

Socio-ecological Research of the Trap-pit Hunting in Jomon Period, Japan¹⁾

Hiroyuki SATO

abstract

We found pit-falls of Jomon period amounting to a. 5,900 from 243 sites in Tama New Town site cluster. There are two topographical characters with the highest density of the pit-falls as the Hill Type and the Terrace Type. The former type is arranged as the pairs consisting 2 to 3 pits around the heads of the narrow valleys for getting wild boar mainly, and the latter is as the rows consisting of more than 4 pits on the terraces for deer. During Jomon, the trap pit-falls hunting system in T. N. T. changed the former to latter, and this inclination can be found all Japanese archipelago. This change is consistent with the change of Jomon hunting society.

日本語要旨

多摩ニュータウン遺跡群では、現在までに縄文時代の陥し穴が1万基以上検出されている。陥し穴の高密度分布域には二つのタイプがあり、ひとつは丘陵頂部の沢の源頭付近に円形・楕円形の陥し穴2-3基を組として繰り返し設置される丘陵型で、他は平坦地に長円形を主とする陥し穴を4基以上列状に配置する段丘型である。丘陵型は縄文早期後半を主として縄文時代前半期に多く、段丘型は中期以降の同後半期によく見られる。多摩ニュータウン遺跡群で見られるこの特徴は、基本的に列島全体でも認められる。

現生狩猟採集民研究や民族考古学的調査の知見を加味すると、これらの陥し穴は追い込み罠に使われたのではなく、罠罠であった可能性が高い。丘陵型を主とする前半期には、イノシシを主としながらも多様な動物を対象としたが、後半期になると、シカを対象とした積極的な罠罠に収斂すると考えられる。この変化は、構造的な土地利用・季節的生業システム・狩猟組織の分節化等の発達といった縄文社会の構造変動に連動していた。

Introduction

In recent years, the explanation of the total image of Japanese Neolithic culture, Jomon period, according to dietary restoration based on the analyses of edible materials from shell mound or other wetland sites has become active. This way of the explanation, however, can not be generalized for Jomon socio-cultural systems, for these sites do not represent all of the Jomon sites, specially reflecting maritime adaptations. Most of the Jomon sites are located inland, so we must investigate them with a particularly-defined research strategy to explain and interpret the modes of adaptations of Jomon hunter-gatherers to inland environments, especially about hunting (Sato 1989a).

The aspects of Jomon hunting, composed of technologies, systems, contexts and their organiza-



Fig.1 Location of T.N.T. Sites Cluster

tions, are still obscure in detail. On the basis of many researches on the modern hunter-gatherer and ethnographic observations, however, it can be said that hunting usually belong to men' activities and the principle of hunting practice influences the social integration of hunter-gatherers a great deal. It appears highly probable, therefore, that the researches on the Jomon hunting will clarify paleoeconomical aspects and the subsistence patterns in Japanese Neolithic, and that the socio-structural approach can manifest the contents of their social adaptations, though grasping how the groups with a specified hunting method of trap-pit hunting were organized. The trap-pit hunting should have

been performed as a part of complex and composite hunting systems at that time.

In the present paper, I assess the functional interrelationship between the hunting systems of modern hunter-gatherers and those possessed by the prehistoric Jomon. The Jomon hunting systems analyzed especially in the *Tama-New-Town* (T.N.T.) sites cluster (Fig. 1). The analysis results produced in T.N.T. are most accurate and minute researches that are being carried out in Japan at present. I also estimate the meanings of the trap-pit hunting in the Jomon culture of Japanese archipelago through interpreting it from an evolutionary point of view.

1. Research of Pit-falls in the Tama-New-Town sites cluster

The T.N.T. sites cluster, located in the range of Tama Hill, west Tokyo, south Kanto District, is some 3,000ha. in area, extending a.14km west-east and a.2-4km north-south. It has yielded 956 sites, and total area of the sites themselves on the cluster amounts to a.423 ha. We have researched and excavated these sites for more than 30 years so far; more correctly speaking, 460 sites in all were excavated until 1987. In these excavations we found pit-falls amounting to a.5,900 from 243 sites (Fig. 2). The average value calculated for the density of pit-falls in these sites is 206 m^2 per pit.

Then, I select the sites with excavated area more than 1,000 m^2 , regardless of whether or not these pit-falls found there, and again calculate the average density of the pits in order to avoid the bias resulting from excavating too small areas and from estimating the geographical zone without the pit-



Fig.2 Distribution of Sites found pit-falls in T.N.T.

falls.

Thus, it becomes clear that this average is 205 m² per pit, with total area of excavation computed a.840,000 m² and pit-falls found from 134 sites to a.4,100. It also becomes clear that there are two topographical characters with the highest density of the pit-falls (Fig. 3).

The first of these locations is on the southern growing terraces of three waterways, that is the *Okuri, Kotta, Misawa* Rivers. These rivers originate in the west part of the hills, and flow into Tama River located to the east. The second location with the highest density is on the hilltops and slopes around the heads of narrow valleys having a long stream with some arborescent waters. The hilltops and steep slopes other than those mentioned above have a few pits, and the bottom of valleys, and adjacent alluvial terraces in the lowest altitude have no pits. In archaeological research, the identification of the area which do not yield any particular features or finds is quite difficult. One of the most fruitful successes of the long T.N.T. research project is that we could find the area and topographic zone without any pit-falls. Probably, the reason why the prehistoric human groups adopting pit-fall hunting could not exploit in these areas for this hunting was that these areas were under too wet and bad an environment at that time, which undoubtedly was unsuitable for pit-fall hunting behavior (Sato 1986; 1988; 1989a).

