

# Kamenje govori: Šandalja u svjetlu litičke tehnologije

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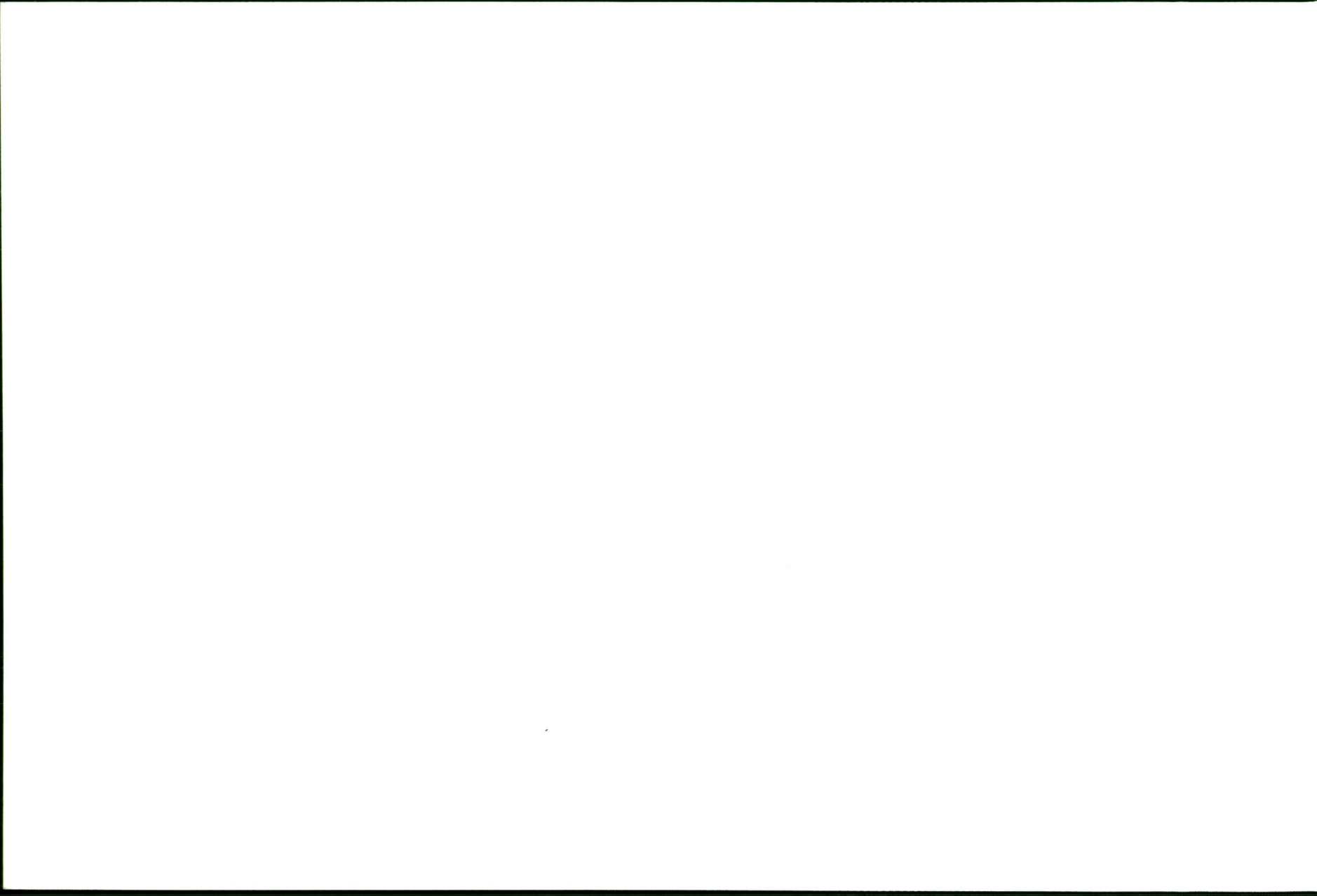
KAMENJE GOVORI STONES THAT SPEAK

ŠANDALJA U SVJETLU LITIČKE TEHNOLOGIJE

ŠANDALJA IN THE LIGHT OF LITHIC  
TECHNOLOGY

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Tools (hard and soft hammer) and raw materials for the manufacture of tools

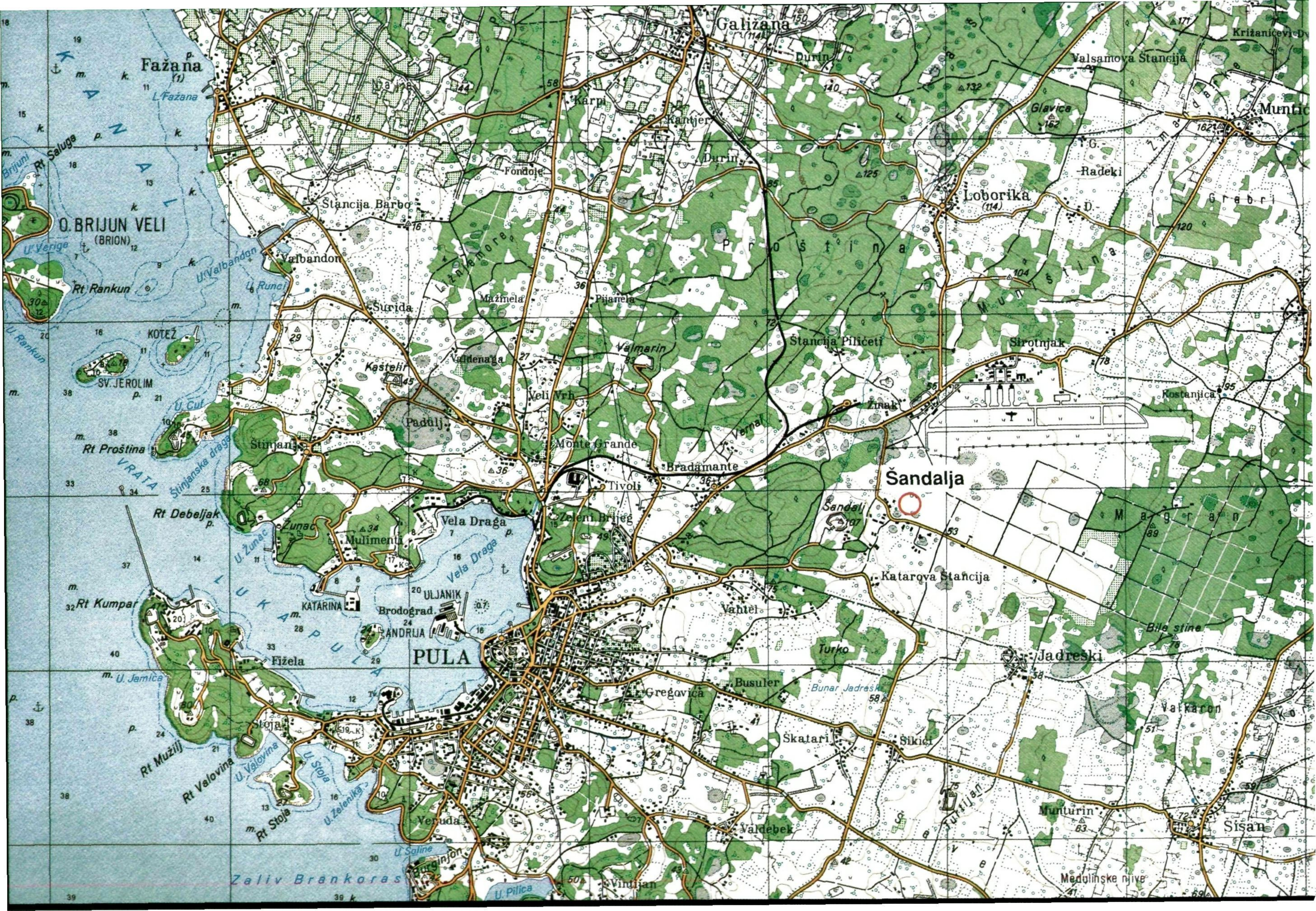
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IVOR KARAVANIĆ - JACQUELINE BALEN



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Pećinski sustav Šandalja (*S. Daniele*) kraj Pule, svrstava se, zajedno s nalazištima na Čićariji i Romualdovom pećinom na Limskom kanalu, u izuzetno značajna nalazišta starijeg kamenog doba Istre. Bogatstvom kamenog i osteološkog materijala Šandalja je vjerojatno najzapaženije nalazište gornjeg paleolitika u Hrvatskoj. Posebno je međutim, istraživačima i zaljubljenicima privlačna i izazovna mogućnost, da je zbog pronalaska kamene alatke Šandalja I uvjetno i jedno od najstarijih ljudskih boravišta u Europi.

Izložba "Kamenje govori" s posebnim prikazom prapovijesnog lokaliteta Šandalja u svjetlu litičkih nalaza obnovljen je i proširen izvorni postav "Dogadanje pret-povijesti - eksperimentom u kameno doba", što su ga 1996. g. priredili Arheološki muzej u Zagrebu i Arheološki zavod Filozofskog fakulteta Sveučilišta u Zagrebu.

Značaj prikaza eksperimentalne metode u suvremenoj arheološkoj znanosti je u vjerodostojnoj provjeri stručne interpretacije, koristeći, u ovom slučaju, izvorni materijal i tehnike iz prapovijesti. Kako je tehnološka analiza osnova za proučavanje kulturnog razvoja u razdoblju starijeg kamenog doba, ona je u izložbi naglašena usporednim prikazom originalnog kamenog materijala i oruda nastalih u procesu eksperimenata.

Izložen je litički materijal iz razdoblja paleolitika i neolitika s nekoliko najznačajnijih nalazišta na području Hrvatske. Kamene alatke naglašavaju vremenski slijed od

The Šandalja (*S. Daniele*) cave system, located in the vicinity of Pula, is ranked, together with sites in Čićarija and with Romuald's cave on the Lim Channel, amongst the most important sites from the Older Stone Age period in Istria. In particular as far as the richness of lithic and osteological materials is concerned, Šandalja probably represents the single most prominent site from the Upper Paleolithic in Croatia. The possibility that on account of the discovery of a stone tool, Šandalja I also perhaps represents one of the oldest known dwelling-places of man in Europe, is on the other hand, particularly attractive and challenging to explorers and enthusiasts alike.

The exhibition "Stones That Speak", in which a particular accent was placed upon the presentation of the prehistoric locality of Šandalja in the light of lithic finds, served to revive and broaden the original exhibition "Events From Prehistory - Experimenting Our Way Into the Stone Age", organised by the Archaeological Museum in Zagreb and the Department of Archaeology at the Faculty of Arts, Zagreb University, in 1996.

The significance attached to the display of an experimental method in modern archaeological science lies in a credible verification of expert interpretation, using in this case the original materials and techniques from prehistory. As technological analysis represents the backbone for the study of cultural development in the Older Stone Age period, in the exhibition an emphasis was laid upon the parallel presentation of original lithic materials and tools manufactured during the experiment.

The exhibited lithic material from the Paleolithic and Neolithic periods stems from some of the most important localities on the territory of



one najstarije iz Šandalje I (sjekač iz donjeg paleolitika), preko slavni ostataka iz Krapine, Vindije i Veternice (musterijenska strugala i šiljci), pa do nalaza iz Šandalje II (gornjepaleolitički artefakti). Od ljudskih osteoloških vrijednosti istaknuti su prikazi lubanja izvornih stvaralaca litičke industrije, a to su arhaični *Homo sapiens*, zatim njegov nasljednik neandertalac, te rani današnji čovjek (*Homo sapiens sapiens*).

Slikovnost izložbe u predočavanju života ovih pradavnih vremena ljudskog života u pećinama postiže se ilustracijama rekonstrukcija izgleda prapovijesnih ljudi, te opisa njihovih tehnoloških dostignuća izrade i načina korištenja raznih alatki. Otvaranje izložbe je oplemenjeno demonstracijom izradbe i upotrebe paleolitičkog oruda (dr. I. Karavanić) i video projekcijom djelovanja francuskih stručnjaka, koji odabiru sirovinski materijal u prirodi, eksperimentalno izrađuju i upotrebljavaju alatke "iz starijeg kamenog doba". Posebnost izložbe u Puli je neposredna demonstracija prapočetaka ljudske duhovnosti i načina pećinskog života u obliku živih eksponata domaćih eksperimentalnih stvaralaca (Branko Gulin, Pino Ivančić).

Ovom prilikom naročito se zahvaljujemo na razumijevanju pri suradnji: Arheološkom muzeju u Zagrebu - ravnatelju prof. Anti Rendiću - Miočeviću i prof. Dubravki Balen, voditeljici Prapovijesnog odjela, te autorici prof. Jacqueline Balen i Arheološki zavod Filozofskog fakulteta Sveučilišta u Zagrebu - autoru dr. Ivoru Karavaniću.

Uspješna izložbena suradnja je istovremeno i poticaj za promišljanje o budućnosti lokaliteta. Temeljica pravne zaštite je u obnovi procedure upisa u registar spomeničkog područja pri Upravi za zaštitu kulturne baštine.

Croatia. Stone tools and arms accentuate temporal continuity, beginning with the oldest implement from Šandalja I (a chopper from the Lower Paleolithic period), followed by famous remains from Krapina, Vindija and Veternica (sidescrapers and points from the Mousterian culture), to the finds from Šandalja II (artefacts from the Upper Paleolithic period). Prominent among human osteological finds are skulls (a single original skull and plaster castings) pertaining to the original creators of lithic industry - archaic *Homo sapiens*, followed by his successor Neanderthal man, and early modern man (*Homo sapiens sapiens*).

The pictorial effect of this exhibition in the presentation of life in these primeval times of human presence in caves is attained by means of illustrations reconstructing the appearance of prehistoric man, and by describing their technological achievements in conjunction with the manufacture and usage of different tools. The exhibition opening has been upgraded by a demonstration of the manufacturing techniques and modes of usage of Paleolithic tools (Dr. I. Karavanić), and a video showing French experts at work, collecting raw materials out in the open, and experimentally manufacturing as well as using tools "from the Older Stone Age". A particularity linked to the exhibition in Pula is a direct demonstration of the primeval beginnings of human spirituality and of the ways life was conducted in caves, in the form of living exhibits from local experimental authors (Branko Gulin, Pino Ivančić). On this occasion we would like to express our most profound gratitude to the Archaeological Museum in Zagreb - headed by Professor Ante Rendić-Miočević, to Professor Dubravka Balen - who heads the Department of Prehistory at that Museum, to Professor Jacqueline Balen - one of the authors of this exhibition, and to the Department of Archaeology at the Faculty of Arts, Zagreb University, represented by Dr. Ivor Karavanić - also an author of this exhibition, for their sheer boundless patience shown while collaborating in conjunction with the preparation of this project.

U sklopu eksploatacije neposrednog vapnenačkog kamenoloma u sastavu Otvorenog kaznenog zavoda Valtura - Pula potrebno je osigurati preduvjete za otkriće novih pećina te urediti prilaze za siguran i atraktivan pristup posjetilaca.

Najznačajniji dijelovi arheološke zbirke s lokaliteta, danas su pohranjeni pri Zavodu za paleontologiju i geologiju kvartara HAZU, te se za posudbu izložbenog materijala posebno zahvaljujemo dr. Maji Paunović. Stoga se može predvidjeti mogućnost izrade proširenja prikaza Šandalje pri Arheološkom muzeju Istre ili izazov pripreme projekta muzealizacije zbirke uz samo nalazište.

Osim nesumnjivo izuzetne vrijednosti danas urušenih fosilnih spilja, višeslojnost lokaliteta izražena je podatkom o uništenju gradinskog naselja i nekropole (brončano i željezno doba), antičkog kamenoloma i srednjovjekovne crkvice, prilikom i nakon gradnje obližnje austrijske utvrde (1884.). Stoga je eventualno stvaranje arheološkog parka blizu izvorne pećinske lokacije, na putu prema poznatom arheološkom parku Nezakciju, moguća smjernica u svjetlu stručno-znanstvene, pedagoško-promidžbene i turističke valorizacije Šandalje.

