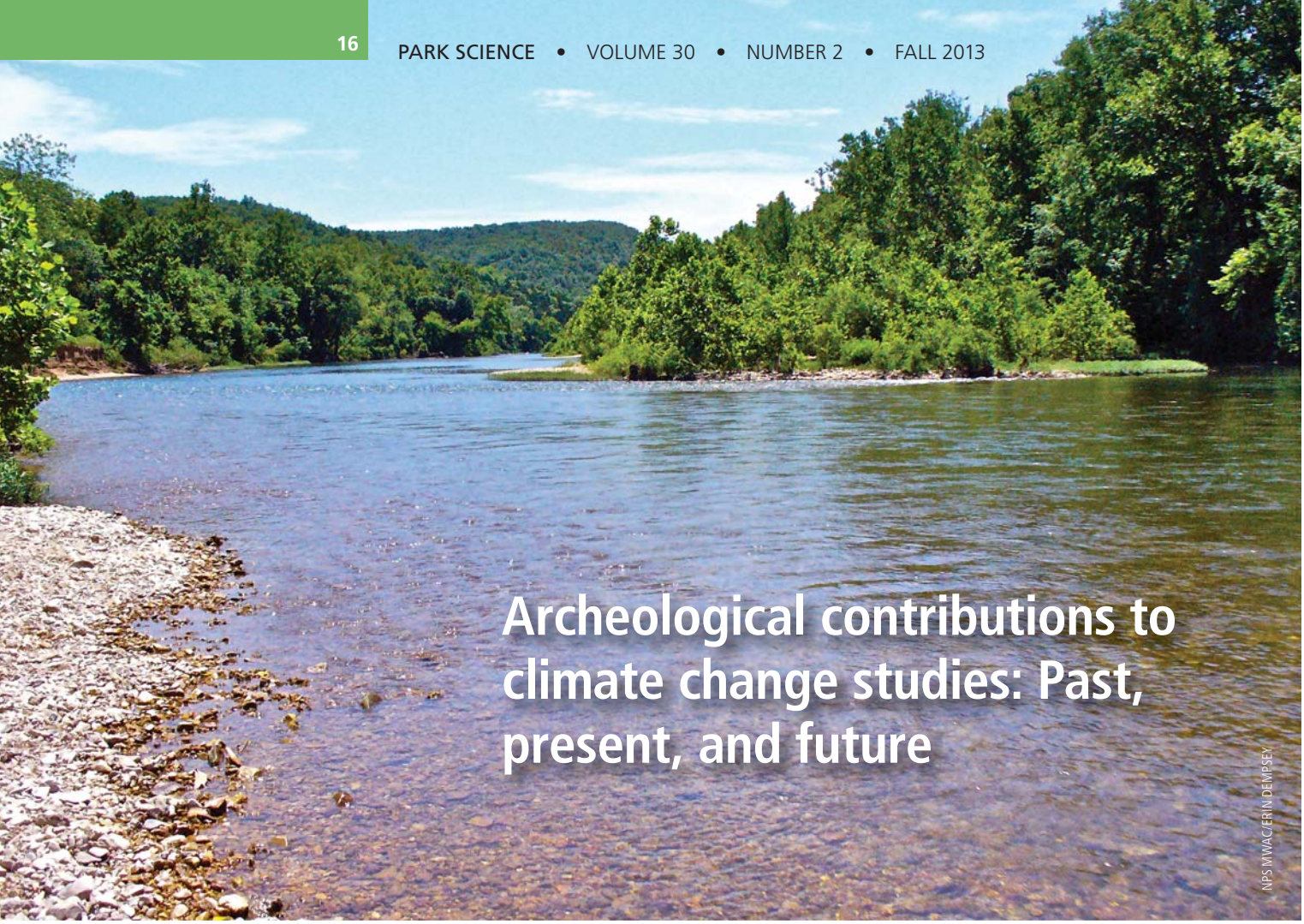

Archeological contributions to climate change studies: Past, present, and future

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The Current River valley has been home to humans for most of the last 12,000 years. Dynamic environmental change during that time period has affected the preservation of archeological sites.

By Erin C. Dempsey and Dawn Bringelson

ARCHEOLOGISTS HAVE A distinct role to play in climate change research, especially in the context of how humans respond to situations of dynamic climate. Archeology pursues information about past human activity as it is reflected in the deposits people left behind and seeks data from a longer history (or deeper past) than other cultural disciplines, such as history or sociology.

