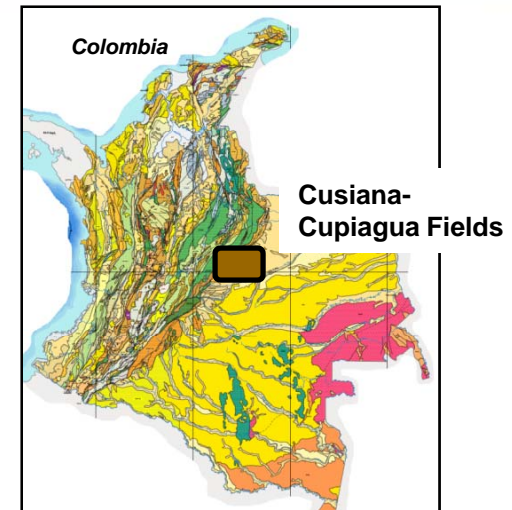


## SFD Case Study: Cusiana-Cupiagua Fields, Colombia (*Structural Traps*)



*Cusiana and Cupiagua fields, were discovered in 1988 and 1992 respectively. They are located about 150 km northeast of Bogota, Colombia.*

*The fields lie in the foothills trend on the edge of eastern Cordillera. An oblique thrust separates the two fields laterally and vertically. Cusiana structure is a sub-thrust southwest plunging anticline while Cupiagua structure is a fault propagation fold separated closed on the west by a back-thrust.*

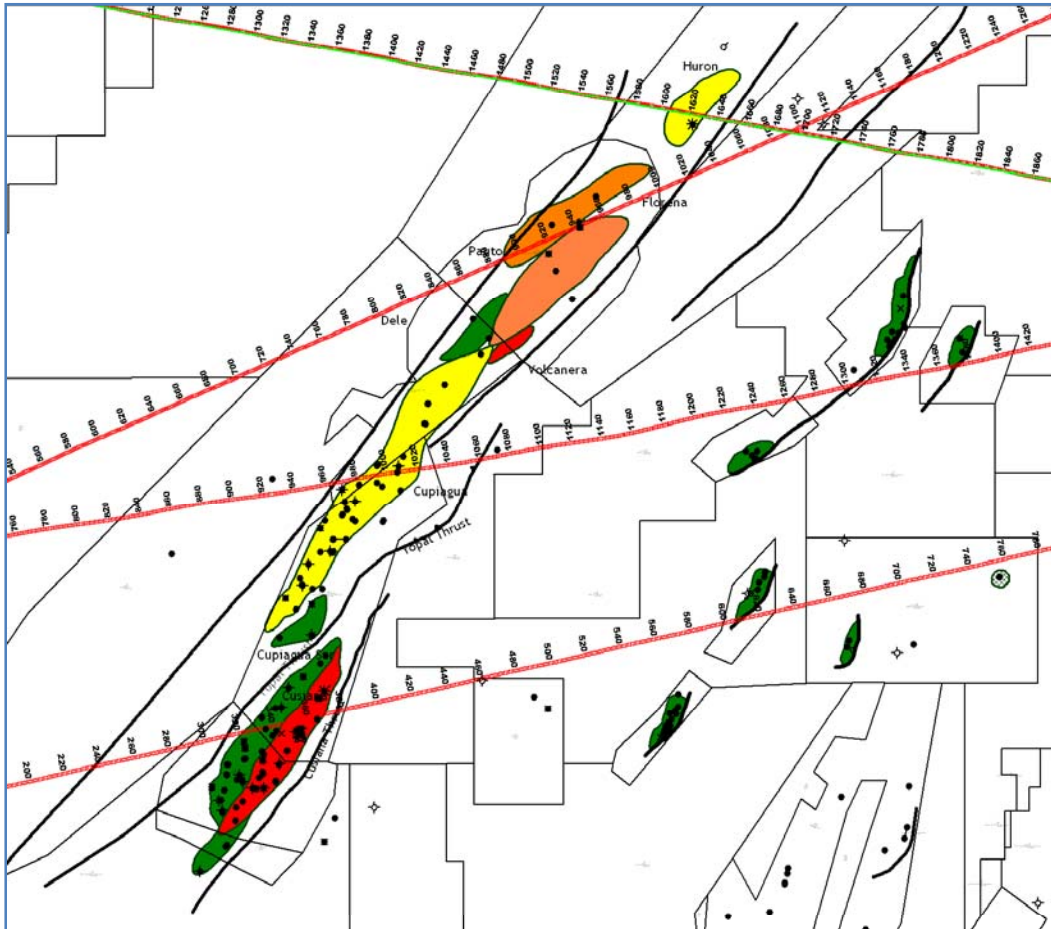


### **References:**

Ramon, J. C., and A. Fajardo, 2006, Sedimentology, sequence stratigraphy, and reservoir architecture of the Eocene Mirador Formation, Cupiagua field, Llanos Foothills, Colombia in P. M. Harris and L. J. Weber, eds., Giant hydrocarbon reservoirs of the world: From rocks to reservoir characterization and modeling: AAPG Memoir 88/SEPM Special publication, p. 433-469

Cazier, E. C., Hayward, A. B., Espinosa, G., Velandina, J., Mugniot, J-F., and Leel, Jr., W. G., 1995, Petroleum Geology of the Cusiana Field, Llanos Basin Foothills, Colombia; AAPG Bulletin, V. 79, No. 10 (October 1995), p. 1444-1463

*SFD Case Example - Colombia*  
**Cusiana-Cupiagua Complex Structural Play**

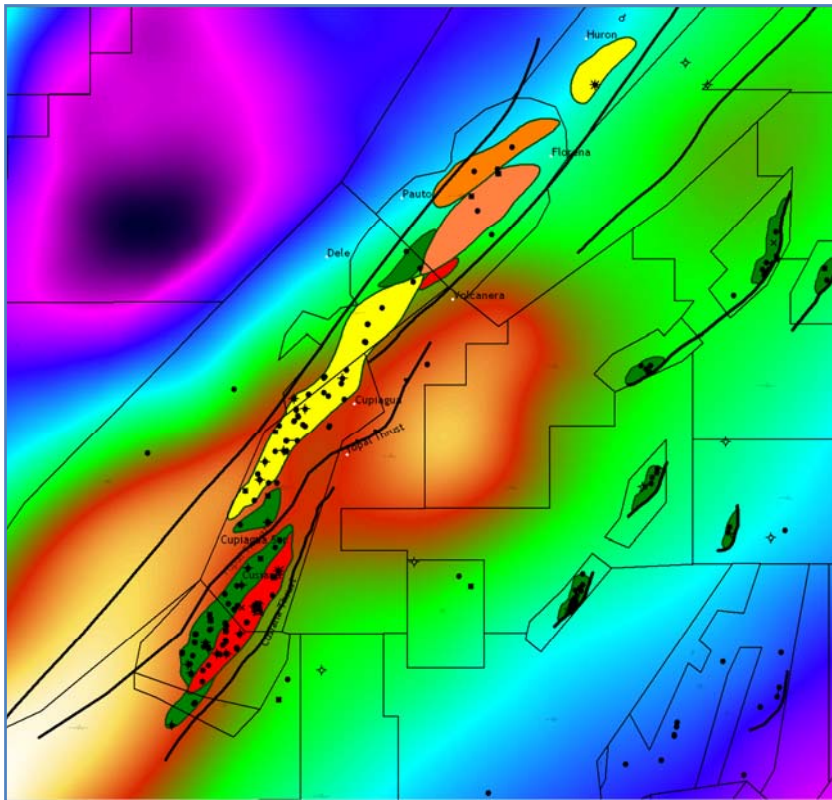


*Cusiana and Cupiagua fields lie in a series of anticlinal features bounded by thrust faults in the Eastern flank of Eastern cordillera*

