سنگ‌مادرهای عظیم و تولید تراشه‌های بزرگ در دهتل:
محوطه‌ای آشولی در پس‌کرانه‌های شمالی خلیج فارس، ایران

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چکیده

محوطه دهتل در غرب هرمزگان اطلاعات جدیدی در خصوص رفتار فن‌آورانه انسان‌ریخت‌های آشولی در طول پلیستوسن قدیم-میانی در اختیار گذاشته، و ظرفیت بالای کرانه‌ها و پس‌کرانه‌های شمالی خلیج فارس در مطالعات باستان‌شناسی پلیستوسن و به‌طور ویژه فرهنگ آشولی را نشان می‌دهد. این محوطه که با وسعتی حدود ۴۰۰ هکتار در یک دشت آبرفتی در نزدیکی خلیج فارس واقع شده است، مجموعه قابل توجهی از صنایع سنگی آشولی شامل سنگ‌مادرهای عظیم (با اثر برداشته‌هایی به بزرگی ۵۰ سانتی‌متر) تراشه‌های بزرگ و ابزارهای برنده بزرگ شامل تبردستی، شکافنده و خراشنده‌های سنگین (انتهایی، جانبی و مدور) را دربرمی‌گیرد. این یافته‌ها، تولید تراشه و ساخت ابزار بزرگ-مقایس را تأیید کرده، و نقش این منطقه در پراکنش انسان‌ریخت‌های پلیستوسن را تقویت می‌کند. وجود سنگ‌مادرهای عظیم و تراشه‌های بزرگ مرتبط، نشان‌دهنده بهره‌برداری روش‌مند از سنگ‌خام، و همسانی مجموعه دهتل با سنت‌های صنایع‌مرکب گسترده آشولی است. نوشتار حاضر نشان می‌دهد که مطالعه این صنایع-مرکب، فرصتی بی‌نظیر برای افزایش درک ما از صنایع سنگی آشولی انسان‌ریخت‌های پارینه‌سنگی قدیم، و همچنین نقش منابع سنگ‌خام و منابع آبی فصلی (چشمه‌ها و نهرها) قابل دسترس در جذب گروه‌های انسان‌ریخت‌های اولیه در طول پلیستوسن قدیم-میانی فراهم کرده، و اهمیت دهتل برای شناخت سازگاری‌های آشولی در این منطقه کمترشناخته‌شده فلات ایران را برجسته می‌کند.

واژگان کلیدی: تراشه بزرگ، ابزار برنده بزرگ، سنگ‌مادر عظیم، آشولی، پارینه‌سنگی قدیم، خلیج فارس.

https://doi.org/10.22034/JINM.2025.2051838.1097

Giant Cores and Large Flake Production at Dehtal:
An Acheulean Site in the Northern Hinterland of Persian Gulf, Iran

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Abstract

The Dehtal site in western Hormozgan Province, Iran, provides critical insights into Acheulean hominin behaviour during the Lower-Middle Pleistocene, and highlight the importance of the Persian Gulf's northern coastal and hinterland areas for tracing Pleistocene human populations and their associated Acheulean technocomplex. Situated on an alluvial plain near the Persian Gulf, this ~400-hectares site has yielded a significant Acheulean lithic assemblage, including giant cores (with flake scars exceeding 50 cm), large flakes, and Large Cutting Tools (LCTs) such as handaxes, cleavers, and massive scrapers. These finds confirm large-scale flake production and tool manufacturing, reinforcing the region's role in Pleistocene hominin dispersals. The presence of giant cores and associated large flakes suggests systematic raw material exploitation, while the tool assemblage aligns with broader Acheulean technocomplex traditions. This paper demonstrates that studying this techno-complex provides a unique opportunity to enhance our understanding of Acheulean industries used by Lower Paleolithic hominins, as well as the role of accessible raw material sources and seasonal water availability (springs and streams) in attracting early hominin populations during the Lower-Middle Pleistocene, and underscores Dehtal's importance for understanding Acheulean adaptations in a previously understudied region of the Iranian Plateau.

Keywords: Large Flake, Large Cutting Tool (LCT), Giant Core, Acheulean, Lower Paleolithic, Persian Gulf.

