Well Music: Translating Well Data to Music for a New Perspective

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Search and Discovery Article #42574 (2022)**
Posted August 22, 2022

*Adapted from extended abstract based on oral presentation given at 2022 AAPG Rocky Mountain Section Meeting, Denver Colorado, July 24-27, 2022
 DOI:10.1306/42574Lindsey2022

[1]Vesmir (alan.lindsey@vesmir.com), Proposed session: Technological and Analytical Tools for Energy Development

Keywords: Well logs, sonification, visualization, auditory display, sound design, oil and gas exploration, stratigraphy, paleontology, log interpretation

Abstract

Oil and gas wells are time machines. As they drill, they uncover the history of planet Earth at a given locale, much as tree rings record the history a tree experiences. These wells record millions of years, and now we can artistically express their experience; the lives, the deaths, the droughts, and the floods that the instruments and fossils reveal.

Almost 100 years ago the Schlumberger brothers kicked off well logging by creating long linear graphs of electrical resistivity. Gamma ray, density, spontaneous potential, and more were added through time and used to compare measurements and stratigraphy from one well to another.

While traditional well logs use a visual approach, Leonardo da Vinci, in 1490, used a tube inserted into the water to detect ships by ear. During World War I, the need to detect submarines prompted more research into the use of sound, with an operational passive sonar system in use by 1918. The first true transformation of measurements to sound was with the Geiger counter in 1908, when higher radiation levels were indicated by more rapid clicks.

Well data and musical data as seen in MIDI displays look very similar. How about translating well data into music? What new insights might we gain from well data by experimenting with auditory perception?

This talk explores techniques and results of using log data to generate music from wells in southern Louisiana and The Netherlands. The approach is called sonification; the use of non-speech audio to represent information.

In the South Louisiana recordings, the SP curve plays Bass, the Sonic curve is on Flute, and the Density curve plays Clarinet. A percussive beat sounds every ten feet, with special beats marking fifties, hundreds, and thousands of feet. The musical texture has a jazz quality to it and varies dramatically from the sandy deltaic intervals to the distal shaly section.

The Netherlands recordings are from the Groningen field which produces from eolian sands in the Permian section. The well includes a mix of clastics, evaporites, and carbonates. Gamma Ray is on Piano and pay is indicated by a timpani riff.

The sonification approach may also be useful for interpretive purposes, comparing the same intervals across many wells in a field, for example, or for monitoring while drilling.

This novel approach provides a totally different way to experience well data that will leave you in awe of the planet we live on and the secrets that oil and gas wells reveal.

(The audio, video, and animation content of this presentation are not conveyed through a PDF alone, so please refer to the YouTube video found here: https://youtu.be/dW2W-Kdo2ZM)

Conclusions

- Sonification adds an additional dimension to our perception of data. Our eyes and ears work well together, with our ears providing 360-degree situational awareness that helps direct our eyes on where to focus.

- Sonification also provides a means of perceiving information that leaves eyes and hands free. You often drive and listen to music, and operators of machinery can work and listen for important information provided through sound.

- Sonification can augment the visual experience, like hearing additional logs that are not in view to allow many more measurements to contribute to an interpretation.

- Especially when combined with animation, sonification provides an immersive experience that encourages a high level of attention.

Acknowledgements

- Ridvan Akkurt of Schlumberger provided public well information, and helpful assistance

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Well Music:

Translating Well Data to Music for a New Perspective

July 25th, 2022

Alan Lindsey

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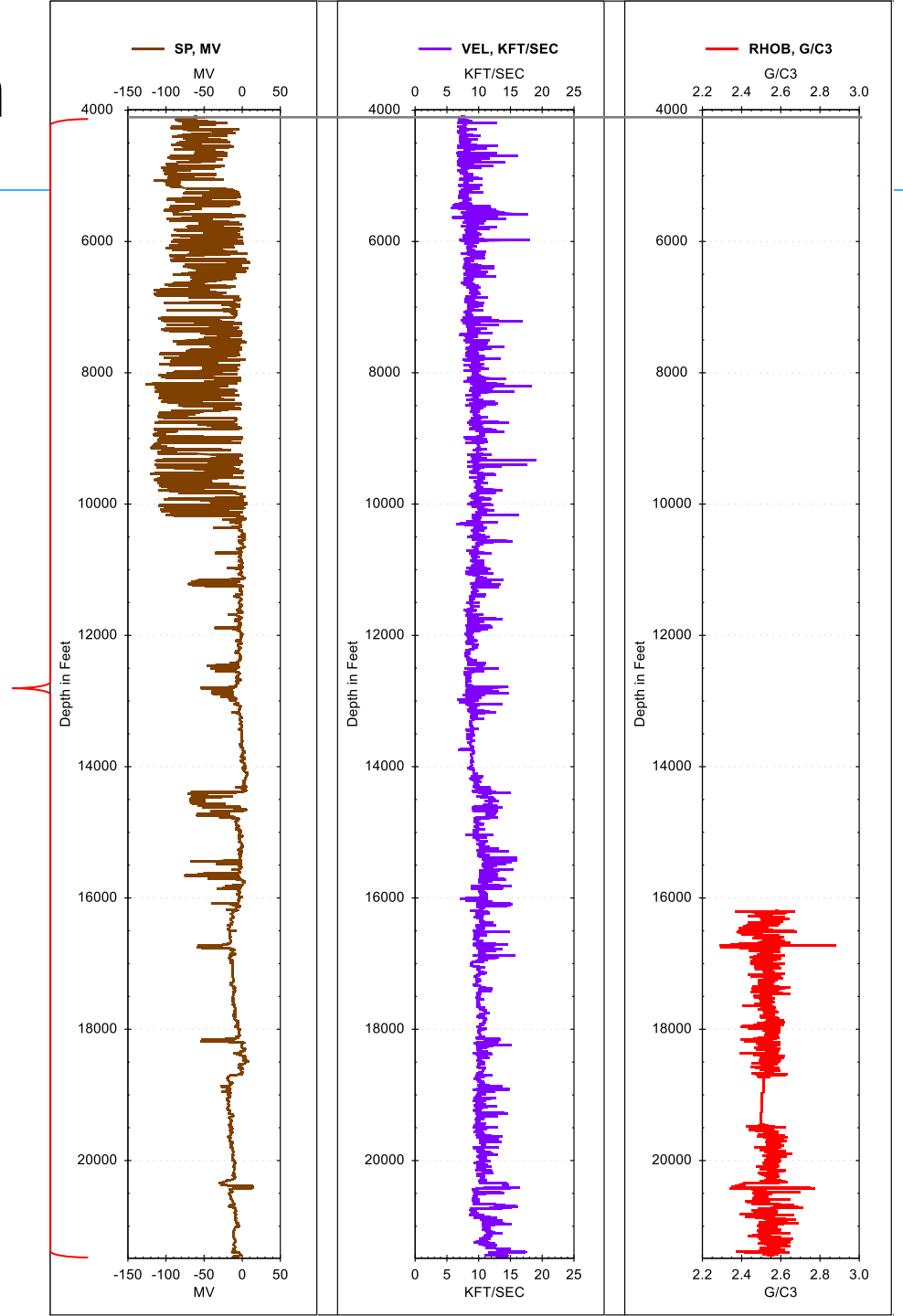
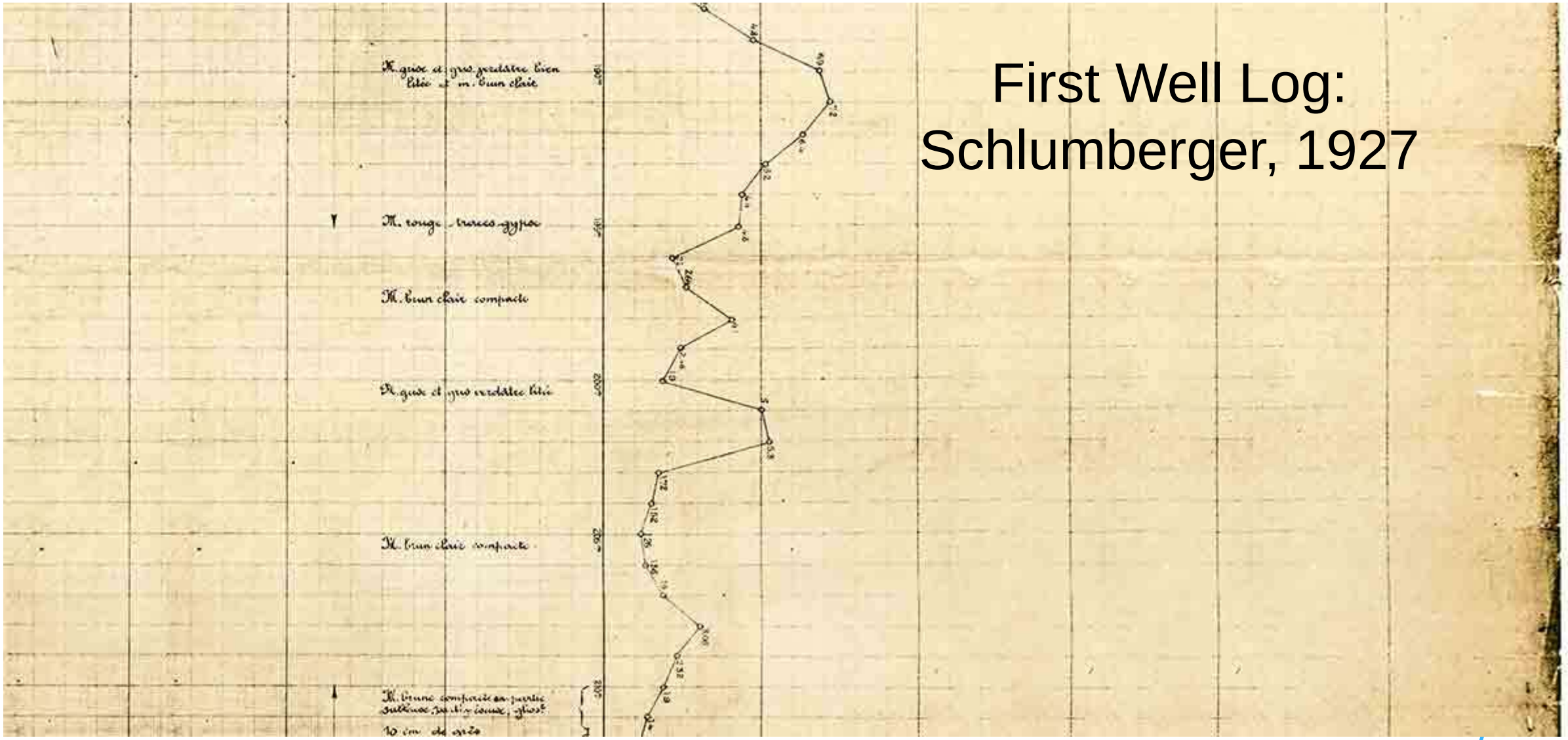
12 Million Years of Earth



