isfactory, it was decided this year to enlarge the scope of the association, so that it now includes "the consideration of uniformity and accuracy in the analysis of fertilizers, soils, cattle-foods, dairy products, and other materials connected with agricultural industry," and "affords opportunity for the discussion of matters of interest to agricultural chemists." All persons exercising official control of the materials above named, or who are connected with departments of agriculture, agricultural experiment-stations, agricultural colleges, and state boards of agriculture, are eligible to membership. Under this extension of its field, the association will, no doubt, do as much for the improvement in accuracy and uniformity of the analysis of other materials as it has done for fertilizers.

The Proceedings contain the reports of committees on the estimation of phosphoric acid, nitrogen, and potash, the discussion of the previous year's experience, and concludes with the official methods adopted for the ensuing year.

The officers elected and the committees appointed by the president are as follows: — president, Dr. E. H. Jenkins of the Connecticut agricultural experiment-station; vice-president, Mr. P. E. Chazal, state chemist of South Carolina; secretary and treasurer, Clifford Richardson of the U. S. department of agriculture. Members of the executive committee: Dr. H. W. Wiley of the U. S. department of agriculture, Prof. M. A. Scovell of the Kentucky agricultural experiment-station. Other committees: phosphoric acid, Prof. W. C. Stubbs (Baton Rouge, La.), Prof. W. E. Moses (Knoxville, Tenn.), Dr. C. W. Dabney, jun. (Raleigh, N.C.); nitrogen, Dr. W. J. Gascoyne (Richmond, Va.), Mr. P. E. Chazal (Columbia, S.C.), Prof. M. A. Scovell (Lexington, Ky.); potash, Mr. Clifford Richardson (Washington, D.C.), Prof. H. A. Huston (Lafayette, Ind.), Prof. W. W. Cook (Burlington, Vt.); feeding-stuffs, Dr. G. C. Caldwell (Ithaca, N.Y.), Prof. W. H. Jordan (Orono, Me.), Mr. Clifford Richardson (Washington, D.C.); dairy products, Dr. H. W. Wiley (Washington, D.C.), Dr. S. M. Babcock (Geneva, N.Y.), Prof. H. P. Armsby (Madison, Wis.).

## *ARTIFICIAL RUBIES.*

THE subject of artificial gems is at the present moment of considerable interest, not only financially, but also as furnishing an example of the manner in which the microscope is constantly called into use by almost every profession. Early this summer the Syndicate des diamants et pierres precieuses were informed that certain stones which had been sold as rubies from a new locality were suspected to be of artificial origin. They were put upon the market by a Geneva house; and it was surmised that they were obtained by the fusion of large numbers of small rubies, worth at the most a few dollars a carat, into one fine gem worth from $1,000 to $2,500 a carat.

Some of these artificial stones were kindly pro-

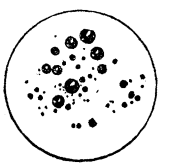

FIG. 1. — SPHERICAL CAVITIES IN ARTIFICIAL RUBY AS SEEN AT ONE TIME (ENLARGED 75 DIAMETERS).

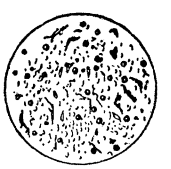

FIG. 2. — SPHERICAL AND IRREGULAR CAVITIES IN ARTIFICIAL RUBY AS SEEN AT ONE TIME, EVIDENTLY FROM THE LOWER PART OF THE CRUCIBLE (ENLARGED 25 DIAMETERS).

FIG. 3. — ACICULAR CRYSTALS IN SAPPHIRE (ENLARGED 100 DIAMETERS).

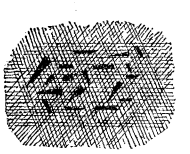

FIG. 4. — CUNEIFORM CRYSTALS IN RUBY AND SAPPHIRE (ENLARGED 200 DIAMETERS).

