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Dhaba: An initial report on an Acheulean, Middle Palaeolithic and microlithic locality in the Middle Son Valley, north-central India

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ABSTRACT

This paper presents the first report on Dhaba, a newly discovered locality in the Middle Son Valley, north-central India. The locality preserves Acheulean, Middle Palaeolithic and microlithic artefacts within a Late Quaternary stratified alluvial sequence. Initial information is provided on the sedimentary sequence, archaeological survey and excavation, topographical mapping, and lithic technological analysis of Dhaba 1, the largest excavation at the locality. The assemblage is situated within the regional geomorphological and hominin occupation sequences, noting that while Dhaba lies within a kilometre of Toba tephra deposits, no temporal link between the tephra and the artefact-bearing sediments is possible at present. Dhaba currently provides the only known extensive occurrence of Middle Palaeolithic artefacts in the Middle Son Valley that lacks handaxes.

1. Introduction

The Middle Son Valley of northeast Madhya Pradesh, India, has one of the most comprehensively studied Late Quaternary sedimentological and archaeological records in South Asia (Thapar, 1979; Sharma and Clark, 1982, 1983; Williams and Royce, 1982; Williams and Clarke, 1984, 1995; Clark and Williams, 1987; Pal et al., 2005; Williams et al., 2006, 2009, 2010; Jones and Pal, 2009; Haslam and Petraglia, 2010). The steep escarpment of the Kaimur range to the north and the Baghelkhand plateau to the south define the east-northeast course of this part of the Son River (Fig. 1), with surveys from the 1960s onwards establishing hominin occupation from the Acheulean through to historic periods (Sharma et al., 1976). The focus of the most intensive archaeological exploration has been a ~50 km stretch from Patpara in the west to the confluence with the Gopad River in the east (from approximately 81°54′ to 82°21′ E), including excavations concentrated to the north of the river and along the southern riverbank (Clark and Sharma, 1983). These excavations have recovered important evidence for Late Acheulean habitation (Kenoyer and Pal, 1983; Haslam et al., 2011), as well as microlithic and potentially 'Upper Palaeolithic' artefacts (Clark and Dreiman, 1983; Sussman et al., 1983; Kenoyer et al., 1983a, 1983b; Misra et al., 1983a). Evidence for the use of Middle Palaeolithic technology in the valley has been found at Patpara (Blumenschine et al., 1983), but the presence of Late Acheulean bifaces in the same locality raises questions as to which industry this assemblage should be attributed. With debates over whether the initial dispersal of *Homo sapiens* into South Asia was associated with a Middle Palaeolithic tool-kit (Clarkson et al., 2012; Mellars, 2006), testing hypotheses over the timing and context of the dispersal process requires Middle Palaeolithic assemblages from well-studied sequences.

This paper presents the initial report on a newly discovered locality, Dhaba, with extensive preservation of Middle Palaeolithic silicified limestone artefacts. The locality is comprised of a series of stratified sites approximately 0.6–1 km upstream (west-south-west) of the Rehi-Son confluence at Ghogara, where the first reported discovery of tephra from the ~74 ka (thousand years ago) Toba super-eruption was made in the early 1980s (Williams and Clarke, 1995; Jones, 2010). Microlithic artefacts, which are known

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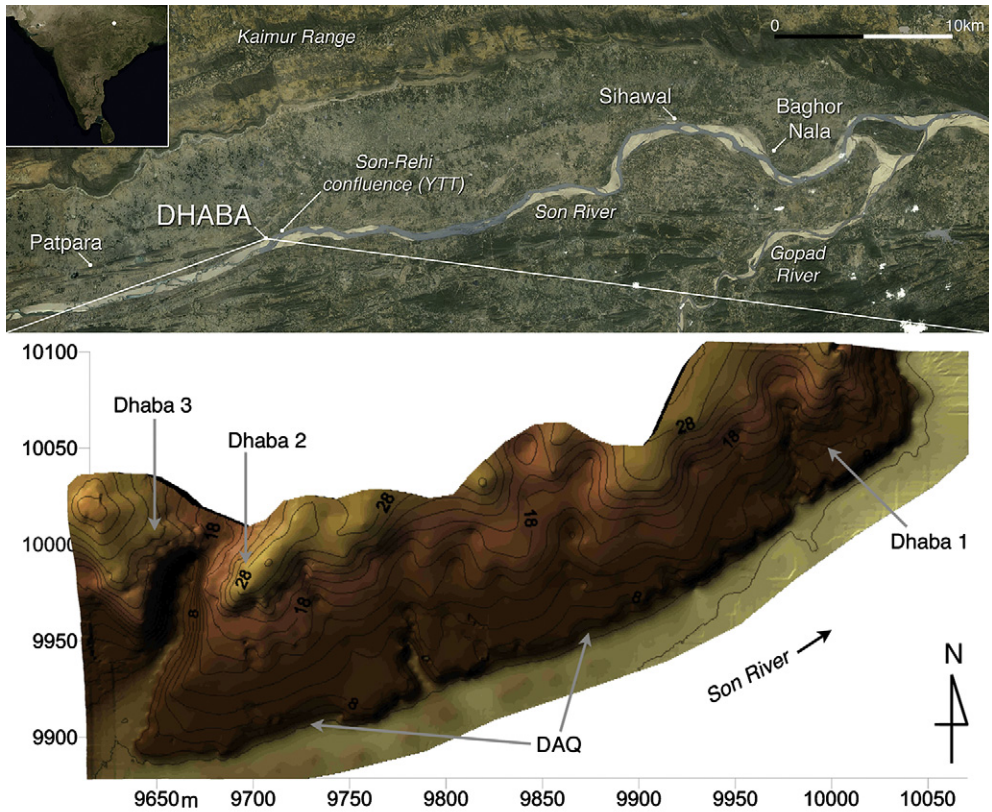

