Mapping the metaclastic units of Angel Island: A study in structural geology and geochronology

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The Franciscan Complex of California formed in a subduction zone along the Mesozoic-Tertiary western North American margin. It represents the Mesozoic forearc and consists mostly of underplated clastic sediment-rich terranes that are metamorphosed from prehnite-pumpyellite to blueschist facies. Angel Island, in the San Francisco Bay, is composed of blueschist facies metasedimentary and metabasic rocks containing potential paleomegathrust faults. Past studies have lumped Angel Island as one block and correlated it to other Franciscan Complex units based on lithology and metamorphic grade without mapping the structural nuances of the island.

We subdivide the metaclastic and metavolcanic units based on structural fabric, modal ratios of framework grains, clast and matrix composition, presence/absence of metamorphic minerals and contact relations. We observe several faults juxtaposing different units. Using fault rock characteristics, fault orientation, and the occurrence of syn-kinematic high-pressure minerals, we identified two low-angle faults that were active as Mesozoic, syn-subduction faults at blueschist depths, for further study. The steep faults contain only brittle fabrics and strike-slip lineations, and little or no veining, so we interpret these as San Andreas–related faults active at shallow depths (potentially recent). Petrography, detrital zircon fingerprinting and ages confirm the clastic unit subdivisions established in the field and suggest additional unit distinctions. Our preliminary results show depositional ages for the clastics range from 85 to 110 Ma. Older detrital zircons are correlated to the Precambrian populations in Paleozoic North American passive margin sediments, suggesting recycling into the Franciscan trench during the Cretaceous.

With this study, we differentiate units and update the structural map of Angel Island with geochronologic and petrologic data to better understand this island. We can then identify paleo-megathrust structures that may have hosted Mesozoic tremor and slip.

Biography: Meghomita Das is a PhD candidate in the department of Earth & Planetary Sciences at McGill University. She studies how earthquakes form and the way they transfer energy to the surface by examining the rock record of ancient earthquakes. She is working at Angel Island to unravel the rock signatures and mechanics of deep tremor and slow slip in subduction zones. She is interested in science communication and science policy. More information about her can be found on her website (www.meghomita.com).