

PS Occurrence of Volcanic Ash Beds in the Wolfcamp and Spraberry of the Midland Basin and Their Potential Challenges to Drilling*

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Abstract

Multiple instances of volcanic ash beds are identified during active drilling within the Wolfcamp shale and Spraberry formation in the Midland Basin of west Texas. These ash beds were initially observed in vertical cores using ultraviolet light and can range between 1 cm to 15 cm (0.5 ft), with most 3 cm or less. During drilling of recent horizontal wellbores, operations has logged cuttings containing 5% ash to greater than 80% ash per sample. Volcanic ash is identified in wells located throughout the entire N-S length of the central portion of the Midland Basin on both the western and eastern margins. Stratigraphically, most volcanic ash occurrences are within the Wolfcamp A and Wolfcamp B operational units. A possible source for these volcanic ash-fall deposits is a Permian-aged volcanic arc located in present-day NE Mexico. Recent drilling and operational issues have occurred in some high-percentage ash-bearing zones that include tight wellbore, wellbore pack-off, directional control issues, and increased drag while setting casing. In some instances, drilling issues were severe enough to require sidetracking the well or setting casing short of planned total depth. Possible problems caused by volcanic ash may include preferential break-out due to low rock strength, sloughing in the wellbore, ineffective wellbore cleaning, and altering the drilling fluid. These adverse effects may slow down drilling performance. Studies are ongoing to identify regions and target zones that contain a high occurrence of ash and to assess the severity of potential challenges during drilling and completion operations.

References Cited

Leary, R.J., P. Umhoefer, M.E. Smith, and N. Riggs, 2017, A three-sided orogen: A new tectonic model for Ancestral Rocky Mountain uplift and basin development: *Geology*, v. 45, p. 734-738.

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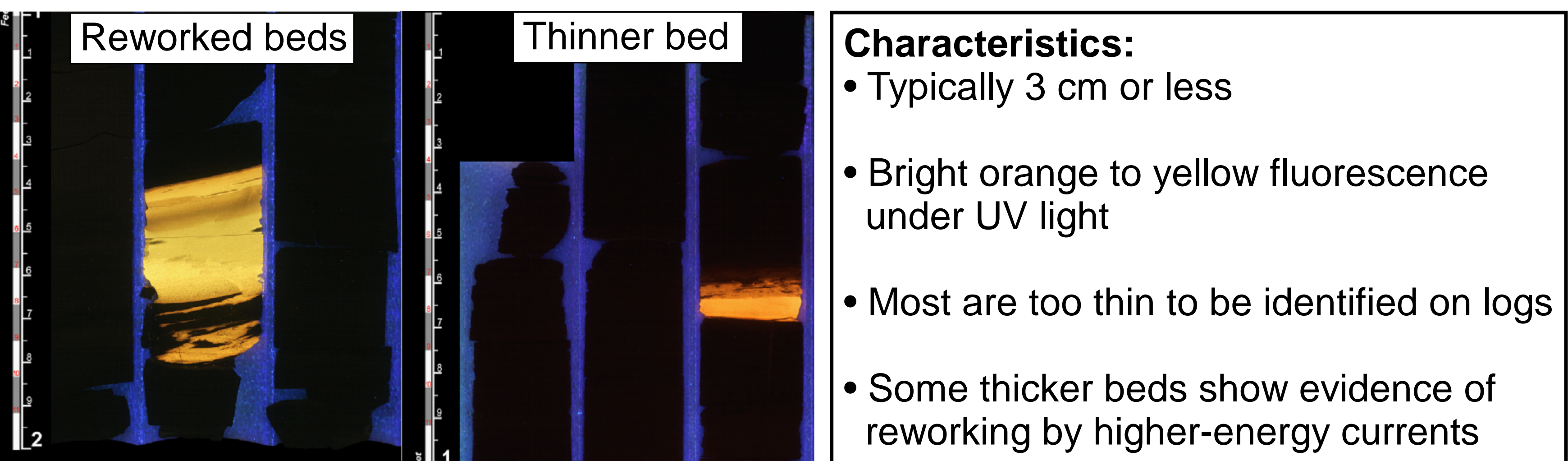
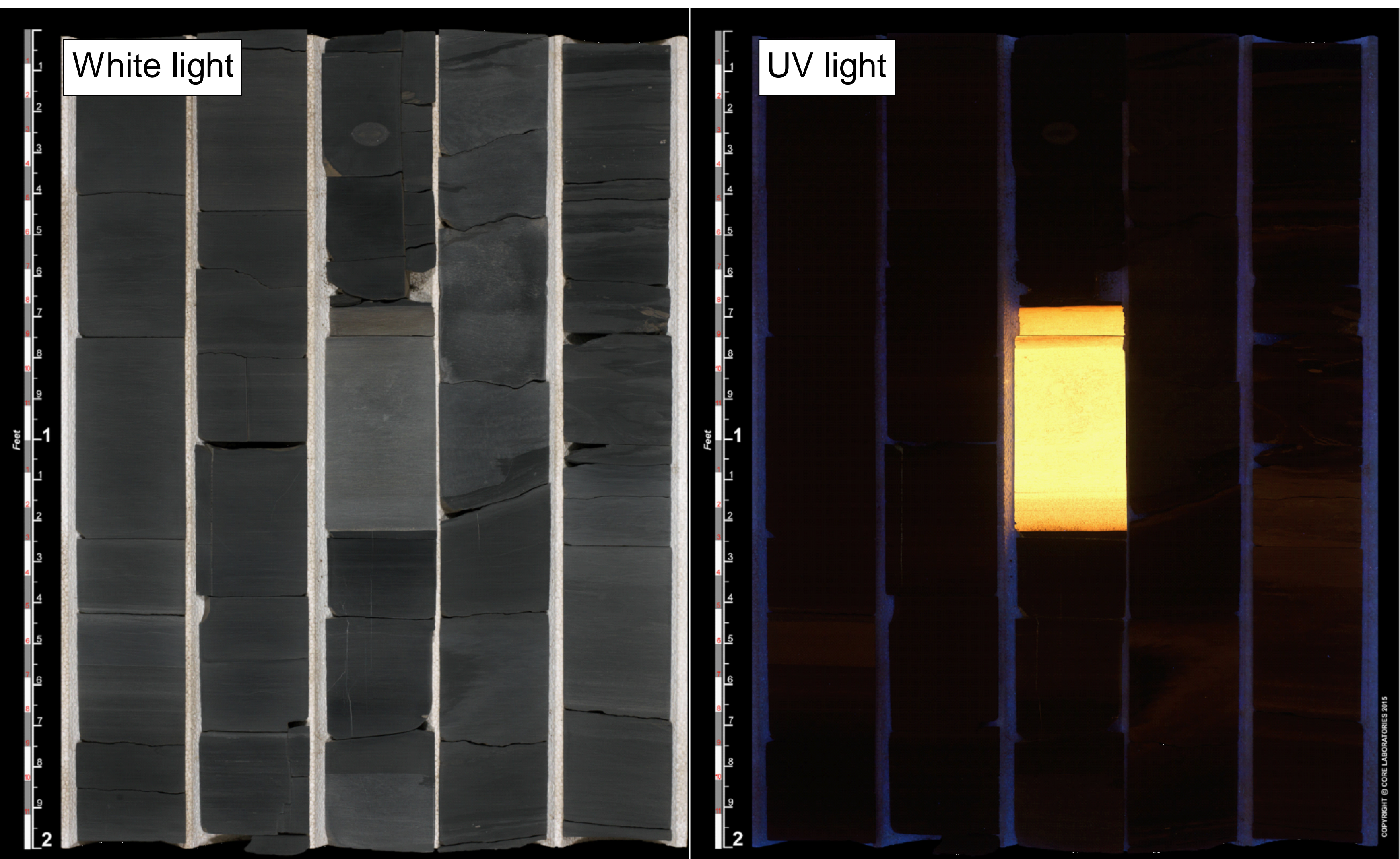
OCCURRENCE OF VOLCANIC ASH BEDS IN THE WOLFCAMP AND SPRABERRY OF THE MIDLAND BASIN AND THEIR POTENTIAL CHALLENGES TO DRILLING

