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Sequence Stratigraphy of Isolated Carbonate Buildups in a Deltaic Province, Kutei Basin, East Kalimantan, Indonesia

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The Kutei basin has been dominated by clastic deposition during the Neogene; however, isolated carbonate buildups are also common in Lower Oligocene to Holocene strata. In general, isolated carbonates accumulated during trangressions when the locus of clastic deposition shifted landward. Carbonate buildups preferentially occurred on structural highs and margins of lowstand deltas. In the western Kutei basin, the Kerendan carbonate platform is 1000 m thick and 10-20 km across. The Kerendan platform built up during a series of Oligocene transgressions (Figure 1).

North of the Mahakam delta, isolated carbonate buildups are common in Pliocene to Recent strata (Figures 1 and 2). Those isolated carbonate buildups have been imaged by 3D seismic data. North of the Mahakam delta, shelf margins prograded basinward during most of the Miocene, but have been generally been stepping back landward during the Pliocene and Holocene due to decreased clastic sediment supply and structural downwarping. Carbonate buildups are common in these backstepping strata. The transgressive systems tracts of two Lower Pliocene sequences contain carbonate buildups that grew immediately landward of the underlying lowstand shelf margin (Figures 3-5). Those shelf margin buildups are typically 100 m thick, 5 km long, and 1 km wide with long directions parallel to the underlying lowstand shelf margin. Most of the carbonate buildups are overlain by prograding clastics which downlap onto the carbonate buildups (Figures 3 and 5). Progradational clastic packages contain both highstand and lowstand systems tracts which are difficult to separate. A few conical carbonate buildups occur to the north, away from the main clastic influx (Figure 6). Those conical buildups contain multiple stacked carbonate sequences that were not interrupted by clastic deposition.

Isolated carbonates are also present in the transgressive parts of Pleistocene and Holocene sequences (Figures 7-9). The latest Pleistocene carbonate buildups can be mapped using the waterbottom reflector from 3D seismic surveys (Figure 2). Pleistocene carbonate buildups vary from 10 m to more than 100 m in thickness, and preferentially occur on lowstand shelf margins and the upthrown side of faults (Figures 7-9). Accommodation space created by middle shelf growth faults promoted carbonate

deposition on the outer shelf by capturing large amounts of clastic sediment, thereby decreasing clastic influx to the outer shelf (Figure 8). Most Pleistocene carbonate buildups are also overlain by prograding prodelta shales, and the contacts are downlap surfaces. Carbonate buildups apparently drowned or at least quit growing because of rapidly rising sea level and/or poisoning (possibly nutrient-poisoning) associated with approaching deltas.

FIGURE CAPTIONS

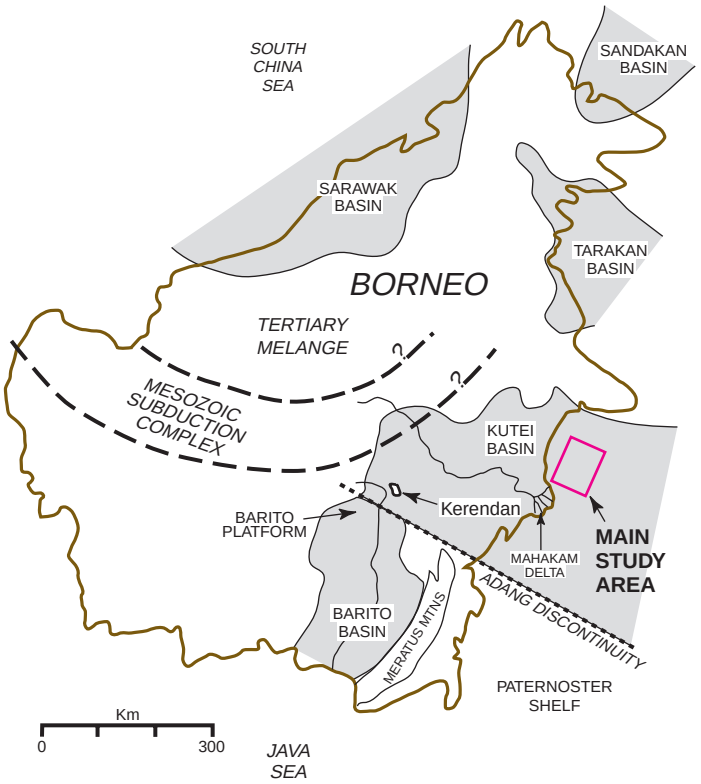

Figure 1

Figure 1. Map of Borneo showing major deltaic basins, location of Kerendan platform, and the main study area north of the Mahakam delta.

