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Lithic raw material exploitation and circulation in Préhistory. A comparative perspective in diverse palaeoenvironments
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2.7. Acquisition and consumption of obsidian in the Upper Palaeolithic on Kyushu, Japan

Résumé
Dans cet article nous examinons des modèles d'exploitation d'obsidienne en divisant la période comprise entre le Paléolithique supérieur et l'ère de la naissance de Jomon, en 10 phases distinctes. Cette périodisation est basée sur les préférences des matières premières et les techno-morphologies dans les ensembles lithiques de l'île de Kyushu, au Sud du Japon. En conséquence trois périodes importantes peuvent être distinguées comme suit. La période 1, correspond au début de l'utilisation de l'obsidienne durant la phase 2 (approximativement 30 000 B.P.) ; c'est le moment où l'homme préhistorique a commencé à utiliser toutes les sources d'obsidienne actuellement connues dans le Sud de l'île de Kyushu. Pendant la période 2, qui correspond à la phase 5 (approximativement 24 000 – 22 000 B.P.), nous constatons l'utilisation d'obsidienne provenant du Nord-Ouest de Kyushu pour la fabrication des couteaux du type de Tanukidai et d'Imagata taillés en pointe. Enfin, la période 3 qui correspond à l'industrie lithique à microlames, phase 8 (approximativement 15 000 B.P.), et qui représente l'apogée de l'exploitation de l'obsidienne au Paléolithique supérieur.

Abstract
In this paper we examine obsidian exploitation patterns by dividing the time between the Upper Palaeolithic and the Incipient Jomon periods into 10 distinct phases. This periodization is based on techno-morphological and raw material preference in the lithic assemblages from southern Kyushu, Japan. As a result, threemajor periods are configured as follows. Period 1 constitutes the beginning of obsidian use during phase 2 (approximately30,000 BP); it is the time when all of the currently known obsidian sources in southern Kyushu start being used. During period 2, which corresponds with phase 5 (approximately24,000–-22,000 BP), we see the use of obsidian in northwestern Kyushu for the manufacture of Tanukidani and Imatoge-type knife shaped point. Finally, period 3 coincides with the micro blade industry, phase 8 (approximately 15,000 BP), and represents the peak of obsidian exploitation during the Upper Palaeolithic. Obsidian use predominates in almost all areas of southern Kyushu. With regard to the reasons behind these changes in obsidian use, it seems that they are related to lithic technology, behavioral patterns, and territorial boundaries of the groups that inhabited the area.

Keywords: Kyushu, Japan, Upper Paleolithic, obsidian use, intermittent change

1 – Introduction

Obsidian sources are almost ubiquitous on Kyushu Island as well as throughout the Japanese archipelago. In particular, a large number of obsidian sources, which were highly exploited, are located in southern Kyushu. Moreover, the evidence suggests that obsidian from northwestern (NW) Kyushu was carried more than 100 km away. Therefore, we can obtain some valuable insight into group interaction and the regions in which people circulated. In addition, I attempt a diachronic investigation of the lithic assemblages and a periodization based on them. In this paper, I examine obsidian use and procurement patterns from the late Palaeolithic to the Incipient Jomon period during which obsidian was used and their respective backgrounds.

2 – Problems with previous studies in Kyushu

Archaeological obsidian research in Kyushu starts with the description of obsidian and a comprehensive survey of the sources by Sakata (1982). Following this, several studies focused on the relationship between the population and obsidian of the Upper Palaeolithic (Watanuki 1992; Ogi 1998). Watanuki (1992) examined the lithic raw material proportions at sites from the Upper Palaeolithic and showed the overall trends for each region. His work showed that despite the low quality of obsidian, the utilization ratio was high; obsidian, however, was never used for blades, a development unique to southern Kyushu. Although Ogi's (1998) research has many problems regarding the proposed interpretations, (such as drawing direct associations between the movement of lithic raw materials with exchange and trade), it was useful in terms of examining the lithic raw materials at each site and mapping the circulation of obsidian. However, in southern Kyushu, the amount of specialized studies increase exponentially since the

2000s and as a result, a significant number of regions need to be added or modified. In the late 2000s, Magome (2008) studied the obsidian exploitation in the Kagoshima Prefecture region, while Kuwahata (2003) summarized the usage of all lithic raw materials also in the Kagoshima region, and Fujiki (2002) studied the transition of obsidian use in the Miyazaki Prefecture region. These studies can be summarized as follows: in the Kagoshima Prefecture region, obsidian was not used for tanged points dated in the early part of the late Upper Palaeolithic, but it was used extensively for bilaterally backed tools (Magome, ibid). It has been shown that some types of obsidian were associated with a particular tool type (Magome, ibid). Furthermore, it has been demonstrated that in the Miyazaki region the obsidian used varies depending on the time period. Moreover, generally speaking, the frequency of obsidian exploitation seems to occasionally increase during the microblade industry period and it is evident that in NW Kyushu obsidian was also used. However, since raw materials from southern Kyushu increased, a detailed study on diachronic changes in obsidian usage, including the activities in these two regions, has not yet been conducted.

3 – Obsidian Sources in Kyushu

Since Sakata's study (1982), more obsidian sources have been found in about 30 locations on Kyushu (fig. 1). However, some of these are geologically similar (Nagaoka *et al.,* 2003). The primary obsidian sources on Kyushu are divided into the following four categories: obsidian contained in the talus sediment or rhyolitic lava flows and pyroclastic in NW Kyushu; those derived from the pyroclastic flow of the Aso volcano; those derived from the Shiroyama volcano in the Himeshima Island off the Kunisaki Peninsula coast; and obsidian from southern Kyushu. The frequency of obsidian use was determined by its output, quality, and size.

NW Kyushu: In this area there is a dense concentration of sources that produce large quantities of high quality obsidian (fig. 3). X-ray fluorescence analysis has shown that the distribution point of obsidian nodules and the primary sources don't correspond, and types of obsidian with different elemental composition may be present at the same primary source (Nagaoka *et al.,*2003). Although this becomes a significant problem when discussing the finer aspects of the raw material's appearance, the main external features can be classified as follows: **Koshidake obsidian** (including Muta obsidian), mainly breccias with high quality in a jet-black color, is derived from Arita rhyolite, which constitutes the peak of Mt. Koshidake located in Imari city, Saga Prefecture. In addition, as will be described later, some obsidian from southern Kyushu is a very similar to Koshidake obsidian. **Hario obsidian** (including Yodohime-jinjya, Futrusato, and Kamidoigyo obsidian), mainly from sub-conglomerate to sub-breccia with high quality blue-gray color, is derived from multiple formation points such as the gravel and rhyolite near Sasebo city, Nagasaki Prefecture. As geochemical analysis has not yet been undertaken for this type of obsidian, for its identification we rely on criteria such as color and quality. In the remainder of the paper I will refer to Koshidake and Hario obsidian collectively as "NW Kyushu obsidian".

Central Kyushu: Oguni obsidian, which is transparent black with a lot of phenocrysts, is derived from the Yamanokogawa rhyolite in the Chikugo River basin and upstream of the Yamanoko River. This obsidian comes in the form of riverbed pebbles or slope deposits. **Zogabana tuff** has been described as "glassy welded tuff" by a recent survey (Obata *et al.,* 2001, p.68). It is derived from the special unit of 2 Aso and is usually referred to as "Aso obsidian"; this obsidian is found in pyroclasticflow deposits in the north-eastern part of the Aso caldera at an altitude of about 700 masl. The flaking surface is opaque with impurities and jet-black in color. When exposed to the elements it tends to form a brownish layer on its surface.

Southern Kyushu: Nitto obsidian can be found along the river from Nitto to Arahira in the Yamano region, Kagoshima Prefecture. It is easy to collect and ranges in size from human head-sized to fist-sized nodules, but in many cases it contains impurities. The supply source of **Kuwanokizuru obsidian** is unknown. It is usually found in the form of nodules deposited along riverbeds or in clay layers. This obsidian is of

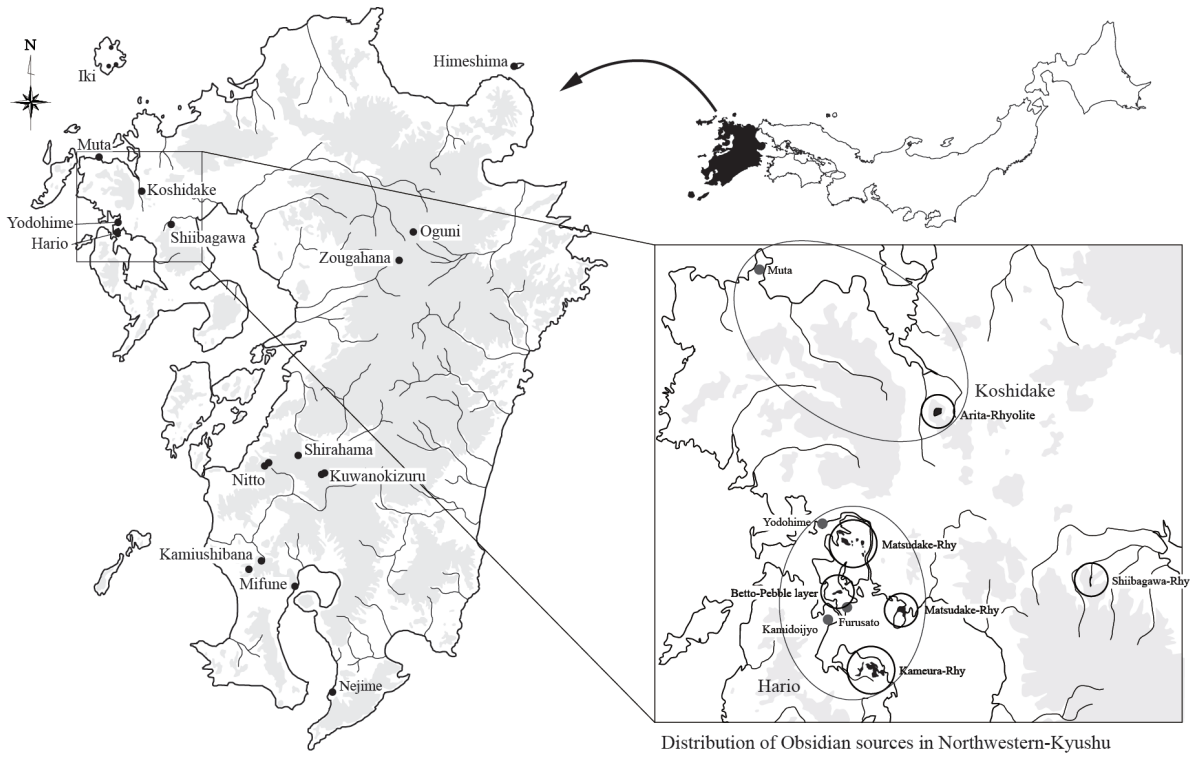
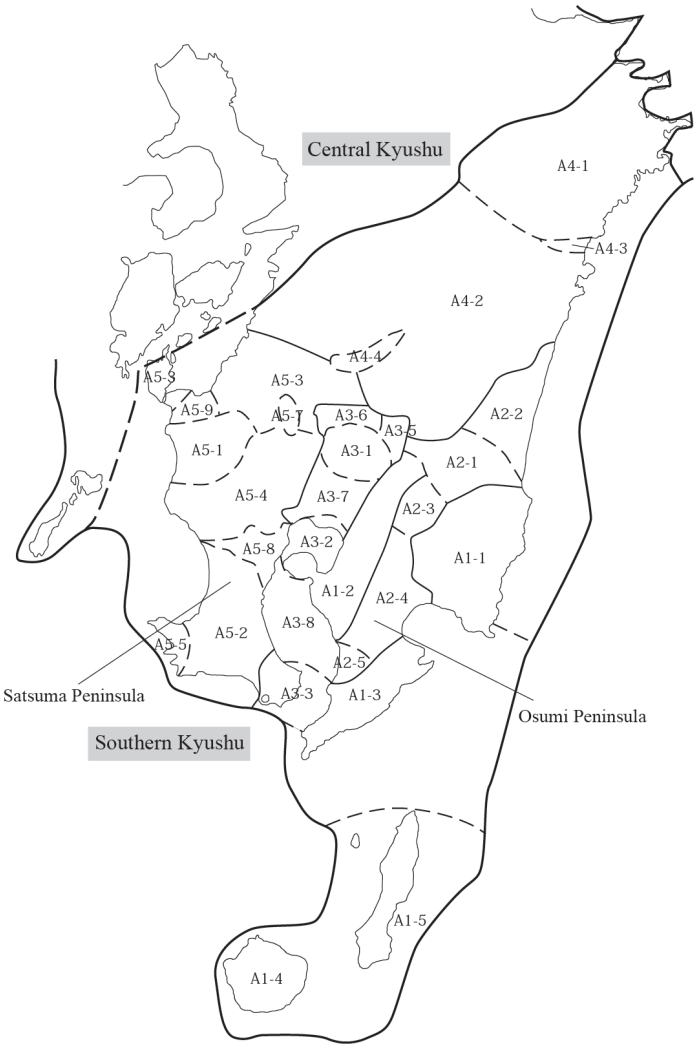


Figure 1 – Distribution of obsidian sources in Kyushu



Section		Subsetion	
A1	Southeastern Kyushu Mountains		
	[Mts.]	A1-1	Wanitsuka Mts.
		A1-2	Takakuma Mts.
		A1-3	Kimotsuki Mts.
		A1-4	Yakushima Isl.
	[Plateau]	A1-5	Tanegashima Isl.
A2	Eastern Plain of Southern Kyushu		
	[Plateau]	A2-1	Morokata Plateau
	[Plateau・Lowland]	A2-2	Miyazaki Plain
		A2-3	Miyakonojyo Basin
		A2-4	Kimotsuki Plain
		A2-5	Kanoya Plateau
A3	Volcanic Mountains in Southern Kyushu		
	[Vol]	A3-1	Kirishima Volcainc Mts.
	[Vol Caldera]	A3-2	Aira Caldera and Sakurajima
		A3-3	Ata Caldera
	[Basin]	A3-5	Kobayashi Basin
		A3-6	Kakuto Basin
		A3-7	Plateau and Lowland of Kagoshima northern Coast
	[Bay]	A3-8	Kagoshima Bay
A4	Kyushu Mountains		
	[Mts]	A4-1	Northern Kyushu Mts.
		A4-2	Southern Kyushu Mts.
	[Valley]	A4-3	Gokase River Valley
	[Basin]	A4-4	Hitoyoshi Basin
A5	Western Mountains in Southen Kyushu		
	[Mts.]	A5-1	Izumi Mts.
		A5-2	Ibusuki Mts.
	[Vol]	A5-3	Hisatsu Volcanic Mts.
		A5-4	Hokusatsu Volcanic Mts.
		A5-5	Nansatsu Volcanic Mts.
		A5-6	Kuroshima Isl.
		A5-7	Oguchi Basin
		A5-8	Plateau and Lowland of Kagoshima Western Coast
		A5-9	Izumi Plain