cured for me by Messrs. Tiffany & Co. I was not, however, permitted to break them for analysis, to observe the cleavage, or to have them cut so that I could observe the optical axes more correctly. I would at any time have detected the artificial nature of this production with a mere pocket-lens, as the whole structure is that peculiar to fused masses. Examination elicited the following facts. The principal distinguishing characteristic between these and the genuine stones is the presence *in*

them of large numbers of spherical bubbles, rarely pear-shaped, sometimes containing stringy portions showing how the bubbles had moved. These bubbles all have rounded ends, and present the same appearance as those seen in glass or other fused mixtures. They are nearly always in wavy groups or cloudy masses. When examined individually, they always seem to be filled with gas or air, and often form part of a cloud, the rest having the waviness of a fused mixture. Some few were observed enclosing inner bubbles, apparently a double cavity, but empty. In natural rubies the cavities are always angular or crystalline in outline, and are usually filled with some liquid, or, if they form part of a 'feather,' as it is called by the jewellers, they are often arranged with the lines of growth. Hence the difference in appearance between the cavities in the natural gem and those in the fused gem is very great, and can readily be detected by the pocket-lens. I have failed to find in any of the artificial stones even a trace of any thing like a crystalline or angular cavity. Another distinguishing characteristic is that in many genuine rubies we find a silky structure (called 'silk' by the jewellers), which, if examined under the microscope or under a $\frac{4}{10}$ to $\frac{8}{10}$ inch objective, we find to be a series of cuneiform or acicular crystals, often iridescent, and arranged parallel with the hexagonal layers of the crystal. When in sufficient number, these acicular and arrow-shaped crystals produce the asteria or star effect, if the gem is cut in *en cabochon* form, with the centre of the hexagonal prism on the top of the cabochon. I have failed to find any of them in the stones under consideration, or even any of the marking of the hexagonal crystal which can often be seen when a gem is held in a good light, and the light allowed to strike obliquely across the hexagonal prism. Dr. Isaac Lea has suggested[1] that these acicular crystals are rutile, and interesting facts and illustrations have been published by him. From my own observations on many specimens, I believe there is little doubt of the truth of this hypothesis.[2] My explanation is, that they were deposited from a solution, either heated or cold, while the corundum was crystallizing, and I doubt very much whether they will ever be found in any substance formed by fusion.

The hardness of these stones I found to be about the same as that of the true ruby, 8.8 or a trifle less than 9, the only difference being that the artificial stones were a trifle more brittle. The testing-point used was a Siamese green sapphire, and the scratch made by it was a little broader but no deeper than on a true ruby, as is usually the case with a brittle material. After several trials, I faintly scratched it with chrysoberyl, which will also slightly mark the true ruby.

The specific gravity of these stones I found to be 3.93 and 3.95. The true ruby ranging from 3.98 to 4.01, it will be seen that the difference is very slight, and due doubtless to the presence of the included bubbles in the artificial stones, which would slightly decrease the density. As a test, this is too delicate for jewellers' use; for if a true ruby were not entirely clean, or a few of the bubbles that sometimes settle on gems in taking specific gravities were allowed to remain undisturbed, it would have about the same specific gravity as one of these artificial stones.

I found, on examination by the dichroscope, that the ordinary image was cardinal red, and the extraordinary image a salmon red, as in the true ruby of the same color. Under the polariscope, what I believe to be annular rings were observed. With the spectroscope, the red ruby line, somewhat similar to that in the true gem, is distinguishable, although perhaps a little nearer the dark end of the spectrum.

The color of all the stones examined was good, but not one was so brilliant as a very fine ruby. The cabochons were all duller than fine, true stones, though better than poor ones. They did not differ much in color, however, and were evidently made by one exact process or at one time. Their dull appearance is evidently due in part to the bubbles. The optical properties of these stones are such that they are evidently individual or parts of individual crystals, and not agglomerations of crystals or groups fused by heating.

In my opinion, these artificial rubies were produced by a process similar to that described by Fremy and Feil (*Comptes rendus*, 1877, p. 1029), — by fusing an aluminate of lead in connection with silica in a siliceous crucible, the silica uniting with the lead to form a lead glass, and liberating the alumina, which crystallizes out in the form of corundum in hexagonal plates, with a specific gravity of 4.0 to 4.1, and the hardness and color of the natural ruby, the latter being produced by the addition of some chromium salt. By this method, rubies were formed, that, like the true gem, were decolorized temporarily by heating.

It is not probable that these stones were formed by Gaudin's method (*Comptes rendus*, xix. p. 1342), — by exposing amorphous alumina to the flame of the oxyhydrogen blowpipe, and thus fusing it to a limpid fluid, which, when cooled, had the hardness of corundum, but only the specific gravity 3.45, much below that of these stones. Nor is it at all likely that they were produced by fusing a large number of natural rubies or corundum of

[1] Proc. Philad. acad. sc., Feb. 16, 1869, and May, 1876.

