

THIRD INTERNATIONAL CONGRESS ON GLASS

THE Third International Congress on Glass was held in Venice during June 29–July 2, associated with the International Commission on Glass, the annual meeting of which was held on July 3. 179 delegates attended from twenty countries; they included 65 from Italy and 22 from Great Britain.

The Congress was organized by a Committee of the Italian Glass Manufacturers Federation. At the opening meeting of the Congress, Principe Giovanni Ginori Conti, who is president of the Federation, was inducted as president of the Congress by Dr. B. P. Dudding in his capacity as president of the Second International Congress on Glass held in London and Sheffield in 1936. This ceremony concluded with the presentation to Prince Ginori Conti by Mrs. W. E. S. Turner of a glass goblet on which the coat of arms of the Conti family had been engraved by Mrs. Turner, who is among the best of present-day English engravers.

The first day of the Congress was devoted to lectures on general subjects open to all members attending. Dr. M. Pasquato (Venice) reviewed the history of the glass industry centred in Murano since the eleventh century and traced the influence Venetian traditions have had on the artistic and industrial developments of the glass industry of the world. Prof. W. E. S. Turner (Sheffield) reviewed the growth of societies and research institutions not associated with specific industrial organizations since the formation of the Glass Research Delegacy in Sheffield in 1915 and the Society of Glass Technology in 1916. This was of particular interest to the Italian members, as negotiations have been proceeding between the Government and industry in Italy for some time, and a definite announcement was made at the end of the Congress reporting a decision to form both a technological society and in addition a research institute supported by government and industrial contributions. M. D'Argenlieu (Paris) reviewed the development of the use of glass in the building industry and raised some pertinent questions as to whether the glass industry had exhausted its contribution in this field. Prof. F. Roma (Bologna) described the sources of natural gas in northern Italy and discussed the conditions necessary to the efficient use in the glass industry. Prof. M. Czerny (Frankfurt am Main) indicated recent advances in the understanding of the problems of glass melting, and in particular the relative importance of heat transfer by radiation convection movements in the molten glass and conductivity through the glass. Mr. Edward Meigh (London) dealt with the interrelation of technology and management in modern industry, referring to the nature of the studies made in Great Britain under the auspices of the Institute of Industrial Administration and the British Institute of Management, with which the former is now amalgamated.

The following two days were devoted to specialized papers classified in four groups, three of which met simultaneously: Group I, Chemical and Physical Properties of Glasses; Group II, Glass Manufacture: Materials, Equipment, Methods; Group III, Form, Design, and Decoration of Glass; Group IV, History and Archaeology.

About fifty papers were presented, and their efficient discussion was secured by making arrange-

ments under which delegates could hear the speaker in any one of four languages, by a microphone and telephone service, which is becoming a general technique at international conferences.

In Group I several papers were presented which dealt with the modern physical concepts of the structure, and the slow changes which take place with time in the physical properties of glasses, depending on their previous thermal history. Another paper discussed the rate of reaction of glass-forming materials and the influence of the particle-size and the scale of operations on the rate of reaction.

In Group II, important and novel ideas concerning the methods employed to melt glasses and the techniques for exploring new designs of glass-melting furnaces were presented and led to extended discussions.

The artistic and archaeological interests of glass brought together artists from eight different countries, and in the course of the discussions the influence of the artist on production of utilitarian glassware was emphasized.

Associated with the Congress were visits to Soc. Venez. Conterie e Cristallerie, Murano, to Vetrococo at Porto Marghera, together with visits to museums, the Giorgio Cini Foundation on the isle of S. Giorgio Maggiore, and to the hydro-electric plant at Caverna, owned by the Società Adriatica di Elettricità. The Congress closed with a banquet at the Excelsior Palace at the Lido, given by the Associazione Nazionale degli Industriali del Vetro.

At the annual meeting of the International Commission on Glass held on July 3, Dr. B. P. Dudding, honorary secretary of the Commission, was elected president in succession to Prof. W. E. S. Turner, who has been president of the Commission since its formation in 1933. Prof. Turner was elected honorary president of the Commission. M. H. Vandecapelle, director of the Institut National du Verre, Belgium, was elected honorary secretary, and M. G. Henry, director general of the Union des Verreries Mécaniques, Belges, was elected honorary treasurer on the resignation of Dr. W. M. Hampton, of Chance Brothers, Ltd., Birmingham.

