processes is carried on concurrently by the same stream, the processes are either found quite distinct in different parts of the stream, or the conditions of flood and tumultuous flow are obviously ill-adapted to effective segregation of the grains by sizes.

If the thesis here implied be correct, the several processes are sufficiently distinct, in spite of overlapping due to variation in velocity, so that detrital materials found in natural deposits occur more abundantly well within the individual coarseness ranges represented by gravel, sand, silt and clay, than in the ranges transitional between those classes. The assumed arrangement of these modes is shown in the figure.

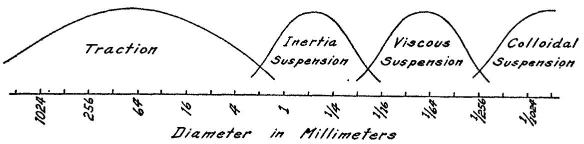

FIG. 1

Column two of Table I suggests a possible further natural contrast of sizes. It is thought that phanerites with grain sizes from ½ mm to 2 or 3 mm are enormously more abundant than similar rocks of coarser grain and that these furnish quartz grains preponderantly in the sand sizes. Among acid rocks, those of finer grain than ½ mm are subordinate to the coarser ones.[4] Aphanitic basic rocks are exposed over far larger outcrop area than coarser basic rocks. Few basic rocks yield mono-mineral grains of sufficient durability to exert any important effect in fixing sand sizes. By far the most important control exerted by the grain size of igneous rocks is due to the predominant sizes of quartz grains in granites.

In the calcareous detrital sediments of certain beaches, the sizes of shells or of other parts of particular species of animals locally give rise to somewhat homogeneous, well-sorted sediments. In particular, one may note the opercula of turbo snails, segments of sea-urchin spines and the tests of foraminifera.[5] These are, of course, much too localized to have been significant in fixing the established concept of sediment grades.

Some may point out that the foregoing discussion is based on the assumption that detrital sedimentary materials have been chiefly sorted by water. The reply is that materials chiefly assembled by other agencies are mostly not readily classifiable in the common terms. For example, glacial till requires a name of its own, the material of kames and eskers deposited by water under somewhat unusual conditions is commonly a somewhat indeterminate mixture of sand and gravel.

Loess, derived perhaps largely from glacial silt and deposited by the wind, does not correspond exactly either with sand or silt or clay. Most soils are also cases in point. Materials accumulated through imperfect action of water are commonly difficult to classify, such as many of the deposits of arid regions and terrace materials deposited by streams excessively flooded by glacial or other waters.

We are forced to recognize that the gravel-sand-silt-clay scale is an aqueous scale and there appears to be a true genetic, even if complex, basis for the grades represented by our common size terms. Wind action may result in superior sorting of sands originally accumulated by aqueous agencies. Whether a well-sorted, well-rounded, mature sand has ever been produced exclusively by the action of wind on the debris from a granite or other suitable rock may well be doubted. If such derivation has taken place, it must be very exceptional and very local.

CHESTER K. WENTWORTH
WASHINGTON UNIVERSITY, ST. LOUIS

[4] R. A. Daly, "Igneous Rocks and Their Origin," pp. 42–52, 1914.

[5] C. K. Wentworth and H. S. Ladd, "Pacific Island Sediments," Univ. of Iowa Studies in Natural History, Vol. XIII, No. 2, pp. 19–23, 1931.

BOOKS RECEIVED

Institute of the Aeronautical Sciences, Inc. *Proceedings of the Founder's Meeting, 1933. Pp. 85.* The Institute.

LUCK, JAMES MURRAY, Editor. *Annual Review of Biochemistry.* Vol. II. Pp. vii + 563. Stanford University Press. $5.00.

MACPHERSON, HECTOR. *Makers of Astronomy.* Pp. 244. Illustrated. Oxford University Press. $2.50.

National Plan for American Forestry. Report of the Forest Service of the Agricultural Department on the Forest Problem of the United States. Vol. I. Pp. x + 1050. Vol. II. Pp. 1051–1677. U. S. Government Printing Office. $1.75 for two volumes.

ROBBINS, WILFRED W. and FRANCIS RAMALEY. *Plants Useful to Man.* Pp. vii + 428. 241 figures. Blakiston. $3.00.

SMITH, GILBERT M. *The Fresh-Water Algae of the United States.* Pp. xi + 716. 449 figures. McGraw-Hill. $6.00.

STEJNEGER, LEONHARD and THOMAS BARBOUR. *A Check List of North American Amphibians and Reptiles.* Third Edition. Pp. xiv + 185. Harvard University Press.

STUHR, ERNST T. *Manual of Pacific Coast Drug Plants.* Pp. 192. Science Press Printing Company. $2.65.

Svenska Linné-Sällskapets Årsskrift. Årgang XVI, 1933. Pp. 152. Illustrated. Almqvist & Wiksells, Uppsala.

SYDENSTRICKER, EDGAR. *Health and Environment.* Recent Social Trends Monographs. Pp. xii + 217. 50 figures. McGraw-Hill. $2.50.

VALLANCE, ALEX and MARSHALL E. FARRIS. *Principles of Mechanism.* Pp. vii + 335. 302 figures. Macmillan. $3.50.

WEEKS, MARY E. *The Discovery of the Elements.* Pp. iii + 363. Illustrations Collected by F. B. Dains. Journal of Chemical Education, Easton, Pennsylvania.

WOOTTON, H. A. and C. W. R. HOOKER. *A Text-Book of Chemistry.* Pp. xi + 488. Cambridge University Press, Macmillan. $1.75.