

Image Based Classification of Weathering Profile in Core Samples

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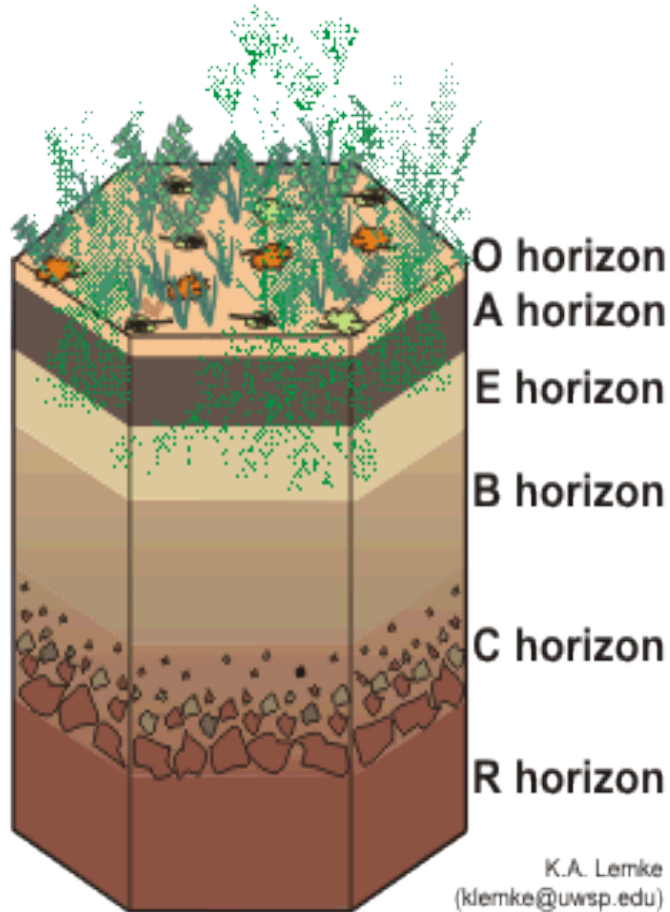
Motivation

Provide an objective and inexpensive means of quantitatively classifying degree of weathering based on color information as a surrogate for mineralogy.

