Geology of Puerto Rico
An Overview of the Plate Tectonic Origin of the Caribbean

Outline
- Rock types in Puerto Rico
- Plate Tectonics review
- Puerto Rico formed WHERE?
- Evidence
- Tectonic Reconstruction

Rocks for Astronomers
Astronomy: H, He, Metals
Geology: Basalt, Other, Volcanic, Marine, Olivine, Limestone, Mg₂SiO₄, CaCO₃

Astronomy (simplified)
- Hydrogen
- Helium
- Metals (everything else)

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Geology
- Hot (igneous)
- Medium (metamorphic)
- Cold (sedimentary)

Geology (continued)
- Hot = Igneous - Volcanic rocks, basalt
  - Lava is molten on the surface, cools quickly
  - Granite is molten underground, cools slowly
- Medium = metamorphic
  - Re-heating of rocks, re-crystallization
  - Cooking of limestone makes marble
- Cold = sedimentary
  - Carried by wind or water, like sandstone
  - Layered sands from dunes near the shore (look along the Jobos beach road cut)
Geology Field Trip

- Let’s look at a nearby outcrop of limestone
- (How often have you had an astronomy field trip?)
More Fossils

Structure of the Earth
- Earthquakes tell us about the interior structure
- Earthquakes generate P-waves and S-waves
- P-waves are pressure waves – in direction of motion
- S-waves are shear waves – perpendicular to the direction of motion
- S-waves do not propagate through liquids

Seismology:
a way to probe the Earth’s interior

Plate Tectonics Overview
- Earth surface is made up of semi-rigid “plates” (lithosphere)
- The plates move on top of a plastic layer of rock (asthenosphere)
- The driving force is convection in the mantle
- Heat from the core fuels the system
Types of Plate Boundaries

- Divergent – Spreading ridge (Atlantic)
- Convergent – Subduction Zone (Lesser Antilles, Pacific Rim)
- Neither - Transverse fault (San Andreas Fault, Puerto Rican trench at present)

Global Tectonic Plates

Island Arc formation at a Subduction Zone

Monserrat Volcano

Soufrière Hills

Before

After
Subduction of a spreading center

- Subduction cut off
- New trench forms on the other side
- Same volcanos may be activated

Caribbean Plate Today
boundary and geologic regions

Plate Tectonic Reconstruction of the Caribbean region:
200 million years ago to present
Caribbean Plate Today
boundary and geologic regions

Puerto Rico and Virgin Islands
microplate