Lessons From the Field

REWARDS LARGE AND SMALL COME FROM GETTING OUT INTO THE WORLD AND DIGGING IN THE DIRT.

THE CHANCE TO LEARN FIRSTHAND ABOUT HUMAN EVOLUTION by joining their teacher, noted chemist Anne Skinner, on an archeological dig in India gave two adventurous Williams College students more than aching muscles. As they labored in the hot sun, they gained new skills and an appreciation of chemistry's contribution to explorations of the past.

Sergio Marte, age 20, and Daniel Jamorabo, age 21—both New Yorkers and community service-minded chemistry majors who plan to become doctors—spent two weeks in January with Skinner and an Indian team exploring several sites along the Narmada River Valley, 100 miles from Bhopal. An HHMI undergraduate education program grant supported their hands-on learning experience about human evolution via chemistry.

"It was a great opportunity to see that chemistry is not just about mixing chemicals and making explosions," says Marte. "It was a lot about going out into the field, collecting data, and working with people … who can provide perspectives and insight into the work you are doing." Marte talked to local villagers who knew that companies had been excavating in the region—crucial information needed to evaluate whether artifacts were indigenous to the site or had been washed down from upriver.

Skinner earned a "very conventional physical chemistry Ph.D." but now regards increasing the understanding of human evolution as her main area of research, and she collaborates with archeologists and geologists from around the world to advance that work. Skinner is expert at dating the bones and teeth of mammal fossils with a relatively new technique, electron spin resonance (ESR), which can determine the extent of damage caused by the radioisotopes that accumulate in the animals' dead tissue and in the surrounding soil. By dating animal fossils from a geologic layer that also contains stone tools or other evidence of human activity—with the understanding that more damage occurs the longer something is buried—Skinner can approximate when human life appeared in that area.

She used ESR to show that antelope bones discovered in a cave near Johannesburg, South Africa, had been burnt at temperatures so high they had to be produced by campfires using wood and not grass fires. Her evidence indicated that hominids harvested fire from lightning 1.5 million years ago—about a million years earlier than previously believed. Skinner says her work reveals that the hominids, while not able to deliberately strike flint to make sparks, could "take advantage of natural occurrences. They displayed more intellectual ability, creativity, and cultural complexity than people would have thought."

The Indian sites—which were challenging because their acidic soil significantly decays whatever is buried in it—gave the students a chance to practice their newfound archeology skills. After rising early, loading their gear, and traveling an hour to a site, or prospecting for a new one, Marte and Jamorabo dug step trenches, or terraces, at outcrops exposed by erosion. The young men kept detailed field notebooks, and Skinner took pictures and soil samples.

Although the most important discovery—a hippopotamus's tooth—was made by the Indian team after Skinner and her young apprentices had returned home (it was later given to her for analysis), Skinner says the students' "main rewards were the experience of being in a different environment intellectually—out in the field, not in the library or lab—and seeing a different way of life."

Jamorabo, who loves traveling and learning for its own sake, says the trip gave him a chance to ponder the broad picture of human evolution as he examined stone tools and discussed their uses with the Indian archeology team. "Dr. Skinner gave us the context [in discussions before and during the trip], but it's not the same as seeing it and doing it yourself," he says. ■ –JUDITH SAKS

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