The West and Central African rift systems: Foreword

J.D. Fairhead

Department of Earth Sciences, The University of Leeds, Leeds LS2 9JT, UK

(Received September 15, 1991; revised version accepted November 28, 1991)

Our understanding of the origin and evolution of continental rifts and their relationship to plate tectonic processes has improved dramatically over the last two decades. Rift Symposia early in this period tended to focus attention on the morphologically prominent continental rift systems of East Africa, Dead Sea, Rhine Graben, Rio Grande and Baikal which were considered by many to be typical of the type of structures associated with the initial fragmentation of continents. The role and relation between uplift, magmatism and rifting has been and still is an important research topic associated with these rifts.

The oil industry, during the same period, has improved its ability to seismically image the deep structure of sedimentary basins and passive continental margins which were once intra-continental rifts. In addition the industry sampled these basins with deep exploration wells and developed interpretational methods of sequence analysis to determine their sedimentary history. Academic institutions have paralleled this with the development of backstripping techniques, using well data, and seismic imaging of the deep crust. Evidence accumulating from these investigations began to show that subsidence, rather than uplift, was a dominant process in the development of many intra-continental rifted basins and continental margin basins. This is supported by the theoretical work of McKenzie (1978) who suggested that extensional basins subside during their active rifting phase which is followed by a thermal subsidence phase lasting up to 150 Ma. after extension has ceased. More recent rift symposia have thus tended to turn their attention toward these ‘new’ rift types. The ‘classical’ rifts, such as those of East Africa, which are strongly associated with uplift and magmatism, now appear to be anomalous; never the less, they remain important in our quest for an overall understanding of geodynamic processes governing the evolution of rifts.

The West and Central African rift systems were first discussed by Browne and Fairhead (1983); the proposed regional tectonic model was further developed through a series of subsequent papers (see Fairhead and Green, 1989; Binks and Fairhead, 1992, this volume). The recognition of these intra-continental Cretaceous rift systems were based on the extensive gravity data base which exists for this region and on data made available by the Petroleum industry for many of the rift basins. This permitted the author to delineate the extensional and strike-slip zones through West, Central and North Africa. This was helped by understanding that the negative gravity anomalies associated with the sedimentary basins, forming part of this rift system, were superimposed on broad positive anomalies which are up to 450 km wide and have amplitudes of up to 80 mGal (see Fairhead and Green, 1989). The spatial and temporal link between the West and Central African rift systems and plate tectonic processes within the Atlantic Ocean was recognised to indicate that their is a strong interaction between oceanic and intra-continental tectonics. The West and Central African rift systems are probably the clearest example of such interactions.

The articles forming this section of the GRS-90 proceedings, reflect the growing understanding of
oceanic-continental tectonic interactions and how these manifest themselves by the subsidence of rifted basins, sedimentary processes and deformation. Binks and Fairhead summarise the geophysical evidence which supports the McKenzie rift type model and proceed to show that the tectonic development of the rifts is closely linked to changing plate movements. The role that magmatism plays in the rifting process is discussed by Wilson and Guiraud who indicate that it has not been a significant process in either the active (tectonic) or passive (thermal subsidence) stage of rift basin development. This is consistent with the general findings of the oil industry from deep exploration drilling in continental margin basins.

The articles by Genik (Exxon) and McHargue et al. (Chevron) provide important new stratigraphic, magmatic and structural data on basin evolution and fit well with the geological evidence amassed for the region by Guiraud and Maurin. The final summary of these studies by Guiraud, Binks, Fairhead and Wilson reveals that a correlation exists between the sedimentation and deformation events within the rifts, orogenic plate interactions and resulting changes in plate movement.

There is now adequate evidence that the West and Central African rift systems should be considered as type examples of the early stage in the development of continental margins. This will make these continental rift zones a focus of new investigations into the tectonic controls on basin complexity and style prior to and during the formation of new continental margins.

References


