

MINERALOGICAL MAGAZINE, DECEMBER 1969, VOL. 37, NO. 288

## Density determination by titration

A SIMPLE extension of the principle of Sollas's diffusion column<sup>1</sup> has the merits of requiring minimal manipulative effort and no weighings in the determination of densities by the 'swimming' method, and eliminates the uncertainties associated with the establishment of a uniformly graded column.

As with the column, reference markers are required of known and convenient densities; these have been commercially available for many years and need no description. If mineral fragments are used as markers they should be carefully selected for their inertness to the heavy liquids employed, and their densities should be accurately known; provided that the fragments are the same size when used as markers as they were when their densities were determined, the presence of inclusions is immaterial.

A suitable quantity of heavy liquid is placed in a glass tube or beaker, together with the mineral fragment whose density is to be measured and the densest marker to be used. The appropriate diluent is added from a burette, with thorough stirring; volume readings are taken just before, during, and after the sinking of the first and subsequent markers, and of the fragment of unknown density. The process is continued until the mineral fragment has been 'bracketed' by markers; a preliminary check is needed to ensure that the first markers used are of greater density than the unknown. A plot is made of the volume readings vs. density, and the density of the unknown fragment is obtained by interpolation on the smooth curve drawn between the points. It may be necessary, with small crystals, to centrifuge the tube at the critical time.

The method as described requires neither an accurately known initial volume of heavy liquid nor an accurately calibrated burette. A slow drift in temperature during the determination is automatically compensated by the markers, and merely alters the slope of the curve. If the heavy liquid is first adjusted by careful use of a marker to a known density, and a known volume is taken (temperature control!), the dilution curve may be used to prepare less dense liquids with reasonable accuracy. I have not been able to find any reference to this method in the literature, and offer my apologies to any author whose work I have overlooked.

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[Manuscript received 22 April 1969]

<sup>1</sup> W. J. Sollas. A method of determining specific gravity. *Nature*, 1891, **43**, 404-5. See also idem, *ibid.* 1893, **49**, 211-12, and *Quart. Journ. Geol. Soc.*, 1902, **58**, 163-78.