# Chapter 2
# Pressure *Débitage* in the Old World: Forerunners, Researchers, Geopolitics – Handing on the Baton

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## 2.1 Introduction

We are indebted to Don Crabtree (1968) for the recognition of pressure *débitage*,[1] which endured into the Historic Period among the Aztecs in Mesoamerica. The leading pioneer in the field of replicative experimentation, Crabtree labored for nearly 10 years in the 1950s to obtain systematically regular blades with parallel edges and a constant thickness, similar in character to the Aztec obsidian blades, which were detached from characteristic fluted cores. He immediately saw a parallel between this type of *débitage* and some Paleoindian technologies from North America. Since then, a large amount of research, comprehensively summarized by J. Clark (2003), has been devoted to this subject in the Americas.

This chapter endeavors to recount how pressure *débitage* came to be recognized in the Old World before exploring the implications that ensued. One of the major issues to be addressed is the part this particular blade *débitage* technique played in the identification (or definition) of specific prehistoric cultures ranging from Upper Paleolithic hunter-gatherers to Neolithic agropastoralists in several geographical regions spanning from the Far East to Europe.

[1] The original French meaning of *débitage* is used in this chapter when referring to the production of blanks. On the other hand, the English definition of this French word refers to the waste flakes.

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P. Desrosiers (ed.), *The Emergence of Pressure Blade Making: From Origin to Modern Experimentation*, DOI 10.1007/978-1-4614-2003-3_2,

## 2.2 The Recognition of Pressure *Débitage* in the Old World

The cornerstone of this research was laid by J. Tixier when he identified pressure *débitage* in the Upper Capsian, an Epipaleolithic culture of the Maghreb dated 9500–5500 B.P. (Rahmani 2004: 89). It is due to J. Tixier's work that research on pressure *débitage* became so prominent for the investigation of prehistoric societies. He favored the use of experimentation as a methodological tool for the purpose of "seeking intentions" (1978: 67), regardless of the technique under investigation.

### *2.2.1 The Lithic Technology Symposium of Les Eyzies (France)*

Although it has never been published, this 1964 symposium held in France (Jelinek 1965) is still viewed as a seminal event in many respects (Fig. 2.1). Not only did it reveal a technique unknown to prehistorians, but it also highlighted the need for


**Fig. 2.1** The 1964 Symposium of Les Eyzies: Don Crabtree pressure flakes obsidian in front of H. Irwin (2), J. Epstein (3), J. Tixier (4), M. Wormington (5), J.-Ph. Rigaud (6)

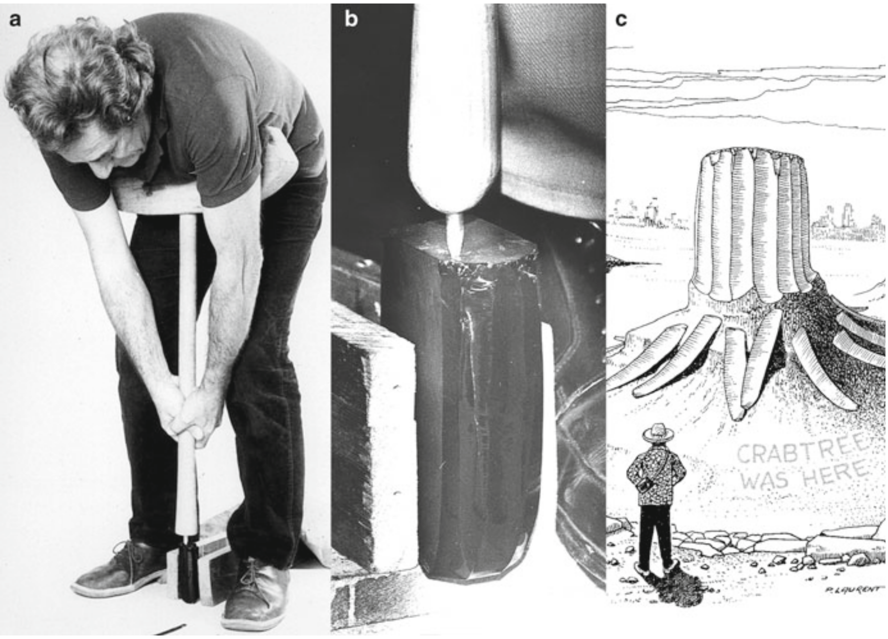


**Fig. 2.2** (**a**) J. Tixier pressure flakes obsidian using a copper-tipped pectoral crutch. (**b**) Detail view of the core. (**c**) Drawing by P. Laurent

the use of experimentation to "decipher" prehistoric detachment techniques. It was during this symposium that "we were introduced to the world of pressure *débitage* and retouch, which the French had only just begun to investigate" (Tixier 1978: 25; translated from the original). European researchers were also made aware of the advantages of heat-treating siliceous rocks for the first time. Once again, it was Crabtree who demonstrated that retouch removals detach more smoothly once the material has been subjected to well-controlled thermal treatment. This inspiration was a joint product of his observation of beautifully pressure retouched Paleoindian bifacial points (Folsom, Clovis, etc.), displaying removals "with greasy luster," and of his perusal of ethnographic documents (Crabtree and Butler 1964). Evidence for the use of heat treatment for pressure *débitage* extends as far back as the Upper Paleolithic (Inizan and Tixier 2001).

Crabtree demonstrated some obsidian blade production in front of a few prehistorians, two of whom, F. Bordes and J. Tixier, were experimental knappers themselves. The core was immobilized in a vice and the pressure applied with a copper-tipped pectoral crutch (Fig. 2.2). J. Tixier reflected that this *débitage* technique called to mind that used for bladelet *débitage* in the Upper Capsian of Algeria. As early as 1963 (p. 43), he had drawn a parallel between the "fluted" Mesoamerican cores and those of the Upper Capsian "whose section mimics that of a Doric column," thus defining them before discovering how they were produced. The first publication that mentions pressure *débitage* in the Upper Capsian dates back to 1971 (Tixier 1971: 122).

**Fig. 2.3** J. E. Clark: experimental body position for achieving blade pressure debitage on obsidian according to the indications left by the Aztecs

It should be noted that Crabtree used obsidian for his experiments, whereas flint was the available raw material in the Capsian. Obsidian is a vitreous and elastic rock and therefore highly suitable for pressure blade making. It facilitates the application of a smaller amount of pressure than flint, and, as a result, the accuracy with which the blades are detached is enhanced. In the course of their trials, Crabtree and Tixier became aware of the varying degree of difficulty induced by the different properties of these two raw materials. In 1969, they successfully pressure-flaked flint for the first time.

### *2.2.2 Method and Technique*

During a symposium in Austria in 1965, J. Tixier emphasized how important it is to distinguish between the terms “technique” and “method”: “The technique is the physical means, the method is the intellect that marshals the means,” and he added: “We reserve the term ‘technique’ for the material side of the process” (1967: 807; translated from the original). J. Pelegrin elaborated on this definition: “Techniques are the modes by which detachment is carried out. They always require the use of a least one tool, animated by a gesture made in a particular body position” (Pelegrin 1995: 20; translated from the original). Thus, what Crabtree had discovered was a technique, whereas it was thanks to the analysis of the Florentino codex, one of the major manuscripts dealing with Aztec obsidian productions and a text of which Crabtree had no knowledge, that the Aztec obsidian *débitage* method was reconstructed. The codex is composed of three texts: one which is pictographic, another which is written in Latin, and a third which is written in Spanish. We are indebted to J. Clark (1982) for analyzing the information in this codex and ultimately achieving pressure *débitage* by following the “directions” left by the Aztecs (Fig. 2.3).

### *2.2.3 Technology and Experimentation*

Flowing from the concept of the "operational sequence" [*chaîne opératoire*], technology is a methodological approach to material culture, which was brilliantly developed by A. Leroi-Gourhan (1943, 1964). When applied to prehistoric stone industries, it highlights the importance of the logical study of detachment techniques to address the relationship between different and/or successive techno-complexes. Identifying production techniques is therefore a crucial step in the sequence. In this respect, it should be stressed that sound technical diagnoses rely mainly on experimental replication. However, it is always the observations made on archaeological material that serve as a reference frame.

Replicative experimentation began to develop in earnest in 1980. The themes addressed at the *tables-ronde de technologie lithique* conferences organized in 1980 at Tervuren (Belgium) and in 1982 at Meudon (France) were at variance with the typological traditions that still prevailed at the time in lithic assemblage studies (i.e., to describe, categorize, and compare). At the first conference entitled (*Tailler pour quoi faire?*), it was argued that experimentation, whose usefulness for deciphering production techniques had already been acknowledged, was also necessary for positioning archaeological documents "in a sequence of events extending from acquisition of raw material by prehistoric man to discovery by the prehistorian" (Cahen 1982: 9; translated from the original).

