

Table S1. Results of GC–MS analysis of volatiles extracted by mechanical shock crushing from olivine MD-18 from basalts (Menshyi Brat volcano, Iturup island, species diversity 225 components).

Formula	Name	<sup>1</sup> CAS	<sup>2</sup> MW	Olivine MD-18	
				<sup>3</sup> RT, min	<sup>4</sup> A, %
<b>Aliphatic hydrocarbons</b>					
<i>Paraffins</i>					
CH <sub>4</sub>	Methane	74-82-8	16	1.48	0.006
C <sub>2</sub> H <sub>6</sub>	Ethane	74-84-0	30	2.05	0.658
C <sub>3</sub> H <sub>8</sub>	n-Propane	74-98-6	44	4.08	0.067
C <sub>4</sub> H <sub>10</sub>	n-Butane	106-97-8	58	6.55	0.168
C <sub>5</sub> H <sub>12</sub>	n-Pentane	109-66-0	72	8.18	0.009
C <sub>6</sub> H <sub>14</sub>	n-Hexane	110-54-3	86	11.76	0.055
C <sub>7</sub> H <sub>16</sub>	n-Heptane	142-82-5	100	15.91	0.109
C <sub>8</sub> H <sub>16</sub>	3-Methyleneheptane	1632-16-2	112	19.39	0.160
C <sub>8</sub> H <sub>18</sub>	n-Octane	111-65-9	114	20.02	0.143
C <sub>9</sub> H <sub>20</sub>	n-Nonane	111-84-2	128	23.93	0.153
C <sub>10</sub> H <sub>22</sub>	n-Decane	124-18-5	142	27.50	0.075
C <sub>11</sub> H <sub>24</sub>	n-Undecane	1120-21-4	156	30.87	0.057
C <sub>12</sub> H <sub>26</sub>	n-Dodecane	112-40-3	170	33.99	0.117
C <sub>13</sub> H <sub>28</sub>	n-Tridecane	629-50-5	184	37.90	0.163
C <sub>14</sub> H <sub>30</sub>	n-Tetradecane	629-59-4	198	43.82	0.108
C <sub>15</sub> H <sub>32</sub>	n-Pentadecane	629-62-9	212	53.17	0.282
C <sub>16</sub> H <sub>34</sub>	n-Hexadecane	544-76-3	226	68.31	0.118
C <sub>17</sub> H <sub>36</sub>	n-Heptadecane	629-78-7	240	92.69	0.027
<i>Halogenated paraffins</i>					
C <sub>4</sub> H <sub>9</sub> Cl	1-Chlorobutane	109-69-3	92	12.28	0.033
C <sub>5</sub> H <sub>11</sub> Cl	1-Chloropentane	543-59-9	106	17.44	0.007
C <sub>6</sub> H <sub>13</sub> Cl	1-Chlorohexane	544-10-5	120	20.39	0.056
C <sub>7</sub> H <sub>15</sub> Cl	1-Chloroheptane	629-06-1	134	24.65	0.070
C <sub>8</sub> H <sub>17</sub> Cl	1-Chlorooctane	111-85-3	148	28.15	0.043
C <sub>10</sub> H <sub>21</sub> Cl	1-Chlorodecane	1002-69-3	176	35.98	0.669
C <sub>11</sub> H <sub>23</sub> Cl	1-Chloroundecane	2473-03-2	190	40.90	0.086
<i>Olefins</i>					
C <sub>3</sub> H <sub>6</sub>	1-Propene	115-07-1	42	3.88	0.012
C <sub>4</sub> H <sub>8</sub>	2-Methyl-1-propene	115-11-7	56	6.28	0.045
C <sub>4</sub> H <sub>8</sub>	1-Butene	106-98-9	56	6.40	0.073
C <sub>4</sub> H <sub>8</sub>	(E)-2-Butene	624-64-6	56	6.48	0.040
C <sub>4</sub> H <sub>8</sub>	2-Butene	107-01-7	56	6.58	0.101
C <sub>5</sub> H <sub>10</sub>	3-Methyl-1-butene	563-45-1	70	7.43	0.094
C <sub>5</sub> H <sub>10</sub>	1-Pentene	109-67-1	70	8.11	0.063
C <sub>5</sub> H <sub>8</sub>	Isoprene	78-79-5	68	8.29	0.093
C <sub>5</sub> H <sub>8</sub>	(E)-1,3-Pentadiene	2004-70-8	68	8.38	0.019
C <sub>5</sub> H <sub>8</sub>	1,3-Pentadiene	504-60-9	68	8.79	0.016

C <sub>6</sub> H <sub>12</sub>	1-Hexene	592-41-6	84	11.41	0.016
C <sub>6</sub> H <sub>10</sub>	(E)-2-Methyl-1,3-pentadiene	926-54-5	82	12.51	0.024
C <sub>7</sub> H <sub>14</sub>	1-Heptene	592-76-7	98	15.51	0.118
C <sub>8</sub> H <sub>16</sub>	4-Methyl-3-heptene	4485-16-9	112	19.10	0.113
C <sub>8</sub> H <sub>16</sub>	1-Octene	111-66-0	112	19.55	0.066
C <sub>8</sub> H <sub>16</sub>	(Z)-3-Octene	14850-22-7	112	19.67	0.158
C <sub>8</sub> H <sub>16</sub>	(E)-2-Octene	13389-42-9	112	19.74	0.051
C <sub>8</sub> H <sub>16</sub>	(Z)-2-Octene	7642-04-8	112	19.87	0.048
C <sub>8</sub> H <sub>16</sub>	2-Octene	111-67-1	112	20.27	0.059
C <sub>9</sub> H <sub>18</sub>	1-Nonene	124-11-8	126	23.62	0.125
C <sub>10</sub> H <sub>20</sub>	1-Decene	872-05-9	140	27.28	0.063
C <sub>11</sub> H <sub>22</sub>	1-Undecene	821-95-4	154	30.65	0.045