Fig. 1. Map of the Dhaba locality. Above: location of the Middle Son Valley in north-central India (inset), with type localities for the Middle Son Valley formations and position of the YTT deposits at the Son-Rehi confluence. Below: reconstructed topographical map of the Dhaba locality, with archaeological trench positions (DAQ = Dhaba Acheulean Quarry), 2 m contours showing heights above the adjacent river sands, and northing and easting grid in metres.

to date from prior to 35 ka up to the late Holocene in India (Possehl, 1994; Clarkson et al., 2009), stratigraphically overlie the Middle Palaeolithic assemblage at this locality, and evidence for Acheulean large-flake quarrying was found among quartzite boulders at the base of the sedimentary sequence. This report outlines the results of initial excavations and sedimentary recording at the Dhaba locality, including detailed topographical survey. It also presents an initial technological analysis of the excavated Middle Palaeolithic assemblage from Dhaba 1, the largest excavated site at the locality.

2. The Middle Son Valley sequence

The Middle Son preserves stratified archaeological assemblages within a general sequence of four sedimentary formations, derived from alluvial, colluvial and aeolian sources. From oldest to youngest, these are the Sihawal, Patpara, Baghor and Khetaunhi formations (Williams and Clarke, 1995), with optically stimulated luminescence (OSL) ages from the Sihawal and Patpara formations demonstrating occupation from at least Marine Isotope Stage (MIS) 6 onwards (Haslam et al., 2011). Williams et al. (2006) proposed a fifth Khunteli Formation that pre-dates the Patpara Formation and contains the ~74 ka Toba tephra, but its validity is disputed (Jones and Pal, 2009). Recently, Williams (2011) further clouded this issue by suggesting that, contrary to his initial report, the Khunteli Formation post-dates the Patpara Formation. The position of the Toba tephra in relation to the Middle Son Valley's named formations is therefore open to question, especially as there is an ambiguous lateral association between the Patpara formation type-locality (dated to c. 140 ka) and the river sections within which the Toba tephra is patchily exposed (Haslam et al., 2011). This paper follows Jones and Pal (2009) in tentatively placing the tephra between the Patpara and Baghor formations, for the reasons outlined by those researchers. Toba tephra deposits have not been found in any of the excavated archaeological sites in the Middle Son Valley, and despite the presence of numerous Late Pleistocene fossils in the Baghor formation (Badam et al., 1989), Pleistocene hominin skeletal remains are yet to be recovered.

Jones and Pal (2009) present a technological analysis of lithic artefacts from the Patpara and Baghor formations, which they suggest span much of the Late Pleistocene. They demonstrate significant changes in the raw materials used for artefact manufacture, with an earlier emphasis on quartzite followed by a shift to limestone and finally chert and chalcedony (see also Clark and Williams, 1987). Both flake size and platform size decrease over time, with a shift from more radial methods of core reduction in the Patpara assemblages towards bidirectional and unidirectional flaking in Baghor formation sites. Levallois cores were rare in the analysed assemblages, with those recovered ($n = 2$) found in the Late Patpara and lower Baghor formations. Microblade and macroblade technologies occur together in several sites within the Baghor formation, and Jones and Pal note a possible overlap between these and previous Middle Palaeolithic production, suggesting that microlithic innovations may have been an autochthonous development in the Middle Son, as seen elsewhere in India (Clarkson et al., 2009; Petraglia et al., 2009). The least well-known aspect of the Middle Son sequence remains the Middle Palaeolithic, as represented by Levallois, discoidal, multi- and single-platform and bidirectional core technologies with occasional low-level blade production from a variety of core types.

