

Upper Bow Spring Centralizer

Collar Locator

Gamma Ray & Telemetry

Transmitter

2ft Radial Receivers (8 or 6)

3ft Receiver

5ft Receiver

Lower Bow Spring Centralizer

CBL: Cement Bond Log (GR-CCL, 3' & 5' Receivers)
RBL: Radial Bond Log (CBL + 2' Radial Receivers)

Factors Influencing Amplitude Measurements

1. Tool not centralized
Reduces amplitude, cement appears better than in actuality
2. Insufficient cementing curing time
Higher amplitude than real may result a pessimistic interp
3. Gas bubbles in borehole fluid
Will decrease acoustic signal
4. Gas bubbles in annulus or void space in cement sheath
Causes amplitudes to read higher than actual free pipe signal
5. Changes in pipe thickness
Will cause different min/max amplitude values
6. Light weight cement
Higher amplitude
7. Micro-annulus
Increases amplitudes
8. Fast formation
Questionable amplitude can appear quite high, may look like partial bond. First arrival on VDL is faster due to Carbonate rock
9. Bonded to pipe, not to formation
Low pipe amplitude but poor cement integrity
10. Cement sheath < 3/4" (2 cm)
Will increase amplitude.

No bond to pipe

High consistent 3' amplitude

3' TOA tracks casing arrivals

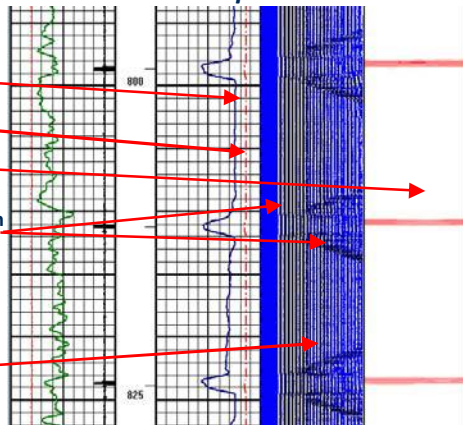
High radial amplitudes

Pipe arrivals "train tracks" with "chevrons located in VDL"

No bond to formation

No formation waves in VDL

Free Pipe



Good Bond to Pipe and Formation

Low 3' amplitude

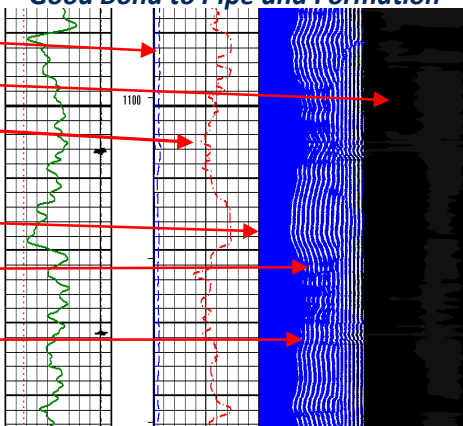
Low radial amplitudes

Late inconsistent travel time tracks lithology

No pipe arrivals in VDL

Good formation waves in VDL follows lithology

Collars not clearly visible in VDL



Good Bond to Pipe & Poor Bond to Formation

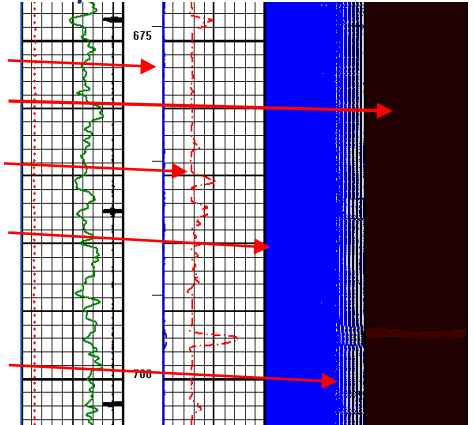
Low 3' amplitude

Low radial amplitudes

Late inconsistent 3' travel time (can be off scale)

No pipe arrivals in VDL

Only mud waves, little to no formation arrivals in VDL

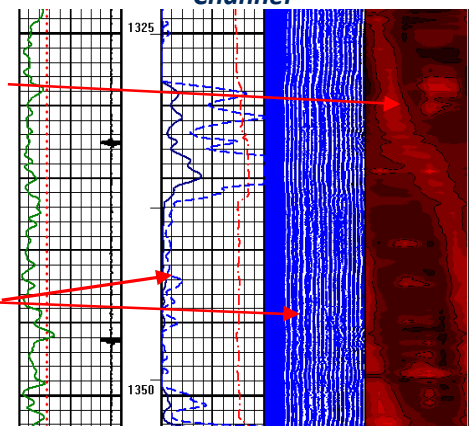


Channel

Mapping of 2' radial readings identify channel

Channel may appear as spiral due to tool rotation

Channel may not be identified from 3' amplitude or VDL



Light Weight Cement

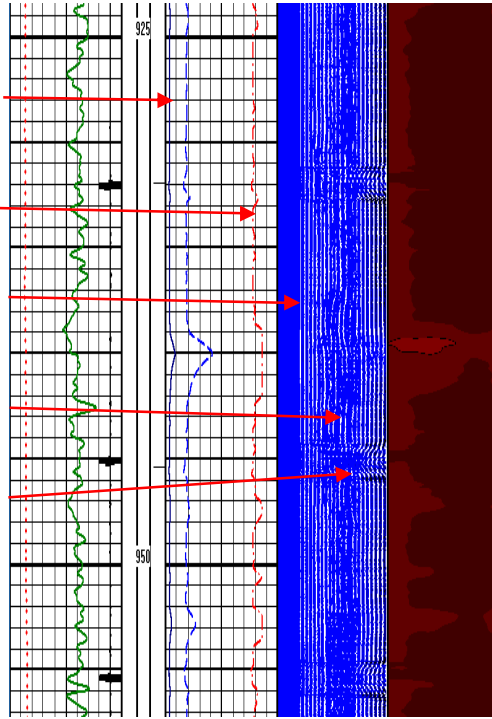
Higher "flat-line" of new 100% bond 3' amplitude (up to +/-10 mv)

