September 7, 2017

Jeff Wright
Weston Solutions
13702 Coursey Blvd
Building #7, Suite A
Baton Rouge, LA 70817

RE: Arkema
Project Number: 66666

Pace Analytical received 6 samples on September 3, 2017 for the following analyses:

1. C3-C12 Quantitative Molecular Characterization by GC/MS
2. C8-C40 Qualitative Molecular Characterization by GC/MS

The field and laboratory IDs are presented below.

Field IDs	Lab IDs
HH01-01-01-170901-21	237330001
HH-01-01-02-170901-21	237330002
HH01-01-03-170901-21	237330003
HH01-01-03-170901-22	237330004
HH-01-01-04-170901-21	237330005
HH01-01-05-170901-21	237330006

The sample was performed in house under laboratory number **23733**.

Please call the lab at 412-826-5245, or you may email any questions or concerns to ruth.welsh@pacelabs.com regarding any analytical data reports.

Respectfully submitted,

Ruth Welsh

Ruth Welsh
Project Manager

7004031

(C3-C12) Quantitative Molecular Characterization by GC/MS - full scan mode

PIANO, Oxygenated Blending Agents, Lead Scavengers, MMT & Thiophenes

Pace Analytical® Energy Services™

Jeff Wright
Weston Solutions
13702 Coursey Blvd
Baton Rouge, LA 70817

Lab ID: 23733-1
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-01-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
Isopentane (2-Methylbutane)	I	IP	10.0	10.0	U
1-Pentene	O	1P	10.0	10.0	U
2-Methyl-1-butene	O	2M1B	10.0	10.0	U
Pentane (nC5)	P	C5	10.0	10.0	U
trans-2-pentene	O	T2P	10.0	10.0	U
cis-2-pentene	O	C2P	10.0	10.0	U
2-Methyl-2-butene (t)	O	2M2B	10.0	10.0	U
2,2-Dimethylbutane (t)	I	22DMB	10.0	10.0	U
Cyclopentane	N	CYP	10.0	10.0	U
2,3-Dimethylbutane	I	23DMB	10.0	10.0	U
2-Methylpentane	I	2MP	10.0	10.0	U
Methyl-tert-butyl ether (MTBE)	ADD	MTBE	10.0	10.0	U
3-Methylpentane	P	3MP	10.0	10.0	U
1-Hexene	O	1HX	10.0	10.0	U
Hexane (nC6)	P	C6	10.0	10.0	U
Di-isopropyl ether (DIPE)	ADD	DIPE	10.0	10.0	U
trans-2-hexene (t)	O	T2HE	10.0	10.0	U
2-Methyl-2-pentene (t)	O	2M2P	10.0	10.0	U
cis-2-hexene (t)	O	C2HE	10.0	10.0	U
cis-3-Methyl-2-pentene (t)	O	C3M2P	10.0	10.0	U
Ethyl-tert-butyl ether (ETBE)	ADD	ETBE	10.0	10.0	U
2,2-Dimethylpentane (t)	I	22DMP	10.0	10.0	U
Methylcyclopentane	N	MCYP	10.0	10.0	U
2,4-Dimethylpentane	I	24DMP	10.0	10.0	U
1,2-Dichloroethane (EDC)	ADD	EDC	10.0	10.0	U
Benzene	A	B	10.0	10.0	U
3,3-Dimethylpentane (t)	I	33DMP	10.0	10.0	U
Thiophene	S	THIO	10.0	10.0	U
Cyclohexane	N	CYH	10.0	10.0	U
2-Methylhexane	I	2MH	10.0	10.0	U
2,3-Dimethylpentane	I	23DMP	10.0	10.0	U
Tert-amyl methyl ether (TAME)	ADD	TAME	10.0	10.0	U
3-Methylhexane	I	3MH	10.0	10.0	U

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Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-01-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
trans-1,3-Dimethylcyclopentane (t)	N	T13DMCYP	10.0	10.0	U
cis-1,3-Dimethylcyclopentane (t)	N	C13DMCYP	10.0	10.0	U
trans-1,2-Dimethylcyclopentane (t)	N	T12DMCYP	10.0	10.0	U
2,2,4-Trimethylpentane (isooctane)	I	224TMP	10.0	10.0	U
1-Heptene	O	1HP	10.0	10.0	U
Heptane (nC7)	P	C7	10.0	10.0	U
trans-2-heptene (t)	O	T2HP	10.0	10.0	U
Methylcyclohexane	N	MCYH	10.0	10.0	U
2,5-Dimethylhexane	I	25DMH	10.0	10.0	U
2,2,3-Trimethylpentane	I	233TMP	10.0	10.0	U
2,4-Dimethylhexane	I	24DMH	10.0	10.0	U
2,3,4-Trimethylpentane	I	234TMP	10.0	10.0	U
2,3,3-Trimethylpentane	I	233TMP	10.0	10.0	U
Toluene	A	T	10.0	10.0	U
2-Methylthiophene	S	2MTHIO	10.0	10.0	U
2,3-Dimethylhexane	I	23DMH	10.0	10.0	U
3-Methylthiophene	S	3MTHIO	10.0	10.0	U
2-Methylheptane	I	2MHP	10.0	10.0	U
4-Methylheptane (t)	I	4MHP	10.0	10.0	U
3-Methylheptane	I	3MHP	10.0	10.0	U
3-Ethylhexane	I	3EHX	10.0	10.0	U
1,2-Dibromoethane (EDB)	ADD	EDB	10.0	10.0	U
1-Octene	O	1O	10.0	10.0	U
Octane (nC8)	P	C8	10.0	10.0	U
2,4-Dimethylheptane (t)	I	24DMHP	10.0	10.0	U
2,5-Dimethylheptane (t)	I	25DMHP	10.0	10.0	U
Ethylbenzene	A	EB	10.0	10.0	U
2-Ethylthiophene	S	2ETHIO	10.0	10.0	U
2,3-Dimethylheptane (t)	I	23DMHP	10.0	10.0	U
m-Xylene	A	MX	10.0	10.0	U
p-Xylene	A	PX	10.0	10.0	U
4-Methyloctane (t)	I	4MO	10.0	10.0	U
2-Methyloctane (t)	I	2MO	10.0	10.0	U

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Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-01-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
3-Methyloctane (t)	I	3MO	10.0	10.0	U
Styrene	A	STRE	10.0	10.0	U
o-Xylene	A	OX	10.0	10.0	U
1-Nonene	O	1N	10.0	10.0	U
Nonane (nC9)	P	C9	10.0	10.0	U
Isopropylbenzene (cumene)	A	IPROPB	10.0	10.0	U
n-Propylbenzene	A	NPRPPB	10.0	10.0	U
1-Methyl-3-ethylbenzene	A	1M3EB	10.0	10.0	U
1-Methyl-4-ethylbenzene	A	1M4EB	10.0	10.0	U
1,3,5-Trimethylbenzene (mesitylene)	A	135TMB	10.0	10.0	U
1-Methyl-2-ethylbenzene	A	1M2EB	10.0	10.0	U
1,2,4-Trimethylbenzene	A	124TMB	10.0	10.0	U
1-Decene	O	1D	10.0	10.0	U
Decane (nC10)	P	C10	10.0	10.8	
sec-Butylbenzene	A	SBUB	10.0	10.0	U
1-Methyl-3-isopropylbenzene (m-cymene)	A	1M3IPROPE	10.0	10.0	U
1-Methyl-4-isopropylbenzene (p-cymene)	A	1M4IPROPE	10.0	10.0	U
Indane	A	IA	10.0	10.0	U
Indene	A	IE	10.0	10.0	U
1-Methyl-2-isopropybenzene (o-cymene)	A	1M2IPROPE	10.0	10.0	U
1-Methyl-3-propylbenzene	A	1M3PROPB	10.0	10.0	U
1-Methyl-4-propylbenzene	A	1M4PROPB	10.0	10.0	U
n-Butylbenzene	A	NBB	10.0	10.0	U
1,3-Dimethyl-5-ethylbenzene	A	13DM5EB	10.0	10.0	U
1,2,diethylbenzene	A	12DEB	10.0	10.0	U
1-Methyl-2-propylbenzene	A	1M2PROPB	10.0	10.0	U
1,4-Dimethyl-2-ethylbenzene	A	14DM2EB	10.0	10.0	U
1,3-Dimethyl-4-ethylbenzene	A	13DM4EB	10.0	10.0	U
1,2-Dimethyl-4-ethylbenzene	A	12DM4EB	10.0	10.0	U
1,3-Dimethyl-2-ethylbenzene	A	13DM2EB	10.0	10.0	U
1,2-Dimethyl-3-ethylbenzene	A	12DM3EB	10.0	10.0	U
Undecane (nC11)	P	C11	10.0	10.0	U
1,2,4,5-Tetramethylbenzene	A	1245TMB	10.0	10.0	U

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Lab ID: 23733-1
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-01-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
1,2,3,5-Tetramethylbenzene (t)	A	1235TMB	10.0	10.0	U
n-Pentylbenzene	A	NPYB	10.0	10.0	U
Naphthalene	A	N	10.0	10.0	U
Benzothiophene	S	BTHIO	10.0	10.0	U
Dodecane (nC12)	P	C12	10.0	10.0	U
1,2,3,4-Tetramethylbenzene (t)	A	1234TMB	10.0	10.0	U
MMT	ADD	MMT	10.0	10.0	U
2-Methylnaphthalene	A	2MN	10.0	10.0	U
1-Methylnaphthalene	A	1MN	10.0	10.0	U

1,2-Dichloroethane-d4 (RS)	90.87	%
Toluene-d8 (RS)	114.46	%
p-Bromofluorobenzene (RS)	91.65	%

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
J - Values greater than the ssRL but less than the PQL (3 x ssRL).
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631

090417-WATER1.D & dilution
090417-WATER1.D

Submitted by,
Pace Energy Services, LLC

PAES ID	**23733-1**
Sample ID	**HH01-01-01-170901-21**
Evaporation	
n-Pentane / (n-Pentane+n-Heptane)	U
2-Methylpentane / (2-Methylpentane+2-Methylheptane)	U
Waterwashing	
Benzene / (Benzene+Cyclohexane)	U
Toluene / (Toluene+Methylcyclohexane)	U
Aromatics / Total Paraffins (n+iso+cyc)	U
Aromatics / Naphthenes	U
wt% < o-xylene	U
Biodegradation	
(C4-C8 Para +Isopara) / C4-C8 Olefins	U
3-Methylhexane / n-Heptane	U
Methylcyclohexane / n-Heptane	U
Isoparaffins + Naphthenes / Paraffins	U
Diagnostic Ratios (Refining Properties)	
2,2,4-Trimethylpentane / (2,2,4-Trimethylpentane+Methylcyclohexane)	U
2,2,4-Trimethylpentane / Total TMPs	U
nC9 / Isopropylbenzene	U
nC10 / 1-Methyl-2-ethylbenzene	U
nC11 / 1,4-Dimethyl-2-ethylbenzene	U
iC5 / (iC5+nC5)	U
(2-methylhexane + 2,3dimethylpentane) / (3-methylhexane + 2,4	U
Naphthalene / (Naphthalene+nC12)	U
Methylcyclohexane/(Methylcyclohexane+Toluene)	U
Toluene/n-Octane	U
Oxygenates & Other (ug/L)	
Methyl-tert-butyl ether (MTBE)	U
Di-isopropyl ether (DIPE)	U
Ethyl-tert-butyl ether (ETBE)	U
Tert-amyl methyl ether (TAME)	U
MMT	U
Lead Scavengers (ug/L)	
1,2-Dichloroethane (EDC)	U
1,2-Dibromoethane (EDB)	U
Sulfur containing HCs (ug/L)	
Thiophene	U
2-Methylthiophene	U
3-Methylthiophene	U
2-Ethylthiophene	U
Benzothiophene	U
Relative Percentages	
% Paraffinic	100.0
% Isoparaffinic	0.0
% Aromatic	0.0
% Naphthenic	0.0
% Olefinic	0.0

Pace Analytical® Energy Services™

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Weston Solutions
13702 Coursey Blvd
Baton Rouge, LA 70817

Lab ID: 23733-2
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-02-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
Isopentane (2-Methylbutane)	I	IP	10.0	10.0	U
1-Pentene	O	1P	10.0	10.0	U
2-Methyl-1-butene	O	2M1B	10.0	10.0	U
Pentane (nC5)	P	C5	10.0	10.0	U
trans-2-pentene	O	T2P	10.0	10.0	U
cis-2-pentene	O	C2P	10.0	10.0	U
2-Methyl-2-butene (t)	O	2M2B	10.0	10.0	U
2,2-Dimethylbutane (t)	I	22DMB	10.0	10.0	U
Cyclopentane	N	CYP	10.0	10.0	U
2,3-Dimethylbutane	I	23DMB	10.0	10.0	U
2-Methylpentane	I	2MP	10.0	10.0	U
Methyl-tert-butyl ether (MTBE)	ADD	MTBE	10.0	10.0	U
3-Methylpentane	P	3MP	10.0	10.0	U
1-Hexene	O	1HX	10.0	10.0	U
Hexane (nC6)	P	C6	10.0	10.0	U
Di-isopropyl ether (DIPE)	ADD	DIPE	10.0	10.0	U
trans-2-hexene (t)	O	T2HE	10.0	10.0	U
2-Methyl-2-pentene (t)	O	2M2P	10.0	10.0	U
cis-2-hexene (t)	O	C2HE	10.0	10.0	U
cis-3-Methyl-2-pentene (t)	O	C3M2P	10.0	10.0	U
Ethyl-tert-butyl ether (ETBE)	ADD	ETBE	10.0	10.0	U
2,2-Dimethylpentane (t)	I	22DMP	10.0	10.0	U
Methylcyclopentane	N	MCYP	10.0	10.0	U
2,4-Dimethylpentane	I	24DMP	10.0	10.0	U
1,2-Dichloroethane (EDC)	ADD	EDC	10.0	10.0	U
Benzene	A	B	10.0	10.0	U
3,3-Dimethylpentane (t)	I	33DMP	10.0	10.0	U
Thiophene	S	THIO	10.0	10.0	U
Cyclohexane	N	CYH	10.0	10.0	U
2-Methylhexane	I	2MH	10.0	10.0	U
2,3-Dimethylpentane	I	23DMP	10.0	10.0	U
Tert-amyl methyl ether (TAME)	ADD	TAME	10.0	10.0	U
3-Methylhexane	I	3MH	10.0	10.0	U

Pace Analytical® Energy Services™

Jeff Wright		**Lab ID:**	**23733-2**
Weston Solutions		**Collected:**	**9/1/2017**
13702 Coursey Blvd		**Received:**	**9/3/2017**
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**Client ID:**	**HH01-01-02-170901-21**
Project #:	**66666**	**Analyzed:**	**9/6/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
trans-1,3-Dimethylcyclopentane (t)	N	T13DMCYP	10.0	10.0	U
cis-1,3-Dimethylcyclopentane (t)	N	C13DMCYP	10.0	10.0	U
trans-1,2-Dimethylcyclopentane (t)	N	T12DMCYP	10.0	10.0	U
2,2,4-Trimethylpentane (isooctane)	I	224TMP	10.0	10.0	U
1-Heptene	O	1HP	10.0	10.0	U
Heptane (nC7)	P	C7	10.0	10.0	U
trans-2-heptene (t)	O	T2HP	10.0	10.0	U
Methylcyclohexane	N	MCYH	10.0	10.0	U
2,5-Dimethylhexane	I	25DMH	10.0	10.0	U
2,2,3-Trimethylpentane	I	233TMP	10.0	10.0	U
2,4-Dimethylhexane	I	24DMH	10.0	10.0	U
2,3,4-Trimethylpentane	I	234TMP	10.0	10.0	U
2,3,3-Trimethylpentane	I	233TMP	10.0	10.0	U
Toluene	A	T	10.0	10.0	U
2-Methylthiophene	S	2MTHIO	10.0	10.0	U
2,3-Dimethylhexane	I	23DMH	10.0	10.0	U
3-Methylthiophene	S	3MTHIO	10.0	10.0	U
2-Methylheptane	I	2MHP	10.0	10.0	U
4-Methylheptane (t)	I	4MHP	10.0	10.0	U
3-Methylheptane	I	3MHP	10.0	10.0	U
3-Ethylhexane	I	3EHX	10.0	10.0	U
1,2-Dibromoethane (EDB)	ADD	EDB	10.0	10.0	U
1-Octene	O	1O	10.0	10.0	U
Octane (nC8)	P	C8	10.0	10.0	U
2,4-Dimethylheptane (t)	I	24DMHP	10.0	10.0	U
2,5-Dimethylheptane (t)	I	25DMHP	10.0	10.0	U
Ethylbenzene	A	EB	10.0	10.0	U
2-Ethylthiophene	S	2ETHIO	10.0	10.0	U
2,3-Dimethylheptane (t)	I	23DMHP	10.0	10.0	U
m-Xylene	A	MX	10.0	10.0	U
p-Xylene	A	PX	10.0	10.0	U
4-Methyloctane (t)	I	4MO	10.0	10.0	U
2-Methyloctane (t)	I	2MO	10.0	10.0	U

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Matrix: Water

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Project #: 66666
Collected by:

Client ID: HH01-01-02-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
3-Methyloctane (t)	I	3MO	10.0	10.0	U
Styrene	A	STRE	10.0	10.0	U
o-Xylene	A	OX	10.0	10.0	U
1-Nonene	O	1N	10.0	10.0	U
Nonane (nC9)	P	C9	10.0	10.0	U
Isopropylbenzene (cumene)	A	IPROPB	10.0	10.0	U
n-Propylbenzene	A	NPRPPB	10.0	10.0	U
1-Methyl-3-ethylbenzene	A	1M3EB	10.0	10.0	U
1-Methyl-4-ethylbenzene	A	1M4EB	10.0	10.0	U
1,3,5-Trimethylbenzene (mesitylene)	A	135TMB	10.0	10.0	U
1-Methyl-2-ethylbenzene	A	1M2EB	10.0	10.0	U
1,2,4-Trimethylbenzene	A	124TMB	10.0	10.0	U
1-Decene	O	1D	10.0	10.0	U
Decane (nC10)	P	C10	10.0	10.0	U
sec-Butylbenzene	A	SBUB	10.0	10.0	U
1-Methyl-3-isopropylbenzene (m-cymene)	A	1M3IPROPE	10.0	10.0	U
1-Methyl-4-isopropylbenzene (p-cymene)	A	1M4IPROPE	10.0	10.0	U
Indane	A	IA	10.0	10.0	U
Indene	A	IE	10.0	10.0	U
1-Methyl-2-isopropybenzene (o-cymene)	A	1M2IPROPE	10.0	10.0	U
1-Methyl-3-propylbenzene	A	1M3PROPB	10.0	10.0	U
1-Methyl-4-propylbenzene	A	1M4PROPB	10.0	10.0	U
n-Butylbenzene	A	NBB	10.0	10.0	U
1,3-Dimethyl-5-ethylbenzene	A	13DM5EB	10.0	10.0	U
1,2,diethylbenzene	A	12DEB	10.0	10.0	U
1-Methyl-2-propylbenzene	A	1M2PROPB	10.0	10.0	U
1,4-Dimethyl-2-ethylbenzene	A	14DM2EB	10.0	10.0	U
1,3-Dimethyl-4-ethylbenzene	A	13DM4EB	10.0	10.0	U
1,2-Dimethyl-4-ethylbenzene	A	12DM4EB	10.0	10.0	U
1,3-Dimethyl-2-ethylbenzene	A	13DM2EB	10.0	10.0	U
1,2-Dimethyl-3-ethylbenzene	A	12DM3EB	10.0	10.0	U
Undecane (nC11)	P	C11	10.0	10.0	U
1,2,4,5-Tetramethylbenzene	A	1245TMB	10.0	10.0	U

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Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
1,2,3,5-Tetramethylbenzene (t)	A	1235TMB	10.0	10.0	U
n-Pentylbenzene	A	NPYB	10.0	10.0	U
Naphthalene	A	N	10.0	10.0	U
Benzothiophene	S	BTHIO	10.0	10.0	U
Dodecane (nC12)	P	C12	10.0	10.0	U
1,2,3,4-Tetramethylbenzene (t)	A	1234TMB	10.0	10.0	U
MMT	ADD	MMT	10.0	10.0	U
2-Methylnaphthalene	A	2MN	10.0	10.0	U
1-Methylnaphthalene	A	1MN	10.0	10.0	U

1,2-Dichloroethane-d4 (RS)	94.63	%
Toluene-d8 (RS)	112.12	%
p-Bromofluorobenzene (RS)	90.68	%

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
J - Values greater than the ssRL but less than the PQL (3 x ssRL).
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631

090417-WATER2.D & dilution
090417-WATER2.D

Submitted by,
Pace Energy Services, LLC

PAES ID	**23733-2**
Sample ID	**HH01-01-02-170901-21**
Evaporation	
n-Pentane / (n-Pentane+n-Heptane)	U
2-Methylpentane / (2-Methylpentane+2-Methylheptane)	U
Waterwashing	
Benzene / (Benzene+Cyclohexane)	U
Toluene / (Toluene+Methylcyclohexane)	U
Aromatics / Total Paraffins (n+iso+cyc)	U
Aromatics / Naphthenes	U
wt% < o-xylene	U
Biodegradation	
(C4-C8 Para +Isopara) / C4-C8 Olefins	U
3-Methylhexane / n-Heptane	U
Methylcyclohexane / n-Heptane	U
Isoparaffins + Naphthenes / Paraffins	U
Diagnostic Ratios (Refining Properties)	
2,2,4-Trimethylpentane / (2,2,4-Trimethylpentane+Methylcyclohexane)	U
2,2,4-Trimethylpentane / Total TMPs	U
nC9 / Isopropylbenzene	U
nC10 / 1-Methyl-2-ethylbenzene	U
nC11 / 1,4-Dimethyl-2-ethylbenzene	U
iC5 / (iC5+nC5)	U
(2-methylhexane + 2,3dimethylpentane) / (3-methylhexane + 2,4	U
Naphthalene / (Naphthalene+nC12)	U
Methylcyclohexane/(Methylcyclohexane+Toluene)	U
Toluene/n-Octane	U
Oxygenates & Other (ug/L)	
Methyl-tert-butyl ether (MTBE)	U
Di-isopropyl ether (DIPE)	U
Ethyl-tert-butyl ether (ETBE)	U
Tert-amyl methyl ether (TAME)	U
MMT	U
Lead Scavengers (ug/L)	
1,2-Dichloroethane (EDC)	U
1,2-Dibromoethane (EDB)	U
Sulfur containing HCs (ug/L)	
Thiophene	U
2-Methylthiophene	U
3-Methylthiophene	U
2-Ethylthiophene	U
Benzothiophene	U
Relative Percentages	
% Paraffinic	0.0
% Isoparaffinic	0.0
% Aromatic	0.0
% Naphthenic	0.0
% Olefinic	0.0

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Lab ID: 23733-3
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
Isopentane (2-Methylbutane)	I	IP	10.0	10.0	U
1-Pentene	O	1P	10.0	10.0	U
2-Methyl-1-butene	O	2M1B	10.0	10.0	U
Pentane (nC5)	P	C5	10.0	10.0	U
trans-2-pentene	O	T2P	10.0	10.0	U
cis-2-pentene	O	C2P	10.0	10.0	U
2-Methyl-2-butene (t)	O	2M2B	10.0	10.0	U
2,2-Dimethylbutane (t)	I	22DMB	10.0	10.0	U
Cyclopentane	N	CYP	10.0	10.0	U
2,3-Dimethylbutane	I	23DMB	10.0	10.0	U
2-Methylpentane	I	2MP	10.0	10.0	U
Methyl-tert-butyl ether (MTBE)	ADD	MTBE	10.0	10.0	U
3-Methylpentane	P	3MP	10.0	10.0	U
1-Hexene	O	1HX	10.0	10.0	U
Hexane (nC6)	P	C6	10.0	10.0	U
Di-isopropyl ether (DIPE)	ADD	DIPE	10.0	10.0	U
trans-2-hexene (t)	O	T2HE	10.0	10.0	U
2-Methyl-2-pentene (t)	O	2M2P	10.0	10.0	U
cis-2-hexene (t)	O	C2HE	10.0	10.0	U
cis-3-Methyl-2-pentene (t)	O	C3M2P	10.0	10.0	U
Ethyl-tert-butyl ether (ETBE)	ADD	ETBE	10.0	10.0	U
2,2-Dimethylpentane (t)	I	22DMP	10.0	10.0	U
Methylcyclopentane	N	MCYP	10.0	10.0	U
2,4-Dimethylpentane	I	24DMP	10.0	10.0	U
1,2-Dichloroethane (EDC)	ADD	EDC	10.0	10.0	U
Benzene	A	B	10.0	10.0	U
3,3-Dimethylpentane (t)	I	33DMP	10.0	10.0	U
Thiophene	S	THIO	10.0	10.0	U
Cyclohexane	N	CYH	10.0	10.0	U
2-Methylhexane	I	2MH	10.0	10.0	U
2,3-Dimethylpentane	I	23DMP	10.0	10.0	U
Tert-amyl methyl ether (TAME)	ADD	TAME	10.0	10.0	U
3-Methylhexane	I	3MH	10.0	10.0	U

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Lab ID: 23733-3
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
trans-1,3-Dimethylcyclopentane (t)	N	T13DMCYP	10.0	10.0	U
cis-1,3-Dimethylcyclopentane (t)	N	C13DMCYP	10.0	10.0	U
trans-1,2-Dimethylcyclopentane (t)	N	T12DMCYP	10.0	10.0	U
2,2,4-Trimethylpentane (isooctane)	I	224TMP	10.0	10.0	U
1-Heptene	O	1HP	10.0	10.0	U
Heptane (nC7)	P	C7	10.0	10.0	U
trans-2-heptene (t)	O	T2HP	10.0	10.0	U
Methylcyclohexane	N	MCYH	10.0	10.0	U
2,5-Dimethylhexane	I	25DMH	10.0	10.0	U
2,2,3-Trimethylpentane	I	233TMP	10.0	10.0	U
2,4-Dimethylhexane	I	24DMH	10.0	10.0	U
2,3,4-Trimethylpentane	I	234TMP	10.0	10.0	U
2,3,3-Trimethylpentane	I	233TMP	10.0	10.0	U
Toluene	A	T	10.0	10.0	U
2-Methylthiophene	S	2MTHIO	10.0	10.0	U
2,3-Dimethylhexane	I	23DMH	10.0	10.0	U
3-Methylthiophene	S	3MTHIO	10.0	10.0	U
2-Methylheptane	I	2MHP	10.0	10.0	U
4-Methylheptane (t)	I	4MHP	10.0	10.0	U
3-Methylheptane	I	3MHP	10.0	10.0	U
3-Ethylhexane	I	3EHX	10.0	10.0	U
1,2-Dibromoethane (EDB)	ADD	EDB	10.0	10.0	U
1-Octene	O	1O	10.0	10.0	U
Octane (nC8)	P	C8	10.0	10.0	U
2,4-Dimethylheptane (t)	I	24DMHP	10.0	10.0	U
2,5-Dimethylheptane (t)	I	25DMHP	10.0	10.0	U
Ethylbenzene	A	EB	10.0	10.0	U
2-Ethylthiophene	S	2ETHIO	10.0	10.0	U
2,3-Dimethylheptane (t)	I	23DMHP	10.0	10.0	U
m-Xylene	A	MX	10.0	10.0	U
p-Xylene	A	PX	10.0	10.0	U
4-Methyloctane (t)	I	4MO	10.0	10.0	U
2-Methyloctane (t)	I	2MO	10.0	10.0	U

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Lab ID: 23733-3
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
3-Methyloctane (t)	I	3MO	10.0	10.0	U
Styrene	A	STRE	10.0	10.0	U
o-Xylene	A	OX	10.0	10.0	U
1-Nonene	O	1N	10.0	10.0	U
Nonane (nC9)	P	C9	10.0	10.0	U
Isopropylbenzene (cumene)	A	IPROPB	10.0	10.0	U
n-Propylbenzene	A	NPRPPB	10.0	10.0	U
1-Methyl-3-ethylbenzene	A	1M3EB	10.0	10.0	U
1-Methyl-4-ethylbenzene	A	1M4EB	10.0	10.0	U
1,3,5-Trimethylbenzene (mesitylene)	A	135TMB	10.0	10.0	U
1-Methyl-2-ethylbenzene	A	1M2EB	10.0	10.0	U
1,2,4-Trimethylbenzene	A	124TMB	10.0	10.0	U
1-Decene	O	1D	10.0	10.0	U
Decane (nC10)	P	C10	10.0	10.0	U
sec-Butylbenzene	A	SBUB	10.0	10.0	U
1-Methyl-3-isopropylbenzene (m-cymene)	A	1M3IPROPE	10.0	10.0	U
1-Methyl-4-isopropylbenzene (p-cymene)	A	1M4IPROPE	10.0	10.0	U
Indane	A	IA	10.0	10.0	U
Indene	A	IE	10.0	10.0	U
1-Methyl-2-isopropybenzene (o-cymene)	A	1M2IPROPE	10.0	10.0	U
1-Methyl-3-propylbenzene	A	1M3PROPB	10.0	10.0	U
1-Methyl-4-propylbenzene	A	1M4PROPB	10.0	10.0	U
n-Butylbenzene	A	NBB	10.0	10.0	U
1,3-Dimethyl-5-ethylbenzene	A	13DM5EB	10.0	10.0	U
1,2,diethylbenzene	A	12DEB	10.0	10.0	U
1-Methyl-2-propylbenzene	A	1M2PROPB	10.0	10.0	U
1,4-Dimethyl-2-ethylbenzene	A	14DM2EB	10.0	10.0	U
1,3-Dimethyl-4-ethylbenzene	A	13DM4EB	10.0	10.0	U
1,2-Dimethyl-4-ethylbenzene	A	12DM4EB	10.0	10.0	U
1,3-Dimethyl-2-ethylbenzene	A	13DM2EB	10.0	10.0	U
1,2-Dimethyl-3-ethylbenzene	A	12DM3EB	10.0	10.0	U
Undecane (nC11)	P	C11	10.0	10.0	U
1,2,4,5-Tetramethylbenzene	A	1245TMB	10.0	10.0	U

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Lab ID: 23733-3
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
1,2,3,5-Tetramethylbenzene (t)	A	1235TMB	10.0	10.0	U
n-Pentylbenzene	A	NPYB	10.0	10.0	U
Naphthalene	A	N	10.0	10.0	U
Benzothiophene	S	BTHIO	10.0	10.0	U
Dodecane (nC12)	P	C12	10.0	10.0	U
1,2,3,4-Tetramethylbenzene (t)	A	1234TMB	10.0	10.0	U
MMT	ADD	MMT	10.0	10.0	U
2-Methylnaphthalene	A	2MN	10.0	10.0	U
1-Methylnaphthalene	A	1MN	10.0	10.0	U

1,2-Dichloroethane-d4 (RS)	97.27	%
Toluene-d8 (RS)	113.17	%
p-Bromofluorobenzene (RS)	91.87	%

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
J - Values greater than the ssRL but less than the PQL (3 x ssRL).
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631

090417-WATER3.D & dilution
090417-WATER3.D

Submitted by,
Pace Energy Services, LLC

PAES ID	**23733-3**
Sample ID	**HH01-01-03-170901-21**
Evaporation	
n-Pentane / (n-Pentane+n-Heptane)	U
2-Methylpentane / (2-Methylpentane+2-Methylheptane)	U
Waterwashing	
Benzene / (Benzene+Cyclohexane)	U
Toluene / (Toluene+Methylcyclohexane)	U
Aromatics / Total Paraffins (n+iso+cyc)	U
Aromatics / Naphthenes	U
wt% < o-xylene	U
Biodegradation	
(C4-C8 Para +Isopara) / C4-C8 Olefins	U
3-Methylhexane / n-Heptane	U
Methylcyclohexane / n-Heptane	U
Isoparaffins + Naphthenes / Paraffins	U
Diagnostic Ratios (Refining Properties)	
2,2,4-Trimethylpentane / (2,2,4-Trimethylpentane+Methylcyclohexane)	U
2,2,4-Trimethylpentane / Total TMPs	U
nC9 / Isopropylbenzene	U
nC10 / 1-Methyl-2-ethylbenzene	U
nC11 / 1,4-Dimethyl-2-ethylbenzene	U
iC5 / (iC5+nC5)	U
(2-methylhexane + 2,3dimethylpentane) / (3-methylhexane + 2,4	U
Naphthalene / (Naphthalene+nC12)	U
Methylcyclohexane/(Methylcyclohexane+Toluene)	U
Toluene/n-Octane	U
Oxygenates & Other (ug/L)	
Methyl-tert-butyl ether (MTBE)	U
Di-isopropyl ether (DIPE)	U
Ethyl-tert-butyl ether (ETBE)	U
Tert-amyl methyl ether (TAME)	U
MMT	U
Lead Scavengers (ug/L)	
1,2-Dichloroethane (EDC)	U
1,2-Dibromoethane (EDB)	U
Sulfur containing HCs (ug/L)	
Thiophene	U
2-Methylthiophene	U
3-Methylthiophene	U
2-Ethylthiophene	U
Benzothiophene	U
Relative Percentages	
% Paraffinic	0.0
% Isoparaffinic	0.0
% Aromatic	0.0
% Naphthenic	0.0
% Olefinic	0.0

Pace Analytical® Energy Services™

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Lab ID: 23733-4
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-22
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
Isopentane (2-Methylbutane)	I	IP	10.0	10.0	U
1-Pentene	O	1P	10.0	10.0	U
2-Methyl-1-butene	O	2M1B	10.0	10.0	U
Pentane (nC5)	P	C5	10.0	10.0	U
trans-2-pentene	O	T2P	10.0	10.0	U
cis-2-pentene	O	C2P	10.0	10.0	U
2-Methyl-2-butene (t)	O	2M2B	10.0	10.0	U
2,2-Dimethylbutane (t)	I	22DMB	10.0	10.0	U
Cyclopentane	N	CYP	10.0	10.0	U
2,3-Dimethylbutane	I	23DMB	10.0	10.0	U
2-Methylpentane	I	2MP	10.0	10.0	U
Methyl-tert-butyl ether (MTBE)	ADD	MTBE	10.0	10.0	U
3-Methylpentane	P	3MP	10.0	10.0	U
1-Hexene	O	1HX	10.0	10.0	U
Hexane (nC6)	P	C6	10.0	10.0	U
Di-isopropyl ether (DIPE)	ADD	DIPE	10.0	10.0	U
trans-2-hexene (t)	O	T2HE	10.0	10.0	U
2-Methyl-2-pentene (t)	O	2M2P	10.0	10.0	U
cis-2-hexene (t)	O	C2HE	10.0	10.0	U
cis-3-Methyl-2-pentene (t)	O	C3M2P	10.0	10.0	U
Ethyl-tert-butyl ether (ETBE)	ADD	ETBE	10.0	10.0	U
2,2-Dimethylpentane (t)	I	22DMP	10.0	10.0	U
Methylcyclopentane	N	MCYP	10.0	10.0	U
2,4-Dimethylpentane	I	24DMP	10.0	10.0	U
1,2-Dichloroethane (EDC)	ADD	EDC	10.0	10.0	U
Benzene	A	B	10.0	10.0	U
3,3-Dimethylpentane (t)	I	33DMP	10.0	10.0	U
Thiophene	S	THIO	10.0	10.0	U
Cyclohexane	N	CYH	10.0	10.0	U
2-Methylhexane	I	2MH	10.0	10.0	U
2,3-Dimethylpentane	I	23DMP	10.0	10.0	U
Tert-amyl methyl ether (TAME)	ADD	TAME	10.0	10.0	U
3-Methylhexane	I	3MH	10.0	10.0	U

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Lab ID: 23733-4
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-22
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
trans-1,3-Dimethylcyclopentane (t)	N	T13DMCYP	10.0	10.0	U
cis-1,3-Dimethylcyclopentane (t)	N	C13DMCYP	10.0	10.0	U
trans-1,2-Dimethylcyclopentane (t)	N	T12DMCYP	10.0	10.0	U
2,2,4-Trimethylpentane (isooctane)	I	224TMP	10.0	10.0	U
1-Heptene	O	1HP	10.0	10.0	U
Heptane (nC7)	P	C7	10.0	10.0	U
trans-2-heptene (t)	O	T2HP	10.0	10.0	U
Methylcyclohexane	N	MCYH	10.0	10.0	U
2,5-Dimethylhexane	I	25DMH	10.0	10.0	U
2,2,3-Trimethylpentane	I	233TMP	10.0	10.0	U
2,4-Dimethylhexane	I	24DMH	10.0	10.0	U
2,3,4-Trimethylpentane	I	234TMP	10.0	10.0	U
2,3,3-Trimethylpentane	I	233TMP	10.0	10.0	U
Toluene	A	T	10.0	10.0	U
2-Methylthiophene	S	2MTHIO	10.0	10.0	U
2,3-Dimethylhexane	I	23DMH	10.0	10.0	U
3-Methylthiophene	S	3MTHIO	10.0	10.0	U
2-Methylheptane	I	2MHP	10.0	10.0	U
4-Methylheptane (t)	I	4MHP	10.0	10.0	U
3-Methylheptane	I	3MHP	10.0	10.0	U
3-Ethylhexane	I	3EHX	10.0	10.0	U
1,2-Dibromoethane (EDB)	ADD	EDB	10.0	10.0	U
1-Octene	O	1O	10.0	10.0	U
Octane (nC8)	P	C8	10.0	10.0	U
2,4-Dimethylheptane (t)	I	24DMHP	10.0	10.0	U
2,5-Dimethylheptane (t)	I	25DMHP	10.0	10.0	U
Ethylbenzene	A	EB	10.0	10.0	U
2-Ethylthiophene	S	2ETHIO	10.0	10.0	U
2,3-Dimethylheptane (t)	I	23DMHP	10.0	10.0	U
m-Xylene	A	MX	10.0	10.0	U
p-Xylene	A	PX	10.0	10.0	U
4-Methyloctane (t)	I	4MO	10.0	10.0	U
2-Methyloctane (t)	I	2MO	10.0	10.0	U

Pace Analytical® Energy Services™

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Lab ID: 23733-4
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-22
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
3-Methyloctane (t)	I	3MO	10.0	10.0	U
Styrene	A	STRE	10.0	10.0	U
o-Xylene	A	OX	10.0	10.0	U
1-Nonene	O	1N	10.0	10.0	U
Nonane (nC9)	P	C9	10.0	10.0	U
Isopropylbenzene (cumene)	A	IPROPB	10.0	10.0	U
n-Propylbenzene	A	NPRPPB	10.0	10.0	U
1-Methyl-3-ethylbenzene	A	1M3EB	10.0	10.0	U
1-Methyl-4-ethylbenzene	A	1M4EB	10.0	10.0	U
1,3,5-Trimethylbenzene (mesitylene)	A	135TMB	10.0	10.0	U
1-Methyl-2-ethylbenzene	A	1M2EB	10.0	10.0	U
1,2,4-Trimethylbenzene	A	124TMB	10.0	10.0	U
1-Decene	O	1D	10.0	10.0	U
Decane (nC10)	P	C10	10.0	10.0	U
sec-Butylbenzene	A	SBUB	10.0	10.0	U
1-Methyl-3-isopropylbenzene (m-cymene)	A	1M3IPROPE	10.0	10.0	U
1-Methyl-4-isopropylbenzene (p-cymene)	A	1M4IPROPE	10.0	10.0	U
Indane	A	IA	10.0	10.0	U
Indene	A	IE	10.0	10.0	U
1-Methyl-2-isopropybenzene (o-cymene)	A	1M2IPROPE	10.0	10.0	U
1-Methyl-3-propylbenzene	A	1M3PROPB	10.0	10.0	U
1-Methyl-4-propylbenzene	A	1M4PROPB	10.0	10.0	U
n-Butylbenzene	A	NBB	10.0	10.0	U
1,3-Dimethyl-5-ethylbenzene	A	13DM5EB	10.0	10.0	U
1,2,diethylbenzene	A	12DEB	10.0	10.0	U
1-Methyl-2-propylbenzene	A	1M2PROPB	10.0	10.0	U
1,4-Dimethyl-2-ethylbenzene	A	14DM2EB	10.0	10.0	U
1,3-Dimethyl-4-ethylbenzene	A	13DM4EB	10.0	10.0	U
1,2-Dimethyl-4-ethylbenzene	A	12DM4EB	10.0	10.0	U
1,3-Dimethyl-2-ethylbenzene	A	13DM2EB	10.0	10.0	U
1,2-Dimethyl-3-ethylbenzene	A	12DM3EB	10.0	10.0	U
Undecane (nC11)	P	C11	10.0	10.0	U
1,2,4,5-Tetramethylbenzene	A	1245TMB	10.0	10.0	U

Pace Analytical® Energy Services™

Jeff Wright
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Lab ID: 23733-4
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-03-170901-22
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
1,2,3,5-Tetramethylbenzene (t)	A	1235TMB	10.0	10.0	U
n-Pentylbenzene	A	NPYB	10.0	10.0	U
Naphthalene	A	N	10.0	10.0	U
Benzothiophene	S	BTHIO	10.0	10.0	U
Dodecane (nC12)	P	C12	10.0	10.0	U
1,2,3,4-Tetramethylbenzene (t)	A	1234TMB	10.0	10.0	U
MMT	ADD	MMT	10.0	10.0	U
2-Methylnaphthalene	A	2MN	10.0	10.0	U
1-Methylnaphthalene	A	1MN	10.0	10.0	U

1,2-Dichloroethane-d4 (RS)	86.70	%
Toluene-d8 (RS)	113.50	%
p-Bromofluorobenzene (RS)	90.98	%

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
J - Values greater than the ssRL but less than the PQL (3 x ssRL).
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631

090417-WATER4.D & dilution
090417-WATER4.D

Submitted by,
Pace Energy Services, LLC

PAES ID	**23733-4**
Sample ID	**HH01-01-03-170901-22**
Evaporation	
n-Pentane / (n-Pentane+n-Heptane)	U
2-Methylpentane / (2-Methylpentane+2-Methylheptane)	U
Waterwashing	
Benzene / (Benzene+Cyclohexane)	U
Toluene / (Toluene+Methylcyclohexane)	U
Aromatics / Total Paraffins (n+iso+cyc)	U
Aromatics / Naphthenes	U
wt% < o-xylene	U
Biodegradation	
(C4-C8 Para +Isopara) / C4-C8 Olefins	U
3-Methylhexane / n-Heptane	U
Methylcyclohexane / n-Heptane	U
Isoparaffins + Naphthenes / Paraffins	U
Diagnostic Ratios (Refining Properties)	
2,2,4-Trimethylpentane / (2,2,4-Trimethylpentane+Methylcyclohexane)	U
2,2,4-Trimethylpentane / Total TMPs	U
nC9 / Isopropylbenzene	U
nC10 / 1-Methyl-2-ethylbenzene	U
nC11 / 1,4-Dimethyl-2-ethylbenzene	U
iC5 / (iC5+nC5)	U
(2-methylhexane + 2,3dimethylpentane) / (3-methylhexane + 2,4	U
Naphthalene / (Naphthalene+nC12)	U
Methylcyclohexane/(Methylcyclohexane+Toluene)	U
Toluene/n-Octane	U
Oxygenates & Other (ug/L)	
Methyl-tert-butyl ether (MTBE)	U
Di-isopropyl ether (DIPE)	U
Ethyl-tert-butyl ether (ETBE)	U
Tert-amyl methyl ether (TAME)	U
MMT	U
Lead Scavengers (ug/L)	
1,2-Dichloroethane (EDC)	U
1,2-Dibromoethane (EDB)	U
Sulfur containing HCs (ug/L)	
Thiophene	U
2-Methylthiophene	U
3-Methylthiophene	U
2-Ethylthiophene	U
Benzothiophene	U
Relative Percentages	
% Paraffinic	0.0
% Isoparaffinic	0.0
% Aromatic	0.0
% Naphthenic	0.0
% Olefinic	0.0

