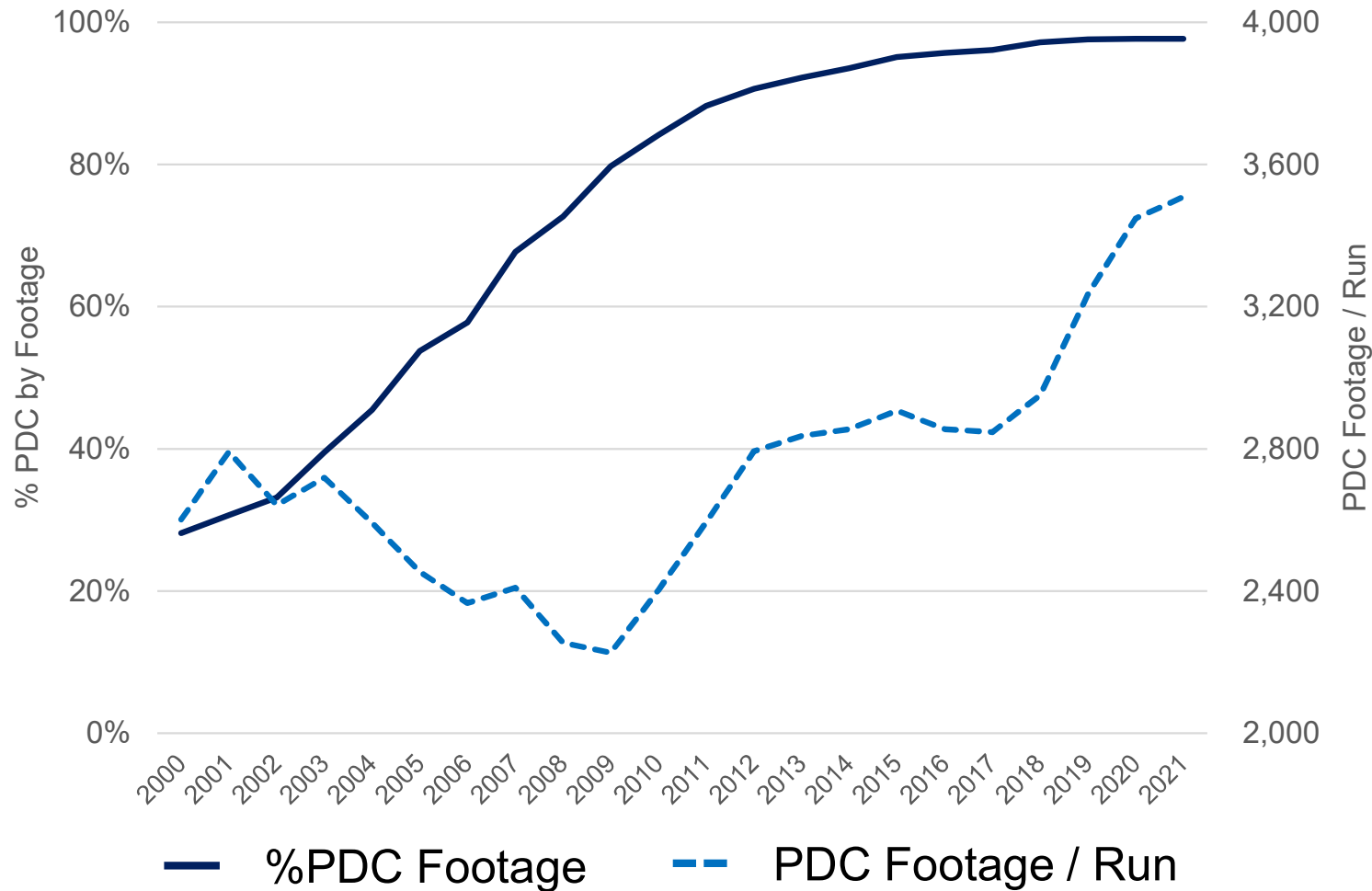


PDC Cutter Development Trends

March 22, 2022



US PDC Bit Trends



2001 – 2009

- Cutter leaching used
- PDC bits aggressively replace roller cones

2010 – 2018

- HP/HT cutter grades
- Significant improvement in PDC bit durability

2019 to date

- Next Gen cutters...