Color Variation with Depth



Soil Profile



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↑
[SiO₂]
decreases

Jackson-Sherman Weathering Sequence

Early Stage

- Primary Silicates
- Gypsum
- Carbonate

Intermediate

- Quartz
- Mica
- Smectite/Vermiculite/chlorite

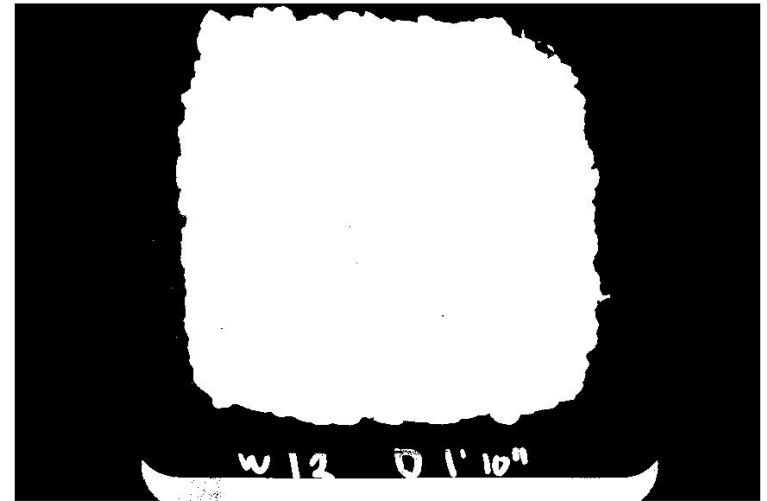
Advanced Stage

- Kaolinite
- Gibbsite
- Fe-Oxides

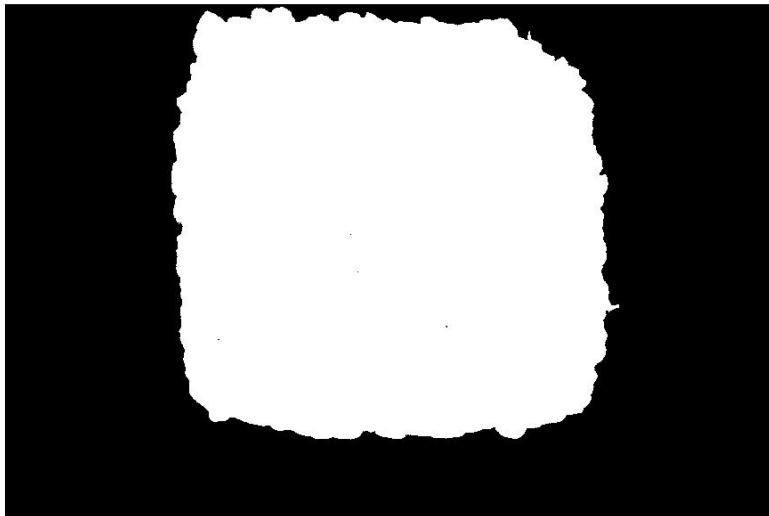
Extracting Relevant Color Information



Original Image



Black and White Image

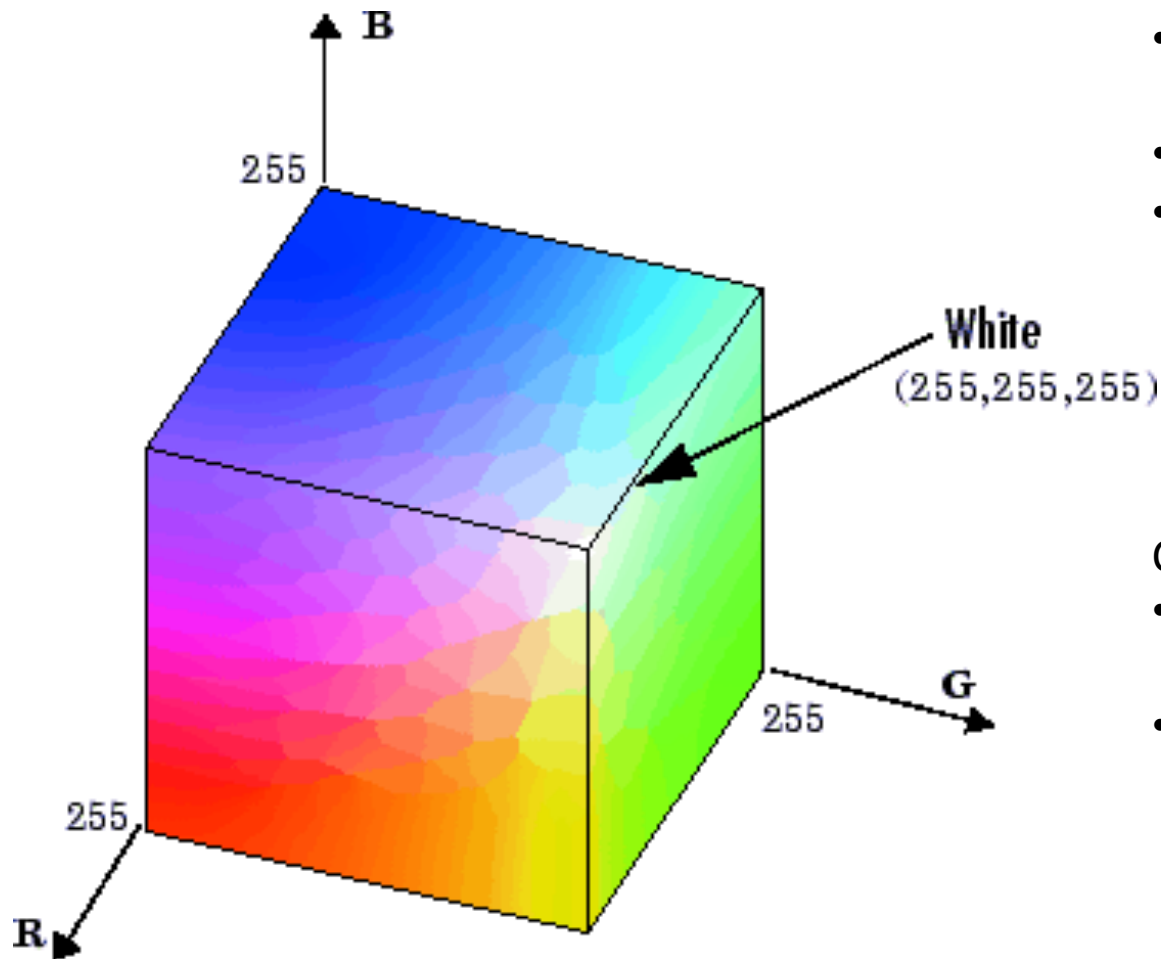


Region of Interest Identified



Color Information Extracted

RGB Color Scheme



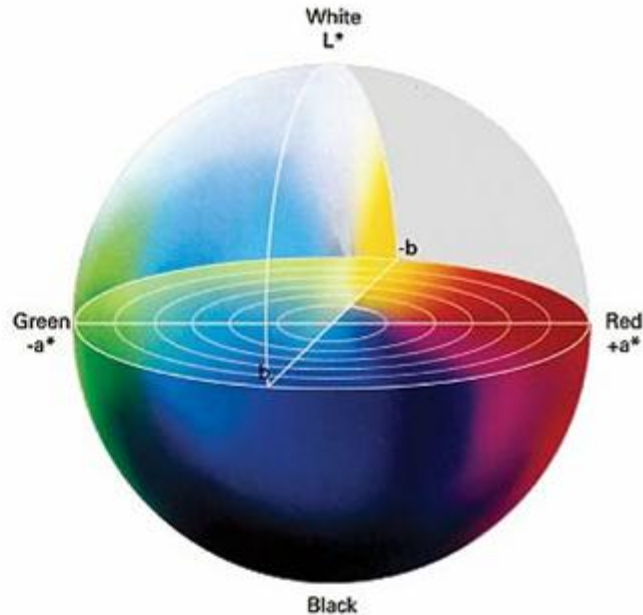
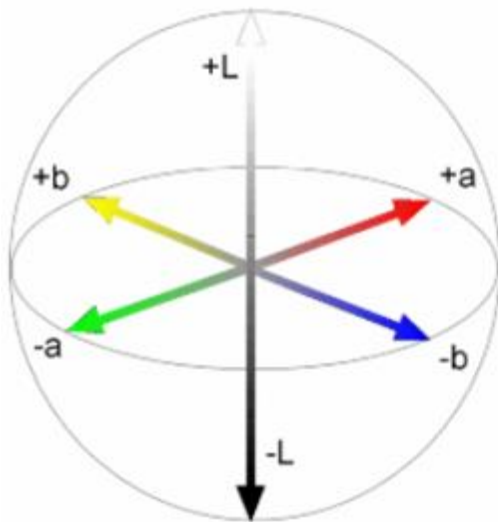
Pros:

