Evidence for coupling of climate and CO_2 during the late Neogene cooling

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The Cenozoic is characterized by a long-term cooling and expansion of continental ice sheets over the past 50 Myrs [1]. The Late Miocene cooling (~7 Ma) and subsequent major Northern Hemisphere Glaciation (NHG) (~3 Ma) during the Pliocene were major transitions in climatic evolution of the late Cenozic. Recent reconstructions indicate that a long-term decline in pCO_2 was a key driver of global cooling and major glaciations in the Cenozoic [2-4]. However, the exact role of CO_2 in driving the final Cenozoic glaciations remains unclear as proxy records suggested that temperature and pCO_2 may be decoupled during part of the last 12 Myr [5]. In this study, we refine the alkenone paleo-pCO_2 barometer, revise previously published Miocene to present pCO_2 datasets [4] [6] [7], and provide additional records that are continuous at a given site in late Miocene. Our refined CO_2 record reveals that, although the change was subtle, strong coupling of pCO_2 and climate has persisted over the last 10 Myr. Causes of the long-term drawdown of pCO_2 remain unknown but it could have been related to intensification of mountain erosion [8] and/or the ocean cooling [9].

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