

3D laser scanning of Parthian sculptural reliefs: The experience of the Iranian-Italian Joint Expedition in Khuzestan (Iran)

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Three-dimensional (3D) digital models obtained by laser scanning are particularly useful for monuments located in remote places and suffering from erosion such as ancient rock carvings. Here we describe research by the Iranian-Italian Joint Expedition in Khuzestan, which conducted surveys on three rock carvings dating to the Parthian period (2nd century B.C.–3rd century A.D.). The rock carvings of Hung-e Azhdar, Hung-e Yaralivand, and Hung-e Kamalvand are located near the modern city of Izeh, in the highlands of the Khuzestan province of southwestern Iran. The 3D digital models of the rock carvings provide new information on their method of manufacture and cultural significance by bringing forward previously undetected details, both technical and iconographical. The digital measurements reveal that the Hung-e Azhdar relief was re-sculpted in antiquity, and that on the upper part of the Hung-e Yaralivand relief there are clear traces of an inscription unnoticed by previous surveys. Given that these observations are the result of objective measurements verifiable by other observers using the same data, the 3D surface analysis offers promise of an advance in the study of ancient sculptural works and the models are innovative means for documenting and sharing both raw and elaborated data.

Keywords: 3D digital models, laser scanning, Parthian carvings, Elymais, Iran

Introduction

High resolution 3D survey systems have been adopted in recent years for use in cultural heritage, with the aim of creating accurate 3D models that are a valuable basis for reproduction, restoration, and conservation purposes. Different solutions have been proposed, such as laser distance measurements on controlled mechanical tables with self-controlled arms or stand-alone instruments, while different measuring principles have been successfully adopted (e.g. laser distance measurements, structured light, and laser triangulation). The flight time for large-scale objects at a distance between 2 and 150 m (buildings and monuments), or optical triangulation used for achieving high resolution acquisitions of small scale objects located at a distance of between 0.6 and 25 m, are the two different types of measurement that 3D laser scanners can take. However, all these systems pose technical problems mainly due to the stability of the acquisition reference systems during the survey or the need to have direct access to the object. Different types

of high resolution and high precision scanners have been introduced in recent decades to solve the latter problems. With a direct survey in a 3D reference system materialized on an object, these instruments—the so-called third generation scanners—allow the acquisition of complex objects and avoid the necessity of moving them from their natural location.

This can be particularly helpful for acquiring information on ancient rock carvings, which are often located in remote valleys or on mountain slopes, where they are continuously exposed to erosion. Once acquired and elaborated, the point cloud that constitutes the numerical matrix of a 3D model allows the examination and study of a carving by specialists remotely.

One of the aims of the Iranian-Italian Joint Expedition in Khuzestan was the reconnaissance of Parthian rock carvings located near Izeh (FIG. 1). The carvings belong to the group of ancient Elymais and have been surveyed by traditional methods, even in recent times, to perform stylistic and iconographic analysis. These analyses are not yet fully published.

Parthian Rock Carvings Near Izeh (Khuzestan)

The rock carvings discovered over the last two centuries on the Bakhtiari plateau, northwest of

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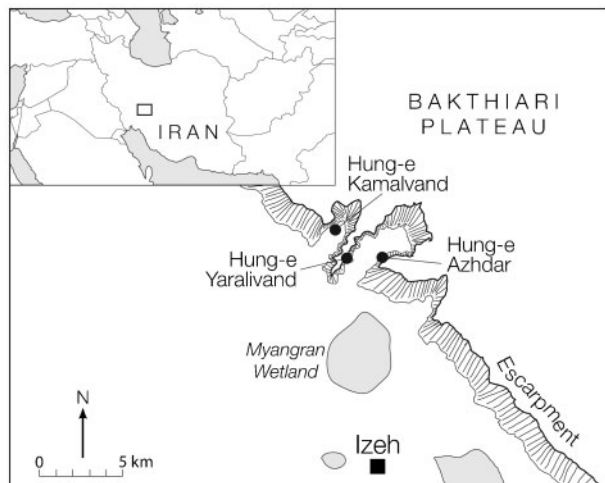


Figure 1 Map of the Area of Izeh in modern day Khuzestan (southwestern Iran).