C <sub>12</sub> H <sub>24</sub>	1-Dodecene	112-41-4	168	33.80	0.104
C <sub>13</sub> H <sub>26</sub>	1-Tridecene	2437-56-1	182	37.65	0.232
C <sub>14</sub> H <sub>28</sub>	1-Tetradecene	1120-36-1	196	43.45	0.218
C <sub>15</sub> H <sub>30</sub>	1-Pentadecene	13360-61-7	210	52.67	0.619
C <sub>16</sub> H <sub>32</sub>	1-Hexadecene	629-73-2	224	67.49	0.135
C <sub>17</sub> H <sub>34</sub>	1-Heptadecene	6765-39-5	238	91.03	0.553
<b>Cyclic hydrocarbons</b>					
<i>Cycloalkanes (naphthenes) and cycloalkenes</i>					
C <sub>5</sub> H <sub>10</sub>	1,1-Dimethylcyclopropane	1630-94-0	70	7.83	0.091
C <sub>5</sub> H <sub>10</sub>	Cyclopentane	287-92-3	70	8.34	0.055
<i>Arenes</i>					
C <sub>6</sub> H <sub>6</sub>	Benzene	71-43-2	78	12.21	0.517
C <sub>7</sub> H <sub>8</sub>	Toluene	108-88-3	92	16.69	0.141
C <sub>7</sub> H <sub>7</sub> F	(Fluoromethyl)benzene	350-50-5	110	20.45	0.016
C <sub>8</sub> H <sub>10</sub>	Ethylbenzene	100-41-4	106	20.75	0.101
C <sub>8</sub> H <sub>10</sub>	p-Xylene	106-42-3	106	21.04	0.176
C <sub>8</sub> H <sub>10</sub>	o-Xylene	95-47-6	106	21.10	0.133
C <sub>8</sub> H <sub>10</sub>	m-Xylene	108-38-3	106	21.49	0.087
C <sub>8</sub> H <sub>8</sub>	Styrene	100-42-5	104	21.65	0.084
C <sub>8</sub> H <sub>9</sub> F	p-Fluoroethylbenzene	459-47-2	124	22.03	0.008
C <sub>8</sub> H <sub>9</sub> F	3-Fluoro-o-xylene	443-82-3	124	22.18	0.007
C <sub>8</sub> H <sub>9</sub> F	5-Fluoro-m-xylene	461-97-2	124	22.58	0.005
C <sub>9</sub> H <sub>12</sub>	Propylbenzene	103-65-1	120	24.95	0.043
C <sub>10</sub> H <sub>14</sub>	Butylbenzene	104-51-8	134	28.40	0.046
C <sub>12</sub> H <sub>18</sub>	Hexylbenzene	1077-16-3	162	35.27	0.121
C <sub>13</sub> H <sub>20</sub>	Heptylbenzene	1078-71-3	176	39.73	0.151
<i>Polycyclic aromatic hydrocarbons (PAH)</i>					
C <sub>14</sub> H <sub>10</sub>	Phenanthrene	85-01-8	178	85.10	0.061
<b>Oxygenated hydrocarbons</b>					
<i>Alcohols</i>					
CH <sub>4</sub> O	Methanol	67-56-1	32	4.06	0.213
C <sub>2</sub> H <sub>6</sub> O	Ethanol	64-17-5	46	5.68	1.321

C <sub>4</sub> H <sub>10</sub> O	1-Butanol	71-36-3	74	12.44	0.206
C <sub>6</sub> H <sub>6</sub> O	Phenol	108-95-2	94	24.48	0.181
C <sub>6</sub> H <sub>14</sub> O <sub>2</sub>	2,5-Hexanediol	2935-44-6	118	25.68	0.047
C <sub>7</sub> H <sub>8</sub> O	o-Cresol	95-48-7	108	27.16	0.049
C <sub>8</sub> H <sub>18</sub> O	2-Ethyl-1-hexanol	104-76-7	130	27.67	0.608
C <sub>7</sub> H <sub>8</sub> O	m-Cresol	108-39-4	108	28.07	0.117
C <sub>7</sub> H <sub>8</sub> O	p-Cresol	106-44-5	108	28.20	0.022
C <sub>9</sub> H <sub>18</sub> O	2-Methyl-2-octen-4-ol	65885-49-6	142	29.42	0.098
C <sub>11</sub> H <sub>16</sub> O	2,3,4,5,6-Pentamethylphenol	x	164	46.44	13.531
C <sub>15</sub> H <sub>24</sub> O	4-(1,1,3,3-Tetramethylbutyl)-o-cresol	2219-84-3	220	86.94	35.370
<i>Ethers and esters</i>					
C <sub>5</sub> H <sub>8</sub> O	3,4-Dihydropyran	110-87-2	84	12.93	0.156
C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	Methyl methacrylate	80-62-6	100	14.07	0.259
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	Butyrolactone	96-48-0	86	20.04	0.231
C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	δ-Valerolactone	542-28-9	100	25.78	0.276
C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	γ-Hexalactone	695-06-7	114	26.76	0.070
C <sub>7</sub> H <sub>12</sub> O <sub>2</sub>	γ-Heptalactone	105-21-5	128	30.45	0.036
C <sub>8</sub> H <sub>14</sub> O <sub>2</sub>	γ-Octalactone	104-50-7	142	33.92	0.107
C <sub>9</sub> H <sub>16</sub> O <sub>2</sub>	γ-Nonalactone	104-61-0	156	38.15	0.099
C <sub>10</sub> H <sub>18</sub> O <sub>2</sub>	γ-Decalactone	706-14-9	170	44.61	0.111