In 1982, the following conference entitled *Economie du débitage laminaire* included a reflection on blade *débitage* and on the need to identify *débitage* strategies as part of a more precise cultural approach. In addition, the issue of pressure *débitage* in the Old World was addressed for the first time (Tixier 1984: 57–70). As a matter of fact, the first identifications of this technique in a variety of chronological contexts across the Old World, e.g., in the Epipaleolithic in the Maghreb (Tixier 1976), in the Mesolithic in Denmark (Callahan 1985), in the Neolithic in Mesopotamia (Inizan 1985, 1986), in the Early Neolithic in Greece (Perlès 1984, 1987), and in the Chasséen in France (Binder 1984), made it clear that this technical phenomenon played a more significant role in prehistoric lithic production than previously thought (Binder and Perlès 1990). It was therefore important to detect its presence in archaeological assemblages through the identification of its associated regular and standardized products. The existence of this blade *débitage* technique opened up new areas of research in the field of lithic technology, particularly for assemblages dating to the Holocene period.

Another peculiarity of pressure *débitage* is that it is exclusively used for the detachment of blade products (blades, bladelets, or microblades), generally during the phase of *plein débitage* (i.e., main blank production phase). Other technical possibilities exist for shaping out the core or, indeed, for executing the initial stage of blade *débitage*. Admittedly, a choice is made based on tradition: "Man has always been granted a wide range of options, he his free to choose and to stand by his choice" (Tixier 1978: 6; translated from the original).

The initial recognition of the technique was but the first step. In fact, the numerous methods used in conjunction with the pressure technique are still being identified in archaeological assemblages and need to be further investigated. While the technique is clearly understood, lithic analysis consistently shows how prolific and complex the methods in the assemblages are, thereby revealing identifiable cultural idiosyncrasies.

Experimentation rapidly proved very useful for the quantification of productivity (Pelegrin, Tixier) and for highlighting both the critical importance of raw material homogeneity and the need for accuracy during the shaping out of the core.

Numerous contributions to the study of several techniques were made by J. Pelegrin during a series of experiments in flintknapping. Pelegrin equipped his pectoral crutch with an antler point and immobilized the core with materials that would have been available to prehistoric knappers (1984: 105–127). He went on to explore the bodily constraints involved in the detachment of "minute to outsize products" before identifying lever-aided *débitage* (Pelegrin 1988). Following the description of the diagnostic criteria for the recognition of the pressure *débitage* produced with a metal point (Pelegrin 1994; Inizan et al. 1994), it was possible to infer the use of such metal points, even in their absence in archaeological material.

Last but not least, Pelegrin's research has had a major bearing on the ability to deduce the technical processes involved in the manufacture of archaeological stone objects in the Old World, resulting in a wealth of cultural interpretations (Pelegrin 2002, 2003, and this volume).

## 2.3 The Significance of the Identification of Pressure *Débitage* in the Capsian

The diagnostic technological criteria were published together with the study of the Upper Capsian industries of the Aïn Dokkara (Algeria) for the first time in 1976 (Tixier 1976).

Carried out as part of a doctoral thesis (Inizan 1976), a new approach to the Capsian lithic assemblages recovered by R. Vaufrey during excavations conducted in the 1930s opened up hitherto unexplored lines of research pertaining to *débitage* strategies and the interdependence of technical systems. Stored in Paris at the Institut de Paléontologie Humaine, these assemblages enabled R. Vaufrey to define the Capsian as the Epipaleolithic culture of the Maghreb. It is characterized by two cultural traditions: the Typical Capsian and the Upper Capsian. Both were present in the stratigraphy of the site The Relilaï in Algeria (Vaufrey 1933a, b).

At the time of excavation, the recovery of retouched tools was favored, to the detriment of *débitage* products, which were regarded as mere waste and perceived to lack any archaeological value. In spite of the absence of the bulk of the *débitage* products, with the exception of a few blade products and some characteristic waste products such as burin spalls, striking or pressure platform rejuvenation flakes, and thanks to a number of technical characteristics recognized under the supervision of

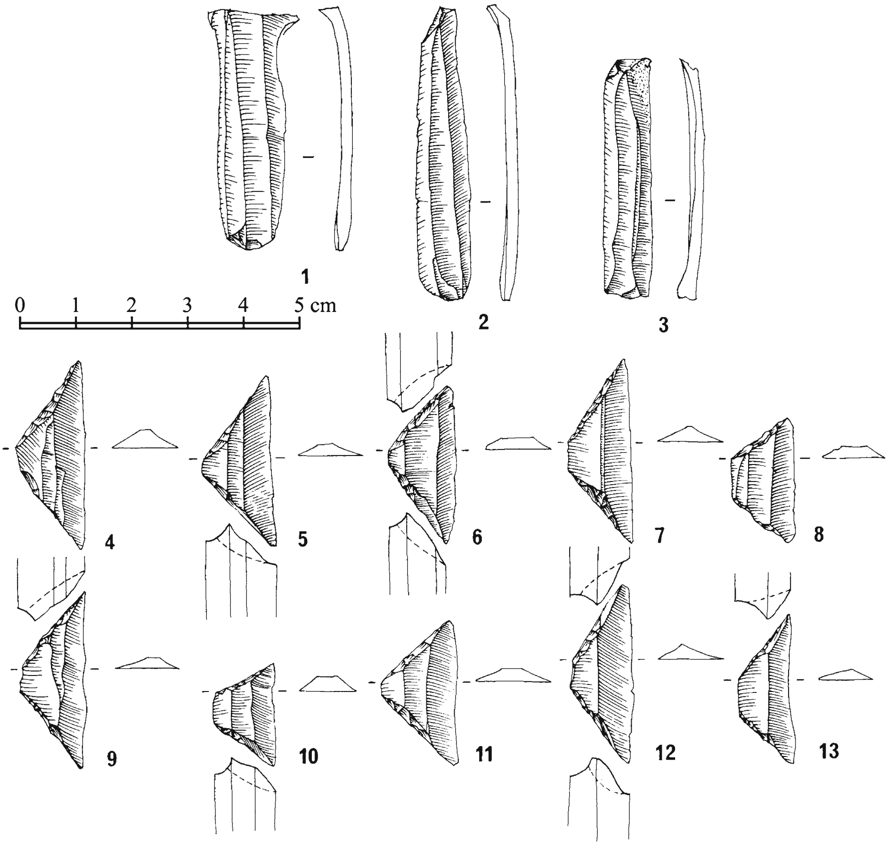


**Fig. 2.4** The Relilaï (Algeria): *1*, *2*, *3* bladelets; *4–13* trapezes obtained from pressure flaked flint blades using the microburin blow technique (Upper Capsian)

J. Tixier, it was possible to postulate the existence of a different *débitage* management (*économie du débitage*) in the Capsian (Inizan 1980: 29). The results of this technological approach demonstrated that pressure *débitage* is present in the Upper Capsian, and established a relationship between this technique and the development of predominantly geometric microliths. Thus, a statistical analysis of 343 trapezes and about 400 unretouched bladelets from The Relilaï showed that the height of the trapezes is a function of the width of the pressure bladelets. Obtained through the microburin blow technique, the geometric elements intended for hafting necessitated the manufacture of regular blanks with a moderate thickness, which could be easily produced using pressure (Inizan 1984: Fig. 2.4).

However, as emphasized by N. Rahmani, the origins of this technical invention in the Upper Capsian still appear to be shrouded in mystery: "Why did Capsians adopt the pressure technique? How did they adopt it, by invention or diffusion?"

(Rahmani 2004: 93). The well-executed character of the pressure *débitage*, attested for by blade dimensions that require elaborate equipment and painstaking core preparation, points toward an adoption of the technique rather than an ex nihilo invention in the Maghreb (Pelegrin 1988).

## 2.4 From North Africa to Mesopotamia

In 1980, J. Tixier identified pressure *débitage* on obsidian at Oueili, a site of the Ubaid culture in the South of Iraq, which is at least 2,000 km away from the nearest obsidian source (Inizan and Tixier 1983). In the same area, he also identified this technique on flint sickle elements at a younger site, dated to the end of the fourth millennium B.C. Supplemented with bibliographical research, the analysis of several lithic collections uncovered in the early twentieth century in Susiana, Southwestern Iran, subsequently highlighted the importance of this technical phenomenon in Iraq and in Iran (Hole et al. 1969; Inizan 1985, 1986, 1988). In addition, later analyses of lithic material from several sites excavated predominantly in Northern Iraq near Mosul showed that obsidian was always pressure flaked. However, this never took place on site. Pressure *débitage* of flint, carried out on site, was a component of lithic industries as early as 9,000–10,000 years ago in Northwestern Iraq, e.g., at Jarmo, Ml'lefaat, Nemrick, Der Hall, Karim Shahir, etc. (Fig. 2.15) (Ohnuma 1993). This tradition seems to have persisted until the third millennium B.C. (Inizan 1986) and coexisted with another form of blade *débitage* (Inizan and Lechevallier 1994). Indeed, another tradition of blade *débitage*, which is referred to as naviform *débitage* and was standardized through the use of percussion rather than pressure, was present in the Mediterranean and covering the area up to the Euphrates throughout the Neolithic period. It is a bipolar type of blade *débitage*, in which series of removals are alternately detached from opposing striking platforms, resulting in rectilinear end products. These two technological traditions involving high-quality blade *débitage* were identified in the obsidian production workshops at Kaletepe in Cappadocia (Turkey) (Binder 2007; Binder and Balkan-Ali 2001).

