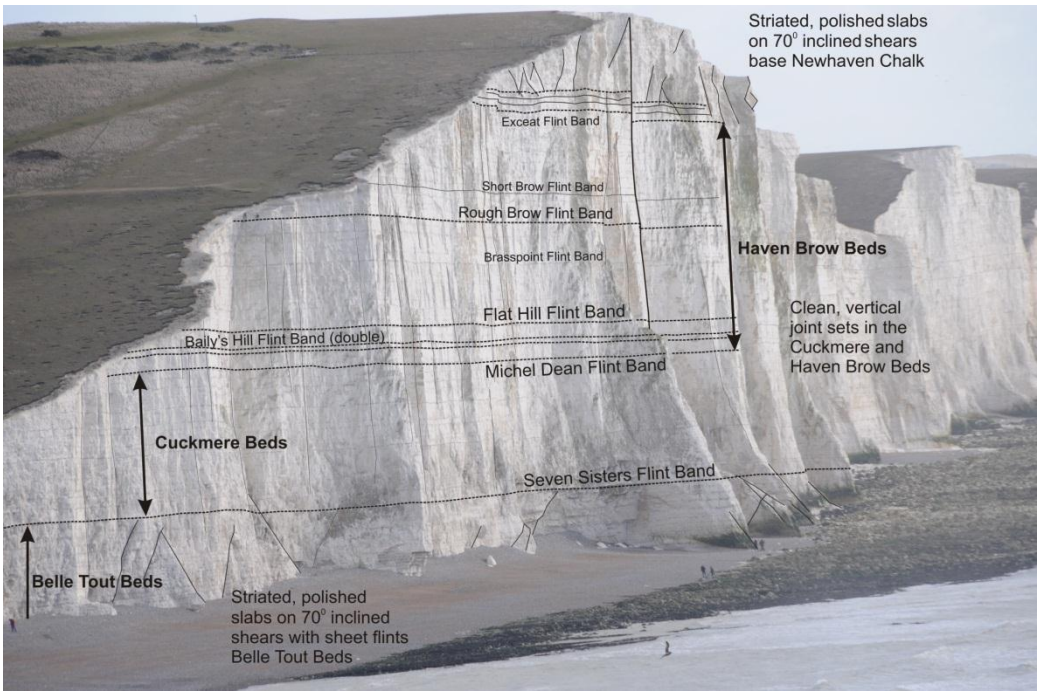
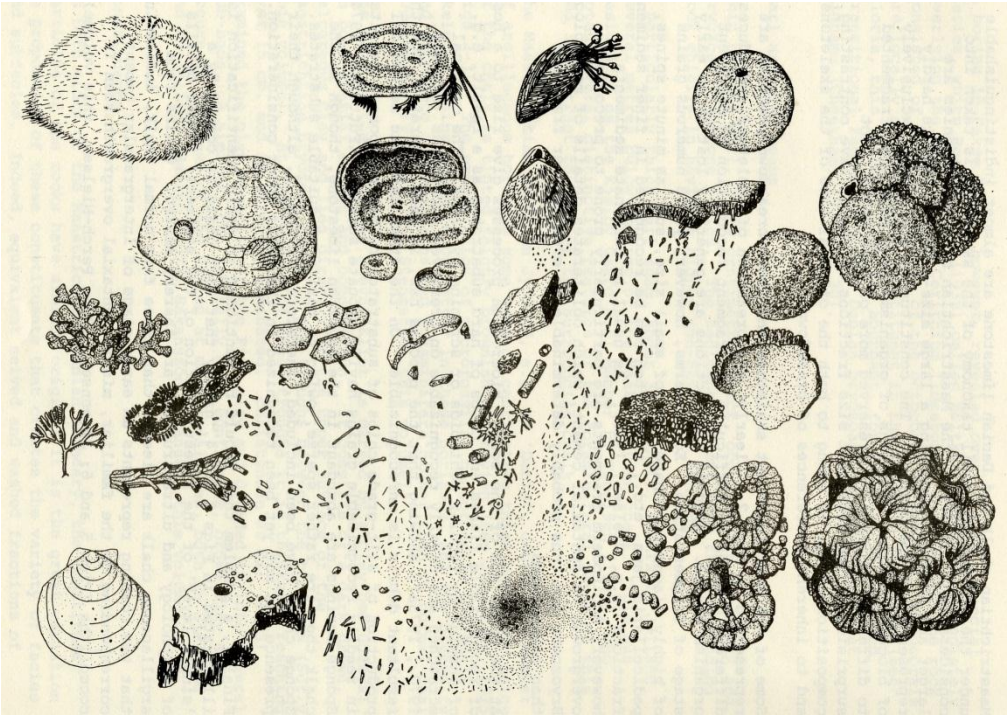
