cerned not with the mechanics but with the content of what they broadcast. As it happens, this should be the objective not merely for the Campaign for Better Broadcasting but for the BBC itself.

MAGNETIC VARIATIONS

Ocean Bottom Profiles

from our Geomagnetism Correspondent

THE magnetic anomalies which Vine and Matthews and others have used as evidence for sea floor spreading were derived from measurements made at the ocean surface. The reason for this was simple enough. Measurements made closer to the sources of the anomalies, near the ocean floor, contain high frequency variations which obscure the long wavelength variations attributable to the normally and reversely magnetized strips of the ocean floor. In other words, the high frequency variations are usually considered merely as noise which tends to conceal the required signal.

During the past year, however, high frequency noise has come to be regarded as an interesting signal in its own right. Observations from magnetometers towed a few tens of metres above the sea floor have shown that a typical linear magnetic anomaly, twenty to thirty kilometres wide and several hundred gammas in amplitude, comprises a series of higher amplitude anomalies, each several kilometres wide. The narrower anomalies are parallel to the linear anomalies recorded at the ocean surface, which suggests that they too are linked with ocean floor spreading. Discussing a typical profile within anomaly 10 (about 35 my) in the north-eastern Pacific, Luyendyk (*J. Geophys. Res.*, **74**, 4869; 1969) has shown that the best model that simulates the observed series of narrow anomalies has the volcanic second layer divided into vertical blocks between one hundred and five hundred metres wide. These blocks are not of course intended as physically distinct entities but merely represent the lateral limits of appreciably uniform magnetizations. The general point is that the narrow anomalies are probably produced by magnetic variations of some sort, in a direction normal to the strike of the wider anomalies.

Interest thus centres on the origin of these magnetic variations. The two most obvious sources to be considered first are topography and variations in the height of the magnetometer above the ocean floor. The effects of the latter were eliminated by forming a composite profile from smaller sections of near-bottom profiles—a procedure which failed to remove the anomalies. Tests designed to look for correlations between anomalies and the topography above the surface of the oceanic second layer were also negative. In short, topographic effects are extremely small and probably confined to anomalies of low amplitude and very short wavelength. A third explanation, contamination of previously magnetized material by vertical dykes magnetized in opposite directions, also seems unlikely. For example, sea floor produced during the Brunhes normal epoch, which is relatively free from reversals, also contains well defined narrow anomalies.

There are two further possibilities between which it is difficult to decide on present evidence. The first attributes the narrow anomalies to petrographic variations within the oceanic second layer. A consequence of Luyendyk's model is a mean susceptibility for the

second layer of $0.005 \text{ emu/cm}^3 \pm 50$ per cent, a variation well within reported ranges for oceanic basalts. Whether petrology could vary smoothly in the required manner seems doubtful but possible. It would, for example, imply a varying magma source at ocean ridges, which has been reported for shallow-chamber eruptions but not for deep fissure eruptions.

This leaves the final explanation in terms of the geomagnetic field intensity fluctuations suggested by Bucha, and independently by Smith (P. J.), in 1967. During the Quaternary, these variations seem to possess periods of about 10,000 years and are of sufficient magnitude to explain the narrow magnetic anomalies. If they exist, they should be recorded by the spreading ocean floor in the same way as field reversals. And if they are so recorded, near-bottom ocean magnetic profiles should offer a method of determining the relative variation of palaeofield intensity with time up to the age of the oldest ocean anomaly—a process not possible with continental rocks which are not continuous in time.

SOLID EARTH

Electricity in the Mantle

from our Geophysics Correspondent

GEOPHYSICS has had a remarkable decade. The influence of the Upper Mantle Project and the money poured into nuclear test detection have borne fruit in the form of a much more comprehensive understanding of the physics of the Earth than anyone would have dreamed of in 1960. Seismology is well instrumented, marine geophysics is still growing, high pressure petrology is attracting much attention and huge computers are now turned on to problems such as automatic data inversion and mantle convection. The inevitable question is whether the growth can last and, if so, in what directions can developments be expected. Everyone has his prejudice and personal ambition, but one field where much remains to be done was outlined by Professor A. T. Price, at the Royal Astronomical Society on October 24, giving the seventh Harold Jeffreys Lecture, on the electrical conductivity of the Earth.

He traced the development of the use of the magnetic response of the Earth to external disturbances as a tool for conductivity prospecting, from Schuster in the 1880s to work done during the past year. Apparently, Schuster appreciated the possibility of learning about the vertical distribution of electrical conductivity from observatory records and put forward the proposal that there is a relatively good conductor within the Earth extending to within about 300 km of the Earth's surface, but that the outermost part of the Earth could be regarded as an insulator. In the 1930s, Chapman, Price and later Lahiri were using not only the long-period components of magnetograms but were extending the response spectrum to shorter periods than exist in magnetic storms. More recently, magneto-telluric observations have also contributed. Schuster proved remarkably near the mark. Although faced with uniqueness problems which have only recently been given a formalism, Lahiri and Price produced a set of acceptable conductivity models in all of which there was a pronounced increase in conductivity at a depth between 400 and 1,000 kilometres. They also saw a