Historic land use and ground condition at Kakamigahara plateau

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ABSTRACT

We investigated the geological ground condition of the Kakamigahara plateau in Japan, and paid attention to the remains on the area. In the long history, the distribution of remains changed. By considering the background, it showed a interesting relation with people and the ground. It was revealed how people built colony, mounded tombs, religion facilities, highways for security and a purpose in the long history.

Keywords: plateau, flood, history, remains, tombs

1 INTRODUCTION

This paper presents the relation between the historical land use and the ground condition at Kakamigahara plateau and the surrounding area. In order to reveal the said relation, the followings are focused. Namely, the distribution of ruins in the area, the configuration and geological ground condition in the area. The noted ruins are the colony ruins, ancient tombs, religious facilities and old main highways.

2 GEOLOGY AND TOPOGRAPHY OF KAKAMIGAHARA CITY

Kakamigahara city in Gifu Prefecture is located at the central part of Japanese main land, Honshu, and also located on the inland of Nobi Plain (Fig. 1). The geology of Gifu Prefecture consists of rocks and strata forming widely the southwest Honshu (Fig. 2). They are divided into 4 zones, namely Hida Zone, Hida Edge Zone, Mino Zone and Ryouke Zone from north to south (Koido, 2011; Fumio et al., 1991).

Kakamigahara city is located in the Mino Zone (Fig. 3). Mino Zone is comprised of sedimentary rocks such as chart, sandstone, mudstone, limestone, etc. and volcanic rock such as basalt. These rocks are collectively referred to as “Mino sedimentary complex”. These Mino sedimentary complex were formed through the complex process due to the movement of ocean plates during the late Paleozoic to the early Cretaceous (Kuwabara, 1975; Yokoyama et al., 1991).

The Mino sedimentary complex had formed a complicated mountainous topography by natural phenomena of folding, breaking, weathering, eroding, etc. in the northern part of Kakamigahara city. Kiso River flows through the southern end of Kakamigahara city and forms a city boundary. There is the diluvial upland called Kakamigahara plateau exists in the area between the northern mountainous zone and the southern Kiso River. The plateau occupies the most area of Kakamigahara city (Fig. 3).

Fig. 1. Position of Kakamigahara city in Japanese main land.
The length of Kakamigahara plateau is about 10 km from east to west, about 5 km from north to south, and the area of the plateau is about 1,900ha. The surface altitude of Kakamigahara plateau is about 60m and about 20m at the east end and at the west end, respectively. The plateau was composed of mud, sands and gravels carried from the upper reaches of Kiso River (Nishimura, 2014b).

It is said that the plateau is formed at a time of Atsuta transgression (about 120,000 years ago) after the Riss glaciation. The plateau was located near the mouth of Kiso River during the Atsuta transgression. The sands and gravels carried by Kiso River in those days developed a delta zone which became later as a part of Nobi Plain. After then, the riverbed of Kiso River was eroded during the Wurm glaciation (70,000 – 18,500 years ago). As a result of the erosion, the remained terrace ground of about 13m in relative height is called “Kakamigahara plateau”.

The present shape of Kakamigahara plateau had been formed about 50,000 years ago (Fig. 4).

3 DISTRIBUTION OF PREHISTORIC COLONY REMAINS AND GROUND

As shown in Fig. 5, many remains of prehistoric colony have been found in the area of Kakamigahara city. It can be recognized a location change of the prehistoric colony depending on the era. The location change of colony would be closely related to the river terrace topography in Kakamigahara city.

The remains of the paleolithic period (35,000 years ago henceforth) are found in the eastern end of Kakamigahara plateau (higher terrace), but not in the lower terrace. The location of these remains indicates that the ground of lower terrace was not stable safe from flooding and not yet completed to form. As shown in Fig. 6, the ground of lower terrace is composed of thick gravelly and sandy layers which indicate the intensity of deposition and erosion.

On the other hand, the ground of Kakamigahara plateau was covered with the aeolian soil and was very stable during the paleolithic period.
Fig. 6. Kakamigahara plateau and surrounding soil layer deposition state.
During the Jomon period (13,000 years ago henceforth), the ancient colony advanced into the fine highland in the lower terrace. Although several branches of Kiso River were turbulently flowing in the lower terrace during the Jomon period, the river channels had been fixed by regression and the stability of climate. Consequently, the ground in the lower terrace had changed for the ancient people to settle there (Nishimura et al., 2013b).

When Yayoi period (2,300 years ago henceforth) began, a big change appeared on the distribution of ruins. That was, the number of ruin had increased in the lower terrace, but no longer in the plateau, during the Yayoi period.

In order to engage in the paddy field, people moved to the lower terrace near watering place. Kakamigahara plateau was poor in water, where was not suited to rice cultivation. Topsoil of Kakamigahara plateau had strong acidity of pH 4.6, which was not suitable for cultivation with the plants of those days. There were neutralized and fertile fluvial soil in the floodplains along small branches of Kiso River, which had been transported by the flood.

