An Eclectic A–Z of Sand: Removing, Treasuring, Recreating and Protecting

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A is for Arenophile

Accidental sand collection—in shoes and clothes, or between our toes—is an unavoidable by-product of a beach visit. But it can also be purposeful. Arenophiles collect samples of sand, a substance varying enormously in texture, angularity and colour as well as mineralogy and locale (which include deserts, lake and riverbeds as well as seashores). Arenophile stems from arena/harena, Latin for sand—retained in Spanish but replaced by sabulum in French sable and Italian sabbia. (A synonym, Psammophile, is the chosen entry for P.) Arena then doubled as the word for stadium because sand was strewn across Roman coliseums and other sporting amphitheatres to soak up spilled gladiatorial (and animal) blood.¹

Pursuing arenophilia requires minimal equipment: re-sealable plastic bags or film canisters, a spoon, a magnifying glass, a notebook and (back home) a display cabinet (a pill organiser works nicely). Collectors—whose hobby has spawned a multiplicity of websites and chatrooms²—range from sedimentologists to vacationers, the spectrum of ambition stretching from systematic sand gathering from every nation or desert to occasional beach holiday samples.³

To acquire rare samples (star sand, for instance, and rarer colours), arenophiles, like philatelists, trade with fellow enthusiasts. Green sand, for example, exists in only a handful of known places, including Papakolea,

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Hawaii, and Hornindalsvatnet Lake, Norway. The business of collecting is regulated and supported by the International Sand Collectors Society, which advises members of legal restrictions, facilitates swaps and arranges an annual conference, SandFest. The Society’s motto: discovering the world, grain by grain.

**B is for Biogenic Sand**

Rock is not the parent substance of all sand. Some derive from biological rather than mineral (abiogenic) sources. These sands (aka organic, calcium or biological sands) are composed of the usually light-coloured remains of bone and other hard (calcareous) bits (rubble) of sea creatures such as barnacles, clams, corals, coralline algae, echinoids (sea urchins, whose purple, black and green spines add dots of colour), foraminifera, sea snails and sponge spicules. A lucky beachcomber may find a tiny tooth, jawbone fragment or even an entire sea urchin spine. Grains of biogenic sand come in all shapes and sizes. The skeletal remains of plants also contribute. Some sand is a mixture of mineral and biogenic grains: the majority component determines whether a beach qualifies as mineral or biogenic. Yet certain isolated tropical beaches are exclusively biogenic. The pinkness of Bermudan beaches derives from pink, single-celled foraminifera, but coral sand is an often misleading label for such beaches. For one-hundred per cent coral sands rarely exist and sands that are mostly coral are confined to beaches near coral reefs occurring in warm waters between 30 degrees N and 30 degrees S.

The proportion of biogenic materials tends to be higher on island beaches, and another biogenic source for Hawaiian beaches is fish excrement: parrotfish eat coral and excrete the pellet-like waste. To establish whether a sand sample is biogenic or abiogenic, douse with a pinch of vinegar. If it contains bones or other skeletal remains, the acid will react with calcium carbonate to produce bubbles of carbon dioxide.

**C is for Cleopatra’s Beach**

Cleopatra has three Needles (London, New York and Paris), but just one beach. Yet unlike the Egyptian obelisks re-erected far from their places of origin in the nineteenth century, this alluring beach, which every guidebook to the Turkish Aegean highlights, enjoys a genuine connection with the Ptolemaic dynasty’s last ruler. The sands of Cleopatra’s Beach, a tiny cove at
Gökova Bay on Sedir Island, consist of grains of creamy white, silky smooth, calcareous Holocene ooids, most of them perfectly spherical and the size of a grain of white sugar. These exotic sands are confined, though, to a surface layer no more than 80 centimetres thick at the beach’s seaward end, vanishing completely a few metres beyond low-tide line. Nowhere else in the Aegean can you find this particular sand type.

According to legend (but unmentioned in any ancient text), Sedir Island was the secret meeting place for Roman ruler Mark Antony and the Egyptian queen. Circa 35-32 BC, to delight his lover, Antony indulged in an extravagant act of beach improvement by importing sand from the Egyptian coast west of Alexandria (Cleopatra’s hometown and capital). Recent “provenance analysis” of sand grains’ microfacies qualities (under a microscope) reveals a close match between Cleopatra’s Beach and Al Agami beach, 12 kilometres from Alexandria, and part of the only stretch of Mediterranean shoreline with an ample quantity of this distinctive sand. Al Agami is also located more or less due south of Sedir Island: according to a sand specialist, fifteen fully loaded Roman corn barges would have been required to bring over the quantity of oolitic sand (180,000 tons) on Cleopatra’s Beach in the late 1980s.5 Sedimentological data also rule out the likelihood of in situ formation—protected Gökova Bay is a site of “low energy” wave and tidal activity, which also accounts for the Egyptian sand’s survival. Research additionally reveals that these sands show “evidence of being out of place” on Cleopatra’s Beach, and that the case for its origin as ship’s ballast is unpersuasive.6

The sand comprising what the signs hail as this “unique beach” is so precious that a stone retaining wall encircles its landward sides. Sand removal is forbidden; and to further minimise loss, swimmers can only access the water via a wooden pathway parallel to and outside the wall; towels, to which sand might cling, are also prohibited.

