SCIENCE IN THE U.S.S.R.*

GEOLOGY AND PALÆOBOTANY

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MUCH has already been written on the expansion of geological research and the development of mineral resources in the U.S.S.R. during the last quarter of a century, and the Seventeenth International Geological Congress held in Moscow in 1937 provided an opportunity for viewing some aspects of that work in the field and in the laboratory, while the sessions and the publications of the Congress summarized achievements to that date. In June of the present year some British geologists were invited to resume personal contact with Russian colleagues, and to learn something of their recent progress on the occasion of the 220th jubilee celebrations arranged by the Academy of Sciences of the U.S.S.R., only a few weeks after the cessation of hostilities in Europe.

Although activities during the past few years have been dominated by the necessity for prospecting for new deposits of various strategic minerals and for further developing previously known deposits, a great deal of incidental stratigraphical, palaeontological and tectonic work has been accomplished. The end of the War therefore brings a rich harvest of important monographs and maps awaiting publication, while the release from the urgent necessity of dealing with practical demands means that now, as the veteran Academician V. A. Obruchev said at Moscow, "it is the theoretical problems that claim our closest attention".

The geological map of the whole of the Soviet Union on the scale of 1 : 5,000,000, edited by D. V. Nalivkin and published in 1937, was partly based on a series of regional manuscript maps on larger scales, and many of these maps have since been published. The Central Geological Prospecting Institute, directed by I. I. Gorsky, is now in process of issuing the sheets of a map again planned to cover the whole of the U.S.S.R., this time on a scale 1 : 1,000,000; European Russia is already completed, as well as considerable areas of central Asia. A new map of the Urals (in preparation) will endeavour to show stratigraphy, tectonics, useful minerals, drift and lithology on the same map. The only regions where geological surveying has not been carried out in any detail are certain areas of north-east Siberia, where the frozen terrain is exceedingly difficult; these regions will probably be left until last in the programme for mapping geologically the whole of the U.S.S.R., but are by no means being neglected in the meantime, for a special Institute for the Study of Permanently Frozen Ground has been set up by the Academy of Sciences under the direction of V. A. Obruchev, with headquarters in Moscow and field stations at Igarka and Yakutsk.

Among publications of the past decade, pride of place should be given to the several different series of volumes planned to cover all aspects of geological science for the whole of the Soviet Union. "The Geology of the U.S.S.R.", edited by J. S. Edelstein, is arranged on a regional basis and will extend to twenty-seven volumes, of which six have appeared so far, on the Urals, Donetz Basin, Kuznetsk Basin,

Transcaucasia (two) and Eastern Kazakstan. "The Stratigraphy of the U.S.S.R.", of which volume 1 on the Pre-Cambrian appeared in 1939, will be completed in fifteen volumes. In addition to "The Palaeontology of the U.S.S.R." and the "Monographs of Palaeontology", there is an "Atlas of the Leading Forms of the Fossil Faunas of the U.S.S.R.", of which some four or five volumes have appeared and another half-dozen are ready for publication. There are also series on the "Minerals", the "Petrography", the "Pegmatites", and the "Soils of the U.S.S.R.", "The Mineralogy of the Urals", and Obruchev's "Geology of Siberia" in three volumes. Six volumes of the Proceedings of the Seventeenth International Geological Congress were issued in 1939 and 1940.

Soviet geology has suffered the loss by death of three of its most distinguished leaders during the last year: A. A. Borissiak (1872-1944), who after an early career in stratigraphy and tectonics became the leading vertebrate palaeontologist in the country, V. I. Vernadsky, the veteran mineralogist (see *Nature*, March 10, 1945), and A. E. Fersman (see *Nature*, July 7).

In palaeobotany, much important work has been done recently on the floras of successive horizons in the upper Carboniferous and Permian of the Asiatic parts of the Soviet Union. A question which has interested palaeobotanists for nearly half a century is the supposed occurrence of elements of the southern hemisphere *Glossopteris* flora in Siberia. *Glossopteris* itself was first reported, but not figured, by Amalitzky, who was not a botanist. Since then a number of other *Glossopteris*- and *Gangamopteris*-like forms have been described by Zalesky and others; but many palaeobotanists outside the U.S.S.R. have long felt dubious about the value of these records. The whole problem still awaits detailed examination, but recent and still largely unpublished work by Maria Neuburg, who kindly showed me some of the material on which her conclusions were based, proves that some at least of the supposed glossopterids are absolutely distinct.

A promising discovery of a rich upper Triassic deposit of plants with well-preserved cuticles has been announced by Prinada, and S. N. Naumova has ready for publication an extensive monograph on the spore- and pollen-content of strata of various geological horizons. The detailed description of Upper Cretaceous and Tertiary fossil plant assemblages and the delimitation of past floral provinces is being continued by A. N. Kryshstofovich and others. Kryshstofovich has recently published, as one of the volumes in the "Palaeontology of the U.S.S.R.", a complete index of the fossil flora, which includes every reference to fossil plants of all ages from all parts of the Soviet Union; with the vast increase in the literature of the subject such works are absolutely indispensable.

Two very able young palaeobotanists lost their lives on active service during the War: K. K. Shaparenko, who had written on *Ginkgo* and on *Liriodendron*, and A. V. Yarmolenko, noted for his work on upper Cretaceous plants and particularly on fossil woods.

