



RENDALL

GEOSCIENCE



Repurposing Depleted Gas Fields for CO₂ Storage: An Operations Geologist's Perspective on Site Characterisation



Focus

- Integrating geoscience, well engineering, and well integrity datasets
- Re-evaluating legacy operational records for site characterisation with a carbon storage containment perspective



5 Aspects

LINKS TO STORAGE LICENCE / PERMIT REQUIREMENTS

Identifying all wellbores

Well integrity

Containment risk

Shallow boreholes

Site characterisation

Well planning

Monitoring baseline

Fluid losses while drilling

Site characterisation

Containment risk

Well planning

Gas peak history

Containment risk

Monitoring baseline

Cement evaluation

Well integrity

Containment risk

Corrective measures

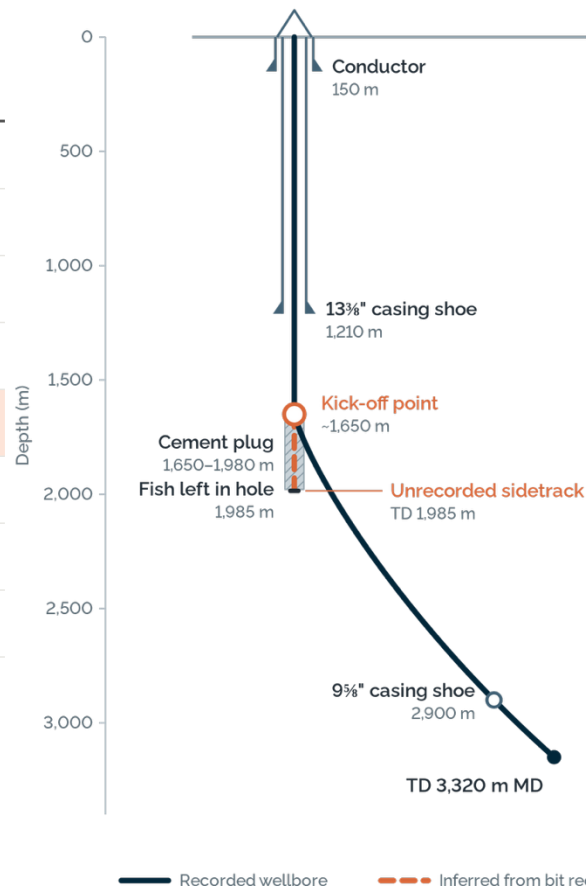
Confirm unrecorded sidetracks with bit records



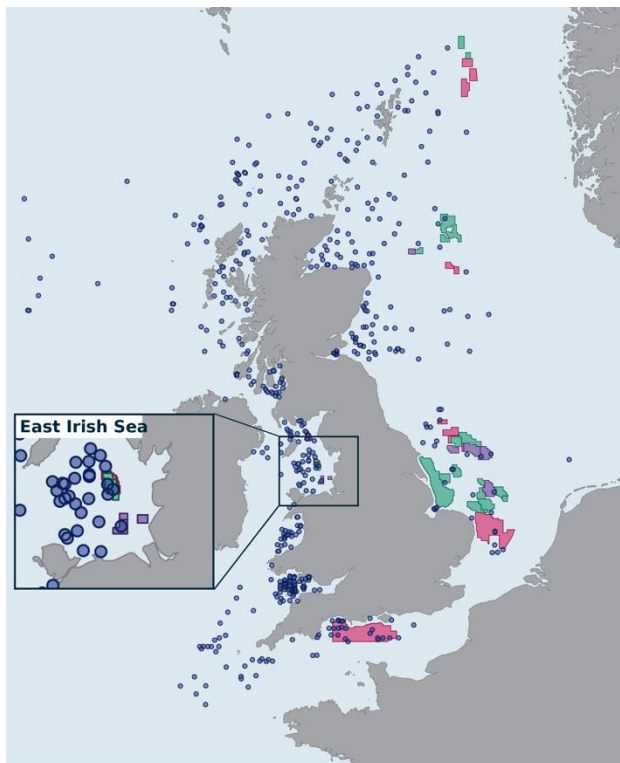
Size	Run	Bit	Depth in (m)	Depth out (m)	Remarks
17½"	1	1	150	420	Spud; drill out conductor shoe
17½"	2	1RR	420	1,210	Drill to 13⅜" casing point
12¼"	3	2	1,210	1,980	Drill ahead
12¼"	4	3	1,980	1,985	Fish left in hole
12¼"	5	4	1,650	1,660	Cement plug / milling run
12¼"	6	5	1,660	2,470	Build angle
12¼"	7	5RR	2,470	2,900	Drill to 9⅝" casing point
8½"	8	6	2,900	3,320	Drill to TD

