

# Concentrated Gas Hydrate in the Shenhu Area, South China Sea: Results From Drilling Expeditions GMGS3 & GMGS4

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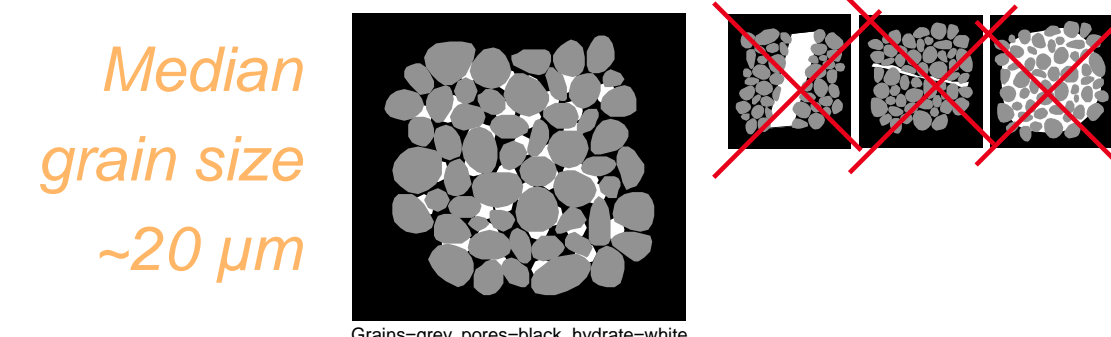
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## Pore-Filling Gas Hydrate in Fine-Grained Sediment

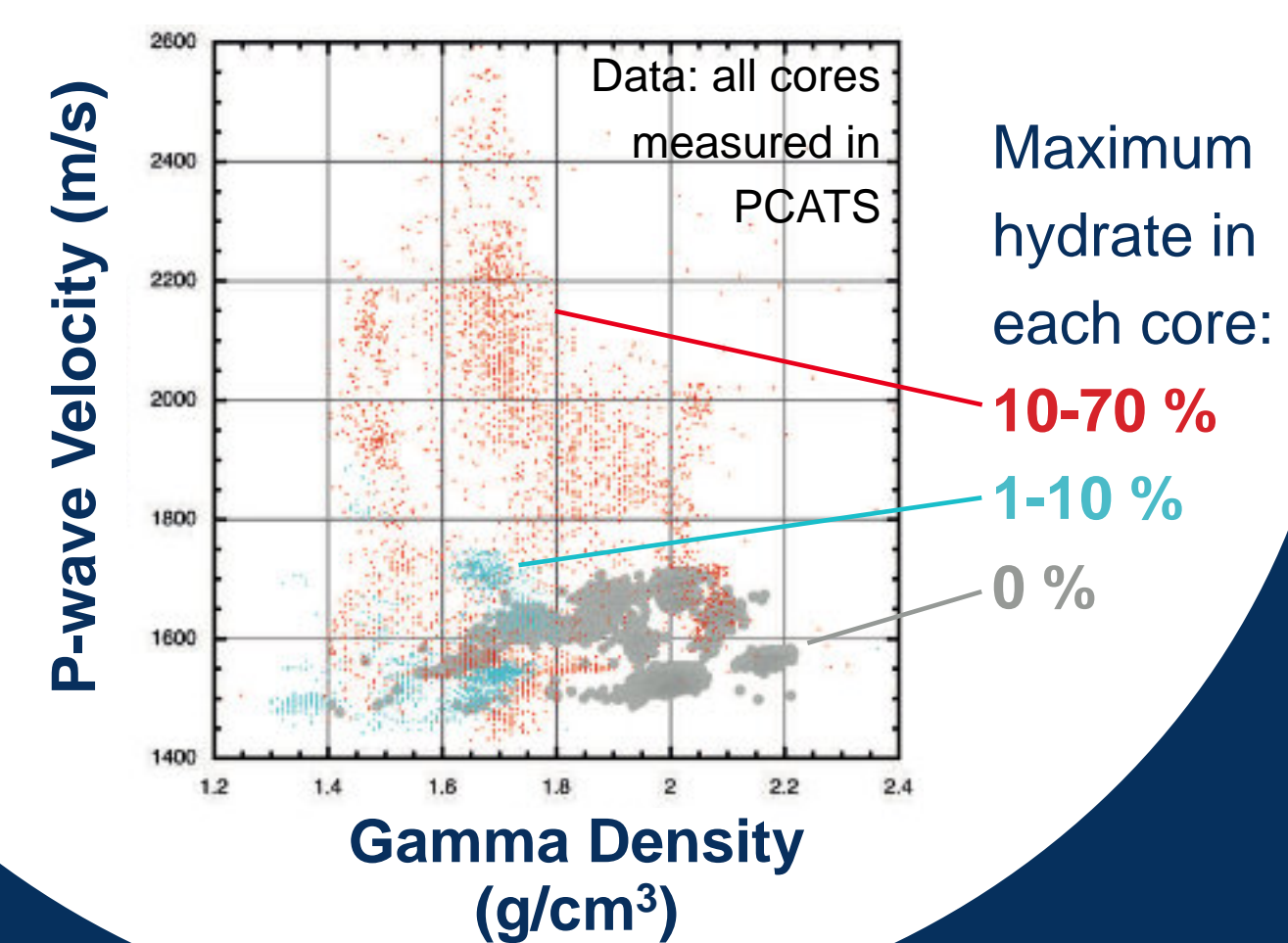
- Hydrate is concentrated (25-70%)
- Hydrate-bearing sediments:
  - No density changes
  - Elevated P-wave velocity
  - Increased strength (see center)

