Frontier Exploration Using an Integrated Approach of Seafloor Multibeam, Drop Core and Seismic Interpretation – A Study Case from North Banggai Sula

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EXTENDED ABSTRACT

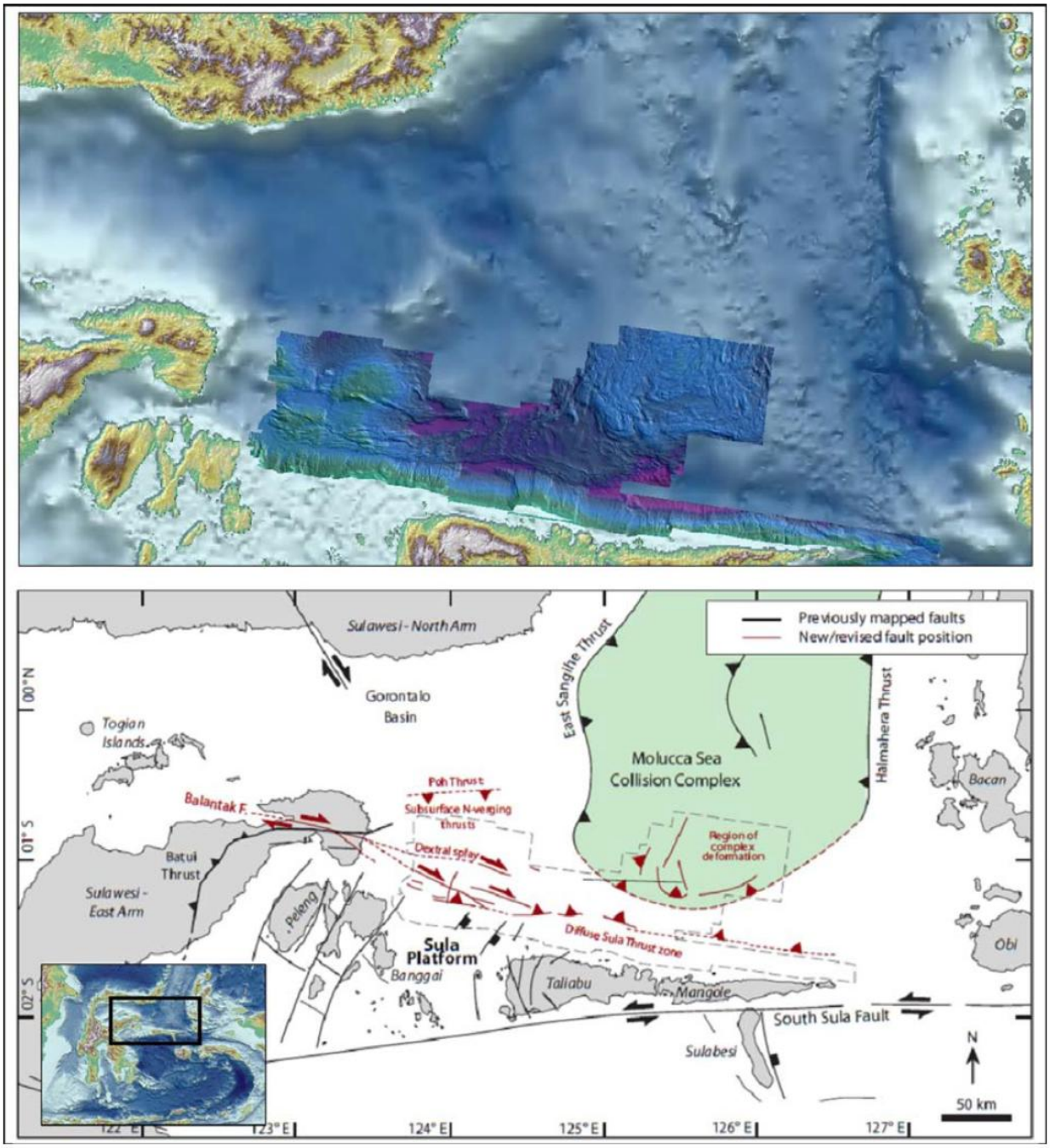


Figure 1. *Regional Structures Map (After Ferdian, 2010 and Ferdian et al., 2010).*

Exploration in frontier areas is always challenging and has resulted in the development of various new technologies including georeferenced, high resolution seafloor multibeam bathymetry and backscatter. The multibeam bathymetry data provides sea floor depth information, while the backscatter data records the amount of acoustic energy received by the sonar after interactions with the sea floor and are used to infer seabed features and materials. Interpretation of these new dataset combined with piston cores and seismic data have been conducted in the offshore of North Banggai Sula. This integrated approach has been termed as SeaSeep™ technology.

