

## Shallow-water Cretaceous-Paleocene transition associated with a rocky low-energy shore: The Kambühel section (Northern Calcareous Alps)

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In shallow-water limestones, stratigraphically fairly complete K-Pg boundaries are rare. At Kambühel, Northern Calcareous Alps (NCA) of Austria, a K-Pg boundary (KPB) is exposed that comprises a hiatus from the upper part of planktonic foraminiferal zone CF3 (*P. hariaensis*) zone of the uppermost Maastrichtian to within planktonic foraminiferal zone P1a (P1a(1) pro parte) of the lower Danian. Age-dating of the section rests on planktic foraminiferal assemblages.

The Maastrichtian limestones are bio-lithoclastic packstones rich in larger benthic foraminifera (e.g., Orbitoides, Lepidorbitoides, Siderolites); these limestones accumulated in a neritic environment. Near their top, the limestones are rich in microkarstic cavities and patches and dykes of diagenetic grainstone.

The KPB is a hardground of complicated relief with an amplitude up to a few decimeters. The hardground is riddled by marine borings and potential root casts. Along the hardground, delicate projecting 'ridges' and 'blades' of limestone between deeper erosional pits were preserved. The top surface is encrusted by benthic foraminifera and serpulids. The hardground started as a subaerial exposure surface that probably was covered by vegetated soil. Upon earliest Danian transgression, the soil was stripped, and the hardground was further shaped by boring and encrustation. The preservation of the complicated hardground relief records a low-energy rocky shore. The hiatus across the K-Pg hardground is bracketed to ~700 ka, similar to hiatuses in many deep-water successions.

The lower Danian limestones, in turn, are poorly-sorted litho-bioclastic grainstones to rudstones with shelter and keystone pores, respectively. Many bioclasts are rounded and strongly abraded, microbored and/or encrusted by red algae and sessile foraminifera. Similar features are displayed by lithoclasts derived from the underlying Maastrichtian limestones and from older rocks. The grainstones–rudstones record early vadose diagenesis (meniscus and pendant cements, interstitial micro-hardgrounds, interstitial geopetals of micropeloids) or, more commonly, of cementation in form of fringes of fibrous cements. Limestones of these characteristics comprise a package ~ 8 m in thickness that hosts abundant shells of rhynchonellid brachiopods. The Danian limestones above the KPB represent beachrocks and, less commonly, cayrocks. A hard-substrate shore zone with shady overhangs is underscored by the abundant rhynchonellids. Within the Danian succession, another hardground has been identified approximately 6.5 m above the K-P boundary. Based on planktic foraminiferal assemblages, the hiatus across the intra-Danian hardground is estimated at 1.5 Ma. The upper part of the Kambühel succession consists of ?Selandian-Thanetian grain- and packstones and, at the top, of an upper Thanetian interval a few meters thick of float- to rudstones rich in colonial corals, red algae (corallines, Parachaetetes), dasycladaleans, and milioline foraminifera.