

A vibrant, cartoon-style illustration of a yellow boat navigating a large, curling white wave on a blue sea. Two people are on the boat: one with dark curly hair wearing a grey shirt, and another wearing a red cap and a white shirt. The scene is set against a light blue sky with white clouds. The text 'Why is the sea salty?' is centered on the page, with the author's name 'Author: Anjali Singhal' below it.

# Why is the sea salty?

Author: Anjali Singhal

Vivek was on a spin with his uncle in a motorboat in the open sea. He was seeing the sea for the first time in his life. It was an exciting experience.

"Vivek, would you like to have some of these?" asked Uncle, offering some homemade French fries in a steel box.

"I would love some!" Vivek said. He popped two of the fries into his mouth and chewed on them gleefully.

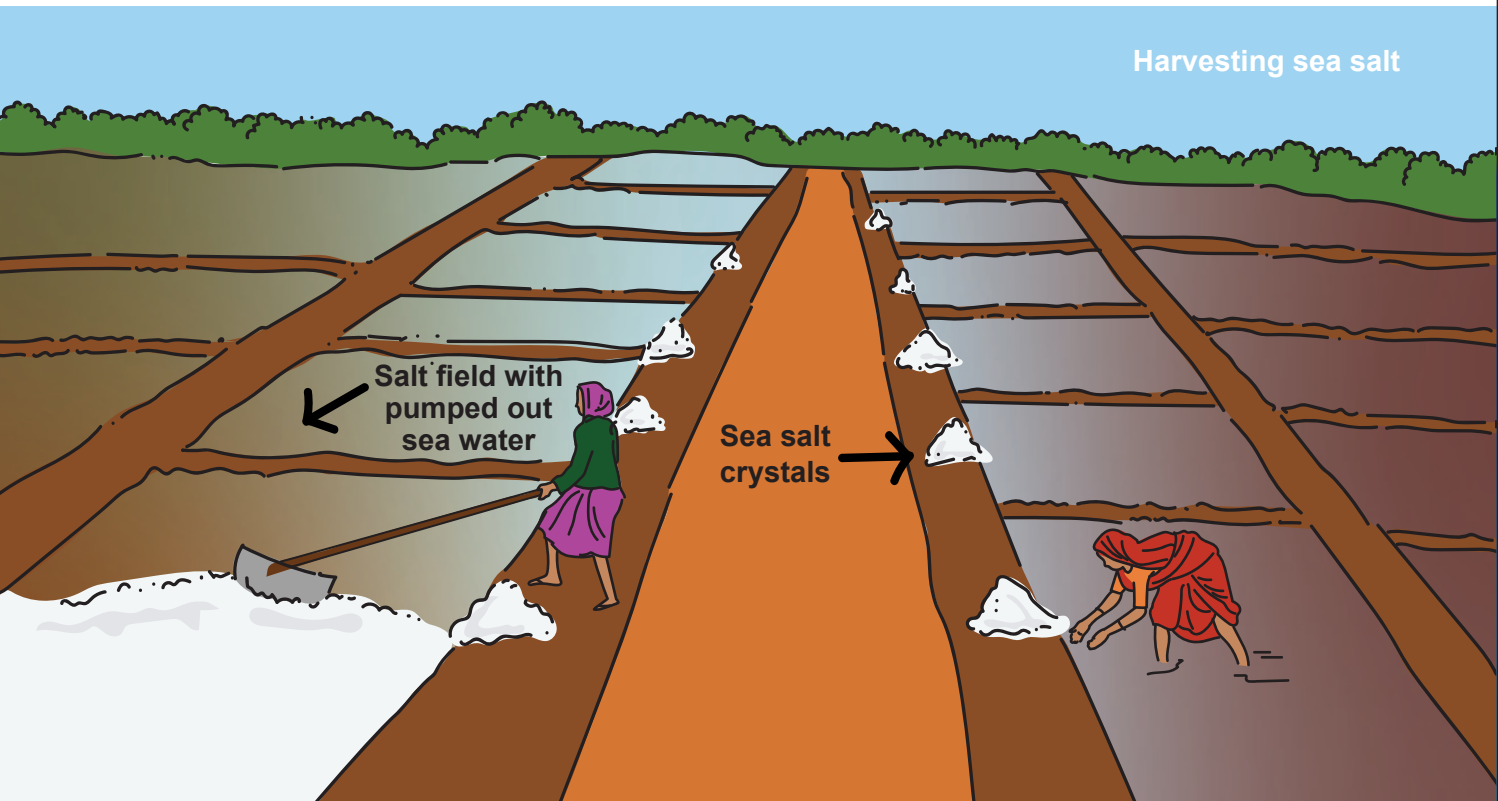
Looking at Vivek licking the salt off his fingers, Uncle remarked, "These ones have sea salt."