Pace Analytical® Energy Services™

Jeff Wright
Weston Solutions
13702 Coursey Blvd
Baton Rouge, LA 70817

Lab ID: 23733-5
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-04-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
Isopentane (2-Methylbutane)	I	IP	10.0	10.0	U
1-Pentene	O	1P	10.0	10.0	U
2-Methyl-1-butene	O	2M1B	10.0	10.0	U
Pentane (nC5)	P	C5	10.0	10.0	U
trans-2-pentene	O	T2P	10.0	10.0	U
cis-2-pentene	O	C2P	10.0	10.0	U
2-Methyl-2-butene (t)	O	2M2B	10.0	10.0	U
2,2-Dimethylbutane (t)	I	22DMB	10.0	10.0	U
Cyclopentane	N	CYP	10.0	10.0	U
2,3-Dimethylbutane	I	23DMB	10.0	10.0	U
2-Methylpentane	I	2MP	10.0	10.0	U
Methyl-tert-butyl ether (MTBE)	ADD	MTBE	10.0	10.0	U
3-Methylpentane	P	3MP	10.0	10.0	U
1-Hexene	O	1HX	10.0	10.0	U
Hexane (nC6)	P	C6	10.0	10.0	U
Di-isopropyl ether (DIPE)	ADD	DIPE	10.0	10.0	U
trans-2-hexene (t)	O	T2HE	10.0	10.0	U
2-Methyl-2-pentene (t)	O	2M2P	10.0	10.0	U
cis-2-hexene (t)	O	C2HE	10.0	10.0	U
cis-3-Methyl-2-pentene (t)	O	C3M2P	10.0	10.0	U
Ethyl-tert-butyl ether (ETBE)	ADD	ETBE	10.0	10.0	U
2,2-Dimethylpentane (t)	I	22DMP	10.0	10.0	U
Methylcyclopentane	N	MCYP	10.0	10.0	U
2,4-Dimethylpentane	I	24DMP	10.0	10.0	U
1,2-Dichloroethane (EDC)	ADD	EDC	10.0	10.0	U
Benzene	A	B	10.0	10.0	U
3,3-Dimethylpentane (t)	I	33DMP	10.0	10.0	U
Thiophene	S	THIO	10.0	10.0	U
Cyclohexane	N	CYH	10.0	10.0	U
2-Methylhexane	I	2MH	10.0	10.0	U
2,3-Dimethylpentane	I	23DMP	10.0	10.0	U
Tert-amyl methyl ether (TAME)	ADD	TAME	10.0	10.0	U
3-Methylhexane	I	3MH	10.0	10.0	U

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Jeff Wright		**Lab ID:**	**23733-5**
Weston Solutions		**Collected:**	**9/1/2017**
13702 Coursey Blvd		**Received:**	**9/3/2017**
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**Client ID:**	**HH01-01-04-170901-21**
Project #:	**66666**	**Analyzed:**	**9/6/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
trans-1,3-Dimethylcyclopentane (t)	N	T13DMCYP	10.0	10.0	U
cis-1,3-Dimethylcyclopentane (t)	N	C13DMCYP	10.0	10.0	U
trans-1,2-Dimethylcyclopentane (t)	N	T12DMCYP	10.0	10.0	U
2,2,4-Trimethylpentane (isooctane)	I	224TMP	10.0	10.0	U
1-Heptene	O	1HP	10.0	10.0	U
Heptane (nC7)	P	C7	10.0	10.0	U
trans-2-heptene (t)	O	T2HP	10.0	10.0	U
Methylcyclohexane	N	MCYH	10.0	10.0	U
2,5-Dimethylhexane	I	25DMH	10.0	10.0	U
2,2,3-Trimethylpentane	I	233TMP	10.0	10.0	U
2,4-Dimethylhexane	I	24DMH	10.0	10.0	U
2,3,4-Trimethylpentane	I	234TMP	10.0	10.0	U
2,3,3-Trimethylpentane	I	233TMP	10.0	10.0	U
Toluene	A	T	10.0	10.0	U
2-Methylthiophene	S	2MTHIO	10.0	10.0	U
2,3-Dimethylhexane	I	23DMH	10.0	10.0	U
3-Methylthiophene	S	3MTHIO	10.0	10.0	U
2-Methylheptane	I	2MHP	10.0	10.0	U
4-Methylheptane (t)	I	4MHP	10.0	10.0	U
3-Methylheptane	I	3MHP	10.0	10.0	U
3-Ethylhexane	I	3EHX	10.0	10.0	U
1,2-Dibromoethane (EDB)	ADD	EDB	10.0	10.0	U
1-Octene	O	1O	10.0	10.0	U
Octane (nC8)	P	C8	10.0	10.0	U
2,4-Dimethylheptane (t)	I	24DMHP	10.0	10.0	U
2,5-Dimethylheptane (t)	I	25DMHP	10.0	10.0	U
Ethylbenzene	A	EB	10.0	10.0	U
2-Ethylthiophene	S	2ETHIO	10.0	10.0	U
2,3-Dimethylheptane (t)	I	23DMHP	10.0	10.0	U
m-Xylene	A	MX	10.0	10.0	U
p-Xylene	A	PX	10.0	10.0	U
4-Methyloctane (t)	I	4MO	10.0	10.0	U
2-Methyloctane (t)	I	2MO	10.0	10.0	U

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Lab ID: 23733-5
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-04-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
3-Methyloctane (t)	I	3MO	10.0	10.0	U
Styrene	A	STRE	10.0	10.0	U
o-Xylene	A	OX	10.0	10.0	U
1-Nonene	O	1N	10.0	10.0	U
Nonane (nC9)	P	C9	10.0	10.0	U
Isopropylbenzene (cumene)	A	IPROPB	10.0	10.0	U
n-Propylbenzene	A	NPRPPB	10.0	10.0	U
1-Methyl-3-ethylbenzene	A	1M3EB	10.0	10.0	U
1-Methyl-4-ethylbenzene	A	1M4EB	10.0	10.0	U
1,3,5-Trimethylbenzene (mesitylene)	A	135TMB	10.0	10.0	U
1-Methyl-2-ethylbenzene	A	1M2EB	10.0	10.0	U
1,2,4-Trimethylbenzene	A	124TMB	10.0	10.0	U
1-Decene	O	1D	10.0	10.0	U
Decane (nC10)	P	C10	10.0	10.0	U
sec-Butylbenzene	A	SBUB	10.0	10.0	U
1-Methyl-3-isopropylbenzene (m-cymene)	A	1M3IPROPE	10.0	10.0	U
1-Methyl-4-isopropylbenzene (p-cymene)	A	1M4IPROPE	10.0	10.0	U
Indane	A	IA	10.0	10.0	U
Indene	A	IE	10.0	10.0	U
1-Methyl-2-isopropybenzene (o-cymene)	A	1M2IPROPE	10.0	10.0	U
1-Methyl-3-propylbenzene	A	1M3PROPB	10.0	10.0	U
1-Methyl-4-propylbenzene	A	1M4PROPB	10.0	10.0	U
n-Butylbenzene	A	NBB	10.0	10.0	U
1,3-Dimethyl-5-ethylbenzene	A	13DM5EB	10.0	10.0	U
1,2,diethylbenzene	A	12DEB	10.0	10.0	U
1-Methyl-2-propylbenzene	A	1M2PROPB	10.0	10.0	U
1,4-Dimethyl-2-ethylbenzene	A	14DM2EB	10.0	10.0	U
1,3-Dimethyl-4-ethylbenzene	A	13DM4EB	10.0	10.0	U
1,2-Dimethyl-4-ethylbenzene	A	12DM4EB	10.0	10.0	U
1,3-Dimethyl-2-ethylbenzene	A	13DM2EB	10.0	10.0	U
1,2-Dimethyl-3-ethylbenzene	A	12DM3EB	10.0	10.0	U
Undecane (nC11)	P	C11	10.0	10.0	U
1,2,4,5-Tetramethylbenzene	A	1245TMB	10.0	10.0	U

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Lab ID: 23733-5
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-04-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
1,2,3,5-Tetramethylbenzene (t)	A	1235TMB	10.0	10.0	U
n-Pentylbenzene	A	NPYB	10.0	10.0	U
Naphthalene	A	N	10.0	10.0	U
Benzothiophene	S	BTHIO	10.0	10.0	U
Dodecane (nC12)	P	C12	10.0	10.0	U
1,2,3,4-Tetramethylbenzene (t)	A	1234TMB	10.0	10.0	U
MMT	ADD	MMT	10.0	10.0	U
2-Methylnaphthalene	A	2MN	10.0	10.0	U
1-Methylnaphthalene	A	1MN	10.0	10.0	U

1,2-Dichloroethane-d4 (RS)	88.01	%
Toluene-d8 (RS)	114.82	%
p-Bromofluorobenzene (RS)	92.20	%

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
J - Values greater than the ssRL but less than the PQL (3 x ssRL).
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631

090417-WATER5.D & dilution
090417-WATER5.D

Submitted by,
Pace Energy Services, LLC

PAES ID	**23733-5**
Sample ID	**HH01-01-04-170901-21**
Evaporation	
n-Pentane / (n-Pentane+n-Heptane)	U
2-Methylpentane / (2-Methylpentane+2-Methylheptane)	U
Waterwashing	
Benzene / (Benzene+Cyclohexane)	U
Toluene / (Toluene+Methylcyclohexane)	U
Aromatics / Total Paraffins (n+iso+cyc)	U
Aromatics / Naphthenes	U
wt% < o-xylene	U
Biodegradation	
(C4-C8 Para +Isopara) / C4-C8 Olefins	U
3-Methylhexane / n-Heptane	U
Methylcyclohexane / n-Heptane	U
Isoparaffins + Naphthenes / Paraffins	U
Diagnostic Ratios (Refining Properties)	
2,2,4-Trimethylpentane / (2,2,4-Trimethylpentane+Methylcyclohexane)	U
2,2,4-Trimethylpentane / Total TMPs	U
nC9 / Isopropylbenzene	U
nC10 / 1-Methyl-2-ethylbenzene	U
nC11 / 1,4-Dimethyl-2-ethylbenzene	U
iC5 / (iC5+nC5)	U
(2-methylhexane + 2,3dimethylpentane) / (3-methylhexane + 2,4	U
Naphthalene / (Naphthalene+nC12)	U
Methylcyclohexane/(Methylcyclohexane+Toluene)	U
Toluene/n-Octane	U
Oxygenates & Other (ug/L)	
Methyl-tert-butyl ether (MTBE)	U
Di-isopropyl ether (DIPE)	U
Ethyl-tert-butyl ether (ETBE)	U
Tert-amyl methyl ether (TAME)	U
MMT	U
Lead Scavengers (ug/L)	
1,2-Dichloroethane (EDC)	U
1,2-Dibromoethane (EDB)	U
Sulfur containing HCs (ug/L)	
Thiophene	U
2-Methylthiophene	U
3-Methylthiophene	U
2-Ethylthiophene	U
Benzothiophene	U
Relative Percentages	
% Paraffinic	0.0
% Isoparaffinic	0.0
% Aromatic	0.0
% Naphthenic	0.0
% Olefinic	0.0

Pace Analytical® Energy Services™

Jeff Wright
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Baton Rouge, LA 70817

Lab ID: 23733-6
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-05-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
Isopentane (2-Methylbutane)	I	IP	10.0	10.0	U
1-Pentene	O	1P	10.0	10.0	U
2-Methyl-1-butene	O	2M1B	10.0	10.0	U
Pentane (nC5)	P	C5	10.0	10.0	U
trans-2-pentene	O	T2P	10.0	10.0	U
cis-2-pentene	O	C2P	10.0	10.0	U
2-Methyl-2-butene (t)	O	2M2B	10.0	10.0	U
2,2-Dimethylbutane (t)	I	22DMB	10.0	10.0	U
Cyclopentane	N	CYP	10.0	10.0	U
2,3-Dimethylbutane	I	23DMB	10.0	10.0	U
2-Methylpentane	I	2MP	10.0	10.0	U
Methyl-tert-butyl ether (MTBE)	ADD	MTBE	10.0	10.0	U
3-Methylpentane	P	3MP	10.0	10.0	U
1-Hexene	O	1HX	10.0	10.0	U
Hexane (nC6)	P	C6	10.0	10.0	U
Di-isopropyl ether (DIPE)	ADD	DIPE	10.0	10.0	U
trans-2-hexene (t)	O	T2HE	10.0	10.0	U
2-Methyl-2-pentene (t)	O	2M2P	10.0	10.0	U
cis-2-hexene (t)	O	C2HE	10.0	10.0	U
cis-3-Methyl-2-pentene (t)	O	C3M2P	10.0	10.0	U
Ethyl-tert-butyl ether (ETBE)	ADD	ETBE	10.0	10.0	U
2,2-Dimethylpentane (t)	I	22DMP	10.0	10.0	U
Methylcyclopentane	N	MCYP	10.0	10.0	U
2,4-Dimethylpentane	I	24DMP	10.0	10.0	U
1,2-Dichloroethane (EDC)	ADD	EDC	10.0	10.0	U
Benzene	A	B	10.0	10.0	U
3,3-Dimethylpentane (t)	I	33DMP	10.0	10.0	U
Thiophene	S	THIO	10.0	10.0	U
Cyclohexane	N	CYH	10.0	10.0	U
2-Methylhexane	I	2MH	10.0	10.0	U
2,3-Dimethylpentane	I	23DMP	10.0	10.0	U
Tert-amyl methyl ether (TAME)	ADD	TAME	10.0	10.0	U
3-Methylhexane	I	3MH	10.0	10.0	U

Jeff Wright		**Lab ID:**	**23733-6**
Weston Solutions		**Collected:**	**9/1/2017**
13702 Coursey Blvd		**Received:**	**9/3/2017**
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**Client ID:**	**HH01-01-05-170901-21**
Project #:	**66666**	**Analyzed:**	**9/6/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
trans-1,3-Dimethylcyclopentane (t)	N	T13DMCYP	10.0	10.0	U
cis-1,3-Dimethylcyclopentane (t)	N	C13DMCYP	10.0	10.0	U
trans-1,2-Dimethylcyclopentane (t)	N	T12DMCYP	10.0	10.0	U
2,2,4-Trimethylpentane (isooctane)	I	224TMP	10.0	10.0	U
1-Heptene	O	1HP	10.0	10.0	U
Heptane (nC7)	P	C7	10.0	10.0	U
trans-2-heptene (t)	O	T2HP	10.0	10.0	U
Methylcyclohexane	N	MCYH	10.0	10.0	U
2,5-Dimethylhexane	I	25DMH	10.0	10.0	U
2,2,3-Trimethylpentane	I	233TMP	10.0	10.0	U
2,4-Dimethylhexane	I	24DMH	10.0	10.0	U
2,3,4-Trimethylpentane	I	234TMP	10.0	10.0	U
2,3,3-Trimethylpentane	I	233TMP	10.0	10.0	U
Toluene	A	T	10.0	10.0	U
2-Methylthiophene	S	2MTHIO	10.0	10.0	U
2,3-Dimethylhexane	I	23DMH	10.0	10.0	U
3-Methylthiophene	S	3MTHIO	10.0	10.0	U
2-Methylheptane	I	2MHP	10.0	10.0	U
4-Methylheptane (t)	I	4MHP	10.0	10.0	U
3-Methylheptane	I	3MHP	10.0	10.0	U
3-Ethylhexane	I	3EHX	10.0	10.0	U
1,2-Dibromoethane (EDB)	ADD	EDB	10.0	10.0	U
1-Octene	O	1O	10.0	10.0	U
Octane (nC8)	P	C8	10.0	10.0	U
2,4-Dimethylheptane (t)	I	24DMHP	10.0	10.0	U
2,5-Dimethylheptane (t)	I	25DMHP	10.0	10.0	U
Ethylbenzene	A	EB	10.0	10.0	U
2-Ethylthiophene	S	2ETHIO	10.0	10.0	U
2,3-Dimethylheptane (t)	I	23DMHP	10.0	10.0	U
m-Xylene	A	MX	10.0	10.0	U
p-Xylene	A	PX	10.0	10.0	U
4-Methyloctane (t)	I	4MO	10.0	10.0	U
2-Methyloctane (t)	I	2MO	10.0	10.0	U

Jeff Wright
Weston Solutions
13702 Coursey Blvd
Baton Rouge, LA 70817

Lab ID: 23733-6
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-05-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
3-Methyloctane (t)	I	3MO	10.0	10.0	U
Styrene	A	STRE	10.0	10.0	U
o-Xylene	A	OX	10.0	10.0	U
1-Nonene	O	1N	10.0	10.0	U
Nonane (nC9)	P	C9	10.0	10.0	U
Isopropylbenzene (cumene)	A	IPROPB	10.0	10.0	U
n-Propylbenzene	A	NPRPPB	10.0	10.0	U
1-Methyl-3-ethylbenzene	A	1M3EB	10.0	10.0	U
1-Methyl-4-ethylbenzene	A	1M4EB	10.0	10.0	U
1,3,5-Trimethylbenzene (mesitylene)	A	135TMB	10.0	10.0	U
1-Methyl-2-ethylbenzene	A	1M2EB	10.0	10.0	U
1,2,4-Trimethylbenzene	A	124TMB	10.0	10.0	U
1-Decene	O	1D	10.0	10.0	U
Decane (nC10)	P	C10	10.0	10.0	U
sec-Butylbenzene	A	SBUB	10.0	10.0	U
1-Methyl-3-isopropylbenzene (m-cymene)	A	1M3IPROPE	10.0	10.0	U
1-Methyl-4-isopropylbenzene (p-cymene)	A	1M4IPROPE	10.0	10.0	U
Indane	A	IA	10.0	10.0	U
Indene	A	IE	10.0	10.0	U
1-Methyl-2-isopropybenzene (o-cymene)	A	1M2IPROPE	10.0	10.0	U
1-Methyl-3-propylbenzene	A	1M3PROPB	10.0	10.0	U
1-Methyl-4-propylbenzene	A	1M4PROPB	10.0	10.0	U
n-Butylbenzene	A	NBB	10.0	10.0	U
1,3-Dimethyl-5-ethylbenzene	A	13DM5EB	10.0	10.0	U
1,2,diethylbenzene	A	12DEB	10.0	10.0	U
1-Methyl-2-propylbenzene	A	1M2PROPB	10.0	10.0	U
1,4-Dimethyl-2-ethylbenzene	A	14DM2EB	10.0	10.0	U
1,3-Dimethyl-4-ethylbenzene	A	13DM4EB	10.0	10.0	U
1,2-Dimethyl-4-ethylbenzene	A	12DM4EB	10.0	10.0	U
1,3-Dimethyl-2-ethylbenzene	A	13DM2EB	10.0	10.0	U
1,2-Dimethyl-3-ethylbenzene	A	12DM3EB	10.0	10.0	U
Undecane (nC11)	P	C11	10.0	10.0	U
1,2,4,5-Tetramethylbenzene	A	1245TMB	10.0	10.0	U

Pace Analytical® Energy Services™

Jeff Wright
Weston Solutions
13702 Coursey Blvd
Baton Rouge, LA 70817

Lab ID: 23733-6
Collected: 9/1/2017
Received: 9/3/2017
Matrix: Water

Project: Arkema
Project #: 66666
Collected by:

Client ID: HH01-01-05-170901-21
Analyzed: 9/6/2017
Q Method: 082317.M

CONSTITUENTS	CLASS	ABBR.	ssRL ug/L	RESULT ug/L	QUALIFIER
1,2,3,5-Tetramethylbenzene (t)	A	1235TMB	10.0	10.0	U
n-Pentylbenzene	A	NPYB	10.0	10.0	U
Naphthalene	A	N	10.0	10.0	U
Benzothiophene	S	BTHIO	10.0	10.0	U
Dodecane (nC12)	P	C12	10.0	10.0	U
1,2,3,4-Tetramethylbenzene (t)	A	1234TMB	10.0	10.0	U
MMT	ADD	MMT	10.0	10.0	U
2-Methylnaphthalene	A	2MN	10.0	10.0	U
1-Methylnaphthalene	A	1MN	10.0	10.0	U

1,2-Dichloroethane-d4 (RS)	83.85	%
Toluene-d8 (RS)	113.37	%
p-Bromofluorobenzene (RS)	89.77	%

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
J - Values greater than the ssRL but less than the PQL (3 x ssRL).
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631

090417-WATER6.D & dilution
090417-WATER6.D

Submitted by,
Pace Energy Services, LLC

PAES ID	**23733-6**
Sample ID	**HH01-01-05-170901-21**
Evaporation	
n-Pentane / (n-Pentane+n-Heptane)	U
2-Methylpentane / (2-Methylpentane+2-Methylheptane)	U
Waterwashing	
Benzene / (Benzene+Cyclohexane)	U
Toluene / (Toluene+Methylcyclohexane)	U
Aromatics / Total Paraffins (n+iso+cyc)	U
Aromatics / Naphthenes	U
wt% < o-xylene	U
Biodegradation	
(C4-C8 Para +Isopara) / C4-C8 Olefins	U
3-Methylhexane / n-Heptane	U
Methylcyclohexane / n-Heptane	U
Isoparaffins + Naphthenes / Paraffins	U
Diagnostic Ratios (Refining Properties)	
2,2,4-Trimethylpentane / (2,2,4-Trimethylpentane+Methylcyclohexane)	U
2,2,4-Trimethylpentane / Total TMPs	U
nC9 / Isopropylbenzene	U
nC10 / 1-Methyl-2-ethylbenzene	U
nC11 / 1,4-Dimethyl-2-ethylbenzene	U
iC5 / (iC5+nC5)	U
(2-methylhexane + 2,3dimethylpentane) / (3-methylhexane + 2,4	U
Naphthalene / (Naphthalene+nC12)	U
Methylcyclohexane/(Methylcyclohexane+Toluene)	U
Toluene/n-Octane	U
Oxygenates & Other (ug/L)	
Methyl-tert-butyl ether (MTBE)	U
Di-isopropyl ether (DIPE)	U
Ethyl-tert-butyl ether (ETBE)	U
Tert-amyl methyl ether (TAME)	U
MMT	U
Lead Scavengers (ug/L)	
1,2-Dichloroethane (EDC)	U
1,2-Dibromoethane (EDB)	U
Sulfur containing HCs (ug/L)	
Thiophene	U
2-Methylthiophene	U
3-Methylthiophene	U
2-Ethylthiophene	U
Benzothiophene	U
Relative Percentages	
% Paraffinic	0.0
% Isoparaffinic	0.0
% Aromatic	0.0
% Naphthenic	0.0
% Olefinic	0.0

Supporting Quality Control Results

Jeff Wright		**Lab ID:**	**090417-BLK.D**
Weston Solutions		**Collected:**	
13702 Coursey Blvd		**Received:**	
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**QC type:**	**Method Blank**
Project #:	**66666**	**Analyzed:**	**9/5/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
Isopentane (2-Methylbutane)	0.5	0.6	
1-Pentene	0.5	0.5	U
2-Methyl-1-butene	0.5	0.5	U
Pentane (nC5)	0.5	0.5	U
trans-2-pentene	0.5	0.5	U
cis-2-pentene	0.5	0.5	U
2-Methyl-2-butene (t)	0.5	0.5	U
2,2-Dimethylbutane (t)	0.5	0.5	U
Cyclopentane	0.5	0.5	U
2,3-Dimethylbutane	0.5	0.5	U
2-Methylpentane	0.5	0.5	U
Methyl-tert-butyl ether (MTBE)	0.5	0.5	U
3-Methylpentane	0.5	0.5	U
1-Hexene	0.5	0.5	U
Hexane (nC6)	0.5	0.5	U
Di-isopropyl ether (DIPE)	0.5	0.5	U
trans-2-hexene (t)	0.5	0.5	U
2-Methyl-2-pentene (t)	0.5	0.5	U
cis-2-hexene (t)	0.5	0.5	U
cis-3-Methyl-2-pentene (t)	0.5	0.5	U
Ethyl-tert-butyl ether (ETBE)	0.5	0.5	U
2,2-Dimethylpentane (t)	0.5	0.5	U
Methylcyclopentane	0.5	0.5	U
2,4-Dimethylpentane	0.5	0.5	U
1,2-Dichloroethane (EDC)	0.5	0.5	U
Benzene	0.5	0.5	U
3,3-Dimethylpentane (t)	0.5	0.5	U
Thiophene	0.5	0.5	U
Cyclohexane	0.5	0.5	U
2-Methylhexane	0.5	0.5	U
2,3-Dimethylpentane	0.5	0.5	U
Tert-amyl methyl ether (TAME)	0.5	0.5	U

Jeff Wright		**Lab ID:**	**090417-BLK.D**
Weston Solutions		**Collected:**	
13702 Coursey Blvd		**Received:**	
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**QC type:**	**Method Blank**
Project #:	**66666**	**Analyzed:**	**9/5/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
3-Methylhexane	0.5	0.5	U
trans-1,3-Dimethylcyclopentane (t)	0.5	0.5	U
cis-1,3-Dimethylcyclopentane (t)	0.5	0.5	U
trans-1,2-Dimethylcyclopentane (t)	0.5	0.5	U
2,2,4-Trimethylpentane (isooctane)	0.5	0.5	U
1-Heptene	0.5	0.5	U
Heptane (nC7)	0.5	0.5	U
trans-2-heptene (t)	0.5	0.5	U
Methylcyclohexane	0.5	0.5	U
2,5-Dimethylhexane	0.5	0.5	U
2,2,3-Trimethylpentane	0.5	0.5	U
2,4-Dimethylhexane	0.5	0.5	U
2,3,4-Trimethylpentane	0.5	0.5	U
2,3,3-Trimethylpentane	0.5	0.5	U
Toluene	0.5	0.5	U
2-Methylthiophene	0.5	0.5	U
2,3-Dimethylhexane	0.5	0.5	U
3-Methylthiophene	0.5	0.5	U
2-Methylheptane	0.5	0.5	U
4-Methylheptane (t)	0.5	0.5	U
3-Methylheptane	0.5	0.5	U
3-Ethylhexane	0.5	0.5	U
1,2-Dibromoethane (EDB)	0.5	0.5	U
1-Octene	0.5	0.5	U
Octane (nC8)	0.5	0.5	U
2,4-Dimethylheptane (t)	0.5	0.5	U
2,5-Dimethylheptane (t)	0.5	0.5	U
Ethylbenzene	0.5	0.5	U
2-Ethylthiophene	0.5	0.5	U
2,3-Dimethylheptane (t)	0.5	0.5	U
m-Xylene	0.5	0.5	U
p-Xylene	0.5	0.5	U

Jeff Wright		**Lab ID:**	**090417-BLK.D**
Weston Solutions		**Collected:**	
13702 Coursey Blvd		**Received:**	
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**QC type:**	**Method Blank**
Project #:	**66666**	**Analyzed:**	**9/5/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
4-Methyloctane (t)	0.5	0.5	U
2-Methyloctane (t)	0.5	0.5	U
3-Methyloctane (t)	0.5	0.5	U
Styrene	0.5	0.5	U
o-Xylene	0.5	0.5	U
1-Nonene	0.5	0.5	U
Nonane (nC9)	0.5	0.5	U
Isopropylbenzene (cumene)	0.5	0.5	U
n-Propylbenzene	0.5	0.5	U
1-Methyl-3-ethylbenzene	0.5	0.5	U
1-Methyl-4-ethylbenzene	0.5	0.5	U
1,3,5-Trimethylbenzene (mesitylene)	0.5	0.5	U
1-Methyl-2-ethylbenzene	0.5	0.5	U
1,2,4-Trimethylbenzene	0.5	0.5	U
1-Decene	0.5	0.5	U
Decane (nC10)	0.5	0.5	U
sec-Butylbenzene	0.5	0.5	U
1-Methyl-3-isopropylbenzene (m-cymene)	0.5	0.5	U
1-Methyl-4-isopropylbenzene (p-cymene)	0.5	0.5	U
Indane	0.5	0.5	U
Indene	0.5	0.5	U
1-Methyl-2-isopropybenzene (o-cymene)	0.5	0.5	U
1-Methyl-3-propylbenzene	0.5	0.5	U
1-Methyl-4-propylbenzene	0.5	0.5	U
n-Butylbenzene	0.5	0.5	U
1,3-Dimethyl-5-ethylbenzene	0.5	0.5	U
1,2,diethylbenzene	0.5	0.5	U
1-Methyl-2-propylbenzene	0.5	0.5	U
1,4-Dimethyl-2-ethylbenzene	0.5	0.5	U
1,3-Dimethyl-4-ethylbenzene	0.5	0.5	U
1,2-Dimethyl-4-ethylbenzene	0.5	0.5	U
1,3-Dimethyl-2-ethylbenzene	0.5	0.5	U

Jeff Wright		**Lab ID:**	**090417-BLK.D**
Weston Solutions		**Collected:**	
13702 Coursey Blvd		**Received:**	
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**QC type:**	**Method Blank**
Project #:	**66666**	**Analyzed:**	**9/5/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	ssRL ug/L	RESULT ug/L	QUAL
1,2-Dimethyl-3-ethylbenzene	0.5	0.5	U
Undecane (nC11)	0.5	0.5	U
1,2,4,5-Tetramethylbenzene	0.5	0.5	U
1,2,3,5-Tetramethylbenzene (t)	0.5	0.5	U
n-Pentylbenzene	0.5	0.5	U
Naphthalene	0.5	0.5	U
Benzothiophene	0.5	0.5	U
Dodecane (nC12)	0.5	0.5	U
1,2,3,4-Tetramethylbenzene (t)	0.5	0.5	U
MMT	0.5	0.5	U
2-Methylnaphthalene	0.5	0.5	U
1-Methylnaphthalene	0.5	0.5	U
1,2-Dichloroethane-d4 (RS) %		90	
Toluene-d8 (RS) %		108	
p-Bromofluorobenzene (RS) %		87	

ssRL - Sample Specific Reporting Limit
Results listed as U would have been reported if present at or above the listed ssRL
B - Exceeds PQL - 3 x ssRL
Q - Surrogate recovery limit exceedance
NC - Not calibrated
J - Values greater than the ssRL but less than the PQL.
Note: Extracted by EPA 5030 (Purge and Trap).

US631
090417-BLK.D

Submitted by,
Pace Energy Services, LLC

Jeff Wright		**Lab ID:**	**090417-25LCS.D**
Weston Solutions		**Collected:**	
13702 Coursey Blvd		**Received:**	
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**QC type:**	**LCS**
Project #:	**66666**	**Analyzed:**	**9/5/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	RESULT ug/L	Recovery %	Spike Conc. ug/L	QUAL
1-Pentene	33.0	132.1	25.0	
Pentane (nC5)	33.0	132.1	25.0	
Cyclopentane	11.5	46.1	25.0	LQ
1-Hexene	21.6	86.2	25.0	
Hexane (nC6)	17.0	68.1	25.0	
Di-isopropyl ether (DIPE)	20.5	82.1	25.0	
Ethyl-tert-butyl ether (ETBE)	17.7	70.8	25.0	
2,4-Dimethylpentane	21.0	83.8	25.0	
Benzene	18.2	72.9	25.0	
Cyclohexane	19.0	75.9	25.0	
Tert-amyl methyl ether (TAME)	17.2	68.6	25.0	
2,2,4-Trimethylpentane (isooctane)	18.6	74.2	25.0	
Heptane (nC7)	24.4	97.5	25.0	
Toluene	21.8	87.0	25.0	
Octane (nC8)	19.6	78.6	25.0	
Ethylbenzene	21.6	86.5	25.0	
m-Xylene	21.1	84.5	25.0	
p-Xylene	21.2	84.7	25.0	
o-Xylene	20.5	81.8	25.0	
Nonane (nC9)	18.3	73.1	25.0	
n-Propylbenzene	21.3	85.0	25.0	
1,3,5-Trimethylbenzene (mesitylene)	19.5	78.2	25.0	
1-Decene	16.8	67.0	25.0	
Decane (nC10)	25.8	103.2	25.0	
n-Butylbenzene	19.8	79.1	25.0	
n-Pentylbenzene	16.1	64.6	25.0	
Dodecane (nC12)	250.6	400.9	62.5	LQ
1,2-Dichloroethane-d4 (RS)		93		
Toluene-d8 (RS)		109		
p-Bromofluorobenzene (RS)		89		

ssRL - Sample Specific Reporting Limit
Q - Surrogate recovery limit exceedance
I - Matrix Interference
NC - Not calibrated
LQ - Percent difference exceedance (50 - 140)
Note: Extracted by EPA 5030 (Purge and Trap).

US631
090417-25LCS.D

Submitted by,
Pace Energy Services, LLC

Jeff Wright		**Lab ID:**	**090417-25LCSD.D**
Weston Solutions		**Collected:**	
13702 Coursey Blvd		**Received:**	
Baton Rouge, LA 70817		**Matrix:**	**Water**
Project:	**Arkema**	**QC type:**	**LCSD**
Project #:	**66666**	**Analyzed:**	**9/5/2017**
Collected by:		**Q Method:**	**082317.M**

CONSTITUENTS	RESULT ug/L	Recovery %	Spike Conc. ug/L	RPD %	QUAL
1-Pentene	31.0	124.0	25.0	6.3	
Pentane (nC5)	30.8	123.3	25.0	6.9	
Cyclopentane	10.3	41.2	25.0	11.3	
1-Hexene	19.4	77.6	25.0	10.5	
Hexane (nC6)	16.3	65.1	25.0	4.4	
Di-isopropyl ether (DIPE)	20.5	82.2	25.0	0.1	
Ethyl-tert-butyl ether (ETBE)	17.5	70.1	25.0	1.0	
2,4-Dimethylpentane	18.7	74.6	25.0	11.6	
Benzene	16.5	66.0	25.0	9.8	
Cyclohexane	16.6	66.3	25.0	13.4	
Tert-amyl methyl ether (TAME)	16.1	64.3	25.0	6.5	
2,2,4-Trimethylpentane (isooctane)	17.4	69.4	25.0	6.7	
Heptane (nC7)	23.4	93.4	25.0	4.3	
Toluene	21.2	84.7	25.0	2.7	
Octane (nC8)	20.2	80.6	25.0	2.6	
Ethylbenzene	20.8	83.2	25.0	3.9	
m-Xylene	21.3	85.2	25.0	0.9	
p-Xylene	19.9	79.5	25.0	6.3	
o-Xylene	20.4	81.5	25.0	0.3	
Nonane (nC9)	19.8	79.3	25.0	8.1	
n-Propylbenzene	21.4	85.4	25.0	0.5	
1,3,5-Trimethylbenzene (mesitylene)	19.7	78.8	25.0	0.9	
1-Decene	18.5	73.9	25.0	9.8	
Decane (nC10)	23.4	93.6	25.0	9.7	
n-Butylbenzene	18.0	72.0	25.0	9.4	
n-Pentylbenzene	16.2	64.7	25.0	0.2	
Dodecane (nC12)	261.1	417.8	62.5	4.1	
1,2-Dichloroethane-d4 (RS)		87			
Toluene-d8 (RS)		115			
p-Bromofluorobenzene (RS)		99			

ssRL - Sample Specific Reporting Limit
Q - Surrogate recovery limit exceedance
I - Matrix Interference

NC - Not calibrated
RQ - Percent difference exceeded (15)
LQ - Percent difference exceedance (50 - 140)
Note: Extracted by EPA 5030 (Purge and Trap).

US631
090417-25LCSD.D

Submitted by,
Pace Energy Services, LLC

Jeff Wright
Weston Solutions
13702 Coursey Blvd
Baton Rouge, LA 70817

Lab ID: 23733
Collected:
Received:
Matrix: Product/Soil

Project: Arkema
Project #: 66666
Collected by:

QC type: NIST SRM 2295
Analyzed:
Q Method: 082317.M

CONSTITUENTS	RESULT mg/kg	ssRL mg/kg	D Flag	NIST Result mg/kg	Passing Diff. %	Actual Diff. %	QUAL
1-Pentene	5740.9	55.6		7400.0	40	25.3	
Pentane (nC5)	40416.2	277.8	D	35700.0	40	12.4	
Methyl-tert-butyl ether (MTBE)	104098.9	277.8	D	145400.0	40	33.1	
Hexane (nC6)	32010.0	277.8	D	37000.0	40	14.5	
2,4-Dimethylpentane	77415.6	277.8	D	79000.0	40	2.0	
Benzene	7988.9	55.6		9900.0	40	21.4	
Thiophene	234.6	55.6		260.0	40	10.3	
Cyclohexane	76141.7	277.8	D	88400.0	40	14.9	
2,2,4-Trimethylpentane (isoocta	100187.8	277.8	D	118000.0	40	16.3	
1-Heptene	18507.4	277.8	D	15000.0	40	20.9	
Heptane (nC7)	81577.2	277.8	D	77700.0	40	4.9	
Toluene	64436.7	277.8	D	78900.0	40	20.2	
3-Methylthiophene	326.7	55.6		300.0	40	8.5	
Octane (nC8)	65773.3	277.8	D	79800.0	40	19.3	
Ethylbenzene	18655.2	277.8	D	19600.0	40	4.9	
m,p-Xylenes	53991.2	555.6	D	58700.0	40	8.4	
o-Xylene	19270.9	277.8	D	19700.0	40	2.2	
1,3,5-Trimethylbenzene (mesityl	18168.3	277.8	D	19700.0	40	8.1	
1,2,4-Trimethylbenzene	18218.7	277.8	D	20010.0	40	9.4	
Decane (nC10)	26996.6	277.8	D	41400.0	40	42.1	SQ
1,2,4,5-Tetramethylbenzene	8496.6	55.6		9600.0	40	12.2	
Naphthalene	8058.2	55.6		11500.0	40	35.2	
Benzothiophene	336.2	55.6		440.0	40	26.8	

1,2-Dichloroethane-d4 (RS) %	102
Toluene-d8 (RS) %	108
p-Bromofluorobenzene (RS) %	99

ssRL - Sample Specific Reporting Limit
D - Secondary dilution perfomed
Q - Surrogate recovery limit exceedance
SQ - SRM percent difference exceeded
I - Matrix Interference
NC - Not calibrated
Note: Extracted by EPA 5030 (Purge and Trap).

US631
FALSE

Submitted by,
Pace Energy Services, LLC

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(C8-C40) Qualitative Molecular Characterization
by GC/MS - full scan mode
TIC, n-Alkanes, Iso-Alkanes, Isoprenoids, Alkylcyclohexanes,
C4-monoaromatics, Bicyclanes, Terpanes, Steranes

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C8-C40 - Qualitative Hydrocarbons Characterization
by GC/MS - full scan mode

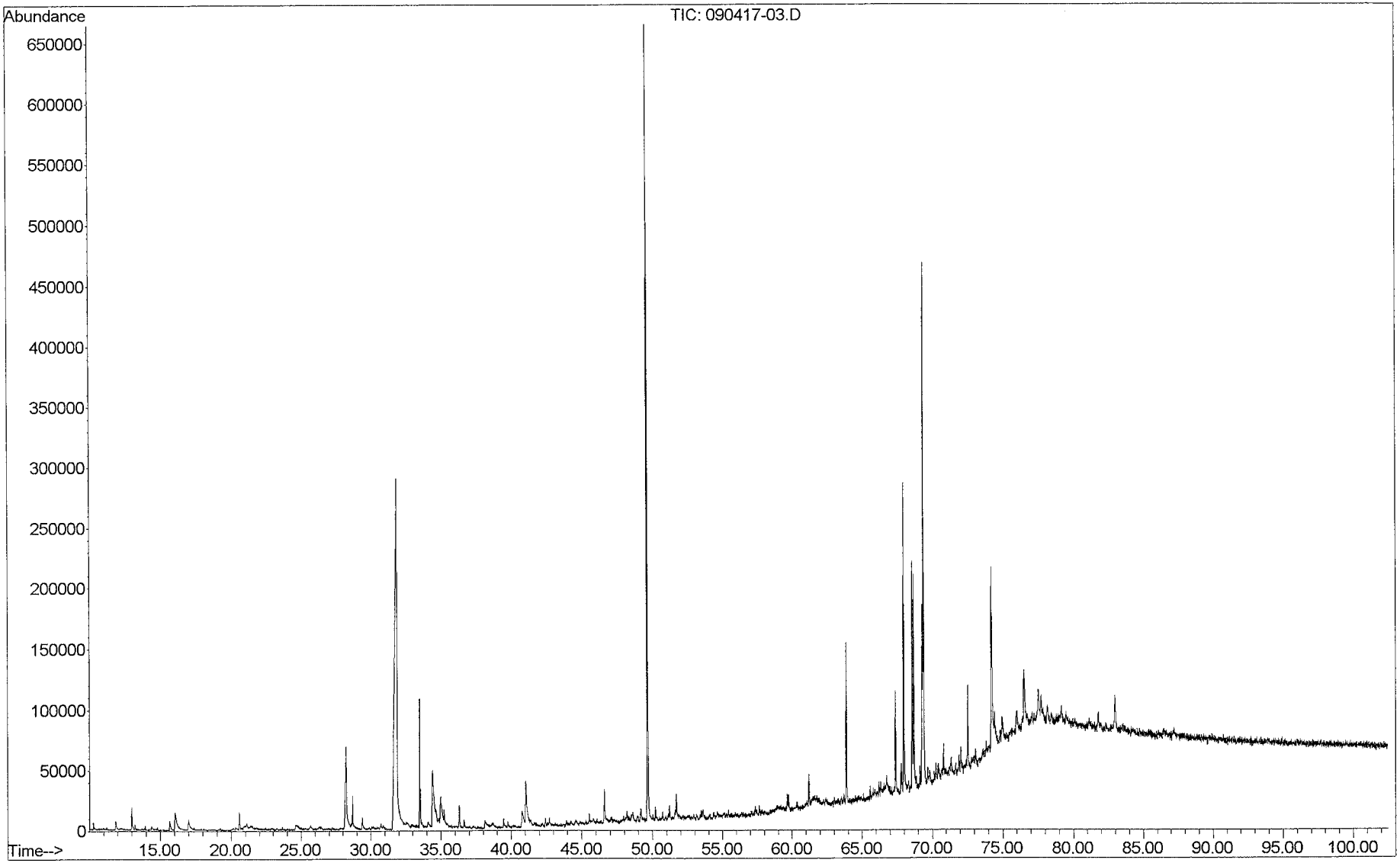
Mass Chromatograms

ION (m/z)	COMPOUND CLASS
TIC	All Compounds
85	n-Alkanes (Paraffins)
113	Iso-Alkanes (Isoparaffins) & Isoprenoids
83	Alkylcyclohexanes
134	C_4-benzenes (monoaromatics)
123	Bicyclanes
191	Terpanes
217	Steranes
Bar Diagram	Monoaromatic and Polyaromatic Hydrocarbon Distribution

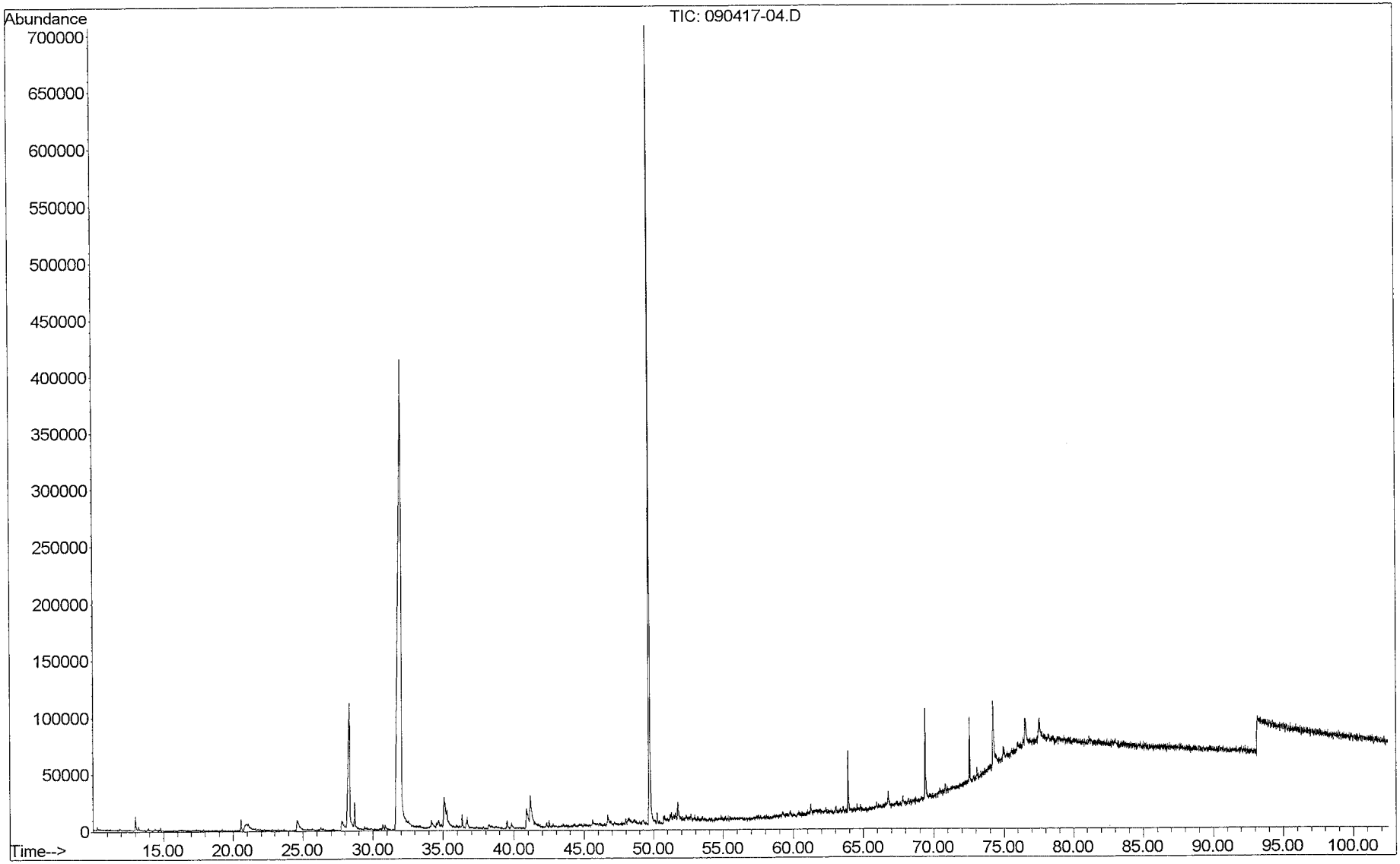
note: Chromatograms and data follow this cover page.