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Introduction

A critical aspect of Paleolithic archaeology and paleoanthropology concerns the dispersal mechanisms and migration routes of Pleistocene hominins associated with the Acheulean techno-complex during their expansion out of Africa (Bar-Yosef & Belfer-Cohen 2001). Following its emergence around 1.7 Ma, the Acheulean techno-complex endured for more than 1.5 million years, demonstrating a remarkable geographic distribution across diverse ecological zones (Sharon 2010). Recent archaeological discovered in the Arabian Peninsula (i.e. Marks 2009; Petraglia et al. 2009; Armitage et al. 2011; Groucutt *et al.* 2021) and Indian Sub-continent (Pappu *et al.* 2011) have yielded significant evidence for hominin presence during at least the Early Pleistocene, associated with Acheulean lithic industries. This issue underscores the growing significance of southern and southeastern Iran (Fig. 1). Recent discoveries along the northern littoral zone and hinterlands of the Persian Gulf reveal the substantial archaeological potential of this region. The Dehtal assemblage has yielded novel insights into Pleistocene hominin behavior in this previously understudied sector of the Iranian Plateau (Fig. 2). This paper presents a technological analysis of Dehtal assemblage, focuses on the giant cores and large flake production.

Dehtal

Dehtal is in the center of the Gawdah basin, Bastak county, west of Hormozgan Province in southern Iran. Geologically, the area is defined by alluvial fan and a system of Pleistocene fluvial gully and seasonal river. The study region is located approximately 80 km north hinterland of the Persian Gulf and geologically belongs to Zagros the Simple Fold Belt. The main topographic feature of Dehtal region is Par-e Lavar Mountain, which extends along the NNW-SSE trending Nakh anticline ridge in its western part. The mountain rises approximate-

Fig. 1. Map of southwestern Asia showing Dehtal and selected Acheulean sites in the Arabian Peninsula and Indian Subcontinent discussed in the text.

Fig. 2. Map of southern Iran showing Dehtal in the northern hinterland of the Persian Gulf.

ly 1400 m above the surrounding terrain, and its highest peak reached an elevation of 2200 m asl. The Nakh anticline mainly consists of Asmari-Jahrom limestone (Biglari et al. 2023). This area is located north of Par-e Lavar Mountain and extends from the Khashova Gorge to the village of Dehtal in the south. Also, it is bounded to the west by a Shur seasonally gully (Bast-e Kuh-e Qibla) and to the east by the Lowz hills (Fig. 3). The Shur Gawdah River passes through the Gawdah basin in a NW-SE direction and eventually joins the Mehran River and flows into the Persian Gulf (National Geographical Organization 2005).

In May 2010, initial reconnaissance survey of the Dehtal area led to the discovery of a large lithic scatter between the village and the northern slope of the Par-e Lavar Mountain. The team conducted limited sampling along the northern edge of the extensive lithic scatter before carrying out a rapid survey of the area between Dehtal and the mountain range. The techno-typological characteristics of the lithic assemblage suggest that Acheulean groups visited Dehtal, producing large flakes from giant cores. (Biglari et al. 2023).

In January and March 2021, fieldwork was carried out to assess the archaeological potential of the Dehtal site. The survey initiated along the western edge of the area, adjacent to the seasonal Shur gully (Fig. 4), and progressed toward the site's center (Fig. 5). During surface reconnaissance targeting diagnostic lithics, large boulders were examined for flaking scars. Consequently, all boulders were topographically mapped, and photogrammetric documentation was conducted for further analysis.

Lithic Assemblage

Dehtal assemblages are entirely on carbonate-cemented sandstone and fossiliferous limestone rock (i.e. peloid-foraminiferal packstone) that is directly related to availability of, and easy access to these rocks, which normally appears as boulders and cobbles of different size that have been transported and deposited by river streams. Their surface conditions range from relatively sharp, with light patination to

