
Silica Occurrences in the Upper Jurassic Arab Carbonate Reservoirs, Saudi Arabia

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Silicification of carbonates involves the precipitation of silica in the form of pore-filling silica cement as well as the replacement of carbonate by chert. Presence of quartz in the Jurassic carbonate sequence of Saudi Arabia was first recognized by Powers (1962). He pointed out a thin chert zone just below the base of the middle Arab-D, which corresponds to the top of Zone-2B, as a marker traced over the Ghawar field in most of the wells. These minor occurrences have not been of interest of investigators to date.

Silica occurrences in the Arab-D intervals have been identified by conducting XRD analyses on continuous veneer samples and visual inspection of cores from five wells. Most occurrences are encountered in dolomitic layers of Zone -2B of the Arab-D reservoir. Silica in the Arab-D occurs as chert nodules, thin chert beds, mottled microcrystals and drusy silica cement. Dominantly microquartz, some megaquartz and chalcedony are the petrographic chert varieties observed in the studied samples. Silt size detrital quartz grains are also observed in a single interval. Cherts were originated from infiltrated silica containing brines, which also caused dolomitization in the carbonates. Saline water expelled from the dewatering of the overlying evaporites became enriched in silica by dissolving sponge spicules and later precipitated chert in the Arab-D carbonates.

Silicification increases microporosity, but matrix permeability remains very low. Microfractures developed due to brittleness of chert contribute in fluid transport. Porosity and pore throat sizes in most silica occurrences are greater than those of the associated micritized carbonate layers and contain more hydrocarbons. The recognition of chert is also significant for the calibration of wireline log responses to lithology for more precise evaluation of the formation.