C <sub>11</sub> H <sub>20</sub> O <sub>2</sub>	γ-Undecalactone	104-67-6	184	54.73	0.039
C <sub>12</sub> H <sub>22</sub> O <sub>2</sub>	γ-Dodecalactone	2305-05-7	198	71.04	0.190
C <sub>16</sub> H <sub>32</sub> O <sub>2</sub>	Methyl 11,12-dimethyltridecanoate	x	256	83.87	1.196
C <sub>13</sub> H <sub>24</sub> O <sub>2</sub>	γ-Tridecalactone	x	212	97.48	0.058
<i>Aldehydes</i>					
C <sub>2</sub> H <sub>4</sub> O	Acetaldehyde	75-07-0	44	4.96	0.168
C <sub>3</sub> H <sub>6</sub> O	n-Propanal	123-38-6	58	6.73	0.237
C <sub>4</sub> H <sub>6</sub> O	2-Methyl-2-propenal	78-85-3	70	9.13	0.204
C <sub>4</sub> H <sub>8</sub> O	2-Methylpropanal	78-84-2	72	9.21	0.273
C <sub>4</sub> H <sub>8</sub> O	n-Butanal	123-72-8	72	10.01	0.247
C <sub>4</sub> H <sub>6</sub> O	2-Butenal	123-73-9	70	11.48	0.212
C <sub>5</sub> H <sub>10</sub> O	3-Methylbutanal	590-86-3	86	13.19	0.066
C <sub>5</sub> H <sub>10</sub> O	n-Pentanal	110-62-3	86	14.19	0.185
C <sub>5</sub> H <sub>8</sub> O	2-Methyl-2-butenal	1115-11-3	84	16.24	0.062
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	2-Furaldehyde	98-01-1	96	16.82	0.026
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	3-Furaldehyde	498-60-2	96	17.65	0.171
C <sub>6</sub> H <sub>12</sub> O	n-Hexanal	66-25-1	100	18.57	0.241
C <sub>7</sub> H <sub>14</sub> O	n-Heptanal	111-71-7	114	22.75	0.397
C <sub>6</sub> H <sub>6</sub> O <sub>2</sub>	5-Methyl-2-furancarboxaldehyde	620-02-0	110	22.72	0.066
C <sub>7</sub> H <sub>6</sub> O	Benzaldehyde	100-52-7	106	23.50	0.783
C <sub>8</sub> H <sub>16</sub> O	2-Ethylhexanal	123-05-7	128	25.25	0.080

C <sub>8</sub> H <sub>16</sub> O	n-Octanal	124-13-0	128	26.61	0.541
C <sub>9</sub> H <sub>18</sub> O	n-Nonanal	124-19-6	142	30.17	0.582
C <sub>10</sub> H <sub>20</sub> O	n-Decanal	112-31-2	156	33.42	0.756
C <sub>11</sub> H <sub>22</sub> O	n-Undecanal	112-44-7	170	37.23	0.300
C <sub>12</sub> H <sub>24</sub> O	n-Dodecanal	112-54-9	184	42.95	0.319
C <sub>13</sub> H <sub>26</sub> O	n-Tridecanal	10486-19-8	198	51.93	0.388
C <sub>14</sub> H <sub>28</sub> O	n-Tetradecanal	124-25-4	212	66.25	0.466
C <sub>15</sub> H <sub>30</sub> O	n-Pentadecanal	2765-11-9	226	89.39	0.577
<i>Ketones</i>					
C <sub>3</sub> H <sub>6</sub> O	2-Propanone	67-64-1	58	6.86	1.747
C <sub>4</sub> H <sub>6</sub> O	2-Butenone	78-94-4	70	9.74	0.074
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	2,3-Butanedione	431-03-8	86	10.14	0.025
C <sub>4</sub> H <sub>8</sub> O	2-Butanone	78-93-3	72	10.14	0.672
C <sub>5</sub> H <sub>10</sub> O	2-Pentanone	107-87-9	86	13.96	0.099
C <sub>5</sub> H <sub>8</sub> O	Cyclopentanone	120-92-3	84	16.51	0.045
C <sub>6</sub> H <sub>12</sub> O	2-Hexanone	591-78-6	100	18.30	0.064
C <sub>7</sub> H <sub>14</sub> O	2-Heptanone	110-43-0	114	22.47	0.127
C <sub>8</sub> H <sub>16</sub> O	4-Methyl-2-heptanone	6137-06-0	128	25.50	0.135
C <sub>8</sub> H <sub>16</sub> O	6-Methyl-2-heptanone	928-68-7	128	25.73	0.143
C <sub>8</sub> H <sub>16</sub> O	2-Octanone	111-13-7	128	26.31	0.088
C <sub>9</sub> H <sub>18</sub> O	2-Nonanone	821-55-6	142	29.85	0.083
C <sub>10</sub> H <sub>20</sub> O	2-Decanone	693-54-9	156	33.10	0.283
C <sub>8</sub> H <sub>4</sub> O <sub>3</sub>	1,3-Isobenzofurandione	85-44-9	148	35.01	1.278
C <sub>11</sub> H <sub>22</sub> O	2-Undecanone	112-12-9	170	36.76	0.110
C <sub>12</sub> H <sub>24</sub> O	2-Dodecanone	6175-49-1	184	42.24	0.105
C <sub>13</sub> H <sub>26</sub> O	2-Tridecanone	593-08-8	198	50.65	0.238
C <sub>14</sub> H <sub>28</sub> O	2-Tetradecanone	2345-27-9	212	64.07	0.336
C <sub>15</sub> H <sub>30</sub> O	2-Pentadecanone	2345-28-0	226	85.99	0.808
<i>Carboxylic acids</i>					
