POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

The Association held its regular weekly meeting at its room at the Cooper Institute, on Thursday evening Nov. 30, 1865, the President, Prof. S. D. Tillman, in the chair.

RARE MINERALS ON THIS ISLAND.

Mr. Chipman exhibited a quantity of sulphate of soda in a phial, and said that he found it as an efflorescence on the rocks which were cut through in grading First avenue, near Forty-second street, in this city.

Dr. Feuchtwanger said that this was the second discovery by Mr. Chipman of rare minerals in the rocks of New York City. Near Forty-seventh street he had found alum—the sulphate of alumina—at the junction of a mass of feldspar above and gneiss below. There had been considerable speculation in regard to the formation of this alum; the most probable theory is that the sulphur came from the decomposition of pyrites, and the alumina from the decomposition of feldspar.

The President remarked that sulphate of alumina is not alum—alum being a double sulphate of alumina and some other metallic oxide.

BOILER EXPLOSIONS.

Mr. Fisher read a paper giving a sketch of some of those theories of boiler explosions which have been fully set forth and disposed of in the columns of the SCIENTIFIC AMERICAN. The paper urged a more respectful consideration of these theories.

Capt. R. G. McDougall, being invited by the President to give an account of the *St. John* boiler explosion, remarked that he had been constantly engaged in using and constructing boilers and boiler plate for the last twenty-two years, and had examined a number of exploded boilers; he was tired of the stereotyped verdicts, "Nobody to blame." He then described the boiler of the *St. John*, saying that he examined it with great care soon after the explosion. The cut in the plate that gave way, made by carelessness of the workman in chipping off the edge of the overlapping plate, he could see across the deck, which is fifty feet wide. He then explained why this plate broke after four months use at 28 lbs. pressure, when it had previously sustained the hydraulic pressure of about 50 lbs. The plate was not on the cylindrical part of the boiler, but on the outside of the fire box, and there was an area of $4\frac{1}{2}\times5\frac{1}{2}$ feet, which was not stayed. The boilers of the *Dean Richmond* have in this same portion and in the same area, thirty-six stay rods passing through the boiler from one side to the other. When the *St. John* boiler was subjected to the hydraulic test, this plate was bulged outward, returning to its previous form when the pressure was removed; at every change of pressure this bending was repeated, and, of course, the principal bend was along the line of the cut; thus the plate was finally broken. When boilers are properly made and properly managed they will not explode. In every case of boiler explosion there is somebody to blame.

Dr. Bradley observed that at about the time of the *St. John* explosion, in which one plate of the boiler only gave way, there was another of a very different character near Fortress Monroe. A steam tug blew up, and she was blown to atoms, not a single one of her crew being left to tell the tale. It seemed to the speaker that in such cases there must be some detonating gases formed in the boiler—something different from steam, to produce such results.

Mr. J. Wyatt Reid remarked that he is a boiler maker, and he agreed with Capt. McDougall, that whenever a boiler explodes it is from faulty construction or bad management. As a possible explanation of the tug-boat case, he would mention a circumstance that occurred in a small steamboat running on the south side of the Island of Cuba. The engineer opened the valve to blow out the salt, and forgot to close it; the water got very low in the boiler, and as the fires were burning brightly the boiler became very hot. When the engineer went down from the deck, he saw tongues of blue steam issuing from the boiler at all the joints. He immediately tried the gage cocks, and found no water. One of the firemen, observing this, started for the feed pump, to throw in water, when the engineer knocked him down with a hammer, and calling to the other fireman to draw the fires, went himself and did what many engineers would not have done—he sat down on the safety valve. He knew that if the safety valve had opened in the least, the small quantity of water in the boiler would have been dashed in spray all over the hot surfaces, and suddenly converted into steam, doubtless blowing the boat to pieces.

Dr. Bradley inquired what is the objection to the theory, so generally received a few years ago, that in these very disastrous explosions the water has been decomposed, and a mixture of explosive gases formed?

The President replied, that there is nothing in any of the mysterious theories of boiler explosions. These disasters are always the result of defective construction or improper management. It was well to have this theory of explosive gases disposed of. Water is composed of oxygen and hydrogen, and they can be separated only by bringing them in contact with something which has a stronger attraction for one of the elements than they have for each other. Red-hot iron will take the oxygen from water and leave the hydrogen, but the hydrogen can be burned only by bringing it in contact with free oxygen, and there is none in a steam boiler. Furthermore, the quantity of water decomposed is too small to produce an explosion, even if air was supplied.

Zinc Manufacture in Illinois.

The existence of rich zinc ores in various parts of the country has long been known, and numerous attempts have been made to turn them to account. As far back as the Revolution we find these experiments beginning to be made and continuing till some twelve years since without success. The first remunerative results were realized in New Jersey by converting the zinc ore known as Franklinite into the white oxide of zinc for paint. Similar works were erected in Pennsylvania, at Bethlehem, using the calamine or carbonate and silicate of zinc. The market was soon stocked with the zinc white now so extensively used as a pigment, instead of white lead.

Practical men having thus turned their attention to the ores of zinc, several attempts were made to reduce them to a metallic state, in New Jersey, Pennsylvania, and Wisconsin. These attempts were generally failures, and the belief was confirmed that metallic zinc could not be successfully manufactured here. One exception is found in the Bethlehem Works, of Pennsylvania, and another in the subject of this article, the zinc works of La Salle, ninety miles west of Chicago.

