

# Zechstein drilling

*WINZ approach & experiences*

- PFFG model uncertainty & offset well analysis
- Seismic mapping of potential floaters
  - Trajectory optimisation – floater avoidance
- Generic well design & drilling strategy
  - Casing/liner design
  - Drilling fluid strategy
- Drilling experiences / challenges / concerns

# PPFG model uncertainty & offset analysis



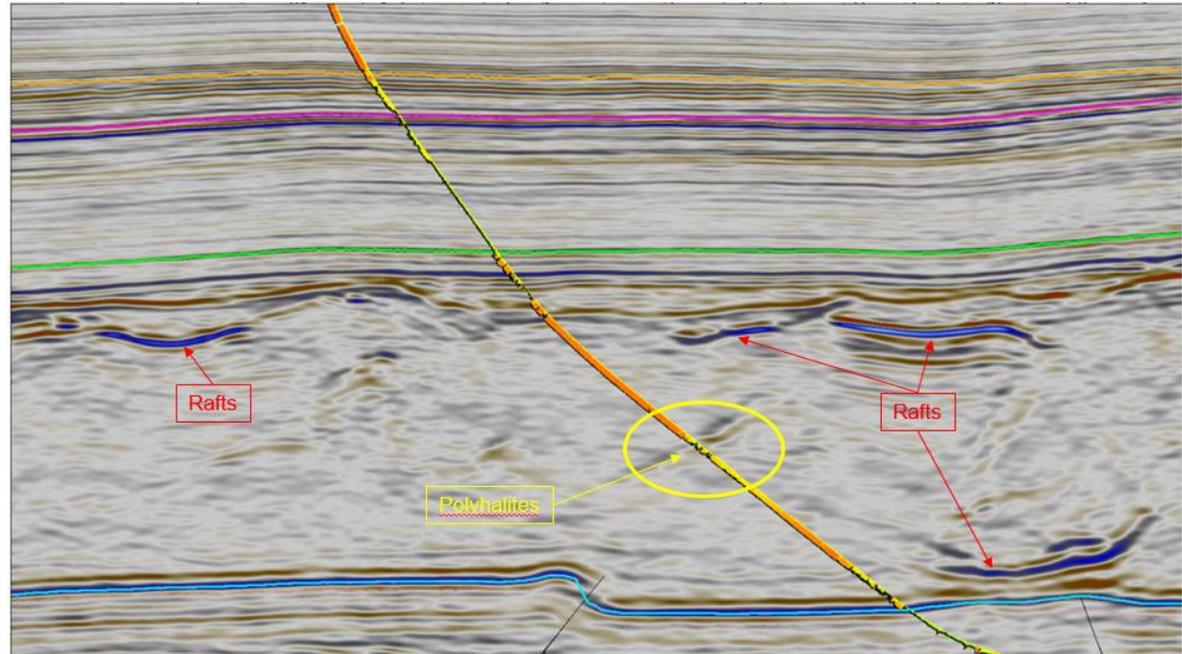
- Modelled fracture gradient in upper Zechstein is lower than indicated by offset data (FIT/LOT data)
- Formation pressure plot does not illustrate formation pressure of potential floaters
  - Annotate plot with relevant offset data points
  - Annotate plot with average Zechstein floater kicks (industry experience – 17.5 ppg brine kicks / 15.4ppg gas kicks)

