Time period determination of the Kuril Ainu's major withdrawal from Kamchatka

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ABSTRACT

The Kuril Ainu are the indigenous people of the Northern and Central Kuril Islands. Although Russian documents have suggested that these people also occupied Sothern Kamchatka, the time period and habitation area in Kamchatka have been poorly understood. However, recent archaeological studies have shown that they emerged in the 15th century AD and occupied not only the Kuril Islands but also a wide area of Southern Kamchatka. Moreover, such studies have indicated that their habitation area in Kamchatka rapidly decreased from the mid-17th to 18th centuries AD. Because the precise time period of their departure remains to be revealed, the present study determines when the Kuril Ainu withdrew from Kamchatka, based on new materials collected from Southeastern Kamchatka. According to the results, the Kuril Ainu's habitation area in Kamchatka rapidly decreased in the early 18th century AD. During that time, the northern boundary of the Kuril Ainu's habitation area on the east coast of the peninsula shifted 350 km south from Kronotsky Bay to Vestnik Bay, whereas there was no significant change on the west coast.

KEYWORDS: Kuril Ainu, Kamchatka, Naiji pottery, Nalychevo Culture, Tar'ya Culture

1. Introduction

The Kuril Ainu are regarded as the indigenous people of the Northern and Central Kuril Islands, according to the Japanese documents recorded in the late 18th and 19th centuries AD (e.g. Torii 1903, 1919). However, Russian documents from the late 17th to mid-18th centuries AD have shown that they inhabited not only the Kuril Islands but also the Southern Kamchatka (Krasheninnikov 1755; Steller 1774; Ogloblin 1891). The Kuril Ainu's habitation in Southern Kamchatka has been supported by linguistic studies on geographical names (Murayama 1968, 1987). Recent archaeological studies have provided detailed information on their appearance in Kamchatka (Figure 1) and the manner in which they lived in the region from the mid- to late-15th century AD (Takase 2013a, 2015, 2019). However, their habitation area in Kamchatka rapidly decreased during the mid-17th century AD and the 18th century AD. Because the exact time period of their departure from Kamchatka remains to be revealed, the purpose of the present study is to determine *when* the Kuril Ainu withdrew

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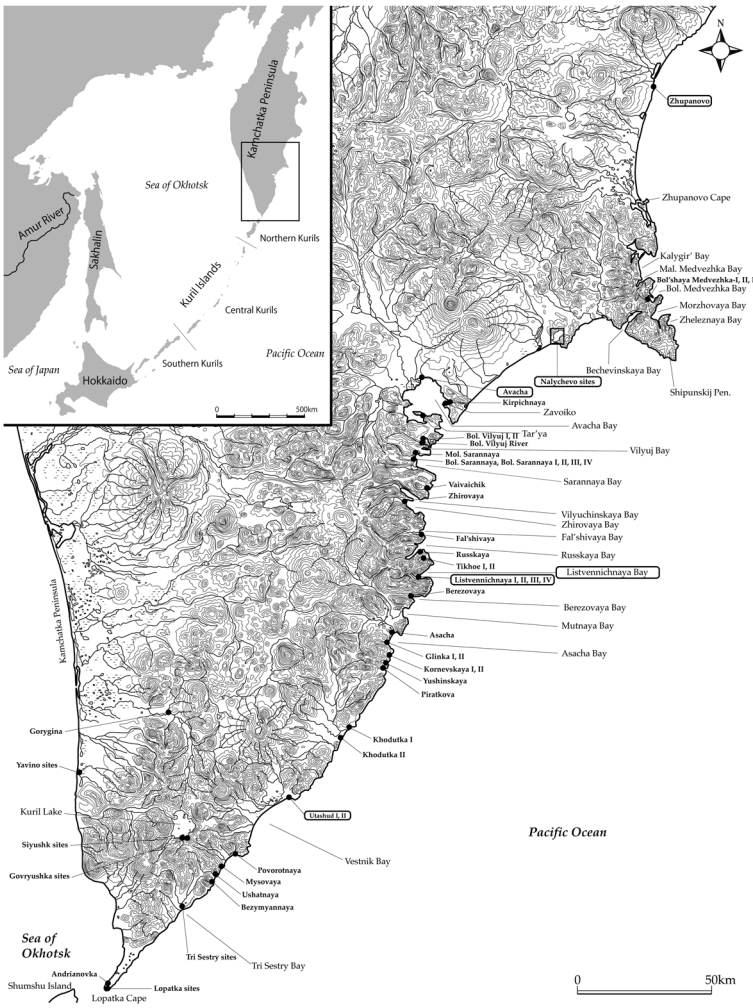

Figure 1. Archaeological sites of the Nalychevo culture in the Kamchatka Peninsula and related sites in this study

from Kamchatka. This event must have drastically changed Kuril Ainu's economy because there is a large difference in the quantity and quality of various resources between the Kamchatka Peninsula and the Kuril Islands as island biogeographical studies demonstrate (Fitzhugh *et al.* 2004, 2016; Takase 2017: Gjesfjeld *et al.* 2020). Moreover, this withdrawal might be caused not only by economic factors but also by social factors such as the relationship with Russians and other indigenous peoples in Kamchatka. As their withdrawal from Kamchatka has the significant meaning in their economy and society, the findings of this study will contribute to a better understanding of the Kuril Ainu's history.

2. Methods and materials

This study focuses on the age and distribution of clay vessels used by the Kuril Ainu, also known as Naiji pottery 内耳土器 (Figure 2). This type of pottery, an imitation of the medieval Japanese iron pans, was produced to compensate for the shortage of iron pans imported from Central Japan. Thus, it was distributed in not only Southern Kamchatka and the Kuril Islands but also Hokkaido and Sakhalin during the second millennium AD (e.g. Amano *et al.* 2007; Baba 1940; Dikova 1983; Jochelson 1928; Kumaki *et al.* 2010; Niioka 1937; Osada 2008; Petei & Fukuda 1974; Takase 2013a, 2013b; Takase & Suzuki 2013; Takase & Lebedintsev 2016, 2019; Torii 1903, 1919).

Naiji pottery was an element of the Nalychevo culture that was distributed in Southern Kamchatka and the Northern Kuril Islands (Dikov 1979). Recent archaeological studies have shown that this archaeological culture emerged in an uninhabited zone (i.e. an area with an extremely low population density) during the mid- to late-15th century AD (Takase 2015; Fitzhugh *et al.* 2016). In addition, there was no tradition of manufacturing pottery in Southern Kamchatka until the occurrence of Naiji pottery, indicating that Naiji pottery users migrated from areas where it had been already distributed before the mid-15th century. Hence, the bearers of the Nalychevo culture should be regarded as the Kuril Ainu, and Naiji pottery should be considered as a reliable indicator of their occupation in the area (Takase 2015)[1)]. Harpoon heads are also important elements of the Nalychevo culture, but the number of harpoon heads in Kamchatka is still small (Dikova 1983; Takase & Lebedintsev 2019), and they must have been used only in the coastal area. On the other hand, Naiji pottery is more ubiquitous archaeological material of the Nalychevo Culture[2)].

