

Brady, Engineer of the Channel Tunnel, under the advice of Professor Boyd Dawkins, F.R.S., and an experimental boring was commenced in a position at the foot of Shakespeare's Cliff, near Dover, in 1895-6."

It would be difficult to compress more errors into one sentence than are in the above quotation. The only statement which is true relates to the place of the boring. The credit of experimentally proving the existence of the coalfield is not due to Mr. Francis Brady, but to Sir Edward Watkin, Chairman both of the South-Eastern Railway and of the Channel Tunnel Company, who acted under my advice, and sent on to me all reports connected with the boring. Mr. Brady was simply engineer in charge of the borehole, and acted under Sir Edward Watkin's instructions. I never had occasion to advise Mr. Brady. Nor was the boring "commenced in 1895-6." It was begun in 1886, and from that time down to the discovery of the Coal-measures in 1890, the work of identifying the specimens and fixing the horizons of the strata penetrated—or, in other words, all the geology—fell to me. The last of a long series of reports to Sir Edward Watkin is dated July 8th, 1891.

All this is ancient history. The progress of the boring was recorded by me, from time to time, in the Reports of the British Association (1887, 1890, 1899), and in the publications of the Royal Institution (June 6th, 1890) and of the Manchester Geological Society (1890-3-4-7). They also were communicated to the public at large in *The Contemporary Review* (April, 1890), in *Nature* (March 6th, 1890), *The Colliery Guardian*, and *The Iron and Coal Trade Review*. Nor is the attribution of the credit to the wrong man new. An attempt was exposed as far back as 1897, after a full debate before the Manchester Geological Society, in which Sir Edward Watkin's claim was amply vindicated. Still later the history of the discovery was dealt with in my statement on the Buried Coalfields of Southern England, prepared at the request of the Royal Commission of Coal Supplies in 1903 (Final Report, pt. x, p. 28).

It is not, therefore, from lack of sources of information that Professor Hull has written the above paragraph in a work which professes to give the last word on British coalfields. I write this in justice to the memory of an old friend, who proved the truth of Godwin-Austen's theory by practical experiment, the first of a series which is likely to yield, in the future in Kent, important economic results, similar to those brought about in the past by similar borings in Northern France and Belgium.

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May 5th, 1905.

MOUNTAIN-BUILDING.

SIR,—The theory that mountainous areas have been produced by lateral thrust crushing and compressing large areas of country is, I think, now generally accepted; for it has been proved that such mountainous regions as have been carefully surveyed are found to

have the strata bent and folded in such a manner as to cover a much smaller area of country than that upon which they must have been deposited. It has not, however, yet been conclusively demonstrated how such thrust is produced. The hypothesis that cooling and consequent contraction is a sufficient cause has been shown to be untenable; the amount of compression such a contraction is capable of producing being quite insufficient to cause the amount of rock-folding required to produce our great mountain ranges.

As far as I am aware, no other theory based upon a possible reduction in the diameter of the earth has been advanced which seems satisfactory. In default of such an explanation I would suggest that we assume that over large areas of the earth's surface there is an actual expansion of the crust, such expansion compressing the weaker portions into the folds forming mountain ranges.

A probable cause of such an expansion of the crust I should like to draw attention to. It may, perhaps, have been suggested before, but if so I do not remember to have seen it.

As profound changes in the physical features of the earth's surface have been produced by apparently insignificant agencies, we must be prepared to find that some agency which at first sight seems quite inadequate is really the one which is producing the results.

A simple experiment will illustrate the theory I wish to suggest for consideration. If a strip of thin sheet lead have two lines drawn across it near the ends, and it be rolled up into a coil about one inch diameter, and then flattened out again, the bending will be found to have lengthened it about 0.2 per cent., and each time the operation is performed further lengthening will be produced. If continued flexure is capable of expanding slips or sheets of lead and many other materials, it may be argued that the earth's crust may undergo extension under the slight flexures the sun and moon produce. Under such flexure it is conceivable that vertical joints might have mineral matter thrown down in them, as they partially opened and closed, and mineral veins of various kinds be thus formed. Or when the pressure at any point is relieved by flexure, matter previously in solution might be thrown down and not be redissolved when the pressure again came on.

It would be interesting to consider the relationship mountain ranges bear to the great plains where it is conceivable expansion is taking place and to the positions of maximum distortion the sun and moon could produce. Some connection there certainly appears to be between the positions of mountain ranges, the great plains, and the direction of the axis of the earth.

As the moon always presents the same face towards us, unless the sun would be a sufficient cause, there should be no great mountain ranges similar to those on the earth. Indeed, on the moon the surface features are apparently produced by volcanic eruptions and ejections of rock or dust into a very attenuated atmosphere.

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