Cleopatra’s Beach could be the world’s first artificial beach (human-made beaches now range from the sands of Barceloneta, part of Barcelona’s redevelopment for the 1992 Summer Olympics, to the more recent urban beach phenomenon of riverside cities like Berlin, Paris and Newcastle). More importantly, that incongruous patch of sand in the Aegean reminds us of the strength of our desire to shape and re-shape our sandscapes and seashores—not to mention sand’s possession of that infinite variety that Enobarbus attributed in Shakespeare’s Antony and Cleopatra to her who inspired the relocation of sand across the Mediterranean.
D is for Dredging

The demand for the right kind of sand (see entry for R) brings massive excavations on land and underwater. Dubai’s offshore creations, Palm Jumeirah and the World—the latter made up of 300 islands—are a stark example of how undersea sand is increasingly scooped up to create land. Dredging the Gulf of Persia’s seabed brings the “undersea equivalent of choking sandstorms” that wipe out marine organisms and coral reefs as well as transforming water circulation patterns. Sand mining (a more appropriate word than dredging) is driven by rampant urban growth worldwide: sand, according to Vince Beiser, is “to cities what flour is to bread”. Associated with a lucrative illegal trade, mushrooming cities are wrecking sandy habitats worldwide, freshwater and marine, including China’s largest freshwater lake. Lake Poyang’s sand is barged down the Yangtze to make the concrete and asphalt of burgeoning Shanghai. The previous source of sand, the Yangtze’s bed, was abandoned when bridges were undermined and sections of riverbank collapsed. Over 30 times more sand than rivers contribute annually to Poyang is currently being gouged out of the lakebed, ruining local fishermen’s livelihoods.

While sand is being appropriated to facilitate Dubai’s expensive new real estate, elsewhere, like Indonesia, sandy islands are literally vanishing, sacrificed to Singapore’s urge to increase its territorial area. In California, protestors fight the last of the sand mines that were a common feature of the state’s coastal sandscapes until the 1980s, when federal legislation shut all of them down, except Marina’s. The CEMEX Lapis plant (est. 1906) survived there thanks to a legal loophole—location in a lagoon above the mean high tide line placed it beyond federal jurisdiction. In January 2017, at Marina state beach near Monterey, activists carrying placards reading “Take a stand, save our sand” emptied 200 pounds of bagged sand bought from a building supply store onto the depleted beach from which it had been removed. In Britain, dredging from the bed of Northern Ireland’s Lough Neagh, an internationally important site for breeding and migratory birds and site of a valuable commercial fishery, also faces opposition. These activists are not arenophiles, conventionally defined, but value sand, in situ, as habitat for nonhuman creatures, the basis for local economies and to slow down the rate of coastal erosion.
**E is for Extra-Terrestrial Sand**

Timanfaya National Park in the Canaries, part of the Lanzarote and Chinijo Islands Geopark, consists of volcanic cones and bowls, variegated sands and lava fields stemming from an almost unbroken string of eruptions between 1730 and 1736. This unearthly landscape provides scientists from the European Space Agency with a research site unique within UNESCO’s Global Geoparks Network: a so-called planetary analogue. Since Timanfaya is the closest terrestrial match for Mars, ESA’s Pangaea programme, whose goal is to send European astronauts to Mars, has been training here since 2016. As Spanish geologist and astrobiologist Jesús Martínez-Frías observes, Lanzarote is “Mars on Earth”. One of the features that create this geological and environmental approximation to other planets is Lanzarote’s multi-coloured sands. Mars, named for the Roman god of war, is commonly referred to as the Red Planet because of the iron oxide its rocks contain that lend its surface sands a rusty hue. Dunes are a common ingredient of the Martian sandscape (though their mobility is much more muted than their earthly counterparts’ since wind energy is substantially weaker there than on earth). The dune complex on Mars that has become most familiar to us earthlings, through images taken in 2014 by NASA’s “Curiosity” mega rover, is the Dingo Gap sand dune, which rises to just a metre.

