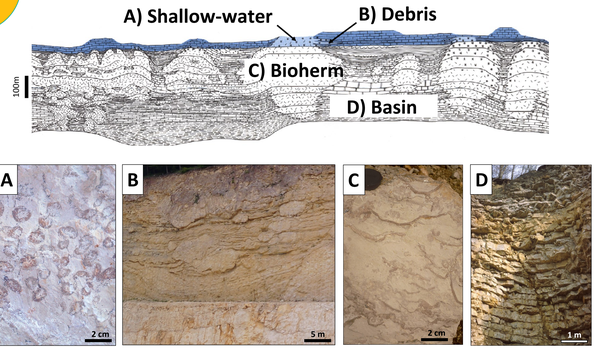
KAUST Research Conference: Maturing Geothermal Energy for Saudi Arabia, January 27 – 29.2020

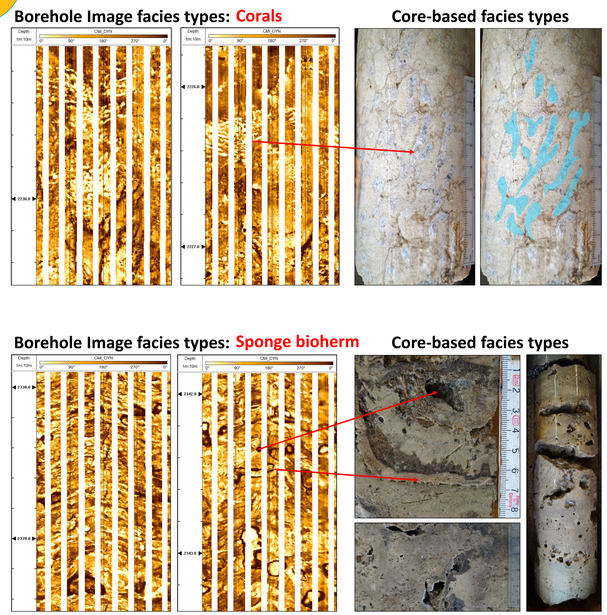
A SYSTEMATIC WORKFLOW FOR GEOTHERMAL EXPLORATION IN CARBONATES: THE UPPER JURASSIC OF THE MOLASSE BASIN / GERMANY

Philipp Wolpert, Thomas Aigner, Kilian Beichel and Daniel Bendias

1 CORE DESCRIPTION



2 LINKING CORE WITH BHI FACIES



WORKFLOW:

(1) The core description reveals 22 facies types and 4 facies associations.

(2) Not all core-based depositional facies can be differentiated unambiguously from the BHI. A rock catalog helps to capture diagnostic criteria of facies from core and to link it with the BHI. Based on this, genetically related depositional sequences can be delineated. The vertical stacking pattern of image facies and marker beds allows ,therefore establishing a robust sequence stratigraphic framework.

(3) Borehole image facies (facies associations) and sequences are integrated into the seismo-stratigraphic interpretation. The seismic interpretation reveals the mayor depositional elements and reflects the schematic cross-section shown in (1). The borehole image facies and facies associations are used to validate the seismic facies interpretation.

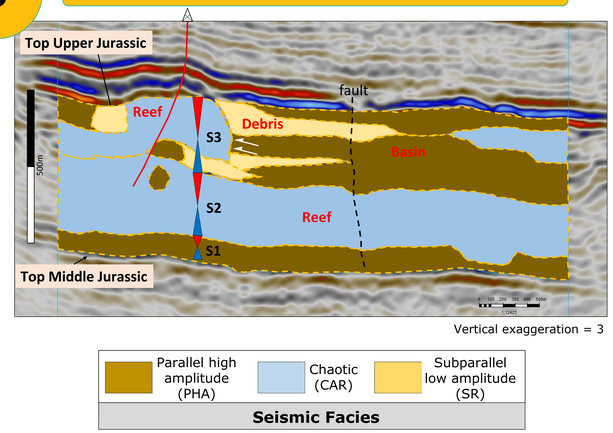
(4) Internal heterogeneities (like baffles, compartmentalization, karst) within the biohermal/reef reservoirs, which are below seismic resolution, can be recognized on the BHI and are key for the geothermal exploration strategy.

(5) Seven geothermal reservoir types are identified and linked with dynamic data. This highlights the most important flow zones, explains their origin and predictability in a sequence stratigraphic context.

CONCLUSION:

- **THE UPPER JURASSIC GEOTHERMAL SYSTEM IS A COMBINATION OF STRATIGRAPHIC AND STRUCTURAL TRAPS.**
- **A SEQUENCE STRATIGRAPHIC FRAMEWORK IS PARAMOUNT TO UNDERSTAND GEOTHERMAL SWEET SPOTS.**
- **INTEGRATION OF DYNAMIC DATA AND RANKING OF RESERVOIR DRIVERS HELPS TO UNDERSTAND FLUID FLOW BEHAVIOR.**
- **THE CAPACITY OF THE PRODUCER WELL IS ONLY AS GOOD AS THE CAPACITY OF INJECTOR WELL (OFTEN THE BOTTLENECK).**
- **IMPORTANT TO AVOID INTER-WELL CONNECTIVITY VIA HIGH-K STREAKS TO PREVENT EARLY THERMAL BREAKTHROUGH.**

3 SEISMO-STRATIGRAPHIC INTERPRETATION



5 INTEGRATION OF DYNAMIC DATA

Well 1 (Producer)

Reservoit type	PLT (spin flowmeter)	Stratigraphic Position
Fractures/Fault	100%	Structural feature. But tendency of clay-smear in Sequence S3 (closed).

Well 2 (Injector)

Reservoit type	PLT (spin flowmeter)	Stratigraphic Position
Shallow water facies	26 %	Highstand, regressive-hemi Sequence S3
Karst	47 % (S3) and 6 % (S2)	Sequence boundary S3 and Sequence boundary S2
Bioturbation	7 %	Highstand, regressive-hemi Sequence S3
Internal baffles	9 %	Below MFS Sequence 3
Bioherm/Reef debris	5 %	Lowstand and Highstand, Sequence S3

4 GEOTHERMAL RESERVOIR TYPES