



## GEOMORPHOLOGICAL INVESTIGATION AND MANAGEMENT OF THE GUVANO COMPLEX LANDSLIDE (CINQUE TERRE NATIONAL PARK, ITALY)

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The Cinque Terre National Park represents a valuable example of integration between man's activity and the maintenance of a beautiful and difficult landscape at the same time; last neotectonic phases have influenced the steep slopes of this coastal area located in Eastern Liguria triggered also to several huge-landslides, especially along the cliffs between Vernazza and Riomaggiore.

The Guvano landslide has been studied since the XIX century by local pioneers of geology such as Girolamo Guidoni and subsequently by Remo Terranova during the 70's.

Guvano landslide is located between the towns of Vernazza and Corniglia and shows an extension of approximately 0,15 km<sup>2</sup>, a maximum length of 650 m measured across the upper portion and a width ranging between 120 m and 400 m at slope toe.

During the 90's between the hamlet of San Bernardino and the beach located under the slope toe a geotechnical investigation (soil borings and installation of inclinometers and piezometers) was performed in order to examine the soil and rock stratigraphy of the area and to obtain information about the groundwater level and the displacement of the landslide mass, which has alternated active phases with dormant periods.

An original engineering geomorphological map has been realized: actually a retrogressive failure, consequence of several crown collapses, is well visible and could represent a risk for the village of San Bernardino, located just above the main scarp. Collapses related to the right flank usually start as rockfall and then evolve in rock avalanches.

The last event which involved the entire landslide body is dated 1853, when tens of thousands of cubic meters were mobilized through the mass sliding.

A tectonic discontinuity between Arenarie di Ponte Bratica and Argille di Canetolo (Canetolo Geological Unit), is recognized as landslide causal factor. Bedding planes dip into the slope, while an orthogonal discontinuity set parallel to slope acts as main sliding surface.

Since the realization of the Genoa - Roma railway line during the 80's of the 18th century along the toe of Guvano landslide area has been involved in several risk mitigation measures: first, a wide concrete channel network was realized in the upper part of the slope with the purpose of draining rain water; then, a sea wall made of concrete blocks was built along the toe slope to protect the railway line against sea wave erosion.

Actually, the railway tracks are abandoned because of their displacement on a tunnel half a mile north from their old position and the gravel and pebble beach generated from the erosion of the landslide mass and subsequent transportation and deposition of sediments has become a popular spot among tourists, trying to reach the area passing through the old railway tunnel and following a steep path along the landslide profile.

