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Gneiss domes in continental wrench zones

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Many gneiss domes are genetically related to continental wrench zones: mid-crustal rocks that core the domes were metamorphosed and exhumed during transpression-transtension cycles associated with wrenching. The Nigde Massif, central Turkey, is an example of a migmatite-cored structural dome that was metamorphosed, deformed, intruded and exhumed in an oblique tectonic regime involving a switch from transpression (prograde metamorphism) to transtension (exhumation). An 80 m.y. history of transpression and transtension is recorded in Nigde metamorphic rocks, and the last 50 m.y. is recorded in both basement and cover rocks. Nigde metamorphic rocks record a high-T, top-to-N, syn-transpression ductile fabric that was overprinted by lower grade, top-to-S, syn-transtension ductile shear zones. Ar data for hornblende, muscovite, and biotite document rapid Late Cretaceous cooling, with the oldest Ar hornblende ages (79-88 Ma) overlapping U-Pb ages in monazite and zircon (78-92 Ma). Muscovite Ar ages are dominantly 78-81 Ma. Biotite Ar ages are 74-79 Ma, with the exception of perturbed samples from the eastern margin of the massif and from young granitic stocks in the dome core, which are Eocene or younger. The eastern margin has less organized mineral lineations than the core, and brittle faults that are most abundant near the Central Anatolian fault zone. The progression of structures represents the transition from crustal thickening in transpression to exhumation in transtension. These features are overprinted by an additional transpression-transtension switch that resulted in reburial/reheating of the basement and cover (yo-yo tectonics). The observed structures and inferred thermal histories are characteristic of orogenic middle crust metamorphosed and exhumed in highly oblique tectonic regimes: rapidly cooled metamorphic domes with lineations parallel to wrench zone boundaries. Exhumation is more rapid than burial because burial occurs at tectonic rates, whereas the combined effects of buoyancy and coupling of surface processes and tectonic denudation accelerate exhumation of buried continental material.