

## **The Nature and Origin of Cyclothem Sedimentation on Quaternary Shelves**

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Earth's climatic history since 2.5 Ma has been controlled by Milankovitch variations in the planetary orbit, comprising alternate periods of glaciation and interglaciation with dominant frequencies of 41 000 yr and 100,000 yr. Concomitantly, eustatic sea-level has fluctuated by 70 to 100 m, causing rapid transgressions and regressions of the shoreline across the world's continental shelves. The resulting shelf sedimentary record is cyclothem, with each cyclothem corresponding to a single Milankovitch climatic or sea-level cycle. Wanganui Basin contains a ca. 2 km-thick, almost complete, composite record since oxygen isotope stage 100 (ca. 2.5 Ma) in the form of 47 superposed cyclothem of shelf origin. Each 41 ka ( $\delta^{18}\text{O}$  stages 100-18) and 100 ka ( $\delta^{18}\text{O}$  stages 17-2) glacial/interglacial stage couplet is represented by an unconformity-bounded depositional sequence comprising transgressive (TST), highstand (HST) and, in many cyclothem, regressive systems tracts (RST).

Of concern to many stratigraphers, is that sequence stratigraphic models were developed from the pre-Quaternary stratigraphic record for which the sea-level history can only be inferred, leading to a circularity of reasoning. This plenary paper outlines the characteristics of Quaternary shelfal sequences that accumulated during phases of certainly known sea-level cycles (Wanganui & Canterbury Basin, New Zealand; Omma Formation, Japan; and Merced Formation, California), as indicated by well-constrained correlations with the oxygen isotope ice-volume/sea-level curve. In these examples, depositional systems are linked unequivocally to sea-level, and their stratal development is examined with respect to real, as opposed to inferred, sea-level changes.