The Klias Peninsula and Padas River: NW Borneo, An Example of Drainage Capture in an Active Tropical Foreland Basin*

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Abstract

The Klias Peninsula is a prominent rectangular geomorphic feature (~1500 km^2) that juts abruptly from the NE-trending shoreline of Sabah between Brunei Bay and the small Papar River delta (Figure 1). This region developed as a Neogene foreland basin and its modern coastline study can serve as an analogue for clastic depositional systems ancient foreland basins. The peninsula's peat deposits, the largest in Sabah, represent a modern example of the deposition of organic-rich tropical coastal plain source rocks. However, preservation of these peat deposits from erosion during Holocene transgression arises from a special circumstance: a natural sea wall of Miocene sandstones.

SE of the Klias Peninsula, Borneo's 4th largest river, the Padas River, flows into Brunei Bay as do the Limbang and Trusan rivers. Although these 3 rivers have a combined discharge greater than that of the Baram River (Figure 2), they have been unable to prograde into and fill Brunei Bay. Miocene cobble conglomerates deposited in a tidally-influenced channel define a major sequence boundary exposed on the Klias Peninsula that can be correlated to paleo-shelf edge gorges imaged offshore on seismic data (Figure 3). Recent beach deposits on the Klias Peninsula, now at 20m elevation, indicate youthful uplift. Likewise, Pliocene gravels at Berakas Beach in Brunei suggest the ancestral Limbang River also followed a different course (Figure 4). These observations suggest that the Padas, Limbang and Trusan rivers have only recently been captured by rapid subsidence of Brunei Bay and previously cut across the NW Borneo shelf to supply turbidite sands to deepwater depositional systems. Concomitant uplift and subsidence within this area, as well as a prominent negative Bouguer gravity anomaly under Brunei Bay, point to a tectonic driving force for drainage reorganization (Figure 5). Thus, the Padas River and Klias Peninsula offer a stellar example of drainage capture and facies variability in an active tropical foreland basin.

Reference

Milliman, J.D. and R.H. Meade, 1983, World-wide delivery of river sediments to the oceans: Journal of Geology, v. 91, p. 1-21.

