LITTLE LIGHT BULBS

A STORY OF SAND

There are some things you need to know about it...

THIS IS SAND
AS DUNES

THIS IS SAND

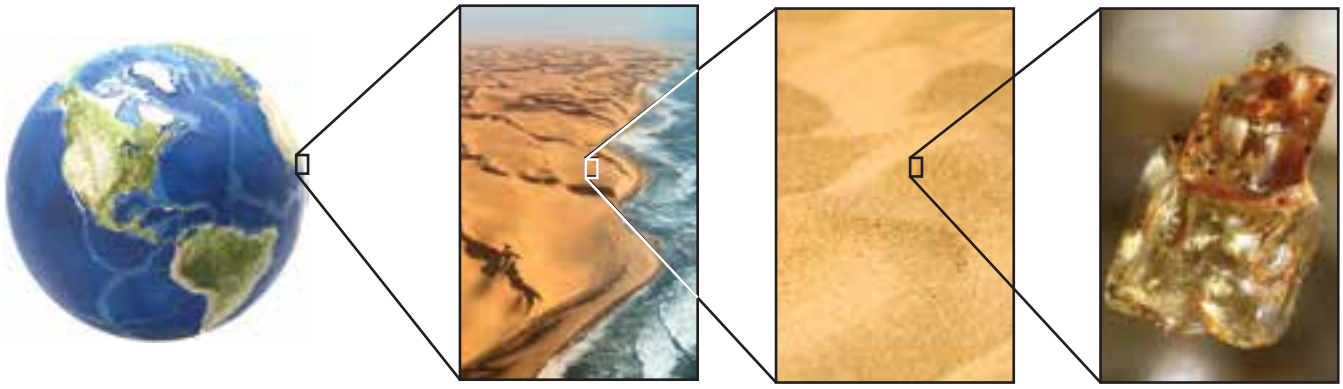
THIS IS SAND
CLOSER UP

GRAINS OF SAND
REALLY CLOSELY

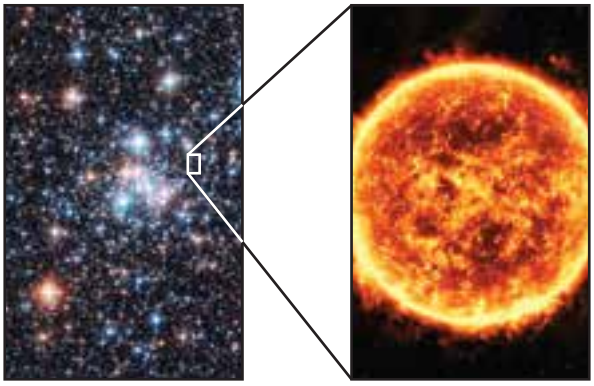
SAND OF THE WORLD
UNDER A MICROSCOPE

On all of Earth's beaches and deserts there are about seven quintillion, five hundred quadrillion grains of sand.

That's 7,500,000,000,000,000,000 grains.



By the way, when they recently counted, astronomers found 10,000,000,000,000,000,000 stars in the universe. Pretty close numbers.



To see a World in a Grain of Sand
And a Heaven in a Wild Flower
Hold Infinity in the palm of your hand
And Eternity in an hour

Auguries of Innocence
by William Blake

"In every curving beach, in every grain of sand, there is a story of the Earth."

- Rachel Carson, environmentalist

There are different types of sand.

The sand we know best, the most common one, is actually made of the same material as glass (silica). But it's shaped differently. Sand is made of broken down crystals called quartz.

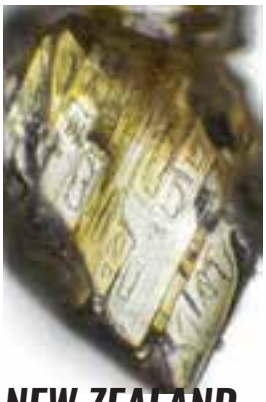
It is the smallest size that such crystals can break down to - less than a millimeter in diameter.

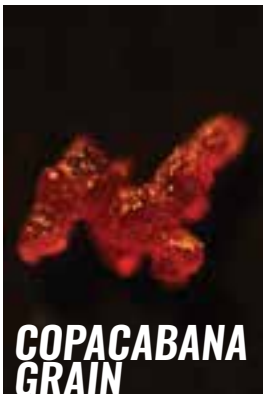
***Sand's Journey:** Thousands of miles from the ocean, rocks slowly travel down rivers and streams, constantly breaking down along the way. Once they make it to the ocean, they erode even more, from the constant action of waves and tides.*

There's also sand that is made of the same material as corals and shellfish (calcium carbonate). This kind of sand actually comes from their shells and skeletons. Gypsum is an incredibly rare type of sand that was created over 280 million years ago.