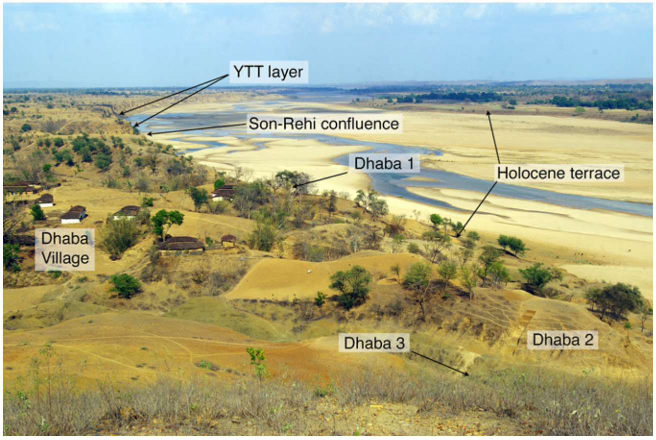

Fig. 2. The Dhaba locality, facing east, photographed from the large shale hill overlooking the western end of the locality. Note the low Holocene terrace on the southern bank of the river, and the high (∼30 m), YTT-bearing alluvial cliffs on the northern margin.

3. The Dhaba locality

The Dhaba locality (Fig. 2) is situated adjacent to the left (north) bank of the Son River, and is named for a village situated above the sites. The locality is comprised of Pleistocene alluvial hillocks overlying unconsolidated quartzite boulders and decomposing shale bedrock. A Holocene terrace associated with the Khetaunhi formation (Clark and Williams, 1987) abuts the lower portion of the site, and seasonally-dry erosional gullies dissect the alluvium, approximately perpendicular to the course of the river. The boundaries of the locality were established by surface survey for archaeological material and natural erosional features, and fall between N 24°29.86′ to 24°29.98′, and E 82°0.36′ to 82°0.62′. Dhaba currently has sparse tree coverage with high levels of human, goat and domesticated water buffalo traffic, and much of the surface is exposed and unvegetated. Local villagers informed the authors that during the summer monsoon period the Son River may occasionally rise to overflow the Holocene terrace (approximately 8 m above the dry season river level observed during fieldwork in early 2009).

The Dhaba locality was first identified in March 2009 as part of the joint Allahabad University-Oxford University Middle Son Valley Archaeological Project. Surface artefacts at Dhaba (Fig. 3) are predominantly silicified limestone flakes typical of the Indian Middle Palaeolithic (Sankalia, 1964; Pal, 2002), including Levallois, discoidal and multiplatform cores and limited numbers of retouched tools. At the western and eastern ends of the site, and topographically higher than the Middle Palaeolithic artefacts, are scatters of microlithic and microblade artefacts made on cryptocrystalline silicates including cherts and chalcedony. Excavations targeting the Middle Palaeolithic and microlithic levels were conducted at three sites within the Dhaba locality (designated from east to west as Dhaba 1–3) during March and April 2009.

3.1. Dhaba Acheulean Quarry

The Holocene terrace has eroded in two sections at the base of the locality, intermittently exposing groups of large, angular, quartzite boulders for over 100 m along the riverfront (Fig. 4). This quartzite underlies both the Holocene terrace and the older sedimentary formation in which the Dhaba sites are located, and its full extent is unknown at present. The largest concentration of exposed quartzite is located at N 24°29′53.9″, E 82°00′30.4″. Close examination of these boulders revealed unambiguous and extensive evidence for the removal of large flakes (typically >10 cm in maximum dimension) using hard hammer percussion. The large cores ($n = 18$) show opportunistic removals from suitable margins, with low numbers of scars per worked boulder and a few instances of systematic flake production.

Sixteen large, unabraded, quartzite flakes were found among the boulders, with large but diffuse bulbs of percussion, wide platforms, and width measurements (perpendicular to the axis of percussion) often larger than lengths (Fig. 3). Initial attempts at refitting these flakes to the boulder cores during survey were unsuccessful. Most flakes showed no evidence of further shaping, although a minority of pieces possessed multiple dorsal flake scars and could be considered incipient bifaces or cleavers. As quartzite was characteristically targeted by Acheulean hominins in the Middle Son Valley (Kenoyer and Pal, 1983; Misra et al., 1983b; Haslam et al., 2011), and large flake production for subsequent biface and cleaver manufacture is a hallmark both of the Middle Son and much of the Old World Acheulean (Sharon, 2009, 2010), this collection of boulder cores is designated as the Dhaba Acheulean Quarry.

3.2. Topographic survey

Concurrent with archaeological survey and excavation, topographic survey of the Dhaba locality was conducted by using a total station (Zeiss Elta R55 EDM) (Fig. 1). The flat river sands were assigned an elevation of 0 m, and an arbitrary grid established and georeferenced via GPS plotting of survey bench marks. Three-dimensional surface reconstructions were generated using Golden Software's Surfer™ 8 software.

