members of the Institute of Geology of the Arctic. In the descriptive part, the author provides a brief geological-tectonic account based on recent publications in the U.S.S.R., Finland, Norway, Greenland and Canada.

Elbrus. According to J. Y. Panteleev and Y. P. Masurenkov (*Priroda*, 5, 61; 1962), Elbrus (5,630 m)—the highest mountain in Europe—is not an extinct volcano, but only dormant. This is testified by its extensive fumarolic field giving out numerous steam and gas emanations under its ice cap. The principal gases emitted are carbon dioxide, chlorine, fluorine and boron compounds. Some emanations are 200°–300° C at their source.

Geothermy. The first All-Union Conference on the problems of geothermy was held in Moscow during March 1–6, 1956, and the transactions, edited by V. I. Vlodavets and others, were published in the form of two volumes entitled "Problems of Geothermy and Practical Utilization of the Heat of the Earth" (*Pub. Acad. Sci. U.S.S.R.*, 1; 1959; 2; 1961). The first volume contains 22 articles, including contributions by I. D. Dergunov, E. A. Lyubimova (both dealing with the thermal regime and history of the Earth), B. N. Dostovalov (the thermodynamic study of the Earth), V. I. Vlodavets (the hydrothermal regions of Italy and New Zealand) and A. M. Zhirmunsky (problems of geothermo-energetics). These volumes also contain sections dealing with problems of regional geothermy and methods of geothermal studies. The second volume contains 26 articles dealing with problems of hydrogeothermy and detailed regional investigations of hydrothermal regions of the Soviet Union. One of the articles, by S. A. Dzhamalov, deals with the thermal waters in Dagestan. In a more popular article (*Priroda*, 6, 74; 1961) the same author describes the progress made in the utilization of thermal waters in Makhach-Kala, the capital of Dagestan. This town has already six active boreholes supplying 4,000 m³ of water at 55°–68° C per 24 h. This water is used for heating and supply of hot water for domestic and industrial needs. A new borehole is projected to supply 2,000 m³

of water up to 160° C per 24 h to a geothermal power station.

Geocryology. Geocryology, or the science of permafrost, as studied in a special Institute of the Academy of Science, U.S.S.R., is of great importance due to its wide application in the Soviet Union, especially in connexion with buildings, canals and roads. A brief account of permafrost in the Union, illustrated by a new geocryological map, has been provided by I. A. Nekrasov (*Priroda*, 2, 19; 1962).

Slow movements of the Earth's crust. In 1960, at the seventh general assembly of the International Union of Geodesy and Geophysics held in Helsinki, a special commission for the study of micropulsation and slow movements of the Earth's crust was established, under the chairmanship of Y. A. Moshcheryakov. Various aspects of this work are presented by L. E. Setunskaya (*Priroda*, 3, 27; 1962) and V. F. Bonchkovsky (*Priroda*, 7, 48; 1962), while V. V. Lamakin (*Priroda*, 7, 53; 1962) discusses the slow movements of the Earth's crust in the region of Lake Baikal.

Geochronology. Much work is being carried out in the Soviet Union on geochronology. Recent research in this field is summed up by I. E. Starik and E. V. Sobotovitch (*Priroda*, 5, 75; 1962), who provide a summary date of absolute age for the geological periods. They also conclude that the ancient parent matter of meteorites is 4,500 million years old, while the minimum age of the Earth is of the order of 3,500 million years. In another article, V. V. Cherdyn'tzev (*Priroda*, 6, 42; 1962) gives an account of the origin and development of the potassium-argon method of geochronology. This method was originally demonstrated by V. G. Khlopin and E. K. Gerling and rapidly developed by numerous research workers, among whom was prominent the group led by A. A. Polkanov in the Laboratory for the Study of the Precambrian at Leningrad. At the present time, more than twenty laboratories carrying out 'potassium-argon' measurements for dating are functioning in the U.S.S.R.

S. I. TOMKIEFF

THE ATOMIC ENERGY COMMISSION OF JAPAN

THE fifth annual report of the Atomic Energy Commission of Japan, which was established in 1956, is the first to be published in English*. It describes in some detail the aims and activities of the Commission and its subsidiary organizations, the Japan Atomic Energy Research Institute (JAERI), the Atomic Fuel Corporation (AFC) and the National Institute of Radiological Sciences (NIRS). The total number of employees of these organizations now exceeds 1,900. About 60 per cent of the Governmental budget (about 8,000 million yen) for atomic energy is allocated to JAERI. The Research Institute has three reactors: JRR-1, which has continued normal operation during the year under review; JRR-2 which reached criticality during October 1960 and which is used by private companies and universities; and JRR-3, which was due to be completed during September 1961 and to become critical by March 1962. The Japan power demonstration reactor (JPDR) is being constructed by the General Electric

Co., United States, and the construction of JRR-4 (shielding research reactor) by JAERI was to be completed by the end of the fiscal year 1961. Reactors are under construction also at Rikkyo University, the Musashi Institute of Technology and Kinki University. Among the private concerns, both Hitachi, Ltd., and Tokyo Shibaura Co., Ltd., have decided to build training reactors and to gain atomic energy experience under Government subsidy. During August 1960, the JAERI concluded a contract for the purchase of a BWR-type power demonstration reactor.

