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Joining the Dots: Sequence Stratigraphy-Based Regional Geology

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Prediction & Geoscience

- Prediction (or extrapolation) is an essential aspect of geoscience – what lies in the unknown between data
- Geologists are often involved in the creation of a 3D or 4D model of the Earth or part of it
- This can be for the search for resources or to answer fundamental questions about the history of the planet and how it operates.

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Tools for "Joining the Dots"

- Biostratigraphically Constrained Sequence Stratigraphy and Eustasy
- Geodynamics: Global and Regional Tectonics
- Palaeoclimate & Source to Sink Relationships Earth Systems Science
- Forward Stratigraphic Modelling



- Illustrated by examples from the Arabian Plate
- N.B. I am not a Permian specialist!



A Framework for Correlation: Biostratigraphy & Isotopes

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Sequence Stratigraphy & Chronostratigraphic Charts



Recognising Sequences: Classic Late Palaeozoic Cyclothem Interpretation



Cyclicity in Arabian Plate Stratigraphy

Sequence Stratigraphy an ideal methodology for placing complexity into systematic order



Mid-Cretaceous Succession, Wadi Mi'aidin, Oman

Chronostratigraphic Charts in Practice: Triassic, Arabian Plate











The Cyclicity of the Permian Stratigraphy of Arabia





Silue IV

The Cyclicity of the Permian Stratigraphy of Arabia



Are The Sequences Eustatic? Evidence From Pakistan



Are the Sequences Eustatic? Evidence from China



Jin et al. 2006, HCNBB_018049



Palaeoclimate and Source to Sink: Earth Systems Science





Slide 19°C 10 20 30

Palaeoclimate model. DecisionSpace® 365 Neftex® Predictions product suite, Halliburton

A Basis for the Bigger Picture



Changhsingian PDEM - Neftex® Predictions product suite, Halliburton

A Basis for the Bigger Picture



Changhsingian PDEM - Neftex® Predictions product suite, Halliburton

A Basis for the Bigger Picture



Changhsingian Palinspastic GDE - Neftex® Predictions product suite, Halliburton

Holistic Earth System modelling – models supported by data



Holistic Earth System modelling – Models supported by data



Solar

Outputs: Air Temperature





Sakmarian

Changhsingian

Outputs: Sea-Surface Temperature



Sakmarian



Changhsingian

Bringing ESS to Bear: Tidal Current Strength Modelling



Changhsingian

Bringing It All Together: Forward Stratigraphic Modelling

- Forward stratigraphic models are physicsbased, numerical simulators capable of modelling entire sedimentary systems
- Require information on different geological forcings



Summary

- Prediction or extrapolation between data is a fundamental aspect of geoscience – no matter if to academic or commercial ends
- A number of geological techniques assist in this regional geology assessment:
 - Biostratigraphically Constrained Sequence Stratigraphy
 - Geodynamics
 - Palaeoclimate/Source to Sink Earth Systems Science
- Forward stratigraphic modelling is a powerful computational technique for modelling geology at a regional scale
- Challenge for the Subcommission on Permian Stratigraphy
 Creation of a definitive Permian eustatic curve?
- Thanks to Halliburton and Neftex colleagues past and present and to Mike and Lucia for the invitation



