SPECTROGRAPHIC DETERMINATION

OF CONTAMINATION OF ROCK SAMPLES

AFTER GRINDING WITH ALUMINA CERAMIC

By P. R. Barnett, W. P. Huleatt, L. F. Rader, and A. T. Myers

Trace Elements Investigations Report 417

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
SPECTROGRAPHIC DETERMINATION OF CONTAMINATION OF ROCK SAMPLES AFTER GRINDING WITH ALUMINA CERAMIC*

By

P. R. Barnett, W. P. Huleatt, L. F. Rader, and A. T. Myers

April 1954

Trace Elements Investigations Report 417

This preliminary report is distributed without editorial and technical review for conformity with official standards and nomenclature. It is not for public inspection or quotation.

*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.
### Distribution (Series A)

<table>
<thead>
<tr>
<th>Institution</th>
<th>No. of copies</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Cyanamid Company, Winchester</td>
<td>1</td>
</tr>
<tr>
<td>Argonne National Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Atomic Energy Commission, Washington</td>
<td>2</td>
</tr>
<tr>
<td>Battelle Memorial Institute, Columbus</td>
<td>1</td>
</tr>
<tr>
<td>Carbide and Carbon Chemicals Company, Y-12 Area</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Albuquerque</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Butte</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Denver</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Douglas</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Hot Springs</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Ishpeming</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, New York</td>
<td>6</td>
</tr>
<tr>
<td>Division of Raw Materials, Phoenix</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Richfield</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Salt Lake City</td>
<td>1</td>
</tr>
<tr>
<td>Division of Raw Materials, Washington</td>
<td>3</td>
</tr>
<tr>
<td>Division of Research, Washington</td>
<td>1</td>
</tr>
<tr>
<td>Dow Chemical Company, Pittsburg</td>
<td>1</td>
</tr>
<tr>
<td>Exploration Division, Grand Junction Operations Office</td>
<td>1</td>
</tr>
<tr>
<td>Grand Junction Operations Office</td>
<td>1</td>
</tr>
<tr>
<td>Technical Information Service, Oak Ridge</td>
<td>6</td>
</tr>
<tr>
<td>Tennessee Valley Authority, Wilson Dam</td>
<td>1</td>
</tr>
<tr>
<td>U. S. Geological Survey:</td>
<td></td>
</tr>
<tr>
<td>Alaskan Geology Branch, Washington</td>
<td>1</td>
</tr>
<tr>
<td>Fuels Branch, Washington</td>
<td>1</td>
</tr>
<tr>
<td>Geochemistry and Petrology Branch, Washington</td>
<td>5</td>
</tr>
<tr>
<td>Geophysics Branch, Washington</td>
<td>1</td>
</tr>
<tr>
<td>Mineral Deposits Branch, Washington</td>
<td>1</td>
</tr>
<tr>
<td>E. H. Bailey, Menlo Park</td>
<td>1</td>
</tr>
<tr>
<td>K. L. Buck, Denver</td>
<td>1</td>
</tr>
<tr>
<td>J. R. Cooper, Denver</td>
<td>1</td>
</tr>
<tr>
<td>N. M. Denson, Denver</td>
<td>1</td>
</tr>
<tr>
<td>C. E. Dutton, Madison</td>
<td>1</td>
</tr>
<tr>
<td>R. P. Fischer, Grand Junction</td>
<td>1</td>
</tr>
<tr>
<td>L. S. Gardner, Albuquerque</td>
<td>1</td>
</tr>
<tr>
<td>W. P. Huleatt, Denver</td>
<td>2</td>
</tr>
<tr>
<td>M. R. Klepper, Washington</td>
<td>1</td>
</tr>
<tr>
<td>A. H. Koschmann, Denver</td>
<td>1</td>
</tr>
<tr>
<td>R. A. Laurence, Knoxville</td>
<td>1</td>
</tr>
<tr>
<td>D. M. Lemmon, Washington</td>
<td>1</td>
</tr>
<tr>
<td>J. D. Love, Laramie</td>
<td>1</td>
</tr>
<tr>
<td>R. G. Petersen, Plant City</td>
<td>1</td>
</tr>
<tr>
<td>L. F. Rader, Denver</td>
<td>10</td>
</tr>
<tr>
<td>R. J. Roberts, Salt Lake City</td>
<td>1</td>
</tr>
<tr>
<td>Q. D. Singewald, Beltsville</td>
<td>1</td>
</tr>
<tr>
<td>J. F. Smith, Jr., Denver</td>
<td>1</td>
</tr>
<tr>
<td>R. W. Swanson, Spokane</td>
<td>1</td>
</tr>
<tr>
<td>A. E. Weissenborn, Spokane</td>
<td>1</td>
</tr>
<tr>
<td>TEPCO, Denver</td>
<td>2</td>
</tr>
<tr>
<td>TEPCO, RPS, Washington</td>
<td>2</td>
</tr>
</tbody>
</table>

