Several unusual details developed during the sinking of concrete drop-shafts by the caisson method: The holding up of one side of the shaft by a boulder under the cutting-edge or shoe, causing the huge concrete tube to tilt out of plumb; tearing of the steel shoe to a distorted wreck by the hard layers it passed through; men with the "bends"; controversies between the mining company and the contractors; the difficulty of inspecting the work; when is "bedrock" too soft and broken up to be "bedrock," or is it hardpan?; leakage of the compressed air out through the soil.

Illustrative of the recognized capability of Lake Superior miners at shaft-sinking is the recent sending of fifty picked miners gathered at Crystal Falls, Michigan, to sink a 1,200-ft. shaft for the Orkla Mining Co. of Christiania, Norway. The contract was awarded by the Norwegian organization to the E. J. Longyear Co. of Minneapolis, partially in order to gain a knowledge of American sinking methods and American machinery, in spite of the fact that European practice in tunneling is reputed to be superior to American methods. The shaft is to be sunk in less than a year's time, and the miners will be paid a bonus for each month's work that is greater than 65 ft. Naturally the first several months' progress will be more rapid than later when depth, water, and darkness will slacken speed. The rock is said to be very hard, but, of course, hard ground if firm and homogeneous is to be preferred to some broken up, softer formations.

GRANBY CONSOLIDATED

Granby Consolidated Mining, Smelting and Power Co. produced 26,705,928 lb. of copper in its fiscal year ended June 30. Of this amount 10,005,278 lb. came from the Grand Forks smelter and 16,700,650 lb. from the new Hidden Creek smelter at Anyox. From both properties precious metals recoveries totaled 415,806 oz. of silver and 32,126 oz. of gold.

The annual meeting of stockholders will be held in October and not until that time will the annual report be available. Notwithstanding the comparatively low cost at which the new Hidden Creek property has been producing copper, there were other factors, including the three months' shutdown last fall at Grand Forks, to keep total costs up to about 10½ cents a lb.

In June the Hidden Creek smelter made a record production of 2,053,027 lb. of copper against 2,021,717 lb. in the preceding month. The output at the old smelter at Grand Forks was 1,573,902 lb. comparing with 1,662,398 lb. in May.

Results of the past year's operations were as follows:

	Grand Forks.	Anyox.	Total.
Copper, lb.	10,005,278	16,700,650	26,705,928
Silver, oz.	179,205	236,601	415,806
Gold, oz.	24,998	7,128	32,126

Granby now has its smelting capacity in full swing as the fourth furnace at Hidden Creek has just been blown in. Production for the year beginning July 1 should exceed all that has gone before and costs at Hidden Creek should bring the average for the entire property down to a fair level if permitted steady operations. At the height of winter the Hidden Creek smelter will doubtless have to close for a few weeks, but this the management expects.

The Midas mine in Alaska has not started production and no definite plans have apparently been made in this direction.

PERSISTENCE OF ORE IN DEPTH*

By G. R. Mickle.

The paper on "Persistence of Ore in Depth" has evidently stimulated a great deal of discussion. It appeals to me as most useful and important, and without discussing the facts presented or the conclusions arrived at, I wish particularly to refer to the mode of reasoning followed. The method used is necessarily influenced by the different nature of the things under observation, but it is similar to that employed in determining the "Expectation of Life" by insurance companies. We are all familiar with the certainty and security of the life insurance business. Two factors contribute to this (1) the existence of many hundreds of thousands of observations on the length of life of the same kind of thing, i.e., healthy males who have been subjected to standard tests; this establishes the "expectation" for the individual, and (2) the fact that insurance companies take risks of comparatively small amounts on thousands of individuals, and not very large amounts on a single individual or small number of individuals.

To determine the "expectation" the thing that is relied upon is the work of the actuary of the insurance company. Physicians, physiologists and bio-chemists might estimate the length of life from their profound knowledge of the human body and the changes that take place in it, but the company that transacted business on their calculations would probably come to grief. At any rate, the results of many years of experience have proved that the actuary's work is reliable.

In the case of mining, the thing we wish to determine frequently is the "expectation" of any mine, using this term in the technical sense defined in works dealing with this subject. Thus, "the expectation from any event is obtained by multiplying the sum to be realized on the event happening by the chance that the event will happen."

It is necessary to ascertain the chance of success or "the chance that the event will happen," and in estimating this a knowledge of the history of similar things seems indispensable. But this is the very kind of knowledge which is not available to any adequate extent.

In any given mining district (for example, one containing gold-bearing quartz veins), in order to find out what proportion of the veins that have been tested are capable of being worked profitably would require probably months of constant investigation on the part of some one who had access to all the workings. This, if done, is very seldom published. It is obvious that any extensive information on such points as this—and it would not be of much value unless it were extensive—would require the co-operation of a great many. The examination would have to be made in some standard manner, that is, as far as determining certain specific things, just as the medical examiners for life insurance subject the applicant to standard tests.

It is clear we can never reduce the business of mining, involving as it does first the determination of the "expectation" of any given vein, and then the taking of the risk, to the same degree of certainty as life insurance, as we can never expect to have as many observations to fix the first, or sufficient capital to embark on thousands of enterprises. Moreover, the things themselves involved in the two cases vary between wider limits. The same degree of certainty is

*A contribution to the discussion of a paper presented before the Institution of Mining and Metallurgy, London.