



تنوع زیستی جانوری طی پلیستوسن جدید و اوایل هولوسن در کوه‌های زاگرس: شواهدی از غار وزمه

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چکیده

نوشتار پیش‌رو به شرح نتایج مطالعات باستان‌جانورشناسی مجموعه بازمانده‌های استخوانی پلیستوسن جدید و هولوسن از کاوش سال ۱۳۹۸ در غار وزمه در استان کرمانشاه می‌پردازد. هدف این مطالعه، کسب آگاهی‌های بیشتر از تنوع زیستی گذشته در غرب زاگرس است. واضح است که این غار کارستی، مکان مناسبی برای جانوران به‌ویژه گوشتخواران بوده است. گونه‌های جانوری متنوعی به تعداد زیاد در مجموعه بقایای جانوری وزمه شناسایی شده‌اند. بقایای گوشتخواران شامل کفتار، خرس، گربه‌سانان بزرگ، گرگ و روباه است. بقایای علفخواران بیشتر به گوزن، گراز، اسب‌سانان، کرگدن، بز و گوسفند و گاو وحشی و اهلی تعلق دارند. طیف گسترده گونه‌های جانوری در وزمه فقط محدود به پستانداران بزرگ و میان جثه نیست؛ تعداد زیادی استخوان پستانداران کوچک نظیر خرگوش، راسو، تشی و مهره‌داران کوچک نیز در غار یافت شده‌اند. بررسی‌های مقدماتی باستان‌جانورشناسی و تافونومی (فراایندهای دگرگونی) نشان‌دهنده تعامل پیچیده بین گونه‌های جانوری با ویژگی‌های بوم‌شناختی متنوع در دوره‌های مختلف است. اهمیت باستان‌شناسی غار وزمه که قدمت نهشته‌های آن حداقل به حدود ۷۰۰۰۰ سال پیش می‌رسد، در استفاده مداوم آن است و اطلاعاتی را در مورد تنوع زیست محیطی منطقه طی پلیستوسن جدید و اوایل هولوسن و حتی پس از آن ارائه می‌دهد. تنوع و تعداد بازمانده‌های استخوانی مکشوفه از کاوش‌های غار وزمه، در فلات ایران بسیار منحصر به‌فرد است و در میان غنی‌ترین مجموعه‌های غرب آسیا قرار می‌گیرد. بررسی این مجموعه جدید، نتایج مطالعات قبلی روی بقایای جانوری غار وزمه را تکمیل می‌کند. یکی از برجسته‌ترین کشفیات قبلی، شناسایی استخوان گونه‌های مختلف انسانی شامل دندان یک کودک نئاندرتال دوره پارینه‌سنگی میانه و بقایای انسان هوشمند (دامپرووران-کشاورزان) اوایل نوسنگی است.

واژگان کلیدی: غار وزمه، زاگرس مرکزی، تنوع زیستی، باستان‌جانورشناسی، پارینه‌سنگی میانه، نوسنگی، مس‌سنگی.

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Animal Biodiversity during the Late Pleistocene and Early Holocene in the Zagros Mountains: Evidence from the Wezmeh Cave Hossein Davoudi^a, Marjan Mashkour^{a,b} and Fereidoun Biglari^c

Abstract

This study presents the faunal remains from the Late Pleistocene and Holocene periods, recovered during the 2019 excavation of Wezmeh Cave near Kermanshah. The findings contribute to a deeper understanding of past biodiversity in the Zagros Mountains. This karstic cavity appears to have served as a favorable place for various animals, particularly carnivores. The osteological remains of a wide range of taxa have been identified. Among the carnivores are hyenas, bears, large felids, wolves, and foxes, while herbivore remains include deer, wild boars, equids, rhinoceroses, as well as both wild and domestic sheep, goats, and cattle. The faunal spectrum at Wezmeh Cave is not limited to large and medium-sized mammals; numerous small mammals such as hares, weasels, and porcupines, along with various microvertebrates, are also present. These species either inhabited the cave or were brought there by natural or anthropogenic agents. Preliminary archaeozoological and taphonomic analyses indicate a complex ecological dynamic among species across different temporal phases. The archaeological significance of Wezmeh Cave is underscored by evidence of continuous or repeated occupation since at least 70,000 years ago, offering valuable insights into environmental and faunal changes from the Late Pleistocene through the Early Holocene and beyond. The diversity and richness of this fossil assemblage are unparalleled on the Iranian Plateau and rank among the most significant in Western Asia. This study also complements earlier research that identified the remains of both a Neanderthal child and an Early Neolithic herder-farmer within the cave.

Keywords: Wezmeh Cave, Central Zagros, Biodiversity, Archaeozoology, Middle Paleolithic, Neolithic, Chalcolithic.

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Introduction

Wezmeh Cave, located in the Kermanshah region in western Iran, is a significant archaeological and paleontological site that has yielded valuable insights into Late Pleistocene and Early Holocene fauna, as well as human-animal interactions in the Zagros Mountains. The discovery of numerous Late Pleistocene faunal remains, a Neanderthal premolar tooth, and Early Holocene human remains - alongside cultural materials from the Middle Paleolithic, Neolithic and Chalcolithic periods - has provided a rich dataset for understanding both human occupation and regional faunal diversity in the west-central Zagros.

The 2019 excavation uncovered a diverse assemblage of faunal remains, reflecting the complex ecological dynamics within this karstic cavity, which appears to have provided a suitable habitat for a wide range of species. These findings underscore the ecological richness and significance of the site.

This paper presents a preliminary report on the faunal remains recovered during the 2019

excavation of Wezmeh Cave. The primary objective is to contribute to the reconstruction of past biodiversity in the Zagros Mountains through the analysis of this material. More broadly, the study seeks to enhance our understanding of the ecological and archaeological importance of Wezmeh Cave, thereby enriching the narrative of human-animal coexistence in one of the most diverse faunal records of Western Asia during the Late Pleistocene and Early Holocene.

Wezmeh Cave: Geography and Features

Wezmeh Cave is located in Kermanshah Province, western Iran, approximately 46 km southwest of Kermanshah city, 10 km southeast of Islamabad-e Gharb, and 3.5 km northeast of the village of Tajar-e Akbar (coordinates: 34°03'17.04" N, 46°38'41.03" E). The cave lies at an elevation of 1,430 meters above sea level, situated 60 meters above the valley floor on the western slope (36° inclination) of Qaziwand Mountain, within the Central Zagros ranges (Fig. 1).

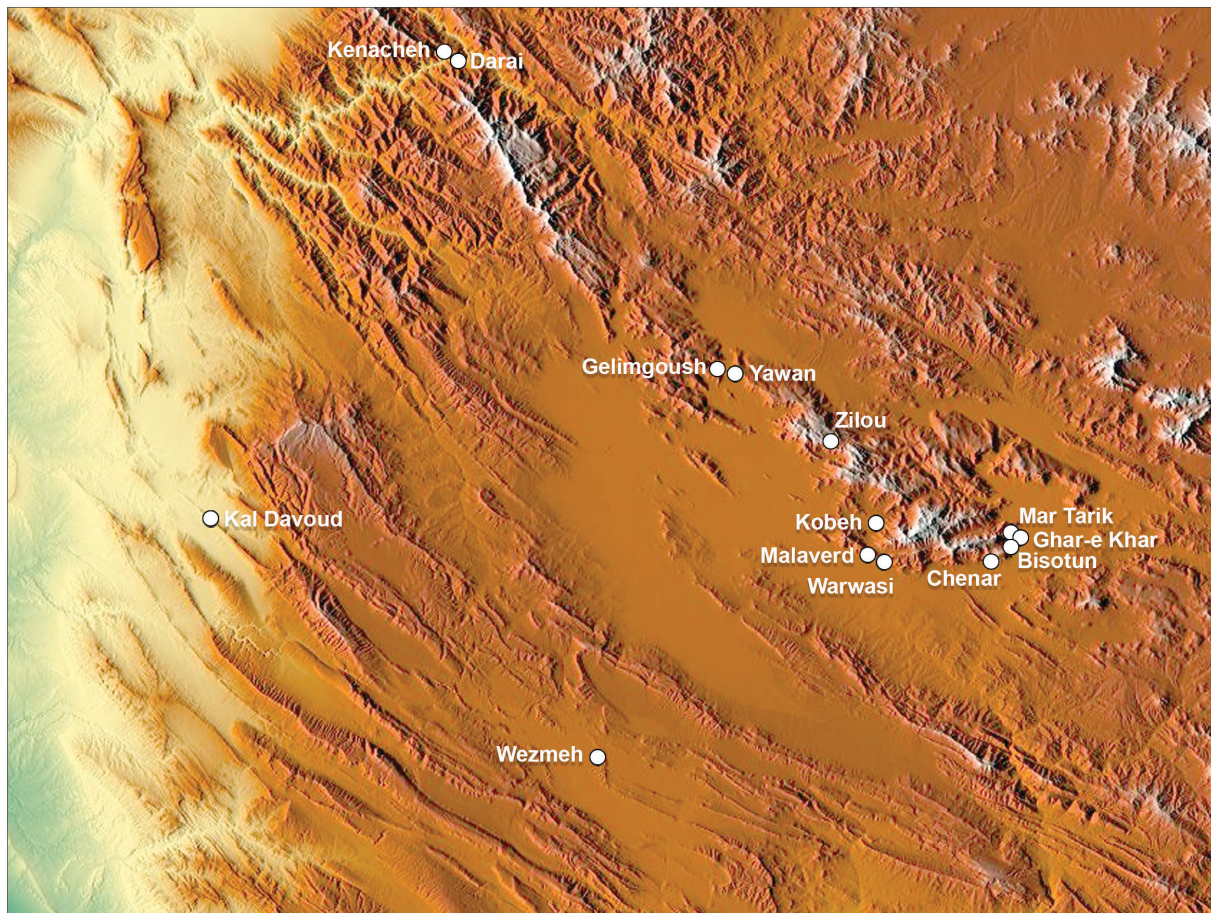


Fig. 1. Location of Wezmeh Cave and a number of excavated Paleolithic sites in Kermanshah (Biglari et al. 2021a: Fig. 1).