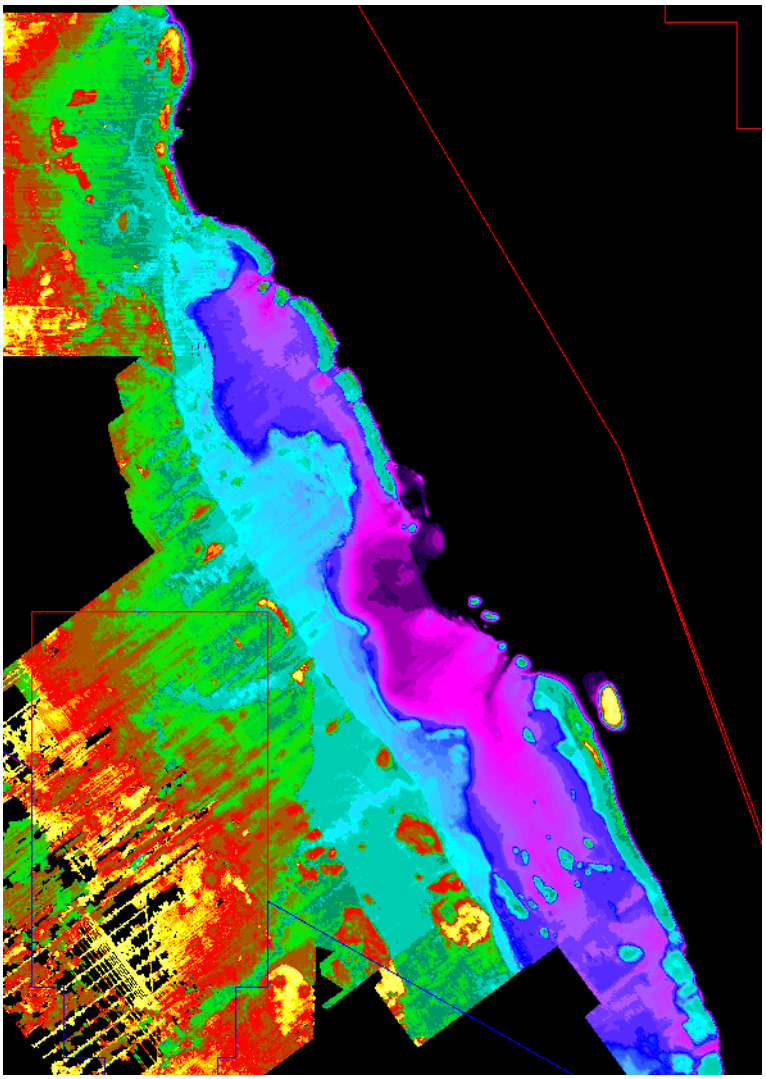

Figure 2. Northern shelf bathymetry from the 3D seismic waterbottom reflector. Yellow areas are highest, and approximately 50 m deep. Lavender areas are the deepest (approximately 200 m). Light blue areas are approximately 100 m below sea level. Features present include traces of active listric faults, latest Pleistocene lowstand deltas and carbonate buildups. A-A' is in Figure 3. B-B' is in Figure 8. C-C' is in Figure 9.