- Widely supported in image file formats
- Most common colorspace
- Easy to conceptualize

Cons:

- Not capable of producing all visible colors
- Represents intensity of colors rather than color value

CIE $L^*a^*b^*$ Color Scheme



Pros:

- Represents full spectrum of colors visible to humans
- Mimics the manner in which humans perceive color

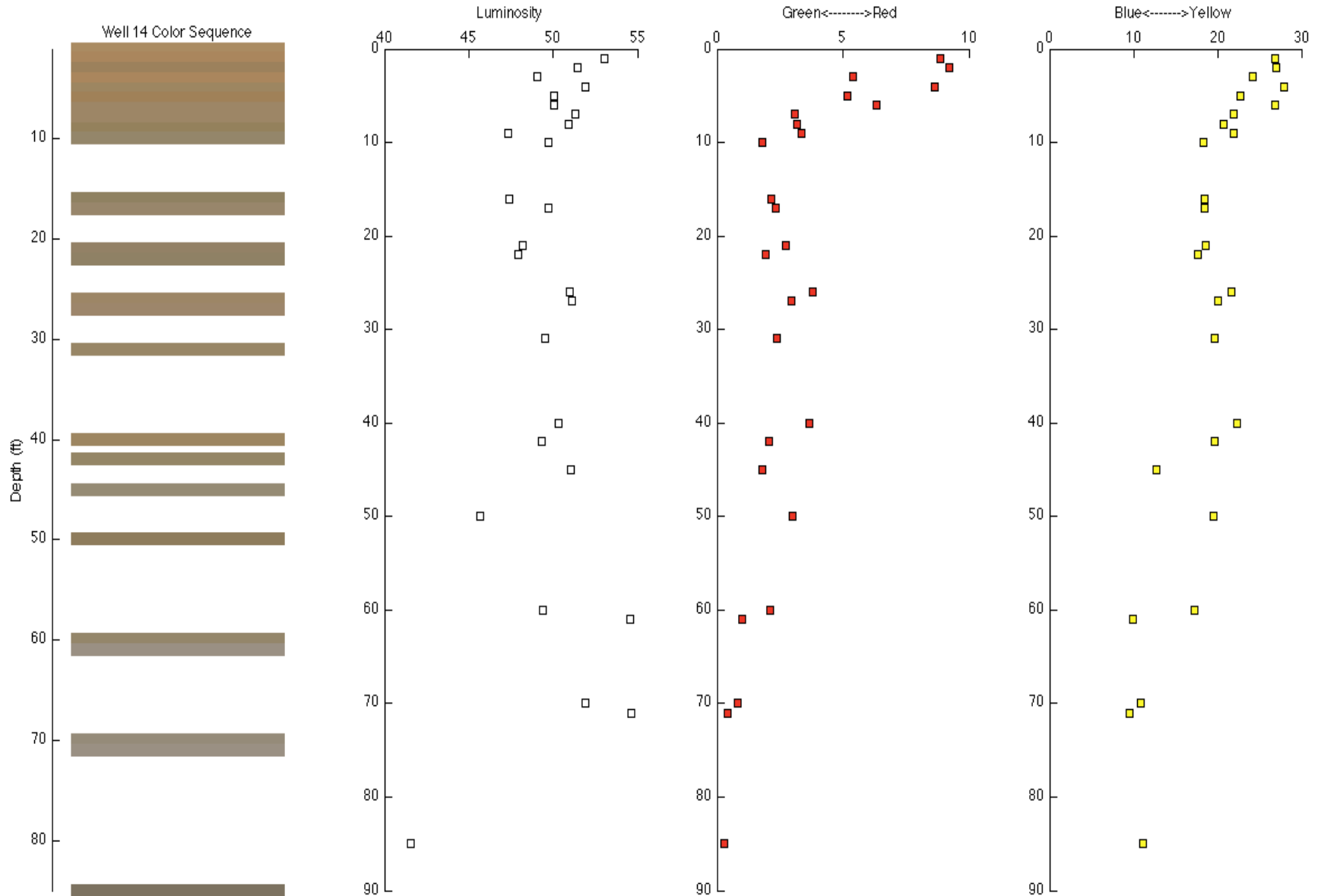
Cons:

