HERIOT WATT UNIVERSITY

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Field Case Study #1

Scale Prediction Workflow and Effect of Souring

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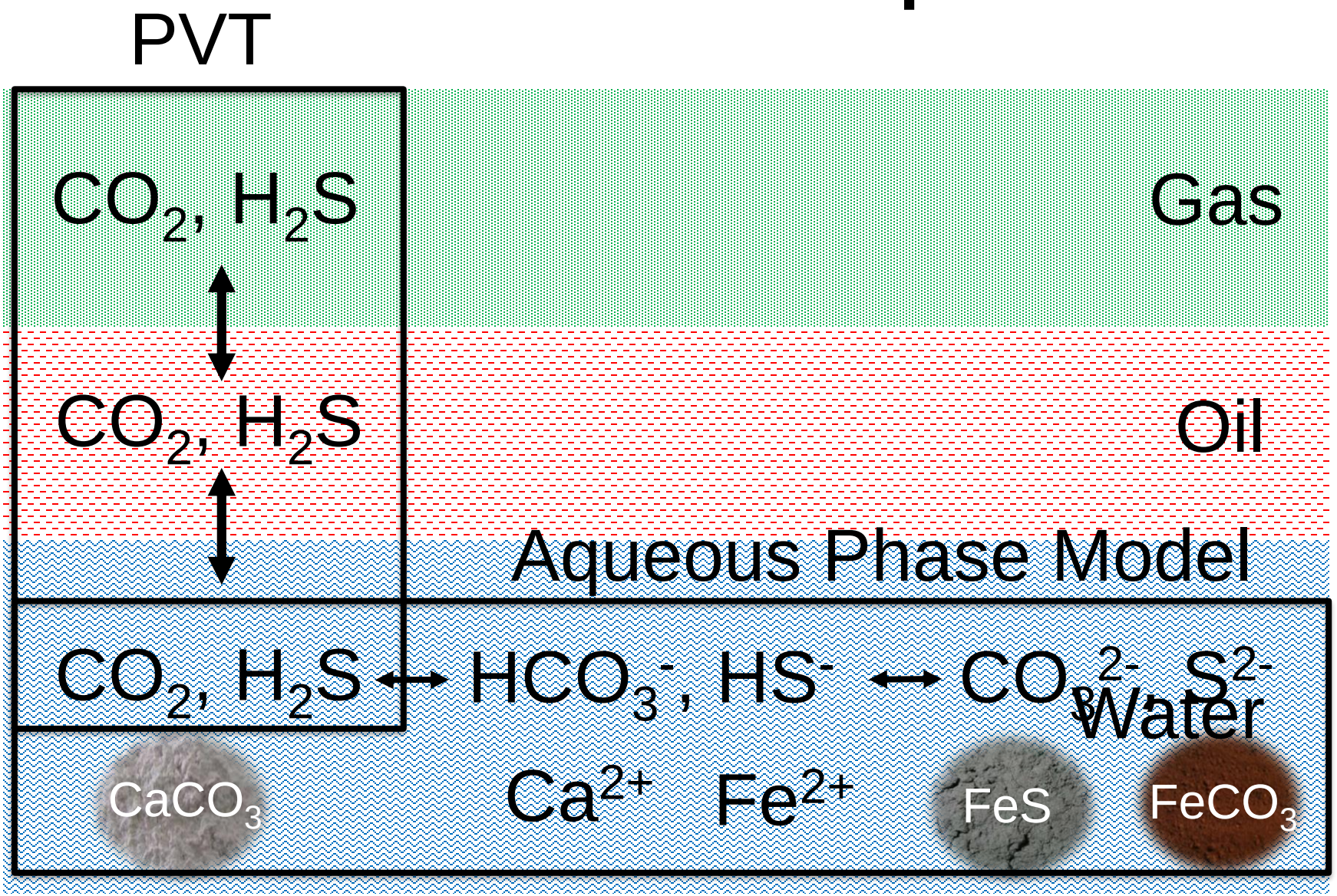
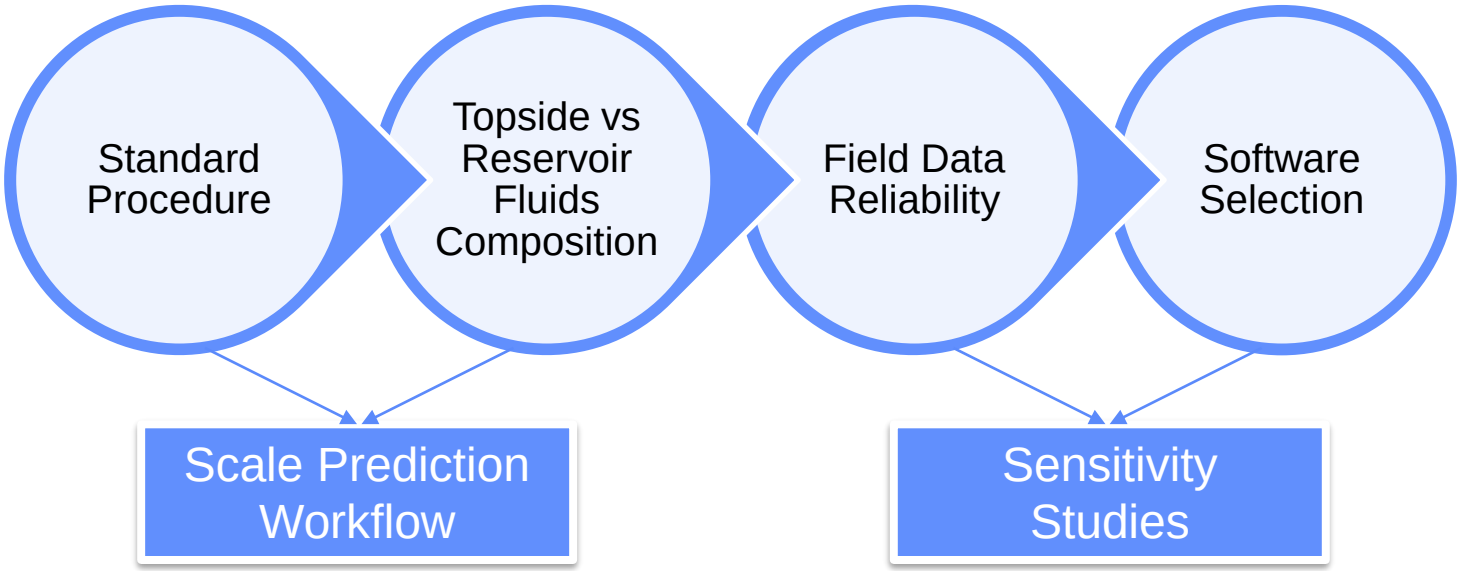
Flow Assurance & Scale Team: Scale Workshop
Treetops Hotel, Aberdeen, 29 January 2019