"That is so cool, Uncle!" Vivek exclaimed. "I read about sea salt in a book in the school library. It comes from really hot places like this. Salt workers dig wells to pump out sea water. The sea water fills up in large square fields. Under the hot sun, the water dries up and leaves behind crystals of sea salt."

"Wow! Impressive!" Uncle said, beaming at Vivek. "We could meet some salt workers once we go ashore." After a pause, he asked, "And do you know what sea salt is made up of?"

"Sodium and chloride ions. Like table salt?" Vivek asked.

"Correct," Uncle agreed. "But these are not the only ions in sea water. Almost 99.8% of the weight of solids dissolved in sea water consists of four anions and four cations. Apart from sodium and



chloride ions, there are  $Mg^{2+}$ ,  $Ca^{2+}$ ,  $K^+$ ,  $SO_4^{2-}$ ,  $HCO_3^-$ , and  $Br^-$  ions. These combine in different ways to form a variety of chemical salts."

Vivek licked some sea spray off his lips and remarked, "It tastes a lot like table salt, Uncle."

"That may be because sodium and chloride ions are the most abundant ions in seawater."

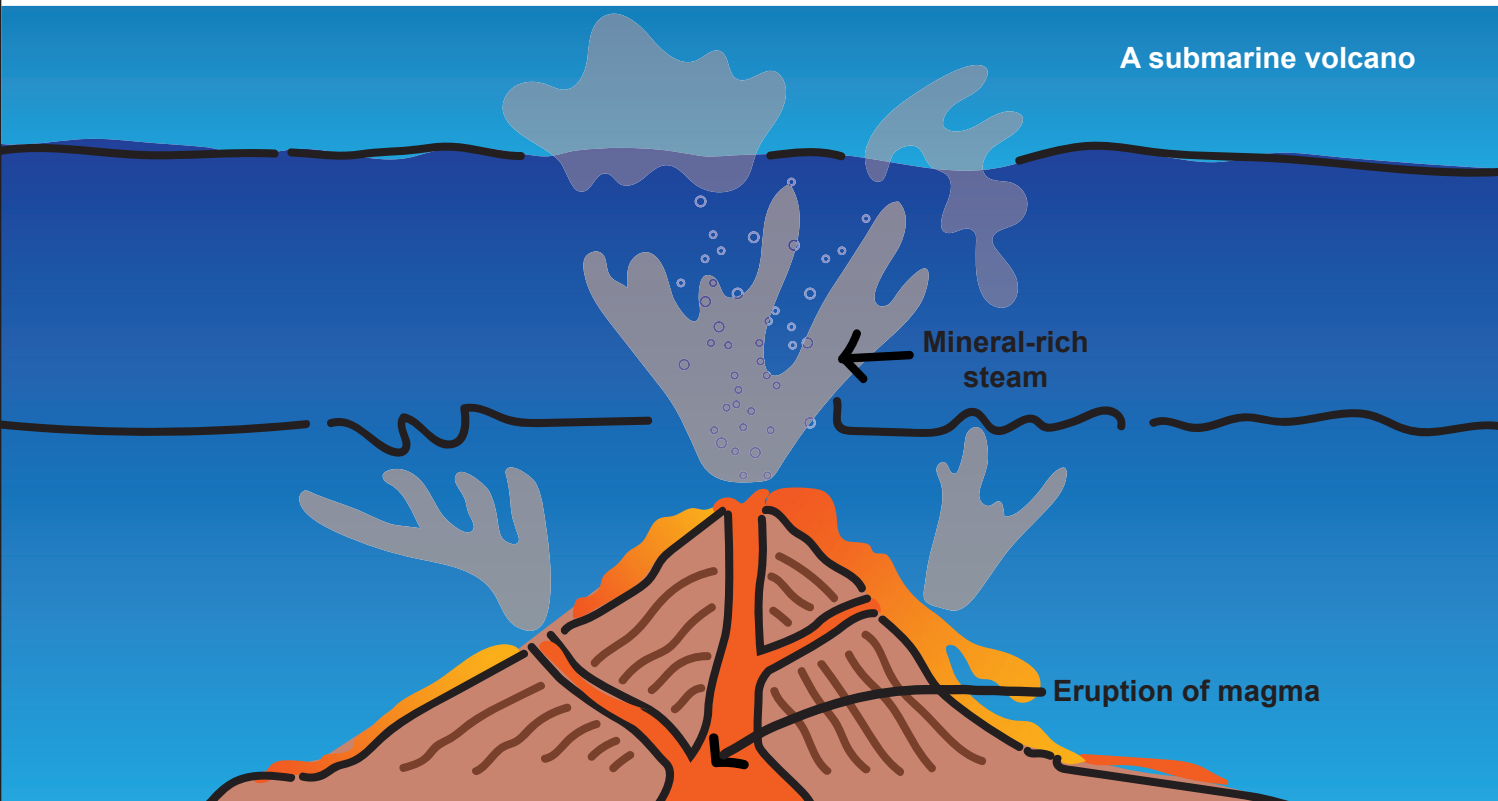
"But how do seas and oceans get these ions in the first place?"