Well Music

- Introduction
- Transformation Process
- Examples from Southern Louisiana
- Examples from The Netherlands
- 12 Million Years of Earth
- Conclusions
- Questions

Visualization



Sonification: Data Represented by Sound

- 1490: Leonardo Da Vinci listened for ships with a tube
- 1918: Passive sonar used to detect submarines
- 1908: First used in the Geiger Counter

Benefits of Sonification

Adds Another Dimension

Eyes Free, Hands Free

Augments sight: Listen to many logs, focus on a few

Provides an immersive experience; Encourages attention

Commonly Used Sound Transformations

Pitch

Duration

Timbre

Volume

Attack

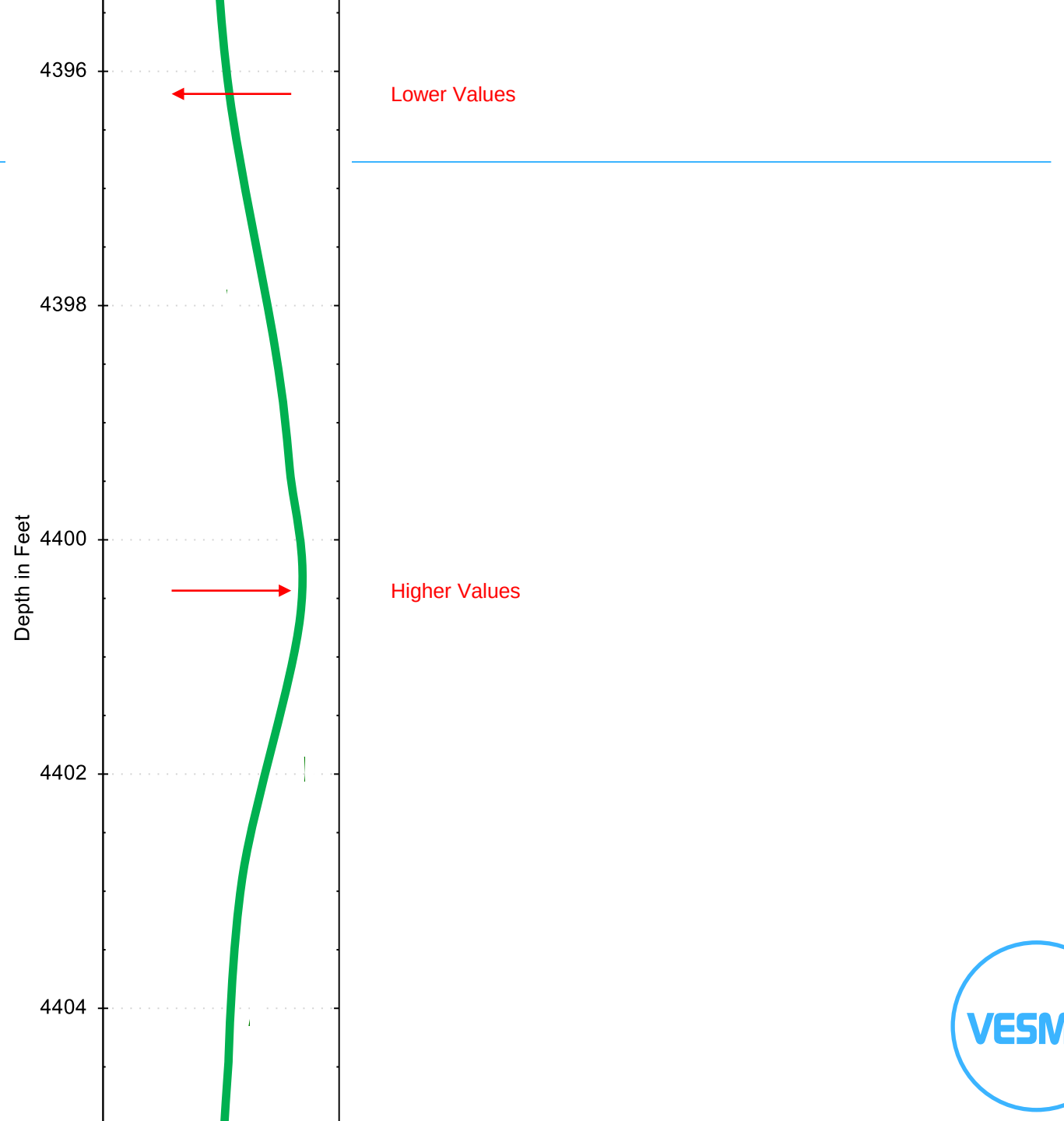
Tempo

Chord

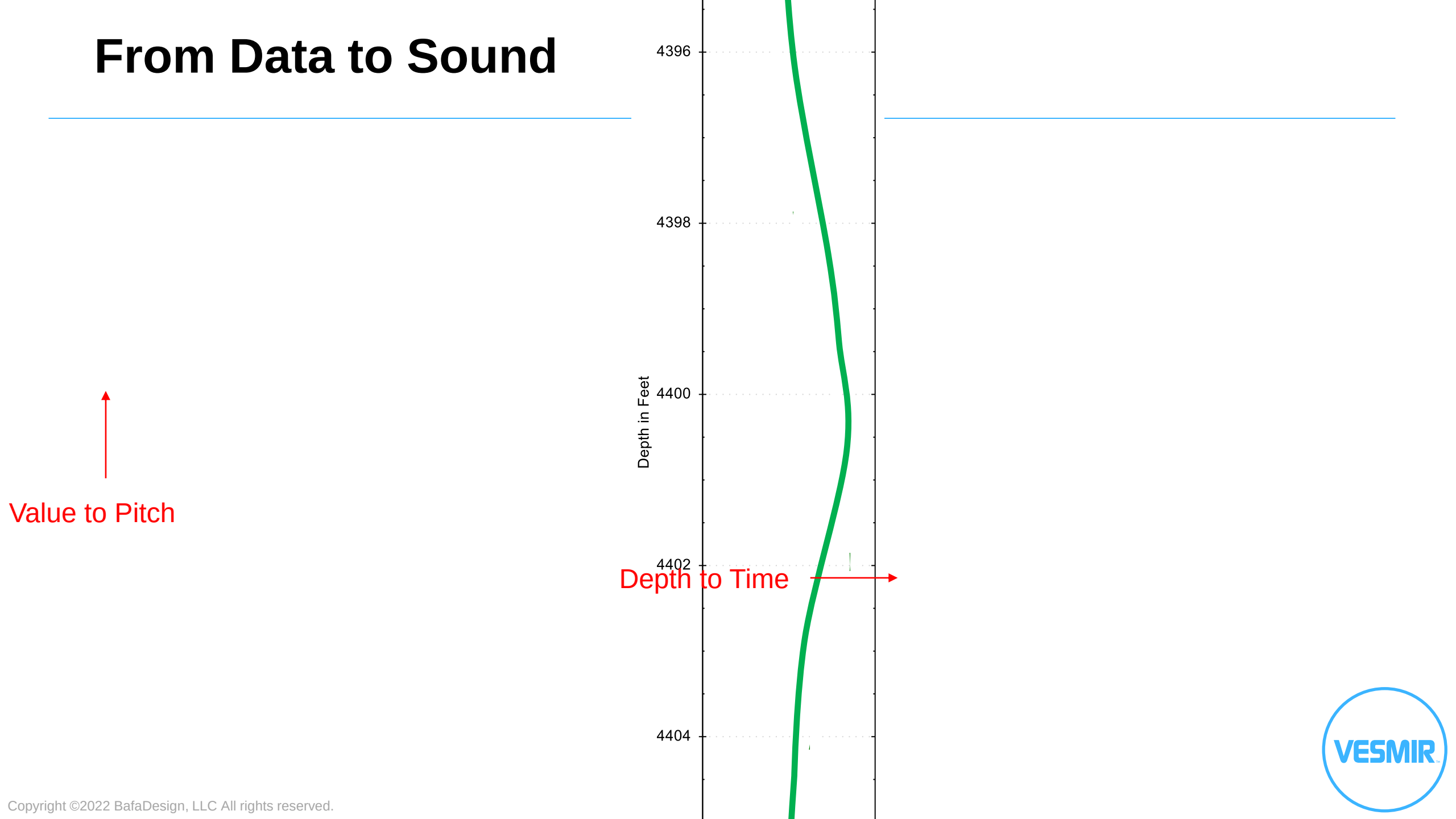
Pulse Rate


by Playmodes Studio

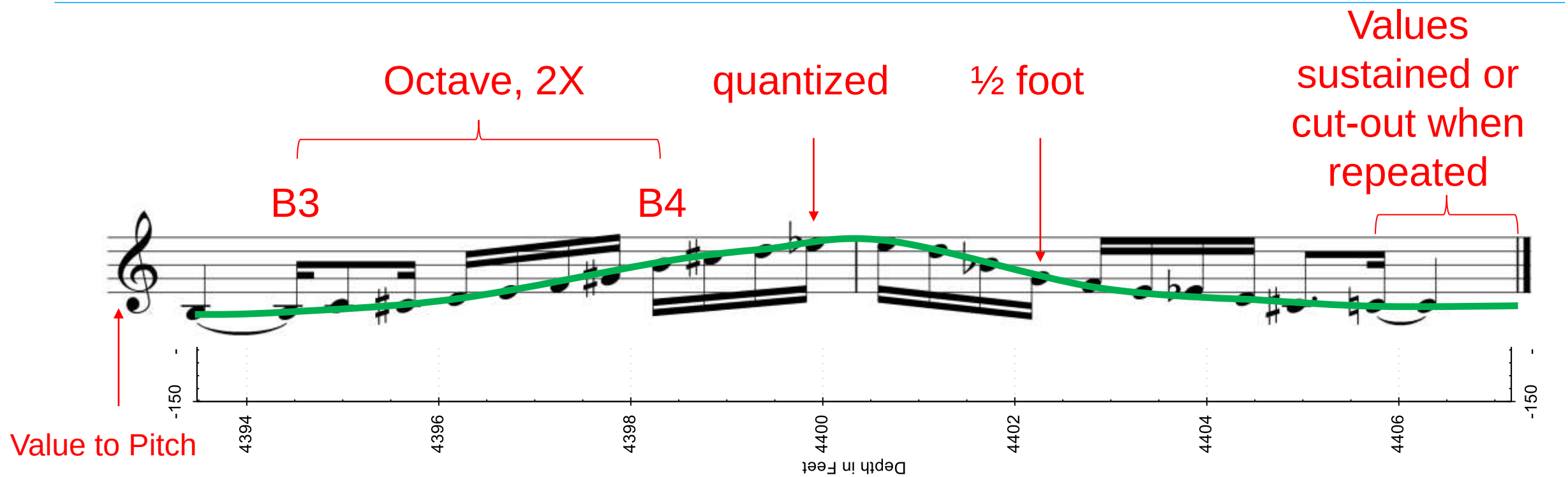
From Data to Sound



From Data to Sound



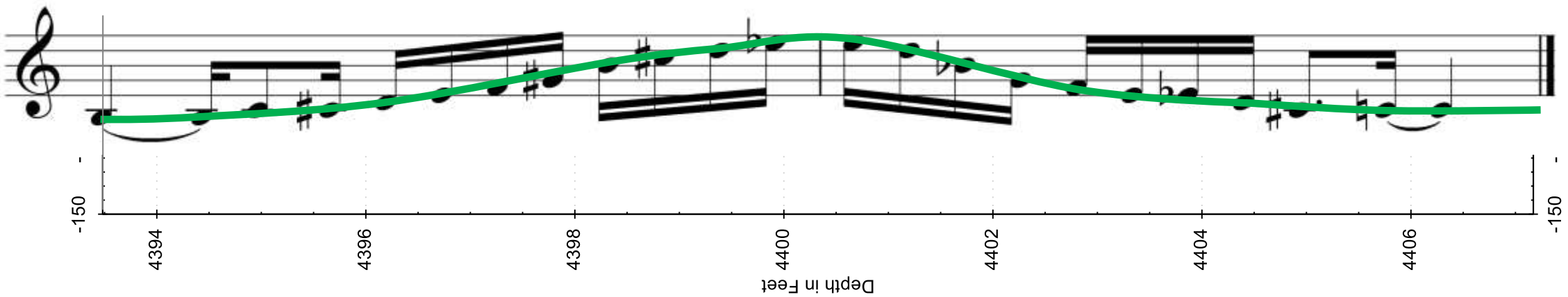
From Data to Sound



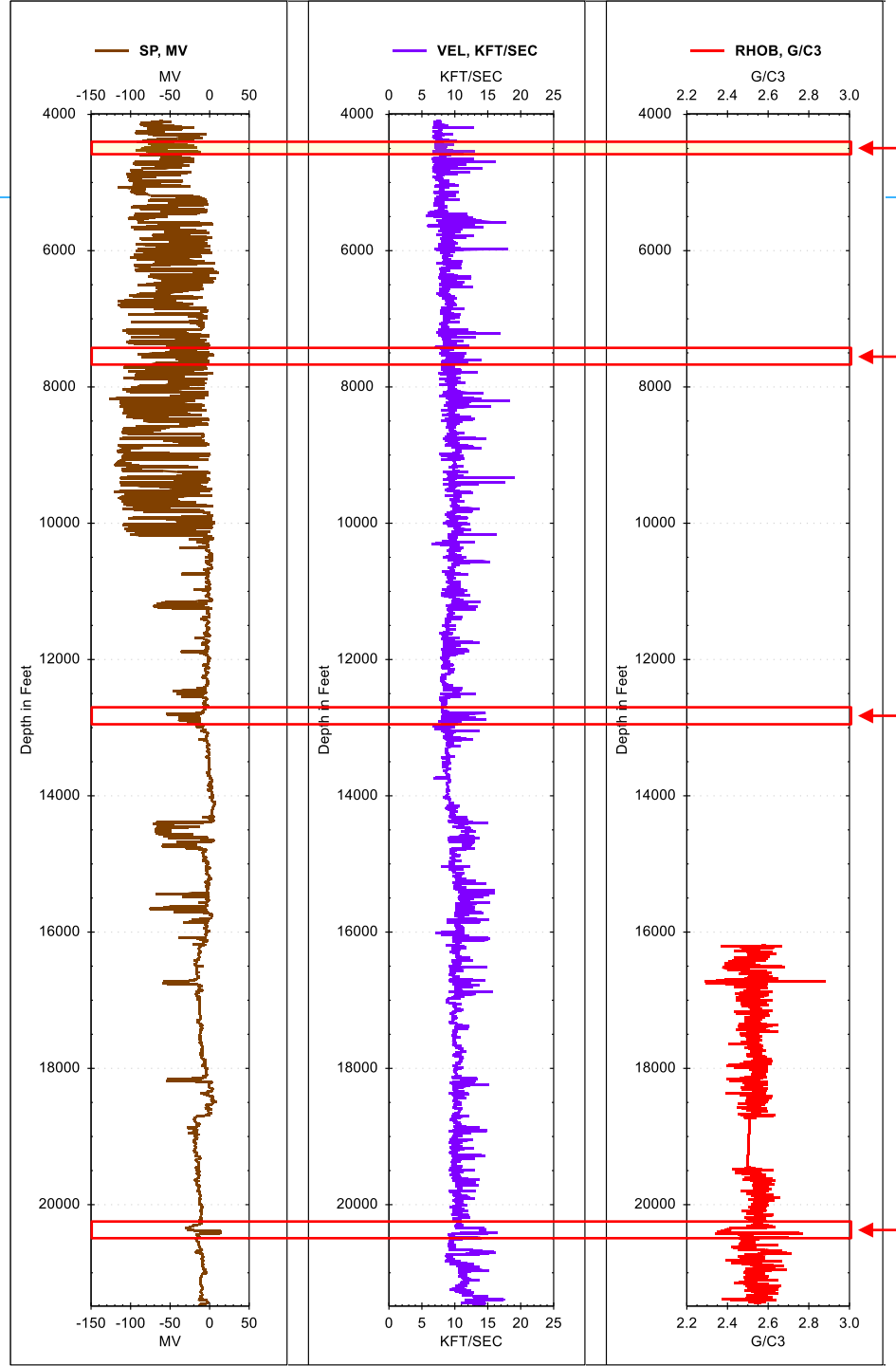
12 equally spaced half-steps on a **logarithmic** scale

