THE AUCKLAND ISLANDS

THE Auckland Islands are a small group about 200 miles south of New Zealand. They were discovered by Captain Bristow in 1806 and visited by American, French and British expeditions in 1840; their flora was studied by Sir Joseph Hooker; and in the days of sailing ships they were the cause of many wrecks, lying as they did on the route between Australia and Cape Horn. After the opening of the Panama Canal, they were left almost deserted—except for a period during the Second World War—until they were visited by an expedition from the Australian Museum during December–January, 1962–63. A preliminary account of this expedition has been published in *Australian Natural History* (14, No. 9; March, 1964).

The main Auckland Island is about 23 miles long, and 15 miles across at its widest part, bordered by precipitous cliffs on the western side while providing fine inlets and harbours on the east. Unlike all other windswept sub-antarctic islands, its coastal areas are covered with a thick growth of gnarled, stag-headed trees, of southern rata (*Metrosideros umbellata*), which rise to a height of 40 ft. Below these, specimens of the Macquarie Island cabbage (*Stilbocarpa polaris*), with strong antiscorbutic properties, are conspicuous, although they have been much reduced through the introduction of sheep, goats, cattle and rabbits.

Above the rata is a dense growth of scrubland vegetation (chiefly *Dracophyllum* and *Suttonia*) difficult to penetrate, although it is interspersed with lines of tussock grass (*Danthonia* and prostrate *Coprosma*). Both winged and wingless forms of a number of Diptera and Lepidoptera were taken, along with semi-apterous ichneumons, use being made of aerial nets in the ship's rigging. A new wingless cricket (*Raphidophoridae*) was found to be abundant at night.

Along the shores a supra-littoral zone, marked by white lichen, was found to change abruptly into a mid-tidal zone of bare rock, except for scattered barnacles and limpets. In turn, this zone changed into a lower-tidal one of encrusting coralline algae and the giant kelp (*Durvillea antarctica*), to be followed by an extensive zone of red and brown algae in the sub-littoral. In the rock pools, among the cryptic fauna of small gastropods, fish and worms, the expedition discovered large numbers of the small crab *Halicarcinus planatus*, the only inter-tidal crab on any subantarctic island. A large red spider crab, *Jacquinotia*, dominated the shallow water; two species of nototheneid fish were taken, along with the large crab, *Leptomithrax australis*, and the edible species, *Cancer novaezealandiae*.

Along the beaches, large numbers of Hooker's sea lion (*Neophoca hookeri*) were observed, the sandy beach on Enderby Island being crowded with these animals. Yellow-eyed penguins (*Megadyptes antipodes*) and crested penguins (*Eudyptes*) were plentiful, and among the other birds observed were Auckland Island shags (*Phalacrocorax campbelli colensoi*), red-billed gulls (*Larus novaehollandiae*), Antarctic terns (*Sterna vittata*), giant petrels (*Macronectes giganteus*), the sooty albatross (*Phoebetria palpebrata*), the southern skua (*Stercorarius lonnbergi*), prions (*Pachytila desolata*), diving petrels (*Pelecanoides urinatrix*), sooty shearwaters (*Puffinus griseus*), and white-headed petrels (*Petrodroma lessoni*). Of special ornithological interest were the large numbers of the Auckland Island flightless duck (*Anas aucklandica*) on Ocean and Ewing Islands.

But the expedition's most striking experience was a visit to a breeding colony of the southern race of the royal albatross (*Diomedea epomophora*), which is held to be the largest of all albatrosses, with a wing span of 11·5 ft. and a weight of 25 lb. This bird is known to nest only on Auckland and Campbell Islands, Taiaroa Head on the South Island, New Zealand, and on the Chatham Islands east of New Zealand.

RESEARCH INTO RESEARCH

DURING January–March a seminar was held in Stockholm to stimulate studies on research in social sciences. This seminar was arranged by the Academy of Engineering Sciences and supported by the Social Science and Technical Research Councils. Dr. Stevan Dedijer from the Sociological Institute of the University of Lund led the work. About half the thirty delegates were young social scientists from the universities. The others came from the Ministries and Research Councils, and from certain large industrial firms and research establishments.

The seminar met in Stockholm for two days every other week, making a total of 10 days. During the intervals, each delegate worked on his individual problem. The programme consisted of some twenty lectures, with discussions. The rest of the time was devoted to discussing the delegates' projects and progress reports.

Visitors from overseas who addressed the seminar included: Dr. Charles Kidd, head of the office for International Research at the U.S. National Institutes of Health, who spoke on "Research, Universities and the Government in the United States"; Dr. Stephen Toulmin from the Nuffield Foundation in London, who gave a stimulating lecture on "Science as the Focus of Academic Study"; Chris Freeman from the National Institute of Economic and Social Research in England, who reported his penetrating investigations into the importance of innovations in the plastics industries of different countries; and Jean Jacques Salomon from the Secretariat of the Organization for Economic Co-operation and Development, Paris, who spoke on "Science and Foreign Affairs in Europe". Almost all the leading Swedish research administrators gave lectures to the seminar. Each aired his own views on activities in different areas of research and on the selective approach necessary in a country of Sweden's size.

Subjects which the delegates considered, and which will be included in the collected essays when they are published, are: methodological problems in connexion with research statistics; the Government budget process in the fields of university research and education; an investment calculus on research and development projects in Swedish industry; civilian utilization of results emanating from defence research and development in Sweden; the ageing of research workers; the development of the theory of planning of science.