"That is a question a lot of us have been asking! And we have some answers," Uncle replied. "Some of these ions come from eruptions of submarine volcanoes."

"Are you saying that there are volcanoes under the sea?" Vivek exclaimed. "How come we do not see huge eruptions of water then?"

"Eruptions keep happening. But because they are underwater, these eruptions are rarely as explosive as the ones that we see on land," Uncle replied. "The magma that pours out of these eruptions carries some of the salt trapped in rocks into seawater."

Anions	Cations
$Na^+$	$Cl^-$
$Mg^{2+}$	$SO_4^{2-}$
$Ca^{2+}$	$HCO_3^-$
$K^+$	$Br^-$



"I know that word, Uncle!" Vivek said. "Isn't magma a hot liquid?"

"Hot molten rock from the earth's core," Uncle said, nodding his head. "Some of the salt comes from hydrothermal fluids released from submarine hot springs!"

"Submarine hot springs?" Vivek asked.

"The ocean floor has cracks. Ocean water seeps into these cracks and is heated by the magma from the earth's core. The hotter the water gets, the more it dissolves minerals in the rocky crust," Uncle paused. "What happens to water when it is heated, Vivek?"

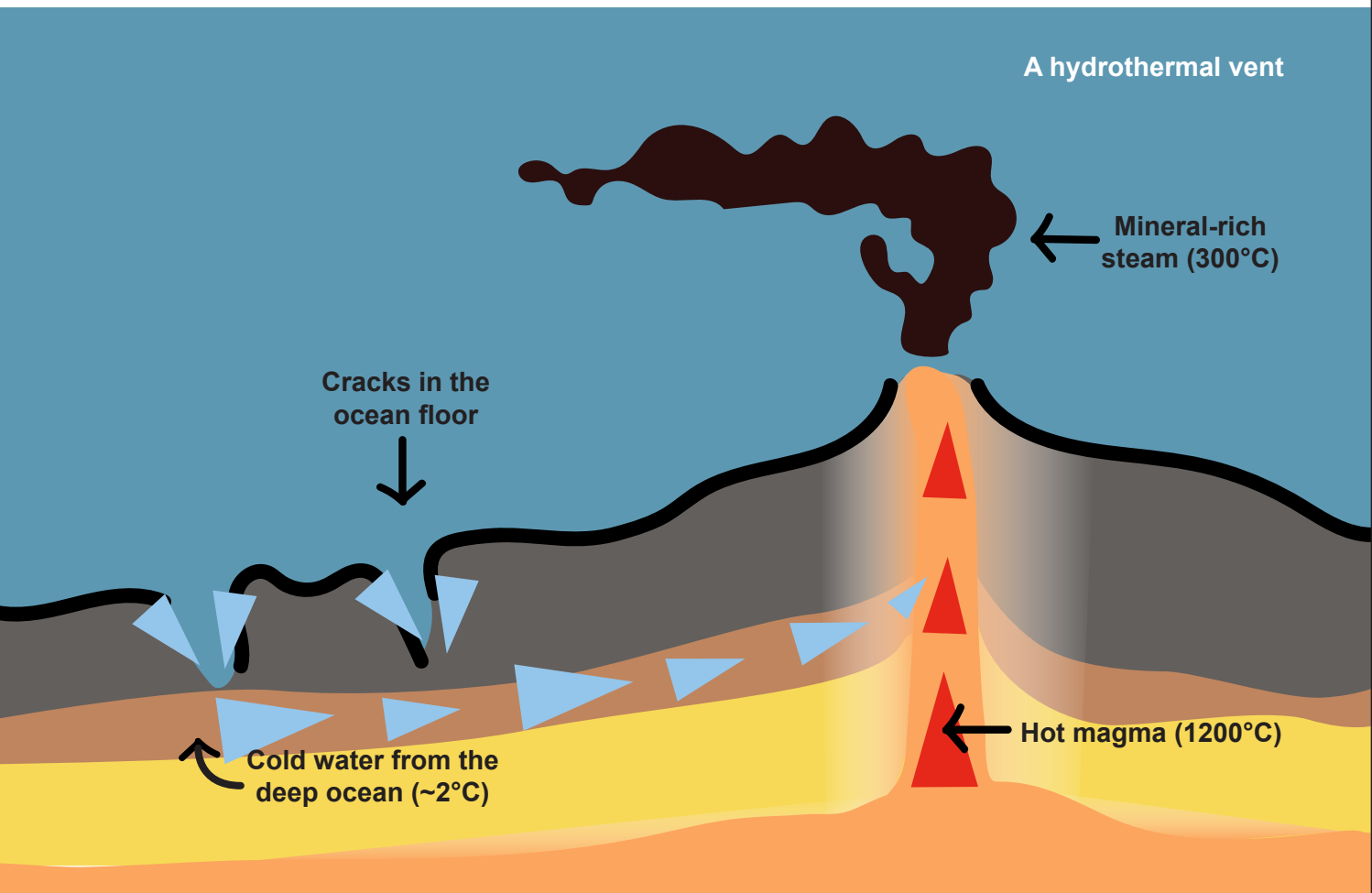
"It changes to steam and rises?" Vivek asked.

"Correct," Uncle smiled. "Eventually, this fluid gets so hot that it erupts from hydrothermal vents in the ocean floor in the form of mineral-rich steam."

"Wow!" Vivek exclaimed.

"Some of these chemical salts may come from salt domes," Uncle continued.

"What are those?" Vivek asked.



"Huge amounts of chemical salts accumulate underground and underwater over very large periods of time," Uncle said. "This salt layer flows upwards forming a mushroom- or plug-shaped column at the surface."

"And some of this salt dissolves into sea water," Vivek finished.

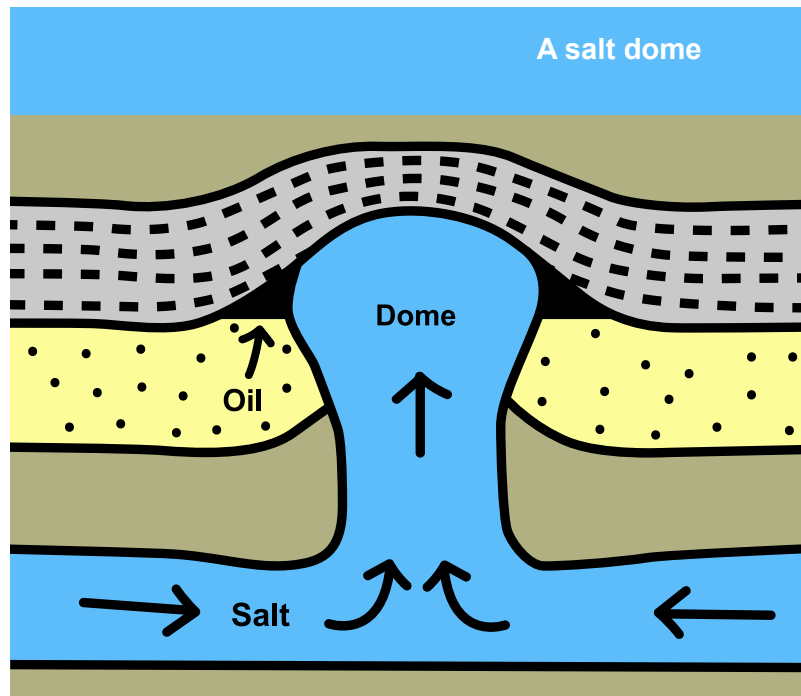
Uncle nodded.

