

Glacial Stones.

By EDWARD M. WRENCH, M.V.O., F.R.C.S.

IN an address I had the honour of delivering before the Manchester Geographical Society in 1907, I remarked that so much had been written and so many observations made since Dr. Buckland, about 1840, wrote "for some time to come the glacial theory must occupy a prominent place in geological investigation," that it might be supposed that seventy years after there was not much left to discover; yet only five years ago Dr. Sollas, Professor of Geology at Oxford, wrote: "Observers are still engaged in the investigation of glacial phenomena, the subject still occupies as prominent a place as it did" (in Buckland's time), "and promises to do so for an indefinite time to come."

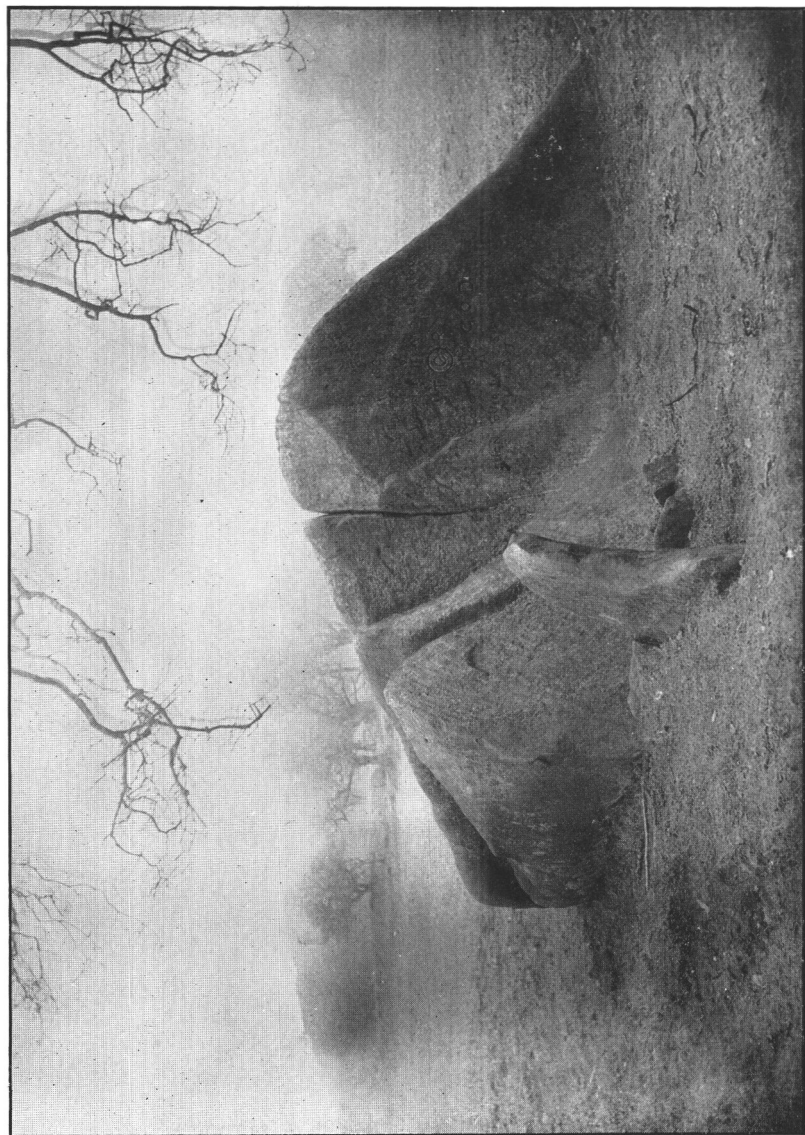
That the words of both Dr. Buckland and Dr. Sollas were indeed prophetic have this year been again verified by the subject of Dr. Bonney's address as President of the British Association at Sheffield in 1910 being "The Glacial History of Western Europe."

Dr. Bonney introduced the subject by describing the two schools of geologists: one, "which of late years has rapidly increased in numbers, claims for glaciers a very large share in the sculpture" of the landscape; the other declares that the action of a glacier is abrasive rather than erosive, and that the sculpture of ridges, crags, and valleys was accomplished in

pre-glacial times by running water and the ordinary atmospheric agencies. I hoped that he would illustrate his subject by reference to the effects of glacial action in the neighbourhood of Sheffield, but he preferred the larger field of the Alps.

