The Middle-to-Upper Palaeolithic
Księcia Józefa open-air Site (Krakow, Poland):
Lithic Technology and Spatial Distribution

by
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The Ksieza Josefa open-air site in Krakow illustrates the time of the latest Middle Palaeolithic (lower layer) and the Earliest Upper Palaeolithic (two upper layers) around 40,000 years ago in Southern Poland. From a behavioural perspective, the Middle and Upper Palaeolithic layers display radical differences rather than transitional traits.

Throughout the whole sequence, activities are dominated by the production of stone artefacts which is documented at both unique preservation and high spatial resolution, thus allowing for intensive refitting of the silex nODULES exploited. If, on the lower occupation surface, every single nodule was really exploited by one (Neanderthal) person at one time, we are facing dozens of episodes representing a wide variety of technical recipes applied by different craftsmen or craftswomen. In the upper layers, lithic recipes changed into patterns usually known as “Upper Palaeolithic” ones, formal tools, however, missing.

The authors opened up one of the most detailed windows into the technological and spatial behaviour at the “time of transition” available at the present moment. The “time of transition” saw the replacement of the latest Neanderthals by the earliest modern humans in Europe – one of the major topics of the Cologne-Bonn-Aachen Collaborative Research Centre (CRC 806) “Our Way to Europe”. Consequently, we are very happy to include the present publication into our series of monographs.

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division of principal activity zone in the western (tools) and eastern (cores) zones. Both zones are connected to the central part of the activity zone. They form a rather compact group. Both unrefitted bidirectional cores and one exhausted core were found together in square D1 (possibly during seasonal activities of the same group) may have introduced visible artefacts into a site structure, either consciously as a result of their own living activities or unintentionally by using artefacts or by ‘cleaning’ the site or unoccupied space.

We can hypothesise that this empty zone was used for purposes without application (production, utilisation) of stone artefacts. Unfortunately, as in all archaeological layers at Księcia Józefa, no organic remnants were preserved here to clarify the role of this empty space. It appears that its clear-cut boundaries were either a principal intensive knapping zone or a refuse area (D2/C2 squares) where the area of highest density of artefacts was recorded. Refitted and unrefitted tools and artefacts were present in the northern part and unrefitted in the southern part (D2/C2 squares). New occupants were unable to attribute the rest, the majority, of the assemblage to a single horizon. The second high-density occupation at Księcia Józefa – layer II – is principally concentrated in a 6 m²area in the western periphery of the scatter. The presence of broken backed knife and notch) cores are concentrated on the western periphery of the scatter. The presence of broken blades strongly support the hypothesis of frozen ground when artefacts were deposited fits well with the important vertical dispersal of artefacts lacking 3D coordinates prevents clarification of spatial organisation of this settlement should be considered. It appears that the vertical perturbations of artefacts do not affect the zone of principal artefact accumulation, about 5 m². All refitted artefacts were found in squares D1 and C1.

The refitting programme resulted in a refitting rate of 90% of blades and bladelets are fragmented (SITlIvy et al. 1999, fig. 4,5). The high-density artefact scatter formed in D2/C2 may be either a principal intensive knapping zone or a refuse area (BORDES’s (1975, 139) definition: “une surface reconnaissable sur laquelle a vécu l’homme paléolithique qui a puister de la position des vestiges quelque temps durant un laps de temps suffisamment court pour qu’on puisse espérer déduire de la position des vestiges quelque chose de son activité.”)

Analysis of refitting distance lines shows some similarity with those of layer III. All classes of distance lines are present, except for very long connection lines (class 5 – 20 – 40 cm) of lithics in some parts of the site (possibly due to post-depositional melting. Very short distance lines (class 1 – 2 cm) and short distance lines (class 2 – 5 cm) are present in all refitted sequences. However, a considerable number of artefacts were not refitted.

The majority of refitted sequences may be evidence of some episodes of longer-duration. They may also reflect the possibility of successive occupations of the site, in which older flint accumulations were uncovered by sediments. New occupants have introduced visible artefacts into a site structure, either consciously as a result of their own living activities or unintentionally by using artefacts or by ‘cleaning’ the site or unoccupied space.

