

Station 3: Chemical Weathering

Directions

1. Read “Cleopatra’s Needle” about the Egyptian monument that has been in New York City for over 100 years.
2. On your station booklet, describe how dissolving takes place on Cleopatra’s Needle. Remember: dissolving is a type of chemical weathering that can be caused by things like acid rain.



Cleopatra's Needle

From Wikipedia, the free encyclopedia

http://en.wikipedia.org/wiki/Cleopatra's_Needle#New_York

There are three Cleopatra's Needles: in London, Paris and New York City. Each obelisk is made of red granite, stands about 68 feet high, weighs about 180 tons and is inscribed with hieroglyphs. Although the needles are genuine Ancient Egyptian obelisks, they are somewhat misnamed as they have no inscriptions associated with queen Cleopatra VII of Egypt. They were originally erected in

the Egyptian city of Heliopolis on the orders of Thutmose III, around 1450 B.C.E. The quarry from which the red granite was obtained was near Aswan. The inscriptions were added about 200 years later by Ramses II to commemorate his military victories. The obelisks were later moved to Alexandria and set up in the Caesarium – a temple built by Cleopatra (hence the name Cleopatra's Needle) in honor of Mark Antony – by the Romans, during the reign of Augustus Caesar, but were later toppled. The knocking down of the obelisks allowed them to be buried in sand, which helped preserve them from local weathering. It is included in this section (Weathering) of the Earth Science Image Archive because it emphasizes the concept of the rate of weathering for the same rock type in different climates. Unfortunately I do not have any "before pictures", just "after pictures" that show significant weathering effects.

The New York City,
Central Park Cleopatra's Needle.



This closer view shows the disintegration of the granite
and loss of the hieroglyphs due to the
accelerated rate of weathering in New York City.



This is the base of the needle.

The processes of weathering proceed at a quicker rate in New York City than in the deserts of Egypt. In the northeastern part of the United States the climate is conducive to frequent freeze-thaw cycles which allow frost wedging. As water works its way between the grains in the granite, it can freeze and expand. This applies a force which can dislodge the mineral grains and hasten the breakdown of the rock.

In addition to this mechanical breakdown of the granite by frost wedging, acid rain also attacks the main component of the granite - feldspar. This chemical weathering process slowly changes the feldspar grains in the granite to clay. Decomposed granite is a granite that has suffered severe chemical weathering, so much so that it may crumble in one's hands.

As an added bonus to the geological visitor to the Needle, the base upon which the Needle rests consists of Egyptian limestone with the fossil Nummulites. Nummulites is a VERY large one celled foraminifera. These foraminifera grew to about 5 inches in diameter. They may have lived as long as 100 years. The Nummulites of Cleopatra's Needle are only about 1 inch in diameter.

The pyramids of Egypt were constructed, in part, using blocks of nummulitic limestone of Eocene age.



This is the limestone base of Cleopatra's Needle.

This is a close-up view to show the disk shaped Nummulites, a type of foraminifera.

Images below are plaques attached to the Needle's base describing the Needle's history.