C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Acetic acid	64-19-7	60	11.21	1.635
C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	n-Propanoic acid	79-09-4	74	15.34	0.120
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	n-Butanoic acid	107-92-6	88	18.97	0.758
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	3-Methylbutanoic acid	503-74-2	102	22.12	0.047
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	n-Pentanoic acid	109-52-4	102	23.02	0.277
C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	n-Hexanoic acid	142-62-1	116	26.55	0.765
C <sub>7</sub> H <sub>14</sub> O <sub>2</sub>	n-Heptanoic acid	111-14-8	130	30.00	0.257
C <sub>8</sub> H <sub>16</sub> O <sub>2</sub>	n-Octanoic acid	124-07-2	144	33.09	0.637
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	n-Nonanoic acid	112-05-0	158	36.60	0.664
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	3-Methylnonanoic acid	35205-79-9	172	40.18	0.074
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	n-Decanoic acid	334-48-5	172	41.89	0.619
C <sub>11</sub> H <sub>22</sub> O <sub>2</sub>	n-Undecanoic acid	112-37-8	186	50.62	0.142
C <sub>12</sub> H <sub>24</sub> O <sub>2</sub>	n-Dodecanoic acid	143-07-7	200	63.69	0.568
C <sub>13</sub> H <sub>26</sub> O <sub>2</sub>	n-Tridecanoic acid	638-53-9	214	86.82	0.075
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	n-Tetradecanoic acid	544-63-8	228	120.36	0.476

Heterocyclic compounds					
<i>Dioxanes</i>					
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,4-Dioxane	123-91-1	88	13.14	0.032
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,3-Dioxane	505-22-6	88	16.77	0.026
<i>Furans</i>					
C <sub>5</sub> H <sub>6</sub> O	2-Methylfuran	534-22-5	82	9.88	0.048
C <sub>5</sub> H <sub>6</sub> O	3-Methylfuran	930-27-8	82	10.18	0.021
C <sub>6</sub> H <sub>8</sub> O	2-Ethylfuran	3208-16-0	96	13.71	0.019
C <sub>6</sub> H <sub>6</sub> O	2-Vinylfuran	1487-18-9	94	14.51	0.006
C <sub>7</sub> H <sub>10</sub> O	2-Propylfuran	4229-91-8	110	17.79	0.015
C <sub>8</sub> H <sub>12</sub> O	2-Butylfuran	4466-24-4	124	22.03	0.028
C <sub>9</sub> H <sub>14</sub> O	2-Pentylfuran	3777-69-3	138	25.88	0.063
C <sub>10</sub> H <sub>16</sub> O	2-Hexylfuran	3777-70-6	152	29.47	0.042
C <sub>11</sub> H <sub>18</sub> O	2-Heptylfuran	3777-71-7	166	32.75	0.036
C <sub>12</sub> H <sub>20</sub> O	2-Octylfuran	4179-38-8	180	36.31	0.028
C <sub>13</sub> H <sub>22</sub> O	2-Nonylfuran	x	194	41.49	0.042
C <sub>14</sub> H <sub>24</sub> O	2-Decylfuran	83469-85-6	208	49.44	0.037
C <sub>15</sub> H <sub>26</sub> O	2-Undecylfuran	x	222	62.39	0.015
Nitrogenated compounds					
N <sub>2</sub>	Nitrogen	7727-37-9	28	1.52	2.873
H <sub>3</sub> N	Ammonia	7664-41-7	17	2.47	0.087
C <sub>2</sub> H <sub>3</sub> N	Acetonitrile	75-05-8	41	5.81	0.481
CHNO	Hydrogen isocyanate	75-13-8	43	6.30	1.811
C <sub>3</sub> H <sub>5</sub> N	Propanenitrile	107-12-0	55	8.78	0.020
C <sub>3</sub> H <sub>3</sub> N <sub>3</sub>	1,3,5-Triazine	290-87-9	81	11.19	0.033
C <sub>4</sub> H <sub>5</sub> N	Pyrrole	109-97-7	67	14.17	0.058
C <sub>5</sub> H <sub>7</sub> N	3-Methyl-1H-pyrrole	616-43-3	81	14.57	0.012
C <sub>2</sub> H <sub>5</sub> NO	Acetamide	60-35-5	59	14.79	0.101
C <sub>5</sub> H <sub>5</sub> N	Pyridine	110-86-1	79	14.74	0.053
C <sub>5</sub> H <sub>9</sub> N	2-Methylpropyl-1-nitrile	625-28-5	83	15.72	0.255
C <sub>3</sub> H <sub>7</sub> NO <sub>2</sub>	Ethyl ester carbamic acid	51-79-6	89	17.22	0.012
C <sub>6</sub> H <sub>9</sub> N	2,3-Dimethyl-1H-pyrrole	600-28-2	95	17.82	0.006
C <sub>6</sub> H <sub>9</sub> N	2,4-Dimethyl-1H-pyrrole	625-82-1	95	18.70	0.005
C <sub>6</sub> H <sub>9</sub> N	2,5-Dimethyl-1H-pyrrole	625-84-3	95	19.67	0.016
