

in leprosy, which indicated that leprosy attacks essentially the Mantoux-negative individuals and that infection with tuberculosis resulted in some resistance to leprosy. A new mass-treatment campaign has been started in Keneba against *Microfilaria bancrofti* infection using 'Hetrazan' in conjunction with an anti-histamine drug. The search for new antibiotic-producing organisms, particularly streptomycetes, from Malayan soil continues, and further mosquito infectivity experiments have confirmed that, in patients carrying gametocytes of a proguanil-resistant strain of *P. falciparum*, anopheline mosquitoes can be infected from a person taking 0.4 gm. proguanil daily. Further observations in the Kitui kala-azar area indicate that an anthropophilic species, provisionally designated *Phlebotomus (Sergentomyia)* sp. nov. 2, is the most likely vector of the epidemic, and experiments in Fiji indicate that the most effective dosage of 'Hetrazan' for control of filariasis is one 50-mgm. tablet taken on one day per month for twelve months.

(To be continued)

#### FOURTH NATIONAL CLAY CONFERENCE IN THE UNITED STATES

THE Fourth National Clay Conference of the National Clay Minerals Committee, United States, was held in the Department of Mineral Industries of the Pennsylvania State University, University Park, Pennsylvania, and consisted of seven sessions during the three days October 11-13. Approximately fifty-four papers were presented. Participants came from all regions of the United States, as well as seven from overseas: Dr. G. F. Walker (Australia), Dr. W. Dekeyser (Belgium), Prof. U. Hofmann (Germany), Dr. J. L. White and Dr. D. M. C. MacEwan (Great Britain), Prof. T. Sudo (Japan), Prof. J. M. Albareda (Spain). Dr. Hénin (France) was prevented by illness from attending. E. W. Radoslovich (Australia), J. Kulbicki (France), J. Zussman (Great Britain) and H. Heystek (South Africa), who were on extended visits to the Pennsylvania State University, were also present.

With such a wealth of papers, it would be difficult to give a detailed report. The present account concentrates on certain topics which seemed to me to be of importance, and is bound to be coloured by personal interests. It may, however, not be entirely a matter of personal prejudice that the study of interstratified, or mixed-layer clay minerals, appeared to emerge as one of the important growing-points of this branch of science. Their existence was reported many years ago by Alexander and others<sup>1</sup>, and, since then, gradually increasing numbers of studies of such minerals have been appearing. At the Pennsylvania meeting, a whole session was devoted to this topic. The use of Geiger-counter recording apparatus for X-ray diffraction allows very extensive surveys to be made in a relatively short time. C. E. Weaver reported on the examination of three thousand sedimentary rocks, his conclusion being that interstratified clays are among the commonest mineral types present in the clay fraction. Systems identified are randomly interstratified illite-montmorillonite, chlorite-vermiculite, illite-chlorite-montmorillonite, chlorite-kaolinite, and regularly interstratified chlor-

ite-vermiculite. A vermiculite-illite system, weathering to a 'chloritic' system (alumina in interlayer positions), was reported from New Zealand soils by T. Tamura. Schmehl and Jackson directed attention to the presence in soil clays of amorphous 'relicts', not giving distinct diffraction maxima, even on heating. T. Sudo reported certain Japanese acid clays which are randomly mixed kaolinite-montmorillonite; some of these minerals show almost no basal reflexions, a phenomenon which has not been satisfactorily explained. Vanadium silicates resembling clay minerals were described by J. C. Hathaway, who reported that they show mixed-layer expanding structures, mica-montmorillonite and chlorite-montmorillonite.

The name 'corrensite' has been proposed<sup>2</sup> for (apparently) a regular 1:1 montmorillonite-chlorite, and two occurrences of similar material were described at this meeting by J. W. Early and I. H. Milne. Vermiculite-chlorite systems from soil and shales were described by H. Heystek. D. M. C. MacEwan reported a Fourier-transform investigation of a mica-montmorillonite interstratified system in a Silurian clay from Worcestershire, the system being strikingly similar to the 'Kinnekulle II' clay from Sweden<sup>3</sup>. E. W. Tooker found mixed-layer illite-montmorillonites as stages in the series biotite-illite-montmorillonite (in an extensive paper on altered wall-rocks in the Pre-Cambrian of Colorado).