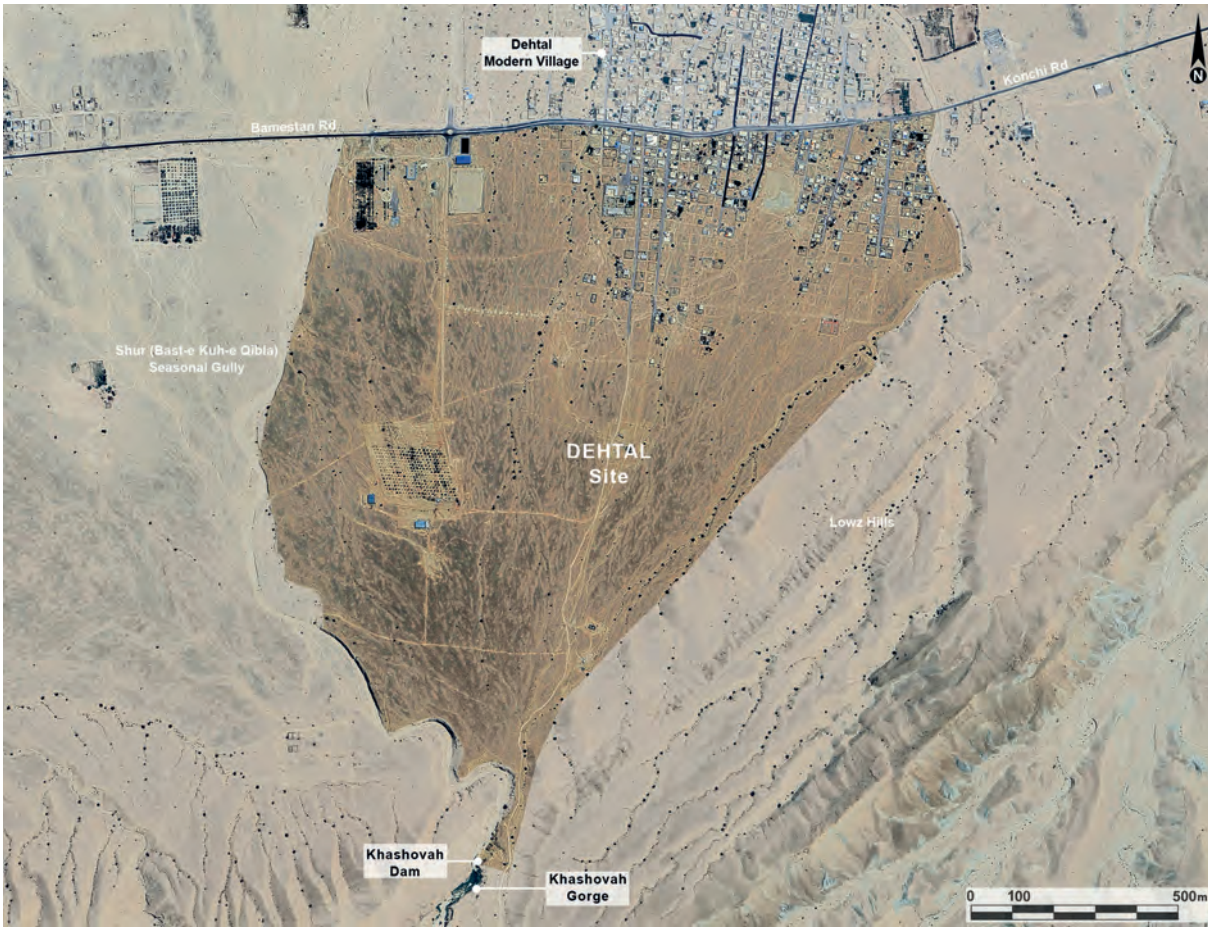

Fig. 3. Satellite image of Dehtal.

Fig. 4. Shur gully (Bast-e Kuh-e Qibla) seasonal watercourse, northward view from Khashova Gorge.

Fig. 5. Dehtal site: a) view from the south, b) view from the north. Boulders display red-brown patination with associated rock art and removal scars.

abraded and heavily patinated. The specimens with light patination have a color range from cream to gray while those with desert varnish are dark brown to deep reddish brown (Biglari *et al.* 2023). The difference in the original color of the raw materials can be observed in samples those parts of exposed and buried that have been recently exposed from sediments (Fig. 6). The relatively fresh and light patination, indicating that they were buried shortly after being discarded on the fan. It appears that they have recently been exposed due to erosion or construction activities related to rural development. However, other specimens exhibit abraded surfaces and heavy patination, indicating that they have been exposed for a significant period of time (*Ibid*).

In the first survey, a small but diagnostic lithic collection was recovered, comprising 1) a handaxe with a cleaver-like distal end made on a large, thick, side-struck sandstone flake with a dorsal face mainly covered by the cortex, 2) a massive end-scraper is made on a large and thick, patinated, fossiliferous limestone flake, 3) a large wedge shape flake, a wide and thick end-struck flake with heavy patina, 4) a flake core made from a slab fragment with two opposite flat natural surfaces, and 5) two boulder cores; based on the techno-typological characteristics of LCTs, Dehtal occupied by Acheulean hominins who produced large flakes from giant cores (*Ibid*).