Depth to Time →

From Data to Sound



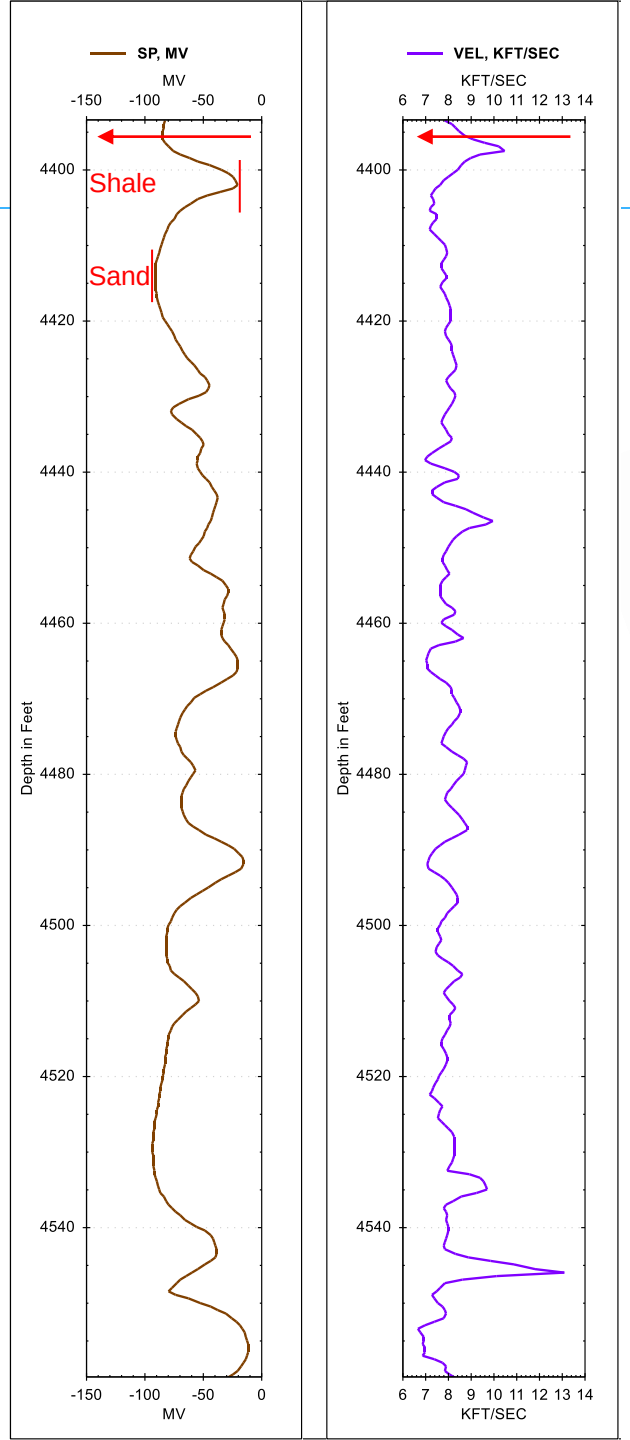
S. Louisiana



S. LA 1

Lower SP =
Lower note

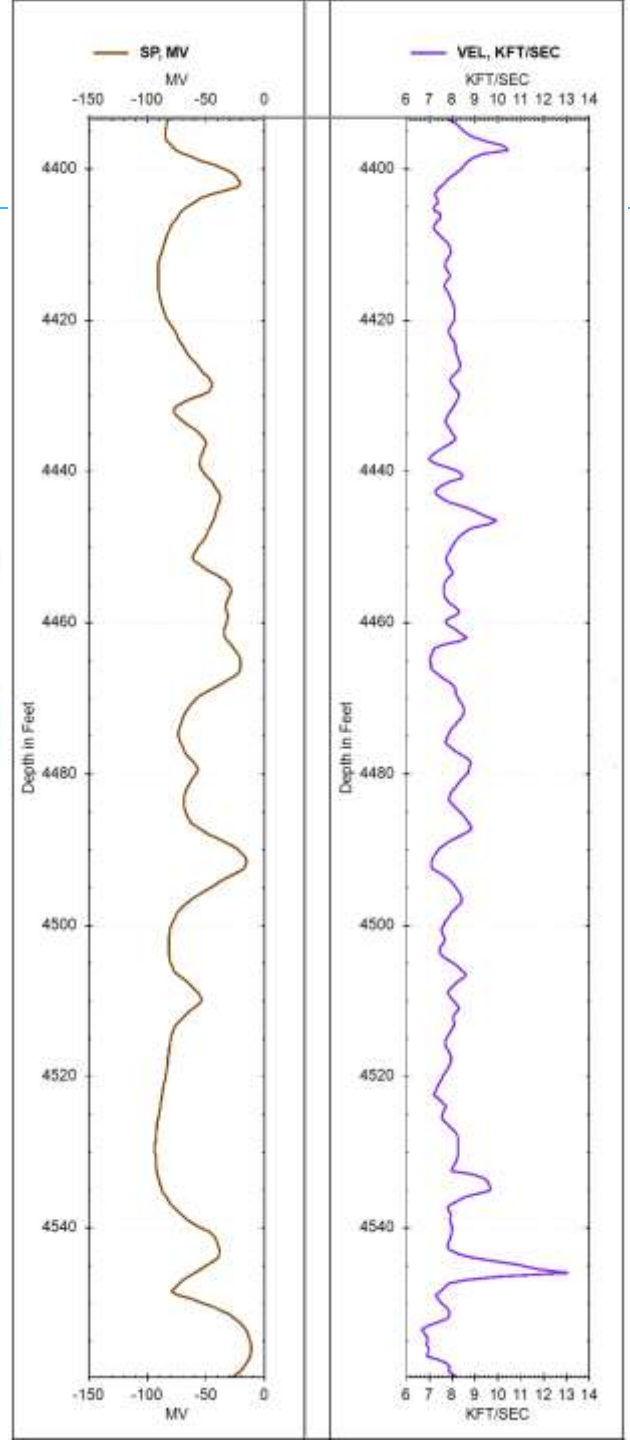
Played on
Double Bass



Slower Velocity =
Lower note

Played on
Flute

S. LA 1



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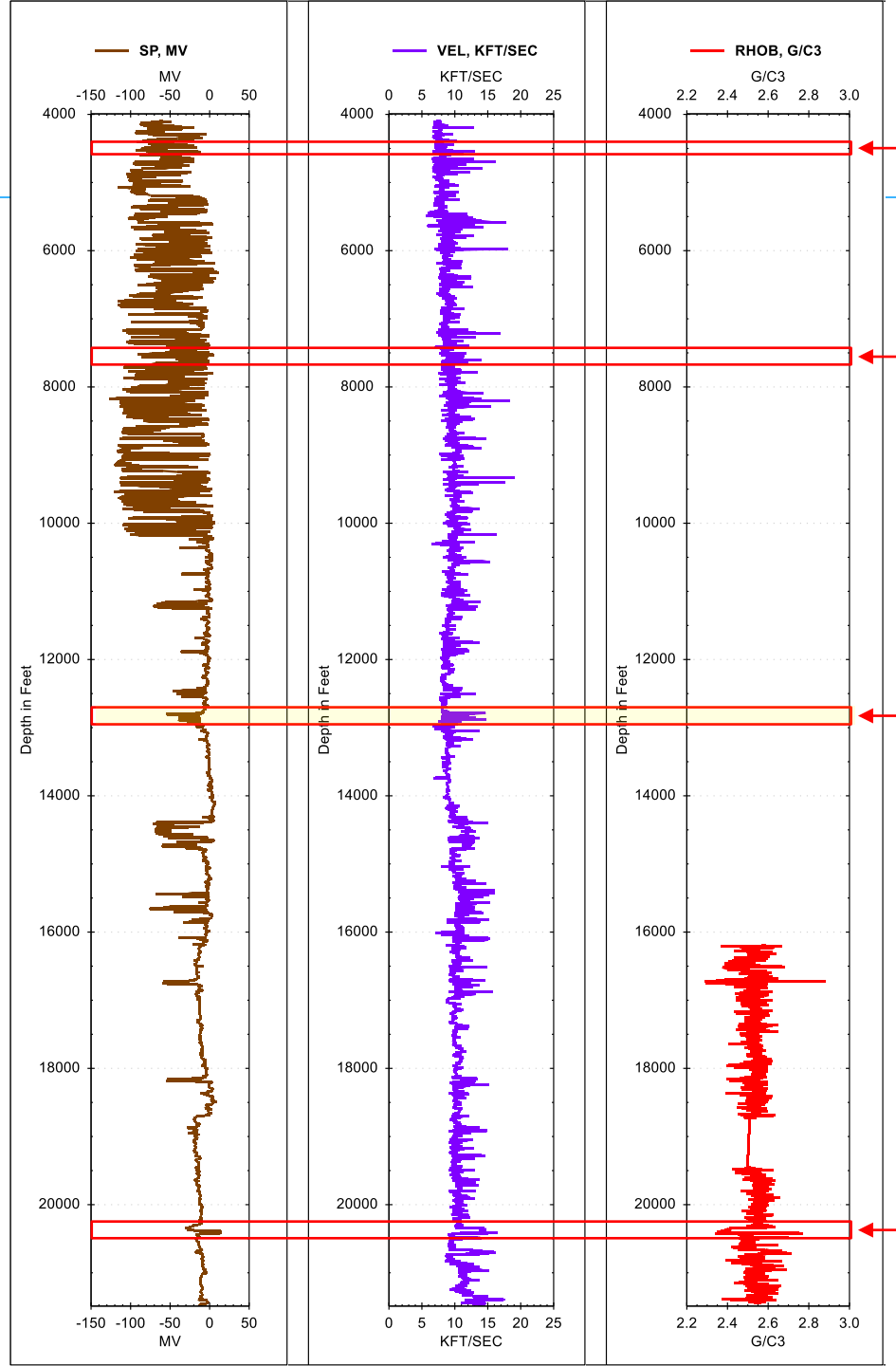