Conclusion:

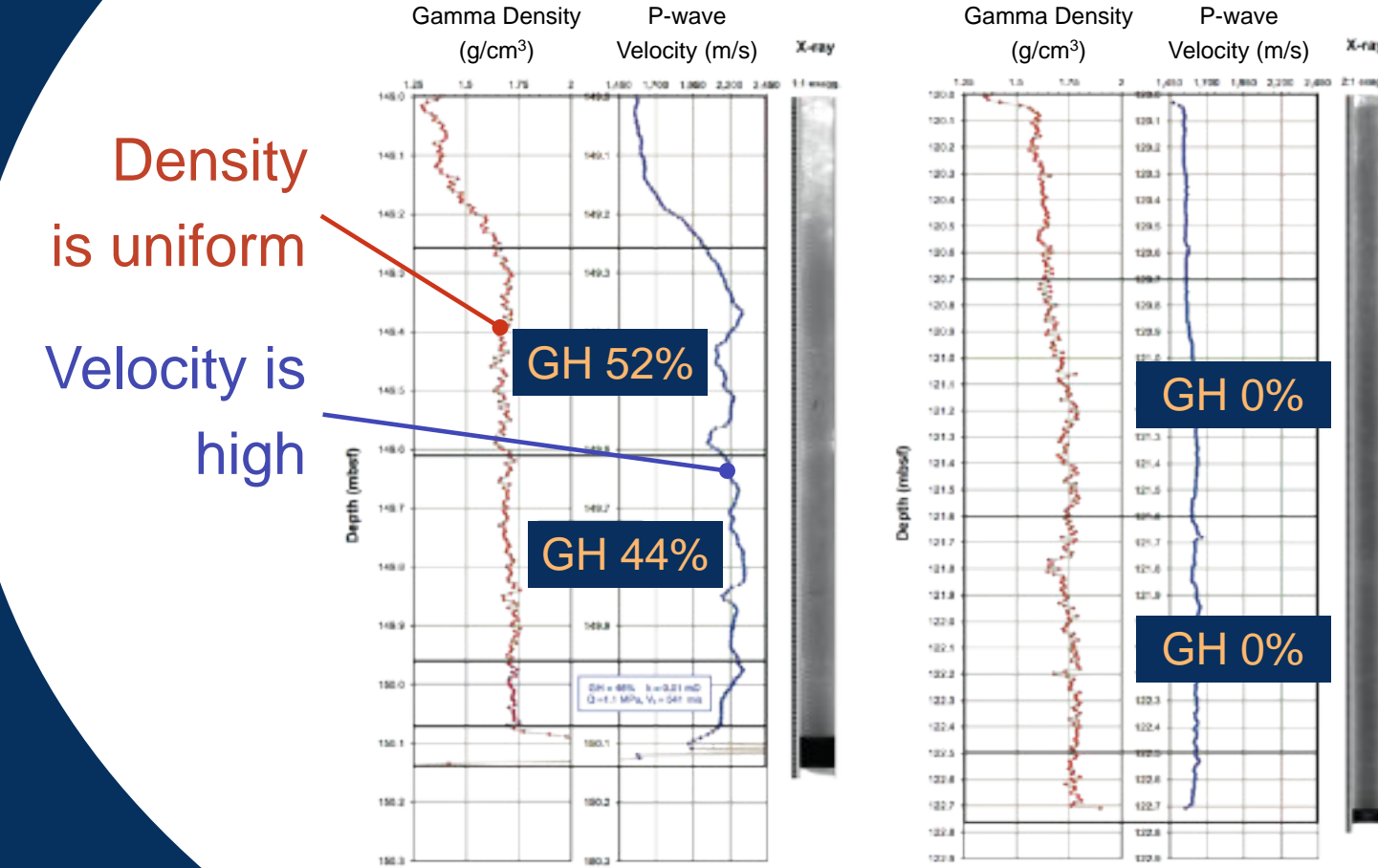
Gas hydrate is PORE-FILLING at Shenhu



Velocity Increases with Hydrate

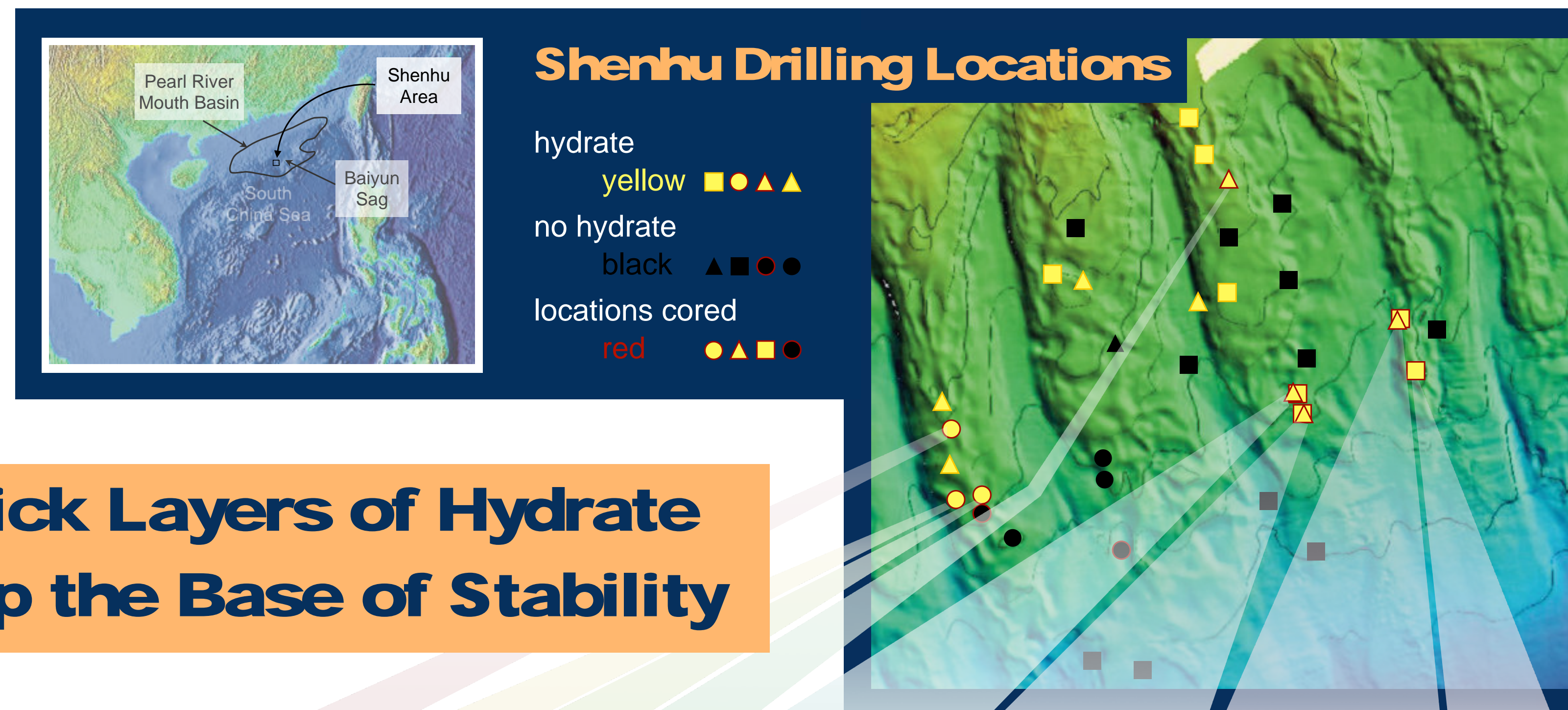