The survey methods employed at Dhaba were also used to record Toba tephra exposures in river sections downstream of the Rehi-Son confluence. Correlation of these datasets indicates that primary, un-reworked volcanic tephra layers, interpreted as basal deposits dating to the time of the eruption ∼74 ka (Lewis et al., 2012), are at lower elevations than the sediments that preserve Middle Palaeolithic artefacts at Dhaba. Using the relative elevations established for the Dhaba locality, the basal tephra is found between 4.05 and 6.59 m elevation, with a trend of increasing elevations moving upstream over a horizontal distance of 330 m. This trend terminates at the Rehi-Son confluence, as no macroscopically visible tephra has been located west of that divide. The lowest Middle Palaeolithic artefacts at Dhaba occur at approximately 9–10 m elevation, with the quartzite boulders below this level, and microlithic artefacts were typically found above 26–28 m near the Dhaba 3 excavation (see below). However, the presence of raised basement shales at Dhaba means that no definitive statement can be made about the relationship between the tephra and Dhaba sites on the basis of topography.

3.3. Excavations at Dhaba 1–3

Each of the three archaeological sites was excavated as a stepped trench placed into hillslope sediments (Fig. 4). Dhaba 1 (N 24°29′57.6″, E 82°00′35.0″) was selected as the site of densest Middle Palaeolithic surface artefact concentration, with artefacts visibly eroding from sediments at several points up the slope. The site was excavated as a lower 2 m-wide trench (Dhaba 1) and an upper 1 m-wide extension (Dhaba 1A), for a total height of just over 13 m. Very few artefacts were recovered from the upper extension, with the lower portion of the site preserving fresh limestone flakes and cores, and a single large quartzite flake from near the base of the excavation. Dhaba 2 (N 24°29′55.4″, E 82°00′24.5″) and Dhaba 3 (N 24°29′56.1″, E 82°00′22.5″) were selected for excavation owing

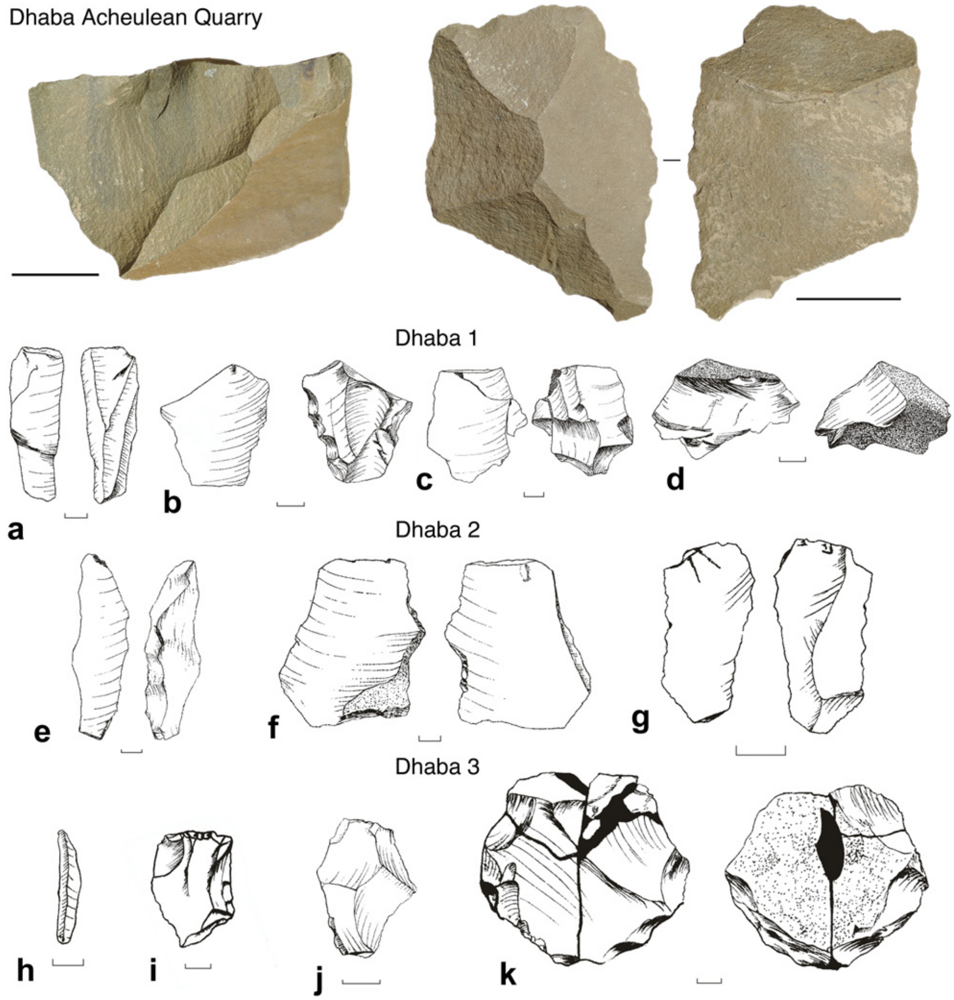

Fig. 3. Artefacts from the Dhaba locality. Scales are 5 cm for Dhaba Acheulean Quarry (DAQ) flakes (surface finds), and 1 cm for all others (excavated). (a) blade segment; (b) retouched flake; (c) flake (radial dorsal scar pattern); (d) flake (cortical platform and dorsal face); (e) redirecting flake; (f) retouched flake; (g) flake; (h) microblade fragment; (i) retouched flake; (j) flake (radial dorsal scar pattern); (k) levallois core (broken). The DAQ flake in the top left is shown in situ in Fig. 4b.

