Collision Tectonics of Taiwan and the Disappearance of Shelf Edge Magnetic Anomaly

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Taiwan As a Laboratory

- Mountain building is still a puzzle
- Taiwan is very young, geologically speaking
- Taiwan is well mapped geologically, but with competing models of tectonics
- With a convergence rate about 8 cm/yr, and a rock-uplift rate of ~2 cm/yr: “2nd most active”? 
- Taiwan orogeny is “alive” – a chance to learn what are the real orogenic processes
- Rate of earthquake occurrence very high - Illumination and mapping internal deformation
- Subsurface data becomes more abundant - testing and modification of models possible
- TAIGER was designed for hypotheses testing: First conceived: 2000; Birth 2004; in progress
“Time-Space Equivalence” (Suppe)
Initial Conditions?

30 km

12-15 km
Possible pre-collision lithospheric configuration

- Crust thins rapidly south of shelf
- Very thin crust at base of slope
- Thicker, slower crust in south—
  not oceanic
- This is what is subducting at the Manila Trench!
Central Taiwan
Magnetotelluric Profiles
Fast arrivals near plate boundary: local event
Texan array (~200m spacing)
Tests of tomographic model

With smaller earthquake data recorded on dense arrays – not used in tomography
Laboratory Vp/Vs Measurements

- Felsic rocks
  - [Jizba, 1991]
  - [Holbrook et al., 1992]
  - [Matsumoto et al., 2010]
- Mafic rocks
  - Oceanic [Hyndman, 1979; Christensen, 1996]
  - Continental [Holbrook et al., 1992]
- Hydrated rocks
  - [Holbrook et al., 1992]
Raw Ts/Tp Across Taiwan


**α-β quartz transition (ABQT)**

- **Upper crust**: Quartz-rich sandstone and mudrock
- **Middle and lower crust**: Mafic rock
- **Middle and lower crust**: Felsic rock

- **CP**: Coastal Plain
- **CR**: Central Range (mountain belts)
- **CoR**: Coastal Range

- **ABQT at 24 km depth**

- **Depth (km)**
- **Vp (km/s)**

- **Legend**
  - Blue triangles: 12 km
  - Green triangles: 18 km
  - Red triangles: 24 km
  - Blue squares: 30 km
  - Green squares: 36 km
  - Red squares: 42 km
  - Blue diamonds: 48 km
  - Green diamonds: 54 km

- **Map**
  - 120° - 122° longitude
  - 22° - 25° latitude

- **Coastal plains and mountain ranges**

- **Geological features**
  - Quadrant markers: CP, CR, CoR
Numerical Geodynamical Experiment of 2-D Arc-Continent Collision by Luc Lavier et al. 2012