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# RESEARCH EXPERTISE & INTERESTS

**Expertise:** The study of the 4-D architecture of crustal structures and tectonic systems through the integration of geologic methods with geophysical and remote sensing tools.

**Specific expertise:**

- Computer-aided structural and stratigraphic interpretation of 3-D and 2-D seismic reflection data. Use of attribute mapping in structural analysis and seismic stratigraphy.
- Study of complex structures and tectonic systems using remote sensing data, including TM, TMS, TIMS, AVHRR, AVIRIS hyperspectral, SAR, and SideScan Sonar.
- Digital mapping and integration of field-based studies with geophysical and remotely sensed data using Geographic Information Systems (GIS).
- Field mapping and tectonic synthesis.
- Structural, microstructural and strain analysis.

## Interests:

### Mechanics of Faulting and Seismogenesis

This work is an outgrowth of my research on modern subduction zone thrusts. Although earthquakes are much studied as a phenomena, the actual mechanics by which seismogenic faults lock to release strain is poorly understood. The critical question is to determine what locks subduction thrusts. The favored hypothesis, in the literature, is that warm fluid migrating up the subduction thrust precipitate quartz, carbonate and zeolites. These minerals both increase the cohesion of the fault zone by cementation and also change the frictional properties of the fault surface making it more susceptible to an accelerating slip or an earthquake. My work on the internal structure of the Barbados Ridge décollement, however, indicates that fault zones may be significantly strengthened by cross-cutting structures that form mechanical asperities in the system. I am working at multiple scales to investigate the strengthening of fault zones and the role of both mineralization and asperity formation in seismogenesis.

### Time-Transient Strain-Partitioning at Convergent Margins

Convergent margin systems are more complex than previously thought. Still poorly understood are the factors separating margins dominated by accretion and those that undergo subduction erosion. Just as enigmatic is the role of obliquity in subduction and strain portioning that may result on regional scales. At the intersection of these two concepts, is the increasingly well-documented phenomenon of arc-oblique transcurrent faulting. My studies of the Barbados Ridge accretionary wedge and the onshore portions of the Cascadia subduction zone indicate that current mechanical models poorly explain the phenomena and that these structures can help to unravel the relationships between subducting slab tectonism and forearc evolution. These studies also show that strain fluctuates episodically over time, on regional scales. Regional patterns of arc-oblique transcurrent faulting indicate changes in regional stress patterns over short temporal periods indicating time-transient strain-partitioning My current work, in this area, involves testing mechanical models of arc-oblique fault formation against other forearcs globally and documenting time-transient strain portioning in both modern and ancient forearc systems.

### Lower Plate Influences in the Evolution of Overlying Thin-Skin Tectonic Systems

I am interested in both fold and thrust belts, such as the foreland fold and thrust belt of the North American Cordillera, and extensional systems, such as the Basin and Range province. This work, also an outgrowth of my use of advanced 3-D seismic reflection techniques to study the Barbados Ridge accretionary wedge, indicates that there are important influences of lower plate evolution on the architecture of thin-skin tectonic systems. My future work, in this field, involves the integration of 3-D seismic, surface mapping and remote sensing to study the specific influence of lower plate tectonism on other thin-skin tectonic systems globally. Some specific problems may include coeval extension within fold and thrust belts and within accretionary systems.