Regional structural study and recent geomorphic deformation analysis along the frontal thrusts in the Serranía del Interior foothills (northern Maturín Sub-Basin, eastern Venezuela)

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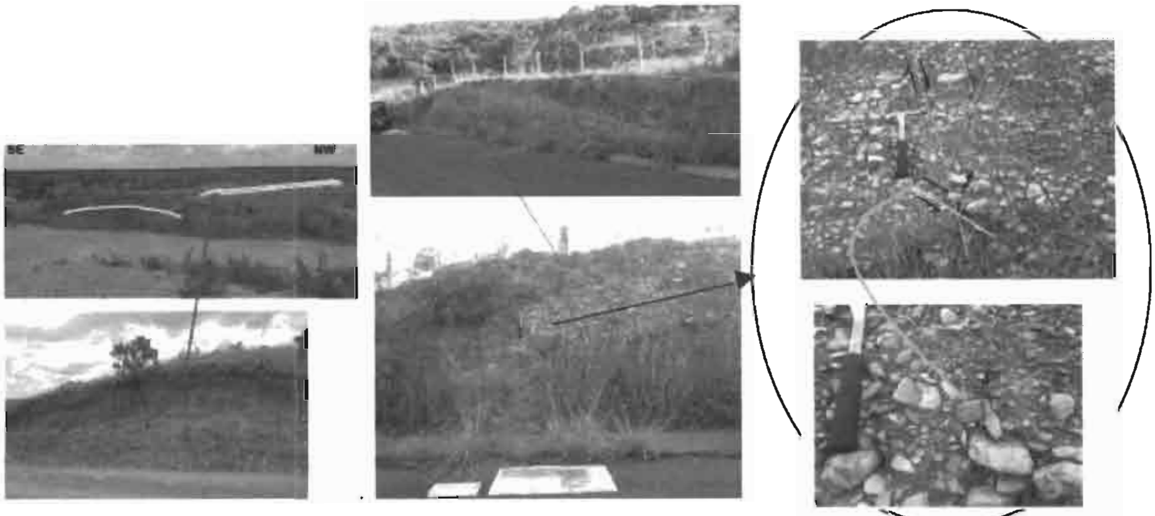
Currently, the knowledge about the recent deformation in the Maturin Sub-Basin has a deep contrast with the amount of geological information that the difference exploration and production campaigns has been handled from subsurface in the last decades. The emergent technologies increase the value, in the research of information when we select and prioritize in the right way the prospective areas with the characterization and modeling of the structures. Remote sensing are one of this technologies that let the geological information and geophysical be integrate with a spatial analysis of the data. The visualization and the cartographic of the structural and geomorphic expressions, became more efficient from other point of view, cost, time and precision, with the use of satellites images that provide value information as well, about the spectral characteristics, forms and the extension of the elements in the surface. The processing, interpretation and integration of 3D remote sensing imagery, digital elevation models, aerial photography and analogue modelling - calibrated with field observations, well data and seismic attribute - has led to the definition of a neotectonic model through geomorphic patterns in tropical conditions for the *Serranía del Interior* Foothills, which is an active south-vergent, Tertiary-foreland-overthrusted, fold and thrust belt in Eastern Venezuela. These geomorphic features are depicted in: Chapapotal, Jusepín-La Toscana and El Furrial thrusts, a discontinuous ENE-WSW-oriented frontal trend. The most frequent and best-exposed geomorphic evidences are: (1) elongated domes in the drainage and flexural scarp with eroded up-thrown compartments that are parallel and close to the thrust front (see figure 1); (2) drainage patterns and anomalies, which reflect very subtle topography modifications (some of them only recognized on 3D satellite imagery modelling with vertical scale exaggeration); (3) change in fluvial terraces incision depth and river gradient along river course. These changes are superposed on an increase of tilt of ground surface with increasing age of the Quaternary alluvial ramp and even older formation. Collectively, these features provided firm evidence for recent deformation, allowed to define the geometry of the active frontal thrusts in *Serranía del Interior* Foothills and some cases to understand the chronology of the tectonics events. In the Jusepin nappe, an out-of-sequence thrust occurred in the late Quaternary in response to SSE trending compression. This thrust propagation fold retrogression could be resulted of the weakness zone created for erosive effect of the Guarapiche River (see figure 2). Well data, seismic attribute, basement structural trend compiled integrated with fracture and fault characterization in micro-macroscopic scale, structural lineation of the Radar image interpreted (figure 3) and the active thrust fault geometric model has led to the definition of a imbricate thrust fault model for the *Serranía del Interior* Foothills (see Figure 4).



