

With reference to the presence of titanitic oxide in the ash of coal, it may be fairly assumed that partly owing to the infiltration of clay and earthy materials, it would be found there, but is it fair to assume that its presence is wholly accounted for in that way? If mention has been made of the presence of titanium in the ash of coal, it has thus far escaped my attention.

The method employed in the above determination is that of A. Weller,¹ which is based upon the fact that hydrogen peroxide, when added to a solution of titanium, produces a compound of an intensely yellow color. There are precautions necessary in the execution of this method which have already been pointed out.²

It will be my pleasure to report additional notes at an early day concerning the presence of titanium in the vegetable kingdom. Valuable service has been rendered in the above work by Messrs. J. O. LaBach and C. O. Hill.

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THE ESTIMATION OF PYRRHOTITE IN PYRITES ORES.

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SOME of the American pyrites ores contain the mineral pyrrhotite (Fe_7S_8) in varying proportions. In the manufacture of sulphuric acid from these ores it is found impossible to burn out at least the greater part, if not all, of the sulphur which is present as pyrrhotite. In the estimation of total sulphur in the sample of such an ore, of course the sulphur present as pyrrhotite is included. It is therefore necessary, in order to make a settlement with the company selling the ore and also in order to figure the yield of acid, to estimate the sulphur present as pyrrhotite as accurately as possible. Authorities give no method to meet the conditions. After a careful investigation of the matter I have perfected the following method; I am indebted to Mr. Lucius Pitkin, of New York City, for some valuable suggestions. It is based on the fact that Fe_7S_8 is magnetic, pyrites being non-magnetic.

¹ *Ber. d. chem. Ges.*, 1882.

² This Journal, 13, 210.

Method.—After the ground sample has been passed through a sixty mesh seive, 13.74 grams are weighed and spread out upon a good-sized sheet of glazed paper. A magnet is passed through and over this several times, the magnetic portion being carefully separated from the magnet by first stroking suddenly the top of the magnet, which dislodges most of the mechanically admixed pyrites, and then, secondly, separating the magnetic portion by means of the armature and a brush. The process is carried out five or six times, enough separations having been made to have reasonably separated all the magnetic portion. This is then finely ground in an agate mortar and the sulphur estimated gravimetrically by oxidation with nitric and bromo-hydrochloric acids. The weight of barium sulphate obtained in grams is the percentage of sulphur present as pyrrhotite.

The accuracy of this method was proved by the following work :

A sample of ore containing a known percentage of pyrrhotite was obtained. It analyzed as follows :

	Per cent.
Total sulphur	35.07
“ iron	57.50
Oxygen as Fe ₃ O ₄	4.26
Copper	0.25
Insoluble matter	2.78
	99.86
Sulphur present as Fe ₇ S ₈	24.14
Iron “ “ Fe ₇ S ₈	36.96
“ “ “ FeS ₂	9.34
Sulphur “ “ FeS ₂	10.68
Iron “ “ Fe ₈ O ₄	11.20

A sample of pyrites containing no pyrrhotite nor magnetic portion was then obtained. To a definite portion of this I added enough of the ore containing pyrrhotite to give 1.20 per cent of sulphur present as pyrrhotite in the mixture ; *i. e.*, to fifty grams of the pyrites I added 2.63 grams of pyrrhotite ore, or

$$\frac{24.14 \times 2.63}{52.63} = 1.20 \text{ per cent. sulphur as Fe}_7\text{S}_8.$$

This mixture was then analyzed for sulphur present as pyr-

rhotite by the method described above, using different weights. Some of the results obtained are :

5.00	grams	gave	0.4120	barium	sulphate	=	1.13	per	cent.	sulphur	as	Fe ₃ S ₈ .
13.74	"	"	1.1300	"	"	=	1.13	"	"	"	Fe ₃ S ₈ .	
25.00	"	"	2.1570	"	"	=	1.18	"	"	"	Fe ₃ S ₈ .	

Others were equally concordant.

The method was also applied to the pyrrhotite, as mentioned above, using portions of one gram or one-half gram giving respectively 24.13 per cent. and 24.15 per cent. sulphur as Fe₃S₈.

This method is accurate to within two-tenth per cent. on ores containing much or little pyrrhotite. The ore must not be finer than that which will pass through a sixty mesh sieve ; if it is, results will be unreliable.

Another method, which I used until the perfection of this one, is based upon the fact that Fe₃S₈ gives off hydrogen sulphide with dilute acid, whereas FeS₂ (pyrite) does not. This is reliable when no other sulphides are present, but as most pyrites contain blende the results are usually unreliable.

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DROWN'S METHOD OF DETERMINING SULPHUR IN PIG IRON.

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OF the various evolution methods of determining sulphur in pig iron, Drown's is perhaps the best. Methods in which the sulphur is precipitated in any other form but barium sulphate (cadmium sulphide for instance), are not so convenient for the reason that the sulphur in the graphitic residue must be determined as barium sulphate. A slight drawback, however, attaches to the method in that the evolution of the gas must not be allowed to proceed too rapidly, and it is an object of this note to point out that by the use of potassium hydroxide solution in conjunction with the potassium permanganate solution as an absorbent for the gas, this caution is made unnecessary, and the gas may be passed through the solution as rapidly as it is possible to make it do so, without danger of loss ; a mixed solution of caustic potash and potassium permanganate possessing stronger oxidizing power, than a solution of the latter salt alone. For there is a tendency in such a mixture, even