As for the Capsian of North Africa, there is evidence of a significant relationship between geometric microliths and a standardized pressure *débitage* of bladelets in the Middle East in the 7th and 6th millennia B.C. At the time when microliths disappeared, another connection emerged between sickle elements and pressure blades. A gradual increase in blade size can be observed in assemblages dating from the 7th to the 3rd millennia B.C., attesting to changes in the knappers' equipment. The small "bullet cores" disappeared at the end of the first half of the sixth millennium B.C. together with the small-sized blades they served to produce (Fig. 2.5). Thick outsized blades (more than 20 cm long), the so-called Canaanite *débitage*, began to appear at the end of the fourth millennium B.C. (Anderson-Gerfaud and Inizan 1994). This corresponds to the development of lever-aided *débitage* (Pelegrin 1988, 1997).

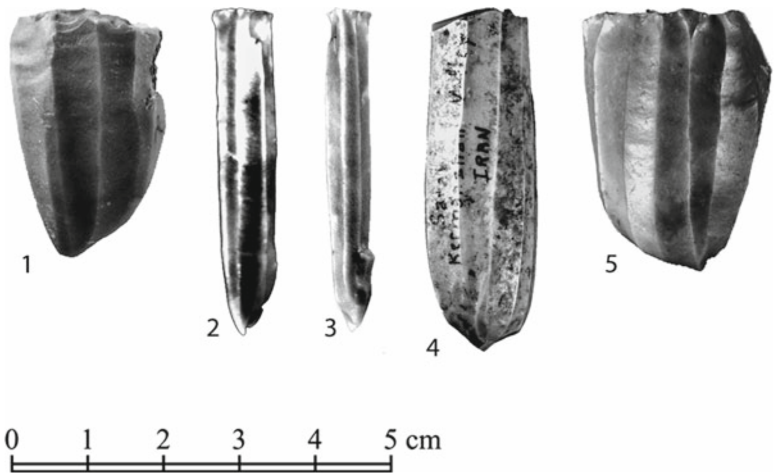


**Fig. 2.5** Pressure flaked cores: *1* Mehrgarh (Pakistan); *2*, *3* Tepe Guran (Iran); *4* Sarab (Iran); *5* M'lefaat (Iraq)

## 2.5 Mehrgarh and Central Asia

Archaeological information from Central Asia has dried up since 1979. Collections from Afghanistan and Iran became unavailable for study just when promising work resulting from surveys and excavations carried out in the early 1960s had been published, in which several illustrations suggested that pressure *débitage* was used by settled villagers in Iran (Hole et al. 1969) and Afghanistan (Davis 1978).

This is why from 1984 onward, research on the lithic industries of the Neolithic sites of Mehrgarh and Nausharo in Pakistan was conducted in collaboration with Monique Lechevallier for over a decade. These studies were to serve as a frame of reference for the investigation of the origins of this technique and how it was passed on to the Old World (Inizan and Lechevallier 1985, 1991, 1997).

The first occupations of Mehrgarh in the Kachi Plain, Baluchistan, are dated to the seventh millennium B.C. and occurred in an aceramic context. Pressure *débitage* was carried out almost throughout the entire period of occupation for at least 4,000 years.

M. Lechevallier (2003) has reconstructed the *débitage* strategies for the lithic assemblages from Mehrgarh. They can be summarized as follows. The flint, not available locally, was brought to the site in the form of partially prepared cores, as indicated by the near absence of core preparation flakes and also by the presence of a hoard of nine cores (Lechevallier and Marcon 1998), suggesting that the roughing out took place at the raw material sources. Indirect percussion was used for the initial *débitage* stages, while the removal of bladelets involved exclusively the application of pressure. Heat treatment is documented but was not practiced systematically (Inizan and Lechevallier 1985).

As was previously observed, the geometric microliths and the sickle elements were exclusively produced on pressure blades. This observation holds true for the

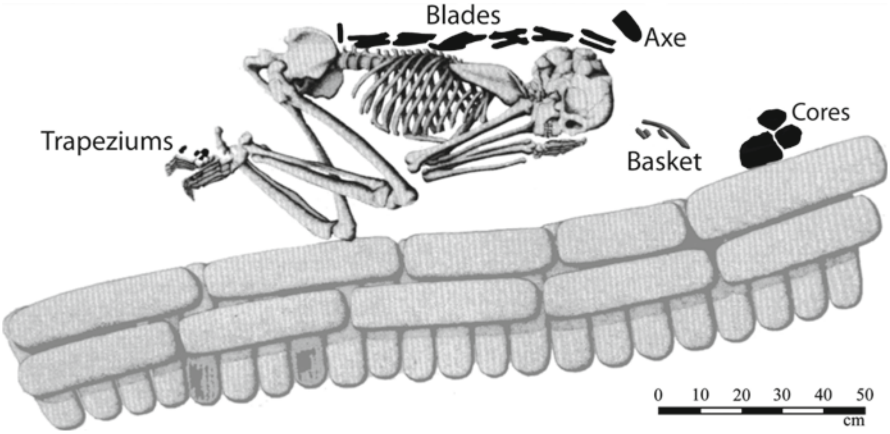


**Fig. 2.6** A blade knapper's grave (Neolithic necropolis of Mehrgarh, Pakistan, sixth millennium B.C.)

entire East, something that can be accounted for by an enduring technological tradition. The standardization of very moderately thick, interchangeable elements appears to be associated with hafting. Indeed, thanks to the discovery of several of these elements found obliquely embedded in the bitumen that fixed them to the handle, it has been possible to reconstruct the tools (Lechevallier 1988: 56).

Microwear analysis carried out by P. Vaughan has shown that some of the microliths were intended to be used for hunting and others for cutting plant material (Vaughan 1995).

In 1989, the use of metal for pressure *débitage* in the industries of Mehrgarh and Nausharo was confirmed by J. Pelegrin (Inizan et al. 1994; Pelegrin 1994).

Regarding the funerary rites, the Neolithic necropolis of Mehrgarh offers some insightful data. Dated to the beginning of the sixth millennium B.C., the cemetery contains 150 graves enclosed by low walls. The grave goods associated with the skeletons unambiguously reveal the status of some of the deceased. Thus, the manner in which the grave goods are arranged in grave 114 (three prepared cores by the head of the deceased, 16 blade blanks along his back, which can all be refitted, but the core is missing, and trapezes at his feet) implies that its occupant was a blade producer. He was probably a technically rather than economically specialized craftsman (Perlès 1990: 36–38) (Fig. 2.6).

## 2.6 Pressure *Débitage* in the Upper Paleolithic of Continental Asia

Pressure retouch was used in the Upper Paleolithic as early as the Solutrean, some 20,000 years ago. However, pressure *débitage* was initially only identified in Neolithic or, at most, in Epipaleolithic contexts. As a result, the use of pressure for *débitage* was regarded as a technical breakthrough, thanks to which it became possible to standardize blade products at the end of prehistory.

We are indebted to J. Flenniken (1987) for recognizing beyond doubt the presence of the Yubetsu-type method of pressure *débitage* (Fig. 2.13) together with the use of heat treatment in the Dyuktaï Paleolithic culture of Siberia, which is dated to 14500 B.P. (Kuzmin and Orlova 1998). The identification of pressure *débitage* in a Siberian Paleolithic culture required a revision of the *débitage* techniques used from the Upper Paleolithic onward in Asian cultural contexts (Seonbok and Clark 1996).

### *2.6.1 The "Microblade Culture Tradition"*

This designation highlights the existence of a culture shared by wide-ranging populations of Final Paleolithic hunters, whose territories spanned Siberia, Mongolia, Northern China, Japan, and extended across the Bering Strait as far as Northern America.

The term "microblade culture" is derived from a morphological recognition of the tiny cores, named "wedge-shaped core," "Gobi core," "true microblade core," etc., rather than from the presence of bladelets and the identification of the technique used to detach these products.

This pressure technique is seldom mentioned, but a correct identification can be arrived at by checking for a series of criteria such as regular arises, curved profiles, small sizes of cores, and bladelets that can even be seen in drawings and would be impossible to obtain by percussion for reasons of inertia (Pelegrin 1988: 49).

Widely used by prehistorians, the term "microblade tradition" is in actual fact a concept referring to a composite tool: a handle or a shaft, fitted with interchangeable lithic elements, obtained by pressure from a handheld core. Thanks to this excellent chronological and typological marker, identified as early as the 1930s (Smith 1974) and referred to as NANAMT (The Northeast Asian-Northwest American Microblade Tradition), one can follow the hunter-gatherers across the wide Siberian steppes and all the way to the American continent. The technology and its bearers easily spread eastward and northward by land during the last glacial maximum (LGM), ca. 18,000–20,000 years ago, when sea levels had dropped by several dozen meters and large land masses became available.

The earliest evidence for microblade pressure *débitage* dates to around 20000 B.P. and can be detected in a large ill-defined area centered in Siberia, Mongolia, and Northern China. Percussion is always used to shape out the cores and to manufacture the heavier tools found in combination with microblade production.

In Korea, an Upper Paleolithic site with evidence of bladelet pressure *débitage* was recently identified (Hong and Kim 2008). The site of Hopyeong-dong was excavated from 2002 to 2004. It is situated within the central part of the Korean peninsula (Fig. 2.15). Hopyeong-dong is one of the earliest sites discovered in this region and bears evidence of a bladelet industry produced by a new technique (pressure *débitage*) that corresponds to the introduction of new raw-material-type obsidian. The use of a pressure technique for the production of obsidian bladelets at this site can be deduced from the refits in conjunction with the numerous, high-quality, illustrations (cf. Hong and Kim 2008). This inference is supported by personal observations of the material during September 2010.