Fig. 4. Dhaba locality and excavations: (a) panorama of the Dhaba locality facing north. The Son River is in the foreground, the prominent shale hill to the west overlooks the Dhaba 2 and 3 sites, and the Dhaba 1 excavation is above the Holocene terrace to the east; (b) Dhaba Acheulean Quarry. The quartzite boulder in the foreground displays multiple sequential large flake removals (arrowed; the scale to the left of this boulder has 5 cm segments), and the find position of one of the flakes shown in Fig. 3 is circled; (c) Dhaba 1 excavation in progress, facing north. Note the angular quartzite overlying shale at the base of excavation (the foreground portion of the trench is 2 m-wide); (d) Dhaba 2 (step trench, centre frame) and Dhaba 3 (foreground) excavation in progress, facing east. Note the exposed shale in the large gully between the two sites (both trenches are 2 m-wide).

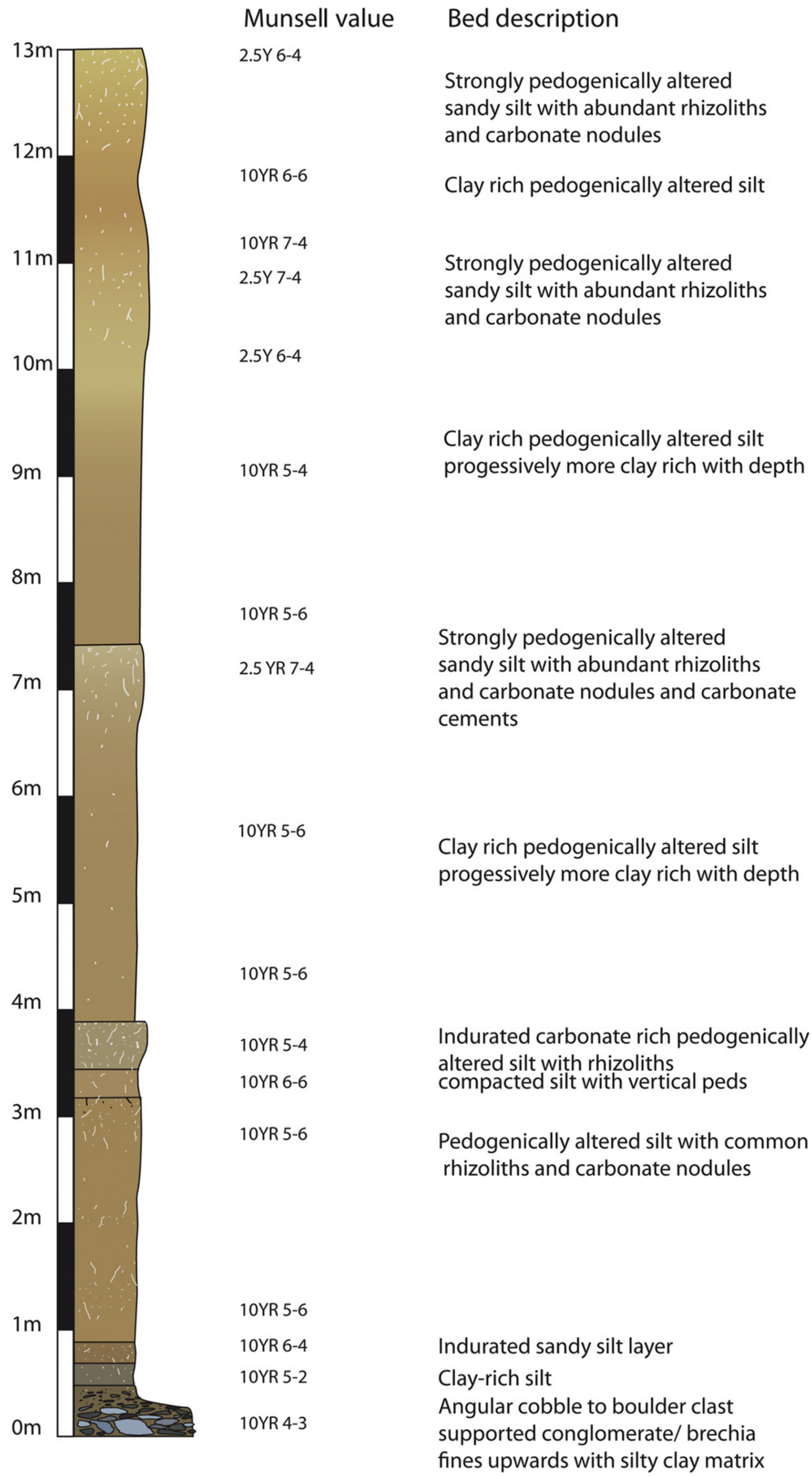

Fig. 5. Sediment log for the Dhaba 1 site.