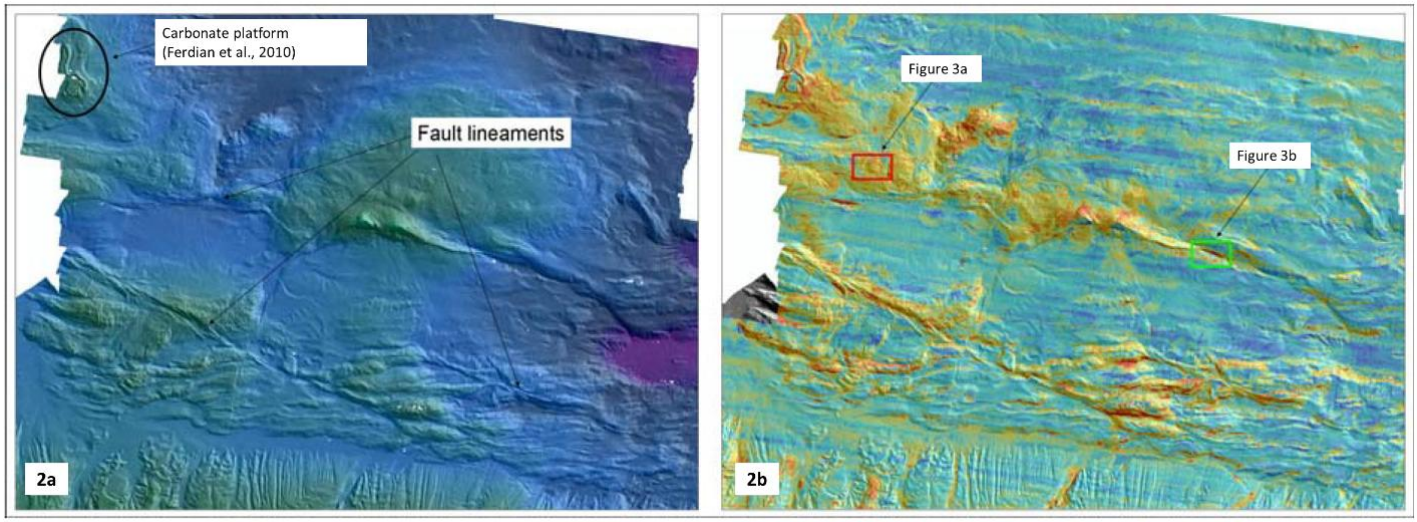


Figure 2. *Seafloor multibeam bathymetry (a) and backscatter (b) of the western portion of study area (After Ferdian, 2010).*