2. Classification of the pit-fall as is seen from hunting system

The pit-falls in T.N.T. Jomon sites can be classified into four types (Fig. 4). The first of these, Type I, has a single specified trace thought to have been a lower part of the equipment to fixing a thing like an abates in order that game to be hunted could not escape under the pit bottom. Plans of

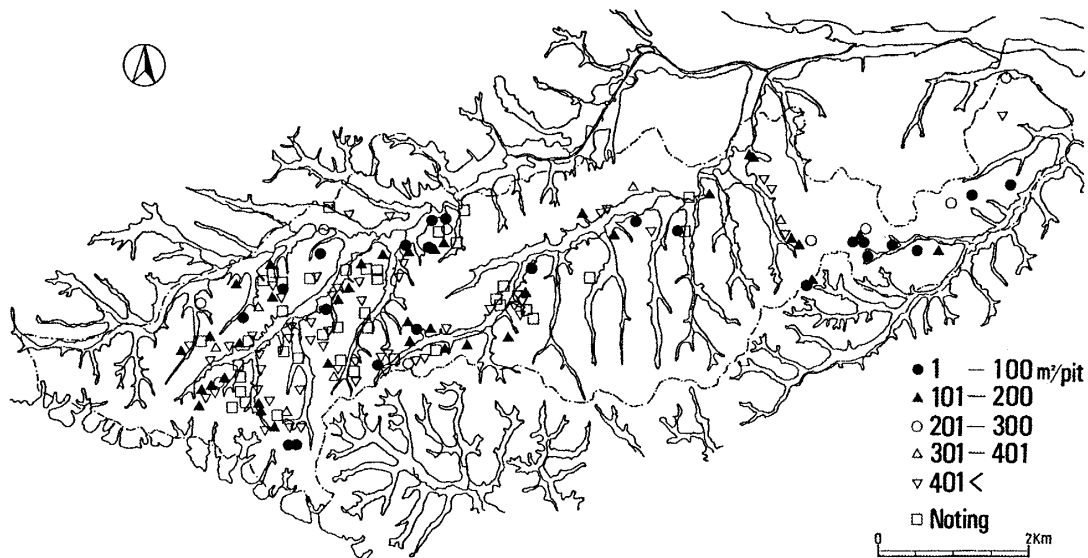


Fig.3 Distribution of pit-falls by every density among sites of over 1000m² excavated area

this type of pit are sub-classified into two: the one which is round and square and the other which is rectangle and elongated oval. These two sub-types, however, vary and are not strictly divided. It is thought that this type of the pit-fall mainly belongs to the second half of Initial Jomon (8,000-6,000 BP) to incipient Early Jomon (6,000-5,000, BP) on the basis of the comparative identification between the covered soil in pits and the standard stratigraphic sequence of T.N.T., according to which other sites so far researched in the area have been dated as to their formation age. Type I pit-falls are most numerous in the T.N.T. Sites cluster, and can be subdivided in terms of their morphological variations (Sato 1984; 1989b).

Second type, Type II, has two abates traces under the pit bottom. The form of this type pits converges to a more elongated oval, and is less varied than Type I. Although Type II is supposedly dated to the time-range after Type I, i.e. from the first half of Early to Middle Jomon (5,000-4,000 BP), on the basis of soil comparison, I think that most of Type II pit-falls belonged to the Early Jomon. Both of types Type I and II are mainly located on the hill, but larger Type II of themselves sometime tends to be located on the terrace, too.

The third type, Type III has neither abates trace nor morphological variations, many of them being rectangle in plan. This type of pit-falls are subdivided into two: one which is larger and is thought to have belonged to the second half of Early to the first half of Middle Jomon, and the other which middle-sized and is dated to the first half of Middle Jomon to Heian Era (9-12th century AD).

Lastly, Type IV is a named "T-Pit", whose plan is much elongated like a ditch. Abates traces under the pit bottom are either present or nothing. Only one example of this type exists in T.N.T., but

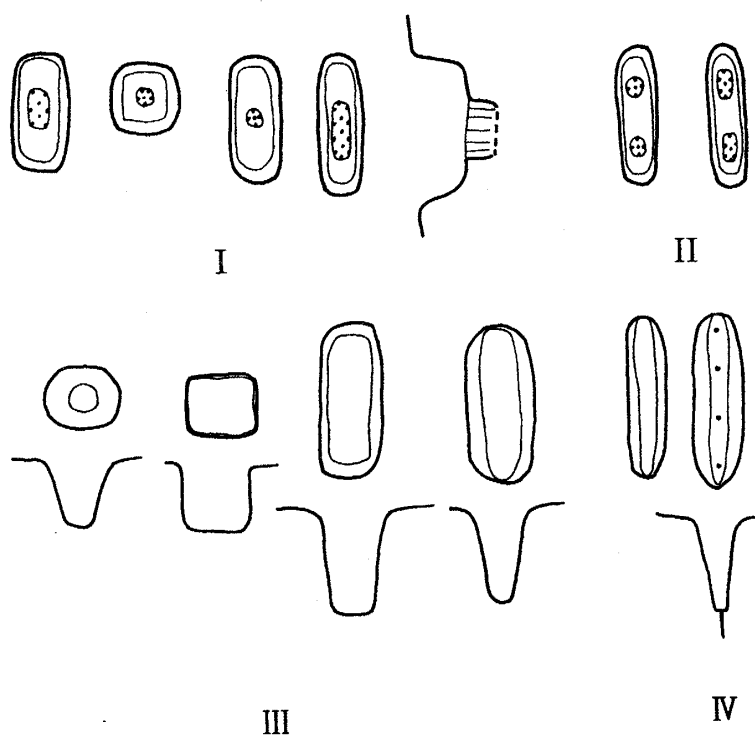


Fig.4 Classification of pit-falls

some pits belong to this type are distributed on the terraces, tableland, and flat hills around the T.N.T. cluster. T.N.T. pits of type IV are distributed all over the Kanto district, but they never form the main pit-falls there as Tohoku and Hokkaido, where this type is distributed most dominantly and is dated to the Middle to the Late Jomon (4,000-3,000 BP).

3. Distribution and location of the pit-falls

I tentatively designate the pit-falls distributed in high density on the terraces mentioned above as Terrace Type of distribution pattern, and those on the hilltops and slopes around the heads of the long valleys as Hill Type. The former type is arranged as the rows consisting of more than 4 pits on the terraces near the topographic changeable area, varying from flat to slope. For example, the row consisting of more than 10 pits is often parallels to this changeable contour line. In some cases, there is some relationship between these rows, which leads me to think that some rows were present at the same time or that these rows consisted of hunting units simultaneously.