The country is indebted to Messrs. Mathieson and Hegehler, two highly intelligent Germans, and graduates of the Mining Academy of Freiburg, for the first success in this direction. These gentlemen came to America in 1857, and began their experiments at the Lehigh Zinc Works, in Pennsylvania, where they produced, as it is believed, the first metallic zinc of American make. Learning of the superior richness of the Wisconsin ores, they went West in 1858, and examined the zinc ores of the lead region, which had been described in the geological reports of Wisconsin in 1853. Satisfied of their value and abundance, they looked for fuel and facilities of manufacture and transportation. La Salle, with its rich deposits of coal, building material, and unequaled means of land and water transportation, presented these conditions in the highest degree, and they at once decided to make it the location of their works. At first they rented a small temporary furnace, and, in a quiet and unpretending way, began experiments upon the ores, coal, and fire-clays within their reach.

The fire-clay for their first retorts was brought from Germany, all American fire-clays then known failing to stand the intense heat required. Great difficulty also was experienced in adjusting the old machinery and processes of Europe to the new materials. For nearly five years these men labored with a patience worthy of all praise, overcoming one obstacle after another by a rare combination of scientific knowledge and practical skill. So numerous have been their changes in the old methods of treating the ores of zinc, that they may justly claim to be the inventors as well as builders of their present furnaces. They have at last achieved a most triumphant success. Their new works are being constructed in the most permanent manner, and, when completed, will be the most extensive and perfect in the world. They consist first, of a powerful mill, in which the ore and fine clay are ground; second, of an extensive pottery, in which the retorts, pipes, and fire brick used in constructing the furnaces are made; third, of the reducing furnaces, each capable of holding 160 retorts. The materials used in building are brick and stone, the latter being obtained from a fine quarry on the grounds of the company. The works are situated about one mile north of La Salle, near the line of the Central Railroad, and opposite the Kentucky coal mine, from which they obtain their coal.

The reducing furnaces are large square structures built up of fire-brick, with a frame-work of iron bars on either side to sustain the retorts. These retorts are from three to five feet in length, and vary in size and shape, from round to oval, and from six inches to one foot in diameter. They are placed horizontally in rows, one above the other, slightly inclining forward to facilitate the separation of the zinc. The ore, after being roasted at the mine, ground, mixed with fine coal, and moistened with water, is placed in the retorts by means of a semi-cylindrical shovel. Conical earthen pipes are inserted into the open ends of the retorts and luted in with fire-clay. The fires below are then increased until a white heat pervades the interior of the furnace. At first the openings in the tubes emit light blue flames, caused by the carbonic acid evolved; later, the flames become whiter, with tints of green, and of great brilliancy, forming at night a pyrotechnical display of wonderful beauty. Sheet-iron tubes fitting the pipes, furnished with handles and closed at one end, are then applied to catch the oxide of zinc or "blue powder," which begins to escape with the flame. These are taken off at short intervals, and the blue powder removed to be mixed with the ore and returned to the retorts again. When the zinc is ready to draw, a large iron ladle is held under the beak of each retort, and the molten zinc is drawn out with an iron scraper. It is then poured into molds which give it the form of flat rectangular ingots, weighing 25 lbs. each. The tubes are then applied again, the firing continued, and after two or three hours more a fresh supply of zinc is obtained. These operations are continued all day and night, when the retorts are cleaned out and refiled. In this way a change is worked off every 24 hours.

The daily yield of the three furnaces is about four tuns. The coal used is mostly slack or waste of the mines, of which about six tuns are required to produce a tun of zinc. The amount of ore consumed is about five tuns, or 2,400 pounds to each tun of metal produced. The zinc made here is said to be the best in the world. Telegraph zincs are already extensively manufactured for Western consumption.

The ore used is obtained from the iron region of Wisconsin, 100 miles north of La Salle. It is found in great quantities among the rubbish of the old lead mines, where it has been thrown aside by the miners under the name of "dry bone." It often attends the lead ore as the matrix, or vein stone, and is in bad repute from the tendency of such veins to give out. The miners say the dry bone eats out the galena. The ore resembles a dirty limestone, and, in its natural state, gives no indication of the brilliant metal which it holds. Heavy deposits of it have been opened in mining for lead, but the surface supply is adequate for present purposes.

The ore is roasted at the mines, and parts with carbonic acid and water, which form 33 per cent of its weight. It is then put on the cars and transported to La Salle—the Illinois Central Railroad, with commendable liberality, charging only a nominal price for transportation—to encourage the development of the manufacture. The price of zinc in the pig is now about $200 per tun. The product of the La Salle furnaces is mostly sold in New York, where it is rolled and manufactured. The proprietors intend erecting rolling mills next season for the manufacture of sheet zinc. One of them is now in Germany securing the means and skilled labor for a still further expansion of the enterprise.—*Hunt's Merchants' Magazine.*

[This process is a modification of that employed at the Vielle Montagne Works, in Belgium Our chemical readers will remark that the light blue flames are carbonic oxide burning to carbonic acid. —EDS. SCI. AM.