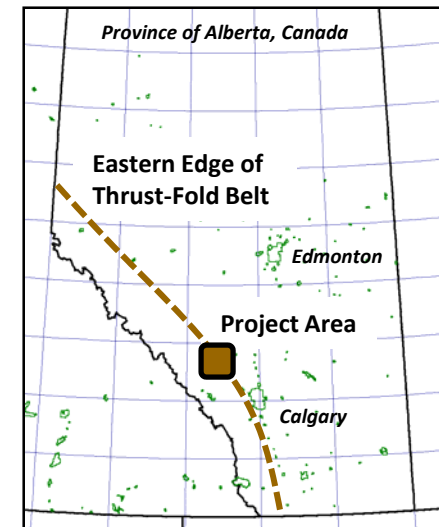


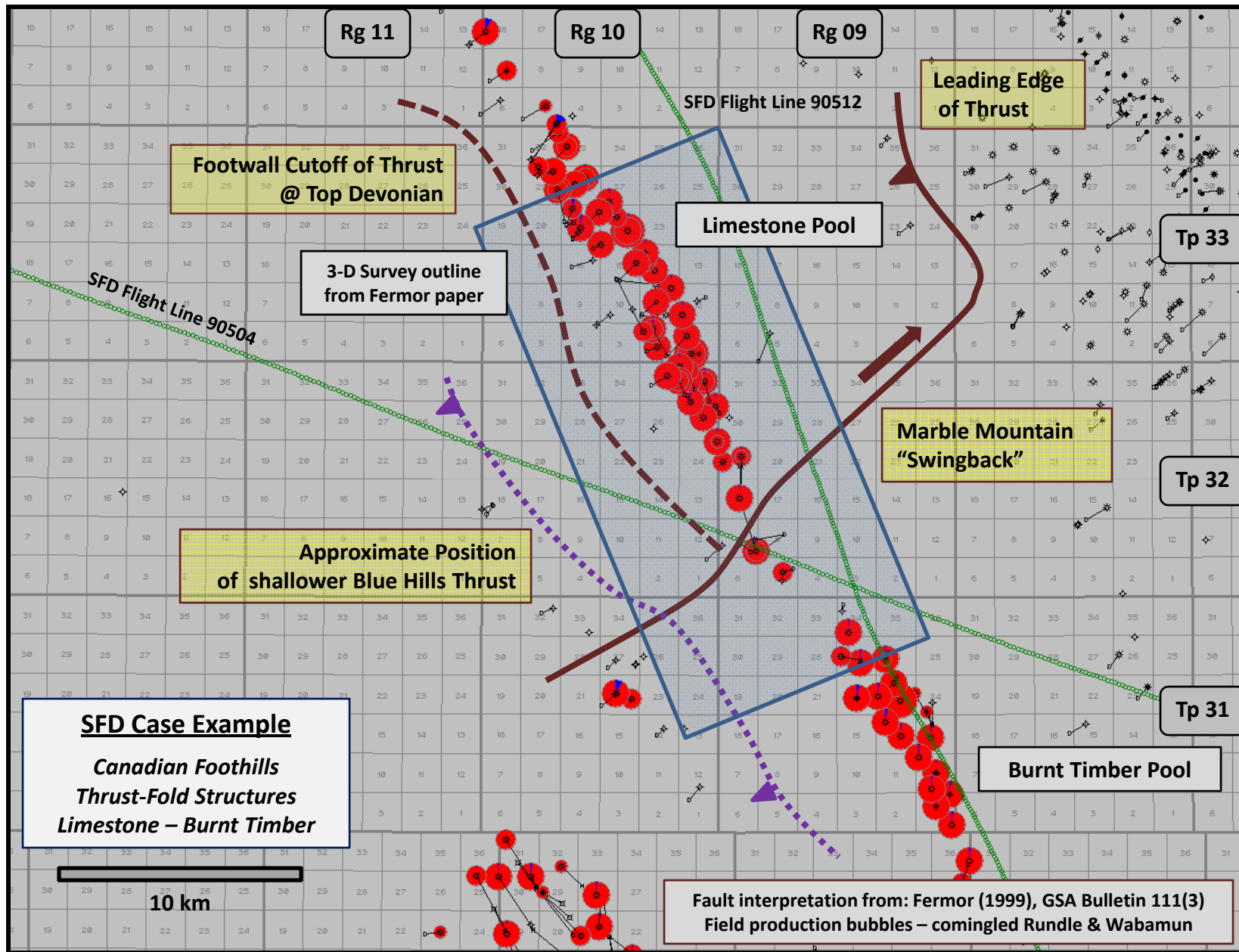
## **SFD Case Example: Thrust-Fold Belt Setting; Canadian Foothills - Limestone & Burnt Timber Fields**

*2009 SFD sensor R&D flight within the western Canada foothills belt provides the opportunity to examine signal detail, response and spatial accuracy over a well-documented thrust-fold structure.*



### **Geological Setting**

- **Reference:** Fermor (1999) “Aspects of the three-dimensional structure of the Alberta Foothills and Front Ranges.” GSA Bull. 111(3) pp.317-346.
- **Dip Section Trap:** Simple Hangingwall Rollover into Burnt Timber - Limestone (BTL)Thrust.
- **Strike Section Trap:** Complex and Abrupt Hangingwall Offset “Swingbacks”.
- **Reservoirs:** Mississippian and Devonian carbonates (*Rundle, Wabamun, Leduc*)
- **Reserves & Production:** Limestone Field: > 1.4 Tcf initial recoverable raw gas @ aggregate rates > 160 MMcfpd.
- **Depth to Reservoir:** 900 – 3,500 meters.



