produce one such unit, whereas with an extreme concentration on high-calorie foods (for example, rice and sweet potatoes) and intensive multiple cropping, as many as $6\frac{1}{2}$ units per acre are produced in Japan, or more than twenty times as much.

At the first session of the General Assembly, four countries were elected to full membership—the U.S.S.R. (which had sent a strong delegation), Iceland, Hungary and Ethiopia. This was the first participation of the Russians since before the Second World War. With the object of helping the development of geographical research in countries with an insufficient number to set up the National Committee required of adhering nations, the General Assembly added to the Statutes provision for a class of Associate Members and elected as such the Sudan, French West Africa, Nigeria, Uganda, Kenya and Iraq.

More than three hundred papers, printed in abstract in advance, were presented to the dozen working sections into which the Congress was organized. Much attention was also given to the presentation and discussion of commission reports. At each Congress, the General Assembly, with the guidance of the Executive Committee, appoints commissions, consisting of not more than six full members, to carry out investigations into specific problems. Each commission must present a report at the next Congress, but may be reappointed for a further term. Reports presented were those on Medical Geography (which also had an active and flourishing section dealing both with the geographical distribution of disease and relevant factors), Evolution of Slopes, Erosion Surfaces around the Atlantic, Coastal Sedimentation, Periglacial Phenomena, Karst Phenomena, Arid Zones, the Library Classification of Geographical Books and Maps, An Inventory of World Land Use (a record of work known to be in progress in different countries) and The Teaching of Geography in Schools (a factual survey). Published reports, printed or mimeographed, on all these subjects were presented; an interim note was received from the Commission for the Bibliography of Ancient Maps. A Special Committee on Conversion Tables presented a report recommending what tables should be prepared and published. Some of the reports have been published as special parts of scientific journals; of most a small number is retained for distribution by the secretariat. An immense amount of valuable work is in progress and, despite extremely limited funds, the General Assembly agreed at its final session to the reappointment of all these commissions. In addition, the Executive Committee has set up two official commissions: one on the Mapping of Population, and the other on the Humid Tropics, to collaborate with other organizations working in these fields. Two new commissions were also approved: on National Atlases and on Applied Geomorphology.

The arrangements for the conference were excellent. The Brazilian Government made generous financial provisions which enabled a number of distinguished foreign delegates to be offered free air passages. The Navy allowed the meetings to be held, and some two hundred delegates to live, in the well-equipped Escola Naval, delightfully situated in Rio harbour on an island, now almost linked with the heart of the city by the reclaimed land on which the City airport is situated. Many nations joined in providing a magnificent map exhibition housed in the new Ministry of Education building, which also provided

an auditorium equipped with simultaneous translation facilities for plenary sessions. In another building was a large selection of Brazilian maps.

The field trips arranged before and after the Congress enabled a large number of delegates to appreciate some of the problems of a vast and difficult country larger than the United States. Travelling by motor-bus over the winding mountainous dirt roads made the reason why 40 per cent of travel is by air obvious: there were times during each day when delegates saw more than one plane a minute handled by the Rio City airport. The extreme contrast between such great skyscraper cities as Belo Horizonte—their very names scarcely known to foreigners—and the vast uninhabited scrub-lands and forests impressed itself on all, while the two three-million cities of Rio and São Paulo left the impression of a growth too rapid for local administration to catch up. Everywhere the delegates met the lavish hospitality and boundless enthusiasm of the Brazilians; but standing above all was the organizing genius of Prof. Hilgard O'Reilly Sternberg and his faithful band of volunteer helpers.

At the final session of the General Assembly the presidency of the Union was handed over to Dr. Hans W:son Ahlmann, of Sweden, distinguished glaciologist, diplomat and don, and the joint invitation of the five Nordic countries of Norway, Sweden, Denmark, Finland and Iceland for the Congress of 1960 was accepted. For the past seven years the secretariat of the Union has been in the able charge of Dr. G. H. T. Kimble as secretary-treasurer: it is now to be transferred to the University of Zurich under Prof. Hans Boesch. The new Executive comprises the President, Secretary-Treasurer and Prof. Sternberg as first Vice-President, together with six Vice-Presidents—Profs. Hassan Awad (Egypt), Chauncy Harris (United States), Max Sorre (France), L. Dudley Stamp (United Kingdom), Fumio Tada (Japan), and Carl Troll (Germany).

L. DUDLEY STAMP

SCIENCE AND STRATEGY

THE modern Totalitarian Government considers itself above all moral criticism, and pursues its aims by murder by the million, routine employment of torture, the use of deliberate lies, the perversion of justice and, above all, by treating formal agreements as stopgaps to be broken whenever any least advantage is to be gained. Into this world, where good faith has almost vanished from international relationships, there has arrived the control of nuclear energy, which at the same time holds out great hopes for the improvement of man's estate and permits the construction of weapons which stand in a more extreme ratio to those of the Second World War than the latter do to the weapons of the Stone Age.

