# Supplementary Information

S1. Procedural Units count following Perreault et al (2013): presence /absence at the 3 sites (P/A); Conservative (C) and Non-Conservative (NC) counts per sites. Differences between sites are highlighted in red (they might be just matter of frequency or visibility because some features such as core rotation or bulb thinning occur in very low numbers)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Kara-Bom** | | | | **Kamenka** | | **Tolbor-16** | |
|  | **P/A** | **C** | **NC** | **C** | **NC** | **C** | **NC** |
| **Preliminary step** |  |  |  |  |  |  |  |
| **1. Heat treatment** | No |  |  |  |  |  |  |
| **Core Preparation technique** |  |  |  |  |  |  |  |
| **2. Decortification** | Yes | v | v | v | v | v | v |
| **3. Shaping of platform** | Yes | v | v | v | v | v | v |
| **4. Shaping of flaking surface** | Yes, but… |  | v |  | v |  | v |
| **5. Shaping of non-flaking surface** | Yes | v | v | v | v | v | v |
| **6. Crest/debordant** | Yes | v | v | v | v | v | v |
| **Core shaping technique** |  |  |  |  |  |  |  |
| **7. Hard Hammer** | Yes | v | v | v | v | v | v |
| **8. Soft Hammer** | ? |  |  |  |  |  |  |
| **9. Bipolar** | No |  |  |  |  |  |  |
| **10. Indirect** | No |  |  |  |  |  |  |
| **11. Pressure** | No |  |  |  |  |  |  |
| **12. Pecking** | No |
| **Blank production techniques** |  |  |  |  |  |  |  |
| **13. Hard Hammer** | Yes | v | v | v | v | v | v |
| **14. Soft Hammer** | ? |  |  |  |  |  |  |
| **15. Bipolar** | No |  |  |  |  |  |  |
| **16. Indirect** | No |  |  |  |  |  |  |
| **17. Pressure** | No |  |  |  |  |  |  |
| **18. Ochre** | No |  |  |  |  |  |  |
| **19. Platform treatment: abrasion** | Yes, but… |  | v |  | v |  | v |
| **20. Platform treatment: overhang** | Yes | v | v | v | v | v | v |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **21. Platform treatment: facetted** | Yes | v | v | v | v | v | v |
| **Product shaping** |  |  |  |  |  |  |  |
| **22. Retouched edge** | Yes | v | v | v | v | v | v |
| **23. Backing** | Yes, but… |  | v |  | v |  | v |
| **24. Notching** | Yes | v | v | v | v | v | v |
| **25. Tanging** | No |  |  |  |  |  |  |
| **26. Unifacial retouch** | No |  |  |  |  |  |  |
| **27. Bifacial retouch** | Yes, but… |  | v |  |  | v | v |
| **28. Bulbar thinning** | Yes | v | v |  | v |  | v |
| **29. Grinding** | ? |  |  |  |  |  |  |
| **Core rejuvenation** |  |  |  |  |  |  |  |
| **30. Tablette** | Yes |  | v |  | v |  | v |
| **31. Overshot** | Yes, but… | v | v | v | v | v | v |
| **32. Debordant** | Yes | v | v | v | v | v | v |
| **33. Secondary Crest** | Yes | v | v | v | v | v | v |
| **34. Rotation of the core** | Yes |  |  |  |  | v | v |
| **35. Face shaping** | Yes, but… |  | v |  | v |  | v |
|  |  | **13** | **20** | **13** | **20** | **15** | **21** |

S2 Assemblage-Level Characters following Kuhn and Zwyns (2018) for IUP/Emirehan industries: presence /absence at the 3 sites (P/A)

## Features of IUP/Emiran Industries

**Site Tolbor-16**

**Layer** Pit 4, AH6

**Coordinates**

**Topographic setting**

**Stratigraphic reliability**

**Raw material source**

Intermontane

**Very good**/good/bad/out of context

**Local/20 km**/over 20 km/mixed/unknown

**Workshop Yes**/No

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | **Scoring** | **Comment** |
| **Lithic reduction** | *Blade Core* |  |  |  |
| Flat-faced (A3-A4) | | | v | Exhausted |
| Narrow-faced (A1-A2) | | |  |  |
| Flat + 1 narrow (A5-A10)1 | | | v | Exhausted |
| Flat + 2 narrow2 | | |  |  |
| Posterior crest | | | v |  |
| Prismatic | | | v |  |
| Pyramidal | | |  |  |
| Other | | |  |  |
| *Flake Core* | | |  |  |
| Levallois Centripetal | | |  |  |
| Levallois Preferential | | |  |  |
| Levallois Recurrent | | |  |  |
| Discoid | | |  |  |
|  | | Convergent |  |  |