## ZECHSTEIN FLOATERS

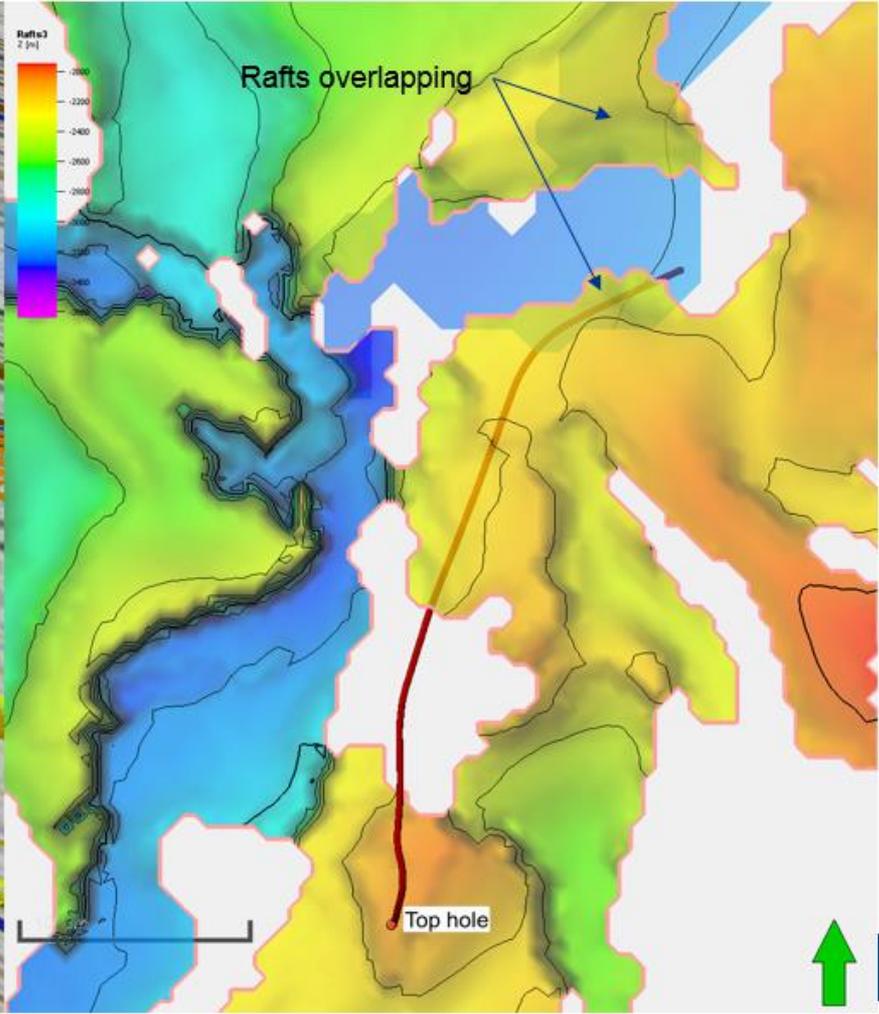
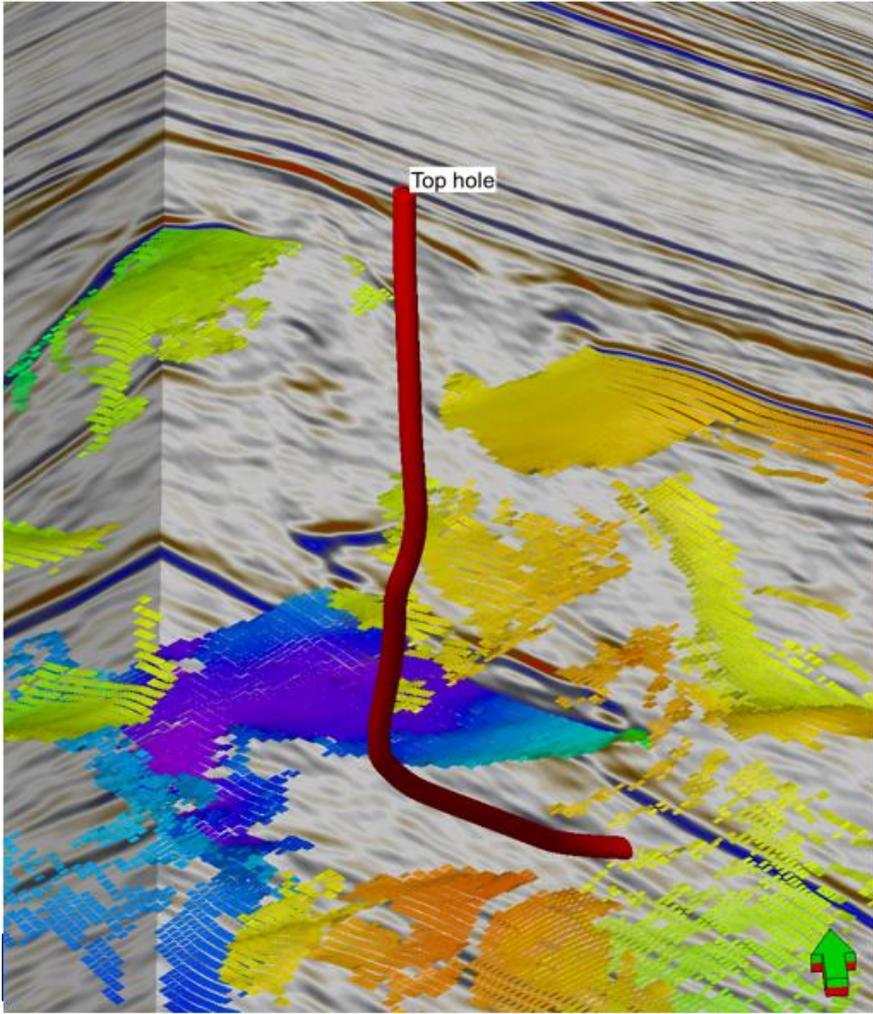
- Upward movement of halite leads to the uplift of (permeable) dolomite.
- Uplift leads to breakup into “rafts” completely encased in halite.
- Once encased these dolomite rafts cannot de-water giving rise to overpressure.
- The expected pressure of rafts cannot be modelled.
- Offset data: No inflows in the listed offsets but one on Wingate A6