Table 1
Techno-typological classification of artefacts from the Dhaba 1 excavation.

Classification	Dhaba 1	Dhaba 1%
Discoidal Core	1	0.12
Levallois Core	10	1.16
Multi Platform Core	5	0.58
Single Platform Core	1	0.12
Blade (>5 cm)	11	1.28
Microblade (<5 cm)	8	0.93
Flake	715	83.04
Flaked Piece	55	6.39
Scraper	17	1.97
Notch	17	1.97
Backed	0	0.00
Redirecting	6	0.70

to apparently stratified surface accumulations of limestone Middle Palaeolithic artefacts, with a dense concentration of cryptocrystalline microblade and small flake artefacts higher up in the sequence. Artefacts from the latter two sites are undergoing analysis and will be documented in future reports.

3.4. Sedimentology

The Dhaba sedimentary sequence presented here is based on field observations, including detailed recording of profiles in the three excavated trenches. All Munsell colours are on dry sediment.

Dhaba may broadly be divided into two units: the lower terrace and the upper sediments. The Holocene terrace and adjacent river sands form the margins of the active Son channel and obscure the base of much of the locality. As noted, these are equated with the Khetaunhi formation (Williams et al., 2006). This terrace is formed from a brown (7.5 YR 5/3) basal clay-rich unit (<1 m thick) with pale grey calcrete rhyzoliths, overlain by an unconsolidated reddish brown (5 YR 5/4) sandy unit up to 0.5 m thick. Above this, the remainder of the terrace is formed from a brown (10 YR 5/3) sandy silt, which includes calcrete nodules reworked into discontinuous lenses and occasional sub-angular mudstone cobbles. In places the shale basement is exposed at the junction of the terrace and the higher Middle Palaeolithic-bearing sediments, as well as in erosional gullies, and sub-angular quartzite boulders similar to those seen at the Acheulean quarry are found resting on the shale (for example, at the base of the Dhaba 1 excavation; Fig. 4).

The sediments that form the upper portion of the Dhaba landscape were exposed most extensively by the Dhaba 1 excavation, which covers an elevation range of ~9–22 m above the river sands (Fig. 5). This sequence bears closest resemblance to either the Baghor fine member or the upper (post-Toba) portion of the disputed Khunteli Formation as previously reported (Williams et al., 2006), and includes silts, clays and occasional sands with carbonate formation. The shale revealed at the base of this sequence slopes downwards to the southeast, with subsequent sediment beds deposited relatively horizontally. Calcrete is variably present as both nodules and vertically-oriented inclusions that may result from degraded rhyzoliths, and the upper portions of the Dhaba 1 trench include black mineral granules, likely manganese dioxide. Calcrete abundance and nodule size appears to increase moving up the profile, as do proportions of medium to coarse sand, although these rarely form noticeable lenses. Sub-angular shale fragments and quartz granules are present in varying abundance throughout the sequence, and there are prominent calcrete layers near the top of the section, where calcrete makes up >50% of the sedimentary matrix. It is likely that much of the Dhaba 1 sequence is comprised of stacked palaeosols, with occasional erosional events.

The sediments exposed by the Dhaba 2 excavation cover the elevation range of ~21–28 m above the river sands, extending the sequence seen at Dhaba 1. The Dhaba 3 excavation (~25–30 m) overlaps this range, however there is a large erosional gully separating Dhaba 2 from Dhaba 3 and correlation of their sedimentary sequences is therefore preliminary at this stage. A measure of the rise in basement elevation across the Dhaba site is provided by the fact that the base of the Dhaba 2 trench contacts the shale at around 23–24 m relative elevation, which is some 14 m higher than at the Dhaba 1 site ~300 m to the east-northeast. The lower sedimentary matrix at Dhaba 2 is pale brown (10 YR 6/3) to yellowish brown clay with occasional small (<1 cm) calcrete nodules, and granule-size shale fragments forming lenses. Sequentially above this are pale brown micaceous clays with black mineral inclusions, medium to coarse yellowish brown (10 YR 5/4) calcrete-rich sands, and light yellowish brown (10 YR 6/4) clay with extensive calcrete and a few rounded quartz grains. The uppermost section of Dhaba 2 is formed of micaceous brown (7.5 YR 5/4) to yellowish brown clayey silt, with occasional calcrete nodules up to 4–5 cm in size. Calcrete is concentrated at the base of the pedogenic zone approximately 20 cm from the modern ground surface.

The tallest section exposed at the Dhaba 3 excavation is at its western end, although this did not reach bedrock. The lowermost 1.6 m is comprised of mottled clast-supported clay with sub-angular limestone and angular shale granules. The mottling ranges from yellowish-red (5 YR 4/6) to very pale brown (10 YR 7/3), and includes discontinuous gravel lenses. Above an erosive contact, there is a clast-supported cobble-boulder layer made up of angular and sub-angular limestone, with shale and a light yellowish brown clay matrix. Overlying this is a series of pale brown (10 YR 6/3) to very pale brown clays with decreasing shale and limestone fragment sizes up the profile. Some fine-grained sandstone clasts are also present. The modern ground surface slopes downwards to the east, while the buried layers show a lesser declination in the same direction.

