

# INTER FACULTY

JOURNAL OF INTERDISCIPLINARY RESEARCH IN HUMAN AND SOCIAL SCIENCES  
UNIVERSITY OF TSUKUBA (JAPAN)

<https://journal.hass.tsukuba.ac.jp/interfaculty>

---

*Inter Faculty*, 3 (2012): 25–37

<https://journal.hass.tsukuba.ac.jp/interfaculty/article/view/54>

DOI: 10.15068/00000457

Published: March 30, 2012

## Article

### Reconsideration of the Use of Salt in the Jōmon Period

Takamune KAWASHIMA

University of Ljubljana (Slovenia)

To cite this article:

KAWASHIMA, T. (2012). Reconsideration of the Use of Salt in the Jōmon Period. *Inter Faculty*, Vol. 3, pp.25–37.

<<https://doi.org/10.15068/00000457>> [Accessed: 2021.12.2]



This is an open access article under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.  
<<https://creativecommons.org/licenses/by-nc-sa/4.0/>>

# Reconsideration of the Use of Salt in the Jōmon Period

Takamune KAWASHIMA  
Department of Asian and African Studies  
Faculty of Arts  
University of Ljubljana

## Abstract

*Pottery salt production, which appears in the Late Jōmon period, has been studied in terms of its exchange networks and production processes as well as the typology of salt-making pottery. Jōmon salt-making pottery is found on the Pacific coast of eastern Honshū Island. The many sites which contain salt-making pottery sherds are widely distributed through the Kantō Plain, even in inland areas. In most previous studies, the use of salt in the region has been assumed to be related to the preservation of marine products because diverse fishing tools have been uncovered from the southern coast of Lake Kasumigaura, the central area of salt production in the Kantō Plain. However, this scenario cannot explain the wide distribution of salt pottery in the Kantō Plain. As salt production was performed in various places over a wide area, in order to interpret the development of salting in the Jōmon period, it is important to compare Jōmon salt production with other examples of salt production. In this paper, using some ethnographic examples from the New Guinea highlands, I will try to clarify the use of salt, and the reason why salt production developed in the Late Jōmon period.*

**Keywords:** Jōmon, hunter-gatherers, salt, use, production

## 要旨

縄文時代後期にはじまる土器製塩は、製塩土器形態や編年などとともに、交換や製塩工程について研究が進められてきた。縄文時代の製塩土器は主に東日本の太平洋岸で出土している。関東地方では、縄文時代の汀線付近だけでなく、内陸部にも製塩土器が分布している。先行研究では、土器製塩の中心地である霞ヶ浦沿岸でヤスなどの漁撈具が同時期に発達することから、生産された塩の用途は漁撈にともなう食品保存と関連付けられることが多かった。しかし、この説では内陸部に分布する製塩土器を説明することはできない。縄文時代における製塩の発達を解明するには、世界各地に見られる製塩活動との比較が必要

であろう。本稿では、ニューギニア高地における製塩の民族資料との比較を通じて、縄文時代の塩の用途と土器製塩の発達の原因を探る。

キーワード：縄文、狩猟採集民、製塩、用途、工芸品製作

## **1. Introduction: previous studies of salt in the Jōmon period**

Salt production in the Jōmon period (16,500-2,900/2,300 calBP) has been studied in terms of production and exchange by hunter-gatherers. Most studies examine the exchange network from production sites to consumption sites, and the production process such as labor division between sites. Since the social organization of the Jōmon is thought to be simple, salt production, which seems to be a too complicated activity for hunter-gatherers, is recognized as an important topic of study.

