Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05394, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05394
EGU General Assembly 2008

Very low term (250 Myr) quanification of the eustasy during Mesozoic - Cenozoic time based on coastal onlap measurement at the tethys and world-scale

C. Robin (1), F. Guillocheau (1) & B. Vrielynck (2)

1. Géosciences, UMR6118 CNRS-University of Rennes, Campus Beaulieu, Rennes, 35042 France – Cedex 05, France (Contact : cecile.robin@univ-rennes1.fr, tel : 33-(0)2-23-23-57-27 - fax : 33-(0)2-23-23-61-00)
2. Tectonique ,UMR 7072, Université Pierre et Marie Curie (Paris 6), 75252 Paris

Eustasy, or absolute sea level variations, is a reference level of primary importance in the Earth Sciences. Variations in sea level control part of the stratigraphic record for all of the world's sedimentary basins, the area of continental surfaces exposed to erosional processes, and the base level of the fluvial systems. Those variations have been used as a reference curve to estimate $p\mathrm{CO}_2$ variations, and the consequent climatic changes, through geological time.

Since the definition of the eustasy concept by Suess (1883-1888), and the publication of the pioneering chart of Stille (1924) enriched by Umbgrove (1938), global-scale transgressions and regressions are now well established from the Jurassic to Present-day (sea the works of Hallam, 1969, 1981, 1992..). At a higher time duration (x100 My) and for the Phanerozoic, two sea level rise and fall cycles were defined, a first one for the Paleozoic and a second one for the Meso-Cenozoic.

Several long term sealevel curves (x100 km) for the past 250 My were published during the 70s and 80s (Pitman, 1978; Matthews, 1984; Haq et al., 1987). The most popular one is the one proposed by Haq et al. (1987). Most agree that sea level rise occurred from the Permian (270 My) to the Upper cretaceous (Cenomanian, 95-90 My, for Haq et al., 1987), and was followed by a sea level fall that continues today.

Controversy persists, however (1) on the amplitude of this sea level variations (highest amplitude 350-250 m, McDonough & Cross, 1991, smallest 70-80 m, Miller et al., 2005), (2) on the kinematics of the sea level fall or rise and (3) about the required mechanism, which must be related to the plate movements, associated with the Wilson Cycle (Worsley et al., 1984 ; Veevers, 1990).

The first objective of this project is to question and to quantify the sea level variations for long (250 My) term time durations. We will focus on the Cretaceous (145-65 My), which displayed the highest sea level during the last 250 My.

The first part of our study will be based on the measurement of the marine flooding of continents through time. This method requires new style world-scale paleogeographic maps, quantified in term of paleotopography, to measure both the coastal onlap and the hypsometry of the Earth at each time-interval. The main challenge is the quantification of the topography of the Earth for Mesozoic times.

Our technique is based on a global-scale measurement of the marine flooding of continents on Earth paleogeographic maps. Sea level is inferred, for a given time interval, from the intersection of this world-scale flooding with the distribution of the world elevation, or hypsometry. The continental flooding is the percentage of the continental domain flooded by the sea. This percentage is defined from a specific geographic reference level that can be the shelf break or the present-day shoreline. The hypsometric curve is the cumulative curve of areas of land between pairs of contour lines as a percentage of the total land area.

We used a new paleogeographical dataset for the Meso-Cenozoic: one at a world-scale (project WGM/UNESCO “Changing Earth Face”, Vrielynck & Bouysse, 2001), and one at a Tethys-scale (PERI-TETHYS project, Dercourt *et al.*, 2000). These first results are based on the present-day continental hypsometry. The main question is: does the present-day altitude distribution apply for the past? Present-day continents are mainly subjected to erosion, and few subsiding domains ($i.e.$ depositional system) occur. The present-day continental topography is different from the past one, mainly Upper Jurassic – Lower Cretaceous time, where large intracontinental basins (intracratonic basins, large passive margins, rifts. . .) with low relief, occurred. The present-day altitude distribution, which could be the best analogue of the Upper Jurassic-Lower Cretaceous time, is the Amazon watershed.

Using the Amazon hypsometry and the world-scale paleogeographic map (the only way to measure eustasy), the highest sea level occurs during Upper Cretaceous time (Cenomanian – Maastrichtian) and the amplitude would be +100 m above present-day sea level. Using Tethys-scale paleogeographic maps (eustasy + Tectonic deformations at Tehys-scale), the highest relative sea level occurs during Cenomanian time and the amplitude would be +250 m above present-day sea level.