- Not as widely supported in image files
- Difficult to conceptualize

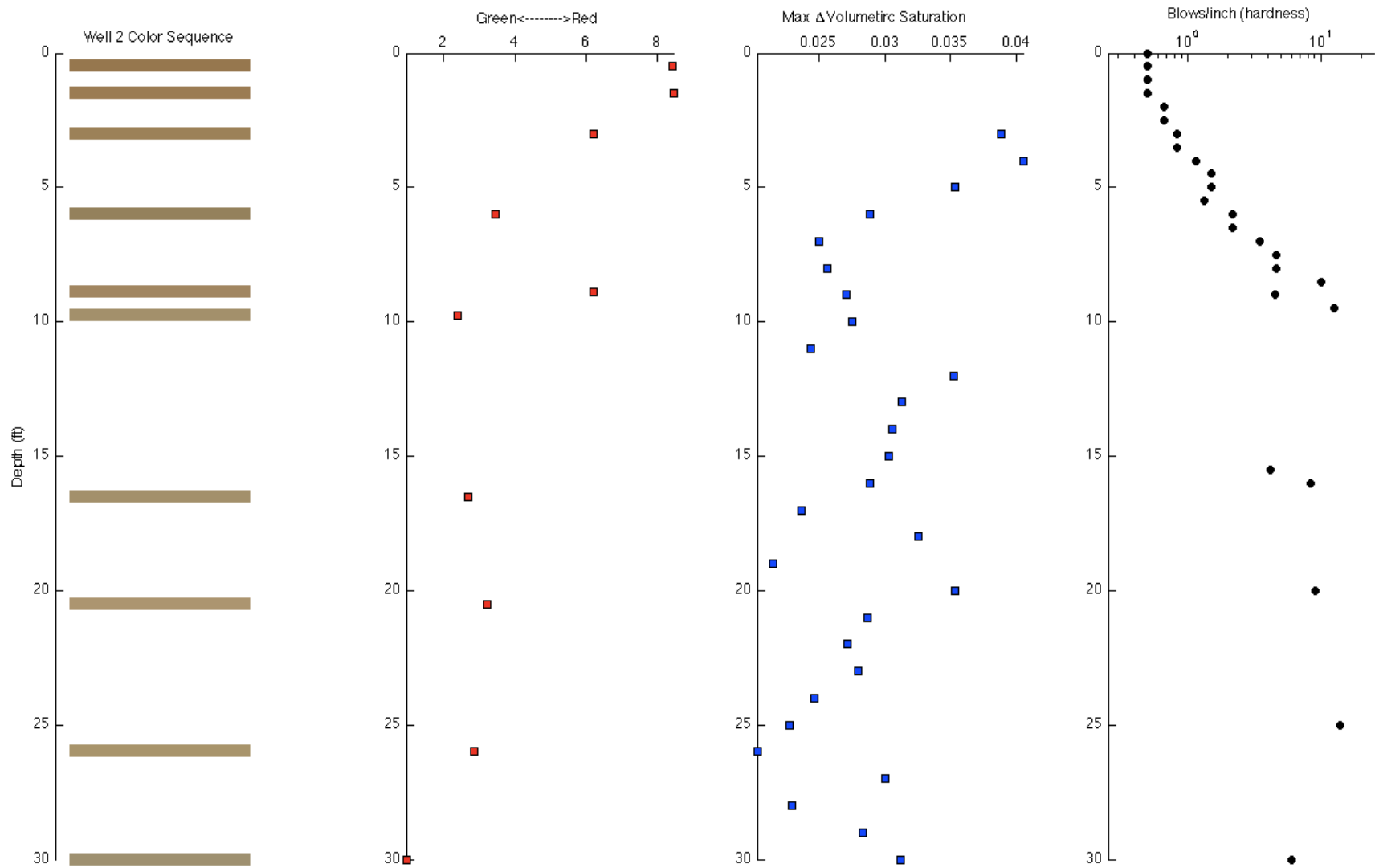
Colorspace converter Matlab code by: Pascal Getreuer (UCLA)