Figure 2 – The Terrain Classification in Southern Kyushu after Machida *et al.,* 2001

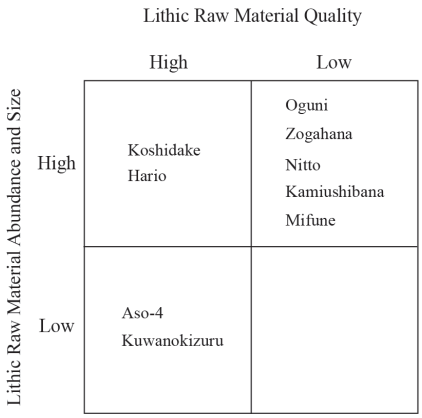


Figure 3 – The Relation between quality and abundance of lithic raw material in each obsidian resources in Kyushu

high quality, its color is amber, and it usually does not have any impurities. Thumb-sized pebbles are most common, even though some large hand-sized ones can be sometimes found. The newly discovered **Hishikari obsidian** seems to be very similar to Kuwanokizuru obsidian (Nagai *et al.,* 2010). Although the relationship between the two is currently unknown, it is possible that secondary sources of Hishikari obsidian are widely spread. **Mifune obsidian** is derived from Mifune rhyolite in Ryugamizu, Kagoshima Prefecture. Fist-sized or bigger pebbles can be found just under the outcrop. This obsidian is highly transparent, black or amber in color with many impurities. **Kamiushibana obsidian** may be derived from Okoba rhyolite or Ichiki acidic rocks in the cityof Satsumasendai, Kagoshima Prefecture. There is no clarity in this jet-black obsidian, and the impurities it contains are less than those in Mifune obsidian. When exposed to the elements, a dark brown or brown layer forms on the surface.

Apart from these known sources there are also types of obsidian whose provenance is still unknown. These types are found at sites in south-eastern Kyushu, which include the so-called Uchiyashiki UT lithic group (Warashina 2001), the Odate OX lithic group (Kishida 2008), etc. It may be difficult to distinguish Koshidake obsidian because in many cases this obsidian has small breccia inclusions and is highly transparent. In fact, it has often been mistaken for Koshidake obsidian. However, when looked at carefully, its pebble surface, texture, and impurities, makes its identification possible with the naked eye.

Figure 3 provides a schematic representation of the relationship between size, quality and abundance of obsidian in Kyushu. Obsidian from the northwest areas tends to occupy the upper left corner of the diagram, i.e., Koshidake and Hario, while other types of obsidian cluster in the upper right corner, i.e., Nitto, Kamiushibana, Mifune. This correlation has a significant effect on the frequency of use and the distribution range of the stone tools in the Upper Palaeolithic.

4 – Obsidian use from the Upper Palaeolithic to the beginning of the Jômon in Southern Kyushu

A – Chronology

The Upper Palaeolithic of Kyushu is typically divided into the early and late Upper Palaeolithic, which occur before and after the Aira-Tn tefra (AT). The early and late periods can be further subdivided into three and five phases respectively, based on the stratigraphy of archaeological sites and the morpho-typological characteristics of the stone tool assemblages, which are as follows (Miyazaki Palaeolithic Association 2005; Miyata 2006; Morisaki 2010; 2011) (fig. 4). The absolute dates presented here have been obtained through C14 uncalibrated data; we have included estimates because of the limited number of dating samples.

Phase 1: Stone tool industry including denticulates and pebble tools (33,000-30,000 BP)
Phase 2: Stone tool industry including edge-ground axes (30,000-28,000 BP)
Phase 3: Stone tool industry including small backed blades (Kyushu type) (28,000-25,000 BP)
Aira-Tn volcanic ash fall (25,000 BP)
Phase 4: Stone tool industry including backed blades similar to those of phase 3 (25,000-24,000 BP)
Phase 5: Stone tool industry including stemmed points (Phase5a)Stonetool industry including Tanukidani type bitruncated points and Imadoge type points(Phase5b) (25,000-21,000BP)
Phase6: Stone tool industry including bilaterally backed tools and Kou-type points (22,000-18,000BP)
Phase 7: Stonetool industry including small backed blade and small trapezes (18,000-15,500BP)
Phase 8:The first half of the Microblade Industry (15,500-13,000BP)

Phase9: The second half of the Microblade Industry (13,000-12,000BP)
Phase 10: Stone tool industry including arrow heads accompanied by pottery production (12,000-11,000 BP)

In the following section, I present my analysis for the purposes of which I divided southern Kyushu into the eastern and the western region while taking into account the distribution of the obsidian sources. Thedetailed geomorphic is conformed to Machida *et al.,* (2001) (fig. 2).

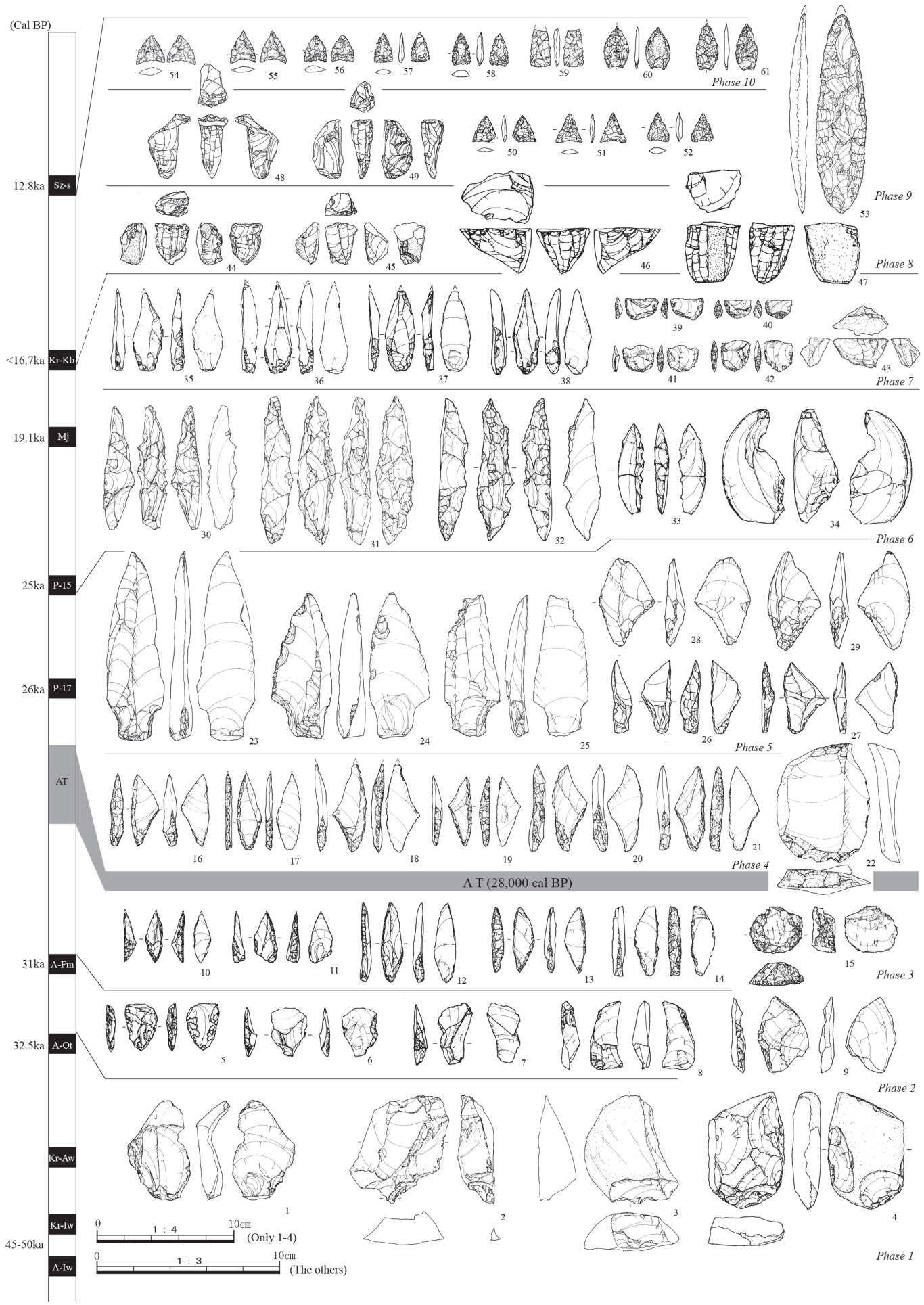
B – The first half of the Upper Palaeolithic (Phase1-3)

Since the Ito pyroclastic flow covers the majority of southern Kyushu, at archaeological sites dated before AT, the ash fall is unevenly distributed in what is now the region of Kumamoto and Miyazaki Prefectures (fig. 5, below).

Western Region: The stone tool industry of phase 1 can be found only in layer 1 of the Chikegamine site, excavated underneath a brown soil layer (the so-called 'ansyokutai') of the Hitoyoshi basin, Kumamoto Prefecture. The exploitation of obsidian during this phase is not certain. During phase 2, the Chikegamine (cultural layer 2) and Ushioyama sites are established on the Hitoyoshi basin. The former consists of an assemblage with edge-grounded axes and trapezes. Although we do not have a complete picture of the stonetool industry, it is worth mentioning the two trapezes made of Nitto obsidian that have been found (Wada and Shiga 2000). At Ushioyama, 12 from the total number of 81 are stone tools made of obsidian. Informal tools, retouched tools and used flakes are among them (Furumori 1999). The bottom of the 6 layer at the Uwaba site located in the vicinity of the Nitto obsidian source also dates to this phase. Even though the total number of tools is unknown, we do know that 43 are made of obsidian, 39 of which are made of Nitto obsidian (Iwasaki 2007). At this site Kuwanokizuru and Kamiushibana obsidian were used in small amounts. On the Satsuma Peninsula, the Maeyama site (cultural layer 1) is the only example. Sangawa and his colleagues (2007) who published the site, divided cultural layer 1 into two phases, 1a and 1b, based on lithic raw material use and the technological characteristics. The obsidian tools are present only in culture layer 1b, which corresponds to phase 2 of the technological features, with features such as the flat flaking adjustment seen in the trapezes. In this assemblage, stone tools made of Kamiushibana and Mifune obsidian comprised 20% of the whole.The stone tools were produced using both types of obsidian because both trapezes and cores have been found.

In phase 3, there are also several sites on the Satsuma Peninsula as well as the Hitoyoshi basin (fig. 5). The lithic raw material used is different at each site, such as the Tanukidani site (cultural layer 1), the Kubo site (cultural layer 1) and the Kunobaru site on the Hitoyoshi basin. At the Tanukidani site, chert was used for the majority of stone tools imitating, as we think, the stone tool production of Kuwanokizuru or Nitto obsidian. Although obsidian was not the typical raw material in stone tool production, formal tools such as knife-shaped points and scrapers were also produced using it (Kizaki 1987). The proportion of obsidian and chert is almost the same as that at Kubo (Kizaki 1993). At Kunobaru, Nitto or Shirahama obsidian account for the majority of lit hic raw materials. The large amount of knife-shaped tools, scrapers, bladecores and flakes excavated point to on-site production (Furumori1999). At the Chochi site (layer 17.18), located in the Ata Caldera area of southern Satsuma Peninsula, the knife-shaped points and scrapers made mainly of shale and agate which can be found in the vicinity of the site; tools made of Kamiushibana and Nitto obsidian have also been found (Nagano 2000). It is believed that they had been produced on-site, because of the dozens of flakes that were excavated, even though no cores were found. Although stone tools made of obsidian were excavated at the Mizusako site (12.13 layers), the location of the source remains unknown.

