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Boulders, outcrops, caves: Documenting cultural use of landscape features in the San Diego region of California

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ABSTRACT

Cultural features such as mortars, basins, and slicks on rock outcrops, boulders, and cave floors have been identified in many parts of the world. They clearly evidence the long history of human use of landscape features; at the same time, they are under-investigated and not well incorporated into archaeological interpretation. Indeed, even accurate documentation of such features is rare, if presented at all. Advances in digital techniques offer archaeologists new tools to address the situation. We recently piloted a new methodological protocol for the efficient and precise documentation of cultural landscape features at two sites in San Diego County, California. In this paper, we describe techniques for the creation of a high-resolution model of each site, of specific rock outcrops or boulders within each site, and of individual cultural features by using Structure from Motion photogrammetry. We present examples of various analyses that are possible once the 3D models are constructed, on intra- and inter-site levels. Our use-wear studies of 159 features and of a curated handstone collection provide new insights into past use of shallow and deep features.

1. Introduction

Cultural features such as mortars, basins, and slicks on rock outcrops, boulders, and cave floors are numerous in many parts of the world and attest to the long history of human use of the natural landscape. Although widely noted, methods for systematic investigation of such features lag behind well-developed study protocols for other archaeological material categories. Answers to questions such as how cultural landscape features were created, how they were used, and how they were incorporated into the spatial organization of sites remain speculative (Crater Gershtein et al., 2016; Hayes et al., 2016; Rosenberg and Nadel, 2016). Even accurate documentation of such features is rare; this, along with terminological issues, hinders inter-site comparison and regional synthesis.

Some recent studies in the southern Levant demonstrate increased interest among archaeologists in addressing the situation (e.g. Eitam, 2008, 2009; Rosenberg and Nadel, 2011). The advantages of using photogrammetry for 3D characterization of bedrock features have been well-demonstrated in Natufian contexts in Israel (Filin et al., 2016; Miller et al., 2014; Nadel et al., 2015; Rosenberg and Nadel, 2016). In San Diego County, California, we recently piloted a new methodological protocol for the efficient and precise documentation of cultural landscape features at two sites aimed at collecting systematic data for intra- and inter-site comparative analysis. In this paper, we describe techniques for the creation of high-resolution 3D models of each site, of specific rock outcrops or boulders within each site, and of individual cultural features by using Structure from Motion photogrammetry (SfM). We show how these models can be used to derive a variety of data and serve as the basis for characterization of specific feature types, and we provide some examples for potential future comparative analyses. We describe the intra- and inter-site analysis of cultural features by identifying types, their spatial distribution and use-wear. Finally, we describe our field observations, made

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both macroscopically and with low-power microscopy, of use-wear on features and surrounding rock surfaces. By combining these observations with feature profiles and study of a curated handstone collection, we suggest possible functional activities involving slicks, shallow basins, and deep mortars.

2. Regional setting

Bedrock 'milling' sites are abundant in San Diego County, distributed across mesa, mountain, and desert zones. Although cultural features worked into boulders and bedrock and within rockshelters can be difficult to date precisely, in the San Diego region they are generally associated with the Archaic (or "Millingstone", Erlandson, 1994) through Late Prehistoric cultural periods (ca. 7000 years ago to A.D. 1769). In some locations their use continued into the early 20th century among Kumeyaay, Luiseño, Cupeño, Cahuilla, and Juaneño tribal groups that occupied traditional territories in the region at the time of European contact. These groups moved seasonally and traded to utilize the resources in different ecological zones, including acorns and other seeds in mountain and mesa habitats, and mesquite beans and agave in desert habitats (e.g. Cline, 1979).

