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Finding the Pearl in the Pearl River Mouth Basin, Offshore China: A Deepwater Turbidite Oil Play?

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Abstract:
The Pearl River Mouth Basin (PRB), offshore China, is reexamined in light of
- advances in understanding deepwater depositional systems;
- better data analysis and display tools and techniques;
- recent experience in South Atlantic margin basins and offshore Borneo illustrating correlations between potential field data and controls on sediment distribution systems.

The Pearl River Mouth Basin is a passive margin rift system composed of three subbasins. The southernmost of these, the Zhu II subbasin, is significantly extended in a new interpretation that integrates potential fields data with geological literature in a GIS-based visual database. The PRB formed over Mesozoic continental crust and inherited the pre-existing tectonic zones of weakness of that crust (Pigott & Ru, 1994). Paleogene extension that formed the depocenters of the PRB occurred mainly from Late Eocene to Late Oligocene and included a component of dextral shear (Edwards, 1992). The shear may originate from reactivation of NW-SE trending strike slip faults (Xia & Zhou, 1993). These basement trends are well suited to imaging with potential fields data. The strike-slip faults appear to control some edges of subbasins and uplifts, including the Shenhu Uplift boundary with the Zhu II Depression. The shear trend also seems to influence the paleo-Pearl River drainage.

The initiation of seafloor spreading is marked by the 30 Ma “breakup” or T_7 unconformity, a key boundary separating the more isolated depocenters containing lacustrine source-prone rift fill from the succeeding and widespread paleo-Pearl River deltaics (Chen *et al*., 1994). The deltaic reservoirs in the Zhu I and Zhu III subbasins have been the target of most PRB exploration. Few wells have tested the edge of the Zhu II subbasin, where a lack of reservoir quality sands has been perceived (Letsch *et al*., 1994). Recent advances in understanding deepwater depositional systems (i.e., Posamentier, 2000; Dickson & Macurda, 2001) predict turbidite reservoirs well outboard of the deltaic environments explored to date.

Recent work on a non-exclusive study of the South Atlantic by one of the authors (Dickson) introduced the possibility of defining controls on sediment distribution systems from regional gravity data. Examples from both Brazilian and West African basins suggested the relationship was not restricted to a single basin.

Offshore northwest Borneo, the authors identified feature patterns on gravity attribute images that correlate with interpreted channel/canyon systems (CCS). These CCS debouch into the known Tertiary Lingan Fan (Mohamad & Lobao, 1997) and additional speculative fans (Figs 1&2); their sources coincide with the locations of slump-scars and back-cutting shelf edges. Similar distinct CCS patterns appear to correlate to the Tertiary Pearl River fan system, initiating at the delta front (Chen *et al*., 1994), extending across the slope and terminating at the southern basin extension, raising the expectation for turbidite reservoirs.

This study significantly extends the Zhu II subbasin beyond the Neogene thick (Hirayama, 1991). A restricted Paleogene-aged basin is inferred, with favorable implications for source rock deposition and with thinner total section, avoiding the over-maturity of the Baiyun depocenter. A channel/canyon system is interpreted, which provides the clastic conduits for bringing sands into the far basin (Fig 3) to form turbidite reservoirs. Despite water depths from 1000 to 2500 m, this area seems ripe for more detailed evaluation.

Figures:

Figure 1 - NW Borneo interpreted channel/canyon systems (CCS, in dark brown) with Lingan Fan (yellow) and speculative fans (white) on background of gravity horizontal derivative (hdx).

Figure 2 - NW Borneo interpreted channel/canyon systems (CCS, in brown) with Lingan Fan (yellow) and speculative fans (cream) on background of dip-azimuth of isostatic gravity anomaly (isodazi).

Figure 3 - Pearl River Mouth Basin (PRB) interpreted channel/canyon systems (CCS, in brown) with interpreted fans (yellow) and speculative fans (cream) on background of dip-azimuth of isostatic gravity anomaly (isodazi).

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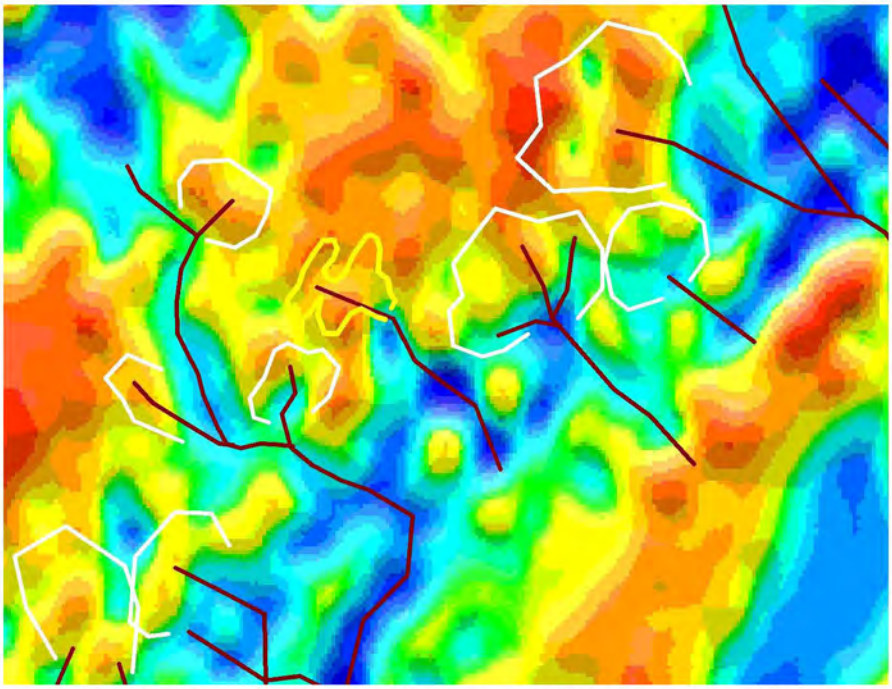

