

## GEOLOGIC AND PETROLEUM EVOLUTION IN OLLEROS BLOCK SANTA BARBARA SYSTEM - SALTA - ARGENTINE

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### INTRODUCTION

The studied area is located in the Province of Salta, in the northwest of Argentina, covering an area of 6300 km<sup>2</sup>. It belongs to the "Santa Bárbara Tectonic System" where many geological studies were performed during the last decades. The results obtained with the wildcats drilled during the 70's - 80's (more than 10 dry wells) associated with geochemistry studies, both indicated that no oil generation had existed regarding Yacoraite Fm (Upper Cretaceous). After this negative exploration stage two shallow oil fields were discovered, both related to structural traps (faulted anticlines), Cuchuma and Lumberas, productive from fractured limestones in the Yacoraite Fm. (Figure 1). To explain their existence, new sedimentary and tectonic models were developed and a most accurate petroleum system is also suggested

### STRATIGRAPHY AND TECTONIC

The stratigraphic column is conformed by rocks that involve ages between Precambrian and Quaternary with a total approx. thickness of 8000m. (Figure 2).

**Precambrian (Puncoviscana Fm. Turner 1960):** mainly composed of slates, its real thickness is unknown, and is highly deformed by several tectonic events.

**Paleozoic:** (Mesozoic Gr. Turner 1960, Mojotoro Fm, Cachipunco Fm. Hagerman 1933) (Cambrian to Devonian). Marine quartzites and shales (Vistalli C. 1987) with a total approx. thickness of 2500m. Affected by the compressive stages (thick skinned) related to the orogenic Oclóyica (Base Silurian) and Chánica (Base Carboniferous).

**Cretaceous, Paleocene, Lower Tertiary (Salta Group - Turner 1959):** This sedimentary cycle represents a Synrift stage. (Bianucci et al 1982) (Pirgua Subgroup. Reyes et al 1973. Lower-Upper Cretaceous), and Postrift (Balbuena - Moreno 1970 and Santa Bárbara Subgroups - Moreno 1970). The total thickness has approx. 2500m and is composed of fluvial and eolian sandstones and conglomerates in the Synrift, whereas the Postrift stage is represented by limestones shales, sandstones and evaporites deposited in shallow lacustrine, playa lake and eolian environments. (Gómez Omil et al 1987.)

**Neogene (Oran Group - Russo 1975) (Upper Miocene to Pliocene):** They represent the synorogenic sediments. The oldest are fluvial distal facies and the youngest local fluvial facies mainly conglomerates, with a maximum thickness about 5000m (Gebhard J. et al 1974). At least three compressive tectonic events have been recognised (thick and thin skinned) during this time interval. The first happened around 17 M years related to tectonic inversion (Grier M. 1990; Letouzey 1990) (Sosa Gómez et al 1993) (Salfity et al 1994) (Quichua phase I-Middle Miocene), the second around 10 M years (Quichua phase II, Upper Miocene), and the third in the Pliocene (Diaguita phase) (Jordan T. 1984). Due to its important deformation many different types of structures could be defined: fault propagation fold, out of the graben thrust faults, and also tensional faults (Syn rift) and strike slip faults. Most of the anticlines

are related to grow structures and have a strong sedimentary control mainly developed since the upper Miocene (Quichua phase II). (Medwedeff D. 1989) (Suppe J. et al. 1992)

#### **PETROLEUM SYSTEM**

**Source Rock:** The only stratigraphic unit with good source potential is the lacustrine Yacoraite Fm (Upper Cretaceous), related with the post rift stage. Shales with TOC values between 1 to 6% and type II-III kerogen has been described. The maximum source rock thickness is about 40m in the studied area.

**Maturity:** Based on vitrinite reflectance values from surface samples and in Basin Mod analysis, mature areas are located just in some synclines where the total subsidence over the Yacoraite Fm was more than 3500m. In all the cases this subsidence happened in the upper Miocene and Pliocene, related to growth anticlines. The difference in thicknesses between the synclines and the anticlines for the upper Miocene and Pliocene is about 2000m. The main oil generation could have begun at 5.5 MM years.

The present geothermal gradient in the region according to wells is about 2.6 to 3° C /100m.

**Migration:** A very short and local migration has been established with no more than 10 km from the kitchen located in the synclines to the nearest anticlines (Cuchuma and Lumbreras).

**Carriers:** There are no good carrier with enough porosity as sandstones or limestones related to the source rock Yacoraite Fm. It is possible that fractures could be the main carriers that connect the kitchen to the final trap.

**Seal:** The shales and evaporites that represent the initial post rift sequences (Olmedo Fm) which cover the main reservoir, have a thickness about 40m and also a regional distribution. It's the proved seal in oilfields Cuchuma and Lumbreras.

**Reservoir:** The reservoir in both oil fields is related to fractured limestones.

**Trap:** The discovered traps are in both cases anticlines with four-way closure, conformed in different timing each.

The Petroleum System herein defined is deficient because the discovered oil fields are filled up about 10% of its structural closure, and also many other structures drilled are dry. The main problem could be related to the restricted and isolated kitchen so the area of effective drainage is very little.

#### **CONCLUSIONS**

A poliphasic tectonic and also a sedimentary evolution are defined since the Precambrian to the present. The Petroleum System is analysed. The behavior of both subjects together allows to explain the existence of the only two oil fields found in the region (Cuchuma and Lumbreras), the bad results obtained in the oil exploration (10 well dry) in past decades, as well as to focus the exploration efforts in specific areas.

