

BARIUM TESTS ARE POSITIVE

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A series of qualitative chemical tests and deductions now confirm without doubt the presence of significant amounts of barium within atmospheric samples. Citizens may now begin the process of collecting the sample materials for formal submission to public environmental agencies and private labs for identification. The testing process can be done at modest expense and the results from laboratory analysis can now be qualitatively and independently verified without great difficulty. Any testing service employed will need to be able to demonstrate no vested interest in the outcome of the results, accuracy of method, and the willingness to have the testing process independently monitored.

The material under analysis has been collected by a plate ionizing filter; it may also be collected with conventional fiber filtration over a longer period of time. HEPA filter collection and subsequent electrolysis of the filter material placed in distilled water has also proven successful. Extended time periods may be required to collect a sufficient volume of material for electrolytic processing and external testing preferences. Readers are referred to previous articles^{1,2} for two methods of collection. The use of electrolysis is significant in producing a final compound for testing purposes. The solid materials (powder/ crystals) collected by the plate ionizing filter, assuming they satisfy the test procedures described on this page, will be sufficient for laboratory analysis. Qualitative chemical tests and flame tests positively establish the significant presence of barium compounds within the atmospheric sample.

Citizens with sufficient environmental concern are encouraged to begin this process of sample collection and identification, along with the documentation of the responses of both public and private environmental services.

Additional Notes:

The process of collection and analysis is summarized as follows:

1. Solid materials are collected with the use of a plate ionizing filter or fiber based filters as described previously.^{1,2}
2. The material can be subjected to low power microscopic viewing to verify similarity of material form before proceeding. The powder/crystal material under collection has a tan, beige or gray cast to it. The presence of fibrous materials within the sample is not the focus of this report, and further analysis of those materials may occur at a later time.
3. The solid powder/crystal material that is the subject of this report will

be found to dissolve easily within distilled water. Extremely small samples have been used for all tests as the material requires time and effort to collect in sufficient quantity. For testing purposes, samples of a fraction of a gram have been dissolved within a few milliliters of distilled water.

4. Solutions of higher concentrations, e.g., 1 part solid to 3 parts water will be found to be strongly alkaline. This indicates the presence of a base and hydroxide ions. A pH value of 9 was recorded in the test that is the subject of this report.

5. A weak solution (fraction of a gram to 40ml water) will be found to permit significant electrolysis reactions. A variety of electrodes have been used to verify the chemical results, including aluminum, iron, copper, silver and graphite electrodes. The work at this point establishes the presence of a soluble metallic hydroxide form in solution.

6. Chromatography experiments and comparative analysis allows us to conclude that the atomic mass of the metallic cation under examination is greater than that of copper, or greater than 63.5 atomic mass units.³ Cations under reasonable consideration⁴ therefore include:

Ag^+ , Au^{+2} , Ba^{+2} , Bi^{+3} , Cd^{+2} , Ce^{+4} , Cs^+ , Ga^{+3} , Hg^{+2} , Pb^{+2} , Rb^+ , Sb^{+3} , Sn^{+2} , Sr^{+2}

7. The results of electrolysis with graphite electrodes permits us to conclude that a reactive metal is a component⁵ of the metallic hydroxide under examination.

8. The electrochemical series and the half-reaction electrode potentials are therefore consulted^{6,7} to establish a list of reasonable candidates for the cation of the metallic salt which disassociates in solution to permit electrolysis. The list of candidate cations, with the condition of hydroxide formation included, is now reduced to:

Ba^{+2} , Sr^{+2} , Rb^+ and Cs^+ with oxidation potentials of 2.91, 2.90, 2.98 and 3.03 volts respectively.

It is noticed that this group is now closely confined within the periodic table, and that chemical properties of these elements are in many ways shared. It is also instructive to note the remarkable similarity in the work functions of these elements, which is an expression of the ionization capability of the element.

