Pli-Pleistocene, aragonite-dominated, cold-water shelf limestones, in eastern North Island, New Zealand

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The Petane Group is a 550 m thick cyclothem of siliciclastic sand, siltstone and temperate limestone deposited during recurring Pli-Pleistocene sea-level fluctuations in eastern North Island, New Zealand. Temperate limestones dominate shallow-marine components in each of the three upper cyclothems in the Tangoio block study area. The limestones are unusual in their skeletal composition for being dominated by aragonitic faunas, especially bivalves. Most New Zealand Cenozoic and modern non-tropical carbonates are dominated by calcite skeletal elements such as bryozoans and barnacles.

Another difference between Petane Group limestones and other cool water carbonates is their proposed depositional setting. Modern temperate carbonate sediment around New Zealand typically accumulates in open shelf environments in water depths of 25 to 250 m. In contrast, Petane Group limestones were deposited in estuarine and neritic settings along a pericontinental seaway and contain four tidally-influenced facies, comprising both sand flats and bar/bank complexes. Due to their proximity to the shoreline, all four carbonate facies commonly contain significant amounts of siliciclastic sediment (occasionally >50%).

The aragonite-rich composition of Petane Group carbonate facies is due, in part, to two factors: 1) their shallow marine environments of deposition and 2) an invariable soft sediment substrate. Sandy seafloors are favorable sites for infaunal colonization, typically by bivalves, and it follows that sediment derived from these sources would be dominantly aragonitic in composition. In contrast, the major areas of temperate carbonate sedimentation on the modern New Zealand shelf contain local tracts of shell-rubble and/or rocky seafloor, and these substrates favor epifaunal taxa such as bryozoans, serpulids, barnacles and brachiopods.

Petane Group limestones also differ from calcite-dominated equivalents in the manner of their diageneric alteration. As they are aragonite-dominated, limestones in the Tangoio block have undergone variable, and in some instances, intense meteoric alteration consisting of calcite cementation and skeletal alteration. Despite several changes in relative sea-level, the cement stratigraphy of all limestones in the Petane Group is simple and uniform. The entire sedimentary succession was likely affected by the same diageneric fluids at the same time, and reflects the uplift and gradual emergence of the Tangoio block.