

Pennsylvania and parts of adjacent States.”<sup>1</sup> Observations were made at 22 points within Pennsylvania; they did not in every case embrace the three elements. Professor Bache made these observations during his summer vacations from 1840-43 and at private expense.

When Bache became Superintendent of the Coast Survey, magnetism was incorporated in the work of the Survey. Since then magnetic observations have been made in every state of the Union by the Coast Survey, and the drawing of isomagnetic maps, and the furnishing of the data for allowance of the secular variation, have become regular functions of the Survey. Owing to its limited appropriation, the Survey cannot undertake, however, the making of observations in such number as would fulfil modern requirements of a magnetic survey. It can at best confine itself to the establishment of secular variation stations in each state, *i. e.*, stations, as permanent as possible, at which observations are made with great refinement and at which observations may be repeated after the lapse of a certain number of years, say about 10 years. Detailed surveys will at present have to be undertaken by the states separately, which course may have its advantages, but likewise has its disadvantages.

Magnetic observations, more or less complete, and magnetic tours, more or less extensive, had been made previous to Bache's work, referred to above, *e. g.*, by Long (1819), Nicollet (1832-36), Locke (1838-43) and Loomis (1838-41). The last made the first general collection of magnetic observations for this country and has the honor of having drawn the first magnetic maps. To be sure, these maps, covering the eastern part of the United States, owing to the scantiness of the material, were only rough approximations; nevertheless, when, 16 years later, a more complete map was made by the Coast Survey,

<sup>1</sup> By an oversight, Mr. Schott fails to make any mention of this work of Professor Bache in his article entitled "Magnetic Survey of North America," prepared for the Chicago Meteorological Congress of 1893. See Part II of the Report of that Congress, published as Bulletin No. 11 of the Weather Bureau. The records and results of Bache's survey are contained in *Smithsonian Contributions to Knowledge* No. 166.