

# **Ground Penetrating Radar (GPR) Expression of Sedimentary Deposits Produced by Channel Cutoffs and Meander Straightening at Killian's Cove, Catawba River, North Carolina**

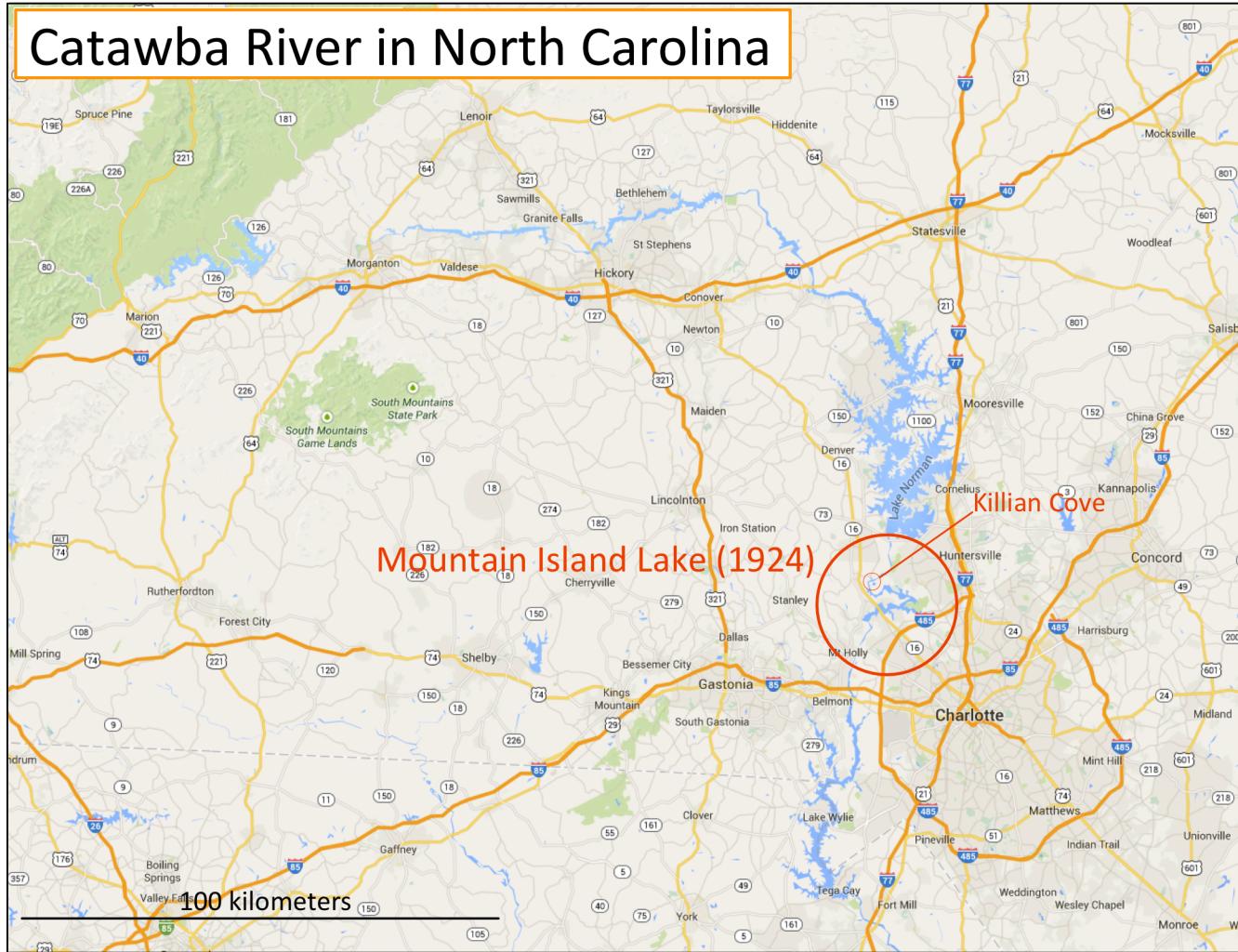
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# Preliminary Comments

- Investigation of the origin and evolution of a highly sinuous meander pair in the Catawba River channel to form the “Meck Neck”.
- Sloughs were produced in flooded meander scars left by meander cutoffs when reservoirs flooded those scars. These are in “coves”.
- Radar stratigraphy can inform the interpretation of the physical stratigraphic evidence for meander cutoffs and channel migration.

# Catawba River in North Carolina



## GPR Profiles in Killian Cove

Composite longitudinal profile and transverse profiles.



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An aerial photograph of Killian Cove, showing a dense forested area on the left and a coastal or riverine area with brownish sediment on the right. Three types of GPR profiles are overlaid on the image:

- Longitudinal Profile**: A red line that starts at the bottom left, dips slightly, and then rises towards the top right.
- Stratigraphic Profile**: A green line that follows a similar path to the longitudinal profile but stays closer to the surface.
- Transverse GPR Profiles**: Four vertical blue lines representing cross-sectional surveys taken perpendicular to the main profiles.

Google earth

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N

300 ft

# Radar Stratigraphy

- Radar stratigraphy<seismic stratigraphy<physical stratigraphy
- Radar facies – mappable sedimentary unit whose radar characteristics define the unit and that may infer depositional environment.
- GPR reflection properties may be non-unique predictors of sedimentary environments.