Our study examined the age of the Naiji pottery pieces by using accelerator mass spectrometric (AMS) radiocarbon dating. To calibrate the conventional radiocarbon age, the IntCal13 calibration curve (Reimer *et al.* 2013) and the OxCal programme (ver. 4.3, Bronk Ramsey 2009) were used. The charcoal samples were collected from several archaeological sites around Listvennichnaya Bay in Southeastern Kamchatka (Figure 3). This location has been particularly important, because there was the possibility that the northern boundary of the younger stage of the Nalychevo culture (type II period in Figure 2) was situated in this region, based on the excavations and findings of a Swedish expedition team (led by Sten Bergman) in the 1920s (Bergman 1924; Schnell 1932).

The detailed examinations of Naiji pottery in Bergman collection revealed that all ceramic sherds were from the older stage of the Nalychevo Culture (type Ia and type Ib periods in Figure 2)[3)]. However, there was no clear evidence on the lack of pottery of the younger stage of the Nalychevo culture, because of the limited number of ceramic materials. Moreover, it was impossible to conduct radiocarbon dating of this site cluster because there were no charcoal samples in the collection. Thus, in 2015, excavations were conducted in

the same location. It is important to note that, because the author is currently working on another article on the examination of Naiji pottery in Bergman collection, the present study focuses on the pottery and radiocarbon dating of the charcoal samples collected in the 2015 excavation project.

On the basis of an archaeological general survey, Ponomarenko (1993) recognised three sites in Listvennichnaya Bay: Listvennichnaya I, Listvennichnaya II, and Listvennichnaya III (Figure 3). The present study used this classification and the Listvennichnaya IV site found in 2015. Although the detailed information on the pit dwellings and the stratigraphy have been provided (Takase 2018), the sites and ceramic materials are summarised in the following text:

Listvennichnaya I: This site, which is situated on a terrace along the southern coast of Listvennichnaya Lake, includes 18 pit dwellings at an elevation of 20–25 m above sea level (Ponomarenko 1993). There were lithics scattered over the eroded surface, possibly caused by brown bears near the entrance of pit dwelling No. 13 named by Ponomarenko (1993). During the cleaning of the eroded surface (for the purpose of documenting the stratigraphy), a total of five pottery fragments were discovered between the surface stratum and the surrounding embankment of the pit dwelling.

The potsherds shown in Figures 4.1–4.4 are ceramic fragments originated from a clay vessel. All the potsherds include inner lugs, and thick charred material is adhered to the exterior surface. The estimated diameter of this particular pan is 32 cm, with a wall thickness of 1.1–1.3 cm. The size of the inner lugs is relatively large (more than 7 cm in length), and small projections can be seen on the rim. A cross-section of the fragments reveals an uneven belt on the exterior rim, whereas the opposite side exhibits a wide and shallow groove typically found in iron pans. The potsherd in Figure 4.5 is a fragment of a different clay vessel. This is a rim fragment of Naiji pottery without an inner lug, complete with a wide and shallow groove on the inner rim and an uneven belt on the opposite side. Although the surface of this clay vessel has been slightly removed through secondary heating, the wall thickness is approximately 0.6 cm. For the purpose of this study, AMS radiocarbon dating was conducted on three charcoal samples found with these potsherds from the cultural layer.

Listvennichnaya II: The site is situated on a terrace near the confluence of the Listvennichnaya River and its unnamed tributary. Although Ponomarenko (1993) found 24 pit dwellings at an elevation of 15–35 m, three new pit dwellings were discovered in 2015: N1, N2 and N3.

The Naiji pottery fragments shown in Figures 5.1–5.9 were found in a test trench near pit dwelling No. 9. Although the ceramic sherds in Figures 5.3 and 5.4 originated from a clay pan, the other clay vessel fragments most likely originated from different pans. The potsherds shown in Figures 5.1, 5.3 and 5.4 are rim fragments without inner lugs. In addition, they include a wall thickness of 0.7–0.9 cm, with an uneven belt on the exterior rim

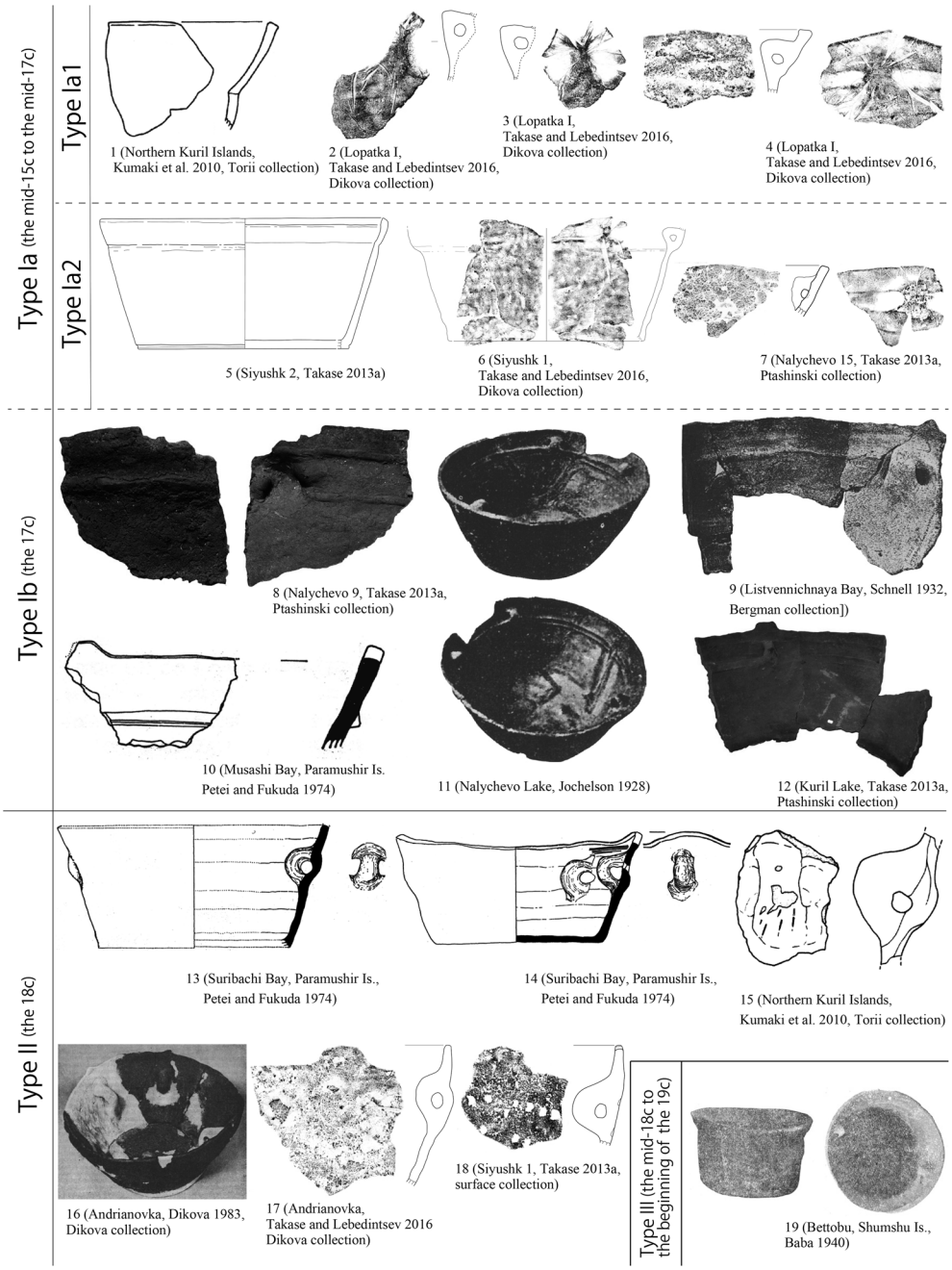

Figure 2. Chronology of Naiji pottery from the Northern Kurils and Kamchatka (revised from Takase 2013a)

