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Relationships between joint apparent separation, Schmidt hammer rebound value, and distance to faults, in rocky outcrops, Calabria, Southern Italy

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Abstract

In order to investigate how the apparent separation of jointing varies according to the distance from faults, and how the mechanical properties of rock masses depend on this distance and jointing density, a number of regression analysis were performed on the variables s (apparent joint separation), d (distance from major fault), and sh (rebound value of Schmidt hammer).

The variables were measured at 380 stations distributed over a wide study area located in the Aspromonte range in Calabria, Southern Italy.

The most significant results of simple regression analysis are expressed by the formulas:

$$s = c + Fd^{05}$$

$$sh = Fd^{k}$$

$$sh = 1/c - Fs$$

where F and c are coefficients that depend on local conditions.

The expressions obtained are characterized by acceptable to good values for correlation coefficient r ($|0.74| \leq r \leq |0.87|$) and standard deviation of residuals ε ($0.01 \leq \varepsilon \leq 0.22$).

The s vs. d regression law confirms previous results of regression analysis on data from granite outcrops in an area to the north of this case study, and this can therefore be regarded as a first step towards finding a generally applicable regression law.

Keywords: Joint separation; Fault; Schmidt hammer; Regression analysis; Calabria

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1. Introduction

This paper studies the relationship between the jointing of rock masses and master faults.

Such relationships have relevant implications in engineering geology (e.g., in the analysis of landslide susceptibility and hazard, in urban and lifelines planning, etc.).

Observations and theoretical studies have led us to assume that the intensity of jointing that accompanies faulting tends to diminish with distance from the faults, but this assumption has never been tested. In works devoted to the assessment of susceptibility to mass movement (Guzzetti et al., 1996; Sorriso-Valvo et al., 1996; Greco, 1999; Luzi and Pergalani, 1999; Murat and Candan, 2004; and many others), proximity to a fault has been considered as a factor favouring mass movement. In a seismologic study of site effects close to faults, Marra et al. (2000) estimated that the width of the fractured band along

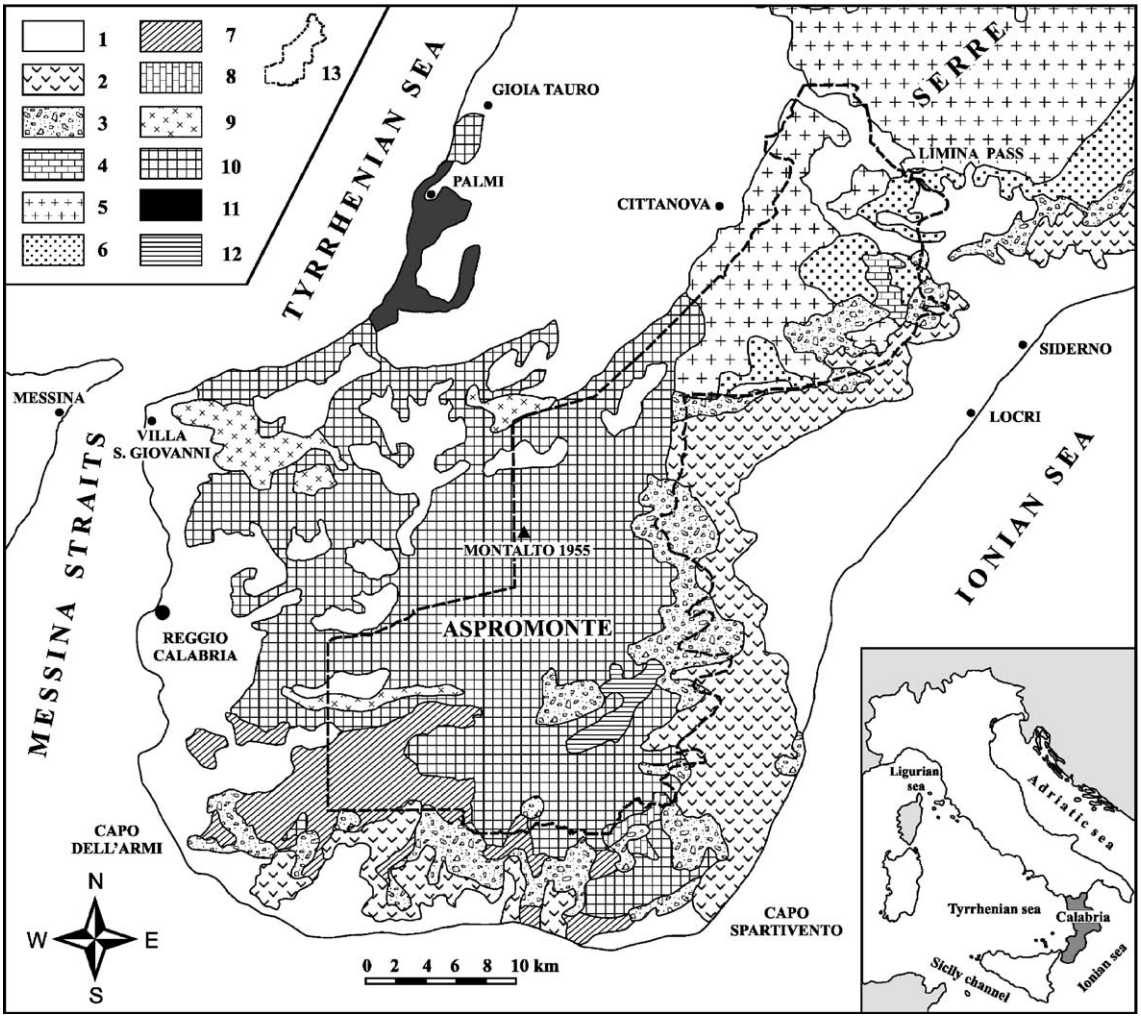

Fig. 1. Geological sketch of Aspromonte massif (from Bonardi et al., 1979, modified). 1=Lower Miocene–Holocene detrital deposits; 2="Argille Varicolori" formation; 3="Stilo Capo d'Orlando" formation; 4="Stilo Unit," sedimentary cover; 5="Stilo Unit," plutonic complex; 6="Stilo Unit," metamorphic complex (phyllitic–gneissic); 7=Stilo Unit," metamorphic complex (phyllitic); 8="Aspromonte Unit," sedimentary cover; 9="Aspromonte Unit," plutonic complex; 10="Aspromonte Unit," metamorphic complex; 11=Palmi–Bagnara migmatites; 12="Africo" and "Cardeto" Units; 13=study area. Inset: Italy, with Calabria region (grey).