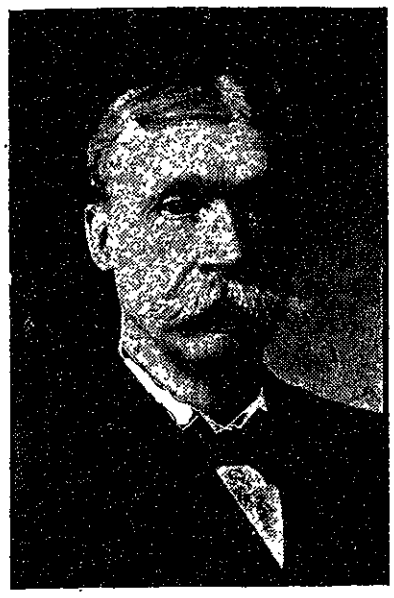
THESIS

By PROF. R. H. RICHARDS.

The thesis is regarded in the mining department as the most important part of the course; in fact, the crowning feature. An investigation calling for an intelligent plan, exact observations, reliable records, intelligent discussion, and wise conclusions calls out into practice all the training the student has received at the school, together with his outside experience. It helps him to fit himself for graduation, and his teachers to decide if he is fitted. Among the many lines for thesis that can be



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chosen, the following are perhaps the most obvious: Ore-dressing test to ascertain the best method of concentrating an ore. This at first glance looks like doing the same thing over and over, but when it is borne in mind that no two ores are alike and the greatest commercial economy will be obtained by crushing one ore to one size and another to another, and that they differ likewise as to the dividing line for re-crushing tailings and also middlings it will be seen there is a great deal to be done to settle these questions. Ore-dressing investigation to ascertain the settling velocity of different sizes of grains of minerals of different specific gravity: This is one line of investigation of great importance to the mill man and the designer of mills; it is only one of many lines that can be suggested. Metallurgical test: A blast furnace can be made on a copper ore, including the preliminary analyses of the ores and fluxes, the computation of the charge to yield the best result in copper recovered and least copper lost in the slag. During the run, heat measurements can be taken and the complete heat balance sheet prepared, showing where the heat was used to advantage and where it was lost, and how the run could be better done the next time. Metallurgical investigation: The student may take the investigation of the fusing point of lime iron silicates as used in lead smelting slags. He will have all the slags to prepare of pure known materials, the apparatus to put in order and calibrate, the tests to make, the conclusions to draw and the paper to write. This is only one of many that might be named. Assaying test: The student may be given an ore and try on it all the known methods of assaying such an ore, he can try all the possible variations in heats at the different periods in the process and all the different proportions in the fluxes to reach the best method of assaying that class of ore. Assaying investigations: The student may try the losses in silver in cupelling, using variable quantities of lead, variable heats and different makes of cupel, at the end he sums up the results and concludes the conditions that will give him the most reliable results. Geological survey: The student can make a geological survey, getting the location, dips, strikes, kinds of rock, and after mapping it all can draw sections and conclude with considerable certainty what he will find and where he will find it when he goes down below the surface. Geological investigation: The student can make a careful examination of a rock formation and take a great many samples of the rock. He can then make slides of the rock and study its structure, microscopically and chemically, and make up his mind to what great group of rocks it belongs, having done so he can then argue from analogy what valuable deposits are liable to be found in its neighborhood, he can also contribute towards the settling of the geological age of the rock.

In every one of these supposed cases the student is living beforehand through one of the experiences which go to make up the life of the mining engineer, the metallurgist and the geologist.

PALEONTOLOGY

By PROF. H. W. SHIMER.

The study of paleontology at the Institute is pursued along two lines. The one considers the identification of the earth's strata through the fossils included in them and the other the evolution of life upon the earth. At the Institute more emphasis is naturally laid upon the former, embodied in the courses in Index Fossils.

If any particular deposit of stratified rock be examined we shall find certain fossil forms peculiar to only that stratum and other strata which were in other regions deposited at the same time. This being demonstrated, we may certainly be able to identify that stratum thereafter by the fossils found in it, no matter in what locality found. The identity of formations in different sections of a country, or, as we usually say, their correlation, is of the utmost importance to both the geologist and the mining engineer. For example, in the lower peninsula of Michigan a stratum of limestone runs about 100 per cent. calcium carbonate and is hence much sought after for use in clarifying sugar and for making Portland cement. It is underlain and overlain by shale beds of similar lithologic characters, but carrying different fossils, and as the strata are almost horizontal, separate outcrops of the limeestone are few. Hence here, in areas of shale outcrops, quarries are located by an examination of the surface fossils which indicate whether the shale is that which underlies or overlies the desired limestone.

