

most important international arrangements was performed, and, I trust, in a manner which will be found satisfactory when the reductions have been made and the work is compared with that done at other places.

Besides this special work, the ordinary work of a magnetic observatory has been carried out throughout the year. This consists of keeping a continuous record of all magnetic changes. The curves so obtained are being reduced, but with the limited assistance I have this will be a long process. The first five months of the year 1902 have been measured, but the reduction even of these is far from complete, and no beginning has yet been made with the special work of "term days," the 1st and 15th of the months. With a view to accelerating this work of reduction, I have made an adaptation of a very well-known instrument to the purpose in view, and hope to get it constructed shortly. Such an instrument is almost necessary under ordinary circumstances if the results are to be reduced and published within a reasonable time. It is, however, under the conditions which result from the absence of the expedition, quite an essential. It will be necessary to publish these results separately. They will consist chiefly of figures.

With regard to the records for the year, there are two or three magnetic points which are of sufficient general interest to touch upon. A considerable magnetic storm occurred on the 10th April. Beginning very abruptly at 9 h. 10 m. p.m. on the evening of this day, it continued for over thirty-six hours. The curves for this day are reproduced (see Plate A.) From an Invercargill paper I see that "a magnificent display of aurora australis was visible about 8 o'clock on Friday evening, 11th April, in the Gore district, the characteristic vertical streamers of light moving with unusual rapidity and affording a most brilliant spectacle." Referring to the curves, (Plate A), it will be seen that this was just at the height of the storm as recorded at Christchurch. I had an opportunity of seeing the Melbourne magnetic curves shortly after this, and they too were very irregular. I have had inquiries from the United States Coast and Geodetic Survey for information regarding this occurrence, and have also seen the curves from the Cheltenham Observatory in the United States. These show fluctuations quite as pronounced as ours, if not more so. The storm began in the United States apparently at 9 h. 7 m. p.m. of our time on the evening of the 10th, whereas with us it began at 9 h. 10 m. p.m., as previously stated. This difference may only be apparent, however, as in the copies of United States curves I have the time scale is much restricted, and it is not possible to obtain the time of an event to an accuracy of one minute, though it would be in the originals. In the Magnetic Declination Table for 1902 of the United States Coast and Geodetic Survey, in which the curves referred to are reproduced, it is stated the storm began practically simultaneously in the United States, in Alaska, and in Honolulu, and to these we may now add Christchurch. Mr. Baracchi, writing to me from South Victoria Land, states that his curves for that day are probably more disturbed than those of any other for the year, but he does not state the time of commencement of the disturbance. Though the beginning of the storm in the United States is remarkably like that in Christchurch, its subsequent history seems to present marked features of difference. Thus, here we have a case of an event of great magnitude starting simultaneously over the whole world, and an event too of which the only indication given to us by our senses was the display of aurora a very considerable time after it had really commenced. The cause of magnetic storms is still very obscure, but some idea of the energy involved may be obtained from the simple experiment of trying the distance at which a bar magnet must be held from another suspended magnet for the effect of one upon the other to be just discernible. With an ordinary large bar magnet and with a magnet suspended with extreme delicacy, and with special means of detecting its slightest motion, this distance is not more than seven or eight yards. How great then must that be which simultaneously affects the magnetism of the whole earth by an easily appreciable amount! And when it is recognised that the seat of a disturbance of this kind is upon the sun and not in the earth, the wonder becomes greater still. This has long been known from the fact that magnetic storms occur more frequently at times when sun-spots are common than when there are few visible. Of recent theories, that of Arrhenius, which ascribes these phenomena to the ejection of excessively minute electrified particles from the sun's surface, has much to support it. We know of cases where such minute electrified particles do exist and travel with enormous velocities—from twenty thousand to sixty thousand miles per second, and possibly with even greater velocity still. And although we can scarcely be said to know that such particles are ejected from the sun to the earth, yet there is nothing impossible or even improbable in the supposition, and if this should be the case it would account for the phenomena of magnetic storms and auroral displays associated with them, and also for many other physical facts the explanation of which is still obscure. Another magnetic disturbance of special interest occurred about a month later than this. The feature of this is that it seems to have begun at identically the same moment as the disastrous eruption of Mount Pelée. The curve reproduced (Plate B) shows how suddenly it began. Owing to the kindness of the United States Coast and Geodetic Survey authorities, I have seen the curves of their Cheltenham Observatory for this day also. As with the disturbance of which I have previously been speaking, this too began apparently in the United States at precisely the same moment as it commenced in Christchurch, and in an almost identical way. Dr. Bauer, in his report already referred to, says, "The magnetic disturbance began simultaneously at the Cheltenham and at the Baldwin Observatories, at 7 h. 53 m. St. Pierre local mean time. According to the newspaper reports the catastrophe befell St. Pierre at about 8 a.m. on May 8th, and it was stated that the town clock was found stopped at 7 h. 50 m. How accurately this clock kept local mean time is, of course, not known." The point marked in our curve "Mount Pelée" corresponds to 7 h. 54 m. a.m. St. Pierre local time. It is thus a very remarkable coincidence, if it is nothing more, that within five minutes of the time when the eruption occurred the magnetographs in two countries so widely separated as New Zealand and the United States should suddenly begin to show signs of uneasiness. In reply to a request from the United States authorities, I have sent them copies of these curves, together with other information relating to about the same time. As a further illustration of the worldwide character of these phenomena, I may add that while