# New Perspectives on the Behavioral Patterns of Early Modern Humans from the Japanese Islands

# Neue Perspektiven auf die Verhaltensmuster früher moderner Menschen von den japanischen Inseln

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## ABSTRACT

This paper presents archaeological research of the Early Upper Paleolithic in the Japanese Islands, introducing the findings of recent research there into early modern humans. The authors provide background to the natural environment of the Upper Paleolithic while offering an overview of research in the area. Five important research topics, related to behavioral modernity of early modern humans, will be described. Based on them, new information and perspectives about the behavioral patterns of early modern humans are discussed with a focus on the Mt. Ashitaka area.

**Keywords:** Japanese Islands, Early Upper Paleolithic, behavioral modernity, obsidian, lithics

## ZUSAMMENFASSUNG

Der vorliegende Aufsatz präsentiert die archäologischen Untersuchungen zum Frühen Jungpaläolithikum auf den japanischen Inseln und stellt die jüngsten Forschungsergebnisse über frühe moderne Menschen auf den Inseln vor. Der Beitrag bietet Hintergrundinformationen über die natürliche Umwelt auf den Inseln während des Jungpaläolithikums und gibt einen Überblick

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über den Forschungsstand zum Jungpaläolithikum in Japan. Anschließend werden im Zusammenhang mit der Erforschung des frühen Jungpaläolithikums auf den japanischen Inseln fünf wichtige Forschungsthemen vorgestellt, die sich auf die Auseinandersetzung mit der Verhaltensmodernität des frühen modernen Menschen beziehen. Als nächstes werden neue Informationen und Perspektiven zur Verhaltensmodernität präsentiert, indem der Fokus auf das Gebiet des Mt. Ashitaka gelegt wird. Schließlich erläutert der Aufsatz die Merkmale der archäologischen Materialien aus dem frühen Jungpaläolithikum, die auf den japanischen Inseln gefunden wurden, und diskutiert ihre Auswirkungen auf unser Verständnis der Verhaltensmodernität früher moderner Menschen.
**Schlagwörter:** Japanische Inseln, frühes Jungpaläolithikum, modernes Verhalten, Obsidian, Steinartefakte

## Introduction

Past research in the Japanese Islands demonstrated a sudden increase in the number of archaeological sites after 39,000–38,000 cal BP; however, sites older than this date are rare or absent altogether. Thus, this period is assumed to be the time of the arrival of *Homo sapiens* to the Japanese Islands (Kudo and Kumon 2012; Izuho and Kaifu 2015; Morisaki et al. 2020). The period of early modern human colonization and settlement in the Japanese Islands is called the Early Upper Paleolithic (EUP, 39,000–29,000 cal BP). Studies exploring the technology and behavior of early modern humans as hunter-gatherers have been undertaken in the past, and their results have been made available to foreign researchers over the past ten years.

Our paper introduces this area of study by outlining the paleoenvironmental and paleontological research from Marin Isotope Stages (MIS) 3 to 2 in the Japanese Islands. Next, we summarize the characteristics of archaeological investigations there and their implications for Paleolithic research. This paper reviews the chronological studies of lithic assemblages and research relating to the concept of behavioral modernity in early modern humans in the archaeological research of the EUP in the Japanese Islands. Finally, we focus on the Mt. Ashitaka area and present new information and perspectives regarding the behavior of early modern humans.

## Paleoenvironment of the Japanese Islands during MIS 3 and 2

The Japanese Islands consist of many smaller islands and four main islands: Hokkaido, Honshu, Shikoku, and Kyushu (Fig. 1). During MIS 3 and 2, Hokkaido was part of a large peninsula formed by the appearance of land bridges between Hokkaido, Sakhalin, the Kurile Islands, and the Russian Far East. Similarly, Honshu, Shikoku, and Kyushu were connected and constituted a single large island. It is estimated that this larger island was separated from Hokkaido and the Korean Peninsula, even during the Last Glacial Maximum (LGM). Figure 2 displays a topographic and biome-level vegetation map of MIS 3 in East Asia, as presented by Takahara and Hayashi (2015). The topographic map was drawn at 60 m below sea level in MIS 3, following Lambeck and Chappell (2001).

Takahara and Hayashi (2015) reviewed paleovegetation research during MIS 3 in the Japanese Islands (Fig. 2). They compiled 47 pollen samples from Taiwan, the Japanese Islands, Sakhalin, and the Amur River Basin, and reconstructed MIS 3 vegetation in East Asia (Fig. 2). The vegetation is characterized by relatively high amounts of deciduous broadleaf trees constituting different types of forests in each region. The distribution patterns of MIS 3 vegetation directly affected the distribution of forests during MIS 2 and the LGM (Takahara and Hayashi 2015). Pinaceous conifers, which include both temperate and boreal species, were prevalent on the Japanese Islands during the LGM. Additionally, temperate broadleaf trees such as beeches and oaks, and temperate conifers, such as *Cryptomeria japonica*, existed in the coastal refugia (Tsukada 1985).

Several papers on the Late Pleistocene fauna in the Japanese Islands (Iwase et al. 2012, 2015; Kawamura and Nakagawa 2012; Takahashi and Izuho 2012) indicate that the fauna in the Japanese Islands during MIS 3 and 2 can be explained in two main groups. The first group has been called the Palaeoloxodon-Shinomegaceroides complex (Hasegawa 1972) and is composed of mammals whose principal habitat was temperate forests. Most of these are endemic species,

