The employer who has the pluck to do this, and to continue doing it, will find that his men will respond to such good treatment. This is the highest type of management under the old system, yet it cannot compete with scientific management, for under the latter there is no spontaneity on the part of the workman, but continuous effort. This, because of the new and unheardof burdens which the management assume.

The first of these principles is the gathering-in of the great mass of traditional knowledge held by the workmen; recording it, and reducing it to laws, rules and mathematical formulas. These deductions become of immense assistance in increasing the output. Rule-of-thumb knowledge is replaced by science.

Secondly, it becomes the management's duty to study carefully every man in the plant, his capacities, possibilities and limitations; and to train each to the highest class of work for which he is shown to be fitted—progressive selection and progressive study.

Thirdly, the science and the scientifically trained man are brought together. This is difficult. It can be accomplished only by binding the workman to work by science. This, however, does not cause appreciable trouble. Nine-tenths of the trouble experienced comes from forcing the management and owners to assume their burdens.

And, fourthly, a great mass of work formerly done by the workmen is now partly taken over by the management, until the whole is more equally divided. On the management's side there is generally one man for every three workmen.

These principles are deduced from years of study and work under scientific management. The system is no longer something which might be found beneficial if tried—it has been well tried—and pays.

To illustrate the application of the principles of scientific management, Dr. Taylor chose the operation of shovelling. A careful study and series of observations in a plant where four hundred to six hundred shovellers were employed resulted in a reduction in the cost of handling iron ore from eight cents per ton to less than four cents, after paying the workmen employed 60 per cent. higher wages, establishing a labor office, employing teachers to instruct the men how to scientifically handle a shovel, and timekeepers, etc., to record performances.

Investigation showed that the loads upon shovels under old methods varied from three and a half to thirty-eight pounds. Placed on a scientific basis, a load of about twenty-one pounds to the shovel, proper motions, simple and untiring, the work was now being done by 140 men. Furthermore, investigation into their private affairs showed the workmen to be living better lives, in every way, than before.

Illustrations were also given in the operation of machinery. The speaker claimed that not one in fifty of the machines in the factories of America are speeded accurately. The majority of them are 200 per cent. to 400 per cent. out, and from two and a half to nine times as much work could be done by them if they were properly adjusted. In the work of the high-class mechanic science is so great a factor that he cannot gain the proper knowledge of himself.

Dr. Taylor instanced, in closing, a case in machine manipulation where mathematicians were confronted with a problem involving twelve unknowns, and struggled with it for eighteen years. Now the problem is solved in twenty seconds on a slide rule taking care of the twelve variables.

"If you are willing to pay the price in time and hard work, things that have through the ages been termed impossibilities, can eventually be solved and put to use for the good of man."

MANITOBA'S MINERALS.

By Dr. R. C. Wallace.*

It cannot be said that a great deal of attention has been paid to the possibilities of Manitoba as a mineral producer. This is as might be expected in a province where agriculture has been and is of paramount importance. And yet the soil is not the only natural asset of any country; and a systematic investigation of the mineral resources must always play a prominent part in contributing to the development of the whole.

If we associate with the name of minerals such ores as are mined for gold or silver or copper, then it is indeed the case that minerals and good agricultural soil are not, as a rule, found together in nature. But under mineral resources must also be included materials such as clays, shales, sands and gravels, limestones, marls and coals, all of which are frequently found in districts which support a thriving agricultural population, and all of which call for development in the agricultural areas of our own province. One need only instance the case of our neighbor across the international boundary line, where a strong State Geological Survey and equally strong School of Mines, both integral parts of the University of North Dakota, are doing magnificent combined work in directing the development of the clays, cements, and coals of that state along the most rational and economical lines. A study of the features of industrial progress in a state pre-eminently agricultural, which are to be directly attributed to the researches and guidance of these organizations, would well repay the people of Manitoba.

But at a time when the province is on the eve of entering into a larger heritage, it is natural that attention should be directed rather to what we are likely to obtain than to what we already possess. Although certain areas in the vast Archaean territory of the new Manitoba have a coating of clay sufficient to provide an agricultural soil, the possibilities of revenue lie mainly in the mineral resources, the timber, the fisheries and the water power which the new territory will provide. And it is here that the onus of the work will fall. Up to the present time it has been found possible to carry out organized geological survey work only along some of the principal waterways, and private prospecting has been desultory in the extreme. In order to realize the extent of our possibilities, and the importance of systematic work in this field, it need only be pointed out that in a district—comparatively speaking at our own doors—a discovery of gold was made over two years ago which has led to the influx of a large number of prospectors into that particular area; and this in a belt which had not previously been geologically examined or even topographically mapped.

In the great Archaean Shield discoveries of ore deposits have been confined to the belts popularly known as Huronian, and consisting usually of Keewatin, Huronian, and even younger deposits, which may be generally characterized as dark or dark-green schists, conglomerates and slates, in contradistinction to the lighter color of the surrounding Laurentian granites and gneisses. Of these dark schists, there lie within the enlarged boundaries of the province several areas, no one of which has as yet been subjected to detailed investigation. Future exploration may discover still more such areas, and it is certain that the boundaries of some of those already located, as for instance the "Huronian" band in the basin of the Hole River, will be considerably extended in the future mapping of the areas concerned. Two of these "Huronian" belts—one of them rather extensive in area—will be rendered directly accessible by the Hudson Bay line. A

* Professor of Geology and Mineralogy, University of Manitoba, Winnipeg.