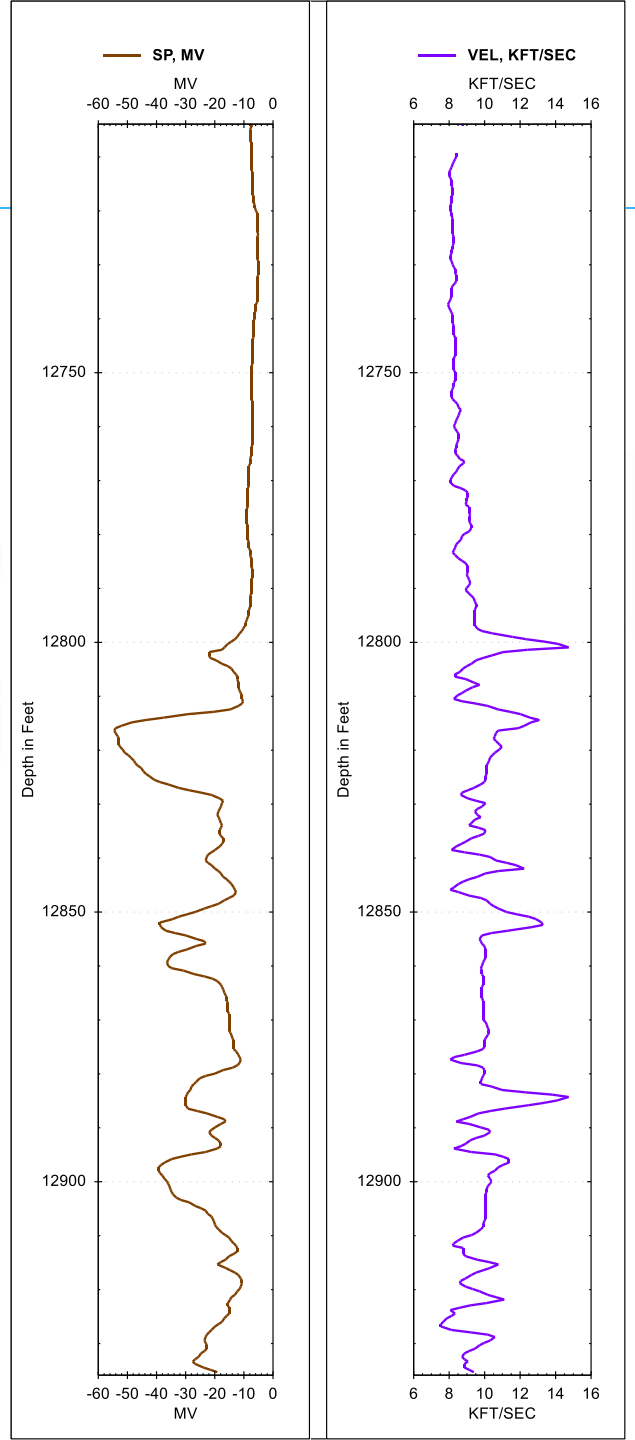
Interval 1

Interval 2

Interval 3

Interval 4

S. LA 3



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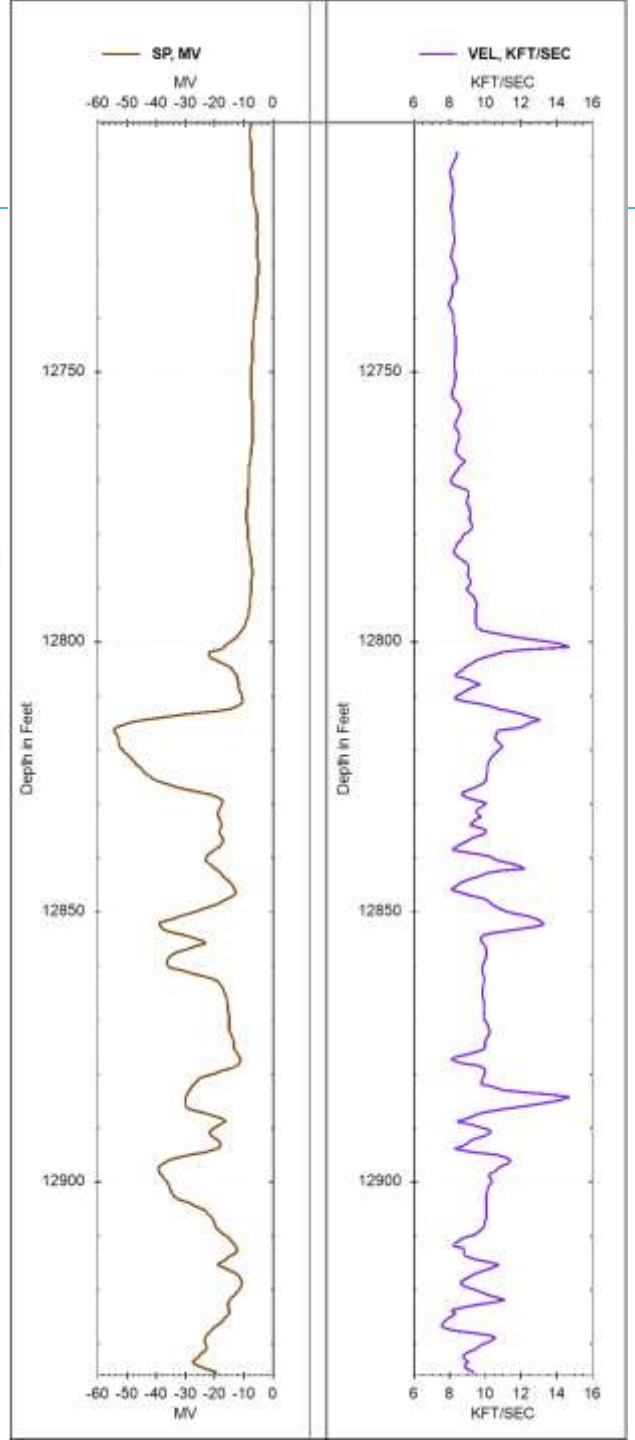
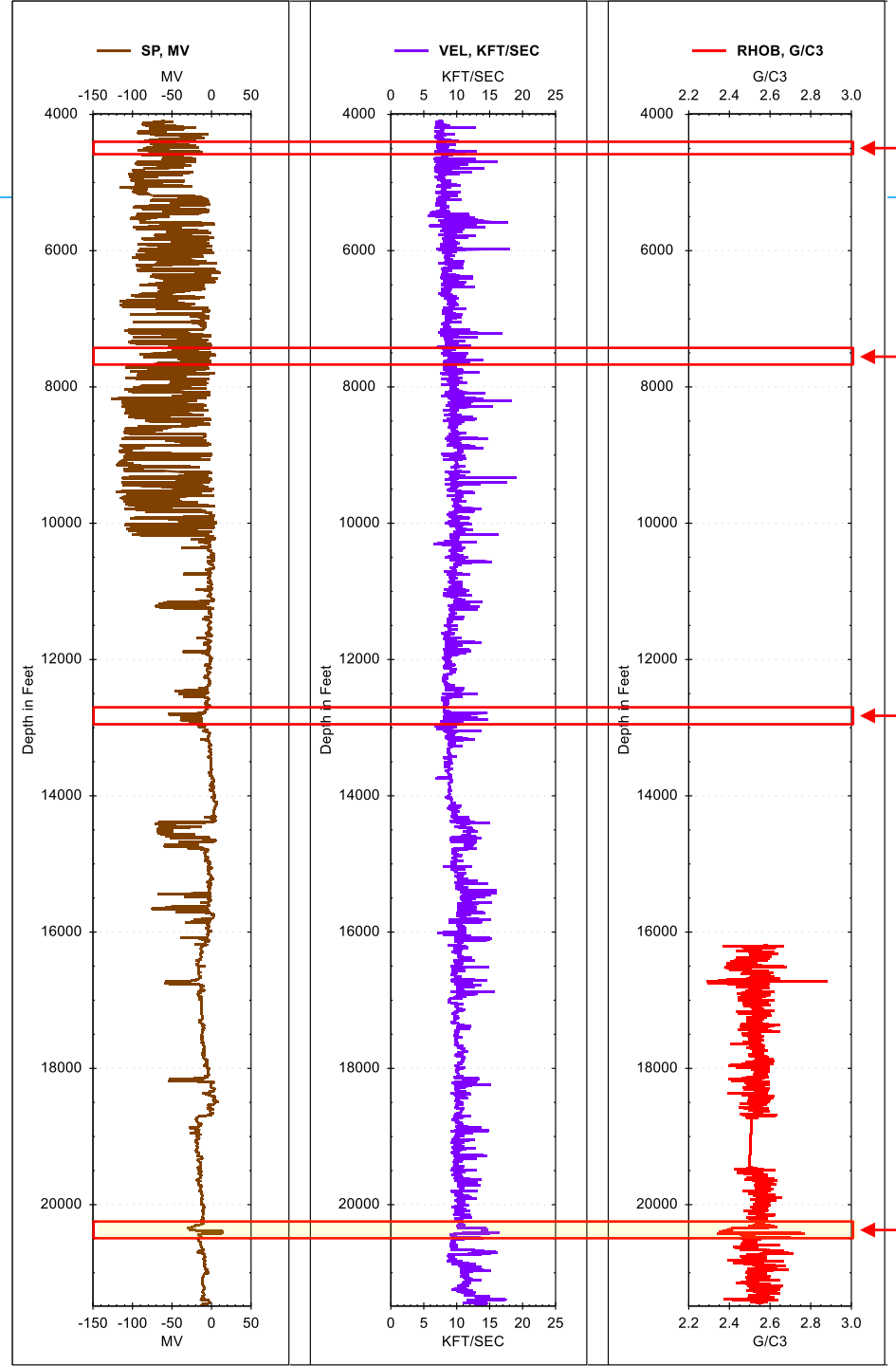
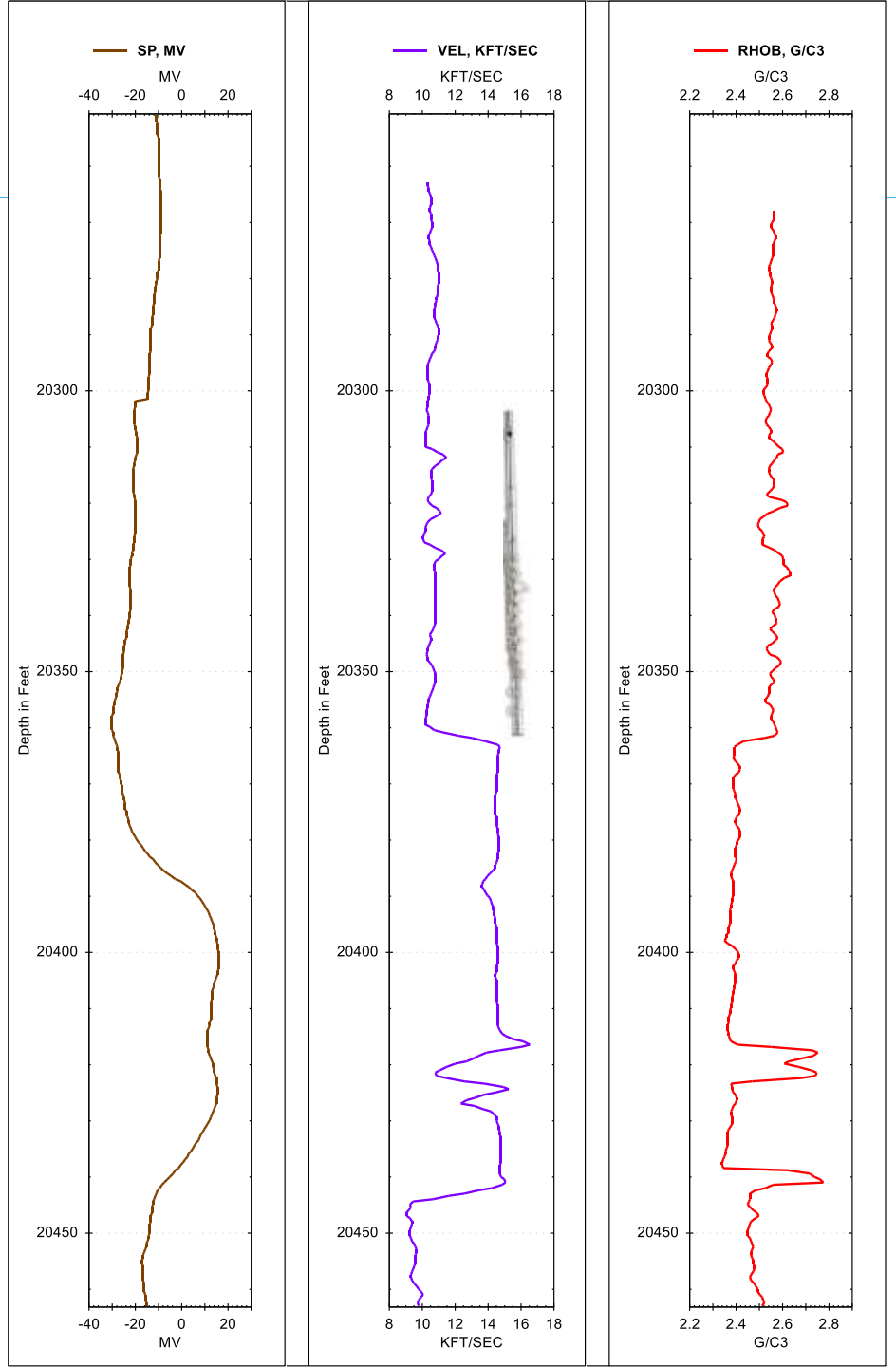