Carbonates and Sulphides



Prediction of pH Dependent Scales Key Challenges

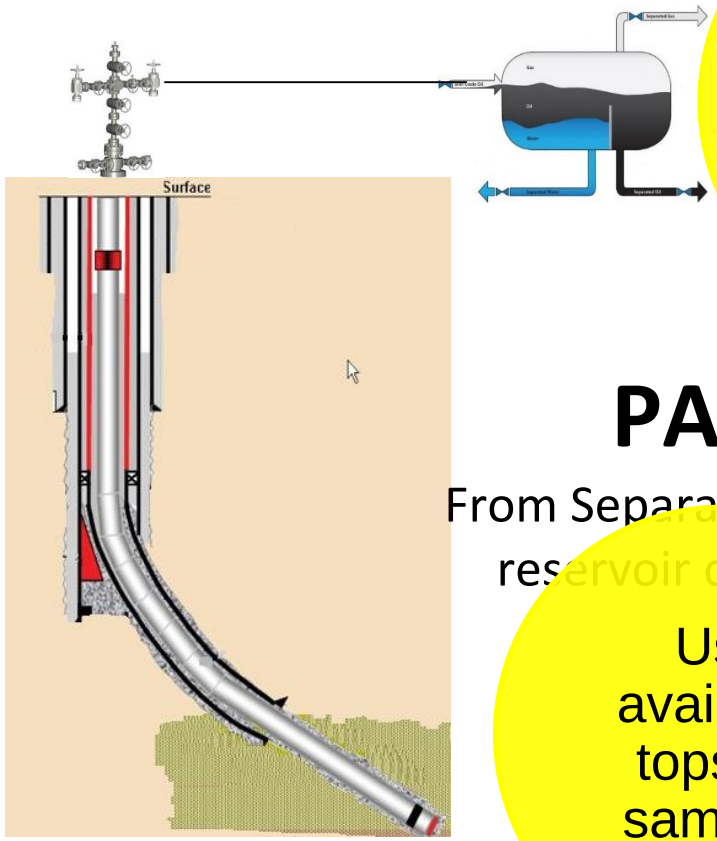
- Identify unique challenges in carbonate and sulphide scale predictions.
- Apply findings to real field scenarios.



