

Aerial photograph showing a coastal industrial facility with large tanks and piping systems situated near a body of water.

Forensic Chemical Analyses Coupled with Detailed Site and Water Column Observations Used to Locate the Primary Cause of a Persistent Sheen off Louisiana's Coast

Part 1: Tiers 1 and 2

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03/08/2017

summary

- We used a four-tiered Forensic Chemical Investigation, coupled with Environmental Data (currents and acoustics), to match surface oil causing the sheens in MC Block 20 with its probable source on the seafloor
- This is a two-part presentation based primarily on the Unified Command's authorized Sheen Source Location Work Group (SSLWG) generated forensic data, as well as previous compositional data available from 2012–13 bottom sediment surveys, surface sheens, and MC21 crudes





In 2004, Hurricane Ivan passed directly over Block MC20, causing a mud slide that toppled this Taylor Energy Platform



"Waves generated by Ivan were the largest ever measured"

Journal of Physical Oceanography 2007
Observed Oceanic Response over the Upper Continental Slope and Outer Shelf during Hurricane Ivan
W. J. Teague, E. Jarosz, D. W. Wang, and D. A. Mitchell

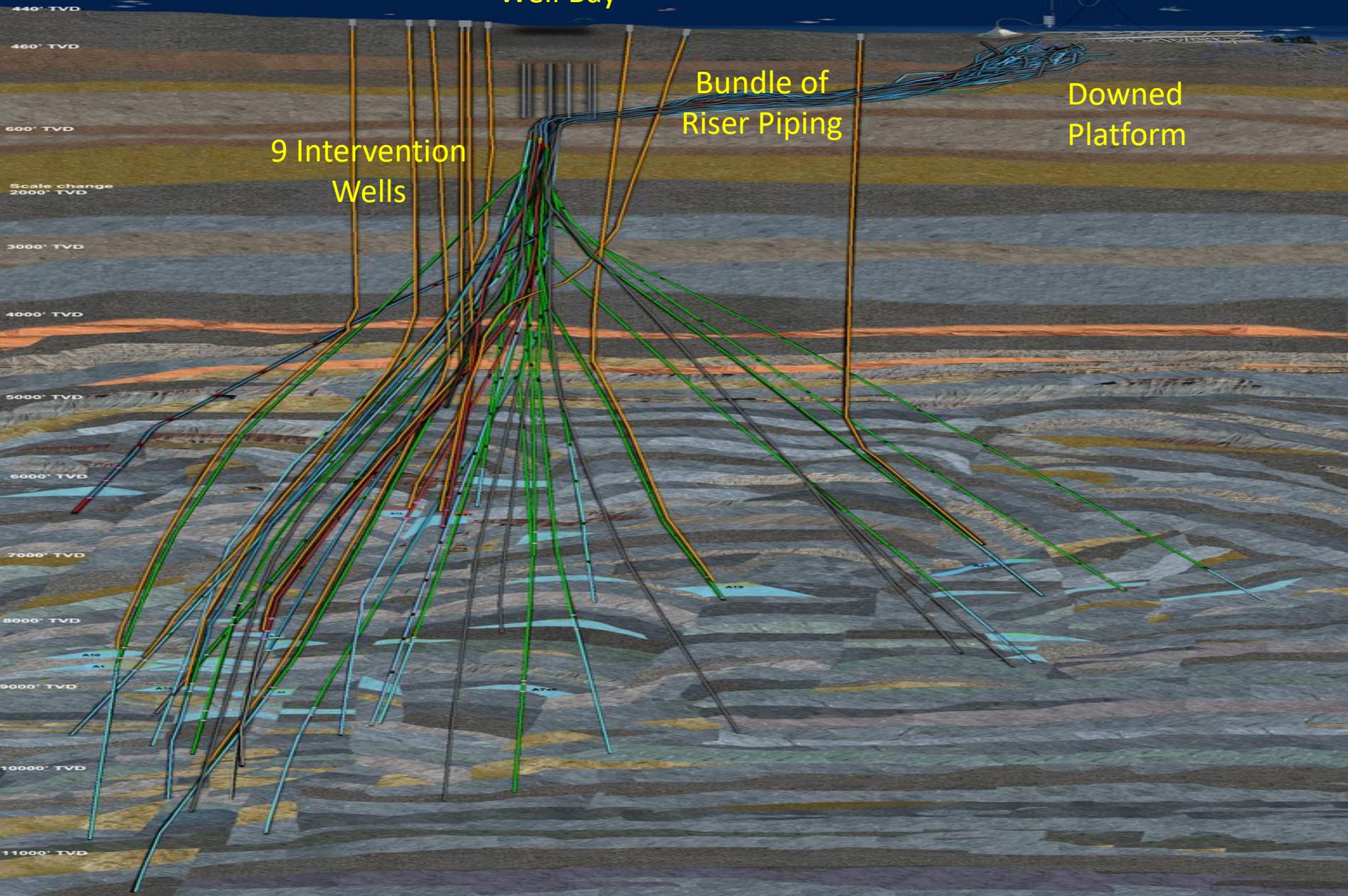
From 2004 to 2010

Well Bay

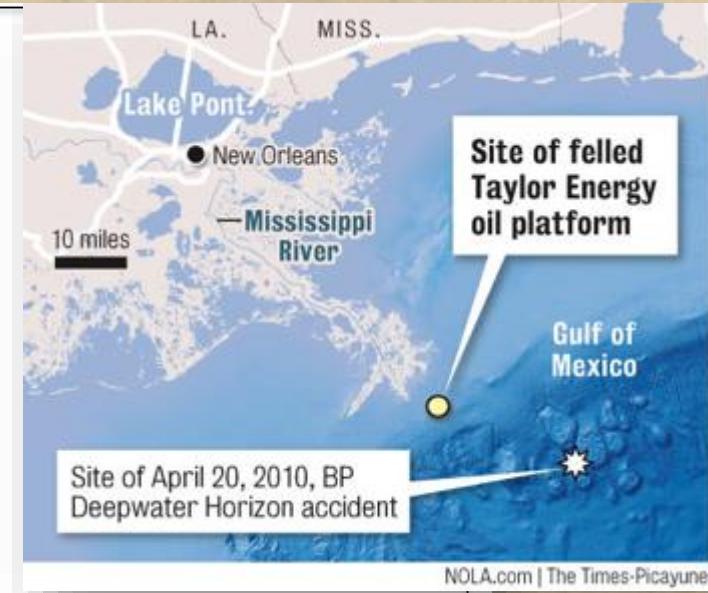
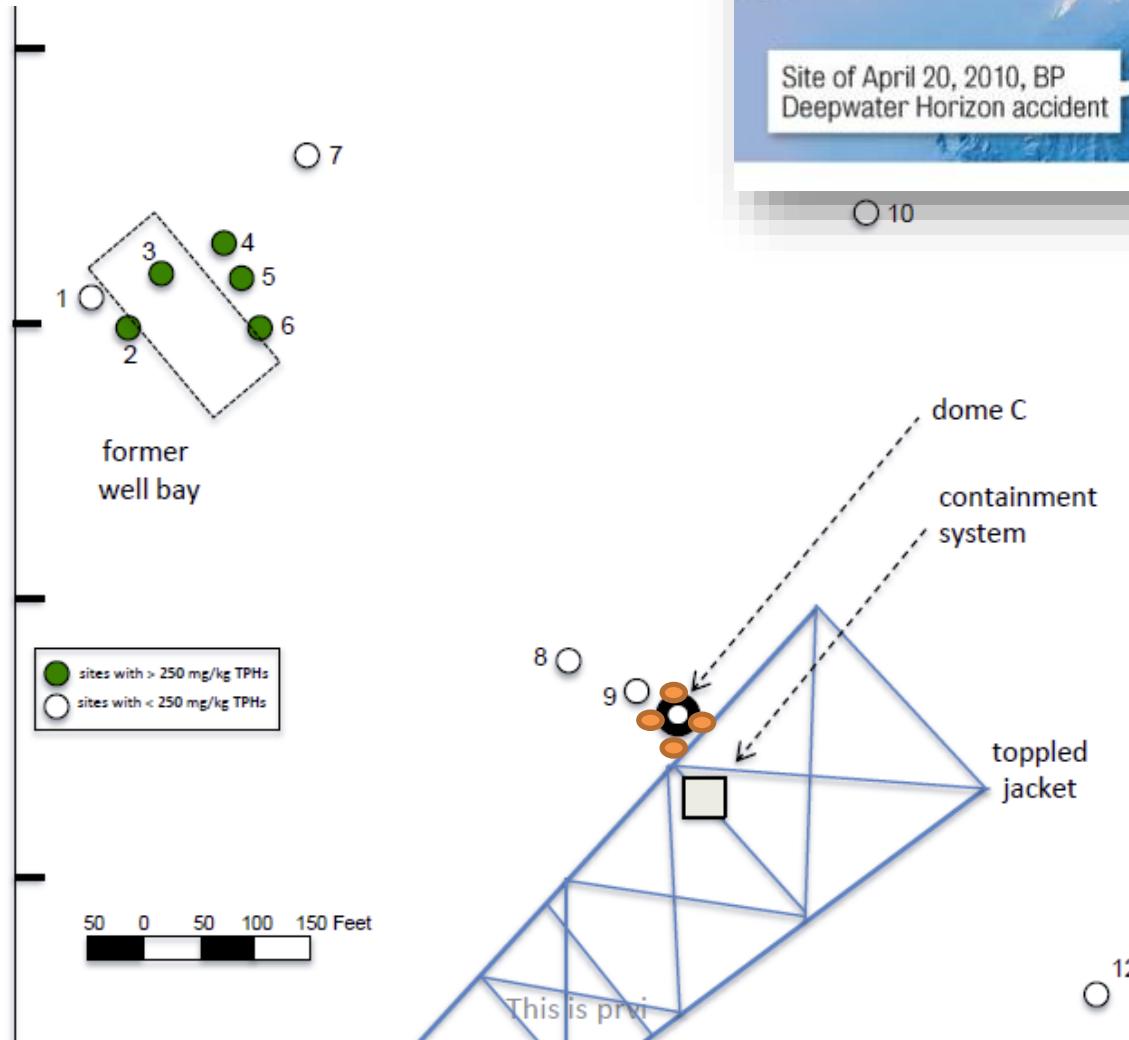
Bundle of
Riser Piping

Downed
Platform

9 Intervention
Wells



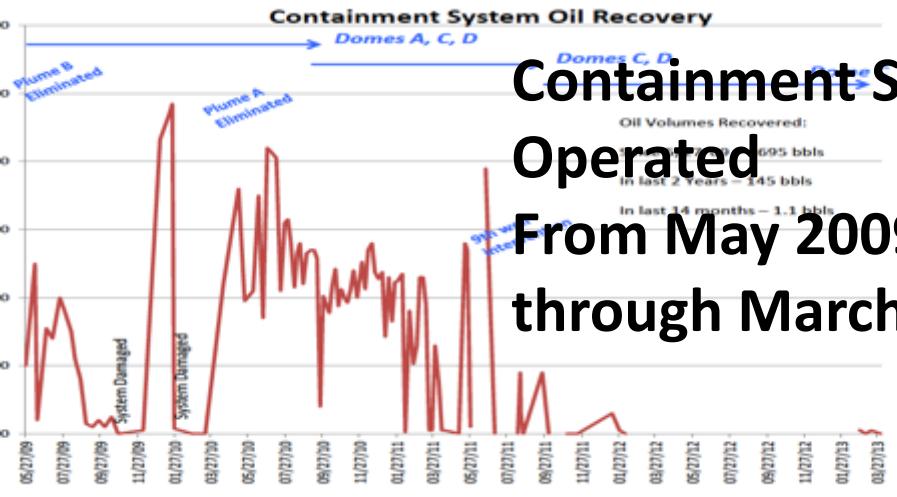
Overhead View of the MC20 Site with Locations of Samples with High Oil Residue Concentrations



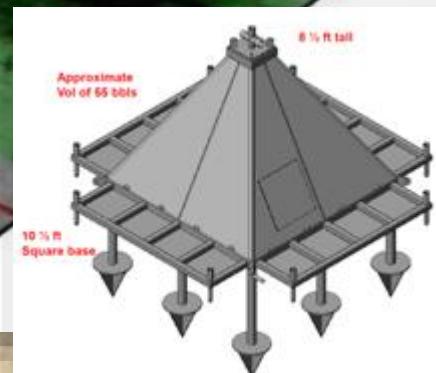
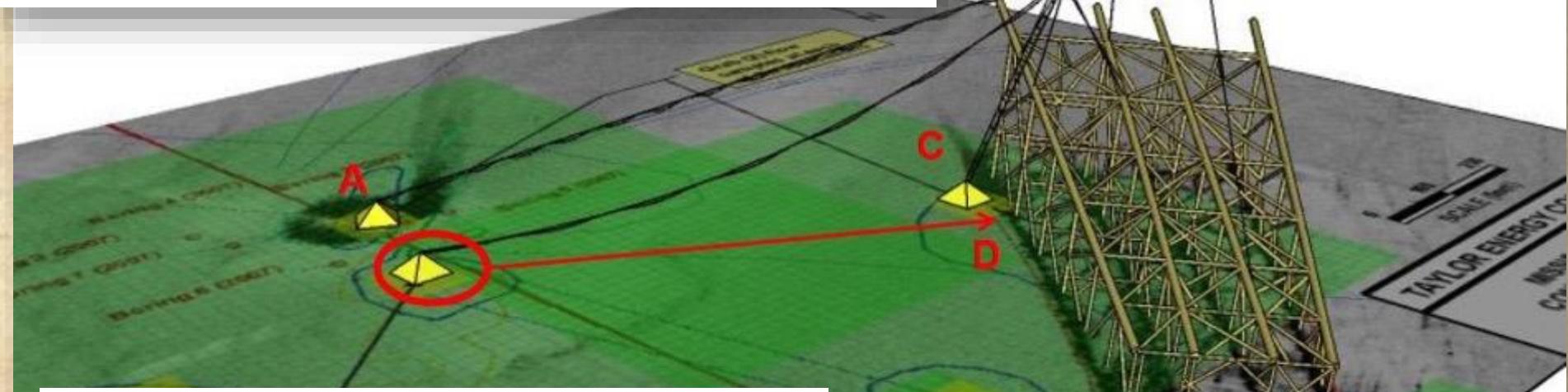
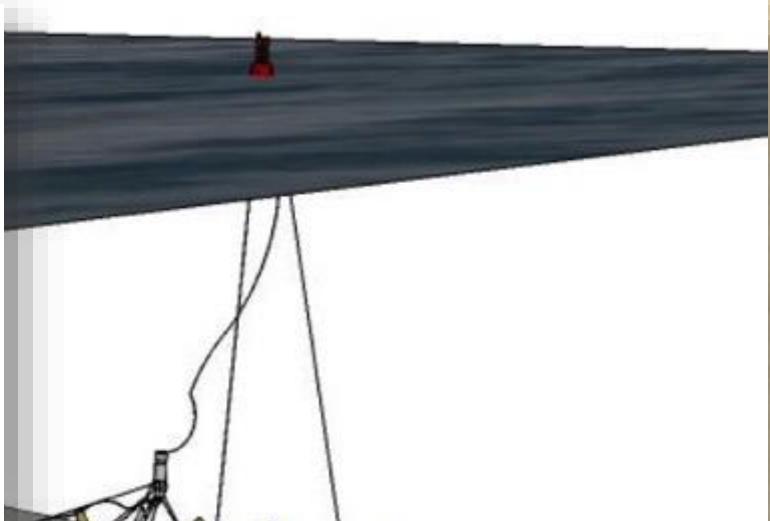
Site of felled
Taylor Energy
oil platform