C <sub>6</sub> H <sub>7</sub> N	2-Methylpyridine	109-06-8	93	18.15	0.015
C <sub>6</sub> H <sub>7</sub> N	3-Methylpyridine	108-99-6	93	19.79	0.016
C <sub>6</sub> H <sub>7</sub> N	4-Methylpyridine	108-89-4	93	19.87	0.010
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	4-Methylpyrimidine	3438-46-8	94	21.85	0.007
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	5-Methylpyrimidine	2036-41-1	94	22.77	0.005
C <sub>3</sub> H <sub>4</sub> N <sub>2</sub>	1H-Pyrazole	288-13-1	68	22.13	0.128
C <sub>7</sub> H <sub>5</sub> N	Benzonitrile	100-47-0	103	24.27	0.094

C <sub>4</sub> H <sub>5</sub> NO <sub>2</sub>	Succinimide	123-56-8	99	28.07	0.188
C <sub>6</sub> H <sub>13</sub> NO	Hexanamide	628-02-4	115	30.42	0.031
C <sub>7</sub> H <sub>15</sub> NO	Heptanamide	628-62-6	129	34.29	0.012
C <sub>8</sub> H <sub>17</sub> NO	Octanamide	629-01-6	143	37.90	0.075
C <sub>9</sub> H <sub>19</sub> NO	Nonanamide	1120-07-6	157	44.11	0.077
C <sub>10</sub> H <sub>21</sub> NO	Decanamide	2319-29-1	171	53.94	0.072
<b>Sulfonated compounds</b>					
H <sub>2</sub> S	Hydrogen sulfide	7783-06-4	34	2.56	0.023
COS	Carbonyl sulfide	463-58-1	60	3.25	0.016
O <sub>2</sub> S	Sulfur dioxide	7446-09-5	64	4.60	5.498
CH <sub>4</sub> S	Methanethiol	74-93-1	48	5.30	0.044
C <sub>2</sub> H <sub>6</sub> S	Dimethyl sulfide	75-18-3	62	7.39	0.021
CS <sub>2</sub>	Carbon disulfide	75-15-0	76	7.01	0.770
C <sub>4</sub> H <sub>4</sub> S	Thiophene	110-02-1	84	11.88	0.022
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	Dimethyl disulfide	624-92-0	94	14.91	0.087
C <sub>5</sub> H <sub>6</sub> S	2-Methylthiophene	554-14-3	98	16.14	0.036
C <sub>5</sub> H <sub>6</sub> S	3-Methylthiophene	616-44-4	98	16.47	0.035
C <sub>6</sub> H <sub>8</sub> S	2-Ethylthiophene	872-55-9	112	20.29	0.012
C <sub>6</sub> H <sub>8</sub> S	3-Ethylthiophene	1795-01-3	112	20.62	0.023
C <sub>5</sub> H <sub>4</sub> OS	2-Thiophenecarboxaldehyde	98-03-3	112	24.00	0.015
C <sub>5</sub> H <sub>4</sub> OS	3-Thiophenecarboxaldehyde	498-62-4	112	24.25	0.080
C <sub>8</sub> H <sub>12</sub> S	2-Butylthiophene	1455-20-5	140	28.08	0.048
C <sub>8</sub> H <sub>12</sub> S	3-Butylthiophene	34722-01-5	140	28.53	0.049
C <sub>9</sub> H <sub>14</sub> S	2-Pentylthiophene	4861-58-9	154	31.57	0.064
C <sub>9</sub> H <sub>14</sub> S	3-Pentylthiophene	x	154	31.87	0.048
C <sub>10</sub> H <sub>16</sub> S	3-Hexylthiophene	x	168	34.97	0.038
C <sub>11</sub> H <sub>18</sub> S	2-Heptylthiophene	18794-78-0	182	39.64	0.045
C <sub>12</sub> H <sub>20</sub> S	2-Octylthiophene	880-36-4	196	46.83	0.039
C <sub>12</sub> H <sub>20</sub> S	3-Octylthiophene	x	196	47.71	0.097
C <sub>13</sub> H <sub>22</sub> S	2-Nonylthiophene	57754-07-1	210	58.13	0.046
<b>Inorganic compounds</b>					
<i>Oxides</i>					
CO <sub>2</sub>	Carbon dioxide	124-38-9	44	1.72	1.077
H <sub>2</sub> O	Water	7732-18-5	18	2.98	0.326
<i>Noble gases</i>					
Ar	Argon	7440-37-1	40	1.55	0.088
Xe	Xenon	7440-63-3	132	21.82	0.056
<i>Permanent gases</i>					
O <sub>2</sub>	Oxygen	7782-44-7	32	1.37	0.182

Note: <sup>1</sup>CAS – unique numerical identifier of chemical compounds included in the register Chemical Abstracts Service (<https://www.cas.org>); <sup>2</sup>MW – nominal mass; <sup>3</sup>RT – retention time;

<sup>4</sup>A – normalized area (the area ratio of the individual gas mixture components to the summ of the areas of all the components in the chromatogram).

Table S2. Results of GC–MS analysis of volatiles extracted by mechanical shock crushing from plagioclase MD-18 from basalts (Menshyi Brat volcano, Iturup island, species diversity 222 components).

