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Massive Cave-In Made Caldera

By Dave Menicucci

For the Journal

Recent scientific work at the Valles Caldera National Preserve has produced some remarkable information about how ancient people used the area over the ages. But the story really begins with its geologic formation.

It is generally known that the Valles Caldera is an ancient volcano, and most believe it was created from a huge eruption, one that blew its top and scattered ash and debris for thousands of miles. In reality, geologic studies suggest just the opposite — the caldera was formed when a rapid outflow of lava left a large cavity deep underground, causing the central part of the region to collapse into that void. Mountain peaks that once existed are now buried deep in the heart of the caldera.

What is most astonishing is the speed at which this process took place. According to Kirt Kempter, a contract geologist with U.S. Geological Survey who has studied the preserve, this cataclysmic collapse may have occurred in only a few days — an infinitesimal geologic period.

Over the ensuing thousands of years, increasing magma pressure has caused the central part of the caldera to surge upward, forming today's landscape of valleys and mountains.

These primal events had a profound impact on how humans have come to know and use the region. Kempter explained that, since the lava flowed from its underground chamber rather than exploding, it produced a very pure form of obsidian — a hard, black, glass-like substance that can be used to produce extremely sharp stone tools such as knives and arrowheads. In fact, this type of obsidian is still used for certain modern surgical tools.

In addition to obsidian, the unique landscape produced grassy valleys with a diverse set of edible plants that attracted large mammals, as well as human gatherers. Ana Steffen, preserve archaeologist and head of the cultural resources program, believes that edible and nonedible plants were as important to ancient people as hunted animals. But she agreed that hunting was an essential activity because animals produced useful products beyond food, such as hides, as well as bones that could be carved into tools.

The earliest recorded human activity is estimated to be more than 10,000 years old, a time called the Paleoindian occupation. The preserve is replete with stone artifacts from that period and beyond, mainly obsidian.

“Everything else is gone,” Steffen said, including wooden shafts of arrows

and spears that carried the razor-sharp obsidian points. “And most of what is left is the debris from the tool making — waste flakes and chips,” the obsidian equivalent to sawdust.

The large deposits of obsidian allowed high-quality weapons to be fashioned on site, making the caldera a prime hunt-staging area. Steffen’s team has also discovered evidence that the obsidian might have been used for barter. The caldera’s obsidian tools, which retain distinctive compositional characteristics, have been traced to areas as far away as 800 miles.

Stone tools from other areas are also found in the preserve. Steffen suggests that visitors replaced their implements with ones fashioned from the caldera’s prized obsidian. It is possible that these exchanges took place as part of primitive business transactions.

Too much information?

With careful study, the ancient way of life is emerging from the historic darkness. Steffen said confidently that based on the number of artifacts, “we know that there was intense human activity here,” mostly related to hunting but also involving the gathering of wild grains, vegetables and fruits.

“Based on grinding implements that we have recovered, we believe that vegetation provided a healthy portion of their diet,” she said.

The evidence of ancient human activity at the caldera is overwhelming. Scott Worman, a doctorate candidate in archaeology at the University of New Mexico, has worked on the preserve and said that a major challenge is “too many artifacts.”

“Nearly every site is yielding thousands of samples, all of which require analysis to draw inferences about the past,” he said.

Recently, his team excavated about 3½ thousandths of 1 percent of a single large site and recovered more than 9,000 artifacts.

“It took months to analyze that small sample,” he said. “There is enough out there to keep scientists busy for a century.”

Indeed, scientists have flocked to the preserve, and there are discussions with various organizations about creating joint research programs. The most recent collaborations involve the UNM Office of Contract Archaeology, UNM Department of Anthropology, the U.S. Forest Service, Glorieta Geosciences and Los Alamos National Laboratory.

