A Research on the Small Attached Buildings of Goshi Properties in the Historic Settlement of Iriki Fumoto, Japan

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Abstract
This paper aims to examine the spatial composition of the small attached buildings in Iriki Fumoto, the most well preserved historic settlement of the Goshi (the persons who usually engaged in farming and sometimes worked as warriors in the Edo period) in Kagoshima domain, Japan, and to consider one of the historic residential properties from a socio-spatial perspective. Specifically, it deals with the stables and outside bath-well houses, which are expected to reflect their characters as farmers, with regard to the building layouts and design principles. Firstly, the authors investigate the building layout of the Goshi properties in the district to reveal two contrasting areas; the official public architecture of the warrior's residence and the private architecture of the farmer. Then, they look into the building plans in detail, including stables, and outside bath-well houses. Here, the principle of arrangement of the rooms will be clarified for the existing 15 stables and 13 outside bath-well houses. In addition, the authors also consider the plans of the stables and outside bath-well houses with regard to their size, area of cattle booths and components to reveal the design process and planning characteristics. In conclusion, the results of the above studies will be summarized, referring to the architectural value of these heritage sites.

Keywords: Iriki Fumoto; stables; outside bath-well houses; house of Goshi; traditional Japanese architecture

1. Preface
In Japanese residential architecture, the main houses are generally attached with several small buildings such as stables and warehouses, used for specific purposes. These small, attached buildings occasionally reflect the owner's occupations. For instance, in the Sake brewery, the main house is surrounded by a number of warehouses related to the brewing processes. Therefore, the analysis of these small buildings and their layout is expected to reveal the relationship between architecture and livelihood, and furthermore, evaluate Japanese residential architecture in the socio-spatial context. In addition, aside from the social aspects of residential architecture, the stables and small structures of farmers' properties are not well researched. When we understand Japanese residential architecture as a compound, deep analysis of these small attached buildings and the accumulation of the related research may be of importance. In fact, in past research of Japanese vernacular architecture, regardless of their deep interests in the plans and structure of main houses¹, there is only a small body of work concerning stables or small structures attached to main houses². The research on the building layout of Japanese residential architecture is in a similar situation³.

In Kagoshima prefecture, at the southern end of Kyushu island in Japan, a local clan called Shimadzu had long governed the domain between the Kamakura and Edo periods (1192-1868). As the clan held...
numerous warriors under their control, they made them settle in various sites throughout their territory to primarily engage in farming and to prepare for potential emergencies. These warriors were called Goshi, and their settlements were called Fumoto. The meaning of Fumoto, which are commonly recognized as Goshi settlements in Kagoshima, allegedly originates from the sites that were inhabited near the foot of medieval castles on the mountains. It is a remarkable point for Goshi to have the two characters of warrior and farmer, and as a result, such characteristics may have influenced the layout of their houses and buildings.

Iriki is one of the most well preserved sites among such Fumoto settlements. Their properties consist of a main house, gates, stables and other small structures including warehouses, bathrooms, sheds etc., and are surrounded by natural stone walls and green hedges thereon. Thus, the natural stone walls with hedges, the traditional gate buildings and the gable of the main house behind these appear along the street, showing the historic townscape (Fig.1.). The authors have surveyed 15 stables and 13 outside bath-well houses as a part of the conservation of the historic district of Iriki Fumoto. Using the result of this survey, the paper aims to examine their spatial composition in the context of the Goshi buildings in Kagoshima prefecture.

The contents of this paper are as follows. Firstly, it describes the site plans of the Goshi house in order to analyze the commonness of the building layout, and to consider which structures belonged to either the warrior or the farmer. This clarifies that the stables and other small structures hold the character of the farmers' architecture. Secondly, the plans of 15 stables and 13 outside bath-well houses are studied to analyze the layout of the rooms and their sizes. According to these investigations, the authors will consider the design process of planning the stables, and compare them with those in other areas to reveal the Iriki's characters. In conclusion, considering the above, the authors will again discuss their value as a mixture of warrior and farmer architecture.