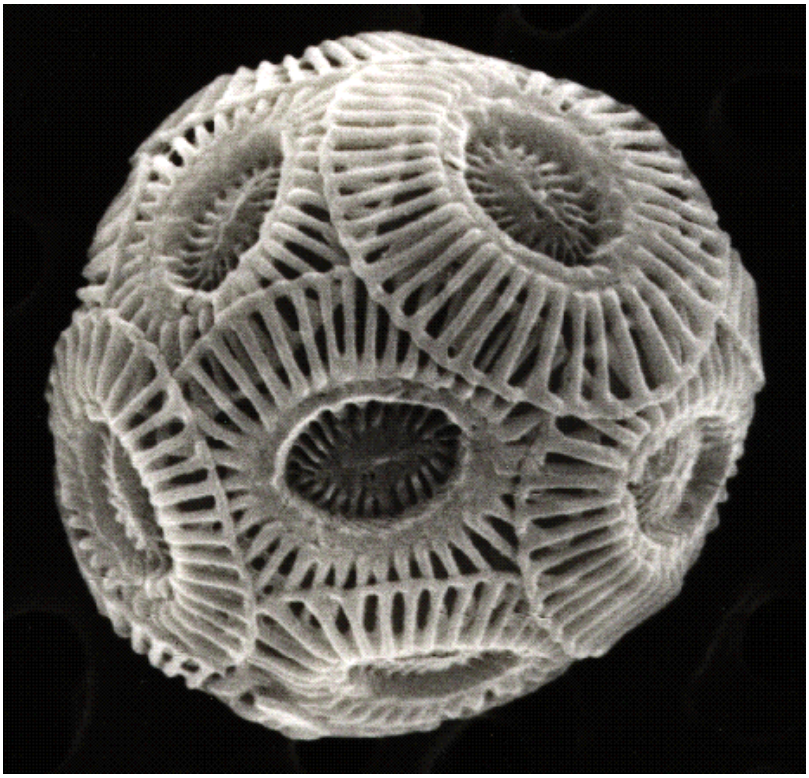
What is chalk?



