STYLE AND TIMING OF DEFORMATION IN THE ORIENTE BASIN OF ECUADOR

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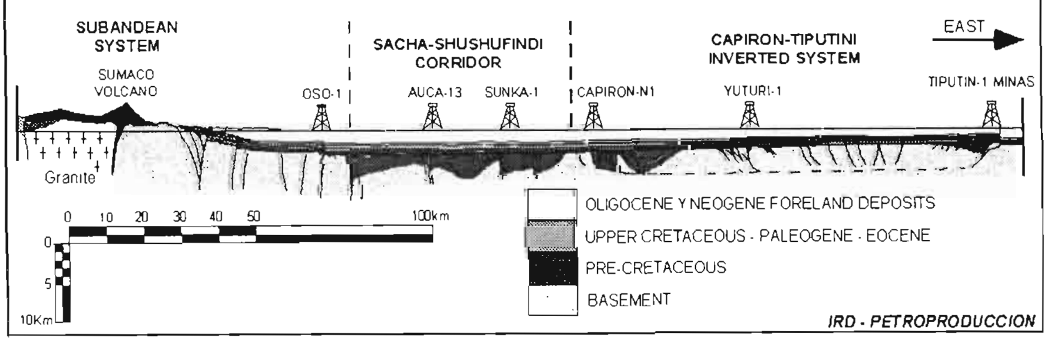
INTRODUCTION

The Oriente Basin of Ecuador (Dashwood and Abbotts, 1990) forms a Sub-Andean foothills and foreland basin comprised between the Putumayo Basin of Colombia and the Marañon Basin of Peru. Petroleum activities of the last 10 years provided new data which permit to clarify its structural features (Figs. 1 et 2) and tectonic evolution (Fig. 3). Stratigraphically, the Oriente Basin preserves a Phanerozoic sedimentary column ranging in age from Paleozoic to Recent (Tschopp, 1953; Canfield et al., 1982; Dashwood and Abbotts, 1990; Jaillard, 1997) which outcrops in the foothills (Napo and Cutucú uplifts). This sedimentary column can be subdivided into three mega-sequences: a pre-Cretaceous series, which is unconformably covered by a continental to shallow marine Cretaceous sedimentary preorogenic cycle and a Cenozoic continental foreland filling. In this paper, we resume the results of the IRD (Institut Français de Recherche pour le Développement) - PETROPRODUCCION tectonic teamwork. A revision and a new presentation of the sedimentary column involved in the deformation is proposed. A geometric and kinematic analysis and a new structural feature of the Oriente Basin are presented. On the base of the analysis of the tectonics-erosion-sedimentation relationships, principal tectonic events of the Oriente Basin development are defined. Geodynamic and Petroleum implications are then discussed.

Fig.1. STRUCTURAL SECTION ACROSS THE ORIENTE BASIN



STRUCTURAL STYLE

The Oriente Basin is deformed by major compressive NNE-SSW wrench fault zones (Figs. 1 and 2), which correspond to inverted Mesozoic rift systems. Main structures correspond to positive flower structures developed along three NNE-SSW right-lateral convergent wrench-fault zones. (1) In the western part, the Subandean System (Napo Uplift and Cutucú Uplift) is still seismically and volcanically active. (2) In the centre of the basin, the Shushufindi-Sacha Corridor results from the inversion of a NNE-SSW trend of Upper Triassic to Lower Jurassic half-grabens which emerges actually in the Cutucú Uplift. (3) To the east, the Capirón-Tiputini play is an inverted system of half-grabens (Fig. 2) probably Permo-Triassic in age. In the Sacha-Shushufindi Corridor as in the Capirón-Tiputini Inverted System, half-grabens were eroded and sealed by Middle Jurassic to Basal Cretaceous volcano-clastic sediments (Chapiza-Yaupi Fm.), or by the Aptian-Lower Albian Hollín Formation. Locally, the Yaupi Fm. is affected by normal faults.

