REPORT

A MID-HOLOCENE PREHISTORIC STRIKE-A-LIGHT FROM THE GOODPASTER FLATS, INTERIOR ALASKA

Yan Axel Gómez Coutouly
UMR 7055 Préhistoire et Technologie, Maison de l'Archéologie et de l'Ethnologie, 21 allée de l'Université, 92023 Nanterre, France; yanaxel@northpacificprehistory.com

Colas Guéret
UMR 7041 ArScAn (Ethnologie préhistorique), Maison de l'Archéologie et de l'Ethnologie, 21 allée de l'Université, 92023 Nanterre, France; colas.gueret@hotmail.fr

Caroline M. Renard
Mission archéologique départementale de l'Eure, 8 rue des thermes, 27930 Le Vieil-Évreux, France;
UMR 7055 Préhistoire et Technologie, Maison de l'Archéologie et de l'Ethnologie, 21 allée de l'Université, 92023 Nanterre, France; caroline.renard@eure.fr

Kathryn E. Krasinski
Adelphi University, Department of Anthropology, 1 South Avenue, Garden City, New York 11530; kkrasinski@fordham.edu

Brian T. Wygal
Adelphi University, Department of Anthropology, 1 South Avenue, Garden City, New York 11530; bwygal@adelphi.edu

"Then Raven flew on, holding the brand of fire in his bill. The smoke from the fire blew back over his white feathers and made them black. When his bill began to burn, he had to drop the firebrand. It struck rocks and went into the rocks. That is why, if you strike two stones together, fire will drop out."
(Indian legend of the Pacific Northwest; Clark 1953:151)

ABSTRACT

Researchers have explored how hearths were used and the composition of fuel to understand cultural differences and environmental adaptations. However, scant research has been conducted to understand and document methods for producing fires. Given the long-lasting durability of stone, the stone-on-stone method for producing fire with a strike-a-light will survive for thousands of years in the archaeological record; hence it is important to recognize and document these tools. This paper will present an artifact used as a strike-a-light for producing fire in the subarctic region of interior Alaska (middle Tanana Valley) some 5,500 years ago. The strike-a-light recognized at Goodpaster-IV is, to our knowledge, the most ancient example currently known in the American Subarctic. By reviewing the current state of research on European strike-a-lights from the French Mesolithic and Neolithic and describing use-wear analysis of the strike-a-light, we demonstrate important characteristics that reveal how strike-a-light tools were implemented in prehistory.

Northern archaeologists commonly identify the ancient presence of fire through hearth remnants or burnt features, charcoal, charred bone and heat-treated lithics (Bellomo 1993; James 1989). The earliest irrefutable evidence of the use and control of fire includes the Gesher Benot Ya'aqov Acheulian site in Israel ca. 780,000 years ago, where discrete concentrations of burned wood, seeds and flint were interpreted as hearths (Goren-Inbar et al. 2004). Fire has been cited as the most important innovation for the colonization of higher latitudes, even if it was used opportunistically until the second half of the Middle Paleolithic in Europe, where evidence for control of fire emerges (Gowlett et al. 1981; Parfitt et al. 2010; Roebroeks and Villa 2011). Humans could not have survived in Siberia or Alaska without fire, and various researchers have explored how hearths were used and the composition of fuel (wood, bone, etc.) to understand cultural differences and environmental adaptations (e.g., Kredrowski et al. 2009). But little is known about methods for producing fire. Before the introduction of steel, there were mainly two techniques for fire production: wood-on-wood friction and stone-on-stone percussion or friction (Collina-Girard 1998; Sorensen et al. 2014). The stone-on-stone technique usually combines a flint (or another siliceous rock) and sulfuric iron (marcasite or pyrite) (Sorensen et al. 2014). Due to the poor preservation of wood in the archaeological record, direct evidence of wood-on-wood friction would rarely be recovered. However, given the long-lasting durability of stone, the stone-on-stone method for producing fire will survive for millennia, hence the importance of recognizing and documenting this important tool type. This paper presents an artifact used as a strike-a-light for producing fire in the subarctic region of Alaska approximately 5500 cal BP, as well as some comparative information on strike-a-lights from Europe, where these tools are common.

GOODPASTER-IV SITE (XBD-405)

The Goodpaster-IV site and strike-a-light were discovered in 2013 in the Goodpaster Flats region of the middle Tanana Valley of interior Alaska as part of a joint U.S.–French archaeological expedition led by Krasinski, Wygal, and Gómez Coutouly (Gómez Coutouly et al. 2015). The project sought to explore the Goodpaster Hills, previously unexplored by archaeologists (Fig. 1). The site was further excavated in 2015.

On State of Alaska land, the site is located on the easternmost and lower extension of a large ridge complex south of a bend in the Goodpaster River and south and west of a shallow unnamed pond. Vegetation surrounding the site is primarily old-growth spruce forest with thick moss undercover. The area is characterized by lowland taiga and subarctic tundra vegetation, which cover the ridge. Following the ridge up in elevation provides a view of the Tanana River to the south and Volkmar Lake to the east. The site has relatively deep stratigraphy (> 1 meter), below which permafrost was encountered.

In 2013, two 0.5 x 1 m^2 shovel tests were dug at the location. The first was negative, while the other (GPT13-1A) contained eighteen lithics, including twelve flakes and six refitting fragments of the strike-a-light tool, as well as calcined bone and charcoal. The bifacial fragments, flakes, charcoal, and calcined bone were recovered at ca. 80 cm below surface from reddened and disturbed earth interpreted as a possible burned feature or hearth, although this could not be confirmed at the time due to the small size of the shovel test. Therefore, in 2015 we returned to the site and opened seven 1 x 1 m^2 units, one of which expanded the 2013 shovel test. Our objective was to confirm whether there was a hearth and to recover more cultural material associated with the strike-a-light.

During the 2015 excavation, a few artifacts were recovered from the same location and at the same depth as the strike-a-light. The most diagnostic tool was a burin on a flake, typologically similar to interior Alaska Donnelly-type burins. It was found at 75 cm below surface, a few centimeters east of the strike-a-light. This new excavation also revealed a more complex situation in terms of site context and stratigraphy. The strike-a-light was in a burnt feature, but instead of a small hearth, the entire site had been subjected to a series of large-scale burns apparent by a stratified sequence of reddened earth and calcined bone, and dense charcoal lenses interpreted as a series of large-scale fire events. Goodpaster-IV is unique to the region in that burn events at this scale have not been documented at any of the eleven prehistoric sites found in the Goodpaster–Volkmar project area (Fig. 1). The frequency of the burn events at the site is admittedly puzzling and could be due to a variety of factors (forest fires, human-induced burn events, etc.). There are reports from northern Alberta of hunter-gatherer-induced boreal forest fire (Lewis 1977; Lewis and Ferguson 1988) and among Ahtna in the Copper River Basin (Simeone 2006) and Gwich'in of eastern interior Alaska (Natcher et al. 2007). If demonstrated, this would be the first documented occurrence in a prehistoric context from Alaska. There is, however, no

