

Professor Tarr has made a most interesting contribution to glacial science. Only a few of the matters dealt with have been referred to, but the whole paper deserves careful perusal.

NOTICES OF MEMOIRS.

RELATIONSHIP OF NIAGARA RIVER TO THE GLACIAL PERIOD. Bulletin
Geol. Soc. America, August 10, 1910, pp. 433-48.

IN this paper Dr. J. W. Spencer records further observations made by him on the Whirlpool - St. David's Valley, Gorge and Canyon. The buried canyon occurs at the south end of the Whirlpool, some 3 miles from the escarpment. Above this is a shallower and smaller channel 2 miles further south. Beyond the ridge is another ancient valley trending to the south, and deepening to 66 feet in $1\frac{1}{2}$ miles at the site of the falls themselves. In this distance the valley broadens from less than one quarter to over a mile, descending gradually a more gentle gradient throughout a longer course than that of the Whirlpool-St. David's Gorge. The buried gorge leading from the Whirlpool is bounded by compact limestones with steep faces, except where rounded and glaciated with striations along the direction of its course. This ancient and now buried gorge increases from 1,400 feet at the Whirlpool to 1,800 feet in a distance of $2\frac{1}{2}$ miles. Professor Spencer discovered in this gorge, at a depth of 186 feet, the remains of a buried interglacial forest. Interglacial beds were first recorded in Canada by Mr. D. F. H. Wilkins, at Port Rowan on Lake Erie, in 1878. A little later, at Scarbo' Heights, east of Toronto, they were recorded by Dr. George Jennings Hinde, F.R.S. (*Canadian Journal*, Toronto, vol. xv, p. 388, 1878). This was the foundation of interglacial geology in the Ontario basin.

In the neighbourhood of the Whirlpool Gorge the surface of the Niagara limestone floor has been planed off, polished, and grooved, the strongest striations being to south 60° west and weaker ones south 60° east; best seen at the quarry on the mountain-top east of St. David's, where the drift is reduced in places to only 4 feet. Several well-sections are described, one of which passed through 293 feet in depth of glacial and other detrital deposits. Everywhere beneath the neighbouring drift-deposits lie buried channels, and high above the Whirlpool Channel is an esker-like ridge of sand and gravel rising at one point to 442 feet above the lake.

In the borings in Whirlpool Channel have been discovered remains of a cool climate forest and soil, at a depth of 186 feet below the surface, with proof of three or four glacial formations since that time, like the Pleistocene Series at Toronto.

Before the forest bed, at least two glacial formations had been left in the buried channel, below which lie some 100 to 200 feet of still older glacial deposits. This lowest drift lies in a rock-bordered valley which had undergone a far greater amount of erosion than that during or since the Glacial period. From all the evidence Professor Spencer concludes therefore that this now filled trough is of pre-glacial origin. The age of the modern Niagara River is also found to be younger than

the glacial deposits about the western end of Lake Ontario, though not so recent as the later Wisconsin accumulations in other localities.

Before the birth of the falls the ice-sheet had receded beyond the greatest of all the moraines of Ontario, which lie between Lake Ontario and Lake Simcoe and between this lake and Georgian Bay, a distance of more than 120 miles north of Niagara Falls, so that the drainage of Lake Huron then passed down the Trent Valley. From the terrace north of Lake Nipissing the ice-sheet had receded 230 miles or more to the north of Niagara before the birth of the falls. But the Ottawa Valley farther down was still blocked. The Ontario Valley was open to at least near the eastern end of the lake, so that it permitted the flow from Algonquin Lake down the Trent Valley, although the ice was not removed from the St. Lawrence till some time after the birth of the falls. This was the last ice-sheet, and we only know that it disappeared so long ago that there was time for the excavation of the inner gorge of Niagara River, extending from Lake Ontario to a point inside the canyon of Niagara, since reflooded and drowned 180 feet by the subsequent north-eastward tilting of the region.

REVIEWS.

I.—A TEXT-BOOK OF GEOLOGY. BY PHILIP LAKE, M.A., F.G.S., and R. H. RASTALL, M.A., F.G.S. 8vo; pp. xvi, 494, with 32 plates and 134 text-illustrations. London: Edward Arnold, 1910. Price 16s. net.

THIS volume, issued as one of "Arnold's Geological Series" under the general editorship of Dr. Marr, is of larger dimensions than the series in course of publication on Economic Geology. As a text-book it will occupy an appropriate position between the *Geology for Beginners* of Professor Watts and the two-volume textbook of Sir Archibald Geikie. In the first part Mr. Rastall gives a clear and concise account of the principles of the science as illustrated by agents now at work; he describes rock-structures and earth-movements, and gives special petrological descriptions of the igneous rocks, of metamorphism, ore deposits, and mineral veins, occupying in all 279 pages. In the remaining portion, also admirably executed, Mr. Lake deals with the principles of stratigraphy, and with the fauna and flora of the great geological systems.

The book is well printed, admirably illustrated, and it has a good index; above all, it is written by two experienced workers and teachers, who have brought before us the latest results of geological research. Few references, however, are given to authorities.

The student will welcome the exposition of rock-structures, of folds, and the formation of overthrusts, the treatment of earth-sculpture and of the agents of denudation, attention being called to the dominant action of particular agents of weathering, transport, and corrosion under different climatic conditions and in different latitudes.

The development of rivers is explained in diagrammatic form, but the student has to bear in mind that the actual river-courses are liable