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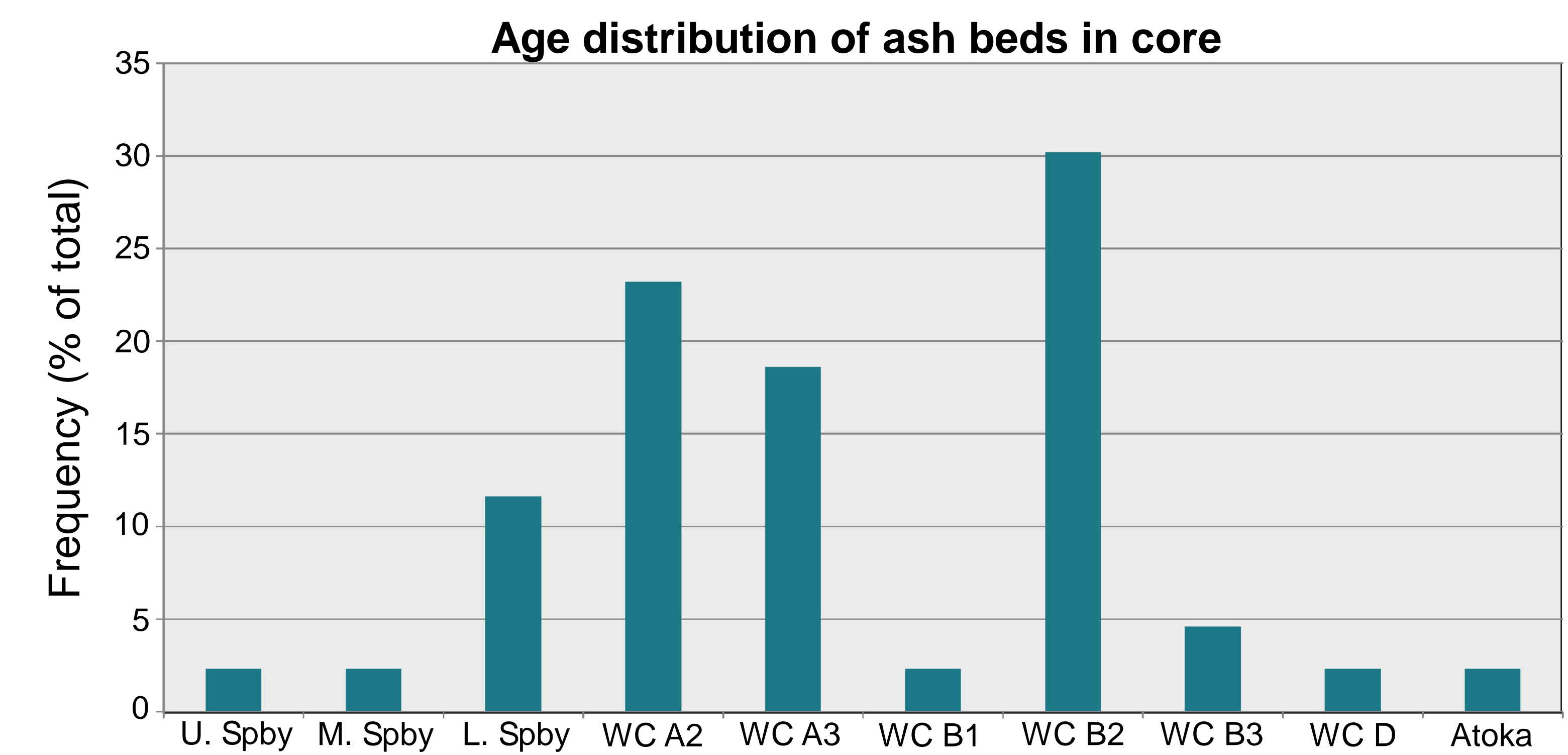
INTRODUCTION