Cores ± Hydrate Measured Under Pressure

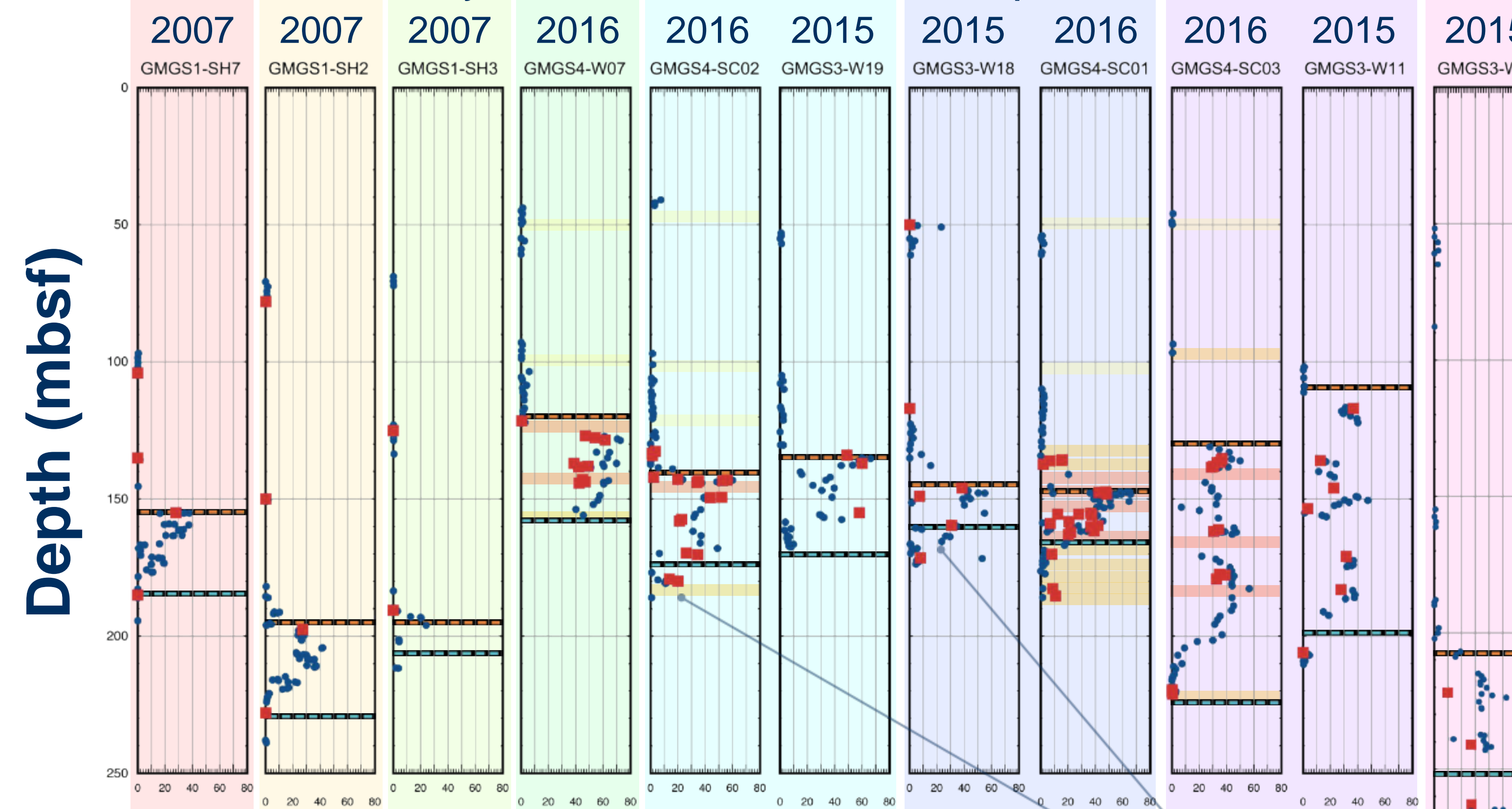


Pressure core data from Geotek PCATS

## Thick Layers of Hydrate Atop the Base of Stability



Gas Hydrate Measured in Cores on Three Expeditions to Shenhu



## Gas Hydrate Concentration (% of Pore Volume)

- calculated from porewater freshening
- calculated from pressure core methane mass balance

