vacuo without fusion at a temperature about 210°, and the vapor condenses in the cooler portion of the tube in beautiful orange colored crystals. When heated to low redness it decomposes into free iodine and phosphide of boron, BP. Nitric acid reacts energetically with it, but without incandescence, and a certain amount of iodine is liberated. Sulphuric acid decomposes it upon warming, without formation of sulphurous and boric acids and free iodine. By the continued action of dry hydrogen upon the heated compound the iodine and a portion of the phosphorus are removed, and a new phosphide of boron, of the composition B_2P_3 , is obtained.—*Nature*.

BORON SALTS.

A PAPER upon the sulphides of boron is communicated by M. Paul Sabatier to the September number of the *Bulletin de la Société Chimique*. *Nature* gives the following: Hitherto only one compound of boron with sulphur has been known to us, the trisulphide, B_2S_3 , and concerning even that our information has been of the most incomplete description. Berzelius obtained this substance in an impure form by heating boron in sulphur vapor, but the first practical mode of its preparation in a state of tolerable purity was that employed by Wohler and Deville. These chemists prepared it by allowing dry sulphureted hydrogen gas to stream over amorphous boron heated to redness. Subsequently a method of obtaining boron sulphide was proposed by Fremy, according to which a mixture of boron trioxide, soot, and oil is heated in a stream of the vapor of carbon bisulphide. M. Sabatier finds that the best results are obtained by employing the method of Wohler and Deville. The reaction between boron and sulphureted hydrogen only commences at red heat, near the temperature of the softening of glass. When, however, the tube containing the boron becomes raised to the temperature, boron sulphide condenses in the portion of the tube adjacent to the heated portion; at first it is deposited in a state of fusion, and the globules on cooling present an opaline aspect. Further along the tube it is slowly deposited in a porcelain like form, while further still the sublimate of sulphide takes the form of brilliant acicular crystals. The crystals consist of pure B_2S_3 ; the vitreous modification, however, is usually contaminated with a little free sulphur. Very fine crystals of the trisulphide may be obtained by heating a quantity of the porcelain-like form to 300° at the bottom of a closed tube whose upper portion is cooled by water. The crystals are violently decomposed by water, yielding a clear solution of boric acid, sulphureted hydrogen being evolved. On examining the porcelain boat in which the boron had been placed, a non-volatile black substance is found, which appears to consist of a lower sulphide of the composition B_2S . The same substance is obtained when the trisulphide is heated in a current of hydrogen; a portion volatilizes, and is deposited again further along the tube, while the residue fuses, and becomes reduced to the unalterable subsulphide B_2S , sulphureted hydrogen passing away in the stream of gas.

Two selenides of boron, B_2Se_3 and B_2Se , corresponding to the above described sulphides, have also been prepared by M. Sabatier, by heating amorphous boron in a stream of hydrogen selenide, H_2Se . The triselenide is less volatile than the trisulphide, and is pale green in color. It is energetically decomposed by water, with formation of boric acid and liberation of hydrogen selenide. The liquid rapidly deposits free selenium, owing to the oxidation of the hydrogen selenide retained in solution. Light appears to decompose the triselenide into free selenium and the subselenide B_2Se .

Silicon selenide, $SiSe_2$, has likewise been obtained by M. Sabatier by heating crystalline silicon to redness in a current of hydrogen selenide. It presents the appearance of a fused hard metallic mass incapable of volatilization. Water reacts most vigorously with it, producing silicic acid, and liberating hydrogen selenide. Potash decomposes it with formation of a clear solution, the silica being liberated in a form in which it is readily dissolved by alkalis. Silicon selenide emits a very irritating odor, due to the hydrogen selenide which is formed by its reaction with the moisture of the atmosphere. When heated to redness in the air it becomes converted into silicon dioxide and free selenium.

NATURAL SULPHIDE OF GOLD.

By T. W. T. ATHERTON.

