VOLATILE EMISSIONS OF VOLCANIC EVENTS OF THE CENTRAL ATLANTIC MAGMATIC PROVINCE: ESTIMATES FROM NORTHEASTERN NORTH AMERICA

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Flood basalts in large igneous provinces may cause mass extinctions by emissions of poisonous gases, sulfuric acid, and carbon dioxide. Because volcanic pollutants are removed relatively rapidly, individual episodes of volcanism must be more responsible for extinctions than the entire sum of province events, including for the end-Tr extinction (ETE). Better estimates can be made for extrusive volumes and resulting emissions from separate volcanic events of the CAMP in northeastern North America, and these can be extrapolated to larger areas of the CAMP.

Basalts preserved in basins of this region are of three tholeiite types that are co-magmatic via synchronous fissure eruptions. From oldest to youngest they are labeled "HTQ," "LTQ," and "HFQ," according to ratios involving iron and titanium. Based on a precise U/Pb zircon date for the HTQ type and depositional rates of intermediate strata, their ages are 201.27 Ma (HTQ), circa- 201.02 Ma (LTQ), and circa-200.65 Ma (HFQ), respectively. They are all younger than the circa-201.3 Ma age of the start of the ETE, as based on paleo- and cyclo-stratigraphy. The end of the ETE as marked by the Tr-J boundary may be 10^5 years later, or between the HTQ and LTQ basalt events.

Three large fissure-dike systems for these basalt types extend between basins. Assuming basalts were extruded along the dikes in proportion to their basin products, we can calculate potential volumes and gaseous emissions of their eruptions. Lava volume estimates are about 50,000 (HTQ), 40,000 (LTQ), and 30,000 (HFQ) cubic km in northeastern North America. Using averages of volatile contents of eastern North American CAMP tholeiitic dikes and sills, volcanic emissions from just this section of the CAMP for the 3 respective types were: CO_2 = 8.31×10^9, 4.04×10^9, and 3.03×10^9 metric tons; and S = 2.13×10^9, 3.19×10^9, and 2.39×10^9 metric tons. The same basalt types extend into the southeastern USA, probably doubling these estimates. More importantly, the HTQ type has variations of slightly different ages in northwestern Africa and western Iberia, including flows older than the start of the ETE. Large fissure dikes of HTQ magmas in that area probably increase the total HTQ lavas to 300,000 cubic km just in the northern areas of the CAMP, with commensurate increases in HTQ volatile emissions during the mass extinction event.