November 21, 2023

Troy Charpentier
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Kean Miller LLP
400 Convention Street, Suite 700
Baton Rouge, Louisiana 70802

Chemical Fingerprint of 7B Cavern Oil – October 2023
Westlake Sulphur Dome Study

Dear Mr. Charpentier,

NewFields is pleased to provide you with this report of chemical fingerprinting results for an oil collected from the 7B cavern well in October 2023 as part of the on-going investigation of the Westlake US 2 LLC (Westlake) salt dome caverns in the Sulphur Mines oil field, Calcasieu Parish, Louisiana (the Site).

This study follows nine earlier chemical fingerprinting studies at the Site.[1,2,3,4,5,6,7,8,9] These earlier studies included four oils from the 7B cavern well (collected between January and June 2023), 13 local crude oil samples collected from nine Yellow Rock wells and the Yellow Rock tank battery. Among other conclusions, these earlier studies showed:

- The 7B cavern oils are chemically distinct from the locally produced (Yellow Rock) crude oils studied, which varied only slightly among themselves.
- There was no change in composition of the 7B cavern oil between January and June 2023, indicating no local crude oil(s) had or was presently entering Cavern 7.

The present study expands upon the latter of these earlier conclusions as it reports on the character of a new sample of 7B cavern oil collected in October 2023.

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[1] Stout, S.A. (2023) Chemical fingerprinting of oils, Westlake Sulphur Dome Study. NewFields Report dated March 10, 2023.
[2] Stout, S.A. (2023) Chemical fingerprint of oily net – No. 20, Westlake Sulfur Dome Study. NewFields Report dated April 27, 2023.
[3] Stout, S.A. (2023) Chemical fingerprint of 7B cavern oil – March 30, 2023, Westlake Sulfur Dome Study. NewFields Report dated May 3, 2023.
[4] Stout, S.A. (2023) 7B Cavern Oil, Cavern 4 Oil, Select Yellow Rock Well Oils, and a Bubble Site 24 Sheen – May 2023, Westlake Sulphur Dome Study. NewFields Report dated July 11, 2023 – Amended July 14, 2023.
[5] Stout, S.A. (2023) Chemical fingerprint of 7B cavern oil, selected Yellow Rock well oils and a Central Lake sheen – June 2023, Westlake Sulfur Dome Study. NewFields Report dated July 25, 2023.
[6] Stout, S.A. (2023) Chemical fingerprinting of additional Yellow Rock well oils – mid- to late-August 2023, Westlake Sulphur Dome Study. NewFields Report dated Oct. 4, 2023.
[7] Stout, S.A. (2023) Chemical fingerprint of floating materials, Central Lake and Bubble Site 14 – September 11, 2023, Westlake Sulphur Dome Study. NewFields Report dated Oct. 5, 2023.
[8] Stout, S.A. (2023) Chemical fingerprint of Bubble Site 14 sheen – September 20, 2023, Westlake Sulphur Dome Study. NewFields Report dated Oct. 17, 2023.

Samples

Table 1 provides an inventory of samples included in this study – along with those previously studied for ease of reference. The newly studied 7B cavern oil sample was collected on October 25, 2023 by personnel from ERM. The sample was sent to NewFields' alliance laboratory, Alpha Analytical (Mansfield, Massachusetts, USA) on October 26 and arrived safely the following day. A copy of the chain-of-custody document received with each shipment is found in **Attachment 1**.

Objectives

The objective of the current study was to determine if the character of the oil within the 7B cavern on October 25, 2023 has remained as it was in January, March, May, and June 2023, or possibly has changed in a manner that suggests locally produced crude oil has or may have entered the cavern.

Methods

This objective was pursued using specific chemical fingerprinting and interpretation methods based on the CEN oil spill identification protocol[10], as were described in the original study's report.[11] The chemical fingerprinting analyses performed herein remain unchanged from the previous reports. For this study, the 7B cavern oil collected October 25, 2023 was prepared and analyzed in duplicate. In addition, and as first described in the study of May 2023 oils,[12] this study also included the (re-)analysis of the cavern 7B oil collected in January 2023, that was adopted as a *site-specific reference oil*. This oil is being re-analyzed for quality control with each "batch" of samples analyzed from the Sulphur Dome site to assess the long-term precision of diagnostic ratios (DRs) used in the quantitative (statistical) comparison of samples from the site. An expanded discussion of this topic was provided earlier.[13] Based on the new results of the duplicate pair and site-specific reference oil reported herein, an updated table of the short-term and long-term precision of DRs is provided in **Attachment 2**. There are no significant changes to either short- or long-term precision attained to date.

Results & Discussion

The complete Alpha Environmental Testing Report (ETR) including all sample preparation data, instrument calibrations, QC data and chromatograms is maintained on file by NewFields (ETR L2363877). The tabulated results for the targeted compounds in each analysis performed are contained in **Attachment 3**. The full-size GC/FID chromatogram obtained in Tier 1 (modified EPA Method 8015D) analysis is provided in **Attachment 4** and selected extraction ion profiles (EIPs) obtained in Tier 2 (modified EPA Method 8270D) are provided in **Attachment 5**. The crude oil assay data provided to me on the 7B cavern oil collected October 25, 2023 is provided in **Attachment 6**.

Specific results most relevant to the study's objectives are presented in **Tables 2 to 3** and **Figures 1 to 5**. Discussion of these results is provided in the following sections.

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[10] Kienhaus, P.G.M. et al. 2016. CEN methodology for oil spill identification. In: *Standard Handbook of Oil Spill Environmental Forensics: Fingerprinting and Source Identification*, 2nd Ed., S.A. Stout and Z. Wang, Eds., Elsevier Publishing Co., Boston, MA, p. 685-728.

[11] See Footnote 1.

[12] See Footnote 4.

[13] See Attachment 3 within Footnote 4.

Character of the October 2023 7B Cavern Oil and Its Comparison to Previous 7B Cavern Oils

Figure 2 shows the Tier 1 GC/FID (C8+) chromatogram for 7B cavern oil collected on October 25, 2023 (Fig. 2A), along with those of the 7B cavern (reference) oil collected in January 2023 that was analyzed herein (Fig. 2B) and more than nine months ago (Fig. 2C). Inspection reveals an obvious similarity between these oil's chromatographic features. This same degree of similarity was also evident when the chromatograms for the 7B cavern oils collected in March, May, and June 2023 were compared to the 7B cavern oil collected in January 2023.[14]

To date, all five of the 7B cavern oil samples studied, including the October 2023 sample studied herein (Fig. 2B), contain compounds that extend up to ~C40. Resolved compounds (peaks) over this range are dominated by n-alkanes that decline in abundance with increasing carbon number. These prominent n-alkanes occur atop a broad, low unresolved complex mixture (UCM) spanning the oils' chromatograms. Also resolved are numerous acyclic isoprenoids, including pristane (Pr) and phytane (Ph) that occur in similar but not identical proportions to each other in all five cavern oils (Pr/Pr ~1.0) and to nearby n-alkanes (C17/Pr and C18/Ph; see Fig. 2 insets and Table 2).

The more detailed characteristics of the 7B cavern oil collected in October 2023 are revealed in its Tier 2 GC/MS extracted ion profiles (EIPs) contained in Attachment 5. Those EIPs depicting petroleum biomarkers, i.e., triterpanes, steranes, and triaromatic steroids, used in oil spill fingerprinting are shown in Figures 3 to 5, respectively. Each figure again contains the EIPs for the 7B cavern oil collected on October 25, 2023 (Fig. 3A, 4A and 5A), along with those of the 7B cavern (reference) oil collected in January 2023 that was analyzed herein (Fig. 3B, 4B and 5B) and more than nine months ago (Fig. 3C, 4C, and 5C). Inspection of these EIPs further reveals the comparability of the 7B cavern oil collected in October 2023 to those collected and analyzed previously.[15] The EIPs for these previously analyzed 7B cavern oil samples from March, May, and June (not shown) were contained in attachments to earlier reports, which further demonstrated the similarity in petroleum biomarkers among all of the cavern 7B oils studied.

This last point can be demonstrated quantitatively using the 30 diagnostic ratios (DRs) measured throughout the Sulphur Dome studies. **Table 2** provides an inventory of the 30 DRs calculated from the concentrations of selected PAHs and biomarkers in the 7B cavern oils collected to date, including the October 2023 sample analyzed herein. (Because each of the 7B cavern oil samples were analyzed in duplicate the average DRs of each duplicate pair are given.) Those DRs that are presently determined to be less precisely measured over both the short term and long term of the Sulphur Dome studies (per Attachment 2) are "greyed out" as they tend to exhibit higher standard errors under repeatability and/or reproducibility conditions (RSD_r and RSD_R) using the CEN protocol's 95% confidence level criteria.[16,17]

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[14] see Footnotes 4 and 5

[15] The EIPs for these previously analyzed 7B cavern oil samples from March, May, and June were contained in attachments to earlier reports. These also demonstrate the similarity among the cavern 7B oils.

[16] Kienhaus, P.G.M. et al. 2016. CEN methodology for oil spill identification. In: *Standard Handbook of Oil Spill Environmental Forensics: Fingerprinting and Source Identification*, 2nd Ed., S.A. Stout and Z. Wang, Eds., Elsevier Publishing Co., Boston, MA, p. 685-728.

[17] The quantitative (statistical) comparisons relied upon the 95% confidence level under conditions of repeatability ($r_{95\%}$) for each diagnostic ratio wherein:

$$r_{95\%} = 2.8 * RSD_r \text{ where } RSD_r = 5\% \text{ standard error, thus}$$

$$r_{95\%} = 14\%$$

If the $r_{95\%}$ between the measured diagnostic between two samples <14% the ratios were considered to statistically **match**, and *vice versa*. The comparable criterion ($R_{95\%}$) is used to compared precisely

The green and red color-coding in Table 2 reveals those diagnostic ratios that statistically match (green) and statistically differ (red) from the January 2023 7B cavern oil (avg.). All 17 of the most precisely measured DRs in the October 2023 7B cavern oil (avg.) are statistically matched to the January 2023 cavern oil. With one exception there are statistical matches for all 17 precisely measured DRs between the 7B cavern oils (avg.) collected in March, May, and June 2023 and the January 2023 cavern oil (Table 2).[18] Thus, the four 7B cavern oils collected in March, May, June, and October 2023 are "positive matches" to the January 2023 7B cavern oil. Collectively, these results indicate that:

- The specific character of the 7B cavern oil has not changed since chemical fingerprinting of the cavern oil began in January 2023.
- All five cavern oils collected and analyzed over the past 9+ months are comprised of the same unweathered[19] crude oil.
- Notable distinguishing features of the 7B cavern oil are reflected in several DRs (Table 2) including:
  - Relatively high amounts of tetracyclic terpane (high T6a/T6bc ratio), Ts (T11/T12 and T11/T19), bisnorhopane (T14a/T19), and homohopanes (T21/T19 and T34 to T35/T19);
  - Near equal amounts of pristane and phytane (Pr/Ph) and of norhopane and hopane (T15/T19); and
  - Relatively low amounts of oleanane (T18/T19) and moretanes (T20/T19).

In addition, and as was previously observed, the 7B cavern oils exhibit conventional (equilibrated) proportions of C32 homohopane 22S and 22R epimers (T27/T26), a feature that is distinct from the Yellow Rock locally produced crude oils studied to date.[20]

Crude Oil Assay Results

The crude oil samples studied to date via chemical fingerprinting (Table 1) also have been analyzed via standard crude oil assay, including the 7B cavern oil collected in October 2023 studied herein (Attachment 6). In addition to the assay data collected for the oil samples in Table 1, the assay data for oils from the Sulphur Mines Strategic Petroleum Reserve (SPR) in 1989 were also provided by USDOE in response to a FOIA request.[21] A compilation of the available assay data most useful in assessing the similarity/differences between crude oils are provided in **Table 3**.[22]

measured DRs under conditions of reproducibility. See Attachment 3 within Footnote 4 for further discussion.

[18] The one exception, DBT3/PA3 in the March 2023 7B cavern oil, had a $R_{95\%}$ of 16.1%, i.e., only slight exceeding the 14% match criteria. This DR has mildly fluctuated and was previously considered to be among the less reliable DRs (e.g., see Footnote 5).

[19] *Unweathered* is used here since this oil exhibits no obvious evidence of *weathering*, a term that refers to changes an oil can experience due to various processes (e.g., evaporation, water-washing, photo-oxidation, biodegradation). The changes due to weathering are well recognized and accounted for in oil spill identification protocol, which instead focuses upon those chemical fingerprinting features resistant to weathering.

[20] See Footnotes 4, 5, and 6.

[21] See Attachment 8 in Footnote 5.

[22] See Footnote 5 for further discussion.

The assay data collected on the October 2023 7B cavern oil are in close agreement with the results collected for Cavern 7 oil dating back to November 2022, i.e., the first-time assay data were collected in the on-going Sulphur Dome study (Table 3). The 7B cavern oils are clearly distinct from the locally-produced crude oils represented by the Yellow Rock well oils studied to date but are relatively comparable to the historic SPR oils (Table 3). These relationships are visually evident in **Figure 5**, inspection of which shows:

- The 7B cavern oil has remained consistent (between November 2022, when it was first analyzed, and October 2023) and is clearly distinguishable from the locally produced, Yellow Rock oils.
- The 7B cavern oils exhibit "bulk" features generally consistent with SPR oil(s) historically stored in Sulphur Dome's caverns.