Heriot-Watt Scale Prediction Workflow

Define rigorous scale prediction procedure

Use ANY PVT and scale prediction model



PART 2

Scale prediction profile from reservoir to separator.

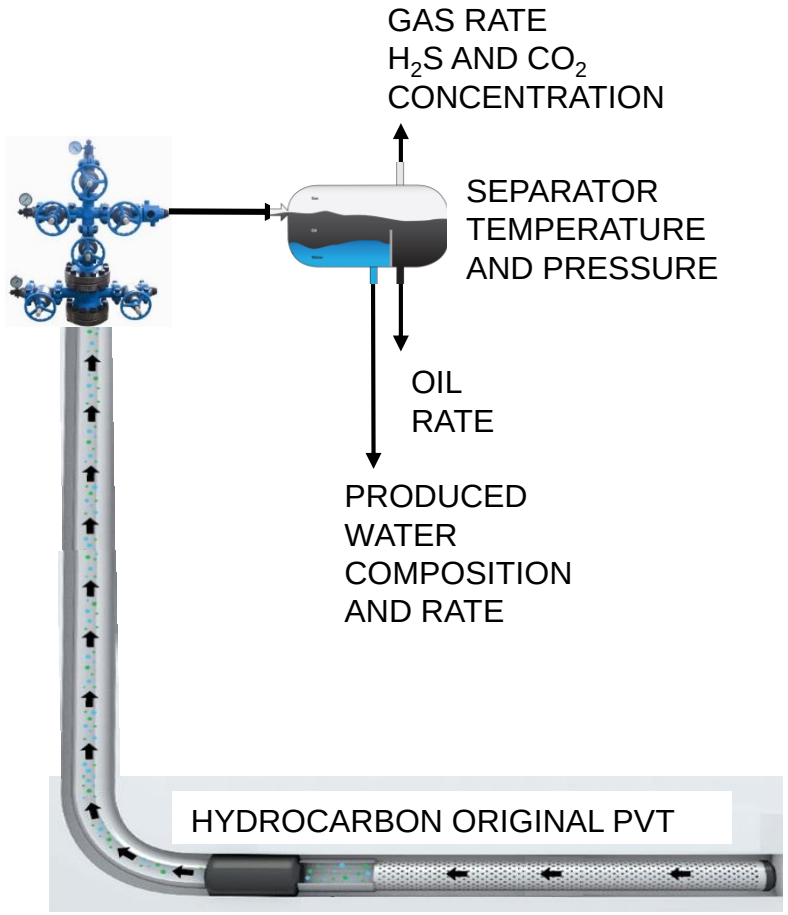
PART 1

From Separator field data to reservoir compositions.

