

PYCNOMETER PROJECT
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by
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Object

This project was undertaken to ascertain the accuracy and reproducibility of the Beckman Air Comparison Pycnometer recently purchased by the Laboratory. In conjunction with this, tests were performed to supply data as to the effective use of the instrument as an analytical tool.

Background

The Air Comparison Pycnometer provides a means of obtaining accurate specific gravities on either coarse particles or powders by a dry, rapid procedure. The instrument affords a great improvement over the wet, volume displacement method which requires a constant temperature bath, Le Chatelier flasks, white kerosene and considerable time. The Pycnometer is used in the barite industry for quality control, the specific gravity being indicative of the percent BaSO_4 present. It was felt that the instrument might be used for operational control for other industries by providing a rapid, yet satisfactory, analysis.

Procedure

The reproducibility of the Pycnometer was verified by repetition with several different minerals. The accuracy was checked

by comparing the results with those obtained with the wet displacement procedure. To test the usefulness as an analytical tool, the products obtained from beneficiating an olivine ore, Lab. No. 3258, were used. Samples were prepared by blending various proportions of olivine concentrate with serpentine gangue. The samples differed by ten percent increments from one hundred percent olivine down to zero percent olivine. Ignition loss determinations (an analytical method for controlling olivine beneficiation) were made for each sample. Specific gravities were determined for each sample using the wet procedure and the Pycnometer.

Ignition losses for the various blends were calculated by using the ignition loss values assigned to the one hundred percent olivine concentrate and one hundred percent gangue.

Results

The accuracy of the Air Comparison Pycnometer as compared with the wet displacement procedure was very good (see Table 1). Reproducible results were obtained on various products and minerals; therefore, it was not necessary to report these duplications. Ignition losses calculated from specific gravity determinations correlate closely with actual ignition losses (see Table 1). A graph of specific gravity versus ignition loss is shown in Table 2. The straight line is a curve connecting the ignition loss of the olivine concentrate with the ignition loss of the gangue. The plotted points of various blends show the deviation from this curve. A graph for converting specific gravity to percent olivine is shown in Table 3.

Remarks

The Air Comparison Pycnometer has the potential for analytical control in industry and mineral laboratories when strict analyses are not required. The successful use of this procedure requires a substantial difference in specific gravity between the product and the gangue. The greater the difference, the more reliable will be the analysis.

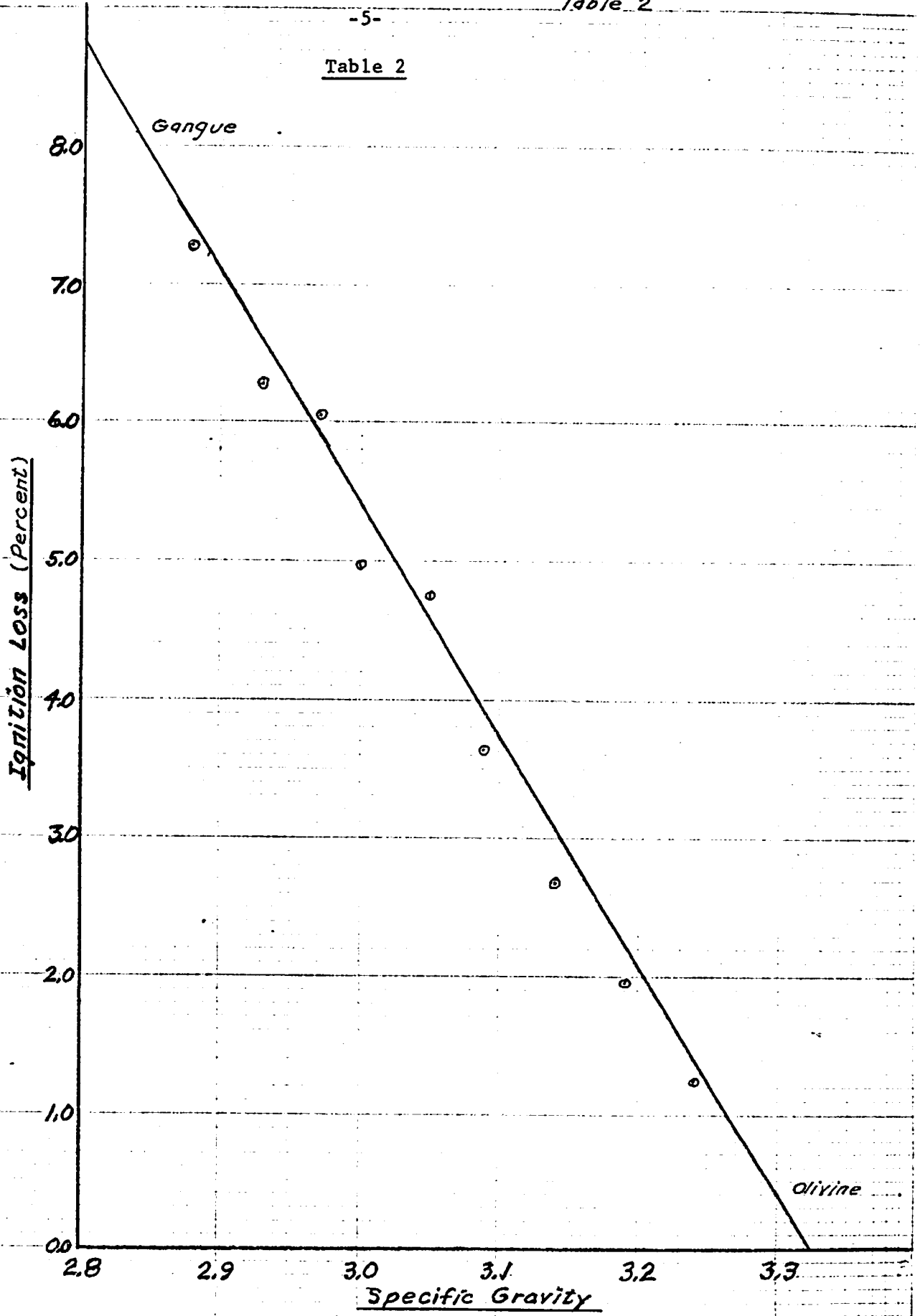
As a word of caution: samples containing three or more minerals, with different specific gravities, could present problems.