Submitted by,
Pace Analytical Energy Services

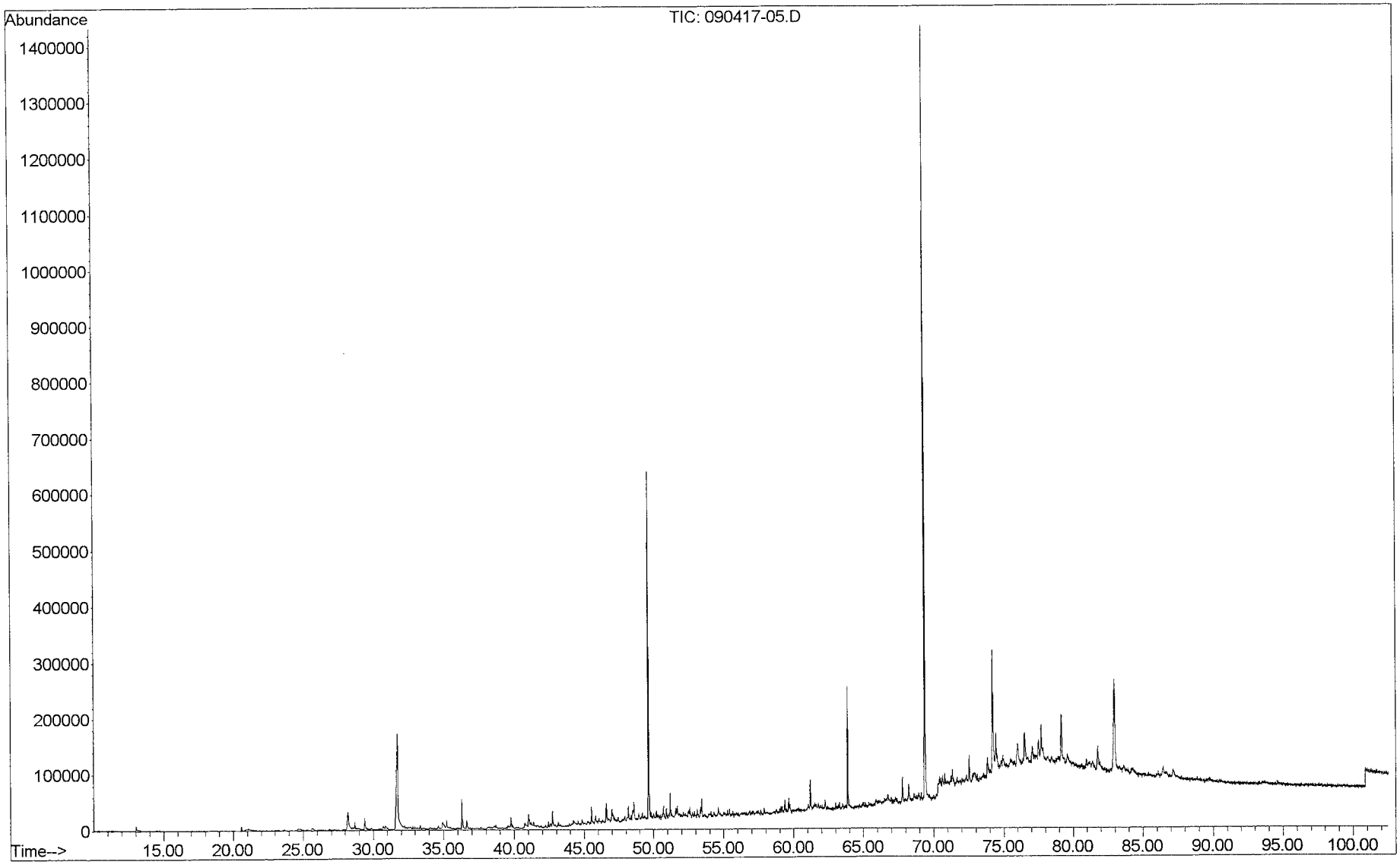
Sample Name: 23733-1 [HH01-01-01-170901-21]
Misc Info : 770mL->1mL



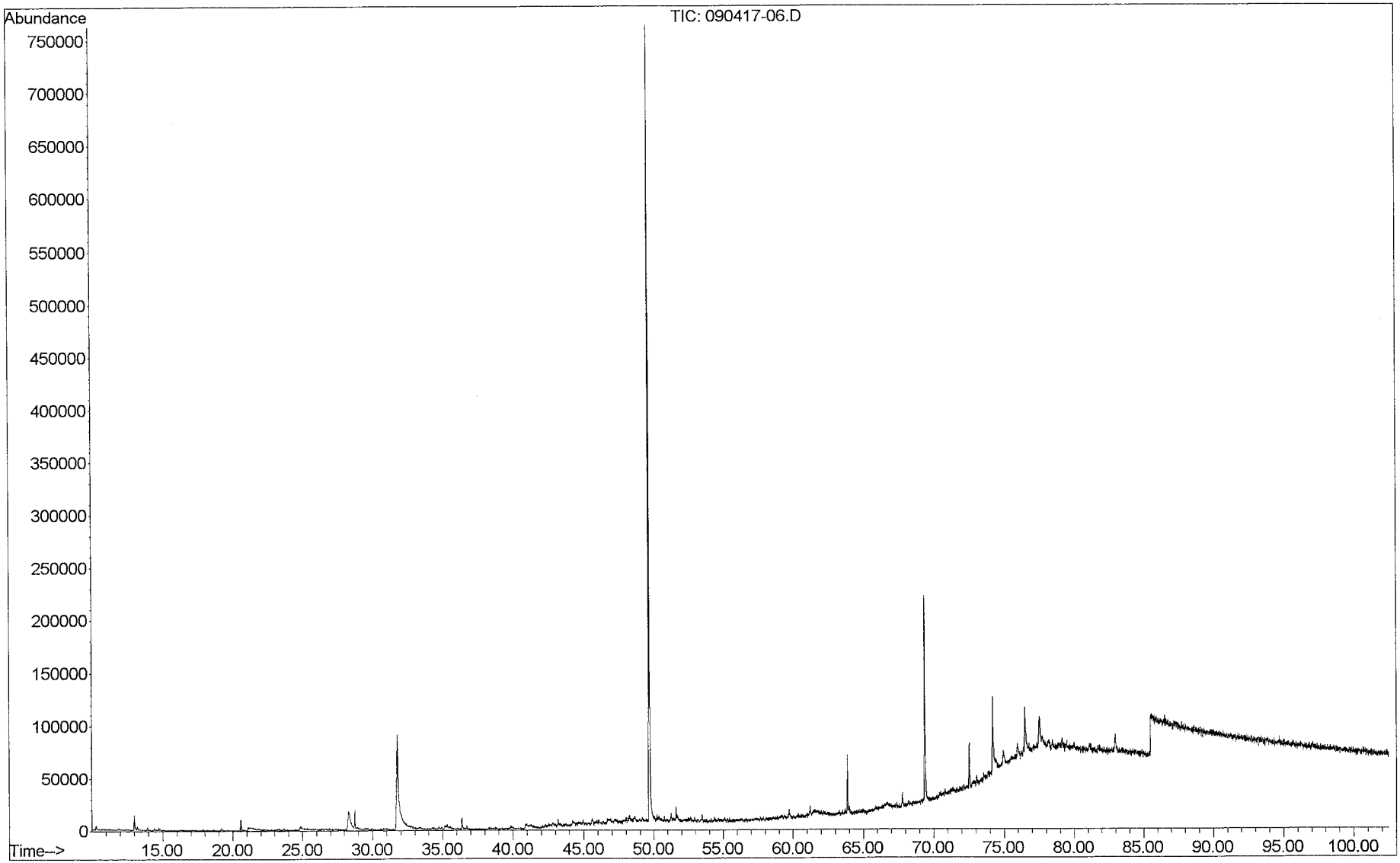
Sample Name: 23733-2 [HH01-01-02-170901-21]
Misc Info : 950mL->1mL



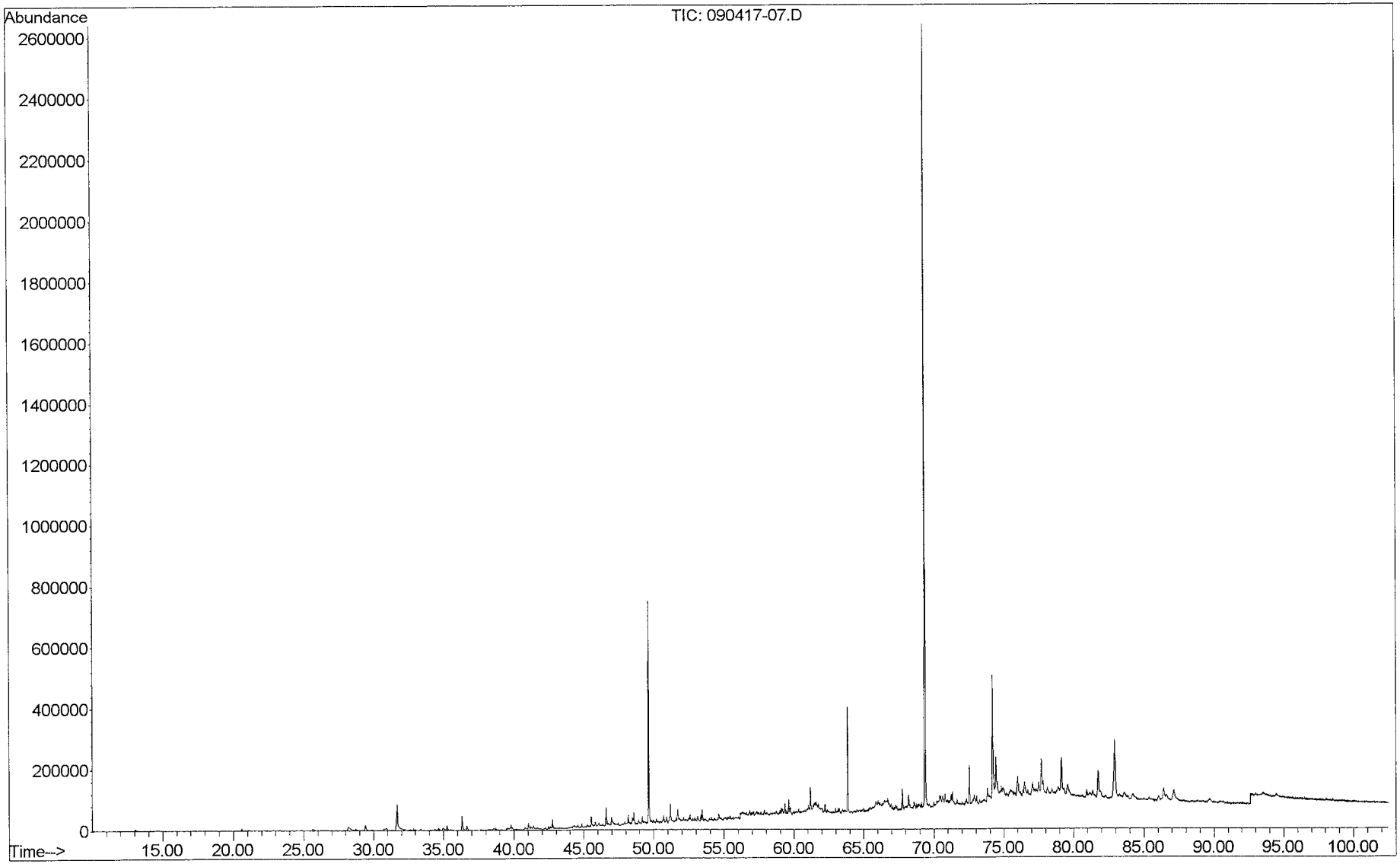
Sample Name: 23733-3 [HH01-01-03-170901-21]
Misc Info : 910mL->1mL



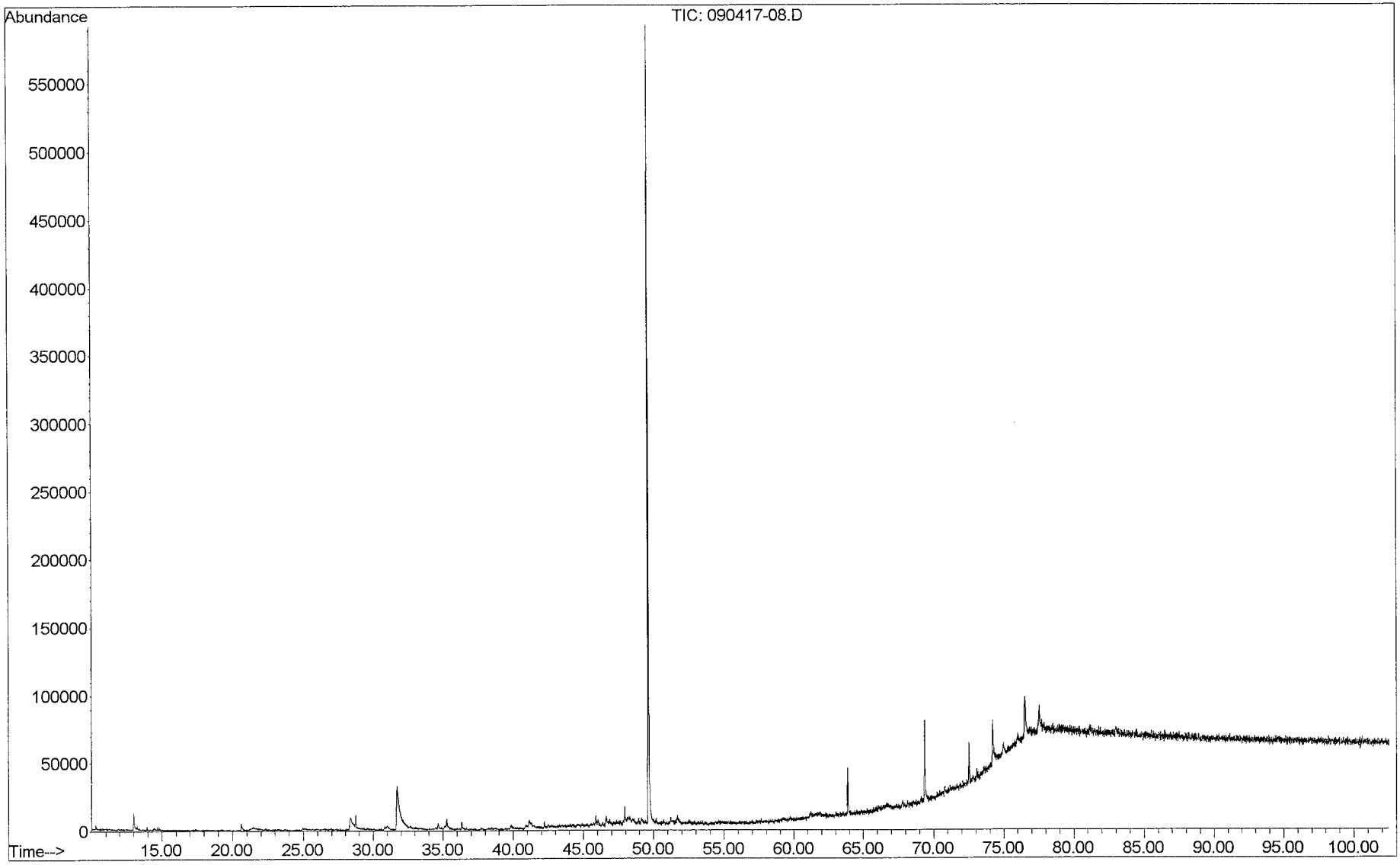
Sample Name: 23733-4 [HH01-01-03-170901-22]
Misc Info : 870mL->1mL



Sample Name: 23733-5 [HH01-01-04-170901-21]
Misc Info : 910mL->1mL



Sample Name: 23733-6 [HH01-01-05-170901-21]
Misc Info : 730mL->1mL



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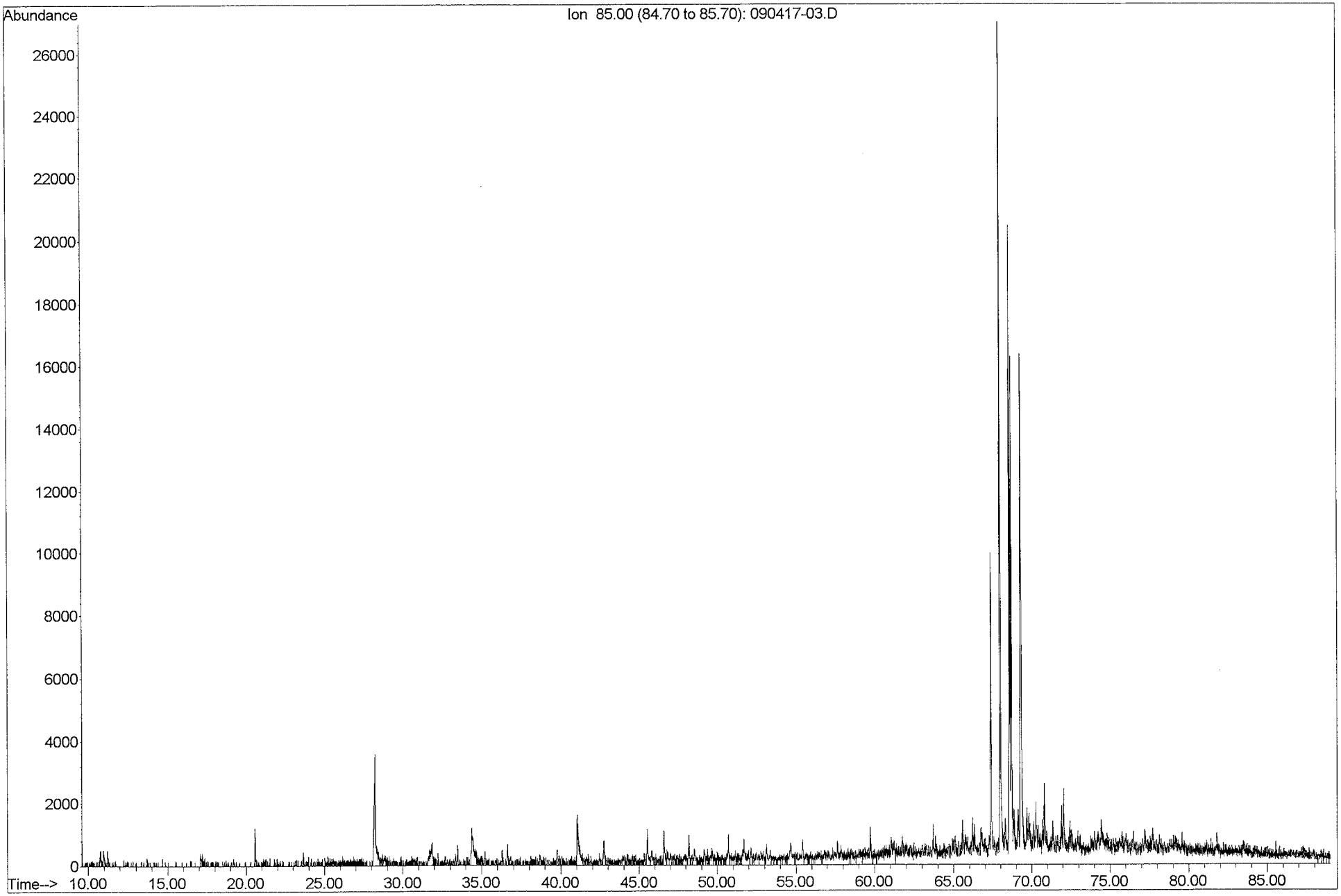
Key to Chromatogram Symbol Identification

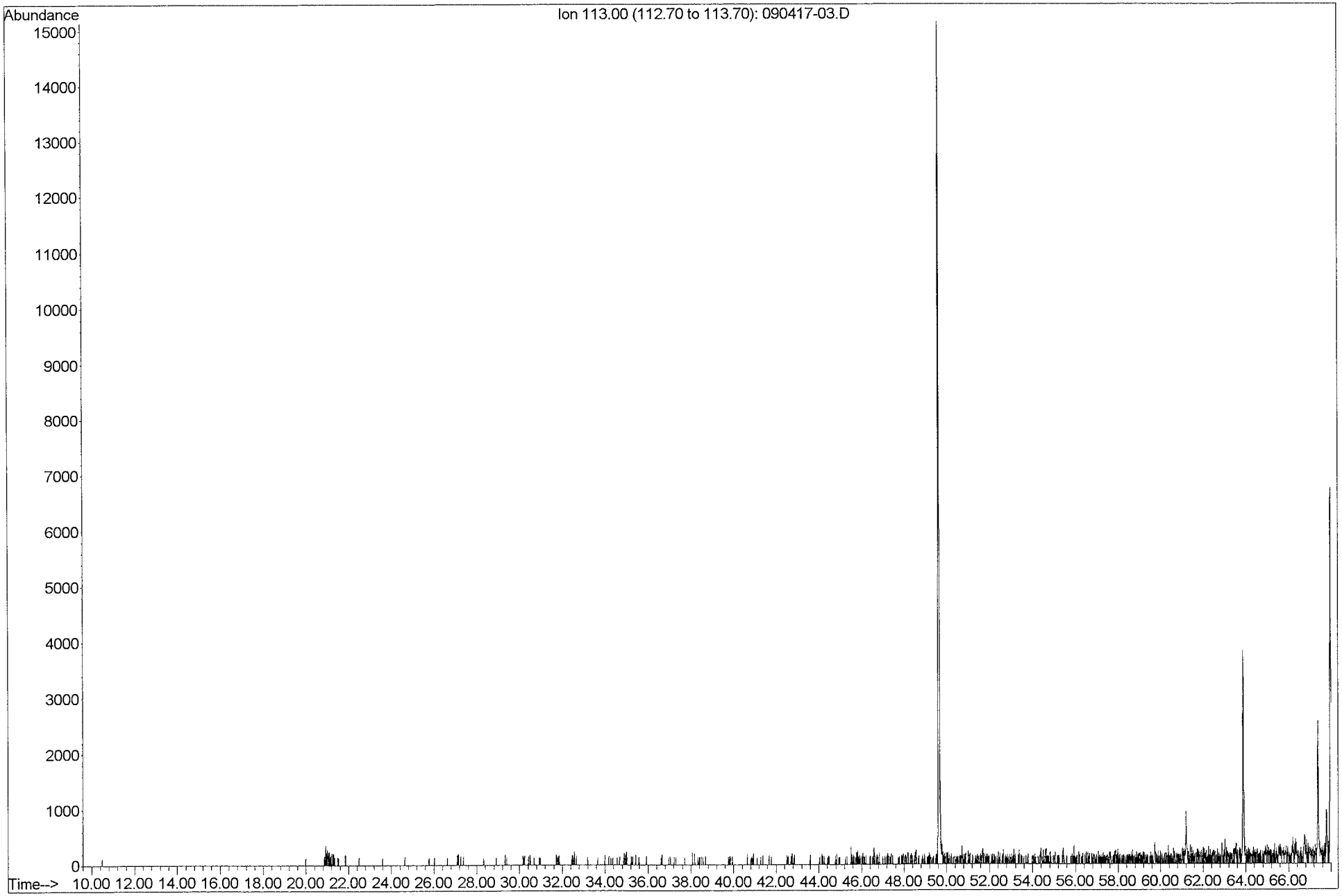
For m/z 85 and m/z 113 Paraffins and Isoparaffins

Symbol	Detail
i-10	Iso-alkane with 10 carbon atoms
i-15	Farnesane (isoprenoid with 15 carbon atoms)
i-16	Isoprenoid with 16 carbon atoms
Pr	Pristane (isoprenoid with 19 carbon atoms)
Ph	Phytane (isoprenoid with 20 carbon atoms)
nC_8	n-C_8 normal Alkane
nC_{15}	$_{n\text{-}C}$15 normal Alkane
i-8	2,5-(2,4)-Dimethylhexane
i-8′	2,3,4-Trimethylpentane
i-8ⁿ	2-3-Dimethylhexane
CH-n	Alkylcyclohexane (where n indicates the number of carbon atoms in the side chain)

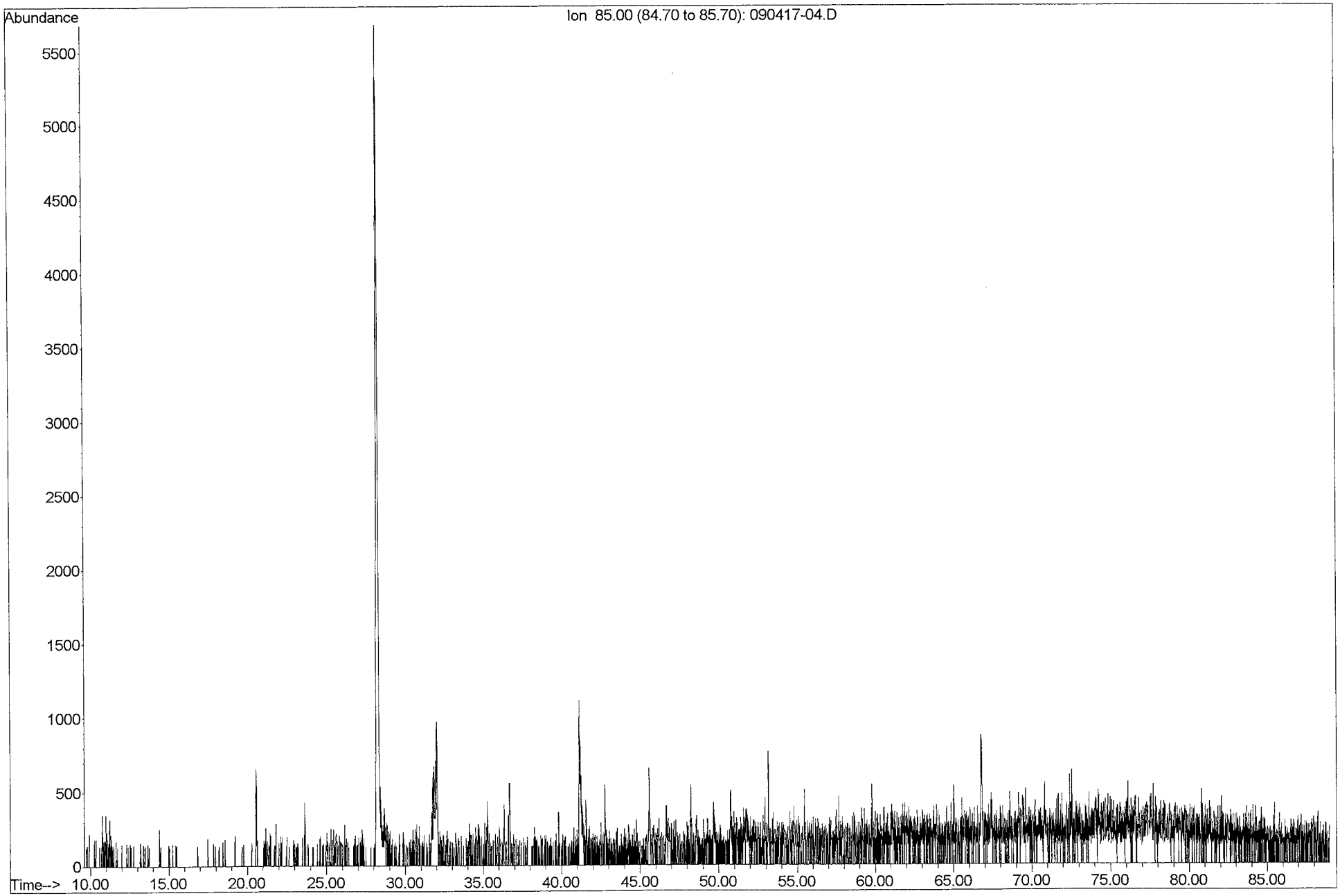
23733-1 [HH01-01-01-170901-21]
770mL->1mL



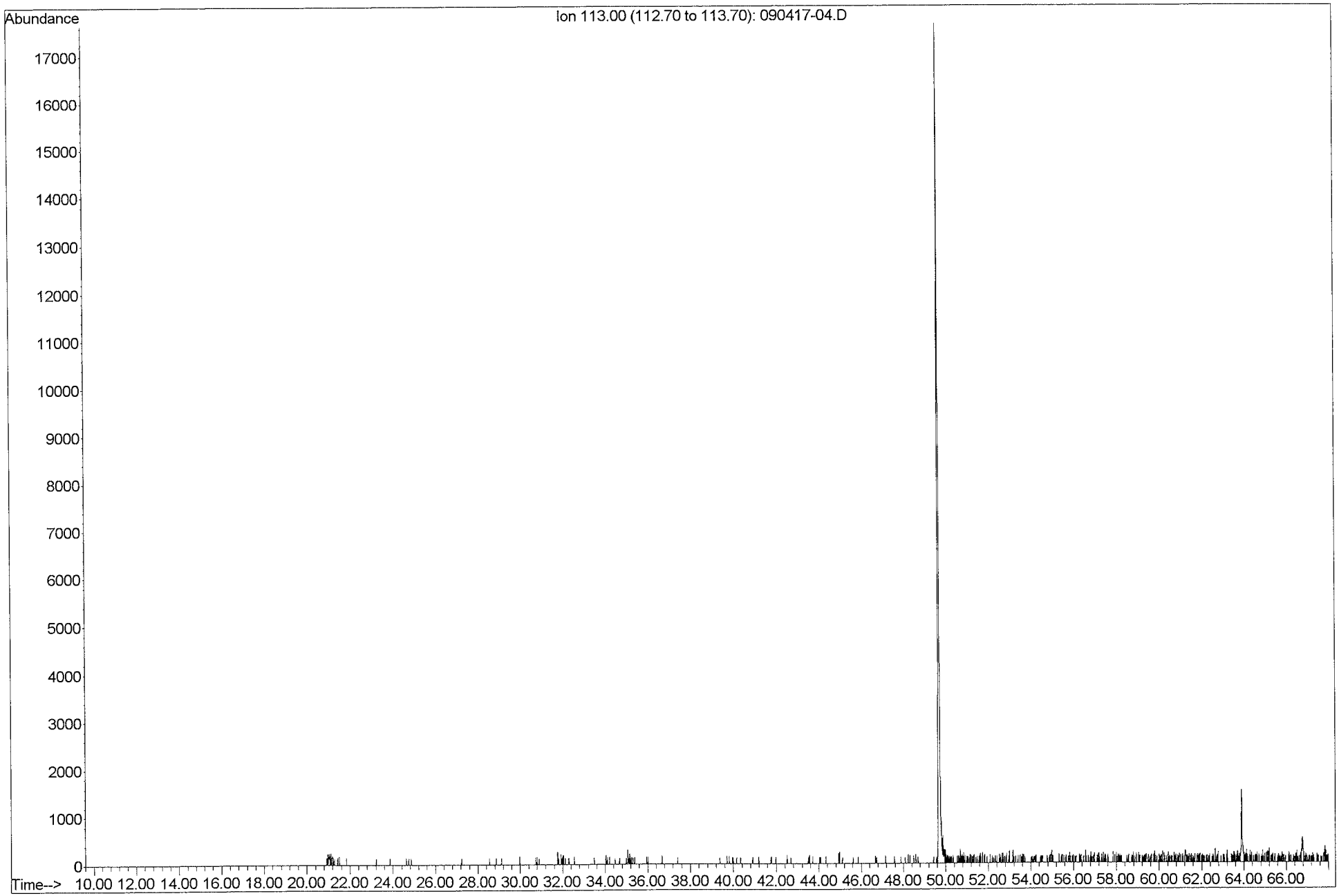
23733-1 [HH01-01-01-170901-21]
770mL->1mL



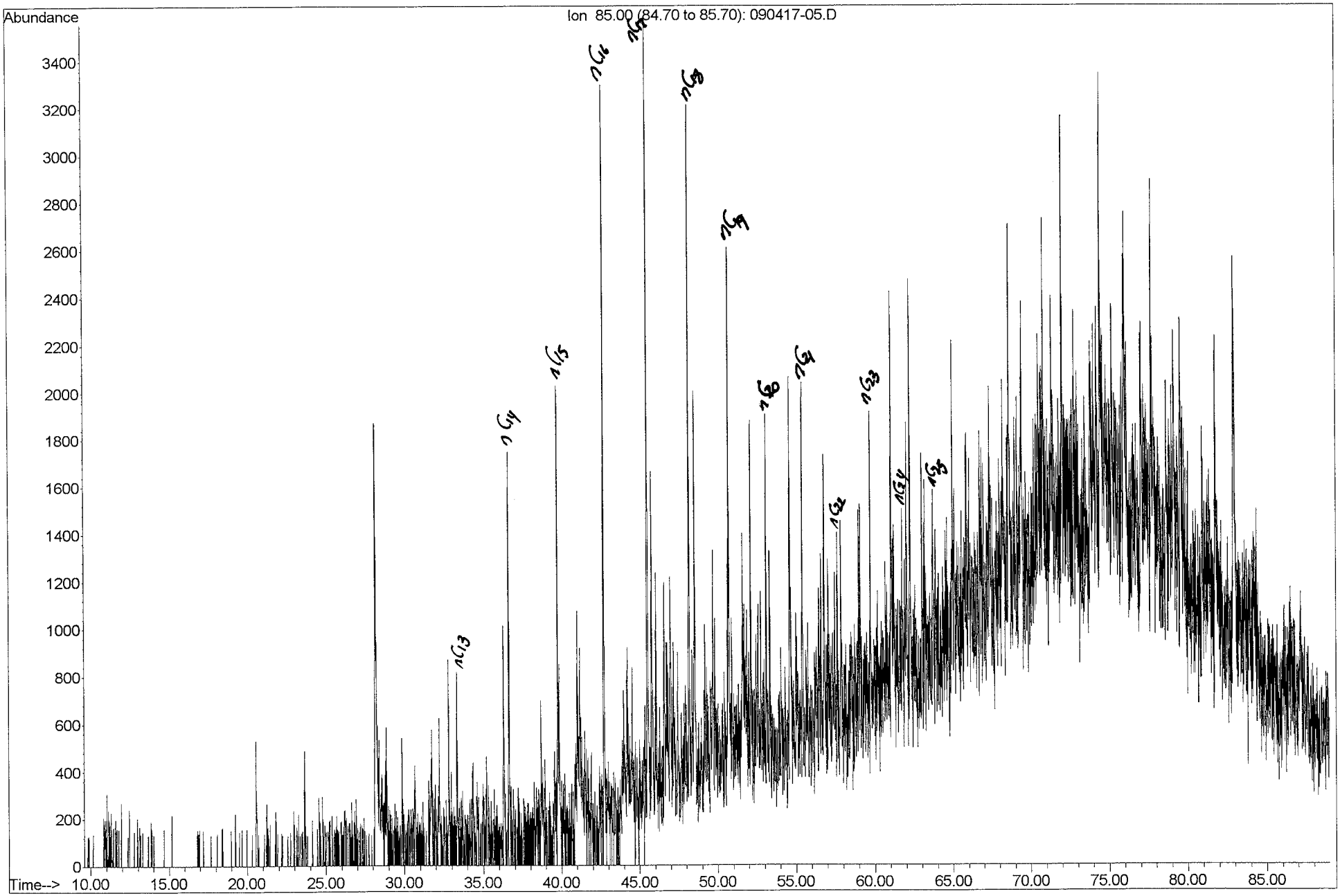
23733-2 [HH01-01-02-170901-21]
950mL->1mL



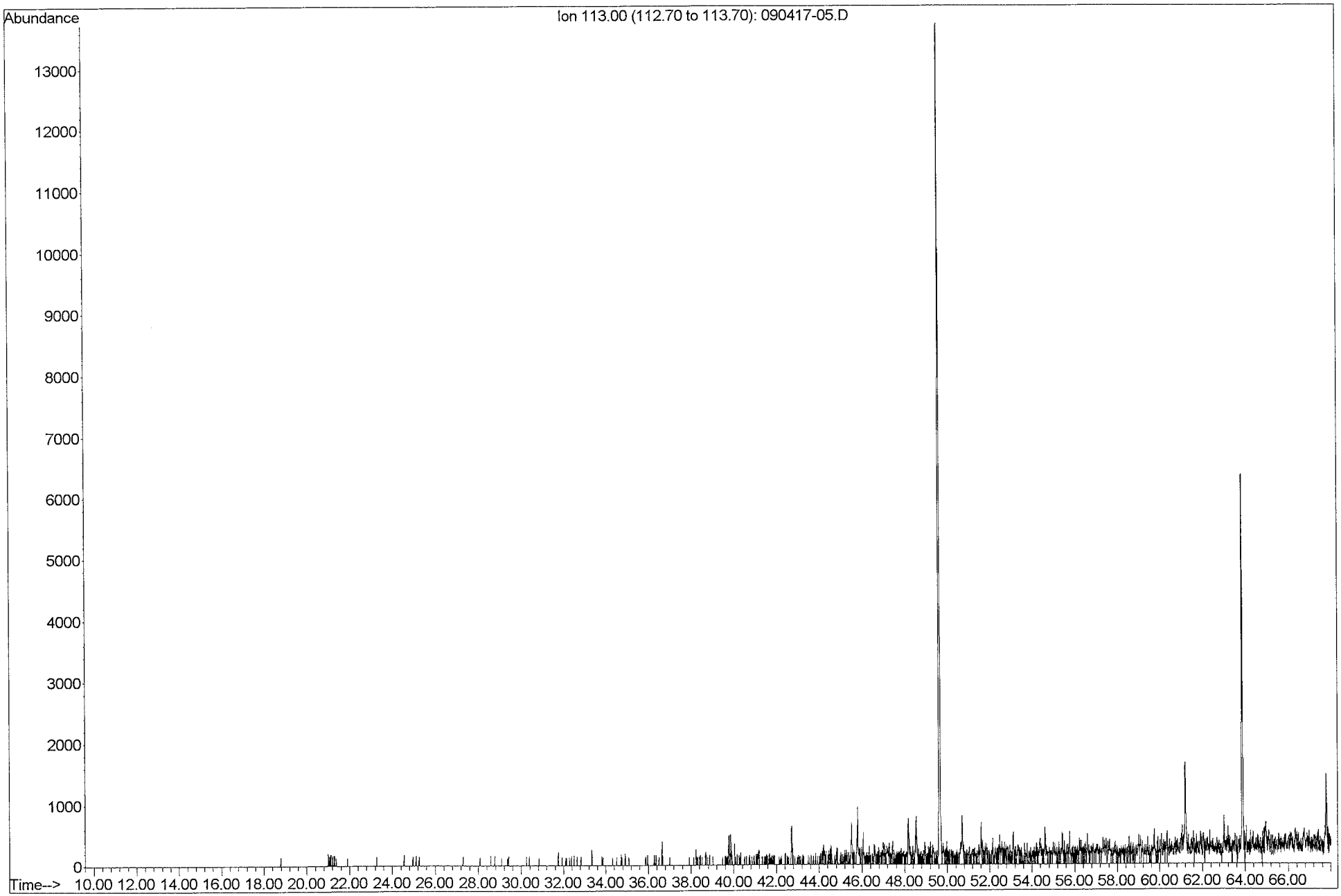
23733-2 [HH01-01-02-170901-21]
950mL->1mL



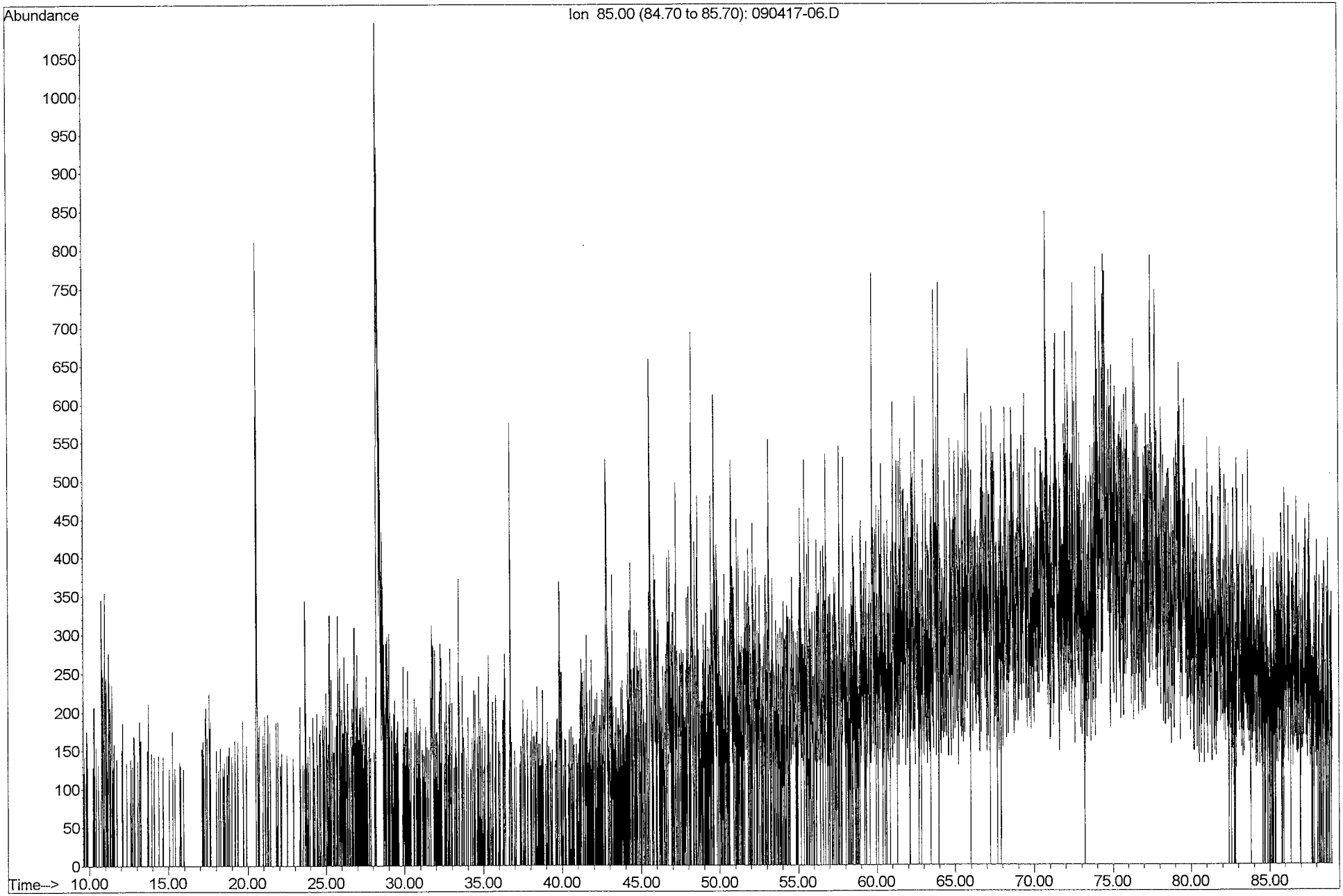
23733-3 [HH01-01-03-170901-21]
910mL->1mL



