

*manni* (Meek), *Macrocheilus*, *Pleurotomaria*, and two species of *Orthoceras*.

I had, in 1860, referred this rock to the Devonian, on the evidence of some of these same fossils (and the absence of any Silurian or Carb. types), brought in, by Col. Simpson's Exploring Expedition, from another locality a little farther north, though at that time this rock was not known to be a silver-bearing formation.

In addition to several of the above-mentioned fossils, I had from this rock, in 1860, fragments of *Phacops*, *Homalonotus*, and of another fossil, I thought might be a *Calymene*, but I do not think now that it could have belonged to that genus.

It is highly probable that the silver-veins of this region come up from the Silurian, but no lower rocks than the Devonian have yet been found just there.

At other localities, farther east in Nevada, Mr. King found *Atrypa reticularis*, a *Spirifer*, and a *Dalmanites*, evidently Devonian types, and apparently from about the horizon of the Corniferous or Onondaga limestone of the N. Y. series.

From other localities he has *Ophilita complanata*, Vanuxem, and two species of those many-whorled depressed shells, often referred to *Euomphalus*, from a low position in the Silurian; also Primordial Trilobites. In West Humboldt range of mountains he obtained a fine collection from the Upper Trias, that afforded some of the same types figured in the California Report. These are as clearly of the age of the St. Cassian, as if the words "St. Cassian" were printed in Roman letters on every specimen. He also has Cretaceous and Tertiary Fossils. All the Tertiary yet known from this great internal region of the Continent, is of fresh or brackish-water origin. The Tertiary rests conformably on the Cretaceous, and the passage from one to the other seems to have been coincident with the change from marine to brackish-water deposits, which were afterwards succeeded by fresh-water formations."

"The information given herein was kindly permitted to be sent by Mr. Clarence King, Director of the Government Geological Survey along the line of the Pacific Railroad."—F. B. MEEK.

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## NOTICES OF MEMOIRS.

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### I.—ON THE SUBMERGED FOREST AT BLACKPOOL, NEAR DARTMOUTH, SOUTH DEVON. By W. PENGELLY, F.R.S., F.G.S.<sup>1</sup>

IN a paper on the Submerged Forests of Torbay,<sup>2</sup> which I had the pleasure of reading to this Association, during the meeting at Tiverton, in 1865, I recorded the facts that a Submerged Forest existed at Blackpool, about two and a half miles south-west of Dartmouth; that it was almost always entirely concealed by the sand thrown up by the waves; that it had been described to me by

<sup>1</sup> Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art. 1869.

<sup>2</sup> *Ibid.* vol. i, pp. 30–42.

persons who saw it during two brief exposures, one in July, 1802, and the other about fifty years afterwards; and that there was reason to believe that it had never been laid bare during the interval; so that two generations of geologists might have traversed the strand at every low water without detecting a trace of the forest beneath them.<sup>1</sup>

The *Torquay Directory* of February 10, 1869, contained the following paragraph:—"The fine beach, situate about midway between Stokefleming and the far-famed Slapton Ley, just now presents a most unusual appearance. The action of the heavy seas during the late tempestuous weather has entirely removed the deep bed of sand from the western end, exposing a bottom of blue clay, in which, at low water, portions of bark and nuts may be found embedded, which indicate the remains of a primeval forest, which, ages ago, flourished on the spot. The place is well worthy a visit from any one interested in geological incidents."

From the description of the locality, it was tolerably certain that the forest alluded to was that at Blackpool. Believing that a shift of wind would cause the waves to restore the sand, and once more to bury this interesting but rarely-seen evidence of a change of relative level of land and sea, I started for Dartmouth the next day, February 11th, accompanied by three ladies who take a lively interest in geological phenomena. On reaching Dartmouth we found, as had been expected, that our destination was Blackpool, and that the forest was still to be seen.

We were so fortunate as to reach the beach at spring tide low water, and to find, admirably exposed, by far the finest example of a Submerged Forest which I have ever seen. It occupied a rectangular area, extending from the small river or stream at the western end of the inlet, about one furlong eastward; and from the low-water line, thirty yards up the strand.

The lower or seaward portion of the forest area, occupying about two-thirds of its entire breadth, consisted of a brownish drab-coloured clay, which was crowded with vegetable débris, such as small twigs, leaves, and nuts. There were also numerous prostrate trunks and branches of trees, lying partly embedded in the clay, without anything like a prevalent direction. The trunks varied from six inches to upwards of two feet in diameter. Much of the wood was found to have a reddish or bright pink hue, when fresh surfaces were exposed. Some of it, as well as many of the twigs, had almost become a sort of ligneous pulp, whilst other examples were firm, and gave a sharp crackling sound on being broken. Several large stumps projected above the clay in a vertical direction, and sent roots and rootlets into the soil in all directions and to considerable distances. It was obvious that the movement by which the submergence was effected had been so uniform as not to destroy the approximate horizontality of the old forest ground. One fine example was noted of a large prostrate trunk having its roots still

<sup>1</sup> Transactions of the Devonshire Association, p. 32.

attached, some of them sticking up above the clay, whilst others were buried in it. This tree had fallen towards the east.