3.5. Lithic technology at Dhaba 1

The lowest excavated levels of Dhaba 1 contain evidence of radial core reduction (Table 1), with occasional removal of Levallois blades (broken $n = 6$, complete $n = 3$; all <5 cm in length), as indicated by radial scar patterns (7.5% of total assemblage) and numerous dihedral and faceted platforms (~20% of the assemblage) on both flakes and blades. Radial cores are typically made on local tabular limestone pieces. Preparatory flake removals from such tabular cores are found in the assemblage in the form of cortical flakes with angular dorsal surfaces (Fig. 3d). A change occurs in the upper layers of Dhaba 1 towards multiplatform flaking, with flakes and cores exhibiting fewer dorsal scars and mostly proximal orientations and a greater use of overhang removal in place of faceting (Fig. 6). There is no evidence of unidirectional cores until around midway through the deposit. Limestone is consistently the dominant raw material throughout the sequence (60–80%), while proportions of cryptocrystalline (chert) stone fluctuate markedly (0–30%). Mudstone and quartz appear late in the sequence. Consistent with surface observations, no evidence of microblade or backed microlith production is found in the Dhaba 1 excavated assemblage. Retouched flakes are all typically Middle Palaeolithic, with a predominance of notches and lightly retouched 'scrapers'.

The Dhaba 1 assemblage bears some typological resemblance to the upper part of the Patpara sequence termed the 'final Acheulean' or 'early Middle Palaeolithic' by Sharma and Clark (1982). The upper Patpara assemblage contains Levallois and radial cores, scrapers and small and large bifaces with greater emphasis on

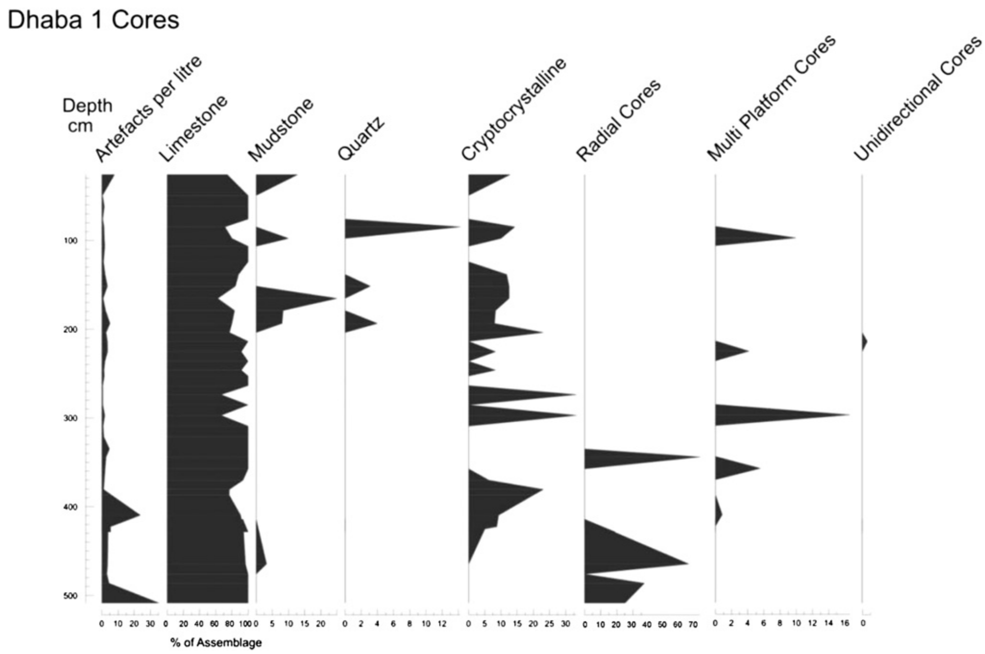

Fig. 6. Core technology and raw materials from Dhaba 1.