## Hydrate Zone Boundaries

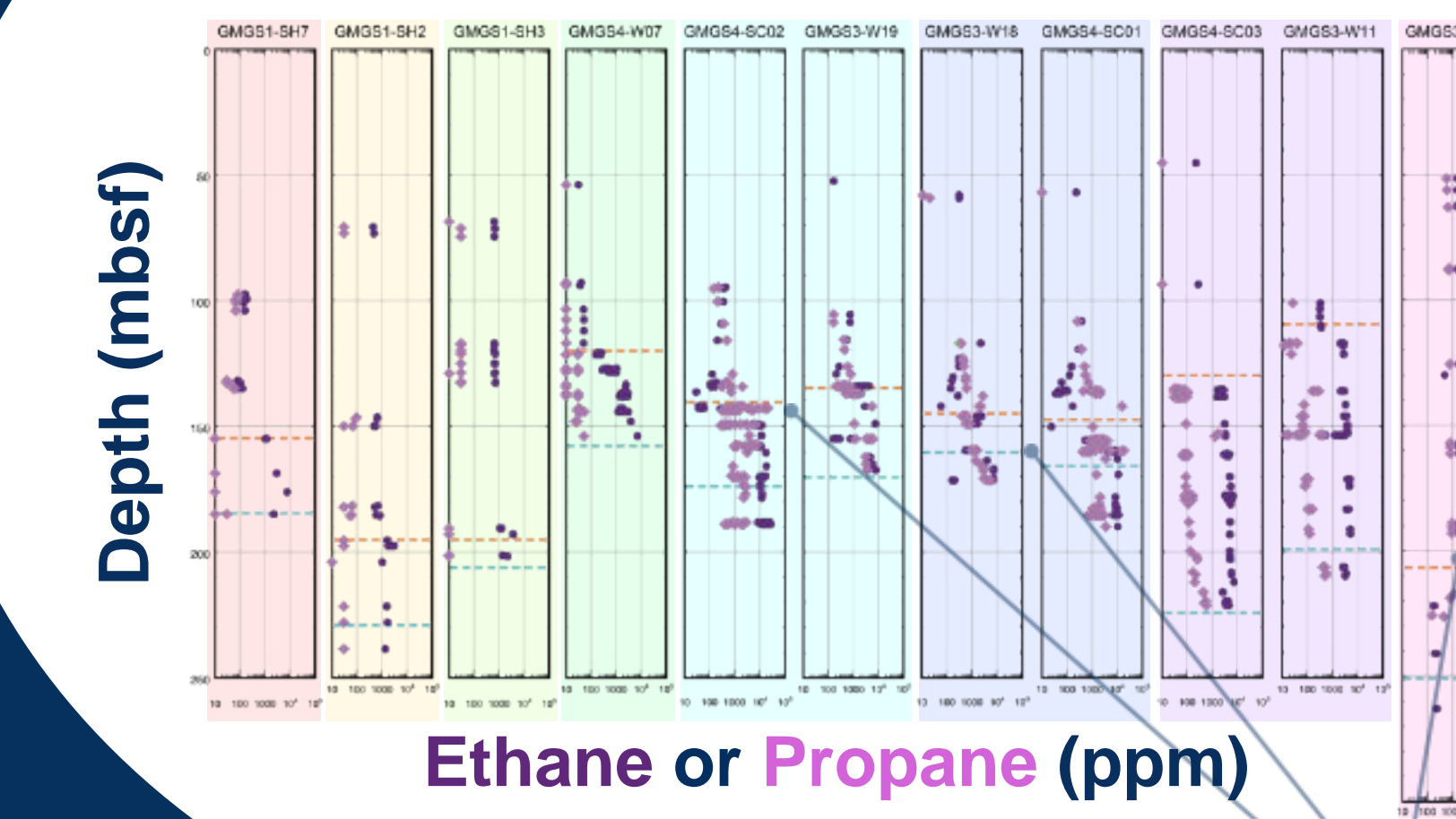
- Top of LWD electrical resistivity anomaly
- Calculated base of SI methane hydrate stability

## In-Situ Strength

- Strength can be used to define the hydrate zone at Shenhu
- < 5 MPa
- 5 to 10 MPa
- > 10 MPa

