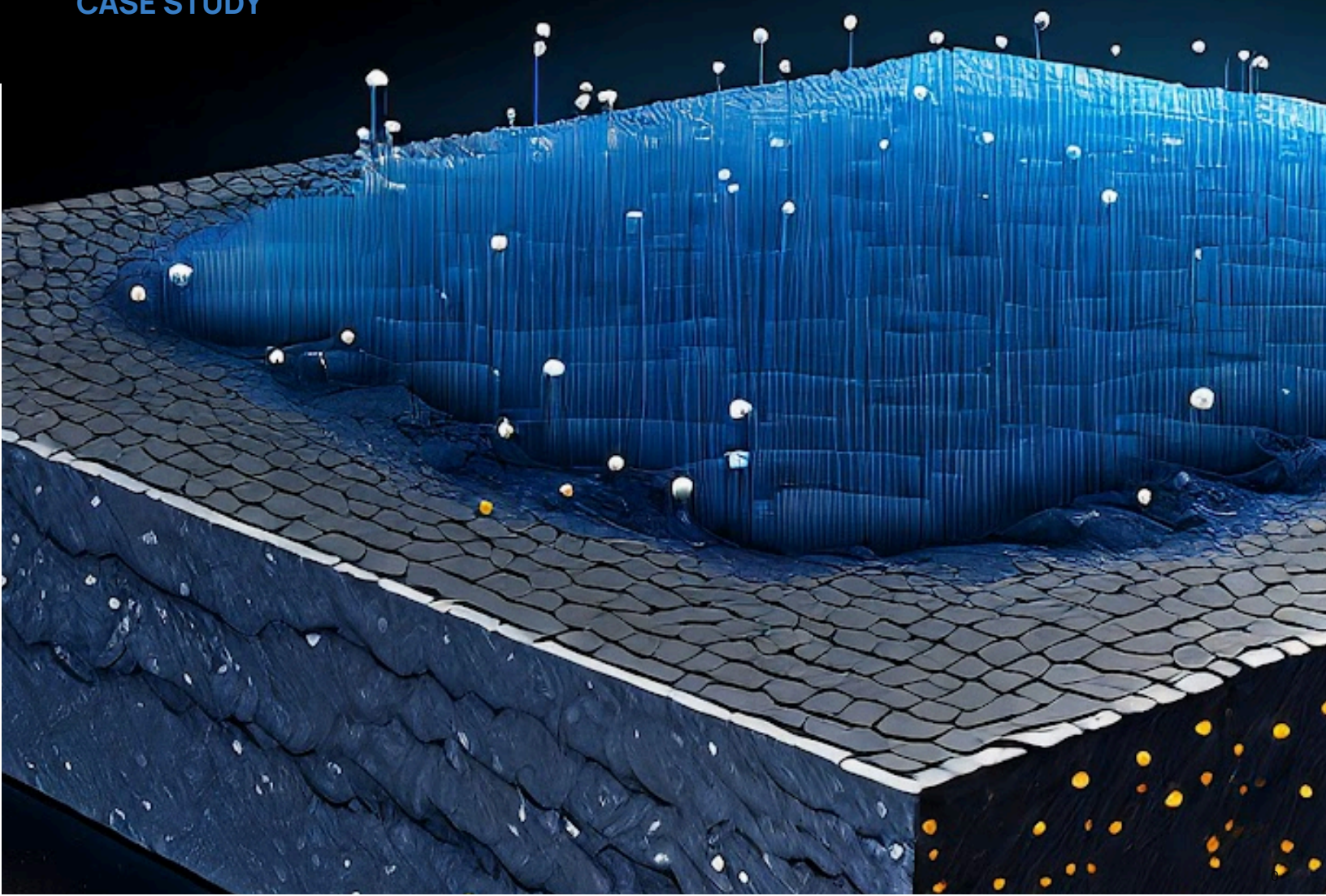
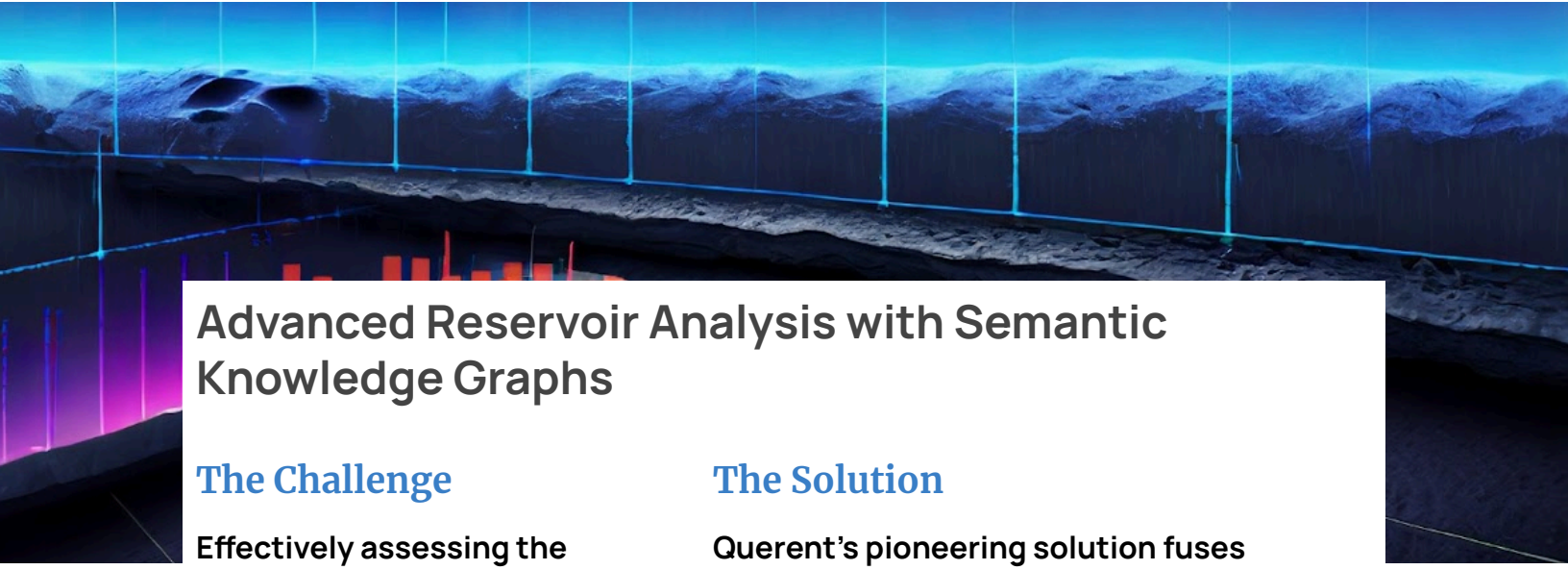
QUERENT

