

DISCUSSIONS AND CONTRIBUTIONS

Serial Gravity Concentration: a New Tool in Mineral Processing

J. H. HARRIS, MEMBER, B.Sc. A.R.S.M.

Further contributed remarks on paper published in December, 1959, pp. 85-94

Mr. P. A. Delmé-Radcliffe: Mr. Harris, in introducing his paper, gave as one of his reasons for premature publication: 'to ensure the rehabilitation of mined land, the last being extremely important'.

There can be no quarrel with this aim, if rehabilitation is the right word to apply to so much of the mining land in Malaya that he quotes as an example. So much of this is, or was, deep swamp never cultivated and hardly even inhabited before mining drained and inevitably improved it. To compare such circumstances with the 'fertile orange plantations' of Florida takes a fairly vivid imagination! The population in the Kinta Valley, and in the mining districts of Selangor, are there to-day only because of mining. Even Kuala Lumpur, that bright, new, fast-growing capital of a newly independent country was born as a mining town. Its name means 'muddy mouth', which should remind anyone of its origin. Ipoh, the leading mining town in the famous Kinta Valley, takes its name from the poison used by the aboriginals for their blowpipe darts. In fact it is first recorded by a French miner who described it as a small Sakai (aboriginal) village. This was less than a hundred years ago. It did not therefore exist as a town until mining made it one.

Mining in Malaya does in fact leave the land in a state highly suitable for urban expansion; many new factories around Petaling Jaya in Selangor are built on the well-drained land left there by mining. At least one mining company has at this moment a splendid stand of forest trees growing on mined land. As for agriculture, why is it that State Governments are so eager that land held under mining lease should be surrendered as soon as it is mined? Furthermore, it must not be overlooked that before urban expansion can take place certain services are required; railways, roads, administrative services, power supply and so on. A glance at the map of Malaya will show that all these things abundantly exist where ever there is mining. It will also show mile upon square mile of flat country elsewhere in Malaya where these things hardly exist and where there is a negligible population—because there is no mining.

As to the hills—what is wrong with living there? The Swiss do it with great charm and success, and so, for that matter, do the Javanese—and many other people. Mining only occupies 1.27 per cent of the Sumatran area of Malaya anyway.

Mining is the making of any under-developed country, and there can be no real conflict between a population and an industry that brought that population where it is, and gave it so much prosperity.

AUTHOR'S REPLY TO DISCUSSION*

Mr. J. H. Harris: The main object of the paper was to report an observation on the behaviour of cassiterite particles in the jiggling of Malayan alluvials, namely that the middle size range in a long-range feed behaved in an anomalous but reproducible manner. This observation has now been confirmed by Lill and Smith† where the slow recovery of middle-size particles in a long-range feed, comprising sizes comparable with those in the paper under discussion, is amply demonstrated. Lill and Smith conclude that existing theories do not adequately explain the performance of jigs and that the art will remain largely empirical.

My own added generalizations were intended as suggestions for consideration and trial on the understanding that results would vary with differing modes of treatment, conditions of ore deposit, mineral assemblage and particle size and shape.

The foregoing is a general reply to those objections in principle raised by the discussion. Mr. Michell and Dr. Schlogl doubt if the loss of middle size range will be perceived in a short-range feed. This was one of the points put forward as meriting further investigation. Messrs. Williams, Bain and Shaw have not noted the effect in Nigeria in some cases where the results had hitherto been regarded as irregular. The conclusions drawn in Malaya and Nigeria are, perhaps, dependent on the nature of the respective ore deposits and minerals and on the sampling and assay procedures, all of which also require further investigation.

Messrs. Bain and Shaw enquire the screen analysis of the Malayan alluvials. Typical figures are given by Chaston‡ who refers there again to the assay method used. In *dulang* washing the samples are first deslimed, then screened on $\frac{1}{4}$ -in or $\frac{1}{8}$ -in mesh according to circumstances and then washed up once to produce a rough concentrate. This concentrate is then cleaned up in coconut shells, with the aid of small screens to produce two or three size ranges, a magnet to remove ilmenite and a simple film flotation with xanthate to assist separation of sulphides. Tin losses from the clean-up stage are usually very low.

Mr. Ortley made several suggestions, with which the author agrees, as to the reasons for the good performance of the cyclone-jig plants and Messrs. Bain and Shaw added a valuable observation on the special aid given by cyclones in the concentration of ultra-fine sizes of cassiterite.

I have not investigated in detail the ragging effect mentioned by Mr. Barwise but I did refer to one aspect of this at the end of the second paragraph on p. 92.

Mr. J. C. Allan's suggestion that the recovery of middle size is affected by jig design is perhaps answered by the results obtained by Lill and Smith. His description of the Panasqueira circular jig is most interesting.

*pp. 295-318.

†LILL, A. D., and SMITH, H. G. A study of the motion of particles in a jig bed. Paper 24, *International Mineral Processing Congress, 1960* (London: Instn. Min. Metall., 1960) in press.

‡CHASTON, J. K. M. Developments in the treatment of Malayan tin ores. Paper 29, *International Mineral Processing Congress, 1960* (London: Instn. Min. Metall., 1960) in press.

The Malayan alluvials are, of course, easier to treat, 40 tons/hr throughput being obtainable there with cyclone-jig plants employing one 2-cell rectangular jig only 7 ft long and 3 ft 6 in wide and taking 2 h.p. in the primary concentration stage.

On the question of wet-screening efficiency raised by Messrs. Michell and Bartnik, the curved screens introduced into Malaya appeared generally successful and, when not entirely so, capable of improvement by suitable adjustment of design and operating conditions. Experience in the long run must be awaited. Elsewhere, as in Nigeria, the shape factor of the minerals sought, e.g. columbite, may have to be taken into account.

Mr. Bartnik also describes a proposed variant of the 'serial' system with a cyclone classification preamble to the second stage which closely parallels Mr. Chaston's view of the desirable feed conditions, expressed in his thoughtful contribution.* I agree that this alternative approach merits trials, with the proviso that adequate safeguards against loss of economically recoverable fines from the cyclone should be included.

Having retired from Malaya, I regret that I am not in a position to contribute further to the aspects of gravity concentration now under discussion and hope that more results of the work that has been initiated there will be published by others in due course.

I am grateful for Mr. P. A. Delmé-Radcliffe's postscript which reveals the importance of mining to Malaya and reinforces my own references to the extensive rehabilitation work undertaken by progressive miners over and above that required by law; but the objective of total mining and maximum extraction of values prior to rehabilitation has not always been attained, with the result that towns have now spread on to incompletely exhausted deposits. It is to be desired that this will be avoided in future.

*Note: On p. 316, Fig. 1, lower right quarter of flowsheet, products from cyclone: for over-size read overflow.

OBITUARY

Stanley Robson died at his home in Birchington, Kent, on 26th March, 1960, at the age of 72.

Mr. Robson was born in Sunderland, Co. Durham, and educated at Bede School. He was student at Armstrong College, now King's College, Newcastle-upon-Tyne, from 1908 to 1912, gaining the B.Sc. degree in 1910. He was awarded the Freire-Marreco medal in 1911 and a Johnstone Chemical Research Scholarship, which enabled him to do post-graduate work at the University of Durham and gain the degree of M.Sc. In 1912 Mr. Robson visited Canada and the U.S.A. as a travelling scholar, and on his return in 1913 came to London as a scholar of the 1851 Royal Exhibition, working on catalysis at the Imperial College of Science and Technology