STRUCTURAL SETTING OF TURBIDITE SYSTEMS: A GLOBAL COMPARISON

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Over the last 40 years exploration and production in deepwater (in waterdepth in excess of 500 m) has increased greatly to the point that a considerable amount of today´s industry budget is spent on these activities. Whereas initially little was known about the geological setting of deepwater systems (and few people believed in the presence of sandstone reservoirs beyond the continental shelf edge), we now know that downdip of several Neogene delta´s, major turbidite systems occur with appreciable reserves of oil and gas. Oil accumulations in turbidite sandstones are not new, in fact production from these reservoirs has been going on in the Mio-Pliocene Los Angeles and San Joaquin pull-apart basins in California before Kuenen coined the term in 1957. Similarly, sizeable accumulations have been found in Upper Jurassic, Lower Cretaceous and Lower Tertiary turbidite sequences in the North Sea in a rift-sag setting. In the mid-eighties exploration moved into deeper water and driven by successes in the US part of the Gulf of Mexico, further efforts focused on the Lower Congo Basin, Campos Basin, offshore Nigeria and deepwater NW Borneo. Currently, the Mexican part of the Gulf of Mexico has become a focus of attention and recent successes in Mocambique have stimulated in turbidite systems all along the Eastern margin of Africa. A common characteristic of these five basins is that the turbidite depocentres overlie a mobile substrate of salt or overpressured shale which provide a high density of traps with a similar and predictable structural/stratigraphic evolution, stacked reservoir/seal pairs, and an easy access to mature source rocks. A regional comparison of these basins suggests that in a general sense four structural play types can be defined: Downdip from the major deltaic expanders, an area of **Inner Folds** with large trap closures postdating the emplacement of channelized turbidite reservoirs. An area of **Mini-Basins** where structuration and sedimentation are more or less coeval leading to the emplacement of stacked confined turbidite sheetsands. In areas of salt withdrawal, inversion of minibasins with turbidite sheet sands leads to the formation of **Turtles.** An oceanward area of very large **Outer Folds** which are structurally coupled to deltaic extension updip and where amalgamated unconfined turbidite channels and sheets occur predating trap formation. Exploration efforts in turbidite basins without a mobile substrate have so far been more limited and concentrated on the Atlantic margins of the United Kingdom and Norway, as well as the transform margin of West Africa, and the Bay of Bengal. Typically the density of structural closures is low but individual structures can be very large in areal extent, quite often with a stratigraphic component. Recently, discoveries in the Guyana basin and in the Caribbean Sea north of Colombia have triggered quite some interest as well as the discoveries made in the Eastern Mediterranean. The objectives of the presentation will be to illustrate with seismic and well data the analogies and differences between the different deepwater basins, as well as to draw some high level conclusions on risks and uncertainties in turbidite exploration at a play level.

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I did my Ph.D on an Upper Cretaceous turbidite basin in the South-Central Pyrenees at Leiden University, the Netherlands, in 1970. After that I joined Shell and had various functions as an exploration geologist in Oman, Japan, Malaysia, Spain, United Kingdom, Netherlands and USA. My last 8 years with Shell I worked on all deepwater basins Shell was involved in at that time.

After retiring in 2002 I have been consulting for various companies in Colombia, Peru, Surinam, USA, Liberia, Ghana, SE Asia, Tasmania and Sakhalin, mostly providing technical assist or reviewing the value of their exploration portfolio.

In addition I have provided AAPG Visiting Geoscientist lectures at numerous Universities in Europe, and enjoying teaching children in my neighbourhood about the geology of the area they live in. Most of the year I am residing in a small village in the foothills of the Spanish Pyrenees, but spend my summers in the Rocky Mountains of Idaho, USA.