The authors of the papers in a discussion published in the *Bulletin of Atomic Scientists* for May, while repeating again and again the urgency of a genuine peace, consider the functions of the Armed Services in a world where no such agreement has been reached. It is generally agreed that the H-bomb is a great deterrent; but the first contributor, Sir John Slessor, tries to see just exactly what it will deter. He concludes that global war in the 1914 or 1939 style is finished, since the object of

governments is to win a war, and the new weapons imply such appalling destruction that no war can be won. But he points out that any ban on nuclear weapons alone would "obviously suit the Communists to engage in a war in which their enormous superiority in manpower and conventional armaments could hardly fail to be decisive". For the Western Powers to refuse ever to use the bomb first would ensure their defeat; any uncertainty about its use might lead to another "drift into war". He then puts forward some very interesting arguments that the function of conventional armaments in this situation is as a "trip-wire" to ensure that any future aggression cannot gain its ends without having to face full-scale nuclear war and that, since no future global war can possibly last long, economies must be looked for in those applications required only for long-term hostilities.

The second author, Dr. R. L. Meier, sets out a series of propositions which he considers valid where "there are no important constraints upon how the major powers may act in the short run". The most important and most controversial are No. III, in which he argues for a sharp distinction between conventional weapons and nuclear weapons (Sir John Slessor separates "tactical" nuclear weapons from the H-bomb), and No. VI, that when superweapons have reached a certain level "it appears to be no longer possible to negotiate disarmament at the nuclear level" because "any nation which does not act in good faith would be able to dictate terms to any part of the world, or annihilate it" since "the margin of error in detection and accounting is still enough to dominate". Back to good faith once more.

The third author, Mr. Hanson W. Baldwin, starts with an illuminating and balanced discussion of the new methods for delivering nuclear explosives, and points out that, while the power of the attack has so enormously increased the power of defence, interception has considerably decreased. He recommends that "we must be capable of fighting all-out nuclear war, a limited nuclear war, a major non-nuclear war, small scale brush-wars". This counsel of despair may perhaps be practicable for the United States with its immense resources; it could scarcely be so for Great Britain.

The fourth author, Mr. C. W. Sherwin, emphasizes a further point. That old-fashioned principle of war was to seek out and neutralize the armed forces of the enemy. But in a modern future war these armed forces will be small, light, mobile machines, which can be fairly easily protected against blast, while cities are large, immobile and from their construction very sensitive to blast. In other words, success is probably much easier by attacking civilian populations. This was once forbidden by a Geneva Convention; but such conventions again imply good faith. Mr. Sherwin proceeds by outlining a set of rules for nuclear strategy in a deterrent war; even supposing these rules to be correct it is most unlikely that they could be followed in the mass hysteria of an atomic war. He concludes by hoping that, while the Mark I solution of peace-through-deterrence is perhaps not the ultimate means of preventing major war, it may give time for a final solution. Dr. Warren Amster concludes the discussion in a short article which emphasizes the points made by the previous authors.

This discussion is of the utmost interest, and can scarcely be summarized in so short a review. The discussion is being continued. E. C. BAUGHAN

RESEARCH COUNCIL OF ALBERTA

REPORT FOR 1955

THE thirty-sixth annual report of the Research Council of Alberta*, covering 1955, refers to increased emphasis of basic geological research and survey in view of its importance to much of the Province's resources. Besides the oil-sand area project, clay research, glacial geological studies and micropalaeontological research carried over from 1954, further work undertaken included a ground-water survey of the Province, stratigraphical studies of the southern foothills, and a laboratory study on the chemical variation between marine and non-marine sediments. The Council's soil surveyors were again engaged principally in the Peace River district of Alberta; but the report refers also to other projects of the Alberta Soil Survey conducted mainly by Federal Survey staff, such as the field-work on the Edmonton map-sheet and irrigation research on solonchic soils at Youngstown, in co-operation with the University of Alberta Department of Soil Science, the Canada Experimental Farms Service and the Provincial Department of Agriculture.

Encouraging progress has been made in the re-orientated coal research programme. Investigations of the physical behaviour of coal in an ultrasonic field demonstrated that the 'true' density of coal appears to remain substantially unaffected, but that the surface area of the coal tends to increase with the frequency of vibration and time of exposure; preliminary carbonization tests have indicated that the presence of traces of nitric oxide in the retort can induce significant modifications in the nature of the tar. A combination of infra-red studies and elementary analysis has indicated the relation between humic acid and coals of various ranks, and studies of the oxidation of phenols to humic acid have shown that oxidative polymerization of aromatic substances can yield naphthenic structures known to occur in coal and petroleum. Polarographic studies indicate that humic acids from hydroquinone and low-rank coal have less condensed structures than humic acids from material of higher rank. The presence of a cracking catalyst such as alumina-silicate in carbonization about 600° C. appeared to affect the primary decomposition of the coal as well as the secondary decomposition of the primary tar.

The work of the Applied Research Laboratory was confined to attempts to surface-seal Albertan sub-bituminous coals against loss of water so as to prevent or reduce disintegration during storage. Some success was achieved with emulsions of wax or bitumen, and substantial progress was also made in a study of the grindability of coal.

Petroleum research has included studies of the kinetics of thermal degradation or maturation for the removal of vanadium or nickel from McMurray oil; the work indicates that geological time has been too short to account for the observed maturation of crude oils in Alberta at the temperatures usually regarded as reasonable during geological time, and suggests that considerable importance must be attached to catalysis in the formation of crude oil. A survey has been undertaken of the carcinogenicity of crude oils of Western Canada; detailed investigations of the sulphur content of heavy oils using

* Research Council of Alberta. Thirty-sixth Annual Report, 1955. (Report No. 73.) Pp. 52. (Edmonton: Research Council of Alberta, 1956.)