Analyses and Interpretations of a Conventional Core from Central Louisiana, which Contains Deposits Resulting from the Effects of the Chicxulub Impact

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EXTENDED ABSTRACT

Justiss Oil Company, Inc. granted us access to the LA Central IPNH No. 2 well conventional core from Olla Field, LaSalle Parish, Louisiana (Figs. 1 and 2). The 120 ft long core contains Upper Cretaceous carbonate, Paleogene Midway Shale and, in between, a complete section of the Cretaceous/Paleogene Boundary Deposit (KPBD) (Sanford et al., 2016).

The KPBD was "accidently" cored with this well when Justiss Oil selected a coring point interpolated from Paleogene shale/Cretaceous chalk contact depths encountered in other wells in the area. They did not recognize that the top of the chalk has one-half mile wavelength, 50 ft high tsunami ripples resulting from the Chicxulub Impact (Egedahl, 2012; Egedahl et al., 2012; Strong, 2013; Strong and Kinsland, 2014). Serendipitously, the IPNH No. 2 well is located in a trough of the tsunami ripple surface and the coring point, predicted from wells higher on the ripples resulted in coring about 30 ft of Paleogene Midway Shale above the desired initial coring horizon at the top of the Cretaceous chalk.

We have performed several analyses on this core including: Visual inch by inch core description (Shellhouse, 2017), description of 35 thin-sections from chosen locations (Shellhouse, 2017 [note that comparisons of his descriptions and other analyses lead to the conclusion that in his figure 26 sample locations 26, 31, and 32 were erroneously located on the core image and erroneously tabulated in the table of his Appendix A when thin-section samples were cut—samples 28 through 31 should be 2 in. samples on 2 in. centers spanning the obvious transition in lithofacies]), 10% HCl acid dissolution studies of the thin-section blanks (Kinsland et al., 2017; Muchiri, 2018), XRF (X–ray fluorescence) and XRD (X–ray diffraction) of the insoluble residue from the thin-section blanks (Frederick, 2018), and scanning electron microscope (SEM) imaging of portions of selected thin-section blanks (Muchiri, 2018). We have XRF data collected by University of Texas at Austin personnel at the Austin core repository, well logs (gamma ray, spontaneous potential, resistivity and FMI [Formation Micro Imager]).

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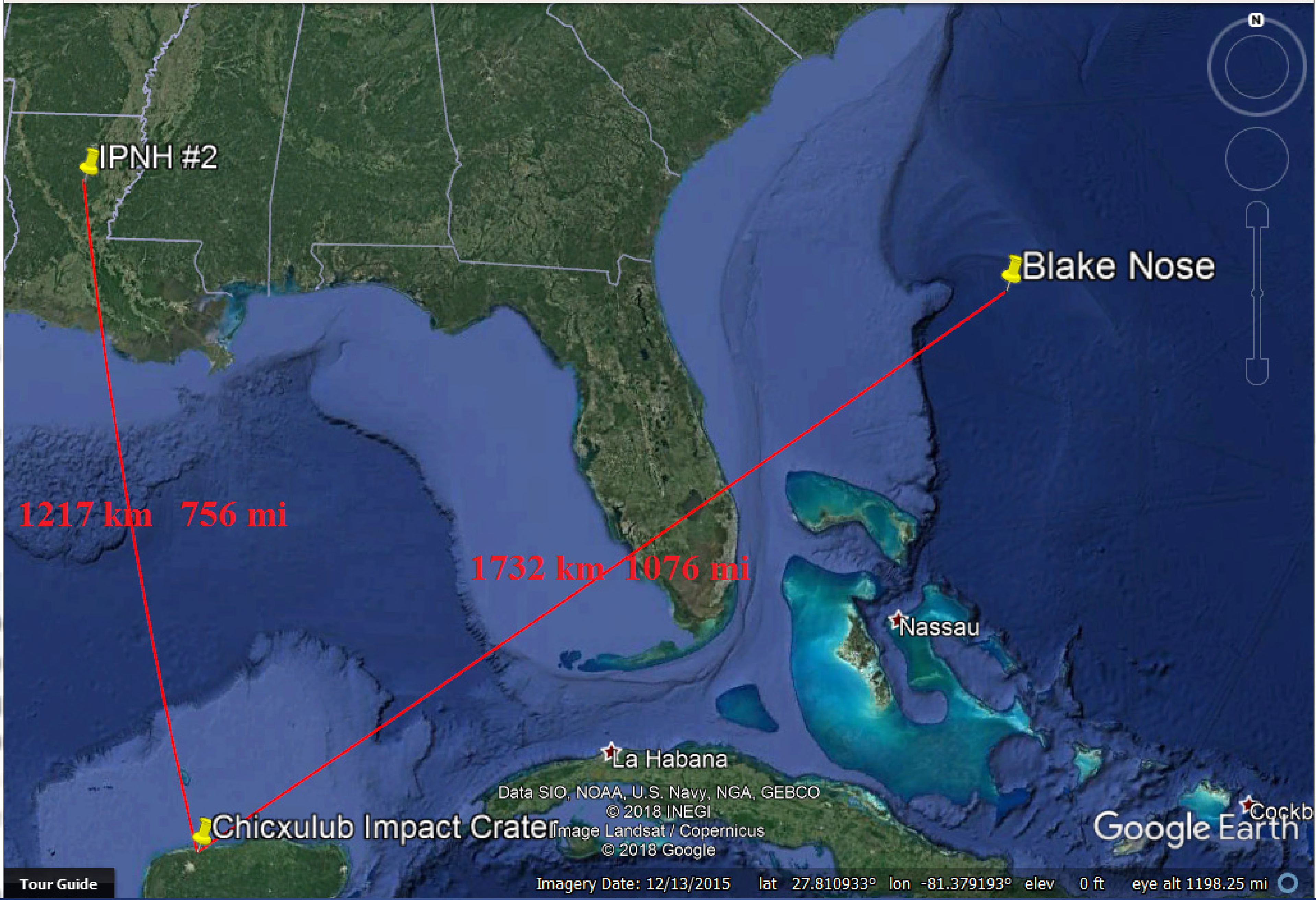


