

**ABSTRACT BOOK**  
7th INTERNATIONAL CONFERENCE OF THE UISPP COMMISSION  
ON FLINT MINING IN PRE- AND PROTOHISTORIC TIMES  
MONS AND SPIENNES 2016

RAPPORTS  
ARCHÉOLOGIE | **5**

SPW | Éditions



Patrimoine



**MINING AND QUARRYING.  
GEOLOGICAL CHARACTERISATION, KNAPPING  
PROCESSES AND DISTRIBUTION NETWORKS  
DURING PRE- AND PROTOHISTORIC TIMES**

**28 SEPTEMBER – 1 OCTOBER 2016**



Wallonie



Patrimoine

# RAPPORTS ARCHÉOLOGIE

# 5

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UISPP COMMISSION ON FLINT MINING IN PRE- AND PROTOHISTORIC TIMES

# MINING AND QUARRYING

## GEOLOGICAL CHARACTERISATION, KNAPPING PROCESSES AND DISTRIBUTION NETWORKS DURING PRE- AND PROTOHISTORIC TIMES

7th INTERNATIONAL CONFERENCE  
IN MONS AND SPIENNES (BELGIUM)  
28 SEPTEMBER – 1 OCTOBER 2016

**RAPPORTS, Archéologie, 5**

Spiennes, 2016

Service public de Wallonie  
Direction générale opérationnelle de  
l'aménagement du territoire, du logement,  
du patrimoine et de l'énergie

Département du patrimoine



Patrimoine

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# PRESENTATION OF THE INTERNATIONAL CONFERENCE



The establishing of a Commission on Flint Mining in Pre- and Protohistoric Times in the International Union of Pre- and Protohistoric Sciences (UISPP) referred to the tradition of organising international symposia on flint, established by the Limburg Branch of the Dutch Geological Society in 1969 at Maastricht. The next meetings were organised in 1975 and 1979 in Maastricht, 1983 in Brighton, 1987 in Bordeaux, 1991 in Madrid, 1995 in Warsaw and Ostrowiec and 1999 in Bochum.

Six conferences have been organised since 2007: Paris, Madrid, Vienna, Florianopolis, Paris and Burgos. The Madrid conference was published in 2011 and the second Paris conference in 2014.

The aim of the commission is to favour cooperation in the area of archaeological research upon siliceous rock mining (flint, chert, hornstone, radiolarite, jasper...), presenting and discussing methods and results. Some of the foremost fields of interest will embrace, among others: research upon different stages of "chaînes opératoires" of manufacture, specialisation of labour and circulation of raw materials, characterisation of raw material as well as investigation on flint mining sites belonging to Pre- and Protohistoric settlement networks. The objective of the commission will be to promote those lines of research upon flint mining and its methods which will allow a better understanding of various phenomena and processes taking place in Pre- and Protohistoric times. The international conference will also draw attention on this outstanding heritage and on its protection.



Patrimoine



## ORGANISING & SCIENTIFIC COMMITTEES

The conference is organised by the Public Service of Wallonia (SPW), the UISPP Commission on Flint Mining in Pre- and Protohistoric Times, the Society for Prehistoric Research in Hainaut (SRPH) and the Museums of the City of Mons.

The conference is organised in partnership with the Regional Museum of Natural Sciences of Mons, the Silex'S, Interpretation Centre of the Neolithic Flint Mines of Spiennes, Sci Tech<sup>2</sup> and UMons, the Royal Belgian Institute of Natural Sciences, La Malogne and the Geopark of the Mons basin.

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# PROGRAM

## Wednesday, 28th of September

10:30	Welcome and official speeches
11:00-11:25	Specialization of the Lithic Production in the Community and among Several Communities during the End of the Early Neolithic in Belgium, the Case of the Blicquian Sites SOLÈNE DENIS
11:25-11:50	Placing the Transmission of Technical Knowledge in the System of blade Production. A Case Study from the Early Neolithic Flint Mine of Casa Montero (Madrid, Spain) NURIA CASTAÑEDA, SUSANA CONSUEGRA, PEDRO DÍAZ-DEL-RÍO
11:50-12:15	Influence and Role of Flint Plate of Salinelles in Southern France - the Example of Cambous Settlement (Viols-en-Laval, Hérault Dept, France) GUILHEM LANDIER
12:15-12:40	Crushing, Hammering and Splitting: Tracing Local Patterns of Lithic Production and Consumption at a Neolithic Chert Quarry Landscape on the Swabian Alb, Germany LYNN FISHER, SUSAN HARRIS, JEHANNE AFFOLTER, CORINA KNIPPER, RAINER SCHREG
12:40-13:00	Discussion
13:00-14:00	<i>Lunch time</i>
14:00-14:25	Lojanik, West-Central Serbia. Catena of Prehistoric Mining through Time and Space VERA BOGOSAVLJEVIĆ PETROVIĆ, DRAGAN JOVANOVIĆ, JUGOSLAV PENDIĆ, DIVNA JOVANOVIĆ
14:25-14:50	Bronze Age Workshop Materials from the Wierzbica "Zełe" Flint Mine Site (Poland) in the Light of Recent Research JACEK LECH, DAGMARA H. WERRA

14:50-15:15	<b>Rijckholt, beyond the Flint Mines. An Investigation of the Surrounding of the Neolithic Flint Mines of Rijckholt-St.Geertruid</b> JAN-WILLEM DE KORT, JOSÉ SCHREURS
15:15-15:40	<b>Methodologies of Extraction: the Mining Techniques in the Flint Mines of Southern England</b> JON BACZKOWSKI
15:40-16:00	<i>Break</i>
16:00-16:25	<b>The Neolithic Flint Mines of Le Petit-Morin Valley (Marne, France)</b> RÉMI MARTINEAU, JEHANNE AFFOLTER, JEAN-JACQUES CHARPY, ANTHONY DUMONTET, LAURE SALIGNY
16:25-16:50	<b>Neolithic Mines and Quarries in Vaucluse (France)</b> PIERRE-ARNAUD DE LABRIFFE, ANDRÉ REGGIO, PIERRE ANDRÉ
16:50-17:15	<b>A New Research Project Focused on the Study of Flint Quarries in NE Iberia</b> XAVIER TERRADAS, DAVID ORTEGA, DIOSCÓRIDES MARÍN, ALBA MASCLANS, CARLES ROQUÉ
17:15	<b>Discussion</b>
20:00	<b>Guest Lecture</b> Les grandes lames en silex de l'Europe du Néolithique et alentour JACQUES PELEGRIN Van Gogh Lecture Hall, University of Mons

## Thursday, 29th of September

8:30	<b>Welcome</b>
09:00-09:25	<b>Flint Mines without the Flint: Symbolic Cultural Practices of Flint Extraction in Northern Europe</b> ANNE TEATHER, LASSE SØRENSEN
09:25-09:50	<b>Human Skeletons in the Flint Mine Shafts of Spiennes: Casualties or Burials?</b> MICHEL TOUSSAINT, HÉLÈNE COLLET, IVAN JADIN, PHILIPPE LAVACHERY, STÉPHANE PIRSON, MICHEL WOODBURY
09:50-10:40	<b>Key Note Lecture</b> The Social Context of Prehistoric Flint and Stone Extraction in the UK PETER TOPPING
10:40-11:00	<i>Break</i>

PROGRAM

11:00-11:25	<b>Mapping the Radiolarite Outcrops as Potential Source of Raw Material in the Stone Age: Characterisation of Polish Part of the Pieniny Klippen Belt</b> KATARZYNA KERNEDER-GUBAŁA, PAWEŁ VALDE-NOWAK
11:25-11:50	<b>Balkan Flint Sourcing and Distribution in the Early Neolithic Balkans</b> MARIA GUROVA, CLIVE BONSTALL
11:50-12:15	<b>Understanding Flint Circulation through Adriatic Sea: First Results</b> ITALO MARIA MUNTONI, EMANUELA DELLUNIVERSITÀ, GIACOMO ERAMO, ALESSANDRO MONNO, IGNAZIO ALLEGRETTA, ZLATKO PERHOČ, STAŠO FORENBAHER, MASSIMO TARANTINI
12:15-12:40	<b>Raw Materials and Distribution of Neolithic Mining Production from the Mons Basin (Belgium). Preliminary Results</b> JEAN-PHILIPPE COLLIN, JEAN-MARC BAELE, FRANÇOISE BOSTYN, HÉLÈNE COLLET
12:40-13:00	<b>Discussion</b>
13:00-14:00	<i>Lunch time</i>
14:00-14:25	<b>Geo-resources and Techno-cultural Expressions in the South of the French Massif Central during the Upper Palaeolithic: Determinism and Choices</b> VINCENT DELVIGNE, PAUL FERNANDES, PETER BINDON, JEAN-PIERRE BRACCO, LAURENT KLARIC, AUDREY LAFARGE, MATHIEU LANGLAIS, MICHEL PIBOULE, JEAN-PAUL RAYNAL
14:25-14:50	<b>Flint Sourcing Revisited, the Bergerac Case</b> PAUL FERNANDES, VINCENT DELVIGNE, STÉPHAN DUBERNET, FRANÇOIS-XAVIER LE BOURDONNEC, ANDRÉ MORALA, LUC MOREAU, MICHEL PIBOULE, ALAIN TURQ, JEAN-PAUL RAYNAL
14:50-15:15	<b>Prehistoric Flint Mine Detection by ALS. Experiences from Poland 2011 – 2015</b> JANUSZ BUDZISZEWSKI, WITOLD GRUŹDŹ, MICHAŁ JAKUBCZAK, KATARZYNA RADZISZEWSKA, MICHAŁ SZUBSKI
15:15-15:40	<i>Break</i>
15:40-17:30	<b>Posters session</b>
15:40	<b>News from H-3, Kálvária-domb (Calvary Hill), Tata, Hungary</b> KATALIN T. BIRÓ, ERZSÉBET TÓTH, KRISZTINA DÚZS
15:50	<b>In Search of the Chocolate Flint Mine in Orońsko (PL1, Southern Poland). New Data for Analysis of Exploitation and Use of Flint in North-western Part of Its Outcrops</b> KATARZYNA KERNEDER-GUBAŁA
16:00	<b>The Concept of Spatial Database for the Prehistoric Flint Mines: Banded Flint, Central Poland</b> KATARZYNA RADZISZEWSKA