**F is for Fennec Fox**

This smallest of canids—the average domestic cat is bigger—reminds us that sand is not just on the beach. The habitat of the fennec fox—Algeria’s national symbol and its soccer team’s nickname—stretches from the western Sahara to Kuwait in the east, including Israel’s Arava Desert. Specialised features allow it to thrive in its sandy environment, where it burrows dens in the sand of stable dunes—the more compacted the sand, the more extensive and complex the dens. Like the sand dune cat, super-furry feet protect its paw pads from being scorched. Enormous ears (bigger than those of the bat-eared fox, and another feature shared with the sand cat) allow it to detect prey (insects, rodents and reptiles) lurking under the sand, as well as providing a cooling mechanism. Thick fur keeps it warm during chilly desert nights and gives extra traction when moving over loose dunes. So finely attuned is the fennec fox to its sandy world, it might as well be called the sand fox.
G is for Goodwin Sands

Goodwin Sands, 3.5 miles off the coast of Kent, is a sandbank 12 miles long and 5 miles at its widest point, built up by tidal rise and fall within the narrow neck of water known as the Dover Straits. At high tide, they are totally submerged; at low tide, as much as a tenth of the overall area is exposed, with ridges up to 13 feet above sea level. A ship that runs aground either partially or fully is liable to break its back as the tide ebbs (as much as 18 feet in spring), leaving the bow or stern unsupported. The proximity of one of the world’s busiest shipping lanes has earned these shifting sands notoriety as the graveyard of ships. Over 2000 wrecks have been recorded. During the Great Storm of 1703, four ships came to grief, with the loss of 1200 sailors in a single night. The peculiar tradition of playing cricket there at low tide in summer began in 1824 and survived until 2003, and equally bizarre proposals to locate a third London airport on the sands were floated in 1974. A recent decision to grant Dover Harbour Board a licence to dredge its subtidal sand prompted the formation of a campaign group. Goodwin Sands SOS wants to protect the site’s rich underwater cultural heritage, its wildlife resources, which include hundreds of grey and harbour seals, as well as the Sands’ increasingly vital role as a natural sea defence for the vulnerable east Kent coastline. In a world of rising sea levels, sandbanks can be a blessing as well as a bane.

H is for Hourglass

In ancient Babylon and Egypt, the water clock (clepsydra) told the time. We do not know precisely (or even roughly) when sand superseded water, but the earliest visual rendition is probably within Ambrogio Lorenzetti’s fresco (Siena), Allegory of Good Government (c. 1338). This detail depicts Temperance holding a large hourglass with sand (aka sandglass) in her right palm (the hourglass’s glass, like all glass, is melted sand). The British Museum’s Horological Collection houses the earliest surviving hourglass (probably German, 1520). The sand used for this purpose was clean, dry and carefully sieved to ensure that grains were of more or less similar size, and preferably smoothly spherical to ensure consistent flow; rate of time passage was determined by the quality and fineness of the sand. Often, though, it was hard to tell whether the so-called sand was actual sand (natural silica) or powdered marble, tin ore, lead oxides or even pulverised eggshell.
Maritime travel in the fourteenth century was the first area of activity that widely adopted the hourglass (marine sandglass). Sand was preferred to water aboard ship because, as well as not freezing, its flow was less prone to disturbance by rocking and pitching.\textsuperscript{16} Also, whereas water clocks were susceptible to the blurring of clarity from condensation resulting from temperature change, if tightly sealed, sand was unaffected. (Nowadays, the hourglass is most frequently encountered in a sauna.) Non-terrestrial deployment was quickly followed by use on terra firma to measure things such as the length of a sermon and cooking times. Though cheaper and easier to use than the first mechanical clocks, from c. 1500, the hourglass lost ground as the former became smaller, more accurate and more affordable. Despite its name, the hourglass could measure shorter periods of time (witness its continuing use as an egg-timer), and a long period “hour” glass can measure up to 24 hours.

The continuing fascination the hourglass exerts may have something to do with its capacity to provide a tangible visualisation of the past and the future, how the narrow waist of the present separates them, and how “the sands of time” eventually run out for us all.

\textbf{I is for Iwo Jima}

The five-week battle of Iwo Jima was fought on the beaches of this second largest of the Japanese Volcanic Islands between 19 February and 26 March 1945. The American invasion (Operation Detachment), whose objective was to capture the whole island, to provide a launch pad for assaults on the main Japanese islands to the north, triggered one of the bloodiest conflicts of the War in the Pacific, with 6800 US and nearly 18,000 Japanese deaths and thousands of casualties. Among the movies the battle has inspired are \textit{Sands of Iwo Jima} (1949, starring John Wayne) and Clint Eastwood’s \textit{Letters from Iwo Jima} (2006), originally entitled, more evocatively, \textit{Red Sun, Black Sand}.\textsuperscript{17} American veterans returning to Iwo Jima’s beaches developed the habit of pocketing mementoes of the black volcanic sand that hindered their progress. One veteran compared it to “walking through wet coffee grounds”.\textsuperscript{18} Ninety-year-old Frank Pontisso, a former Marine who returned in 2015 to mark the 70th anniversary, packed a 20-ounce plastic soft drinks bottle with the super-fine grains of black sand from places such as Green Beach, where he first landed (to distribute among friends back home in Des Moines, Iowa).\textsuperscript{19} In Pennsylvania, the Gettysburg Museum of History’s gift shop sells authenticated vials of Iwo Jima sand a Marine collected in the 1980s, and bags
containing two teaspoons-worth (plus validation picture) are advertised on eBay.

