Dredge-Sluice Efficiency

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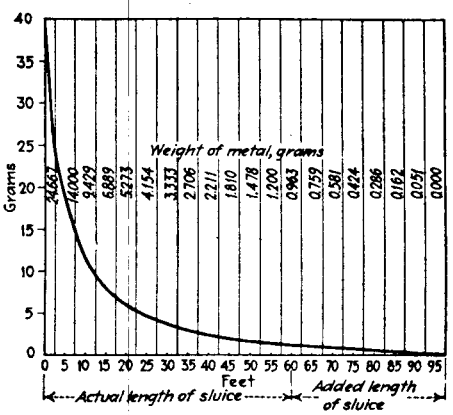
PERCENTAGE RECOVERY is undoubtedly known with less accuracy in sluicing operations than in any other method used for the recovery of precious metals. This may be said to apply both to dredging and to hydraulic operations, although the mobility of the former makes examination of the tailing more impracticable. Much has been written and a great deal more argued about the proper length, type, grade, and amount of water that should be combined in the perfect sluice, and a rare find is a dredge master, winchman, superintendent, or clean-up man who has not his own ideas as to what constitutes the one and only proper type of riffle. Such arguments and conclusions are valueless in most instances, as the conclusions are based on undetermined premises. Each type of riffle has its place, and no one type is best suited for all conditions.

Various methods are used in dredging to determine the percentage of recovery, none of which, in my opinion, except under ideal conditions, gives the information sought. Even if gold or platinum is evenly distributed over a relatively smooth bedrock, accuracy cannot be expected in the final computations of the value per yard when economic considerations do not ordinarily permit churn-drill holes to be placed closer than 100-ft. intervals. Six-inch drill holes at 100-ft. intervals establish a ratio of the sample to the whole of about 1 to 50,000. Credit should be given the churn drill, as it alone has made the testing of placer ground, even successful dredging, possible, but absolute accuracy cannot be expected from it, though under the careful supervision of an expert driller or engineer. For this reason I maintain that any comparison of the drill logs and the amount of metal recovered by a dredge has little bearing on the efficiency of the sluices. In many instances the yardage dug by a dredge, especially in open river work, with continuous movement of gravel, is extremely difficult to determine. However, the yardage as estimated by the dredge master is invariably greater than that shown by actual measurements. Further, one must consider that at many places the bedrock is uneven, and the deposition of the metal is consequently irregular and spotty. This places additional hurdles in the path of the engineer who attempts to secure accuracy with the churn drill.

Many engineers lose sight of the fact that the criterion of efficient dredging is the percentage of recoverable metal that is recovered, and not a recovered percentage of the amount estimated by drill examination. In the district where



Curve of metal recovery

these observations were made the bedrock is uneven and the metal spotty. Drilling, often done in the open river under great difficulties, served, in my opinion, only to estimate roughly the amount of metal and to determine the channel. In many instances the drill results could have been cut in two or doubled, if checking against the recovery had any value in calculating efficiency. On bench drilling, the dredges often recovered as high as 150 per cent of the indicated metal present, and often as low as 60 per cent. These facts and a study of the reasons for them gave rise to a belief that actual dredge recoveries under normal drilling and dredging conditions cannot be placed against estimated ground content to determine the percentage of existing metal recovered. Many engineers will disagree with this view, but no dredge operator knows the actual amount of metal that goes into his hopper, and to check an unknown amount against a problematical amount, as indicated by drill logs, leaves too much to guesswork.

The practice of having the dredge master watch the tailing sluices and pan there at frequent intervals is a proper one, as it gives a comparative idea of losses. However, this means little in the determination of the actual and percentage loss or recovery. Various types of samplers might be arranged as in mill practice, placing them at the end of the tailing sluices, but economic considerations as well as mechanical difficulties must be taken into account. As to the former, one man per shift would be needed to operate the samplers, and additional laboratory expense would be entailed. The arrangement of efficient sampling devices is mechanically possible, but they would be complicated, as they would cover the entire width of the sluices, and would have to be placed aft, where little provision for machinery usually exists. This method is impracticable.

In view of these considerations and of the difficulties encountered in determining the percentage of gold and platinum actually recovered, I advanced the theory, while in the employ of a dredging company in South America, that, if the amount of platinum and gold in a sluice be weighed by short sections of the sluice, these weights could be plotted against the sluice lengths involved and a curve would result that would show the actual recovery in percentage and indicate an efficient length of sluice. Also, a comparison of results obtained using different types of riffles, different grades, and different amounts of water would be of assistance in the design of dredges and the arrangement of sluices.

I left the company soon after making the original test, so was unable to continue the experiments. As a test was made of only one sluice, the curves that might be drawn would not show a regularity that represented the result of several trials. However, the results were interesting, and they are offered for what they may be worth. The tests were made on a conventional single-decked California-type dredge having a revolving screen and belt stacker. Transverse sluices had a grade of 1½ in. in 12; longitudinal ones, 1⅜ in. in 12. The riffles were 1½-in. angle iron over the entire table area.

With the aforesaid theory in mind, the center transverse sluice on the starboard slide of the dredge was selected for the test. The riffles were lifted on clean-up day in 5-ft. sections, and each sample was panned with the same care that would be used in panning drill samples. The longitudinal sluice, into which the transverse empties, was also treated in a like manner; and, as this sluice receives material from the adjoining transverse sluice forward, the weights of metal allotted to the sluice were in proportion to the whole as the weight of metal in the head of the sluice considered was to the sum of the weights of metal in it and the forward adjoining sluice. Thus the sluice treated was considered as one sluice 60 ft. in length. The results of the weighing are presented in Table I.

As might be expected, the one trial did not provide sufficient data from which to construct a curve without irregularities. An inspection of the figures in the table will indicate, however, that if a curve is drawn on rec-

graphical method is probably the more characteristics, is not caught on the gine is read. The curve drawn from