Bull Eng Geol Environ
DOI 10.1007/s10064-013-0502-7

ORIGINAL PAPER

Landslides in the marly slope of the Kapsali area in Kithira Island, Greece

B. Christaras · M. Argyriadis · E. Moraiti

Received: 9 August 2012 / Accepted: 18 July 2013

Abstract In April 2004, the uphill area of the touristic Kapsali Golf, in the southern part of Kithira Island was affected by large-scale landslides. These landslides, which also affected the road between Kapsali–Kalamos, occurred in ground consisting of marl, overlain by limestone. This investigation indicated that the back analysis method of study gave more realistic results than the original laboratory tests because it more effectively factors the conditions at the time of ground failure—in particular, those parameters relating to the mechanical characteristics c and Φ of the substrate material. The natural slope of the marl-rich substrate presents a limited stability; this stability decreases during heavy rainfall. The cause of the slides investigated is the interaction between the silty clayey (CL-ML) substrate and heavy rainfall. The low porosity of the substrate impedes the slope drainage which in turn leads to saturated, unstable ground. The potential for new slides to occur in the area is real if no protective measures are taken.

Keywords Landslides · Marly · Marls · Silty–materials

B. Christaras (✉)
School of Geology, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece
e-mail: christar@geo.auth.gr

M. Argyriadis
Argyriadis and Collaborators, Geotechnical Studies, 9, Evrou Str., 18345 Piraeus, Greece
e-mail: argyri@otenet.gr

E. Moraiti
Institute of Geology and Mineral Exploration (IGME), Olympic Village, 13677 Acharnai, Greece
e-mail: moraiti@igme.gr

Introduction

The basis of this investigation is the use of a back analysis technique to enable a realistic slope stability analysis. Using this framework, derived data of possible c and Φ values, were used for investigating other neighbouring sites underlain by marly, fine-grained sediments (Christaras et al. 2011) (Fig. 1).

The study area, located at the southern part of Kithira Island, includes the uphill area of the Kapsali Golf and part of the road which connects Kapsali village with Kalamos village, the capital of the island. The landslides described, occurred in marls overlain by limestones (Danamos 1992).

The ground immediately above Kapsali village, consists of partially weathered, marls with occasional thin sandstone intercalations (Fig. 2). The marl comprises low plasticity, silty clay (with occasional low percentages of sand). These stratified sediments have a direction of dip and dip angle of 280/35. The uppermost part of the hillside (called the "Plateau") comprises calcareous conglomerates (Fig. 3); these sediments overlie the marls. Structurally, the area is divided into large blocks constrained by E–W and NW–SE trending vertical joints.Two NW trending faults limit the northern part of the area. This local structure forms part of the general tectonic framework of Kithira Island (Danamos 1992). In addition, the island is subject to high seismotectonic activity as it forms part of the western Greek arc; during the period 1750 to 1937, earthquakes of magnitude $M = 6.0$–7.2 were recorded (Papazachos and Papazachou 2002).

Slope stability analysis

As noted, the slope in question consists of marls overlain by calcareous conglomerates. The landslides occurred

Published online: 25 January 2014