Location of our core and of marine core off of the Blake Nose relative to the Chicxulub Impact

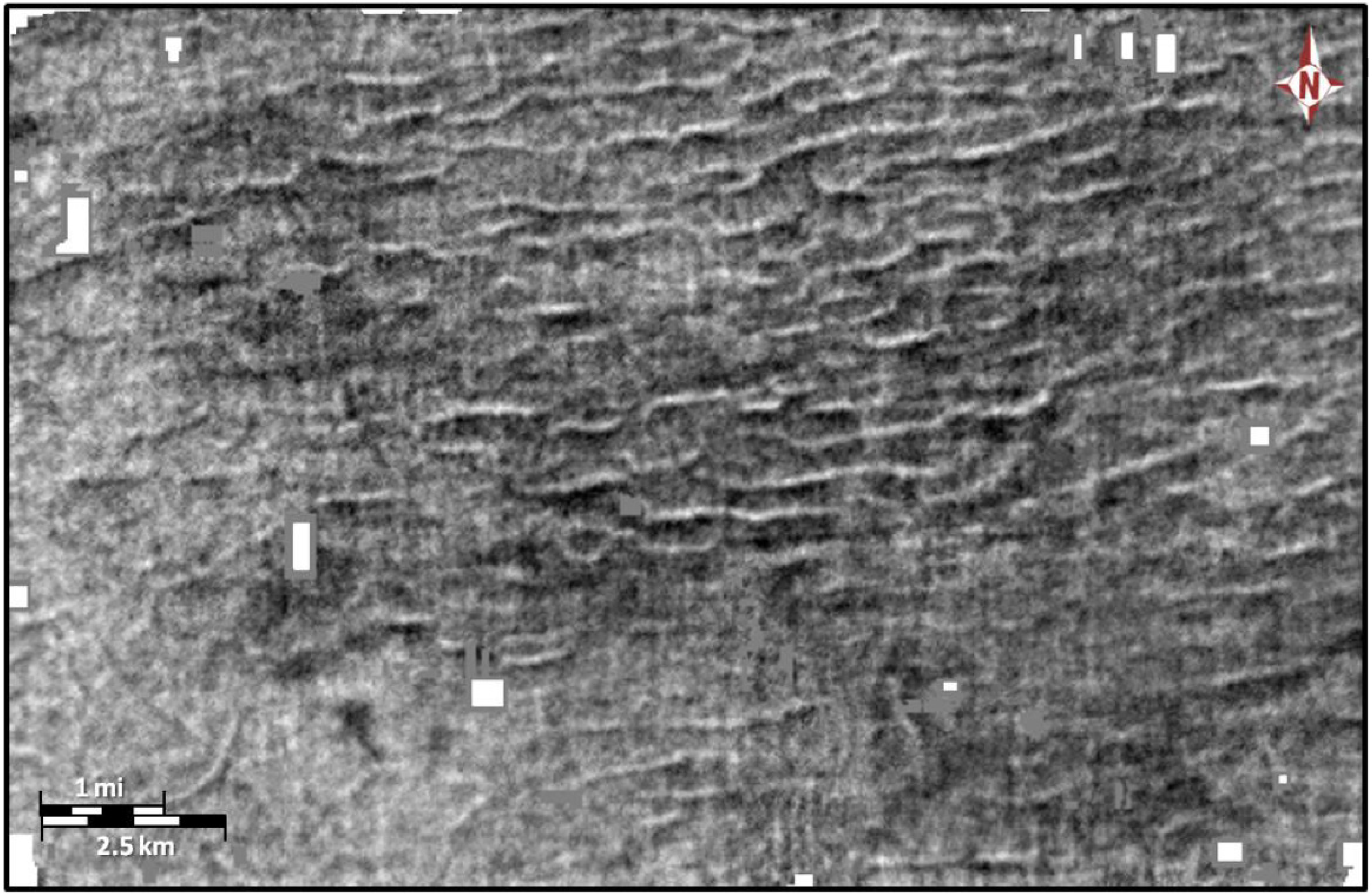


Figure 50: Amplitude map of a stratal slice just slightly above the positive peak reflection event that represents the top of the Cretaceous interval within the seismic data. Ripple like features can be viewed in plan view. These lineations do not correlate to faulting.

