Catastrophism is still viable

SIR—It is true, as Weissman states[1], that Innanen *et al.* proposed that the Sun's galactic motion might correlate with geophysical periods. Similar claims have been made over the years for ice ages, mass extinctions, the Earth's magnetic field reversal frequency, the extrusion of carbonatites in Canada and so on. Indeed Holmes some fifty years ago, without the benefit of radiometric dating or the plate tectonic revolution, pointed out that there were 30 Myr and 250 Myr cycles in the geological record. These long-standing claims, largely neglected and only now being rediscovered, were an important element in our conception of the galactic theory of terrestrial catastrophism. But what was missing from all the papers before 1978 was a *mechanism*. And although it seems to elude Weissman, a new idea has emerged, namely that the well known periodicities in the terrestrial record may arise because of the dominating influence of giant comets on the Earth's evolution and of the molecular clouds in the Galaxy in turn on their intermittent influx (see ref. 2 for a review, including references therein). Giant comets in particular take precedence because they contain most of the incident mass: the prolonged effects of the dust input from giant comets may therefore compete with the prompt effects expected from bombardments by their larger debris.

There have been claims recently of course that the mechanism does not work on the grounds that the Sun, unlike other stars of its age, must remain so close to the galactic plane that it cannot yield any significant modulation of the comet flux[3,4]. However, such claims neglect the fundamentally stochastic nature of the galactic interaction, affecting the Sun's orbit as well as the comet cloud. Thus the current solar orbit is anomalously flat, tending to depress the 30 Myr component, but it experiences large gravitational deflections including a probable memory-erasing disturbance during the very recent encounter with Gould's Belt[2]. Terrestrial cyclicities can only be avoided therefore if the Sun avoids molecular clouds, an eventuality that now appears to be hardly realistic.

By the same token it is misleading to favour stochasticity[5] at the expense of cyclicity. It has been argued[6] for example that the occurrence of large sea regressions immediately preceding the Permotriassic and end-Cretaceous extinctions is too large a coincidence to swallow on the impact hypothesis. This comment is only applicable to the stray meteorite hypothesis[7] however and would not apply to the galactic theory — we have ourselves pointed out that the two great mass extinctions were each preceded by the onset of a strong mixed magnetic interval. Thus the meteorite hypothesis predicts no cyclicities and, like Nemesis, seems to owe its erstwhile popularity more to Californian hype[8] than the real astronomical environment.

Whilst it seems therefore that Weissman's quixotic comment has little bearing on the status of the galactic theory of terrestrial catastrophism, the question of how the Earth responds to the huge astronomical perturbations that are now expected remains one of formidable complexity, hardly yet tackled in a quantitative fashion, and to that extent one might agree that catastrophism is as yet unexplained.

S.V.M. CLUBE
Department of Astrophysics,
South Parks Road,
Oxford OX1 3RQ, UK

W.M. NAPIER
Royal Observatory,
Blackford Hill,
Edingburgh EH9 3HJ, UK

1. Weissman, P.R. *Nature* **316**, 572 (1985).
2. Clube, S.V.M. & Napier, W.M. in *The Galaxy and Solar System* (Tucson Symposium) University of Arizona Press, in the press).
3. Thaddeus, P. & Chanan, G.A. *Nature* **314**, 73–74 (1985).
4. Bahcall, J.N. & Bahcall, S. *Nature* **316**, 706–708 (1985).
5. Hoffman, A. *Nature* **315**, 659–661 (1985).
6. Van Valen, L.M. *Nature* **316**, 396 (1985).
7. Alvarez, L.W., Alvarez, W., Asaro, F. & Michel, H.W. *Science* **208**, 1095–1105 (1980).
8. Maddox, J. *Nature* **308**, 685 (1984).

Tenuous evidence for the luminous mouthed shark

SIR—The capture of a second specimen of the 'Megamouth' shark *Megachasma pelagios*[1] has prompted further discussion of its feeding mechanism by J. Diamond in a *News and Views* article[2]. The published description of the first specimen[3] noted that the lining of the mouth had a silvery appearance with pore-like structures and reported that "At the time [24 hours after its capture] it was speculated that these might be luminescent organs, but we have no evidence for this". These initial speculations were given more prominence in an earlier popular article[4]. The account of the second specimen describes the upper jaw and palate as "remarkably iridescent"[1] and the previous speculations have been revived and developed by Diamond, who makes a number of assumptions in support of the premise that Megamouth has a luminous mouth into which the prey (euphausiid shrimps, copepods and jellyfish) are attracted. Beguiling though such a hypothesis may be, its factual basis is too tenuous for it to be allowed to go unchallenged.

The two specimens have been captured at epipelagic depths (< 38m and 165m) yet their "eclectic combination of habitus characters"[3] suggest they are relatively weak swimmers. Diamond infers from this that they live "well below the rich plankton zone" and cannot support themselves by direct filter-feeding, unlike the whale shark and basking shark. He infers further that because the prey is itself bioluminescent it would be attracted to an illuminated mouth. There are few grounds for either inference. The nighttime biomass peak of the micronekton in general and Megamouth's euphausiid diet in particular, lies in the upper few hundred metres, rather than right at the surface. Nor is there any direct evidence to suggest that euphausiids are attracted to a bioluminescent source. There is really no basis for speculation that the mouth is bioluminescent other than its unusual iridescence. Even so, although some luminous organs are silvery it does not follow that all silvery tissues are luminous. It could equally (perhaps more plausibly?) be argued that a reflective lining to the upper part of the mouth might make it less conspicuous than a wholly dark maw, and therefore more efficient in any daytime filter-feeding.

Like Diamond, I do not know of any filter-feeder that uses light to attract plankton (although it was once suggested as a function for the luminescence of the piddock, *Pholas*[4]). The answer to the question he poses of why filter-feeders do not attract prey into their mouths is probably a function of the difficulty of generating a non-specific signal of sufficient potency and range to supply the dietary needs. It is more likely that the problem of Megamouth's feeding methods will be solved by better understanding of both its sensory abilities and its jaw and filtration mechanics. The extraordinary nasal capsules, and the suggestion that Megamouth is more closely related to the whale shark than originally suspected[5], may both be relevant in this respect.

The analogy drawn by Diamond, between the fishy example of Megamouth's proposed pelagic moth-trap and the feathered one of the frogmouth's nocturnal flypaper, is certainly entertaining but probably more fabulous than factual.

PETER J. HERRING
Institute of Oceanographic Sciences,
Brook Road,
Wormley,
Surrey GU8 5UB, UK

1. Lavenberg, R.J. & Siegel, J.A. *Terra* **23**, 29 (1985).
2. Diamond J. M. *Nature* **316**, 679 (1985).
3. Taylor, L.R., Compagno, L.J.V. & Struhsaker, P.J. *Proc. Cal. Acad. Sci.* **43**, 87 (1983).
4. Taylor, L.R. *Oceans* **10**, 46 (1977).
5. Damant, G.C.C. *Proc. Isle of Wight nat. Hist. Soc.* **4**, 155 (1951).
6. Matsey, J.G. *Copeia* (No. 1) 228 (1985).

Scientific Correspondence

Scientific Correspondence is intended to provide a forum in which readers may raise points of a rather technical character which are not provoked by articles or letters previously published (where the Matters Arising sections remains appropriate).