2. Layout of Buildings in Goshi Properties

The building layout of Goshi properties in the Fumoto settlements has been partially explained in past research. Accordingly, it has been described as follows. The Fumoto settlements are basically located along the major roads spreading from the Kagoshima main castle in the domain. The location of the settlements was a result of the distribution of warriors throughout the local clan's territory, as they needed to observe and notice any emergencies easily.

The Shimadzu family, the local clan in Kagoshima at that time, was one of the defeated clans in the battle of Sekigahara (1600). This was the great war to divide most Japanese clans into two groups; Tokugawa versus Toyotomi. Shimadzu had belonged to the latter, and was defeated by the Tokugawa group. After the war, the Tokugawa family established the Edo Bakufu government reigning over the whole country, and most clans of the Toyotomi groups were destroyed or removed from their original territory. However, the Shimadzu family was fortunately permitted to keep their territory by the Tokugawa family. It is possible that Shimadzu worried that they were vulnerable to attack and could easily be overthrown by the Edo Bakufu government. This political unsteadiness might have influenced the birth of the Goshi system, the distribution of their settlements and the form of architecture there.

In Iriki Fumoto, every Goshi property shows the gates and hedge on the natural stone walls along the streets. Behind these, the main house stands crossing its ridge of the roof towards the street. The main house normally consists of two buildings; Omote and Nakae. The Omote building includes the sitting room (Zashiki) with Tokonoma (decorative alcove to show pictures or ornaments) and the anteroom (Tsugi-no-ma) as they are intended for public and official purposes. Sometimes, a private small garden is arranged near the sitting room, connecting to each other through an Engawa (verandah). On the other hand, the Nakae building contains an earthen floor (Doma) and fireplaces (Kamado) for the family's private purposes. These two buildings are connected to each other with the small and generally floor-boarded room called a Tenoma. Tenoma means the room under the gutter where rain water flows down from the Omote and Nakae roofs respectively.

The Omote building, garden and gates stand facing the street, and form the official area for the warrior's house. People here may have watched the street so that
Fig. 3. Plans of Stables in the Iriki Fumoto Settlement (All areas have earthen floors except when otherwise noted.)
they could immediately notice any unusual situations in the settlement. Thus, the buildings and structures in this public area represent the warrior architecture.

In contrast, the rear buildings around the Nakae are concerned with the private area for the farmers. The earthen floors with fireplaces and washing basin serve the Goshi and his family’s daily life. The outside bath-well houses stand around the Nakae, containing the baths, well, and toilets. Thus, the area around the Nakae represents the farmer architecture. Therefore, it is a significant feature of the Goshi properties that there are two contrasting areas used for official and private purposes on one property.

In the properties of Iriki Fumoto, all 15 stables stand next to the Nakae building, and 10 buildings of the 13 outside bath/well houses also stand around the Nakae. In fact, the bathhouses require plenty of water. Similarly, it is convenient that the well house stands around the Nakae, where they need water in the washing basins, fireplaces and stoves. Thus, they belong to the private area and reflect the architectural environment of the farmer’s life.

As for the architectural curiosity of the building layout in Iriki Fumoto, the ridges of Omote and Nakae buildings are arranged in the same direction, and their eaves are connected above the Tenoma room. In addition, the roof of the stables touches the roof of the Nakae. Consequently, the narrow and long gabled roof covering the three buildings appears in the property (Fig.2.). Such a layout is one of the particular points of Iriki Fumoto properties, as it has not been recognized in other Fumoto settlements, where the stables are usually built well away from the main house.

3. Plan of Stables in Iriki Fumoto

3.1 Room Layout in Stables

The stables of Iriki Fumoto consist of the cattle booths, compost room and storage room (Fig.3.). These three rooms form the main body of the building, attached to the lean-to-roof and surrounding passage. With the lean-to-roof in front, the cattle booths face the outside. The compost room is arranged behind them. In the compost room, the columns stand on a waist height stone block walls to avoid the rotting of timbers owing to organic matter. The storage area is arranged next to the cattle booths and compost rooms. The compost room is accessible through the cattle room or storage area, and sometimes the passage is arranged on the side of cattle booths. The only exception is that the cattle booths, compost room and storage area in the property of the Kiyose family are built as independent buildings because the cattle booths had been transferred from another place and constructed there in 1928 (Showa 3). In some properties, bathrooms (toilets) for private use are laid around the Nakae and stables. This might relate to the use of compostable waste for farming purposes.

