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Southern Asian magmatic lull drove Eocene global cooling

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Accumulating multidisciplinary evidence reveals plate tectonic processes as a fundamental control on Cenozoic paleoclimate evolution, with Neo-Tethyan volcanic pulses matching well with the Early Eocene Climatic Optimum (EECO; ca. 53-49 Ma). However, the driving mechanisms governing the subsequent (ca. 49-34 Ma) long-term global cooling remain contentious. To address this knowledge gap, we compile available magmatic/detrital records across southern Asia, supplemented by a global radiometric dating dataset and a newly-reconstructed uplift history of the Tibetan Plateau. Our synthesis, along with geologic observations, reveals a widespread magmatic shutdown throughout southern Asia during ca. 45-32 Ma, which probably resulted from the termination of Neo-Tethyan subduction and subsequent coupling and flat subduction of the Indo-Australian plate. Critically, we demonstrate that Early Eocene magmatic flare-ups along southern Asia correlate with the atmospheric CO_2 buildup during ca. 60-50 Ma, thus triggering the EECO, and that the subsequent regional magmatic quiescence, giving rise to a strong reduction in volcanic and metamorphic CO_2 outgassing, exhibits a striking temporal correspondence with the middle to late Eocene secular decline in atmospheric CO_2 and global cooling—a relationship discordant with the Tibetan Plateau uplift model. Such strong systematic covariations compel us to hypothesize southern Asian magmatic lull as the primary tectonic driver of post-EECO atmospheric CO_2 drawdown and consequent global cooling.