VIII. DR. DAVID ALTER, A NEARLY FORGOTTEN PENNSYLVANIAN, WHO WAS THE FIRST DISCOVERER OF SPECTRUM ANALYSIS.[1]

By W. J. Holland.

A few years ago Dr. Frank Cowan of Greensburg, Pennsylvania, died, and through the kindness of a friend, who had known him for many years, the Carnegie Museum came into possession of his scientific collections. Among his treasures was a prism, which I have the pleasure of exhibiting. It was made out of a piece of glass which composed a part of a large mass found in the ruins of Bakewell's glasshouse after the disastrous fire, which on April 10th, 1845, nearly destroyed the city of Pittsburgh. It was made by Dr. David Alter, of Freeport, Pennsylvania, a physician of inquiring and ingenious mind, who was early in life attracted to the study of electricity and chemistry, having as a boy read the story of Franklin, and who, quite independently, and yet in fact before the discovery of Morse, invented a crude system of telegraphing.

There was no connection between himself and Morse, and Dr. Alter was most emphatic in disclaiming any credit for the introduction of the telegraphic apparatus which the genius of Morse evolved.

In the year 1853, Dr. Alter having made the prism, which I hold in my hand, began a series of experiments an account of which was published in November, 1854, in Silliman's *American Journal of Science and Art*, Second Series, Volume XVIII, p. 55. The title of the article is as follows:

> "Article VI.—On certain Physical Properties of Light produced by the combustion of different metals in the Electric Spark, refracted by a prism; by David Alter, M.D., Freeport, Penn."

He began his article by saying: "We are indebted to the celebrated Mr. Frauenhofer for the fact that the solar spectrum is covered by numerous fixed lines, and that the light of some of the fixed stars differs from that of the sun in the number and situation of these lines.

[1] Read before the Academy of Natural Sciences of Philadelphia on the morning of the Centenary meeting, March 20, 1912.

In order to see some of these lines without the aid of a telescope, I ground a prism of flint glass with a large refracting angle (74°)."

He then proceeds to state the results of his observations upon sunlight, upon the light of a petroleum lamp, a tallow candle, the flame of alcohol, the electrical spark, and the various metals when subjected to the action of powerful electrical discharges, such as silver, copper, zinc, lead, tin, iron, bismuth, antimony, and brass (an alloy of copper and zinc), and an alloy of copper and silver.

He describes with minute particularity the appearance of the spectrum and the Frauenhofer lines when the light is affected by the presence of the various substances with which he experimented.

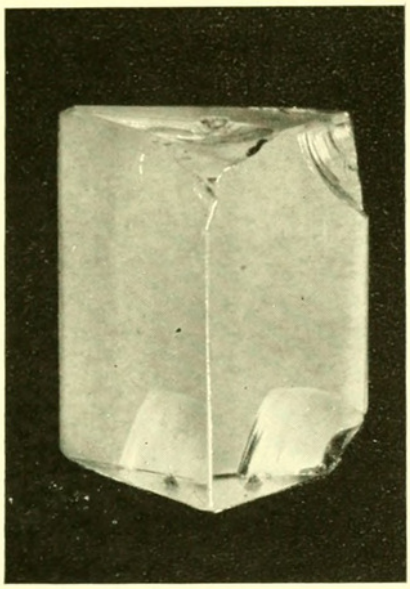
In May, 1855, there appeared in the same journal, 2nd Series, Vol. XIX, p. 213, an article the caption of which is as follows:

> "Article XXI.—On Certain Physical Properties of the Light of the Electric Spark with certain Gases, as seen through a Prism, by D. Alter, M.D., Freeport, Pennsylvania."

In this article he clearly points out the applicability of the method of spectrum analysis to celestial phenomena. He says, "The colors also, observed in the aurora borealis, probably indicate the elements involved in that phenomenon. The prism may also detect the elements in shooting stars, or luminous meteors." Accompanying this article the author sent to Dr. Silliman two daguerreotypes of the dark lines in the solar spectrum which he had made. The art of photography had not advanced beyond daguerreotyping in those days.

And now it is interesting to know that these articles of Dr. Alter were reproduced in foreign scientific journals in abstract or their entirety. A half page abstract of the first article was published in the *Jahresbericht der Chemie* of Liebig & Kopp for the year 1854, p. 118; the second paper was reproduced in its entirety in *L'Institut* of Paris in the year 1856, p. 156, and in the Twenty-ninth Volume of the *Archives des Sciences Physiques et Naturelles*, p. 151, published in Geneva. An annotated abstract of the second article appeared in Liebig & Kopp's *Jahresbericht der Chemie* for the year 1855, p. 107. In the latter special attention is called to Dr. Alter's statement that it is possible by means of the spectrum to distinguish gases as well as metals.

It was not until the year 1859 that announcement was made of Kirchhoff's discovery that Frauenhofer's lines were due to the presence of various elements in the sun.



Prism made by Dr. David Alter, of Freeport, Pennsylvania,
with which he made his experiments in 1853.

My good friend Cowan in his pamphlet, which he gave forth in 1894, and which is now rare and hard to obtain, reflects severely upon Kirchhoff's failure to allude in any way to Dr. Alter's discoveries, which clearly antedated his own by five years, and which Dr. Cowan is inclined to think must have been known to the distinguished German physicist. Be that as it may, it is established by testimony which cannot be controverted, that five years before Kirchhoff announced the possibility of determining the existence of various substances in the solar photosphere, a modest and unassuming investigator, living in the retirement of a small village on the banks of the Allegheny, definitely described the possibility of determining various metals and gases by their lines in the spectrum, and had pointed out that this method of investigation might be employed in the case of heavenly bodies, and had succeeded in daguerreotyping the lines in the solar spectrum.

Priestley, one of the fathers of modern chemistry, sleeps the long sleep on the banks of one of the beautiful rivers of this commonwealth; and Alter, the first discoverer of spectrum-analysis, also rests beneath the sods of this state, on the banks of another of its fair streams, to which the French long ago gave the name of "la belle rivière."

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5. *L'Institut*, Paris, 1856, p. 156.
6. *Archives des Sciences Physiques et Naturelles*, Geneva, p. 151 (1856).
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