Once Upon a Time… In the Colombian Foothills: Discovery of the Cusiana and Cupiagua Fields

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Abstract

This case history from Colombia shows that frontier plays can also sit on your doorstep, in a province with a well-established geological framework and in spite of 17 previous unsuccessful wells. The point of departure was a farm-out opportunity on a block located on the easternmost margin of the Cordillera Oriental. A critical analysis of the petroleum system and the technical and business conditions can be summarized as follows. The negatives: Low porosity of the reservoirs, recent Andean trap-creating tectonics (5 Ma) with a chance to postdate the main charging events, difficult costly drilling (depth > 4,000 m). The positives: Presence of a Cretaceous source rock, stratigraphically equivalent to the world-class La Luna of the Maracaibo Basin, oil and gas shows encountered in past wells, an undisputable sizable 4-way closure. At the end it was decided to give a chance to the half-full glass rather than half-empty option and make a deal (Total and BP as farm-in partners and Triton the rights owner). The result was the amazing discovery of Cusiana, a giant accumulation with a 500 m column of hydrocarbons. A second structural feature was successfully drilled, giving birth to Cupiagua, another giant field. These two discoveries contained in excess of 1,400 MMB, with a production plateau of 500,000 bo/d.

Some important keys for success and messages for risk management can be derived from this case: The need for an optimistic and perseverant attitude, unforgiving risk analysis, positive view of past failures, genuine confidence between explorers and decision-makers, and reaching a consensus to invest huge amounts of money on such high risk projects.
References Cited


Once Upon a Time…
In the Colombian Foothills

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Eastern Cordillera Foothill Play. Pre-Cusiana Exploration
Analysis of Past Programs

- 17 wells drilled by 13 companies (Conoco, Exxon, BP, Chevron, Ecopetrol...)

- A limited number of wells could reach the objective: depth (>4000m), difficult drilling...

- Wells located with (very) poor quality seismic

- Those wells that did get down to the reservoir have all found some oil & gas shows, but no commercial production
Colombia: “Old" Seismic Line in the Foothills Area...

*Can you see something?*
Colombia: “New" Seismic Line in the Cusiana Area

A much improved structural image
Analysis of Past Programs

- 17 wells drilled by 13 companies (Conoco, Exxon, BP, Chevron, Ecopetrol...)

- A limited number of wells could reach the objective: depth (> 4000m), difficult drilling...

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Cusiana Area Stratigraphy
Outcropping La Luna
« Late » Trap Formation

...continues until present

6MA

12MA

generation-expulsion starts here...

20MA

35MA
Cusiana Cross-Section

Falla de Guicaramo
Falla de Yopal
Falla del Cusiana

Sinclinal de Zapatosa
Guayabo
Leon
Carbonera
Mirador
Une
Cretaceo Inferior

10 kilometers
Porosity Measurements from Core Plugs (Mirador & Barco Sands)

Mirador / Barco Porosity Distribution

- Number of samples: 2631
- Porosity measurements from Core Plugs (Mirador & Barco Sands)

from E.C. Cazier et al., AAPG bull vol. 79/10
Eroded Anticline of the Foothills with Outcropping Mirador
Décision Criteria (1)

- **Pessimism (half empty glass)?**: shows present everywhere, hydrocarbons have gone through the system, but no HC concentration was possible because traps were absent at migration time?
Decision Criteria (2)

- **Pessimism (half empty glass?)**: shows present everywhere, hydrocarbons have gone through the system, but no HC concentration was possible because traps were absent at migration time?

- **Optimism (half full glass?)**: shows indicate a working petroleum system, and it only remains to find the right location (this anticline?)
Enlarging the Vision: a Regional Perspective

Here they are! ⚡⚡
Décision Criteria (3). Technical Conclusion

- **Pessimism (half empty glass)?:** shows present everywhere, hydrocarbons have gone through the system, but no HC concentration was possible because traps were absent at migration time?

- **Optimism (half full glass)?:** shows indicate a working petroleum system, and it only remains to find the right location (this anticline)

- **The « silver bullet »:** 2 fields discovered over the Andean Foothills within the same tectonic context...600km away: the system worked somewhere in a similar context
The Discovery

CUSIANA-2A

CARBONERA

C 3

C 5

C 7

MIRADOR

BARCO

GUADALUPE

GACHETA

324 m
And a Surprising Twin Sister!!!
Cusiana Field
Central Processing Facility
Design Capacity:
405 MBD & 1.5 BCFD

Cupiagua Field
Central Processing Facility
Design Capacity:
220 MBD & 1.3 BCFD
A Final Word

DON'T EVER GIVE UP!
Drilling Site in the Foothills