Formula	Name	<sup>1</sup> CAS/(NIST)	<sup>2</sup> MW	Plagioclase MD-18	
				<sup>3</sup> RT, min	<sup>4</sup> A, %
<b>Aliphatic hydrocarbons</b>					
<i>Paraffins</i>					
CH <sub>4</sub>	Methane	74-82-8	16	1.80	0.042
C <sub>2</sub> H <sub>6</sub>	Ethane	74-84-0	30	2.27	0.893
C <sub>3</sub> H <sub>8</sub>	n-Propane	74-98-6	44	4.17	0.008
C <sub>4</sub> H <sub>10</sub>	n-Butane	106-97-8	58	5.92	0.061
C <sub>5</sub> H <sub>12</sub>	n-Pentane	109-66-0	72	8.62	0.075
C <sub>6</sub> H <sub>14</sub>	n-Hexane	110-54-3	86	12.12	0.176
C <sub>7</sub> H <sub>16</sub>	n-Heptane	142-82-5	100	16.19	0.289
C <sub>8</sub> H <sub>16</sub>	3-Methyleneheptane	1632-16-2	112	19.67	1.001
C <sub>8</sub> H <sub>18</sub>	n-Octane	111-65-9	114	20.28	0.580
C <sub>9</sub> H <sub>20</sub>	n-Nonane	111-84-2	128	24.15	0.667
C <sub>10</sub> H <sub>22</sub>	n-Decane	124-18-5	142	27.75	0.378
C <sub>11</sub> H <sub>24</sub>	n-Undecane	1120-21-4	156	31.08	0.225
C <sub>12</sub> H <sub>26</sub>	n-Dodecane	112-40-3	170	34.20	0.139
C <sub>13</sub> H <sub>28</sub>	n-Tridecane	629-50-5	184	38.27	0.320
C <sub>14</sub> H <sub>30</sub>	n-Tetradecane	629-59-4	198	44.49	0.388
C <sub>15</sub> H <sub>32</sub>	n-Pentadecane	629-62-9	212	54.26	0.898
C <sub>16</sub> H <sub>34</sub>	n-Hexadecane	544-76-3	226	69.91	0.656
C <sub>17</sub> H <sub>36</sub>	n-Heptadecane	629-78-7	240	95.04	1.282
<i>Halogenated paraffins</i>					
C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>	1,2-Dichloroethane	107-06-2	98	11.83	0.066
C <sub>4</sub> H <sub>9</sub> Cl	1-Chlorobutane	109-69-3	92	12.74	0.213
C <sub>10</sub> H <sub>21</sub> Cl	1-Chlorodecane	1002-69-3	176	35.28	0.946
C <sub>12</sub> H <sub>25</sub> Cl	1-Chlorododecane	112-52-7	204	47.45	0.507
C <sub>13</sub> H <sub>27</sub> Cl	1-Chlorotridecane	822-13-9	218	58.40	3.077
C <sub>14</sub> H <sub>29</sub> Cl	1-Chlorotetradecane	2425-54-9	233	83.74	4.194
<i>Olefins</i>					
C <sub>2</sub> H <sub>2</sub>	Acetylene	74-86-2	26	2.07	2.020
C <sub>2</sub> H <sub>4</sub>	Ethylene	74-85-1	28	2.20	1.460
C <sub>3</sub> H <sub>6</sub>	1-Propene	115-07-1	42	4.08	0.019
C <sub>4</sub> H <sub>8</sub>	1-Butene	106-98-9	56	5.71	0.198
C <sub>4</sub> H <sub>8</sub>	(E)-2-Butene	624-64-6	56	6.06	0.272
C <sub>4</sub> H <sub>8</sub>	2-Butene	107-01-7	56	6.26	0.070
C <sub>5</sub> H <sub>10</sub>	1-Pentene	109-67-1	70	8.40	0.092
C <sub>5</sub> H <sub>8</sub>	Isoprene	78-79-5	68	8.63	0.164
C <sub>5</sub> H <sub>8</sub>	3-Methyl-1,2-butadiene	598-25-4	68	8.86	0.045
C <sub>5</sub> H <sub>8</sub>	(E)-1,3-Pentadiene	2004-70-8	68	9.11	0.052
C <sub>6</sub> H <sub>12</sub>	1-Hexene	592-41-6	84	11.79	0.188



C <sub>7</sub> H <sub>14</sub>	1-Heptene	592-76-7	98	15.84	0.080
C <sub>8</sub> H <sub>16</sub>	2-Methyl-1-heptene	15870-10-7	112	19.49	0.162
C <sub>8</sub> H <sub>16</sub>	1-Octene	111-66-0	112	19.83	0.491
C <sub>8</sub> H <sub>16</sub>	(Z)-3-Octene	14850-22-7	112	19.95	0.366
C <sub>8</sub> H <sub>16</sub>	3-Methyl-3-heptene	7300-03-0	112	20.05	0.433
C <sub>8</sub> H <sub>16</sub>	(E)-2-Octene	13389-42-9	112	20.16	0.325
C <sub>8</sub> H <sub>16</sub>	2-Octene	111-67-1	112	20.39	0.287
C <sub>9</sub> H <sub>18</sub>	1-Nonene	124-11-8	126	23.87	0.137
C <sub>10</sub> H <sub>20</sub>	1-Decene	872-05-9	140	27.52	0.127
C <sub>11</sub> H <sub>22</sub>	1-Undecene	821-95-4	154	30.89	0.099
C <sub>12</sub> H <sub>24</sub>	1-Dodecene	112-41-4	168	34.05	0.134
C <sub>13</sub> H <sub>26</sub>	1-Tridecene	2437-56-1	182	38.03	0.192
C <sub>14</sub> H <sub>28</sub>	1-Tetradecene	1120-36-1	196	44.08	0.200
C <sub>15</sub> H <sub>30</sub>	1-Pentadecene	13360-61-7	210	53.57	0.867
<b>Cyclic hydrocarbons</b>					
<i>Cycloalkanes (naphthenes) and cycloalkenes</i>					
C <sub>5</sub> H <sub>10</sub>	Cyclopentane	287-92-3	70	8.59	0.173
