Fig. 5 Banded flint square axe together with a flintknapping tool kit. ■ Hotová pazourková sekera společně s pomůckami pro štípání pazourku. ■ Angebundene viereckige Feuersteinaxt mit einer Zubehör-Garnitur fürs Feuersteinspalten. ■

The role of experimental flint knapping for the reconstruction of Neolithic flint processing

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Experimental flint knapping is considered by the majority of people as a spectacular event, vividly explaining some methods of flint tools production in prehistory. Although common interest is shown in this particular archaeological field, sadly this doesn't apply too much to an understanding of the flint processing itself. This paper focuses on the role of some flint knapping experiments in the understanding of the Neolithic flint manufacturing.

The beginning of our flint knapping experiments date to the early 1980's and was closely related to an archaeological excavations held in the Krzemionki Opatowskie flint mines. Since then experiment has become a key element of our scientific methodology.

The aims of our flint knapping experiments can be presented as:

- defining the characteristic of morphological features related to applied knapping methods or techniques;
- reconstruction of chain operatoire efficiency or other particular concept used in analysis;
- and finally description of characteristic waste.

In our experiments various factors are being studied. The most obvious is in the use of diverse knapping tools for flint processing, knapping techniques and their application modes, described as methods. Various flints are examined regarding their natural properties for particular tools, knapping quality and abilities to undergo artificial transformations, such as thermoalteration. Furthermore, flint knapping concepts are also reconstructed. We practice the various strategies the knapper applies to overcome flint nodule shape differences or other such obstacles in order to produce a specific tool or half product. An example of such concept appear in the

Fig. 1 Striking blades with an antler; punch (soft hammer) technique. ■ Použití techniky odštěpování k výrobě čepelek. ■ Abspaltentechnik verwendet für Klingen. ■

Fig. 4 Retouching bifacial dagger with direct pressure technique. ■ Použití přímého tlaku při retušování dýky. ■ Der direkte Druck beim Retuschieren eines zweiseitigen Dolches. ■

Fig. 2 Indirect pressure technique with a use of simple implement. ■ Technika nepřímého tlaku s použitím jednoduchého nástroje. ■ Technik des indirekten Druckes mit einfachem Werkzeug. ■ **Fig. 3** Blades obtained with indirect pressure technique. ■ Čepelky získané technikou nepřímého tlaku. ■ Die durch den indirekten Druck mit einfachem Werzeug gewonnenen Klingen. ■

differences between antler punch technique used to produce axes from oval or flat flint nodules, that result in distinct chain operatoire. Even more advanced are the reconstructions of a main concept and its varieties, such as four ways of producing square banded flint axes as described by W. Migal and S. Sałaciński (*Migal - Sałaciński 1996*). Finally, advanced waste studies are being done to characterize waste products which result from the application of different methods and techniques. These concentrate on describing the typical features of square and bifacial core tool production, as well as various types of blade cores preparation. To achieve this goal we analyze a variety of butts and striking platforms, overall blades silhouettes and their relations to their knapping techniques and methods.

As a result of our work various flint knapping traditions can be distinguished on non-homogenous archaeological sites. It also helps in comparing particular flint knapping traditions, as well as enabling a detailed description of flint knapping tradition of an analyzed group of people.

In the case of the Polish Neolithic the flint industry may be seen as follows (*Migal, in print*).

1. The flakes were obtained by splintering and from changing the orientation of the flake cores.

2. The most popular way to obtain blades was with a soft hammer stone using a direct knapping technique, struck from a single - platform cores. Blades are irregular in shape and have uneven longitudinal section, their bulbs are pronounced and butts may be doubled, as a result of the stone hammer striking point. Such production was accessible to almost every member of Neolithic society, and as such abounds in total flint processing record.

3. Some more regular blades, straight, with tipped ends and flat, punctual butts, about 6 cm long, of the Mesolithic tradition (resembling Janislavician Culture halfproducts) seem now to have been stroked by applying some indirect pressure to a single - platform core with cirrcumferencial flaking platforms. Such production appears in the Polish Neolithic Forest Zone in the Neman Culture.