"Submarine volcanoes, hot springs, and salt domes!" Vivek exclaimed. "Seas and oceans are so interesting!"

"Yet, we know so little about what happens on the seafloor," Uncle responded. "But some of the ions in seas and oceans come from rocks on land too."

"Really?" Vivek turned to look at Uncle. "How?"

"Through rivers and runoff," Uncle paused for effect.



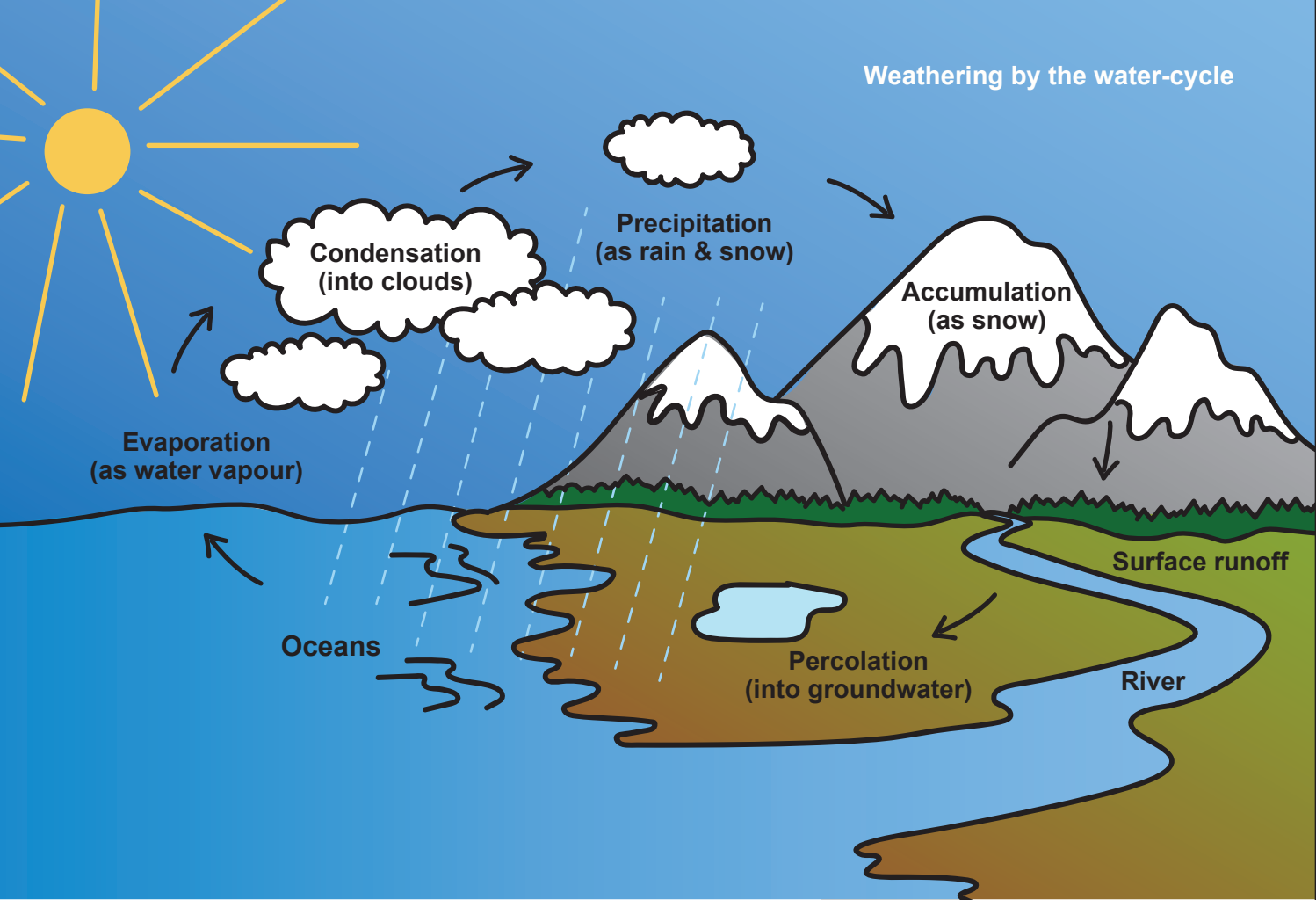
"Surely, you are joking!" Vivek exclaimed looking at his uncle doubtfully. "Rivers have fresh water. Remember how good the water from the river near our home tastes? How can it bring salt to the sea?"