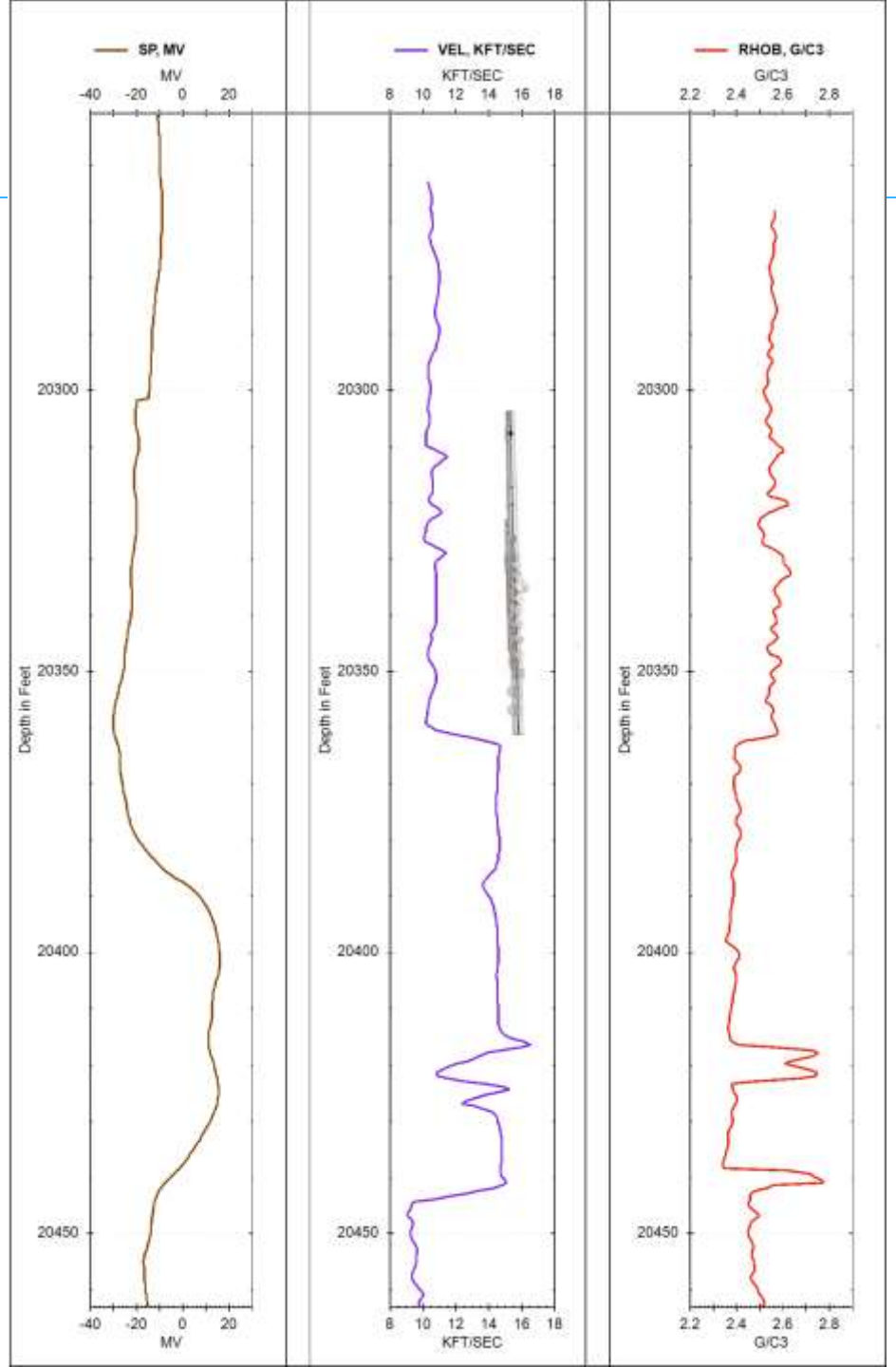
S. Louisiana



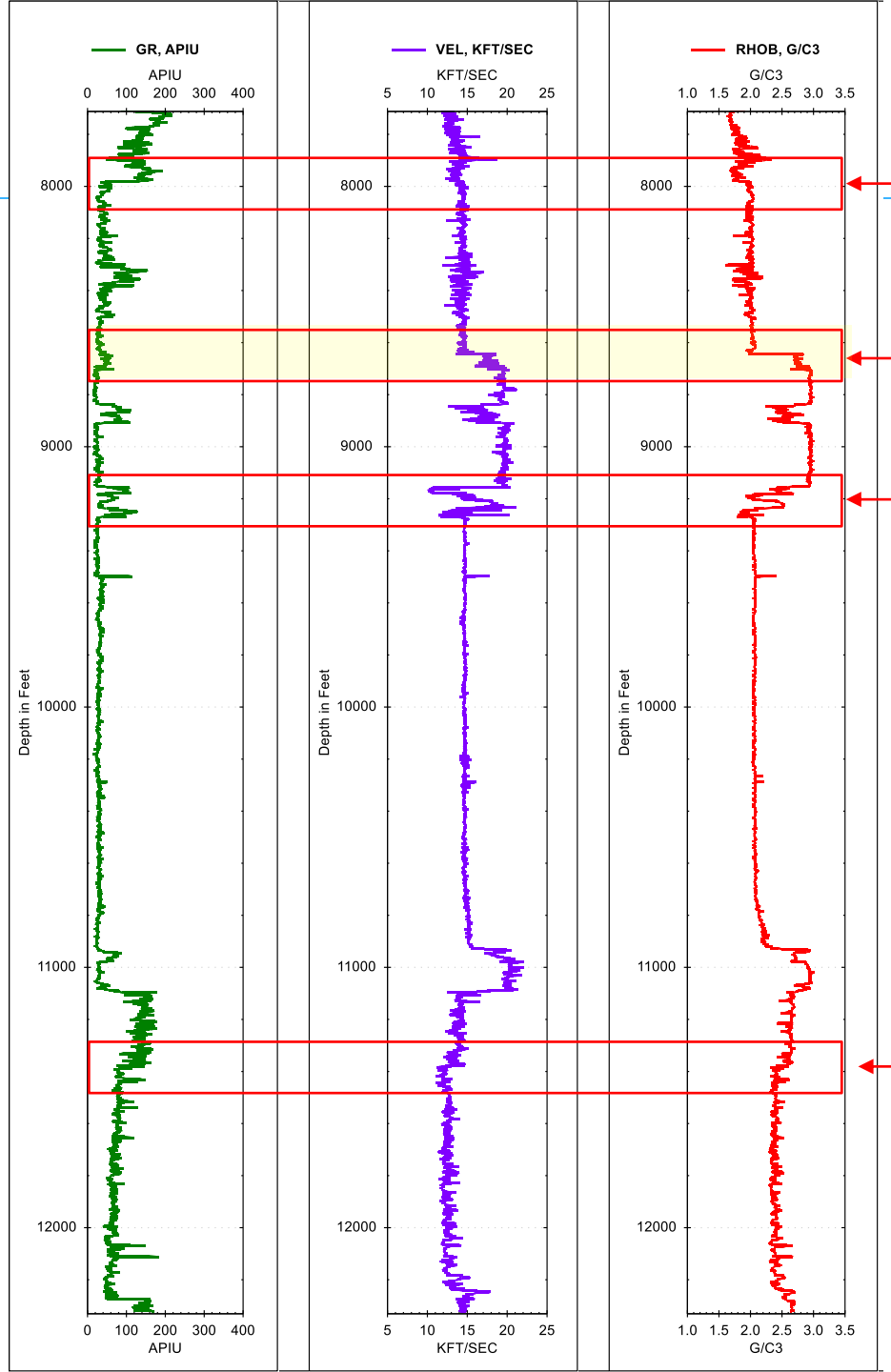
S. LA 4



S. LA 4



Netherlands



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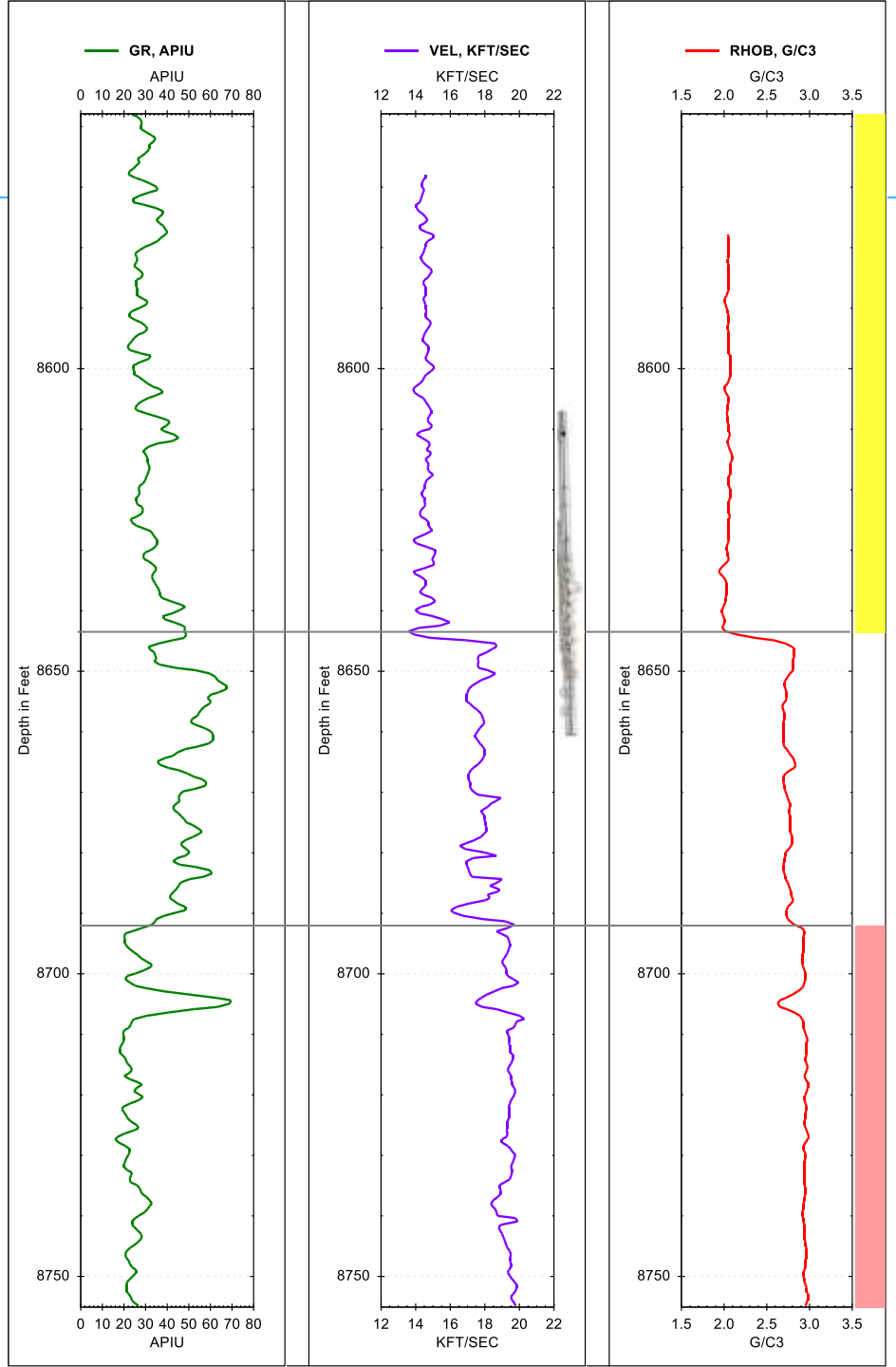
