

Cannon, Jr., under whose immediate supervision this work was carried out.

## REFERENCES

- COOKE, S. R. B., 1937, Short column hydraulic elutriator for subsieve sizes: U. S. Bur. Mines Rep. Inv. 3333.
- GAUDIN, A. M., GROH, J. O., AND HENDERSON, H. B., 1930, Sizing by elutriating of fine ore-dressing products: *Indus. and Eng. Chemistry*, v. 22 p. 1363.
- GROSS, JOHN, ZIMMERLEY, S. R., AND PROBERT, ALAN, 1929, A method for sizing of ore by elutriation: U. S. Bur. Mines, Rep. Inv. 2951.
- TAGGART, A. E., 1945, *Handbook of mineral dressing*: New York, John Wiley and Sons, Inc.

THE AMERICAN MINERALOGIST, VOL. 44, JULY-AUGUST, 1959

USING THE MICROSCOPE FOR SPECIFIC GRAVITY  
DETERMINATION OF MINUTE MINERAL GRAINS

B. M. SHAUB, *Northampton, Massachusetts.*

The determination of the specific gravity of the larger pieces of solid materials is comparatively easy and is accurately performed by means of the various balances now in common use. The system of comparing the specific gravity of an unknown solid with that of calibrated heavy liquids is also very useful for quick determinations of their relative specific gravities. The approximation to the actual specific gravity of the unknown by this method depends upon the variation in the specific gravities between the individual liquids in the set. The actual specific gravity of a solid can, of course, be determined by adjusting the density of the liquid to equal that of the solid. This state is obtained when the latter merely swims about in the liquid for its movement is then determined by convection currents rather than by any differences in specific gravities.

The application of the heavy liquid technique for specific gravity determination can be done with considerable facility by means of a petrographic microscope or any microscope which permits tilting the stage and tube to 60 degrees or preferably more. A sample of the material is prepared by crushing a fragment of the specimen, allowing some of the pieces to be several times larger than the majority of the smaller ones. A microscope slide is made from the crushed material in the same manner as in preparing a specimen for the index of refraction determination. After covering the grains with a cover glass a liquid of known specific gravity is placed between the slide and the cover glass. The slide is then placed on the microscope stage and the stage is then tilted to 60 degrees or more. Upon rotation of the stage one will observe that the smaller

particles will either rise or sink in the liquid between the glass slide and the cover glass, depending upon the relative densities of the mineral fragments and the liquid. Surface tension will hold the cover glass in place if the separation is not too great. The movement of the particles in the liquid is, of course, slowed up when the viscosity of the specific gravity liquid is appreciable. As petrographic microscopes invert the image, a grain heavier than the liquid will appear to rise in the medium; however, one soon becomes accustomed to this reversal.

The fine-grained material, which must have a specific gravity within the range of the liquids used, can be most effectively handled by mixing it with a small amount of coarser material to provide and maintain a relatively larger space between the slide and the cover glass. Two advantages are that only a very small amount of material is required and with smallness of the pieces one also obtains a maximum of purity and freedom from associated minerals.

The specific gravities of the rock-forming minerals come within the range of the common heavy liquids, hence the microscopic method of determining the specific gravity of such minerals may readily and quickly be carried out. One can easily pick out individual clean grains from a mixture by using the optical features of the microscope as he is proceeding with the manipulations for determining the specific gravity. The specific gravity of detrital material too fine-grained for handling by conventional methods or in too small amounts can readily be determined by this method.

The accuracy of the method will depend largely on the differences between the specific gravities of the adjacent individual liquids in the set and upon their viscosities, also on the angle to which the microscope is tilted. The optimum position is when the tube is horizontal. For small particles in the more viscous liquids the movement may be slight when the gravities are approximately the same, hence the operator must pay strict attention to the relative motion between the free and stationary particles in the preparation.

In making a more precise determination of the specific gravity of a solid the density of the liquid in use can be adjusted to match the material after which the density of the final liquid can be determined by any one of the several usual methods.

The transfer of a limited amount of sample material from one slide to another will depend upon the degree of skill that the researcher possesses. The transfer is performed in the same manner as transferring scarce material from slide to slide during the determination of the indices of refraction.