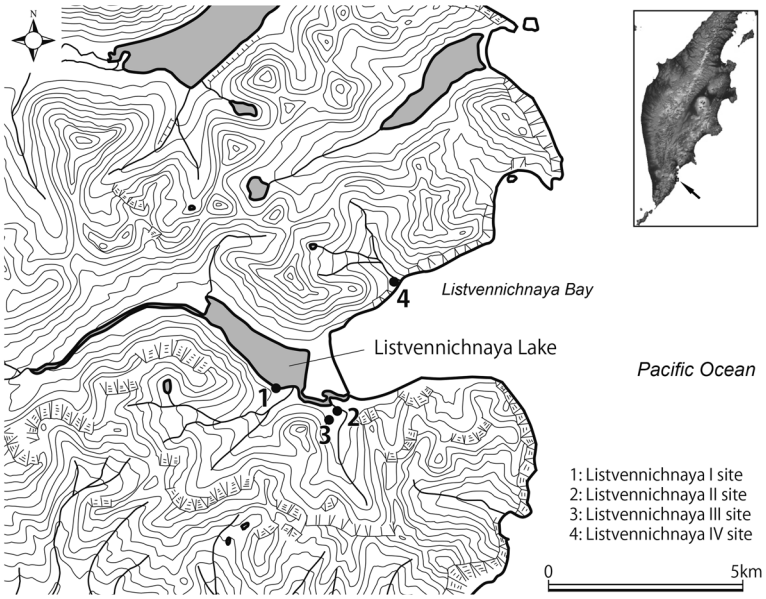

Figure 3. Map showing the location of the examined sites

and a wide and shallow groove on the inner rim.

The fragment shown in Figure 5.6 also includes an uneven belt on the exterior rim and a wide and shallow groove in the inner rim (although they are obscure to a certain extent). The potsherd shown in Figure 5.2 is a rim fragment with a relatively small inner lug (4.1 cm), with a wall thickness of approximately 1.0 cm. It is notable that the cross-section of the inner lug includes a triangular shape, suggesting the imitation of the morphological features of the original iron pan. The other specimens include fragments of the flat bottom (Figures 5.8 and 5.9) and body (Figures 5.5 and 5.7) of Naiji pottery.

The potsherds in Figures 5.10–5.16 were excavated from the test pits near pit dwelling No. N1. As shown in Figure 5.10, the rim fragment includes a relatively small inner lug (4.3 cm), with a cross-section exhibiting a triangular shape. There is also a small projection on the rim and a wide and shallow groove on the inner rim surface. As for the body fragment shown in Figure 5.11, a wide and shallow groove can be seen in the upper part of the ceramic sherd. Regarding the bottom fragments shown in Figures 5.13–5.16, the surface layer of the inner face has been removed through secondary heating.

At the Listvennichnaya I and II sites, the Naiji pottery was found in the upper cultural layer. Below this layer, a lower cultural layer was discovered (Takase 2018), which contained thumb-shaped end scrapers, adzes with triangular/D-shaped cross-sections and stemmed stone scrapers. However, because no pottery fragments were recovered, this lower layer is assigned to the Tar'ya culture in the first millennium BC (Dikov 1977; Ponomarenko

