Tectonic Evolution of the India-Asia Suture Zone since ~40Ma, South-Central Tibet

Veronica Sanchez

Suture zones represent more than the location where continents have welded together. They are zones that extend for tens (if not hundreds) of kilometers and often archive complex geologic histories and episodes of long-term deformation associated with collision. The discontinuous exposure of Gangdese magmatic arc rocks has long been recognized along the India-Asia suture zone. The relatively undeformed Cretaceous-Tertiary Linzizong volcanics, which cap Gangdese rocks, crop out mostly from 89.5° to 84° E longitude. Forearc deposits along the suture are discontinuous. The nature of these discontinuities may be attributed to the irregularity of the active margin, the nature of Neotethyan subduction, or trapped oceanic crust within irregular sections of the margin. The area in the vicinity of 29°54'N, 84°24'E in south-central Tibet is unique because field relationships between passive margin rocks (Tethyan sedimentary sequence), forearc deposits (Xigaze Group), magmatic arc rocks (Gangdese Batholith), and post-collision deposits can be evaluated. To assess the structural history of this area, I mapped across the north-directed Great Counter Thrust system (GCT) and implemented biotite $^{40}Ar/^{39}Ar$ thermochronology and zircon U-Pb geochronology on a granite footwall sample. Results show that a U-Pb zircon age of ~40 Ma corresponds to the age of emplacement of the granite, while a younger ~19 Ma $^{40}Ar/^{39}Ar$ age implies a reset of the biotite system as the granite passed through the 350°C isotherm. I correlate the post-collision deposits to the Eocene-Oligocene Qiuwu Formation based on field relationships, stratigraphy and petrology. In the mapped area, the Qiuwu Formation (~3 km thick) comprises three conglomerate units. These range from cobble/gravel/pebble conglomerates rich in volcanic and plutonic clasts to a young unit that is made up entirely of sedimentary clasts. I infer from petrology and clast composition that the Qiuwu Formation had a northern provenance (Lhasa block and magmatic arc) that supplied fluvial deposits and alluvial fans to the south. My observations are consistent with other regions, where paleocurrent data from other studies suggest south-directed paleoflow. Previous work in the area suggests that the south-directed Late Oligocene Gangdese Thrust (GT) crops out north of the GCT; however, there is no evidence of GT deformation in the study area. In the structural model, the granite intrudes at ~40 Ma, is exposed, buried, then exposed by the GT ~27-24 Ma, buried a second time, then exposed by the GCT ~19 Ma. I assume the GCT cut the GT ≥ 19 Ma because the GT is older than the GCT. To explain the 20 million year gap between the time of emplacement (~40 Ma) and the time of exposure (~19 Ma), I invoke the GT to facilitate exhumation of the 40 Ma granite ~27-24 Ma, thus providing detritus to the Qiuwu conglomerate. The Qiuwu conglomerate shows evidence for greenschist facies alteration, requiring it to have been buried to ~12-10 km (~30°C/km). I suggest a blind thrust in the GCT system was responsible for exposing the magmatic arc rocks in this area from ~12-10 km at ~19 Ma. A Middle Miocene ~N-striking, W-dipping oblique normal fault system cuts and offsets the India-Asia suture zone. I interpret that this fault exposes a shallower structural level to its west (where the GT is not exposed) compared to the east, where the GT has been previously interpreted by others to crop out. These results highlight events that have modified the architecture of the India-Asia suture zone since ~40 Ma. ■