As mentioned above, it is possible to map obsidian exploitation during phase 2 in the southwestern Kyushu. The formation of sites in the vicinity of the Nitto obsidian source, such as the Uwaba site, indicates that this is the point when its full-scale use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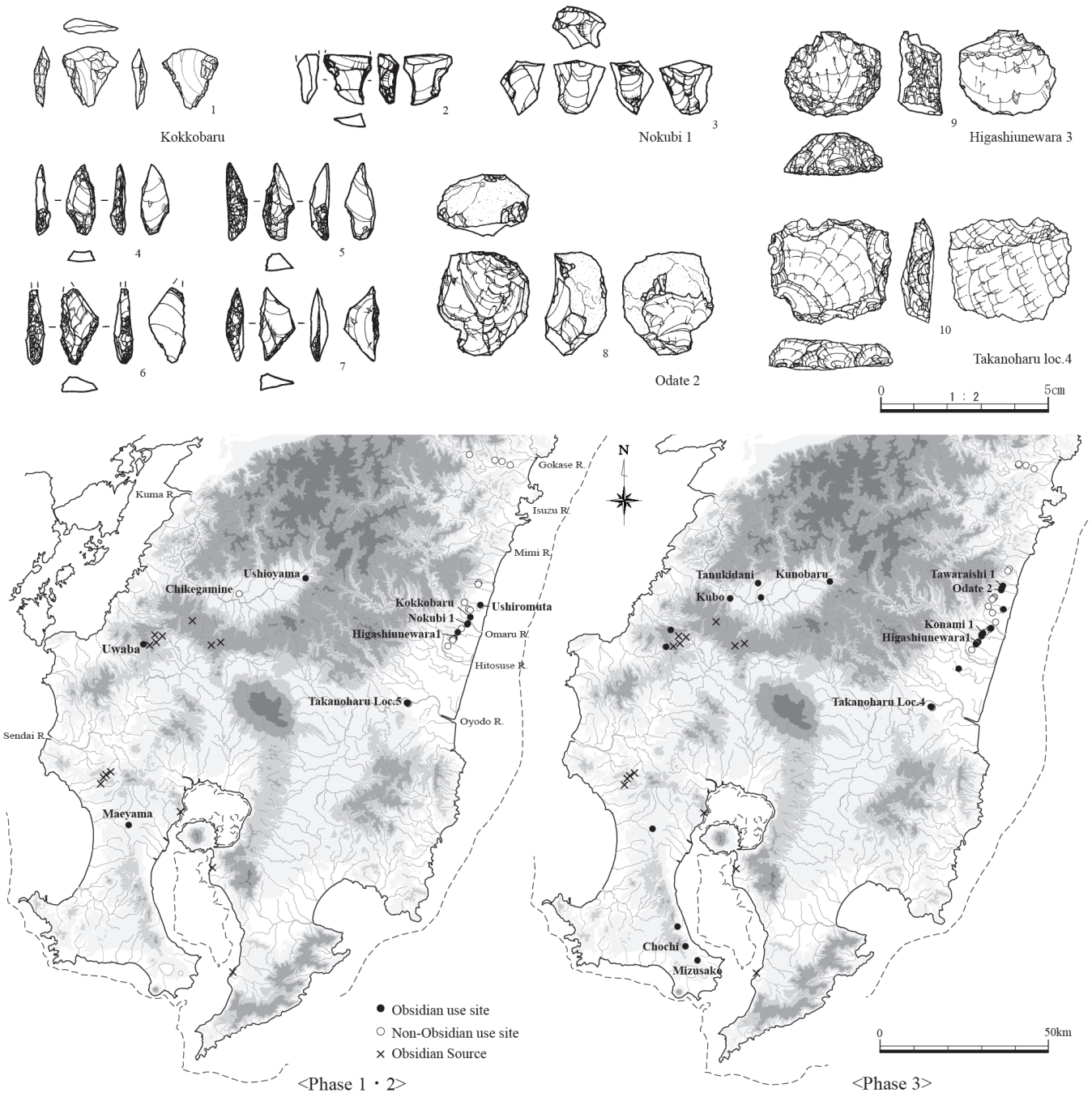


Figure 4 (Left page)
The Chronology of Upper Paleolithic in Southern Kyushu (modified from Miyata 2006)

1, 7-8: Retouched Flake, 2: Drill, 3: Pebble tool, 4: Chipped Axe, 5-7: Trapizoid, 10-14, 16-21, 35-38: Khife Shaped Point, 15,22: End Scraper, 23-25: Stemmed Point, 26-27: Tanukidani-type Bitruncated Point, 28-29: Imatoge-type Point, 30-32: Bilaterally Backed tool, 33: Kou-type Point, 34: Kou-type Point Core, 39-42: Trapeze, 43 Core for Trapeze, 44-49: Microblade-Core, 50-53, 54-61 Arrowhead, 53: Bifacial Point, 1-4, 6-9: Ushiromuta site, 5,10-12: Takanoharu site locality 5, 13- 15: Higashiunewara 3 site, 16-22: Kasugachiku site locality 2, 23-25, 39-43, 54-56, 59: Kirikimimitori site, 26-27: Mitsukuri site, 28-29: Kitaushimaki 5 site, 30-32: Jyogao site, 33-34: Nakanosako 1 site, 35-38: Nokubi 2 s ite, 44: Imazato site, 45: Nishimaruo site, 46: Ikemasu site, 47: Tsukabaru site, 48-49: Tateyama site, 50-52: Yokoitakenoyama site, 53: Asoharaue site, 57-58: Soujiyama site, 60-61:Fukiagekonakabaru site

Figure 5 (Above)
Lithics made of obsidian (above) and Site distribution (below) of Early Upper Palaeolithic on Southern Kyushu

began. It is also important to note that at the Uwaba and Maeyama sites, stone tools made of Kuwanokizuru, Kamiushibana, Mifune Obsidian are also present. Therefore, it is clear that all obsidian sources in southern Kyushu have been found and were developed during phase 2.

***Eastern Region*:** For the first period, we can confirm 1 laminar flake found at Uhiromuta (cultural layer 3) (Tachinaba *et al.,* 2002). Although the details are not known because it was not included in the publication, it may be one of the oldest uses of obsidian in southern Kyushu.

During phase 2, obsidian was used at several sites on the Miyazaki Plain; for example: Kokkobaru site cultural layer 1, Ushiromuta site cultural layer 2, Nokubi 1 site phase 1 industry, Higashiunewara 1 site phase 1 industry and Takanogharu site locality 5 cultural layer 2 etc. One trapeze made of Kuwanokizuru obsidian in Kokkobaru (Ando 2007), 4 stone tools (including a retouched flake) in Nokubi 1 site (Tanaka *et al.,*2004) (fig. 5: 1-3), 1 trapeze and a few flakes made of Nitto obsidian at the Higashiunewara 1 site were also found (Oyama 2006). It must be noted, however, that obsidian during this period was used in very small amounts. At the Takanoharu site locality 5, trapezes, with flat flaking adjustment, flakes and cores made of blue-gray obsidian have been recovered (Hidaka *et al.,* 2004). Even though the color of these types of obsidian is similar to Hario obsidian, there are differences in terms of texture and presence of impurities, and as a result it is thought that these do not come from the Hario source but perhaps from somewhere nearby.

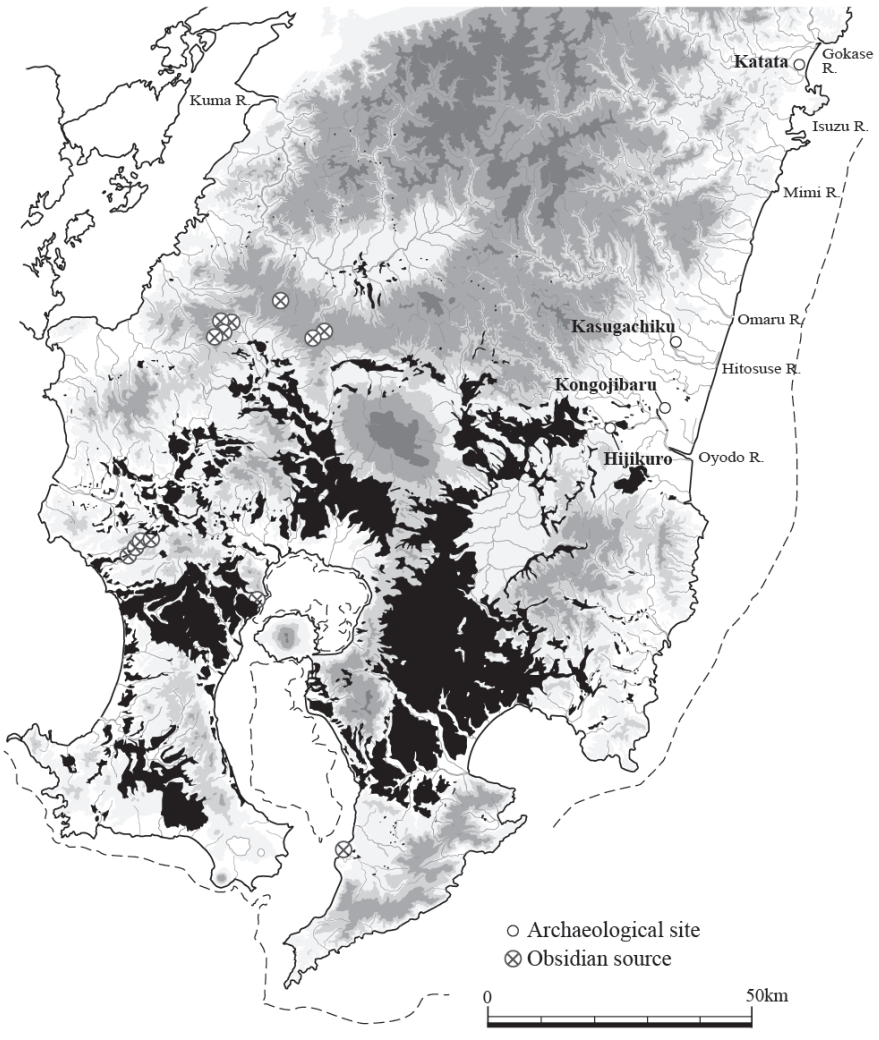


Figure 6 – Relaton between Ito pyroclastic frow (black part) and distribution of archaeological sites in phase 4

The lithic industries of phase 3 include Tawaraishi 1 site, Odate 2 site phase 2, Konami 1 site cultural layer 1, Onmyoji 2 site cultural layer 2, Kandaiji site cultural layer 1, Higashiunewara 3 site cultural layer 2, Nagasako 1 site locality 2 layer 9 etc. The Odate 2 site lithic concentration A comprises of stone tools of the Odate OX group almost all of which are made of obsidian from an unknown source (Kishida 2008) (fig. 5: 4-8). Stone tool production was most certainly taking place on site because firstly, all stagesof the *chaîne opératoire* are present (small knife blade, cores and flakes), and secondly, because several tool shave been successfully refitted. On other sites, however, lithic concentrations are quite rare, and the amount of stone tools or even flakes is usually quite small. A broken knife-shaped tool and several flakes were found at the Konami 1 site (Kuriyama and Nagatsu 2007) and the Onmyo ji 2 site (Yamaguchi 2003) discarded after having been consumed beyond repair. We should also mention the characteristic circular scrapers made of Nitto obsidian such as the ones found at the Takanoharu site 4 (Hirota 2002) and Higashiunewara 3 site (Fukumatsu *et al.,*2004) (fig.5: 9-10). These are also finished tools carried from a different site. Besides these, about 30 flakes made of Zogahana tuff have been excavated at the Tawaraishi 1 site (Yokoyama and Imashioya 2011), which constitutes the

earliest exploitation of lit hic raw material from central Kyushu on the Miyazaki Plain. There are several flakes of what has been described in the publication as NW Kyushu obsidian, such as Koshidake and Hario, found at the Higashiunewara 1 site cultural layer 1 and one small knife-shaped tool found at the Konami 1 site. However, this hypothesis has not yet been confirmed through physicochemical analysis.

Even though the use of obsidian in southern Kyushu cannot be completely verified during phase 1, its use is attested with certainty during phase 2 by the small flake tools. It must be noted that in phase 2 almost all of the currently known obsidian sources were in use. Later, in phase 3, Nitto, Kamiushibana and Mifune obsidian were carried in southwestern Kyushu, whereas Nitto and Kuwanokizuru obsidian were carried in the southeastern region. Lithic raw materials of central Kyushu were used on the Miyazaki Plain. In addition, the quantity of obsidian used on sites increased. The proportion of obsidian used in phase 2 is not so high in these areas; during phase 3, however, the situation changed in both regions. In southwestern Kyushu there are industries in which obsidian is used mainly on the Hitoyoshi basin, and on-site production is evidenced on the Satsuma Peninsula. The overall quantities of obsidian however were still small, as was the scale of stone tool production using obsidian in southeastern Kyushu. In addition, reliable examples of stone tools made of NW Kyushu obsidian cannot be confirmed at present.

C – The second half of the Upper Palaeolithic

Phase 4

The following industries can be dated to phase 4 after the AT ash fall: the Katata site, Kasugachiku site locality 2, Kongojibaru 1 site, and the Hijikuro site on Miyazaki Prefecture (fig. 6). At present the sites in the region of the Miyazaki Prefecture are the only one for which we can be fairly sure they belongs to phase 4. Obsidian was used to make one scraper at Kongojibaru 1 (Miyashita1990) and four flakes at Hijikuro (Fujiki 2005). Techno-morpho logically there areknife-shaped points similar to those from phase 3, but the characteristic obsidian tool cannot be seen in these sites. Regarding this issue, Fujiki (2011) proposed that the Aira caldera where obsidian sources are located is no longer available, possibly. Because the recovery of the vegetation from damage of Ito pyroclastic flow was very slow. However, obsidian is not completely absent: the small quantities present at sites need to be carefully evaluated.

Phase 5

126 sites with tanged points have been excavated (JPRA2010); the number of sites increases to more than 130 if we add to this the excavated sites where Tanukidani type bitruncated points and Imadoge type points were found. Compared to phase 4, the number of sites increases dramatically (fig. 7, below left).

***Western Region*:** In the Hitoyoshi basin, obsidian was not used for tanged points, but it was used for other tools found in the same assemblages. Trapezes made of Kuwanokizuru obsidian have been found at Tendogao (Nisjizumi 1990). In addition, obsidian was used for the knife-shaped points and trapezes at Daimaru-fujinosako (Kizaki 1986), Kogamine (Nishizumi 1986), and at Shiratoribira A (Miyazaka 1993). However, since bilaterally backed tools have been found at all of the sites, the possibility cannot be denied.