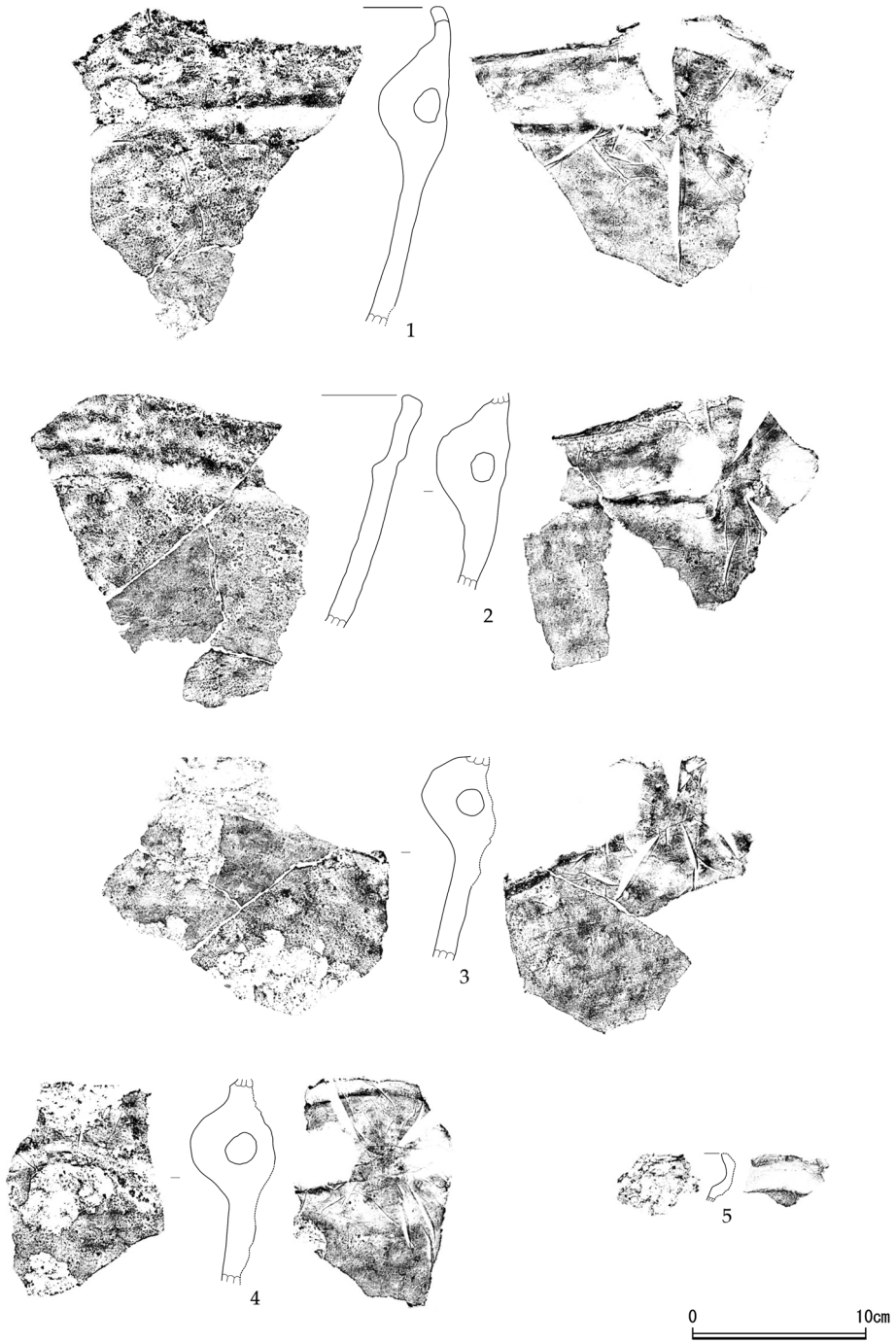

Figure 4. Naiji pottery from the Listvennichnaya I site

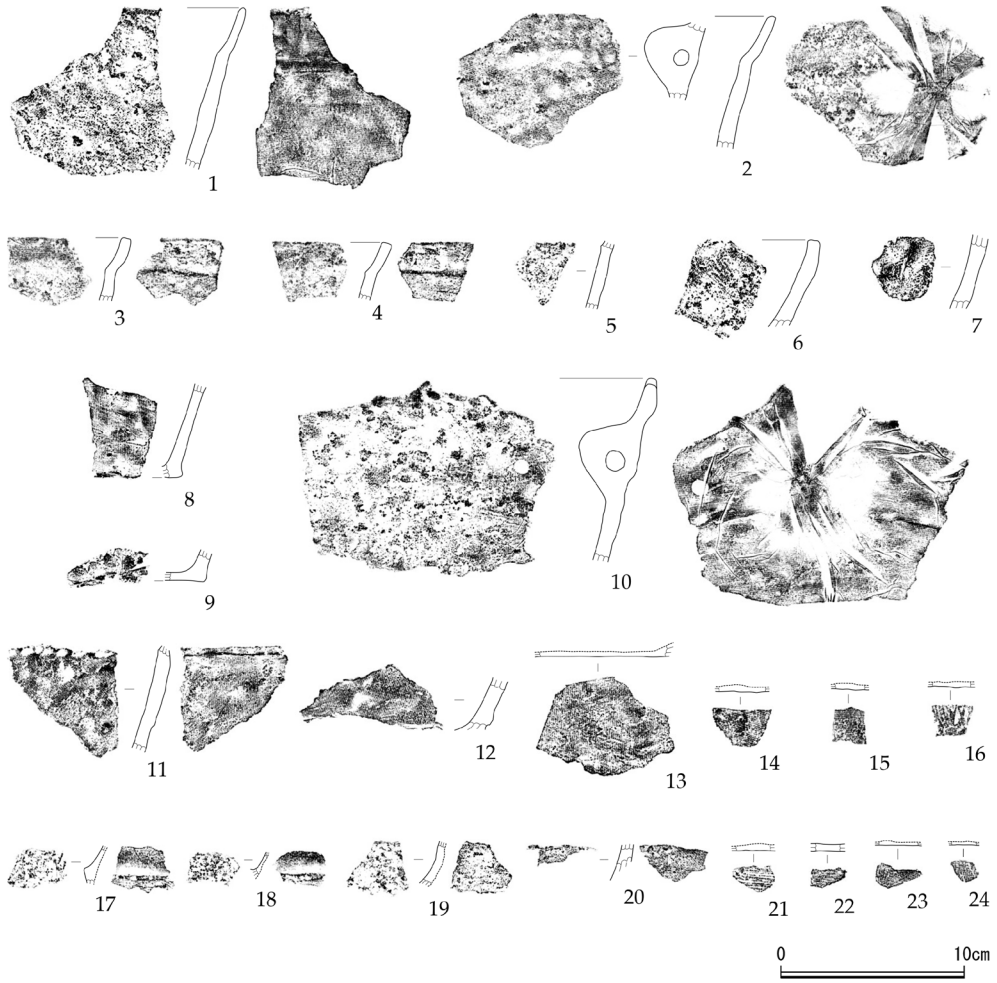

Figure 5. Naiji pottery from the Listvennichnaya II (1–16) and III (17–24) sites

1985). For the purpose of this study, AMS radiocarbon dating was conducted on 20 charcoal samples from the upper and lower cultural layers of the Listvennichnaya II site.

Listvennichnaya III: This site is situated on a natural levee between a nameless tributary of the Listvennichnaya River and the terrace on which the Listvennichnaya II site is located. The relative elevation between the riverbed and the natural levee is approximately 1.5 m, with an absolute elevation of approximately 5 m. Although six pit dwellings were previously found by a general survey (Ponomarenko 1993), a 4 m×4 m area in the western part of the site was excavated in 2015. Moreover, in the cultural layer under the surface stratum, an outdoor hearth and various artifacts, including eight Naiji pottery fragments, were

discovered. Although each potsherd was small, the fragments exhibited wide and shallow grooves on the inner rims, with uneven belts on the exterior surfaces (Figures 5.17–5.20). As for the ceramic sherds shown in Figures 5.21–5.24, they are bottom fragments of Naiji pottery. For the purpose of this study, AMS radiocarbon dating was conducted on two charcoal samples from this cultural layer.

Listvennichnaya IV: Situated on a terrace along the northern coast of Listvennichnaya Bay, this site includes several pit dwellings and some lithics from the eroded surface. However, no pottery fragments were recovered at this site. For the purpose of this study, AMS radiocarbon dating was conducted on a charcoal specimen collected from the cultural layer of the eroded surface.

4. Results

Table 1 presents the radiocarbon dates of the 26 charcoal specimens in this study. Although most specimens were collected from the upper cultural layer associated with the Nalychevo culture, three samples were obtained from the lower cultural layer at the Listvennichnaya II site for comparison (L-II-15, L-II-42 and L-II-43). The dates of the samples from the lower cultural layer ranged from 2280 BP to 1870 BP. In Southeastern Kamchatka, the Tar'ya culture was found under the KS-1 tephra layer, which dates to 1806±16 BP (Braitseva *et al.* 1997). At the Listvennichnaya I and II sites, the lower cultural layer was also found under a tephra layer that was estimated to be the KS-1 (Takase 2018). Thus, these radiocarbon dates are consistent with the age and stratigraphy of the Tar'ya culture. Several specimens from the upper cultural layer also included similar dates (L-II-13, L-II-14, L-II-25, L-II-41, L-II-07, L-II-24 and L-II-08). Apparently, these charcoal samples moved from the lower cultural layer to the upper cultural layer, because the building of Nalychevo culture pit dwellings typically destroyed the KS-1 layer and the lower cultural layer.

Although the radiocarbon date obtained from the Listvennichnaya IV site was 1140±20 BP, it is impossible to determine the archaeological culture of this site, because the artefacts from this period are poorly understood in Southern Kamchatka. Other radiocarbon dates obtained from the Listvennichnaya sites (ranging from 440 to 150 BP) belong to the Nalychevo culture period. Although some of the specimens had a greater $\delta^{13}C$ value than –24.0‰, the influence of the marine reservoir effect was not considered, because all the specimens consisted of charcoal.