Illustrative synthetic data only

**Next run starts 330 m shallower than the last depth out → a kick-off point.
Is this sidetrack in the well records?**

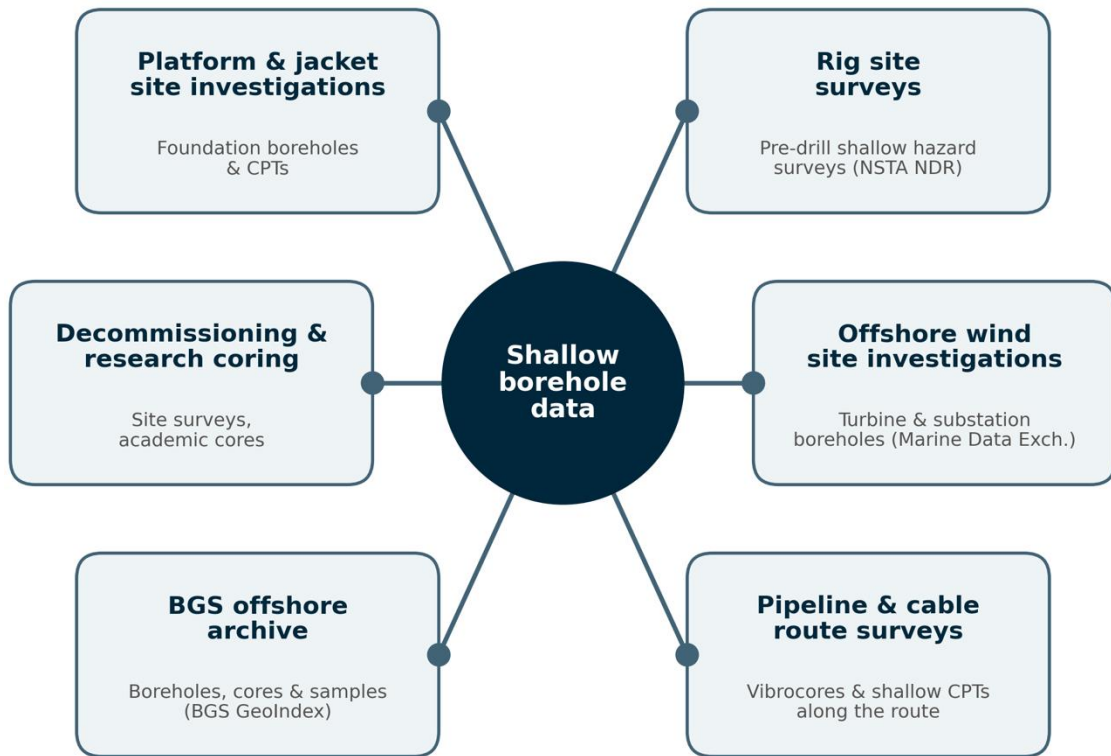


Legacy geotechnical samples



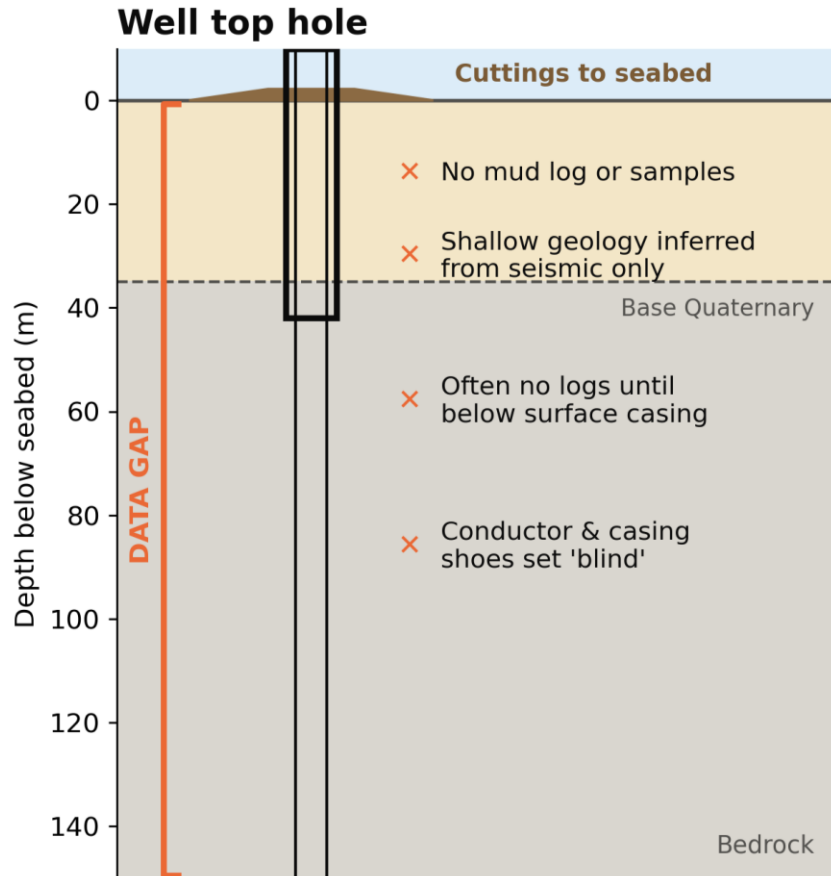
- BGS borehole
- Round 1 (2023)
- Out of round
- Round 2 offered

