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Examination of Japanese View of Nature in Lime Mining and Establishment of Prefectural Nature Park in Chichibu, Saitama Prefecture

— The Struggle between Industrialization and Landscape Conservation —

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Ⅰ Introduction

This report searches for the Japanese view of beauty and nature through a study of the history of lime mining and landscape conservation at Mt. Buko in Chichibu, Saitama Prefecture, and the mapping of the transformation of a mountain's shape. A normal map primarily intends to express existing shapes, but this report maps the vanished shape of a mountain from the limestone mining of its slopes. This is done to consider how its vanished shape has impacted the Japanese view of beauty and nature.

Ⅱ Study area

The mountain studied is Mount Buko located in Chichibu City and Yokoze-machi in Saitama Prefecture (Fig. 1). Mount Buko is suitable for limestone mining, and during the Edo Period, lime-

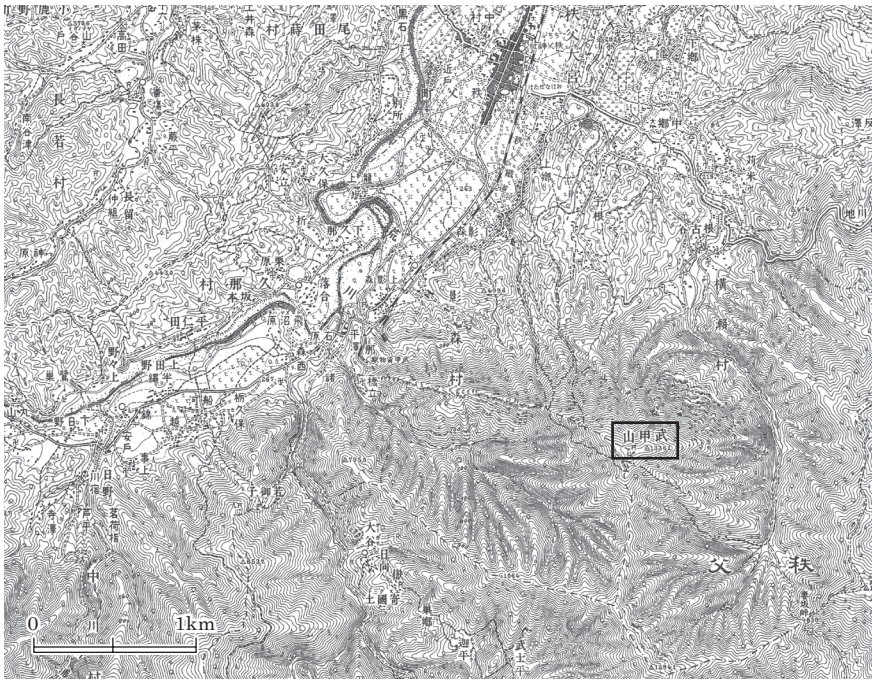

Fig. 1　Study area
This map is based on the Map 50,000 (Chichibu, modification of main parts in 1929).

stone was mined on this mountain to obtain material for mortar and fertilizer. In the Meiji Period, cement was used in Japan to construct buildings and surface roads, and limestone (raw material for cement) was produced and consumed in large quantities. During the Taisho Period, corporations started to mine vast quantities of limestone. At Mount Buko, the shapes of the mountain was heavily transformed by limestone mining (Fig. 2, and 3).

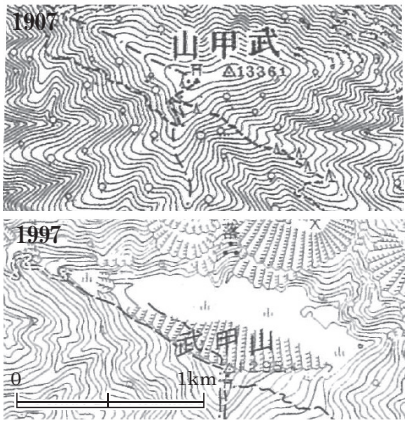

Fig. 2　Topographic map of the summit of Mount Buko —1907 and 1997—
This map is based on the Map 50000 (Chichibu, survey in 1907 and modification of main parts in 1929, and modified in 1997).