A tentative invitation was extended by the Swedish delegate to the Commission to hold its annual meeting in Sweden in 1954. No decision was taken in respect of the next Congress; but it is hoped that it will be held on the Continent in 1956.

ADVANCES IN METHODS OF STUDYING CLAYS

A MEETING of the Clay Minerals Group of the Mineralogical Society, held in the Department of Geology and Mineralogy, Marischal College, Aberdeen, during April 10–11, was mainly devoted to a discussion upon advances in methods of studying clays. On the morning of April 10, the laboratories of the Macaulay Institute for Soil Research and the Chemistry Department of the University were visited by members of the Group. At the scientific sessions the chair was occupied on the afternoon of April 10 by Dr. G. W. Brindley (University of Leeds) and on the following morning by R. H. S. Robertson (Glasgow).

Introducing the discussion, Dr. G. Nagelschmidt (Safety in Mines Establishment, Sheffield) reviewed

the methods currently available for clay investigations, stressing particularly those of recent introduction. Following the course of a sample from its reception to the elucidation of its mineralogical composition, he referred to the following techniques and indicated the present limits to their application: deflocculation, clay mineral separation (for example, use of Clerici solution, sedimentation, electrophoresis, flotation, etc.), chemical analysis, light microscopy (including phase contrast), electron microscopy, X-ray examination, differential thermal analysis and infrared spectroscopy. Since many of these techniques, although at present very useful, are still not fully developed, more research into the basic principles upon which they are established is vital to the development of clay mineralogy.

The interpretation of X-ray diffraction patterns of interstratified minerals was considered theoretically by Dr. D. M. C. MacEwan (Rothamsted Experimental Station, Harpenden). Although previous work had established that curves showing the types of scattering to be expected from various mixtures of layers could be constructed and used for identification purposes¹, under certain circumstances (for example, for poly-component mixtures, or where segregation occurs), the construction of these curves becomes very laborious. The same applies to the alternative calculation of the appropriate Fourier transform; but by using an approximation, this latter method can, with very little calculation, give the requisite information as to the nature of the interstratified material². Dr. MacEwan, replying to comments by Dr. Nagelschmidt and by Dr. H. P. Rooksby (General Electric Co., Ltd., Wembley), agreed that reflexions to higher angles are necessary to refine the transform, and that there is an analogy to scattering of X-rays by glasses. When R. Greene-Kelly and G. Brown (both of Rothamsted Experimental Station) questioned whether absorption difficulties, etc., would allow the requisite minimum number of orders of the basal spacing to be recognized in the diffraction patterns of, for example, many soil clays, Dr. MacEwan replied that he had as yet had little opportunity to apply the method to these materials.

Two papers from the Safety in Mines Research Establishment, Sheffield, dealt with quantitative X-ray methods. In the first, Dr. R. L. Gordon, O. G. Griffin and Dr. Nagelschmidt defined the criteria for internal standards to be of use in the photographic diffraction method, and demonstrated that both magnesium oxide and boehmite ($\gamma\text{-AlOOH}$) can be used for quartz. The former is best when large amounts of quartz (more than 30 per cent) are present, but the latter, for the comparison lines used, is not so good in the presence of kaolin. Some applications were described, and the results obtained were compared with those derived from chemical investigations. In the second paper, Dr. Gordon and Mr. Griffin described in detail a Geiger-Müller counter X-ray diffraction apparatus. Accurate measurement of line intensity rather than line position was aimed at, and was achieved by monitoring the primary X-ray beam by an auxiliary Geiger counter. Internal standards are unnecessary where accuracy of ± 10 per cent is adequate. In practice, this method is complementary to the photographic one. In the discussion Dr. Rooksby, Mr. Brown and Mr. Greene-Kelly referred to difficulties which might arise from differential absorption when using internal standards, but Dr. Gordon indicated that in the systems investigated all the minerals had approximately the same

absorption coefficient. In reply to a further question by Mr. Brown, Dr. Nagelschmidt stated that, since the materials being investigated did not contain either boehmite or lepidocrocite, the former was a satisfactory internal standard. Dr. Gordon, commenting upon remarks by Dr. Brindley and E. W. Radoslovich (Cavendish Laboratory, Cambridge), stated that for the Geiger counter method a large sample is preferable to a small one, since the latter would entail narrowing the X-ray beam.

