American plates meet. Although the data are few, they show a distinct geographical correlation; on ridge crests flanking axial valleys the heat flow is high, in the depressions of fracture zones and axial valleys it is intermediate to low and on ridge flanks it is low. At one extreme, four values higher than 4.0 μcalorie $cm^{-2} s^{-1}$ were observed on the crests of three ridge segments, whereas at the other, a value of 0.4 μcalorie $cm^{-2} s^{-1}$ was found in a depression of an axial valley near its intersection with an adjacent fracture zone.

The problem with these and previous similar results from less complex areas is that they conflict with the conditions of steady state heat conduction, by which heat flow should be higher through depressions and valleys than through ridges. Variations in the thermal conductivity of the sediments in which the heat flow was measured would be one possible way of reconciling observation with conduction theory, but in the case of the South Atlantic triple junction such variations do not exceed 50% whereas heat flow values vary by at least an order of magnitude.

Lee and Von Herzen thus favour an explanation involving hydrothermal circulation in the cracks produced by thermal and/or tectonic tensional stresses near the spreading axis. According to this view, which is apparently the only one offering any hope at present, the high heat flow over a ridge crest reflects the topographically controlled ascending limb of the circulation system in the permeable basement rocks (although it could result from conductive cooling of the crust following the sealing of cracks generated at the spreading centre). The intermediate to low values in the axial valleys may then be attributed to the circulation's descending limbs. Similar values in fracture zone depressions are not quite so easily explained in detail, although reasons for cracking and subsequent hydrothermal circulation there are not difficult to envisage.

The only real difficulty is in accounting for the low heat flow over ridge flanks. One possibility is that the irregular topography here supports a locally controlled hydrothermal system which imitates the wider pattern. Thus hot water would ascend through elevated terrain and descend in depressed regions. The observed low heat flow would then result from a known sampling bias towards local sediment-filled topographic lows. A second possible explanation is that secondary circulation occurs in cracks reopened during the dehydration of rocks previously hydrated near the spreading axes. But either mechanism affirms the crucial role of hydrothermal circulation.

A similar conclusion has also been reached by Piper *et al.* (*Earth planet. Sci. Lett.*, **26**, 114; 1975) but in a quite different context. Piper and his colleagues have analysed (for major, trace and rare earth elements and uranium isotopes) an iron-rich (about 30%) deposit dredged from the upper flank of Dellwood Seamount in the north-east Pacific. What attracted them to the sample in the first place was its iron-richness, because oceanic deposits with high iron contents (20–35%) and high Fe/Mn ratios (3–75) have previously been associated with active ridge spreading. Indeed, in overall composition and mineralogy the new sample closely resembles other iron-rich deposits attributed to volcanic hydrothermal activity. But do the separate elemental compositions and distributions also support such an origin?

As Dellwood Seamount is close to the North American continent, an obvious possibility is that some of the elements in the sample are terrigenous, introduced into the oceans by rivers. This view may be rejected, however, partly because the major element composition differs from that of metal deposits from hemipelagic environments and partly because the Th content and Th/U ratio are much lower than those of typical river muds. Are, then, any of the elements derived from sea water? The fact that the rare earth element pattern and the $^{234}U/^{238}U$ ratio differ significantly from those of normal sea water suggests that this is unlikely, at least for the rare earths and uranium isotopes (and probably for others too). Indeed, although the absolute concentrations of rare earth elements are much lower than those in oceanic sediments and basalts, the pattern of these elements is almost identical to that of ridge basalt.

Taken together, these observations can only be explained on the assumption that the unusual composition of the iron-rich deposit derives from a suboceanic source. And the only known way in which this source may be tapped is by hydrothermal circulation which leaches out the metals from flow interiors and transports them to the surface. Admittedly there is a problem. The $^{234}U/^{238}U$ ratio is not only much higher than that of normal sea water, it is also much higher than that generally found in iron deposits now forming near known active volcanic centres. In the case of the Dellwood deposit it is therefore also necessary to assume that ^{234}U is leached from the rock preferentially. The point is, however, that even this anomaly can be accommodated within a hydrothermal system. □

A hundred years ago

In the Paris International Maritime Exhibition there is a small object deserving of notice. It is a platinum wire placed in a bottle and ignited by electricity from a bichromate battery. It is intended to be immersed in the sea, and the light emanating from it is said to attract an immense number of fishes. Experiments have been tried lately on the coast of the Côtes du Nord department with a fishing-boat, and have proved very satisfactory, on a bank of sardines. The glass must be green or black, otherwise the fish are frightened by the glare and do not follow the submarine light.

from *Nature*, **12**, 388; Sept. 2, 1875

Constructing semisynthetic polypeptides

from D. G. Smyth

A SEMISYNTHESIS is one that utilises a fragment of a natural substance as a prefabricated unit in the construction of a larger molecule. The term does not include the preparation of simple derivatives of a natural protein nor of course does it cover the chemical synthesis of peptides from their building bricks, the constituent amino acids. The hallmark of a semisynthesis is that it involves the combination of two components, the one a fragment of a natural substance, the other a product formed by chemical synthesis. This description would include the preparation of ribonuclease S by association of the subtilisin-produced S-protein (residues 21–124 of ribonuclease) with a synthetic S-peptide (corresponding to residues 1–20). The combination of natural insulin A-chain with synthetic B-chain, or *vice versa*, would also qualify as a semisynthesis, as would the conversion of porcine insulin to human insulin by replacement of the B-chain octapeptide.

In the field of peptide synthesis, the idea that an intermediate fragment might be obtained by excision from a protein of known structure is attractive. Such fragments can be obtained in pure form and without racemisation by the action of proteolytic enzymes;