Fig. 3　Current mining situation in Mount Buko —2017—
This picture is a reprint of Mt. Buko Cooperative Mining Technical Committee's report.

Ⅲ　The popular perception of Mount Buko during the Edo Period

The Chichibu 34 Kannon Sanctuary, a group of sites, is in Chichibu, where Mount Buko is also located. These sanctuary sites together form the Chichibu pilgrimage, and people visit them to pray. During the Edo period, Mount Buko was depicted in the Chichibu pilgrimage guides, as well as in the diaries of those who made the pilgrimage. In the Eiri Chichibu Junrei Hitori Annai Ki, or the "Illustrated Guide to a Solo Chichibu Pilgrimage" (Fig. 4), Enshu describes the route to Chichibu and the temples on the way from Edo, as well as depicts the famous places along the way. The settlement depicted in the foreground in the illustration of Mount Buko has been confirmed to be Omiya-machi. This implies that this illustration captures Mount Buko from the northwest direction. If we

Fig. 4　Drawing of Mount Buko in Edo period.
This picture is a reprint of Eiri-Chichibu-Junrei-Hitoriannai-ki
（円宗『絵入秩父順礼独案内記』1745年）,
Owned by Saitama Prefectural Library.

focus on vegetation, trees are depicted around the village and at the base of Mount Buko, but no trees can be seen around the middle of the mountain or on its summit. In addition, the summit of Mount Futago, seen in the background,is round, but Mount Buko is drawn in an angular fashion.

Based on these observations, it appears that people considered Mount Buko to be a mountain on which trees did not grow naturally, and which had a rocky surface that was exposed to the elements. Chichibu Hitori Annai, or "A Solo Guide to Chichibu" (Fig. 5), drawn by Hashimoto Tokubei and based on Eiri Chichibu Junrei Hitori Annai Ki, is a colorful picture that offers a bird's eye view of the Chichibu region. The upper-left portion of this picture depicts the north, and Mount Buko is drawn on the left edge of the picture, which would be in the west. Although the mountains around Mount Buko have round tops and are colored using green and blue, Mount Buko is angular and entirely devoid of color.

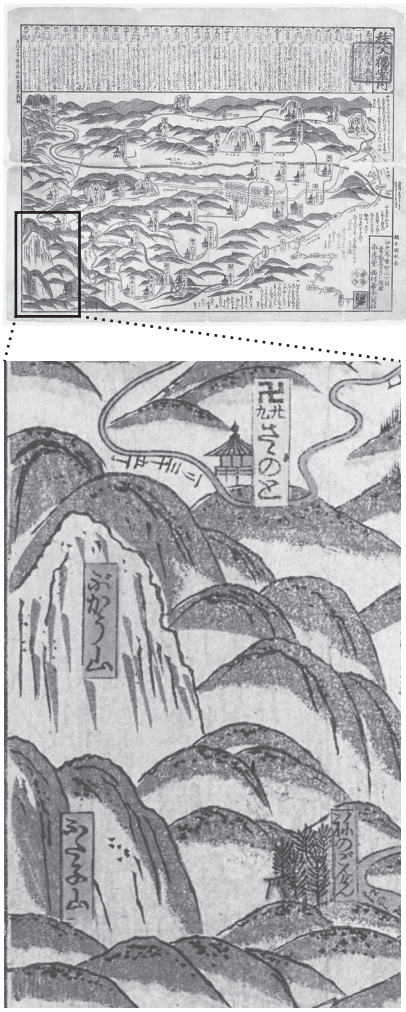

Fig. 5　Drawing of Mount Buko in Edo period. This picture is a reprint with some modifications of Chichibu-Hitoriannai (橋本徳瓶『秩父独案内』1813年), Owned by Saitama Prefectural Library.