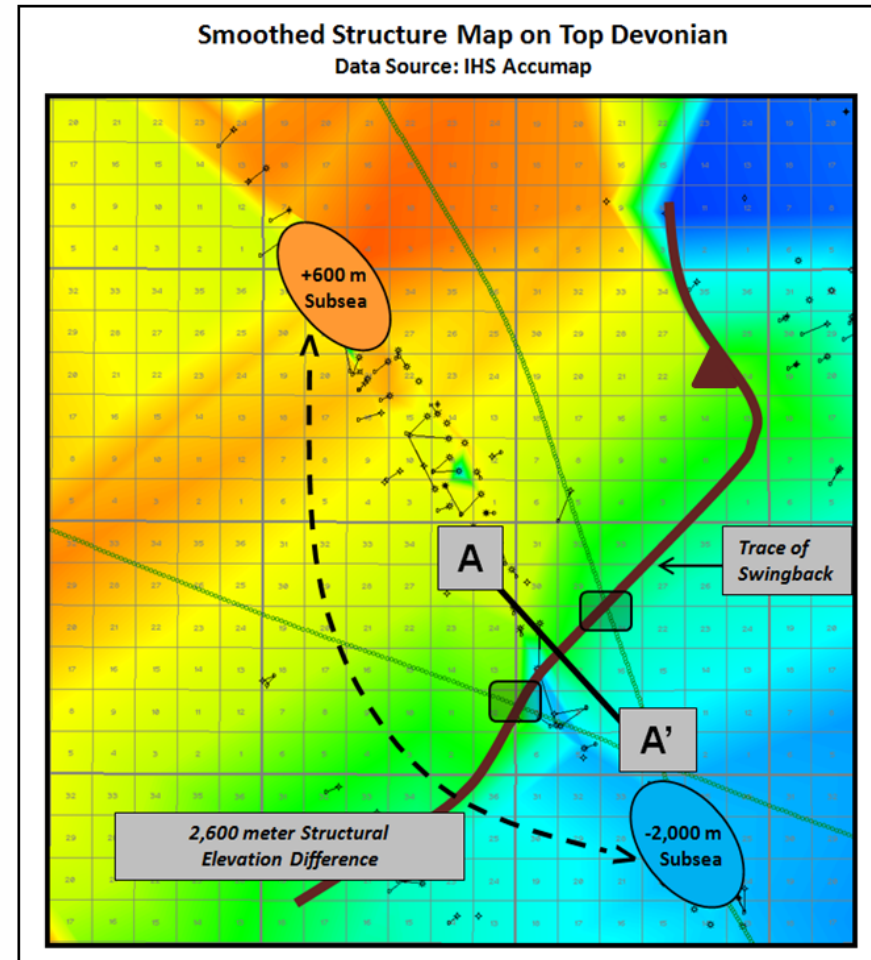
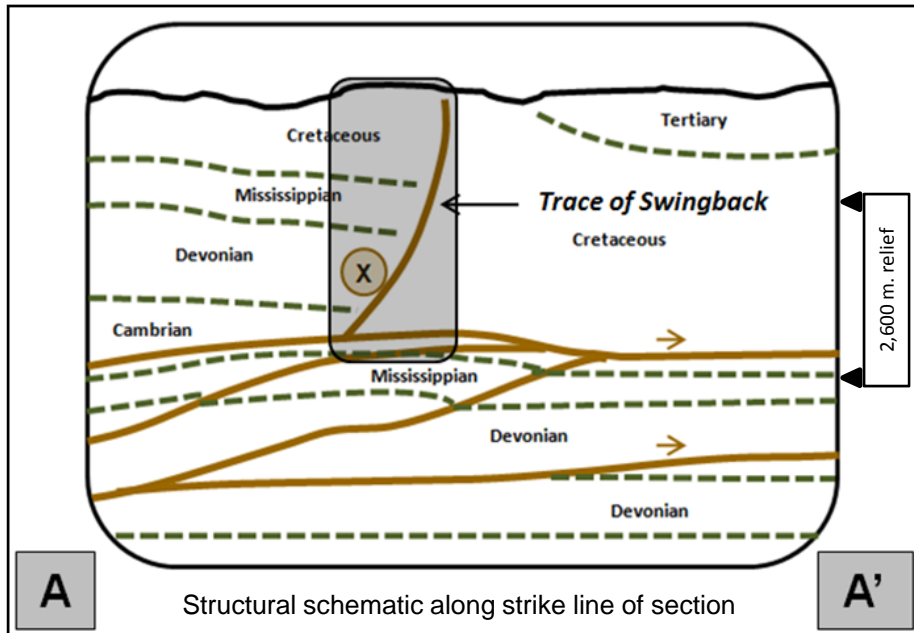
## SFD Case Example

