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From metasomatized lithosphere to bimodal magmatism: geochronology, isotopic, and zircon δ18O constraints on the Late Jurassic flare-up in the Sierra Nevada arc

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Continental arcs commonly experience brief, high-flux magmatic pulses, and the Late Jurassic Sierra Nevada continental arc records one such event expressed as a bimodal suite of silicic plutonic, hypabyssal, and volcanic rocks, associated cumulate gabbros, and a regionally extensive andesitic dike swarm. The timing, magma sources, and tectonic controls of this flare-up, however, remain debated.We integrate high-precision CA-ID-TIMS U-Pb zircon geochronology, whole-rock Sr-Nd-Pb isotopes, zircon $\delta^{18}O$, trace-element geochemistry, and structural data from the southeastern Sierra Nevada and Mojave Desert. New ages constrain magmatic activity to a short interval between 152 and 149 Ma, following a magmatic lull from 158 to 153 Ma, demonstrating that emplacement of the bimodal suite, the Independence Dike Swarm, and contraction along the East Sierran Thrust System were broadly coeval.Geochemical and isotopic data indicate that andesitic magma acted as the parental melt. High-silica, crystal-poor volcanic, hypabyssal, and plutonic rocks formed as evolved interstitial melts, whereas mafic gabbros represent complementary cumulates. Isotopic signatures support partial melting of hydrated lower crust or lithosphere, followed by differentiation in shallow, deformation-influenced reservoirs. The transition to oblique subduction and a transpressional regime likely enabled rapid magma generation, ascent, and emplacement during the 152–149 Ma flare-up.