The latter type is arranged as the pairs consisting of 2 to 3 pits without fulfilling the condition of rows. As the result of repeated construction of these pairs of pits around the heads of the narrow valleys in many cases, there are the aggregations or crossings of many pits in same areas. It is impossible, however, to recognize some relationship between the pairs of pits as a hunting unit.

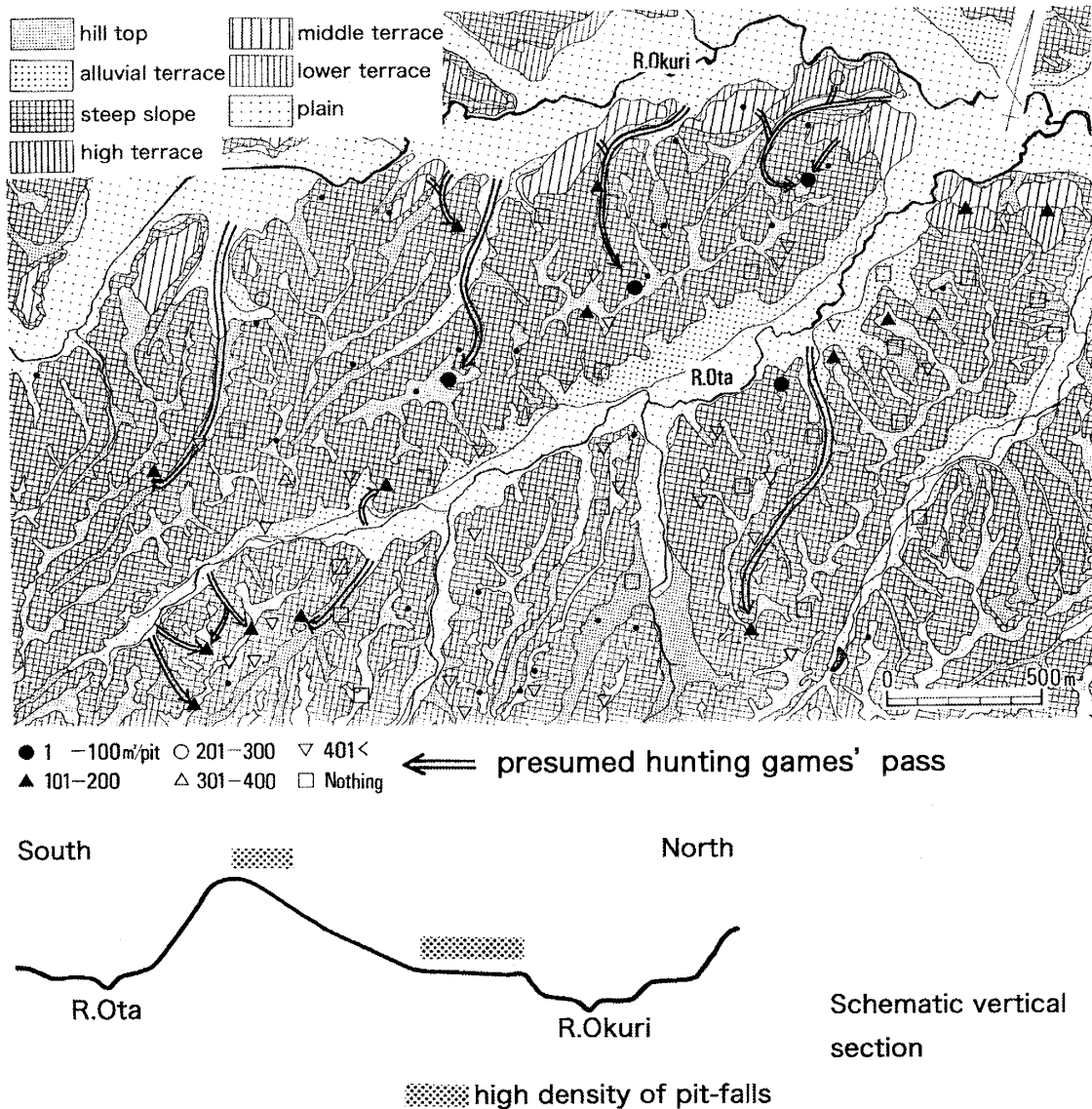


Fig.5 Matsugi research area

The Hill Type of distribution pattern consists of Type I and II, almost all of the trap pits of the T.N.T. belong to this pattern. And, the Terrace Type consists of type I, II, and III, and there is the tendency that the main type on the higher terrace is Type I, whereas on the lower terrace Type III.

Consequently, I selected the area extending 3.5km in the east to west direction and 2km in the north to south direction in western part of T.N.T., that is the area covering *Matsugi*, Hachioji-city, in order to investigate the pattern of the Hill Type pit-fall hunting in more detail (Fig. 5). Researches conducted in this area have been sufficient enough without exception, and sites excavated so far total 96 in all. I choose the sites with excavated areas more than 1,000 m², and calculated the density of pit-falls per site to compare them with 205 m² which is the average density of all T.N.T. As the result of this analysis, the high density areas (more than 205 m²) of pit-falls are on both the southern

river terrace and the hilltops and slopes around the heads of long valleys opened northwards. This result possibly reflects the fact that in the chosen area there are hills expanding from east to west, with slopes of the hillside, gentle in the north and steep in the south, and wide river terrace chiefly on the southern bank of river. These pits mainly belonged to Type I and II. The pit-fall hunting in this area is supposed to have been dominant on two spots. Especially on the hilltops, the game was hunted of while going up a valley (Sato 1984; 1988).

Next, I examined the excavation case of Site No.426, located on the wider southern river terrace of *Okuri* River, in order to investigate the content of high density type on terraces (Sato 1989b). The main type of pit-fall at this site is the I, which constructs the Hill Type despite that the site itself is located on a terrace. The pit-fall hunting using Type I was the most dominant of in all of the sites in T.N.T., including No.426, during the Jomon period without exception. Because site the typological difference between pairs consisting of two or three type I pit-falls is large at No.426, and there is a negligible relation between these locations, it is thought that each pair was constructed independently. At No. 426, there are some type II pit-falls which are thought to have belonged to the succeeding stage of type I (Sato 1987). The characteristics of this type of pit-falls as compared to type I are as follows (Fig. 6).