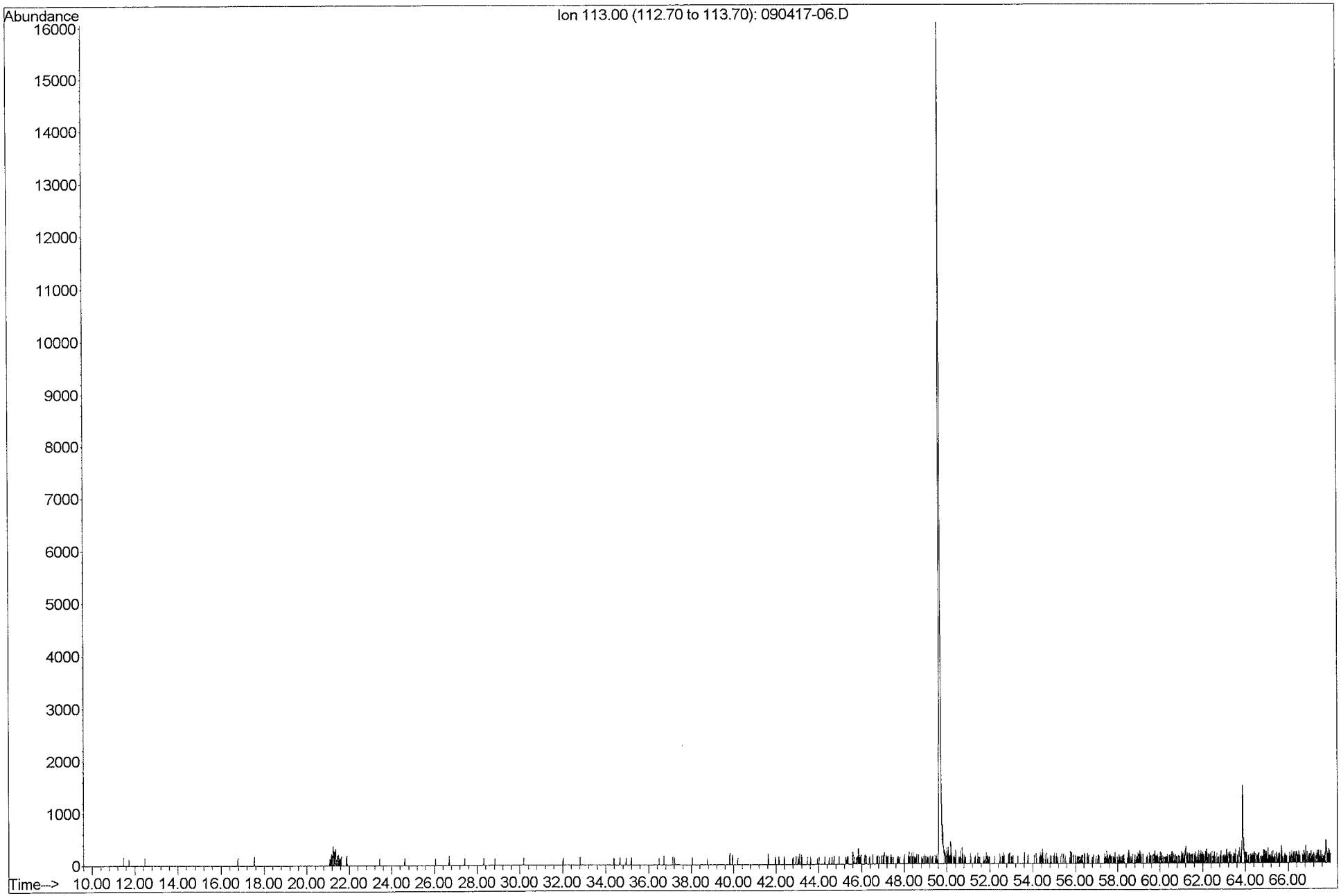
23733-3 [HH01-01-03-170901-21]
910mL->1mL



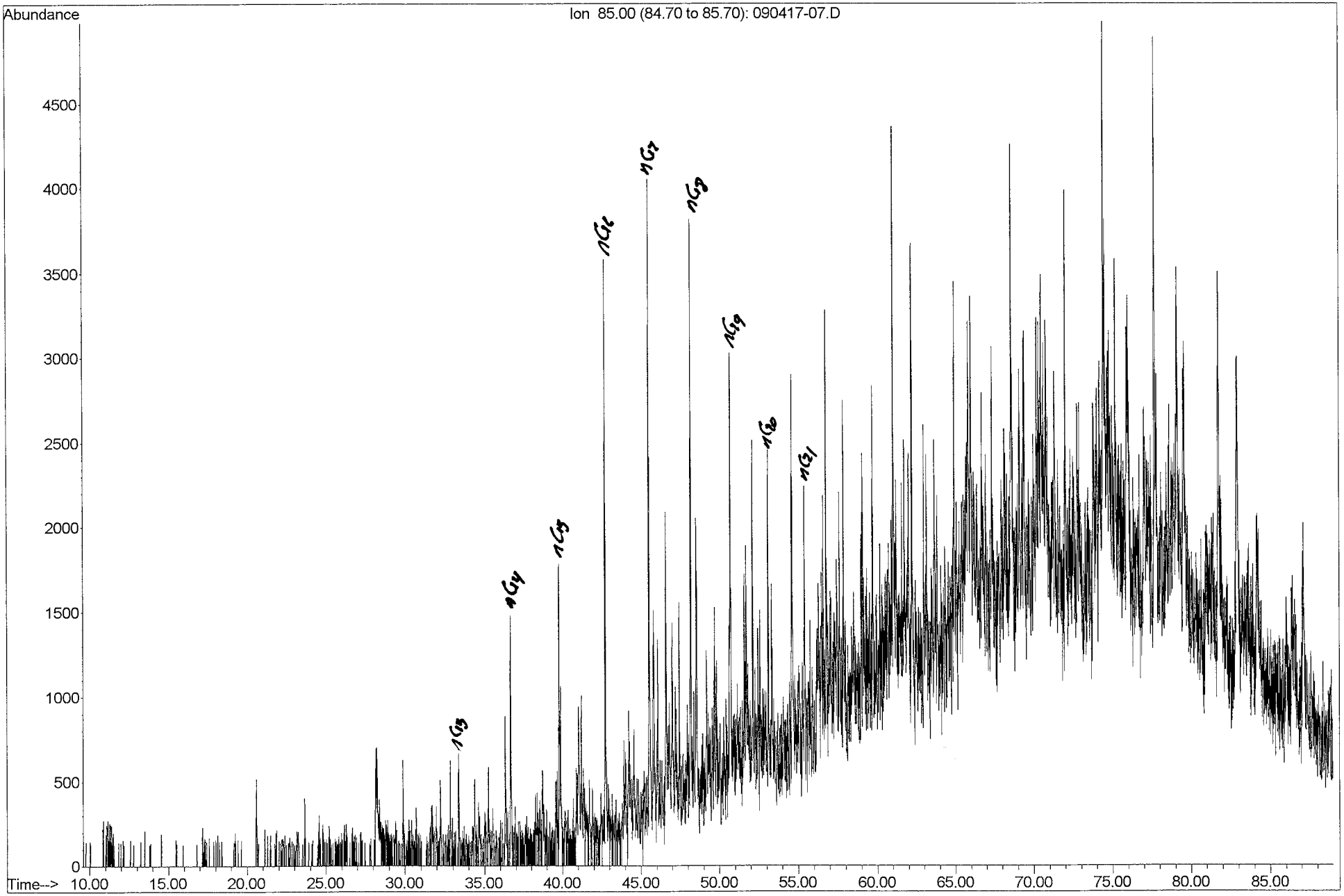
23733-4 [HH01-01-03-170901-22]
870mL->1mL



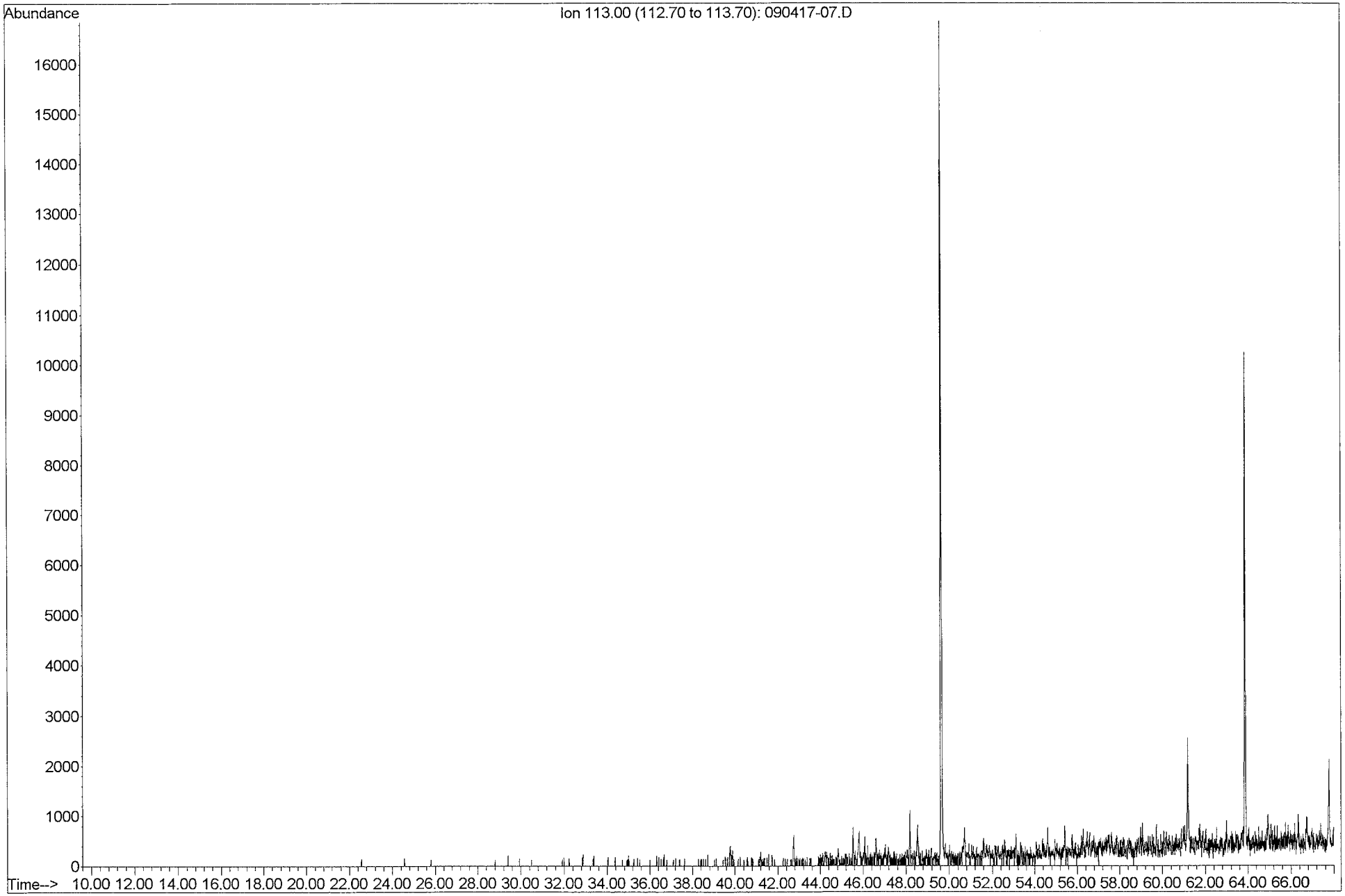
23733-4 [HH01-01-03-170901-22]
870mL->1mL



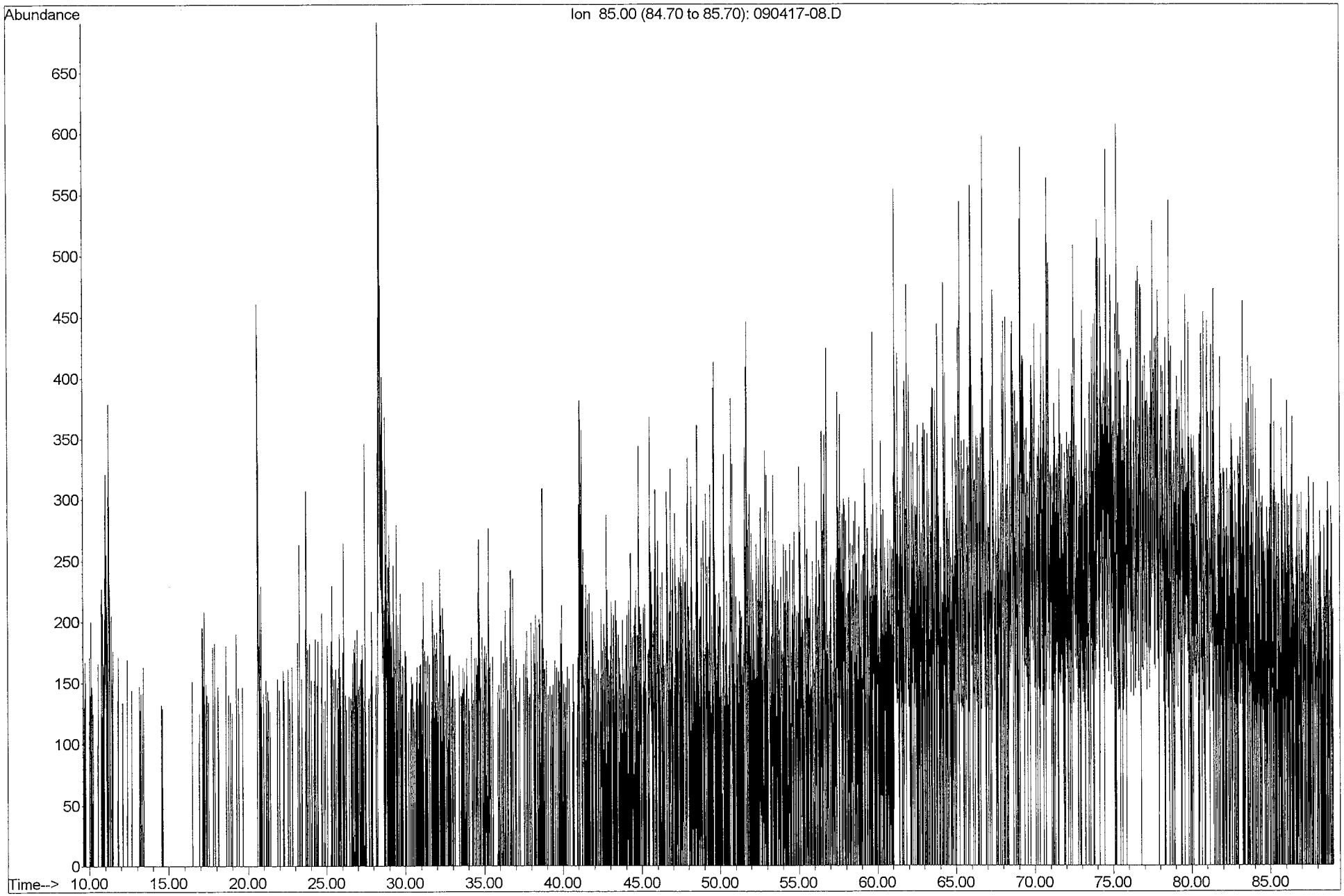
23733-5 [HH01-01-04-170901-21]
910mL->1mL



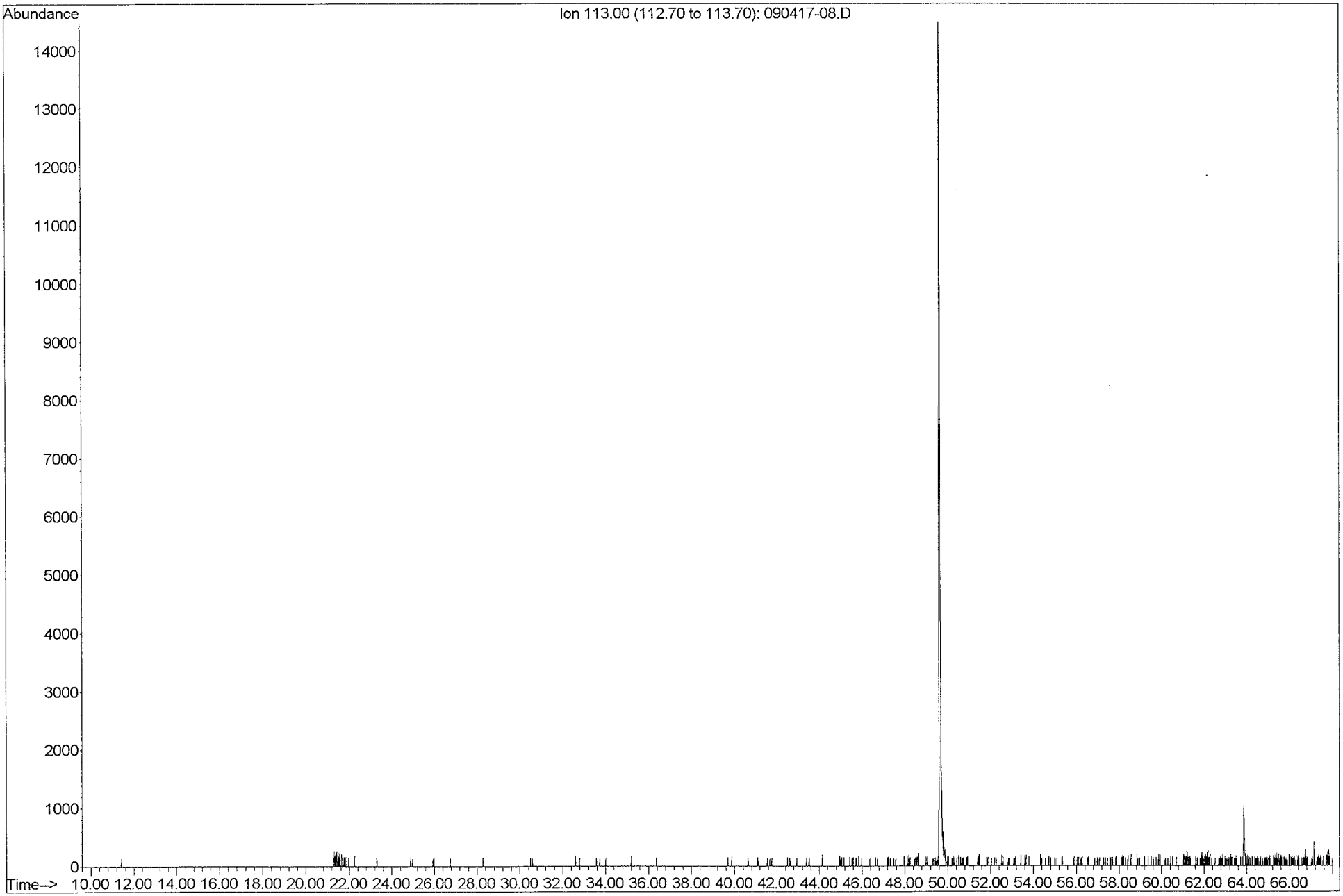
23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL



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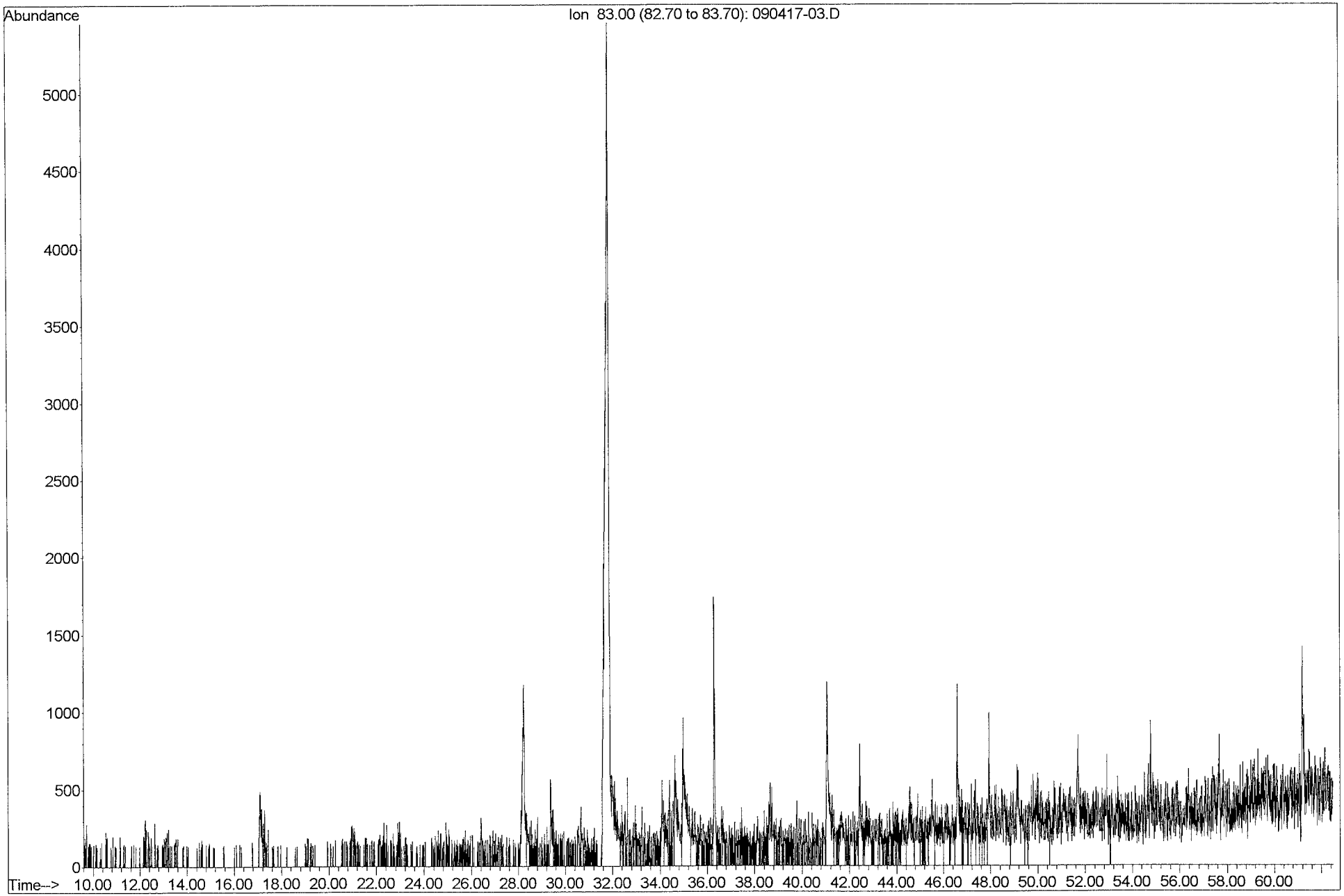
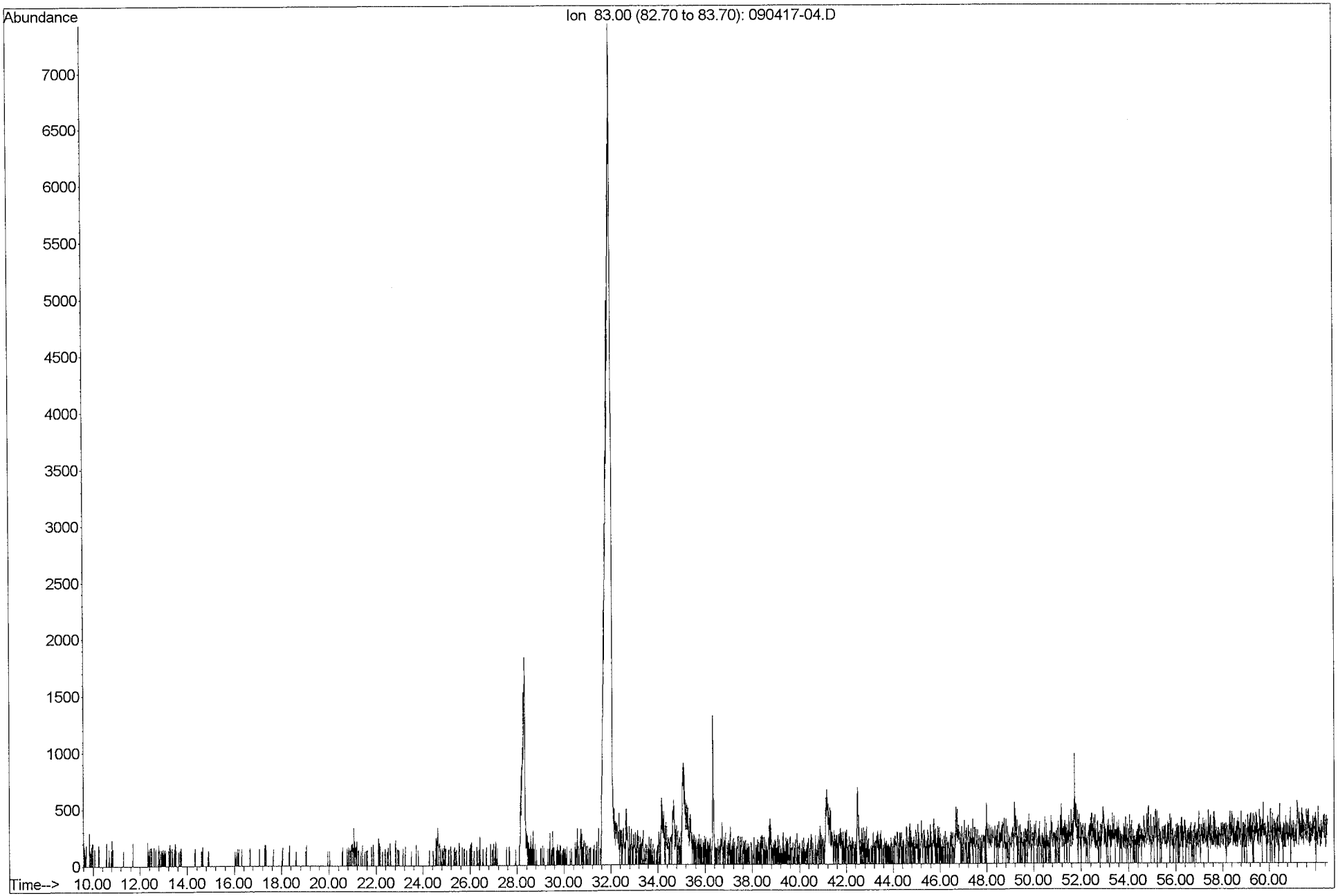
Key for Alkylcyclohexanes at m/z 83

Symbol	Detail
CH-1	Methylcyclohexane
CH-2	Ethylcyclohexane
CH-3	Propylcyclohexane
CH-4	Butylcyclohexane
CH-5	Pentylcyclohexane
CH-6	Hexylcyclohexane
CH-7	Heptylcyclohexane
CH-8	Octylcyclohexane
CH-9	Nonylcyclohexane
CH-10	Decylcyclohexane
CH-11	Undecylcyclohexane
CH-12	Dodecylcyclohexane
CH-13	Tridecylcyclohexane
CH-14	Tetradecylcyclohexane

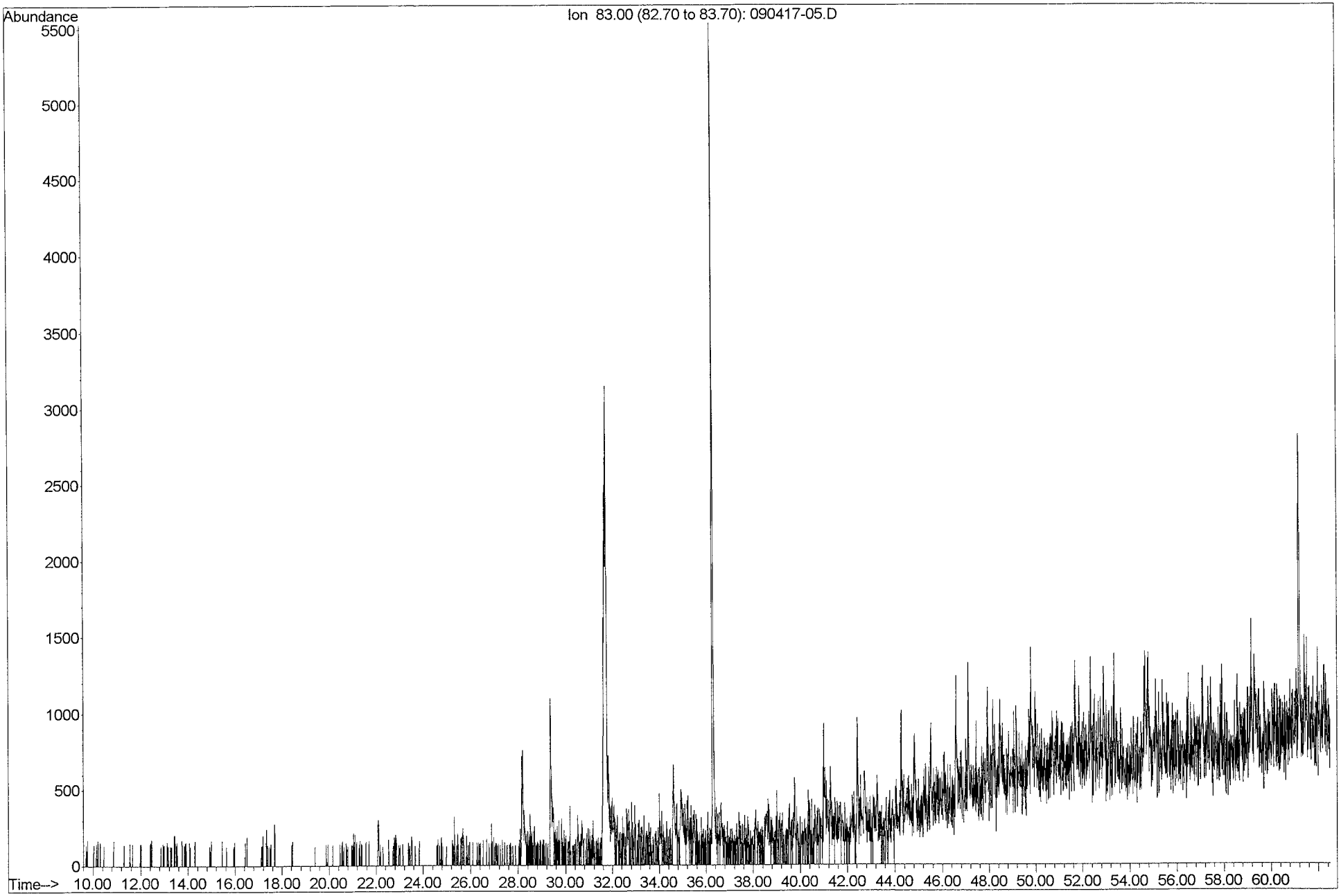
23733-1 [HH01-01-01-170901-21]
770mL->1mL



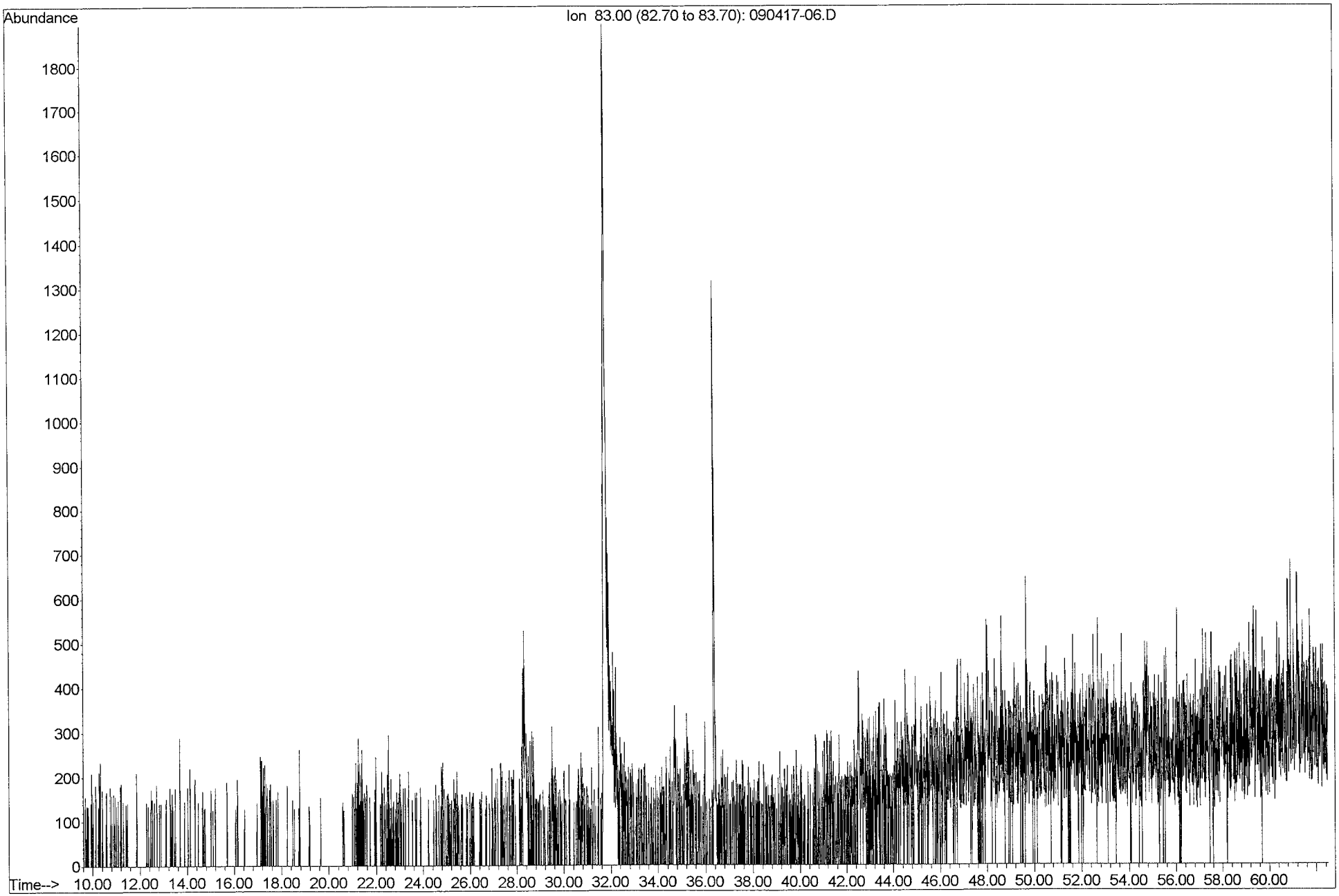
23733-2 [HH01-01-02-170901-21]
950mL->1mL



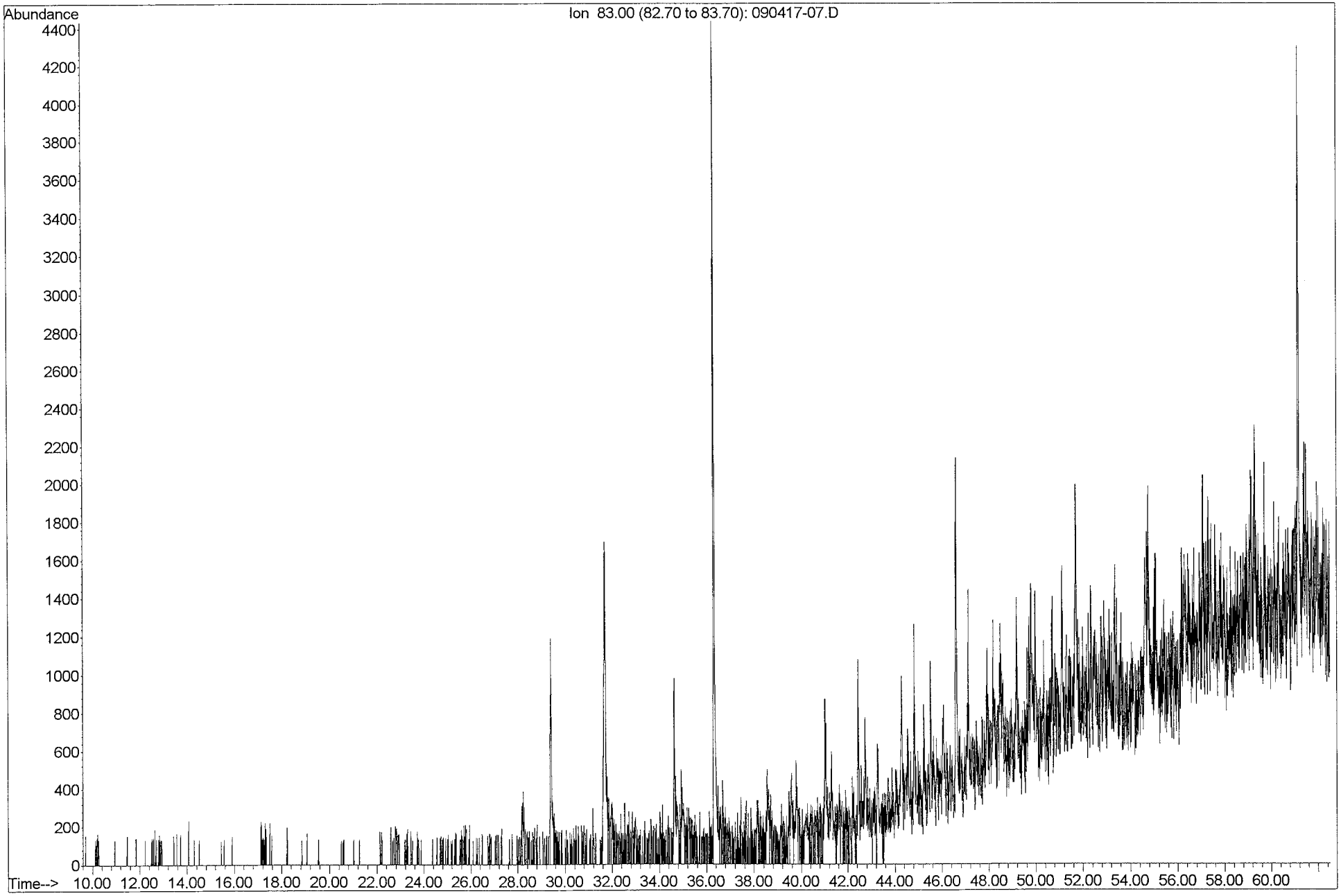
23733-3 [HH01-01-03-170901-21]
910mL->1mL



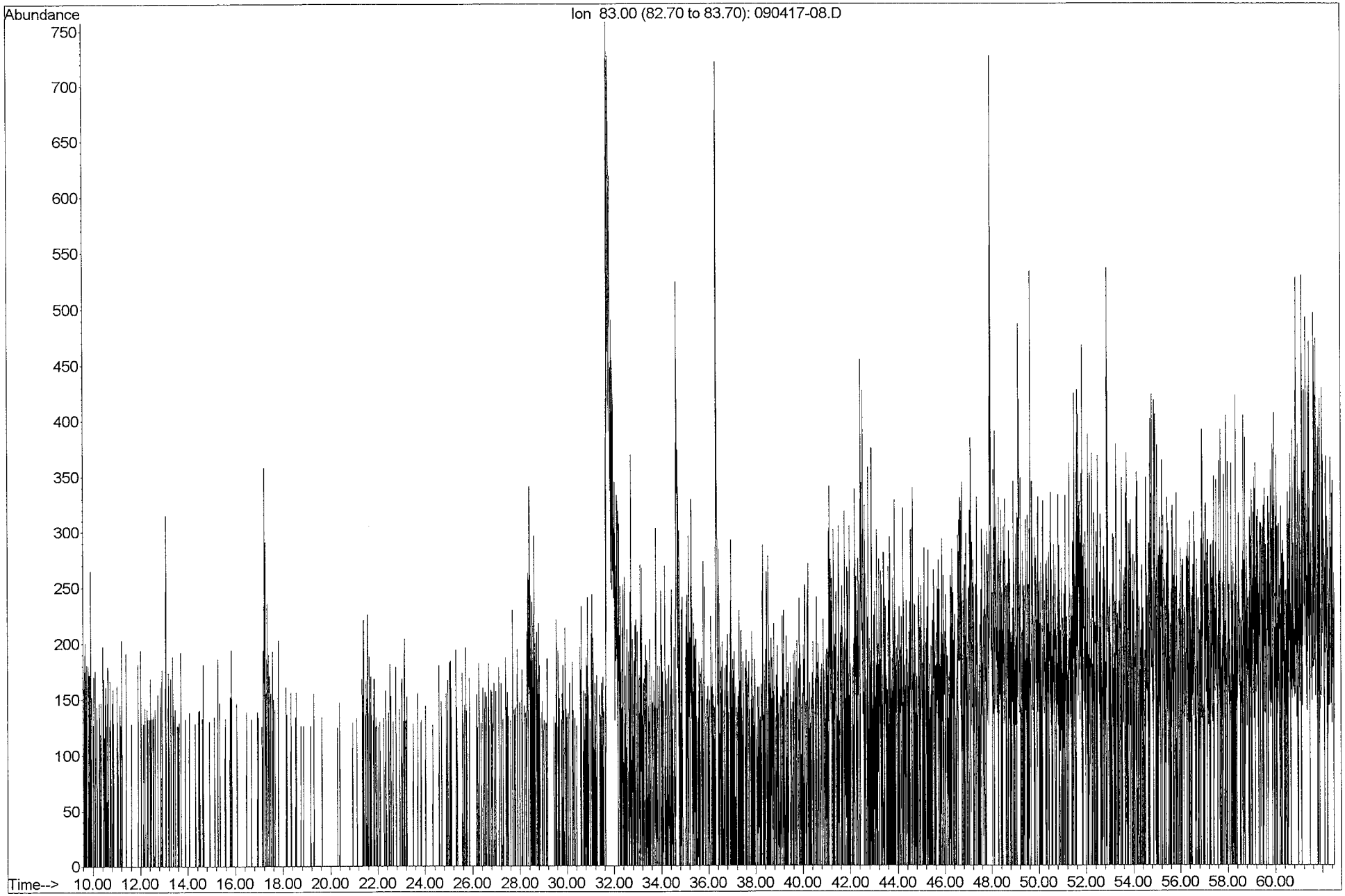
23733-4 [HH01-01-03-170901-22]
870mL->1mL