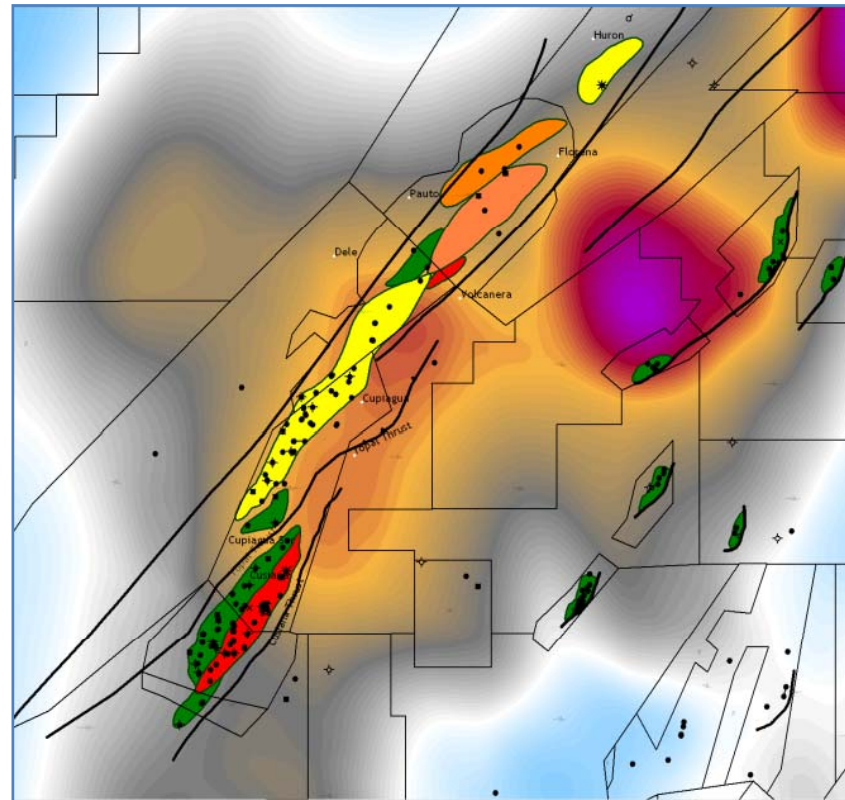
*During numerous surveys done within Llanos basin NXT flew across the complex acquiring some of the SFD data over the Cusiana-Cupiagua complex.*

*Comparison of the results with other exploration methods in the following presentation show the applicability of SFD survey as an independent tool to point to the areas of hydrocarbon traps. 4 individual crossings are studied with maps, seismic and published information.*

*Other Airborne Methods: Gravity and Magnetic Surveys*



*Airborne Gravity Survey*



*Airborne Magnetic Survey*

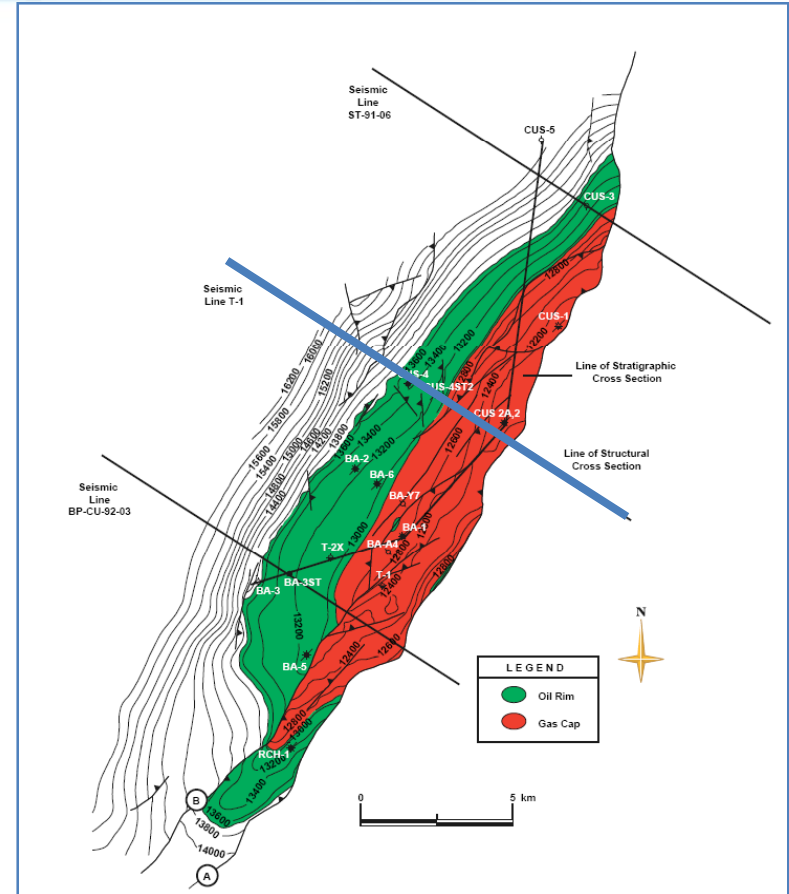
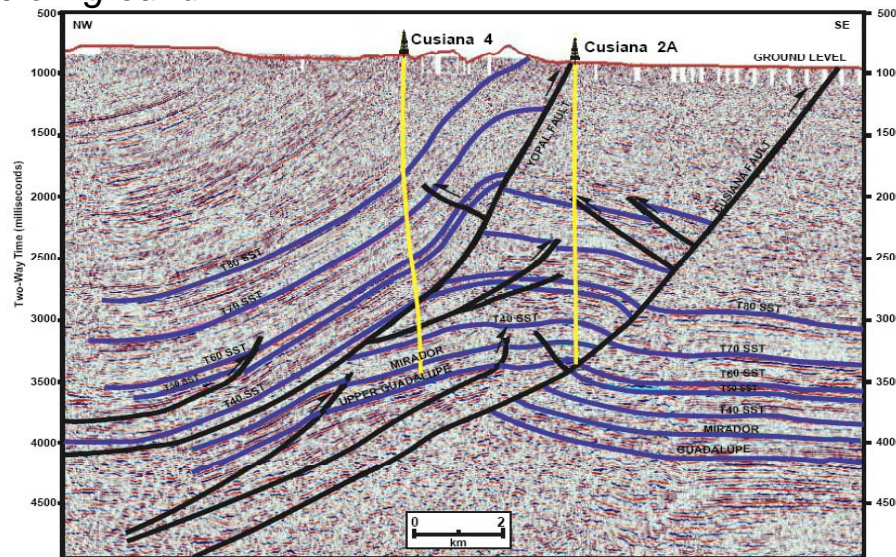
SFD Case Example - Colombia  
**Cusiana-Cupiagua Complex Structural Play**

# Cusiana Field



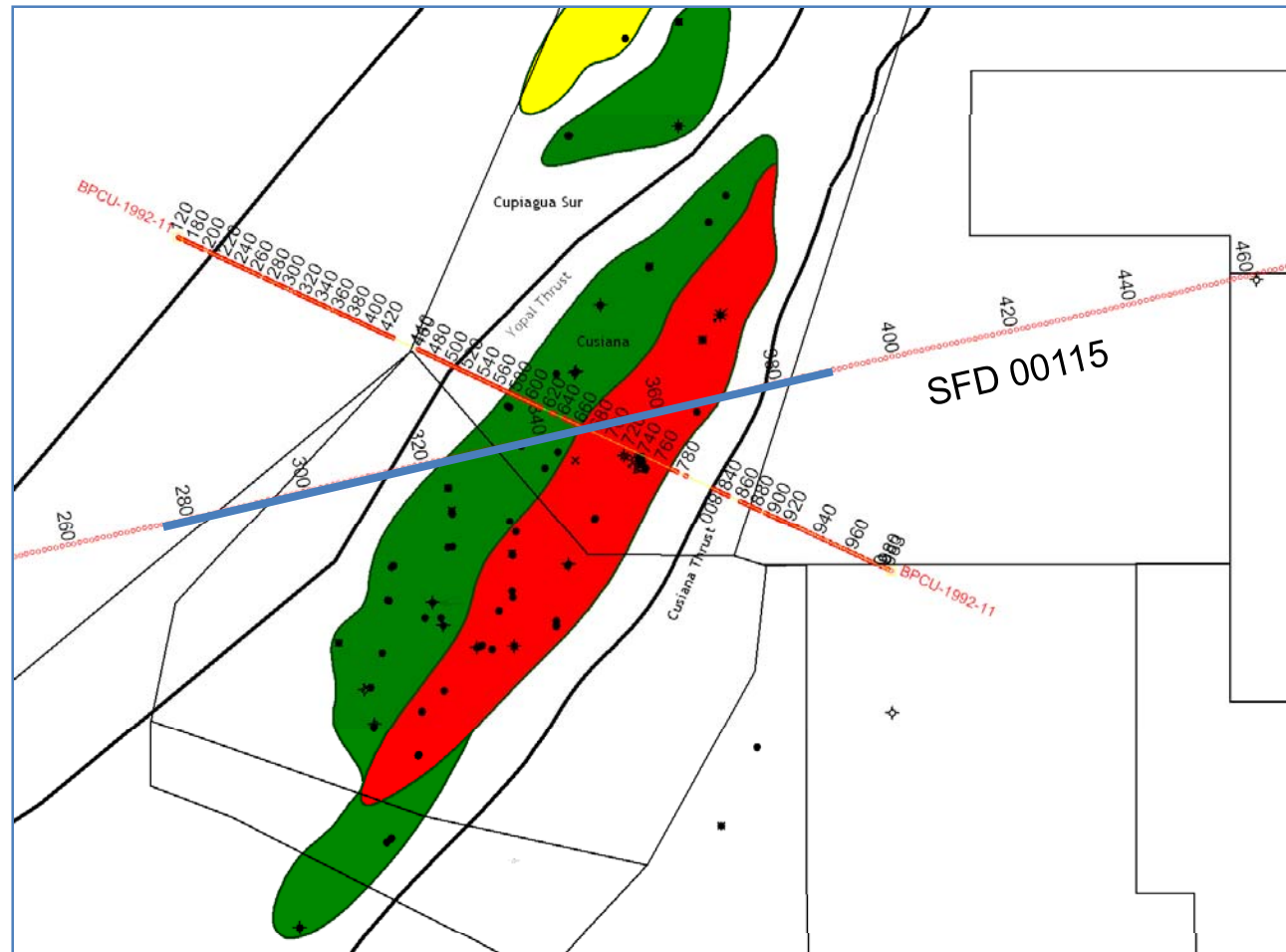
According to Cazier et al., 1995 Cusiana Field was discovered in 1988. The oil with gas-cap is trapped in a hanging wall anticline. The trap is further hidden due to its sub-thrust position related to the Yopal thrust.

