Office and Bell Telephone Laboratories. The first Lincompex system was introduced in 1967, and since then about 500 sets have been installed on point-to-point circuits.

Although radio telephony may suggest analogue techniques, about half the presentations dealt with digital signal transmission. Many aspects of signal processing are achieved more easily when the signal is digital, and analogue-to-digital conversion enables speech to be represented in this form. Digital transmission also brings the advantages of regeneration, tolerance to crosstalk and interference, and the opportunity for high security encoding.

Several contributors discussed the conversion of speech to digital form, including Mr R. M. Wilkinson (Signals Research and Development Establishment, Christchurch), who gave a subjective assessment of the various methods (all of which inherently give rise to distortion). He concluded, for example, that a six digit pulse code modulation system, compressed and then expanded, requiring a transmission rate of 40·6 kbits/s, gives a received speech quality which can be understood with almost complete relaxation in ideal transmission conditions. On the other hand, vocoder processing gives speech which is understood with slight effort, but the transmission rate is reduced to 2·4 kbits/s. Vocoder processing is important because 2·4 kbits/s can be transmitted in a single sideband channel normally used for conventional analogue speech transmission, although this is not achieved at h.f. without advanced signal processing. Four contributions dealt with adaptive methods of reception of such high rate data streams. This technique involves cascading the channel with a time varying network at the receiver, which serves to minimize dynamically the effects of channel distortion. But the usefulness of adaptive systems on h.f. channels was doubted by W. Struszynski (Marconi), who compared their performance with more simply realized systems.

Apart from the many problems of h.f. and v.h.f. radio telephony in analogue and digital form, the solutions of similar problems at higher frequencies were presented. G. L. Grisdale (Marconi) proposed a new application of swept frequency techniques for speech and data transmission from air to ground, via satellite, and R. C. Fitting (Motorola) presented design information and gave test results for a 2·8 Mbits/s tropospheric scatter data link.

ROCK MAGNETISM

Effects of Oxidation

from a Correspondent

THERE were some differences of opinion about marine magnetic anomalies and oxidized basalts at the annual meeting of the American Geophysical Union in Washington from April 20 to 24. The origin of the Mason–Raff magnetic lineations on the ocean floor has been explained by the Vine–Matthews hypothesis, which appeals to the normal and reversely polarized lava flows on the ocean floor. Direct confirmation of the hypothesis must wait until continuous coring can be extended beyond the sediments to the basalt flows. In anticipation of this, however, the basalts dredged from the mid-Atlantic ridge and away from it have been studied by Drs S. E. Haggerty (Carnegie Institution, Washington) and E. Irving (Observatories Branch, Ottawa) for an explanation of a certain peculiarity of the marine magnetic lineations.

The amplitude of the anomaly at the ridge is usually twice as large as the anomalies 5–10 km away (laterally). Farther from the ridge, the amplitude continues to decrease, but more slowly. Haggerty and Irving explained the initial decrease in amplitude on the basis of magnetic and petrological properties of basalts dredged from the Median Valley at the Mid-Atlantic Ridge (45° N) and those collected about 5 km away. They found that the opaque titanomagnetites in the Median Valley are unoxidized and carry an unusually large (10^{-1} gauss) natural remanent magnetization (NRM). Away from the ridge, however, titanomagnetites were oxidized ("maghaemitized") with a much lower (5×10^{-3} gauss) NRM. Haggerty explained the lack of oxidation in the Median Valley as the influence of the trapped sulphur volatiles: large concentrations of pyrite, pyrrhotite and chalcopyrite were found. Oxidation presumably starts as soon as the basalts are carried away from the ridge by sea-floor spreading. The NRM is partially destroyed and a chemical remanent magnetization (CRM) results which is much weaker than the initial NRM.

These results from dredged basalts were contradicted by laboratory oxidation studies performed on oceanic basalts by Drs M. Marshall and A. Cox (Stanford University). To be sure, they also found that the NRM can be destroyed by heating (to temperatures between 200° C and 300° C in air). But the new CRM that resulted from the laboratory oxidation was stable and strong and, for some specimens, several times larger than the original NRM.

There was doubt at the meeting as to whether the chemical composition and the crystallographic structure of the products of laboratory oxidation were the same as those relating to the maghaemites found by Haggerty in the naturally oxidized samples.

Professor K. Creer and his co-workers (University of Newcastle, England) presented magnetic data obtained from maghaemites or oxidized titanomagnetites, which were formed by heating to 200° C in air, after wet-grinding with water in a ball mill. Creer claimed that the preliminary wet-grinding process allows a more accurate simulation of the magnetic minerals found in natural basalts. But Creer was followed by Drs S. K. Banerjee and P. E. D. Morgan (Franklin Institute, Philadelphia), who reviewed all attempts at laboratory simulation of the magnetic minerals of natural basalts and pointed out their deficiencies. They pointed out that Mössbauer data obtained from Creer's wet-ground titanomagnetites show that even such materials undergo spurious changes in magnetic properties when oxidized, because the wet-grinding process produces ultrafine, superparamagnetic particles which later change their magnetic properties, not only because of oxidation, but also due to sintering and grain growth. It seemed to be crucial that in order to simulate natural oxidation, the starting laboratory samples must contain cation vacancies but no nuclei of rhombohedral haemo-ilmenite impurities. The presence of such impurities even in microscopic amounts (for example, stacking faults in the cubic titanomagnetites) leads to a kinetically preferred magnetite–ilmenite intergrowth, rather than the cation-deficient maghaemite found in nature.