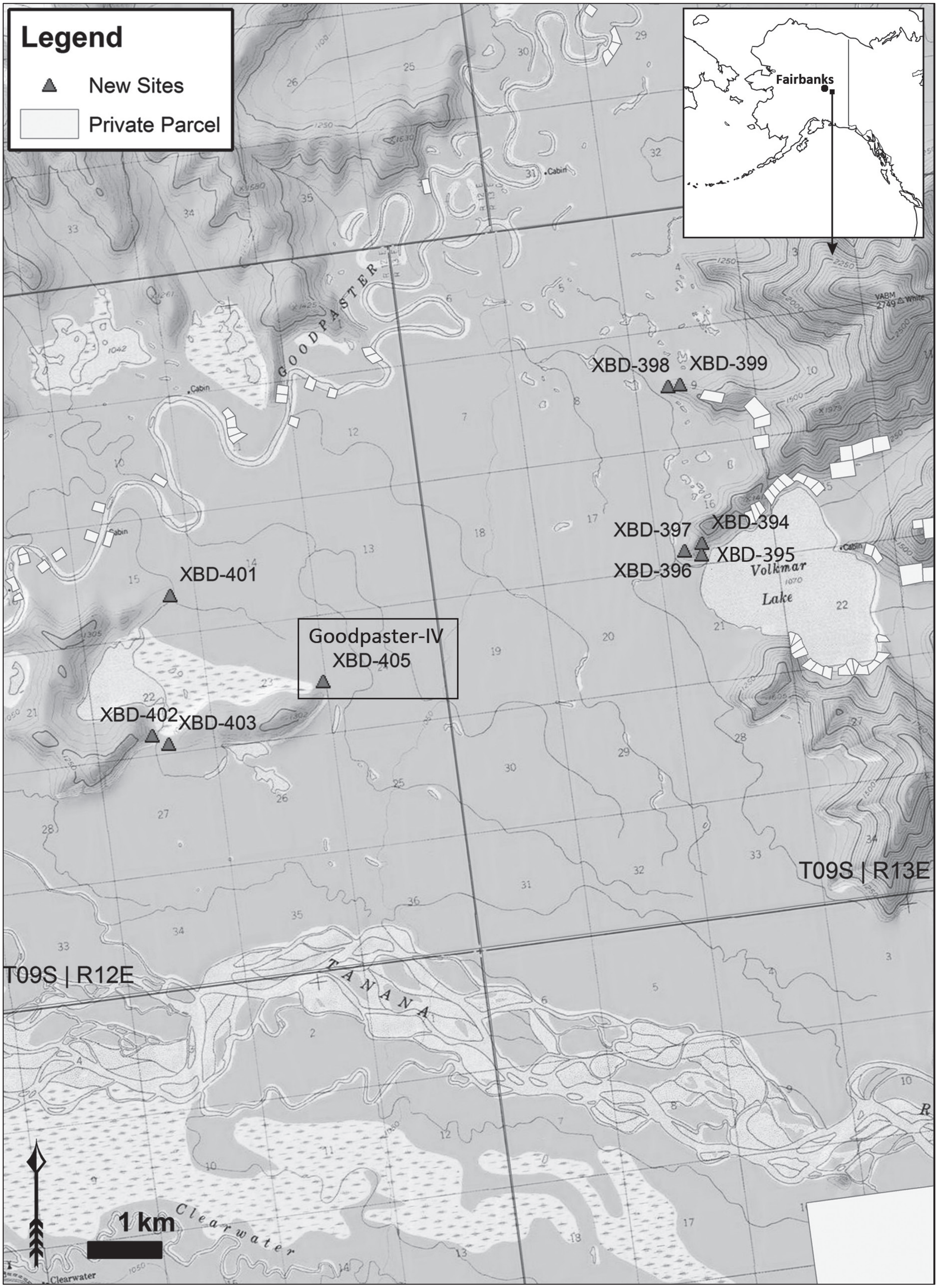


Figure 1. Map with the location of Goodpaster-IV, Goodpaster Flats, middle Tanana Valley, interior Alaska.

specific evidence suggesting that the burn events seen at the Goodpaster-IV site were human induced.

In Unit 4, where the strike-a-light was discovered, the profile is mainly composed of three stratigraphic units (Fig. 2): (1) forest brown horizon, (2) yellow loess, and (3) gray loess. The root mat is about 10 cm thick. The forest brown horizon, ca. 50 cm thick, can be divided into two subunits, with the second half being slightly redder and including denser charcoal lenses and bands than the first half. This horizon is seen in other units of the site. The yellow loess horizon, ca. 40–50 cm thick, includes gray loess pockets and, in some profiles, dark red bands (Fig. 2). The gray loess horizon continues at least 20 to 30 cm up to permafrost, although it may continue much deeper (over 2 m deep), as suggested by nearby units.

THE PREHISTORIC STRIKE-A-LIGHT FROM GOODPASTER-IV

Two radiocarbon dates on charcoal are associated with lithic artifacts from this test pit and returned Middle to Early Holocene ages (Table 1). The youngest of these dates (Beta-363108) was most closely associated with one of the strike-a-light fragments, thus seemingly indicating a ca. 3650–3500 cal BC (ca. 5600–5500 cal BP) age for the tool. It is important to note the stratigraphic reversal of the ages in terms of depth below surface, which may be due to post-depositional colluvium resulting in a secondary deposit.

The strike-a-light found at Goodpaster-IV is made on a brown chert bifacial blank (Fig. 3) consisting of six refitted fragments (found between 78 and 82 cm below surface). The refitting was not complete, and small fragments of the artifact are still missing. The tool is 7.0 cm long by 3.3 cm wide, 1.3 cm thick, and weighs 31 g. To our knowledge, this type of tool has not been identified by archaeologists in this region, thus delivering valuable information on fire production in mid-Holocene interior Alaska.

USE-WEAR ANALYSIS ON THE GOODPASTER-IV STRIKE-A-LIGHT

Use-wear analysis (Fig. 4) was carried out by Colas Guéret. The preliminary observation of the strike-a-light identified a general alteration of the surface condition. The tool was fractured, probably via frost action, and the flake scar ridges on both sides presented a soapy and very smooth appearance. The exact reason for the surface alteration is unknown. However, this type of surface alteration is rare among other lithic assemblages from the Goodpaster project area. Given the surface condition of the artifact, a microscopic use-wear approach was not feasible and use-wear analysis thus concentrated on a macroscopic approach using a binocular lens (5 to 40x magnification).

Two active use areas were identified at both the proximal and the distal ends of the biface, both of them presenting more favorable surface preservation than the rest of the artifact. Therefore, without being completely sure, it is possible that the general smooth surface and relatively fresh active use areas were the result of the recycling of an older weathered bifacial tool into a strike-a-light. The alteration of the surface and flake scar ridges are likely due to taphonomic processes. Indeed, the general smooth aspect of the tool indicates homogenous wear due to natural processes that differs from use-wear caused by manipulation of the tool (Rots 2012) or transport damage as has been documented by some traceologists (Plisson 1985; Claud 2008).

