

Study on water quality formation process in gravitational mass rock creep in Akadani area, Nara prefecture, Japan

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Due to Typhoon Talas in September 2011, many deep-seated landslides were occurred in Kii mountainous area. In order to mitigate the damage caused by the landslides, it is necessary to grasp the hazardous areas of the landslides beforehand and take measures from both sabo facilities and hazard map etc. So far, as a method of extracting the dangerous slopes for the landslides, the method using topography data such as laser profiler, the method using the airborne electromagnetic survey, the method using the presence of spring water at the end of the slope, and the method using electric conductivity of spring water, etc. have been done. Among them, the method using electric conductivity of spring water is one that the dangerous slopes are extracted by using the characteristic that the electric conductivity of spring water is empirically high in dangerous slopes. On the other hand, there is also a problem that there is little technical ground for why the electric conductivity becomes high. In this study, a boring survey was conducted on the rock creep slope of the Akadani district of the Kumano river basin, and the dissolution tests using the boring cores were conducted. We analyzed the relationship between the degree of development of the crack in the core and the concentration of electric conductivity and ions after the dissolution tests and analyzed the cause of the increase in the electrical conductivity of the spring water in the dangerous slope.

The study sites were the slopes where there are the gravitational mass rock creeps around the Akadani district in the Kumano river basin. In order to specify the depth of the collapse surface in advance, the airborne electromagnetic survey was carried out to estimate the resistivity distribution in the depth direction. On these slopes, a boring survey was conducted, and the slip surface was identified using an borehole inclinometer. For the boring core, classifying of crashed rock was performed based on the classification of Wakisaka et al. (2012), and the opening amount was measured. Thereafter, the dissolution tests using the boring cores were carried out. The elution period was 28 days, and the concentrations of electric conductivity and ions were measured after 28 days. From the measurement results, the relation between the depth and the opening amount, the relationship between the depth and the ion concentration / electric conductivity, the relationship between the opening amount and the ion concentration / electric conductivity were investigated.

As a result of the dissolution tests, it was found that there is a high correlation between the ion concentration and the electric conductivity. Among the ions, it was found that Ca^{2+} and HCO_3^- have different concentrations after the test depending on the cores, and become ions serving as indicators. Regarding the opening amount, the ion concentration and the electric conductivity, it was found that the peak was around 3 mm, and it was found that the ion concentration / electric conductivity decreased as the opening amount and ion concentration / electric conductivity became larger or smaller. From these facts, it is suggested that as the crack develops, the elution of ions progresses, but if the crack develops too much, the elution decreases.

Keywords: Deep-seated landslide, Gravitational mass rock creep, Electric conductivity, Ion concentration,
Airborne electromagnetic survey