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Deformation Analysis of the Pliocene-Pleistocene Sedimentary Rocks Mountain using Lidar Data

ASAHINA, Toshihiro[1*]

[1]PASCO CORPORATION

1.Introduction

Be a topic for the deformation of the Shimanto Supergroup in the Oigawa River basin and in the Kii Peninsula in many cases. How deformation of sedimentary rocks of the Pliocene to Pleistocene age strata earlier age and lower strength than the Shimanto Supergroup is in progress, I report on the basis of the analysis result of airborne Lidar data. The study area is the mountain in Tsunan of Niigata Prefecture around located on the border between Nagano and Niigata Prefecture. Geologically, the study area is located in the south side of the Matsunoyama dome and the Uonuma formation of Pliocene to Pleistocene age is widely distributed.

2.Mountain block geology and geomorphology

The northwestern part of Tsunan is a steep mountain of 1100m altitude from 200m, where the Uonuma formation, being of sand, silt, alternating beds of silt and sand, massive silt and volcanic rocks, is distributed. The investigation mountain has a monoclinic structure facing the Shinanogawa River on geological structure, which the Uonuma formation dips 40 degrees from 15 degrees SE generally and shows a monotonic spread to the whole.

In this area, a number of landslides have occurred, but at the time of the earthquake in northern Nagano Prefecture (March 12 2011, M6.7, depth: 8km, epicenter: Sakae village in Nagano Prefecture), the large plane slip presumed to be caused by this earthquake has occurred.

3.Lidar data

An airborne Lidar survey was conducted on May 14, 2013 for the morphological analysis of the northwest mountain of Tunan. Lidar measurement was carried out in the range of about 30km2 by ALS60 system. The Lidar point data were interpolated using a natural neighbor method on a grid with 1.0m spacing.

In order to understand the characteristics of the mountain deformation, I analyzed the mountain terrain in the following procedure.

1)Analysis 1

a.Classification of slope gradient (a grid with 5.0m spacing),b.Extraction of the cells of 40 degrees from 15 degrees slope gradient,c.Analysis of surface structure,d.Extraction of bedding surface slopes that is likely to cause a slip

2)Analysis 2

a.Image analysis,b.Extraction of linear deformation terrain , such as a lineation or an edge,c.Extraction of deformation terrain surface, such as a depression zone,d.Integrated analysis of analysis 1 and 2

4.Discussion

The GIS analysis of the cells obtained by the process of Lidar data and GIS processing has revealed that the slopes which are considered to bedding plane are found very widely in the mountain. Furthermore, based on the morphological features obtained, the two mountain blocks with a trace of a slip plane as the bedding planes were extracted. These mountain slopes have a characteristic of both showing a bedding plane sliding surface morphology on the terrain surface and the irregular linear trough. The largest linear trough is running diagonally across the hillside slope, and its extension reaches 600m from 550m. The thickness of the terrain block forming a linear trough is about 10m from 6m maximum. These morphological features suggest that the bedding surface played a major role in events that may have caused the extensive deformation and collapse of the edifice. The above is a morphological characteristic that is not found in such the Shimanto Supergroup.

These are important key points in extracting mountain deformation due to the bedding slip.

5.Conclusions

By the analysis of Lidar data, it has been confirmed the distribution of distinctive slopes to suggest that the edifice extensive deformation has occurred in the past in this area.

6.References

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Keywords: Lidar, surface morphology, bedding plane slip, line trough, edifice deformation