ABSTRACT

Upper Miocene turbidites are a proven oil and gas play in the deepwater Kutei basin where over six tcf of gas and 200 million barrels of oil have been discovered to date. Pre-Miocene objectives are largely beyond the reach of the drill bit in most of the deepwater Kutei basin, except along an uplifted area south of the Mangkalihat Peninsula. Here Middle to Lower Eocene turbidite deposits are penetrated by a few wells and also exposed onshore. A regional integrated outcrop, core, petrographic and micropalaeontological study has constrained basin evolution, depositional history and the potential for petroleum system development.

Two main turbidite facies types are interpreted: 1) thin-bedded, low net-to-gross distal turbidites and 2) thick-bedded, high net-to-gross proximal turbidites. The distal turbidites are fine-grained arkosic arenites with limited reservoir potential. The proximal turbidites include fine- to coarse-grained, friable and porous, quartz-rich sandstones that form the primary reservoir objective.

Oil produced from onshore Miocene marine sandstone reservoirs and sampled surface seeps along the southern Mangkalihat Peninsula indicate a non-marine source rock. Basin modeling studies show that the top of the oil window is at about 2400 m, indicating Eocene or older source rocks. The presence of non-marine kerogen is thought to have been derived from transported organic matter deposited as organic-rich laminations within turbidite sandstone and mudstone deposits, similar to source rock models proposed by others for the Kutei basin Upper Miocene deepwater turbidite play.

A period of east-west compression during the Miocene to Pliocene resulted in reactivation of northwest- and northeast-trending faults creating a series of basin inversion anticlines creating a series of basin inversion anticlines along the margins of Eocene half grabens. A thick interval of Oligocene bathyal shale was deposited in the basinal areas flanking Oligocene carbonates deposited on the Mangkalihat platform, with the shale forming a regional top seal for the Eocene play.

INTRODUCTION

There are proven petroleum systems in several Paleogene rift basins in Indonesia (Howes, 1997; Doust and Noble, 2008). These are characterized by syn-rift terrestrial source rocks overlain by fluvial to marginal marine clastic and shallow marine carbonate reservoirs. Exploration for marine Eocene syn-rift petroleum systems has been limited primarily due to the perceived lack of: 1) high quality (particularly oil-prone) source rocks and 2) high quality reservoir rocks deposited in outer shelf settings.

New source rock models, such as Peters et al. (2000), have provided a better understanding on the controls of source rock potential in marine outer shelf and slope settings for the Miocene in the Kutei basin. Recent drilling in the deepwater Kutei basin has confirmed the presence of high quality, oil-prone source rocks associated with transported terrigenous kerogen deposited within Upper Miocene turbidite sandstones (Saller et al., 2006). Over six tcf of gas and 200 million barrels of oil have been discovered to date from primarily Upper Miocene turbidite sandstone reservoirs in the deepwater Kutei basin (Guritno et al., 2003; Saller et al., 2006).

The purpose of this paper is to outline the play elements for a new deepwater Kutei basin play.