The use-wear analysis confirmed that the bifacial tool was used as a strike-a-light, based on the following traces. Both active areas of the artifact (Figs. 3a, 3b) bear the marks of very pronounced wear modifications; given their appearance and pattern, they undoubtedly correspond to the same type of use. The first type of traces consists of localized deep and rugged scars directed towards the surface of the tool (Figs. 4a, 4c, 4d). These removals are difficult to analyze in detail because they are systematically covered with many crushing impacts, completely

Table 1. Radiocarbon (AMS) dates from the Goodpaster-IV site (XBD-405)

Lab Identification	Material	Uncalibrated RCYBP (1σ)	Calibrated Date (2σ) BC	Calibrated Date (2σ) BP	$\delta^{13}C$ Value (‰)	Depth Below Surface
Beta-363107	charcoal	6900 ± 40 BP	5885–5715 cal BC	7830–7665 cal BP	–26.3	74 cm
Beta-363108	charcoal	4790 ± 30 BP	3645–3520 cal BC	5595–5470 cal BP	–24.1	82 cm

Calibrated with Oxcal v. 4.2.4 using the IntCal13 atmospheric curve (rounded to five years).

Figure 2. Profile of Unit 4 from Goodpaster-IV and detail of a dark red band in the yellow loess horizon from Unit 2.

transforming the active part of the object. These crushing impacts spread over nearly 1 cm of the surface and are the result of repeated percussion gestures. Moreover, the pattern of these pecked marks allows us to suggest a more specific striking gesture. Indeed, these traces are localized not only on the active edges, but also on the faces of the artifact near the active areas. Therefore, it indicates the striking was carried out through a transversal gesture with an acute angle between the active face of the tool and the worked material. This mode of use also generated traces from friction that are easy to recognize on the distal active zone in the form of a flat blunt surface scratched with deep and wide striations (Fig. 4b).

These specific use-wear patterns are similar to numerous European examples, especially in France. It is hard to confirm whether this tool was used as a strike-a-light for a long period of time or in an expedient manner, since "experiments show that even very short-term usage of a strike-a-light can produce abundant and readily identifiable microscopic wear traces" (Sorensen et al. 2014:482).

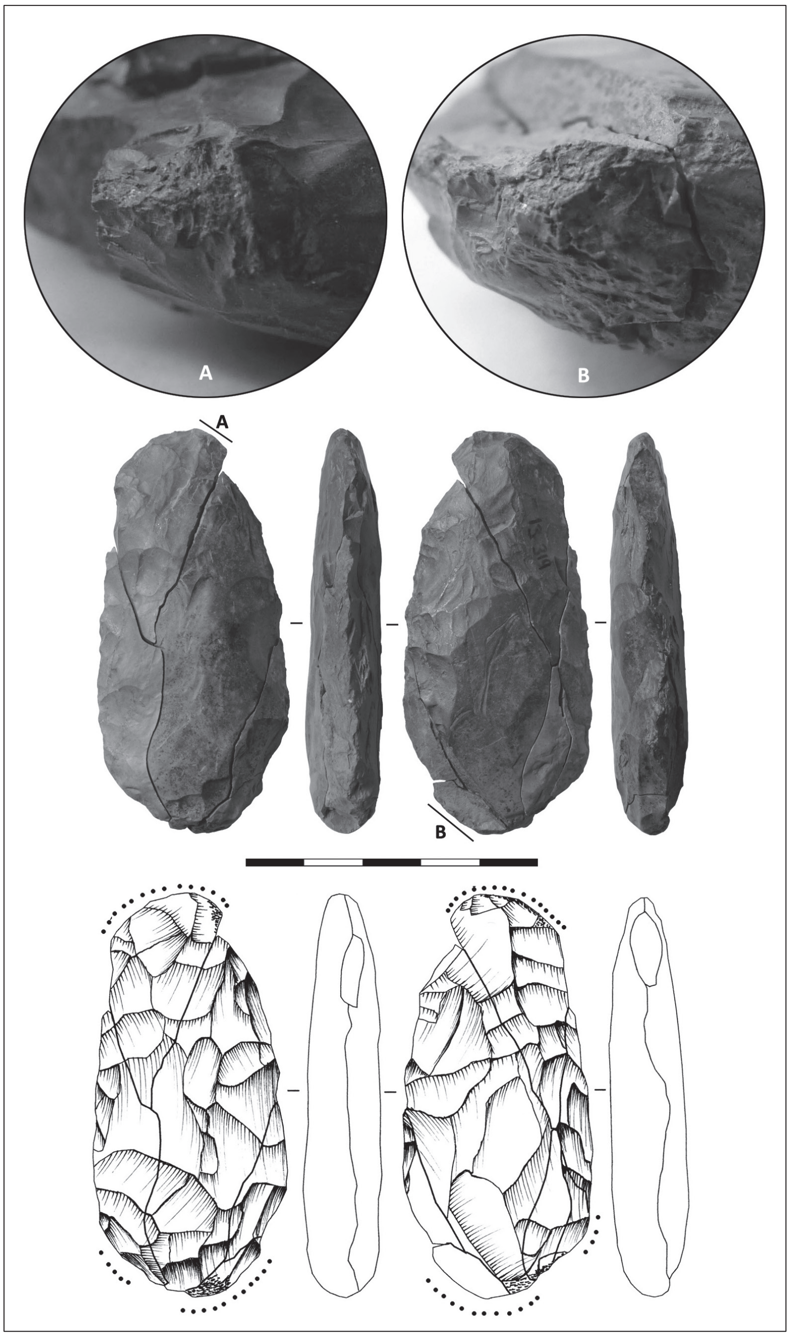


Figure 3. Strike-a-light from Goodpaster-IV.

STRIKE-A-LIGHTS IN THE PREHISTORIC AND ETHNOGRAPHIC RECORD

Ethnographically, the method of producing fire with stone strike-a-lights and sulfuric iron is known in various areas of the world, including in North America (Hough 1928; Roussel 2005). Eskimos and American Indians used this method as late as the eighteenth and nineteenth centuries (Collina-Girard 1998) and ethnographic reports are widespread among Inuit, Athapascan, and Algonquian tribes along the North Pacific and Arctic coasts to Newfoundland (White 1913). To our knowledge, there are no strike-a-lights documented from the Late Pleistocene to Middle Holocene period in the western Subarctic. Perhaps this is unsurprising because Osgood (1937:107) observes "the strap-drill is the only method which the Tanaina use to build fires" and that the Ingalik primarily use a fire drill and rarely a bow drill for making fire (Osgood 1940). Mishler (1986) does not mention specific fire-starting techniques of the Goodpaster band. There are, however, some from Arctic contexts. For example, in Early Holocene Mesolithic Finland, the wear found at both ends of a prismatic core from the Pöydänpääniemi site has been considered indicative of a secondary use as a strike-a-light, and similar wear patterns also occur on a blade from Myllykoski, another Finnish Mesolithic site (Manninen and Hertell 2011). Strike-a-lights appeared in Greenland as early as the Paleo-Eskimo tradition (Saqqaq and Dorset-I), starting about 2500 BC, and up

