A Study of the Ondol (Gudul, Floor Heating System) and Kitchen Space in the Traditional Houses on Jeju Island, Korea

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Abstract : Jeju-do is a volcanic island located off the shore of the Korean peninsula facing the Pacific Ocean. The traditional housing styles of the Jeju Province, therefore, reflect the impact of these natural backgrounds and reveal different housing styles that are distinctive from those of mainland Korea. The purpose of this research is to analyze the peculiarities of the Ondol (floor heating system) and the kitchen space of traditional housing of Jeju Island in terms of lifestyles. This study shall employ two research methods: a literature review and field survey methods. The literature review shall focus on the observations of characteristics noted in previous studies of Jeju's private houses. The field survey shall employ field survey and interview methods originating from the ethnography of the culturological-anthropologist approach. (1) The Jeju-do Ondol system is a "Weibang-Gudul" system which means one Gudul per fire hole. (2) The definition of terms for Gulmook show variations depending on the various regions on Jeju-do. (3) Major facilities in Jeongji include Gulmook, Sotduck, and Busup. Gulmook is a heating facility and Sotduck refers to a cooking facility; Busup refers to a combination of heating, cooking, and illuminating facilities.

Key Words : Ondol (Gudul, Floor Heating System), kitchen space, traditional Korean houses, traditional Jeju-do houses

I. Introduction

The Jeju Province is identical to the Jeju Island; it is located off the shore of the Korean peninsula, facing the eastside of the Pacific Ocean. The island displays a variety of climatic characteristics due to the geographical influence of the Halla Mountain located in the center of the island. These natural environmental characteristics have helped to develop a uinque residence system quite different from the residence system on the mainland. The heating systems of the houses on Jeju are also unique. They are quite different from Korea's traditional Ondol heating system, especial in terms of appearance and structure. Nevertheless, existing studies have failed to identify these differences clearly; in fact, most studies have dealt with the heating system and kitchen system separately, even though the two facilities occupy the same space. Therefore, this study attempts to first, identify the differences between the Ondol in traditional houses on Jeju-do and that of other

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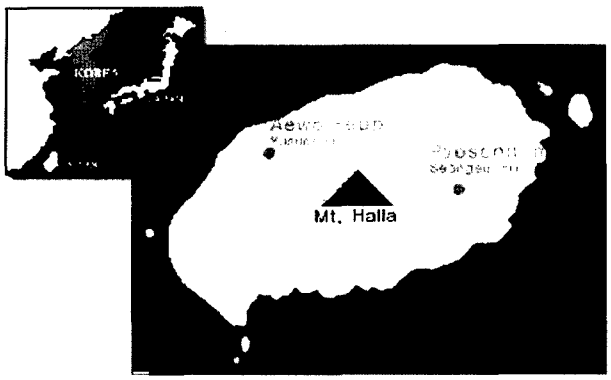


<Figure 1> Location of Jeju-do

regions; secondly, analyze the Ondol in terms of its function which is connected to the Jeongji (Kitchen), and finally, identify the characteristics of the Ondol (or Gudul) system on Jeju-do.

II. Study Methodology and Definition of Terms

1. Study Methodology

Our study methodology employs two methods: a literature review and a field survey. The literature review will discuss our observation of the forms of architectural structures through the existing studies of traditional houses on Jeju-do. The field survey will employ site investigation and interview methods based on the ethnography of the culturological-anthropologist approach. The field survey was conducted in both Seongeup-ri, Pyoseon-myon, South Jeju-gun, and Yusuam-ri, Aewol-eup, North Jeju-gun.

Seongeup-ri is a village designated as a folk-village; it is supported financially and supervised by an administrative authority. Thus, the Ondol heating system is well preserved in this region. Our research method included a literature review, actual measurement, and interviews with residents and architects of the traditional houses in Seongeup-ri. Yusuam-ri is an area where houses increasingly use chemical fuels for heating due to changes in life environment. Nevertheless, the area was selected as a survey target area because it is an agricultural-based village located on a mountainside where actual investigations of the traditional Ondol on Jeju-do and interviews with residents are possible. The survey was conducted between October 2000 and September 2002.

2. Definition of Terms

Key terms explaining the heating system of traditional houses are as follows: (Table 1).