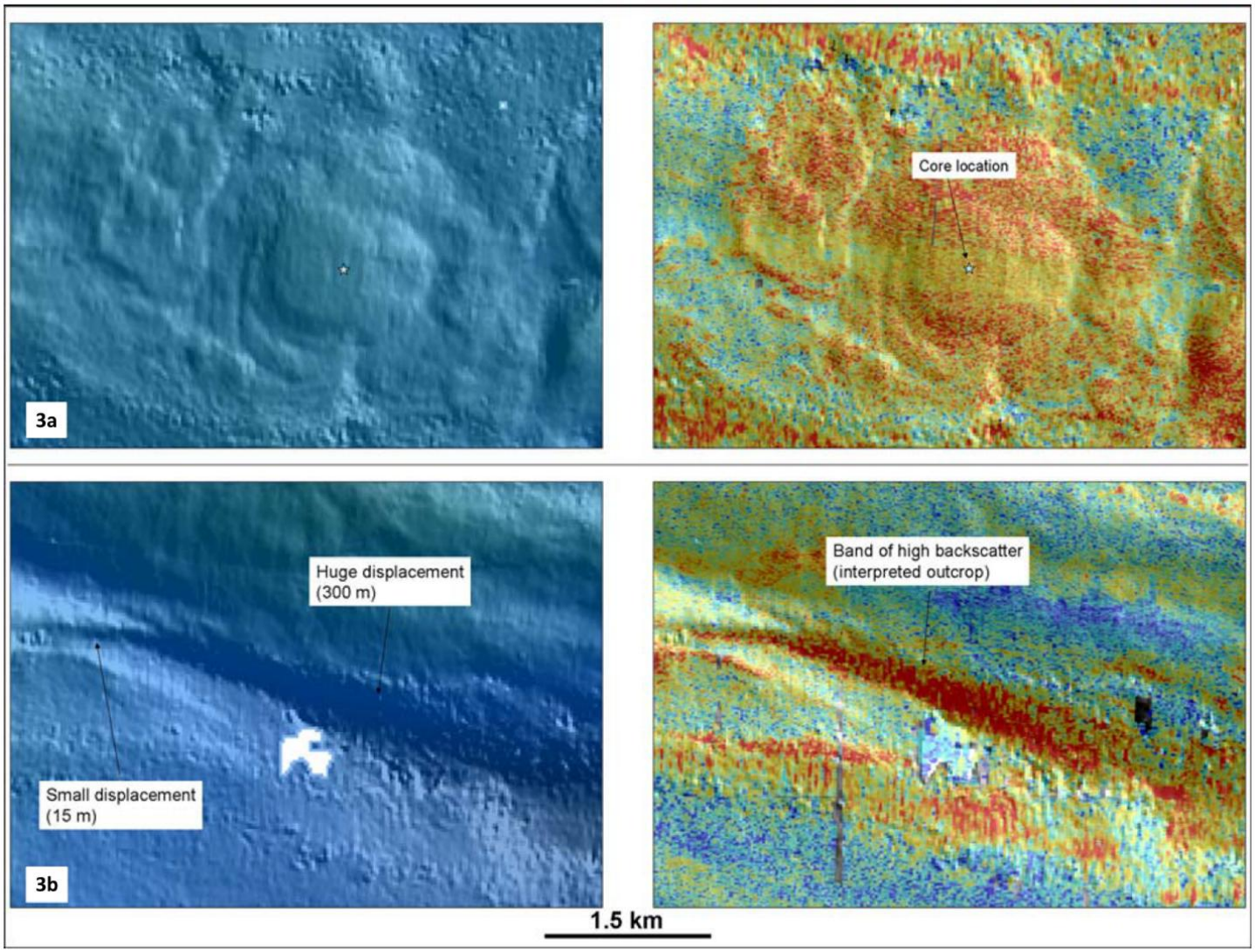


Figure 3. *Seafloor multibeam bathymetry and backscatter which corresponds with: 3a. Mounded feature interpreted as mud volcano; 3b. Subsea outcrop due to fault displacement.*

In 2007, TGS-NOPEC with co-operation of Migas has conducted Indodeep multi-client project which is comprised of acquiring seafloor multibeam bathymetry and backscatter, seafloor piston cores and regional 2D seismic survey across the frontier areas of Eastern Indonesia, including the study area presented here (Figure 1). Subsequent publications on the application of these new data (e.g. Decker et al., 2009; Noble et al., 2009; Orange et al., 2009; Riadini et al., 2009; Ferdian et al., 2010; Rudyawan et al., 2011 etc.) have given a new understanding of the geology and hydrocarbon prospectivity of these frontier areas. One of the publications, entitled "Evolution and hydrocarbon

prospects of the North Banggai-Sula area: an application of Sea Seep™ technology for hydrocarbon exploration in underexplored areas" and was written by current author and published in the Proceedings of 2010 IPA Convention, is summarized here as this extended abstract.

Interpretation of both seabed multibeam bathymetry and 2D seismic lines has identified several new structures in the area (Figure 1). In the west, a dextral fault system is clearly identified which is thought to continue onshore to the Poh Head of Sulawesi's East Arm. In this Poh Head area, an abrupt elevation change with steep-sided topography most likely indicates a strike-slip fault. Along the slope base of Banggai-Sula Microcontinent (BSM) a series of relatively south-verging thrusts is identified. However, these thrusts are not a single fault system such as the so-called North Banggai-Sula fault that has been published by many workers (Hamilton, 1978; Silver, 1981; Silver et al., 1983; Garrard et al., 1988; Davies, 1990). These thrusts are actually formed by at least two different events: in the west it relates to the dextral fault system described above, while in the east it formed as a southward continuation of the widespread south-verging thrust due to gravitational slide from the Central Molucca Sea Collision Zone. In the middle area where these two structure systems met, a large scale slip plane was formed at the seafloor.

Multibeam backscatter data show numbers of anomalously high backscatter areas across the study area which correspond to locations of fault lineaments (Figure 2), mud volcanoes (Figure 3a), authigenic carbonates and possibly outcrops (Figure 3b) [Ferdian, 2010]. The well-positioned of the piston cores deployed into these anomalies can give further insights on the sedimentology of the basin through subsequent geochemical analyses performed by TDI Brooks. Seven core locations contain possible migrated liquid hydrocarbon (oil), 5 locations of possible migrated thermogenic gas and another 5 locations of possible migrated both oil and gas. Hydrocarbon charges from certain parts of this area show definite marine characteristic (Noble et al., 2009) with the Mesozoic marine shale (i.e. Buya Fm.) being the possible source rocks.

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