The humblest of them all

By Vibhustuti Thapa

It trickles in front of me like a liquid. But it is not liquid. I squint to get a closer look, and notice, up close, that this substance is actually dry, made of miniscule grains of matter gathered together. This fine, milk-colored sand, every grain slightly different in size and shape, and maybe even texture, falls together collecting in a conical heap at the bottom of its hourglass-shaped crystalline vessel.

If I do not tire from tipping this sand-timer repeatedly, hourly, the sands inside the glassy receptacle will not grow weary either. Sand is hardy like that. Liutprand, a French monk who lived in the eighth century, must have been a first-class geologist and a keen observer of sand, perhaps an arenophile (*arena* is sand in Latin, and *phil* is Greek for love), to have spent his priestly efforts inventing this time-(less) piece using sand instead of any other material—mud, coal, diamonds—on earth.

While I have seen various shades of tan sands, white sand, fine and salt-like, is rare to me. I wonder where this sand comes from. Author and conservationist Rachel Carson said, "In every outthrust headland, in every curving beach, in every grain of sand, there is the story of the earth." What kinds of stories might these tiny, white nuggets be telling me? A quick search of white sand sources suggests names of exotic white-sand beaches like those in Hawaii, Tahiti, Philippines, Italy, and the Maldives. *These sands could literally be from anywhere on this planet*, I tell myself.

Usually, sand forms when mountains and boulders chip away, shedding loose granules of rocks. Large rocky structures like mountains often contain granite, which consists of quartz, a form of silicon dioxide or silica, and a key component of sand. Quartz also reacts with iron oxide found in nature, determining the various shades of sand. When mountains become weathered by

repetitive contact with rain, wind, microorganisms, or the freeze-thaw cycles of glaciers, the minute rocks that break free from sizable mountainous structures get washed away by rains into streams, rivers, and riverbeds. Sometimes, in a river's journey south, when floods arise or when river channels move and shift their course naturally over hundreds of years, sands originating from the upstream boulders will spill out to produce land along waterways, deltas and beaches. Within the span of a millennia, countless two-millimeter particles of rock, eroded from the Appalachian Mountains, for instance, travel all the way south to form the sandy shores of a Florida beach.

There are times when sands are not driven by wanderlust. In these cases, the non-nomadic fragments lay asleep, buried under heaps of new sediments that emerge from eroding mountains. This process, where new sand piles on top of old sand, which in turn piles on top of even older sand, which piles on top of antique sand, takes over 150-200 million years. Erosion continues even as layers of rock bits start becoming compact enough to form other boulders and mountains. Frequently, after the new booming boulders are formed, continuous exposure to the elements causes yet more rock fragmentation to uncover the older, sedentary sands, which finally make their way to streams, rivers, and ultimately the oceans. As these cycles repeat, the sand particles also get rounder and more polished. Sometimes, by the time the nuggets reach their respective beaches and oceanic deltas, over millions of years, they will have even become the consistency of granulated sugar.

If we study sand carefully, the different shapes and compositions of granules resemble bedrock and earth from their birthplaces. Like people, sands are made of places.[1] As such, the colors, makeup and properties of sands exposed to multiple environments are also as varied as the

[1]"People are made of places. . ." writes Elizabeth Brewster in the first line of her poem "Where I Come From."

stories of folks from across the globe. For instance, weathered-rock sand is different than the scarcer sands caused by volcanic eruptions. Hardened and blackened lava from volcanoes combined with minerals from inside the boiling mountains create black sand like those found on Hawaiian or Spanish beaches. These sands are usually fine, heavy, and glossy. Desert sands are much different and may consist of frosted or pure quartz grains that have been naturally separated from the non-quartz bits as a result of winds and rains. These sands are smooth when compared to manufactured sand, which are angular and comprise of artificially crushed rocks. Sands from tropical beaches, on the other hand, are dissimilar because they are made up of either broken-down shells or dead coral remnants, or both. These sands are brittle and porous.

As for the mesmerizing white sand before me, I cannot tell where the salt-like grains are from, especially not with my naked eyes. I observe the falling, powdery bits for a few seconds and wonder if the sand and its hourglass both originated from the same place. Using the sand-timer as a clue, I look up the product online. It was manufactured in China. No mention of sand. *Perhaps these sands were from Asian white sand beaches*.

I start reading about white sand and find it fascinating to learn that a lot of it is technically composed of parrotfish feces found in the Indo-Pacific and Atlantic oceans. White sands are made from calcium carbonate found in dead corals, which are chewed-up by the beaked, blue and green parrotfish, and then pooped out as sand. It appears that the colorful parrotfish are responsible for creating over 80 percent of white sands found in reefs. *Was I mulling over parrotfish poop from some distant coast?* I am reminded of William Blake's poem, “Auguries of Innocence” where he writes that the "world is in a grain of sand," and that we may have held "infinity in the palm of our hands, and eternity in an hour.” *What must the white sands have conveyed over the course of this hour?* If only I could tell.