What makes the Chalk in these cliffs? Marker beds in this case are the named flint bands (see separate information sheet on 'What is flint?'). The Chalk in these cliffs is about 80 million years old.

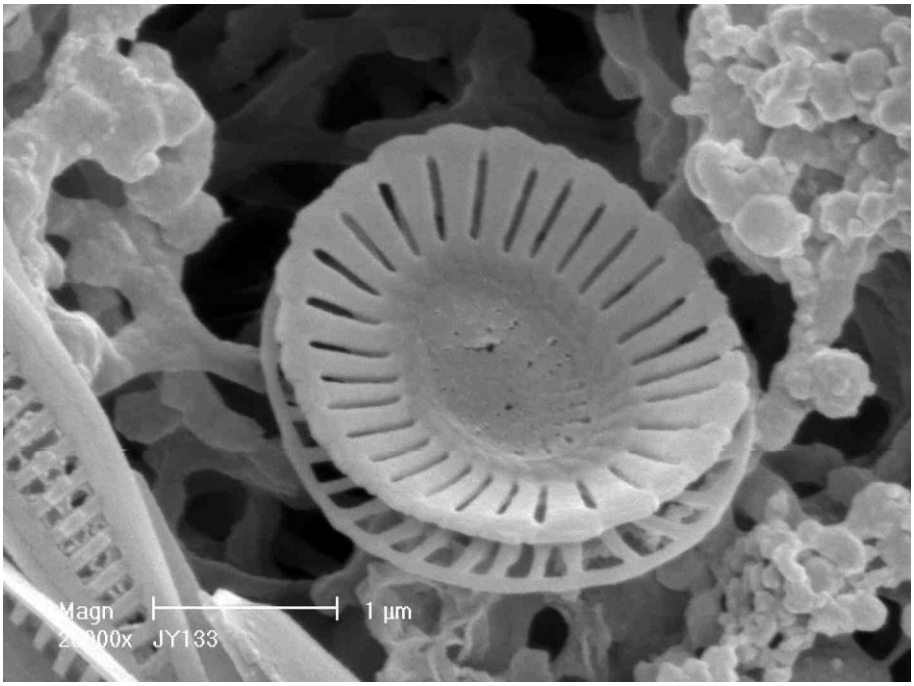


Chalk comprises the calcareous debris from the many organisms that swam or floated in the oceans and shallow seas at the time and also those animals that lived in and on the seabed. (Drawing from Bromley, 1979). Chalk is a very special limestone that formed from a rain of calcareous debris onto the sea or ocean floor from the marine plankton of the oceans and shallow seas.

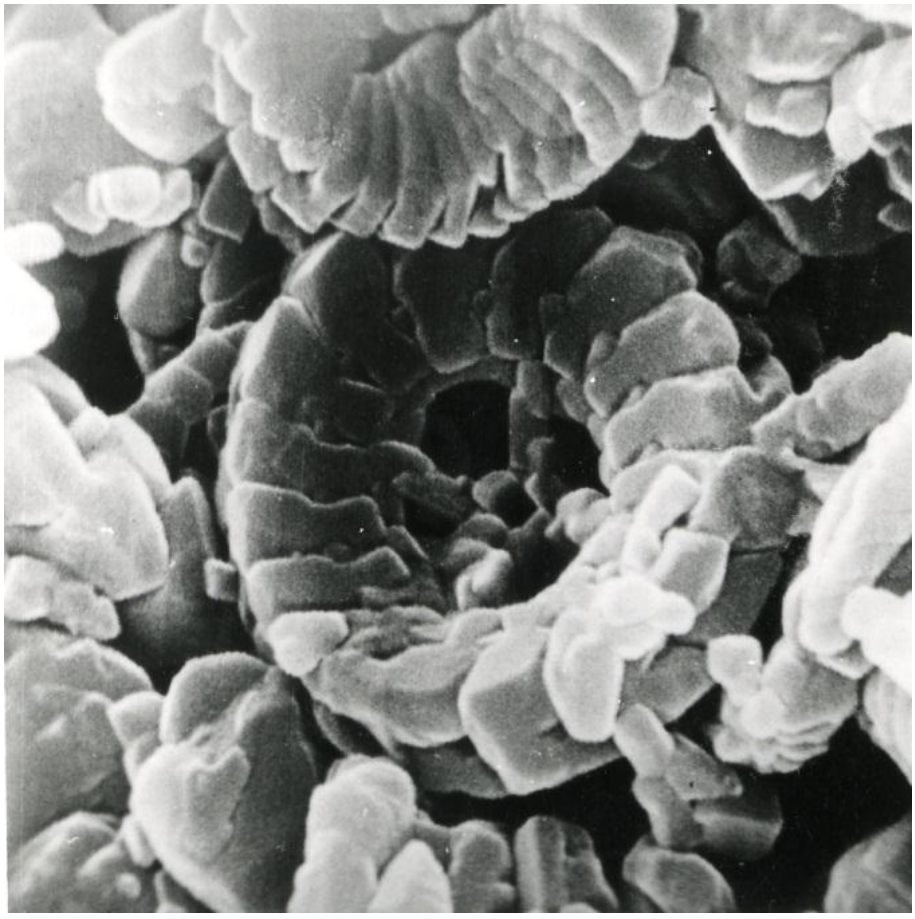


By far the most dominant organisms making chalk are the calcareous golden brown algae that float in the upper waters of the seas and oceans like the modern coccosphere of *Emiliania huxleyi* shown above which is the calcareous skeleton with the organic matter removed. When the organism dies its skeleton sinks to the sea-floor to make chalk.

