

tained by eminent authority, and that the priority of the auriferous formation to the Middle and Upper Silurian has not been universally conceded, or is altogether so evident as most people appear to imagine. There appears to be some reason for supposing that the rocks in question may be Devonian, as the only rocks found directly superimposed upon these are the unquestionable lower carboniferous. If this were taken as indubitable or even presumptive evidence of the position, it would carry too far and lead to the conclusion that every argillite immediately overlaid by lower carboniferous was Devonian, and we would thus be carried back to a very remote period in the History of Nova Scotian Geology, if any such period ever existed. It will be observed that all that I attempt to prove is that the auriferous slates and grits of Nova Scotia are older than the Middle and Upper Silurian, and newer than the Laurentian, and may be Cambrian or Huronian, or Lower Silurian or both. If they are Huronian and Lower Silurian, as Prof. Hind seems to have established, then Nova Scotia has a complete series of formations from the Azoic or Eozoic to the last of the Paleozoic series, viz : Laurentian, Huronian, Lower Silurian, Middle Silurian, Upper Silurian, Devonian, Carboniferous, New Red Sandstone.

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ART. V. REMARKS ON THE GEOLOGY AND PHYSICAL GEOGRAPHY OF THE NORTH-EAST COAST OF KENT (ENGLAND.)  
AUGUST, 1870. BY ALFRED S. FOORD, ESQ., LONDON.

(Read January 9, 1871.)

MY attention was first directed to that part of the coast of Kent between Ramsgate and \*Broadstairs, covering a distance of about five miles, and consisting of the Upper Chalk Formation, the cliffs being well exposed along the whole distance in a bold escarpment, attaining an altitude in some places of from sixty to eighty feet.

The most striking point observable in viewing these rocks from

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\*Formerly Bradstowe.

the sea, is the effect produced by the enormous wasting power of the waves. The whole line of the coast is deeply embayed, and exhibits a series of projecting headlands or promontories. In some places caves of considerable size have been formed at the base of the cliff, hollowed out by the constantly wearing action of each tide. These caves are apparently the cause of great masses of the chalk giving way at the summit of the cliff; large boulders of chalk strew the beach, and a flooring is formed in some places, by the consolidation of these masses: in others the rock falls in, and makes an inclined plane with the surface of the beach, sometimes ten or fifteen feet in height.

Almost the entire length of the coast at low water is strewn by large boulders of chalk; locally termed "the rocks," extending seawards for a distance of nearly a quarter of a mile; quantities of seaweed—fucus—and barnacles, adhere to these boulders, thereby protecting them from the force of the breakers.

On a closer inspection of the cliff, regular layers of flint are seen in a horizontal position, at intervals of from four to six feet apart,—parallel with the lines of stratification. Some of the layers obliquely intersect the beds of chalk. The shape which the flints assume is either tabular or rounded in the most fantastic forms, having filled up cavities in the chalk, and taken the form of these cavities.

\* "The flat tabular flints, which are coincident with the stratification, are of a different age from the similar layers which are found filling cracks and joints. The former are contemporaneous with the chalk, and the flinty matter was deposited at the same time as the chalky matrix; the latter are, on the contrary, of more recent date, having been formed by the percolation of infiltrating water holding silica in solution, into cracks and joints which were formed in the chalk, during or after its solidification."

It may perhaps be needless to remark that chalk is nearly pure carbonate of lime, and may therefore be considered an earthy limestone.

Mr. Henry Clifton Sorby (the distinguished Microscopist), from an examination of thin slices of chalk under a microscope, has

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\*From Catalogue of Museum of Practical Geology, 1862.

found it to consist of from ninety to ninety-five per cent of the cases of foraminifera, and of comminated shells. Considering that the thickness of the chalk formation in England amounts to from six hundred to nine hundred feet, we are hardly able to realize the incalculable profusion of life which was required in order to build up such a vast thickness and superficial extent of material.

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A curious instance of marine denudation occurs at Margate, consisting of a detached mass of chalk about forty feet high, known as the "Fort Rock," (fig. 3.) Before this rock became isolated, the sea had made an extensive excavation around it, and at last the soil above it crumbled and fell. On visiting the spot this summer, I found the space from the edge of the cliff to the rock on all sides to be at least ten or twelve feet. This marine denudation offers a strong contrast to atmospheric denudation, the former produces jagged peaks, as in the Needle rocks at the Isle of Wight, the latter results in undulating slopes, such as the North and South Downs of Kent and Sussex.

