

Society Islands, were definitely glaciated during the Ice Age, and that glaciation of at least the southern portion of Banks Island is probable. Evidence obtained by a Canadian Government Expedition in 1908-9 suggests glaciation of Melville Island. No geological evidence seems to be on record indicating lack of glaciation on other islands in this region. It appears that glaciation was of considerable areal importance in Canada's Western Arctic, but information concerning the complete areal extent must await further expeditions.

It was emphasized by Dr. D. A. Nichols, of the Canadian Bureau of Geology and Topography, that most of the present knowledge of the glacial geology of Canada has been gleaned incidentally to studies of other aspects of geology, notably the economic, and that great opportunities for specialized glacial studies exist. Correlation of glacial and marine features of the Atlantic Coast was considered by Prof. Paul MacClintock, of Princeton University, and the contributions of botanical studies to knowledge of post-glacial climates were presented by Prof. W. S. Cooper, of the University of Minnesota, who concluded that the record from pollen studies and the facts of plant geography apparently agree in indicating a mid-post-Pleistocene warm-dry period followed by a return towards cool-moist conditions during the last few thousand years.

Petroleum

The fourth symposium related to geological frontiers in the search for oil and was opened by A. I. Levorsen, chairman of the Research Committee of the American Association of Petroleum Geologists. Among the many interesting points brought out by Mr. Levorsen in his discussion of trends in petroleum geology was a point often overlooked by those interested in mineral resources, namely, that petroleum reserves contrast with reserves of other mineral resources in that it is impossible to estimate them in advance of discovery by drilling. Thus, whatever may be the *true* reserves, *estimated* reserves have always been small, and continued discovery is essential to continued development.

The role of modern surface methods in the search for oil was described by E. W. Owen, president of the American Association of Petroleum Geologists, and the role of micro-palaeontology by Prof. Carey Croneis, of the University of Chicago. Dr. W. C. Krumbein, also of the University of Chicago, spoke of the importance of a fuller knowledge of the principles of sedimentation in the search for stratigraphic oil traps in contrast to structural traps.

In speaking of the role of ground water in petroleum accumulation, Prof. F. B. Plummer, of the University of Texas, concluded that recent extensive investigations of pore sizes, of the forces required to move liquid and gas hydrocarbons through them, of the variation in subsurface pressures, and of the forces due to interfacial tension, indicate that crude oil droplets cannot move through a porous sand from synclinal positions to anticlinal positions by gravity alone. The conclusion is reached that hydrocarbons migrate largely as gas particles and partly as liquid films enveloping gas bubbles, along with the slow downward movement of the ground water towards the lower part of the region, and that as the tiny gas bubbles come within the influence of decidedly low pressures they accumulate in the trap.

FOOD INVESTIGATIONS IN CANADA

FOOD studies constitute a very important field of research. In the National Research Laboratories at Ottawa nearly one half of the work in the Division of Biology and Agriculture now relates to food. Preparation, processing, packaging and preservation during transport are all subjects of research.

Since the autumn of 1939 the investigations in the food laboratories of the National Research Council have been directed almost wholly to new problems arising from the War. Among these is improved preservation of perishable products such as bacon and eggs shipped to Great Britain, the object being to overcome the effects of the longer shipping period and the lack of refrigerated space. The utilization of market poultry and other perishable products for which the export market has been reduced, and improvements in the nutritional value of canned goods and other processed foods have been studied. Special problems such as the storage of blood for transfusion, which the storage laboratories are well equipped to study, have also been given attention.

Poultry

One of the first problems undertaken in the food storage laboratories dealt with the preservation of dressed poultry in the frozen state. The results of this study led to definite recommendations as to pre-cooling, freezing, packaging and storage practices that should be followed to avoid impairment in appearance or eating quality. A new package was designed to facilitate moisture-proof sealing of the product in order to prevent deterioration from surface-drying during storage.

The use of the improved package for dressed poultry for export has been restricted owing to the shortage of refrigerated space on ocean-going vessels. This emphasized the importance of canning. A canning laboratory was established towards the end of 1939 and has now been almost completely equipped.

Following a preliminary survey of the canned poultry on the domestic market, improved methods of processing have been developed and their suitability to plant conditions demonstrated. The recommended processes include pressure pre-cooking, retort pre-cooking, improved methods of handling the raw and finished product and broth, and the use of side-opening cans, lacquered with a gold storing-type enamel which adds to the attractiveness without materially affecting the total cost. Attention has also been given to the development of a grading system, and apparatus has been devised for quantitative separation of the meat and jelly and for measuring the strength of the meat broth and jelly.

Another set of experiments was concerned with the development of rancidity in poultry fat during storage. Prompt pre-cooling and freezing were found essential to the preservation of quality.