5. Discussion

5.1 Chronological location of the Naiji pottery from the Listvennichnaya sites

In Southern Kamchatka and the Northern Kuril Islands, Naiji pottery is classified into four

Table 1. The results of the AMS radiocarbon dating of charcoal specimens collected from the Listvennichnaya sites in Southeastern Kamchatka

Specimen ID	Site	Provenance	Archaeological culture	Sample type	14C age (BP)	δ13C (‰) (AMS)	Lab code
L-I-01	Listvennichnaya I	Eroded slope near Pit Dwelling No.13, 1st cultural layer	Nalychevo	Charcoal	150±20	−25.28±0.52	IAAA-150965
L-I-02	Listvennichnaya I	Eroded slope near Pit Dwelling No.13, 1st cultural layer	Nalychevo	Charcoal	440±20	−23.41±0.45	IAAA-150966
L-I-03	Listvennichnaya I	Eroded slope near Pit Dwelling No.13, 1st cultural layer	Nalychevo	Charcoal	250±20	−21.97±0.63	IAAA-150967
L-II-05	Listvennichnaya II	Test pit east of Pit Dwelling No.9, Layer 4 (1st cultural layer)	Nalychevo	Charcoal	400±20	−23.52±0.58	IAAA-150968
L-II-11	Listvennichnaya II	Test pit east of Pit Dwelling No.N2, Layer2 (1st cultural layer)	Nalychevo	Charcoal	320±20	−23.24±0.33	IAAA-150969
L-II-13	Listvennichnaya II	Test pit east of Pit Dwelling No.N1, Layer 2 (1st cultural layer)	Nalychevo	Charcoal	1830±20	−24.63±0.54	IAAA-150970
L-II-14	Listvennichnaya II	Test pit east of Pit Dwelling No.N1, Layer 4 (1st cultural layer)	Nalychevo	Charcoal	1820±20	−25.46±0.47	IAAA-150971
L-II-15	Listvennichnaya II	Test pit east of Pit Dwelling No.N1, Layer 8a (2nd cultural layer)	Tar'ya	Charcoal	1870±20	−25.21±0.54	IAAA-150972
L-II-25	Listvennichnaya II	Test pit south of Pit Dwelling No.N1, Embankment along the house	Nalychevo	Charcoal	1880±20	−22.74±0.51	IAAA-150973
L-II-27	Listvennichnaya II	Test pit south of Pit Dwelling No.N1, Bottom of the groove around dwelling	Nalychevo	Charcoal	420±20	−25.90±0.44	IAAA-150974
L-II-41	Listvennichnaya II	Test pit near Pit Dwelling No.17, 1st cultural layer	Nalychevo	Charcoal	2250±20	−22.64±0.69	IAAA-150975
L-II-42	Listvennichnaya II	Test pit near Pit Dwelling No.17, 2nd cultural layer	Tar'ya	Charcoal	2150±30	−26.82±0.26	IAAA-150976
L-II-43	Listvennichnaya II	Test pit near Pit Dwelling No.17, 2nd cultural layer	Tar'ya	Charcoal	2280±30	−24.21±0.37	IAAA-150977
L-III-04	Listvennichnaya III	Grid "B-2," Hearth	Nalychevo	Charcoal	350±20	−24.66±0.51	IAAA-150978
L-III-05	Listvennichnaya III	Grid "B-2," Hearth	Nalychevo	Charcoal	330±20	−24.55±0.41	IAAA-150979
L-IV-01	Listvennichnaya IV	Eroded cliff facing Listvennichnaya Bay, Cultural layer	Unknown	Charcoal	1140±20	−21.87±0.46	IAAA-150980
L-II-01	Listvennichnaya II	Test pit east of Pit Dwelling No.9, Layer 2 (1st cultural layer)	Nalychevo	Charcoal	390±20	−26.53±0.60	IAAA-153774
L-II-07	Listvennichnaya II	Test pit in Pit Dwelling No.N1, Layer 7 (1st cultural layer)	Nalychevo	Charcoal	1950±20	−26.60±0.34	IAAA-153775
L-II-24	Listvennichnaya II	Test pit south of Pit Dwelling No.N1, Layer M3 (1st cultural layer)	Nalychevo	Charcoal	1860±20	−27.61±0.42	IAAA-153776
L-II-28	Listvennichnaya II	Test pit south of Pit Dwelling No.N1, Groove 2 (1st cultural layer)	Nalychevo	Charcoal	330±20	−24.56±0.47	IAAA-153777
L-II-02	Listvennichnaya II	Test pit east of the Dwelling No.9, 1st cultural layer	Nalychevo	Charcoal	370±20	−25.59±0.41	IAAA-162714
L-II-03	Listvennichnaya II	Test pit east of the Dwelling No.9, 1st cultural layer	Nalychevo	Charcoal	290±20	−26.32±0.29	IAAA-162715
L-II-04	Listvennichnaya II	Test pit east of the Dwelling No.9, 1st cultural layer	Nalychevo	Charcoal	250±20	−29.75±0.35	IAAA-162716
L-II-06	Listvennichnaya II	Test pit east of the Dwelling No.9, 1st cultural layer	Nalychevo	Charcoal	390±20	−24.43±0.30	IAAA-162717
L-II-08	Listvennichnaya II	Test pit in Pit Dwelling No.N1, 1st cultural layer	Nalychevo	Charcoal	1850±20	−26.08±0.40	IAAA-162718
L-II-09	Listvennichnaya II	Test pit in Pit Dwelling No.N1, 1st cultural layer	Nalychevo	Charcoal	370±20	−24.73±0.41	IAAA-162719

main types: Ia, Ib, II and III (Figure 2). Type Ia pottery is characterised by morphological features that are similar to those of Japanese iron pans, including a thin wall (less than 1.0 cm), an uneven belt on the outer rim, a wide and shallow groove on the inner rim, small inner lugs and no ornamentation. In contrast, type II pottery is characterised by different factors such as a thick and simple wall without an uneven belt, projections on the rim, coarsely made large inner lugs and ornaments on the exterior surface. Because type Ib pottery is an intermediate type between type Ia and type II pottery, it is characterised by coexisting morphological features of both types of pottery. As for type III pottery, it is similar to Russian iron pans that is characterized by the vertical wall and lugs attached on the rim. However, this type of pottery is extremely rare, because only one sample has been found in the Northern Kuril Islands.

According to the radiocarbon dates, type Ia pottery is assigned to the mid-15th to mid-17th centuries, whereas type II pottery is assigned to the mid-17th and 18th centuries (Takase 2013a). Although there are no radiocarbon dates for type Ib pottery and type III pottery, type Ib pottery is tentatively assigned to the 17th century, because it is placed under a transitional phase between type Ia pottery to type II pottery. Because the date of type III pottery is completely unknown, it is placed between the mid- and late-18th century. Such temporal changes in Naiji pottery indicate its development from high-quality imitations of Japanese iron pans to low-quality copies.