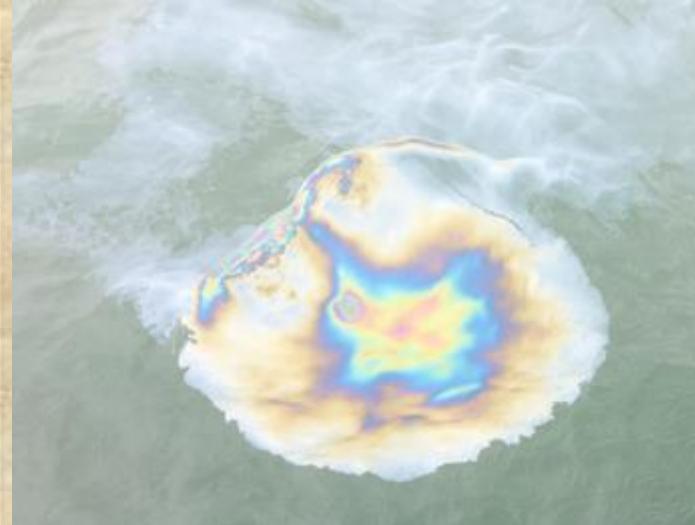
Site of April 20, 2010, BP
Deepwater Horizon accident

NOLA.com | The Times-Picayune

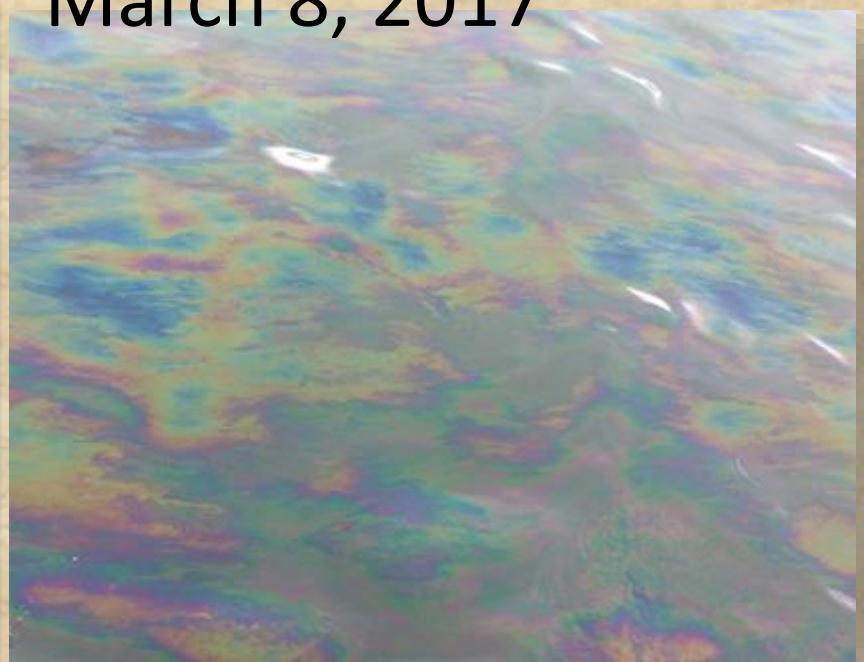


**Containment System
Operated
From May 2009
through March 2013**



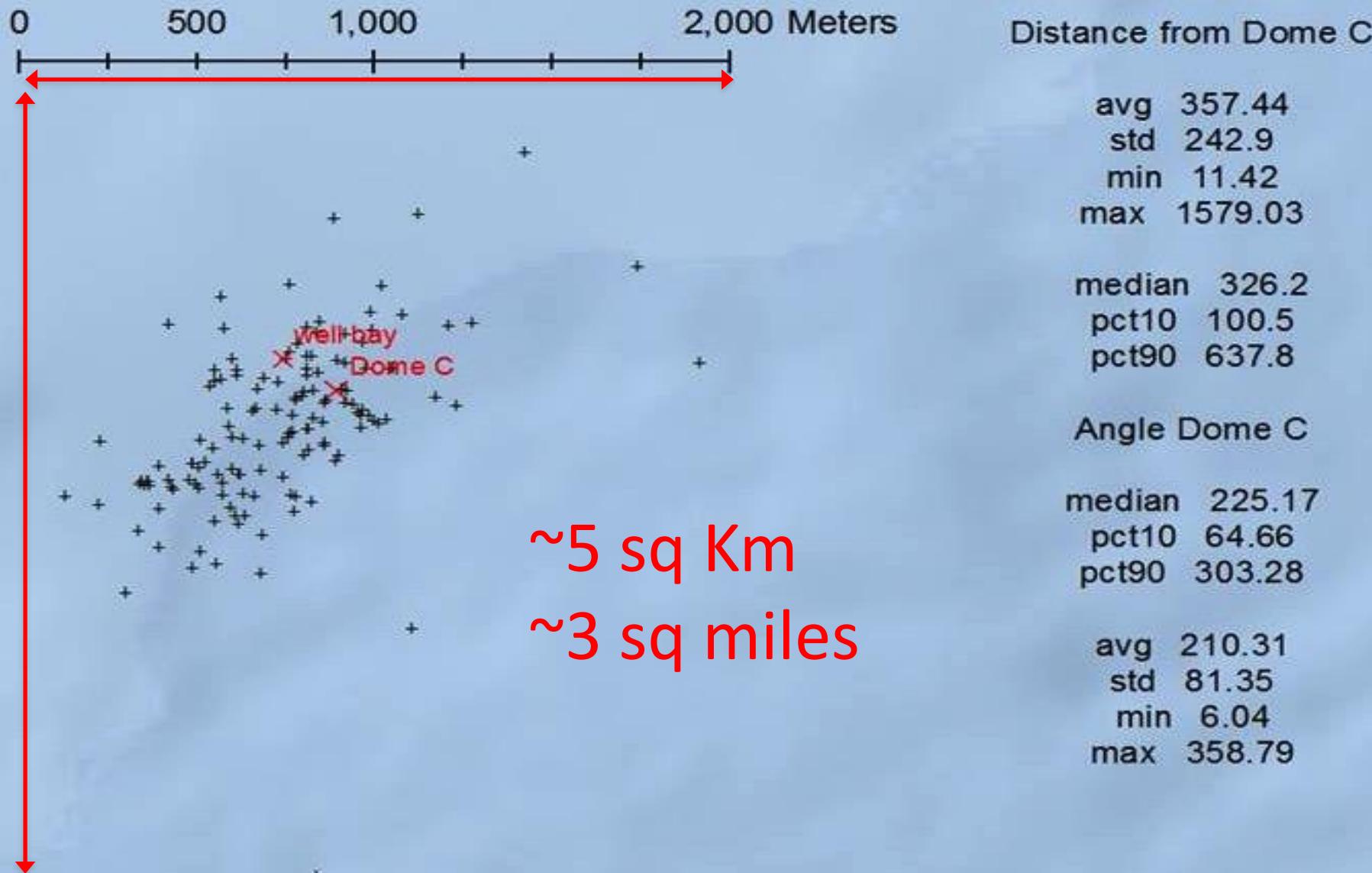


Looks of the Sheen
March 8, 2017



Aerial extent of initial surfacing location of oil

Locations determined via overflights between 10/20/2015 to 9/29/2016



1/2016 Sheen Source Location Workgroup Chartered by the UC

FOSC directed SSLWG to provide the X/Y/Z coordinates of hydrocarbon release(s) from the seabed that are causing surface sheens at MC20

Work Plan:

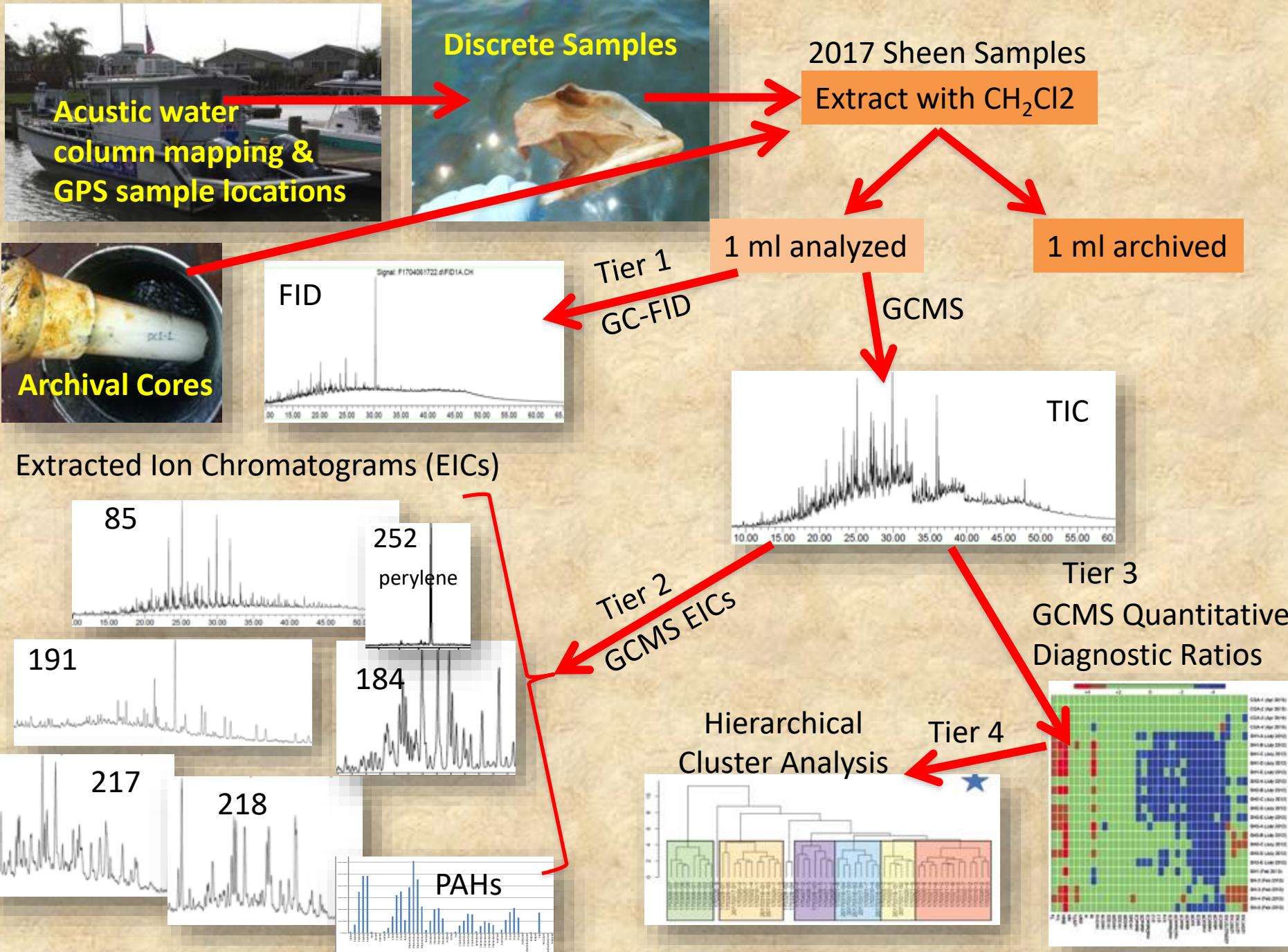
- Evaluate the chemical composition of discrete surface oil sheen residues (discrete oil droplets or rosebuds) collected just as they surfaced. Further, Provide forensic metrics capable of relating the sheen residue's chemical compositions at specific locations and times with concurrent visual observations and current measurement
- Compare the 2017 surface sheen's chemical composition to those sheens collected in July 2012 and February 2013, to determine whether chemically noticeable changes occurred over five years.
- Compare the chemical composition of the 2017 surface sheens to MC21 crudes and 2012/2013 sediment cores collected at MC20 to support other observations concerning the location on the seafloor where oil is being released and creating surface sheens.

Archived Sample Analytical Data and 2017 Sheen Analytical Data Evaluated as part of the SSLWG Forensic Analytical Task:



- **12 Box Cores, collected in 2012, mostly from Well Bay area***
- **45 Piston Core sections collected in 2012, mostly from Well Bay area***
- **16 Diver Core Sections collected in 2013, exclusively from Dome C area**
- **28 Sheens collected in 2012 and 13, MC20 location of surface sheens**
- **19 MC21 Crude Oils, collected in 2012, adjacent block to MC20**
- **57 Surface sheens collected in 2017, MC 20 block area**

* Only Piston & Box core sections that contained elevated oil levels were examined



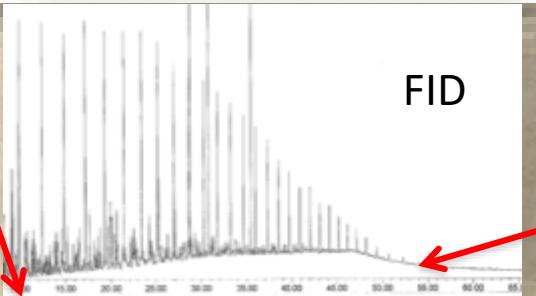
m/z 85

GC/GCMS Analytical Data

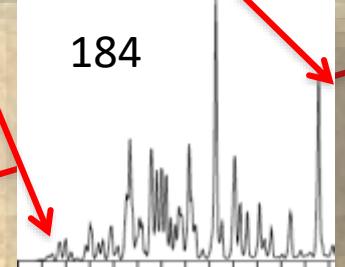
TIC

00 15.00 20.00 25.00 30.00 35.00 40.00 45.00 50.00 55.00 60.

