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The Importance of Primitive Pottery Culture in the Korean Foodways

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Abstract

To explore the origins of Korean food culture, the results of archaeological excavations of pottery relics from the early Neolithic period on the Korean Peninsula were examined, and the changes in the form and usage of the potteries in the stratified layers of shell mounds were investigated. The findings revealed that pottery was made for use as cooking vessels, fermentation crocks, and storage jars. Advances in materials. shapes, and techniques reflected efforts to produce larger vessels that were more durable, water-resistant, and heat-resistant. The consequent food items developed were traced, the biochemical changes in cooking pot and fermentation crock were estimated, and the nutritional and hygienic contributions of the early pottery to the Neolithic people were evaluated. The primitive pottery culture era is considered an important starting point that determined the food culture of Koreans. It is argued that the production of traditional Korean cuisine, *jjigae*, and fermented foods such as *kimchi*, *jeotgal* and *makgeolli* began by using pottery. As a result, the food availability of the early Neolithic period greatly expanded, and the nutrition and hygiene of Neolithic people were drastically improved, leading to the beginning of sedentary life and agriculture, and the formation of ancient Northeast Asian states.

Key Words : Korean food culture, early neolithic pottery, boiling culture, jjigae, fermented foods

I. Introduction

The invention of pottery made of fired clay and its use in cooking food in East Asia can be plausibly argued to be the second most epochal event in human dietary and cultural history after the use of fire. For food scientists, the first bioreactor man made can be seen in primitive earthenware. Pottery use was an important turning point that divided human civilization into a Western roasting culture and the Eastern boiling culture (Lee 2024a). Advances in boiling and fermentation technologies resulted from the use of pottery greatly expanded the range of food availability and dramatically improved food storage capabilities. This paper focuses on reinterpreting archaeological findings and anthropological insights regarding the invention of pottery from a food science perspective.

As far as is known, pottery was first produced in East Asia around 12,000 BP, after the last glacial period. Up to now, sherds from Xianrendong Cave in China are the oldest evidence of pottery, dating to the final Last Glacial Maximum (LGM) some 19,000 cal. BP (Wu et al. 2012). Early pottery sherds in Yuchanyan Cave (18,300-15,300 BP) along the Yangtze River in South China and Hutouliang shell tomb (16,300-14,700 BP) along the Sanggan River in northwest Hebei Province have also been reported (Liu & Chen 2012). Meanwhile, in the Russian Far East the oldest pieces of earthenware were discovered in the Amur River Basin, at Gasya (12,960-10,875 BP) and Khummy (13,000-10,000 BP) (Zhushchikhovskaya 1997). For a time, earthenware sherds found at Fukui Cave in Kyushu, southern Japan, and Kamikuroiwa Cave in Shigoku, estimated to date to 12,000 BP, were known to be the earliest (Barnes 1993).

In Korea, however, comparable archaeological evidence of Pleistocene pottery has yet to be uncovered. The lack of early pottery on the Korean Peninsula, located in the heartland of East Asia, remains an enigma that has not been satisfactorily explained despite the significant increase in the quantity and quality of archaeological work carried out in South Korea over the last three decades (Kim & Seong 2022a). A post-Pleistocene sea-level rise has been suggested as a cause for a dearth of the transitional sites, rather than a discontinuous habitation (Lee 2017). It is presumed that most of the late Paleolithic to Incipient Neolithic cultural relics of Jeju Island and the southern coast of the Korean Peninsula are buried under the sea due to the rise in sea level. On the other hand, Kim & Seong (2022a) argue that a significant

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decline in population is the main reason why Pleistocene and postglacial pottery does not appear in Korea.

Recent international cooperation has mapped Korean Neolithic culture onto a broader Northeast Asian context beyond modern national borders (Lee 2017). Several Neolithic sites along the Korean south coast reveal obsidian tools and pottery of Jomon origins from Kyushu, Japan, while pottery, stone tools, and ornaments of Korean origin are also found on Tsushima Island and in Kyushu. Such evidence is usually interpreted as the result of long-term exchange and population movements in Northeast Asia.

In-depth research on the impact of the production and use of earthenware in East Asia on the development of human civilization and of food culture has not been discussed as much as their importance warrants (Shelach 2012). Advances in boiling technology for food preparation and fermentation technology for food storage resulted from the use of pottery expanded the range of food availability. As a result, humans in some parts of East Asia may have developed a sedentary lifestyle far earlier than other significant innovations such as agriculture or metallurgy, and the foundations for relatively long-term settlement in one area might be thereby laid. In this paper, the early production and use of primitive pottery, and the consequent development of dietary culture and fermentation technology in Korean Peninsula are investigated to infer that this region is a birthplace of early Neolithic culinary practices in Northeast Asia.

