Santorini volcanic ash found in Egypt

Today towns of brilliantly white houses cling to the tranquil but steep cliffs of the partially collapsed volcano called Santorini in the southern Aegean Sea of Greece. But 3,500 years ago the volcano raged with a fury at least comparable to the 1883 eruption of Krakatoa, whose blast was heard 1,500 kilometers away and whose ash cloud extended 50 km into the sky. Santorini's massive eruption may have given rise to the Atlantis legend and is thought to have destroyed the Minoan civilization on Crete, 120 km to the south.

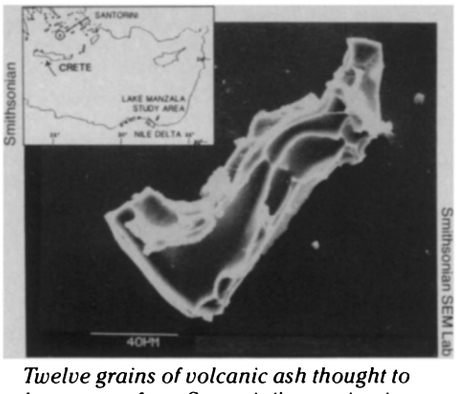
In spite of the 13 to 18 cubic km of material ejected by Santorini, until recently no traces of the ash had been found on land south of Crete. Last week, however, at the Geological Society of America meeting in Orlando, Fla., two researchers reported the southernmost find of Santorini volcanic ash grains — microscopic glass shards—along Egypt's northern coast, 800 km southeast of Santorini.

Daniel Jean Stanley and Harrison Sheng of the Smithsonian Institution's National Museum of Natural History in Washington, D.C., discovered the ash grains in four cores taken from the banks of Lake Manzala in the Nile Delta. The researchers had searched for a year, sorting through hundreds of thousands of silt grains, before they found 12 volcanic shards. Microprobe and scanning electron microscope analyses revealed that the chemical makeup of the ash grains closely coincides with that of the ashes that cover Santorini.

Stanley and Sheng dated the grains by interpolating the radiocarbon dates of core mud layers lying 1 meter above and below the ash layers. They obtained an age of about 3,500 years, which falls right in the range of eruption dates estimated for Santorini by others. "It's right on the button," says Stanley.

According to Stanley, the find confirms that Santorini produced a tremendously powerful blast and that the ash cloud covered a wide area including Egypt. The site of the new discovery extends the pattern mapped by previous finds in deep-sea cores, indicating that the Santorini ash was carried southeast by winds. Stanley suspects that the grains found in Egypt survived because they had been dropped into a quiet coastal environment; grains dropped farther offshore were probably carried away by strong ocean currents or masked by large sediment deposits from the Nile.

The new find also adds some scientific spark to a long-standing debate among archaeologists and historians over the date of the Israelites' exodus from Egypt, for which the Bible notes: "... for three days there was deep darkness over the whole land of Egypt" (Exodus 10:21). Many biblical scholars have maintained that the exodus took place around 1200 B.C., while others have suggested a date closer to 1450 B.C. Stanley believes that some of the ash that darkened Egyptian skies now provides the strongest nonarchaeological evidence in favor of the latter theory by offering a radiocarbon-based date of about 1500 B.C. —*S. Weisburd*



Twelve grains of volcanic ash thought to have come from Santorini's eruption in 1500 B.C. were discovered in northern Egypt. The scanning electron micrograph shows one of the micron-scale grains. Researchers plan to hunt through 17 newly drilled Egyptian sediment cores for additional Santorini ash.

Asteroid origin of the Everglades?

A crowd of earth scientists, eager to hear Edward J. Petuch's saga of how the Everglades formed, packed the lecture room at last week's Geological Society of America meeting in Orlando, Fla. What enticed so many people was Petuch's idea that the evolution of the United States' largest tropical wetland began when an asteroid slammed into the region 36 million years ago, at the end of the Eocene epoch.

However, at least one crater specialist in the audience remained unconvinced. "There are seeds of something very interesting in his talk, but I don't think it points to an impact," observes Gene Shoemaker of the U.S. Geological Survey in Flagstaff, Ariz.

The Everglades is a swampy and forested area surrounded by an oval-shaped system of ridges upon which most of southern Florida's cities sit. "The general consensus has been that the Everglades is a surficial [surface] feature, a little puddle or very shallow basin produced... in the Holocene [the epoch of the last 1 million years] as groundwater etched down into the limestone and sand built up around the rim," says Petuch, a paleontologist at Florida International University in Miami. But now, drawing on nine years of his own field work and the data of others, Petuch presents a much different picture.

He and Jack Meeder of the University of Miami in Coral Gables, Fla., recently discovered that a giant, oval-shaped coral reef, dating from the Pliocene epoch 6 million years ago, is buried beneath the rim surrounding the Everglades. "My curiosity was really stimulated," says Petuch. "No other carbonate platforms [limestone beds] in the world have anything comparable to this."

So Petuch started poring through the literature. He found that the layer of limestone formed 25 million years ago, during the Oligocene epoch, dipped under the southern tip of the Everglades; at its lowest point, other scientists had measured a magnetic field strength greater than 25 times that of the surrounding region. Then Petuch discovered that 250 to 300 meters of the next-deepest section, originally laid down about 40 million years ago, during the Eocene epoch, were missing over most of the southern part of the Everglades. Other scientists had noted that an extensive network of fractures in the rocks works its way up through the Eocene layers but then abruptly stops.

For Petuch, all of this adds up to an impact. Near the end of the Eocene, he postulates, an asteroid slammed into the limestones covered by about 180 meters of water, fracturing rocks and generating enormous tidal waves that may have swept away much of the nearby Eocene sediment. Perhaps a piece of the asteroid became lodged in the crater, or the impact induced molten rock to well up from the underlying mantle. Either of these events might explain the anomalous magnetic field readings obtained today. Petuch thinks the Everglades basin actually formed during the next epoch, the Oligocene, when the sea level dropped about 300 meters and the climate became much colder. Groundwater percolating down the limestone may have leached out the mineral gypsum, weakening the limestones and causing the collapse of a basin about one-third the size of the present Everglades.

Petuch proposes that as the world warmed at the end of the Oligocene, coral reefs began to form around the essentially circular collapsed basin. But as sea level rose, the reefs grew toward the north, where the ground was higher. Petuch thinks that by 4 million years ago, this process had caused the reef system to elongate into an oval that completely enclosed an area much larger than either the original crater or collapsed basin. Sediment and sand filled in the Everglades basin, built up the coral atoll and eventually connected the atoll to the mainland.

What really convinced Petuch of the impact idea, he says, were studies of the Eocene-Oligocene boundary layer in the Caribbean island of Barbados. Scientists had found that this layer contains high levels of iridium (an element abundant in extraterrestrial bodies but rare on earth) but none of the silicate spherical particles called tektites that are usually created when an asteroid collides with continental