aspect is of interest as one of the very few reports from analogous cell-free translation studies gave a low efficiency of translation (Crawford and Gesteland, *J. molec. Biol.*, **74**, 627; 1973) and whether the efficiency is greater *in vivo* (in relation to other *in vivo* translation), or if it is very message dependent, is unknown. Consequently, any generalisations from the present study should await the results of complementation studies done with a considerable number of different auxotrophs.

The presentation at the recent Miles Symposium by J. Carbon and colleagues suggest that such reports will soon be forthcoming. □

More rapidly growing manganese

from Peter J. Smith

Two years ago Scott *et al.* (*Geophys. Res. Lett.*, **1**, 355; 1974) reported the discovery of an unusual manganese oxide crust about 5 km from the axis of the mid-Atlantic ridge at 26°N. The sample in question, a 4.2 cm thick deposit of birnessite with a trace of todorokite, had an abnormally low iron concentration (compared with typical ferromanganese nodules and crusts), was depleted in ^{230}Th and ^{231}Pa and contained unexpectedly small amounts of Cu, Ni and Co. Its most startling characteristic, however, was its rapid growth rate. Whereas ferromanganese nodules and crusts grow on the ocean floor at typical rates of 0.1–1.0 cm per million years, the new sample had apparently grown at a rate of 13.0–25.0 cm per million years.

On the basis of all the evidence Scott and his colleagues concluded that their newly-discovered crust was a product of hydrothermal activity along an active ridge crest and had not, as 'normal' ferromanganese crust, precipitated from seawater. At that time the importance of hydrothermal processes at ridges, though not unrecognised (for example, Lister, *Eos*, **55**, 740; 1974 and others had recently drawn attention to it), was not widely appreciated. Today, however, the situation is rather different. Hydrothermal activity is increasingly commonly acknowledged to play a major part in heat transfer at oceanic ridges, probably explaining both the great variability of axial heat flow and the low average axial heat flow observed compared with that predicted from cooling lithosphere models. It is probably also closely involved with the formation of metal-rich sediments at ridge crests.

It is in this changing context that Moore and Vogt (*Earth planet. Sci. Lett.*, **29**, 349; 1976) now report the discovery of two more manganese oxide crusts (A and B), similar to that of Scott and his coworkers but from the vicinity of the Galapagos spreading axis. Sample A is a 2–4 cm thick deposit recovered from an almost sediment-free wall of an axial valley of the spreading centre where the basement age estimated from magnetic anomalies is 0.3 Myr. It consists of a grey banded zone comprising mixed todorokite and birnessite covering a darker friable zone of todorokite. Assuming this sample to have remained a chemically closed system, its maximum age obtained from the ^{230}Th/^{234}U ratio is 6,000 years at a depth of 9–13 mm within the crust and 9,000 years at 6–9 mm. On this basis the growth rate for the outer 1 cm was therefore 100–200 cm per million years, or 100–2,000 times greater than the rate for seawater-precipitated deposits.

Compared with typical ocean floor ferromanganese deposits, sample A has very low Fe/Mn and ^{232}Th/^{238}U ratios, a higher manganese concentration and lower transition metal concentrations. These properties, combined with the rapid growth rate, strongly support the idea of formation by ridge hydrothermal activity in an area where the supply of manganese is enhanced. Indeed, circumstances suggest that hydrothermal activity may be more vigorous here than is usual along spreading axes, for the recovery site is close to the position of the proposed Galapagos hot spot. Be that as it may, the chief competing explanation—that the extra manganese is remobilised from a sedimentary source—would seem to be ruled out by the obvious lack of sediment at the recovery site and a direct association of the crust with igneous rocks such as tholeiitic basalts and, unusually, soda rhyolite.

Sample B, a 4–6 cm thick crust recovered further from the ridge axis at a point where the basement age is 2.4 Myr, is more complex, less amenable to study but in some ways more interesting than sample A. It has a 4–6 cm core of grey todorokite and birnessite which is chemically similar to sample A and thus believed likewise to be of hydrothermal origin. But, by contrast, the core is covered with a 3 mm thick layer of darker material indistinguishable from seawater-precipitated manganese deposits.

Chemical analysis shows that this sample could not have remained a closed system. No ages can therefore be calculated from the ^{230}Th/^{234}U ratio, although given the basement age the growth rate must have been at least 2.5 cm per million years. Assuming average precipitation growth rates, the 3 mm covering would then have taken about 1 million years to form around the core. The implication is that the core formed hydrothermally whilst the sample was close to the spreading axis, but acquired a seawater-precipitated coating more slowly as it was taken out of the hydrothermal zone by seafloor spreading.

Taken together, these two samples provide further support for the existence of hydrothermal processes at ridge crests. Why such activity should lead to extreme fractionation of iron and manganese, and thus to deposits abnormally rich in manganese, is another question, however. Moore and Vogt support the view that the iron was removed from the hydrothermal solutions before they debouched into the seawater. Bonatti *et al.* (*Econ. Geol.*, **67**, 717; 1972), following Krauskopf, noted, for example, that iron should precipitate from a hydrothermal fluid before manganese as sulphides or oxides, thereby gradually lowering the Fe/Mn ratio in the remaining fluid. Clearly this process could produce a solution depleted in iron so that at debouchment the manganese would be rapidly oxidised and precipitated. But this explanation is almost certainly incomplete— and there are other possibilities. The full details and significance of hydrothermal activity at ridge crests have yet to be worked out.

Borrowed polypeptides in Qβ replicase

from Pamela Hamlyn

THE enzyme which replicates the genetic material of the single-stranded RNA phage $Q\beta$ — $Q\beta$ replicase — has many interesting properties, not least its specificity. The enzyme recognises, and begins initiation, at the oligonucleotide CCCA found at the 3′ end of both the plus and minus strands (it is a two step replication). The first residue to be incorporated is a G; the A is not copied. *In vitro* the enzyme will replicate poly(C) and C-containing copolymers which suggests it is not too choosy, perhaps only requiring some Cs at the 3′ terminus. But it will not replicate the RNA of other similar phages which also end with CCCA. Weissman has proposed—and there is some supporting evidence—that as well as the terminal Cs the enzyme also recognises another region within the RNA molecule and it is the spatial relationship between these regions that acts as a signal for initiation (Weissman *et al.*, *A. Rev. Biochem.*, **42**, 303; 1973).

Another notable feature of $Q\beta$ replicase is that three of the four subunits comprising the enzyme are polypeptides 'borrowed' from the host —*E. coli*. One is the ribosomal protein S1 which the host uses for the correct