II. Archaeological findings on primitive pottery culture in the Korean Peninsula

Chronologies of the Korean Neolithic vary with the geographical variations in pottery and different archeological methods for developing chronologies (Ahn et al. 2015). Lee (2017) divided the human development from the late Paleolithic to the early Neolithic in Korea into four stages; the Terminal Paleolithic (17,000-10,000 cal. BP), the Incipient Neolithic (10,000-8000 BP), the Initial Neolithic (8000-7000 BP), and the Early Neolithic (7000-5500 BP). The Terminal Paleolithic is characterized by the appearance of microblades, arrowheads and projectile points as transitional from the 12,000 to 10,000. The Incipient Neolithic is characterized by grinding slabs and the first pottery sherds excavated in Gosan-ri, Jeju Island. Early Neolithic is divided into Initial and Early Neolithic. The Initial Neolithic is characterized by the use of Osan-ri pottery, raised-pattern pottery, and polished stone tools, and the Early Neolithic is chronologically dated to the beginning of the use of *Jeulmun* pottery.

Notwithstanding the absence of Terminal Paleolithic pottery sherds found, Korean Peninsula exhibits the highest density of Early Neolithic pottery remains in Northeast Asia (Lee 2017). <Table 1> shows some of the representative Incipient/Early pottery sites in Korea.

The oldest pottery discovered in Korea to date is the primitive plane (patternless) (*Wonsi-mumun*) pottery from Gosan-ri, Jeju Island. This pottery is an undecorated coarse earthenware with fiber temper (Lee 2017).

According to Kim (1999), a total of 164 shell mounds have been found on the Korean Peninsula: 18 in the northeast region of the lower Tumen River, nine in the northwest region, 38 in the central region of the west coast, and the remaining 96 sites are concentrated on the south coast. At the Dongsam-dong and Sangnodaedo sites in southeast coast,

<Table 1> Early pottery sites in Korea

Site/Province	AMS date cal. BP	Pottery	Other relics	Ref.
Gosanri/Jeju	11,840-9750	Primitive plane pottery, potsherds with fiber embedded.	Microblades, scrapers, burins, projectile points	(1)
Bibongri/Changnyeong	7580-7470	Primitive plane (*Wonsi-mumun*) pottery, Potsherds with animal drawings.	Stone tools, grinding stone, mesh bag, animal/ plant remains, pit-shelters, furnace sites,	(2)
Sejukri/Hwangseong-dong, Ulsan	7390-7260	Pottery sherds with pressed pattern (*Abinmun*)	Pit-shelters, animal bone, whale bone attacked by bone-point, obsidian arrowheads,	(2)
Sangnodaedo/Tongyoung	7300	Primitive plain (*Wonsimumun*) pottery, raised patterned (*Yunggimun*) pottery	Stone tools, bone fishing tools, shell-bracelets, animal bones, human teeth.	(2), (3)
Dongsamdong/Busan	7340-5700	Primitive plain (*Wonsimumun*) pottery, raised pattern (*Yunggimun*) pottery	Stone tools, obsidian tools, bone tools, whale/ animal bones, shell ornaments	(2)
Osanni/Yangyang, Gangwon	7040-6950	Raised pattern, impressed pattern (*Abinmun*) pottery,	Pit-shelter & furnace sites, stone/bone tools, fishing tools, scrapers, projectile points.	(2)

(1) Lee 2017, (2) Lee et al. 2011, (3) Shin 1984

primitive patternless (*wonsi-mumun*) pottery and fine-line raised-pattern (*seseonyunggimun*) pottery have being excavated from the lower part of the comb-patterned (*jeulmun*) pottery layer (Shin 1984). According to radiocarbon dating of the Dongsam-dong potsherds, the primitive plane patternless pottery is estimated to have been made before 8000 BP, the raised-pattern (*yunggimun*) pottery in 8000-7000 BP, the grooved-pattern (*jidumun*) pottery in 7000-6500 BP, the stamped-pattern (*abinmun*) pottery in 6500-5500 BP, the large fishbone pattern (*taesuneogolmun*) pottery in 5500-4500 BP, and the late patternless pottery (*hugi-mumun*) in 4500-3500 BP (Lim 1983).