It is a nearly horizontal karstic cavity formed within limestone geological formations. The cave entrance, which faces north, measures approximately 2 meters in width and 1.5 meters in height (Fig. 2). The total length of the corridor of cave and rear shaft is approximately 27 meters, encompassing a floor area of roughly 160 square meters.

The main corridor follows a north–south orientation, extending about 15 meters, with widths ranging from 1.7 to 2.2 meters and a ceiling height varying between 1 and 1.2 meters. At the southern end, the corridor turns sharply westward at a 90-degree angle and, after approximately four meters, leads to a shaft. This shaft, also aligned along a north–south axis, measures 4.6 meters in length, with a maximum width of 1.3 meters and a ceiling height of approximately 7 meters. Due to the small size of the entrance, only the initial portion of the main corridor receives natural daylight; the remainder of the interior, particularly the final 15 meters, remains in complete darkness (Biglari et al. 2021a, 2021b).

Research Background

Wezmeh Cave was first discovered and registered during the second season of the Islamabad Plain Archaeological Research Project, directed by Kamyar Abdi in 1999. The initial survey resulted in the collection of a substantial number of bones and teeth from various animal species. Many of these remains were

displaced from their original context due to illicit excavations carried out in the rear shaft of the cave in 1990s. As a result, they became mixed with sediments on the slope in front of the cave entrance. In addition to faunal material, several human bone fragments and Chalcolithic potsherds were also recovered. In light of these significant findings, a formal excavation was undertaken in August 2001 under the direction of Kamyar Abdi (Abdi et al. 2002).

A test trench measuring 2.5×3 meters and approximately 70 centimeters deep was excavated at the cave entrance, revealing three distinct stratigraphic layers, possible stone structures, and a range of cultural materials, including potsherds and chipped stone artifacts. Subsequently, six smaller test trenches were excavated at intervals of approximately 2 meters along the main corridor of the cave, reaching bedrock at depths ranging from 37 to 78 centimeters. These test excavations yielded additional faunal remains and ceramic fragments primarily attributed to the Early and Middle Chalcolithic periods. Moreover, sediments from illegal excavations deposited on the slope opposite the cave entrance were sieved, resulting in the recovery of numerous animal remains, a few human bones, and further pottery fragments (Abdi et al. 2002).

Analysis of the faunal assemblage, conducted by Marjan Mashkour and colleagues, provided crucial insights into the biodiversity of the region during the Late Pleistocene. Notably, teeth from brown bears, spotted



Fig. 2. The entrance of Wezmeh Cave (Biglari et al. 2021a: Fig. 3).

hyenas, and wild boars were dated using the uranium-series method, yielding ages between approximately 70,000 and 11,000 years ago. These results suggest episodic use of the cave by large carnivores, likely as temporary shelters (Mashkour *et al.* 2009).

Additional research on hyena coprolites from the cave revealed that at least four specimens date to the Late Pleistocene. One was dated to between 19,000 and 20,000 years ago, and another to between 12,000 and 13,000 years ago. The contents of these coprolites indicate the presence of grasses and wild ancestors of wheat and barley in the region at the time. Remarkably, the discovery of tulip pollen in one of the Ice Age coprolites is of particular interest, as such pollen is rare in the ancient palynological record (Djamali *et al.* 2011).

Initially, the human remains discovered at the site were presumed to belong to the Chalcolithic period or later. However, a re-evaluation by Erik Trinkaus suggested that one tooth may date to the Late Pleistocene, based on its size and morphological characteristics (Trinkaus *et al.* 2008). This upper molar, belonging to a child aged between 6 and 10 years at death, was analyzed at the University of Poitiers using high-resolution X-ray microCT imaging. The internal structure, particularly the dentin-enamel junction, was examined, revealing features consistent with Neanderthal dental morphology. Its crown dimensions place it among the largest known dental specimens from Late Pleistocene hominins (Zanolli *et al.* 2019).

Genetic analyses of Early Neolithic human remains from Wezmeh Cave and Tepe Abdul Hosein, conducted by Farnaz Broushaki and colleagues, revealed that these populations diverged from Early Neolithic Anatolian farmers between 77,000 to 46,000 years ago. Their genetic profiles most closely resemble those of modern Iranian Zoroastrians, and they also share ancestry with present-day populations in Pakistan and Afghanistan. These findings suggest that multiple genetically distinct hunter-gatherer groups independently transitioned to farming across southwestern Asia. The study highlights the persistence of pre-Neolithic population structures during the spread of

agriculture and underscores the Zagros region as a critical area for the eastward expansion of Neolithic lifeways (Broushaki *et al.* 2016).

Excavation at Wezmeh Cave: 2019 Season

In light of the significance of previous finds - most of which originated from disturbed contexts - the site was re-excavated in 2019 under the direction of Fereidoun Biglari from the National Museum of Iran (Biglari 2019; Biglari *et al.* 2021a, 2021b, 2024). The primary objectives of this excavation season were to investigate undisturbed deposits at the rear shaft of the cave and to sieve disturbed sediments in front of the cave entrance in order to recover archaeological materials, including faunal remains, lithic artifacts, and pottery fragments.

Prior to excavation of the rear shaft, the disturbed surface deposits were systematically removed and sieved. Upon reaching in situ deposits, a test unit measuring 1.5×1 meters was opened along a north-south axis at the base of the rear shaft. To prevent collapse of the eastern wall at a depth of 80 centimeters, the unit width was reduced by 50 centimeters, resulting in a final excavation area of 1.5×0.5 meters, which was excavated to a depth of 120 centimeters (Fig. 3).

The test excavation in the rear shaft revealed a stratigraphic sequence consisting of three natural layers, all characterized by dark brown sediments. The stratified deposits primarily contained faunal remains, particularly microvertebrates, and yielded no substantial archaeological artifacts. However, sieving of the disturbed deposits from the slope in front of the cave produced a significant quantity of animal bones, potsherds, and a limited number of lithic artifacts (Biglari *et al.* 2021a, 2021b, 2024).

The lithic artifacts recovered through the sieving of disturbed deposits both inside and outside the cave can be attributed to the Middle Paleolithic and Neolithic / Chalcolithic periods. Numerous potsherds were also collected from these disturbed contexts, particularly in the rear shaft and on the slope outside the cave entrance. These pottery fragments have been assigned to the Neolithic, as well as the Early, Middle, and Late Chalcolithic periods, and in some cases to the Historic and Islamic periods (Fig. 4). The



Fig. 3. Test excavation at the rear shaft of the Wezmeh Cave (Biglari et al. 2021a: Fig. 4, 2021b: Fig. 3).

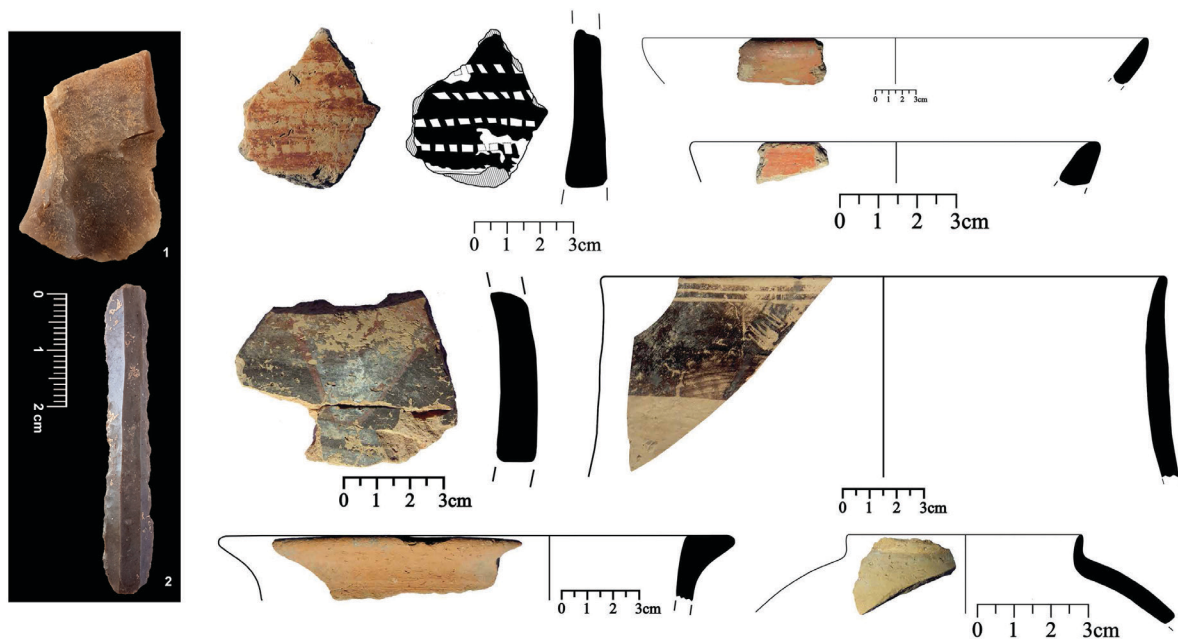


Fig. 4. Left: lithic artifacts of probably Middle Paleolithic (No. 1) and Neolithic (No. 2) periods; Right: potsherds of Chalcolithic period (Biglari et al. 2021a: Figs. 6 and 7).

new findings suggest that, in addition to its use during the Chalcolithic period, Wezmeh Cave was intermittently occupied by Middle Paleolithic hunter-gatherers and Neolithic pastoral communities (Biglari et al. 2021a, 2021b, 2024).

