STARKEYITE, A CORRECTION

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Starkeyite[1] was described as a new mineral by the writer in 1945. It was found as a dull, white, powdery efflorescence on an altered mixture of pyrite and marcasite at the Starkey Mine in Madison County, Missouri. The country rock is a gray, granular glauconitic dolomite containing vugs lined with dolomite crystals. The dolomite rests upon a white friable sandstone and laps against a Precambrian felsite porphyry.

The association of the efflorescence with iron disulfide, qualitative tests for iron, and especially the agreement between the *x*-ray diffraction data for the new mineral and that for $FeSO_4 \cdot 4H_2O$ led the writer to believe the composition of the mineral to be $FeSO_4 \cdot 4H_2O$. However, upon publication of data on the new mineral, Dr. Michael Fleischer[2] of the United States Geological Survey reported that Dr. W. T. Schaller had called his attention to the fact that the refractive index reported for starkeyite, 1.496, did not conform to the progression of indices for other hydrated iron sulfates when these are arranged in order of decreasing degree of hydration. The writer submitted a sample of the mineral to Dr. Fleischer for checking. As a result of further checking of the mineral at the United States Geological Survey, the refractive index reported by the writer was found to be correct. A partial analysis by the late Norman Davidson gave FeO 0.9, MgO 14.5, insol. in HCl 6.9 per cent. The powder diffraction patterns for $MgSO_4 \cdot 4H_2O$ and $FeSO_4 \cdot 4H_2O$ are nearly identical, which accounts for the writer's elementary error. On the basis of the analysis made at the United States Geological Survey, the composition of starkeyite should be $MgSO_4 \cdot 4H_2O$.

[1] Grawe, Oliver R. (1945), Pyrite deposits of Missouri: *Missouri Geological Survey and Water Resources*, pp. 209–210.

[2] Fleischer, Michael, Personal Communications, December 12, 1945 and January 24, 1946.

IMPROVED TECHNIQUES FOR STAINING POTASH FELDSPARS*

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INTRODUCTION

Chayes (1952) has described techniques for staining potash feldspar in thin sections so that it may be readily distinguished from quartz and untwinned plagioclase feldspar. His techniques were based upon earlier papers on the subject by Gabriel and Cox (1929) and Keith

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(1939). This note describes modifications of Chayes' techniques that have been tested and used in a field office of the U. S. Geological Survey since March, 1954, with rapid and satisfactory results. Chayes' techniques were tried, using equipment described by him, but difficulties in manipulation of the equipment and uneven stains tended to discourage routine staining of thin sections. The following modifications of these techniques allow greater ease and control of the HF etch, and a simpler method of applying the cobaltinitrite stain. No attempt was made to test these modifications upon Na-rich potassium feldspars—the need for such tests never arose in our work—but we anticipate that the quality of the stain will be as poor as Chayes reported it to be.

THE HF ETCH

Chayes described a plastic butter dish cover, to hold HF acid, and a tray to support uncovered slides, face up, above the acid. When the tray is placed on plastic supports in the bath and covered by the bottom of the butter dish, fumes from the warmed HF rise around the slides and etch the minerals in the thin section for 30 seconds to prepare them for staining. We found that HF fumes, welling up and over the slides, etched the peripheries of the slides more than the centers, despite care in controlling the temperatures of the slides and the HF bath. A much more even HF etch is possible by placing slides face down over HF at room temperature (ca. 20° C.) in a small plastic fly-box (obtainable at most fishing-supply stores). Not only is the etch more easily controlled, but no backing is required on the slides since only the rock surfaces are exposed to HF fumes. Our present equipment is a 4-compartment box; each compartment is 1 inch by almost $1\frac{1}{2}$ inches and $\frac{1}{2}$ inch deep. The bottoms of 2 diagonal compartments are just covered with HF and two 1-inch by 2-inch slides (at room temperature) are etched at the same time for about 15 seconds. Similar results were achieved by H. W. Jaffe (1955, written communication) using an elongate lead dish upon which 6 or 8 thin sections were etched at one time.

An exposure of about 15 seconds was found to yield an evenly etched surface able to take any desired intensity of stain for thin sections: the intensity of the stain is controlled by the exposure to the staining solution. An etch of more than 30 seconds by this method is likely to cause pitting on the surface of potash feldspar and produce uneven, intense staining with many irregular clear areas in each grain. Thin sections should be thoroughly dry before etching to avoid solution of HF fumes in tiny water droplets and consequent over-etching. Before staining, HF fumes should be blown away or allowed to dissipate.

The acid may be stored in the fly-box by covering with the close-fitting lid and placing it in a cool place, but in practice it has been poured back into a plastic bottle using a plastic funnel in order to reduce the danger of accidental spilling.

The Cobaltinitrite Stain

In place of Chayes' method of agitating slides (presumably one at a time) in the staining solution for 2 to 3 minutes, we stain 5 sections at a time in a Coplin jar filled with this same solution (ca. 60 grams sodium cobaltinitrite per 100 ml. water) for 15 to 20 seconds. Coplin jars, used by the medical profession for staining tissue sections, come provided with screw caps so that the staining solution may be stored in the jar when not in use. After staining, slides should be rinsed immediately in a gentle flow of cold water and allowed to dry thoroughly before covering.

Neither the rapidity of etching and staining nor the re-use of staining solution has caused any harm to any of the several hundred slides stained to date. A pale yellow color, just enough to distinguish potash feldspar from plagioclase feldspar and quartz rapidly in plane-polarized light, is the goal which has dictated the etch- and stain-periods given above. Notable success was achieved with numerous calcalkalic plutonic rocks and with the few metamorphic, arkosic, gabbroic, and syenitic rocks that were tried.

The clay minerals in altered rocks absorb the cobaltinitrite stain, but these may be distinguished by their unevenness in stain, their microcrystalline hummocky surfaces, and where potash feldspar is present for comparison, their different intensity of color.

Overstained thin sections may be restained by first gently rubbing the surface with "600 alundum" to remove the debris of the last etch and stain. According to Chayes (1955, written communication) the stain may also be removed with warm dilute HCl. After thoroughly drying the thin section, it may again be etched and stained as outlined above. Merely running warm water over the intensely stained surface will wash the stain out of the section, but in trying to lighten the stain by this means, we have had limited success. In most cases the stain is removed differentially and the result is blotchy; occasionally the result is usable.

References

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