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Thermochronology and Tectonics of the Leeward Antilles: evolution of the Southern Caribbean Plate Boundary Zone and accretion of the Bonaire Block

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Tectonic reconstructions of the Caribbean Plate are severely hampered by a paucity of geochronologic and exhumation constraints from anastomosed basement blocks along its southern margin. New zircon U/Pb, 40Ar/39Ar, apatite fission track and apatite (U-Th)/He data constrain quantitative thermal and exhumation histories, which have been used to propose a model for the tectonic evolution of the emergent parts of the Bonaire Block, and the Southern Caribbean Plate Boundary Zone. An east-facing arc system intruded through an oceanic plateau during $\sim$90 to $\sim$87 Ma, and crops out on Aruba. Subsequent structural displacements resulted in >80°C of cooling on Aruba during 70-60 Ma. In contrast, exhumation of the island arc sequence exposed on Bonaire occurred at 85–80 Ma and 55–45 Ma. Santonian exhumation on Bonaire occurred immediately subsequent to burial metamorphism and may have been driven by the collision of a west-facing island arc with the Caribbean Plate. Island-arc rocks intruded oceanic plateau rocks on Gran Roque at $\sim$65 Ma and exhumed rapidly at 55–45 Ma. We attribute Maastrichtian – Danian exhumation on Aruba and early Eocene exhumation on Bonaire and Gran Roque to sequential diachronous accretion of their basement units to the South American Plate. Widespread unconformities indicate late Eocene subaerial exposure. Late Oligocene – early Miocene dextral transtension within the Bonaire block drove subsidence and burial of crystalline basement rocks of the Leeward Antilles to $\leq$1 km. Late Miocene – recent transpression caused inversion and $\leq$1 km of exhumation, possibly as a result of the northwards escape of the Maracaibo Block.