An ancient coccosphere from the Chalk cliffs of Sussex. Such coccospheres are relatively rare as the skeleton usually fragments into individual coccoliths.



A modern coccosphere of *Emiliania huxleyi* breaks down into individual coccoliths: one micron = one millionth of a metre. It has been calculated that 300,000 coccoliths could fit on a single pinhead

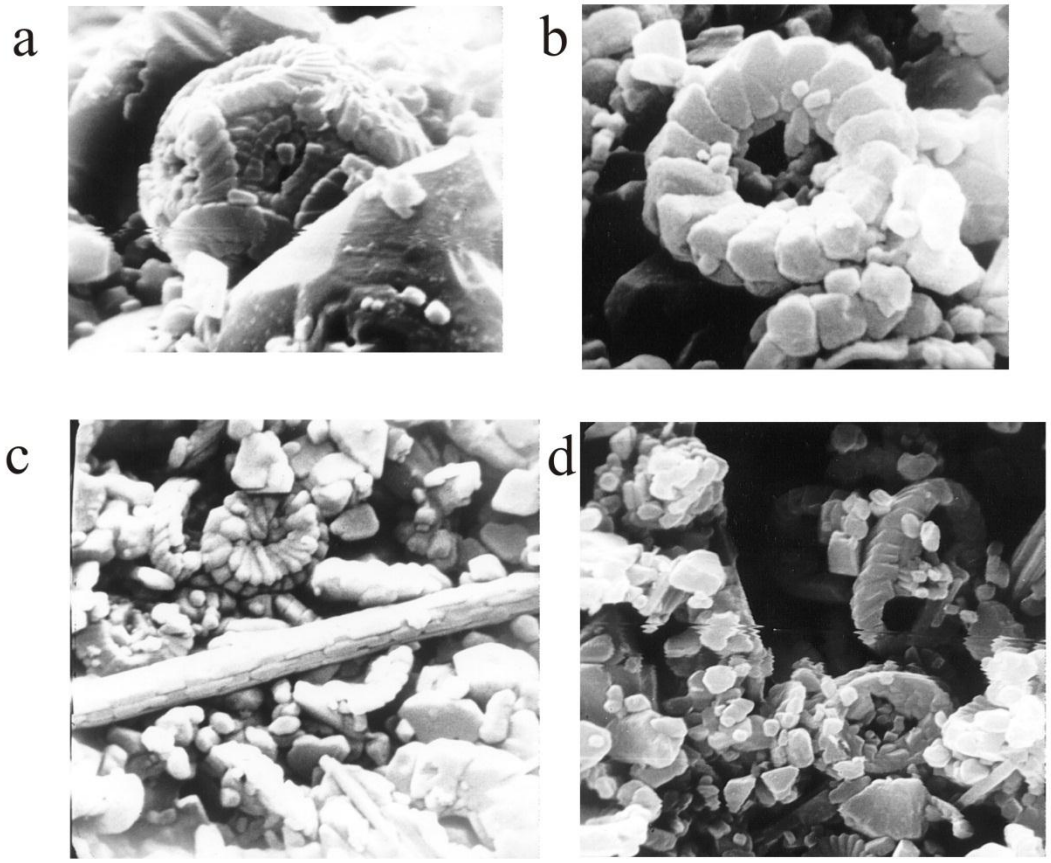


Ancient Coccoliths from the Chalk cliffs at Lewes; smaller than a speck of dust

A modern bloom of calcareous algae (*Emiliania huxleyi* nannoplankton blooms) form a turquoise soup in the oceans and seas, here in the Western Approaches off southwest England. (Photo from NOAA satellite image). Some blooms cover entire oceans and this must have been the case when our Chalk cliffs were made.