16:10	<b>The Spiennes Collection at the Royal Museums of Art and History (RMAH)</b> BRITT CLAES, VALÉRIE GHESQUIÈRE
16:20	<b>A Jade Axe in the Middle of the Famous Neolithic Flint Mines of Spiennes?</b> MICHEL ERRERA, PIERRE PÉTREQUIN, ALISON SHERIDAN, IVAN JADIN
16:30	<b>History of Research and Flint Exploitation in Zelków (South Poland) – Gunflint Workshop – the Use and Meaning of Flint in Modern Times</b> DAGMARA H. WERRA, MARZENA WOŹNY
16:40	<b>A Gunflint Place at Masnuy-Saint-Jean (Jurbise), Hainaut Province, Belgium</b> ANNE HAUZEUR, HÉLÈNE COLLET, MICHAEL BRANDL, GERHARD TRNKA
16:50	<b>Use of Flint during the 19th Century in the Spiennes and Cibly Areas (Mons Basin, Belgium): Gunflints and Earthenware Productions</b> HÉLÈNE COLLET, ANNE HAUZEUR, GERHARD TRNKA, CLAUDE MEUNIER (†)
17:00	<b>19th Century Gunflint Production in Brandon (UK) and the RBINS Collection</b> ANNE HAUZEUR, IVAN JADIN
17:10	<b>Flint mining and blades management in the Blicquy/Villeneuve-Saint-Germain culture through the earliest mines of Normandy and North-Western France settlements</b> FRANÇOIS CHARRAUD
17:20	<b>The Interplay of Geological Constraints towards Determining the Locations of Quarries, Scale of Activity, and Style of Extraction: Examples from the Chert-bearing Cambrian and Ordovician Carbonate Rocks of the New York Tri-State Region</b> PHILIP C. LAPORTA, MARGARET C. BREWER-LAPORTA, SCOTT A. MINCHAK, KARL H. SZEKIELDA
17:30	<b>Investigation in Pozarrate quarry at the Prehistoric flint mining complex of Araico-Cucho (Treviño), South Basque-Cantabrian Basin. Latest results.</b> ANTONIO TARRIÑO, IRANTZU ELORRIETA, JAVIER FERNÁNDEZ-ERASO, JOSÉ ANTONIO MUJICA, FERNANDO JIMÉNEZ-BARREDO, ANA ISABEL ÁLVARO, ALFONSO BENITO, ANA ISABEL ORTEGA, MAITE GARCÍA-ROJAS, IOSU JUNGUITU, AITOR SÁNCHEZ, LUCÍA BERMEJO, MIKEL AGUIRRE, ÍÑIGO ORUE
17:40	<b>UISPP Flint Mining Commission Meeting: News and Future Activities</b>

## Friday, 30th of September

9:30	Excursion to Spiennes: visit of the Neolithic flint mines: a walk around the site, a visit of the mines (Camp-a-Cayaux and Petit-Spiennes) and of the Interpretive Centre (Petit-Spiennes)
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## Saturday, 1st October

9:30	Excursion to Spiennes: visit of the Neolithic flint mines: a walk around the site, a visit of the mines (Camp-a-Cayaux and Petit-Spiennes) and of the Interpretive Centre (Petit-Spiennes)
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# ORAL AND POSTER SESSIONS - ABSTRACTS

WEDNESDAY, 28th OF SEPTEMBER  
11:00 – 11:25

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## SPECIALIZATION OF THE LITHIC PRODUCTION IN THE COMMUNITY AND AMONG SEVERAL COMMUNITIES DURING THE END OF THE EARLY NEOLITHIC IN BELGIUM, THE CASE OF THE BLICQUIAN SITES

Solène DENIS

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### Keywords

*Early Neolithic, Blicquy group, Belgium, lithic technology, labour specialization, diffusion networks*

In the North of France and Belgium, the Blicquy/Villeneuve-Saint-Germain culture marks the end of the Danubian traditions (Early Neolithic Period). The eleven sites found in Belgium belong to the Blicquian facies of this cultural entity. Two settlement areas, separated by 100 km, are highlighted (in Hainaut and in Hesbaye). An analysis of the technical and economical characteristics of the Blicquian lithic industry was performed in order to describe the socio-economic organization relating to the lithic production as well as the relationships between the different settlements areas of this culture. The study concluded that there were two distinct types of production. A group of knappers produced flakes and faceted tools (outils facetés) in a domestic context. Another group of knappers, who had specific skills, produced blades which were found in each house. However, arguments converge to suggest that the latter moved from one house to the next and even from a site to another, suggesting some kind of specialization of the laminar production in the community or even among several communities. The circulation of Ghlin flint (probably originating from Hainaut) shows that some knappers moved between Hainaut and Hesbaye. The

circulation of tertiary Bartonian flint (originating from the Paris Basin) was following more diverse modalities. Some knappers may have moved from the Paris Basin to Hainaut, but it is certainly not the only way that Bartonian flint was introduced on the Blicquian sites. This study shows the intensity of the relations between villages, demonstrating the importance of exchanges for the socio-economical organization of those agro-pastoral communities.

WEDNESDAY, 28th OF SEPTEMBER  
11:25 - 11:50

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## PLACING THE TRANSMISSION OF TECHNICAL KNOWLEDGE IN THE SYSTEM OF BLADE PRODUCTION. A CASE STUDY FROM THE EARLY NEOLITHIC FLINT MINE OF CASA MONTERO (MADRID, SPAIN)

Nuria CASTAÑEDA, Susana CONSUEGRA, Pedro DÍAZ-DEL-RÍO

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### Keywords

*Early Neolithic, Casa Montero, flint mining, knowledge transmission, blade production*

Recent research at Casa Montero (c. 5300-5200 cal BC) has provided key information to understand the earliest Neolithic technical system of flint production at the flint mine. This is a result of a complex web of different operational sequences.

Both the ageing process and the continental nature of Casa Montero's flint limited the efficiency of blade production, one of the main goals of the mine. As a result, most of the extracted raw material was discarded throughout the process. However, a resourcefully planned management

allowed its reuse for other socially critical purposes. The optimization of raw material stands out as a key feature of the technical system specifically developed at the site. A complex network of six reduction sequences with different goals was accomplished there. They were all successfully harmonized in order to allow the performance of others sequences. This organizational knowledge was a substantive part of the social capital of Early Neolithic communities and, as such, required of its inter-generational transmission.

Younger community members were progressively introduced in this complex technical system; taking part in a multifaceted set of tasks and parts of the whole production process, from extraction to recycling and waste management. One of the key social activities that took place at the mine was knapping apprenticeship. As part of a 'situated learning' they were involved in the mining tasks in order to become gradually full members of their community.

WEDNESDAY, 28th OF SEPTEMBER

11:50 - 12:15

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### INFLUENCE AND ROLE OF THE FLINT PLAQUETTES OF SALINELLES IN SOUTHERN FRANCE - THE EXAMPLE OF CAMBOUS SETTLEMENT (VIOLS-EN-LAVAL, HÉRAULT, FRANCE)

Guilhem LANDIER

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*Keywords*

*Flint plate, sourcing distribution, habitat, bifacial knapping, final Neolithic*

In the South of France, several sources of flint production emerged during the different phases of the final Neolithic period. The Oligocene outcrops of Salinelles (Gard, France) deliver a particular type of material, flint plaquettes (5 to 20 mm thickness), used during the third millennium BC to make tools shaped by bifacial retouching. These include large items, such as daggers, natural backed scrapers, convex bi-scrapers, or armatures.

Identified since the early twentieth century, this site was the subject of fifty years of excavations that exposed two mine shafts. Subsequently, ground surveys allow identifying several flint knapping workshops near the outcrop. The excavation of the site Pouget 1 (Souvignargues, Gard), less than two kilometers away from the outcrop, revealed a waste pile of flint plaquettes.

Furthermore several studies concerning the dissemination of this material show a regional distribution (about 50 km from the extraction sites) of these pieces shaped by bifacial retouching. This is primarily found in the context of sepulchres but also, more discreetly, among household implements.

The study of the household objects found at Cambous (Viols-en-Laval, Hérault), located close to another outcrop of the Eocene Age, that of Saint-Martin-de-Londres (Hérault), allows us, on one hand to better understand what are the routes used by the flint pieces from Salinelles up to Cambous and on the other hand, to assess the importance of this material used for household objects, the tools fashioned with this type of material in the context of settlements.

Indeed, with the scarcity of these shaped pieces, (although some elements seem to have been shaped on the Cambous site), and the simplicity of these pieces, it may suggest this type of raw material took a specific distribution route, developed during the period Fontbousse between 2800 and 2200 cal BC. We will present a new distribution map of the material, based on the inventory we have made of the Languedoc collections.

WEDNESDAY, 28th OF SEPTEMBER

12:15 - 12:40

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### CRUSHING, HAMMERING, AND SPLITTING: TRACING LOCAL PATTERNS OF LITHIC PRODUCTION AND CONSUMPTION AT A NEOLITHIC CHERT QUARRY LANDSCAPE ON THE SWABIAN ALB, GERMANY

Lynn FISHER, Susan HARRIS, Jehanne AFFOLTER,

Corina KNIPPER, Rainer SCHREG

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*Keywords*

*Upland Neolithic, regional survey, Jurassic chert, lithic production, microfacies analysis*

The Swabian Alb in southern Germany has long been known as a major regional source of chert for Neolithic stone tool production, but Neolithic activities on this upland limestone plateau had not been directly investigated. Instead, the focus has been on well-documented settlement landscapes in neighboring lowland areas of the Neckar and Danube valleys and the Alpine Foreland. In addition, studies of Neolithic chert acquisition and transport in the region have focused largely on long-distance distribution of blades or sickle blades made on distinctive stone types

such as the tabular Jurassic cherts of Bavaria. Drawing on a regional project aimed at addressing questions about the chronology and function of upland Neolithic settlement on the southeastern Swabian Alb, we examine aspects of local lithic production and consumption at the first documented chert quarry landscape on the plateau. Results begin to shed light on chert acquisition in an upland Neolithic landscape.