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The objective of systematic refitting of flint artefacts at the Late Middle and Early Upper Palaeolithic assemblages of Księża Józefa was to reconstruct and study the lithic technology and spatial organisation of three different occupation horizons. Despite the short time span of 45–40 ka BP, as determined by AMS dating of charcoal (Sitlivy et al. 2004) or around 40 ka BP by TL of burnt flints (H. Valldadas, pers. comm.), the lithic industries, exploitation of raw materials, site function and spatial organisation of the same excavated space appeared to be very different in the different horizons.

Artefacts from layer I (upper complex) were recovered from the lower and middle parts of Series II (silty muds). The assemblage is not rich (68 flints, or 2714 g of overall weight), but many artefacts were localised in the northern part of the trench. Two cores were also found in this concentration, as well as one notched tool on a flake that could be refitted with a volumetric mixed blade/point core. The rest of the tools were recovered outside of this concentration, evenly distributed throughout the excavated sector. Blade production of Upper Palaeolithic type is documented by the presence of blade blanks, crested blades with two slopes, and the use of soft stone hammer percussion. Tools are rare and non-specific (‘neutral’). One Levallois preferential flake is heavily altered by water and contrasts strongly with the ‘fresh’ assemblage. This complex, characterised by Upper Palaeolithic blade production, some Bohunician influence on core reduction strategy (one incomplete refitted block) and non-characteristic tools, was interpreted as the peripheral or destroyed part of a larger occupation or, more probably, an ephemeral site (Sitlivy et al. 1999; Zięba 2005; Zięba et al. 2008; Sitlivy et al., eds., 2009). An intact knapping area, with a high-density accumulation of chips and small waste, evidences blade/bladelet production activity, which took place next to the hearth. The results of various analyses document the specialised workshop nature of this occupation as well as several short and some longer visits during which exclusively blade core reduction in a limited knapping zone took place.

The high-density artefact scatter found in squares D2/C2 may be either a permanent knapping post or refuse dump where waste from previous flaking activities was deposited. In this scatter, artefacts from all of the reconstructed blocks are present. In fact, using the knapping post classification identified at Pincevent (Bodu et al. 1990) – a multifunctional post is defined as permanent, stable, with in situ refuse next to a hearth; this corresponding to one knapping event (idem, 146) – might fit this scatter to a certain extent (keeping in mind the specialised workshop character of layer II at Księża Józefa). Thus, an additional term as ‘permanent specialized knapping post’ might be a better interpretation of this concentration.

Characteristic small compact and small semi-circular and circular clusters with short and very short distance lines strongly support intensive flaking activity during several short-term visits/work sessions. Medium and long distance lines are present in the majority of refitted production sequences and may support the hypothesis of some longer stay episodes. They may also reflect a scenario of successive occupations of the site, during which older lithic accumulations were uncovered by sediments. Then, new inhabitants (possibly during seasonal activities of the same group) may have introduced visible artefacts into the existing site structure, either intentionally by using artefacts or by ‘cleaning’ the site or unconsciously simply by the living activities carried out.

This occupation differs significantly from the uppermost one in that it has a clear, compact high-density zone (about 6 m² out of the 80 m² excavated trench) which yielded medium-sized/small narrow blades (length rarely
exceeds 100 mm), including bladelets mostly destined for exportation (complete blades are often irregular and account for only 10.5 %). The industry includes 2189 pieces of local flaked flint and 5 small abrading pebbles of overall weight of about 7681 g (2575 g or 33.5 % of the flint volume was reconstructed with a refitting rate of around 27.7 %, calculated from all flaked flints bigger than 2 cm). Abundant macro- and micro-waste, crested removals, tablets, failed laminar blanks or blanks broken during debitage, 13 cores (6 reconstructed and 7 unreftitted, including burnt, exhausted and fragmented) contrast with the modest tool-kit (rare non-specific isolated tools/used blanks) and especially with the absence of knapping implements – hammerstones (notwithstanding clear evidence for the stone hammer percussion technique) which were taken away by the flintknappers.

