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Late stage differential exhumation of the Nevado-Filábride Complex, Betic Cordillera, southern Spain: Evidence from apatite (U-Th)/He and fission track thermochronology

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Previous apatite and zircon fission track ages of the Nevado-Filábride Complex support rapid cooling from 300°C at 12 to 8 Ma (Johnson et al., 1997). However, apatite fission track ages from the western end of the complex are less than 5 Ma, implying that it experienced significant cooling/denudation during the Neogene that was linked to both the movement of tectonic detachments and erosion (Johnson et al., 1997; Johnson, 1997; Reinhardt et al 2007). Here combine the first apatite (U-Th)/He ages with new apatite fission track (AFT) ages from the region in an attempt to constraint the Neogene cooling of the Sierra Nevada.
(U-Th)/He ages from western Sierra Nevada vary from 9.7 to 5.0 Ma and those from eastern Sierra Nevada and Sierra de los Filabres are from 12.6 to 6.3 Ma. AFT ages of the western Sierra Nevada samples are essentially identical to He ages (8.7 to 6.4 Ma) while the eastern Sierra Nevada and Sierra de los Filabres samples yield ages of 15.5 to 6.9 Ma. The similarity of (U-Th)/He and AFT ages in western Sierra Nevada indicate rapid exhumation from a depth corresponding to $\sim$110ºC, while those of the eastern Sierra Nevada and Sierra de los Filabres show a slower cooling rate. The distribution of the cooling rates across the entire Nevado-Filábride complex suggests that the western and eastern borders were uplifted by different mechanisms. The cooling rates suggest that the Mecina Fault was segmented. This fault was inactive in the central and eastern Sierra de los Filabres and the erosion and folding were the main mechanisms of uplifting of the rocks in the uppermost crust during Late Tortonian times. The segment of Mecina Fault, now outcropping in western Sierra Nevada, was active at the same time producing a rapid cooling and exhumation.