Previous Archaeozoological Research at Wezmeh

Information on the diversity of animal species during the Pleistocene in the Zagros region has traditionally been derived from a limited number of Middle and Late Palaeolithic sites, such

as Warwasi (Turnbull 1975; Bakken 2000), Kobeh (Marean and Kim 1998), Bisotun (Coon 1951), Kunji (Hole and Flannery 1967), among others. These faunal assemblages are predominantly composed of herbivores and rodents, with carnivore remains being notably scarce.

The faunal assemblage from Wezmeh Cave, first identified in 1999, deviates significantly from this pattern. One of its most striking features is its high taxonomic diversity and the unusually high proportion of carnivores. Among these, the red fox is the most frequently identified species, followed by the spotted hyena, brown bear, wolf, and various felids (lion, leopard, lynx / caracal, and wildcat). Additional carnivore taxa include mustelids (badger, weasel, and marten) and viverrids (mongoose). Herbivore taxa are also present and include artiodactyls (bovids, cervids, suids), equids, and rhinoceroses. The assemblage further contains a wide array of small animals, such as hare, porcupine, tortoise, snake, and various bird species (Mashkour *et al.* 2009; Monchot 2008; Monchot *et al.* 2019).

U-series dating suggests that Wezmeh Cave was intermittently occupied by carnivores from approximately 70,000 years ago through to more recent periods (Trinkaus *et al.* 2008; Mashkour *et al.* 2009).

Wezmeh 2019 Faunal Assemblage

In 2019, a substantial assemblage of animal bones was recovered from both the interior and the slope in front of Wezmeh Cave, comprising 11,431 specimens with a total weight of approximately 30.5 kg (Table 1). This overview does not present a detailed taphonomic analysis, which is currently underway, but instead provides a general descriptive summary for the

reader. The bones are generally well-preserved, exhibiting minimal alteration from post-depositional processes. While some specimens show evidence of fracturing and weathering cracks, the overall integrity of the assemblage remains high. Concretions are limited and do not obscure the bone surfaces, allowing for clear observation of anatomical and surface features (Fig. 5). Some herbivore bones display black, brown, and white discoloration on their surfaces, resulting from burning and heating caused by human activities (Fig. 6).

Taxonomic Composition

The faunal assemblage has been analyzed at the Osteology Department of the National Museum of Iran and the Bioarchaeology Laboratory of Central Laboratory of the University of Tehran, using comparative osteological collections and specialized reference atlases (e.g., Pales and Lambert 1971; Pales and Garcia 1981; Schmid 1972; Hillson 1986, 1992; Barone 1999).

The majority of identified remains belong to the class Mammalia, with carnivores representing 34% of the Number of Identified Specimens (NISP), and herbivores accounting for 16.1%. Although carnivores are more numerous in terms of NISP, the overall weight of carnivore and herbivore remains is relatively equivalent. The carnivore assemblage includes a wide taxonomic range across several families - Hyaenidae, Ursidae, Canidae, Felidae, and Mustelidae - encompassing large, medium, and small-sized species. Taxonomic identification is ongoing for several specimens within these groups.

The herbivore remains include representatives of the families Bovidae, Cervidae,

Table 1. The frequency of animal bone remains in the 2019 assemblage of the Wezmeh Cave.

Location	Number of remain	Weight of remain (G.)
Sieving illegal excavation deposits in the slope front of the cave	9356	27177.7
Sieving of illegal excavation deposits in main corridor and pit inside the cave	1709	931.9
Rear shaft excavation	366	2260.4
Grand Total	11431	30370



Fig. 5. An overview of a selection of tooth and cranial remains of the 2019 assemblage of Wezmeh and its state of preservation.

Equidae, Suidae, and Rhinocerotidae, as well as both wild and domestic Caprinae. Lagomorphs are represented by identifiable *Lepus* remains, comprising approximately 1% of the NISP.

The microvertebrate assemblage is primarily composed of rodents (18.7% of NISP and 1.1% of WISP), along with birds (3.2% of NISP), reptiles (2.8% of NISP), and fish. In addition, remains of crabs and gastropods were recovered. These resources represent a minor component, accounting for 0.2% of the total number of remains.

A total of 2,743 bone fragments (approximately 24% of the assemblage) consist of undiagnostic skeletal elements that have been provisionally classified as “Varia.” These largely belong to medium- and large-sized mammals, predominantly herbivores. Further analysis of the “Varia” category is currently underway (Fig. 7; Table 2).

Of particular note, several herbivore remains from the Holocene layers have been

identified as belonging to domesticated species associated with Neolithic and Chalcolithic occupations at Wezmeh Cave, as previously reported (Abdi et al. 2002).

Carnivora

The majority of the 2019 faunal assemblage from Wezmeh Cave, comprising 3,910 cranial and postcranial elements, belongs to the order Carnivora (Table 2). All carnivore families previously documented at the site are represented in this collection, including Hyaenidae (likely *Crocota crocuta*, the spotted hyena) (Figs. 8 and 9), Ursidae (*Ursus arctos*, the brown bear) (Figs. 10 and 11), Felidae (*Panthera leo*, *Panthera pardus*, *Caracal caracal*, *Lynx lynx*, and *Felis silvestris*) (Fig. 12), Canidae (*Canis lupus* and *Vulpes vulpes*), and Mustelidae (*Meles meles*, *Martes foina*, and *Mustela nivalis*).

The most numerous specimens, totaling 588 bones, are attributed to the Hyaenidae. Morphological analysis has confirmed the presence of the spotted hyena (*Crocota crocuta*),



Fig. 6. Selected burnt herbivore long bones

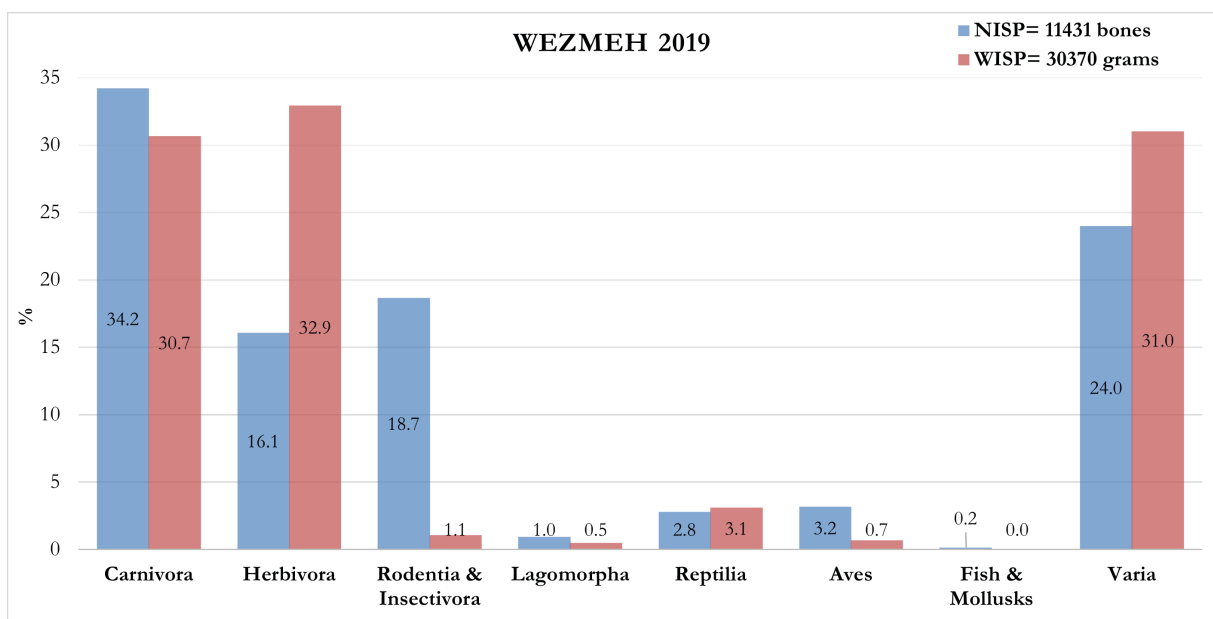


Fig. 7. The frequency of faunal remains by means of number (NISP) and weight (WISP) of identified specimens.

Table 2. Relative proportion of taxa based on number (NISP) and weight (WISP) of identified specimens.

