

ence has made its most valuable contribution.

Interesting studies reported included those described by Dr T. D. Brock (University of Wisconsin) of sulphur bacteria living at 95° C and pH 2 in hot springs of Yellowstone National Park; by Dr W. E. Krumbein (Biologische Anstalt, Helgoland) of lichens which bring about the formation of "desert varnish" on the exposed rock surfaces; by Dr H. L. Ehrlich (Rensselaer Polytechnic Institute) of the microorganisms involved in the formation and dissolution of ferromanganese oxide nodules on the ocean floors; and by Dr J. V. Beck (Brigham Young University) of those bacteria (*Thiobacillus oxidans*) responsible for accelerated leaching of copper from mine tips. Some environments were discussed at considerable length, especially those involving stromatolite formation by blue-green algae. Thus, Dr S. Golubic (Boston University) gave a fascinating account of the sequence of events taking place on the coast near Abu Dhabi in the Persian Gulf. These modern environments provide invaluable insights into the fossil record for geologists, geochemists and palaeontologists. Dr Golubic's contemporary stromatolites serve as a guide to the understanding of the Precambrian stromatolites described in talks by Dr J. W. Schopf (University of California, Los Angeles), Dr S. M. Awramik (Harvard University) and Professor P. E. Cloud (University of California, San Diego).

Other studies described by participants included investigations of aquatic environments in the Everglades of Florida, the Severn Estuary and certain lakes in the British Lake District and North America, and the Arctic Seas. Mathematical models built up in small computers are now in common use by geochemists and ecologists for the study of element, energy and mass balances within individual organisms and complete ecosystems. The kinetic models of Dr R. A. Berner (Yale University) for the early diagenesis of nitrogen, phosphorus and sulphur in anoxic marine sediments were described by Dr I. Kaplan (University of California, Los Angeles) and other speakers as helpful though incomplete treatments of very complex situations. In this context it is clear that pollution studies have to be seen in relation to the natural fate and the natural variability of elements and compounds in environments. This was illustrated by the work of the group at the University of Bristol (described by Dr G. Eglinton) on the short-term fate of selected biolipids (oleic acid, phytol and cholesterol) and of DDT in estuarine and lacustrine sediments.

The meeting concluded with a field trip to the algal mats at the north

shore of the Great Salt Lake. Such a trip should be an integral part of any future conference, for it provides a focus for first-hand joint experience and discussion of a particular ecosystem. The interfaces between biosphere and geosphere need just this type of interdisciplinary attack. There was enthusiastic support for the organization of another conference in two years time with participation extended to include natural product chemists, biochemists, kineticists and mathematicians so that the problems can be more thoroughly discussed.

MICROWAVES

Expanding above 10 GHz

from a Correspondent

A FEATURE of radio research and development in recent years has been the increasing interest in propagation at frequencies greater than about 10 GHz. The large bandwidth available at these frequencies is particularly attractive in terrestrial and space communication systems for additional channels of information. Absorption and scattering in the lower atmosphere also becomes more important, however, as the frequency increases about 10 GHz. Consequently, practical exploitation of this part of the spectrum requires extensive basic research on wave propagation. This dual theme of the development of communication systems and the limitations imposed by meteorological factors was

emphasized at the international conference held between April 10 and 13 at the Institution of Electrical Engineers.

In his opening address Mr J. H. H. Merriman, deputy president of the IEE, pointed out that the upper limit of radiofrequencies discussed within the context of international control was increasing by a factor of about ten every decade. Frequencies up to nearly 300 GHz (wavelengths down to 1 mm) have provisionally been allocated for various requirements. A topic of particular interest is the reliability of terrestrial radio relay systems above 10 GHz, and the prediction of their performance from radio meteorological data. Very heavy rain can cause serious fading and this effect increases steadily with increasing frequency. Contributions from authors at the Radio and Space Research Station of the Science Research Council and from the Post Office Research Department described a comprehensive experiment to investigate this problem. Simultaneous measurements of rainfall structure and of fading on several links at frequencies of 11, 20 and 37 GHz are in progress in Suffolk. From this work it is hoped to predict the optimum lengths and spacings of microwave links to avoid the worst effects of heavy rain. Members of the Post Office Research Department also discussed the fading ("multipath propagation") which can occasionally occur in clear conditions on terrestrial links as a result of abnormal refraction. These multipath effects are particularly important in view

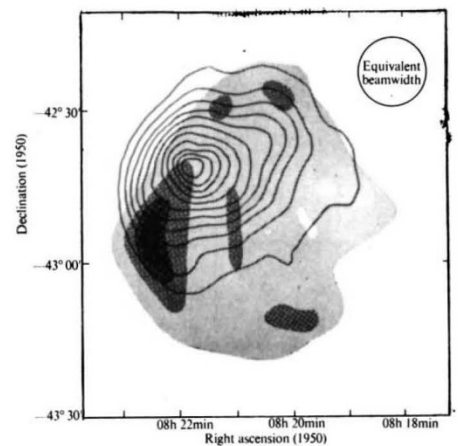
Puppis A Mapped by Copernicus

THE supernova remnant Puppis A has been mapped in the energy range 0.5 to 1.5 keV with better resolution than in any previous observations. The X-ray emission is found by Zarnecki and his colleagues to be strongly peaked and concentrated chiefly in the north-east quadrant of the radio shell (see next Monday's *Nature Physical Science*, May 7).

Previously, one-dimensional scans of Puppis A and rocket borne collimated proportional counters have shown that the angular size of the X-ray emitting region is less than 0.5 arc degree. The source is one of the brightest known at X-ray frequencies less than 2 keV and the X-ray spectrum is best fitted by a combination of thermal bremsstrahlung and line emission from a plasma at 4×10^6 K. The latest map, however, provides the first data obtained with high spatial resolution in two dimensions.

The data are not consistent with a simple point source and disk model of the source, and the X-ray emission is contained within the corresponding

radio shell. A compact object may remain inside the remnant, but the evidence is not conclusive in this respect. On the whole, Zarnecki *et al.* feel that the observed X-ray and radio features can be adequately explained by existing supernova models.



Contour map of Puppis A at soft X-ray frequencies (shaded). Solid contours are radio observations, after Milne (*Austral. J. Phys.*, **24**, 429; 1971).