The successful co-operation in the mounting of this exhibition is likewise an impetus for deliberations dealing with the future of this locality. The basis for legal protection of this site lies in the renewal of the registration procedure for entry into the regional list of monuments of the Agency for the Protection of Cultural and Natural Heritage. Prerequisites for the discovery of new caves must be provided for, and safe and attractive access for visitors must be arranged within the framework set by the exploitation of the limestone quarry, located in close proximity, and run by the Open Penitentiary of Valtura - Pula.

The most important parts of the archaeological collection from this site are nowadays located at the Institute for Palaeontology and Quaternary Geology, Croatian Academy of Sciences and Arts, and we take this opportunity to express our sincere thanks to Dr. Maja Paunović, for kindly lending us the materials exhibited. It is hence feasible to envisage either a possibility for an extension of the display covering Šandalja at the Archaeological Museum of Istria, or a challenge in conjunction with the preparation of a permanent exhibition of the collection on the site itself.

Except for the undeniably exceptional value of the nowadays fallen-in fossil caves, the multi-layeredness of the locality is also revealed by information about the destruction of a hillfort settlement and necropolis (Bronze and Iron Age), of a Roman quarry and mediaeval church, during and after the erection of a nearby Austrian fortification (1884). That is why the eventual creation of an archaeological park in the vicinity of the original cave locality, situated on the road leading towards the well-known archaeological park of Nesactium, represents a possible guideline in the light of a professional-scientific, pedagogical-promotional, and tourist valorisation of Šandalja.

Željko Ujčić  
Ravnatelj - Director



## Zašto analiziramo kamene rukotvorine?

Izrada i korištenje kamenih alatki zasigurno zauzima posebno mjesto u povijesti ljudskog roda. Može se reći da je prvi tehnološki iskorak čovječanstva učinjen izradom prvih alatki što se zbilo na afričkom tlu. Od tada pa do odlaska čovjeka na Mjesec, široke primjene računala, interneta i ostalih dostignuća današnjeg vremena prošlo je približno 2,5 milijuna godina. Kroz cijelo to razdoblje čovječanstvo nije potpuno odbacilo prapovijesne načine izrade kamenih alatki. Njihova izrada na tlu Europe stara je približno 900.000 godina. Prvi stanovnici sjevernoameričkog kontinenta, tzv. Paleoindijanci izrađivali su kameno oruđe prije 11.000 godina, a ceremonijalne vrhove kopalja, koji imaju formu skulptura s ljudskim likovima, Maje su okresali prije više od 1.200 godina. Još prije desetak godina urođenici Nove Gvineje izrađivali su i razmje-njivali kamene sjekire koristeći se prapovijesnim načinima obrade kamena a ta tradicija možda još uvijek nije potpuno izumrla (Schick & Toth 1994.).

Arheolozi danas detaljno analiziraju prapovijesne kamene alatke, kao i otpadne proizvode nastale njihovom izradom što omogućuje rekonstrukciju cjelovitog procesa proizvodnje samih alatki. Ipak, krajnji ciljevi litičke analize znatno su širi i kompleksniji. Oni mogu obuhvaćati spoznaju promjena i inovacija unutar litičke tehnologije tijekom vremena te utjecaj tih promjena na svakodnevni život čovjeka, sagledavanje stupnja ovladavanja određenom psihomotoričkom vještinom te pokušaj isčitavanja socijalnih odnosa različitih prapovijesnih populacija ili grupa.

Međutim, sam arheološki materijal često nije dovoljan za rješavanje i postizanje tako ambicioznih zadataka. Na

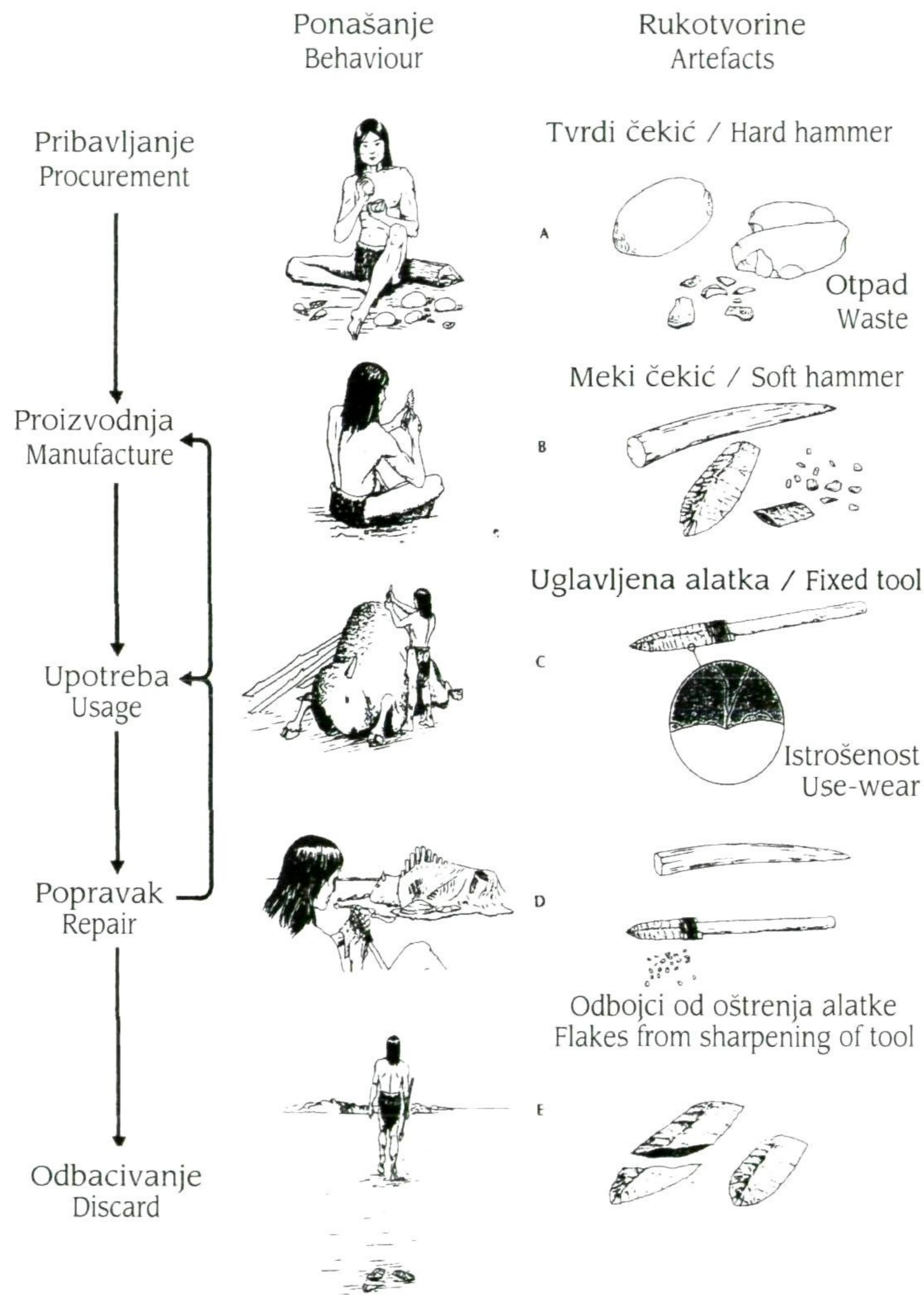
## Why is it that we analyse stone artefacts?

The manufacture and use of stone tools undoubtedly occupies a prominent position in the history of mankind. One could say that the manufacture of the first tools represents the first technological step that mankind made, and that took place on African soil. A time span of roughly 2.5 million years elapsed between those times and the landing of man on the moon, the widespread use of computer appliances, the internet, and other accomplishments that are synonymous with modern times. Throughout this whole period mankind had not completely discarded the prehistoric methods employed for the manufacture of stone tools. These manufacturing processes are about 900.000 years old on the European continent. The first inhabitants of the American continent, the so-called Paleoindians, were producing stone implements about 11,000 years ago, whereas more than 1,200 years ago the Mayas had ceremonial lance heads formed like sculptures with human figures, that were manufactured by knapping. As recently as ten years ago, or thereabouts, the natives of New Guinea still manufactured and bartered stone axes, using age-old methods of stone processing, and it is feasible that this tradition had not been thoroughly eradicated yet (Schick & Toth, 1994).

Archaeologists nowadays analyse, in great detail, these prehistoric stone tools, as well as waste material created during the process of their manufacture, which in turn facilitates the reconstruction of the entire manufacturing process used for the production of these tools. For all that, the final goals of lithic analysis are far wider and more complex. They can encompass the cognition of changes and innovations in lithic technology itself, during the passage of time, and the influence of these changes on the day to day life of man, the perception of the degrees of mastering a certain psychomotoric skill, and an attempt to fathom social relations between different prehistoric populations or groups.

svom putu rekonstrukcije prošlosti znanstvenicima uvelike pomaže eksperimentalna arheologija i/ili etnoarheologija. Štoviše, tehnologija litičkih rukotvorina obično se temelji na izravnom eksperimentiranju dobivanja sličnih alatki, ali i na etnomodelima uočenima na nižim stupnjevima ekonomskih odnosa suvremenih nomada ili lovaca. Korisnost eksperimenta u arheologiji dobro pokazuje primjer S. Vukovića (1973:24) koji je za 21 sat uspio izbušiti rupu na kamenoj sjekiri, unatoč mišljenju predavača arheologije koji je držao da je za taj posao prapovijesnom čovjeku bilo potrebno od šest mjeseci do godinu dana. S druge strane, etnoarheologija proučavanjem današnjih lovačko-skupljačkih ili ponekad ratarskih skupina daje moguće modele pristupa rekonstrukciji života prapovijesnih skupina, što je posebno vrijedno za sagledavanje procesa proizvodnje alatki.

"Životni ciklus" paleoindijanske obostrano obradene alatke (modificirano prema Rathje & Schiffer 1982:sl. 4-11).



Archaeological materials alone, however, often do not suffice for the solution and attainment of such ambitious tasks. In their efforts to reconstruct the past, scientists are greatly helped by experimental archaeology and/or ethnoarchaeology. Moreover, lithic artefact technology is usually not only based on direct experimentation, as far as the creation of similar tools is concerned, but also on ethnomodels detected on lower levels of economic relations pertaining to coexisting nomads and hunters. The usefulness of experimentation in archaeology is well illustrated by the example set by S. Vuković (1973: 24), who in 21 hours managed to drill a hole through a stone axe, notwithstanding an opinion that was held by a lecturer in archaeology, who maintained, that prehistoric man needed from six months to a full year, to complete this job. On the other hand, ethnoarchaeology, with its research of present-day groups representing hunters/gatherers or at times tillers, offers the possible models of

"Life cycle" of paleoindian biface (modified according to Rathje & Schiffer 1982: 4-11)

Osnovne metode i tehnike korištene za izradu alatki okresivanjem kamena bit će ukratko opisane u ovom katalogu. Pri tom se pod metodom misli na ukupnost primijenjenih procedura kojima se doseže željeni cilj, u ovom slučaju izrada kamene alatke, dok je tehnika praktična metoda, vještina ili umjetnost koja se primjenjuje s određenim zadatkom (Inizan et al. 1992.).

## Načini analize

Postoji više načina analize litičkih rukotvorina koji obično imaju različite ciljeve. Vidna je razlika između tipološkog proučavanja alatki i tehnološkog pristupa litičkim rukotvorinama. Tipologija isključivo sagledava finalne proizvode tj. gotove alatke, nastojeći ih na temelju njihova oblika svrstati u određene tipove radi određivanja kronološke i kulturološke sekvence kojoj pripadaju. Za razliku od takva statičkog pristupa, tehnologija je dinamična, ona analizirajući sav litički materijal rekonstruira proces proizvodnje, nastojeći sagledati društvene odnose prapovijesnih skupina, jer je način izrade nekog predmeta barem djelomičan odraz globalnih socijalnih prilika nekog društva (Blaser et al. 1999./2000.). Čuveni francuski prapovijesničar A. Leroi-Gourhan uveo je značajnu metodološku novinu u proučavanju tehnologije okresanog kamena ustanovivši tzv. lanac operacija (chaine operationelle), tj. kronološku ljestvicu različitih faza koje kameni materijal prolazi u svom "životnom ciklusu". Lanac operacija započinje pribavljanjem sirovine, obuhvaća

approach for the reconstruction of the way of life of prehistoric groups, which is of particular importance for a close examination of the processes employed in the manufacture of tools.

The basic methods and techniques employed for the manufacture of tools by stone knapping will be briefly described in this catalogue. Within this context a method represents the totality of applied procedures that lead to the attainment of a set goal, in this case the manufacture of a stone tool, whereas a technique represents the practical method, skill, or craft, applied in conjunction with a specific task (Inizan et al. 1992).

## Modes of analysis

There are several modes, with usually varying scopes, to analyse lithic artefacts. A difference between the typological examination of the tools and the technological approach to lithic artefacts is quite discernible. Typology deals exclusively with final products, i.e. finished tools, aiming to sort them out, based on their form, into certain types, so as to determine the chronological and cultural sequence they belong to. As distinguished from such a static approach, technology represents a dynamic approach, by analysing the entire lithic material it reconstructs the manufacturing process, endeavouring to fathom the social relations of the prehistoric groups, as the mode in which a certain object was manufactured at least partially reflects the global social circumstances of a society (Blaser et al. 1999/2000). A. Leroi-Gourhan, the famous French prehistorian, introduced an important methodological novelty to the study of knapped stone technology, establishing the so-called chaine operationelle, i.e. the chronological scale of the different phases the stone material passes through during its "life cycle". The chaine operationelle begins with raw material procurement, and it encompasses diverse reduction phases of the lithic material during the manufacture of the tool, the usage of the tool, its

različite faze redukcije litičkog materijala pri izradi alatke, upotrebu alatke, njezino dotjerivanje, ponovno korištenje i naposljetku odbacivanje. Tijekom litičke analize svaki kameni komadić promatra se ponajprije pojedinačno, tj. određuje se njegovo mjesto u lancu operacija, a nakon što se tako razvrstaju svi nalazi može se ustanoviti jesu li sve ili samo neke faze lanca prisutne na nalazištu.

Sam postupak rekonstrukcije okresivanja često je moguće provesti pomoću metode međusobnog spajanja odbojaka, te odbojaka i jezgre od koje su odbijeni. Bitni aspekt litičke analize je i sitnozrno isčitavanje tragova istrošenosti radnog ruba alatki. Time se može odrediti funkcija same alatke te primjerice ustanoviti je li ona bila uglavljena u držak.

Za izradu kamenih alatki uglavnom se koristi kamenje velike tvrdoće i školjkastog loma (primjerice kremenje, magmatske i metamorfne stijene). Često korištena stijena je rožnjak, koji se sastoji od vrlo sitnih kristalića kremenja i opala. Premda je vrlo tvrd, moguće ga je lomiti u svim smjerovima pa je zbog toga pogodan za obradu okresivanjem. Osim rožnjaka, koriste se i druge stijene, kao što su kvarc, kvarcit, različiti tufovi. Odredba vrste i porijekla sirovinskog materijala bitna je odrednica litičke analize. Ona se može provesti makroskopski i/ili mikroskopski. Nakon određivanja vrsta stijena korištenih za izradu alatki valja pokušati locirati primarna ležišta sirovina. Bitno je uočiti da sam oblik alatke ponekad može biti uvjetovan kakvoćom sirovinskog materijala. Naime, sve vrste stijena ne lome se jednako dobro, pa se neki zahtjevniji oblici neće moći postići korištenjem lošijeg sirovinskog materijala. Također je ustanovljeno da se određene vrste sirovinskog materijala lakše obrađuju nakon što su duže vrijeme zagrijavane, a potom ohladene (tzv. toplinski postupak), i taj se postupak upotrebljavao već u paleolitikumu.

repair, its renewed usage, and its final rejection. During lithic analyses, every little stone piece is initially examined individually, i.e. its position in the chaîne opératoire is being established, and after all the finds had been thus classified, it is possible to determine whether all or only some of the phases of the chaîne opératoire are present on the site.