Carbonate and sulphide scale prediction profiles

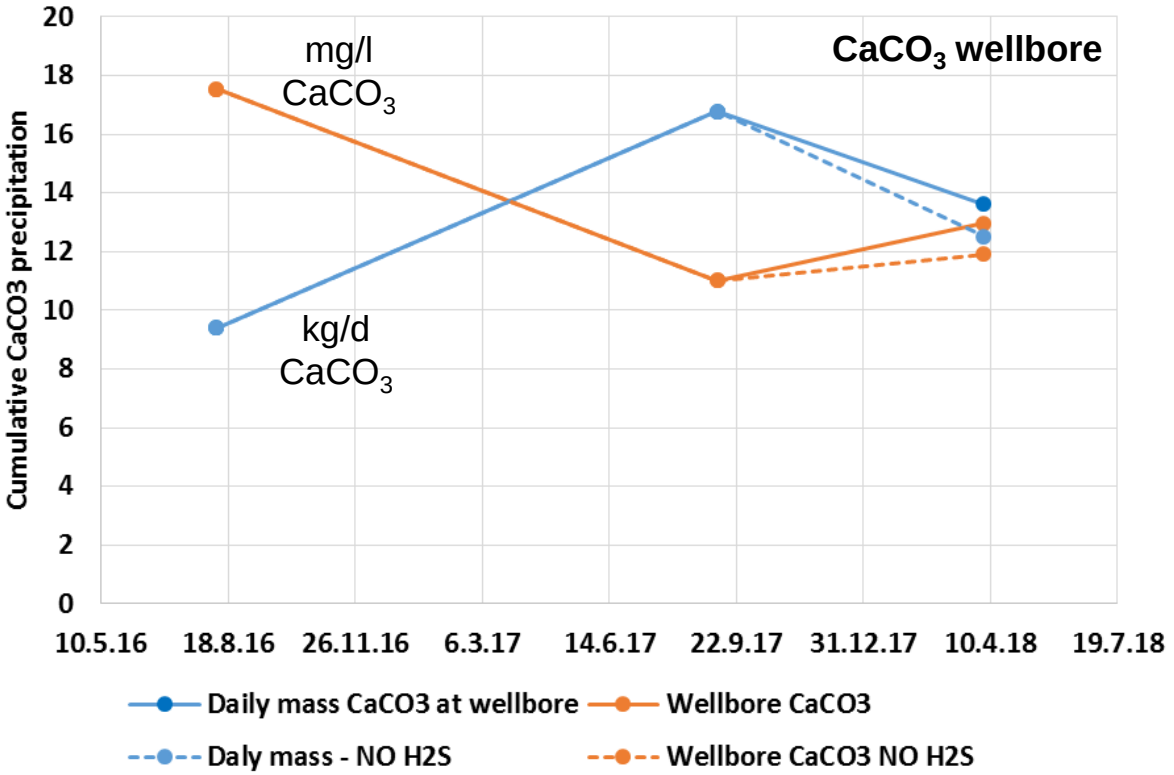
Use available topside samples

North Sea Oil Well Carbonate Problem



- North Sea Oil Well
- High water cut
- Low H_2S Concentration
- Slow PI decline
- Different potential causes investigated
- Suspected $CaCO_3$ (effective formic acid job) but not predicted in the past. Is it forming? How has the problem changed over time?
- What is the impact of H_2S?

Results – $CaCO_3$ Wellbore



- The concentration of precipitated scale drops and then increases again when the well becomes sour.
- H_2S has an impact on the carbonate scale risk but it is minor in this low H_2S well.
- The potential daily mass of $CaCO_3$ precipitation increases over time as water cut and total water production increase.
- $CaCO_3$ is likely to contribute to sand consolidation and PI reduction.
- Full study presented at Oilfield Chemistry 2019 in April.