On February 8, 1961, the Commission announced a new long-range programme of nuclear power generation. On the assumption that nuclear power will become competitive with thermal power in cost in about 1970, it is estimated that new power-generating capacity of 36,000 MW will be required between 1961 and 1970, and 48,000 MW between 1971 and 1980, and that of this 1,000 MW and 6,000–8,000 MW will be provided by nuclear power plants during the respective decades. Private companies are expected to install the nuclear power stations, which will be

* Japan, Atomic Energy Commission, Fifth Annual Report, 1960–61. Pp. iv + 167. (Tokyo: Atomic Energy Bureau, Science and Technology Agency, 1962.)

of the light-water-cooled and gas-cooled types, and possibly in later years the organic cooled type.

A centre for nuclear research and development is being completed at Tokai-mura, and an institute for plasma physics is being set up on the Higashi-yama campus of Nagoya University. The institute will consist of seven research divisions covering theoretical studies and high-temperature generation experiments. An investigation of the required high-voltage supply and of the pinch effect was initiated in 1957 at Osaka University and since then plasma physics research has been carried out at Tohoku University, Tokyo University of Education, Tokyo University, Nagoya University and Kyoto University. At present there are approximately sixteen different forms of apparatus planned or under construction by twelve plasma physics research groups in Japan.

In the chapter of the annual report dealing with uses of radiation it is stated that most of the radioisotopes used in Japan are imported. During 1960 a total of 55,000 curies were imported, consisting mainly of

cobalt-60, phosphorus-32 and iodine-131. By the end of March 1961, 867 establishments, representing medical organizations, private firms and universities and research institutes, in approximately equal numbers, were using radioisotopes. JAERI is preparing for full-scale production of radioisotopes in order to fulfil the future domestic requirements. The first six isotopes to be produced will be sodium-24, phosphorus-32, sulphur-35, potassium-42 and gold-198.

Other chapters of the report deal with nuclear equipment and materials; radioactivity surveys; treatment of radioactive waste; regulations and radiation protection; and training of scientists and engineers. It is considered that 11,000–13,000 scientists and engineers in nuclear energy will be required in the next ten years and it will be necessary to train and educate some 8,000 in those ten years. At present, the possible number to be trained each year is 150–200 at universities, about 200 at JAERI and NIRS, and 90 at institutions outside Japan.

S. WEINTROUB

GASEOUS OPTICAL MASERS

BELL Telephone Laboratories Inc. have issued a brochure describing recent work at Murray Hill, New Jersey, on the gaseous optical maser. The Bell Laboratories are the most active single organization in this field, and have recently extended the range of wave-lengths available from the maser. The first type of gas discharge optical maser, initially operated by Javan, Bennett and Herriott in February 1961, used a helium–neon mixture and produced an output at 1.15μ . Since then, population inversion sufficient to support maser oscillation has been obtained in gas discharges in pure inert gases (helium, neon, argon, krypton and xenon) providing a total of fourteen different wave-lengths in the range 1.618 – 2.189μ . Inversion has also been achieved between two levels of the oxygen atom by dissociating molecular oxygen in collisions with an inert gas atom, either argon or neon, in a metastable state, using a discharge in a mixture of oxygen and the inert gas. The maser output in this case is at 8446 Å . The shortest wave-

length, and consequently the most useful for applications involving high-efficiency photoelectric detection, lies in the visible at 6328 Å , and has been obtained from a helium–neon maser with mirrors having a high reflectivity at this wave-length.

Power outputs of these new masers are in the range from a fraction of 1 mW to 10 mW. The experimental work has been done with masers using external confocal mirrors and a discharge tube having end windows at the Brewster angle to the emergent beam, thus eliminating, for the appropriate plane of polarization, reflexion and consequent energy loss at the windows.

The information in the Bell Telephone Laboratories brochure is an indication of the great effort which is being put into the development of the gaseous maser, which is already being applied to a number of research problems and may, in the future, find uses in the communications field.

J. H. SANDERS

EFFECT OF MOISTURE MOVEMENT OF NATURAL AGGREGATE ON CONCRETE

SOME years ago investigations of concrete failure, thought to be due to the chemical reactivity of certain rock-types involved with the cement during hydration, were carried out in the United States and later in the United Kingdom. Arising from this, certain rock-types, for example, some dolerites, especially those containing the chlorite mineral chlorophaeite, became suspect. Experimental work was based largely on chemical and petrological studies to determine potential reactivity with alkalis released during hydration of Portland cement in concrete involving aggregates dominated by supposedly unstable components. Methods of determination of such components were tentatively laid down by the American Society for Testing Materials (*Proc.*, 48, 1948; and *Standards*, 1952), and in the United Kingdom F. E. Jones has discussed the subject in some detail (*National Building Research Studies*, Nos. 14, 15, 16; 1952).

The evidence from this experimental work cannot be considered as conclusive; in fact, some of it is so conflicting as to raise grave doubts on the alleged chemical vulnerability of certain dolerite aggregates, including natural gravels containing these rock-pebbles, or others loaded with acid volcanic types, also suspect. There is at present what appears to be a more convincing explanation of this type of concrete failure. In a paper by L. C. Snowdon and A. G. Edwards, entitled "The Moisture Movement of Natural Aggregate and its Effect on Concrete" (*Concrete Research*, 14, 109; 1962), is described the work of the Scottish Laboratory of the Building Research Station on the failure of pre-cast concrete products in which certain crushed dolerite aggregates had been used. It is pointed out that in Scotland dolerite aggregate is extensively used in concrete.

The interest of the Department concerned "... became focused on its performance in 1952 when