The knapping reconstruction procedure itself can often be performed with the aid of a method, whereby flakes are mutually conjoined, as well as by conjoining flakes to the core from which they were removed. Microscopic examinations of the traces suggesting wear of the working edge of a tool are likewise an essential aspect of lithic analysis. By this, the function of the tool itself can be determined, and for example, whether it was fixed onto a handle.

Stones of great solidity and of shell-like fracture (e.g.: flint-stones, magmatic and metamorphic rocks) were mostly used for the manufacture of stone tools. The use of chert, that is made up of very minute crystals of flint-stone and opal, is very common. Even though chert is very solid, it is nevertheless possible to fracture it in all directions, which makes it particularly well adapted for retouch by knapping. The use of other rocks besides chert, such as quartz, quartzite, and different sorts of tuff, is also widely spread. The determination of the type and origin of raw materials represents an essential point of reference in lithic analysis. It can be carried out on a macroscopic and/or microscopic level. After the type of rock employed for the manufacture of the tools had been determined, a try should be given to locate the primary layers of the raw material. It is important to note that the shape of the tool itself can sometimes be influenced by the quality of the raw materials. As it happens, all types of rock do not break equally well, and hence it is impossible to attain some of the more complicated forms out of lesser quality raw materials. It has likewise been established, that the retouch of certain types of raw materials is rendered easier if beforehand they had been exposed to a prolonged period of heating, followed by a cooling period (so-called heat treatment); this treatment had been in use already in the Paleolithic period.

## Značajke okresanog kamena

Da bi se moglo određenije govoriti o analizi litičkog materijala potrebno je ponajprije razjasniti temeljne pojmove te pravila orijentacije litičkih izradovina. Pri tome je važno odabrati prikladno strukovno nazivlje koje nažalost na hrvatskom jeziku još uvijek nije u potpunosti ustanovljeno. Osnovni nazivi vezani za litičku industriju, prevedeni s francuskog ili engleskog (Bordes 1961.; Brézillon 1983.; Inizan et al. 1992.), prilagođeni su hrvatskom jeziku prema savjetima T. Ladana (Karavanić 1993.; vidi i rječnik na kraju kataloga) i ovdje će biti ukratko navedeni.

Sirovinski materijal za izradu alatki često se nalazi u obliku oblutaka ili gomolja. Njihova vanjska površina prekrivena je korom koju nazivamo okorinom ili korteksom. Nakon okresivanja može doći do prirodne promjene površine kamenih komada i tu promjenu za razliku od okorine nazivamo patinom. Komad sirovine od kojeg su namjenski odbijeni komadi naziva se jezgrom. Okrhak je bilo koji komad litičkog materijala pogodnog oblika i veličine za izradu alatke, dok je odbojak kameni komadić koji se zbog udarca čekićem odvojio od jezgre. Ako je njegova duljina barem dvostruko veća od širine, a rubovi su mu više ili manje usporedni, nazivamo ga sječivom. Termin pločice ponekad se koristi za mala sječiva. Najčešće debeli ulomak kamena neodređenog oblika koji se ne može klasificirati u neku pobližu kategoriju možemo nazvati krhotinom. Pod pojmom lomljevine obuhvaćeni su svi komadi okresani od jezgre tj. potencijalne alatke (odbojci, sječiva, pločice), tzv. dotjerivi odbojci i krijestasta sječiva (koja je nužno odbiti za nastavak tehnološkog procesa) te otpad. Alat koji se koristi u odbijanju za udaranje po jezgri je čekić. Jezgra, odbojak ili sječivo

## Characteristics of knapped stones

In order to be able to speak about lithic material analysis in a more concrete fashion it is necessary to first explain the basic conceptions and rules covering the orientation of manufactured lithic objects. With respect to this it is important to choose a suitable specialised terminology, that unfortunately, has not yet been fully established in the Croatian language. The basic terms tied to lithic industry, translated from French or English (Bordes 1961; Brézillon 1983; Inizan et al. 1992), had been adapted to the Croatian language, based on advice given by T. Ladan (Karavanić 1993; also, consult the terminological lexicon at the end of the catalogue), and will be briefly listed here.

The raw materials for the manufacture of tools are often found in the form of pebbles or nodules. Their outside surface is covered by a crust called cortex. A natural alternation of the surface of stone objects can occur after knapping, and in contrast to the cortex this alternation is called patina. A block of raw material from which pieces have been removed as a result of intentional action is called a core. A blank is any piece of lithic material with an appropriate shape and size for the manufacture of a tool, whereas a flake is a fragment of hard stone which had been detached from a core by percussion with a hammer. If its length is at least twice as large as its width, and its edges are more or less parallel, it is called a blade. The term bladelet is sometimes used for small-sized blades. A thick stone fragment without any particular shape, that cannot be classified into any of the known categories, can in most cases be called debris. Debitage products is a term that applies to all removals resulting from knapping of a core, i.e. potential tool blanks (flakes, blades, bladelets), so-called rejuvenated flakes and crested blades (that have to be removed in order to continue with the technological process), and all waste products. The tool used for core knapping is called a hammer.

The terms core, flake or blade necessitate a more detailed description. A striking platform and flake scars are found on a core. A striking

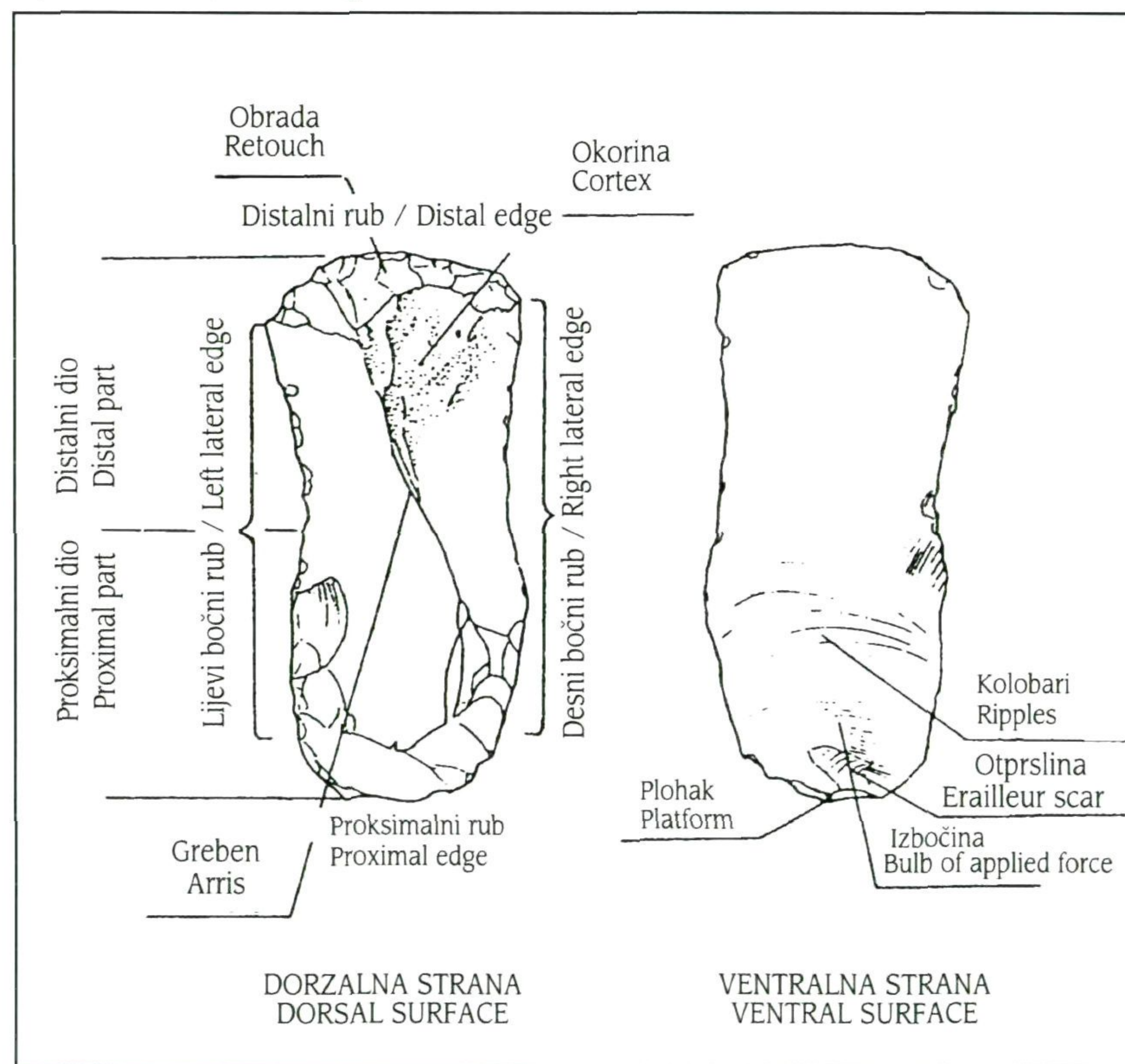


zahtijevaju detaljniji opis. Na jezgri se nalazi udarna ploha i tragovi odbojaka. Udarna ploha je pripremljen dio jezgre po kome se udaralo direktno čekićem (udaračem) ili preko dlijeta (komad kosti, rog) da bi se dobili odbojci ili sječiva. Dio udarne plohe koji je ostao na odbojku ili sječivu nazivamo plohom ili talonom. Moguće je razaznati više tipova, primjerice plohak prekriven okorinom, gladak, višeplošan (fasetiran), dvopovršinski (diedričan).

Razlikujemo dorzalnu i ventralnu stranu odbojka ili sječiva. Ventralna strana je prije odbijanja bila spojena s jezgrom, dok je dorzalna strana vanjska. Na ventralnoj strani ispod ploha nalazi se izbočina (bulbus), ispod i oko izbočine šire se kolobari, a ponekad je na izbočini uočljiva i brazgotina koju nazivamo otrprslinom. Odbojak, sječivo ili alatka ima lijevi i desni bočni (lateralni) rub, i dva poprečna (transverzalna) ruba. To su: distalni (dalji) i proksimalni (bliži).

Ponekad neće biti lako prepoznati je li komad

Orijentacija i značajke alatke  
(Crtež M. Gregl)



platform is a prepared core surface which is struck, either directly with a hammer (striker) or using a punch (a piece of bone, antler), in order to get flakes or blades. The part of the striking platform that remained on the flake or blade is called a platform or talon. Several types can be discerned, e.g. a cortical platform, a plain faceted, dihedral platform.

We distinguish between a dorsal and a ventral surface of a flake or blade. A ventral surface is the one that was conjoined with the core

before removal, whereas a dorsal surface represents the outer surface. A bulb of applied force is located on the ventral surface underneath the platform, ripples are extending underneath and around the bulb of applied force, and sometimes a bulb scar called an erailleur scar is likewise discernible on the bulb of applied force. A flake, a blade, or a tool has its left and right lateral edge and two transverse edges – the distal edge (the farther one) and the proximal edge (the nearer one).

At times it will not be easy to identify whether the removal of a stone fragment was due to the labours performed by a human hand or if it can be ascribed to

Orientation and characteristics of a tool (drawing by M. Gregl)

kamena odbijen ljudskom rukom ili je proizvod nekih drugih procesa. Kamenje može pucati uslijed smrzavanja, međusobnog udaranja, pritiska i sl. Zato treba biti posebno oprezan pri analizi nalaza skupljenih na površini, jer postoji veća mogućnost njihovog prirodnog nastanka i oštećivanja, premda i kamenje u arheološkim slojevima također može popucati uslijed promjena topline i/ili povećanog pritiska. Kod takvih komada često će izostati sve ili barem neke značajke lomljenih rukotvorina (plohak, izbočina, kolobari, itd.), a ukoliko je kut između ploha i tragova na dorzalnoj strani tup, malo je vjerojatno da je komad nastao ljudskom rukom (Barnes 1939.). U svakom slučaju nalaz se nikada ne promatra izdvojeno iz konteksta u kojem je pronađen, jer značajke i stanje više nalaza daje veću mogućnost pravilne rekonstrukcije onoga što se zbilo.

Za provedbu litičke analize, mjerenje i crtanje nalaza, vrlo je bitno poznavanje načina orijentacije izradevina. Prema ustaljenim konvencijama dorzalna strana okrene se prema sebi, a ventralna leži na podlozi. Osim dorzalne strane ponekad se može nacrtati i ventralna strana ili samo jedan dio njezina ruba, ako se primjerice na njemu nalazi obrada. Plohak odnosno proksimalni dio treba biti dolje. Iznimke su obično šiljak čiji je vrh načinjen na plošku ili pak grebalo načinjeno na plošku. Vrh šiljka bit će usmjeren prema gore, a isto je i s grebalom. Velike alatke načinjene na jezgri kao što su recimo šačnici bit će orijentirane tako da njihov vrh bude postavljen prema gore.

other processes. Stones can fracture because of freezing, mutual striking, pressure, and the like. Extreme caution is consequently imperative when analysing finds that have been collected out on the surface, as there is a greater possibility of their artificial creation and damaging, even though stones found in archaeological layers can likewise fracture as a consequence of temperature changes and/or an elevated pressure. It is with pieces like this that very often all or at least some of the characteristics pertaining to debitage artefacts (platform, bulb of applied force, ripples, etc.) will be missing, and furthermore, if the angle between the platform and the scars on the dorsal surface is obtuse, the odds that the piece was made by human hand are indeed negligible (Barnes 1939). In any case, a find is never to be studied isolated from the surroundings where it was found, as characteristics and conditions stemming from several finds give a greater probability for a correct reconstruction of past events.

For the execution of lithic analyses, measurements, and drawings of finds, it is quintessential to be well acquainted with the modes of orientation of the manufactured items. According to long standing conventions, the dorsal surface is to be turned towards oneself, whereas the ventral side lies on the base. Apart from the dorsal surface, the ventral one can also be drawn at times, or only part of its edge, if the latter has been retouched. The platform, i.e. the proximal part, should be down. Exceptions are usually represented in the form of a point whose apex is made on a platform, or an endscraper made on a platform. The apex of the point will be directed towards the top, and the same applies to an endscraper. Larger tools manufactured on the core, such as bifaces, will be oriented in such a way that their apex is placed towards the top.

