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ORIGINAL ARTICLE

Falconry petroglyphs in Iran: new findings on the nexus between ancient humans and birds of prey

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Abstract

Ethnoornithology is a multidisciplinary field of study that focuses on human-bird relationships and humans' knowledge of the Earth's avifauna. Falconry (the use of trained birds of prey—usually eagles, falcons, and hawks—to hunt wild animals) is one type of human-bird relationship, with its origins obscured in poorly understood prehistoric times. We hypothesized that falconry would have been memorable enough to prehistoric peoples to be the subject of rock art, and that evidence of prehistoric falconry could be found in the petroglyphs of the Persian Plateau. To assess this hypothesis, we visited 13 major rock art sites in the Persian Plateau, and searched for petroglyphs depicting a person bearing a bird on the forearm. We found, identified, and photographed 11 petroglyphs depicting falconry. Most (n = 10) occurred in the archaeological region of Teymareh, most (n = 7) showed a falconer mounted on horseback or elephant, and many (n = 6) included an accompanying trained canid or cheetah. These tableaus suggest that falconry was but one aspect of a suite of human-animal associations developed and maintained by the prehistoric peoples of the Persian Plateau. Based on previous surveys of the petroglyphs of Teymareh, along with other evidence, we assume that most of the petroglyphs we discovered were inscribed approximately 4000 years ago, likely making them some of the oldest remaining evidence of falconry in the world. We suggest that our work indicates that future research on petroglyphs may be useful in further exploring and understanding the relationship between prehistoric mankind and wildlife.

Keywords Birds of prey · Ethnoornithology · Persian Plateau · Prehistoric rock art · Teymareh · Zoomorphic petroglyph

Introduction

Birds of prey are a species-rich group, with over 500 species widely distributed throughout all continents except Antarctica (McClure et al. 2019). Given their near ubiquitous distribution, birds of prey have a long history with hominins (Hominidae, Hominini) not limited to modern humans (*Homo sapiens*). For example, based on recent hypotheses, Neanderthals used the feathers, claws, and bones of birds of prey as ornamental items (Finlayson et al. 2012; Radovčić et al. 2015; Rodríguez-Hidalgo et al. 2019).

Modern humans admire birds of prey for their piercing looks, mastery of the sky, and ability to take prey in spectacular maneuvers, epitomizing strength, power, and wealth (Umoh 2014; Greet 2015; Gersmann and Grimm

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2018). Studies of birds of prey remains in prehistory and history appear in many contexts, including as musical instruments (Morejohn and Galloway 1983), cultural symbols, art and iconography (David 1989; Holmes 2018; Negro 2018), tools (Gala and Tagliacozzo 2014; Holmes 2018), food (Barrett 1939; Oberg 1973), adornment with feathers (Turney-High 1941; Negro 2018), talismans (Vaughan 1992; Albright 1984), and medicine (Bostock and Riley 1855; Derwent and Mander 2017). In particular, eagles of various species long symbolized heroic characteristics such as courage, leadership, great strength, and freedom for ancient Romans, Greeks, and Persians in the Eastern Hemisphere (Hayes 2014; Greet 2015), and even left their traces in Christian mythology (Collins 1913). Eagles were similarly important to Native Americans (Miller 1957; Lawrence 1993) in the Western Hemisphere, and condors as the largest birds of prey in the world have long held important cultural roles for Andean tribes (Benson 1997). The ancient Egyptians mummified eagles, falcons (Ikram 2005), and kestrels (Ikram et al. 2015) for burial with humans as status symbols and regarded falcons as a sacred deity termed *Horus* or the 'God of Sky'. Horus was often recorded in Egyptian petroglyphs, pictographs, and statues as a human form with a falcon head (Wilkinson 2003; Porter 2011).