At Dozonobira on Kagoshima Bay West Coast Hills on the Satsuma Peninsula, Imatoge knife-shaped points made of obsidian were found in addition to tanged points (Sangawa 2006) (fig. 7: 1-6). Thirty-four out of fifty knife-shaped points that were excavated were made of obsidian, primarily Kamiushibana obsidian and secondarily Mifune obsidian. Furthermore, four knife-shaped tools made of NW Kyushu obsidian were presumably found on this site as well. Of these, knife-shaped blades and Tanukidani type bitruncated points were made of Hario obsidian, while the Imatoge type point was made of Koshidake obsidian. Both tools must have been discarded as either defective or overused. In this region, there is a tendency for obsidian to be used for the manufacture of bitruncated points. For example, at the Shimotsukiden site in

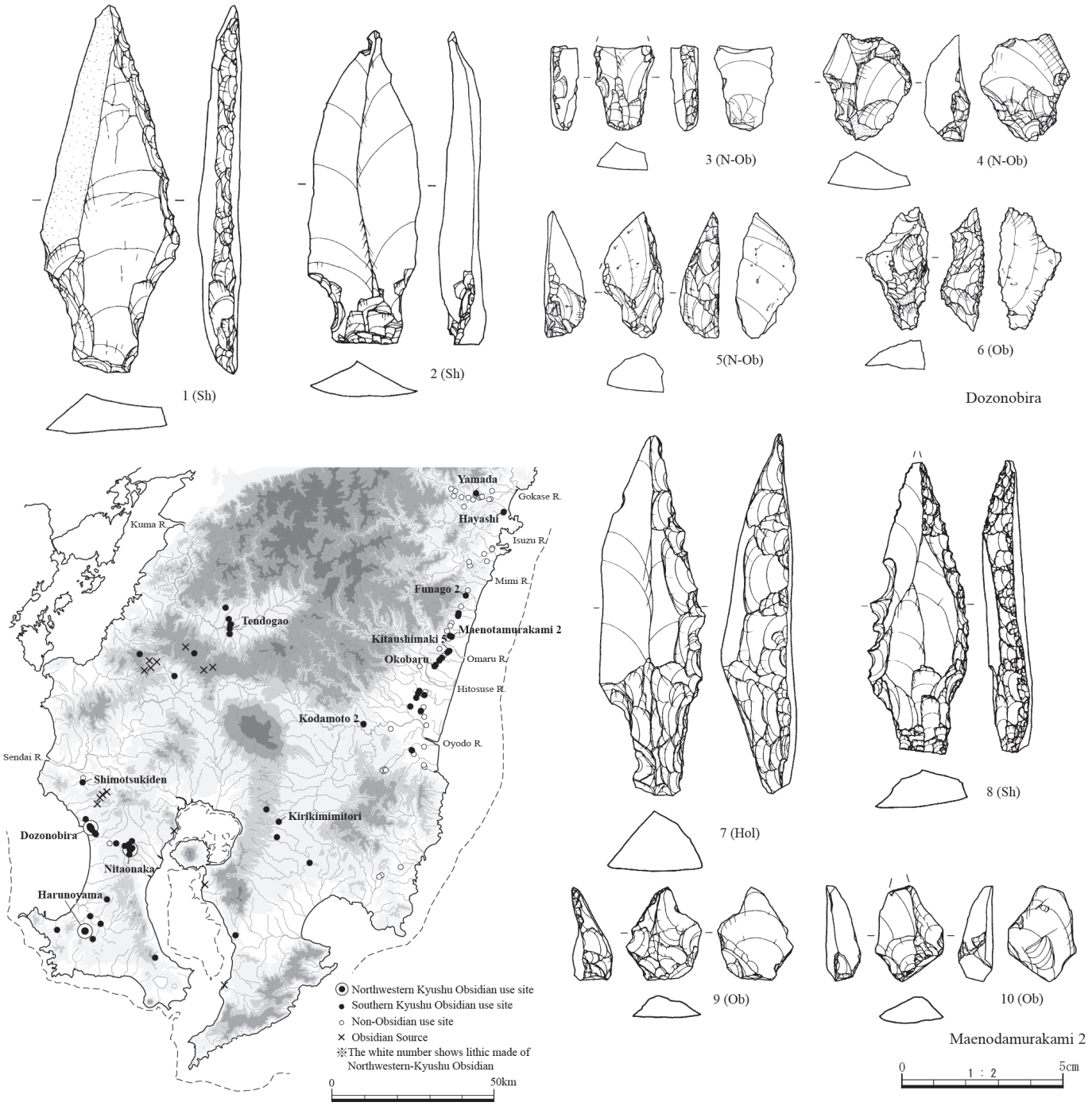


Figure 7 – Lithics (above and below right) and Site distribution (below left) of phase 5 in Late Upper Palaeolithic on Southern Kyushu

the region downstream of Sendai river (Iwaya *et al.,* 2008), four out of five are made of this type of obsidian and at the Okariya-ato site locality B four out of eight were made of one type (Konohara and Minei 2006). At Nitao a large amount of knife-shaped points was excavated made of Mifune and Kamiushibana obsidian (Miyata 2008). In rare cases, some of them were made of Nitto and Kuwanokizuru obsidian, and in one case a knife-shaped point was made of Hario obsidian. The use of NW Kyushu obsidian for Tanukidani type bitruncated points is also attested at the Harunoyama site on the Ibusuki Mountains. Knife-shaped tools and scrapers made of Hario obsidian have been excavated in the eastern part of this site (Uehigashi *et al.,* 2002).

There are two characteristic traits of obsidian use in phase 5 in the western part. Firstly, obsidian is not used for tanged points. However, southern Kyushu obsidian is consistently used for other tool types. Secondly, a small amount of NW Kyushu obsidian was used for bitruncated points and Imatoge type points. The latter trait

is particularly important, as it constitutes a major change in obsidian use patterns in southern Kyushu.

***Eastern Region*:** Obsidian stone tools have been found at the Yamada and Hayashi sites of Gokase River valley. In the Gokase River valley, the use of southern Kyushu obsidian had not been recognized at all prior to this making this the first occurrence of obsidian use. These are either knife-shaped tools or retouched tools. The quantity of obsidian used was very limited. At Yamada only one scraper made of Kuwanokizuru obsidian has been found (Akasaki 2007), at the Hayashi site, however, in addition to the knife-shaped point, stone tools made of obsidian such as Nitto and Kamiushibana obsidian were excavated (Higashi *et al.,*2008). However, it is possible that the obsidian bilaterally backed tools may be later in time in that case.

The secure examples at the Miyazaki Plain, including the Gokase River valley, are one bitruncated point at Funago and Okobaru, four knife-shaped points including an Imatoge type point at Maenotamurakami 2, four trapezes at Kitaushimaki 5, and one tanged point at Kodamoto 2. Outside of this area, flake-dominated industries have been found at a dozen of sites on the south of the Omaru River on the Miyazaki Plain.

At Menotamurakami 2 knife-shaped points made of Kuwanokizuru and Nitto obsidian have also been found (Shimada 2007) (fig. 7: 7-10). Both the large tanged point industry and the bilaterally backed tool industry have been recovered from different stratigraphic layers at this site; small flake tools are associated with the former industry. The knife-shaped points produced small oblique flakes, similar to the Imatoge type points. Since in both cases damage or macro-flaking is observed, it is clear that they were used and discarded. There are also trapezes made of Kuwanokizuru obsidian at the Kitaushimaki 5 site, in which Imatoge type points are the majorit y (Kusanag i and Yamada 2003). It is hard to fit them in any of the existing trapeze types; their main characteristic is that they are sharpened at the base. What is referred to as a tanged point made of obsidian from Kodamoto 2 is also problematic with regard to its morphology, because the notch adjustment is weak and does not look like typical microblade material (Shimada 2003). However, X-ray fluorescence analysis had determined that the tool was made of Mifune obsidian, providing therefore solid evidence of the transportation of Mifune obsidian to the Miyazaki Plain.

At the Kirikimimitori site (cultural layer 1) at the 15tharea on the Takakuma Mountains, knife-shaped points using the oblique flakes were excavated (Nagano *et al.,*2005). These are round and more than 5 cm long; they have not been found on the Miyazaki Plain described above. They were most likely produced on site because they are made of Nitto and Mifune obsidian and we have also found cores and flakes from the same raw materials.

As mentioned above, in general, obsidian is not used fortanged points in the eastern region. However, obsidian is used for Tanukidani type bitruncated points and Imatoge type points that may be found alongside tanged points. In order to understand this, we would need to research both the Miyazaki Plain and the Takakuma Mountains. Obsidian use in the former region is limited and no traces of on site production have been found at present. In addition, stone tool size is also generally small. This tendency is similar to that in phase 3. On the other hand, in the latter region, there is evidence of on site production, and the tool size is larger.

Phase 6

There are 126 sites in total where bilaterally backed tools have been found (JPRA 2010) (fig. 8, below). It is thought that the appearance of bilaterally backed tools goes back to the phase 5. What follows is a comprehensive discussion of this.

***Western Region*:** In the Hitoyoshi basin, the use of obsidian for bilaterally backed tools, though not extensive, has been established. Although there is almost no detailed description in the publication (Miyasaka 1993), judging from the photo provided, it seems that Kuwanokizuru and Nitto obsidian were used. It has been noted that

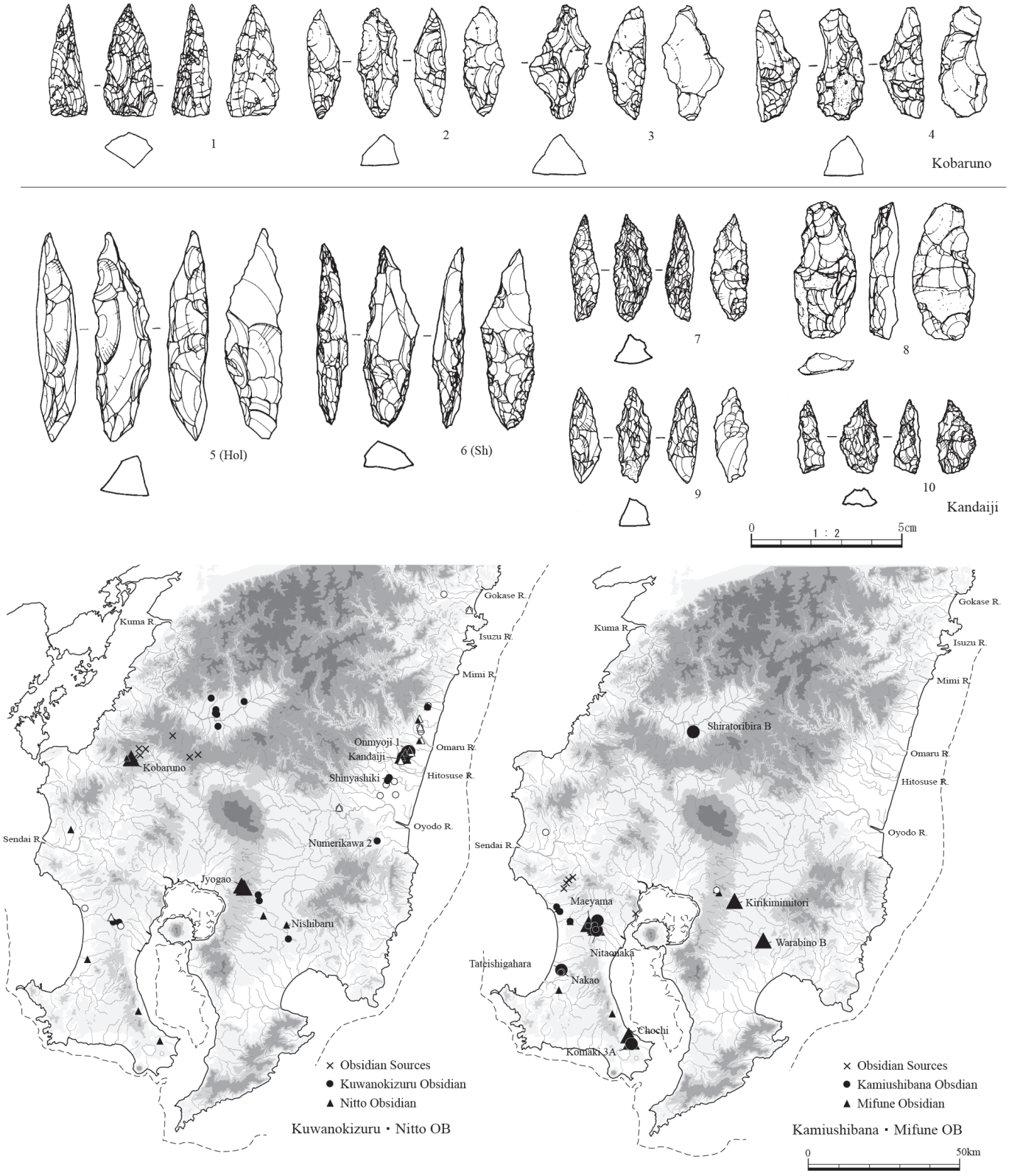


Figure 8 – Lithics (above) and Site distribution (below) of phase 6 in Late Upper Palaeolithic on Southern Kyush

bilaterally backed tools were made of Kamiushibana obsidian at Shiratoribira B site. Eight out of the ten tools were made of this obsidian; flakes and debitage have been also recovered (Miyasaka 1994). It appears that the flakes were brought as raw materials to the site because no cores were found. The case of Shiratoribira B, a highly isolated site with access to Kamiushibana obsidian, has to be carefully studied.

Around the area of the Nitto obsidian source, the production loci of bilaterally backed tools are scattered at such locations as the Kobaruno, Okubo and Asahidake B sites. In particular, stone tools reaching as many as 300,000 have been excavated at the Kobaruno site, which is located at an altitude of 500 masl. Even though not all of these are dated necessarily to phase 6, seventybilaterally backed tools, ranging from medium to small size, were excavated, and it is possible to say with certainty that the production loci must be in the vicinity (Nakamura 1999) (fig. 8: 1-4). At the Okubo site, ten bilaterally backed tools have been excavated in an area of about 80 square meters, eight of which are made of Nitto obsidian (Iwasaki 2007b). The other two were made of Kuwanokizuru obsidian; knife-shaped points have also been recovered at the same site. The site had very dense concentrations of lithic material. The fact that stone tools made of Kuwanokizuru obsidian were also found is important for our understanding of human mobilitypatterns.

The industry including bilaterally backed tools has been distributed abundantly throughout the Kagoshima Bay West Coast Hills. At these sites, bilaterally backed tool made of obsidian are made of either Mifune or Kamiushibana obsidian predominantly. At the Maeyama site culture layer 3 lithic concentration (LC) 12, twelve of thirteen bilaterally backed tools are made of obsidian, seven of which on Kamiushibana and five on Mifune obsidian (Sangawa *et al.,* 2007). A similar situation can be seen at Nitaonaka A and B sites. 122 bilaterally backed tools were excavated in this site, 96 of which are made of obsidian and half of those of Kamishibana obsidian, while the other half is made of obsidian from Mifune, Nitto, and Kuwanokizuru. The lithics made of Nitto obsidian included deficient bilaterally backed tools and scrapers (Nagano *et al.,* 2007). These round scrapers were typical in south-eastern Kyushu during phase 3, but they are also seen during this phase in south-western Kyushu.

While Mifune or Kamiushibana obsidian are predominant, Nitto and Kuwanokizuru obsidian are included in a fixed amount on Ibusuki Mountains and the Ata Caldera region. At the Tateishigahara site, all six bilaterally backed tools are made of Kamiushibana obsidian (Nakamura *et al.,* 2005); the same trend can be observed at the sites Arata, Nakao, Kashiranashisakoda located in the vicinity. There is one bilaterally backed tool made of Nitto obsidian at Nakao and one scraper also made of Nitto obsidian found at the Sakuradani site (Seki *et al.,* 2009). As described above, the fact that Nitto obsidian is often used in this region is remarkable in that it is a phenomenon rarely seen other than in phase 6 (fig.8: below left).