## Metode i tehnike

Prve, vrlo jednostavne kamene alatke načinjene od oblutaka, pronađene su u Africi. Stare su približno 2,5 milijuna godina a izradivali su ih vjerojatno robusni australopiteci i čovjek vrste *Homo habilis*. Te alatke nazivaju se sjekačima, a izradene su vrlo jednostavnim metodom. Oblutak se pri rubu vertikalno udari drugim kamenom koji je služio kao čekić. Ta se radnja može ponoviti dva ili više puta kako bi se dobio oštar rub. Tako je na alatki, koja je ujedno i jezgra, izradena oštrica. Ona može poslužiti za razbijanje kostiju kako bi se iz njih izvadila srž, a i odbojci se mogu upotrijebiti. Alatka na oblutku može biti i savršenije izradena. Nakon što se odbije odbojak s jedne strane, oblutak se okrene te se s druge strane dva puta udari po rubu. Taj proces tehnološki je nešto složeniji od izrade običnog sjekača, a dobivene alatke imaju tragove odbojaka s obje strane površine oblutka i nazivamo ih sjeckalima. Sjekači i sjeckala tipične su alatke olduvajenskog razdoblja. Osim u Africi, takve su alatke najstarije i na europskom tlu premda se one tu javljaju

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Sjekač iz Šandalje I

## Methods and techniques

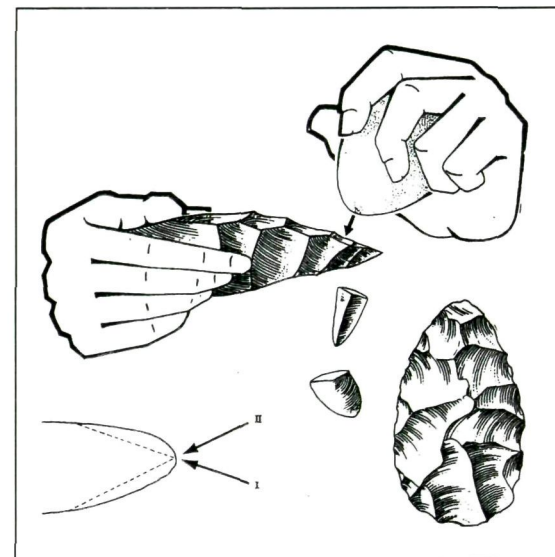
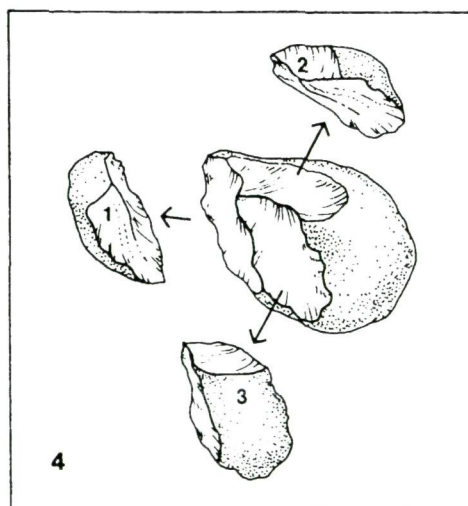
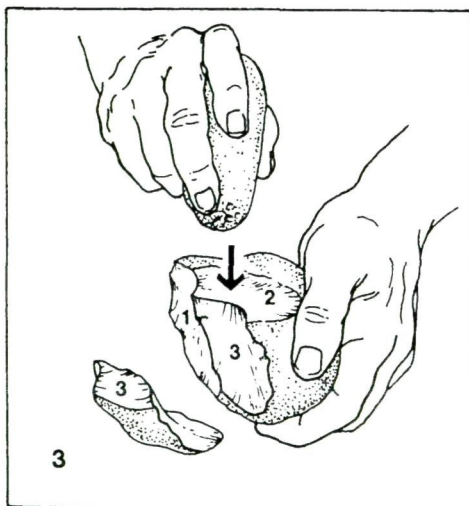
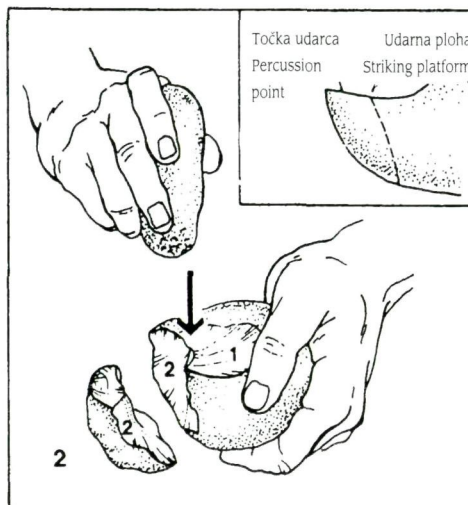
The first very simple stone tools made from pebbles were discovered in Africa. They are approximately 2.5 million years old and were probably made by both robust australopithecuses and humans of the *Homo habilis* species alike. These tools are called choppers and were made by an extremely simple method. A pebble is struck vertically near its edge with another stone that served as a hammer. This action can be repeated two or more times so as to obtain a sharp edge. It was thus that a cutting edge was made on a tool that

is at the same time a core. It can be useful for smashing bones in the process of marrow extraction, and the flakes can be used as well. A tool on a pebble can also be manufactured in a more thorough manner. After a flake has been removed from one surface, the pebble is rotated and struck twice on the other side of the edge. This process is technologically somewhat more complicated than the manufacture of an ordinary chopper, and on tools thus obtained there are flake scars on both sides of the pebble surface; these tools are called chopping tools. Choppers and chopping tools are tools that are typical for the Oldowan period. Save in Africa, such tools are also the oldest ones on the

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Chopper from Šandalja I





Izrada šačnika  
(prema Leroi-Gourhan 1992:83)

Manufacture of a biface  
(after Leroi-Gourhan 1992:83)

Izrada sjeckala koje je ujedno i jezgra  
(modificirano prema Schick and Toth 1994:121).

Manufacture of a chopping tool that at the same time  
represents a core (modified after  
Schick and Toth 1994: 121)

znatno kasnije (prije približno milijun godina), a izrađuje ih prvi stanovnik Europe *Homo erectus*. Sjekač pronađen na nalazištu Šandalja I kraj Pule možda bi mogao biti istovremen s najstarijim alatima različitih europskih nalazišta (primjerice Vallonet u Francuskoj, Isernia u Italiji), te predstavljati najstariji trag ljudske djelatnosti na tlu Hrvatske (Malez 1987.).

Obostrano lomljenje kamena (s obje površinske strane) pojavilo se u istočnoj Africi prije milijun i pol godina na kraju olduvajenskog razdoblja, i taj se način obrade održao do današnjih dana (Inizan et al. 1992.). Primjenom takvog naizmjeničnog odbijanja, s jedne i s druge strane kamena po dužini rubova, može se dobiti alatka bademasta oblika, tipična za kulturu ašelejana, koju nazivamo šačnikom. Sitnim se udarcima odstrane neravnine, a pri dovršavanju alatke može se upotrijebiti palica od roga koju nazivamo mekanim čekićem. Smatra se da je upotreba mekanog čekića započela u Africi prije 700.000 godina (Inizan et al. 1992.).

Premda su mnogi primjerci šačnika vrlo simetrično oblikovani, ta je alatka, izrađena na kamenoj jezgri, još uvijek velika i gruba. Osim primjenjene tehnike, na oblikovanje šačnika vidno utječe i mogućnost odabira sirovinskog materijala. Primjenom mekanog čekića na rožnjaku vješt majstor može izraditi vrlo simetričan i relativno tanak šačnik, dok na nekom drugom sirovinskom materijalu (primjerice nekim eruptivnim stijinama) takav rezultat neće moći postići, bez obzira na umijeće koje posjeduje. Usporedno sa šačnicima proizvode se i mnoge alatke na odbojcima, obično ograničenih namjena. Za razliku od njih šačnik može objединiti više potpuno različitih funkcija, primjerice: razbijanje kostiju i komadanje mesa, rezanje, struganje, kopanje.

European continent, even though they appear considerably later over here (approximately a million years ago); they were manufactured by *Homo erectus*, the first inhabitant on the European continent. A chopper discovered on the Šandalja I site in the vicinity of Pula, could perhaps be of contemporaneous manufacture as compared with the oldest tools from different European sites (e.g. Vallonet in France, Isernia in Italy), and as such it could possibly represent the oldest trace of industry found on the territory of Croatia (Malez 1987).

The process of stone shaping on both surfaces appeared a million and a half years ago in East Africa, towards the end of the Oldowan period, and this process of retouching was retained to the present days (Inizan et al 1992). With the usage of such an alternate removal method, from either side of a stone and along the length of the edges, an almond shaped tool can be obtained that is typical for the Acheulean culture and called a biface. All uneven spots are removed by delicate blows, and during the tool completion process a piece of antler called a soft hammer can be used. It is believed that the use of the soft hammer began in Africa 700,000 years ago. (Inizan et al 1992).

Even though many biface specimens are very symmetrically shaped, this tool manufactured on a stone core still remains large and rough. The biface shaping process is visibly influenced, not only by the technique applied, but also by the ability to choose raw materials. With the use of a soft hammer on chert, a skilled worker is able to manufacture a very symmetric and relatively thin biface, whereas on some other raw materials (e.g. certain volcanic rocks) he would not be in a position to equal these results, notwithstanding all the skills he might possess. The production of many tools on flakes, usually for very limited purposes, is running abreast with that of bifaces. As distinguished from the former, a biface can unite scores of completely different functions, such as: the smashing of bones, butchering, cutting, scraping, digging.

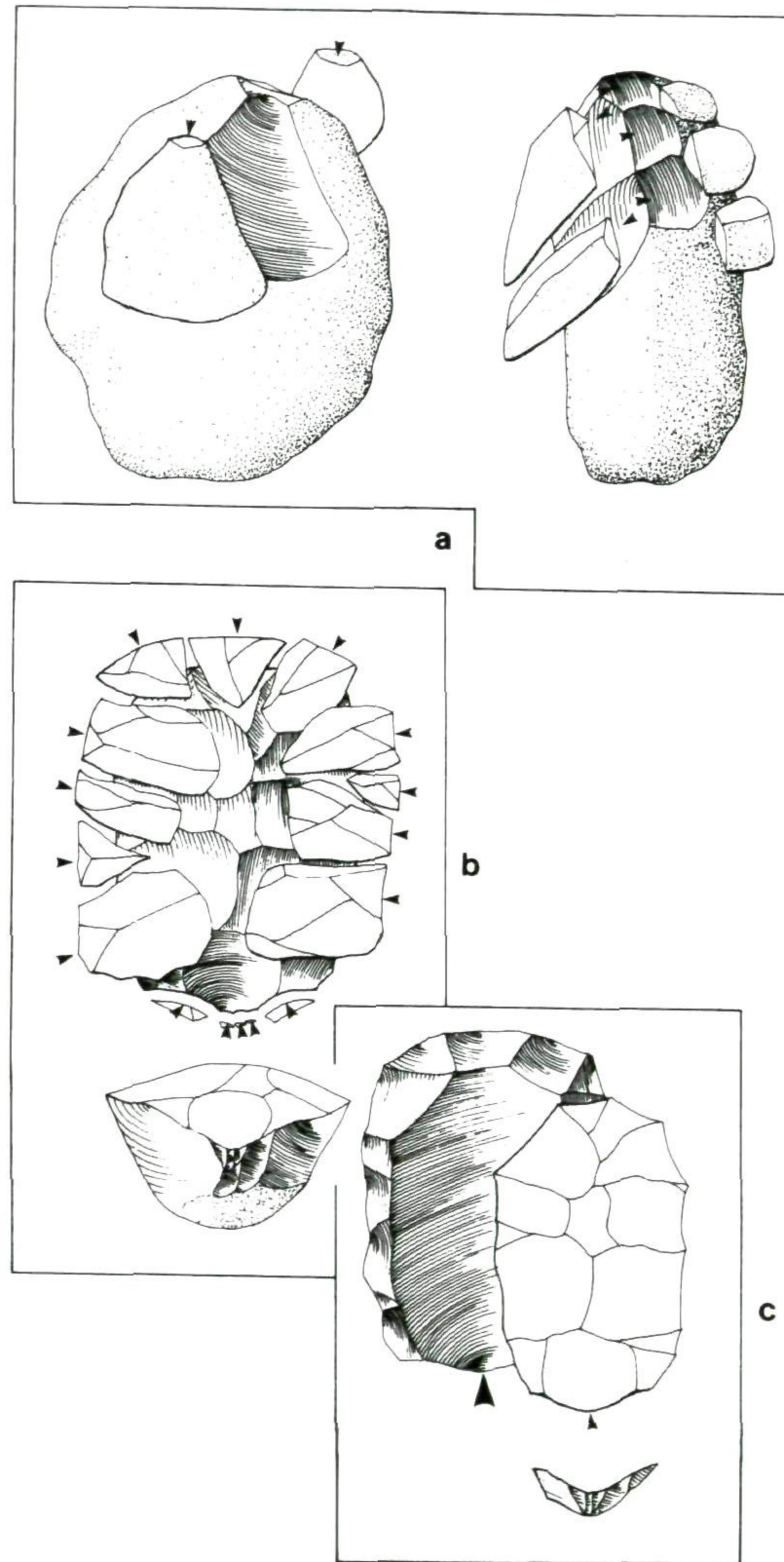
Nakon ašelejena, obostrano oblikovanje alatki ponovno će se pojavljivati u različitim periodima prapovijesti. Svoj vrhunac vjerojatno doseže u kulturi gornjeg ili mladeg paleolitika koju nazivamo solitrejenom. Obostrano obradeni šiljci te kulture vrlo su tanki, a završna obradba na njima provodi se pritiskom. Kamen se obostranim odbijanjem obrađuje i u neolitiku, posebno za dobivanje strelica, te u kasnijim razdobljima. Metodu obostranog odbijanja koristili su novogvinejski urođenici pri izradi sjekira, još prije desetak godina, kako bi pogodno oblikovali kamen za daljnju obradu glačanjem (Schick & Toth 1994.). Još u donjem paleolitiku prije približno pola milijuna godina čovjek je počeo upotrebljavati metodu za postizanje odbojaka unaprijed osmišljene forme, koju prema eponimnom nalazištu Levallois-Perret (predgrađe Pariza) nazivamo levaloaškom metodom. Česta je u srednjem paleolitiku gdje dolazi u musterijenu koji se gotovo uvijek veže za neandertalca. Međutim, levaloaška se metoda može javiti i u gornjem paleolitiku, te nekim ne toliko davnim litičkim industrijama (Inizan et al. 1992.). Da bi se postigao željeni cilj, tj. odbijanje jednog predodređenog odbojka, ili više njih određenih oblika, važno je posebno oblikovati jezgru. Ukoliko je cilj odbijanje jednog glavnog odbojka redoslijed je slijedeći: centripetalnim odbijanjem ponajprije se oblikuju dvije izbočene površine, zatim se izradi udarna ploha i završno oblikuje površina kako bi se na kraju odbio levaloaški odbojak. Ukoliko obujam jezgre dopušta, isti se postupak ponavlja. Uvijek se primjenjuje tehnika odbijanja tvrdim čekićem. Važnost nastanka levaloaške metode nije samo u vještini postizanja standardiziranih odbojaka, već u složenoj koncepciji koja, po mnogim znanstvenicima, odražava povećanje kognitivne sposobnosti čovjeka koji je tu metodu počeo upotrebljavati

After the Acheulean period, the bifacial shaping of tools will again appear during different periods of prehistory. Its pinnacle was probably reached in the Upper Paleolithic period, in the Solutrean culture. The bifacially retouched points of this culture are very thin, and the final retouch on them is performed by the application of pressure. Bifacial flaking is also used for stone retouching in the Neolithic period, especially for the manufacture of arrows, as well as in later periods. The bifacial flaking method was used by New Guinea natives for the manufacture of axes as late as ten years ago, in order to shape the stone in a manner that is favourable to its further treatment by polishing (Schick & Toth 1994).

As early as in the Lower Paleolithic, roughly half a million years ago, man began to use a method for the creation of predetermined flakes, that in accordance with the eponymous site of Levallois-Perret (a suburb of Paris), we call the Levallois method. It is very recurrent in the Middle Paleolithic period, where it appears in the Mousterian culture, that is almost always associated with Neanderthal man. However, the Levallois method was also known to appear in the Upper Paleolithic, as well as in some recent lithic industries (Inizan et al. 1992). It is important to shape the core in a special manner in order to attain the desired goal, i.e. the removal of a predetermined flake, or of several flakes with a defined shape. If the goal consists from flaking a single main flake, the sequence is as follows: with centripetal flaking the two convex surfaces are initially created, then the striking platform is made and the surface is finally shaped, so as to obtain a Levallois flake at the end. If the volume of the core allows it, the same procedure is repeated. A flaking technique with a hard hammer is always used. The importance in conjunction with the creation of the Levallois method lies not only in the skill to achieve standardised flakes, but moreover, in a complex conception, that according to numerous scientists reflects an increase of the cognitive ability of man, that started to use this method (the archaic *Homo sapiens*), as compared with his predecessors. Before approximately 40,000 years, at the beginning

(arhaični *Homo sapiens*), u usporedbi s njegovim prethodnicima.

