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Introduction

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Rift basins of the Triassic–Jurassic age associated with the breakup of the Pangean supercontinent contain an extraordinary record of the physical and biological conditions at a critical period of Earth history. Rather than considering the rift basins as local features of limited interest, ongoing work reveals that these Triassic–Jurassic rifts should be studied in a broader context that spans the entire proto-Atlantic realm, including eastern North America, Greenland, the British Isles, and North Africa, as well as South America and central West Africa (figure 1.1). The rift province, collectively called the central Atlantic margin (CAM) system (Olsen 1977), spans more than 45° of paleolatitude and records more than 35 million years of Earth history (figure 1.2). The CAM basins are of broad appeal to researchers interested in topics as diverse as extensional tectonics, the global magnetostratigraphic timescale, the evolution of early mammals, the appearance and diversification of dinosaurs, rift to drift crustal dynamics, astronomical forcing of climate, and models for the formation and occurrence of economic mineral and fossil fuel deposits.

The Late Triassic and Early Jurassic was a critical time in Earth history, representing one of the fundamental end members of the Earth System. The breakup of the most recent supercontinent, the emplacement of what may be the largest igneous province on Earth, the sedimentary record of the largest known system of rifts, and the pattern of biotic change during the second largest mass extinction of the Phanerozoic (figure 1.3) are fundamental problems of Earth System

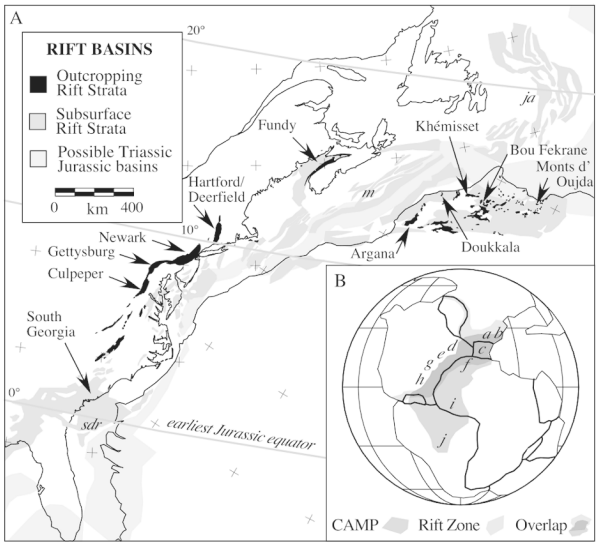

FIGURE 1.1 Distribution of rift basins in eastern North America and Morocco and the distribution of the CAMP). (*A*) Eastern North American rift basins; *ja,* Jeanne d'Arc basin of the Grand Banks area; *m,* Mohican basin on the Scotian Shelf; *sdr,* seaward-dipping reflectors on the southeastern United States continental margin. (*B*) Pangea in the earliest Jurassic, showing the distribution of rifts, the CAMP, and areas discussed in the text; *a,* pyroclastics and ?sills of the Aquitaine basin of southwestern France; *b,* alkali basalt pyroclastics and flows in Provence and the Ecrins-Pelvoux of the external massif of the Alps, France; *c,* flows in Iberia, including the Pyrennes; *d,* flows in the basins on the Grand Banks region, Canada; *e,* Fundy basin area of the Maritime Provinces, Canada; *f,* flows in Morocco, Tunisia, and Algeria; *g,* flows in the major rifts in the eastern United States; *h,* flows in the South Georgia rift and the offshore seaward-dipping reflectors; *i,* ultrabasic layered plutons and dikes of Liberia, Mali, and Senegal; *j,* CAMP flows of Brazil.