Archeologists are also interested in learning about changes in human activities through time and often posit climate change as an explanation for why these changes occurred. In order to test such explanations, archeologists rely upon (and often collect) paleoenvironmental data, which are critical to the study of human behavior within the context of a dynamic physical environment. By collecting these types of data, archeologists are well positioned to ask and answer questions concerning human-landscape interactions, particularly during periods of climate change.

Landscape change and archeology at Apostle Islands National Lakeshore

The National Park Service has sponsored archeological surveys at Apostle Islands National Lakeshore (Wisconsin) for inventory and management purposes since the mid-1970s. The cumulative data set represents only a fraction of the total land at the national lakeshore, but each new project adds to our knowledge about prehistoric human use of this archipelago at the southern shore of Lake Superior.

In general, this information indicates that people used certain settings on the islands repeatedly, likely in short-term and perhaps seasonally specific ways. Based on historical documents and oral histories, archeologists presume that people exploited nearshore resources such as fisheries, blueberries, and wild rice. Until recently, information on dates of occupation was rare at the national lakeshore, but radiocarbon, thermoluminesence, and typological dating indicate that humans occupied this area at least as early as the middle Holocene (around 5,000 years ago) and continued to do so at various points up to the recent past.

Questions now turn to how changes in the physical environment through time influenced people's use of the landscape. Combining archeological site distributions with paleoclimatic information such as lake level shifts helps us envision ways in which humans adapted to these changes. For example, several sets of archeological deposits situated at the intersection of alluvial sands and overlying eolian or wind-

Abstract

Archeological research is positioned to provide useful information on human-landscape interactions during periods of dynamic climate. Several recent investigations across the mid-continent highlight the connection between climate change and archeology, informing us about various aspects of human behavior throughout the last 12,000 years of the late Pleistocene and Holocene. Deep geomorphic testing of river terrace sediments and soils at Ozark National Scenic Riverways provides landscape evolution and paleoenvironmental data, and allows for the identification of landforms people may have occupied at various times. Archeological and environmental data at Apostle Islands National Lakeshore offer insights on changes in land uses through time and ways in which they correlate with environmental shifts. Archeology is a critical component of multidisciplinary studies that seek to understand past human responses to climate change.

Key words

alluvial geomorphology, Apostle Islands National Lakeshore, archeology, climate change, Current River, lake levels, Lake Superior, optically stimulated luminescence, Ozark National Scenic Riverways, Ozark Plateau, paleoclimate, stable carbon isotopes, thermoluminescence

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Figure 1. Staff of the Midwest Archeological Center, Apostle Islands National Lakeshore, and a Student Conservation Association intern investigate an archeological site dated using luminescence to approximately 4,500 years ago.

blown deposits have been dated to the Late Archaic period, approximately 4,500 years ago (fig. 1). Vertical and horizontal distribution of these materials suggests beach-front land use at that time of higher lake levels (also called the Nippissing transgression) and later (more rare) occupations in these locations during the last millennium.

Ongoing research questions revolve around understanding human occupation during the "quiet" time of the late-middle Holocene: are there other sites yet undiscovered on the archipelago, did people move farther inland, did they occupy areas now inundated by Lake Superior? Each new data point refines our understanding of how humans responded to environmental change over thousands of years, providing insights for modern decision makers. One other consideration brings this full circle: the sandy benches created during the Nippissing transgression, within which key sites are found, are also among those predicted to be most vulnerable to lake level fluctuation in coming years (see Pendleton et al 2007). Thus, current climate change may be the largest hindrance to understanding humans' response to such change in the past.

Geoarcheological investigations at Ozark National Scenic Riverways

Integrating archeological and paleoclimate data sets helps archeologists understand how environmental change has formed and altered the record of the human past. Site formation processes alter the preservation potential of archeological resources from various time periods. Issues such as where sediments have been deposited and removed through time, stream channel movement (Saucier 1987), and vegetation regime change (Delcourt and Delcourt 1984) are important components of finding and interpreting the archeological record. These data are also critical for natural resource specialists studying how dynamic climate changes environments.