Prije približno 40.000 godina, početkom gornjeg ili mladog paleolitika, dolazi do pojave ranog modernog čovjeka (*Homo sapiens sapiens*) na europskom tlu, a u litičkim industrijama tog razdoblja vidno mjesto zauzimaju sječiva, premda se te izradevine javljaju i znatno ranije. Izrada sječiva je osmišljen postupak lomljenja kamena čiji je cilj masovna proizvodnja sječiva iz jedne jezgre koja za tu svrhu mora biti posebno oblikovana (najčešće je piramidalna ili prizmatična). Sječivo je, ponovimo to još jednom, odbojak relativno paralelnih rubova, čija je duljina barem dva puta veća od njegove širine. Sječiva mogu biti različite duljine, a za izrazito mala sječiva može se koristiti naziv pločice. Jezgra za sječiva može imati jednu, dvije ili više udarnih ploha, koje mogu biti prekrivene okorinom, glatke ili obradene. To se odnosi i na jezgre za pločice. Da bi se dobilo sječivo, ponajprije treba izabrati ljevkasto oblikovani kamen od



of the Upper Paleolithic period, the early modern man appears (*Homo sapiens sapiens*) on the European continent, and in lithic industries of the time blades occupy a prominent position, even though these artefacts began to appear much earlier as well. The manufacture of blades is a theoretically organised procedure of stone debitage, whose goal is the mass production of blades from a single core that has to be specially formed for this purpose (in most cases it is pyramidal or prismatic in shape). A blade is, let us repeat it again, a flake with relatively parallel edges, whose length is at least twice the size of its width. Blades can vary in length, extremely small blades can, however, be called bladelets. A blade core can have either one, two, or more striking platforms, that can be cortical, be smooth or prepared. This applies to bladelet cores as well. In order to obtain a blade, a funnel-shaped block of rock from a quality raw material has to be chosen before anything else, and then its top is removed. In this manner a smooth striking platform is obtained. Then the cortex is removed from around the core with the aid of a hard hammer, and in this way a core with a single striking platform is formed. The manufacture of blades usually starts with debitage of the so-called crested

Levalloška metoda izrade predodređenog odbojka (prema Inizan et al. 1992: slika 12)

The Levallois method for the manufacture of a predetermined flake (after Inizan et al. 1992: picture 12)

kvalitetnog sirovinskog materijala i odbiti njegov vrh. Tako se dobije glatka udarna ploha. Zatim se uokolo jezgre tvrdim čekićem odstrani okorina i na taj se način oblikuje jezgra s jednom udarnom plohom. Proizvodnja sječiva obično započinje lomljenjem tzv. krijestastog sječiva, s naglašenim središnjim grebenom, koje je zapravo rub jezgre. Nakon toga, uokolo jezgre, lome se standardna sječiva.

Sječiva se mogu izrađivati primjenom različitih tehnika. Izravno odbijanje tvrdim čekićem najstarija je tehnika proizvodnje sječiva koja se pojavila još prije stotinjak tisuća godina u srednjem paleolitiku. Izravno odbijanje mekanim čekićem učestalo je u gornjem paleolitiku. Kao mekani čekić može poslužiti palica od roga, kosti ili tvrdog drva. Tom su tehnikom vjerojatno odbijana sječiva iz orinjasijenskih slojeva špilje Šandalje II. Sječiva se mogu i neizravno odbijati preko dlijeta čiji se vrh priloni na rub udarne plohe, a po bazi dlijeta udari se mekanim čekićem. Međutim upotreba te tehnike nije dokazana prije mezolitika (Inizan et al. 1992.). Pri odlamanju sječiva pritiskom, uz pomoću oslonca, pritiskivalo se pritiskačem pri rubu jezgre. Vrh pritiskača bio je od kosti ili bjelokosti, a kasnije od metala. Ta se tehnika javlja u gornjem paleolitiku, ali samo na određenim zemljopisnim područjima.

Toplinski postupak često je u vezi s ovom tehnikom.

Jezgra za sječiva. Šandalja II, epigravetijen

blade, with an accentuated central crest, that in reality represents the edge of the core. Afterwards, standard blades are knapped from around the core.

Blades can be manufactured by using a variety of techniques. Direct flaking with a hard hammer represents the oldest technique for the manufacture of blades, that first appeared approximately a hundred thousand years ago, in the Middle Paleolithic period. Direct flaking with a soft hammer is a common occurrence in the Upper Paleolithic period. Pieces of antler, bone or wood can be used as a soft hammer. It is with this technique that blades from the Aurignacian layers of the Šandalja II cave were probably flaked. Blades can likewise be indirectly flaked with the help of a punch, whose top is leant against the edge of the striking platform, while the base of the punch is hit by a soft hammer. However, the use of this technique had not been proven for periods preceding the Mesolithic period (Inizan et al 1992). During pressure knapping of a blade with the aid of a support, pressure was

applied against the edge of a core with a pressing tool. The upper part of the pressing tool was made out of bone or ivory, and later on from metal. This technique appears in the Upper Paleolithic period, but only in certain geographic regions. The thermal treatment is often associated with this technique.

A flake or a blade is sometimes immediately put to use as a tool, however, in the majority of cases they went through an additional retouching process. A retouch is usually made by the removal of small-sized flakes from the working edge or surface of the future tool, its scope being the manufacture or finishing of that tool.

Blade core. Šandalja II, Epigravettian period





Odbojak ili sječivo katkad se odmah koriste kao alatke, ali najčešće se ponajprije dodatno obrade. Obrada tj. dodatna obrada (retuš) obično nastaje kvrcanjem manjih odbojaka na radnom rubu ili površini buduće alatke sa svrhom izradivanja ili dovršavanja te alatke. Međutim tragovi obrade na rubu ponekad mogu potjecati od upotrebe alatke ili pak predstavljaju oštećenja možda uzrokovana djelovanjem prirodnih procesa. Ukoliko se ustanovi da je riječ o potonjem slučaju, nalaz neće biti uvršten u alatke. Tip obrade bitna je odrednica analize litičkog materijala i može ovisiti o tehnici odbijanja. Tako se primjerice upotrebom tvrdog čekića obično postiže duboka i žljebasto oblikovana obradba, a korištenjem mekog čekića obrada je plića i pravilnija (Bordes 1961.). Obradu je moguće podijeliti u više tipova, primjerice po obliku, rasprostiranju, smještaju, kutu.

Po obliku obrada se može podijeliti na slijedeće tipove (Bordes 1961):

- a) i b) Ljuskasta obrada - široka je i kratka. Izgleda kao riblje ljuske. Dobiva se direktnim odbijanjem kamenim ili drvenim čekićem.
- c) Suusporedna obrada - Manje je pravilna od usporedne.
- d) Usporedna obrada - Uska je, plitka, izdužena i usporedna. Nastaje odbijanjem mekanim čekićem, indirektnim odbijanjem (preko dlijeta), ili pritiskom.
- e) Stepeničasta obrada - Njezin izgled podsjeća na stepenice. Dobiva se upotrebom čekića

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Sječivo s obradom na dvama rubovima. Šandalja II, epigravetijen



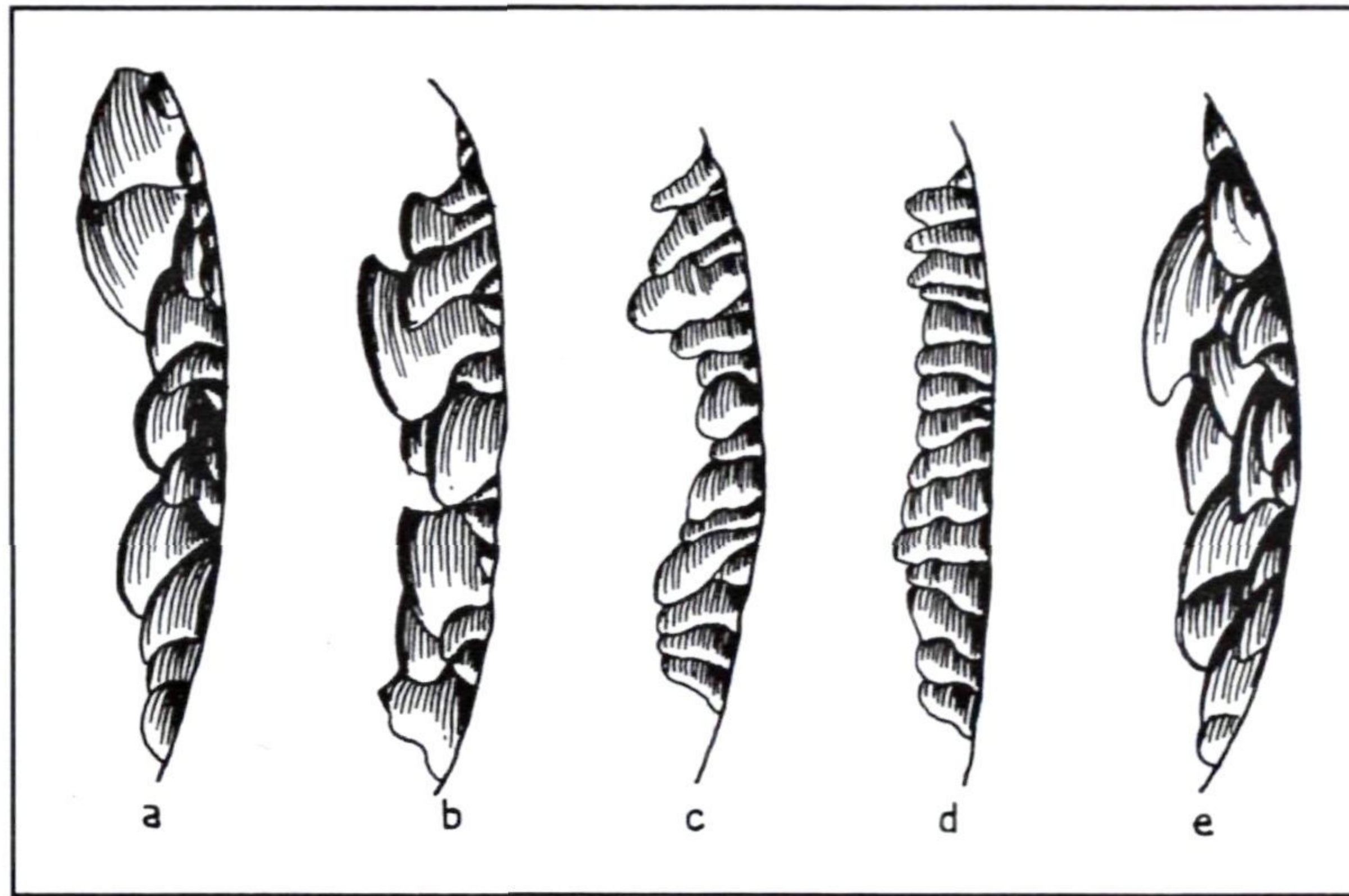
Retouch scars on the edge, however, can sometimes stem from the use of the tool, or else they can represent damages that have perhaps been sustained from the effects of natural processes. If it is established that the latter is the case, the find will not be classified as a tool. The type of retouch is an essential term of reference for lithic material analysis and can depend on the flaking technique. In this manner, for example, a deep and fluted retouch is usually attained with the use of a hard hammer, whilst usage of a soft hammer results in a shallower and more regular retouch (Bordes 1961). A retouch can be classified into several types, e.g. according to shape, extension, location, angle.

According to shape a retouch can be classified into the following types (Bordes 1961):

- a) and b) Scalar retouch- it is broad and short and reminiscent of scales. This type of retouch is attained by direct flaking with a stone or wooden hammer.
  - c) Sub-parallel retouch- it is less regular than parallel retouch.
  - d) Parallel retouch - it is narrow, shallow, elongate and parallel. This type of retouch is attained by flaking with a soft hammer, indirect flaking (using a punch), or by pressure.
  - e) Stepped retouch- it is reminiscent of steps. This type of retouch is attained with the use of a wooden or bone hammer; during the retouch process the part of the hammer that is distant with regard to the top is used.
- Special retouching techniques also exist, their scope, however, being the manufacture of specific tools. For example, geometrical microliths, otherwise appearing frequently in the Mesolithic period, and microburins,

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Blade retouched on two edges. Šandalja II, Epigravettian period



Tipovi obrade (prema Bordes 1961)  
Retouch types (after Bordes 1961)

od drva ili kosti koristeći se pri obradivanju dijelom čekića što je udaljen od vrha.

Međutim, postoje i posebne tehnike obrade čiji je cilj izrada specifičnih alatki. Primjerice geometrijski mikroliti, inače česti u mezolitiku, te mala dubila, dobijaju se pomoću posebne tehnike lomljenja sječiva, što je jedna faza u njihovu lancu operacija.

Dubila uobičajene veličine također se izrađuju primjenom posebne tehnike. Izduženi ulomak koji nazivamo iverom dubila odstrani se udarcem ili pritiskom od uskog ruba koji je gladak ili obraden, ili pak od brida nastalog lomom. Cilj tog postupka je dobiti dljetasto oblikovan radni rub.

U znanstvenoj se literaturi često spominje i tehnika izrade tzv. klaktonskih udubaka koji su prisutni u musterijenu. Od

are attained by a special technique of blade fracturing, representing a single phase in their chaîne opératoire. Standard size burins are likewise manufactured with the application of a special technique. An elongate fragment that we call a burin spall is removed, either with percussion, or with pressure from a narrow edge that is smooth or retouched, or else from an edge that resulted as a consequence of break. The scope of this procedure is to obtain a punch-shaped working edge.

Frequently mentioned in scientific literature is the manufacturing technique of the so-called clactonian notch pieces, that appear in the Mousterian culture. From a larger flake a smaller flake is obtained by a single blow from a hard hammer, resulting in a tool with a depression. They should be distinguished from ordinary notch pieces manufactured by a series of small blows (Debénath & Dibble 1994). Experiments showed that the former could have been used for wood cutting by alternate rotation, while the latter were used for rounding off wooden objects (Bordes 1961).