Firstly, type II pit-falls are more stable with smaller in morphological variation, and more elongated and larger than type I. Secondly, type II has a strong tendency to be located on one topographic unit. Thirdly, the sign of row situation appears in pit-falls arrangement.

The characteristics of type II mentioned above are also seen in following stage. Above all, the elongation of pit-fall form is the most important of all the evolutionary changes in pit-falls, so the change in elongation and the addition, from one to three, of abates trace on the bottoms of pits was the response to this elongation of pit form (Fig. 7). At the same time, the type II pit-falls were made onto terraces.

Concluding what is stated above, I would like to insist that the evolutionary change of pit-falls in T.N.T. passed two stages (Tab. 1). In the first stage, dated to the second half of Initial Jomon to Early Jomon, a number of smaller and diversified pits of Type I and II, only slightly elongated, were arranged again and again all over the hills as the pairs consisting of two or three pits with no relation to each other. Especially on the hilltops around the heads of waters, many pits are arranged, but only a few rows of pits were arranged on terraces. In the second stage, dated to the Early to the Middle Jomon and to later periods, rows consisting of more than four bigger pits of type II or III, more elongated and standardized than the pits of the preceding stage, gradually became to be arranged mainly on the flat land such as terraces. There were some relations between these rows.

Since distribution pattern of both of the Hill and Terrace Type is based on a set of pits as a pair or