[2] Paper on star garnets, N. Y. acad. sc., May, 1886.

small size, because by this process the specific gravity is lowered to that of Gaudin's product. The same also holds good of quartz, beryl, etc.

The French syndicate referred the matter to M. Friedel of the Ecole des mines, Paris, supplying him with samples of the stones for examination. He reported the presence of the round and pear-shaped bubbles, and determined the hardness and specific gravity to be about the same as of the true ruby. On analysis, he found them to consist of alumina, with a trace of chromium for the coloring-matter. The cleavage was not in all cases distinct; and the rough pieces given to him as examples of the gem in its native state had all been worked, so that nothing could be learned of their crystalline structure. When properly cut according to axes, they showed the annular rings. The extinction by parallel light was not always perfect, which he believed to be due to the presence of the bubbles. He states that he himself has obtained small red globules with these inclusions by fusing alumina by oxyhydrogen light; and, although having no positive evidence, he believes these stones to be artificially obtained by fusion.

On the receipt of M. Friedel's report, the syndicate decided that all cabochon or cut stones of this kind shall be sold as *artificial*, and not precious gems. Unless consignments are so marked, the sales will be condsidered fraudulent, and the misdemeanor punishable under the penal code. All sales effected thus far, amounting to some 600,000 or 800,000 francs, shall be cancelled, and the money and stones returned to their respective owners.

The action taken by the syndicate has fully settled the position which this production will take among gem-dealers, and there is little reason to fear that the true ruby will ever lose the place it has occupied for so many centuries. These stones show the triumphs of modern science in chemistry, it is true; and although some may be willing to have the easily attainable, there are others who will almost want, what the true ruby is becoming to-day, the unattainable. One will be nature's gem, and the other the gem made by man.

I presented this paper at the meeting of the New York academy of sciences, Oct. 4.

GEO. F. KUNZ.

## *A DULL BOOK.*

WITH the exception of the members of the Royal geographical society, perhaps no body of men has done more to advance our knowledge of the geography of the earth's surface than the American missionaries taken as a class. Explorer after explorer has acknowledged his indebtedness to them for the most important successes of his exploration. Yet how little they have written, and how worthless, comparatively speaking, is that little! The present volume is no exception to this rule. The author had abundant opportunity to see and learn, and he undoubtedly saw and learned a great deal. Every page of the volume attests his knowledge of the country of which he is writing; but somehow he has not told of the things one wishes to know, while he has encumbered his book with facts that have little or no interest, and, what is more to be regretted, he has said what he has said in the most wretched English.

There are a few interesting passages in the volume, especially one where he describes the harem, or shrine, of the Imam Reza at the city of Khorasan, more often called Mashad. Singularly enough, he did not see the shrine itself, and got his description second-hand, from an artist whom he employed to paint a representation of it for him. The book further contains the most recent description of the government and social state of Persia that we have: it therefore has a value not dependent on the amount of interest one feels in its perusal. There are, in addition, good accounts of his journeyings in the region between the Black and Caspian seas; but, unfortunately, these regions have been so recently described by more entertaining, though not more competent writers, that this portion of the work lacks the charm of novelty, to say the least.

One other objection to the volume is to be found in the new and fantastic spelling of proper names adopted by the author. He says in his preface that in the orthography of Persian and Arabic names he "endeavored to adhere to the Persian and Arabic forms. In some instances this, however, did not seem to be expedient." One wishes that he had more often retained the more usual spelling. The best feature of the book, and one which goes a good way towards giving it a value at the present time, is the good map of Persia and its border regions, prepared by the author. In its preparation, special attention was given to the details of the eastern border. In conclusion, we are heartily sorry that the book was not published eighteen months ago, when it would have received more attention.

*Persia, the land of the Imams.* By JAMES BASSETT. New York, *Scribner*, 1886.

## *NOTES AND NEWS.*

ONE of the tasks, says *Nature*, Sept. 23, undertaken by the British museum since printing has taken the place of writing in the Catalogue, is the publication of certain important sections of the Catalogue in separate parts. Thus the entries