CIE: International Commission on Illumination

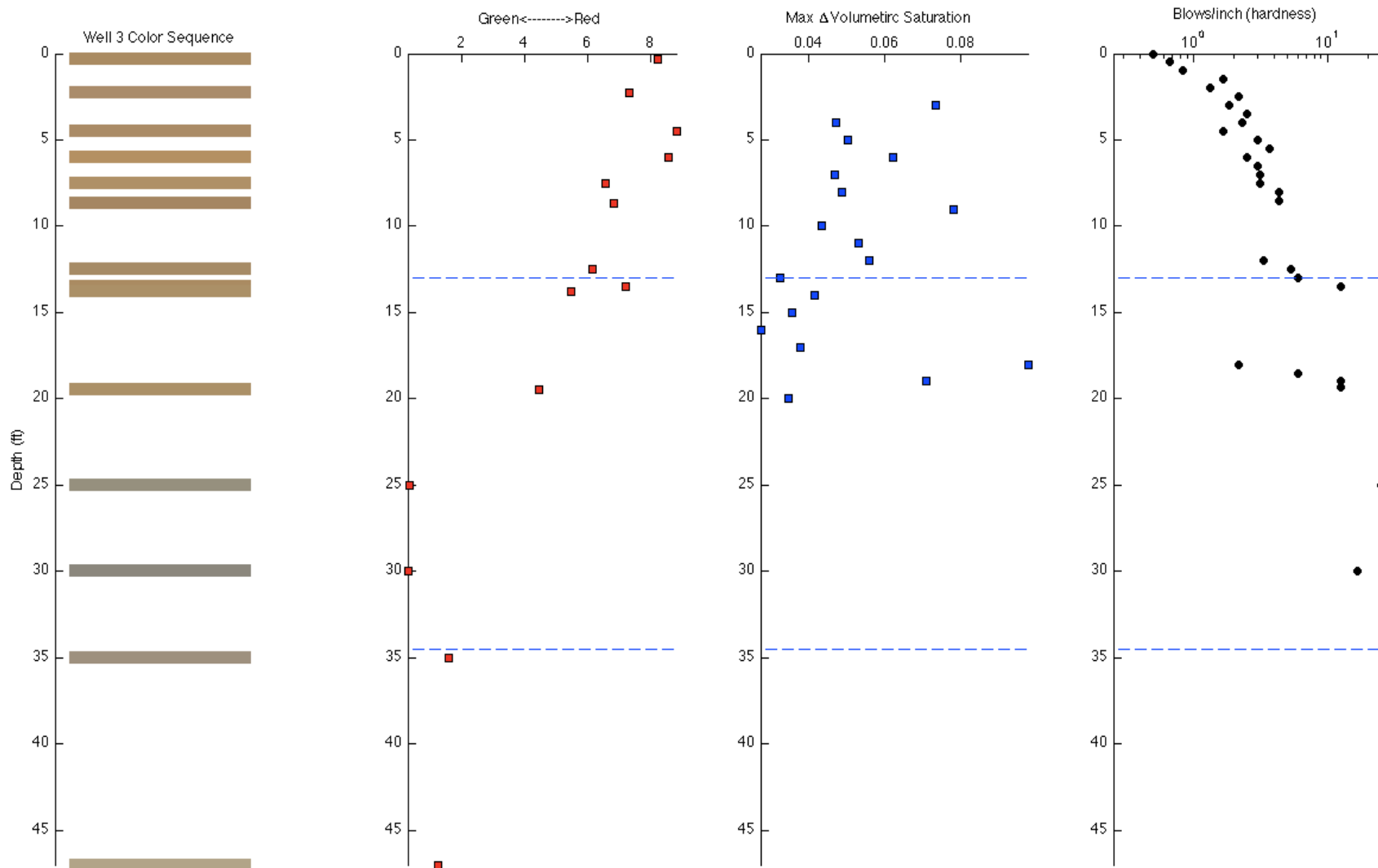
CIE L*a*b* Statistic



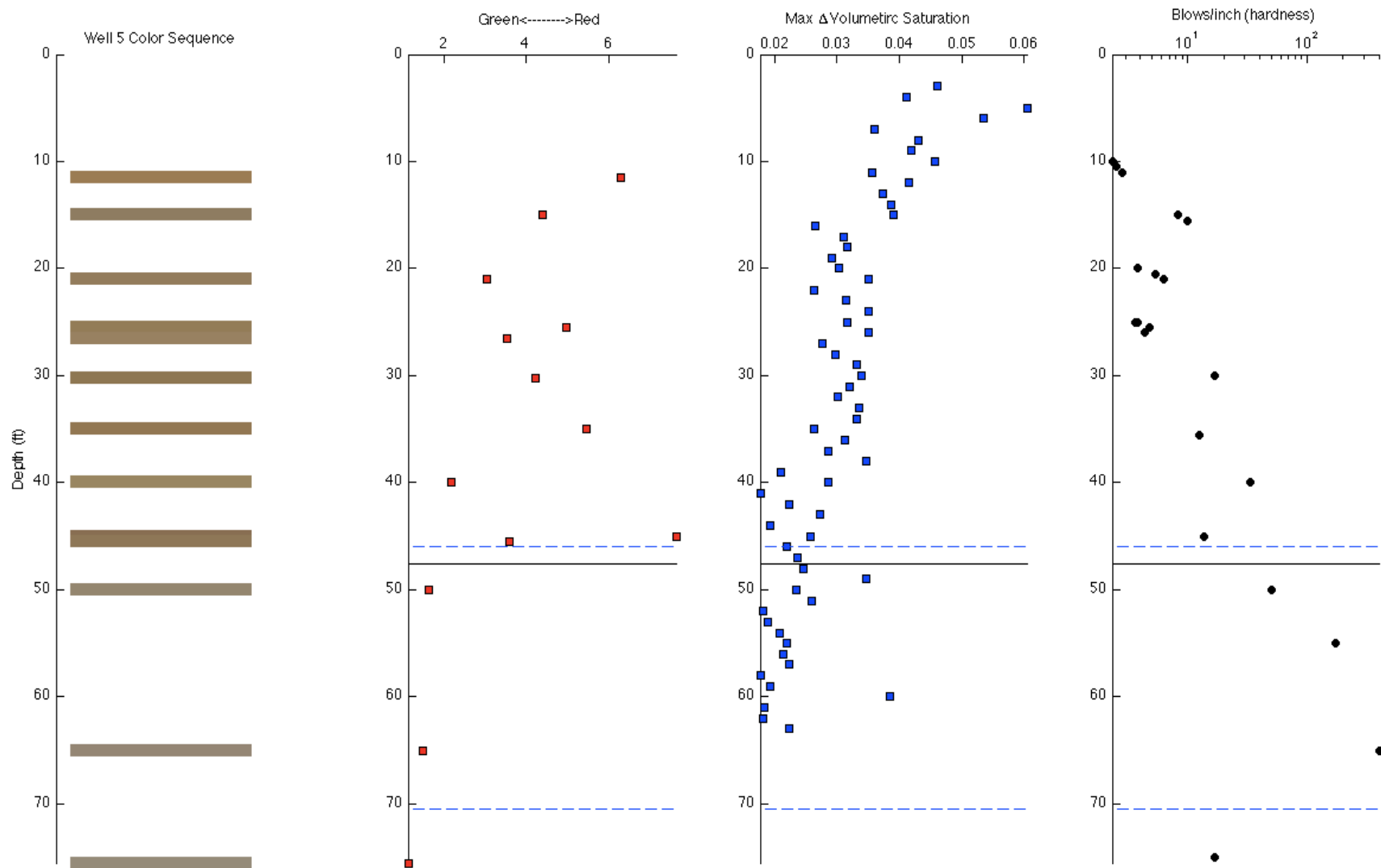
