Geophysical Research Abstracts, Vol. 9, 05181, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05181


# Role of sea-level controlled sedimentary processes on space and time distribution of organic carbon-rich marine sediments.

**R. Capozzi**

Dipartimento di Scienze della Terra e Geologico-Ambientali, University of Bologna (I).
rossella.capozzi@unibo.it

The sequence stratigraphic approach to the study the organic carbon-rich sedimentary intervals (sapropels and black shales) underlines the correspondence of their deposition mainly intervening during the deposition of condensed sections, within 3rd-order cycles. On the other hand, shorter-term cycles are controlled by high-frequency tectonic and eustatic changes during which alternation of OC-rich to background sediments is tuned by precessional modulation. Literature on this argument is not abundant, however some papers evidenced that some Neogene sapropels, Cretaceous OAEs and older black shales occur during high stand system tract (Stefani 2002; Capozzi and Picotti 2003; Arthur and Sageman 2005; Beckmann et al. 2005).whereas other have been correlated to low stand system tracts (Cobianchi and Picotti 2001; Tucker and Zheng 2003)

In addition to these, Capozzi et al. (2006) discussed the different potential in OC preservation and/or dilution in relation to the role of different basin sedimentation rate. This presentation focuses on the fundamental role exerted by sedimentary processes in controlling. space and time distribution of organic carbon accumulation during Neogene.

During Neogene sapropel deposition in the Mediterranean, organic carbon cycles developed at the basin margins mainly starting from the maximum flooding surfaces and, after, during high stand system tracts. Their deposition has been correlated to thinner deep basin sapropels in the Eastern Mediterranean. As sapropel deposition is modulated by minima in the precession index, their occurrence within the precession cycles take part of a fifth-order frequency superimposed on fourth- or third-order cycles.

As sea level rises, successive parasequences are built generating "retrogradational stacking pattern," (transgressive systems tract). As sea level reaches its highstand, the shelf is under fairly deep water and is starved for sediment. A condensed section, thin marine stratigraphic interval characterized by very slow depositional rates, is deposited, encompassing thin OC-rich layers composed of mostly pelagic and hemipelagic clastics widely distributed throughout the basin. This is, in fact, the better condition which may record wetter climate and runoff, triggering, enhanced primary productivity and density stratification in the water column and consequently expanding Oxygen Minimum Zone (OMZ).,In this condition, the increase of POM settling velocity due to entrapment of pelites in marine snow occurs, partially prevents the OM recycling in the water column contributing to the sedimentation of sapropels. The subsequent “progradational stacking patterns," characteristic of highstand systems tracts, allow to carry on these processes until the prograding shelf-wedge will overwhelm the OC-rich fine-grained laminae. At this time OC-rich intervals could likely survive in deep basin and expanded OMZ could cyclically permit OC sedimentation.

In contrast, during lowstand system tracts the continental shelf, or in an epeiric sea, the shallower portions of the sea floor are exposed to subaerial erosion. Sediments transported down valleys are delivered mainly off the shelf edge into deep water, to form sea floor fans or low stand wedges. Slopes also undergo to dominant mass-wasting processes**.** In this low stand scenario (fourth- or third-order LST), the precession cycles likely persist and control wetter and warmer climate during precession minima, however, the lowstand prograding wedges overwhelms the OC deposition because of high frequency oxygen replenishment at the basin-floor, due to the deposition of mainly gravity- and density-driven sedimentary processes and these sediments also cause dilution of primary productivity derived OM. During low sea-level stands, cyclic wetter conditions can increase fine sediment supply which can reach slopes via lutite flow processes that, when coupled to water stratification and partially expanded OMZ, confine OM accumulation to the slope environment.

Summarizing, Neogene Mediterranean sapropels can be recorded from basin margin to deep basin-floor only when terrigenous sediment starvation is reached. Their occurrence may be progressively shifted basin-ward by the prograding shelf-wedge. On the contrary, during low sea-level, the slope is the only environment that could record enhanced OC accumulation during the higher frequency sea-level oscillations.

References

Arthur M., Sageman B., 2005. Sea-level control on source-rock development: perspectives from the Holocene Black Sea, the mid-Cretaceous Western Interior Basin of North America, and the Late Devonian Appalachian Basin. In: N. Harris and B.

Pradier, Editors, *The Deposition of Organic-Carbon-Rich Sediments: Models, Mechanisms, and Consequences*, SEPM Spec. Pub. **82**, 35–59.

Beckmann B., Wagner T., Hofmann P., 2005. Linking Coniacian-Santonian (OAE3) black-shale formation to African climate variability: a reference section from the eastern tropical Atlantic at orbital time scales (ODP Site 959, off Ivory Coast. In: N. Harris and B. Pradier, Editors, *The Deposition of Organic-Carbon-Rich Sediments: Models, Mechanisms, and Consequences*, SEPM Spec. Pub. **82**, 125-143.

Capozzi R**.,** Picotti V., 2003. Pliocene sequence stratigraphy, climatic trends and sapropel formation in the Northern Apennines (Italy). Palaeogeogr. Palaeoclimat. Palaeoecol., 190, 349-371.

Capozzi R., Dinelli E., Negri. A., Picotti V., 2006. Productivity-generated annual laminae in Mid-Pliocene sapropels deposited during precessionally forced periods of warmer Mediterranean climate. Palaeogeogr. Palaeoclimat. Palaeoecol., 235, 208-222.

Cobianchi M, Picotti P., 2001.Sedimentary and biological response to sea-level and palaeoceanographic changes of a Lower–Middle Jurassic Tethyan platform margin (Southern Alps, Italy) Palaeogeogr., Palaeoclimat., Palaeoecol., Volume 169, Issues 3-4, 15 May 2001, Pages 219-244.

Stefani C., 2002. Variation in terrigenous supplies in the Upper Pliocene to Recent deposits in the Venice area. Sediment. Geol.,153, 43-55.

Tucker H. F., ZhengH 2003. High-frequency Miocene sequence stratigraphy, offshore Louisiana: Cycle framework and influence on production distribution in a mature shelf province. AAPG bull. 87, 197-230.