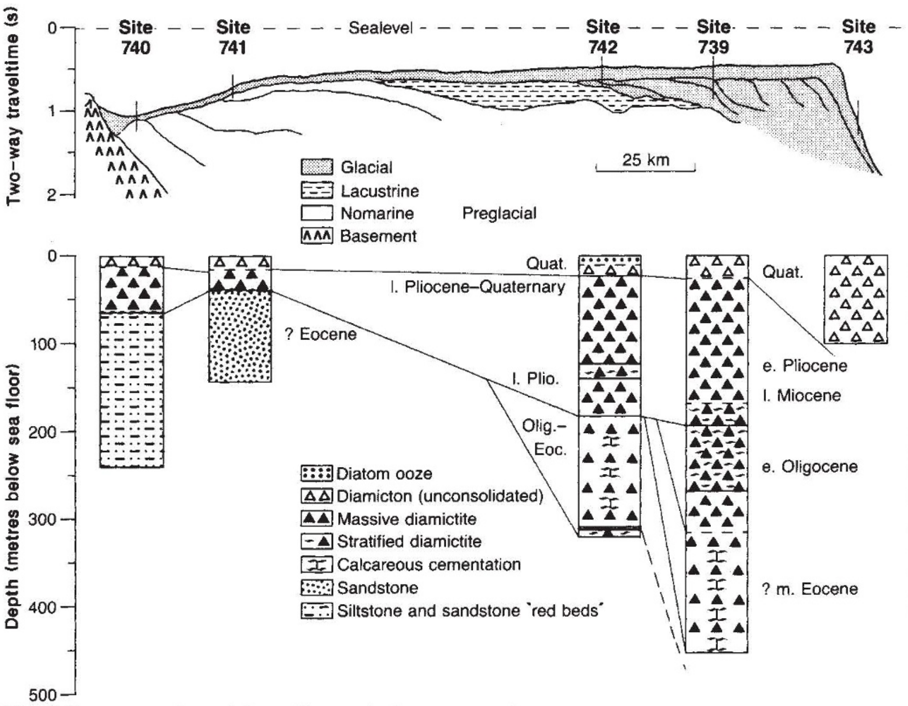

Fig. 2 Representation of the sediment facies recovered from Prydz Bay during Leg 119. Based on seismic and stratigraphic data collected during Leg 119. l, late; m, middle; e, early.

abundant and well preserved in the lowermost Oligocene unit and were not regarded as reworked by the shipboard diatom biostratigraphers. By correlating these with similar assemblages from the southern Kerguelen Plateau (site 744) dated magnetostratigraphically, we find that they date from at least 35.3 Myr ago (upper part of magnetic polarity chron 13). Unfortunately, magnetostratigraphy at site 739 is nondiagnostic. These earliest Oligocene diatom assemblages are underlain by 168 m of undated diamictite (Fig. 2), which is the lowermost sediment cored at site 739. Seismic stratigraphy reveals that these strata are younger than the basal 144 m of the section cored at site 742 (29 km to the south-east). The composite section of 300 m of diamictite, which underlies the dated lowermost Oligocene diamictite, contains sparse, possibly reworked but well-preserved calcareous nannofossil assemblages, which constrain their age to be middle Eocene to Oligocene.

Shipboard magnetostratigraphy indicates that the lower 144 m of this diamictite sequence at site 742 is dominantly of normal magnetic polarity but is interrupted by six short reversed events. The published magnetic polarity timescale below anomaly 13 shows only one interval in the lowermost Oligocene and Eocene characterized by such dominantly normal polarity separated by numerous brief reversals, namely the interval of anomalies 15 to 18 (37.24–42.73 Myr or late Eocene to latest middle Eocene). Within this interval, anomalies 17 and 18 (38.8–42.7 Myr) most closely resemble the magnetic polarity record at site 742.

Thus our drilling results suggest that a large glacier complex reached the region of site 739 in Prydz Bay during earliest Oligocene time and possibly during late middle Eocene time (about 42.5 Myr), 6 Myr earlier than has been proposed for other Antarctic areas[1]. The sediments also indicate that the outer limit of the ice front was beyond that of the present by at least 140 km and that full-scale ice-sheet development took place over East Antarctica by early Oligocene time or possibly earlier. This suggests that the early Oligocene glaciation recorded in the Ross Sea in West Antarctica was more than a local event and extended beyond the Transantarctic Mountains.

The series of late-Oligocene ice advances in the Ross Sea can be matched in Prydz Bay if we assume that ice advanced beyond site 739, removing sediment and causing the late Oligocene to middle Miocene hiatuses. Because of the sparse occurrence of datable microfossils and the incomplete sedimentary record, we cannot determine the full glacial chronology for Prydz Bay. But it is clear that the glacial depositional record extends through the early Oligocene, the late Miocene to early Pliocene and the late Pliocene to Quaternary times. Evidence of a Quaternary ice cover to the shelf edge was observed at site 743, which implies at least one advance of 170 km of the ice front. The entire Oligocene to Quaternary sediment record at site 739 gives evidence of the proximity of ice. Most of the time this ice was probably grounded. □

1. Barrett, P.J., Hambrey, M.J. & Robinson, P.R. in *Antarctic Earth Science Symposium Volume* (ed. Thompson, M.R.A.) (Cambridge University Press, in the press).
2. Margolis, S.V. & Kennett, J.P. *Am. J. Sci.* **271**, 1–36 (1971).
3. Leg 113 shipboard scientific party *Nature* **328**, 115 (1987).

Daedalus

Reagan's crystal

Most chemical reactions release their excess energy as heat: random, disordered molecular motion. But, says Daedalus, consider an explosion initiated uniformly over one face of a perfect single crystal of a high explosive. Each molecule on that face will decompose identically, transmitting a pattern of molecular recoil to the next molecule below it, which will decompose in its turn.

Now a collision transmitted down a chain of spheres is 'self-focusing'. Even a highly oblique initial impact, as it travels down the chain, is rapidly aligned into an in-line impulse transmitted unchanged from sphere to sphere. Small 'thermal' disorders of velocity or position are also focused away. So a planar explosion wave in a single crystal should not scramble into thermal chaos, but should converge to a stable pattern handed on from layer to layer. Each type of decomposition molecule will spring off the reaction-face at a characteristic angle determined by the mechanism of reaction, so the exploding crystal will emit all its chemical energy as a fan of molecular beams. Each beam will consist of molecules of one type, travelling on accurately parallel paths at a velocity of many kilometres per second.

So DREADCO's intrepid chemists are cutting and polishing single crystals of selected high explosives, suspending them in vacuum, and launching planar shock waves into them by means of a laser pulse on one face. Once the velocity and direction of the resulting molecular beams has been determined (and apparatus strong enough to withstand their colossal impact on its walls has been constructed), Daedalus will look for technical applications. The most promising application is to rescue President Reagan's Strategic Defense Initiative from its current credibility crisis.

A parallel, high-velocity molecular beam, capable of being fired at a ballistic missile through thousands of kilometres of space, is a splendid space weapon. A cheap and simple single-crystal charge of high explosive, concentrating much of its energy in a deadly beam, is obviously far preferable to the nightmarishly complex and inefficient lasers and particle guns now lined up for the job. So many such charges could be economically accumulated in orbit that the crudest aiming software, blazing away furiously in true Wild West tradition, should hit most of the missiles in a flight by sheer random shotgun overkill. Best of all, a molecular beam (unlike a laser beam) is useless for Earth-bound warfare. Fired in the atmosphere, the most perfect single-crystal beam gun would simply explode in the conventional way, killing the gunner.

David Jones