

ject. The academic side is well handled, the practical or the commercial side does not seem to have occurred to the authors. And yet in other parts of the book detailed instructions are not lacking. We are told that coke furnaces should be started with wood, as the coke is hard to ignite. We are even told that when preparing samples "one ore should be done at a time." But these are minor details, only of importance as they shed light on the general trend of mind or method of the teachers.

On the all-important question of the choice of methods of procedure the book is safe and solid. Except in the one case of tin it makes no effort to be up-to-date; it stands by the old reliable methods, and sometimes one is almost tempted to call it Archaic. One fails to find any attempt at quick methods or short-cuts. In fact, accuracy, and accuracy only, seems to be the qualification sought after. Time and simplicity of operation are so unimportant that one fails to find even a hint concerning them. The preliminary roasting of ores, sometimes in roasting dishes, sometimes in crucibles buried in coke (!) is recommended, and only once are nails referred to. It is true, it is sometimes recommended to use a bar of iron with sulphide ores, but we who never roast (or hardly ever), and to whom nails are as common in the assay office as crucibles, cannot help wondering at these methods.

There are, however, two good things in the way of methods. The authors condemn the pot or dry assay for lead. They say "it is only applicable to rich ores and with these only gives approximate results." They also damn the cyanide method for copper. This is good. They also in a great many cases show the effect on the accuracy of results of changes in the conditions of procedure. This is often in the form of series of actual results. This is most excellent; it is the best point in the book, and one to which we would draw especial attention.

But though we have spoken well of their methods of determination, it must not be considered that even here their standards are such as we should look up to as high. They devote nearly six pages to the dry assay for copper. To the historian this method may be of interest, but why teach it to modern students? They say the electrolytic "is the most satisfactory method for copper," and they give eight pages to it, in which they describe old-fashioned apparatus, recommending the use of two cells of the old type Daniell battery, the porous pot of which "must be emptied out and recharged daily." They allow the current to act for sixteen hours and then say: "It still remains to determine any copper left undeposited in the solution," and they proceed to estimate this colorimetrically!

Now the electrolytic method for copper is not only the most useful that we have, but it is second to no other assay in accuracy of results, and it is less dependent on the skill of the assayer than any other assay. On the other hand, the colorimetric method depends entirely on the judgment of the assayer, and at best is only an approximation. To complete the electrolytic by the colorimetric is like doing most of a survey with a transit reading to minutes, and then finishing up with a prismatic compass; or perhaps a better simile would be to say that it was like making a journey in most part by automobile and then finishing up by walking the last few miles on foot. This may be all right and pleasant if one is an amateur and time is no object, but we learn assaying to earn money by

it and we must get results. The electric current can be used to leave no measurable trace of copper in the solution, and even 10 years ago it did not take sixteen hours to do this. Nowadays it does not take four, and even on the weakest solutions the electrolytic method is much more accurate than the colorimetric.

However, as we have said before, the authors make not effort to be anywhere nearly up-to-date, except in the case of tin. In assaying cyanide solutions for gold they evaporate to dryness in a lead dish and make no mention of the zinc and lead acetate method. They always precipitate copper with sulphuretted hydrogen and make no hint of the possibilities of using aluminium. And their sulphuretted hydrogen they make in an ordinary bottle (upon which they waste one of their very few illustrations), that goes on making gas uninterruptedly till all the material is consumed!

Upon the whole question of apparatus they are very weak. They only mention two types of furnace, the wind furnace and the muffle furnace, both using coke. They illustrate these with the ash pit scorching the legs of the assayer. They mention no other fuel but coke, say nothing of gasoline furnaces, and never think of putting a crucible in a muffle, always using it in a bed of coke. They say that the fused material may be left in the crucible and "separated from it by breaking when cold." Also "wrought iron crucibles are very useful for making galena assays." And these statements, which appear to us foolish, carry as much emphasis in their book as their most valuable ones.

The whole subject of sieves is dismissed in three lines, and practically nothing is said about the degree of fineness to which a sample should be crushed, until they get to Appendix C, where there is a disappointing lecture on the theory of sampling. The only crushing appliance they mention is a "bruising-plate" which looks like our buck-board. It is used with a "bruising-hammer," which has a face four inches square! Not a word is said about any of the crushing or grinding machinery, which is so necessary to us. There is not even a word about the riffle-samplers (of the Jones or other types), which we consider essential. They impress the importance of thorough mixing, but they give not one word as to how it may be done beyond laboriously forming the material into a cone. In fact, all the way through the book no evidence is given of the slightest appreciation of the value of time. Very little is said about balances, nothing about their care. It is not even mentioned that more than one kind may be required in an assay office. In fact the only specification in regard to balances is the unqualified statement that "a fairly good balance should be sensitive to 0.0001 gram." Of course everyday gold balances are sensitive to one-tenth of this.

But enough! Evidently this book, despite all pretentious environment of its birth, is not a standard, at least not a standard for us. What is the matter? It has several faults, but from the broadest view it has two main faults. It shows no sign of progress in the art. With the one exception of the chapter on tin, this book might have been written almost entirely 20 years ago. The second fault is that it is academic and not commercial. What is the cause of these faults? There are probably many causes, and we are not in a position to define them, but, with all deference, we must remember that the book was produced in Cornwall. Now the sum total of progress in mining in Cornwall divided by the number of years they have been mining there is less