In Japan, due to the absence of rock salt and salt lakes, seawater has been used for salt production since the Jōmon period. The existence of salt-making pottery in the Late Jōmon period has been proven since the 1960s. Evidence of salt production in the Jōmon period has been found in eastern Japan, mainly along the Pacific Ocean, such as Mutsu Bay (Kitabayashi 1994), Sanriku Coast (Kimishima 1999), Sendai Bay (Koikawa and Katō 1994), Lake Kasumigaura (Kondō 1962), and the Tōkai region (Takahashi 2008). The places where salt production developed are geographically separate, and no technological relations between the different regions have so far been found. The reason why salt production appeared thus still remains one of the most debated issues.

Three dominant lines of argument exist with regard to the emergence of salt production in the Late Jōmon period. First, Kondō (1962) asserts that the increasing demand for crystallized salt in inland areas promoted salt production in coastal areas. He notes that in coastal areas the physiological need for salt is easily satisfied from seawater, and that salt could be produced for exchange as well. According to this theory, salt is supposed to have been used in the preservation of food, for medicine, seasoning, tanning, etc. Since Jōmon society is regarded as a hunter-gatherer society, the theory concerning physiological need is not widely accepted, although a few early studies mention the possibility that physiological need could be one of the reasons for salt production (Kondō 1962: 18; Terakado and Shibasaki 1969: 11).

Secondly, the disappearance of large shell mounds along Tokyo Bay is related to the emergence of salt production. Gotō (1973) supposes that large shell mounds, which developed in the Middle and the Late Jōmon periods, were made from the refuse of dried shellfish production, which was used in exchange. His theory explains that the demand for salt existed before salt production started, and that salt production replaced dried shellfish as the exchange item. His argument is based on the fact that salt production developed in the same period as the disappearance of large shell mounds.

Thirdly, salt production is thought to have started for the preservation of fish around Lake Kasumigaura (Suzuki and Watanabe 1976; Suzuki 1992; Tsunematsu 1997). Archaeological remains such as spear points imply that local populations were still actively engaged in fishing in the latter half of the Late Jōmon, while in other areas the evidence of fishing in this period gradually diminished. Suzuki and Watanabe (1976) believe that salt production developed in order to support fishing. They reject the demand for salt from inland areas as leading to the establishment of systematic salt production because physiological needs for sodium could be satisfied by bone marrow. They also reject the second theory mentioned above, because, in contrast to the Tokyo Bay area, on the shores of Lake Kasumigaura the formation of shell mounds continued until the end of the Late Jōmon. The existence of diverse fishing tools is interpreted as evidence of specialized fishing, even in the face of coastline regression, which then increased the demand for salt for preserving marine food products (Suzuki 1992; Tsunematsu 1997).

This scenario has now been generally accepted. However, the center of salt production is located on the southern shore of Lake Kasumigaura, therefore, this scenario cannot explain the fact that salt pottery is widely distributed throughout the Kantō Plain. While the amount of sherds from inland areas is quite restricted, there are still approximately 100 sites which are located away from the coast (Tsunematsu 1994: fig. 1). If all the produced salt had been used for the preservation of fish then salt-making pottery, which has traces of secondary firing, would not have been distributed. The distribution of salt-making pottery sherds in the inland areas leaves space for discussion regarding exchange networks as well as the reasons for the invention of salt production. This paper aims to reconsider the use of salt, and the reasons why salt production developed in the Late Jōmon period.



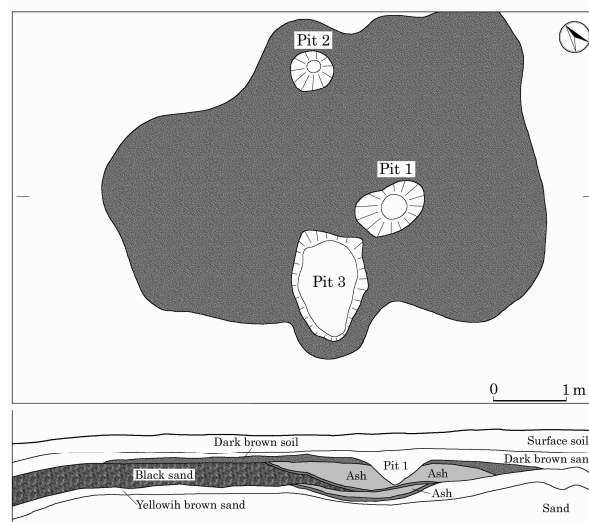
**Fig. 1: Distribution of sites mentioned and salt pottery sherds**  
 1. Hōdō, 2. Hirohata, 3. Maeura, 4. Kamitakatsu, 5. Koyamadai  
 (after Kawashima 2010b: fig. 1)

