Predator or prey?

Peter D. Moore

IT is not unreasonable to suppose that a predator normally reduces the numbers of its prey, but there are certain exceptions to this general principle. One example emerged from the experiments of Porter (*Nature*, **244**, 179; 1973) on the grazing of zooplankton upon planktonic algae. In a small mesotrophic lake in Connecticut she enclosed water samples in 0.5 m^3 polythene bags and artificially enriched the population of zooplanktonic grazers within some of these. After four days Porter sampled the various bags and determined whether each of the phytoplanktonic taxa represented had decreased or increased in density.

Flagellates, nanoplankton and diatoms were suppressed by raised grazing pressures; desmids, dinoflagellates and chrysophytes were unaffected but, rather surprisingly, the larger green algae increased in density under more intense grazing. The unaffected groups were rarely found in the guts of the grazers; they were probably selectively avoided. The greens, particularly those species with a gelatinous sheath around their cells, were found to be viable after passing through the guts of grazing zooplankton. Porter suggested that the fragmentation of larger colonies of gelatinous greens in *Daphnia* guts could enhance population growth rates. She also considered it possible that the gelatinous sheaths could protect the cells against digestive enzymes and yet allow the cells to take up inorganic ions and small molecules even within the animal's gut.

Porter has now put these ideas to the test (*Science*, **192**, 1332; 1976) in a series of experiments involving radioactive tracers. The colonial alga *Sphaerocystis schroeteri*, which has a mucilage sheath, was fed to the grazing crustacean *Daphnia magna*, together with the desmid *Ankistrodesmus falcatus* (no mucilage sheath) which had been supplied with $NaH^{14}CO_3$ and $K_2H^{33}PO_4$. Subsequent sectioning and autoradiography of the *Daphnia* gut showed that both ^{33}P and ^{14}C had been taken up by *Sphaerocystis* from the broken cells of *Ankistrodesmus*. ^{14}C uptake was enhanced by light, suggesting that its uptake was autotrophic. Thus nutrient supply, as well as the physical dissociation of algal colonies, may contribute to the observed enhancement in population growth rate. Porter has now been able to quantify the enhancement, for in a controlled experiment, the population of algae which had passed through a *Daphnia* gut had grown by 63% in 24 h. Ungrazed populations were unchanged in the same period.

Porter points out that the mucilaginous green phytoplanktonic taxa like *Sphaerocystis* have summer rather than spring blooms. At this time free nutrients in the water are depleted and the guts of grazers provide a locally enriched microhabitat. Porter refers to the relationship as one of 'nascent symbiosis' between acquatic plants and grazing animals. But it is certainly not a mutualistic one. It is a refreshing example of an evolutionary confidence trick whereby the hunter is exploited by its supposed prey.

How closely should continents fit together?

A RECENT article by Hallam (*News and Views*, **262**, 94; 1976) in which my paper on global expansion and continental displacement during the Mesozoic and Cenozoic (*Phil. Trans. R. Soc.*, **A281**, 223; 1976) is reviewed, contains certain factual errors which need to be corrected. Less important is his initial statement that I have argued post-Pangaea continental displacement to be a consequence of global expansion since the early Jurassic. This is not entirely correct, and the importance of the role of convection in the asthenosphere in the production of the Earth's oceanic crust is implicit throughout the paper. The continental geological information, oceanic-floor spreading patterns and the distribution of present and former subduction zones during the last 180 Ma indicate global expansion at the rate envisaged in my paper. These data do not support the concept of an Earth of constant modern dimensions, as progressive subtraction of isochronous oceanic crustal area on such a model readily shows.

Hallam cites three examples of areas of continental crust which occur in the magnetic quiet zones, and which might affect the fit of the continents together to reform Pangaea such as that given in my maps. The paper by Jansa and Wade (*Geol. Surv. Canada Pap.*, **74-(30)2**, 51; 1975) to which he refers actually describes the submerged continental shelf off Newfoundland including Flemish Cap. It is indeed continental crust and is shown as such on my maps. The adjacent Atlantic oceanic crust with its typical seismic and magnetic characteristics is well described by Grant (*Geol. Surv. Canada Pap.*, **74-30(2)**, 217; 1975) in the same volume. The magnetic quiet zone east of the Vöring Escarpment described by Talwani and Eldholm (*Bull. geol. Soc. Am.*, **83**, 3575; 1972) is also included in my maps as continental crust; the area to the west of it shows simatic crustal characteristics. The paper by Burollet and Byramjee (*Notes Mém. Comp. Fr. Pétroles*, **11**, 71; 1974) does not provide definitive evidence that widespread crustal areas off the continental shelf of Africa consists of downfaulted continental crust. The evidence available does indicate that east of the margin of the east African continental shelf, a thick sequence of sediments occurs probably extending back into the mid-Mesozoic as in the case of the eastern region of the Wharton Basin adjacent to the Australian continental shelf. The continental shelf off Tanzania shown on my maps has a sequence of sediments extending back into the Palaeozoic (Kent and Perry (*Sedimentary Basins of the African Coasts* (Edit. by Blant, G.) **2**, 113; 1973) and Kent and Tarling (*Nature*, **261**, 304; 1976)). The examples given by Hallam, therefore, cannot be considered as convincing evidence against the major geometric problems considered in my paper, and indeed, the mounting geological evidence against the triangular Tethys Ocean required by constant dimensions reconstructions cannot be ignored (and this specific problem is recognised by Burollet and Byramjee (*op. cit*)).

Hallam refers to the controversy about the original position of Madagascar in the Gondwanaland reconstructions. There is evidence that Madagascar reached its northern position relative to the eastern African margin in the early Mesozoic, having moved northward during the Palaeozoic in response to pre-Pangaea crustal movements. The evidence put forward by Flores (*Trans. geol. Soc. S. Afr.*, **73**, 1; 1970) for a position of Madagascar adjacent to South East Africa and Rhodesia—Mozambique during the deposition of the lower Karroo should be given careful consideration by workers interested in this area.

H. G. OWEN