Perhaps one of the most distinctive relationships between humans and wild animals is that of falconry, which has been called the oldest sport known to men (Forsyth 1944). Falconry, or hawking, is defined as 'the capture of animal quarry in its natural state and habitat by means of trained birds of prey' (Soma 2013; Gersmann and Grimm 2018), usually with species of the families Falconidae and Accipitridae. Falconry has recently gained much attention, owing to the recent acknowledgement of falconry as an Intangible Cultural Heritage of Humanity by UNESCO (Flynn 2018). In addition, the United Arab Emirates announced the preservation of falconry as part of their sporting and cultural heritage, a service that provides economic and social benefits to local people (Seddon and Launay 2008; Wakefield 2012; Panter et al. 2019) and is a major source of economic revenue for some. Falconry remains relevant today, not only as a link to the cultural history of many peoples, but because many of the historical methods of capturing birds of prey for use in falconry remain foundational to modern capture of birds of prey for conservation research in tracking studies (Bub 1978); moreover, falconry techniques are widely used in the rehabilitation process of birds of prey and for educational purposes (Phillott 1908; Sielicki 2016).

The precise origins of falconry are ambiguous with evidence of falconry practices scattered widely over time and space, and presumably shared across tribes and cultures (Macdonald 2006; Soma 2012; Schafer 2018). Falconry is thought to have originated in Asia either with the early advanced civilizations of Mesopotamia (parts of Syria and Iraq) (Epstein 1943), or with the peoples of the Persian Plateau (Latham 1633; IAF 2008), or with Eurasian nomads in the eastern steppes (Schafer 2018) where the horse would have been a critical component in the development of falconry (Warmbier 1959). To date, the earliest convincing evidence for falconry is from Tell Chuera, Syria, where a pottery sherd dated around 5000 BP depicts a raptor on the fist with quarry and possible jesses (Epstein 1943; Canby 2002). Jacobson-Tepfer et al. (2006) and Wallis (2014) suggest that the oldest known petroglyphs of falconry are located in the Altai region at the junction of China, Russia, Mongolia, and Kazakhstan, where they were etched around 3000 BP (Kortum 2014). The oldest evidence of falconers on horseback is dated around 1300 BP in Britain and Continental Europe (Wallis 2014). There are also two findings from the Hittite Empire (modern Turkey) which include a 3300-year-old ryton-style cup and a 2800-year-old gravestone statue, each depicting birds on the hand (Canby 2002; Soma 2012). Though interesting, neither convincingly demonstrates the practice of falconry (Gersmann and Grimm 2018).

Although the precise origin of falconry is difficult to pinpoint, its spread is well documented. For example, several Chinese artifacts dated 2100–2200 BP illustrate the use of birds of prey in hunting, presumably learned from their northern neighbors, the nomads of central Asia (Wallace 2012; Soma 2013; Schafer 2018). Falconry then spread from China to Korea and Japan (Gersmann and Grimm 2018). In southwest Asia, falconry initially traveled from Persia to neighboring Armenians, Aramaeans, and Arabs (Allsen 2006; Epstein 1943) and from there, rapidly expanded into northern Africa and western Europe (Prummel 1997), with ancient mosaics in Tunisia and Portugal depicting falconry as early as approximately 1500 BP (Gersmann and Grimm 2018).

The Persian Plateau (also known as the Iranian Plateau) is located within the proposed spreading pattern of falconry and has even been suggested as one of the likely cradles of falconry where techniques were developed and refined over generations (IAF 2008; Daryaee and Malekzadeh 2018). Due to its climate, geology, and long history of human settlement, the Persian Plateau is also a site where numerous petroglyphs have been found (e.g. Naserifard 2009; Jamali 2015; Karimi and Ujang 2015; Kolnegari et al. 2020b). We hypothesized based on the long-standing practice of falconry throughout the Persian Plateau that evidence of falconry should be prevalent in a particular class of petroglyphs, called 'zoomorphic petroglyphs'. If so, then we expected the results of a focused search for zoomorphic petroglyphs at major rock art sites of the Persian Plateau would

provide new information on the history of falconry, and on the pre-historic relationship—in last 10,000 year—between birds of prey and humankind.

