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TITLE: Quantitative challenges to our understanding of the tectonostratigraphic evolution of rift basin systems *(Invited)*

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ABSTRACT BODY: Pervasive orbitally-paced lake level cycles combined with magnetic polarity stratigraphy in central Pangean early Mesozoic rift basins provide a thus far unique and very large-scale quantitative basis for observing patterns of basin fill and comparisons with other basins. The 32 Myr accumulation rate history of the Newark basin is segmented into intervals lasting millions of years with virtually no change in the long-term accumulation rate (at the 400-kyr-scale), and the transitions between segments are abrupt and apparently basin-wide. This is startling, because the basin geometry was, and is, a half graben - triangular in cross section and dish-shaped in along-strike section. The long periods of time with virtually no change is challenging given a simple model of basin growth (1), suggesting some kind of compensation in sediment input for the increasing surface of the area of the basin through time.

Perhaps even more challenging are observations based on magnetic polarity stratigraphy and the cyclicity, that basins distributed over a huge area of central Pangea (~700,000 km2) show parallel and correlative quantitative changes in accumulation rate with those of the Newark basin. The synchronous changes in the accumulation rate in these basins suggests a very large-scale linkage, the only plausible mechanism for which would seem to be at the plate-tectonic scale, perhaps involving extension rates. Together, we can speculate that some kind of balance between extension rates, basin accommodation space and perhaps regional drainage basin size might have been in operation

The most dramatic accumulation rate change in the basins' histories occurred close to, and perhaps causally related to, the Triassic-Jurassic boundary and end-Triassic extinction. The Newark basin, for example exhibits a 4-to-5-fold increase in accumulation rate during the emplacement of the brief (<1 Myr) and aerially massive Central Atlantic Magmatic Province (CAMP) beginning at 201.5 Ma, the only igneous event known during this long rifting episode. Parallel and correlative accumulation rate changes are seen in several of the other northern basins within central Pangea. Surprisingly, the rate of accommodation growth apparently increased dramatically during this time, because not only did the accumulation rate dramatically increase, the lakes apparently deepened during the same time as a huge volume of CAMP igneous material entered the basins. At the same time, the more southern basins in the southeastern US, apparently ceased to subside (2).

Our ability to measure time in these rift basins using the orbitally-paced cycles, coupled with the ability to correlate between the basins using magnetic polarity stratigraphy, challenges us to form new mechanistic explanations and quantitative models to test against this rich library of observations.

References: 1) Schlische RW & Olsen PE, 1990, Jour. Geol. 98:135. 2) Schlische et al., 2003, in Hames WE et al. (eds), Geophys. Monogr. 136:61.

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