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Written and designed by Roy Shepherd ©2011. Special thanks to my wife Lucinda Shepherd, friend Robert Randell and various experts for their support.

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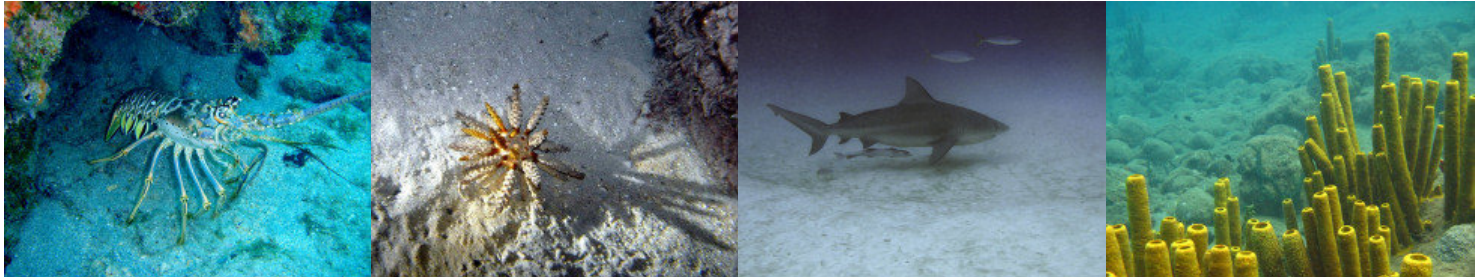


Littlehampton (West Sussex)

Location maps



How might the Littlehampton area have looked 80 million years ago?



Location summary

Geological period

Late Cretaceous epoch

Approximate age

90-71 million years

Fossil diversity

Echinoids, bivalves, sponges...

Supply of fresh material

Limited

Dangers to consider

Fast flowing river nearby... [read more](#)

Equipment needed

None

Protection status

None

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Introduction

It would be misleading to describe Littlehampton as a 'fossil collecting location', as the volume of new beach material naturally supplied to the area is relatively low; however it does represent one of many significant flint pebble beaches that occur along the south and east coasts of England in particular. Furthermore, the town has a nostalgic significance to both myself (Roy) and my wife Lucinda, as our home town and early inspiration for the subject, and for these reasons its geology and fossils are documented below.

Littlehampton is a seaside town situated on the West Sussex coast, 9 miles east of Chichester and 16 miles west of Brighton. The town is home to 27,500 people and the destination for many more visitors seeking the town's sandy beaches and river views. The River Arun passes through the town and separates the beaches to the east and west; the east side is popular with tourists due to its accessibility and family facilities, whereas the west is fringed by sand dunes and is generally more tranquil.



Left: The view from the beach access point looking north towards Littlehampton town. **Right:** Parking and refreshments are available alongside the access point.

Access to the beach can be made on either side of the river, although what new flint material there is, is more prevalent along the west beach. Parking is available on the west side at the end of Rope Walk, providing immediate access to the beach. Toilets and a small cafe are also located alongside the car park.

The geology of Littlehampton's pebble beach



Left: Littlehampton's west beach continues uninterrupted for 2 miles. **Right:** The internal flint mould of an *Echinocorys* echinoid resting among other flint pebbles.

The geological history of the Littlehampton area can be traced back hundreds of millions of years, however the interval of particular relevance in this instance began during the Late Cretaceous epoch between 90-71 million years ago. At this time Littlehampton and much of Great Britain, along with Europe, lay beneath a relatively shallow sea around 40°N of the equator, on an equivalent latitude to the Mediterranean Sea today.

In comparison with present-day conditions, global sea-levels during the Late Cretaceous were over 200 meters higher. The higher sea levels likely reflect a combination of extreme greenhouse conditions and heightened plate tectonics. Elevated tectonic activity and the associated volcanics delivered greenhouse gases to the atmosphere, fuelling the greenhouse effect. Global high temperatures melted much (perhaps all) of the ice at high latitudes, introducing significant amounts of water to the world's oceans.

The absence of any nearby landmass meant the primary sediment accumulating on the seafloor was the tiny skeletons of marine plankton, known as coccolithophores. These skeletons slowly accumulated to form a white lime mud. Over time the lime mud was compacted and hardened, and eventually turned to chalk rock. The chalk is particularly relevant to this story as the flint formed within it soon after it was deposited, throughout the Late Cretaceous. To read more about chalk [click here](#).