## **2. Two centers of salt production: Sendai Bay and Lake Kasumigaura**

In order to consider the reasons for salt use, I will first provide an overview of the salt production around Lake Kasumigaura and Sendai Bay.

On the southern shore of Lake Kasumigaura, three salt production sites are known (Fig. 1). The Hirohata site was excavated in 1960 (Kondō 1962), initiating the study of salt production in the Jōmon period. A large amount of coarse pottery was accompanied by Angyō 1-3c pottery types (3,400-2,850 calBP). Kondō assumes that the coarse pottery was made for boiling and for evaporation of the brine, for the following reasons: different typological features from normal pottery; accumulation of coarse pottery and ash; exfoliation of the exterior surfaces of the pottery; and light gray material attached to the coarse pottery. The Hōdō site, which is located near Hirohata, contains a large quantity of salt-making pottery, approximately 70% of the total number of pottery sherds (Tozawa and Handa 1966). Also, in this site, a possible salt workshop which measures four meters by six meters and consists of three pits, probably hearths, was discovered (Fig. 2). At the Maeura site, a hearth, a pit dwelling, and ash layers that contain salt pottery were found (Terakado 1983). Although only the preliminary report has been published, data from Maeura show evidence of salt production in this area. These three sites are located on slightly elevated land along the lake, which suggests this area was suitable for salt production.

Another center of Jōmon salt production is in the Sendai Bay area in northern Japan. At the Satohama shell mound site, several hearths with accumulations of salt-making pottery were discovered (Okamura et al. 1982; Koikawa et al. 1983; Koikawa and Katō 1988). As the hearths are concentrated in one place, this place is recognized as a workshop. The hearths consist of pits and construction material, which is probably plaster. At the Nigade shell mound site, several pits have been dug into the bedrock which is composed of tuff. They are considered to be containers for brine (Okamura et al. 1982; Suzuki and Watanabe 1976). Although in the Sendai Bay area salt-making pottery has similar characteristics to that from the Kasumigaura area, the distribution of salt-making pottery is restricted to the coastal area.

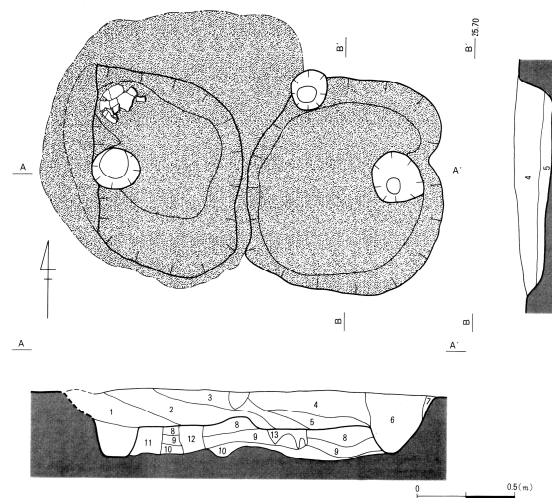


**Fig. 2: Salt-producing hearths at Hōdō.**

(after Tozawa and Handa 1966, see Kawashima 2008b: fig. 3)

