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Digging in the Dirt and Keeping Research Clean: Bridging Two Majors with Hands-on Work

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—Rebecca M. Philibert

Whenever I mention that I want to be an archaeologist, people tend to conjure up images of Indiana Jones and his crazy adventures or, even worse, dinosaur bones. Both images are wrong. It would be fun to be the next Indiana Jones, but that is a popularized view of archaeology, and many real-life archaeologists cringe when they watch his movies. This is mainly because he fails to properly excavate his finds and simply grabs the "treasure" and runs. The other misconception, dinosaur bones, involves an entirely different field, paleontology, which is the study of fossils. Archaeology, another subdivision of anthropology, involves the scientific study of past *human* societies, including their artifacts and other remains often found buried in the dirt.

Although I now know that popular culture has twisted archaeology into an incorrect image of puzzle solving and treasure hunting, the idea that archaeology is used as a window into the past has always interested me. When I was younger, my favorite book was a large golden book with fake jewels on the front in the shape of the Egyptian god Osiris. This book's cracked spine shows that I would reread the pages until I could recite them from memory.

Years later, when it came time to pick a major, memories of those pages came flooding back. I remembered how archaeology captivated my curiosity, and decided I would pursue a career in it. My plan is to specialize in archaeology in graduate school, but because most US academic programs in archaeology are based in anthropology, that's where I started my career path at the University of New Hampshire (UNH). After my parents expressed concern over how much an archaeologist gets paid, I decided to draw from another lifelong interest of mine: Earth science. Majoring in both areas was a

The author at archaeology field school in Belize.

logical decision; archaeologists regularly need to consult geologists and other Earth scientists as part of their work. Having two majors would also give me more options for graduate school and in the job market later in life.

With this double major and the amazing opportunities available at UNH, I was able to get hands-on experience in both majors. First, as a sophomore, I participated in an archaeological field school, working on ancient Maya sites as part of the Belize River East Archaeology (BREA) project run by Professor Eleanor Harrison-Buck from the Department of Anthropology. Then, most recently, I worked in Professor Julie Bryce's clean lab in the Department of Earth Sciences for my senior thesis research project examining ancient Maya clays from the BREA project. My research in the clean lab was funded by a Summer Undergraduate Research Fellowship (SURF), which the Hamel Center for Undergraduate Research awarded to me. My time in Belize gave me a great foundation in archaeological digging (excavation) practices, and my research in the lab further showed me that archaeology is a lot more than bullwhips and Indiana Jones–style fedoras. I learned how archaeologists work with geologists and that hard science can be applied while analyzing the finds.

Digging Up the Past in Belize: 2017 Field School

Imagine this: you wake up, get dressed, apply bug spray that is 90 percent deet, and smear on sunscreen before leaving your bedroom to grab your work boots (not forgetting to turn those boots upside down and knock them against the railing to check for scorpions), and then head down to breakfast—all before the sun rises. That was how each morning started at the archaeology field school in Crooked Tree, Belize. As I sat down to eat breakfast with other UNH students, faculty from UNH and other institutions, and Belizean locals, the sky began to brighten. By 6:00 a.m. we were walking down to the Northern Lagoon, where we would await our ride to the dig site: two small motorboats. The sun would be rising by the time we were racing down the lagoon toward the dig site.

Once we reached the site, we each took some supplies—surveying instruments, digging tools (such as trowels, buckets, and brushes), water jugs, and the food we had packed for lunch—and headed off through a muddy field, sometimes passing by grazing cows. Just on the other side of the field we settled to work for the day on a patch of higher ground, where the site was. Each day we worked toward making maps of the mounds (structures) of an ancient Maya site there on the shores of the lagoon. We were also excavating the ancient structures and looking for associated artifacts that would help date them to a specific time period in Maya history.

The Maya civilization captures the attention of scholars and everyday people because it lasted for thousands of years and left behind great monuments and awe-inspiring pyramids, like Altun Ha and Lamanai, which we were able to visit with the UNH field school, but already had declined mysteriously by the time the Spanish made contact with them in the early sixteenth century. Between AD 800 and AD 950, known as the Terminal Classic period, the civilization experienced economic and political power shifts as well as a large number of population migrations (Harrison-Buck et al. 2013). During this time some sites disappeared entirely, but the whole civilization did not collapse (Aimers 2007).

Today archaeologists believe that many factors combined to cause the decline, including extreme droughts (Luzzadder-Beach et al. 2012; Iannone et al. 2014; Aimers 2007). This might explain why sites like the one we were excavating were right on the lagoon, where there was a steady source of water and food, including fish. The site we were excavating did not have big pyramids, but the structures contained artifacts that showed that the site lasted well into the Terminal Classic and Postclassic periods.

Although I was able to excavate pieces of ancient ceramics, known in the field of archaeology as potsherds or just sherds, the class we were enrolled in was focused on surveying the area and creating maps. To survey the area, we used a tool called a total station. The total station uses an infrared signal to measure the distance from the machine to a reflector placed at some distance away on the site. The total station measures distance based on the time the signal takes to return to the machine and also calculates the elevation by analyzing the angle needed to send the signal to the reflector and the height of the reflector itself. We refer to this measurement process as "taking points" on the site. Once we have taken enough points in an area, the data can be used to create a topographical map using software called ArcMap.