Figures 1. Fluvial terraces deformation induced by thrust faulting. Kilometric flexure in the "Mesa de Masacua"(left); Flexural scarp are the most conspicuous evidence of gently dipping thrust systems observed (center). In some case, inside of axial plane there are pebbles exploded (right).

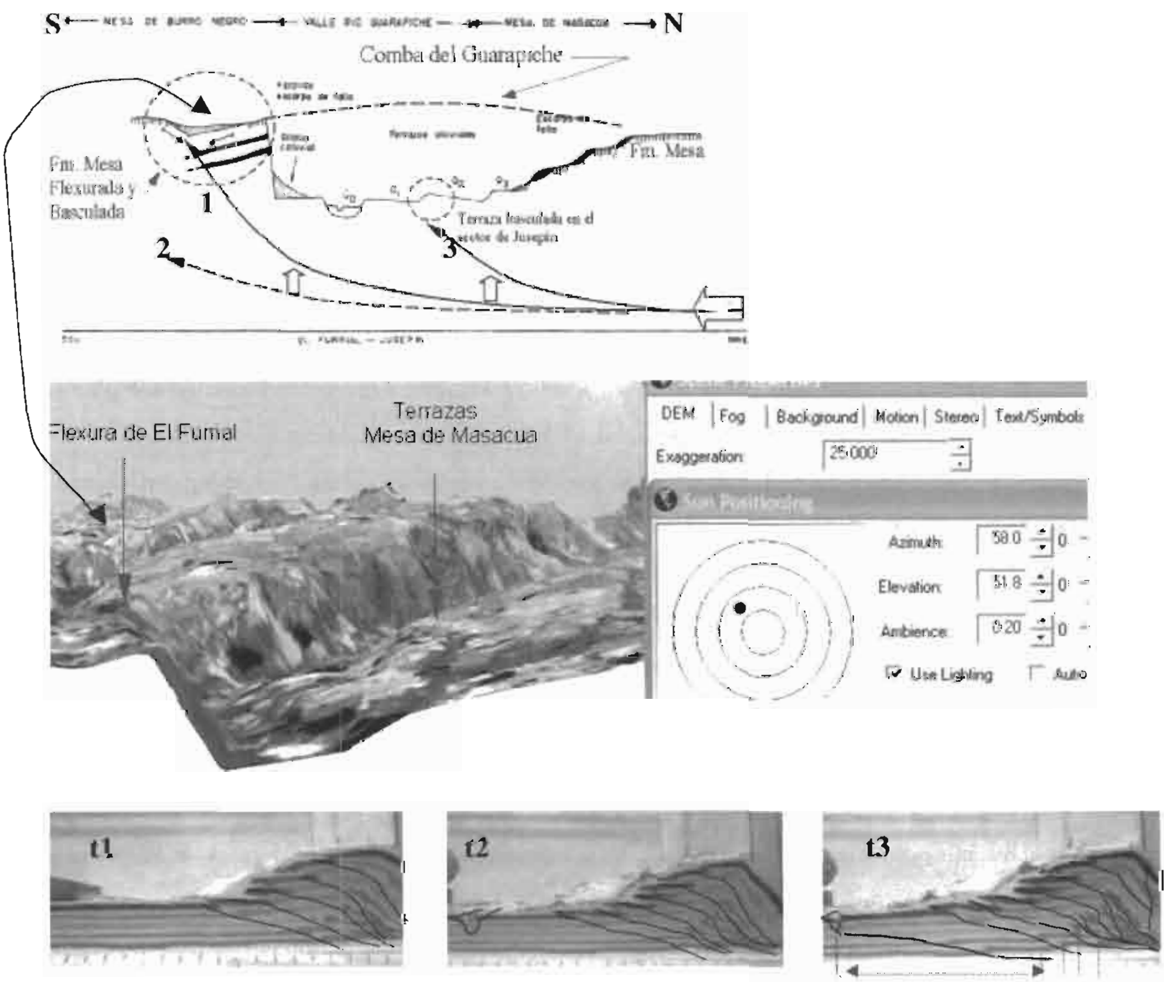


Figure 2. Cross section "N-S" of the Blind Foothills in the Guarapiche River. Thrust propagation fold retrogression (out of sequence - Jusepin nappe) evidenced for the late deformation of Q_2 3 (upper); 3D Image of the Blind Foothills in the Guarapiche River with transversal section showing the structural match (center); Displacement field measurement in cross section during erosive thrust model deformation(t1? t2? t3). Observe that the next propagation plane achieve the furrow or weakness zone created (Guarapiche valley) (lower).