R. Roy, with his collaborators, has continued his important studies at the Pennsylvania State University on clay synthesis and equilibria, and he reported (with D. M. Roy) on hydrogen-deuterium exchange and the assignment of infra-red frequencies in clays (a caution against a too light-hearted assignment of absorption maxima to certain atomic groupings), and also on thermal transformations in dickite—namely, the formation of kaolinite by hydrothermal treatment of 'metadickite' and 'meta-metahalloysite', these substances being, of course, the analogues of 'metakaolin'. With F. A. Mumpton he has investigated the relation of ionic substitution to hydrothermal stability of montmorillonoids. Saponites are the most stable; the addition of polarizable ions ( $Zn^{2+}$ ,  $Ni^{2+}$ ) decreases the stability, as does the substitution of  $Ga^{3+}$  for  $Al^{3+}$  in beidellite. The interlayer ions also affect stability. Mumpton and Roy have further succeeded in synthesizing both regularly and randomly interstratified minerals.

G. W. Brindley and his collaborators have been continuing detailed structural work on clays. At the meeting, Newnham and Brindley reported on the structure of dickite, a two-dimensional Fourier investigation, which shows the octahedral layer of this mineral to have distortions of the same general type as in gibbsite (the first study of this sort on a dioctahedral mineral of the clay group); and on allevardite, confirming in general the results of Caillère *et al.*<sup>4</sup>. Brindley and Radoslovich have commenced a study of the hydrothermal alteration of single crystals of feldspars. In Dr. Hénin's absence, Prof. Brindley also read his paper on low-temperature synthesis of clay minerals.

Other structural studies were reported by J. Zussman and G. F. Walker. Zussman proposes to divide the serpentine minerals into ortho- and clinochrysotile, antigorite, and a third variety with orthogonal packing. (Whittaker, reporting on these minerals in November to the Mineralogical Society in London, proposed the name 'lizardite' for this

variety.) Walker has investigated in detail, using two-dimensional Fourier syntheses, the dehydration mechanism in vermiculite, and his paper may well form the foundation for much future thought on clay-water relationships, replacing the earlier ideas of Hendricks and Jefferson<sup>5</sup>. He recognizes a two-layer stage for the interlamellar water, with octahedral co-ordination around the exchange cations; then a less hydrous stage where the cations migrate to the mineral surface, followed by a one-layer stage; and finally, as more water is removed, the 'collapsed' form without interlamellar water occurs in interstratification with the previous stage.

Walker's paper was read during a symposium on "Clay-Water Relationships", in which H. van Olphen presented experimental evidence for the magnitude of the linking force in pure clay gels ( $10^{-4}$  dynes), and the height of the energy barrier for thixotropic gelling in 0.03 *N* sodium chloride solution (7 *kT*). In the same session, D. T. Oakes and E. J. Bureik described a method for electro-osmotic charge determination in concentrated suspensions; W. H. Wood, W. T. Granquist and I. M. Krieger described viscosity measurements on very dilute suspensions; W. C. Ormsby, R. M. Witucki and W. A. Weyl reported investigations on the effect of wetting agents on deformation of kaolinite suspensions; and U. Hofmann gave experimental evidence for a relation between surface charge of montmorillonite minerals (determined by chemical analysis) and swelling properties. C. W. Marshall, who was unable to be present, sent a paper on thermodynamic, quasi-thermodynamic and non-thermodynamic methods of investigating the electrochemistry of clays.

Another symposium was devoted to "Thermal Transformations in Clay Minerals". R. A. Rowland, E. J. Weiss and W. F. Bradley reported on the study of mono-ionic montmorillonites (Na, K, Li, NH<sub>4</sub>, H, Ca, Mg, Mn), using the 'oscillating-heating' method, which consists in continuously scanning a small diffraction region, while heating the sample. The resulting diagrams illustrate very prettily the onset and progress of reactions. J. L. White described work on the effects of molten salts on layer-lattice silicates, the most striking result being the removal of potassium from (silt- and clay-grade) mica by molten lithium nitrate, giving a montmorillonite-like product. Other papers were on the dehydroxylation of illite (B. W. Nelson), and comparison of natural and synthetic montmorillonites (L. B. Sand and M. S. Crowley).