Well 2



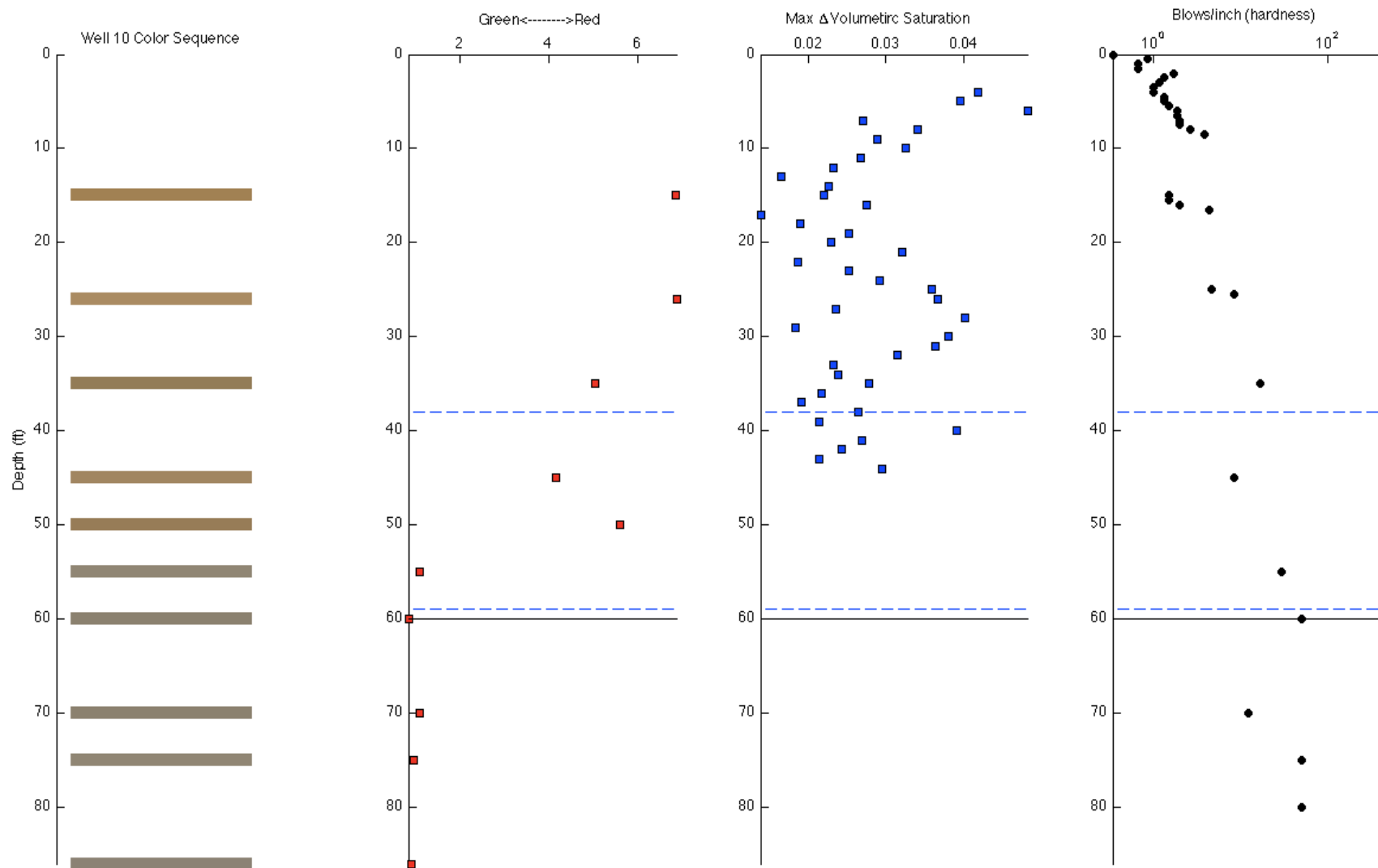
Well 3



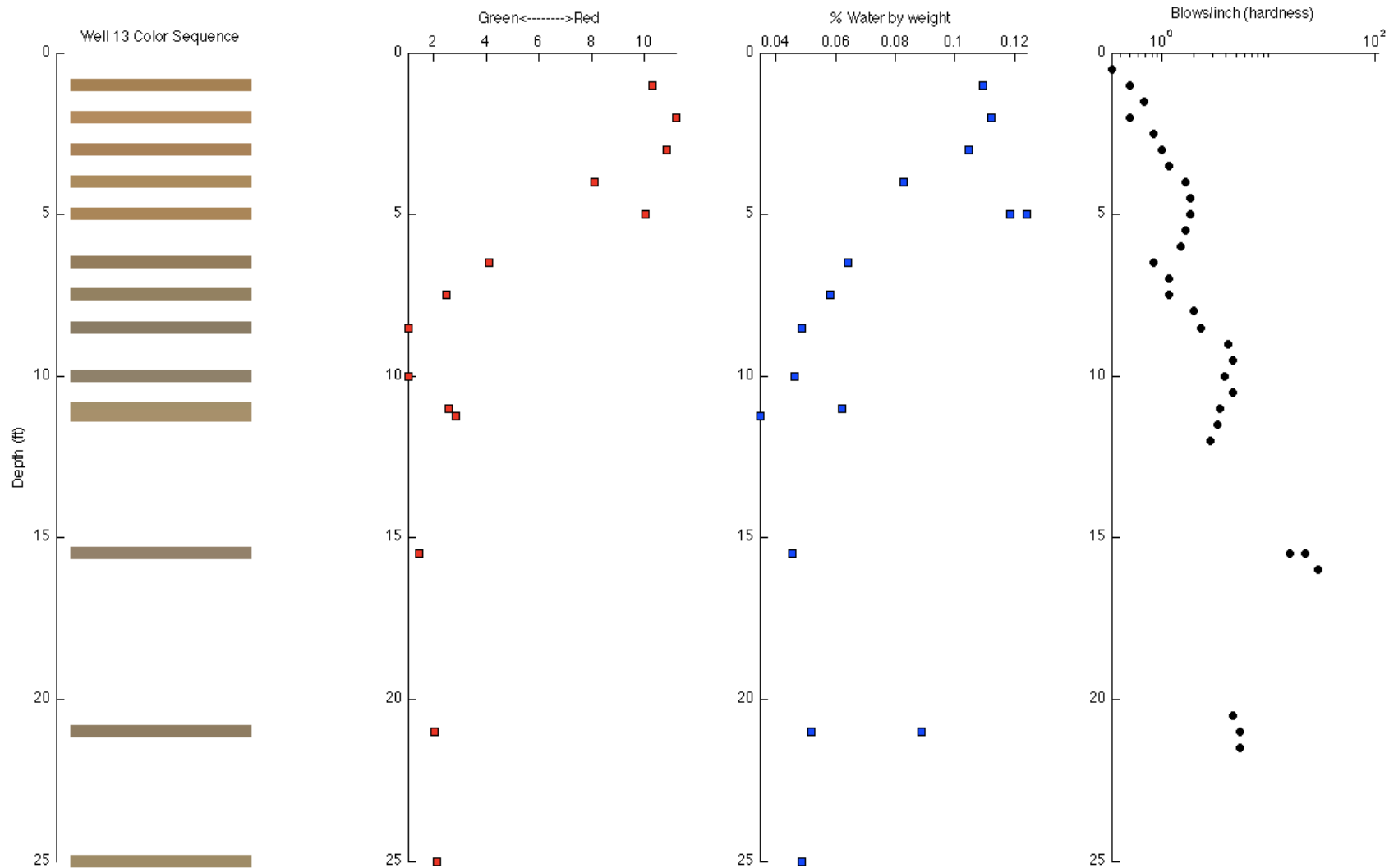
Well 5



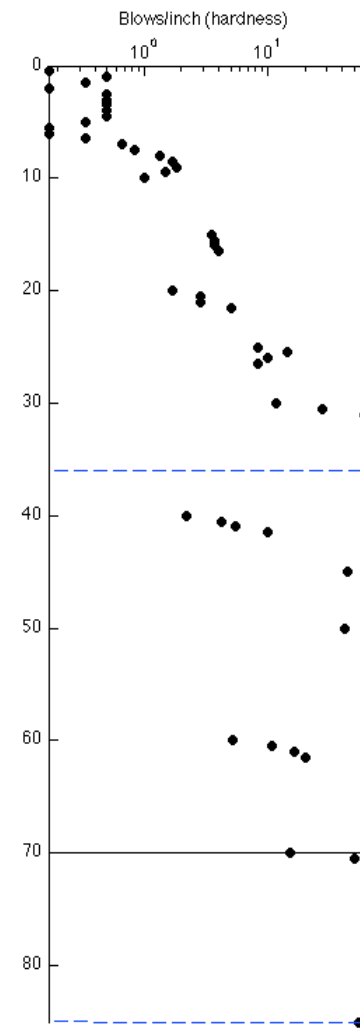
