A SIMPLE TEST FOR THE DETECTION OF THE BERYLLIUM MINERALS[1]

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The beryllium minerals in hand specimens are frequently confused with topaz, quartz, apatite, garnet and other minerals. A simple but specific qualitative chemical test for beryllium would preclude any uncertainty. This paper describes a rapid fluorescent microtest which can be used with assurance for the detection of this element. It is essentially an adaptation of the qualitative (1) and quantitative (2) procedures developed for the determination of beryllium.

The apparatus required consists of a platinum loop, several small pyrex test tubes, a porcelain spot plate (optional), and a source of ultra-violet light. The light source should preferably be a B-H-4 General Electric high-pressure mercury lamp equipped with a Corning Filter #5874. These lamps have a strong emission at 3654 Å and are excellent activators for the production of the fluorescence in the reaction involved here. However, lamps which produce light rich in 2537 Å radiation can be used. The fluorescence produced by the shorter wavelengths (2537 Å) is appreciably weaker than that induced by the longer wavelengths (3654 Å) consequently when such a lamp is used the solutions to be examined should be held about 2 inches from the light source.

The reagents required are:

Fusion mixture, (3:1) sodium carbonate+borax glass.
Hydrochloric acid, (1:1).
Sodium hydroxide, 10%.
1-4 dihydroxyanthraquinone (quinizarin), 0.03% concentration in *C.P.* acetone, kept in a glass-stoppered bottle;

or

1-amino-4-hydroxyanthraquinone, 0.03% concentration in *C.P.* acetone, kept in a glass-stoppered bottle.
(Dropping pipettes with rubber bulbs should not be used for either of the dye solutions, as acetone in contact with rubber reacts to form a brilliant blue fluorescent solution which ruins the test.)

The Test

Make a bead of the fusion mixture in the loop of a platinum wire in the usual manner. Add a single small crystal (about 40 mesh) of the

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mineral to be tested, or touch the bead to some of the powdered material. Heat again to decompose the sample. Dissolve the melt in 6–8 drops of (1:1) hydrochloric acid contained in a small test tube by placing the platinum wire and bead in the acid and warming. Cool the solution, and add 2 drops of either quinizarin or 1-amino-4-hydroxyanthraquinone. After addition of the dye, do not expose the solution to sunlight as strong light decomposes the dye and ruins the test. Add sodium hydroxide dropwise until the solution is purple. Avoid an excess, as this destroys the test. Expose the solution to ultra-violet light in a darkened room and examine for fluorescence. If beryllium is present a strong orange-red fluorescence (5700–6400 Å) is apparent.

The solution may be examined in the original test tube or it may be transferred into a non-fluorescent porcelain spot plate, or a drop of the solution may be placed on a piece of filter paper. The spot plate gives the clearest test.

If iron or manganese hydroxide precipitates upon addition of the sodium hydroxide, a condition which will occur if the mineral is helvite, the following procedure should be used.

Place a small amount (1–2 mg.) of the powdered material in a small test tube and boil with 6–8 drops of 1:1 hydrochloric acid. Make alkaline with an excess of sodium hydroxide. Filter the solution into a clean test tube, cool the solution and add 2 drops of either dye solution. Add hydrochloric acid dropwise until the purple color disappears and then sodium hydroxide until the solution is again purple. Examine for fluorescence as before.

Lithium when present in sufficient amounts will give the same reaction. However, if the small samples recommended are used, a negative test will be obtained with lithium-bearing minerals.

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