4. Another blade variety of a thin cross section, bearing flat butts, pronounced bulbs and small lips typical of the antler punch technique, come from single - platform cores. Such blades are up to 25 cm long, most likely curved in the middle or towards the tip. They appear in Poland with the Linear Pottery Culture and continue within Western groups of the Funnel Beaker and Corded Ware Culture.

5. Finally there is evidence for the production of narrow, regular blades with a trapezoid cross section and an indistinct bulb, over 25 cm long which come from single - platform cores. The size of such blades and their regularity implies the use of a simple pressure device. Core shapes vary depending on the method of placing core within the pressure device, e.g. bullet or triangular shape. This production appeared within the Funnel Beaker, Globular Amphorae and Eastern Corded Ware Cultures. However it was highly organized and emerged from specialist centers, usually located in the vicinity of flint outcrops or other secondary deposits, e.g. Holly Cross Mountains or Volhynia.

6. When it comes to core tools, the first group is formed by square axes. Their production was organized mainly in three phases:

- rough outs were made using hard hammer stones
- the main forming was done with an antler punch technique
- final retouching might have been done with direct pressure

Various concepts evolved, related to the initial raw material - in case of Jurassic and Volhynian flints - large nodules were the sources of large flakes, and these were formed into axes, banded flint knappers used the flints natural fractures forming plates, so the majority of the banded axes were made of such plates. Square axe production is a source of a characteristic waste, which helps to identify workshops e.g. large flakes - from removing the parallel edges of an axe or the struck off edges flakes. The axes were manufactured mainly in the mine workshops such as in Krzemionki Opatowskie and Swieciechow in Holly Cross Mountain region. They are found in the inventories of the Funnel Beaker, Globular Amphorae and Corded Ware Cultures.

7. Bifacial axes production in the Polish Neolithic is known from the Forest Zone and the late phases of the Corded Ware Culture, otherwise it flourished during the Early Bronze Age. The production centers were located in the vicinity of outcrops, because tools were made of large flakes. The technique was applied by direct striking with a soft antler or wooden hammer. Waste flakes are very distinctive: always curved, bearing a clear lip instead of a butt.

8. During the Neolithic/ Bronze Age transition period bifacial daggers and sickles started to appear. Their presence seems to be initiated by the Bell Beaker Culture. Their production was similar to bifacial axes, but the flakes are rather flat, not curved. In many cases excess flakes damaged the tools. The final phase of retouch was done by direct pressure.

9. The last category of Neolithic core tools is reserved for arrowheads. Their shapes vary among cultures. They are also characteristic for final Neolithic and Bronze Age. Their concept consisted of two stages:

- standardized flake production from cores bearing a characteristic layout - struck using a soft hammer stone, for they were meant to be flat and fairly triangular in shape
- and secondly final direct pressure retouch.

Particularly numerous are Corded Ware Culture workshops producing flint arrowheads.

This brief description of the major flint tool production from the Polish Neolithic is the result of over 20 years of studies, where experiment played an equally important role to other scientific methods. As such it should be useful, when describing and estimating flint knapping waste and workshops found during archaeological excavations. We encourage archaeologists to apply the knowledge coming from flint knapping experiments more commonly, not only by knappers themselves.

Bibliography

Migal W. - Sałaciński S., 1996: Eksperymentalne wytwarzanie siekier czworościennych z krzemienia pasiastego. W: Z badań nad wykorzystywaniem krzemienia pasiastego. Studia nad gospodarką surowcami krzemienymi w pradziejach 3, s.121 – 139, Warszawa

Migal W.: The social condicions of flint processing during the Bronze and Early Iron Age in Poland and Eastern Europe. In Cardiff 2000 Conference Papers in print.

Migal W.: About the variability of reduction sequences at the Globular Amphorae Culture, Bochum Flint Symposium Papers in print.

