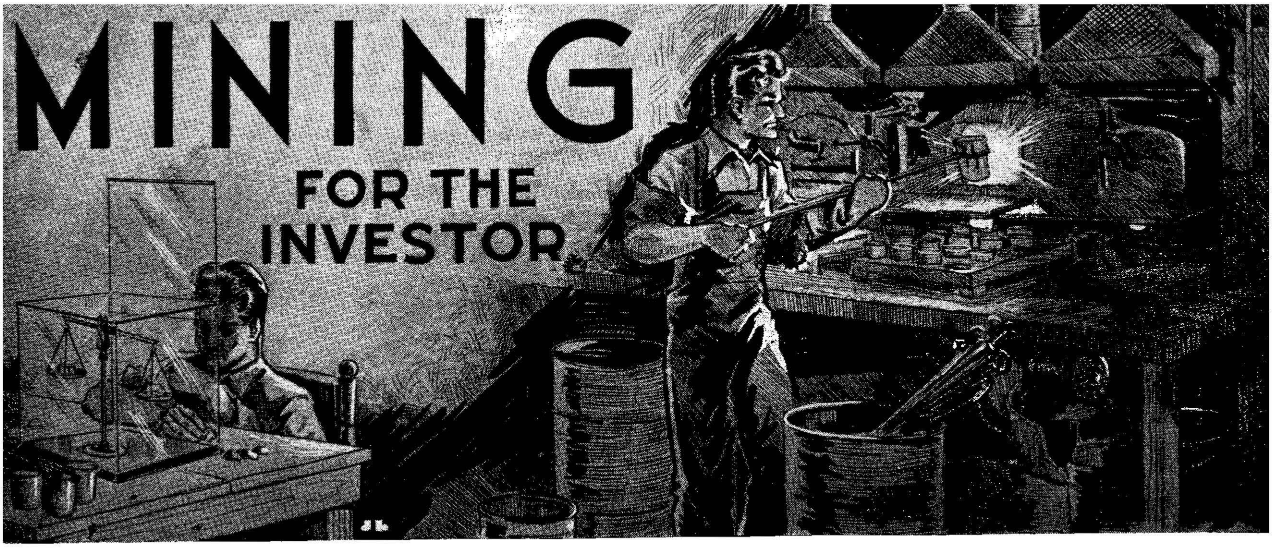


By Ralph Keeler

SAMPLING

Underground sampling, (the sampling of lode mines) is considered the hardest physical job that the mining engineer is called upon to perform. Care must be taken that the face is more or less smooth and clean, that all of the fine material broken during the cutting of the sample is recovered, that none of the country rock, or barren material, is left, and, above all, that the sample is not salted.

It may take a whole day, or even more, to secure one good sample of from ten to 25 pounds. Usually, however, a crew can take ten or more satisfactory samples underground a day. Mine car samples, and samples at various stages during the milling process are, of course, much easier to take, since by this time the material is more or less homogeneous.

An ideal sample should be a uniform grove, or channel, across the full width of the ore, and no more; how closely this may be approached in practice will depend upon the material sampled and upon the time and care given to the work. ("The Examination of Prospects" by C. Godfrey Gunther).

There is no substitute for elbow-grease in taking samples. A hammer and moil (short length of steel tapered to a point) are the favorite tools for this work. Sometimes a small air-driven hammer drill may be available, in well-equipped mines.

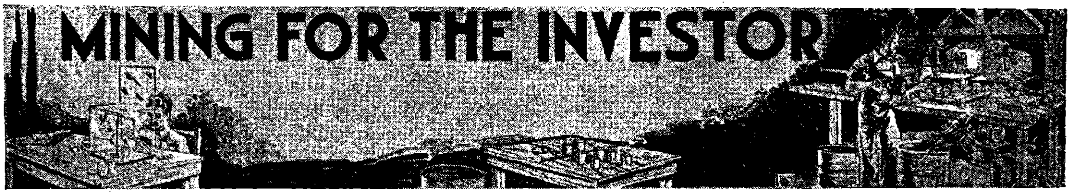
The precautions to be taken in sampling are legion. To the layman investor the job of sampling seems the simple process of gathering up pieces of rock here and there. Here are 17 chances for error in hand sampling, as listed by T. J. Hoover in "The Economics of Mining."

1. Intentional salting for purposes of fraud (more about "salting" later).

2. Friable streaks in the ore, causing an excess of one such portion to enter the sample.

3. Hard streaks in the ore, causing a deficiency of one such portion to enter

(The first of this series appeared in the April Magazine)



the sample, the converse of the situation given above. If the friable portion in the above case was comparatively rich, the assay would indicate too high a value; if the hard portion were comparatively rich, the assay would indicate too low a value. The way to avoid this difficulty is to sample the friable and hard portions separately, even though they are quite narrow, even less than an inch in width in certain cases where rich streaks occur. This calls for very careful measurement, and also the allowance, in calculations, for possible variations in specific gravity of hard and soft portions.

4. Failure to recognize ore, thus leaving it unsampled. (A classic example of this is the zinc carbonate deposits of Leadville, Colorado, which went untouched for years before being recognized as ore).

5. Laziness and fatigue. The influence of these are felt in the actual cutting of samples.

6. Ignorance and inexperience. This can usually be corrected by instruction from the experienced engineer.

7. Failure to see and examine all openings. Blocked-up sections may contain low-grade ore, although they also have been known to contain bonanzas.

8. Failure to take samples at right angles to the vein, or, to make the necessary mathematical correction for width sampled.

9. Undue haste. A bad sample is worse than no sample.

10. Contamination of low-grade samples by material from high-grade samples adhering to tools, utensils, canvas, or machinery. Invariable and scrupulous cleanliness is the antidote for this.

