Basement Evaluation- An Integrated Workflow

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Keywords

Basement, facies, fractures, stonely, RQI, NPI.

Summary

The present study is carried out, using all modern day logs in the eight basement wells of Pandanallur and Madanam Fields of Cauvery Basin, with the objectives to understand open fracture intervals, present day stress direction and reasons for variations in log characters of Basement across different wells. The Basement encountered in wells of Madanam Field has more productive zones as most of the wells are proximal to the faults and the fractures are critically stressed. Reservoir Facies Analysis coupled with semi quantitative water saturation estimations characterize the producible facies in a better way. Development of suitable work flows including all high tech logs for comprehensive evaluation and calibrating with dynamic flow characters make the Basement reservoir exploitation more successful.

Introduction

Basement exploration in Cauvery basin has got impetus in recent times with the establishment of basement play in Madanam and Pandanallur areas of Ariyalur-Pondicherry sub-Basin. However, uncertainties in the nature of basement characters and fracture patterns have been translated into anomalous behaviour of these unconventional reservoirs in terms of hydrocarbon occurrence and producibility. A series of longitudinal faults trending northeast/southwest are the main extensional faults associated with the syn-rift regime of the Basin formation, and an orthogonal fault system trends northwest/southeast dissecting the older northeast/southwest-trending fault is also noticed. These fault systems played a major role in hydrocarbon accumulation and migration in the entire Basin.

Study Approach

An integrated approach has been adopted for basement evaluation by combining all the qualitative and quantitative evaluation methods viz. fracture analysis through processed micro resistivity image data, identification of permeable fractures & anisotropy analysis through sonic attributes, reservoir & rock facies characterization through CMR & ECS-NGS logs, water saturation computation using conventional $P^{1/2}$ method and finally validation through PLT and testing results.
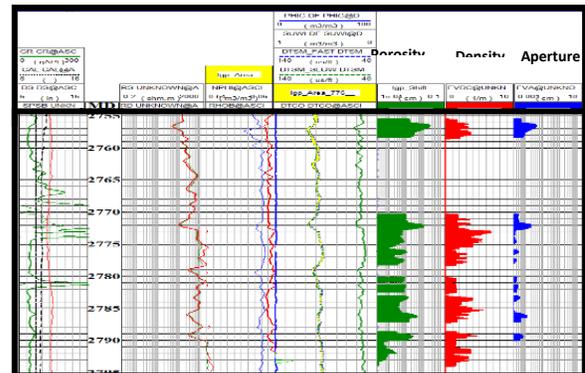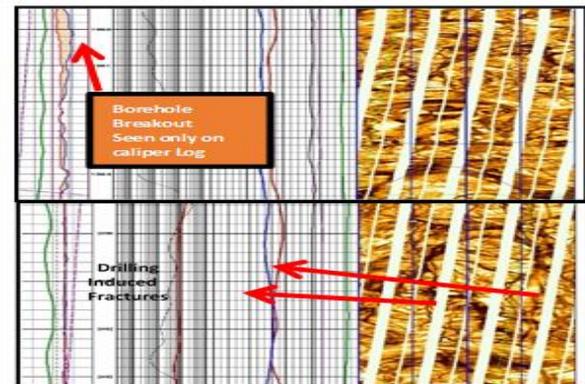

