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Integrated Modeling of Karstification of a Central Luconia Field, Sarawak

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Abstract

It is well established that some of the carbonate fields in the Central Luconia Gas Province, Sarawak, Malaysia, have been subjected to karstification as demonstrated by sometimes severe drilling losses. Although significant progress has been made mapping and predicting these karstification features on seismic, there is quite some uncertainty left on the exact size and occurrence of these features. Furthermore there is little known about the impact of karstification on GIIP and water breakthrough.

For the field with the largest discovered GIIP in the Central Luconia Province, karstification was seen as the largest contributor to GIIP uncertainty. GIIP uncertainty was large, with a 40% difference between high and low cases, despite a long history of production. The field has been on production since 1987 and more than 60 % of the GIIP have been produced to date.

For the redevelopment study that kicked off in 2007, a 2006 repeat 3D seismic swath study gave information on the 2006 Gas Water Contact. Good quality 3D seismic attribute data enabled identification of karst features that were incorporated in reservoir modelling. This, together with the good reservoir surveillance data, made this field the ideal candidate for studying different aspects of karstification that are also relevant to the other fields in the area. Important questions are when did karstification occur, what is its morphology and most importantly, what is its impact on ultimate recovery?

Dynamic history matching and synthetic seismic data provided a means to sense check assumptions for karst dimensions and associated reservoir properties. As a result this detailed study work has not only reduced the uncertainty in GIIP and ultimate recovery for the field but will also help to improve understanding of the impact of karstification on reservoir performance of other Miocene carbonate fields.

Introduction

The studied field is a mature carbonate gas field located offshore Sarawak, Malaysia, approximately 175 km north-northwest of Bintulu in a water depth of 280 ft. The field was discovered in 1969 and is the largest gas field in the Central Luconia Gas Province, with a GIIP of 6 to 7 Tscf over an area of 90.5 km^2 (Figure 1). The field is an elongated carbonate build-up of Miocene age. The first 3D seismic data over the field were acquired in 2002, 15 years after first production.

The gas-bearing interval can be split into two main units: the Upper Reservoir (Zone 1 and Zone 2) and the Lower Reservoir (Zone 3). The two reservoir units are separated by a zone of relatively low porosity that forms a field-wide baffle (Zone 2.3).