Cusiana Field had more than 1.5 Billion bbl of oil in-place and is approximately 25 km long and 5-6 km wide. It has an oil column height of 1500 ft and was found at a drilling depth of 15000 ft below ground.



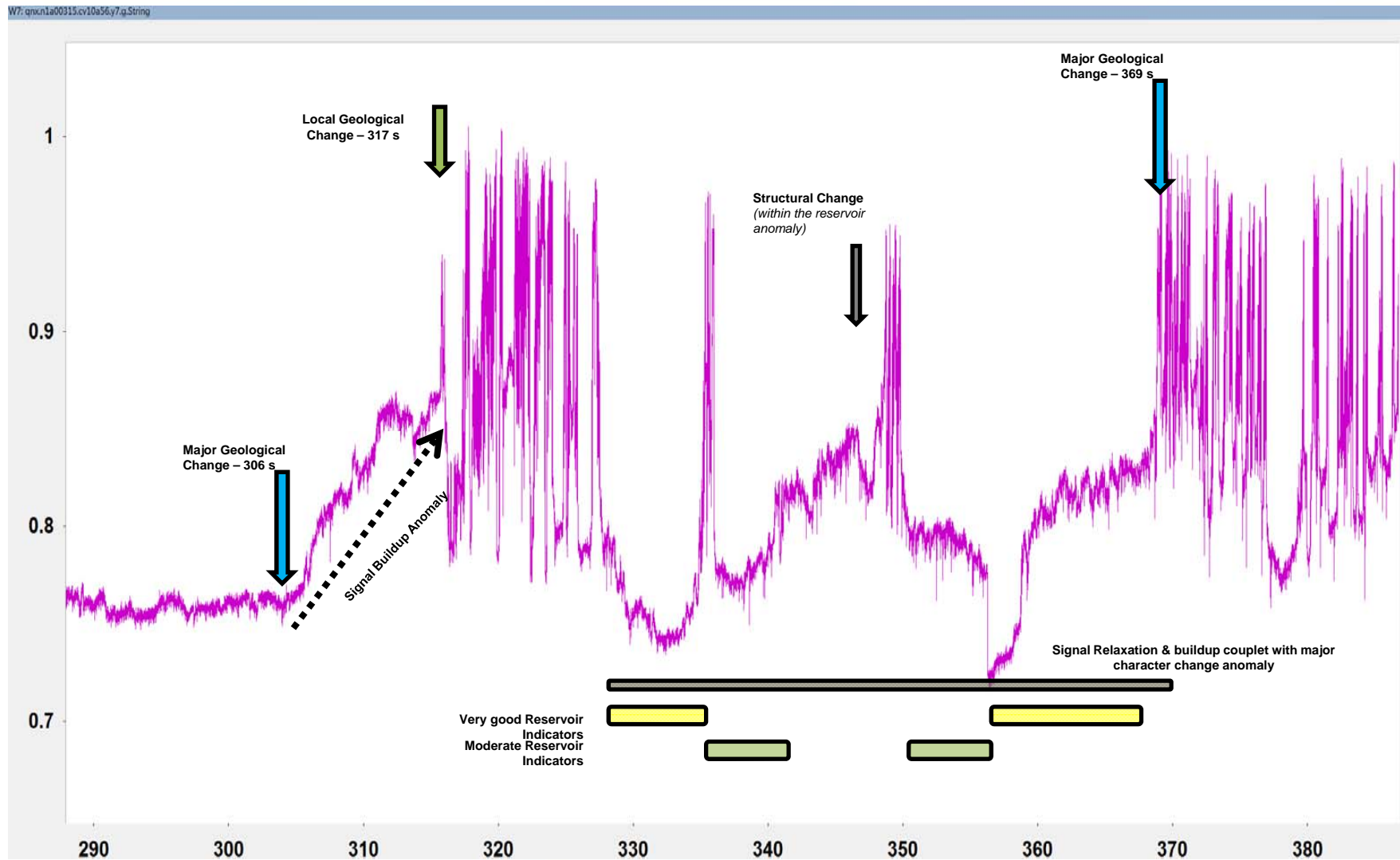
SFD 00115 was acquired across the Cusiana Structure on January 15, 2010. The SFD data is analyzed in comparison to the seismic line BPCU-1992-11 and also to the spatial boundaries of the Cusiana reservoir.

The 3D structure and trap boundaries are well defined by development drilling and published literature. The map shows the extent of oil and gas cap at top Mirador Fm. As the oil production decline over the years, the gas cap may have been more extensive than published in the literature.

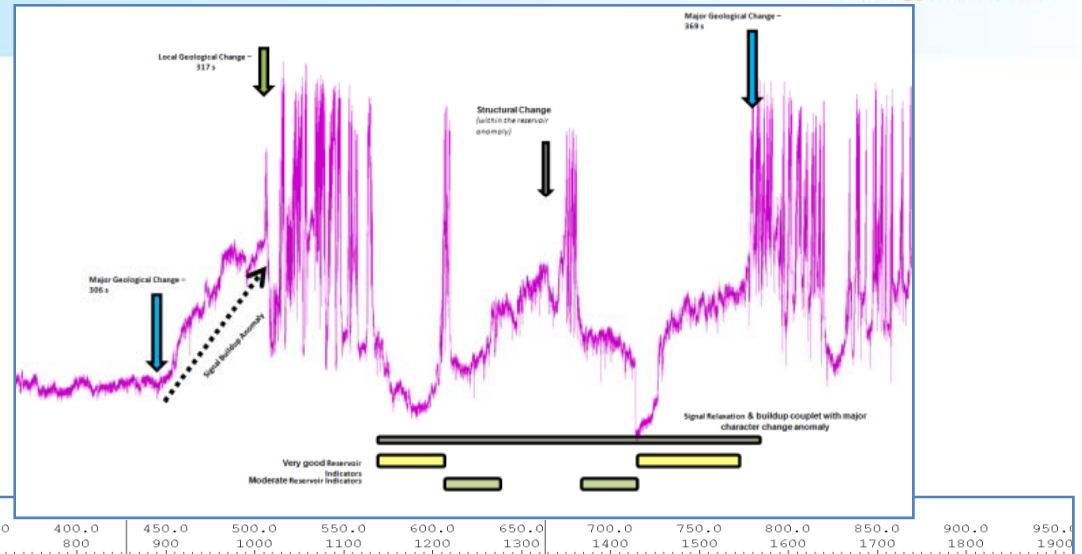
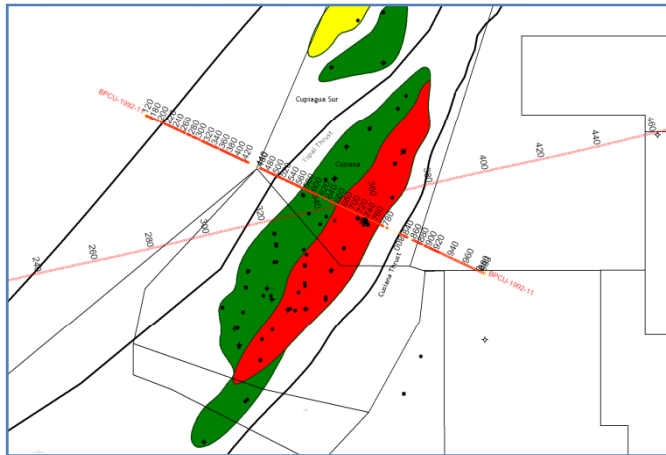


SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play

# Cusiana Field

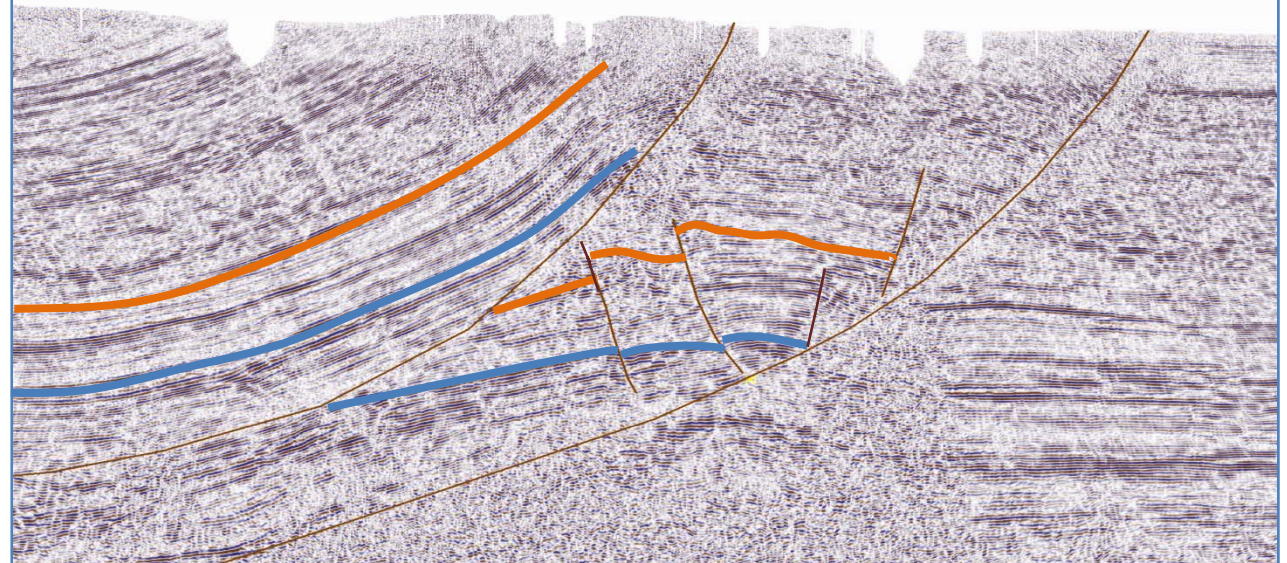


SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play



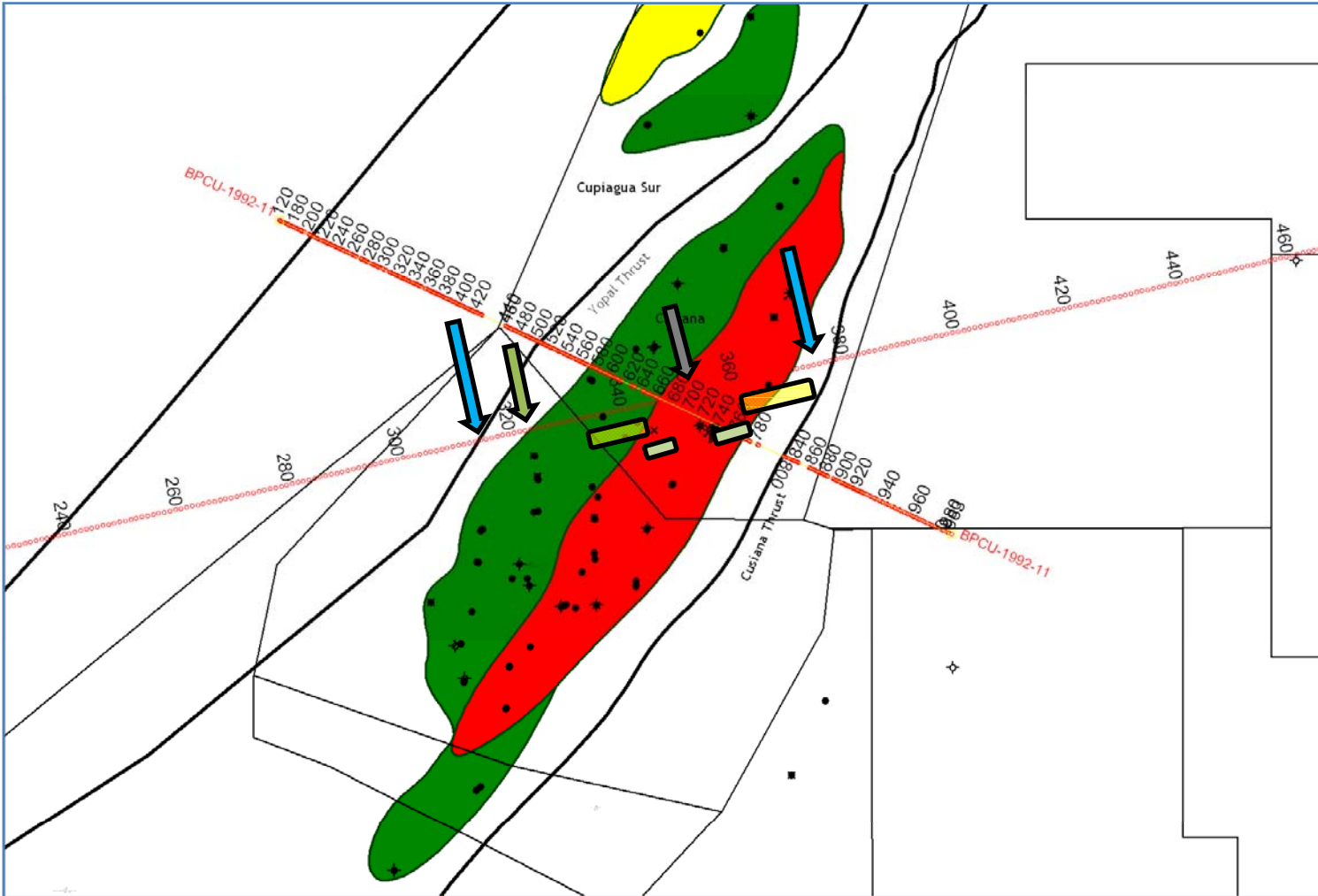
Although SFD 00115 is not exactly over the seismic line BPCU-1992-11 but it does provide the comparison of SFD signal to the extents of sub-thrust trapping. The start of the signal build-up is strikingly corresponding to the lower reservoir trapping limits of the Cusiana field.

Also note the structural change on the signal corresponds directly to the apex of the anticlinal where the dip of the beds change from west to east.



SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play

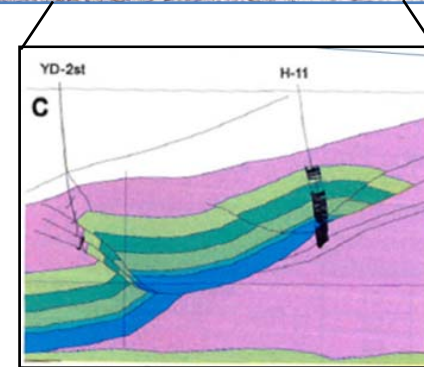
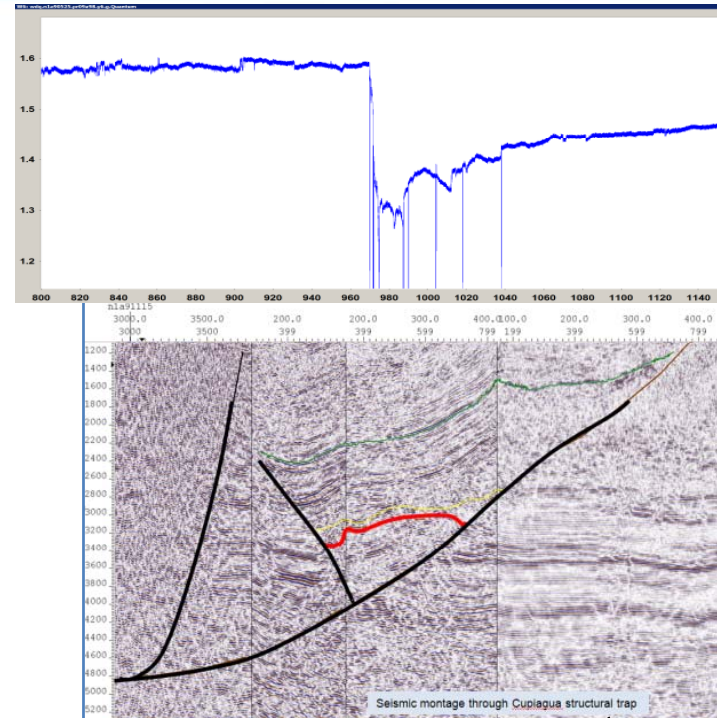
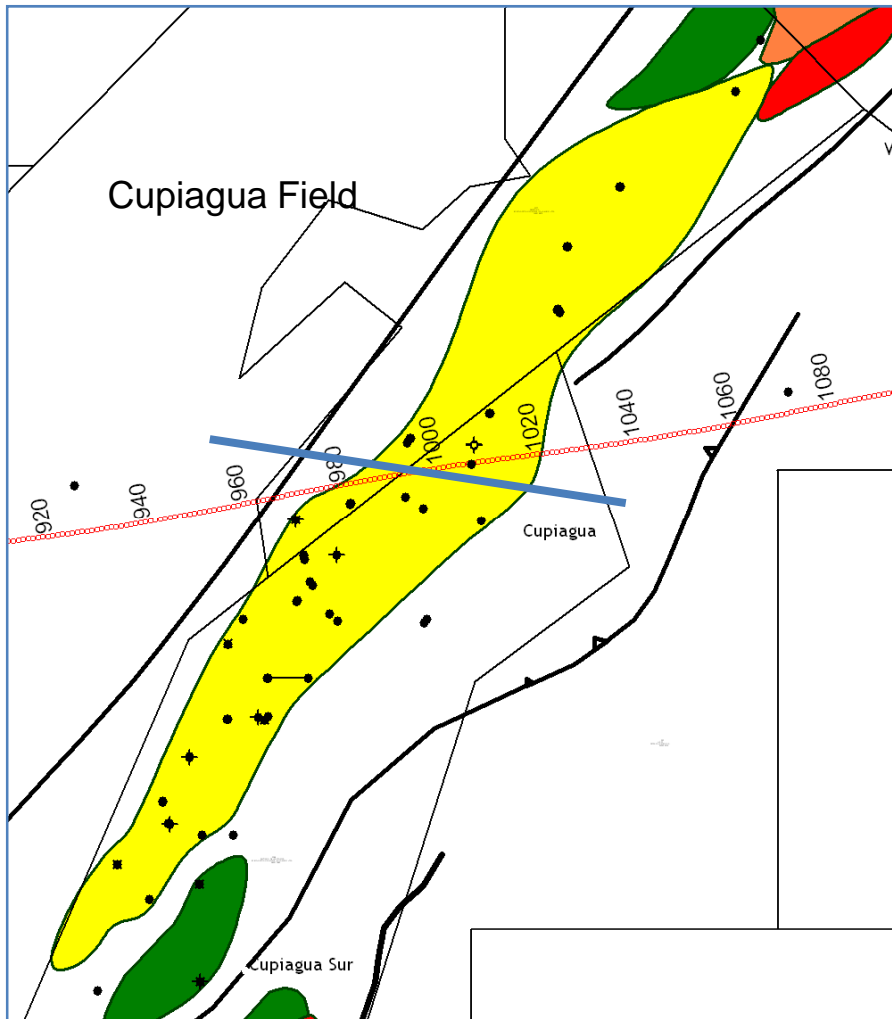
Cusiana Field





SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play



# Cupiagua Field

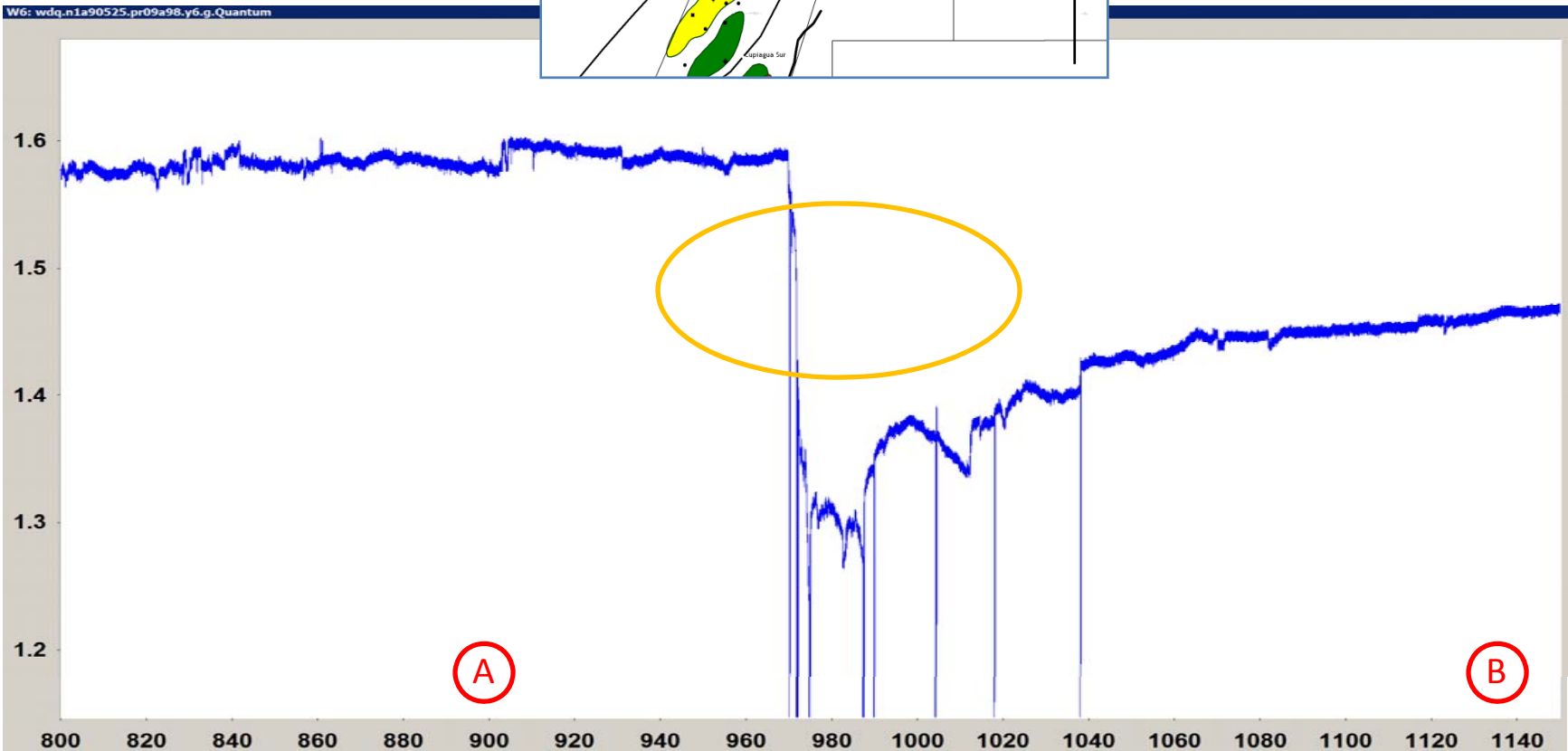
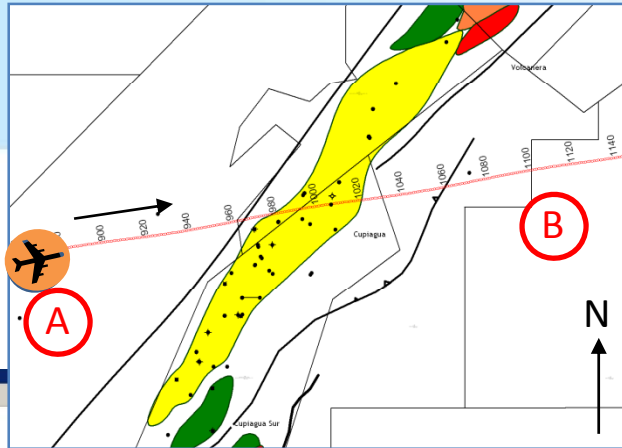