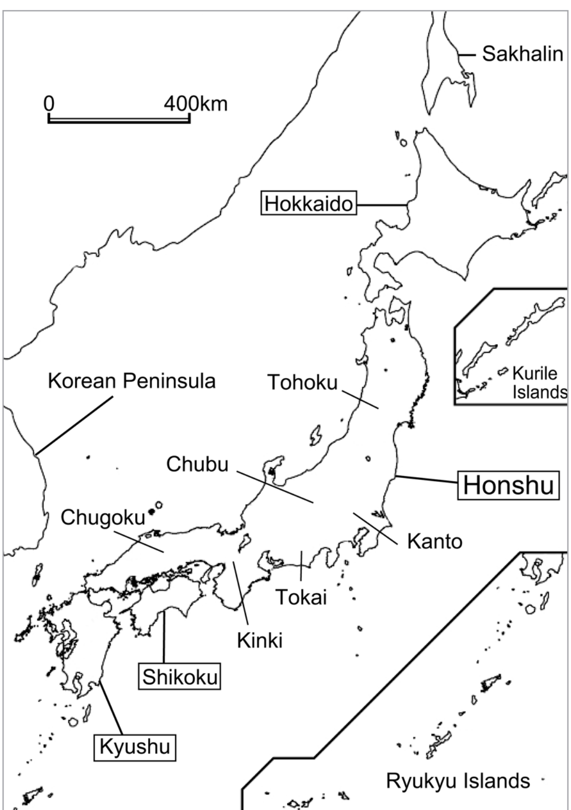


**Fig. 1:** Map of the Japanese Islands.

**Abb. 1:** Karte der Japanischen Inseln.

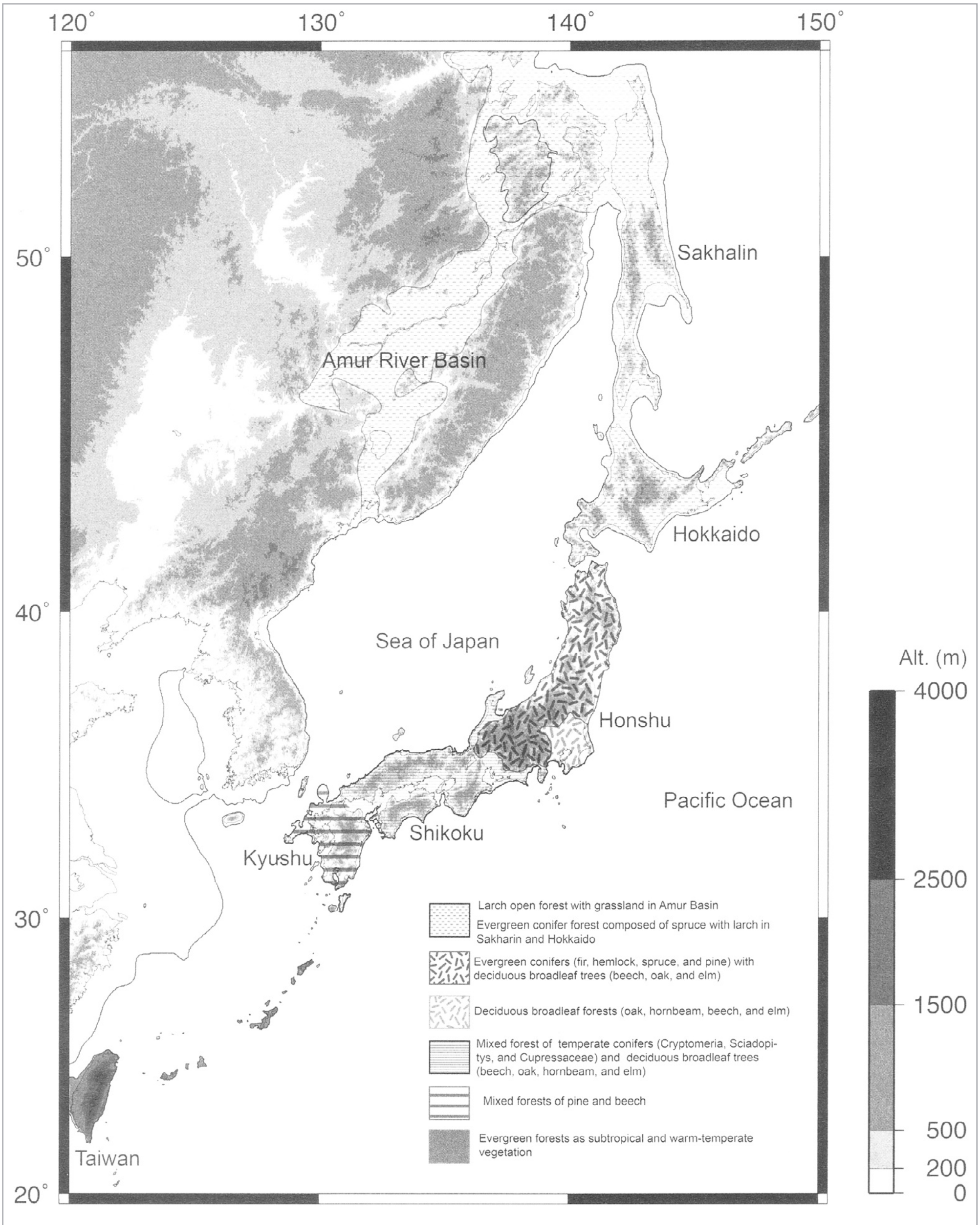


**Fig. 2:** Topographic and biome-level vegetation map of MIS 3 in East Asia (Takahara and Hayashi 2015: Fig. 22.2).

**Abb. 2:** Topografische und Vegetationskarte auf Biomebene aus dem MIS 3 in Ostasien (Takahara und Hayashi 2015: Abb. 22.2).

with representative species being Naumann's elephant (*Palaeoloxodon naumanni*) and Yabe's giant deer (*Sinomegaceros yabei*). The group mainly inhabited the larger islands including Honshu, Shikoku, and Kyushu. The second group, the mammoth fauna, mostly consists of species that lived in patches of taiga and grass in a cold environment. Their principal habitat was the northern parts of the Asian mainland and the large peninsula that included Hokkaido. It is estimated that some species of the mammoth fauna could have expanded their habitat onto the larger islands of Honshu, Shikoku, and Kyushu during colder periods (Takahashi and Izuho 2012). While Kawamura and Nakagawa (2012) argue that mammoths and *P. naumanni* could have coexisted in Hokkaido during MIS 3, Takahashi and Izuho (2012) contend that mammoths could have retreated north to the southern limit of the colder environment and *P. naumanni* could have extended north to the area where mammoths once lived during MIS 3.

In the Japanese Islands, mammoths, *P. naumanni*, and giant deer became extinct during the Late Pleistocene. Various arguments have been raised regarding the causative factors, such as climate change (Iwase et al. 2012, 2015; Takahashi and Izuho 2012), direct and/or indirect human impact (Norton et al. 2010), and the combination of climate change and human impact (Kawamura and Nakagawa 2012).

## Archaeological material and chronological studies from the Paleolithic in the Japanese Islands

More than 10,000 Paleolithic sites have been found in the Japanese Islands, with most of them dating to MIS 2. The oldest widely accepted sites date as far back as 39,000–38,000 cal BP (Kudo and Kumon 2012; Izuho and Kaifu 2015; Morisaki et al. 2020). Many "Early Paleolithic" records were dismissed after an Early Paleolithic hoax was exposed; it was discovered that an amateur archaeologist had been forging Early and Middle Paleolithic stone tool industries from the Miyagi and other prefectures since the 1980s (Nakazawa 2010, 2017). Subsequently, several possible sites of human occupation in the Japanese Islands from before the Upper Paleolithic (UP) were excavated, and potential assemblages were recovered from them. However, not all Paleolithic researchers in Japan view these assemblages as reliable records.

Most UP sites in the Japanese Islands are open-air sites. Due to the humid climate of the Japanese Islands and the nature of the deposits, which were formed from volcanic ash, aeolian dust, and so on. Organic materials at open-air sites are hardly preserved or entirely absent. The only artifacts that remain are rock materials. Aside from lithic artifacts and cobbles, charcoal has also been recovered from UP sites. Some sites, however, have yielded animal bones and flaked bone tools, such as the Tategahana sites (Lake Nojiri) in the Nagano prefecture (Ono 1998, 2001). Additionally, archaeological materials from the LGM or earlier time periods have been discovered in two cave sites in the Aomori and Okinawa prefectures in recent years (Nara et al. 2015; Okinawa Prefectural Museum and Art Museum 2015). Hopefully, excavations at these cave sites will continue and more sites bearing organic materials will be discovered.

The majority of the archaeological excavations at open-air UP sites in the Japanese Islands were salvage excavations undertaken to preserve a record of the sites before their destruction.

A large number of these salvage excavations occurred in the period of high economic growth in the 1970s that led to extensive construction of roads, buildings, and facilities; thus, the distribution of archaeological features at the sites was documented on a large scale. Archaeological features discovered include lithic, cobble, and charcoal concentrations, and on rare occasions, hearth features. While these excavations yielded a large number of artifacts, dry sieving was employed rarely as the excavations had to be concluded in a limited time period. Thus, methods employed in the salvage excavations lack reliability in terms of recovering smaller materials. Under such conditions and methods, large collections of archaeological materials, in particular lithic artifacts, were collected.

Archaeological materials from the UP sites in several regions are buried in well-stratified, thick eolian deposits, which were mainly formed by volcanic ash. Numerous volcanic tephras in and around the Japanese Islands from the late Quaternary have been identified and documented. Particularly, the Aira-Tn tephra (AT), which was spread by the eruption of the Aira Caldera at 30,009±189 cal BP (Smith et al. 2013; Izuho and Kaifu 2015), is distributed over a broad area covering most of the Japanese Islands, the Korean Peninsula, part of eastern China, and the southern Primorye in the Russian Far East (Machida and Arai 2003). The Aira-Tn tephra is used as an indicator for separating the EUP and the Late Upper Paleolithic (LUP) in the Japanese Islands. Chronological research utilizes several other widespread tephras identified as having fallen during the Late Pleistocene; these have been used along with local tephras that fell across narrower areas.

In addition, the Mt. Ashitaka and Mt. Hakone areas in the eastern Tokai region and several areas in the southern Kyushu region have extremely favorable conditions for chronological research; the eolian deposits in these regions are thick and well-stratified with their proximity to the volcanoes, which are the sources of the volcanic ash that formed the deposits. Several areas in the southern Kanto region, such as the Musashino and Sagamino Uplands (Fig.1 and Fig. 3), also have relatively thick, well-stratified eolian deposits. These areas in the eastern Tokai region, the southern Kyushu region, and the southern Kanto region reveal black bands (buried paleosols) in addition to volcanic tephras in stratigraphy, with changes in lithic assemblages studied based on these indicators. Thus, chronological research has been conducted in accordance with time resolution in each region with detailed geochronological information.

Cultural and chronological research across the Japanese Islands has resulted in a clarification of the changes in lithic industries during the UP. Broad shifts in lithic industries in the following order have been revealed: Lithic industry mainly with pointed elongated flakes (knife-shaped tools), trapezoids, pen-head shaped points (Fig. 4, Type F) and adzes (or axes) (with a ground edge); lithic industry containing backed points (knife-shaped tools); lithic industry including backed points (knife-shaped tools), marginal, unifacial, and bifacial points; and lithic industry with microblades. Furthermore, more detailed change processes in lithic industries have been clarified due to rich geochronological information in some areas. Additionally, $^{14}C$ dates have been obtained at many sites in recent years, which enable estimating the dates of each industry (Kudo 2012; Kudo and Kumon 2012; Morisaki et al. 2020). Basic information on the UP sites

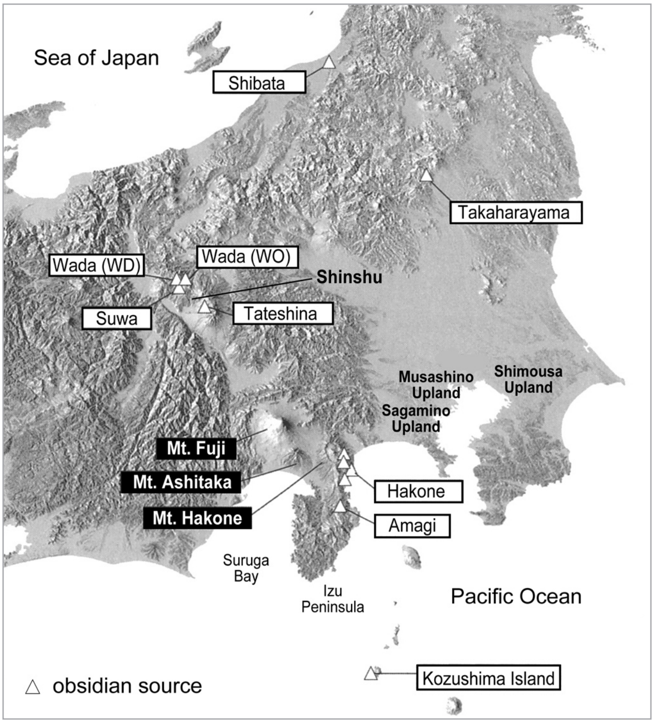


**Fig. 3:** Detailed map of the island of Honshu indicating sources of obsidian (modified from Ikeya 2015: Fig. 25.1)

**Abb. 3:** Detailkarte der Insel Honshu mit Angabe von Obsidianquellen (verändert nach Ikeya 2015: Abb. 25.1).

in the Japanese Islands was compiled to form a database (Japanese Paleolithic Research Association 2010), and chronologies have been established in almost every region of the Japanese Islands, including Hokkaido, Tohoku, Kanto, Chubu, Tokai, Kinki, Chugoku, Shikoku, and Kyushu (Inada and Sato 2010).