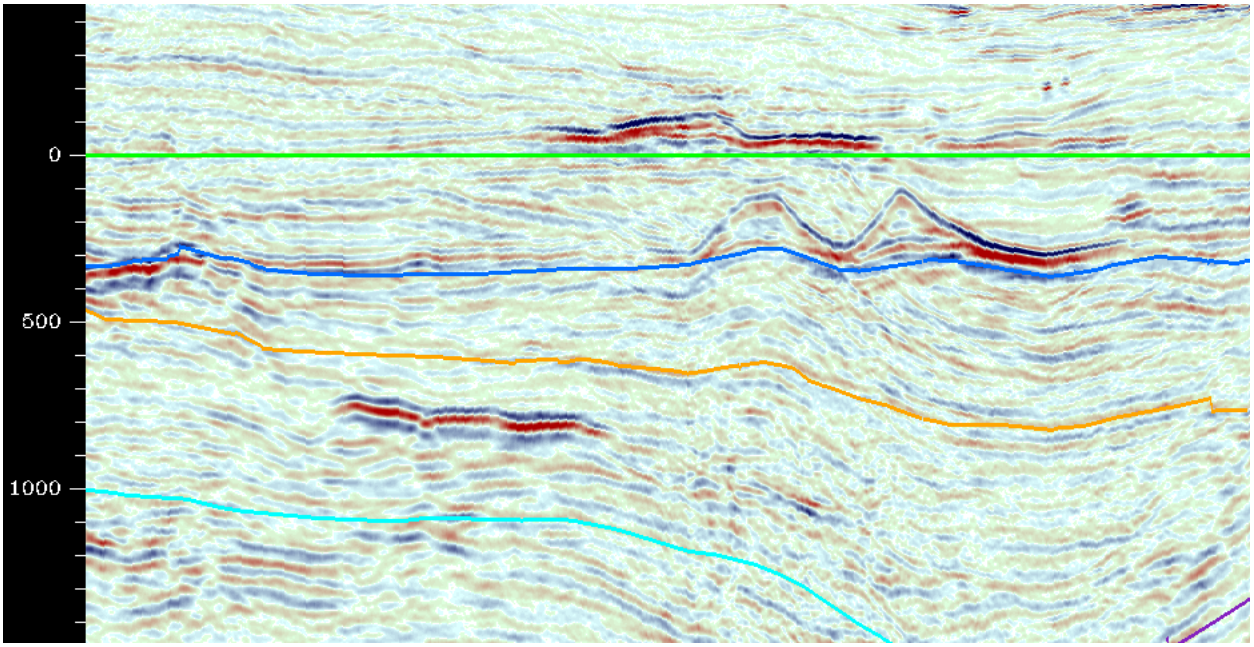

Figure 3. Seismic line flattened on a Lower Pliocene horizon. This line crosses the Miocene lowstand shelf margin. Vertical scale is in milliseconds (ms) of two-way travel time (TWTT). Approximate location is shown in Figure 2.