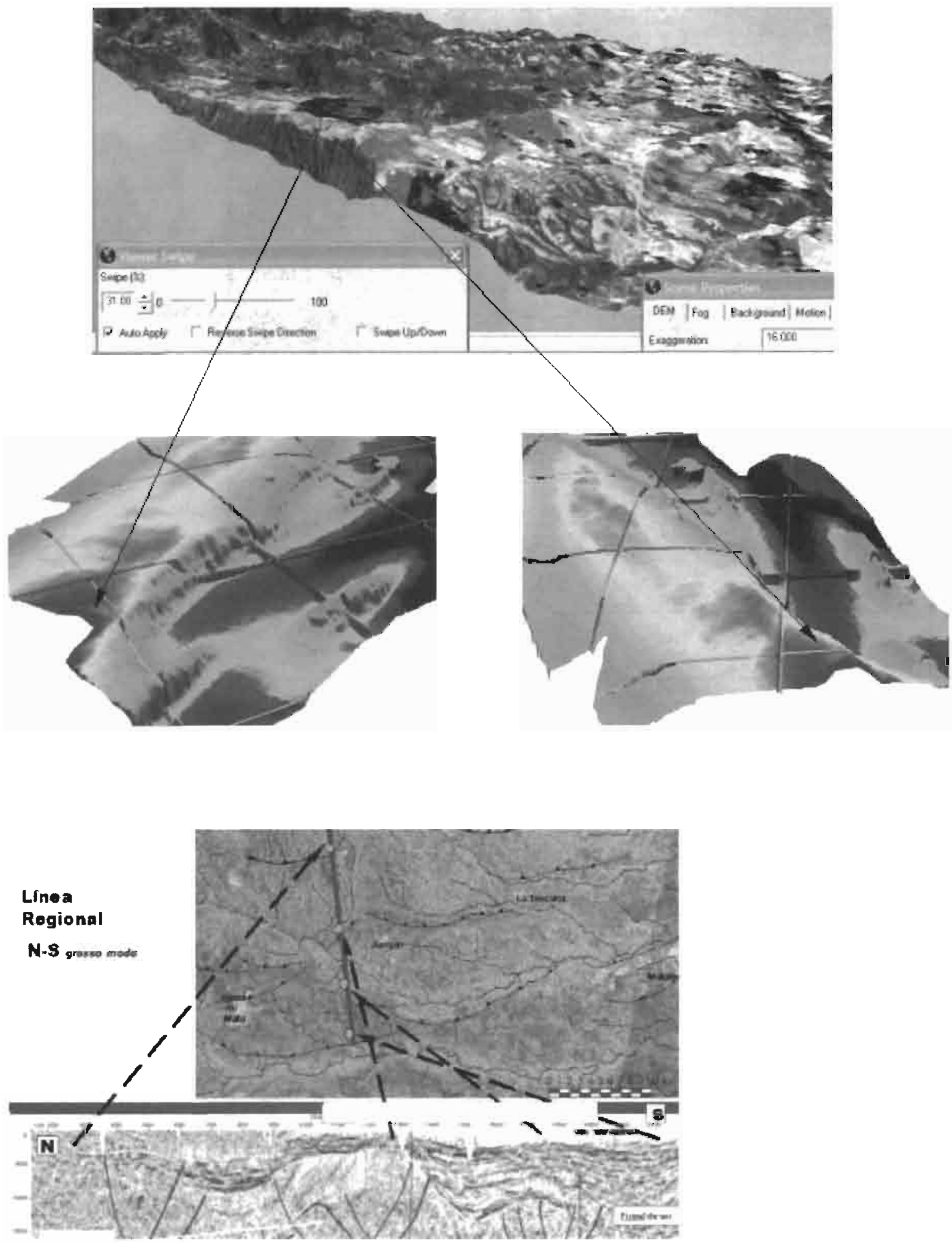


Figure 3. Correlation example between 3D satellite image surface modelling and 3D image subsurface modelling (upper); Radar image interpreted with help of the drainage pattern and propagation of shallow reflectors seismic line (lower)

