



Ecosystems response and restitution time across the K/Pg boundary transition at high-latitudes, Southern Hemisphere, New Zealand – a palynological approach

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Several major groups of biota/fauna disappeared globally across the Cretaceous-Paleogene boundary (K/Pg boundary) and several other important groups suffered considerable, but not complete, species-level extinction. For marine phytoplankton – a major driver of ocean productivity – darkness and suppression of photosynthesis, in the aftermath of the asteroid impact, was likely a major killing mechanism. Thus, in the marine realm there is a separation in extinction rate between strongly affected groups with calcareous shells and groups that had organic cysts or siliceous tests. Detailed regional records of the long-term post-K/Pg boundary therefore still need to be undertaken to enhance the understanding of how each of the major microfossil groups recovered to elucidate recovery in different ecosystem types following this unique event.

Throughout the New Zealand region, widespread deposition of siliceous sediments occurred during the Late Cretaceous to early Paleocene indicating the existence of a south Pacific upwelling regime (Hollis 1993, 1995; Strong et al. 1995). Silica concentration in the oceans increased after the K/Pg event and remained high for 1-2 millions years during the early Paleogene, reflecting high bio-siliceous productivity in the aftermath of the K/Pg boundary event (Hollis et al. 1995, 2003). The geological archives of New Zealand includes outcrops from several basins which provide a unique possibility for examining ecosystem response and restitution time from latest Cretaceous to early Paleogene in a suite of depositional environments spanning from terrestrial to bathyal (Willumsen 2000, Vajda et al. 2001, Vajda and Raine 2003).

High-resolution palynological comparative studies of organic-walled microfossils such as dinoflagellate assemblages (dinocysts), spores and pollen are currently carried out on New Zealand sediments. The recovery period in the marine realm is much extended compared with the much shorter recovery time reflected by the terrestrial record e.g. “Fern-spike” interval (Vajda et al. 2001; Vajda and Raine 2003; Vajda and McLoughlin 2004). Interestingly, the dinocyst *Trithyrodinium evittii* has first occurrence immediately above the K/Pg boundary horizon in the southwest Pacific (Helby et al., 1987; Wilson 1987, 1988; Williams et al. 2004; Willumsen 2000, 2006). This dinocyst pattern is interpreted to reflect an invasion of this species into the southwest Pacific, in the aftermath of the Chicxulub impact. In the New Zealand sections, two earliest Paleocene intervals with dominance of *T. evittii* are separated by an acme interval of *Paleoperidinium pyrophorum* (Willumsen 2000, 2006; Willumsen et al., 2004a; 2004b). The sudden acme of *P. pyrophorum* ca. 0.5 Ma after the K/Pg boundary event is interpreted to reflect a regional cold water pulse taking place after a period with relatively warmer sea-surface e.g. *T. evittii* dominated dinocyst assemblages. A second period with warm-surface water is observed c. 0.8-1.5 Ma after the event. The end of the main marine recovery period is marked by a gradual arrival of new suite of dinocyst species and oligotrophic conditions. The timing of these early Paleocene events in New Zealand aligns well with D'Hondt et al. (1998, 2005) who propose that the marine ecosystem was radically altered due to the K/Pg boundary event and that the post-K/Pg boundary is divided into several recovery steps before the open-ocean ecosystem was fully recovered c. 3 Ma after the event.