THE existence of gold in the form of a natural sulphide in conjunction with pyrites has often been advanced theoretically as a possible occurrence, but up to the present time this occurrence has, I believe, never been established as an actual fact.

During my investigations on the ore of the Deep Creek Mines, I have found in them what I believe to be gold existing as a natural sulphide. The description of this ore will, no doubt, be of interest to your readers.

The lode is a large irregular one of pure arsenical pyrites, existing in a felsite like near the sea coast. Surrounding it on all sides are micaceous schists, and in the neighborhood is a large hill of granite about 800 ft. high. In the lode and the rock immediately adjoining it are large quantities of pyrophyllite, and in some places of the mine are deposits of this pure white, translucent mineral, but in the ore itself it is a yellow and pale olive green color, and is never absent from the pyrites.

From the first I was much struck with the exceedingly fine state of division in which the gold existed in the ore. After roasting and very carefully grinding down in an agate mortar, I have never been able to get any pieces of gold exceeding the one-thousandth of an inch in diameter, and the greater quantity is very much finer than this. Careful dissolving of the pyrites and gangue, so as to leave the gold intact, failed to find it in any larger diameter. As this was a very unusual experience in investigations on many other kinds of pyrites, I was led further into the matter. Ultimately, after a number of experiments, there was nothing left but to test for gold as a sulphide.

Taking 200 grammes of pyrites from a sample assaying 17 ounces fine gold per ton, grinding it finely, and heating for some hours with a solution of sodium sul-

phide (Na_2S_2), on decomposing the filtrate and treating it for gold I got a result at the rate of 12 ounces gold per ton. This was repeated several times with the same result.

This sample came from the lode at the 140 ft. level, while samples from the higher levels where the ore is more oxidized, although carrying the gold in the same degree of fineness, do not give as high a percentage of auric sulphide.

It would appear that all the gold in the pyrites (and I have never found any apart from it) has originally taken its place there as a sulphide.

The sulphide is an analysis of a general sample of the ore:

• Silica.....	13.940 p.c.			
Alumina.....	6.592 "			
Lime.....	0.9025 "			
Sulphur.....	16.584 "			
Arsenic.....	33.267 "			
Iron.....	27.720 "			
Cobalt.....	0.964 "			
Nickel.....	Traces			
Gold.....	5 ozs.	3 dwts.	8 grs.	
Silver.....	0 "	16 "	0 "	
	99.969			

Nambucca Head's Gold Mining Company, Deep Creek, N. S. Wales, Oct. 9, 1891.—*Chemical News*.

SOME MEANS OF PURIFYING WATER.

THERE are several methods extant for the purpose of purifying and softening water, and in the following brief account some of the chief features of these methods are summarized. The Slack and Brownlow apparatus we will deal with first. This purifier is one which is intended to remove the matter in suspension in the water to be treated by subsidence and not by filtration. The apparatus consists of a vertical iron tank or cylinder, inside which are a series of plates arranged in a spiral direction around a fixed center, and sloping at an angle of 45° on both sides outward. The water to be dealt with flows through a large inlet tube fixed to the bottom of the cylinder, rises to the top by passing spirally round the whole circumference, and depositing on the plates or shelves all solids and impurities at the outer edges of the plates. Mud cocks are placed to remove the solids deposited during the flow of the water upward to the outlet pipe, placed close to the top of the cylinder. One of these tanks, a square one, is at work purifying the Medlock water at Manchester, and on drawing samples of water from nearly every plate, that from the lower mud cock showed considerable deposit, which decreased in bulk until the top mud cock was reached, when the water was quite free from deposit. It is stated that one man would be sufficient to attend to 20 of these purifiers.

To filter or purify 2,000,000 gallons per 24 hours would require 40 tanks, 10 ft. by 7 ft. diameter, each doing 2,000 gallons per hour, and would cost, with their fittings, £6,400, including all patent rights, but exclusive of lime mixing tanks, agitators, lime water and softening tanks, engine and boiler, and suitable buildings, the cost of which would not be far short of £5,000, or a total of £11,400 to soften 2,000,000 gallons per 24 hours. The labor and other working expenses in connection with this plant would not be less than that necessary to work the Porter-Clark process, which is given as 0.55d. per 1,000 gallons.