In order to make clear the principle of planning, the authors note the percentage of the area of the cattle booths in the main body of the table (See column B/A in Table 2.). According to the calculation, it ranges between 20% and 30%. However, there are some different examples. The stable of the Kiyose family, as already mentioned above, was removed and re-built separately. The stable of the Miwa family has the compost room under the lean-to-roof at the rear of building, and that of the Irikiin family was remodeled in later years showing a percentage of 14%. The percentage of the cattle booths and compost room in the main body indicates around 50%, including an error of plus/minus 10% (See B/C in Table 2.).
Table 1. Stables in Iriki Fumoto (Resident’s Names, Building Years, Locations, Sizes)

| No. | Resident’s name | Building year | Building year of main house *1 | Location | Size of main body of building (width by depth) (mm.) | Area of the main body (A) (square m.) |
|-----|----------------|---------------|--------------------------------|----------|---------------------------------------------------|-------------------------------------|
| 1   | Saisyo         | Unknown       | 1960s.                         | Nakae    | 6570 by 5260                                      | 34.558                              |
| 2   | Ichiki         | 1958          | Recent *2                       | 2        | 8101 by 5461                                      | 44.240                              |
| 3   | Koujiro        | 1955          | 1900-1910s.                     | Nakae    | 6385 by 5265                                      | 33.617                              |
| 4   | Miwa           | Unknown       | 1914                           | Nakae    | 5508 by 2875                                      | 15.836                              |
| 5   | Tanaka         | Unknown       | 1880-1900s.                    | Nakae    | 7800 by 6450                                      | 50.310                              |
| 6   | Irkin          | c. 1955 *3    | 1860s.                         | Nakae    | 9128 by 3745                                      | 34.184                              |
| 7   | Takahashi      | Unknown       | Unknown                         | Nakae    | 6658 by 3668                                      | 24.422                              |
| 8   | Taneda         | Unknown       | 1910s.                         | Nakae    | 7261 by 5464                                      | 39.674                              |
| 9   | Honda          | Unknown       | 1915                           | Nakae    | 6672 by 3005                                      | 20.049                              |
| 10  | Taniyama       | Unknown       | 1860-1870s.                    | Nakae    | 7205 by 2285                                      | 16.463                              |
| 11  | Onobuchi       | c. 1970       | 1860-1870s.                    | Nakae    | 7368 by 4989                                      | 36.088                              |
| 12  | Maruyama       | Unknown       | 1917                           | Nakae    | 7635 by 6550                                      | 50.009                              |
| 13a | Kiyose (Stable)| Unknown       | 1860-1870s.                    | Nakae    | 5870 by 4125                                      | 24.214                              |
| 13b | Kiyose (Storage)| Unknown | Ibid.                          | Nakae    | 5038 by 3935                                      | 19.824                              |
| 13c | Kiyose (Compost rm.) | 1928 | Ibid. | Nakae | 5880 by 2920 | 17.170 |
| 14  | Ebihara        | Unknown       | 1900s.                         | Nakae    | 10360 by 5350                                     | 55.426                              |
| 15  | Nagasaka       | 1860s.        | 1860s.                         | Nakae    | 10000 by 5810                                     | 58.1                                |

*1. Building years of main house are derived from past research, where it is described as ‘early Meiji period’ for instance. Here, the authors converted them into the Anno Domini system.

*2. As the main house of the Ichiki family is a recent architecture, it cannot be distinguished whether the stable belongs to Omote or Nakae.

*3. 1955 is the year that the stable of the Ikirikin family was remodeled.