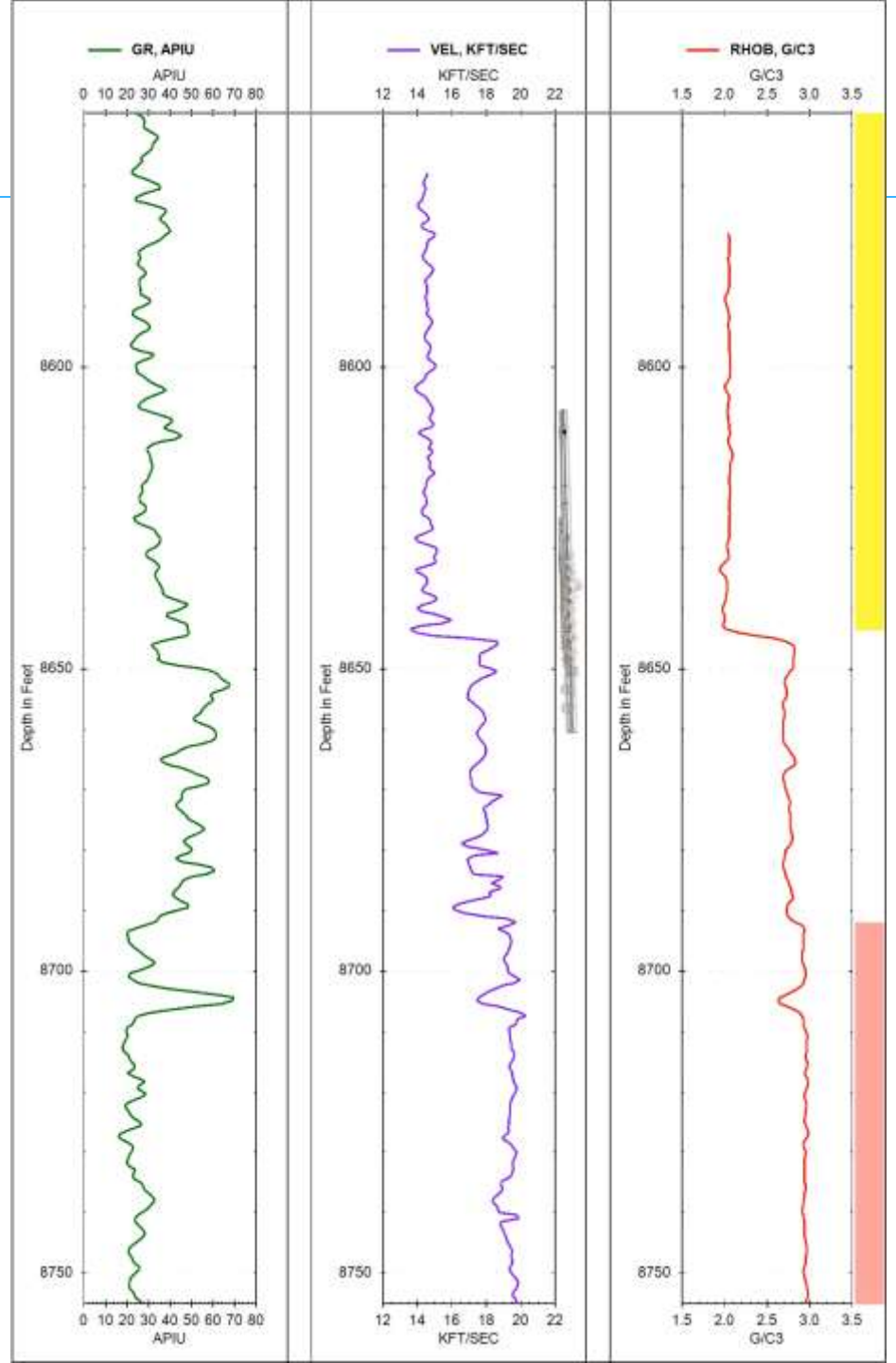
NED 2



Gas-filled Eolian SS

Anhydrite

NED 2



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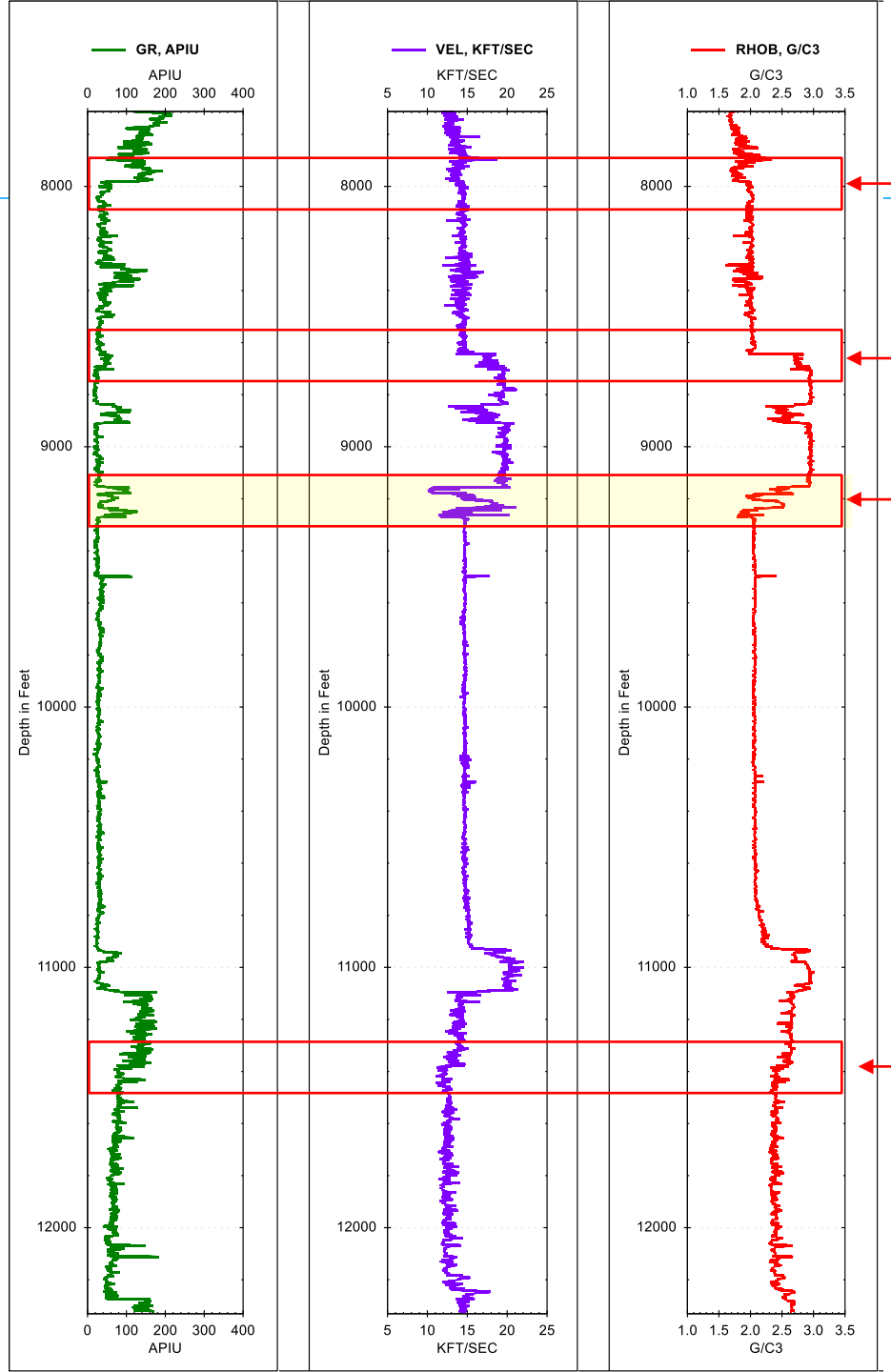