Not many of the dwellers in Derbyshire are able to visit the Alps, much less afford the time to study the effects of glacial action there, hence we must be satisfied with what is indeed an interesting study—the effects of ancient glaciers in the Peak, which were so long overlooked; for it is stated in the geological memoir accompanying the Ordnance Map in the last century that when Sir Archibald Geikie was asked his opinion of the scratches on the bloodstone (a sheet of chert overlying limestone) at Bonsall, he replied that, had he seen such marks in Wales or Scotland, he should have unhesitatingly said that they were the result of glacial action; but since he could find *no other trace* of ice action in the Derwent Valley, he felt some doubt as to their origin. This was an excellent example of the truth of the old saying, “The eye sees what it brings with it to see.” Sir Archibald had hitherto been studying ice action on the hard rocks of Scotland and Wales, on which the scratches are seldom more than a fraction of an inch in depth, whereas the marks on the more friable gritstone are often over one inch in depth. Such marks I noticed soon after reading Sir Archibald’s remarks, but was myself so unwilling to attribute them to ice action that I considered they were caused by careless ploughing, until I found them on rocks too deep to be reached by any ploughshare, and abraded on several faces.

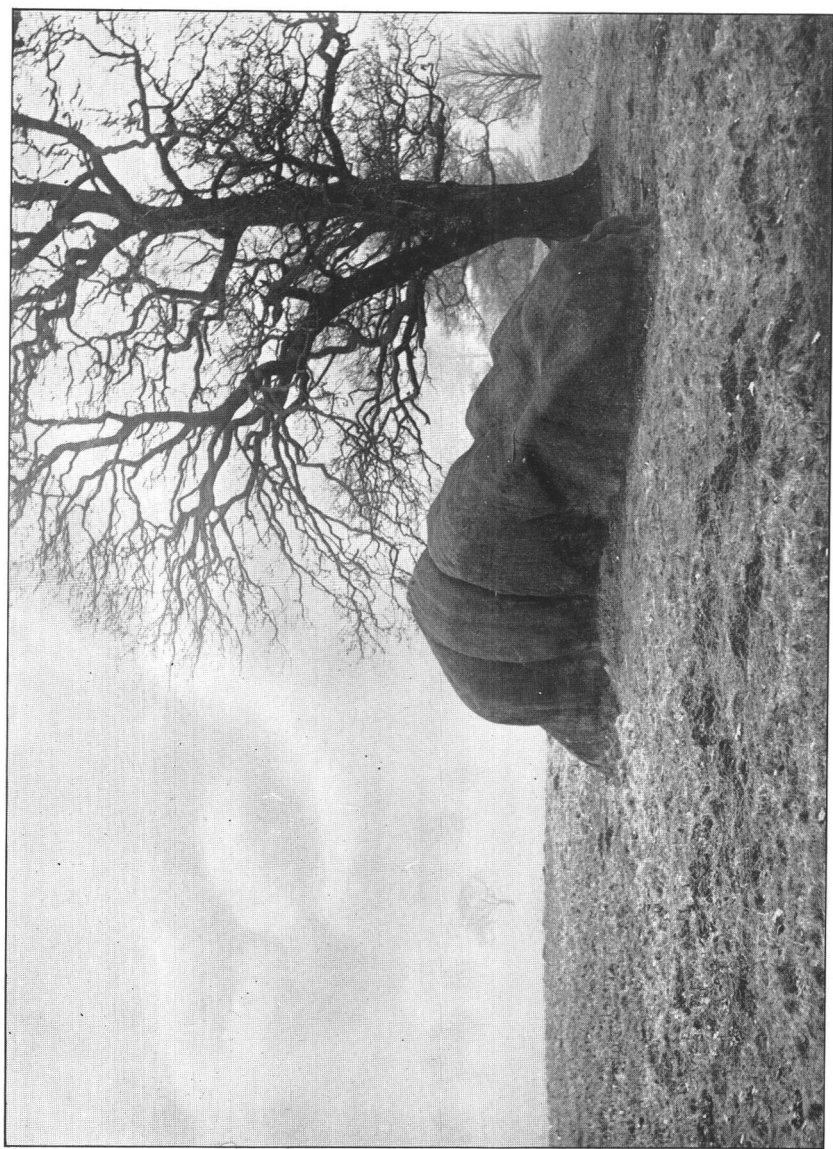
I first noticed these marks on rocks at the N.E. corner of Chatsworth Park (a photograph of a typical example is shown on page 204). The other photographs show a boulder a few hundred yards lower down the hill from the scratched stone (dedicated to commemorate the Jubilee of Queen Victoria in 1887), on which is seen, I believe, what Dr. Bonney calls the erosive action of a glacier, for the face of this stone towards the east moor, on which was probably the snowfield that fed the lateral glacier, is, as will be seen in the photograph, rounded like the back of an elephant, whereas the face towards the valley,



