A NEW APPROACH AND PROSPECTIVITY OF SAND INJECTITE IN MALAYSIA

Askury Abd Kadir & Tengku Amran Bin Tengku Mohd
Geoscience & Petroleum Engineering Department,
Universiti Teknologi PETRONAS, 31750 TRONOH, Perak

ABSTRACT

In recent years, there has been increased interest in sandstone injectite features as a significant source for reserve calculation. Sand injectites are classified into ‘intrusive’ bodies, which result from the remobilization and injection of sand into fractures due to factors such as overpressure, hydrocarbon migration, diagenesis and seismicity. Their occurrences are in the form of sandstone dykes (discordant to bedding) and sills (concordant to bedding) structures. Typically, such fractures are in sedimentary strata. The development of technology and knowledge led the recognition of injectites as an attractive exploration targets with huge significance when planning and optimizing hydrocarbon recovery. They have long been considered mere geological oddities and often being misinterpreted (Figure 1) for insignificant features as their thickness is beyond the resolution of conventional seismic data. Outcrop observation and subsurface exploration including cores, wellbore image logs and seismic sections (Figure 2) are typically utilized to recognize their assemblages and features. The objective of the study is to gain better understanding on the features and characteristics of injected sands as a new prospective fluid conduit in reservoirs as well as their mechanics, implications and challenges. This preliminary study has been conducted based on literature review of published papers, journals, books and other resources, which are gathered, analyzed and revised in accordance to the relevance of the project. Three case studies were analyzed on Gryphon, Volund and Alba Fields highlighting their successful explorations in terms of injectite styles and significance for exploration and production. The results provide better understanding on injectite features which contribute additional reserves, improve the connectivity between reservoir layers and are characterized by chaotically distributed, unconsolidated sands with high porosity and permeability, forming excellent pay zone. Injectite explorations in Gryphon, Volund and Alba fields showed their characteristics as good quality reservoirs which may not be simply ignored for future exploration targets. Do we have sand injectites in Malaysia? Perhaps, we need to re-examine an oil-prune formations in Malaysia which is more emphasis on sand injectite conceptual.

Figure 1: Two models of sandstone distribution interpreted from one set of well data (Source: Braccini et al., 2008)

Figure 2: Cross section of seismic migrated stack trace data volume showing steeply dipping events, interpreted as sandstone injectites (arrow), (Source: McCugo et al., 2003)
REFERENCES

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BASIN MODELING OF MALAY BASIN EASTERN FLANK FOR PREDICTION OF SOURCE ROCK POTENTIAL

Ku Rafidah Ku Shafie & Lakhdar Benchilla

The offshore eastern flank of Malay Basin is considered a challenging phenomenon for petroleum exploration in the synrift plays. The large amount of quality data from Petronas provides an opportunity to reduce the uncertainty in geological risks to exploration success in these deep plays. The application of basin modeling technique such as PetroMod in petroleum exploration giving us the ability to illustrate petroleum generation history of potential source rocks in our study area. The 1-D basin modeling was carried out on 12 calibration wells in the eastern flank of Malay Basin with an objective to investigate the presence of mature source rock and hydrocarbon charging in the study area. The red-dotted box in Figure 1 shows the location of the study area where the structural setting is severely affected by the tectonic evolution of the basin.

Temperature data for calibration of present-day temperatures in the wells were obtained from the log header and the data were generally of good quality. Those data were corrected using published methods, and results were generally consistent and reasonable. Most of the wells drilled in this block have penetrated the K and L groups and a few wells have penetrated the basement. Models were constructed within the PetroMod software program in the standard ways. The stratigraphy within each well was constructed as burial history by using the top formation depth and age. The deposition of all the stratigraphy in this area is based on the Regional Malay Basin Stratigraphic Chart (Figure 2).

Two source rocks were considered in this study: the Group L-Shale deposited during synrift episodes are widely interpreted as offshore lacustrine and the Group I that was deposited in the fluvial-deltaic environments (Madon et al., 1999). Hydrocarbon generation in Group L-Shale source rocks was modeled using Pepper and Corvi (1995) _TI(C), which should be appropriate for these source rocks. The Group L-Shale source rock was generated at 12.5Ma and significant oil generation was initiated at around 10.5Ma. The expulsion of large amounts of oil began at about the same time of the oil generation. This has allowed the oil to be trapped in the entire formation group (Epic Study, 1994).

Based on the geological concept, the Group-L source rock are onlapping at the half graben and is believed to be charging the basement laterally. This onlapping attribute can be observed in the seismic section. For the clastic part, most probably the Group K-Shale source rock will charge the K reservoir which is a stratigraphic play type i.e braided stream. In summary, from the perspective of total hydrocarbon generation and expulsion, L-Shale is a potential source rock in this area since most of the wells are discovered within oil zone in the basement play. Figure 3 demonstrated a