Although flint is inorganic, the silica that formed it was primarily sourced from the remains of sea sponges that grew on the seafloor. Flints are concretions that grew within the chalk after its deposition by the precipitation of silica; filling burrows/cavities and enveloping the remains of marine creatures, before dehydrating and hardening into the microscopic quartz crystals which constitute flint. To discover more about flint [click here](#).

By the end of the Late Cretaceous (65 million years ago) a great volume of chalk and flints had been deposited/formed, measuring up to 425m thick in the Sussex area. Since then and in particular between 30-25 million years ago, the southeast of England (including the Littlehampton area) has been uplifted by the tectonic forces associated with the European and African continental plates colliding (generating the Alps). This uplift was accompanied by a return to lower sea levels, and the chalk seabed was subsequently exposed and eroded, leaving the more erosion-resistant flint nodules behind.

More recently, following the end of the last ice age and a subsequent increase in sea levels (albeit to a less extent than 65 million years ago), the coastline has moved inland, exposing the remaining chalk to further erosion and sculpting it into vertical cliff-faces, as seen nearby at Seven Sisters for example. This continuous erosion exposes more flint nodules in the process, replenishing the pebble beaches.

As a result of past and present erosion, the English Channel and the surrounding river flood plains and chalk valleys contain vast quantities of loose flints. These flints are transported by tidal currents and rivers (including the River Arun) to the coastline where they accumulate to form vast pebble beaches.

At Littlehampton a large reef of flint and chalk pebbles is present approximately a mile west of the River Arun, although foreshore exposures are mostly obscured beneath the sand for much of the year. This exposed reef is the source of the least worn specimens shown below and perhaps the more worn examples too. It's unclear to what extent the sea defences constructed west of Climping are having on the supply of fresh material to Littlehampton's west beach, but it seems likely that fresh material will accumulate west of Climping to a greater extent.



Left: A reef of flint and chalk pebbles exposed at low-tide approximately a mile west of Littlehampton. **Right:** A close-up of the reef.

Where to look for fossils?

Fossils can be found along the entire pebble beach between Littlehampton and Climping in the west (and beyond). The best time to visit is during a falling tide when the full expanse of pebbles is visible, however even when the tide is at its highest there's usually sufficient pebbles at the top of the beach to explore. For a relatively low one-off cost we recommend the use of Neptune Tides software, which provides future tidal information around the UK. To download a free trial [click here](#). Alternatively a free short range forecast covering the next 7 days is available on the BBC website [click here](#).



Left: Fossils can be found among the pebbles towards the top of the beach. **Right:** Looking east along the beach towards the River Arun.

It's apparent when exploring the beach that the repeated tidal action of the sea has graded the pebbles into areas of similar size. For example the proportion of larger pebbles is generally greatest towards the River Arun end of the beach, likewise the larger pebbles tend to occur in graded horizontal bands as shown in the photo below-right.



Left: The pebbles at the river end of the beach tend to include a greater proportion of large pebbles. **Right:** Larger pebbles occur in visible horizontal bands.

Large pebbles are important as they generally contain a higher volume of complete specimens, in particular the internal flint moulds of echinoids which typically measure around 5cm (2 inches) across. Fossils can of course be observed on the surface of smaller pebbles however these are often partial or badly worn.

What fossils might you find?

The fossils at Littlehampton reveal the variety of organisms living on the seabed 90-71 million years ago. Among the more frequent finds include the internal flint moulds of two irregular (bilaterally-symmetrical) echinoid genera - the heart-shaped *Micraster* and the taller, oval-shaped *Echinocorys*. In life these particular echinoids were covered with small hair-like spines, which they used to propel themselves through the sediment in search of food. These spines are always absent from internal flint moulds, however specimens found *in situ* within the chalk elsewhere, occasionally include a small number of spines.



Left: A relatively unworn *Echinocorys* echinoid, note the white test is retained and very little of the internal flint mould is visible.
Right: The test has been largely worn away from this *Echinocorys* echinoid, leaving the internal flint mould.



Left: Echinoids such as this *Echinocorys* began life in a planktonic state, however fossil specimens below 2.5cm are less common.
Right: Some *Echinocorys* grew to the size of a tennis ball, including this specimen within a large chalk pebble (note that flint is absent from this example).



Left and right: Beach-worn internal flint moulds of irregular *Micraster* echinoids, found loose among the pebbles.



