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The western end of the Serrania del Interior, Venezuela: A review

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INTRODUCTION

Emile Rod (1959) published a groundbreaking contribution to geological study of the western Serranía. Many structural characteristics described in his paper are equally valid today. He was among, the first to notice that the frequency of structures is markedly different on either side of the Urica fault (Fig. 1). He also interpreted the change in the trend of fold axes from ENE to E-W to WNW, as they approached the fault from the east, as the effect of drag caused by right-lateral movement of blocks on either side of the fault. Rod calculated the difference in fold frequency on either side of the fault to represent differential shortening of about 40 km, which he then assigned as the relative horizontal component, or the amount of right-lateral slip on the NW end . At the SE end of the fault in the Tacata region, Rod was emphatic in stating and illustrating that, from seismic and gravity surveys and also, a few exploration wells, the Urica fault continued into the Pirital thrust, thus effecting a transfer of strike-slip to thrust motion.

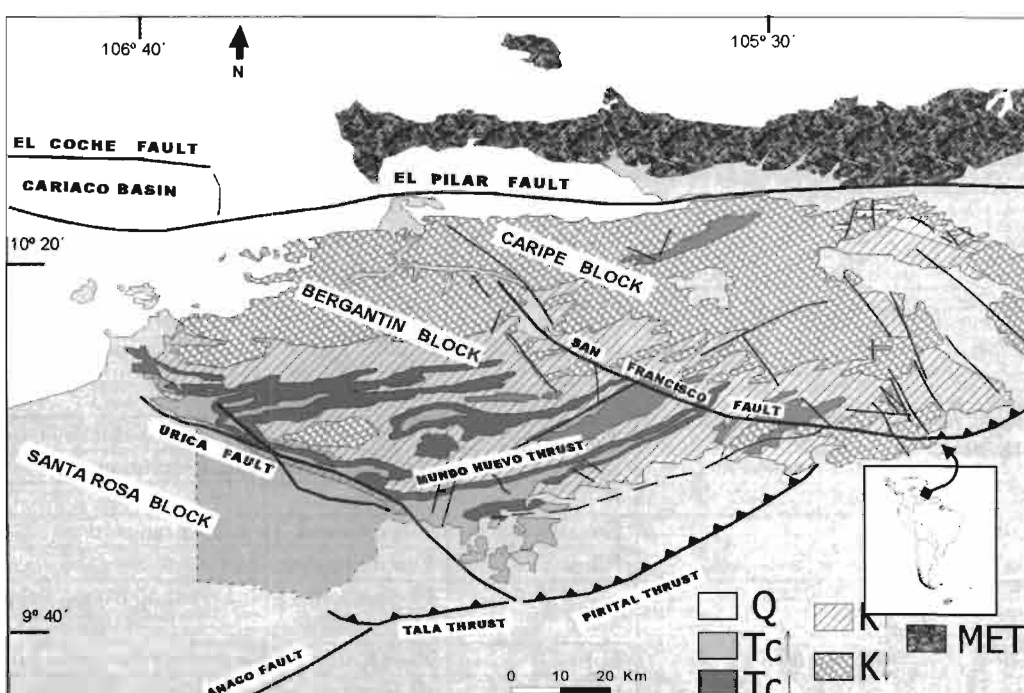

Figure 1. Serranía Fold and Thrust Belt map. Note the convex inflexion of the Urica fault at the intersection with the Mundo Nuevo thrust.

Rod also suggested a right-lateral displacement along the fault of 5-10 km since the Pleistocene, or possibly late Pliocene, from an analysis of drainage systems, the displacement of part of Capaya Z fold and the change in the fold attitude from almost vertical axis near the Aragua fault, decreasing to 30-40 degrees three kilometers W of the fault. A fundamental interpretation of the Urica fault by Rod might infer that it persists at depth to cut the basement. This feature, has lead nother authors to explain the origin of the Urica fault as a reactivation of a Jurassic transform fault or acommodation zone (George and Sams, 1993; Uliana, 1995).

Munro and Smith (1984) considered that the Urica fault could be traced in subcrop more than 100 km ESE beyond the Tacata area and also speculated on the basis of SLAR images, that the fault could extend another 75 km to the south. These authors interpreted the Urica fault as a 10-km-wide transpressive flower structure that offsets the basement. Roure et al (1993), postulated that the Urica fault is a lateral ramp for the El Furrial unit, but a tear fault for the Pirital thrust.