Wezmeh 2019 - Taxonomic identification		Name	NISP	WISP (G.)
Carnivora	Hyenidae	Hyena	588	3758
	Ursidae	Bear	70	952.4
	<i>Panthera leo</i> / <i>Panthera pardus</i>	Lion / leopard	9	101.6
	Felidae (large and medium-sized)	Lion / leopard / caracal / lynx / wildcat	14	83.2
	<i>Canis lupus</i>	Wolf	3	1.9
	<i>Vulpes vulpes</i>	Red fox	41	32.7
	<i>Mustela</i> sp.	Weasel	8	39.4
	Carnivorae (large-sized)	Hyena / bear / lion / leopard / wolf	42	620.6
	Carnivorae (medium and small-sized)	Jackal / fox / wild cat/ badger / stone marten / weasel	2645	3047.2
	Carnivorae (large to small-sized)	Hyenidae / Ursidae / Canidae / Felidae / Mustelidae	490	674.5
<i>Total</i>			<i>3910</i>	<i>9311.5</i>
Artiodactyla	<i>Bos primigenius</i> / <i>Bos taurus</i>	Aurochs / cattle	57	989.4
	<i>Cervus elaphus</i>	Red deer	161	1437.1
	<i>Sus scrofa</i>	Boar	173	901.6
	<i>Gazella</i> sp.	Gazelle	43	139.1
	<i>Ovis orientalis</i>	Wild sheep	2	25.5
	<i>Capra aegagrus</i>	Wild goat	3	53.7
	<i>Capra</i> cf. <i>hircus</i>	Domestic goat	239	870.8
	<i>Capra</i> sp.	Wild or domestic goat	12	151.2
	<i>Ovis</i> cf. <i>aries</i>	Domestic sheep	57	288.5
	<i>Ovis</i> sp.	Wild or domestic sheep	45	126.6
	Caprinae (wild / domestic)	Sheep / goat	943	3804.8
	Small ruminants	Sheep / goat / gazelle	63	143
<i>Total</i>			<i>1798</i>	<i>8931.3</i>
Perissodactyla	<i>Stephanorhinus</i> sp.	Rhinoceros	1	157
	<i>Equus</i> cf. <i>caballus</i>	Horse	1	42
	<i>Equus hemionus</i>	Hemione (Persian onager)	7	178.7
	Equidae	Horse / Donkey / Onager	30	696.5
<i>Total</i>			<i>39</i>	<i>1074.2</i>
Lagomorpha	<i>Lepus europaeus</i>	Hare	109	150.9
	<i>Total</i>			<i>109</i>
Rodentia & Insectivora	Muridae	Mice / rat / gerbil	203	77.5
	Rodents	Muridae / Indian porcupine / hedgehog	1930	246.9
	<i>Total</i>			<i>2133</i>
Reptilia	<i>Testudo</i> cf. <i>graeca</i>	Spur-thighed tortoise	306	942
	<i>Varanus</i> sp.	Monitor lizard	12	2.8
<i>Total</i>			<i>318</i>	<i>944.8</i>
Aves	Aves	Birds	363	209.7
	<i>Total</i>			<i>363</i>
Fish & Mollusks	Pisces	Fish	13	1
	<i>Potamon</i> sp.	Crab	3	1.2
	Helicidae	Snail	2	0.4
<i>Total</i>			<i>18</i>	<i>2.6</i>
Varia	Large and medium-sized mammals	Herbivores / Carnivores	2743	9420.6
	<i>Total</i>			<i>2743</i>
Grand Total			11431	30370

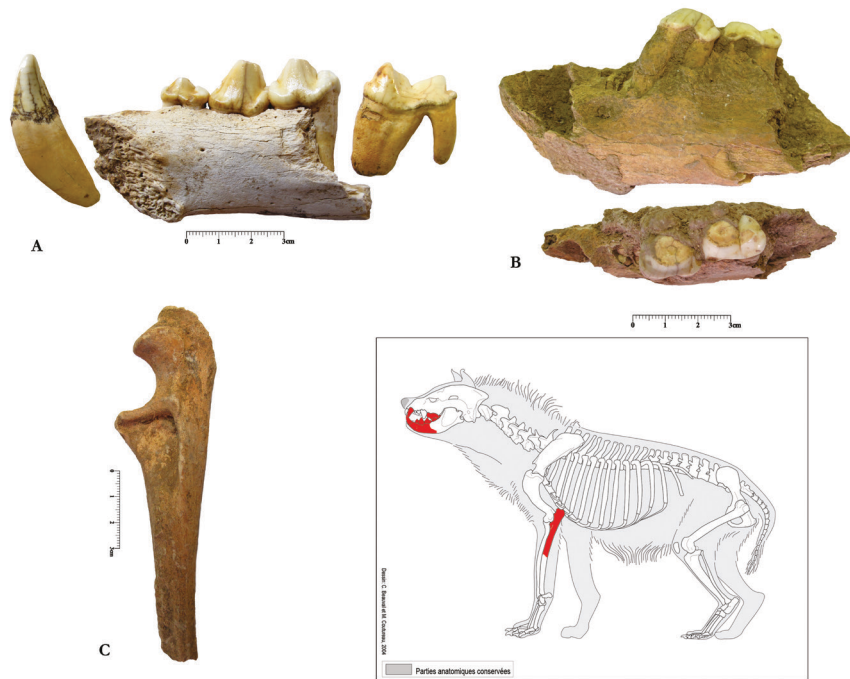


Fig. 8. Hyaenidae, cf. spotted hyena (cf. *Crocota crocuta*), A and B: mandible; C: ulna.

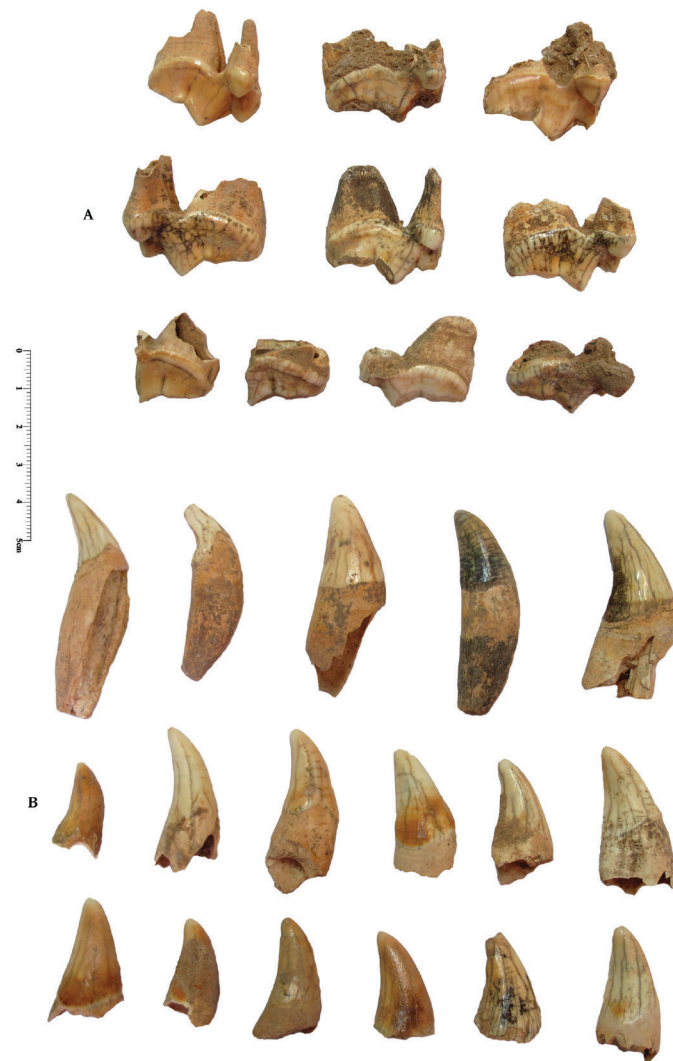


Fig. 9. Hyaenidae, A: upper fourth premolar; B: canine.

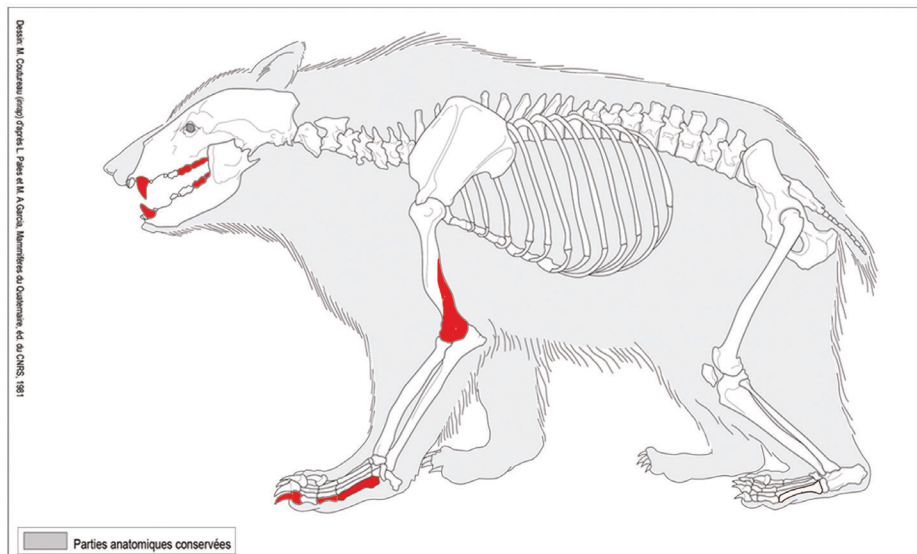
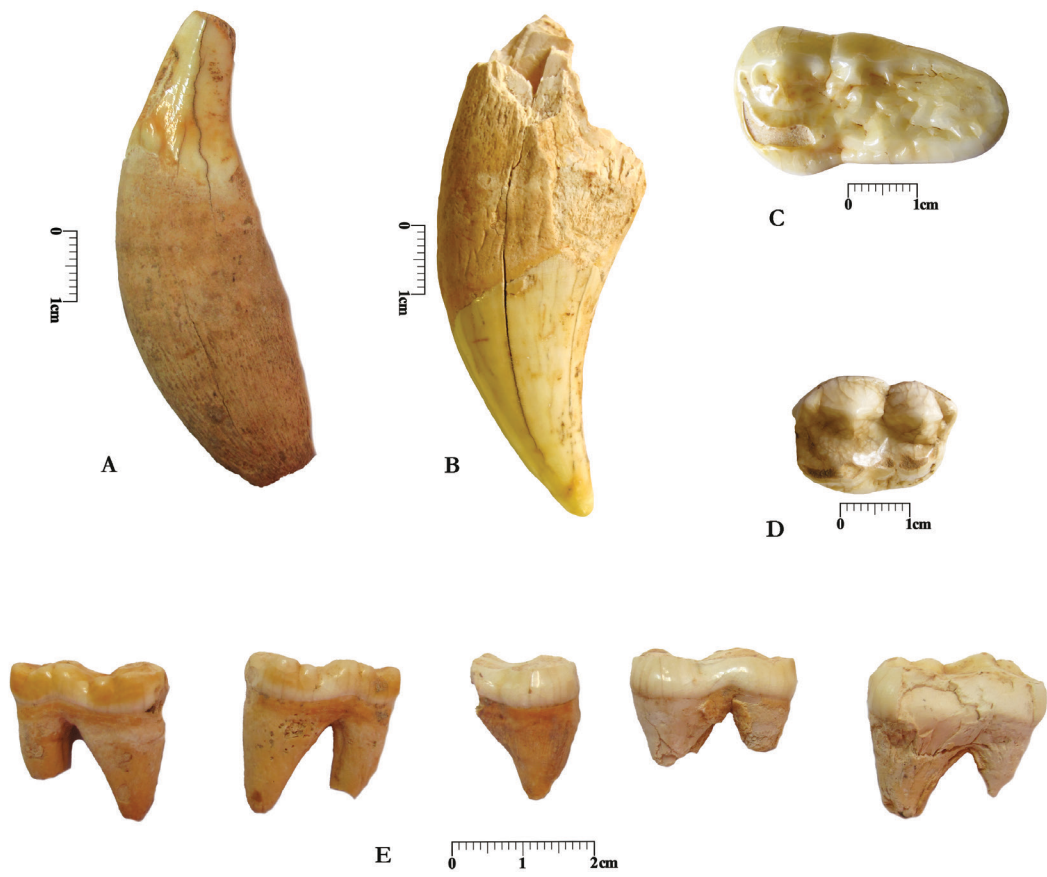


