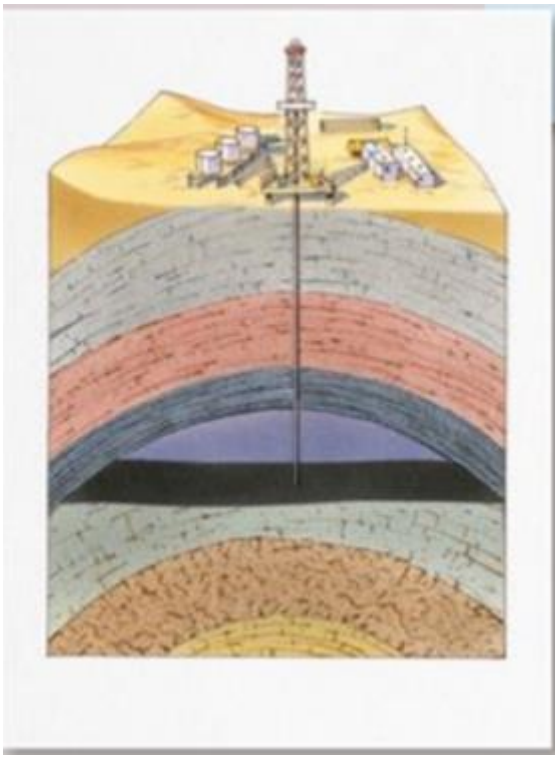

Formation Evaluation Product Development & Case Study

DEFINITION AND SCOPE OF WORK

Monsoon Semester | GPD502 | 2023

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Introduction

Hello everyone! Welcome to Formation evaluation tutorial. My self Partha Pratim Mandal, your course instructor. My specialization is experimental petrophysics, rock mechanics, geomechanical modelling, and rock physics. I will meet you over next 13 weeks during tutorial session. It is important to follow the tutorial session every week to understand the practical concept which will benefit you in long term for large scale data analysis/petrophysics/reservoir characterization. I will be available for online/face-to-face discussion after the class. Either python programming, Matlab or R skills are essential to complete the task.

Product Development

As part of this unit learning, combined team members will work on the development of an educational graphical user interface (GUI) for formation evaluation of wireline logs. The phase consists of four sections (i) data loading (ii) formation evaluation (iii) visualization and (iv) graphical user interface as displayed in Figure 1. A small outline of each section is provided below. A demo is visible by following this link https://github.com/andymcdgeo/las_explorer

Data loading: This section should read following format well-log file (.las), renaming of header, unit change. It should also allow loading of core data, formation tops information (.txt, .csv). Error message should be prompted for wrong data format.

Formation evaluation: This is the most important section of the product. It should contain bad data identification, nan removal, evaluate basic petrophysical properties (volume of shale, porosity, and saturation).

Visualization: This part will display different kinds of plots such as triple-combo, cross-plots, histogram, and core data. Include option to create reservoir flag and NTG ratio. Allow the user to choose different colour scale as required.

Graphical user interface: This part will combine the above three sections and allow the user to select different tabs (data loading, formation evaluation and visualization) separately and conduct formation evaluation of a well-log.

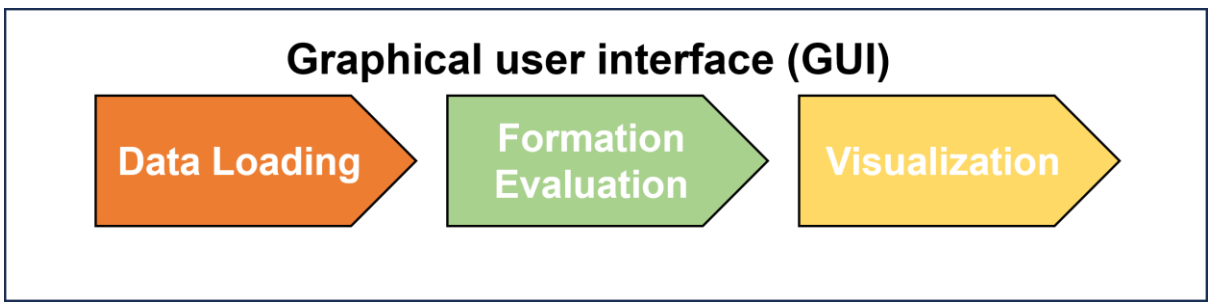

Figure 1 Basic graphical user interface to perform automated wireline log data interpretation.

