THE NEOTECTONIC EVOLUTION OF THE GULF OF GUAYAQUIL: A TAIL STRUCTURE BETWEEN CONVERGING PLATES

J.F. DUMONT [A,], E. SANTANA [B], W. VILLEMA [C], M. ORDOÑEZ [C], N. JIMENEZ [C], I. ZAMBRANO [C], and K. PEDOJA [D]*

[a] IRD, URM Geosciences Azur, AP 0903 30096, Guayaquil, Ecuador
[b] INOCAR Base Maritima Sur, Av. 24 de Julio, Guayaquil Ecuador
[c] Petroproducción, CIG-G, Km 6,5 via a Salinas, Guayaquil, Ecuador
[d] UPMC, UMR Geosciences Azur, La Darse, 06235 Villefranche s/Mer, France

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INTRODUCTION

The Gulf of Guayaquil opens during the Neogene at the south tip of the North Andean Block (Fig. 1A) (Kellogg and Bonini, 1982; Pennington, 1981). This block is the northwestern broken corner of the South American continent, in the position of a triple junction between the Nazca, Caribbean and South American plates (Ego et al., 1996). It moves northward along a NE trending wrench fault zone joining Santa Clara and Puná Islands to Pallatanga (Fig. 1A). The Gulf of Guayaquil opens along the southwest segment of this fault zone, at the junction with the Ecuadorian subduction zone (Fig. 1B).

The recent evolution of the Gulf is characterized by transtension deformation involving flower structures and diapirism, with very important accumulation of Pliocene sediments (Benitez, 1995; Deniaud et al., 1999; Lions, 1995).
The present study is based on field works in the Santa Clara and Puná Islands.

DATA

Three major neotectonic events are observed in Pliocene to early Pleistocene shallow marine sediments:

- 1) a NW-SE shortening evidenced by right and left hand faults is observed in the Zambapala Cordillera. This shortening is coherent with 300 m uplift of the Zambapala Cordillera during the early Pleistocene, in relation to a positive flower structure.

- 2) a E-W shortening is observed in several places. It is principally represented by right hand movement along the NE-SW trending Zambapala-Lechuza wrench zone. Drainage offset of up to 300 m are observed, and a cumulated 3 km offset is registered by the Lechuza pull apart.

- 3) The more recent event are all extension trending NNW-SSE to NNE-SSW. In Santa Clara this event post date, transtension deformation along the northward extension of the Amistad structure. This event emphasizes faults and structures trending parallel to the Santa Elena and Progresso Basin. This is the main style of deformation in the north of Puná Island, as well as probably all the Guayas area located north of the Zambapala-Pallatanga wrench zone.

CONCLUSIONS

The strong shortening rising the Zambapala Cordillera and the following and probably related W-E shortening are interpreted in relation to a compressive event originated in the subduction system. The introduction of the Grijalva Scarp in the subduction may be responsible for this shortening event which predate and postdate transtension or extension events. The Grijalva scarp is a South looking scarp separating an old and morphologically lower oceanic crust to the south from a younger crust post dating the break of the Farallon platform to the north. It constitutes not only an asperity but also a major break in the subducting plate.

The recent and roughly N-S extension initiates a new morphostructural pattern, resulting in partitioning of the deformation between the Zambapala-Pallatanga wrench zone and the subsiding Guayas Basin. The opening of the Del Moro Channel since the last interglacial period, as well as the cluster of shallow seismicity located below Guayaquil is results of this partitioning.

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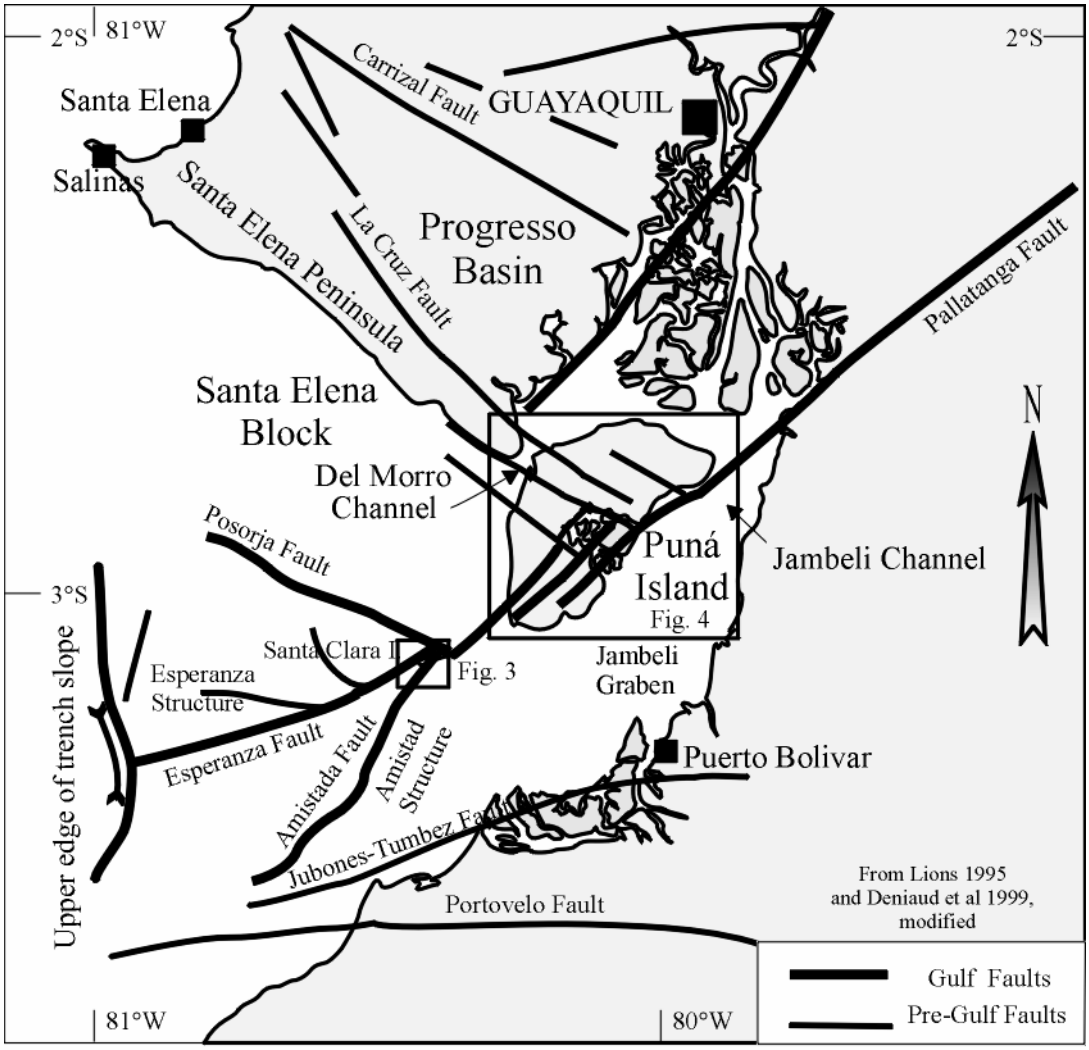

Fig. 1. Structural scheme of the Gulf of Guayaquil. From Lions (1995), Deniaud et al., (1999), simplified.