- This study focuses on better understanding the characteristics, geographic distribution, and stratigraphic range of Midland Basin ash beds to help mitigate potential drilling challenges.
- Multiple volcanic ash beds have been recognized in both vertical cores and cuttings from horizontal wells in the Spraberry and Wolfcamp.
- Ash beds present in core range from 1-15 cm with most < 3 cm.
- A majority of the occurrences are within the Wolfcamp A and Wolfcamp B.
- Recent drilling and operational issues have occurred in high-percentage ash-bearing zones including tight hole, pack-off, directional control issues, and increased drag while running casing.

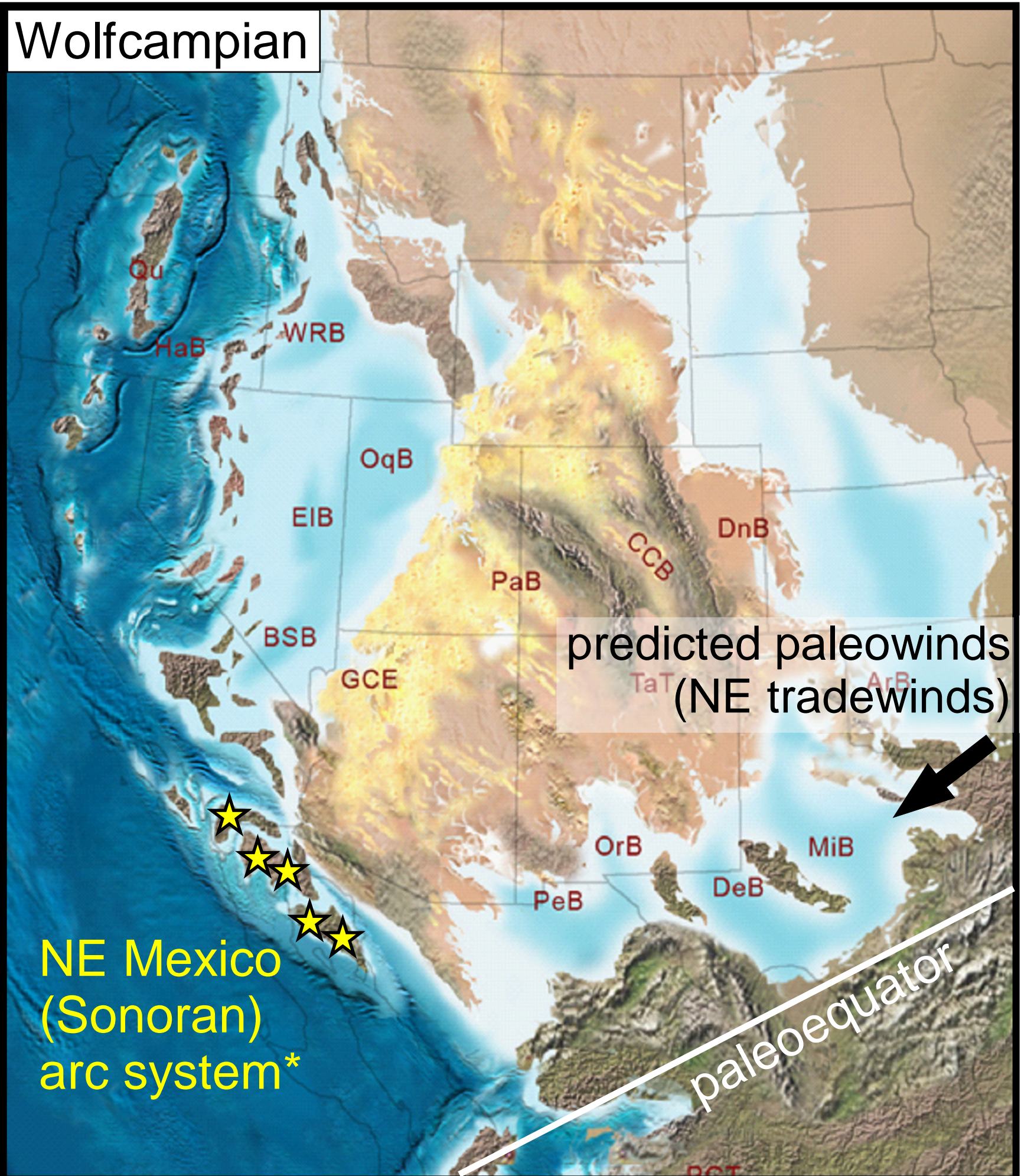
ASH BEDS IN CORE



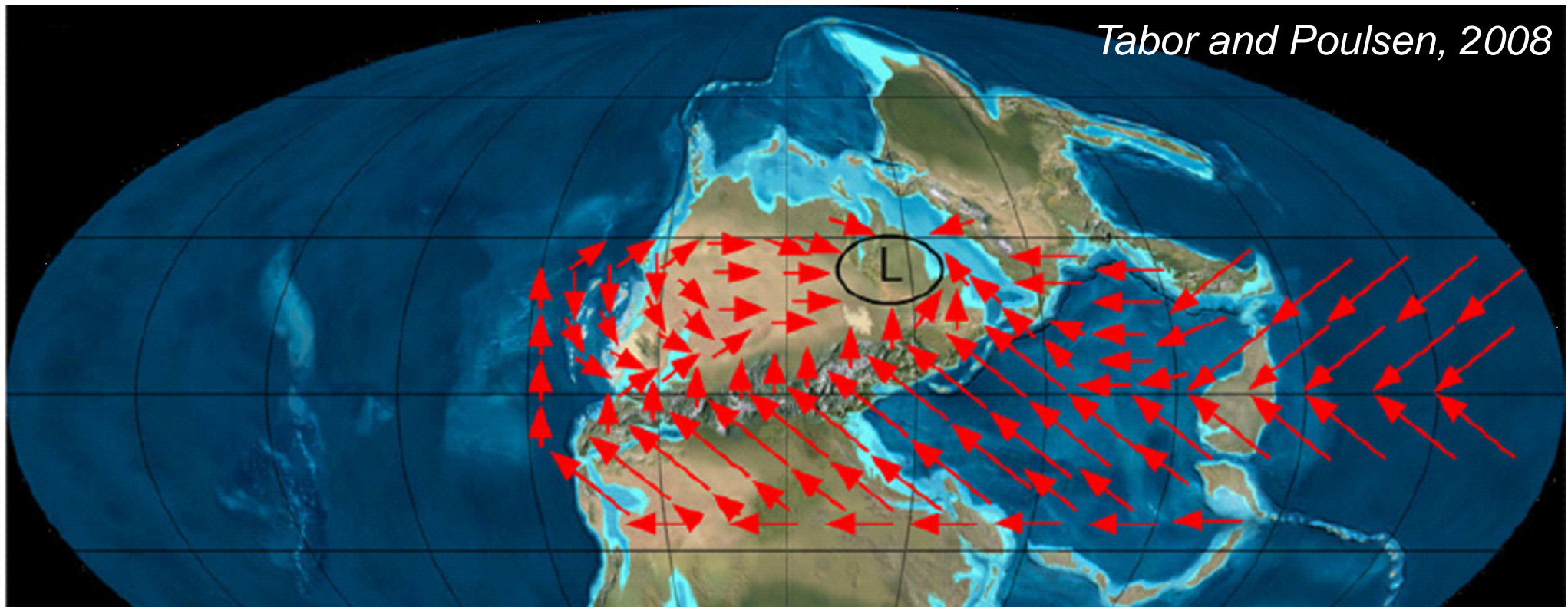
- Characteristics:**
- Typically 3 cm or less
 - Bright orange to yellow fluorescence under UV light
 - Most are too thin to be identified on logs
 - Some thicker beds show evidence of reworking by higher-energy currents



