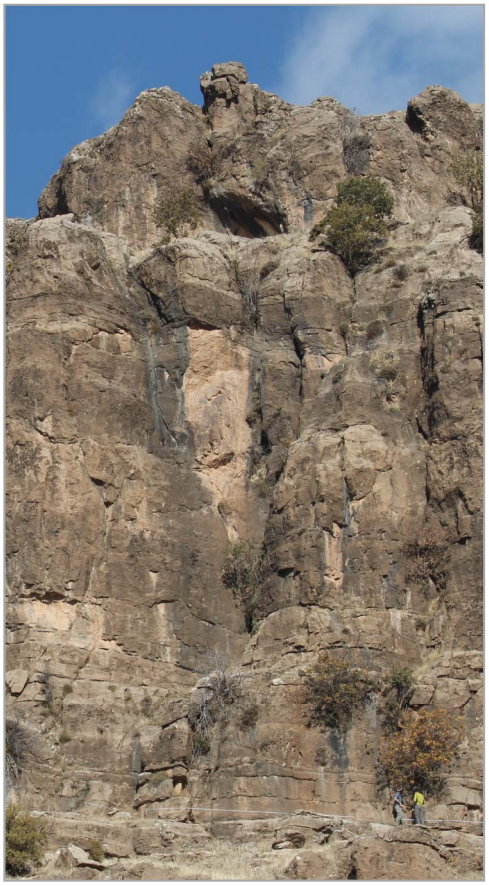
Quantitative Characterisation of Fractured Jurassic and Triassic Reservoir Units, Kurdistan

Product Summary

Based on 221 collective days of detailed fieldwork and thousands of hours of processing and interpretation, we provide quantitatively constrained fracture parameters that can be used to improve the accuracy of fracture modelling and prediction of fracture porosity, connectivity and permeability for all the major Jurassic and Triassic reservoir units in Kurdistan.

Data is correlated with subsurface wells using detailed outcrop logs, gamma ray outcrop measurements, and dated samples from across the Kurdistan region. Localities include the stratigraphic type sections, and locations that are not usually accessible near Iraq's borders with Turkey and Iran.

This product is a successful multi-client collaboration supported by most of the companies that were targeting Jurassic and Triassic reservoirs in Kurdistan prior to the start of the project in 2013.

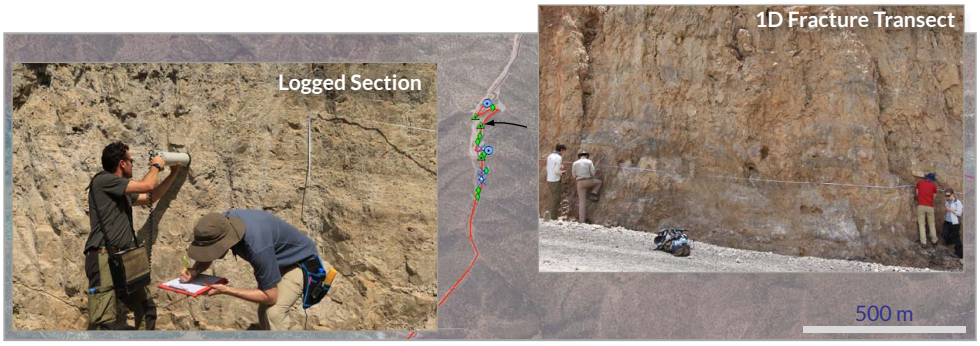


Direct Relevance to E&P Challenges

The outputs of the study are specifically aimed to provide you with:

- In-depth understanding of the most significant factors affecting fracture porosity, permeability, and reservoir connectivity.
- Conceptual understanding of the fracture systems for each formation — and a clearer basis for establishing high case and low case scenarios.
- Potential improvements in development strategy: new insights to optimise well planning and maximise fracture intersections with the wellbore.
- Quantitative parameters suitable for Discrete Fracture Network (DFN) and other fracture modelling.
- Detailed insight into intensity drivers needed when upscaling to create full-field predictive models.

> *"Excellent! We simply took values direct from your report straight into our fracture models … easy!"*
>
> Fractured reservoir expert from a European supermajor in 2016, following purchase of our Kurdistan Triassic-Jurassic study.



