INL archaeologists Dino Lowrey and Clayton Marler survey a vast empty lake bed, where prehistoric hunter-gatherers may have stopped during their seasonal migrations.

Secrets of ancient travel routes hidden in volcanic rock

by Roberta Kwok, *Research Communications Fellow*

On a drive through a remote patch of Idaho desert, archaeologist Clayton Marler makes an unexpected right turn. "It gets a little bumpy here," he says as his truck bounces along a dirt path into the sagebrush. Two antelopes watch from the foothills of the nearby Lemhi Mountains. Perched on the truck's rattling dashboard is a black chunk of obsidian, the glassy volcanic rock favored by ancient toolmakers.

Marler has been cataloging obsidian pieces, along with thousands of other artifacts, on the Idaho National Laboratory Site for more than two decades. He believes these tools could be a window into the lives of Native American hunter-gatherers who inhabited the area over the past 13,000 years. Because the volcanic eruptions that produced the obsidian each had their own unique chemistry, Marler can use a method called X-ray fluorescence to trace an artifact to its geological source. The resulting map could help recreate old trade and migration routes travelled by these roaming tribes.

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Sprawled over 890 square miles of southeastern Idaho, the INL Site has yielded artifacts dating back to the end of the last Ice Age, about 13,000 years ago. Marler's job, along with the rest of the lab's Cultural Resources Management Office, is to help protect and record these finds. The Site has been closed to the public since World War II, so much of the evidence has stayed intact, including everything from turn-of-the-century townsites to prehistoric cave drawings. The area is especially rich in obsidian because it resides on the Snake River Plain, a long comma-shaped region marked by volcanic activity.

Today, Marler and fellow INL archaeologist Dino Lowrey are investigating an area near one of the Site's rivers. As he steers through the grass, Marler explains that much of this area used to be under water. Bison, mammoths and ancient horses would have wandered the land; instead of rabbit brush and prickly pear cactus, the soil likely sprouted willows, cattails and reeds. The site where they're headed is an old playa, a dried-out lake bed hundreds of acres large that provided a temporary home for Native Americans on their seasonal travels.

Click here to see a more detailed map of the obsidian sources identified by Marler.

As the truck rounds a bend, a sea of pink flags comes into view. Each flag marks the discovery of an artifact, many of them crafted from obsidian. The archaeologists park at one end of the field and tramp over to a flag marking an old spearpoint. While Lowry sits down to sketch the artifact, Marler takes out a GPS device to record the location.

Obsidian was a popular material for making tools, Marler says, because it is easily shaped and can be made very sharp. But unlike other rocks used by ancient Americans, all of the obsidian from a particular geological source has the same chemical makeup. Samples from Bear Gulch near Idaho's Centennial Mountain range, for example, have three times more zirconium than samples from Malad Pass, 180 miles to the south. That's because obsidian is formed from underground liquid magma flows that evenly mix the elements together, giving each source a distinct chemical signature.

Marler has analyzed about 500 obsidian samples from the Site and 250 more from the Museum of Idaho. "Clayton is working with one of the most complete records in eastern Idaho of 13,000 years of human occupation in the region," says anthropologist Richard Holmer, a collaborator at Idaho State University. To determine the origin of an obsidian artifact, Marler and Holmer beam it with X-rays using an instrument at ISU. The X-rays energize atoms on the surface of the rock, causing a shuffle of electrons that emit radiation at specific wavelengths. By measuring the wavelengths, the researchers can identify the obsidian's chemical elements and match them to the right geological "family."

Since beginning the project in spring, Marler has found obsidian from sources all over the Snake River Plain, including Big Southern Butte, Teton Pass and Obsidian Cliff in Yellowstone National Park. Some tools appear to originate from the California-Nevada border, 600 miles to the

southwest, which Marler speculates could signify a past trade route. A few artifacts' sources can't yet be identified, so the researchers will have to look for matches with more distant volcanic flows in Nevada and Oregon.

Marler hopes to eventually take the X-ray fluorescence instrument into the field for portable field testing. "That thing is so cool," he says. "It looks like a Flash Gordon ray gun."

For now, Marler's best instrument is a sharp eye. Dozens more artifacts are likely scattered around the playa's edges, hidden among grass and ant hills. He and Lowrey have already made some puzzling finds, such as an unusually high number of rounded scraper tools that might have been used to harvest a wetland plant. With a handful of pink flags, Marler heads across the field to look for more clues.

Using a technique called X-ray fluorescence, Marler can determine the exact geological source of an obsidian spearpoint.

Find out more about the history of human occupation in the INL area.
Read about the geographic history of the Snake River Plain.
See a list of obsidian sources in Idaho.

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