The latter of these conclusions tends to support the apparent predominance of residual SPR oil that presently remains within Cavern 7. On this point, documents recently provided in response to your FOIA request indicate that more than 100,000 bbl of non-recoverable/trapped SPR oil, reportedly "*sour crude primarily purchased from Mexico*", may have remained in the Sulphur Mines caverns upon completion of drawdown in the early 1990s.[23] Notably, the 7B cavern oils' average sulfur content (1.377 wt%; Table 3) is clearly "*sour*" (*def*. S > 0.5 wt%).

Summary of New Findings

Chemical fingerprinting of 7B cavern oil collected on October 25, 2023 was conducted and the results were compared to 7B cavern oils collected on January 25, March 30, May 25, and June 16, 2023. Results showed that all five 7B cavern oils are comprised of the same specific type of unweathered crude oil and are "positive matches" to one another. Additionally, the "bulk" crude oil assay data collected on the 7B cavern oil collected on October 25, 2023 are also consistent with 7B cavern oil results dating back to November 2, 2022, when the recent monitoring began. Collectively, these result show:

- There has been no change in the chemical fingerprints or "bulk" properties of the crude oil recovered from the 7B cavern well since these data were first collected in late January 2023 and early November 2022, respectively. Thus,
- There is no evidence that locally produced crude oil is currently entering Cavern 7.

All earlier conclusions regarding (1) the distinct chemical fingerprinting and "bulk" property differences that exist between the 7B cavern oil from the locally produced Yellow Rock oils and (2) the multiple surface sheens containing oil being are derived from spilled, leaked, or seeped locally produced oils remain unchanged. These results further show:

- There is no evidence that locally produced crude oil ever (historically) entered Cavern 7.
- There is no evidence that oil is presently leaking from Cavern 7 to impact the area's near surface environment.

Please let me know if you have any questions.

[23] DOE document: SM COARB 07-13-93; e.g., p. 29 and 31 of 73.

Sincerely,

Scott A. Stout, Ph.D., P.G.
Sr. Geochemist

Attachments:
1: Chain-of-custody
2: Updated RSD table
3: Tabulated concentrations of TPH/SHC, PAH, and biomarkers
4: Full size GC/FID chromatograms
5: Selected GC/MS extraction ion profiles
6: Bulk assay data for the sample studied

Table 1: Inventory of samples from the current study and studied previously.

Current Study Samples

Client/ Field ID	Lab ID	Matrix	Date Collected	Description of Sample
7B Oil*	L2363877-01	Oil	10/25/2023	Cavern oil from brine well 7B
7B**	L2361423-02	Oil	1/25/2023	Site-specific reference oil; 7B Cavern Oil (Jan 2023)

Previously-Studies Samples

Client/ Field ID	Lab ID	Matrix	Date Collected	Description of Sample
Westlake #19	L2361423-01	Net	10/15/2023	Surface sheen from bubble site No. 19
7B**	L2361423-02	Oil	1/25/2023	Site-specific reference oil; 7B Cavern Oil (Jan 2023)
No. 14 Sheen Sample	L2355855-01	Net	9/20/2023	Surface sheen from bubble site No. 14
7B**	L2355855-02	Oil	1/25/2023	Site-specific reference oil; 7B Cavern Oil (Jan 2023)
Algae Sample Central Lake	L2353106-02	Net	9/11/2023	Sheen with pond "scum/algae"; suspected biologic
No. 14 Sheen Sample	L2353106-03	Net	9/11/2023	Surface sheen from bubble site No. 14
7B**	L2353106-04	Oil	1/25/2023	Site-specific reference oil; 7B Cavern Oil (Jan 2023)
253998*	L2348036-01	Oil	6/16/2023	Yellow Rock 253998
41842	L2348036-02	Oil	6/16/2023	Yellow Rock 41842
189416 (1250')	L2348036-04	Oil	6/16/2023	Yellow Rock 189416 from 1250' (bottom of oil column)
189416 (170')	L2348036-05	Oil	6/16/2023	Yellow Rock 189416 from 170' (top of oil column)
7B**	L2348036-03	Oil	1/25/2023	Site-specific reference oil; 7B Cavern Oil (Jan 2023)
Pad Oil	L2335058-01	Oil	6/16/2023	Stock tank oil used as cavern blanket/pad
7B*	L2335058-02	Oil	6/16/2023	Cavern oil from brine well 7B
252112	L2335058-03	Oil	6/16/2023	Yellow Rock 252112
109963	L2335058-04	Oil	6/16/2023	Yellow Rock 109963
185997	L2335058-05	Oil	6/16/2023	Yellow Rock 185997
209459	L2335058-06	Oil	6/16/2023	Yellow Rock 209459
Sheen	L2335058-07	Net	6/12/2023	Surface sheen from central lake
7B**	L2335058-08	Oil	1/25/2023	Site-specific reference oil; 7B Cavern Oil (Jan 2023)
209459	L2325505-01	Oil	5/2/2023	Yellow Rock 209459
185997	L2325505-02	Oil	5/2/2023	Yellow Rock 185997
Cavern 4	L2325505-03	Oil	5/25/2023	Cavern oil from brine well PPG No. 4
Cavern 7B*	L2325505-04	Oil	5/25/2023	Cavern oil from brine well 7B
210185	L2325505-05	Oil	5/25/2023	Yellow Rock 210185
Tank Battery	L2325505-06	Oil	5/25/2023	Yellow Rock Tank Battery
7B**	L2325505-07	Oil	1/25/2023	Site-specific reference oil; 7B Cavern Oil (Jan 2023)
BS-24	L2325505-08	Net	5/22/2023	Surface sheen from bubble site No. 24
Cavern 7B*	L2317387-01	Oil	3/30/2023	Cavern oil from brine well 7B
No. 20	L2313362-01	Net	3/9/2023	Surface oil sheen on water body west of the salt dome
7B*	L2305221-04	Oil	1/25/2023	Cavern oil from brine well 7B
110159	L2305221-02	Oil	1/25/2023	Yellow Rock 110159
Stock Tank	L2305221-03	Oil	1/25/2023	Stock tank oil used as cavern blanket/pad
Brine Well 22 BS*	L2305221-01	Net	1/25/2023	Surface oil brine well 22 excavation
Central Pond	L2305221-05	Net	1/25/2023	Surface sheen from central pond

* sample prepared and analyzed in duplicate

**re-analysis of Jan. 25, 2023 oil (L2305221-04) for quality control only

Table 2: Diagnostic ratios for the 7B cavern oil collected in January 2023 *versus* the 7B cavern oils collected in March, May, June 2023, and October 2023 analyzed over a span of approximately 9.3 months.

Top three ratios are derived from Tier 1 GC/FID data; all others from Tier 2 GC/MS data.

CEN - Diagnostic Ratios	CEN Diagnostic Ratios per Alpha Abbreviations	Cavern Oil 7B (Jan. 21, 2023; Avg. n=2)	7B Cavern Oil (March 2023; Avg; n=2)	7B Cavern Oil (May 2023; Avg; n=2)	7B Cavern Oil (June 2023; Avg; n=2)	7B Cavern Oil (Oct. 2023; Avg; n=2)
	Analysis Date	2/4/2023	4/26/2023	6/18/2023	7/15/2023	11/9/2023
NR-C17/pris	C17/Pr	2.38	2.41	2.66	2.36	2.71
NR-C18/phy	C18/Ph	2.17	2.14	2.13	2.09	2.08
NR- pris/phy	Pr/Ph	1.01	1.00	0.90	1.00	0.94
NR-4-MD/1-MD	4-MDBT/1-MDBT	2.14	2.71	2.15	2.40	2.06
NR-2-MP/1-MP	2-MP/1-MP	1.01	0.97	1.06	1.05	1.07
NR-27Ts/30ab	T11/T19	0.23	0.23	0.24	0.23	0.24
NR-27Tm/30ab	T12/T19	0.29	0.26	0.26	0.25	0.27
NR-28ab/30ab	T14a/T19	0.20	0.18	0.19	0.18	0.18
NR-29ab/30ab	T15/T19	0.84	0.83	0.83	0.85	0.83
NR-30O/30ab	T18/T19	0.04	0.03	0.00	0.04	0.00
NR-31abS/30ab	T21/T19	0.59	0.59	0.58	0.62	0.60
NR-27dbR/27dbS	S4/S5	0.50	0.53	0.46	0.45	0.44
NR-27bb/29bb	(S14+S15)/(S26+S27)	0.85	0.88	0.86	0.81	0.84
NR-SC26/ RC26+SC27	TAS09/TAS01	0.13	0.14	0.14	0.13	0.13
NR-SC28/RC26 + SC27	TAS02/TAS01	0.69	0.71	0.69	0.67	0.72
NR-RC27/RC26+ SC27	TAS03/TAS01	0.75	0.78	0.78	0.75	0.75
NR-RC28/RC26+SC27	TAS04/TAS01	0.58	0.59	0.58	0.58	0.59
DR-Ts/Tm	T11/T12	0.82	0.87	0.92	0.89	0.89
DR-29Ts30ab	T16/T19	0.21	0.20	0.20	0.21	0.19
DR-29bb/29aa	(S26+S27)/(S25+S28)	1.15	1.82	1.33	1.49	1.55
DR-C2-dbt/C2-phe	DBT2/PA2	2.28	2.07	2.06	2.16	2.21
DR-C3-dbt/C3-phe	DBT3/PA3	2.62	2.23	2.32	2.51	2.59
DR-C28C29/30ab	T7 to T10/T19	0.19	0.23	0.24	0.22	0.26
DR-29aaS/29aaR=	S25/S28	1.36	1.22	1.28	1.34	1.27
DR-C20TA/C21TA	TAS05/TAS06	0.95	1.30	1.19	1.32	1.29
DR-TA21/ RC26+SC27	TS06/TAS01	0.49	0.40	0.40	0.39	0.36
DR-C24Tet/C26Tri	T6a/T6bc	1.60	1.67	1.55	1.55	1.78
DR-30ba/30ab	T20/T19	0.07	0.08	0.07	0.09	0.08
DR-35ab/30ab	(T34 to T35)/T19	0.33	0.33	0.31	0.38	0.34
DR-32abR/32abS	T27/T26	0.74	0.72	0.74	0.75	0.70
	Conclusion:		**Positive Match**	**Positive Match**	**Positive Match**	**Positive Match**

red: statistical non-match to 7B Cavern Oil (Jan. 21, 2023; Avg.)

green: statistical match to 7B Cavern Oil (Jan. 21, 2023; Avg.)

grey: indicates less precision ratio (per Attachment 3)

Table 3: Selected crude oil assay results for the 7B cavern oils, Yellow Rock (locally produced) crude oils, and Other oils from Sulphur Dome along with historic data for Strategic Petroleum Reserve oils from Sulphur Dome from 1989. New data for 7B cavern oil studied herein indicated within red box; na – not analyzed

	Client ID	Date Collected	API gravity	Sulfur (wt%)	V (ppm)	Ni (ppm)	V/ (V+Ni)
7B Cavern Oils							
Cavern Oils	7B Cavern Oil	11/2/2022	32.8	1.380	23	6.1	0.79
	7B Cavern Oil	1/18/2023	34.0	1.400	23	5.9	0.79
	7B Cavern Oil	1/25/2023	na	na	12	3.8	0.76
	7B Cavern Oil	3/30/2023	33.6	1.370	100	26	0.79
	7B Cavern Oil	5/25/2023	33.5	1.401	23	6	0.79
	7B Cavern Oil	6/16/2023	34.0	1.350	25	6	0.81
	7B Cavern Oil	10/25/2023	33.9	1.362	21	5	0.81
		Average	33.6	1.377	32	8.4	0.79
		St. Dev.	1.5	0.030	30	7.8	0.01
Yellow Rock (Locally Produced) Oils							
Yelllow Rock Oils	189416	11/2/2022	26.0	0.302	1.2	7.0	0.15
	110159	1/25/2023	na	na	0.4	3.7	0.10
	209459	5/2/2023	22.8	0.435	2.0	8.0	0.20
	185997	5/2/2023	21.5	0.407	2.0	9.0	0.18
	210185	5/25/2023	22.8	0.476	2.0	10.0	0.17
	Tank Battery	5/25/2023	27.0	0.327	1.0	6.0	0.14
	252112	6/16/2023	27.7	0.295	1.0	5.0	0.17
	109963	6/16/2023	24.1	0.431	2.0	8.0	0.20
	185997	6/16/2023	23.0	0.411	2.0	10.0	0.17
	209459	6/16/2023	21.6	0.433	2.0	9.0	0.18
	253998	8/17/2023	16.9	0.747	2.3	9.6	0.19
	41842	8/17/2023	26.6	0.403	2.0	22.2	0.08
	189416 (1250')	8/29/2023	20.7	0.450	<0.1	10.9	<0.01
	189416 (170')	8/29/2023	20.8	0.447	<0.1	8.3	<0.01
		Average	23.2	0.428	1.7	9.1	0.16
		St. Dev.	3.1	0.112	0.6	4.3	0.04
Other Oils							
Other	Stock Tank	1/25/2023	na	na	19.3	4.7	0.80
	Cavern 4	5/25/2023	31.2	1.55	42	9	0.82
	Pad Oil	6/16/2023	29.3	1.27	18	5	0.78
Sulphur Mines Strategic Petroleum Reserve Oils							
SPR Oils	SM007	6/14/1989	31.9	1.69	23.1	10.1	0.70
	SM007*	6/14/1989	32.4	1.75	32.7	9.0	0.78
	SM006	5/31/1989	31.0	1.42	34.0	20.6	0.62
	SM006*	5/31/1989	32.9	1.56	41.6	11.6	0.78
	SM002	8/14/1989	32.7	1.63	52.8	10.6	0.83
	Cavern 7	1989 rpt.	32.5	1.80	na	na	na
	Cavern 6	1989 rpt.	32.7	1.60	na	na	na
	Cavern 2-4-5	1989 rpt.	32.9	1.60	na	na	na