III. General Characteristics of the Ondol System in Traditional Korean Houses

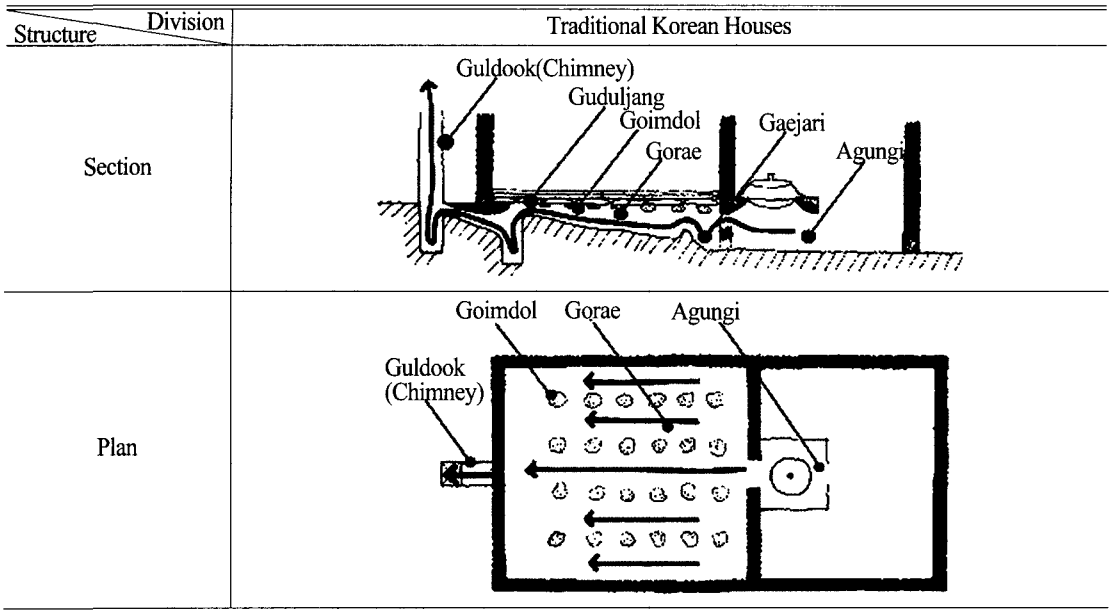
The invention of the Ondol originates from the

<Table 1> Key terms explaining the heating system of traditional houses

Terms for Space	Gudul	A room in which Ondol facilities are built in the traditional houses of Jeju-do.
	Jeongji	The kitchen of the traditional houses of Jeju-do.
	Gorimchae	A space in which only Gulmook facilities are constructed in the traditional houses of Jeju-do.
Terms for Facility	Guduljang	A wide and flat stone plate used for the construction of Ondol.
	Goimdol	Stones supporting Guduljang.
	Agungi(or fireplace in kitchen)	A fire-entrance for an Ondol facility in traditional Korean houses.
	Gorae(or hypocaustflues)	A tunnel through which smoke passes under the Guduljang.
	Gaejari	Pits under the Ondol where smoke stays.
	Gulmook	The fire entrance of the Ondol facility through which fire-heat is delivered in the traditional houses of Jeju-do.
	Sotduck	A cooking facility, composed of three cubic-shaped supporting stones, in the traditional houses of Jeju-do.
	Busup	A stone fire-pot in a quadrangle shape installed in Jeongji for the auxiliary function of heating, cooking, and illuminating.
	Changgom	A window for ventilation through which smoke produced in the course of cooking passes off in the traditional houses of Jeju-do.

life styles of the lower classes in the northern regions of Korea. It was in the period of the Chosun dynasty that most houses in Korea, both high and low class and in the northern as well as southern regions, adopted the Ondol system with some regional variations. The Ondol is a room-floor heating system in which fire in a fire hole of the kitchen passes under the room's floor, making the room's floor warm. This is a unique heating method to Korea. The principle of the Ondol heating system is the use and transfer of heat. Fire-heat is first applied to the Guduljang, wide stone-plates laid under the room's floor, and then the heated stone-plates raise the room's temperature.