Another python-based package is available for your reference.
https://code.agilescientific.com/welly/

You can review all the source files but need to bring your own idea to make it useful tool for academic purposes.

Marking of Product development: You will explain individual part as a team with selection of your own team leader. If there is more than 4 members, two persons need to explain the product. This section marking will be divided into three parts product design, usability and outcome (3 x 5 = 15).

Case study instructions

The aim of this exercise is to complete formation evaluation for Gorognichthys-1 well located in the NWS, Western Australia. You need to download digital log dataset, formation tops, porosity permeability database and well completion report. Your interpretation should be focused within Brewster member as outlined in Figure 2.

Link to download all information of Gorgonichthys-1 well:

https://wapims.dmp.wa.gov.au/WAPIMS/

Additional information can be downloaded or requested to commonwealth website:

https://nopims.dmp.wa.gov.au/nopims

1. Optimize total porosity calculation (combination of neutron and density log) after calibrating with core data.
2. Calculate water saturation with Archie and Simandoux method respectively and compare.
3. Estimate NTG ratio (Cutoffs: V_{sh} < 50%, ϕ > 5% and S_w < 50%).
4. Build empirical porosity-permeability relationship from core data (you can discard anomalous data point during regression analysis). Use corrected permeability data for empirical equation derivation. Then compute continuous permeability profile from porosity log.

Geology and well information

The Ichthys gas-condensate field is located in the Browse basin, North West Shelf, Australia with water depth ranging from ~200m to 400 m. This field consists of a ~600 km2 anticline structure. Produced gas and condensate will be brought to an onshore liquefied natural gas (LNG) plant in Darwin through a ~890 km long subsea pipeline. The Brewster Member of the Early Cretaceous Upper Vulcan Formation is one of the main reservoirs in this field (Figure 2). The Brewster Member consists mainly of thick bedded, massive sandstone (quartz arenite) with a very high net-to-gross (NTG >90%) sand ratio (Syed et al., 2018).

