

Extreme Events—The Geological Perspective
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For geologists, the definition problem of extreme events lies not just in the word "extreme" but in the word "event" as well. Most people think of an event as something that happens over a short period of time—on human time scales. Note the modifier, "human time scales," which no doubt seems odd to anybody but the geologists who might be reading this. Geology offers—almost uniquely among the sciences—the perspective of time. Depending on the context, an "event" to a geologist might be something that is instantaneous or that takes as long as a million years or more. This contextual meaning, then, applies as well to the definition of event as it does to the definition of extreme.

Why should humans care about events that are spread out over such long intervals of time? First, geologic time adds to the contextual environment—what might by any definition be termed an extreme event on human time scales may be nothing of the sort on geological time scales. Second, the definition of "extreme" takes on great breadth when events are viewed in the context of geologic time. Third, the geologic record provides what might be called baseline information.

Earth's climate is currently in an atypical state, and we are in what, in geologic terms, is a glacial event. For example, to calibrate what we mean by "extinction event," we need to understand past extinctions. By those standards, calling the modern disappearance of species an extinction event could be viewed as alarmist. In contrast, by geologic standards, an instantaneous occurrence such as an asteroid impact is catastrophic not just on the familiar human time scales but on *any* time scale. This throws new light on how catastrophic events might be defined.