Fig. 10. Brown bear (*Ursus cf. arctos*), A: lower canine; B: upper canine; C: first upper molar; D: second upper molar; E: cheek teeth.

consistent with prior studies (Monchot 2008; Mashkour et al. 2009). Earlier research also identified brown bear remains (*Ursus arctos*), as well as lion (*Panthera leo*), leopard (*Panthera pardus*), and smaller felids (Mashkour et al. 2009; Monchot et al. 2019).

Among the Canidae, the red fox (*Vulpes vulpes*) and wolf (*Canis lupus*) are particularly well represented in both the earlier and 2019 collections. Of special interest is the discovery of eight weasel skulls (*Mustela nivalis*), a rare find in regional Paleolithic assemblages (Fig. 13). Of



Fig. 11. Bear, (*Ursus* sp.), A: distal end of humerus; B: metapodial; C: first phalanx; D: third phalanx.

the 3,177 bones broadly classified as belonging to carnivores, a significant portion (2,645 fragments) can be associated with medium- and small-sized carnivores such as jackals, foxes, wild cats, badgers, martens, and weasels; further taxonomic refinement is currently in progress.

Taphonomic analysis - including assessments of coloration and degree of fossilization - com-

bined with absolute dating (U-Th Alpha and Gamma spectrometry) and biochronology of previously recovered faunal material in 1999, suggests that most of the carnivore remains originate from the Late Pleistocene (Mashkour et al. 2009).

Herbivora

The collection comprises 1,837 cranial and postcranial fragments of herbivorous species,

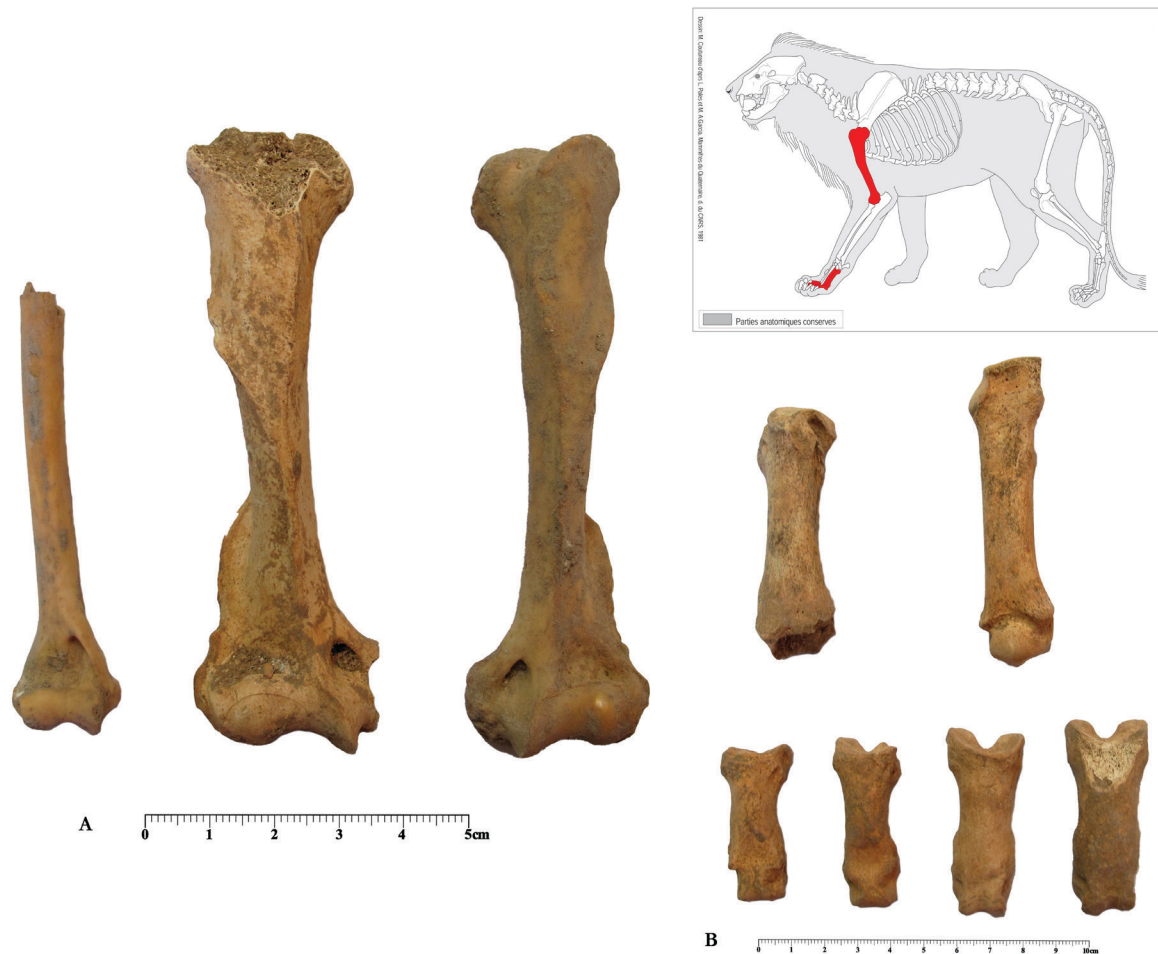


Fig. 12. A: medium and large-sized felids, humerus; B: large felids (*Panthera* sp.), metapodial and first phalanges.

predominantly from the Caprinae subfamily (including both wild and domestic sheep and goats). Additional taxa represented in the assemblage include wild boar (*Sus scrofa*), red deer (*Cervus elaphus*), aurochs (*Bos primigenius*), and gazelle (*Gazella* cf. *subgutturosa*) (Fig. 14). Equids are also present, notably the Persian onager (*Equus hemionus*), horse (*Equus caballus*), and probably donkey (*Equus asinus*) (Fig. 15). Notably, a talus bone identified as belonging to a rhinoceros (*Stephanorhinus* sp.) is also present (Fig. 16).

The majority of the herbivore remains belong to sheep and goats. Among these, 57 elements have been specifically identified as domestic sheep (*Ovis aries*), and 239 as domestic goats (*Capra hircus*). These domesticates likely date to the Holocene and were probably exploited by Neolithic and Chalcolithic pastoral communities. Additionally, there appears to be some remains of domestic cattle (*Bos taurus*) in the collection (Fig. 17; Table 2).

Beyond domesticated animals, similar herbivorous species have been documented in previous studies (Mashkour et al. 2009). The presence of red deer, wild boar, rhinoceros, aurochs, and equids suggests the coexistence of substantial nearby woodland and grassland environments.

The assemblage includes burnt bones, primarily from domestic herbivores of Holocene age, suggesting anthropogenic activity in the formation of at least part of the deposit (Fig. 6). It seems that small to medium sized carnivores (e.g. foxes and hyenas and some felids) and humans may be responsible for the accumulation of many remains as revealed by the presence of various traces on the bones. Nonetheless, most bone surfaces lack such marks, indicating that natural processes likely played a significant role in their deposition. This interpretation is particularly plausible for wild ovi-caprines, supported by eco-ethological data suggesting that some individuals may have died