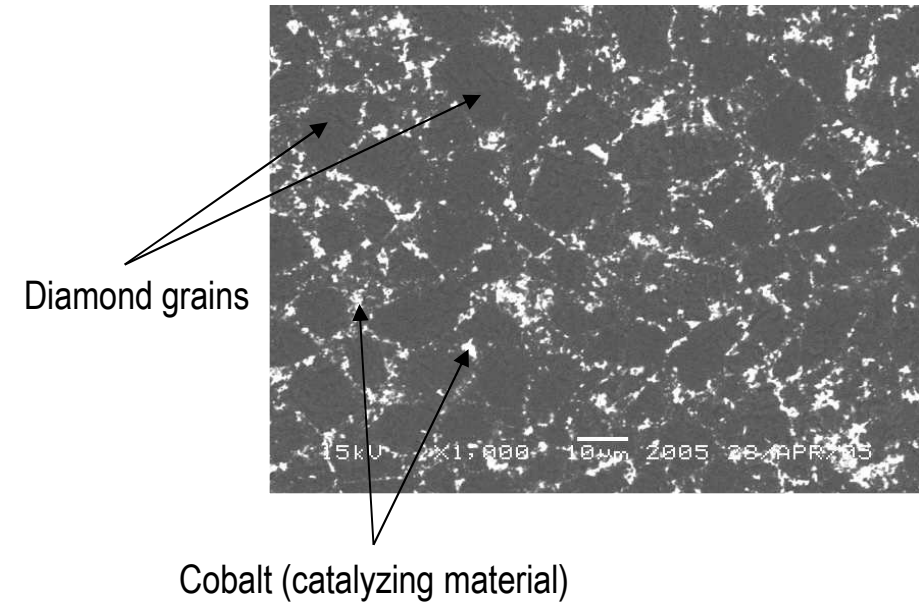
PDC Cutters – The Cobalt Challenge

The GOOD

- Catalyzing agent
- Bonds diamond to substrate

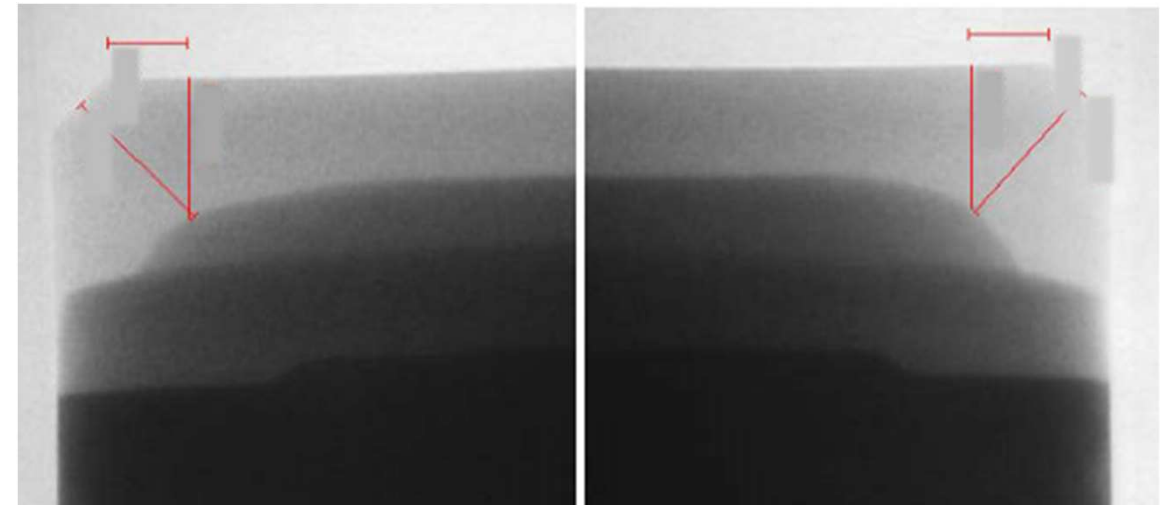
The BAD

- Dissimilar material to diamond
- Relatively low thermal conductivity



PDC Cutter Leaching

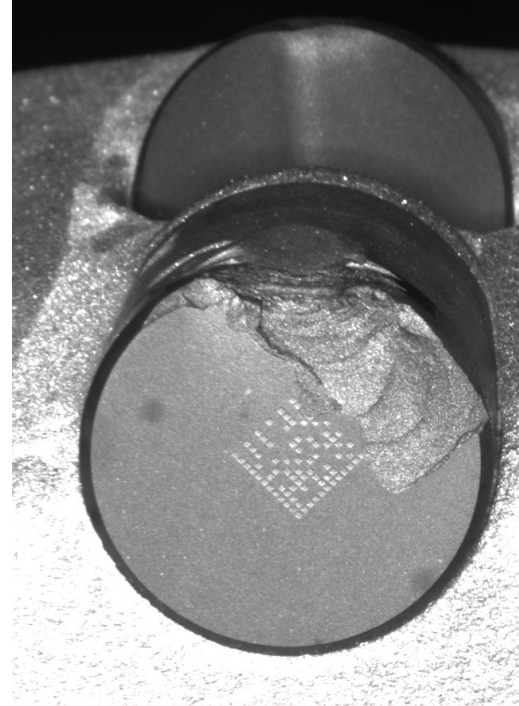
- Acid removes cobalt
- Deeper leaching provides better thermal stability
- Leach depth limited diamond table thickness