* sample values from Word files provided by DOE; other SM### sample values from Excel file provided

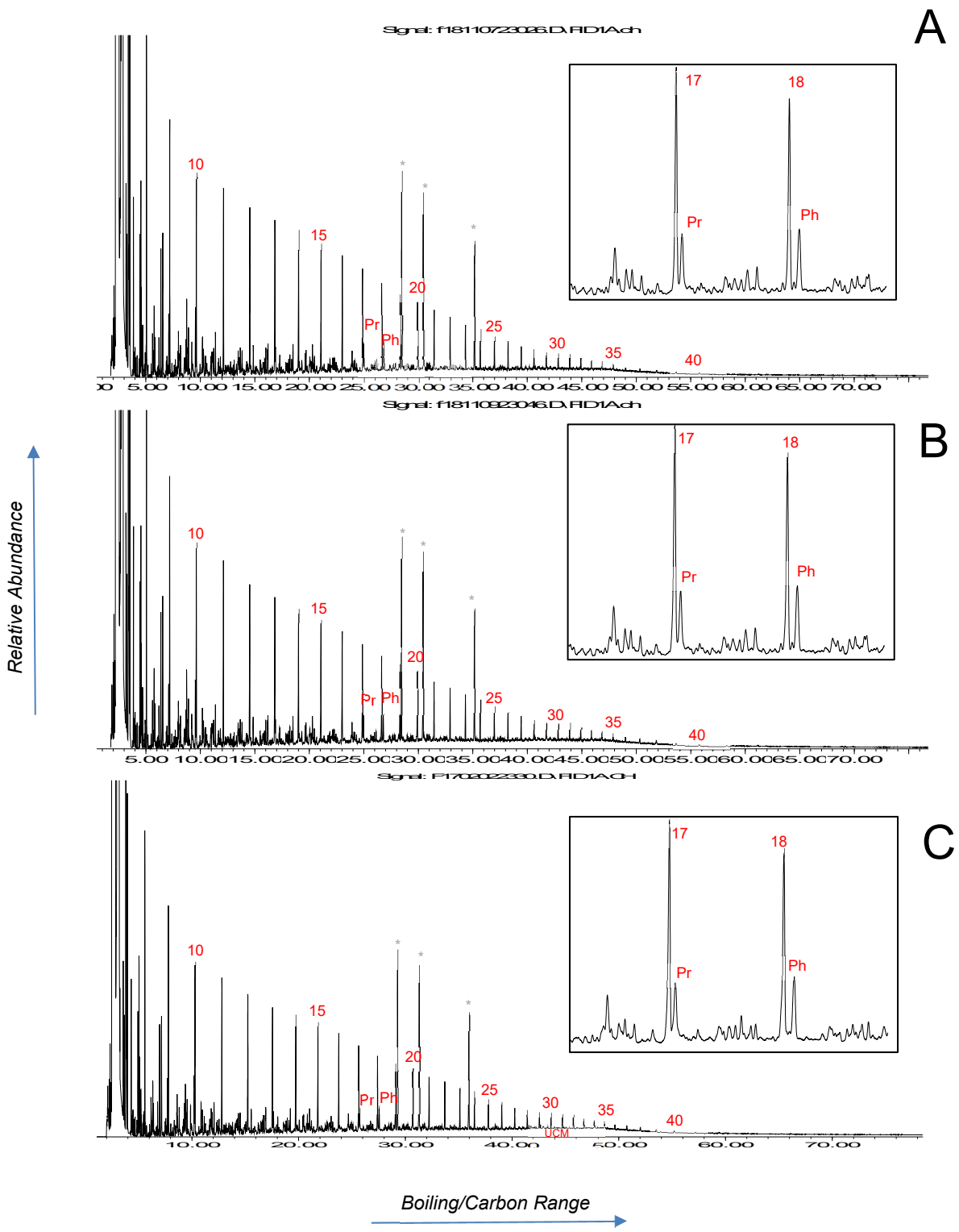

Figure 1: GC/FID (C8+) chromatograms for (A) 7B Cavern oil collected October 25, 2023 analyzed herein, (B) 7B Cavern oil collected Jan. 21, 2023 analyzed herein, and (C) 7B Cavern oil collected Jan. 21, 2023 analyzed Feb. 2, 2023. Insets show further expanded view of C17-C18 range. #: n-alkane carbon number; Pr: pristane; Ph: phytane; UCM: unresolved complex mixture; *: internal standard.

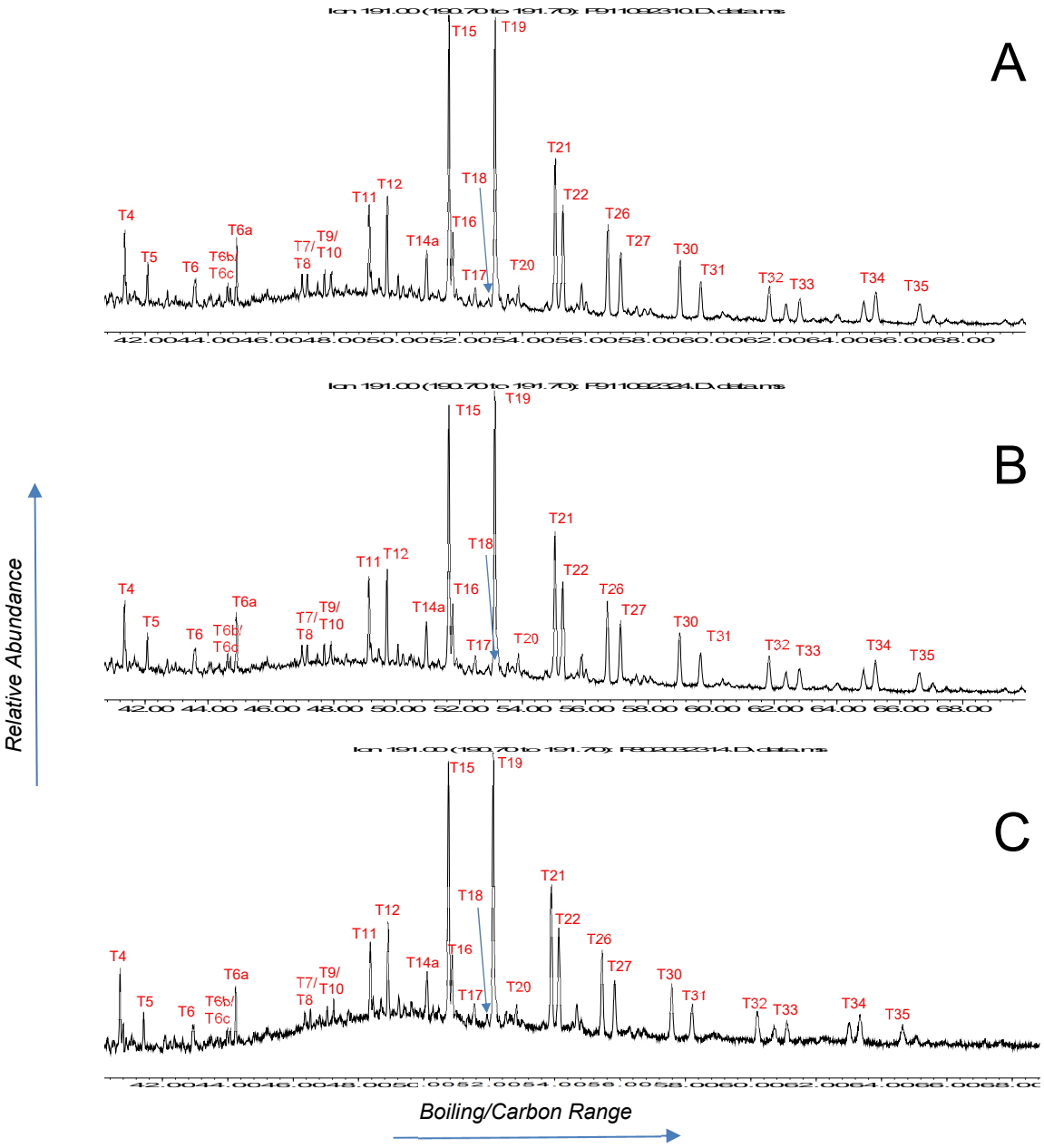

Figure 2: Partial extracted ion chromatograms (*m/z* 191 for (A) 7B Cavern oil collected October 25, 2023 analyzed herein, (B) 7B Cavern oil collected Jan. 21, 2023 analyzed herein, and (C) 7B Cavern oil collected Jan. 21, 2023 analyzed Feb. 2, 2023. red labels: various triterpane biomarkers, see Attachment 3, Table A3-2 for compound names.

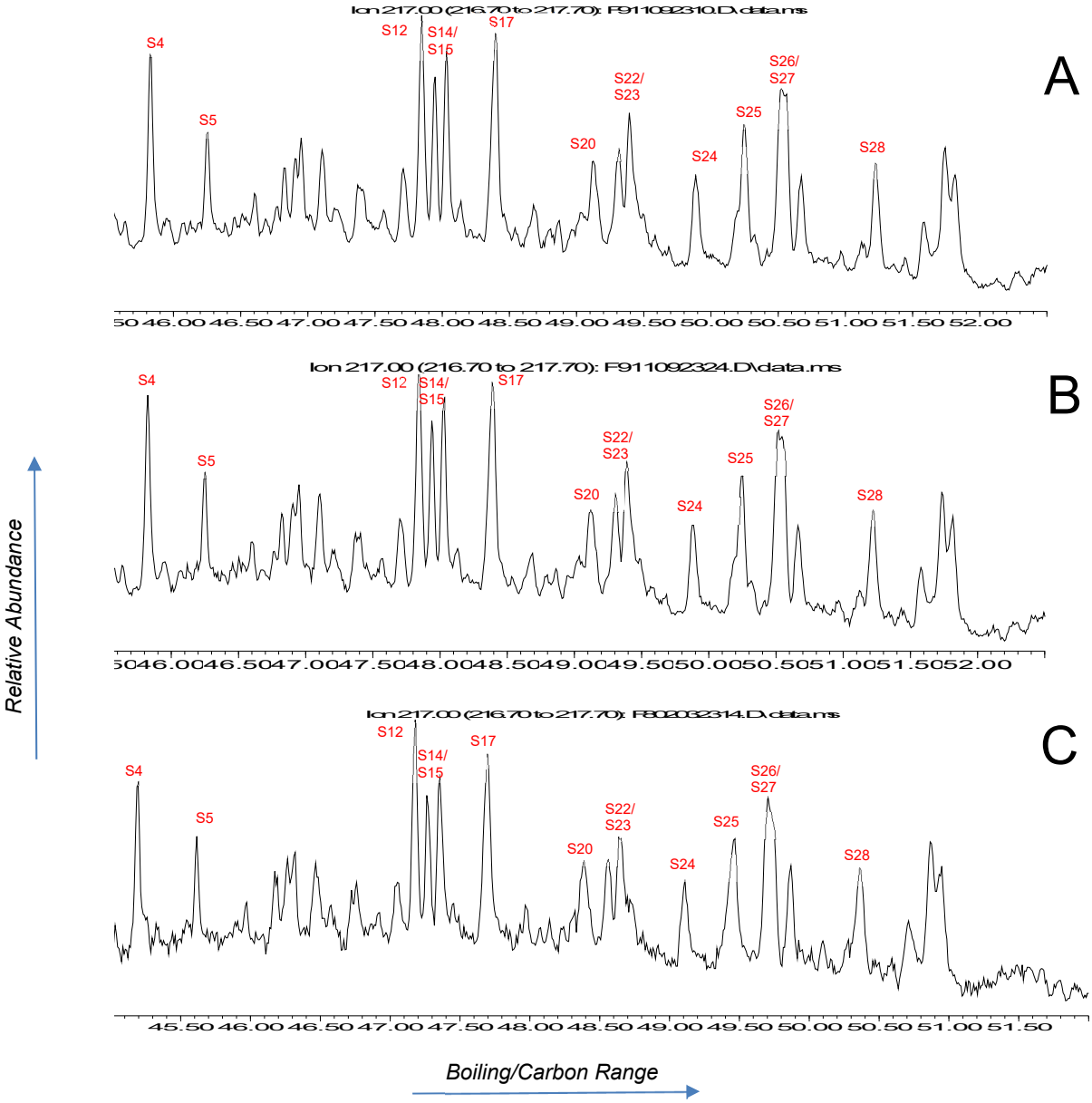

Figure 3: Partial extracted ion chromatograms (*m/z* 217 for (A) 7B Cavern oil collected October 25, 2023 analyzed herein, (B) 7B Cavern oil collected Jan. 21, 2023 analyzed herein, and (C) 7B Cavern oil collected Jan. 21, 2023 analyzed Feb. 2, 2023. red labels: various triterpane biomarkers, see Attachment 3, Table A3-2 for compound names.

