rance of the structure of coal and the researches of Thiessen, Turner and the reviewer have made clear what was previously a dark subject. The writer has made full use of the American work on coal and his treatment is most appreciative.

The work is divided under a number of headings, namely, "Classifications of coals," "The macroscopic structure of coal and its origin," "The microscopic structure of coal and its origin," "The petrographic constituents of coal," and "The participation of the various substances of the plant and animal body in their organization." The volume contains 271 pages and 80 illustrations, the most of the latter original or from very recent sources. A particularly commendable feature is a large amount of attention given to the micro-chemistry of coal, a subject which the author has made particularly his own and which is of great importance. Naturally, his father's views are treated at considerable length and with respect, but the author nevertheless shows a highly commendable open-mindedness on many subjects. This book will be indispensable to all geologists, chemists and botanists who are interested in the subject of coal.

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Out of the Valley of the Forgotten, or From Trinil to New York. By JOHN EDMISTON BAUMAN, head of the Biology Department, Augustana College, Sioux Falls, South Dakota. Two volumes. Published by the author.

A MOST unique work is Bauman's "Valley of the Forgotten," which may be briefly described as an encyclopedia of deductions from evolution.

The poetic title is thus explained by the author:

> It is intended among other things to show that in the forgotten days of man's early evolution, he went grievously astray in his ideas, falling into progress—and initiative—stupefying superstitions on the one hand and into many irrational ways of looking at the universe in general, and into a not only utterly irrational, but debasing and brutalizing notion of intimate sexual concerns, being shameful and indecent, on the other.

Accepting the known and rationally implied facts of orderly change, termed evolution, which he gives with much care and general accuracy, Professor Bauman sets out to show the relation of evolution to human conduct in all its varied phases. In this he shows broad reading and good judgment, though somewhat disposed to "lay down the law" in disputed questions. He repudiates "fundamentalism," with all its cumbersome traditions, while insisting on his right to be a Christian. He argues for "immortality" on scientific data as well as for the "existence of God." He has much to offer on sex problems, not all of it likely to be generally accepted. His discussions range from the regulation of restaurants, the use of proper nasal sprays and the sins of St. Augustine to bacteria, wicked and benign, to woman's dress, to the abolition of war and to the purification of religious belief. Amidst very much that is true and wise, and as varied as human interests, we stumble on one sentence: "The whole drift of human evolution would be a meaningless and sinister affair if there were to be no future existence."

> I ask for nothing; let the balance fall,
> All that I am or know or may confess
> Swells but the weight of mine Indebtedness!

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PREPARATION OF PROTOZOA FOR CLASS USE

THE rapidity of movement of protozoa makes their study a matter of great difficulty for the beginner, particularly if he is getting acquainted with the use of the microscope at the same time. Identification and careful study likewise are rendered equally trying for the more experienced student. The time-honored method of partially immobilizing the organisms in a viscous medium such as a gum solution or by means of cotton fibers is of great assistance and has the advantage of permitting a study of the living organism. The use of the surface tension, as developed by the microdissectionists, is not feasible for class use unless perhaps as a means of demonstration.

Attention is called to the following method because of the rapidity with which the common protozoa and algae may be prepared for class use. The method is not by any means new, but does not appear to have received the attention it deserves. The material is collected from the aquaria or other source of protozoans by means of a pipette and placed in a centrifuge tube. A hand centrifuge will throw down the organisms within a minute at most, and immediately after the removal of the tube from the centrifuge the greater portion of the superlatent water is pipetted off. A few drops of 1 per cent. osmic acid solution are added so that the resulting solution of osmic acid is about one half per cent. Two cubic centimeters of such a strength of osmic acid will fix a cubic centimeter of precipitated organisms, so that the expense of the reagent is negligible. A few drops of distilled water are added and the material is ready for class use. For continued study a glycerine solution is better. The common fresh water protozoa—

amoebae, ciliates and flagellates—when so prepared can scarcely be distinguished from living material except for the absence of movement. Chloroplasts such as those found in Euglena and the algae retain their green color, and with a nearly closed condenser the finer details, particularly of the cilia or flagella, are shown very clearly.