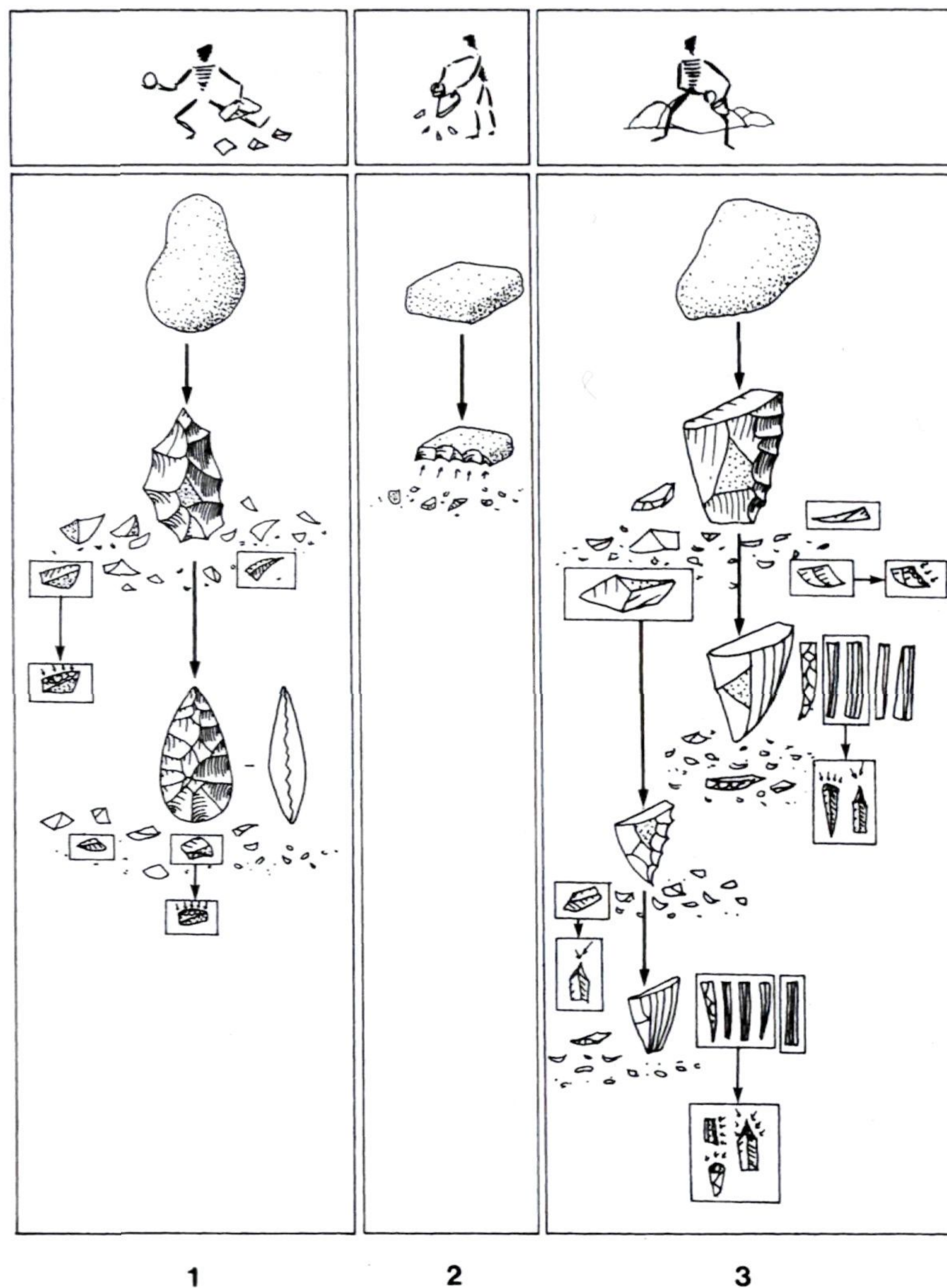


Dubilo.  
Šandalja II, epigravetijen  
Burin.  
Šandalja II, Epigravettian period

većeg odbojka jednim udarcem tvrdog čekića odbije se manji odbojak, čime se dobije alatka s udubljenjem. Valja ih razlikovati od običnih udubaka koji su izrađeni nizom sitnih udaraca (Debénath & Dibble 1994). Eksperimenti su pokazali da su prvi mogli poslužiti za rezanje drva izmjeničnim okretanjem, dok su potonji bili upotrebljavani za zaobljavanje drvenih predmeta (Bordes 1961.).

Na kraju ovog kratkog pregleda glavnih metoda i tehnika okresivanja kamena prisjetimo se još jednom da je tehnološki razvoj čovječanstva započeo upravo izradom prvih kamenih alatki prije približno 2,5 milijuna godina. Tijekom paleolitika ili starijeg kamenog doba koje je trajalo do prije desetak tisuća godina, te mezolitika ili srednjeg kamenog doba kamen je ključan materijal za proizvodnju

Shematski prikaz triju različitih načina okresivanja kamena (prema Inizan et al. 1992: slika 7). Cilj trećeg načina je proizvodnja sječiva i alatki na sječivima



Towards the end of this short review covering the main methods and techniques of stone knapping, let us once again recall, that the technological development of mankind began precisely with the manufacture of the first tools, approximately 2.5 million years ago. During the Paleolithic period or the Old Stone Age, that lasted until about ten thousand years ago, and the Mesolithic period or the Middle Stone Age, stone represents the key material in the manufacture of tools that are absolutely indispensable for hunting as well as for other daily necessities. Different methods and techniques of knapping are employed, and often several of them

Schematic display of three different modes of stone knapping (according to Inizan et al. 1992: picture 7). The aim in conjunction with the third mode being the manufacture of blades and implements on blades

alatki neophodnih za lov i druge svakodnevne potrebe. Primjenjuju se razne metode i tehnike okresivanja, a često je više njih prisutno unutar istoga kulturnog ili vremenskog razdoblja. Tehnološke inovacije, premda u početku vrlo rijetke, omogućile su razvoj metoda okresivanja kamena čija primjena daje sve veću dužinu upotrebnih rubova alatki s obzirom na istu težinu iskorištenog sirovinskog materijala (Tablica 1). To je rezultiralo većom neovisnošću od izvora sirovinskih materijala i time izravno povećalo pokretljivost različitih skupina lovaca i skupljača.

RAZDOBLJE	CILJ PROIZVODNJE	DULJINA RADNIH RUBOVA
donji paleolitik	sjekač ili grubi šačnik; 2 fina šačnika	10-40 cm
srednji paleolitik	levaloaški šiljci (šiljasti odbojci)	200 cm
gornji paleolitik	sječiva	600-2000 cm

Tablica 1. Postignute duljine radnih rubova iz 1 kg rožnjaka, primjenom različitih metoda u izradi rukotvorina tipičnih za pojedina paleolitička razdoblja. Modificirano prema A. Leroi-Gourhan (1992:107).

Premda se u neolitiku kamen počinje obradivati glačanjem (glačane sjekire), okresivanje kamena nije iščezlo, a ponekad se upravo njime oblikuje poluproizvod prije glačanja. Tehnologija okresanog kamena prisutna je i u metalnim razdobljima iako ona sve više gubi na značenju te mnoge metode padaju u zaborav. Međutim prapovijesni načini obrade kamena nisu se potpuno izgubili. Još su nedavno novogvinejski urođenici izrađivali kamene

are present within the same cultural or temporal period. Technological innovations, although very rare at the beginning, rendered possible the development of stone knapping methods, whose application resulted in the achievement of ever increasing lengths of tool working edges out of the same amount of used raw material (Table 1). This resulted in a greater independence from sources of raw materials, and with it directly increased the mobility of the different groups of hunters and gatherers.

PERIOD	PRODUCTION SCOPE	WORKING EDGE
Lower Paleolithic	Chopper or 2 fine bifaces	10 - 40 cms coarse biface;
Middle Paleolithic	Levallois points (pointed flakes)	200 cms
Upper Paleolithic	Blades	600 - 2,000 cms

Table 1. The obtained working edge lengths from 1 kg of chert, with the application of different methods for the manufacture of artefacts, typical for individual Paleolithic periods. Modified after A. Leroi-Gourhan (1992: 107).

Although the processing of stone by polishing begins in the Neolithic period (polished axes), stone knapping had not disappeared, and sometimes it is precisely by the use of this method that preforms are formed that await to be polished. Stone knapping technology is also present in the metal periods, even though it is increasingly losing in importance and many methods fall into oblivion. However, prehistoric ways of stone processing had not disappeared completely. Not long ago, natives from New Guinea were still manufacturing stone

sjekire, a potrebu za održanjem te tradicije možda nisu potpuno istisnule suvremene metalne alatke. S druge pak strane arheolozi izravnim eksperimentiranjem oživljuju mnogobrojne prapovijesne vještine obrade kamena bez čega bi spoznaje o tehnološkom umijeću i cjelovitoj slici davnasnjih ljudi bile zasigurno značajno skromnije.

## Što govore litički nalazi Šandalje?

Uz pomoć suvremenih metoda litičkih analiza mnoge nam spoznaje mogu pružiti nalazi iz špilje Šandalja. Već je spomenut sjekač iz Šandalje I koji bi možda mogao biti jedna od najranijih alatki pronađenih na europskom tlu. U arheološkom smislu mnogo je interesantnija Šandalja II iz čijih slojeva potječe petnaestak tisuća litičkih nalaza i koštane rukotvorine iz razdoblja gornjeg paleolitika. Istraživanja je započeo B. Bačić 1961. godine, a dugotrajna sustavna iskopavanja tog lokaliteta vodio je M. Malez. Osim litičkih nalaza prikupljeni su mnogobrojni faunistički ostaci te ulomci ljudskih kostiju (Malez 1987.; Miracle 1995.). Po količini prikupljenog materijala Šandalja II najbogatije je gornjopaleolitičko nalazište Hrvatske, vrlo važno za proučavanje života lovaca i skupljača te rekonstrukciju njihova okoliša u istočnojadranskoj regiji. Analiza litičke industrije pokazala je prisutnost dvaju glavnih razdoblja: orinjasijena i epigravetijena (Karavanić 1999.). Prvo se na nalazištu javlja pred približno dvadeset i sedam tisuća godina, a drugo sedam tisuća godina kasnije. Najčešće lovljene velike životinje bile su konj, pragovedo i jelen, a njihova zastupljenost varira ovisno o razdoblju kad su lovljene (Miracle 1995.; Brajković &

axes, and perhaps it was not modern metal tools that completely stifled the need for continuing with this tradition. On the other hand, with the help of direct experimentation, archaeologists had been reviving numerous prehistoric stone processing skills, and without this the perceptions in conjunction with these technological skills and with the complete picture of ancient man, would surely have to be presented in a far more modest manner.

## What are lithic finds from Šandalja telling us?

It is with the aid of modern lithic analysis methods that finds from the Šandalja cave can offer us a better understanding of things. The already mentioned chopper from Šandalja I, could perhaps represent one of the earliest tools discovered on the European continent. Šandalja II is far more interesting from the archaeological point of view, as approximately fifteen thousand lithic finds were discovered in its layers, as well as bone artefacts from the Upper Paleolithic period. Exploration activities were started by B. Bačić in 1961, while long lasting systematic excavations on this locality were conducted by M. Malez. Apart from lithic finds, numerous faunal remains and human bone fragments were also discovered (Malez 1987; Miracle 1995). Judging by the quantity of collected materials, Šandalja II represents the richest Upper Paleolithic site in Croatia, and at the same time it is very important for the study of the way hunters and gatherers lived, as well as for the reconstruction of their surroundings in the Eastern Adriatic region.

A lithic industry analysis showed the presence of two main periods: the period of the Aurignacian industry and that of the Epigravettian industry (Karavanić 1999). The former appeared on this site approximately twenty-seven thousand years ago, whilst seven thousand years later the same is true for the latter. The most widely hunted large animals were horses, aurochs and deer, their representation

Miracle 1997.). Slojevi nataloženi prije desetak tisuća godina, pred sam kraj paleolitičkog razdoblja, najbogatiji su litičkom industrijom koja pripada kasnom epigravetijenu. Tada je špilja bila najintenzivnije nastavana. Jezgre, lomljevina i alatke pronadene su u mnogim slojevima. Sirovinski materijal za izradu alatki šandaljski su lovci možda sabirali u dolini rijeke Soče ili drugih alpskih rijeka koje su zbog niže razine mora tekle bliže Šandalji, te u srednjoj i istočnoj Istri (Zupanič 1975.).

Prisutnost odbojaka s okorinom u mnogim slojevima pokazuje da je prvi stupanj proizvodnje (isprobavanje kakvoće materijala i skidanje okorine) često obavljan na samom nalazištu. Ostali nalazi (lomljevina) upućuju na neprekidnu proizvodnju do finalnih alatki koje su u velikom broju pronadene, posebno u slojevima kasnog epigravetijena. Alatke su izradivane na odbojcima, sječivima i pločicama. Analiza sječiva upućuje na primjenu tehnike izravnog odbijanja mekim čekićem tijekom orinjasijena, a ta je tehnika vjerojatno bila prisutna i u epigravetijenu. U orinjasijenskim slojevima



Sječiva. Šandalja II, orinjasijen

Blades. Šandalja II, Aurignacian period

well as in Central and Eastern Istria (Zupanič 1975). The presence of cortical flakes in many layers shows that the primary level of production (material testing and cortex removal) was often executed on the site itself. Other finds (debitage products) indicate an uninterrupted manufacturing process, up to the finished tools that were discovered in large numbers, especially in Late Epigravettian period layers. Tools were manufactured on flakes, blades and bladelets. Blade analyses point to the use of the direct flaking technique with a soft hammer during the Aurignacian period, and it is probable that this technique was likewise present in the Epigravettian period. In the

varying in accordance with the period when they were hunted (Miracle 1995; Brajković & Miracle 1997). Layers that were deposited about ten thousand years ago, just before the end of the Paleolithic period, are the richest ones in lithic industry which belongs to the Late Epigravettian culture. It was then that the cave was most intensively inhabited. Cores,debitage products, and tools were discovered in many layers. It is possible that the hunters from Šandalja collected the raw materials needed for the manufacture of tools in the Soča river valley, or in valleys of other alpine rivers, that due to the lower level of the sea flowed closer to Šandalja, as



Njuškoliko grebalo. Šandalja II, orinjasijen

Nosed endscraper. Šandalja II, Aurignacian period

Izrazita mnogobrojnost litičkog materijala u slojevima kasnoga epigravetijena Šandalje, te različita zastupljenost sezonskih vrsta lovnih životinja (Miracle 1995.) upućuje na zaključak da je Šandalja II u tom vremenskom razdoblju vjerojatno bila dugotrajno stanište, s očitim dokazima radionice alatki na tom mjestu, premda je mogla biti i kratkotrajno stanište koje je često i vrlo intenzivno bilo nastavano.

pronadene su tipične alatke za tu kulturu, njuškolika i kobiličasta grebala, dok epigravetijenski slojevi obiluju kratkim grebalima, malim šiljcima zvanim gravetice te pločicama s hrptom, koje su kao i gravetice bile dijelovi lovačkog oružja.

Aurignacian layers tools typical for this culture were discovered, such as nosed and keeled endscrapers, whereas Epigravettian layers abound with short endscrapers, small points called microgravettes, and backed bladelets, that like microgravettes were parts of hunting arms.

The conspicuous large numbers of lithic finds in layers belonging to the Late Epigravettian period in Šandalja, and the different representation of seasonal varieties of animals that were hunted (Miracle 1995), suggest a conclusion, that during that particular period of time Šandalja II probably represented a dwelling for long-term occupation,

with palpable proof that a workshop for the manufacture of tools stood there, even though Šandalja could also have been a dwelling for short-term occupation, that was often and very intensively inhabited.



Kratka grebala (Kružna i noktolika grebala). Šandalja II, kasni epigravetijen

Short endscrapers (circular and thumb-nail endscrapers). Šandalja II, Late Epigravettian period

Gravetica. Šandalja II, kasni epigravetijen



Microgravette. Šandalja II, Late Epigravettian period



Pločice s hrptom. Šandalja II, kasni epigravetijen

Backed bladelets. Šandalja II, Late Epigravettian period



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ALATKA, gotov proizvod u procesu proizvodnje, načinjen za određenu upotrebu.

ARTEFAKT, vidi RUKOTVORINA.

AŠELEJEN, kultura donjeg paleolitika koja je dobila naziv po eponimnom lokalitetu Saint-Acheul u Francuskoj. Tipične alatke su šačnici i sjekirice, a uz njih dolaze i alatke načinjene na odbojcima: strugala, grebala i udupci.

BULBUS, vidi IZBOČINA.

ČEKIĆ - prirodni udarač, kojim se pri okresivanju kamena udara po jezgrinoj udarnoj plohi ili po rubu alatke. Tvrdi čekić je kameni oblutak ili blok, a meki čekić je palica od roga, kosti ili tvrdog drva.

DLIJETO, obično komad roga čiji se vrh postavlja na rub jezgrine udarne plohe da bi se udarcem mekim čekićem po bazi dljeteta izvršilo neizravno odbijanje sječiva.

DODATNA OBRADA, obično nastaje kvrcanjem manjih odbojaka na radnom rubu ili površini buduće alatke sa svrhom izradivanja ili dovršavanja te alatke. Ponekad sa primjenjuju posebne tehnike odrade, primjerice pri izradi dubila.

DORZALNA STRANA, vanjska strana odbojka, sječiva, pločice ili alatke koja pokazuje tragove ranijih odbojaka. Može biti djelomično ili potpuno prekrivena okorinom.

DUBILO, kameno oruđe s dljetasto oblikovanim radnim rubom koji može biti sjecište dviju ili više ploha alatke, sjecišta jedne ili više ploha s poprečno obradenim

ACHEULEAN - describing a culture of the Lower Paleolithic period that was named after the eponymous locality of Saint-Acheul in France. Typical tools are bifaces and small axes, together with tools manufactured on flakes: sidescrapers, endscrapers and notch pieces.

