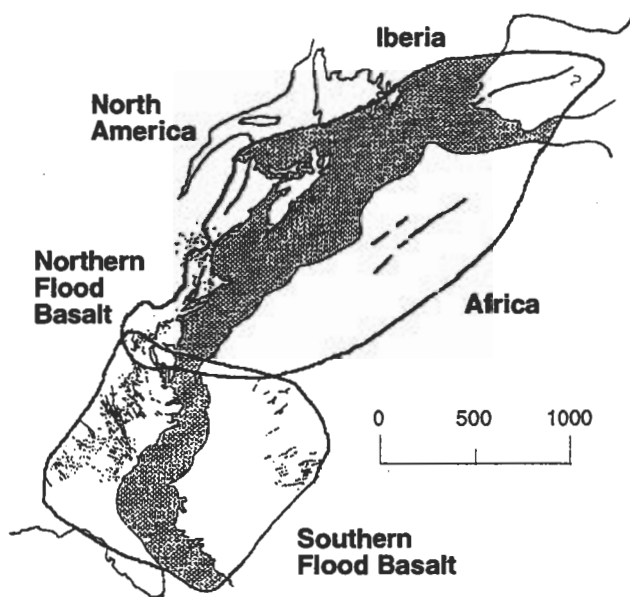


HETTANGIAN FLOOD BASALTS ACROSS THE INITIAL PANGAEAN RIFT

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The original extent of Hettangian (earliest Jurassic) rift basalts can be estimated from maps of their source dikes and of Mesozoic basins that contain remnants of the basalts. At least two major provinces were formed, including a northern province of relatively high-TiO₂ quartz-normative tholeiites and a southern province of lower TiO₂ quartz and olivine tholeiites. A correlation of dikes and basalts on both sides of the Initial Pangaeon Rift has been accomplished by new radiometric dates, by stratigraphic studies of associated basin sediments, and by comparisons of characteristic Ti, Mg, K and other large-ion elements.



The northern flood basalt province has relatively fewer but larger source dikes, and its HTQ-type basalts still remain in basins in northeastern North America and Morocco. The northern province stretched from present-day northern Virginia (Culpeper basin) northeast-ward across Atlantic Canada to include the Avalon dike of Newfoundland, and eastward across much of modern Morocco, Algeria, Portugal, and Spain. An area of at least 1.5×10^6 km² is indicated. Dikes and basalts of the northern province probably formed within a short time span (c. 6×10^5 years) between 196 and 202 Ma. Gaps in the lava sheets may be due to highs in the Hettangian topography, and their relation to the younger ocean-crust magmatism remains unclear.

The southern province is poorly constrained because most of its exposed basalts have been removed by erosion. An initial basalt cover of possibly 8×10^5 km² was spread across the present southeastern U.S. and conjugate areas of western Africa. An age of c. 196 Ma is likely for at least some dikes of the southern province, although a younger age near 180 Ma has been suggested for flood basalts beneath the South Carolina coastal plain and continental shelf. The latter section may overlap with a portion of the "seaward dipping reflector" basalt and basaltic wedge at the Atlantic Ocean - North America margin, and it should thus be almost contemporaneous with the formation of the initial ocean crust.

Environmental problems from such enormous areas and volumes of basalt include acidic rains and both cooling and greenhouse effects from the liberation of up to 3×10^{12} metric tons of CO₂ and 2×10^{11} tons of SO₄ aerosols, as well as considerable amounts of halides and ash. Although the Initial Pangaeon Rift basalts appear to be slightly younger than the Tr-J mass extinction, their possible role in such catastrophes should be assessed.