VOLCANIC SOURCE

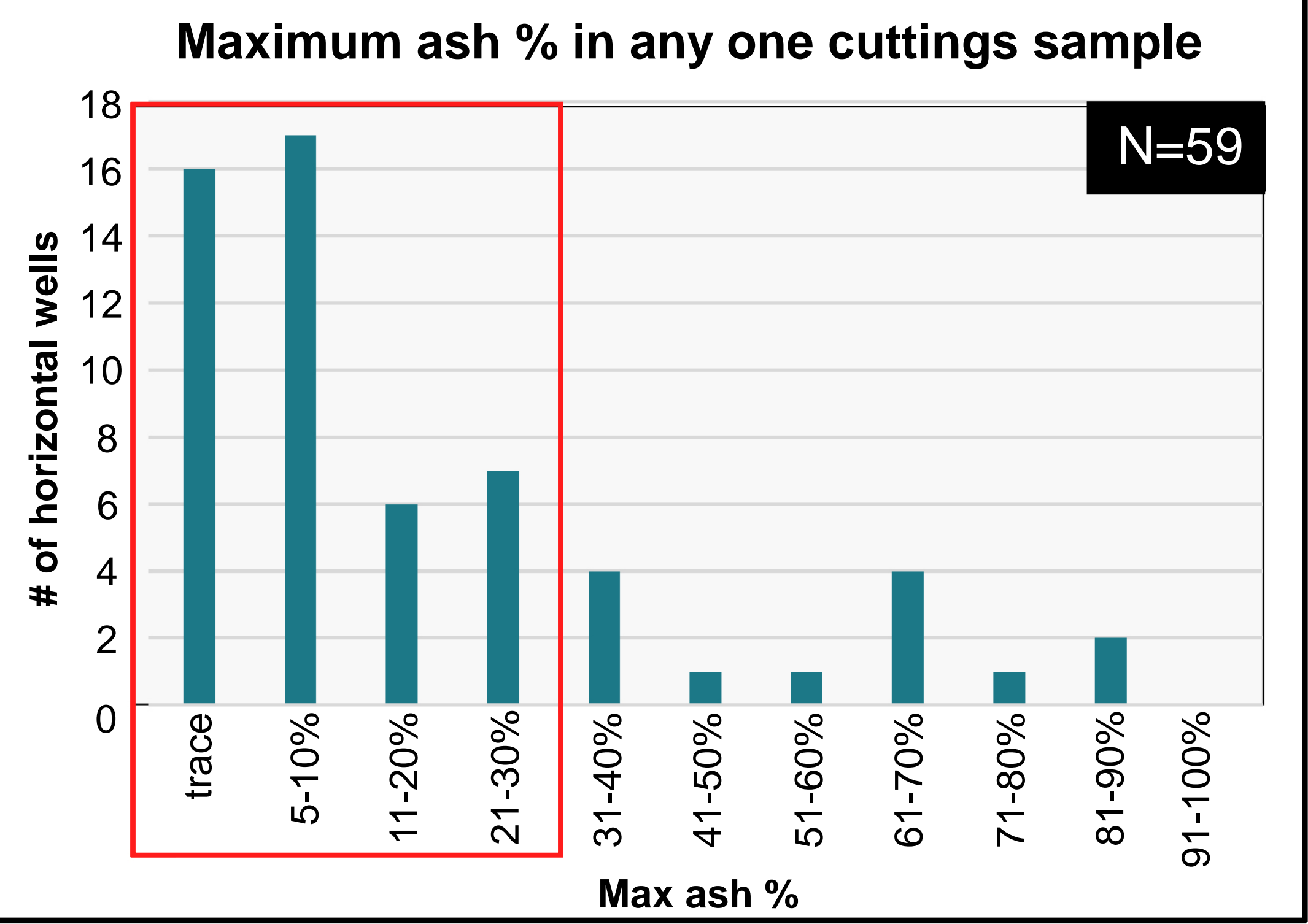
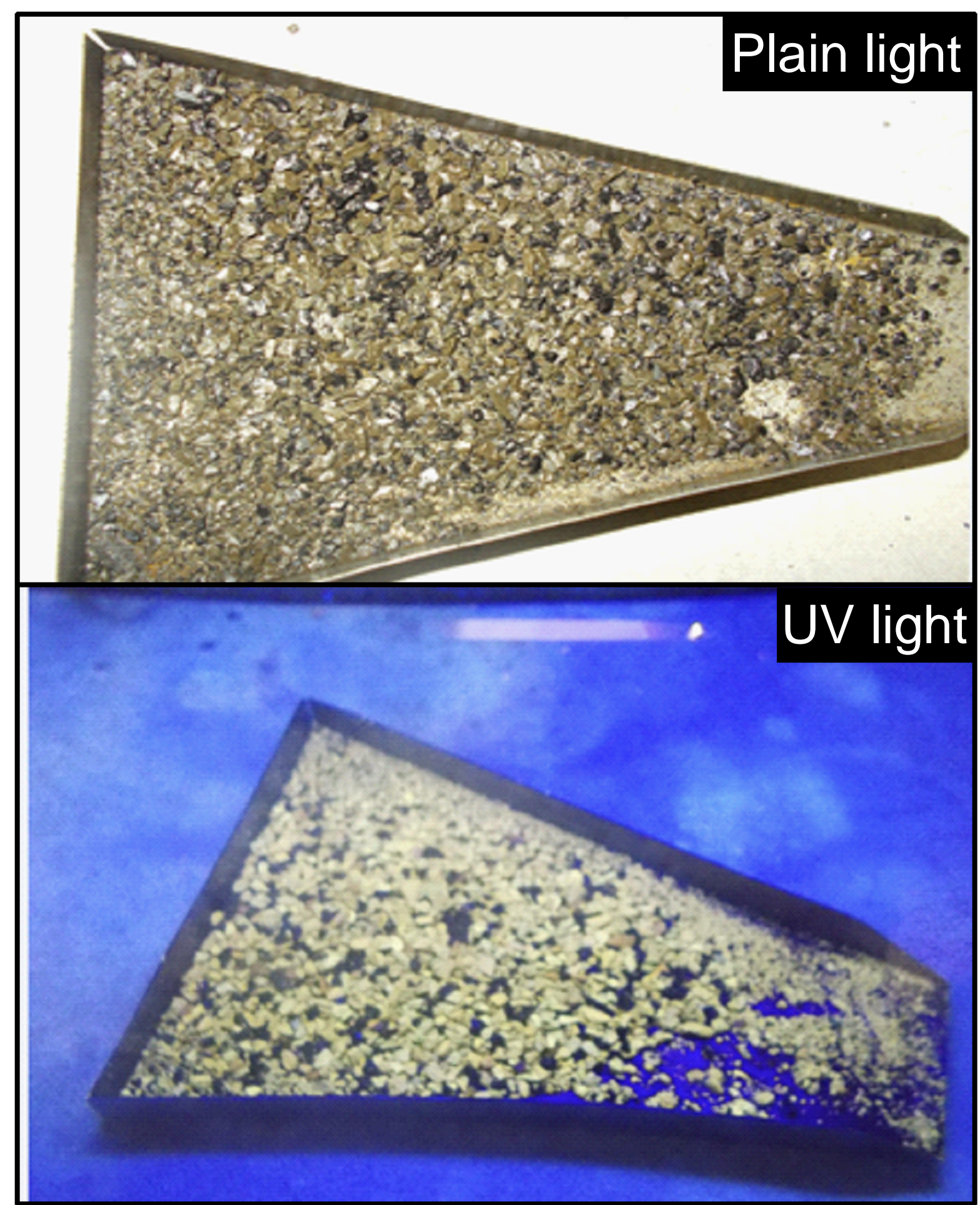


map: Ron Blakey, NAU/Colorado Plateau Geosystems
* Leary et al., 2017



- ~280 Ma: Northward shift in plate motion converted transpressive southern margin to NE-directed convergent margin and initiated Sonoran volcanic arc in NE Mexico (Leary et al., 2017).
- Predicted paleowinds (NE tradewinds) expected to carry ash away from Midland Basin. However, “megamonsoonal” pattern over western Pangea resulted in northwesterlies & southwesterlies blowing from Pacific arc towards Midland Basin (Tabor and Poulsen, 2008).
- Additional arc sources may be present (H. Tian, UTA).