## Thermogenic Gases and Evidence for SII Hydrate

Propane Concentration Varies Across Shenhu Locations



- Propane at three locations exceeds 1000 ppm
  - possible SII methane-propane hydrate
- Same three locations show hydrate below the base of SI CH<sub>4</sub> hydrate stability (see center)
  - two locations also show recent hydrate formation (see lower left)

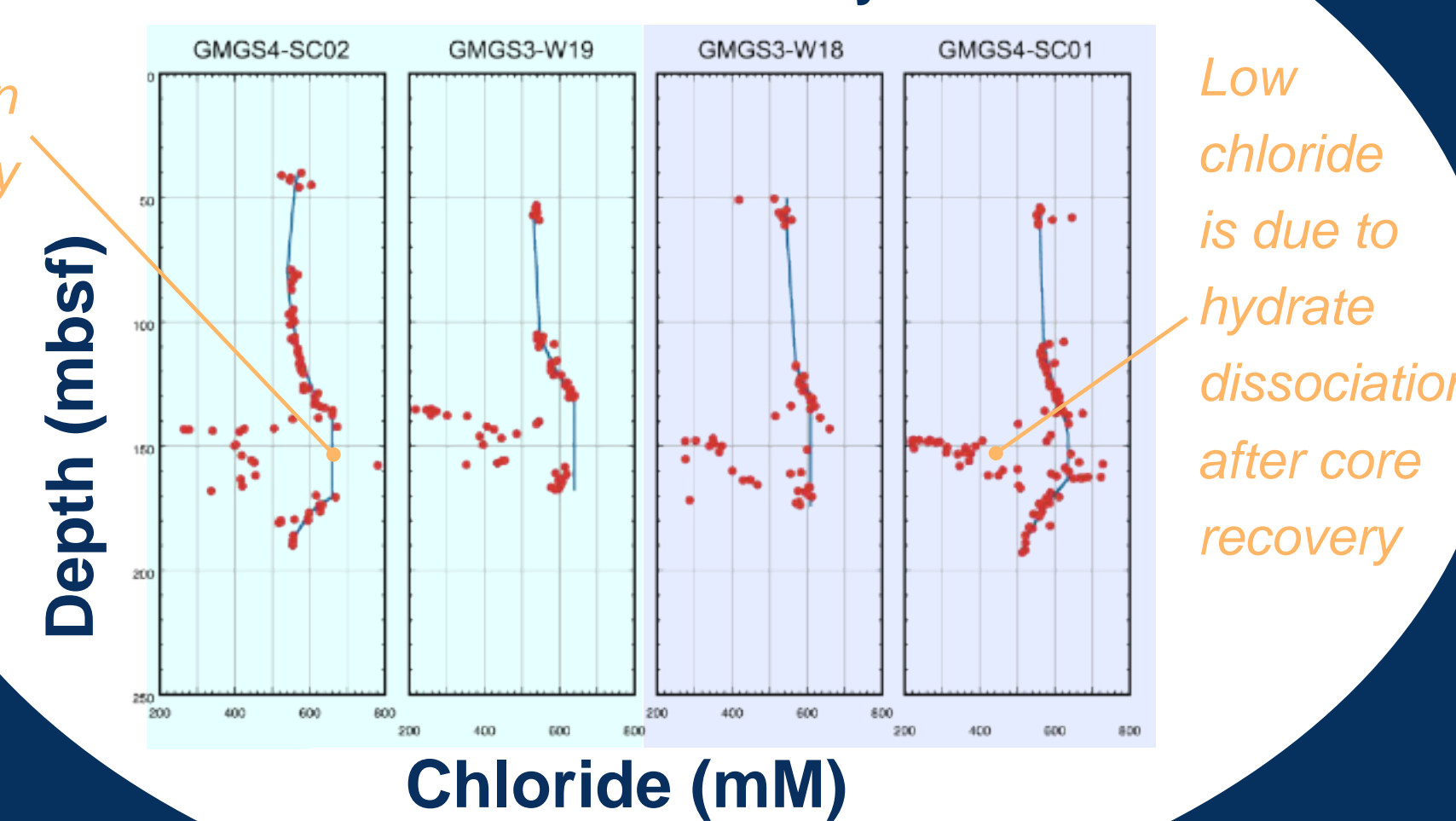
Propane >1000 ppm; butane, isobutane, isopentane 100-1000 ppm

## Evidence for Local Area with Recent Hydrate Formation

- Four holes show high chloride near hydrate
- Elevated chloride is consistent with ion exclusion due to hydrate formation
- Local phenomenon: all four holes within ~1 km