23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL



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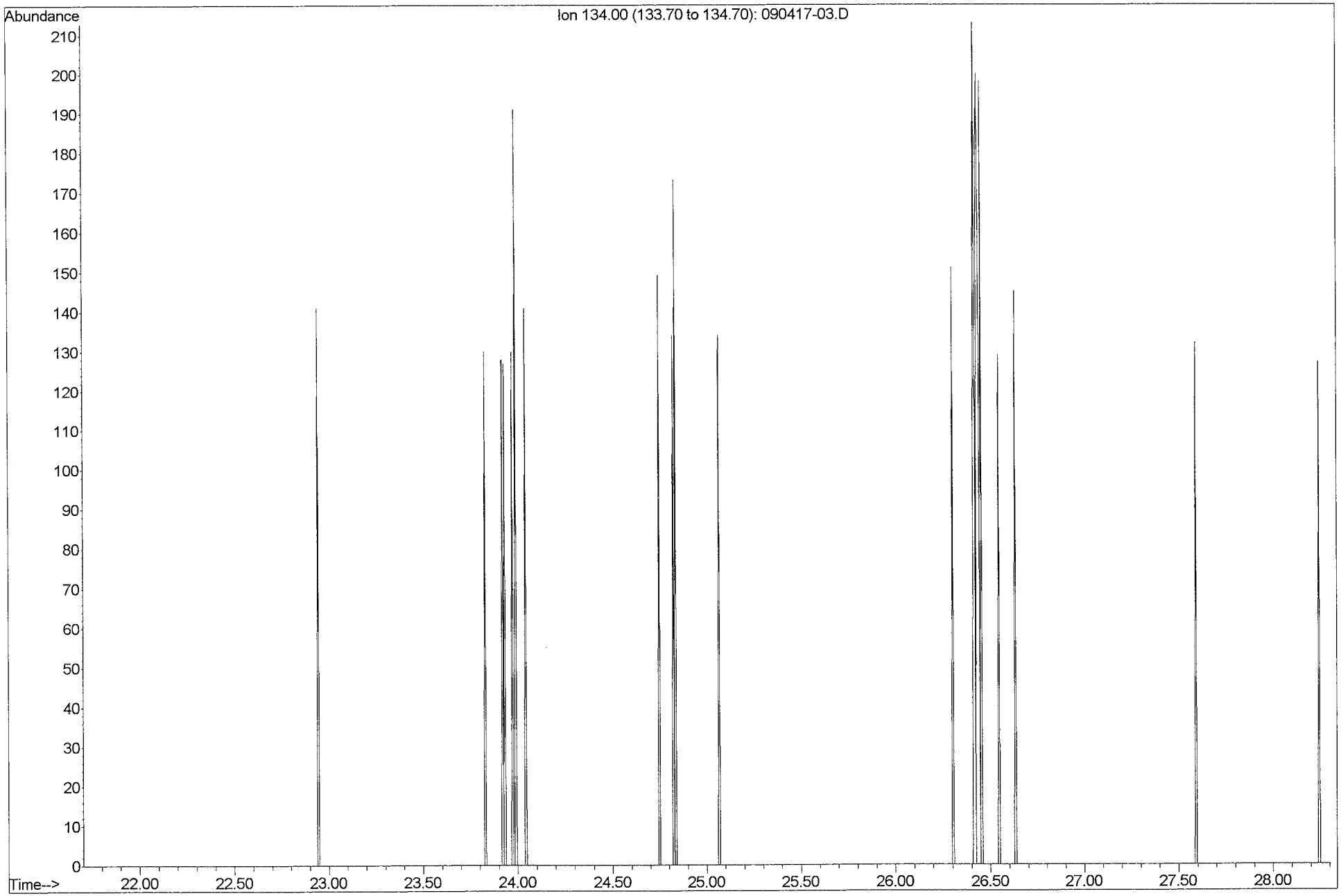
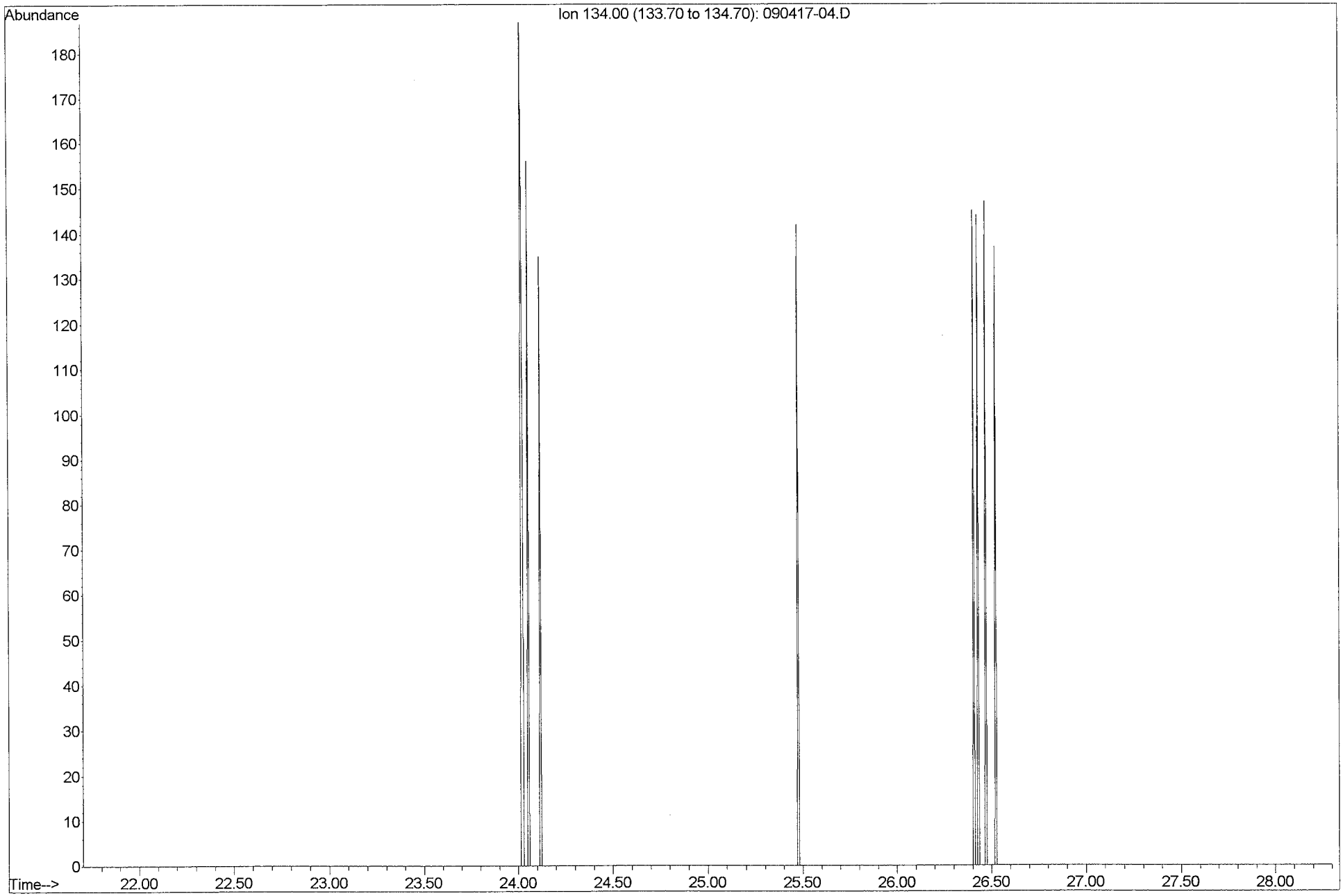
Key for C_4-Alkylbenzenes (m/z 134)

Symbol	Detail
16	Sec-Butylbenzene
17	1-Methyl-3-Isopropylbenzene
18	1-Methyl-4-Isopropylbenzene
19	1-Methyl-2-Isopropylbenzene
20	1,3-Diethylbenzene
21	1-Methyl-3-Propylbenzene
22	Butylbenzene
23	1,3-Diethyl-5-Ethylbenzene
24	1,2-Diethylbenzene
25	1-Methyl-2-Propylbenzene
26	1,4-Dimethyl-2-Ethylbenzene
27	1,3-Dimethyl-4-Ethylbenzene
28	1,2-Dimethyl-4-Ethylbenzene
29	1,3-Dimethyl-2-Ethylbenzene
30	1,2-Dimethyl-3-Ethylbenzene
31a	1,2,4,5-Tetramethylbenzene
31	1,2,3,5-Tetramethylbenzene
32	1,2,3,4-Tetramethylbenzene

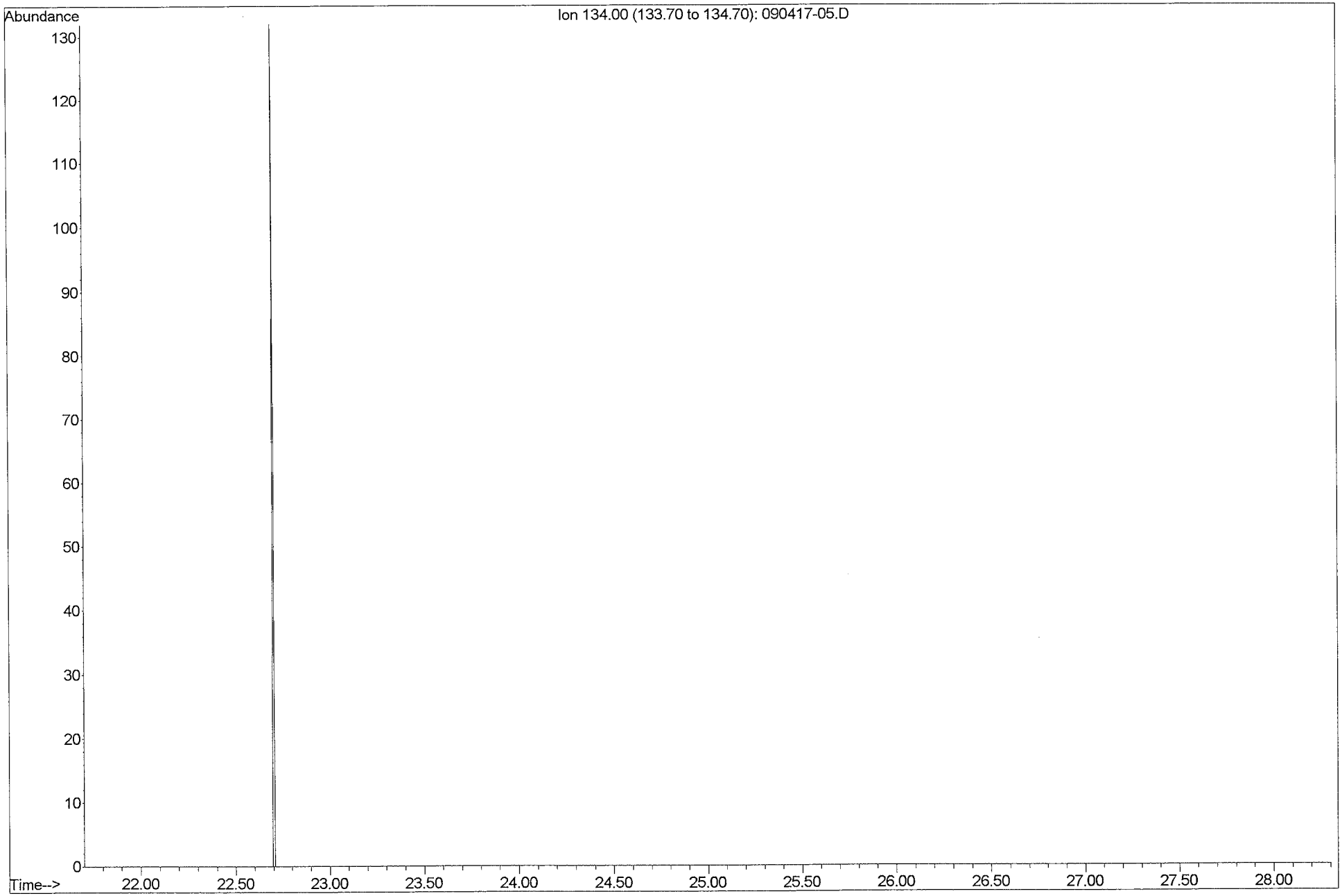
23733-1 [HH01-01-01-170901-21]
770mL->1mL



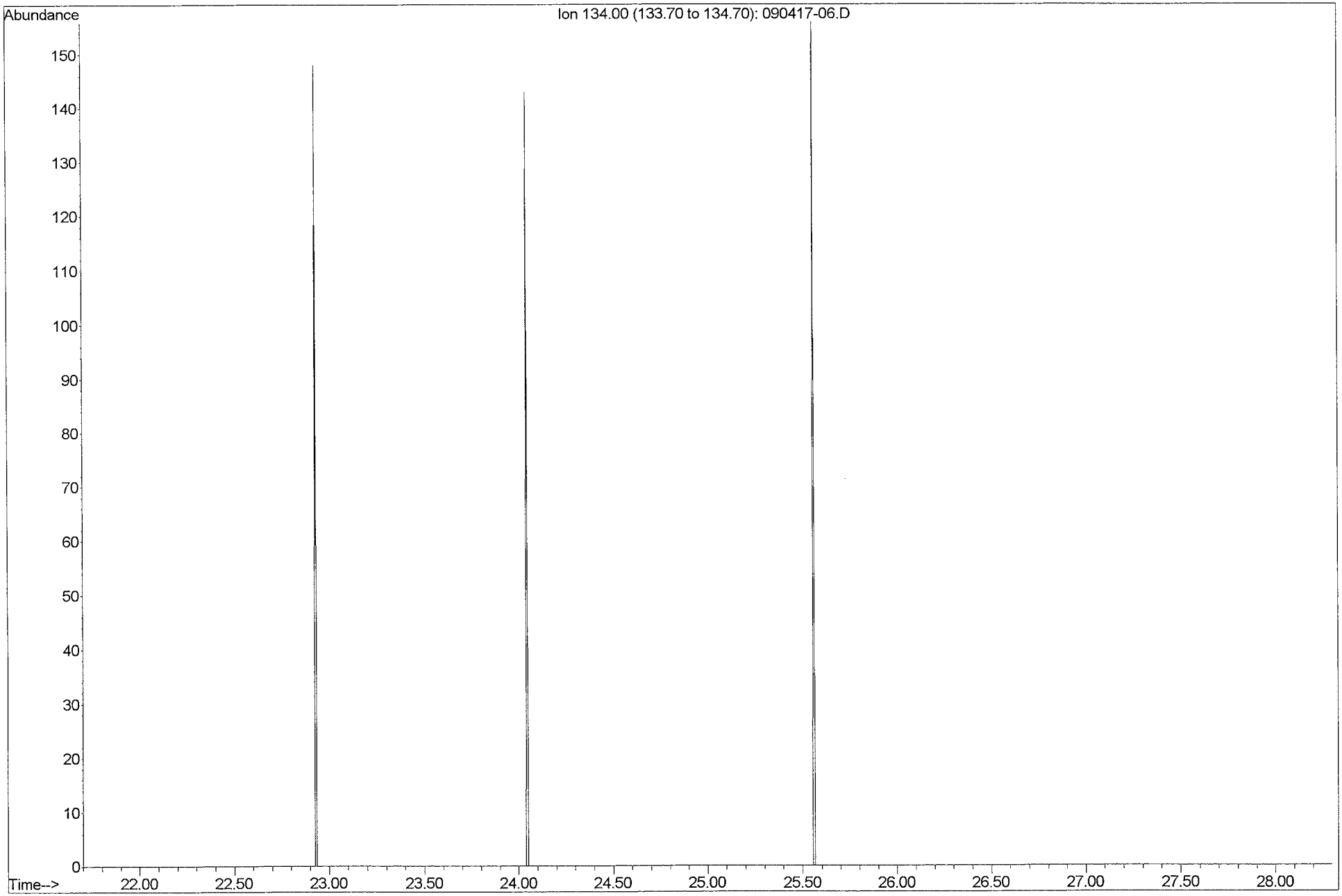
23733-2 [HH01-01-02-170901-21]
950mL->1mL



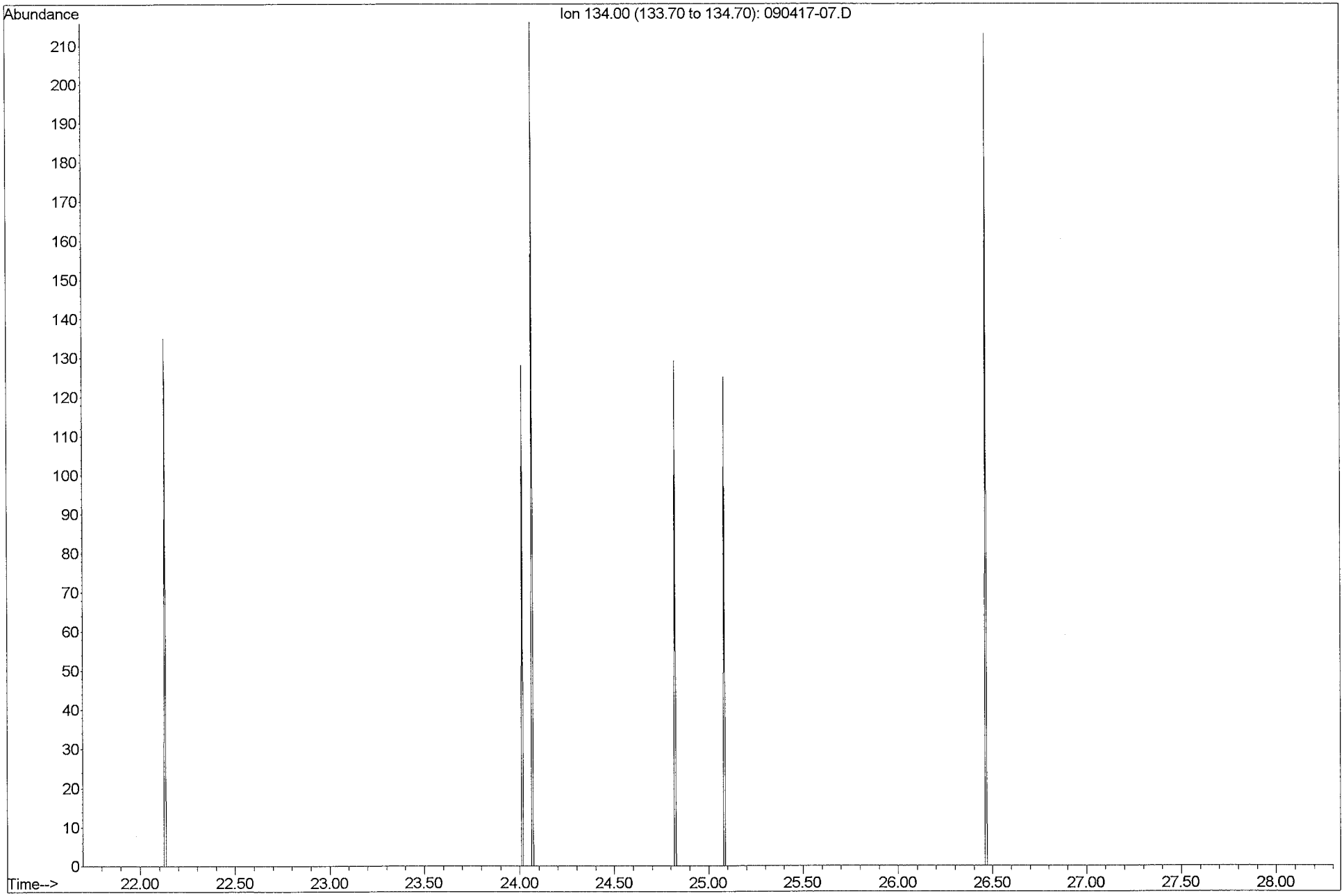
23733-3 [HH01-01-03-170901-21]
910mL->1mL



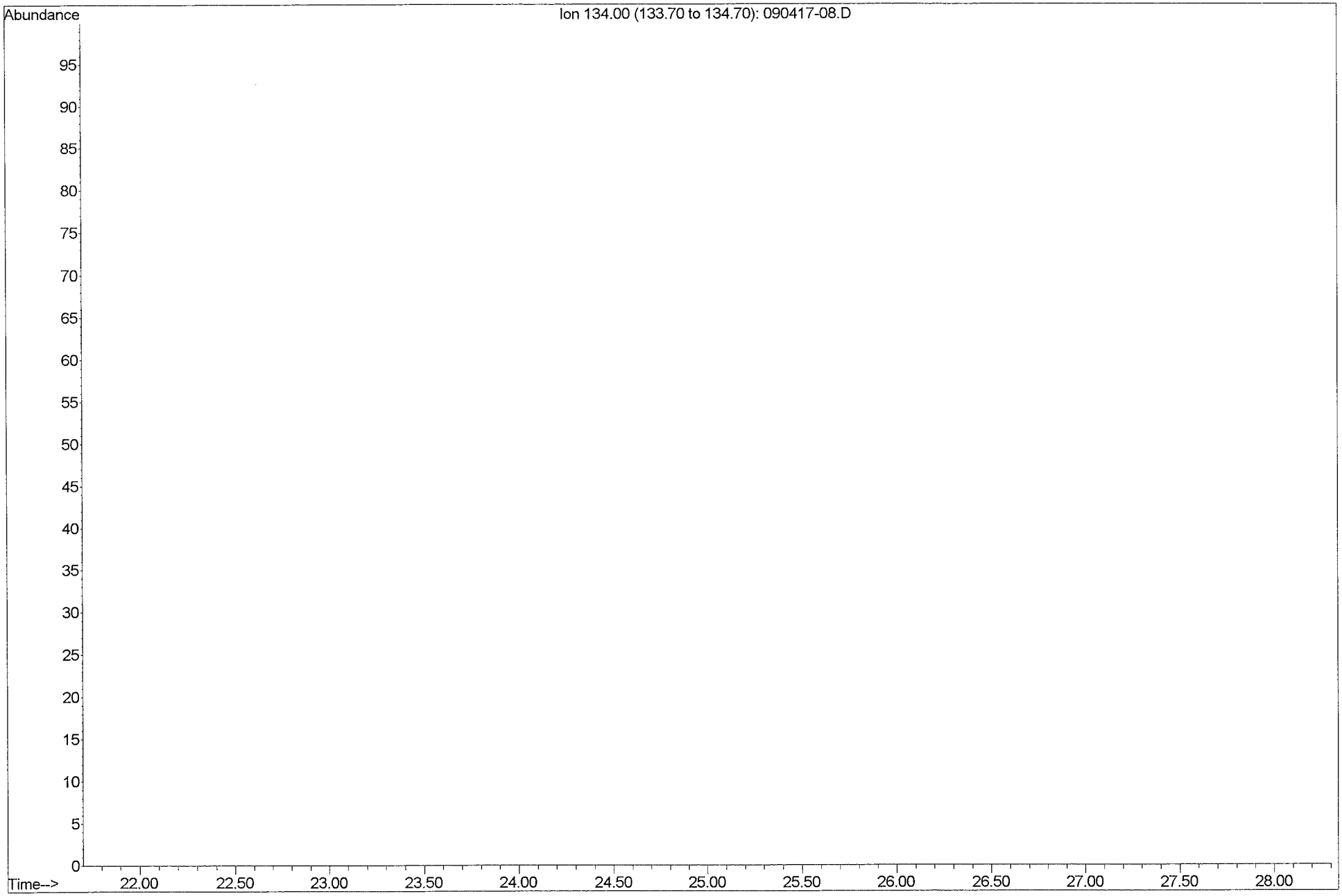
23733-4 [HH01-01-03-170901-22]
870mL->1mL



23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL



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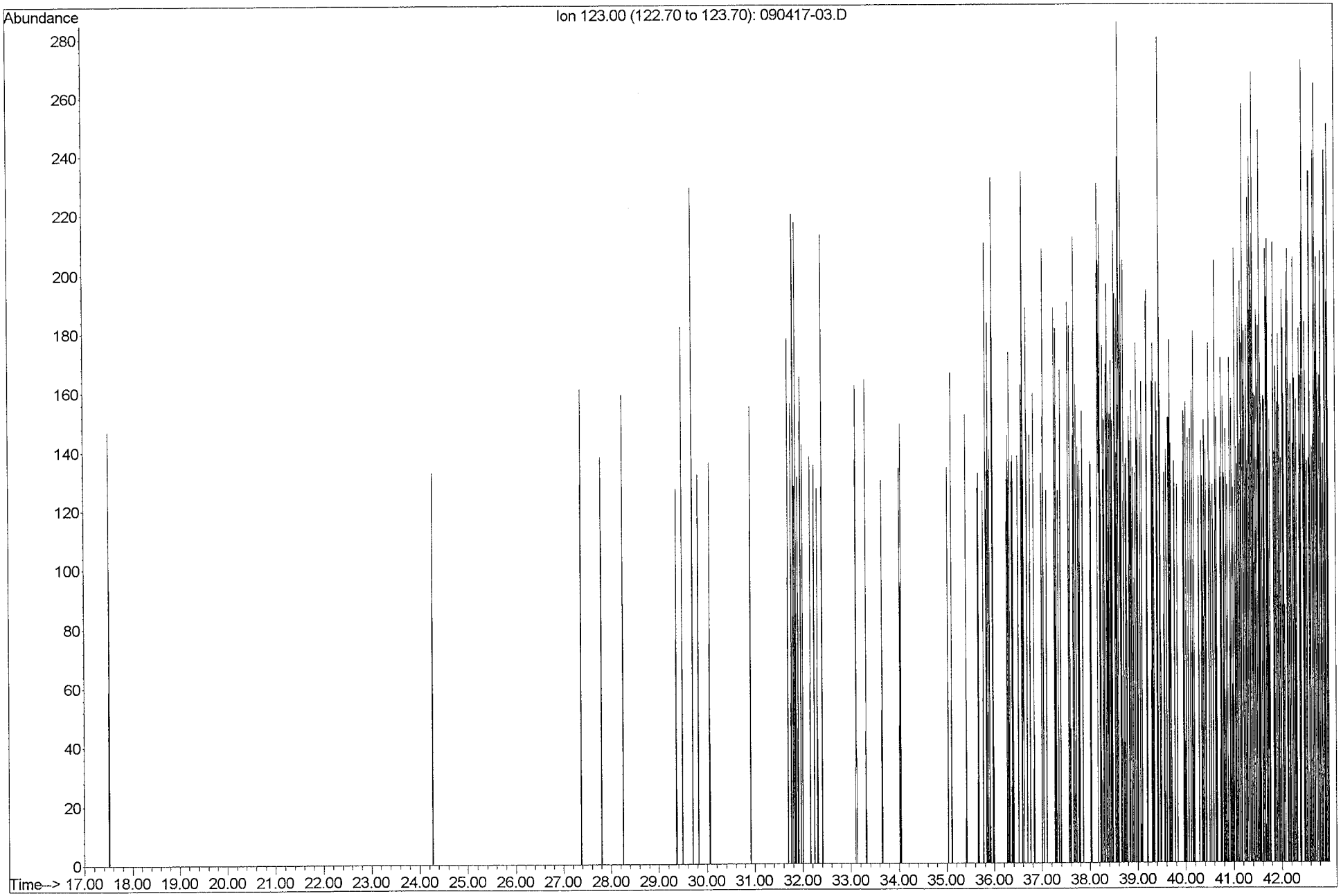
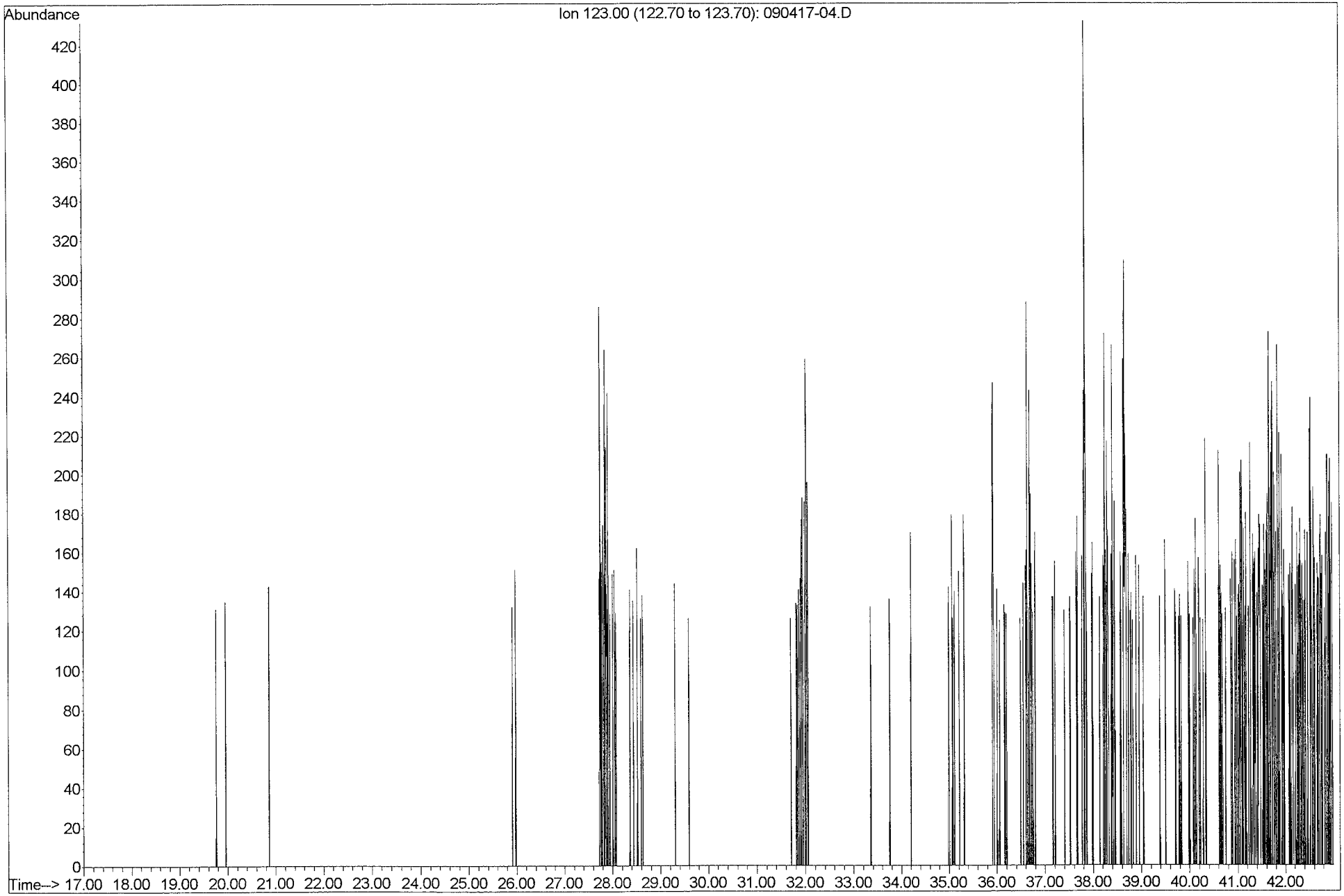
Key for Identification of the Bicyclanes (m/z 123)

Peak No.	Identity	Formula	M.W.
a	2,2,3-Trimethylbicycloheptane	$C_{10}H_{18}$	138
b	C_{10} bicycloalkane	$C_{10}H_{18}$	138
c	3,3,7-Trimethylbicycloheptane	$C_{10}H_{18}$	138
d	C_{11} Decalin	$C_{11}H_{20}$	152
f	Nordrimane	$C_{14}H_{26}$	194
g	Nordrimane	$C_{14}H_{26}$	194
h	Rearranged drimane	$C_{15}H_{28}$	208
j	Rearranged drimane	$C_{15}H_{28}$	208
k	Isomer of Eudesmane	$C_{15}H_{28}$	208
l	4β (H) Eudesmane	$C_{15}H_{28}$	208
m	C_{15} Bicyclic Sesquiterpane	$C_{15}H_{28}$	208
n	8β (H) Drimane	$C_{15}H_{28}$	208
o	C_{15} Bicyclic Sesquiterpane	$C_{15}H_{28}$	208
p	C_{16} Bicyclic Sesquiterpane	$C_{16}H_{30}$	222
q	C_{16} Bicyclic Sesquiterpane	$C_{16}H_{30}$	222
r	8β (H) Homodrimane	$C_{16}H_{30}$	222

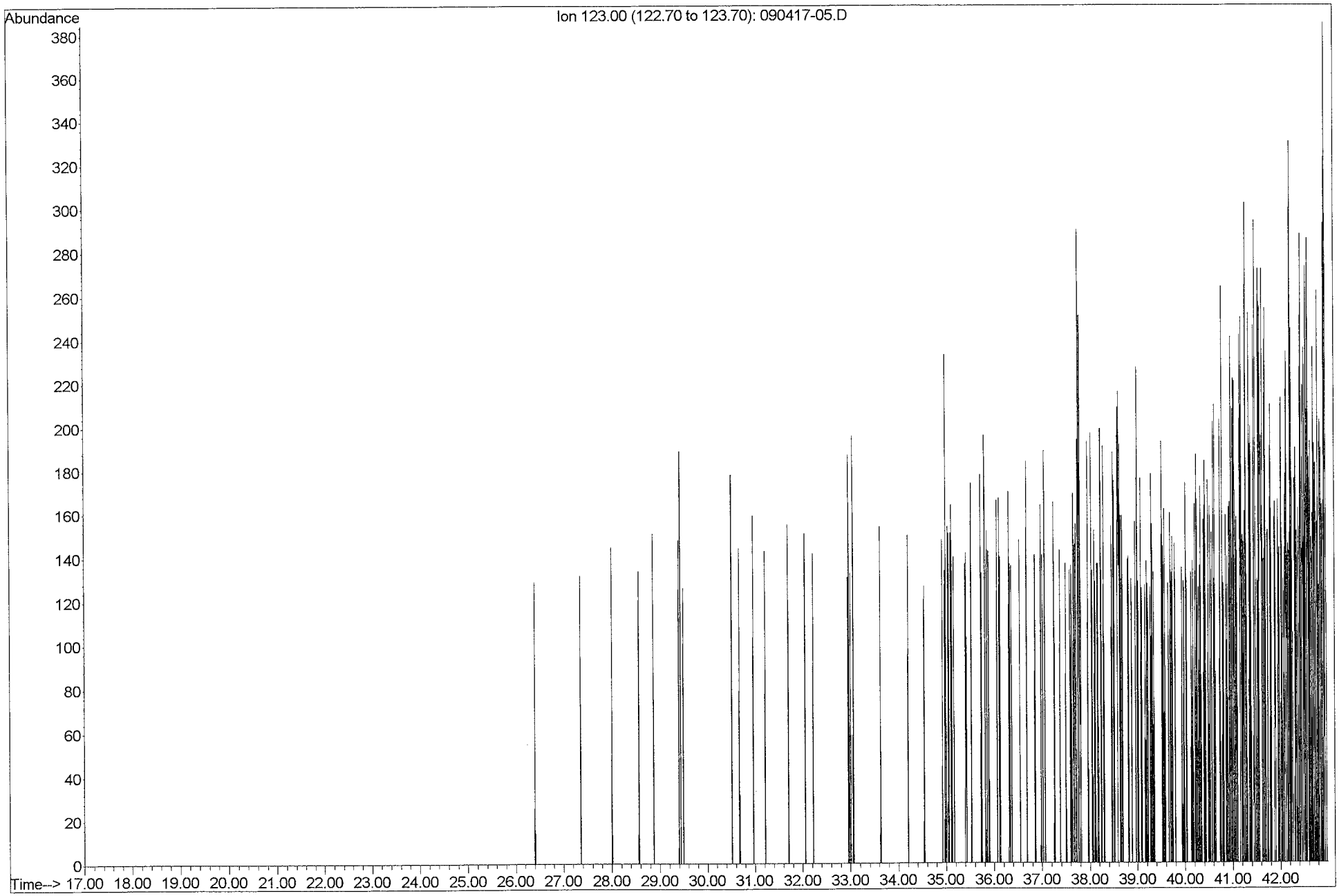
23733-1 [HH01-01-01-170901-21]
770mL->1mL



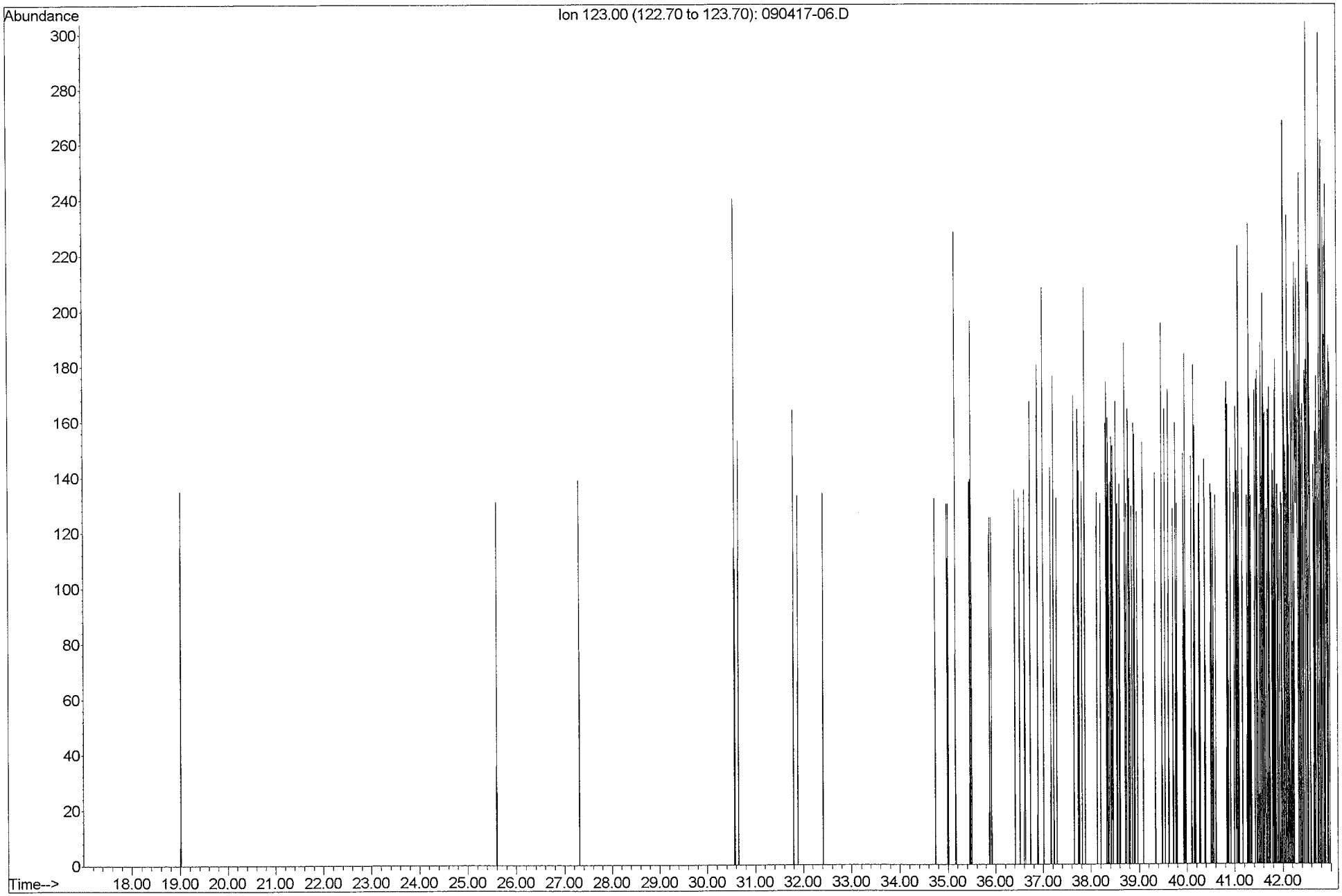
23733-2 [HH01-01-02-170901-21]
950mL->1mL



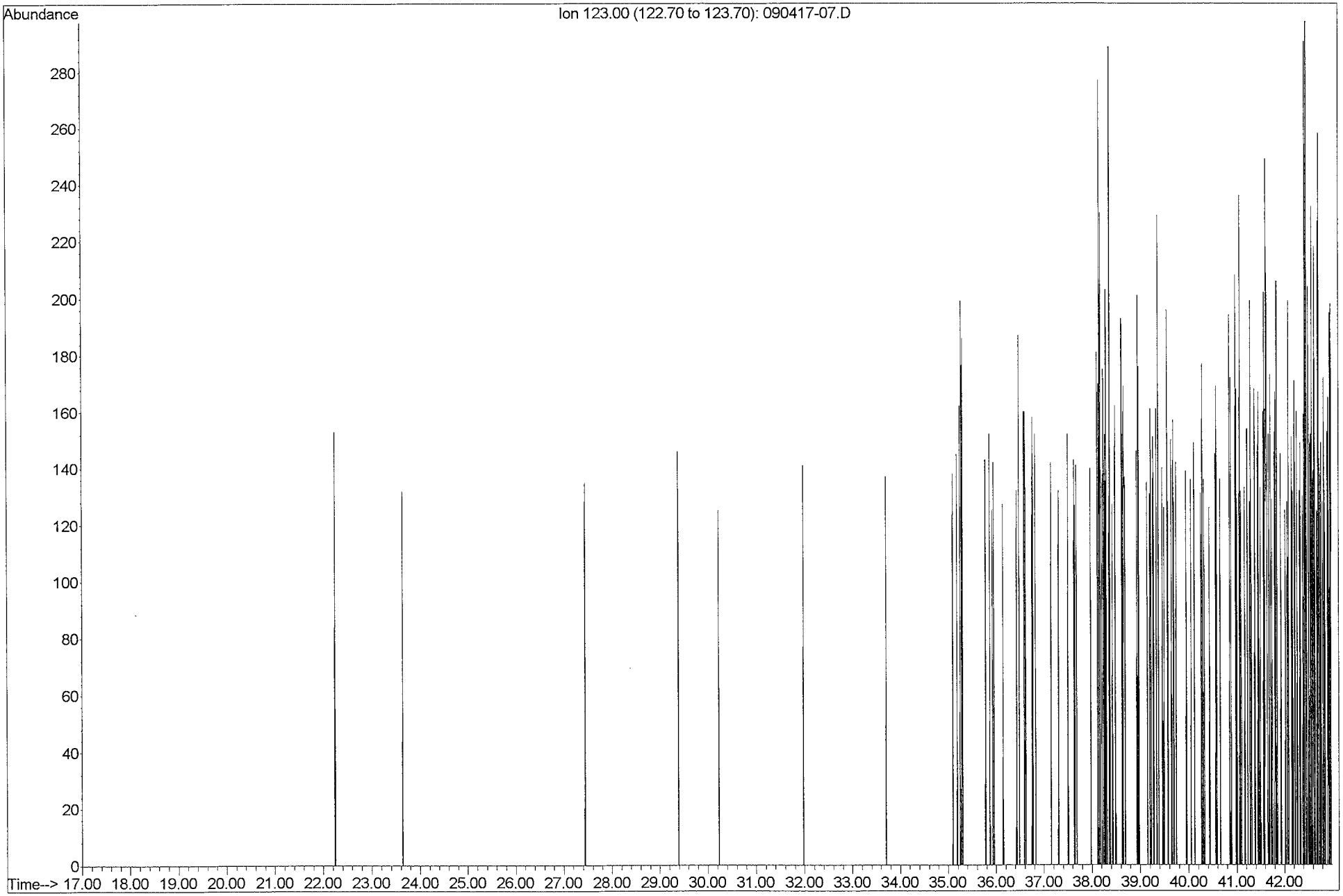
23733-3 [HH01-01-03-170901-21]
910mL->1mL