mMD	mTVD	mTVDSS	MW (ppg)	SIP (psi)	EMW (ppg)
3557	3428.3	3380.8	13.7	1950	17.0

- 3D seismic evaluation
  - Seismic resolution ~30-50m
  - Lateral uncertainty
- Define “avoidance windows/targets” as input for well placement / trajectory optimisation
  - Aim for >200m clearance

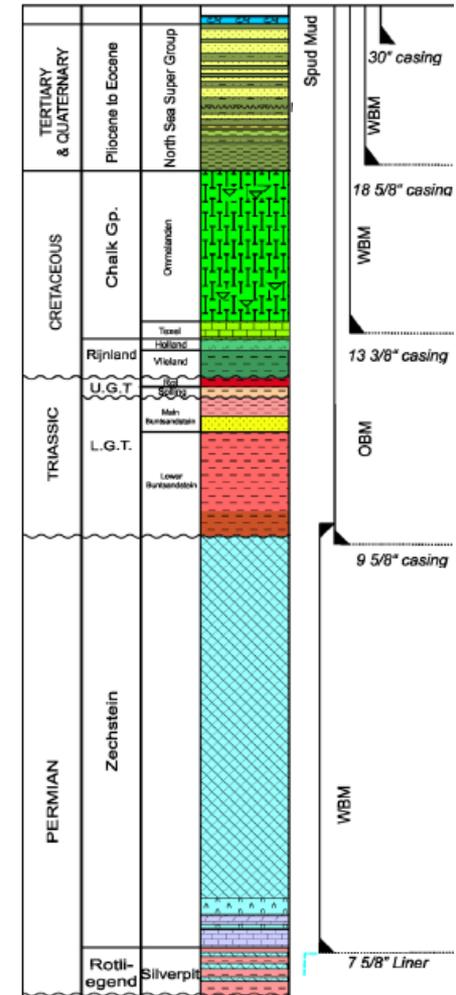


# Zechstein floater mapping & well placement



# Generic well design & drilling strategy

- 9 5/8" Production casing in top Zechstein salts to ensure sufficient shoe strength
  
- Drill Zechstein sequence separately or in combination with Silverpit sequence
  - Section/sequence lengths
  - MW / ECD vs PPF
  
- 7 5/8in MUST liner to case off Zechstein
  - Mobile/squeezing salts
  - Non-uniform loading in washed out areas