Left: An exquisite flint *Conulus* echinoid. **Right:** The underside view, showing the central opening in the test through which it fed and the anus on the right.

Evidence of other echinoids that inhabited the seafloor include the regular (radially-symmetrical) *Cidarid* echinoids. Unlike the aforementioned irregular echinoids, which spent their lives burrowing within the sediment, regular echinoids grazed on the seabed. This exposed lifestyle leaves the regular echinoids more exposed to predators, including starfish and fish in particular, subsequently these echinoids possess large defensive spines that help shield them from attack. The spines are also used for locomotion and to right the echinoid from an upturned position - following attack for example. Complete tests with associated spines are very rare, it's more common to find the impressions of test fragments and isolated spines on the surface of flint pebbles.



Left: The impression of partial *Prinonocidaris*(?) regular echinoid test. The centre of the plates are the attachment points of the spines.
Right: The impression of partial *Temnocidaris*(?) regular echinoid test.



Left: The impression of a spine belonging to a regular echinoid *Temnocidaris*. **Right:** A second spine impression *Tylocidaris*.

As well as echinoids, other benthic (seafloor dwelling) organisms include crinoids (very rare), bivalves, brachiopods and sponges. Flint is also notorious for appearing to resemble other organic structures, such as the pseudo human skull towards the bottom of the page.



Left: The impression of a *Marsupites* crinoid calyx plate. Flint impressions such as this are very rare.



Right: A flint pebble containing three *Marsupites* crinoid calyx plates.



Left: A near-complete internal mould of the *Spondylus* bivalve, visible on both sides of a flint nodule. Specimens from the chalk possess long spines.



Right: A flint pebble containing fragments of an inoceramid bivalve shell - visible in section as narrow white bands and voids.



Left: A brachiopod shell on the surface of a flint pebble. The shell has not been preserved, resulting in a narrow void between the internal and external moulds.



Right: A largely intact fossilised sponge encased by flint.



Left: A pseudo fossil, actually a banded flint pebble. These formations are not yet fully understood, however they are thought to occur during crystallisation.
Right: A pseudo fossil skull, actually the 'eyes' and 'mouth' represent the spaces previously occupied by fossil sea sponges.

Protecting your finds

It's important to spend some time considering the best way to protect your finds onsite, in transit, on display and in storage. Prior to your visit, consider the equipment and accessories you're likely to need, as these will differ depending on the type of rock, terrain and prevailing weather conditions.

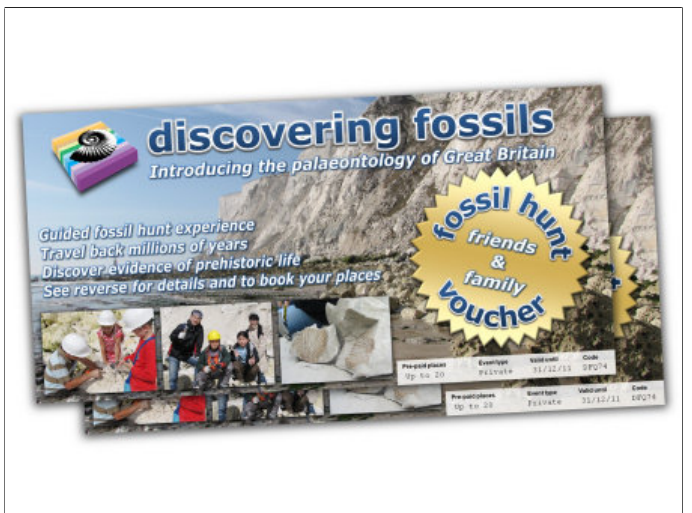


Left: Fossil wrapped in foam, ready for transport. **Right:** A small compartment box containing cotton wool is ideal for separating delicate specimens.

When you discover a fossil, examine the surrounding matrix (rock) and consider how best to remove the specimen without breaking it; patience and consideration are key. The aim of extraction is to remove the specimen with some of the matrix attached, as this will provide added protection during transit and future handling; sometimes breaks are unavoidable, but with care you should be able to extract most specimens intact. In the event of breakage, carefully gather all the pieces together, as in most cases repairs can be made at a later time.

For more information about collecting fossils please refer to the following online guides: [Fossil Hunting](#) and [Conserving Prehistoric Evidence](#).

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Left: A birthday party with a twist - fossil hunting at Peacehaven. **Right:** Send someone special a Fossil Hunt Experience Gift Voucher

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