Example background map showing location of logs, fracture transects, 3D datasets and hand samples, overlain on GRL's Zagros-wide digital geological map (available separately). From northern Kurdistan near the Turkish border.

Pricing

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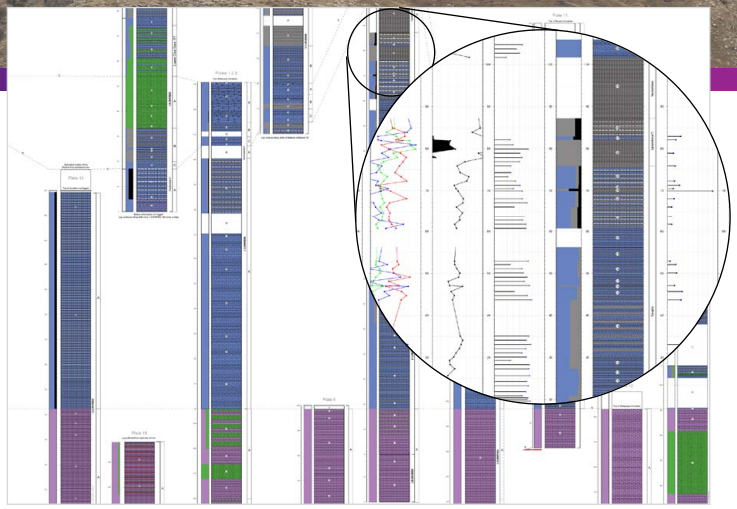
Fracture Analysis

Integrated Geoscience from Fieldwork, Satellite and Sub-Surface Data

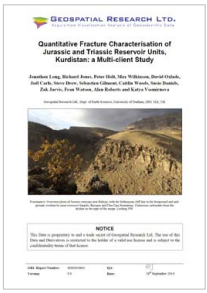


Characterisation of the fracture systems is based on detailed outcrop studies, analysis of Cretaceous cliff-sections, and multi-scale satellite image analysis.

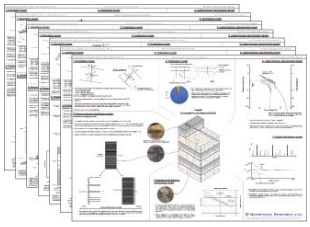
Product Details

Product deliverables are focused towards a set of conceptual fracture network models (CFMs) derived for each of the main reservoir formations. Each CFM is structured in terms of seven parameters that are central to fracture modelling:

- Fracture **orientation**, including allocation of fracture sets, analysis of the orientation of fractures relative to local bedding and large-scale four-way closing anticlines, and regional variations across Kurdistan.
- Linked fracture **size-intensity**, to predict multi-scale length and height distributions, and aspect ratios.
- **Spatial clustering**, to assess scale-dependant background fracture distributions, and fracture corridors.
- Vertical and horizontal **connectivity**, based on analysis of ca. 7300 fracture intersections and terminations.
- New insight into fracture **apertures** and **morphology**.
- **Mechanical stratigraphy** of the Jurassic and Triassic units and implications for fracture size distributions and connectivity.
- **Intensity drivers**, including the effects of map-scale folds and faults on background fracture intensity.



Report



CFM plates for each formation

Appendices

Product Contents

- Fracture data was collected from 159 locations from northern, central and southern Kurdistan, within the **Chia Gara**, **Barsarin**, **Sargelu**, **Sehkaniyan** (**Alan-Mus-Adaiyah**), **Sarki** (**Butmah**), **Kurra Chine**, and **Geli Khana**. We have particularly rich data from the major reservoir units of the Sehkaniyan and Kurra Chine.
- 23 detailed litho-stratigraphic logs (including gamma ray and Schmidt hammer mechanical hardness measurements) were collected to help correlate the outcrops with corresponding units in the sub-surface. Regional correlation panels and well correlations are also included.
- In addition, hand samples from 47 locations were collected, of which 27 have undergone biostratigraphic dating (by RPS Energy). All samples have been analysed in detail petrographically to correlate the logged section and associated fracture data to the subsurface.

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