1 Core asymmetrical in section

2 When flaking surfaces are perpendicular (core is rectangular in cross-section) as opposed to turning or semi- turning cores (circular section).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Other | v | Exhausted, preforms |
| *Blade* | |  |  |
| Unidirectional point/blade | | v |  |
| Bidirectional point/blade | | v |  |
| With orthogonal removals | | v |  |
| Lateral crest/neocrest | | v |  |
| Median crest | |  |  |
| Debordant | | v |  |
| Other | |  |  |
| *Flake* | |  |  |
| Levallois | |  |  |
| Levallois Point | |  |  |
| Debordant | | v |  |
| Bifacial thinning | | v | A few |
| Other | | v | Crest shaping, tablet |
| *Core for small blank* | |  |  |
| prismatic | |  |  |
| carinated core/scraper3 | |  |  |
| carinated burin (B4)4 | |  |  |
| narrow-faced | |  |  |
| truncated-facetted | | v |  |
| burin-core (B1-B3; B5-B7)5 | | v |  |
|  | atypical burin-core6 |  |  |

3 Typologically close to carinated endscrapers, nosed/shouldered endscrapers

4 Transversal flaking surface, perpendicular to the direction of the core blank removal. E.g. B4 is a bladelet core on blade blank.

5 Typical on BC is on blade/laminar flake blank only

6 Similar to BC but on flake, slab, nodule, or undetermined blank

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | prior to blade/point removal7 | v |  |
| Other | | |  |  |
| *Platform* | | |  |  |
| Plain | | | v |  |
| Facetted | | | v |  |
| Overhang facetted | | | v |  |
| Overhang abraded | | | v |  |
| Overhang hammered | | | v |  |
| Lip | | | v |  |
| Small platform (<4mm thick) | | | v |  |
| Other | | |  |  |
| **Tools** | *Retouch tools* |  |  |  |
| Endscraper | | | v |  |
| Convergent scraper | | |  |  |
| Transverse scraper | | | v |  |
| Dejete Scraper | | | v |  |
| Emireh point8 | | |  |  |
| Point/blade with inverse proximal thinning | | |  |  |
| Point/blade with inverse proximal truncation | | | v |  |
| Burin on oblique truncation | | |  |  |
| Perforator (retouched) | | |  |  |
| Blank with lateral notch/stem | | |  |  |
| Tanged pieces | | |  |  |
| Leaf points | | | v | Bifacial preform? |
| *Retouch* | | |  |  |
|  | | Abrupt/backing |  |  |

7 Similar to dorsal trimming

8 Bifacial proximal retouch

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Direct proximal thinning | v |  |
| Inverse proximal thinning | | | v | Kombewa |
| Bifacial proximal thinning | | |  |  |
| Bifacial shaping (preform) | | |  |  |
| Carinate (laminar scars) | | |  |  |
| *Formal Bone tools* | | |  |  |
| Awls | | |  |  |
| Points | | |  |  |
| Needle | | |  |  |
| Retouchoir | | |  |  |
| Others | | |  |  |
| **Others** | *Beads* |  |  |  |
| Perforated shell | | | |  |
| Perforated Animal tooth | | | |  |
| Perforated Stone | | | |  |
| Ostrich eggshell | | | |  |
| Bead blank with natural perforation | | | |  |
| Other | | | |  |