DISCUSSION

The surface trace of the Urica fault (Rod, 1959; Figs. 1 & 2) trends NW-SE some 110 km from near Barcelona to the region of Tacata. A slight northeastward convexity of the fault is present near its intersection with the Mundo Nuevo anticline (Figure 1). Further southwest, the Santa Rosa area is defined as an independent block. The subsurface structural features are shown in Figure 2 based on both on seismic data and also exploration and production wells.

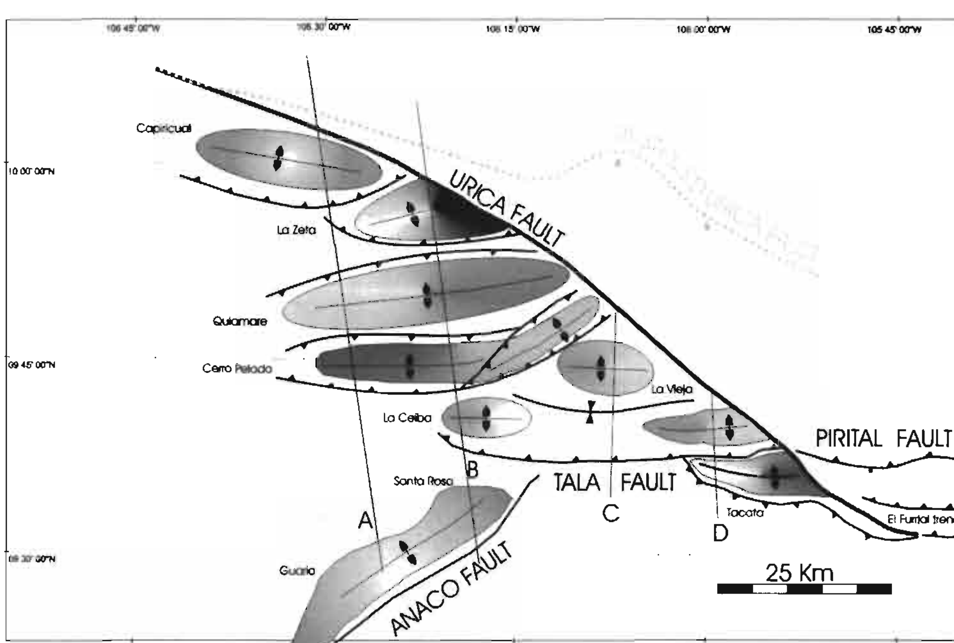

Figure 2. Santa Rosa Block subsurface structural map.

Four cross section where constructed along the Santa Rosa Block (Figure 3) to calculate the shortening between the Urica fault and the deformation front represented by Anaco-Tala-Tacata faults. The shortening increases to the west involving basement in most of the structures with the exception of the Tacata wedge (section D), which is developed in Miocene units. Undoubtedly, the shortening of Tacata is related to Tala thrust activity, forming a hinterland vergence deformation front whereas a foreland vergence deformation front characterizes the Furrial zone, east of the Urica fault.