Cutter Development Themes



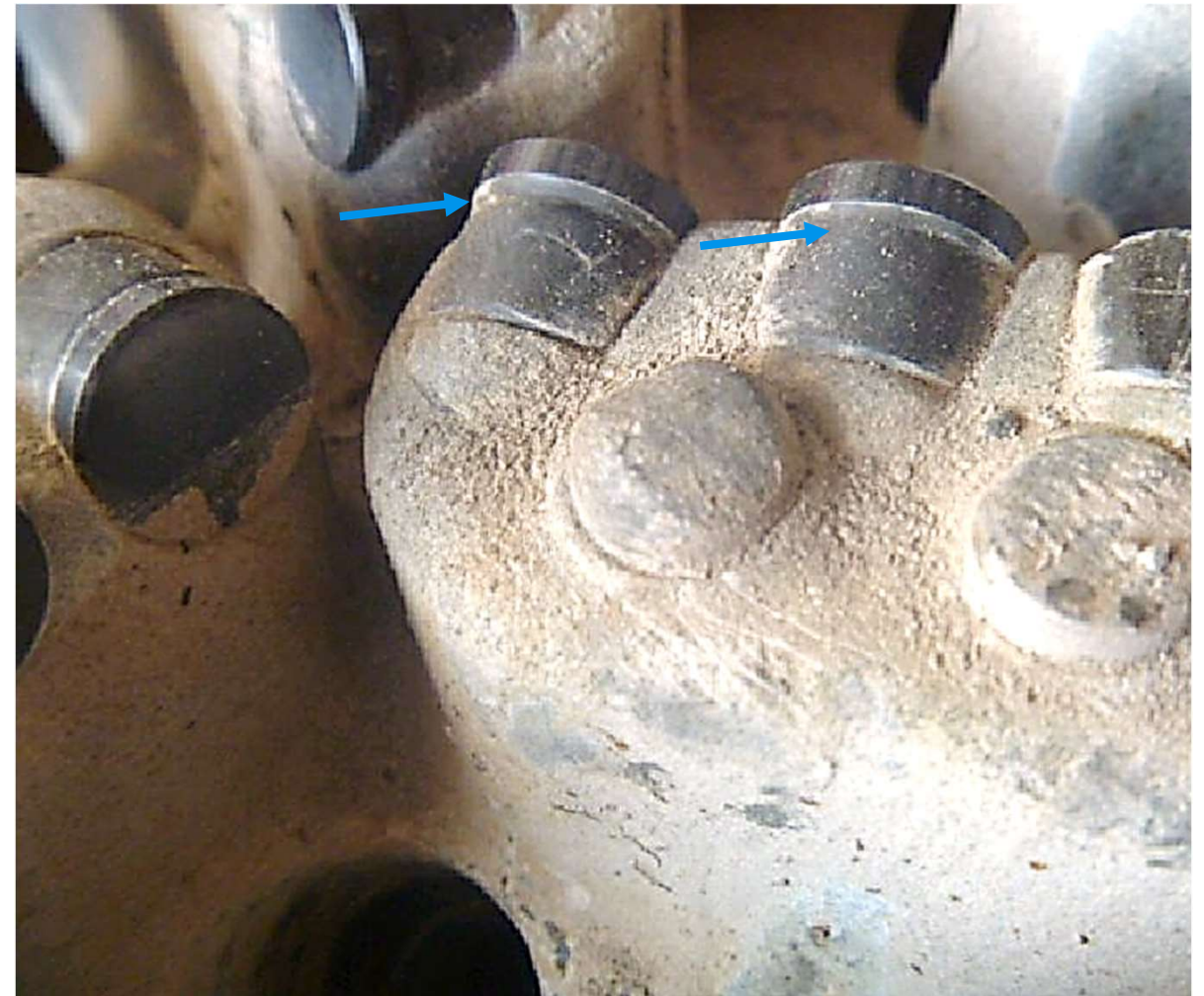
Corrosion Resistance



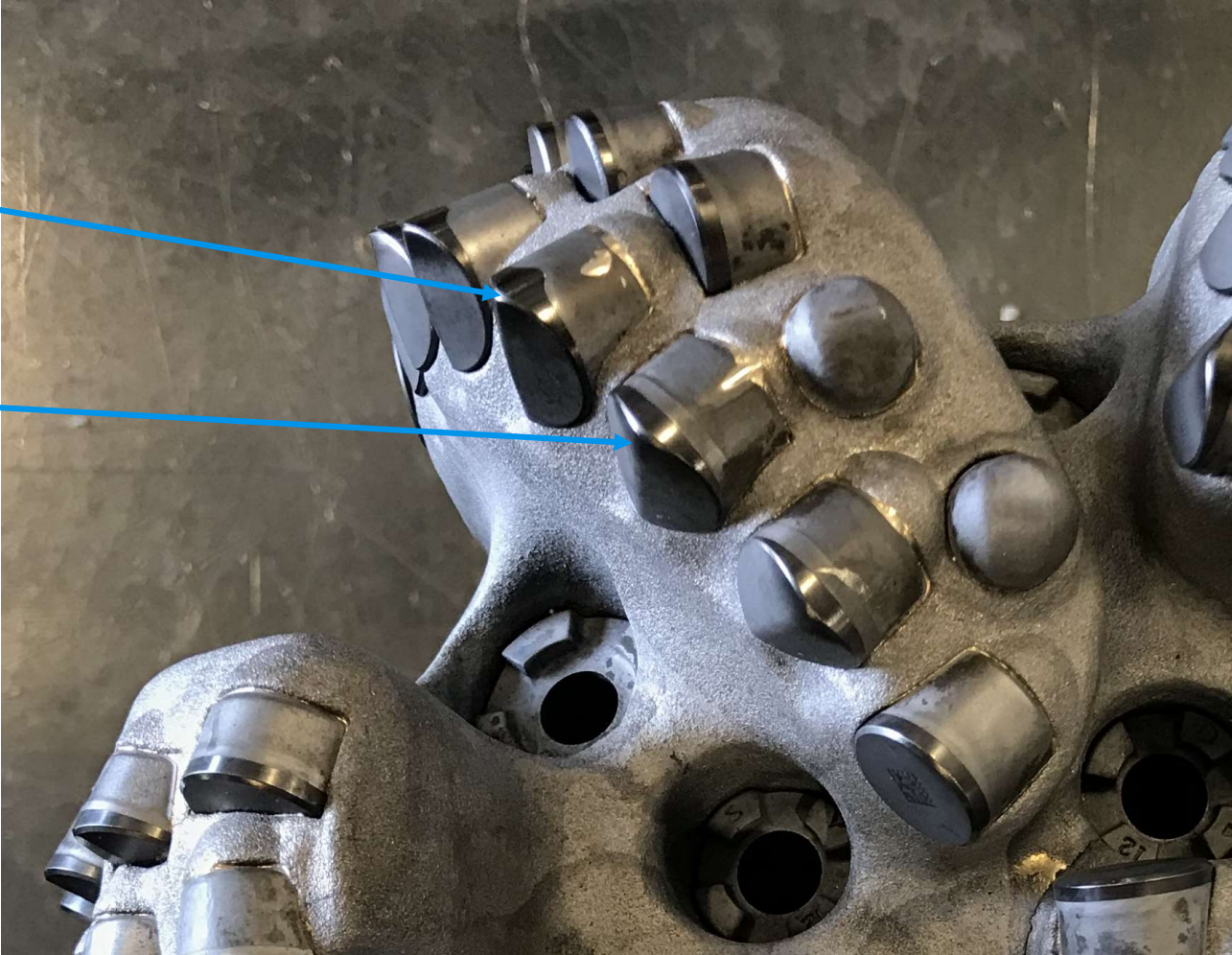