The flexibility in the organization of scientific research in the Soviet Union, leading frequently to the combination of previously separate bodies or journals,

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and the habit of changing the names of institutions, is apt to be confusing to outsiders. The Academy of Sciences presented all those who attended the Jubilee Celebrations with a finely produced volume of more than three hundred pages which describes in detail all the sections and institutes of the Academy itself; this is a most useful and up-to-date work of reference but is not, of course, all-embracing. The compilation of a directory of all scientific institutions, giving not only their present but also their previous names, addresses, functions and publications, would be an inestimable boon.

PHYSICAL CHEMISTRY

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A VISIT to the scientific institutes of Moscow and Leningrad leaves one with several vivid impressions. Perhaps the strongest is that of a numerous and enthusiastic community of scientific workers, led by the most eminent scholars of the country, housed in excellent buildings, well equipped with all the facilities necessary for their work, and enjoying a nation-wide prestige which must be almost unprecedented in the history of learning.

The institutes have passed through a period of great difficulty, having been uprooted by war and evacuated to other parts of the country: as one of the directors remarked, "Two evacuations are about the equivalent of one earthquake". Nevertheless, the return to normality has gone on with remarkable speed: and new institutes seem to arise in the course of a few months. On the outskirts of Moscow, overlooking the river, and adjoining what will presently be a splendid park, stand the laboratories of Academician Kapitza and of Academician Semenov. The latter laboratory has been converted from a very fine old house and has been entirely refitted in a very short space of time to accommodate work which is now being permanently transferred from Leningrad to Moscow. The appreciation of the fact that scientific work flourishes best in serene and agreeable surroundings seems to be general. The psychology is sound, and we must hope that a similar understanding will be shown by those responsible for establishing new research centres in Britain.

It was also interesting to observe that, despite the exigencies of war, there had been a general realization of the importance of maintaining long-range fundamental research; indeed, while admiring the breadth of view which seemed to have been shown by those directing the general policy, one wondered a little uneasily whether too much of the future in our own country might not have been sacrificed to immediate needs.

Various members of the Academy of Sciences discussed quite frankly with their visitors certain aspects of their present arrangements which they have found not quite satisfactory and which they are in process of modifying. There is, for example, a feeling that in the past the organization of the work in laboratories was rather too centralized, and that for the best results rather more decentralization is beneficial. Another aspect of the same thing is that the great institutes have tended rather to overshadow the universities in research, and that the position of the latter will probably need strengthening. On the other

hand, students from the universities actually do part of their work in the research institutes, so that a measure of valuable co-operation comes about. One can scarcely expect that in a vast and rapidly evolving country like the Soviet Union any of the forms of society have yet reached their stable level; but it is most gratifying to feel that in scientific matters the future seems, so far as can be judged, to be largely in the hands of the best men of science themselves.

It is only possible to mention specifically a few of the institutes and laboratories in which physico-chemical work is in progress. In Moscow there is the Institute of Academician Frumkin, which deals with problems of colloid science, taking the expression in the widest sense, which includes the study of adsorption, catalysis and electrokinetic phenomena. Beautiful experiments on the motions of charged mercury droplets in different solutions were demonstrated by Frumkin himself and discussed in a lecture during the anniversary celebrations of the Academy last June. In Moscow also are two new institutes, one presided over by P. Kapitza, known as the Institute for Physical Problems, and the other the Institute of Physical Chemistry, presided over by N. Semenov (whose name, English chemists should know, is pronounced Semyónov). The work of the former deals largely with low-temperature phenomena, and although much of it, especially the brilliant investigations on the properties of liquid helium, is of the greatest interest to physical chemists, it is perhaps best dealt with under the heading of physics. The Institute of Academician Semenov, recently transferred from Leningrad, houses a school of workers who, under the inspiration of their chief, have made one of the most characteristic of the Russian contributions to modern physical chemistry, namely, the intensive study in all their aspects of the phenomena of flame, combustion and explosions. The work of Semenov on the theory of branching reaction chains and the interpretation of explosion limits, thermal and non-thermal explosions, degenerate explosions and so on, is too well known to need description. Some of the more recent work has included ingenious studies of the way in which chemical reactions may be initiated upon a solid surface and propagate themselves into the whole volume of the material. Another development is the study of the surface electrical conductivity as a means of investigating films in which catalytic reactions occur. Much interesting work is being carried out on the part played by hydrogen atoms and hydroxyl radicals in reactions (some of this work in the Semenov Institute, some in the Frumkin Institute). It would be extremely difficult in a short account to mention individual workers; but perhaps I might remark how illuminating I found the contributions of Zeldovitch on the fascinating but extremely difficult problem of the rate of propagation of flame through combustible mixtures. This subject is of the greatest practical importance and of considerable theoretical interest, and the recent contributions maintain the traditions of the Semenov school.

It is not surprising at the present time to find much work of a physico-chemical nature going on in the Organic Chemical Institute in Moscow, especially in the high-pressure laboratory and in the sections dealing with catalytic reactions (Balandin and others).

In Leningrad it is hard to say whether the great Physico-Technical Institute, of which the head is