Acatlan Complex, Southern Mexico
Paleozoic

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Outline

• Acatlan Complex
  – Subunits
  – Pluton
• Deformational/Tectonothermal Events
• Location (Oaxaca Terrane)
• North American Analog

Acatlan Complex

• Uncomformable basement of Mixteco Terrane
• ~35,000 km²
• Nd crustal residence age = 1.5 Ga (Yanez, et al. 1991)
• Sequence <15 km thick
• Deformed mixture: metasedimentary rocks, granitoids, schists, eclogites
• Tectonically up against Oaxacan Complex
• Global location uncertain

Principal Metasedimentary Units

• Cosoltepec Formation
  2 major thrust slices
  – Petatlcingo Subgroup (Lower plate)
    • Lower Chanumba Formation
    • Upper Cosoltepec Formation
  – Acateco Subgroup (Upper plate)
  – Separated by west vergent thrust
    • 200km displacement
    • Late Ordovician-Early Silurian

• Tecomate Formation
Petlalcingo Subgroup
- Lower plate
- Thick sequence of siliciclastic rocks
- Inferred ocean floor fragments
- Obducted accretionary prism
- Parautochthonous trench & forearc deposits of convergent continental margin
- Strongly metamorphosed (high T, moderate P) (Yanez, et al., 1991)

Lower Chazumba Formation
- Qtz-rich biotite schist
  - Garnet, staurolite, sillimanite
- Amphibolite facies
- Psammitic & pelitic rocks
  - Upper Cosoltepec Formation
    - Most exposed
    - Greenschist facies
- Quartzose phyllite-chlorite-phengite schists dominate
  - Retrogressed biotite, abundant quartz veins
  - Lesser amounts: pillow greenstones, metachert, massive quartzite, serpentinite, manganiferous rocks

Acateco Subgroup
- Upper plate
- Xayacatlan Formation
- Esperanza Granitoids
  - Obducted ophiolitic sequence
  - Eclogite Facies

- Xayacatlan Formation
  - High grade, mafic-ultramafic, interlayered pelitic & siliceous metasedimentary rocks
  - Foliated garnetiferous schists, gneisses, porphyroblastic amphibolites, serpentinites, mylonitic ultramafics
  - Eclogite
- Esperanza Granitoids
  - Sheet-like mylonitic granitoids
  - Megacrustic K-spar augen gneiss, migmatite, schist, minor amphibolite
  - Interpreted as syntectonic with emplacement of thrust nappe 440 Ma (Malone, et al., 1991)
  - Local metamorphism (Late Ordovician-Late Devonian)
  - Intrude Oaxaca terrane

Tecomate Formation
- Uppermost unit
- Mildly metamorphosed, strongly deformed
- Thinly bedded pelitic & psammitic sedimentary rocks
- Volcano-sedimentary
  - Some marbles, pebble conglomerates, volcaniclastic units of basaltic-andesite, & rarely felsic turbiditic volcanic arc sequence deposited in front of arc-continent collision
- Crinoids, bryozoan, mollusks found in limestone
**Tectonothermal Events**
(Yanez, et al. 1991)

- Early-Mid Devonian (380-400Ma)
  - Formation of schists & eclogite w/in terrane & intrusion & deformation of Esperanza granitoids
- Late Pennsylvanian-Permian:
  - Totoltepec pluton intrudes (287Ma)
  - Result of NA-Gondwana collision
  - Matches up w/ other tectonothermal activity in S. Mexico
- Early-Mid Jurassic (205-170 Ma)
  - Formation of later intrusion (San Miguel Intrusion) & Magdalena migmatite

**Deformational Events**
(Malone, et al. 2002)

- 3 events
  - Late Ordovician-Early Silurian Acatecan Event
    - Effects Cosoltepec Fm.
  - 2 in Early Permian
    - Occurred around same time as Ouachitan orogeny
      - D2: south vergent thrust, N-S dextral shear
      - D3: E-W shortening

Where are we exactly?

Malone, et al. 2002
Keppie et al. 2000

**North American Analogs**

- No metamorphism in NA Western Cordillera at this time
- Acatlan sediments are much older than sediments of Western Cordillera terranes during this time (ex. Wrangellia)
- Eastern Cordillera Acadian Orogeny

**Totoltepec Pluton**

- Tectonically overrides Tecomate Formation
- Grades upward:
  - gabbro/diorite → trondhjemite/tonalite → mafic marginal phase
- Foliation, compositional banding, mild metamorphism
- Postdates main metamorphic & deformational events
- Series of plutons extending length of Mexico
- 287±2Ma (U-Pb Zircon dating) (Malone, et al., 2002)

**A. Acatlan Complex**
Deformed w/ Acadian belt during Gondwana-Laurentian collision.
B. Moved away from NA w/ Gondwana attached to present day Colombia
C. 2nd NA-Gondwana collision cause deformation and plutonism in S. Mexico
D. Break up of Pangea, Acatlan complex moves w/ NA plate to present position

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