## Migration of early modern humans into the Japanese Islands in the EUP

A sudden increase in the number of archaeological sites after 39,000 cal BP is seen as a sign of the arrival of early modern humans (Kudo and Kumon 2012; Izuho and Kaifu 2015; Morisaki et al. 2020). The earliest sites have been found on Honshu and Kyushu, which formed the large island with Shikoku. This indicates that early modern humans used boats for their migration. Three possible routes are thought to be the migration routes of early modern humans to the Japanese Islands: 1) the route from the Korean Peninsula to Kyushu; 2) the route from the Russian far east via Sakhalin and Hokkaido to the northern end of Honshu; and 3) the route from Taiwan via the Ryukyu Islands to Kyushu (Tsutsumi 2012). The first route is thought to be the most plausible one for migration of early modern humans in the earliest stage of the EUP since no archaeological site which goes back to this early stage was found in Hokkaido and the Ryukyu Islands. The number of EUP sites in both areas are indeed few. However, representative stone tools, such as pointed elongated flakes, trapezoids, pen-head shaped points and adzes (or axes), in the initial phase of the EUP in the Japanese Islands are not included in lithic assemblages from the Korean Peninsula in the same time range. Accordingly, there is little clear evidence for it. The lithic assemblages in the initial phase of the EUP in the Japanese Islands include pebble tools as well as adzes (or axes). Those elements in the assemblage are common to Late Pleistocene Hoabinhian lithic assemblages from Vietnam (Nguyen 2005, 2015; Yi et al. 2008), and southern China (Ji et al. 2016), with the oldest dating to 43.5 ka (Ji et al. 2016). If this is considered relevant, then there is a possibility that early modern humans expanded their distribution area in southern China, Taiwan and the coastal areas of the continent, crossing the sea from the Korean Peninsula to Kyushu.

## Archaeological research of the EUP in the Japanese Islands and behavioral modernity of early modern humans

As mentioned above, several possible sites of human occupation before 39,000 cal BP have been found in the Japanese Islands; however, not all Japanese Paleolithic researchers view them as reliable records. As a result, there is no situation where researchers can investigate archaeological records and clarify behavioral modernity based on the comparisons between archaeological records after 39,000 cal BP made by early modern humans and those before 39,000 cal BP made by possibly archaic humans. Certain cultural elements are thought to reflect behavioral modernity based on the results of research carried out around the world. Below, archaeological records related to behavioral modernity of early modern humans in the Japanese Islands are explained by referencing investigations about behavioral patterns in other regions.

### Changes in lithic assemblages and behavioral changes of hunter-gatherers during MIS 3 in the Japanese Islands

By the 1990s, cultural chronologies of the EUP had been constructed based on both stratigraphy and technological analyses of stone tool assemblages in the Japanese Islands. Most of these studies adopted qualitative technological analyses (Sekki bunka kenkyu kai 1991; Sato 1992). The previous studies revealed that flaking technology for elongated flakes and blades changed during the EUP. Elongated flakes and their flaking technique are found in lithic assemblages of the initial phase of EUP, while the platform and fringe trimmings and core rejuvenation are seldom found in them. Conversely, blades and blade cores are frequently found in lithic assemblages from the final phase of the EUP. Platform and fringe trimmings and core rejuvenation are also found in these assemblages.

The previous studies have demonstrated that the composition of formal flaked tools changed through time during the EUP. Formal tools in lithic assemblages from the initial phase of the EUP consist of pointed flakes (knife-shaped tools) (Fig. 4: Type A), trapezoids (Fig. 4: Types D and E), pen-head shaped points (Fig. 4: Type F), side scrapers (Fig. 4: Type G), end scrapers (Fig. 4: Type H), and adzes (or axes) with a ground edge. Formal tools in lithic assemblages of the final phase of the EUP are composed of backed points (knife-shaped tools) (Fig. 4: Types A, B, and C), side scrapers (Fig. 4: Type G), and end scrapers (Fig. 4: Type H). The rate of the formal

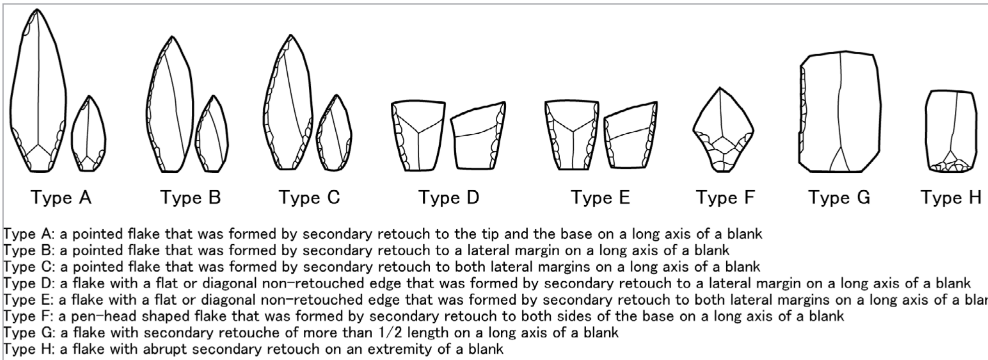


**Fig. 4:** Definitions of formal flaked tools (Yamaoka 2011: Fig. 4).

**Abb. 4:** Definitionen formaler Abschlagwerkzeuge (Yamaoka 2011: Abb. 4).

flaked tools made of blade blanks increased through time during the EUP. They are scarce in the assemblages of the initial phase. Conversely, many formal flaked tools in the final phase were made from blade blanks. These morphological and technological changes in the EUP lithic assemblages have often been explained as arising from the development (i.e., increasing sophistication of tool-making skills) of blade technology and methods of formal tool production (Sekki bunka kenkyu kai 1991).

Yamaoka (2006, 2011) re-examined EUP lithic assemblages from the sites on the Musashino Upland, where a standard of EUP chronology was first established, and suggested a different interpretation of the changes in the EUP assemblages. Quantitative comparisons of lithic raw materials, core reduction (blade technology), and formal tool production were conducted, focusing on EUP assemblages from 32 sites. The results of the analyses indicated transitions of the EUP lithic assemblages in three sequential phases (the initial, the middle, and the final phases) (Fig. 4 and Fig. 5), based on the composition of lithic raw material, variation of technology in core reduction and formal tool production, and the composition of formal tools. The changes in the lithic assemblages were interpreted as changes in the purpose and the manner of lithic raw material usage instead of as technological developments (i.e., increased sophistication and proliferation of blade technology and methods of formal tool production) as lithic raw material selection, forms of core reduction, and formal tool production all changed simultaneously. It was also suggested that the changes in lithic raw material usage were caused by transformations in the scale of territories foraged, residential mobility, and changes in the usages of organic raw material (while not archaeologically visible, presumably existing) in response to changes in the environmental settings (Yamaoka 2004, 2006, 2011, 2012b, 2012c, 2014).

Based on the analyses of use-wear and breakage patterns of adzes (or axes), the most probable use of the larger adzes (or axes) was estimated to have been for clearing the forest and woodworking (Sato 2006; Tsutsumi 2006, 2012). Thus, it can be presumed that hunter-gatherers in

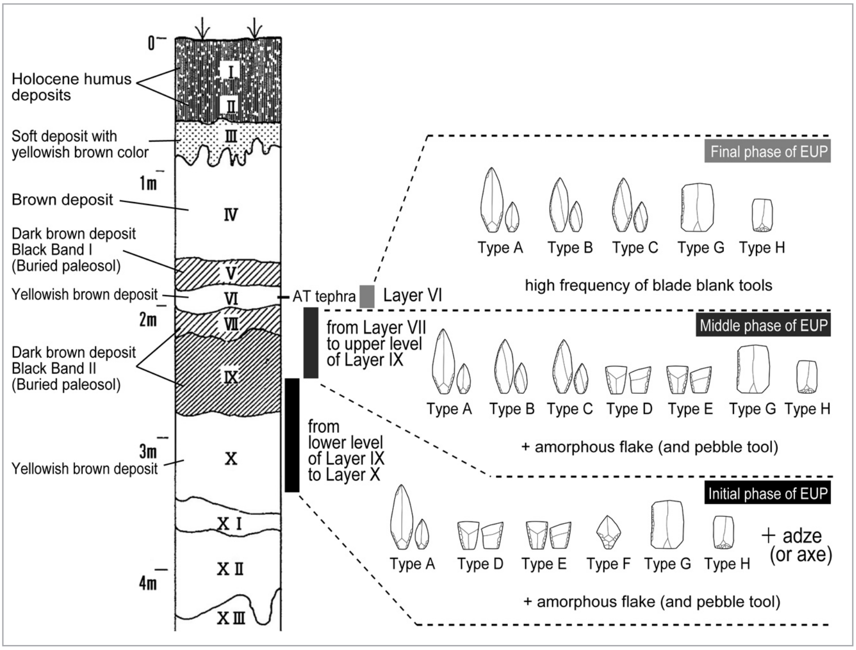


**Fig. 5:** Changes of lithic assemblages during the EUP in the Musashino Upland.

**Abb. 5:** Änderungen lithischer Inventare während des EUP im Musashino-Hochland.

the initial phase of the EUP depended more on floral resources, such as wood, for making instruments as compared to hunter-gatherers in the final phase of the EUP (Sato 2006; Yamaoka 2011, 2014, 2021a).