Petroglyphs are prehistoric engravings in rock, found most often on the walls of caves and shelters (Bradley et al. 1994). These engravings range from simple geometric shapes to complex representations of important aspects of daily life (van der Sluijs and Peratt 2010). The study of petroglyphs can provide insight into the tools, cultures, and animal husbandry practices of the people who carved them (Kazemi et al. 2016; Kolnegari et al. 2020a, b). Zoomorphic petroglyphs include illustrations of animals hunted for food, and animals domesticated for food, work, or pets (Ira et al. 1994). For example, petroglyphs of wild goats are particularly common in the rock art of the Persian Plateau (Naserifard 2009; Moradi et al. 2013; Jamali 2015; Karimi and Ujang 2015). We suspected that falconry's combination of animal hunting and animal husbandry may have been a subject of the prehistoric rock art of local peoples, and therefore, of the petroglyphs of today (Konstantinov et al. 2016).

Methods

Numerous zoomorphic petroglyphs have been found in the mountainous regions surrounding the Persian Plateau in Iran (Kazemi et al. 2016; Kolnegari et al. 2020a, b). To identify petroglyphs with potential illustrations of falconry, we conducted field surveys across 13 major rock art sites in seven provinces of Iran covering 652,392 km^2 and by visiting approximately 42,000 petroglyphs during 2009–2019 in search of rock art depicting a person bearing a bird on the forearm. We chose a person bearing a bird on the forearm because the proximity of human and bird in the drawing would likely exclude other birds in rock art, and because we hypothesized that the memory of a person with a bird of prey perched on the forearm would be memorable enough to observers or participants to become the subject of rock art.

To document the petroglyphs, we followed protocols of preservation through digitization (Landon and Seales 2009). We measured and photographed each petroglyph, and we classified the subjects. The presence of ongoing erosion and growing rock varnish (a natural process of particulate deposition) on some of the petroglyphs we documented caused them to be difficult to distinguish from the rock upon which they were carved, so we also used Adobe Photoshop CC 2015.5 (San Jose, CA, USA) to adjust lighting and contrast to create high-quality permanent records that clearly showed the petroglyphs. In the interest of protecting culturally sensitive sites, detailed petroglyph locations and original image files are not provided here but are available upon demonstration of legitimate credentials, expertise, and intent. In interacting with local stakeholders and documenting petroglyphs, we followed guidelines developed by the Chartered Institute for Archeologists (CIfA) and recorded in the CIfA's Code of Conduct document (CIfA 2014).

Results

We discovered 11 falconry petroglyphs across three provinces in Iran (Table 1; Figs. 1 and 2). Of these, 10 petroglyphs were located in the vast archaeological region of Teymareh, which extends into portions of Isfahan, Lorestan, and Markazi provinces in central Iran. We also identified one petroglyph in South Khorasan province. The main technique applied in producing these petroglyphs was hammering (direct percussion).

Discussion

We hypothesized that evidence of prehistoric falconry could be found in the petroglyphs of the Persian Plateau, and we subsequently found evidence to support our hypothesis. Retrospective to our hypothesis, the petroglyphs we found can be assessed for age and content to provide new insights into the timing and context of prehistoric falconry. Ideally, we would have assessed our findings with sophisticated dating techniques to estimate creation dates for the petroglyphs we found. Doing so was not possible, because the technologies necessary are not available in Iran due to US sanctions.