One of the characteristic traits of this phase in the western region is the presence of a Nitto obsidian source site. This site has produced a large amount of bilaterally backed tools in Kobaruno, and there is also a similar situation at a nearby site. This has not been observed in the previous phase. The other characteristic is that the consumption of Kamiushibana and Mifune obsidian seems relatively increased and the lithic industries in which obsidian is the preferred raw material have also increased (fig. 8).

Eastern Region : Although examples from the Yamada and Hayashi sites on the Gokase River valley of phase 5 could actually belong to phase 6, the obsidian used for the bilaterally backed tool industry was found on the Omaru River basin. At the Odate 2 site phase 3 industry, bilaterally backed tools made of Nitto and Kuwanokizuru obsidian were excavated (Kishida 2008). In particular, Nitto obsidian has been also used to produce scrapers and flakes, which form large lithic concentrations. At present, this is the northernmost site with evidence for on-site production. In addition to this, several knife-shaped points trapezes made of obsidian have been excavated at Tawaraishi 1 located on the Omaru River basin (Yokoyama and Imashioya 2011).

In the sites between the Omaru and Hitotsuse rivers, the use of obsidian is common but quantities vary (fig. 8: below left). It should be noted that the existence of industries with a largeamount of stone tools made of obsidian were found. For example, 65 bilaterally backed tools made of obsidian out of 186 have been excavated at the Kandaiji site (Tategami 2007). Jet-black color obsidian from Hishikari, similar to the Kuwanokizuru variety, is the primary raw material, alongside Nitto obsidian. Small tabular nodules

of Hishikari obsidian constitute the raw material for the bilaterally backed tools (fig. 8: 5-10). On-site production most probably took place there as suggested by the unfinished tools that were also found. At Onmyoji 1, twenty-six bilaterally backed tools have been excavated, seven of which made of obsidian (Yamaguchi2003). The large amount of flakes excavated, clearly suggests on-site production, even though at a smaller scale than at Kandaiji. In addition, the sites also produced 1-5 bilaterally backed tools made of obsidian is evident and there are many industries such as the ones at Nakanosako 1 (2 of 8), Konami 1 (1 of 9), Makiuchi 2 (3 of 13), Higashiunewara 1 (2 of 16), Uenoharu (6 of 57), Shinyashiki (4 of 22) etc. Nitto and Kuwnaokizuru obsidian, including Hishikari, is often used, but north-western obsidian is never used. The proportion of each type of obsidian at these sites is equally low.

On the Takakuma Mountains obsidian exploitation patterns are completely different from those on the Miyazaki Plain. In this area the type of lithic raw material used for the bilaterally backed tools is obsidian. Moreover, obsidian from all the sources in southern Kyushu has been used. At the Nishibaru site, large bilaterally backed tools, more than 5 cm long, have been found (Maesako and Yokote 2008): 6 of 15 are made of obsidian and it is possible that most of them are Nitto obsidian based on macroscopic observations. At the Jyogao and Tateyama sites, small to medium-sized bilaterally backed tools predominate, the majority of which was made of Nitto obsidian. At Jyogao, 60 of 104 bilaterally backed tools are those made of obsidian and it is believed that 42 of these were made of Nitto obsidian (Arima *et al.,* 2003); some were also made of Kamiushibana and Kuwankizuru obsidian. This situation can be also seen at Warabino B, where many preparation flakes and blanks have been found (Kubota *et al.,* 2007).

As explained above, in the eastern part, the appearance of the obsidian used is notably different from that found on the Takakuma Mountains and the Miyazaki Plain. However, the exploitation of obsidian has increased significantly in both areas compared to the previous phase, which is undoubtedly one of the most important traits of these industries. At sites on the Miyazaki Plain large amounts of Kuwanokizuru and Nitto obsidian have been found, along with evidence for on-site production. Moreover, it is important for our understanding of the mobility of the population that such industries were distributed intensively from Omaru River all the way to Hitotsuse River. Bilaterally backed tool industries were distributed in many regions of the Miyazaki Plain, attesting to the intensive consumption of obsidian in the region. The concentrated distribution of obsidian consuming sites can be seen in the micro-blade industries below. It is not clear whether Kamiushibana and Mifune obsidian were used, but if they were, only a very small amount of them was used. On the other hand, the lithic industries on the Takakuma Mountains are characterized by the large number of bilaterally backed tools made of Nitto obsidian (fig. 8, below right). This is considered to be a temporary phenomenon as this is a pattern observed primarily after phase 7 (see below). However, this is important, as is the problem of the formation of Nitto obsidian source site described above, since they pertain to issues of interaction and mobility patterns.

Phase 7

These industries include both small knife-shaped points and trapezes in the second half of phase 7, with bilaterally backed tools included in the first half. The number of sites decreases compared to the phase before and the one after; there are currently approximately 40 sites (Matsumoto 2005; Shiba 2011).

***Western Region*:** The number of sites is quite low, however, there is a large amount of stone tool production sites that exist on the Satsuma Peninsula. Setogashira A and B, Okariya-ato B, Nishino hara B, Maeyama cultural layer 3, Nitao cultural layer 2, Nitaonaka A-B cultural layer 2 correspond to these industries. As a general trend, Kamiushibana and Mifune obsidian accounted for the overwhelming majority, with shale, chert, chalcedony, agate, and iron quartz following. These lithic raw material proportions are the same for every tool type. It is important to note that NW Kyushu obsidian was found in small amounts in the industries of this region. In Maeyama andNitaonaka A-B site,the trapezes and detached flakes made of Hario obsidian were

included. On the Ibusuki Mountains, the ratio of obsidian is low, with shale, agate, and chalcedony taking the lead. The Miyanoue site is the shale source site of this phase, butthere are also small amounts of Kamiushibana and Mifune obsidian tools (Magome 2010). This combination of lithic raw materials is thought to reflect the history of the mobility route.

As shown above, large quantities of Kamiushibana and Mifune obsidian were consumed in this region. This situation remains much the same as in phase 6; it was noted, however, that several stone tools made of NW Kyushu obsidian were also found in the assemblages.

***Eastern Region*:** The most important sites of this phase are the following: Obana A, Nokubi 2, Kodamoto2, Jyogao cultural layer 3-4, Kirikimimitori cultural layer 2. While the raw material preference is as diverse as that of the western region, there is a significant difference based on a detailed terrain classificat ion. On the Miyazaki Plain, the frequency of obsidian use is extremely low. At Nokubi 2 located in the Omaru River basin, the raw material for knife-shaped points is mainly siliceous shale, although a certain amount of rhyolite, chert and obsidian are also utilized (Ozono *et al.,* 2007). Only 3 of the 85 are made of Kuwanokizuru obsidian; 2 of the 3 are fragmented. In small trapezes, chert is preferred with only 2 of the 58 made of obsidian. At Obana A, siliceous shale is the main rock, and hornfels, rhyolite and Kuwanokizuru obsidian is also used (Deyama *et al.,* 2009). The obsidian tools are finished products. At Kodamoto 2, eight small knife-shaped points have been excavated, one of which is made of Kuwanokizuru obsidian (Shimada 2003).

At Jyogao, knife-shaped tools were manufactured using various materials such as obsidian, shale, chert, chalcedony etc. (Arima *et al.,* 2003); however, more than 90% of the knife-shaped tools were made of obsidian at the Kirikimimitori site, cultural layer 2, LC12. Obsidian is often used for small trapezes, with the preferred raw material beingKuwanokizuru obsidian (Nagano *et al.,*2005). At Jyogao, many knife-shaped tools made of Kuwanokizuru obsidian have been excavated with two of them made of Hario obsidian.

It is necessary to consider separately the eastern region of the Miyazaki Plain and the Takakuma Moutains during this phase. In the former, the frequency of obsidian use is reduced compare to that of phase 6. Although the number of sites is low, the industries' formal tools are abundant, such as those found at Nokubi 2; only a few obsidian tools are found and on-site production is not taking place. On the other hand, in the Takakuma Mountains, Nitto obsidian is consumed in large quantities during phase 6. However, while in phase 7 obsidian is consumed in large quantities, evidence of stone tool production has also been found. In both regions the size and shape of the tools are also slightly different, which should be the focus of future studies.

D – From the final phase of the Upper Palaeolithic to thebeginning of the Jômon Period Phase 8-9

Microblade industries have been found at 311 sites (JPRA 2010). In the phase characterized by the microblade industries, the number of sites with obsidian increased dramatically, and obsidian is found in all regions except for one part of the Miyazaki Prefecture (fig. 10). This is a new trend that develops during this phase.

***Western Region*:** In the Hitoyoshi basin, Kuwanokizuru obsidian is the main raw material used. At Jyobaba 2 and Shiratoribira A, all macroblades and macroblade cores are made of this obsidian. At Uwaba layer 3, twenty-three microblade cores were excavated eight of which were made of Koshidake, two of Hario, and seven of Kuwanokizuru obsidian. Micro-blades made of Koshidake obsidian comprised 67% (104 of 155) (Iwasaki 2007a). Fifty-eight of the seventy-two micro-blades and the majority of microblade cores collected were made of NW Kyushu obsidian at the Shirinashibira site on the Nagashima Island (Ikezaki and Yoshidome 1979). A similar situation is also attested for the microblade industries located on the Izumi Plain.

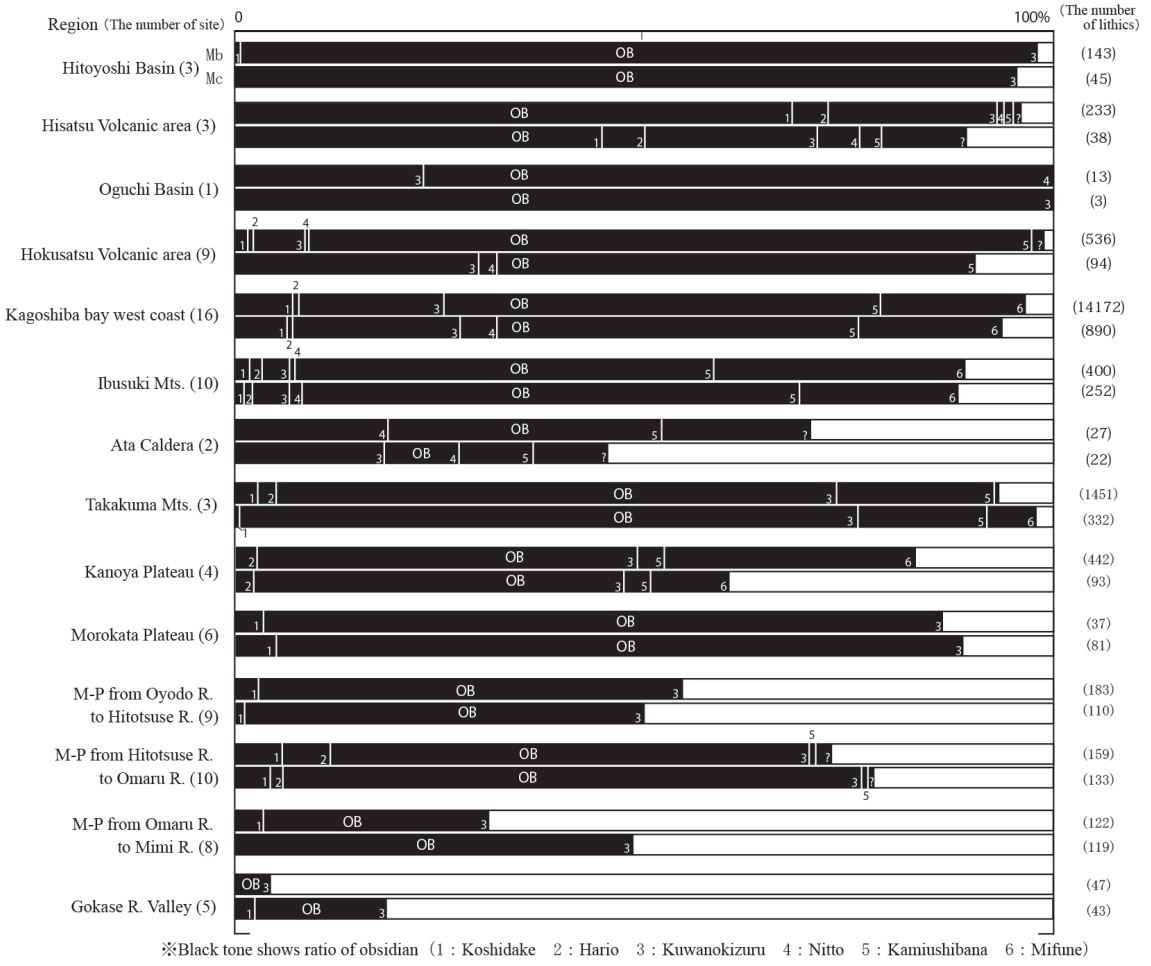
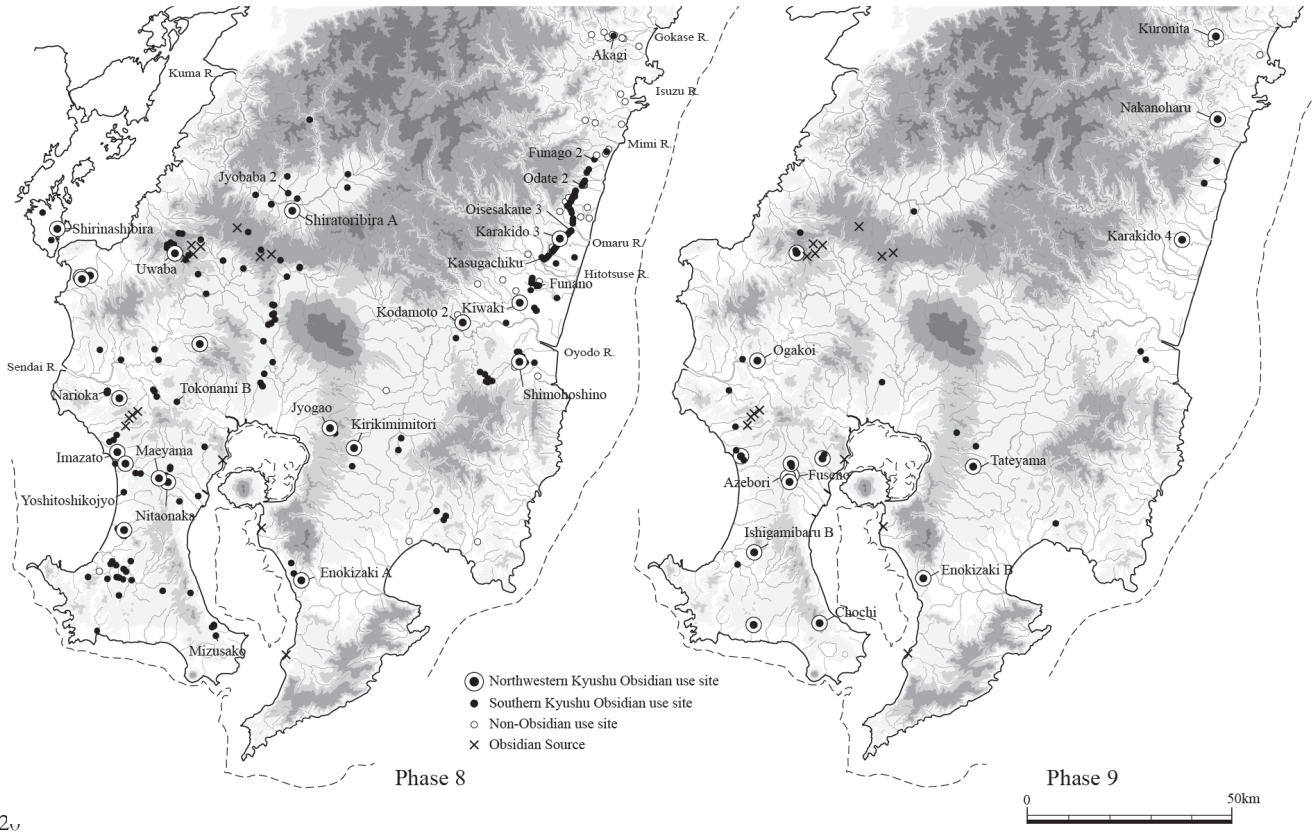


