A survey for the larger block distribution on the block slopes around the summit area of Mount Tateshina, central Japan: an application of combined on-site measurements with UAV-SfM method providing clues as to the understanding of block slope development

*Motoi Kikuchi[1], Hidetsugu Yoshida[1], Hiroyuki Obanawa[2]

1.Meiji University, 2.The University of Tokyo

There are a number of studies concerning the “block slope”. Some studies indicate that the block slopes are formed by material transport due to rapid mass-movements such as slope failures and landslides, while the others conclude that the periglacial processes are highly involved to their formation. However, in fact, the conclusive or clear-cut idea has not been presented. The block slopes generally develop in the relatively inaccessible sites, with steep slopes around and larger than 30 degrees. Besides, large blocks occasionally over meters in diameter are unsteadily scattered and numerous gaps among them are sometimes unfilled by topsoil. In such circumstances, the topographic survey with commonly used tools, such as theodolite or totalstation, requires the greatest time and energy. It must be now requested the more sophisticated measurement techniques to realize the higher degree of understanding of the formation processes of the block slopes.
In this study, we carried out an on-site measurement investigation how located the larger blocks on the block slopes, around the top of Mount Tateshina, central Japan. At the same time, in order to recognize the panoramic surficial characteristics of the studied block slope, aerial photographs of the south part of the summit area were obtained by a UAV (Phantom3, DJI), producing DSM (Digital Surface Model) with an orthophoto by SfM software. These were used for validation with field data to testify the usability of this new remote technique. In the field, we established two line transects along the west and south slopes of Mount Tateshina from near the mountaintop to the lower altitudinal parts. On-site measurements along these transects were accomplished for major axis length, its azimuth orientation, and the relative degrees of weathering of selected block surface. The tentative results are as follows, though more detailed investigations will be planed in the near future.
1) Larger blocks are generally distributed in the lower altitude in both slopes, which is also recognized by the areal photos (orthophoto) by UAV. The major axis direction of the larger blocks is roughly parallel to the maximum slope direction. Based on the produced DSM, it becomes much clear the direct relationship between topographic condition (slope, direction and so on) of the block slope and the alignments of surficial blocks on the slope.
2) A possible process of block slope formation is a bit complicated. Firstly, a large number of blocks were produced and concentrated in the lower part of slopes, probably due to the rapid mass-movements after the emergence of summit dome of Mount Tateshina (ca. 40 ka). After that, the major axis direction of such larger blocks was arranged parallel to the slope orientation by a strong periglacial process perhaps during the LGM. Distal end of the block slopes has the tongue-shape with a small cliff, indicating that the periglacial process had likely to played an initiative role as a formation factor of the studied block slopes.

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