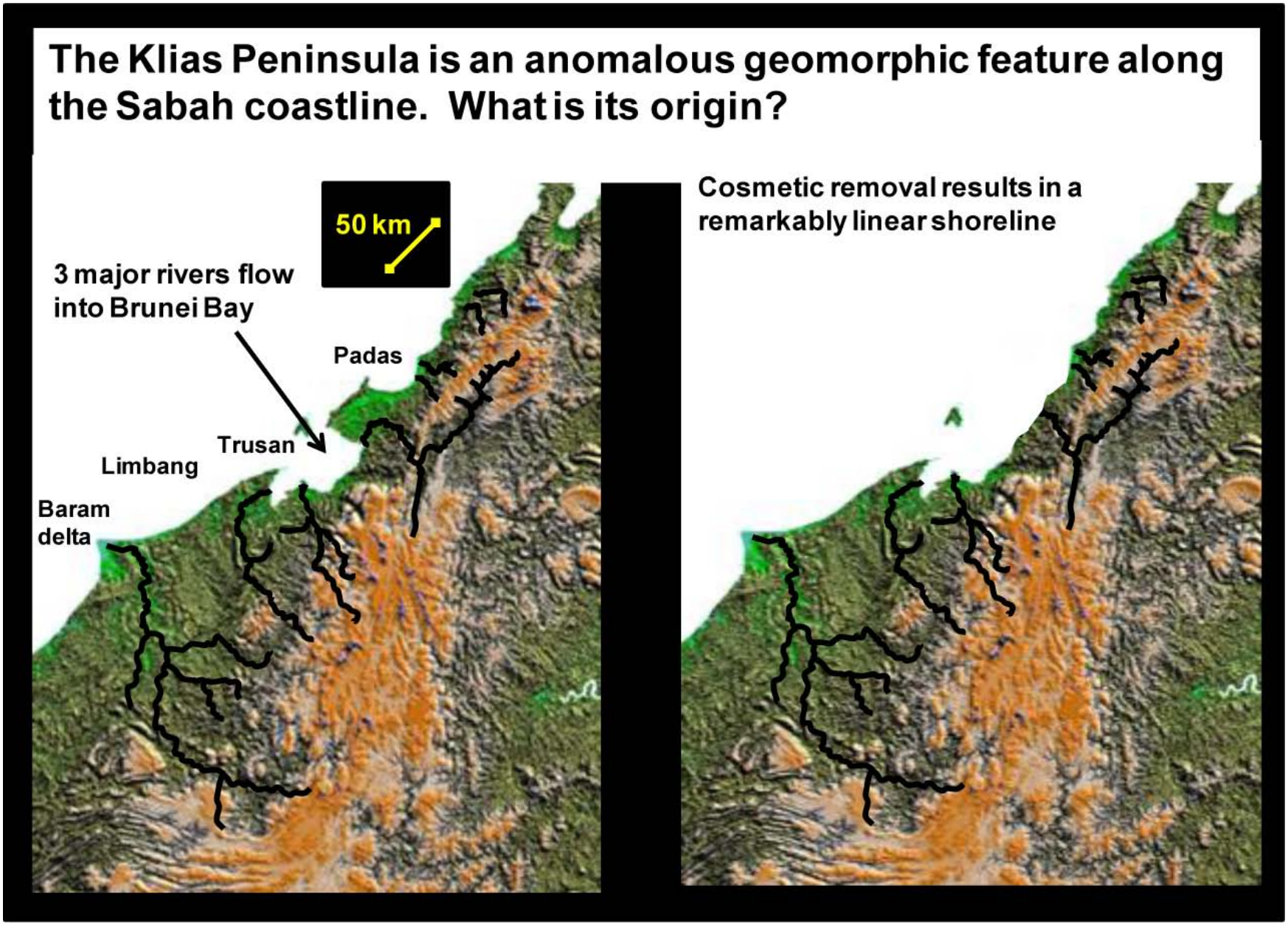

Figure 1. Digital Elevation Model for NW Borneo with major drainages highlighted; right side of figure shows coastline with Klias Peninsula digitally removed from image.

