Which direction for ocean drilling?

from J.R. Cann

A recent conference* on ocean drilling (COSOD) enabled some one hundred and fifty geologists and geophysicists — including both those involved in the field as well as sceptics from other areas — to take a cool look at the long-term future of scientific drilling of the ocean floor. Of particular interest was the debate over whether the drillship *Glomar Challenger* should continue to be used or whether it should be replaced, at considerable expense, by conversion of the much larger *Glomar Explorer.*

Ocean drilling has been conducted since 1968 from the special dynamically positioned drillship *Glomar Challenger,* originally entirely USA funded, but expanded in the mid 1970s to include participation by the UK, France, Germany, Japan and the USSR. Currently the project costs $21 million per year of which $14 million is required to run the ship. The non-US subscription runs at $2 million per year per partner, on top of which is the spending required to support the experiments connected with drilling.

Following a similar conference in 1976, plans were initiated to convert the six times larger *Glomar Explorer* from its original deep lifting role to a vessel for deep ocean margin drilling, carrying all the safety equipment necessary for drilling holes 6 km deep in water 3 km deep. Although at first it seemed that the *Challenger* and *Explorer* programmes might develop in parallel, progressively revised cost estimates showed that this was unlikely.

Scientific returns from *Challenger* increased in quality, especially with the development of the hydraulic piston corer that recovers almost undisturbed sediments from as deep as 200 m below the ocean floor, but financial pressures became greater. The planned *Explorer* drilling was too costly for the US Government to undertake alone, and under President Carter the joint government/oil company Ocean Margin Drilling Program was evolved. Eventually, after an initiative from the NSF to merge the two programmes, the oil companies withdrew from the *Explorer* program on 6 October this year. A number of detailed geophysical compilations for the areas selected for deep drilling (to be available next year) were carried out as well as various feasibility studies for the engineering involved. A Lockhead–Sedco venture is currently studying how best *Explorer* could be converted — without the expensive and complex safety systems necessary for really deep penetration in deep water.

COSOD, which was originally conceived as coordinating the *Challenger*- and *Explorer*-based drilling programmes, was left with two principal tasks, both of greatest importance. One was to examine the scientific justification for drilling beyond 1983, and the other to consider, if drilling was to continue, whether using *Explorer* or *Challenger* would be best.

A. Shinn, newly appointed director of the Office of Scientific Ocean Drilling at NSF, set the framework from the NSF point of view. He pointed out four options: (1) to terminate all scientific drilling at the end of 1983, when *Challenger* finishes her current phase of operations; (2) to extend the *Challenger* program for up to five more years; (3) to convert *Explorer* to a *Challenger*-like ship and use her instead of *Challenger*; and (4) to convert *Explorer* to a ship fully equipped for deep penetration in deep water as envisaged by the Ocean Margin Drilling Program.

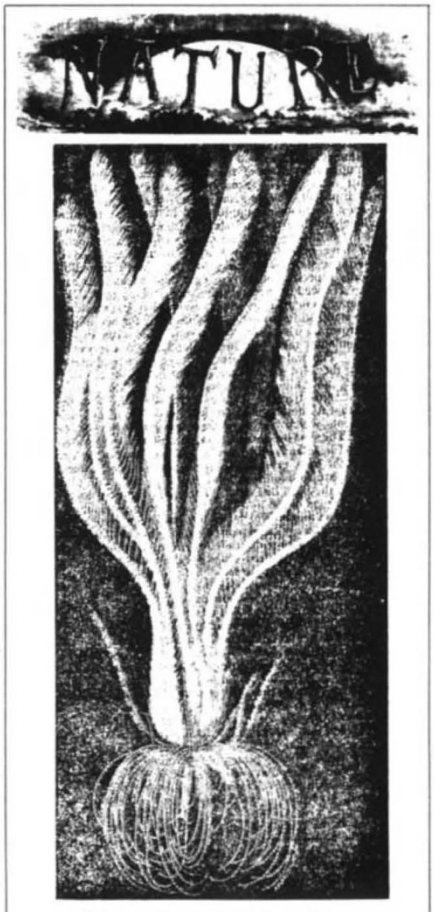
Option (1) he presumed, correctly, would be rejected by the conference, and option(4) he regarded as too expensive to support, leaving options (2) and (3). He indicated that running costs for *Explorer* would be similar to or somewhat more than those of *Challenger,* but that conversion of *Explorer* would put a halt to drilling (so that conversion could be funded) for about 18 months. He asked the conference to help decide between the two options, by assessing the ability of *Explorer* to handle larger amounts of drilling materials, to drill in high latitudes (especially in the Southern Ocean), to carry more scientists and to increase in drilling capability through a longer life, compared with the known and continuously available capability of *Challenger.*

A series of scientific reports and workshop discussions followed, including presentations from planning groups associated with both the present *Challenger* drilling and the Ocean Margin Drilling Program originally planned for *Explorer.*

On the final day the chairmen of the working groups presented their proposals to the reassembled conference, together with priorities for drilling. There were far too many proposals for excellent science than could be accommodated by one drilling ship. Among the highest priority targets presented, 'natural laboratories' was one watch word. These would consist of groups of holes in the ocean crust to study hydrothermal circulation, crustal construction and tectonics, which would act not just as sources of rocks for examination, but also as sites for *in situ* measurements and experiments, both in the short term and as long-term observatories. Work of this kind has already started, and shows great promise. Some holes would be sited on young, newly created crust where water at 350°C is seen to bring out sulphide ores from within the crust, and technical problems of drilling on bare, sediment-free rock, as well as at these very high temperatures, must be solved.

Testing the Vail Curve was another priority. This curve shows sea level in the geological past and was constructed by Peter Vail and his associates at EXON on the basis of seismic reflection profiles and drilling in shelf areas. Various aspects can best be tested outside traditional oil-producing areas, including the magnitude, suddenness and synchronism of the changes, and a number of such tests were proposed. If the Vail Curve can be made entirely reliable, then the consequences for understanding the geology of sediments would be great indeed.

Island arc regions, near the chains of volcanoes that border the Pacific and some other parts of the oceans, are places where plates are being subducted back into the Earth's mantle. They are still poorly understood, and are clearly of great importance in understanding global geology. Many kinds of targets were identified here, of which the most graphic is the drilling through the pile of sediments on the inner wall of ocean trenches into the descending plate of oceanic material,



Hairstar from the Taimur Coast.
From *Nature* **25**, 22 December, 181 (1881).

*The 'Conference on scientific ocean drilling' (COSOD) was held in Austin, Texas on 16–18 November, 1981. The steering committee is preparing a report which will be available in the spring.

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0028-0836/81/510613-02$01.00