11. Failure to include seemingly barren spots in the sample scheme. These must be sampled separately or else recorded and excluded from later ore estimates.

12. Inability later to mine to the exact limits of the sampled block. This must be taken into consideration in the calculation.

13. Failure to include, in samples or calculations, weak ground adjoining the walls of the lode which will be broken with the ore in stoping operations.

14. Failure to clean sampling surface. Clean thoroughly, even to the extent of blasting a new face where necessary.

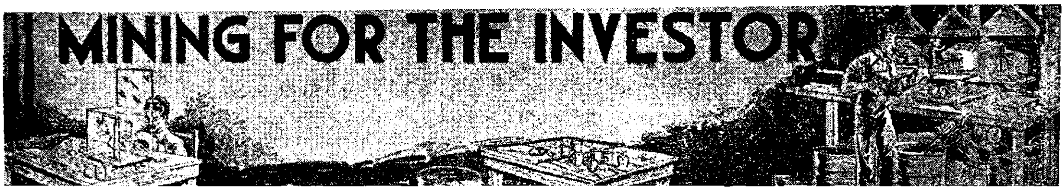
15. Improper reduction to assay pulp of samples taken in the mine, or incorrect assaying.

16. False assumption that samples for irregularly spaced levels represent the average of each block. Such levels sometimes have followed the best ore, and the reasons for the irregular spacing call for investigation.

17. Confusion of samples. If critical samples cannot be allocated, unending trouble will follow. The remedy is painstaking recording and marking of all samples.

This list gives an idea of the difficulties encountered in accurate sampling—and accurate sampling is probably the most important single operation in the complex routine of mining. Upon the results of sampling the investor risks his money, the mining company plans its mill, the metallurgist lays out his flow sheet, and the miner devises a method of mining.

Millions of dollars have been wasted because of misleading reports on samples. In some cases mining companies



have been formed, capital raised, development work started, and mills even built because those in authority were under the delusion, because of glowing reports on picked samples, that they had a mine and that prosperity was just around the corner.

There were surprisingly few cases of false samples, wrong assays, and salting in the recent mining boom in the Philippines, but those which did occur did much damage.

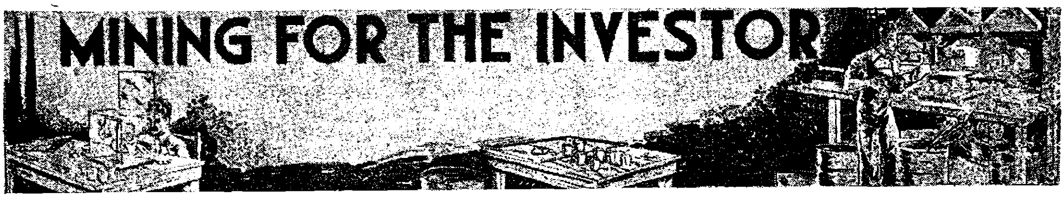
Many new companies capitalized on high assays, and used such assay reports in their prospectus and in advertising. The reproduction of legitimate assay reports showing values of ₱100 or ₱200 a ton in gold was of great psychological value in the sale of stock. Most of such assay reports were entirely true —but the catch was that they were assays of picked samples and were not at all representative of the entire property. A classic example of the sad results of the failure to sample a mine carefully and accurately may be seen in an abandoned mill in the Baguio district. This mill was built after a year's development work; ore reserves were announced as being high, certainly plenty to warrant a mill. After one month's operation, however, it was discovered that the ore had been exhausted—that the engineer in charge had not sampled the mine accurately. If a careful check of the ore reserves had been made by independent engineers, as is the usual practise before a milling plant is ordered, some ₱600,000 would have been saved.

Another outstanding case in the Philippines was that of a mine north of Baguio, where the general superintendent reported gradually increasing ore reserves over a year or more. An independent engineer sent to check on the work came back with a glowing report studded with high assays. He returned a short time later, however, and discovered that he had been salted from start to finish. In this particular case the youth and inexperience of the engineer concerned caused his first highly optimistic report—which careful sampling soon corrected.

The classic in the Philippines, however, was the "discovery" of a new and virgin gold field in the Bicol area, south of Manila. Seven companies were formed, and the leading businessmen of Manila scrambled to put their money into the projects. Samples sent to Manila brought unfailingly good reports. Mills were planned, and most of the investors were ready to retire and spend their dividend checks. Two reliable operating engineers went to the property, took their own samples, and reported favorably.

It was not until a small mill had actually been bought, and an engineer of wide experience and outstanding ability engaged to install it, that it was discovered that the gold of the area was almost 100 per cent imaginary. The consulting engineer for the group of companies (who had been drawing some ₱3,000 a month in salaries) was extradited from Hongkong, (where he had gone hastily when the blow-up came) and was tried—the evidence was faulty, however, and he was acquitted. In this case a competent man could have sampled any one of the properties and learned the true facts of the case. A willingness on the part of laymen directors and investors to take assay reports at their face value is often noticeable, particularly in the stress of boom times.

In general, the mining engineer in taking samples learns to trust no one,



not even himself. It is only after taking hundreds of samples, and after checking and rechecking calculations, that the competent engineer makes an approximate estimate of ore reserves. This is particularly true of a new property, when the decision to build a mill, lease the mine, or abandon work, depends upon the results of sampling. In the case of an operating mine, sampling is very important, of course, but soon becomes a matter of routine. The mine superintendent sees to it that samples are taken from every face, and from, every car that leaves the mine; he can thus plan his development and stoping work systematically. The mill superintendent samples the ore from the time it reaches his plant down to the final tailing which flows to waste; he thus checks on the efficiency of his flow sheet and is able to alter it from time to time for better results.

(*To be continued*)