

rairie (the immediate 'fringe' in the western part of the state excepted) was made because of certain statements to the contrary quite recently made by a distinguished authority. It was made only after a thorough investigation of every locality supposed to be glaciated.

In conclusion, I may be permitted to say that while, owing to the necessarily limited length of a public lecture, the rocks of Philadelphia could not be so fully treated of as the superficial formations, this latter — and in this region more debatable — subject will form the topic of future lectures, which may perhaps be worthy of further comment by my friendly critic.

HENRY CARVILL LEWIS.

Philadelphia, Sept. 7, 1883.

The pre-Cambrian rocks of Wales.

Those who are interested in the questions raised by Dr. Henry Hicks in his criticism of Professor Geikie in *SCIENCE* for Aug. 10, may find it to their advantage to consult my paper entitled 'History of some pre-Cambrian rocks in Europe and America,' which appeared in the *American journal of science* for April, 1880 (vol. xix. p. 268-283). I had the good fortune, in 1878, to spend several days with Dr. Hicks, in going over the typical localities previously studied by him, not only at and near St. Davids in South Wales, but also those of Carnarvon, Dinorwic, and Anglesea, Messrs. Tosell and Tawney being our companions, in North Wales. As a result of these studies, I am satisfied that the views of Messrs. Hicks and Hughes are correct, and their criticisms of Professor Geikie well founded.

The Dimetian, alike in North and South Wales and in Anglesea, has both the lithological characters and the stratigraphical relations of the Laurentian of North America. The Arvonian corresponds in like manner to the great series of *hällfjintas* or *petrosilex* rocks, jaspery and porphyritic, whose distribution on the coast of Massachusetts and of New Brunswick, in the Blue Ridge of Pennsylvania, in Missouri, and on Lake Superior, I have studied and elsewhere discussed (*Second geol. surv. Penn.*, rep. E, p. 189-195). Similar rocks have also been described by Irving in the Baraboo river in central Wisconsin, a locality which I have lately had an opportunity of examining. The conglomerates of Arvonian pebbles, which form the basal beds of the Cambrian near Snowdon, are indistinguishable from those found at Marblehead and elsewhere on our eastern coast, lying on or near the Arvonian.

The Pebidian of Hicks is our typical Huronian, as seen in eastern Canada and around the lakes Huron and Superior. Professor Bonney, who has lately received a collection of these, is struck with their complete resemblance to the Welsh Pebidian which I had seen and called Huronian thirteen years since. The succeeding gneisses and mica-schists (upper Pebidian or Grampian of Hicks, and Caledonian of Callaway), which are our Montalban series, are not met with in Wales, but appear not only in Scotland, but, as I have pointed out, across the channel, in the Dublin and Wicklow hills in Ireland.

The similar succession in the Alps, I have described in a late paper, of which an abstract appeared in *SCIENCE* for Sept. 7 (p. 322). The student who compares the succession of stratified crystalline rocks alike in North America, in the British Islands, and in southern Europe, can scarcely fail to recognize, in their constant stratigraphical and lithological relations, something like a 'universal law.'

T. STERRY HUNT.

Montreal, Sept. 11, 1883.

SERGEANT FINLEY'S TORNADO STUDIES.

Report on the character of six hundred tornadoes. Professional papers of the signal service, No. vii. By J. P. FINLEY, Washington, *Signal service*, 1882. 19 p., 3 maps, 4°.

Tornadoes: Their special characteristics and dangers. By J. P. FINLEY. Kansas City, 1882. 30 p.

So striking a phenomenon as a tornado, and one so destructive in its effects, would naturally receive much attention; yet, curiously enough, the competent treatment which these storms have received is remarkably inadequate. Those omniscient gentlemen, the reporters of the newspapers, have written much about tornadoes, and many columns of our summer dailies are filled with accounts of them; but, aside from the books of Peltier and Reye, the scientific literature is fragmentary. Half a century ago, at the time of the battle between Reid, Redfield, Piddington, Espy, Hare, and others, over the rotatory theory of storms, the tornado-literature took a considerable development; but it soon fell to small dimensions, and here it has remained until quite recently. The present activity in this field is largely due to the signal service, and Sergeant Finley's contributions form an important part of the current literature.

Mr. Finley's specialty is the collection of facts concerning tornadoes. He has accounts of individual tornadoes in many of the annual reports of the chief signal officer. They represent the facts collected by him on the field of destruction itself. They are evidently gotten together with great care; measurements are made when practicable, and explanatory maps and sketches are numerous. His evident object is to put before the reader the accurate representation of what he saw, encumbered as little as possible by explanatory theories. The result is that his reports are interesting reading, and afford a mine of wealth for the future Kepler of tornadoes.

Not quite so important, perhaps, from a scientific point of view, but of far more general interest, is his report. Its principal feature is the tabulation of the tornadoes discussed, with headings for time, dimensions, velocity, clouds, and other meteorological features. These are summed up, and from the results are drawn various interesting conclusions concerning maxima, minima, and averages.

Mr. Finley's search for accounts of tornadoes has been extensive; but as he has unfortunately given no references, we cannot tell how extensive it may have been. Evidently he has not gone through the Proceedings of the Amer-