9. Each of these cations must form a soluble hydroxide. Solubility tables⁸ indicate that these conditions are satisfied by each of the hydroxide forms: $\text{Ba}(\text{OH})_2$, $\text{Sr}(\text{OH})_2$, RbOH and CsOH .

10. Practical levels of worldwide production of the elements are helpful to consider⁹. Barium and strontium both are produced at high tonnage levels worldwide, rubidium and cesium are inconsequential in production. Barium production is stated at 6 million tons per year, strontium at 137,000 tons, cesium at 20 tons and rubidium in such low levels as to not be available. Common hydroxide forms are also to be considered in this analysis. This

reduces the candidate cation list to strontium and barium, whereupon additional conditions of qualitative testing are to be imposed.

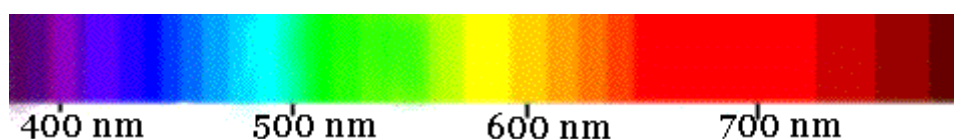
11. The material in solution must produce a cation and a hydroxide ion in solution. Precipitate tests are conducted with carbonate, oxalate and sulfate compounds for the existence of barium or strontium ions, using a combination of the unknown with sodium carbonate, sodium oxalate and copper sulfate¹⁰. The material in question forms a precipitate under all three conditions. The consideration of barium hydroxide and strontium hydroxide continues to be valid under these results.

12. The precipitate formed with the use of copper sulfate is hypothesized to be barium sulfate. The precipitate formed under electrolysis is also hypothesized to be a barium sulphate compound. Solubility tests are necessary to test this hypothesis. The precipitate and the compound formed from electrolysis pass the solubility tests when subjected to water, hydrochloric acid, sulfuric acid and ethanol. The identification of barium sulphate remains valid. The sulfate precipitate fails the solubility test for strontium sulfate, as strontium sulfate is soluble in hydrochloric acid. The sulphate compound that has been formed by both displacement and electrolysis is highly insoluble, and is insoluble in hydrochloric acid.

13. The solubility test for barium carbonate should also be verified. The carbonate precipitate is soluble in hydrochloric acid and passes this test. The identification of barium compounds in the analysis remains valid. No solubility tests for barium oxalate are specified¹¹.

14. The next test which is to be conducted is the flame test. Barium burns yellow-green under the flame test^{12,13}. A sample of the electrolysis compound, identified as barium sulphate, is subjected to a flame test using a nichrome wire. The compound is observed to burn with a yellow-green color. The identification of barium compounds within the analysis is valid under all conditions and circumstances examined.

15. The final test is a viewing of the spectrum of the flame test with a calibrated spectroscope and an optical spectroscope. Dominant green and yellow emission spectral lines are measured at approximately 515 (wider line, boundary line) and 587 nanometers (narrow and distinct), they are confirmed with the optical spectroscope, and they correspond to the green and yellow wavelengths specified for the flame test. A secondary wide line in the green portion of the spectrum borders at approximately 560nm. For comparison purposes, the spectrum of barium chloride and barium hydroxide test salts in solution appears and measures identically within the green portion of the spectrum. The identification of barium compounds within the analysis remains valid under all conditions and examined and tests conducted.



The most reasonable hypothesis at this point is that the original compound is a barium oxide form. This compound readily combines with water to form barium

hydroxide. The ionizing plate filter and the fiber filter both appear to be successful at accumulating the solid form of this metallic salt. Solubility, pH, precipitation, chromatography, electrode, electrolysis, flame, spectroscopy and spectroscopy comparison tests all support the conclusion within this report that significant levels of barium compounds have been verified to exist and are now to be examined in the atmospheric sampling process. This report corroborates, at an elevated level, the previous research that is available on this site.

This page is subject to revision.

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