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Enhanced Recovery Methods in Unconventional Plays: 'Soaking' – Friend or Foe?

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Steep decline curves and poor recovery rates plagued the initial onset of the unconventional shale plays. However, as our knowledge base grows and we begin to understand the inner workings of these reservoirs, these plays have become the new 'normal'. Core Laboratories has been there since the beginning, working with operators and developing new technologies in order to characterize rocks that where previously thought of as non-reservoir.

Just like in the conventional world, where strategies were developed to enhance the recovery, i.e. water/fire flooding, thermal/steam injection, etc., the unconventional plays are following suit. A number of operators in various shale plays across North America have observed improved well performance after an extended shut-in period following initial flow-back of the well. Traditionally thought of as detrimental to flow rates, due to imbibition and water block issues, these shut-in periods where usually by pure accident or poor logistical planning, but fortunately came with a surprising and significant upside. This extended shut-in period is now common practice in numerous unconventional plays and has been coined 'soaking'.

A number of key observations have been noted in wells that have been shut-in and 'soaked':

1. Poor load recovery (~20%)
2. High salinity on flowback (increases with time)
3. No halite observed in fresh core (XRD or SEM)
4. Sub-irreducible water saturation (Sw << Swir)
5. Salt crystallization on fresh core with moisture exposure

To assess the validity of 'soaking' we have to look at concepts like sub-irreducible water saturations (Figure 1), amount of clays, types of clays and degree of clay desiccation (Figure 2). This presentation is centered around looking at these controls, the mechanisms and potential benefit around 'soaking' wells and the ultimate upside of increased production and higher recovery rates.

In a time where production is being curtailed in Canada - it may not necessarily be a bad thing to shut wells in for a period of time, especially when the benefits may outweigh the costs.

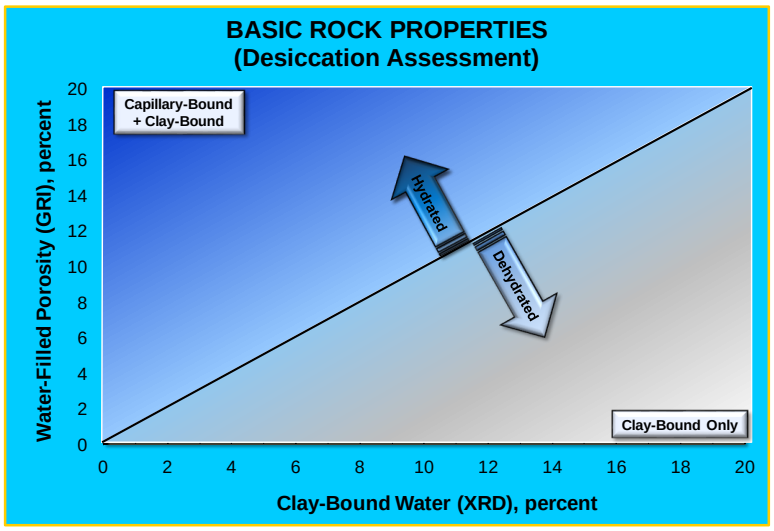

Figure 1: Determination and application of sub-irreducible water saturations

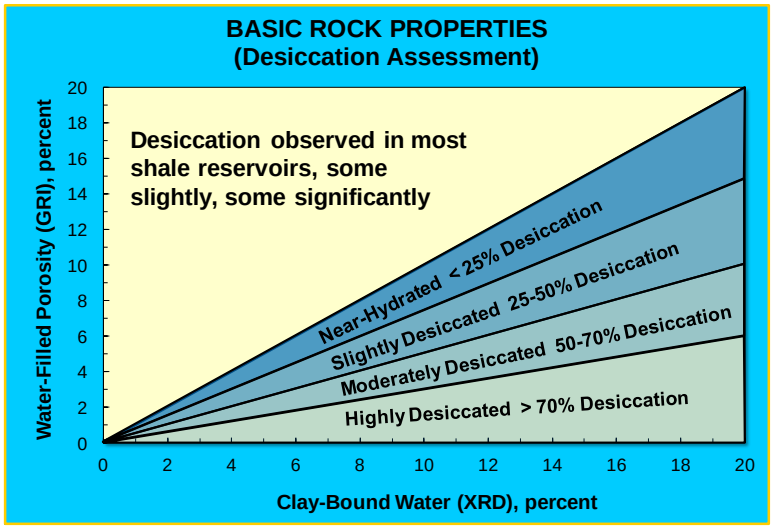

Figure 2: Degrees of clay desiccation