# GPR Collection and Processing

- GSSI-3000 system with 100 MHz monostatic antenna
- 300/75 MHz low/high pass collection filters
- Vertical spikes = loose connector
- Full pass FIR background removal
- No migration
- Display relative permittivity 8 (probably low)
- Maximum depth of core samples in Killian Cove is about 4 meters.
- GPR depth of penetration observed  $\sim 7.5$  m (theoretical  $\sim 5$  m in sandy soil at  $\epsilon_r = 15$ )

# GPR Collection and Processing

- Theoretical vertical resolutions (m) at 100 MHz: saturated sand 0.15-0.3, damp sand 0.25-0.5, dry sand 0.375-0.75.
- Theoretical horizontal resolutions (m) (sandy soil at  $\epsilon_r = 15$ ) at 100 MHz: 0.5 at 1 meter depth, 1.5 at 5 meter depth.

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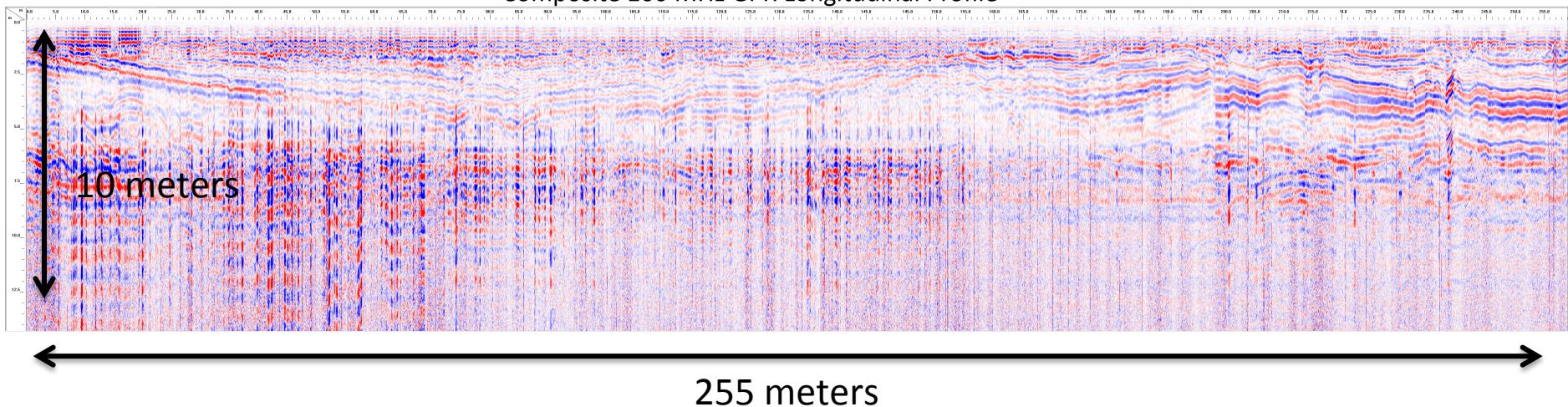
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300 ft