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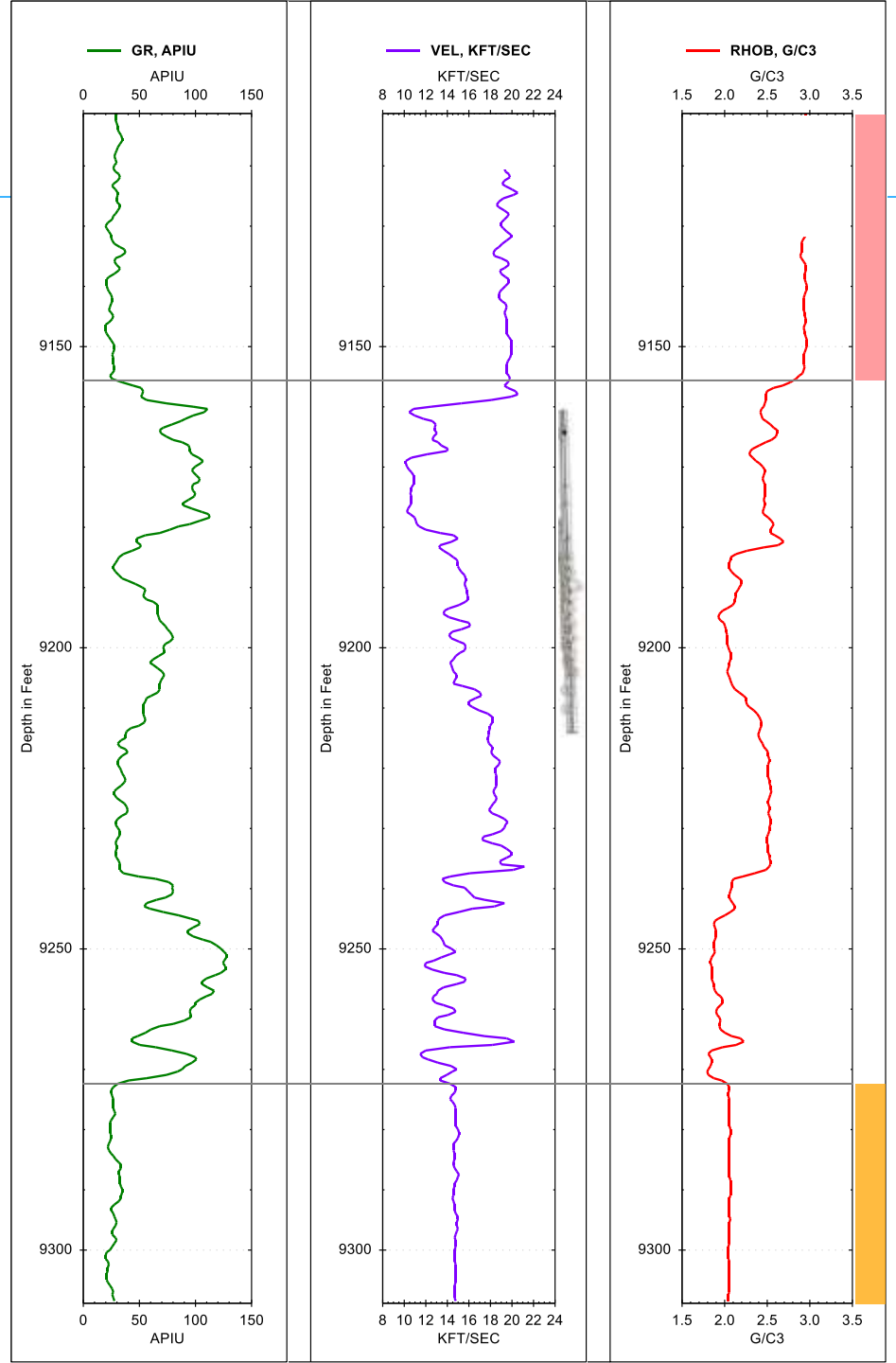
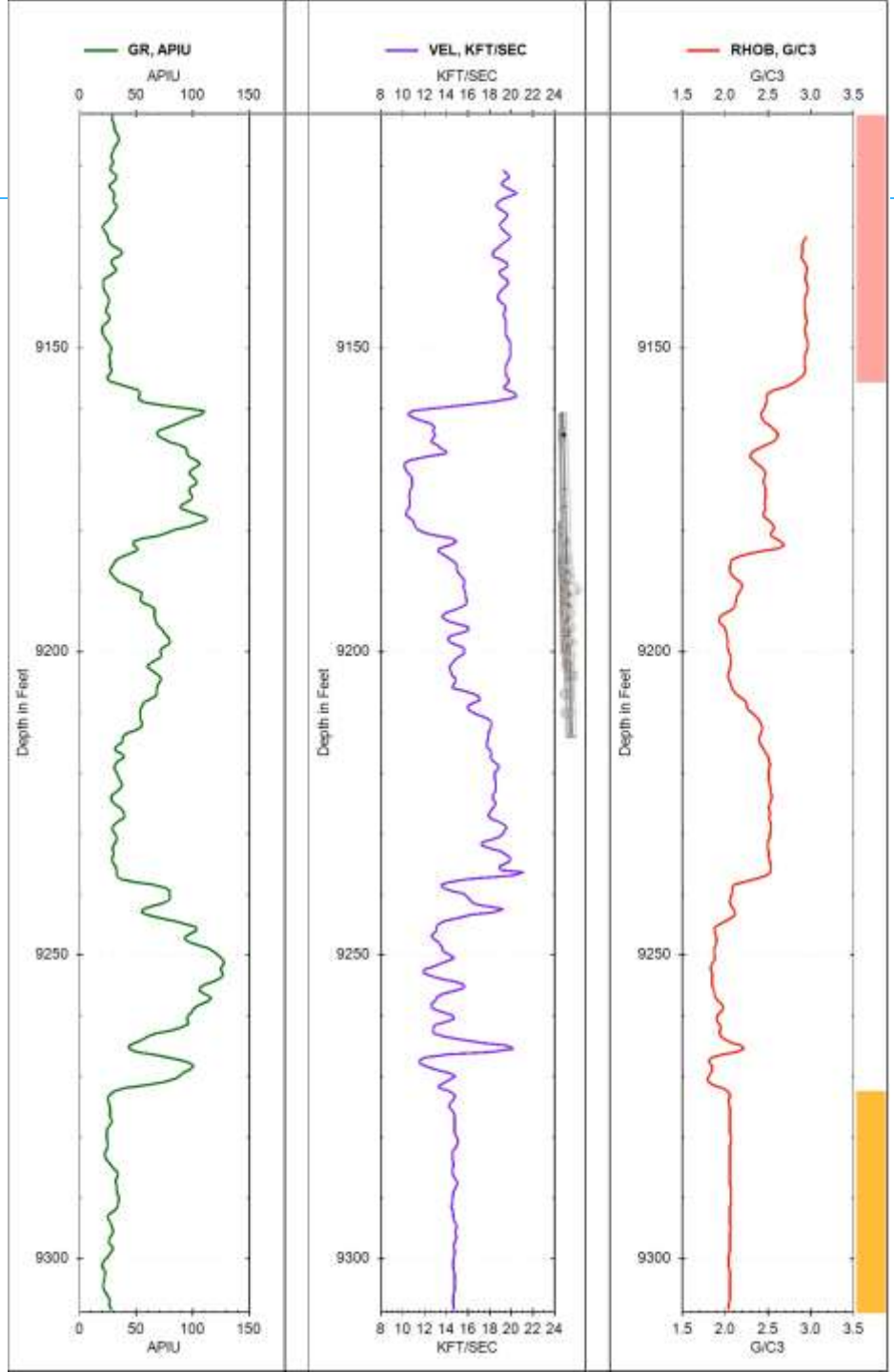


Anhydrite

Halite

NED 3



Anhydrite

Halite

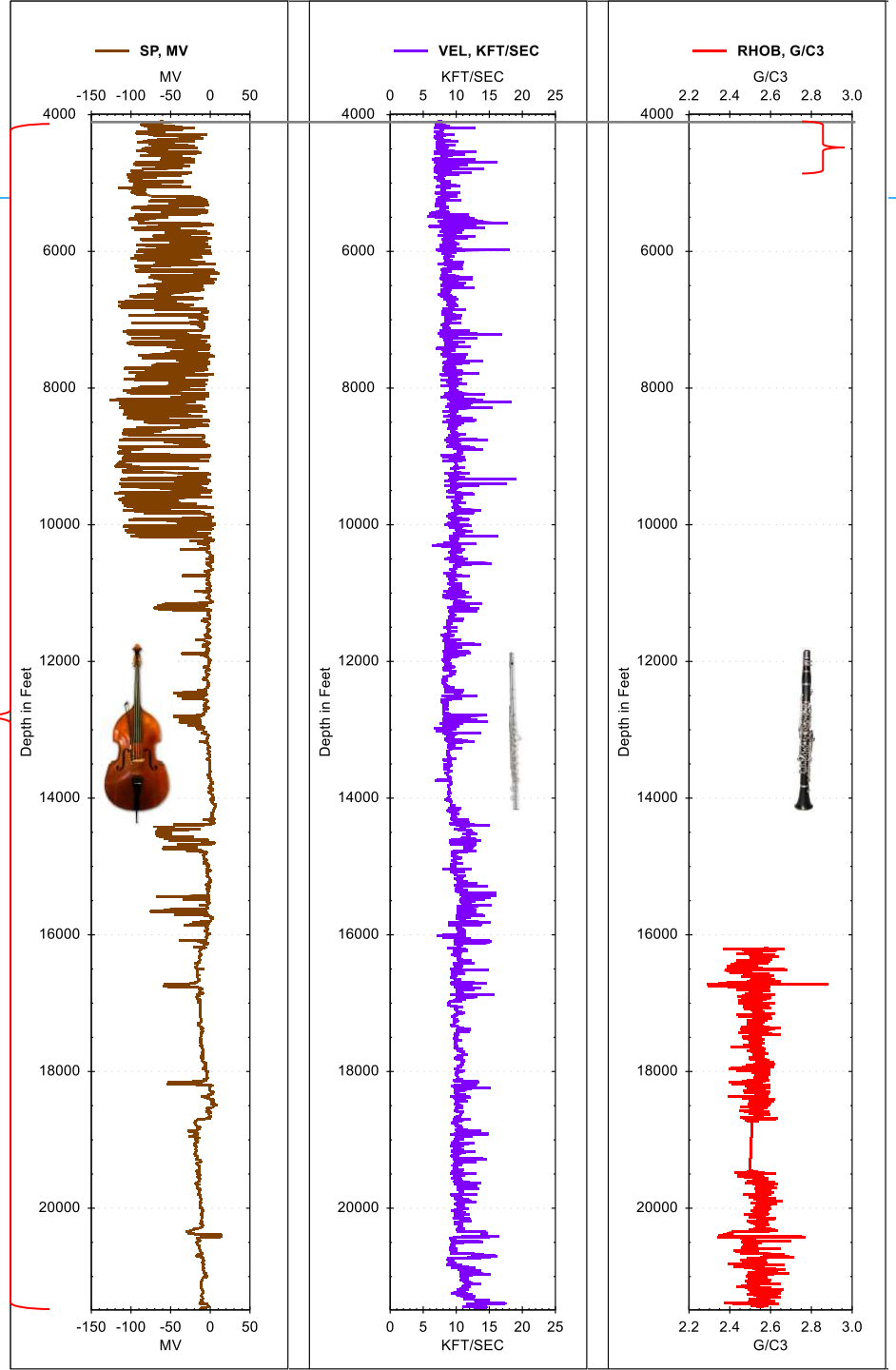
12 Million Years of Earth

12 million years of Earth

17,390’

in 20 minutes

at 800 feet per minute



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