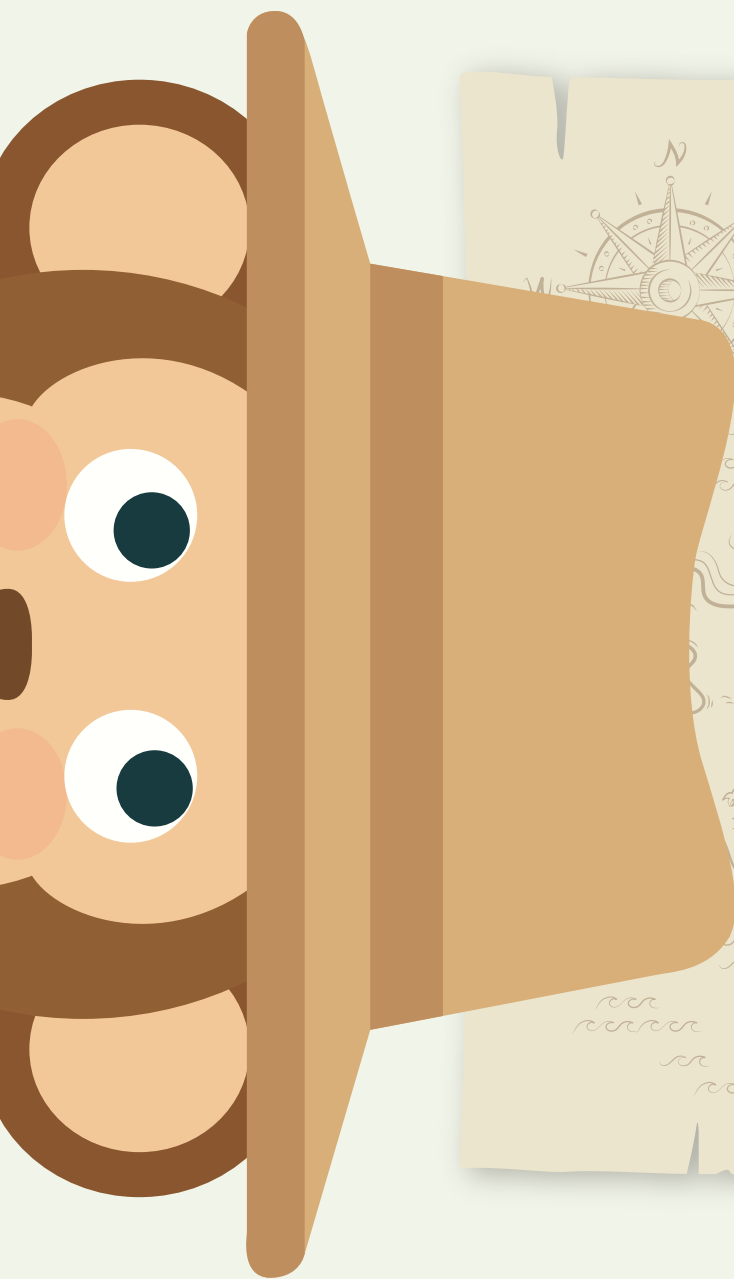


UnEarthed

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UNIVERSITY OF
PENNSYLVANIA



Letter from the Editors

Dear Readers of UnEarthed,

Our names are Daphne Cheung, Editor-in-Chief, and Chloe Gong, Managing Editor. On behalf of our executive board and our fantastic team of writers, editors, and designers, it is our pleasure to bring you the third issue of UnEarthed! The articles which you hold in your hands now are a product made by a group of undergraduate students at the University of Pennsylvania. We specialize in everything from Biology to English to Architecture to Dinosaurs, and with our diverse, educational backgrounds, we have loved putting together this magazine.

Our team grew up on nostalgic goodies like Bill Nye the Science Guy and National Geographic KIDS, but we noticed that there aren't as many resources like these anymore. Whether it's on the topic of human evolution, the spread of coffee, or a survey of famous archaeological sites, we want to encourage you to be EXPLORERS with these fun, short, education pieces. As always, the theme of this issue was inspired by the goal of UnEarthed. The world is a vast, vast place, and we want UnEarthed to be a resource that not only educates you on the unknown vastness of our wonderful home planet, but one that also whisks you away into the depths of your imagination and enthusiasm for learning.

It was a joy for us to put together this issue of UnEarthed for you, and we really hope you enjoy flipping through the pages and marveling at the artwork. Each issue we put out will feature a different theme, so be on the lookout twice every year to learn more and more about our world. And if twice every year sounds like too long of a wait, amazing news: UnEarthed has also recently kickstarted a digital branch too! Visit www.unearthedpenn.com to explore digital-only articles, fun quizzes, and informative videos—all uniquely made by our amazing Digital team especially for you!

As always, please let us know if you have any suggestions to improve the publication or artwork that you would like to see published in future issues. We hope you enjoy!

Daphne Cheung
EDITOR-IN-CHIEF

Chloe Gong
MANAGING EDITOR

UnEarthed
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Journey to the Ocean's Depths

Writing by SARAH ROOT

Space is often seen as the final frontier – unexplored and uncharted territory full of mysteries, big and small. So often are our gazes captured by the numerous stars and planets that we tend to forget the first frontier, the place where life began: the crystal blue waters of the ocean. Despite the fact that oceans cover 70% of the Earth's surface, to this day only 5% of the ocean floor has been explored¹. Yet, when we pull back the curtains and truly begin to examine the murky depths, we find wilder, more alien things than we thought were possible.

