The Concentration of Graphite Ores--Past and Present

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I.—Introduction.

Some day, someone may write a complete history of the graphite industry of this country. The result will be interesting, and instructive, inasmuch as it will illustrate the remarkable and devious wanderings of the human mind in search of a certain definite result.

It is quite beyond the scope of this paper to attempt to explore the various backways and byeways of metallurgy that graphite has, in the past travelled. Only generalities can be dealt in.

Canadian graphite occurs principally in more or less flat flakes ranging in size from one-eighth of an inch in diameter to microscopical dimensions, disseminated throughout the rocks of its occurrence. Its specific gravity is in the vicinity of 2.2. That of its accompanying gangue is around 2.6.

Refined graphite enters into many phases of our everyday life; but its chief use is in the manufacture of crucibles. Only the largest flake is used for this purpose, and, as this material is the most valuable, the efficiency of a process for concentrating graphite is, to some extent, governed by the amount of crucible flake produced.

For example: Consider two mills each operating with a recovery of 85 per cent. One, however, produces 110 lbs. of crucible flake per ton of ore treated, while the other produces only 100 lbs., the remainder of the production, in each case, being made up of finer grades. The mill producing 110 lbs. of crucible flake would be considered the most efficient and, would probably remain a better paying proposition, even if its recovery dropped 5 or 10 per cent below that of the other. Thus it is obvious that a high recovery figure does not always mean a paying graphite proposition.

The small difference in the specific gravities of graphite and its accompanying gangue, makes it difficult to concentrate the mineral by any methods that have gravity as their underlying principle, and it will be readily understood that it also aggravates certain problems that are familiar to all mill men. In fact, the average millman, inexperienced in the mineral, upon tackling its concentration, finds himself in a veritable land of topsy turveydom where precepts and precedents often fail. He finds concentrates where he is used to finding tailings. He finds settling tanks that don't always settle. He finds values, to alarming amounts, in overflows, and other places where they have no earthly reason to be. He finds his elusive mineral floating in the air about him, and polluting the country side. In fact, after a while, he begins to thing that there is graphite everywhere in the wide world, except in the one place where it should be, namely, the bags at the end of his often intricate pulp flow.

These introductory remarks will show, to some extent, the obstacles that have had to be overcome by the old operators. Couple to the physical characteristics of the mineral, erratic market conditions, and less modern machinery, and, in the light of latter-day knowledge, one can see that the whole thing was more or less futile.

It is to be regretted, however, that those who have gone before, have left us little record of their endeavours, and apparently few, if any, records of results have been kept.

Thus it is that, doubtless, much of the futile ground covered once, has been covered repeatedly since, and the bitter lessons of failure have had to be relearnt again and again.

II.—The Past.

Briefly, all efforts in concentrating graphite, up to the introduction of the flotation process, may be considered commercial failures.

The first graphite mill in this country apparently started to operate about fifty years ago. I have talked with an aged individual who remembers that his first job in life was to carry whiskey for the mill crew of this particular venture. From local tradition, and Government records, we learn that there was a considerable amount of activity in graphite about this period.

The concentrating device used was the well known buddle, and, as this was a more or less standard machine, graphite, in its infancy, did not stray far from the well beaten paths of common practice.

The flow sheets in use may be broadly described as follows: The ore was broken in crushers and stamps, and roughly classified. The resulting products were then fed to buddles. Buddling resulted in three products: Concentrates, middlings, and tailings. Middlings were re-treated in buddles, concentrates were treated with buhr stones and screens.

The use of buhr stones and screens has survived, and still forms a part of graphite milling practice; but the use of the buddle has died completely. It is obvious that, with such a small difference in the specific gravities of values and gangue, the buddle could never be an efficient concentrating device for graphite; but in one case its use survived until a short time ago, when it was superceded by oil flotation. Only remarkable local conditions, however, rendered this possible.

The general use of the buddle persisted for some years before it was finally abandoned as a failure, and, after its abandonment, graphite for a time departed completely from accepted practice. Each operator appeared to follow his own particular line of experimentation, and the ramifications to which fancy lead are extraordinary.

It would be useless to attempt to describe all the machines and devices employed. Some worked on the gravity principle, among which might be listed, air jigs, air float machines, and various wet concentrators. Some operators delved into electrostatics. In one case a bulk oil process was tried. Mr. H. P. H. Brumell evolved a surface tension machine. This apparently was not successful, though the use of devices, employing surface tension, continued in use, largely in Alabama, right up to the advent of the flotation process.

One operator, in the Buckingham district, tried for two years to design, and perfect, a machine that depended upon the flat shape of the flake for concentration. In other words, he endeavoured to make every individual flake follow the particular laws of dynamics that govern aeronautics. The outcome of