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Report 1: Mantle waves induced by rifting

First Topic:

Mantle convection is a focus of the article, as it aims to establish the processes behind the main headline. This concept relates to learning objective 2.6, Describe how the oceanic plates participate in mantle convection. Tom Gernon's interest in the topic of what is pushing up the plateaus discussed in the article had to be tested in a way similar to how mantle convection occurs on the Earth. The article discusses that "...hot mantle rock rises up into the gap between diverging tectonic plates. Like a lava lamp, this rock cools, becomes denser, and sinks in a churning, circular pattern called convection". This is the exact same thing we learned about in lecture, that mantle that is in a magma-like consistency pushes up at a divergent plate boundary. The article does not particularly discuss the style of mantle convection, as we discussed in lecture, but it can be inferred it is referring to whole mantle convection. Furthermore, the article touches upon seismic activities being a phenomenon that closely relates to the pushing up of the plateaus. In lecture, we learned that seismic observations are what make scientists daily confident that whole mantle convection is what takes place underneath Earth's surface. In reference to the tall plateaus, Tom Gernon noticed that "... the arrangement of these plateaus looked "suspiciously systematic": A parade of them, one after another, begins near the coasts, and they appear to get gradually younger at greater distances inland…he had seen the same pattern in South Africa with the ages and locations of kimberlites, diamond-containing volcanic

deposits". Though not necessarily related to mantle convection, this phenomena references mantle plumes, which help develop the topology of Earth too. In lecture, the formation of the Hawaiian islands were mentioned to have been formed by mantle plumes exuding magma over time while plates move over the spot. This creates a "line of volcanoes" similar to the Kimberlite volcanoes mentioned which can be dated due to the sequential nature of their formation.

Second Topic:

Continental Drift is another topic the article discussed which can be traced back to the aftermath of plate movement caused by plate tectonic theory. The article gives background information that is relevant to the phenomena being proposed in the article. It mentions Alfred Wegener's findings that all pointed to the movement of tectonic plates developing much of Earth's topology. The article clearly states that "Geologists now know the continents float buoyantly on the hot rocks in Earth's mantle, which behave like a thick ooze". This is factually correct, comparable to what we learned in lecture. This is also a good starting point for understanding mantle convection also. The article also mentions a model constructed to test the phenomena of mantle waves induced by rifting. In the scientist Gernon's model, churnings caused by mantle convection are said to have "...propagated out laterally on each side of the rift, like a wave. The model showed the waves rippling across the underbellies of the continents at a rate of 15 to 20 kilometers per million years, an imperceptible fraction of a sloth's pace". This portion of the article mentions movement of plates at a rate similar to what was discussed in class. The article provides a range, indicating that different plates move at different rates, which was also noted in lecture.

Topic Not Yet Taught:

One topic we have not yet discussed in lecture is that of biogeochemical cycles. The article mentions that Gernon's team of researchers "...think mantle waves could explain more than just plateaus and diamond eruptions. Gernon is close to publishing a paper that examines how wave-driven uplift could help explain biogeochemical cycles in the geologic past, with increased erosion bringing sediments into the ocean that consumed oxygen, leading to marine extinctions". We have partially discussed erosion being part of the rock cycle. Sedimentary rock is formed when other types of rock get eroded and release "dust"-like particles, which when compressed under pressure over time form sedimentary rock. That much is clear. However, the part that discusses the ocean absorbing oxygen, which partnered with erosive sediment leads to marine fauna and flora damage, is unclear. I predict that the biogeochemical cycles refer to things like the Carbon cycle, which involves both living organisms and nonliving solids, liquids, gasses, etc.