The History

Not so long ago, scientists believed that life could only exist when in contact with the sun. Photoautotrophs, or organisms that can make their own food using light – such as plants, formed the base of the food chain. Animals would eat the plants, and then other animals would eat them, and then when those animals died, fungi and bacteria would decompose their bodies to turn them back into nutrients for new plants to grow. Since the ocean floor received no light, scientists thought it impossible that thriving communities of organisms could exist there. While some creatures could live in the aphotic zone – the depth at which no sunlight passes through² – of the ocean either by hunting or scavenging for the dead remains of other organisms, without the light of the sun, nothing could ever be permanent.

The Discovery

This belief all changed in 1977, when researchers were exploring the seabed close to the Galapagos Islands in the Pacific Ocean.³ The area that they planned to explore was very deep down—too deep for humans or ordinary submarines to journey to. Instead, they sent down a special submarine robot that contained a camera. To their amazement, their cameras captured the sight of what appeared to be underground chimneys pouring “smoke” into the surrounding water. But what was even more astounding were what surrounded the vents: vibrant, bustling communities of organisms, the likes of which had never been seen before. There were worm-like creatures that appeared to have feathers, other long, white tube worms with red heads, ghostly crabs, and mussels, along with so much more.⁴ Scientists were shocked—how could life survive this deep in the ocean, without any traces of sunlight?

The Biological Revolution

If light couldn't reach that deep, and hence no plants could survive, then these underwater communities of organisms had to be getting their energy from somewhere else. The vents themselves provided the answer! These dense clouds of shimmering smoke were spewing key nutrients and chemicals into the water. Just like the photoautotrophs on the surface using light to generate energy, microorganisms—known as chemoautotrophs—at the vents could use those chemicals to generate their own energy.⁵ The worms and mussels fed off the microorganisms, and the crabs fed off of them, creating a distinct food web far away from the influence of the sun.⁴ These vents were revolutionary, not only for showing that life can exist where we would least expect, but also because of how the vents mimic the early days of our planet. In fact, some scientists have begun to wonder if life on Earth actually began at the vents!⁵ Only time and more careful study will tell.

DID YOU KNOW?

1. Hydrothermal vents form near places where the tectonic plates that make up Earth's crust are moving³
2. Water coming out of the vents can reach temperatures greater than 700°F – that's 500° hotter than the normal boiling point of water!³
3. Due to the high pressure, the water remains a liquid and does not boil³
4. The color of the “smoke” coming out of the chimney depends on the types of minerals found in the surrounding area³

Design by SYDNEY EAVEY

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Zora Neale Hurston:

Novelist & Anthropologist Extraordinaire

Written by MALKIA OKECH
Design by DELIA CHEN

Zora Neale Hurston is one of the most influential black female writers and anthropologists of the 20th century. She was born on January 7, 1891 in Alabama. She died on January 28, 1960.

Zora Neale Hurston participated in the Harlem Renaissance, befriending other writers like Langston Hughes. You may recognize her from her notable literary contributions such as *Their Eyes Were Watching God* (1937). What you may not know about her is that she was educated in anthropology!

Anthropology is the study of people and how they interact and develop within different societies and cultures. An anthropologist may conduct fieldwork or go to places where they want to study to collect data from the people, places, and communities which they want to research.

Zora Neale Hurston studied anthropology at Barnard University under Franz Boas, a man considered the “Father of American anthropology.” She was the first black woman to receive a degree there in 1928 and would go on to become one of the first to do research on voodoo and folklore from the south as well as the Caribbean. Hurston was groundbreaking not only for her efforts as the first black woman to do this kind of extensive research, but also as a major influence on the development of ethnography—that is, researching people by joining them and viewing life from their perspective.

Hurston also broke the conventions of anthropology. At that time, anthropology was a field consisting of mostly white, male researchers who used racial bias to inform their opinions of cultures. Hurston approached black cultures she was familiar with, with the goal to document them more objectively and sincerely. The search for authentic African American stories and lore went on to influence the characters and stories Hurston would share in her novels.

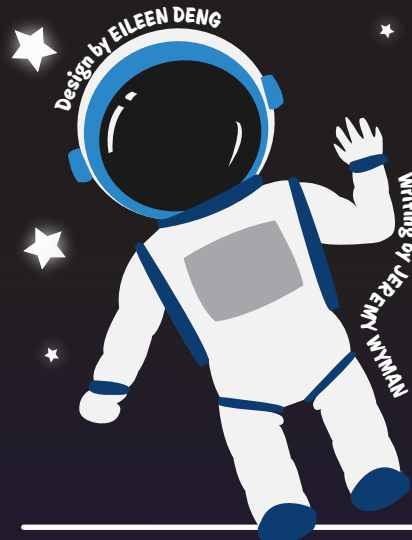
Anthropology still carries the baggage of old racist theories, but it is up to us to change this by continuing to study other cultures with an open mind, and to help others share their stories and ways of life that they wish to tell.

Zora Neale Hurston did not gain much popularity until she died, so she made very little money from her literary work. She could not even afford a proper burial when she passed away, and she had no tombstone! Alice Walker, author of *The Color Purple* (1982), discovered the burial of Hurston in Fort Pierce, Florida, and marked her grave accordingly. This action alone illustrates Hurston’s anthropological legacy!

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History of the Astronaut

Space has always appeared to us as the ultimate goal, the last horizon for human exploration. This timeline begins long before the invention of rockets and continues to present day.



1957

The Soviet Union launches Sputnik I and II. Sputnik is a satellite that looks like a metal ball on poles. These launches kicked off the “Space Race,” a technological competition between the Soviet Union and the United States which led to many of the developments on this timeline. Sputnik II contained Laika, a Soviet dog. The first creature in space was not a human, but a dog!

1963

The Soviets launch Valentina Tereshkova, the first woman in space. It was almost 20 years before another woman was sent into space. Since then, there have been over 40 women from 11 different countries.