The primitive pottery culture refers to the unique cultural development stage related to pottery use that occurred along the Korea Strait littoral during the first 3,000 years from the Incipient Neolithic era to the Early Neolithic (10,000-7000 BP) when the use of Jeulmun pottery began (Lee 2022).

III. The development of pottery making techniques in the Korean Peninsula

The incipient pottery made with clay by mixing plant fiber or molding in a plant bag would not have been suitable for boiling water on a fire. Early primitive pottery consisted of thick-walled, concave clay dishes shaped by hand (*sunal*) and heated outdoors over a fire. When fired over a low-temperature flame, the resulting vessels would have a high moisture absorption rate and not harden sufficiently to store large amounts of watery food for long periods of time. Such vessels were not suitable for cooking. As these early attempts at pottery moldered underground for thousands of years, the clay continued to absorb moisture, eventually reverting to a form almost indistinguishable from the surrounding dirt. For this reason, probably most pottery from 12,000-8000 BP is unrecoverable. Level X at the Sangnodaedo site, the oldest and lowest stratigraphic level, reveals only tiny fragments of such pottery (Shin 1984). An analysis of production characteristics of excavated pottery by layer at the Sangnodaedo site, based on the research of Shin Sook-Jeong was carried out, and the results are summarized in <Table 2> (Lee 2022).

Early pottery development indicates that during this period people tried to make earthenware containers that could store watery foods or be used for boiling food over a fire. Analysis of pottery materials, shapes, and techniques reveals an effort toward forging larger vessels that would be stronger, impermeable to water, and able to withstand the heat of fire.

In its early days, pottery was baked over an open fire at the comparatively low temperature of about 500°C. The resulting vessels were not strong, crumbled easily, and absorbed too much liquid; the form they took is unknown due to their near-complete reintegration back into the earth. Beginning around 8000 BP, people succeeded in hardening their pottery by increasing baking temperatures dramatically, a development that could point to the use of early kilns. The improved durability of earthenware vessels means that more sherds from this period have been found at archeological digs. By 6000-5000 BP, baking temperatures increased again, this time reaching 700-750°C (1292-1382°F). The discovery of this technique ushered in a revolution in the utility of pottery.

Early earthenware was made of saline base clay that was sticky and iron-bearing, but after 6000 BP, the use of sandy, iron-bearing clay became more prevalent. This shift gave rise to new pottery shapes and a lower damage rate during firing, two indicators of technological advancement. However, between 6000 and 5000 BP, people began using seashell powder to temper their earthenware. The main ingredient of seashells is calcium carbonate, which melts and fills in the gaps and pores of the earthenware when heated to around 700°C. Upon recrystallization, the pottery's moisture absorption rate decreases, while density and hardness increase.

Widely divergent levels of moisture absorption (5-25%) appear in pottery made during this time. At first, such

<Table 2> Development of production technology for primitive pottery on the Korean Peninsula

Period	Before 8000 BP	8000 BP	7000 BP	6000 BP	5000 BP
Main ingredient/ additives	Clay, ferrous salt clay/ quartz, granite, pottery powder	Ferrous salt clay, rock powder/pottery powder, quartz	Ferrous salt clay, rock powder/quartz, feldspar, pottery powder	Ferrous salt clay, rock powder/pottery powder, clamshell powder,	Sandy soil/clamshell powder, pottery powder, mica
Molding technique	Hand shaping	Hand rolling, Coiling	Hand rolling, Coiling	Hand rolling, Spinning	Hand rolling, Spinning
Baking temp.	500-600°C	Below 700°C	Near 700°C	Near 700°C	700-750°C
Wall thickness	7-8 mm	4-12 mm	7-8 mm	5-6 mm	6 mm
Water absorbency	9.5-25.3%	9.7-17%	10-16.8%	5.2-17.2%	6.2-15.1%

variation may have reflected an unintended consequence, but as the impact of higher and lower levels of hardness and moisture came to be understood, it seems likely that different types of pottery were produced for different purposes. Vessels built to store liquid foods for a longer period would have a low moisture absorption rate, but those made to store grain, fruit, or roots would have more pores and be more absorbent. Pottery used for boiling would not need to be elaborate, but it would be important to know what degree of porousness would allow the vessel to endure while cooking food over a fire.

Thus, the period between 8000-6000 BP was marked by trial and error in pottery making, the use of a given vessel assigned after firing, based on its resultant hardness. After 6000 BP, however, techniques improved to the point where people were able to design pots for a specific purpose by adjusting materials and heat levels. This evolution marked the beginning of specialization in pottery manufacture. From this time on, baking pits dedicated to making pottery were created; flat, open kilns led to kilns built on an inclined plane, which eventually led to enclosed kilns.