Water sample from a modern *Emiliania huxleyi* nannoplankton bloom – the soup in the oceans

Different types of calcareous algae make chalk including coccoliths, rhabdoliths and nannoconus (the nannoplankton). Other types of organisms include the microfossils (calcispheres and foraminifera).

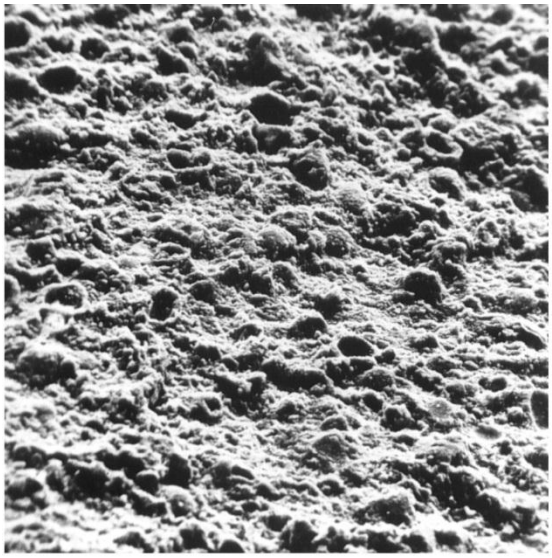


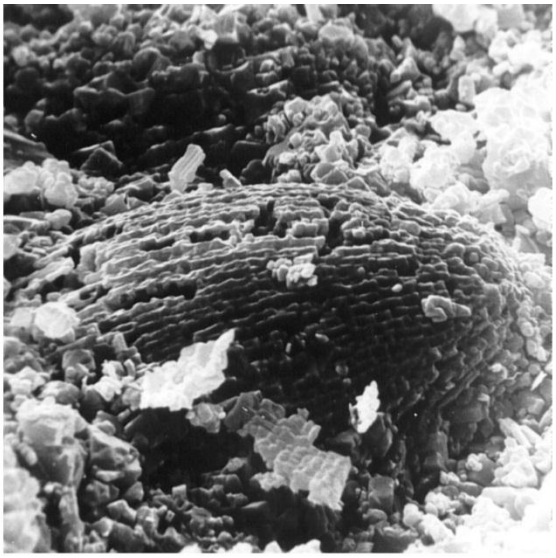
a. A coccosphere (diameter 8-10 microns) comprising plates of coccoliths.

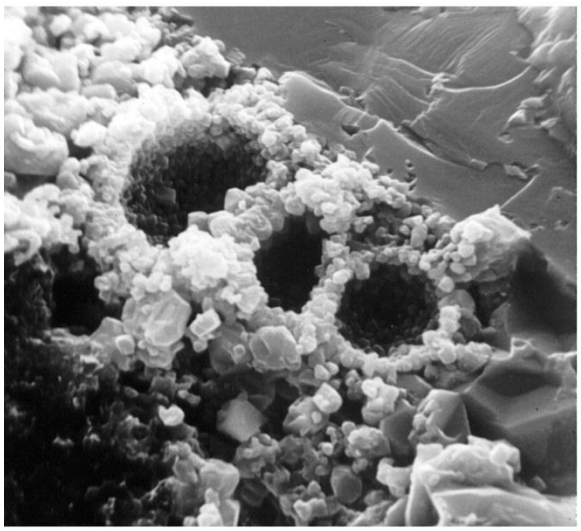
b. Typical coccolith (diameter 5 microns) from the low density, soft, white Early Campanian Newhaven Chalk, Seaford Head, Sussex.