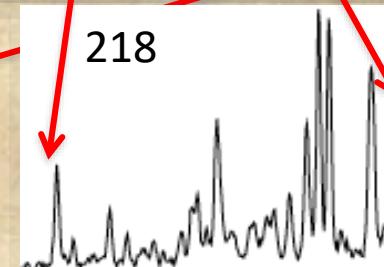
PAHs



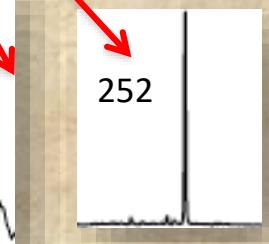
184



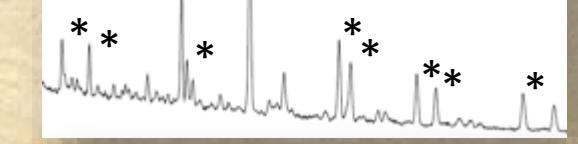
218



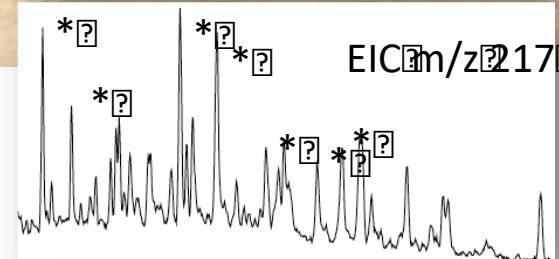
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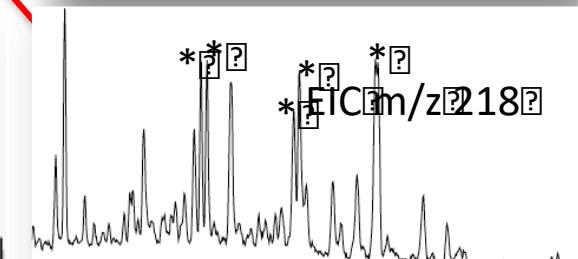
EIC m/z 191



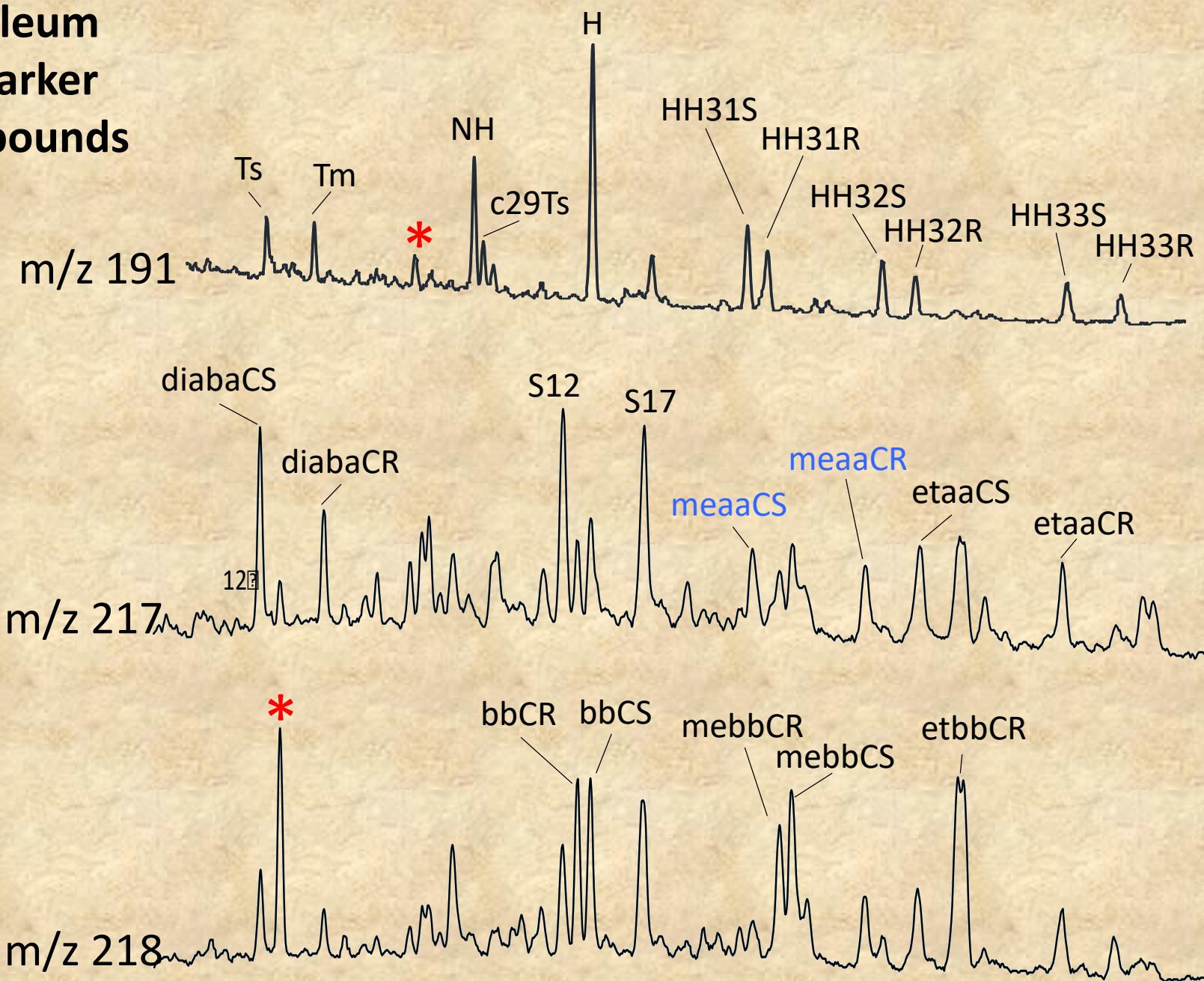
EIC m/z 217?



EIC m/z 218?



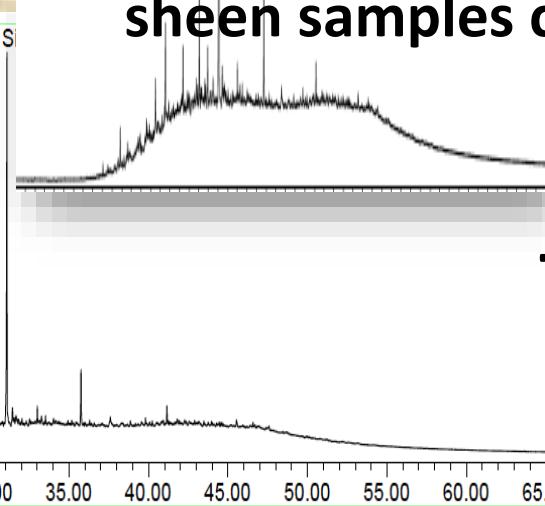
Petroleum Biomarker Compounds



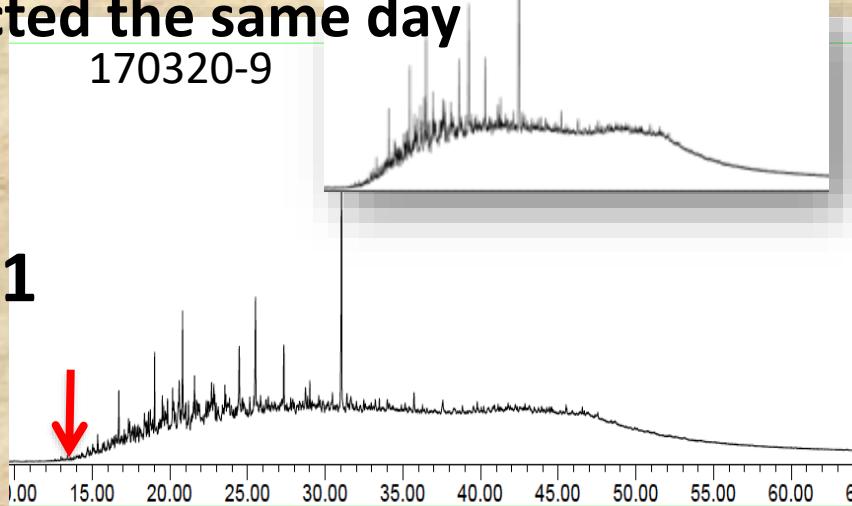
Looking for Differences and Similarities (binning)

sheen samples collected the same day

170320-1

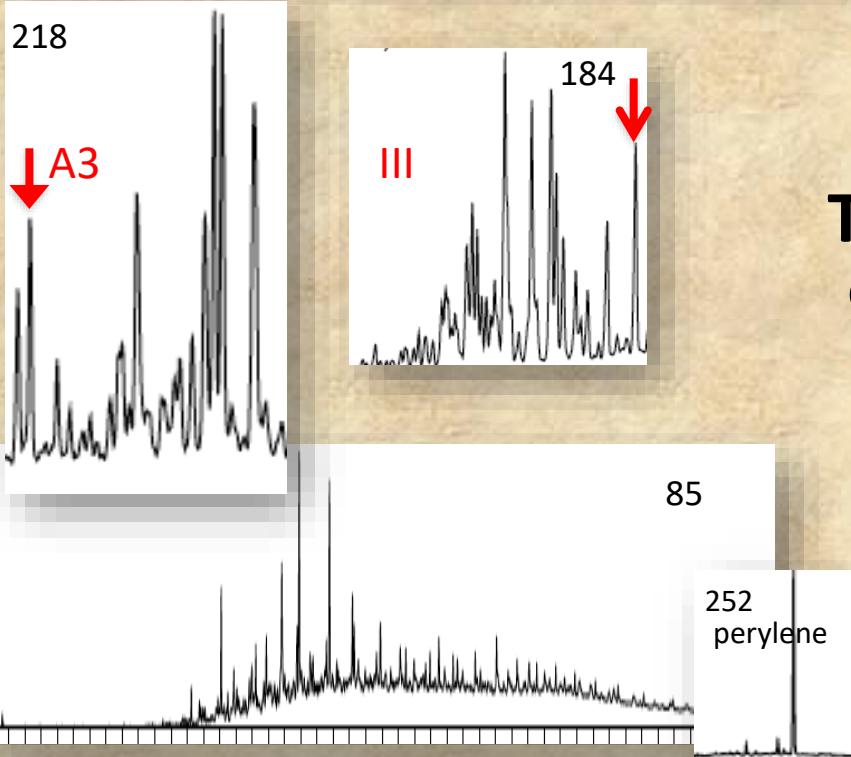


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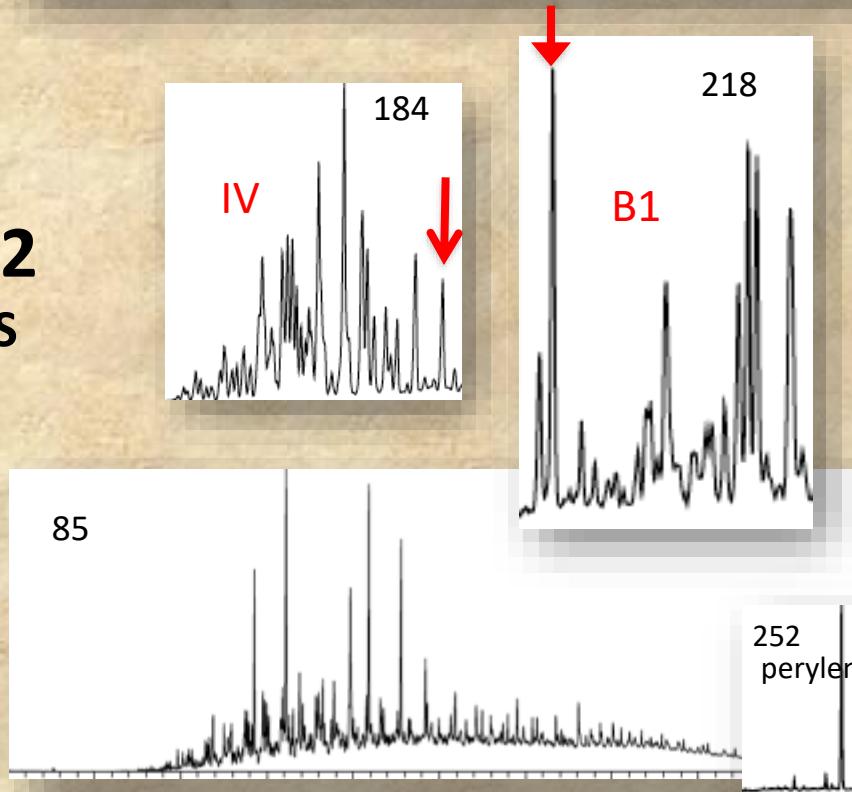


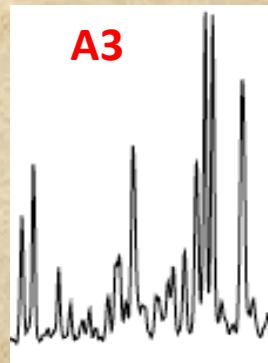
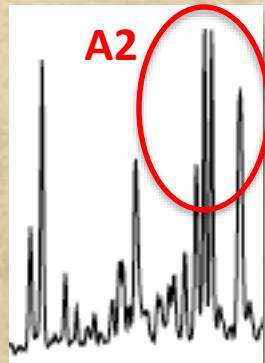
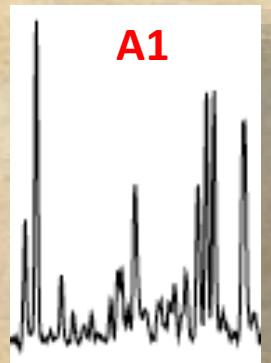
Tier 1