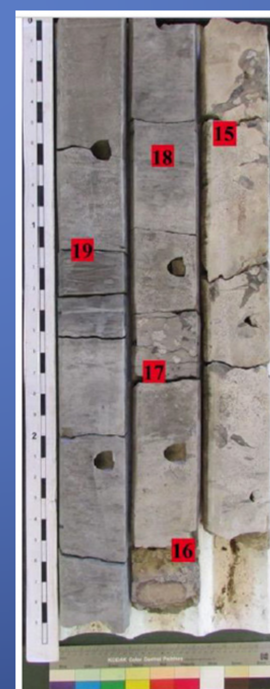
(Egedahl, 2012)

Midway Shale

Mass Transport Deposit: KPBD

Pre-impact Chalk/Marl

Upper Hard Ground



Lower Hard Ground

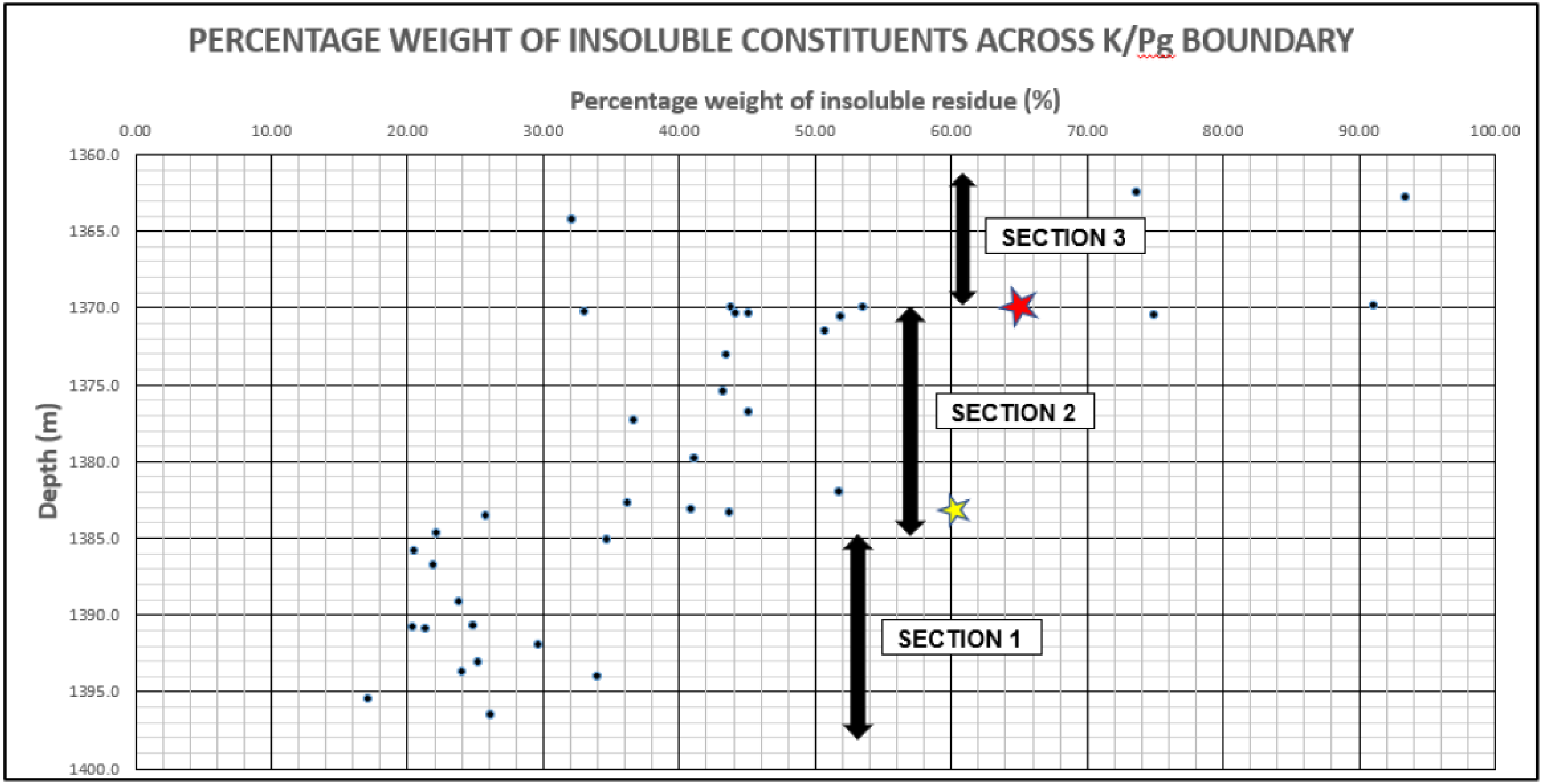
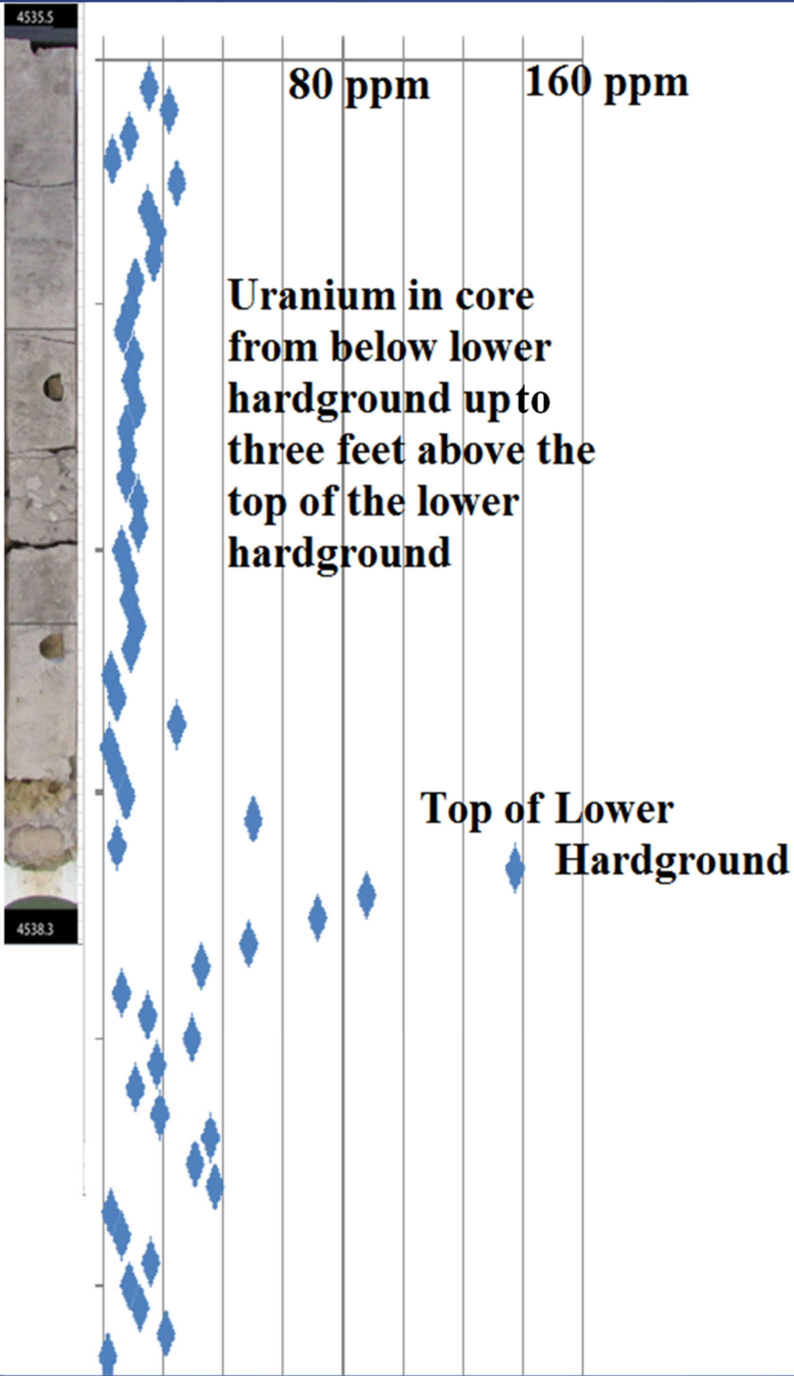
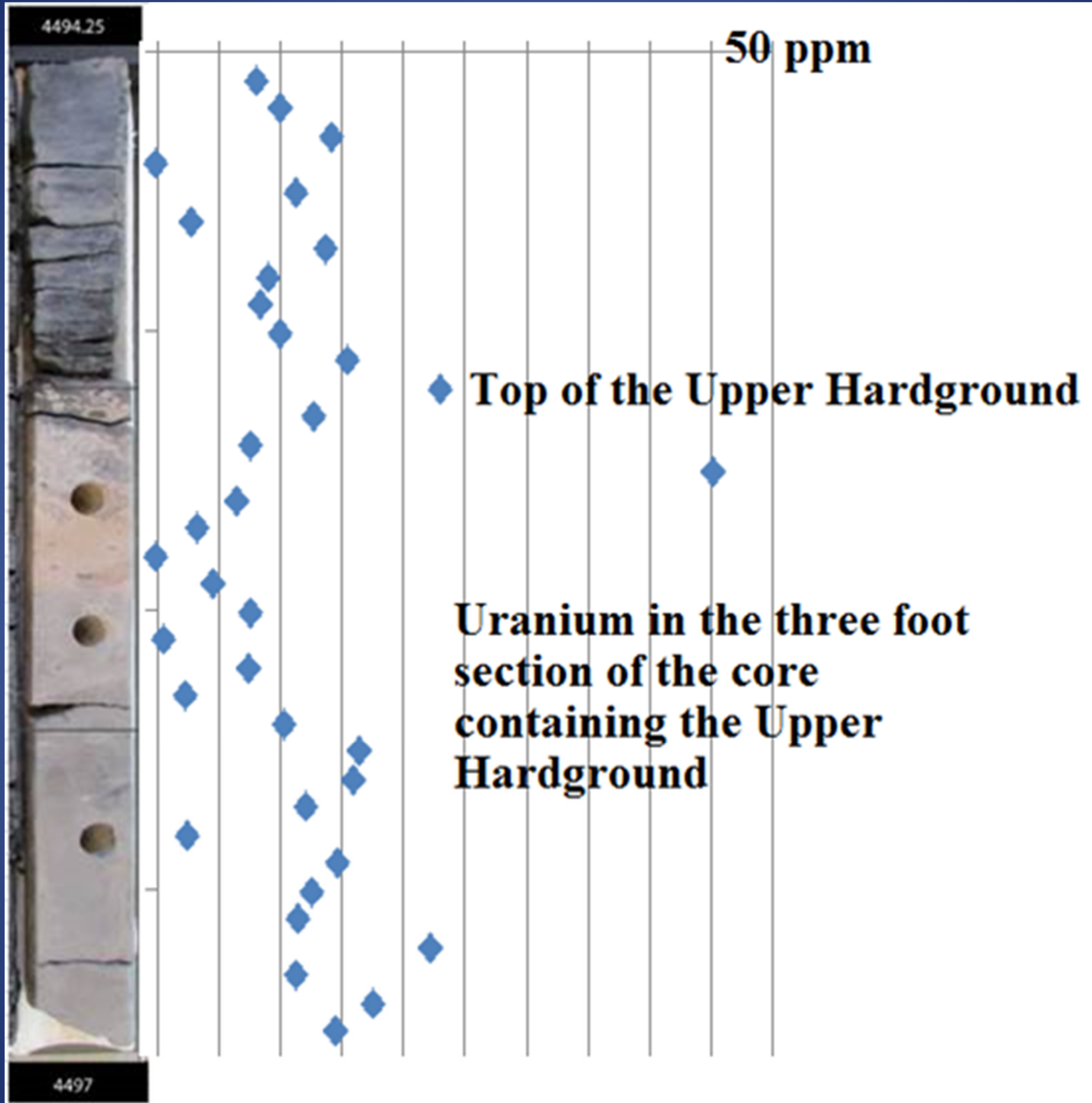


