

1. Introduction

The late Pliocene to early Pleistocene deposits are distributed in the southwestern part of the studied area. These are called as the Yaoroshi, Hanno, Bushi Formations and Toyooka Gravel in ascending order. Correlation of these formations to the Tama Hills in the southern outside of the studied area was difficult for the different lithostratigraphic classification. The present author divided the above mentioned formations by the lithostratigraphic classification as shown in Table 1 and corrected the traditional stratigraphy and chronology as shown in Table 4. As a result of this classification, the both areas became possible to be correlated (Table 2).

The Musashino Plateau is situated in the southern part of the studied area. The areas of Tama River, Tama Hills and Shimosueyoshi Plateau in Yokohama and Kawasaki Cities of Kanagawa Prefecture are well known as the type localities of the several Quaternary terraces and volcanic ash formations in Japan. Various studies on Quaternary geology had been carried out in these areas, and in Chiba and Ibaraki Prefectures on the east of the studied area. The marine Pleistocene Kazusa (lower) and Shimosa (upper) Groups are distributed in Chiba Prefecture. The correlatives with the Kazusa and Shimosa Groups exist also in the southwestern part of the studied area.

On the foot of the mountains in the west of the studied area, a landform called the hill is developed. The summit level of the hill is equal at the altitude between 50 and 300 m.

A landform called as the plateaus is developed between the hills and the eastern lowlands. The height of plateaus is usually lower than that of the hills and are higher than the alluvial plains.

The component layers of the hills and plateaus in Saitama Prefecture and Tokyo Metropolis have been investigated.

The present study deals with the late Pliocene to Holocene stratigraphy, tephrochronology, division of terraces by utilization of tephrochronology, transition of the environment and deformation of topography.

Previous works on geomorphology and geology in the Kanto Tectonic Basin

Since the 1920's, many studies on the Yaoroshi, Hanno and Bushi Formations and its equivalent units in the western part of Kanto Region had been published.

Asai (1925) reported that the Yaoroshi, Hanno and Bushi Formations including the deltaic deposits in the Kanto Plain were the marginal deposits of "Paleo-Tokyo Bay" of Fujimoto (1926). The term "Paleo-Tokyo Bay" was used by Yabe (1931) for the bay existed from the Middle to Late Pleistocene around Tokyo. The "Paleo-Tokyo Bay" was also used by Fujimoto (1926) earlier than in Yabe (1931)'s "Paleo-Tokyo Bay". It should be called as the Pre-Paleo-Tokyo Bay for Fujimoto's proposal.

There are many publications about the stratigraphic succession of Yaoroshi, Hanno and Bushi Formations, since there are some confusions. For example, Iguchi (1951) regarded the Bushi Formation as the lowest formation (Table 1). Fukuta and Takano (1951) reported the classification of the Hanno Formation (Table 1) by careful investigation. They revised the classification in the areas of Azuyama (= Kaji) Hills and Hanno City. The upper part of their Hanno Gravel differs remarkably from the lower part in lithofacies. Mitomo *et al.* (1986) and Machida, (1988) classified their Hanno Gravel into the Yaoroshi Tuff and Hanno Gravel by lithofacies. Relation between the Yaoroshi Tuff and Hanno Gravel is partial unconformity (?) and both lithofacies differ entirely. Fukuta and Takano (1951) considered the geologic age of their "Hanno Formation" (Hanno Gravel and Bushi Clay of Fukuta and Takano, 1951; Yaoroshi Tuff, Hanno Gravel and Bushi Clay of Mitomo *et al.*, 1986 and Machida, 1988) is the late Pliocene.

The stratigraphic classification of the Pleistocene in the Tama River Basin was summarized by Juen (1966a,b). Horiguchi *et al.* (1977) subdivided the Bushi Formation into five members and measured 113 m in thickness.

Fujita (1977) and Takegoshi *et al.* (1979) discussed the sedimentary structures of the "Hanno Gravel" (author's Yaoroshi and Hanno Formations; Pls 1, 2 and 3).