The stratigraphy of Hopyeong-dong presents two successive, culturally distinct, levels. The lower level, dated to 30–27 kyr B.P. (AMS-C14), contains a lithic industry characterized by tanged points, a few quartz and rhyolite blades, and pecked pebbles. Dating to the last glacial maximum (LGM; OIS2 or MIS2), the base of the upper level (24–16 kyr B.P.) corresponds to a radical change in the lithic industry. This departure from the preceding tool kit comprised of end scrapers, burins, and drills introduces the use of high-quality obsidian for the production of bladelets using the pressure technique.

The refits and debris demonstrate that these obsidian bladelets recovered from the uppermost two levels were produced on-site with the exception of the initial core preparation. The Yubetsu method sensu stricto is not present. The *plein débitage* bladelets, which are predominantly fractured, do not exceed 60 mm in length, 5 mm in width, and 2 mm in maximum thickness (Hong and Kim 2008: 356–363), indicating that they can be produced from a core stabilized by hand. A use-wear analysis attests to these bladelet fragments having had multiple functions and indicates hafting in wooden handles (Kononenko 2008). The early appearance of obsidian material at the site of Hopyeong-dong confirms that this part of Korea witnessed the invention and diffusion of pressure bladelet production in the Asian continent (Fig. 2.15).

### *2.6.2 The Invention and Origin of Pressure Débitage*

During the two Franco-Soviet symposiums on the prehistory of Central Asia held in 1982 at Dushanbe in Tajikistan and in 1985 in Paris, some contributions suggested that the origins of pressure *débitage* lie in the Far East and that this technique was first developed in the Upper Paleolithic (Inizan et al. 1992). In addition, a single center of invention was proposed.

The arguments in favor of a single center of invention are based on the enduring presence of the tradition from the Paleolithic onward in Asia and on its absence in Western Eurasia prior to the Holocene. In Asia (Siberia, Mongolia, Japan, etc.), pressure *débitage* is practiced continuously to obtain first microblades and then blades, i.e., "minute to outsize products," from the Paleolithic onward and up to and including the Neolithic period (Pelegrin 1991). In China, Gai Pei (1985: 231) stressed the occurrence of a large number of sites with microblade *débitage*, especially in the Northeast and in Inner Mongolia, and the long chronologies which span from the Upper Paleolithic until the first millennium B.C. In Central Asia, F. Brunet states that "the adoption of pressure *débitage* is a considerable departure … from the ancient Upper Paleolithic traditions" (Brunet 2002: 11; translated from the original).

The process of diffusion probably took place from East to West (Inizan 1991; Inizan and Lechevallier 1994; Inizan et al. 1992).

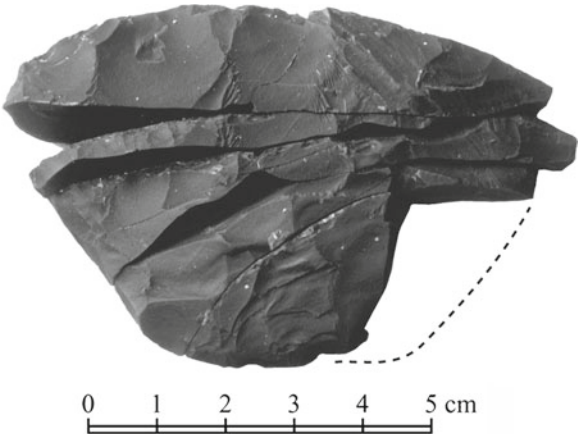


**Fig. 2.7** Refitted core from Bolshoj Yakor (Siberia) (photo M.-L. Inizan)

On the African continent, microblade *débitage* exists in the Capsian of North Africa and in some Neolithic industries of Egypt and of Mauritania (Midant-Reynes 1983; Boeda 1987).

Pressure *débitage*, particularly in the case of bladelets detached from handheld cores, is a technical invention that could be easily transmitted. Larger products, which require devices for the immobilization of the core to facilitate the application of pressure (crutch), suggest the existence of more complex skills and, therefore, were probably more difficult to pass on and to disseminate over a wider area.

In 1990, Prof. Medvedev was kind enough to allow scholars to examine some Siberian material in Irkoutsk for the first time. The key feature was a group of 11 refitted microbladelets (L = 12–18 mm; l = 2–3 mm) on a narrow-fronted Yubetsu-type core from the site Bolshoi Yakor, located on the bank of a tributary of the Lena River and dated to 11500 B.P. (Fig. 2.7). This refitted group allowed for the recognition of the pressure technique as well as the Yubetsu method and its outstanding efficiency (Ineshin 1993). At Bolshoi Yakor, some of the bifacial preforms were introduced to the site in a prepared state. The cores from the older levels have the narrowest *débitage* surfaces (E. M. Ineshin, personal communication 1991).

Two questions still required an answer: What use were these microbladelets designed for and how were they hafted? Possible explanations were found in assemblages that derived from a number of Siberian sites located on an Arctic island, which had recently been excavated from the thawing permafrost. For instance, at the hunting site of Zhokhovskaja, dated to 8790 ± 90 B.P., several bone and ivory implements were found complete with their hafted microblade insets. In addition, these implements showed that hafting could be achieved with or without the use of adhesives. These 25 objects account for 50% of all the known hafted composite tools from Siberia (Fig. 2.8) (Pituljko 1998). A wooden sledge was also identified. Evidence for a workshop comprising of pressure cores and bladelets is associated with these various pieces of equipment.

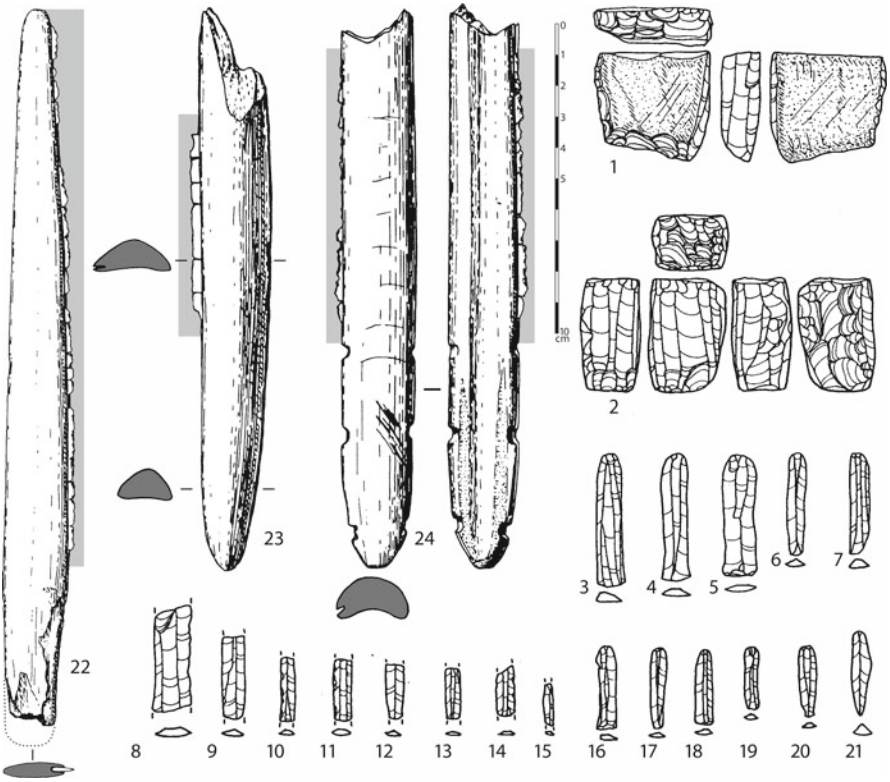


**Fig. 2.8** Pressure debitage: core (1–2) and bladelets (3–21); bladelets inserted into bone *baguettes* (22–24) (site of Zhokhovskaja; redrawn by H. Kimura 1999: 10, 12)

## 2.7 Pressure *Débitage* as Evidence of Mobility

Two examples are developed below to illustrate how the identification of elaborate production techniques helped to outline the migrations of cultural groups. The first example addresses the question for Scandinavia in Northern Europe, and the second highlights the importance of pressure *débitage* methods for understanding the chronology of the colonization of the Japanese Archipelago in the Upper Paleolithic.

### *2.7.1 Migrating into Northern Europe: Sujala in Lapland*

Although mention can be found in the literature of the presence in Northern Europe of the pressure *débitage* technique, this is not backed by a description of the diagnostic criteria. The morphology of the "wedged-shaped cores," for which a Siberian origin is accepted, has also been used as an argument for the presence of this technique (Svoboda 1995).

At higher latitudes, the Finnish site of Sujala in Lapland, which was excavated in 2004, was occupied by reindeer hunters at around 9000 B.P. (Rankama and Kankaanpää 2007: 51). The presence of blade pressure *débitage* (identified by J. Pelegrin) at such an early date was an unexpected discovery, because the technique was supposed to have first reached Scandinavia via Northern Europe at around 7800 B.P., during the Atlantic period. Moreover, it had been generally accepted that Lapland was settled by coastal groups from Norway belonging to the original Ahrensburgian techno-complex. Now, the occupation of Sujala points to the arrival of a group of reindeer hunters who brought with them the knowledge of the blade pressure *débitage* technique, which had been widely used in the Eastern Baltic, and who carried hunting weapons (arrowheads) characteristic of the post-Swiderian culture identified in Russia (and different from those of the Ahrensburgian techno-complex). Migrating from the Northeast and possibly following reindeer herds, these people may well have been the first settlers to arrive in Lapland. They bore witness to a hitherto unsuspected Northern European route for the spread of the pressure *débitage* technique (Fig. 2.15).

