Ninetyeast Ridge, study which also confirms that the eastern fracture zone is an old plate boundary. One consequence of the plate boundary theory is that Ninetyeast Ridge must always have been attached to the old Indian plate, implying that palaeolatitudes obtained from Ninetyeast Ridge should always agree with the corresponding ones from the Indian subcontinent but should disagree with those from DSDP sites to the east of the ridge for the period before the fusing together of the Indian and Australian plates.

They do on both counts. The new palaeolatitudes from both basalts and sediments indicate that Ninetyeast Ridge moved northward with respect to the south pole at an average rate of 14.9 ± 4.5 cm yr^{-1} from 70 Myr ago to about 40 Myr ago when it slowed to 5.2 ± 0.8 cm yr^{-1}. These rates of absolute motion, resulting in a total movement of about 5,000 km since the late Cretaceous, are in good agreement with the relative rates of closure between Asia and India estimated by Molnar and Tapponnier (*Science* **189**, 419; 1975) on the assumption that Eurasia remained almost stationary, and are entirely consistent with the palaeolatitudes from India's Deccan traps. In other words, the rates of motion of Ninetyeast Ridge may be regarded as applying to the old Indian plate as a whole. On the other hand, these rates are inconsistent with the palaeolatitudes determined from a DSDP site 400 km east of Ninetyeast Ridge, confirming that there must once have been a plate boundary between this site and the ridge.

But to return to the origin of Ninetyeast Ridge, both the hot spot and migrating spreading centre hypotheses are consistent with the northward drift of the Indian plate. Where they may be distinguished, however, is in their consequence for the basement palaeolatitudes along the length of the ridge. For a hot spot which was more or less fixed to the mantle, basement palaeolatitudes should be constant, or nearly constant, along the whole ridge. For excess volcanism, on the other hand, basement palaeolatitudes should vary with the varying latitude of the migrating spreading centre. Specifically, for the sites studied by Peirce the ridge basement palaeolatitudes should vary between 55 °S and 30 °S with a migrating spreading centre, whereas they should be constant at about 50 °S if the ridge was formed by the postulated Kerguelen hot spot and at about 40 °S if it was formed by the Amsterdam-St Paul hot spot.

Peirce shows that the basement palaeolatitudes throughout almost the complete length of Ninetyeast Ridge are about 50 °S, indicating that the source of the Ninetyeast Ridge material must have remained stationary, or almost stationary, for 60–70 Myr. The hot spot hypothesis would therefore seem to win, notwithstanding a strong piece of circumstantial evidence against it. For the close association of Ninetyeast Ridge with the fracture zone along its eastern edge is demanded by the transform fault-migrating spreading centre hypothesis but is only a coincidence in the hot spot theory. Is it likely that the Indian plate would move northwards in such a way as to keep a hot spot trace very close to the bounding transform fault for a distance of several thousand kilometres? It is possible but hardly likely. Yet if Peirce's palaeomagnetic data and his interpretation are correct, as they seem to be, the unlikely would seem to have occurred.

Certainly there seem to be no geophysical or geological data from the vicinity of Ninetyeast Ridge actually inconsistent with ridge formation by hot spot, even though other interpretations cannot be ruled out definitely. One curious feature, however, is the ridge which exists on the adjacent Antarctic plate as a 'mirror image' of Ninetyeast Ridge across the Indian plate-Antarctic plate boundary for the period 80–40 Myr ago. Again, this is precisely what one would expect from excess volcanism at the junction of the Indian-Antarctic spreading centre and the Ninetyeast transform fault, for it is likely that such excess volcanism would straddle the spreading centre rather than remain on one side.

If, on the other hand, this mirror image ridge is to be explained by a hot spot, it is necessary to conclude that the hot spot remained close to the Indian-Antarctic spreading centre, thereby forming traces on both the Indian and Antarctic plates. And since the hot spot was fixed, the Indian-Antarctic spreading centre must have been fixed too. Yet throughout this period the Indian plate was moving rapidly northwards whilst other evidence suggests that the Antarctic plate was more or less stationary, apparently kept so by forces external to those controlling the Indian-Antarctic plate separation. The inevitable conclusion this leads to is that the accretion of new oceanic lithosphere at the Indian-Antarctic boundary was highly and atypically (at least by today's spreading standards) asymmetrical. □

Split gene transcription

from Bob Williamson

THE function of the non-coding inserts found in a range of eukaryotic structural gene sequences is still unclear, but it is now known that at least some of these intervening sequences are transcribed into RNA in the nucleus and then excised at a later processing step. S. Tilghman, D. C. Tiemeier and P. Leder of the National Institutes of Health, and P. Curtis and C. Weissmann of the University of Zurich have shown (*Proc. natn. Acad. Sci. U.S.A.*, **75**, 1309; 1978) that the non-coding insert found in the mouse β-globin gene is present in the 15S nuclear precursor of β-globin mRNA.

Leder and his colleagues had previously demonstrated by hybridisation that cloned genomic β-globin DNA contained a 550-nucleotide long sequence that was not present in cytoplasmic β-globin mRNA. On annealing with β-globin mRNA the non-coding sequence on the genomic DNA does not hybridise and can be seen as a characteristic R loop in the electron microscope. The DNA insert is at the position corresponding to amino acids 104–105 of β-globin. When the same clone of genomic DNA is annealed to the 15S nuclear precursor of β-globin mRNA, prepared by Curtis and Weissmann by sophisticated affinity chromatography techniques, a continuous R-loop is seen, with no intervening segment. This can only occur if the 15S precursor RNA contains the transcript of the insert.

As the authors comment, an accurate mechanism is required to cleave the transcribed insert from the HnRNA and to rejoin the mRNA sequence accurately. There is little evidence for amino acid sequence errors which might be caused by a failure to rejoin these segments precisely. Some inserts such as those in ovalbumin genes are more than 5,000 nucleotides long, and it is not clear yet whether these are transcribed, nor is it known whether a new class of specific nucleases and ligases must be postulated. Sequence data on the inserts will soon be available and should give clues to the mechanism of processing the primary transcript to functional mRNA.

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0028–0836/78/0272—0753$01.00