*The famous white-sand beaches of Hawaii actually come from the **poop of parrotfish**. The fish bite and scrape algae off of rocks and dead corals with their parrot-like beaks, grind up the inedible calcium-carbonate reef material (made mostly of coral skeletons) in their guts, and then excrete it as sand. Parrotfish can produce hundreds of pounds of white sand each year!*

What other sands are there?


NEW ZEALAND GRAIN




ANTARCTIC GRAIN


SPANISH MAJORCA SAND


PHILIPPINES SAND


SAND FROM GULF OF MEXICO

Sand captured by Jenny Natusch: artist, sand-gazer and photographer

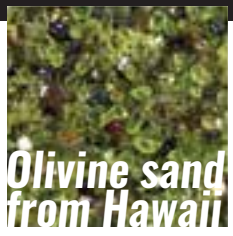
DUG BY MICROSCOPIC WORMS

GROWING AROUND A SPECK OF SAND

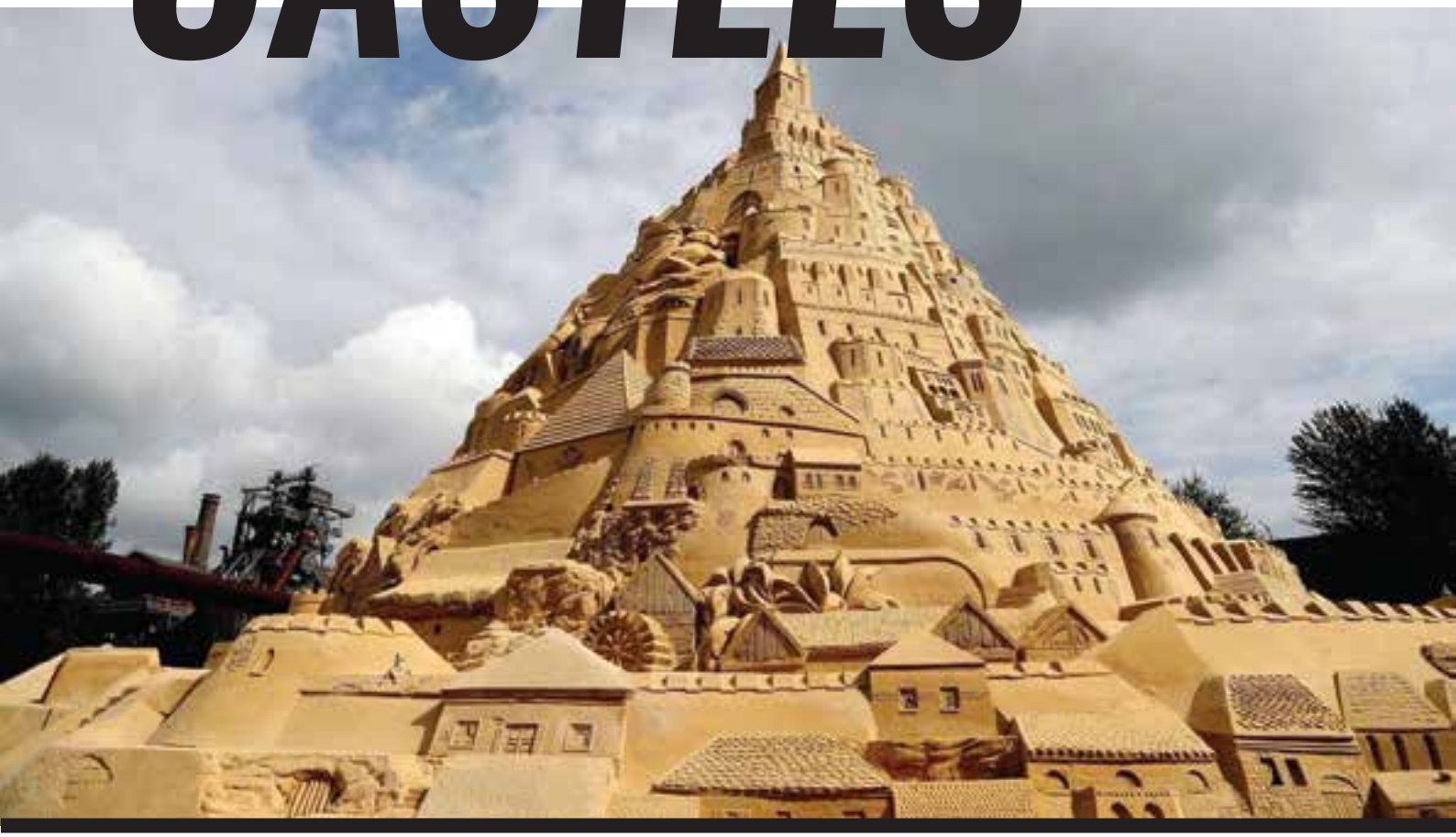
More sand...