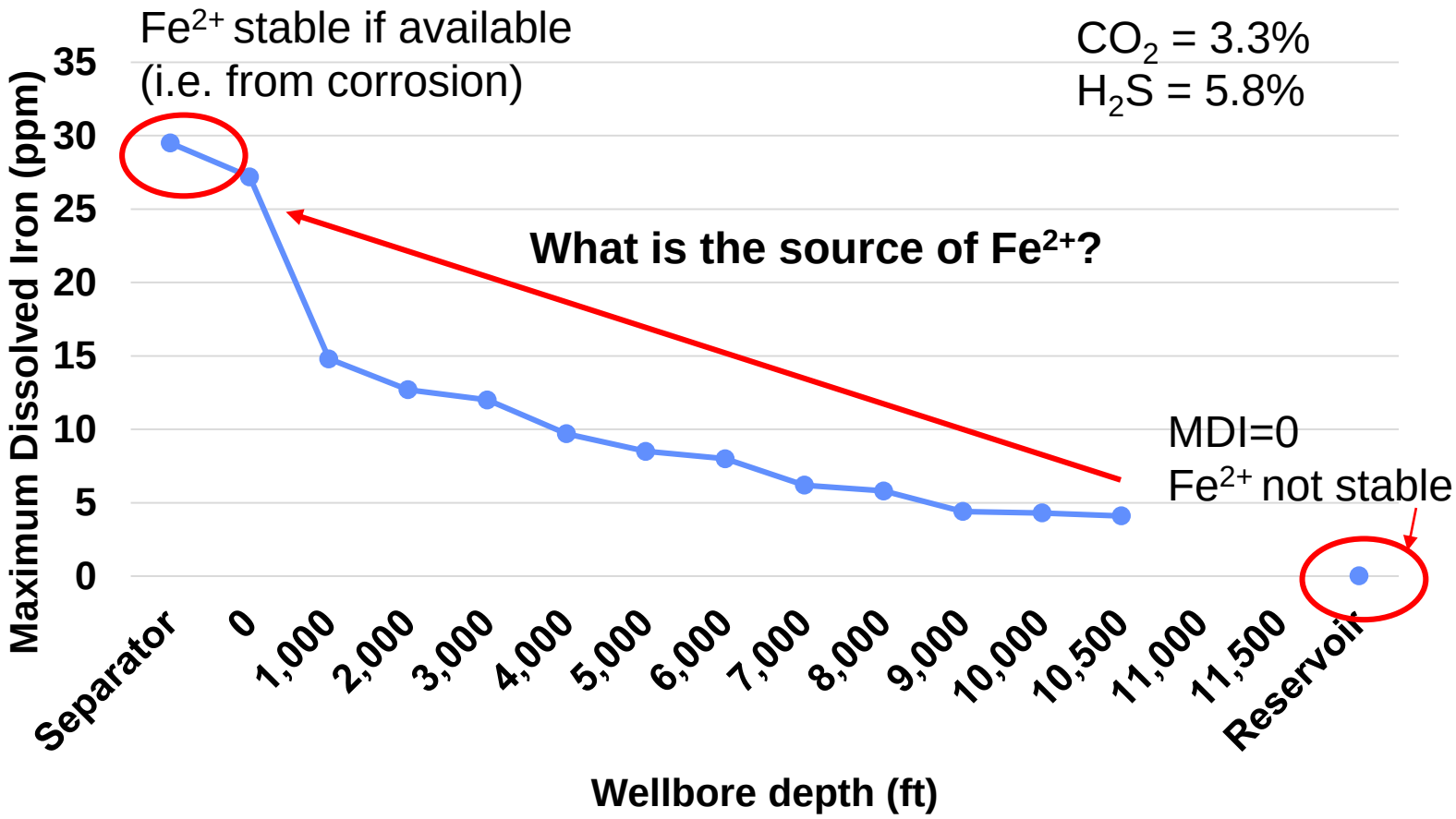
Maximum Dissolved Iron (MDI)

- Challenges associated with Fe^{2+} measurements cause problems with FeS scale prediction.
- The full water chemistry is calculated using the workflow, then Fe^{2+} is added to the system.

The concentration of Fe^{2+} stable in solution before any precipitation occurs is defined as the Maximum Dissolved Iron (MDI).

- If MDI=0 , iron minerals can be present in reservoirs but will be stable in solid form only.
- MDI is *not the actual* concentration of Fe^{2+} in water but the maximum thermodynamically stable concentration.

Middle East Gas/Condensate Well Iron Sulphide Problem



Conclusions

- ✓ Unique challenges associated with carbonate and sulphide scale predictions.
- ✓ Challenges addressed using rigorous procedure – HWU Workflow + sensitivity studies.
- ✓ Example of mild carbonate issue in North Sea oil well.
- ✓ Use MDI concept to help identify iron source and understand FeS precipitation in the well – example from Middle East sour well.

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