1969

Apollo 11 lands on the moon. Neil Armstrong becomes the first person to walk on the moon.

1981

The first space shuttle is launched, indicating a shift in how we transport people to space.

1998

Russia sends up the first segment of the International Space Station.

Since then, space travel has become more privatized. Businesses like Space X and Virgin Galactic have taken over advancements in space exploration.

Late 1920s

Robert Goddard, the father of modern rocketry, launches the first set of rockets with liquid fuel. Liquid fuel allows rockets to travel farther.

1959

The Soviet Union launches Luna I, a satellite that looks a lot like Sputnik, which is the first object to leave Earth’s orbit. The United States launches the first primates into space: Able, a rhesus monkey, and Baker, a squirrel monkey.

1961

One month apart from each other, the United States and the Soviet Union each send a man into space. The first person in space was the Soviet Yuri Gagarin. The first American in space was Alan Shepard.

1966

The Soviets make soft landings on the moon and on the planet Venus. Soft landings are controlled landings where the spacecraft is not hurt.

1975

The American Apollo 18 and the Soviet Soyuz-19 join together in space. This signals cooperation and a change in the relationship between the two powers.

1992

The United States Cosmic Background Explorer detects the first residual radiation from the Big Bang. This helps give a scientific explanation for the beginning of the universe.

HUMANS: Where Did We Come From?

According to scientists, humans have inhabited the Earth for over 200,000 years.¹ That may sound like a really long time, but in terms of Earth's history, it actually is quite short. The earliest living organisms were alive three billion years ago.² This means humans have been around for only 0.01% of the time that life has existed – that is 1/10 of 1/10 of a percent! So what was going on before humans were on Earth, and where did mankind come from? Many explorers have searched for the answers to these questions by using scientific practices and exploring living organisms for clues!

Writing by **ALEKSO MILLER**

Design by **JAHYUN YANG**

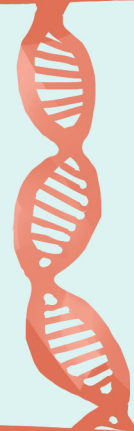
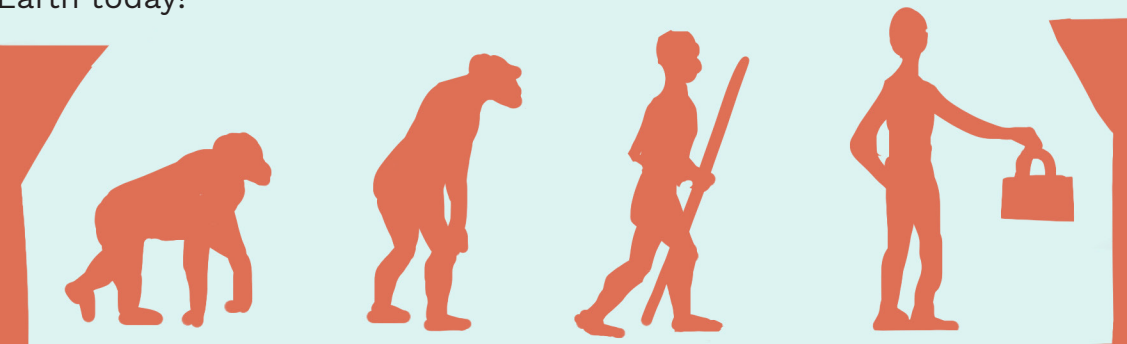
Some biologists and paleontologists spend their time studying what life was like before humans lived. They examine fossils, rock formations, and the animals living today. Fossils tell scientists a lot of information about past animals, such as what they looked like, where they lived, and when they were alive. Scientists often look for changes in animal morphology, or the shape and structure of an organism's body and bones, to identify points in time when their bodies went through changes. Scientists know that Earth and its organisms have changed a lot over the past billions of years: the continents used to be in different places; different animals, such as dinosaurs, have lived and gone extinct; in addition, the climates of today have varied with extreme high and low temperatures. Most importantly, scientists know that species can change—and have not remained the same—over the course of history.



The famous explorer and biologist who is credited with discovering the theory of evolution is Charles Darwin. Darwin lived in England from 1809-1882, where his extensive studies of different animals lead him to discover how organisms change into different species over time. Darwin got this idea when he was studying different species of finches on the Galapagos Islands and noticed there was lots of biodiversity, meaning lots of different animal and plant species, in a small isolated area.³ According to the theory of evolution, humans actually evolved from other closely related species.



When scientists examined the DNA of different species, they found that chimpanzees are the closest living relatives to humans.⁴ This means that over the course of millions of years, as chimpanzees with different and unique traits were born, these traits added up in future generations, until these new organisms became so different from their chimpanzee ancestors that they became humans. People haven't always looked the same—it has taken millenia for human life to reach the point it is at today. Evolution is a slow process, and it is also random. This means the traits that are passed down are completely up to chance. For this reason, it is incredible that humans are even alive and living on Earth today!



Species of animals evolve over long periods of time. This means that slight variations in an organism's DNA, which is a chemical sequence that stores the information for the special traits each organism has, lead to that organism having physical traits different from other members of its species. This creates long term changes in the DNA of the whole species. The process of evolution is slightly more complex than that, but scientists know that as time passes and more changes occur in the DNA of a species, new species are formed as a result.

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MONARCH BUTTERFLIES

Writing by MEGHANA IYER • Design by JESSI OLARSCH

If you have ever seen a bright orange butterfly flying around, chances are it is a monarch! Monarch butterflies are found all over North America, including here in Philadelphia! Though monarchs are characterized by their signature white and orange wings, they are actually best known for their mass migration patterns, in which they travel from all over North America to central Mexico for the winter months. These monarchs are the only butterflies in the world that will travel up to 3000 miles to warmer weather. They are explorers in their own special ways!