West

East

Composite 100 MHz GPR Longitudinal Profile

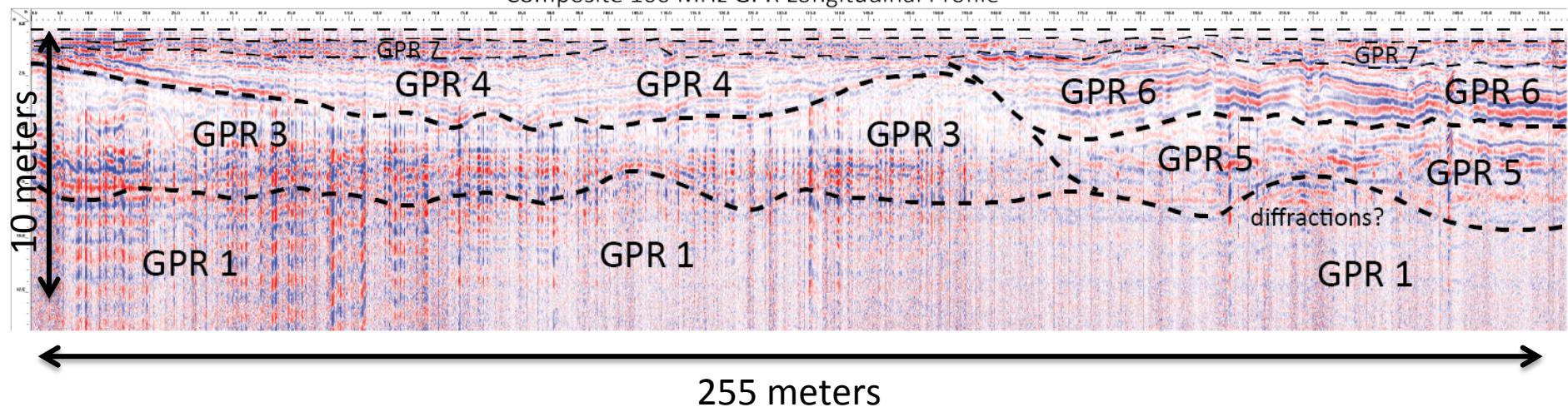


GPR Facies	Characteristics	Interpretation
8	High amplitude, thin banding, sub-horizontal to undulating laterally continuous reflections. Upper boundary is ground wave. Drapes facies 4, 6 and 7.	Vertical accretion deposits on the modern floodplain.
7	Very high amplitude, thin banding, inclined to south (river). Onlaps GPR facies 6 to north (cove).	Lateral accretion deposits of FU3 on the northern margin of the modern Catawba River.
6	Medium thick banding with very strong amplitude, dipping to the east. On west lower boundary is truncation onlap over GPR Facies 3.	Upper point bar and channel fill deposits of FU2 composed of sandy material.
5	Medium thick banding with strong amplitudes, mostly horizontal although the reflections rise to the west and onlap a truncation surface onto GPR Facies 2. Reflections locally convex up (possible diffractions).	Base of point bar deposit FU2 composed of sand with possible cobbles as a channel lag. Western margin is possible cut-bank for channel.
