Quaternary International 461 (2017) 102–107

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Walking closer to the sky: High-altitude landscapes and the peopling of the New World

Margaret A. Jodry [a, *], Calogero M. Santoro [b]

[a] Department of Anthropology, National Museum of Natural History, MRC 112, Smithsonian Institution, 10th and Constitution Avenue NW, Washington D.C., 20560, USA

[b] Instituto de Alta Investigación, Laboratorio de Arqueología y Paleoambiente, Universidad de Tarapacá, Antofagasta 1520, Casilla 6-D, Arica, 100236, Chile

1. Introduction

Mountains occupy 24% of the earth's landscape and more than 140 million people live permanently at elevations greater than 2500 m above sea level (m asl), including an estimated 56% in Asia, 26% in Central and South America, 17% in Africa, and less than 1% in North America (e.g. Moore et al., 2000). What physical and cultural circumstances enabled highlanders to gain successful footholds in terrains characterized by less oxygen and lower temperatures? What material and intangible qualities of the high-altitude natural world were deemed important by different groups of Paleoamericans? How and why might they have tailored their movements to visit seasonally, and to reside for longer stays, above 3000 m elevation some 12,000 to 15,000 years ago? The papers in this issue collectively employ biological, genetic, archaeological, and ethnohistoric information to explore and illuminate such questions.

The 1991 discovery of the 5300-year-old naturally mummified, tattooed body of Ötzi, together with his clothing, tools, and other items of personal gear, including medicine, in a glacier in the Ötzal Alps on the border between Austria and Italy, stunned and excited the world (Kutschera et al., 2014). Detailed study of this individual and his belongings shed particular light on his movements from lower elevations into the high mountains. In North America, melting snow and ice have begun to give up their secrets as well. As glaciers and ice patches retreated in the late 20th century, archaeologists in the Northern Rockies advanced upslope to salvage perishable artifacts and fragile plant and animal remains (Dixon et al., 2005; Lee, 2012; Lee and Puseman, 2017). The results of recent ice patch surveys, in combination with earlier alpine investigations (Husted, 1965; Benedict, 1992) challenge long-held views regarding the high-altitude distribution of human foragers and prey.

Andean archaeologists started enthusiastically in the sixties, particularly in the central Peruvian highlands, with national (Cardich, 1958, 1964) and international (Kaulicke, 1980) scientific missions looking for summer camps of supposed transhumant hunter-gatherers coming from the coast (Lynch, 1971, 1981); or even more revolutionary, to demonstrate that the high Andes supported a year-round occupation of hunter-gatherers (Rick, 1980). More conservative approaches were designed to understand the Andean roots of human prehistory in Peru (Lavallée et al., 1995). Collectively, these endeavors prompted the idea of a rather late Paleoamerican presence in the Peruvian highlands above 4000 m asl (Aldenderfer, 2006; Osorio et al., 2011).

Papers in this issue of *Quaternary International* offer material perspectives, methodological approaches, and explanatory models, which contribute to a growing recognition that Terminal Pleistocene peoples may have adapted to a variety of high-altitude environments within two millennia of arriving in the New World.

This essay considers the implications of these papers for future directions in high-altitude studies. We highlight three themes: 1) preconceived ideas about the biological, social, and cultural capacities of Paleoamericans to inhabit landscapes above 3000 m asl exert a strong influence on the development of new knowledge, 2) interdisciplinary studies (among geneticists, archaeologists, ecologists, geologists and others), and collaborative research with indigenous peoples, offer vital perspectives for developing and refining interpretive models, and 3) explicit recognition of the seminal place of mountains in human ideology and spiritual practice is an idea whose time has come in Paleoamerican studies.

2. Preconceived ideas

The humorist Mark Twain wryly suggested that, “It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so.” Examples considered here include traditional views regarding human biological adaptation to altitudes above 3000 m asl and archaeological expectations regarding the presence/absence of earlier Paleoamerican sites in these settings.

Genetic research has dramatically improved in recent years. Studies conducted among Tibetan, Ethiopian, and Andean peoples show that *Homo sapiens* developed different adaptive mechanisms in high-altitude landscapes (above 3000 m asl) that involved both genetic and physiological changes. Therefore, a linear,

* Corresponding author.
E-mail addresses: jodrym@si.edu (M.A. Jodry), calogero_santoro@yahoo.com (C.M. Santoro).

https://doi.org/10.1016/j.quaint.2017.10.007
1040-6182/

developmental perspective, which suggests that several thousands of years might have been required for Early Americans to adapt biologically to high altitudes, is not a given. Rather, the process of "developmental plasticity" (Weinstein, 2017) across an individual's lifetime may have enabled people to move more quickly into high-altitude environments.

Fehren-Schmitz and colleagues (2017) concludes from preliminary data that "selection promotes beneficial alleles in Andean high-altitude people over time," that limited gene flow is evident in the Central Andes, and that all Andean populations (ancient and modern) form a distinct branch from Amazonian human groups. He further notes that the genetic structure of central Andean populations changed internally through time, and that ancient Andean people form a subgroup different from late highland Aymara and Quechua groups (see also Rothhammer, 2017; Rothhammer et al., 2003, 2017).

It is worth noting that most Andean people suffer symptoms similar to altitude sickness (hypoxia) after living several days in the lowlands, like anyone from the coast who goes for the first time to the highlands. Although the challenge of distinguishing developmental plasticity from genetic adaptations is not fully resolved (Labie and Jacques, 2012), neither is it clear that biological adaptation necessarily involves a lengthy, linear process. Preconceived ideas about the time required for Paleoamericans to adapt to high-altitude settings are reflected not only in biological studies, but in archaeological research as well.