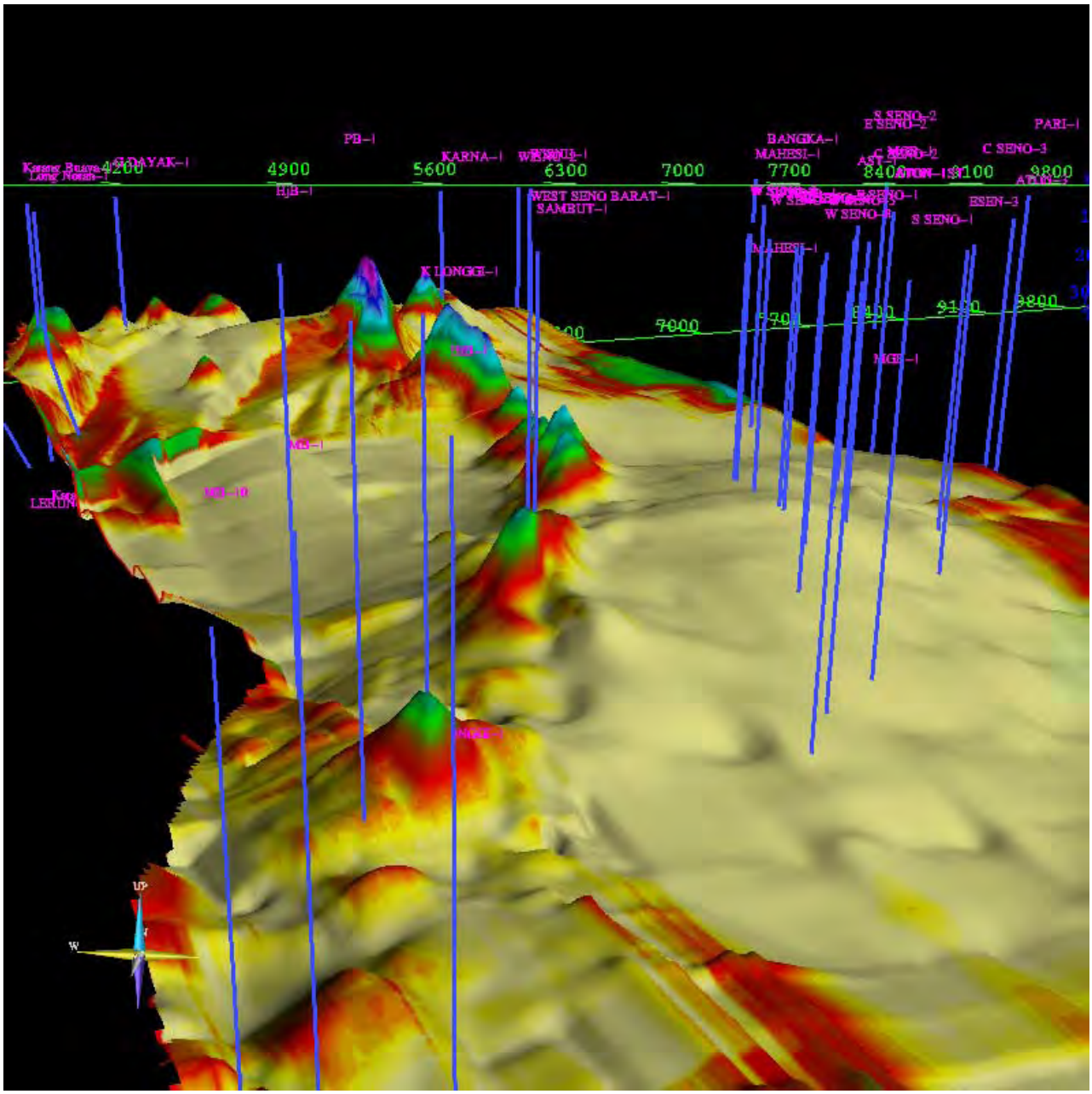

Figure 4. 3D image of carbonate buildups in the upper interval of lower Pliocene shelf margin carbonates north of the Mahakam delta.