Because of these reasons mentioned above, the people of Yayoi period migrated to the lower terrace and began there for farming rice. However, the people had to understand the flood crisis as the price of immigration to the lower terrace.

The ancient people had no effective construction technology for river dyke in that day. Therefore, the people might carefully learn the relationship between weather change and river water level. Then, people seem to be responded by evacuating to the higher ground during flooding.

4 DISTRIBUTION OF TOMBS AND GROUND

The Kofun period is the first historical age in Japan. Agricultural economy at that time brought the rich-poor gap and created the ruling classes who built their tombs as own graves in the second half of the 3rd century. Those mounded tombs were the typical ancient earthwork structure in Japan. It was called the Kofun period during the era when the mounded tombs were considered.

About 600 tombs were built in Kakamigahara city during the Kofun period. Among them, the largest tomb was Bonozuka tomb which had a unique Japanese style of keyhole-shaped mound with 120m in length (Fig. 7). A large ancient tomb was generally build on a stable ground overlooking the ruling land. Accordingly, the Bonozuka tomb was built at the vantage point on the eastern edge of Kakamigahara plateau (Fig. 8).

The hard layer of volcanic mudflow exists in the eastern edge of the plateau (Fig. 9, Fig. 10). The origin of mudflow deposit was the Ontake Volcano. The mudflow deposits were carried by the water flow of Kiso River to the Kakamigahara area about 50,000 years ago (Nishimura and Kani, 2012).

In order to construct Bonozuka tomb, about 18,400m³ of embankment soil was required, which was collected from the surrounding ground. Since the mudflow deposits were too hard to dig with tools at the time, the excavation work had run into difficulties (Nishimura et al., 2012).

Since the 6-7th century, the ancient tombs had spread simultaneously with the land development. At that time, many small round tombs of about 12 m in diameter were built in Kakamigahara area. These small tombs have a characteristic in the built area that they
concentrate on the skirt of hill (Fig. 11). The reasons why the small tombs concentrate on the hill skirt are considered as follows.

Ancient people had a policy to separate the graveyard from the sphere of life. To save the effort spend on the earthwork for borrow construction by excavating a ridge-shaped protuberance. The chert stones were willingly used by the ancient people as the stone chamber in barrow. The chert was the dominant rock of Mino sedimentary complex as mentioned in the chapter 2. Therefore, the barrows were constructed on the hill skirt where the chert stones were easily available from the outcrops at hilltop.

The proliferation of tombs indicates the following background. It is the development of irrigation technology and increase of the farmers. The said background indicates that the dispute age has come for the farming groups.

5 DISTRIBUTION OF RELIGIOUS FACILITIES AND GROUND

The object of primitive religion was often a mountain facing the human dwelling. A symbolic rock in mountain became the object of faith in many cases. In the Kakamigahara area, the symbolic rock was the outcrop of chert in the Mino sedimentary complex. And then, an altar was established by the ancient people at the foot of mountain such as Kasami Shrine and Mii Shrine in this area (Fig. 12). Shrines were given a religious status in 10th century.

6 MAIN STREET AND GROUND

An old highway named Tosan-do Road had passed
through the Kakamigahara city region. Tosan-do Road was one of the main highways established in the 8th century. After the time in 17th century, Nakasen-do Road had established in the Kakamigahara city region as one of five main highways at Edo period (Fig. 13). Tosan-do Road was built diagonally through Kakamigahara plateau from northwest to southwest direction. Nakasen-do Road was built through the plateau from east to west. Both highways were built on the stable plateau as long as possible. It has to emphasize also that there were a few topographical obstacles on the plateau, so that these highways could maintain the linear routes (Nishimura et al., 2013a).

It is known that Unuma Road, Toukan Road and Yamagata Road had passed through the Kakamigahara plateau. These Roads had been connected to the 14 ferry terminals located along Kiso River. These Roads could maintain their function by connecting to the said ferry terminals, but no more, today (Nishimura, 2014).

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7 CONCLUSIONS
The Kakamigahara plateau is located at the hollow of Mino Zone and formed as the upper river terrace by Kiso River. The Kakamigahara plateau is surrounded with the lower terraces.

The people belonging to the paleolithic period and Jomon period lived on Kakamigahara plateau or a part of the lower terrace.

The people started farming and settled in the lower river terrace near watering places at the Yayoi period.

The ruler in power built the large tomb on the stable plateau overlooking his ruling land at Kofun period. Then, the smaller tombs become in popular and were built along the hill skirt of Mino Zone.

The object of faith were often the chert mountain rock in the Kakamigahara area. Old shrines were not found on the plateau but on the lower river terrace, which indicated that the economy of those days had revolved around agriculture. Old temples had been built intentionally and politically based on the urban planning.

Many roads had been built in all directions on the Kakamigahara plateau. The Kakamigahara plateau provided a stable and safe ground. There were 14 ferry terminals along Kiso River for the south-north traffics connecting to the roads on the plateau.