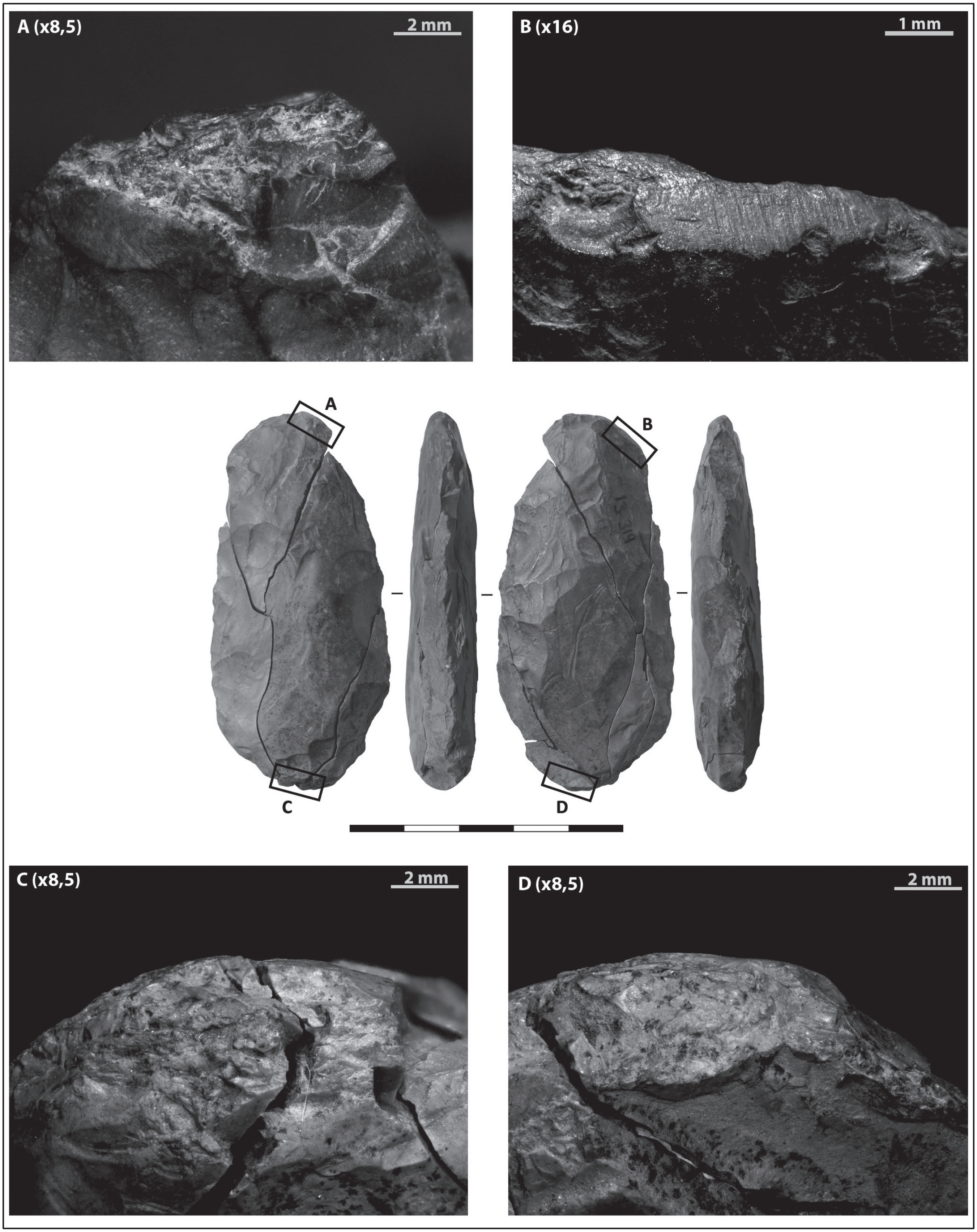


Figure 4. Use-wear detail of the strike-a-light from Goodpaster-IV.

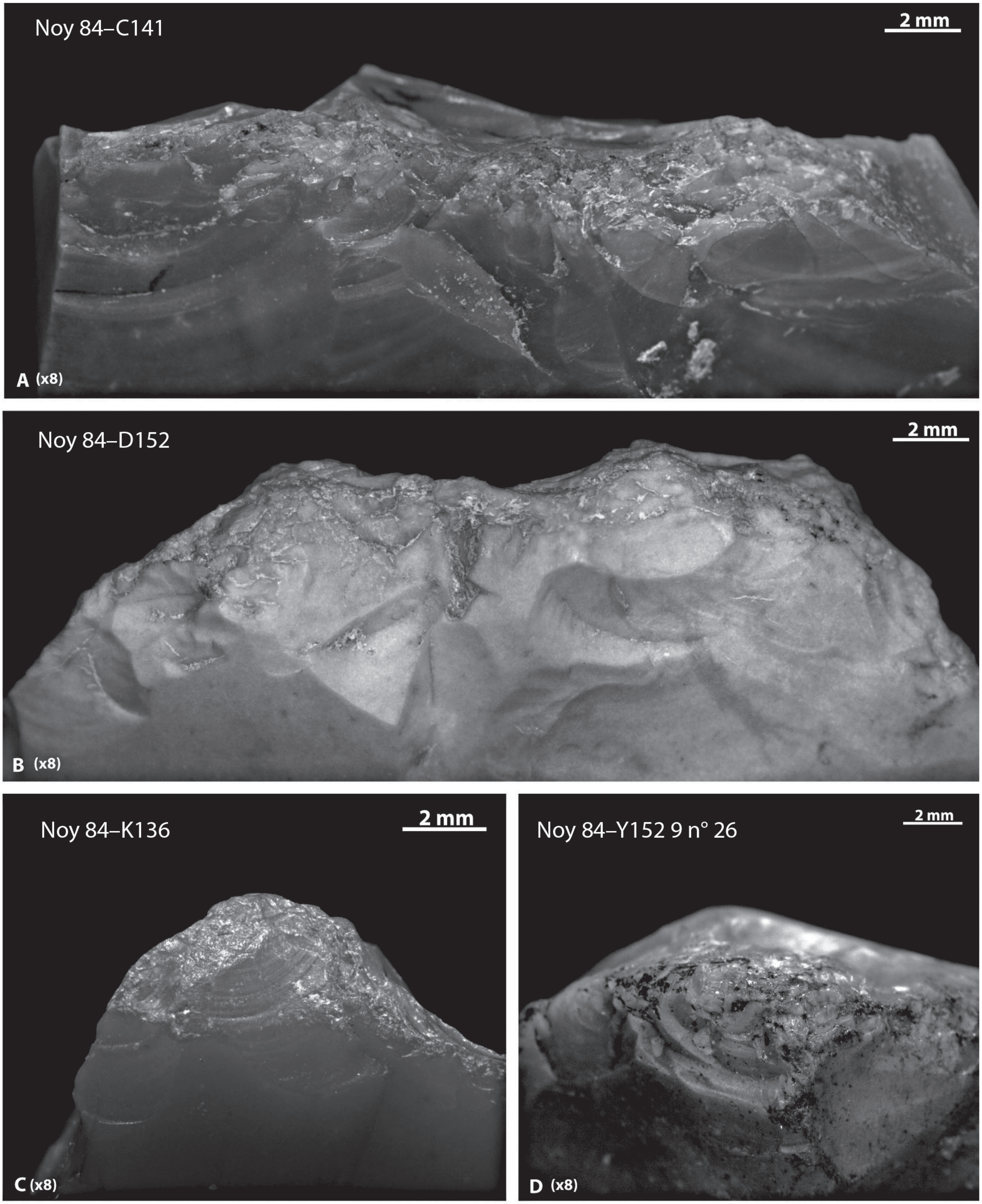


Figure 5. Use-wear details of French Mesolithic strike-a-lights from Noyen-sur-Seine, Seine-et-Marne department, northern France. Figures 5a, b, and c correspond to Figures 6a, b, and c.