Figure 9 (Above) – The Ratio of Obsidian use in Microblade Industries on Southern Kyushu (Modified from Shiba 2011)

Figure 10 (Below) – The Site Distribution of Microblade Industries on Southern Kyushu



However, the situation is different south of the Okuchi Basin and in the Hokusatsu volcanic area. The amount of NW Kyushu obsidian circulating among the sites sharply decreased; on the contrary, the frequency of use of southern Kyushu obsidian increased. At the sites in upstream the Sendai river, the lithics made of Kuwanokizuru obsidian are the main ones and Kamiushibana obsidian is also included. On the other hand, at the sites in the middle of and downstream of the Sendai, the sites, located behind the Kamiushibana source, show an intensive consumption of this type of obsidian. Tokonami B, Kamuragasako, Narioka B-C and Oharano are the most important of these sites. At Tokonami B site 408 microblades and 27 microblade cores were found, all made of Kamiushibana obsidian except for one of the cores (Dokome 1993). At Narioka site LC B lithics made ofKuwanoizuru obsidian constitute the majority of the assemblage (Ushinohama and Miyata 1985).

On the Kagoshima Bay West Coast Hills, Kamiushibana and Mifune obsidian are the main raw materials. One of the traits of obsidian use in this region is that o only a few microblade cores made of NW obsidian were found on site. However, even in sites where they are present they are very few; such is the case at Imazato, Dozonobira, Maeyama, Nitaonaka A-B and Okariya-ato B etc. At Imazato and Nitaonaka A-B in particular, lithics made of Kamiushibana obsidian are the majority. At Imazato, 73 of the 101 macroblade cores were made of this obsidian, similar to what is happening downstream of the Sendai River described above (Hashiguchi 2002). Nitaonaka A-B yielded a very large assemblage of 667 macroblade cores and 12,782 macroblades in total. The proportions of different types of obsidian used for the manufacture ofmacroblades are the following: 55% (n=7166) made ofKamiushibana obsidian, 18% (n=2330) of Kuwanokizuru and 15% (n=1931) Mifune obsidian. The macroblade Miyagasako (Yagisawa *et al.,* 2000) and Setogashira A (Dokome *et al.,* 2005), Mifune obsidian dominates theassemblages. The fact that either Mifune or Kamiushibana cores have almost the same ratios (Nagano *et al.,* 2007). Dozens of the macroblade core are thought to have been made of Koshidake obsidian. On the other hand, at obsidian is dominant is an important development for this phase, as it shows the distance travelled between the obsidian source and the sites where it was found.

The most common routes of population mobility most likely involved the procurement of the type of obsidian mostly used. However, there are sites, such as Maeyama (Sangawa *et al.,* 2007) and Yoshitoshikojyo (Tsuneta *et al.,*2007) where Kuwanokizuru obsidian predominates. We believe thatKuwanokizuru obsidian was procured and used only for macroblades knapped using the Funano technique for which almost no other type ofobsidian was ever used. The situation at the Ibusuki Mountains area is similar to that in the western coast of the Kagoshima plateau. However, there is no site where microblades are made using Kuwnaokizuru and NW Kyushu obsidian in the region, which is quite different from what is found in the northern region. Komaki 3A and Mizusako are located in the southern Kyushu volcanic area.

In the former, microblade production on crystal quartz is predominant, with obsidian being secondary (Nagano 1996). On the other hand, in the latter, obsidian is the main raw material, among the 7 microblade-cores, 2 Kuwanokizuru, 2 Mifune and 1 Kamishibana obsidian (Shimoyama *et al.,* 2002). However, both microblades and microblade cores are also very small; the length is on average 2 cm less. Most likely this indicates that they must have been discarded after being exhausted.

According to the existence of the NW Kyushu obsidian and composition rate of each obsidian source in southern Kyushu, there are delicate differences in obsidian consumption based on a detailed terrain classification (fig.9).

***Eastern part*:** On the Gokase River valley rhyolite seems to be the exclusive raw material. The Akagi site is one such example (Nobeoka city 1987). In this region, the quantity of stone tools made of Kuwanokizuru obsidian is very small, but present nonetheless.

On the Miyazaki Plain a certain degree of unity is observed in the lithic raw material

used in the region between the rivers Mimi and Omaru; that is, the component ratio of non-obsidian raw materials and obsidian is approximately the same. In this area rhyolitecan easily be found at the banks of Gokase. In this area, industries using Kuwanokizuru obsidian can be found only at the Kirishima site. The industries in which the proportion of both obsidian and non-obsidian is almost the same are mentioned and they include sites such as Maenotamurakami 2, Tateno 5 site and Odate 2.

In between the Omaru and Hitotsuse rivers, Kuwanokizuru obsidian is used in many cases at sites such as Kasugachiku site 2, Oisesakaue 3, and Onmyoji 1. At Karakido 3, two microblade cores were made of Hario obsidian. Since preparation flakes were also found, on site production of microblade is almost certain.

In the assemblages found at sites between the Hitotsuse and Oyodo rivers, both obsidian and non-obsidian raw materials are used. The sites Funano 1 and 2 illustrate this trend (Tachibana 1975). Kuwanokizuru obsidian is the main material used at the former, whereas at the latter, all microblade cores are made of hornfels and shale; Kuwanokizuru obsidian is used only for the microblades.

At the Shimohoshino and Kiwaki sites located in the lower reaches of Oyodo river, microblades are produced using Kuwnaokizuru or Kirishima obsidian. One microblade made of Koshidake obsidian was found at both sites (Torihana 2001); one microblade core made of Kamiushibana obsidian, which is rare in this region, was also found.

On the Takakuma Mountains the main types of obsidian are Kuwanokizuru, Kamiushibana, and Mifune obsidian at different proportions for each site. Lithics made of NW Kyushu obsidian are also found, but there is only small amount in these industries. A lithic concentration consisting of about 20 microblades made of Koshidake obsidian was excavated at the Kirikimimitori site (Nagano *et al.,* 2005); however, there were no indications of om-site production, but rather it seems that the stone tools had been brought in as finished products. At Nishimaruo located south of the Takakuma Mountains, microblade production on Mifune obsidian dominates the assemblage (Miyata 1992). Evidence of production is scarce, but several microblades and microblade cores made of Kamiushibana obsidian have also been found. At Enokizaki A microblade production on Kuwanokizuru obsidian is the main industry, even though there are also two microblades made of Hario obsidian (Aosaki *et al.,* 1992).

One characteristic trait of the southeastern Kyushu area is that Kuwanokizuru obsidian is commonly used along with small amounts of NW Kyushu obsidian, such as Koshidake and Hario. However, there are differences in the use ratio of obsidian and

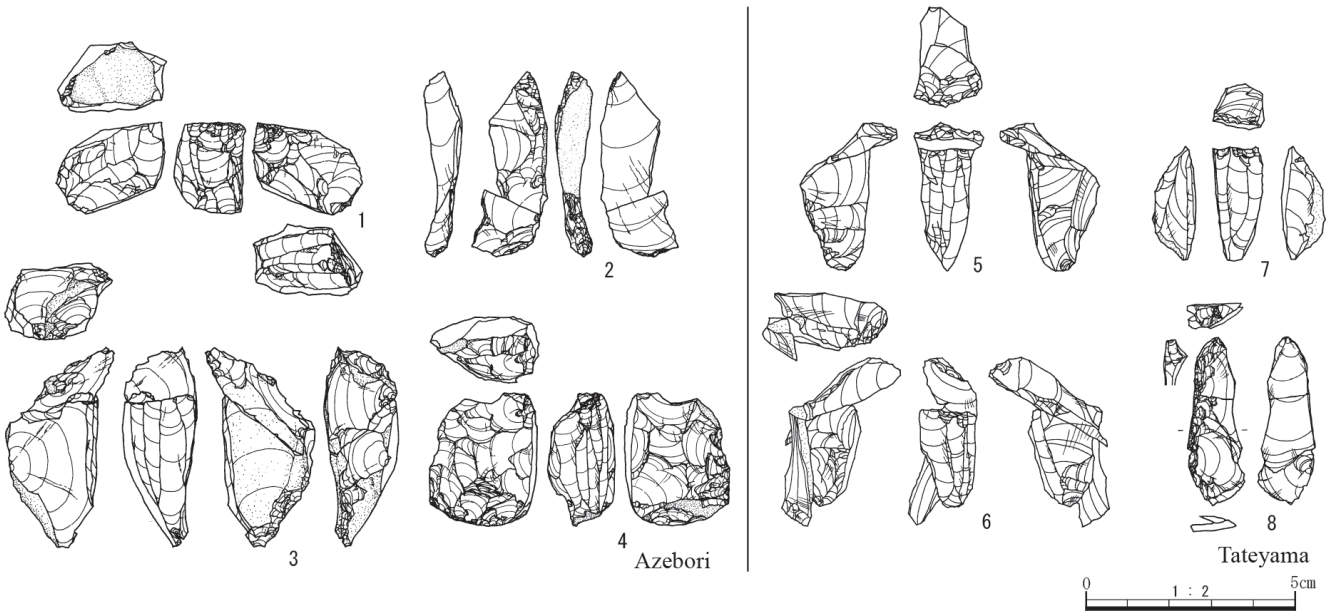


Figure 11 – Microblade-cores and Spalls made of NW Obisidian of Phase 9 on Southern Kyushu

non-obsidian for each terrain category. The former predominates in the south and the latter is common in the north (fig. 9).

This way obsidian is used in southern Kyushu (east and west regions) is essentially specific to the microblade phase. In phase 9, however, large amounts of NW Kyushu obsidian are also used. This is observed throughout the entire area of southern Kyushu and is particularly prevalent in the western part of the island. The specific industries where this trend is visible come from the following sites: Azebori, Fuseno, Tateyama, Karakido 4, and Kuronita site. In all these sites microblades and microblade cores made of NW Kyushu obsidian have been excavated. Especially at Azebori (Nagano *et al.,*2006) and Tateyama (Yae *et al.,* 2009), a fixed amount of the NK obsidian was introduced to the degree that it formed several lithic concentrations (fig. 11). The microblade technology used is the Fukui technique; biface blank and several large flakes are brought on the sites to make microblade cores and then produce microblades. At Enokizaki B (Inoue *et al.,* 1993) and Kuronita (Hirayama 2009), both typical sites for southeastern Kyushu, a simple technique with no core preparation was used.

Phase 10

The raw material used for the manufacture of arrowheads varies depending on whether or not they were associated with the micro blade industry. Non-obsidian materials, such as black andesite were mainly used at Kakuriyama (Aosaki 1981) and Yokoitakenoyama (Deguchi 1990) accompanied also by microblades (Miyata 1996). However, a large amount of Ryutaimon pottery decorated with clay ridges, was excavated at sites such as the Kakoinohara (Uehigashi *et al.,* 1998) and Sojiyama (Deguchi 1992), where obsidian is the main lithic material used. It is also important that the lithics made of Kuwanokizuru obsidian were transported to Tanegashima Island. However, since no evidence of on-site production have been observed, all of these were likely to have been brought in as finished products. It is worth noting that, while in the 'Ryutaimon', thick liner-relief, pottery phase, the microblade industry changed over completely to the arrowhead industry, inphase 10 obsidian use began to take over once again and, in particular, the use of Kuwanokizuru obsidian. This phenomenon is common in the southeastern and western Kyushu (Shiba 2011). During this phase the two most common types of arrowheads are the flat-based equilateral or isosceles triangular points: the former mainly appears before emergence of Ryutaimon pottery, while the latter is associated with the Ryutaimon pottery phase. However, after this phase, additionallyto these two types, more types appear such as the elongated triangular, the tear drop-shaped and clear convex-based types. It is important to mention that certain types of arrowheads are made on specific raw materials: small points tend to be made of obsidian, in particular Kuwanokizuru, whereas larger ones are made non-obsidian materials, such as andesite and shale.