Both the trunks and the soil, though carefully examined, failed to disclose any traces or indications of ancient tools. Nor was the search for bones, teeth, antlers, or, indeed, animal remains of any kind, much more successful. The only relic of this nature which was met with was a portion of a wing-case of some coleopterous insect, and this the wind carried off almost as soon as it was found.

Hazel nuts were extremely abundant—some entire, others broken, and some obviously gnawed. A few appeared to have been flattened as if from long-continued pressure. On digging into this mass and exposing new surfaces, a very disagreeable odour was emitted, which affected some of the party with nausea.

Towards the uppermost or landward margin of the area, the clay was of a bluish lead-colour, and traversed by a considerable number of rectilinear furrows, which, at first, I was inclined to regard as hollows out of which trunks of trees had been washed. This hypothesis, however, appeared to be negatived by the facts that there were no roots, or, indeed, vegetable débris of any kind, to be seen in this part of the clay, and that the longest axis of every furrow was at right angles to the water-line. Hence, to suppose that they had formerly been occupied by trunks of trees, it would be necessary to suppose also that all the latter had fallen in one and the same direction; but this, as has been stated, is by no means borne out by the trunks remaining on the lower belt of the area, where they appear to have fallen towards every point of the compass. In all probability the furrows were scooped out by the waves, perhaps during previous exposures.

If a conjecture may be hazarded on the point, I would suggest that the blue clay is perhaps the substratum on which the brown clay lies, and that the latter, with its vegetable débris, has been stripped off the landward belt of the old forest ground.

It has been stated that the forest area reached the spring-tide low-water line; hence, as the greatest tidal range on this coast amounts to eighteen feet, we are warranted in inferring that the submergence amounted to eighteen feet as a minimum, even if we suppose that some of the trees grew in a soil the surface of which was not above the level of high water. There is satisfactory evidence that in Torbay it was not less than forty feet, and that in Falmouth harbour it amounted to at least sixty-seven feet.<sup>1</sup>

The means at my disposal did not allow me to bring away many samples of the forest for careful examination at leisure, but shortly after my visit I was so fortunate as to meet two gentlemen of Kingsbridge, who, with Mr. Vivian, of Torquay, had also inspected the forest, and on their return kindly sent me a hamper filled with selected portions of the vegetable débris.

To the same gentlemen I am indebted for a rather small horse-chestnut, which, though perhaps somewhat bright, may be said to

<sup>1</sup> See *Trans. of the Devon. Association*, vol. i. pp. 131 and 134. 1868.

have the forest aspect. It was found lying loose on the surface of the forest area, and may have been cast up by the waves.

Mr. A. Hunt informed me, on March 23rd, 1869, that the forest had entirely disappeared. For about a week immediately preceding there had been strong north-easterly winds, sometimes becoming very heavy gales. The forest therefore could not have remained uncovered for more than a month, or five weeks at the utmost. This, however, was a long exposure when compared with those of earlier periods, according to the accounts which have reached us.

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II.—ARCHIVES OF THE NATURAL HISTORY EXPLORATION OF THE COUNTRY OF BOHEMIA. Published for the Committee of Exploration under the direction of Professor Dr. CARL KOŘISTKA, and Professor I. KREJČÍ.

Vol. I. Contains,<sup>1</sup> under *Orographical Section-Measurements*, one-tenth part of the Map of Bohemia, upon which 4,000 points have been measured and verified.

The *Geological Section* contains :—

(1). A detailed stratigraphical description of the entire Chalk-formation of Bohemia by Professor Krejčí.

(2). A Palæontological Monograph of the lowest strata of the Chalk-formation in Bohemia (Upper Greensand) by Dr. A. Fritsch, containing a detailed description of 92 localities.

A plate illustrating new freshwater shells of the "Perncen" strata (lower part of Upper Greensand).

(3). An examination into the microscopic structure of *Eozoon Bohemicum*, with 2 plates by Dr. A. Fritsch.

(4). On Fossil Crinoids, etc., from the Urkalk of Pankratz, by Dr. A. Fritsch.

(5). Additions to our knowledge of the Tertiary Freshwater Gasteropoda of Tucharitz Bohemia, by Alfred Slavik, assistant to Dr. Fritsch in the Museum of Prague.

(6). Note on a *Locusta* from the Braunkolen formation of Bohemia.

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III.—THE MINERAL WEALTH OF INDIA.

THE *Englishman* (Calcutta), of the 5th February, 1870, contains some lengthy notes on the Mineral Wealth of India. Their chief object is to show that this wealth has never yet been fully developed, and that no reason exists why wealth, similar to that in which the ancients luxuriated, should not again be realised by those who may be induced to search for it.

The historical evidence is first set forth, and numerous references are made to ancient writers to prove the riches of the land.

<sup>1</sup> We are indebted to our friend Dr. Anton Fritsch, the able and energetic Keeper of the Palæontological and Zoological collections in the Royal Bohemian Museum, Prague, for the above interesting Report of the contents of the first volume of this truly national work.—*Edit.*

India has been justly reputed for immense mineral wealth, especially in diamonds and other gems, in which she, no doubt, at one time, bore the palm before the rest of the world, but no large amount of the precious metals has been enumerated among her products.