The author excavating Maya artifacts in Belize.

When we weren't taking points, we became encrusted in dirt, searching for pieces of everyday life left behind by the Maya over a thousand years earlier. In Belize, it is hard not to find pottery sherds lying on the ground, but finding them on the surface doesn't always help date the site. Sherds found on the surface could have been moved there much later. Finding sherds in the digging pits (excavation units) that were associated with the structures was much more satisfying, because then the sherds had archaeological *context* and could help us understand the use for and age of a particular structure. We found broken sherds in a variety of colors and sizes, ranging from the size of a fingernail to the size of our palms. We would break for lunch when the sun was at its highest point. We returned to work for a couple more hours after lunch and then headed back through the field to reboard the boats and head back to our lodge.

Once back we completed a few different tasks. We would wash artifacts, attend lectures on how to use ArcMap software for mapping, spend time finishing sketches we had started in the field, and/or head down to the village store for a snack. My favorite snack was always a bag of unsalted, roasted

peanuts still in the shell, along with a cold drink. Dinner was then served, after which many of us students would head up to our rooms, where we would socialize for a bit before going to bed so we could repeat the process the next day.

This field school left me exhausted every day, but I couldn't get enough of it. I have spent most of my life thinking that I wanted to become an archaeologist, and my work in Belize was my first real experience in the field. It left me feeling validated that I had chosen this career path. It was also my first time out of the country, and the exposure to such a different culture left me wanting to travel to more places, see more cultures, and work on many more archaeological digs in my future.

Trading the Dirt for a Clean Lab

To further my work in archaeology, I applied for and received a SURF from the Hamel Center for Undergraduate Research for the summer of 2018. I focused on analyzing clay samples that had been taken during the field seasons of 2013 and 2014 from the BREA project research area and stored at UNH.

Map of Belize showing source location of clay samples.

Archaeology has been used to learn more about the material of daily life, like tools, ritual items, and burial practices, but it has struggled to quantify the nonphysical aspects of a culture, like their social interactions. My SURF project aimed to better understand local and long-distance social interactions by trying to connect ceramic pieces to the clays from which they were made. My goal in my SURF project was to identify distinctive geochemical markers in the clays and see if I could match them to the ancient ceramics that BREA had excavated from nearby sites.

The work I began for my SURF has continued into my senior year as a senior thesis project. With this work I aimed to trace the presence or absence of trade and social interactions during the decline of the Maya civilization in the Terminal Classic period. In my analysis I developed neodymium isotopes (atoms with the normal number of protons but different number of neutrons in the nuclei) to characterize clay samples from Belize, which had been collected by UNH alum Alan Jones. The use of neodymium is a relatively new method to archaeology; Dr. Bryce and Dr. Harrison-Buck have done the only analysis so far (Bryce et al., in prep). But neodymium has been used as a tracer to unravel geological problems for decades. Neodymium isotopes may be especially useful in places like the Belize River valley, where carbonate rock underlies the soils and the carbonate can be incorporated in the ceramic production. Carbonate rock is high in the element

strontium. A common previous tracer method for ceramics uses strontium isotopes, but if clays being analyzed already naturally include this element, the analysis is flawed.

During the summer of 2018, I worked in the James Hall clean lab to prepare clay samples for neodymium analysis. In the clean lab, instead of wearing cargo pants and a thin layer of dirt and sweat as I had in Belize, I had to wear a white Tyvek suit, hairnet, goggles, and rubber clogs. The setting was very different from what I had become used to through the field school, but it was interesting to see another side of archaeology. My work process in the clean lab started with the meticulous task of weighing out small aliquots of each sample. Then I added the clay samples to small beakers and placed them on a hot plate (in actuality an electric pancake griddle) to dry down completely. The hot plate with samples on it was inside a laminar flow hood, a clean work space that prevents contamination. Once the samples were sufficiently dry, I treated them with acids, hydrogen peroxide, and more heat to remove unneeded materials, mainly organic material, and to start the process of digestion, or the breaking up of the silicon-oxygen bonds in the minerals.

The author processing Belize clay samples under the laminar flow hood in the clean lab.

After the samples were digested, I moved them through multiple columns (tubes) filled with special resin to concentrate the elements of interest. Concentrating the elements makes it possible to measure them accurately with an instrument called an inductively coupled plasma mass spectrometer. There are two mass spectrometers in the UNH geochemistry group, and both use a plasma (an ionized and electrically conductive gas) to ionize samples into a beam of charged particles. The beam of charged particles is then steered through a magnetic field and separated based on the mass of the element that is ionized. I used the data from the mass spectrometer to create figures and understand the composition of the clay. It is hoped that this data will aid in the creation of a database of known neodymium concentrations that future researchers will use as a reference to trace the origins of people and ceramics. As my senior year ends, I will be presenting my findings in my senior thesis and at the UNH Undergraduate Research Conference.

Conducting the geochemical work in a clean lab and instrument lab allowed me to become more well rounded, and now I can say with confidence that though I enjoy working in the field more, I realize the importance of lab work.