Investigations at the large chert quarry landscape of Asch-Borgerhau, near Blaubeuren, Germany, documented visible surface features and chert acquisition pits dating to Early/Middle, Younger, and Final Neolithic periods. Sedimentary microfacies analysis allows us to trace the transport of chert from the quarry to surrounding settlements and surface archaeological sites. We present results of technological analysis of cores, hammerstones, splintered pieces, and debitage samples to identify lithic production practices on the quarry site. Distinctive marks of crushing, hammering, and splitting are interpreted, in the light of literature on experimental archaeology and our own limited experiments, as representing a combination of techniques for splitting large nodules, producing useable blocks and large flakes. Comparisons to materials found in surface survey, including cores on large flakes, offer insights about patterns of local chert consumption. Results of this project contribute to an understanding of diversity in local patterns of resource use, consumption and transport in the Central European Neolithic.

WEDNESDAY, 28th OF SEPTEMBER

14:00 – 14:25

### LOJANIK, WEST-CENTRAL SERBIA. CATENA OF PREHISTORIC MINING THROUGH TIME AND SPACE

Vera BOGOSAVLJEVIĆ PETROVIĆ,  
Dragan JOVANOVIĆ, Jugoslav PENDIĆ,  
Divna JOVANOVIĆ

#### Keywords

*Mining, circulation of raw materials, workshop, characterisation of raw material, Palaeolithic, Neolithic*

The Lojanik Hill rises immediately above the modern settlement of Mataruška Spa (West Central Serbia), 200 km south of Belgrade. It represents a unique site of paleobotanical and archaeological character. This is the area where fossil remains of a silicified forest and remains of a long-lasting mining activity have been found, dating from the Middle Palaeolithic to the Early Neolithic and the Late Neolithic, with indications of exploitation during the Bronze Age.

Silicification was caused by Tertiary volcanic activity, i.e. action of hot hydrothermal solutions on organic matter of wood. On Lojanik, the characteristics of raw material mining and the zones of intensive workshop activities, but also modern exploitation from the seventies of the 20th century, were separated. The aims and models of mining changed during time regarding the selection of raw materials, but the source of ores remained the same. In order to assess the terrain configuration and map the surface distribution of lithic raw/processed material clusters, close range photogrammetry procedures were implemented on site, using a pole mounted DSLR camera to acquire imagery data.

The economy of the settlements in the close vicinity of Lojanik, such as the Early Neolithic settlement of Crkvine or the Palaeolithic open-air site of the Joldovića houses were crucially dependent on opal and other siliceous rocks from Lojanik. Based on macroscopic petrological analyses, a part of artefacts from Early Neolithic settlements of Central Šumadija (over 50 km far away) may originate from Lojanik.

Archaeological research of Lojanik is important for several reasons, and two of them are emphasized here. It is the first raw material mine in Serbia which is the topic of a separate scientific-research project. The second reason lies in the fact that investigations into the relationship between the mine and neighbouring settlements both in a narrower and a wider territory can be conducted and that a hypothesis on the distribution network can be set up. It is often impossible to connect mining activity with concrete communities in the surroundings. In the case of Lojanik, two settlements from two different time periods have been confirmed as the consumers of its mining activity.

WEDNESDAY, 28th OF SEPTEMBER

14:25 – 14:50

### BRONZE AGE WORKSHOP MATERIALS FROM THE WIERZBICA "ZELE" FLINT MINE SITE (POLAND) IN THE LIGHT OF RECENT RESEARCH

Jacek LECH, Dagmara H. WERRA

#### Keywords

*Wierzbica "Zełe", flint, flint mining, Bronze Age, Central Poland*

The flint mine Wierzbica "Zełe" in central Poland is one of the most important archaeological sites in Europe relating to chipped stone production in the Bronze Age and at

the beginning of the Iron Age. The site was excavated in 1980–1988 by Hanna and Jacek Lech.

In 1984, “World Archaeology” published the first results concerning workshop places of the “Zelev” mining field and its trends in flint working. The radiocarbon dates indicated the existence of the mine in the Bronze Age and beginning of the Iron Age. Preliminary results showed that during the Early Bronze Age, the most popular material for making tools were small flat-shaped nodules. The “Zelev” finds dateable to this period include numerous early and advanced roughouts for bifacial headaxes produced from such nodules, as well as fragments of tabular flint plates. In the Late Bronze Age, at the end of the 2nd and beginning of the 1st millennium BC, the “Zelev” mine was exploited by communities of the Lusatian culture, belonging to the cinerary urnfield complex. A characteristic feature of the flint industry of these communities was large tools known as “Zelev” type backed blade knives. They were made from massive blade blanks, blade-flake blanks and flake blanks obtained from large, irregular cores.

Since 2011 we started a new analysis of the flint materials. This paper will present the aim, method and new results of the study. We focused on comparison of inventories from the Early Bronze Age (shaft 17), and from the Late Bronze Age (shaft 28).

#### Acknowledgements

Presentation of the investigations was possible thanks to the financial support of the Institute of Archaeology and Ethnology Polish Academy of Science in the competition *Adulescentia est tempus discendi* (11/ATD6/MN/2016).

WEDNESDAY, 28th OF SEPTEMBER

14:50 – 15:15

### RIJCKHOLT, BEYOND THE FLINT MINES

#### AN INVESTIGATION OF THE SURROUNDING OF THE NEOLITHIC FLINT MINES OF RIJCKHOLT-ST. GEERTRUID.

Jan-Willem DE KORT, José SCHREURS

#### Keywords

*Surrounding of Flintmines, Neolithic, methods of prospection and value assessment*

The flint mines have been extensively investigated by the Prehistoric Flint Mines Working Group of the Dutch Geological Society in the sixties and early seventies of the

last century. Subsequently, the mines have been listed as an archaeological monument.

Little attention has been paid to the surrounding area. The flint mines are located predominantly in a woodland area. In contrast, the surroundings are in agricultural use: mostly arable land, pastures and orchards. This area is until now excluded from legal protection.

From 2008 until 2013 the Cultural Heritage Agency of the Netherlands has investigated a 250 hectares large area surrounding the mines. The main reason was to assess the nature, scale, age and physical quality of the archaeological features and their context. The results are used as a basis for recommendations as to whether the areas surrounding flint mines qualify for protection (statutory or otherwise) and sustainable preservation.

The second aim was to develop methods and techniques that allow conclusions to be drawn about past activities in this area, especially specialised flint working and the domestic and ritual activities. The prospective methods used to interpret past activities were analyses of surface finds, field surveys, geophysical research, archaeological data from drilling surveys and mapping of the subsoil structure.

One of the questions was if proxies could be defined such as distinctive features and artefacts types, assemblage composition, heating flint, to discriminate different past activities at mine surroundings. The results of the prospective methods have been tested by excavations, such as trial trenches. We think that our research strategy could be useful for assessment of past activities on other archaeological sites.

WEDNESDAY, 28th OF SEPTEMBER

15:15 – 15:40

#### METHODOLOGIES OF EXTRACTION: THE MINING TECHNIQUES IN THE FLINT MINES OF SOUTHERN ENGLAND

Jon BACZKOWSKI

Recent research on the chronology of the Early Neolithic (4000-3500 BC) in southern England has highlighted that a small group of flint mines in West Sussex are amongst the earliest monuments to appear in the landscape (Whittle *et al.*, 2011). These sites are now considered central to the spread of Early Neolithic ideologies across the region,

rather than being viewed as peripheral to monuments, such as causewayed enclosures and long barrows, which were long thought to be their contemporaries, but are now proved to be later in the southern chronology.

The presentation will outline findings from research into the mining methodologies that underlie extraction techniques at the flint mines in Sussex. It will be proposed that a common set of procedures and techniques were followed that not only connect the Sussex mines to each other, but also the southern English mines to Continental sites. This comparison has significant implications for how the Sussex mines are understood to have developed within a framework for the spread of Early Neolithic culture in southern England.

Underlying this research is the notion that the mining methodology was developed through many years of trial and error, meaning that the techniques could only be learnt by direct contact between individuals and groups. These procedures were likely to have been passed on to generations of miners through direct experience, rather than being learnt casually between disparate communities. As there is an absence of evidence for the development of mining at the Sussex sites, it is proposed that the technology arrived fully formed from the Continent. Further to this, it will be reasoned that they relate to the movement of mining communities, rather than informal cross-channel contact.

Finally, the presentation will outline recent data from geophysical surveys of mine sites in Sussex, conducted by the presenter as part of his PhD project. A major objective of the research is to gather data on the nature of production activity in the wider mining environs, as these areas were often ignored in historical research. The presentation will investigate how data gathered from zones of production, located away from the deep shafts, can be placed within the mining methodology and chronology. It is also important to understand how their research may affect wider studies of Early Neolithic communities in southern England, especially the problem of defining settlement patterns in this key period of prehistory.

WEDNESDAY, 28th OF SEPTEMBER

16:00 – 16:25

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## THE NEOLITHIC FLINT MINES OF LE PETIT-MORIN VALLEY (MARNE, FRANCE)

Rémi MARTINEAU, Jehanne AFFOLTER, Jean-Jacques CHARPY,  
Anthony DUMONTET, Laure SALIGNY

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The Neolithic sites in the valley of Le Petit-Morin, in the marshes of Saint-Gond (Marne, France) have been known since the discoveries of Joseph de Baye, between 1870 and 1886. As his discoveries were made during the pioneering times of French Neolithic archaeology, these sites are still very poorly known today. Of the 150 hypogea discovered in the Marne department, around 120 are located in the Saint-Gond marshes. These collective burials, dated between 3500 and 3000 cal BC, are grouped in 15 necropolises. The graves were dug in the chalk of the right bank of Le Petit-Morin, on the Île-de-France cuesta, in the east of the Paris Basin.

Although several flint mines were discovered between 1872 and 1942, these sites have not yet been fully explored in the Saint-Gond region. The process and system of exploitation, the precise dates, the characterisation of the flint, the identification of the knapping techniques used and the reconstruction of the method of production should now be investigated.

