

The Revival of Local Ore Treatment

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One of the outstanding features of metallurgical economics during the past 30 years have been the consolidation of treatment plants at strategic centres. This was of course the logical and inevitable result of what our socialistic friends call "economic determinism." It would seem, however, that for causes which I shall attempt presently to show, this movement has about reached its maximum and that the pendulum is due to swing in the opposite direction.

Those of you who are familiar with metallurgical history will recall that prior to 1890 there were only three ore-treatment processes in general use, viz.: Amalgamation, Smelting, and the numerous more or less unsuccessful leaching schemes. During this period little smelters dotted the landscape wherever there were mines, unless the ore were readily amenable to amalgamation; and this was usually true only while the mine was working in the oxidized zone.

Throughout the Western States were hundreds of little smelters operating often inefficiently and always expensively because of lack of variety in their ore supply. This situation continued until the period of consolidation, which might be dated from 1890 to approximately 1920.

In British Columbia out of nine or ten plants formerly in active operation, Pilot Bay, Nelson, Sullivan, Revelstoke, Vancouver, Trail, Van Anda, Crofton, Ladysmith and Northport (a British Columbia smelter built in Washington, and no longer to be counted as a British Columbia asset), Trail alone survives. In the Western States, Tacoma, the Selby Plant at San Francisco, two or three plants at Salt Lake, one at Denver, one at Leadville, and one at East Helena, at Northport and at Kellogg represent the hundred or more smelters, large and small, of which they are the lineal descendants and successors in interest.

Monopoly, yes, inevitably under the circumstances; stifling of competition of course, due to the immutable laws of chemical combination.

The smelting business is as natural a monopoly as the street car business, or the telephone business. That does not mean it should be free from scrutiny, quite the contrary indeed.

Let me illustrate briefly and simply by a hypothetical case. Suppose we have three mines, A, B, and C, each producing 200 tons of smelting ore, and each manager smelting this at his own mine. A. has a silicious ore; B. an iron ore; C. a limey ore. Let us assume further in order to make the thing quite concrete, that each ton of ore requires a ton of flux and that the total smelting cost per ton of furnace burden is, let us say, \$4. Then the cost to A. to B. and to C. will be \$8 per ton of ore smelted; that is \$4 per ton of flux, which yields no valuable product. Now if the smelting of these three ores can be carried out at one centrally located plant with a capacity of 600 tons, the cost under the conditions assumed, will probably be less than \$4 per ton, plus freight, so that the central plant will be able to charge \$5 or \$6 per ton, make

a profit of \$1 or \$2 and cut the cost for A., B. and C. of a like amount, thereby making a profit of \$500 to \$1,200 per day, and a saving to the three mines concerned of a like amount.

This illustration is, of course, schematic, and not at all exact, it will serve nevertheless to demonstrate the logic and inevitability of smelter consolidation. Yet I believe we have gone about as far as we are going in that particular direction — not that I think Trail is going to be put out of business and that we are going back to the days of the little inefficient smelter, but that metallurgical developments of the last 30 years, beginning with the application of the cyanide process by McArthur and Forrest in South Africa, here made it evident that smelting has no longer the supremacy in ore treatment which it formerly enjoyed. This situation is due to the developments in two fields, flotation and hydrometallurgy.

As long as recoveries by water concentration were hovering around 70 per cent, direct smelting was often, indeed I would say, in most cases, preferable, because of the higher recoveries possible by smelting. With the coming of flotation, making possible recoveries of 90 per cent or better, smelting is no longer necessarily preferable as a primary treatment process—and hence the field of raw ore smelting is being continually narrowed and more and more the smelters are being embarrassed by receipts of larger and still larger tonnages of flotation concentrate.

Meanwhile great strides have been made in the field of hydrometallurgy. This is perhaps best exemplified in the case of zinc, the hydrometallurgy of which has progressed by leaps and bounds in the last five years. The leaders in this work have been the metallurgists at Trail and at Anaconda, and while there has and probably will continue to be a good deal of dispute as to who was the inventor or discoverer of this process, it must be said of the men at Anaconda and Trail, as was said of McArthur and Forrest in the historic cyanide controversy, that "They converted what had heretofore been a pretty chemical scheme into a sound commercial success." Indeed so successful has electrolytic zinc become that in spite of predictions to the contrary, it will be able to stay in the market in competition with retort zinc even at the present low price levels.

Leaching of copper ores, both oxidized and semi-oxidized, is being carried out on a large tonnage basis in the south-western States and in South America. So far as sulphide copper ore is concerned, not much progress has been made, but there is no inherent reason why a method similar to that employed for zinc-roasting, followed by sulphate leaching, should not be successfully developed.

The hydrometallurgy of lead lags behind that of her sister metals, perhaps because of the relative insolubility of lead compounds. There is promise, however, in the new process for the volatilization of lead and silver in the form of chlorides, followed by recov-