During the second phase of survey, numerous LCTs were documented (Fig. 7). Initial typological analysis revealed three distinct manufacturing approaches: (1) production on plano-convex cobbles, (2) utilization of flat cobbles (featuring two natural flat surfaces), and (3) preferential selection of large, thick side-struck flakes as blanks.

The Dehtal assemblage is predominantly characterized by large flakes exhibiting minimal secondary modification (Fig. 8). Notably, no LCTs manufactured from flint or chert have been identified to date. The available raw materials appear to have consisted primarily of large cobbles or slabs, as evidenced by both finished products and debitage. Spatial analysis revealed multiple loci containing refitting frag-

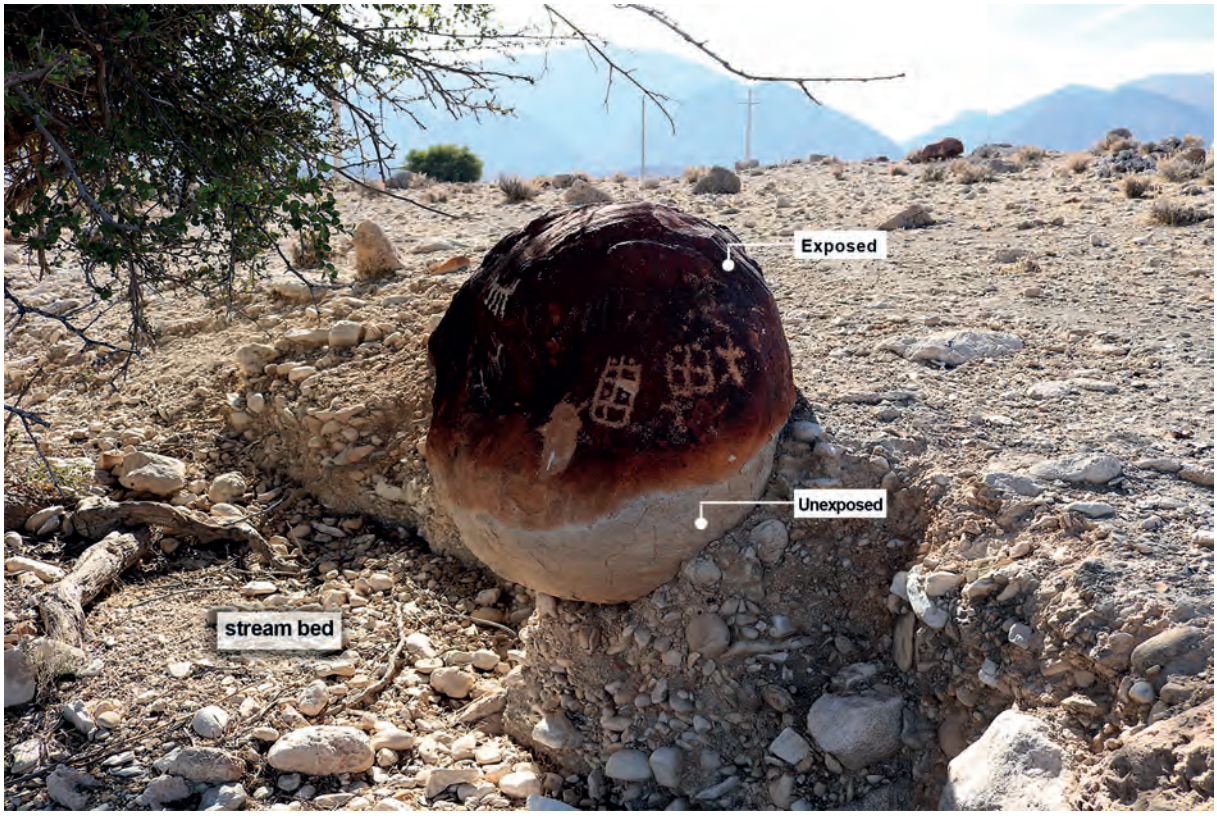

Fig. 6. Large rounded boulder bearing Holocene rock art, exhibiting two distinct patination surfaces. The stream-eroded lower portion displays lighter patination compared to the upper surface.

Fig. 7. LCTs from Dehtal, including one specimen exhibiting double patination

Fig. 8. Large Flake artifacts from Dehtal.

ments adjacent to their parent cores. Of particular significance is the high concentration of massive scrapers surrounded by associated debitage, strongly suggesting the presence of *in-situ* knapping stations (Fig. 9). The integrity of these surface assemblages is particularly noteworthy, as their spatial distribution and refitting patterns indicate primary deposition unaffected by post-depositional processes such as flash floods or erosional displacement.