Due to our inability to accurately date the petroglyphs we discovered, we could not infer the commencement of falconry within the Persian Plateau. In the absence of a dating approach, we can only note that most of the previously studied petroglyphs of the Teymareh were carved approximately 4000 BP (Naserifard 2009), but some are apparently as old as 40,000 BP (Samuels 2016). Taking into account the latest findings regarding the onset of horse domestication (Schiettecatte and Zouache 2017) and elephant taming (Sukumar 2011), we suggest that the petroglyphs we found depicting falconry paired with horseback riding and elephant riding were probably created later than 9000 and 4500 BP, respectively. Based on iconography of the swords depicted in Fig. 2 f and k, we suggest that the rock art described herein dates to the later prehistoric period, probably to the middle to late Bronze Age or early Iron Age (Moradi et al. 2013). Rock varnish, a term describing the natural deposition of windblown

Table 1 The characteristics of 11 zoomorphic petroglyphs depicting prehistoric falconry in the Persian Plateau. See Fig. 2 for photographs (Fig. 2a through k) of each petroglyph

No., Fig.	Depiction	Size (cm)	Locality, Province	Credit*
1, 2a	A horse-riding falconer with a bird of prey on the forearm and a ring-tailed saluki-like hound pursuing a large felid	13×51	Golpayegan, Isfahan	MJ
2, 2b	A horse-riding falconer with a bird of prey on the forearm followed by, probably, a domesticated dog	15×28	Golpayegan, Isfahan	MJ
3, 2c	A horse-riding falconer with a bird of prey on the forearm; reproduced in black and white to improve clarity	10×7	Khusf, South Khorasan	KG
4, 2d	A horse-riding falconer with a bird of prey on the forearm and, probably, a ring-tailed hound, pursuing, perhaps, a large felid	25×54	Golpayegan, Isfahan	MJ
5, 2e	A horse-riding falconer with a bird of prey on the forearm; reproduced in black and white to improve clarity	15×7	Golpayegan, Isfahan	MJ
6, 2f	A falconer bearing a bird of prey on the left forearm and the right forearm	21×11	Golpayegan, Isfahan	MJ
10, 2g	A master falconer and servant, the former bearing a bird of prey and the latter bearing (possibly) a kind of perch on the forearm	15×38	Golpayegan, Isfahan	MJ
11, 2h	Master falconer and servant, with a bird of prey and, probably, a leashed Asiatic cheetah (*Acinonyx jubatus venaticus*)	27×54	Golpayegan, Isfahan	MJ
7, 2i	A horse-riding falconer with a bird of prey on the forearm and a domesticated dog pursuing, probably, a gazelle (*Gazelle* sp.)	17×19	Khomein, Markazi	MN
8, 2j	Two falconers, one with a bird of prey on the forearm, riding an elephant and pursuing an unidentified mammal	19×22	Khomein, Markazi	MN
9, 2k	A falconer bearing a bird of prey on the forearm, and flanked by two domesticated dogs pursuing a wild goat (*Capra aegagrus*)	20×24	Khomein, Markazi	MN

* Credit for discovering, identifying, and photographing petroglyphs: MJ = Mohsen Jamali, KG = Kamal Ghous, MN = Mohammad Naserifard