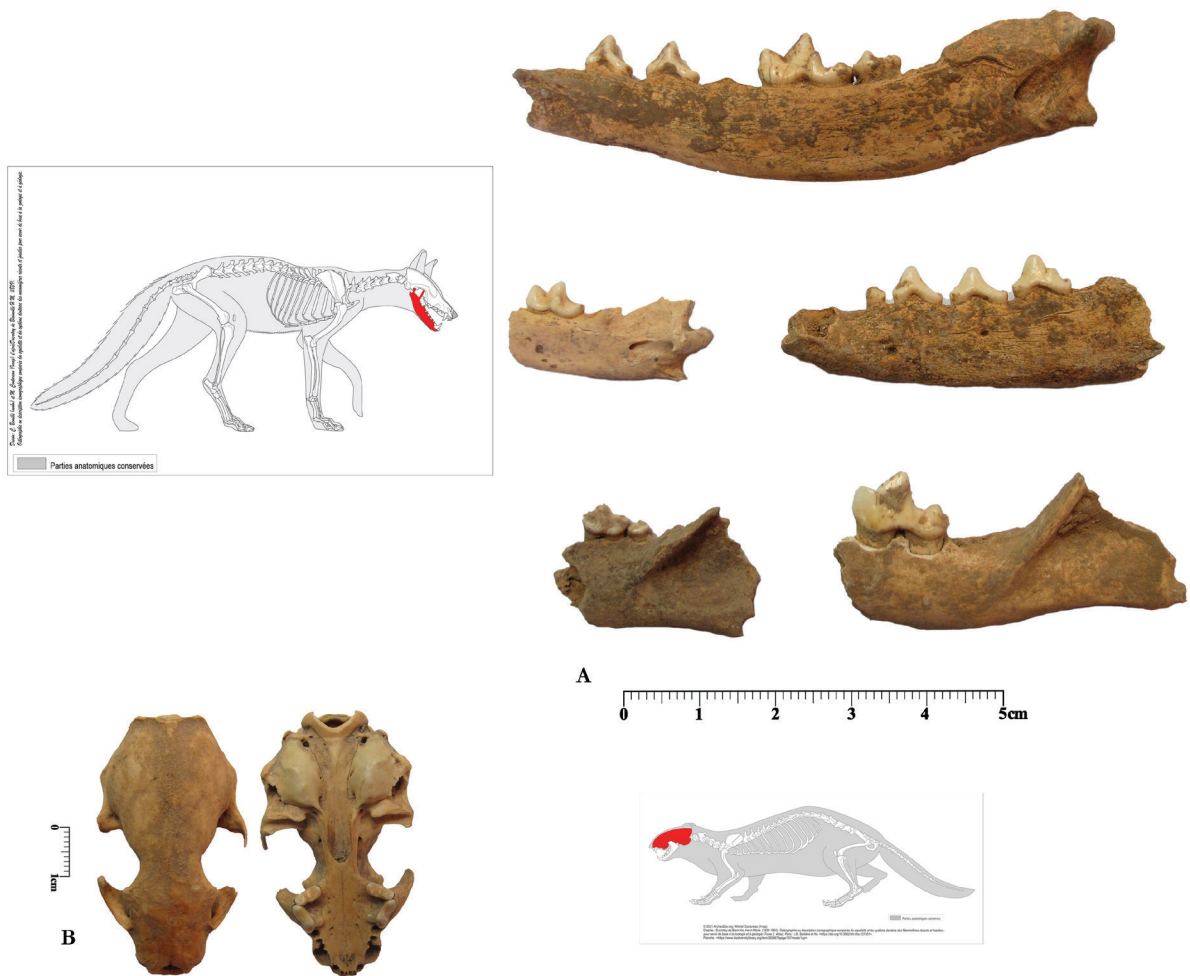


Fig. 13. A: small carnivores (canids and mustelids), mandibles; B: weasel (*Mustela* sp.), skull.

in situ and that the cave functioned as a den mainly for carnivores (Mashkour *et al.* 2009). The rear shaft may have functioned as a natural trap, ensnaring smaller carnivores and herbivores that could access the deeper sections of the cave.

Small Species

Rodents and insectivores represent the most abundant orders among the small vertebrates, comprising a total of 2,133 bone fragments. Of these, 203 remains have been attributed to the Muridae family, which includes mice, rats, and gerbils. Additional specimens are identified as belonging to the Indian porcupine (*Hystrix indica*) and hedgehog (*Erinaceus* sp.).

The hare (*Lepus europaeus*), represented by 109 elements, appears to have been a primary prey species for small to medium-sized carnivores. Among reptiles, tortoises (*Testudo* cf.

graeca) are particularly well represented, with 306 skeletal and shell fragments, followed by specimens of monitor lizards (*Varanus* sp.). These taxa were also documented in earlier studies (Mashkour *et al.* 2009).

The 2019 field season yielded 363 cranial and postcranial elements of birds, which are currently the focus of ongoing specialized analyses. Aquatic resources are minimally represented, comprising 16 bones in total and including fish and freshwater crabs (*Potamon* sp.). Two terrestrial snails (family Helicidae) also identified.

Lastly, the assemblage includes 2,743 bone fragments classified as “varia,” for which detailed taxonomic identification is currently in progress and will be the subject of future publication (Table 2).

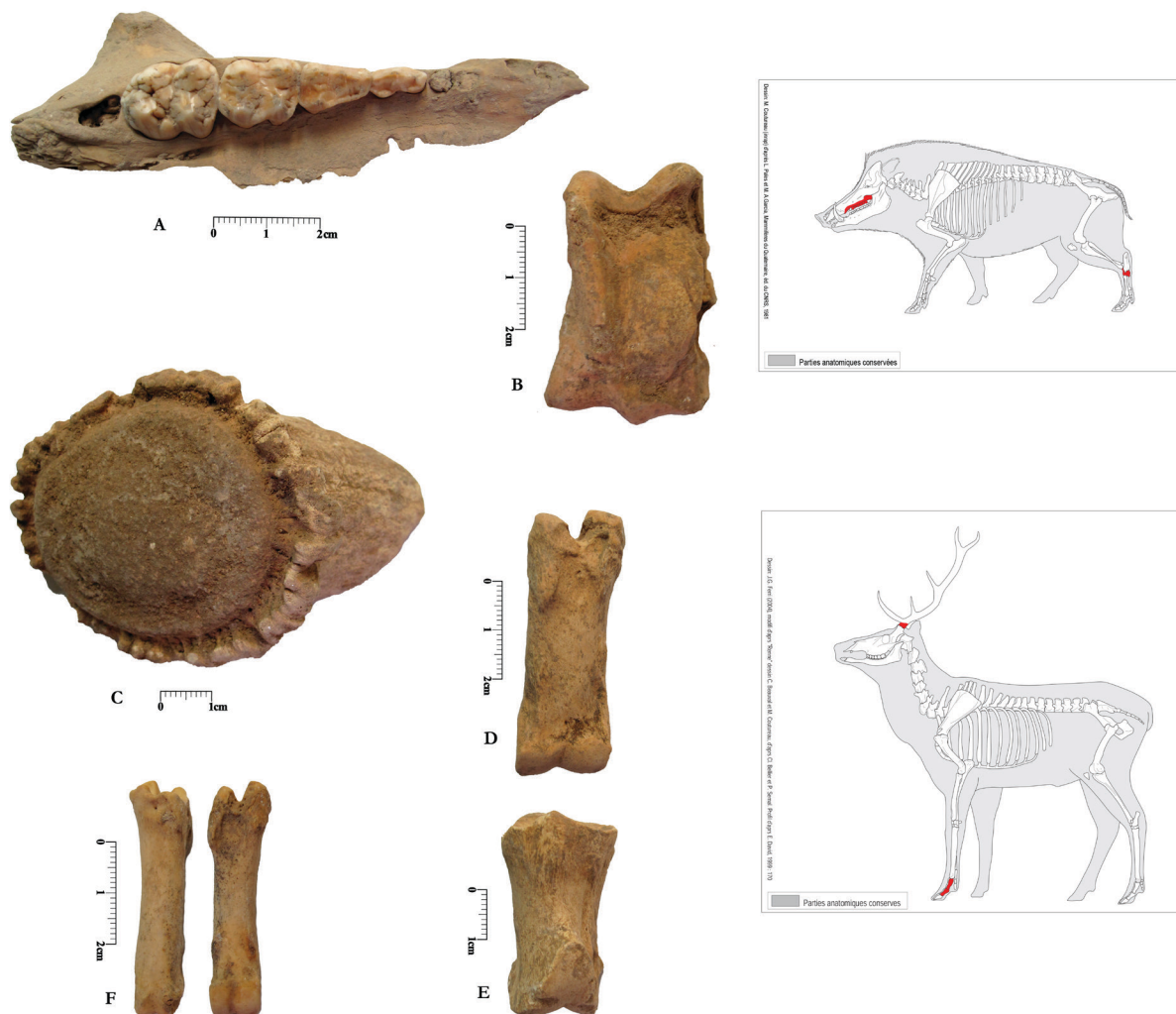


Fig. 14. Boar / pig (*Sus* sp.), A: maxilla of a young specimen; B: talus. Red deer (*Cervus elaphus*), C: distal view of a shed antler; D: first phalanx; E: second phalanx. F: gazelle (*Gazella subgutturosa*), first phalanx.

Discussion

This preliminary report presents the results of the 2019 analysis of faunal remains from the archaeological project at Wezmeh Cave. Given the substantial volume and taxonomic diversity of the assemblage, detailed analyses are still ongoing. These include species identification with the help of proper comparative collections, metric analysis, taphonomic assessments, characterization of fossilization and bone coloration, and the study of herbivore kill-off patterns, among other lines of investigation.

While the list of taxa identified in this report is not expected to change significantly, the total number of identified specimens (NISP) is likely to increase as work progresses, and additional species may be recognized. For instance, many bones currently classified

under general categories of medium- and small-sized carnivores are anticipated to be more precisely attributed to families such as Mustelidae or Canidae upon further examination.

When compared to previously studied assemblages (Mashkour et al. 2009; Monchot 2008; Monchot et al. 2019), the same faunal taxa are represented in the 2019 collection. However, the recent assemblage is significantly larger, comprising 11,431 faunal remains, more than five times the size of the season 1999 collection, which totaled 1,949 bones (Mashkour et al. 2009: Table 1).

