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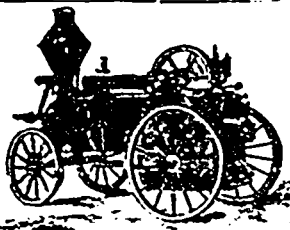
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**MINING.****THE CHEMISTRY OF GOSSAN.**

Written for the Engineering and Mining Journal by Stephen H. Emmens.  
(Concluded)

If we review the preceding observations and summarize the facts therein set forth, we shall see that the outcrop of a mineral vein containing sulphuretted ores must inevitably, by the combined action of air, moisture and iron, pass into the condition of gossan; that is to say, it must become a porous, honeycombed mass of gangue and ferric hydrate. We shall also see that this gossan must, as compared with the original outcrop, be very much poorer in copper, zinc, nickel and lead, and very much richer in gold and silver. I say "very much poorer" in the case of the base metals, because it can rarely happen that these are entirely dissolved and washed away. The iron remains as ferric oxide. The lead, which in the first place forms an almost insoluble sulphate upon the surface of the gangue, becomes largely protected, in the form of residual galena, against further attack. The zinc and copper, by a secondary reaction with carbonic acid, sulphurous anhydride and lime, will, to some extent, form comparatively insoluble oxides or carbonates; and part of the copper will assume a metallic condition. The nickel alone will, as a rule, almost entirely disappear, being the first, and most easily, attacked by ferric sulphate. Accordingly we are justified in deducing the following conclusions from the examination of a gossan:

- 1.—It proves the prior existence of a body of sulphuretted ore.
- 2.—If we see that it is the outcrop of a vein or lens, and not an isolated fragmentary mass, we know that in depth it will, if it continues, change to unaltered sulphides.
- 3.—If we find it to contain particles or patches of copper, lead or zinc compounds we know that in depth the mineral deposit will yield chalcopryrite, or chalcocite, bornite, galena or blende, with a probability of these being the predominating ores.
- 4.—If we find it practically free from copper, lead or zinc compounds, we are warranted in regarding the unaltered ore in depth as composed mainly of iron sulphides.
- 5.—If we find residual particles of iron sulphides, some or all of which are pyrothite and on analysis show traces of nickel, we may infer that the gossan will at no great depth lead to bodies of nickeliferous pyrothite.
- 6.—If we find silver or gold or both, and also copper, lead or zinc compounds, we expect to find the deposit in depth to carry argentiferous sulphides.
- 6.—If we find gold without any appreciable copper, lead or zinc, we may properly infer that the deposit in depth will consist mainly of auriferous pyrites.
- 8.—Whatever may be our deduction as to the character of the vein in depth, we must not expect the vein, as a whole, to be so rich in the precious metals as is the gossan; for the latter, while being much lighter, bulk for bulk, than the unaltered vein, carries an equal average weight of gold and silver, and will, therefore, yield a larger number of ounces per ton.
- 9.—On the other hand, the concentrates from the unaltered vein in depth will almost certainly be richer in precious metals than an equal weight of the gossan.

We glean from *The Weekly Bulletin* of London, that the fifth ordinary meeting of the Cape Copper Company, Limited, has lately been held at the Cannon Street Hotel, under the presidency of Mr. Edmund A. Pontifex (the chairman of the company).

As the company, in addition to their Cape properties, own and work the Tilt Cove Mine in Newfoundland, we extract from the report the chairman's remarks in regard to that property:—"Our Tilt Cove Mines, in Newfoundland, which, as I have already stated, we took over to provide for a possible diminution in the output at Ookiep, have so far confirmed the expectations we formed as to the extent of the ore bodies which exist there. We have during the past year raised from these mines 52 000 tons of ore, containing about 1 800 tons of copper metal. The composition of the ores is such as to make them extremely useful to the Briton Ferry Chemical Works, and thus to assist that company in earning a profit, of which the sum of about £4 000 appears to the credit of the Cape Copper Company in last year's accounts. These ores, however, are of comparatively low assay, and necessarily, therefore, any diminution in the price of copper seriously affects the profit obtainable. Had the price of copper remained at anything like that which ruled at the time we acquired these mines we should now have been reaping a very large profit; whereas at the present moment we only about cover costs. In all comparatively new undertakings, and until their organization gets thoroughly established, the costs of production run somewhat high, and it is only in course of time, and as difficulties are met and surmounted, that these costs can be sufficiently reduced. Had the costs at Ookiep remained such as they were, even so recently as ten years ago, we should now be working that concern at severely any profit. And so with Tilt Cove; the costs of working there remain higher than they should be, and we are taking every step in our power to reduce them. If, and when, we succeed in reducing them to the same point as at Ookiep, we should be reaping very satisfactory profit from Tilt Cove, even at present prices. One satisfactory feature with regard to these ores is that they have been recently found to contain an appreciable quantity of gold. How much of this gold can be obtained in the process of smelting we are endeavoring to determine; but certainly a notable quantity can be extracted, and one which will go towards improving their value. Claudet's assay of eight cargoes, representing about 8 000 tons, is equal to nearly 2 z. of gold per ton of copper contents. I am glad to state that in the smelting operations at Briton Ferry a very