The Brock and Minton filter press system is another method. This patent press is made of steel, perforated with 1/2 inch holes. On the inside of the shell there is first laid a layer of fine wire netting, then a layer of cloth, and lastly another layer of wire netting of a larger mesh than the other. The matter treated is pumped into the body of the cylinder, the liquid passing through the filtering material to the outside, the solids being retained inside, and are got rid of by partially revolving the upper half to relieve it from the knuckle joint, and, after being raised, the lower half is turned over by machinery, and the solid matter is simply allowed to fall out into wagons or trucks run underneath for that purpose. Such, in brief, is the manner of using this filter press for chemical works' purposes. The cost of each filter press, including royalties, is from £250 to £300, the size being 8 ft. by 4 ft. diameter. Having a filtering area of 100 square feet, it would require 32 of these applied to softening water to effectually deal with 2,000,000 gallons per 24 hours; this, at the lowest estimate for filters alone, would be £8,000, and, using the same figures, £5,000 for lime mixing tanks, etc., as referred to in the "Slack and Brownlow" purifier, would bring the total cost up to £13,000, and the working expense would not be less than that required to work the Porter-Clark process, and would probably be very much greater. This filter press is not in use anywhere for dealing with large quantities of water in connection with a town water supply.

A process which has been working for a long time at Southampton is the Atkins system, which also includes the use of filter presses. The pumping station and softening works are situated at Otterbourne, eight miles from Southampton, and were built together as one scheme. The mixing room has two slaking lime tanks, with agitators driven by steam power. The mixture is then run as cream of lime into a tank 20 ft. square and is then pumped into the lower ends of two lime water producing cylinders. The agitation is here obtained by pressure from a small cistern placed above them with a 12 ft. head, the pipe from which is attached to the lower ends of the cylinders. This has been found by experiment to be the most satisfactory means of obtaining the proper degree of agitation necessary; the clear lime water is then drawn off at the top of the cylinders, and flows by gravity into a mixer, where it comes in contact with the hard water. Both flow together into a distributing trough, from which it overflows into a small softening reservoir, having a capacity of one hour's supply, a weir being placed along the lower end, over which the water flows to 13 filter presses. The clear water from the filters is then conveyed to a small well, from which the permanent engines raise it to the first of a series of high level covered service reservoirs.

In the filter press there are 20 hollow disks representing a filtering area of 250 square feet, or a total of 3,250 square feet. The water to be filtered passes into the

body of the filter and then through a filtering medium of cloth laid on a thin perforated zinc plate, into the inner side of the disks, from whence it is conveyed through the hollow shaft, to which the disks are attached, to the high level pumps.

The filter cloths are cleaned three times every 24 hours, without removal, by jets of softened water from the main, having a pressure of 60 pounds to the square inch. During cleaning operations the disks are made to revolve slowly; this only occupies a space of five minutes for each cleaning. The cloths last from six to eight months without being renewed. They also occasionally use for further cleaning the cloths a jet of steam injected upon the center of the disks in order to remove by partial boiling the insoluble particles engrained in the cloths. This has been found to make the cloths last longer. This cloth is obtained from Porritt Bros. and Austen, Stubbing Vale, Ramsbottom, and costs 13 1/2 d. per lineal yard of a width to suit the disks.

The quantity softened is 2 1/4 million gallons per 24 hours, but the present plant can deal with 3 1/2 million gallons, and the buildings are erected for 3 1/2 million gallons, additional filters and lime producing tanks being only required to deal with the increased quantity. The costs of the softening works was £10,394, of which £7,844 was for the softening machinery and plant and £2,550 for the reservoir, buildings, etc.