FID

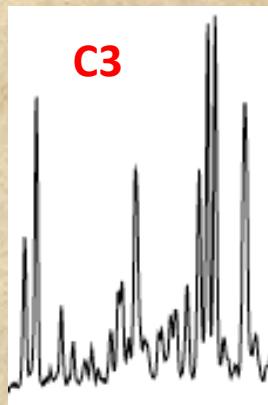
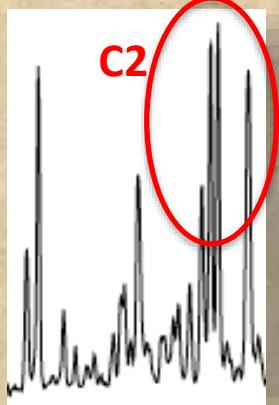
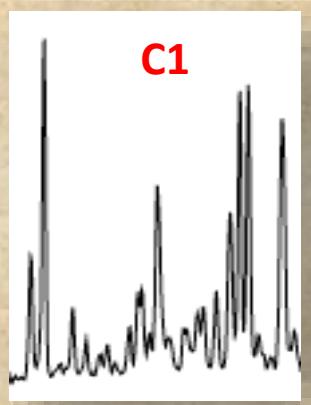
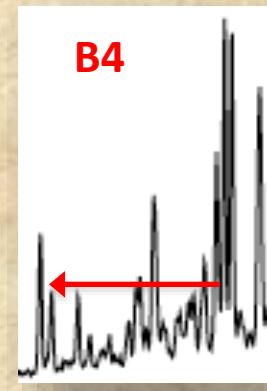
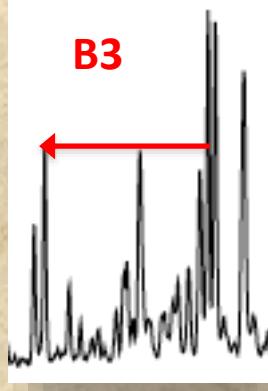
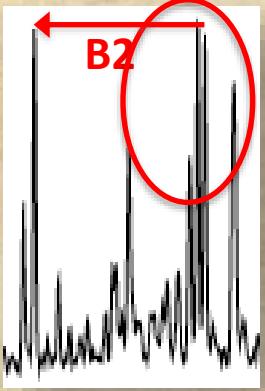
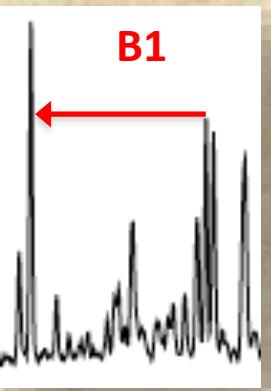


Tier 2
GCMS

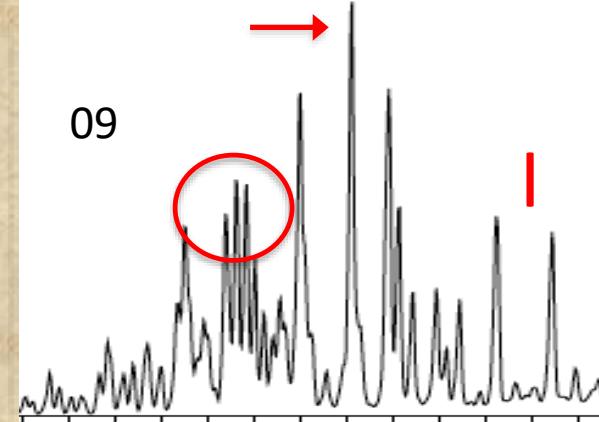
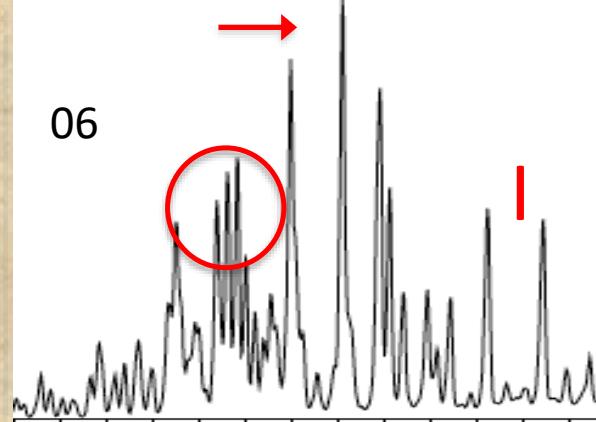
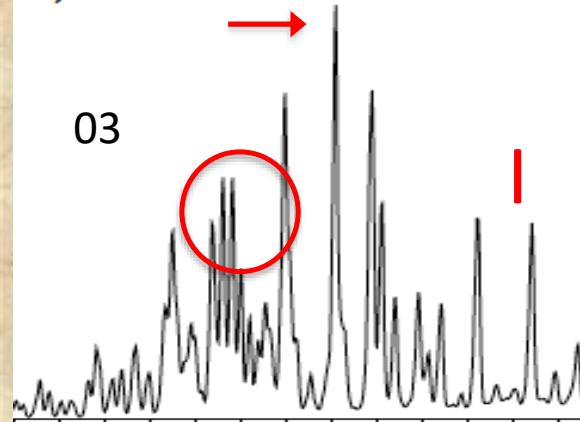
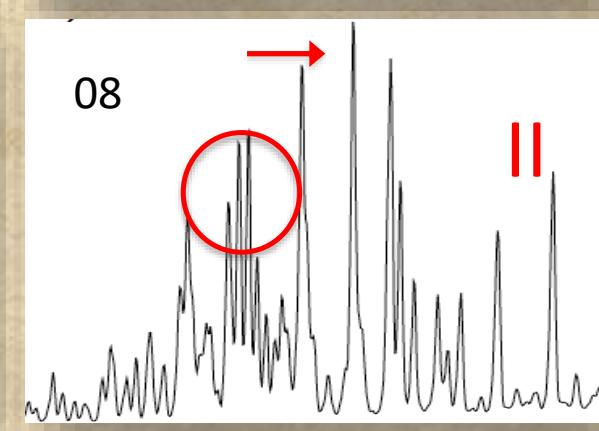
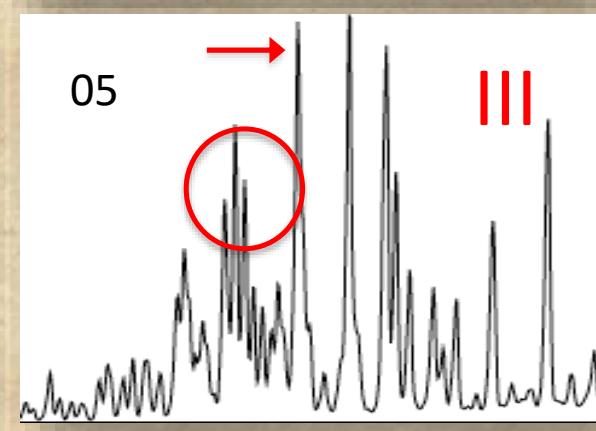
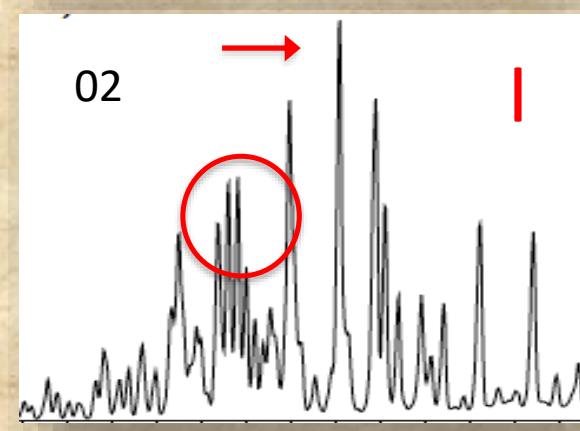
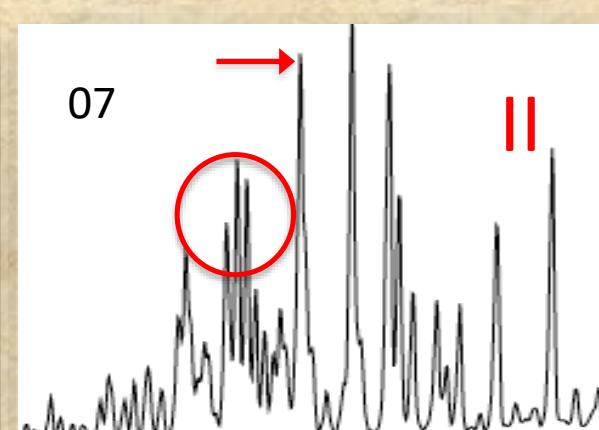
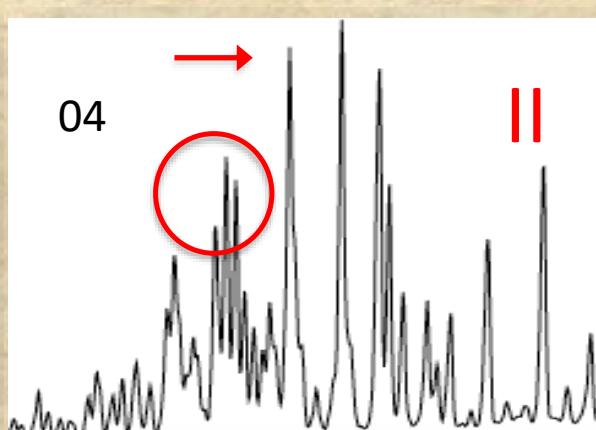
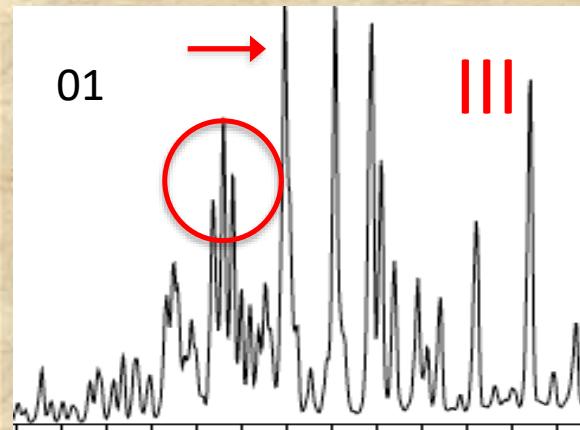




**Tier 2 binning of
features in m/z 218 EICs
from 2017 Sheens**

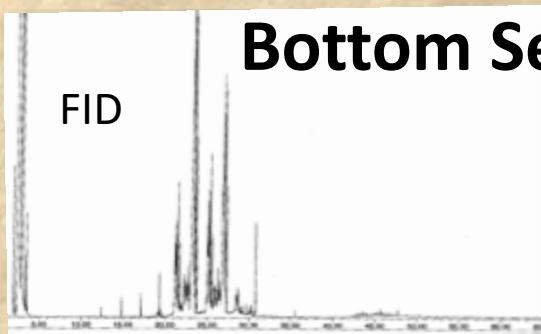


m/z 184 EIC from surface sheens collected on March 21, 2017



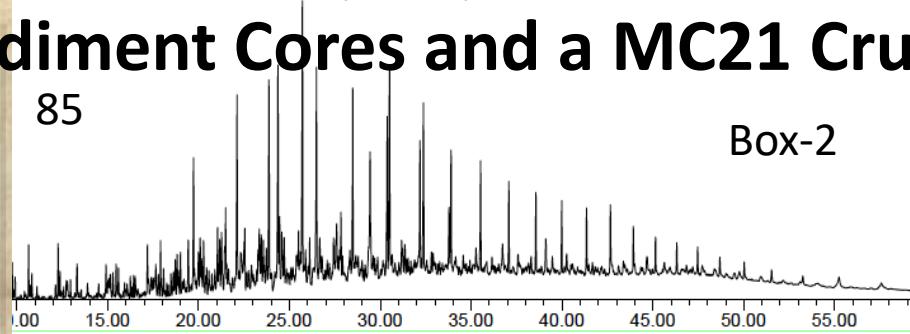
Bottom Sediment Cores and a MC21 Crude oil

FID

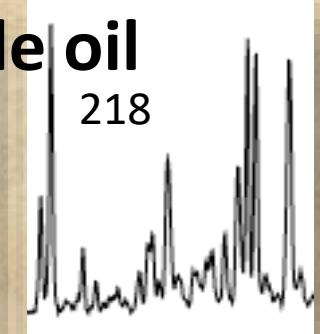


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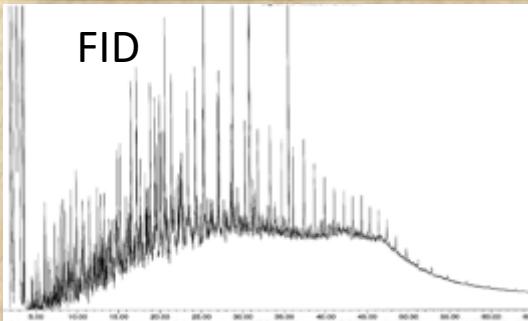
Box-2



218

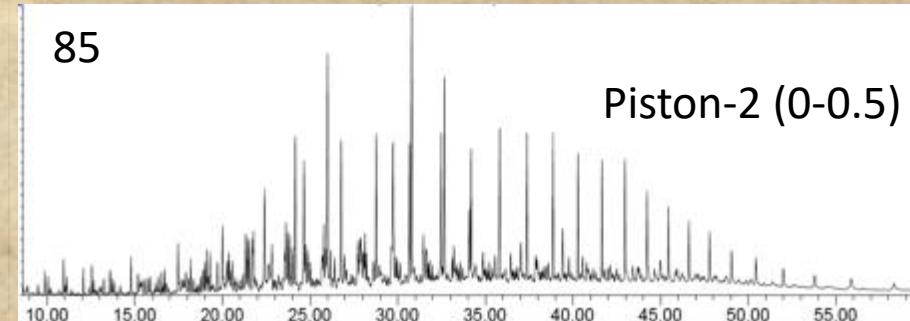


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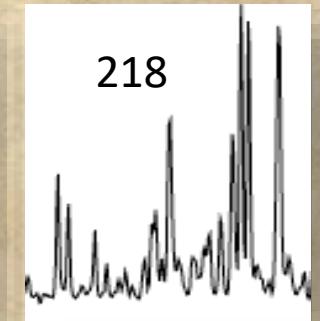


