CONSTRAINTS ON GEODYNAMIC MODELS FOR THE CENTRAL ATLANTIC MAGMATIC PROVINCE: NON-PLUME RIFTING AND MAGMATISM

J. Gregory McHone, GLSP, Wesleyan University, Middletown, CT 06459-0519

Dikes, sills, and surface basalts of the Central Atlantic Magmatic Province (CAMP) are spread over at least 10 million km^2 within four continents, centered upon but extending far outside of the initial Pangaean rift zone. In addition, basalts of the East Coast Margin Igneous Province (ECMIP) of North America, which cause the East Coast Magnetic Anomaly, covered about 60,000 km^2 with perhaps 1.3 million km^3 of extrusive lavas. If only half of the continental CAMP area was originally covered by 200 m of lava, the total volume of CAMP and ECMIP basalt exceeded 2.4 million km^3 and may be the largest known sub-aerial flood basalt event.

Observations of CAMP include the following features: (1) Intermediate Ti and Mg basalts are found over the entire 6700-km length of the province. Low Ti/high Mg basalts are abundant only on the western side (southern USA), and high Ti/low Mg basalts are common in the south-central zone around Liberia and northern Brazil. (2) Magmatic types may be related to heterogeneous mantle sources and to local differences in mantle melt depths. (3) Dike swarms occur in overlapping trend groups of distinct tholeiite varieties that are not connected horizontally. (4) The western border of CAMP coincides with the cratonic terrane edge and orogenic axis of the Appalachian Mountains. (5) New radiometric data indicate most magmatism occurred in a brief period of less than 1 to 2 million years near 200 Ma throughout the enormous CAMP area. (6) Tectonic activity along much of the Pangaean rift zone of the incipient central Atlantic Ocean started 25 m.y. before CAMP and continued for 25 m.y. afterward. (7) CAMP basalts appear to be contemporaneous with the thick linear ECMIP basalt wedge along 2000 km of the eastern edge of North America. (8) There is no evidence for any region of significant domal uplift associated with CAMP. (9) There are no Early to Middle Jurassic hotspot tracks associated with CAMP. (10) Proposed modern locations for CAMP plume hotspots show only Cretaceous or younger alkaline basalts that are unrelated to CAMP tholeiites. (11) CAMP basalts appear to have evolved through the ECMIP into ocean crust basalt as produced by mid-ocean ridge processes.

Given these observations, a standard deep-mantle plume origin for CAMP is unlikely. The initial Pangaean rifting and magmatism were essentially lithospheric plate events. CAMP-related geodynamic mantle activity is better modeled with regional convection cells and wide-ranging shallow thermal zones under the continental cover of Pangaea, and controlled in part by its lithospheric terrane structures. CAMP basalts and associated

Pangaean rifting are linked to the upper-mantle initiation of ocean crust production and the mid-Atlantic ridges, not to a narrow stem or wide head of a deep-mantle plume.