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THE GEOMORPHIC EXPRESSION OF NEOTECTONIC ACTIVITY IN THE NORTHERN PORTION OF SILA (CALABRIA, SOUTHERN ITALY)

CONTENTS

ABSTRACT

In active tectonic regions, the topography is a primary reflection of the interaction of tectonics and surface processes. We characterize tectonic processes through geomorphic investigations in the northern portion of Sila Massif (Calabria, Italy), that has been affected by both crustal extension since the early Pliocene and regional, rapid surface and rock uplift in the Pleistocene. Our study focuses on river long profiles and related relief metrics. The results are consistent with a landscape adjusting to both the influence of local fault offset as well as regional base level fall. In particular, along the northern flank of Sila, our analysis identifies an anomalously high-relief region (the OD-ridge) bound by extensional faults. This ridge has induced changes in the drainages, locally retarding headward extension of channels into this part of the plateau, which helps preserve the Sila upland as a relict landscape reflecting the prevailing tectonic and climatic setting prior to Quaternary uplift.

KEY WORDS: Topography, uplift, extensional tectonics, Calabria

1. INTRODUCTION

First-order topographic features in a tectonically active landscape represent ways to quantitatively characterize the interaction of tectonics that deforms and moves rock masses, and surface processes that rearrange materials on the resulting relief, providing a basis to model landscape evolution. We characterize tectonic processes through geomorphic investigations in the Sila Massif (Calabria, Italy). Here the Apennines arc is a narrow chain, composed of relatively uniform rock-type (crystalline plutonic and metamorphic rocks) (OGNIBEN, 1973; AMODIO-MORELLI *et alii*, 1976), that has been affected by extensional tectonics since the early Pliocene, and that was rapidly raised above sea level in the Pleistocene (MOUSSAT *et alii*, 1986; PALMENTOLA *et alii*, 1990; TORTORICI *et alii*, 1995; MORETTI & GUERRA, 1997; MOLIN *et alii*, 2002). Our study examines the tectonic geomorphology of the northern portion of the Sila Massif focusing on the general topographic metrics, drainage patterns, and river longitudinal profiles.

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2. TOPOGRAPHIC METRICS

We have extracted and studied the valley long profiles of seven streams from paper topographic and DEM-based datasets. The analyzed long profiles show a general concave-up shape, but they also exhibit knickpoints that typically correspond to mapped tectonic lineaments and several knickzones. Spatial variation of changes of channel slope with respect to stream length are measured using the SL index (HACK, 1973). The broader topography and relief between the drainages was quantified by generating a high-resolution DEM from 1:100,000 scale maps. From this DEM, we constructed an envelope (general form of the peak elevations) and subenvelope (general configuration of valley bottoms) maps. The smoothed topography in these visualizations shows a bowl-shape plateau surrounded by a more elevated edge, that is locally absent where major streams extend into the Sila interior. Subtracting the subenvelope from the envelope, we generated the map of the residual relief that illustrates where the landscape is most deeply incised. In this map the bowl-shape plateau is still visible and its NE edge is well defined by a NNW-SSE trending ridge (the OD-ridge). This ridge is further recognizable in the longitudinal profiles, corresponding to the knickzones (Fig. 1) and to high values of the SL indices . Drainage basin asymmetry measures the general tilt of the landscape to local and regional tectonic deformation. The results suggest a general tilt to the north and east but on the northern flank the general NE tilt is clearly disrupted by the OD-ridge. Lastly, we generated two swath profiles showing the maximum, minimum, average, and residual topography. In both the profiles, the configuration of the maximum residual relief reveals the broad plateau-like upland of La Sila and an accordance of its height with the more rugged crest of the Catena Costiera.

3. DISCUSSION AND CONCLUSIONS

The topographic metrics are consistent with active, ongoing local uplifts and with a high-standing plateau dissected by extensional tectonics. So the results speak to a landscape dominated by intra-chain extensional tectonics, superimposed on a regional uplift. In particular, in the northern flank of Sila, the relief, the drainage pattern and the stream long profiles strongly point out a more uplifted sector, the OD-ridge. To the N-NE it is delimited by WNW-ESE extensional faults that contribute here to the formation of the edge of the Sila top plateau. Its western flank is bounded by NNW-SSE extensional faults, that downthrown the plateau. The formation of the OD-ridge induced changes in the channel slopes of the streams that cross it, pre-

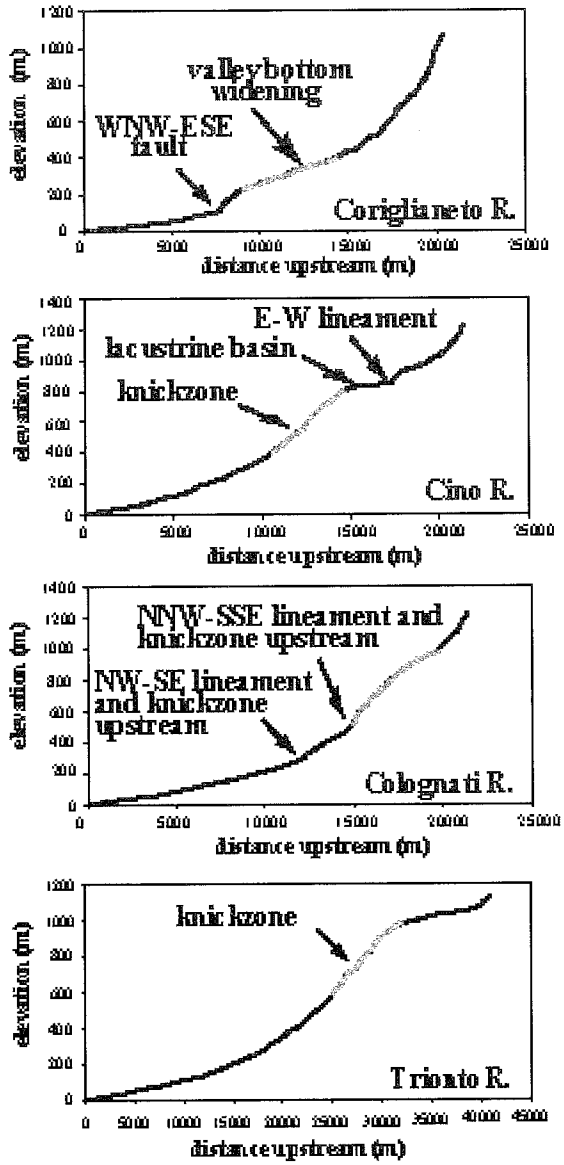

Fig. 1 - Although the OD-ridge has been deeply incised by streams, it is still possible to recognize it in the longitudinal profiles. Indeed it corresponds to the knickzones evidenced in grey.

vented partially their headward erosion and made the streams to shift away radially from its highest peak. In this way it influenced the integration of drainages into the plateau, preventing the dissection of its upland surface that represents an old landscape developed before the Quaternary regional broad uplift.

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