"I do remember the water from the river near your home—so cool and fresh," agreed Uncle. "But it does bring ions to the sea, Vivek. Even sodium chloride. The sodium chloride may be in such small concentrations that we cannot detect its taste." said Uncle, smiling at the doubtful expression on Vivek's face.

Vivek thought about this in silence for a few minutes. Then asked, "But, Uncle, how do minerals from the rocks on land get into rivers?"

Pat came Uncle's reply "Through rainwater."

"I do not believe it, Uncle. I have tasted rainwater. It is not salty like sea water," Vivek's face reflected his disbelief. "We have studied this in school too. Water from oceans, seas, rivers, puddles, and even soil evaporates in the sun's heat to form water vapour. As the water vapour rises, it condenses to form clouds, and returns to earth as rainfall. Where would salt come from?"



"Does your textbook tell you that water is a universal solvent?" Uncle asked.

"Yes..." Vivek said.

"And that the earth's atmosphere has gases like carbon dioxide."

"Yes, Uncle," Vivek said a little impatiently. "But what does carbon dioxide in the atmosphere have to do with salt in the seas?"

Uncle smiled. "When it rains, carbon dioxide from the atmosphere dissolves in the rainwater and reacts with it to form carbonic acid ( $H_2CO_3$ ). This is a weak acid but it is corrosive. Guess what happens when this rain falls on soil and rocks on land?"

"The acid reacts with them?" Vivek asked.

"Exactly!" Uncle nodded. "This is one of the ways by which weathering happens. Many minerals that are in rocks and the soil dissolve in this rainwater. This runoff flows into rivers."

"And rivers flow into seas and oceans?" Vivek added.

Uncle nodded. "Some estimates suggest that seas and oceans receive about four billion tons of ions and salts from rivers every year."

"**That** is a lot!" Vivek exclaimed.

"And seas and oceans receive runoff from the land from millions of sources," Uncle said.

"Plus there is all the underwater activity!" Vivek chimed in.

"Yes. And this has been happening for millions of years."

"So seas and oceans must be getting saltier?" Vivek asked.

"Not really," Uncle replied. "We are not entirely certain why. But it seems likely that the saltiness of seas and oceans may be balanced by other processes. For example, a lot of these ions are deposited as sediments at the bottom of seas and oceans. Seas and oceans also keep receiving fresh water from rivers, rain, snow, and the melting of ice."

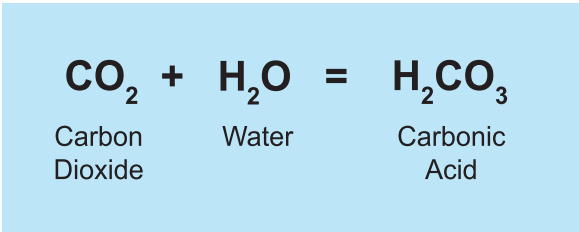
Uncle let Vivek mull over things a bit. They could hear waves lapping against the boat and see some birds flying towards them.

Struck by a new thought, Vivek asked, "Uncle, is it possible that the sea salt in these chips is a thousand years old?"

"It could be," Uncle spoke seriously. "Ions of sodium and chloride are used up by other processes to a lesser extent than other dissolved minerals. So there is a chance that the specific crystals of salt in your fries may be centuries old."

"That is amazing, Uncle!" Vivek replied, grinning. "I cannot wait to tell Mom and my teacher at school. If they used sea salt, finger chips would no longer be **fast** food!"

Uncle laughed.



## About the author

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Anjali Singhal completed an MSc at Banaras Hindu University (BHU), Varanasi, and an MPhil-PhD from Jawaharlal Nehru University (JNU), Delhi. She has worked as a Postdoctoral Fellow at the Department of Botany, University of Allahabad, Allahabad. Anjali discovered a passion for writing stories for children during the COVID-19 lockdown. More recently, she has started a YouTube channel called 'Bolti Books with Anjali' (@BoltiBookswithAnjali25). She can be contacted at: [singhal.anjali@gmail.com](mailto:singhal.anjali@gmail.com).

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