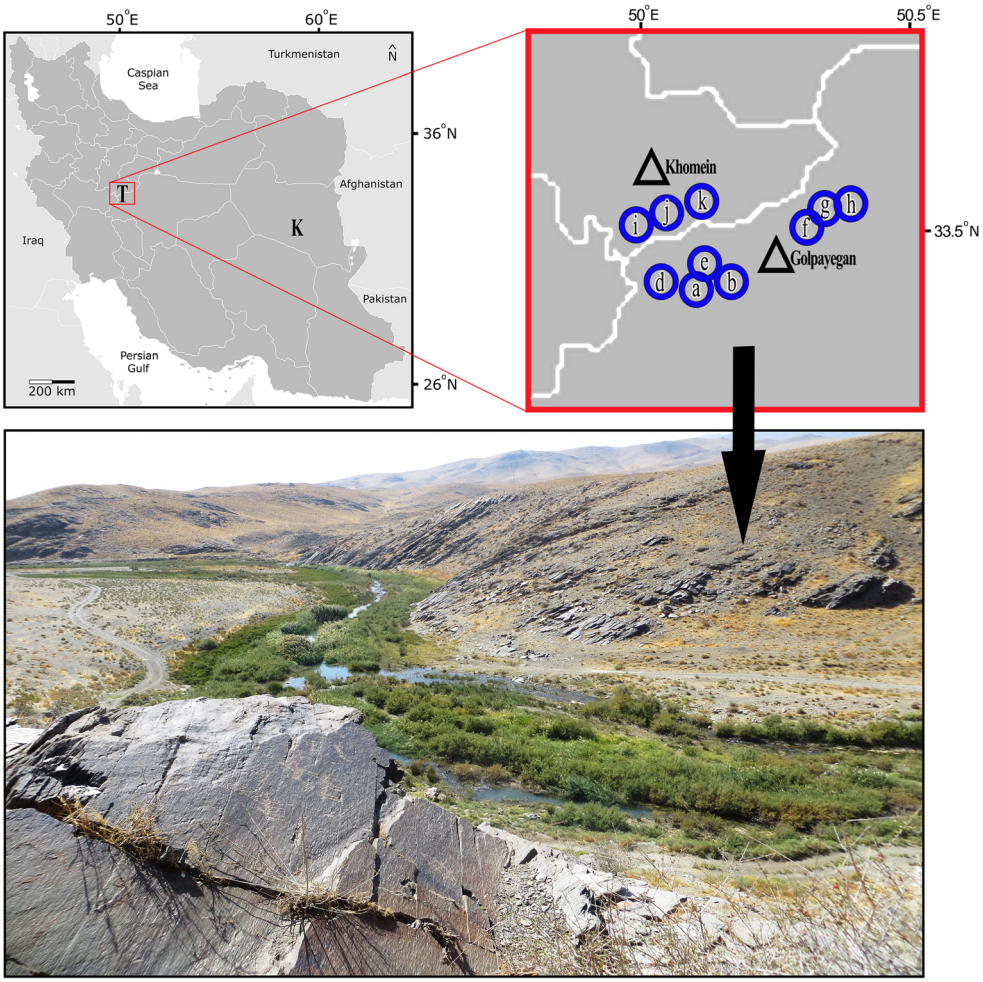

Fig. 1 Locations of the zoomorphic petroglyphs depicting prehistoric falconry in Iran. Left: map of Iran indicating the location of the Teymareh rock art sites (with ten falconry petroglyphs) labelled 'T', and the location of the Khusf petroglyph labelled 'K' (with one falconry petroglyph). Right: distribution of ten falconry petroglyphs in Teymareh rock art sites. Bottom: a view of the Teymareh region in the Persian Plateau. Note that the Khusf petroglyph labelled 'c' in Fig. 2 was found at South Khorasan outside the Teymareh rock art sites

Fig. 2 **a**–**k** Eleven zoomorphic petroglyphs depicting prehistoric falconry in the Persian Plateau. See Table 1 for detailed information (depiction, size, location, and discoverer-photographer) describing each image

particles onto stable rock not exposed to frequent precipitation, fracturing, or wind abrasion, can also be used to assess the relative age of petroglyphs (Welsh and Welsh 2000; Moradi et al. 2013). In our data, the colour of most of the petroglyphs retains an obvious dichotomy from the rock varnish, though the petroglyphs in Fig. 2 b and e show some rock varnish, and the petroglyph in Fig. 2d is almost completely covered with varnish, suggesting that Fig. 2d, which depicts falconry by a bowman (archer), is the oldest petroglyph in our data.

From the viewpoint of falconry history, the importance of the Teymareh region seems considerable, as 91% of the falconry petroglyphs in our study were documented from the Teymareh, and because falconry continues in the Teymareh today. For example, in the Mighan Wetland, the Haftad-Gholeh Protected Area, and the Mouteh Wildlife Refuge, each areas of conservation focus near the Teymareh, illicit trapping of birds of prey for use in falconry, particularly Barbary Falcons (*Falco pelegrinoides*), Saker Falcons (*Falco cherrug*), and Peregrine Falcons (*Falco peregrinus*), remains prevalent today (Kolnegari and Hazrati 2018). In these areas of high diversity at the intersection of the Zagros Mountains and the Dasht-e Kavir Desert (Tavassoli 2016), prehistoric peoples likely interacted with a considerable breadth of birds of prey, and of prey species, perhaps forming a cornerstone for the development of falconry in the Persian Plateau.

