Differences in the Texture of Chalk as observed by NMR

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In this study, three cases under investigation illustrate how changes in the surface-to-volume ratio of chalk affect the low-field Nuclear Magnetic Resonance signal:

1. Outcrop chalk saturated with high salinity brine showed that saturation with divalent ions can cause major shifts in the $T_2$ curve.

2. Fluid samples where precipitation reactions caused shifts in the $T_2$ curve due to the creation of crystals within the fluid.

3. Two types of chalk with different surface-to-volume ratio, saturated with the same brines produced different NMR signals.

NMR signal decay time (known as relaxation) is affected by the solid phase:

- Differences in the rock texture
- Precipitants within the pore space
- Variations in the bound water thickness

may affect the transverse relaxation time by altering the surface relaxivity or the surface-to-volume ratio in the following equation:

$$\frac{1}{T_2} = \rho \frac{S}{V}$$

as observed from the following results:

## Low field NMR was successfully used to identify changes in the surface-to-volume ratio.

Samples with high surface-to-volume ratio result in smaller relaxation times. Samples saturated with Mg-rich brines, brines containing precipitants, and chalk with different texture illustrate this.