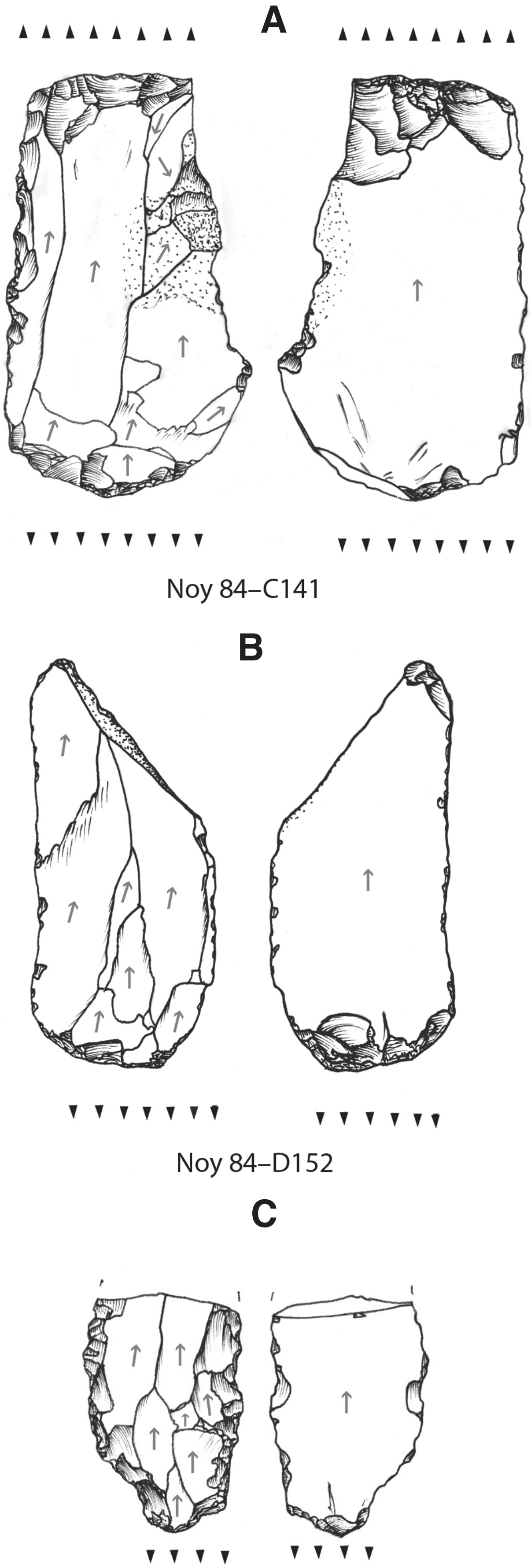
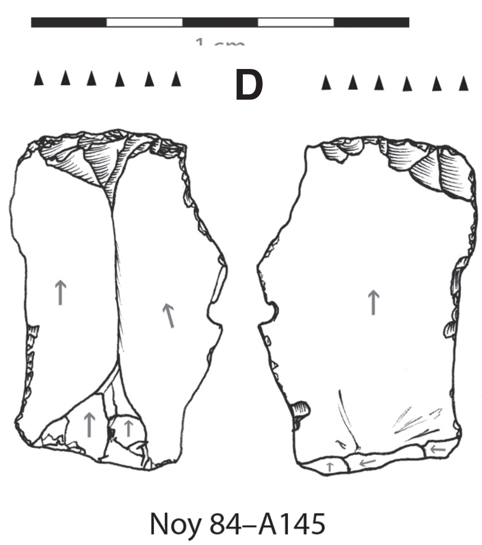


Figure 6. Strike-a-lights from the French Mesolithic site Noyen-sur-Seine, Seine-et-Marne department. Figures 6a, b, and c correspond to Figures 5a, b, and c.



to the Norse period (Grønnow et al. 2014; Johansen and Stapert 1997; Sørensen 2012). Many strike-a-lights have been recognized and documented in the prehistoric record in Europe, from several stages of the Neolithic (Beugnier and Pétrequin 1997; Collin et al. 1991; Renard 2010; Van Gijn 2010), and in the Mesolithic (Guéret 2013a, 2013b) and Upper Paleolithic (Slimak and Plisson 2008; Sorensen et al. 2014; Stapert and Johansen 1999). Some recent research has focused more intently on identifying the origin of the percussion pyro-technology as early as the Middle Paleolithic (Sorensen et al. 2014).

STRIKE-A-LIGHTS IN THE FRENCH MESOLITHIC AND NEOLITHIC

Considered retouchers (i.e., tools to retouch the edges of stone artifacts) at first, these tools were later reinterpreted as strike-a-lights given their association with sulfuric iron nodules in some Neolithic burials (Patte 1960). Starting in the 1990s, experimental research confirmed this hypothesis (Collin et al. 1991) and drew the attention of European archaeologists to these objects. We feel a review of that discussion here would benefit the Alaska archaeological community and open the possibility for future discoveries among existing collections. Therefore, we present some relevant information on strike-a-lights from the French Mesolithic (Guéret 2013a, 2013b) and Neolithic (Renard 2010).

Up to a few years ago, no strike-a-lights had been formally recognized in the European Mesolithic record (tenth–fifth millennia BC). Beugnier and Crombé (2005) mentioned possible strike-a-lights from the Early Mesolithic site of Verrebroek, but the functional interpretation remained cautious. The research carried out at Noyen-sur-Seine in France (an Early Mesolithic site from the start of the seventh millennium BC) permitted for the very first time confirmation of the presence of seventeen tools with scars, pecked and blunted extremities (Guéret 2013a, 2013b) (Figs. 5, 6). After comparing these artifacts with various experimental tools, these were identified as strike-a-lights used in combination with sulfuric iron nodules. In this Mesolithic site, selected blanks are always elongated (irregular blades or elongated flakes) and used at their extremities. Active use areas are not retouched but are easily recognizable due to the intense use-wear traces, similar to those seen in the Goodpaster-IV specimen. Although Noyen-sur-Seine is the first site to reveal the existence of unquestionable percussion strike-a-lights from the Mesolithic, there are abundant examples in the literature that illustrate similar Mesolithic artifacts with scars in the extremities and similar blunt surfaces indicative of use as strike-a-lights (Guéret 2013b).

In the French Neolithic (sixth–second millennia BC), strike-a-lights are a common tool and have been studied in detail, especially those from the Late Neolithic (3500–2200 cal BC) (Renard 2010). Strike-a-lights from the Late Neolithic are usually found in graves, revealing the importance of this tool. They were often deposited along with sulfuric iron nodules, ready for use, sometimes right next to a deceased individual, possibly indicating burial of individuals with their personal belongings. Strike-a-lights almost always present active use areas at both the proximal and distal ends of the blanks (Figs. 7, 8). Blanks used for strike-a-lights are quite varied and include, among others, flint nodules (Fig. 8a), polished axe fragments, flakes, blades (Figs. 7a, 7e) and reused end-scrapers (Fig. 8c). Cross sections of strike-a-lights are also quite varied (triangular, rectangular, trapezoidal, lenticular, or circular) as can be the position of the retouch (direct, inverse, or bifacial), characteristics deeply influenced by the general morphology of the blank.