Recent archaeological research in Southeast Asia and Oceania reveals that early modern humans adapted to various kinds of environments in these regions, providing different kinds of archaeological records related to behavioral modernity compared with the archaeological records found in Europe, West Asia, and Africa (Barker et al. 2007; O'Connor et al. 2011; Hiscock 2015; Roberts and Amano 2019). Hiscock (2015) suggested that "at a global level, dispersing *Homo sapiens* are not characterized by a single or even a simple set of artifacts or behaviors. Instead, it is more productive to think of the unifying character of this migration as the capacity of human groups to adapt social, economic, and technological activities to the different contexts they encountered." This explains technological flexibility of early modern humans as hunter-gatherers. Therefore, it is thought that the transition in the EUP assemblages in the Japanese Islands shows changes in technological adaptation during the EUP, and reflects the flexibility of early modern humans in technological adaptations. However, it is also possible that the changes in the lithic assemblages of the Japanese EUP reflect early modern human dispersal along the northern and southern routes in Eurasia (Goebel 2007), and early modern human migrations into the Japanese Islands (Yamaoka 2012b, 2014, 2021a).

## Armatures

The stone technologies of the initial phase of the EUP may appear to be simple technologies; however, recent studies have clarified that there were sophisticated and complex technologies related to armatures during this phase. Studies on armatures from this phase have been ongoing since the 2000s. Impact fractures were found on pen-head shaped points made from hard shale from the Tohoku region, indicating that pen-head shaped points were used as armatures (Kanomata 2005, 2011). Impact fractures were also found on trapezoids made on obsidian from Layer BB V at the Doteue site in the Mt. Ashitaka area (Yamaoka 2010, 2012a) (Fig. 11). In addition, an analysis of broken trapezoids suggests that hunting weapons were repaired at the Doteue site, as a high proportion of broken trapezoid bases were found at the site (Yamaoka 2010, 2012a). Striations running parallel to the working edges were also found on some obsidian trapezoids from the site. Their distributional patterns indicate that obsidian trapezoids were used for cutting or sawing soft materials (Yamaoka 2012a). The trapezoids were thought to have been used for butchering or processing animals (Yamaoka 2020b). Similar striations were also identified on obsidian trapezoids from a site in the Chubu region (Tsutsumi 2006, 2012). Thus, it can be concluded that obsidian trapezoids were used as multifunctional tools for hunting and processing.

Based on morphometric analysis, Tamura (2011) argued that some of the formal flaked tools in the EUP could have been used as darts or arrowheads. Sano et al. (2012) reported results of shooting and stabbing experiments using replicated trapezoids made from shale. Sano (2016) assumed that trapezoids and pen-head shaped points made from shale from the Tohoku region could have been used as arrowheads on the basis of the projectile experiments and morphometric analysis. Yamaoka (2017) reported results of shooting and stabbing experiments using replicated trapezoids made on obsidian. Based on comparisons between experimental and archaeological specimens, Yamaoka (2017) suggested that hunting weapons equipped with obsidian trapezoids had a mechanism for cushioning at their hafting parts or the connected parts between the shafts and fore-shafts, and that several trapezoids left at the Doteue site were broken by high impact. Therefore, it is assumed that hunting weapons equipped with obsidian trapezoids were used with complex projectile technology (Shea 2006), such as spear-throwers and darts (Yamaoka 2017).

Thus, recent studies on armatures, such as pen-head shaped points and trapezoids in the Japanese Islands, support arguments for complex projectile technology in Africa, West Asia, and Europe (Shea 2006; Sisk and Shea 2011). Sisk and Shea (2011) have explained that complex projectile technologies, like bow/arrow or spear-thrower/dart, are composite technologies that propel a high velocity projectile by storing or enhancing energy in a non-projectile component. It is regarded as an important technological adaptation and one of the behavioral changes associated with the dispersal of early modern humans after 50 ka.

## Use of obsidian

Studies on sources of lithic raw materials have progressed since the 1970s, and obsidian sourcing studies presented several important results with regard to the EUP of the Japanese Islands (Ikeya 2015). Obsidian sourcing analysis began in the 1970s for UP sites in the Kanto region, and it became much more common in salvage excavation reports for the UP sites since the 1980s (Ikeya 2015). Large-scale source analyses using x-ray fluorescence (XRF), which is a non-destructive method for measuring atomic composition, were first conducted in 1994 (Mochizuki et al. 1994; Ikeya and Mochizuki 1998; Ikeya 2015). They investigated sources of obsidian from UP sites in the Mt. Ashitaka area, analyzing more than ten thousand obsidian artifacts from the sites. The results of the analyses revealed that obsidian from sites in the Mt. Ashitaka area came from the Shinshu area, Hakone, Amagi, and Kozusihma Island (Fig. 3). Temporal changes in the exploitation of obsidian sources in the Mt. Ashitaka area and the XRF results were further supported by the Nuclear Activation Analysis (NAA) (Ikeya 2015). Kozushima Island is a small volcanic island located in the Pacific Ocean, currently 50 km offshore from the main Japanese island of Honshu. The two islands have never been connected, even during the LGM. The results of the analyses revealed that Kozushima obsidian was the main stone material at multiple sites during the earliest phase of the UP (Phase 1: Layers SC IV – BB IV) in the Mt. Ashitaka area. Kozushima obsidians significantly decreased in later phases of the UP (Phase 2 - Phase 4); however, they increased again in the latest phase of the UP (Phase 5, which is characterized by microblade technology in the terminal Pleistocene) (Fig. 9). The division of phases during the UP in the Mt. Ashitaka area is explained in the next section. The use of Kozushima obsidians in the sites of the earliest phase (Period 1: ca. 38,000–34,000 cal BP) suggests that active maritime transportation occurred among early modern humans (Ikeya 2015).

Recently, databases that compiled all of the provenance data for more than 85,000 obsidian artifacts from Upper Paleolithic sites in the Chubu and the Kanto regions were published (Serizawa et al. 2011; Tani et al. 2013). The databases were used by Shimada et al. (2017) to discuss human responses to climatic change in the exploitation of obsidian sources during the UP in the Shinshu area.

The use of exotic lithic raw materials and long-distance procurements of raw materials are regarded as examples of modern behavioral traits (McBrearty and Brooks 2000). In the Japanese Islands, obsidian sourcing studies clearly show the same behavior in the initial phase of the EUP. Moreover, those studies indicate that active maritime transportation was performed by early modern humans during this phase. Considering that obsidian could be obtained in Shinshu and other areas, the use of obsidian from Kozushima Island seems to indicate that early modern humans included adjacent seas in their territory for obtaining resources other than obsidian.

## Circular aggregations

A circular aggregation is a characteristic archaeological feature in the Japanese EUP (Izuho and Kaifu 2015). It is characterized by several (or many) lithic concentrations (scatters) aligned in a circle. A total of 146 circular aggregations were found from 119 sites throughout the Japanese

Islands (Sakai and Murai 2019). They were left mainly during the initial phase of the EUP. Their sizes vary from about 11 m to 80 m in diameter, the average being 20 m (Hashimoto 2006). Refitting analyses indicate a high frequency of refitted lithic artifacts from different concentrations in most of the circular aggregations. Most researchers therefore assumed that a circular aggregation was formed temporarily at each site. Excavations at several sites also revealed that different groups of lithic concentrations in a circular aggregation have different compositions of lithic raw materials. For example, in a circular aggregation from the Kamibayashi site in the northern part of the Kanto region, locally available lithic raw materials, such as chert, were mainly left in lithic concentrations located on the western half of the circular aggregation, and exotic lithic raw materials, such as obsidian, aphyric andesite, rhyolite, and shale, were mainly left in lithic concentrations located on the eastern half of the circular aggregation (Idei et al. 2004) (Fig. 6). Similarly, in circular aggregations from the Doteue site (Ikeya 1998, 2015: Fig. 25.5) in the Mt. Ashitaka area and the Izumikitagawa Dai San site (M. Yamaoka 2012) in the Shimousa Upland in the eastern part of the Kanto region, obsidian sourcing analyses revealed different groups of lithic concentrations (or different lithic concentrations) in a circular aggregation had different compositions of obsidian provenances. Thus, many researchers assume that the circular aggregations were formed temporarily by the multiple groups of hunter-gatherers who had different foraging territories.

