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Department of Earth Science

Speakers Club

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Climate forcing by silicic large igneous provinces: an example from the Middle Jurassic arc of southwestern North America

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The eruption of large igneous provinces (LIPs) is widely recognized as the driving force behind environmental changes occurring in association with the major Phanerozoic mass extinction events (e.g. climate change, oceanic anoxia, ozone depletion, carbon isotope shifts), although cause-effect details remain the focus of intense scientific debate. Here, the ~2500-km-long Jurassic continental margin magmatic arc segment extending from eastern California to east-central Mexico is recognized as a silicic large igneous province (Silicic LIP) on the basis of its aerial extent, thick rhyolite ignimbrite-dominated volcanic/sedimentary sections, and rapid emplacement during an arc magmatic flare-up at ~170-165 Ma. This flare-up is synchronous with the high latitude Chon Aike Silicic LIP of South America-Antarctica, both coinciding with an abrupt acceleration in opening of the Central Atlantic Ocean at 170 Ma and increased subduction rates of oceanic lithosphere beneath the western edge of Pangea. The inception of explosive silicic volcanism in these areas correlates tightly with Bajocian (170-168 Ma) global cooling, oceanic anoxia, and a positive $\delta^{13}\text{C}$ carbon isotope excursion. Ocean iron fertilization by silicic volcanic ash is suggested as a possible forcing mechanism driving these changes.