**Track 29**

Throughout history the achievements of women explorers have been less celebrated than those of men. Have you heard of any of these women? The first woman to circumnavigate Earth, Jeanne Baret, was an expert botanist who collected many plants during her travels between 1766 and 1769. Named by The New York Times as one of the leading women explorers in the world, Harriet Chalmers Adams wrote 21 articles for National Geographic in the early 1900s. Archaeologist Sue Hendrickson is best known for her 1990 discovery of “Sue,” a Tyrannosaurus rex in the Black Hills of South Dakota, US. After surviving two types of cancer, Barbara Hillary began traveling at age 79 and became the first black woman to trek to both the North and South Poles, in 2007 and 2011. A Swiss convert to Islam, Isabelle Eberhardt’s exploration of North Africa inspired a 1991 film and the 2012 opera Song From the Uproar. Who knows what motivated these women to push both their personal boundaries and society’s? Maybe it was curiosity, to seek thrills or to make new discoveries – or perhaps it’s a combination of all three!

**Track 30**

Archaeology is a messy business. Digging holes – in the dirt, in the sand, in the rainforest – is essential. Now there's a new way to search, with no shovels needed. Some 400 miles up in space, satellites collect images that are used to identify buried landscapes with astonishing precision. Like medical scans that let doctors examine parts of the body they couldn't otherwise see, satellite images help scientists find and map long-lost rivers, roads, and cities, and discern archaeological features in conflict zones too dangerous to visit. “There is much we miss on the ground,” emphasizes University of Alabama at Birmingham archaeologist Sarah Parcak, a pioneer in using satellite imagery in Egypt. “We've only discovered a fraction of one percent of archaeological sites all over the world,” she says.

Parcak is nudging that fraction up. Through “thousands of hours” of trial and error she has perceived what the human eye can't. Hard-won successes have taught her what works: combining and processing images so she can peer into the infrared part of the light spectrum, which is invisible to the naked eye. The images allow her to detect subtle surface changes caused by objects like mud bricks a foot or less underground. In 2011, relying on infrared satellite images, Parcak and her team identified seventeen potential buried pyramids, some 3,000 settlements, and 1,000 tombs across Egypt. At the 3,000-year-old city of Tanis, once a capital in the Nile Delta, she found evidence of hundreds of dwellings. “Above ground, you can't see anything,” she says. “It's a silty mound with brown, muddy earth covering everything,” she reports. After a few days of processing and peering at the images, she recalls “This amazing map popped out.”

Using laborious, low-tech excavation, it might have taken a century to assemble a similar city plan. But old-fashioned digging is exactly what's needed to confirm these high-tech finds. A French team has made a start, excavating a single Tanis house. When it comes to archaeology, distance provides crucial perspective, but there's no substitute for being up close.

**Track 31**

 The day before classes started at the University of California, San Diego in September 2015, senior Dominique Meyer returned from mapping Maya ruins in Mexico. There are hundreds of Maya ruins throughout Guatemala, Belize, and Honduras, but the Yucatán Peninsula in Mexico has some of the most significant and impressive.

This wasn't Meyer's first trip to Mexico: The then 19-year-old Swiss astrophysics major had already flown camera-equipped drones over the coastal Yucatán state of Quintana Roo, much of which is covered by dense forests. The images he captured were then used to create a 3-D map of the area and were analyzed with data from satellites and a technique called lidar, which can detect terrain levels through the tree canopy. Lidar works like radar, but uses light from a laser. Clues from this analysis hinted at possible architectural structures, so Meyer and three others, including archaeologist Dominique Rissolo, returned on a National Geographic grant in search of the ruins.

“Some of our technology has really revolutionized archaeology and excavations,” Meyer said. “In the past, surveying a site would take multiple months, but we're able to go there and accurately do it in a couple of hours,” he continued.

The team strung up hammocks and spent 10 days hiking around three settlements, including three pyramids, all previously undocumented and – surprisingly – unlooted. The looting of ancient archaeological sites remains a challenge not only in Mexico, but around the world. Meyer stresses this wasn't their discovery: He said, “The locals know pretty much every square meter of the rainforest.” But he does hope that the mapping will mean the structures are protected and studied for clues as to how the mysterious Maya people lived. It is still unclear where the Maya originally came from and what happened to end their advanced civilization.

“Archaeologists always say that you learn by sitting in environments,” Meyer said. And while he does concede that seeing the sites by drone is not quite the same as being there, he argued, “You lose a little. But now anyone is able to look at data. Archaeologists don’t need to hike to Mexico; they can just sit in their offices.”

**Track 32**

1. There must be something we can do to help.

2. He has already left the house so he might arrive on time.

3. They can’t have studied for three weeks and not remembered anything!

4. The vacation couldn’t have been cheap.

**Track 33**

A Distant Moon May Support Alien Life

In 1897, English novelist H.G. Wells wrote his classic science fiction novel, The War of the Worlds. The book told the story of an invasion by aliens from a distant universe, and it captured the imagination of people everywhere. Today, we have made massive advances in space exploration and remain fascinated by the possibility of life on other planets. Recently, the scientific community has been especially excited by research suggesting that there could be life on one of Saturn’s moons, Enceladus.

Enceladus was discovered by British astronomer William Herschel in the 18th century. The name was chosen by Herschel’s son and refers to one of the Giants of ancient Greek mythology. Due to Enceladus’s small size it was difficult for Herschel or his contemporaries to make detailed observations. In addition, its proximity to Saturn’s rings meant that Enceladus was often obscured. As a result, very little was known about the moon for the next two hundred years.