4	Thin bands with strong amplitudes that occupy flat-topped lenticular deposits and tapers to the west and east. Upward decreasing amplitudes possibly due to water content.	Channel fill at top of FU1.
3	Low frequency, undulating reflections with medium to strong amplitudes, dipping to the east.	Upper point bar of FU1 with lateral accretion surfaces dipping to east. May be composed of medium to fine sands.
2	Strong amplitudes, thick banding, mostly horizontal, locally convex up (diffractions).	Base of point bar deposit FU1 composed of sand with possible cobbles as a channel lag.
1	Poorly defined, bright upper bounding surface, weak to non-existent internal reflections.	Bedrock/saprolite.

West

East

Composite 100 MHz GPR Longitudinal Profile



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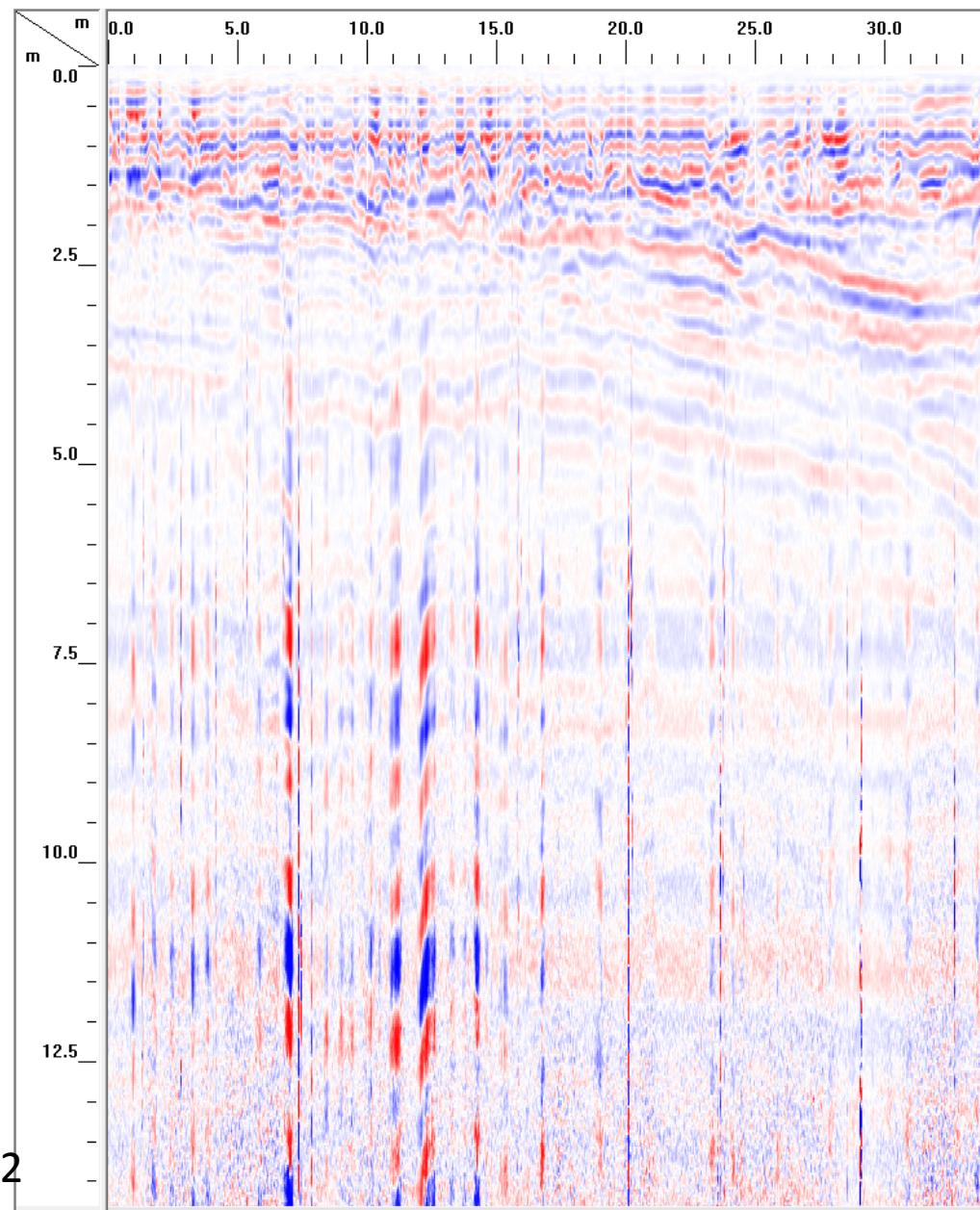
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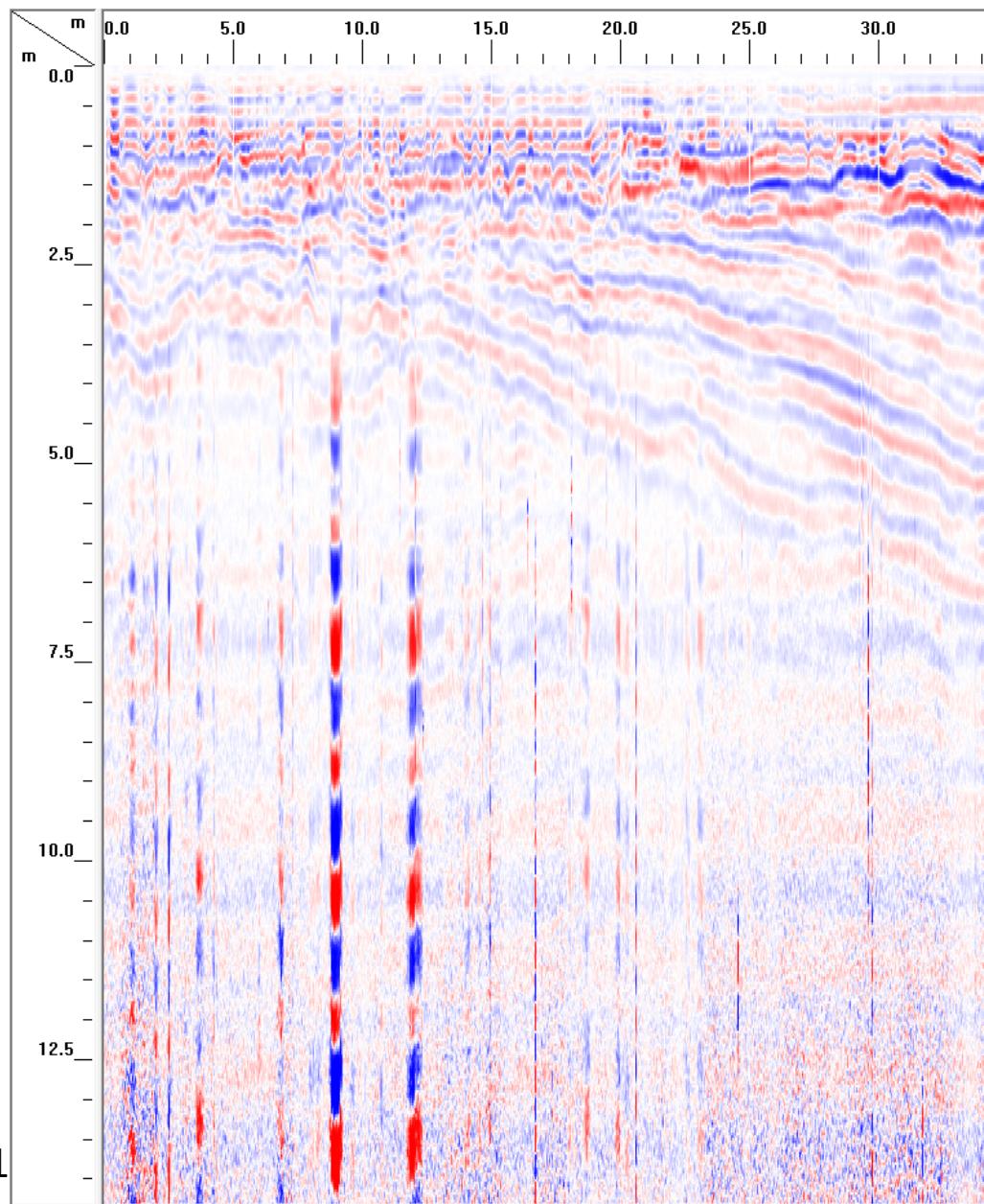
300 ft