What Has Combining Majors and Combining Opportunities Brought Me?

The hands-on projects during my undergraduate years have allowed me to experience both of the sides that make up archaeology: the fieldwork, where I was rediscovering long-forgotten pieces of Maya history in the dirt, and the lab work, where I carefully followed clean lab protocols with small samples every day. Although it is fair to say that I enjoyed the fieldwork more than the lab work, being able to experience both has allowed me to receive a well-rounded education about what is expected from archaeological research—a far cry from the Indiana Jones experience popularized in the movies. Having both field and lab experience under my belt gives me a competitive edge for the future, and I am proud that I pushed myself in my own independent study.

Looking toward the future, I know that I want to focus more on fieldwork than lab work. With my senior year coming to a close, I have decided to work for a year before applying to graduate archaeological programs so that I can carefully consider the geographical areas or cultures in which I may want to specialize. Thanks to my work, I have a better understanding of my chosen field for all that it is, which I think is even more exciting than the glamor, or bullwhip, of our good friend Indiana Jones.

I would like to thank Mr. Dana Hamel, Mr. Richard Roberts, and the Grand Challenges for the Liberal Arts Initiative, who have made generous donations to the Hamel Center for Undergraduate Research, which, in turn, funded my Summer Undergraduate Research Fellowship that made this project possible. The importance of programs like these, which aim to better the opportunities available to undergraduates and the ever-expanding research interests in our community, cannot be overstated. This project wouldn't have been possible without my co-mentors, Dr. Julie Bryce and Dr. Eleanor Harrison-Buck, who both planted the seed that would later sprout into this project. Their guidance, from the very start, has been invaluable to seeing this project through. Next, I would like to thank Florencia Fahnestock, who has become an amazing colleague and mentor while becoming a role model as a graduate student. Last, I would like to thank UNH alum Alan Jones, who left behind this research project and enough samples so that I could branch off from his work.

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Author and Mentor Bios

Rebecca M. Philibert is majoring in both anthropology and Earth science and minoring in Latin American studies at the University of New Hampshire and will graduate in May 2019 with a bachelor of arts degree. Her research, which began with a Summer Undergraduate Research Fellowship and continued through the following fall and spring, will culminate as her senior thesis and capstone project for her Earth science degree. Knowing of Rebecca's combined passion for anthropology and Earth science, her adviser told her in her first year at UNH about the ongoing research on sediments from Belize, but it was only after archaeology field school in Belize that she became drawn to getting involved. Her work in a clean lab setting was a challenge, because all the processes involved were new to her. However, the experience helped Rebecca learn about the wide variety of areas within her chosen field, including the hard science that goes into analyzing information from an archaeological dig. Learning about the patience and flexibility required to complete a long research process, paired with her fieldwork experience, Rebecca feels, has given her a well-rounded base going into the graduate studies she plans to pursue in archaeology. She also points out that “the lab work has also shown me which parts of the field I’d like to go into and which I can respect from a distance.”

Eleanor Harrison-Buck is an associate professor in the Department of Anthropology at the University of New Hampshire, where she has been teaching since 2008. She is an archaeologist who specializes in ancient Maya culture and teaches courses on world archaeology, ancient Mesoamerica, and ancient religion and social identity. She also teaches a new course on public archaeology, which she described as “making what we do relevant to the general public—beyond movies like Indiana Jones.” Dr. Harrison-Buck directs the Belize River East Archaeology project, the site of the field school that Rebecca attended and describes in her *Inquiry* article. At UNH, Dr. Harrison-Buck has worked for several years with Dr. Julie Bryce, professor in the Department of Earth Sciences, looking at ceramic sourcing using neodymium. Both thought Rebecca, with her double major in anthropology and Earth sciences, would be a perfect fit for further developing this project and conducting research through a Summer Undergraduate Research Fellowship. Dr. Harrison-Buck notes that she enjoys mentoring promising students, like Rebecca, and showing them the power of interdisciplinary research and the importance of collaboration.

Julie Bryce is a professor in the Department of Earth Sciences at the University of New Hampshire (UNH), where she has worked since 2003. She studies how elements and isotopes cycle through the Earth system. Dr. Bryce teaches Earth science Discovery courses, upper-level geochemistry and volcanology courses, and, to early-career graduate students, proposal development. In addition to working with other Earth scientists within the field on such topics as how molten rock assembles beneath volcanoes prior to eruptions, she and her group work collaboratively with professionals and

scholars in other disciplines, including studies in archaeology (as for the Belize project), microbiology, and ecology. Rebecca's research project stems from a longtime collaboration between Dr. Bryce's geochemistry group and UNH Professor Eleanor Harrison-Buck in her archaeological studies of ancient Maya civilization. Dr. Bryce relates that Rebecca's hard work during her Summer Undergraduate Research Fellowship paid off with "some amazing results." She has mentored many undergraduate researchers, and Rebecca is the first mentee to publish in *Inquiry*. Of writing for publication, Dr. Bryce said, "The age of alternative facts has made it increasingly apparent that we as physical, life, or social scientists must be able to communicate our findings to the public in a comprehensible way."