While this sort of sand collecting may be a harmless activity, larger-scale removal constitutes theft. In August 2019, police discovered 40 kg of white sand from the beach at Chia, Sardinia, jammed into fourteen plastic bottles, in the trunk of a vehicle boarding the ferry from Porto Torres to Toulon, France. The couple could face a fine of up to €3000 and a prison term of up to six years under legislation (2017) outlawing removal of the sand that represents a vital ecological asset and tourist attraction.

**J is for Jaywick Sands**

In the early 1930s, a few miles from the well-established Essex resort of Clacton-on-Sea, and 60 miles northeast of London, a local developer sold small parcels of land on the North Sea coast (“a certain number of cheap grass plots adjoining the sea at Jaywick Sands Estate are offered….£25 freehold. A chalet can be erected for £20”). The buyers were working-class Londoners (hence the soubriquet “Stepney-by-the-sea”), not least those with jobs at the recently opened Ford factory at Dagenham. The village of glorified beach huts, chalets and bungalows that sprouted up on the saltmarshes and grazing lands of Jay Wick Farm became known as Jaywick Sands. “Come and see Jaywick, the Model Seaside BUNGALOW TOWN, where you may own a freehold chalet right by the sea for LESS THAN THE COST OF A CARAVAN”, urged a 1934 advert. Though ill-equipped for year-round residence (many dwellings lacked heating, running water and proper drainage), many holiday homes became permanent homes for those bombed out of their East End communities during the Blitz. Decaying buildings and unpaved, potholed roads were just the most visible signs of blight in the village’s steady decline since the late 1940s. In 2010 and again in 2015, the Index of Multiple Deprivation (Department for Communities and Local Government) designated the eastern half of Jaywick Sands as the most deprived area in England; youth unemployment, for instance, is the nation’s highest. To make matters worse, the risk of flooding the village faces is the most acute in England.

The golden sanded, crescent-shaped beach that originally attracted Londoners mobilised by private automobile ownership—part of a seven-mile stretch of sandy coastline—rarely if ever features in Jaywick’s heavy media coverage triggered by the 2015 report. Early 1930s photographs show deckchair dotted sands and bathing costumed fitness enthusiasts stretching their limbs on the beach. Wild swimming advocate Roger Deakin recalled
family holidays in a rented wooden shack on stilts directly fronting the beach shortly after World War II (“it was like living in our own sandcastle”).\textsuperscript{26} Christine Lee remembered a family holiday around the same time at the chalet her father bought in 1939. She and her sister built “ever-larger sandcastles, and buried each other up to our necks in cool, damp sand”.\textsuperscript{27} The adjacent Martello Beach Holiday Park still provides caravan accommodation and pitches for camping and the sands remain golden. Despite inclusion on Deakin’s wild swimming map of Britain, Jaywick Sands, like many other British seaside resorts, is unlikely to enjoy a reprise of its interwar and post-war golden age.

**K is for Kahana Beach**

Golden sanded Kahana Beach on Maui’s west coast is one of Hawaii’s best-known beaches. Yet it is also one of Hawaii’s most threatened, having suffered drastic sand loss through a combination of rising sea level, increasingly frequent storm events and sea defence construction. An $8 million plan (2020) for rehabilitation and stabilisation (“nourishment”—the British term is re-charging) through the addition of 50–100,000-cubic yards of sand sourced from offshore “borrow” areas will expand the beach by widths between 11 and 46 metres. This will not only buffer it against erosive waves but also increase the amount of “dry” beach at beachgoers’ disposal.

**L is for Antonie van Leeuwenhoek**

A renowned early arenophile—perhaps the original—was self-taught Dutch scientist Antonie van Leeuwenhoek (1632–1723). A successful draper, he developed an interest in glass grinding and learnt how to make his own single-lensed microscopes, with which the pioneering microbiologist discovered bacteria, among other things. Describing foraminifera (single-celled protists) as “little cockles […] no bigger than a coarse sand-grain”, van Leeuwenhoek also used his microscopes to enlarge actual grains of sand.\textsuperscript{28} In a letter written to the Royal Society (4 December 1703), he included a red chalk drawing of sand grains from the Dutch East Indies as they appeared to him through his microscope. What we really owe to van Leeuwenhoek is an appreciation of the uniqueness of each grain. “I remember I have formerly affirmed of Sand”, he wrote in that letter, “that you cannot find in any quantity whatsoever two Particles thereof, that are entirely like each other, and tho perhaps in
their first Configuration they might be alike, yet at present they are exceeding different”.29

M is for Margate

Donkey rides are no more, but north-facing Margate Main Sands in Kent remains perhaps the ultimate Great British “bucket-and-spade” beach (Brighton’s is pebbled). The wide sands slope gently into the sea so children can paddle safely; the golden sand is soft and ideal for building castles; deckchairs are for hire; fish and chip shops are just a stone’s throw away; ample car parking is available nearby and the railway station (central London is only an hour and a half away) literally opens onto the seafront. Opportunistic seagulls, invigorating breezes and dramatic sunsets that local resident J. M. W. Turner loved to paint complete the scene. Overlooking the beach is the Turner Contemporary gallery, whose first photography exhibition, in the summer of 2019, “Seaside: Photographed”, aptly, was all about the beach and beach life.

