

Hydrocarbon Entrapment in Triassic to Late Jurassic Reservoirs in the Timor Sea, Australia: New Insights

Ellis, Grant K., Eni Australia Limited, West Perth, Australia

Abundant oil-filled fluid inclusions at quartz overgrowth/detrital quartz boundaries and in fractures cutting quartz grains are often used as the primary evidence of palaeo-oil columns in Triassic to Late Jurassic reservoirs in numerous wells in the Timor Sea. Based on fluid inclusion analysis of sandstone reservoirs in present oil columns, a Grains containing Oil Inclusions (GOI) value of 5% has been used as a threshold with values >5% indicating palaeo-oil columns. However, values <5% have been measured in present oil columns, indicating that low GOI values do not necessarily preclude past or present oil entrapment as the trapping of oil in inclusions is dependent upon reservoir conditions conducive to formation of fluid inclusions at the time of oil entrapment.

Other indications of palaeo-oil columns are evident below and/or within GOI-define palaeo-oil columns; good to excellent direct and cut fluorescence on cuttings and/or core, elevated resistivity and/or reservoir diagenesis. In the case of oil shows these hydrocarbon indications have been discounted as indicating focussed oil migration below a palaeo-oil/water contact rather than indicating a palaeo-oil column.

While GOI provides valuable data to support the interpretations of palaeo-oil columns, it provides a picture at one instance in the hydrocarbon entrapment history and therefore should not be used in isolation. Other hydrocarbon indications are equally valid proof of oil entrapment at one or more different times in the hydrocarbon entrapment history, and should be used with GOI data to provide a comprehensive picture of the evolution of a hydrocarbon trap. Case histories from wells Eclipse-2, East Swan-2, Oliver-1 and Crux-1 in the Timor Sea illustrate how an integrated picture of hydrocarbon entrapment history can be developed and demonstrate that structures in the Timor Sea have undergone more than one phase of oil entrapment and leakage with each phase potentially from a different source.