ARTEFACT - a product or object made by human hand. It can be either a finished product (a tool), an unfinished product, or any debitage product.

AURIGNACIAN - of or pertaining to an Upper Paleolithic culture; named after the eponymous site of Aurignac, a town in Haute-Garonne, France. It lasts during a period approximately defined as between 40,000 and 20,000 years before present. It appears in regions of Europe, the Middle East, and Northern Africa. Characteristic for it is the manufacture of blades and the often appearing stepped retouch technique. Tools typical for this period are nosed and keeled endscrapers, as well as split and massive-base bone points.

BIFACE - a bifacially formed, almond-shaped tool, typical for the Acheulean culture. A core of stone is usually formed into a biface, mostly by removal with a hard hammer, whereas in the finishing phase of manufacture a soft hammer was frequently used.

BLADE - a flake with more or less parallel lateral edges, whose length is at least twice the size of its width. One or both of the lateral edges can be retouched, and the same applies for the transverse edge (truncated edge). Different tools can be manufactured on blades, such as endscrapers, burins, drills. Blades often appear in the Upper Paleolithic period, although they are present already in the Mousterian culture.

- rubom ili s bridom koji je nastao lomom. Česta su u gornjem paleolitiku.
- EPIGRAVETIJEN, kulturni kompleks koji se nastavlja na gravetijen. Započinje prije približno 18.000 godina, a završava pred desetak tisuća godina. Dolazi na Mediteranu te kontinentalnim dijelovima srednje i istočne Europe. Učestale alatke obično su šiljci s usijekom, kratka grebala i geometrijski mikroliti.
- GREBALO, kamena alatka načinjena na odbojku ili sječivu, s obradenim jednim ili oba poprečna ruba. Obradeni rub obično je zaobljen premda ponekad može biti ravan. Česta je u gornjem paleolitiku.
- IZBOČINA, izbočenje vidljivo na ventralnoj strani odbojka, sječiva ili pločice koje se nalazi ispod ploha.
- JEZGRA, kameni komad od kojeg su namijenski odbijani odbojci, sječiva ili pločice. Ukoliko kamen pokazuje samo pripremu jezgre (izrada udarne plohe, skidanje okorine) radi se o pred-jezgri, dok je prava jezgra ona od koje su odbijeni pravi odbojci.
- KOLOBARI, linije u obliku valova obično vidljive na ventralnoj strani.
- KORTEKS, vidi OKORINA.
- KRHOTINA, obično debeo ulomak kamena neodređenog oblika koji se ne može klasificirati u neku poblizu kategoriju.
- LANAC OPERACIJA, kronološka ljestvica različitih faza kroz koje sirovinski materijal prolazi zbog izravne ljudske djelatnosti tijekom svog "životnog ciklusa" (primjerice sabiranje i ispitivanje sirovine, više faza proizvodnog procesa, upotreba alatke, dorada, odbacivanje). Ustanovio ga je A. Leroi-Gourhan.
- LEVALOŠKA METODA, metode izrade odbojaka predodređenih formi. Pojavljuje se pred približno pola
- BLADELET - a small blade (usually 3 cms or less in size), i.e. a small, thin and elongate artefact. Bladelets are not always retouched, however, if they serve as tools they have one or two retouched edges (lateral or transverse), and they can have one or more notches. They appear on a regular basis in the Upper Paleolithic and Mesolithic periods.
- BLANK - any lithic material removal of appropriate shape and size for the manufacture of a tool.
- BULB OF APPLIED FORCE - a bulge visible on the ventral surface of a flake, blade or bladelet, situated underneath the platform.
- BURIN - a stone implement with a punch-shaped working edge that can be a point of intersection of two or more tool scars, a point of intersection of one or more scars with a transversely retouched edge or with an edge that was created by break. They are widely spread in the Upper Paleolithic period.
- CHAINE OPERATOIRE - a chronological scale of the different phases to which the raw material is exposed because of direct human activity during the course of its "life cycle" (e.g. collecting and testing of raw materials); several phases in the production process, tool usage, repair, discard. It was established by A. Leroi-Gourhan.
- CHOPPER - a coarse tool that at the same time also represents a core, obtained by debitage of larger flakes with a hard hammer in the vicinity of the pebble edge, from one side only. It is typical for the Oldowan industry, even though it appears in later periods as well.
- CHOPPING TOOL - a coarse tool that at the same time also represents a core, obtained by knapping of larger flakes with a hard hammer along an edge of a pebble, on both sides of the same edge. It is typical for the Oldowan industry, even though it appears in later periods as well.
- CONJOINING - a procedure involving the mutual matching and gluing of the flakes themselves, and of flakes to the core from

milijuna godina. Naziv je dobila po predgradu Pariza Levallois-Perret, gdje se nalazio eponimni lokalitet.

LOMLJEVINA, svi komadi okresani od jezgre tj. potencijalne alatke (odbojci, sječiva, pločice), dotjerivi odbojci i krestasta sječiva koje je nužno odbiti za nastavak tehnološkog procesa, te otpad.

LOMLJENJE, okresivanje kamena čiji je cilj proizvodnja lomljevine, koja se može odmah upotrijebiti ili dalje obrađivati u različite tipove alatki.

Lomljenje (DEBITAGE) obično se u literaturi na engl. jeziku koristi za lomljevenu (DEBITAGE PRODUCTS).

METODA, ukupnost postupaka koji vode do zadanog cilja, tj. izrade alatke.

MEZOLITIK, srednje kameno doba, termin koji označava period lova i skupljanja od kraja pleistocena (10.000 godina prije sadašnjosti) do pojave poljodjelstva. U litičkim industrijama dolazi do izrazite mikrolitizacije, a često i do geometrijske standardizacije alatki.

MIKROLIT, mali kameni komadić, obično alatka, čija je duljina manja od 4 cm. Može biti izrazito malih dimenzija (manji od 25 mm). Često se uz taj termin vežu različiti geometrijski oblici premda on obuhvaća i druge tipove alatki.

MUSTERIJEN, kultura koja pripada razdoblju srednjeg paleolitika i gotovo se uvijek veže za neandertalce. Naziv je dobila po eponimnom nalazištu Le Moustier u Francuskoj. Počinje prije približno 130.000 godina i traje do tridesetak tisuća godina prije sadašnjosti. Dolazi na zemljopisnim prostorima Europe, Afrike i dijelovima Azije. Razaznaje se više tipova te kulture, a tipične alatke obično su strugala, udupci ili nazupci.

NEOLITIK, mlade kameno doba, razdoblje koje je obilježeno poljodijelstvom i pripitomljavanjem

which they were removed, in order to reconstruct the knapping process.

CORE - a block of raw material from which flakes, blades or bladelets were intentionally taken. If a stone merely shows traces of core preparation (execution of a striking platform, removal of cortex) we speak about a pre-core, the real core being the one from which real flakes were removed.

CORTEX - the outer surface, i.e. the crust covering a pebble or nodule.

DEBITAGE - knapping of stone in order to manufacture debitage products that can be either used immediately or subjected to further retouching processes so as to create different types of implements. In English literature the term debitage is usually used for debitage products.

DEBITAGE PRODUCTS - all removals knapped from a core, i.e. potential tools (flakes, blades, bladelets), rejuvenation flakes and crested blades that have to be removed in order to proceed with the technological process, as well as waste.

DEBRIS - a usually thick fragment of stone of undefined shape that cannot be classified into any more detailed categories.

DORSAL SURFACE - the outer side of a flake, blade, bladelet or tool, showing scars of earlier flakes. Sometimes it can be either partially or wholly covered with a cortex.

DRILL - a tool made on a flake or blade, having one or more pointed peaks. A pointed peak can be straight, offset or incurved. It appears much more often in the Upper Paleolithic than in the Middle Paleolithic.

EDGE - a flake or a tool usually has four edges, even though at times it may possess only three or two edges. We differentiate between the left and right lateral edge, and the two transverse edges. These are: the distal (distant) and proximal (near) edges.

ENDSCRAPER - a stone tool manufactured on a flake or blade, with one or with both transverse edges retouched. The retouched edge

životinja. Zamjenjuje ga bakreno doba ili eneolitik. U neolitiku se javljaju stalna naselja i keramika, a kamen se osim okresivanjem obrađuje i glačanjem.

**OBLIKOVANJE**, postupak okresivanja koji komad sirovinskog materijala stavlja u određen oblik.

**OBRADA**, vidi DODATNA OBRADA.

**ODBOJAK**, obično tanji kameni komad, odbijen od jezgre, na kojem su uočljivi plohak i izbočina.

**OKORINA**, vanjska površina tj. kora kojom je prekriven kameni oblutak ili gomolj.

**OKRESIVANJE**, lomljenje, oblikovanje ili obrađivanje kamena s ciljem izrade ruketvorina, bez obzira koje se metode i tehnike primjenjuju.

**OKRHAK**, bilo koji komad litičkog materijala pogodnog oblika i veličine za izradu alatke.

**OLDUVAJEN**, razdoblje prvih i najjednostavnijih kamenih alatki, koje su ujedno i jezgre (sjekači i sjeckala). Definirano po nalazima iz klanca Olduvai (ležište I) u Tanzaniji. Alatke se izrađuju od oblutaka izravnim udarcima tvrdim čekićem po rubu. Ustaljeno je mišljenje da ih je izrađivao *Homo habilis*, premda su u ležištu I klanca Olduvai pronađeni i ostaci *Australopithecus boisei*, pa je vjerojatno i on mogao izradivati te alatke. Na drugim lokacijama istog klanca olduvajenske alatke pronađene su s ašelejskim šačnicima koje je izrađivao *Homo erectus*, pa nije jasno treba li te alatke svrstati u razvijeni olduvajen, odvojivši ih od ašelejena, ili ih smatrati dijelom lokalne ašelejske kulture.

**ORINJASIJEN**, kultura gornjeg paleolitika nazvana po eponimnom nalazištu Aurignac u Francuskoj. Traje približno između 40.000 i 20.000 godina prije

is usually rounded off, even though at times it can be straight. Widely spread in the Upper Paleolithic.

**EPIGRAVETTIAN** - denoting a cultural complex that follows the Gravettian period. It started approximately 18,000 years ago and ended approximately 10,000 years ago. It appears on the Mediterranean and in continental parts of central and eastern Europe. Tools that often appear are usually shouldered points, short endscrapers and geometric microliths.

**ERAILLEUR SCAR** - a bulb scar that can be situated on the ventral surface.

**FLAKE** - a usually thin stone removal, flaked from a core, on which a platform and a bulb of applied force are visible.

**HAMMER** - a natural striker with which the core's striking platform or a tool edge was struck during the stone knapping process. A hard hammer is a pebble or a block of stone, a soft hammer is a piece of antler, bone, wood.

**HEAT TREATMENT** - the heating up of certain types of raw materials, so as to make them more suitable for further retouching. This procedure probably appears already in the Upper Paleolithic, during the manufacture of foliate points of the Solutrean culture.

**IMPLEMENT** - see tool.

**KNAPPING** - producing debitage products, shaping or retouching of stone with the scope of manufacturing a tool, regardless of the applied methods and techniques.

**LEVALLOIS METHOD** - a method for the manufacture of flakes with predetermined shapes. It first appears approximately 500,000 years ago. Its name was acquired from the Parisian suburb of Levallois-Perret, where the eponymous site was located.

**MESOLITHIC** - pertaining to or describing the Middle Stone Age, a term denoting a period of hunting and gathering from the end of the Pleistocene (10,000 years before present) until the advent of a settled agriculture. Lithic industries are subject to a distinctive

sadašnjosti. Dolazi na prostorima Europe, Bliskog istoka i Sjeverne Afrike. Označuje ju izrada sječiva i učestala stepeničasta obrada. Tipične alatke su njuškolika i kobiličasta grebala te koštani šiljci s rascijepljenom i punom bazom.

ORUĐE, vidi alatka.

OTPRSLINA, brazgotina koja se može nalaziti na ventralnoj strani.

PALEOLITIK - starije kameno doba, najstarije i najduže razdoblje prapovijesti. Započinje prije približno 2.500.000 godina i traje sve do približno 10.000 godina prije sadašnjosti. Kameno oruđe izrađuje se isključivo okresivanjem. U ekonomskom smislu to je razdoblje lova i skupljanja plodova. Najstariji paleolitik označuje olduvajen. Za donji ili stariji paleolitik značajan je ašelejen, premda on nije jedina kultura tog razdoblja. Izrada šačnika na kamenoj jezgri, ali i alatki na odbojcima, označuje tu kulturu. U donjem paleolitu javlja se levaloaška metoda. Srednji paleolitik je vrijeme musterijena i neandertalaca. Primjena levaloaške metode česta je u tom razdoblju. Gornji ili mladi paleolitik razdoblje je ranog modernog čovjeka. Iznimka je šatelperonijen koji se još uvijek veže za neandertalca. Gornji paleolitik označava smjenjivanje mnogobrojnih kultura koje su prisutne na širim ili samo ograničenim zemljopisnim prostorima. Neke od tih kultura su: orinjasijen, gravetijen, solitrejen, magdalenijen. Vrlo je česta izrada sječiva, koja se oblikuju u različite alatke, i proizvodnja koštanih alatki. Iz tog razdoblja potječu mnogobrojna umjetnička djela špiljskog slikarstva i predmetne umjetnosti.

PATINA, prirodna promjena površine kamenih komada do koje može doći nakon okresivanja.

process of microlithisation, and often to geometrical standardisation of tools.

METHOD - the totality of procedures leading to the set goal, i.e. the manufacture of a tool.

MICROLITH - a small stone fragment, usually a tool, whose length measures less than 4 cms. Its dimensions can be distinctively small (less than 25 mm). Very often different geometrical forms are tied with this term, even though it also encompasses other types of tools.

MOUSTERIAN - pertaining to or describing the culture stage of the Middle Paleolithic, represented in western Europe by stone artefacts and other materials believed to indicate the social forms of the Neanderthal race of hunters. The name stems from the eponymous site of Le Moustier in France. It starts approximately 130,000 years ago and lasts until about thirty thousand years before present. It appears in Europe, Africa, and parts of Asia. Several types of this culture can be distinguished. Typical tools are sidescrapers, notch pieces or denticulate pieces.

NEOLITHIC - of or pertaining to the period of human culture following the Mesolithic. The New Stone Age, a period marked by settled agriculture and animal domestication. It in turn is followed by the Copper Age or Eneolithic. It is characterised by the appearance of permanent settlements and ceramics, while stone is processed not only by knapping but also by polishing.

NOTCH PIECE - flake or blade with a notch (recess), situated on an edge that can be shaped in various manners. We differentiate between an ordinary notch piece, retouched on its notch, and a notch piece created by usage, resulting from the scraping of an object with a circular cross-section, for example.

We likewise distinguish a notch piece of the Clactonian type, that is of bigger proportions and made by a single blow with a hammer along the edge. If a tool has several notches it is called a denticulate piece.



PLOČICA, malo sječivo (obično dužine 3 cm ili manje) tj. sitna, tanka i izdužena rukotvorina. Neobrađene su ili, ukoliko su alatke, imaju obrađeni jedan ili dva ruba (bočna ili poprečna), a mogu imati jedno ili više izrađenih udubljenja. Pločice su česte u gornjem paleolitu i mezolitu.

PLOHAK, dio jezgrine udarne plohe koji je ostao na odbojku. Moguće je razaznati više tipova, primjerice plohak prekriven okorinom, gladak, višeplošan (fasetiran), dvopovršinski (diedričan).

PRITISKAČ, alat kojim se pritišće po rubu buduće alatke ili jezgre da bi se dobila željena dodatna obrada ili odlomila sječiva, odnosno pločice. Za odlamanje sječiva pritiskač može imati oslonac za trbuh, što omogućuje veću silu pritiska. Vrh pritiskača u paleolitu bio je načinjen od roga, a u kasnijim razdobljima zamjenjuje ga metal.

