magnesium with an indefinite amount of sodium phosphate, directions which are, of course, impossible to follow.

Sundry other slips have crept into the text; for instance, on page 14 "The quantity of chlorine in a liter of sea-water is never less than 200 grams." Doubtless one-tenth of that figure was intended. Again, on page 45. "With the waters containing sulphates the scale is more difficult to deal with." Also on page 136 "The tanner endeavors to secure a water containing plenty of carbonic acid, and he can do this by forming an artificial waterfall and thus aerating the stream."

The free use of chemical equations throughout the body of the text is especially noteworthy.

The book contains much that will prove of value to those interested in the subject of "water." W. P. MASON.

QUANTITATIVE ANALYSIS FOR MINING ENGINEERS. By EDMUND H. MILLER, PH.D., Adjunct Professor of Analytical Chemistry and Assaying in Columbia University. New York: D. Van Nostrand Co. 137 pp. Price, $1.50.

This excellent little book was written primarily "to furnish the engineering students at Columbia University with the directions required for their course in quantitative analysis. No attempt is made to cover the entire field of inorganic analysis, but a few important analyses are given in considerable detail." Within these self-imposed limits the book is one of the best of its kind. The methods given are up-to-date and the most praiseworthy feature of the work is the way in which all the most recent literature on the methods is not only utilized but is referred to most copiously, whether it be found in journals, special pamphlets or larger works. In fact, it will be found very useful as a condensed bibliography of many important common analytical methods. This feature must have the effect of impressing on the students the necessity of remaining in touch with original sources and newer publications. It overcomes, to a certain extent, the chief pedagogical criticism which might be made of the method of instruction, *viz.*, that, in the reviewer's opinion, it would be more desirable to develop self-reliance in students after two months of analysis by gradually giving them less explicit laboratory directions and more copious references to the literature of an analytical method.

In two introductory chapters there are brief statements on such fundamental theoretical points as ionization, mass action, the

solubility product, along the lines laid down in Ostwald's "Scientific Foundations of Analytical Chemistry," and throughout the book reference is made to these important principles. The treatment of this part is, on the whole, clear and satisfactory; only here and there objection might be made to the presentation. Thus, on page 10, it is unfortunate that in the calculation illustrating mass action, the concentrations in gram-molecules per liter (0.0015 and 0.0985) were not used so as to bring out the real ionization constant of acetic acid. The constant developed is the ionization constant times the volume containing a gram-molecule, and as no mention is made of this latter factor, the illustration, while correct, loses its perspicacity and chief value for the average student who studies the definition of concentration on the same page. Then, on page 11, while it is true that the addition of sodium acetate has made the acetic acid weaker than hydrogen sulphide, it is absolutely wrong to say that this "is shown by the experiment with ferric acetate." If the precipitation of iron sulphide proved that, then the precipitation of copper sulphide from a solution of copper chloride would make hydrogen sulphide stronger than hydrochloric acid. The correct explanation, of course, is found in the section on the solubility product. The conception of methyl orange acting as an acid as an indicator, page 12, is no longer tenable. It really is a very weak base, being used in the form of the sodium salt of the sulphonic acid. The ionization theory of the change of color of indicators, which is alone referred to, must undoubtedly be modified. The addition of barium chloride, "drop by drop," in the precipitation of barium sulphate is certainly not due especially to a fear of cooling the solution (page 17), but to the endeavor to obtain a crystalline precipitate of larger grain by a slower formation of crystals and one which does not enclose more than traces of barium chloride.[1]

In spite of these and similar minor faults, the writer takes pleasure in heartily recommending this excellent book for courses in quantitative analysis in technical schools and as a book of reference and bibliography for such courses in colleges and universities.

JULIUS STIEGLITZ.

CHICAGO, April 2, 1904.

[1] Richards and Parker: *Ztschr. anorg. Chem.*, **8**, 413 (1895).