The style and theme used in Teymareh petroglyphs show similarities where multiple petroglyphs occur in close proximity to one another. Specifically, four petroglyphs (Fig. 2 a, b, d, and e) in the vicinity of Kucheri village are less than 200 m from each other, and all depict falconers on horseback, each with a distinct triangular body and each with a bird of prey on the left hand. Perhaps these four petroglyphs were created by a single artist, or created by multiple artists inspired by one

another's work. In another group in the vicinity of Gharghab village, two of three petroglyphs (Fig. 2 g and h) closely resemble each other, again suggesting the possibility of connected origins. The content of the petroglyphs also provides insight into the role and mechanics of falconry in the prehistory of the Persian Plateau. For example, eight of the 11 petroglyphs (73%) included a depiction of a horse (n = 7) or elephant (n = 1). Domestication of large herbivores for mobility and labour in agriculture overlapped with falconry practices (Werth 1954). The mobility and improved field of view provided by being on horseback or on an elephant may have improved hunting success in falconry in the short term and may have served to spread falconry across cultures in the long term (Soma 2012). Importantly, our documentation of elephant-riding associated with falconry (Fig. 2j) provides one of the few reports of this merging of two disparate human-animal associations. Six of the 11 petroglyphs (55%) included a depiction of a dog (n = 5) or, perhaps an Asiatic Cheetah (*Acinonyx jubatus venaticus*) (n = 1), and two included servants. In conjunction with the use of horses and elephants, these tableaus suggest falconry was but one aspect of a suite of human-animal associations developed and maintained by the prehistoric peoples of the Persian Plateau. Similar associations between humans and domesticated animals have been reported from archaeological excavations of pre-Islamic monuments and from early historic writings (Soma 2012; Daryaee and Malekzadeh 2018). For example, in the Persian epic poem, 'Shahnameh', written approximately 1000 BP, kings on hunting trips were often accompanied by some combination of servants, birds of prey, tamed felids, and elephants (Ferdowsi 1987).

Generally, because animal motifs in petroglyphs are highly stylized, it is not always clear which species are depicted (Prummel 1993). In our study specifically, the bird motifs lack the morphologic detail necessary to distinguish species, but we may be able to provide general identification informed by other components of the scenes. The birds of prey in the petroglyphs we discovered were frequently paired with canids, which were and are often used in falconry to find, point, and flush prey such as pheasants, partridges, grouse, and ducks (Phillott 1908; Forsyth 1944; Flynn 2018; Wolfe 2018). In most falconry traditions, the trained bird primarily hunts animals within its natural prey spectrum (Soma 2015; Oehrl 2018). If that generalization applies to the petroglyphs we discovered, then Fig. 2j may depict a Golden Eagle (*Aquila chrysaetos*), because among raptors only Golden Eagles have the size and disposition necessary to pursue large mammalian prey without the support of canids. We base this assertion on modern observations of Golden Eagle predation of large-sized herbivores such as Red Deer (*Cervus elaphus*), Siberian Ibex (*Capra sibirica*), Argali (*Ovis ammon*), and antelope (Goodwin 1977; Oehrl 2018). However, there is little other evidence for Golden Eagles having been used in falconry in Persian Plateau (Phillott 1908; Daryaee and Malekzadeh 2018) or by neighbouring Arabs (Seddon and Launay 2008).