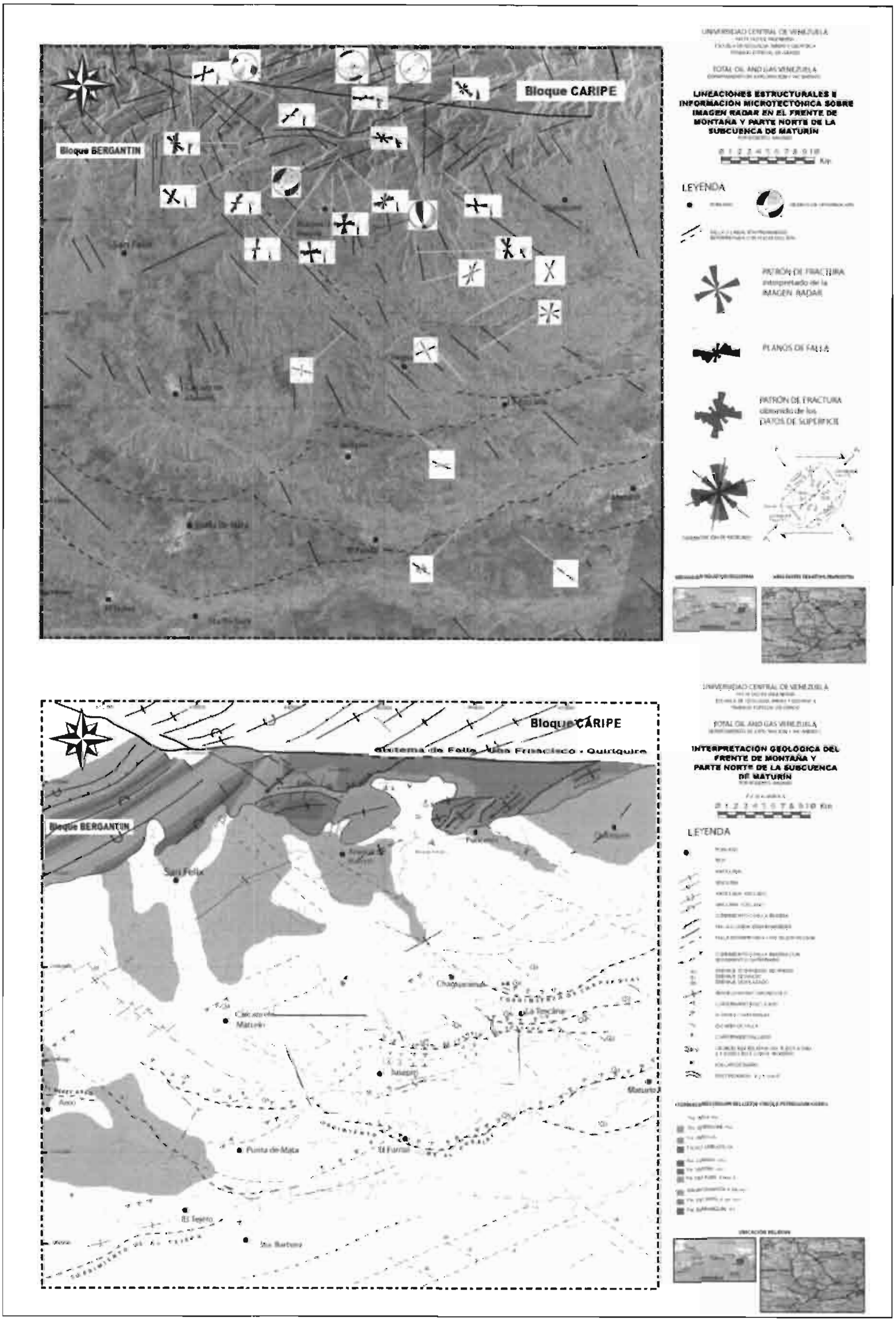


Figure 4. Structural lineation and microtectonic data integrated in radar image (upper).; Geological interpretation of the Serranía del Interior Foothills.