The Ondol structure is composed of the Go-rae through which the heat passes. Flat pieces of granite (their thickness ranging in general from 50 to 80 mm) are supported by stones of regular height in order to keep the pieces of granite located right above the Gorae. Mud is used to paste over the surface and connect the leveled pieces of granite. Then a more softened soil, a combination of clay and sand, is pasted over the rough surface of mud-plaster on leveled granite. After the clay-plaster dries out, the process of lining the floor with paper is proceeds. When the paper dries out, sheets of oilpaper are applied to the floor in order to complete the Ondol construction process. In most cases, the Ondol, which is connected directly to the fire-hole is also used as cooking facility in the kitchen. This takes advantage of the heat generated at mealtimes and displays the Ondol's dual function for heating and cooking.



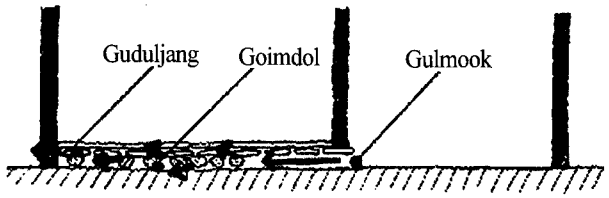
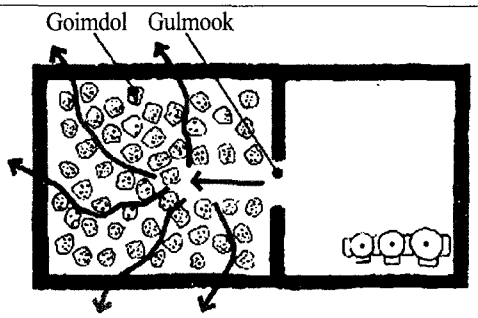
<Figure 2> The structure of Ondol in traditional Korean houses

IV. The Characteristics of the Ondol System in Traditional Jeju-Do Houses

As Jeju-do is a volcanic island, whinstone is used for the construction of traditional houses. Since whinstone is a material made during volcanic explosions, it is characteristically porous. For the construction of the Ondol on Jeju-do, builder's used whinstone and soil as its main materials; these substances are distinctive from other regions. Although it shares the basic principles of the Ondol from other regions, the Jeju-do Ondol differs in its structure because of the differences in its main materials and the island's mild climate conditions, Jeju-do experiences warm weather conditions even during the winter season.

1. Structure of the Ondol

The structure of the Ondol is characterized by the Gulmook, the heating-pass-tunnel (250 × 200 × 1200 mm), through which fire-heat and smoke pass. Half of the Gudul size while smokes with heat continue to pass through the disordered, scattered, small stones, so as to get away in course of time, performing natural exhaust. Although it has been sometimes reported that the Ondols on Jeju-do had exhaust tunnels. This is not previous reporters failed to confirm that exhaust tunnels were newly built in the course of repairing houses. It has now been confirmed through interviews that the Ondols did not have exhaust tunnels, nor chimneys, in the traditional houses on Jeju-do. The holes found in the lower part of the Sangbang's in the residences of the traditional folk-villages were

Structure \ Division	Traditional Jeju-do Houses
Section	
Plan	

<Figure 3> The structure of the Ondol in traditional Jeju-do houses

built to protect wooden floors and allow for the adjusting of humidity.

In the past, small stones were neatly laid on the surface of supporting stones, or Goimdol. However, owing to the development of rock-breaking technology and equipment, wide and flat stone-plates began to be used to cover whole room-floors. Then clay, combined with barley straw or dry-field rice straw, was plastered on the stones as a finishing material. The heating area in the Ondol system of other regions is relatively wide and large so as to cover most room-floors. The heating process occurs through the smoke exhaust tunnels. The Jeju-do's heating area is limited to only a quarter of the whole room-floor (called the Aratmock, or the lower warmer-part of an Ondol floor) and is heated directly by the Gulmook.

2. Fuel for heating and heating method

1) Fuel

Wood was used as a major fuel in most other regions of the Korean Peninsula, whereas pine needles, feces and urine from stock were the major fuels in Jeju-do. This was due to the development of stock-farming in this region. The level of dryness was also very important for heating because fuel that was dries burned out too quickly while fuel that was damp produced too smoke. In the areas where the feces and urine of horses and cows were hard to get, pine needles and wood were used for fuel. Ashes in the Gulmook were cleared once a year and the ashes were used as fertilizer during the showing season for buckwheat every August.

