make much from one speech, so I will endeavor to combine my subject to make it clear to all, and will take up the ore treatment from the dump as Mr. Carlyle has left it.

Mr. Carlyle has had long experience in mining matters. He has brought you through the various changes which occur in the different forms of mineral veins met with in mining. Mining, you understand, is but a gamble anyway. I have nothing to do with ore formation, but will speak of the ore itself as it is brought from the mine. The chief and foremost point to be considered by the student of metallurgy is to obtain an understanding of the nature of the ore he wishes to treat. There are various means of acquiring this knowledge. As a rule the prospector makes use of the blow-pipe to test the ore, to show exactly what it contains, and so classify the mineral. Personally I am not entirely in favor of the blow-pipe analysis, especially in this new country where we find not only the oxides, carbonates, sulphides, etc., of many metals but also many metals in combination. The reaction given by the blow-pipe test would give a complex return instead of a decided one. For instance, should you have copper and silver in combination, one color is given you for copper and quite a different reaction for silver taken separately ; but together, the two would make such a mixture that it would be impossible to detect with certainty the one from the other unless the operator had great experience. The prospector in going into the field has to consider that the chief obstacle to a complete assaying outfit may be its weight, and that the materials he selects should be as light as possible ; still with careful selection he could take along a few test tubes and certain acids that would enable him to get more accurate returns. The principal acids required would be hydrochloric, nitric, and sulphuric, together with ammonia and potash to give the different reactions, and borax and carbonate of soda.

I have here to-night a good many specimens from the Kootenay Country and elsewhere throughout the Province, besides 350 specimens from various parts of world ; and in discussing the different ores which will be spoken of, as it will assist you in learning their properties, I wish you to handle the ores themselves while following what I have to say about the practical detection of minerals by assay, coloration, and solution.

I will deal for a minute with the subject of ore sampling, which is an important one The miner is too apt, when he gets a pile of ore on the dump, to pick for assay the best specimens. In order to make it very clear how the sampling should be carried out so as not to mislead the miner and others, I will handle a little pile of ore I have here, and will show the system of sampling from the dump down to the hand sample. (Here pile of ore is sampled.) We have also a diagram here which shows on a more extended scale the method adopted in the Cornish works where they have rough sampling, in fact all the sampling is carried on in a crude way there at the present time, as it usually is also in this country. Referring to the diagram, the first figure represents a pile of ore as brought from the dump. The rock in this pile is broken to a certain size, perhaps to a quarter inch mesh, before sampling. Having crushed it to the first size you must find how to get the average. The next thing to be done is to strip the pile from the top, thus widening the base, increasing the circumference of the circle, and flattening the ore on top. You then cross-cut it at right angles through the centre into four sections evenly divided. Remove half the pile to form a new pile by taking opposite sections (two opposite quarter sections). Crush the new pile smaller than the original one ; form it the shape of a cone ; flatten it down ; and divide as before. Continue this until the pile is brought down from 1,000 to 100 pounds, or from 100 to 10 pounds. The diagrams will assist you in understanding this, but to make it more clear I will repeat the process. First you will note the pile is made in a conical form. Then it is stripped from the top and brought down till it is of even thickness ; quartered through the centre ; and opposite sections 1 and 3, or 2 and 4 taken away. This is first broken to a smaller mesh and then the process repeated until the sample is as small as desired.

There are other modes of sampling which are more rapid, more convenient, and, if possible, more accurate. These would be by machinery. In the large smelting works, and in some of the smaller ones in fact, a big parcel of, say, rich sulphides is sampled by taking 1 bag in 10 of the ore sent to be treated. Thus if 100 bags were sent, 10 of them would be picked out and crushed to a very fine pulp. After the machinery has pulverized the ore, it passes, during discharge, through a revolving apparatus having a number of little chutes. As the wheel revolves one way a certain amount of the ore is caught in one tube ; as it reverses it is caught in another. It is thus subdivided mechanically until it is brought down to the sample ready for the assay office. When I point out to you the benefits to be derived from accurate sampling you will see that a little expense and a little time thus employed saves a lot of future trouble, and may save the miner a great deal of money. If you send your ore parcel to the smelter after taking only a rough sample it is difficult to tell if they have made a mistake in the returns, but by going to the expense of putting up a sampling mill you can tell if your assay differs from that of the smelting works that they have made a mistake. In this country, or in all countries where mining is in its infancy, the mine owner invariably loses a lot of money by poor sampling. I would impress upon him the advisability of being cautious, and to find out just what copper, lead, silver, gold, etc., his ore contains by accurate sampling, which will enable him to check the smelter in its returns. You all know that certain metals are valued at so much per unit or pound by assay, silver at so much an ounce, and gold at so many dollars to the ton of ore treated. From this must be deducted the smelter charges. The smelter endeavors on receiving various parcels of ores from different parts of the world not to smelt the rich metallic ores by themselves, but to add an ore richer in quartz or lime, or whatever is necessary to get from the ore the greatest amount of gold, silver, or copper at the least cost. We now come to the subject of the detection of the various ores commonly met. Samples are often taken to the assayer to be assayed for silver or for gold when they do not contain it. By a little practice the prospector could easily ascertain for himself whether or not a specimen contained copper, gold, or other metals by a preliminary test. Some specimens containing gold, silver, and copper, like this sample I hold in my hand, would present some difficulty perhaps to the prospector to determine its composition, though he would at once suspect it contained copper, or if not he could treat it roughly for various metals till he found the colorization. It should be pulverized to 80 mesh. To avoid roasting the ore should be dissolved in nitric acid which oxidizes the sulphides.

Before taking this up we will give a test for copper. I have here some Chili bar copper from the Chili mines prepared by electrolysis and which is 96 per cent. pure copper. Chili bar copper is sent to England for treatment. Before shipping the shipper samples it by boring through the bar in different places and then takes an average. If the molten copper is not poured into moulds carefully prepared there will be a difference in the purity of the copper on cooling in different parts of the same bar.