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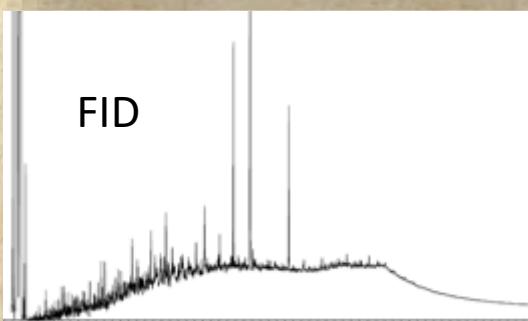
Piston-2 (0-0.5)



218

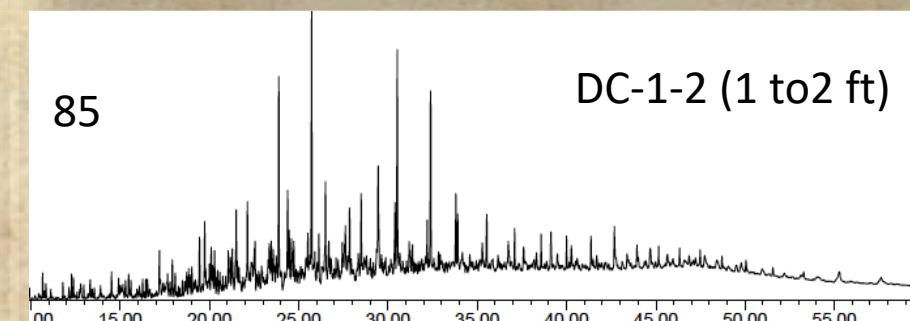


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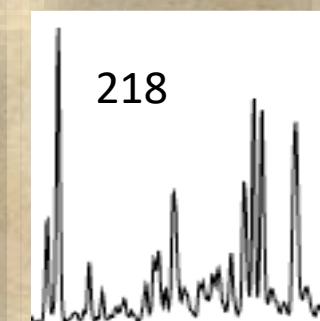


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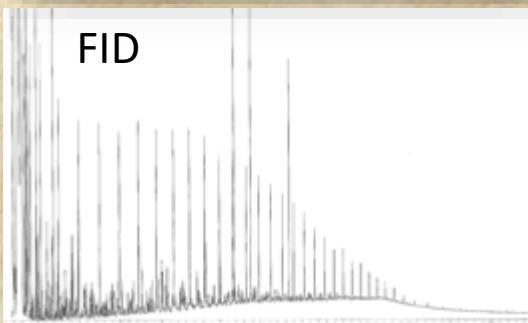
DC-1-2 (1 to 2 ft)



218

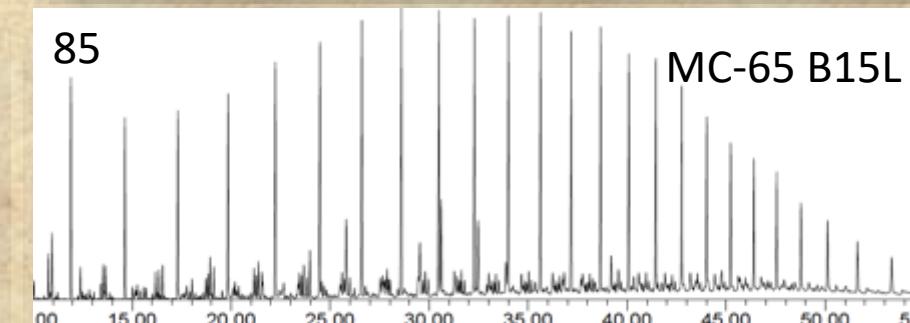


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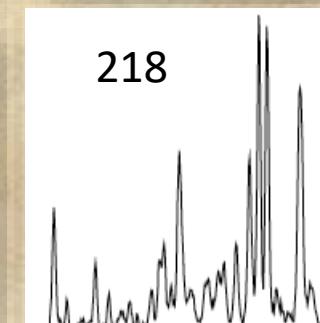