Despite the likely presence of a Golden Eagle in one of the petroglyphs we discovered, and despite the importance of eagles in prehistoric cultures around the globe (Collins 1913; Miller 1957; Lawrence 1993; Greet 2015), we suggest that most of the petroglyphs depict raptors other than eagles, likely falcons and buteos, which are smaller, generally less aggressive, and lack the capability to capture the large mammalian prey (Phillott 1908; Soma 2015). This brings up two important questions. Did the non-eagle Falconiformes in prehistoric falconry on the Persian Plateau play an active role in hunting large mammalian prey depicted in the petroglyphs, and if so, what was that role? Based on several sources of falconry in Asia (Johnson 1822; Phillott 1908; Oehrl 2018), we suggest that birds of prey did have an active role in hunting large mammals, particularly Persian Gazelle *Gazella subgutturosa* and Arabian Gazelle *Gazella arabica*. To hunt those species, birds of prey were trained to attack the prey's head to disturb the prey or to injure the eyes, driving the prey from cover, and increasing its vulnerability to the canids in the hunting party. One of the roles of non-eagle birds of prey in prehistoric falconry in the Persian Plateau may have been to increase the vulnerability of prey in this way. A second role was likely to hunt smaller prey. Smaller prey were likely captured far more often, but because those hunting successes were less spectacular, they may not have been the subject of rock art.

We interpret two of the petroglyphs as idealized or exaggerated scenes (Fig. 2 a and d), where a canid is depicted on horseback with the falconer in pursuit of what appears to be a large felid, perhaps an Asiatic Lion (*Panthera leo persica*) or a Persian Leopard (*Panthera pardus saxicolor*). Depictions of imaginary scenes are relatively common in petroglyphs (Naserifard 2009; Jamali 2015; Kolnegari et al. 2020a), and may be related to early myths or fables, now lost (Welsh and Welsh 2000). Alternatively, it is possible that these two petroglyphs depict hoped-for situations, termed sympathetic hunting magic (Welsh and Welsh 2000). In contrast to the Altai petroglyphs, proposed as the oldest falconry petroglyphs, the petroglyphs we discovered seem more stylized, lack detail, and depict a broader range of scenes and styles of falconry (*see* Konstantinov et al. 2016).

The Persian Plateau contains several rock art sites, including the Teymareh region which includes 32 known rock art sites and more than 25,000 petroglyphs (Jamali 2015). Despite the archaeological importance of petroglyphs, and the abundance of Zoomorphic petroglyphs (Karimi and Ujang 2015; Kolnegari et al. 2020a, b) in the Teymareh in particular, studies of the petroglyphs of Iran are still in a preliminary stage (Kazemi et al. 2016) and are relatively under-represented in English-language publications (Moradi et al. 2013). We hope

that this study will lead to increased interest in, and study of, petroglyphs in Iran and in the Teymareh. Future research should continue to explore these sites to document additional depictions of falconry, and should employ chronological methods for dating the zoomorphic petroglyphs. Such research may benefit from a multidisciplinary approach, such as the approach demonstrated here, whereby archaeologists and zoologists collaborated to develop and explore a hypothesis pertaining to the origins of the zoomorphic petroglyphs we discovered.

Future research should also employ the same chronological methods for dating the Persian petroglyphs discovered in the study and as were used to date the Altai petroglyphs, because the two sets of petroglyphs could potentially provide new insight into the origins and spread of falconry in Asia. This approach may provide new support, or may refute the hypothesis that 'the art of hunting with birds' could have been invented independently in different regions (Gersmann and Grimm 2018).

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Author contribution All authors contributed to writing the manuscript. Mahmood Kolnegari, Mohsen Jamali, Mohammad Naserifard, Kamal Ghous, and Mandana Hazrati conceived of the study and acquired and interpreted data.

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Code availability N/A.

Declarations

Ethics approval In interacting with local stakeholders and documenting petroglyphs, we followed guidelines developed by the Chartered Institute for Archeologists (CIfA) and recorded in the CIfA's Code of Conduct document (CIfA 2014) available online at http://www.archaeologists.net/sites/default/files/CodesofConduct.pdf.

Consent to participate N/A.

Consent for publication N/A.

Conflict of interest The authors declare that they have no conflict of interest.

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