Timing of CAMP magmatism in Eastern North America: Potential for Causing the Tr-J Boundary Extinction

J. Gregory McHone, Geosciences Program, University of Connecticut

The mass extinction at the Tr-J boundary is one of the “big five” catastrophes of Phanerozoic time. Evidence for a coinciding bolide impact remains poor, and the best candidate for causing the extinction is high-volume fissure volcanism of the Central Atlantic Magmatic Province (CAMP). Unfortunately, the huge lava flows of quartz tholeiite in basins across the northern part of the CAMP appear to post-date the extinction horizon by as much as 20,000 years (Olsen, 1997), at least in northeastern North America. However, field aspects of olivine dolerite sills and dikes in the southern USA indicate an age slightly older than the northern basalts, which allows an overlap in time with the boundary extinction.

The earliest event of dike intrusions with fissure volcanism in the northern basins created large sills such as West Rock in Connecticut and the Palisades Sill in New Jersey. Hydrothermal effects of the intrusions led to physical changes of the basin strata, so that subsequent dike generations did not form sills. In North Carolina, the Durham Sill was formed from olivine tholeiite, and so that magma type must be older than non-sill-forming quartz dolerite dikes that also cut its basin. Rare cross-cutting relationships of dikes also show that olivine dolerites are older than the quartz type. Intervals between volcanic events in the northern basins were about 200,000 years or less, and so southern volcanism of olivine tholeiite probably occurred near the end of the Triassic Period, not in the earliest Jurassic. Extensive lava flows of this type still exist in basins buried under the southern coastal plain.

Sulfur in the olivine dolerite dikes and sills averages 0.067 % by weight, which is twice as high as the younger quartz dolerite average. At least 20,000 km^3 of olivine basalt (possibly much more) was extruded across 100,000 km^2 or more of the southern rift basins during this event of fissure volcanism. This is more than a thousand times larger than the Laki fissure eruption of 1783-1784, in which sulfur aerosols cooled the northern hemisphere about 1° C and caused crop failures and famine. The southern CAMP olivine basalts had the size, location, timing, and emissions to cause the mass extinction at the Tr-J boundary.