Monarch butterflies begin their lives as small eggs for about four days before they eventually hatch into larvae that eat their own eggshells. The larvae grow into large caterpillars after feeding exclusively on milkweed plants. Soon, the caterpillars encase itself in a chrysalis as it enters the pupa stage. After about 15 days, they emerge as beautiful white and orange butterflies! Interestingly, the time of year when butterflies are born is indicative of what their future holds: if they are born in the late spring or summer, they will probably live short lives in the areas where they were born. However, if they are born in summer or early fall, they were born to fly! These butterflies know that they must eventually make the 3000 mile journey to the south.

Unlike other animals that embark on yearly round-trip migrations, the individual monarch explorers travel to

the warm South and never return to their birthplace! After waiting out the winter in the midst of the central Mexican mountains, the individual butterflies will travel north to areas with warmer climates such as Texas. There, they will find more milkweed and lay eggs for a new generation of monarch butterflies! These new butterflies then will then fly further north after the winter to find more milkweed and continue the cycle! By the time a new generation of butterflies reaches the northernmost parts of North America, it will have been about four generations since the original butterflies made the harrowing journey down south all the way to Mexico.

Monarch butterflies are incredible creatures who were born to be explorers. Though they are constantly in motion traveling all across North America, they are doing helpful things for our environment and ecosystem. They pollinate many flowers and also control many pests. Not to mention, they are beautiful creatures to observe, and it is always fun to watch them fly around!

So, the next time you see a monarch butterfly gliding in the sky, know that it is most likely preparing for its very long journey to warmer weather! Just let it naturally get ready for its adventure and don't try to disturb its habitat or lifestyle.

Bon voyage to the monarch butterfly!

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JEANNE BARET

The First Woman to Circumnavigate the Globe

Jeanne Baret was born in 1740 to Jean and Jeanne Baret. Growing up in a rural area, she became interested in studying plants at a very young age—she even came to be known as the “herb woman” in her hometown because of her knowledge regarding plant medicine. Soon after she reached adulthood she began working as a housekeeper for Philibert Commerson, a botanist (someone who studies plants). They became close friends, and after the death of Commerson’s wife, they had an illegitimate child together.

In 1765, French explorer Louis-Antoine de Bougainville asked Commerson to serve as his botanist on his trip around the world. Commerson insisted that his “assistant” Baret be allowed to come as well, but, unfortunately, the French Navy did not allow women on their ships. Baret, however, was not about to pass up on a chance to travel around the world, so, after mulling it over for a bit, she came up with the perfect solution: she would dress as a man and change her name to Jean. Sure enough, she was hired immediately. Her journey around the world began in 1766 when she and Commerson set sail on a ship called the *Étoile*.

URUGUAY. Their first stop was Montevideo, the capital of Uruguay, a small country just to the east of Argentina. Baret and Commerson intended to work together collecting plant samples and studying the Uruguayan wilderness, but after Commerson fell ill, Baret did the majority of the work on her own.

BRAZIL. Rio de Janeiro, a large city in southern Brazil, was their next stop. It was here that Baret made one of her most famous discoveries, a thorny vine dripping with pink or purple flowers. She named this vine *Bougainvillea* after the leader of their expedition.

TAHITI. After crossing the Pacific Ocean, the *Étoile* docked at a small island called Tahiti. Unfortunately Baret could not hide her

identity forever, and, as the story goes, the moment she stepped ashore, the Tahitian natives figured out she was a woman. She was immediately forced back onto the ship where she had to confess her true identity.

PAPUA NEW GUINEA. Baret endured many hardships once the crew members discovered she was a woman, but perhaps the worst of them occurred while she was studying shells on the beach in Papua New Guinea, an island just to the north of Australia. Some of the crew members, deciding they wanted proof that she was a woman, attacked her to see for themselves. Although she survived the attack, Baret hardly left the ship after this.

MAURITIUS. When the *Étoile* stopped in Mauritius, a small island in the Indian Ocean, to stock up on supplies, Baret and Commerson left the ship and took up residence with the governor. Here, Baret took care of Commerson until his death in 1773. Then, in 1774, after marrying a man named—you guessed it—Jean, she returned to France, thereby completing her trip around the world.

Baret led a complicated and at times scandalous life, but there is no denying the lasting impact she had on the world. Not only was she the first woman to circumnavigate the globe, she also made many contributions to the field of botany that are still relevant today and, despite the countless hardships she faced, remained both brave and steadfastly dedicated to her work. One can only hope she will one day get the recognition for her achievements she always deserved.

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Writing by DANA JONES
Design by JAHYUN YANG

Famous Archeological Dig Sites



Writing by SADIE SMITH • Design by JESS TAN

EUROPE: Crete, Greece

1

Known for its colorful frescoes and paintings created with cement, the Palace of Knossos sits on the Greek island of Crete. Archeologists estimate that it was built between 1700 and 1400 B.C.E. What is most notable about the elaborate, winding, colorful palace is that it was possibly the inspiration for Daedalus' famous Labyrinth in Greek Mythology.¹ According to the myth, King Minos kept his architect, Daedalus, as his prisoner so that the design of the labyrinth would be kept secret. This labyrinth was believed to hold captive the Minotaur, a monster with the body of a man and the head of a bull who would roam the labyrinth corridors, trapping and killing humans until the hero Theseus defeated him. Today, there is no evidence of this bloody and epic past; rather, the palace is brightly decorated with frescoes of dolphins and other aquatic life.²