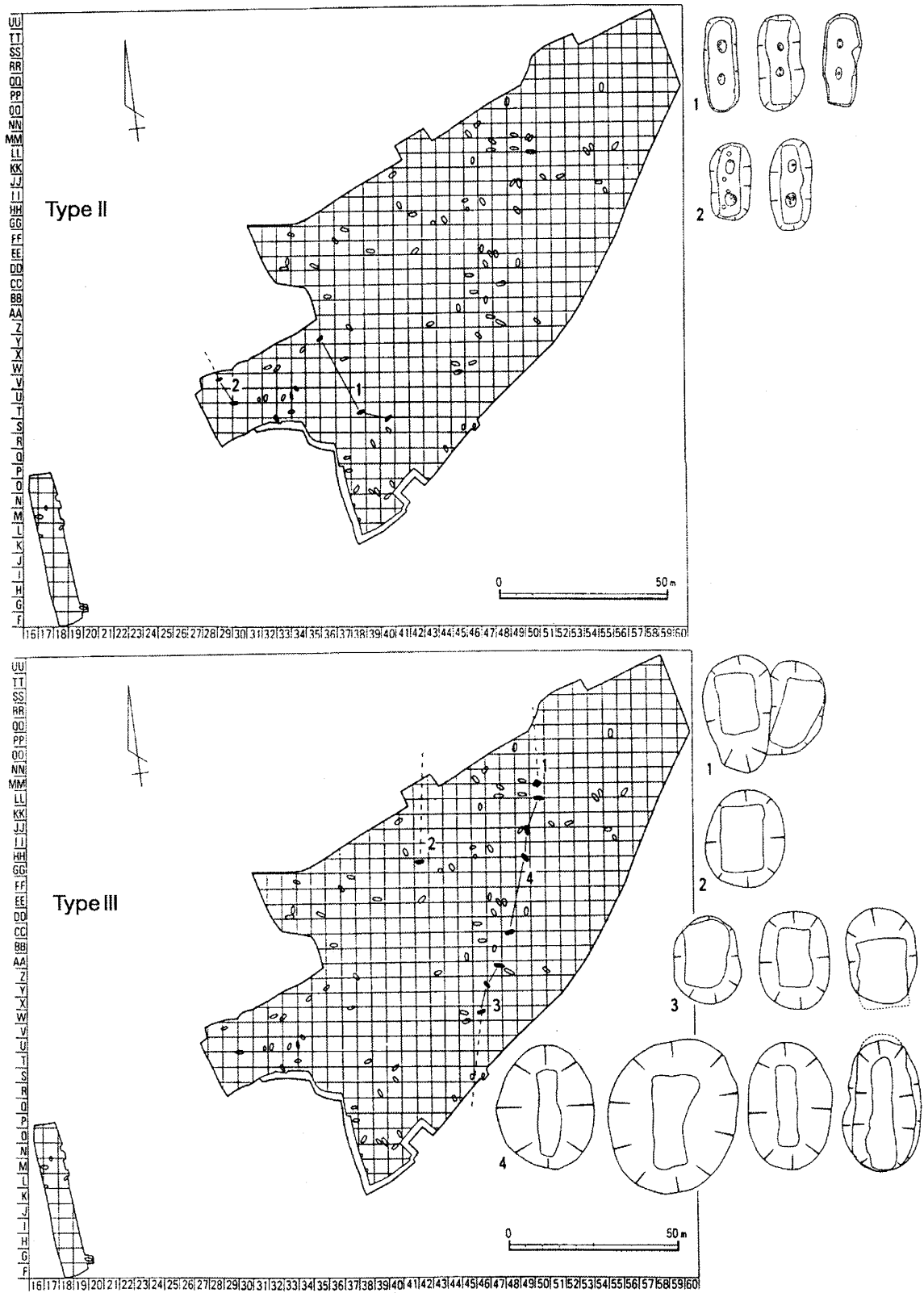


Fig.6 Pit-falls arrangement in T.N.T. No.426 site

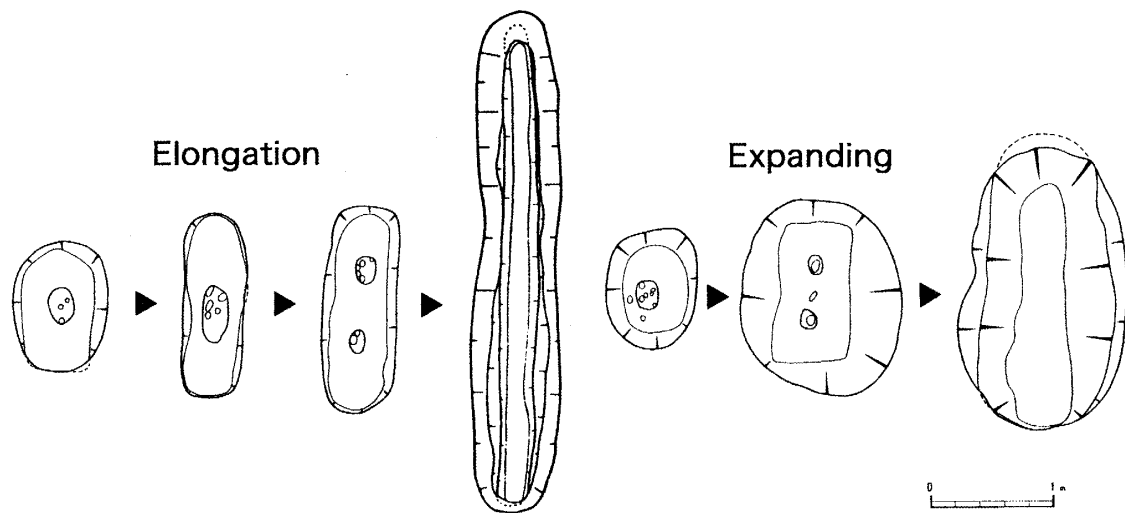


Fig.7 Elongation and expanding of pit-falls

Tab.1 Temporal Change of Archaeological Aspects of Trap-pits in Tama-New-Town Site Cluster

stage	topographic location	distribution pattern	arrangement	pit type	number	size	variation	tendency of elongation	period
first	all	hill type + (terrace type)	a pair of 2 or 3, no relation between pairs	I → II	many	small	large	feeble	late Initial to Early Jomon
second	convergent	terrace type	a row of more 4, relation between rows	III (IV)	few	large	small	strong	Early, Middle Jomon and after

a row, it is assumed that these pits were combined by fences made of grass, tree, log or stone (Sato 1993).

Including the type IV pit-falls which are not located in the T.N.T. but are located around this, I again estimated the tendency of elongation and the expansion of pit-falls through time. Probably, both of the elongating and expanding tendencies concerned all the pit-falls in the first stage, but these tendencies were divided into different directions in the second stage. Though the pit-falls having the latter tendency developed on the flat lands in T.N.T., the pit-falls with the former tendency developed on flatter lands such as a tableland outside this area. It is convinced that the expanding tendency was at its height in the second stage, and the expanded pit-falls continuously succeeded this stage up to recent years. The elongating tendency also was at its height in the second stage and after, as is named T-pits, which are too elongated like a short ditch and which developed in east Japan like Tohoku or Hokkaido District. The pit-falls with this tendency, however, disappeared gradually. The transitional phase between the first and second stage was continuous, and type II pit-falls or a few pit-falls with three abates trace forms on the bottom have the intermediate characteristics between these two phases, i.e. the change of location selection from hill to terrace, elongation of

pit form and its relational change like expansion and increase of the abates trace, expansion and smaller variation of pit forms, moderate duration of existence, decrease in the number of pits from type II to pit-falls with three abates trace forms, and so on.

4. The trap-pit hunting: ethnoarchaeological and socio-ecological examination

Many ethnographic parallels about pit-falls have been observed all over among worldwide hunter-gatherers. However, from the ethnoarchaeological point of view as Hodder stood on (1982:11-27), we must compare them by examining adaptation similarities of these parallels on the basis of cultural, social, ecological and context conditions. Consequently, I try to assess the Jomon trap-pit hunting in comparison with the hunting systems of some sorts of deer among northern hunter-gatherers for the following reasons.

Firstly, although the prehistoric Jomon hunters were suited to mid latitude hunting and gathering ecologically, there are no suitable people at present except for North American indigenous natives. Their group hunting systems are more similar to that of the northern hunter-gatherers than that of the southern (Brink and Rollans 1990; Davis and Reeves 1990; Driver 1961; Frison 1978; 1987; Frison et al. 1990; Nelson 1973).

Secondly, as seen in the stable territoriality of the distributions of types of Jomon pottery, it is rational to think that Jomon hunting systems did not stagnate the level of southern hunting systems, which were chiefly based on personal and expedient hunting or small group hunting, but that they developed the level of northern systems using organizational and communal hunting.

Thirdly, since it is assumed that the pit-fall hunting was a part of Jomon hunting systems for games as deer and wild boar (Imamura 1987; Sato 1986; 1989) that were main edible games in Jomon periods (Kaneko 1983), it is important to examine the communal deer hunting among the northern hunter-gatherers.

Fourthly, Oswalt (1976) chose 36 sample hunter-gatherer societies as research samples without adaptation, ecologically and geographically biased way of selection. Assessment of cases of pit-falls abstracted from this data shows that the trap-pits among tropical farmers and a few hunter-gatherers in temperate zone are mainly used for insects, birds or small games, and only a few large pit-falls are used to defend against the games trying to get agricultural products as on hill garden. And, the games to be hunted among the hunter-gatherers in the northern temperate and northern or circumpolar zones are mostly reindeer or other kinds of deer, and their hunting systems in these places are more organized. So, the Jomon hunting that used pit-falls as trap-pits should have been very similar to the hunting among northern hunter-gatherers (Holliday 1998).

1) Ethnographical observations of northern hunter-gatherers and their trap-pit hunting

The land where the northern hunter-gatherers live is very wide, but the environmental conditions and ecosystems surrounding them are simpler and more similar each other than those surrounding their southern neighbors. The circumpolar zones of tundra (north) and a forest (south) in which they lived, covering from Greenland through northern Eurasia to America, have environmental conditions only slightly diversified between east and west. They hunt reindeers in tundra and sorts of deer as elk chiefly in forest. They have developed their hunting systems in adaptation to behavior in hunting games. There are many factors in the hunting systems that are throughout these areas. It can be said that the basic similarity between these hunting systems is highly due to adaptation.

