

Re: Why is 70% of Earth's sial missing?

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Greg Neill wrote:

Sial is the top layer and would be expected to be the source of much of the material ejected by the mars-sized impactor that created the Moon. The 70% of the Earth's surface covered by ocean is largely areas produced by spreading zones where magma is welling up.

So what's the problem?

1. When a ball-shaped moon collides with a ball-shaped Earth, the moon cannot scrape 70% of the Earth's surface. Even a shovel-shaped moon cannot scrape 70% of the Earth's surface.
 2. The oceanic crust is made of sima, not sial.
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John Curtis wrote:

Fresh sima (magnesium-iron silicate) and sial (aluminum silicate, clay) are produced at midocean volcanoes: <http://www.asu.edu/clas/csss/csss/News/life.html>
Unlike sima, sial (aluminum silicate, clay) does not precipitate at the midocean volcano (residual negative charge prevents clumping), but is propelled toward the continent by the waves.

Sial is the material that continents are made of. There is little sial on the ocean floor. You are saying that sial bedrock is somehow moved by the waves that are hundreds of meters above the sial bedrock. How is that possible?

On shore it settles out as clay, feldspar or anorthosite

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(lunar highlands). When Earth's oceans evaporate, clay and mud, which line portions of the seafloor, will create the appearance of sial also dominating Earth's crust.

Feldspar and anorthosite are NOT sedimentary rocks. They crystallized from magma long time ago, in the Archean and Proterozoic eons. Clays make up minuscule part of the Earth's crust, so they are not worth mentioning. Sial is sometimes called granitic layer of the crust, because it is made mostly of granite, which is made mostly of silica (SiO₂ content = 72%).

Jeff Root wrote:

Hi Jeff! I was a member of the Minnesota Space Frontier Society long time ago. Then I wrote the Earth-to-Orbit Transportation Bibliography; it is posted at:
<http://www.islandone.org/LEOBiblio>

First, for anyone else reading this, "sima" refers to rock rich in (si)lica and (ma)gnesium, while "sial" refers to rock rich in (si)lica and (al)uminum. Moon rock more closely resembles the lighter sial than the heavier sima.

True. The Moon's crust is very similar to the sial, but it has more iron than the sial.

I have no idea how Earth's crust was arranged before the impact which formed the Moon. Maybe it was already separated into sima and sial, maybe it wasn't. Maybe there were continents and oceans, maybe there weren't.

The interior of the Earth is very hot now because it is heated by the radioactive decay. Most of the Earth's crust is a solid bedrock made from cooled, solidified magma (igneous rock) rather than something resembling the moon dust. This fact indicates that the Earth was even hotter in the past and its surface was liquid. Another good reason for the hot, liquid surface of the early Earth is that it was made from smaller parts that collided at high velocity. When a rock from space falls on the modern Earth, its minimum velocity is the escape velocity of the Earth (= 11.2 km/s = 6.96 miles per second). When rocks smash against each other at such velocity they do not melt; they become plasma.

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I believe that the early Earth was so hot that the lightweight, liquid sial floated on top and solidified as a layer of uniform thickness. According to Wikipedia: (http://en.wikipedia.org/wiki/Crust_%28geology%29) "The Earth has likely always had some form of basaltic oceanic crust, but there is evidence it has also had continental style crust for as long as 3.8 to 3.9 billion years."

The "continental style crust" means sial made mostly of granite. This means that sial is very old.

In any case, the material that got scooped up all came from one part of the Earth-- not likely the area where the Pacific Ocean is now, but I can't say it wasn't. The material was heated to the point that much or most of it vaporized. The gases that were heavy enough not to be blown away by solar wind were incorporated throughout the body of the Moon.

True.

It seems pretty likely that the rock closest to the surface was preferentially scooped up. That would naturally be the lighter sial.

On the other hand, just because 70% of Earth's surface lacks continents made of sial is no indicator that any sial is missing. Any mantle rock which is exposed at the surface cools to become part of the crust. That is mostly sima, exposed at mid-ocean ridges where seafloor spreading takes place. The spreading pushes the lighter sial around, causing the sial to pile up into continents. Piling up and erosion are in dynamic balance, so the continents never get very much higher than they are now, or very much lower.

Good try, but...

The temperature of Earth increases about 36 degrees Fahrenheit (20 degrees Celsius) for every kilometer (about 0.62 miles) you go down. Near the center, its thought to be at least 7,000 degrees Fahrenheit (3,870 Celsius). Sial is made mostly of granite, which is a hard rock made mostly of silica, which is the main ingredient of glass.

This means that the top 10 kilometers of the sial is made of hard and rather cool rock. It is too hard and too brittle to deform under pressure. It is difficult to imagine what could generate the enormous force needed to break and pile up the

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granite into a pile up to 70 km deep. Furthermore, the sial part of the crust does not look like a messy pile of rocks, but like a solid, rather uniform layer of bedrock.