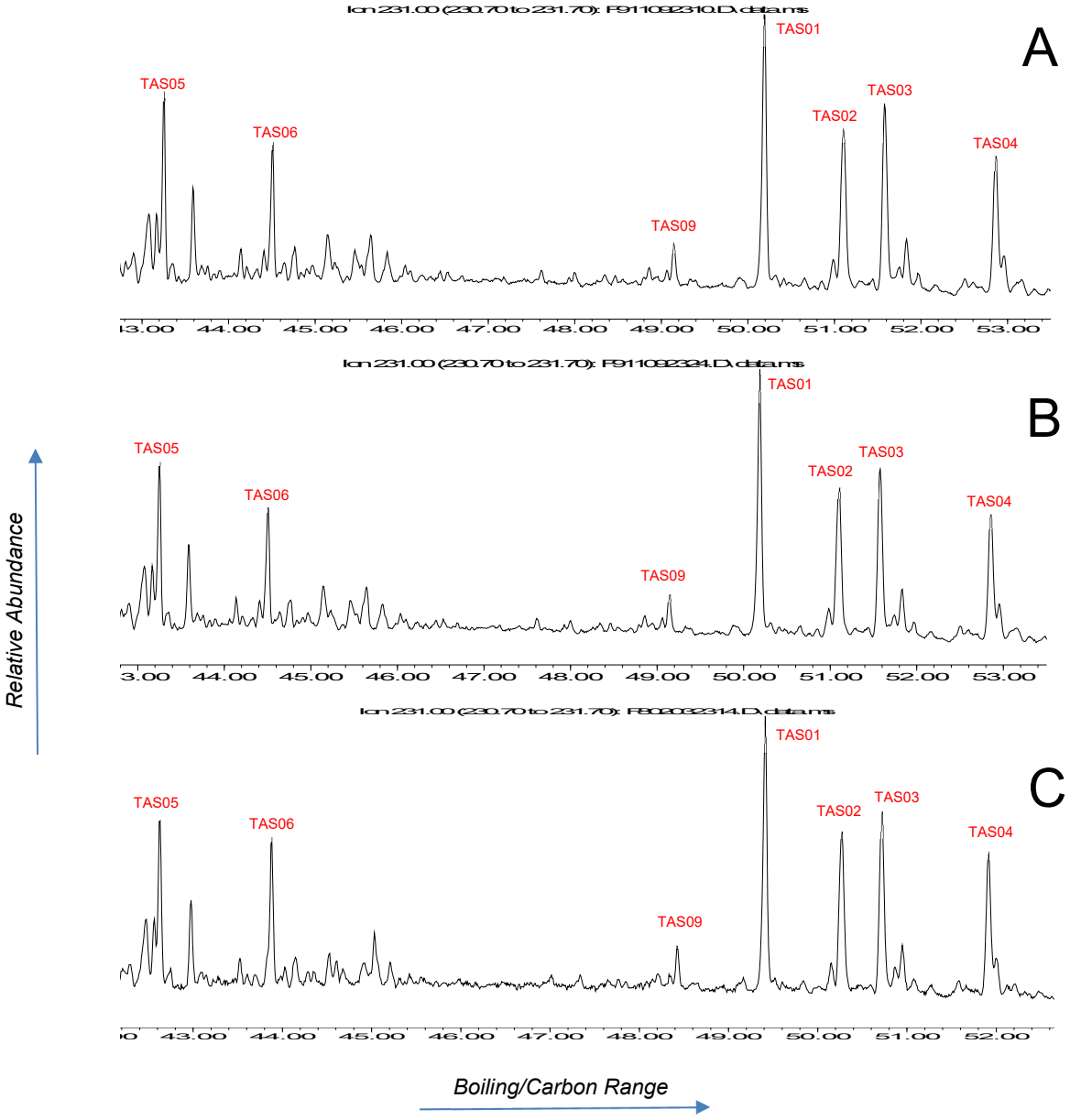

Figure 4: Partial extracted ion chromatograms (*m/z* 231 for (A) 7B Cavern oil collected October 25, 2023 analyzed herein, (B) 7B Cavern oil collected Jan. 21, 2023 analyzed herein, and (C) 7B Cavern oil collected Jan. 21, 2023 analyzed Feb. 2, 2023. red labels: various triterpane biomarkers, see Attachment 3, Table A3-2 for compound names.

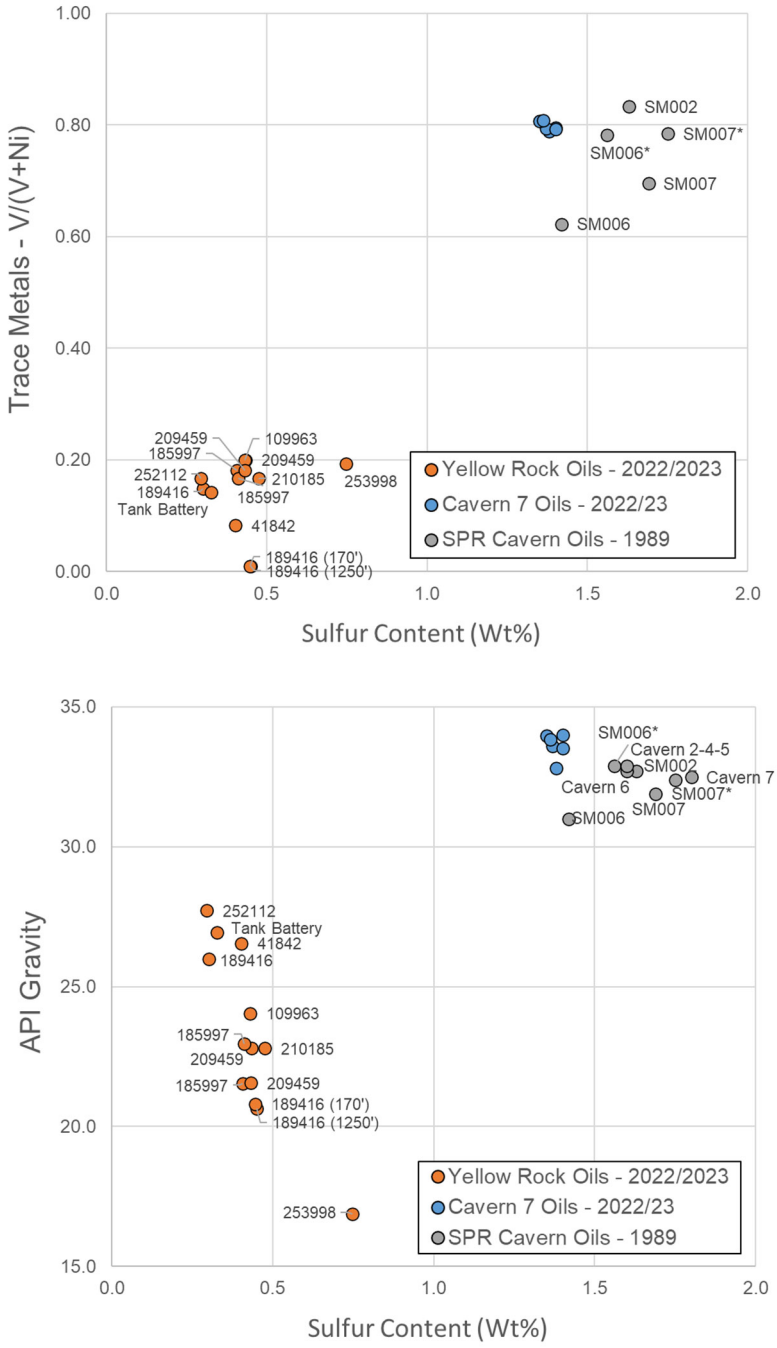

Figure 5: Crude oil assay results for the Cavern 7 oils and Yellow Rock (locally produced) oils recently studied and historic SPR cavern oils from 1989. All data from Table 3.

ATTACHMENTS

NewFields
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10/27/23

Chain of Custody

L2363877

Environmental Forensics Practice LLC

Proj. No	Proj. Name
0701093	Sulphur Dome

SAMPLERS: Signature: Taylar Brown

DATE	TIME	LAB ID	CLIENT ID	SAMPLE DESCRIPTION	MATRIX (* see below)	GC-FID-TPH (C_6+)	GCMS-Alkyl PAH	GCMS-Biomarkers	PIANO - VOA	Organic Lead	METALS	PCB	Pesticides	PRESERVED	Total Number of Containers
10/25/23	14:15	-01	7B Oil	liquid oil	O	X	X		X						2

ANALYSIS REQUESTED → "NUMBER OF CONTAINERS"

Relinquished by:	Date/Time	Received by:	Date/Time
Taylar Brown	10/26/23 12:00	FEDEX	
FEDEX	10/27/23 958		10/27/23 958

* O=Oil, SO=Soil, SE=Sediment, T=Tissue, W=Water

Samples to be shipped to: Alpha Laboratory, 320 Forbes Blvd, Mansfield, MA 02048, Tel: (508) 844-4117, Attn: Sue O'Neil

Comments: RUSH TURN-AROUND

Attachment 1

Chain-of-Custody

Attachment 2

Average short-term and long-term relative standard deviations (RSD_r and RSD_R) calculated for the 30 diagnostic ratios used in the Sulphur Dome monitoring studies to date.

CEN - Diagnostic Ratios	CEN Diagnostic Ratios per Alpha Abbreviations	Sulphur Dome Site Precision: Repeatability RSD_r	Sulphur Dome Site Precision: Reproducibility RSD_R	Most Precise Ratios*
NR-C17/pris	C17/Pr	2.0	5.4	
NR-C18/phy	C18/Ph	0.9	2.7	x
NR- pris/phy	Pr/Ph	1.6	4.4	x
NR-4-MD/1-MD	4-MDBT/1-MDBT	2.6	9.6	
NR-2-MP/1-MP	2-MP/1-MP	2.3	3.7	x
NR-27Ts/30ab	T11/T19	3.5	2.0	x
NR-27Tm/30ab	T12/T19	2.1	3.1	x
NR-28ab/30ab	T14a/T19	3.2	7.1	
NR-29ab/30ab	T15/T19	2.1	2.2	x
NR-30O/30ab	T18/T19	6.8	67.7	
NR-31abS/30ab	T21/T19	1.3	2.9	x
NR-27dbR/27dbS	S4/S5	5.3	14.1	
NR-27bb/29bb	(S14+S15)/(S26+S27)	3.5	2.5	x
NR-SC26/ RC26+SC27	TAS09/TAS01	2.6	4.9	x
NR-SC28/RC26 + SC27	TAS02/TAS01	2.9	1.9	x
NR-RC27/RC26+ SC27	TAS03/TAS01	1.9	2.0	x
NR-RC28/RC26+SC27	TAS04/TAS01	3.1	1.8	x
DR-Ts/Tm	T11/T12	2.7	3.2	x
DR-29Ts30ab	T16/T19	3.9	2.8	x
DR-29bb/29aa	(S26+S27)/(S25+S28)	4.4	13.2	
DR-C2-dbt/C2-phe	DBT2/PA2	0.7	3.5	x
DR-C3-dbt/C3-phe	DBT3/PA3	0.5	4.4	x
DR-C28C29/30ab	T7 to T10/T19	4.8	10.6	
DR-29aaS/29aaR=	S25/S28	7.7	21.4	
DR-C20TA/C21TA	TAS05/TAS06	4.1	9.8	
DR-TA21/ RC26+SC27	TS06/TAS01	4.2	9.3	
DR-C24Tet/C26Tri	T6a/T6bc	3.9	6.8	
DR-30ba/30ab	T20/T19	3.8	12.3	
DR-35ab/30ab	(T34 to T35)/T19	4.8	7.3	
DR-32abR/32abS	T27/T26	1.7	3.4	x

*both RSD_r and RSD_R < 5% based on current QC datasets

RSD_r = average RSD for sample duplicate pairs studied to date

RSR_R = average RSD for 7B cavern (reference) oil studied to date

Attachment 3

Tabulated Concentrations

Table A3-1: Concentrations (mg/kg) of n-alkanes and isoprenoids in the samples studied.