Neolithic people shaped early pottery by rolling clay into long, thin coils and stacking them in a spiral form—a technique known as *Kwonsang*. Before 8000 BP, the coils were made by hand-rolling heavy clay, which resulted in crude pottery with rough, thick walls. Later, amendments added to the clay and improved baking techniques together with spinning wheel to coil (*yonjok*) led pottery with a more uniform shape and thinner walls. From 8000-6000 BP the range of earthenware wall thickness varied from 4-12 mm, but after 6000 BP, 6 mm became the standard.

IV. The shapes and uses of pottery in the Korean Peninsula

All vessels excavated from the period of incipient pottery have round or flat bottoms and vary in shape from small bowls and half-oval shaped containers to large, round bowls. At first, the diameter of the mouth hovered around 12-24 cm for a small dish or bowl-shaped container, but as time passed, the diameter of vessel openings expanded to 48 cm and were sometimes marked by a double rim, or lip. Scholars presume that small vessels were used to cook over fires, and large vessels were used to store grains, while medium-sized vessels, which were about the size of traditional kimchi crocks, were used for pickling and fermenting vegetables (Lee 2022). <Table 3> shows the changes in pattern, size and shape of primitive pottery of the Korean Peninsula in time.

Pottery excavated in Korean Peninsula can be categorized according to shape and size. For example, each of the following types of vessels has a characteristic size and shape: a pot for cooking over a fire (*ttukbaegi*), a crock for fermentation (*hang-ari*), and a jar for storing dried grains (*dok*). The *ttukbaegi*, which was used for cooking, typically had a mouth 6-12 or 12-24 cm in diameter; it was a relatively small vessel, did not absorb much moisture, and the bottom was round or conical. Fermentation crocks were medium-sized vessels, with a volume of 4-7 liters and low moisture absorption rate, the bottom narrow and conical. Storage jars were larger, with a volume of 17-56 liters, high moisture absorption rate, and round or flat bottoms (Lee 2022).

Most of the pottery unearthed from the Sangnodaedo excavation site consists of bowl-shaped vessels with a

<Table 3> Changes in patterns, size and shapes of primitive pottery of the Korean Peninsula

Period	Before 8000 BP	8000 BP	7000 BP	6000 BP	5000 BP
Pattern	No pattern (plane) *Wonsi-mumun*	No Pattern, Attached strips, *Yunggimun*	Attached strips, Raised pattern, *Yunggimun Jidumun*	Fishbone, Stamped pattern, *Abinmun*	Slash, wave or comb pattern *Jeulmun*
Color	Brown	Light brown	Brown, gray	Brown, gray	Black-brown, Gray-brown
Shape	Round bottom, Flat bottom	Round bottom	Round bottom	Round bottom, flat bottom dish, crocks	Inclined lips, double lips, Round bottom
Size	Half-egg bowls, Big vessel	Small bowls, Shallow dish	Large dish, Big vessel	Big vessel	Big vessel, Large dish
Rim diameter	12-38 cm	18-34 cm	14-38 cm	6-42 cm	12-42 cm

diameter of about 24 centimeters at the mouth, big enough to cook one meal for a single family. Earthenware was not made to hold individual servings of food; large leaves, clam shells, or pieces of wood were probably used instead. Larger cooking vessels, which begin to be seen later, are indicative of family groups making meals together. The discovery of small earthenware vessels with a diameter of 6-12 cm at Sangnodaedo garnered much interest in the academic world: The hypothesis was that if earthenware dishes for personal use were unnecessary at this time, then perhaps the small vessels were created for a specialized use.

After examining similar pieces at Japan's Jomon excavation sites, Ishige (1995) has suggested that small pottery vessels may have been used to make salt from seawater.

However, it is assumed that salt making from sea water was practiced much earlier in the primitive pottery era (Lee 2022). The invention of pottery was a groundbreaking event in the history of humanity's food culture for many reasons, not least of which concerns the use of salt in food preservation.

Shin Sook-Jeong's efforts to classify the pottery at Sangnodaedo led to the discovery that plane and patterned pottery sherds appear with nearly equal rates of frequency throughout the Neolithic era (Shin 1984). Whether or not patterns exist on pottery may depend less on time or place, and more on aspects of functional use.