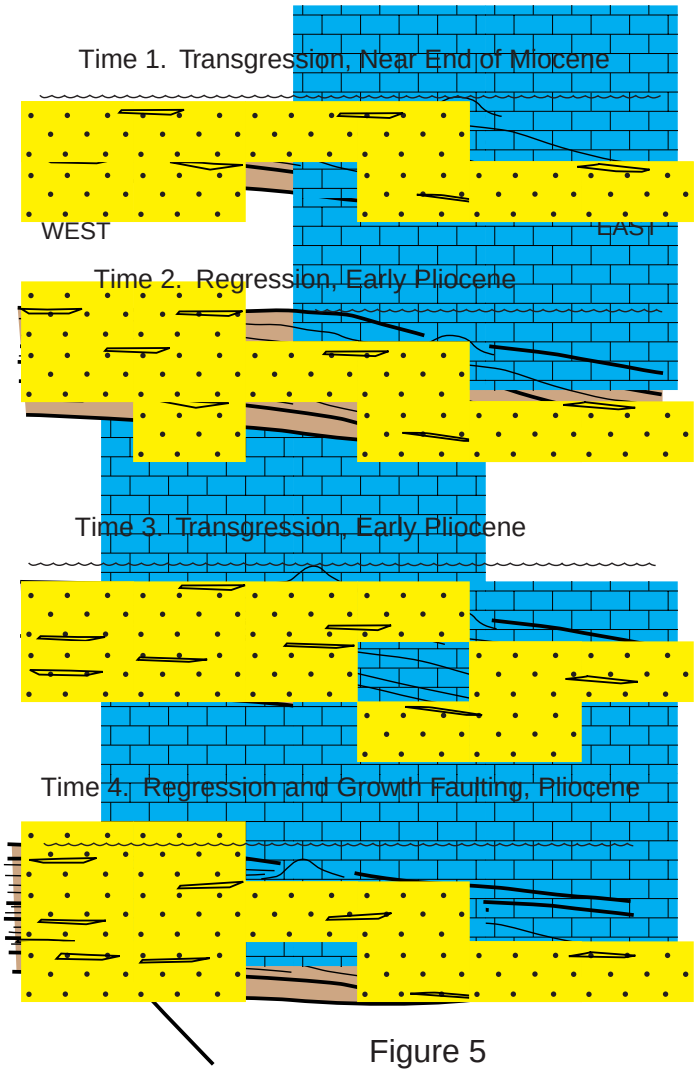

Figure 5. Stratigraphic model for uppermost Miocene and lower Pliocene shelf margin strata north of the Mahakam delta.

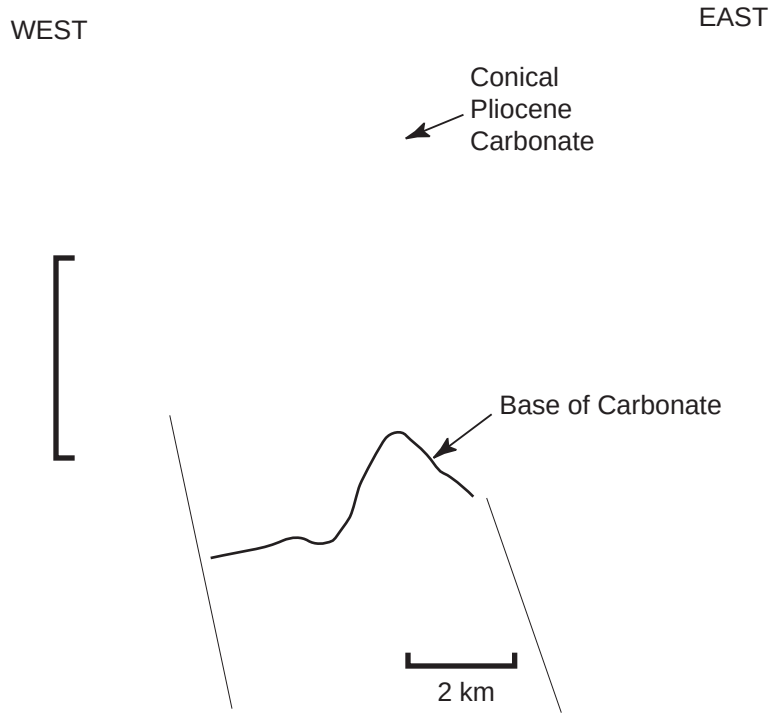

Figure 6. Conical carbonate buildup just north of the map in Figure 2. The buildup contains many stacked sequences. The base is Lower Pliocene, and the top of the buildup is either Upper Pliocene or Pleistocene. The top of the buildup is now at approximately 600 ms or 500 m below sea level.