Figure 3 Hung-e Azhdar sculpted boulder viewed facing north. The Parthian scene of homage or investiture is sculpted onto the boulder's southern side.

modern day Khuzestan (the ancient region of Elymais), were created between the Elamite (20th–7th centuries B.C.) and Parthian periods (2nd century B.C.–3rd century A.D.). Numerous studies have provided classification on the basis of the representation and style of the scenes (Vanden Berghe 1963a: 34–47, 1983: 27, 111–112; Hinz 1966: 43–47; De Waele 1972: 17–32; Amiet 1992: 81–86; Potts 1999: 253–255) and have revealed that a school of rock carving appears to have arisen and flourished in the Parthian period, based on the presence of 14 Parthian monuments that survive today (Mehr Kian 1997: 67–72, 2001: 293–298).

The Parthian carvings of Elymais are of particular importance for two reasons. First, they constitute the most outstanding group of carvings in Parthian Iran, as only four Parthian carvings are known within modern Iran (one at Sar-i Pul and three at Bisutun) outside of the Elymais group. Second, their individual characteristics set them apart from other sculptural works found in other regions of the Parthian empire. The carvings dated to the first three centuries A.D. appear quite uniform because of their composition: an absolute hieratic frontality of the figures prevails, the choice of iconographic themes (e.g., scenes celebrating the sovereign, the homage of dignitaries, or investiture

scenes), and some figurative details, such as the clothing.

However, some of the Elymaean rock carvings are not well understood because of their incoherent iconography and style, which are characterized by the influence of ancient Mesopotamian prototypes on the local tradition and their interaction with Greek art following Alexander the Great's conquests at the end of the 4th century B.C. Despite the research being carried out, some aspects regarding their iconography, style, and manufacture require clarification as available documentation strategies are limited to photographs or drawings, which do not allow for more in-depth examination. Such is the case of a relief depicting a scene of homage or investiture, sculpted into the surface of an enormous boulder at Hung-e Azhdar, a valley located near the city of Izeh (FIGS. 2, 3). There a bearded and diademed horseman, followed by a walking attendant, is shown in profile while proceeding towards four standing men in a frontal position and Iranian dress characteristic of the Parthian period (namely belted tunic and baggy trousers with curved folds) (FIG. 4). The horseman and the standing central figure are invested with royal emblems by two flying birds (possibly eagles) that fly toward them holding wreaths or rings (Vanden

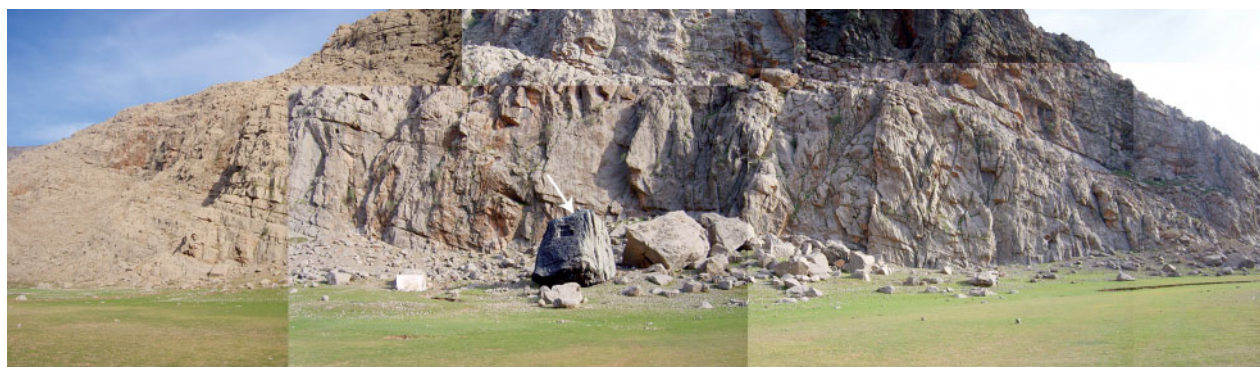


Figure 2 Valley of Hung-e Azhdar. Mosaic of the southern slope. In the foreground, the sculpted boulder viewed facing south.