N is for Nurdle Beach

Widemouth Bay Beach is a broad, mile-and-a-half stretch of proverbial “golden sands” near Bude, north Cornwall. Until a few years ago, Widemouth (pronounced “wid-muth”) had a simple reputation: as one of Cornwall’s best Atlantic beaches for surfing, bodyboarding and family holidays. Since the weekend of 3–5 February 2017, that reputation has been complicated, and somewhat tarnished.30 While oil spills have darkened the histories of beaches from Santa Barbara, California (1969) to Barafundle Bay, Pembrokeshire (1996), beaches like Widemouth have been tainted more recently by a tide of tiny plastic objects. “Nurdles” are the pre-production building blocks for nearly every plastic product, from drinking straws to keyboards. A lentil-sized raw plastic pellet, the nurdle is readily transportable, meltable and mouldable. These lightweight, bouncy and floating discs also spill easily during manufacturing and transit, then wash or blow down storm drains designed to intercept bigger and heavier materials.31 Then they flush out to sea, eventually fetching up on beaches like Widemouth.

According to Fidra, a Scotland-based environmental NGO (named for a small island in the Firth of Forth), an estimated 53 billion nurdles a year “escape” into the UK’s marine environment from terrestrial sources (2016).
Many more are spilled directly into the sea during transportation and cargo handling (the UK imports almost as many nurdles as it produces—and each tonne consists of 10 million). Birds and fish ingest these fish-egg resembling “mermaid tears”, whose toxicity exacerbates as they absorb persistent organic pollutants such as PCBs from their surroundings. Potentially lethal microbes such as *E. coli* also colonise nurdles, which simply fragment over time under UV light into ever tinier particles.

That weekend in February 2017, in collaboration with Flora & Fauna International, Greenpeace, the Marine Conservation Society and Surfers Against Sewage, Fidra organised the Great Winter Nurdle Hunt Survey (the beach clean-up phenomenon can be traced back to an Ocean Conservancy initiative on the Gulf Coast of Texas in 1986). Six hundred volunteers scoured 279 coastal locations from the Scilly Isles to the Shetlands. They found nurdles at almost three-quarters of the sites sampled. If any of those sites deserves the dubious moniker of Nurdle Beach, it is Widemouth, where 33 volunteers from the Widemouth Taskforce collected the weekend’s record number: 127,500 pellets along a 100-metre section of beach. The Great Nurdle Hunt has become an annual event held internationally in February. Nurdle Free Oceans, a Fidra initiative, maintains a team of nurdle hunters that monitors the world’s beaches and has organised over 2200 hunts to date, logging the data onto a global map.

Nurdles should not be confused with microplastics. These minute pieces measuring less than 5 mm, often smaller than a grain of sand, represent the mechanical (as distinct from biodegradable) breakdown of larger pieces of plastic into ever more miniscule bits that marine biologist Richard Thompson first named in 2004. This pioneering identification of the scale of the microplastics problem was also based on materials collected from Britain’s beaches. Thompson’s team compared them to plankton samples collected regularly since the 1960s along sea routes between the north of Scotland and the Shetlands and Iceland respectively. Since then, the amount of often fibrous and brightly coloured plastic “archived among the plankton” in the water column has steadily grown and increasingly matches the microplastic content of the grains gathered from beaches. But there is no equivalent for microplastics to the great nurdle hunts. Citizen science-style beach clean-ups like Widemouth’s in 2017 cannot reveal the scale of microplastic pollution as many microparticles are concealed beneath the surface. Scientists are just beginning to understand how the embedding of microplastics within sand is affecting its temperature and how water flows through it. For now, Microplastic Beach is a generic, non-site specific concept.
O is for Omaha Beach

Omaha Beach was the code name for an 8-km stretch of “golden” and firm sanded beach in German-occupied Normandy, northern France, during the Allied Forces’ D-Day landings on 6 June 1944 (one of five landing points along an 80-km section of coastline). The US Army’s hard-won objective was to secure a beachhead to link up with a British landing to the east and an earlier American landing to the west at Utah Beach. Given that all battle debris was removed long ago, it was thought, until recently, that no physical evidence survived. But when they visited in June 1988, US geologists Earl McBride and Dane Picard (hard-core arenophiles) collected a jar of sand from a point near the high-water mark, close to the War Memorial overlooking the beach. On returning home, though, they effectively put the jar on the shelf. When they finally gave it their full attention in 2011, they were surprised to find significant quantities of angular, rusty metallic “grains”—shrapnel particles—among their sample (4%). This unexpected material record of the landings—how representative the quantity of shrapnel in the sample is of the beach as a whole is unclear—will probably endure the onslaught of chemical corrosion from saltwater and mechanical abrasion from wave action for at least another century.\(^3^4\) However, these strange, sharp-edged grains will eventually disappear, leaving only regular rather than militarised sand.

