need to put in a thin conducting layer near the Earth's surface, but could not say definitely that this was the effect of the oceans.

More recent work on samples of data spanning longer intervals has confirmed the change of conductivity in the upper mantle, amounting to five orders of magnitude, and has shown the need for a shallower conducting layer, possibly extending deeper than previously thought. Price, however, suggested that the next developments were in the delineation of local conductivity anomalies in the crust and upper mantle and the theory and observation of rocks at high pressures and temperatures—both are being vigorously pursued at present.

It may be asked whether a subject in which only order-of-magnitude studies are possible at present tells anything useful about the Earth, especially with such detailed seismological information now available. The answer is clearly yes. Seismic observations can only tell about elastic properties and density variations; for the rest we know very little except what electromagnetic methods can tell us. The thermal state of the Earth and possible phase changes lean very heavily for evidence on what can be learnt about the electrical conductivity profile. Here at least is a very fertile field for a long time to come.

VOLCANOES

Mount Rainier Restless

from our Geomagnetism Correspondent

MOUNT RAINIER is a beautiful, snow-capped volcanic peak, 14,410 feet high, in the western part of the state of Washington. It has the most extensive single-peak glacier system in the United States outside Alaska, which makes it a landmark for transcontinental airline passengers and a Mecca for ground-based tourists. Encyclopaedias and local residents describe it as extinct; but a recent announcement by the US Geological Survey suggests that it is merely dormant.

According to a new geological history of Rainier (*The Geologic Story of Mount Rainier*, by D. Crandell, US Government Printing Office, Washington, DC, \$0.65), the volcano has been characterized by long periods of quiescence punctuated by violent activity. Its precise age is not known with certainty, although it must be at least several hundred thousand years old. About 10,000 years ago, the summit built up to a height of about 16,000 feet. About 6,000 years ago, another violent eruption destroyed the old summit and produced a giant mudflow which rolled down the White River Valley, submerging an area of more than 100 square miles. A depression left in the top of the volcano by this eruption was later filled by the lava cone which exists today. The last eruption from Mount Rainier probably took place between 100 and 150 years ago, although ash clouds were observed as recently as seventy-five years ago.

Since then, there have been no external signs of activity, although an infrared photograph from a military aircraft recently revealed a new warm spot on the cone. An array of portable seismometers which has been monitoring Rainier for the past two summers has not revealed a corresponding increase in seismic activity, which suggests no imminent eruption. The immediate danger arises more from the possibility

of steam emission, which could cause melting of the snow and ice, produce flash-flooding of streams and thus endanger campers in the national park in which Rainier stands. Meanwhile, seismic monitoring will continue in an attempt to detect patterns of activity which might make it possible to predict future eruptions.

PULSARS

Now a Planet Too

from our Cosmology Correspondent

NP 0532 is in many ways the most interesting pulsar yet discovered, having the shortest period and being directly associated with a known supernova remnant. Now the close watch that has been kept on this object during the past few months has revealed another interesting feature which suggests that it may possess a companion with mass comparable with that of the Earth. D. W. Richards, G. H. Pettengille, C. C. Counselman and J. Rankin report a quasi-sinusoidal variation in the arrival time of pulses from NP 0532, with an amplitude of 600 μ s and period of three months (*IAU Circular No. 2178*). This behaviour suggests the presence of a companion planet, and the figures fit in very well with a planet of mass close to that of the Earth and orbital distance of 0.4 astronomical units from a primary of one solar mass.

Publication of the detailed report from this American team will be eagerly awaited by the theoreticians, and meanwhile it is noteworthy that there are already strong grounds for believing that NP 0532 and NP 0527 were formed in the same supernova explosion of AD 1054 so that the existence of another fragment from that catastrophe should not be too surprising.

STEREOLOGY

Microstructure Analysed

from our Materials Science Correspondent

MEASURING the grain size of a piece of metal may not be as straightforward as it seems. The routine method for determining the grain size of a metal, alloy or ceramic is to superimpose a series of regular honeycomb grids of different coarseness on a magnified image of a polished and etched section until a match is obtained. But the real grain structure, unlike the grids, is subject to many kinds of statistical scatter. The maximum diameter, ratio of maximum to minimum diameters, number of sides, mean diameter, mean length of sides and the form of distribution of diameters can all be expected to vary from one sample to the next; yet some of these variables, such as the form of distribution of diameters, may behave more regularly than others. The experimental methodology and mathematical superstructure involved in investigating such variables constitute the little known science of stereology. Metallurgists often call it quantitative metallography, but the more general name is preferred by biologists concerned with the quantitative geometrical study of cells and their microconstituents.

An intriguing set of stereological regularities has been published recently by Aboav and Langdon (*Metallography*, 2, 171; 1969). They examined the