ASH IN HORIZONTALS



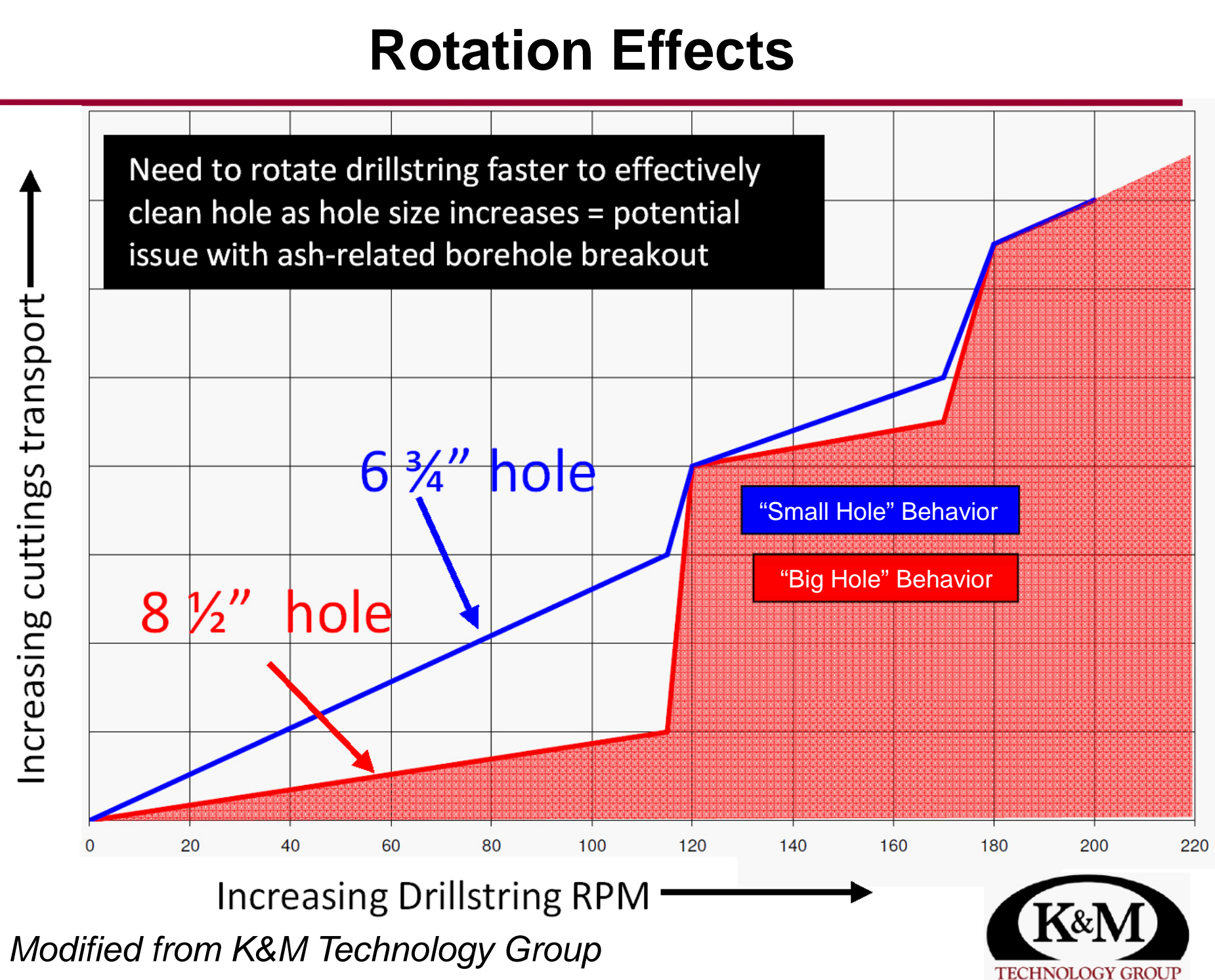
Most report <30% max ash % in any one sample -
Cores indicate ash beds typically only ~1"-2" thick