Client ID	7B OIL	7B OIL (dup)	7B
Lab ID	L2363877-01	WG1847984-4	L2363877-02
Date Collected	10/25/2023	10/25/2023	1/25/2023
Date Analyzed	11/8/2023	11/8/2023	11/10/2023
Analytes	Result	Result	Result
n-Nonane (C9)	10,900	10,800	11,200
n-Decane (C10)	9,320	9,190	9,250
n-Undecane (C11)	8,990	8,830	8,790
n-Dodecane (C12)	8,460	8,430	8,360
n-Tridecane (C13)	7,680	7,550	7,540
2,6,10 Trimethyldodecane (1380)	1,360	1,320	1,310
n-Tetradecane (C14)	6,990	6,900	6,890
2,6,10 Trimethyltridecane (1470)	2,010	2,050	1,990
n-Pentadecane (C15)	6,390	6,320	6,360
n-Hexadecane (C16)	5,820	5,710	5,650
Norpristane (1650)	1,320	1,230	1,320
n-Heptadecane (C17)	4,980	4,870	4,960
Pristane	1,820	1,820	1,830
n-Octadecane (C18)	4,060	3,980	4,070
Phytane	1,950	1,910	2,000
n-Nonadecane (C19)	3,590	3,480	3,550
n-Eicosane (C20)	3,430	3,390	3,450
n-Heneicosane (C21)	2,670	2,640	2,810
n-Docosane (C22)	2,520	2,440	2,490
n-Tricosane (C23)	2,060	2,030	2,050
n-Tetracosane (C24)	2,100	1,960	1,990
n-Pentacosane (C25)	1,710	1,680	1,690
n-Hexacosane (C26)	1,450	1,420	1,460
n-Heptacosane (C27)	1,200	1,130	1,230
n-Octacosane (C28)	967	969	1,020
n-Nonacosane (C29)	1,110	1,070	922
n-Triacontane (C30)	809	783	844
n-Hentriacontane (C31)	818	790	898
n-Dotriacontane (C32)	608	580	679
n-Tritriacontane (C33)	496	467	557
n-Tetratriacontane (C34)	460	457	699
n-Pentatriacontane (C35)	499	484	596
n-Hexatriacontane (C36)	296	288	376
n-Heptatriacontane (C37)	265	258	346
n-Octatriacontane (C38)	255	261	371
n-Nonatriacontane (C39)	202	207	265
n-Tetracontane (C40)	188	162	239
Total Saturated Hydrocarbons	110,000	108,000	110,000
Total Petroleum Hydrocarbons (C9-C44)	608,000	612,000	617,000

Table A3-2: Concentrations (mg/kg) of PAHs, related compounds and petroleum biomarkers in the samples studied.

		7B OIL	7B OIL (dup)	7B
	Client ID			
	Lab ID	L2363877-01	WG1847984-4	L2363877-02
	Date Collected	10/25/2023	10/25/2023	1/25/2023
	Date Analyzed	11/9/2023	11/9/2023	11/10/2023
	Analytes	Result	Result	Result
D0	cis/trans-Decalin	272	274	209
D1	C1-Decalins	471	478	364
D2	C2-Decalins	412	428	325
D3	C3-Decalins	266	270	207
D4	C4-Decalins	255	254	214
BT0	Benzothiophene	11	12	8
BT1	C1-Benzo(b)thiophenes	63	64	48
BT2	C2-Benzo(b)thiophenes	216	216	161
BT3	C3-Benzo(b)thiophenes	406	405	302
BT4	C4-Benzo(b)thiophenes	336	334	250
N0	Naphthalene	295	298	224
N1	C1-Naphthalenes	899	901	675
N2	C2-Naphthalenes	1,510	1,510	1,130
N3	C3-Naphthalenes	1,310	1,300	976
N4	C4-Naphthalenes	740	741	559
B	Biphenyl	43	43	32
DF	Dibenzofuran	33	32	24
AY	Acenaphthylene	5.0	4.7	17.6
AE	Acenaphthene	10	10	10
F0	Fluorene	61	61	45
F1	C1-Fluorenes	166	166	125
F2	C2-Fluorenes	275	272	207
F3	C3-Fluorenes	316	306	235
A0	Anthracene	nd	nd	6
P0	Phenanthrene	117	117	86
PA1	C1-Phenanthrenes/Anthracenes	345	344	260
PA2	C2-Phenanthrenes/Anthracenes	444	442	325
PA3	C3-Phenanthrenes/Anthracenes	328	323	247
PA4	C4-Phenanthrenes/Anthracenes	175	171	128
RET	Retene	nd	nd	22
DBT0	Dibenzothiophene	244	243	181
DBT1	C1-Dibenzothiophenes	630	626	474
DBT2	C2-Dibenzothiophenes	982	979	733
DBT3	C3-Dibenzothiophenes	846	841	632
DBT4	C4-Dibenzothiophenes	475	474	352
BF	Benzo(b)fluorene	4.6	4.2	3.8
FL0	Fluoranthene	1.9	2.0	1.5
PY0	Pyrene	12	11	9
FP1	C1-Fluoranthenes/Pyrenes	46	46	42
FP2	C2-Fluoranthenes/Pyrenes	100	98	76
FP3	C3-Fluoranthenes/Pyrenes	143	145	109
FP4	C4-Fluoranthenes/Pyrenes	138	138	104
NBT0	Naphthobenzothiophenes	46	46	34
NBT1	C1-Naphthobenzothiophenes	160	155	116
NBT2	C2-Naphthobenzothiophenes	257	255	192
NBT3	C3-Naphthobenzothiophenes	234	226	173
NBT4	C4-Naphthobenzothiophenes	170	170	128
BA0	Benz[a]anthracene	1.5	1.6	1.5
C0	Chrysene/Triphenylene	20	20	17
BC1	C1-Chrysenes	47	47	37
BC2	C2-Chrysenes	85	82	70
BC3	C3-Chrysenes	120	118	100
BC4	C4-Chrysenes	88	86	69

Table A3-2 (cont.)

		7B OIL	7B OIL (dup)	7B
	Client ID			
	Lab ID	L2363877-01	WG1847984-4	L2363877-02
	Date Collected	10/25/2023	10/25/2023	1/25/2023
	Date Analyzed	11/9/2023	11/9/2023	11/10/2023
	Analytes	Result	Result	Result
BBF	Benzo[b]fluoranthene	2.9	2.7	2.3
BJKF	Benzo[j]fluoranthene/Benzo[k]fluoranthene	0.7	0.5	0.4
BAF	Benzo[a]fluoranthene	nd	nd	nd
BEP	Benzo[e]pyrene	7	7	6
BAP	Benzo[a]pyrene	1.4	1.3	1.4
PER	Perylene	1.1	1.1	1.1
IND	Indeno[1,2,3-cd]pyrene	0.7	0.6	0.8
DA	Dibenz[ah]anthracene/Dibenz[ac]anthracene	0.8	0.6	0.5
GHI	Benzo[g,h,i]perylene	2.5	2.4	2.6
CAR	Carbazole	9.4	9.1	7.0
4MDT	4-Methyldibenzothiophene	260	260	197
2MDT	2/3-Methyldibenzothiophene	232	233	178
1MDT	1-Methyldibenzothiophene	127	126	94
3MP	3-Methylphenanthrene	63	63	48
2MP	2-Methylphenanthrene	80	80	60
2MA	2-Methylanthracene	3.2	3.1	2.9
9MP	9/4-Methylphenanthrene	123	122	90
1MP	1-Methylphenanthrene	75	75	57
2MN	2-Methylnaphthalene	740	740	559
1MN	1-Methylnaphthalene	700	704	527
26DMN	2,6-Dimethylnaphthalene	618	618	462
235TMN	2,3,5-Trimethylnaphthalene	126	127	90
PY2	2-METHYLPYRENE	3.2	3.1	2.4
PY4	4-METHYLPYRENE	12.6	12.4	10.3
PY1	1-METHYLPYRENE	7.2	7.2	6.0
T4	C23 Tricyclic Terpane	18	20	16
T5	C24 Tricyclic Terpane	11	10	9
T6	C25 Tricyclic Terpane	13	12	10
T6a	C24 Tetracyclic Terpane	15	16	13
T6b	C26 Tricyclic Terpane-22S	4.9	5.2	4.6
T6c	C26 Tricyclic Terpane-22R	3.8	3.9	2.4
T7	C28 Tricyclic Terpane-22S	6.6	6.4	5.8
T8	C28 Tricyclic Terpane-22R	7.5	6.8	4.9
T9	C29 Tricyclic Terpane-22S	6.3	5.9	4.8
T10	C29 Tricyclic Terpane-22R	7	8	6
T11	18a-22,29,30-Trisnorneohopane-TS	26	25	20
T11a	C30 Tricyclic Terpane-22S	5.2	5.3	4.1
T11b	C30 Tricyclic Terpane-22R	5.7	5.5	3.8
T12	17a(H)-22,29,30-Trisnorhopane-TM	28	28	23
T14a	17a/b,21b/a 28,30-Bisnorhopane	20	19	16
T14b	17a(H),21b(H)-25-Norhopane	nd	nd	2.5
T15	30-Norhopane	88	87	71
T16	18a(H)-30-Norneohopane-C29Ts	21	19	18
X	17a(H)-Diahopane	3.6	2.7	2.5
T17	30-Normoretane	9	8	6
T18	18a(H)&18b(H)-Oleananes	nd	nd	2.2
T19	Hopane	105	106	87
T20	Moretane	7	8	7
T21	30-Homohopane-22S	64	63	50
T22	30-Homohopane-22R	47	49	39

Table A3-2 (cont.)

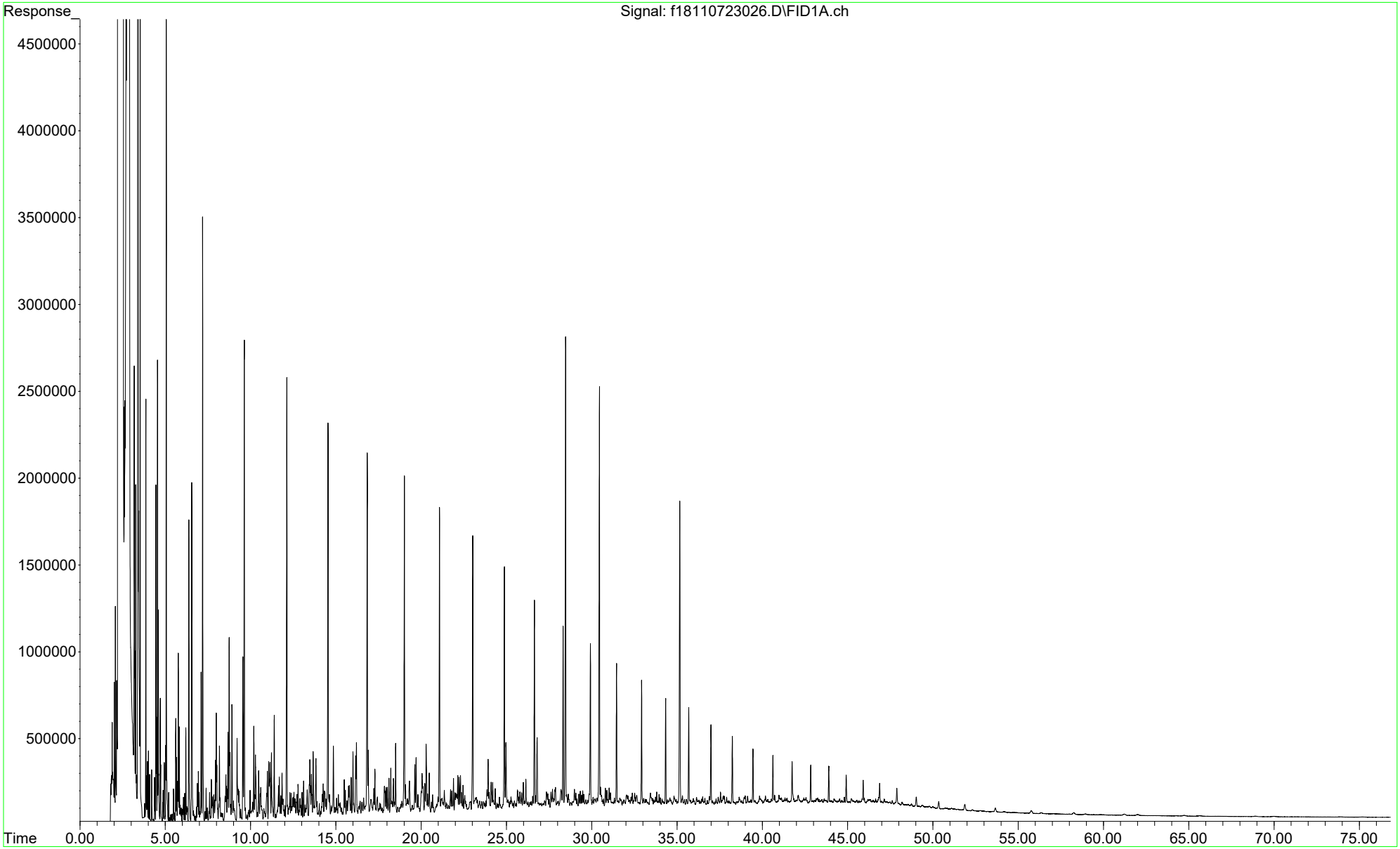
		7B OIL	7B OIL (dup)	7B
	Client ID			
	Lab ID	L2363877-01	WG1847984-4	L2363877-02
	Date Collected	10/25/2023	10/25/2023	1/25/2023
	Date Analyzed	11/9/2023	11/9/2023	11/10/2023
	Analytes	Result	Result	Result
T22A	T22a-Gammacerane/C32-diahopane	11	13	10
T26	30,31-Bishomohopane-22S	41	39	32
T27	30,31-Bishomohopane-22R	29	28	23
T30	30,31-Trishomohopane-22S	29	29	23
T31	30,31-Trishomohopane-22R	20	20	16
T32	Tetrakishomohopane-22S	21	20	18
T33	Tetrakishomohopane-22R	14	15	12
T34	Pentakishomohopane-22S	21	20	17
T35	Pentakishomohopane-22R	15	16	12
S4	13b(H),17a(H)-20S-Diacholestane	39	41	30
S5	13b(H),17a(H)-20R-Diacholestane	18	18	15
S23	14b,17b-20S-Methylcholestane	38	39	33
S26	14b(H),17b(H)-20R-Ethylcholestane	56	54	49
S27	14b(H),17b(H)-20S-Ethylcholestane	33	37	23
TAS05	C20 PREGNANE	100.0	101.0	81.9
TAS06	C21 20-METHYLPREGNANE	79.0	77.4	62.6
TAS07	C22 20-ETHYLPREGNANE (A)	42.6	42.1	33.5
TAS08	C22 20-ETHYLPREGNANE (B)	27.6	27.6	22.0
TAS09	C26,20S TAS	28.8	27.3	22.0
TAS01	C26,20R+C27,20S TAS	217	215	179
TAS02	C28,20S TAS	151	158	122
TAS03	C27,20R TAS	163	163	130
TAS04	C28,20R TAS	125	128	102
TAS10	C29,20S TAS	57.7	54.3	46.0
TAS11	C29,20R TAS	27.6	24.8	22.0