Table 2. Stables in Iriki Fumoto (Size and Area of Cattle Room, Compost Room and Their Percentage)

| No. | Whole size of cattle booths (width by depth) (mm.) | Total area of cattle booths (B) (square m.) | Area of cattle and compost room (C) (square m.) | B/A (%) | B/C (%) | No. of cattle booths | Size of each cattle booth (width by depth) (mm.) | Area of cattle booth (square m.) |
|-----|--------------------------------------------------|------------------------------------------|-----------------------------------------------|---------|---------|----------------------|-----------------------------------------------|--------------------------------|
| 1   | 3330 by 2220                                    | 7.392                                    | 17.674                                        | 27.19   | 41.82   | 2                    | 1740 by 2220                                   | 3.863                          |
| 2   | 4398 by 2570                                    | 11.302                                   | 24.837                                        | 25.55   | 45.5    | 2                    | 2269 by 2570                                   | 5.831                          |
| 3   | 2933 by 2868                                    | 8.412                                    | 15.204                                        | 25.02   | 55.33   | 1                    | 2933 by 2868                                   | 8.412                          |
| 4   | 3208 by 2838                                    | 9.104                                    | 12.912                                        | 57.49   | 70.51   | 2                    | 1523 by 2838                                   | 4.322                          |
| 5   | 5840 by 2290                                    | 13.374                                   | 30.458                                        | 26.58   | 43.96   | 3                    | 2135 by 2290                                   | 4.889                          |
| 6   | 1839 by 2603                                    | 4.787                                    | 21.459                                        | 14.00   | 23.21   | 1                    | 1839 by 2603                                   | 4.787                          |
| 7   | 3260 by 2095                                    | 6.830                                    | 11.958                                        | 27.97   | 57.12   | 2                    | 1633 by 2095                                   | 3.421                          |
| 8   | 3636 by 2122                                    | 7.716                                    | 19.930                                        | 19.45   | 38.72   | 2                    | 1818 by 2122                                   | 3.858                          |
| 9   | 1703 by 3088                                    | 5.259                                    | -                                             | 26.23   | -       | -                    | -                                             | -                              |
| 10  | 1695 by 2280                                    | 3.865                                    | 9.484                                        | 23.48   | 40.75   | 1                    | 1695 by 2280                                   | 3.865                          |
| 11  | 3623 by 3053                                    | 11.061                                   | 17.75                                        | 30.65   | 62.32   | 2                    | 1811 by 3053                                   | 5.529                          |
| 12  | 3675 by 2440                                    | 8.967                                    | 24.071                                        | 17.93   | 37.25   | 2                    | 1851 by 2440                                   | 4.516                          |
| 13a | 3870 by 2340                                    | 9.056                                    | -                                             | 37.40   | -       | -                    | -                                             | -                              |
| 13b | -                                               | -                                        | -                                             | -       | -       | -                    | -                                             | -                              |
| 13c | -                                               | -                                        | -                                             | -       | -       | -                    | -                                             | -                              |
| 14  | 6305 by 2540                                    | 16.015                                   | 38.969                                        | 28.89   | 41.10   | 3                    | 2220 by 2540                                   | 5.639                          |
| 15  | 4530 by 2860                                    | 12.956                                   | 34.686                                        | 22.30   | 37.35   | 2                    | 2545 by 2860                                   | 7.279                          |

Although there are some exceptions and errors, the planning principle of cattle barns could be roughly described as follows; a quarter of the whole area of the main body is given to the cattle booths and another quarter to the compost room, while the remainder is given to the storage area. In front of them, the lean-to-roof is prepared to access the rooms inside.

Unfortunately, the building years of the stables could not be certified in the authors’ survey. The stables in the Iriki Fumoto settlements lack sufficient records of construction, partly because they were built for practical use, and did not require any ceremonial occasion to be recorded.