Illustrative based on BGS Geoindex and NSTA

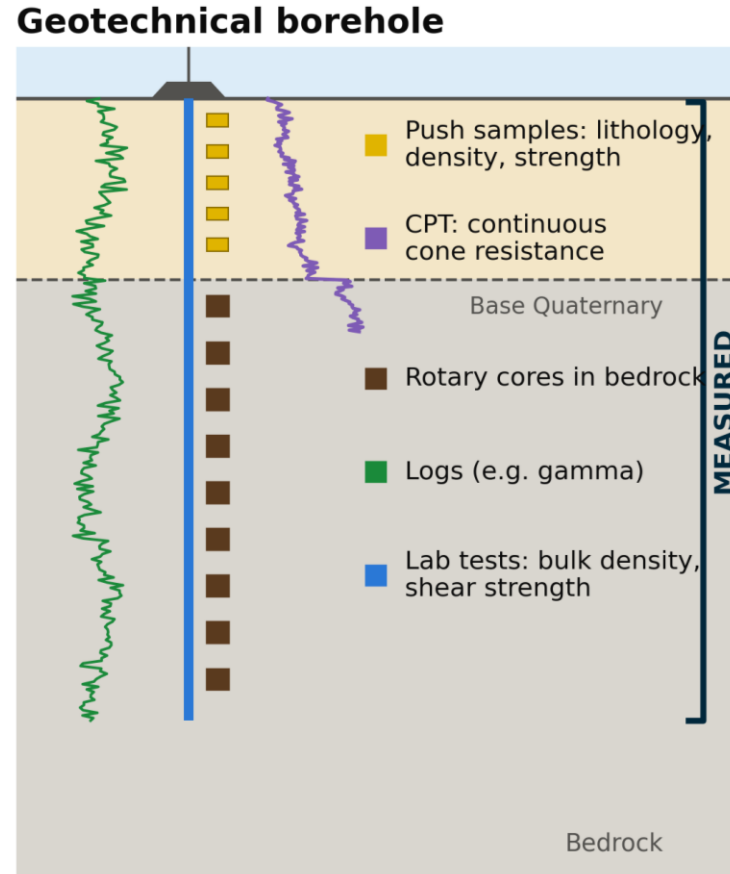




Constrain the shallow with legacy boreholes

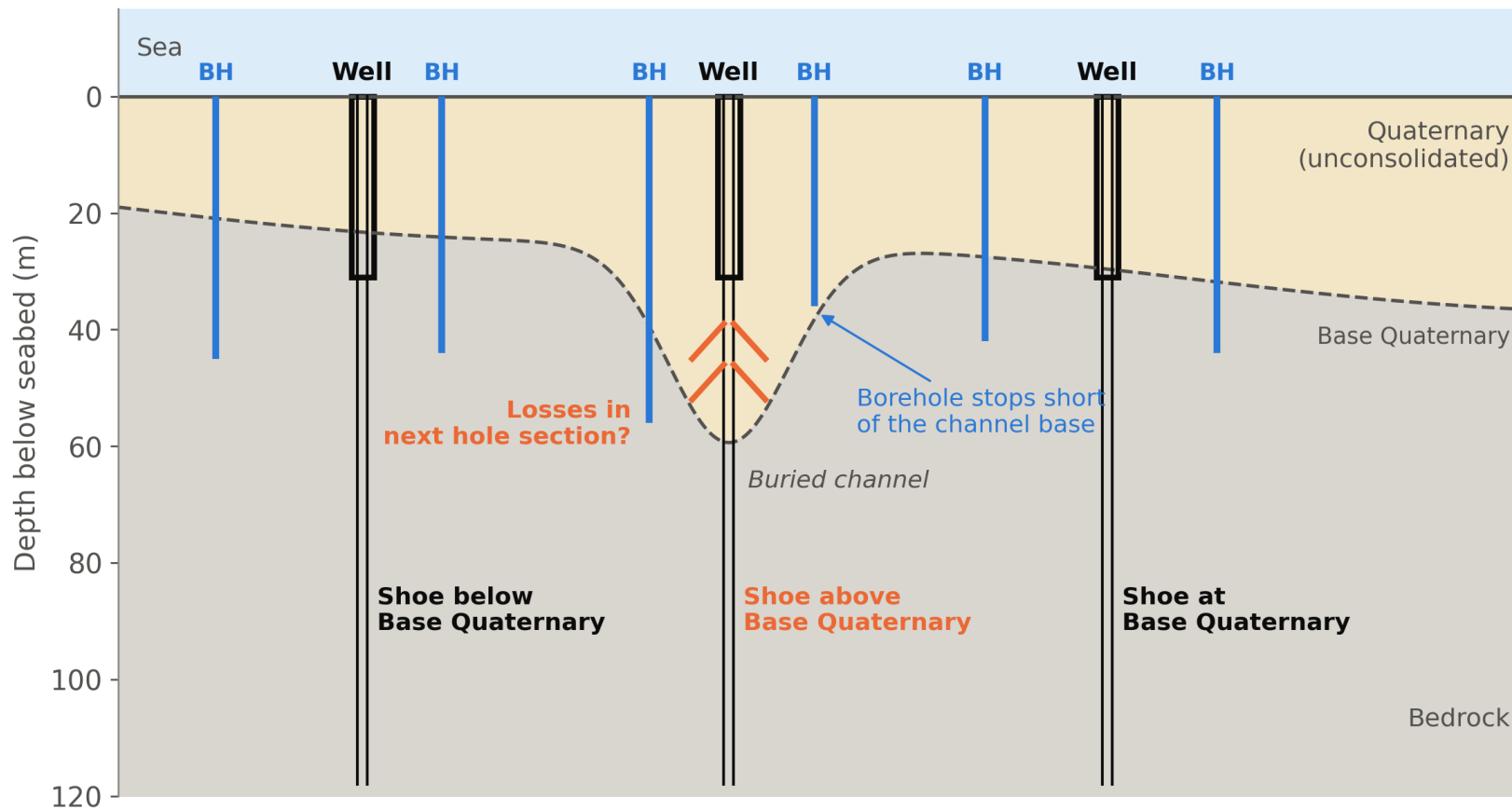