On the southern coast of Lake Kasumigaura, there are three sites known as salt production sites. While other sites in the inland area also contain salt-making pottery sherds, the amount of sherds from most sites is less than 100, with the exception of a few sites, such as Kamitakatsu, Koyamadai, Nakatsuma. At Kamitakatsu (Shioya et al. 2000) and Koyamadai (Nagamatsu et al. 1976) respectively, not only a certain amount of salt-making pottery sherds but also a large outside hearth have been found. While some archaeologists insist that small-scale salt production was carried out at these sites with large hearths, only a few salt-making pottery sherds were found at the hearth at Kamitakatsu (Fig. 3). Chemical analysis of the residue on salt-making pottery from Kamitakatsu suggests that it derives from seawater. At the bottom of the large hearth,

diatoms which live on marine plants were found, which implies salt production using marine plants may have been performed. However, the amount of salt-making pottery and ash is clearly less than that from the sites on the southern coast of Lake Kasumigaura. It is notable that four complete vessels of salt-making pottery, including small ones, have been found at Kamitakatsu, the likes of which have not been uncovered from the sites on the southern coast of Lake Kasumigaura. This also shows the difference between production sites and other sites.



**Fig. 3: A large hearth at Kamitakatsu**  
(after Shioya et al. 2000: fig. 17)

While they can be the key to clarifying the process of Jōmon salt production, only a few hearths have so far been excavated. For this reason, it is difficult to understand which technique was employed in the Jōmon period. Although experimental archaeology can be used as an alternative method in this case (Nakamura 1996, 1997), it is not directly applicable to prehistoric examples because there are many techniques and conditions for salt production. In this paper, I will use comparative ethnographic data from New Guinea in order to speculate on the salt producing technique and the usage of salt in the Jōmon period.

### 3. Salt production and the use of salt in New Guinea

Several examples of simple salt production have been reported from Highland New Guinea, (Godelier 1976; Heider 1970; Honda 1967; Ishige 1976; McArthur 1972; Meggitt 1958). In most of these examples, salt springs are used as the source of salt, although some groups use salt-containing grass instead.

At the salt spring called Kumupa, the Moni tribal group produced salt according to the following procedure (Ishige 1976: 369). They soaked dried grass into the salt spring, and the following day they burnt it with firewood. After collecting small salt crystals from the ash, these were compressed and dried, and were finally formed into salt cakes which weighed approximately 1.5 kg. The Moni could produce salt throughout the year, possibly on demand from the consumers who visited the salt spring.

The Enga tribal group also produced salt in a similar way, with each salt maker owning a small section of the salt spring. They burnt the soaked wood and made salt cakes from the crystallized salt, which weighed 2.3-2.7 kg. They worked in a small hut in order to avoid moisture.

The Baruya tribal group produced salt from the ashes of a plant (*Coix gigantea koenig ex Rob*) which was cultivated in wetlands. The salt water was made from a mixture of ash and water. The salt was crystallized in the long and narrow molds of specially made hearths in five days. Several salt bars, 25-30 kg in total, were produced on average during one operation. The number of salt makers was limited to two to five, usually men, in a village of thirty adult men. Whereas the salt makers carried out the salt production, ten people were required to harvest the plant and to burn it to ash. It is assumed that the Baruya produced a maximum of 500 kg salt for twenty-one salt makers per year (Godelier 1976).

Ishige (1976: 371-372) reports several examples of exchange in New Guinea. At the time of research, the value of 6.5 kg of salt was equal to one adult pig, two woven bags, or two most valuable cowries. During his stay at Ugimba village, Ishige collected information on four cases of exchange. Of these, three cases were observed at Ugimba, from where it takes five days to Kumupa on foot. Ishige points out that Ugimba functions as a camping point for exchange, therefore exchange activity at this village could be more intensive than at others. Ishige also mentions one example where traders needed ten days to reach Kumupa. Although there are several salt springs in the Central Highlands of New Guinea, only the salt from Kumupa was distributed widely, up to



170 km to the west. On the other hand, the salt from other salt springs was consumed locally. This fact shows that not only the salt itself, but also the quality or the place of production is important.