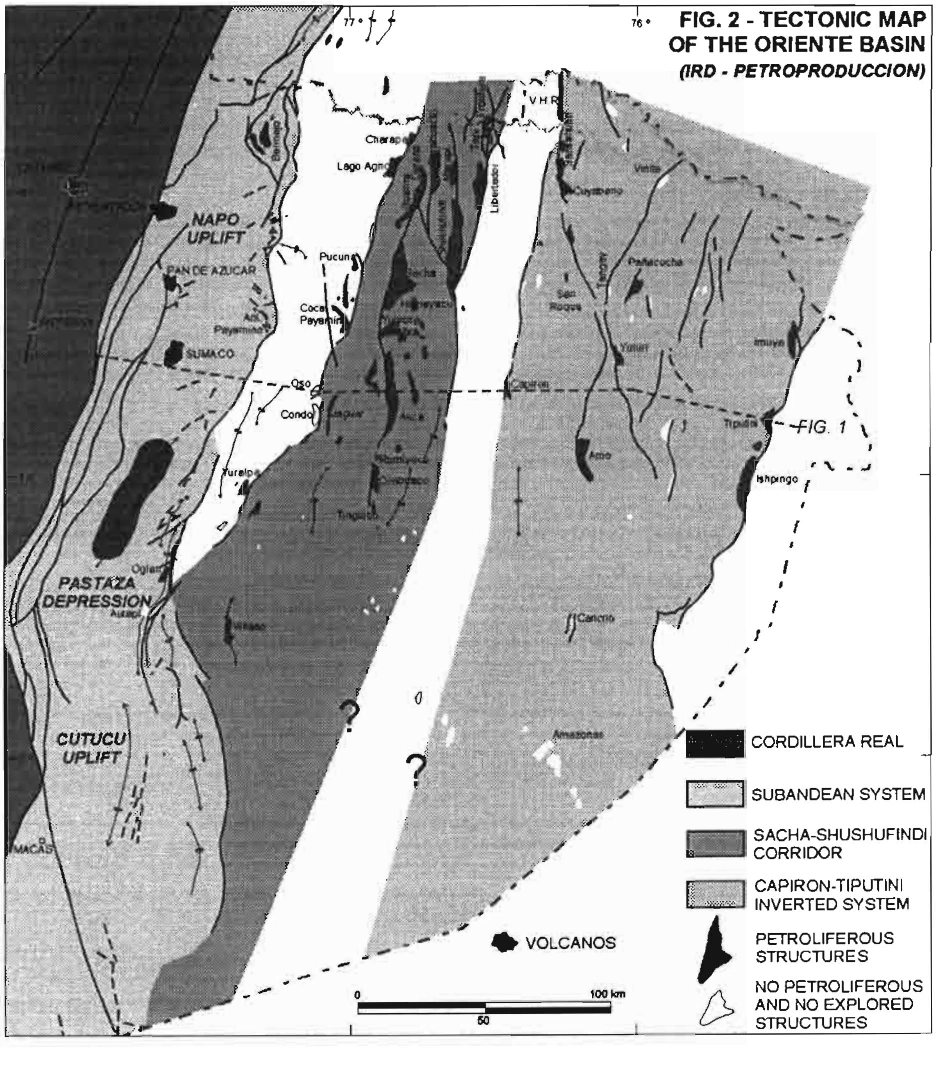
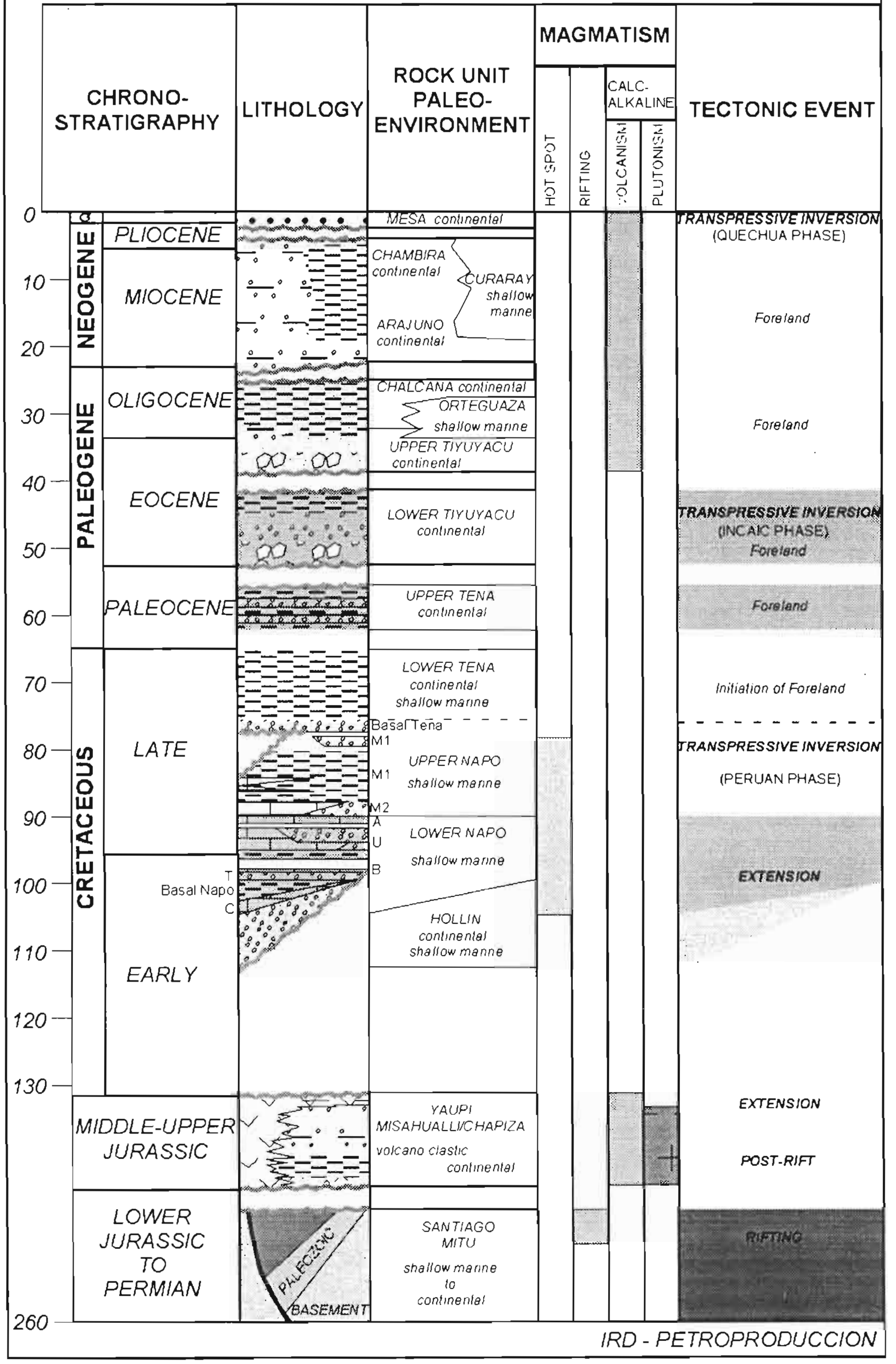