Illustrative synthetic data



SPE CO2 Conference, Aberdeen, 7 October 2026

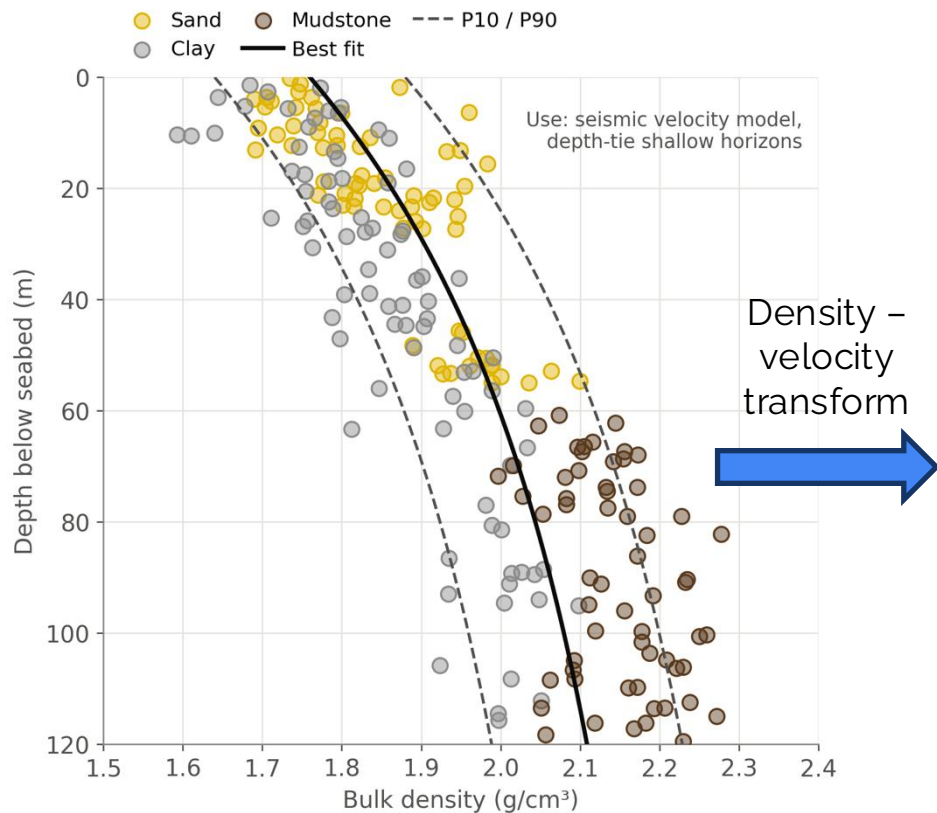
Constrain the shallow with legacy boreholes