DRILLING CHALLENGES

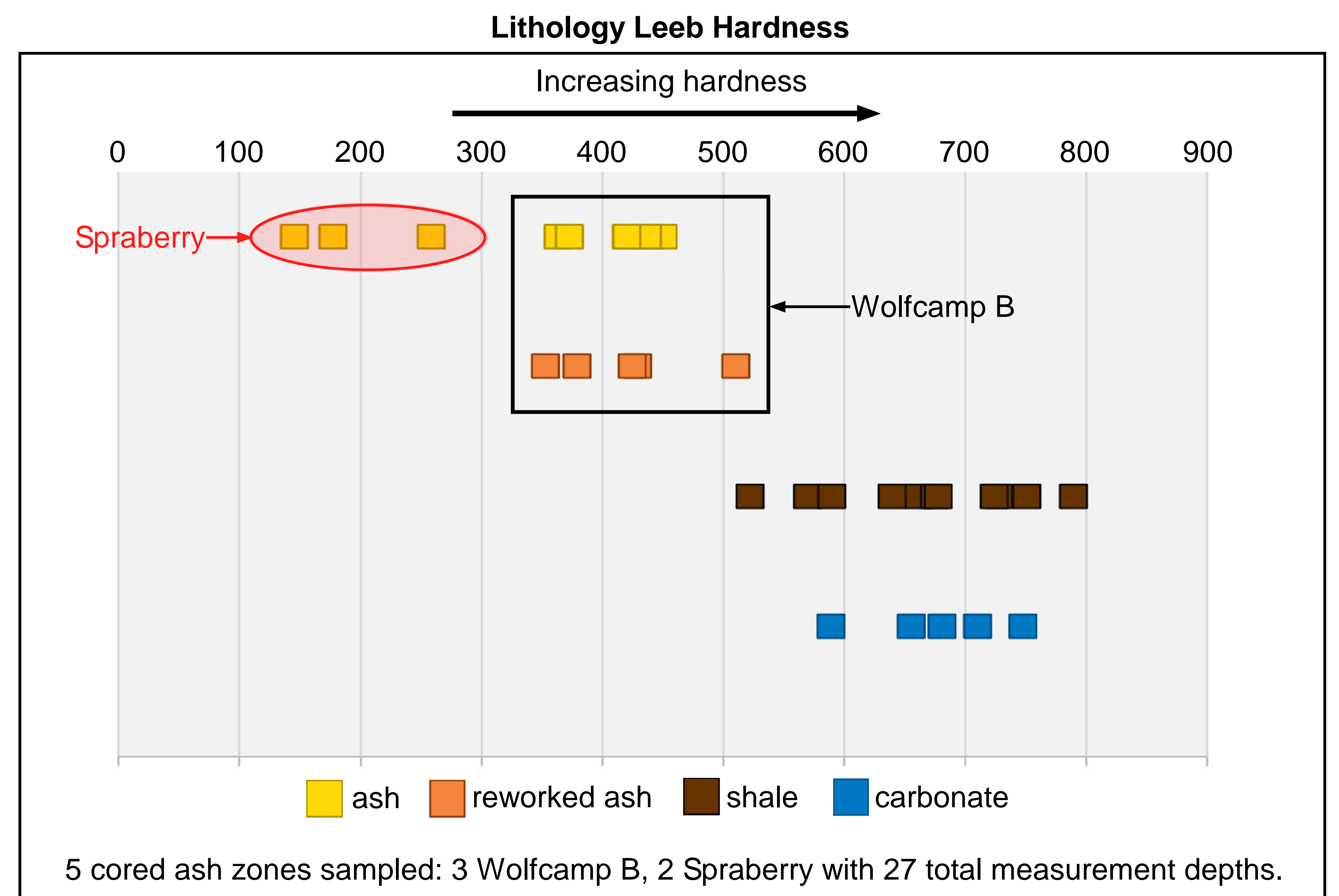
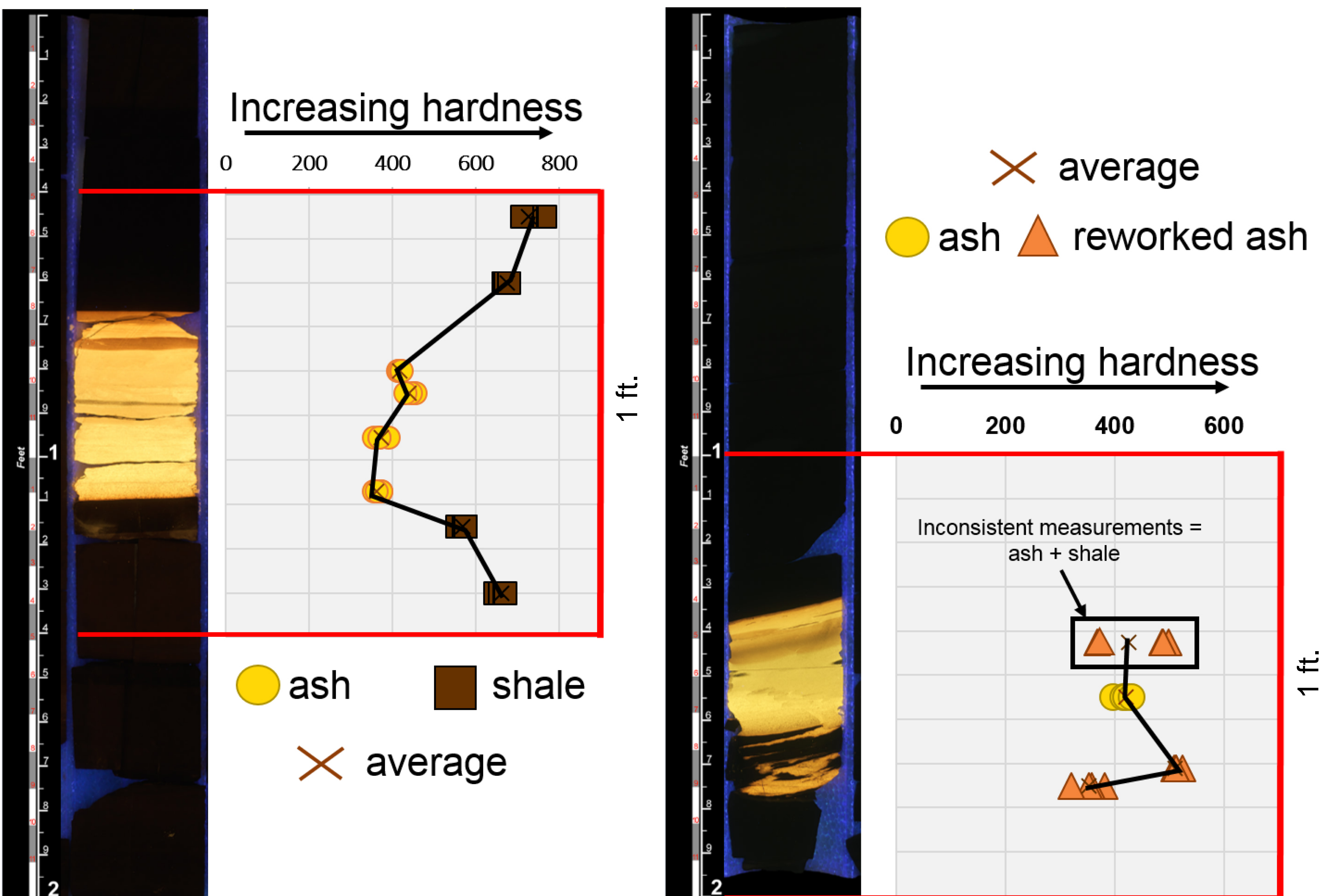
- Issues observed in ash-rich intervals:**
- Tight hole and pack-off
 - Directional issues
 - Increased drag while running casing
 - Need to adjust mud parameters