Attachment 4

GC/FID Chromatograms

File :D:\West Lake Salt Dome_850.000079.023\Alpha Data\L2363877\SH
... C\f18110723026.D
Operator : FID18:AMV
Instrument : FID 18
Acquired : 08 Nov 2023 03:41 am using AcqMethod FID18.M
Sample Name: L2363877-01
Misc Info : WG1849438,WG1847984,ICAL20298

7B OIL
L2363877-01



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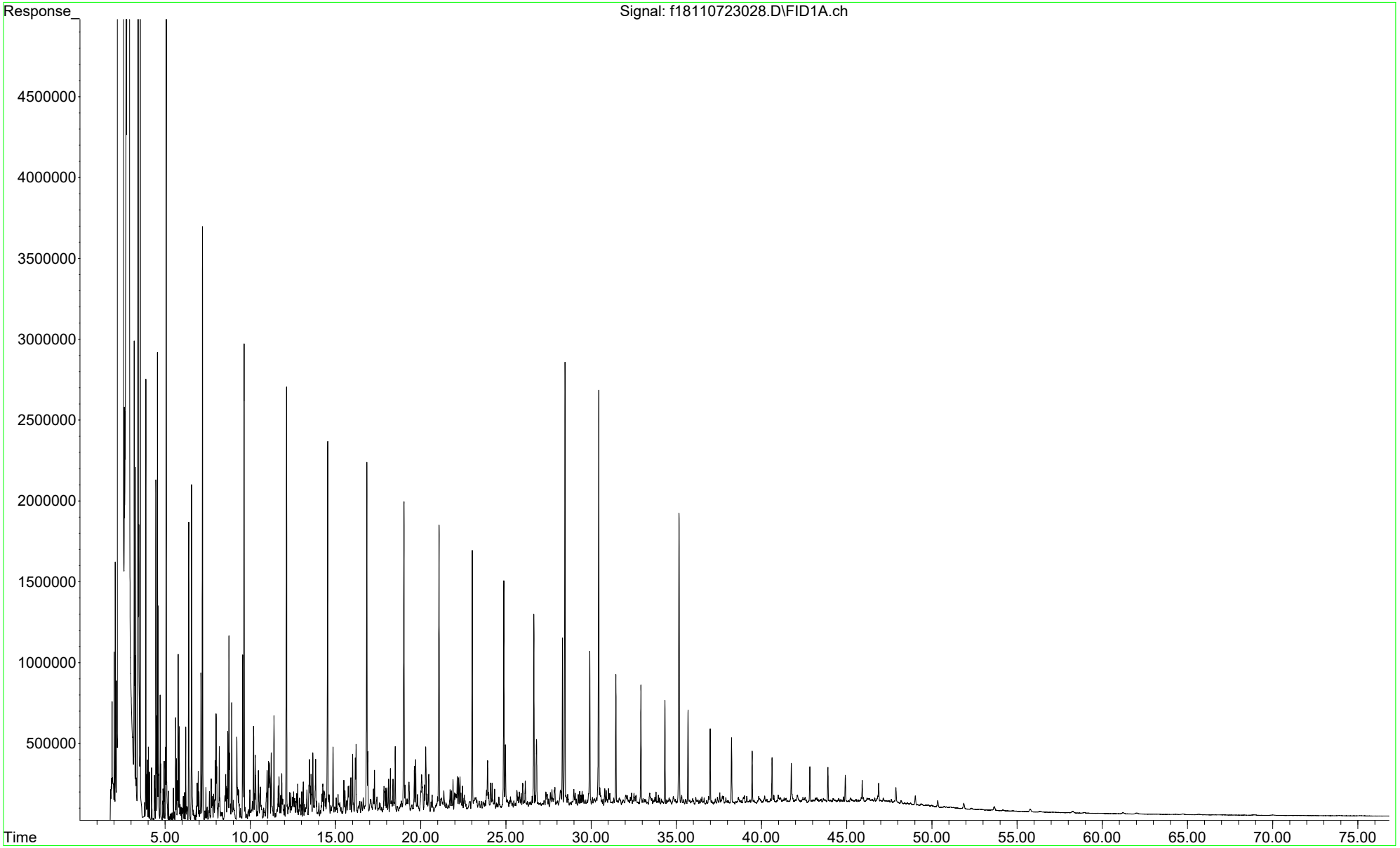
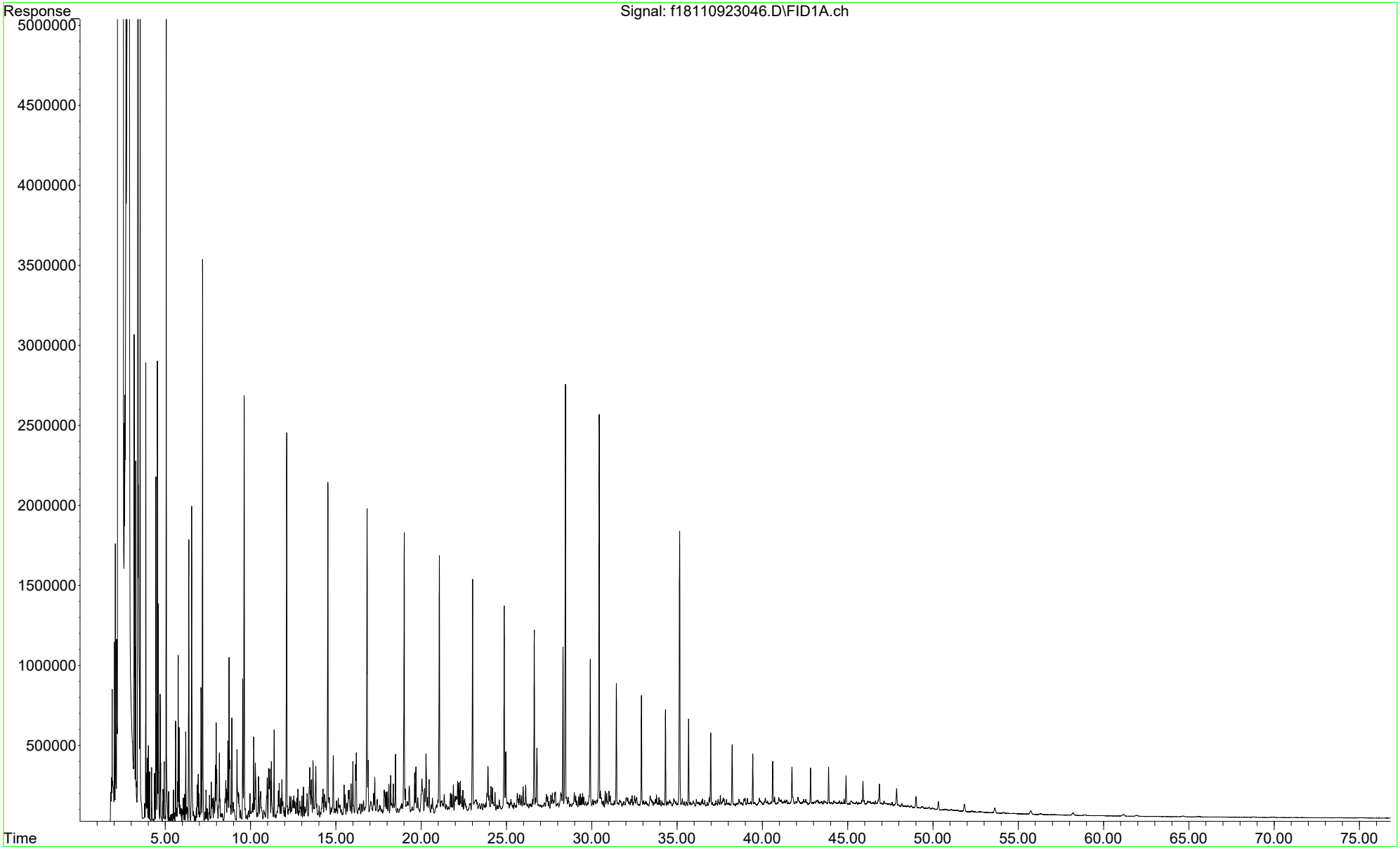
... C\f18110723028.D
Operator : FID18:AMV
Instrument : FID 18
Acquired : 08 Nov 2023 05:05 am using AcqMethod FID18.M
Sample Name: WG1847984-4
Misc Info : WG1849438,WG1847984,ICAL20298

L2363877-01 Duplicate
WG1847984-4



File :D:\West Lake Salt Dome_850.000079.023\Alpha Data\L2363877\SH
... C\f18110923046.D
Operator : FID18:AMV
Instrument : FID 18
Acquired : 10 Nov 2023 04:59 pm using AcqMethod FID18.M
Sample Name: L2363877-02
Misc Info : WG1850484,WG1847984,ICAL20298

7B-Reference Oil
L2363877-02



Attachment 5

GC/MS Extracted Ion Profiles

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... KPAHBIO\F911092310.D
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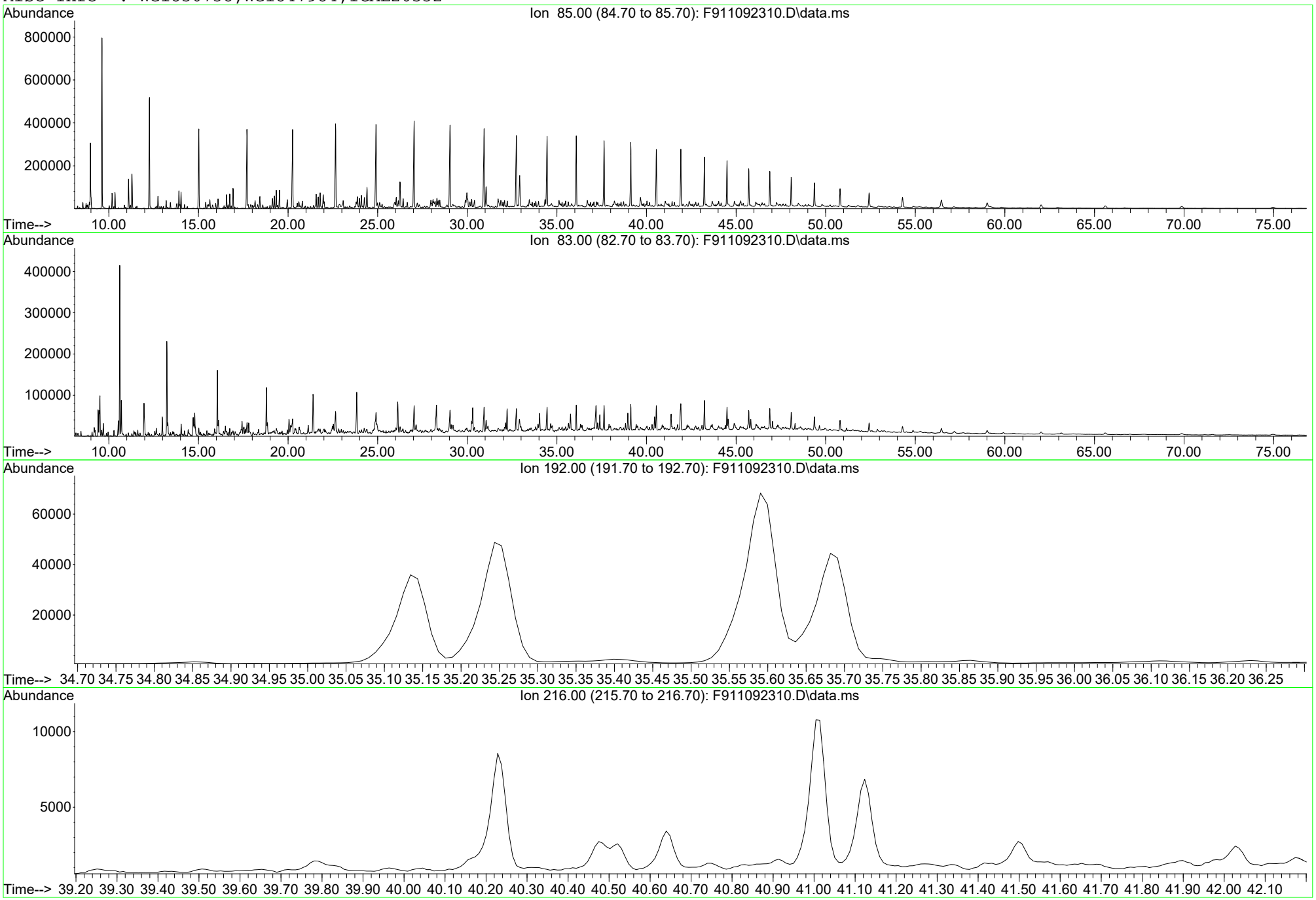
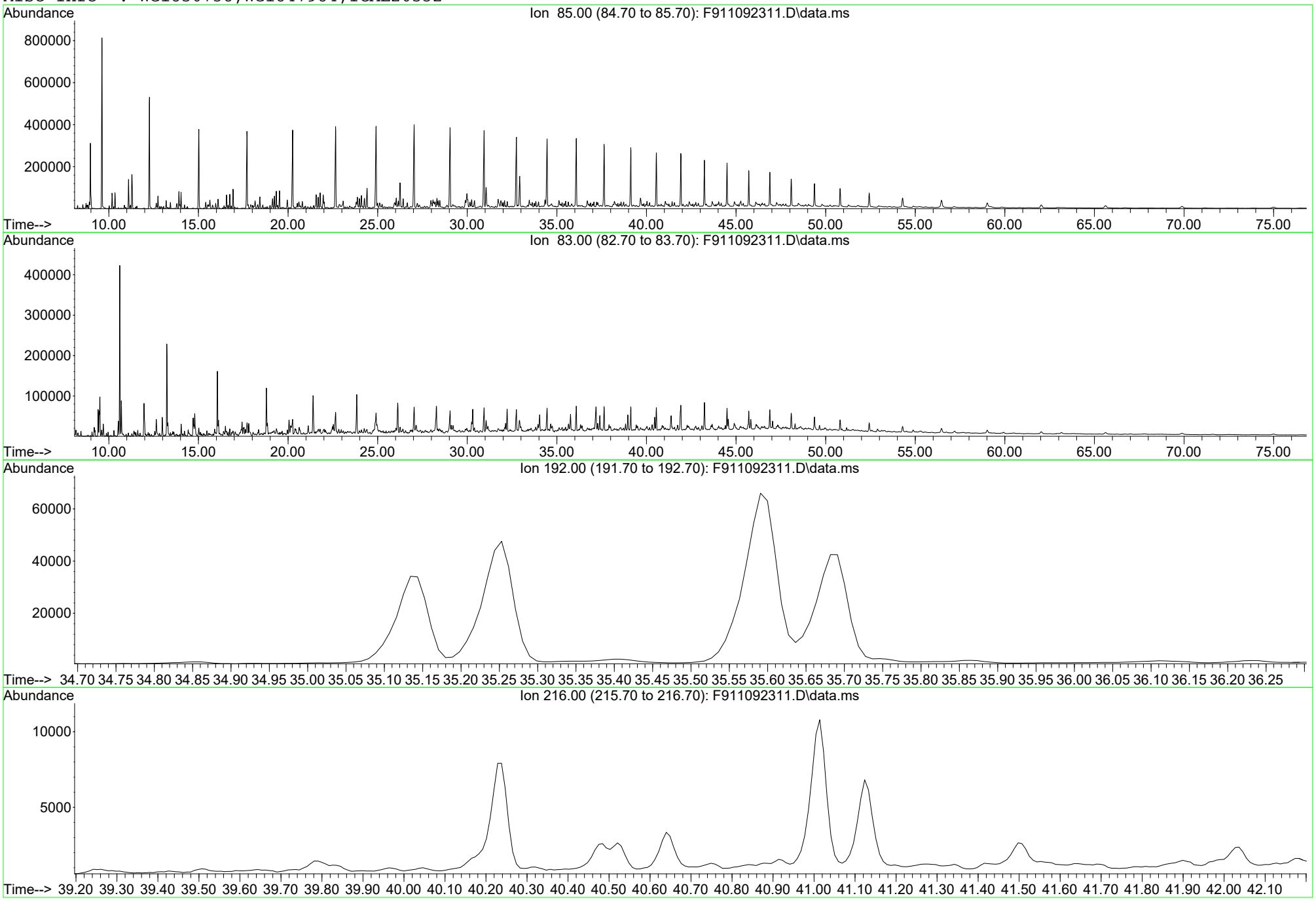
Instrument : PAH9
Acquired : 9 Nov 2023 7:59 pm using AcqMethod FRNC9ALT.M
Sample Name: l2363877-01,32,,,r4g
Misc Info : WG1850738,WG1847984,ICAL20532