### *2.7.2 Migrating into the Japanese Archipelago*

The Japanese Archipelago stretches from latitude 25° to 45° N. The four major islands are Kyushu, Shikoku, Honshu, and Hokkaido. The present-day shorelines gradually took shape after the last glacial maximum (LGM, ca. 18,000–20,000 years B.P.), stabilizing at ca. 10,000–12,000 years B.P. (Ono 1999). Figure 2.9 shows the shoreline displacement and the extent of dry land during the LGM. At that time, the Northernmost Hokkaido Island was part of continental Eurasia, together with Sakhalin Island and the Kamchatka Peninsula in Siberia. It was separated by a strait from the other islands of the Archipelago, which formed a single land mass adjacent to continental Korea (Fig. 2.9). The position of the ancient shorelines had a bearing on human expansion as well as on animal migrations (Fig. 2.10) and on the vegetative cover.

Two fact-finding missions in Hokkaido (1993) and in Kyushu (2000) afforded the opportunity to ascertain that the pressure technique had been systematically used to detach bladelets in Japan for many thousands of years and to study the variety of *débitage* methods. The islands of Japan are of volcanic origin and yield large quantities of high-grade stone raw material that was suitable for pressure blade making, e.g., obsidian, which is primarily found in Northeastern Hokkaido, and various neogene volcanic rocks such as shale and chalcedony. Antler was widely available for use as tools for percussion and pressure techniques.

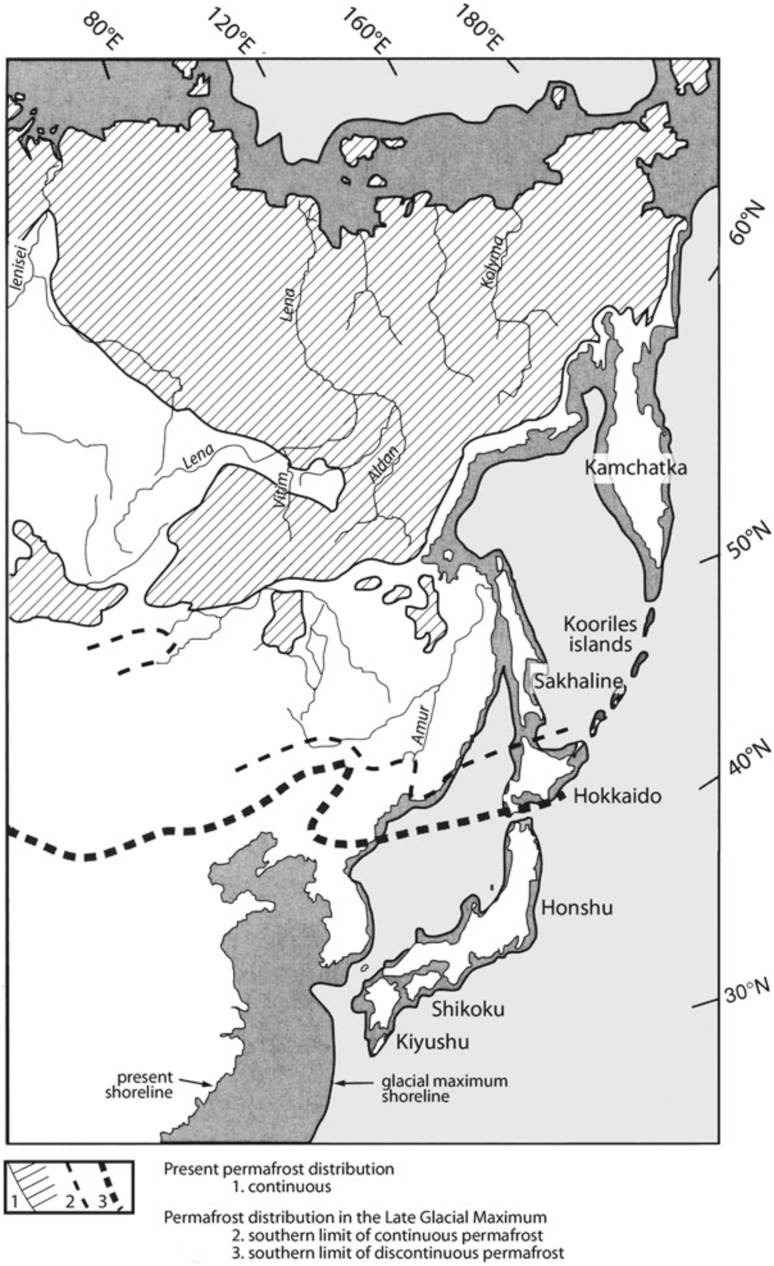


**Fig. 2.9** The major post-LGM shorelines of Japan (Modified after Ono 1999)

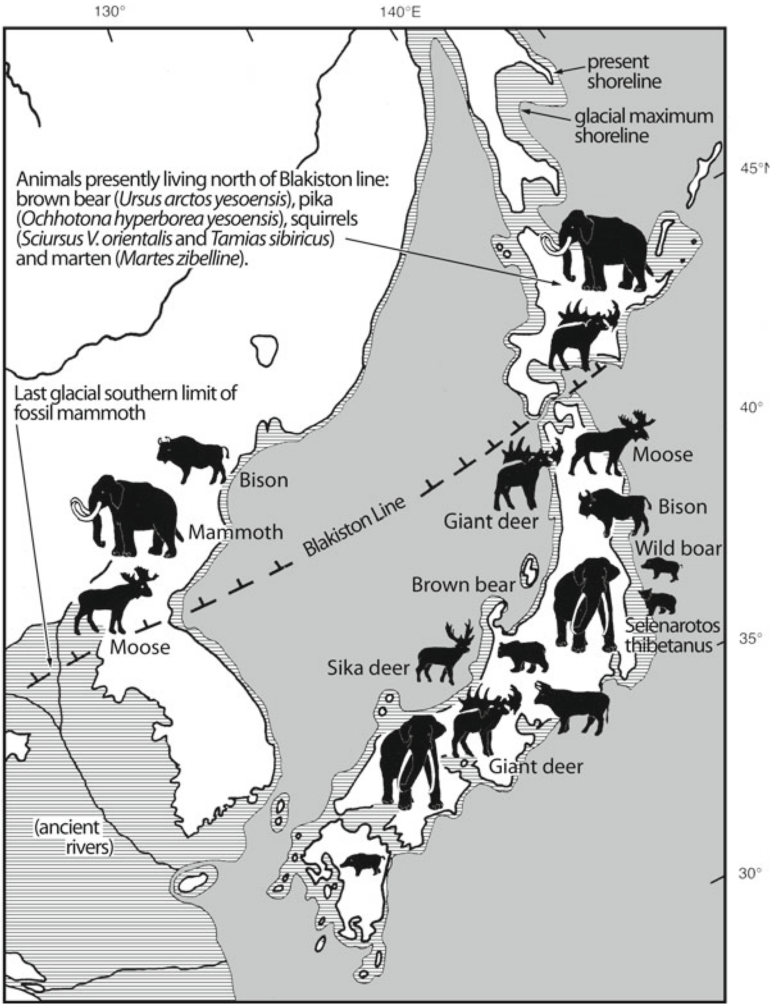


**Fig. 2.10** Migration routes of large mammal faunas during the LGM (Ono and Igarashi 1992)

## 2.8 The "Microblade Tradition" in Japan

This microblade tradition, identified in the Far North of America, in Siberia, Northern China, Mongolia, Korea, and Japan, has been widely published over the last 30 years by a large number of researchers. It was however necessary to date these cultures in order to compare them. Following the 1990 Novosibirsk Symposium, an international meeting dedicated to "The origin and dispersal of microblade industry in Northern Eurasia" was organized by Professor H. Kimura at Sapporo on the Hokkaido Island in 1992 (1993, Japanese/English). This was triggered by the fact that Japan, and more particularly Hokkaido, has the largest number of known and published settlements containing such industries.

The earliest bearers of a microblade tradition appear on what is today the Hokkaido Island at around 20000 B.P. As soon as bladelet industries had been recognized in Japan, a continental origin was attributed to them, and it was generally accepted that the presence of this technical tradition was an expression of a similar subsistence model (Kajiwara and Yokoyama 2003).

### *2.8.1 Japan's Earliest Inhabitants*

Information about the initial colonization of Japan has not been circulated widely, and, therefore, one must welcome Yajima's (2004) recent English publication who gives an overview of the prehistory of the Archipelago, its chronology, and major stone industries. So far, the earliest settlement of the Archipelago dates back to the Upper Paleolithic and is only associated with *Homo sapiens sapiens* populations.