The seminar was a bold experiment, but one which, in retrospect, appears to have succeeded in its essential aims. The primary object was to pin down linguistic usage in connexion with research, so as to be able to attack clearly defined problems within various disciplines of the social science. A number of the investigations initiated by the seminar may clearly be of immediate relevance to Swedish research policy. The essential gain, however, is that young research workers have had their attention directed to the vital tasks connected with the social relations of science. Increased knowledge is needed in this field in order to weigh the value of different research projects in the industrial countries and to build up a research apparatus in the developing countries.

Social science investigations of numerous aspects of 'research' were started by English scientists in the 'thirties. That these studies did not lead further was due largely to ideological disagreement on the planning of science. To-day the chances of success are better, but occasional reflexions on the vital importance of this field will not suffice. What is needed is much hard work by a great many competent persons over a prolonged period.

SVERKER GUSTAVSSON

ADVANCEMENT OF SCIENTIFIC EDUCATION IN SCHOOLS

THE final report of the Industrial Fund for the Advancement of Scientific Education in Schools* is a brief record of a creditable episode in the history of education in the United Kingdom and Northern Ireland, which has now come to an end. The Fund was established in 1955, mainly on the initiative of Lord Weeks, Sir Alan Wilson, Mr. J. Oriel and Mr. G. Courtauld. Its object was to give a boost to the supply of scientists and technologists. Contributions were received from 141 industrial concerns, and the total sum accumulated amounted to £3,211,035. From this sum grants amounting to £2,640,500 were made to 210 schools for the renovation and extension of buildings for science teaching, and 129 schools received assistance for obtaining apparatus. Among the smaller items, a sum was set aside for the publication of a book on the planning and equipment of laboratories, based on experience acquired through the Fund; seven schools were given an engine test bed; and a special grant was allotted to Malvern College where, through aid provided by the Nuffield Foundation, new approaches are being made to the teaching of physics. Assistance was limited to independent and direct-grant schools for boys and girls, since maintained schools are the concern of the Government and Local Education Authorities; throughout the duration of the scheme interest was concentrated on the 'exact' sciences, so that the teaching of biology benefited only indirectly.

In attempting to assess the success of the scheme it is not possible to arrive at precise conclusions because of the interplay of a variety of factors. But one point not mentioned in the report is that the Fund must have been a great boon to the schools concerned in a post-war period of economic and personal austerities. Since 1955, the number of sixth-form members specializing in mathematics and science has greatly expanded; it is now common practice for all boys to be taught some science before taking the Ordinary Level Examination of the General Certificate of Education, and many schools have organized courses in science for arts specialists.

Only in the fourteen girls' schools which received grants have the results been disappointing. In them, staffing may have been a more difficult problem than lack of facilities; and apart from medicine and its associated services, girls and headmistresses alike do not look favourably on careers in science. Yet the few girls who do take science at the Advanced Level of the General Certificate of Education do well in it and particularly well in biology.

Other questions are posed by the report. In some boys' schools the "express line" of preparation for the Ordinary Level Examination of the General Certificate of Education is producing an increasing number of boys spending a third year in the sixth form, which would seem to be undesirable. Again, in recent years arts specialists have been increasing about twice as fast as specialists in science; in fact, recently in the larger public schools the number of science specialists has tended to fall, suggesting that science is not appealing to some of the most able boys. That in turn may have some relation to the limited amount of science being taught in preparatory schools, although in them there has been some improvement over the past few years. Finally, to the credit of the Fund it can be said that the standard of accommodation for teaching science which it provided was higher than that envisaged by the Ministry of Education in its *Building Bulletin* No. 2A, 1954, while the standard of equipment in maintained schools continues to give grounds for concern in relation to the place of science in the modern world and the extent to which teachers become discouraged and frustrated by present conditions.

* Report on the Industrial Fund for the Advancement of Scientific Education in Schools. Pp. iii+36. (Barbary, Maresfield Park, Uckfield: Sir Graham Savage (Chief Assessor), 1964.)

ANISOTROPY OF FRICTION IN CRYSTALS

By DR. F. P. BOWDEN, C.B.E., F.R.S., DR. C. A. BROOKES and A. E. HANWELL

Laboratory for the Physics and Chemistry of Solids, Cavendish Laboratory, University of Cambridge

EARLIER experiments in this laboratory have shown that the friction of diamond is dependent on the crystallographic direction of sliding[1,3]. With a diamond slider (of constant orientation) sliding at low speed on the cube face of a polished diamond the coefficient of friction was $\mu = 0.15$ when sliding in the [100] direction (parallel to the cube edge) and $\mu = 0.05$ in the [110] direction (diagonal to the cube edge). Frictional anisotropy has also been observed on other crystals, for example, sapphire[4] and copper[5].

Magnesium oxide. We have recently examined the frictional behaviour of single crystals of magnesium oxide. This is a convenient crystal since it cleaves readily on the (001) face to give a flat surface and the techniques for examination by chemical polishing, dislocation etching and electron microscopy are well established. With a hemispherical slider moving at low speed (0·1 mm/sec) on a cleaved face in air under a load of 30 g the coefficient of friction was $\mu \simeq 0.2$ and appreciable plastic deformation occurred beneath the surface of the crystal. This is illustrated by Fig. 1. There are two major features revealed by this photo-micrograph. First, the processes of fracture which govern the formation of wear debris occur both on and beneath the surface. Secondly, slip has taken place predominantly on those (110) planes which intersect the deformed surface at 45°, although some slip on those (110) planes at 90° to that surface is revealed. The maximum shear stress, under these conditions, is at a point below the surface and it is from this region that the dislocation loops originate and multiply. Similar deformation has been observed under conditions of rolling friction[6].

A crystal of magnesium oxide exhibits a marked anisotropy in its mechanical properties. Measurements of hardness, for example, show that this is very dependent