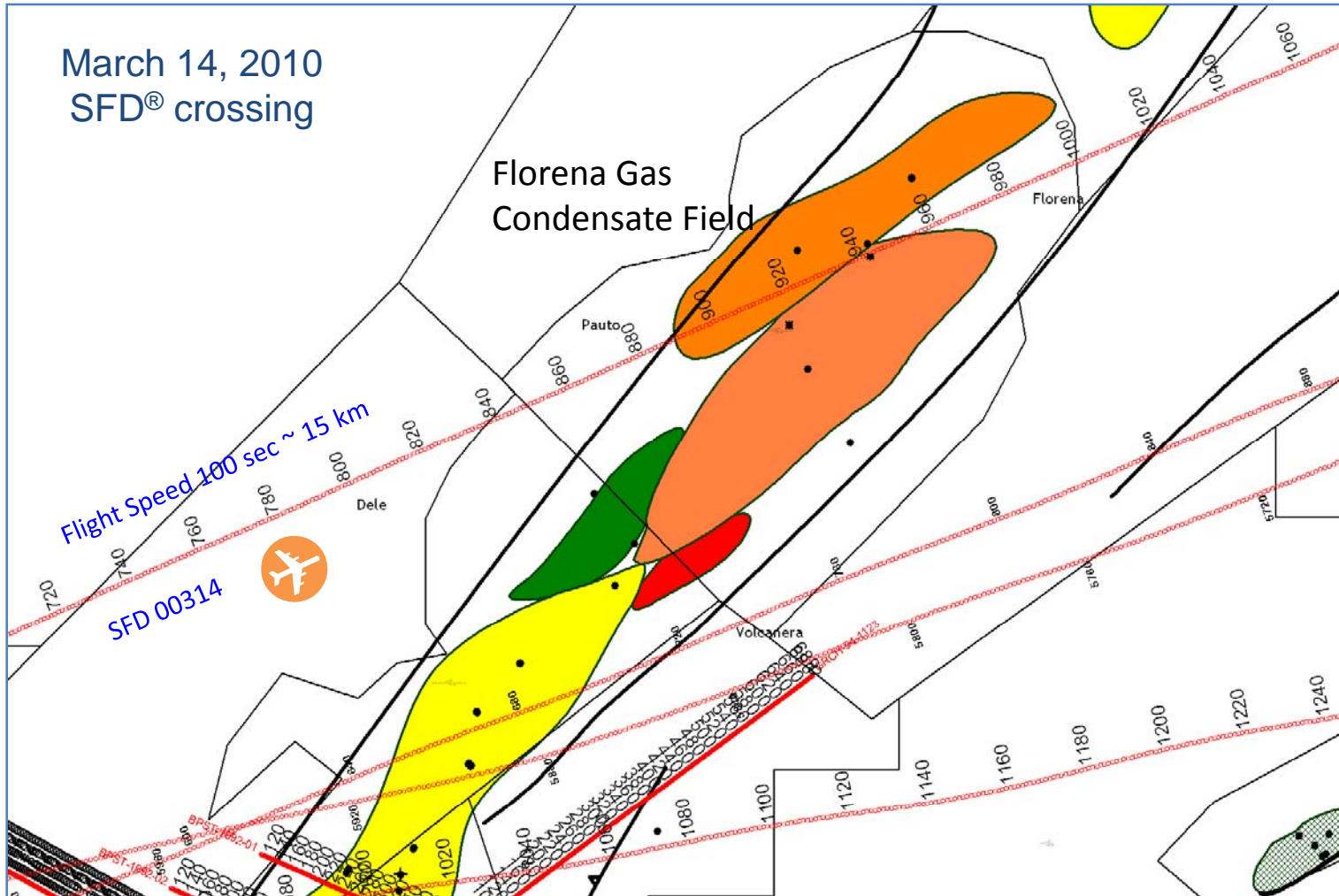
SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play



