A. Dickite from Pine Knot Colliery, Schuylkill Co., Pa.

B. Dickite from National Bell Mine, Red Mountain, Colorado, after J. W. Gruner "The Crystal Structure of Dickite" *Zeit. Kryst.*, (A), Bd. **83,** Heft 5/6, 1932.

C. Dickite from National Bell Mine, Ouray, Colorado, after C. S. Ross and P. F. Kerr "The Kaolin Minerals" **165-E,** *U.S.G.S.*, Prof. Paper, 1932.

D. Kaolinite from subway tunnel at Brooklyn, N. Y. After J. W. Gruner, "The Crystal Structure of Kaolinite," *Zeit. Kryst.*, (A) Bd. **83,** Heft 1/2, 1932.

E. Nacrite from Brand, Saxony, after J. W. Gruner, *Zeit. Kryst.*, (A) **85,** 345–354, 1933.

A PETROGRAPHIC USE OF FLUORESCENCE

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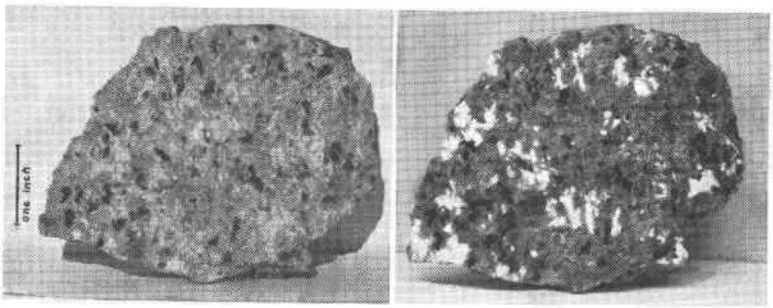
The use of fluorescence in determining the relative abundance, distribution, and textural relationships of minerals which are not readily distinguished in ordinary light is not new. So far as the writer is aware, this has been applied mainly to mineralogy rather than to petrography. The purpose of this short paper is to call attention to one rather specialized use of this method in petrography and to describe briefly how photographs of fluorescent minerals may be taken to show petrographic relationships that would hardly be possible in ordinary light.

The writer is engaged in a study of the rocks of Red Hill, N. H., among which is the interesting nephelite syenite, or foyaite, described by Pirsson.[1] Because of the great variation shown by different thin-sections of this rock from the same or nearby localities an attempt has been made to study the relationships of the minerals in large specimens. To accomplish this purpose satisfactorily it is desirable to be able to distinguish at a glance as many of the main constituents as possible. Macroscopically, the rock is composed of potash feldspar, nephelite, sodalite, and hornblende. The hornblende, of course, is easily distinguished from the rest of the minerals. The feldspathoids are different from the feldspar by possessing a more greasy luster, but that distinction is not sufficiently marked so that one can see readily the existing relationships. On certain exposed surfaces the feldspathoids have weathered in such a manner as to leave pits which make the relationships rather apparent. The distinction between the nephelite and the sodalite is hardly possible to the unaided eye, however. Progress

[1] Pirsson, L. V., and Washington, H. S., Contributions to the Geology of New Hampshire, no. III, On Red Hill, Moultonboro: *Am. Jour. Sci.*, vol. **23** (4th series), pp. 266–274, 1907.

towards making this distinction was made when it was discovered that certain specimens of nephelite syenite contain grains that fluoresce in an orange-red color when exposed to a mercury vapor tube. Further study has revealed that the fluorescent material was not nephelite, as had been suspected, but sodalite. That made it possible to trace very readily certain petrographic relationships, because a large number of specimens could be examined in a very short time. Thus, it became apparent immediately that sodalite is an irregular, but much more abundant constituent than had been supposed: Pirsson had stated that the rock contained about five



A B

Fig. 1

A. Nephelite syenite in white light.

B. Nephelite syenite (same specimen as A) in ultraviolet light. White is fluorescent sodalite. Black is hornblende. Gray is feldspar and nephelite.

per cent of sodalite.[2] Different parts of the same specimen may contain widely varying amounts of sodalite and the size of the grains varies greatly in different specimens and even in the same specimen. It became obvious that any one thin-section would probably not be representative. This method is of little use for weathered specimens, however, for the weathered surfaces of sodalite grains fluoresce not at all, or possibly in a faint greenish color.

The fluorescence of sodalite in this rock is an aid not only to the student handling the rocks in the laboratory, but it also adds to the possibilities of demonstration to others, through photographs showing the relationships of this one constituent. The accompanying photographs are of the same specimen, one taken in ordinary white light and one in ultra-violet light. They show very clearly

[2] Pirsson, L. V., and Washington, H. S., *loc. cit.*, p. 272.

the relationships of three groups of constituents: (1) the hornblende in black, (2) the sodalite in white, and (3) the feldspar and the nephelite in gray. As yet, no method has been discovered for distinguishing clearly the nephelite from the feldspar, although B seems to show the nephelite in a darker gray than the feldspar and certain enlargements of this picture make this distinction slightly more pronounced.

An extensive study of the possibilities of obtaining photographs of this sort has not been made, but one fairly successful method for this particular set of rocks was developed. It is, herewith, described briefly. "Defender X-Fast Panchromatic" film was used. Much of the violet and ultra-violet light was filtered out by filters of the type described in this journal by Stephens.[3] The equivalent of two "G" or "Wratten 16" filters and one filter composed of four sheets of red cellophane were placed over the lens of the camera. The exposure time was forty-five minutes and the aperture was set at F-16. Other procedures might prove equally or more successful for this particular rock. Other rocks would almost certainly demand different methods because of varying colors and intensities of light.

It is not expected that this use of fluorescence will become general, for only a few rocks or mineral assemblages show relationships clearer under ultra-violet light than in white light. Not all nephelite syenite rocks have fluorescent constituents and not all sodalite fluoresces. It is expected that other special uses such as herein described will be found and that occasionally the method will have considerable value.

[3] Stephens, Maynard M., Photography for the mineralogist: *Am. Mineral.*, vol. **18**, pp. 253–254, 1933.