# 100 MHz Transverse Profile, Killian Cove



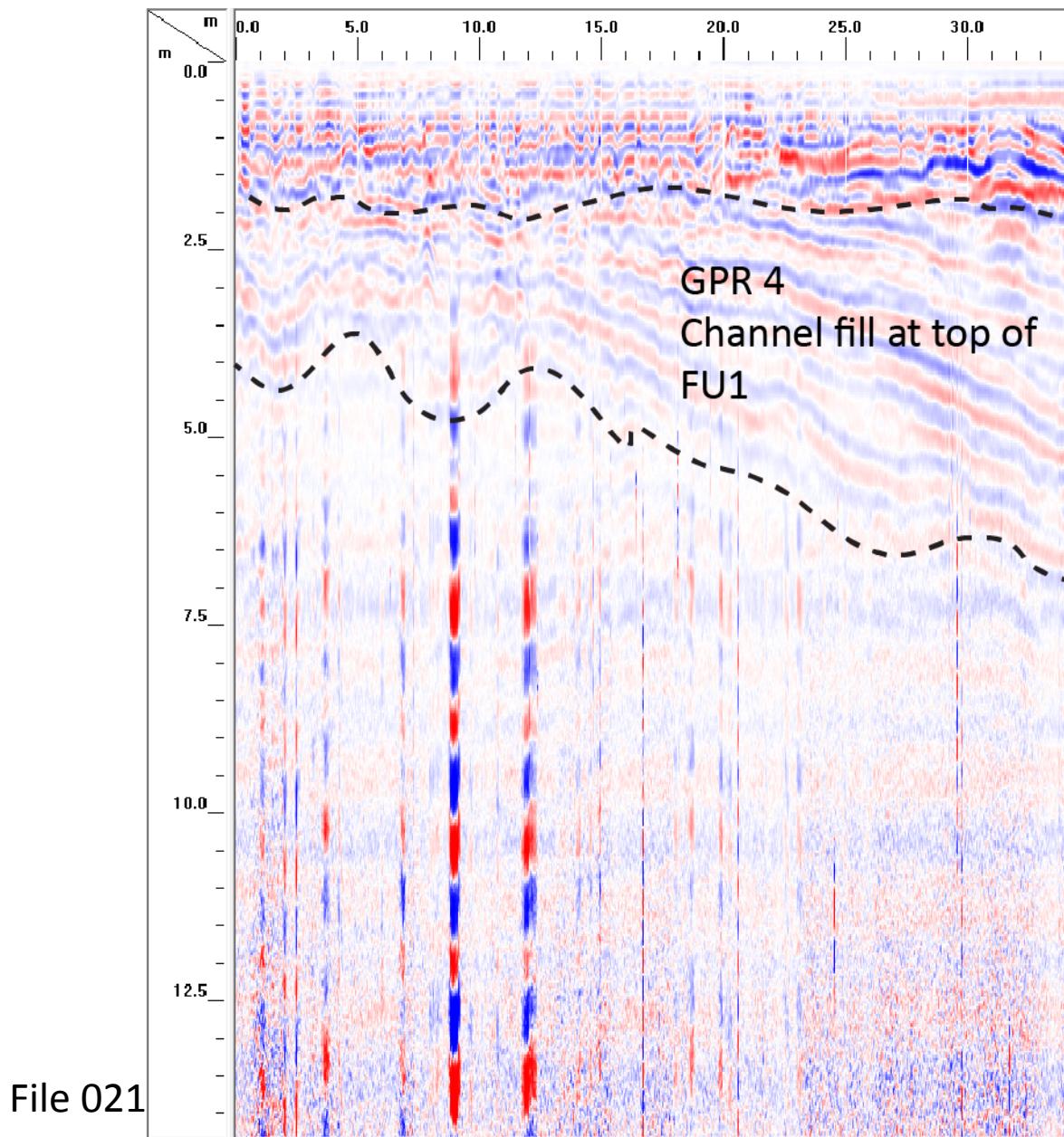
File 022

# 100 MHz Transverse Profile, Killian Cove



File 021