FIG. 2 - TECTONIC MAP OF THE ORIENTE BASIN
(IRD - PETROPRODUCCION)

FIG. 3 - TECTONO-STRATIGRAPHIC UNITS OF THE ORIENTE BASIN



IRD - PETROPRODUCCION

TIMING OF CRETACEOUS AND CENOZOIC COMPRESSIVE DEFORMATIONS

Reflection seismic data show syn-tectonic sedimentation which recorded 3 stages of transpression: Turonian-Maastrichtian; Early Eocene; Pliocene-Quaternary. The Sacha-Shushufindi Corridor formed in large part between the Turonian and the Maastrichtian, while the Capirón-Tiputini Inverted System is principally Eocene in age. The Subandean uplift developed during the Pliocene and Quaternary, but includes some Maastrichtian structures as the Bermejo field.
The Turonian-Maastrichtian tectonic crisis is contemporaneous with an "intra-continental hot-spot" under the Oriente Basin, as show the extrusive magmatic bodies associated to the right-lateral wrench-fault zone of the Sacha-Shushufindi Corridor (Barragan et al., 1999). The maturity of Cretaceous source rocks in this zone is due to this thermal anomaly.

DISCUSION AND CONCLUSION

The Figure 3 resumes the tectonic and sedimentologic evolution of the Oriente Basin. Initialisation of the foreland basin starts during the Turonian-Maastrichtian tectonic crisis, and its Cenozoic evolution is controlled by interference of tectonic and eustatic events (Jaillard, 1997; Christophoul, 1999).

The more productive oil fields of the Oriente Basin correspond to Late Cretaceous and Eocene structural traps. Oil was accumulated in Aptian to Maastrichtian sandstones. Cretaceous source rocks maturity is due to subsidence of the Cenozoic foreland basin and the continental "intra-continental hot-spot" contemporaneous with the Turonian-Maastrichtian tectonic crisis. The Napo Uplift is probably the remnant part of a largest petroleum system which developed towards the west. Two peaks of oil generation and expulsion are evidenced. The first one occurred in the Lower and Middle Eocene, in a foreland basin which extended to the west of the present basin limits. Upper Eocene to Oligocene times correspond to a period of erosion and poor subsidence, where oil expulsion stopped. During the Neogene, the second peak of oil expulsion occurred with the return of the foreland basin subsidence, and the western part of the petroleum system was progressively deformed and destroyed by the Andes uplift.

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