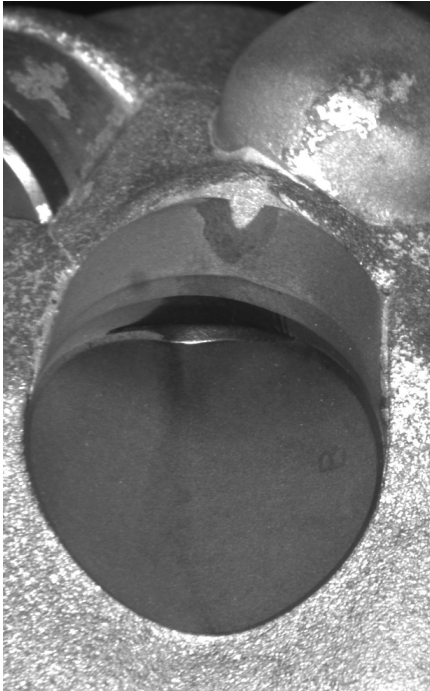
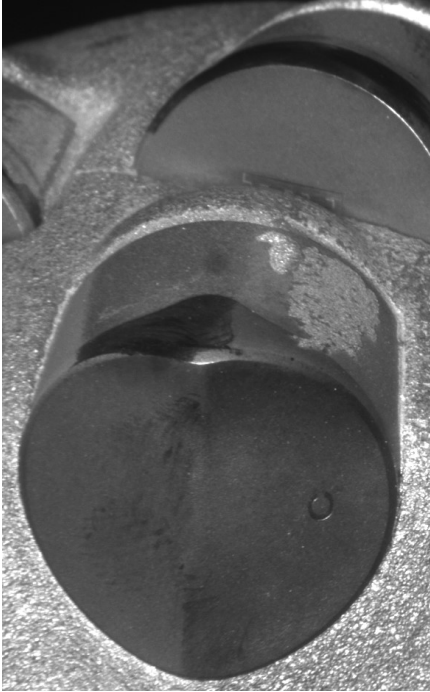
Thermal Stability

