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The Hautawa Shellbed: a study of lateral variations observed in outcrops from the Pliocene-Pleistocene boundary in Whanganui Basin, New Zealand

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The dominant tectonic feature of the North Island of New Zealand is the Hikurangi margin: the subduction of the Pacific Plate beneath the Australian Plate. The Whanganui Basin was formed in the back-arc position and contains a nearly continuous 4 km sequence of mostly marine strata recording the cyclic eustatic sea level changes of the Pliocene and Pleistocene epochs. Uplift of the axial ranges along the north-eastern basin edge causes the entire sedimentary fill to gently tilt south-west toward the modern coastline. Hence, the strata are well exposed as outcrops throughout the major north-south trending river valleys. The Whanganui Basin therefore expresses one of the best sedimentary records of eustatic sea level cycles from the time when cryospheric activity began to amplify in the Northern Hemisphere at the base of the Pleistocene.
The Hautawa Shellbed was first described as the 'Hautawa Reef Horizon' by the Superior Oil Company of New Zealand in 1943. Its identification was followed by Charles Fleming's foundation work in the mid-20th century invstigating Whanganui strata. He recognised the shellbed as a marker of cooling global conditions expressed by the influx of a sub-Antarctic molluscan assemblage into Whanganui Basin. This global cooling represents increased cryospheric activity associated with the development of the Northern Hemisphere ice sheets. Though this cooling is observed in the Hautawa Shellbed occurring at 2.40 Mya – over 150 thousand years younger than the lower boundary age of the Pleistocene Epoch expressed in Europe.
Analysis of sedimentary, taphonomic, and macrofaunal assemblage variability has been integrated in this study to investigate nuances in paleoenvironment preserved in the Hautawa Shellbed. Within 5 km the outcrop structure was observed to rapidly change from presenting the shellbed in compound form (upper portion directly overlying the and lower portion) to contrastingly being divided by over 2 m of silt with low mollusc content. Cluster analysis of the newly recorded outcrop data has revealed distinctive subunits within the Hautawa Shellbed which can be linked between sites overcoming the complications in outcrop structure. Results also suggest that water depths during deglaciation remained stable while the shellbed was forming – suggesting rates of sedimentation, basin subsidence, and seal level rise were in equilibrium hence no net water depth change is expressed in the faunal assemblage.