A clay vessel from the Listvennichnaya I site (Figures 4.1–4.4) includes the characteristics of type Ia pottery such as a wide and shallow groove on the inner rim and an uneven belt on the outer rim. Meanwhile, it has the characteristics of type II pottery such as large inner lugs, projections on the rim, a thick wall and the mounded surface on the opposite side of the inner lugs. Thus, this clay pan is classified as type Ib pottery, because it is an intermediate type between type Ia pottery and type II pottery. The ceramic fragments shown in Figures 5.2 and 5.10 are also type Ib pottery, as they include the characteristics of type Ia pottery and type II pottery.

Concerning the identification of the type of other potsherds, it was difficult because of the fragments lacking inner lugs. However, a wide and shallow groove can be seen on all the rim fragments and some body fragments (Figures 4.5, 5.1–5.6, 5.11 and 5.17–5.19). Among them, the elaborate pottery fragments with thinner walls and shorter rims are most likely type Ia pottery (Figures 4.5, 5.3, 5.4 and 5.17–5.19), whereas the ceramics sherds with the relatively thick walls should be recognised as type Ib pottery (Figures 4.1–4.4, 5.1, 5.6 and 5.11). Moreover, other fragments with relatively thin walls are classified as type Ia or type Ib pottery (Figures 5.5, 5.7–5.9, 5.12 and 5.20). Conversely, no ceramic fragments were classified as type II or type III pottery. Thus, it is prudent to conclude that the clay vessels excavated from the Listvennichnaya sites solely consist of type Ia pottery and type Ib pottery.

5.2 Time period of the Kuril Ainu's major withdrawal from Kamchatka

Figure 6 presents the calibrated dates regarding the Nalychevo culture at the Listvennichnaya sites. According to the typological examination, the dates represents the type Ia and type Ib time periods. It is, however, impossible to specify the temporal boundary between these two types, because the potsherds and related charcoal fragments were mixed in each site. Nevertheless, it is possible to determine the time period for the termination of type Ib pottery. Although Figure 6 indicates that the type Ib period basically ended in the 17th century, it is important to determine whether this period extended into the 18th century.

Firstly, as the calibrated dates of the L-I-03 and L-II-04 samples show, type Ib pottery was obviously used in the mid-17th century. However, if this type of pottery was also used in the mid- to late-18th century (as the probability distribution of the L-1-01 sample suggests), there is a large time gap ranging from 40 years to 120 years. Instead, it is reasonable to consider that type Ib pottery terminated at the end of the 17th century, as indicated by the older calibrated date of the specimen.

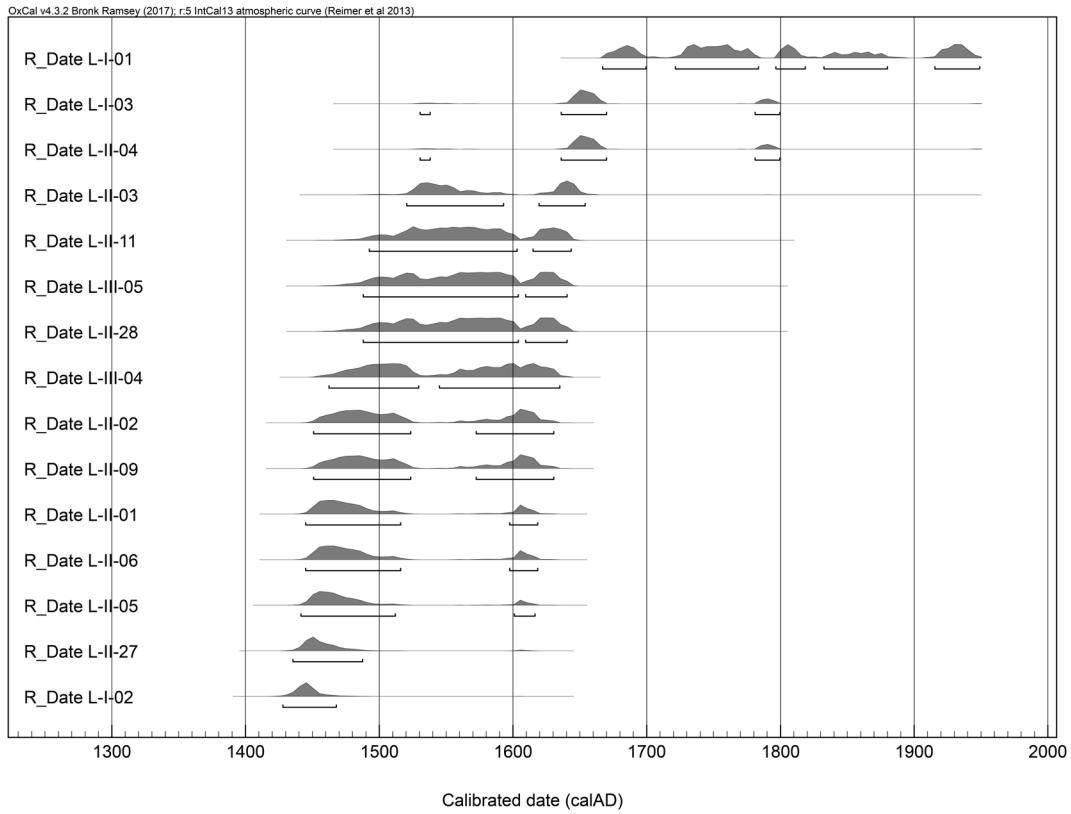

Figure 6. Probability distribution (2σ) of the calibrated dates regarding the Nalychevo culture

Secondly, as stated earlier, the habitation area of the Kuril Ainu rapidly decreased during the mid-17th to 18th centuries. This understanding is based on the rapid decrease in the distribution area of type II pottery, compared to that of type Ia pottery and type Ib pottery (Figure 7). Considering that type Ib and type II pottery were used simultaneously, it is difficult to provide a reason for such discordance in the distribution of pottery in the same archaeological culture. Apparently, there is a difference in the continuance between type Ib pottery and type II pottery.

The radiocarbon dates also suggest that the temporal boundary between these two types can be best explained if the termination of type Ib pottery occurred at the end of the 17th century and type II pottery emerged at the beginning of the 18th century. Moreover,