P is for Psammophile

Psammophile is not just another term (derived from ancient Greek) for a person who loves sand (see Arenophile). It is also a biological term for a plant that thrives in a sandy environment, such as Aleppo pine, sea holly, sea daffodil, Cretan trefoil, marram grass and European searocket.

Q is for Quicksand

The opposite of sand so hard you can ride or drive on it is sand that, despite the appearance of solidity, can quickly liquify and then collapse. Quicksand is fine sand and clay so heavily saturated with water that the usual friction between individual particles is reduced to the point where the substance cannot bear even the slightest weight. At the merest disturbance, water separates from the sand and clay as viscosity (resistance) weakens. Just
one per cent of physical stress causes the flow speed of the affected particles to multiply a millionfold. Even a single human foot is hard to pull out, requiring strength equivalent to that needed to lift a medium-sized automobile. That does not mean, though, that complete submergence is just a question of time.\textsuperscript{35} Despite what numerous B-movies have suggested over the past 70 years (peaking in the 1960s), sinking in completely is physically impossible.\textsuperscript{36}

Research by physicists at the University of Amsterdam (2005) involving laboratory simulations based on a sample from a saltwater lake in northern Iran showed that our bodies—like aluminium beads and plastic toys—are not dense enough.\textsuperscript{37} Even those who do die in quicksand get stuck rather than sucked under. In 2015, a man swimming in the San Antonio River, Texas, got caught in quicksand “to the bottom of his buttocks” and, unable to extricate himself, probably died of thirst and exposure, or maybe drowned when the river level temporarily rose after heavy rains upstream (news reports are unclear regarding cause of death). Unless the quicksand you are trapped in is within an intertidal zone subject to big tidal variation, your chances of survival are reasonably good. Resist the urge to fight the quicksand, and you are unlikely to sink above the waist. The particles will eventually re-settle and the buoyancy of the mix of sand, clay and water slowly lift you to the top. But thanks to the enduring pull of films such as \textit{The Mongols} (1961)—in which Anita Ekberg expired in a tank in a studio filled with a metre of sand and water—and \textit{Lawrence of Arabia} (1962), that sobering scientific truth will take a long time to sink in.

\textbf{R is for the Right Kind of Sand}

The only natural resources we use more than sand are water and air. As Beiser observes, sand is the “most important solid substance on earth”.\textsuperscript{38} Some types of sand are more suitable for human uses than others. Ironically, beach sand is actually the wrong kind for beach volleyball: too hard for injury-free play, it also sticks to sweating skin. Recently, a global specification has been developed that regulates grain size, shape and hardness. The resultant product drains so well that a court is match-ready soon after heavy rains. Sourcing an accessible supply of the right kind of sand for the Olympics and other international tournaments confronts suppliers with a major challenge.\textsuperscript{39} As not all sand is commercially usable as “aggregate”, whether for beach volleyball courts, coastal fortification or key ingredient for concrete, sand, to quote a United Nations Environment Programme report (2014) is “rarer than one
Most desert sand, for example, has no construction value because the round grains formed by wind erosion bind ineffectively: the sand in the bunkers of Dubai’s golf courses is imported from North Carolina, Ontario and Australia.

**S is for Sandman**

A mythical character in Northern European folklore, the Sandman sprinkles sand (or fine dust) into children’s eyes at night to get them to sleep and also to dream, as related in Hans Christian Andersen’s story, *Ole Lukøje* (1841), named for the main character, who represents the Sandman. The gritty “sleep” (rheum) we rub from our eyes when we wake up is supposedly the remnant of his nocturnal activity. A more sinister persona features in E. T. A. Hoffmann’s story, *Der Sandmann* (1816), in which he tosses sand into the eyes of naughty children who refuse to sleep. Their eyes then fall out and the Sandman takes them to his nest on the Moon, where he feeds them to his own children.

**T is for TIGL (Trump International Golf Links)**

“Direct encounters with sand”, reflects Michael Welland, “are typically at the beach or, more frustratingly, on the golf course”. The word links, a synonym for golf course, is derived from linksland, a sandy coastal environment shaped by the wind and characterised by dunes and hollows carpeted with grass kept short by grazing and strong winds (*hlinc* is Old English for “rising ground”). Linkslands line the Atlantic coast of Outer Hebridean islands such as South Uist. This terrain lent itself naturally to golf as well as grazing, and Scotland’s renowned links along its North Sea “golf coast” embrace these ingredients. The bunker probably originated as a sandy hollow abraded through skimpy turf by cattle huddled together for shelter. In fact, many of Scotland’s early courses required little re-engineering; the design flowed from the lay of the sandy land.