Advances in the technique of identification of minerals were referred to by E. B. Kinter and S. Diamond, and I. H. Milne and C. M. Wardshaw (preparation of samples for an X-ray diffractometer); and by A. Auskern and R. W. Grimshaw (infra-red spectrography). Aspects of industrial interest included paper-coating by kaolinite (H. H. Murray and S. C. Lyons); green compression strengths of bentonites (W. F. Bradley); and colloidal properties of silica and silicones (E. A. Hauser).

There was no symposium on weathering and alteration of minerals, but several papers were concerned with related questions. In Illinois (H. H. Murray and R. K. Leininger), and in Wisconsin (L. D. Whittig and M. L. Jackson), illite and chlorite have been found to alter to montmorillonoid (montmorin), or vermiculite. B. N. Rolfe described surficial sediments from Lake Mead (Hoover Dam area). B. Osthaus has studied the acid dissolution of montmorillonite and nontronite, and is able to

distinguish two first-order reactions in the removal of iron and aluminium (octahedral and tetrahedral co-ordination?). G. T. Kerr, R. H. Zimmerman and F. H. Wells have found two stages in the degradation of acid hectorite, with the release first of magnesium, and then of silicon dioxide. Anion exchange was discussed by S. J. Buckwold.

The entire series of meetings gave an impressive picture of clay mineral researches in the United States at the present time. It is noteworthy that some fine pieces of research have been done by industrial laboratories, especially those of oil companies. Most of the foreign visitors seemed to find the programme over-full, and would have preferred more time. This conference represented, of course, a year's research in the field. As compared with the diversity of effort in Europe (two meetings a year in Great Britain, France and Sweden; and others in Germany, Belgium, etc.) it showed the great advantages of organization on a continental scale, enabling all the workers on the subject to get together for an intensive discussion. The result was very inspiring. The complete proceedings of the conference will appear in book form, and are at present being edited by Miss Ada Swineford, of the Kansas Geological Survey. Like the second and third conferences, they will be published by the National Research Council, Washington, D.C., as will, so it is intended, the proceedings of subsequent conferences. The proceedings of the first (Bull. 169, Calif. Dept. of Mines, 1955) and second conferences have already appeared and form attractive and valuable records of progress in this field.

D. M. C. MACÉWAN

<sup>1</sup> Alexander, L. T., Hendricks, S. B., and Nelson, R. A., *Soil Sci.*, **43**, 273 (1939).

<sup>2</sup> Lippmann, F., *Heidelberger Beitr. Min. Petr.*, **4**, 130 (1954).

<sup>3</sup> Byström, A.-M., *Nature*, **173**, 783 (1954).

<sup>4</sup> Caillère, S., and Hémin, S., *C.R. Acad. Sci., Paris*, **230**, 668 (1950).

<sup>5</sup> Hendricks, S. B., and Jefferson, M. E., *Amer. Min.*, **23**, 855 (1938).

## THE METAPHYSICS OF SCIENCE

IN the Riddell Memorial Lectures\* Prof. R. O. Kapp discusses a question which is, he says, of even greater importance for science than for theology, namely, "whether non-material influences have a real existence or not" (p. 8). Kapp defends an affirmative answer to this question, a doctrine that he calls "dualism", as against the negative thesis which he describes as "monism". This nomenclature is, I think, misleading, because various theorists such as Hegel have advocated a non-material, that is, spiritual, monism. Kapp supposes not only that the two metaphysical theories of dualism and monism are answers to a genuine problem, roughly "What are the ultimate and irreducible constituents of reality?", but also that they are the only two possible answers to the problem. These are, of course, very large assumptions indeed, and it is regrettable that Kapp fails not only to defend them but even to state them. He gives no grounds for presenting us with what, to my mind, are equally erroneous doctrines, nor for his assumption that one must vote for one rather than the other.

Kapp regards his problem as raising an empirical issue, namely, whether or not a certain sort of entity exists. The dualism that he defends is a causal

\* "Facts and Faith". By Reginald O. Kapp. Riddell Memorial Lectures. University of Durham. Pp. 63. (Oxford University Press, 1955.) 5s.