Facies-Based Sedimentological Modelling for Use in Simulation of Organic Carbon Deposition and Burial*

M. Felix[1], M. Majewska-Bill[1], U. Mann[1], and J. Rinna[1]

Search and Discovery Article #120123 (2013)
Posted March 13, 2013

*Adapted from extended abstract prepared in conjunction with poster presentation at AAPG Hedberg Conference, Petroleum Systems: Modeling The Past, Planning The Future, Nice, France, 1-5 October 2012, AAPG©2012

[1]Basin Modelling, SINTEF, Trondheim, Norway (marten.felix@sintef.mo)

Abstract

The deposition and burial of organic carbon in marine deposits are strongly influenced by the concurrent deposition of inorganic material. Both the rate of sedimentation and type of sediment material influence the burial efficiency of the organic material, and thereby the resulting amount and mixture of different types of organic material in the deposit. When simulating the fate of organic matter in marine environments it is thus important properly to model the inorganic basin fill at the same time. One way of doing this is by using forward models of sediment transport, but this does not necessarily take into account all the available information from the basin under consideration. For example, information from wells and seismic (depth maps) can be used to determine directly the amount of sediment present. A method to include this information is currently under development for use in the Organic Facies Model OF-Mod 3D (Mann and Zweigel, 2008). Using palaeobathymetry reconstructions and present-day depth maps, marine siliciclastic sedimentary facies distributions are determined based on fuzzy logic, which takes as input various variables such as water depth and distance to shore. Each sedimentary facies is assigned a sand fraction and by using Sugeno rules of calculation (e.g. Demicco and Klir, 2004), a sand fraction map is determined from the sedimentary facies. Sedimentation rate is determined from decompaction of the present-day deposits. Results of the method are shown for the Benguela area off the west coast of Africa, where the sand fraction map can be compared to measured values (Figure 1).

References Cited

Demicco, R.V., and G.J. Klir, 2004, Fuzzy logic in geology: Elsevier, 347 p.

Mann, U., and J. Zweigel, 2008, Modelling source-rock distribution and quality variations: the organic facies modelling approach: International Association of Sedimentologists, Special Publications, v. 40, p. 239-274.

Rogers, J., and J.M. Bremner, 1990, The Benguela Ecosystem; Part VII, Marine-geological aspects: Oceanography and Marine Biology, v. 29, p. 1-85.

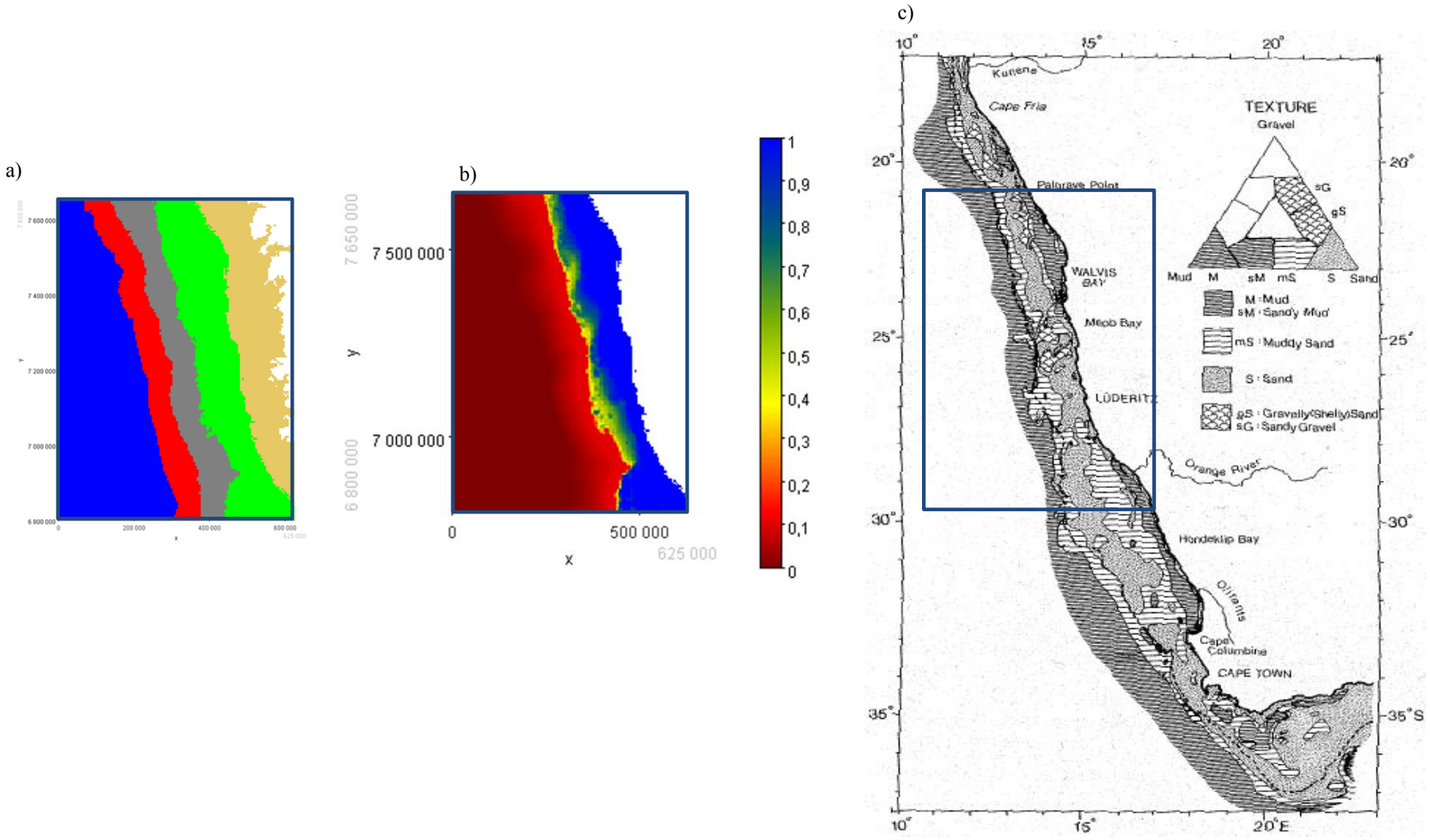

Figure 1. a) Sedimentary facies determined from water depth and distance to shore (brown = land, green = continental shelf, grey = continental slope, red = continental rise, blue = deep sea). b) Sand fraction determined from sedimentary facies. c) Measured sand fraction (map from Rogers and Bremner, 1991). The trends of sand fraction (width of zones and grain size decrease trends) are reproduced, but not all details of the measured sand fraction distribution are captured. To do so requires adding local point sources, which has not been done for the results shown here.