Cutter Corrosion

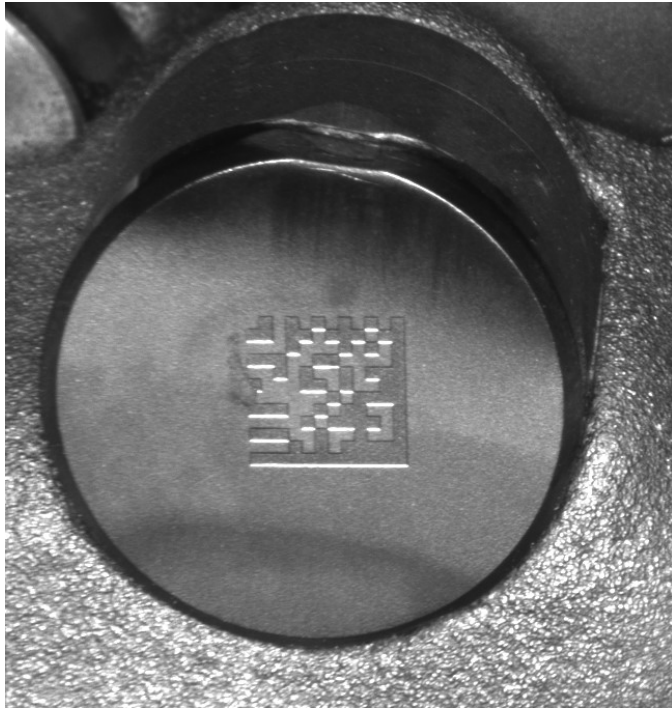
- Chemical and/or galvanic attack
- Accelerates substrate erosion
- Weakens overall cutter integrity
 - Lose diamond table support
 - Cutter breakage
 - Deterioration of cutting structure
- New corrosion-resistant carbide grades available



