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Luminescence dating of anthropogenic features of the San Luis Valley, Colorado: From stone huts to stone walls

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ABSTRACT

The Snake Nest Wall site and the Crestone Stone Huts are in the northern San Luis Valley, Colorado, and provide a unique opportunity to date high-altitude archeological sites of unknown age and origin using optically stimulated luminescence (OSL). We sampled sediment underlying foundation stones of these structures to establish a chronological framework for each site's construction. OSL dating of the quartz grains directly under the Snake Nest Wall suggest that the stones and, therefore, the structure was most recently emplaced between 1855 and 1890 A.D. Dating of the sediment beneath the Crestone Stone Huts suggests the construction time of these huts is between 1860 and 1890 A.D. Analysis of the equivalent dose (D_E) dispersion of the OSL samples at Snake Nest Wall and the Crestone Huts shows that the majority of sediments were fully bleached prior to deposition and the low scatter suggests that short-term or shallow alluvial processes were the dominant transport for sediments. In both cases, the OSL ages show that the construction was during very recent historical times, although it is likely that the Snake Nest Wall was rebuilt in the late 19th century. Further study is warranted at the Snake Nest Wall since it shows signs of greater antiquity and a continued presence of human use. The Crestone Huts are shown to be a product of railroad building during the boomtown days of Lucky and Crestone.

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1. Introduction

Humans have hunted, gathered, built, and left signs of their presence in the San Luis Valley of Colorado for well over 11,000 years (Cassells, 1997; Simmons, 1999; Jodry, 1999a) (Fig. 1), as evidenced by the discovery of stone tools from both the Clovis and Folsom cultures (Jodry, 1987). The San Luis Valley, and the associated Rio Grande Rift, has a rich archeological legacy with Folsom points being found more often than Clovis points (Cassells, 1997). Some of the earliest and best-known studies are from the Medano Ranch Mammoth Site where reputed Clovis points were found along with scrapers and ground flaking platforms (Cassells, 1997), the Zapata Site with an associated Folsom artifact assemblage (Button, 1987; Simmons, 1999); also "Stewart's Cattle Guard Site," the better-known Folsom site of Linger (Pitblado and Brunswick, 2007), and the decades of archeological research the Smithsonian has done in the valley (Jodry, 1987, 1999b) near the Great Sand Dunes National Park.

The Archaic people that occupied the San Luis Valley from about 6950 BP to 5950 BP have been called the Rio Grande Complex (Honea, 1969). This culture has been associated with the Oshara Tradition of northern New Mexico (Irwin-Williams, 1973; Moore, 1994) and alternately as a component of the Mountain Tradition (Black, 1991). The Tewa Pueblo, established circa 1300 A.D., and the Taos Pueblo people both have origin stories that indicate the emergence of these Puebloan peoples were from a place near Blanca Peak (Fig. 1) on the eastern edge of the San Luis Valley. These people likely also utilized resources of the valley such as bird hunting and turquoise mining (i.e. the King Mine 9 miles (14.5 km) east of present day Manassa, Colorado, or the Hall Mine about 5 miles (8 km) northwest of Villa Grove, Colorado). Mountain Ute, Navajo, Apache, and Comanches came in later and all variously contested access to favored hunting and camping sites (Simmons, 1999).

In addition to these older and more well-known sites, are a wealth of smaller but equally enduring features such as cairns, effigies, stone circles and walls, and rock art (Simmons, 1999; Fig. 2a). All parts of the northern San Luis Valley, where our sampling took place, have yielded Archaic-age sites (Martorano et al., 2001) but little else is known about the construction age for such sites. The