Long sequences of blade core reduction, containing ‘technological gaps’ during knapping, were identified after refitting. It appears that both on-site and off-site core decoration/shaping took place. Refitting indicates only four cases of in situ cortex removal and on-site reduction of nodules. Also, the incompleteness of full debitage stages supports the hypothesis of blank selection and blade transportation. Very long sequences, based on large nodule reduction, and much shorter technological chains, using rather small nodules, fragments and flakes, have been reconstructed. The general assemblage composition, blank to core ratio (44:1) and blade to core ratio (26:1) support an interpretation of productivity. Except for two large semi-complete refitted blocks, blade production was not ‘exhaustive’, being often based on frontal and partially turned reduction of mid-sized/small nodules, fragments and flakes. The final stage – exhausted cores – was represented by only two unreftitted items. Abandoned cores (reconstructed or not) were still rather large and could still have been used, given the volume remaining. Reduction was terminated because of hinge fractures and rarely because of crystal inclusions in the raw material. Other cores do not display any technical accidents or failures, and blade production on these cores was intentionally terminated during initial or full debitage stages (production only of blades needed?).

Finally, abundant macro-waste (various crests, tablets, flanks) and micro-debris (chips of faceting and core reduction, tiny pieces of abrading), the quality of some abandoned blades (intact, fragmented or reconstructed) and especially refits document the careful preparation and maintenance of debitage as well as a generally good level of knapping skill. Rather standard uni-/bidirectional reduction methods of Upper Palaeolithic type were used. Employ-
(22,362 pieces with an overall weight of about 328,514 kg) made it possible to reconstruct knapping processes with a rather high rate of ca. 26% (including all types of breaks) and a weight of about 124,979 kg for all conjoined pieces (i.e., 38% of the overall flint mass). The general lithic artefact composition, a high (31:1) blank to core ratio and the large number of refitted production sequences, modifications, and breaks suggest on-site core reduction as well as production and use of tools. Flint outcrops are local, but not directly at the site.

The tool kit has similar proportions of simple scrapers, notches, and retouched flakes, which were accompanied by raclettes, natural and retouched backed knives, denticulates and rare endscrapers. Retouch is non-invasive, light, and often marginal or of the raclette type. A number of tools have been reconstructed and recovered from broken or questionable pieces (e.g. scrapers on butts/debordant edges) due to refitting. In situ production of large sidescrapers or e.g. an angled denticulate (+ chips of retouching) on a large plunging flake was recorded. Smaller blanks (except for raclettes) were often used directly as ad hoc tools (‘light’ tools), with non-invasive discontinuous retouch. Some of these (e.g. notches, irregularly retouched pieces) may also show pseudo-retouch due to mechanical pressure or contact between flints during knapping (artefacts falling on others) or afterwards (working on them, trampling), for example. However, several experiments with this flint applying different mechanical impacts resulted in no continuous or raclette type retouch.

The high-density character of layer III, where some square metres yielded more than 1000 artefacts (another contained 2618 lithic pieces) inevitably formed vertical compact clusters in several zones of the site. In these cases, the creation of a palimpsest, as a result of multiple occupations of a site, becomes extremely likely. On the other hand, cleaning of the palaeo-surface by the same knappers or by newcomers cannot be rejected. Also, after spatial analysis, the presence of anthropogenic structures has been identified: several pits (mostly in the western part of the excavated area). These were filled up with artefacts, either refitted or fied: several pits (mostly in the western part of the excavated area). These were filled up with artefacts, either refitted or afterwards (working on them, trampling), for example. However, several experiments with this flint applying different mechanical impacts resulted in no continuous or raclette type retouch.