Travel time (TOA) is flat and tracks casing arrivals

Pipe signals not fully attenuated and shown in VDL

Formation waves weak or not present

No Chevrons. "Straight" collars under good bond



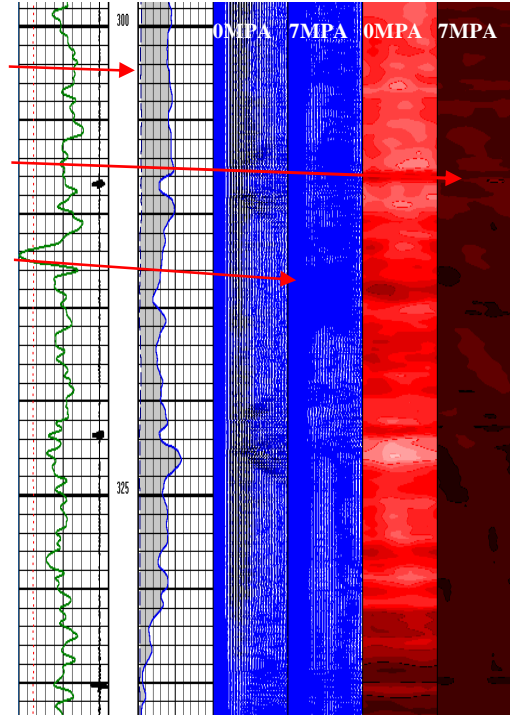
Light Weight Cement has less compressive strength, doesn't fully attenuate pipe signal, so VDL and Travel Time will show pipe arrivals. A higher 100% bond baseline for Bond Index interpretation.

Micro Annulus

Lower 3' amplitude under pressure

Lower radial amplitudes under pressure

Loss of pipe arrivals in VDL under pressure



Micro annulus is the small gap between the pipe and cement sheath. To test it, log the pipe under pressure to see reduction of 3' and radial amplitudes and improved VDL (compared to OMPA). The presence of a micro annulus indicates cement present.

Fast Formation

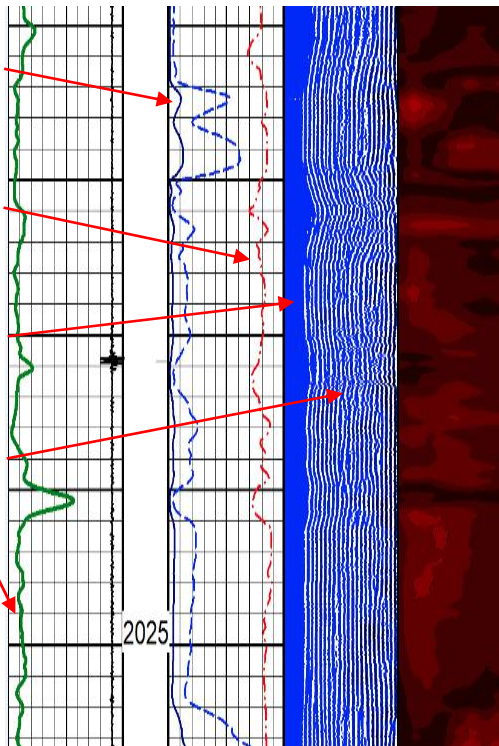
Amplitude can look like partial or poor bond

Travel Time (TOA) earlier the pipe arrival time

Earlier arrival time in VDL

Wavy VDL no Chevrons

Typically low GR indicating carbonate rock

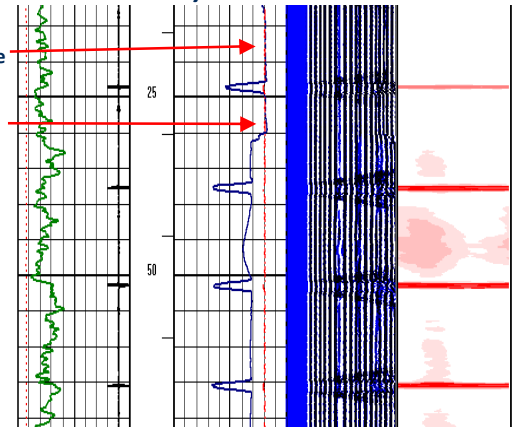


Formation arrivals appear like pipe signals. To identify Fast Formation look for earlier arrivals on Travel Time and VDL, wavy VDL without Chevrons.

Gas /Air in Annulus

Higher 3' amplitude reads higher than actual free pipe signal

Fluid level behind casing



Gas/Air in Wellbore

Lower 3' amplitude and radial amplitudes

"Broken" VDL due to inconsistent fluid

Higher amplitude (and improved VDL) under pressure

