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Preliminary results of Canterbury Basin Sea-Level transect, New Zealand, IODP Expedition 317

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Integrated Ocean Drilling Program Expedition 317 was devoted to understanding the relative importance of global sea level (eustasy) versus local tectonic and sedimentary processes in controlling continental-margin sedimentary cycles. The expedition recovered sediments dating from the Eocene to Recent, with a particular focus on the sequence stratigraphy of the late Miocene to Recent, when global sea-level change was dominated by glacioeustasy. Drilling in the Canterbury Basin, on the eastern margin of the South Island of New Zealand, takes advantage of high rates of Neogene sediment supply, which preserve a high-frequency (0.1-0.5 m.y. periods) record of depositional cyclicity. The Canterbury Basin provides an opportunity to study the complex interactions between processes responsible for the preserved stratigraphic record of sequences because of the proximity of an uplifting mountain chain, the Southern Alps, and strong ocean currents.

Upper Miocene to Recent sedimentary sequences were cored in a transect of three sites on the continental shelf (landward to basinward, Sites U1353, U1354, U1351) and one on the continental slope (Site U1352). The transect provides a stratigraphic record of depositional cycles across the shallow-water environment most directly affected by relative sea-level change. Lithologic boundaries, provisionally correlative with seismic sequence boundaries, have been identified in cores from each site and provide insights into the origins of seismically resolvable sequences. This record will be used to estimate the timing and amplitude (using backstripping) of global sea-level change and to document the sedimentary processes that operate during sequence formation. Sites U1353 and U1354 also provide significant, double-cored, high-recovery sections through the Holocene and late Quaternary for high-resolution study of recent glacial cycles in a continental shelf setting.

Continental slope Site U1352 represents a complete section from modern slope terrigenous sediment, through to hard Eocene limestone, with all the associated lithologic, biostratigraphic, physical, geochemical and microbiological transitions. The site also provides a record of ocean circulation and fronts during the last 35 m.y. The early Oligocene (approximately 30 Ma) Marshall Paraconformity was the deepest target of Expedition 317 and is hypothesized to represent intensified current erosion or non-deposition associated with the initiation of thermohaline circulation in the Southern Ocean.

Expedition 317 set a number of scientific ocean drilling records: 1) deepest sediment hole (Hole U1 352C; 1927 m), 2) deepest hole on the continental shelf (Hole 1351B; 1030 m) and also the second deepest (Hole 1353B; 614 m), 3) shallowest water depth for a site drilled by JOIDES Resolution for scientific purposes (Site U1353, 84.7 m water depth) and 4) deepest sample taken by scientific ocean drilling for microbiological studies (1925 m at Site U1352).

Expedition 317 supplements previous ODP drilling of sedimentary successions for sequence stratigraphic and sea-level objectives, particularly that on the New Jersey margin (ODP Legs 150, 150X, 174A, and 174AX; IODP Expedition 313) and in the Bahamas (ODP Leg 166), but includes an expanded Pliocene section. Success of the drilling on the shelf and slope in Canterbury Basin suggests that drilling of tectonically active siliciclastic margins provide us high resolution

sequence stratigraphy frameworks, which contain information of global sea-level and local tectonics.

Reference: Expedition 317 Scientists, 2010. Canterbury Basin Sea Level: Global and local controls on continental margin stratigraphy. IODP Prel. Rept., 317. doi:10.2204/iodp.pr.317.2010

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