Analysis of the vertical distribution of refits reveals a complex phenomenon, in which high artefact density and rather considerable thickness of archaeological layer were combined with interstratification of the reconstructed blocks, often displaying overlapping of refitted artefacts belonging to different chaînes opératoires. Establishing the linear chronology/succession/evolution of reconstructed knapping methods found in layer III, on the basis of vertical distribution of refitted artefacts alone was not possible (if of course, such a chronology existed). In fact, we do not now who the first humans of the site were: responsible for many ‘crude’ polyhedral/discoidal remnants or producers of some blades or Levallois points. Regular succession or chronological order could not be confirmed. The general picture shows sandwiching of individual production sequences. For example, polyhedral and discoidal refits appear at the basal, middle and upper parts of layer III across the entire excavated surface. In some areas, other reconstructed blocks display different successions and vertical patterns of lithic technologies (see Chapter 4). Apparently, we can determine only zonal technological successions (refit microstratigraphy). Line-by-line analysis of vertical distribution for the refitted blocks indicates that we should analyse intra-block stratigraphy on a case by case basis. For instance, in squares K-4 and L-4, a sequence of refitted blocks can be easily followed. At the base, there is an orthogonal block, overlain by a few artefacts resulting from tool recycling sequences and blocks with unidirectional, discoidal and blade production sequences. All of these individual refits are overlain by polyhedral blocks. Seemingly, flintknappers belonging to one group/tradition were responsible for the entire technological mosaic at this site. Otherwise, we must accept the hypothesis that representatives of different ‘technological schools’ equally shared this space.

On the other hand, judging from the horizontal distribution maps, the high degree of well-preserved scatter of different shapes and sizes (resulting from 67% of complete and semi-complete reconstructed blocks) attests to the primary position of these artefacts. Moreover, distance between the elements of each scatter can also be used to interpret the position of the knapper during the working session. Gilead & Fabian (1990) argue that a sitting person would produce a very tight and small cluster, while standing knappers would create a much more diffused flint concentration (see Fig. 5.2: blocks 28 and 37). The majority of clusters in layer III evidence that the knapper was sitting or kneeling. Also, it seems possible for some of the bigger semi-circular and circular clusters (diameter >30 cm) to identify the probable working place where the knapper was sitting or kneeling (Figs. 5.1: 5.2) (see also in Chapter 2 e.g. polyhedral blocks: 36, 46, 60, 83, 292+174+70; discoidal 30; unidirectional: 20, 43, 81, 162, 198; bidirectional: 197, 298).

Another outstanding feature of this site is intensive fire use, shown by the presence of 29 hearths of different types connected to various degrees of flint heating and burning. It would appear that several models of hearth function were...
employed: (a) after extinguishing a fire, knapping activity took place on the same spot (hearths contain fresh artefacts); (b) hearths functioned simultaneously with flaking sessions (hearths of different types); (c) hearths were installed in the knapping area after the conclusion of certain activities (abundant burnt material) (Zięba 2005; Zięba et al. 2008b; Sitlivy et al. 2009b). These models also support recurrent exploitation of the space. Mapping of refitted artefacts brings additional understanding of the overall site structure. Even if we consider layer III to be a palimpsest of several successive shorter or longer visits, fire appeared to be used only on the periphery of the zone with the richest artefact accumulations and where technological variability of refitted blocks was greater. The presence of hearth zones is also easily recognisable on maps with vertical artefact distribution in the form of ‘wavy’ profiles.

Several flint knapping areas have already been recorded, varying in size, density, composition, and type of activity (debitage, tool production posts, raw material reserve, burnt artefact clusters, or combinations of these types of accumulations). Refitting and spatial studies of stone artefacts presented in this monograph permit description and interpretation of some of the lithic clusters.

Non-diagnostic clusters: low refitting rate, incomplete reduction sequences, missing pieces contrasting with abundant debitage products, waste and cores. Cleaning, natural perturbations and excavation/refitting limits could not always explain such composition of these features. Possible explanations might be related to longer artefact life-histories including group and/or individual behaviour of flintknappers, accompanying persons and other visitors.

Permanent multifunctional posts are clusters which are characterised by: 1) occurrence in high-density zones; 2) different activities; 3) great variability of production sequences; 4) blank modification/tool production; 5) generally long operational chains (combined and composite reduction sequences: especially polyhedral, discoidal, Levallois, some blade, uni-/bidirectional) accompanied by short reduction; 6) stable, in situ refuse/lithics next to a hearth; 7) some cases of site cleaning/caches (pits); and 8) a usually high refitting rate.