A new research program concerning the Neolithic of the Saint-Gond marshes (directed by R. Martineau, supported by the French Ministry of Culture, the University of Bourgogne and Franche-Comté, and by the CNRS), which began in 2012, has improved our knowledge of these questions. Further investigation of the sites involved 20 weeks of archaeological excavations and 6 weeks of archaeological surveys. The surveys characterised and mapped the sites, and identified new site evidence, notably dwelling-sites. The flint sedimentary lithofacies were also described during the surveys. All the topographic data were integrated into a GIS.

Results to date consist of a distribution map of the flint outcrops, and of all the Neolithic sites, including the flint mines, as well as a better knowledge of the ancient discoveries of flint mines by studying their archives. Radiocarbon analyses from excavations at two sites, in Vert-la-Gravelle (Vert-Toulon) « La Crayère », and Loisy-en-Brie « 56 Grande Rue », have provided a more precise chronology of flint exploitation. The system of flint extraction was reconstructed based on the topography and the distribution of flint layers in the Campanian chalk.

Possible relations between the hypogea necropolises and the mining centres in this region will be examined by spatial analysis and by radiocarbon dating. One of the main goals is to try to understand the territorial organisation of the Late Neolithic societies in this region.

WEDNESDAY, 28th OF SEPTEMBER

16:25 – 16:50

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## NEOLITHIC MINES AND QUARRIES IN VAUCLUSE (FRANCE)

Pierre-Arnaud DE LABRIFFE, Adrien REGGIO, Pierre ANDRE

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### Keywords

*Flint mines, grooved hammers, south of France*

The Vaucluse department, located on the left bank of the lower Rhone valley, possesses a great amount of flint of high quality that lays in the Cretaceous Bedoulian stage. Neolithic people of Southern France used this raw material on a massive scale. Tools made from that flint are known for the beginning of the Neolithic and can be found miles away. During the middle Neolithic the use of this flint becomes even more important. This period sees the implementation of a production of bladelets, made according to a very specific chaîne opératoire, which is spread over several hundred kilometres (Toulousian region, Catalonia). Finally in the Recent / Final Neolithic the exploitation of the Bedoulian flint continues with the production of blades.

As frequently in the Neolithic, the flint which was used comes from mines or quarries. Those of Vaucluse are known since more than a century. It is first of all the presence of a significant number of grooved hammers which attracted the attention of the first researchers, especially in the municipalities of Murs and Malaucène. They quickly made the link between these very particular tools and the existence of important workshops in the middle of which they had been abandoned. The relation between hammers and flint extraction was thus established from the first publications.

Beyond the surveys, limited fieldwork was achieved only on the site of Malaucène. We will focus on both small digs made by E. Schmid in 1959 and 1962. It is her publications (Schmid on 1960, 1963 and 1980) that allowed the community of the mining archaeologists to become aware of the importance of the site. The hypothetical reconstruction of the system of extraction which she proposed in the article of 1980 drew a lot of attention.

Since the research of E. Schmid the extraction sites of Vaucluse were forgotten again. We decided to resume work on the sites of Murs and Malaucène, where most hammers were found. In this communication, after a quick history of research, we shall present the first results of our project. We will insist on both the mining features and the operating systems. We will also see that Murs and Malaucène are not

the only extraction sites of Bedoulian flint in Vaucluse.

WEDNESDAY, 28th OF SEPTEMBER

16:50 – 17:15

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## A NEW RESEARCH PROJECT FOCUSED ON THE STUDY OF FLINT QUARRIES IN NE IBERIA

Xavier TERRADAS, David ORTEGA, Dioscórides MARÍN, Alba MASCLANS, Carles ROQUÉ

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### Keywords

*Flint, Quarries, Raw Material, Neolithic, NE Iberia.*

Over the last years, many thematic surveys have been carried out with the goal of creating a lithotheca focused on the availability of siliceous rocks into North-Eastern Iberia (LITocat project). In the frame of these fieldwork seasons abundant evidence of prehistoric flint exploitation have been attested, such as negative structures on the surface outcrops, accumulations of mining waste or some mining tools. As a consequence, we have launched a research project devoted to study these quarries and specific sites where the first transformation of siliceous raw materials took place. Its aim is to characterize the nature of flint procurement, trying to determine its chronology, the strategies of flint extraction put into practice as well as the first stages of raw material processing.

The project considers the intervention on four of these specific sites. So far, excavation works focused on a quarry where nodular brown flint was extracted from lacustrine Oligocene limestones in the Serra Llarga Hills (Castelló de Farfanya, NE Spain). Up to now, this site constitutes the only example of a specialized flint extraction site in the North-East of the Iberian Peninsula. Flint extraction was easy thanks to the fact that the targeted strata outcrop vertically and are quite accessible, flint being extracted by means of several stepped exploitation fronts opened into the slopes of the hills. This situation allowed the opening of successive extraction fronts without the need to remove huge quantities of mining waste.

At the same time we are developing a strategy focused on diffusing our scientific activity in the specific places where we are carrying out excavations. This way we expect to reach more visibility on ongoing research, raising the awareness among local population about the patrimonial significance of that type of archaeological sites.

WEDNESDAY, 28th OF SEPTEMBER

20:00 – 22:00

Van Gogh Lecture Hall, University of Mons

## GUEST LECTURE LES GRANDES LAMES EN SILEX DE L'EUROPE DU NÉOLITHIQUE ET ALENTOUR

Jacques PELEGRIN  
Directeur de Recherche, CNRS

Sur la base d'une série de tests expérimentaux, sont d'abord présentés les caractères morphologiques et les stigmates techniques du débitage de grandes lames en silex par percussion indirecte et par pression au levier, cette dernière au bois de cervidé ou avec pointe de cuivre.

Ces critères d'identification sont ensuite appliqués aux produits de différents centres ou régions de l'Europe et alentour, du 7<sup>e</sup> au 3<sup>e</sup> millénaire av. J.-C., du Proche-Orient à la péninsule ibérique, et du Danemark à l'Algérie.

Au moins six « traditions techniques » originales sont ainsi identifiables, ainsi que de probables déplacements de tailleurs spécialisés à très longue distance.

THURSDAY, 29th OF SEPTEMBER

09:00 – 09:25

## FLINT MINES WITHOUT THE FLINT: SYMBOLIC CULTURAL PRACTICES OF FLINT EXTRACTION IN NORTHERN EUROPE

Anne TEATHER, Lasse SØRENSEN

*Keywords*  
*Chalk, art, Mesolithic-Neolithic transition, symbolism, galleries*

The northern European early Neolithic flint mines have chronological and technological similarities, but little attention has been focused on their cultural similarities. Since the survey of the British mines (Barber *et al.*, 1999) and Topping's (2005) work on the complexities of structural deposition in shaft fills, it has been possible to arrive at the conclusion that the mines had much more of a monumental and symbolic role in Neolithic life than previously thought (Teather 2016). There is compelling evidence that the voids – shafts and galleries created through the process of flint extraction - were not merely the abandoned features of

flint exploitation but instead should be seen as dynamic and monumental architectural spaces where creative and meaningful social actions took place. Work by one of the co-authors (AT) identified examples of chalk art from Cissbury (UK) within a museum archive in Oxford, UK (Teather 2015) with similar examples from Spiennes being located at the Cinquantenaire Museum, Brussels, Belgium, in 2015. Collaborative research between the co-authors has not only linked the UK sites with Spiennes but also identified cultural similarities with Hov in northern Jutland, Denmark.

The integration of this data and these monuments within broader discussions of the Mesolithic-Neolithic transition (e.g. Sørensen and Karg, 2014) suggests that the role flint mining played in the adoption of Neolithic ways of life was not just economic but part of a broader spectrum of widespread and meaningful cultural behaviours.

BARBER, M., FIELD, D. and TOPPING, P. 1999. *The Neolithic flint mines of England*. Swindon: English Heritage.

SØRENSEN, L. and KARG, S. 2014. The expansion of agrarian societies towards the north – new evidence for agriculture during the Mesolithic/Neolithic transition in Southern Scandinavia. *Journal of Archaeological Science* 51: 98–114.

TEATHER, A. M. 2015. The first British Neolithic representational art? The chalk engravings at Cissbury flint mine. *Antiquity Project Gallery*

TEATHER, A. M. 2016. *Mining and materiality: Neolithic chalk artefacts and their depositional contexts in southern Britain*. Oxford: Archaeopress.

TOPPING, P. 2005. 'Shaft 27 revisited: an ethnography', in P. Topping & M. Lynott (ed.) *The cultural landscape of prehistoric mines*: 63–93. Oxford: Oxbow.

THURSDAY, 29th OF SEPTEMBER

09:25 – 09:50

## HUMAN SKELETONS IN THE FLINT MINE SHAFTS OF SPIENNES: CASUALTIES OR BURIALS?

Michel TOUSSAINT, Hélène COLLET, Ivan JADIN, Philippe LAVACHERY, Stéphane PIRSON, Michel WOODBURY, Joël ELOY, Sylviane LAMBERMONT

*Keywords*  
*Neolithic, human skeletons, flint mining, casualty, interment*

The region of Mons has a long-standing reputation for producing evidence of Neolithic mining casualties. At the end of the nineteenth century and the beginning of twentieth century, skeletons of miners were discovered in Obourg and Strépy. At about the same time another two skeletons were found in the slope of the « Camp-à-Cayaux » and

attributed to prehistoric miners. Several isolated human bones were also found during excavations of the upper part of mining shafts from the 1920s to the 1950s. However, the careful re-examination in the beginning of the 1990s of the context of discovery and the dating of the Obourg and Strépy finds demonstrated that those skeletons were neither Neolithic nor mining accident victims. This study cast severe doubts on the whole collection of so-called Neolithic skeletons found in Spiennes.

Since 1997 new archaeological research on the mining site of Spiennes driven by the Service public de Wallonie and the Société de Recherche préhistorique en Hainaut led to the discovery of other human skeletons, these ones clearly deposited in mining shaft backfills. Radiocarbon dating confirmed their Neolithic age. This new data led to a full-scale dating program of the old discoveries which revealed that most of them were actually Neolithic. We now have very accurate archaeological and stratigraphical data to address the question: are those skeletons remains of mining casualties or proper burials ?