Through time, the Ozark Plateau region has been a highly dynamic environment with deeply incised, narrow, and bedrock-lined river valleys and, in some places, karstic features (Sauer 1968). Such dynamism interferes with traditional pattern identification in the archeological record; it affects a variety of factors such as flood frequency and magnitude, terrace formation, and preservation of alluvial fills (Saucier 1987, 1996). Therefore, in addition to asking questions such as "what places did people occupy at different times?" and "what did they do there?" we can ask questions such as "how has climate change affected where these archeological sites may be preserved?" and "how did a changing environment affect human-landscape interactions?" This "ground-up" approach to understanding the archeological record and human behavior requires obtaining knowledge of late Quaternary landscape evolution.

The current study, funded by both the National Park Service and the ODYSSEY Archeological Research Fund (Kansas Geological Survey, University of Kansas), synthesized archeological, environmental, geomorphological, and chronological data to make inferences about geological preservation of archeological resources in the Current River valley at Ozark National Scenic Riverways (Missouri; see photo, facing page). Environmental data were obtained through stable carbon isotopes ($\delta^{13}C$) on soil organic matter. Optically stimulated luminescence (OSL) dating

ROLFE MANDEL, KANSAS GEOLOGICAL SURVEY

Figure 2. National Park Service staff collect a soil core from the alluvial fan at the Chubb Hollow locality using a hydraulic coring rig.

helped establish the chronology of soils and sediments. Eight localities within the park, representing a variety of alluvial landforms (first, second, and third terraces, as well as one alluvial fan) were sampled using hydraulic coring (fig. 2). Correlating the OSL ages and soil-stratigraphic data, including particle size distribution data, indicates that buried soils (formerly stable surfaces) of various ages are preserved in the alluvial fills at Ozark National Scenic Riverways. The $\delta^{13}C$ data demonstrate that the late Pleistocene and Holocene environment of the last 12,000 years was dominated by forest plant species. Plant resource availability certainly affected how and when people occupied the Ozark Plateau; perhaps as the Prairie Peninsula (a tallgrass prairie biome) spread eastward during the middle Holocene, people exploited forest resources that were continually established on the Ozark Plateau.

The geoarcheological work under way at Ozark National Scenic Riverways also provides insight into the preservation of cultural resources through time by presenting a predictive geomorphic model for cultural deposits in alluvial landforms. This work lays the foundation for more specific archeological, geological, and paleoenvironmental investigations in the future and leaves room for using these data to make predictions for the preservation of archeological resources in the face of modern climate change. Additionally, it facilitates our understanding of geomorphological processes in the Current River valley and their effects on the archeological record and lays the groundwork for helping us understand human use of dynamic environments.

Combining archeological site distributions with paleoclimatic information such as lake level shifts helps us envision ways in which humans adapted to [physical environmental] changes.

Conclusions and further study

Archeologists often collect data that contribute to climate change–driven research questions and climate databases. While these data are primarily useful for archeology, they can be made available to cultural and natural resource specialists within the National Park Service, as well as to researchers from sister agencies and cooperating research institutions. Combining archeological and environmental data is critical for fully understanding human-landscape interactions in the past, which may serve as a proxy for developing human response to modern climate change.

References

Delcourt, P. A., and H. R. Delcourt. 1984. Late Quaternary paleoclimates and biotic responses in eastern North America and the western North Atlantic Ocean. Palaeogeography, Palaeoclimatology, Palaeoecology 48:263–284.

Pendleton, E. A., E. R. Thieler, and S. J. Williams. 2007. Coastal change-potential assessment of Sleeping Bear Dunes, Indiana Dunes, and Apostle Islands National Lakeshores to lake-level changes. USGS Open-File Report 2005–1249. U.S. Department of the Interior, U.S. Geological Survey, Reston, Virginia, USA.

Saucier, R. T. 1987. Geomorphological studies. Pages 103–169 *in* J. E. Price, C. R. Price, and R. T. Saucier, editors. Archaeological investigations in the Ozark National Scenic Riverways, 1984–1986. Center for Archaeological Research Report No. 580. Southwest Missouri State University, Springfield, Missouri, USA.

———. 1996. Geomorphological context of the Gnat Alley Woods site (23CT351) (Peavine Road Project), Carter County, Missouri. Report on file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska, USA.

Sauer, C. O. 1968. The geography of the Ozark Highland of Missouri. Greenwood Press, New York, New York, USA.

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