

The Great Dying: the extinction of life at the end of the Permian (P-Tr) 250 million years ago.

250 million years ago the world underwent the “great dying”. Over 90% of life on this planet vanished. Many major geological species, like trilobites, disappeared. Just what caused this extinction is still open to public debate. The most accurate date given is that the extinction event is recorded in a study of zircons from rock sequences in multiple locations in southern China that date the extinction to 252.28 ± 0.08 ma. This date is the most accurate we have and has been cross-correlated by K/Ar and U/Pb dating methods, hence its validity. (2)

The Cause of the end-Permian Extinction: Five Theories

There are five leading theories that attempt to explain what happened at the end of the Permian. The main theories are: the impactor (bolide) theory, the volcanism theory, the regression theory, the oceanic overturn theory and the methane catastrophe theory. (1)

1. Impactor

The impactor theory is inspired by the success of the Alvarez's explanation for the end-Cretaceous catastrophe. Clearly the impact from this asteroid or comet caused an extraordinary catastrophe for many organisms. Obviously, according to impactor advocates, an even larger impactor would have the energy to do even greater damage to the biosphere. Consequently, the impactor theory has had a strong appeal and needs to be examined.

The problem with the impactor proposal, however, is that there has been no evidence to support it. There is no iridium layer, as found at the Cretaceous-Tertiary boundary. There is no accepted evidence for shocked quartz. There are no microtektites -- or the clay spherules which the microtektites by now would have weathered into. There are no tsunami deposits that record a great impact in the ocean. No impact crater has been located.

2. Volcanism

The second theory regarding the cause of the end-Permian catastrophe is the volcanism theory. Unlike the impactor theory, the volcanism theory starts with extraordinarily good evidence. The Siberian Traps eruptive event was a large event. There has been little doubt that Traps volcanism was somehow involved with the end-Permian catastrophe.

There have been continuing suggestions that Traps volcanism could have been triggered by an impact. Again, this is not an unreasonable proposal. Impactors do have extraordinary destructive power.

3. Catastrophic Regression

This theory enjoyed some support about a decade ago, but that support seems to have waned. The basic idea is that the end-Permian extinction was caused by a major drop

(regression) in the global sea level. This regression may have been as great as 280 meters though others suggest it was far less. This would have reduced shallow ocean areas.

4. Ocean Anoxia – lack of oxygen/increase in hydrogen sulfide.

Several studies have indicated that the Late Permian to Early Triassic Ocean was partially or even significantly anoxic (lacking in oxygen). The anoxia constituted the cause of the end-Permian extinction. Oceanic anoxia is an excellent mechanism for killing off aerobic marine organisms. A lack of oxygen caused sulfur-reducing bacteria to dominate the seas causing the release of hydrogen sulfide that killed off many marine species.

5. Continental Margin Methane Release

Permafrost and seafloor methane hydrate release may have played a role in the end-Permian extinction. The seabed probably contained methane hydrate deposits, and the lava caused the deposits to dissociate, releasing vast quantities of methane causing temperature changes.

Validity of the information communicated to the public.

Information that is presented comes mainly from reputable geological sources. The US geological society produces resources that explain the geology in layman's terms. Wikipedia has a good series of accounts for the "great dying" and these are backed up with links to geological sources worldwide. *Scientific American* has a series of articles related to this extinction event and produces reports for the general public. The resources on the internet are written by geologists and though there are many competing reasons for the "great dying" these resources are valid but do show a bias to the geographic area the geologists work in. All scientists follow the scientific method so bias is expected but the scientific method explains this bias. For example, Australian geologists show a real interest in the impactor theory because there is a structure off the NW coast of Australia of about the correct age: the Bedout structure. It is yet to be proven it is an impact structure. (2)

Conclusion:

There is no doubt that the Earth suffered a major extinction event at the end of the Permian (250ma). What caused it is still up to negotiation. The final answer is possibly a series of events rather than one single event. Possible causes supported by strong evidence appear to describe a sequence of catastrophes, each one worse than the last. The Siberian Traps eruptions were bad enough in their own right, but because they occurred near coal beds and the continental shelf, they also triggered very large releases of carbon dioxide and methane. The resultant global warming may have caused perhaps the most severe anoxic event in the oceans' history. According to this theory, the oceans became so anoxic, anaerobic sulfur-reducing organisms dominated the chemistry of the oceans and caused massive emissions of toxic hydrogen sulfide. (3)