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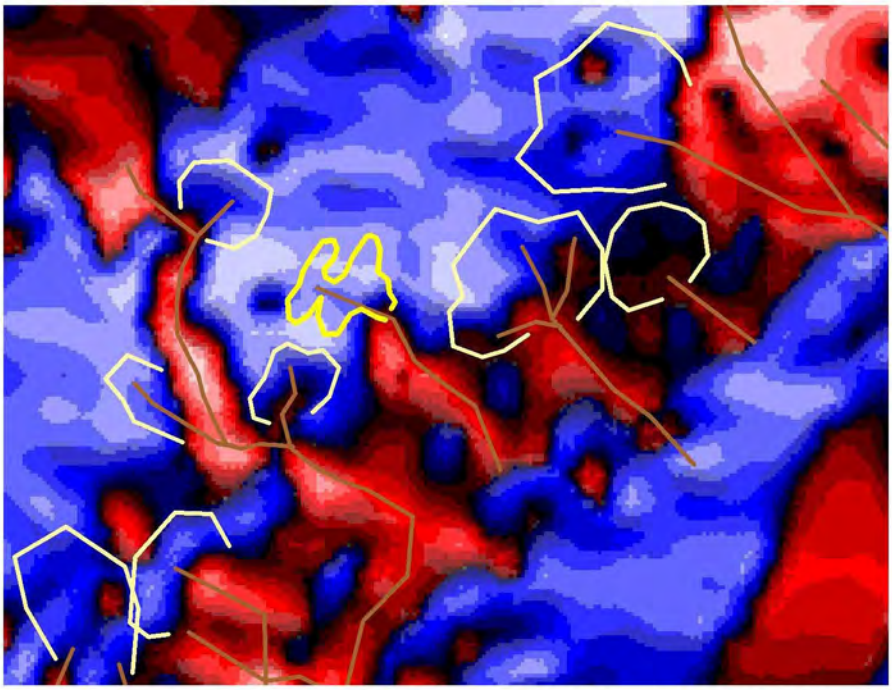

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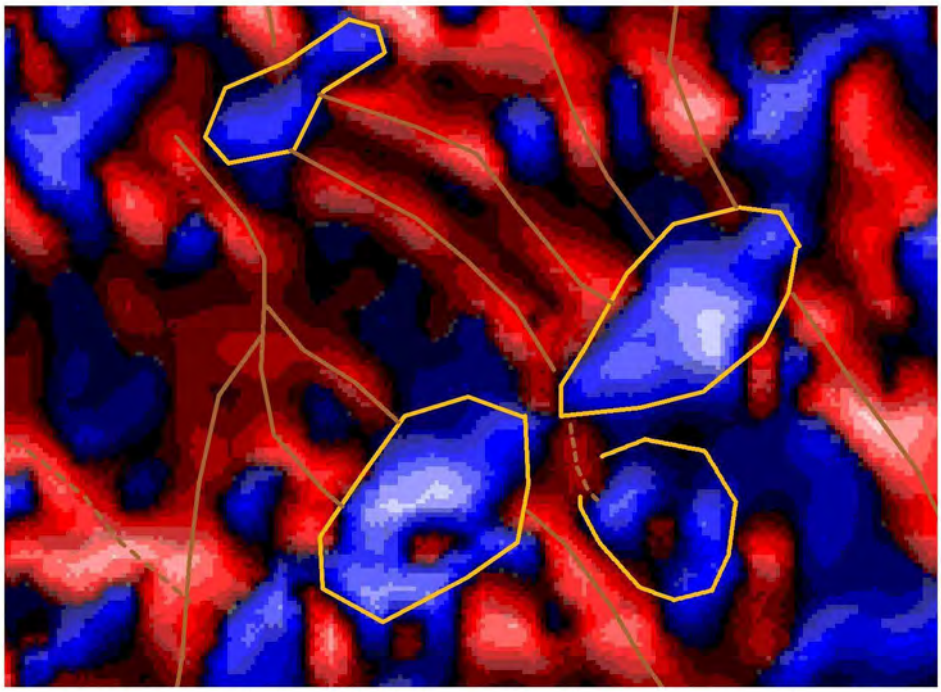

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