the south, till we arrive at the points of convergence of all their directions; for there are only two *such* poles, one in the Arctic and one in the Antarctic region. But in consequence of the irregularity of the magnetic constitution of the earth, if we follow the inclination of the magnetic force round the earth on any parallel of latitude, we find that it has two *maxima* and two *minima*, as if there were four magnetic poles. The isodynamic map is a new presentation of the facts of this subject; the first having been constructed by Colonel Sabine in 1837.

I have stated also that the magnetic elements at each place are to be observed in such a manner as to bring into view both their *periodical*, their *secular*, and their *irregular* or *occasional* changes. The observations made at Toronto in Canada, and at Hobart Town in Van Diemen's Land, two stations at equal distances from the two poles of the earth, and also at St. Helena, a station within the tropics, have been discussed by General Sabine with great care, and with an amount of labor approaching to that employed upon reductions of astronomical observations. And the results have been curious and unexpected.

The declination was first examined.[2] This magnetical element is, as we have already seen (p. 232), liable both to a diurnal and to an annual inequality; and also to irregular perturbations which have been termed magnetic storms. Now it was found that all these inequalities went on increasing gradually and steadily from 1843 to 1848, so as to become, at the end of that time, above twice as large as they were at the beginning of it. A new periodical change in all these elements appeared to be clearly established by this examination. M. Lamont, of Munich, had already remarked indications of a decennial period in the diurnal variation of the declination of the needle. The duration of the period from minimum to maximum being about five years, and therefore the whole period about ten years. The same conclusion was found to follow still more decidedly from the observations of the dip and intensity.

This period of ten years had no familiar meaning in astronomy; and if none such had been found for it, its occurrence as a magnetic period must have been regarded, as General Sabine says,[3] in the light of a fragmentary fact. But it happened about this time that the scientific world was made aware of the existence of a like period in a pheno-

[2] *Phil. Trans.* 1852 and 1856.

[3] *Phil. Trans.* 1856, p. 382.