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Pangea breakup, seafloor area-age balance and sealevel

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Recent reappraisals of oceanic crust dynamics based on the distribution of seafloor isochrons have questionned the admitted idea of high spreading rates during the Cretaceous. Rather than anomalously high spreading rates at that time, we have proposed that Pangea breakup might be the first-order forcing mechanism of sealevel change since 180 myr. The Atlantic and Indian Oceans and the oceanic part of the Antarctic plate (so-called AIA oceans) have formed at the expense of consuming Panthalassa global ocean (closure of Mongol-Okhotsk and Tethys oceans, reducing area of Paleo-Pacific) as a result of Pangea breakup over the last 180 myr. This major plate reorganization has changed the area/age distribution of oceanic lithosphere. Based on measurements of isochron length and inter-isochron areas evolution since 180 myr, we show that (1) ridge length increases linearly and (2) spreading rates are constant in newly formed AIA since the beginning of breakup. Assuming that (1) total area of oceanic lithosphere has remained constant and (2) that the area/age structure of Panthalassa has remained similar to the present-day global distribution from 180 Ma to Present, we evidence a 3rd order polynomial relationship between the global mean age of oceanic lithosphere and time t since beginning of Pangea breakup. Evaluation of parameters of this equation demonstrates an excellent correlation between the inferred mean-age evolution and first-order changes in sea-level, with the Cretaceous highstand linked to a global rejuvenation of seafloor, and the Tertiary global decrease in sealevel related to a progressive global re-aging of ocean floor. Finally using isostatic estimates of global ocean depth evolution with time, we discuss amplitudes of sealevel changes due to this mechanism. We conclude that changes in mean age of the oceanic lithosphere (varying between 56 and 62 ś 0.2 myr), due to Pangea breakup, are

one of the main controls, accounting for 50 to 70%, of first-order changes in sealevel.