USE-WEAR AND FEATURES SEEN ON FRENCH MESOLITHIC AND NEOLITHIC STRIKE-A-LIGHTS

One of the recurrent use-wear patterns typical of tools used as strike-a-lights is a blunt surface (Figs. 7, 8, 9), smooth scar ridges (Figs. 8c–d), frequent edge-crushing (Figs. 5, 6), and bright spots (Figs. 8d, 9) visible at the extremities (the active parts) and on the ridges (Beugnier and Pétrequin 1997). These traces can sometimes be confused with taphonomic alterations, but are the result of use, transport damage, and prehension of the tool. For example, when carrying out experiments, bright spots are present on the totality of each experimental artifact. This is due to the dust generated by the sulfuric iron during its use, which is released in abundance and gets deposited on the artifacts and on fingers (Beugnier and Pétrequin 1997).

Some of the strike-a-lights also show other distinctive features. First, the presence of a dark residue located in the active parts (Fig. 9) results from ferrous residues filling the bottom of the retouched removals during

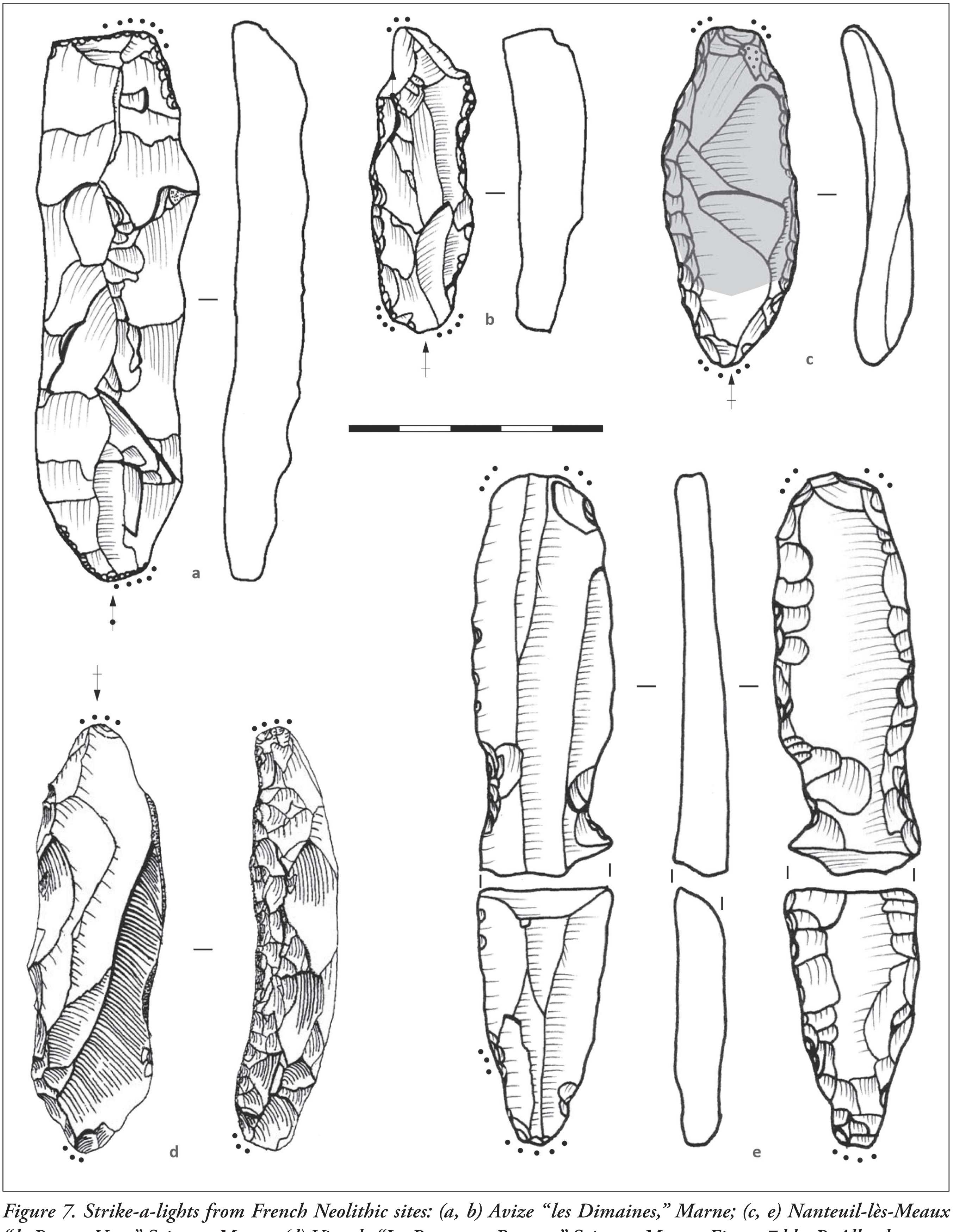


Figure 7. Strike-a-lights from French Neolithic sites: (a, b) Avize "les Dimaines," Marne; (c, e) Nanteuil-lès-Meaux "le Poteau Vert," Seine-et-Marne; (d) Vignely "La Porte aux Bergers," Seine-et-Marne. Figure 7d by P. Allard.

Figure 8. Strike-a-lights from the French Neolithic site of Marais de Saint-Gond, Marne.