In 1922, British archeologist Howard Carter discovered the tomb of a boy-king named Tutankhamun. King Tut is now one of the most recognizable Egyptian pharaohs, but before Carter's discovery, his name was only known by a small group of historians. He was probably not well known because of his short reign— he became king at seven years old and died when he was only sixteen. What makes King Tut's tomb unique is that his treasures had remained in the tomb until it was discovered. Many other tombs were looted centuries ago, but remarkably, his still held magnificent stashes of gold and precious gems.³

2

AFRICA: Thebes, Egypt

NORTH AMERICA: Hillsboro, Ohio

3

The Great Serpent Mound is a mysterious mound structure located in the United States. It spans 1300 feet and looks like a giant snake with its head pointed eastward, its tail pointed westward, and has seven winding coils between the

two ends. The mound was likely created by a Native American tribe—the Fort Ancient tribe—in the Ohio River Valley around 1070 C.E. In order to fully appreciate its size and shape, researchers had to view it from a bird's eye perspective. Its creation and history remains mostly a mystery because archeologists have not been able to find any writing about the structure. Some researchers hypothesize that it was used as an astronomical chart since the head is aligned with the summer solstice sunset and the tail with the winter solstice sunrise. As such, it might have been used to indicate seasons, or mark when to plant or harvest crops. Additionally, some believe it was thought to possess supernatural powers because serpents were associated with supernatural activity in many native cultures.⁴



In South America, the Moai of Easter Island remain a great mystery. The Moai are large, imposing rock sculptures of human heads. The average weight of the structures is 14 tons and the average height is 13 feet. In order to carve and move these rock structures, the Rapa Nui people must have gone through an unimaginable amount of effort, so these structures must be of great cultural significance. Scholars believe that they represent the respected ancestors of the people of Rapa Nui, although there are no written records to confirm their exact purpose.

4

SOUTH AMERICA: Easter Island, Chile

ASIA: Xi'an, China

5

The now famous Terra Cotta Soldiers of Xi'an, China were discovered fairly recently, in 1973. In ancient China, like in ancient Egypt, leaders believed that they would be able to use their worldly possessions—such as gold, silk, and other expensive goods—in the afterlife. They also believed that their graves needed protection to reach a heavenly realm. No one was more afraid of death than Chinese Emperor Qin. He believed that mercury, a silver, poisonous substance, would make him immortal so he consumed the toxin. In preparation for his much-dreaded death, Emperor Qin oversaw the building of a giant burial complex, complete with thousands of life-sized clay soldiers. Remarkably, each of these soldiers had unique features, facial expressions, and positioning. The soldiers were all poised for battle, given their purpose was to protect Emperor Qin from tomb invaders. Archeologists began to dig beyond the site of the Terra Cotta Warriors and discovered evidence of more life-sized statues, but of dancers and actors, instead of soldiers. They have since stopped digging near the performer statues because the archeologists worry that digging will do irreversible damage to the statues. Archeologists are hoping to continue digging once they are certain they will not disrupt the figures to uncover more of these non-warrior statues.



Rottneest Island is rich in history. The Whadjuk Noongar people are the original inhabitants of the island and the land is of great spiritual importance to them. They believe that in death, their spirits remain on the island until their souls move west and travel into the sea to Kooranup, their final resting place. Today, Rottneest Island remains a culturally rich archaeological site, as well as a recreational destination.⁵

6

OCEANIA: Rottneest Island, Australia

ANTARCTICA

7

Although Antarctica is largely uninhabited due to extremely cold temperatures throughout the year, evidence shows that the land mass was once covered by forests. According to National Geographic, “[Researchers] had uncovered 13 fossil fragments from trees dating back more than 260 million years, around the time of the world's greatest mass extinction event.” Antarctica was once a habitable continent, and its state now demonstrates the changing nature of our world's environments. Who knows what future generations of archaeologists might find in Antarctica. Following the pattern of past discoveries, anything from from legendary places to intricut statues is possible!⁶



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THE LOCATIONS OF Crystals & Geodes

Writing by ANTONELLA STURNIOLO • Design by SYDNEY EAVEY

Selenite

The largest Selenite crystals can be found under the Sierra de Naica mountain in Chihuahua, northern Mexico. The cave where these gigantic white beams of crystals live is called the Cueva de los Cristales (Cave of the Crystals). Some of the crystals are as long as 36 feet and span more than 3 feet in width!¹

Amethyst

Amethysts, the famous purple crystals, can be found in Minas Gerais, Rio Grande do Sul, Marabá, and Bahia, all located in Brazil. Brazil is the largest producer of Amethysts, as well as Artigas, Uruguay; Ontario, Canada; and locations in the United States such as Arizona, North Carolina, Georgia, and Maine. Amethysts range from light to dark purple and are discovered in large geodes inside of volcanic rocks.⁴

Aquamarine

The beautiful greenish-blue gemstone, Aquamarine, is part of the Beryl family of minerals. Brazil produces a large portion of Aquamarine, specifically in the Jequitinhonha Valley and Medina in Minas Gerais, as well as Pedra Azul, and Guaratinga in Bahia. Other locations where Aquamarine can be found include the Shigar Valley, Skardu District, Baltistan; and Nagar, Hunza Valley, Gilgit District in the northern mountains of Pakistan.⁷

Quartz

Quartz is one of the most common crystals on Earth that can be found around the globe. Some locations include the Mohawk Valley region of central New York; La Gardette Mine in Bourg d'Oisans, France; Caldoveiro Peak in Asturias, Spain; and the Hot Springs area of Garland County, Arkansas. What is super interesting about this crystal is that it is used in many electronics, such as radios and watches, because it has the ability to generate small electric currents.²



