Mirabilite Spring Mounds Near Great Salt Lake Marina

January 2020

What are these white mounds and when did they form?

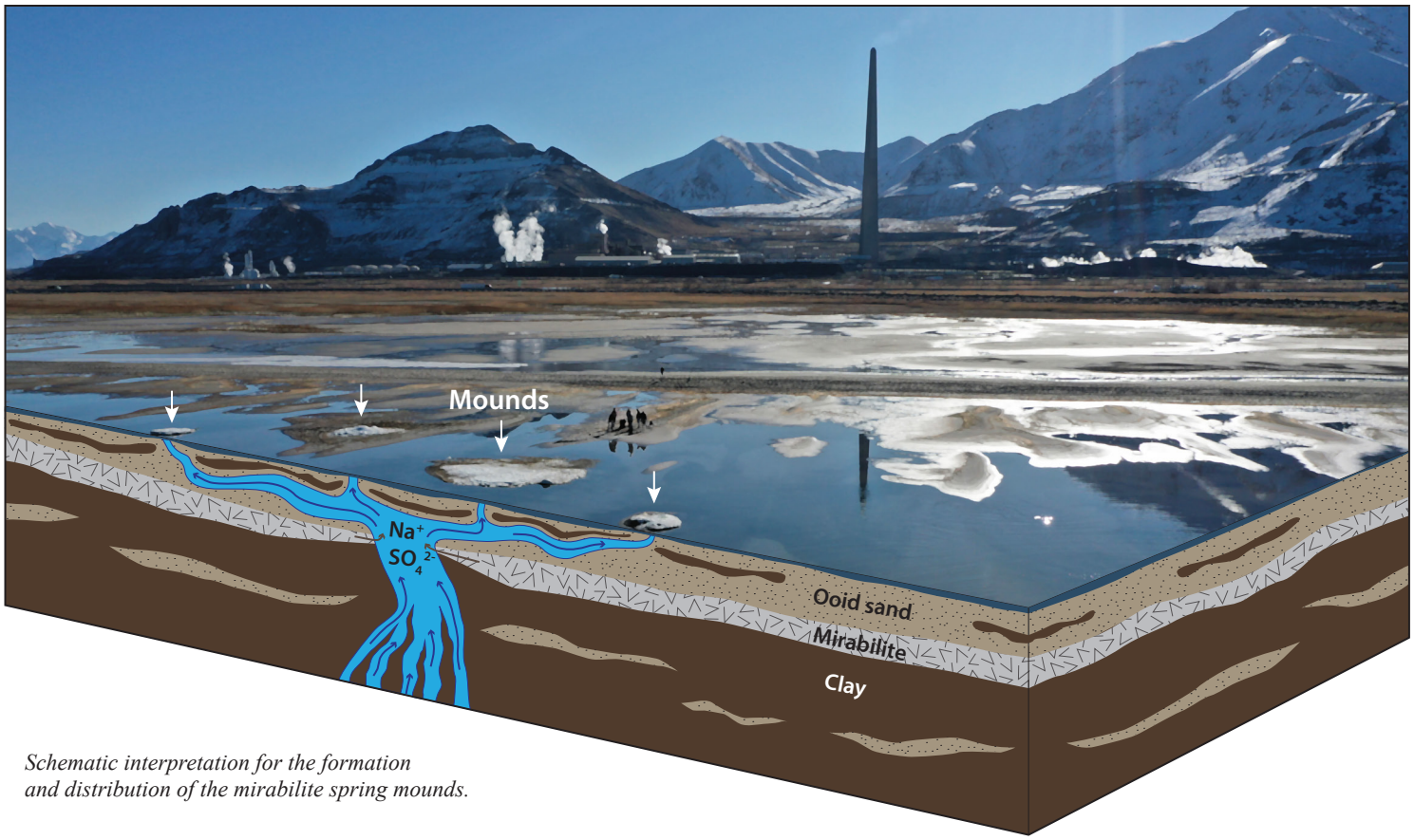
In late October 2019, as air temperatures started to cool to near freezing, unique mineral mounds began forming on the south shore of Great Salt Lake, just east of the Great Salt Lake Marina. They are not composed of common table salt (sodium chloride—NaCl), but mirabilite (hydrated sodium sulfate—$Na_2SO_4 \cdot 10H_2O$), also known as Glauber's salt.

How do mirabilite mounds form?

When the sodium-sulfate-rich spring water hits the cold winter air, mirabilite crystals form and build up a collection of small terraces, similar in appearance to the travertine rimstone and dam terraces that form at Mammoth Hot Springs in Yellowstone National Park.

What conditions are needed for the mounds to form?

In the 1940's, researchers investigated this area and reported finding a 3-6 foot thick mirabilite layer 30 inches down in the subsurface. Groundwater seems to be partially dissolving this mirabilite layer, which is then reprecipitated at the surface as the spring water emerges. Additionally, mirabilite is most stable and precipitates in sub-freezing dry environments. When temperatures rise above freezing, the impressive clear mirabilite crystals that form the mounds will dehydrate to form a white, powdery, easily eroded mineral called thenardite (Na_2SO_4). Furthermore, the mounds will only form if the area (at about 4194 ft) is above lake level, a rare occurrence until the past few years.



Schematic interpretation for the formation and distribution of the mirabilite spring mounds.

Why are there multiple mounds?

It is hypothesized that as the mounds grow, they eventually seal off their spring water source, causing the groundwater to find a new pathway to the surface, and thus, a new mound begins to form a few dozen yards away. As of January 2020, the beach has four mounds that have grown up to 3 feet tall and several yards wide.

How rare are mirabilite mounds?

The mineral mirabilite is quite common and found in saline lakes around the world, including the north arm of Great Salt Lake. In saline lakes, mirabilite crystals form in the water column, float to the surface, and are washed ashore to form an amorphous, slushy slurry or dune-like accumulations of crystals. However, spring-fed crystalline mirabilite mounds are rare—they have never before been scientifically documented at Great Salt Lake. Mirabilite-precipitating springs and the formation of terraced mounds have been documented in the Canadian Arctic, central Spain, and the Antarctic. These features are ephemeral; warmer spring temperatures will eventually turn the mirabilite to the powdery, easily eroded thenardite, if the rising lake level doesn't erode the mounds first. These features may or may not reform again next winter.

Is there a Mars connection?

While Mars has conditions conducive to the formation of mirabilite (dry, cold, etc.), the mineral has not yet been documented there. Mars does have topographic mounds that some researchers believe may be related to saline groundwaters. In addition, orbital spectrometers have suggested the presence of sulfates on the surface. Because of these similarities, some researchers are interested in the growth of mirabilite mounds on Earth because they may serve as analogues for understanding geologic processes on Mars.

Don't tread on me.

These mirabilite mounds are fragile and researchers are still actively studying them. Please do not walk on the mounds or collect samples. Besides, mirabilite is unstable at temperatures above freezing and dehydrates to form a white powder (thenardite), so the samples would not last more than a day.