- Potential causes:**
- Preferential break-out due to rock strength
 - Ash not cleaned effectively from hole/bit
 - Ash reacting to mud

- Possible solutions:**
- Increase mud weight
 - Manipulate mud properties
 - Understand distribution to avoid during planning and/or geosteering phase

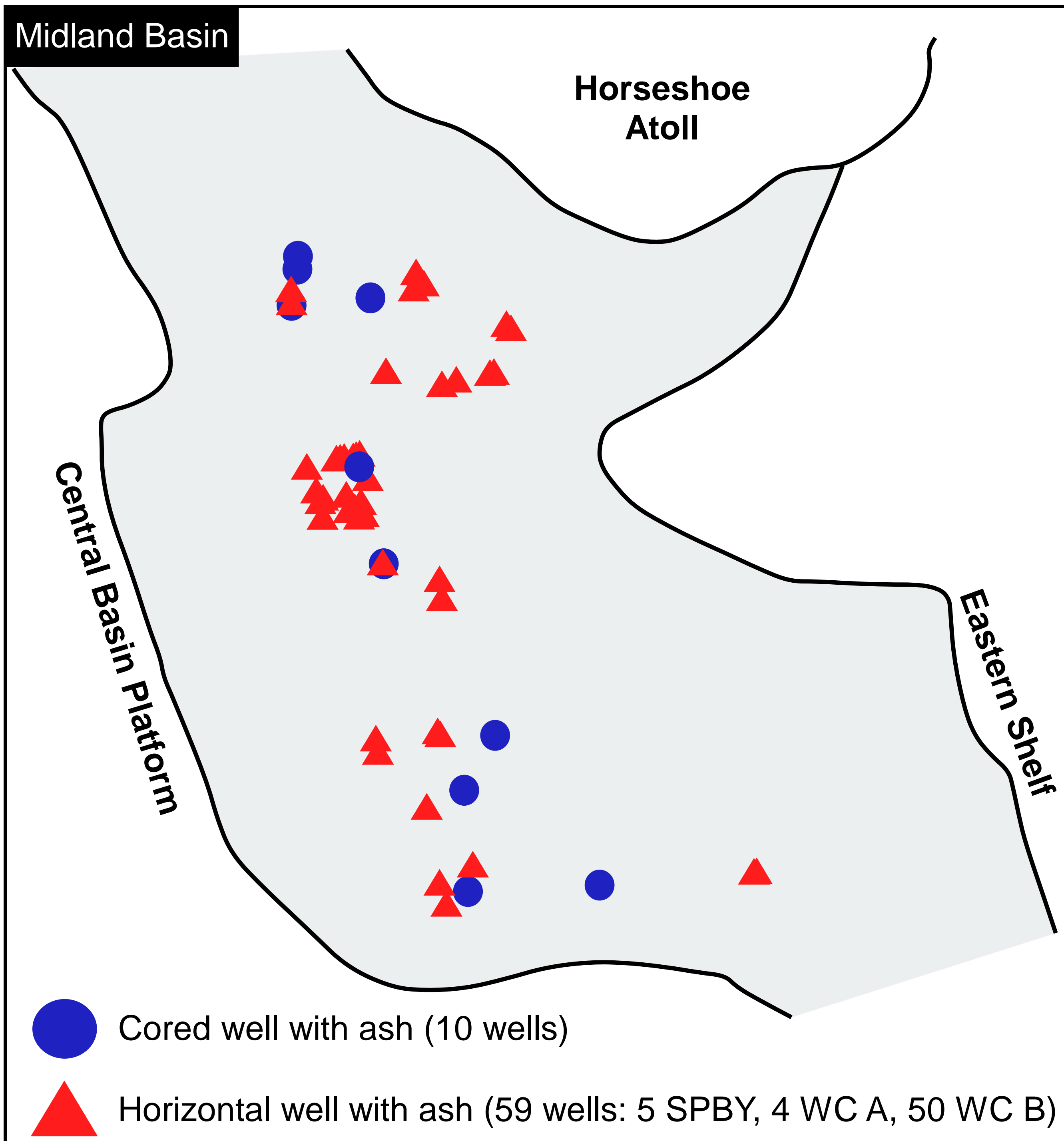


ASH BED ROCK STRENGTH: BAMBINO HAMMER ANALYSIS



- Findings:**
- Ash beds are weaker than shale and carbonate and plot distinct from these surrounding lithologies.
 - Inconsistent measurements within the reworked ash beds are interpreted to be a result of the mixed lithology.
 - Spraberry ash beds are weaker than Wolfcamp ash beds resulting in difficulty obtaining measurements.
 - The mineralogy of the Spraberry ash beds differs from the Wolfcamp ash beds (H. Tian, UTA).

DISTRIBUTION OF PXD WELLS WITH ASH



SUMMARY

- Cored and horizontal wells indicate the majority of ash beds occur in the Wolfcamp A and B and are distributed across the Midland Basin. Most ash beds observed in core are thin (<3 cm) and a majority of horizontal wells report a maximum of 30% ash in any one sample of cuttings.
- A Sonoran arc in NE Mexico is the hypothesized volcanic source with westerlies from a “megamonsoonal” pattern over Pangea delivering the ash over the Midland Basin. However, additional arc sources may be present.
- The ash beds are weaker than surrounding lithologies which could result in preferential break-out and consequential difficulty cleaning the wellbore effectively. These findings may help explain observed drilling challenges while encountering ash-rich zones including tight hole, pack-off, directional issues, and increased drag.
- The Spraberry ash beds are weaker than the Wolfcamp ash beds which may be due in part to their different mineralogy.

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REFERENCES

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