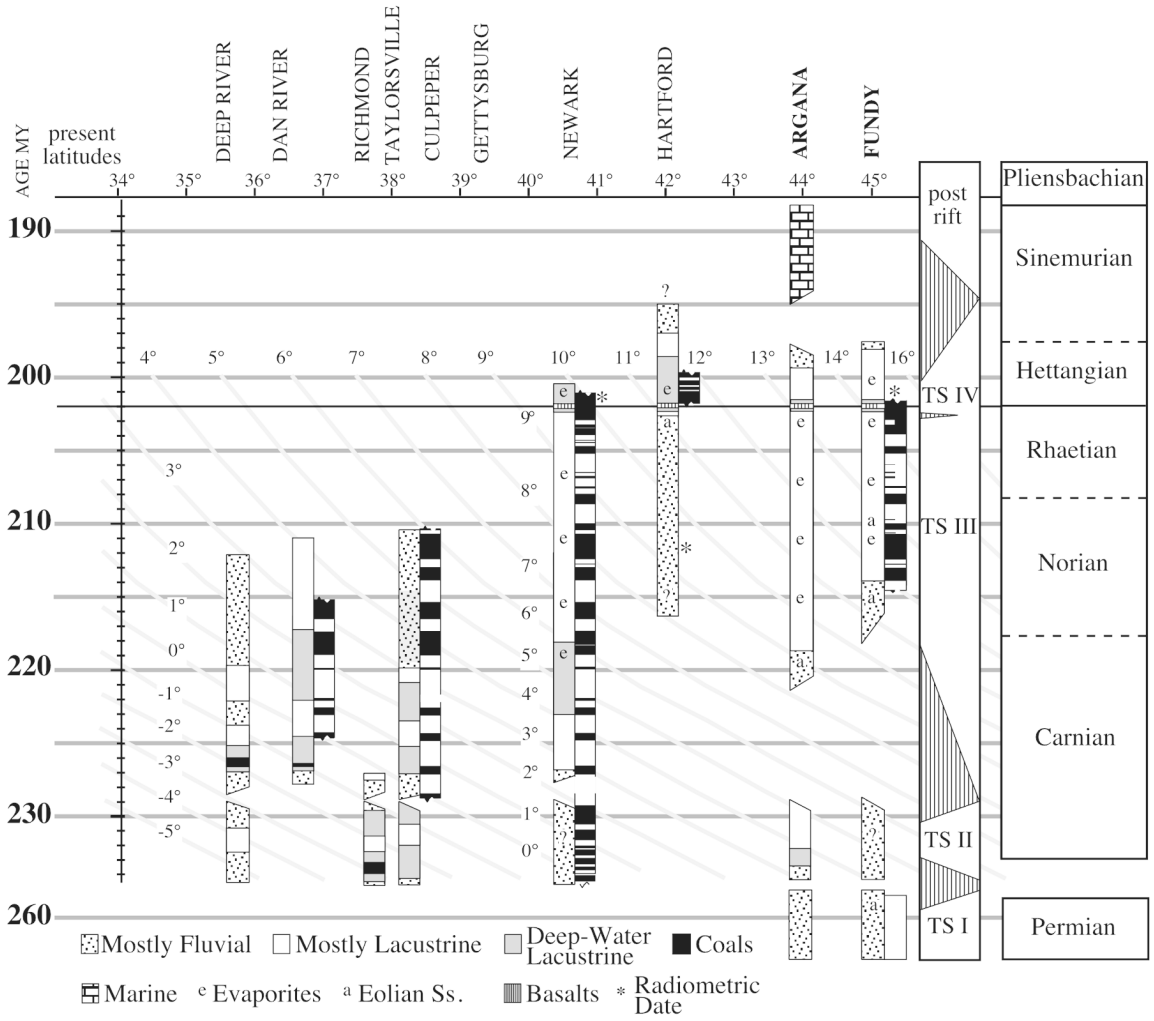

FIGURE 1.2 Spatiotemporal matrix of tectonostratigraphic sequences of CAM basins. Darker-gray tones represent facies deposited under wetter climates. (Data from Olsen 1977; Kent, Olsen, and Witte 1995; Olsen and Kent 1999; LeTourneau 1999, 2001; and Kent and Olsen 1997, 2000)

studies that require innovative approaches and high-resolution records for their analysis. Fortunately, CAM basins preserve a spectacular sedimentary and igneous record of Triassic–Jurassic tectonic, climatic, and biotic events. The North American components of the CAM rifts are the focus of the two volumes of *The Great Rift Valleys of Pangea in Eastern North America.*

Volume 1, *Tectonics, Structure, and Volcanism,* addresses recent advances in structural geology, tectonics, and volcanism of the Central Atlantic Magmatic Province (CAMP). Volume 2, *Sedimentology, Stratigraphy, and Paleontology,* presents new interpretations of Triassic–Jurassic rift sedimentology and stratigraphy and new findings in vertebrate and invertebrate paleontology.

Each volume is further divided into two parts that reflect the main concepts that these essays address. Each part, in turn, opens with an introductory chapter, which is followed by the separate thematic papers. The introductory chapters set the thematic papers in a larger context for the general reader. Although we wanted to integrate the chapters as much as possible into a larger context to benefit general readers, we also recognized that it would be most useful to both authors and readers if the papers could be freestanding. Thus there is some unavoidable duplication of introductory material and figures in the papers.

The chapters in part I of volume 1, "Tectonics and Structure of Supercontinent Breakup," establish the tectonic and structural context of these rifts and of the Newark Supergroup in particular, ranging from the

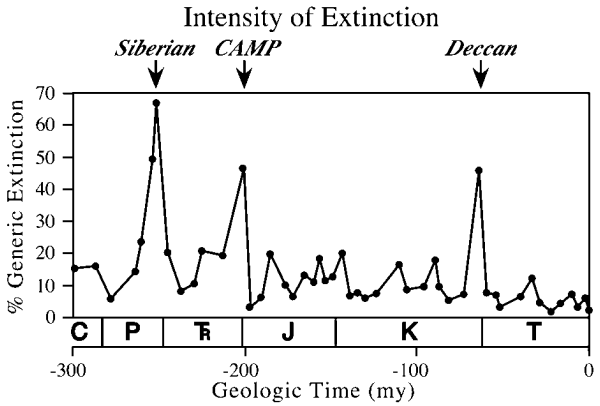

FIGURE 1.3 Generic-level extinctions of marine, shelly organisms during the past 300 million years and the distribution of giant flood basalt provinces (*italics*). Modified from Sepkoski (1997), with timescale modified according to Kent and Olsen (1999), to reflect more recent estimates of the age of the Triassic–Jurassic boundary.

scale of global plate tectonics (chapter 3) to microscale structural analysis (chapter 8). The regional-to basin-scale structure and tectonic development of eastern North American rifts are described in chapters 4 to 7.

Aspects of what may have been the largest known igneous event in Earth history—the 6,000 km diameter CAMP event, which may also mark the emplacement of the earliest Atlantic Ocean seafloor—are analyzed in part II: "The Central Atlantic Large Igneous Province." After an overview of the global context of the CAMP (chapter 9), the North American components of CAMP are dealt with in more detail in chapter 10. Chapters 11 and 12 explore the spatial and temporal trends of the geochemistry of mafic igneous rocks in the CAMP and in other continental large igneous provinces, and chapter 13 describes evidence for the mode of emplacement of this large igneous province.

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