Even though white sand is incredibly alluring to me, I decide to shift my attention to the more familiar, common type of sand that is weathered from rocks and exposed to water bodies. This sand is extremely useful in the production of concrete—about forty per cent of sand is mixed with water and cement to form concrete—and we can find it all around us. Everything from the top of the Burj Khalifa to the floors of its concrete basements to the innumerable homes, buildings, bridges, and even hydropower dams around the world typically contain this type of sand. Unlike fine, white sand, or desert sand, which is eroded by wind rather than water making the particles too rounded to form stable concrete, sand from rivers and lakes are constantly beaten by water currents. This sort of exposure to water makes the sand grains angular and able to lock together during concrete formation. As such, the functional significance of river-washed sand has turned it into a coveted commodity for urbanizing societies across the globe. In his book *The World in a Grain,* Vince Beiser suggests that usable sand is the foundation of life in the modern world. As a primary raw material in concrete, it has quickly become one of the most important and commonly used solid substances on the planet today.

But while the ubiquitous presence of this material can lead some to wrongly assume that sand is limitless, infinite even, Beiser asserts that the world is actually running out of it. Sand and sediments, which are transported by waterways, are crucial for checking erosion caused by river currents. However, due to its high demand, which has led to increased sand mining and haphazard extraction across many nations worldwide, angular sand is declining and humans are influencing rivers' abilities to transport sediments to oceans. This is problematic because the decrease in available sediments leads to riverbank and coastal erosion, and in turn, habitat destruction. Increased sand removal can also cause flooding because of the ground's reduced ability to absorb water, as a result of decreasing volumes of sand deposits on riverbeds and banks. As such, sand

mining operations, especially in urban areas pose a threat to the lives (and infrastructure) of those already situated in and around river floodplains. Sand excavation can also lead to lower crop output, loss of biodiversity in the region, and contamination of surface and groundwater.

The growing trend of sand extraction has affected many riverbeds, banks, and beaches in South Asia too, and I would be remiss to talk about the loss of sand without transporting us back to the place where I was born. I am made of Kathmandu. Partly. The landlocked Kathmandu Valley was once a great lake. Legends say that God Manjushree of wisdom and mental perfection slashed a hill at Chobar with his massive, flaming sword to form a gorge from which he was able to drain out the lake waters, creating a valley for mortals. Beyond the mythology, geological accounts based on the study of fossils and sediments also prove that the region was a lake before its waters started draining and drying over time.

The fact that Kathmandu was once a lake meant that sediments from the mountains were settled on the floors of the Valley. This sediment-rich land was the foundation of the present civilization, especially since the Valley's soil made for productive agriculture. At the same time, the region was also littered with several *dhiscos* or hillocks—fertile, windswept sand dunes that are made of loose grains of angular quartz. *Dhiscos* have high permeability, which means that these mounds of sand can soak up large quantities of water and store the absorbed water temporarily. Ecologically, these qualities help hillocks manage destructive flows during monsoons since the sand can take in and accumulate extra water from the rainy months. During drier seasons when water is a little scarce, the same *dhiscos* feed the rivers and streams with the water stored from rainier times, thus helping to regulate the water cycle in the ecosystem.

Unfortunately, the same materials that make Kathmandu Valley ideal for water storage, agriculture and ultimately, a thriving ecology, have also made sand mining possible. In the

concretizing jungle that is Kathmandu, only a handful of the once abundant *dhiscos* remain. Most of them have been dug, extracted and exploited, and in their place now stand concrete buildings, which are partially made of the sand mined from the dunes. Intensive hillock excavation has also created more flat lands in the area. Flattened lands are considered immensely valuable because they can be used for more housing, apartments, malls, or parking lots, leading to further sand excavation.

As the hillocks of Kathmandu vanish, the region's groundwater storage and ability to regulate waters seasonally is destroyed. The loss of the hillocks and their functions lead to higher volumes of floods, and while the flat lands 'made of' the same sands as the hillocks still retain the capacity to absorb and store water, these plots are continually cemented or concretized with little to no consideration for drainage. In the face of water shortage in the Valley, the ground's existing water storage capacity is choked, leaving no additional room for rain or flood water to permeate into the soil.

A watershed expert I recently chatted with told me, "If you lose forests, they will regrow over the years. If you lose fertility of the land, you can replace it by adding nutrients. But if you lose sand, there is no way to completely restore it." He added, "Even if one hypothetically breaks down all the concretized structures in the Valley to go back to a nature-oriented life, living in small nature-based farms and eating off the land, the hillocks (and their ecological functions) will still not be restored. It would take ages to replenish the soil." As such, it appears that the hillocks are a part of the Valley's watershed that has been lost forever.

Today, the city is running out of space, water and people, more of whom are migrating abroad, and Kathmandu seems to be on its way to becoming a stifling desert full of concrete homes. Perhaps eons from now, one day, a foreign traveler will walk over a buried, 'flat' civilization

devoid of *dhiscos* and stumble upon half-sunken, lifeless, concrete visages almost entirely swallowed up by boundless and bare debris.[2] Even Ozymandias, King of Kings, met such a fate when he was buried after death and simply turned to dust, underneath the lone and level sands of a once mighty, now entombed, land.

[2]Reference to the poem, "Ozymandias" by Percy Bysshe Shelley.