



## **Geological risks in urban areas in the south of the metropolitan area of Monterrey, Nuevo León, México**

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In the last years, the metropolitan area of Monterrey, Nuevo León, Mexico (third biggest city of Mexico, located in the Northeast) has experienced a great demographic explosion (4 million inhabitants), opening a very large number of urban areas on mountain slopes that surround the city. It is important to point out that this city has grown in a very disordered form and lacking urban planning, concerning human establishments in the mountainous regions. The Sierra Madre Oriental slopes, in the South of Monterrey, with very rugged terrains (650-1300 MSL) are areas preferred by the wealthy class of this region, due to the great nature contact that they offer.

It is important to point out that this area presents diverse problems in the field of geologic engineering, such as: Mass movements, blocking of superficial currents due to the construction of civil works, material extraction in quarries applying inadequate methods, falling of blocks etc. In spite of the advances in the technical and scientific knowledge of the geologic processes that happen in the study area or in similar urban areas, many regions are still vulnerable to disasters. The urban geology is in continuous evolution and the processes affect as well as the rocky materials as the soil.

Geologically speaking, the study area is located in the NE flank of the anticline of Los Muertos, or in the North margin of the “*Monterrey Salient*” of the Sierra Madre Oriental. The layers of this flank are in a vertical position and the peak (2100 MSL) is formed by massive limestones, continued towards the valley by a sequence of limestone-marl-clay, and in the valley by shale, all of the Cretaceous. This sequence is in large extent overlaid by units of the Quaternary.

In the 90's, geologists began to work with a methodology of Geologic Engineering that has allowed them to resolve the different geologic problems that appear when building housing estates in mountainous areas and also in their valleys. This methodology was applied in the study area and a series of analysis like geomorphologic, geologic and structural analysis were carried out using a scale of 1:10000. Based on this data, a map of homogeneous areas for rock and soil was made. A study of stability was performed with the purpose of determining slip wedges in artificial banks, as well as to evaluate the geotechnical problems to establish different areas of risks.