This simple and small-scale form of salt making was performed in simply organized societies. The subsistence of these societies was based on agricultural production of sweet potatoes as the staple food, and the raising of pigs. It is generally believed that agriculturists need more salt than hunter-gatherers, but there is no clear evidence to support this idea. At Ugimba village inhabited by the Moni and the Western Dani, salt used for cooking was observed only twice during thirty-four days of fieldwork (Ishige 1976: 369). This village was located five days on foot from the salt spring at Kumupa. In addition, the Baruya did not use salt for daily consumption, only for ritual occasions. An owner of salt used only half a salt bar that weighed 1.7-2.0 kg per year. Salt was considered to belong to the same food category as meat, which testifies to its high value in Baruya society.

#### **4. The use of salt in the Jōmon period: discussion and conclusion**

Ethnographic examples from Highland New Guinea are interesting in terms of the origin of salt production as well as its purpose. In the coastal areas of New Guinea, it is reported that driftwood from the sea is collected and burnt for making salt (Meggitt 1958; Kanō 2001; McArthur 1972). As driftwood contains seawater, this kind of salt must contain a certain amount of NaCl. On the other hand, the method performed by the Baruya without seawater or salt springs produces salt which contains potassium chloride (Meggitt 1958: 309; McArthur 1972: 1027). Potassium chloride tastes similar to sodium chloride but actually functions to eliminate sodium chloride from the body. As it is said that New Guinea highlanders mostly consume plant foods, their potassium chloride intake is, then, contradictory to the physiological-needs explanation of salt intake. Salt intake clearly must be determined culturally rather than physiologically (Ishige 1976: 358; McArthur 1972: 1027).

If this fact is generally accepted, can we understand the salt production of the Jōmon in the same way? Although few examples of salt production by hunter-gatherers have been reported (Kroeber 1925: 236; McLendon and Oswald 1978: 286; Parsons 2001: 226-227), simple societies can also obtain salt directly from salt lakes, salines, exposed rock salt, and so on. There is a possibility that in the Jōmon period, salt production without pottery

had been performed prior to pottery salt production (Kanō 2001). While it was derived from preexisting coarse pottery, it is notable that Jōmon society developed special pottery for salt production. If salt production was performed earlier, the appearance of salt pottery can be understood as the development of specialization rather than invention *ex nihilo*. This line of argument is also supported by the specialized sites on the southern coast of Lake Kasumigaura.

It seems that in the Late Jōmon period, the demand for salt increased rapidly. As I noted above, in the study of salt production in the Jōmon, the preservation of marine food products was supposedly the main reason for the development of salt production. However, there are very few ethnographic examples of salt production in hunting-gathering societies (Kawashima 2010a). Moreover, no examples of food preservation with salt by hunter-gatherers are known.

As I noted elsewhere (Kawashima 2008a, 2010b), in the Late Jōmon period, exchange related to rituals seems to have developed. Although the theory that salt itself or salted food was distributed to inland areas is commonly accepted, it is difficult to suppose that Jōmon salt was used for preserving marine food if we consider how precious salt generally is in simple societies. Even in agricultural societies in New Guinea, salt is not consumed in daily use. In fact, several methods for preserving food are known, such as smoking, drying, and making dried shellfish by boiling in seawater.