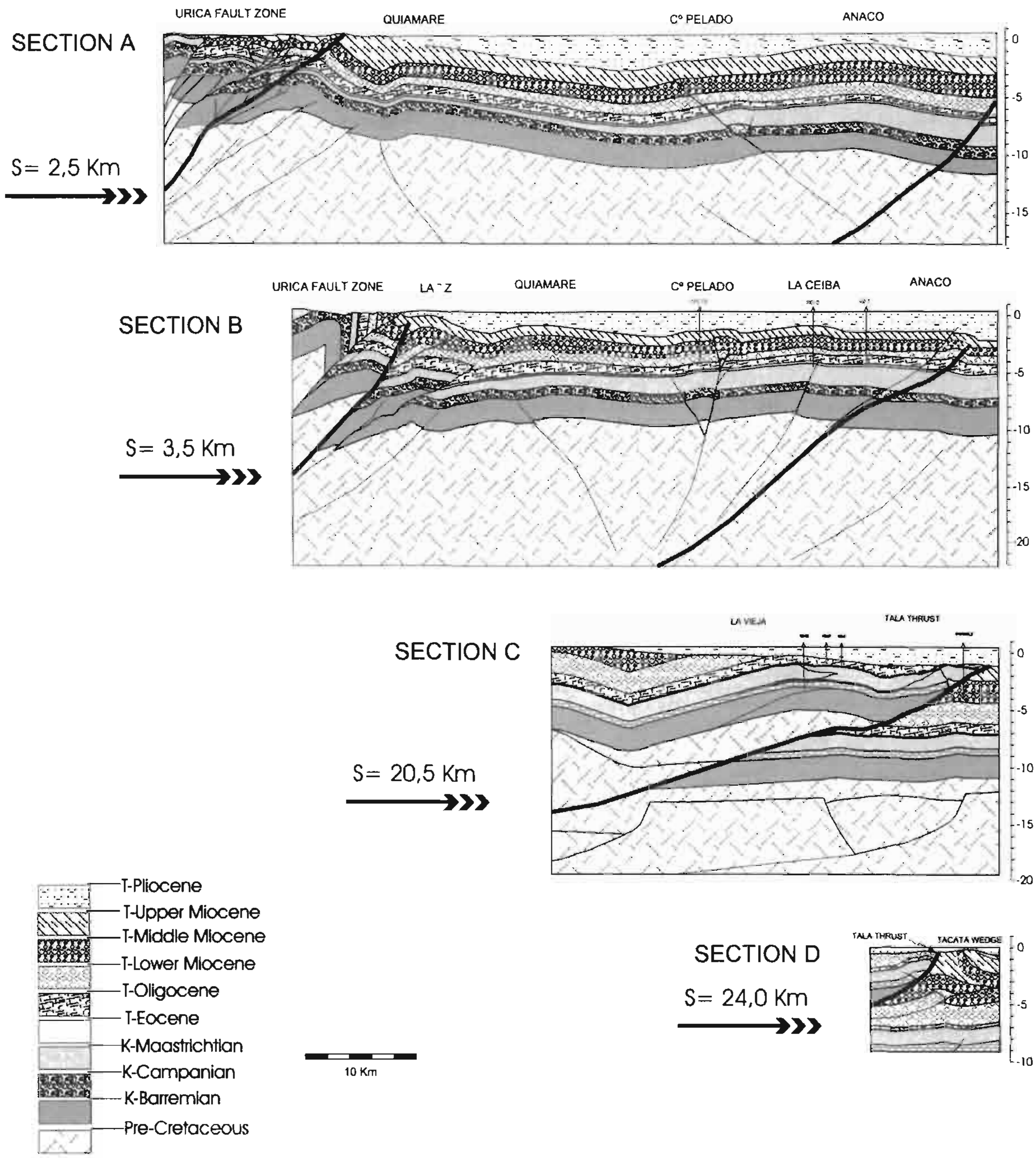

Figure 3. Cross sections along the Santa Rosa block. See Figure 2 for location.

The shortening of the sections (S in Figure 3) permits the reconstruction of the original position of the Urica fault (Figure 2). The northwest portion of the Urica fault can be considered as a lateral ramp of the most of the thrust present in the Bergantin block. The southeast portion, after the point where the fault trace become convex, is very difficult to relate the restored shape and the orientation with a Cretaceous or Jurassic lineament or be a lateral ramp.

Taking into account the shortening of the Tala thrust in the southeast portion of the Santa Rosa block and the similarity to shortening of the Pirital thrust in the Bergantin block, identical structural characteristics and the small offset between them across the Urica fault, it is postulated in this paper thrusts originally just formed a single thrust during the Upper Miocene-Pliocene. Subsequently, differences en shortening between the Tacata wedge and Furrial foreland vergence, during the Pliocene, and the interaction between the remote stress and the Urica fault orientations produced a divergent lateral reactivation of the Urica fault and the splitting between the Tala and Pirital thrusts. As such, the Pirital thrust shouldn't be considered as a ramp of the Urica fault.

The seismic lines which cross the Urica fault in the Tacata area show a normal throw at shallow depths as a result of this divergent lateral displacement. Urica fault reactivation is contemporaneous with the activity along most of the thrust in the Tacata-El Furrial area and also some of the out-of-sequence thrust during the Pliocene-Pleistocene. Consequently, the west end of the Serranía has been in a compressional regime since Miocene time, despite the presence of normal displacement along The Urica Fault, in this south segment.

In conclusion the Urica fault is a boundary between the Santa Rosa and Bergantin blocks only in the northwest portion, which acts as a lateral ramp. The southeastern segment underwent a divergent lateral reactivation during the last stage of the formation El Furrial trend, producing the separation of the previously formed, Tala-Pirital thrust. The intersection between the Urica fault and the Tacata-El Furrial trend divides the deformation front in hinterland vergence (Tacata) and the foreland vergence (El Furrial).

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