The author clarified the distribution of the tuffaceous mud and gravel in the

"Hanno Gravel", and named the Yaoroshi Formation for the former and for the facies of gravel as the Hanno Formation. Both formations are thick and have different lithofacies.

Research Group for Geology of the Western Hills of the Kanto Plain (1995) recognized the equivalent formations of the "Hanno Gravel" in the Kasumi Hills and regarded them to be the upper and lower parts of the Kasumi Gravel, respectively.

Kanto Loam Research Group (1954) classified the terraces and loams into four planes and units in ascending order; Tachikawa, Musashino, Shimosueyoshi and "Tama"; "Tama", Shimosueyoshi, Musashino and Tachikawa together with the fundamental framework of the stratigraphy of the Kanto Loam Formation in relationship with the geomorphic development.

Kanto Loam Research Group (1956) defined the term of the Kanto Loam as "the general name for the layers of volcanic ash" and adopted the term for "a unit of group". The Group (1956) described the four volcanic ash formations and presented the subjects of the morphogenesis of topography underlain, and origin, deposition and weathering of the loam formations.

Tsurumi and Ohmura (1966) recognized a new Tsuchihashi Terrace covered by the Tsuchihashi Loam of the upper part of the Tama Loam in the eastern part of the Tama Hills based on the results of Kanto Loam Research Group (1965). This is the youngest terrace covered by the Tama Volcanic Ash. Kobayashi *et al.* (1968a, b) traced the Pumice Bed I of the Kiso Ontake Volcano (Kobayashi and Shimizu, 1962; abbreviation: Pm-I) from the Shinshu Loam into the middle part of the Shimosueyoshi Volcanic Ash in the southern part of the Kanto Region.

Minagawa and Machida (1971) found the pumice bed containing many biotite flakes in the "Tama Volcanic Ash" and named it as the Hachioji Biotite Pumice (abbreviation: HBP). Machida and Moriyama (1968) investigated the pumice beds intercalated in the tephra layers of the Oiso Hills from a stratigraphic point of view. Endo and Uesugi (1972) reported the stratigraphy of the Tama Volcanic Ash in the Oiso and Yokohama areas. Machida *et al.* (1974) reported the pumice beds

intercalated in the tephra layers in the southern part of the Kanto Region. Arai *et al.* (1977) correlated the pumice beds in the marine deposits of the Boso Peninsula with those of the Oiso Hills. Kanto Quaternary Research Group (1980) reported the stratigraphy of volcanic ash formations and terrace deposits in the Yokohama and Kawasaki areas.

There are a few studies on the environmental changes in the studied area. Fukuta (1950), and Fukuta and Ando (1951) reported the succession of the Pleistocene deposits and shell beds (Table 5) in the northeastern part of the Musashino Plateau and discussed about marine environment.

Shimakura (1936), Narahara Fossil Plant Research Group (1967), Fujimoto (1977), Itsukaichi *Stegodon* Research Group (1980), Kimura *et al.* (1981) and Mitomo *et al.* (1986) reported fossil plants and molluscan shells in Hanno and Hachioji Cities, and mentioned about sedimentary environment and climate.

Horiguchi *et al.* (1976) reported on the Holocene deposits and their ages in Higashimatsuyama City. The Kanto Loam Research Group (1964) and Kinosaki *et al.* (1963) analyzed fossil pollens collected from the peaty beds at Taguro, Tamagawa-mura, Hiki-gun, Saitama Prefecture and reported climatic changes.

Concerning the geomorphic processes of topography in the studied area, Kaizuka (1957) stated the deformation of the Musashino Plateau was connected with the movement of the Kanto Tectonic Basin. Horiguchi in the book edited by Kakimi and Suzuki (1974) clarified about the deformation of topography of the Kanto Tectonic Basin including Saitama and Gunma Prefectures.