The period 1918–40 is that which is best covered by holdings of Russian periodicals in this country. For the future, however, the outlook may not be so good. In June 1947 a Decree of the Council of Ministers of the U.S.S.R. classified as a state secret "geological reserves and production of non-ferrous and rare metals and rare earths". It is sincerely to be hoped that this will not be interpreted too ruthlessly. It would be a very great pity if the exchange of information, built up between the wars and at last reaching a point at which really useful quantities of material are available, were to be abruptly stopped.

TERENCE ARMSTRONG

RECENT SOVIET RESEARCH ON PERMANENTLY FROZEN SOIL

[Based on papers in *Trudy Instituta Merzlotovedeniya im. V. A. Obrucheva* (*Transactions of the V. A. Obruchev Institute for the Study of Permanently Frozen Soil*) (Moscow, Leningrad), Tom 5, 1947.]

A start has been made in the U.S.S.R. in applying electrical prospecting methods to the study of permanently frozen soil—particularly with the object of determining the thickness of the upper thawed (or "active") layer and of the permanently frozen layer beneath it. The Geophysical section of the V. A. Obruchev Institute for the Study of Permanently Frozen Soil [*Institut Merzlotovedeniya im. V. A. Obrucheva*] carried out a certain amount of experimental work on this subject in the years immediately preceding the war, and a recent issue of the Institute's *Transactions* contains a number of papers which give the results of this work.

There are broadly speaking two principal ways in which electrical methods can be used for prospecting: conductivity methods, which the Russians call "electrometry", and electro-magnetic methods, which they call "ondometry". The problem is to apply these methods to permanently frozen soil.

B. S. Enenshteyn contributes two papers on "electrometry". In one he studies the conductivity of permanently frozen soil and surveys his own experimental work of 1935–40 carried out in various parts of the permanently frozen soil zones. His results show that the method he used—the Schlumberger direct current method—is applicable to permanently frozen soil, since the latter is a sufficient conductor; but it will only work under certain conditions. The temperature of the frozen layer must be roughly between $-1°$ and $-5°$ C.—lower temperatures render the system useless; and such factors as lenses of ice within the frozen layer or the presence of frozen sea water disturb the results. Enenshteyn obtained reasonably accurate readings of the thickness of the upper thawed layer up to about 20 m. and the frozen layer up to about 100 m., when working under good conditions.

In the other paper Enenshteyn writes of his measurements of earth currents in the thawed layer and concludes that they must emanate from the boundary between thawed and frozen layers. This then may be another possible method of determining the depth of the dividing line.

Results of work on electro-magnetic methods are also contributed. A. A. Petrovsky, head of the Geophysical Section of the Institute, together with

B. N. Dostovalov, carried out a series of experiments in 1940 at Igarka on the lower Yenisey. Electro-magnetic waves had been used before in the U.S.S.R., by Petrovsky and others, in prospecting for minerals. As early as 1927 it had been possible to penetrate 120 m. of rock on wave-lengths varying from 50 to 250 m. The work at Igarka was the first attempt to penetrate permanently frozen soil. Working between an underground tunnel and the surface of the ground above, radio waves were successfully received through 10 m. of soil, of which 1 to 2 m. formed the upper thawed layer and the remainder was permanently frozen. The wave-lengths used were about 44 and 76 m., and it was noted that better results were obtained with the shorter wave-length.

The same two men have also explored the possibilities of using a radio method based on antenna impedance for measuring the depth of the interface between upper thawed and permanently frozen layers. A horizontal antenna is placed at varying heights above the ground to be examined, and the capacity of the antenna measured. In this way both the dielectric constant of each layer and the depth of the dividing line should be ascertainable. In 1939 and 1940 experiments were made at Moscow and Igarka, working on a wave-length of 142 m. It was established that for successful working of the method the dielectric constant of the upper layer must not exceed 15 e.s.u., and must be less than that of the lower layer. For this reason it proved possible to measure the thickness of ice lying on water (dielectric constant (ϵ) of ice $\simeq 4$ e.s.u., of water $\simeq 81$ e.s.u.) up to a thickness of 50 cm., and of frozen soil ($\epsilon \simeq 5$ e.s.u.) above thawed soil ($\epsilon \simeq 20$ e.s.u.), but not of thawed soil above frozen soil.

It is clear from the foregoing that the start that has been made on this problem promises well. It would appear that the direct current method should be developed for use in the southern parts of the permanently frozen soil zone since it cannot be used when the soil temperature falls below $-5°$ C. The radio methods are more appropriate for use in the north for establishing the thickness of the permanently frozen layer when there is no thawed layer lying above it. The direct current method is now, in the opinion of senior members of the V. A. Obruchev Institute, sufficiently developed for practical use; but clearly much work remains to be done on the other method. The war and Professor Petrovsky's death in 1942 combined to hold up work and to delay the publication of this volume of results for six years. Further advances along these lines may be expected in the near future. TERENCE ARMSTRONG

LOCATION OF ICEBERGS BY RADAR

[Based on "The transmission characteristics of micro-waves through advection fog and the reflection properties of floating ice" by Loren E. Brunner. Unpublished MS. supplied by the United States Coast Guard in November 1947.]

Lt.-Cdr. Loren E. Brunner of the United States Coast Guard has written a paper in which he considers the practical problem confronting the sailor on the look-out for icebergs, and gives some results obtained by recent experiments with radar in the region of the Grand Banks of Newfoundland.

The first task was to examine the reflection characteristics of an iceberg

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