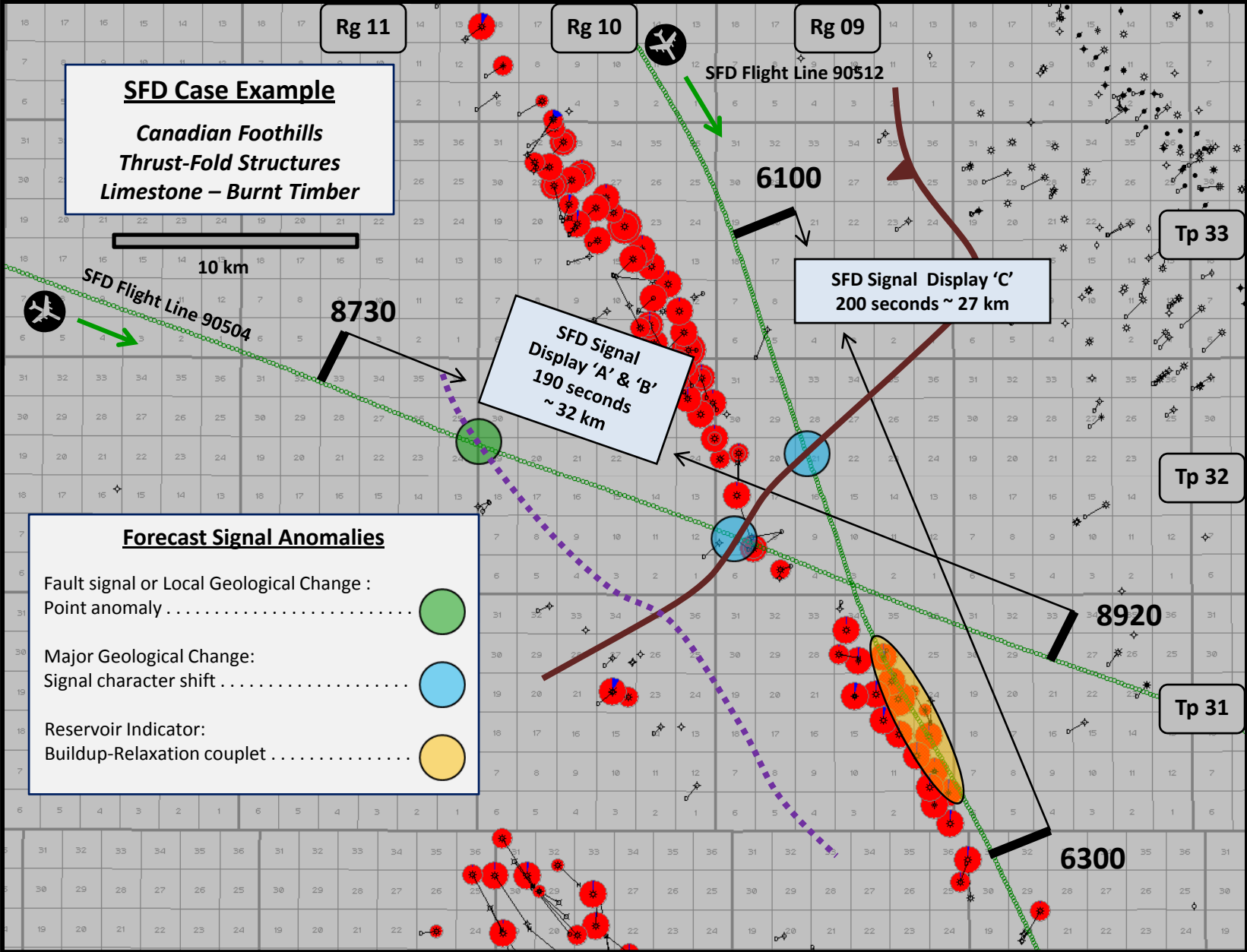
Canadian Foothills  
Thrust-Fold Structures  
Limestone – Burnt Timber

## Geological Model

Structure map and simplified schematic of the Burnt Timber – Limestone thrust swingback.

Stippled areas illustrate expected positions of strong sensor response.



