Geophysical Research Abstracts
Vol. 12, EGU2010-3796-3, 2010
EGU General Assembly 2010

Emeishan volcanism and the end-Guadalupian extinction: New U-Pb TIMS ages

Roland Mundil (1), Steve Denyszyn (1,2), Bin He (3), Ian Metcalfe (4), and Xu Yigang (3)

(1) Berkeley Geochronology Center, Berkeley, United States (rmundil@bgc.org), (2) EPS, University of California, Berkeley, (3) Laboratory of Geochronology and Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Science, Guangzhou, China, (4) University of New England, Armidale, Australia

High-resolution geochronology with an age resolution at the permil level is instrumental in testing proposed causal links between continental-scale, short-term volcanic events and environmental crises that affect life globally. Synchroneity with large-scale volcanic events has been shown for three of the five most severe extinctions, namely the end-Permian extinction coinciding with Siberian Trapp volcanism, the end-Triassic extinction with Central Atlantic Magmatic Province) volcanism and the end-Cretaceous with Deccan Trapp volcanism. Recent studies also show that the magnitude of the extinction is not solely a function of the size (volume) of the volcanic event but more importantly of the eruption rate and also the nature of the host rock that is intruded, and the resulting reactions and release of gases that can affect climate.

The end-Guadalupian (end Middle Permian, ca 260 Ma) biotic crisis has traditionally not been included in the "big five" mass extinctions, possibly because of its close proximity in time to the end-Permian event, although its magnitude (in terms of total extinction rate) is comparable to the three most severe extinctions (end-Ordovician, end-Permian, end-Cretaceous). As a result, research of the end-Guadalupian event has so far been neglected and its timing as well as the temporal relation to the Emeishan volcanic province in western China is as yet not fully studied. Geochronological data are so far mostly based on ambiguous $^{40}Ar/^{39}Ar$ analyses of commonly altered basaltic products and U-Pb zircon analyses on felsic products using micro-beam techniques that typically result in radio-isotopic ages with percent-level uncertainty, and thus insufficient for high-resolution correlations of events. In addition, no precise and accurate radio-isotopic data exist from this time period so that evolutionary events (extinction and recovery) on land and in the ocean are notoriously difficult to correlate though biostratigraphic records are available from numerous sedimentary archives. A further complication arises from the severe tectonic (and resulting thermal) overprint, due to the closure of the Tethys and the collision of the Indian plate with Asia, of most of the area where Emeishan volcanic products are exposed. Also, currently existing paleo-environmental data are scarce and insufficient for testing this hypothesis with confidence, because studies using stable isotopes as proxies are restricted to short profiles from only a few sites. Therefore, fundamental questions remain unanswered.

We present new data U-Pb IDTIMS ages with permil-level resolution that constrain the timing of Emeishan volcanism and the timing of biotic events recorded in sediments. In detail, U-Pb results are from felsic intercalations within late stage Emeishan products and biostratigaphically calibrated marine sedimentary sections in southwestern and central China as well as thick tuffs within terrestrial sections from the Bowen Basin in eastern Australia. There is also great potential for obtaining precise U-Pb age results on volcanic products with basaltic composition using the accessory mineral baddeleyite the occurrence of which we have already confirmed. Geochronological and geochemical research is complemented with paleo-enviromental studies and biostratigraphy. We expect that through integration of U-Pb and $^{40}Ar/^{39}Ar$ geochronology with chemo- and biostratigraphy, the time scale of the Middle through Late Permian will be greatly improved and will lead to a more realistic evaluation of potential causes for the biotic crisis and its aftermath.