imity and feelings of good-fellowship for his brother-workers in the field of science, concede to me the position of leader in this investigation."

"FURTHER RESULTS SHOWING THAT FREE CYANOGEN DOES NOT DISSOLVE OR EVEN ATTACK GOLD.
(By WILLIAM SKEY, Analyst to the Mines Department.)

"[Read before the Wellington Philosophical Society, 7th October, 1896.]

"The scientific and other interests that attach to the statements I made before the Society a few weeks ago, that free cyanogen does not attack gold, has induced me to continue my investigations on the subject by the application of tests of a more severe character even than those were upon which I based this statement.

"I should premise the description of the results of this further investigation by informing you that soon after the paper referred to was read I learned that Mr. Park, late lecturer at the Thames School of Mines, had made a series of valuable experiments on the subject, in which he used the gravimetric method for determining whether there was not a dissolution of gold by aqueous solution of this gas.

"The results of these experiments do not confirm the correctness of this statement of mine (that cyanogen is unable to dissolve gold), but, still, they clearly show that, at least, solutions of this gas do not dissolve this metal at all readily. Mr. Park informs us that he performed his experiments with a button of pure 'parted' gold gently hammered to a coherent spongy mass of about $\frac{1}{8}$ in. in diameter, and weighing 0·340 grain. This button was placed in an aqueous solution of cyanogen, and the containing vessel loosely covered. Upon again weighing this button, at intervals of twenty-four hours, he found there was generally a loss of about $\frac{1}{330}$ of its weight at every weighing —that, in fact, about $\frac{1}{1000}$ gr. of gold dissolved per diem.

"This does not appear to be a great loss: still, it is very much more than I should have anticipated, but, knowing that the most recent works on chemistry to hand in the colony decide that cyanogen in water alone does not decompose to substances solvent of gold, this scientist could not support my contention as he desired to do.

"It was this unsatisfactory state of the case that induced me to make further researches in the matter. Now, as you are aware, cyanogen is a substance that in the presence of even minute traces of ammonia or potash is decomposed to form alkaline cyanides which are solvent of gold, and when once this action starts it proceeds with ever-increasing rapidity. The atmosphere of a laboratory in full operation is frequently alkaline; the vessels used for receptacles in chemical work are capable of yielding alkaline matter to cyanide-solutions. For these reasons any experimental results obtained in a laboratory are likely to be misleading.

"It is evident, therefore, that any method which requires considerable periods of time, such as the gravimetric method does, is not well adapted for this kind of research; one is required that will speedily give reliable results. Eschewing, therefore, the use of even the hypothetical just balance as an abomination in this case, I adhered to my old method, which is that of testing by sight alone whether any loss of gold does occur by the action of free cyanogen. For this I merely replaced the gold-leaf of my former experiments by gold-paper, which is a Swedish filter-paper, in which gold has been chemically precipitated in a very finely-divided state. A sample of this test-paper is tabled here for exhibition, and the red tint of its gold is easily perceptible in this paper, $\frac{1}{10}$ in. square, by contrasting it with the same kind of paper that has not been so treated. A few short statements showing the extreme tenuity of the gold in this paper may be interesting.

"A square inch of the paper contains $\frac{1}{10000}$ gr., and $\frac{1}{10}$ in. square contains $\frac{1}{1000000}$ gr. of gold. Were the gold in this paper agglomerated to a film having a like area with that of the containing paper, that film would be only $\frac{1}{5000000}$ in. thick—that is, 250 of these would be the thickness of gold-leaf. In the paper itself (being, as it is, $\frac{1}{120}$ in. thick) this film (of the $\frac{1}{5000000}$ in.) is broken up to occupy a volume 400,000 times that which it occupies in the form of a film.*

"It follows, therefore, that the gold in this paper, volume for volume, only weighs half as much as hydrogen gas.

"Broken up in this manner in the test-paper before you, it is in very truth fine gold—in fact, gold divided almost to its ultimate atom (if, indeed, atoms do exist)—gold in the cloud form, as it were, and therefore in the best condition that I know of for my purpose. Provided with a test so delicate as this is, we get results in an hour that, using the gravimetrical test for loss, would require several days, and so we avoid those errors that are apt to creep in and vitiate our results when long periods of time are required for experiments of this nature.

"Placing then in a porcelain vessel a strong aqueous solution of cyanogen, along with a little of this gold test-paper, I closed the vessel down airtight, and on examining at periodic intervals I found that even after the expiration of six hours, corresponding to sixty-two days for gold-leaf, there was no visible diminution of the colour of that test-paper. After this, however, the tint gradually faded, until in thirty hours it had quite disappeared. Thirty hours to dissolve the millionth of a grain of gold so finely divided as this gold was, shows that if cyanogen itself does dissolve gold it is only at an extremely low rate—at such a rate that ordinary gold-leaf would require about one year to become entirely dissolved therein.

"Now, this result is a very different one to those that I am faced with both by Professor Black and Mr. Park; still, while it is clearly shown that for gold-milling the gas cyanogen as a direct solvent is useless, it does show that there is an infinitesimal dissolution of gold either by cyanogen or its derivatives, and in the interest of exact science the question has to be decided which of these it is.

"Now, the cyanogen I used, though very carefully prepared, had a slight acid reaction; it contained traces of ammonia, hydrocyanic and hydrochloric acids, and this even when to avoid

* The method for accomplishing this is given in the "Transactions of the New Zealand Institute," Vol. xxv., p. 383.