Thus, Mount Buko was depicted using white color and angular characteristics in the Edo period. As many of the mountains around Mount Buko are higher in elevation than Mount Buko, it is unlikely that the mountain is depicted to be white due to climate-related factors such as snow or frost. The whiteness of the mountain is instead meant to indicate exposed limestone, as the mountain was considered to be made of limestone during the Edo period.

Ⅳ　Creating a Three-Dimensional Diagram

In this study, we reconstructed the form of Mountain Buko from the Meiji period onward using the following process (Fig. 6).

For the three-dimensional diagram, the CP program Adobe Photoshop (AP) was used and a 50,000 : 1 topographic map was produced as the foundation for the diagram. The version of AP used was CS4. AP is equipped with a function that allows a 3D mesh to be created, making it possible to depict something three-dimensionally in response to the color and lighting of the object.

The 3D mesh was produced using Direct3D, which is included with AP. Direct3D is an API (Application Programming Interface) for creating 3D graphics and can be used in such a way that it in-

teracts with the functions of CP. By using Direct3D, mapping data could therefore be transmitted to the graphics board installed in CP and converted to a 3D object in response to color and lighting. A graphics boards is a circuit board used in all types of computers, and it can export or import images as signals. Within Direct3D itself, variables called D3DRS_SLOPESCALEDEPTHBIAS and D3DRS_DEPTHBIAS, for creating 3D diagrams of mountains, as well as the functions defined by these variables, are very important. The maximum incline is a standard determined by these variables. By fixing these variables, the offset can be calculated. The offset refers to positions and distances from standard points that are necessary for creating a 3D diagram. That is, based on the mountain's maximum incline, the slope of the mountain at each point is expressed. The 3D diagram is then composed of these slopes. This function is as follows.

Offset=m*D3DRS_SLOPESCALEDEPTHBIAS+D3DRS_DEPTHBIAS

This m is the maximum incline depth of triangles used in rendering. Rendering refers to producing an image by calculating higher order descriptions (numeric data, formulas, etc.). This m is obtained in the following manner.

m=max(abs(delta z/delta x), abs(delta z/delta y))

Here, the max function and abs function are used. The max function returns the largest of its target values, the abs function returns the absolute value of a number, and delta expresses the amount of change. That is, here, either the slope of the x or the y axis with respect to the slope of the z axis is expressed, depending on which slope represents the greatest incline depth. This is calculated based on the absolute value by using the abs function. That is to say, when looking from the summit (z axis), the x axis direction and y axis direction are compared to determine which one of the two is steeper, and that value is used to calculate m (Fig. 7.1, 7.2). By conducting the rendering based on an offset derived in this manner, a 3D diagram that reproduces the slope of the mountain can be completed.

V The Establishment of a Natural Park and Environmental Conservation Efforts

(1) Activities by local residents

The Japanese park system does not aim to protect untouched wilderness but is rather marked by the inclusion of both conservation and development as goals, such as in creating sites for tourism while also preserving natural landscapes.

After the Second World War, a rise in the demand for lime caused an increase in lime mining. As the shape of Mount Buko changed considerably due to this mining, the local residents of the area surrounding Mount Buko became interested in the

