was given to various wax-like bituminous substances such as pitch and natural asphalt, it was later restricted to a special wax-like substance found in thin layers in the mountains of India, Iran and China. In 1964 thicker layers were found in Antarctica, with chemical, infrared and ultraviolet properties indicating their similarity to the Asian deposits. Investigations revealed that mumiyo is not a product of the rocks and has no connexion with mineral oil. Mumiyo was then thought to be a product of organic life or its metamorphosed remains.

Dr Winsnes has watched snow petrels in their nests, situated in crevices between rocks in the mountains of Dronning Maud Land, Antarctica. Like the Arctic fulmar petrel, the snow petrel (*Pagodroma nivea*) spits in self defence when disturbed in its nest. The spittle is an oily pink substance, the colour probably caused by the crustaceans which constitute most of the bird's diet. The spittle accumulates—sometimes several kilos of it—around the nest in the form of wax, sometimes hanging down like stalactites. Dr Winsnes believes that this substance is the mumiyo of the Antarctic, although, of course, he cannot say whether it has a similar origin in Asia.

MOLECULAR BIOLOGY

Dissection of Transfer RNA

from our Molecular Biology Correspondent

SOME years ago Nishimura and Novelli found that limited nuclease digestion of tRNA could be tolerated without complete loss of acceptor activity. Last year a Russian group (Bayev *et al.*) reported that yeast valine tRNA could be cleaved by T1 ribonuclease at the anticodon, and that the two pieces together retained full acceptor activity. Two reports have now appeared which confirm and extend this finding.

Seno, Kobayaski and Nishimura (*Biochim. Biophys. Acta*, **174**, 408; 1969) have prepared T1 digests of formylmethionine tRNA of *E. coli*, and fractionated the products by ion-exchange chromatography. Several partially resolved components were obtained, and two of these were identified as intact halves of the molecule, separated not at the anticodon but in the dihydrouridine loop, in fact apparently next to the dihydrouridine residue itself. When these two components were mixed, half of the native acceptor activity was forthwith restored. A further report in press from Nishimura's laboratory is also quoted, in which *E. coli* valine tRNA is split at the anticodon, just as in the work of Bayer *et al.* Here, however, restoration of activity requires a preincubation, or annealing, step.

A specific cleavage at a single bond has also been achieved in Zachau's laboratory (Philippsen *et al.*, *Biochem. Biophys. Res. Commun.*, **33**, 922; 1968), but these workers have gone a step further in that a chemical method has been used. Yeast phenylalanine tRNA contains a base of still unknown structure next to the anticodon. This unknown base is lost on mild acid treatment, leaving an aldehyde group on the ribose, which renders the adjoining phosphodiester bond reactive. On treatment with aniline it is broken, revealing a new end-group, susceptible to phosphatase. The product of this reaction, which was shown electrophoretically to be completely free of intact tRNA, retained 50–60 per cent phenylalanine acceptor activity.

The activity of fragments of this kind in combination is reminiscent of the situation encountered in some enzymes, in which a hydrolytic fragment binds non-covalently to the residuum of the molecule to give an active structure, effectively identical with the native protein. At the same time the RNA fragments evidently do not associate very strongly, since they are so readily separable by electrophoretic and chromatographic methods. Studies of their interaction with the aminoacyl synthetases will clearly be of the greatest interest.

The independent behaviour of different helical regions of tRNA is demonstrated once more in observations of thermal melting curves of species containing thiouridine, which has an absorption band at 336 mμ, and so can be observed independently of all the other bases (Seno *et al.*, *Biochim. Biophys. Acta*, **174**, 71; 1969). Seven different species containing this nucleotide have been examined, and substantial differences between the melting profiles at 336 mμ and 260 mμ were noted. In some cases the curves for 336 mμ were bimodal, and were taken to reflect the presence of more than one conformational form.

An interesting observation, concerning the modification of a tRNA-bound amino-acid, comes from Bernfield and Nestor (*Biochem. Biophys. Res. Commun.*, **33**, 843; 1968). They have found that *E. coli* glutamyl-tRNA is a substrate for the enzyme glutamine cyclotransferase, which brings about cyclization of the glutamine to pyrrolidone carboxylate. This is interesting because N-terminal pyrrolidone carboxylate residues occur in several mammalian proteins, including immunoglobulins and collagen. This then is a situation inviting comparison with the initiation of bacterial protein synthesis by N-formylmethionine. Whether a comparable mechanism indeed obtains in these cases, of course, remains to be determined. It should be mentioned that terminal acetylation, for example in haemoglobin, is thought to occur after completion of the polypeptide chain.

GEOCHEMISTRY

Mapping Trace Elements

AGRICULTURE, the mining industry and public health can all hope to benefit from the geochemical reconnaissance of England and Wales which is to be carried out during the next five years by the Applied Geochemistry Research Group at Imperial College. The group, led by Professor J. S. Webb, has been given £65,000 by the Wolfson Foundation to map the distribution of between twenty and thirty trace elements in order to compile a geochemical atlas of England and Wales.

Field work will begin this summer, when students will be employed to start collecting the 60,000 samples that will be needed. An average of one sample per square mile is to be taken from the stream sediments of tributary drainage. Stream sediments were chosen because they approximate more or less closely to a composite sample of the products of weathering derived from the rocks and soil upstream from the sample site. An automatic spectrograph will analyse the samples, and the data will be plotted automatically.

Although the eventual aim of the survey is to produce the geochemical atlas, provisional maps will be published annually after 1970 to provide any useful infor-