Porosity Preservation by Inhibition of Quartz Cementation: Microquartz Versus Hydrocarbons

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Our group has been investigating the influence of hydrocarbons and microquartz on quartz cementation. Both of these factors have been called upon to explain the occurrence of high porosity zones in the Miller Field in the UK North Sea (Marchand, et al., 2000, 2001, 2002 invoke hydrocarbons whereas Aase & Walderhaug, 2005 invoke microquartz). In an independent examination of samples from 4 Miller Field cores, we found that microquartz coated sandstones have significantly lower quartz overgrowth cement than nearby samples lacking such coatings.

To test whether microquartz coatings can inhibit quartz overgrowth development, we used a hydrothermal reactor to induce quartz cementation in Miller Field samples. The samples had both microcrystalline quartz coatings and naked quartz surfaces at grain contact scars. While large quartz overgrowths formed on naked contact scars, surfaces covered by microcrystalline quartz showed only minor growth suggesting that microquartz inhibits “normal” quartz growth because it grows at much slower rates.

To test the potential inhibition of quartz cementation by hydrocarbons, we also conducted quartz growth experiments in the presence of hydrocarbons at varying water saturations. Experiments were conducted at 350°C and 250°C. The 350°C experiments showed a strong dependence between quartz growth rate and water saturation. However, in the 250°C experiments the quartz cementation rate did not decline with decreasing water saturation. We hypothesize that the different results of the 350° and 250° experiments reflect a change in the rate limiting step for quartz cementation between these two temperatures and that the experiments conducted at 250°C are more likely to reflect natural conditions.