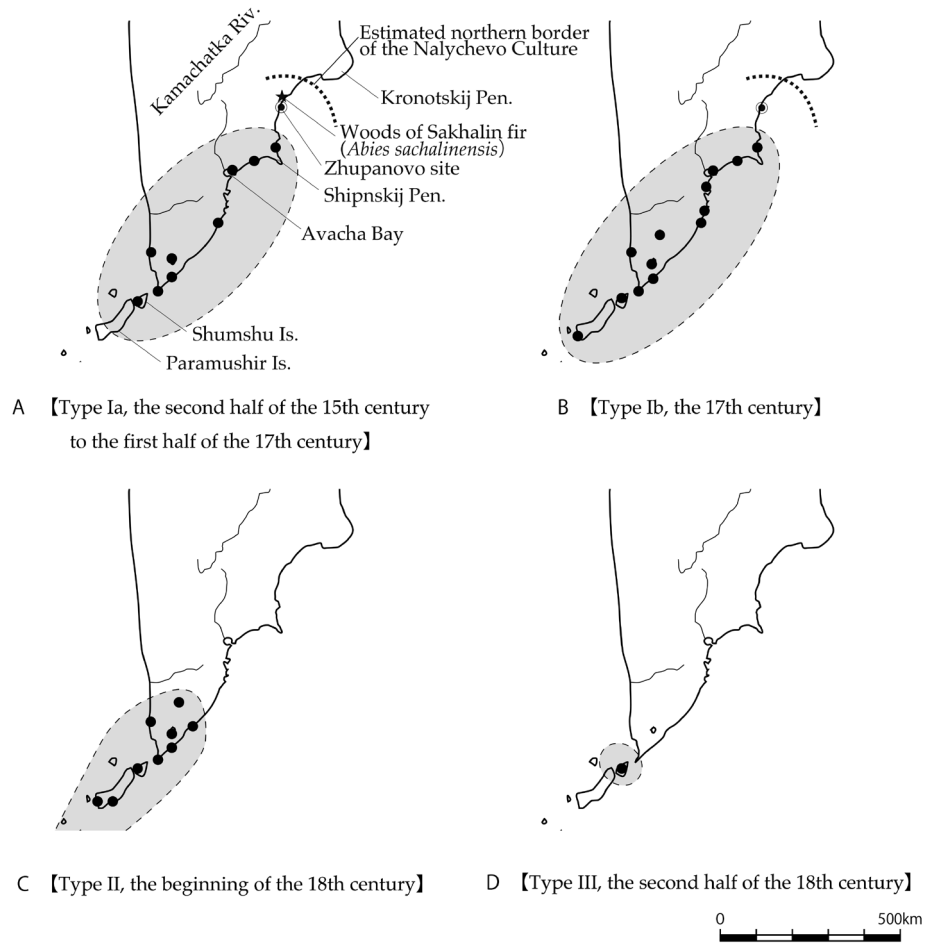

Figure 7. Temporal change in the distribution area of Naiji pottery (revised from Takase 2015)

Table 2. Naiji pottery types from each site (revised from Takase 2015)

Site or region	Ia	Ib	II	III
Bol'shaya Medvezhka	(+)	+		
Nalychevo Lake	(+)	+		
Nalychevo 9		+		
Nalychevo 12	(+)	+		
Nalychevo 15	+			
Kirpichnaya	+	+		
Bol'shaya Sarannaya	(+)	+		
Bol'shaya Sarannaya II		+		
Listvennichnaya Bay	+	+		
Utashud I			+	
Tri Sestry I	(+)	+	+	
Kuril Lake		+	+	
Shiyushk 1	+		+	
Shiyushk 2	+		(+)	
Lopatoka Cape and Lopatka I	+	+	+	
Andrianovka	(+)	+	+	
Yavino 3			+	
Yavino 4	(+)	+	+	
Yavino 7	(+)	+		
Gorygina		(+)	+	
Northern Kurils	+	+	+	+
Central Kurils			+	

+: present; (+): possibly present

a significant decrease in the distribution area of the Nalychevo culture simultaneously occurred with the formation of type II pottery at the beginning of the 18th century. It is important to note that the Kuril Ainu lived in Listvennichnaya Bay until the end of the 17th century, but they disappeared by the beginning of the 18th century. Overall, the Kuril Ainu's major withdrawal occurred at the beginning of the 18th century.

As mentioned earlier, Listvennichnaya Bay was expected to have been the northern border of type II pottery, based on limited information regarding Bergman collection. However, according to this author's examination of pottery in Bergman collection, there is no type II pottery in this particular region, and this understanding is supported by artefacts collected by our 2015 campaign. Regarding the convincing northern boundary of type II pottery on the east coast, there is the Utashud I site in Vestnik Bay (Ponomarenko 1993, Figure 1 and Table 2). Because the Kuril Ainu's habitation area expanded to the Zhupanovo site in Kronotsky Bay during the type Ia and type Ib periods (Ponomarenko 1985, Figure 1), the northern boundary of the Kuril Ainu shifted 350 km south from Kronotsky Bay

to Vestnik Bay in the beginning of the 18th century (Figure 7). Although there was no significant change in their habitation area on the west coast, it is clear that the early 18th century was an important turning point in the history of the Kuril Ainu. Based on these findings, it is possible that they stopped living in Kamchatka by the end of the 18th century and solely occupied the Northern and Central Kuril Islands during the 19th century.

It is still difficult to determine the reason(s) for the Kuril Ainu's ceasing to live in Southern Kamchatka. However, according to historical documents, Russian invasion of Kamchatka and subsequent battles between the Russians and indigenous peoples occurred during the early 18th century (Okun' 1935). Thus, the Kuril Ainu might have fled Kamchatka to avoid any conflicts with the Russians, although a change in the subsistence, a change in the relationship with other indigenous peoples and the Japanese or a change in trade should be also taken into consideration (Takase 2015).

5.3 Time period regarding the occurrence of the Kuril Ainu

According to Figure 6, which provides important information for the occurrence of the Kuril Ainu, the two oldest ages (L-I-02 and L-II-27) include a narrow range of calibrated dates. They also suggest that the occurrence of the Nalychevo culture in Southern Kamchatka can be dated to the mid-15th century. In previous studies by the author, it was impossible to specify the exact date for the oldest stage of the Nalychevo culture, because all the calibrated dates for type Ia pottery included a wider time range (i.e. the mid-15th to mid-17th centuries). This is because the studies also used the harpoon typology to estimate the time period for the occurrence of the Kuril Ainu (Takase 2015, 2019). However, because the radiocarbon dates in the present study clearly demonstrated that the Nalychevo culture emerged in the mid-15th century, this was the time period for the occurrence of the Kuril Ainu.

Although the homeland of the Kuril Ainu remained to be identified, there is no doubt that they migrated from the Ainu habitation area to Southern Kamchatka and the Northern Kurils through the Southern Kurils (Takase 2015, 2018). The time period for the occurrence of the Nalychevo culture suggests that archaeological materials between the 14th and 15th centuries are extremely important for determining the homeland of the Kuril Ainu. Perhaps, future research can compare various specimens from this time period, especially those from Hokkaido, Sakhalin and the Southern Kurils to determine the Kuril Ainu's origin.

5.4 Time period regarding the Tar'ya culture

As a by-product of the radiocarbon dating in this study, the time period regarding the Tar'ya culture can be clarified. According to Dikov (1977), the radiocarbon dates for this culture are approximately dated to the first millennium BC, despite their large margin of error (2070±190 BP (Mo-354), 2160±290 BP (MAG-5), 2440±80 BP (RUL-607)). In a more recent study, Ponomarenko (1993) reported two radiocarbon dates from the

Listvennichnaya II site as 2360±40 BP (GIN-6381) and 890±40 BP (GIN-6382). The older age most likely belongs to the Tar'ya culture, whereas the newer one is inconsistent with other dates regarding the culture. There are also two reliable AMS radiocarbon dates for the Tar'ya culture from Southeastern Kamchatka: 2480±40 BP (Beta-243239) and 2420±40 BP (Beta-243240). The former is the date of a charcoal fragment collected from the cultural layer contained a labret at the Nalychevo 8 site (Figure 1), whereas the latter date is derived from a charcoal specimen collected from the cultural layer at the Avacha site (Dikova 1983).