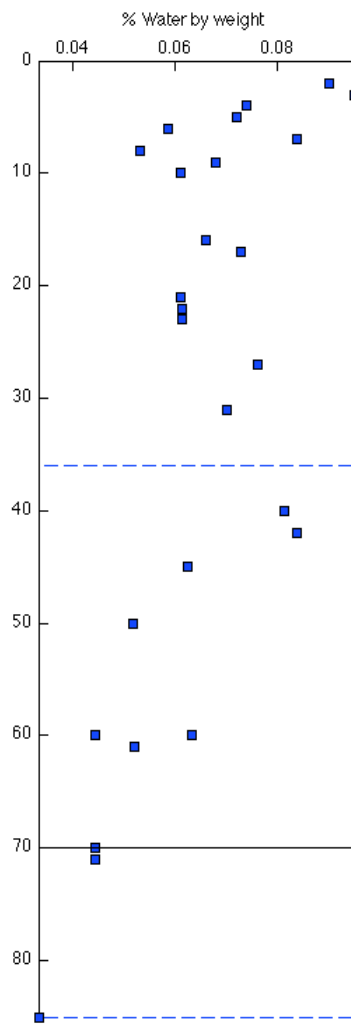
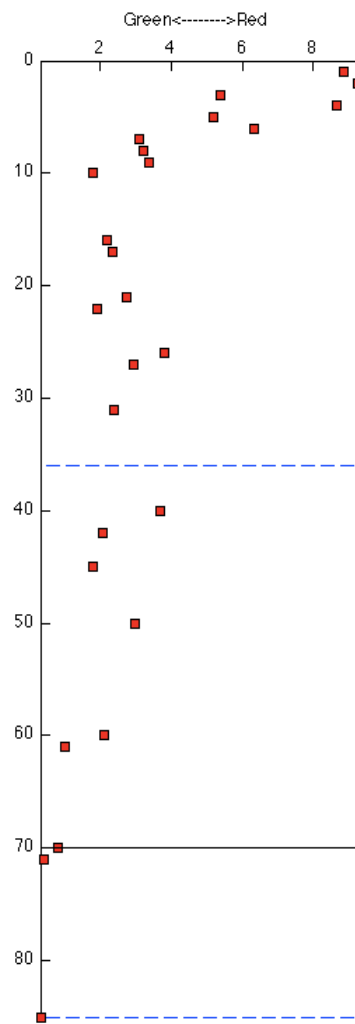
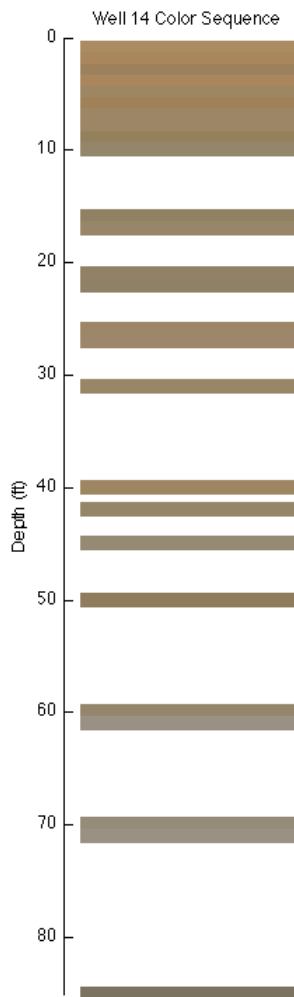
Well 10



