A STAINING METHOD FOR THE QUANTITATIVE DETERMINATION OF CERTAIN ROCK MINERALS

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Introduction

Speed and accuracy may be increased in the quantitative determination of the more abundant mineral constituents in thin sections or polished surfaces of igneous rocks, or in the sands or grains derived from them, by decomposing the surface of the mineral constituents with hydrofluoric acid, and then very carefully immersing this in a concentrated sodium cobaltinitrite solution. This reagent produces a precipitate of yellow potassium cobaltinitrite on the potash feldspars which clings tenaciously to them. No precipitate is formed on the plagioclases. After this simple treatment the potash feldspars are intensely yellow, quartz is transparent, the plagioclases are white and opaque to transmitted light, the micas remain white or black, depending on the variety, but they can be differentiated by their flat surfaces. The percentages of the minerals can be determined by grain count.

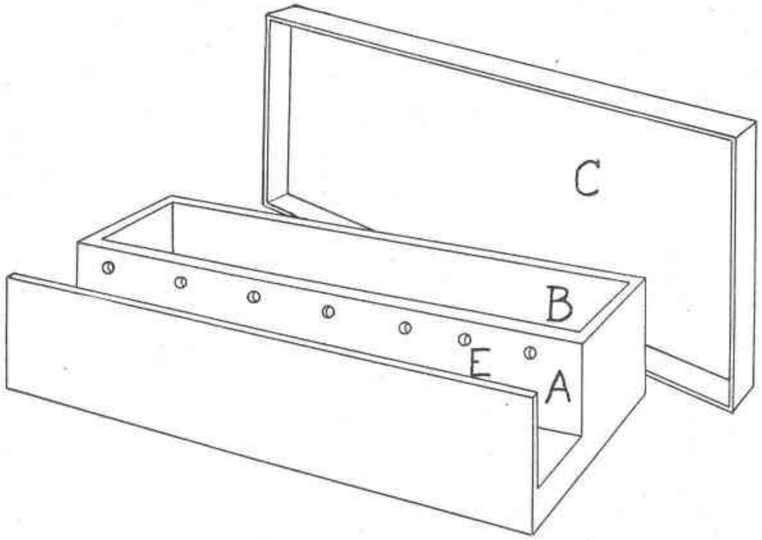

Fig. 1

If the biotite is decomposed by weathering it yields a yellow precipitate and the original black will show through the yellow and give the grain a decided green color. The micas, however, especially muscovite, are not usually decomposed by the treatment.

If desired, the identification of the plagioclases can be further enhanced by the use of a dye such as eosine, which stains them but leaves the potash feldspars predominately yellow.

APPARATUS

The treatment with hydrofluoric acid is carried on in a lead casting consisting of an enclosed chamber on one side and an open channel on the other (See A & B, Fig. 1); the whole covered by a lead top.

A number of lead trays (Fig. 2 D) used to carry the grains or specimens to be etched, are made of such a size as to slip easily in the channel (A). Enough trays are made to more than fill the length of the channel, so that the last, on being inserted, will force the first one out. Thus the cover (Fig. 1 C) need not be removed to take trays from the bath and no corrosive fumes escape into the room. A lead bank (Fig. 2 F) is used to cover the ends of the channel during the etching period as a further precaution against escaping fumes.

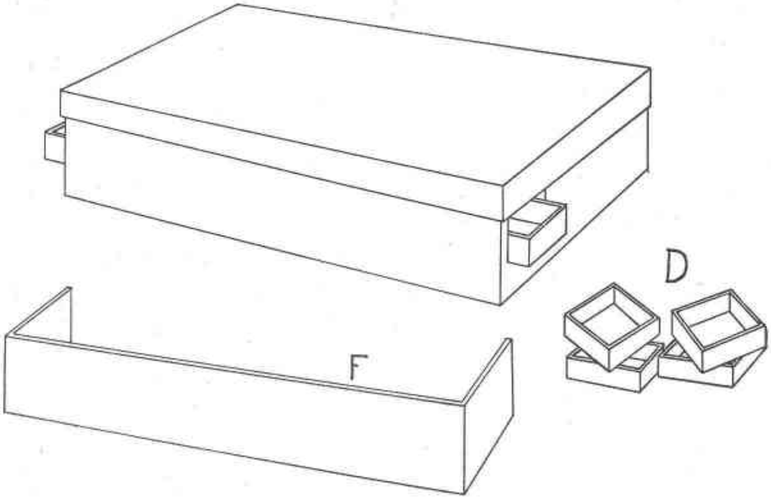

FIG. 2.

The holes in the casting (Fig. 1 E) allow the vapors to pass from B to A and should be large enough to insure a high gas density.

PROCEDURE

The crushed rock or sand sample should pass through a 65 mesh sieve and be caught on a 200 mesh sieve. To reduce the proportion of excessively fine material, the sample should be crushed in the presence of a crystalline sucrose buffer. After crushing the sucrose may be removed by solution in water. The screened sample is well mixed and a representative sample of 0.1 to 0.2 grams is placed, one layer deep, in one of the lead trays (Fig. 2 D). A thick paste of calcium fluoride and sulphuric acid is placed in the channel B, the trays are slid into the lead channel E and exposed to the acid vapors until a faint white coating can be seen on the grain or rock surface. This usually takes about 10 to 12 minutes. A temperature of 60°C to 70°C is maintained throughout the etching period in order to insure a rapid and constant evolution of hydrofluoric acid vapor.

The samples are now transferred to a wide shallow dish and well distributed. A concentrated sodium cobaltinitrite solution is carefully poured over the grains and allowed to remain in contact with them for about one minute. The sodium cobaltinitrite solution can be made by adding 15cc. of glacial acetic acid and 25cc. of water to 12.5 gms. of $Co(NO_3)_2 \cdot 6H_2O$ and 20 gms. of $NaNO_2$.

The sample is then decanted free of the reagent and washed thoroughly with water by further decantation and dried. The grains are now ready for microscopic examination.

Uncovered, thin sections and polished rock surfaces are treated with hydrofluoric acid in a special lead box. After this treatment they are stained and dried and, if required for permanent record, covered with a cover glass. It has been found that the dye changes slightly with time if exposed to the air and is easily removed by abrasion.

ACKNOWLEDGEMENT

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