

is supplied by mechanical force precisely in the same way that light, heat, and electricity supply energy in the endothermic changes which they bring about."

The experiments consisted chiefly in the reduction of silver, mercury, platinum, and gold, from their salts. The result was indicated in each case by a darkening of the powder, and in one case, sodium chloraurate, the reduced gold was separated and weighed.

In a first series of experiments the substance operated upon, wrapped in platinum or silver foil, was subjected to a pressure of about 70,000 atmospheres by means of a specially devised apparatus. More interesting, however, is a second series of experiments, in which similar results were obtained by grinding the powder by hand in a stout porcelain mortar, so as to give a shearing motion. The important conclusions drawn are:

(i.) That in these experiments the mechanical energy does not undergo any intermediate conversion into sensible heat. The operation may be conducted slowly or intermittently, and the apparatus does not become warmed.

(ii.) That shearing stress is enormously more effective than simple pressure.

These two points are well illustrated by the behaviour of mercuric chloride. A simple pressure of 70,000 atmospheres was not sufficient to produce any change, but trituration in a mortar for fifteen minutes caused a very evident reduction to calomel. In this instance the decomposition is one which *cannot be produced by heat*.

Although the chemical transformations involved in dynamic metamorphism are of a more complex kind than those here noted, it seems fair to conclude that, in so far as they are endothermic, they may be brought about by mechanical force only, without the intervention of heat, and that the most marked effects of this kind are to be looked for where shearing stress has been brought into play.

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May 4th, 1894.

THE DEVONIAN VOLCANIC ROCKS OF START BAY.

SIR,—In my paper "On Certain Affinities between the Devonian Rocks of South Devon and the Metamorphic Schists" (*GEOLOGICAL MAGAZINE*, June, 1892), no attempt was made to define the horizon of any of the Devonian rocks themselves. The schists were merely referred to unaltered rocks whose position had been elsewhere declared.

In his recent address to the Geological Society, Mr. W. H. Hudleston, in noticing my paper, remarks that Lower Devonian diabases "in some districts are not by any means in evidence" (*Proc. Geol. Soc.* vol. 50, p. 130).

As a matter of fact the exact horizon of the Devonian diabases in Start Bay (to which the metamorphic green rocks were referred) does not affect my notes concerning them, which merely go to show that the green rocks at the Start and neighbourhood are of about the same age as the said Start Bay diabases, whether the latter be Lower, Middle, or Upper Devonian.

The stratigraphical questions of Start Bay lie entirely outside my province; but I may, perhaps, be allowed to point out how little they affect my position.

In the course of a walk from near the Start Lighthouse to Dartmouth, we may notice the following rocks:—Westward of the lighthouse, forming the cliff face, is a mass of compact greenrock, which, previously to Mr. Ussher's survey, seems to have been invariably overlooked by geological visitors. Immediately to the north are the mica-quartz-schists of Start Ridge, succeeded along the coast by a series of mica-schists which pass into the ordinary Devonians at Hallsands, with but slight indications of an important area of greenrock inland.

Devonian slates and sandstones are interrupted by volcanic rocks at Torcross, and then continue to Blackpool, where volcanic rocks reappear in force, and are considerably developed up to the entrance of Dartmouth Harbour, where the Mewstone islet and the eastern and western blackstones indicate the seaward extension of the diabases.

Now, from Hallsands to Dartmouth Harbour, the rocks including the diabases are admitted to be Devonian, of some age. If they are Lower Devonian, Mr. Hudleston tells us that in other districts Lower Devonian diabases "are not by any means in evidence." If, on the other hand, they are Middle Devonian, it is equally noticeable that the limestones (the characteristic rocks of that horizon) are absent.

If the explanation be that Middle Devonian slates and diabases are folded together with Lower Devonian slates and sandstones (with no useful fossils to assist the observer) the difficulty of the case as a purely Devonian problem is sufficiently obvious. But so far as the main problem of the age of the metamorphic green rocks is concerned, the question of the exact horizon of the Start Bay diabases, whether Lower or Middle Devonian, is of very minor consequence or interest. My point is that the sandstones, slates, and diabases north of the metamorphic boundary are the analogues of the quartz-schists, mica-schists, and green rocks to the south of that boundary; of which fact I do not entertain the shadow of a doubt.

A. R. HUNT.

OBITUARY.

CHARLES S. BEACHLER.

BORN NOVEMBER 5TH, 1870. DIED APRIL 5TH, 1894.

WE greatly regret to hear of the death of this young American geologist, which occurred at Crawfordsville, Indiana, on the above date, and was due to a complication of heart and lung trouble. Charles Beachler's scientific studies were begun at Wabash College, when he was fifteen years old. Here he became interested in herpetology, and made a collection of the reptiles of Indiana for the College at his own expense. Subsequently he was employed by Mr. Frank Springer to collect Crinoids from the Carboniferous beds of Crawfordsville, and the Niagara Limestone of Waldron and