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The recovery of the biological pump across the K/Pg boundary in the GSSP of El Kef, Tunisia

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The study of Earth's Big Five mass extinctions provides insight into the resilience of ecosystems to environmental perturbations. Earth's most recent mass extinction at the Cretaceous/Paleogene boundary (K/Pg) was caused by the impact of an asteroid in the Yucatan peninsula rather than by intense volcanism. Mass extinctions among marine calcareous nannoplankton heavily disrupted the marine food web resulting in a severe weakening of the ocean's biological pump. The timing and heterogeneous nature of the recovery of the biological pump remain poorly resolved in the neritic zone in the aftermath of the impact. Here, we address the evolution of the biological pump across the K/Pg at the Global Boundary Stratotype Section (GSSP) at El Kef, Tunisia using high-resolution compound-specific carbon isotope records ($\delta^{13}\text{C}_{\text{biomarker}}$) of non-calcareous marine phototrophs from an outer shelf to upper bathyal setting of the southwestern Tethys Ocean. We use $\delta^{13}\text{C}_{\text{biomarker}}$ to reconstruct ϵ_p , which is a function of the community structure of marine phototrophs, their rate of carbon fixation, and the concentration and isotopic composition of aqueous CO_2 . We then use our ϵ_p record to constrain the recovery of the biological pump in this region while considering the composition of marine phytoplankton, the assemblage and isotopic composition of benthic foraminifera, state-of-the-art physiological models for ϵ_p , and carbon cycle simulations using cGENIE. Our results indicate that the recovery of the biological pump in the outer shelf-upper bathyal zone likely outpaced the recovery in the open ocean. This is in

agreement with the selective extinctions among phytoplankton at the K/Pg, with most survivors that would later repopulate open-ocean sites being adapted to neritic environments.