

## THE CHALK CLIFFS OF DOVER

BY

J. KAY WHITE

*DesPlaines, Illinois.*

As you travel from London to Dover which is a health resort, a channel port, and one of the main gateways of the continent, you pass through some very rough and hilly country. You may travel along the English Channel for several miles and pass by Shakespeare's Cliff before entering Dover. As you approach the city of Dover, you may notice the large fortifications in the distance to your left. The Chalk cliffs in the distance are crowned by the Norman castle which, in 1216, the brave Herbert de Burgh successfully defended against the French. Dover is the headquarters of the Southeastern district of the British army and is not only a charmingly situated watering place, but the nearest point of the English coast to France. The fortifications are very extensive on these chalk cliffs. To the east of town rises Dover castle, founded by the Romans fortified and enlarged by the Saxons and Normans. It contains the remains of a Roman pharos, or lighthouse, and an old fortress-church, a unique specimen of Roman and British architecture. To the north of the castle is Fort Burgoyne. On these heights are large barracks and ruins of another pharos and a circular church of the Knights Templar. The cliffs are honeycombed in all directions with military works.

Chalk is the name given to any soft, pulverent, pure-white limestone. The word is an old one having its origin in the Saxon "gealc," and the hard form "kalk" is still used among the country folk of Lincolnshire. Chalk is found in the upper Cretaceous group of rocks. On poor chalky ground the Sainfoin, a plant which flourishes in calcareous soils is an excellent fodder for cattle and has been cultivated with great success; the herbage of the chalk downs of Sussex, and other counties of England afford good pasture land for sheep.

The chalk formation, in addition to the typical chalk material, comprises several variations: argillaceous kinds, known locally as malm, marl, clunch, and more hard varieties called rag, freestone, rock, hurlock or harrock in different districts. In its purest form chalk consists of 95 to 99% of calcium carbonate (carbonate of lime). In this condition it is composed of a mass of fine granular particles held together by a somewhat feeble calcareous cement.

The earliest attempts at subdivision of the chalk formations were initiated by William Phillips and were based upon lithological characters and such a classification as upper chalk with flints, middle chalk (divided into chalk rock, chalk with few flints, chalk without flints), and lower chalk marl, including Totterhoe stone and Totterhoe marl.

The upper chalk has a maximum thickness in England of about 1,000 feet, but post-cretaceous erosion has removed much of it in many districts. It is more constant in character and more typically chalky than the lower stages; flints are abundant, and the more hard nodular beds are limited to the lower portions, where some of the compact limestones are known as "chalk rock." The thickness of the middle chalk varies from 100 feet to 240 feet; flints become more scarce in descending from upper to lower portions. The nodule layers are more frequently called the "chalk rock" of Dorset. The Isle of Wight belongs to this stage. At the base is the hard "Melbourne Rock."

The lower chalk varies from 60 to 240 feet. This stage includes part of the "white chalk without flints," the "chalk marl," and the "grey chalk." The Totterhoe stone is a hard freestone found locally in this stage. In Devonshire the lower chalk has become thin sandy calcareous series.

Chalk is usually yellowish or white in color, has an earthy texture, is rough to touch and adheres slightly to the tongue. It is formed by accumulation on the ocean bottom, of the tiny shells of Foraminifera, fragments of Molluscan shells, sea urchins, spines and spicules which can be seen with the microscope.

Chalk is not used extensively as a building stone, chiefly because of its low resistance to the weather. In England some of the solid beds are occasionally employed for structural purposes. It is burned to lime and the mortar is used generally in the construction of buildings in London. Some great projects built on chalk are the Admiralty Pier in Dover Harbor, which was begun in 1847 and finished in 1871 with a length of over 2,000 feet, and the Prince of Wales Pier constructed in 1893, running parallel to the general direction of Admiralty Pier. The artificial harbor for naval purposes has an area of 610 acres, of which one-half was to have a depth of 30 feet at low water. The scheme comprised three enclosing breakwaters, which, with a united length of more than two miles, are of massive concrete blocks in the form of a vertical wall, built on the solid chalk and rising to a quay level of ten feet above high water.

In England, chalk has been used for many years as an ingredient of Portland cement. When ground and mixed with water it forms white-

wash. If the ground material is freed from grit, it is known as "whit-in," which is used for cleaning silver and making putty. "Gilders white" and "Paris white" are forms of the same material which have been more carefully washed. Like lime, chalk is used in farming to decrease the acidity of the soil. The flint concretions so abundant in chalk of Europe are used for pebbles in ball mills. Chalk is employed in the manufacture of cements and of carbonate of soda in the preparation of carbonic acid gas, and in many other chemical processes; also, for the making of paints, numerous kinds of crayons, and toothpaste. On the return trip from Europe our ship carried a great cargo of chalk, consigned to Colgate-Palmolive Company. Have you realized when you clean your teeth that the largest part of the ingredient in toothpaste comes from across the sea and is composed mostly of chalk?