Dr. Beveridge gave evidence contrary to the belief that phospholipids comprise a vehicle for the transportation of fatty acids, although he pointed out that the phospholipids as β-lipoproteins may play a part in the transport of neutral fat. Finally, he quoted from the literature in support of the theory that choline-containing phospholipids facilitate the oxidation of fatty acids. He emphasized that no single function of the phospholipids could be stated in a positive manner. Dr. O. F. Denstedt (McGill University) commented on the physico-chemical function of phospholipids at biological interfaces.

JAMES F. BERRY

MELTING OF SOLIDS

SYMPOSIUM IN OTTAWA

A SYMPOSIUM on melting, diffusion and related topics was held during October 24–25 at the National Research Council Laboratories, Sussex Drive, Ottawa, under the chairmanship of Dr. D. K. C. MacDonald. The meeting was held at the invitation of the Low Temperature and Solid State Physics Group of the Division of Pure Physics, National Research Council of Canada, for the purpose of bringing together scientists within easy reach of Ottawa interested in melting from the different points of view of chemist, geophysicist, metallurgist and physicist. Twelve lectures were given; fifty minutes was allotted to each, of which about twenty was reserved for questions and discussion. It was found that this schedule allowed each speaker time for an adequate exposition of his subject, while preserving the balance of lecture and discussion.

A contrast soon became apparent between the working concepts of the physicists and chemists and those of the metallurgists. The physicists and chemists tended to regard both solid and liquid as homogeneous down to atomic dimensions, and thought in terms of thermodynamics and statistical mechanics. Thus, in his introductory lecture, Dr. MacDonald discussed self-diffusion and melting, using the model of 'hole' formation in the crystal lattice, and outlined the evidence which suggests that melting occurs when the hole concentration has risen to the order of 10^{-3}. J. S. Dugdale (National Research Council) gave a comprehensive review of both experimental and theoretical work on the behaviour of the melting curve at high pressures. Two papers from Chalk River described investigations of structure and diffusion in liquids using slow-neutron diffraction: D. G. Henshaw and D. G. Hurst have determined radial distribution functions in liquid helium, which show marked increase in short-range order with increase of pressure; and B. N. Brockhouse has made some preliminary measurements of the energy distribution in neutrons scattered from liquids, data which, after suitable analysis, can give information about self-diffusion and time-dependent pair distribution functions in the liquid. J. A. Morrison (National Research Council) described experiments on surface melting in adsorbed layers of argon and nitrogen on substrates of titanium oxide, with an anomaly in specific heat becoming rapidly sharper as the thickness of the layer increased. The interpretation of these results was discussed by D. C. Patterson (University of Montreal), using an order–disorder model for melting, and later by the meeting at large.

W. B. Pearson (National Research Council) described experiments on dilute alloys illustrating the effects of lattice distortion upon melting temperatures. The other metallurgists were concerned to make plain the inhomogeneous nature of the melting process, making use of photographs of the melting and freezing interfaces in metals. A. Rosenberg (University of Toronto) showed that freezing in 'pure' lead takes place by lamellar growth, and that melting appears to be the same process in reverse; this was effectively illustrated in a film using suitable space and time magnification. J. W. Rutter (University of Toronto) described the freezing of impure metals and showed how the formation of impurity substructures depends upon the concentration of impurity, rate of freezing, and temperature gradient in the liquid. E. H. McLaren (National Research Council) has used precision (10^{-4} deg. C.) resistance thermometry for investigating the freezing and melting temperatures of zinc and tin, and has found that differences of freezing technique and thermal history can cause changes up to about 10^{-2} deg. C. In a brief, provocative talk, W. C. Winegard (University of Toronto) emphasized the difference of outlook of physicist and metallurgist and criticized the theories of the former for taking no account of the impurities and dislocations which are known to play an important part in melting. A lively discussion followed, profitable because the participants had already listened to uninterrupted expositions of each other's work.

Any doubts of the usefulness of even the crudest of fundamental theories was dispelled by R. J. Uffen (University of Western Ontario), who described how knowledge of the physics of condensed phases is used in attempts to deduce the composition and state of the Earth's mantle and core. For this purpose not nearly enough is yet known about the physics of high pressures, and bold extrapolations from laboratory pressures have to be made. The success of the symposium makes it probable that similar meetings will be arranged for the discussion of other subjects related to work in low-temperature and solid-state physics.

T. H. K. BARRON

CHEMICAL COMPOSITION OF PARTHIAN COINS

AN outstanding example of the value of accurate and complete chemical analyses in the investigation of ancient metals, when these are afterwards interpreted by an ingenious mind, is given in a monograph on the "Chemical Composition of Parthian Coins", by Earle R. Caley, published by the American Numismatic Society, New York (Numismatic Notes and Monographs, No. 129; 1955). The author has made a large number of analyses of Parthian silver and bronze coins not only for the major constituents but also for minor impurities. There is internal evidence that these are reliable, and much new light is thrown on a field of historical metallurgy concerning which knowledge has hitherto been most meagre.

An elegant piece of detective research has revealed, practically beyond doubt, the materials from which the debased silver coins of the King Orodes I (57–38/37 B.C.) were made. From analyses of silver coins of the highest fineness for the time, it is shown that

the 'pure' silver available might contain just over 99 per cent of silver and gold together (the presence of traces of gold in the silver was not recognized by early metallurgists) and perhaps 0·4 per cent of lead. Accepting this composition for the basis metal, the other impurities—tin, part or all of the lead, iron, nickel and, in one case, zinc—will, in the main, have come in with the copper when this and the silver were melted together. It is possible, therefore, to calculate the composition of the copper alloy used.