A knowledge of Index Fossils in each year becoming increasingly necessary for the geologist and the mining engineer more and more freqently do we find practical mining men coming back to take such work. The following is an extract from a letter of such a man from the southwestern United States: "I find that I cannot carry on my work to the best advantage without a knowledge of the fossils. I do

PROF. H. W. SHIMER.

not see how any man can do prospecting and development work in this region unless he knows something about fossils. Since I have been here, a graduate of a technical school came down to direct the sinking of a shaft for his company. He spent an immense amount of money and time in sinking that shaft in Devonian limestone. Now the ore only occurs in the Carboniferous of that region. He had crossed a fault which brought up the barren Devonian rock. If he had known the fossils, which were abundant, he could have told in five minutes that he was on the wrong track, and could have saved his company an immense amount of money."

In working out the structure of a country, noting faults or boring artesian wells, such knowledge is equally necessary. As an instance of its use in the latter work, the following may be quoted: "In two instances within the past year by the aid of these fossils (oysters) brought up from great depths in diamond drill cores, cities in Texas upon the point of abandoning the attempt to procure artesian water have been warranted in drilling a few feet farther where the desired artesian flow was procured."

Likewise is a knowledge of index fossils most desirable for work upon the geological surveys of Canada, the United States and Mexico, for each of which the Institute has trained men. A couple of years ago one of our men on the Mexican survey, was deploring that he had not taken more work in that line since so much of his work on the survey was along lines involving the knowledge of fossils.

The undergraduate work in Index Fossils at the Institute is confined to two courses: (1) The laboratory part of the stratigraphic geology, showing what a fossil is, how preserved, and, through constant comparison with recent forms of life, what the soft and hence unpreserved parts of the body were like, and how these built up the hard parts which are preserved in the fossil state. (2) The course in North American Index Fossils which, through the identification of two or three hundred very common fossils gives a good knowledge of classes and ages, ability to note minute differences, and the training to identify unknown fossils and thus the age of the rock enclosing them. In the advanced courses in paleontology, the knowledge and training thus gained are used in original work for publication upon some specific area, including identification of fossils, determination of the age of the rocks, etc.

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SLIMES.

Course III is perhaps the most cosmopolitan given at the Institute. Besides men from twenty-one states in the Union, Central America sends one man, China three, Japan one, Mexico two, Nova Scotia one, British Columbia one, South Africa one, and West Indies one.

The following is an approximate classification of the undergraduates according to their options:

	Op. I	Op. II	Op. III	Totals
Seniors ...	13	2	14	29
Juniors ...	23	2	3	28

Option I is the general mining course. Option II is metallurgy, and Option III is mining geology.

In regard to the preparation a mining engineer should have for his work, the matter of reference books is important. Among the more essential ones are: Spurr's "Geology Applied to Mining"; Trumbull's "Underground Surveying," a book containing much valuable information in little space; the handbooks of Trautwine and Kent; "Estimation of Ore in a Mine," by T. A. Rickard; Richards' "Ore Dressing"; Hofmans' "Metallurgy of Lead" and Peters' "Metallurgy of Copper."

ORE-DRESSING.

(Continued from page 23.)

making a complete treatment, including the coarse crushing, the fine crushing, the preliminary and the finishing concentration. (3) The remaining laboratory equipment is to provide for the study of individual machines; for example, the magnet with high magnetic power for treating minerals with low magnetic susceptibiiity; the magnet with low power for minerals of high susceptibility; the various designs of classifiers, the Wilfley table, the Wilfley slimer, the steep end shake vanner, and such other machines and processes as may from time to time come forward for investigation.

There are three stages in the work: (1) The introductory object lessons; (2) the testing of ores for a process; and (3) the investigation of principles of ore-dressing to obtain constants or data for the guidance of mill men and investigators of the future. The second and third stages are used in the thesis work.

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