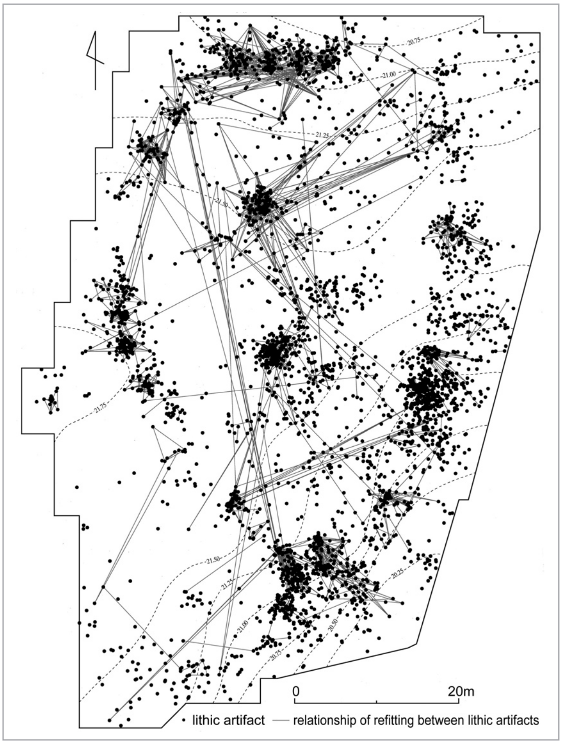


**Fig. 6:** Circular aggregation from the Kamibayashi site (modified from Idei et al. 2004: Fig. 640).

**Abb. 6:** Kreisförmige Ansammlung am Fundplatz Kamibayashi (verändert nach Idei et al. 2004: Abb. 640).

Various interpretations of the factors involved in forming the circular aggregations and of the causes for groups of hunter-gatherers to have gathered there have been proposed (Kosuge 2006; Tsutsumi 2012), including the exchange of lithic raw materials (Kurishima 1990), hunting large game (Daikuhara 1991), confirming inter-group solidarity (Sato 2006), coalitions against external threats (Inada 2001), and so on.

The interpretation by Sato (2006) seems to be the most convincing, although it is difficult to judge which interpretation is more plausible due to the scarcity of evidence. At any level, the circular aggregations indicate that hunter-gatherers in the initial phase of the EUP in the Japanese Islands had social networks in wide geographical ranges and complex social organizations.

In Europe, hunter-gatherers in the EUP are estimated to have had larger and more complex social groups than in previous time periods, based on the appearance of artifacts laden with symbolic meaning, such as figurines, personal ornaments, and musical instruments (Conard 2008). The EUP sites in the Japanese Islands have not yielded such artifacts; however, they have provided other forms of information about social groups in the EUP.

## Trap-pits

Many pitfalls of the Upper Paleolithic have been found throughout the Japanese Islands since excavations at the Hatsunegahara site (Fig. 7) in the Mt. Hakone area were conducted in the late 1980s (Suzuki et al. 1999). Based on the characteristics of the pitfalls, and comparative data from the Jomon period sites and modern hunter-gatherers, these pitfalls are interpreted as traps (Sato 2012, 2015). A total of 376 trap-pits have been excavated from 51 Paleolithic sites in the Japanese Islands (Sato 2012). The oldest examples were found from the Otsubobata site on Tanegashima Island located in the Pacific Ocean, currently 40 km offshore from Kyushu. They belong to the initial phase of the EUP at ca. 38,000–34,000 cal BP (Sato 2012). Trap-pits were also found at sites with microblade assemblages in the terminal Pleistocene in Kyushu.

The largest number of trap-pits, however, were found in the Mt. Ashitaka and Mt. Hakone areas. A total of more than 200 trap-pits were found from at least 15 sites in both areas. All of the trap-pits were dug from Layer BB III, and belong to the middle phase of the EUP. Almost all of them are round or nearly round in plan view. The depth is usually much more than 1 m, and their vertical cross-sections are bucket-like shapes. There are two types of arrangement for these trap-pits, which are similar to those of the Jomon period (Sato 2012, 2015). One, called a "set arrangement," consists of several trap-pits set on terrace slopes or valley heads and positioned near each other. Another, known as "line arrangement," involves many trap-pits arranged in long lines on a flat terrace or a hill. Representative examples of the line arrangements were found at the Hatsunegahara site (Fig. 7).

While Imamura (2004) suggested that these line arrangements crossing terraces were used for drive hunting, other researchers suggested that they were used as traps (Inada 2001, 2004; Sato 2002). Sato (2015) discussed the possible reasons in detail. The main targets of trap-pits are assumed to be medium-sized animals in the Palaeoloxodon-Sinomegaceroides complex, such as wild boar and deer, based on the size of the trap-pits. Some researchers assume that

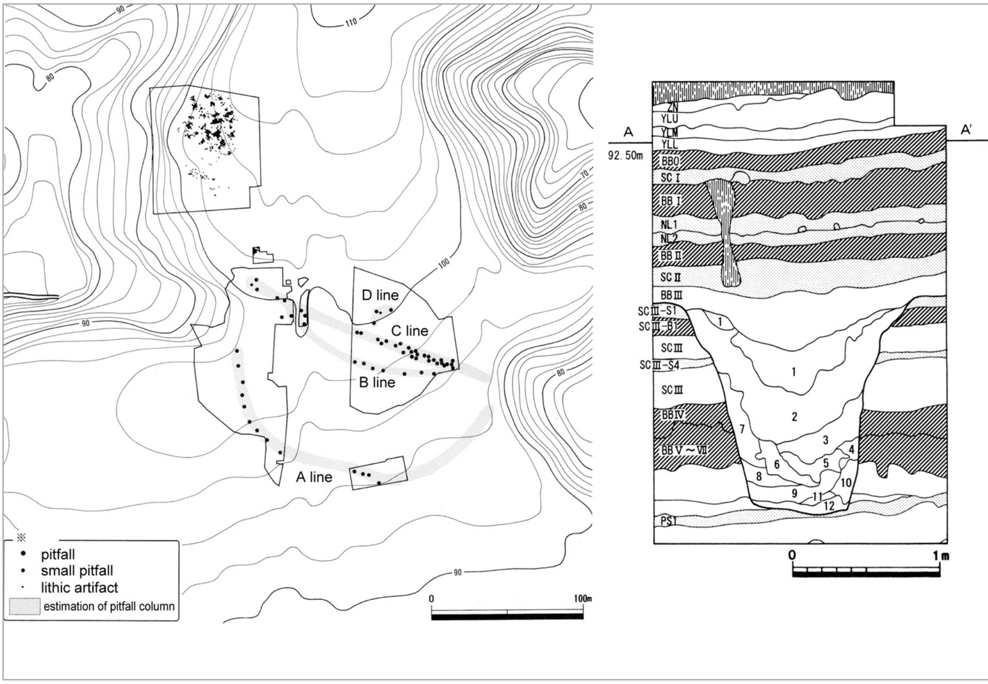


**Fig. 7:** Pitfalls from the Hatsunegahara site (modified from Suzuki et al. 1999: Fig. 175 and Fig. 245).

**Abb. 7:** Fallgruben am Fundplatz Hatsunegahara (verändert nach Suzuki et al. 1999: Abb. 175 und Abb. 245).

these pitfalls must have been used in trap hunting as part of a sedentary behavioral strategy based on data from modern hunter-gatherers (Ikeya 2009a; Sato 2012, 2015). Ikeya (2009a), in examining the results of the obsidian sourcing analyses for obsidian artifacts from archaeological horizons in the Layer BB III period in the Mt. Ashitaka area, argues that obsidian provenances are roughly limited to near sources, such as Amagi and Hakone in that time period (Fig. 3). Sato (2012, 2015) estimated that the groups of hunter-gatherers who used trap-pits in the Mt. Ashitaka and the Mt. Hakone areas as well as southern Kyushu during the EUP also frequently exploited plant food because of the floral environment, which was relatively abundant in edible plant food, based on floral data from the LGM of the Japanese Islands. It is also worth noting that sites where many trap-pits are found exist in the regions which have well-stratified, thick, Late Quaternary tephra sequences.

Pitfalls in the Japanese EUP provide evidence for trap-hunting during the EUP. Trap-hunting is presumed to be one of the hunting methods used by early modern humans in Southeast Asia based on the results of analyses of faunal remains from Niah Cave (Barker et al. 2007). There seems to be no evidence of trap-hunting by archaic humans; thus, this kind of hunting is thought to be a manifestation of behavioral modernity.

## Archaeological research of the EUP in the Mt. Ashitaka area

The last section introduces important research on the EUP in the Japanese Islands. Most of the studies in question include research into the Mt. Ashitaka area, as most of the important artifacts and features of this period in the Japanese Islands have been found in here. It can be said that recent studies in this area lead EUP research in general in the Japanese Islands. Below we present new information and perspectives about the behavioral modernity of early modern humans.