New techniques for preparing oriented-aggregate specimens for X-ray examination were reported in two brief papers. W. A. Mitchell (Macaulay Institute) has obtained parallel orientation of platy minerals by mechanical compression of the clay between two flat metal surfaces. The amount of orientation produced and the improvement in orientation for certain specimens over that produced by the conventional method were demonstrated by X-ray photographs. Mr. Brown described a semi-micro method utilizing special 'Perspex' centrifuge tubes with detachable bases, the clay settling on the flat inner surface of the base as an oriented aggregate. By using only about 1 mgm. of clay, the time necessary for preparation of the finished specimen from the original soil could be considerably shortened. In the discussion Mr. Greene-Kelly commented that the pressure technique would be very useful for platy minerals which would not disperse, and Mr. Mitchell reported that orientation had been obtained with soil clays containing only 5-10 per cent of platy minerals. Mlle. M. J. Deudon (I. R. Sidérurgie, Paris) and Dr. Brindley both referred to experiments with pressure, the latter reporting that high mechanical pressure could expel the water from hydrated halloysite and partially collapse the 'tubes'. The possibility of some orientation occurring during preparation of specimens for the Geiger counter X-ray diffraction apparatus, and consequent interference with results, was referred to by Dr. Rooksby.

Of two papers on differential thermal analysis, one dealt with technique and the other with interpretation of results. The apparatus for carrying out the analysis under inert atmospheres was fully described by Prof. A. L. Roberts and Dr. K. Carr (University of Leeds), who found this necessary where bituminous materials were involved, as these were not oxidized by hydrogen peroxide pre-treatment. The use of this modification for the quantitative determination of clay minerals in the presence of coal dust was demonstrated. In discussing the interpretation of the low-temperature endothermic peak of expanding minerals, Mr. Greene-Kelly reviewed previous theories³ and pointed out their weaknesses. The occurrence of double peaks was shown to be normal where the hydration energy of the cation is sufficiently high for differences in mobility of desorbed water to be fully developed. When the hydration energy is below a certain value the mobility of the more tightly held water is apparently increased and the two peaks merge, as with sodium-, potassium-, rubidium- and caesium-montmorillonite. In the discussion, the unsatisfactory nature of hydrogen peroxide as an oxidizing agent for organic matter was commented upon by Dr. R. C. Mackenzie (Macaulay Institute) and by D. A. Holdridge (British Ceramic Research Association, Stoke-on-Trent); the former reported the formation from certain soil clays of insoluble oxalates which interfere with thermograms, and the latter suggested the use of organic solvents for removing bituminous

materials. Mr. Holdridge also remarked upon correlation between the size of the low-temperature exothermic peak and the amount of carbon as determined chemically. Dr. B. S. Neumann (Fuller's Earth Union, Redhill) inquired about Prof. Roberts's and Dr. Carr's experience with ferrous compounds in inert atmospheres. Welcoming Mr. Greene-Kelly's theory, Dr. Mackenzie said that the explanation of the previously anomalous Li^+ result is most encouraging. Dr. Brindley and he also referred to the possibility of diffusion being the peak-determining factor for materials other than montmorillonoids—for example, kaolins⁴.

Possible methods which could be developed for the separation of clay minerals from mixtures were discussed and assessed by Miss K. R. Farquharson (Macaulay Institute). An attempt to use the reputed hydrophobic character of Deuel's montmorillonite-organic complexes⁵ has been unsuccessful. The results of electrophoretic mobility measurements are now being applied using a constant-flow cell. Concentration of one component of a binary mixture has so far been observed, and further work is in progress. To a comment of Mr. Greene-Kelly upon the possibility of sorption of montmorillonite on kaolinite⁶ at the pH values used (about pH 7), Dr. Mackenzie and Miss Farquharson replied that absence of electrolyte is necessary to avoid other undesirable effects. Mr. Robertson suggested that, because of rugosity⁷ differences, separations might be possible by centrifugation of very dilute suspensions.

B. D. Mitchell (Macaulay Institute) and Dr. Mackenzie described a completely inorganic method for removing free iron oxide from clays, based upon the use of sodium hydrosulphite ($\text{Na}_2\text{S}_2\text{O}_4$)⁸. The effects of pH, time of extraction, etc., upon the efficiency of iron removal and upon the crystal lattice of various clay minerals were assessed, and a comparison made of the constituents brought into solution by this and by various other methods. Replying to I. H. Warren (English Clays, St. Austell), they indicated that neither sulphoxylates nor zinc hydrosulphite have yet been tested. The nomenclature of sodium hydrosulphite was discussed by Mr. Holdridge and Mr. Robertson; of the names hydrosulphite, hyposulphite and dithionite, the last was considered to be probably the least ambiguous. The effect of sodium hydrosulphite upon chlorites was referred to by Mlle. Doudon.