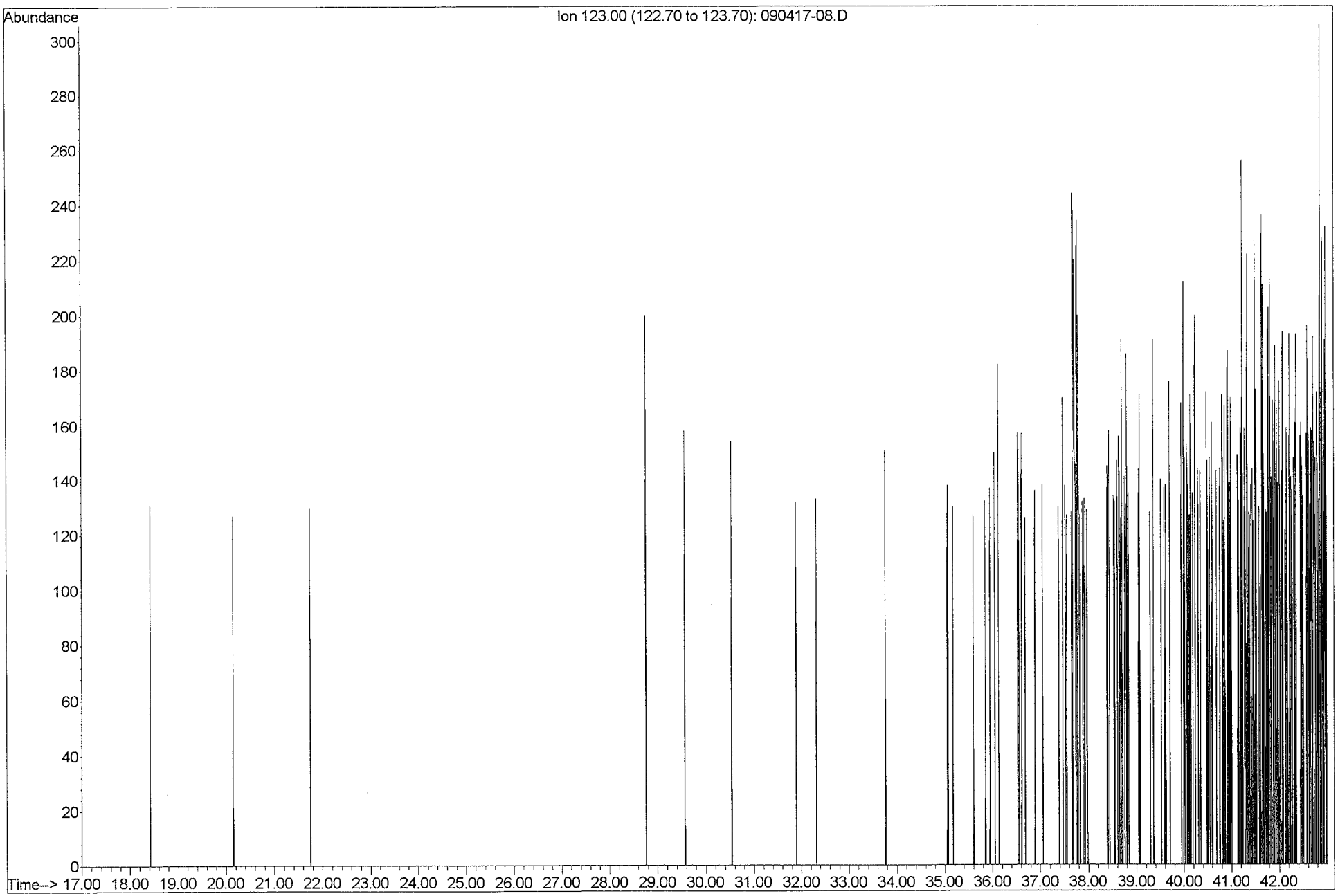
23733-4 [HH01-01-03-170901-22]
870mL->1mL



23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL



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Key for Tricyclic, Tetracyclic, and Pentacyclic Terpanes Identification (m/z 191 Mass chromatograms)

Code	Identity	Carbon #
0	C_{20}-Tricyclic Terpane	20
1	C_{21}-Tricyclic Terpane	21
2	C_{22}-Tricyclic Terpane	22
3	C_{23}-Tricyclic Terpane	23
4	C_{24}-Tricyclic Terpane	24
5	C_{25}-Tricyclic Terpane	25
Z4	C_{24}-Tetracyclic Terpane	24
6a	C_{26}-Tricyclic Terpane	26
6b	C_{26}-Tricyclic Terpane	26
7	C_{27}-Tricyclic Terpane	27
A	C_{28}-Tricyclic Terpane #1	28
B	C_{28}-Tricyclic Terpane #2	28
C	C_{29}-Tricyclic Terpane #1	29
D	C_{29}-Tricyclic Terpane #2	29
E	18 α-22,29,30-Trisnorneohopane (Ts)	27
F	17 α-22,29,30-Trisnorhopane (Tm)	27
G	17 β-22,29,30-Trisnorhopane	27
H	17 α-23,28-Bisnorlupane	28
10a	C_{30}-Tricyclic Terpane #1	30
10b	C_{30}-Tricyclic Terpane #2	30
I	17 α-28,30 Bisnorhopane	28
11a	C_{31}-Tricyclic Terpane #1	31
J	17α-25-Norhopane	29
11b	C_{31}-Tricyclic Terpane #2	31
K	17 α,21β-30-Norhopane	29
C_{29}Ts	18α-30-Norneohopane	29
C_{30}^{*}	17α-Diahopane	30
L	17β-21α-30-Normoretane	29
Ma	18α-Oleanane	30
Mb	18β-Oleanane	30
N	17α-21β-Hopane	30
O	17β-21α-Moretane	30
13a	C_{33}-Tricyclic Terpane #1	33
13b	C_{33}-Tricyclic Terpane #2	33

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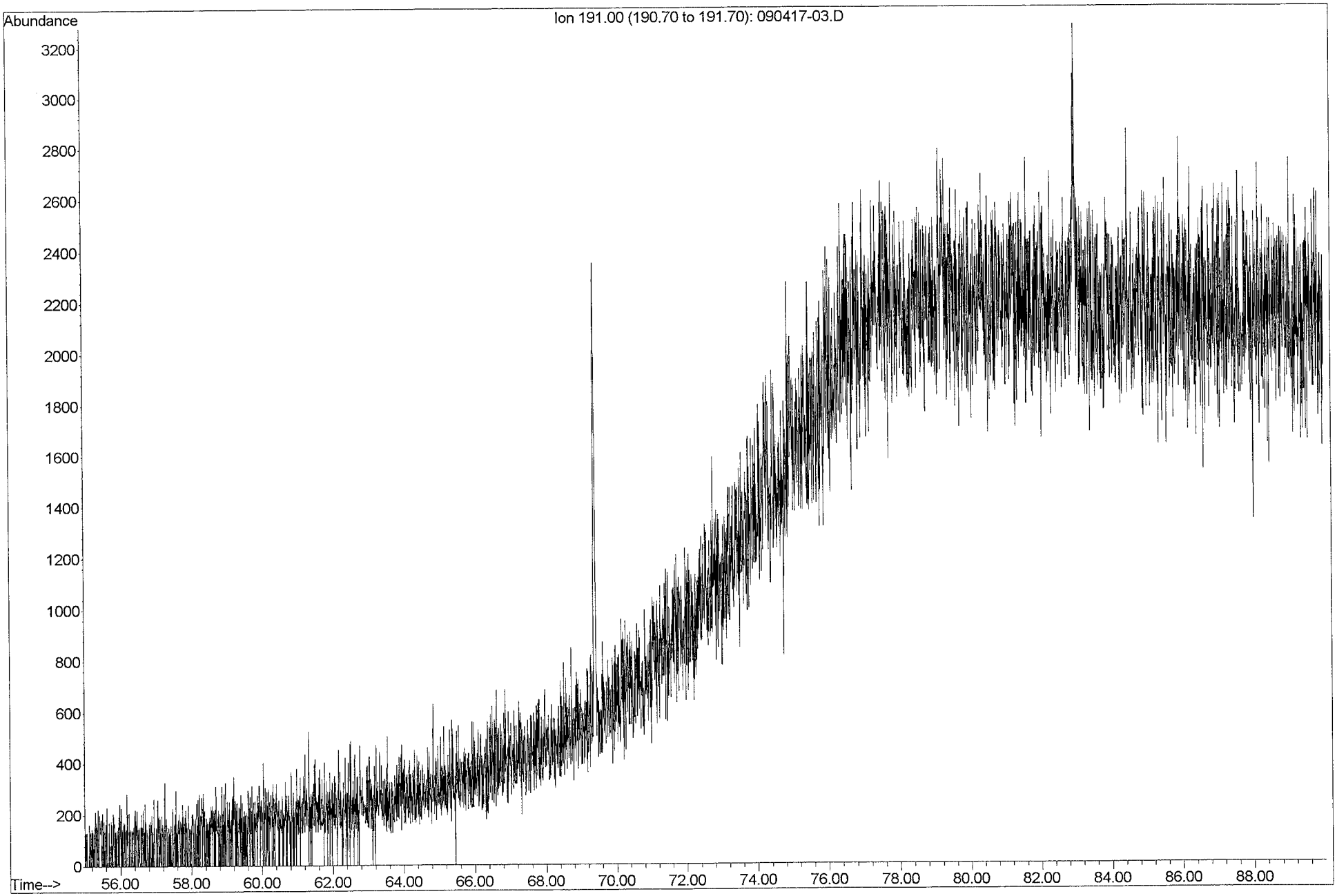
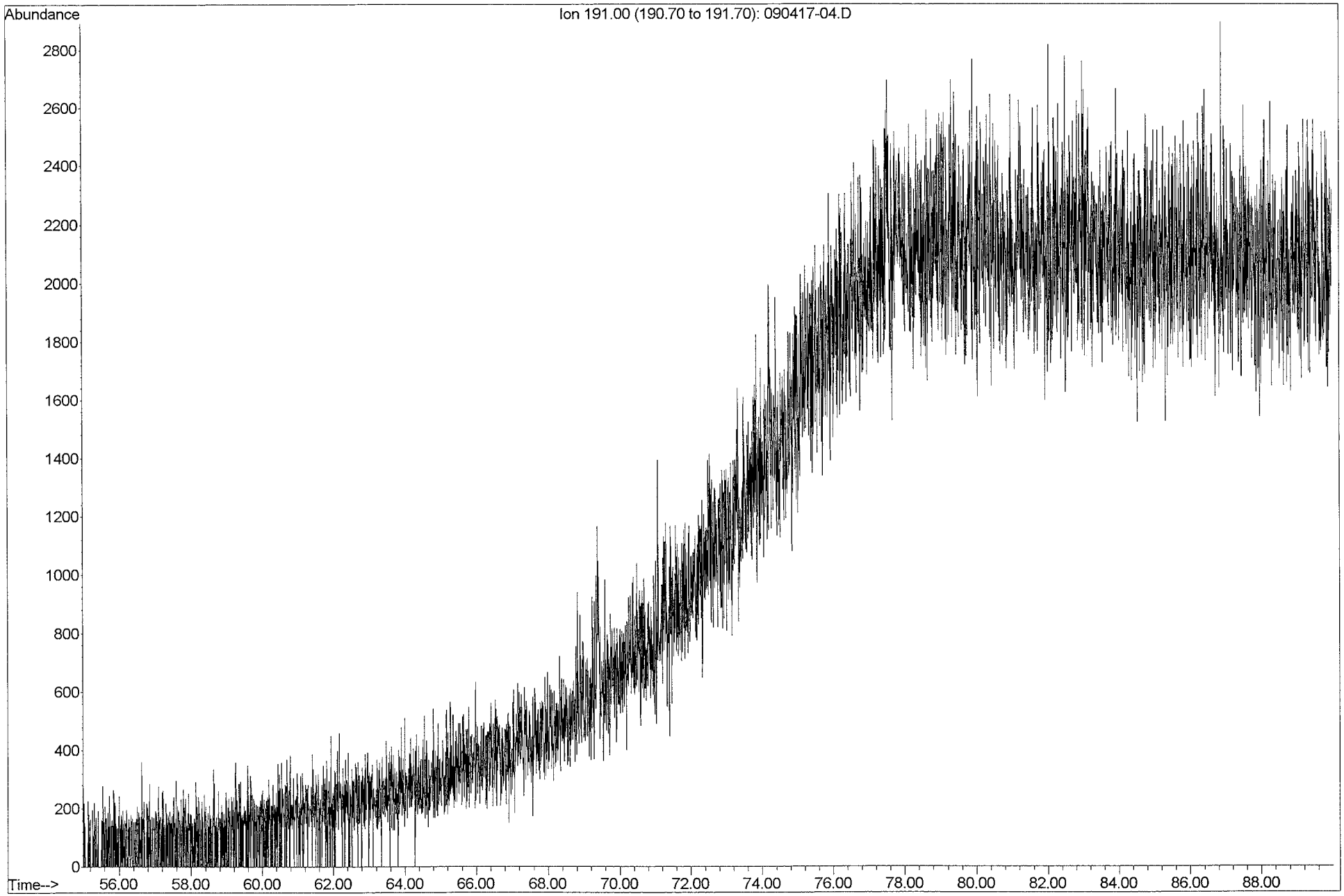
Key for Tricyclic, Tetracyclic, and Pentacyclic Terpanes Identification (m/z 191 Mass chromatograms) – Cont.

Code	Identity	Carbon #
P	22S-17α,21β-30-Homohopane	31
Q	22R-17α,21β-30-Homohopane	31
R	Gammacerane	30
14a	C_{34}-Tricyclic Terpane #1	34
S	17β,21α-Homomoretane	31
14b	C_{34}-Tricyclic Terpane #2	34
T	22S-17α,21β-30-Bishomohopane	32
U	22R-17α,21β-30-Bishomohopane	32
15a	C_{35}-Tricyclic Terpane #1	35
15b	C_{34}-Tricyclic Terpane #2	35
V	17β,21α-C_{32}-Bishomomoretane	32
WS	22S-17α,21β-30-Bishomohopane	33
WR	22R-17α,21β-30,31,32-Trishomohopane	33
16a	C_{36}-Tricyclic Terpane #1	36
16b	C_{36}-Tricyclic Terpane #2	36
XS	22S-17α,21β-30,31,32,33-Tetrahomohopane	34
XR	22R-17α,21β-30,31,32,33-Tetrahomohopane	34
YS	22S-17α,21β-30,31,32,33,34-Pentahomohopane	35
YR	22R-17α,21β-30,31,32,33,34-Pentahomohopane	35

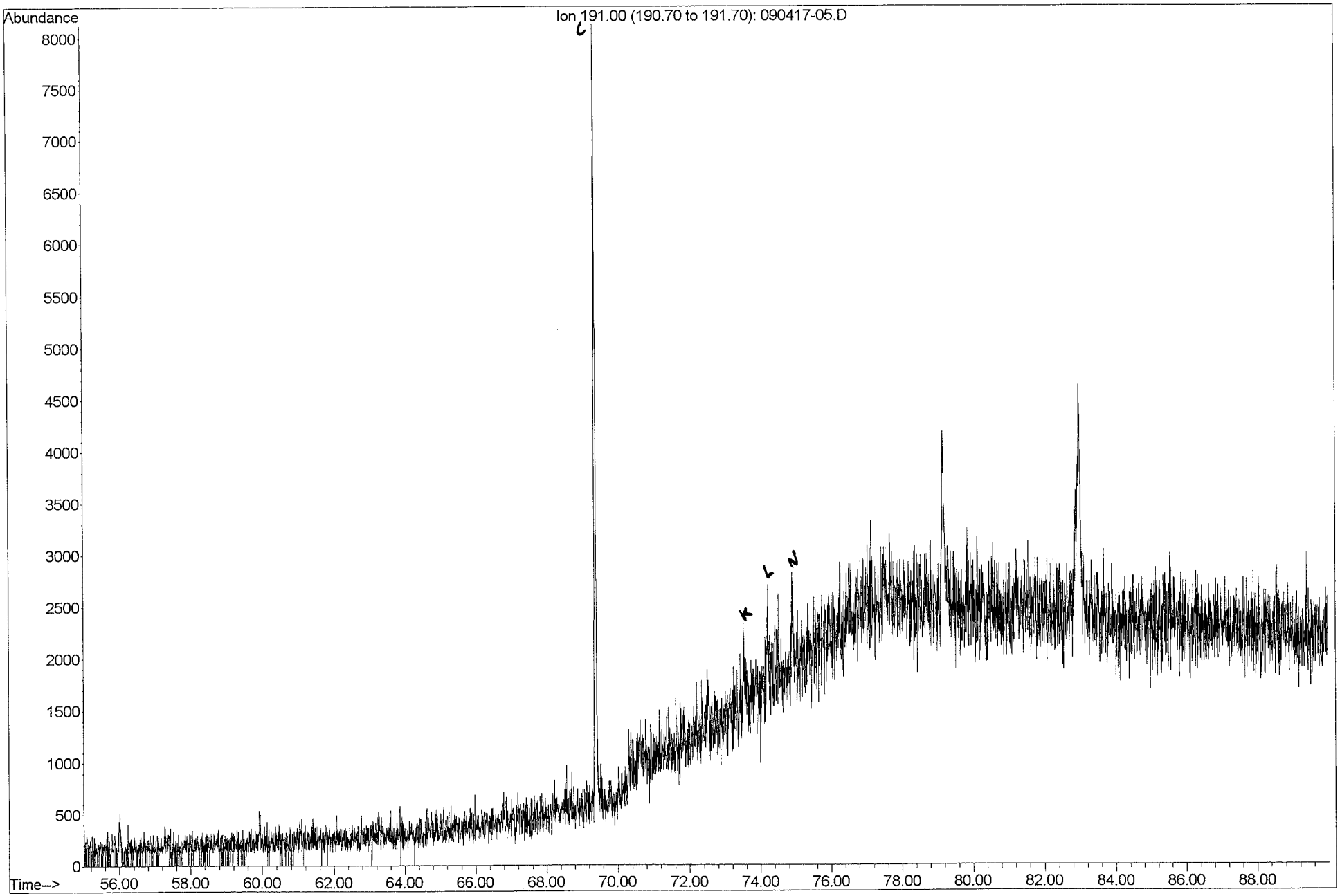
23733-1 [HH01-01-01-170901-21]
770mL->1mL



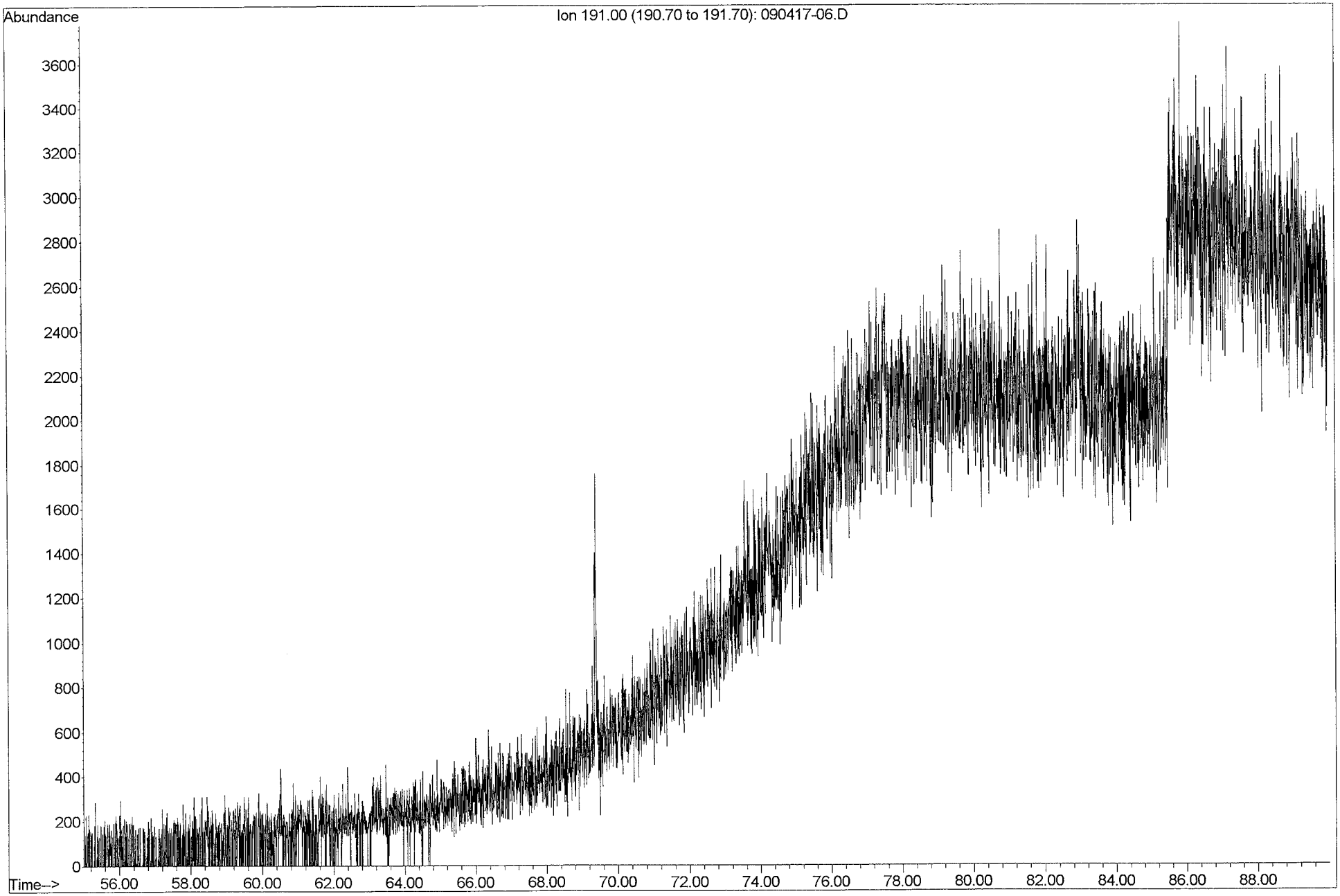
23733-2 [HH01-01-02-170901-21]
950mL->1mL



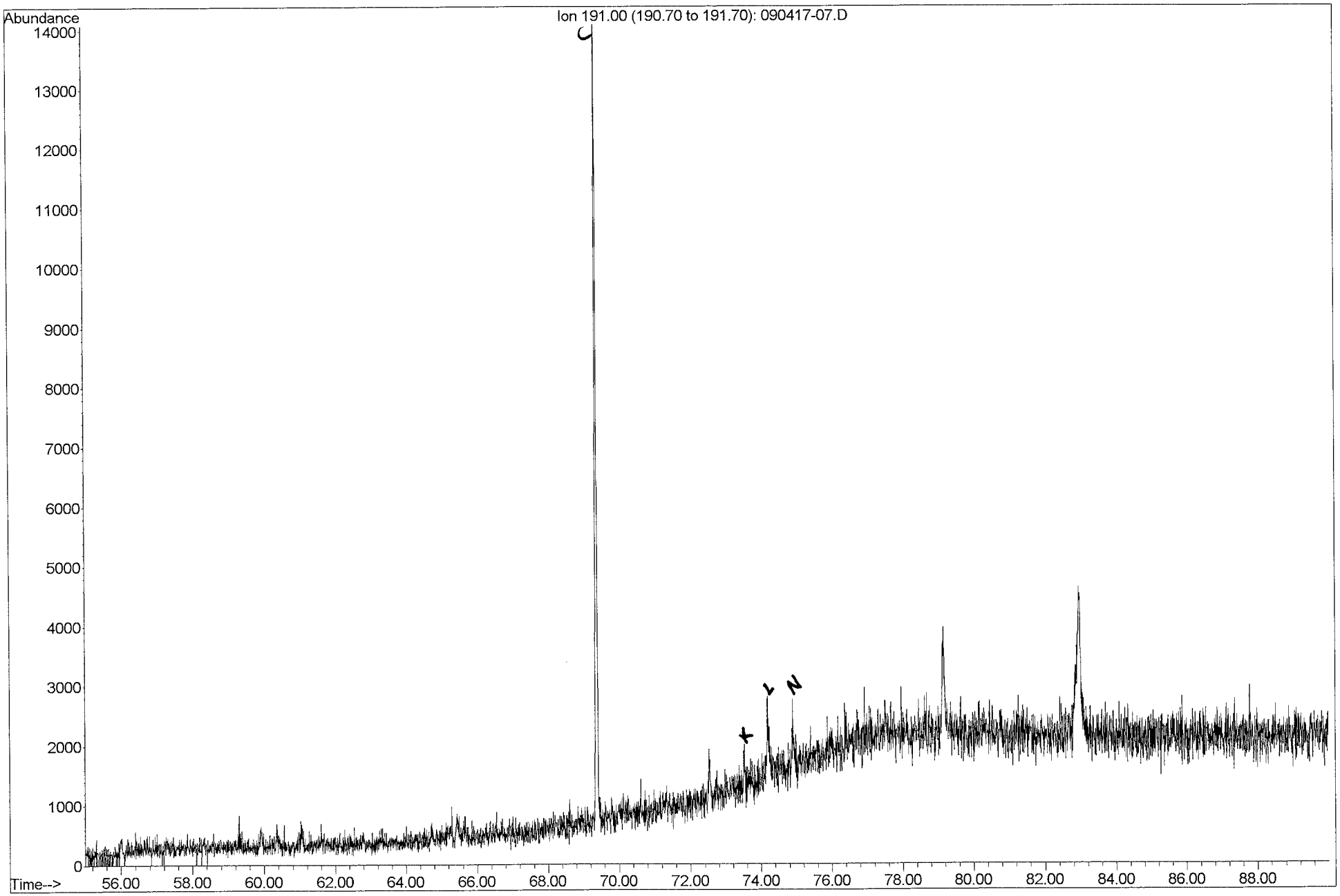
23733-3 [HH01-01-03-170901-21]
910mL->1mL



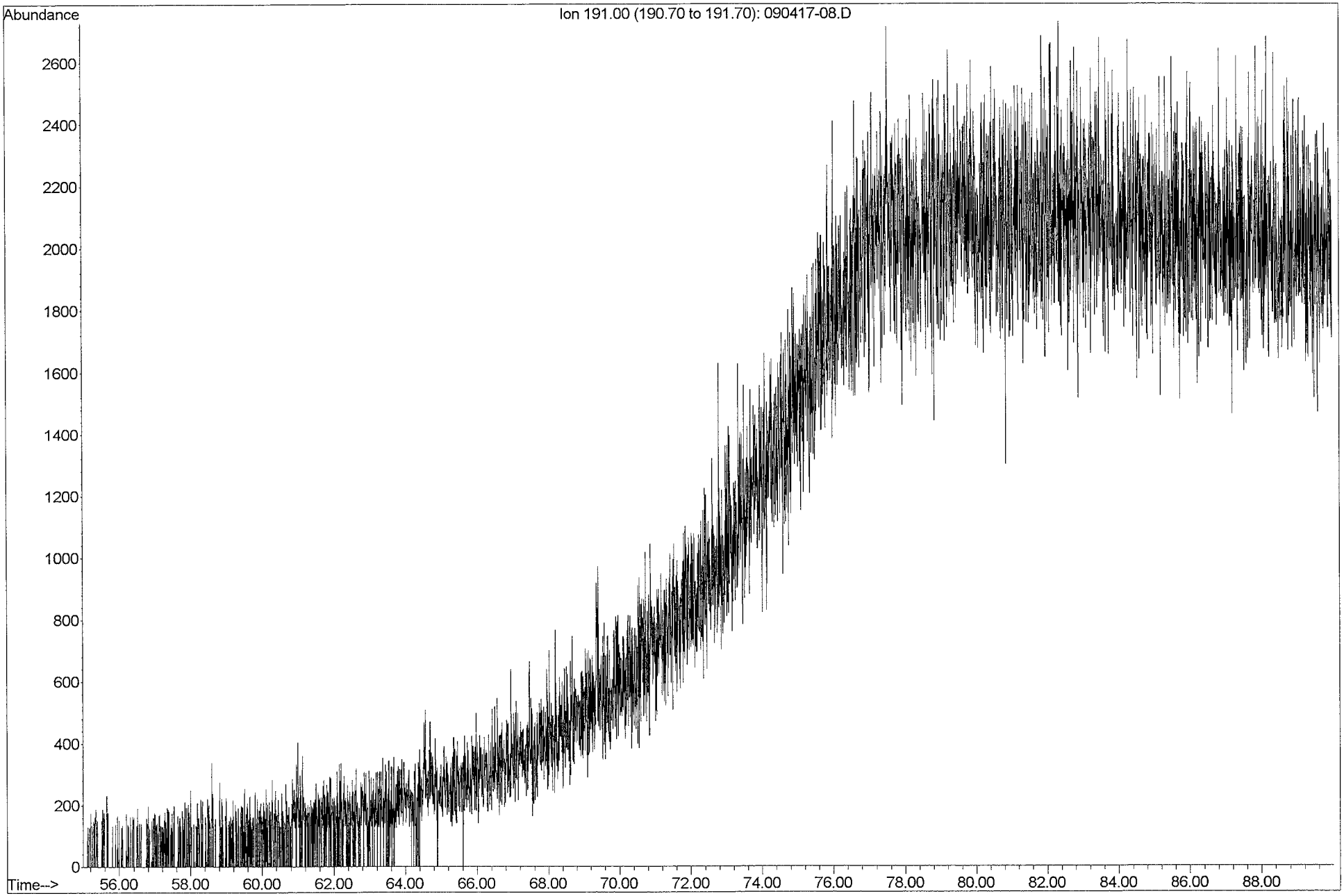
23733-4 [HH01-01-03-170901-22]
870mL->1mL



23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL

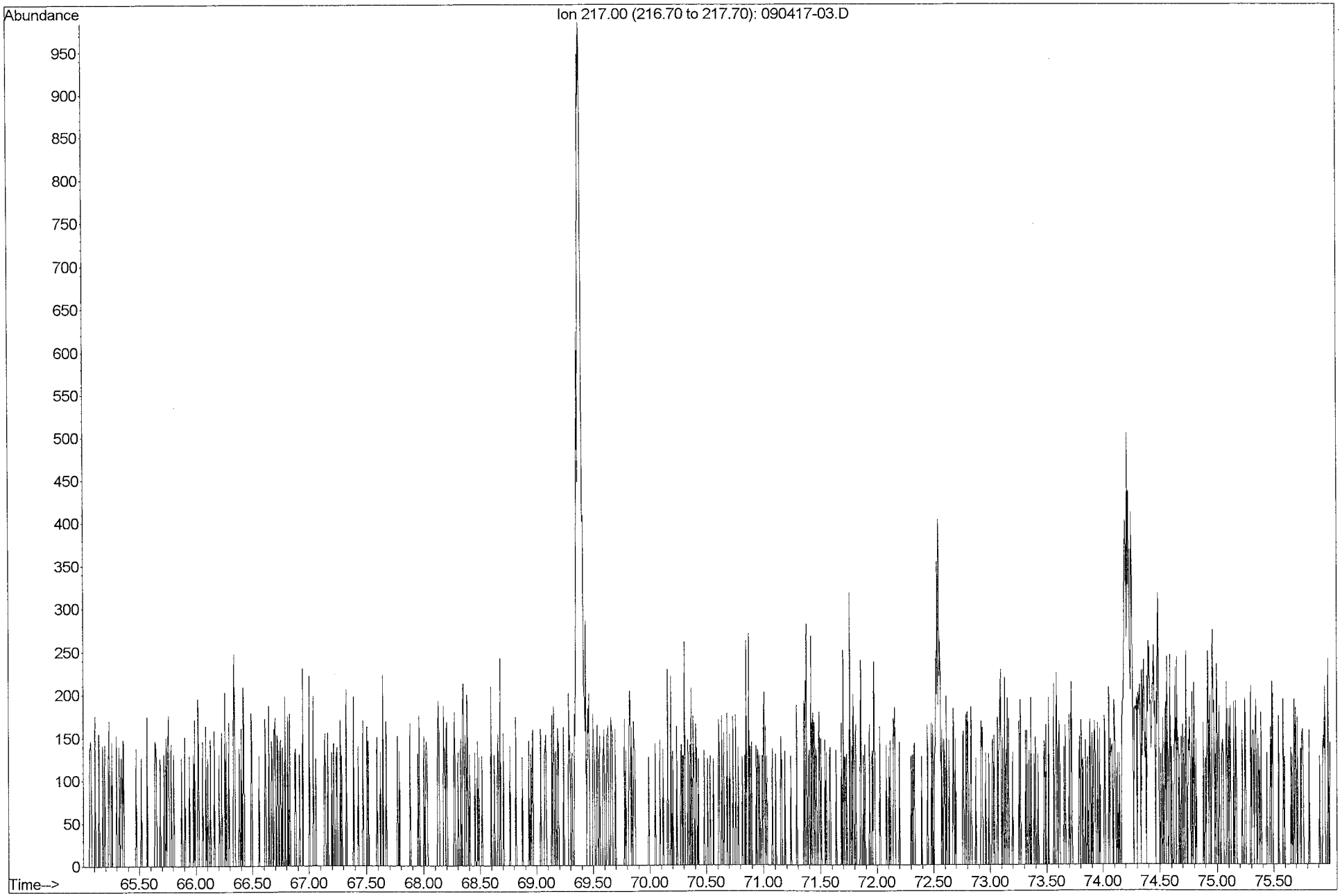


Pace Analytical®
Energy Services™

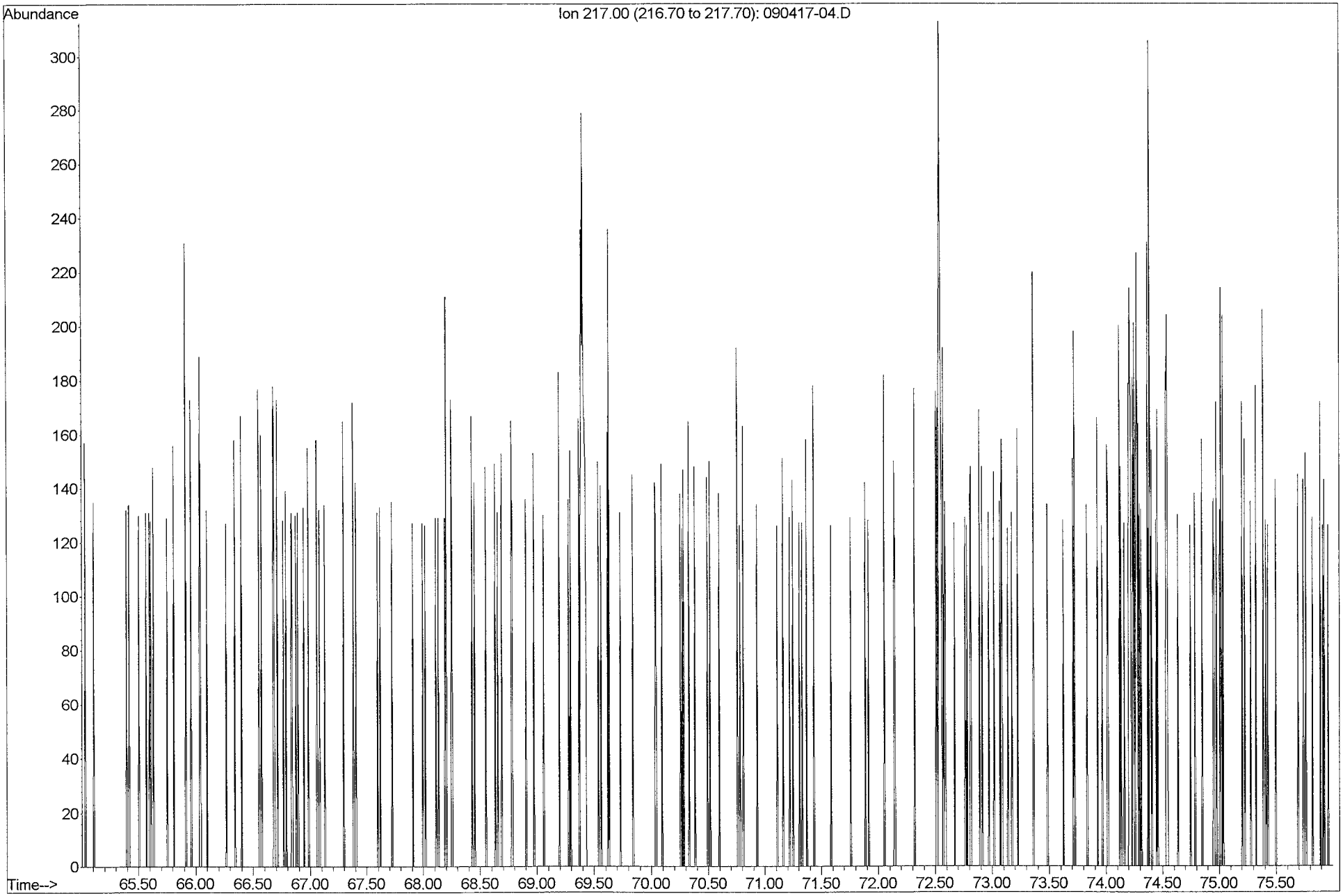
Key for Steranes Identification (m/z 217 Mass Chromatogram)

Code	Identity	Carbon #
1	13β, 17α-Diacholestane (20S)	27
2	13β, 17α-Diacholestane (20R)	27
3	13α, 17β-Diacholestane (20S)	27
4	13α, 17β-Diacholestane (20R)	27
5	24-methyl-13β,17α-Diacholestane (20S)	28
6	24-methyl-13β,17α-Diacholestane (20S)	28
7D	24-methyl-13α,17β-Diacholestane (20S)	28
7	14α,17α-Cholestane (20S)	27
8D	24-ethyl-13β, 17α-Diacholestane (20S)	29
8	14β,17β-Cholestane (20R)	27
9	14β,17β-Cholestane (20S)	27
9D	24-methyl-13α,17β-Diacholestane (20R)	28
10	14α,17α-Cholestane (20R)	27
11	24-ethyl-13β, 17α-Diacholestane (20R)	29
12	24-ethyl-13α, 17β-Diacholestane (20S)	29
13	24-ethyl-13α, 17α-Diacholestane (20S)	28
14D	24-ethyl-13α, 17β-Diacholestane (20R)	29
14	24-methyl-14β, 17β-Cholestane (20R)	28
15	24-methyl-14β, 17β-Cholestane (20S)	28
16	24-methyl-14α, 17α-Cholestane (20R)	28
17	24-ethyl-14α-Cholestane (20S)	29
18	24-ethyl-14β, 17β-Cholestane (20R)	29
19	24-ethyl-14β, 17β-Cholestane (20S)	29
20	24-ethyl-14α, 17α-Cholestane (20R)	29
21A	24-n-Propylcholestane (20S)	30
21B	4-methyl-24-ethylcholestane (20S)	30
22A	4α-methyl-24-ethyl-14β,17β-cholestane (20S)	30
22B	24-n-Propyl-14β,17β-cholestane (20S)	30
23A	4α-methyl-24-ethyl-14β,17β-cholestane (20R)	30
23B	24-n-propyl-14β,17β-cholestane (20R)	30
24A	4α-methyl-24-ethylcholestane (20R)	30
24B	24-n-propylcholestane (20R)	30

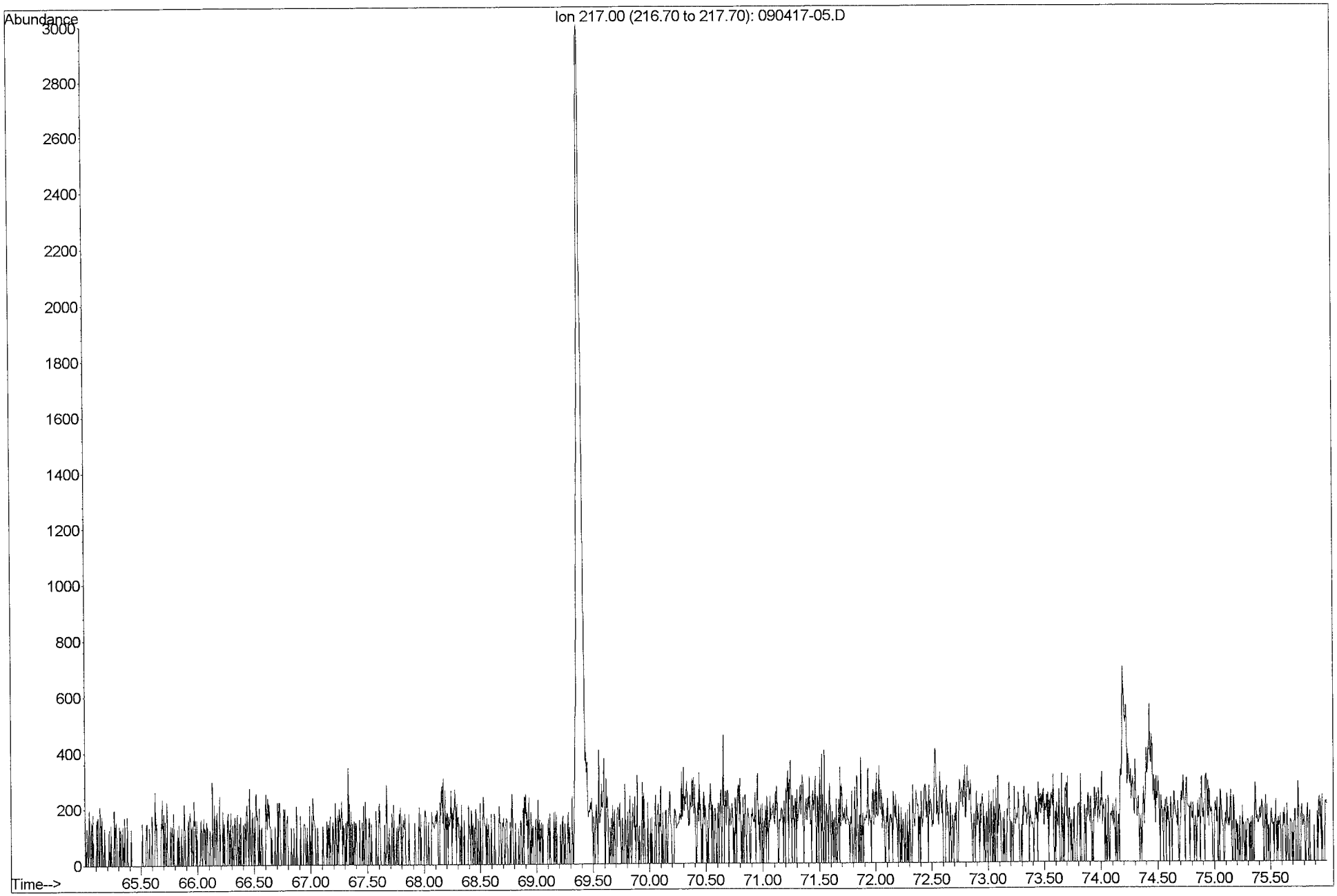
23733-1 [HH01-01-01-170901-21]
770mL->1mL