Giant Cores and Large Flake Production

The use of large flakes (>10 cm) as blanks for LCTs has been recognized since the earliest studies of Acheulean technology, yet this technological phenomenon has consistently received inadequate systematic attention in the literature. (Sharon 2010). The production and utilization of large flakes represents a fundamental technological practice documented from the earliest phases of both African and non-African Acheulean complexes. Notably, numerous Lower Paleolithic assemblages from Western Asia contain LCTs manufactured from large flakes struck from massive 'Giant Cores' (sensu Shea 2013), demonstrating the widespread application of this reduction strategy across Pleistocene hominin populations. As established, Dehtal represents an Acheulean occupation site characterized by large flake production and an associated LCT assemblage. The lithic industry demonstrates multiple reduction strategies, including: (1) production of LCTs on naturally occurring large flakes, (2) utilization of large flakes detached from cobbles, and (3) exploitation of locally available deposited boulders as giant cores for large flake removal. These widespread boulders appear to have served as primary raw material sources for the Acheulean toolkit at the site. Here, the lithic assemblage recovered from Dehtal, and its associated production technologies are discussed.

The first example consists of an *in-situ* boulder measuring 45 cm in exposed height and 58 cm in length. Like other lithic materials at Dehtal, this specimen exhibits characteristic reddish-brown surface coloration with pronounced patination and desert varnish. The artifact

Fig. 9. A surface lithic scatter containing multiple flakes (indicated by yellow arrows) directly refittable to a massive scraper, with an inset showcasing the tool. The refitting relationship between the flakes and the scraper confirms in-situ tool production or rejuvenation.

displays at least three large flake removal scars (>10 cm) concentrated on one face, with individual scar dimensions ranging from 15-20 cm in length and 15-30 cm in width. The removal scars and natural cortex exhibit identical surface characteristics in terms of coloration, patination, and desert varnish development (Fig. 10). The boulder appears to have been longitudinally split prior to flaking, though the anthropogenic origin of this bisection remains

Fig. 10. A Giant core partially embedded in sediments, its debitage surface showing at least three very large flake detachment scars.

uncertain—it may represent intentional preparation or result from natural fracturing. The flake scars display a consistent maximum detachment angle of 45 degrees.

The second specimen represents an *in-situ* boulder with exposed dimensions of 90 cm (height) × 70 cm (length) × 25 cm (thickness). This artifact displays bifacial working at its upper extremity, with one flaked surface additionally featuring petroglyphic carvings. Technological analysis identified a minimum of seven removal scars per face, measuring 10-20 cm in both length and width. The intact cortex exhibits characteristic reddish-brown patination under black desert varnish (Fig. 11).

While this specimen typifies the giant core reduction strategy at Dehtal, the site also contains numerous smaller boulders (with 1-2 removal scars >10 cm) demonstrating comparable reduction techniques. This pattern suggests a continuum of core utilization across varying raw material sizes (Fig. 12). A distinctive specimen consists of a massive circular flake (>40 cm diameter, ~15 cm thick) exhibiting plano-convex cross-section. This artifact demonstrates secondary utilization as a core, evidenced by at least seven flake removal

Fig. 11. Partially buried giant core showing bifacial flake scars along its upper edge and lightly patinated Holocene rock art on both surfaces.

Fig. 12. Boulder cores with heavily patinated flake scars adjacent to lightly patinated Holocene rock art.

scars present on both dorsal and ventral surfaces. Notably, the ventral surface bears superimposed Holocene-period rock art, indicating later cultural reuse of this Acheulean artifact (Fig. 13).

Discussion

Initial observations demonstrate the coexistence of multiple blank-selection strategies for LCTs at Dehtal, including production on cobbles, slabs, and giant cores. This pattern finds parallels in other Lower Paleolithic localities across the northern Persian Gulf.

At the Strait of Hormuz, Thibault's (1977) survey documented an assemblage containing small flakes and cores (Zarei n.d., 2021a), including one partial biface (90 × 120 mm) crafted from grayish-green volcanic rock. This specimen exhibits distal retouch forming a transverse edge analogous to a cleaver bit (Biglari & Shidrang 2006). Additional evidence comes from Gip VIII, a major Lower Paleolithic site yielding three LCTs—one handaxe and two unifacial tools—found in association with choppers, flakes, and cores. A biface was also recovered at the nearby surface site of Chuch VIII (Anjomrouz 2019).