Occasional posts are characterised by: 1) appearing in both zones of low (periphery) and high density (main knapping areas); 2) short reduction sequences; 3) rather complete reconstruction reflecting one rapid knapping event (testing of raw material, flake reduction/Kombewa, tool production and accidents).

The data collected reflect the complicated, non-trivial nature of raw material exploitation, technological behaviour, and site function in comparison with other Middle Palaeolithic occupations known in this region. A high degree of technological variability in the layer III assemblage, the combination of overlapped knapping methods and using both economical and wasteful production strategies (Zięba et al. 2008b; Sitlivy et al. 2009a) seem to have more than only ‘cultural’ or chronological meaning. Indeed, dur-
ing this time span (ca. 40 or 40/45 ka BP) and not only in the Kraków area and across the broader territories of Europe, such co-occurrence and fusion of production chains reconstructed by refitting is still unusual. It might be reasonable to attempt to analyse such a technological mosaic at this site in terms of variability of individual technical behaviour (e.g. BODU et al. 1990). We do not expect to attain such impressive results and ‘idyllic’ episodes as have been proposed for several Late Upper Palaeolithic settlements (e.g. Pincevent, Etiolles). Nevertheless, the capacity of layer III (state of site preservation) and reconstruction potential makes it possible to distinguish different levels of flintknapping mastery based on the same local raw material which was used in later prehistoric periods. For example, on one hand, we are dealing with many (if not 100 %) failed attempts to produce Levallois points by both Middle Palaeolithic and Early Upper Palaeolithic Bohunician methods (using mediocre and good flint) and on the other hand, ‘professional’ manipulation of large nodules in order to obtain the needed quantity of blades (as elaborate as in layer II). Flaking accidents are a trivial matter when studying a rich debitage assemblage. However, these accidents/mistakes occurred too often in layer III: extremely abundant hinges, Siret breaks, double and triple bulbs evidencing violent blows and traces of smashing; broken well retouched tools during careless re-sharpening, etc. All of these facts, together with the dominant position of unusual/’archaic’ polyhedral knapping over a number of various blank production systems put us in the rather uncomfortable situation of interpreting them in terms of a unique local ‘tradition’/’culture’. In many cases in layer III, we are dealing with results of working activities of different individuals with different technological skills: ‘experts’, ‘failures’ or ‘beginners’. It seems that long reduction by constant turning of initial raw material in order to change flaking surfaces (independent or combined polyhedral reduction sequences) producing many different blanks (often only large cortical flakes were carefully modified by regular scalar retouch) may have had a training purpose of less experienced persons. Some other refits may display careless flaking with abundant formless blanks or imitation resulting in some anecdotic refits (e.g. block 27 with polyhedral reduction of originally micro nodule into tiny cube with final ‘baby’ crest obtained). Looking at individual behaviour in this assemblage, we might to a certain extent also explain the huge technological gap between standardised blade manufacturing of overlying Early Upper Palaeolithic non-Aurignacian layer II and the mosaic of methods and failed attempts in blank production in lowermost Late Middle Palaeolithic layer III. In several cases, it is difficult to explain such considerable technological change in stone knapping within the short time span of several thousand years, or probably less (even trusting a rapid transition scenario after JORIS & STREET 2008) exclusively by the cumulative process of technical development or techno/typological variability, or again population replacement.

Technological and typological variability, as well as comparative analysis of artefact attributes and the origin of Late Middle Palaeolithic and Early Upper Palaeolithic industries of Kraków region have been discussed in a number of publications (ZIĘBA 2005; SITLIVY & ZIĘBA 2006; 2008; 2009; SITLIVY et al. 2006; 2009b). Taking into consideration the different site ‘nature’ and often incomparable data, an Early/Initial Upper Palaeolithic attribution of the two uppermost layers I and II is acceptable. However, a core reduction in layer I (failed attempt of the combined blade/point method similar to Boker Tachtit, layer I or the fusion manner of the Bohunician) differs from the exclusive laminar chaînes opératoires used in layer II where cores were flaked strictly in parallel (carefully prepared and maintained unidirectional and especially bidirectional methods, including bladelet production from the narrow part of cores-on-flake similar to the Chatelperronian pattern at Roc-de-Combe, layer 8) or burin-like core reduction of broader regions: e.g. early Kozarnikien, layer VII (TSANOVA 2008) or Baradostian of the Zagros (TSANOVA et al. 2012). Thus, the layers I and II assemblages may express certain technological variability in the framework of the Early Upper Palaeolithic complex regardless of by whom they were made: ‘experts’ or ‘failures’.