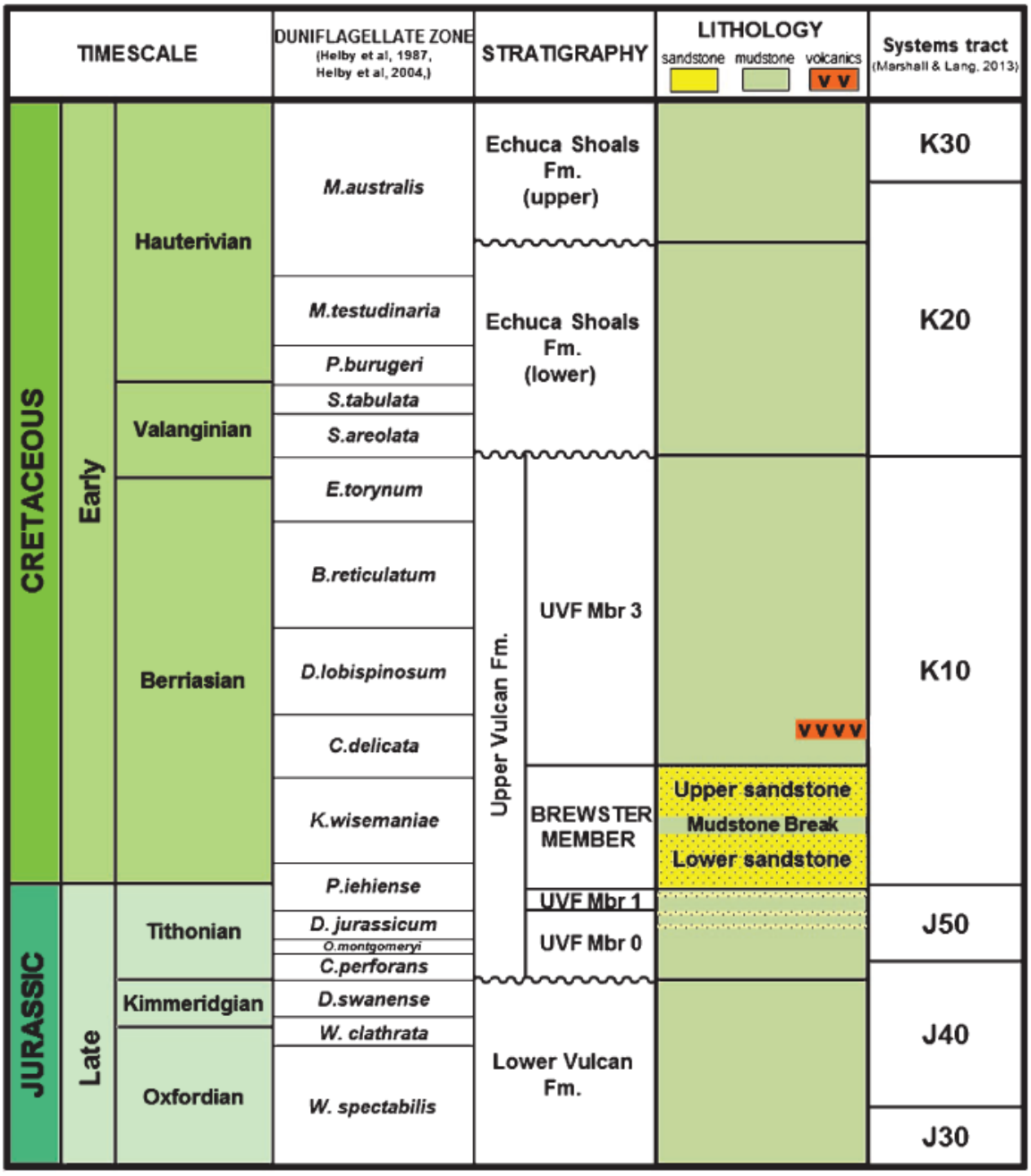

Figure 2 Generalized stratigraphy of the Ichthys field (Arsalan et al., 2017).

The Gorgonichthys-1 exploration well was drilled in the Exploration Permit WA-285-P on the North West Shelf. The well is in the central part of the Browse Basin, about 420 km north-northeast of Broome (Figure 3).