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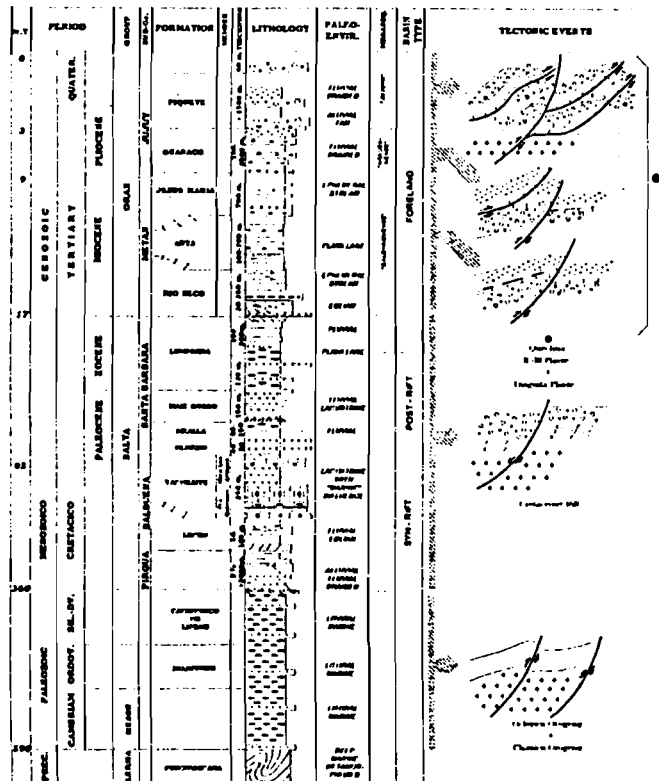
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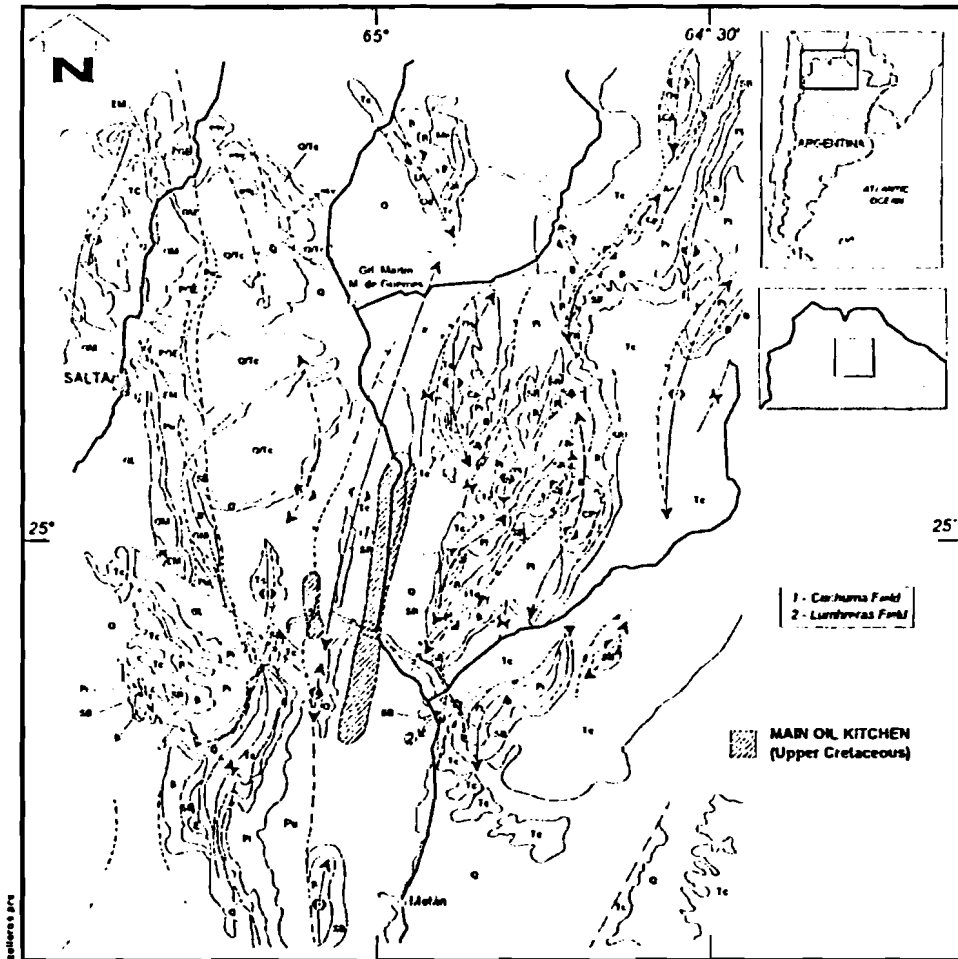
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FIGURE 1

STRATIGRAPHIC COLUMN



### GEOLOGIC MAP



Modif.: F. Garrasno 1984

<b>Q/Tc</b> QUATERNARY - TERTIARY	<b>Li</b> LIPEON Fm.	<b>EM</b> MESON Gr.	CAMBRIAN
<b>Q</b> QUATERNARY	<b>Cp</b> CACHIPUNCO Fm.	<b>SILURIAN DE VONIAN</b>	<b>Pu</b> PUNCOVISCANA Fm.
<b>Tc</b> TERTIARY SEDIMENTITES	<b>Me</b> MENDIETA Fm.		
<b>SB</b> Sta. BARBARA SubGr.	<b>Ac</b> A* COLORADO Fm.		LOWER-CAMBRIAN
<b>B</b> BALBUENA SubGr.	<b>GM</b> MOJOTORO Gr.	<b>ORDOVICIAN</b>	<b>PGE</b> METAMORPHITES
<b>Pi</b> PIRGUA SubGr.	<b>OSV</b> Sta. VICTORIA Gr.		

NEOGENE

NEOCRETAC. PALEOGENE