Dune systems are all more or less unstable; parts of the original greens established in the late nineteenth century at Askernish on South Uist had been lost to coastal erosion or buried deep under windblown sand when the course was refurbished (reopening in 2008). One of northwest Europe’s finest and largest examples of a dynamic windblown dune system is Foveran Links, Aberdeenshire. Shaped by thousands of years of reconfigurations as the spit and bar complex at the mouth of the Ythan, the sandy beach and the
dune belt exchange materials in an ongoing cycle of deposition and removal governed by wind and waves; historically, the dune system moves north at a rate of some ten metres per year. The associated flora of this Site of Special Scientific Interest (SSSI, est. 1984) is rich and complex as highly mobile sand scours down to the water table, uncovering wet sand that plants colonise before themselves becoming covered.43

Infamy now complicates Foveran’s fame. In the summer of 2012, the Trump International Golf Links controversially opened for business at Menie Links, Balmedie, a site overlapping with a third of the SSSI. Oblivious to what was required to create and maintain the topographical features that attracted him, Trump (2007) hailed proposals to stabilise the dune “dome” by planting marram grass as a tremendous environmental improvement: “dunes can be gone with the wind […] it’s a piece of land which is disappearing. It’s blowing all over the place”.44 Tarmacadamed paths for golf buggies cross turf laid for greens and fairways over scraped and levelled sands. Stripped of many of its signature features, ecologists and environmentalists believe Foveran Links risks losing its SSSI status.

Whereas other “golf coast” links were laid out among fairly stable sands, Trump’s 18-hole course “amidst the Great Dunes of Scotland” (membership brochure) tries to “freeze” sand, to defy a highly restless dune world. Ancient cities have been entombed in sand in the Sahara and Taklamakan deserts, a fate that may also await Trump’s project.

**U is for Uber Beach Bag**

Uber launched its free promotional Beach Bag in selected cities in New Jersey, New York and New England in July 2014. The promotion is now annual, and for the fortunate few, the tote bag (delivered by an Uber driver) comes filled with other branded goodies, such as sunscreen, a skincare gift pack, sunglasses, baseball hat, beach ball and a gift card for a pair of espadrilles.

**V is for Volcanic Sand**

“Volcanic blend” is not a variety of coffee but a dark sand type that pet owners can buy from the company Komodo to provide a “safe and hygienic terrain” for “desert dwelling reptiles”. Black sanded beaches (not the source for “volcanic blend”) can be formed by heavy minerals such as magnetite or garnet, but most—and certainly the best known—are volcanic in origin. They
are associated with volcanoes’ extrusive igneous rocks, comprising massively eroded fragments (mostly) of basaltic lava, which blackens as it cools and firms up. Volcanic sand comes from the erosion of this volcanic terrain’s immature rock fragments, which, unlike mature sands formed of weathering resistant quartz, readily decompose. Or black sand can derive from eruptions. Iceland has spectacular black beaches, such as Reynisfjara. The Aleutians, Canaries and Azores also have notable black beaches, but Europe’s most famous is probably Ficogrande on Stromboli, a miniature Aeolian island off the northeast coast of Sicily, right under the eponymous volcano that rises 2700 metres out of the Tyrrhenian Sea.

The most renowned beaches of this kind, however, are found on the Hawaiian Islands. Kehana Punalu’u Beach was forged literally overnight when scalding lava met saltwater. Volcanic sand beach is actually a transient feature unless the black material is replenished by further eruptions: in Hawaii, it is illegal to remove black sand. Yet an eruption can jeopardise a volcanic beach in the short term. In 1990, lava flows obliterated Kaimu Beach (aka Black Sand Beach) and also buried the nearby town of Kaimu 15 metres deep; meanwhile, though, a new Kaimu Beach is forming. Hawai'i’s newest black sand beach was created by an eruption at Pohoiki in the summer of 2018. A lava flow emptied into the sea, forming a mass of black sand that the currents shoved down the coastline to Pohoiki Beach, in Isaac Hale Beach Park, where it currently obstructs the entrance to the boat harbour. Eruptions give black sand and take it away.

Though they reflect the sun more softly, volcanic beaches are also hotter. Black sand absorbs more solar radiation than white or green sanded counterparts. Walking on them barefooted can feel like the proverbial cat on a hot tin roof.