The presentation will review the state of knowledge about human remains on the flint mining site of Spiennes and compare those finds with other similar finds from European Neolithic mines.

THURSDAY, 29th OF SEPTEMBER

09:50 – 10:40

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## KEY NOTE LECTURE THE SOCIAL CONTEXT OF PREHISTORIC FLINT AND STONE EXTRACTION IN THE UK

Peter TOPPING

*Keywords*

*Ethnoarchaeology, probability analysis, social context*

The social context of mines and quarries is a fundamental issue concerning the interpretation of Neolithic stone extraction, particularly in pre-literate societies. Why did communities choose to exploit certain raw materials in preference to others which were often more accessible? To attempt to answer this question a review of 168 ethnographic studies, drawn from around the world, has analysed the ways in which traditional communities use extraction sites, to identify the common trends and behaviours in extraction practices and produce a suite of robust statistics. The collated ethnographic statistical data has been used to construct an interpretive framework to provide a probability analysis to aid interpretation of the material record

at prehistoric extraction sites. This framework was tested against 223 global archaeological sites, revised further, and then it was used to interpret the structures, features and assemblages from published excavations at 79 flint mines and 51 stone axe quarries in the UK and Ireland.

This ethnoarchaeological interpretive framework suggests that we can now *probably* identify with reasonable confidence those extraction sites which were associated with myths and storied locations, sites which might be under some level of ownership, sites that were only used seasonally, the sites which practiced ritualised extraction, and something of the functionality and social significance of extraction site products.

This analysis suggests that many of the UK extraction sites were special places in the cultural landscape and distant from settlements. The sites were often used in proscribed ways following general patterns of working, and particular types of artefact assemblages were carefully deposited in the workings. The framework suggests that this reflects not only technical skill combined with ritualised practice, but also a level of social exclusivity – the sites were probably controlled by clans or technical elites who passed on their skills through systems such as apprenticeships. Previous data from the petrographic analysis of stone axes, and to a lesser extent for flint, demonstrates that many extraction site products travelled long distances from their source, and were often unused and deposited in non-settlement contexts. This contrasts dramatically with the studies of artefacts knapped from expedient sources, which generally occur in more mundane domestic contexts, and confirms the special nature of many extraction sites.

Taken together, the statistically robust ethnoarchaeological probability analysis now provides a more confident foundation upon which to model the social context of extraction sites through the detailed contextual analysis of their assemblages.

THURSDAY, 29th OF SEPTEMBER

11:00 – 11:25

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## MAPPING THE RADIOLARITE OUTCROPS AS POTENTIAL SOURCE OF RAW MATERIAL IN THE STONE AGE: CHARACTERISATION OF POLISH PART OF THE PIENINY KLIPPEN BELT

Katarzyna KERNEDER-GUBAŁA, Paweł VALDE-NOWAK

*Keywords*

*Radiolarite, Pieniny Klippen Belt, exploitation, Palaeolithic*

Radiolarite is a siliceous raw material originated of radiolarian skeletons in a deep-sea context. In primary deposits it occurs mostly in stratified beds or nodules. Its macroscopic features, as well as its colour, texture and lustre are diversified.

Radiolarite is present in many geological units and was commonly used during the Stone and Early Bronze Age in Europe. In some regions it was the main raw material. One of the most important sources of good quality radiolarites in Central Europe is the Pieniny Klippen Belt in Carpathians (Romania, Ukraine, Slovakia, Poland). It occurs in the Southern part of Poland, in Pieniny Mountains and Podhale region (Nowy Targ district, Małopolskie voivodeship). Before research conducted in this area by P. Valde-Nowak and J. Rydlewski (since 70s of the 20th century) that brought discoveries of sites based on the local radiolarite, it was thought that all the artefacts made of this raw material found among inventories from the Stone Age sites in Poland came from Slovakian or other foreign quarries.

As indicated by the latest discoveries from Obłazowa Cave, radiolarite was exploited and used in this area since the Middle Palaeolithic and in the Upper Palaeolithic. Large scale processing of radiolarite was still conducted during the Late Palaeolithic.

The actual mining of radiolarite is confirmed through examples in Slovakia or Austria. In Poland direct evidence of mining are not yet known, but the presence of workshops in the vicinity of outcrops, as well as mining tools made of antler from layer VIII in Obłazowa Cave suggest, that it could have taken place also in this area.

The distribution of radiolarite is well documented in Poland. This raw material is even present among the inventories of Stone Age sites located a few hundred kilometres from the outcrops. The identification of the exact beds from which the artefacts come is still under discussion, but recently new attempts of solving this problem in Europe brought some positive results.

This presentation focuses on the geological characterisation as well as raw material differentiation among the different radiolarite outcrops in the Pieniny Klippen Belt in Poland, in view of its possible exploitation and exportation.

THURSDAY, 29th OF SEPTEMBER

11:25 – 11:50

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## BALKAN FLINT SOURCING AND DISTRIBUTION IN THE EARLY NEOLITHIC BALKANS

Maria GUROVA, Clive BONSALE

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### Keywords

*Balkan flint, Upper Cretaceous, Early Neolithic, formal toolkit, network distribution*

A distinctive feature of the Early Neolithic Karanovo I culture of Bulgaria is a flint industry characterized by 'macroblade' technology and widespread use of 'Balkan Flint' in conjunction with formal toolkits. The origins of this technology and the associated raw material procurement system are still unresolved. Balkan flint also occurs in Early Neolithic contexts outside the Karanovo I culture area, notably in the southern Balkans (Turkish Thrace) and in the lower Danube catchment (Carpathian Basin, Iron Gates, southern Romania and northern Bulgaria). The distribution corresponds closely with what has been termed the 'First Temperate Neolithic' comprising the Karanovo I-II, Starčevo, Criș and Körös cultures. Did the Balkan flint used by Early Neolithic communities across the Balkans come from one or more sources on the Moesian platform in northern Bulgaria and, if so, where were those sources located? This question has prompted several attempts to provenance flint raw materials using petrological and/or trace element analyses. The only securely identified outcrops of Balkan flint are in the Upper Cretaceous Mezdra Formation in the Pleven-Nikopol region of northern Bulgaria.

The paper focuses on several challenging aspects of the Neolithization of the Balkans, introducing into the debate the evidence provided by lithic studies, especially that relating to the sourcing and exploitation of Balkan flint. Among outstanding questions are: (I) was Balkan flint used by the first ('pre-Karanovo') Neolithic communities in Bulgaria; (II) what role did Balkan flint play in the Neolithization of Southeast Europe; (III) did access to Balkan flint result in the emergence of a new laminar technology; (IV) how did the Early Neolithic Balkan flint exchange network compare to that based on obsidian, which developed in and around the Aegean Basin; and (V) what and where were the origins of the Balkan flint network and the formal tools associated with it?

THURSDAY, 29th OF SEPTEMBER

11:50 – 12:15

## UNDERSTANDING FLINT CIRCULATION THROUGH ADRIATIC SEA: FIRST RESULTS

Italo Maria MUNTONI, Emanuela DELLUNIVERSITÀ, Giacomo ERAMO, Alessandro MONNO, Ignazio ALLEGRETTA, Zlatko PERHOČ, Stašo FORENBAHER, Massimo TARANTINI

### Keywords

*Late Palaeolithic and Neolithic, Gargano mines, Tavoliere Area, Southern Dalmatia, CIE L\*a\*b\*, pXRF*

Current archaeological knowledge about the circulation of flint in the central Mediterranean Sea identifies the Gargano Promontory as one of the main sources. In addition, the Gargano is located along one of the supposed Neolithic expansion routes in Southern Italy, which is the “bridge” of Adriatic islands connecting the Southern Dalmatia to the north of Apulia.

Our previous study, based on macroscopic and chemical analysis of a selection of 151 samples of flint from mining districts and geological outcrops throughout Gargano Promontory (Northern Apulia), provided a reference dataset to compare with new data obtained on 45 flint tools and debitage from archaeological excavated contexts at Scaloria, Masseria Candelaro and Monte Aquilone (Neolithic, Tavoliere area).

In this contribution we present new data on 292 Late Palaeolithic and Neolithic flint tools from nine archaeological sites located in Southern Dalmatia. A selection of representative geological flint from Gargano mines (33 samples), from Neolithic villages of Tavoliere (33 samples) and from Late Palaeolithic and Neolithic sites of Southern Dalmatia (70 samples) was analysed by pXRF in order to verify the hypothesis of Gargano flint circulation across the Adriatic.

New colorimetric (CIE L\*a\*b\*) and chemical (portable XRF) data on 292 samples (only 70 were analysed with pXRF) showed relevant matches between Gargano and Southern Dalmatian samples. pXRF data let exclude Defensola A and San Marco as source areas while some flint samples from archaeological site of Vela Cave and Sušac can be strictly related to the flint mines of Arciprete, Mastrotonno (both in the Vieste district) and probably Carmine near Manfredonia. Flint samples from Palagruža show a different chemical composition and they could be interpreted as source area for some groups of samples from Vela. As regards colorimetric CIE

L\*a\*b\* data, most of the samples from Vela Cave dated from the Neolithic to the Bronze Age match those from the Late-Upper Palaeolithic, but a new yellowish flint with mottled structure is present only among Neolithic to Bronze samples.

pXRF data for the Tavoliere area show that Scaloria samples have a strict correspondence with the Gargano mines of Arciprete and Mastrotonno while the Neolithic village of Masseria Candelaro and Monte Aquilone show higher chemical variability to be related with acquisition of raw materials from different (alluvial?) sources.

THURSDAY, 29th OF SEPTEMBER

12:15 – 12:40

## RAW MATERIALS AND DISTRIBUTION OF NEOLITHIC MINING PRODUCTION FROM THE MONS BASIN (BELGIUM). PRELIMINARY RESULTS

Jean-Philippe COLLIN, Jean-Marc BAELE, Françoise BOSTYN, Hélène COLLET

### Keywords

*Raw materials, sourcing, Mons Basin, distribution network*

The Mons Basin (Province of Hainaut, western Belgium) is a geologically rich region, particularly from the point of view of Upper Cretaceous sedimentary deposits, conducive to an important flint extraction activity during Neolithic.