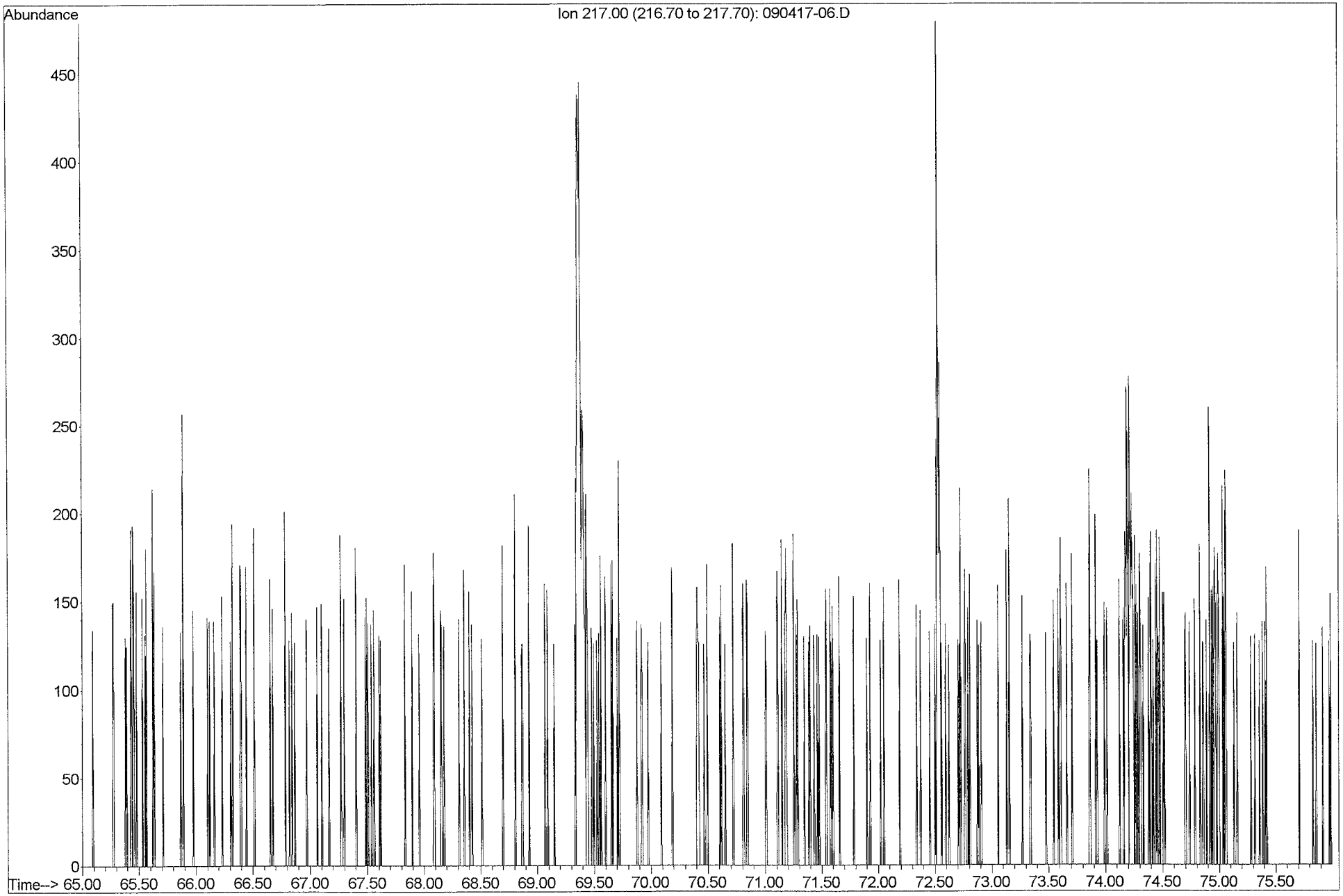
23733-2 [HH01-01-02-170901-21]
950mL->1mL



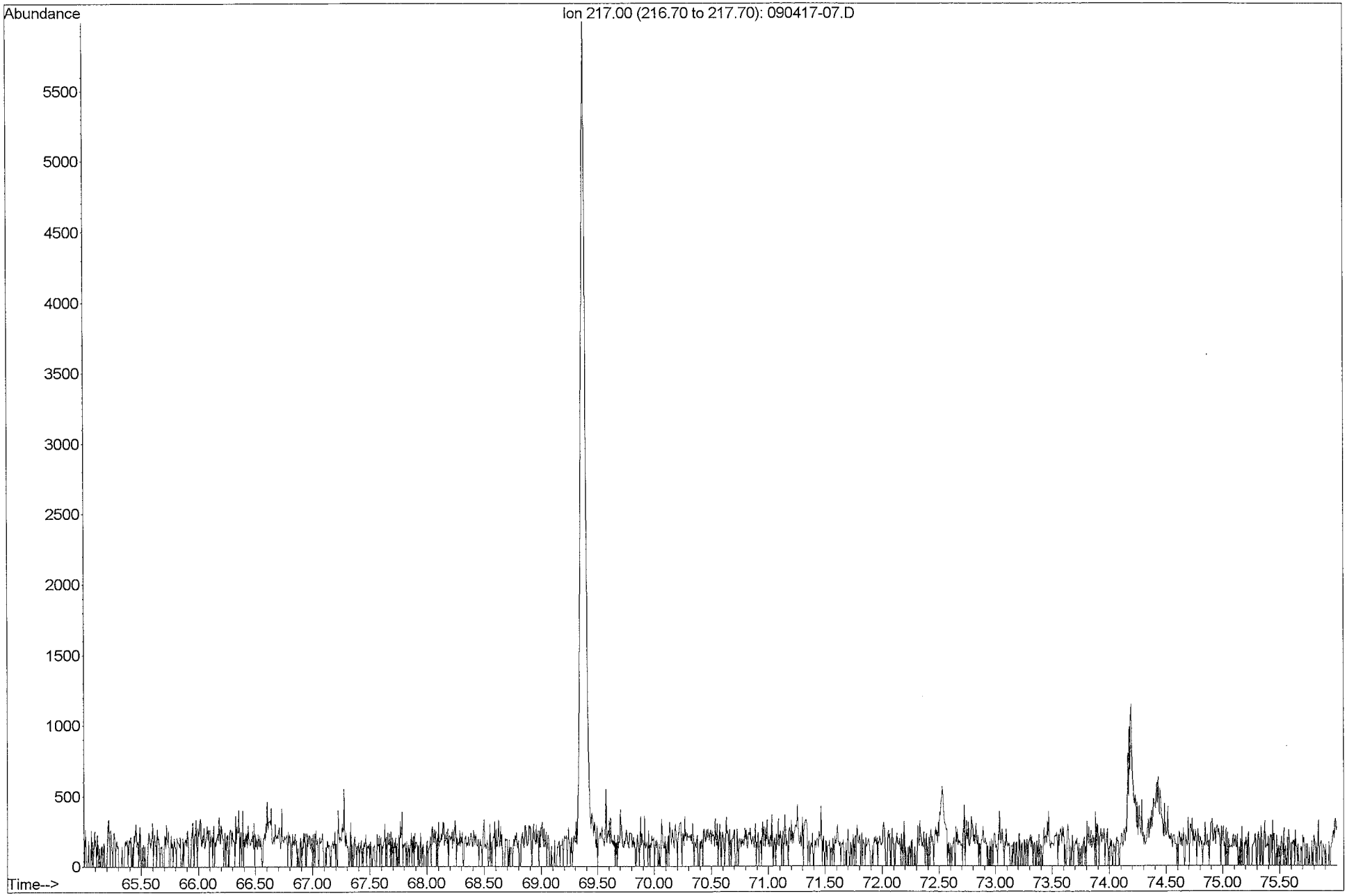
23733-3 [HH01-01-03-170901-21]
910mL->1mL



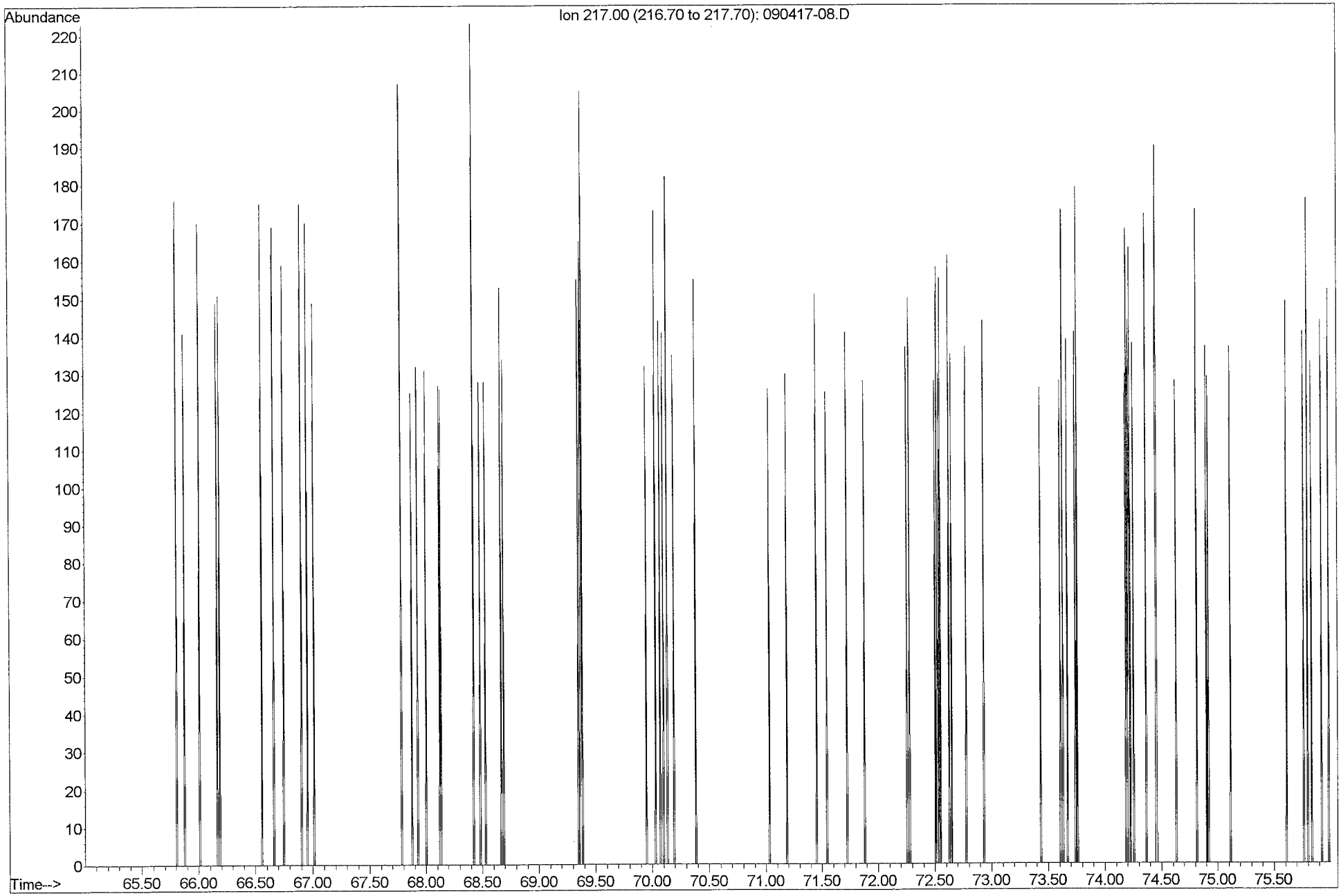
23733-4 [HH01-01-03-170901-22]
870mL->1mL



23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL

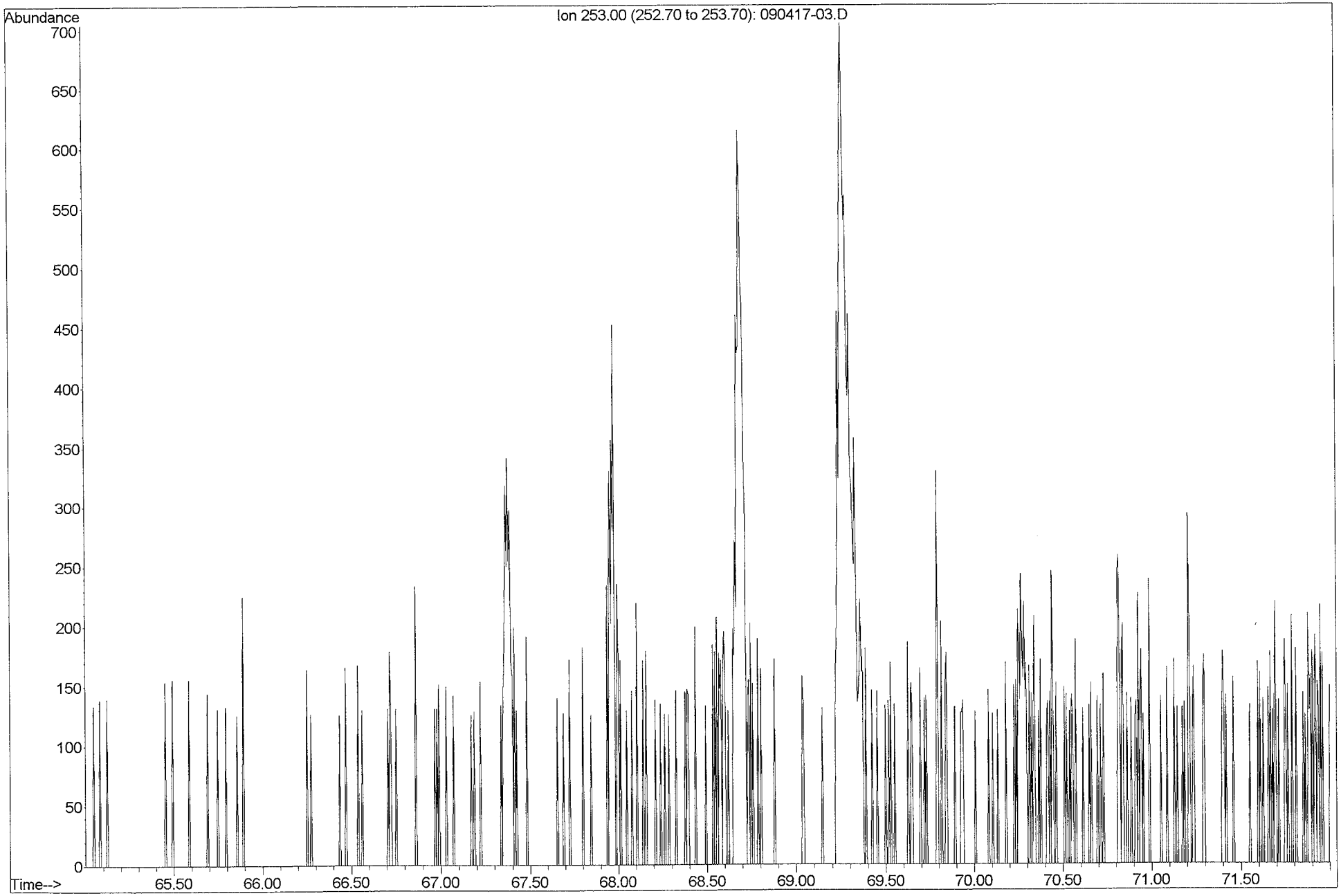


Pace Analytical® Energy Services™

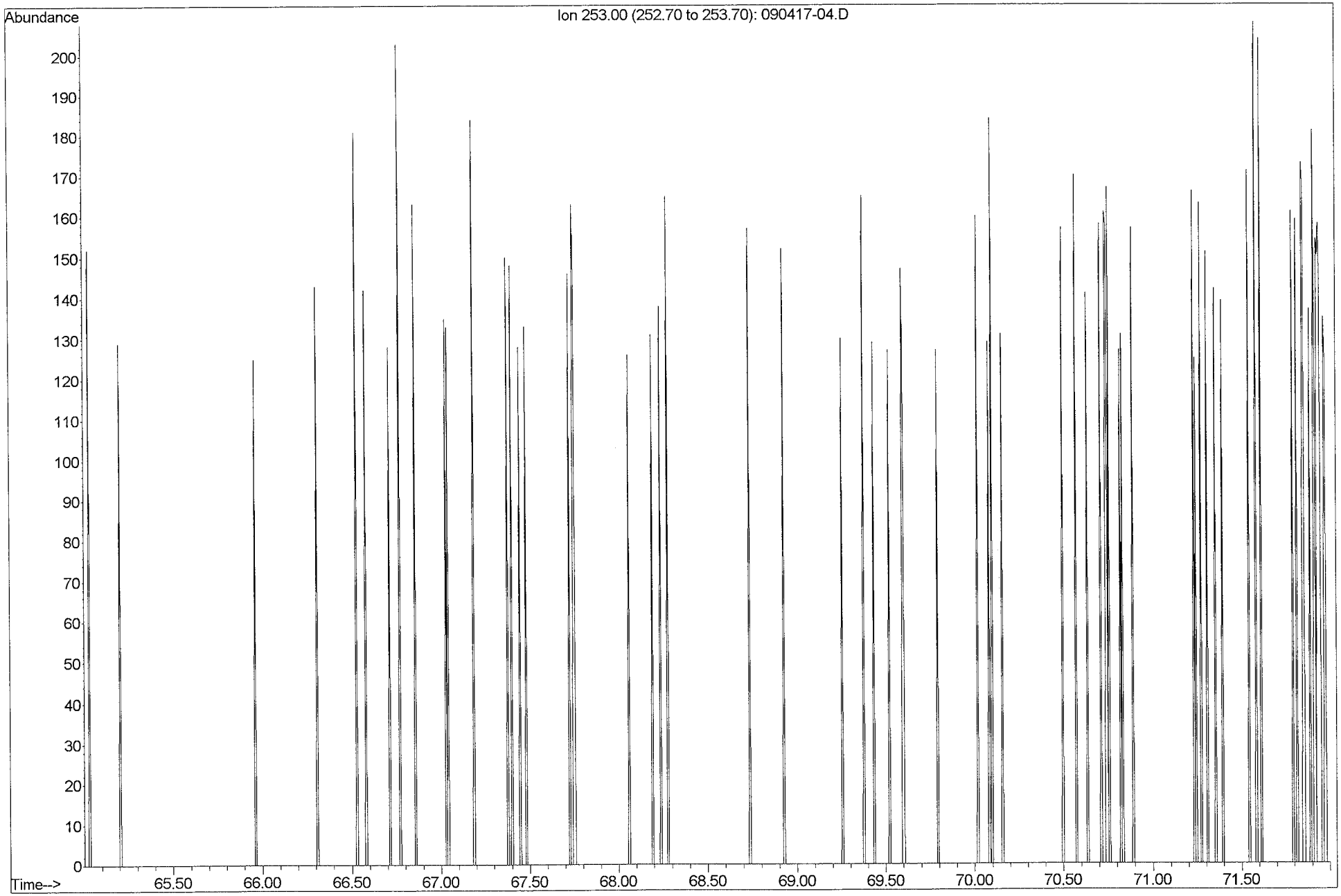
Key for Monoaromatic Steranes Identification (m/z 253 Mass Chromatogram)

Code	Identity	Elemental Composition
a	20S, 5β C_{27}-Monoaromatic Sterane	$C_{27}H_{42}$
b	20S, dia C_{27}-Monoaromatic Sterane	$C_{27}H_{42}$
c	20R, 5β C_{27}-Monoaromatic Sterane + 20R C_{27} dia MAS	$C_{27}H_{42}$
d	20S, 5α C_{27}-Monoaromatic Sterane	$C_{27}H_{42}$
e	20R, 5β C_{28}-Monoaromatic Sterane + 20S C_{28} dia MAS	$C_{28}H_{44}$
f	20R, 5α C_{27}-Monoaromatic Sterane	$C_{27}H_{42}$
g	20S, 5α C_{28}-Monoaromatic Sterane	$C_{28}H_{44}$
h	20R, 5β C_{28}-Monoaromatic Sterane + 20R C_{28} dia MAS	$C_{28}H_{44}$
i	20S, 5β C_{29}-Monoaromatic Sterane + 20S C_{29} dia MAS	$C_{29}H_{46}$
j	20S, 5α C_{29}-Monoaromatic Sterane	$C_{29}H_{46}$
k	20R, 5α C_{28}-Monoaromatic Sterane	$C_{28}H_{44}$
l	20R, 5β C_{29}-Monoaromatic Sterane + 20R C_{29} dia MAS	$C_{29}H_{46}$
m	20R, 5α C_{29}-Monoaromatic Sterane	$C_{29}H_{46}$

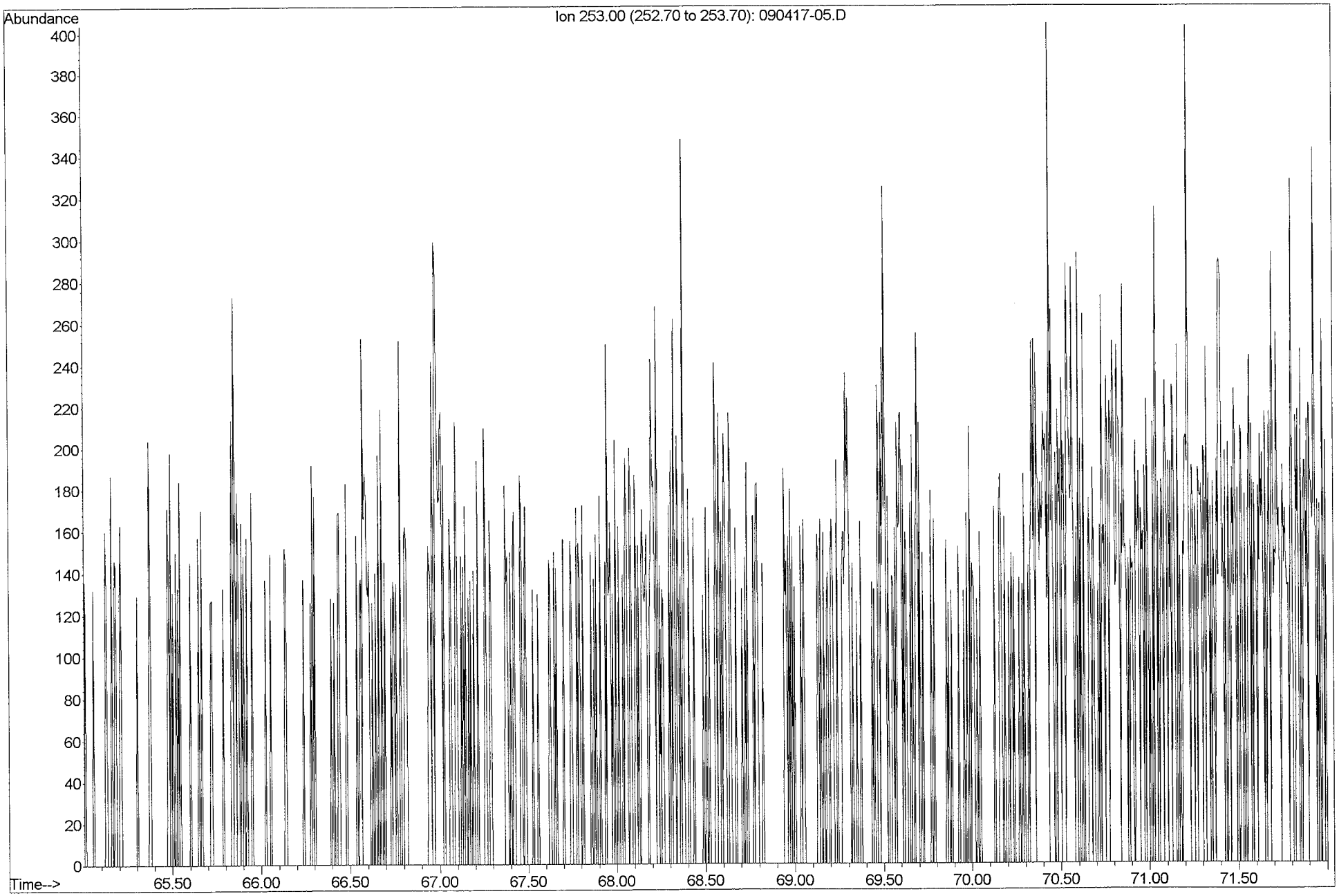
23733-1 [HH01-01-01-170901-21]
770mL->1mL



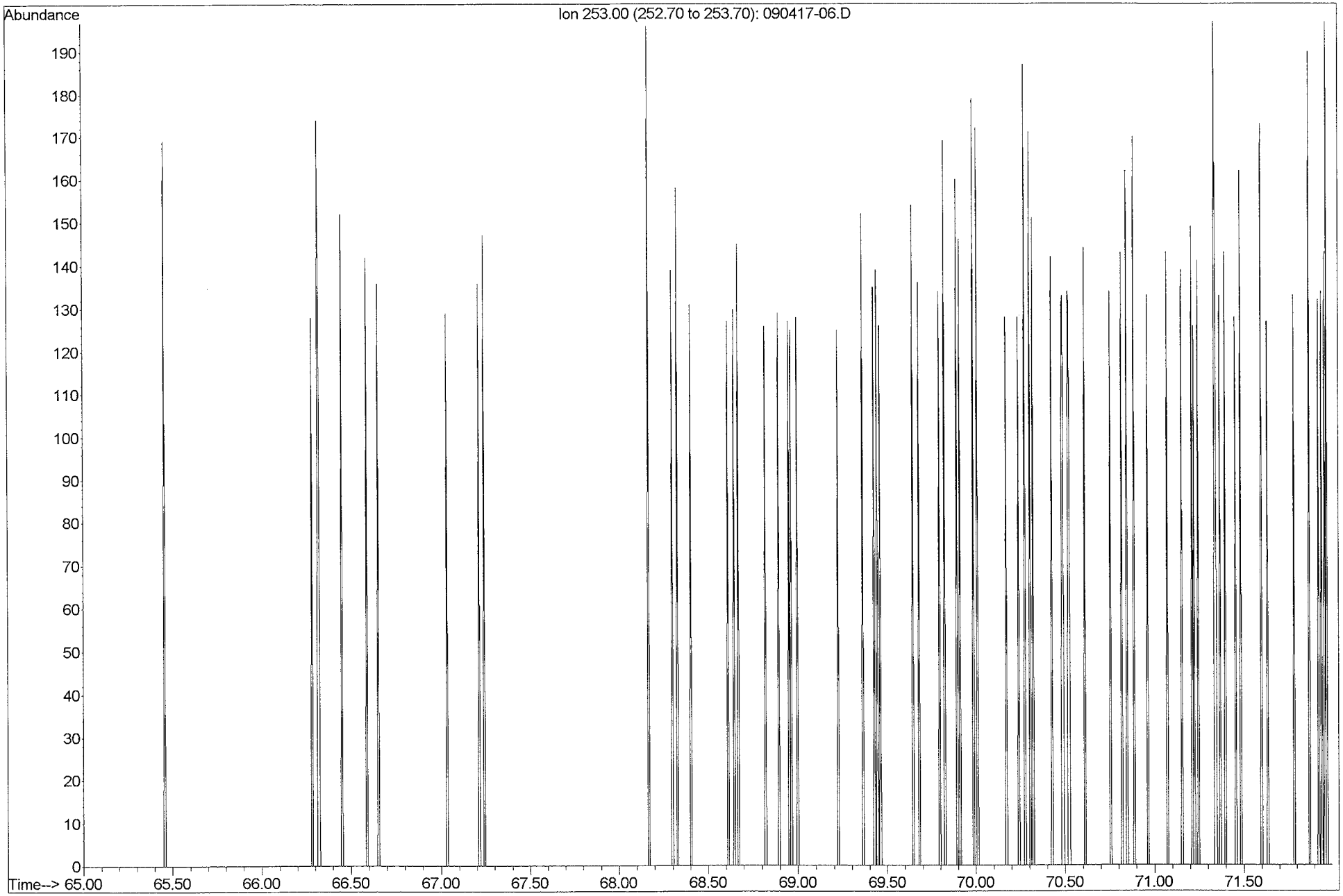
23733-2 [HH01-01-02-170901-21]
950mL->1mL



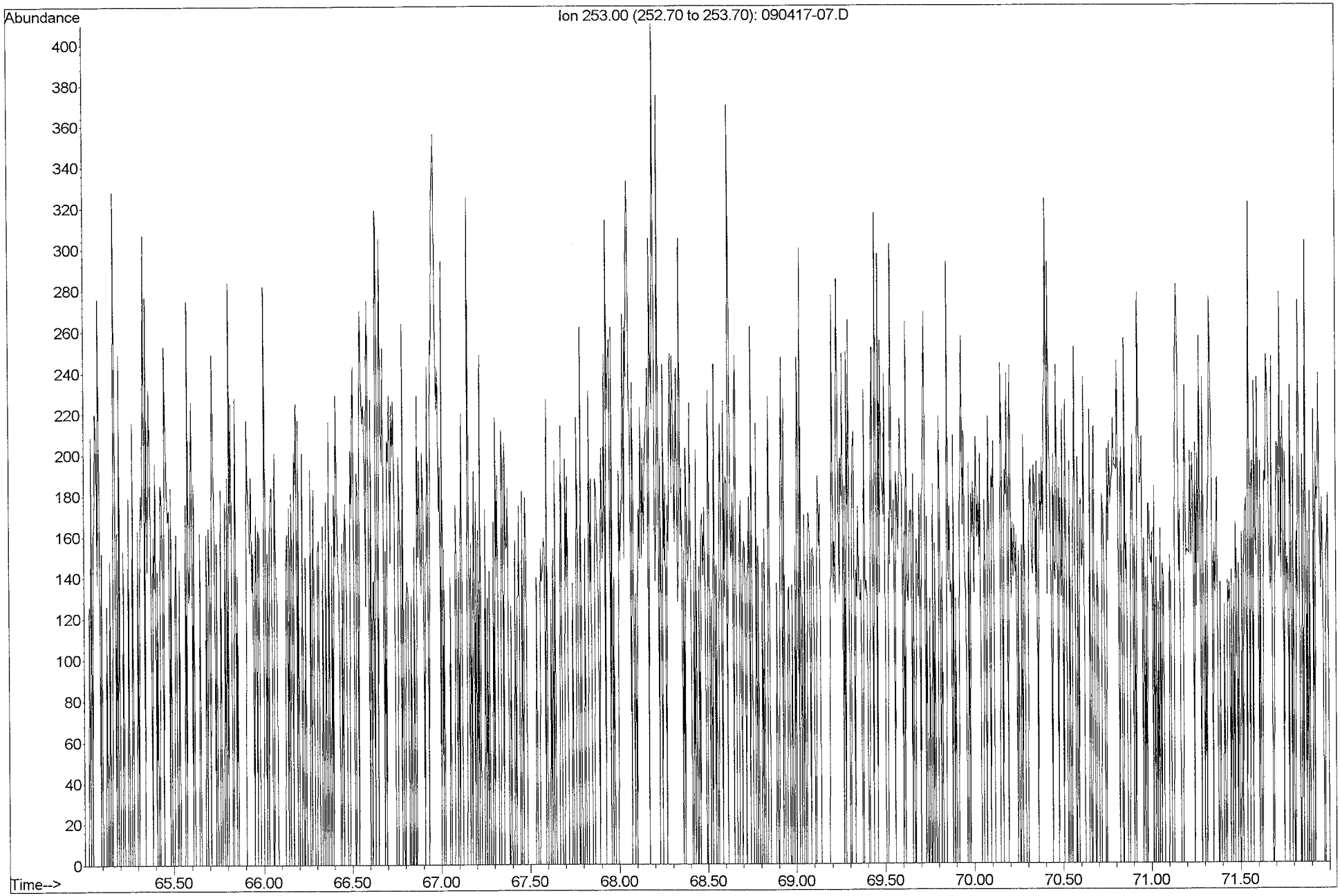
23733-3 [HH01-01-03-170901-21]
910mL->1mL



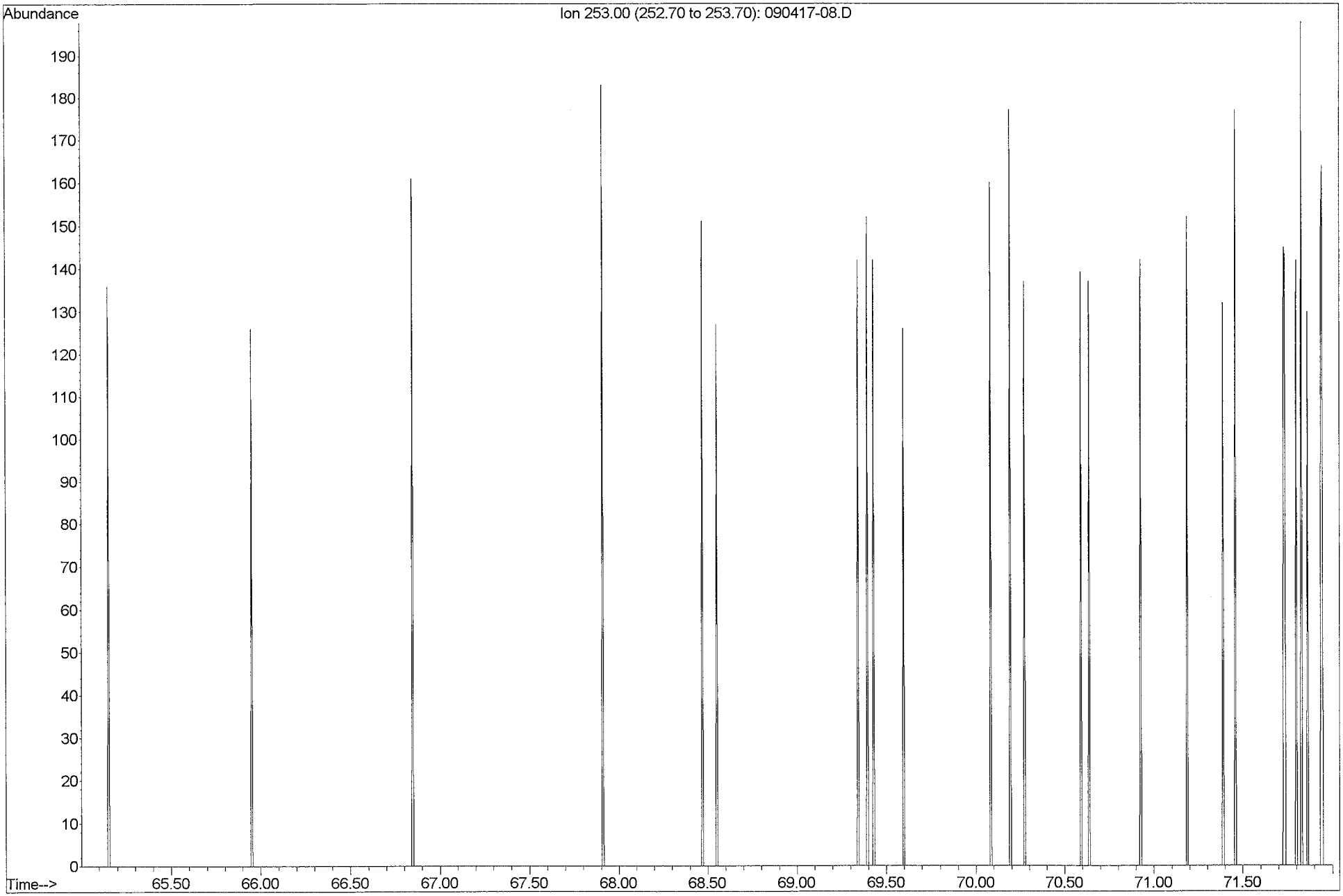
23733-4 [HH01-01-03-170901-22]
870mL->1mL



23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL

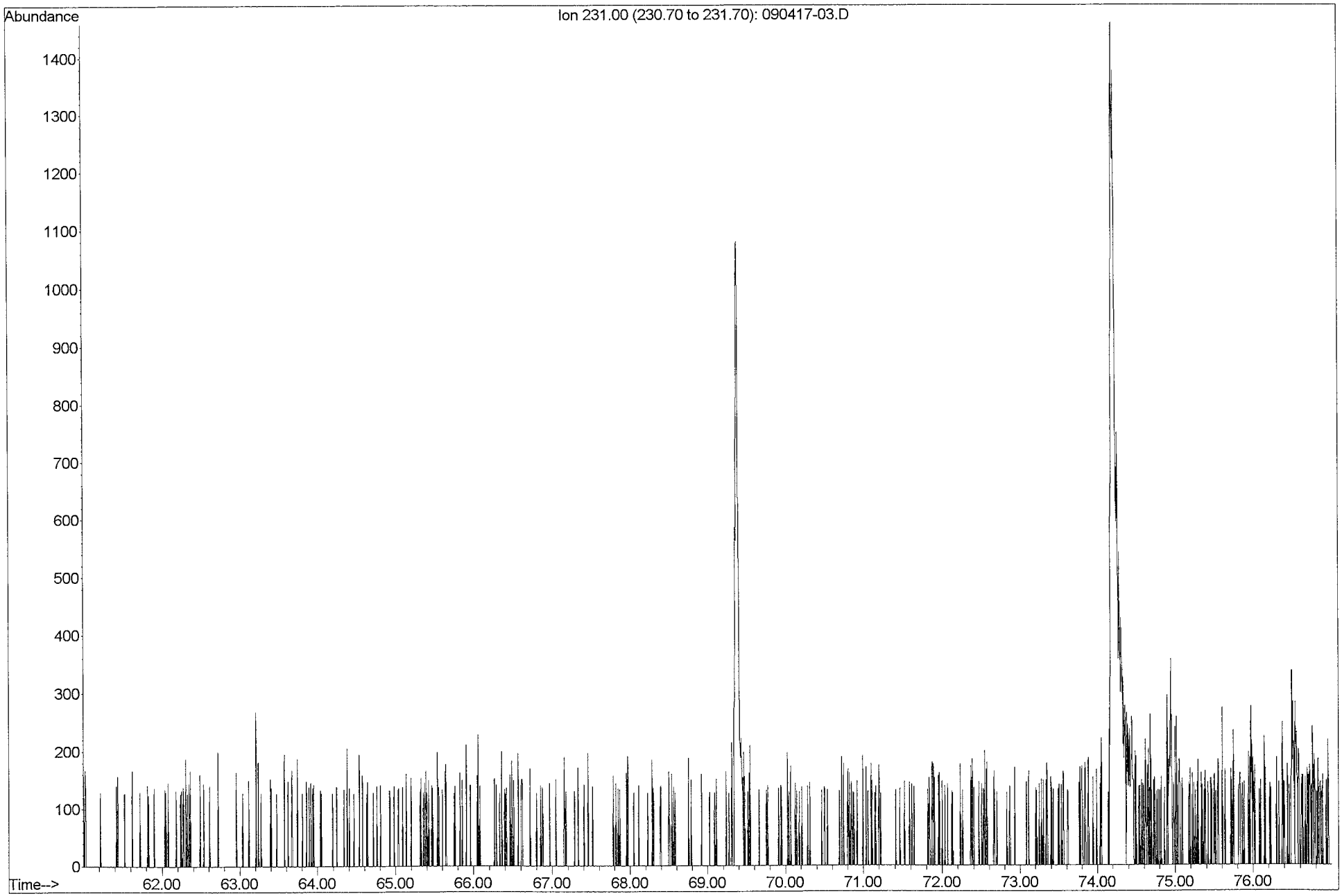


Pace Analytical®
Energy Services™

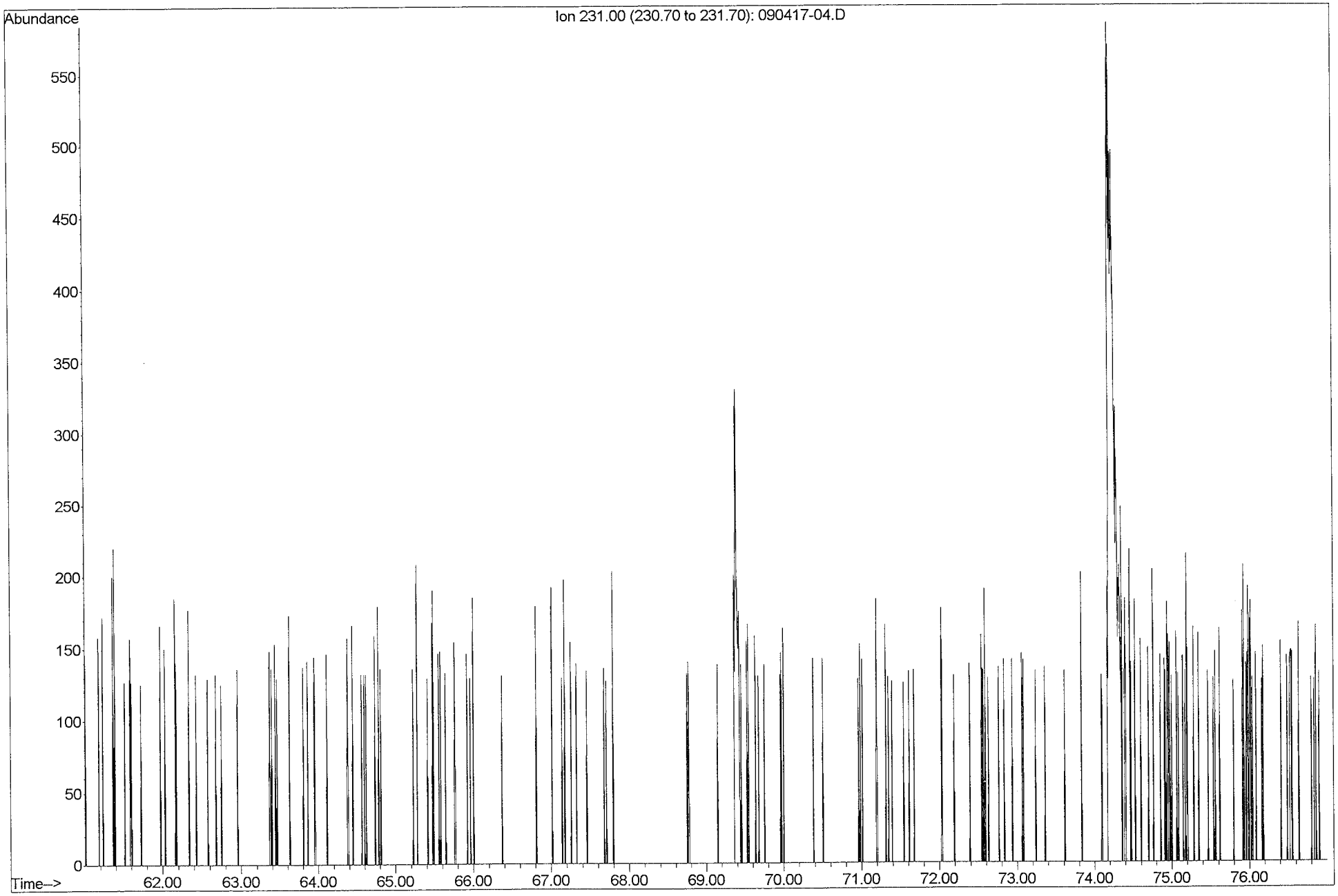
Key for Triaromatic Steranes Identification (m/z 231 Mass Chromatogram)

Code	Identity	Elemental Composition
T1	C_{20} Triaromatic Sterane	$C_{20}H_{20}$
T2	C_{21} Triaromatic Sterane	$C_{21}H_{22}$
T3	20S C_{26} Triaromatic Sterane	$C_{26}H_{32}$
T4	20R C_{26} + 20S C_{27} Triaromatic Steranes	$C_{26}H_{32}$ + $C_{27}H_{34}$
T5	20S C_{28} Triaromatic Sterane	$C_{28}H_{36}$
T6	20R C_{27} Triaromatic Sterane	$C_{27}H_{34}$
T7	20R C_{28} Triaromatic Sterane	$C_{28}H_{36}$