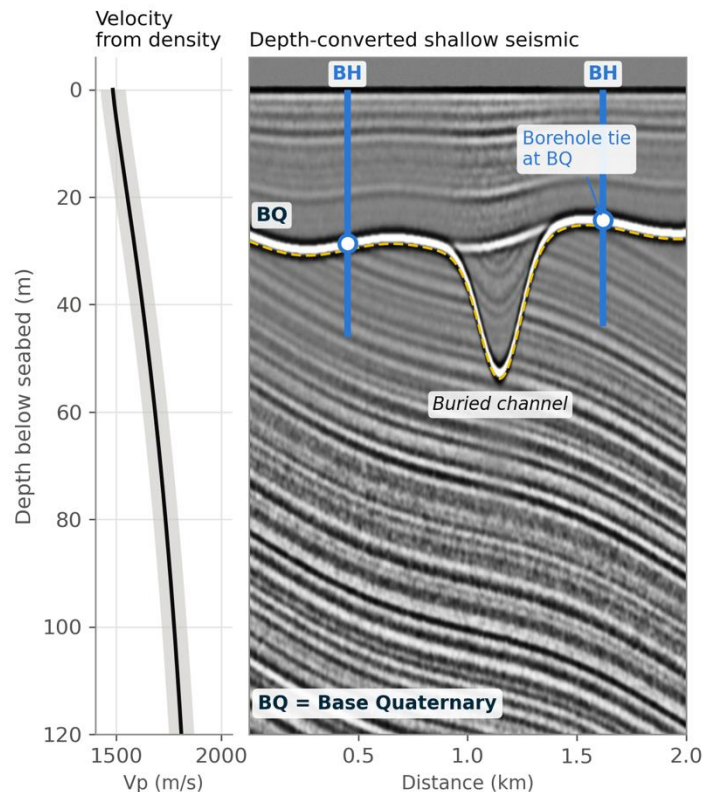
Illustrative synthetic data



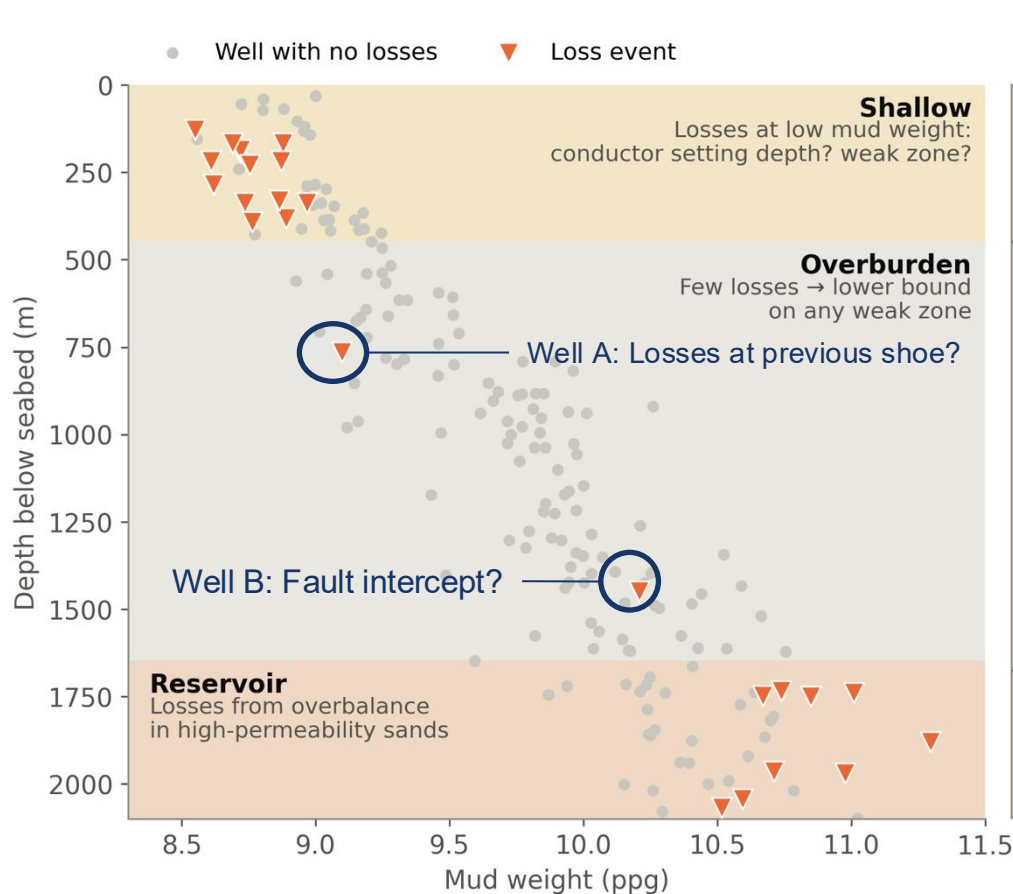
Shallow density from geotechnical samples – Shallow Velocity Model



Illustrative synthetic data



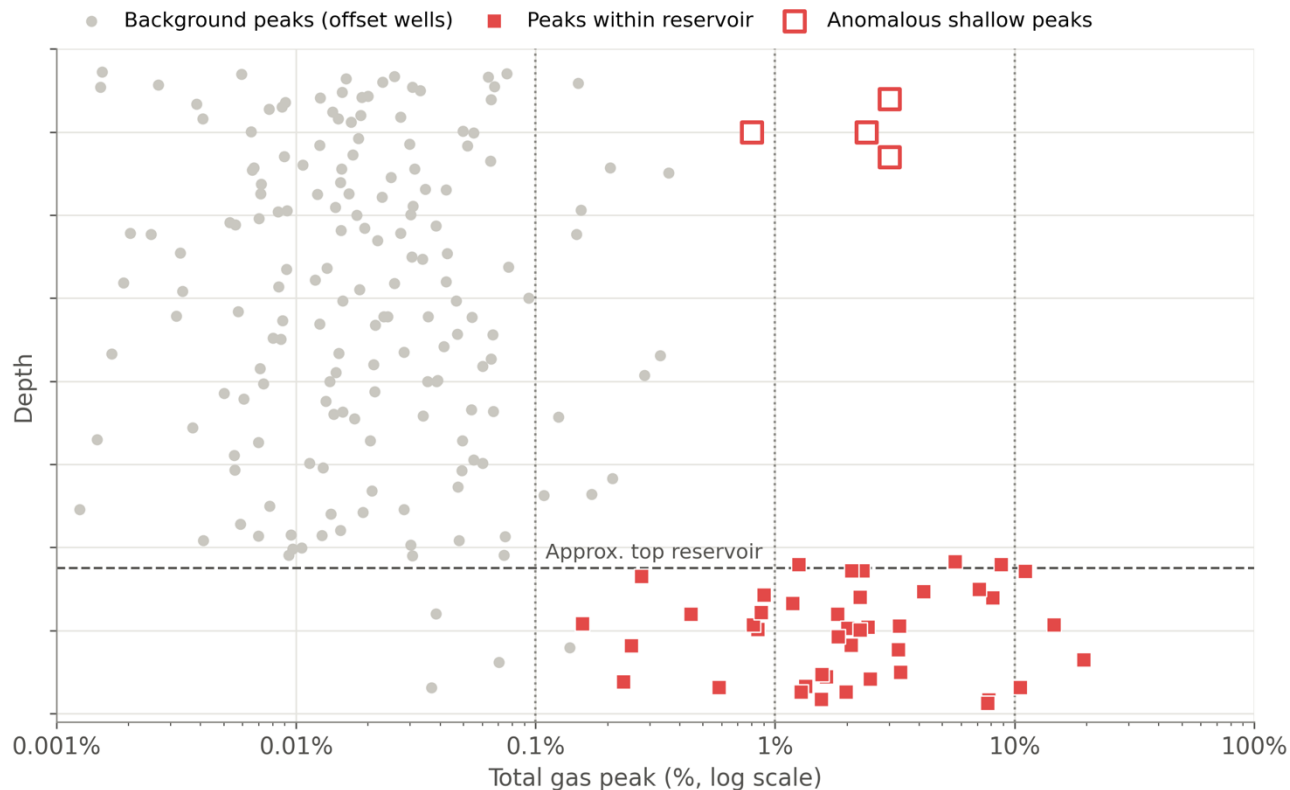
Losses history as an overburden strength map