Volcanic glass sand from California

Quartz, chert, igneous rock, shell fragments



SAND CASTLES



The tallest sandcastle
17.65 m (57 ft 11 in) tall,
made by Skulptura Projects in Germany, in 2019.
It took a team of 12 sculptors and 8 technicians 3.5 weeks working 8 hours a day to complete the sandcastle.
It took 11,000 tonnes of sand mixed only with water.
There were no other additives or internal support structure.

But you know,
we live in sand cities...

Sand is very valuable for constructing buildings.

The concrete used to construct shops, offices, and apartments, and the asphalt we use to build roads connecting them, are mostly just sand and gravel (larger grains) glued together.
The glass in every window and smart phone screen is made of melted-down sand.
Even the **silicon chips** inside our phones, computers and virtually every other piece of electronics in our homes – are made from sand.

Other than water, sand is the natural resource we use most. People use some 50 billion tonnes of sand and gravel every year. That's more than enough to blanket the entire United Kingdom.

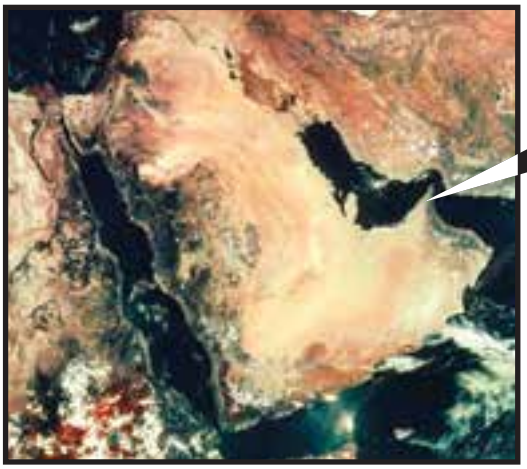
We're even using sand to create land where there was none before -

MAN-MADE ISLANDS MADE OF SAND

RUNNING OUT OF SAND

There's plenty of sand in the desert but unfortunately that's not the kind of sand we can use - it is too smooth and rounded.

Dubai, which sits on the edge of an enormous desert, imports sand from Australia. That's like selling ice to Inuits (people who live in Arctic regions).



The sand we need to build with is the more angular stuff found near rivers, lakes and on the seashore.

Also from the bottom of the sea.

All over the world, powerful dredging ships vacuum up millions of tonnes of sand from the sea floor each year.

SAND GREED

Sand is so in-demand that riverbeds and beaches are being stripped bare, and farmlands and forests torn up to get at the precious grains. Some claim that river dredging stops floods. Others claim it makes it worse.

Either way, there's a problem. When dredging, the ground is churned-up and clouds of sediment murk the water, suffocating fish and blocking the sunlight that sustains underwater plants.

That's not the only problem... Ocean dredging has damaged coral reefs. It tears up marine habitat and muddies waters with sand plumes that can affect aquatic life even far from where it is happening. Digging up sand have made it very difficult for farmers in Sri Lanka to find clean and suitable water to grow their crops.

Dredging in Cambodia and Laos is causing river banks to collapse, dragging down crop fields and even houses.

Fishermen in Malaysia have seen their livelihoods decimated by dredging. In China, land reclamation has wiped out coastal wetlands, annihilated habitats for fish and shorebirds, and increased water pollution.

STEALING SAND

Sand mining is contributing to its disappearance. It is home to 20 million people and is the source of half of all the country's food.

