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CHEMISTRY OF THE CYANIDE PROCESS

CONTRIBUTIONS TO THE, BY WILLIAM SKEY, ANALYST TO THE MINES DEPARTMENT AND GOVERNMENT ANALYST.

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THE great and the growing importance of the cyanide process for extracting gold from its matrices makes anything that is explanatory of the chemistry of this process interesting, and more or less valuable according to its precise nature.

In this place I would first refer to the fact that, in 1895, in the annual Report of the Mines Department is a copy of a report of mine to the Hon. the Minister of Mines, in which I describe certain singular effects that occur when a piece of gold-leaf is partly immersed in an aqueous solution of potassic cyanide, also other phenomena, and which appeared to me at that time not easily explainable; and, being then pressed for time, I let these matters stand over, but I promised a further investigation of them, and a statement of the results thereof, at the first opportunity. I have since spent a good deal of time in following up these subjects, and have communicated some results thereon to the public at various times, but not in the Mines Reports. I now, therefore, make a special report of these results, together with other later ones of mine that have not yet been published, so as to give a complete and connected account of my investigations of the subject since the publication of the report referred to (1895). For this purpose I shall not keep to the order of time, but shall arrange the facts brought out by them, so that they shall be stated in a natural sequence, and in such a way that their comprehension by the reader may be as easy as possible. I will first deal with those results that bear upon the question—

HOW IS THE CYANIDING OF GOLD EFFECTED?

Every chemist of our cyanide plants is now very well aware that to do this profitably a very weak solution of potassic cyanide, or its chemical equivalent, free oxygen, and, of course, a sufficiency of gold in a rather fine state of division, are necessary; and he further knows that it so happens that the gold he wins is won as the *auro-cyanide of potassium*, but the precise way in which this happy event comes about he does not know. A good deal he knows, and he has several plausible-looking theories to choose from for his guidance and information; but (as it appears to me, at least) there are certain facts underlying the whole process—certain phenomena—hitherto unknown, which, if circumstances were unfavourable for their occurrence, would make any attempt to cyanide gold at all a complete failure. It is these facts that I shall endeavour to show as clearly as I can, and, as it so happens that the experimental results upon which my evidence for these facts is grounded were initiated by the study of a remarkable phenomenon first noticed by Professor Faraday, I commence my subject by reference to this.

It was in the year 1857, in his Bakerian Lecture, that this eminent chemist informed the scientific world that gold-leaf, as resting on the surface of a solution of potassic cyanide, dissolves about one hundred times quicker than gold-leaf that is wholly immersed therein—a fact that is now taken advantage of by cyaniders for a rough and ready test of the strength of their cyanide-solution. The difference is, indeed, marvellous, and there are at present two theories proposed to account for this. The first in time is that of Faraday himself, to which, indeed, great weight should attach notwithstanding its antiquity. It has not (to my knowledge, at least), hitherto been directly challenged. It is, as stated in his own words, “air voltaic currents are formed in these cases” (the cyaniding of gold resting on the solution), “and the gold is dissolved almost entirely under their influence.”