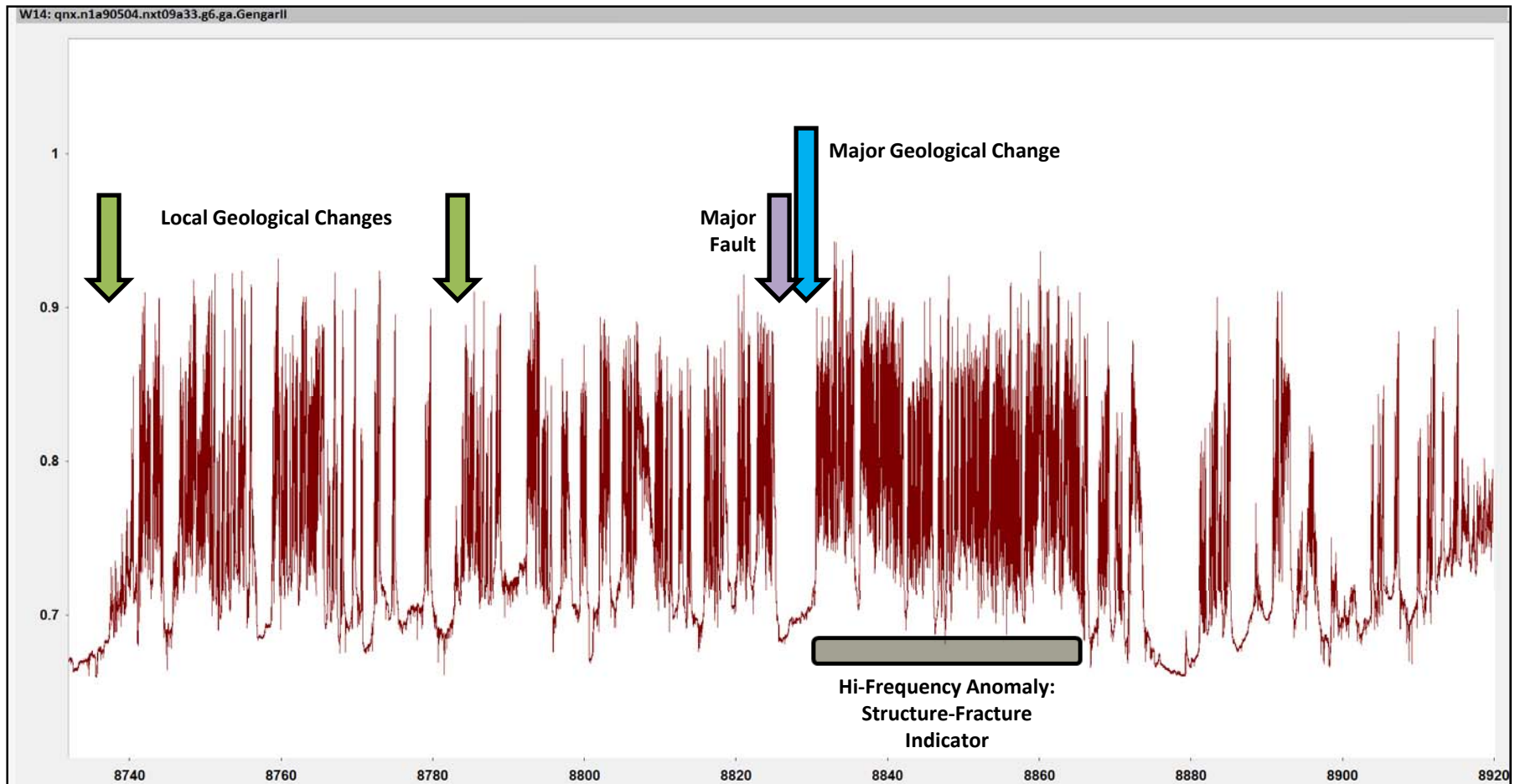


## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

## SFD Signal Display 'A' along Line 90504: 8730 - 8920 seconds.

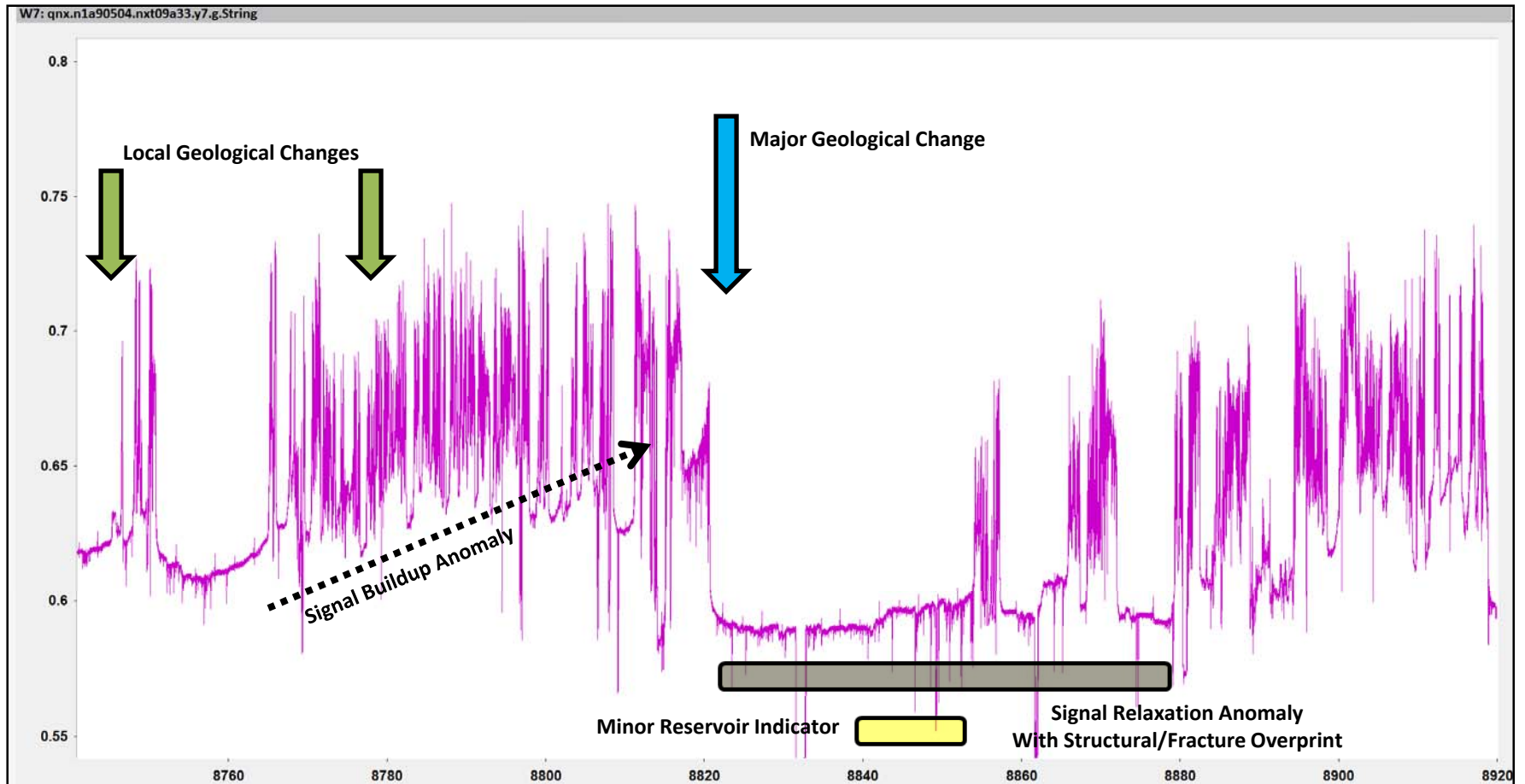


## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

### SFD Signal Display 'B' along Line 90504: 8740 - 8920 seconds.

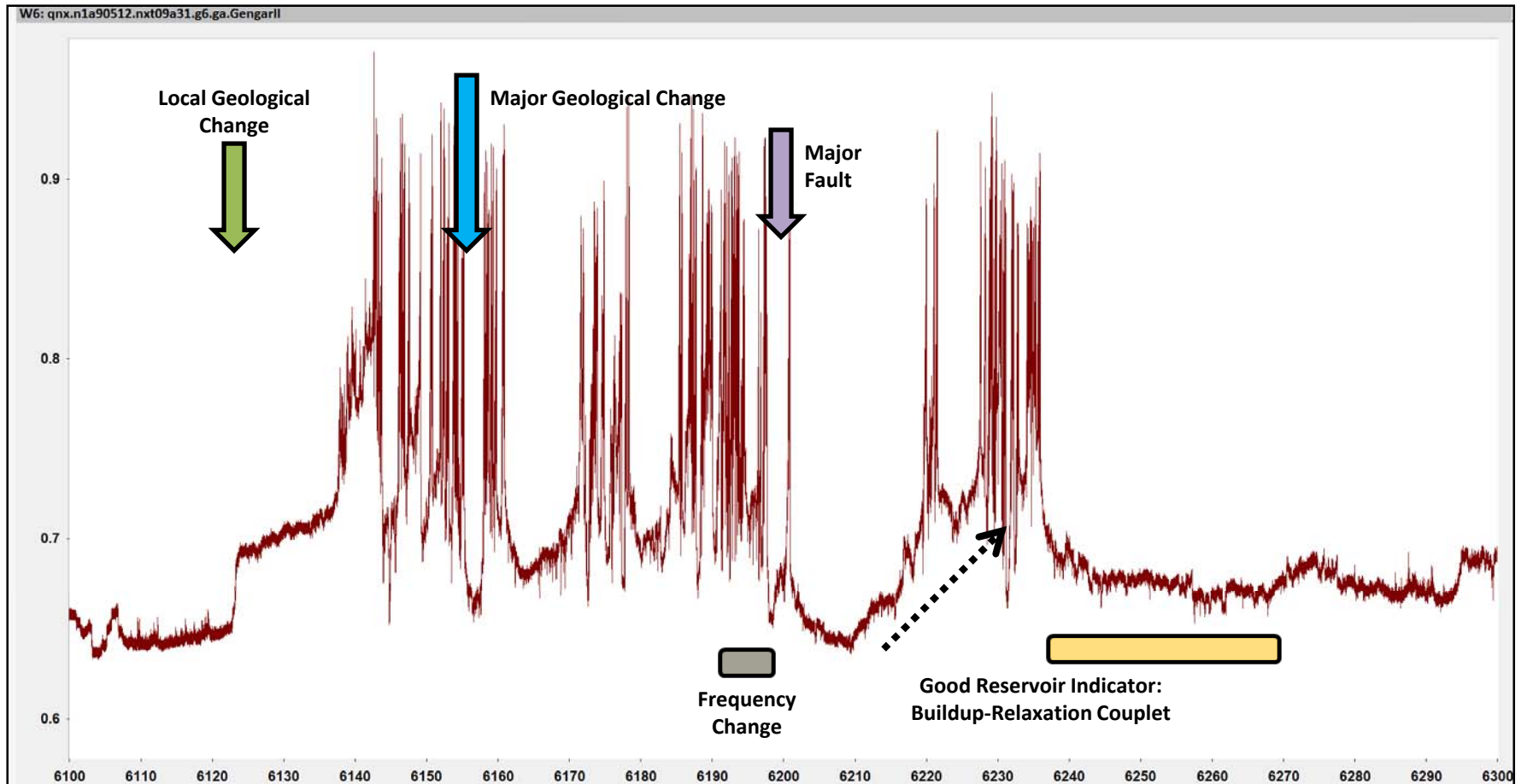


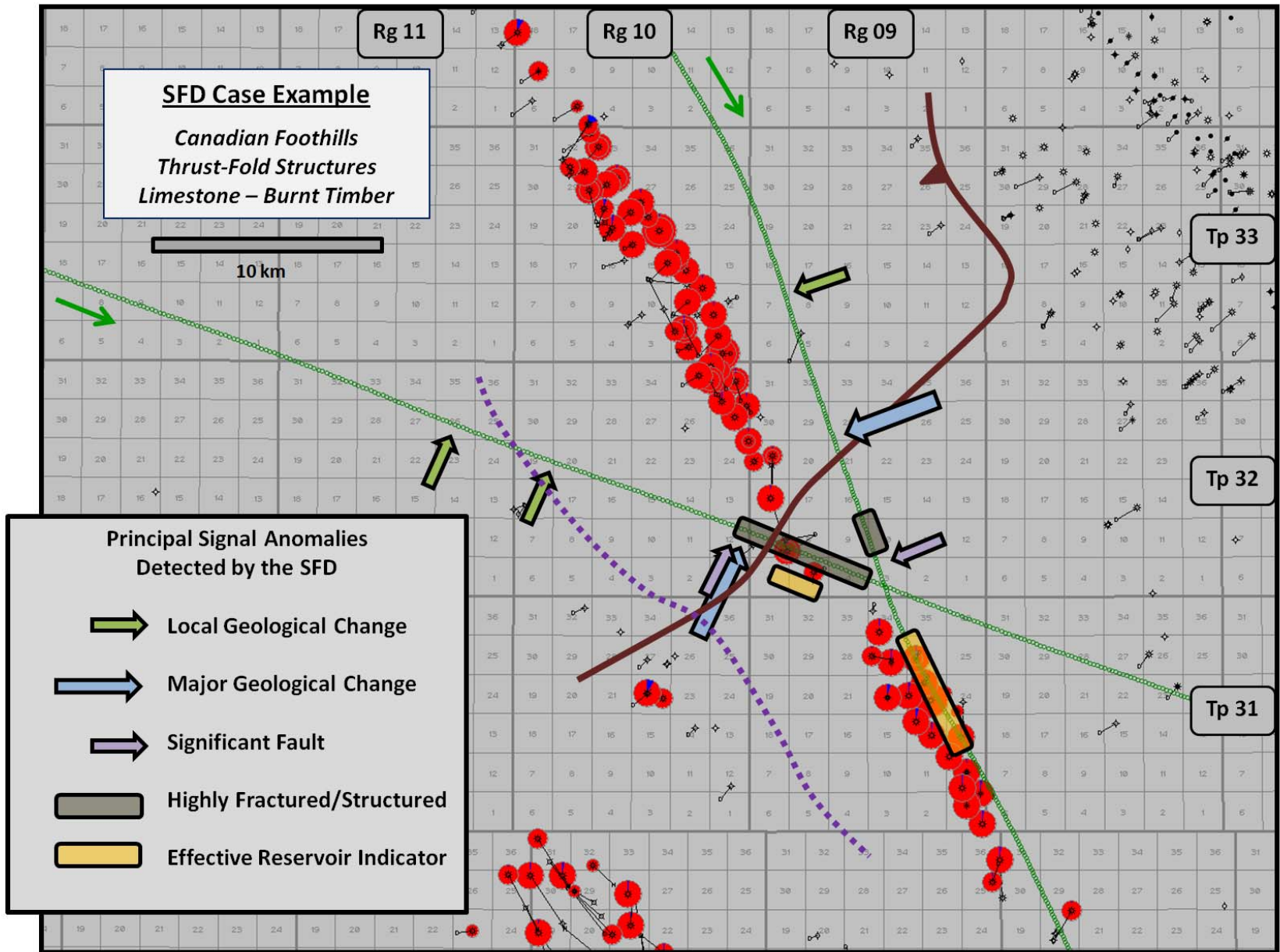
## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