C <sub>10</sub> H <sub>16</sub>	dl-Limonene	138-86-3	136	28.03	0.100
<i>Arenes</i>					
C <sub>6</sub> H <sub>6</sub>	Benzene	71-43-2	78	12.66	0.243
C <sub>7</sub> H <sub>8</sub>	Toluene	108-88-3	92	17.11	0.428
C <sub>7</sub> H <sub>7</sub> F	(Fluoromethyl)benzene	350-50-5	110	20.79	0.080
C <sub>8</sub> H <sub>10</sub>	Ethylbenzene	100-41-4	106	21.14	0.111
C <sub>8</sub> H <sub>10</sub>	p-Xylene	106-42-3	106	21.43	0.392
C <sub>8</sub> H <sub>10</sub>	o-Xylene	95-47-6	106	21.49	0.185
C <sub>8</sub> H <sub>10</sub>	m-Xylene	108-38-3	106	21.78	0.268
C <sub>8</sub> H <sub>8</sub>	Styrene	100-42-5	104	22.06	0.152
C <sub>8</sub> H <sub>9</sub> F	p-Fluoroethylbenzene	459-47-2	124	21.66	0.020
C <sub>8</sub> H <sub>9</sub> F	3-Fluoro-o-xylene	443-82-3	124	22.44	0.071
C <sub>8</sub> H <sub>9</sub> F	5-Fluoro-m-xylene	461-97-2	124	22.52	0.075
C <sub>9</sub> H <sub>12</sub>	Propylbenzene	103-65-1	120	25.31	0.061
C <sub>10</sub> H <sub>14</sub>	Butylbenzene	104-51-8	134	28.75	0.097
C <sub>11</sub> H <sub>16</sub>	Pentylbenzene	538-68-1	148	32.14	0.086
<i>Polycyclic aromatic hydrocarbons (PAH)</i>					
C <sub>10</sub> H <sub>8</sub>	Naphthalene	91-20-3	128	32.26	0.048
C <sub>12</sub> H <sub>12</sub>	2,7-Dimethylnaphthalene	582-16-1	156	42.24	0.043
C <sub>12</sub> H <sub>12</sub>	1,7-Dimethylnaphthalene	575-37-1	156	43.01	0.017
C <sub>13</sub> H <sub>14</sub>	1-(1-Methylethyl)-naphthalene	6158-45-8	170	55.02	0.118
C <sub>14</sub> H <sub>10</sub>	Phenanthrene	85-01-8	178	88.78	0.157
<b>Oxygenated hydrocarbons</b>					
<i>Alcohols</i>					
CH <sub>4</sub> O	Methanol	67-56-1	32	4.74	5.795
C <sub>2</sub> H <sub>6</sub> O	Ethanol	64-17-5	46	6.82	0.880

C <sub>3</sub> H <sub>8</sub> O	Isopropyl Alcohol	67-63-0	60	8.53	0.212
C <sub>3</sub> H <sub>8</sub> O	1-Propanol	71-23-8	60	9.58	0.096
C <sub>4</sub> H <sub>8</sub> O	Cyclopropyl carbinol	2516-33-8	72	12.26	0.131
C <sub>4</sub> H <sub>10</sub> O	1-Butanol	71-36-3	74	12.89	0.075
C <sub>6</sub> H <sub>6</sub> O	Phenol	108-95-2	94	25.20	0.432
<i>Ethers and esters</i>					
C <sub>5</sub> H <sub>8</sub> O	3,4-Dihydropyran	110-87-2	84	13.53	0.104
C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	Methyl methacrylate	80-62-6	100	14.57	0.236
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	Butyrolactone	96-48-0	86	21.06	0.288
C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	γ-Hexalactone	695-06-7	114	27.58	0.140
C <sub>7</sub> H <sub>12</sub> O <sub>2</sub>	γ-Heptalactone	105-21-5	128	31.20	0.082
C <sub>8</sub> H <sub>14</sub> O <sub>2</sub>	γ-Octalactone	104-50-7	142	34.68	0.202
C <sub>9</sub> H <sub>16</sub> O <sub>2</sub>	γ-Nonalactone	104-61-0	156	39.21	0.356
C <sub>10</sub> H <sub>18</sub> O <sub>2</sub>	γ-Decalactone	706-14-9	170	46.16	0.293
C <sub>11</sub> H <sub>20</sub> O <sub>2</sub>	γ-Undecalactone	104-67-6	184	57.03	0.126
C <sub>12</sub> H <sub>22</sub> O <sub>2</sub>	γ-Dodecalactone	2305-05-7	198	74.64	0.211
C <sub>14</sub> H <sub>18</sub> O <sub>4</sub>	Diisopropyl phthalate	605-45-8	250	84.99	1.153
C <sub>13</sub> H <sub>24</sub> O <sub>2</sub>	γ-Tridecalactone	x	212	102.55	0.200
C <sub>13</sub> H <sub>8</sub> ClFO <sub>2</sub>	3-Chlorophenyl ester 4-fluorobenzoic acid	(325529)	250	103.48	0.261
C <sub>13</sub> H <sub>8</sub> ClFO <sub>2</sub>	3-Chlorophenyl ester 2-fluorobenzoic acid	(325752)	250	105.83	0.240
C <sub>13</sub> H <sub>8</sub> ClFO <sub>2</sub>	2-Chlorophenyl ester 4-fluorobenzoic acid	(299050)	250	111.83	0.509
C <sub>13</sub> H <sub>8</sub> ClFO <sub>2</sub>	2-Chlorophenyl ester 3-fluorobenzoic acid	(299057)	250	114.40	0.162
C <sub>12</sub> H <sub>14</sub> FNO <sub>3</sub>	Ethyl ester N-(2-fluorobenzoyl)-sarcosine	(321239)	239	118.74	1.101
C <sub>14</sub> H <sub>11</sub> FO <sub>2</sub>	3-Methylphenyl ester 2-fluorobenzoic acid	(307685)	230	121.96	0.175