2) Heating Method

Between 6 and 7 o'clock in the evening, residents began to make their fires in the Gulmooks of each room. Around 11 o'clock in the evening, 3 to 4 hours after the fire were ignited, fuels were moved to the inside of the Gulmooks. Afterwards, the entrance of the Gulmooks were blocked by stone so that fuel could be burned slowly; this kept the temperature constant until 5 or 6 o'clock in the morning. The reasons they blocked the entrances were to prevent a drop in temperature with the influx of cold air, to prevent the rapid burning of fuel from too much oxygen, and to prevent the unexpected fires caused by the wind during the night. As the warmth lasted for about 8 hours after the fires were extinguished, the supply of new fuel could be brought in the evening of the next day. The period for heating was, in general, from early November to February and could be extended to March in households with aged or weak residents.

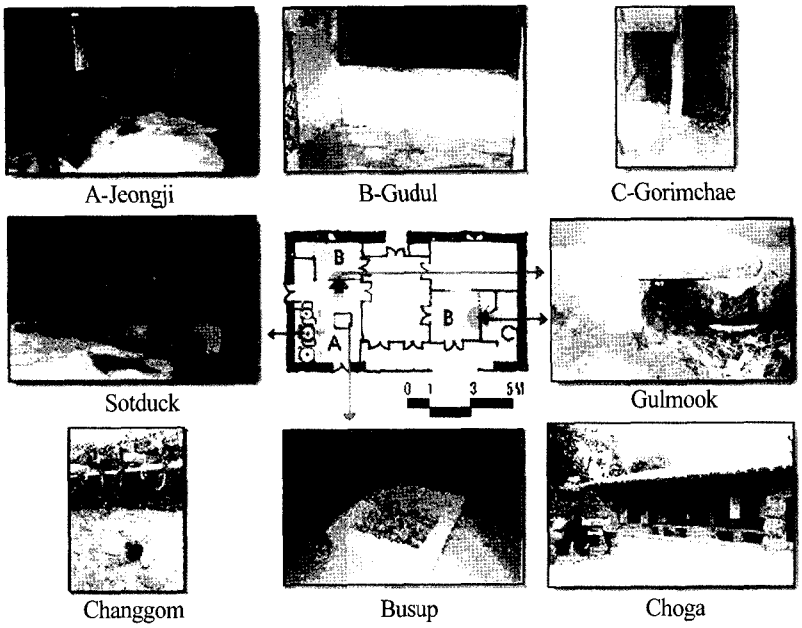
V. Heating and Cooking Space

1. Gorimchae (independent heating space)

A Gorimchae (area C in Fig. 4) is a space built in the course of constructing the outer-walls; it protects the Gulmook. Since it is only a Gulmook facility and acts as a heating facility space for a big Gudul without any cooking facilities, it can be viewed as an independent space for heating only. As a Gorimchae has a Gulmook only, it is sometimes called, in some villages, a Gulmook. Nevertheless, it needs to be noted that a Gorimchae refers to a space, whereas a Gulmook refers to a

<Table 2> Comparison of the Ondol's structures and functions

Structure and Function \ Division	Traditional Korean Houses	Traditional Jeju-do Houses
Guduljang	O	O
Gaejari	O	×
Gorae	O	× (Heuteun Gudul Type)
Smoke Exhaust Tunnel	O	×
Structure of Fireplace	• One fireplace per room (Weibang-Gudul Type) • One fireplace for all rooms (Tonggorae-Gudul Type) • Multiple fireplaces for multiple rooms (Ssangtongjip-Tonggorae-Gudul Type)	• One fireplace per room (Weibang-Gudul Type) only
Procedure of Finishing Materials	Goimdol → Guduljang → Mud/clay →soil/sand → papers	Goimdol → Guduljang → soil/straws → papers
Ondol Material	Eruptive rocks/granite	Whinstone
Auxiliary Function In addition to heating	O (Cooking Function)	× (Separate cooking system)



<Figure 4> Floor plan of Leeyoungsuk's house in Seongeup-ri

heating facility. The corner of the Gorimchae was used to stack fuel; at othertimes it was used to shore farming tools.

