Geophysical Research Abstracts, Vol. 9, 03341, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03341

Multidisciplinary study of geodynamical hazards at Machu Picchu World Herritage site, Peru.

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The Machu Picchu archaeological site is thought to have been affected by landsliding activity in the past, and may be at risk from mass movements in the future. Nevertheless, along with slope movements, fluvial erosion and tectonic disturbance of the rocks dominate the landscape evolution, there. In order to assess geodynamical hazards was necessary to establish a clear chronology of past landsliding activity, using a multidisciplinary approach.

Several geomorphological and engineering geological, hydrogeological and mineralogical and structural-geological methods were applied. They ranged from field based - historic-genetical study, and direct ground movements monitoring, to laboratory microscopy, which included petrological and microfractographical observations of rock samples.

The basic event in the paleogeomorphological evolution of the area was the large-scale slope movement, which destroyed the originally higher ridge between Machupicchu Mt. and Huaynapicchu Mt. Within remnants of that primary deformation, several younger generations of slope movements occurred. The laboratory analyses of granitoids revealed high-strained zones on the slopes of Machupicchu Mt., which strongly conditions the largest slope deformation. The majority of various types of younger slope movements on the so-called Front slope (E facing slopes) and Back slope (slopes oriented to the W) are influenced by alignment between post-large-scale-landslide topography and joints. A monitoring network (dilatometric and extenzometric measurements) shown spatially differentiated present-day activity of rock displacements

within the archeological site. In discussion of causes of those movements and their spatial-temporal distribution, results as of a preliminary ranking of weathering intensity and thus surface exposure age, as hydrogeological description of main features of underground water flow were used.