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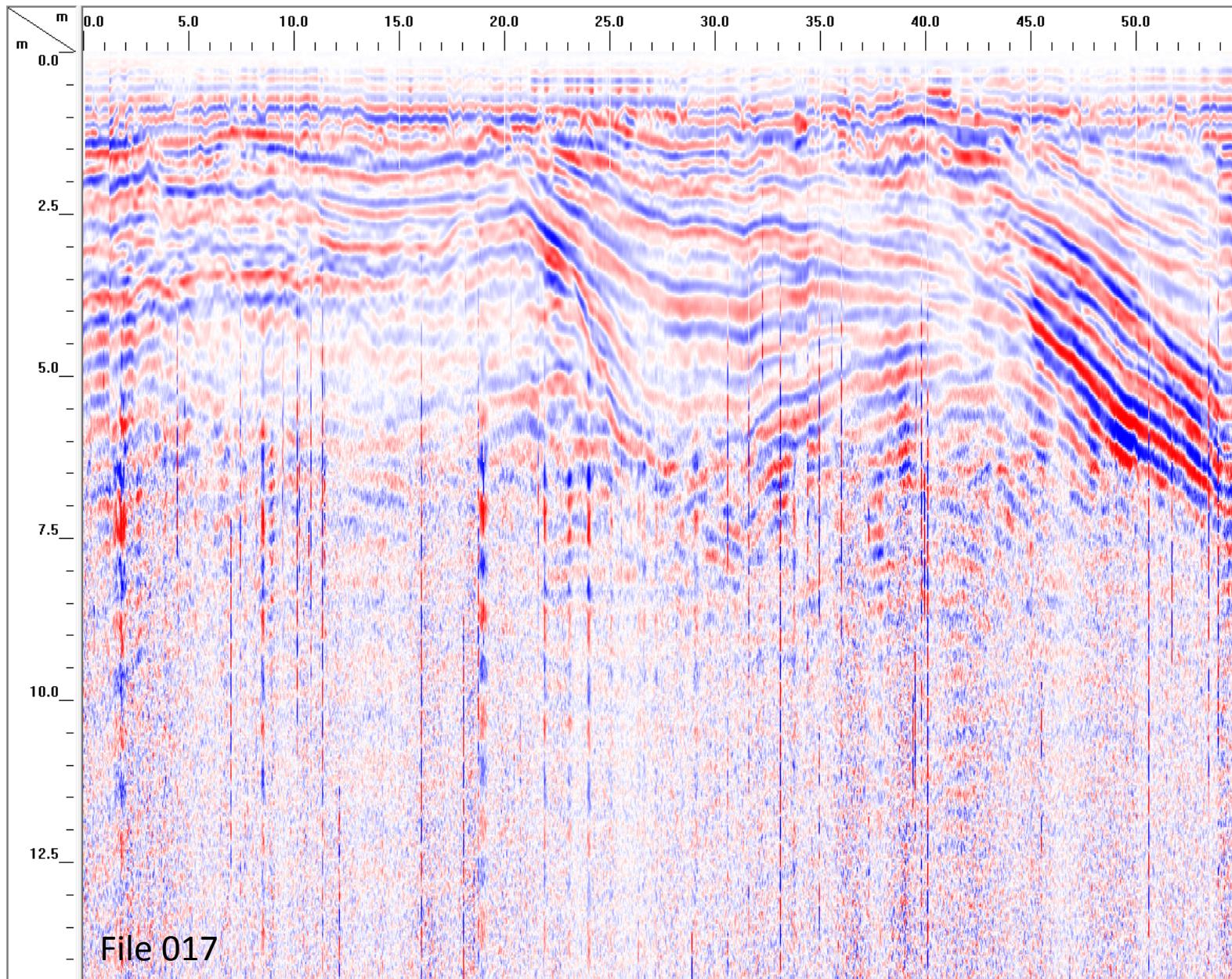
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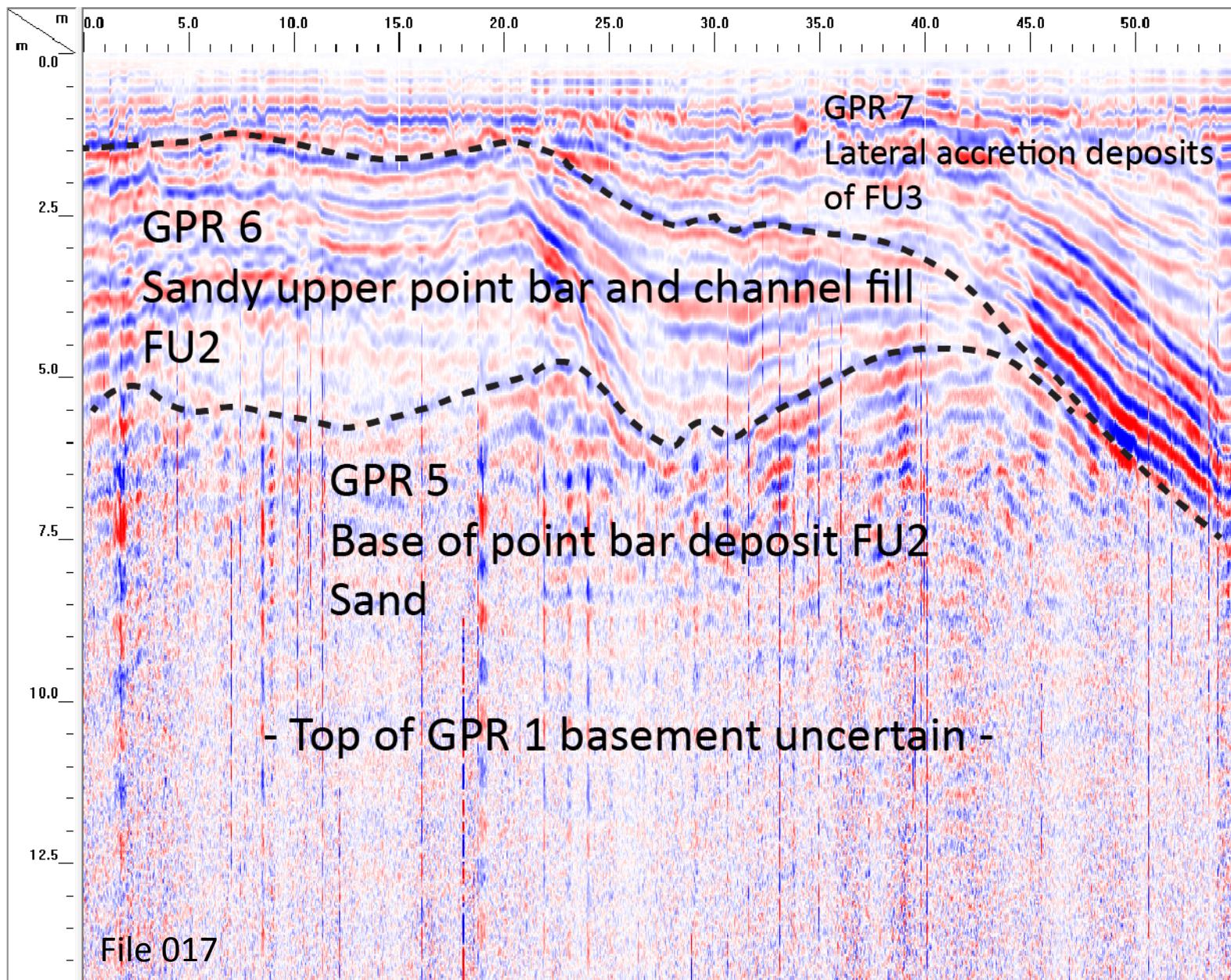