### SFD Signal Display 'C' along Line 90512: 6100 - 6300 seconds.







## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

### Key Observations

- ✓ SFD detects and correctly locates the position of the swingback as a major **'geological change'** on both flight lines ( $\pm 0.5$  km).
- ✓ SFD correctly detects a significant **fault/fracture anomaly** in the vicinity of the swingback crossing (downthrown block) on both lines.
- ✓ SFD detects **major faults** at the start/finish of the swingback.
- ✓ SFD detects and correctly locates **porous reservoir** in the Burnt Timber pool (Line 90512  $\pm 0.25$  km).
- ✓ SFD detects **porous reservoir** at the south margin of the Limestone pool (Line 90504  $\pm 0.25$  km).
- ✓ SFD detects and correctly locates the **secondary thrust** (Line 90504  $\pm 1$  km).

### Conclusion

**The SFD survey provided excellent identification and spatial resolution of the major geologic boundaries/interface phenomena associated with the Burnt Timber – Limestone thrust complex.**

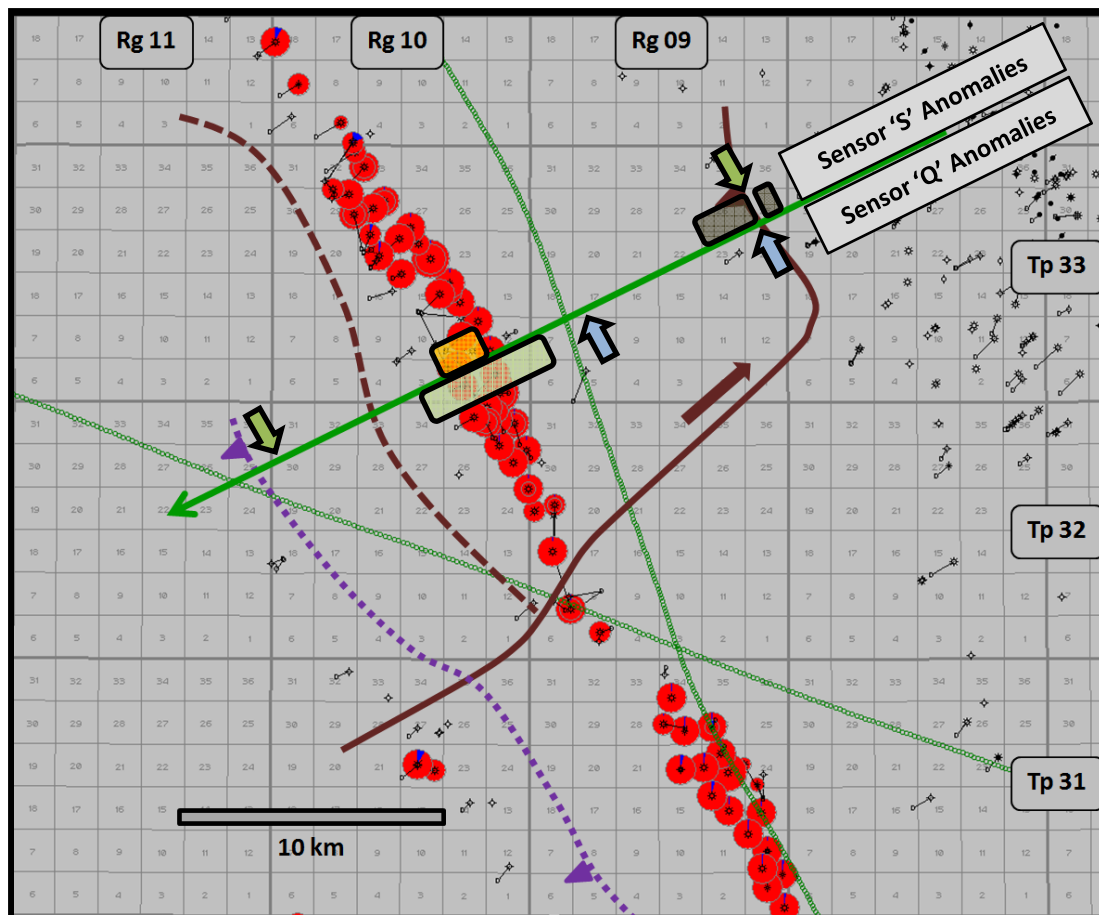
*Note: The correlation of SFD signal response to actual geologic features represents an informed technical opinion as prepared by the NXT interpretation team. These interpretations, while believed reasonable, are non-unique. Other correlations and interpretations are possible.*

## SFD Case Example






Canadian Foothills

Thrust-Fold Structures; Limestone – Burnt Timber

New SFD Survey Line 10427 Acquired April 2011



Location of principal SFD anomalies from sensors 'Q' and 'S' related to the Limestone – Burnt Timber complex.

