Predicting Calcite Cement Distribution in the Sunrise Gas Field Using Analogues

Alsop, David B., and R. Bruce Ainsworth, Woodside Energy Ltd, Perth, WA, Australia

Vertical reservoir connectivity within the Sunrise field is influenced by calcite cement, which occurs at discreet intervals in many of the sandstones within the Bathonian Plover Formation. The objective of this study was to characterise the lateral extent of the carbonate cements and their impact on fluid flow within the reservoir. Core from three wells along with wireline logs, isotope and petrographic data were used to characterise the origin and vertical distribution of the carbonate cement within a sequence stratigraphic framework. Outcrop analogues were then used to predict the lateral continuity of the cements. The reservoir units were deposited in lowstand incised valley fill and shoreface environments. Shell beds overlie transgressive surfaces near the top of two units with some biogenic carbonate also occurring within the reservoir units.

Gas inclusions between quartz overgrowths and calcite cement indicate that calcite precipitated after gas charge entered the reservoir. The calcite cement formed as concretions on a nucleus of biogenic carbonate such as shell debris. This biogenic carbonate has been the primary source of material for the calcite cement along with CO_2 from the maturation of organic material. Calcite cement concretions which have formed at the tops of shoreface sandstone units with abundant shell debris are most likely coalesced to form laterally continuous beds.

Incised valley fill sandstones show only minor biogenic carbonate suggesting a limited extent of calcite cement and non-coalescence of calcite concretions. The dominant factor influencing distribution of calcite cement within the Sunrise Field is the lateral distribution and amount of biogenic carbonate as observed in analogues. The distribution of transgressive shell beds is an important factor in controlling vertical connectivity within the Field.