RADNI RUB, rub alatke koji je bio korišten. Tragovi korištenja pouzdano se utvrđuju sitnozrnim analizom ruba.

RUB, odbojak ili alatka obično imaju četiri ruba, premda ponekad mogu posjedovati samo tri ili dva ruba. Razlikujemo lijevi i desni bočni (lateralni) rub, i dva poprečna (transverzalna) ruba. To su: distalni (dalji) i proksimalni (bliži).

RUKOTVORINA, izradovina odnosno predmet načinjen ljudskom rukom. Može biti gotov proizvod (alatka), nedovršen proizvod ili bilo koji dio lomljevine.

SJECKALO, gruba alatka, ujedno i jezgra, dobivena odbijanjem većih odbojaka tvrdim čekićem po rubu oblutka, s obje strane istog ruba. Tipična je za olduvajen, premda dolazi i u kasnijim razdobljima.

OLDOWAN - denoting a period of the first and simplest stone tools that at the same time represent cores (choppers and chopping tools). It is defined by finds from the Olduvai Gorge (Bed I) in Tanzania. Tools are made from pebbles by direct percussion with a hard hammer along the edge. An established notion is that they were manufactured by *Homo habilis*, even though the remains of *Australopithecus boisei* were also discovered in Bed I of the Olduvai Gorge, and consequently, it is probable that he too was in a position to manufacture these tools. On other localities of the same gorge, Oldowan tools were discovered with Acheulean bifaces manufactured by *Homo erectus*, and as a consequence it is not clear, whether these tools should be classified into the developed Oldowan period, thereby separating them from the Acheulean period, or if they should be regarded as part of the local Acheulean culture.

PALEOLITHIC - of, pertaining to, or associated with the Old Stone Age, the oldest and longest period from prehistory. It starts about 2,500,000 years ago and lasts until approximately 10,000 years before present. Stone tools are made exclusively by knapping. In an economic sense this represents a period of hunting and gathering. The oldest Paleolithic period is denoted as the Oldowan industry. The Acheulean culture is of particular significance for the Lower Paleolithic period, even though it does not represent the only culture of that period. Characteristic for this culture is the manufacture of bifaces on stone cores, and of tools on flakes. In the Lower Paleolithic the Levallois method appears. The Middle Paleolithic is a time belonging to the Mousterian culture and to Neanderthal man. The application of the Levallois method is common in this period. The Upper Paleolithic is a period of early modern man. The Chatelperronian culture represents the sole exception to this, as it is still tied to Neanderthal man. The Upper Paleolithic marks the removal of numerous cultures that are

**SJEČIVO**, odbojak s više ili manje usporednim bočnim rubovima, čija je dužina barem duplo veća od širine. Na jednom ili oba bočna ruba može se nalaziti dodatna obrada, a ona može doći i na poprečnom rubu (zarubak). Na sječivima mogu biti izradene različite alatke poput grebala, dubila, svrdla. Sječiva su česta u gornjem paleolitiku premda se javljaju već u musterijenu.

**SJEKAČ**, gruba alatka, ujedno i jezgra, dobivena odbijanjem većih odbojaka tvrdim čekićem pri rubu oblutka, samo s jedne strane. Tipična je za olduvajen, premda dolazi i u kasnijim razdobljima.

**SOLITREJEN**, kultura gornjeg paleolitika nazvana po nalazištu Solutré u Francuskoj. Počinje prije više od 20.000 godina i traje do približno 18.000 godina prije sadašnjosti. Dolazi na prostorima Francuske, Španjolske i Portugala. Tipične alatke su tanki listoliki, obostrano oblikovani šiljci. Usporedna obrada postiže se primjenom tehnike pritiska u završnoj fazi izrade. Pri izradi tih šiljaka vjerojatno se već primjenjivao toplinski postupak.

**SPAJANJE**, postupak međusobnog sljepljivanja odbojaka, te odbojaka i jezgre od koje su odbijeni u cilju rekonstrukcije okresivanja.

**STRUGALO**, alatka načinjena na odbojku ili sječivu s obradom na jednom ili više radnih rubova koji su obično izbočena, ravna ili udubljena poluoštrica. Najkarakterističnija su za musterijen iako su pojedini tipovi musterijena siromašni strugalima. Već se pojavljuju u ašelejenu a rijetko dolaze u gornjem paleolitiku ili neolitiku.

**SVRDLO**, alatka načinjena na odbojku ili sječivu koja ima jedan ili više šiljastih vrhova. Šiljasti vrh može biti

present either in broader or in limited geographical regions. Some of these cultures are the Aurignacian, Gravettian, Solutrean, Magdalenian cultures. Very common during this period is the manufacture of blades that are formed into different tools, as well as the manufacture of tools made from bone. Numerous works of art, ranging from cave paintings to sculptured forms, stem from this period.

**PATINA** - a natural change of the surface of stone removals that can occur after knapping.

**PLATFORM** - a part of the core's striking platform that was left on the flake. Several types can be discerned, e.g. a cortical platform, a plain, faceted, dihedral platform.

**POINT** - a thin elongate tool with a sharp peak. The lateral edges come closer and join at the top, thus creating a sharp angle. Big differences in size, shape and manufacturing techniques are visible when comparing points from the Middle and Upper Paleolithic periods. Upper Paleolithic points are smaller in size, much thinner, and manufactured by an abrupt retouch technique (e.g. the Gravettian point).

**PRESSING TOOL** - a tool for pressing along the edge of a future tool or core, so as to obtain the desired retouch or to obtain blades and bladelets. During debitage of a blade the pressing tool may have its abdominal crutch, which allows for a greater pressure strength. The top of the pressing tool was made from antler in the Paleolithic period, in later periods antler was substituted by metal.

**PUNCH** - usually a piece of antler, whose top is placed on the edge of the core's striking platform, so as to perform an indirect flaking of a blade by a soft hammer blow on the base of the punch.

**RETOUCH** - usually results from the removal of smaller flakes from a working edge or surface of a future tool, with the scope of manufacturing or finishing this tool. Sometimes special retouching techniques are applied, e.g. during the manufacture of burins.

ravan, kos ili zakrivljen. Znatno je češće u gornjem paleolitiku nego u srednjem paleolitiku.

ŠAČNIK, obostrano (bifacijalno) oblikovana alatka bademasta oblika, tipična za ašelejen. Obično se kamena jezgra oblikuje u šačnik ponajprije odbijanjem tvrdim čekićem, a u završnoj fazi izrade često se koristio meki čekić.

ŠANDALJA, špilja, arheološko nalazište udaljeno približno 4 km sjeveroistočno od Pule, smješteno na istočnoj padini manjeg brda zvanog Sv. Daniel, po kome je i dobilo ime. Istraživanja je započeo B. Bacić 1961. godine, a ubrzo ih je preuzeo i vodio M. Malez. Istraživanja su završila 1989. godine. Naziv Šandalja I obično se odnosi na nalaz koštane breče koja je sadržavala ostatke vilafranske faune, sjekač i jednu valuticu koja je možda mogla poslužiti kao čekić. Šandalja II dala je mnogobrojne litičke i faunističke nalaze iz gornjeg paleolitika i najbogatije je nalazište iz tog razdoblja u Hrvatskoj. Nalazi svjedoče da je špilja bila nastavana tijekom orinjasijena, epigravetijena i brončanog doba. Ostaci fosilnih ljudi iz Gornjeg Paleolitika također su pronađeni na ovom nalazištu.

ŠILJAK, izdužena tanka alatka oštroga vrha. Bočni se rubovi primiču i spajaju u vrhu tvoreći oštar kut. Uočljive su velike razlike u veličini, obliku i tehnici izrade između šiljaka srednjeg i gornjeg paleolitika. Gornjopaleolitički su manji, znatno tanji i izradeni strmom obradom (primjerice gravetijenski šiljak).

TALON, vidi PLOHAK.

TEHNIKA, način s kojim se okresuje (primjerice, izravno okresivanje mekim čekićem, odlamanje pritiskom).

RIPPLES - lines in the form of waves that are usually visible on the ventral surface.

SCAR - a depression on the side of a core and of a blank, originating from knapping of a flake, blade or bladelet.

SHAPING - a knapping treatment whereby a piece of raw material is formed in a certain manner.

SIDESCRAPER - a tool made on a flake or blade by retouching one or more working edges, representing more or less a cutting edge, usually convex, straight or concave in shape. Sidescrapers represent the most characteristic tools of the Mousterian culture, even though in certain types of the Mousterian culture sidescrapers are a rare occurrence. They appear already in the Acheulean culture and are rarely found in the Upper Paleolithic or Neolithic.

SOLUTREAN - pertaining to or characteristic of an Upper Paleolithic culture, named after Solutré, a village in central France, where remains were discovered. It starts more than 20,000 years ago and lasts approximately until 18,000 years before present. It appears in France, Spain and Portugal. Typical tools are represented by thin bifacial foliate points. A parallel retouch is obtained with a pressure technique applied in the finishing phase of the manufacturing process. The heat treatment was in all probability already in use during the manufacture of these points.

STRIKING PLATFORM - the prepared part of a core that was treated by percussion directly with a hammer, and indirectly by using a punch, or by applying pressure with a pressing tool, so as to obtain flakes, blades or bladelets.

ŠANDALJA - a cave and archaeological site to be found roughly 4 kms to the north-east of Pula, situated on the eastern slope of a small hillock called St. Daniel, from whence it also got its name. In 1961 B. Bacić started with exploration activities there, and soon afterwards they were continued under the leadership of M. Malez. The excavations were concluded in 1989. The name Šandalja I cus-

TOPLINSKI POSTUPAK, zagrijavanje određenih vrsta sirovinskog materijala kako bi postali pogodniji za daljnju obradu. Taj se postupak vjerojatno javlja već u gornjem paleolitiku pri izradi listolikih šiljaka solitrejena.

TRAG, udubljenje na strani jezgre i okrhka nastalo okresi- vanjem odbojka, sječiva ili pločice.

UDARNA PLOHA, pripravljen dio jezgre po kome se udaralo izravno čekićem, neizravno preko dlijeta ili pritiskalo pritiskačem da bi se dobili odbojci, sječiva ili pločice.

UDUBAK, odbojak ili sječivo s urezom (udubljenjem) na rubu koji može biti različito oblikovan. Razlikujemo pravi udubak, kod kojeg se na urezu nalazi obrada, od tzv. udupka od upotrebe koji je nastao primjerice struganjem predmeta kružnog presjeka. Također razlikujemo udubak klaktonijenskog tipa koji je većih dimenzija, načinjen jednim udarcem čekića po rubu. Ukoliko alatka ima više udubljenja nazivamo je nazupkom.

VENTRALNA STRANA, može se nazvati i unutarnjom stranom. Prije odbijanja bila je spojena s jezgrom. Na njoj se ispod ploha nalazi izbočina, ispod i okolo izbočine šire se kolobari, a ponekad je na izbočini uočljiva i brazgotina koju nazivamo otrprslinom.

tomarily refers to a find in the form of breccia, containing faunal remains of the Villefranchian period, a chopper and a single pebble that might have served as a hammer. Šandalja II gave us numerous lithic and faunal finds stemming from the Upper Paleolithic, and represents as such the richest site from this period in Croatia. These finds bear witness that the cave was inhabited during the Aurignacian period, the Epigravettian period, and the Bronze Age. Remains of fossil man from the Upper Paleolithic were likewise discovered at this site.

TECHNIQUE - manner in which knapping is performed (e.g.: direct knapping with a soft hammer, pressure debitage).

TOOL - a finished product in the production process, manufactured for a definite application.

VENTRAL SURFACE - it can also be called the inner surface. Before removal it was connected to the core. On it we can observe a bulb of applied force situated underneath the platform, while below and around the bulb of applied force ripples are spreading, and sometimes a bulb scar, called an erailleur scar, is visible on the bulb of applied force.

WORKING EDGE - the used edge of a tool. Microscopic edge analyses represent a reliable manner to determine wear traces.

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Šandalja II, 1962.

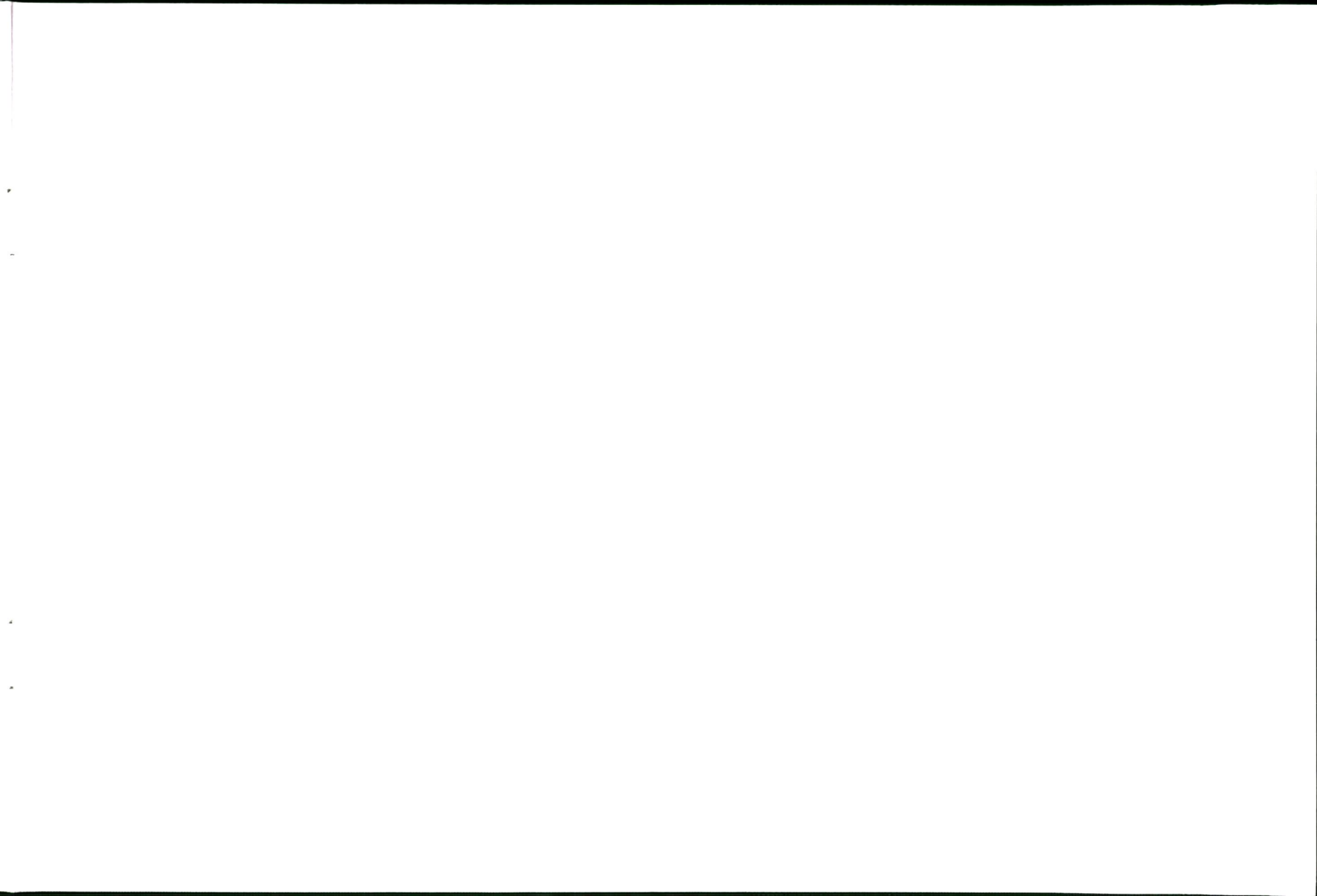




**SANDALJKO**

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PULA · 2000







ARHEOLOŠKI  
MUZEJ  
ISTRE