85

MC-65 B15L



218

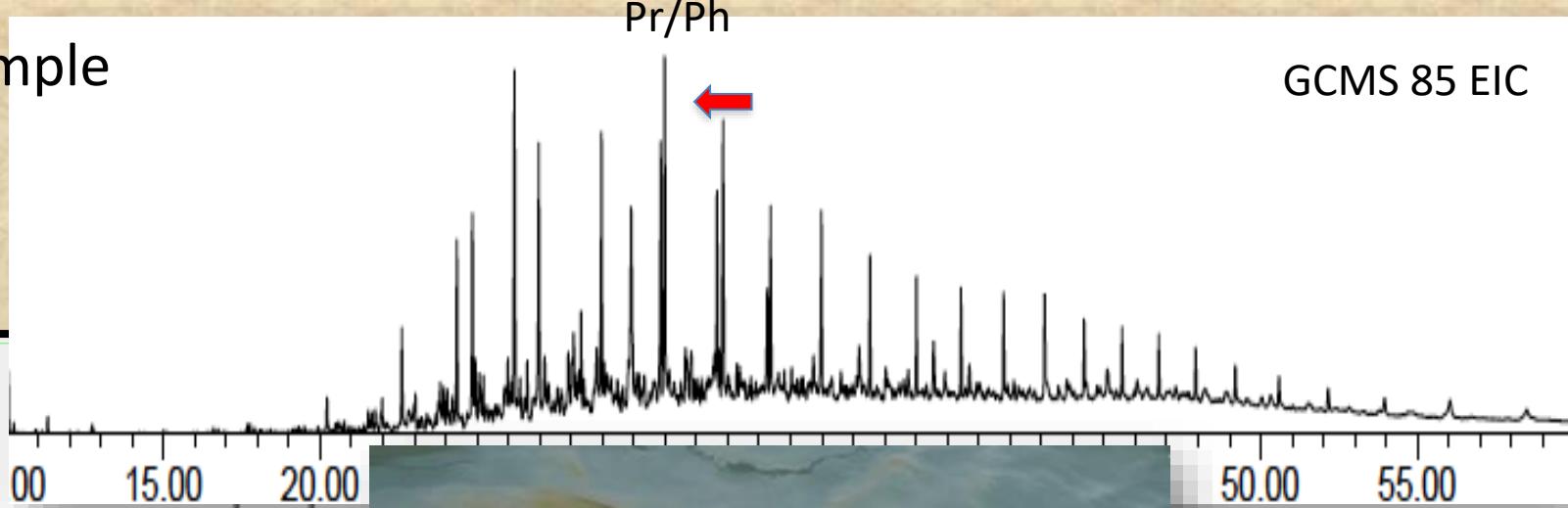


Sheen Sample
3/8/17

#170308-01

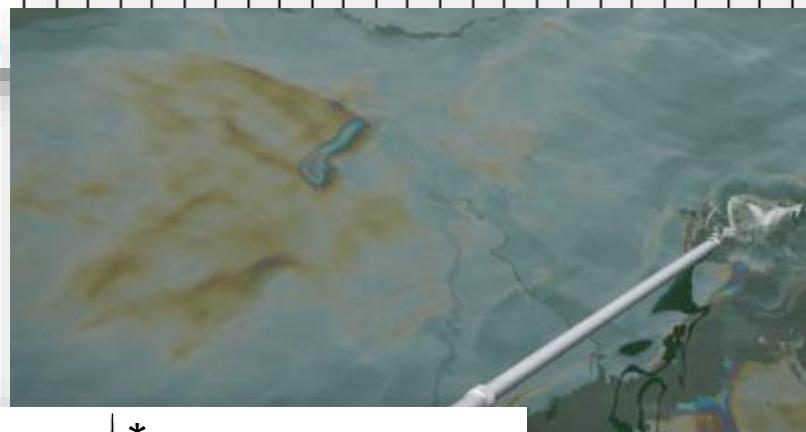
Pr/Ph

GCMS 85 EIC



EIC m/z 191

A1
218

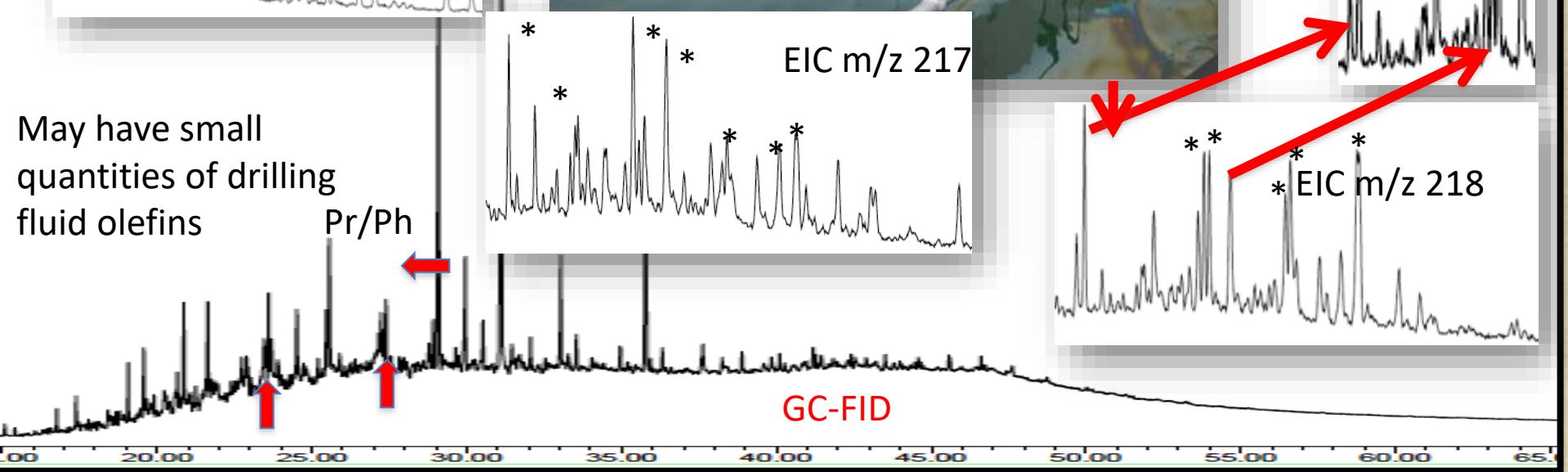


May have small
quantities of drilling
fluid olefins

Pr/Ph

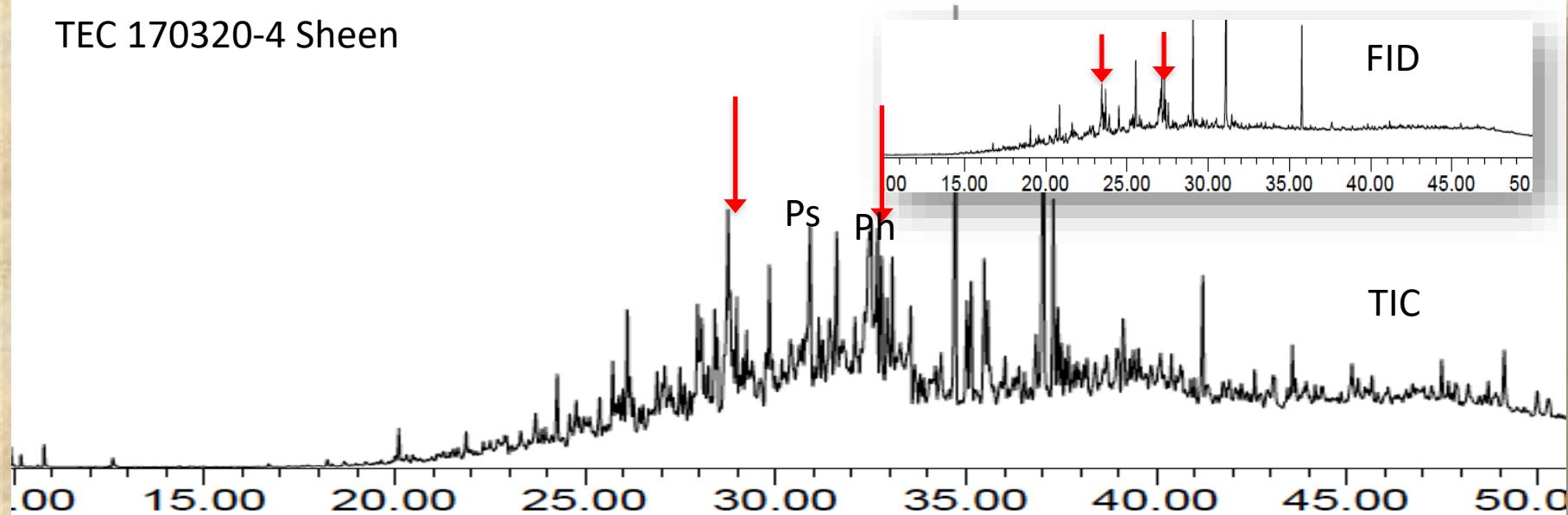
EIC m/z 217

* EIC m/z 218



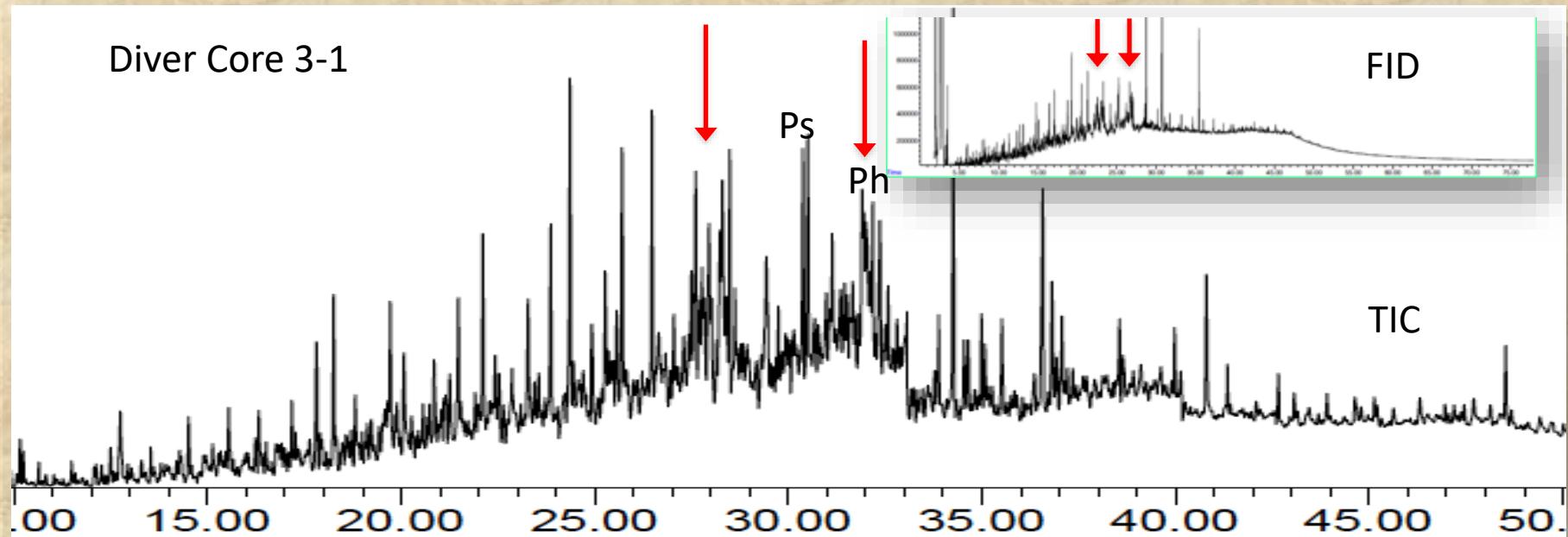
GC-FID

TEC 170320-4 Sheen

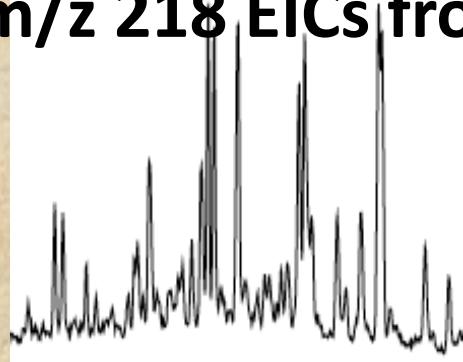


Samples with evidence of contamination from drilling mud olefins

Diver Core 3-1



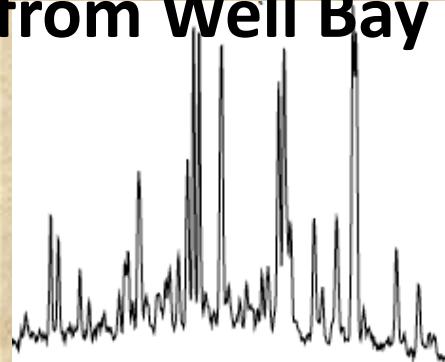
m/z 218 EICs from Piston Core Sections from Well Bay Area



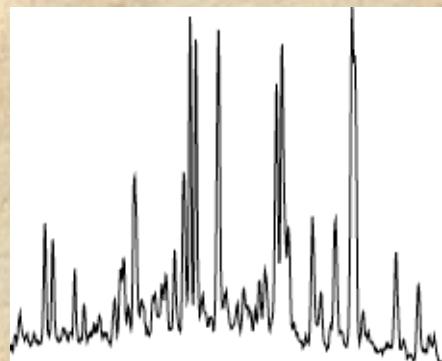
DC-4 Piston 0.5-1.0



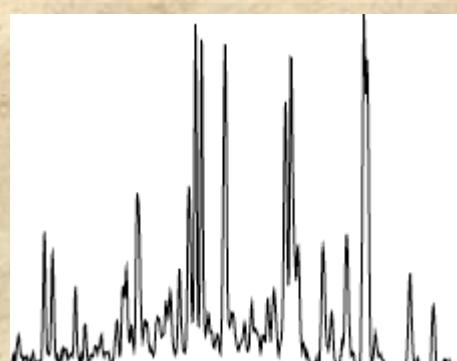
DC-5 Piston 0.5-1.0



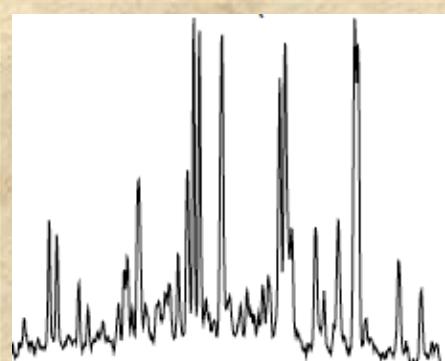
DC-6 Piston 05.-1.0



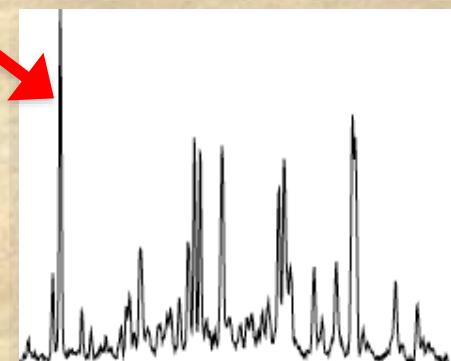
DC-4 Piston 1.5-2.0



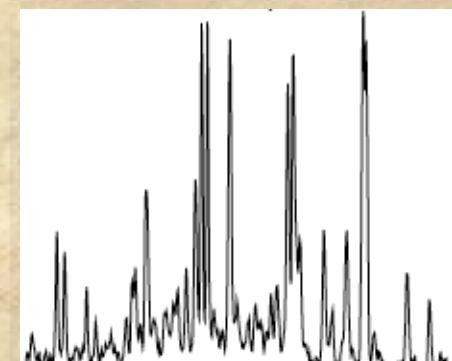
DC-5 Piston 1.5-2.0



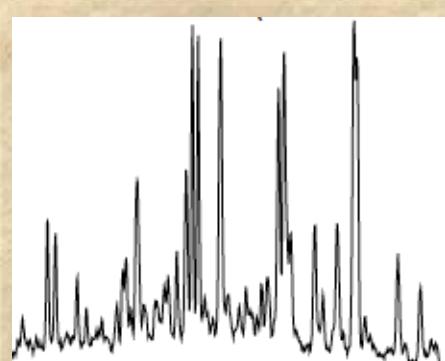
DC-6 Piston 1.5-2.0



DC-4 Piston 2.5-3.0

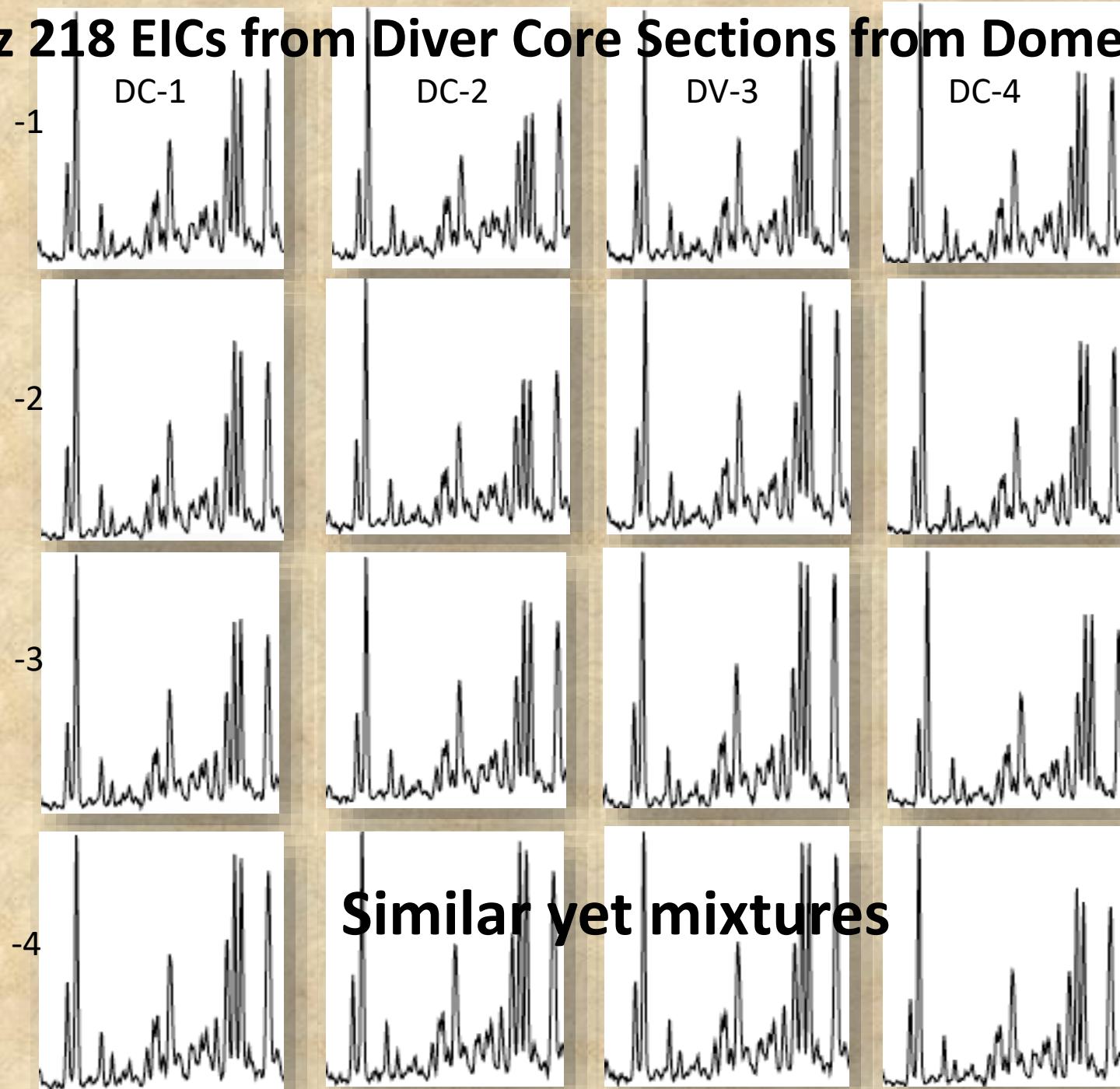


DC-5 Piston 2.5-3.0

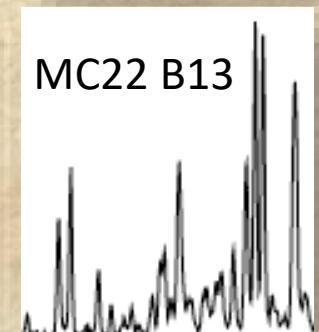
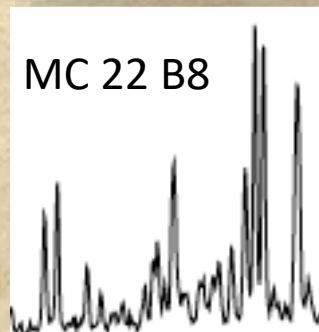
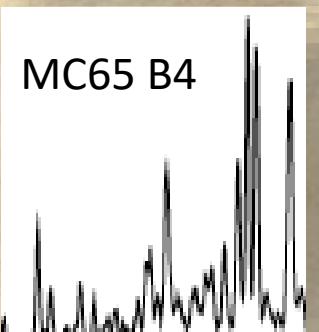
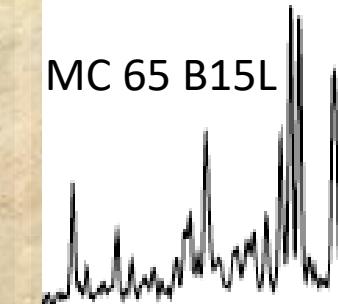
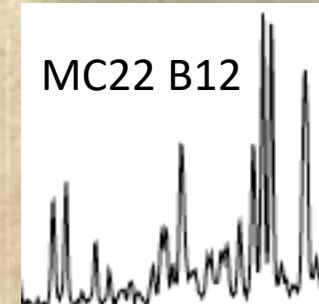
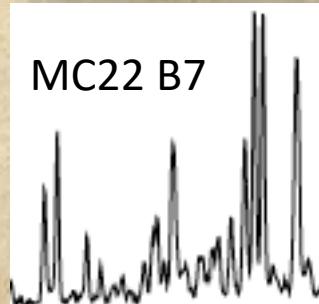
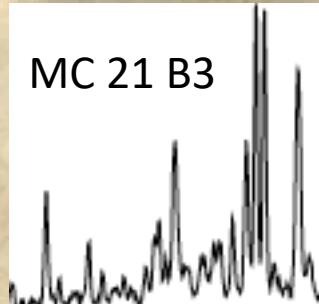
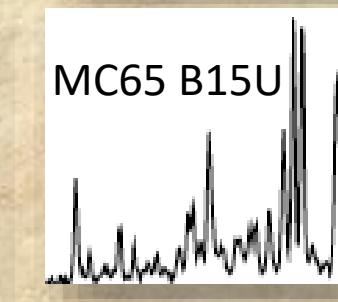
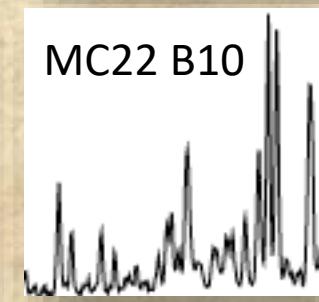
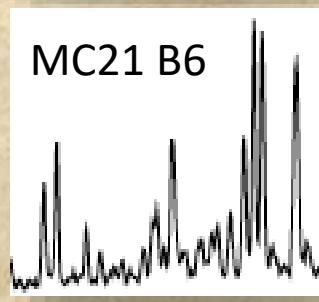
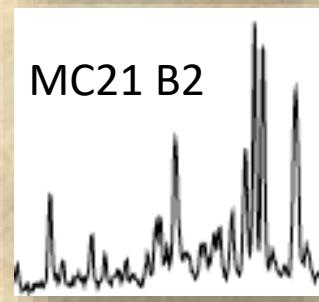
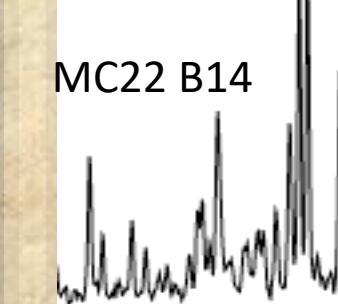
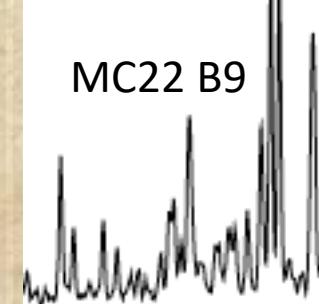
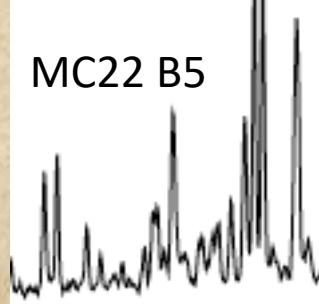
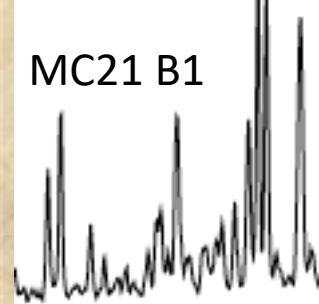


