Lithosphere and Asthenosphere

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Learning Objectives

• Define lithosphere and asthenosphere, and describe their characteristics.

Can you think of a solid that can flow?

You use one twice a day! Toothpaste is a solid that can flow. Is the asthenosphere made of toothpaste? Only if the toothpaste is ultramafic in composition, and then it would only be able to flow if it were really, really hot. Still the toothpaste analogy gives you a good image of how the asthenosphere might behave if you squeezed it!

Lithosphere

The **lithosphere** is composed of both the crust and the portion of the upper mantle that behaves as a brittle, rigid solid. The lithosphere is the outermost mechanical layer, which behaves as a brittle, rigid solid. The lithosphere is
about 100 kilometers thick. How are crust and lithosphere different from each other?

The definition of the lithosphere is based on how Earth materials behave, so it includes the crust and the uppermost mantle, which are both brittle. Since it is rigid and brittle, when stresses act on the lithosphere, it breaks. This is what we experience as an earthquake.

Although we sometimes refer to Earth’s plates as being plates of crust, the plates are actually made of lithosphere. Much more about Earth’s plates follows in the chapter "Plate Tectonics."

**Asthenosphere**

The asthenosphere is solid upper mantle material that is so hot that it behaves plastically and can flow. The lithosphere rides on the asthenosphere.

**Summary**

- The lithosphere is the brittle crust and uppermost mantle.
- The asthenosphere is a solid but it can flow, like toothpaste.
- The lithosphere rests on the asthenosphere.

**Review**

1. Where is the lithosphere? What layers does it include?
2. What is the asthenosphere?
3. How do the lithosphere and asthenosphere differ?
4. If the lithosphere is resting on the asthenosphere and you put a lot of weight on the lithosphere, say ice in a glacier, how would the lithosphere respond?

**Explore More**

Use this resource to answer the questions that follow.

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References