It is known that the more in the north, the more hunter-gathers prefer to hunting, and that in Arctic zone their subsistence is only hunting (Lee 1968; Watanabe 1978.). They have the high level of communal hunting, so that the fruits of personal hunting are commonly restored to a group (Maeda 1985). Their main ways of hunting are devised to get many games such as reindeer or elk by driving-in. In Siberia and others areas, hunting by driving is proceeded in such a way that after the construction of a pair of inducing rows or fences made from trees, logs, stone poles and stone heaps, gregarious games are driven between rows, to waters such as lake or river, to cliffs or some equipments like cages, enclosures, hollows and narrow corridors, where these games are killed by beating, shooting, stabbing or dropping down the cliffs. The inducing fences are different according to whether they are in tundra or forest, and made from tree or stone. These constructions are usually several kilometers, but longest example measures more than 70km. There are several hunting ways varying from simple driving to complex one as in arrangement of traps and shooters nearby, but the driving hunting is the skilful way and the best technique to get numerous deer, which is well adapted to the behavior of deer migrating seasonally and moving in a group. Consequently, the driving hunting is conducted seasonally, and has a complementary relation with other trap or personal hunting. Some hunter-gatherers in the southern temperate zone hunt bison or black mountain sheep by driving, and their hunting structures are very similar to the northern one (Frison 1978; 1987; Frison et al.1990). It can be thought, therefore, that the hunting in the northern and temperate zones in the prehistoric periods was exercised by driving.

The deer hunting among the northern hunter-gatherers also use the pit-falls. It is rare to use pit-falls in a large scale hunting by driving, and when used they are arranged to break inducing fences for the individual games trying to escape. As reports of the hunting way using pit-falls are scarce, we are not able to correctly restore this way of hunting. On the basis of a few cases such as that by Barth (1982; 1983), however, this hunting way is characterized by a trap on a small scale. Judging from

ethnographic observations, there are a plenty of pit-falls that are not used for large scale of driving hunting but are used in simpler ways for games to pass. After all, the Jomon pit-falls can be interpreted to use as traps with inducing fences.

In conclusion, it is possible to think that the northern hunter-gatherers use hunting systems which consist of seasonal communal hunting, which allows hunting of many games at one time, and complementary personal hunting using traps or bows and arrows to live on reindeers and other deer such as elk. Pit-falls are used in both of these hunting systems: less often in the former system and more often in the latter. The pit-fall hunting as is in ethnography, therefore, is supposed to be based on trap²⁾. Such a functional similarity and the tremendously wide equality of the deer hunting among the northern hunter-gatherers lead me to think that it is at least possible to speculate a function or method, similar to the ethnographic cases, for the Jomon pit-fall hunting, though the extent of specialization or development may differ each other. Consequently, the Jomon pit-fall hunting was the trap-based, and it is thought that the types of trap were changed by the evolution of trap-pit hunting.

2) The deer hunting of Ainu

The systems of deer hunting among the northern hunter-gatherers are considered as the response to strong seasonality. The most important ethnography in interpreting the Jomon hunting from the viewpoint of ecological anthropology is obtained by the research results on *Tokachi* Ainu of East Hokkaido, presented by Hitoshi Watanabe (1972). Ethnographic and anthropological observations by Watanabe demonstrate that the deer hunting system of *Tokachi* Ainu is similar to the northern hunter-gatherers.

The diets and objects of subsistence activities most important in *Tokachi* Ainu in winter are salmon and deer, for the Ainu live in the sub-arctic region as Hokkaido. The *Kotan*, village of the Ainu, is located on a river terrace near a place where the salmon spawns. The *Kotan* is the center of the activities and cosmology of the Ainu people. The main games to be hunted are bear and deer; the former is not important as food and is usually hunted for bear festival, and the latter, deer, is as much important food as salmon to winter and is hunted according to the schedule established seasonally.

Deer dispersedly inhabits all the plains and mountains in spring to early autumn. In summer, fishing and gathering are active, but the meat and skin of deer are bad quality in summer, so the Ainu do not hunt them in this season. The seasons for deer hunting are spring and autumn. In spring, the Ainu carry out the trap-bow hunting with poison arrows as well as the small scale of driving hunting named mountain hunting, while staying in a cottage in a group. In autumn, they firstly carry out the deer fence hunting, in which the trap-bows with poison arrows are arranged in the breaks of induc-

ing fences, and after fishing, in late autumn, they carry out the mountain hunting. The most important and efficient hunting is the deer fence hunting, and the mountain hunting is carried out in order to complement the shortage of gains by the deer fence hunting. The gears by the Ainu people are only bows and arrows used in hunting and trapping. The trap-bow hunting is conducted in the mountains where the deer fence hunting, carried out in the river terraces or hillsides behind *Kotans*, is not practiced. This trap-bow hunting is conducted at dominant spots, already fixed for individual sub-groups belong to the same group practicing deer fence hunting, and consists of adult kinship men from one to three families. These spots are usually on the slopes at both sides of rivers, which have *Kotans* on the terraces of their down streams. The trap-bows are placed in the same points on the habitual routes of migrating deer from winter to other seasons. The deer fences are made of a tree, and from several hundreds meters to several kilometers long in the areas, where within the limits of 4-5 km people can go round from *Kotan*, and are same every year. This hunting is carried out to take advantage of the habit of deer, attached to the flat lands for pairing in autumn, and to avoid the competition with the salmon fishing conducted at the same time of the year.

The deer hunting of the Ainu using the trap-bows can be seen as the reflection of strong seasonality. Two ways of hunting, especially, that is the trap-bow hunting in the mountain and the deer fence hunting, are thought to be similar to the two ways of Jomon trap-pit hunting in T.N.T. Needless to say, simple comparison between mere factors of these two cultures, which are distant from each other both spatially and temporally, is too dangerous. It seems possible in the pertinent case, however, to compare them for the reasons why follows.

Firstly, the strong similarity among the deer hunting systems of the northern hunter-gatherers including the Ainu is ascribable to adaptation. So, I think it is possible to compare between the Ainu hunting and Jomon trap-pit hunting, for it is assumed that deer was one of the main games to be hunted in the Jomon periods. Secondly, the research on the *Tokachi* Ainu by Watanabe, an ecological anthropologist, seems to be the most preferable direct historical approach (Hodder 1982:28-46), to analyze the Jomon society and their subsistence on the basis of ecological, geographical and cultural contexts. As mentioned above, I would like to investigate the aspects of the Jomon trap-pit hunting in T.N.T., referring to the hunting systems of the Ainu including the trap-bow hunting, on condition that I totally recognize that the *Kotan*, village of the Ainu, is the center of the living systems, usually located near the spot where the salmon spawns.