The fact that local craft production, such as stone rods, shell bracelets, and clay earrings, developed in the Late Jōmon indicates the reason for the emergence of salt production. The ingredient for Jōmon salt, i.e. seawater, is available everywhere, for example anywhere along the Pacific coast, but intensive salt production is observed only on the southern coast of Kasumigaura. With regard to salinity, this place actually seems to be disadvantageous for the location of salt production sites, as it is located at the deepest area of a bay. This may be related to the method of salt production in the earlier stage, for example using certain types of marine plants. Compared with salt production in New Guinea, Jōmon salt production sites have similarities to Kumupa in terms of site location and distribution of salt pottery sherds, the latter being partly equivalent to the traces of salt exchange. Salt from Kumupa was regarded as the most valuable salt in the region, even though salt was also produced in several other locations. While there

remains a possibility of small-scale salt production at other sites, salt from the southern coast of Kasumigaura could similarly have been recognized as valuable. The size of the exchange network around Kumupa covers the entire distribution area of salt pottery in the Kantō Plain. Although the amount of salt produced in the Jōmon period should be examined in further research, Jōmon salt could have been supplied for exchange and used in ritualized contexts, similarly to the New Guinean examples.

---

\* I am deeply grateful to Prof. Mark J. Hudson and Dr. Maja Veselič for their useful corrections, comments and suggestions on the manuscript.

## Bibliography

- AKAZAWA Takeru (1972). *Report of the Investigation of the Kamitakatsu Shell-midden Site*. Tokyo: The University of Tokyo. (The University Museum Bulletin; 4).
- GODELIER Maurice (1973). *Horizon, Trajets Marxistes en Anthropologie*. Paris: Librairie François Maspero; Japanese translation by YAMAUCHI Hisashi 山内 昶 訳 (1976). *Jinruigaku no chihei to shinro* 人類学の地平と針路. Tokyo: Kinokuniyashoten.
- GOTŌ Kazutami 後藤和民 (1973). Jōmon jidai ni okeru Tōkyōwan engan no kaizuka bunka ni tsuite 縄文時代における東京湾沿岸の貝塚文化について [Shell Mound Culture along Tokyo Bay of the Jōmon]. In: Chihōshi kenkyū kyōgikai 地方史研究協 議会 (ed.). *Jōsōchihōshi no kenkyū* 常総地方史の研究. Tokyo: Yūzankaku.
- HEIDER Karl G. (1970). *The Dugum Dani: A Papuan Culture in the Highlands of West New Guinea*. Chicago: Wenner-Gren Foundation for Anthropological Research. (Viking Fund Publications in Anthropology; 49).
- HONDA Katsuichi 本田勝一 (1967). *Kyokugen no minzoku* 極限の民族 [Tribes in Farthest Lands]. Tokyo: Asahishinbunsha.
- ISHIGE Naomichi 石毛直道 (1976). Kumupa no shio: Irian Jaya chūōkōgen no busshitsu bunka (1) Kumupa の塩—イリアン・ジャヤ中央高原の物質文化 (1) — [Salt Making at Kumupa: Material Culture in the Central Highland of Irian Jaya]. *Bulletin of the National Museum of Ethnology* (Suita), vol.1, no.2.
- KANŌ Tetsuya 加納哲哉 (2001). *Bishō dōbutsu izontai no kenkyū* 微小動物遺存体の研究 [A Study of Micro Faunal Remains]. Tokyo: Kokugakuindaigaku daigakuin. (Collection of Studies at Graduate School of Kokugakuin University).
- KAWASHIMA Takamune 川島尚宗 (2008a). Feasting and Inter-Village Networks. *Documenta Praehistorica* (Ljubljana), vol.35.