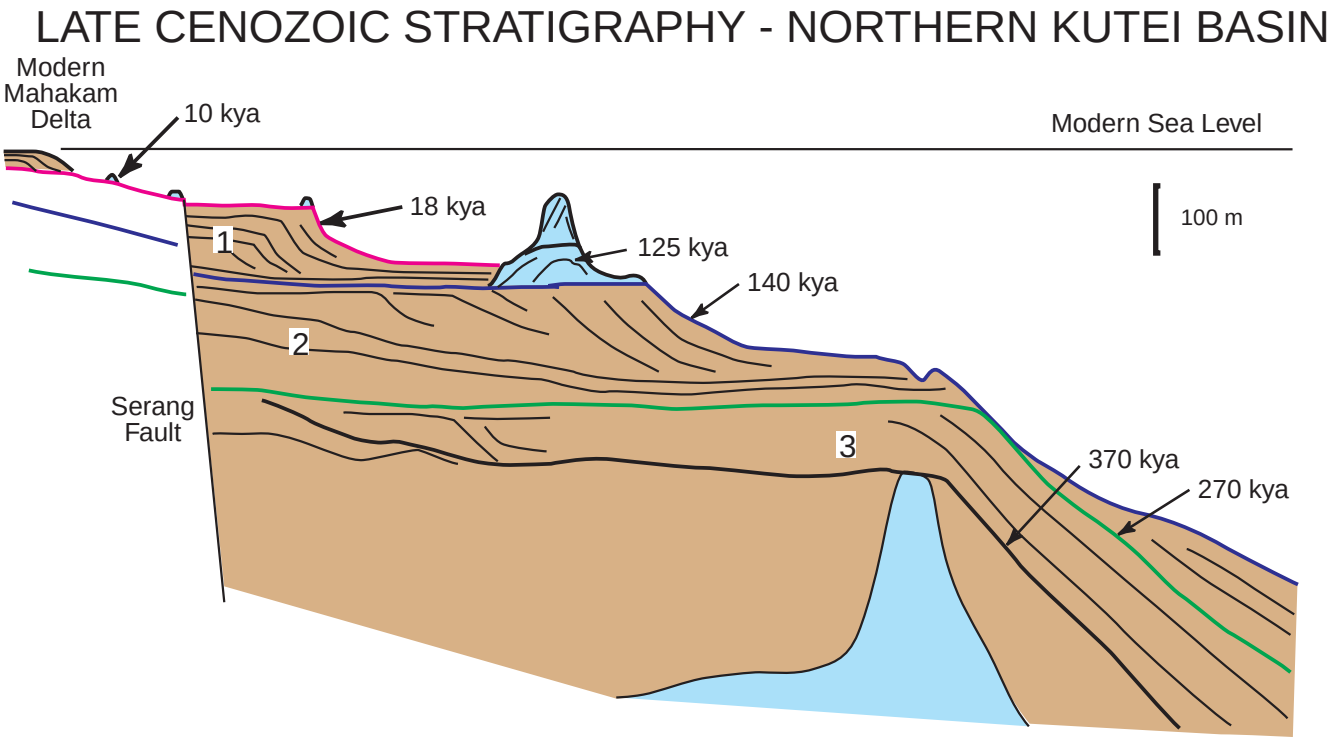

Figure 7. Schematic cross section of Pleistocene strata north of the Mahakam delta showing isolated carbonate buildups growing on prograding clastics. Carbonates are blue, and clastics (sands and shales) are light brown.