V. Geographical background and motivation of pottery use for food processing in the Korean Peninsula

During the Last Glacial Maximum the Korean Peninsula was connected on the west to the mainland continent of China with no geographic barrier. Sea level regression exposed a low and flat plane that replaced the Yellow Sea (Lee 2022). There were also marshes and lakes supporting many types of animals and birds that hunter-gatherers made productive use of. Jeju Island was connected to the continent. It is estimated that the shoreline was located 60 km southeast of the modern location and the strait between the Korean Peninsula and the Japanese Archipelago was a "channel-like sea way" some 10-20 km wide during the LGM, while the distance between Busan and Tsushima is about 50 km today. After the LGM global sea level rose as much as 16-25 m in about 300-500 years. The region suddenly transformed into a peninsula in less than a half a Millennium (Kim & Seong 2022b). The marine transgression was likely a huge challenge for the local hunter-gatherers who lost traditional foraging habitats on the exposed continental shelf.

The Korean Peninsula became a land bridge connecting the Japanese Archipelago to Manchuria and the Russian Far East. Lee (2001; 2024b) illustrated in a map the migration routes of the Paleolithic people by connecting the Paleolithic remains in this region. The Korea Strait was narrower than it is now, so it is thought that there was a dry land passage connecting the southern coast of the Korean Peninsula through Tsushima Island to the northern coast of Kyushu, Japan.

As sea level rose, Korea Strait became an obstacle on the migration root, and people gathered on the shore to prepare crossing the strait. People who gathered along the coast would naturally have gathered shellfish or caught fish for food rather than hunting wild animals, and fishing gradually became the main form of subsistence.

As seafood became an important food resource for coastal gatherers, the decomposition of fish and shellfish would have emerged as an important factor limiting food availability. Since marine products quickly decompose and deteriorate through autolysis and do not dry easily, they had to be consumed immediately at the place where they were collected. In a situation where the catch changed rapidly depending on the climate and season, marine products could not be a reliable food resource. Since marine products have a high moisture content and soft tissue, cooking and drying directly by fire were not suitable, and so a method of boiling them in a container was needed. This requirement led to the creation of cooking earthenware that had a low moisture absorption rate and could withstand fire. The use of pottery accelerated sedentism of the people, and fishing and gathering became their main subsistence economy.

The population density along the Korea Strait would have been higher than other nearby regions due to people being able to cross the channel seasonally. On the southeast coast of the Korean Peninsula, rock carvings and patterns have been discovered in about 20 places, including the Ulsan Bangudae petroglyphs from 7000-3500 BP (Kim & Seong 2022b; Lee 2022). Around half of the world's dolmen sites are found in Korean peninsula. According to the Britannica, more than 30,000 dolmens are in Korean peninsula. This reflects the fact that this region was a place where many people stayed for long periods and was a centre of prehistoric culture. Due to these geographical and meteorological characteristics, the Korea Strait coast of the Korean Peninsula was equipped with conditions that could be presumed to be the birthplace of the early Neolithic primitive pottery culture.

VI. Korean foods inherited from the Primitive Pottery Culture

The invention of pottery meant that early communities had access to vessels that could hold and boil water. With the use of earthenware, ingredients such as seeds, stems and roots in plant tissue, which are hard and contain nutritional inhibitors, could be boiled in water to make soft, safe, easily digestible, and appetizing food. In addition, the use of earthenware made it possible to store food with a high moisture content and, in this process, the fermentation phenomena caused by microorganisms were discovered. There are many traditional foods in Korea that are believed to have originated from the primitive pottery culture. Representative examples are shown in <Table 4>.

1. *Jjigae*

Primitive Pottery culture, particularly along the Korea Strait, came to appreciate the taste of salt and learned methods for acquiring it while living along the coasts. The Neolithic people in this region boiled seawater in earthenware vessels and added seafood, then mixed in greens, grains, roots, and nuts collected in the fields. This stew-like concoction became the basis of what is still considered Korean food culture's representative specialty: *jjigae*. To this day, *jjigae* continues to be cooked in earthenware pots, *ttukbaegi*. The Neolithic method of boiling seafood in earthenware vessels with sea vegetables gathered from the water and greens and roots collected in the fields fundamentally mirrors the recipe used for *ttukbaegi jjigae* today.