Background Chloride Increases Toward Hydrate Zone

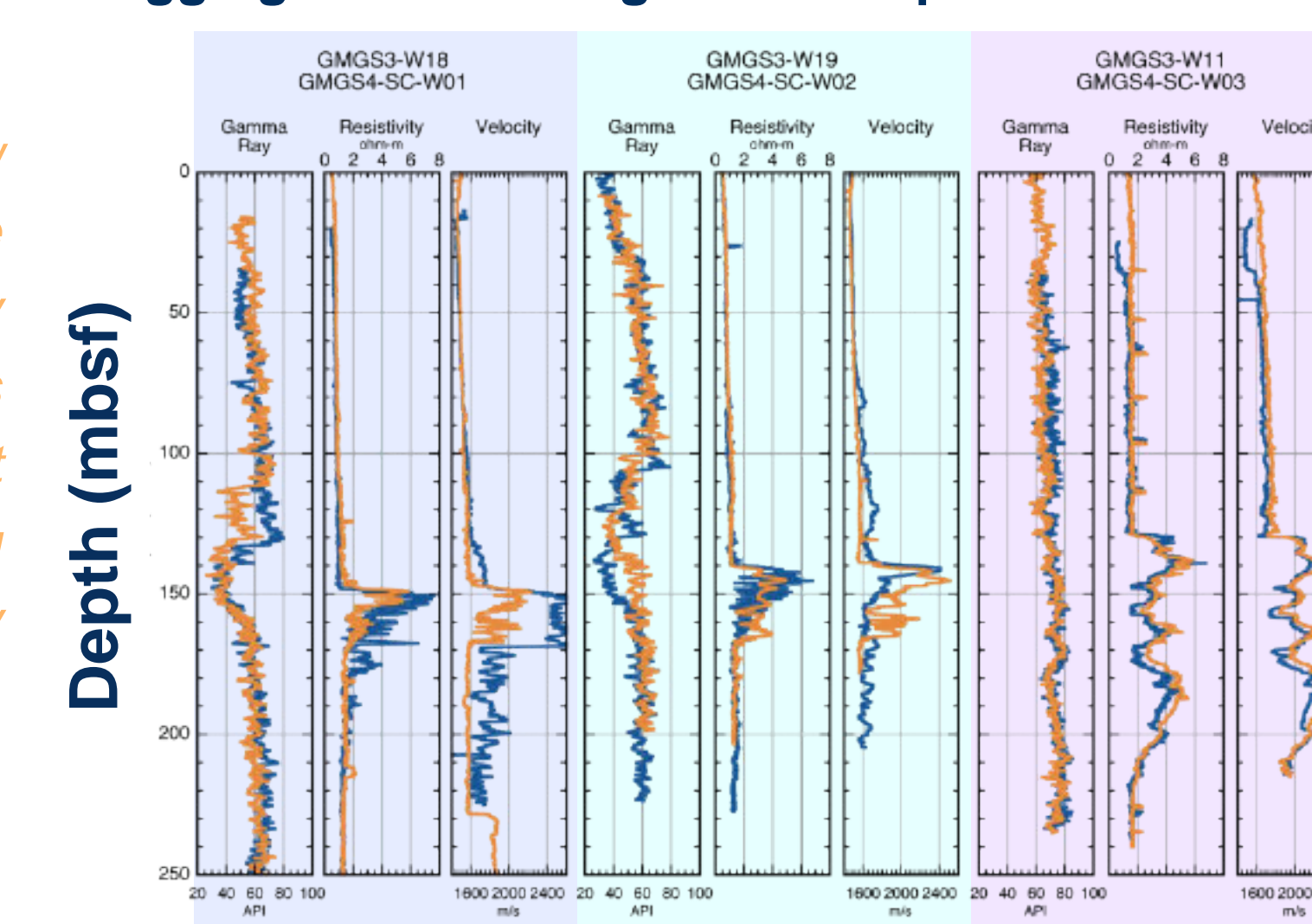
"In situ" chloride for hydrate calculation has significant uncertainty



## Laterally Continuous Hydrate Deposits

Logging-While-Drilling Data Comparison for Three Re-Occupied Sites

Low magnitude of resistivity anomalies support pore-filling morphology



- Vertical of sets applied as required
- Prof les are similar to extremely similar

Many thanks to the crew of the D/V Fugro Voyager and the science parties of GMGS3 & GMGS4.

