NEWS AND VIEWS

Marginal Basins Form by Seafloor Spreading

THE problem of the origin of the marginal basins which lie between trench-island arc systems and their corresponding continental margins has vexed Earth scientists for as long as any living geologist can remember. Of course, there has been no shortage of proposals, either for the origin of marginal basins in the context of island arc development as a whole or for the formation of single basins seen as localized phenomena. In the early part of this century, for example, the discovery within island arc systems of rocks thought to be characteristic of continents led many geologists to believe that marginal basins were continental areas which had subsided, subsidence being attributed variously to crustal warping associated with orogenic compression, subcrustal erosion, oceanization (and that very recently), and many other processes. On the other hand, Wegener, who quite naturally viewed the world in terms of continental drift, saw marginal basins as the extensional spaces left in the wake of moving land masses.

Not surprisingly, the conflict between the various hypotheses for the origin of marginal basins stood little chance of resolution until much more information about the basins themselves became available ; and the acquisition of hard data only became possible with the development of reliable marine geophysical techniques during the late 1950s and early 1960s. Then, for example, seismic refraction studies showed the crust beneath marginal basins to be similar to that of normal ocean basins and bathymetry indicated that the basins have oceanic depths which are intermediate to normal. These and other discoveries clearly required the rejection of all hypotheses describing marginal basins as essentially continental ; and with the field thus narrowed the way was open to a more detailed comparison between marginal basins and the wider ocean floor the origin and evolution of which were coming to be seen in terms of the now-familiar processes embodied in the new global tectonics.

The next important step was the deduction from a wide variety of geological and geophysical evidence that marginal basins must be created by crustal extension. Apparently it took some time for this conclusion to follow from the available data, for as late as 1969 some workers were attempting to explain the high heat flow in some marginal basins by models which did not involve extension. But in an article which has now become an important landmark in the subject, Karig (*J. geophys. Res.*, **76**, 2542 ; 1971) convincingly pressed the case for crustal extension from a consideration of all geological and geophysical data then available. In the process, he found it convenient to divide marginal basins into two natural groups—the first involving those basins in which crustal extension is currently active (Tonga, Kermadec, Mariana, Bonin and New Hebrides) and the second comprising those in which extension has ceased (the rest). The inactive marginal basins were then further divided into those with high heat flow and those with normal heat flow, the difference being essentially one of age. Karig supposed that once activity in a basin had ceased the crust would cool, so that, by implication, the basins with high heat flow should be younger.

It follows from this view that marginal basins differ principally only in their stage in history, although Karig admitted that the case for extension in the now inactive basins is based primarily on similarities with active basins rather than the result of direct evidence. But accepting an extensional origin for all basins, Karig went on to propose a model for the extension which involved a thermal diapir of mantle material rising buoyantly from the shear-heated upper surface of the downwelling lithosphere. At the same time, Packham and Falvey (*Tectonophysics*, **11**, 79 ; 1971) were proposing the injection of mantle material close to island arcs, resulting in a form of asymmetric seafloor spreading. Unfortunately, neither Karig nor Packham and Falvey had access to one vital piece of information—an adequate set of magnetic data from a marginal basin.

As Hayes and Ringis show on page 454 of this issue of *Nature*, such data are now available for the Tasman Sea (inactive and with normal heat flow in Karig's classification) and indicate symmetric magnetic anomalies which correspond to part of the global pattern of Cainozoic lineations. In short, the magnetic evidence together with seismic and bathymetric data demonstrate convincingly that the Central Tasman Sea formed between 80 and 60 million years ago by a process of symmetric seafloor spreading almost identical to that now taking place in the principal oceans of the world. In view of Karig's case for the similarity of marginal basins, even this one example strongly suggests that most, if not all, other marginal basins will ultimately be found to have formed in like manner.

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Selecting Sequences

READERS will recall the experiments on evolution in the test tube in which the template dependent RNA polymerase from Qβ infected *Escherichia coli* replicates Qβ RNA which evolves in response to the metabolic challenges provided by Spiegelman and his colleagues. In particular, when the products are selected for rapid growth, the greater part of the original genome—containing genes not immediately concerned with replication *per se*—are jettisoned and a much shorter molecule is produced. This too can evolve in response to changes in the reaction mixture, and it becomes interesting to ask what detailed molecular changes occur.

Mills *et al.* (*Science, N.Y.*, **180**, 916 ; 1973) have now provided the first steps to an answer to this problem by sequencing the 218 residue molecule which they call MDV-1. The methods used in this operation involve several clever dodges worthy of comment. MDV-1 replicates by way of a two stranded intermediate and both the plus and minus strands are copied though apparently with unequal efficiency. It is thus possible to make a mixture of both strands which can be annealed to give a mixture of the plus strand and a 1 : 1 complex of the plus