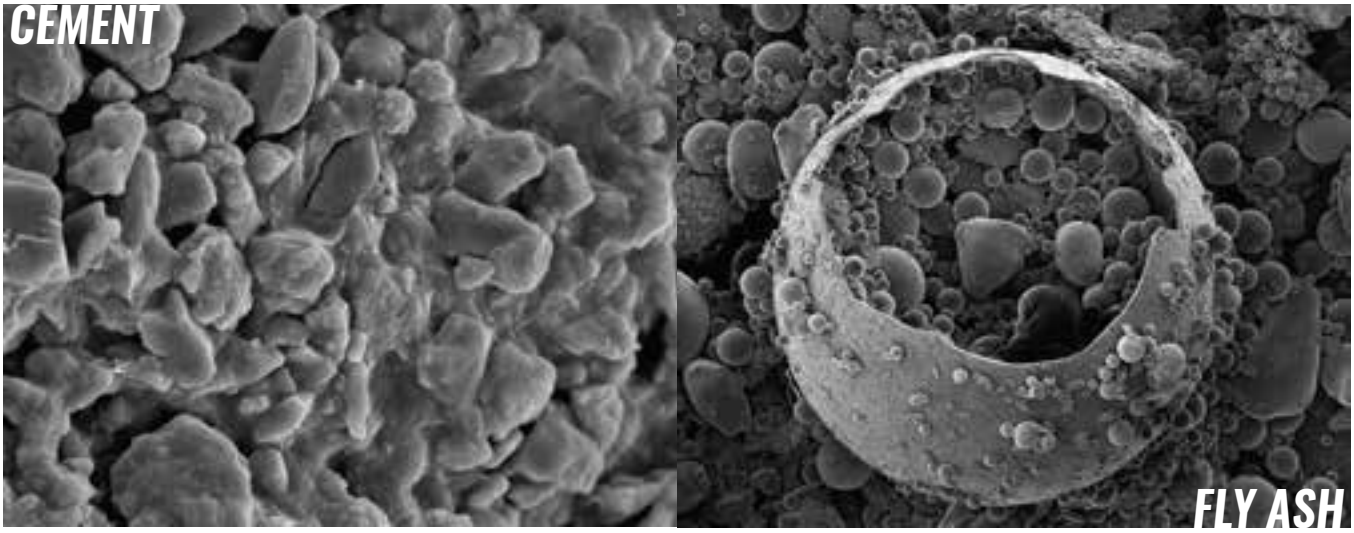
One year, 50 million tonnes of sand were stolen from the delta - enough to cover an entire city two inches deep. At this rate nearly half of the delta will be wiped out by the end of this century.

Because sand is so valuable, gangs of robbers have been mining it without permission, digging grains up by the megatonne, spawning an often lethal black market of sand. Some, such as in India, have established ***Sand Mafias****, using violence, bribery & intimidation to continue mining the coveted grains.*

ROBBING THE BEACHES

SCIENCE SOLUTIONS

Scientists are working on ways to replace sand in concrete with other materials, including something called ***fly ash*** *- the material left over by coal-fired power stations. They are also exploring shredded plastic, and even crushed oil palm shells and rice husks.*



Other scientists are developing concrete that requires less sand, while researchers are also looking at more effective ways to grind down and recycle concrete.

OTHER SAND STUFF

Sand is very abrasive, meaning that it is capable of polishing or cleaning hard surfaces by rubbing or grinding against them.

Sandblasting uses sand to clean metals by pumping sand through a hose pipe at extremely high speeds. And of course, sandpaper is used to smooth surfaces, such as wood.

*Up to 60% of the human adult body is water. **Palythoa**, a genus of corals, can be made up of about 65% sand.*

*Sand temperature determines the gender of baby sea turtles. Cooler sand produces more males, while warmer sand produces more females. This phenomenon is called **Temperature-Dependent Sex Determination** (TSD).*

*No beach has the same sand! **Sand forensic experts** reveal that each beach has a unique set of sand.*

*You can hear the '**sand whistle**', in certain parts of the world. This is caused by the collective movement of billions of grains of sand as the **dunes move**.*

Dune 7 *in Namibia, Africa, is the tallest sand dune in the world! It's nearly 400 meters tall, which makes it taller than the Eiffel Tower!*

Your average sand grain has over ***1 billion bacteria*** *on its surface!*

There's a legend about ***Cleopatra's Beach*** *- a stretch of white sand beach in Turkey. According to the legend, Mark Antony - a Roman general who had a love affair with the famous pharaoh - had sand shipped from Egypt to create the beach. Its sand is similar to the sand found on the coast of Alexandria, in Egypt.*

During medieval times, sand was used as a ***weapon in warfare****. Before missiles, burning sand was thrown at the enemy. Or, men would heat sand and pour it on invading troops.*

The sorites paradox:
There's a heap of sand. Let's say it has 1,000,000 grains of sand.

Grains are removed from the heap, one by one.
After one grain is removed, it is still a heap, right?
Remove another one, and a heap it remains. Correct?

But we all agree that when there's only 1 grain left, or even 2 or 3, it is no longer a heap. Agreed?

So... if you continue to remove a single grain at a time, at what point does the heap stops being a heap?

Little Light Bulbs *is here to make learning artful and imaginative.*
We are using information and inspiration we'd like our kids to love.
We are picking subjects sure to fascinate them - they definitely fascinate us.

We're not creating 'learning materials'.
We are collecting packets of wonder.
We are weaving threads of curiosity.
We are making stuff that blows minds, or at least piques some interest.

This is one of our firsts.
If you think we've succeeded -
please visit us at littlelightbulbs.com
or email me at saar.shai@gmail.com
Please visit or email even if you think we haven't -
we'd love to hear how we can improve,
and you might find other things that do the job.