Worden and others, 2000 Data Set 70

Reference: Worden, R.H., M. Mayall, and I.J. Evans, 2000, The effect of ductile-lithic sand grains and quartz cement on porosity and permeability in Oligocene and Lower Miocene clastics, South China Sea: Prediction of Reservoir Quality, American Association of Petroleum Geologists Bulletin, v. 84, n. 3, p. 345-359.

Authors' affiliation: Queen's University Belfast and BP Amoco

Age: Oligocene and early Miocene

Formation: unnamed

Location: Nam Con Son Basin, South China Sea

Well: Four cored wells

Depth range: 2300 to 4000 m depth

Lithology: "Quartz and lithic grains dominate the detrital mineralogy of the sandstones. The feldspar population tends to be negligible (less than 5%). The quartz grain population is dominated by monocrystalline quartz, but with a significant quantity of polycrystalline grains, presumably of metamorphic origin. The lithic grain population is dominated by clay-rich ductile rock fragments." QFR diagram shows that samples are sublithic and lithic sandstones.

Grain Size and Sorting: "The sandstones are generally fine to medium grained….The grain size of the sandstones ranges from about 100 to 500 micrometers with a mean of about 250 micrometers. The sandstones show a variety of degrees of sorting from moderately well sorted through to poorly sorted with no relationship to primary sand composition. ... The coarser grained (and structureless) sandstones tend to have low ductile contents, although the finer grained (cross-bedded) sandstones can have both high and low ductile contents."

Ductile Grains: "Ductile grains account for between approximately 5 and 50% of the original sand grain population. … There is a moderate inverse correlation between grain size and ductile grain content."

Alteration: "The lithic grains were deformed between the less plastic quartzose grains. In such cases, they became smeared over the surfaces of the rigid grains and were squeezed into pore throats. In addition, these lithic grains also underwent varying degrees of recrystallization, which in some cases led to locally developed redistributional, secondary, intragranular microporosity." "Quartz cement has grown as pore-throat-blocking clots rather than the more common equal-thickness overgrowths."

Depth Dependence: "There is a pronounced loss of porosity with increasing burial depth in the basin. At depths of less than 3000 m this is due solely to ductile grain compaction where the rate of porosity loss with depth increases with increasing ductile grain content. At depths grater than 3000 m, the steep porosity loss with depth is due to combined ductile grain compaction and quartz cementation. The amount of quartz cement increases with increasing burial depth; however, cleaner sandstones tend to have greater amounts of quartz cement at any given depth below 3000 m. This leads to convergence of porosity evolution for the clean and ductile-rich sandstones below 3000 m. There is a rapid loss of permeability with decreasing porosity because compaction of ductile grains smears them between rigid quartzose grains leading to blocked pore throats. A consequence of this process is that the lowest permeabilities are found in sandstones with the highest ductile grain contents. Quartz cement does not have a clear and discernible control on permeability."

Production: not stated.

Core measurement conditions: not stated.

Data entry: hand entry from Figure 9 of the reference.