It may not be out of place here to allude to the supposed former junction of England with the Continent; the following being the chief grounds for the assumption:—

*Firstly.*—The close resemblance in the chalk formation of the two opposite countries of England and France (which may be said to be continuous,) at Dover and Cape Griznez, for example, (*see map.*)

*Secondly.*—The extreme shallowness of the water in the straits of Dover—the existence of sand banks—notably the \* "Goodwin Sands," where the chalk has been found by borings underlying fifteen feet of sand, resting on blue clay.

*Thirdly.*—The identity of the wild animals in historic times, such as the wolf, which infested both countries; and *lastly*, the discovery of fossil remains of the cave bear, hyæna, rhinoceros, lion,

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\*NOTE—An obscure tradition has come down to us, that the estates of Earl Godwin, the father of Harold, who died in the year 1053, were situated here, and some have conjectured that they were overwhelmed by the flood mentioned in the Saxon Chronicle, sub. anno. 1099. The length of this sand bank is about ten miles, by one and one-half in breadth.

tiger, and other tropical mammalia, not only indicating a warmer climate, but also suggesting the idea that these creatures must have found their way from the continent by means of an isthmus, which at that time may have united the neighbouring shores.

Subjoined is a list of fossils, and other specimens, from the chalk, collected principally near Ramsgate, in illustration of this paper.

Upper Chalk.	{	Ananchytes ovatus.
		Diadema ornatum.
		Pecten nitidus.
		Terebratula subrotunda.
		Galerites albo-galerus.
		Ventriculitas in flint, (with Pyrites) and Selenite sulphate of lime.
		Spongia.
		Micraster, cor-anguinum, (in Chalk.) Ditto. (in flint.) Scales of Beryx ornatus (?)

At Pegwell Bay, the chalk thins out and finally disappears on approaching a low lying tract at the mouth of a small river called the Stour. The Thanet sand, a fine soft light colored sand, (the lowest member of the Tertiary or Eocene group,) here resting on the chalk, commences just below the surface soil; it is much crumbled by the sea, the debris being scattered about the beach.

Some of these masses hardened by exposure, act as natural breakwaters.

In many places, one finds in walking along the edge of the cliff, that the footpath has been remade several yards further inland, in consequence of large portions of the cliff having fallen in, and been rapidly washed away by the sea. In some parts of the cliff, close to the village of Pegwell, it has become necessary to build up the chalk with brick-work in order to prevent its further destruction.

Miniature landslips are very frequent, both of the chalk and the Thanet sand, dragging with them small trees and bushes growing on the edge of the cliff, strewing the shore with roots and soil.

Having ascertained that the coast line from Herne Bay (a

place still retaining the name of a bay, although it is no longer appropriate as the waves and currents have swept away the ancient headlands,) to the Reculvers displays a good section of the Tertiary beds, I started off along the cliff, from the former place to examine it. For the first mile or so the cliffs shelved gently down to the beach, covered with grass and stunted bushes. Further on continual disintegration of the soft clay and sands (partly due to atmospheric causes), prevented the growth of vegetation of any kind except a few patches of weeds. Landslips of considerable magnitude are constantly occurring.

In one spot I noticed that at least a quarter of an acre of soil, upon which potatoes were planted, had sunk about ten feet from the top of the bluff upon which I stood; and now rested on a platform made by a previous falling in of the cliff. When about a mile and a half from the Reculvers I reached a deep gorge, (called Oldhaven Gap,) opening out on to the beach—the cliffs forming as it were the walls of the Gap, attaining an altitude of from sixty to eighty feet. At length I arrived at the venerable towers of “Reculver,” and repaired to the “King Ethelbert” inn, to recruit myself previous to a return to Herne bay, along the sea-shore. A brief account of the past history of this interesting spot will, I venture to think, be acceptable to the Society, especially to those who are interested in the subject of Archæology.