2. Jeongji (space for cooking and heating)

A Jeongji (area A in Fig. 4) is a place where both cooking and heating can be arranged. However, each function has its own independent facility. Thus, heating is arranged in the Gulmook, while cooking is arranged in a separate fireplace called the Sotduck which is located in the corner of the Jeongji. The Jeongji has also been used as an informal dining place, a workshop to prepare harvested crops, or a place to fix farmworking tools on rainy days.

1) Gulmook

A Gulmook is an independent heating facility, as noted in the preceeding paragraphs, and performs the major function of heating the Ondols. The secondary function is to keep the charcoal from extinguishing. These functions imply the close interrelationship between its two independent functions, cooking and heating, as the live charcoal for cooking was obtained from the Gulmook. As the preservation of live charcoal was one of the most important residential activities until chemical fuels began to be used, it is one of the notable characteristics of Gulmooks that they have been used as a place to preserve live charcoal in the traditional houses on Jeju-do.

2) Sotduck (or cooking fireplace)

A Sotduck is a cooking facility composed of

three cubic-shaped supporting stones in one pair (600 mm away from the wall) on which kettles are placed for cooking. The number of kettles on each Sotduck is usually 4; however, 5 to 6 kettles could be placed on the Sotduck in big houses. On the back-wall, right next to the Sotduck, an air-ventilating window called a Changgom was constructed to let in natural light and ventilate the smoke produced in the course of cooking. Barley straws, foxtail millet straws, and pine needles were its major fuels. This is a notable characteristic on Jeju-do: the fuels used for a Sotduck differ from those used for heating. Cooking facilities in other regions were often combined with heating facilities, which led to the disadvantage of unwanted heat during the summer season. However, the cooking facilities called the Sotduck in the traditional houses on Jeju-do provided distinct advantages; they meant a comfortable life during the summer season because of the separation of the cooking facilities from the heating facilities.

3) Busup

A Busup is an auxiliary facility which supports and complements the heating and cooking functions. It is similar to a stone fire-pot, has a quadrangle shape, and is installed at the center of the Jeongji. It has been used as complementary heating facility for the Jeongji during winter seasons. It has also been used for drying harvested crops and washed clothes and for illumination purposes. In addition, it has been used as an extra cooking appliance to heat and cook meat or fish in the case of household celebrations.

VI. Conclusions and Suggestions

The Ondol of traditional houses in Jeju-do show characteristics of structural differences distinctive from that of other regions on the Korean peninsula. The heating and cooking function in the kitchen, called "Jeongji", were performed in independent facilities. The major characteristics, distinctive from those of other regions, are summarized below.

1. The Jeju-do Ondol system is a "Weibang-Gudul" system which means one Gudul per fire hole. Each room relied on its own independent heating system and it took the form of Heuteun-Gudul (or disordered, scattered flat stones in combination with small stones). No orderly arranged exhaust tunnels for smoke, nor chimneys, were found under the Ondol substructure. However, it is assessed that natural ventilation or natural extinguishing were possible under this system because it was constructed with whinstone, a kind of effusive rock.

2. The definition of terms for the Gulmook shows variations depending on the Jeju-do region. Nevertheless, it is clear that heating facilities for the Ondol were called the Gulmook while the space where only the Gulmook facilities were built was called Gorimchae. A Gulmook in a Gorimchae has facilities only for heating, whereas a Gulmook in a Jeongji has functions for heating and for preserving live charcoal.

3. Major facilities in the Jeongji include the Gulmook, Sotduck, and Busup. The Gulmook is a heating facility and the Sotduck refers to a cooking facility; the Busup refers to a combination of heating, cooking, and illuminating facilities. The

Gulmook and Sotduck maintain independent functions, providing for a comfortable life during the summer season when the separation of cooking and heating is called for.

4. Fuels for heating were obtained from the urine and feces of stocks whereas fuels for cooking were obtained from grain leftovers, such as barley straws and pine needles. This indicates a difference between fuel choices heating and cooking.

Considering the above, the Ondol heating system of the traditional houses on Jeju-do can be assessed to provide a very rational and pro-environmental model for heating systems. They, therefore, need to be reassessed. These rational and pro-environmental heating structures can use pro-environmental fuels and be incorporated into modern pro-environmental architecture.

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