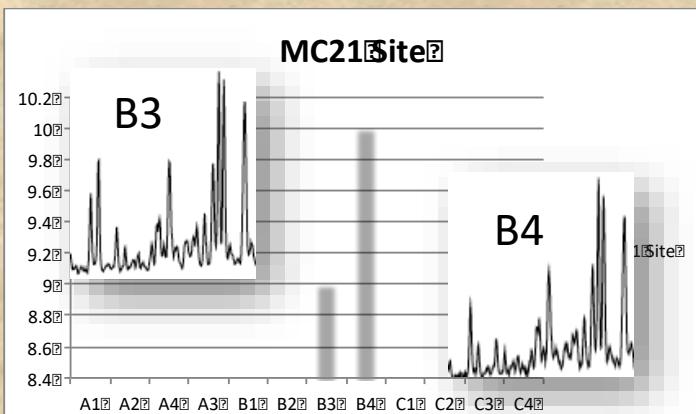
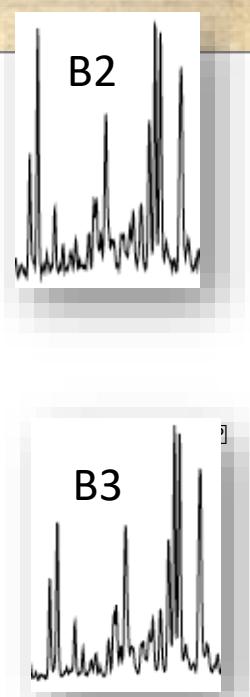
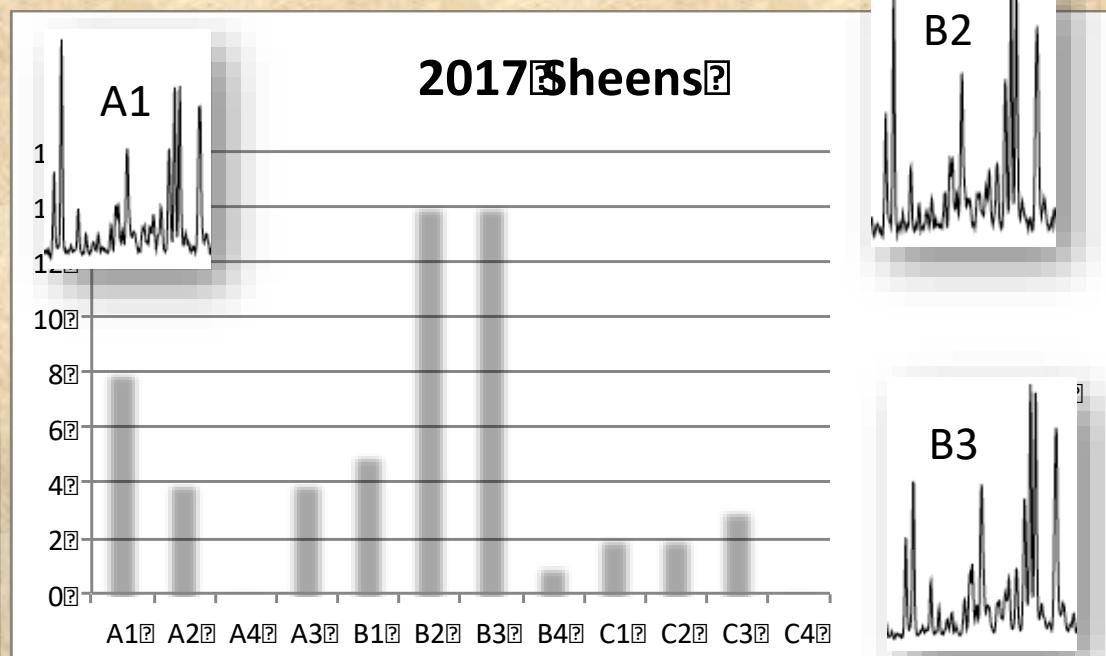
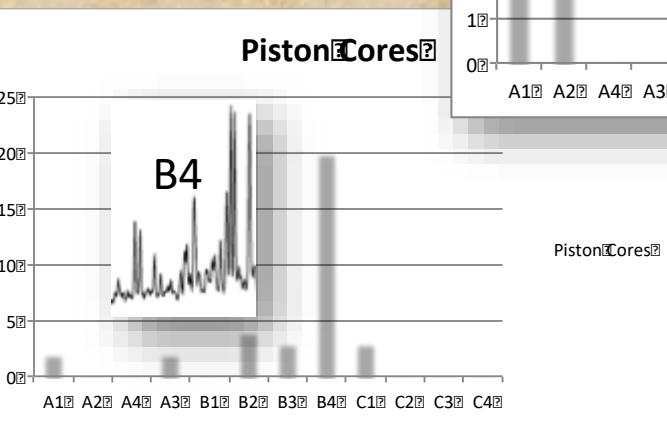
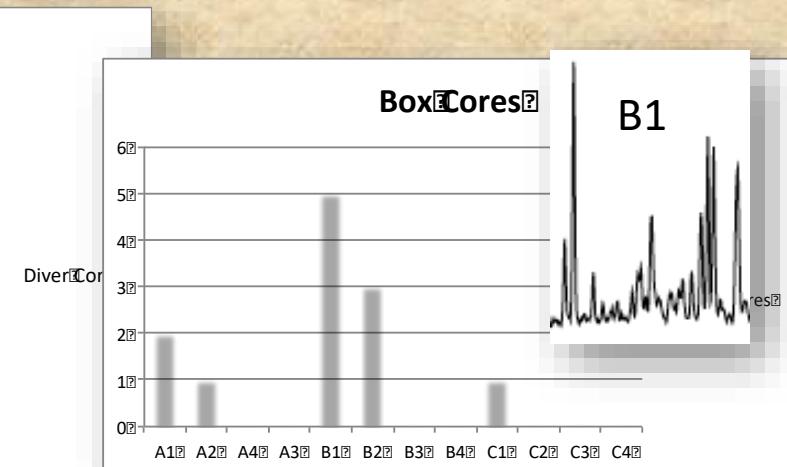
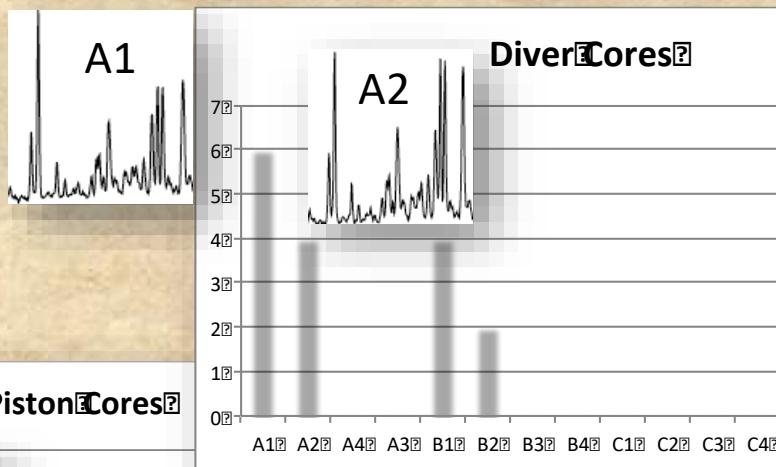
DC-6 Piston 2.5-3.0

m/z 218 EICs from Diver Core Sections from Dome C Area



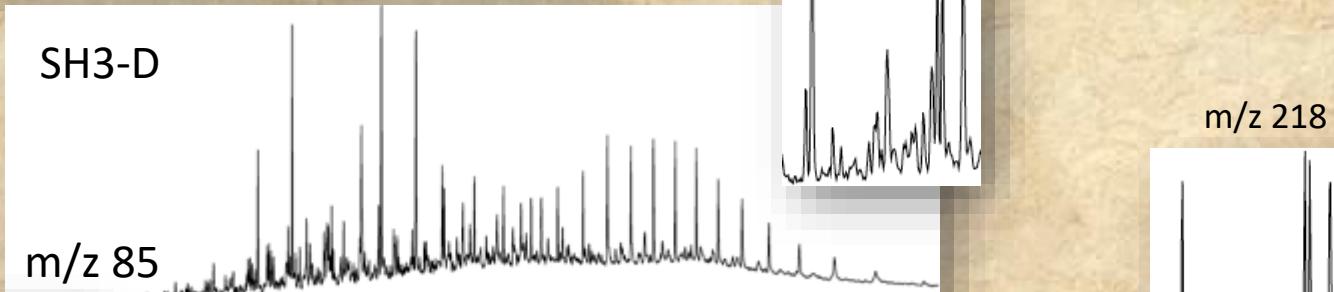
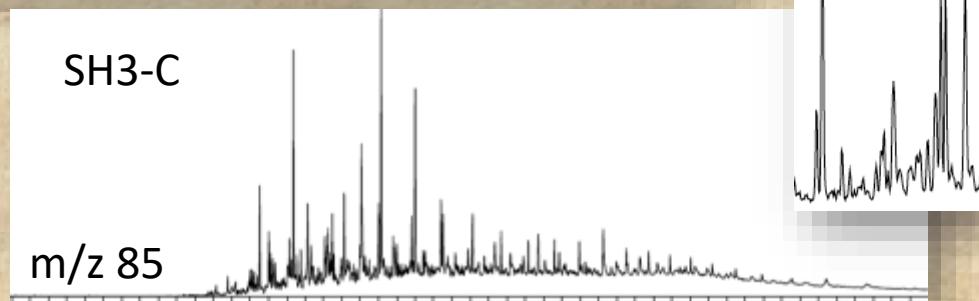
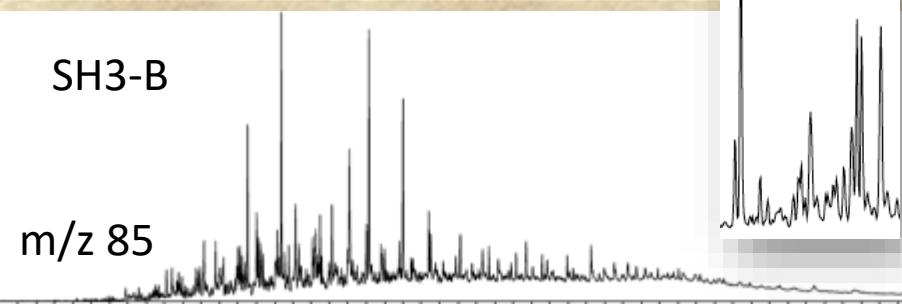
m/z 218 EICs from Crude Oil collected in Block MC21



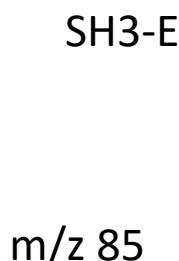
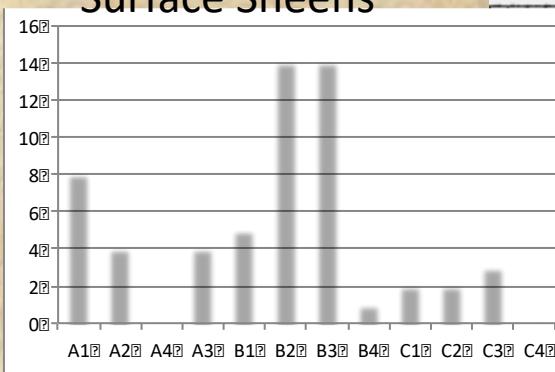


Sorting By Sterane Bin Numbers

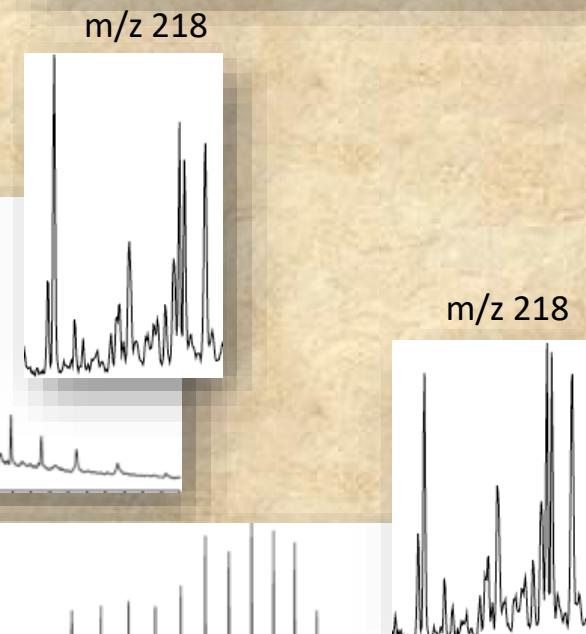
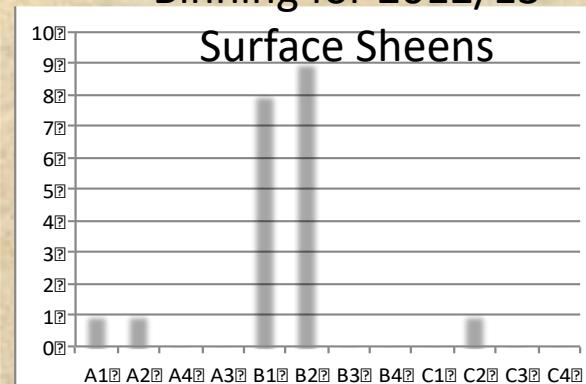
2012 Surface Sheen EICs



