

Staringlezing 2009 door Bruce Levell

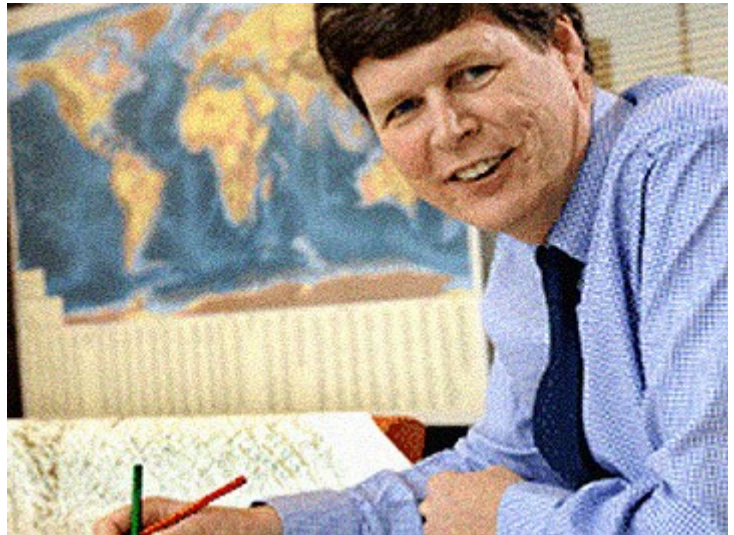
De Staringlezing werd dat jaar gehouden door dr. Bruce Levell, met als onderwerp:

The sameness of rocks and the uniqueness of the geological record: what does that mean for hydrocarbon exploration and production?

Dinsdag 13 oktober 2009, KIVI, Prinsessegracht 23, 2514 AP Den Haag.

Over Bruce Levell

Bruce Levell was appointed Shell Chief Scientisty Geology in 2008. Bruce holds a Ph.D. in Geology from Oxford University, and is actively involved in professional societies. He regularly speaks at industry conferences and serves on the editorial board of Petroleum Geoscience.



Abstract

Since the publication of Lyell's Principles of Geology, there has been a clear realisation that although uniformitarianism based on consistency of physical laws is a valid and useful approach to earth science, there are also 'directional' trends, cycles of change or 'events' in the earth's history which make the geological record far from simply a monotonous repetition of the consequences of those actual causes we can infer from direct observation.

The hydrocarbon industry has in general been at the Lyellian, uniformitarianist, end of the spectrum when it comes to sub-surface interpretation. The success of facies sedimentology as a basis for clastic reservoir modeling is a good example. Irrespective of geological age, reservoir modelers feel confident that they can make sensible subsurface models of the complete range of depositional environments.

Carbonate geologists are more circumspect, being well aware that dealing with the consequences of organic evolution and changing sea water chemistry that they need to modify conclusions based on actualistic examples to apply them to the rock record. In general however temporal effects are treated at best as second order.

Recently there has been a major increase in studies of earth systems. For example of climatic and oceanic circulation changes in response to plate tectonics and mountain building, eustatic sea level change as a result of multiple causes, physical and chemical effects of the biosphere through organic evolution, extra-terrestrial events, and the consequent feedback loops between all of the above as reflected in changes atmospheric and oceanic chemistry. These studies reveal a picture whereby the convolution of the time-series of 'signals' (for example record of sea level, atmospheric CO₂, atmospheric pressure, average global temperature, pole-to equator temperature gradients) results in a picture whereby each geological interval, at the resolution of a stage or lower, can usefully be considered distinct. Does all this 'distinctiveness' really have little impact on

our understanding of hydrocarbon accumulations? Or does it deserve more attention from industry professionals?

As a test of this thought, five geological intervals were arbitrarily chosen namely: 5 Ma (near base Pliocene, Pliocene), 50 Ma (Ypresian, Middle Eocene), 100 Ma (Albian, Upper Cretaceous), 200 Ma (Rhaetian / Hettangian and Triassic / Jurassic boundary), and 400 Ma (Emsian, Middle Devonian). All age/stage correlations based based on Gradstein, 2008.

For each age an attempt has been made to stay within 1 Ma of the arbitrary geological age or within the error of the stage definitions, and avoid the temptation to extend the interval up or down to include interesting geological curiosities ! A survey was then undertaken of oil and gas fields whose reservoirs, cap-rocks or source rocks fall within that time interval and ask in the context of a review of the state of the earth at that time what could be both a distinctive attribute of the age context and of relevance to the hydrocarbon industry.