Since 1949, when a series of surveys directed by Prof. C. Serizawa (1971) resulted in the recognition of a Japanese Paleolithic, over 5,000 sites have been located throughout the Archipelago. The chronology is now based on several hundred radiocarbon dates (Ono et al. 2002). Since the breakthrough of AMS (Accelerator Mass Spectrometry) radiocarbon dating, over 400 dates with possible calibrations to as far back as 11850 B.P. have helped to clarify and understand the earliest prehistoric settlement of the Archipelago. They predate the major volcanic eruption in Kagoshima Bay south of Kyushu (AT, Aira-Tanzawa), the ashes of which reached Korea, China, and the Siberian territory of the Primorye. These levels have been dated to 25–24 kyr. With the exception of Hokkaido, ashes are present throughout the territory and alternating loess deposits from the continent contribute further to establishing a more refined chronology.

As a result, the stratigraphic observations and the dates show that the earliest human occupations took place in the South of the Peninsula at ca. 30,000–35,000 years ago. The oldest industries derive from sites located for the most part on the Kyushu Island, in the Kumamoto and Kagoshima prefectures, and on the Tanegashima Island (Fig. 2.11). They do not contain a bladelet component, but they share a "trapezoidal-shaped" tool type (Ono 2004: 29), which was identified at Ishinomoto (31000–33000 B.P.), Nitao (lowest of three cultural levels yielding a total of 150,000 artifacts), Mimikiri (28000 B.P.), Maeyoma (30000 B.P.), and Tachikiri (31000 B.P.) (Fig. 2.12). These small tranchets with a thick cross section were found in association with used cobbles akin to grinding stones, tanged points with a triangular cross section, and *limaces*. These occupations always predate the volcanic eruption (AT1-25–24 kyr).

In the north, on the Hokkaido Island, the earliest occupations recorded so far are located in the south of the island and do not predate 23000–24000 B.P. It is worth repeating here that there was no land bridge linking Hokkaido to the southern part of the Archipelago during the LGM. At Obihiro, Kashiwadai, and Kamioka, bladelet

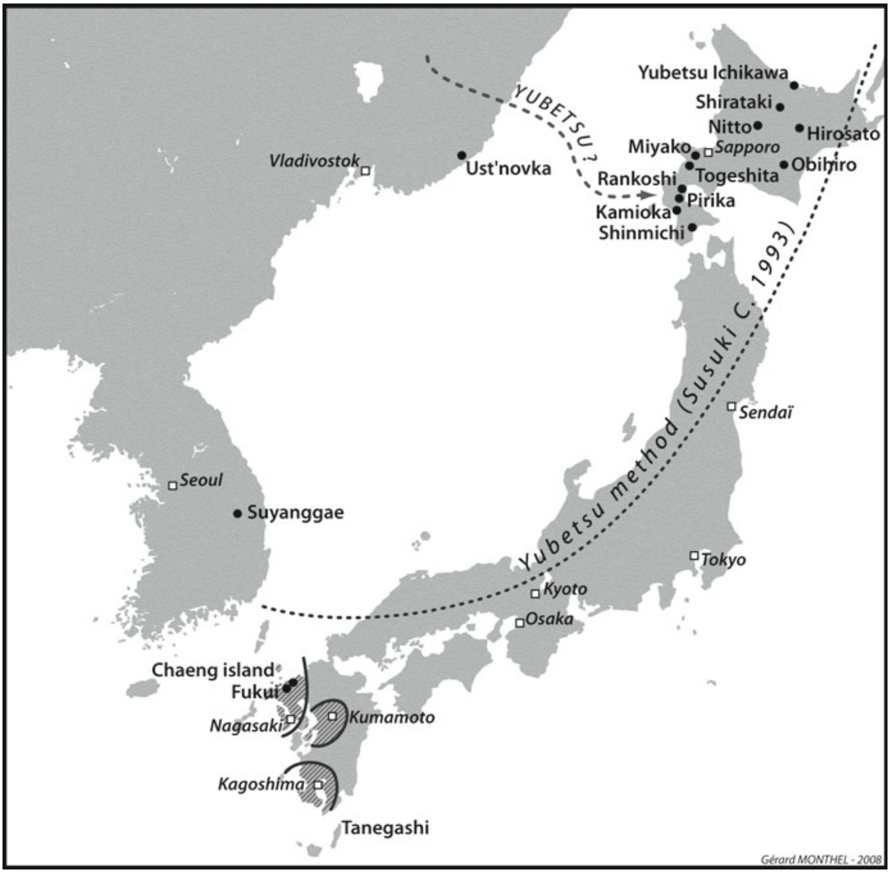


**Fig. 2.11** Sites and locations mentioned in the text and the distribution of the Yubetsu method

industries are absent from the oldest occupation levels. This also holds true for the Northeastern Kamishirataki sites (Fig. 2.11). There are similarities between the tool kits of these sites and those of the Honshu sites, e.g., backed blades, big trapezes, etc. The implication is that the earliest populations first settled the south of the Archipelago and then spread northward, almost certainly via the sea.

## *2.8.2 Pressure Débitage and the Yubetsu Method*

The Japanese Archipelago plays a significant part in the history of the invention and diffusion of pressure *débitage* in the Upper Paleolithic because this is the area where the Yubetsu method (or technique, depending on the customary use) was first identified. As early as 1959, when prehistoric bladelet industries were discovered in Hokkaido, M. Yoshizaki (1963) provided a description of the Yubetsu bladelet

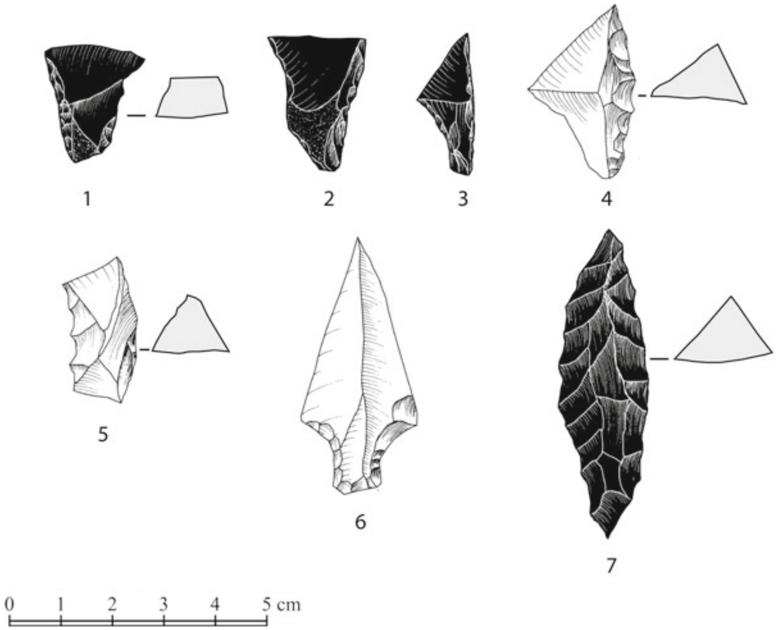


**Fig. 2.12** Diagnostic upper paleolithic tools from the island of Kyushu (23000–30000 B.P.): *1*, *2*, *3*, *4* Nitao; *5*, *6*, *7* Maeyoma

*débitage* on obsidian, supplemented by drawings. While the method was well understood, the techniques for shaping out the core and detaching the bladelets were not addressed. In spite of the language barrier, knowledge about this original *débitage* method filtered through to the international community of prehistorians thanks to the publication of numerous diagrams showing refitted sequences, particularly from the Hokkaido sites. It was even suggested that pressure *débitage* might have been invented in this obsidian-rich territory (Tixier 1984: 59). However, the use of the term "Yubetsu" to denote a particular method of pressure *débitage* should not be taken as an indication of this invention's geographical origin. The same holds true for the use of the term "Levallois," which also denotes a specific shaping out of the core prior to the detachment of blanks. Besides, there are methods other than the Yubetsu method in Japan.

### 2.8.3 The Yubetsu Method

Schematically, the method entails the preparation of the core to obtain a generally asymmetrical bifacial piece from which one of the ridges is then removed, thus creating a surface that corresponds to a section of the biface. This surface is then prepared by several removals, often supplemented by abrasion. The resulting elongated pressure platform is suitable for the detachment of numerous bladelets or microbladelets of identical length. This effective and productive method was identified on obsidian material from sites located along the Yubetsu River, in Northeastern Hokkaido, not far from the Shirataki obsidian cliffs (Tozawa 1974; Kimura 1992). The lava flows are abundant, and their quality is excellent. Obsidian is highly suitable for pressure *débitage*, but other rocks such as chalcedonies, shales, and schists were also selected for the same purpose throughout the Archipelago (Inada et al. 1993).

In Japan, the term "Yubetsu" is only used for the method involving a strictly bifacial shaping of the core and the detachment of one of the ridges using one or several removals (ski spall) to create an elongated pressure platform, which is no larger than the thickness of the biface. Within the framework of the same concept, there are a number of related methods, e.g., in the *Togeshita* method, the preform is not strictly bifacial, and in the *Rankoshi* method, the bladelets are removed along the length of the biface.

### 2.8.4 Other Methods

A distinct method involving the reduction of a boat-shaped microcore pertains to another operational scheme of which the *Horoka* method is a good example. The pressure platform, wider than in the previous methods, is obtained by one or several removals. The sides of the cores are then created by means of removals that originate from and join opposite this surface to form a crest resembling the keel of a boat (Fig. 2.13). The platform is semicircular and the *débitage* carried out perpendicular to the platform.

