

printed in the *American Journal of Science* and elsewhere, he is the author of the following works :

- A System of Mineralogy, 1837, 1844, 1850.
- Zoöphytes, 1846.
- Manual of Mineralogy, 1848, 1857, 1878, 1887.
- Coral Reefs and Islands, 1853.
- Crustacea, 1852-54.
- Manual of Geology, 1862, 1874, 1880, 1895.
- A Text-Book of Geology, 1864, 1874, 1882.
- A System of Mineralogy, 1868.
- Corals and Coral Islands, 1872, 1890.
- The Geological Story Briefly Told, 1875.
- Characteristics of Volcanoes, 1890.
- The Four Rocks of the New Haven Region, 1891.

CORRESPONDENCE.

THE EDUCATION OF THE TOPOGRAPHER.

TO THE EDITOR OF SCIENCE: Part of Professor Merriman's review in SCIENCE for April 26 interests me as being the direct opposite of my own opinion. He says, apropos of Mr. Gannett's statement that the topographer must be able to generalize through his knowledge of geological processes: "These are dangerous doctrines. The earth exists, the duty of the topographer is to map it truly, and the study of the origin of its features should come later." I should like very much to learn through the columns of SCIENCE the opinions of other geographers and topographers on this question.

It is not alone the earth that exists; a large series of topographical maps of various parts of the earth also exist; and through their study the young topographer can learn much about the kind of work he will have when surveying those separate parts of the earth that are not yet mapped. This kind of knowledge will help him in mapping new regions in about the same way that prelimi-

nary study of known forms of plants and animals helps the systematist to describe new forms when he finds them.

It is certainly the duty of the topographer to make true maps; but the truest map is always only a generalization. Something is necessarily omitted, and the topographer has to choose between what he shall omit and what he shall represent. He sees many things that he can not map. How shall he be best aided in making on the small sheet of paper before him an expressive map of the broad surface of country around him? I do not say 'an accurate map,' because the word 'accurate' is so generally misunderstood in this connection. It is often taken to imply that the topographer has actually measured every part of the surface of the country and carefully constructed every line on his paper. As a matter of fact, by far the larger part of all maps is sketched, and in the sketching more facts often have to be omitted than can be represented. Hence, everything should be taught to the topographer that will aid him in really seeing the facts that are before him and faithfully representing such of them as come within the limit of the scale he employs.

Nothing is of more assistance in seeing the facts, and in thus making a good beginning towards sketching them properly, than some understanding of their origin and meaning. Hence I believe that the best course of education for topographers while yet in school should include a careful study of the development of land forms, and that the best practical work by topographers will require a very careful and sympathetic study of the origin of the land forms on the ground before him. The prepossession that contour lines bend up-stream has deceived many a topographer into giving a wrong expression to flat alluvial cones. Indifference to the significance and importance of the sharp edge of a gorge or a cliff

has rounded off many a truly angular contour line into an inexpressive curve.

The objection that is sometimes made against this view of a topographer's education and work is that, if he tries to sketch what he thinks he understands, he will sometimes sketch what is not really before him. There may be a certain amount of truth in this, but there are sufficient answers to it. A topographer who is too far guided by his imagination has been badly taught, or else he is of a mental quality that will prevent his ever becoming a good topographer, quite apart from whatever education he has had. The well taught topographer will make no larger share of mistakes on account of being well informed on his subject than will the well taught systematic botanist or zoölogist. The few mistakes of interpretation that the well taught topographer may make will, I believe, be far outweighed by excellence of the other part of his work.

It is perhaps because I have a higher idea of a topographer's work than ordinarily obtains that I should like to see him generally better educated for it. To my mind, a map is so far from being a copy of nature that I should prefer to call it a graphic description of nature, and in the making of this graphic description the topographer should study his subject and his graphic signs with the same care that a writer should study his thoughts and the words he employs to represent them. Instruments, to which some topographers seem to give their first attention, ought to have about the same place in their real work that a typewriting machine has in the work of a literary man.

The chief subject of the topographer's study should be the form of the land before him; and until this is recognized in engineering schools and enforced by a careful course of preparatory physiographical study, I believe we shall not have the best maps

that can be made. Even further, it is as impossible to make a good topographer by merely teaching him about plane tables and stadia and logarithms as it is to make an essayist by teaching him about writing and spelling. It seems to me, in fine, that Professor Merriman's interest in the mathematical aspects of the art of topography leads him to place too low a value on the importance of studying the chief subject of the topographer's attention, the forms of the land.

W. M. DAVIS.

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THE HELMHOLTZ MEMORIAL.

A FEW months ago Hermann von Helmholtz died, one of the greatest scientific geniuses of all time, whose name will not be forgotten as long as men care for the knowledge of Nature. His invention of the ophthalmoscope made the success of the modern oculist possible; his papers on the conservation of energy gave the strongest impulse to modern physics; his books on seeing and hearing became the basis of modern psychology.

It seems a matter of course that the present generation should express its gratitude in a lasting monument. Not only his friends and pupils all over the world, but men of science and physicians everywhere have supported this idea, and so last month an International Committee was formed to collect money for the erection of a great Helmholtz monument in Berlin, where for the past twenty-five years he lived and worked. The plan has nothing to do with local patriotism; America, France, England, Italy and Russia are represented on the Committee; not a decoration of the city of Berlin is in question, but a universal expression of devotion to the spirit of natural science.

No doubt America will take a very high place in the list of givers. There has been seldom such an opportunity to show that the United States does not stand behind any