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How Sharp and Angular Rocks Become Round and Smooth
Earth Science Lesson

Rocks! Think of a rock and one imagines a hard, rough, jagged-edged object.
Yet, in nature, there are circumstances where rocks are quite smooth and rounded.
All sharp, angular edges have been removed.
The culprit? The good old processes of Weathering and Erosion.

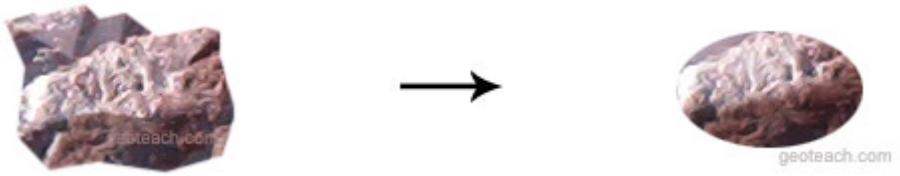
Let's explore some of the situations where one finds this smooth, rounded rock material and also the processes that create them.

Tumbling in Running Water

Tumbling of rocks in running water (streams, rivers, oceans) causes the rounding of angular, jagged edges into smooth and rounded ones inevitably occurs. Also, the size and mass of the rock will decrease.

Time is an important factor here as in all weathering processes. The longer a rock tumbles in a river and/or the faster the water is moving, the smaller and more rounded the rock will become.

Rocks in running water will transform from:
THIS SHAPE into THIS SHAPE

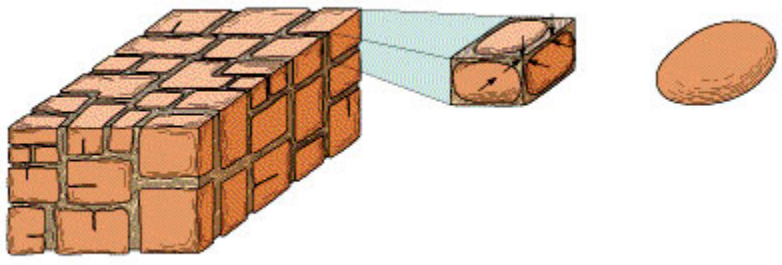


Spheroidal Weathering

Spheroidal weathering is a chemical weathering process. It affects large blocks of rock material. It is also termed onion skin weathering or concentric weathering. Cracks (joints) in a large rock break up the rock into smaller adjoining blocks, thereby increasing surface area for further attack by physical and chemical weathering processes. Water that seeps into the cracks weathers (breaks down) each new block from the outside towards the center by dissolving chemicals

that bond the rock particles together. Corners and edges weather the most rapidly. The weathered rock peels off the unweathered core like onion skin, ranging in diameter from 2 cm to 2 m, similar to what occurs on a grander scale in the formation of an exfoliation some (See Below).
As its name implies, the end result of Spheroidal Weathering are rocks that look "spherical" (rounded and smooth) in shape.

Time is an important factor here as in all weathering processes. The longer a rock is exposed at earth's surface, the more cracks there will be to expose greater rock surfaces and, therefore, the more rounded the rock will become.



Photographs of Spheroidal Weathering: Photo 1, Photo 2 and Photo 3.

Exfoliation Domes

Exfoliation is the spalling off of sheets of rock material from a once buried igneous intrusive pluton that, over time, becomes exposed at Earth's surface due to the removal of overlying material by the processes of weathering and erosion.
The exfoliation process causes the sharp, angular edges of huge granitic plutons to become rounded and smooth on a very large scale. As onion skin-like sheets of rock erode from the intrusion, a rounded dome forms.