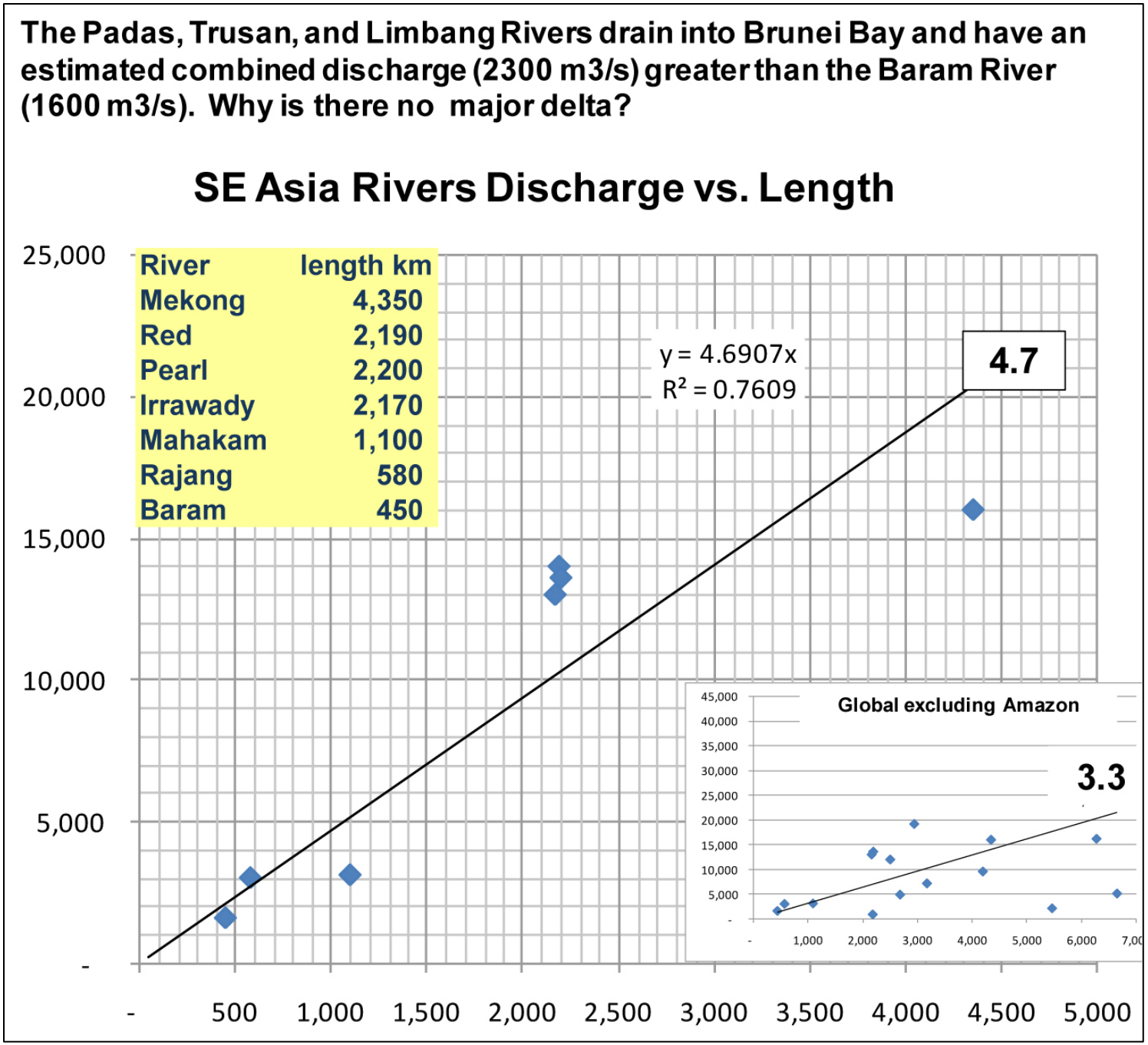

Figure 2. Data for calculating discharge of Limbang, Trusan, and Padas rivers, from Milliman (1983).