5 – Obsidian source exploitation patterns

In the previous sections I examined the obsidian usage patterns diachronically, dividing them into two regions, namely south-eastern and western Kyushu. In this section, I look at each obsidian source separately (Fig. 12). The exploitation of NW Kyushu obsidian, Koshidake, and Hario started in approximately phase 5, at sites such as Dozonobira and Harunoyama. In the publication (Nagano 2000), although the potential has been shown in the AT lower, nothing was confirmed by physical and chemical analysis. There is no reliable example from phase 5 in southeastern Kyushu, but it is quite possible that they will be found in the future judging from the situation in the west. A physical and chemical analysis of the lithics in question is deemed necessary. Both Koshidake and Hario obsidian were transported shortly after the AT ash fall. Since a small amount has been found in phase 7, in the future the possibility that it will be found in phase 6 cannot be excluded. Whether these were brought at any opportunity is an important issue; however, it is thought that from the carrying amount of the materials, and not in the context of the population of north and south Kyushu, that they were frequently in contact with each other. In the future, it will be necessary to consider this issue from a multilateral perspective such as lithic technology and an examination that includes other lithic raw materials. Subsequently, it is in phase 9 that the frequency of NW

Northwestern Kyushu Obsidian Sources

Region / Phase	Koshidake OB							Hario OB							epoch
	HS-V	HK-V	KBW	I-M.	O-P	M-P	G-V	HS-V	HK-V	KBW	I-M.	O-P	M-P	G-V	
1					-							-			
2					-							-			1
3				?	-						?	-			
4															
5-1							?								2
5-2					?	?	?					?			
6				?	?	?	?					?			
7															
8															3
9															
10															

Central Kyushu Obsidian Sources
Aso (Zogahana Tuff, Oguni OB)

Region / Phase	HS-V	HK-V	KBW	I-M.	O-P	M-P	G-V	epoch
1					-			
2					-			1
3					-			
4								
5-1							?	2
5-2							?	
6							?	
7								
8								3
9								
10								

Remarks

- in-site produce is majority
- in-site produce is minority
- only tools

? shows materials which have issue of identifing or phase.

HS-V ; Hisatsu Volcanic Region
HK-V ; Hokusatsu Volcanic Region
KBW ; Kagoshima Bay West Coast Hills
I-M. ; Ibusuki Mountains
O-P ; Osumi Peninsula
M-P ; Miyazaki Plain
G-V ; Gokase River Valley

Bold-italic types are regions located obsidian sorces.

Southern Kyushu Obsidian Sources (Hisatsu Region)

Region / Phase	Nitto OB							Kuwanokizuru OB (including Hishikari)							epoch
	HS-V	HK-V	KBW	I-M.	O-P	M-P	G-V	***HS-V***	HK-V	KBW	I-M.	O-P	M-P	G-V	
1					-							-			
2					-							-			1
3					-							-			
4						?		?					?		
5-1							?							?	2
5-2							?		?					?	
6							?								
7															
8															3
9															
10															

Southern Kyushu Obsidian Sources (Satsuma Peninsula Region)

Region / Phase	Kamiushibana OB							Mifune OB							epoch
	HS-V	***HK-V***	KBW	I-M.	O-P	M-P	G-V	HS-V	HK-V	***KBW***	I-M.	O-P	M-P	G-V	
1					-							-			
2					-							-			1
3					-							-			
4															
5-1							?								2
5-2							?								
6							?								
7															
8															3
9												?			
10															

Kyushu obsidian uses in southern Kyushu increases significantly. This phenomenon is essentially different from NW Kyushu(Tachibana 2008; Miyata2011); however, I do not think that is valid for the following reason: the preparation for the elimination of the overhang on the microblade as well as the characteristic microwear on the microblades found in southern Kyushu are not found in northern Kyushu. These are what should be called the unique traits of the southern Kyushu population; the changes in form and amount used should be understood in the context of the lithics exchange network (Shiba 2011).

The nature of central Kyushu's obsidian use trends is still not clear. However, it is no doubt that at the least Zogahana tuff was used in the north of the Miyazaki Plain during phase 3. This suggests that there was a movement of population from around the Aso region to the Miyazaki Plain. Due to the fact that there are cases in which it is difficult to identify Nitto and Oguni obsidian when the pieces of obsidian are small, for the materials in quest ion, it will be necessary to conduct both physical and chemical analyses.

There are extremely complex aspects to the obsidian use in southern Kyushu. However, it is important to note that the use of each obsidian source started in phase 2. This indicates that the development and use already began in the Early Upper Palaeolithic for almost all obsidian sources currently known. Next, I would like to consider the individual aspects diachronically. The Nitto obsidian has been used almost continuously in the region with the exception of the Gokase River valley; however, there is little use of obsidian in these industries. Before phase 6, with the exception of the Kagoshima Bay west coast hills, more than a few flakes made of Nitto obsidian related to lithic production are found in the region, but after phase 7 the frequency of the use is reduced in places not around the source. Kuwanokizuru obsidian is also utilized evenly temporally and spatially. However, there is a change in the quantities used from one time period to the next. It should be noted that its exploitation patterns are opposite to those of Nitto obsidian. In other words, after phase 7 the frequency Nitto obsidian is used is reduced significantly, while by contrast that of Kuwanokizuru obsidian increases. In particular, on the Osumi Peninsula and Hisatsu region, the latter type of obsidian constitutes the main raw material in the assemblages. This may have been a factor in the adoption of pressure flaking technology and the decrease in tool size. In addition, it is possible to indicate that since these two sources are relatively close, they were used interchangeably without changing significantly the mobility routes of the population. The exploitation patterns of Mifune and Kamiushibana obsidian show similarities. There is a slight change through time, but the consumption rate is consistently high in Kagoshima Bay West Coast hills and Hokusatsu region where both sources are located, and it decreases at sites distant from there. The distribution area of stone tools made of Kamiushibana obsidian is slightly larger than those of the Mifune; in the Miyazaki Prefecture, Mifune obsidian use is hardly found.As mentioned above, the temporal and spatial differences related to the use of each type of obsidian are evident when viewed for each obsidian source separately. One of the reasons for these differences is the technique used to define tool form. It cannot however, be explained solely by it. For example, even though Mifune obsidian is not suitable for microblade production, it was used many times for this purpose; similarly, Nitto obsidian was not. As mentioned earlier, I think that it is related not only to the lithic technology but the mobility routes of population and territorial boundaries.

6 – Diachronic overview of obsidian resource use in southern Kyusyu

Period 1 (phase 2) (fig. 13: left): Once obsidian use started, it spread fast. All the obsidian in all southern Kyushu that is currently known started being used during this period. Initially, however, in all areas it was used in small quantities.

Period 2 (phase 5) (fig. 13: center): After the AT ash fall, NW Kyushu obsidian was used for some of Tanukidani and Imatoge type knife-shaped points. Furthermore, during the next period of bilaterally backed tool subsequent to this, namely phase

Figure 12 (Left page) – Use Trend of Obsidian in Upper Paleolithic Southern Kyushu

6, large amounts of lithics appear to have been produced near the obsidian source. Accordingly, obsidian use increased compared to the previous phase. Thus, it is possible that period 2 can be divided into two, but if we also take into account the chronological problem, it seems best to understand this period as it stands now.

Period 3 (phase 8) (fig. 13: right): Obsidian use predominates in almost all areas of southern Kyushu in this phase. It is the time of maximum use in the Upper Palaeolithic. In particular, a large amount of NW Kyushu obsidian was carried in the subsequent phase 9. This was most likely due to the good quality of the raw material exchange network extending over the entire island of Kyushu.

The important thing to remember is, that the trends observed for each period were frequently changing, and that in no way were they continuous or uniform. For example, obsidian use increased considerably in phase 3, but was reduced in phase 4 most likely due to the influence of the AT ash fall. After this there was an increase in use again as sites close to the sources formed in phase 6; the inclination, however, to also use other materials was documented in phase 7 where the frequency of obsidian usage was reduced. Finally, in phase 8 there was a reversal of the pattern and obsidian use was again maximized. Such changes indicate that the use of obsidian has been influenced by a variety of factors and that these factors need to be unravelled through future research.

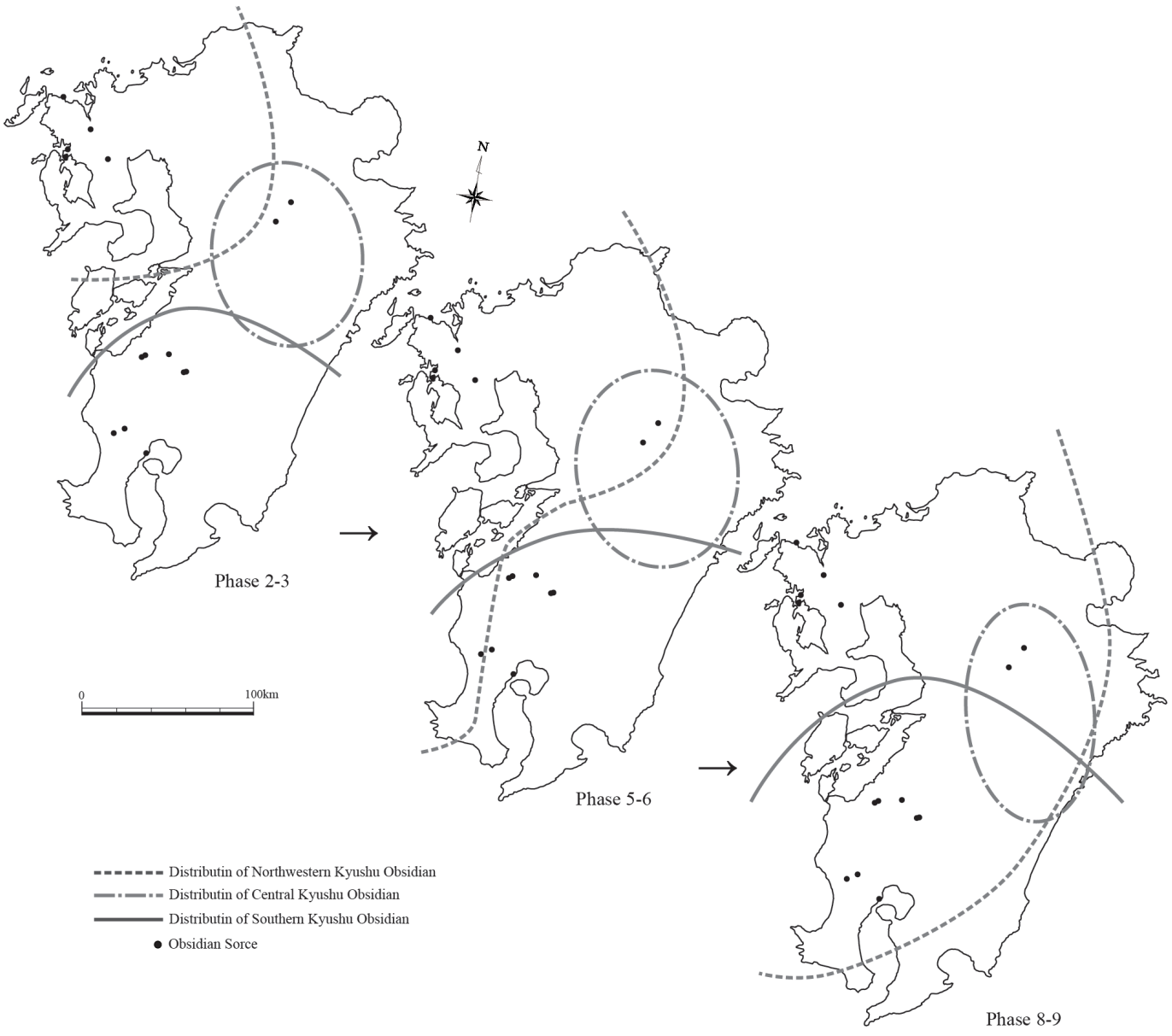


Figure 13 – Circulation of Obsidian use in Paleolithic Kyushu Disitribution of Northwestern and Central Kyushu obsidian are based on Shiba (2010, 2011)

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References

AKASAKI, H. (ed.) (2007) – *Yamada Site*, 292 p. Miyazaki Prefectural Archaeological Center (in Japanese).

AOSAKI, K. (ed.) (1981) – *Kyushu jyukanjidosyado kankei maizoubunkza ichosahouoku 5,* 508p., Kagoshima Prefectural Board of Education (in Japanese).

AOSAKI, K. (ed.) (1992) – *Enokizaki A Site*, 371p. Kagoshima Prefectural Board of Education (in Japanese).

ANDO, M. (ed.) (2007) – *Kokkobaru Site*, 158p. Miyazaki Prefectural Archaeological Center (in Japanese).

ARIMA, K., MAGOME, R., SAMESHIMA, S., MANABE, Y. & NAGANO, S. (2003) – *yogao Site*, 242p. Kagoshima Prefectural Archaeological Center (in Japanese).

DEGUCHI, H., UEMURA, J., AMEMIYA, M. & USHINOHAMA, O. (1990) – *Yokoitakenoyama Site*, 133 p. Kagoshima City Board of Education (in Japanese).

DEYAMA, S. & KISHIDA, Y. (ed.) (2007) – *Obana A Site 1 –Palaeolithic and Jyomon period*, 321p., Miyazaki Prefectural Archaeological Center (in Japanese).

DOKOME, H. (ed.) (1993) – *Tokonami B Site*, 73p. Iriki Twon Board of Education (in Japanese).

DOKOME, H., NAGASAKI, S. & KUWAHATA, T. (2005) – *Setogashira A-B-C Site*, 178p. Kagoshima Prefectural Archaeological Center (in Japanese).

FUJIKI, H. (ed.) (2005) – *Hijikuro Site*, 68p. Takaoka Twon Board of Education (in Japanese).

FUJIKI, S. (2002) – Obsidian use of Prehistory in Miyazaki Prefecture, *Stone Sources* 1, pp. 59-62, Research Association of Stone sources (in Japanese).

FUJIKI, S. (2011) – Ito Pyrocrastic Frow and Historical Features of KatataPhase, *Palaeolithic Kyushu* 14, pp. 171-176. Association of Kyushu Palaeolithic (in Japanese).

FUKUMATSU, T., YOKOTA, M. & KANEMARU, K. (ed.) (2004) – *Higashiunewara 3 Site*, 166p., Miyazaki Prefectural Archaeological Center (in Japanese).

FURUMORI, S. (ed.) (1999) – *Ushioyama Site and Kunobaru Site*, 138 p. Kumamoto Prefectural Board of Education (in Japanese).

HASHIGUCHI, K. (2002) – *Imazato Site,* 126p. Kagoshima Prefectural Archaeological Center (in Japanese).

HIGASHI, N., MATSUBAYASHI, T. & HIDAKA, H. (ed.) (2008) – *Hayashi Site 2,* 228p. Miyazaki Prefectural Archaeological Center (in Japanese).

HIDAKA, H., TAKEI, M. & YANAGIDA, Y., (ed.) (2004) – *Takanoharu Site,Locality 5*, 114p. Miyazaki Prefectural Archaeological Center (in Japanese).