If permanent mounts are desired the usual staining methods may be applied, the various reagents being added to the material in the centrifuge tube. Iron haematoxylin gives splendid results after fixation with osmic acid, and with the exception of the destaining process with iron alum, the material need not be removed from the tube until it is in xylol. Chloroplasts do not seem to be affected by the various reagents, and material in balsam will remain green for weeks, after which the chloroplasts slowly fade. For finer details in such organisms it is better to bleach the chloroplasts with potassium permanganate, 1 per cent., and oxalic acid, 5 per cent., for about five minutes each before staining. Fixation in the osmic acid should be for from thirty minutes to an hour if permanent preparations are desired. This fixation, being cytoplasmic, offers an enlightening contrast to the more customary Schaudinn's fluid.

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SPECIAL ARTICLES

THE RELATION BETWEEN PROPERTIES AND CHEMICAL COMPOSITION OF SOIL COLLOIDS

IN previous publications of the Bureau of Soils it has been shown that the colloidal materials extracted from different soils may vary widely in adsorptive capacity, in heat of wetting and in chemical composition. During the past two years a series of different colloidal soil materials has been investigated for many other properties, such as size of particles, swelling, viscosity, electrical behavior and exchange of bases. The data, which are being prepared for publication, show that the colloidal materials extracted from different soils vary with respect to these properties also.

It appears, as might be expected, that the various properties of the colloid are more or less related. A colloid, for instance, which undergoes a large volume change when wetted by water, usually shows a high heat of wetting and a high adsorptive capacity for ammonia gas.

The properties of different soil colloids appear also to be related to their chemical composition. The major constituents of the soil colloidal material are silica, alumina and iron, and, in the case of many colloids, the properties vary fairly regularly with the contents of these major constituents as expressed by the molecular ratio of silica to alumina plus iron.

An example of interrelationship between properties of the colloid and of parallelism between properties and chemical composition is shown in Table I. In this table a series of colloids extracted from different soils is arranged in ascending order of the ratio, silica to alumina plus iron. The heat (in small calories) evolved by these colloids on immersion in water and the ammonia gas adsorbed are shown in columns 3 and 4. In order to make the relationship more apparent and to bring out individual exceptions, the data of columns 2, 3 and 4 are expressed relatively in columns 5, 6 and 7. The lowest value in each series of determinations is placed at zero and the highest value at 100. By this procedure the different orders of magnitude of the three series of data are equalized; also the amplitudes of variation between the lowest and highest determinations are brought to 100 in each series. Most of the data in the table are taken from previous publications of this Bureau.[1, 2, 3]

It is apparent that on the whole there is a close parallelism between the heats of wetting, ammonia adsorptions and the silica ratios of the different colloids. Coefficients of correlation[4] for these three series of values are as follows: heat of wetting with ammonia adsorption 0.99, heat of wetting with silica ratio 0.93 and ammonia adsorption with silica ratio 0.90. The high coefficients of correlation, together with the fact that correspondence between the lower relative values in columns 5, 6 and 7 is about as good as correspondence between the higher relative values, indicate that the three series of values are approximately straight line functions of one another.

The correlation between heat of wetting and ammonia adsorption may be expected to hold fairly well for practically all soil colloids. But the correlation between heat of wetting (or ammonia adsorption) and $\frac{SiO_2}{Al_2O_3 + Fe_2O_3}$ is probably subject to

[1] Anderson, M. S., "The heat of wetting of soil colloids," *Jour. Agr. Research*, 28: 927–935 (1924).

[2] Gile, P. L., *et al.*, "Estimation of colloidal material in soil by adsorption," U. S. Dept. Agr. Bul. 1193 (1924).

[3] Robinson, W. O., and Holmes, R. S., "The chemical composition of soil colloids," U. S. Dept. Agr. Bul. 1311 (1924).

[4] Calculated according to the formula given by Tolley, H. R., and Mendum, S. W. "A method of testing farm-management and cost-of-production data for validity of conclusions," U. S. Dept. Agr. Circular 307 (1924).