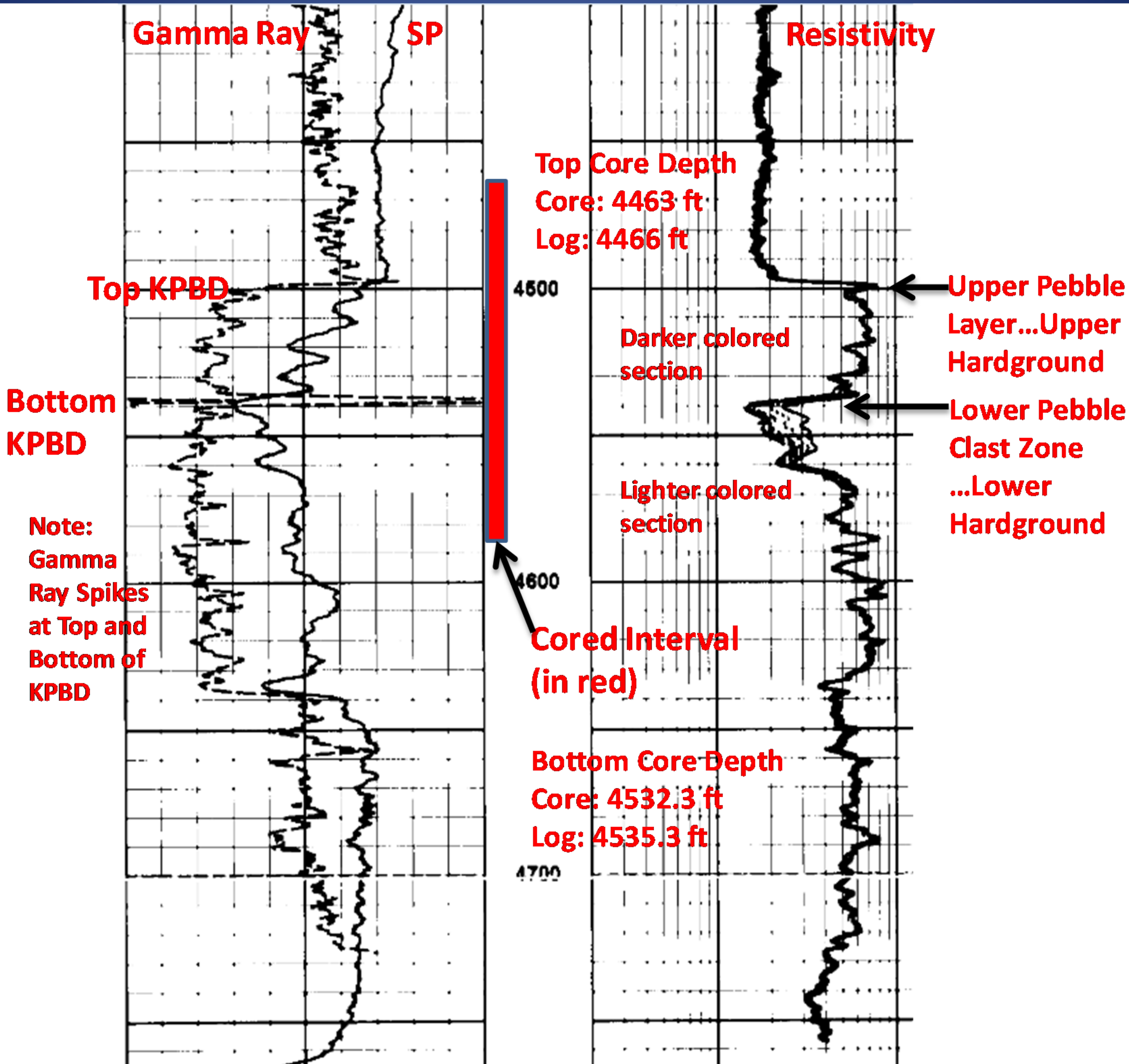
Figure 21. A cross-plot showing percentage weight of insoluble components of the Justiss LA Central IPNH No. 2 well-core with depth; ★ represents the K/Pg boundary and the upper hardground and, ☆ represents the lower hardground

