

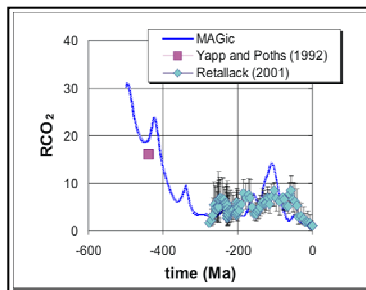
## How tightly coupled are seafloor spreading rates and seawater-atmosphere composition?

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Although many current models of the geologic history of atmosphere and seawater composition assume that seafloor spreading and volcanic degassing rates have varied over the Phanerozoic Eon, the mechanism and role of these variations are poorly understood. Although spreading rate was an important forcing function in the earlier BLAG model, GEOCARB's paleo-CO<sub>2</sub> curve is relatively insensitive to degassing rate variations, and the current version suggests that degassing has played a minor role in CO<sub>2</sub> regulation compared to that of vascular plants, paleocontinental organization, shifts in skeletal carbonate deposition, and other factors (e.g., Berner and Kothavala 2001).



Variations in spreading rate have played a much more central role in models that compute seawater compositions from marine evaporite and carbonate mineral proxies (e.g., Stanley and Hardie 1998;

Lowenstein et al. 2001). However, the relationship between seawater chemistry and spreading/degassing rates has been complicated by the controversy over whether the production of new oceanic lithosphere has varied significantly over the past 180 Ma (Rowley 2002). This argument questions the relationships between seafloor spreading rate, volatile fluxes, and eustatic changes assumed in previous shallow earth system models. As a means of resolving whether these divergent views are necessarily incompatible, we have modified our MAGic model to accommodate isotopic constraints. By integrating critical Earth system processes over time, this detailed model offers insight into how tectono-physical, chemical, and biological driving forces have interacted to produce the stable hothouse/greenhouse modes that characterize Phanerozoic climate.

## $\delta^{13}\text{C}$ tracing of dissolved inorganic carbon sources in major world rivers

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The significance of rock weathering and river transport in the global carbon cycle has already been discussed by many authors. Rivers discharge into the oceans on average 1 GtC.y<sup>-1</sup> of which 40% as Dissolved Inorganic Carbon (DIC). DIC originates mainly from atmospheric CO<sub>2</sub>, soil organic matter oxidation and carbonate dissolution. Only geochemical modeling and geochemical tracers have been used until now to distinguish DIC sources. Nevertheless each DIC sources have different  $\delta^{13}\text{C}$  isotopic signatures (-26‰ to -9‰ for soil organic matter according to C3 or C4 plants, -8‰ to -6‰ for the atmospheric CO<sub>2</sub> and around 0‰ for carbonate rocks) but few studies have been devoted to the use of carbon isotopes to trace the different DIC sources and their behaviour in the river water. This study presents the results obtained for some large rivers in South America, in India, in Africa and in Europe.  $\delta^{13}\text{C}_{\text{DIC}}$  values are greatly variable from one river to another, going from very negative values as for the Amazon river (until -27‰) to less negative values as for the Patagonian rivers (until -2‰ for the Chico). All these results are also compared with literature values which are not yet very abundant. These variations show that the average isotopic signature of the DIC fluxes discharged into the world ocean (-10‰ to -12‰) which is used in the oceanic carbon cycle modeling needs to be revised, at least regionally. The major result of this study concerns the negative relationship between  $\delta^{13}\text{C}_{\text{DIC}}$  and the dissolved organic carbon (DOC) content, showing that the organic carbon oxidation greatly contributes to decrease the riverine  $\delta^{13}\text{C}_{\text{DIC}}$ .