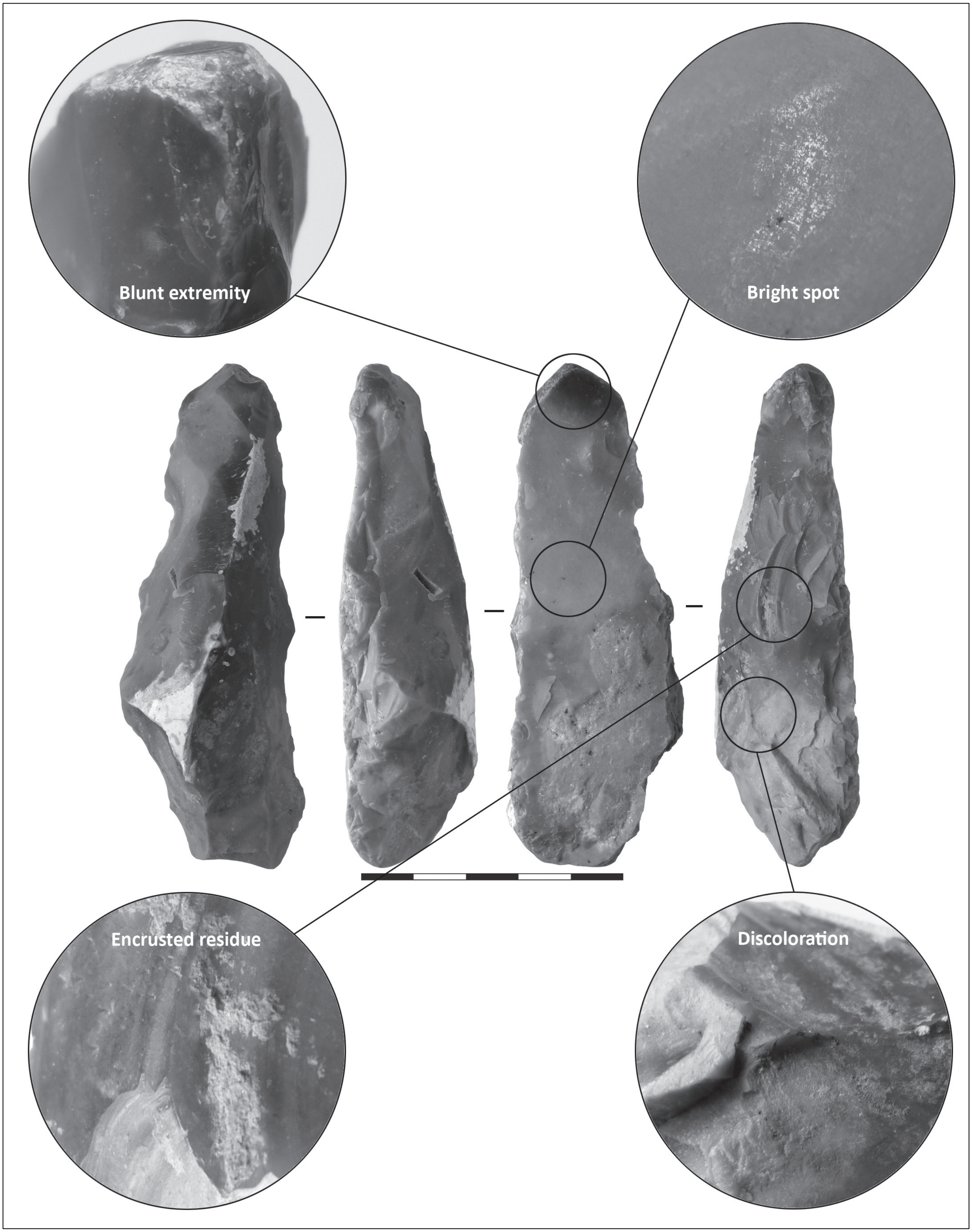


Figure 9. Typical use-wear traces and features found on strike-a-lights from the French Neolithic site of Fleury-sur-Andelle "La Côte des Monts – collège Guy-de-Maupassant," Eure.

use (Beugnier and Pétrequin 1997). Residues have also been found and analyzed on seven strike-a-lights from a Neolithic site in Zurich (Lombardo et al. 2016). Second, a discoloration and/or an encrusted residue is typically red to orange in color and located on wide surface areas, on edges, or on the upper and lower faces (Figs. 8a, 9). These discolorations or encrusted residues are the result of oxidized sulfuric iron deposited in close contact with the strike-a-light (Nieszery 1998; Renard 2010).

On some Late Neolithic strike-a-lights, a bilateral constriction (i.e., reduced section width) is found on the mesial sections (Figs. 7e, 8b), which does not correspond to a resharpening of the tool since the active parts are located at the extremities. Although the reason for these constrictions (waisted mesial sections) is not established, it could point towards an adjustment made for hafting or for a better handling, such as the presence of a cord or string that may have allowed the strike-a-light to hang from a belt.

CONCLUSION

The chert strike-a-light recovered from Goodpaster-IV in the Tanana Valley of Alaska is, to our knowledge, the most ancient example identified from the western Subarctic. Two radiocarbon dates on charcoal associated with the strike-a-light place this artifact around 5885–3500 cal BC (7830–5500 cal BP), the most closely associated dating to 3650–3500 cal BC (5600–5500 cal BP). The macroscopic analysis presented here reveals use-wear patterns consistent with the use of the tool as a strike-a-light. Based on the differential surface preservation between the general bifacial preform and the two active areas, it is possible this was an older worn-out bifacial tool recycled as a strike-a-light.

The comparative analysis with similar pyro-technology from French Mesolithic and Neolithic sites strongly supports the hypothesis that the Goodpaster-IV tool was used as a strike-a-light. Other features not seen on the Goodpaster tool can also in some instances indicate use of a tool as a strike-a-light, such as the presence of a dark orangey residue located in the active parts resulting from ferrous residues filling the bottom of the retouched flake scars, as well as a discoloration and/or encrusted residue on the surface due to oxidation of the sulfuric iron nodule when deposited in close contact with the strike-a-light. Although in European sites, strike-a-lights are often found in burial contexts, no human remains or evidence of graves have been recovered in the Goodpaster localities.

Outside Europe, and North America is no exception, research regarding the recognition and use-wear analysis of strike-a-lights is scant, hence the importance of documenting this type of tool. The single strike-a-light described here only represents a snapshot of Middle Holocene pyro-technology in interior Alaska about 5,500 years ago. There is, however, no doubt that producing fire with the stone-and-pyrite method existed in the area long before the mid-Holocene, and similar tools most likely already exist in the archaeological record of Beringia but are yet to be identified. We hope that our article will contribute to this overlooked tool type and will assist researchers in recognizing new strike-a-lights in the near future. By doing so, we will be able to build a clearer understanding of fire production and specialized tool kits in the Pleistocene/Holocene of the western Subarctic.

ACKNOWLEDGEMENTS

Research support for this project was provided by Adelphi University and by the French Ministry of Foreign and European Affairs (MAEDI) through the funding of the French archaeological mission in Alaska (mafAK). All our gratitude also extends to the French and American field crews involved in this project.

REFERENCES

Bellomo, Randy V.
1993 A Methodological Approach for Identifying Archaeological Evidence of Fire Resulting from Human Activities. *Journal of Archaeological Science* 20(5):525–553.

Beugnier, Valérie, and Philippe Crombé
2005 Étude fonctionnelle du matériel en silex du site mésolithique ancien de Verrebroek (Flandres, Belgique): premiers résultats. *Bulletin de la Société préhistorique française* 102(3):527–538.

Beugnier, Valérie, and Pierre Pétrequin
1997 Pierres à briquet: utilisation de la marcassite. In *Les sites littoraux néolithiques de Clairvaux-les-lacs et de Chalain (Jura) III. Chalain Station 3, 3200–2900 av. J.-C.*, edited by Pierre Pétrequin, pp. 429–434. Maison des sciences de l'Homme, Paris.

Clark, Ella E.
1953 *Indian Legends of the Pacific Northwest*. University of California Press, Berkeley.

Claud, Émilie
2008 Le statut fonctionnel des bifaces au Paléolithique moyen récent dans le Sud-Ouest de la France. Étude tracéologique intégrée des outillages des sites de La Graulet, La Conne de Bergerac, Combe Brune 2, Fonseigner et Chez Pinaud/Jonzac. Ph.D. dissertation, Université de Bordeaux I.

Collin, Fernand, Désiré Mattart, Louis Pirnay, et al.
1991 L'obtention du feu par percussion: approche expérimentale et tracéologique. *Bulletin des Chercheurs de la Wallonie* 31:19–49.

Collina-Girard, Jacques
1998 *Le Feu avant les allumettes*. Éditions de la Maison des sciences de l'homme, Paris.

Gómez Coutouly, Yan Axel, Brian T. Wygal, Kathryn E. Krasinski, et al.
2015 À la recherche des premières occupations préhistoriques de l'Alaska: programme international de recherches archéologiques dans la vallée de la Tanana, région intérieure de l'Alaska (États-Unis). *Les Nouvelles de l'Archéologie* 141:6–12.