W is for Wet Sand

Though this entry is not about “Wet Sand” (2006), a song by the Red Hot Chili Peppers, like the band, it is rooted in coastal California. Despite state legislation (1976) guaranteeing open entry to the state’s 1350-km coastline as a fundamental right, the super-rich and other property owners have tried various means to privatise beaches adjacent to their beachfront properties, such as the deployment of security guards and erection of “no trespassing” signs. But activist groups such as California Coastal Protection Network and the Surfrider Foundation are starting to enjoy success in legal battles that have lasted up to a decade. In 2018, the US Supreme Court turned
down a last-ditch appeal by Silicon Valley billionaire Vinod Khosla against an order to unlock an access gate to Martins Beach, a popular surfing and picnicking spot in San Mateo County (the 1976 law requires property owners to permit public access through their land in the absence of alternative forms of access). In 2019, the California Coastal Commission, which administers the 1976 Coastal Act, fined the Ritz-Carlton Hotel in Half Moon Bay (just to the north of Martins Beach) $1.6 million for repeatedly blocking public access.

The legal basis for universal access is the “wet sand” doctrine, which stipulates that the beach is public up to the mean high-water line. Still, drawing a line in the sand between public (wet) and private (dry) will prove increasingly difficult, as rising sea levels move the demarcation line between wet and dry sand—and public and private property—further up the beach.

X is for Xanadu Beach

Xanadu Beach, at Freeport, Grand Bahama, is the white powder sand beach of tourists’ Caribbean dreams. Nowadays, though, it is much quieter than it was in the 1980s and 1990s, with an abandoned feel. Over a decade ago, the adjacent Xanadu hotel and resort—a getaway destination for Hollywood stars after US property magnate Howard Hughes bought it in 1972—shut down after sustaining severe hurricane damage in 2004–2005.

Y is for Yemen

War and famine-ravaged Yemen, located on the southern strip of the Arabian Peninsula, is as rich in sand as it is poor in monetary wealth. The country’s northeast is dominated by the reddish-orange dunes of the Rub’ al Khali desert (“Empty Quarter”) that occupies the southern third of the peninsula and represents the world’s largest expanse of sand (bigger than mainland France).

Z is for Cra-Z-Sand

Cra-Z-Sand, made by LaRose Industries of Randolph, New Jersey, is a nontoxic and antibacterial substance that never dries out (“amazing creative sand”). It is available in various colours (including sparkling pink and sky
blue) for those aged four and above to create “no-mess” sandcastles away from the beach (“Shape It, stack it, slice it!”).

Postscript

These alphabet entries are selective as well as eclectic. C could easily be for Concrete (difficult to make without sand) or Coral Springs Beach (Jamaican site of one of the world’s most notorious sand heists in 2008). And as I check these entries in late March 2020, as social distancing is enforced on beaches as well as in supermarkets, from Weston super Mare to Sydney, C could also be for Covid-19 beach closure. Likewise, D could stand for Dune; F for Fulgurite; G for Glass, Glass Beach, Golf or Gobi Desert; H for Sand Heist (see Coral Springs beach); M for Marram grass, Sand Mining or Sand Mafia; N for Nourishment (beach sand replenishment); S for Sandstorm, Sahara, Singapore, Silicone or Silicon; W for World islands (Dubai) or White Sands, New Mexico. Throughout, though, I’ve tried to mix three ingredients: substances, processes/activities and sites. In other words, different kinds of sand (biogenic, volcanic), various things we do to sand (collect, dredge) and a range of specific sandy places. The third element is clearly the most personal. M, for instance, might have been for Marina Beach or P for Poyang, rather than these two sites featuring under Dredging. But I resisted the temptation to choose my boyhood beach at Formby Point, Merseyside—renowned for the prehistoric human and animal footprints preserved in the foreshore mud for millennia but now exposed by sand erosion—as the entry for F.

Despite its eclecticism, selectivity and personalisation, certain themes run through this alphabet from start to finish. Firstly, the sheer variety of sand as a material entity and its diverse locations. Secondly, the range of activities that sand supports and inspires, exploitative, recreational and protective: gathering, removing, collecting, playing, treasuring, replenishing and saving. The final theme is the spectrum of values we attach to sand: functional, commercial, aesthetic, amenity, ludic, scientific and ecological—a spectrum as wide as the beach at Ainsdale, immediately north of Formby, Merseyside, where I learnt to drive.

Notes

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3. Swiss arenophile Marco Bonifazi (who possesses over 8000 samples), co-curated an exhibition, *Le Sable*, at the Natural History Museum in Neuchâtel (2002/2003). An avid current practitioner is Michael Welland, geologist and author of the 2009 *Sand: The Never-Ending Story* (Berkeley: University of California Press), who maintains the lavishly illustrated website, “Through the Sandglass”, [http://throughthesandglass.typepad.com/](http://throughthesandglass.typepad.com/).

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9. Beiser, *World in a Grain*, 2.

10. Peduzzi, *Sand, Rarer Than One Thinks*, 5; Vince Beiser, “Sand Mining: The Global Environmental Crisis You’ve Probably Never Heard Of”, *Guardian* (27 February 2017), [https://www.theguardian.com/cities/2017/feb/27/sand-mining-global-environmental-crisis-never-heard](https://www.theguardian.com/cities/2017/feb/27/sand-mining-global-environmental-crisis-never-heard).

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