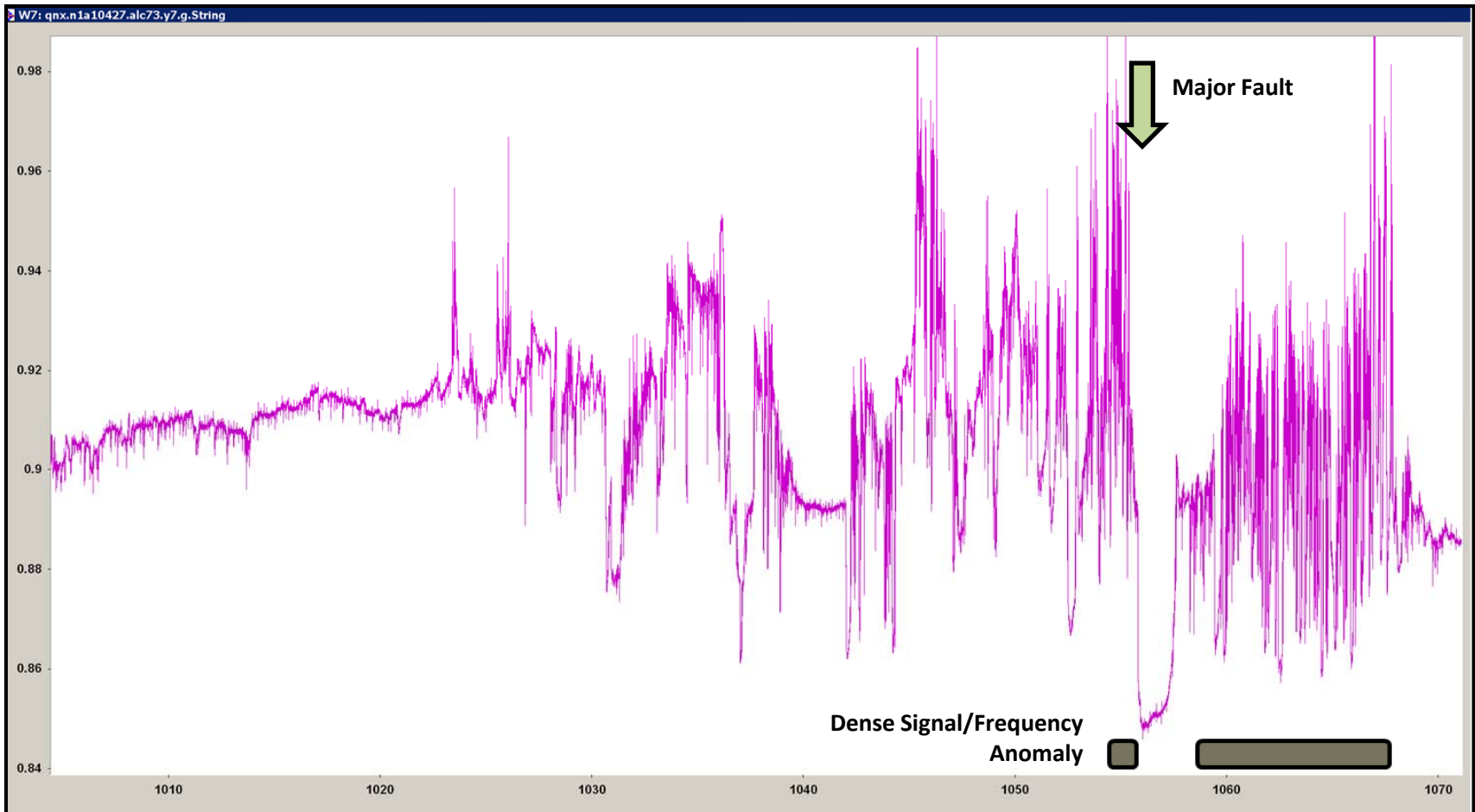
-   Major fault or geological change
-  Good reservoir indicator
-  Moderate reservoir indicator
-  Dense signal/frequency anomaly

## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

SFD Flight Line 10427; April 2011; Sensor 'S'; 1005 – 1070 seconds

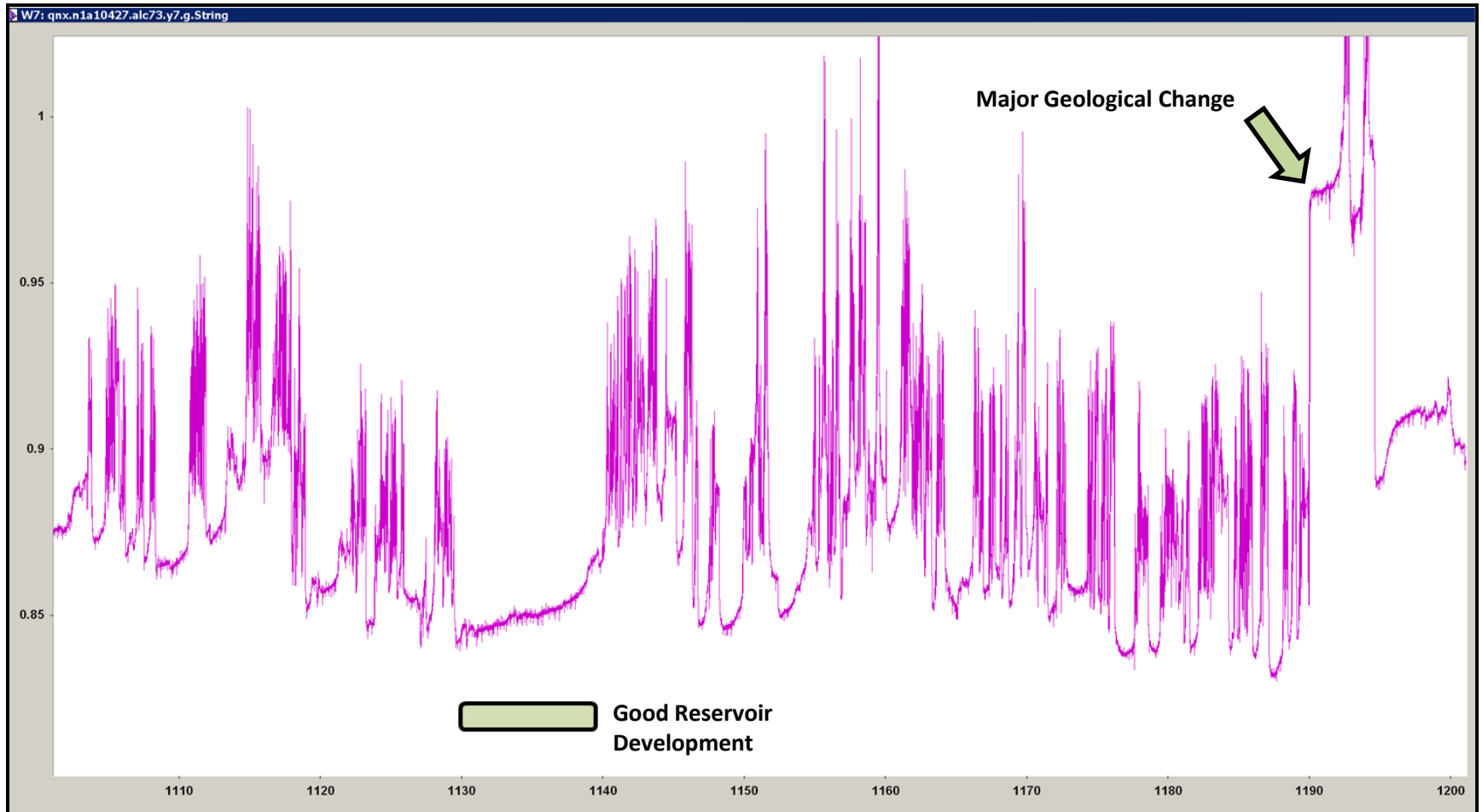


## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

SFD Flight Line 10427; April 2011; Sensor 'S'; 1100 – 1200 seconds

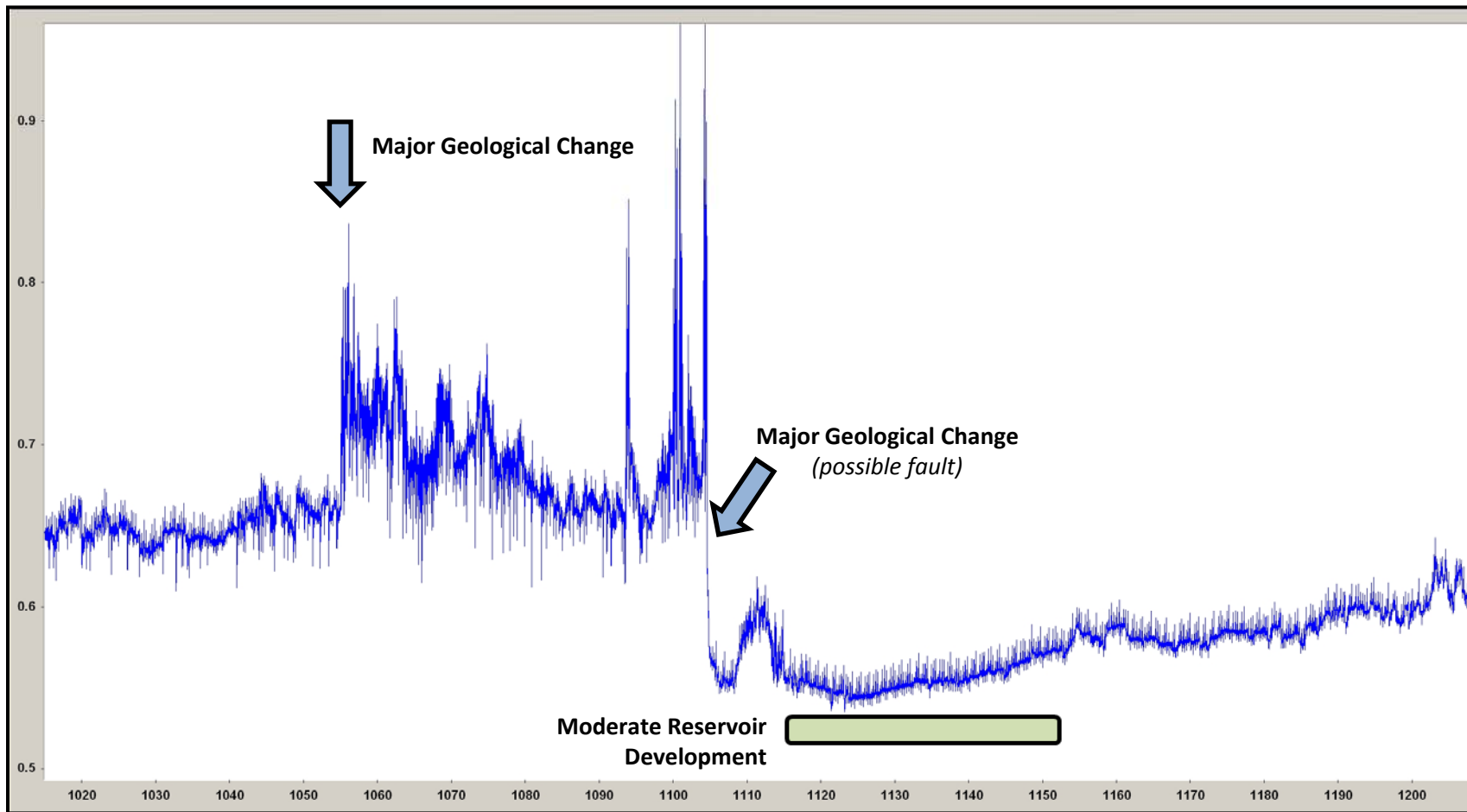


## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

SFD Flight Line 10427; April 2011; Sensor 'Q'; 1015 – 1210 seconds



## SFD Case Example

*Canadian Foothills*

*Thrust-Fold Structures; Limestone – Burnt Timber*

### Supplementary Observations

On the new (2011) line:

#### Sensor 'S'

- ✓ Correctly identifies and accurately positions the leading edge of the Limestone – Burnt Timber thrust
- ✓ Correctly identifies and locates the position of the Blue Hills thrust
- ✓ Detects a 'good' (geographically constrained) reservoir signal corresponding to the Limestone field production
- ✓ Detects a dense signal/frequency anomaly adjacent to the leading edge of the Limestone – Burnt Timber thrust

#### Sensor 'Q'

- ✓ Correctly identifies and positions the leading edge of the Limestone – Burnt Timber thrust as a major geologic change
- ✓ Detects a fault or major geologic change anomaly at the leading edge of the Limestone field reservoir signal
- ✓ Detects a 'moderate' (geographically lapped) reservoir signal corresponding to the Limestone field production

*Note: The correlation of SFD signal response to actual geologic features represents an informed technical opinion as prepared by the NXT interpretation team. These interpretations, while believed reasonable, are non-unique. Other correlations and interpretations are possible.*