Table 1

Olivine-Serpentine Blend Data

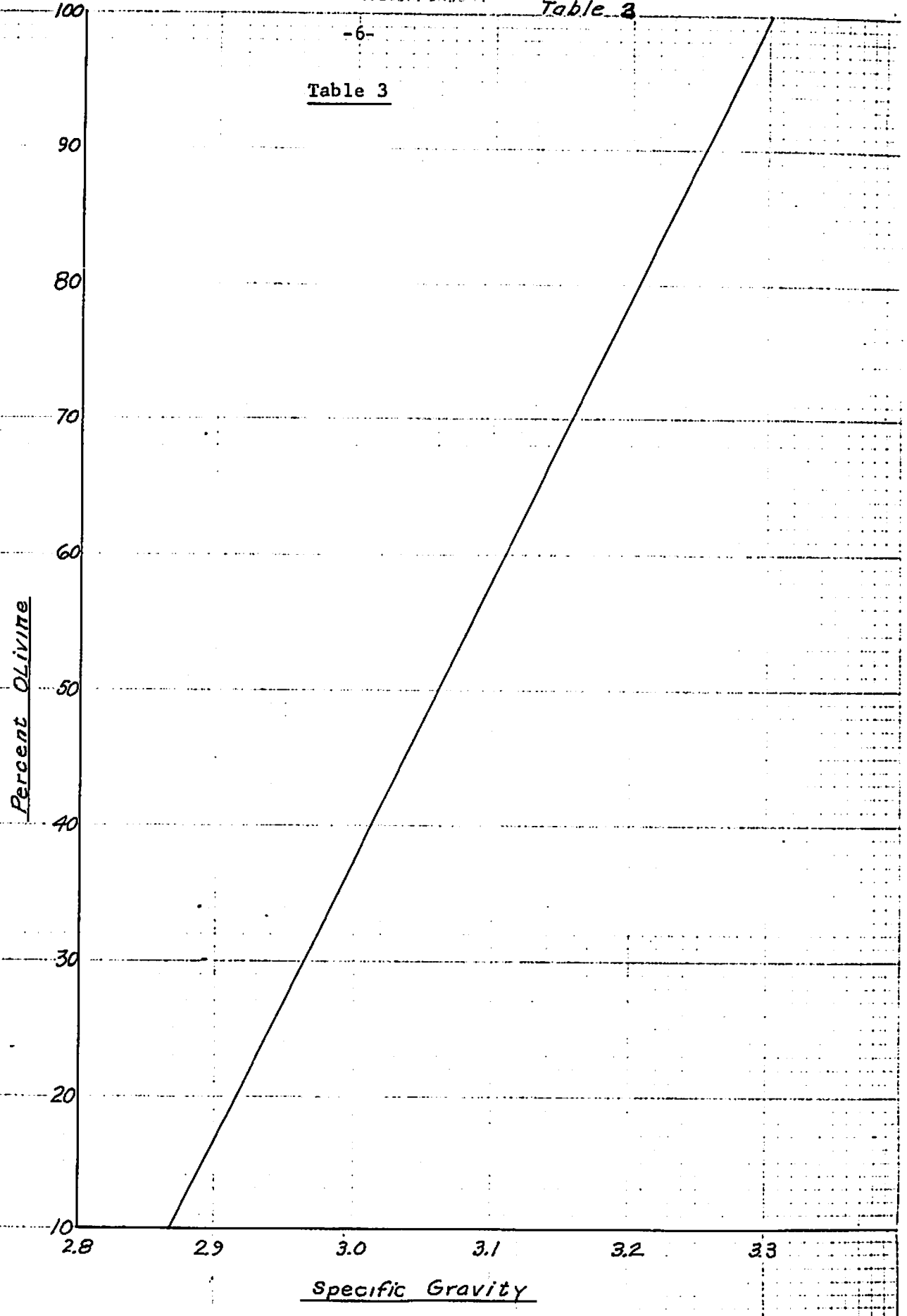
<u>Sample Blend</u>		<u>Specific Gravity</u>		<u>Ignition Loss</u>	
<u>% Olivine Concentrate</u>	<u>% Serpentine Gangue</u>	<u>Pycnometer</u>	<u>Wet Displacement</u>	<u>Calculated</u>	<u>Assayed</u>
100	0	3.29	3.30	0.41	0.40
90	10	3.24	3.24	1.18	1.24
80	20	3.19	3.19	1.96	1.96
70	30	3.14	3.13	2.73	2.69
60	40	3.09	3.06	3.51	3.64
50	50	3.05	3.02	4.27	3.74
40	60	3.00	2.97	5.04	4.98
30	70	2.97	2.97	5.82	6.04
20	80	2.93	2.86	6.59	6.28
10	90	2.88	2.83	7.37	7.28
0	100	2.84	2.78	8.14	8.10

