weight of a liter of air or by using some of the published tables for obtaining the weight of a volume of water at different temperatures, an error of two-tenths of a gram might be introduced into the calculated weight of a liter.

The weights used had been compared with a standard set, originally tested and furnished with a table of corrections by the U. S. Office of Standard Weights and Measures, so that all weights were in terms of the International kilogram.

The balance was made especially for this kind of work, with large bows and pans. A variation of one division in the rest-point corresponded to six milligrams with a load of 1200 grams in each pan.

It remains for us to consider how the individual members of this society may advance the cause of uniformity in volumetric apparatus. There are two parties to be kept in mind, who look at this matter from entirely different points of view; namely, the manufacturer and the consumer. The manufacturer can be influenced only by the demands of his customers. If any considerable number of them ask for one thing, although he may decline the first few orders, the constant dropping will finally wear away the stone, and the article asked for will be added to his regular stock list.

Therefore, it must remain for us as individual customers, after committees, etc., have furnished the necessary information, to produce uniformity in the graduation and use of volumetric apparatus by instituting an overwhelming demand for the proper kind.

LABORATORY AND GRADUATING DEPARTMENT
OF WHITALL, TATUM & CO., August, 1898.

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# THE ALKALINE REACTION OF SOME NATURAL SILICATES.[1]

BY F. W. CLARKE.

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THAT pure water exerts a distinct solvent action upon many natural silicates has long been known. As far back as 1848 the Rogers brothers published a series of observations upon this subject,[2] and showed that some species of minerals would

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[1] Read at the Boston meeting of the American Chemical Society, August, 1898.

[2] *Am. J. Sci.* (2), 5, 401.

give an alkaline reaction to test paper. They did not, however, give details concerning the individual minerals thus investigated. The more recent researches of Daubrée and of Cossa are well known.

By the use of phenolphthalein as an indicator the alkalinity of many silicates can be demonstrated with the utmost ease, and the experiments described below serve to bring out very clearly the relative decomposability of certain minerals and rocks by pure water. The method adopted was as follows: A series of glass-stoppered bottles was placed against a white background. In each bottle half a gram of finely pulverized mineral was put, and then fifty cc. of distilled water, containing a very little alcoholic phenolphthalein, was added. As the indicator was mixed, once for all, with the total amount of water taken for the entire series, the twenty-two samples examined were treated exactly alike. Two of the bottles were filled with the water and indicator in blank, in order that possible action upon the glass itself might be detected if it occurred. The two blanks, however, remained colorless during the two weeks through which the experiments lasted. The results obtained were as follows:

*Muscovite.*—A doubtful trace of coloration, which soon disappeared.

*Lepidolite.*—Like muscovite.

*Phlogopite.*—The peculiar non-fluoriferous variety from Edwards, N. Y. Gave a very distinct, permanent, pink coloration.

*Orthoclase.*—A trace of coloration which increased for a few days and then faded.

*Oligoclase.*—The transparent variety from Bakersville, N. C. Distinct and permanent, but pale coloration.

*Albite.*—From Amelia County, Va. Gave a good, permanent, alkaline reaction.

*Leucite.*—A slight reaction at first, which faded in a few days.

*Nephelite.*—The elaeolite from Litchfield, Maine. Good coloration, but partly fading in time.

*Cancrinite.*—Litchfield, Maine. Gives a deep rose coloration, which is permanent.

*Sodalite.*—From Canada. A deep, permanent rose color.

*Spodumene.*—The transparent, yellow variety from Brazil. A good reaction, but gradually fading.

*Scapolite.*—The wernerite from St. Lawrence County, N. Y. Gave a faint, evanescent trace of coloration.

*Laumontite.*—A doubtful trace of coloration.

*Stilbite.*—Faint, evanescent coloration.

*Chabazite.*—Like stilbite.

*Heulandite.*—Slight reaction, but distinct.

*Thomsonite.*—Variety lintonite. A fairly strong reaction, fading in time.

*Analcite.*—Good alkaline reaction.

*Natrolite.*—From Bohemia. Strong coloration, permanent.

*Pectolite.*—From Bergen Hill. Gave a very deep rose color.

*Apophyllite.*—From Bergen Hill. A very deep rose color.

In nearly every case the reaction was obtained at once, showing a more rapid action of water upon the silicate than had been anticipated. In some instances fading is noted. This is doubtless due, in general, to the action of light; but in certain cases the colored solution separated into two layers, the color being wholly in the lower. Here the color was really held as a coating upon the fine solid particles, and as they subsided the appearance of stratification was produced. Towards the end of the experiments the mineral aegirite was added to the series. This also gave a strong alkaline reaction and a fairly deep rose color.

A neat method of demonstrating the reactions described above is the following: Place a little of the mineral to be tested in a watch-glass upon a sheet of white paper. Add a drop of alcoholic phenolphthalein solution, and then a few drops of pure water; in most cases the reaction is given instantaneously. Orthoclase gave no coloration, leucite a trace, and scapolite a trace; albite, nephelite, and phlogopite furnished distinct reactions. Under the same circumstances thomsonite, aegirite, natrolite, cancrinite, sodalite, pectolite, and apophyllite gave immediately a deep, rich, rose color. The strongest alkaline reactions seemed to be given by pectolite and apophyllite.

In general, the order of intensity of the color produced was what might have been expected. Among the micas, muscovite and lepidolite showed little or no solubility, while phlogopite was distinctly attacked. In nature the magnesian micas are far more easily alterable than muscovite, a fact which is reiterated by these experiments. Again, orthoclase was slightly dissolved, albite much more so, and oligoclase gave a reaction between the two ; that is, more than the one, less than the other. In other words, the plagioclase feldspars alter more easily than orthoclase, as is apparent in the study of the rocks themselves.

In order to bring out the latter point more clearly, a series of rocks which had been analyzed in the laboratory of the U. S. Geological Survey, was placed in a row of bottles, and treated just as the mineral species had been, with water and phenolphthalein. A granite and an amphibole gabbro gave no alkaline reaction. A rhyolite, trachyte, leucite basalt, feldspar basalt, and diorite gave faint traces of color. Granitite, gneiss, phonolite, diabase, and camptonite yielded distinct alkaline colorations.

In all of these instances the production of color is doubtless due to the solution from the mineral or rock of alkaline silicates. The noteworthy point is the quickness with which the reaction can be obtained. With minerals like cancrinite, sodalite, natrolite, pectolite, and apophyllite, the reaction is striking enough to be used as a lecture-table experiment.

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[CONTRIBUTION FROM THE LABORATORIES OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.]

# THE SOLUBILITY OF SALTS OF WEAK ACIDS IN STRONGER ACIDS.[1]

BY ARTHUR A. NOYES AND DAVID SCHWARTZ.

Received August 29, 1898.

## I. PURPOSE OF THE INVESTIGATION.

THE theory of the influence of one electrolyte on the solubility of another whose ions differ from those of the first, has up to this time, in spite of the practical importance of the question, been developed and tested only in a very incomplete way. A few years ago, to be sure, the influence on the solubility of a strongly dissociated salt by another of approximately the same dissociation was calculated by one of us,[2] and was experimentally determined in the case of thallium chloride in

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[1] Read at the Boston Meeting of the American Chemical Society, August, 1898.

[2] *Ztschr. phys. Chem.*, 6, 262.