## Features of IUP/Emiran Industries

**Site Kara-Bom**

**Layer** OH5/OH6

**Coordinates**

**Topographic setting**

**Stratigraphic reliability**

**Raw material source**

Intermontane

Very good/**good**/bad/out of context

Local/20 km/**over 20 km**/mixed/unknown

**Workshop Yes**/No

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | **Scoring** | **Comment** |
| **Lithic reduction** | *Blade Core* |  |  |  |
| Flat-faced (A3-A4) | | | v |  |
| Narrow-faced (A1-A2) | | | v |  |
| Flat + 1 narrow (A5-A10)9 | | | v |  |
| Flat + 2 narrow10 | | |  |  |
| Posterior crest | | | v |  |
| Prismatic | | | v |  |
| Pyramidal | | |  |  |
| Other | | |  |  |
| *Flake Core* | | |  |  |
| Levallois Centripetal | | |  |  |
| Levallois Preferential | | |  |  |
| Levallois Recurrent | | |  |  |
|  | | Discoid |  |  |

9 Core asymmetrical in section

10 When flaking surfaces are perpendicular (core is rectangular in cross-section) as opposed to turning or semi- turning cores (circular section).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Convergent |  |  |
| Other | |  |  |
| *Blade* | |  |  |
| Unidirectional point/blade | | v |  |
| Bidirectional point/blade | | v |  |
| With orthogonal removals | | v |  |
| Lateral crest/neocrest | | v |  |
| Median crest | |  |  |
| Debordant | | v |  |
| Other | |  |  |
| *Flake* | |  |  |
| Levallois | |  |  |
| Levallois Point | | v |  |
| Debordant | | v |  |
| Bifacial thinning | | v | A few |
| Other | |  | Tablet |
| *Core for small blank* | |  |  |
| prismatic | |  |  |
| carinated core/scraper11 | |  |  |
| carinated burin (B4)12 | |  |  |
| narrow-faced | | v | Context? |
| truncated-facetted | | v |  |
| burin-core (B1-B3; B5-B7)13 | | v |  |
|  | atypical burin-core14 |  |  |

11 Typologically close to carinated endscrapers, nosed/shouldered endscrapers

12 Transversal flaking surface, perpendicular to the direction of the core blank removal. E.g. B4 is a bladelet core on blade blank.

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14 Similar to BC but on flake, slab, nodule, or undetermined blank

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | prior to blade/point removal15 | v |  |
| Other | | |  |  |
| *Platform* | | |  |  |
| Plain | | | v |  |
| Facetted | | | v |  |
| Overhang facetted | | | v |  |
| Overhang abraded | | | v |  |
| Overhang hammered | | | v |  |
| Lip | | | v |  |
| Small platform (<4mm thick) | | | v |  |
| Other | | |  |  |
| **Tools** | *Retouch tools* |  |  |  |
| Endscraper | | | v |  |
| Convergent scraper | | | v |  |
| Transverse scraper | | |  |  |
| Dejete Scraper | | |  |  |
| Emireh point16 | | |  |  |
| Point/blade with inverse proximal thinning | | | v |  |
| Point/blade with inverse proximal truncation | | | v |  |
| Burin on oblique truncation | | |  |  |
| Perforator (retouched) | | | v |  |
| Blank with lateral notch/stem | | |  |  |
| Tanged pieces | | |  |  |
| Leaf points | | |  |  |
| *Retouch* | | |  |  |
| Abrupt/backing | | | v |  |
|  | | Direct proximal thinning | v |  |

15 Similar to dorsal trimming (cfr. Umm el Tlel)

16 Bifacial proximal retouch

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Inverse proximal thinning | v |  |
| Bifacial proximal thinning | | |  |  |
| Bifacial shaping (preform) | | |  |  |
| Carinate (laminar scars) | | |  |  |
| *Formal Bone tools* | | |  |  |
| Awls | | |  |  |
| Points | | |  |  |
| Needle | | |  |  |
| Retouchoir | | |  |  |
| Others | | |  |  |
| **Others** | *Beads* |  |  |  |
| Perforated shell | | | |  |
|  |  | Perforated Animal tooth | v |  |
| Perforated Stone | | | |  |
| Ostrich eggshell | | | |  |
| Bead blank with natural perforation | | | |  |
|  |  | Other | v | Perforated bone pendant; ochre, exotic rock |