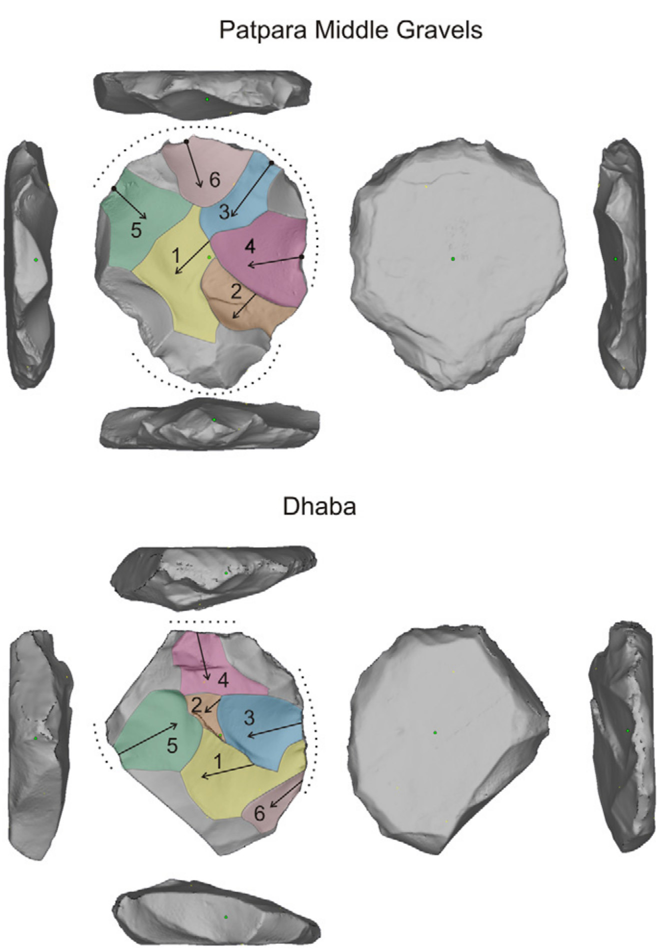

Fig. 7. Cores from the Middle Gravels at the Patpara type-locality (top) and Dhaba 1 (bottom), showing the sequence of recurrent Levallois flaking from one surface of the tabular limestone core in each case.

silicified limestone and cryptocrystalline materials over quartzite. The single large quartzite flake at the base of Dhaba 1 possibly links this assemblage to the final Acheulean at Patpara. Both localities show dominant use of recurrent centripetal Levallois flaking of flat limestone slabs, with only minimal flaking on the lower hemisphere to create steeply faceted platforms with the majority of the underside remaining cortical (Fig. 7). Continued centripetal reduction results in marked thinning of the piece, often resulting in a concave upper removal surface and sometimes breakage of the core when it becomes too thin. The Patpara and Dhaba cores illustrated in Fig. 7 show identical preparation and removal strategies and very similar overall morphology. This approach is evident on around 50% of the cores from Middle Palaeolithic levels at both sites. The remainder of the core assemblages are comprised of multiplatform, recurrent uni-and bidirectional Levallois, and rare preferential Levallois, discoidal and single-platform cores.

The Patpara sequence was recently re-dated by Haslam et al. (2011) to c. 140 ka. Unlike at Patpara, bifacial handaxes and cleavers are absent from the Dhaba 1 assemblage, indicating that either the majority of the sequence post-dates the Acheulean, or that there is functional or occupational variation between the two localities. If Dhaba 1 spans the late Acheulean through to the Middle Palaeolithic, this site would provide a 'missing link' in the Middle Son archaeological record, but absolute dates from the excavated sites are required before such a claim could be verified. Results from OSL and cryptotephra programs currently underway are expected to shed light on any temporal relationships with artefact assemblages elsewhere in the Middle Son Valley.

4. Conclusions

Previous investigations in the Middle Son Valley form one of the most widely-cited research programmes in Indian Palaeolithic archaeology and Late Quaternary sedimentology (Sharma and Clark, 1983; Williams and Clarke, 1984; Williams et al., 2006; Jones and Pal, 2009) The Dhaba locality has seen the first major combined archaeological, sedimentological and geomorphological investigation in this area since the early 1980s, and research at the locality has begun to fill a lacuna in the understanding of Late Pleistocene sedimentary and behavioural development in this region. Survey and excavation at Dhaba have documented one of the few stratified sequences to include all of the major South Asian Late Pleistocene (Late Acheulean, Middle Palaeolithic and microlithic) technological industries, presenting an opportunity to reconstruct and investigate long-term hominin adaptations and replacement.

The stratified lithic assemblages from Dhaba suggest that Middle Palaeolithic occupation of the valley may be distinguished from the Late Acheulean by the absence of bifaces and cleavers in the former, accompanied by distinct raw material and technological changes. Late Acheulean quarrying activity may correlate with similar finds dated to c. 140–125 ka at Bamburi and Patpara (Haslam et al., 2011), which are situated 10 km west and 23 km east of Dhaba respectively. Microlithic production in the Middle Son Valley is not chronologically well-constrained, but at this stage it can be expected to fall into a similar pattern as that found other Indian sites, where microliths occur from late MIS 3 into the Holocene (Possehl, 1994; Petraglia et al., 2009). Tentatively, it is suggested that the Dhaba locality was occupied at least periodically from the terminal Middle Pleistocene through to the Holocene, with the similarity of the Middle Palaeolithic technology at Dhaba 1 to that seen at Patpara placing the evidence from Dhaba 1 towards the earlier end of that temporal spectrum. While the Toba caldera most likely erupted sometime between the first and last occupation of the Dhaba locality, there is currently no direct evidence that the site was occupied close to this ~74 ka event, and speculation on the role of the Dhaba sequence for understanding the effects of that eruption would be premature at this stage.

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