3.2 Size of Cattle Booths

Here, the authors investigate the size of the cattle booths depending on their measurement survey. The area of each cattle booth in the 15 existing stables in Iriki Fumoto is between 3 and 7 square meters. The width and depth of each booth ranges from 1.5 to 2.3 meters and 2 to 3 meters (Table 2.). However, there are some exceptions showing larger sizes (Fig.7.). The plans of Nos. 3 & 15, showing larger width sizes, take a square shaped booth although most ordinary booths take a rectangular form. This may mean that in these square booths the cattle are housed in large and rather comfortable spaces. The plans of Nos. 9 & 11 show a
larger depth. In fact, the stable of the Honda family (No. 9) is a particular plan with 4 cattle booths laid on the side of the building. The stable of the Onobuchi family (No. 11) holds two cattle booths, and here a passage is arranged behind a booth. As a consequence, the other cattle booth becomes deeper, including the depth of booth and the width of the passage.

Regardless of some exceptions, it could be understood that each cattle booth in Iriki Fumoto shows a basic size of about 1.8 meters in width and 2.5 meters in depth. Particularly, when we look at the size of the main body, which shows great differences ranging over 2 meters, the size of each cattle booth shows relatively even numbers in contrast (Fig. 8). This may be because the size of each cattle booth was customarily fixed in the settlement, although there were slight differences owing to the type of animals kept and the building year.

As already mentioned, in the 14 stables of the 15 existing buildings in Iriki Fumoto, the cattle booths are designed to face outside through the lean-to-roof in front of the main body. The cattle enter their booth from the front of the building. People tend to them at the front of each booth also. As the compost room is connected behind the cattle booths, the compostable wastes are collected from the rear of the booths.

3.3 Planning Considerations of Stables in Iriki Fumoto

As studied in the above sections, there are some principles in the design of the stables in the Iriki Fumoto settlement. The authors here consider the design process of the plan of stables and the architectural particulars of Iriki Fumoto’s stable by means of comparison with those in other areas.

The process of planning could be described as follows. Firstly, the resident or owner of the property decides the type of livestock (horse/cattle) and their number, which corresponds to the number of cattle booths. As the size and layout of the cattle booths are generally fixed in the settlement, the total area of the cattle booths will be set automatically. With regard to the layout of cattle booths, they are basically put in the front of the building to face the outside for the convenience of farming purposes. Then, the owner decides the size of storage and compost room. They sometimes vary according to the owner’s social demands and other reasons, but generally indicate 50% of the total area of the main body for storage and 25% of that is for the compost room. The storage is put in next to the cattle booths, and the compost room is situated behind them.

As per the example of the stables of the farmer’s property in South Kyushu, the authors know the architectural details of those in Shiba village and the central area in Miyazaki prefecture. Miyazaki is the neighbor of Kagoshima, and Shiba is a remote mountain village where the properties have developed on the stepped ground on the slope of mountains. According to the survey reports, each cattle booth covers around 7.3 square meters in Shiba and 5.5 square meters in the central district. The number of booths is two or three. The buildings in both areas are mostly two story, where the upper floors are used as haylofts. In the Iriki Fumoto settlement, each cattle booth ranges between 3 and 6 square meters, and the number of booths is mostly two or three. These buildings are single story. In fact, the stables in the two areas of Miyazaki are built for horses. Because they may be more powerful and need a large space, each booth is a square shape, while those in Iriki Fumoto used to house cattle are a narrow rectangular shape.

4. Plan of Outside Bath-Well Houses

The components of outside bath-well houses in the Iriki Fumoto settlement are different in every property (Table 3.). The basic components are wells, baths and
Table 3. Outside Bath-Well Houses in Iriki Fumoto (Resident's Name, Location, Components, Size)