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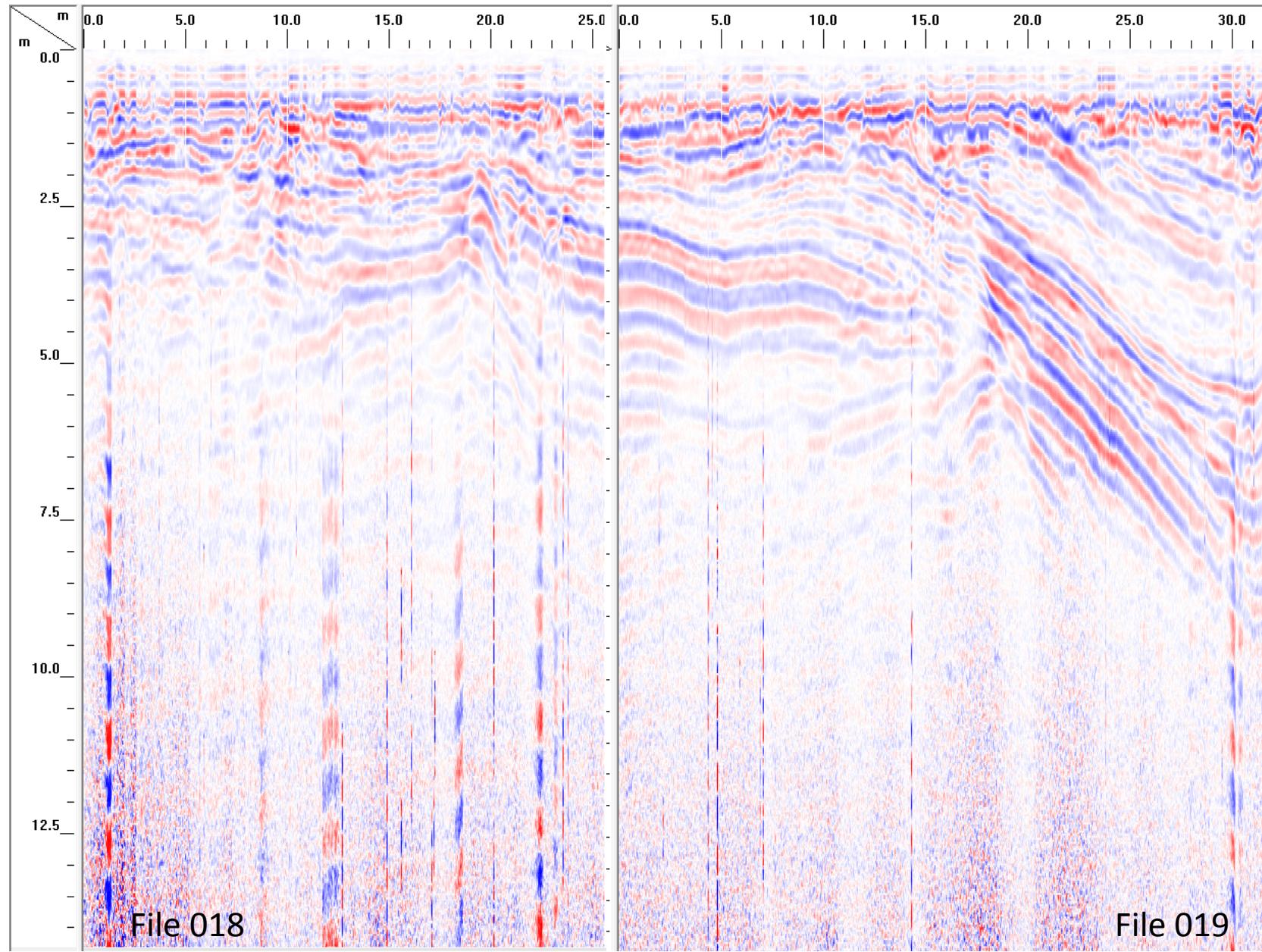
# 100 MHz Transverse Profile, Killian Cove