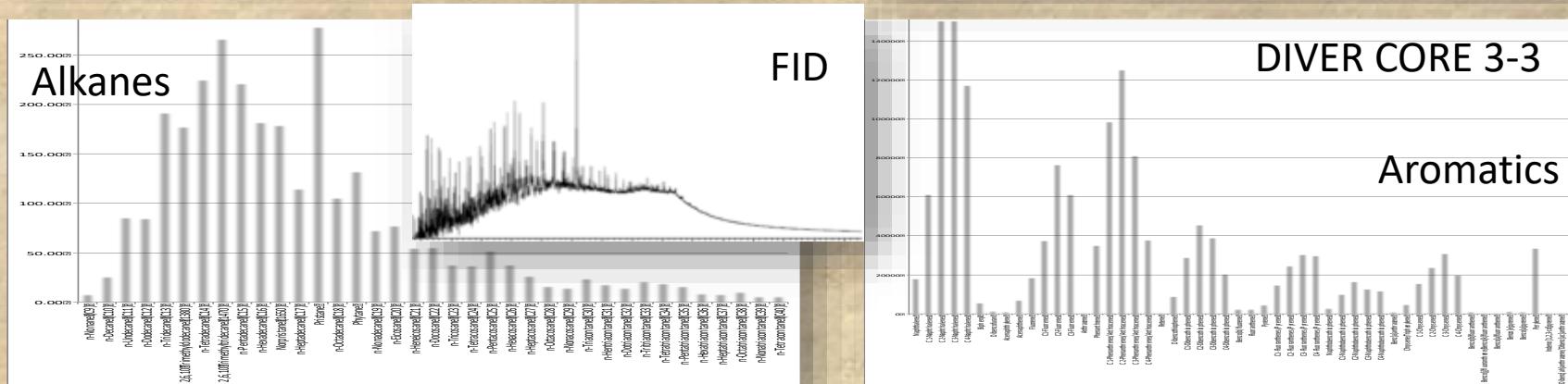
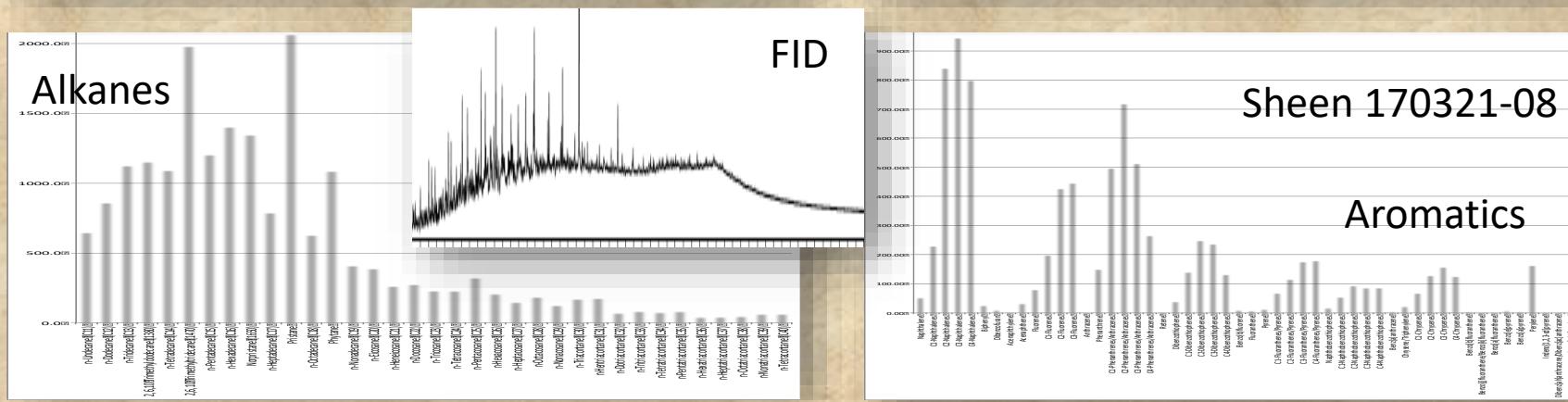
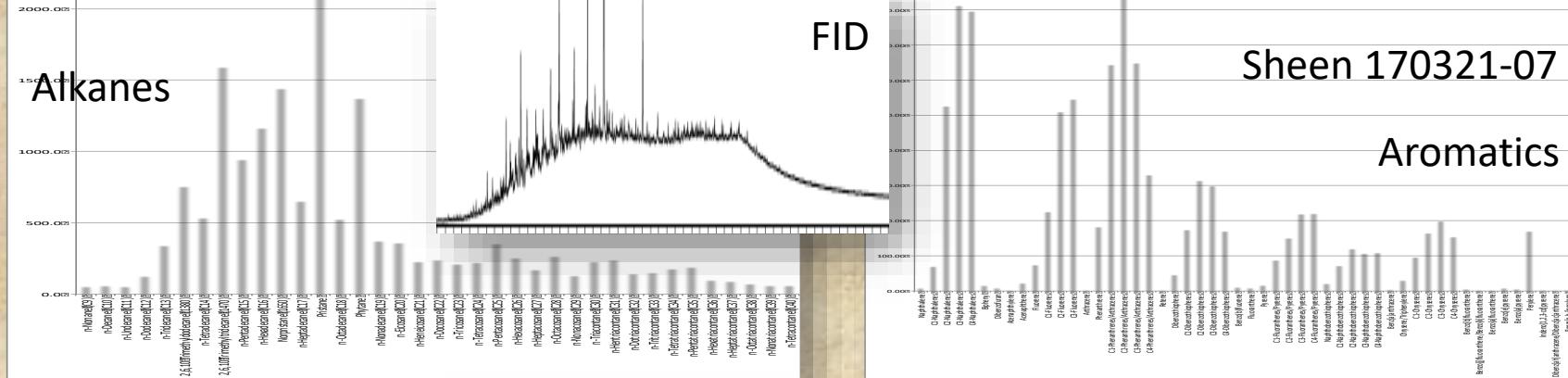
Binning for 2017
Surface Sheens

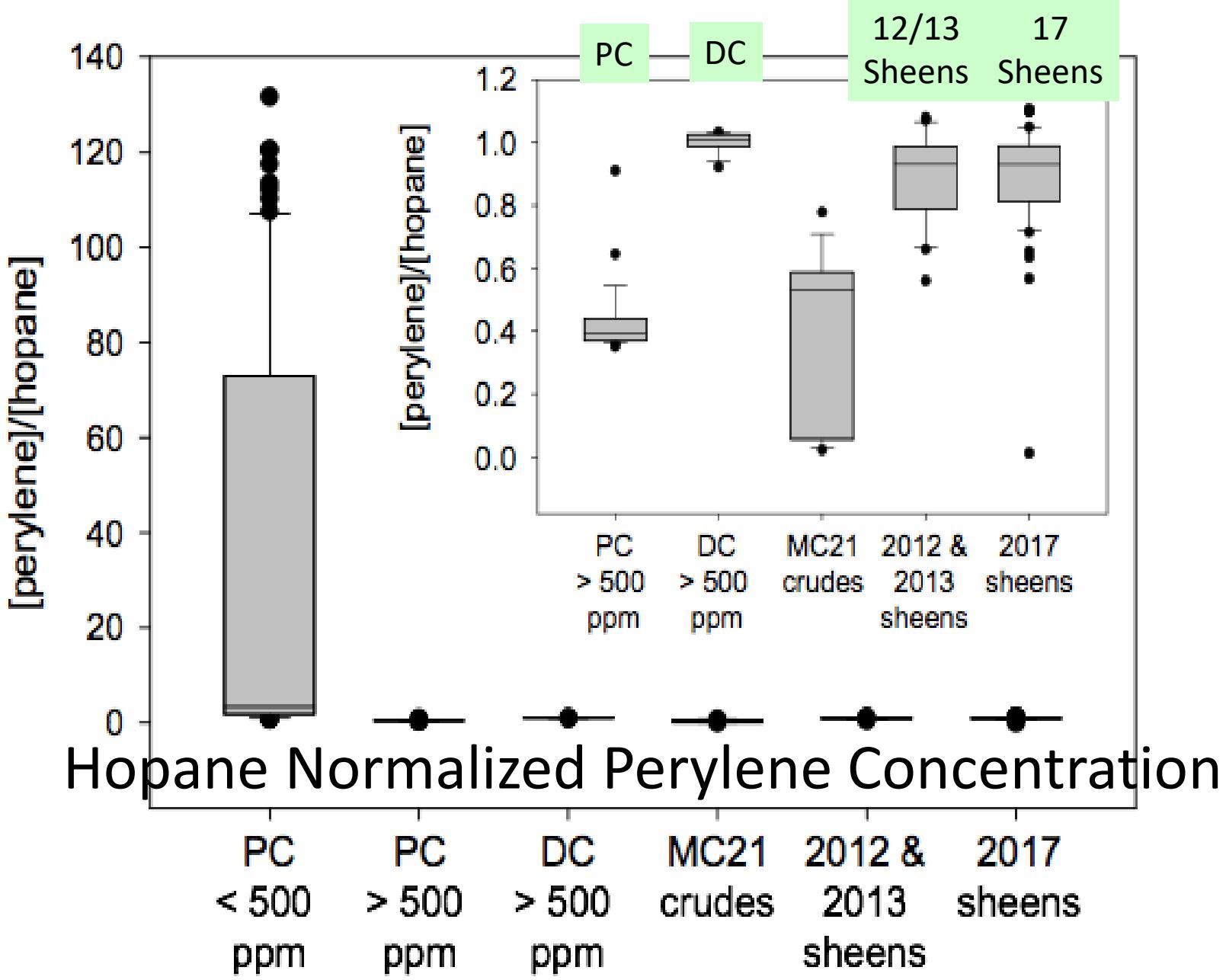


Binning for 2012/13

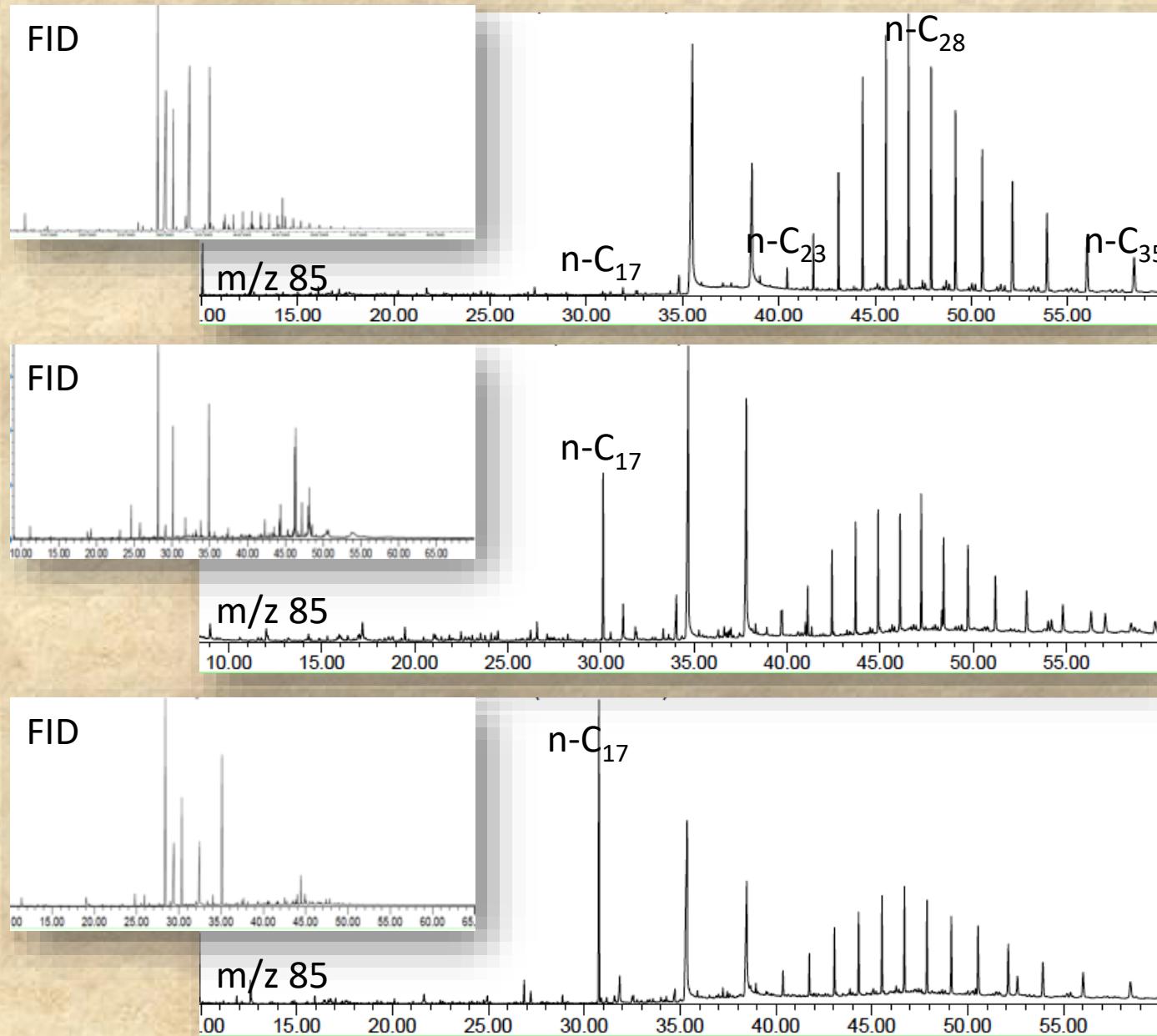


Slight Weathering of Surface Sheens compared to Diver Cores





2017 Sheens containing no Biomarker Compounds



Concluding Remarks

- Using Tier 1 and 2 Forensics, the Taylor site is a complex area, with heterogeneous oil residues sequestered in two locations on the bottom
- The results do point to a compositional similarity of the diver cores, collected where the conductors terminated at the base of the jacket (and highly contaminated) with 2012, 2013 and 2017 surface sheens.
- Even with compositional similarities, every sample was distinct, underscoring the fact that the probable source has a heterogeneous composition.
- A heterogeneous source makes sense when considering the base of the jacket was a mix of different oil residues.