(Muchiri, 2018; Kinsland et al., 2017b)

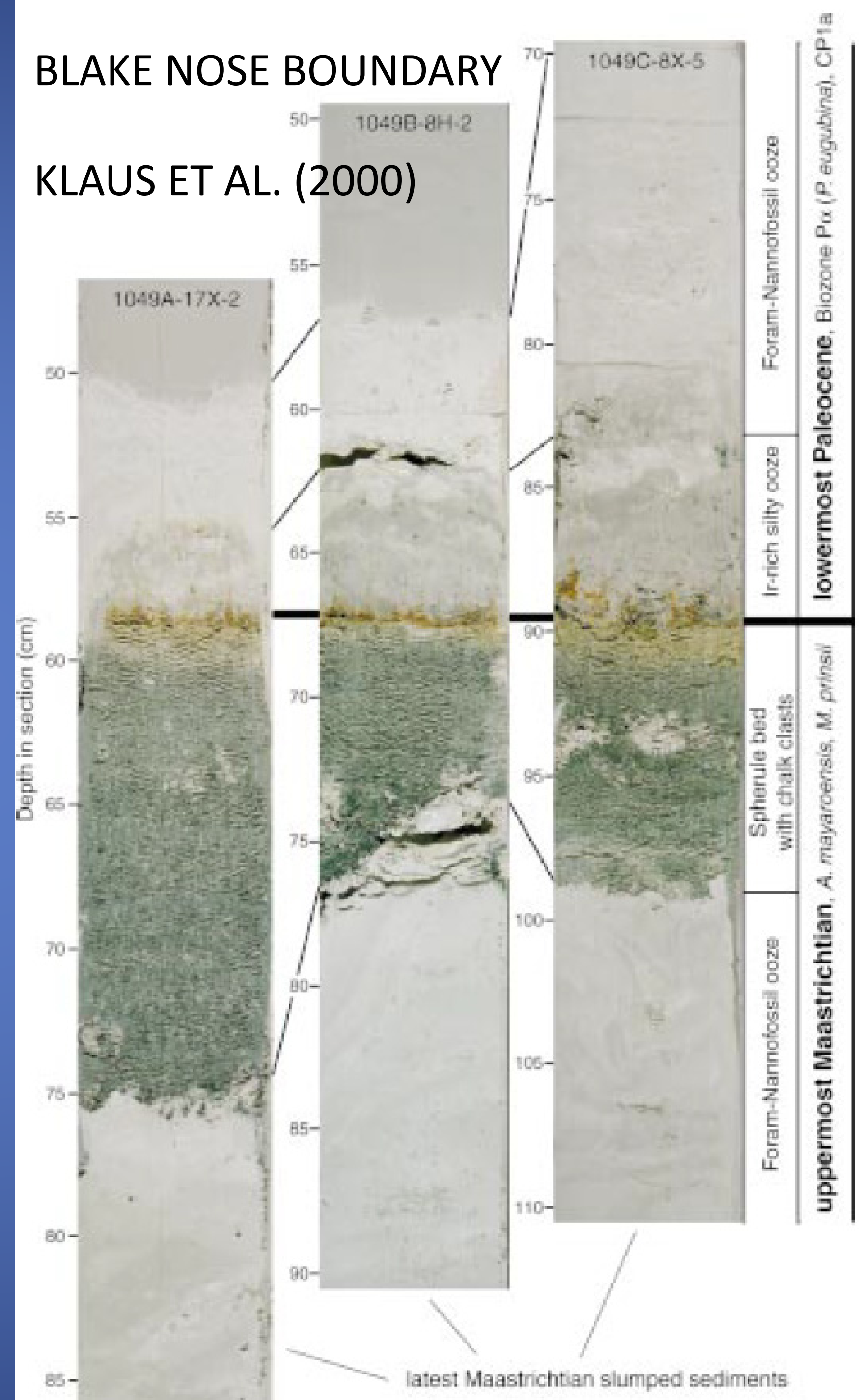


