

Upper Miocene to Lower Pliocene Sigaboy Formation turbidites, on the Pujada Peninsula, Mindanao, Philippines: internal structures, composition, depositional elements and reservoir characteristics

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Abstract

Turbidites of the Upper Miocene to Lower Pliocene Sigaboy Formation on the Pujada Peninsula, southeastern Mindanao, Philippines, potentially provide a superb record how a forearc basin may fill up. Investigation of the basin sequences allows the provenance of the material to be established and hence the data are useful for tectonic models of the sub-region. In addition, information obtained from the basin may give insights that are useful for petroleum exploration, which Mindanao is an important area.

The Sigaboy Formation is exposed for ~45 km along the western coast of Pujada Peninsula. The unit directly overlies various levels within the Pujada Ophiolite. Various facies within the formation, identified from the detailed stratigraphic logs of six major outcrops, represent channelized and unchannelized deposits of submarine fans that were deposited largely by turbidity currents. Field and petrographic evidence suggest that the portions of the Sangihe arc and its uplifted outer arc ridge (now forming the Pujada Peninsula) provided the main source of detritus that was shed into the forearc basin. This event probably followed the initial subduction of the Snellius Plateau-Halmahera Arc in Mindanao (latest Middle Miocene) and prior to the initiation of the Philippine Trench in the region (<5 Ma). Although the outcrop of the Sigaboy Formation is in places limited, it is likely that there were numerous point sources feeding material into the basin. Porosity studies of the different facies of the Sigaboy Formation from various stratigraphic intervals clearly show that porosity is very low, rarely exceeding 5%. The unstable mineralogical characteristics of the different facies of the formation, diagenesis (replacement, compaction, and cementation) and the poorly sorted character of the deposits contribute greatly to this physical attribute. Such findings cast doubt as to whether the turbidites in the adjacent basins can be viewed as possible petroleum reservoirs.

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Keywords: Sigaboy Formation; Turbidite; Facies; Forearc basin; Submarine fan

1. Introduction

An increasing emphasis in the oil industry on the exploration for turbidite-hosted reservoirs has been the driving force behind the growing research on turbidite systems (e.g. Shanmugan and Moiola, 1991; Johnson et al., 2001; Hickson and Lowe, 2002). Significant information about the facies architecture of a turbidite system is derived from the study of modern submarine fans. However, such information is often limited to the geometry of

morphological features and lateral continuity of facies. The value of modern studies is also hampered by the limited resolution of remote sensing techniques which are used to gather data from the deep marine bodies (Hickson and Lowe, 2002).

Outcrop studies of turbidite units allow a more precise documentation of the preserved facies, particularly on their internal structure/s, thicknesses, vertical stacking and other attributes such as grain size, sorting and composition. The well-exposed Upper Miocene to Lower Pliocene Sigaboy Formation in southeastern Mindanao, Philippines, provides an excellent opportunity to examine the key features of a turbidite system. Extending for about 45 km, the formation consists of conglomerates, sandstones and mudstones.

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The sedimentology and depositional setting of the Sigaboy Formation has not been studied in detail, thus the stratigraphic architecture of this rock unit is unknown.

The work reported here is the first detailed sedimentologic study of the Sigaboy Formation. The main aim of the investigation is to provide a comprehensive overview of the facies and architecture of this rock formation, allowing the

depositional processes and environments to be elucidated. Facies, as defined by Mutti and Lucchi (1978), is used herein to indicate a group of strata or a single stratum with well-defined lithology, stratification, sedimentary structures and texture. The results of the study also permit the basin history to be deduced and provide insights into the petroleum exploration potential of the region.

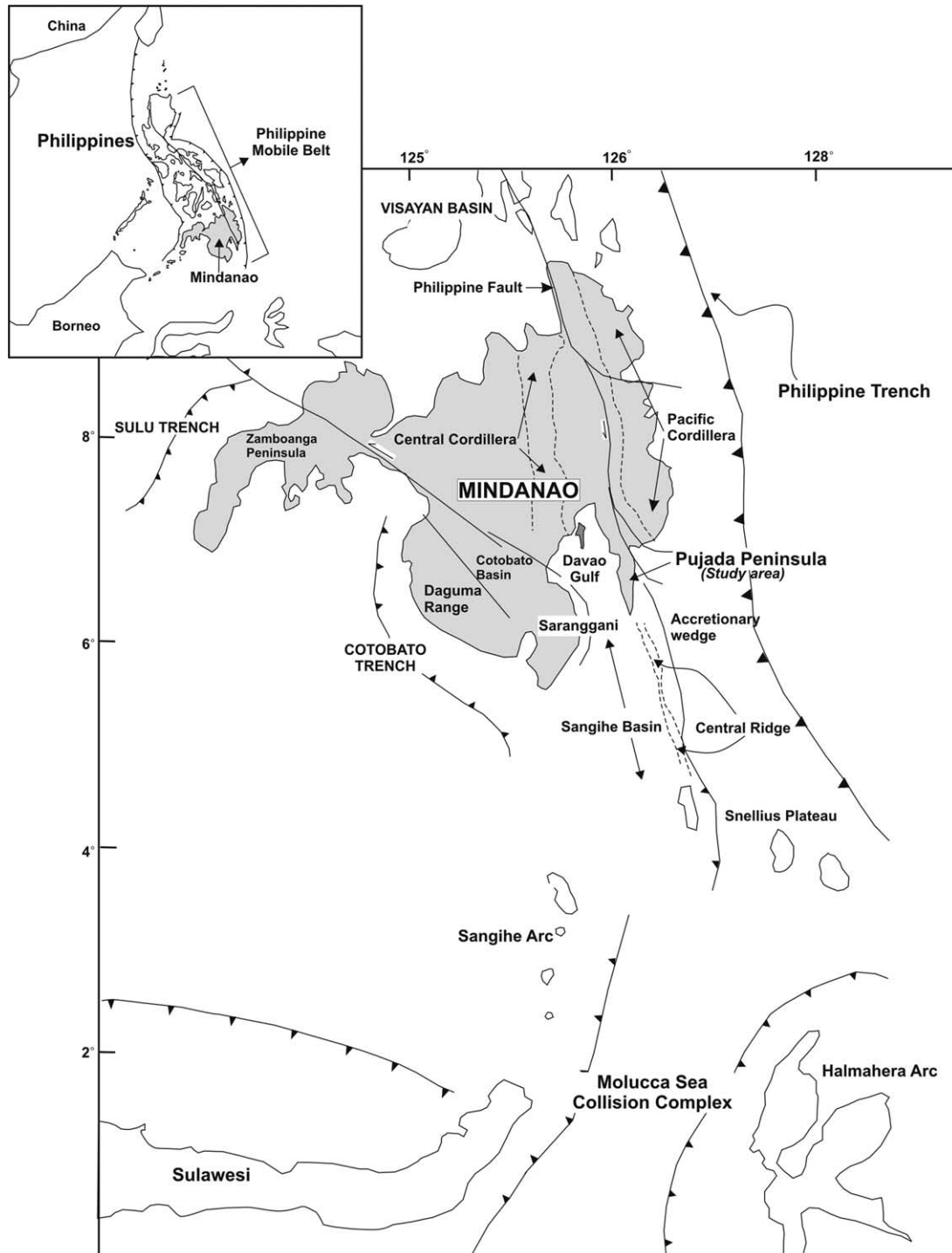


Fig. 1. Regional geologic setting of the study area (Hall et al., 1995a,b; Pubellier et al., 1999; Aurelio, 2000).

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