Opal

Australia produces approximately 95 percent of the Opal in the world! Most of the Opal can be found throughout central Australia, and in the town of Coober Pedy located in South Australia. Australia is the only country on Earth with such an abundant amount of this colorful gemstone.⁵

Volcanic Ice Crystals

These ice crystals can be found on Mount Erebus in Antarctica, the southernmost active volcano in the world. Many ice caves surround its summit, inside of which grows fragile ice crystals that look like clusters of snowflakes.³

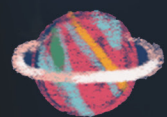
Ruby

A Ruby is a gemstone that ranges from the color pink to a blood-red color. The name "Ruby" comes from the Latin word ruber which means red. The Mogok Valley in Upper Myanmar, Southeast Asia was once the main source for Rubies. However, Rubies have recently been discovered under the receding ice shelf of Greenland, as well as in the Republic of Macedonia around the city of Prilep in mainland Europe.⁶

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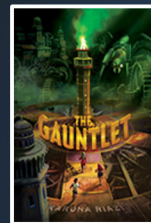
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A Realm of Book Recommendations

Anyone can be an explorer. Whether you live in the hustle and bustle of West Philadelphia, the quiet streets of the suburbs, or the grassy fields of rural farmland, adventure awaits for those who dare to look. Sometimes, though, real life can get in the way. And when you don't quite have the time to put on your own explorer hat, the next best thing is to read about the adventures other explorers go on. At UnEarthed, we have compiled a list of books featuring kids becoming explorers... kids your age, who we hope you will take some inspiration from. Enjoy!



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The Gauntlet, by Karuna Riaz

When twelve-year-old Farah and her two best friends get sucked into a mechanical board game, it's up to them to defeat the game's diabolical architect to save themselves and those who are trapped inside, including her baby brother Ahmed. But first they have to figure out how.

The Hidden Oracle, by Rick Riordan

After angering his father Zeus, the god Apollo is cast down from Olympus and lands New York City as a regular teenage boy. Without his godly powers, the four-thousand-year-old deity must learn to survive in the modern world against enemies who would love to see the former Olympian permanently destroyed. Apollo needs help, and he can think of only one place to go... an enclave of modern demigods known as Camp Half-Blood.



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The Emperor's Riddle, by Kat Zhang

Mia Chen is on what her mother calls a Grand Adventure. She's not sure what to make of this family trip to China, but she's excited about exploring with her Aunt Lin, the only adult who truly understands her. Then Aunt Lin disappears and Mia discovers an old map filled with riddles. She quickly pieces together her mission: find the treasure, find her aunt—and maybe unearth a treasure greater than her wildest dreams.

The Serpent's Secret, by Sayantani DasGupta

Meet Kiranmala: interdimensional demon slayer. Only she doesn't know it yet. Kiranmala is just a regular sixth grader living in Parsippany, New Jersey... until her parents vanish and a drooling rakkhosh demon slams through her kitchen, determined to eat her alive. Turns out there might be some truth to her parents' fantastical stories—like how Kiranmala is a real Indian princess and how she comes from a secret place not of this world.



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The Darkdeep, by Ally Condie and Brendan Reichs

When a bullying incident sends twelve-year-old Nico Holland over the edge of a cliff into the icy waters of Still Cove, where no one ever goes, his friends rush to his rescue... only to discover an island hidden in the swirling mists below. Shrouded by dense trees and murky tides, the island knows their wishes and dreams, and their darkest, most terrible secrets. Do they have what it takes to face the shadowy things that lurk within their own hearts?

City of Ghosts, by Victoria Schwab

Cassidy Blake's parents are The Inspectres, a (somewhat inept) ghost-hunting team. But Cass herself can REALLY see ghosts. When The Inspectres head to ultra-haunted Edinburgh, Scotland, Cass meets Lara, a girl who can also see the dead. But Lara tells Cass that as an In-betweener, their job is to send ghosts permanently beyond the Veil, drawing Cass into an epic fight that stretches through the worlds of the living and the dead in order to save herself.



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Design by JESSI OLARSCH

Writing by CHLOE GONG

the compass

Writing by OLIVIA WEDIG

The forest surrounds you. As you turn, each direction looks the same: gnarled trunks, jutting branches, and unkempt bushes. You have no idea what's lurking behind the trees—what was that sound? Your phone died hours ago, and it's starting to rain. You don't know which way to go, but you remember the guides saying to head north to get back to camp. Which way should you go? Luckily, there is a simple tool that can save you. It guided explorers and adventurers for thousands of years before iPhones or Google Maps existed. Its design is so simple that you could make one yourself using only a few supplies. It's a compass!

Compasses are small enough to fit in your pocket, but they serve a mighty purpose. One side is clear, like a watch, allowing you to see the little metal needle inside. Behind the needle, the four cardinal directions, north, south, east, and west, are printed on the background. A compass doesn't look like much, but something truly incredible goes on inside. No matter which way you point, twist, or spin a compass, the needle will always point north, pulled by an almost magical invisible force.

But the secret to the compass is not magic—it's magnetism! You are probably familiar with magnets—maybe there are even a few hanging on your refrigerator or locker right now! The needle in a compass is a magnet too. The force that holds magnets onto a fridge is the same force that makes a compass needle point north. How can this be? A long time ago, scientists realized that the Earth itself is like a giant, planet-sized magnet. This magnet can interact with other magnets, like the needle in a compass. To understand why, it's important to know that magnets have north and south poles. "Opposite" poles attract each other, but "like" poles repel each other. If you try shoving the north end of a magnet toward the north end of a different magnet, it will be pushed away before they even touch!