### Stratigraphic sequences, the dates of layers, chronological studies of EUP sites in the Mt. Ashitaka area

The Mt. Ashitaka area has produced the most reliable data for understanding EUP chronology since the late 1990s, due to well-stratified, thick, Late Quaternary tephra sequences with detailed geochronological information. More than 90 Paleolithic sites have been discovered at the foot of Mt. Ashitaka (Ikeya 2009b). Additionally, volcanic ash from the Paleo-Fuji volcano and the Komitake volcano, which were located northwest of Mt. Ashitaka, has accumulated on the foot of Mt. Ashitaka (Fig. 3). These volcanic ashes (Pleistocene tephras) formed the Ashitaka Loam Formation, which is divided into Lower, Middle, and Upper Members. The lowest layer of the Upper Member of the Ashitaka Loam Formation is Layer SC IV, the fourth scoria layer, from which the oldest lithic assemblage in the area was found at the Idemaruyama site, which dates back about 38,000 years ago (Takao and Harada 2011). Artifacts have never been found from deposits below Layer SC IV. The Upper Member of the Ashitaka Loam Formation consist of alternate eolian depositions of reddish-brown scoria (SC) layers (Layers SC I, SC II, SC III-s1, s2, s3, s4, s5, SC IV, and so on) and ten buried paleosol layers, called Black Bands (BB) (Layers BB 0, BB I, BB II, BB III, SC III-b1, SC III-b2, BB IV, BB V, BB VI, and BB VII) (Fig. 9). Most of the archaeological assemblages recovered were found in the Black Band layers. The middle of the Upper Member of the Ashitaka Loam Formation contains Layer NL, consisting of weathered

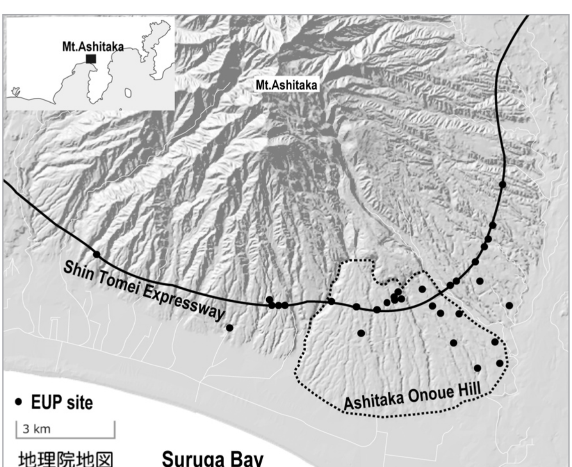


**Fig. 8:** Distribution of EUP sites in the Mt. Ashitaka area.

**Abb. 8:** Verteilung von Fundstellen des EUP (Early Upper Paleolithic) im Gebiet des Mt. Ashitaka.

scorias and volcanic glasses. The latter is AT tephra. These clear and high-resolution stratigraphic sequences provide geological contexts for establishing a detailed and reliable Upper Paleolithic chronology in the Mt. Ashitaka area. It was reported in the middle of the 1990s that changes in the lithic assemblages during the EUP in the Mt. Ashitaka area were almost similar to those in the Musashino Upland, and in other regions in southern Kanto (Symposium Jikko Iinkai 1995). Other sites that yielded EUP assemblages have also been excavated since then. Particularly, a number of archaeological sites were excavated accompanying the construction of the Shin Tomei Expressway. So far, more than 95 archaeological horizons of the EUP from more than 30 sites (and locations) have been excavated and reported (Fig. 8).

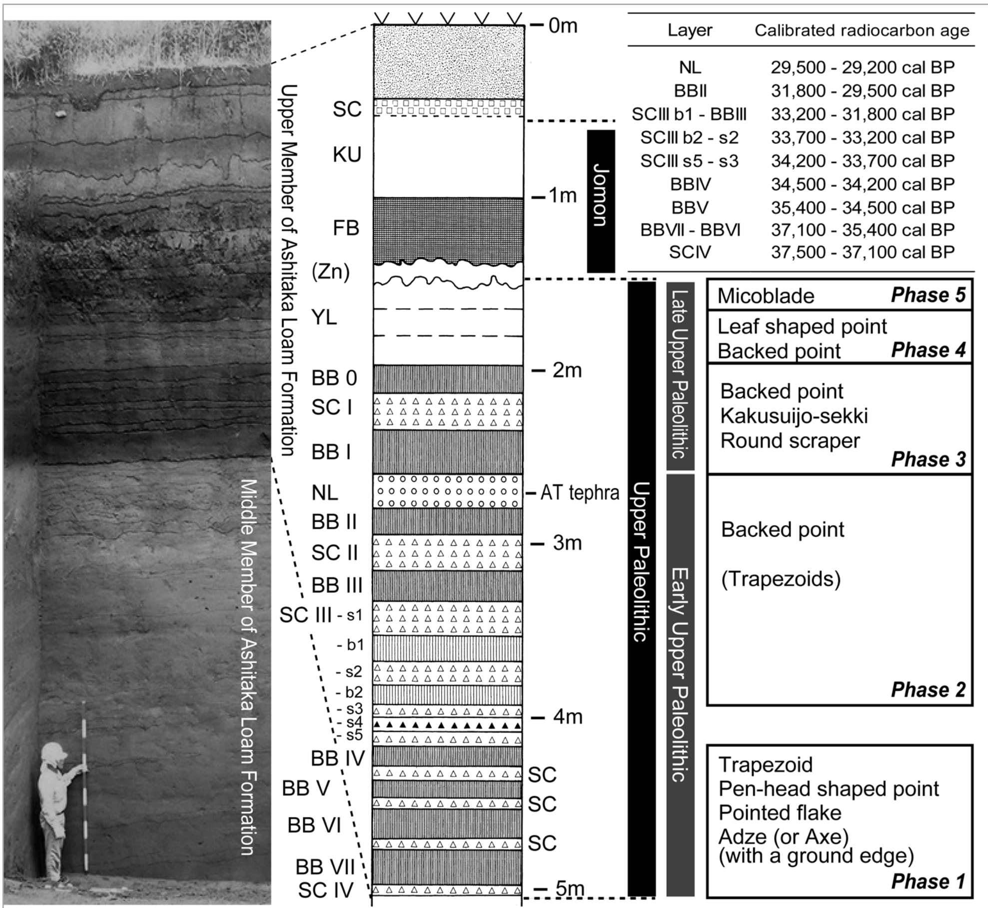


**Fig. 9:** Stratigraphic sequence and the UP chronology in the Mt. Ashitaka area (modified from Ikeya et al. 2011: Fig. 10).

**Abb. 9:** Stratigraphische Abfolge und jungpaläolithische Chronologie im Gebiet des Mt. Ashitaka (verändert nach Ikeya et al. 2011: Abb. 10).

Figure 9 also shows the UP chronology in the Mt. Ashitaka area. The UP period is divided into five phases, with phases 1 and 2 belonging to the EUP. Representative formal tools in Phase 1 include pointed flakes, trapezoids, pen-head shaped points, and adzes (or axes); representative formal tools in Phase 2 include backed points, although a few trapezoids were found from Layer BB III in some sites (Fig. 10). A comparison between these assemblages and the EUP assemblages in the Musashino Upland showed that transitions of EUP lithic assemblages from both areas correspondend with each other. Contents of lithic assemblages in Phase 1 of the Mt. Ashitaka area correspond to those in the initial phase of the EUP of the Musashino Upland. Contents of lithic assemblages from Layers SC III-b2 to BB II (or BB III) in Phase 2 of the Mt. Ashitaka area correspond to those in the middle phase of the EUP of the Musashino Upland. Contents of lithic assemblages from layer NL (or Layers BB II and NL) in Phase 2 of the Mt. Ashitaka area correspond to those in the final phase of the EUP of the Musashino Upland. Quantitative analyses of lithic assemblages in the Mt. Ashitaka area have yet to be conducted. Pitfalls (trap-pits), which were explained above, belong to Layer BB III because they were only dug from the lower level of Layer BBIII. Circular aggregations were found in Layer BBV and on the top surface of Layer BBVI. They are thought to have been formed in a relatively short period and to have belonged to the Layer BB V period.

There are 218 $^{14}$C dates from the archaeological horizons of the UP sites. Using their calibrated dates, the ages of the strata and environment in each period have been examined (Miyoshi 2020). Fig. 9 includes a small table showing the ages of the strata of the EUP. A total of 138 $^{14}$C dates from archaeological horizons of the EUP were calibrated using an IntCal 20 (Reimer et al. 2020) and the OxCal platform (Bronk Ramsey 2009) to formulate it. Based on the comparisons between calibrated dates, the NGRIP$\delta^{18}$O data (Svenson et al. 2008) and Lake Nojiri data (Kudo and Kumon 2012), the time ranges of Layers SC IV, BB V, SC III-b2, and BB III were found roughly to coincide with the periods of the Greenland Interstadials, and the climate in the periods of the layers seem to have been relatively warm and temperate (Miyoshi 2021).

## Circular aggregations in the Mt. Ashitaka area

Most of the circular aggregations are estimated to have been left in the initial phase of the EUP in the Japanese Islands. There are few circular aggregations where reliable radiocarbon dating was possible. Therefore, accurate dating of the appearance and continuation of circular aggregations is not yet possible in regions and areas other than the Mt. Ashitaka area. However, the Mt. Ashitaka area holds information about the appearance and continuation of circular aggregations for the clear and high-resolution stratigraphic sequences. Archaeological data here suggested that circular aggregations were left within a relatively short period.