7B OIL
L2363877-01



File :D:\West Lake Salt Dome_850.000079.023\Alpha Data\L2363877\AL
... KPAHBIO\F911092311.D
Operator : PAH9:slr
Instrument : PAH9
Acquired : 9 Nov 2023 9:23 pm using AcqMethod FRNC9ALT.M
Sample Name: wg1847984-4,32,,
Misc Info : WG1850738,WG1847984,ICAL20532

L2363877-01 Duplicate
WG1847984-4



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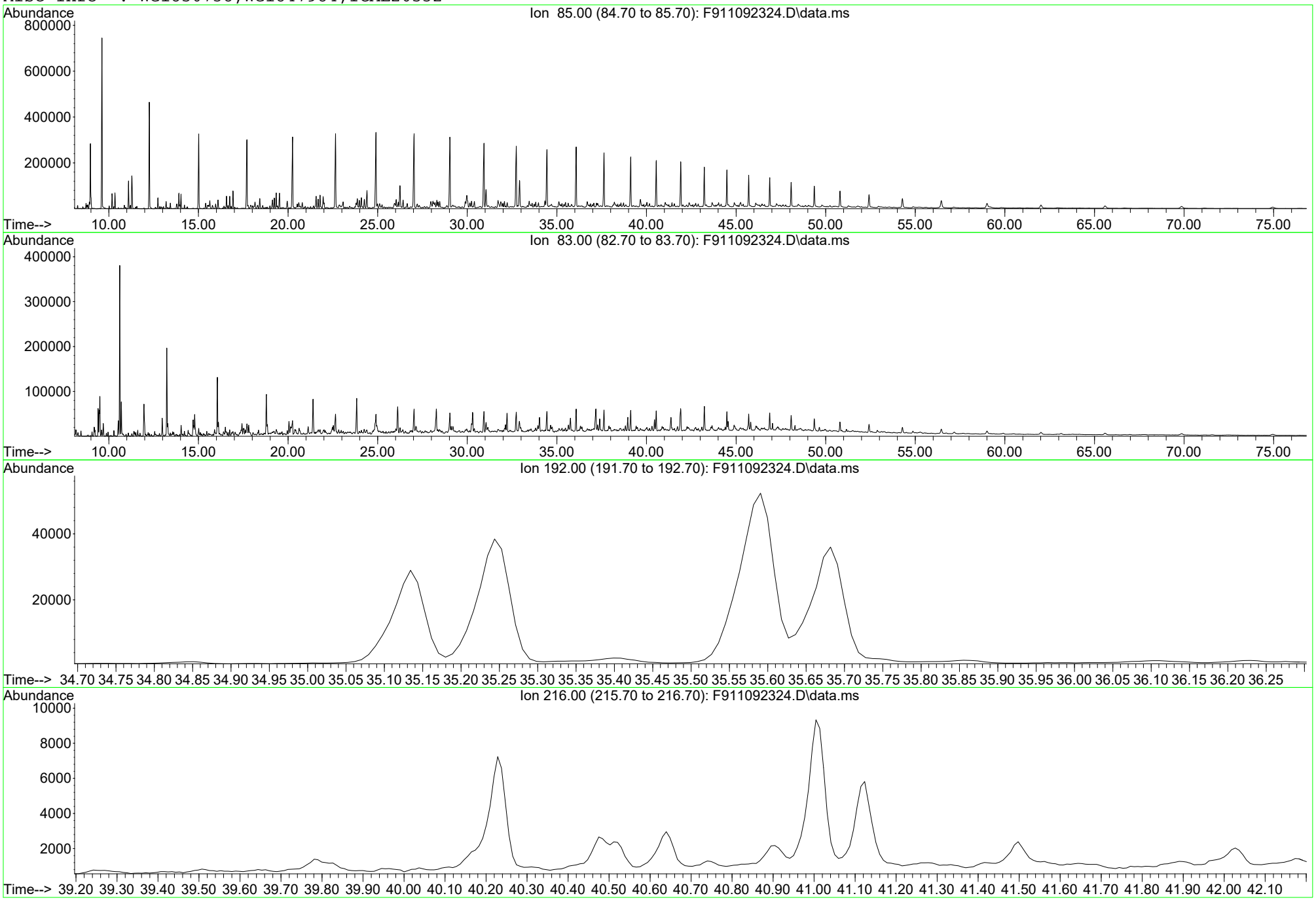
Operator : PAH9:slr
Instrument : PAH9
Acquired : 10 Nov 2023 3:32 pm using AcqMethod FRNC9ALT.M
Sample Name: L2363877-02
Misc Info : WG1850738,WG1847984,ICAL20532

7B Ref Oil
L2363877-02



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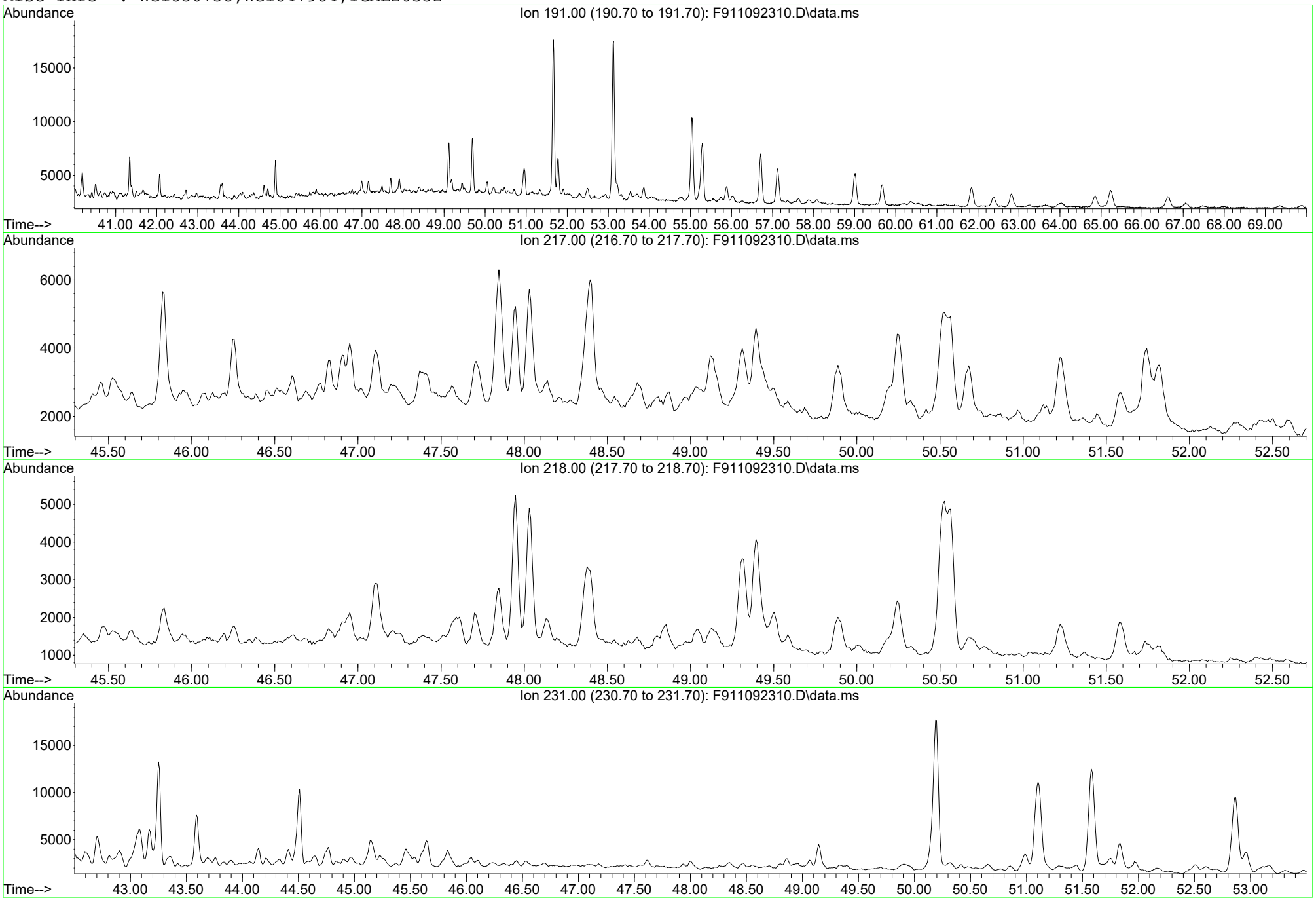
Instrument : PAH9
Acquired : 9 Nov 2023 7:59 pm using AcqMethod FRNC9ALT.M
Sample Name: l2363877-01,32,,,r4g
Misc Info : WG1850738,WG1847984,ICAL20532