Despite the relative proximity between flint extraction areas, new data about sourcing and raw material characterization based on macroscopic observation completed by selective analysis (e.g. petrography and electron probe microanalysis) allow to distinguish distinct facies from the main mining sites (Spiennes, Douvrain, Flénu).

This leads us to make a first evaluation of the distribution of the mining production outside the Mons Basin. Some considerations regarding the chronology of the mining activity in the Mons Basin will be discussed.

This work is a step towards an important objective of a PhD research project, namely the identification of economic networks resulting from the distribution of lithic productions, from extraction sites to Neolithic settlements in- and outside the Mons Basin.

THURSDAY, 29th OF SEPTEMBER

14:00 – 14:25

## GEO-RESOURCES AND TECHNO-CULTURAL EXPRESSIONS IN THE SOUTH OF THE FRENCH MASSIF CENTRAL DURING THE UPPER PALAEO-LITHIC: DETERMINISM AND CHOICES.

Vincent DELVIGNE, Paul FERNANDES, Peter BINDON, Jean-Pierre BRACCO, Laurent KLARIC, Audrey LAFARGE, Mathieu LANGLAIS, Michel PIBOULE, Jean-Paul RAYNAL

### Keywords

*Prehistory, geology, flint, petro-archaeology, lithic industry, French Massif Central, Gravettian, Badegoulian, Magdalenian, evolutionary chain of silicification, paleo-geography, territory, settlement*

The petro-archaeology of flint defines the origin of the siliceous raw material found in archaeological sites. Recent methodological advances, like more precise facies definition, determining the flint supply routes in studied sites, the “evolutionary chain concept” and precise mapping of siliceous mineral domains, enable us to identify not only the location where any particular flint formed (primary outcrop), but also from where it was collected (primary or secondary outcrop).

Exhaustive studies of Upper Palaeolithic flint collections from sites in the South of the French Massif Central (Recent and Final Gravettian: Le Blot and Le Rond-de-Saint-Arcons; Badegoulian: Le Rond du-Barry and La Roche-à-Tavernat; and Upper Magdalenian: Sainte-Anne II) reveal an unexpected diversity of raw materials indicative of huge mineral territories being exploited. Accordingly, we have developed a new figurative model for the origins of lithic raw material discovered in these archaeological sites, not as a site-centred radiant form, but more akin to an interrelated network of places, which is congruent with the ethnographic and geographic data. The different types of flint in the lithic industries correlated with their position within the “evolutionary chain” allow speculation on the choices made by prehistoric hunter-gatherers within the natural constraints they faced. This in turn enables the addition of the mineral space into reconstructions of the palaeo-social-space.

THURSDAY, 29th OF SEPTEMBER

14:25 – 14:50

## FLINT SOURCING REVISITED, THE BERGERAC CASE

Paul FERNANDES, Vincent DELVIGNE, Stéphan DUBERNET, François-Xavier LE BOURDONNEC, André MORALA, Luc MOREAU, Michel PIBOULE, Alain TURQ, Jean-Paul RAYNAL

### Keywords

*flint, petro-archaeology, characterization, evolutionary chain of silicification, raw material provenance, Bergerac.*

Studies on the origin of lithic raw materials have become increasingly important since the 1980's. Sourcing studies play a key role in appreciating territory management and group mobility, two major issues of the Archaeology of prehistoric hunter-gatherer societies.

Most approaches use only part of the potential information contained within archaeological lithic material. The improvement in our understanding of the nature of flint and its formation processes has allowed our interdisciplinary research-group to refine the methods used for its characterization. A major aspect of this new approach is the “chaîne évolutive” concept. Our work opens up new research directions like the surface analysis of flint artefacts which complements taphonomic studies of archaeological sites in terms of assemblage integrity and site formation processes.

We present preliminary results of ongoing petrographic and geochemical analyses of geological samples of Bergerac flint. Our approach aims to establish the geological history of flint prior to its collection by humans and to characterize the successive events which affected lithic artefacts after they were discarded. The multi-technical and multi-scale approach presented in this paper appears to be particularly applicable in reconstructing the litho-space of each archaeological site to finally approach the prehistoric territories.

THURSDAY, 29th OF SEPTEMBER

14:50 – 15:15

## PREHISTORIC FLINT MINE DETECTION BY ALS. EXPERIENCES FROM POLAND 2011 - 2015.

Janusz BUDZISZEWSKI, Witold GRUŻDŹ, Michał JAKUBCZAK,  
Katarzyna RADZISZEWSKA, Michał SZUBSKI

### Keywords

Flint mining, remote sensing, ALS, LiDAR

Research on flint mining in Poland has a long history. It started at the beginning of the twentieth century through the pioneering research by S. Krukowski and J. Samsonowicz. Over the years, successive generations of Polish researchers continued investigations of prehistoric extraction and distribution of rich siliceous deposits in the whole country. Unfortunately, in the end of 1990s research in this area stood somewhat to a dead-end.

Only recently, the advance of new methods of remote sensing opened the way to new research in this topic. The Institute of Archaeology of the University of Cardinal Stefan Wyszyński in Warsaw since 2011 has been researching prehistoric flint mining using airborne laser scanning (ALS, LiDAR). Within two projects, conducted in the years 2011 - 2014, we tested nondestructively a number of different mines from a chronological and geological point of view. At this time we have developed a research methodology, allowing remote sensing and verification of new sites and also increase our knowledge about mines already known.

We want to present briefly all the mines we investigated. These include flint mines situated on the northern margin of the Świętokrzyskie Mountains - with the famous "Krzemionki" mine, but also one of the newly discovered banded flint mine. We study also sites with destructed anthropogenic relief - associated with the extraction of chocolate flint. In north-eastern Poland we localized a number of previously unknown flint mines of erratic raw materials, with preserved anthropogenic relief. Completely different kinds of mines are these located in the Żelków forest, near Krakow. These are primarily associated with modern flint mining for the production of gunflints.

THURSDAY, 29th OF SEPTEMBER

15:40 – 15:50

## NEWS FROM H-3 (KÁLVÁRIA-DOMB, CALVARY HILL, TATA)

Katalin T. BIRÓ, Erzsébet TÓTH, Krisztina DÚZS

### Keywords

Tata-Kálváriadomb, radiolarite, antler tool, Baden Culture, Lengyel Culture

Tata-Kálváriadomb is one of the oldest known "flint mines" in Hungary. It was excavated in the 1960-ies by J. Fülöp and E. Bácskay. It had already been included in the first European flint mine Bochum catalogue. The archaeological age of the exploitation was attributed to the Late Copper Age Baden Culture, based on the evidence of pottery fragments found in the extraction pits. The site is equally famous for its geological features (Upper Triassic-Lower Cretaceous sedimentary sequence) and is open to public as a geological park, including the flint extraction pits (developed on Jurassic radiolarite).

Recent conservation work in the geological park has led to the discovery of new mining features in 2015. A test trench on the bedrock surface, 42 meters from the old pits yielded at least three antler tools with cutmarks and a new mining pit for the radiolarite. The antler tools were suitable for radiocarbon dating performed in the ATOMKI, Debrecen by M. Molnár and his team and extended the known period of use of the mine to the Late Neolithic period/Early Copper Age Lengyel Culture. We are aiming at further excavations on the Tata site.

### References

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THURSDAY, 29th OF SEPTEMBER

15:50 – 16:00

## IN SEARCH OF THE CHOCOLATE FLINT MINE IN OROŃSKO (PL1, SOUTHERN POLAND).

### NEW DATA FOR ANALYSIS OF EXPLOITATION AND USE OF FLINT IN NORTH-WESTERN PART OF ITS OUTCROPS

Katarzyna KERNEDER-GUBAŁA

#### Keywords

*Orońsko, mine, flint, Late Palaeolithic*

The presentation focuses on new data obtained during the last field research conducted in the Orońsko region, where in the 1920s Stefan Krukowski discovered extraction sites and knapping workshops where the local chocolate flint was processed. In 1935 he conducted small excavations, which lead to the discovery of a few prehistoric shafts. On the base of technological and typological analysis of artefacts, they were dated to the Late Palaeolithic (Arched Backed Piece Techno-complex), making it one of the oldest shaft mine in Poland. Since then, no other excavations were conducted in this area. Further surface survey, carried out recently by other leading polish researchers on several occasions confirmed the existence of an extensive Stone Age settlement dedicated to the exploitation of the local chocolate flint. The contemporaneous extraction sites in the north-western part of the chocolate flint outcrops area are visible thanks to the presence on the surface of a large number of flint artefacts, mixed from different chronological periods and stages of exploitation, as well as limestone nodules. No visible mining relief has been preserved. This area was very modified by modern agricultural economy. The most likely area to find traces of older excavations and mining shafts in further exploration was identified on the basis of preserved archival field documentation\*.

\*The project "Exploitation and processing of chocolate flint during Palaeolithic and Mesolithic in the North-Western part of its deposits based on non-invasive archaeological and geophysical research and test-trenches" is financed by National Centre of Science, Poland: 2015/17/N/HS3/01279, 2016-2019

THURSDAY, 29th OF SEPTEMBER

16:00 – 16:10

## THE CONCEPT OF SPATIAL DATABASE FOR THE PREHISTORIC FLINT MINES: BANDED FLINT, CENTRAL POLAND

Katarzyna RADZISZEWSKA

#### Keywords

*Banded flint, flint mining, spatial databases*

Banded flint occurs in Middle Oxfordian to Lower Kimmeridgian carbonate sediments, in the north-eastern and south-western outskirts of the Holy Cross Mountains. Prehistoric exploitation sites, such as the famous "Krzemionki" mining field, are known solely from the first of the regions mentioned above. Thanks to a unique pattern as well as its hardness, banded flint was frequently used among the prehistoric communities. Nowadays, its aesthetic value became increasingly appreciated on the jewellery market. Unfortunately, the growing popularity of banded flint has destructively influenced some of the prehistoric mining fields, which began to be used for illegal extraction.