The last three papers, while not on the subject for discussion, demonstrated the results obtainable by current refined techniques. Mr. Brown gave evidence for a new clay mineral—a dioctahedral analogue of vermiculite—in a soil clay. The parent material is a dioctahedral mica. Data for the effect of various ions upon the relative intensities of the various X-ray reflexions were given. In reply to comments by Mr. Warren, Dr. Brindley and Dr. Nagelschmidt, Mr. Brown stated that the mineral reacted with ammonium ions after hydrogen peroxide treatment. Although five clay minerals were present, he considered all the reflexions described belonged to one mineral. W. A. Mitchell compared the weathering data with those for the formation of trioctahedral vermiculite in Scottish soils. A Geiger-Müller X-ray spectrometer together with exchangeable cation techniques similar to those described in the preceding paper were used by Dr. B. N. Rolfe (United States Geological Survey) and Prof. C. D. Jeffries (Pennsylvania State College) to elucidate the weathering sequence of mica in soils derived from Devonian

shales and sandstones under different pedogenic conditions. The results were described in a communicated paper. The weathering sequence appeared to be: unweathered mica → 'mica intermediate' → hydrated mica (vermiculite); chlorite was present during initial stages of weathering. In the discussion, the evidence for chlorite and vermiculite and the relative stabilities of these minerals to heat treatment were discussed by Mr. Brown, W. A. Mitchell and Dr. Brindley. In the final paper, Dr. Brindley described recent X-ray investigations upon antigorite. Superimposed upon a band of scattering extending upwards from 4.6 Å. has been observed a sequence of sharp, closely spaced lines, indicating a super-lattice. The dimensions have been calculated, and the significance of this finding in relation to Aruja's super-lattice and Onsager's interpretation was discussed. In discussion Mr. Robertson suggested that electron-micrographs might show if the super-lattice were caused by regular corrugations.

This discussion, while showing the need for further research into methods, also amply demonstrated the wealth of information available from present techniques—and especially indicated that only by application of all techniques available can a full understanding of the mineralogy and properties of any clay be obtained.

In a report of a previous meeting of the Clay Minerals Group held in Stoke-on-Trent during November 7–8, 1952 (see *Nature*, 171, 681; 1953), the statement on p. 682, second column, lines 18–16 from the bottom should read: ". . ., only dioctahedral components with the charge in the octahedral layer (that is, the montmorillonite type) will not swell".

ROBERT C. MACKENZIE

¹ Brown, G., and MacEwan, D. M. C., "X-Ray Identification and Crystal Structures of Clay Minerals" (ed. G. W. Brindley), chap. 11, 266 (Min. Soc., London, 1951); *J. Soil Sci.*, 1, 239 (1949).

² MacEwan, D. M. C., *Nature*, 171, 616 (1953).

³ Hendricks, S. B., Nelson, R. A., and Alexander, L. T., *J. Amer. Chem. Soc.*, 62, 1457 (1940). Macey, H. H., *Trans. Brit. Ceram. Soc.*, 41, 73 (1942). Mackenzie, R. C., *Clay Min. Bull.*, 1, 115 (1950).

⁴ Robertson, R. H. S., Brindley, G. W., and Mackenzie, R. C., *Amer. Min.* (in the press).

⁵ See *Nature*, 168, 107 (1951).

⁶ See *Nature*, 171, 681 (1953). Schofield, R. K., and Samson, H. R., *Clay Min. Bull.*, 2, 45 (1953).

⁷ Robertson, R. H. S., and Emödi, B. S., *Nature*, 152, 539 (1943).

⁸ Galabutskaya, E., and Govorova, R., *Min. Suv'ezh.*, 9, 27 (1934).

SEPARATION OF CALF THYMUS DEOXYRIBONUCLEIC ACID INTO FRACTIONS OF DIFFERENT COMPOSITION

By PROF. ERWIN CHARGAFF, DR. CHARLES F. CRAMPTON and MISS RAKOMA LIPSHITZ

Department of Biochemistry, College of Physicians and Surgeons, Columbia University

IN the light of current conceptions, a preparation of deoxyribonucleic acid, which may be presumed to be an important component of the genetic material, could be regarded as consisting of many chemically different, though closely related, individuals, the constant composition of the whole being a statistical reflexion of the unchanging condition of the cell¹. The composition, with respect to the distribution of