(Including master) 78
SPECTROGRAPHIC DETERMINATION OF CONTAMINATION OF ROCK SAMPLES
AFTER GRINDING WITH ALUMINA CERAMIC

By P. R. Barnett, W. P. Huleatt, L. F. Rader, and A. T. Myers

As a previous study by Myers and Barnett (1953) had shown that rock samples pulverized in heavy grinding machinery were contaminated with tramp iron containing certain alloying elements used in the manufacture of steel, a search was started for suitable materials to substitute for steel grinding plates. Arrangements were made with the Coors Porcelain Co., Golden, Colo., to make experimental grinding plates from a high-alumina base. This material is relatively pure, particularly with regard to alloying elements of steel, and is very hard and durable. One set of alumina-ceramic grinding plates ground about 1,400 two-ounce rock samples to -80 mesh before replacement was necessary. Thus the grinding of rock samples with the ceramic material was successfully demonstrated as a means of rapid preparation of samples for spectrographic analysis and is now standard practice in one grinding laboratory of the Geological Survey.

Figure 1 shows the grinder with a set of plates attached and ready for use. The bottom plate is attached to the vertical rotating shaft of the grinder by means of a tapered steel bushing through the center of the plate. This plate is supported and strengthened by an aluminum housing machined to hold it firmly in place. Two steel taps are inserted diagonally opposite each other in the upper plate near its edge to receive bolts that hold the plate stationary when mounted in the grinder. A second set of ceramic grinding plates is shown in the right foreground of figure 1.
The pan to catch the ground sample is also shown. This pan is made of aluminum to prevent sample contamination by other metals.

To determine the kind and degree of contamination introduced by the ceramic grinding plates, selected vein quartz (massive) and quartzite samples from the same source as the samples used in the previous study (Myers and Barnett, 1953) were used. As in the previous study, control portions of the rocks were ground to -100 mesh in agate and analyzed spectrographically to compare with splits pulverized to -100 mesh with the ceramic grinding plates. The method of analyses was that described by Fleischer et al. (1952).

The quantitative data in table 1 show the effectiveness of the ceramic in preventing contamination of rock samples, especially with respect to iron and the other elements usually found in steel.

Note.—The authors are designing a new type of grinder for use with the alumina-ceramic grinding plates for pulverizing rock samples under conditions that are even less subject to metal contamination than the present system.

REFERENCES


Table 1.--Qualitative spectrographic analysis comparing contamination of quartzite and massive quartz by grinding with ceramic and with steel (in percent).

<table>
<thead>
<tr>
<th>Element</th>
<th>Quartzite Spec. determination after grinding in agate</th>
<th>Contamination by grinding by ceramic</th>
<th>Spec. determination after grinding with ceramic</th>
<th>Contamination by grinding by steel 1/</th>
<th>Massive quartz Spec. determination after grinding in agate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0003</td>
</tr>
<tr>
<td>Cr</td>
<td>0.0003</td>
<td>0.0002</td>
<td>0</td>
<td>0</td>
<td>0.001</td>
</tr>
<tr>
<td>Cu</td>
<td>0</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0</td>
<td>0.0001</td>
</tr>
<tr>
<td>Fe</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9</td>
<td>0</td>
<td>0.01</td>
</tr>
<tr>
<td>Mo</td>
<td>0</td>
<td>0</td>
<td>0.001</td>
<td>0</td>
<td>0.002</td>
</tr>
<tr>
<td>Mn</td>
<td>0.0006</td>
<td>0.0006</td>
<td>0.006</td>
<td>0</td>
<td>0.006</td>
</tr>
<tr>
<td>V</td>
<td>0.0004</td>
<td>0.0004</td>
<td>0.005</td>
<td>0</td>
<td>0.0007</td>
</tr>
<tr>
<td>Ba</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ca</td>
<td>.04</td>
<td>.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>La</td>
<td>.02</td>
<td>.02</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mg</td>
<td>.0007</td>
<td>.01</td>
<td>.003</td>
<td>&lt;.001</td>
<td>.003</td>
</tr>
<tr>
<td>Na</td>
<td>.04</td>
<td>.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sr</td>
<td>.0002</td>
<td>.002</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ti</td>
<td>.04</td>
<td>.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Y</td>
<td>.005</td>
<td>.005</td>
<td>-</td>
<td>0</td>
<td>0.001</td>
</tr>
<tr>
<td>Zr</td>
<td>.01</td>
<td>.01</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1/ Data from Myers and Barnett (1953).

Also looked for but not found in the control, and not found as a contaminant after grinding with ceramic: P, Ag, As, Au, B, Be, Bi, Cd, Ce, Co, Dy, Er, Ga, Gd, Ge, Ef, Hg, In, Ir, Li, Mo, Nb, Nd, Ni, Os, Pb, Pd, Pt, Re, Rh, Ru, Sb, Sc, Sn, Sm, Ta, Te, Th, Tl, U, W, and Zn.
Figure 1.—Grinder with set of ceramic plates attached.

A second set of plates is in the foreground.