| Building No. | Resident's Name | Location | Components of Outside Bath-Well houses | Size of Building (mm) | Building Year of Main House *1 |
|--------------|-----------------|----------|----------------------------------------|-----------------------|-------------------------------|
| a            | Ichiki          | *2       | Yes                                    | 5110 by 1660          | Recent                        |
| b            | Katsuta         | *2       | Yes                                    | 4125 by 2120          | Recent                        |
| c            | Tanaka 1        | Nakae    | -                                      | 2867 by 1935          | 1880-1900s.                  |
| d            | Tanaka 2        | Detached House | Yes                                | 3698 by 1718          | 1912-1927                    |
| e            | Ando            | *3       | Yes                                    | 3943 by 1981          | 1878                          |
| f            | Onobuchi        | Nakae    | Yes                                    | 2858 by 1825          | 1860-1870s.                  |
| g            | Taniyama        | Nakae    | Yes                                    | 3615 by 1890          | 1860-1870s.                  |
| h            | Miyazato 1      | Nakae    | Yes                                    | 3720 by 1985          | 1936                          |
| i            | Miyazato 2      | Nakae    | -                                      | 2627 by 1568          | 1936                          |
| j            | Masuda          | Nakae    | Yes                                    | 4953 by 3013          | 1860s.                        |
| k            | Shirinashihama  | Nakae    | Yes                                    | 4811 by 1258          | 1930                          |
| l            | Yamaguchi       | Nakae    | -                                      | 2093 by 1855          | 1878                          |
| m            | Kiyose          | Nakae    | Yes                                    | 5880 by 2920          | 1860-1870s.                  |

*1. Building years of the main house are derived from past research, where it is described as 'early Meiji period' for instance. Here, the authors converted them into the Anno Domini system.

*2. As the main house was demolished and recently re-built, it cannot be distinguished whether the out-houses belong to Omote or Nakae.

*3. The main house does not take the Omote and Nakae form.

toilet booths containing urinals and toilet seats inside. Five buildings of the 13 outside bathhouses have the well and baths together. Because bathrooms normally require plenty of water, it may be convenient to build the baths next to the well room. The size of building varies between 2 and 5 meters in width, 1.5 and 3 meters in length. Among them, the bath house of the Masuda family is one of the largest structures in the settlement. The waist height stone block walls are placed on the basement to avoid the rotting of timbers. Processed stones are also observed in the urinals and floors of toilet booths, indicating the stone building culture in Kagoshima (Figs. 5. & 6.).

5. Conclusion

For the purpose of making a basic report of small buildings in relation to residential architecture, this paper explored the stables and outside bath-well houses in Iriki Fumoto settlements from the perspective of Goshi architecture. The architectural particulars of the stables and outside bath-well houses in the Goshi properties in Iriki Fumoto can be summarized as below.

(1) The layout of buildings in the property could reflect the Goshi architectural characteristics. The buildings and structures around the Omote represent the public purposes for warriors. On the other hand, the buildings around the Nakae are a private area for the farmer's life. The stable and outside bath-well houses belong to the latter.

(2) As a representative of Goshi architecture, the paper examined the plans of stables. As a result, the following three points have been clarified.

There is a principle of planning in the arrangement of rooms of the stables. That is, a quarter of the whole area of the main body of the building is given to the cattle booths, another quarter is given to the compost room, and the rest is for storage.

The size of each cattle booth is around 1.8 meters in width and 2.5 meters in depth, and may be customarily fixed in the settlement rather than that of the main body. The layout of the booth, facing outside by the lean-to-roof with the compost room behind, are also commonly recognized in most stables in the settlement.

The design process of the plan of stables could be as follows; first, the owner decides the number of cattle and booths, the sizes of which are customarily fixed in the settlement. Then, they add the compost room and store stocks around it. Although their sizes depend on the owner's social demands, the distribution of the area shows a trend. The area of each cattle booth shows around 3 to 6 square meters, which is smaller than those in other areas in Miyazaki, where horses are housed for farming purposes instead of cattle as in Iriki Fumoto.

(3) There are basic components in the plans of outside bathhouses; wells, baths and toilet booths, among which wells and baths are occasionally connected for the convenience of water. In addition, some buildings are constructed with stone building techniques showing Kagoshima's architectural culture.

Currently, the stables and outside bath-well houses are out of use owing to the transformation of life style; residents there prefer and use the bathrooms newly built in the main house, and farming machines and vehicles have taken the place of livestock in the stable. In fact, some structures are not in good condition. However, as analyzed in the layout of the buildings, the Goshi properties contained two contrasting characters; that of both warriors and farmers. The gates on the stone walls and sitting rooms are representative of warrior architecture, whereas the stables around the Nakae are represent the farmers' architecture. As a part of Goshi buildings in Kagoshima, they are an indispensable part of the heritage and the history of Japanese architecture.
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