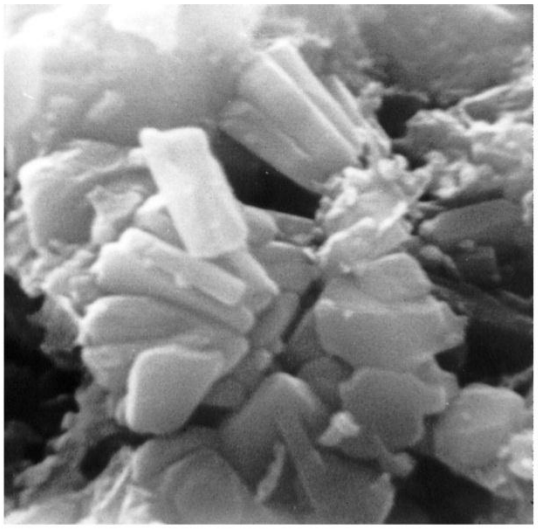
c. Low density (<1.55Mg/m^3), soft white Early Campanian Newhaven Chalk Newhaven, Sussex, showing coccolith plates and a rhabdolith.

d. Very soft grey - white chalks illustrating the pore spaces and weakly cemented material forming the martrix of such chalk.









a. Low magnification (x500) SEM photomicrograph of a calcisphere hardground (density>2.00Mg/m^3), Late Turonian Lower Lewes Chalk, Lewes, Sussex.

b. Close up view of **a** showing detail of calcisphere (length 500 microns).

c. Coarser, 0.5mm sized calcareous fragments in chalk include foraminifera; showing chambers only slightly filled with calcite crystals.

d. *Nannoconus* (8 microns across), from the Early Coniacian Lewes Chalk (Beeding Hardgrounds), Shoreham Cement Works, Upper Beeding, Sussex.

a. b. c.

