NEWS AND VIEWS

Formaldehyde in Space

THE past four months, since December last year, have seen a spate of discoveries of molecules in space by their microwave radio emission. First was the detection of ammonia by the group at Berkeley (Cheung, A. C., Rank, D. M., Townes, C. H., Thornton, D. D., and Welch, W. J., *Phys. Rev. Lett.*, **21**, 1701; 1968), then water by the same team (*Nature*, **221**, 626; 1969) and now, more surprisingly, formaldehyde has been picked up at the National Radio Astronomy Observatory at Greenbank, West Virginia, by L. E. Snyder, D. Buhl, B. Zuckerman and P. Palmer (*Phys. Rev. Lett.*, **22**; 1969). A group at the Massachusetts Institute of Technology has also been using the Arecibo dish to look for signals from sulphur hydride, so far without success (Meeks, M. L., Gordon, M. A., and Litvak, M. M., *Science*, **163**, 173; 1969). As much as anything, the discovery of signals from ammonia and from water by the Berkeley team, working at Hat Creek Observatory, must be the result of the influence of Professor C. Townes, who recently moved from MIT to Berkeley, taking with him, it seems, his interest in the microwave part of the spectrum. Some of the enthusiasm has obviously spread to West Virginia, where formaldehyde (HCHO) was found in fifteen of twenty-three sources surveyed with the 140-foot telescope. Before December, the only molecule known in space from its radio emission was the hydroxyl radical, discovered in 1963 at MIT.

All the molecular emissions which have so far been picked up come from cool regions in the galaxy, which is why the signals are more than curiosities. The cool regions are clouds of dust and gas which are thought to be in the process of contraction into stars and planetary systems. As well as the prospect that the radio measurements will provide estimates of the concentration and temperatures of molecules during star-forming processes, some light may also be shed on the constituents of primaeval atmospheres and thus on the origin of life. The discovery of formaldehyde is held to be significant because it is indirect evidence for the existence of methane in the cool interstellar clouds. Unfortunately, there seems no hope that methane, one of the chemicals believed to be necessary for life to start, can be detected in space by its radio emission, but there is a possibility that radio astronomy may now answer at least part of the question of how substances such as ammonia, water and methane came to be in primaeval atmospheres in the first place.

This begs the question of how the molecules have been formed in space. Particles of interstellar dust, which are an important constituent of the cool clouds, may encourage a process that would happen much more rarely if the collision of atoms were the dominant mechanism. For example, Cheung and his colleagues have suggested that their ammonia may have been formed by the adsorption of nitrogen and hydrogen on the grains, with the dust clouds protecting the ammonia from ultraviolet radiation.

Another problem which will have to be dealt with is the occurrence of ammonia and water in separate regions. The intensity of the microwave line from water implies that maser action is probably involved. Cheung, Rank, Townes and Welch have explained some of the difficulties in correlating the ammonia and the water lines (*Nature*, **221**, 917; 1969). There seem to be three possibilities to explain the line from water. The water may be more abundant than ammonia; it may be seen in quite a different region from the ammonia or there may be high temperature source of energy exciting both ammonia and water in circumstances in which the water is abundant enough to trap its own resonant infrared radiation. The question is that of seeing how the energy levels which are observed in ammonia and water can be excited. According to the measurements from the US National Radio Astronomy Observatory, the formaldehyde has been found in the same sources as the water, and ammonia and formaldehyde have not so far been found together, although one ammonia source near the galactic centre may be the same as a formaldehyde source.

Whatever the explanation, these discoveries seem to show that the intensity of ultraviolet light in interstellar clouds, previously thought to be enough to prevent the formation of complex molecules, is not as great as expected. This should be a stimulus for the search for radio signals from more complex molecules.

RED SEA

The Teenage Ocean

from our Geophysics Correspondent

LAST week 200 Earth scientists spent three days at the Royal Society discussing the Red Sea and its environment. The fascination of this meeting was as a gathering of geologists and geophysicists, mariners and land workers, academics and prospectors in well balanced proportions. The prospectors were naturally fairly reticent in the presence of their rivals. (At one stage, a speaker from the floor publicly asked his exploration manager for clearance to give some information—commendably, this was granted.) And, naturally enough, the geophysical academics were rather less than reticent in postulating what was happening. But the ingredients mixed remarkably well, with lively discussion and the establishment of new informal links