May 25, 2009  
SFD® signal over  
Cusiana field

Reservoir =   
Frequency change = FRQ = 

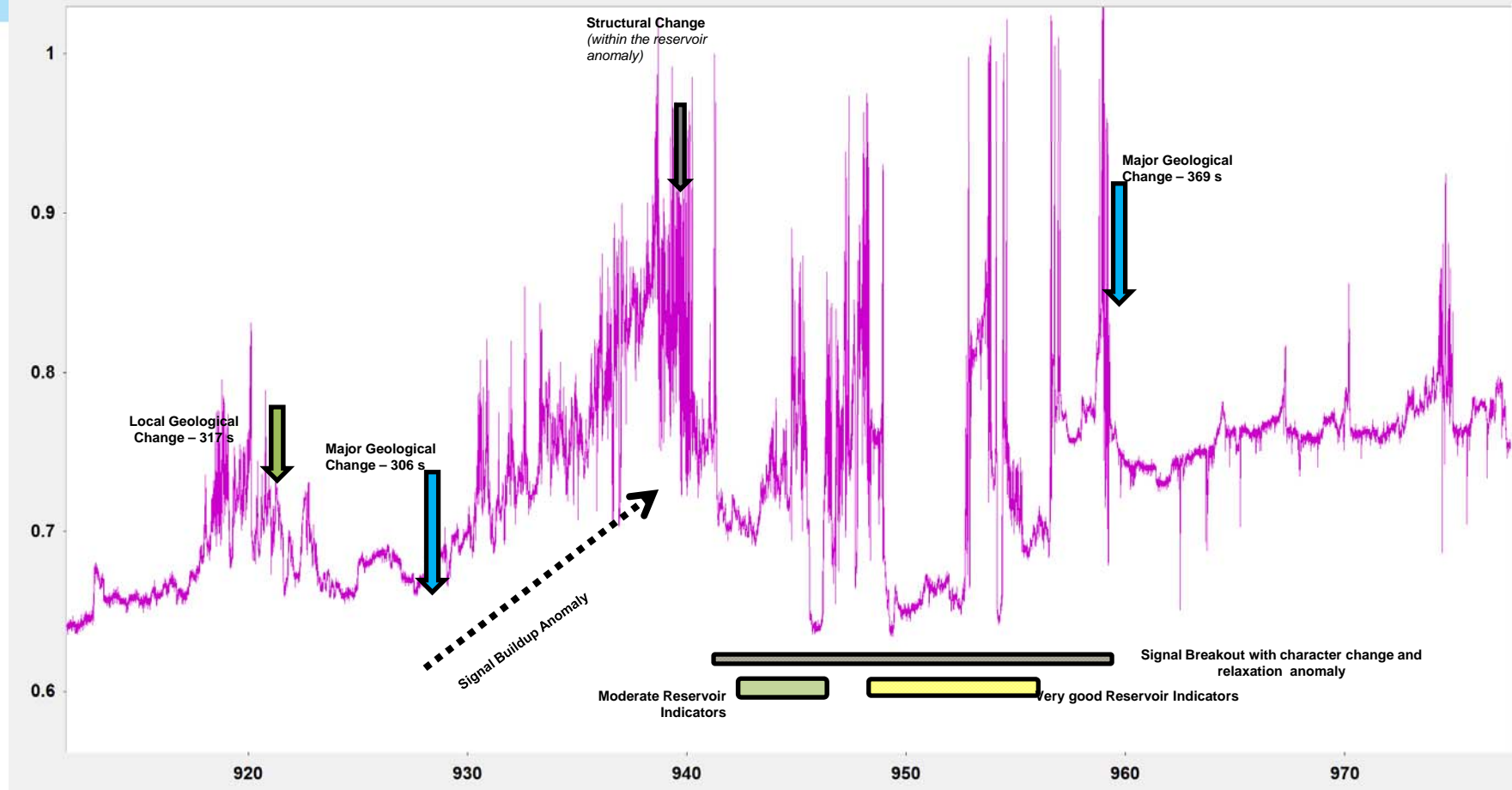




SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play

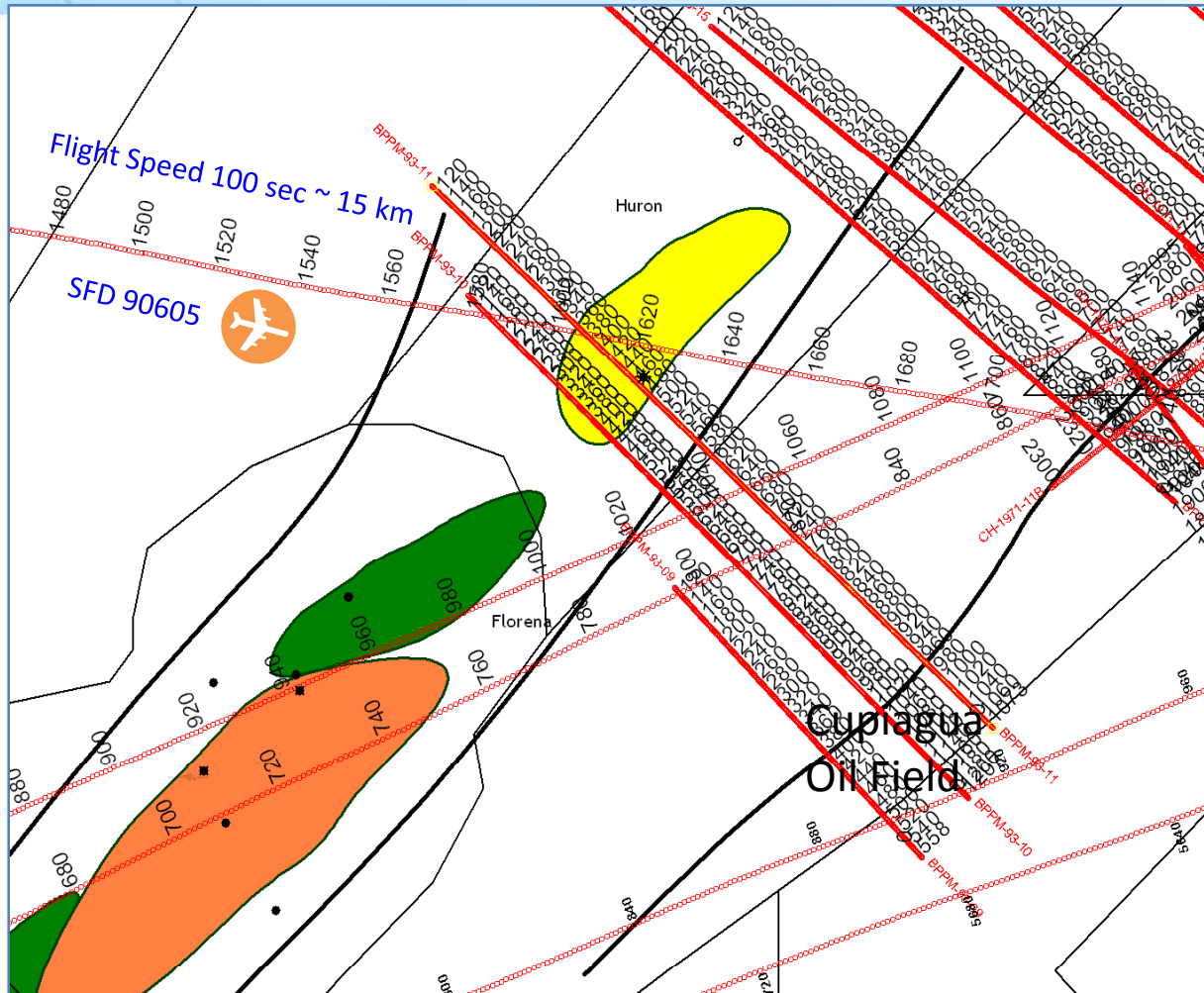


W7: qnx.n1a00314.ecp10a89.y7.g.String



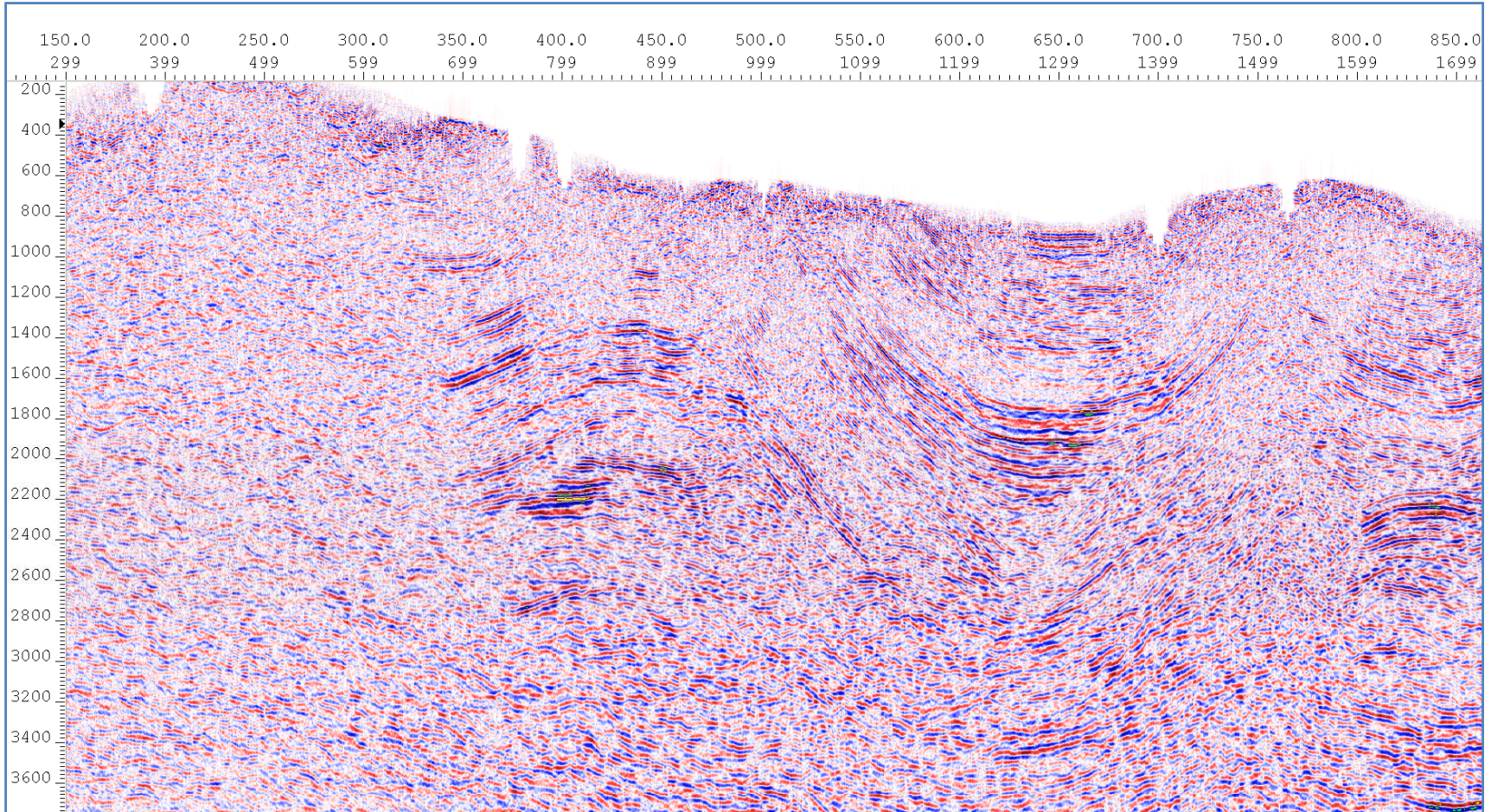
SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play

New Discovery - Huron



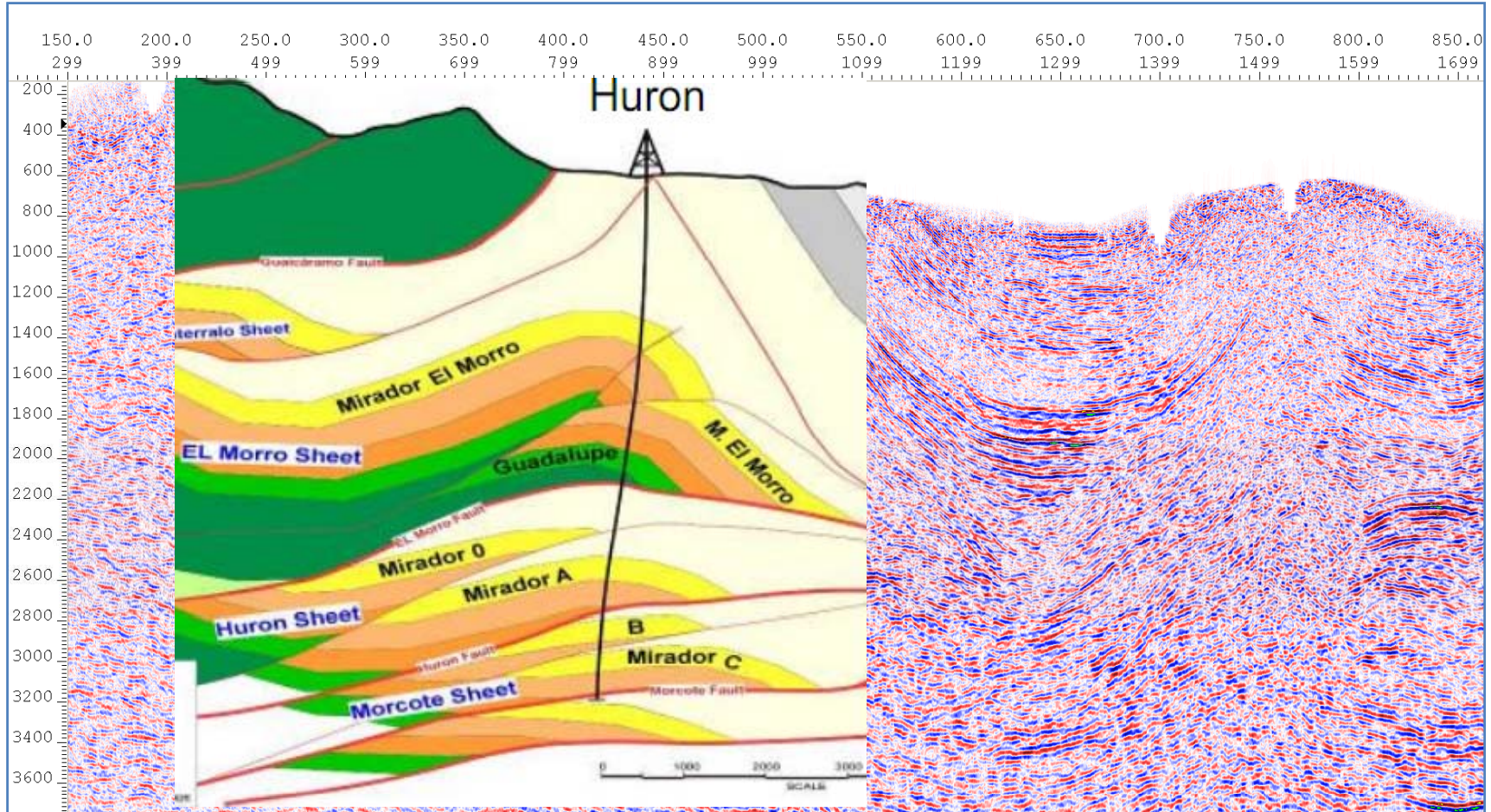
*SFD Case Example - Colombia*  
**Cusiana-Cupiagua Complex Structural Play**