For years, Rocky Mountain archaeologists presumed that an abundance of late Paleoindian sites (<10,000 rcybp [<11,500 cal yr BP]), relative to earlier Clovis (11,200–10,900 rcybp [13,250–12,800 cal yr BP], Waters and Stafford, 2007) and Folsom (10,700–10,270 [12,610 to 12,170 cal yr BP], Surovell et al., 2016) sites, was due to a developmental period lasting from one to two thousand years during which people adapted socially and culturally to high-altitude settings. The perceived near-absence of high-altitude Clovis and Folsom occupations was taken as evidence of absence. Thus, high-altitude finds of Clovis and Folsom projectile points were often interpreted as items transported upslope by later people (e.g. Benedict, 1992: 356), rather than as indications of Clovis and Folsom highland landscape use.

In the 1990s, Smithsonian excavation of a Folsom hunting camp at 3097 m asl in the Rio Grande headwater area in the southern Rockies (Black Mountain site, Jodry et al., 1996; Jodry, 1999) challenged this long-held perspective. Paleoenvironmental reconstruction from well dated lake sediments at 3413 m elevation (Reasoner and Jodry, 2000) showed that this camp was located near upper treeline during the Folsom occupation. This alpine-timberline ecotone was a preferred location for human occupation in the southern Rockies for more than 11,000 years. Jodry (1999) suggested that differences in site formation processes (including greater subalpine sediment accumulation, nearly 10,000 years of positional stability in alpine treeline *after* Folsom times, and longer snow-free seasons *after* Folsom times) contributes to greater archaeological visibility of later Paleoindian sites. Perhaps the meaning of larger samples of late v. early Paleoindian sites above 3000 m asl are being over-interpreted in cultural terms.

How researchers *perceive* past and present environments influences all subsequent interpretations of land use, as Bonnie Pitblado (2017) points out in her thought-provoking paper. She notes that her own preconception of northeast Siberia as stereotypically "flat, windswept tundra" led to an under-appreciation of its significant mountainous terrain. This reinforces the importance of making implicit ideas explicit and then testing them against empirical evidence. Her study (Pitblado 2017) of lithic raw materials represented in Clovis caches in the northern Rockies points out that high-quality stone materials used by Clovis peoples derive from some source areas that are themselves situated in high-altitude settings. This holds for Folsom as well. A stone source (Mosca Creek, 5HN392) used by Folsom people at the Black Mountain site is located above 3000 m asl, 50 km away across the Continental Divide, along a long-established trail and elk migration route that connects the San Juan Basin with the Rio Grande Headwaters. This material was transported to Folsom camps in the San Luis Valley (2346 m asl) some 150 km to the east.

In South America, the transport of Alca obsidian ~12,400 to 11,800 years ago, from high outcrops (4355 m asl) in the Pucuncho Basin in the southern Peruvian Andes to the Pacific coastal site of Quebrada Jaguay in southern Peru, links the world's oldest marine fishing site and the highest elevation Paleoamerican site currently known (Rademaker et al., 2014). Whether the people living at Quebrada Jaguay acquired obsidian via transhumant, direct procurement and/or through down-the-line exchange is uncertain. Either way, the movement of stone from highland to lowland settings encouraged people to cultivate ideological, social, and settlement relationships between low and highland landscapes.

To return to theme of preconceived ideas: The good news is that we are learning. The not-so-good news is that preconceptions, *if* they are wrong, and *if* they lose their explanatory potential in the face of new discoveries *and are not revised*, actually depress the learning curve and deleteriously prevent archaeological theory and understanding from moving forward.

A notable example of this was the vociferous adherence to a Clovis-First model for the Peopling of the Americas, decades *after* solid evidence verified the presence of pre-Clovis sites in both South and North America. Rather than strengthening Paleoamerican databases through careful, objective scrutiny of surprising discoveries (i.e. pre-Clovis occupations at Meadowcroft and Monte Verde), many archaeologists participated in needlessly acrimonious debates from the seventies into the 21st century. Some of the finest Paleoindian archaeologists in the Americas were vilified and forward research progress was arguably set back as time and energy were diverted to redundant rebuttals, as Pitblado rightly notes in her paper. This emphasizes the need in the future to restrain a tendency toward over-commitment to single points of view and to respectfully consider alternative hypotheses.

3. Collaboration: interdisciplinary and interethnic studies

Paleoamerican researchers have long pursued interdisciplinary studies on a site-specific basis. Cooperative undertakings among researchers in different disciplines increasingly benefit by broadening their international scope and their inclusion of indigenous experts. We experienced the former first-hand during the symposium, when South and North American colleagues, geneticists and archaeologists, assembled to share perspectives and datasets of mutual interest. This cross-fertilization process, organized by Pitblado and Rademaker, proved highly beneficial, enjoyable and inspiring.

Worldwide collaborative networks created by geneticists to deal with major research questions provide a good model. Lars Fehren-Schmitz as well as others (Bastien Llamas, Alan Cooper, and Francisco Rothhammer) are currently realizing the advantages of expanding their research programs by increasing and widening their interactions with archaeologists, bioanthropologists, linguists, and paleoecologists. As Paleoamerican researchers increasingly follow suit, it provides a counterpoint to an inclination toward rather narrow, territory-oriented, research initiatives. It is also important to include indigenous voices in the studies.

Zedeño's (2017) paper clearly demonstrates what can be accomplished when archaeologists and applied anthropologists work in mutually beneficial and respectful ways with indigenous people. No one knows the land like the people who live on it, and have lived on it for thousands of years. And nothing brings