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Relative Quantification of Costal Cordillera (Ecuador) Uplift : Preliminary Results from Quantitative Geomorphology

Pedro Reyes (1,2), Olivier Dauteuil (3), and François Michaud (2)

(1) Departamento de Geologia, Escuela Politecnica Nacional, and Institut de recherche pour le développement (IRD) Quito (Ecuador) pedro.reyes@epn.edu.ec, (2) Geoazur, UPMC, La Darse, BP 48, 06230 Villefranche sur mer (France) micho@geoazur.obs-vlfr.fr), (3) UMR-CNRS 6118 Géosciences Rennes, 35042 Rennes cedex (France). olivier.dauteuil@univ-rennes1.fr

The coastal cordillera of Ecuador (culminating point around 800 m) includes on its littoral margins uplifted marine terraces (maximum known 360 m). The coastal cordillera constitutes an important barrier of drainage and on nearly 600 km the drainage resulting from the Andes is diverted towards Río Guayas in the South and Río Esmeraldas in North. What is the uplifting mode of the coastal cordillera? For how long it has constituted a barrier of drainage? Does the coastal cordillera rising be linked with the littoral margin rising? Does the cordillera have raised in a homogeneous or segmented way? What is the geodynamic process of the uplift of the cordillera? Can this uplift be related with the subduction of the Carnegie ridge?

The first objective of this work is to analyze the morphology of the coastal cordillera with helps of quantitative geomorphology using digital techniques such as DEM (realized with a resolution of 30 m by Marc Souris, IRD), to specify the evolution of the coastal cordillera uplift. This study was carried out starting combining analysis of morphology, maps derived from the slopes and anomalies of the drainage of the hydrographic network. In the second time, three methods were applied to DEM data using the ArcGIS software: 1) the digitalization and the interpolation of basal surface of the last marine formation of regional distribution (the Borbón formation on the geological map of Ecuador) to determine paleo-horizontal and to see its deformation; 2) the extraction of 109 profiles of rivers which allow us to calculate for each river the vertical, horizontal, and total deviation compared to the theoretical profile of the river and the associated SL index; 3) the measurement of the relief incision (depth + half width of the valley, on the whole 7500 measurements) according to the method of Bonnet et al. (1998). We adapted this method to be able to represent the state of incision in any point, correcting from the influence of the lithology and the influence of altitude.

The analysis of the profiles of the rivers and incision combined with the morpho-structural analysis show that the coastal cordillera is segmented in blocks that have each one their own period of rising and their own rate of uplift. Six blocks are individualized.

The results on the profiles of river show that the coastal area of the cordillera in as a whole in uplift. The results on the incisions show that the uplift is relatively more important in the northern part of the coastal cordillera.

Two fault systems have guided the evolution of the coastal cordillera, the Jipijapa system and the Jama system that is prolonged in the East of Río Esmeraldas. The two systems seem to control the exhumation of the peninsula of Manta, whereas the system of Jama controls the rising of a North-west block.

The coastal cordillera starts rising in its central part. The beginning of rising probably happens at the end of Pliocene. Rising continues then to the South-west and finally develops in the North and in the peninsula of Manta. The highest rates of relative uplift are seen in blocks of the North of the coastal cordillera that is not located in front of the Carnegie ridge.