## Features of IUP/Emiran Industries

**Site Kamenka**

**Layer** A-C

**Coordinates**

**Topographic setting**

**Stratigraphic reliability**

**Raw material source**

Intermontane

Very good/**good**/bad/out of context

Local/20 km/**over 20 km**/mixed/unknown

**Workshop Yes**/No

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | **Scoring** | **Comment** |
| **Lithic reduction** | *Blade Core* |  |  |  |
| Flat-faced (A3-A4) | | |  |  |
| Narrow-faced (A1-A2) | | |  |  |
| Flat + 1 narrow (A5-A10)17 | | | v |  |
| Flat + 2 narrow18 | | |  |  |
| Posterior crest | | | v |  |
| Prismatic | | | v |  |
| Pyramidal | | |  |  |
| Other | | |  |  |
| *Flake Core* | | |  |  |
| Levallois Centripetal | | |  |  |
| Levallois Preferential | | |  |  |
| Levallois Recurrent | | |  |  |
|  | | Discoid |  |  |

17 Core asymmetrical in section

18 When flaking surfaces are perpendicular (core is rectangular in cross-section) as opposed to turning or semi- turning cores (circular section).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Convergent |  |  |
| Other | |  |  |
| *Blade* | |  |  |
| Unidirectional point/blade | | v |  |
| Bidirectional point/blade | | v |  |
| With orthogonal removals | | v |  |
| Lateral crest/neocrest | | v |  |
| Median crest | |  |  |
| Debordant | | v |  |
| Other | |  |  |
| *Flake* | |  |  |
| Levallois | |  |  |
| Levallois Point | | v |  |
| Debordant | | v |  |
| Bifacial thinning | | v |  |
| Other | |  |  |
| *Core for small blank* | |  |  |
| prismatic | |  |  |
| carinated core/scraper19 | |  |  |
| carinated burin (B4)20 | |  |  |
| narrow-faced | | v | Context? |
| truncated-facetted | | v |  |
| burin-core (B1-B3; B5-B7)21 | | v |  |
|  | atypical burin-core22 |  |  |

19 Typologically close to carinated endscrapers, nosed/shouldered endscrapers

20 Transversal flaking surface, perpendicular to the direction of the core blank removal. E.g. B4 is a bladelet core on blade blank.

21 Typical on BC is on blade/laminar flake blank only

22 Like BC but on flake, slab, nodule, or undetermined blank

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | prior to blade/point removal23 | v |  |
| Other | | |  |  |
| *Platform* | | |  |  |
| Plain | | | v |  |
| Facetted | | | v |  |
| Overhang facetted | | | v |  |
| Overhang abraded | | | v |  |
| Overhang hammered | | | v |  |
| Lip | | | v |  |
| Small platform (<4mm thick) | | | v |  |
| Other | | |  |  |
| **Tools** | *Retouch tools* |  |  |  |
| Endscraper | | | v |  |
| Convergent scraper | | | v |  |
| Transverse scraper | | |  |  |
| Dejete Scraper | | |  |  |
| Emireh point24 | | |  |  |
| Point/blade with inverse proximal thinning | | |  |  |
| Point/blade with inverse proximal truncation | | | v |  |
| Burin on oblique truncation | | |  |  |
| Perforator (retouched) | | | v |  |
| Blank with lateral notch/stem | | |  |  |
| Tanged pieces | | |  |  |
| Leaf points | | |  |  |
| *Retouch* | | |  |  |
| Abrupt/backing | | | v |  |
|  | | Direct proximal thinning | v |  |

23 Similar to dorsal trimming (cfr. Umm el Tlel)

24 Bifacial proximal retouch

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Inverse proximal thinning | v |  |
| Bifacial proximal thinning | | |  |  |
| Bifacial shaping (preform) | | |  |  |
| Carinate (laminar scars) | | |  |  |
| *Formal Bone tools* | | |  |  |
| Awls | | | v |  |
| Points | | |  |  |
| Needle | | |  |  |
| Retouchoir | | | v |  |
| Others | | |  |  |
| **Others** | *Beads* |  |  |  |
| Perforated shell | | | |  |
| Perforated Animal tooth | | | |  |
|  |  | Perforated Stone | v |  |
| Ostrich eggshell | | | |  |
| Bead blank with natural perforation | | | |  |
|  |  | Other | v | Engraved bone |