- KAWASHIMA Takamune 川島尚宗 (2008b). Salt Production and Social Complexity in the Jōmon Period. In: *Living with Diversity, the Proceedings of 1st Slovenia Japan University Cooperation Network Graduate Student Forum*. Tsukuba: IFERI.
- KAWASHIMA Takamune 川島尚宗 (2010a). Jōmon jidai doki seien ni okeru rōdōkeитай 縄文時代土器製塩における労働形態 [Labor Organization in Salt Production of the Jōmon Period]. *Tsukuba Archaeological Studies* (Tsukuba), no.21.
- KAWASHIMA Takamune 川島尚宗 (2010b). Mounds and Rituals in the Jōmon Period. *Documenta Praehistorica* (Ljubljana), vol.37.
- KIMISHIMA Takeshi 君島武史 (1999). Tōhoku chihō no seiendoki: Sanriku hokubu wo chūshin ni 東北地方の製塩土器—三陸北部を中心に— [Salt Pottery in Tohoku Region]. *Kitakamishiritsu maizōbunkazai sentā kiyō* (Kitakami), no.1.
- KITABAYASHI Yasuharu 北林八洲晴 (1994). Aomoriken 青森県 [Aomori Prefecture]. In: KONDŌ Yoshirō 近藤義郎 (ed.). *Nihon doki seien kenkū* 日本土器製塩研究 [A Study of Pottery Salt Production in Japan]. Tokyo: Aokishoten.
- KOIKAWA Kazuo et al. 小井川和夫他 (1983). *Satohama kaizuka 2* 里浜貝塚 [Satohama Shell Mound Site 2]. Tagajō: Tohoku Museum of History.
- KOIKAWA Kazuo and KATŌ Michio 小井川和夫, 加藤道男 (1988). *Satohama kaizuka 7* 里浜貝塚 7 [Satohama Shell Mound Site 7]. Tagajō: Tohoku Museum of History.
- KOIKAWA Kazuo and KATŌ Michio 小井川和夫, 加藤道男 (1994). Miyagiken Iwateken 宮城県・岩手県 [Miyagi Prefecture and Iwate Prefecture]. In: KONDŌ Yoshirō (ed.). *Nihon doki seien kenkyū* 日本土器製塩研究 [The Study of Pottery Salt Production in Japan]. Tokyo: Aokishoten.
- KONDŌ Yoshirō 近藤義郎 (1962). Jōmon jidai ni okeru doki seien no kenkyū 縄文時代における土器製塩の研究 [The Study of the Jōmon Salt Production]. *Okayama daigaku hōbungakubu gakujutu kiyō* (Okayama), vol.15.
- KROEBER Alfred L. (1925). *Handbook of the Indians of California*. Washington, D.C.: Smithsonian Institution. (Bureau of American Ethnology Bulletin; 78).
- McARTHUR Margaret (1972). Salt. In: *Encyclopedia of Papua and New Guinea*, vol.3. Melbourne: Melbourne University Press in association with the University of Papua and New Guinea.
- McLENDON Sally and OSWALD Robert L. (1978). Pomo: Introduction. In HEIZER Robert F. (ed.). *Handbook of North American Indians*, vol.8. Washington, D.C.: Smithsonian Institution.
- MEGGITT Mervyn J. (1958). Salt Manufacture and Trading in the Western Highlands of New Guinea. *The Australian Museum Magazine* (Sydney), vol.12, no.10.
- NAGAMATSU Minoru et al. 永松実他 (1976). *Koyamadai kaizuka* 小山西貝塚 [Koyamadai Shell Mound]. Tokyo: Toshokankōkai.