For the same reason, inside a compass, the north pole of the needle is pulled towards

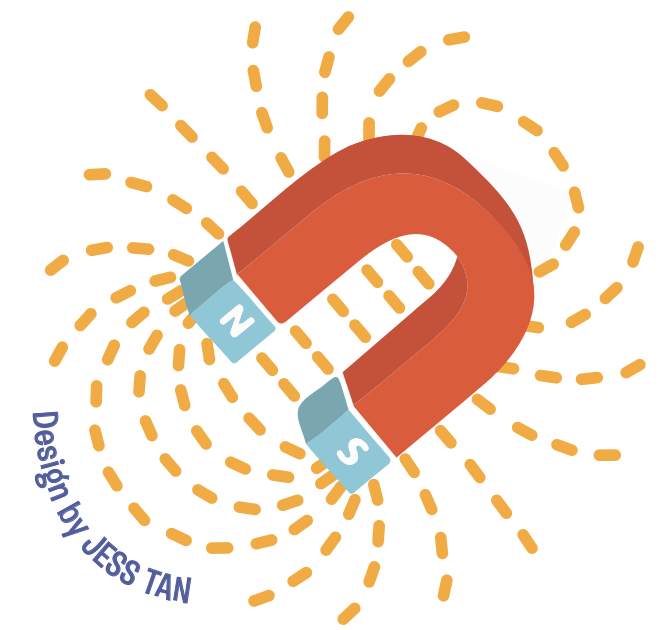
the Earth's south magnetic pole. So why don't compasses point south? Somewhat confusingly, it turns out that the planet's south magnetic pole is aligned with the geographic north pole. It wasn't always this way, though. The location of the planet's magnetic poles is constantly shifting by amounts so small we can barely notice them. There have also been times in our planet's history when the position of the magnetic poles has flipped completely! So, if you had been on Earth 800,000 years ago, your compass would have pointed south, instead of north.

People have been using compasses to navigate for over 1,000 years. Humans began to wonder about magnetism far before that—as far back as the ancient Greeks! The invisible pull of magnetism has long fascinated us, and the compass is just one of the many mysteries that it plays a hand in. So, next time you're lost in a forest you can thank magnetism and the compass for helping you find your way!

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Spilling Coffee Around

the World

Whether taken with a dash of cream, a sprinkle of cinnamon, or a swirl of mocha syrup, a cup of coffee is all we need. From the everyday rituals of your average adult with the morning cup or two to the Starbucks on every street, coffee has become a staple. How did such a gift come to be?

The truth is, no one really knows! How, when, or exactly where coffee was discovered may never truly be unearthed. As is the case with every fantastical mystery, exploring the history of coffee comes with a slew of legends and theories.

To begin, the very first and perhaps most popular legend of origin points to excited goats. Yes, that's correct: a herd of excited goats. It is believed that Kaldi, a lonely Ethiopian goat herder, in 19th century Ethiopia first discovered the immense caffeinated effects of the berries from a coffee tree in the 19th century after feeding them to his goats.¹ After directly witnessing his hyperactive, caffeinated goats, Kaldi ran to the abbot of the local monastery with the news of the magical berry. The abbot threw the berries into the fire, deciding to boil the berries into a beverage and test them himself. Just like any visit to a nearby coffee shop, the rich earthy aroma of ground coffee

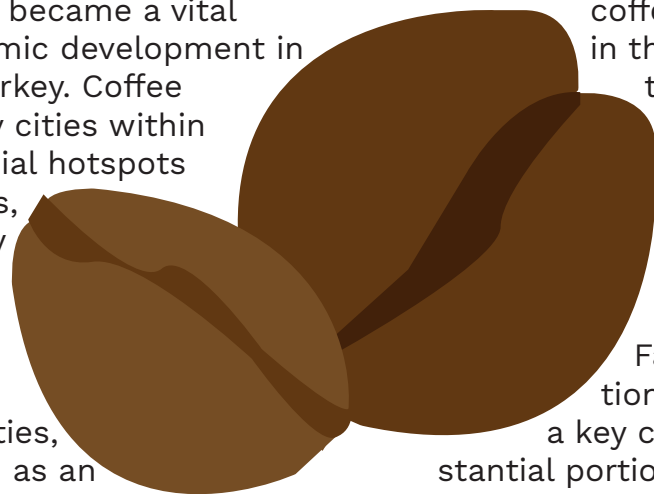


Writing by ROBIN HU

beans immediately permeated the air. The abbot, just like the caffeinated goats, could withstand long hours of work after consuming the beverage. It didn't take long for others to hear about this newfound miracle elixir, and soon enough, monks were using coffee for its stimulating caffeinated richness during long prayer sessions. As the findings spread from monastery to monastery, stories of the dancing goats and the coffee beans migrated across the Arabian Peninsula and soon dominated the globe.

By the 16th century, coffee became a vital aspect of trade and economic development in Persia, Egypt, Syria, and Turkey. Coffee houses popped up in many cities within these areas, serving as social hotspots with live music, performers, board games, and everyday conversations. (Sounds familiar!).³ Despite its developing presence in numerous Middle Eastern and East African communities, coffee became stigmatized as an addicting and immensely powerful "Satanic sin" in 17th century Europe. That is, until Pope Clement VII took one sip and deemed it too delicious to waste.²

