Geomorphological evolution of staircase shaped slopes and landslide occurrence in the Aburra Valley, Colombia

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Geomorphological evolution of gentle slopes and frequently occurrence of landslides around the Aburra Valley, Central Colombian Andes, have been studied. Staircases shaped gentle slopes are widely distributed in both side of the Aburra Valley, where the second largest city Medellin is located. Narrow fluvial plain extends along the Medellin River flowing on the bottom of the valley in elevation 1,500m. Distribution of gentle slopes ranges from 1,500 to 2,700 m in elevation.

Numerous landslides have occurred on these gentle slopes as well as steep slopes. Many houses and farms are located in there. People live on the slopes are, therefore, severely affected with great economic losses and casualties when landslides occurred.

Gentle slopes are composed of various sediments since the Pliocene, whereas steep slopes are basement rocks of schistose rocks and ultra basic rocks. Although longitudinal gradient of the Iguana Stream, one of major tributaries of the Medellin River, is steep and ranges 5 to 6 degrees, some remarkable knick points are distinguished along the river profile. Based on relative height above the current riverbeds, several terrace surfaces are distinguished. Relative height of terrace surfaces ranges from 20 to 180m, and it tends to decrease toward upstream. Existence of knick points and upstream decreasing of relative height of terraces means that these have been formed with lowering of base level of erosion for the Iguana Stream.

Small topographic features indicating results of landslide movements are well recognized in the slope area. One type of landslide is edge failure of terrace deposits. A small gentle slope dipping toward mountainside is interpreted as results of rotational slide of edge portion of the terrace deposits. River dissecting of the stream changes this morphogenetic regime from stable slopes to potential instability.

Consequently, we conclude that the upstream propagation of erosion due to lowering of riverbeds of the Medellin River is the major cause to develop staircase shaped gentle slopes and the occurrence of landslides in the relation to river dissecting. This may depend on tectonic movements during the Quaternary Period.