Two sites were selected for our project, using the following criteria: 1) known prehistoric/ethnohistoric context, and 2) variety, quantity and preservation of cultural landscape features. The sites, CA-SDI-2537 (Indian Hill Rockshelter) and CA-SDI-9538 (Ah-ha'Kwe-ah-mac') had been previously recorded, excavated, and documented by archaeologists (Wallace and Taylor, 1960; True, 1970; Wilke et al., 1986; McDonald, 1992; Bruce and Sweet, 2004) and are administered by the California Department of Parks and Recreation. Both sites are within traditional Kumeyaay territory, are underlain by Cretaceous plutonic rocks of the Peninsular Ranges batholith (Fig. 1), and have cultural features worked into granitic outcrops and boulders. However, they are situated in different ecological zones with distinct kinds of resources and climatic regimes. Indian Hill Rockshelter is located at the western margin of the Colorado Desert, in the southern part of Anza-Borrego Desert State Park, at an elevation of 660 m AMSL with average annual precipitation of 87 mm. The site has one of the deepest cultural deposits (1.5 m) in the region with occupation intermittently spanning at least 4000 years. The location was most likely visited seasonally in order to utilize locally abundant agave, ocotillo, cholla and galleta grass. In contrast, Ah-ha'Kwe-ah-mac' lies near some of the highest peaks of the Peninsular Ranges mountain system in a sheltered valley surrounded by oak-pine woodland. At the site, the elevation is 1440 m AMSL and average annual precipitation is 856 mm. It is a large village complex of the prehistoric and ethnohistoric periods (Bruce and Sweet, 2004; Hector, 2004). Over 22 ha in area, the site includes deep midden deposits and a cemetery associated with rocky outcrops around a perennial spring.

3. Material and methods

We documented cultural features at the two sites at several different scales aimed at facilitating comparative analysis. The scales include 1) site (field observations, Unmanned Aerial Vehicle (UAV) photography), 2) area/landscape feature (field observations, pole photography), and 3) individual cultural feature (field

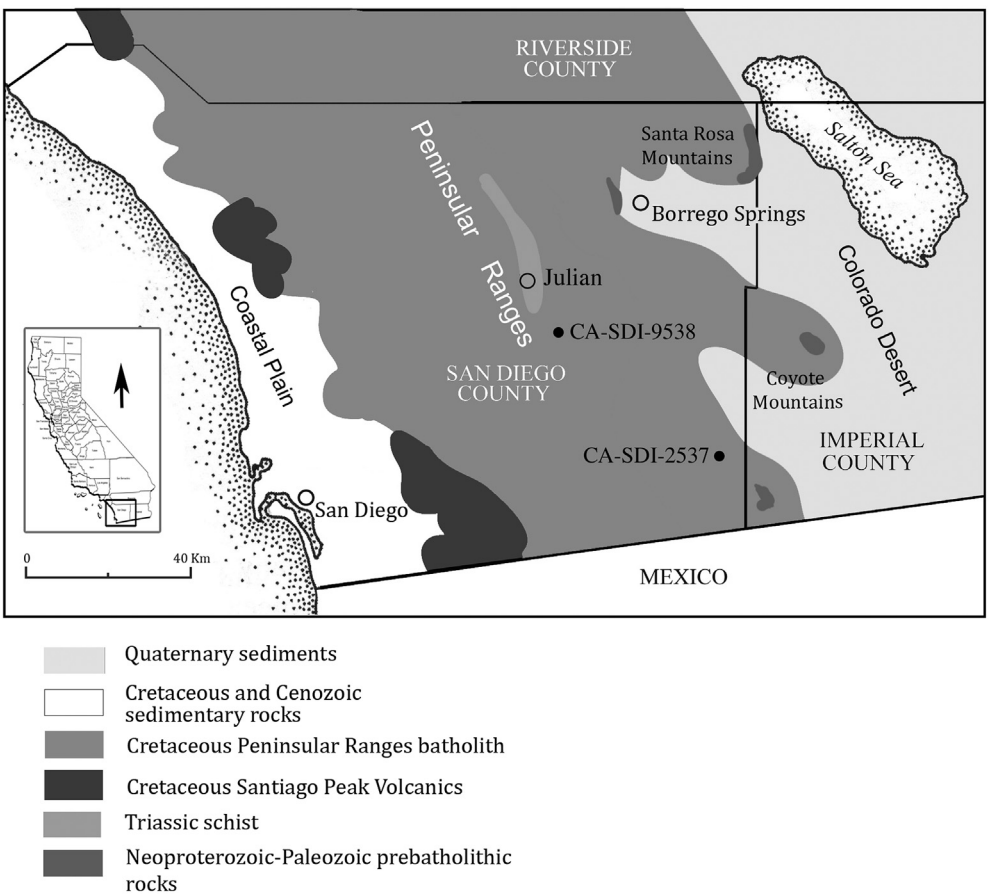

Fig. 1. Simplified geological map of San Diego county with locations of the two sites included in this project. The Peninsular Ranges batholith is comprised of intrusive (plutonic) rocks. Open circles indicate modern towns shown for reference.

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