How flint is formed

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The formation of flint is a complex process which began in the chalk seas millions of years ago and is, summarised below:

Organisms such as sponges (on the macro scale) and radiolaria/diatoms (on the micro scale) use silica from sea water to manufacture the biogenic opal which forms their skeletons. When the organisms die and the organic parts decay the microscopic silica is scattered on the sea bed and becomes incorporated in the accumulating sediment.

At depths of 1 to 5m within this sediment, the biogenic opal breaks down, enriching the water between the sediment particles (sediment pore water) with silica.

At sediment depths of less than 10m, there is an oxic-anoxic boundary where hydrogen sulphide rising from the decomposing organic material within the sediment diffuses upwards meets oxygen diffusing downwards from the water column above. At this interface, the hydrogen sulphide is oxidised to sulphate with hydrogen ions as a by-product. The hydrogen ions lower the local pH, dissolving the chalk and thereby increasing the concentration of carbonate ions. These act as a seeding agent for the precipitation of silica.

Silica precipitates by the molecule-by-molecule replacement of chalk. The silica is initially in the form of crystalline opal but gradually transforms to quartz (flint) during later burial and with time.

The chalk sea bed is deeply burrowed by many different organisms, such as shells, echinoids and worms etc. Some of these burrows are quite deep or branching, or have open living spaces. The burrows fill with sediment after the organism has died, this is slightly different material from the sediment around it. These filled burrows act as preferential pathways (conduits) for the chemical reactions to occur. Flint formed within these old burrows often has a nodular shape which reflects the whole, or part of, overgrown remnants of such burrow systems.

There are two possible explanations for why flint forms in bands or layers. Firstly because chalk sedimentation occurs in cycles and secondly because the process above exhausts the silica within a given depth of sediment and flint formation can only recommence when there is enough silica to start the process again.

If you would like further explanation of the complex formation of flint, with pictures and diagrams. I would recommend a visit to https://depositsmag.com/2020/07/17/flints-in-the-late-cretaceous-chalk-of-nw-europe/ website.

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