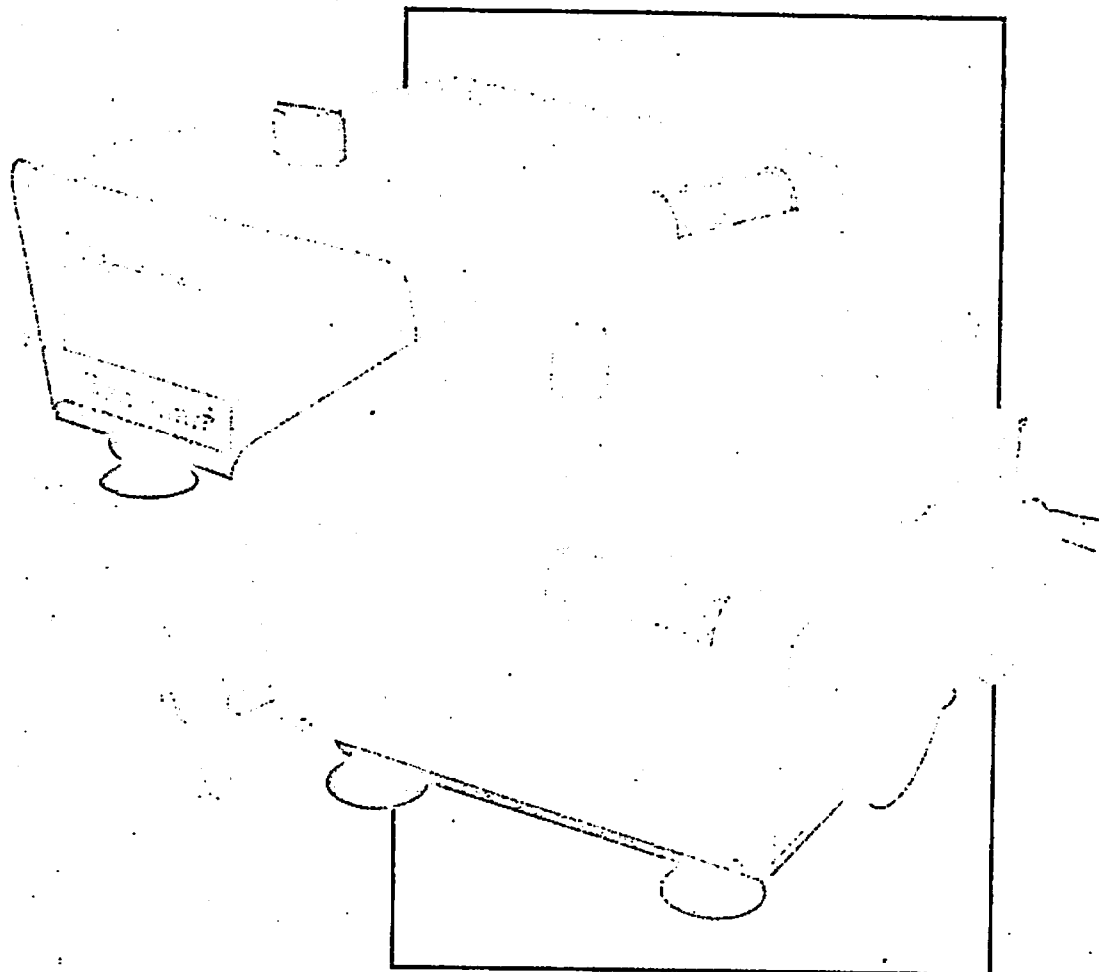
Table 2



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Table 3





MODEL 930
AIR COMPARISON
PYCNOMETER*

For Laboratory, Industrial, and Field Use.

Rapid, non-destructive volume measurements for density and porosity determinations of irregular, powdered, and porous solids are now possible with the Air Comparison Pycnometer. The new design principle provides accurate (better than 0.1 cc.) direct digital readout with unequaled speed. It is a valuable laboratory and field instrument for saving time on measurements formerly done with displaced liquids or involving direct pressure determinations.

*Patent Pending