HIRAYAMA, T. (ed.) (2009) – *Kuronita Site*, 218p. Miyazaki Prefectural Archaeological Center (in Japanese).

HIROTA, H. (ed.) (2004) – *Takanoharu Site*, 154p. Takaoka Town Board of Education (in Japanese).

IKEZAKI, J. & YOSHIDOME, H. (1979) – Palaeolithic in Nagashima Island, *Kagoshima Kouko* 13, pp. 221-229, Kagoshima Archaeological Association (in Japanese).

INOUE, H., MIYATA, E. & KUMASAKI., A. (ed.) (1992) – *Enokizaki B Site*, 262p. Kagoshima Archaeological Center (in Japanese).

IWASAKI, S. (ed.) (2007a) – *Excavation Report of the Site in Izumi City*, 392p. Izumi City Board of Education (in Japanese).

IWASAKI, S. (ed.) (2007b) – *Okubo Site and Okubo B Site*, 119p. Izumi City Board of Education (in Japanese).

IWAYA, T., KINOSHITA, E., MATUMOTO, Y. & TSURUTA, S. (ed.) (2008) – *Shimotsukiden Site and Miyakohara Site*, 191p. Kagoshima Archaeological Center (in Japanese).

JAPANESE PALAEOLITHIC RESEARCH ASSOCIATION (JPRA). (2010) – *Palaeolithic Sites in the Japanese Islands*: A Database, 379p. (in Japanese).

KISAKI, Y. (ed.) (1986) – *Daimaru Fujinosako Sit*e, 249 p. Kumamoto Prefectural Board of Education (in Japanese).
KISAKI, Y. (ed.) (1987) – *Tanukidani Site*, 333p. Kumamoto Prefectural Board of Education (in Japanese with english Summary).
KISAKI, Y. (ed.) (1993) – *Kubo Site*, 91p. Kumamoto Prefectural Board of Education (in Japanese).
KISHIDA, Y. (ed.) (2008) – *Odate 2 Site*, 152p. Miyazaki Prefectural Archaeological Center (in Japanese).
KONOHARA, H. & MINEI, Y. (2006) – *Okariya-ato Site Locality B*, 95p. Kagoshima City Board of Education (in Japanese).
KUBOTA, S., MUNEOKA, K., YUNOMAE, H. & YAMASAKI, K. (2007) – *Ymanoda Site Locality B-WarabinoB Site-MatsugaoSite, Tanigasako Site*, 215p. Kagoshima Prefectural Archaeological Center (in Japanese).
KURIYAMA, M. & NAGATSU, M. (ed.) (2007) – *Konami 1 Site*, 198p. Miyazaki Prefectural Archaeological Center (in Japanese).
KUSANAGI, Y. & YAMADA, Y. (ed.) (2003) – *Kitaushimaki 5 Site Ginza 3A Site*, 158p. Miyazaki Prefectural Archaeological Center (in Japanese).
KUWAHATA, T. (2005) – Lithic Raw Marerial Use of Palaeolithic on Kagoshima Prefecture, *Kagoshima Kouko* 38, pp. 7-24, Kagoshima Archaeological Association (in Japanese).
MACHIDA, H., OTA, Y., KAWANA, T., MORIWAKI, H. & NAGAOKA, S. (2001) – *The geography in Japan 7 Kyushu and Southwestern Islands*, 358p. Tokyo University Publish (in Japanese).
MAESAKO, R., YOKOTE, K. (ed.) (2008) – *Nishibaru Site-Makinohara Bsite-Haramura 1 Site, Haramura 2 Site*, 206p. Kagoshima Prefectural Archaeological Center (in Japanese).
MAGOME, R. (2009) – Obsidian Use of the Upper Palaeolithic on Southern Kyushu, *Obsidian, Interaction, and Society*, pp. 113-128. Grant-in-Aid for Scientific Research (A) 'Formation Transformation of Human Society based on Circulation and Consumption of Obsidian' group (in Japanese).
MAGOME, R. (ed.) (2010) – *Miyanoue Site -Palaeolithic ver-*, 385p. Kagoshima Prefectural Archaeological Center (in Japanese).
MATSUMOTO, S. (2005) – The Terminal Stage of Knife Shaped Points Culture in Kyushu Region, *Stone Age Culture* 12, pp. 5-24, Stone Age Culture Association (in Japanese).
MIYASAKA, T. (ed.) (1993) – *Shiratoribira A Site*, 197p. Kumamoto Prefectural Board of Education (in Japanese).
MIYASAKA, T. (ed.) (1994) – *Shiratoribira B Site*, 268p. Kumamoto Prefectural Board of Education (in Japanese).
MIYASHITA, T. (ed.) (1990) – *Kongojibaru 1 Site and Kongojibaru 2 Site*, 71p. Miyazaki City Board of Education (in Japanese).
MIYATA, E. (1996) – *The Terminal Phase of Microblade Industry in Southern Kyushu, the Various Aspects of Archaeology*, pp. 961-978. (in Japanese).
MIYATA, E. (2006) – *The Regional Chronology on Southeastern Kyushu, Study on Regional Chronology in Palaeolithic*, pp. 241-273. Douseisha (in Japanese).
MIYATA, E. (2011) – The Microblade Indutry of Tateyama Site and this significance, *Palaeolithic Kyushu 14*, pp. 151-160. (in Japanese).
MIYATA, E. (ed.) (1992) – *Nishimaruo Site*, 336p. Kagoshima Prefectural Board of Education (in Japanese).
MIYATA, E. (ed.) (2008) – *Nitao Site*, 1361p. Kagoshima Prefectural Archaeological Center (inJapanese).
MORISAKI, K. (2010a) – *Structural Change of Palaeolithic Society and Regional Adaptation*, 263 p., Rokuichi shobo (in Japanese).
MORISAKI, K. (2010b) – The evolution of lithic technology and human behavior from MIS 3 to MIS 2 in the Japanese Upper Palaeolithic, *Quaternary International* (2010), pp. 1-14.
NAGAI, M. (2010) – A New Discovery of Obsidian Source and that Significance, *Abstracts of the 27th Annual Meeting of the Japan Society for Scientific Studies on Cultural Property*, pp.122-123. (in Japanese).
NAGANO, S. (ed.) (1996) – *Komaki 3A Site, Iwamoto Site*, p.309. Kagoshima Prefectural Archaeological Center (in Japanese).

NAGANO, S. (ed.) (2005) – Kirikimimitori Site, 1624p. Kagoshima Prefectural Archaeological Center (in Japanese).

NAGANO, S. (ed.) (2005) – *Fuseno Site Kakurezako Site Azebori Site Nitao Site Okariya-ato Site*, 478 p., Kagoshima Prefectural Archaeological Center (in Japanese).

NAGANO, S., KUNISHI, H. & MAGOME, R. (ed.) (2007) – *Nitaonaka A-B Site*, 1181p. Kagoshima Prefectural Archaeological Center (in Japanese).

NAGANO, T. (ed.) (2000) – *Chochi Site*, 302p. Kirire Town Board of Education.

NAGAOKA, S., TSUKAHARA, H., KAKUBUCHI, S., UTSUNOMIYA, M. & TAMURA, T. (2003) – *Lithic Raw Materials and this Physicochemical Estimation of Sources, Nokubi Site*, pp.1-101, Ojika Town Board of Education (in Japanese).

NAKMURA, K. & IWAYA, T. (2005) – *Sites of Agriculture Develop Center 1*, 211p. Kagoshima Prefectural Archaeological Center (in Japanese).

NAKAMURA, M. (ed.) (1999) – *Kobaruno Site*, 203p. Oguchi City Board of Education (in Japanese).

NISHIZUMI, K. (ed.) (1986) – *Kogamine Site*, 235p. Kumamoto Prefectural Board of Education (in Japanese).

NISHIZUMI, K. (ed.) (1990) – *Tendogao Site (2),* 379p. Kumamoto Prefectural Board of Education (in Japanese).

NOBEOKA CITY BOARD OF EDUCATION. (1987) – *Akagi Site*, 55p. (in Japanese).

OBATA, H., OKAMOTO, S., FURUMORI, S, WATANABE, K. & TAGUCHI, K. (2001) – New Discovery of outcrops of so-called "Aso Obsidian"-A raw Material of the stone tools in Prehistoric Middle Kyushu-, *Palaeolithic Archaeology* 62, pp. 63-76. The Palaeolithic Culture Association (in Japanese with English abstract).

OGI, K. (1998) – Lithic Raw Materials in Palaeolithic Kyushu, *Kobunkadanso* 40, pp. 105-163. Kyushu Kobunka Kenkyu kai (in Japanese).

OYAMA, H. (ed.) (2006) – *Higashiunewara 1 Site 3rd and 4th Excavation*, 210p. Miyazaki Prefectural Archaeological Center (in Japanese).

OZONO, K., SHIGEDOME, Y. & MATSUMOTO, S. (ed.) (2006) – *Nokubi 2 Site*, 234p. Miyazaki Prefectural Archaeological Center (in Japanese).

THE PALAEOLITHIC CULTURE SSOCIATION OF MIYAZAKI PREFECTURE. (2005) – A general view of Palaeolithic Sites in Miyazaki Prefecture, *Palaeolithic Archaeology* 66, pp. 47-61. The Palaeolithic Culture Association (in Japanese with English abstract).

SAKATA, K. (1983) – Obsidian of Kyushu, *Shigaku Ronso* 13, pp.71-216. Beppu University Archaeological Society (in Japanese).

SANGAWA, T. (ed.) (2006) – *Dozonobira Site*, 215p. Kagoshima Prefectural Archaeological Center (in Japanese).

SANGAWA, T., MIYATA, E., SOUMI, I. & UCHIMURA, M. (ed.) (2007) – *Maeyama Site*, 283p., Kagoshima Prefectural Archaeological Center (in Japanese).

SEKI, A., NAGASAKI, S., YOSHIOKA, Y. & SHIN-NAKA, N. (2009) – *Sites of Agriculture Develop Center 6*, 328p. Kagoshima Prefectural Archaeological Center (in Japanese).

SHIBA, K. (2010) – Obsidian use in Northern and Central Kyushu, *Obsidian, Interaction, and Society* 2, pp. 68-87. Grant-in-Aid for Scientific Research (A) 'Formation and Transformation of Human Society based on Circulation and Consumption of Obsidian' group (in Japanese).

SHIBA, K. (2011) – *Study on Microblade Industries in Kyushu*, 309 p. Rokuichi shobo (in Japanese).

SHIMADA, F. (ed.) (2007) – *Maenodamurakami 2 Site*, 116p. Miyazaki Prefectural Archaeological Center (in Japanese).

SHIMADA, M. (ed.) (2003) – *Kodamoto 2Site*, 104p. Takaoka Town Board of Education (in Japanese).

SHIMOYAMA, S., NAKAMA, K., WATANABE, T. & KAMATA, H. (2002) – *Mizusako Site 2*, 461p. Ibusuki City of Education (in Japanese).

TACHIBANA, M. (1975) – Microblade Culture in Funano Site, *Miyazaki Prefecture, Koukogaku Ronso* 3, pp. 1-70. Beppu University Archaeological Association (in Japanese).

TACHIBANA, M. (2009) – Circulation of Northwestern-Kyushu Obisidian and Formation of Microblade Industry in Asebori Site, Kagoshima Prefecture, *Jomon Period of the South and Regional Culture*, pp. 1-14. Jomon Culture of Southern Kyushu Association (in Japanese).

TANAKA, H., FUJIKI, S. & IIDA, H. (ed.) (2004) – *Nokubi 1 Site*, 191p. Miyazaki Prefectural Archaeological Center (in Japanese).

TATEGAMI, Y. (ed.) (2007) – *Kandaiji Site 2nd Excavation*, 165p. Miyazaki Prefectural Archaeological Center (in Japanese).

TORIHARA, T. (ed.) (2001) – *Gongenbaru 1 Site,* Shimohoshino Site, 142p. Miyazaki Prefectural Archaeological Center (in Japanese).

TSUNEDA, K., EDAMOTO, Y., BABA, M. & NISHIKUBO, A. (2007) – *Yoshitoshikojyo Site*, 109p. Hioki City Board of Education (in Japanese).

UEHIGASHI, K., FUKUNAGA, H. & AMEMIYA, M. (ed.) (1998) – *Kakoinohara Site*, 198p. Kaseda City Board of Education (in Japanese).

UEHIGASHI, K., FUKUNAGA, H. & AMEMIYA, M. (ed.) (2002) – H*arunoyama Site, Nakazono Site, Torigoeshita Site, Mukaeharu Site,Miyanogahara Siteand Miyazono Site*, 180p., Kaseda City Board of Education (in Japanese).

USHINOHAMA, O. & MIYATA, E. (ed.) (1985) – *Narioka Site 2*, 115p. Kagoshima Prefectural Board of Education (in Japanese).

YAMAGUCHI, N. (ed.) (2003) – *Onmyoji 2 Site*, 182p. Miyazaki Prefectural Archaeological Center (in Japanese).

YAE, H., MIYATA, E., TAKAOKA, K., SHINHO, T., KUNISHI, H., TABATA, T. & KIUCHI, T. (2009) – *Tateyama Site, Nishiharadan Site, Noshikakura Site,* 374p. Kagoshima Prefectural Archaeological Center (in Japanese).

YAGISAWA, R., KUWAHATA, T. & KONOHARA, H. (2000) – *Miyagasako Site,* 88 p., Matsumoto Town Board of Education (in Japanese).

YOKOYAMA, M. & IMASHIOYA, T. (ed.) (2011) – *Tawaraishi 1 Site,* 156p. Miyazaki Prefectural Archaeological Center (in Japanese).

WADA, Y. & SHIGA, S. (2000) – *The Palaeolithic Industry lower AT Tefra of Chikegamine Site in Hitoyoshi City, Emergence of the Upper Palaeolithic Culture in Kyushu,* pp. 401-406, Kyushu Palaeolithic Association (in Japanese).

WARASHINA, T. (2001) – *XRF analysis of obsidian artefacts from Nakahara site, In* Shimada, M., (ed.), *Nakahara site,* pp. 26-36, Takaoka Town Board of Education (in Japanese).

WATANUKI, S. (1992) – Lithic Raw Materials of Palaeolithic Kyushu*, Kouokgaku Journal,* 345, pp. 28-33, New Science Sha (in Japanese)