The working expenses, including lime, labor, cloths, general repairs, and steam, is stated to be 0.225d. per 1,000 gallons, the labor required being only two men, one on the day and the other on the night shift, with an occasional man to assist.

The hardness of the Southampton water on Clark's scale is 18° of total hardness, and this is reduced down to 6° or 8° by this process.—*Chem. Tr. Jour.*

A NEW LABORATORY PROCESS FOR PREPARING HYDROBROMIC ACID.

By G. S. NEWTH.

THIS method is a synthetic one, and consists in passing a stream of hydrogen and bromine vapor over a spiral of platinum wire heated to bright redness by means of an electric current. A glass tube, about 7 inches long and 5/8 of an inch bore, is fitted at each end with a cork carrying a short straight piece of small tube; through each cork is also fixed a stout wire, and these two wires are joined by means of a short spiral of platinum wire, the spiral being about 1 inch long. One end of this apparatus is connected to a small wash bottle containing bromine, through which a stream of hydrogen can be bubbled. The other end is attached to a tube dipping into a vessel of water for the absorption of the gas, or, if a large quantity of the solution is required, to a series of Woulff's bottles containing water. Hydrogen is first slowly passed through the tube until the air is displaced, when the platinum spiral is heated to bright redness by the passage of a suitable electric current. Complete combination takes place in contact with the hot wire, and the color imparted to the ingoing gases by the bromine vapor is entirely removed, and the contents of the tube beyond the platinum are perfectly colorless. The vessel containing the bromine may be heated to a temperature of about 60° C. in a water bath, at which temperature the hydrogen will be mixed with nearly the requisite amount of bromine to combine with the whole of it. So long as even a slight excess of hydrogen is passing, which is readily seen by the escape of bubbles through the water in the absorbing vessels, the issuing hydrobromic acid will remain perfectly colorless, and therefore free from bromine; so that it is not necessary to adopt any of the usual methods for scrubbing the gas through vessels containing phosphorus. When the operation is proceeding very rapidly a lambent flame occasionally appears in the tube just before the platinum wire, but this flame is never propagated back through the narrow tube into the bromine bottle. The precaution may be taken, however, of plugging this narrow tube with a little glass wool, which renders any inconvenience from this cause quite impossible. By this method a large quantity of bromine may be rapidly converted into hydrobromic acid without any loss of bromine, and the operation when once started can be allowed to proceed without any further attention.—*Chemical News*.

SAPOTIN: A NEW GLUCOSIDE.

By GUSTAVE MICHAUD.

Achras Sapota, L., is a large tree scattered through the forests of Central America and the West Indies; its fruit is often seen upon the Creole dinner table. This fruit is a berry, the size of an orange, the taste of which suggests the flavor of melon, as well as that of hydrocyanic acid. The fruit contains one or two seeds like large chestnuts, which, if broken, let fall a white almond. This last contains the glucoside which I call *sapotin*.

I obtained sapotin for the first time by heating dry raspings of the almond with 90 per cent. alcohol. While cooling, the filtered liquid deposited a good deal of the compound. Since that time I have advantageously modified the process and increased the amount of product. I prepare sapotin in the following way: The almonds are rasped, dried at 100° C. and washed with benzene, which takes away an enormous quantity of fatty matter. The benzene which remains in the almond is driven out first by compression, afterward by heating. Then the raspings are exhausted with boiling 90 per cent. alcohol. The solution is filtered as rapidly as possible, in order to avoid its cooling and depositing the sapotin in the filter. As soon as the temperature of the filtered liquid begins to fall, a voluminous precipitate is seen to form, which is the sapotin.

In order to purify it, the precipitate is collected in a filter and expressed between sheets of filter paper. When dry it is washed with ether, which takes away the last particles of fatty and resinous matter. The purification is completed by two crystallizations from 90 per cent. alcohol. At last the substance is dried at 100°.

The sapotin separates from its alcohol solution in the form of microscopic crystals. When dry, it is a white, inodorous powder. Its taste is extremely acrid and burning. If the powder penetrate into the nostrils or