different animals that lived in the mud of the Chalk seafloor, which is why they can be oddly shaped.

Look carefully at flint pebbles on the beach and you may find complete or partial traces of fossils like those illustrated here.



Fossil sea urchins and sponges preserved in flint.

Types of Flint

Flint is the most common building material of the South Downs and coast, used in walls as rubble (often in rows known as coursing) or knapped (trimmed) for high quality finishes. Four different sources of building flint have been recognised although the primary geological source is always the Chalk. These are Quarry Flint and flints eroded into more recent 'superficial' sediments of Quaternary age (less than 1 million years old).



A wall illustrating all varieties of flint in use.

Quarry Flint

These flints have been dug from the Chalk, for use as a building stone or as a by-product of chalk quarrying. The flint is typically nodular, grey or black with a white skin (cortex). There are subtly different flints that come from foreshore outcrops, where the white cortex has often been turned a pale blue-grey colour by contact with sea water.

Quaternary Flint

Flints from superficial deposits are distinctly different from quarried or foreshore outcrop flints. Two forms are easily recognised, namely white-weathered Downland Field Flint and brown-weathered flint from various sources that grades into Beach Pebble Flint.

Downland Field Flints are generally those that have been collected from field brash (loose stones) on the surface of the South Downs and immediately adjoining areas. Some white-weathered flints may come from other weathered Quaternary deposits.

Brown-weathered flints are stained by burial in Quaternary sediments, such as Clay-with-Flints on the South Downs, river gravels, or reworked 'brickearth' (originally Ice Age wind-blown soil). Collected from gravel pits or field brash, these flints are frequently broken or sub-rounded.

Beach Pebble Flint is easily recognised by the rounded shape (even when knapped, although close inspection of the edges may be required) and surface 'chatter-marks' made as the pebbles are knocked against each other by the sea. When used as a building material, most pebbles will have been collected from the foreshore. Occasionally, pebbles may come from fields or gravel pits on raised beach deposits of the coastal plain, formed during warmer periods of high sea level between the Ice Ages.

Flint in buildings

Flint is often used in the construction of older walls as it was readily available whereas good quality stone had to be brought in from further away. Look carefully at the flint walls and you should be able to recognise the different forms of flint and even find a fossil.

This flint wall along the side of St Paul's Church in Worthing is a Sussex Cobble wall of beach pebbles; you will see many of these in seaside towns.



The corners of the building (quoins), window and door surrounds are carved from solid stone, in this instance an oolitic limestone from the Cotswolds. Unlike flint, stone like this can be carved and also gives strength to the building which flint alone cannot provide.

The Parish Church of Christ Church is at the end of Ambrose Place, in Portland Road, Worthing. This was built in 1843 in Gothic Revival style and is a



good example of a building faced with flint, some knapped, and finished with a technique known as galletting. This is made of small flint flakes pressed into

the mortar between the stones, adding strength to the mortar and helping to repel rainwater, as well as looking decorative finish.

© West Sussex Geological Society 2019

The West Sussex Geological Society:

- Founded in 1977 with over eighty members
- For all interested in geology, from beginners to experts
- Welcomes new members
- Publishes our Outcrop magazine twice a year

Our Meetings are held on the third Friday of every month, (apart from July and August), in St. Stephens Church Hall, Angola Road, Worthing BN14 8DU. These start at 7.30 p.m. and we have a varied and interesting programme of talks.

We run half a dozen field trips each year, with a longer residential trip so we can go further afield. These have included building stones, landscapes, rocks, quarries, and fossil and mineral collecting

Interested? www.wsgs.org.uk

Enthusiastic young geologist? Think about joining:



<https://www.rockwatch.org.uk/>