In Phase 1 in the Mt. Ashitaka area, 30 archaeological horizons have been identified from 23 sites (and locations). Circular aggregations were found in Layer BB V and on the top surface of Layer BB VI. The circular aggregations which were found on the top surface of Layer BB VI are thought to have been left very close to the time of the Layer BB V period. Based on their context, they can be seen to have been left in the earliest stage of the Layer BB V period.

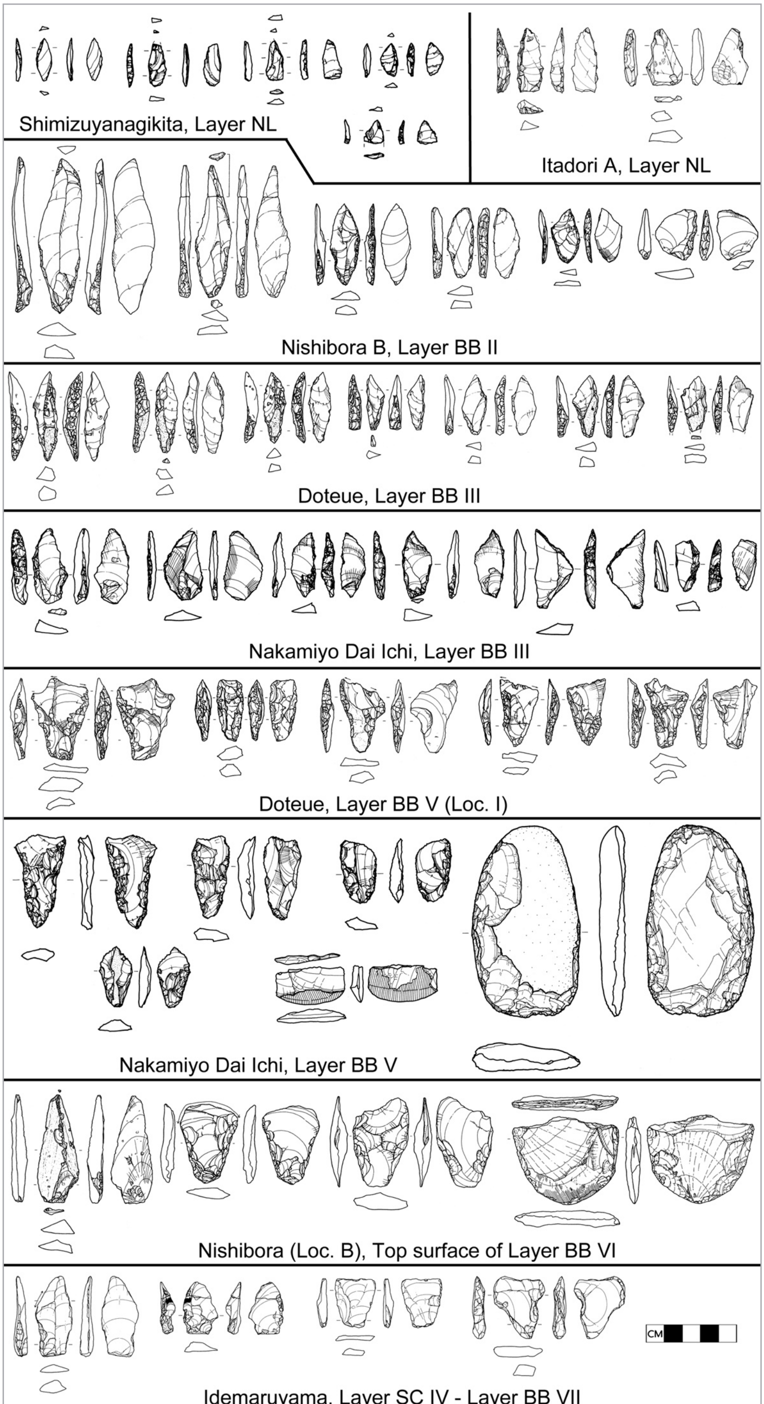


**Fig. 10:** Representative formal stone tools during the EUP in the Mt. Ashitaka area; drawings from excavation reports of sites (Takao 1989; Ikeya 1998; Sasahara 1999; Mibu and Sugiyama 2009; Takao and Harada 2011).

**Abb. 10:** Repräsentative formale Steinwerkzeuge während des EUP im Gebiet des Mt. Ashitaka; Zeichnungen aus Ausgrabungsberichten der Fundplätze (Takao 1989; Ikeya 1998; Sasahara 1999; Mibu und Sugiyama 2009; Takao und Harada 2011).

Table 1 shows that the numbers of lithic scatters (concentrations) and lithic artifacts changed in Phase 1. Both the numbers of lithic scatters (concentrations) and lithic artifacts of archaeological horizons in the Layer BB V period (including archaeological horizons from the top surface of layer BB VI) are much greater than those in other periods in Phase 1. This suggests that the population size of the Layer BB V period was larger than those of other periods, and that the circular aggregations were left during the period when the population size was large (Yamaoka 2020a).

It is worth noting that lithic assemblages in the Layer BB V period include relatively large and standardized trapezoids (Fig. 10). These standardized trapezoids were found at sites in other regions, such as the Kanto and Chubu regions. The same design concept was shared within the distribution of the standardized trapezoids (Tamura 2001). The results of the obsidian sourcing from the archaeological horizons in the Layer BB V period confirmed that obsidian provenances include both of these remote sources, such as the Shinshu area and Kozusihma Island, and near sources, such as Amagi and Hakone (Ikeya 2009a).

The circular aggregations, as well as other information, suggest that hunter-gatherers in the initial phase of the EUP in the Japanese Islands formed social networks covering wide geographical ranges and exhibiting complex social organizations. Furthermore, archaeological data from the Mt. Ashitaka area indicate that they were left during the period when the population size was large.

## Implications of study results on trapezoids from the Doteue site

The analyses of trapezoids suggest that hunting weapons were repaired and animals were butchered or processed at the three locations of the Doteue site during the Layer BB V period (Yamaoka 2010, 2012a, 2020b). A circular aggregation was found at one of these locations (Ikeya 1998, 2015: Fig. 25.5). This reveals that activities related to hunting were conducted at the circular aggregation. However, similar evidence was not observed on trapezoids from circular aggregations at other sites in the Mt. Ashitaka area (Yamaoka 2020b). This indicates that activities related to hunting were not necessarily conducted in all circular aggregations.

In addition, based on experiments, hunting weapons equipped with trapezoids were estimated to have had a cushion mechanism in their structures, indicating a general effect in the complex structures of hunting weapons formed by connecting various raw materials for hafting. Various reasons for hafting have been proposed in the research: increasing force, formation of cutting edges, conserving raw materials, and so on (Keeley 1982). The cushion mechanism seems to have been one of the reasons for hafting and connecting raw materials for making complex structures of tools (Yamaoka 2020b).

In the Doteue site, most of the trapezoids were made from obsidian. They were used as tips of hunting weapons and processing implements. In general, producing sharp edges on obsidian is possible despite the material's fragility. Thus, we can argue that hunter-gatherers, who left

**Table 1:** The numbers of lithic scatters (concentrations) and lithic artifacts from archaeological horizons of sites in Phase 1 in the Mt. Ashitaka area (modified from Yamaoka 2020a: Table 1).

**Tabelle 1:** Die Anzahl der lithischen Fundstreuungen (Konzentrationen) und Steinartefakte aus archäologischen Horizonten von Fundplätzen in Phase 1 im Gebiet des Mt. Ashitaka (verändert nach Yamaoka 2020a: Tabelle 1).

| Site / Archaeological horizon (AH) / Layer (Giological horizon) | Number of lithic scatters | Number of lithic artifacts | Circular aggregation |
|---|---|---|---|
| Fuchigasawa (Dai Ni Tomei Loc. 27-2) / AH II / BB IV - SC III-s5 | 6 | 158 | |
| Fujiishi / AH V / BB IV-SC III-s5 | 1 | 7 | |
| Futatsubora / - / BB IV | 1 | 17 | |
| Fuchigasawa (Dai Ni Tome Loc. 27-1) / AH I / BB IV | | 2 | |
| Sakurabatakeue / AH I / BB V-BB IV | | 4 | |
| Shimizuyanagikita-Higashione / - / BB V | 2 | 384 | |
| Doteue BBV Loc. I / - / BB V | 30 | 2207 | ✓ |
| Doteue BBV Loc. II / - / BB V | 21 | 995 | |
| Doteue BBV Loc. III / - / BB V | 30 | 1171 | |
| Nakamiyo-Dai Ichi / AH V / BB V | 8 | 1856 | ✓ |
| Matoba / - / BB V | 5 | 711 | |
| Sanmyouji / - / BB V | 19 | | ✓ |
| Nishibora (Dai Ni Tomei Loc. No.8) / AH I / BB V lower | 13 | 1844 | ✓ |
| Nishibora Loc. B / - / Top surface of BB VI | 14 | 421 | ✓ |
| Umenokizawa / AH II / Top surface of BB VI | 15 | 474 | ✓ |
| Oidaira B / AH II / BB VII - BB V | 5 | 773 | |
| Fujiishi / AH II / BB VI | 1 | 33 | |
| Hosoo / - / AH I / BB VI - BB VII | 1 | 14 | |
| Umenokizawa / AH I / BB VII | 1 | 14 | |
| Fujiishi / AH I / BB VII | 5 | 491 | |
| Higashino / AH I / BB VII | | 1 | |
| Matoba / - / BB VII | | 2 | |
| Motono / - / BB VII | 1 | 12 | |
| Fuchigasawa (Dai Ni Tomei Loc. 27-2) / AH I / BB VII | 2 | 32 | |
| Akihabayashi / AH I / BB VII lower | 1 | 6 | |
| Mukouda A / - / SCIV - BB VII | | 6 | |
| Idemaruyama / AH I / SC IV - BB VII | 9 | 1329 | |
| Motono / - / SC IV | | 3 | |

lithic scatters (concentrations) at the Doteue site in the Layer BB V period, were aware of the physical properties of obsidian and that they used obsidian trapezoids for the hunting and processing of animals. The cushion mechanism was a technological device to maximize the function of the tip of the hunting weapon made in obsidian (Yamaoka 2020b).