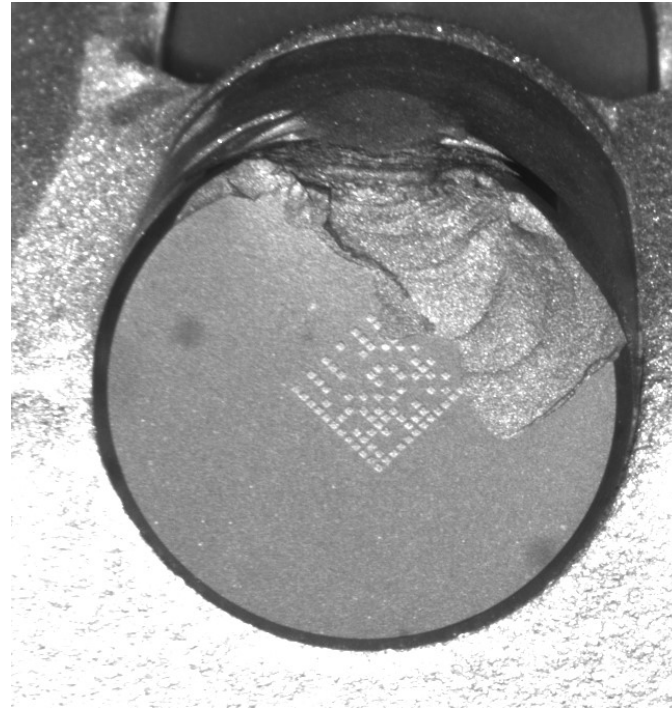
Paired Comparison Test



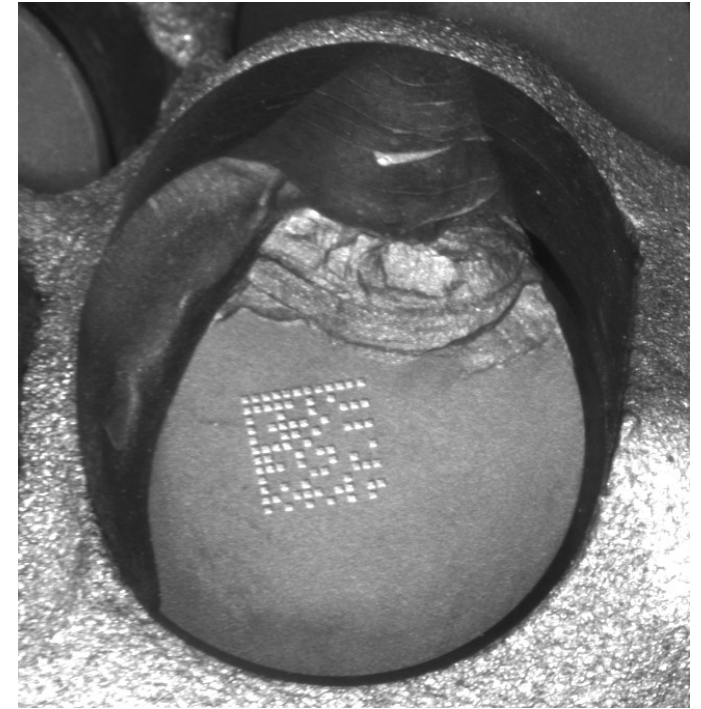
Thermal Stability – Failure Progression



Cutter Wear



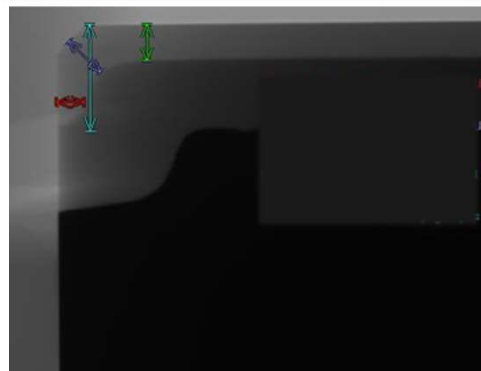
Cutter Spalling



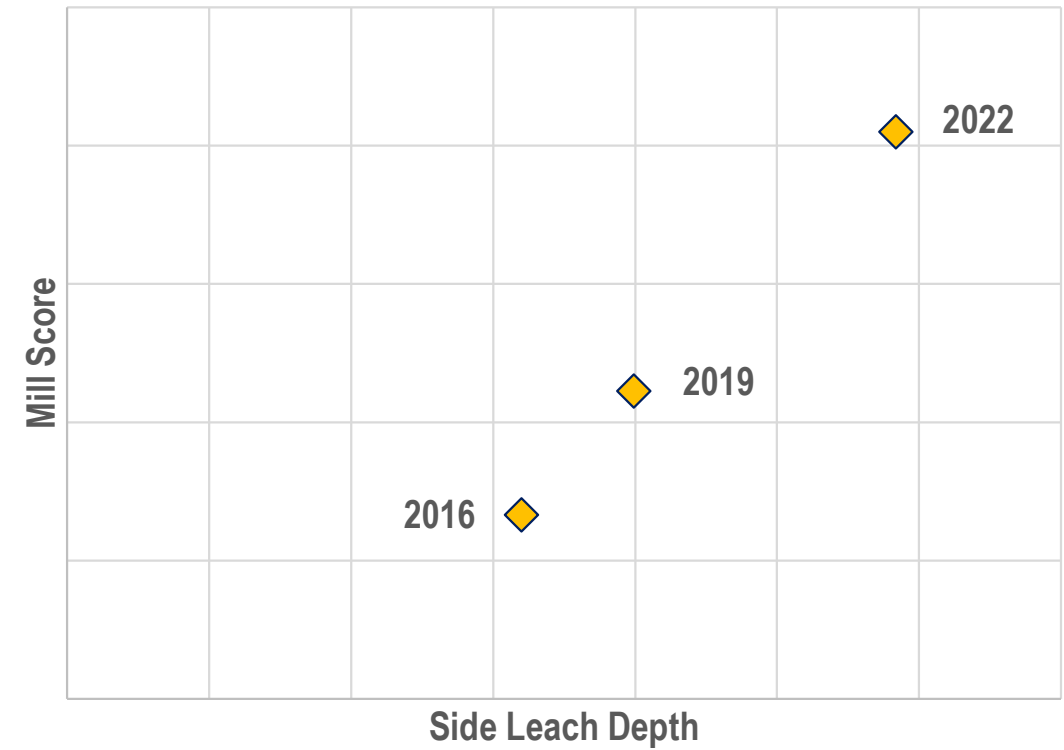
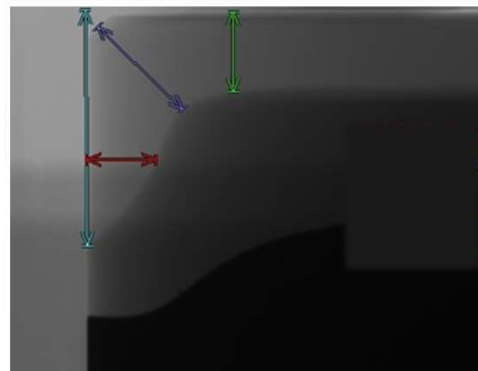
Cat-eye Failure