Hydrocarbon Source

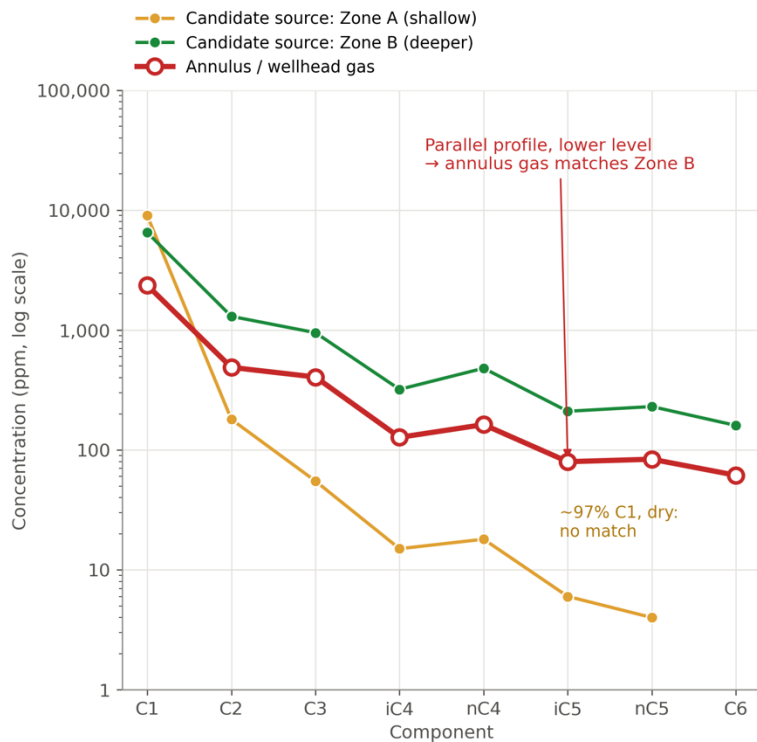


Where did the gas come from?