## Features of IUP/Emiran Industries

**Site Kara-Bom**

**Layer** OH5/OH6

**Coordinates**

**Topographic setting**

**Stratigraphic reliability**

**Raw material source**

Intermontane

Very good/**good**/bad/out of context

Local/20 km/**over 20 km**/mixed/unknown

**Workshop Yes**/No

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | **Scoring** | **Comment** |
| **Lithic reduction** | *Blade Core* |  |  |  |
| Flat-faced (A3-A4) | | | v |  |
| Narrow-faced (A1-A2) | | | v |  |
| Flat + 1 narrow (A5-A10)25 | | | v |  |
| Flat + 2 narrow26 | | |  |  |
| Posterior crest | | | v |  |
| Prismatic | | | v |  |
| Pyramidal | | |  |  |
| Other | | |  |  |
| *Flake Core* | | |  |  |
| Levallois Centripetal | | |  |  |
| Levallois Preferential | | |  |  |
|  | | Levallois Recurrent |  |  |

25 Core asymmetrical in section

26 When flaking surfaces are perpendicular (core is rectangular in cross-section) as opposed to turning or semi- turning cores (circular section).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Discoid |  |  |
| Convergent | |  |  |
| Other | |  |  |
| *Blade* | |  |  |
| Unidirectional point/blade | | v |  |
| Bidirectional point/blade | | v |  |
| With orthogonal removals | | v |  |
| Lateral crest/neocrest | | v |  |
| Median crest | |  |  |
| Debordant | | v |  |
| Other | |  |  |
| *Flake* | |  |  |
| Levallois | |  |  |
| Levallois Point | | v |  |
| Debordant | | v |  |
| Bifacial thinning | | v | A few |
| Other | |  | Tablet |
| *Core for small blank* | |  |  |
| prismatic | |  |  |
| carinated core/scraper27 | |  |  |
| carinated burin (B4)28 | |  |  |
| narrow-faced | | v | Context? |
| truncated-facetted | | v |  |
|  | burin-core (B1-B3; B5-B7)29 | v |  |

27 Typologically close to carinated endscrapers, nosed/shouldered endscrapers

28 Transversal flaking surface, perpendicular to the direction of the core blank removal. E.g. B4 is a bladelet core on blade blank.

29 Typical on BC is on blade/laminar flake blank only

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | atypical burin-core30 |  |  |
| prior to blade/point removal31 | | | v |  |
| Other | | |  |  |
| *Platform* | | |  |  |
| Plain | | | v |  |
| Facetted | | | v |  |
| Overhang facetted | | | v |  |
| Overhang abraded | | | v |  |
| Overhang hammered | | | v |  |
| Lip | | | v |  |
| Small platform (<4mm thick) | | | v |  |
| Other | | |  |  |
| **Tools** | *Retouch tools* |  |  |  |
| Endscraper | | | v |  |
| Convergent scraper | | | v |  |
| Transverse scraper | | |  |  |
| Dejete Scraper | | |  |  |
| Emireh point32 | | |  |  |
| Point/blade with inverse proximal thinning | | | v |  |
| Point/blade with inverse proximal truncation | | | v |  |
| Burin on oblique truncation | | |  |  |
| Perforator (retouched) | | | v |  |
| Blank with lateral notch/stem | | |  |  |
| Tanged pieces | | |  |  |
| Leaf points | | |  |  |
| *Retouch* | |  |  |  |

30 Similar to BC but on flake, slab, nodule, or undetermined blank

31 Similar to dorsal trimming (cfr. Umm el Tlel)

32 Bifacial proximal retouch

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | Abrupt/backing | v |  |
| Direct proximal thinning | | | v |  |
| Inverse proximal thinning | | | v |  |
| Bifacial proximal thinning | | |  |  |
| Bifacial shaping (preform) | | |  |  |
| Carinate (laminar scars) | | |  |  |
| *Formal Bone tools* | | |  |  |
| Awls | | |  |  |
| Points | | |  |  |
| Needle | | |  |  |
| Retouchoir | | |  |  |
| Others | | |  |  |
| **Others** | *Beads* |  |  |  |
| Perforated shell | | | |  |
|  |  | Perforated Animal tooth | v |  |
| Perforated Stone | | | |  |
| Ostrich eggshell | | | |  |
| Bead blank with natural perforation | | | |  |
|  |  | Other | v | Perforated bone pendant; ochre, exotic rock |

# Core modes used by Kuhn & Zwyns (2018)