In the 1980s, NASA’s Voyager missions were able to photograph Enceladus for the first time. From these expeditions, scientists learned that Enceladus had a varied terrain. The surface was covered with a layer of ice, but whereas some parts of the landscape had craters, other areas were very smooth. These observations led scientists to theorize that Enceladus had some sort of mechanism whereby the surface ice was periodically replenished. However, they were unsure what the nature of this process might be.

The next breakthrough in our understanding of Enceladus came in 2005. An unmanned spacecraft called the Cassini space probe was able to study the moon more closely while on a lengthy interplanetary voyage. The mission determined the presence of active geysers on the moon’s south pole. Interestingly, scientists also realized that particles expelled by the geysers were the source of one of Saturn’s rings. Scientists speculated that liquid water, a kind of concealed ocean, was present under the moon’s surface. This theory was enthralling because where there was water, there could be life.

Subsequent explorations of Enceladus confirmed the presence of an active ocean. It was also determined that, though the average temperature on Enceladus’s surface was a chilly minus -324 degrees Fahrenheit (minus -197 degrees Celsius), subsurface temperatures were much higher. However, the most compelling discovery about Enceladus was still to come. In early 2017, the Cassini space probe was scheduled to wrap up its final voyage. The spacecraft had been programmed to self-destruct so as not to contaminate the interstellar environment once its mission was complete. Days before Cassini’s final orbit, the probe came into contact with a large volume of hydrogen molecules being emitted by Enceladus. The presence of hydrogen suggested that there could be hotspots in Enceladus’s ocean that resemble the hydrothermal vents on Earth’s sea floor. Located in the deepest parts of our oceans, the vents are rich in minerals and are home to a range of microbial life. Scientists speculated that a similar ecosystem might exist on Enceladus.

The Cassini mission could not carry out further investigations, but the scientists involved in the exploration are now keen to study Enceladus’s ocean in more detail. However, the discovery of hydrogen molecules is the most powerful evidence yet that we are not alone in the universe. The vision that H.G. Wells described could well be in our future. Moreover, as Enceladus is just one of sixty-two moons that orbit Saturn, it is likely that other fascinating discoveries will be made in years to come.

**Track 34**

Andrés Ruzo, The Boiling River of the Amazon

1. I asked colleagues from universities, the government, oil, gas and mining companies, and the answer, well, was a unanimous no.

2. What was amazing is that the locals had always known about this place, and that I was by no means the first outsider to see it. It was just part of their everyday life.

3. I've been back every year since that first visit in 2011, and the fieldwork has been exhilarating, demanding, and at times dangerous.

4. We mapped the temperatures along the river, and this was by far the most demanding part of the fieldwork.

5. Basically, it works like this: So, the deeper you go into the Earth, the hotter it gets.

6. And the thing there is, we define significance. It's us. We have that power. We are the ones who draw that line between the sacred and the trivial.

**Track 35**

1. What exactly do you mean by that?

2. Well, what I’m saying is, let’s do a little more research.

3. I have to say, I’m not quite clear what you’re saying.

4. What I mean is, I see a few problems with the article.

5. My opinion is that this plan will only kind of work.

6. Am I right in thinking that the mission was a success?

**Track 36**

1.

**A:** What exactly do you mean by that?

**B:** What I mean is, let’s think about it before we commit.

2.

**A:** So, are you saying that you’re ready to get started?

**B:** No, I’m not saying that exactly.

3.

**A:** Could you tell me a bit more about the benefits?

**B:** Well, thanks to this new technology, we can work much faster.

4.

**A:** So, am I right in thinking that we’re almost finished?

**B:** Yes, exactly. We should be finished by tomorrow.

5.

**A:** So, do you agree with my opinion?

**B:** Of course. Without the satellite, we would have to rely on mobile phone networks.

6.

**A:** I have to be honest. I'm not clear what you’re saying.

**B:** Well, what I mean is, maybe we should reconsider.

**Track 37**

**A:** I’ve reviewed your proposal and, I have to say, I have a number of doubts about the purchase of the drone.

**B:** What do you mean, exactly?

**A:** Well, the thing is, I’m just not sure we can afford the expense. $2,000 is a lot of money. And if we buy a thermal camera, it will cost even more.

**B:** I understand where you’re coming from, but the drone has a lot of advantages. As I explained in the proposal, it will enable us to carry out excavations much more quickly. I estimate that within a space of 2–3 months, the investment will pay off.

**A:** I’m not clear what you’re saying.

**B:** Well, we’ll have to pay an upfront cost of $2,000, but when you consider that it will help us map archaeological sites faster, down the line we’ll save on other costs. Instead of digging for hours, just hoping to make a find, we’ll be able to scan large areas instantly. Excavations that currently take weeks will only take a few days.

**A:** I see. So you think we’ll save on staff salaries, accommodation, and other expenses.

**B:** Yes, exactly. Moreover, aerial photography is a much safer way to take pictures.

**A:** How so?

**B:** Well, Professor Mendelssohn fell off that ladder a few months ago while he was trying to get a good shot of the site. Don’t you remember?

**A:** Ah, yes, I do remember. He broke his leg.

**B:** Using the drone will avoid that kind of accident. There won’t be a need for anyone to climb up tall ladders, because the drone will capture images for us from the air.

**Track 38**

The researcher believes that the drone is a good investment because it will enable the laboratory to save time and money. By capturing accurate pictures of excavation areas from the air, archaeologists will have a better sense of where to look when they dig for ancient tools and other instruments. They will be able to carry out digs much faster, which will save money. In addition, before drones were invented, archaeologists had to climb up tall ladders in order to take pictures. This can be dangerous; some months ago, another researcher had an accident when he fell off a ladder while trying to take a photograph.