Thick Diamond Table Cutters – Benefits

2016 Cutter

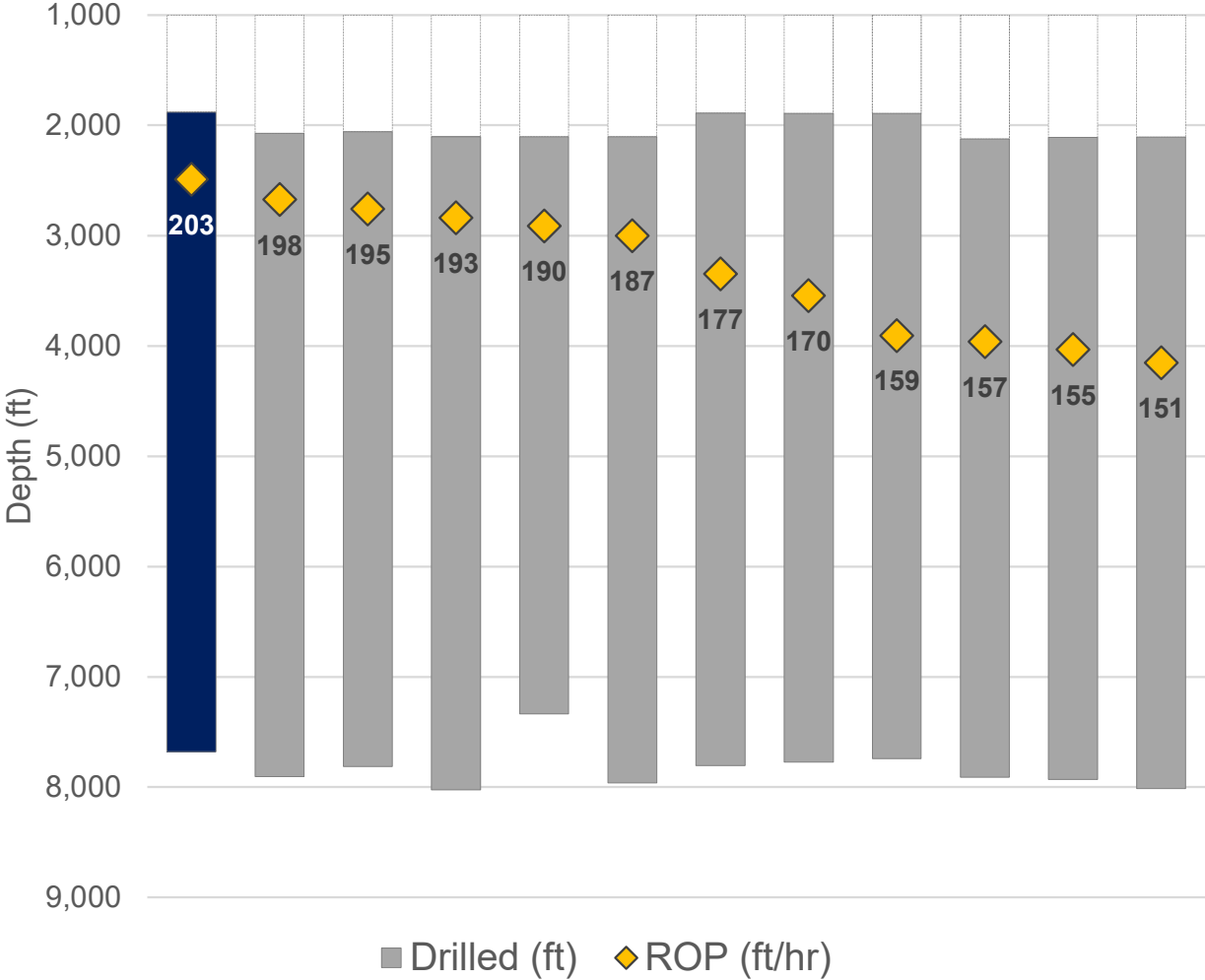


2022 Cutter



Thicker diamond table → deeper leach → higher mill score

Williston Basin Drill Out