Seismic Line across Huron Field



SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play

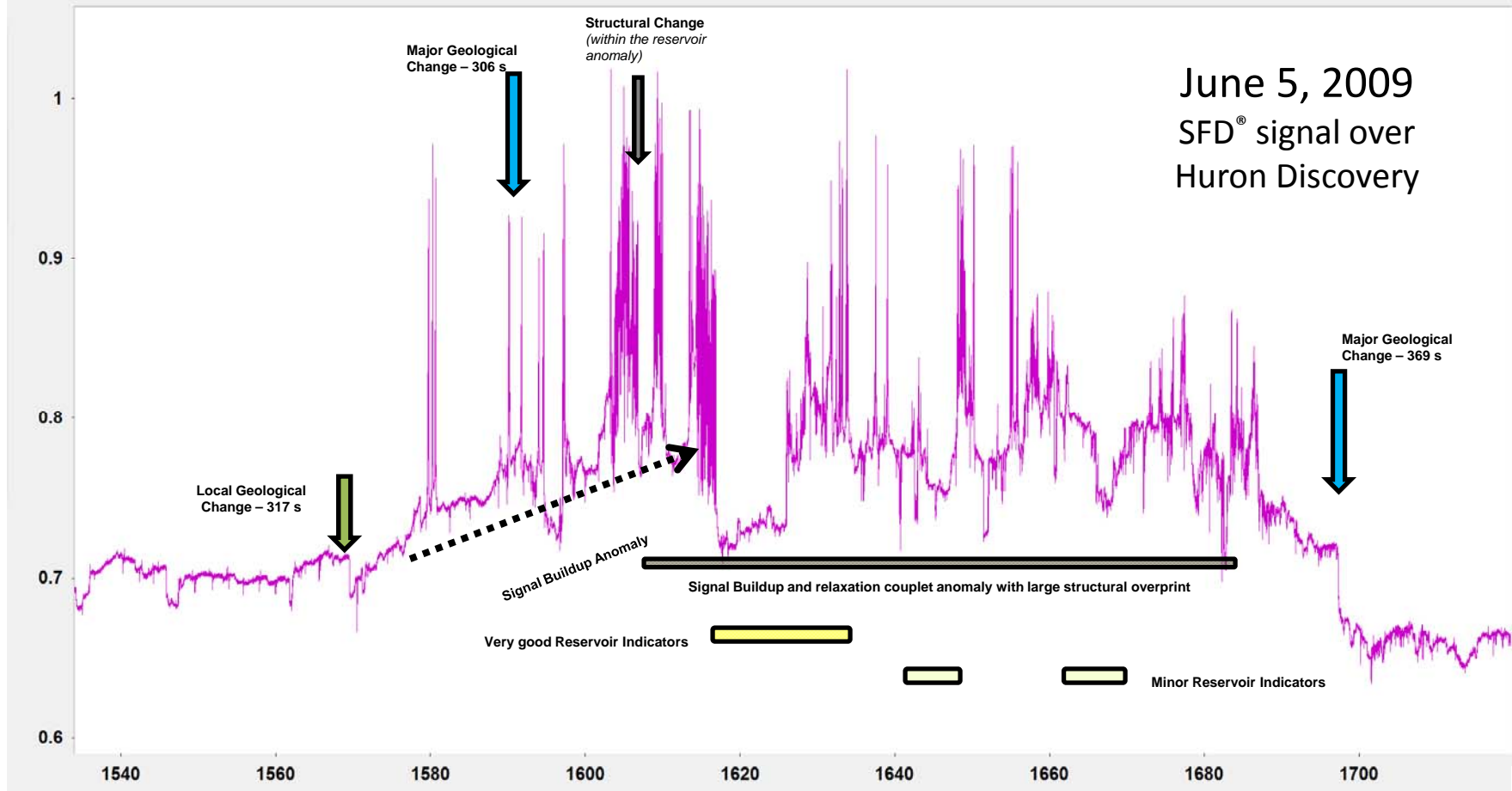
Seismic Line with Talisman interpretation



SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play



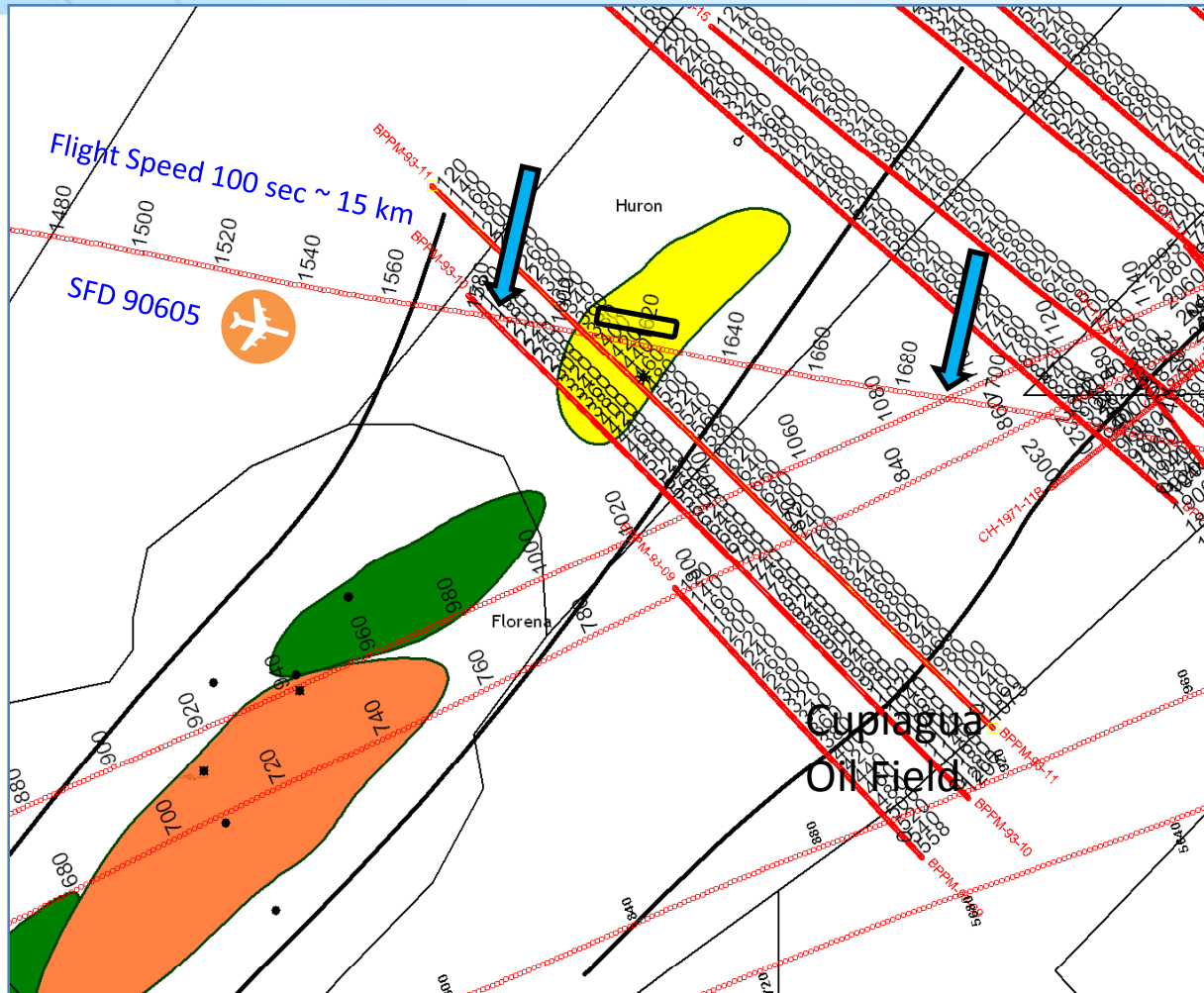
W7: qnx.n1a90605.pr09a51.y7.g.String





SFD Case Example - Colombia  
Cusiana-Cupiagua Complex Structural Play

New Discovery - Huron



### **Summary & Conclusions**

1. Cusiana-Cupiagua Complex is one of the largest oil and gas fields of Colombia
2. Other airborne systems do not show reservoir level indicators while SFD shows a consistent anomalous behaviour throughout all the crossings
3. High grade anomalies are over the areas with best traps as proven by production and well testing

*The Structural traps like Cusiana-Cupiagua are very high potential targets and SFD is able to show their trap potential without getting affected by the background structure which usually masks the signal of many other tools.*

# Thank you

