Large scale introduction of compaction water expelled from overpressurized shales in gas field reservoirs of the Mahakam delta (Indonesia)

F. WALGENWITZ [1] AND N. JACQUEMET [2]

[1] Total, Pau, France; frederic.walgenwitz@total.com
[2] Present address: Total, Pau, France

The range of water salinity in giant gas fields from the Mahakam delta (Indonesia) is similar to the range of connate water composition (fresh water in the fluvial channels to seawaterl in the marine mouth bars). However, a combination of chemical and isotopic analyses shows that water composition has actually considerably evolved since the time of deposition. Salinity vs. δ18O and δD plots (Fig.1A) indicate that present-day water composition results from the mixing of original connate waters with a variable amount of a third end-member characterized by a low salinity (<2g/l), and δ18O and δD values of ~+6‰ and ~-10‰ respectively (Fig.1A). The proportion of this water end-member has been determined in every sample by geometric calculation. Plotted against depth, the proportion of this third end-member shows a relatively progressive downward increase as we approach the underlying overpressurized prodelta shales (Fig.1B). This feature suggests that the 3rd end-member is formed of compaction water expelled from the over pressurized shales, migrating upward into the connected sand bodies. Similar observations have been made in the Niger delta and suggest that large scale expulsion of compaction water can be a common process in this type of geologic setting.

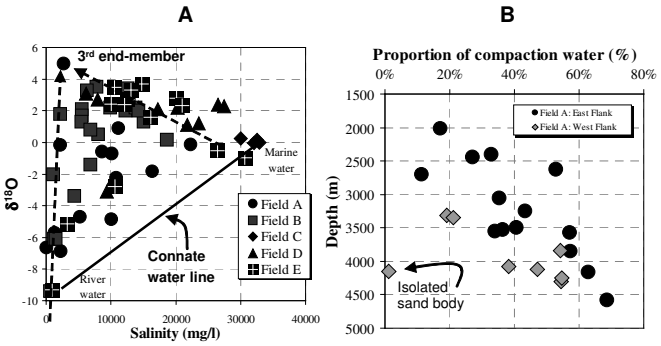

Figure 1: A- Salinity vs. δ18O plot showing the shift from the connate water line, interpreted as the result of mixing with a 3rd end-member formed of compaction water. B- Variation of the estimated proportion of compaction water with depth.