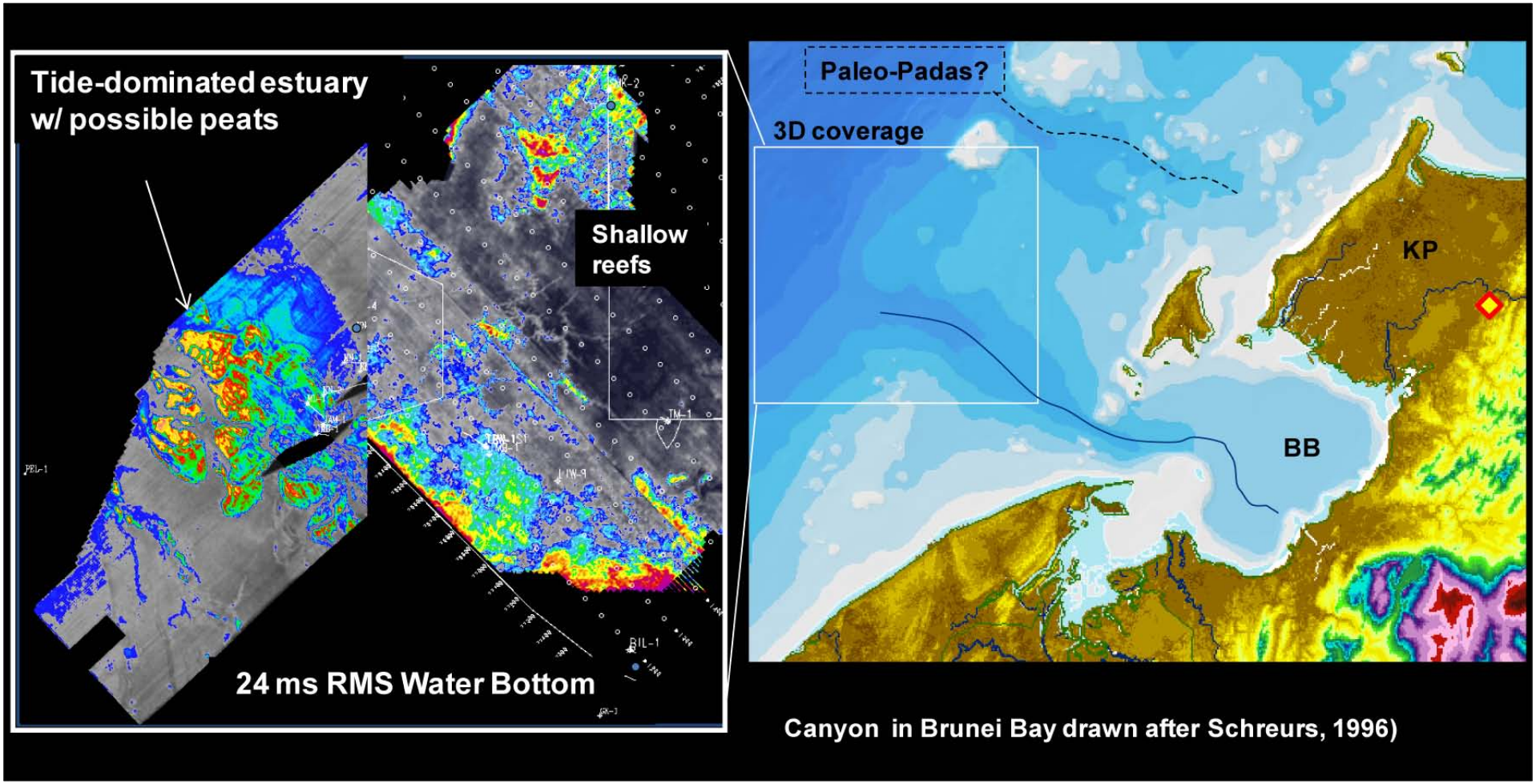

Figure 3. Holocene incised valley extending into Brunei Bay (BB). Paleo-Padas does not appear to cut across Klias Peninsula (KP).