As for the layer III assemblage, it is easier to establish differences with other industries rather than to find similarities. Another question is of much importance: did any technological links exist with the two uppermost layers at Księża Józefa? Domination of Middle Palaeolithic approaches in lowermost layer III is unquestionable with respect to lithic technology, blank production techniques and tool production. However, some innovations become evident when studying the many refits. Levallois points resulted from different reduction sequences representing at least three methods. One option was based on cores with convergent unidirectional preparation in order to produce one or at maximum two target point(s) per wide working surface – linear model. The same result (one or two short broad-based point[s] or laminar point/point-blade) could be obtained during mixed (with blade direct or prepared by crest) core reduction on initial or final stages of technological chains: similar to the Bohunician (SVOBODA & SKRDLA 1995) and Boker Tachtit, layer I (MARKS & VOLKMAN 1983) technological trend, or again to failed reduction in layer I at Księża Józefa.

Other refitted blocks with parallel uni-/bidirectional reduction sequences document the use of several methods with different modes destined for flake, flake/blade and blade production of Middle Palaeolithic, Upper Palaeolithic...
type or their mixing. Both uni-/bidirectional debitage was often unprepared (contra usual crest installation in layer II). Blade production was confirmed by reconstruction of one fusion refit with a narrow-faced blade episode and two independent reduction sequences representing unidirectional turned and partially turned modes. The latter has a very long reduction chain (large initial blank) with opportunistic use of a natural crest and shows a Upper Palaeolithic type of blade production resulting in high quality elongated narrow blades (many were exported and one in situ selected narrow blade was transformed into raclette/बैकेड किन्ज). Also, the unidirectional prepared (by lateral crests) partially turned method is documented by two different refitted blocks resulting in flakes and blades. One was based on core-on-flake reduction with initial lateral crest installation, unidirectional exploitation of the narrow slice, crest re-preparation and extension of blade-bladelet debitage to the wide ventral face (possible technological link with bidirectional bladelet Chatelperronian type core-on-flake/burin-like reduction in layer II?). Typical bidirectional knapping in layer II was also reconstructed in underlying layer III. The bidirectional prepared partially turned method is represented by one refit and differs from more numerous blocks with partially turned longitudinal wide-faced and narrow-faced unprepared reduction from the same layer by core narrowing and lateral crest installation during the full debitage phase. Some blades were also produced from a long combined reduction of block 162 (fusion of unprepared, firstly unidirectional longitudinal partially turned flaking with secondly bidirectional transversally turned debitage after core breakage), which resulted in a carinated core of à museau type (interesting resemblance with the Aurignacian reduction model after Le Brun-Ricalens 2005).

In sum, then, parallel uni-/bidirectional reconstructed sequences in layer III produced more flakes than blades. However, several refits with unidirectional partly turned exploitation evidence the existence of a clear Upper Palaeolithic model for blade production based on long (nodule) or short (narrow core-on-flake) reduction sequences similar to the future exclusive laminar production in layer II.

Curiously, most crested removals recovered in layer III (expected fossile directeur of Upper Palaeolithic blade production) were refitted with polyhedral and even with some discoidal cores at different reduction stages. Thus, blade production in this assemblage after refitting became much less ‘crested’, however, Upper Palaeolithic laminar ‘habits’ were confirmed by clear reconstructed production sequences. We have the impression that dominant wasteful ‘crude’/‘archaic’ polyhedral flaking, resulting in volumetric cubic/polyhedral cores, numerous flakes, some blades (about 10%) and technical removals (Upper Palaeolithic crests and double/triple débordants), may be related to blade production (e.g. apprenticing).

Finally, using all of the available data, and especially analysis of the rich reconstructed material, some of the technological links between the three very different assemblages at Księcia Józefa have become more visible.