From such calculations it is clear that two different materials have been employed at different times, for the drachm and for the tetradrachm, and presumably at different mints. In one case the alloy appears to have been prepared from the 'pure' silver and very impure, but virgin, copper, the average analysis of that used in the manufacture of the drachms being: copper, 95; tin, 1·7; lead, 2·8; iron, 0·1; and nickel, 0·1. The copper used for the tetradrachms was of much better quality, being approximately: copper, 99; tin, 0·3; lead, 0·5; iron, 0·1; and nickel, 0·1; which in all probability was of the highest purity then available to the mint. The marked difference in these two analyses would suggest that the drachms and the tetradrachms were struck at different mints, which were possibly a considerable distance apart.

In the other case, there is consistent evidence that a bronze was employed the composition of which was very approximately: copper, 91; tin, 5·5; lead, 3; iron, 0·1; and nickel, 0·1. Comparison of this result with analyses of the earlier Parthian bronze coins shows that the two compositions are in many cases not greatly different either in the major elements present or in the content of impurities. It is suggested, therefore, that the bronze used for preparing the debased alloys was obtained by melting down bronze coins of the earlier Parthian kings. In some cases the amount of lead present is in excess of that likely to be present in the silver and that introduced by the bronze, and it may be, therefore, that in such coins a relatively small amount of lead was deliberately added as such.

F. C. Thompson

NATIONAL RESEARCH COUNCIL OF CANADA

REPORT FOR 1954–55

THE thirty-eighth annual report* of the National Research Council of Canada covers the year ended March 1955, and comprises, besides the president's report, the financial statement and the balance sheet and annual statement of Canadian Patents and Developments, Ltd. The president's report notes that in 1954 the National Research Council provided 2·5 million dollars in 410 awards and 263 scholarships for fundamental research at the universities, and that since the end of the Second World War the Council's support to the universities has increased five-fold. The Council's own scientific staff numbered 548, with 711 technicians and 775 engaged in general service and administrative, as well as about a hundred postdoctorate Fellows. Technical inquiries from Canadian industries numbered about seven thousand five hundred, and the president stresses the value of the work of the twenty-eight associate committees in dealing with scientific and technical problems of national scope.

In an effort to reduce the surface drying of foodstuffs, the Division of Applied Biology has obtained relative humidities approaching saturation by cooling an experimental room indirectly through a jacket of cold air, and recent studies by the Division have shown that the grey discoloration of processed pork occurs much more rapidly in the muscle pigment, myoglobin, than in the blood pigment, hæmoglobin. Investigations of the frozen storage of living cells and small organisms have shown that glycerol reduces freezing damage by changing the pattern of ice-formation. Studies of the carbohydrate composition of various grains, woods and marine algæ have shown that in most plant tissues large quantities of hemicellulose and other complex sugars are associated with cellulose.

The scientific interests of the Maritime Regional Laboratory have been broadened considerably, and a dryer capable of operating on half-ton batches has been designed and constructed for studies of the drying of seaweeds and similar material. Nutritional tests on dried dulse and rockweed meals indicated that the meals compared favourably with casein and were superior to gelatin or soybean in regeneration of liver protein. A method has been developed for determining the presence of carrageenin in seaweeds, and a study of the cause of the flakiness of cod fillets was commenced. At the Prairie Regional Laboratory, Saskatoon, work was continued on the utilization of agricultural materials, including the utilization of straw for pulp, and an investigation on the production of lysine by fermentation. A new fermentation has been developed for *d*-arabitol, glycerol and erythritol. A study of contributory factors in elevator dust explosions points to particle size as the most important factor, only those fractions which pass through a 150-mesh screen being potentially dangerous in initiating explosions.

In the Division of Applied Chemistry, special attention was given to the corrosion in automotive cooling systems by ethylene glycol and the corrosion of iron in aqueous solutions, while studies of the adsorption and desorption of detergents by textiles, using radioactive tracer techniques, have led to a better understanding of detergent action and indicated possibilities for obtaining higher efficiencies in laundering. Work on the direct oxidation of ethylene to ethylene oxide has led to basic studies on the phase behaviour and magnetic susceptibilities of oxidation catalysts, the kinetics of the photochemical oxidation of hydrocarbons, the catalytic polymerization of ethylene and physical adsorption at gas–solid interfaces. Promising results were obtained in a new drying technique for contacting solids and fluids.

The Division of Pure Chemistry continued its investigations of alkaloids and also work on the quantitative description of solvolytic reactions of aromatic and aliphatic sulphonic acids in water and alcohols. Studies of infra-red spectra have been applied to the identification of small amounts of steroid hormones and metabolites isolated from natural sources, and work on free radicals has been extended to the liquid and solid states. A method has been developed in the Molecular Spectroscopy Section for obtaining standard Raman intensities, the sum of which is useful in determining the structure

* Thirty-eighth Annual Report of the National Research Council of Canada, 1954–55, including the Annual Report of the Canadian Patents and Development, Ltd. Pp. 44. (N.R.C. No. 3607.) (Ottawa: National Research Council, 1955.)