Mid to Late Cretaceous plutons recording strain variations in the Sierra Nevada, California

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The resurgent granitic Shellenbarger pluton of the Mid-Cretaceous Minarets caldera is located in the Ritter Range Pendant of the Sierra Nevada magmatic arc. Based on new field and structural maping, supported by anisotropy of magnetic susceptibility (AMS) data and LA-ICP-MS dating, we have refined the evolution of the Minarets caldera as follows: (1) pre-collapse Plinian eruption at ~101 Ma; (2) caldera collapse; (3) ductile transpressional shearing; (4) magma resurgence (100 Ma, U-Pb on zircons); and (5) post-caldera volcanic activity (~96.7 Ma). After emplacement, the granitic magma was overprinted by ~NNE–SSW horizontal shortening as evidenced by ~WNW–ESE hypersolidus magmatic and postmagmatic AMS foliations.

Similar ~NNE–SSW to ~NE–SW horizontal shortening is documented in several Late Cretaceous syntectonic plutons of the central Sierra Nevada, but they record variable stretching directions: subvertical in older ~102–86 Ma plutons and moderate to horizontal in younger ~87–86 Ma plutons. This is corroborated by our AMS data from the ~88–86 Ma Cathedral Peak Granodiorite which exhibits steep to moderately plunging magnetic lineations (in contrast to steep mesoscopic lineations). Thus the Cathedral Peak Granodiorite may potentially preserve a key information on the nature of Late Cretaceous regional strains in the Sierra Nevada. The Cretaceous Sierra Nevada arc was constructed during overall dextral transpression, however, we propose that a significant change in the deformation regime occurred at ~87–86 Ma, documented by the change in lineation orientation.

We suggest that the older plutons were emplaced during pure shear-dominated transpression, whereas the younger plutons record a switch to wrench-dominated transpression. Such kinematic switch is explained as reflecting increased relative convergence obliquity of the Farallon Plate subducting beneath North American Plate. Moreover, the deformation switch overlaps with termination of Cretaceous high-magma-flux event, one episode of cyclic magmatism along the North American active continental margin.