Yet another method, named *Hirosato*, involves a core/burin. This is a *burin busqué* on a truncated blade, where the opposing truncations serve as pressure platforms for the detachment of twisted bladelets.

### 2.8.5 Some Production Techniques

In Japan, comparative experimental tests involving microblade detachments using direct and indirect percussion as well as pressure were carried out by K. Ohnuma and M. Kubota. These experiments confirm the similarity of the detachment technique, i.e., the use of pressure, between the sites of Shirataki-Hattoridai (Hokkaido) and Karim Shahir and M'lefaat (Iraq). My familiarity with the techniques used in Japan is the result of only two research visits: one to Hokkaido in 1993 and another in 2000, which focused mainly on the Kyushu material. Nevertheless, these short visits offered an insight into the territories located in very different latitudes. In Sapporo, it was possible to examine products from the obsidian quarry of Toma (Shirataki) as well as the material from the sites of Miyako and Yubetsu/Ichikawa. In Imagane, it was possible to access the material from the sites of Pirika and

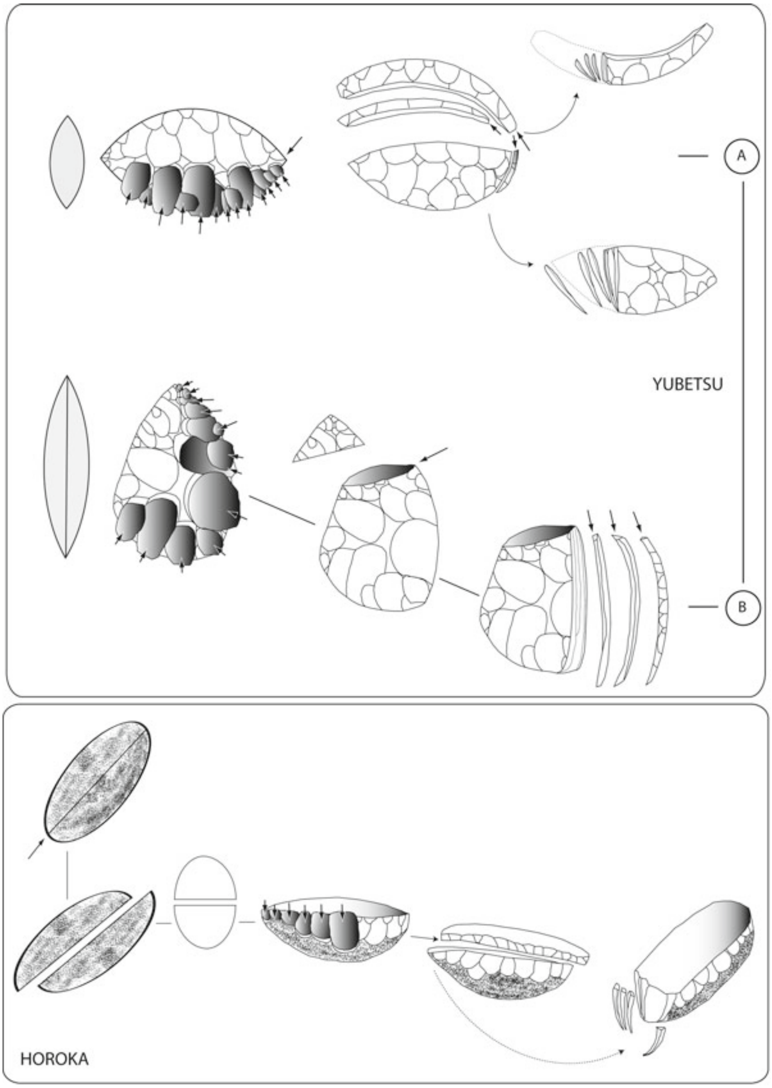


**Fig. 2.13** Some pressure debitage methods in Japan: Yubetsu (*A stricto* sensu, *B* Rankoshi); Horoka (G. Monthel *del*.)

Kamioka thanks to H. Terasaki (Fig. 2.11). Percussion with a hard or soft hammer was used on the various raw materials to prepare the core, together with technical procedures such as the abrasion of the overhang, which were systematically carried out when shaping out obsidian cores (Toma), as well as the intentional scratching of pressure platforms.

Numerous bladelets were detached using pressure (Pirika, see below). The many dozens of examined bladelets and cores all displayed the distinctive criteria associated with pressure *débitage* on handheld cores, i.e., regular and parallel arises, small lengths of bladelets, and bladelet removal negatives. Additional criteria on bladelets are small butts and a short bulb below the impact point.

### 2.8.6 The Chronology of Bladelet Débitage: Northern Japan (Hokkaido)

The site of Pirika is a good example to discuss the chronology of Northern Japan. Pirika is composed of three separate locales. At Pirika 1, three archaeological levels were identified and dated to between 20900 and 17500 B.P. (Ono et al. 2003). Numerous refits allowed for the recognition and description of the *débitage* methods and their chronological development. In addition to the main raw material shale, some obsidian is available in the south of the island, where the outcrops are inferior in quality and less abundant than those at Shirataki in the Northeast. None of the archaeological levels yielded any evidence of the presence of the *Yubetsu* method.

Evidence for the use of the *Togeshita* method, i.e., there are no true bifaces with regularized ridges, is already present in the first occupation level. The elongated core is shaped out using percussion and displays a narrow *débitage* surface. The blades are obtained by pressure. Several hundred generally broken bladelets were recovered (there are 721 drawings). Most of them are very regular and thin, with two parallel arises, small butts, and short bulbs.

A trend toward the production of systematically longer bladelets can be observed in level 2 of Pirika 1, owing to the development of the *Rankoshi* method, in which *débitage* is carried out along the length of the core.

It seems that the presence of the *Yubetsu* method stricto sensu in Hokkaido is not present prior to 15000 B.P. Bladelet *débitage* was abandoned at around 12000–11000 B.P. and replaced with blade pressure *débitage* (L = 15 cm). The cores are pyramid-shaped with a single pressure platform, as observed for instance at Nitto.

### 2.8.7 The Chronology of Bladelet Débitage: Southern Japan (Kyushu)

In the South, the earliest evidence for the use of microblade *débitage* does not predate 15000 B.P. and is therefore more recent than that in the North. On Chaeng Island (Nagasaki prefecture) just off Kyushu, where three occupation levels were uncovered during excavations, the oldest and undated level contained no evidence for bladelet pressure *débitage*. This technique was used on obsidian in level 2, which dates to 15450 B.P.

High-quality obsidian flows are known to exist in the Nagasaki area. Raw materials from these sources were identified on Chaeng Island and were also transported as far as Korea. Small obsidian and shale nodules were generally flaked along one

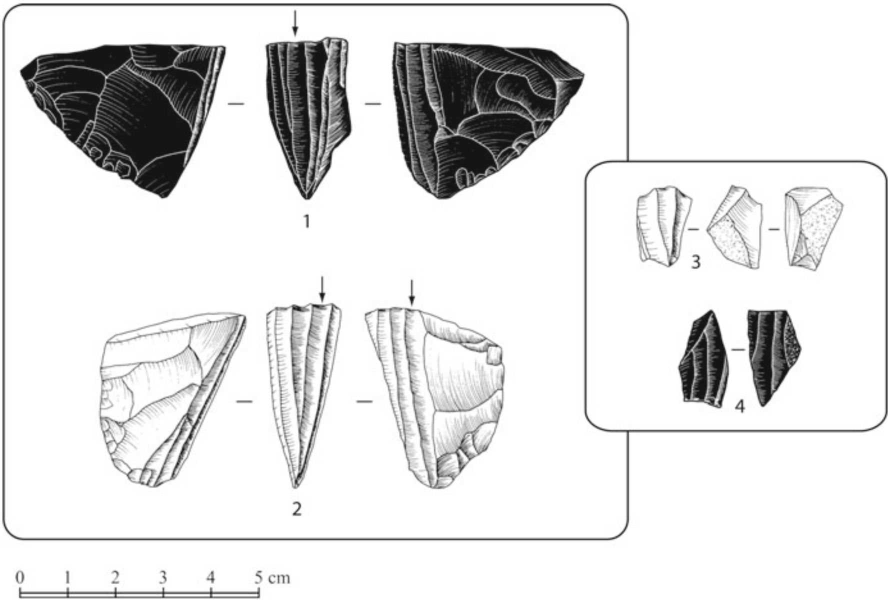


**Fig. 2.14** Pressure flaked cores: *1*, *2* (Hokkaido) Yubetsu *stricto* sensu from Miyako, obsidian; *3*, *4* (Kyushu) Nitao, shale; *4* Jyobaba, obsidian

side (Fig. 2.14), while the other side was left cortical. There is no evidence of the Yubetsu tradition on Chaeng Island, but this *débitage* method was identified in Korea, in particular at the site of Suanggae (Lee and Yun 1993).

When the Jomon culture had begun to develop (Incipient Jomon), i.e., when pottery first appeared at around 14000 B.P., bladelet pressure *débitage* was still in use. It disappeared with the onset of the second stage of the Jomon period (Initial Jomon) at around 10000 B.P. Recently, pottery dated by AMS to around 15500 cal B.P. was found at the site of Odai Yamamoto, at the Northernmost tip of Honshu Island (Kobayashi 2007: 92).