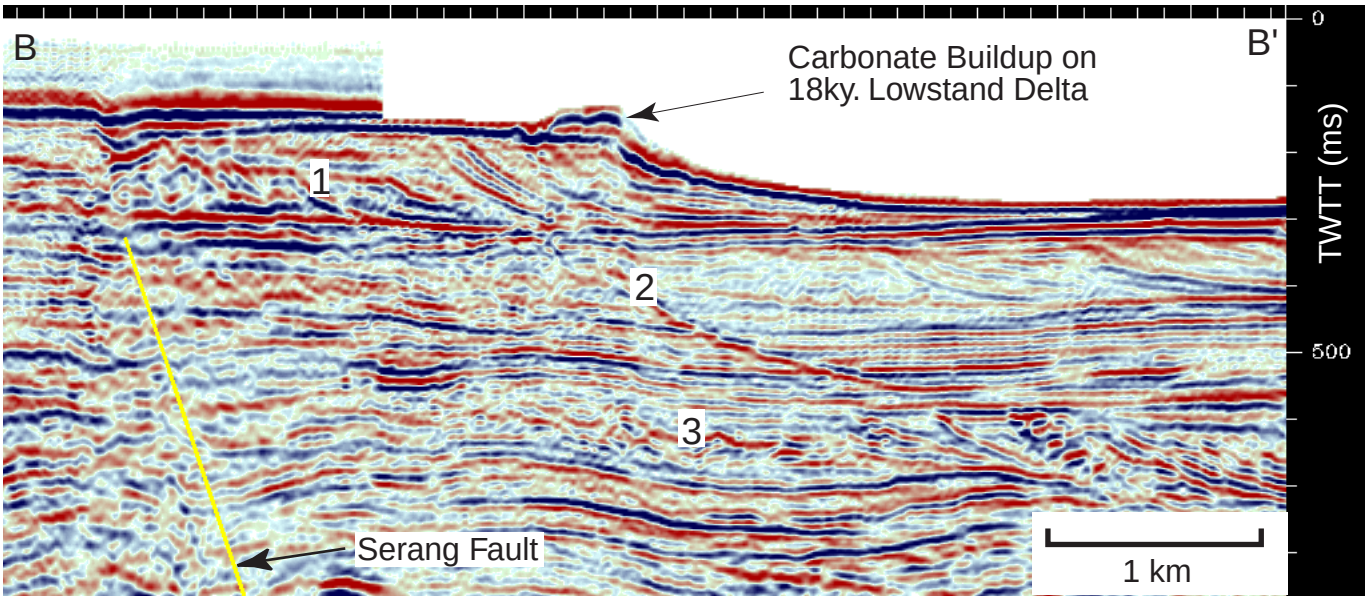

Figure 8. Seismic line showing a small carbonate buildup on the uppermost prograding Pleistocene lowstand delta (18 kya?). Numbers of prograding sequences correspond to sequences in Figure 7. Approximate location of seismic line is shown in Figure 2.

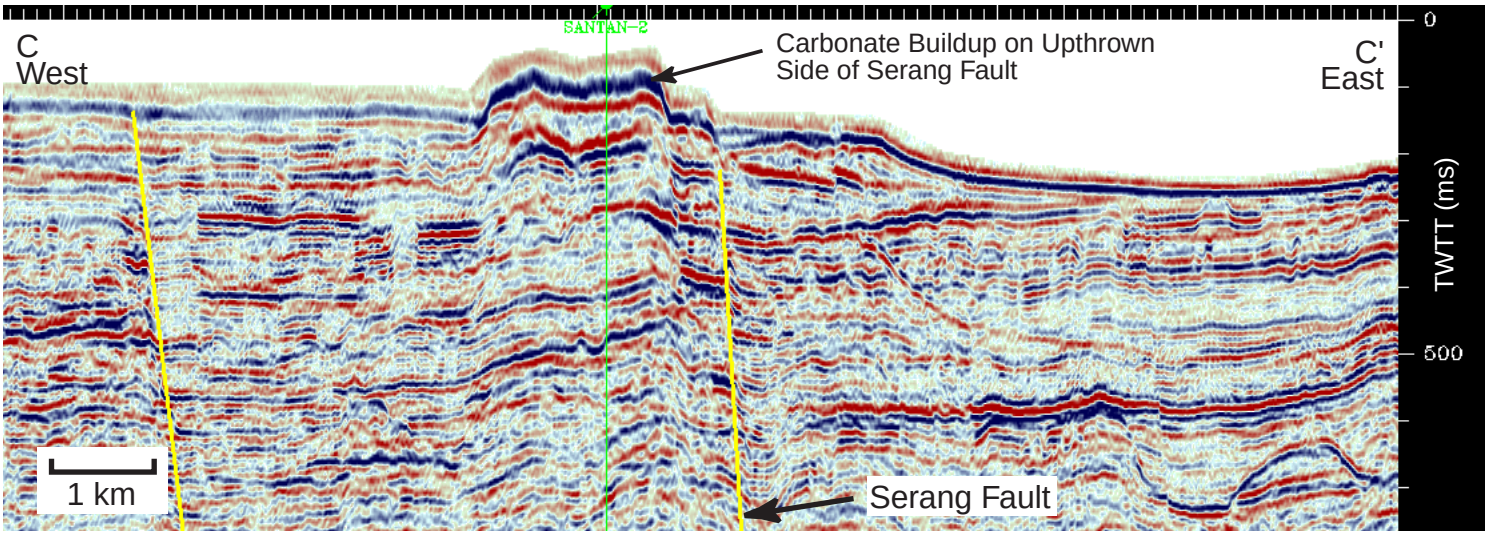

Figure 9

Figure 9. Seismic line showing a carbonate buildup on the upthrown side of the Serang fault. Approximate location is shown in Figure 2.