In the Mint, at Delhi, there are ancient traditions of the art of refining both gold and silver.

The so-called "silver mines" at Manikaru have never been worked to any extent, the produce is arsenical pyrites and galena.

Of about twenty mines about to be opened in Kulu, one is an antimony mine, in which a vein, about two feet thick of the solid ore, nearly pure, is reported to exist. Others are of argentiferous galena, yielding a large per centage of copper—90 ounces of silver to the ton, besides lead and gold—while those of copper have not been sufficiently opened up to obtain fair samples for assay. It is expected, however, with additional capital and a larger tutored staff, another year's exploration will add considerably to the known mineral wealth of Kulu and the Southern Himalayan range.

The geological formation of Kulu in the Himalayahs, and especially of Vazeeri Russi, is very favourable to the discovery of the precious metals, being composed of Silurian rocks, sandstone, shales, clay-slate, micaceous and quartzose schists, with numerous quartz lodes, most of which are highly metalliferous.

Burrampore is said to have produced from 2,500 to 3,000 lbs. Troy of gold annually.

That a considerable quantity of lead has been produced in India there can be no doubt, from the quantities the natives used for war purposes as well as sport, and from the many little diggings wherever any indication appeared. The import of gold and silver into India since 1800 has exceeded the export by 256 millions sterling, and the total amount of gold and silver coined exceeds 231 millions sterling, all of which has been absorbed by India.

If India is poor, however, in her produce of precious metals, she makes ample amends for it in her boundless wealth in gems. In the Deccan, in the river Pennair, in the lower Kistna, Ellore, and Punnah, in the river Sonar, in Bundelkund, at Sumbulpore on the Mahanuddy, and numbers of other places in India which produced large quantities of diamonds two hundred years ago, have since become so unproductive, or so neglected, that not only the places themselves but the very names are almost unknown to the present inhabitants.

Garcia al Horto, physician to the Viceroy of Goa, states that diamonds are found in only three or four places. In the province of Besnagar there are two or three rocks that produce them. There is another rock in the Deccan, not far from the territory Imadixa (Imad Shah), etc. These are the stones known by the name of "the diamonds of the old rock," and are brought for sale for Lispor, a town of the Deccan, where there is a noted fair held. The Guzerat merchants buy them and bring them here.

The richest mines, however, were at Golconda, on the gulf of the

Ganges, about 108 miles from Musilipatam. These used to be farmed out for 300,000 pagodas per annum (£150,000). In 1676 no less than 60,000 persons were employed in them. The plan of working was very rude, some of the labourers were employed in digging, others in baling out water by hand, having no mechanical contrivances for that purpose. They sunk shafts ten or twelve fathoms deep, carried out the earth, which was red mixed with white and yellow chalk, and, when dried in the sun, broke and sifted it.

India now sends no diamonds to market. She gets her gold from England, her silver from China, and her copper from Russia. Some gold comes from Yarkand in dust, but in small quantities; also emeralds, rubies, and other gems, precious jade, sulphur, copper, lead, borax, and rock-salt. The mountainous tracts to be crossed, however, prevent, to a great extent, the importation of merchandise from this inhospitable country.

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## REVIEWS.

### I.—MEMOIRS OF THE GEOLOGICAL SURVEY OF ENGLAND AND WALES.

I. *The Geology of the Carboniferous Limestone, Yoredale Rocks, and Millstone Grit of North Derbyshire, and the adjoining parts of Yorkshire.* By A. H. Green, M.A., F.G.S.; C. Le Neve Foster, B.A., D.Sc., F.G.S.; and J. R. Dakyns, M.A. Appendix and list of Fossils. By R. Etheridge, F.R.S.E., &c. 1869. 8vo. pp. 168. (London: Trübner & Co.)

II. *The Triassic and Permian Rocks of the Midland Counties of England.* By Edward Hull, M.A., F.R.S., F.G.S. 1869. 8vo. pp. 128. (London: Trübner & Co.)

I. This Memoir is the result of explorations in the field, from 1864–7, by the authors whose names are affixed to the paper; each of whom (with the exception of Dr. Le Neve Foster) describes portions of the country surveyed by himself. The general arrangement of the Memoir has been intrusted to Mr. Green.

The Memoir is prefaced by a useful bibliography of the books and papers relating to the country described from 1700 to 1867, and contains a general description of the physical features, geological structure, and drainage of the district, which is followed by a notice of the formations examined, viz.: Mountain Limestone, Yoredale Rocks, Millstone Grit, and Coal-measures. Next follows a detailed description of these formations, as observed in the different localities examined, and occupies more than 100 pages of the Memoir. The Post-Pliocene, and more recent deposits, follow, including the Boulder beds, the River deposits, and the Clay and Gravels of the Cleaver Hills.

A chapter, embodying a summary of the more important observations, as well as a few points not previously noticed, completes the monograph, to which is appended a valuable list of the fossils of the