Discovering complex reservoir insights using semantic knowledge graphs

CASE STUDY





Advanced Reservoir Analysis with Semantic Knowledge Graphs

The Challenge

Effectively assessing the potential of geological reservoirs for Carbon Capture, Storage, and Utilization (CCUS) is crucial for mitigating climate change. However, traditional methods struggle to integrate diverse data types and sources comprehensively, hindering robust reservoir management and CCUS project planning.

Understanding the geological characteristics of a reservoir is paramount for successful long-term CO2 storage projects. Depleted reservoirs offer abundant data to assess CO2 injection risks, while saline aquifers require extensive exploration due to their vastness. Caprock integrity varies between saline and depleted reservoirs, impacting pressure management during injection.

The Solution

Querent's pioneering solution fuses multimodal learning and semantic knowledge graph computing- two powerful elements that had the potential to completely transform the landscape of reservoir analysis.

To validate this inventive approach, Querent AI embarked on an exhaustive venture. Our research team scrutinized an exhaustive dataset of **500 scientific documents** pertaining to five key reservoirs: Ghawar Field, Eagle Ford Shale, Johan Sverdrup Field, Karachaganak Field, and Maracaibo Basin. The chosen dataset was then transformed into semantic knowledge clusters, a process that facilitated the identification of crucial entities and the meaningful relationships between them.