Similar observations were made in the Kumamoto area. For instance, at the site of Nitao, microblade *débitage* was present in a horizon dated to 13000 B.P. It is also conducted on small shale and obsidian nodules, flaked along one side.

Around Kagoshima, the obsidian flows are generally of medium-grade quality, owing to their many inclusions. Moreover, the nodules are small, thus imposing a size limit on the products.

Based on the dates and the *débitage* methods used, several stages for the arrival of this technique in Japan can be suggested. First, it seems that a 4,000–5,000-year-long gap existed between the adoption of pressure in the south and in the north of the Archipelago. Second, the analysis of the different production methods and operational schemes showed that Hokkaido and Kyushu did not share a common technological tradition. It is extremely likely that pressure *débitage* was introduced to Kyushu via Korea, whereas the presence of this technique in Hokkaido points to an earlier Siberian tradition.

Similarly, C. Suzuki (1993) suggested the existence of two components of bladelet *débitage* in Japan, which are distinct in terms of their origins and purpose. It is argued that the tradition characterized by the Yubetsu method, which was in use on Hokkaido and in the western part of the Archipelago adjacent to the Sea of Japan, was related to a continental climate, while the much later tradition is thought to have developed in a more temperate climate (Fig. 2.11).

## 2.9 Discussion and Conclusion

Allowing for the deficiencies of this vast overview in terms of geography, chronology, and technology, there appears to be substantial evidence for the existence of a single center of invention of pressure *débitage* in the Upper Paleolithic of Eurasia. The technique then spread rapidly and afar with its bearers – mobile groups of hunters. Later on in the Holocene, it progressed westward across the Old World, most likely along multiple pathways and through a variety of transmission modes (Perlès 2007). It is also a good marker for the colonization of Northern America (Inizan 2002).

As a prerequisite for the identification of pressure *débitage* on archaeological material, it was necessary to master this technique during experimental replication and to describe its diagnostic characteristics. The discovery that pressure can be used to detach blades by D. Crabtree was certainly a surprise (see above). The subsequent identification of this technique in the Capsian of the Maghreb and in the Upper Paleolithic of Asia was even more unexpected. What J. Clark had reconstructed was the method and technique used by the Aztecs to produce their obsidian pressure blades. It was therefore difficult to imagine that this technique, which was never universal, was developed by Paleolithic hunters during the LGM in Southern Siberia and/or in Northern China.

Thanks to experimental replication, it became obvious that the technical practice of applying pressure to a core, rather than a blow to detach bladelets, was efficient for the production of large numbers of such standardized items. These interchangeable bladelets, intended for hafting in bone, ivory, or wood implements, were found in a vast geographical area spanning Siberia, Mongolia, China, Korea, and extending as far East as Japan. They represent an innovation, which was initially described by prehistorians as "microblade culture" (or "microlithic industry" in China) and considered to be the hallmark of Mongoloid hunters of large mammal faunas, e.g., mammoth.

The dimensions of the bladelets remained stable throughout the Upper and Epipaleolithic, with a mean length of less than 8 cm. Therefore, it can be inferred that there was a change neither in the technology of the implement shafts which accommodate the insets nor in the knappers' skills and equipment.

Unfortunately, due to the fact that detachment techniques are seldom identified and that there are but a few recently excavated, stratified, and dated sites, it is still not absolutely clear when and where this technical innovation first occurred. In China, microblade industries were found in a horizon dated to 21959 ± 100 B.C. at the site of Xiachuan (Gai Pei 1985: 231) and in even older levels at the site of Salawasu.

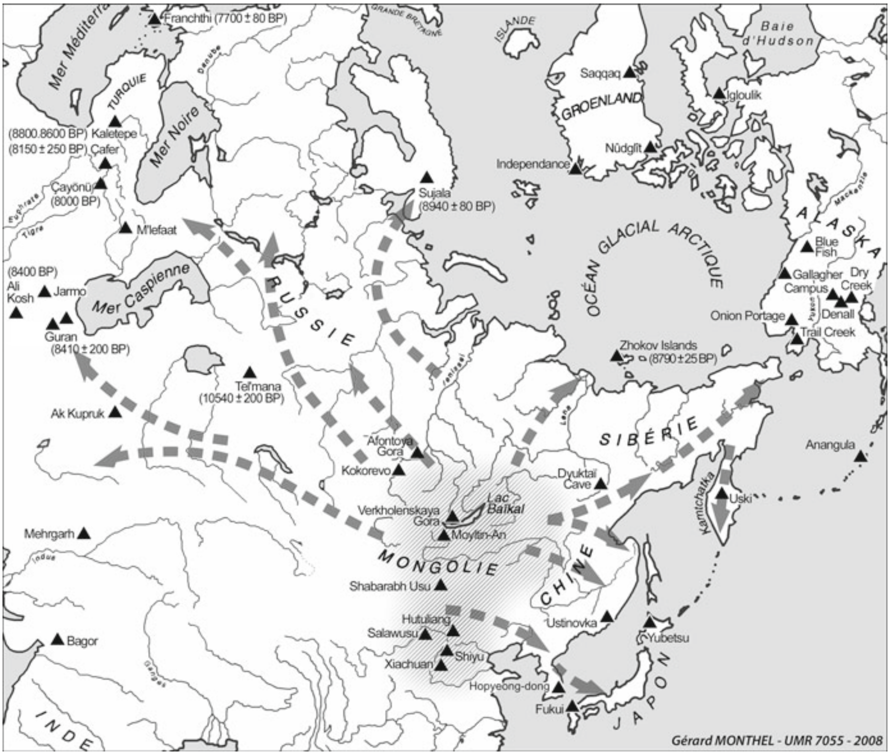


**Fig. 2.15** Invention zone of pressure debitage (hatched area) and some hypothetic diffusion routes

Should these dates be confirmed, and should the *débitage* technique be verified, then the tradition of pressure blade making would be more than 20,000 years old.

Compensating for this lack of accuracy, the sites in the Japanese Archipelago are informative regarding the earliest presence of the technique and the different methods implemented. There exists a wealth of excavated, studied, published, and well-illustrated sites. In the north of the Archipelago, the environmental context was identical to that in Siberia, and populations with similar subsistence practices could have easily reached Hokkaido to hunt mammoth, deer, etc. (Fig. 2.10). While the presence of bladelet pressure *débitage* was recorded at sites from the southwestern part of the island which date to ca. 20000 B.P., the first instances of the use of the Yubetsu method stricto sensu only appeared at about 15000 B.P. In the south of the Archipelago (Kyushu), bladelet pressure *débitage* was also practiced from ca. 15000 B.P. onward. However, here evidence for the Yubetsu method is absent, and alternative methods were in use, thus suggesting influences other than those present in the north.

As the Jomon culture developed at the end of the last glaciation, just prior to the Holocene, the use of this technique began to wane but did not disappear entirely.

It continued to be used for the making of obsidian blades on Hokkaido Island, e.g., at Nitto where it was dated to ca. 8000 B.P.

As far as the rest of the Old World is concerned, pressure *débitage* was practiced in various cultures to obtain blades as opposed to bladelets throughout the Epipaleolithic and/or the Mesolithic and predominantly in the Neolithic period. The increase in the dimensions of the blade products signifies that other skills were involved. This invariably would have influenced the way in which the technique was transmitted.

From Central Asia to Iran, the Near East and the North of the Mediterranean, several important sites punctuate the progression of pressure *débitage* (Fig. 2.15).

The Capsian has been repeatedly mentioned in the course of this paper and will also be the subject of some closing remarks. The archaeological evidence can be used to argue against the ex nihilo invention of pressure *débitage* in the Maghreb. On the other hand, the other possibilities for its introduction such as the diffusion by land or by sea cannot be sufficiently supported based on the present state of our knowledge. The technique may have arrived overland via Egypt after having reached the Near East, but this seems unlikely because pressure *débitage* in Egypt is only documented for the final Neolithic. In addition, there are no earlier archaeological sites with assemblages that are characterized by this technique between the Maghreb and the Near East. Diffusion from the Near East by sea could be contemplated, but this in turn poses problems because the Capsian was an inland cultural tradition, i.e., it has never been recorded on the shores of the Mediterranean. Clearly, the origin of pressure *débitage* in the Upper Capsian is a problem that remains to be solved in the future.

**Acknowledgments** I would like to express my gratitude to Prof. V. Ranov in Dushanbe, who unfortunately went missing in 2006, and Prof. H. Kimura in Sapporo, for their gracious invitations which have allowed me to extend the present research into pressure *débitage*, in particular. I also thank Y. Teraski who provides me access to the Pirika's collections (Imagane, Hokkaido). A special mention should be made for Prof. I. Yamanaka of Kyoto University for his support and the preparation of two long research visits in 1993 and 2000, during which I was provided with access to numerous collections throughout Japan.

I am deeply grateful to Dr. M.Y. Hong and Dr S.J. Park, without whom my research in Korea during September of 2010 would not have been possible. My gratitude also goes out to the director and assistant director of the Gyonggi Cultural Foundation Mr. Y.J. Jo and Mr. S.T. Kim, respectively, as well as Pr. Y.J. Lee and Pr. G.G. Lee of the Chungbuk and Chosun University Museums. Additional thanks are extended to Farina Sternke whose revisions and comments greatly improved this manuscript.

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