7B OIL
L2363877-01



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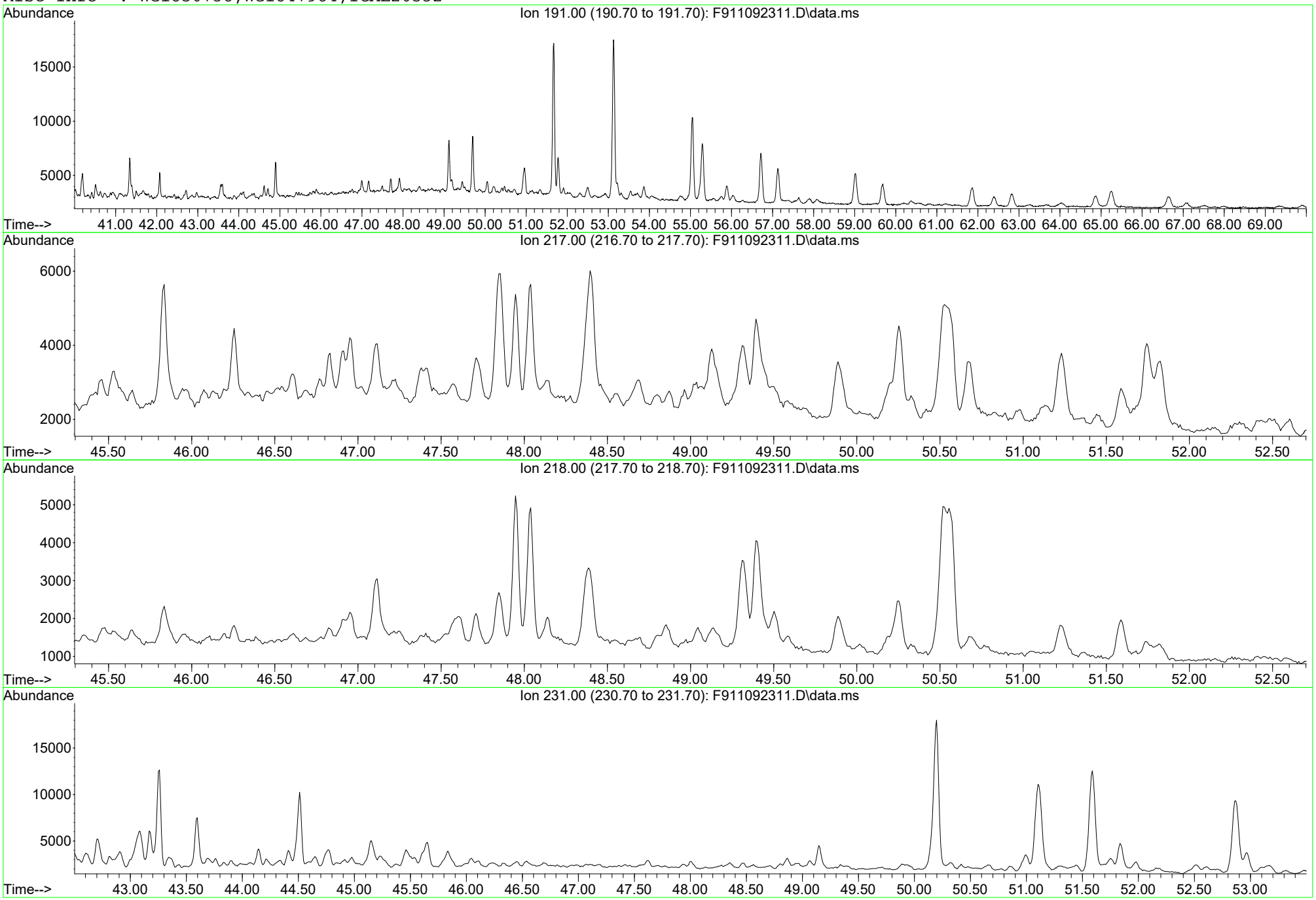
Instrument : PAH9
Acquired : 9 Nov 2023 9:23 pm using AcqMethod FRNC9ALT.M
Sample Name: wg1847984-4,32,,
Misc Info : WG1850738,WG1847984,ICAL20532

L2363877 Duplicate
WG1847984-4



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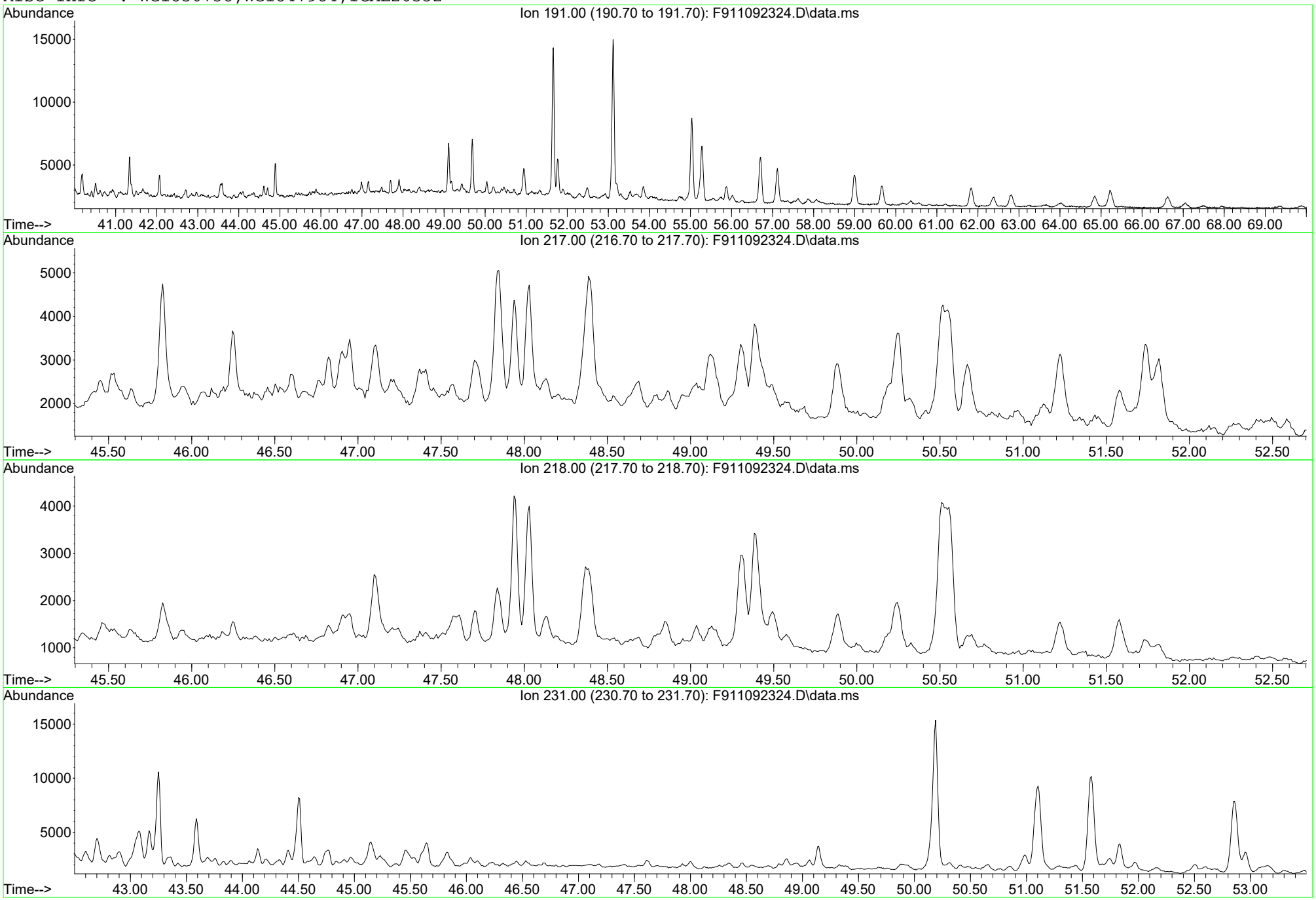
Operator : PAH9:slr
Instrument : PAH9
Acquired : 10 Nov 2023 3:32 pm using AcqMethod FRNC9ALT.M
Sample Name: L2363877-02
Misc Info : WG1850738,WG1847984,ICAL20532

7B Reference Oil
L2363877-02



Attachment 6

Crude Oil Assay for October 2023 7B cavern oil

Houston Laboratories
8820 Interchange Drive
Houston, TX 77054
Phone 713-660-0901

Certificate of Analysis

Number: 1030-23100986-001A

Nov. 07, 2023

Scott Himes
ERM
840 W. Sam Houston Parkway North
Houston, TX 77024-4613

Station Name:	Sulphur Dome	Sampled By:	
Station Number:	0701093	Sample Of:	Oil Spot
Station Location:	Sulphur, LA	Sample Date:	10/25/2023
Sample Point:	7B Oil	Sample Conditions:	
Analyzed:	10/27/2023 00:00:00 by ES	Method:	ASTM D-86

ASTM D-86 Distillation

% Recovery	°F @ 767 mm Hg
Initial Boiling Point	142
5	228
10	270
20	354
30	NR
40	NR
50	NR
60	NR
70	NR
80	NR
85	NR
90	NR
95	NR
Final Boiling Point	400
Volume % Recovery	21.0
Volume % Residue	79.0
Volume % Loss	0.0

Comments: Visual color is Crude.
IBP to 400°F Naphtha Cut Mass Fraction = 0.2373

Michael Staley

Data reviewed by: Michael Staley, ASTM Manager

Quality Assurance: The above analyses are performed in accordance with ASTM, UOP, GPA guidelines for quality assurance, unless otherwise stated.

Houston Laboratories
8820 Interchange Drive
Houston, TX 77054
Phone 713-660-0901

Certificate of Analysis

Number: 1030-23100986-001A

Nov. 07, 2023

Scott Himes
ERM
840 W. Sam Houston Parkway North
Houston, TX 77024-4613

Station Name: Sulphur Dome
Station Number: 0701093
Station Location: Sulphur, LA
Sample Point: 7B Oil

Sampled By:
Sample Of: Oil Spot
Sample Date: 10/25/2023
Sample Conditions:

Analytical Data

Test	Method	Result	Units	Detection Limit	Lab Tech.	Analysis Date
Salt in Crude Oil	ASTM D-3230	23.2	lbs/1000 bbls		MG	10/27/2023
Sulfur Content by X-ray	ASTM D-4294	1.362	wt%		EC	10/30/2023
Organic Chloride	ASTM D-4929	<1.0	ppmw		FSN	10/28/2023
API Gravity @ 60.01 °F	ASTM D-5002	33.85	°		MG	10/27/2023
Specific Gravity @ 60.01/60.01 °F	ASTM D-5002	0.8557			MG	10/27/2023
Density @ 60.01 °F	ASTM D-5002	0.8549	g/ml		MG	10/27/2023
Nickel	ASTM D-5708A	5	ppmw		CMN	11/02/2023
Vanadium	ASTM D-5708A	21	ppmw		CMN	11/02/2023
Iron	ASTM D-5708A	1	ppmw		CMN	11/02/2023

Comments:
AS-D-4929: Sample analyzed by ASTM D-4929 procedure B.
Mass Fraction = 0.2373

Michael Staley

Data reviewed by: Michael Staley, ASTM Manager

Quality Assurance: The above analyses are performed in accordance with ASTM, UOP, GPA guidelines for quality assurance, unless otherwise stated.

SPL, Inc.
Analysis Request Chain of Custody Record

SPL

SPL Work Order No.:	Acct. Mate Code:	Dept. Code	Page	Pages
			1	1

Report To: (Company Name):	ERM			Project/Station Name:	Project/Station Number:	Project/Station Location:	Requested TAT*
Address:	840 W. Sam Houston Parkway North Suite 600			Sulphur Dome	0701093	Sulphur, LA	
				Special Instructions: Rush turn-around			5 business days
City/State/Zip:	Houston	TX	77024-4613				
Contact:	Scott Himes	Scott.Himes@erm.com		Indicate Billing Type: (Place "X", where appropriate)	Net 30 day Acct.	X	Check #
Phone:	832-209-8811	Fax:			Credit Card		<<<Contact SPL, Inc for CC payment arrangements.

Invoice To: (Company Name):	ERM		
Address:	840 W. Sam Houston Parkway North Suite 600		
City/State/Zip:	Houston	TX	77024-4613
Contact:	Scott Himes	Scott.Himes@erm.com	
Phone:	832-209-8811	Fax:	
Client PO# or Ref. No.:			
Contract/Proposal #: (i.e. SPLQ####)	SPLQ10978		

† Terms: Cylinders will be rented for $10/cyl. All cylinders checked out are to be returned within 21 days, whether they contain sample or not. Cylinders not returned after 30 days will be considered lost and will be billed at current replacement cost.

* Surcharges May Apply (See quote for details)

RECEIVED
OCT 26 2023
BY: MS

Sample ID (used to log/track sample)	Sample Date	Sample Time	Sample Type (Gas/Liq. /Solid)	Duplicate	Composite	Spot	Cylinder Tracking Info† Cylinder #	Date Out	Date In	AS-D-5002	AS-D-4294	ASTM D-5708	AS-D-3230	ASTM D-86-IBP-400°F	AS-D-4929							Comments
										Requested Analysis (Place an "X" next to Sample ID below)												
7B Oil	10/25/23	14:15	Liq Oil			X				X	X	X	X	X	X							(1) 1-L jar

Sampled By-Print Name:	Taylar Brown			Received By-Company:			
Signature:	Taylar Brown						
Relinquished By-Print Name:	Taylar Brown	Date: 10/26/23	Time: 12:00	Received By-Print Name:		Date:	Time:
Signature:	Taylar Brown			Signature:			
Relinquished By-Print Name:		Date:	Time:	Received By-Print Name:		Date:	Time:
Signature:				Signature:			
Relinquished By-Print Name:		Date:	Time:	Received By-Print Name:		Date:	Time:
Signature:				Signature:			

Choose SPL Facility>>>	Corporate HQ - Houston, TX	Ship to Address:	8820 Interchange Dr., Houston,TX 77054	Phone:	713.660.0901

Note - As a convenience to our clients, this form is available in an electronic format. Please contact one of our offices above for the form to be e-mailed to you.