Geology of banded flint, as well as the systems of its prehistoric exploitation, have been studied for over a century now. Over the years, the amount of material and data collected has been constantly increasing. Recently, the development of new technologies has provided archaeologists with a variety of means. As a result, new opportunities for archiving data began to appear. Database Systems allow us to gather and join all the data, and if they are web-based, it can be available to many researches from all over the world simultaneously.

In this paper I would like to present a spatial database, designed to compile and summarize our current knowledge of banded flint. I hope that the results, combined with planned, analogous databases for other raw materials, will contribute to the creation of one, complete and efficient, spatial information system for all raw materials found in Poland.

THURSDAY, 29th OF SEPTEMBER

16:10 – 16:20

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## THE SPIENNES COLLECTION AT THE ROYAL MUSEUMS OF ART AND HISTORY (RMAH)

Britt CLAES, Valérie GHESQUIÈRE

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### Keywords

*Spiennes, Neolithic, digitisation, collection management, inventory verification*

The RMAH's National Archaeology collection preserves a very important and large collection of artefacts collected from the Neolithic flint-mining complex at Spiennes (Mons, Belgium), that was constituted from 1867, shortly after the first archaeological discovery of the site, until 1958. Several fortuitous findings, surface explorations and archaeological campaigns initiated by the Belgian government led up to the amassing of more than twenty thousand artefacts and ensembles in the museum's storage rooms. In total more than 350 cases and wooden trays were filled with discoveries in flint, chalk, bone, ceramic and antler. Consultation and management of the collection became nearly impossible because of the absence of a consistent inventory. The first inventory of the collection, which started in the beginning of the 19th century, was only made up of a brief description of the items and the circumstances in which they were found. No information was noted about the artefacts' whereabouts or the state in which they were found. Furthermore missing labels or erased inventory numbers caused by the involuntary accumulation of objects highly endangered scientific exploitation of the collection.

In the course of the NACIP-project (National Archaeology Collections Inventory Project), initiated in 2012 and funded by the Belgian Science Policy Office, the entire National Archaeology collection, including the Spiennes findings, underwent a complete facelift. This resulted in the re-shelving of the items in adequate storage conditions and in a digitalized inventory. As a result of NACIP, renewed scientific research is triggered, since the complete collection is now easily accessible and a digital inventory catalogue of the collection has been created (Access). It brings together information such as inventory number, morphological identification, period, origin and location in the storage rooms. Inventory-verifications and the retrieval of scientific data have been linked to the objects and made it possible to draw up a correct and up-to-date historiography of the items.

The objective of our presentation is triple. Firstly, we aim to present our rich Neolithic collection from Spiennes with a focus on the recently established inventory that permitted to retrieve information on, in some cases, long lost discoveries. Secondly, we will propose a brief collection historiography combining several key-moments in the early on-site archaeological activity, together with the conducted scientific research on the museums' artefacts. Finally, we will present a general appraisal of preservation and scientific value, emphasizing renewed electronic accessibility and management of the collection.

THURSDAY, 29th OF SEPTEMBER

16:20 – 16:30

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## A JADE AXEHEAD IN THE MIDDLE OF THE FAMOUS NEOLITHIC FLINT MINES OF SPIENNES?

Michel ERRERA, Pierre PÉTREQUIN, Alison SHERIDAN, Ivan JADIN

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### Keywords

*Spiennes, jadeite, late Neolithic, thin blade, spectroradiometric analysis, source determination*

Over a century ago, businessman Alfred Lemonnier donated several small but prestigious collections to the Natural History Museum of Brussels (now the Royal Belgian Institute of Natural Sciences, RBINS) while he served as Director of a limestone quarry in the Mons area for the Solvay company. An axehead made of green stone, the subject of this poster, is part of a collection of "sharpened flint" that the museum acquired on March 28th, 1904. This object would originally have been more than 12–15 cm long, allowing for its missing cutting-edge.

Walter Campbell Smith, a member of the Department of Mineralogy in the formerly-named British Museum (Natural History) (BM(NH)) – now The Natural History Museum – had taken a slice from the fracture surface of this axehead in order to make a petrological thin section slide (or slides), and he concluded that the type of stone was very close to other specimens that had come from archeological sites in Brittany, France and England. The remaining part of the slice that Campbell Smith had cut from the axehead, and kept in the BM(NH), was analysed for *Projet JADE*, using reflectance-scatter spectroradiometry. The resultant spectra were unfortunately of poor quality because of the small surface area available for measurement. Subsequently, additional spectral analyses were performed on the axehead itself, first in 2010, then in 2013 with a more powerful instrument. These analyses

confirmed and clarified the original identification of the raw material. It was indeed a characteristic/typical jadeitite, micaceous and retromorphosed, from the blueschists facies. The most convincing comparisons with the *Projet JADE* reference database of Alpine rocks indicate that its origin is likely to lie in the Group of Voltri, and more specifically at the west of the Beigua massif, near Genoa.

Between 1963 and when the last spectroradiometric analyses were undertaken half a century later, there have been significant shifts in attitudes towards archaeological artefacts – with a decisive move away from destructive techniques towards the use of non-destructive techniques – and also in the goals of stone axehead research. When Campbell Smith was writing, the goal was to characterise axeheads in the hope that this would help to locate the as-then unknown primary source areas in the Alps. Now, thanks to *Projet JADE*, the high-altitude quarries have been located and extensively studied; and with spectroradiometric analysis, it no longer makes sense to damage a museum piece in order to determine its origin; this can be achieved (at least in most cases) by simple reflection of the light on a specimen.

Now that the stone's origin is no longer of concern, a new and fascinating question has emerged: how can the presence of a jadeitite axehead found in the middle of a production site of grey flint axeheads in Spiennes be explained?

THURSDAY, 29th OF SEPTEMBER

16:30 – 16:40

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### HISTORY OF RESEARCH AND FLINT EXPLOITATION IN ZELKÓW (SOUTH POLAND) – GUNFLINT WORKSHOP – THE USE AND MEANING OF FLINT IN MODERN TIMES

Dagmara H. WERRA, Marzena WOŹNY

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#### *Keywords*

*Gunflint, flint mining, history of archaeology, Zelków, South Poland*

As the Bronze Age came to its end and the Iron Age began, flint ceased to be the key material for making tools, supplanted by iron for centuries to come. Flintstone lost its previous significance yet remained in use, contrary to the prevailing views. However, the extent of its use was fairly limited indeed. It was mostly exploited locally and

for domestic use. Ethnographic research proves that it was still in use in the first decades of the 20th century.

One of more interesting issues is the mass use of flint in modern times (17th-19th centuries) for military needs as an element of firearms.

In Europe, small firearms came into use in the 2nd half of the 14th century and evolved through time. Around the 16th century, wheel locks, and subsequently flint locks, began to be used. In early modern times, all European armies were commonly equipped with this type of weapon. Initially, France was the leading European manufacturer of gunflints. Significant quantities were also produced in England, which shipped them practically worldwide, especially in the 19th century.

Gunflints were a commodity indispensable for the modern military, having a key role in the weaponry of all armies. The wars of the time increased demand for weapons, and, consequently, for significant supplies of gunflints. To have their own source of raw material was a strategic objective of all governments. The Hapsburgs, who ruled the Austrian and then Austro-Hungarian Empire, brought gunflints for their troops from regions such as Galicia, part of the Polish and Ukrainian lands annexed to the Hapsburg monarchy in the late 18th century as a result of the partitioning of Poland. Gunflints for the needs of the imperial army were made from flint mined in the Jurassic deposits in the Krakow area (southern part of the Kraków-Częstochowa Upland) and around Stanislavov (now western Ukraine).

Several flint manufactories were located in the neighbourhoods of Krakow where flint was abundant. One of the largest and best preserved was a manufactory in Zelkow, a town which in the 19th century lied just on the border of Russia and Austro-Hungary. This paper discusses some issues regarding the mass production of gunflints in the modern era based on the case study of the flint manufactory in Zelkow, and presents the history of the Zelkow manufactory in comparison with similar establishments in other parts of Europe.

#### *Acknowledgements*

Presentation of the investigations was possible thanks to the financial support of the Institute of Archaeology and Ethnology Polish Academy of Science in the competition *Adulescentia est tempus discendi* (11/ATD6/MN/2016).

THURSDAY, 29th OF SEPTEMBER

16:40 – 16:50

## A GUNFLINT PLACE AT MASNUY-SAINT-JEAN (JURBISE)

Anne HAUZEUR, Hélène COLLET, Michael BRANDL, Gerhard TRNKA

*Keywords*

*Gunflint, Masnuy-Saint-Jean, Belgium, nineteenth century*

One of the huge gunflint workshops at Masnuy-Saint-Jean was settled by the French 'caillouteur' A. Bigaud, during the years 1820. The flint quality there made this place one of the biggest quarry known in the surrounding of Mons.

In 2013, there was an opportunity to rediscover those workshops on a private property. Evidences of quarrying and knapping could be observed. As J. Breuer wrote (1955), extraction features are now flooded by a pond, but heaps of flakes and *debitage* products remain. They are several meters large and high, containing hundreds of thousands of typical gunflint blade and cores. Blanks were obviously prepared on the spot but the gunflints themselves were finished elsewhere, at home according to custom.

THURSDAY, 29th OF SEPTEMBER

16:50 – 17:00

## USE OF FLINT DURING THE 19TH CENTURY IN THE SPIENNES AND CIPLY AREAS (MONS BASIN, BELGIUM): GUNFLINTS AND EARTHENWARE PRODUCTIONS

Hélène COLLET, Anne HAUZEUR, Gerhard TRNKA, Claude MEUNIER (+)

*Keywords*

*Gunflint, earthenware, Boch Keramis, Nouvelles, Spiennes, Ciplly*

Around 1819, at the time when Belgium was under the governance of the Netherlands, A. Bigaud, a French craftsman, set up workshops close to the city of Mons to produce gunflints for firearms lock mechanism as it existed for example at the famous French site of Meusnes/Saint-Aignan.

According to Jacques Breuer (1955) and Jean Emy (1978), this company collapsed after a few years. One of these workshops was located at Nouvelles 'near by the "Pont du Prince" [Bridge of the Prince] on the river bank of Nouvelles stream' (Letocart, 1957). During a 2006 field

survey evidence of gunflint *debitage* was found on the western slope of the Petit-Spiennes plateau near the 'Michelsberg enclosure' on the right bank of the river La Wampe at the bottom of the old railway. Flint *debitage* products proved what was known throughout literature.