Summary

Role experimentálního štípání pazourku pro rekonstrukci zpracování pazourku v neolitu

Experimentální štípání pazourku je většinou lidí posuzováno jako působivá možnost, jak živě vyložit některé metody výroby pazourkových nástrojů v pravěku. Této oblasti je věnován široký zájem, ale málokdy je využívána pro hlubší porozumění samotnému procesu zpracování pazourku. Tento článek se soustředí na roli některých experimentů pro porozumění zpracování pazourku v neolitu.

Je rekonstruována výroba čepelí, jsou vysvětleny techniky odštěpování, přímého a nepřímého tlaku. Dále je z experimentáního pohledu popsána výroba jádrových nástrojů, jako jsou hranolovité sekery a dýky.

Spolu s různými způsoby výroby neolitických nástrojů jsou popsány i pro ně charakteristické odpadní produkty. Tyto poznatky mohou být využity při interpretaci archeologických nálezů dílen a odpadu z výroby štípaných pazourkových nástrojů. Autoři se domnívají, že výsledky experimentů s výrobou štípaných nástrojů by měly být v archeologii šířeji využity.

Bedeutung des experimentellen Feuersteinspaltens für die Rekonstruktion der vorzeitlichen Feuersteinbearbeitung

Mehrere Leute sehen in dem experimentellen Feuersteinspalten eine wirkungsvolle Möglichkeit, einige Methoden der vorzeitlichen Feuersteinindustrie-Herstellung anschaulich klarzumachen. Dies wird mit einem breiten Interesse gefolgt, aber nur selten ist diese Möglichkeit zum tieferen Verständnis der Feuerstein-Bearbeitungsprozesses ausgenutzt. Dieser Beitrag konzentriert sich an die Rolle einiger Experimente für das tiefere Verständnis der Feuersteinbearbeitung in der neolithischen Zeit.

Zuerst sind Klingenproduktion und Abspaltentechnik rekonstruiert und die Technik des direkten und undirekten Druckes werden klargemacht. Weiterhin ist die Herstellung der Kerninstrumente wie viereckige Äxte und Dolche aus dem Experiment-Gesichtspunkt beschrieben.

Die Herstellungsmethoden für neolithische Instrumente und Werkzeuge werden gefolgt in der Beziehung zum beim Steinspalten entstehenden Abfall. Die Relation zwischen der Herstellungsmethode und dem Abfall kann dann bei der Interpretation der archäologischen Funde der Produktionswerkstätten und des Feuersteinwerkzeuge-Herstellungsabfall ausgenutzt werden. Autoren sind der Meinung, dass die Archäologen die Ergebnisse der Feuersteinspalten-Experimente annehmen und mehr verwenden sollten.

Rôle de l'expérimentation de la taille de silex dans la reconstitution des processus de tailles au néolithique

L' expérimentation de la taille de silex est perçue pour une majorité de personnes comme un moyen efficace de confronter en condition réelle la théorie et la pratique de certaines méthodes de fabrications d'outils de la préhistoire. Ce domaine de l' archéologie expérimentale rencontre un engouement certain mais il n'est que rarement utilisé pour approfondir la compréhension des processus de tailles.Cet article se concentre sur le rôle de quelques expérimentations dans la compréhension des phases de travail de taille au néolithique. La production de lames est d'abord reconstituée et les techniques de retouches directes et indirectes sont éclaircies. Ensuite, est décrite d' un point de vue expérimental la confection d'outils tel que haches polies et poignards. Les méthodes de fabrication des outils néolithiques sont par la suite mises en relation avec la production de déchets de taille. Ce rapport créé entre l'objet et le déchet résultant de sa fabrication pourrait etre utilisée dans l' interprétation de structure archéologiques, comme par exemple les ateliers de taille. Des lors, les auteurs supposent que les archéologues gagneraient a accepter et élargir dans leurs applications les conséquences de ces expérimentations ayant pour trait la taille d'industrie lithique.