THE "JUBILEE STONE." S.W. FACE DOWN THE VALLEY, HENCE PROTECTED FROM EROSION.
ROUGH AND ANGULAR.

500 feet above Sea level.

Photographed by Mr. A. H. Allen.



THE "JUBILEE STONE" MAMMILATED GRITSTONE BOULDER IN CHATSWORTH PARK,
EASTERN FACE—TOWARDS THE SOURCE OF THE PROBABLE LATERAL GLACIER.

the direction to which the ice would be falling, is comparatively rough and perpendicular. Since being convinced that these phenomena were the result of glacial action, I have sought examples elsewhere, and traced them from the head of the Derwent Valley as far down as Belper, and since others have come to the same conclusion regarding ice action on gritstone, many typical examples have been discovered and placed for general observation, such as those in the grounds of the Whitworth Institute, Darley Dale, and in the small Public Garden at Matlock, where also is to be seen a well-marked limestone erratic.

No doubt now exists of the fact that the Peak of Derbyshire was covered by a dome of *névé*, over which few of the northern erratics were able to mount. Yet numerous specimens of moraines¹ are now known to exist; indeed, many of the graveyards in the Peak are, from the scantiness of soil over the mountain limestone, located in patches of glacial clay, mixed (as at Longstone) with ice-scratched limestone boulders, and I opine that sooner or later an "ice-mill" or pot-hole will be discovered similar to that at Lucerne, where a boulder weighing many tons has ground for itself a circular pit some five feet deep in a softer rock, the mill-stone having been rotated by a current of water flowing beneath a glacier.

Dr. Bonney concluded his address at Sheffield on the two schools (the sea ice and land ice advocates of glacial effects in Britain) in these words: "I cannot as yet declare [either] to be satisfactorily established, and I think we shall be wiser in working on in the hope of clearing up some of the perplexities."

I take it that the most devoted advocates of the "sea ice" hypothesis will admit that there are no signs of its effects in the Derwent Valley. I am not aware that any marine shells have been found in the patches of glacial clay already alluded to, or in the patch (so rich in erratics) at Fritchley, near Ambergate. To induce a search for such, and for other signs of ice action in North Derbyshire, I have, at the request of the Editor,

¹ The accumulation of stones and other matter caused by a glacier.

contributed these remarks, which, I feel sure, will not convey any new information to many of my readers, but may be instrumental in directing the attention of others to this interesting and, as Dr. Bonney said, yet undecided question regarding the origin and movement of ice in this district, one effect of which has hitherto, I believe, not attracted much attention, though it has had much to do with the physiography of the limestone and gritstone uplands.

All admit that the mammified surface of rocks is due to passage over them (of which the Jubilee stone is an example) of glacial ice. May we not attribute the vastly larger mammified surface of so many of the shale and limestone hills, illustrated in outline and name at Mam Tor, to the same cause. Long continued water and aerial denudation results in the craggy cliffs and deep valleys of the Wye and Dove Dales, but neither of these causes will account for the swelling upland on the west of the Peak district as the planing or erosive action, as Dr. Bonney called it, of a vast ice sheet slowly moving across the tough but easily eroded limestone, while it harrowed or tugged the more easily fractured gritstone, leaving the surface strewed with fragments.



EAST AND WEST STRIAE ON MILLSTONE GRIT BOULDER. ABOUT 100 YARDS ABOVE THE
"JUBILEE STONE" IN CHATSWORTH PARK.