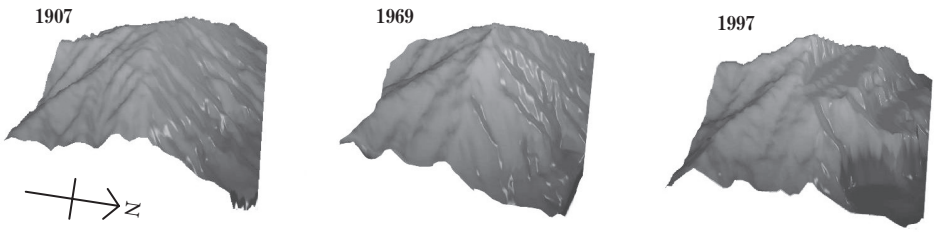

Fig. 6 Reproductions of Mount Buko (1910, 1969, and 1997)
This figure is based on the Map 50,000 (Chichibu, survey in 1907, modified in 1969, 1997)

changing shape of the mountain. As a result, the Buko Nature Park, including Mount Buko, was established in Saitama Prefecture in 1957. In the 1970s, amidst an increase in interest in environmental problems due to increasing pollution in Japan, organizations in the area around Mount Buko, such as the Council on the Promotion of Measures for the Conservation of Plant-Life on Mount Buko, the "Citizen Group for the Protection of Nature on Mount Buko," and others, began to push for nature conservation on Mount Buko. The result of these activities was a push for environmental conservation on Mount Buko by ensuring "the protection of the plants that are native to Mount Buko," which would prevent sudden changes in the shape of the mountain caused by the mining of lime. These activities then indirectly checked the mining of lime on Mount Buko. Mount Buko has unique plants

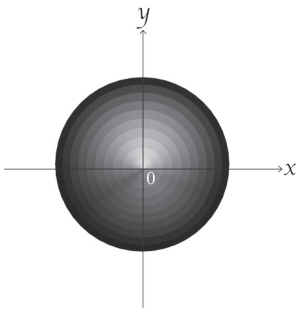

Fig. 7.1 Each axis in the max incline (m) model—seen from the z axis

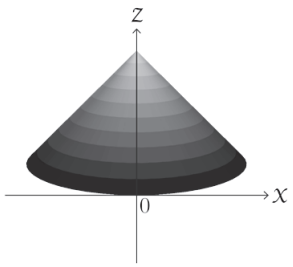

Fig. 7.2 Each axis in the max incline (m) model—seen from the y axis

such as the Chichibu Iwazakura (a member of the primrose family), and mining has been restricted in the areas where these plants grow. As people employed in the mining of lime were the residents of the area around the mountain, environmental conservation efforts and the establishment of the nature park became a method of reconciling the "internal conflict" between the mining of lime as a means of earning a livelihood and the desire to prevent the changes in the shape of the mountain.

(2) Activities by mining companies

In response to these local activities, mining companies are working on sustainable mining. There are three companies that conduct mining at Mount Buko. They signed an agreement in 1974 and started cooperative mining in 1981. Until then, each company independently mined, and the mining method used by each company had a difference in mining progress, resulting in a residual wall at the mining area border. By mining in cooperation with the three companies, the remaining wall of the mining area boundary is eliminated and mining waste can be eliminated. Furthermore, by jointly conducting environmental conservation and consultation with local residents, conservation of the landscape of Mt. Buko has become possible. One of the mining companies' efforts to preserve the environment of Mt. Buko is planting trees at the mining site. This tree planting activity is based on the guidelines created in 1982, and is continuously cultivating seedlings and planting seedlings on mining sites (Fig. 8 and 9). The conflict over the transformation of Mt. Buko has been resolved. By mining companies working together on sustainable mining.

Ⅵ Conclusion

This study shows that the Japanese view of

Fig. 8　A field that fosters seedlings to be planted in mining areas — 2019 —
This picture was taken during an on-site survey at the Une mine located at Mount Buko.

Fig. 9　Planting situation in mining area— 2019 —
This picture is provided by the Mt.Buko Cooperative Mining Technical Committee.

beauty and nature does not consider only untouched wilderness to be the object of conservation efforts, but rather also seeks to conserve natural places that have experienced human activity, whether through the construction of buildings or some other means. The Japanese view of nature conservation and development can be found in the sequence of events triggered by the changes in the shape of Mount Buko, and the related environmental protection activities.

〔Acknowledgments〕

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