

bers, and cause widespread consternation. No doubt climatic and other influences have much to do with these sudden up-risings, as we find species that are known to be parasitized but very little, which fluctuate in numbers greatly with different seasons. All the effect, then, cannot be attributed to parasites.

The difference between the work of parasites and other influences, is quite marked and distinct in certain channels, and can be easily traced. The tendency of parasites is to increase or decrease in numbers as the host is numerous or scarce. A few years ago the wheat aphid was so numerous over the wheat plants that it threatened to destroy the whole crop in this region. Presently certain of the aphids looked brown and swelled, which told plainly that the parasites were there too. The wheat grew and headed. Still the aphids increased by the thousands daily, and the parasites increased in numbers also. Then there came a time when the parasites were in the majority, and, before the wheat-heads had ripened, a live aphid was a scarce and hard thing to find. The next year the wheat aphid was not common, and what did appear were disposed of early by the parasites.

Sometimes the work of the parasites is not as prompt as the instance just cited. For illustration, the oak army worm, *Edema albifrons*, was never known to be numerous enough to greatly injure the oak till two years ago, when the species came in such numbers as to strip whole forests of their foliage. Of the several hundred caterpillars and pupæ collected, only one pupa was parasitized. Last year the trees were again stripped by countless numbers as the year before, but from the pupæ collected, about every one in ten was parasitized. Probably this year the caterpillars will be less numerous, and by next will be scarce, because of the work of parasites.

An ideal parasite is one that would keep its host in such complete subjection that no outbreak would occur, and the numbers not great enough to do any harm. While the effect of parasitism is not ideal in every respect, it nevertheless is a boon to economic entomology, and has already been used to good advantage, by introducing many foreign parasites that are known to work on certain species. As we become still more familiar with these parasites and their hosts, much more good, through parasitic species will undoubtedly result.

EARTHQUAKES IN AUSTRALASIA.—II.

BY GEORGE HOGGEN, M.A., SECRETARY OF THE SEISMOLOGICAL COMMITTEE OF THE AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

In my former communication I explained the nature of the work that the Seismological Committee of the A. A. S. proposes to do anent earthquakes. In the present contribution I shall endeavor to sketch briefly what has already been done for New Zealand earthquakes.

The committee has published two reports, 1891 and 1892. The former was drawn up by Sir James Hector, F.R.S., and deals with New Zealand earthquakes to the end of the year 1890. It contains a list of earthquakes (537) felt in New Zealand from the earliest settled times, and gives interesting details concerning the somewhat severe shocks of October, 1848, and January, 1855. The last named is notable as being one of the few in any country in which movement of the land has been actually observed by skilled observers on the spot. Captain Drury, R.N., was engaged at the time on the nautical survey of the New Zealand coast, and, being in the neighborhood of the land raised, was able by actual re-measurement to confirm the general impression. "An area of 4,600 miles was estimated to have been raised from one foot to nine feet, the greatest elevation being on the west side of the Wairarapa Valley, the vicinity of Porroia Harbor not being affected, and the west side of Cloudy Bay, north of Blenheim, having actually been depressed to the extent of five feet." (Transactions, A. A. S., 1891, p. 522). The elevation has been permanent. The same report (1891) contained a map by Sir James Hector, showing the seismic areas, principal fault and earthquake-rents in the islands of New Zealand. The division into seismic areas is not, however, based upon the

determination of the earthquake origins, and, in the opinion of the present writer, is on that account misleading. At the same meeting of the Australasian Association (Jan., 1891), I read a paper on New Zealand Earthquakes, which contained a somewhat larger list (775) than the report of the committee, together with two maps and a diagram showing curves of monthly seismic frequency, the New Zealand curve based upon the records of 745 shocks being compared with Mallet's curves for the Northern and Southern Hemispheres—5,879 and 223 earthquakes, respectively—(See Milne on Earthquakes, p. 256). The record for New Zealand shows a maximum of frequency in September, with smaller maxima in January and March, and minima in April and October, November, December. The inclusion of these facts might modify Mallet's curve for the Southern Hemisphere, but it does not appear that they point to any connection between earthquake-frequency and the season of the year.

One of the maps exhibited showed, by shading, the earthquake-frequency of the shocks in various parts of New Zealand, the region most effected being a portion of Cook Strait, included in the triangle Wellington, Blenheim, Wanganui; the next shade of frequency includes Christchurch, the next, Nelson. There is an isolated district of local earthquakes round Rotorua and Taranaki. On my other map were marked the epicentra of 35 earthquakes for which the data were sufficient to ascertain them with any degree of probability, and I have since been able to determine more or less exactly the origins of a few of the earthquakes of 1891–1892. The two chief sources are situated—(1) 10 miles north of Lake Sumner, or about 80 miles north-northwest of Christchurch. Hence proceeded the shock which on the 1st of September, 1888, threw down the upper portion of the spire of Christchurch cathedral. To the same origin I am able definitely to assign 10 other shocks, and probably many more belong to it. (2) 45–50 miles north-northwest of Wellington, in Cook Strait. This and some other origins near it are accountable for most of the New Zealand shocks, the average intensity being very low, III.—IV., on the Rossi-Forel scale.

The method used for finding the origins has been, in general, founded on the observed times of the shock at the several places at which it was felt, with the help of the isoseismals, when the effects were sufficiently definite to assign the degree of intensity on the Rossi-Forel scale.

One somewhat striking point in connection with all the recent earthquakes in New Zealand, is the low velocity of propagation they possess (less, with one exception, than 20 miles a minute). At first this made me doubt the correctness of the calculations, but the large number of shocks for which the velocity can now be approximately ascertained renders the results tolerably certain. In the solitary exception (an earthquake of the present year, which I am still investigating) the velocity is probably between 45 and 55 miles per minute. The depth of the origin has not been found in many cases, but in those for which the solution of the equations is most satisfactory, the depth is in each case about 24 or 25 miles below the surface.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Some Recently Discovered Trilobites with Appendages.

THE past winter the Geological Department of Columbia College came into possession of some extremely interesting specimens of *Triarthrus Beckii*, which were discovered by Mr. W. S. Valiant, now of Rutgers College, in the Utica shales at Rome, N.Y. They were entrusted to W. D. Matthew, our fellow in geology, for complete description, and Mr. Matthew's paper, recently read before the New York Academy of Sciences, will appear in the Transactions of the Academy for May. Owing to the unavoidable delay in their issue, and because the subject is such an interesting one, this preliminary announcement is made. The Trilobites possess two undoubted antennæ that come out together