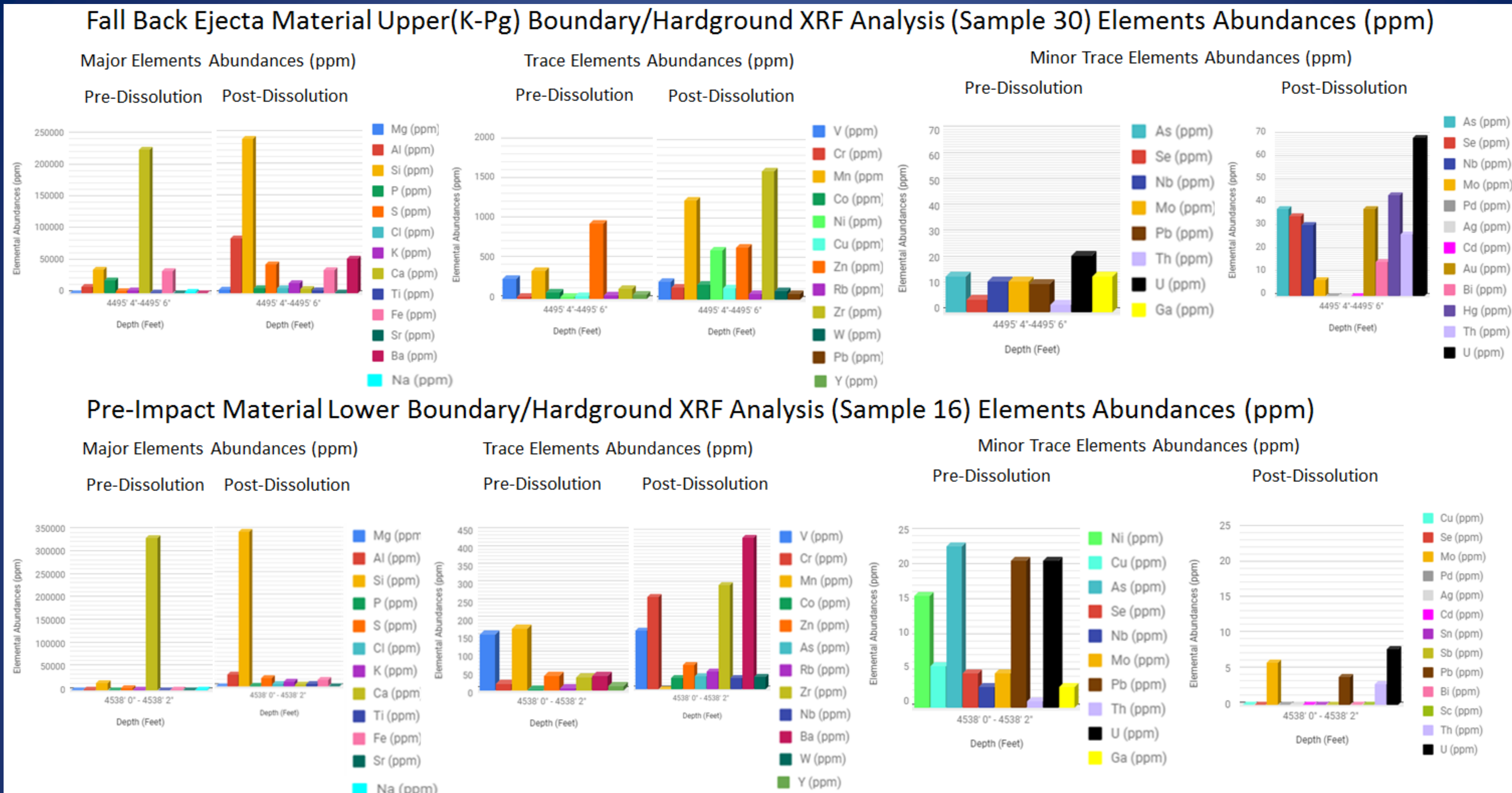
These and other XRF Data from core: John Virdell, UT Austin