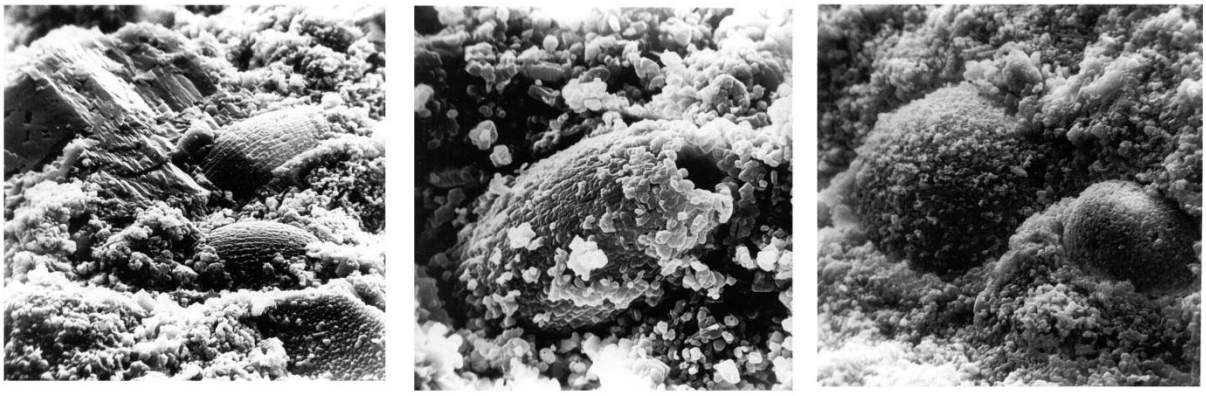
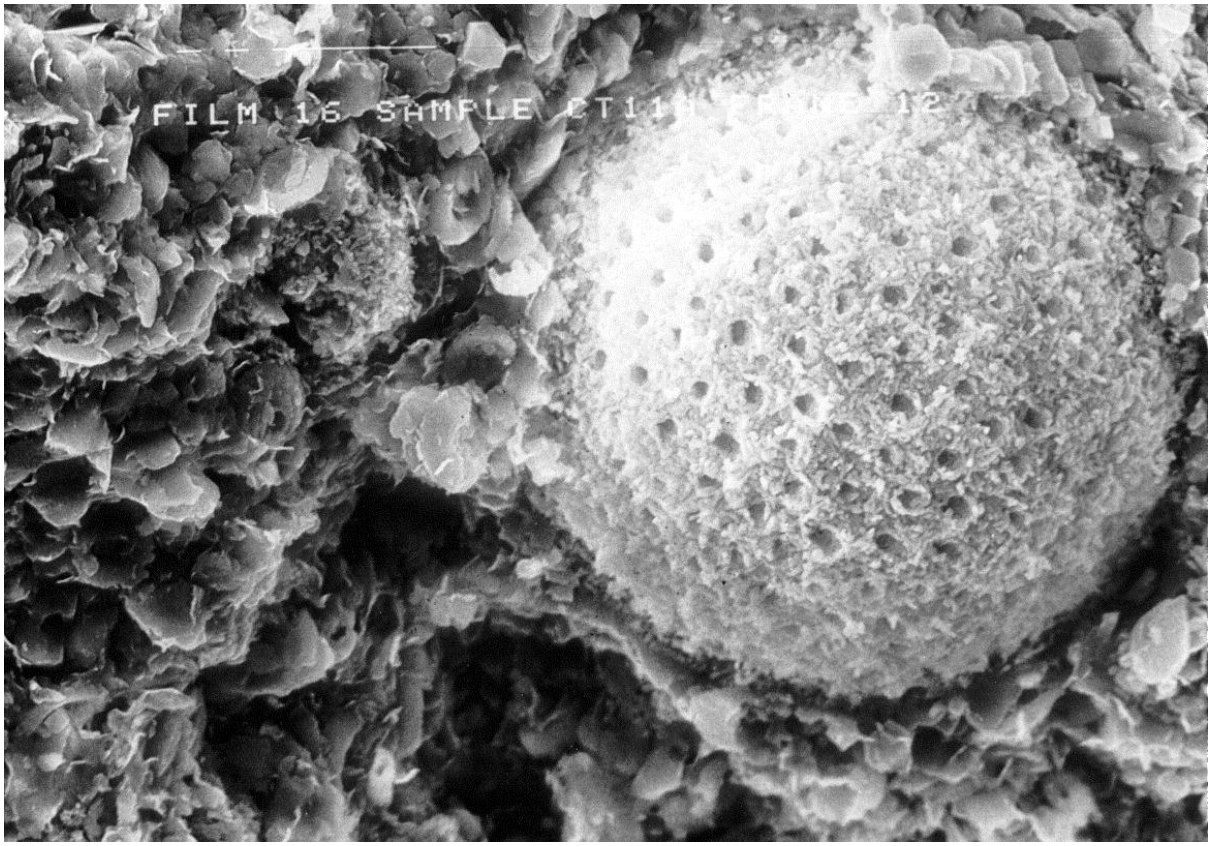


Plate 3. Calcisphere-rich chalks comprise two main forms, oval and spherical shapes :
a. Oval-shaped *Pithonella* from a high density hardground in the Lewes Nodular Chalk Formation (Lewes Tunnel BH1 depth 24.2m x1.05K)
b. *Pithonella* close up from high density nodular chalk showing aperture and shell layers (between the Shoreham Marls, Shoreham Cement Works, Sussex x2.09K)
c. *Calcispherula* from a high density nodular bed in the Lewes Chalk (Lewes Tunnel BH1 depth 21.6m x1.16K)



This scanning electron microscope image of Chalk from Southerham Grey Pit, Lewes, Sussex, shows a spectacular sphere surrounded by smaller coccoliths and flake-like clay minerals (it is the clay minerals that make the colour of the chalk grey).