5. Discussion

1) The trap-pit hunting in T.N.T.

The pit-fall hunting conducted in the Jomon periods in the T.N.T. area manifests such peculiarity

as specialization of hunting system, leading me to think, on the basis of following ethnological observations, that these pit-falls were traps.

a). The functional adaptations in the deer hunting systems among the northern hunter-gatherers are very similar each other. These hunting pit-falls are used mainly for trap (Barth 1982; 1983; Fitzhugh and Crowell 1988; Frison 1987; Gronnow 1986; Kusterer 1987; Spiess 1979; Maeda 1985; Oswalt 1976; Imamura 1976).

b). As the meanings of trap-pit hunting in hunting systems, the arrow trap of the Ainu or Siberian ethnic minorities furnish us with much functional and structural information (Watanabe 1972; Sato 1986).

c). There is a large divergence in scale between the trap hunting and the driving hunting of the northern hunter-gatherers.

d). Trap-pits of the Hill Type in T.N.T. at least should be speculated to have been traps.

e). Although the arrangement of rows in the T.N.T. trap-pits is linear in the short axes direction of pit, ethnographic observations concerning the driving hunting show that the equipments such as traps or fences are not arranged linearly due to topographic constraint. Usually, driving hunting is carried out in such way that the games are surrounded by obstacles and driven into one place, composing of a funneled fence, jump, water, bigger shallow pit, enclosure, narrow corridor, and so on. This place does not consist of smaller trap-pits at all, for the games excited by driving may not fall in them and jump over them. If the assumption about the utilization of pit-falls in the driving hunting is correct, the goal for the games to be driven into should not have been linear arrangement of trap-pits, but should have been between linear rows. In this case, however, it is impossible to consider that the gaps between rows of pit-falls were topographically chosen. So, the difference between the first and the second stage of the evolutionary change of pit-falls in T.N.T. was the developing-perfecting process of the trap-pit hunting

What are the characters of these two stages of the trap-pit hunting? Important clue for further analysis lies in the formal change of the abates traces. Detailed observations about this matter show that the length to width ratios of the abates traces of Type I are equal in almost every case in spite of the strong variation of pit forms. The elongation of pit form advanced through time with the appearance of Type II or the pits with three abates traces, both the elongation and the increasing of the abates traces having occurred. In other words, this tendency was the option to hold the area influenced by abates in response to the elongation of pit-falls. This phenomenon leads to an interpretation that these pit-bottom equipments were not spears but abates. Also, detailed research for the way of constructional these pit-bottom equipments supports this interpretation (Sato 1987). On the basis of this research, the structure of these equipments could not keep the spears supporting large

weight of games, and it is supposed that were flexible like an abates. Moreover, trap capturing is better than killing by a trap-spear in terms of the preservation and consumption of meat and the reuse of trap-pits. Consequently, the change of the trap-pits from, Type I or II with abates traces to Type III or IV without them shows both the process that the organization of the hunting group advanced in order to complement the increasing of labor volume in pit construction and the transition from the negative trap-pit hunting to the positive one.

It is supposed, on the basis of other researchers (Sato 1983; Otaishi 1983), that the elongation and standardization of trap-pit forms resulted from the limited range of games to be hunted, deer. Probably, the Hill Type trap-pit hunting in the first stage had several games for targets, i.e. deer, wild boar and other small animals, which altogether came to the headwaters to drink or wriggle. So, in the case of trap-pits of the Hill Type their location was superior to the games to be hunted. The trap-pit hunting of the Terrace Type, on the other hand, was carried out on and around the routes of migrating deer to winter or during the pairing habitat. And, in this case the game to be hunted was superior to the location of trap-pits, the method of their hunting responding to the behavior of the target animal, deer. In the first stage, there were several trap hunting methods at every location, including both of the Hill and Terrace Types. In the second stage, however, the technique and system on for hunting was developed and specialized toward the trap-pit hunting of the Terrace Type, because of higher availability of the gregarious deer in this type of hunting.

In the first stage of the evolution of trap-pits in T.N.T., the distribution of the *Jokonmon* pottery coincides with the area having many trap-pits, but there is seen the distribution of fire-pits, supposed to have been equipments for processing the meats of games and the pit-dwellings or settlements of the same age around or outside T.N.T. So, it is thought that all the areas in T.N.T. was jointly owned by several hunting groups as the hunting place without residential activities. Probably, the base camp of hunting groups was located outside T.N.T. at that time, and the people recognized every area in T.N.T. as the place for hunting. And, the small scale of trap-pit hunting might have been carried out by small groups in the hilly areas in T.N.T., probably consisted of adult kinship men as family member. Because the trap-pits could not be constructed again and again in a short time, as they were deep and were not dug easily, and because the location was superior to the games to be hunted, it is supposed that the spaces was utilized simply and fixedly by hunting, and the seasonality progressed only slightly.

This fixed utilization of space disappeared following emergent appearance of the positive trap-pit hunting in the second stage. In T.N.T., pit-dwellings appeared and increased gradually after Early Jomon period. This means the complex and seasonal utilization of space by hunting, gathering and settling. When the seasonal trap-pit hunting made progress, the area for hunting was limited mainly

Tab.2 Evolutionary Change of Trap-pit Hunting System in East Japanese Jomon

stage	characters	objective games	adaptation	seasons	utilization of hunting area	membersip of hunting group	spatial utilization	seasonality
first	negative	several, but mainly deer and wild boar	location > game	all	common	adult kinship men as a family	simple, fixed	no progress
second	positive	deer	location < game	limited (spring, autumn)	occupational	adult men come from some kinship families	complex, classified	progress

on terraces, and the trap-pit hunting was developed for the adaptation to the behavior of deer such as the migration in winter and pairing in group, it becomes possible that this hilly land was really used for many and complex objectives. This means not only the evolution of the hunting system including the trap-pit hunting, but also the establishment and development of the total hunting-gathering systems, based on seasonality, closely related to the adaptation change of the social and subsistence structure. The content of the progress of trap-pit hunting, therefore, supposedly shows that this change was gradual and continuous (Tab. 2).