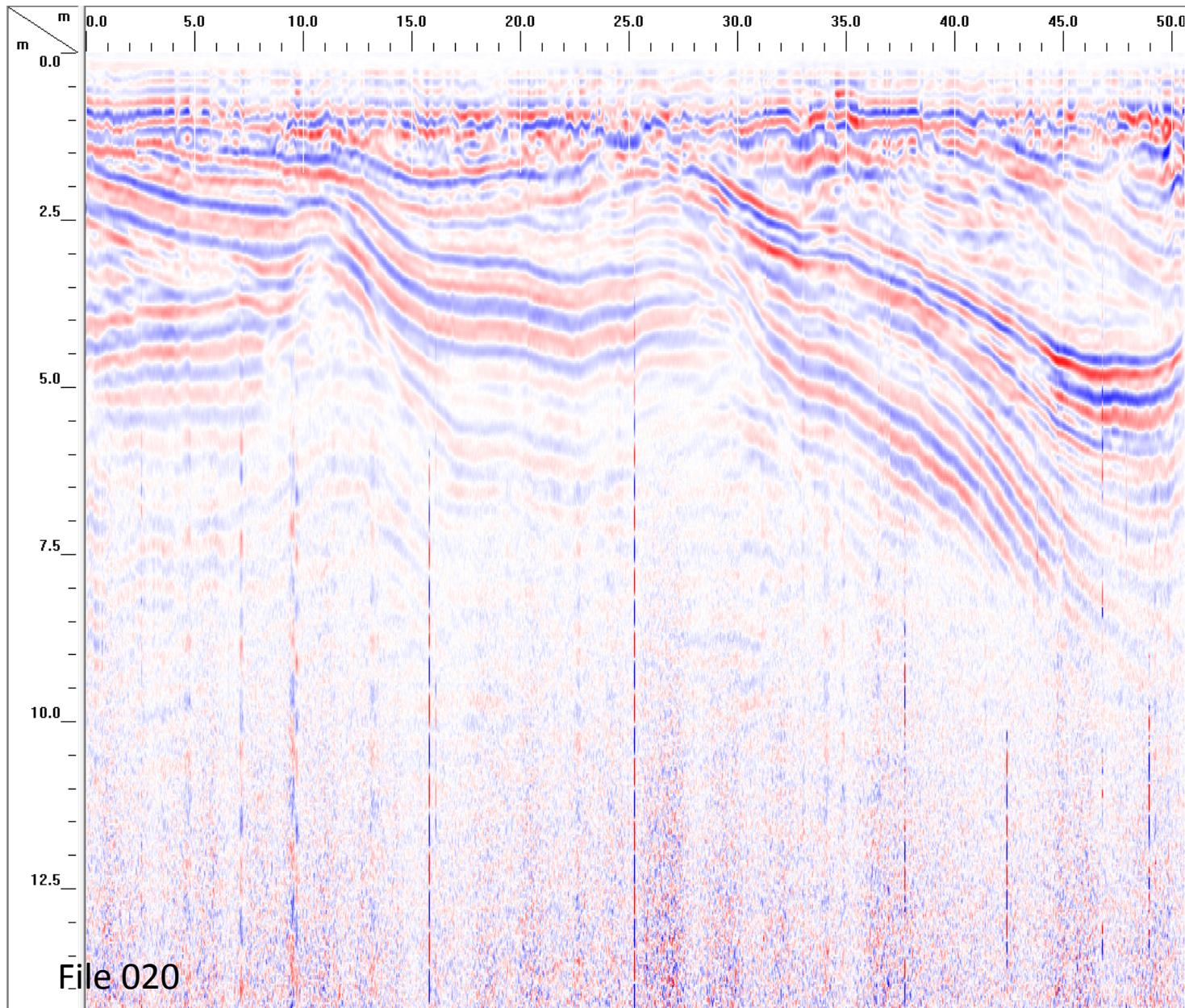
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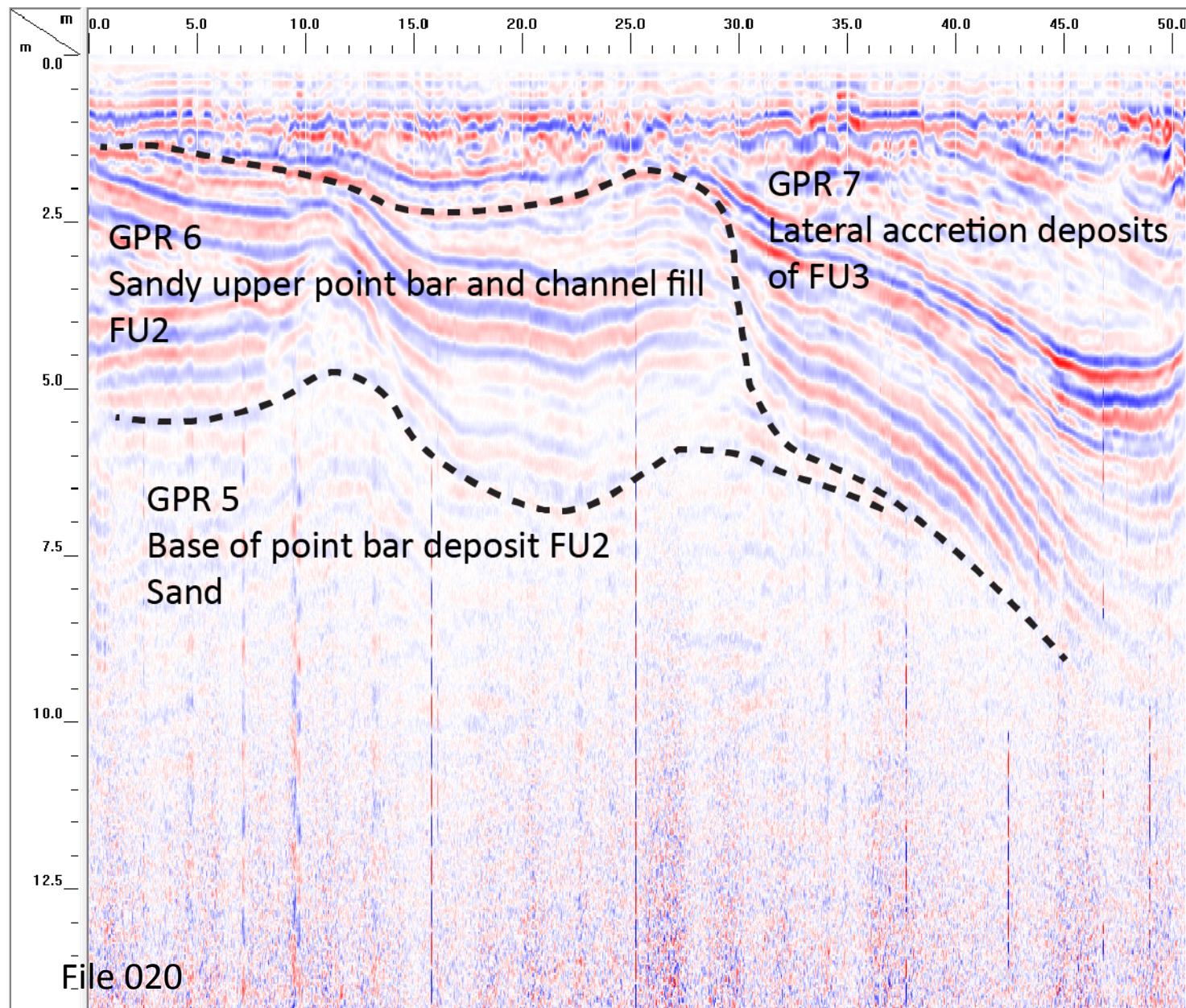
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