

GEL MINERALS (COLLOID MINERALS)

CYRIL W. GREENLAND

*Cornell University**(Continued from page 138)*

It is the belief of the writer that considerable confusion has arisen over the significance of the property of taking up dyes. When a mineral is in a hydrogel condition it is capable of adsorbing foreign matter but, upon drying out, this property is lost to a greater or less extent. Dittler pointed out, further, that the rate of decolorization of a dye solution seems to be dependent on the water content of the mineral powder. Also, that the acid and basic character of the mineral is a considerable factor,—the more acid a gel the more quickly it seems to adsorb a dye. From the experiments performed by the writer, he has been led to believe that the power of taking up dyes may be due in large part to capillarity, induced by structures such as granularity, strain cracks, drying cracks, cleavage and porosity, which may occur in crystalline minerals as well as in gels.

The conclusion to be drawn, then, is that the adsorptive properties of minerals are not reliable for the determination of their gel character.

The method of attack was as follows: The preliminary treatment was like that employed in "The Determination of Minerals of Non-Metallic Lustre."¹⁴ The mineral was crushed (not ground) to pass a 100-mesh screen and be retained on 120-mesh. The crushed material, carefully sized, was then treated with dye solutions of different strengths and at different temperatures. After filtration and washing the fragments were examined under the microscope. It was found that classification on this basis was not at all satisfactory. For example, samples of the same substance from different localities gave in the majority of cases widely different results. This was due to the difference in content of water, structures, etc.

The same objections apply to the use of highly colored mineral salts, such as potassium dichromate and copper sulfate. The mineral was boiled with a solution of potassium dichromate, filtered and washed, and a dilute solution of silver nitrate added to the fragments on a slide glass; in some cases the reddish-brown

¹⁴ *School Mines Quart.*, 34 (4), 1913.

precipitate stained the fragments thruout. This method seemed to be the most practical and is to be recommended for the determination of gel minerals where the adsorptive property is used. It, however, has limitations and allowances must be made for capillarity, etc., in crystalline minerals.

Another method used was staining with copper sulfate. Here the fragments, after boiling, filtering and washing, were treated on a slide glass with dilute ammonia. The method has the disadvantage of there being an interchange of copper ion in some cases, especially with the aluminium silicate gels such as halloysite, allophanite, etc.

Another attempt with tincture of iodine was made. The procedure was to allow the mineral fragments to soak in a solution of iodine for half an hour. Upon removal, and after rinsing with water, dilute ammonia was added, on a slide glass. The ammonia decolorized the iodine too rapidly for any useful result to be obtained from this method.

After apparent failure with dyestuffs, another method of attack was investigated. The possibility of obtaining colloidal solutions by simply boiling a gel mineral in water and filtering thru the best grade of filter paper obtainable, was the principle underlying the procedure. The mineral, finely powdered, was boiled in water for half an hour. After filtering through five filters, careful precautions being taken to avoid the entrance of dust, the filtrate was observed by means of the apparatus described under Tyndall ray phenomena (see first instalment).

Powdered opal gave an opalescent solution which showed a marked Tyndall cone. Psilomelanite and wad similarly treated gave a less marked Tyndall effect. However, if larger particles of opal, free from powder, were treated in the same manner, no opalescent solution was obtained, and the Tyndall light cone diminished greatly. Calcite, carefully sized between 100 and 120 mesh, and treated in the same manner, also gave a positive Tyndall effect. Finely powdered quartz (crystallized) gave the same results.

The conclusion to be drawn from this is that the effect produced is merely the result of fine grinding, of disintegration due to boiling, or of a combination of both. No reliance can be placed upon the method whereby simple solutions of the gel mineral in water are employed.

In experimenting with a few samples of clayey material the

writer obtained one which was fairly plastic and which removed the coloring matter from methylene-blue solution. After digesting with the dye the clayey matter was examined under the microscope and some flaky sericite particles it contained were seen to have taken up the dyestuff between fine cleavage plates. This would tend to cast some doubt upon the results Ashley¹⁵ obtained for the determination of the plasticity in clays from their adsorptive power, regarded by him as due entirely to colloidal matter.

Bibliography.—An elaborate summary of the older literature of gel minerals has been compiled by Himmelbauer;¹⁶ space will not permit its reproduction here. More recent articles are abstracted in *Chemical Abstracts* and in various mineralogical publications.

Conclusion.—The original object of this paper was to secure some method for the certain identification of minerals as gel minerals. However, few new facts of a positive nature have been obtained. This is due mainly to the fact that much more experimental data is necessary, and any conclusions which may be drawn from present results are merely tentative and subject to revision.

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PROCEEDINGS OF SOCIETIES

PHILADELPHIA MINERALOGICAL SOCIETY

The Wagner Free Institute of Science

The Philadelphia Mineralogical Society held its twenty-fifth anniversary meeting on October 11, 1917, with President Leffmann in the chair.

Messrs. Leffmann, Rothermel, Allen, M. Bernstein, Bradford, Egee, Flack, Gordon, Geist, Groth, Herwegh, Jones, Knabe, Koch, Munson, Oldach, Trudell, Warford, Wherry and eight visitors, were present.

Dr. Leffmann made a brief address on the modern development of mineralogy.

Dr. Wherry outlined how he had become acquainted with the P. M. S. and how he came to make his first contribution to mineralogy. He then described his new work in the Bureau of Chemistry, U. S. Dept. of Agriculture. A thoro study of the optical-crystallographic properties of materials entering into foods and drugs is contemplated, along similar lines to past work in mineralogy. Heretofore the possibilities of the petrographic microscope in the quick and accurate determination of chemical substances outside of minerals have been little appreciated.

¹⁵ *Bull.* 388, U. S. Geol. Survey, 1909.

¹⁶ *Fortschritte Mineralogie, etc.*, 3, 1913.