

Chalk and Flint

Formation of chalk

Chalk is sedimentary rock made up of pieces of plant and animal remains. Sediment settles, become compacted, cemented together and forms sedimentary rock.

Sedimentary rock formed from animal shell is limestone or flint.

Chalk was formed during the Cretaceous Period, some 100 million years ago. At the time of the formation of the chalk downs England lay closer to the equator than we are today and the mean global temperatures were 10 – 15 C higher than today. Earth's sea levels were possibly hundreds of meters higher creating large areas of shallow seas.

There were lots of greenhouse gases, CO₂ and sulphur dioxide and no polar ice caps.

Round the centre of the equator was one vast ocean; Africa, South America, Australia and Antarctica formed one continent and North America, Europe and Asia formed another. Britain was joined to this northern continent.

There were large areas of forest, flowering plants and reptiles. Dinosaurs had died out.

Chalk is formed from

- 1) Calcareous platelets secreted by microscopic marine plankton called coccolithophores which were algae (plants because they photosynthesised but with animal tendencies). These platelets or coccoliths formed an overlapping protective layers and were shed throughout the algae's life time.
- 2) Shell debris from the protozoan (single-celled organisms) group Foraminifera. These had special shells with openings for feeding with thread like extensions which they also used to move around.
- 3) Sponges, sea urchins, molluscs, shrimps

Today there is 360 m of chalk still un-eroded, still standing.

Chalk is divided into Grey Chalk and White Chalk which is further divided into seven substrata.

The chalk at the Seven Sisters was formed from the Seaford Chalk Member. It is 65 – 70 m thick, soft, firm pure white chalk with well developed and regularly spaced seams of flint.

Flint

Bands of tabular flint can be seen in the chalk face of the cliffs. They normally run parallel to the bedding of the chalk although flint can be seen in vertical and oblique cracks.

Flint is a compact, hard, brittle mineral, brown-black or grey in colour, consisting of fine grained silica (silicon oxide) similar to quartz.

It was formed after the deposition of chalk by surface water percolating down through the chalk carrying soluble silica from the fossil remains of sponges or micro-animals. Silica is found in the skeletons or spicules of sponges. Silica is attracted to organic remains e.g. bivalves, sea urchins, sponges. It encapsulates them to form hard flint nodules.

Flint can develop in burrows left by burrowing invertebrates. It is often covered in a whitish cortex or outer layer which is porous and reflects the light and appears white. When exposed it can be stained by iron minerals giving it a brown tan tint.

Marcasite can also be found on the beach – fool's gold. These are heavy, dark, rust-brown nodules composed of iron sulphide and inside have radiating gold crystals.

The deposition of chalk ended around 65 million years ago and the chalk was pushed up above sea level when the African and Eurasian tectonic plates collided to form North-west Europe.

This marks the end of the Cretaceous Period.

During the Tertiary Period (65 – 1.8m years ago) that followed land surfaces were elevated, planed off and re-submerged by the sea on at least two occasions with only the highest part of the downs remaining above sea level.

During the Tertiary period the softer central part of the chalk dome was worn away as a result of weathering by rain. The steep escarpment of the Downs and dry valleys were created. This process of weathering has left behind the line of the North Downs on the border with Surrey, the area known as the Weald and the hills that run parallel with the coastline the length of Sussex which we know as the South Downs.

The smooth rolling shape of the Downs is the result of ice melting during warm periods in the summer during the last Ice Age. The thaw would have produced streams of water running down the hillside, smoothing off the underlying rock.

The Seven Sisters - Erosion of the Coastline

The different composition of the chalk with different fossil remains has led to different fracture patterns, different porosity and rock strength and different rates of erosion on the cliffs.

There can be large falls of chalk caused by landslips when the underlying clay slips due to groundwater seeping into the chalk. The chalk literally slumps. The cliffs between Seaford Head and Beachy Head are particularly exposed to the force of the waves along this stretch of the coastline.

Undercutting can be seen at the bottom of the cliffs caused by waves eroding the base of the chalk. Notches are formed at the foot of the cliffs and sometimes short-lived caves are created.

The erosion of the chalk by the sea has left behind a wave cut platform. This protects the cliffs from future erosion although it is itself eroding at the rate of 1.3 – 5mm per year.

A large part of the erosion of the wave cut platform (35%) is caused by limpets and piddocks living on the seashore.

The Seven Sisters are eroding at a rate of .51meters per year (1873-62) which is above the regional average and this rate has showed signs of increasing recently.



Seaford Head

Seaford Head is overlaid with Tertiary deposits of loess (fine glacial dust)



The Beach

The beach mainly consists of flint fragments, rounded by abrasion and discoloured by iron compounds in the sea water which turn them a light brown.

The beach was formed 3,000 to 2,000 years BP during a period of storminess.

The material supplied to the beach came from off shore rock deposits laid down during the periglacial and from the river sediment that was carried upstream as rivers extended during the glacial period as sea levels fell. It is also supplied by the erosion of the chalk bedrock.

Over the last two centuries erosion of the beach has been controlled by the use of groynes

Shingle has been extracted from Cuckmere Haven since 1932. A light railway was built between the river mouth and the area now opposite the visitor centre at Exceat. This carried shingle up the valley to where it was washed and sold to be used in the building industry.



The Soil

Above the chalk is a thin layer of soil called a rendzina. The top layer is brown in colour and rich in humus formed from grass and leaf litter. Beneath this is a light grey/brown layer. Unlike other soils there are no distinctive horizons or layers in this type of soil.

The underlying chalk (or parent rock) releases calcium carbonate which produces an alkaline soil with a pH of 7-8.

Because chalk is permeable and nutrients get washed down soil fertility is low. The soil lacks phosphate which is essential for plant growth. Low fertility on chalk grassland produces a species rich habitat because there are insufficient nutrients in the soil for any one plant to become dominant and eliminate other species. Up to 45 different species of plant have been recorded in a metre square area on Coombe Bottom along the Cuckmere valley. Where there is a high diversity of plants there is also a high diversity of insects and birds.

On the top of the hill overlooking the Cuckmere River there is a glacial cap or coombe deposit of sand and clay dust which was deposited at the end of the last Ice Age as melting glaciers moved southwards.

Terracettes

These can be seen on the steep slopes of the Downs forming a ribbed pattern of grass-covered horizontal steps a foot or two high. They are formed by soil creep rather than the feet of sheep as is popularly believed. Soil creep is the result of soil freezing in the winter, lifting and then settling further down the slope as it thaws.

Saltmarsh

Near the mouth of the river and extending up the canal along the side of the water there is saltmarsh.

This is formed on mud carried down by the river which is colonised by specialized vegetation that can withstand emersion by saltwater for long periods of time.

Saltmarsh is a rare and important habitat and provides food for wading birds. The saltmarsh at the Seven Sisters comprises 10% of all of Sussex's saltmarsh.

If sea levels continue to rise as a result of global warming the river valley would flood and form new saltmarsh.

