Continental Breakup and Formation of Rifted Margins: The Gulf of Mexico as a Natural Laboratory

D. Harry, Colorado State University
R. Stern, University Of Texas At Dallas
E. Anthony, University Of Texas At El Paso
G.R. Keller, University Of Oklahoma
I. Norton, University Of Texas
J. Van Wijke, University Of Houston

Community planning meetings

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PART I
Why the Gulf?
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PART III
Opportunities & Challenges
Why the Gulf of Mexico?

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- Science Beyond RIE – a Mesozoic gateway between the Atlantic and Pacific Oceans
Tectonic Evolution

- Rift initiation ~ 215 Ma (Eagle Mills and La Boca Fms.)
- Seafloor spreading began ~ 165 Ma (inferred – no direct evidence)
- Opening ceased ~138 Ma (inferred)
- Followed Ouachita orogenic trend (sort of)
- The widest known rifted margin
Tectonic Evolution

**North America**
- Ouachita Trough
- Wiggins Arc
- Gulf of Mexico

**South America**

**Mississippi (early Ouachita orogeny)**
- Ouachita Suture

**Pennsylvanian (late Ouachita orogeny)**
- Black Warrior Basin
- Alleghanian Suture

**Triassic (rifting)**
- Ouachita Orogen
- Wiggins Arch
- Gulf of Mexico
- South America
- Salt Basin
Tectonic Evolution

- Counterclockwise rotation of Yucatan away from North America
- Transform motion between Yucatan and eastern central Mexico
- Extreme stretching on central North American margin, oblique to trend of Precambrian transform margin and Paleozoic Ouachita orogen

Pindell et al., 2000
Opportunities

- **Tectonic Inheritance** – The Gulf of Mexico provides an opportunity to compare rifting of a “soft” collision orogen in the central and eastern Gulf and a “hard” collision in the western Gulf: thin-skinned vs. thick-skinned.
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- **Rift Segmentation.** What controls whether transitional crust is broad (among the broadest in the world in the central GOM) or narrow (as in the western GOM)? The Gulf offers an opportunity to compare rift vs. transform margins. What controls along strike changes from a magmatic margin (western Gulf) to an amagmatic margin (eastern Gulf).
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- **Mantle Fabrics.** Slightly depleted spinel peridotite mantle. Some evidence of margin-parallel S-wave splitting. A rift relic, or a relic of older orogenic events?
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- **Fluid Evolution and Migration.** The GOM is a factory for generating a wide variety of fluids: CO$_2$, brines, and hydrocarbons. The GOM provides an opportunity for understanding how these fluids form, migrate, and interact.
Challenges

- Dodging industry and ship traffic
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- Great depth to basement & lack of exposure
- Imaging through salt & separating Salt Tectonics from Rift Tectonics
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