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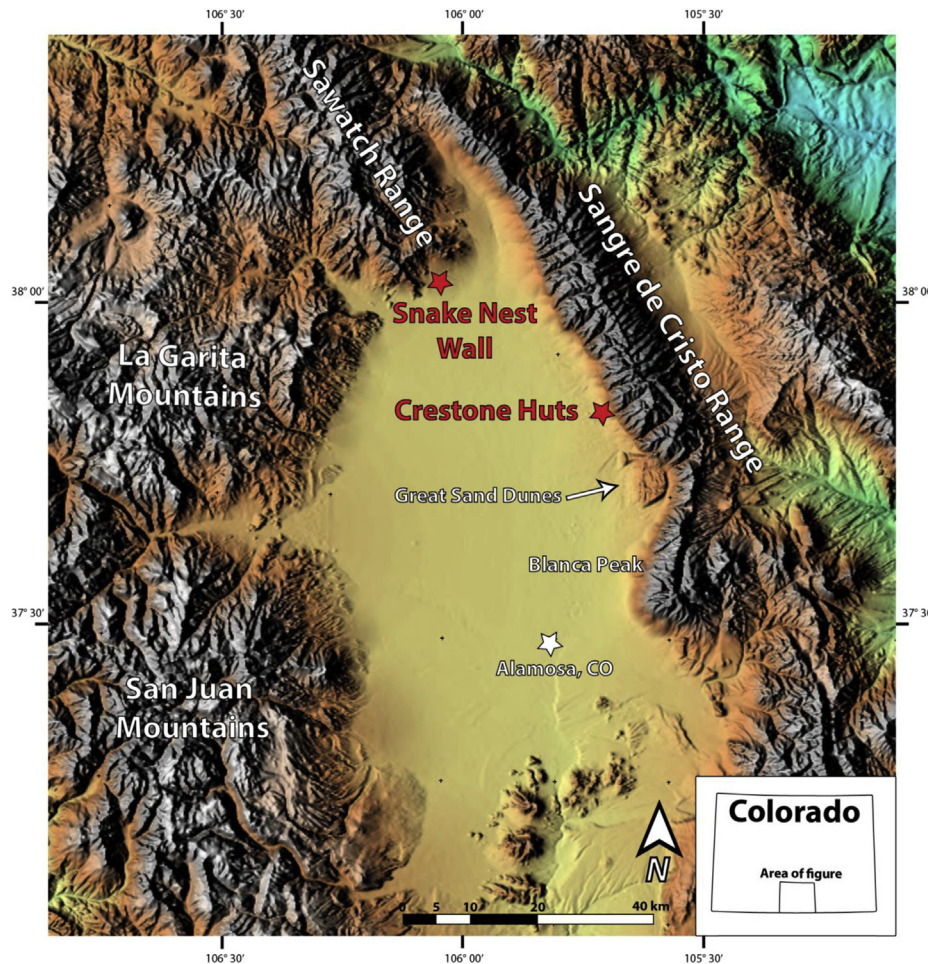


Fig. 1. Features of the San Luis Valley within Colorado. The town of Alamosa, the surrounding mountain ranges, Blanca Peak, and the Great Sand Dunes National Park are shown (figure used with permission of Tien Grauch and Cal Ruleman, USGS).

structures within these sites could have been built by peoples utilizing the San Luis Valley any time between 7000 BP and the early 20th century. This time period encompasses the entire Archaic (Early, Middle, and Late), Puebloan, Ute, and Navaho periods, as well as early European settlers including Spanish, Mexican, and Anglo (Martorano et al., 2001). Therefore, these features could have been created, modified, and maintained by a variety of people and cultures over a nearly 11,000 year period, but the lack of ages on the time of construction or reconstruction has resulted in curiosity, frustration, and puzzlement.

Although radiocarbon is usually the first geochronological technique of choice, many of the structures do not incorporate organic components or did not contain preserved organic remains and thus are better suited for dating using the OSL method. OSL dating has a prolific history of archeological use since its inception in the 1960s, particularly in Europe, Africa, and Asia and its role in dating many of humanity's oldest sites is well summarized in Duller (2008) and Liritzis et al. (2013). The physical basis of luminescence (growth of natural environmental radiation in minerals that results in trapped electron charged signals that are eliminated by exposure to light or intense heat) means OSL has also been utilized in North American archeology for rock surface dating and earthen mound building and protocols and applications can be found in Liritzis et al. (2013; their Table 4.1), mainly from the works of Jim Feathers (see Feathers, 1993, 2012; Feathers et al., 2006). One critical feature that is different in North American archeology is that often sites

that are being studied and dated with OSL are places that are still active or tightly connected with the Native American religion and culture and thus require the scientist to include the relevant tribe or guide in planning the sampling methodology.

In order to provide a case study for future OSL work in the San Luis Valley and to understand the more general parameters that might be important to know before, during, and after OSL sampling, we decided to date one well-known site of probable recent (i.e. <150 years) construction and another site of complete unknown age but suspected of greater antiquity (i.e. >1000 years and informally named for its most prominent feature, Snake Nest Wall).

The potential for heterogeneous or incomplete bleaching is of foremost concern in any optical dating study involving alluvial or fluvial processes (Rittenour, 2008) because alluvial processes dominated at the studied sites. However, if transport pathways and burial conditions can be assessed based on sedimentologic or geomorphologic parameters prior to OSL sample collection (Alexanderson et al., 2008; Simms et al., 2011; Bateman et al., 2012), then luminescence dating can provide age estimates for materials deposited in a variety of geologic settings, including those found at many of the younger archeological sites of the San Luis Valley. Moreover, if dose rates (D_R) are sufficiently high, stable luminescence signals are present in the sediments, or grains in the active soil surface cycled to the surface through bioturbation and were exposed to sunshine before stones were placed on them, then the technique can provide reliable ages from as low as 25 years ago

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