4494.25
50 ppm
Top of the Upper Hardground
Uranium in the three foot section of the core containing the Upper Hardground
4497


Gamma Ray
SP
Resistivity
Top Core Depth
Core: 4463 ft
Log: 4466 ft
Top KPBD
4600
Upper Pebble
Layer…Upper
Hardground
Darker colored
section
Bottom
KPBD
Lower Pebble
Clast Zone
…Lower
Hardground
Lighter colored
section
Note:
Gamma
Ray Spikes
at Top and
Bottom of
KPBD
4600
Cored Interval
(in red)
Bottom Core Depth
Core: 4532.3 ft
Log: 4535.3 ft
4700

BIG QUESTION: CLEARLY BLAKE NOSE CLEANER CHALK BEFORE IMPACT. WE UNDERSTAND THAT MIDWAY SHALE IS WHAT'S LEFT TO ACCUMULATE IN OUR CORE AFTER COCCOLITHS "ELIMINATED" FROM DEPOSITION AT OUR SITE.......HOWEVER: WHY WERE THE CARBONATES "ELIMINATED" AT OUR SITE AND NOT AT THE BLAKE NOSE?





This slide and the next three slides are from Forrest Frederick’s thesis work in progress.

(Frederick, 2018)

All Samples

- The pre-dissolution 10% HCl XRF data and the post-dissolution 10% HCl XRF data are significantly different in the amount and types of elements present within each sample.
- Generally, the pre-dissolution samples contain elements such as Na, Y, and Ga which are not found in the post-dissolution samples. This occurs because the XRF machine used to detect the elemental abundances in the post-dissolution samples is more limited in its elemental detection range and cannot measure these elements.
- Contrastingly, the post-dissolution samples contain elements such as Pd, Ag, Cd, Au, Bi, Sc, Sn, Sb, and Hg, which most likely result from the removal $CaCO_3$, which is dominant in the pre-dissolution samples and acts as a mask for all of these elements.
- More research is currently being conducted on all core samples using XRD analysis which will give further insights into the mineralogy of the core.

Sample 30

- Sample 30 originates from the upper (K/Pg) boundary section currently identified as the Fall Back Ejecta Material Zone, and its deposition is directly affected by the Chicxulub Impact.
- This sample is located directly at the K-Pg boundary within the core and has a heterogeneous particle size makeup and contains a mixture of various elements suggesting that the depositional environment was profoundly affected by the Chicxulub Impact as the Fall Back Ejecta particles collided with each other and settled in the sediment layer.
- Some elements such as Hg and Au appearing only in sample 30 and nowhere else within the samples taken from the core, making the sample distinct from any other sample within the core.
- Ba is present in substantial amounts in sample 30, which upon investigation proved to occur from the outside contamination of drilling mud
- This sample also contains some elements associated with bolide impacts such as Ni, Cu, Mn, Zn, Zr, As, Se, Nb, and U which have significant increases in elemental abundances compared with surrounding samples. These elements were also some of the trace elements found in the K-Pg boundary clay in Denmark (Alvarez et al., 1980). This suggests that an impact such as Chicxulub could have affected the depositional environment in which this sample was taken.

Sample 16

- Sample 16 originates from the lower boundary section currently identified as the Pre-Impact Material Zone in which the Chicxulub Impact had no effects on the depositional environment at this stage of the core.
- This sample also is heterogeneous and is considered to be part of a hard ground depositional environment due to evidence of borings in and around the sample.
- The hard ground is hypothesized to have been in place prior to the Chicxulub Impact and is considered to be a depositional environment in which a significant reduction in the deposition of sediment occurred. One hypothesis for this reduction in sedimentation is the presence of bottom ocean currents which swept away sediment during the Late Cretaceous.
- Just below sample 16 is a sizeable gamma-ray spike which is attributed to a sudden spike in U of 138 ppm (Pre-Dissolution 10% HCl) as compared with much lower values of less than 50 ppm in the surrounding samples.
- Sample 16 also has significant increases in Zr and Cr post-dissolution. More study will need to be done on this to determine why these elemental abundances increase.
- This sample also contains a significant increase in Ba which is attributed to mud contamination from drilling.

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Interpretation of the Core (numbered in time order…bottom up)

6) Paleogene terrestrially sourced clays of the Midway Shale
5) less-well-developed hardground, “upper pebble layer” of Kinsland et al. (2017), with some material ballistically/atmospherically transported from the Chicxulub Impact site.
4) Modification by tsunamis from the impact
3) mass transport deposit mobilized by the Chicxulub Impact earthquake (Sanford et al., 2016), at least at this locality, material from up-dip was transported over intact hardground. The mass transport/hardground contact is then the K/Pg boundary (Molina et al., 2006),
2) a well-developed marine hardground, that this “lower pebble clast zone” of Kinsland et al. (2017) is a hardground was originally suggested by Galloway (2017)
1) relatively undisturbed Upper Cretaceous coccolith rich chalk (marl) Kinsland et al. (2017), Muchiri (2018), Shellhouse (2017)

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