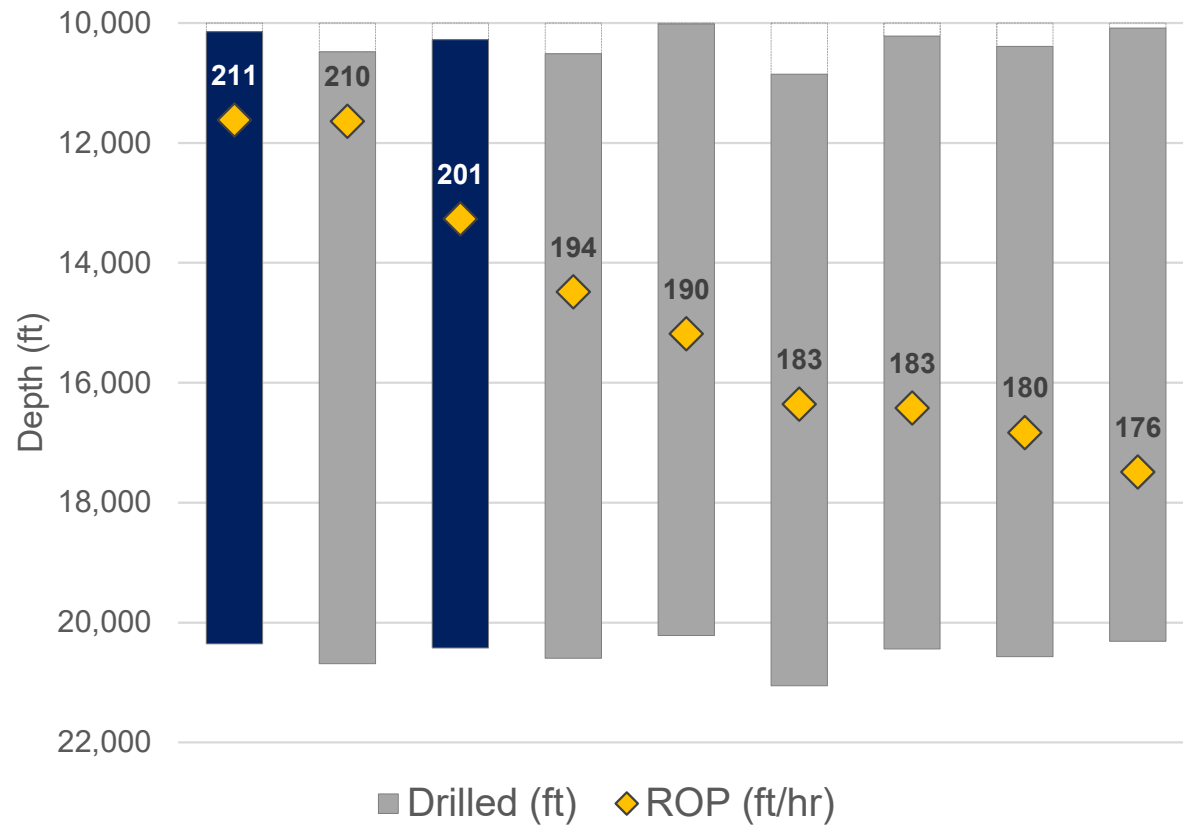


Baseline Dull



New Cutter Dull

Middle Bakken Lateral



Baseline Dull



New Cutter Dull

THANK YOU

Wiley Long

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