The selection of raw materials differed between formal flaked tools and adzes (or axes). For example, in the Musashino Upland, formal flaked tools were made of obsidian, hard shale, and others. Adzes (or axes) were made of green tuff, sandstone, and others (Yamaoka 2012c). The lithic raw materials used to form adzes (or axes) are thought to have been suitable for heavy-duty tasks. Recently, Nakamura (2015) explained that a special kind of rock was used for making adzes (or axes) in the coastal areas of the Sea of Japan during the EUP. The tremolite rock, which consists of tremolite and actinolite, is formed through contact metamorphism of serpentinite. It is denser, tougher, and less magnetic than serpentinite. It is a very dense and tough material, and it is also a rare material. The main sources are found in areas along the borders of Niigata, Nagano, and Toyama Prefectures in the Chubu region (Nakamura 2015). The utilization of this material for adzes (or axes) also demonstrates a deep understanding of the physical properties of raw materials.

It is suggested that these examples share similar characteristics with new bone technology in the UP in Europe and Western Asia. The new tool forms and technology of bone and antler tools appeared during the UP in these regions (Mellars 1989). However, the Early and Middle Paleolithic were characterized by the use of flaked bone tools; it is known that tool categories of flaked bone tools are similar to those of flaked stone tools (Ono 1998, 2001). Similar technology and tool categories were applied to stone tools and bone tools in the previous time periods. Early modern humans in Europe and Western Asia during the UP seem to have adopted new tool forms and technology based on a precise understanding of the physical properties of bone and antler. A similar technological change in bone tools is known in Africa, although its date is older than in Europe and Western Asia (McBrearty and Brooks 2000).

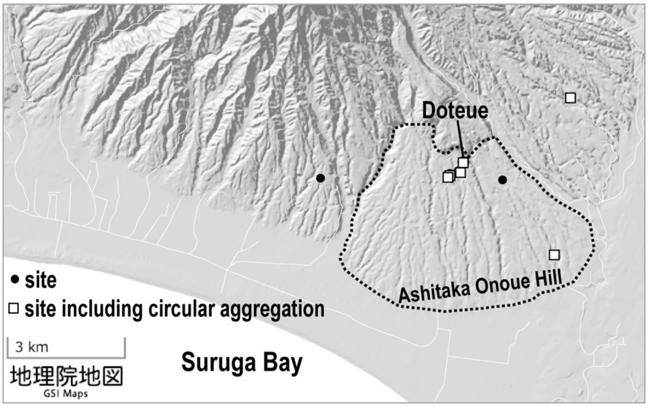


**Fig. 11:** Distribution of sites in the Layer BB V period in the Mt. Ashitaka area.

**Abb. 11:** Verteilung von Fundplätzen in der Periode von Schicht BB V im Gebiet des Mt. Ashitaka.

These examples show that early modern humans acquired the ability of a more specific understanding and utilization of the physical properties of raw materials for making implements. This ability has been viewed as an indication of behavioral modernity among early modern humans (Yamaoka 2021b).

## Land use in the Layer BB V period and the Layer BB III period

Research into the EUP in the Mt. Ashitaka area provides some clues about land use among early modern humans. Impact fractures on trapezoids and other broken trapezoids evidencing the repair of hunting weapons were only found at the three locations from Layer BB V of the Doteue site. They were not found in the other sites of the Layer BB V period. The Doteue site is thought to have been a suitable place for a hunting base, located on the apex of a reverse fan-shaped hill called the Ashitaka Onoue (Fig. 11). The hill can be estimated to have been a hunting ground during the BB V period, as activities related to the repair of hunting weapons and butchering or processing of animals were conducted at the Doteue site.

However, the location of sites related to hunting in the Layer BB III period is different from those in the Layer BB V period. The sites where pitfalls were found are on the narrower ridges of the hills outside the Ashitaka Onoue hill (Ikeya 2009a) (Fig. 12). These are assumed to be the primary location of hunting-related activities, as other evidence from lithics, such as impact fractures, is absent from the archaeological horizons of the sites during the Layer BB III period (Yamaoka 2020a). They indicate that hunting grounds and land use were different between the two periods.

Research in soil science has generated a hypothesis concerning land use in the EUP for the Mt. Ashitaka area (Sase et al. 2006, 2008; Hosono and Sase 2015). Researchers studied buried paleosol layers from the UP sites in the Mt. Ashitaka area and the Sagamino Upland of the Kanto region. The buried paleosol layers were called the Kurobokudo layers (black humic volcanic ash soil), which formed under the following conditions: (base material is) tephra material; humid

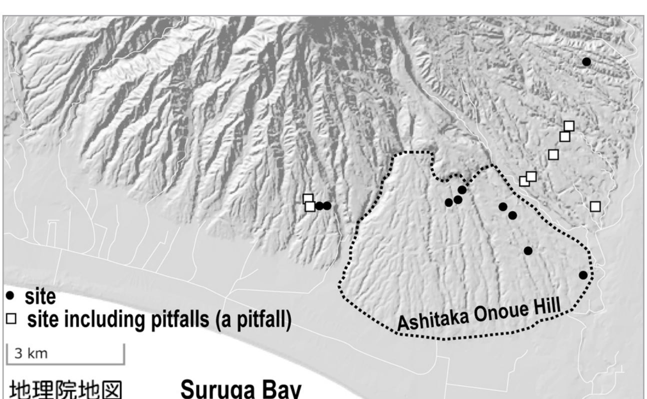


**Fig. 12:** Distribution of sites in the Layer BB III period in the Mt. Ashitaka area.

**Abb. 12:** Verteilung von Fundplätzen in der Periode von Schicht BB III im Gebiet des Mt. Ashitaka.

and warm or cool climate; and grassland vegetation. Black bands (BB) in the Mt. Ashitaka area correspond to the Kurobokudo layers (Fig. 9). On the basis that the beginning of the formation of the Kurobokudo layers coincides well with the appearance of the archaeological sites, and climax vegetation in this region was forest even in the late Pleistocene, the research estimated that the Kurobokudo layers developed under semi-grassland vegetation resulting from human activities, such as burning and deforestation, to create man-made ecosystems.

Recent archaeological research revealed that the Kurobokudo layers in the Mt. Ashitaka area are only found in a limited range: the Ashitaka Onoue hill, and its eastern and western hills. Furthermore, distributions of EUP sites roughly coincide with the distribution of the Kurobokudo layers (Ikeya 2021). These findings support the hypothesis on the artificial modifications of vegetation during the EUP. There is a possibility that such vegetative alterations were associated with land use for hunting and other activities (Yamaoka 2021c). Thus, the Mt. Ashitaka area also holds great potential in studying niche construction (Nikulina et al. 2022) by early modern humans. Interdisciplinary work in this area is planned for the future.

## Conclusions

Archaeological research exploring the EUP in the Japanese Islands supports and reinforces various arguments supporting the presence of behavioral modernity among early modern humans, and some findings contribute to new knowledge and perspectives regarding this question. Archaeological material of the Japanese EUP can be characterized as follows: substantial amounts of lithic artifacts and a chronology based on rich geochronological information; significant data from obsidian sourcing analyses; and archaeological features, such as circular aggregations and trap-pits, which are rare or absent in other regions. These features are significant due to their geographical condition, and the systems and methods of excavations in the Japanese Islands. The geographic setting of the Japanese Islands in a volcanic zone provides many advantages: rich geochronological information and many obsidian sources. However, it also presents disadvantages, such as dissolving organic materials. Many large-scale salvage excavations at open-air sites help us to understand the distribution of archaeological features in a site on a larger scale, although we lose information in not recovering smaller materials. The Mt. Ashitaka area, containing all the relevant elements described above, is the most representative area of study for the EUP in the Japanese Islands.

Geographical conditions and environmental settings of the sites and regions, as well as excavation systems and methods, affect the archaeological record. This points to the following: No region contains complete information about the technology and behavior associated with early modern humans. Thus, the nature of information about behavioral modernity in early modern humans varies widely from region to region, and is mutually complementary. The many discoveries from the Japanese Islands help to complement the record of the behavioral repertoire of early modern humans as they spread across Eurasia and colonized new regions and geographic settings.

## Acknowledgments

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