This expanded dataset results from the systematic recovery of all bone material through comprehensive sieving of in situ, surface, and disturbed deposits. As a result, the collection

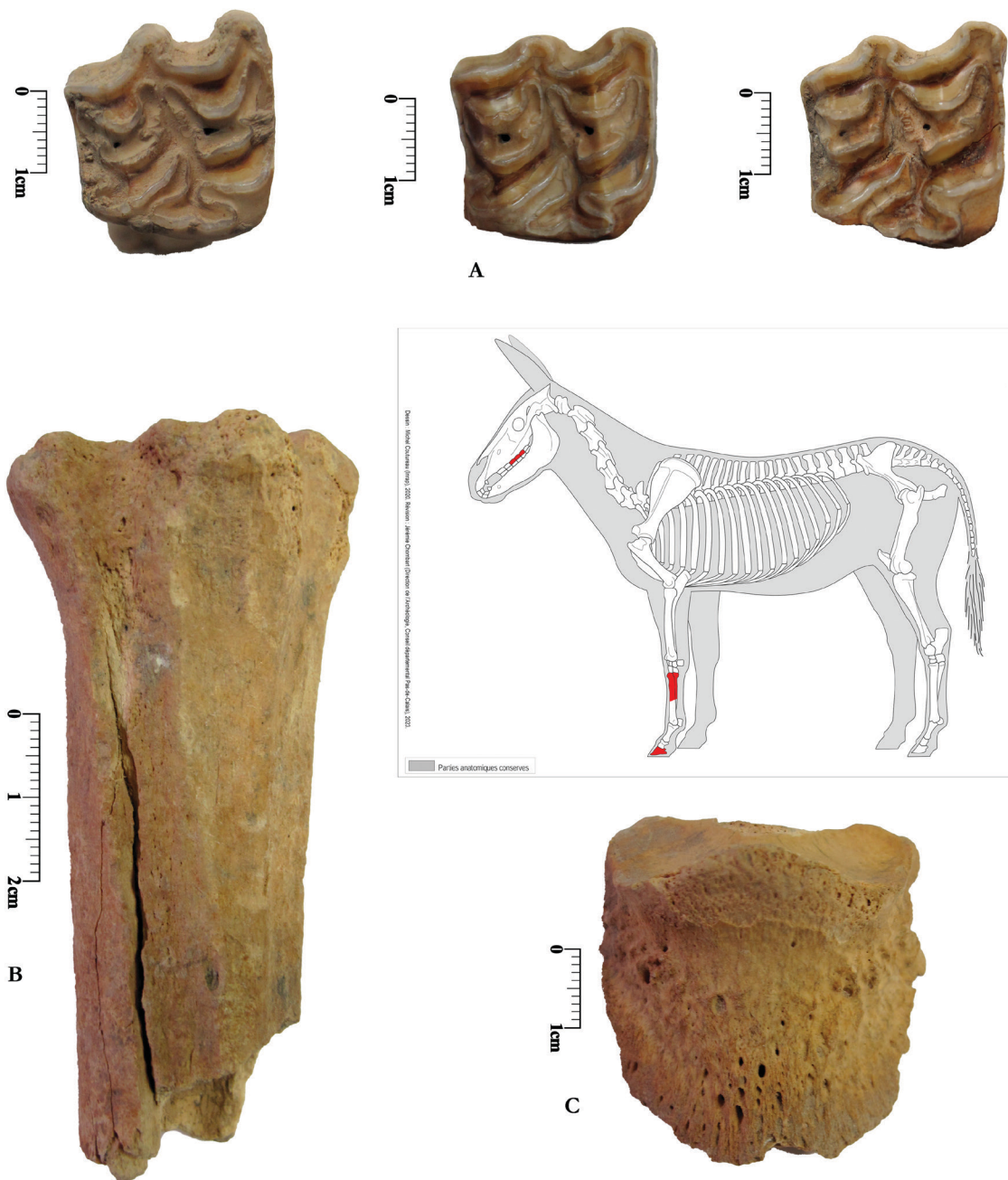


Fig. 15. Equids, A: cheek teeth; B: proximal end of metacarpal; C: third phalanx.

provides a wider array of both cranial and postcranial elements, increasing the potential for identifying new species. Notably, taxa such as domestic herbivores, birds, and aquatic animals - absent from earlier reports - are now represented, offering new insights into the faunal spectrum of cave.

In the 1999 collection, carnivore remains made up approximately 73% of the total predators and prey, compared to 67% in the 2019 assemblage. Conversely, herbivore remains

increased from 18% in 1999 to 31% in 2019. Additionally, the relative abundance of Reptilia and Insectivora has grown significantly in the 2019 assemblage (Table 3).

Conclusion

The faunal assemblage from Wezmeh Cave offers valuable insights into vertebrate biodiversity during the Late Pleistocene and Early Holocene, reflecting substantial taxonomic diversity. The presence of a variety of her-

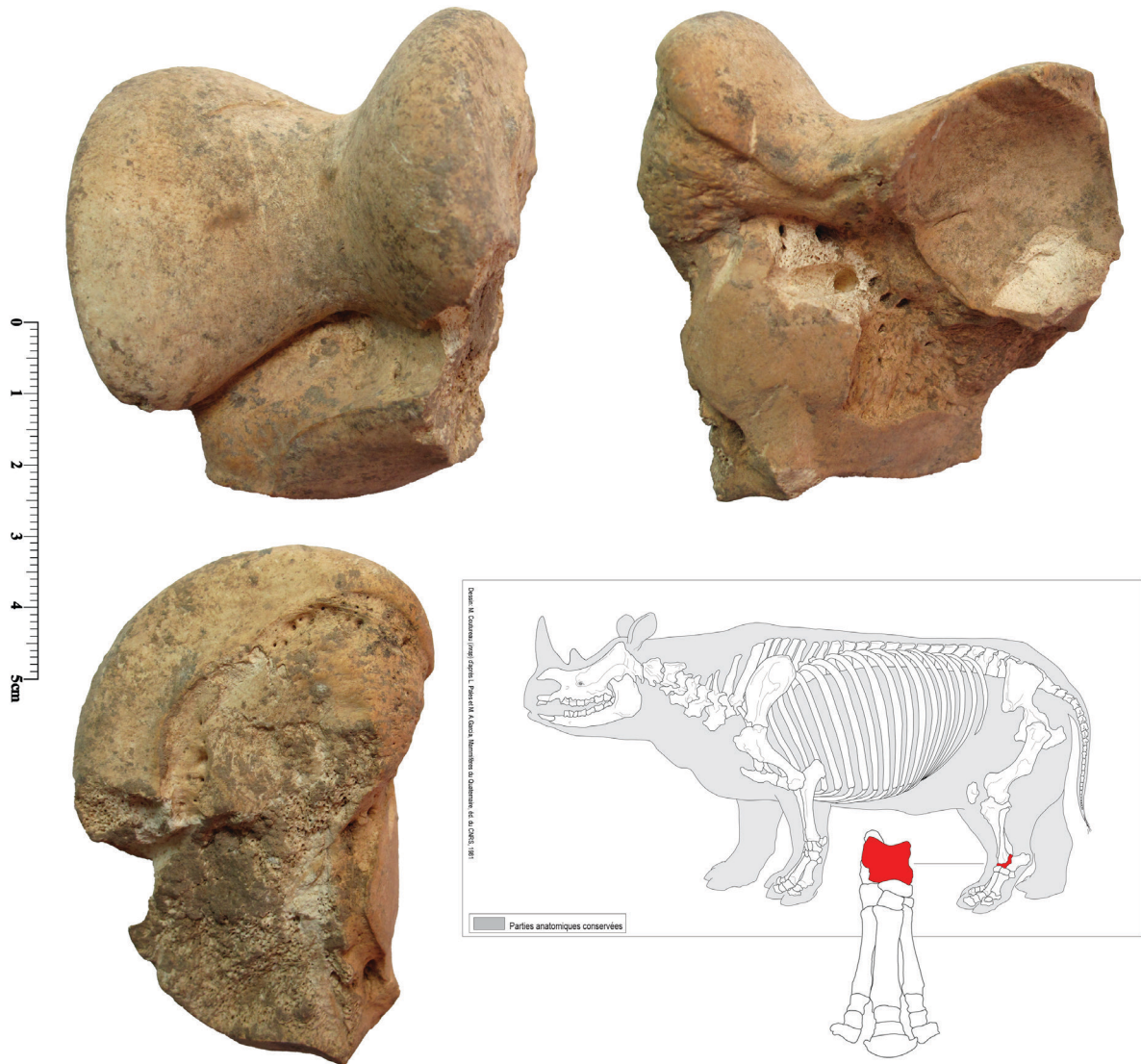


Fig. 16. Rhinoceros (cf. *Stephanorhinus* sp.), talus.

Table 3. Comparison of the Number of Identified Specimens (NISP) between the 2019 excavation season and 1999 faunal collections (data from Mashkour et al. 2009: Table 1). Note that the 2,743 specimens categorized as “Varia” in the 2019 assemblage have been excluded from this comparison.

Wezmeh Cave		2019 collection		1999 collection	
Taxa		NISP	NISP%	NISP	NISP%
Predator and Prey animals	Carnivora	3910	66.8	1383	73.6
	Herbivora	1837	31.4	351	18.7
	Lagomorpha	109	1.9	145	7.7
	<i>Total</i>	<i>5856</i>	<i>100.0</i>	<i>1879</i>	<i>100.0</i>
Environmental animals	Rodentia & Insectivora	2133	75.3	7	10.0
	Reptilia	318	11.2	63	90.0
	Aves	363	12.8		0.0
	Fish & Mollusks	18	0.6		0.0
	<i>Total</i>	<i>2832</i>	<i>100.0</i>	<i>70</i>	<i>100.0</i>
Grand total		8688		1949	



Fig. 17. Domestic cattle (*Bos taurus*), A: first inferior molar; B: second phalanx. Domestic goat (*Capra hircus*), C: horn core; D: mandible. Domestic sheep (*Ovis aries*), E: distal end of metacarpal showing traces of rubefaction and carbonization; F: talus. G: small ruminant, bone object (awl).

bivores suggests that the primary accumulators of the assemblage, likely carnivores, preyed upon wild sheep and goats inhabiting the rocky mountain slopes of the Islamabad region, while also targeting fauna from adjacent valley environments, including equids, gazelles, red deer, suids, and aurochs. These species are frequently recorded in faunal assemblages across Southwest Asia.

The remains of domesticated sheep and goats, recovered from Holocene deposits, suggest that the cave was used by early pastoralists. Of particular note, several human

skeletal elements were recovered during the 2019 sieving of sediments from the slope in front of the cave. Preliminary analyses indicate that the majority of these remains date to the Holocene, although further investigation is ongoing.