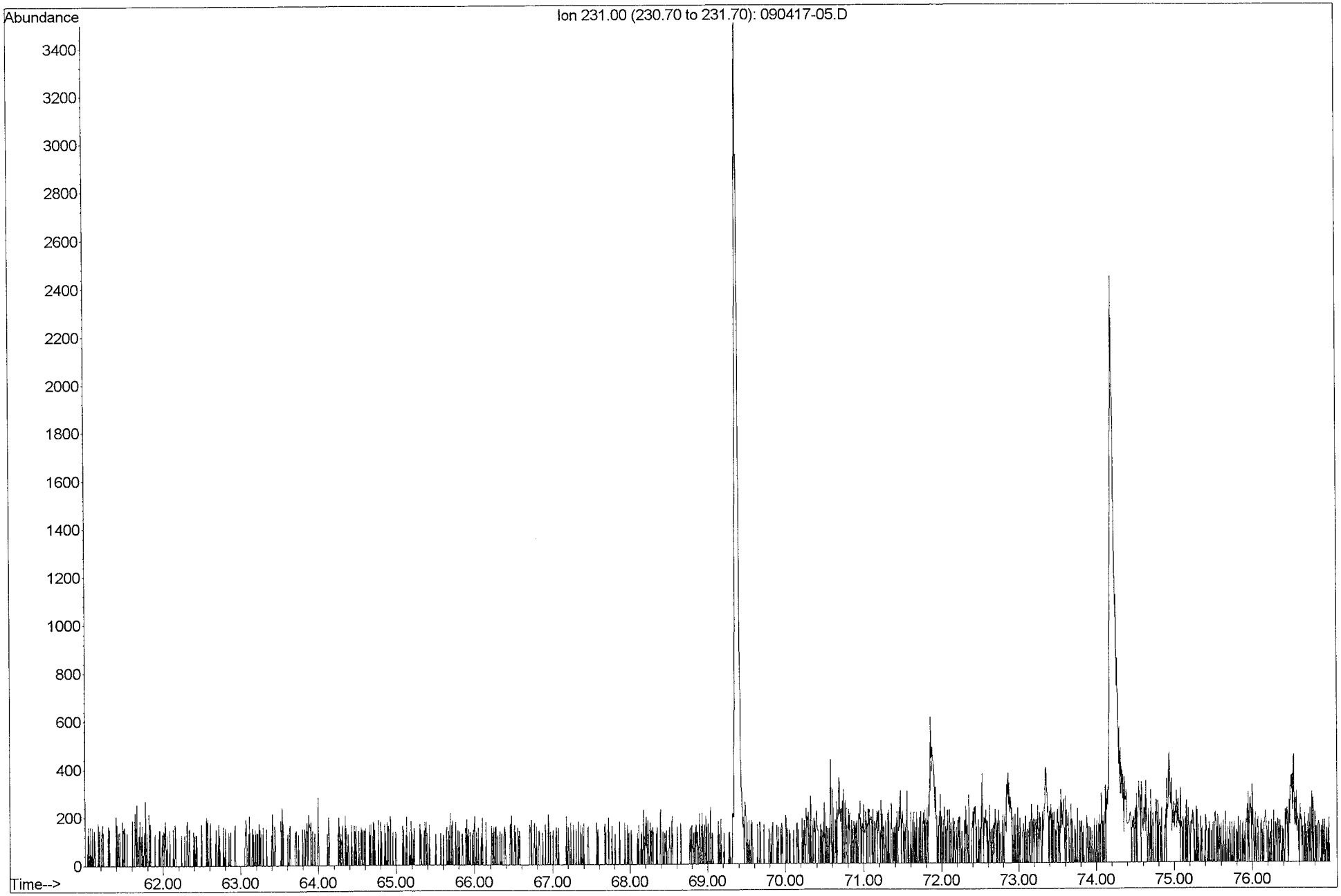
23733-1 [HH01-01-01-170901-21]
770mL->1mL



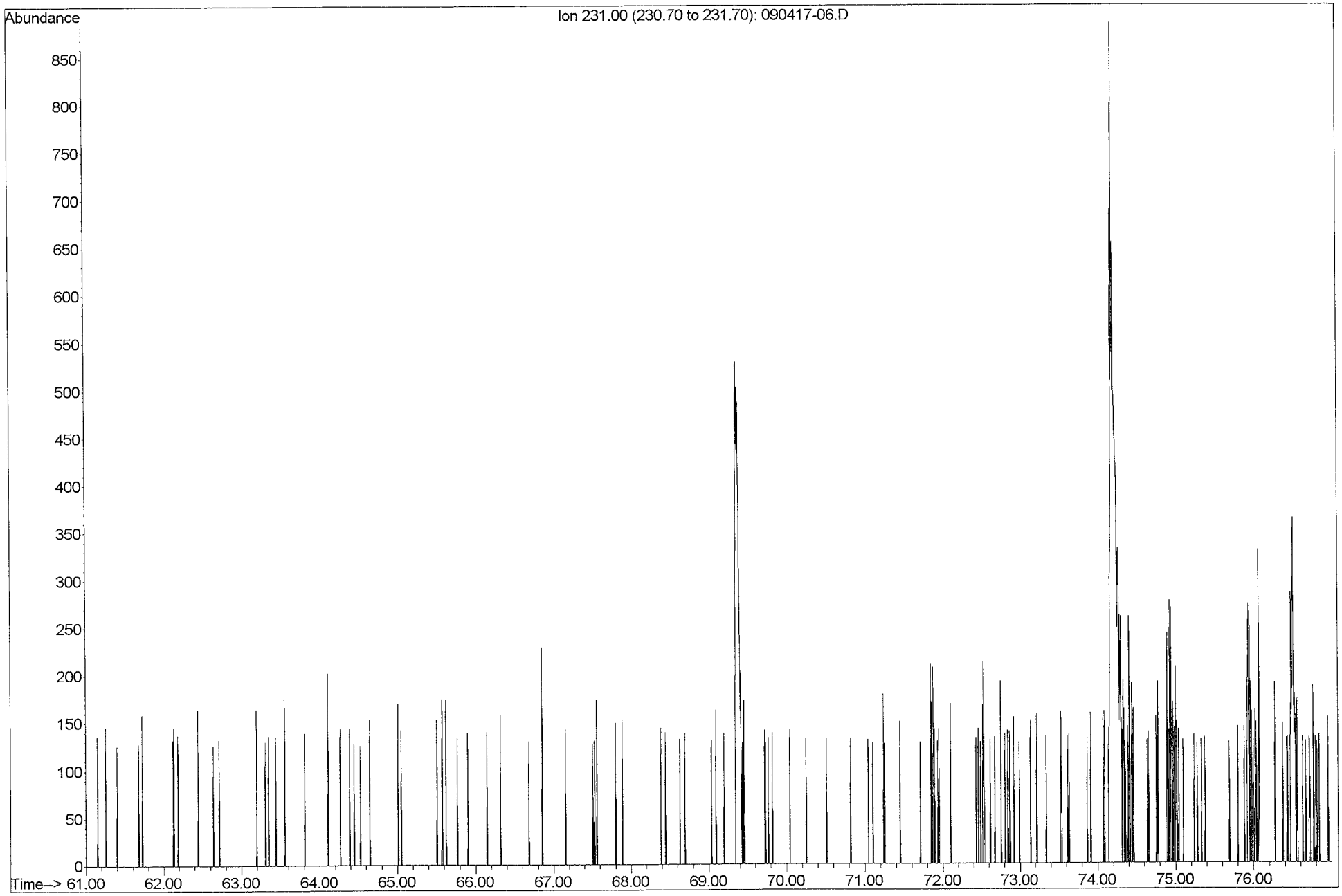
23733-2 [HH01-01-02-170901-21]
950mL->1mL



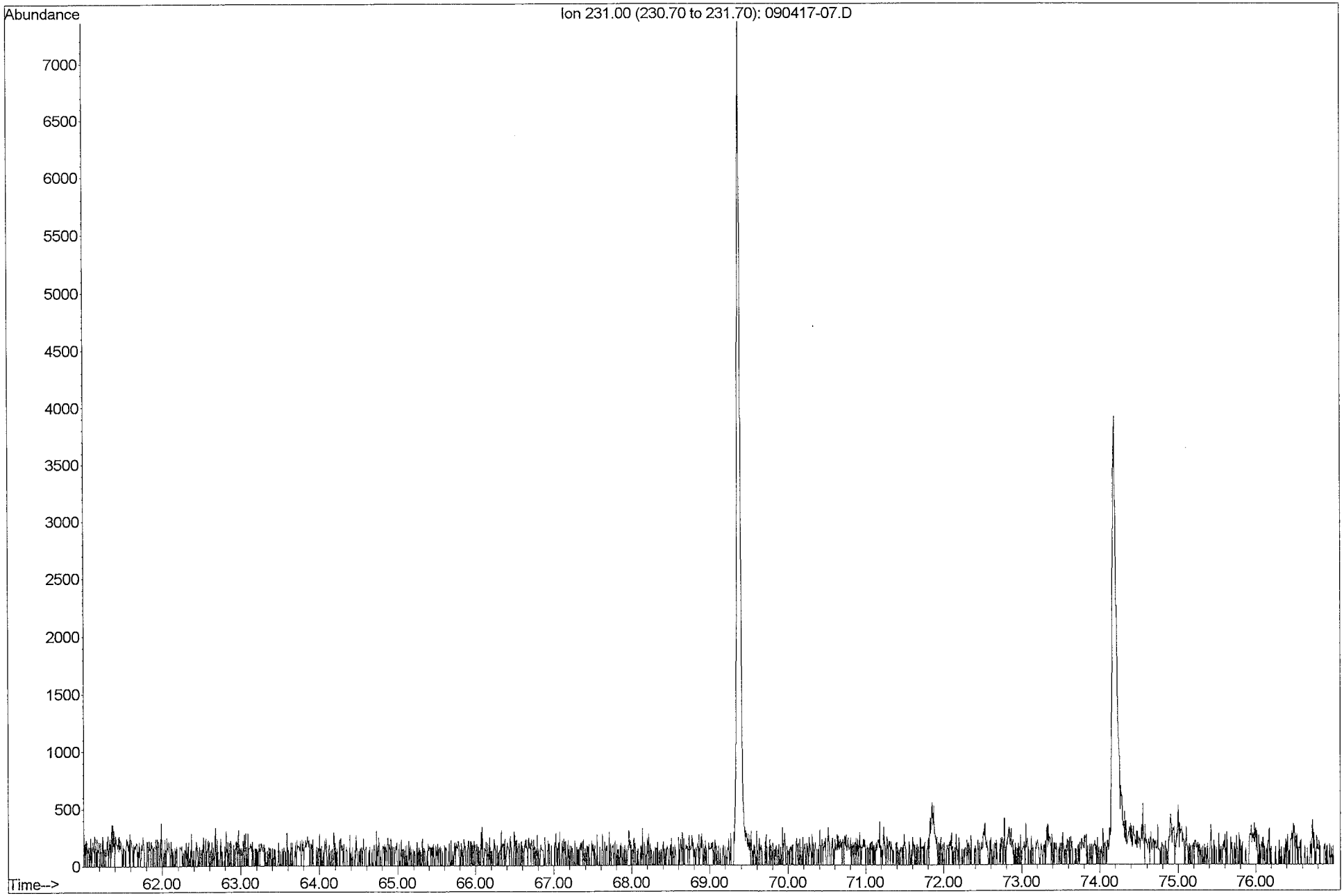
23733-3 [HH01-01-03-170901-21]
910mL->1mL



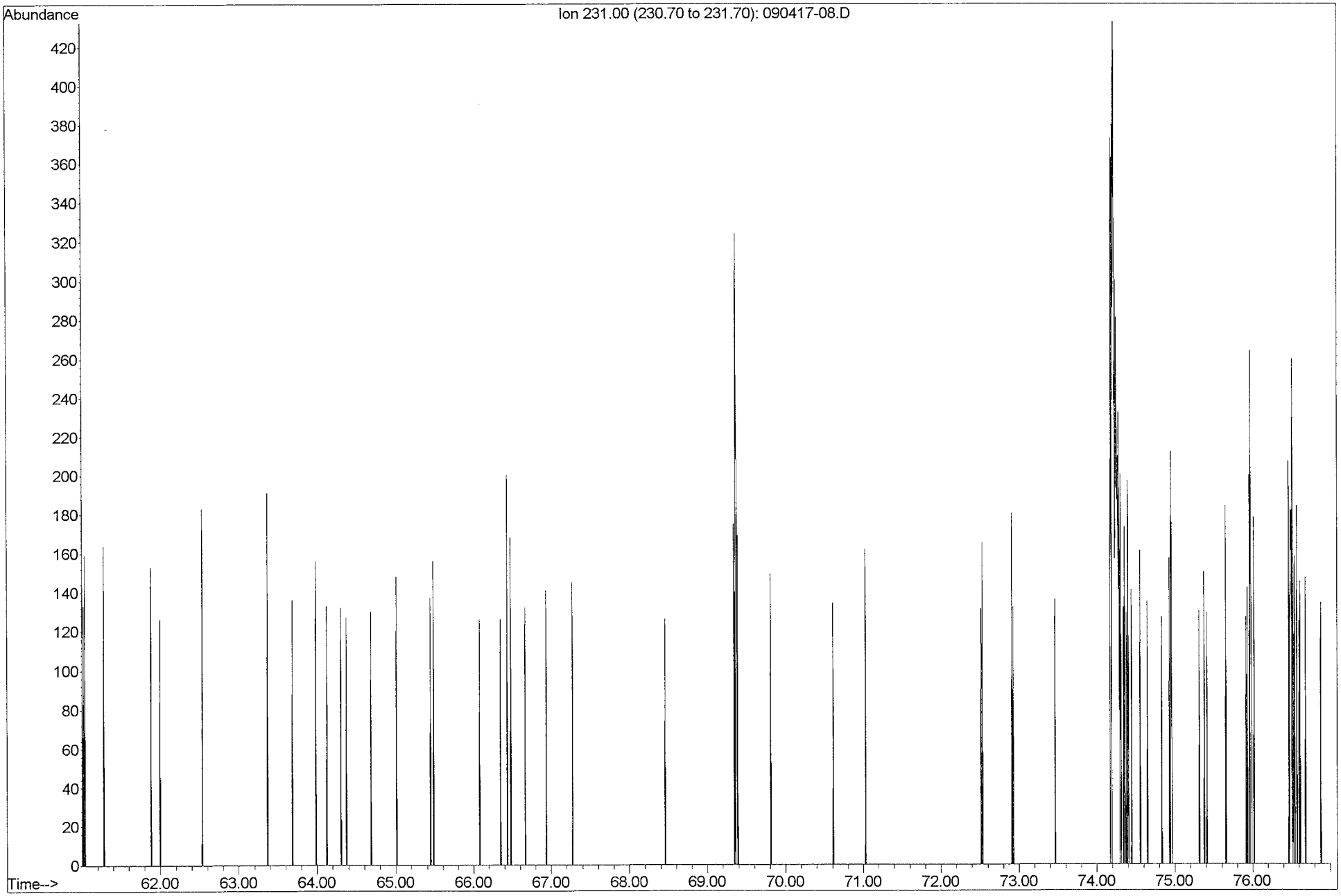
23733-4 [HH01-01-03-170901-22]
870mL->1mL



23733-5 [HH01-01-04-170901-21]
910mL->1mL



23733-6 [HH01-01-05-170901-21]
730mL->1mL



Pace Analytical® Energy Services™

Key for Identifying Aromatic Hydrocarbons

No	m/z	Abbreviation	Compound
1	120	AB	C_3-alkylbenzenes
2	134		C_4-alkylbenzenes
3	148		C_5-alkylbenzenes
4	162		C_6-alkylbenzenes
5	128	NAPH	C_0-naphthalene
6	142		C_1-naphthalenes
7	156		C_2-naphthalenes
8	170		C_3-naphthalenes
9	184		C_4-naphthalenes
10	166	FL	C_0-fluorene
11	180		C_1-fluorenes
12	194		C_2-fluorenes
13	208		C_3-fluorenes
14	222		C_4-fluorenes
15	154	BP	C_0-biphenyl
16	168		C_1-biphenyls + dibenzofuran
17	182		C_2-biphenyls + C1 Dibenzofuran
18	178	PHEN	C_0-phenanthrene
19	192		C_1-phenanthrenes
20	206		C_2-phenanthrenes
21	220		C_3-phenanthrenes
22	234		C_4-phenanthrenes
23	202	PY	C_0-pyrene/fluoranthene
24	216		C_1-pyrenes/fluoranthenes
25	230		C_2-pyrenes/fluoranthenes
26	244		C_3-pyrenes/fluoranthenes
27	258		C_4-pyrenes/fluoranthenes
28	228	CHR	C_0-chrysene
29	242		C_1-chrysenes
30	256		C_2-chrysenes
31	270		C_3-chrysenes
32	284		C_4-chrysenes
33	148	BT	C_1-benzothiophenes
34	162		C_2-benzothiophenes
35	176		C_3-benzothiophenes
36	190		C_4-benzothiophenes
37	204		C_5-benzothiophenes

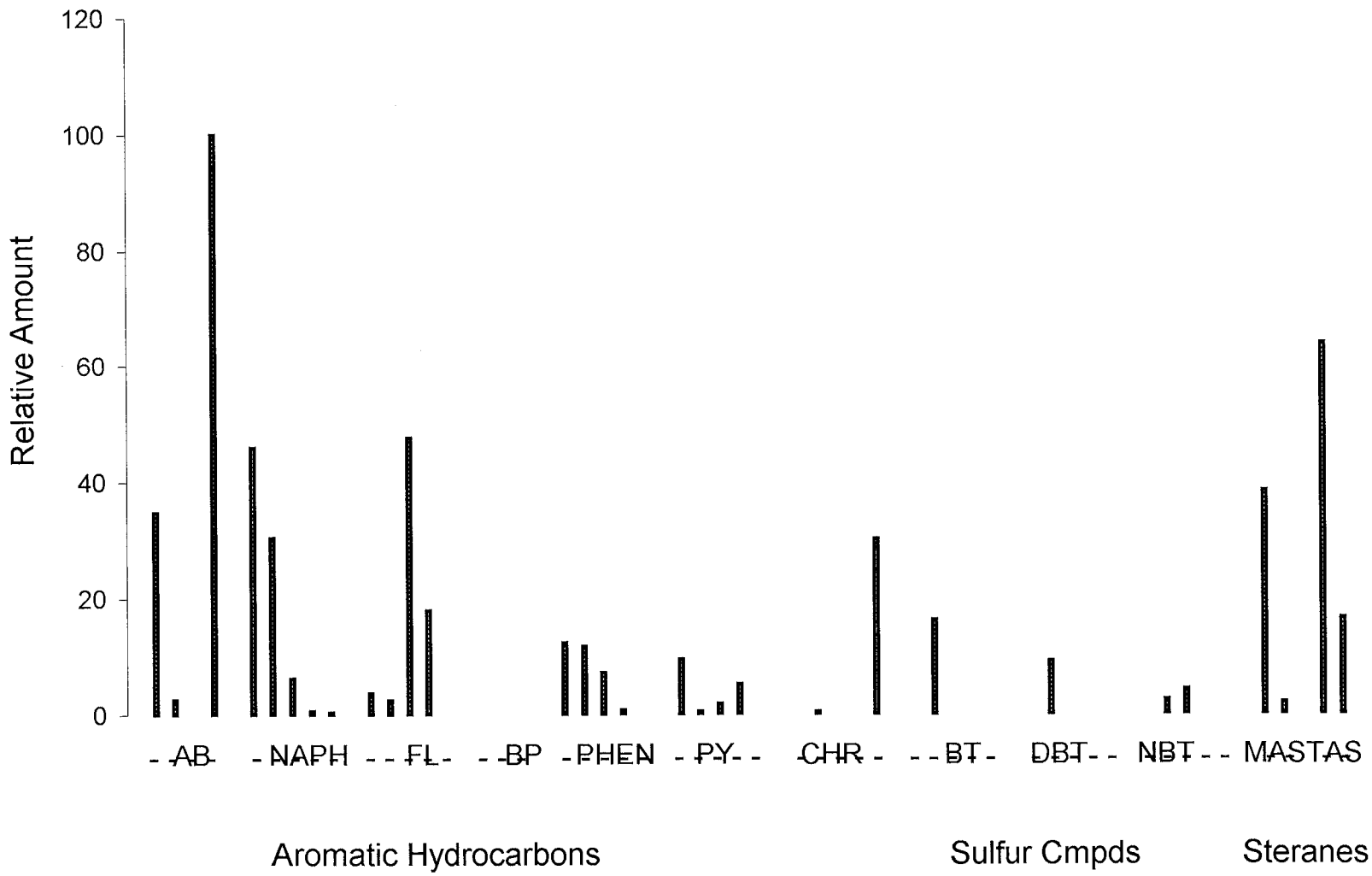
Pace Analytical®
Energy Services™

Key for Identifying Aromatic Hydrocarbons – Cont.

No	m/z	Abbreviation	Compound
38	184	DBT	C_0-dibenzothiophene
39	198		C_1-dibenzothiophenes
40	212		C_2-dibenzothiophenes
41	226		C_3-dibenzothiophenes
42	240		C_4-dibenzothiophenes
43	234	NBT	C_0-naphthobenzthiophene
44	248		C_1-naphthobenzthiophenes
45	262		C_2-naphthobenzthiophenes
46	276		C_3-naphthobenzthiophenes
47	290		C_4-naphthobenzthiophenes
48	253	MAS	Monoaromatic steranes
49	267		Monoaromatic steranes
50	239		Monoaromatic steranes
51	231	TAS	Triaromatic steranes
52	245		Triaromatic steranes

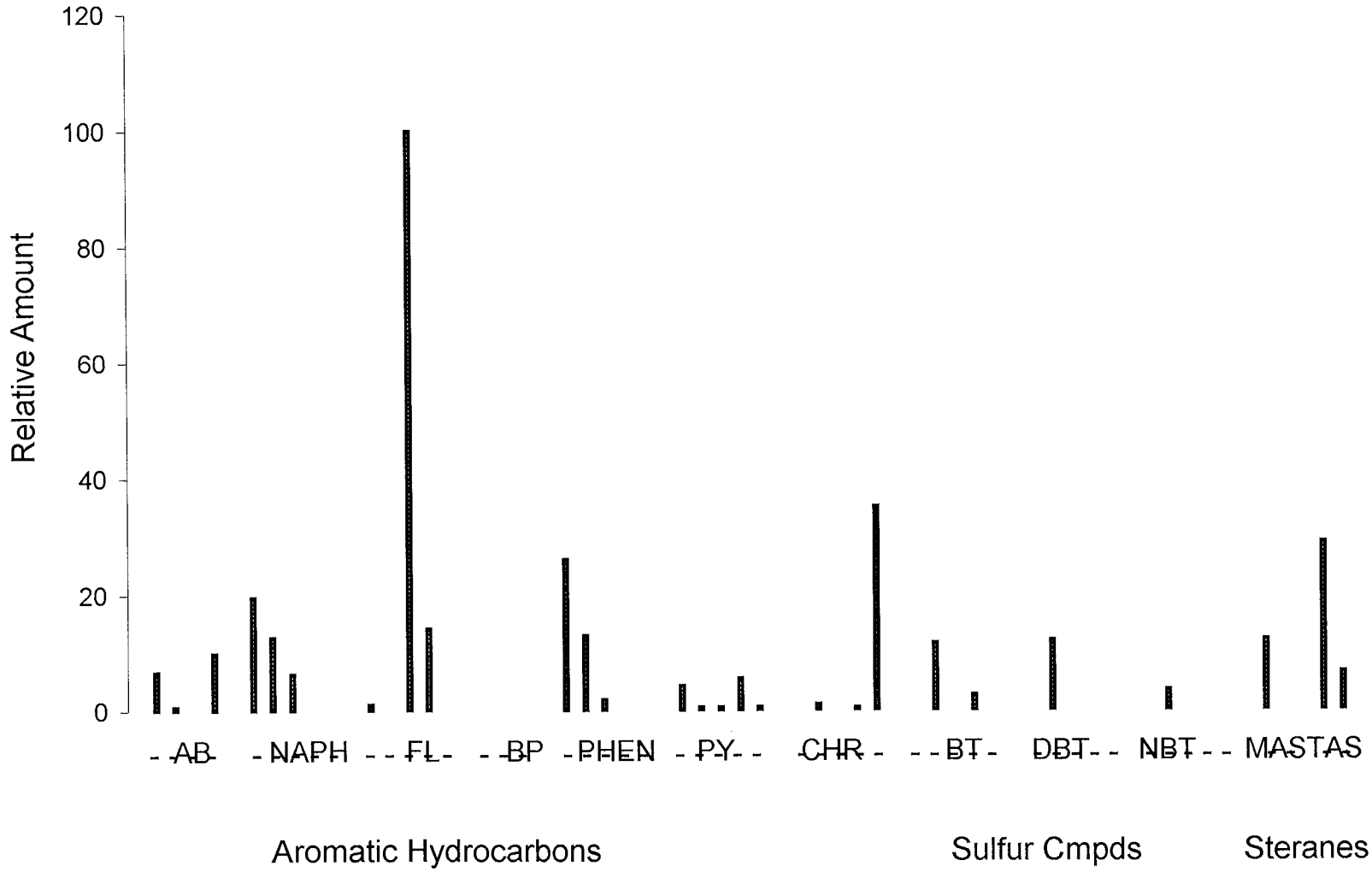
Aromatic Hydrocarbon Distribution

23733-1 [HH01-01-01-170901-21]



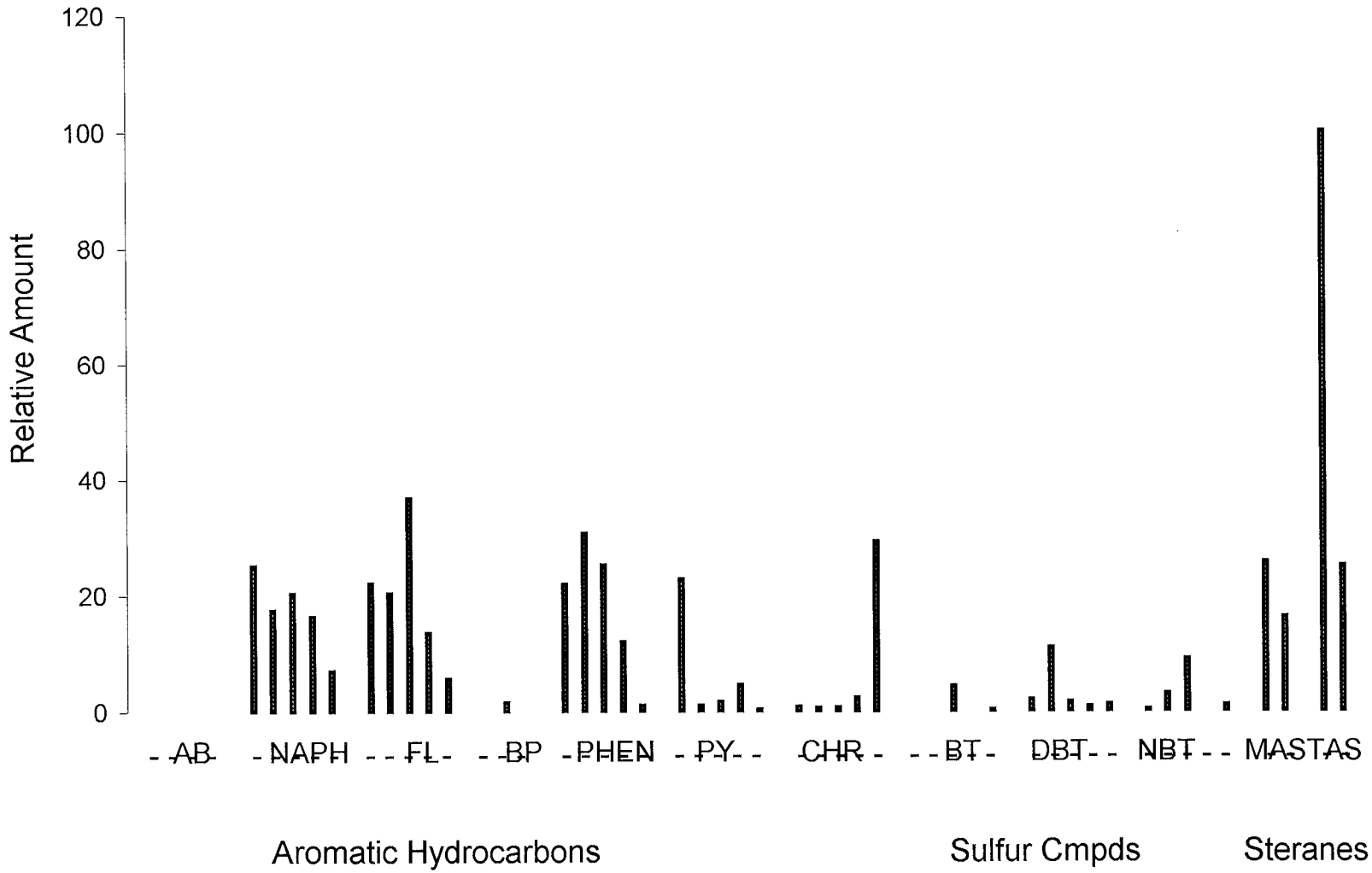
Aromatic Hydrocarbon Distribution

23733-2 [HH01-01-02-170901-21]



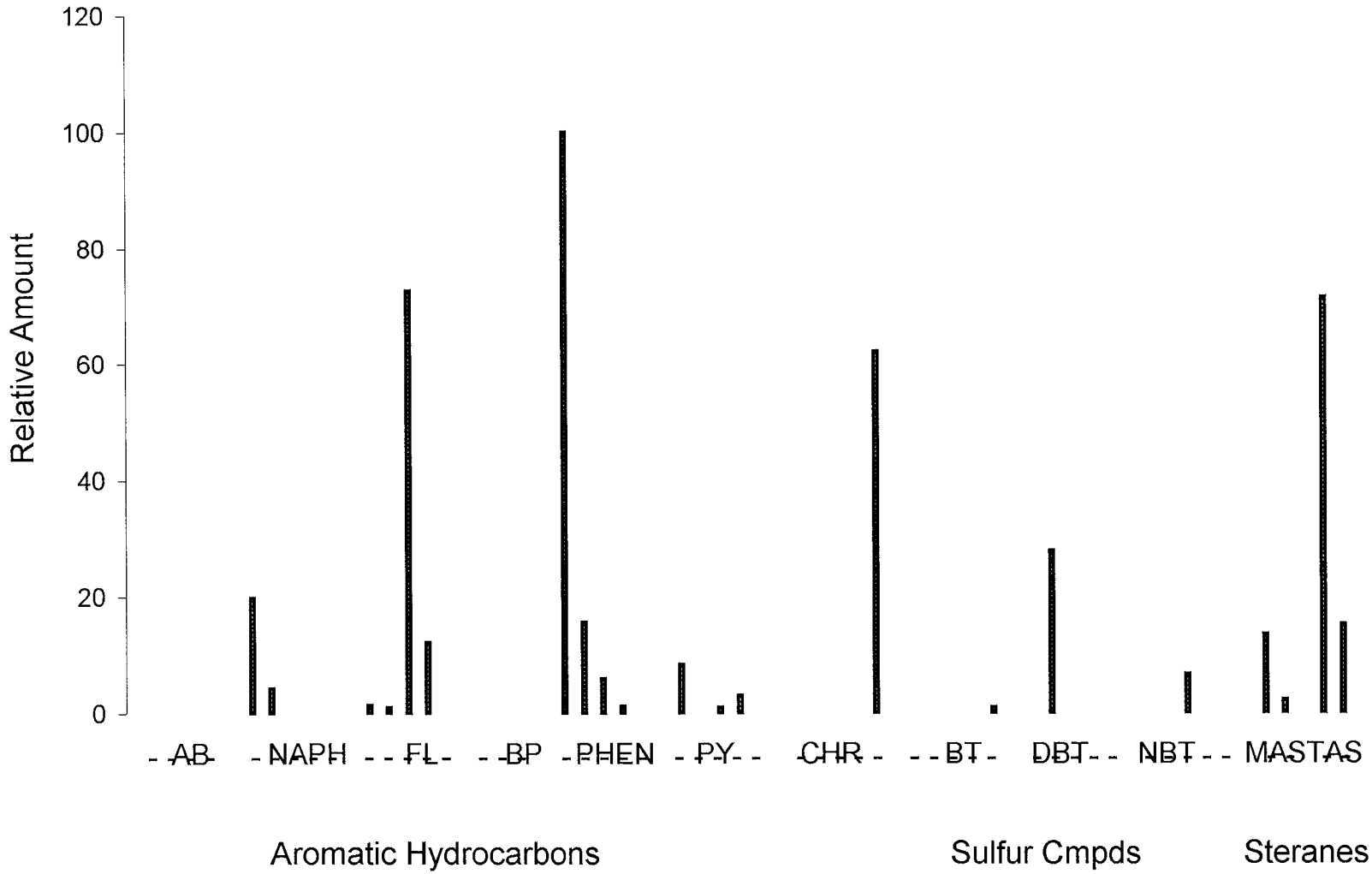
Aromatic Hydrocarbon Distribution

23733-3 [HH01-01-03-170901-21]



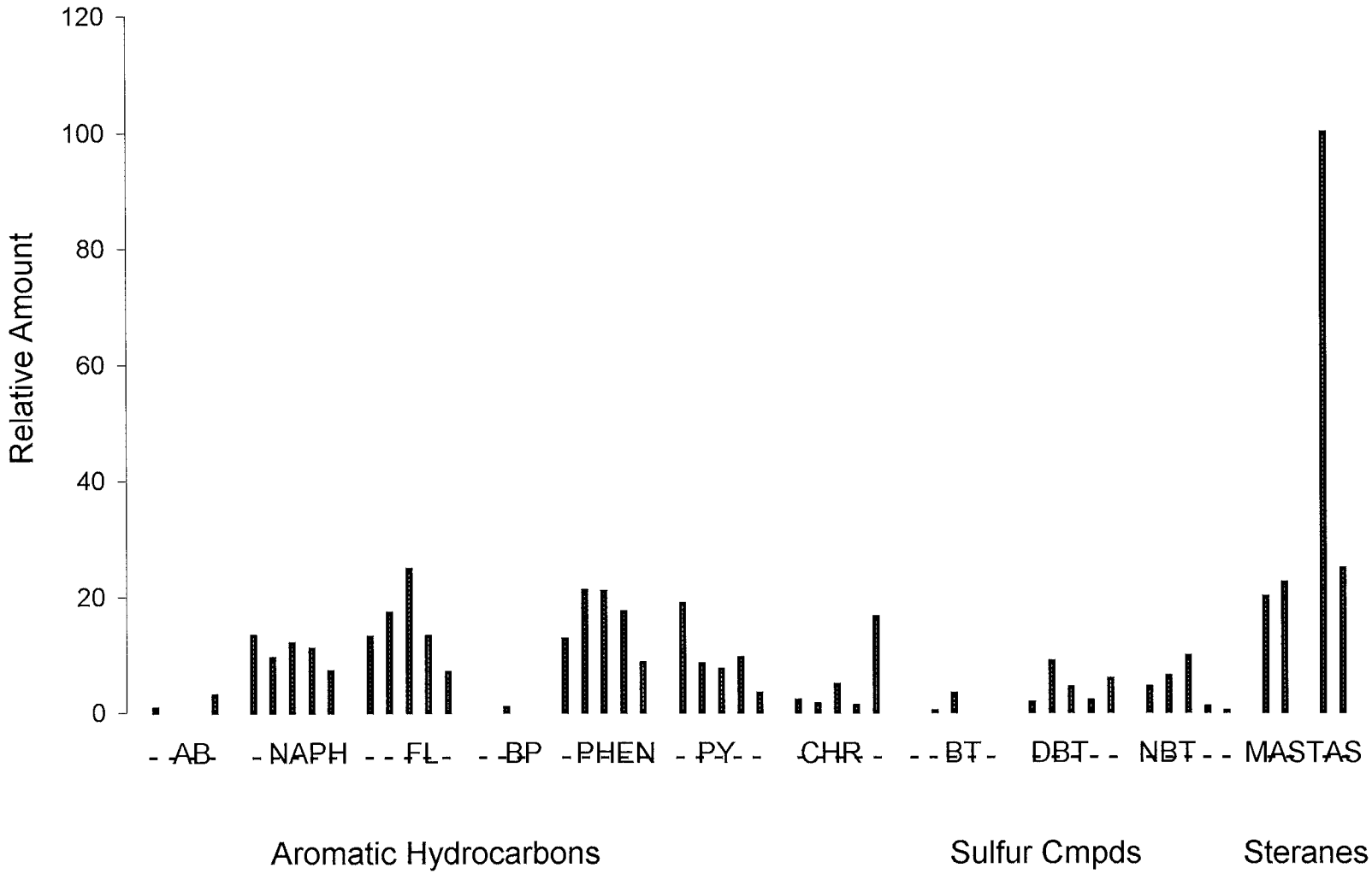
Aromatic Hydrocarbon Distribution

23733-4 [HH01-01-03-170901-22]



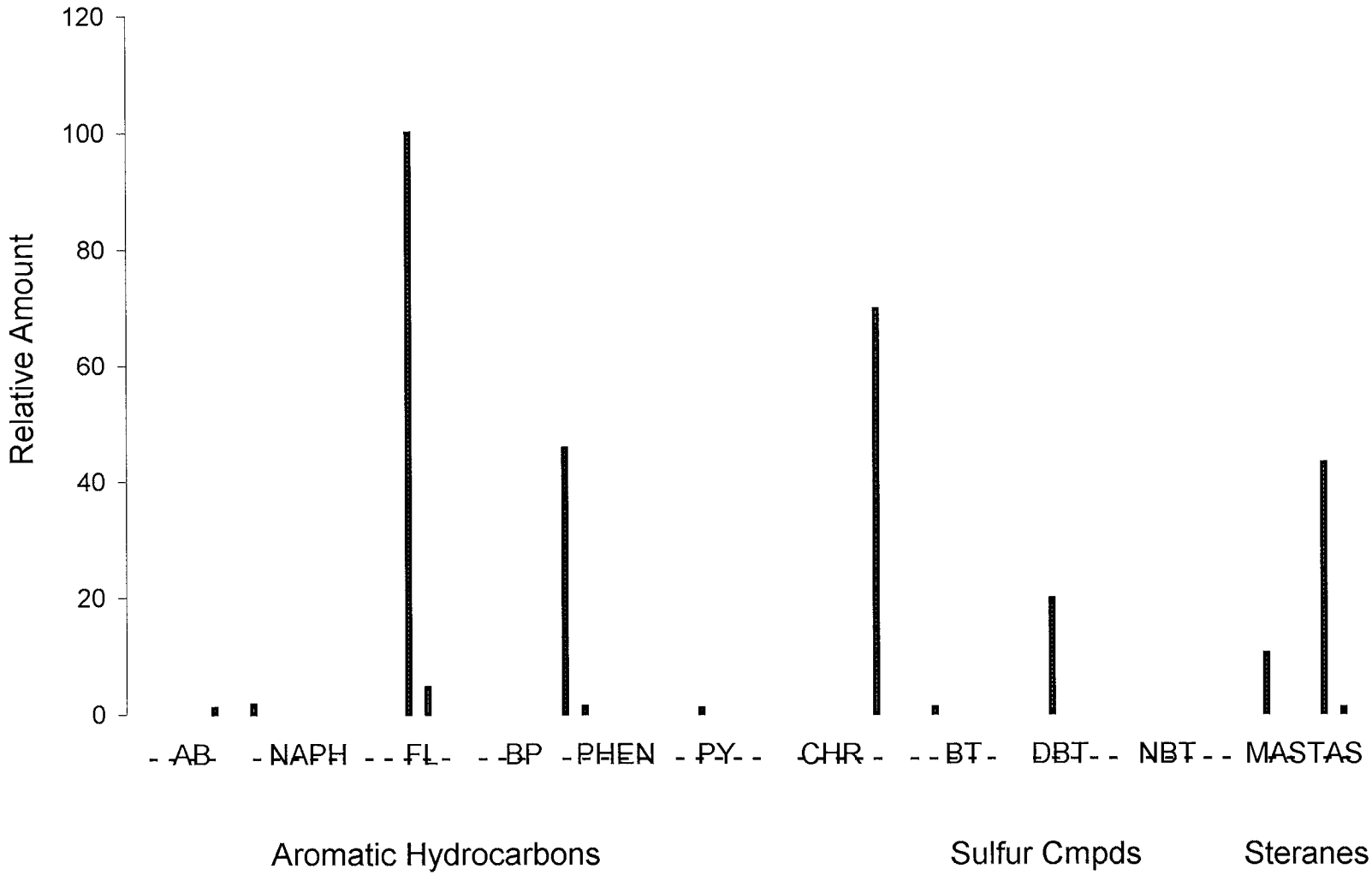
Aromatic Hydrocarbon Distribution

23733-5 [HH01-01-04-170901-21]



Aromatic Hydrocarbon Distribution

23733-6 [HH01-01-05-170901-21]



USEPA
DateShipped:
CarrierName:
AirbillNo:

CHAIN OF CUSTODY RECORD
Site #: 66666
Contact Name: Jeff Wright
Contact Phone: 225-278-8406

No: 6-090117-213229-0003
Cooler #:
Lab: Pace Energy Lab
Lab Phone: 412-209-8995

Lab #	Sample #	Location	Analyses	Matrix	Sample Date	Sample Time	Numb Cont	Container	Preservative	Lab QC
	HH01-01-01-170901-21	1	Naptha PIANO	Surface Water	9/1/2017	17:36	2	40 ml VOA	HCl	
	HH01-01-01-170901-21	1	Naphtha full scan	Surface Water	9/1/2017	17:36	2	1 liter amber	4 C	
	HH01-01-02-170901-21	2	Naptha PIANO	Surface Water	9/1/2017	18:20	2	40 ml VOA	HCl	
	HH01-01-02-170901-21	2	Naphtha full scan	Surface Water	9/1/2017	18:20	2	1 liter amber	4 C	
	HH01-01-03-170901-21	3	Naptha PIANO	Surface Water	9/1/2017	19:25	2	40 ml VOA	HCl	
	HH01-01-03-170901-21	3	Naphtha full scan	Surface Water	9/1/2017	19:25	2	1 liter amber	4 C	
	HH01-01-03-170901-22	3	Naptha PIANO	Surface Water	9/1/2017	19:25	2	40 ml VOA	HCl	
	HH01-01-03-170901-22	3	Naphtha full scan	Surface Water	9/1/2017	19:25	2	1 liter amber	4 C	
	HH01-01-04-170901-21	4	Naptha PIANO	Surface Water	9/1/2017	20:00	2	40 ml VOA	HCl	
	HH01-01-04-170901-21	4	Naphtha full scan	Surface Water	9/1/2017	20:00	2	1 liter amber	4 C	
	HH01-01-05-170901-21	5	Naptha PIANO	Surface Water	9/1/2017	20:40	2	40 ml VOA	HCl	
	HH01-01-05-170901-21	5	Naphtha full scan	Surface Water	9/1/2017	20:40	2	1 liter amber	4 C	

Special Instructions:

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt

Cooler Receipt Form

Client Name: [illegible] Project: [illegible] Lab Work Order: _____

A. Shipping/Container Information (circle appropriate response)

Courier: FedEx UPS USPS Client (Other) Southwest Cargo Air bill Present: Yes No

Tracking Number: _____

Custody Seal on Cooler/Box Present: (Yes) No Seals Intact: (Yes) No

Cooler/Box Packing Material: Bubble Wrap Absorbent Foam Other _____

Type of Ice: (Wet) Blue None Ice Intact: Yes (Melted)

Cooler Temperature: 4.7 Radiation Screened: Yes (No) Chain of Custody Present: Yes No

Comments: _____

B. Laboratory Assignment/Log-in (check appropriate response)

	YES	NO	N/A	Comment Reference non-Conformance
Chain of Custody properly filled out	✓			
Chain of Custody relinquished		✓		
Sampler Name & Signature on COC		✓		
Containers intact	✓			
Were samples in separate bags	✓			
Sample container labels match COC Sample name/date and time collected	✓			
Sufficient volume provided	✓			
PAES containers used	✓			
Are containers properly preserved for the requested testing? (as labeled)	✓			
If an unknown preservation state, were containers checked? Exception: VOA's coliform			✓	If yes, see pH form.
Was volume for dissolved testing field filtered, as noted on the COC? Was volume received in a preserved container?			✓	

Comments: _____

Cooler contents examined/received by: [illegible] Date: [illegible]

Project Manager Review: _____ Date: _____