In the 1950s, at Ciplly, 'Trou des Sarrasins', rare evidences of gunflint production was discovered by Louis Letocart. In the same place, years after, one of us (Claude Meunier) collected very characteristic short blades and cores testifying of gunflint production.

In the nineteenth century, quarries were also in activity in Spiennes and Ciplly to provide flint to be used in the earthenware manufacturing process. Archives reveal that tons of flints were sold to the Boch Keramis earthenware factory. On the site of Spiennes remains of those quarries are still visible at Petit-Spiennes.

THURSDAY, 29th OF SEPTEMBER

17:00 – 17:10

## 19th CENTURY FLINT PRODUCTION IN BRANDON (UK) AND THE RBINS COLLECTION

Anne HAUZEUR, Ivan JADIN

*Keywords*

*Gunflint, Brandon, knapping tools, RBINS collection*

Since the mid 17th century, gunflints were produced on an industrial scale throughout Europe. In the Brandon area (Suffolk, UK) -not far from the Grime's Graves mining complex- such a production was still alive till the first half of the 20th century. At that time gunflints were made for colonies or for the USA. A set of different pieces have been bought at the end of the 19th century by Édouard Dupont, director of the RBINS, from Edward Lovett, a collector and folk amateur from the London suburb. The collection presented here with the complete *chaîne opératoire* from the core to the finished pieces, is a testimony of a dead practice. The technique fits with the known knapping and retouching techniques, and the gunflint shapes correspond to the English standard in use at the time of production. This is obviously not the production of a professional gunflint knapper: albeit the knapper used the proper lithic reduction processes, the end product -the gunflints- were different from what was produced in Brandon. This collection, however, is interesting from a historical point of view. At the end of the 19th century prehistorians were focusing on the understanding of flint *debitage*, and were looking for technical comparisons.

THURSDAY, 29th OF SEPTEMBER

17:10 – 17:20

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### FLINT MINING AND BLADES MANAGEMENT IN THE BLICQUY/VILLENEUVE-SAINT-GERMAIN CULTURE THROUGH THE EARLIEST MINES OF NORMANDY AND NORTH-WESTERN FRANCE SETTLEMENTS

François CHARRAUD

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#### Keywords

*Neolithic, North-Western France, Normandy, technical system, chaîne opératoire, flint mines, Jurassic flint, technology, flint tools, blades*

The discovery of the flint mine of Espins "Foupendant" allows to question the socio-economic behaviour that affected the Neolithic in the west of France, through the exploitation of Cinglais flint. This material is present in the form of blades on the majority of LBK, Villeneuve-Saint-Germain and older Cerny sites, in Normandy and Brittany. Its use is documented by 45 excavated sites and 63 surface sites. Espins allows characterizing for the first time the precise geographical and geological origin of Cinglais flint, and the early stages of its processing.

Espins is located in the south of the plain of Caen, in the territory of Cinglais, between the Jurassic Normandy plains and the Armorican Massif. It is one of the last sources of good flint at the western margin of the Paris Basin, before the extensive Armorican territories where there is no good flint. This material was used exclusively for the production of blades obtained by indirect percussion, distributing supports for most Western settlements.

Not far from Espins, the flint mine of Soumont-Saint-Quentin (Calvados) "Les Longrais" was discovered at the same time. It provides comparison and reinforces the idea of the systematic nature of this exploitation.

The territory of Cinglais is characterized by flint clays under a silt layer, which contain flint nodules. That is evidenced by 33 pits discovered during surveys. A lot of technical flakes associated with the *chaîne opératoire* blade production were discovered across the plateau, and around or inside the shafts.

They are characteristic of a production site. This abundance of technical flakes can be opposed to the deficit of end products (blades), which were systematically collected. Their surface distribution draws the outline of a large mining complex (about 30 ha). Produced blades

are short (between 7 and 12 cm long) and have not been processed or used locally. No evidence of domestic occupation was observed (ceramics, stone bracelets, household equipment) on the mines or around.

The blade production is similar to that of the Blicquy/Villeneuve-Saint-Germain contexts in the Paris Basin and Belgium. The chrono-cultural attribution of the site of Espins is based on this similarity and on two radiocarbon dates that target a range between 5000 and 4750 BC. As such this site is integrated into the technical system of the Danubian Neolithic tradition, documented in North-Western Europe. Espins "Foupendant" is one of the few flint mining sites known in this chronocultural phase, since discoveries made in Central Europe.

THURSDAY, 29th OF SEPTEMBER

17:20 – 17:30

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### THE INTERPLAY OF GEOLOGICAL CONSTRAINTS TOWARDS DETERMINING THE LOCATIONS OF QUARRIES, SCALE OF ACTIVITY, AND STYLE OF EXTRACTION: EXAMPLES FROM THE CHERT-BEARING CAMBRIAN AND ORDOVICIAN CARBONATE ROCKS OF THE NEW YORK TRI-STATE REGION

Philip C. LAPORTA, Margaret C. BREWER-LAPORTA, Scott A. MINCHAK, Karl H. SZEKIELDA

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#### Keywords

*Bedrock chert quarries, salient, recess, boudinage, petrofabric*

Mapping of chert bearing carbonate terrains, complimented with analysis of excavated quarry tailings, has elucidated an organization to quarry development controlled by tectonics, structural geology, stratigraphy, and diagenesis of raw materials at several scales. A predictive model for prehistoric bedrock-quarry development has quantified the existence of an elaborate chain of operation organized on the intersection of fracture cleavage with foliation and bedding surfaces; all bounded by well-defined master joints.

Inter-regionally, chert occurs within the arm-bends of the Pennsylvania salient and is diminished on the Virginia and New York recesses. The recesses are characterized by high-angle reverse faults, while the salient is dominated by decollement-style thrust systems, with associated duplexes. Several thousand prehistoric chert quarries are housed within this carbonate terrain.

Regionally, tectonism forged a structural scenario involving normal-fault, thrust-ramp, and fold-thrust sections within the Wallkill River Valley of New York and New Jersey. The normal-fault section exhibits fault-block rotation of chert units ranging from  $4^{\circ}$ - $50^{\circ}$ . Prehistoric quarries are restricted in their development by shallow dips and a veneer of glacial overburden. The thrust-ramp section rotates the stratigraphy into steeply dipping ( $50^{\circ}$ - $90^{\circ}$ ) panels. Bedding attitudes permit access from below and above the ore target through accentuation of master joints. Type and style of prehistoric quarries is controlled by stratigraphic and structural considerations related to the lateral persistence of chert bearing sedimentary facies. Rheological contrasts between ductile dolomite and rigid interbedded cherts result in boudinage structures which generate ideal conditions for raw-material extraction. The fold-thrust section involves folds truncated by southeast and northwest dipping thrust faults. Rocks located in fold hinges abruptly change orientation, leading to complications impacting quarry prospection and extraction techniques. Dip angles range from  $20^{\circ}$ - $50^{\circ}$ . Quarries fail due to pinch-out of beds, fading of sedimentary facies along strike, and/or radical changes in dip angle.

At outcrops, chertification occurs as silica replacement of algal stromatolites; oolitic, pisoidal and oncolidal facies; tempestites; unconformity linings; paleokarst sequences; and pressure-solution halos.

Spatial limits of quarries are related to geometry of sedimentary facies. Tectonic and structural elements determine the orientation of stratigraphic packages, which in turn controls access to chert beds. Intersection of joint surfaces focuses the locations of zones of extraction. Foliation affects the pathway of flaking technology. The microlithon, the largest quantifiable homogenous volume of chert which can be successfully refined into a stone tool, influences the chain of operation and the final quarry product.

THURSDAY, 29th OF SEPTEMBER

17:30 – 17:40

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### INVESTIGATION IN POZARRATE QUARRY AT THE PREHISTORIC FLINT MINING COMPLEX OF ARAICO-CUCHO (TREVIÑO), SOUTH BASQUE-CANTABRIAN BASIN. LATEST RESULTS

Antonio TARRIÑO, Irantzu ELORRIETA, Javier FERNÁNDEZ-ERASO, José Antonio MUJICA, Fernando JIMÉNEZ-BARREDO, Ana Isabel ÁLVARO, Alfonso BENITO, Ana Isabel ORTEGA, Maite GARCÍA-ROJAS, Iosu JUNGUITU, Aitor SÁNCHEZ, Lucía BERMEJO, Mikel AGUIRRE, Íñigo ORUE

*Keywords*

*Prehistoric mining, flint, raw materials, Neolithic, Western Pyrenees*

Recent works in the quarry of Pozarrate are providing new data for the understanding a part of the prehistoric mining complex of Araico-Cucho (Treviño). The quarry is one of many structures that are found throughout the area and that were made for the exploitation of the nodular flints outcropping along the landscape unit (lacustrine-palustrine Miocene). Pozarrate is composed of 8 structures that we identified and classified as crescent-shaped dumps. The archaeological excavation focused on the inferior dump which was dated 6000-5600 BP (uncal.) and thousands of lithic remains and artifacts have been collected, including mining tools. The investigation continues till today in order to find the limits of the quarry. Geophysical surveys (Electrical tomography and Geo-radar) have been carried out providing information that was likened to what at first intuited, confirming the existence of a quarry face between 4 and 5 meters high. The relevance of the flint mining complex is corroborated by the identification of the use of this raw material in many archaeological sites of the Cantabrian (from Asturias to the Basque Country), the Western Pyrenees and the south of Aquitanian Basin (France), with dates from the Upper Pleistocene to the Holocen

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The aim of the Commission on Flint Mining in Pre- and Protohistoric Times in the International Union of Pre- and Protohistoric Sciences (UISPP) is to favour cooperation in the area of archaeological research upon siliceous rock mining, presenting and discussing methods and results. Fields of interest will embrace research upon different stages of "chaînes opératoires" of manufacture, specialisation of labour and circulation of raw materials, characterisation of raw material as well as investigation on flint mining sites belonging to Pre- and Protohistoric settlement networks.

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