Figure 8 presents the calibrated dates older than the Nalychevo Culture period. They are derived from charcoal specimens collected at the Listvennichnaja II, the Nalychevo and the Avacha sites. Based on the findings, the specimens could have been dated between the eighth century BC and the third century AD, which is consistent with date of the Tar'ya Culture shown in previous studies (Dikov 1977; Ponomarenko 1985). Thus, all results in Figure 8 should be regarded as dates of the Tar'ya Culture. However, Ponomarenko (2014) speculated that the age for this culture might include a wider range. Therefore, a detailed examination of the artefacts, stratigraphy, and possible specimen contamination is warranted to determine the time period for this culture's occurrence. Currently, the time

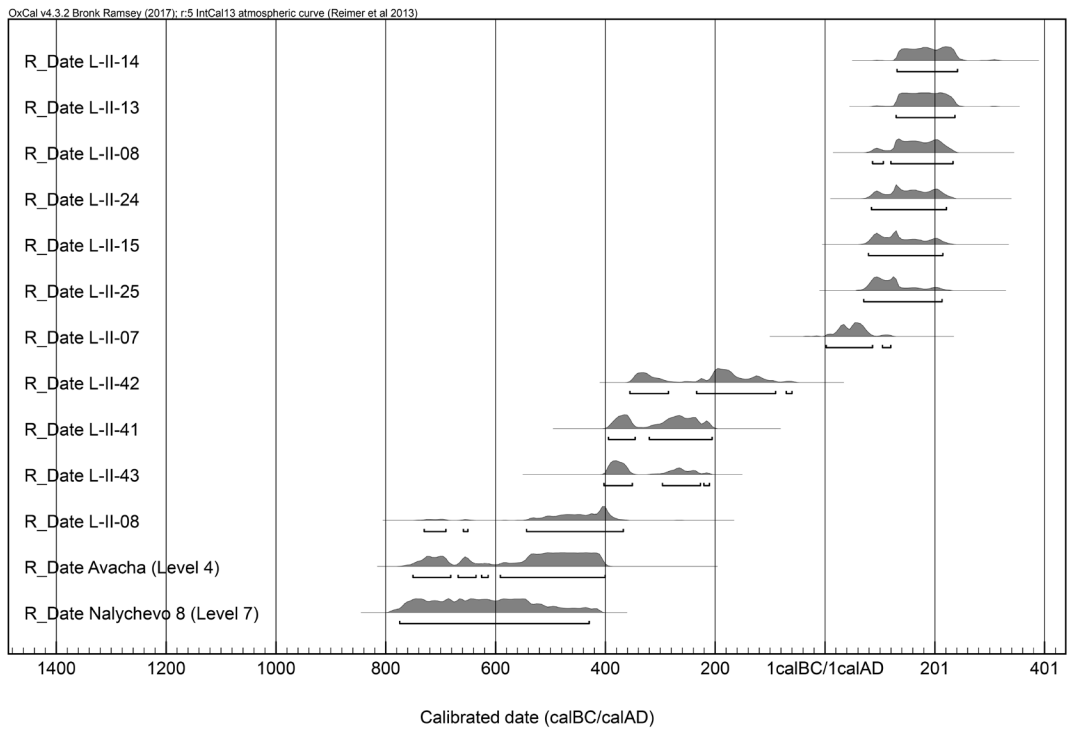

Figure 8. Probability distribution (2σ) of the calibrated dates of samples regarding the Tar'ya culture

period between the eighth century BC and the third century AD should be recognised as the core period for the Tar'ya culture in Southeastern Kamchatka.

According to Figure 8, the Tar'ya people did not persist in Listvennichnaya Bay after the early third century AD, which is relevant for examining the termination of this culture. As stated earlier, the pit dwellings of the Nalychevo culture were often constructed by destroying the KS-1 tephra layer and underlying cultural layer (e.g. Ptashinski & Takase 2008). Because there were no artefacts found between the Tar'ya cultural period and the Nalychevo cultural period in Southeastern Kamchatka, it could be that either the people did not live in this region or the population density was extremely low after the termination of the Tar'ya culture. Based on the close ages between the KS-1 layer (1806±16 BP, 134 AD–251 AD at 95.4% probability) and the end of the Tar'ya culture (i.e. the second century AD to the first half of the third century AD), it is posited that the Tar'ya culture disappeared after the Ksudach volcanic eruption (KS-1) in Southern Kamchatka (Figure 1). It is important to note that, according to the Volcanic Explosivity Index (Newhall & Self 1982), this particular eruption was assumed to be of a magnitude of six (colossal eruption). Although this eruption cannot explain the extinction of the Tar'ya culture in the entire Southern Kamchatka, it makes sense to consider the influence of such volcanic activity on humans in Southeastern Kamchatka.

6. Conclusions

This study examined various fragments of Naiji pottery and conducted radiocarbon dating of charcoal samples from the four Listvennichnaya sites in Southeastern Kamchatka. Based on the typological examination of the pottery, all the ceramic fragments were categorised as type Ia or type Ib pottery. The radiocarbon dating of the charcoal samples also demonstrated that the Kuril Ainu habitatation area in Southern Kamchatka rapidly decreased in the early 18th century. At that time, the northern boundary of their habitation area shifted 350 km south from Kronotsky Bay to Vestnik Bay, whereas there was no significant change on the west coast. In addition, because the time period of the Nalychevo culture occurrence was determined to be the mid-15th century, this was also the date of Kuril Ainu's formation. Finally, the age of the Tar'ya culture was dated from the eighth century BC to the third century AD. Although further research is required, this study posited that the large eruption of the Ksudach volcano (KS-1) might have caused the extinction of the Tar'ya culture in Southeastern Kamchatka.

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Notes

1) It is notable that an archaeological culture usually does not necessarily correspond to a certain ethnic group. However, the main bearers of the Nalychevo culture should be regarded as the Kuril Ainu, based on certain conditions (Takase 2015, 2019).
2) As recorded in the Russian documents from the 17th and 18th centuries, the Kuril Ainu included a mating network with the Itel'men. Thus, some of the Kuril Ainu were assimilated in Southern Kamchatka (e.g. Krasheninnikov 1755; Ogloblin 1891). However, the archaeological sites of the Itel'men culture were distributes around the Kamchatka River basin, whereas the archaeological sites along the coastal areas of Southern Kamchatka (particularly those from the latter half of the second millennium AD) basically belonged to the Nalychevo culture. According to a physical anthropological examination, the Kuril Ainu people were tightly clustered with the Hokkaido Ainu and the Sakhalin Ainu (Yamaguchi *et al.* 1993). A study on ethnographic documents also suggests that the cultural elements of the Ainu were well preserved even in the mid-18th century (Sasaki 2015). Thus, the Kuril Ainu in the present study refers to the Ainu who spoke the Kuril dialect of the Ainu language.
3) Bergman collection also contains artefacts from the Japanese Islands and the Southern Kuril Islands (Schnell 1932). Detailed information on various artefacts and human bones from the Southern Kuril Islands has been reported by Shubina (2017).

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