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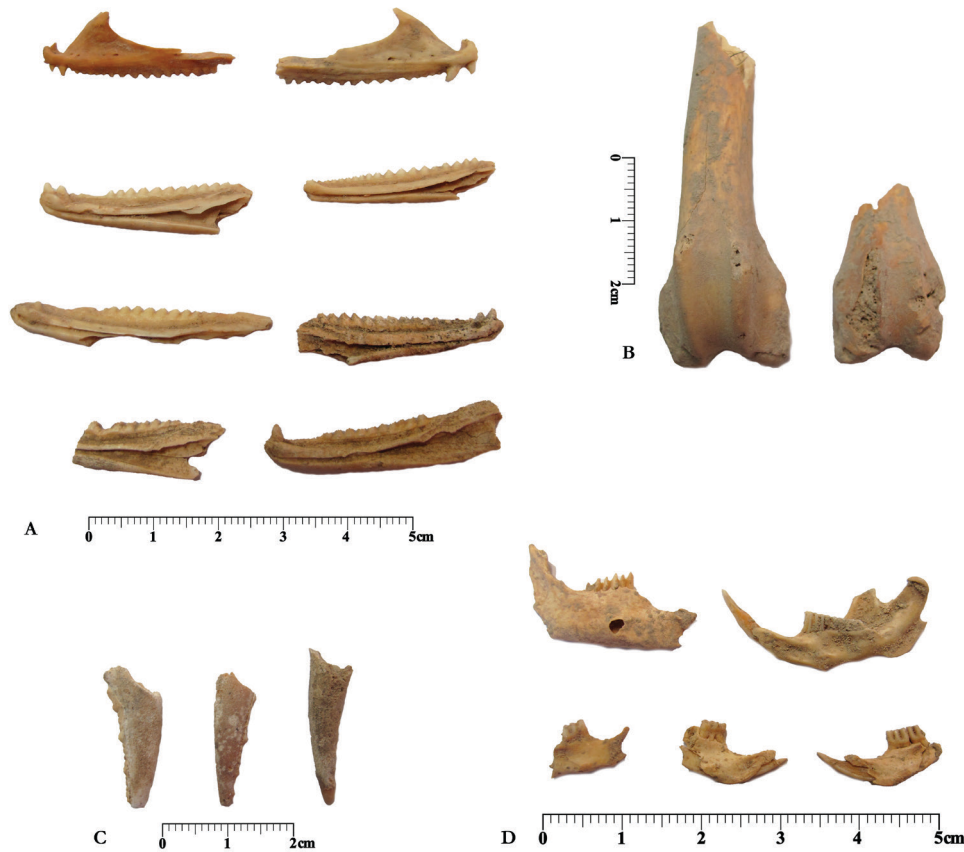


Fig. 18. A: Squamata (Lizard), dentary bone; B: Aves, bird, distal femur; C: crab (*Potamon* sp.), claw; D: Rodentia and Insectivora, mandibles.

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Bibliography

Abdi, K.; F. Biglari, S. Heydari
2002 "Islamabad Project 2001. Test Excavations at Wezmeh Cave", *Archäologische Mitteilungen aus Iran und Turan*, Band 34: 171–194.

Bakken, D.
2000 "Hunting Strategies of Late Pleistocene Zarzian Populations from Palegawra Cave, Iraq and Warwasi Rock Shelter, Iran." In *Archaeology in the Near East IV B: Proceedings of the Fourth International Symposium on the Archaeology of Southwestern Asia and Adjacent Areas*, M. Mashkour, A. M. Choyke, H. Buitenhuis and F. Poplin (eds), 11-17, ARC-Publicatie 32, University of Groningen: Center for Archeological Research and Consultancy.

Barone, R.
1999 *Anatomie comparée des mammifères domestiques*, Paris: Vigot Fresnes.

Biglari, F.
2019 *Excavation at the Wezmeh Cave and Survey of the Surrounding Area in the Qaziwand Mountains, the Islamabad Plain, Kermanshah 2019*. Unpublished report, Tehran: Archive of Iranian Center for Archaeological Researches (in Persian).

Biglari, F.; M. Mashkour, S. Shidrang, M. Rahmati, H. Davoudi, A. Saed Moucheshi, K. Taheri, S. Samei, K. Abdi
2021a "Excavation at the Wezmeh Cave and Survey of the Surrounding Area in the Qaziwand Mountains, the Islamabad Plain, Kermanshah 2019." In *Proceedings of the 18th Annual Symposium on the Iranian Archaeology*, R. Shirazi (ed.), 137-144, Tehran: Research Institute of Cultural Heritage and Tourism (in Persian).

- 2021b “Excavation at the Wezmeh Cave and Survey of the Surrounding Area in the Qaziwand Mountains, the Islamabad Plain, Kermanshah 2019.” In *A Collection of Archaeological Finds from Excavations in Iran, 2019-2020, 18th Annual Symposium on Iranian Archaeology*, M. Mosalla (ed.), 7-16, Tehran: Research Institute of Cultural Heritage and Tourism.
- Biglari, F.; M. Mashkour, S. Shidrang
2024 “Nouvelles découvertes dans la grotte de Wezmeh.” *Archéologia*, Vol. 628: 16.
- Broushaki, F.; M. G. Thomas, V. Link, S. López, L. van Dorp, K. Kirsanow, Z. Hofmanová, Y. Diekmann, L. M. Cassidy, D. Díez-del-Molino, A. Kousathanas, C. Sell, H. K. Robson, R. Martiniano, J. Blöcher, A. Scheu, S. Kreuzer, R. Bollongino, D. Bobo, H. Davoudi, O. Munoz, M. Currat, K. Abdi, F. Biglari, O. E. Craig, D. G. Bradley, S. Shennan, K. R. Veeramah, M. Mashkour, D. Wegmann, G. Hellenthal, J. Burger
2016 “Early Neolithic Genomes from the Eastern Fertile Crescent.” *Science*, Vol. 353, Issue 6298: 499-503.
- Coon, C.
1951 *Cave Explorations in Iran, 1949*. Museum Monographs, Philadelphia: The University Museum, University of Pennsylvania.
- Djamali, M.; F. Biglari, K. Abdi, V. Andrieu-Ponel, J. L. de Beaulieu, M. Mashkour, P. Ponel
2011 “Pollen analysis of Coprolites from a Late Pleistocene-Holocene Cave Deposit (Wezmeh Cave, west Iran): Insights into the Late Pleistocene and Late Holocene Vegetation and Flora of the Central Zagros Mountains.” *Journal of Archaeological Science*, Vol. 38, Issue 12: 3394-3401.
- Hillson, S.
1986 *Teeth*. Cambridge: Cambridge University Press.
- 1992 *Mammal Bones and Teeth*. An Introductory Guide to Methods of Identification. London: Taylor and Francis Group.
- Hole, F.; K. V. Flannery
1967 “The Prehistory of Southwestern Iran: A Preliminary Report.” *Proceedings of the Prehistoric Society* 33: 147-206.
- Marean, C. W.; Yeun Kim, S.
1998 “Mousterian Large-Mammal Remains from Kobeh Cave Behavioral Implications for Neanderthals and Early Modern Humans.” *Current Anthropology*, Vol. 39, No. S1: 79-114.
- Mashkour, M.; H. Monchot, J. L. Reyss, E. Trinkaus, S. Bailon, F. Biglari, S. Heydari, K. Abdi
2009 “Carnivores and their Preys in the Wezmeh Cave (Kermanshah, Iran): A Late Pleistocene Refuge in the Zagros.” *International Journal of Osteoarchaeology*, Vol. 19: 678-694.
- Monchot, H.
2008 “Des hyènes tachetées au Pléistocène supérieur dans le Zagros (grotte Wezmeh, Iran).” *Archaeozoology of the Near East VIII*, TMO 49, Maison de l’Orient et de la Méditerranée, Lyon: 65-78.
- Monchot, H.; M. Mashkour, F. Biglari, K. Abdi
2019 “The Upper Pleistocene Brown Bear (Carnivora, Ursidae) in the Zagros: Evidence from Wezmeh Cave, Kermanshah, Iran.” *Annales de Paléontologie*, Vol. 106, No. 2: 102381.
- Pales, L.; C. Lambert
1971 *Atlas ostéologique*. Paris, éditions du Centre National de la Recherche Scientifique, Antole-France-VII.
- Pales, L.; M. A. Garcia
1981 *Atlas ostéologique pour servir à l’identification des mammifères du quaternaire*. 2 Vols., Paris, éditions du Centre National de la Recherche Scientifique.
- Schmidt, E.
1972 *Atlas of Animal Bones: For Prehistorians, Archaeologists and Quaternary Geologists*. Elsevier publishing company.
- Trinkaus, E.; F. Biglari, M. Mashkour, H. Monchot, J.-L. Reyss, H. Rougier, S. Heydari, K. Abdi
2008 “Late Pleistocene Human Remains from Wezmeh Cave, Western Iran.” *American Journal of Physical Anthropology*, Vol. 135, No. 4: 371-378.
- Turnbull, P. F.
1975 “The Mammalian Fauna of Warwasi Rock Shelter, West-Central Iran.” *Fieldiana Geology*, Vol. 33, No. 8: 141-155.
- Zanolli, C.; F. Biglari, M. Mashkour, K. Abdi, H. Monchot, K. Debue, A. Mazurier, P. Bayle, M. Le Luyer, H. Rougier, E. Trinkaus, R. Macchiarelli
2019 “A Neanderthal from the Central Western Zagros, Iran. Structural Reassessment of the Wezmeh 1 Maxillary Premolar.” *Journal of Human Evolution*, Vol. 135: 1-12.