Shoda et al. (2017) conducted organic residue analysis on pottery sherds and adhered surface deposit on the wall of pottery vessels (foodcrusts) excavated from the Sejukri shell midden (7700-6800 cal. BP) on the southeastern coast and the Jukbyeonri site (7009-6900 cal. BP) on the eastern coast of the Korean peninsula. Through chemical and isotopic residue analysis, they concluded that the use of pottery at these sites was oriented towards marine resources, supported by lipid biomarkers typical of aquatic organisms and stable carbon isotope values that matched authentic marine reference fats. An economy dependent on maritime resources is a generally accepted subsistence for the littoral foragers, but recent studies suggest a broad spectrum foodways in southern coastal Korea in the Holocene (Kwak et al. 2022). A stable carbon and nitrogen isotope analyses of collagen extracted from 10 human bones excavated from the Janghang site (7000-6000 BP) in Gadeok Island, Busan, the largest Early Neolithic burial site in Korea, showed that the buried people consumed mainly marine foods, and the possibility of consuming terrestrial animals and wild plants could not be ruled out (Shin et al. 2013).

Seafood *jjigae*, boiled together with seeds, greens, tubers and tree nuts, would be a staple meal for the Early Neolithic people in Korea Strait coastal region. At the later stage when millet and rice cultivation started, cooked cereals and legums, *bab*, was prepared for main dish, and *jjigae* became a side dish. Adding soybean curd and soybean paste instead of sea-water in *jjigae* would be taken place much later when soybean cultivation and its food use were initiated by the Korean people in Bronze Age (Lee 2022). Koreans today can easily imagine a family sitting around an earthenware pot filled with boiled *jjigae*. Of necessity, *jjigae* culture required the use of spoon, and at this time there may have been a flowering of tools used for scooping or ladling, but because these implements would probably have been made of wood, no evidence of such utensils has been found.

2. Kimchi

When vegetables like cabbage or radish are submerged in a 3% salt solution in a container, lactobacilli will create spontaneously the sour taste and smell of fermentation within 3 or 4 days (Lee 2022; Lee 2024b). During the primitive

<Table 4> Korean foods inherited from the Primitive Pottery Culture

Items	Early Neolithic mode of processing	Usage
Jjigae (stew)	Boiling marine resources with vegetables/seeds in seawater in an earthen vessel	Staple food. whole meal. Today side-dish for cooked rice
Kimchi	Natural fermentation of vegetables in sea-water in a crock. lactic acid bacteria	Vegetable storage for winter. Acidic fermented vegetables
Jeotgal	Natural fermentation of fish/shellfish with acidic fruits, gut enzymes, microorganisms	Fish storage. Meaty flavor condiment, Ingredient for kimchi
Makgeolli	Natural fermented cereal alcoholic beverage in a crock. porridge-like drinks	High-energy alcoholic drink. Turbid liquid by filtration

pottery era, fermentation likely occurred spontaneously when people stored wild greens and root vegetables from a field in sea water in a pottery, which would result almost without exception in lactic acid fermentation. Among the countless bacteria that grow naturally under these conditions, *Leuconostoc mesenteroides* is the most beneficial in the early stages of this process (Rhee et al. 2011). This bacterium produces both lactic acid and acetic acid, resulting in a slightly acidic, heterolactic fermentation, with a pH of just over 4.8. The predominance of this strain of bacteria at the beginning of fermentation prevents the putrefaction that occurs when harmful bacteria proliferate. Homolactic fermentation takes over when the bacterium *Lactobacillus plantarum* becomes dominant, and the large quantities of lactic acid it produces lowers the pH to 3.0 or less, resulting in the strongly acidic bath of pickled vegetables. The phenomenon of fermentation occurs in the natural world whenever similar conditions are met.

3. *Jeotgal* (fermented fish)

If the motivating factor behind incipient pottery use by Paleolithic peoples along the coast of the Korea Strait was that they required containers to quickly cook or store seafood, there remains the question of what techniques they used to store the seafood. During the Primitive Pottery era, there would not yet have been the quantities of salt needed for storage involved in today's manufacture of fish sauce and *jeotgal*. Without ample salt, there would be few ways of storing seafood for long periods of time. One method would be to mix seafood with lactic acid fermented vegetables or sour fruit, such as *maesil* (green plum). Combining quick-rotting seafood with acid fermented vegetables would lower the pH to below 4.5, thus preventing the propagation of noxious microorganisms and allowing the seafood to be preserved for a longer period of time (Lee et al. 2024). Low concentrations (<5%) of salt would cause rapid autolysis by the enzymes in the entrails and innards of fish and shellfish, releasing a strong, rancid meat flavor. The putrid smell and taste thusly formed would be unpalatable even to Northeast Asians today, but to people living in the Primitive Pottery era, salt fermented sea food with acidic fruits and vegetables could well have been reminiscent of the powerful flavor of the half-dried and half-spoiled animal meat and organs to which they were accustomed. The salt concentration increased gradually up to 20% to control the spoilage and to reduce off flavor (Lee & Kim 2016). During the Primitive Pottery era, as people moved away from a carnivorous diet and toward a marine and vegetable-based diet, the combination of fermented vegetables with seafood introduced an inevitable flavor profile that may have served as the origin of dishes such as the *sikhae* (fermented fish mixed with cooked grains) and various types of *jeotgal* enjoyed throughout East Asia today.