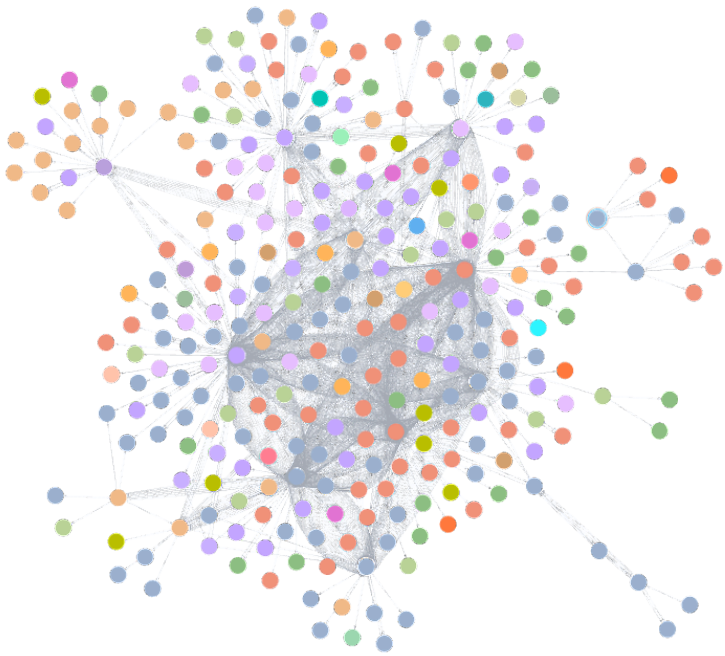


Figure 1: Semantic knowledge graph of the entire dataset

Complex and integral data such as geological features, well logs, production rates, and seismic data was seamlessly interconnected via a robust semantic knowledge graph. Each node was linked with others to denote significant relationships, such as stratigraphic proximity, fluid dynamics, or influences on reservoir behavior.

The Impact

The use of Querent's AI-Driven solution allows geological researchers to retrieve broader contextual information, providing insights that direct connections alone could not reveal.

Additionally, the integration of vector similarity and semantic knowledge graph computing enhanced whole dataset reasoning tasks, ensuring fast retrieval of factual information with increased precision.

The visualization of comprehensive geological, operational, and engineering factors enable more accurate assessments of a reservoir's potential for oil and gas production.

The practical application of this method is then demonstrated through specific queries. The system retrieves the most relevant information, then generates a focused subgraph enabling the retrieval of broader contextual information providing insights direct connections alone may not reveal.

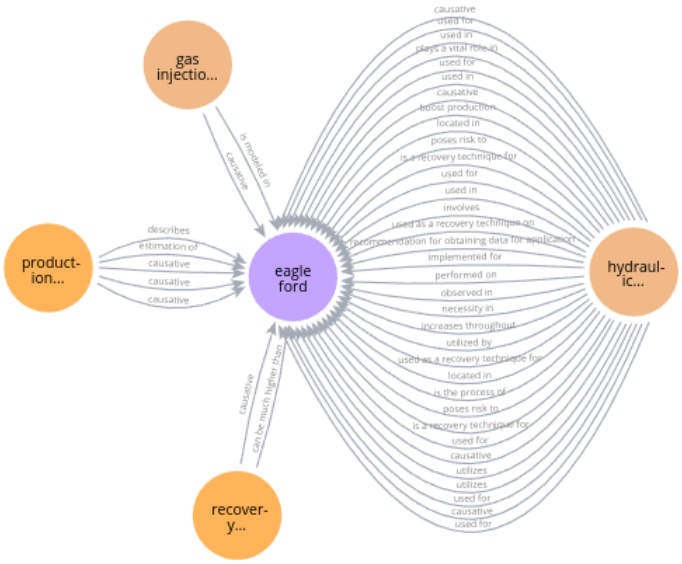


Figure 2. Eagle Ford Shale reservoir, focusing on recovery techniques, reservoir characteristics, and production metrics.

Sample Insights

Impact on Production Rates
The data points to the effectiveness of fracking in increasing production, a vital factor for the economic viability of shale operations.

Recovery Factor Improvements
The recovery factor is mentioned in relation to hydraulic fracturing, a technique implied to potentially increase recovery factors, making it an essential practice for maximizing the extraction of available resources.

Technological and Geological Challenges
Observations in the data suggest implementing these recovery techniques in the Eagle Ford Shale involves navigating technological and geological challenges such as managing induced seismicity, ensuring cap rock integrity, and optimizing fracture networks to improve hydrocarbon flow paths.

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