An interim account of the dentition of an important Triassic mammal whose correct name is even a matter of controversy was given by Dr Mills of the Institute of Dental Surgery. *Morganucodon* (or *Eozostrodon*) has a molar tooth pattern which may or may not represent a primitive pattern for all mammals. Mills, from the evidence of a large collection of *Morganucodon* teeth, suggested the mode of tooth replacement and commented on its relationships. Professor Crompton of Harvard introduced a welcome functional note by considering the evolution of early mammal molar teeth in the light of his own and his colleagues' studies on jaw movement in living mammals. The emphasis was on the development of simultaneous shearing surfaces anteriorly and posteriorly on each upper molar for its occlusion with the corresponding lower molar.

Dr Krebs of Berlin was able to move from teeth to whole jaws in an account of a very early (Kimmeridgian) and a late (Lower Cretaceous) dryolestid pantothere, both from the Iberian Peninsula. Although the pantotheres are certainly the group of Mesozoic mammals most closely related to living placentals, they nevertheless show very reptilian characteristics in the jaw in their earlier forms.

The first paper of the second day, delivered by Professor Kielan-Jaworowska of Warsaw, extended to discussion of whole skulls and, with an account of the skull of *Morganucodon*, gave an airing to the most controversial extant theory in mesozoic mammal palaeontology: that early mammals were divided into two distinct groups and even derived from distinct groups of mammal-like reptiles. This was followed by papers including some detailed tooth morphology by Dr Slaughter of Texas and Dr Fox of Alberta and finally a paper from Dr William Clemens, who considered mammalian history in the Cretaceous in the light of palaeogeography and particularly continental drift.

DATING

Fission Tracks and Thermal History

from our Geomagnetism Correspondent

THE most serious source of error in the dating of glasses by the fission track method is the effect of thermal annealing. If a sample has been heated, even to a moderate temperature, since its formation, some of the tracks will have disappeared. As a result, the measured fission track age will be lower than the radiometric age by an unknown amount. Storzer, however, has managed not only to overcome the problem of reheating but also to turn it to positive advantage (*Earth Plan. Sci. Lett.*, **8**, 55; 1970). Thus as well as being able to calculate the true age of the glass sample from its apparent age, he can use the fission tracks to trace the thermal history of the glass.

The critical discovery made by Storzer is that reheating not only removes some of the fission tracks, but reduces the diameters of the etch pits of those that remain. This being the case, it is a simple matter to obtain a "calibration" plot of track density against diameter as the temperature varies in a given sample, by heating the sample in the laboratory after first inducing in it artificial tracks. The original preheating track density (from which the true age is calculated) may then be obtained by comparing the mean diameter of tracks in the virgin sample with the calibration curve.

The particular samples on which Storzer worked were Permian pitchstones from South Tyrol (Italy). In spite of the known, similar stratigraphic ages of the samples, the uncorrected fission track ages ranged from 61 million years in the north to 186 million years in the south with a regular variation in between. The fission track ages were thus not only wrong but wrong by different amounts, which suggested to Storzer that each sample had been reheated to a different temperature.

As expected, when the ages were corrected for thermal effects they converged to a mean age. The only problem was that the corrected ages were still younger than Permian, showing that the thermal histories of these glasses were not quite as simple as had been supposed. In fact, Storzer soon discovered that the histogram of the track diameters possessed not one peak but two. From this he argued that at some point since the Permian each sample had been annealed, thereby reducing the natural fission track densities and diameters. Thereafter, further fission tracks were produced by natural processes and remained thermally unaltered to the present day. The age of each sample thus contained two components, a thermally lowered age and a thermally unaffected age. When the thermally lowered age was corrected against the calibration curve and combined with the thermally unaffected age for each sample, the true ages turned out to lie within the range 231 million years to 276 million years with a mean at 256 million years. The Permian stratigraphic age was thus confirmed, and the inferred thermal history substantiated.

In some ways the thermally unaffected ages are as interesting as the final corrected ages for they effectively date the last thermal event in the histories of the rocks. These ages, too, increased towards the south, varying from 21 million years to 149 million years. Because the number of samples used by Storzer was small the precise significance of this variation is not clear. What is clear, though, is that in principle the analysis of fission tracks can lead, via the thermal histories of many samples, to the thermal history of the geographic or tectonic region in question. There is no doubt that in turning one problem into the solution of another, Storzer has done a very clever piece of work.

EARTH'S CRUST

Layered Complexes Under Oceans

from our Geomagnetism Correspondent

THERE can be no doubt that much of the ocean floor immediately beneath the sediment is basalt. The sea floor spreading hypothesis strongly implies that this is so, and direct evidence comes from the number of basalt samples dredged up from mid-oceanic ridge areas. On the other hand, it is equally clear that not all the oceanic crust is extrusive. At least twenty samples of gabbro, dolerite and anorthosite have been obtained from the world's mid-oceanic ridge system, which suggests that some magma is intruded and crystallizes at depth. Does this, then, imply that the oceanic crust contains layered basic complexes which are gravity differentiated, such as those found on continents ?

An analysis of dredge samples obtained from the Romanche Fracture, equatorial Atlantic Ocean, by