Fig.1 Fracture Attributes

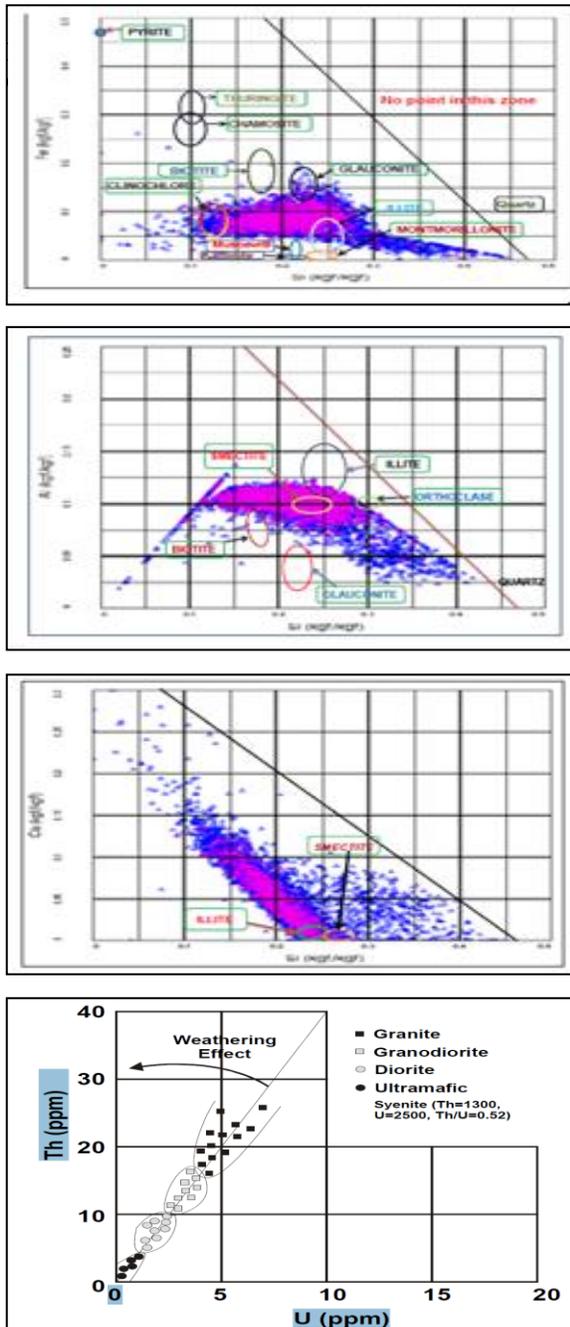

Fig.2 DIF and Borehole Breakout

Fig.3 **Ca vs Si, Fe vs Si, Al vs Si and TH-U crossplots.**
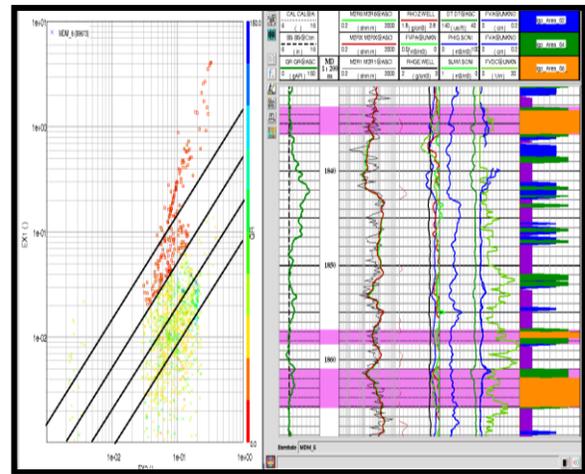

Fig.4 **A log-log plot of RQI and NPI taking GR on Z-axis.**

Conclusions

The analysis of natural fracture vis a vis present day stress orientation indicate that studied wells in Madanam field have good fracture system and most of the fractures are oriented in present day stress direction. These wells are also proximal to the faults. These may be the reasons for good production. In Pandanallur area less number of fractures are observed in basement section and many of them are not critically stressed, thus vindicating less or non-producibility character of basement in this area. The $P^{1/2}$ method of saturation estimation appears to be more suited for weathered basement than the fresh /fractured basements

The overlay of elastic stonely slowness computed from shear slowness and density and measured stonely slowness indicated that weathered portions are having more permeable layers compared to the mafic bottom sections. The top parts of the wells, where PLT characterizes the producibility from these layers, are seen to be more felsic from cross plot analysis of ECS & NGS logs (Fig.4). Reservoir Facies Analysis coupled with semi quantitative water saturation estimations characterize the producible facies in a better way (Fig.4). A detailed workflow incorporating all advanced tools data along with convergent interpretation inferences would define better evaluation procedures.

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