Eggs

Eggs shipped to Great Britain in ordinary storage are subject to deterioration from the growth of micro-organisms on the exterior or interior of the eggs, desiccation through loss of moisture, and thinning of the 'thick' white through loss of carbon dioxide. Preservative treatments have been tested and methods of handling investigated. Oil dipping appears to be

the most practicable commercial treatment. Canadian spray-dried whole eggs have been examined for export to Great Britain.

Pork

The frozen storage of pork is of considerable importance since the seasonal production of pigs in Canada demands that a considerable amount of pork must be placed in storage during peak seasons in order to maintain reasonably uniform export of bacon throughout the year. Studies have been made on colour changes and on development of rancidity in pork during storage.

Bacon

Investigations into the curing and transport of Wiltshire bacon, begun in 1938, have been continued as the major project in the food laboratories of the National Research Council. Before the War this work was extended to include comparative tests of Canadian and Danish bacon as received in Great Britain.

Wiltshire bacon is the most important perishable product which Canada exports to Great Britain during peace or war. Bacon studies undertaken before the War included a survey of the curing processes used in Canada. This disclosed variations in the method of producing Wiltshire sides in different plants. An extensive study of the bacon produced by these factories followed. The companies concerned co-operated actively with the National Research Council in these studies.

The results showed that the principal variation in Canadian bacon with respect to bacteriological, chemical and physical composition and such attributes of quality as colour, colour stability and tenderness was in the product manufactured in different factories. This indicated that differences in the curing process, rather than the differential response of individual carcasses to curing, were the primary cause of variable quality. The market value, of course, is also affected by the preference of consumers for sides of a certain conformation.

In recent months more emphasis has been laid on methods for converting the extremely perishable unsmoked bacon normally shipped to England into a form that will withstand the delays in transport while maintaining the highest possible quality. It has been found that smoked bacon is less perishable than the unsmoked material. The possibility of smoking the product in Canada, and the use of cures that render the product less perishable are being investigated.

Smoking is almost universally used in the processing of bacon but Canadian Wiltshire sides have hitherto been exported to Great Britain in the 'green' or unsmoked condition and smoked there. It is generally accepted that smoking has a preservative action but little information of a quantitative nature is available. Extensive studies have therefore been undertaken on the relative perishability of smoked and unsmoked bacon as judged by colour measurement, peroxide oxygen content of fat, and surface bacterial counts. In the storage studies unsmoked bacon was found to be rancid after forty-two days, whereas the smoked product was usually satisfactory after seventy days.

Wiltshire bacon is usually matured for two or three weeks before smoking and then consumed immediately. This procedure is believed to produce the most desirable flavour. If smoking were employed as a method of preservation during transit, the material would have to be smoked shortly after cure and then be carried through a relatively extended transport period before reaching the consumer.

As regards the research on Wiltshire bacon, it may be noted that twenty-three papers on this subject have been published in the *Canadian Journal of Research*. These papers have dealt with such subjects as: a survey of Canadian plant and curing processes; distribution of chloride; effect of heat treatment on nitrite content, colour and toughness; measurement of the colour of meat; seasonal variations in colour; bacteriological and chemical changes during cure; the effect of temperature and bacterial growth on nitrite content, etc. Further work on these topics has had to be curtailed in favour of work on the improvement of methods of preservation of bacon for export to Great Britain.

Influence of Conditioning Factors

Precise control of temperature, humidity and other factors are frequently necessary for the storage and freezing of foodstuffs. Earlier investigations into the humidification and the reduction of temperature variations in cold stores have been continued. Apparatus has been developed for the measurement and control of humidity in cold stores.

Blood Storage

Shortly after the outbreak of war, certain problems relating to storage of whole blood were referred to the Division of Biology and Agriculture by the Subcommittee on Blood Storage of the Associate Committee on Medical Research. The object of these studies was to determine the conditions under which human blood could be stored for the longest possible period. This work has been completed.

Vitamin Fortification

Current attempts to raise the nutritional level of the population, including the vitamin fortification of certain foods, have emphasized the need for information on the effect of processing and storage treatments on the vitamins, several of which are destroyed by exposure to air or by high temperature. Methods and equipment for studying these problems by chemical means are being developed.

The vitamin B complex contains at least two components that can be determined chemically by means of a fluorimeter. Such an instrument has been designed and constructed. It is cheap, simple, self-contained, stable in operation and is capable of measuring thiochrome (produced from thiamin or vitamin B₁) in concentrations as low as one part per hundred million.

Many other investigations relating to foods are under way in the laboratories of the National Research Council or in other laboratories under the programme of work decided upon by the Canadian Committee on Storage and Transport of Food.

Special mention may be made of the development and testing of improved methods of controlling temperature in refrigerated cars. In this work the Division of Physics and Electrical Engineering co-operated by designing the necessary apparatus, and the Fisheries Research Board successfully carried out test shipments of frozen fish from Prince Rupert to Montreal.

Detailed accounts of investigations in food storage and transport are contained in papers published in the *Canadian Journal of Research* and in the annual review of activities issued by the National Research Council of Canada.