- NAKAMURA Atsuko 中村敦子 (1996). Jōmon jidai dokiseien ni kansuru ichishiron: Ikō niyoruseien kōtei no hukugen 縄文時代土器製塩に関する一試論—遺構による製塩工程の復元— [An Attempt on the Salt Production Using Pottery in the Jōmon Period: Restoration of the Salt Making Process from Archaeological Features]. *Shikan* (Tokyo), vol.135.
- NAKAMURA Atsuko 中村敦子 (1997). Jōmon jidai no seien doki wo meguru shomondai: Kantō chihō wo chūshin ni 縄文時代の製塩土器をめぐる諸問題—関東地方を中心に— [Problems over the Jōmon Salt Production: Focusing on the Case of the Kanto Region]. In: *Shinpojiumu: seien doki no shomondai: Kodai ni okeru shio no seisan to ryūtsū* シンポジウム 製塩土器の諸問題—古代における塩の生産と流通—. Japan: Shio no kai shinpojiumu jikkōiinkai.
- OKAMURA Michio et al. 岡村道雄他 (1982). *Satohama kaizuka 1* 里浜貝塚 1 [Satohama Shell Mound Site 1]. Tagajō: Tōhoku Museum of History.
- PARSONS Jeffrey R. (2001). *The Last Saltmakers of Nexquipayac, Mexico: An Archaeological Ethnography*. Ann Arbor: Museum of Anthropology, University of Michigan. (Anthropological Papers; 92).
- SHIOYA Osamu et al. 塩谷 修他 (2000). *Kamitakatsu kaizuka E chiten* 上高津貝塚E地点 [Kamitakatsu Shell Mounds: Location E]. Tsuchiura: Tsuchiurashi kyōikuiinkai.
- SUZUKI Masahiro 鈴木正博 (1992). Dokiseien to kaizuka 土器製塩と貝塚 [Pottery Salt Production and Shell Mounds]. *Quarterly the Archaeology* (Tokyo), vol.41.
- SUZUKI Masahiro and WATANABE Hiromi 鈴木正博, 渡辺裕水 (1976). Kantō chihō ni okeru iwayuru Jōmon shiki “doki seien” ni kansuru shōkō 関東地方における所謂縄紋式『土器製塩』に関する小考 [An Essay on So-called Pottery Salt Production in the Jōmon period in the Kanto Region]. *Jōsōdaichi* (Hitachinaka), vol.7.
- TAKAHASHI Mitsuru 高橋 満 (1996). Dokiseien no kōtei to shūdan: Seien doki bunpuken no naritachi 土器製塩の工程と集団—製塩土器分布圏の成り立ち— [The Process of Salt Production and the Organization: The Distribution of Salt Pottery]. *Quarterly the Archaeology* (Tokyo), vol.55.
- TAKAHASHI Mitsuru 高橋 満 (2008). Seien doki 製塩土器 [Salt Pottery]. In: KOBAYASHI Tatsuo (ed.). *Sōran Jōmon doki* 総覧 縄文土器 [Handbook of Jōmon Pottery]. Tokyo: UM Promotion.
- TERAKADO Yoshinori 寺門義範 (1983). Seien 製塩 [Salt Production]. In: *Jōmon jidai no kenkyū* 縄文時代の研究, vol.2. Tokyo: Yūzankaku.
- TERAKADO Yoshinori and SHIBASAKI Nobuko 寺門義範, 芝崎のぶ子 (1969). Jōmon kō banki ni mirareru iwayuru seien doki ni tsuite 縄文後、晩期にみられる所謂『製塩土器』について [So-Called Salt Pottery in the Late-Final Jōmon]. *Jōsōdaichi* (Hitachinaka), vol.4.

- TOZAWA Mitsunori and HANDA Junko 戸沢充則, 半田純子 (1966). Ibarakiken Hōdō iseki no chōsa: Seienshi wo motsu Jōmon jidai banki no iseki 茨城県法堂遺跡の調査—「製塩址」をもつ縄文時代晩期の遺跡— [Hōdō Site, Ibaraki: A Final Jōmon Site with Salt Workshops]. *Sundaishigaku* (Tokyo), vol.18.
- TSUNEMATSU Shigeto 常松成人 (1994). Kantō kakutoken 関東各都県 [The Kanto Region]. In: KONDŌ Yoshirō (ed.). *Nihon doki seien kenkyū* 日本土器製塩研究 [The Study of Pottery Salt Production in Japan]. Tokyo: Aokishoten.
- TSUNEMATSU Shigeto 常松成人 (1997). Kokinuwan "seien iseki" wo chūshin to shita Angyōshiki shūdan no dōtai 古鬼怒湾「製塩遺跡」を中心とした安行式集団の動態 [The Dynamism of the Groups along Paleo Kinu Bay in the Angyō Period]. *Ibarakikenshikenkyū* (Mito), vol.78.