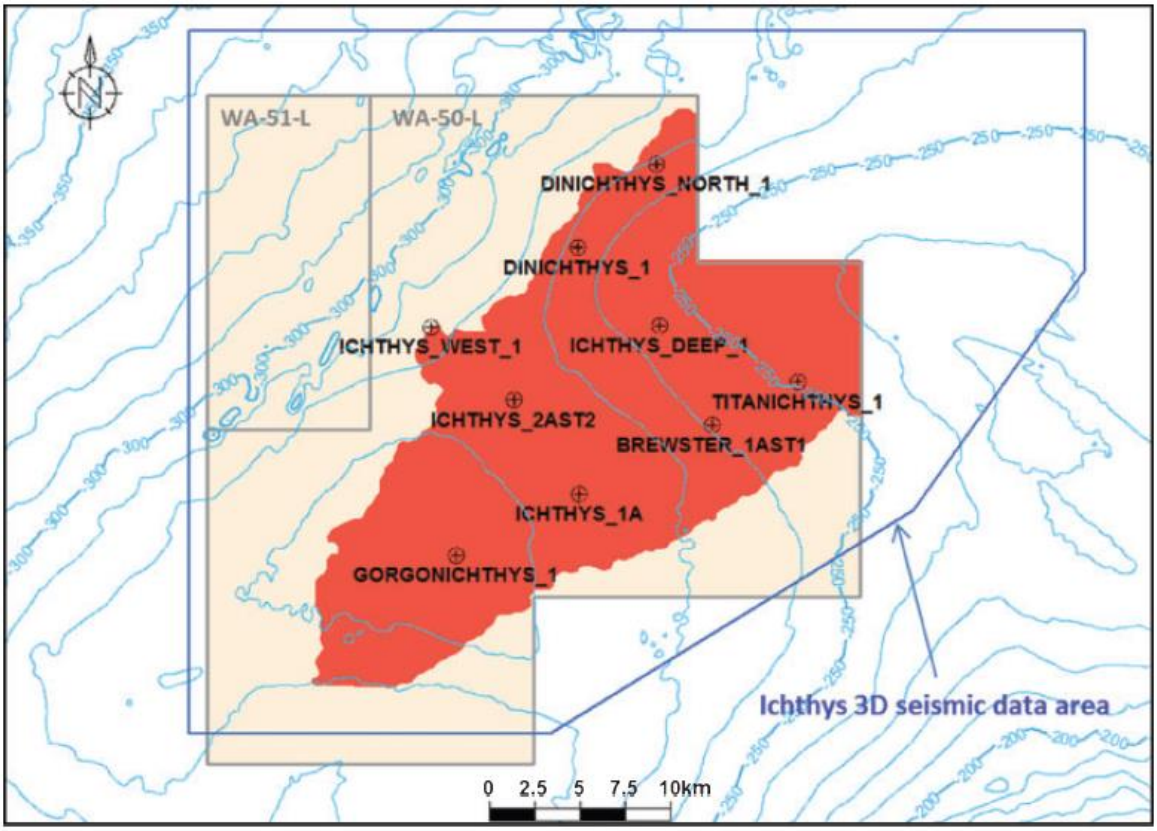

Figure 3 Ichthys filed 3D seismic contour and drilled well location (Arsalan et al., 2017).

References

Arsalan, S. I., Ichizawa, K., & Furuya, K. (2017). Visualisation of geomorphological features and interpretation of the depositional system of the Brewster Member, Ichthys Field. *The APPEA Journal*, *57*(1), 288-300.

DMIRS (2019). Petroleum and Geothermal Information (WAPIMS). https://www.dmp.wa.gov.au/Petroleum-and-Geothermal-1497.aspx.

Case Study Presentation Guidelines

Each group is required to prepare a professional presentation. The presentation should be 15 minutes in length (each student ~4 minutes) and 5 minutes for QA. All group participants should take an active role in both preparing for the case study and presenting it.

Marking scheme for group presentations (15 marks)

Content: (50%)

- Is the group presentation well-organized and interesting?
- Has the group answered the case study questions and present them clearly?
- Have they given relevant concepts/theories/ideas and knowledge to the questions?

Presentation Style: (30%)

- Is the presentation lively and interesting?
- Is it structured effectively with a clear introduction, results, discussion, conclusion supported by evidence?
- Have the group shown initiative and creativity in the design of the presentation?
- How well do the presenters present themselves? Voice projection, eye contact, confident delivery, and interactions?
- How well prepared are the group to answer or pose questions that are relevant to the topic?

Group skills: (20%)

- Is the presentation clearly an integrated group effort as opposed to individual contributions?
- How well have they co-ordinated their activity and planned their presentation?

Marking of the presentation

Marking total -15	Content - 8	Presentation style - 4	Group skills - 3
Group-1			
Group-2			
Group-3			
Group-4			
Group-5			
Group-6			
Group-7			