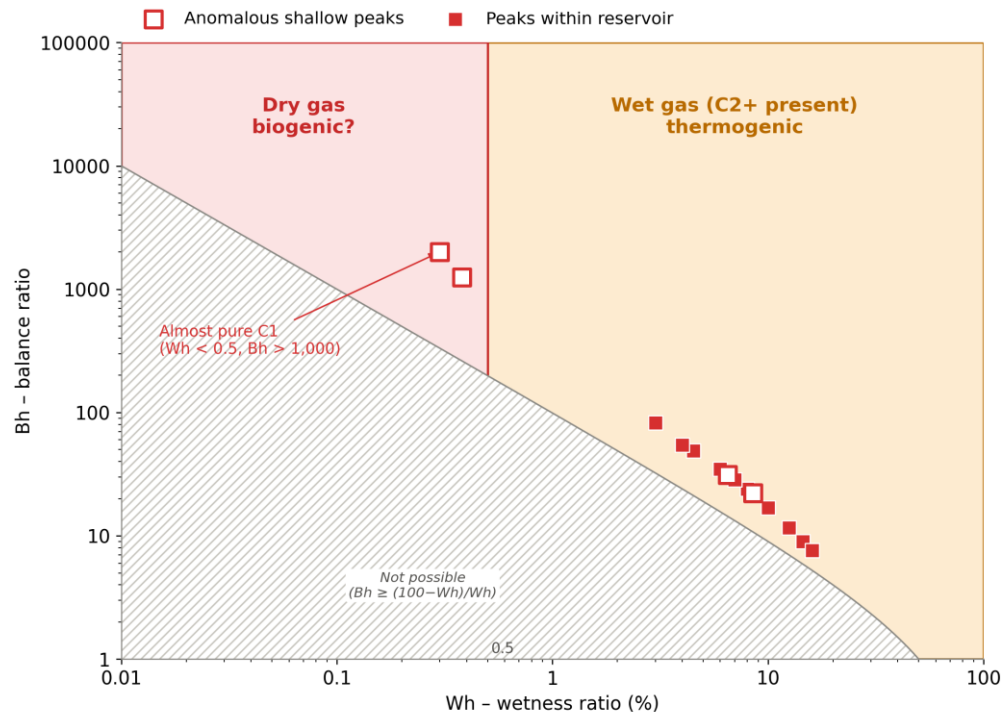


Illustrative synthetic data

Hydrocarbon Fingerprinting

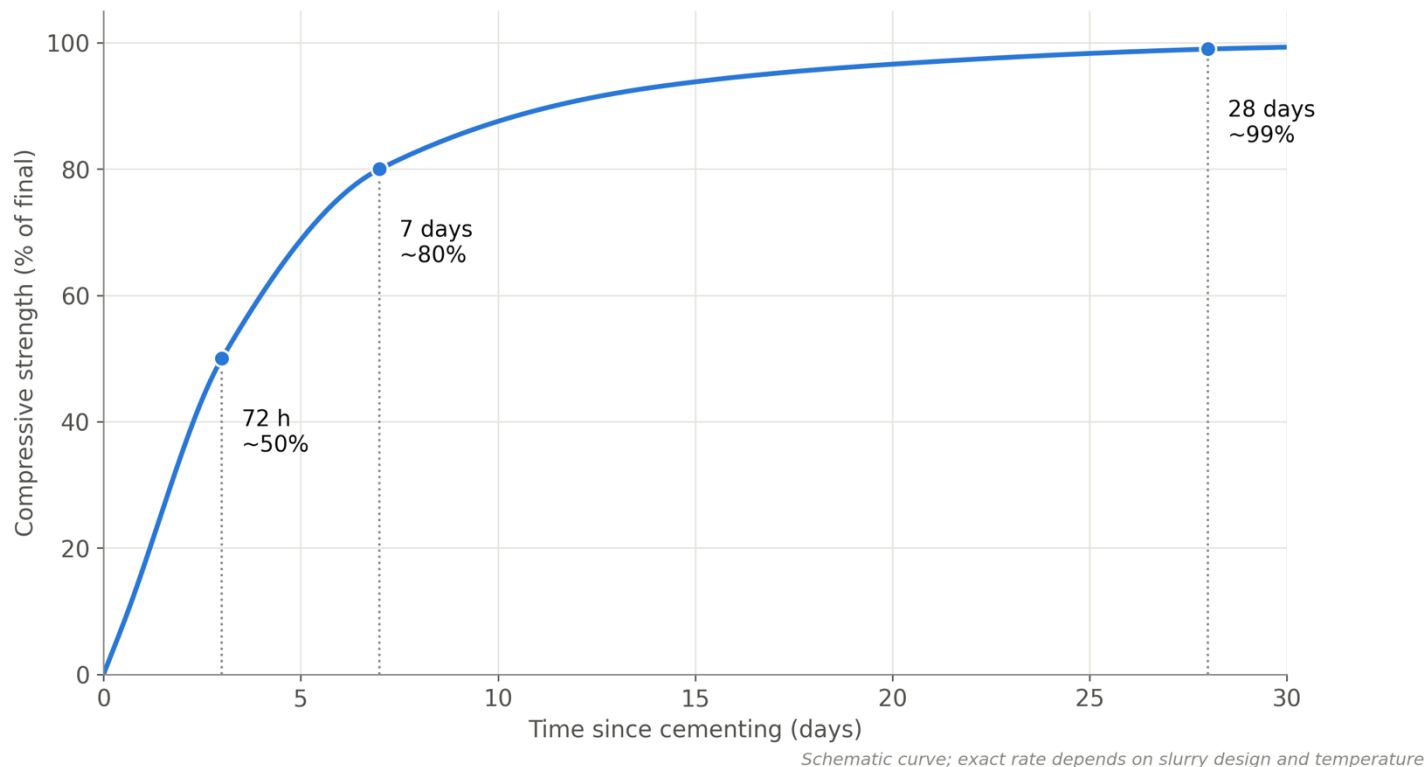


Illustrative synthetic data only



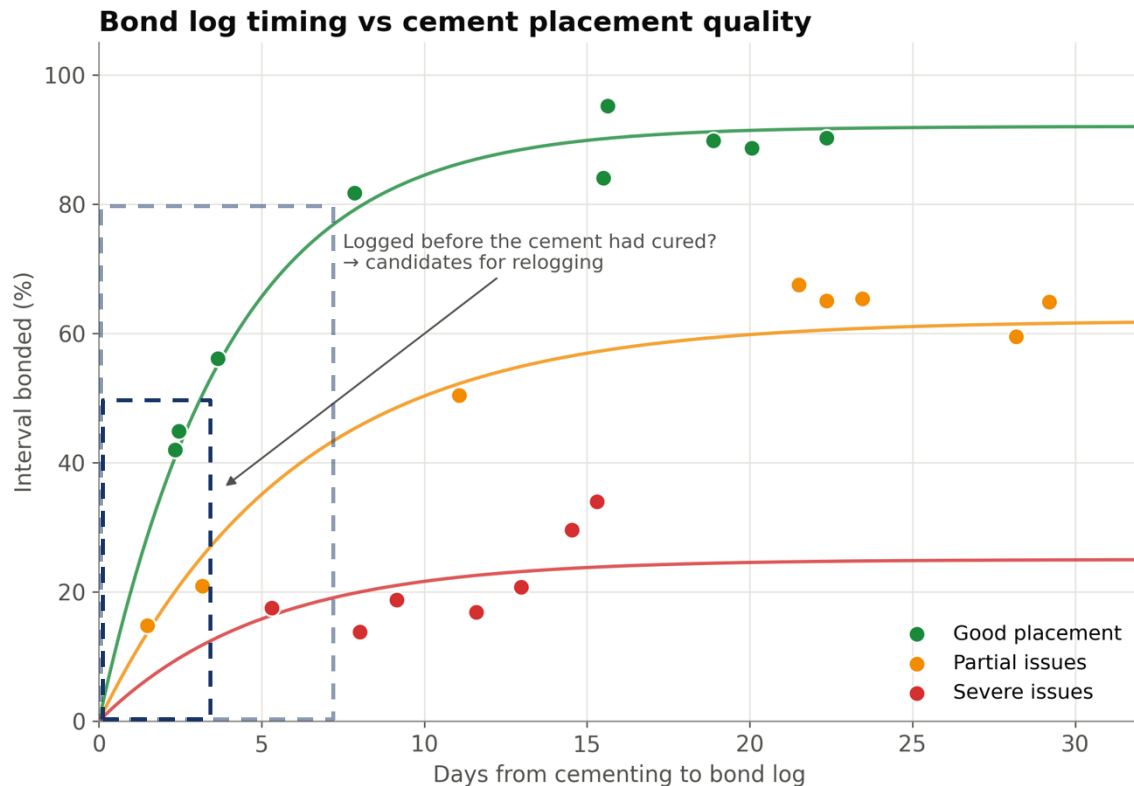
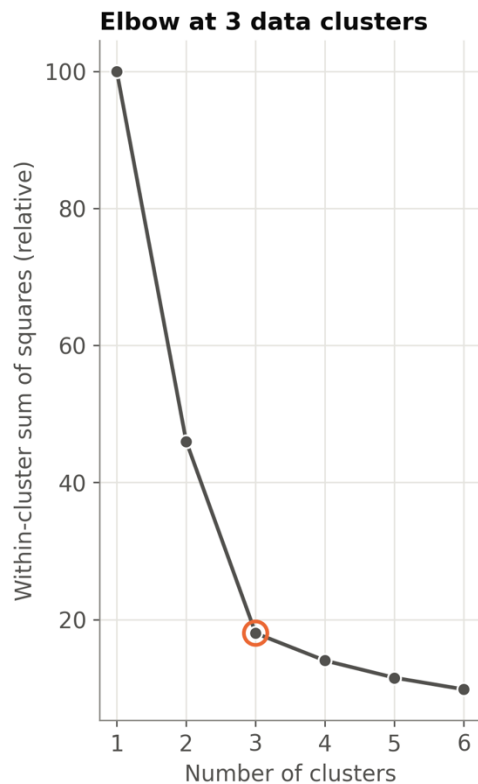
Fields after Haworth et al. (1985) · illustrative synthetic data

Cement strength builds over weeks, not hours



So does time of logging time change the bond we see?...

Cement Bond Log Timing



Illustrative synthetic data

See also *Time Lapse Logging of Cement Bond Logs SPWLA 2015 symposium paper, The Effect of Time on Apparent Cement Integrity* ([OnePetro](#)).

Ian Leslie; Tom Bradley; Julius Balamaga; Iain Whyte



From existing records to actionable results

DATASET	WHAT IT TELLS US	ACTIONABLE RESULT	PERMIT REQUIREMENT
1 Bit Records	An auditable check that every sidetrack is accounted for	Complete, verified well record	Well integrity Containment risk
2 Geotechnical Boreholes	- Shallow correlations - Depth ties to seismic surfaces - Density trends	- Better shallow seismic imaging - Improved depth conversion - Improved storage complex characterisation	Site characterisation Well planning Monitoring baseline
3 Losses While Drilling	- Conductor depth vs unconsolidated formation - Weak zones in storage complex / overburden	- Deeper conductors where needed - Image logs on injectors to define weak zones - Casing shoes set clear of weak zones	Site characterisation Containment risk Well planning
4 Drill Gas Logs	Ties hydrocarbons to their probable source zone	- Overburden characterisation - Clearer view of potential leakage pathways	Containment risk Monitoring baseline
5 Cement Bond Logs	Time since cementing affects measured bond quality	- Time logging runs for best results - Set realistic expectations for improvement - Select wells for relogging	Well integrity Containment risk Corrective measures



Thank you....