2) Jomon trap-pit hunting in Japan: hypothetical reasoning

What does the change of hunting systems, which determined the trap-pit hunting in T.N.T., mean for the Jomon hunting systems in Japan? The trap-pits are distributed almost of all over Japan, from Kyushu Island, west Japan (Imamura 1983; Takahashi 1994), through Honshu, central Japan (Inada 1993; Ishii 1988; Miyazawa and Imai 1976), to Tohoku, Hokkaido in east Japan, but the area with the densest distribution are in east Japan and along the coast of the Japan Sea. Among these areas, Kanto, Tohoku and Hokkaido, manifest relatively local spatiotemporal phases of trap-pits (Tamura 1986; Morita and Endo 1984). It is comprehended, on the basis of several researches, that the temporal change of trap-pit types in Kanto, Tohoku and Hokkaido bore close resemblance to that in south Kanto including T.N.T.

As regards Iwate Prefecture, northern Tohoku, it is thought that Type I with round form is dated to before initial Early Jomon, for this type pits were covered by the *Nakazuri* volcanic ash, estimated to date to the first half of Early Jomon. Type II in Iwate, on the other hand, is not fixed yet in its dating. Type III, however, is dated from middle Final Jomon to Early Heian, 9-10th century A.D.; there was recognized *Towada* A volcanic ash in the upper part of inside soil of Type III trap-pits. And, many of Type IV pits were used during a short period from the Middle to the initial Late Jomon, with rows of pits recognized for the instances of small scale and some related rows for large scale (Tamura 1986). In Hokkaido, Type I and II, of which both are distinct, are not observed, and the nature of type III is supposed to be different from that T.N.T. The trap-pits of Type IV

progressed singularly, and the duration of their presence was short as in Iwate, from the Middle to the initial Late Jomon (Morita and Endo 1984).

On the basis of investigation results of these instances, I conclude that the change from the first to second stage of the trap-pit hunting in T.N.T. basically had the same direction with that of east Japanese Jomon, lacking type IV. It is not easy to clarify the aspects of transformational process of trap-pits as is done in T.N.T., but there is a tendency that the pit-falls were more elongated and expanded in the east Japanese Jomon. It is not thought that the difference in the methods of trap-pit hunting between the north and the south was influenced by the difference in environments or temperature reflecting the change of the location pattern. It is thought that this difference does reflect different degrees of progress of hunting systems.

Probably, the first stage of the trap-pit hunting can be widely seen in east Japan except for Hokkaido. After the first stage, the center shifted from Kanto and Chubu to Tohoku with the adaptation evolution and progress of hunting methods. It is considered that in the second stage in T.N.T. the trap-pit hunting progressed singularly to be Type IV trap-pit hunting, i.e. T-pit hunting in Tohoku and Hokkaido. The fact that the T-pit hunting can not be seen in T.N.T. leads us to suggest that hilly land was not chosen for this type of hunting. Although the expanded pits remained on flat lands such as small areas of terraces in hilly land, the elongated pits of Type IV or T-pit advanced to the locations, outside the hilly lands such as T.N.T, where a wide flat land could be reserved. The positive hunting adapted to the behavior of the deer evolved peculiarly in these locations. It is difficult to explain the causes for the prosperity and rapid disappearance of Type IV (T-pit) hunting. Through the research so far accumulated on the trap-pit hunting, however, it is possible to say that this phenomenon reflect not the change of the methods of the trap-pit hunting, but also the social and subsistence change including hunting-gathering systems. It may be assumed that Type IV trap-pits disappeared rapidly, but a part of them survived and converged to the expanded pits. I think that the expanded trap-pits did not disappear until the end of the Jomon period, continuing perhaps until recent years.

The development and the disappearance of the trap-pit hunting should have had several causes. Firstly, it is supposed that both the replacement from pit-falls to other traps, such as noose, snare and trap-bow, and low frequency for the trap-pits to have been used to strengthen other hunting methods were important causes, for the trap-pit was an indispensable constituent of the trap hunting system. Secondly, it is supposed that the change of hunting-gathering systems and adaptation patterns to establish the seasonality, in response to the change of natural environments such as fauna or flora, was an important cause. For example, it is a likely phenomenon that the trap-pits decreased from the first to second stage by increasing efficiency in trap-pit hunting in terms its evolution, and

not by over-kill (Imamura 1983). The establishment of the seasonality was not brought about by the development of the trap-pit hunting only. Because the phenomena like the transition, from the simple hunting system which utilized traps were arranged at the efficient locations to hunt various games being superior to limiting the sort of games, to the developed one which limited the sort of games, the locations and the seasons, as the trap-pit hunting, are to be also assumed on other aspects of subsistence systems. It is possible to say that various factors such as techniques for gathering, collecting, hunting and so on developed the subsistence system correlatively. The trap-pits was one of these factors, and makes splendid data for the research of the total subsistence systems of Jomon culture.

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Notes

1. This paper had been reported in the international symposium "From Jomon to Star Carr: Hunter-Gatherers of East and West Temperate Eurasia", University of Durham, September 4 to 8, 1995.
2. As regards the grounds of viewpoint that Jomon pit-falls can not be thought to have been traps, some researchers often point out the inefficiency that needs cost but produces less benefit (Hayashi 1983; Morita and Endo 1984). Their insistences, however, ignore the ecological and cultural contexts in actual hunting systems. As is seen among northern hunter-gatherers or the Ainu, the most efficient hunting system does not remain through selections; such a system usually is the relational and complex system composed of several ways of hunting. In the case of the Ainu, for example, the best time of hunting coincides with the time for other main subsistence activities, such as the salmon fishing, and the trap hunting is needed. Therefore, the trap hunting has the basic function complementing other main subsistence activities at one time, and a simple economical determinism can not be established in such a case. In addition, the trap hunting has a social meaning. Ordinarily, hunting is carried out by men, but there are reports describing participation of women, children and elders in trap hunting. This is an example of the social division of labor in hunting practice.

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