Numerous Acheulean sites associated with LCTs—including bifaces, handaxes, cleavers, and giant cores—have been identified in the southern Persian Gulf region. At Dawādmi in central Saudi Arabia and Wadi Fatimah near the Red Sea, assemblages are predominantly flake-based but contain characteristic bifaces and cleavers (Groucutt & Petraglia 2012). These sites share technological and landscape similarities with Dehtal, particularly in large flake production strategies and their proximity to raw material sources within riverine systems. Saffaqah, located in central Arabia and dated to at least 190 ka, represents the youngest documented Acheulean occupation in southwest Asia. Its assemblage, featuring large flakes, handaxes, and cleavers, shows strong technological affinities with African Acheulean traditions (Scerri *et al.* 2018).

Fig. 13. Giant flake (~40 cm length) with large flake scars along its margins.

One hypothesis posits that this large flake technology reflects African influence within the Acheulean tradition. However, the so-called Large Flake Acheulean occurs widely beyond Africa, including in Western Asia (Sharon 2010). Beyond its geographical distribution, this technology is notable for its persistence over more than one million years. Sharon (ibid.) proposes its disappearance around 0.5 Ma in the Levant and likely North Africa, where it was replaced by technologies utilizing flint and fine-grained materials for biface and cleaver production. Yet sites like Dehtal in the northern Persian Gulf hinterland, probably dating to later Acheulean periods, indicate the technology's continued use in regions such as southern Iran during the Middle Pleistocene's later phases.

Giant cores on blocks and sedimentary boulders have been documented both in Arabia (e.g., Groucutt & Petraglia 2012; Scerri *et al.* 2018) and the Indian Subcontinent (e.g., Shipton et al. 2009). Fluctuations in mean sea level during the Middle and Upper Pleistocene significantly impacted the Persian Gulf's surface morphology, causing repeated retreats toward the Strait of Hormuz and complete desiccation during multiple phases (Rose & Petraglia 2009). The presence of Lower and Middle Paleolithic artifacts on Persian Gulf islands (Dashtizadeh 2010; Rahmati & Dashtizadeh 2019; Zarei 2021b) suggests potential migration routes for African Pleistocene populations along the northern Gulf shores after traversing the Arabian Peninsula and crossing the dry Strait of Hormuz. This evidence raises important questions about Pleistocene hominin capabilities to navigate the Persian Gulf's dry valley systems. While the crossing of the desiccated Strait of Hormuz represents one probable route, maritime and coastal adaptations may have also facilitated the dispersal of Pleistocene populations throughout the region—a promising avenue for future research.

Conclusion

Recent discoveries in the Dehtal area provide new evidence of Acheulean hominin occupation during the Lower Paleolithic period. Systematic surveys conducted in 2010 and 2021 revealed extensive surface assemblages containing characteristic Acheulean LCTs, including handaxes, cleavers, and massive scrapers. While numerous Paleolithic localities have been identified in this region since the 1970s, Dehtal represents the only site where stone tool assemblages have been definitively attributed to the Acheulean tradition. A significant feature of Dehtal is the abundant evidence of early-stage reduction activities. The site's strategic location near stone resources and freshwater sources - particularly local springs and seasonal streams fed by the Par-e Lavar mountain - likely played a crucial role in hominin occupation patterns. At Dehtal, archaeologists have documented both giant cores used for large flake production and numerous associated LCTs.

These findings have recently been used to propose potential technological connections between Acheulean industries in the northern and southern Persian Gulf regions, particularly through the shared presence of giant core technology and large flake production methods. The Dehtal assemblages not only demonstrate Acheulean expansion into previously understudied areas but also highlight the behavioral diversity of Middle Pleistocene hominins in adapting to varied landscapes.

Acknowledgments

I extend my sincere gratitude to Mohammad Abdollahi, the village head of Dehtal, for his assistance and support during the field survey. Special thanks are due to Peiman Pasalari for his efforts and collaboration in the field. I am also grateful to Abbas Norouzi for facilitating my fieldwork mission. I wish to express my appreciation to Dr. Fereidoun Biglari of the Paleolithic Department at the National Museum of Iran for his constructive comments on an earlier version of this manuscript. Finally, I acknowledge the anonymous reviewers for their meticulous critiques and suggestions, which significantly enhanced the quality of this paper.

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