Control of clay swelling and fines production using $Mg(OH)_2$ precipitation

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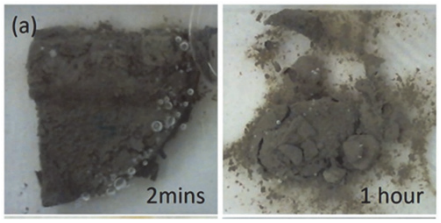
Introduction

The production of solids is a key technical issue affecting productivity of coal seam gas (CSG) wells in Queensland. A primary source of the solids is understood to be smectite-rich clays in interburden layers. These clays swell on contact with drilling fluids and the water produced from coal during the CSG extraction process. This leads to the breakage of particles as shown in Figure 1.

Three potential novel clay swelling inhibitors were studied in this project: (1) SiO_2 and MgO nanoparticles; (2) precipitation of $Mg(OH)_2$ from $MgCl_2$ and NaOH; and (3) a selective well bore polymer coating. This poster reports our findings of the $Mg(OH)_2$ method.

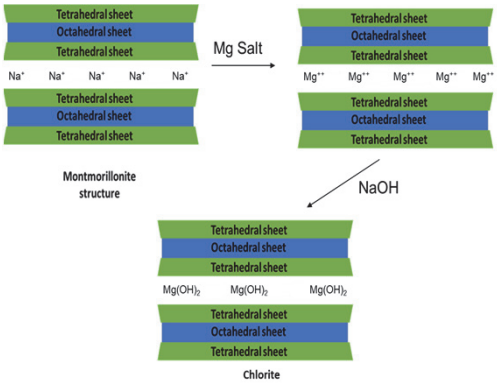
Breakage of mudstone in fresh water.



Hypothesis

The structure of swelling montmorillonite clays can be transformed to a non-swelling chlorite structure by intercalation and precipitation of $Mg(OH)_2$. This transformation has potential to control clay swelling and breakage.

$MgCl_2 \cdot 6H_2O + 2\ NaOH \rightarrow Mg(OH)_2 + 2\ NaCl + 6H_2O$

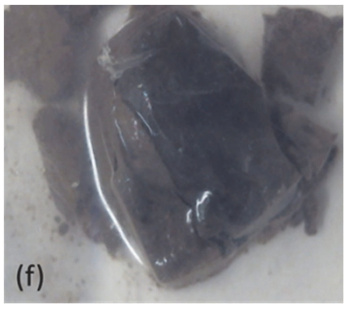


Methodology

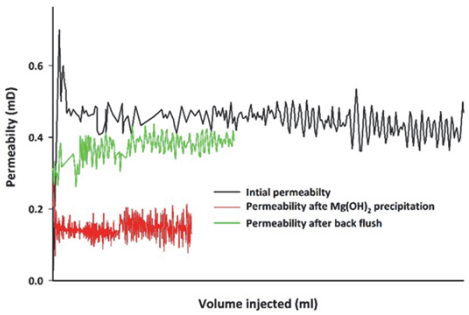
1. Soak (i) bentonite clay powder or (ii) mudrock in $MgCl_2$ solution.
2. Dropwise addition of NaOH.
3. Observe (i) swelling index of clay powder in vial swell text, or (ii) mudrock stability in flow cell with circulating formation water.
4. Repeat tests at different NaOH:$MgCl_2$ ratios.

Mudrock tests

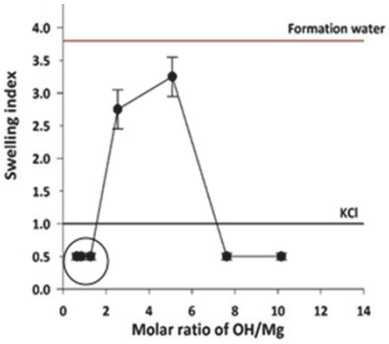
4% KCl brine after 5 hours



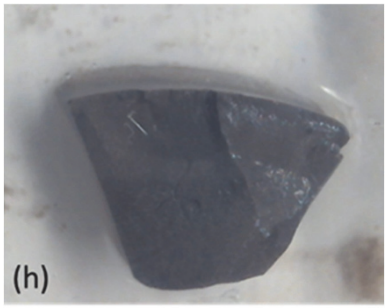
Permeability of coal core (Dawson mine) before and after $Mg(OH)_2$ treatment



Visual swell index test of bentonite clay



$Mg(OH)_2$ treated mudrock after 72 hours



Conclusions

- $Mg(OH)_2$ precipitation shows promise as a well bore treatment to stabilise clays.
- Future work is required to evaluate effectiveness across a variety of rock samples and to optimise the treatment.

Acknowledgements

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References

1. Xeidakis, GS. 1996. Stabilization of swelling clays by $Mg(OH)_2$. Factors affecting hydroxy-Mg-interlayering in swelling clays (in *Engineering Geology* 44 (1-4): 93-106.