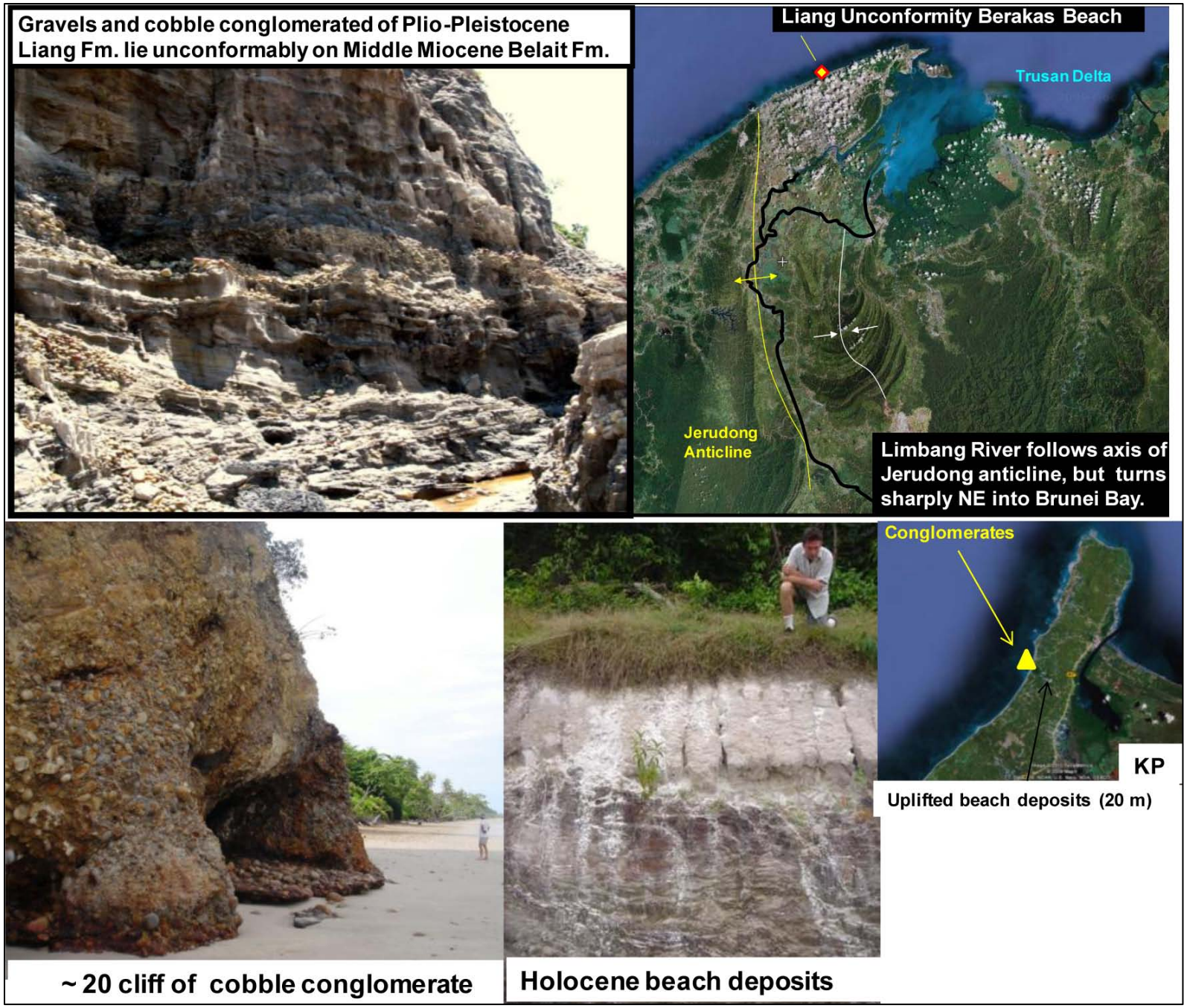

Figure 4. Outcrop evidence for youthful capture of Limbang and Padas rivers by Brunei Bay.

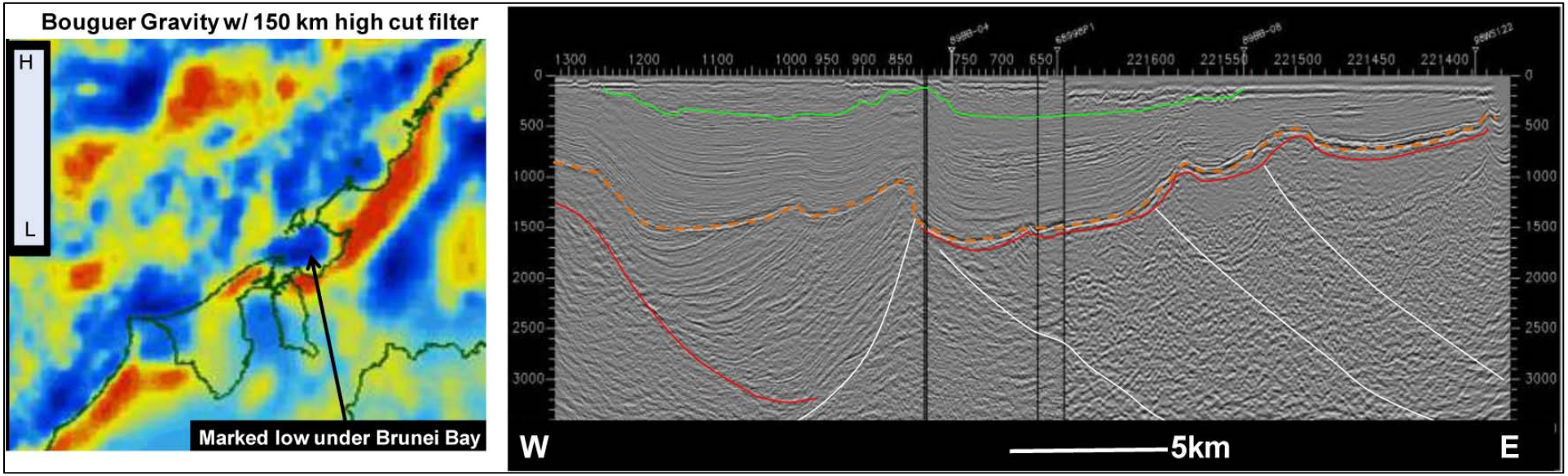

Figure 5. Bouguer gravity and seismic data indicating deep structural origin for Brunei Bay.