Geology and geomorphology of the 2017 Xinmo landslide and its preceding gravitational slope deformation at Maoxian, Sichuan, China

*Siyuan Zhao[1], Masahiro Chigira[2], Xiyong Wu[3]

1. Graduate School of Science, Kyoto University, Japan, 2. Disaster Prevention Research Institute, Kyoto University, Japan, 3. Faculty of Geosciences and Environmental Engineering, Southwest Jiaotong University, China

A large catastrophic rock avalanche with a volume of ~18 ´10^6 m^3 occurred at 5:38 am, 24 June 2017, at Xinmo village, Maoxian, Sichuan, China, resulting in 102 casualties (10 deaths, 3 injuries, and 89 missing). We conducted a geological and geomorphological investigation of the Xinmo landslide before and after the landslide event to clarify its formative mechanism. The landslide with an initial volume of 4.3 ´10^6 m^3, was induced by rainfall on a previous landslide scar near the ridge top. This initial landslide then struck and remobilized older landslide deposits in the middle and lower parts of the slope, which subsequently buried the village at the landslide toe. The landslide occurred on a dip slope of Triassic calcareous psammitic and pelitic schists. The bedding plane, which dips downslope at 48˚, and high-angle joints trending along the maximum slope line bounded the landslide at its base and sides, respectively. Satellite image analysis and field observations of the landslide scar before and after the landslide strongly suggest that the beds in the source area had already begun gravitationally deforming (e.g., buckling) prior to the landslide. Moreover, pits on the sliding surface, which observed, were likely the result of the dissolution of calcareous material. This dissolution probably reduced the rock strength along the bedding plane. A rainfall event occurred from 16 to 24 June probably dominated the groundwater drainage and finally triggered the catastrophic rock avalanche. In addition to the 2017 landslide, the hillslope just to the east of the Xinmo landslide exhibits pronounced gravitational slope deformation, including “A-tent”-like cracks and warps induced by buckling. This suggests that this slope could also fail like the Xinmo rock avalanche in a future rainfall or earthquake event.

Keywords: Xinmo landslide, Geological structure, Geomorphology, Buckling, Gravitational slope deformation

