The sedimentary record of the transition from passive to active tectonic settings; North Canterbury Basin, New Zealand

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The Cenozoic was a time of climatic, tectonic and eustatic change in the Southern Hemisphere. Cooling at the pole, glaciation and substantial sea ice formation occurred as latitudinal temperature gradients increased and tectonics altered Southern Hemisphere circulation patterns. During this same time frame, the tectonic regime of the New Zealand continental block transitioned from a passive margin to an active plate boundary, resulting in the reversal of a long-standing transgression and an influx of terrigenous sediment to marine basins. In this transition, depositional basins in the South Island became more localized. However the complexity of the basins, as well as the influence of oceanographic and tectonic drivers, is locally poorly understood. Here we apply sedimentological, biostratigraphic and geochemical analyses to determine the relevant input of changing climatic regime and active tectonics on the development of carbonate and siliciclastic sedimentary basins.

The Late Oligocene to Middle Miocene sedimentary rocks of the northern Canterbury Basin, South Island, New Zealand record oceanographic and tectonic influences on basin formation, sediment supply and deposition. Palaeocene to Late Eocene rocks in the basin are micrites and biogenic cherts recording deepwater, terrigenous-starved environments, and do not record any influence of active tectonics. The Early Oligocene development of ice on the Antarctic continent and the associated global sea level response is seen in this North Canterbury basin as an eroded, glauconitized and phosphatized firm ground and hardground atop deep-water micrites. Late Oligocene and Early Miocene sedimentation above this unconformity are cleaner, deep-water, bathyal planktic foram packstones and wackestones in eastern areas and Late Oligocene inner shelf volcaniclastic packstones in parts of the western basin. Post-unconformity sedimentation resumed earlier in western areas, driven by oceanographic change and subtle seafloor shallowing from thermal influence of basaltic intrusions. The development of tectonic uplift in terrestrial settings is first seen in the northwestern basin in Lower Miocene fine quartz-rich sandstones. By the Middle Miocene, these bathyal sandstones are also seen in the eastern basin, as shelf sandstones develop in the west.

In this North Canterbury basin, passive tectonics are reflected in widespread carbonate facies that are able to record global Oligocene climate events. The transition to regionally active tectonics is seen during the Early Miocene in a progression from carbonate dominated environments to progressively more quartz-rich sandstones that reflect uplift and erosion of terrestrial landscapes.

References

Browne, G.H., 1995, Sedimentation patterns during the Neogene in Marlborough, New Zealand Journal of the Royal Society of New Zealand, v. 25, p. 25.

Kennett, J.P., 1980, Paleoceanographic and biogeographic evolution of the Southern Ocean during the Cenozoic, and Cenozoic microfossil datums: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 31, p. 123-152.

King, P.R., 2000, Tectonic reconstructions of New Zealand: 40 Ma to the Present: New Zealand Journal of Geology and Geophysics, v. 43, p. 611 - 638.

Rattenbury, M.S., Townsend, D., and Johnston, M.R., 2006, Geology of the Kaikoura area; scale 1:250,000 geological map: Lower Hutt, New Zealand, Institute of Geological and Nuclear Sciences.