4. *Makgeolli*

Like fruit wine, cereal-based alcoholic beverages were produced through natural spontaneous fermentation processes (Lee 2022). The process of making an alcoholic drink from a cereal requires two separate biochemical steps: saccharification and fermentation. In hot and humid areas, storing grains such as rice, millets, and starchy tubers in earthenware induces the growth of mold, some of which contains strong enzymes for breaking down raw starches. These molds—for example, *Rhizopus* species—quickly convert starch into sugar, and with the help of natural yeast (*Saccharomyces cerevisiae*) in the environment, the sugar soon turns into alcohol. If a little water is added to the moldy grains, the scent begins to improve, and in 2-3 days the concoction becomes an alcoholic drink. It is not hard to imagine that people in the Primitive Pottery era would have experienced this natural phenomenon. Thus, early grain wine was made by fermenting uncooked starchy grains in an earthenware, and the use of pottery may mean the start of cereal alcoholic fermentation (Lee & Kim 2016). Use of *nuruk*, which is made for yeast starter, and steaming of cereals before fermentation probably emerged soon after. At first, grain wines would probably have taken the form of unfiltered, porridge-like drinks. With the development of weaving, cloth would have been used to filter out coarse ingredients, thus allowing for a turbid alcoholic liquid. Placing bamboo basket (y*ongsu*) in a brewing crock is another traditional method of filtration for rice wine, *yakju*.

Alcoholic drinks are the oldest processed food in human history. Beer was being made in Egypt around 4000 BCE, and the phrase "Yao's one thousand wines" in a Chinese old book, *Shijing*, Book of Songs, compilation of records dating from 11th to 7th centuries BCE, indicates the universality of cereal wines in Northeast Asia at around 2000 BCE (Lee 2022; Lee et al. 2024). Alcohol is universally treated as a well-known drink in records referring to the Heroic Age of Northeast Asia, 4000-3000 BCE. Countless myths that include alcohol have been passed down over the years. Thus, the hypothesis that by 6000 BCE people of the Primitive Pottery culture living along the Korea Strait made grain alcohol along with their pottery has temporal validity. Perhaps the knowledge of how to make grain alcohol

hastened the advent of a farming culture centered on grains, given that farmers would have placed a high value on the grains used to make alcohol.

VII. Conclusion

1. The primitive pottery culture is the foundation of traditional Korean dietary habits

Compared to neighbouring countries, such as China and Japan, Koreans have a unique food habit consuming soup (*tang*) and stew (*jjigae*) as favourite dishes for everyday meal. Generally speaking, Chinese people eat food fried or stir-fried in oil, while Japanese people enjoy eating raw fish or sushi. Korean *jjigae* and *tang* are symbolic foods that find their provenance in the early pottery culture of the littoral foragers. Sea mustard (*miyouk*) soup is considered an essential food for lactating women and seaweed rice roll (*gimbap*) is synonymous with lunch boxes. Even in high-end restaurants, Koreans have a unique eating habit of putting hot fish stew, *jjigae*, bubbling in a clay pot (*ttukbaegi*) on the table and scooping it up with a spoon. Koreans use spoons more than chopsticks compared to Chinese and Japanese.

The traditional Korean diet includes fermented sauces such as soybean sauce (*ganjang*), soybean paste (*doenjang*), hot bean sauce (*gochujang*) and *cheonggukjang*, which are basic ingredients for *jjigae* preparation, and fermented foods such as kimchi and salt fermented seafood (*jeotgal*) are essential side dishes (Lee 2022). The average daily kimchi consumption of Koreans is about 100 g per person, and rice, kimchi, and stew are basic dishes in a traditional meal setting (*chopbansang*). Koreans eat the traditional standard meal three times a day. The drink that Koreans enjoy is a turbid, off-white beer (*makgeolli*) made by alcoholic fermentation of grains (mainly rice) and filtering them through cloth or *yongsu*. The fact that Koreans still maintain unique fermented food based eating habits inherited from their ancestors suggests that this region is one of the origins of primitive pottery culture.