LANL and Glorieta are working on the problem of bioturbation. Paul Drakos, a Glorieta geologist, explained that archeologists often depend solely on soil characteristics and its layering to date buried artifacts. The problem, he said, is that “over time critters dig into the soil and move artifacts from a younger soil horizon to an older layer.”

Drakos’ team is trying to determine how to properly connect displaced materials with their associated soil layers.

An emerging picture

Some of the most fascinating findings are emerging from collaborations between UNM and the Santa Fe National Forest. Ann Ramenofsky, a UNM anthropology professor, and Jeremy Kulishek, an archeologist with the Santa Fe National Forest, have been studying the living patterns of people in the Jemez Mountains in a time called the Pueblo Occupation, about 1,500 years ago.

An amazing picture is emerging about how those people, particularly the ancestors of modern neighboring tribes, used the caldera. Dozens of stone field houses and terraces have been documented on the southwest corner of the preserve. The ruins suggest that ancestral pueblo people used the area for agriculture and lived in the houses during the growing season.

When this evidence is coupled with the thousands of field houses that have been discovered in other areas of the Jemez Mountains, it suggests the existence of a sophisticated society that involved detailed agricultural knowledge, transportation and communication systems, complex tool making, and political organization.

Kulishek proposed that during this period dozens of villages — each with about 1,000 residents — existed south of the caldera. The field houses were employed as a kind of remote agricultural encampment, but their sturdy stone structures suggest that they were occupied repeatedly. He explained that “these people would trek up to the sites in the spring, tend to their crops during the summer, harvest them, and haul processed foodstuffs back to their villages in the fall.”

Tools, he said, consisted of shovels made from animal shoulder blades and hoes created from antlers.

Successful agriculture in the southwest corner of the preserve — more than 8,000 feet in elevation — posed an interesting agricultural challenge. At that altitude, the growing season is short, probably 90 days, but there is generally more rainfall.

Kulishek considers these people to be expert managers of risk.

“They were the Wall Street traders of their day,” he said. “They had to decide how much of their resources to invest in an area subject to significant variations in weather” ranging from drought to flooding to summer frosts.

The stone terraces, Kulishek suggested, were used to manage water retention and control erosion, and demonstrate a high degree of technical sophistication and knowledge. He also believes that due to the density of the field houses, which certainly were occupied by many different families, political and legal systems were needed to define ownership rights and to adjudicate disputes.

“The more I learn about these people, it is clear that they were very clever indeed,” Kulishek said.

Early events had impact on how humans came to use area

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Geologic Events Shaped Humans' Use of Caldera

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COURTESY PHOTO

Ruins of a portion of an agricultural terrace are visible at the Banco Bonito area of the Valles Caldera National Preserve.

General information about the Valles Caldera

Valles Caldera National Preserve home page

www.vallescaldera.gov

Valles Caldera National Preserve reference documents

www.vallescaldera.gov/about/trust/trust_ref.aspx

Valles Caldera National Preserve news reports

www.vallescaldera.gov/newsmedia/index.aspx

Caldera Action news issues

www.caldera-action.org/pressRelease.htm

Archaeology and cultural resource tours

Valles Caldera National Preserve archaeology van tours (July 10 and 24, Aug 4 and 21, Sept. 10)

www.vallescaldera.gov/comevisit/tours/tours_viewall.aspx?cat=49

Jemez Pueblo history van tours at the Valles Caldera National Preserve (today, Aug. 9, Sept. 2)

www.vallescaldera.gov/comevisit/tours/tours_viewall.aspx?cat=22

Books about the Valles Caldera National Preserve

“Valles Caldera: A Vision for New Mexico’s National Preserve” by William deBuys and Don J. Usner

“Valle Grande: A History of the Baca Location No.

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Valles Caldera National Preserve news reports
www.vallescaldera.gov/newsmedia/index.aspx
Caldera Action news issues
www.caldera-action.org/pressRelease.htm
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deBuys and Don J. Usner
“Valle Grande: A History of the Baca Location No. 1” by Craig Martin

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