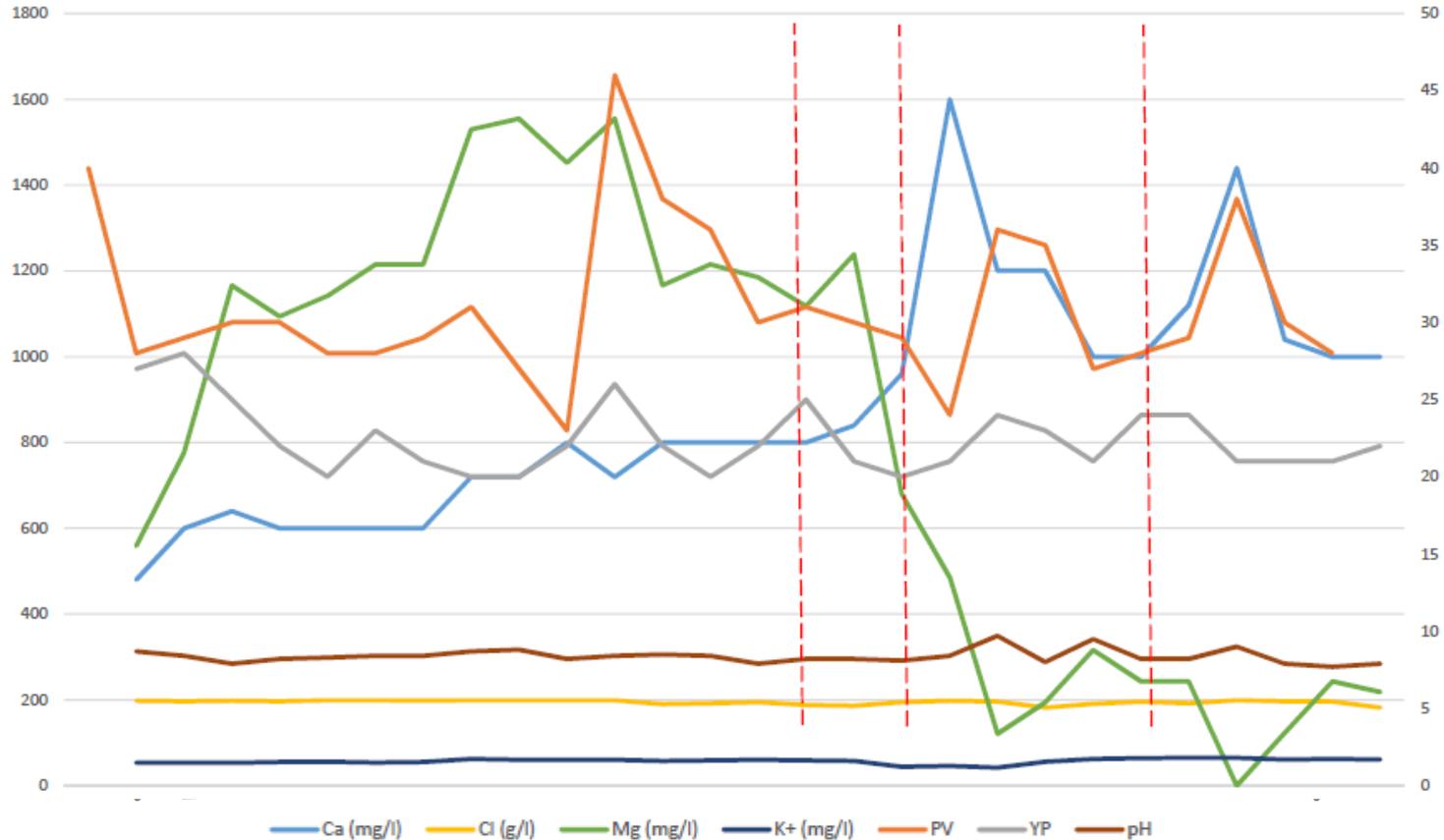
# Drilling fluid strategy for Zechstein



- 13.5 – 14.5ppg salt saturated WBM for most applications
  - Tolerance to formation brine influx / fluid exchange
  - Preference for NaCl/KCl type salt saturated WBM for corrosion management
  
- Pilot testing with salt saturated WBM
  - Confirm ability to use 'active' mud system to successfully weigh up from planned drilling weight to kill weight
  - Confirm ability to build and pre-shear fresh mud on the rig with use of shearing system in pit

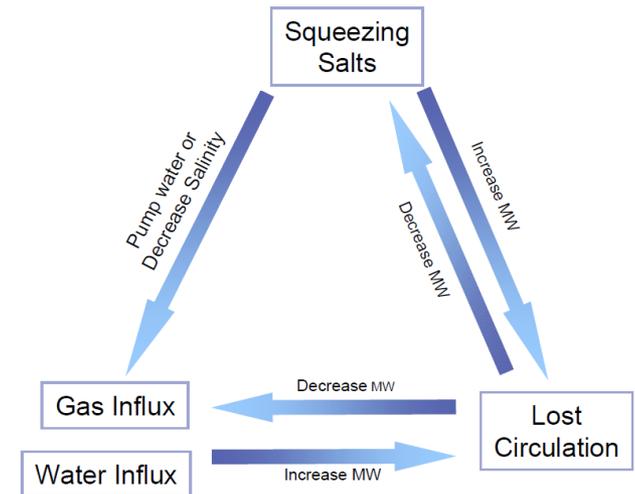
# Experiences / challenges / concerns

## ■ Monitoring type of salts present and effect on drilling fluid



# Experiences / challenges / concerns

- Brine / gas kicks
  - Controlled successfully with MW increase
    - potential for losses in basal carbonates
    - Planned shoe depth achievable?
- (Dynamic) Losses & flowback in basal carbonate sequence
  - Establish/confirm flowback scenario
    - Gain rate trends
    - Any associated hydrocarbons?
- Investigate options for use of rotating control device / MPD control unit



# Zechstein drilling WINZ approach & experiences

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Questions?