Goren-Inbar, Naama, Nira Alperson, Mordechai E. Kislev, et al.
2004 Evidence of Hominin Control of Fire at Gesher Benot Ya'aqov, Israel. *Science* 304(5671):725–727.

Gowlett, John A. J., John W. K. Harris, Derek Walton, et al.
1981 Early Archaeological Sites, Hominid Remains and Traces of Fire from Chesowanja, Kenya. *Nature* 294:25–129.

Grønnow, Bjarne, Martin Appelt, and Ulla Odgaard
2014 In the Light of Blubber: The Earliest Stone Lamps in Greenland and Beyond. In *Northern Worlds: Landscapes, Interactions and Dynamics*, edited by Hans Christian Gulløv, pp. 403–422. National Museum, Copenhagen.

Guéret, Colas
2013a Identité et variabilité de l'outillage lithique du Premier Mésolithique en Belgique et dans le Nord de la France: Les apports de l'approche fonctionnelle. In *Palethnographie du Mésolithique. Recherches sur les habitats de plein air entre Loire et Neckar*, edited by Boris Valentin, Bénédicte Souffi, Thierry Ducrocq, et al., pp. 147–167. Société préhistorique française, Paris.
2013b L'outillage du Premier Mésolithique dans le Nord de la France et en Belgique. Eclairages fonctionnels. Ph.D. dissertation, Université Paris I, Panthéon-Sorbonne, Paris.

Hough, Walter
1928 Fire-Making Apparatus in the United States National Museum. *Proceedings of the United States National Museum* vol. 73, article 14, pp. 1–72.

James, Steven R.
1989 Hominid Use of Fire in the Lower and Middle Pleistocene: A Review of the Evidence. *Current Anthropology* 30(1):1–26.

Johansen, Lykke, and Dick Stapert
1997 Vuurmakers uit Paleo-Eskimonederzettingen in West-Groenland. *Paleo-aktueel* 8:24–27.

Kedrowski, Brant L., Barbara A. Crass, Jeffrey A. Behm, et al.
2009 GC/MS Analysis of Fatty Acids from Ancient Hearth Residues at the Swan Point Archaeological Site. *Archaeometry* 51(1):110–122.

Lewis, Henry T.
1977 Maskuta: The Ecology of Indian Fires in Northern Alberta. *Western Canadian Journal of Anthropology* 8:15–52.

Lewis, Henry T., and Theresa A. Ferguson
1988 Yards, Corridors, and Mosaics: How to Burn a Boreal Forest. *Human Ecology* 16(1):57–77.

Lombardo, Tiziana, Daniel Grolimund, Anna Kienholz, et al.
2016 The Use of Flint-Stone Fragments as "Fire-Strikers" during the Neolithic Period: Complementary Micro-Analytical Evidences. *Microchemical Journal* 125:254–259.

Manninen, Mikael A., and Esa Hertell
2011 Few and Far between—An Archive Survey of Finnish Blade Finds. In *Mesolithic Interfaces: Variability in Lithic Technologies in Eastern Fennoscandia*, edited by Tuija Rankama, pp. 113–142. Archaeological Society of Finland, Saarijärvi.

Mishler, Craig
1986 *Born with the River: An Ethnographic History of Alaska's Goodpaster and Big Delta Indians.* Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys Reports, Public Data File 68-14, Fairbanks.

Natcher, David C., Monika Calef, Orville Huntington, et al.
2007 Factors Contributing to the Cultural and Spatial Variability of Landscape Burning by Native Peoples of Interior Alaska. *Ecology and Society* 12(1):7.

Nieszery, Norbert
1998 Briquets de la céramique rubanée. *Revue archéologique du Loiret* 23:75–90.

Osgood, Cornelius
1937 *The Ethnography of the Tanaina*. Yale University Publications in Anthropology, no. 16, New Haven, CT.
1940 *Ingalik Material Culture*. Yale University Publications in Anthropology, no. 22, New Haven, CT.

Parfitt, Simon A., Nick M. Ashton, Simon G. Lewis, et al.
2010 Early Pleistocene Human Occupation at the Edge of the Boreal Zone in Northwest Europe. *Nature* 466(7303):229–233.

Patte, Etienne
1960 Les briquets dans les sépultures au Néolithique et au Bronze. *Bulletin de la Société préhistorique de France* 57(1–2):51–55.

Plisson, Hugues
1985 Étude fonctionnelle des outillages préhistoriques par l›analyse des micro-usures: recherches méthodologique et archéologique. Ph.D. dissertation, Université Paris I—Panthéon-Sorbonne, Paris.

Renard, Caroline M.
2010 L'industrie lithique à la fin du Néolithique dans le bassin de la Seine de la deuxième moitié du IVe millénaire à la fin du IIIe millénaire av. J.-C. Ph.D. dissertation, Université Paris I—Panthéon-Sorbonne, Paris.

Roebroeks, Wil, and Paola Villa
2011 On the Earliest Evidence for Habitual Use of Fire in Europe. *Proceedings of the National Academy of Sciences* 108(13):5209–5214.

Rots, Veerle
2012 Trace Formation, Strike-a-Lights, and the Contribution of Functional Analysis for Understanding Paleolithic Contexts. In *A Mind Set on Flint: Studies in Honor of Dick Stapert*, vol. 16, edited by Marcel Niekus, Martin Street and Thomas Terberger, pp. 149–162. Groningen Archaeological Studies, Groningen.

Roussel, Bertrand
2005 *La production du feu par percussion de la pierre. Préhistoire, Ethnographie, Expérimentation*. Editions Monique Mergoil, Montagnac.

Simeone, William E.
2006 Some Ethnographic and Historical Information on the Use of Large Land Mammals in the Copper River Basin. Alaska Region Technical Report Series Cultural Resources Report NPS/AR/CRR-2006-56, National Park Service, Anchorage.

Slimak Ludovic, and Hugues Plisson
2008 La sépulture paléolithique de l'enfant du Figuier (Ardèche, France), emboîtement d'une symbolique funéraire. In *La valeur fonctionnelle des objets sépulcraux*, vol. 14, edited by Maxence Bailly and Hugues Plisson, pp. 29–38. APPAM, Aix-en-Provence.

Sørensen, Mikkel
2012 *Technology and Tradition in the Eastern Arctic, 2500 BC–AD 1200. A Dynamic Technological Investigation of Lithic Assemblages from the Palaeo-Eskimo Traditions of Greenland*. Museum Tusculanum Press, Copenhagen.

Sorensen, Andrew, Wil Roebroeks, and Annelou van Gijn
2014 Fire Production in the Deep Past? The Expedient Strike-a-Light Model. *Journal of Archaeological Science* 42:476–486.

Stapert, Dick, and Lykke Johansen
1999 Flint and Pyrite: Making Fire in the Stone Age. *Antiquity* 73:765–777.

Van Gijn, Annelou
2010 *Flint in Focus: Lithic Biographies in the Neolithic and Bronze Age*. Sidestone Press, Leiden.

White, James
1913 *Handbook of Indians of Canada*, published as an Appendix to the Tenth Report of the Geographic Board of Canada. C. H. Parmelee, Ottawa.