years of experience as mineralogist on the Geological Survey has furnished him with knowledge that will be worth untold wealth to the Company."

Far be it from us to appraise Mr. Willimott's value. It is for us to contradict flatly the assertions quoted. The statement that all minerals brought to the survey were submitted to Mr. Willimott, is false. Further, Mr. Willimott did not have 38 years' experience on the survey. He never was mineralogist, nor was he at any time a technical officer.

As Mr. Willimott's signature is attached to this document we wish to inform him that he has ample grounds for proceeding against whomsoever is responsible for subscribing his name to patent lies.

SAMPLING OF COBALT ORES.

By Albert R. Ledoux, Ph.D.

[Editor's Note.—This article was written at the special request of the Canadian Mining Journal.]

The first carload of Cobalt ore was received at Ledoux & Company's sampling works, at the port of New York, in February, 1905, although specimens and samples had been submitted to us in January of that year. In the very beginning we learned that this ore constituted a class by itself and could not be sampled accurately by ordinary methods, due very largely to the presence of nuggets and smaller particles of native silver, and to the fact that the silver is very unevenly distributed.

In Volume X. of the Journal of the Canadian Mining Institute, appears a statement prepared by me, showing that up to that time, February, 1907, about 18 per cent. of Cobalt ores received at our sampling works had run between 1,000 and 2,000 ounces of silver per ton; 10 per cent. contained from 2,000 to 3,000 ounces; 4 per cent. from 3,000 to 4,000 ounces; 3 per cent. from 4,000 to 5,000 ounces; 17 per cent. from 100 to 200 ounces, and 11 per cent. below 100 ounces. The highest carload handled by us up to that time ran 7,402 ounces of silver per ton, and the next in grade were from 6,000 to about 7,000 ounces.

When one considers that this silver occurs largely in native form, and is an alloy with arsenic, nickel and cobalt, the difficulty of obtaining an accurate sample is manifest. We long ago discovered that to secure an accurate sample, the coarser part of the metallics had to be removed and treated separately. The method devised by us, and followed until recently, has been quite accurately described in the paper of Mr. F. F. Colcord, published in the Engineering and Mining Journal for December 22, 1906, but it may be briefly repeated as follows:

All the ore is passed through crushers and rolls in order to reduce the material as nearly as possible to one quarter inch size. Nuggets passing through the rolls, being malleable, tend to separate them, allowing some proportion of ore larger than quarter mesh to pass through. In practice, it was not found necessary to return these larger particles to the rolls, but we leave about ten per cent. of the material larger than quarter inch. The ideal preliminary crushing would be to have the whole material pass a quarter inch screen before proceeding further.

The ore passing the crusher and rolls, is piled in two parallel ridges, which we may designate as No. 1 and No. 2 by alternate shovelling to left and right. Large silver nuggets, and coarser pieces also containing silver, are picked out by hand for separate treatment. The two ridges contain substantially half a carload each, and are shovelled together alternately into one long ridge for the purpose of mixing (ridge No. 3). This ridge is again "half shovelled" as in the beginning, to make ridges No. 4 and No. 5. No. 5 is then half-shovelled to make ridge No. 6, the alternate or rejected shovelfuls going back to ridge No. 4. Ridge No. 6, which now contains one quarter of the original carload, is half shovelled, making a pile or cone containing one-eighth of the original carload, the rejected half going back likewise to ridge No. 4. The resulting sample is coned up into what might be called pile No. 7 and quartered down to make pile No. 8, the rejected portion returning to No. 4.

Coning and quartering is then proceeded with until pile No. 9 is reached, which will weigh perhaps a thousand pounds, all the rejects having been returned in each case to ridge No. 4.

This thousand pounds, more or less is passed through a mill, including all the metallics which have remained with it. This mill grinds the material to about one-eighth mesh, including the metallics. The material, after passing an eight-mesh screen, is turned over with shovels three times and passed through a Jones sampler, reducing it to about 40 pounds, the rejects again returning to ridge No. 4.

This 40 pounds, which now constitutes the twelfth stage of sampling, is ground through a mill until it will pass a 20-mesh screen, thoroughly mixed and again divided into two parts, one of which is temporarily held at the works, in case of need, and the other sent to the laboratory.

In the laboratory, the sample is reground and subdivided to a sample of about five pounds weight. After weighing this, it is ground in a pebble mill until it will pass a 100-mesh screen. The metallics which cannot be finely ground, are left on this screen, then weighed and suitably sub-divided to make final samples. The fines passing the 100-mesh screen are mixed and also sub-divided into several parcels, corresponding with the metallics. The final samples each consist of two parcels, one contains the metallics, the other the fines. The weights of fines and the weights of metallics from the five pound sample, are recorded on each package, so that the final assays may be calculated.

The rejects, forming ridge No. 4, represent every portion of the original carload except the negligible 40 pounds taken for a sample. The second sampling proceeds as before and finally a third sampling, and a fourth, so that four samples are taken from each carload, differing in no respect from one another, excepting that each one is taken from a bulk of a few pounds less in weight than the preceding samples.