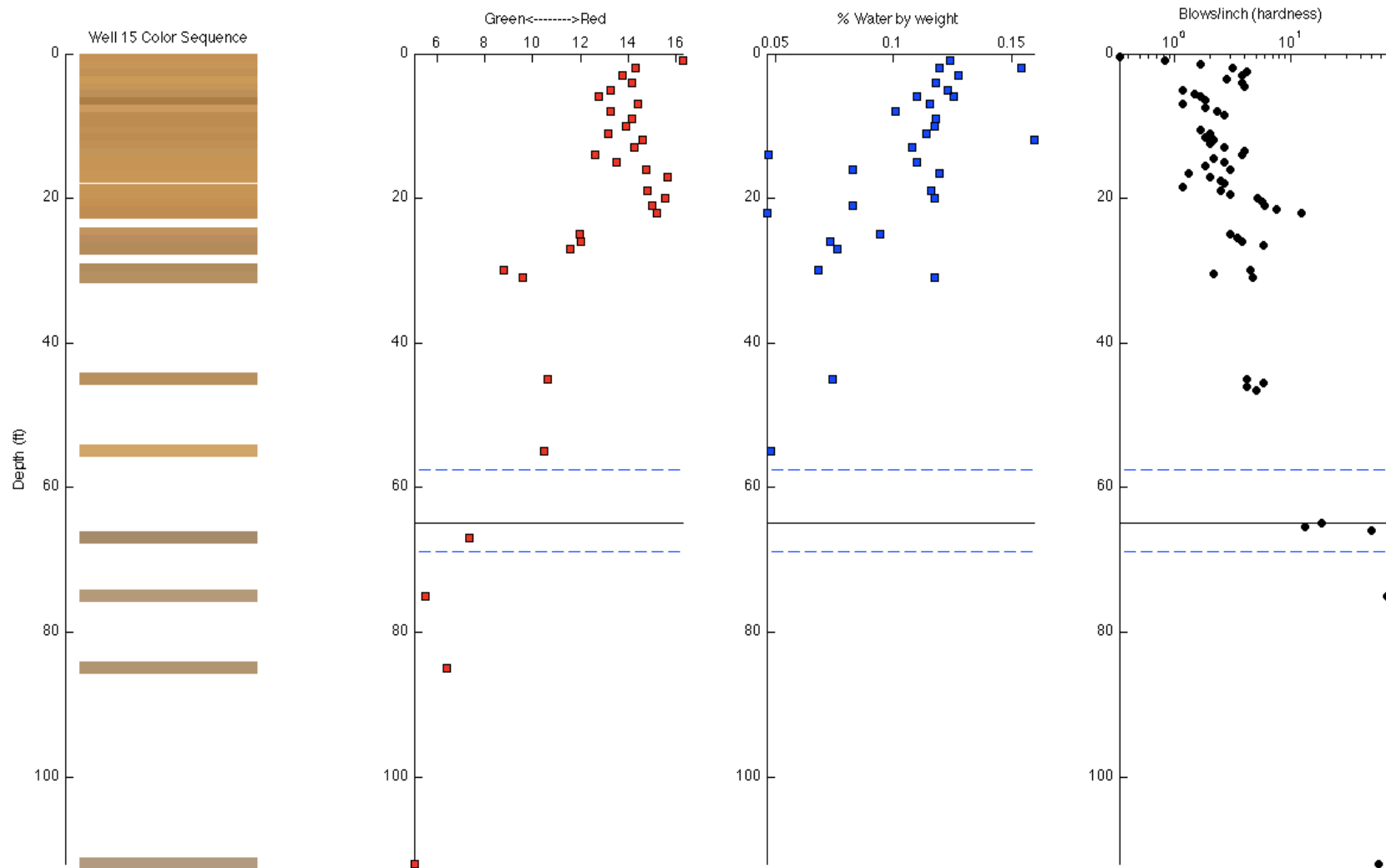
Well 13



Well 14



Well 15



Conclusion

- Color Information informs us about:
 - Mineralogy
 - Degree of Weathering
 - Potential Sites to Investigate
 - Potential Boundaries
- Future:
 - Correlate red color value with XRD data