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A Theory Accounting for The Stratigraphic Control on Sedimentary Organic Matter Distribution at The 1st And 2nd Order Scales

The variability of the abundance of sedimentary organic matter throughout the stratigraphic record is considered with regard to 1st and 2nd order depositional sequences and controlling factors are proposed. It is well documented that at the 1st order scale (30 M y), two time periods host up to 80% of the known source rocks, and that, at the 2nd order scale (3-30 My), six specific stratigraphic intervals are characterised world wide by relative enrichment in organic matter.

The apparent relationship between these periods and 1st and 2nd order high stands of sea level, suggests the role of two main driving mechanisms: a) increase in CO₂ pressure in the atmosphere due to increased tectonic and volcanic activity. b) tectonically induced eustatic sea level rise.

High PCO₂ stimulates primary production on land promoting more aggressive chemical weathering of rocks, ultimately enhancing the nutrient supply into the water bodies and consequently their bioproductivity. The flooding of large continental shelf areas resulted in generally shallow epicontinental seas, reducing the residence time of organic matter in the water column, enhancing its preservation.

At the first order scale there is a time shift between the maximum of bulk organic accumulation and the maximum of coal formation alone. Such a situation can be explained by the creation of conditions more favourable for coal accumulation and preservation at the end of the megacycles, including continuous and regular subsidence of continental basins due to global relaxation of tectonic stresses, and of marginal basins due to progressive cooling of passive margins.