a

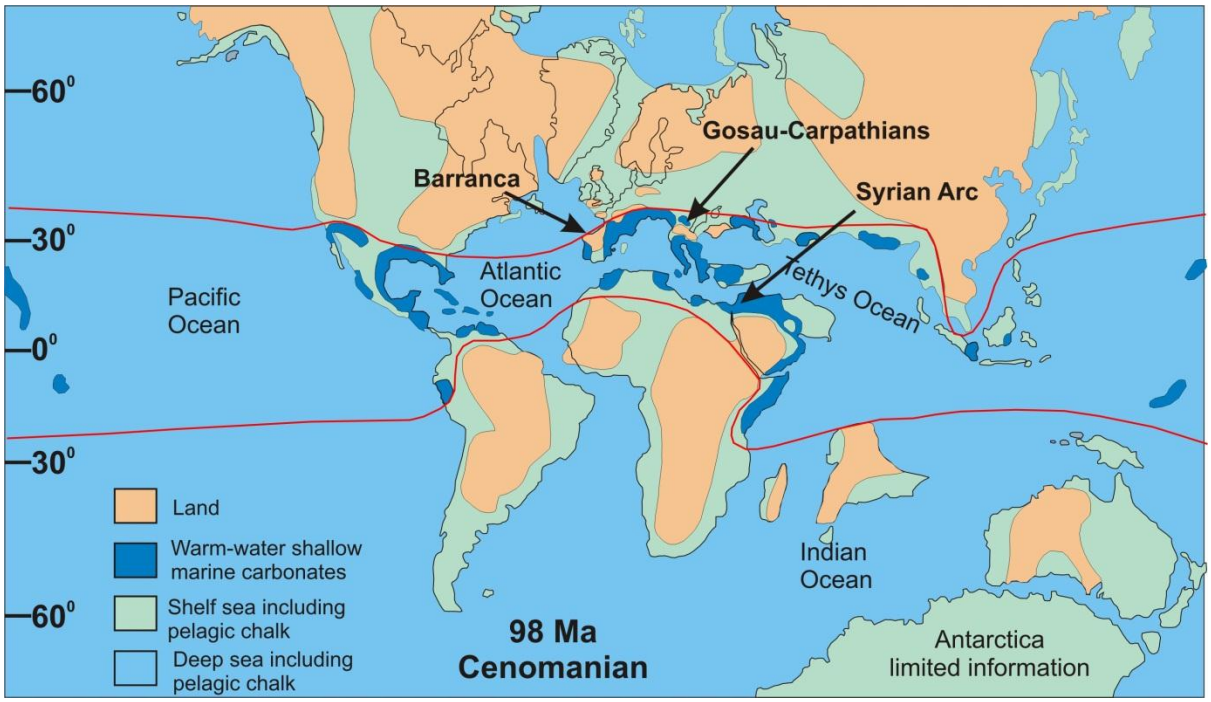
b

one micron bar

a. Very high density (2.20 Mg/m^3), calcareous (14% clay) marly chalk: West Melbury Marly Chalk (Chalk Marl) TI = 31-33. Note the 'cornflake-like' clay minerals enclosing coccolithic carbonate.

b. Close-up of part of a above showing clay flakes enclosing coccoliths.

Chalk forms the classic white cliffs of Dover and the Seven Sisters and is a very pure, white limestone, usually soft but can be hard in places like the Yorkshire Wolds, the Antrim coast of Northern Ireland and in parts of the Isle of Wight and Dorset. The Chalk of the U.K. formed during the Upper Cretaceous period between about 100 and 65 million years ago. Younger Chalks are present in the Palaeogene such as the Danian chalks of the North Sea and Denmark and the Eocene Chalks of the Middle East. Chalk deposits were a world-wide phenomenon and can be found forming the cliffs of the Black Sea in Crimea, the white cliffs of Southern Lebanon near Tyre



This map shows the probable extent of chalk during the Upper Cretaceous when our Chalk cliffs formed (Based on Skelton, 2003). Pelagic organisms are those that occupy the upper water layers of oceans and seas and either drift passively with currents and winds (planktonic) or are free swimming (nektonic). The calcareous golden-brown algae that made most of our chalk cliffs and downland were pelagic, planktonic organisms.