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Comment on "Impact Ejecta Layer from the Mid-Devonian: Possible Connection to Global Mass Extinctions"

The interesting report by Ellwood *et al*. (*1*) demonstrated the applicability of magnetic susceptibility field methods to the identification of distal impact deposits. However, the evidence that they have presented for a bolide impact during the Middle Devonian, immediately preceding the Eifelian-Givetian (E-G) stage boundary at ~380 million years ago (Ma), requires further confirmation and, in particular, better evidence for shock metamorphism. The images identified by Ellwood *et al*. (*1*) as shocked quartz grains are not convincing, and the orientation measurements suffer from an insufficient number of observations. The possible presence of an extraterrestrial component also needs confirmation: As and V anomalies are certainly not indicative of a cosmic component, and Ir data, which would be more characteristic, are absent.

Even if there were strong evidence for a mid-Devonian impact, the interpretation presented by Ellwood *et al*. (*1*) would be too far-reaching in one key respect. In the title of the report, Ellwood *et al*. announce a possible cause-and-effect relation between the putative bolide impact and a global mass extinction. This extinction in question is the late Eifelian Kacák/*otomari* event (*2*–*4*). Ellwood *et al*. claim that this biospheric perturbation "may represent the extinction of as many as 40% of all marine animal genera" (*1*). They cite the work of Sepkoski (*5*) as their only reference for this claim, but the 40% figure is not derived from this work. The crucial figure 6 from Sepkoski (*5*) illustrates the extinction pattern of only "well-preserved" marine genera during the Devonian substages, and the E-G passage is marked by demise level of approximately 15% (Fig. 1). More significant, however, is that this so-called mass extinction of the late Eifelian is at the sixth position among the Devonian intervals in a relative ranking, and has only half the magnitude of the peak that marks the late Frasnian event, a true mass extinction. Indeed, Walliser (*2*) characterized the impact-related Kacák/*otomari* biotic crisis as a minor two-step event that constituted at most a third-order extinction limited primarily to pelagic biota. Its main cause is seen to be the anoxic conditions recorded in widespread, long-lasting (perhaps 1 million years in duration) black-shale deposition during a pulse of marine transgression (*2*–*4*). The sulfide-forming and redox-sensitive trace metals, reported by Ellwood *et al*. (*1*) as evidence for an impact, may be alternatively thought as a geochemical signature of oxygen deficiency only.

Altogether, the term "global Kacák/*otomari* mass extinction" is an original proposal of Ellwood *et al*. (*1*), and an overestimate of the actual biotic changes at this stratigraphic horizon. Similarly negligible ecosystem collapse, at least in an immediate feedback, is established for the well-dated mid-Frasnian Alamo impact event in Nevada (*6*). The insistent search for causal link between an extraterrestrial impact of unknown magnitude and an obligatorily major extinction represents a circular argument [see, for example, (*7*, *8*)], and such a link has not been demonstrated in this case.

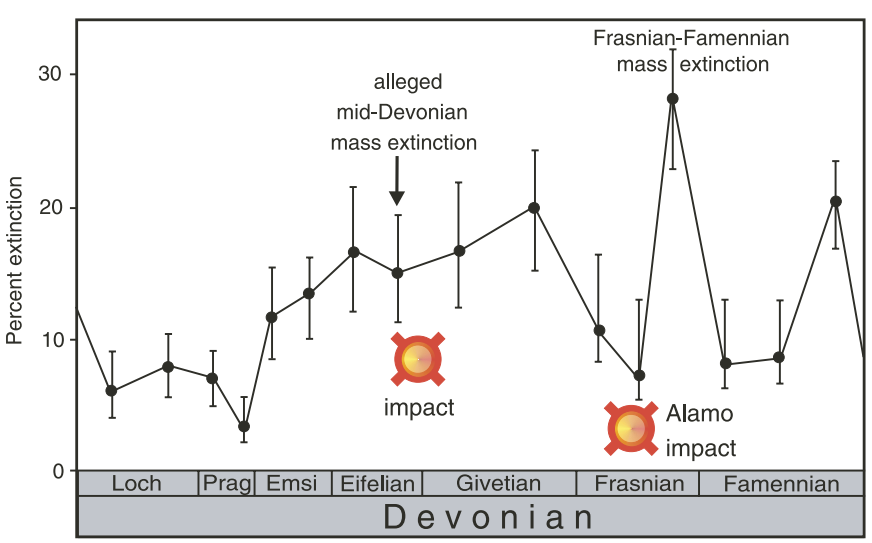


Fig. 1. Two selected impact events plotted against percent extinctions of "well-preserved" marine genera through 16 substages of the Devonian [adapted with permission from figure 6 of Sepkoski (*5*); copyright © 1996 by Springer-Verlag]. As in the original diagram, end-stage extinction data are not plotted at the graphed stage boundary lines, but slightly before them. Loch, Lochkovian; Prag, Pragian; Emsi, Emsian.

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6. A gradually more destabilized Frasnian marine ecosystem by series of comet showers is hypothesized in (*9*), and the Frasnian-Famennian mass extinction is suggested in (*10*) to have been triggered by a rapid global cooling that followed Alamo impact–produced anomalous greenhouse interval.
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