2. The Primitive Pottery Culture facilitated agriculture and the formation of tribal nations

The *jjigae* and fermented foods developed in tandem with primitive pottery by the people living on the coasts of Korea Strait, and later throughout the peninsula and Northeast Asia, had a significant effect on the state of human nutrition and the development of society. The method of adding several different ingredients to a pot of boiling water for *jjigae* supplied a well-balanced meal and constituted a major step forward in hygiene. As foods began to be seasoned with salt, their flavor improved, and various hitherto inedible vegetables became suitable as cooked ingredients. Due to fermentation techniques, quick-rotting seafood and vegetables could now be stored for longer periods of time, thus securing a stable food supply and even improving the taste of such foods. The development of such techniques during the Primitive Pottery era multiplied the nutrients available to these people, and when compared with paleolithic groups elsewhere, their life spans and birth rates increased, leading to a mushrooming population. Improved nutrition and food sanitation also led to stronger and larger physiques compared to people living in surrounding areas. These societal advances facilitated agriculture and the formation of tribal nations in the 3000s BCE, especially the Dongyi (Eastern Archers) tribes, who became leaders in the emerging chieftain-based system of the Northeast Asian megalithic culture (Lee 2024a).

According to the triangular study (genetics, archaeology, linguistics), cultivation of broomcorn millet began in the West Liao basin ca. 9000 BP, spread to the east around 6500 BP to the *Jeulmun* pottery area of the Korean Peninsula, and ca. 5000 BP to the Liaotung, Amur, and Neolithic regions of maritime provinces (Robbeets et al. 2021). The period when primitive pottery was used for food preparation along the southeast of the Korean Peninsula coincides with the period when the Ural-Altaic people in the West Liao basin began cultivating millet. The oldest state, Gojoseon, founded in this region in history, was emerged in much later stages (ca. 2300 BCE) of the human civilization.

Despite the fact that the Primitive Pottery culture of the Korean Peninsula played an important role in the developmental stage of humanity, especially regarding the ancient history of Northeast Asia, it has not yet been properly evaluated on the world stage. I have suggested that the primitive pottery culture period be listed before the Korean *Jeulmun* pottery period in the chronological comparison of Northeast Asian prehistoric cultures proposed by Lee Gyeong-ah et al. (Lee et al. 2011), because the primitive pottery culture era was an important period that determined the food culture of not only the Korean people but also the Northeast Asians (Lee 2022).

VIII. Discussion

Modern Korean archaeological research only began in earnest in the 1960s, some 150 years later than the origins of the modern methods of excavation in the West, and about half a century later than in Japan or China. In the meantime,

the prehistory of Eastern societies was reckoned to have lagged behind that of Europe, and the long-term development of those who would become the Korean people was completely eclipsed in the history of ancient Northeast Asia. This is not mere happenstance. In particular, the Korean people suffered from Japanese incursions, most notably in 1910 when Japan annexed the Korean Empire, precisely at a time when East Asian societies were being seriously studied by Western scholarship. Korea would be a Japanese colony until the end of the Second World War in 1945. One profound consequence was the destruction and extortion of huge quantities of ancient historical records and relics and the imposition of an instrumental colonialist perspective (Kim 2011; Choi 2023; Lee 2024a). Despite the efforts of Korean history academia after liberation, Korean ancient history, which was badly distorted and lost, has not been properly restored. In this context, careful investigations are needed to explain the enigmatic lack of early pottery on the Korean Peninsula located in the heartland of East Asia.

The cultural contribution and importance of pottery use in Northeast Asia have not been discussed properly compared to other issues on human development. Parzinger (2020) acknowledges that the first pottery production began in East Asia, at least 3000 years earlier than the West, but does not mention its transfer route or its influence on the history of human civilization (Lee 2024b). The Western-dominated archaeological and historical communities do not pay much attention to the history of pottery production and its use, which brought about a major transformation in the food culture of Northeast Asia. Use of primitive pottery by Northeast Asians is a watershed development that divided human food culture into roasting and boiling cultures (Lee 2024a). The roasting culture of Westerners, descended from nomadic peoples, developed into a meat-oriented food culture. By contrast, East Asians who used pottery achieved early sedentism in vegetarian culture premised on soaking hard grains, plant tissues, and roots in water for boiling.

Specific research and discussion are needed on the historical processes that led to the development of a boiling and fermentation culture through the production and use of pottery, which dramatically improved the availability, hygiene, and nutritional value of food in the early Neolithic Age. Food history research is a field of inquiry that deals with the oldest prehistory of human survival, and requires collaboration between archaeology, linguistic ecology and food science among many other disciplines, that can contribute to finding clues to recovering ancient history.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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