Geophysical Research Abstracts
Vol. 14, EGU2012-3804-1, 2012
EGU General Assembly 2012

Warm Eocene climate enhanced petroleum generation from Cretaceous source rocks - a potential climate feedback mechanism?

KF Kroeger and RH Funnell

GNS Science, Resources, Lower Hutt, New Zealand (k.kroeger@gns.cri.nz)

Surface and deep sea temperatures from late Paleocene to early Eocene until the Early Eocene climatic Optimum increased by 5 - 10˚C. This change was associated with a negative δ^{13}C trend which implies major changes in global carbon cycling and enrichment of surface systems in isotopically light carbon. The degree of change in sedimentary δ^{13}C requires emission of >10,000 gigatonnes of isotopically light carbon into the ocean.

We reveal a relationship between global warming and increased petroleum generation in sedimentary basins operating on 100 kyr to Myr time scales that may explain the observed isotope shift. We use TEX_{86}-based surface temperature data[1] to predict how change in surface temperature influences the temperature evolution and resultant petroleum generation in four southwest Pacific sedimentary basins. Models predict an up to 50% increase in oil and gas expulsion rates in response to the increase in temperatures from late Paleocene to early Eocene in the region. Such an increase in petroleum generation would have significantly increased leakage of light hydrocarbons and oil degeneration products into surface systems.

We propose that our modelling results are representative of a large number of sedimentary basins world-wide and that early Eocene warming has led to a synchronization of periods of maximum petroleum generation and enhanced generation in otherwise unproductive basins through extension of the volume of source rock within the oil and gas window. Extrapolating our modelling results to hundreds of sedimentary basins worldwide suggests that globally increased leakage could have led to the release of an amount of CH_4, CO_2 and light petroleum components into surface systems compatible with the observed changes in δ^{13}C. We further suggest that this is a significant feedback effect, enhancing early Eocene climate warming.

[1]Bijl, P. K., S. Schouten, A. Sluijs, G.-J. Reichart, J. C. Zachos, and H. Brinkhuis (2009), Early Palaeogene temperature evolution of the southwest Pacific Ocean, *Nature*, 461, 776-779.