With that, coffee continued to travel through communities across the globe. Coffeehouses called "penny universities" in England sold coffee for the price of only 1 cent. Cafes in Germany, Holland, Austria, and France became a norm. People were no longer drinking wine and beer in the mornings—they were drinking coffee.³ Coffee took over the New World. Yet colonists were devoted to drinking tea all the time, so what happened? At the time, the king imposed a heavy tax on tea, causing a major



revolt that would forever shift American preference towards coffee. As coffee seedlings popped up around the Americas in the 18th century, coffee plants began to thrive. Per France's King Louis XIV's orders, coffee plants were planted in the Royal Botanical Garden in Paris. After traveling through thunderstorms and turbulent waters, surviving an attack by a saboteur, and enduring a pirate invasion, a courageous naval officer transported a seedling he stole from the Royal Botanical Gardens to the Martinique islands. Once there,

coffee began to spread even further in the Caribbean and South and Central Americas with almost 20 million coffee trees planted in just a few decades. Explorers, missionaries, travelers, and traders continued to transport coffee seedlings to different cities and new exotic lands. Farmers created coffee plantations, and unsurprisingly, coffee, a key crop export, constituted a substantial portion of economic foundations in communities. However, it's important to never forget that despite the dominant rise of a prosperous crop, this came at the expense of many. While coffee did usher in a transformative period in history, it also signaled the presence of a deep-rooted problem. Particularly in Brazil, thousands of coffee plantations' owners employed hundreds of thousands of individuals living in extreme poverty to work as slaves as a readily accessible source of physical labor in cultivating the coffee crops.⁴ A less well-known form of slavery in today's society, the black market of slavery in coffee plantations signifies the cost that accompanies the daily cup of coffee.



Chances are, there is at least one person you know who is an avid coffee drinker. However, remember that coffee didn't spread across the continent overnight. The story of coffee, its unknown origins and its stigmas have made their mark in history, both good and bad. Perhaps, the next time you smell its marked roasted, nutty fragrance, ponder the hundreds of years of history that arose from a tiny berry from a coffee tree.

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LET'S GO SPELUNKING!

Writing by ANIA ALBERSKI
Design by DELIA CHEN

No, it's not a typo—let's talk about **spelunking!** This fun-sounding word refers to the exploration of natural cave systems. Spelunkers typically suit up with tall hiking boots, hard helmets, and bright flashlights to explore the undiscovered terrain of deep caves. Spelunking isn't as easy as it may sound. You can walk through parts of a cave, but most of the time, you're squeezing through tight corridors, ducking under stalagmites, crawling between stalactites, and even sloshing through knee-deep water. Some spelunkers can even dive with scuba equipment in underwater caves, or zipline through taller jungle caves.

First of all, caves are formed by the dissolution, or breaking down, of limestone. When rain picks up carbon dioxide from the air, it will slowly, over hundreds or thousands of years, begin to drip through soil and limestone. As it dissolves the rock, the water will bend through fractures and sometimes expand these fractures enough to make the openings that allow us to enter caves. On the inside, caves are characterized by slippery rock that takes the shape of thousands of icicles. Stalactites are the name for the structures that look like they're hanging from the ceiling of the cave, while stalagmites are like the pyramids that grow from the ground up. All of the stalagmites and stalactites form in different shapes and sizes.

Vietnam is home to the largest cave in the world: Son Doong Cave, meaning Mountain River Cave. In 1991, a man living

in the jungle discovered the entrance to the cave but was unable to enter because the drop was more than 200 feet. 28 years later, a group of spelunkers from the British Cave Research Association conducted an expedition through the enormous cave. They had to be careful scaling down the side of the slippery rock, using ropes to belay each other down. As it had never been explored before, the cave was pitch-black! The first spelunkers were prepared with flashlights and no fears to observe and measure the insides of the cave.

It turns out that the cave is over 5.5 miles long, and it is tall enough to fit an average New York City skyscraper. This is no ordinary underground chamber, however. Inside, trees grow up to 100 feet tall, a jungle can be found 600 feet underneath the Earth's surface, a river flows between all of the exotic plants, and monkeys can be spotted swinging from branches.

A little closer to us is the longest cave in the world. With more than 365 miles in length explored, Mammoth Cave in Kentucky takes up over 80 square miles. This cave is known for the thousands of stalactite formations that crowd the innerspace.

Sistema Sac Actun in Mexico is the longest underwater cave system known to our world. Spelunkers can swim through the cave by entering the Gran Cenote (cenote means sinkhole) and will typically snorkel or scuba dive to see the entireties of the cave.

Do you think you might want to try out spelunking for yourself? Check out some of these popular cave sites in the northeastern United States.

1 Natural Stone Bridge and Caves Park - 535 Stone Bridge Road, Pottersville, NY
Featuring the largest marble entrance on the East coast, this cave will take you through a network of rock arches, gorges, and waterfalls. There, you can dig for dinosaur bones and explore the crystal mine.

2 Howe Caverns - 255 Discovery Drive, Howes Cave, NY
To enter this six million-year old cave, you'll have to take an elevator down 156 feet and begin your adventure through the stalagmites and stalactites. At Howe Caverns, you can practice your gemstone mining skills, crack open a geode, or test out the ziplines and rope courses.

3 Laurel Caverns - 200 Caverns Park Road, Farmington, PA
This is the largest cave in Pennsylvania, formed by limestone dissolving for over three million years. The cave is very sandy and has a slanted floor for much of the tour that visitors can embark on while there. For the super adventurous, there is an option to try controlled rappelling (like rock climbing) off the side of one of the cliffs inside the cave.



4 Lost River Caverns - 726 Durham Street, Hellertown, PA
This cave in the Lehigh Valley has five chambers adorned with crystals and fluorescent minerals lit up with ultraviolet light. The cave can be explored by foot—be on the lookout for the clear Lost River which seemingly flows without an end or beginning.

5 Penn's Cave - 222 Penn's Cave Road, Centre Hall, PA
This cave in the Amish country will provide you with a more unique experience: the cave must be explored by boat! Hour long tours are available through the Nationally Registered Historic cave where you can spot stalactites that resemble the Statue of Liberty or Rock of Gibraltar.

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