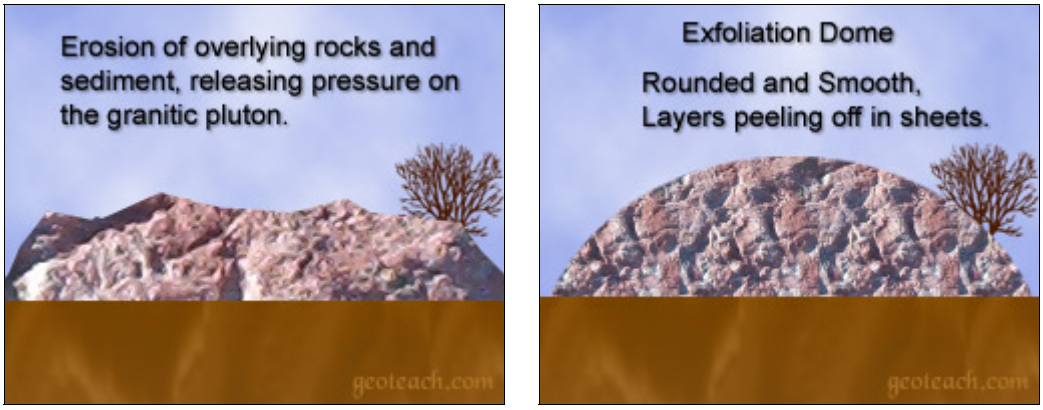


Illustration Credit: Super Simple Exfoliation Explanation! Lesson, Geoteach.com.
To see some photos of Stone Mountain, Georgia, an exfoliation dome, visit the following website: Stone Mountain Photo and Video Gallery.

Wind Erosion - "Sandblasting"

For an example of rounding of rocks by wind erosion, take a look at Arches National Park in Utah. (See photos to the left and below).

"Exfoliation of the Entrada Sandstone, in conjunction with differential weathering and wind erosion, are responsible for nearly all the arches in the park".[1]

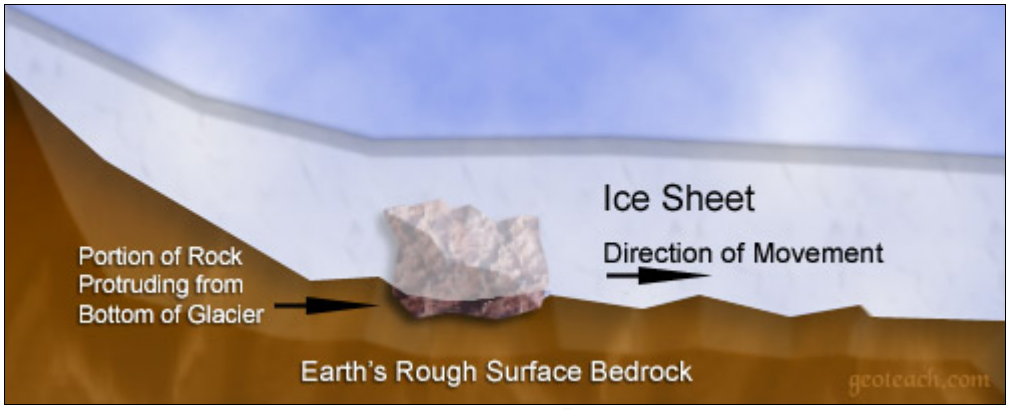
Wind erosion rounds and smoothes landscapes. Over time, small grains of sand and clay that are carried in wind will sandblast larger rocks that they come in contact with. The effects take a long time and are slow to reveal themselves but the inevitable end is that the larger rock will become quite smooth and jagged edges will change into more rounded ones.

Glacial Erosion

As a glacier carries its bedload and travels over rough bedrock below, any rocks that protrude from the base of the ice sheet will be scraped along the bedrock's surface. This abrasion will round the edges of the rock...but *ONLY* on the surface sticking out of the bottom of the glacier and in contact with the earth's rocky surface. The remaining portion of the rock, which remains inside the ice, will retain

its original, jagged appearance.

After the ice sheet melts and deposits its load, the tell tale sign that a rock was carried by a glacier is the rock's *"half and half"* appearance. It will be partly angular and jagged and partly rounded, often with a "polished" appearance and with scratches on the surface.



The Protruding Rock Transforms:
From *THIS SHAPE into THIS SHAPE* - with scratches.

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Earth Science Assignment is also available from Geoteach.com

Credits and References:

Spheroidal Weathering
Soil Forming Factors - About Weathering
3-D Geology of Arches National Park
National Park Service
The above links were active at the time this document was written.