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A re-examination of the hypotheses for the Permian-Triassic Boundary extinction event

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The biological crisis that occurred at the Permian-Triassic boundary represents the most extensive loss of species of any known event in the past ~600 million years.

Various models/hypotheses for the **cause** of this extinction event have been proposed, including bolide impact (1) and volcanism (2,3), and their **effects**; i.e. oceanic anoxia, oceanic overturn, excessive methane release, environmental change and even combinations of these possibilities (4,5). Massive volcanism (Deccan Traps) and/or bolide impact (Chicxulub) has been considered as the cause(s) of the end-Cretaceous extinctions. In this paper, a number of these models/ hypotheses for the end-Permian will be discussed in terms of how they change the global carbon cycle; a measure of the severity/rapidity of an extinction event.

In addition, new evidence for a major impact event at the end-Permian will be discussed (1). The implication for yet another large impact event (Bedout) occurring contemporaneously with extensive continental volcanism suggests that other severe mass extinction events that have occurred over the past ~600 million years require 'multiple catastrophes'. The idea of multiple catastrophes was also applied to the current $\delta^{13}C$ data for the Permian-Triassic boundary (2) and the outcome of this study shows that there is good overall agreement with both the long-term (volcanic CO_2) and short-term (methane CH_4) perturbations observed in the carbon isotopic record across the boundary (6). Thus, it would appear that a combination of causes (impact/volcanism) and their subsequent effects (CO_2, CH_4) are needed to explain the most severe mass extinction event in the history of life on our planet.

References:

1. Becker, L. Poreda, R. J., Basu, A. R., Pope, K. P., Harrison, M., Nicolson, C. and

Iasky, R. (2004) Bedout: An End-Permian Impact Crater Offshore Northwestern Australia. *Science* **304** 1469-1476.

2. Renne, P. R., Z. Zichao, M. A. Richards, M. A. Black, and A. R. Basu. (1995). Synchrony and causal relations between Permian-Triassic boundary crises and Siberian flood volcanism. *Science* **269** 1413-1416.

3. Ward, P.D., Botha, J., Buick, R., De Kock, M.O., Erwin, D. H., Garrison, G.H., Kirchvink, J. L., Smith, R. (2005) Abrupt and gradual extinction among Late Permian land vertebrates in the Karoo basin, South Africa. *Science* **307** 709-711.

4. Wignall, P. B., and R. J. Twitchett (1996) Oceanic anoxia and the end-Permian mass extinction. *Science* **272** 1155-1158.

5. Retallack, G. J., A. Seyedolali, E. S. Krull, W. T. Holser, C. P. Ambers, and F. T. Kyte. 1998. Search for evidence of impact at the Permian-Triassic boundary in Antarctica and Australia. *Geology* **26** 979-982.

6. Berner, R. A., (2002) Examination of hypotheses for the Permo-Triassic boundary extinction by carbon cycle modeling. *PNAS* **99** 4172-4177.