“Reculver (Reculvium) was an important military station in the time of the Romans, and appears, from Leland’s account, to have been, so late as Henry VIII’s reign, nearly one mile distant from the sea. Some time before the year 1780, the waves had reached the site of the ancient Roman camp, or fortification, the walls of which had continued for several years after they were undermined to overhang the sea, being firmly cemented into one mass. They were eighty yards nearer the sea than the church, and they are spoken of in the *Topographica Britannica*, in the year 1780, as having recently fallen down. In 1804, part of the church-yard, (with some adjoining houses,) was washed away, and the ancient church, with its two spires, was dismantled as a place of worship.” (*Sir Charles Lyell’s “Principles of Geology,”* page 312.)

I recollect as a child visiting the spot in 1850, and finding some

human bones in the church-yard, which was then partly exposed on the sea-ward side.

It is said that King Ethelbert chose Reculver as his place of residence, and that he was buried there about the year 616. The church is now preserved as a landmark by the Trinity House, and being situated on a headland, it is a conspicuous object to vessels making for the mouth of the Thames.

As the tide was now ebbing, though slowly, in consequence of a very strong north-easter, I turned back along the beach in the direction of Herne Bay. A most interesting section was here exhibited of the superposition of some of the beds constituting the Lower Eocene formation. Fig. 1 shows the manner in which these Beds are disposed; and how much they have been denuded, particularly the Oldhaven beds. The greater part of the rock exposed to view between Reculver and Herne Bay consists of a yellowish quartzose sand, very friable, but becoming more argillaceous at the base; this is the Thanet sand. Large tabular blocks of indurated sandstone are interspersed at the upper part; these masses become detached from the parent bed and strew the beach, serving in some measure to retard the destructive progress of the waves. A water-worn pebble of this sandstone, coloured with iron, is exhibited.

Beneath the "Thanet sands" is a highly fossiliferous deposit, in which cyprina are met with in great abundance. These are so brittle that it is almost impossible to obtain a perfect specimen. The London clay is found capping these sands. It contains great quantities of concretionary nodules of an argillaceous substance, called septaria, which is in some places dug out of the clay, and used for making cement. Selenite, (sulphate of lime,) also abounds. Two specimens are shown, which I picked up on the beach, much water-worn; the larger one being an arrow-headed crystal, the characteristic form of this mineral.

The general appearance of the coast between Herne Bay and the Reculvers is remarkably picturesque. The large boulders of sandstone which bestrew the shore; the imposing height and broken aspect of the cliffs, with the surf dashing up, and loosening large fragments of rock, that come tumbling down amidst clouds of spray; all combine to form a wild and beautiful picture.

Tradition tells us that in times long past, the fields with their crops now on the verge of the precipice, were once nearly a mile from the sea; but every year, nay every day, is preparing for them a "watery grave;" and where the husbandman now guides his plough along the furrowed earth, the fisherman will some day (perhaps not far distant) be seen steering his little craft through the foaming waves.

N. B.—Reference is made in several parts of the foregoing paper to "Figures" illustrating various deposits; but it is hardly necessary to reproduce them.

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ART. VI. ON THE MAMMALIA OF NOVA SCOTIA. BY J. BERNARD GILPIN, A. B., M. D., M. R. C. S.

(Read February 13, 1871.)

*Lepus, Americanus*, (Erxleben, Shaw, Richardson, Dekay, Audubon, Baird.)

*Lepus, Hudsonius*, (Pallas, Bodaert.)

*Lepus, nanus*, (Schreiber.)

*Lepus, Virginianus*, (Harlam.)

*American Hare*, (Penant, Foster.)

THE AMERICAN HARE.

From measuring many specimens before me, the following are the least and the greatest measurement I have made:—

Length of body.....	17 inches.
Length to outstretched hind leg.....	24 "
Length of body.....	20 <sup>7</sup> / <sub>10</sub> "
Length to outstretched hind leg.....	28 <sup>5</sup> / <sub>12</sub> "
Length of hind leg.....	5 <sup>2</sup> / <sub>10</sub> "
Height of ear.....	3 <sup>5</sup> / <sub>10</sub> "
Length of head.....	3 <sup>5</sup> / <sub>10</sub> "

Their bodies seeming to vary more than their extremities. The smaller were doubtless the young of the year. In form they shew the usual leporine characteristics of arched forehead, high back and great length of hind leg, a crouching attitude when in repose with feet