C <sub>17</sub> H <sub>19</sub> FO <sub>2</sub>	2,7-Dimethyloct-7-en-5-yn-4-yl ester 3-fluorobenzoic acid	(292606)	274	123.73	0.110
C <sub>13</sub> H <sub>7</sub> BrF <sub>2</sub> O <sub>2</sub>	2-Bromo-4-fluorophenyl ester 4-fluorobenzoic acid	(299051)	312	126.22	0.941
C <sub>13</sub> H <sub>7</sub> BrF <sub>2</sub> O <sub>2</sub>	2-Bromo-4-fluorophenyl ester 3-fluorobenzoic acid	(299058)	312	129.45	0.599
<i>Aldehydes</i>					
C <sub>2</sub> H <sub>4</sub> O	Acetaldehyde	75-07-0	44	5.01	7.977
C <sub>3</sub> H <sub>4</sub> O	2-Propenal	107-02-8	56	7.26	0.464
C <sub>3</sub> H <sub>6</sub> O	n-Propanal	123-38-6	58	7.57	0.202
C <sub>4</sub> H <sub>6</sub> O	2-Methyl-2-propenal	78-85-3	70	9.81	0.419
C <sub>4</sub> H <sub>8</sub> O	2-Methylpropanal	78-84-2	72	9.83	0.176
C <sub>4</sub> H <sub>8</sub> O	n-Butanal	123-72-8	72	10.64	0.175

C <sub>4</sub> H <sub>7</sub> ClO	2-Methylpropanoyl chloride	79-30-1	106	11.44	0.188
C <sub>5</sub> H <sub>10</sub> O	3-Methylbutanal	590-86-3	86	13.81	0.177
C <sub>5</sub> H <sub>10</sub> O	n-Pentanal	110-62-3	86	14.79	0.133
C <sub>5</sub> H <sub>8</sub> O	(E)-2-Pentenal	1576-87-0	84	17.03	0.099
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	2-Furaldehyde	98-01-1	96	17.57	0.021
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	3-Furaldehyde	498-60-2	96	18.46	0.135
C <sub>6</sub> H <sub>12</sub> O	n-Hexanal	66-25-1	100	19.13	0.348
C <sub>7</sub> H <sub>14</sub> O	n-Heptanal	111-71-7	114	23.25	0.267
C <sub>6</sub> H <sub>6</sub> O <sub>2</sub>	5-Methyl-2-furancarboxaldehyde	620-02-0	110	23.51	0.031
C <sub>7</sub> H <sub>6</sub> O	Benzaldehyde	100-52-7	106	24.21	1.228
C <sub>8</sub> H <sub>16</sub> O	2-Ethylhexanal	123-05-7	128	25.73	0.511
C <sub>8</sub> H <sub>16</sub> O	n-Octanal	124-13-0	128	27.08	0.382
C <sub>9</sub> H <sub>18</sub> O	n-Nonanal	124-19-6	142	30.56	0.607
C <sub>10</sub> H <sub>20</sub> O	n-Decanal	112-31-2	156	33.81	0.858
C <sub>11</sub> H <sub>22</sub> O	n-Undecanal	112-44-7	170	37.82	0.116
C <sub>12</sub> H <sub>24</sub> O	n-Dodecanal	112-54-9	184	43.81	0.334
C <sub>13</sub> H <sub>26</sub> O	n-Tridecanal	10486-19-8	198	53.19	0.297
C <sub>14</sub> H <sub>28</sub> O	n-Tetradecanal	124-25-4	212	67.94	0.516
C <sub>15</sub> H <sub>30</sub> O	n-Pentadecanal	2765-11-9	226	92.62	0.347
<i>Ketones</i>					
C <sub>3</sub> H <sub>6</sub> O	2-Propanone	67-64-1	58	7.68	2.409
C <sub>4</sub> H <sub>6</sub> O	2-Butenone	78-94-4	70	10.45	0.041
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	2,3-Butanedione	431-03-8	86	10.73	0.206
C <sub>4</sub> H <sub>8</sub> O	2-Butanone	78-93-3	72	10.81	0.483
C <sub>5</sub> H <sub>10</sub> O	2-Pentanone	107-87-9	86	14.57	0.137
C <sub>5</sub> H <sub>8</sub> O	Cyclopentanone	120-92-3	84	17.29	0.120
C <sub>6</sub> H <sub>12</sub> O	2-Hexanone	591-78-6	100	18.85	0.090
C <sub>7</sub> H <sub>14</sub> O	3-Heptanone	106-35-4	114	22.65	0.159
C <sub>7</sub> H <sub>14</sub> O	2-Heptanone	110-43-0	114	22.95	0.244
C <sub>5</sub> H <sub>9</sub> ClO	5-Chloro-2-pentanone	5891-21-4	120	25.95	0.254
C <sub>5</sub> H <sub>6</sub> O <sub>3</sub>	Dihydro-3-methyl-2,5-furandione	4100-80-5	114	26.78	0.199
C <sub>8</sub> H <sub>16</sub> O	2-Octanone	111-13-7	128	26.75	0.373
C <sub>9</sub> H <sub>18</sub> O	2-Nonanone	821-55-6	142	30.24	0.192
C <sub>10</sub> H <sub>20</sub> O	2-Decanone	693-54-9	156	33.46	0.233
C <sub>8</sub> H <sub>4</sub> O <sub>3</sub>	1,3-Isobenzofurandione	85-44-9	148	36.11	0.405
C <sub>11</sub> H <sub>22</sub> O	2-Undecanone	53452-70-3	170	37.25	0.338
C <sub>12</sub> H <sub>24</sub> O	2-Dodecanone	6175-49-1	184	42.95	0.150
C <sub>13</sub> H <sub>26</sub> O	2-Tridecanone	593-08-8	198	51.80	0.329
C <sub>14</sub> H <sub>28</sub> O	2-Tetradecanone	2345-27-9	212	65.98	0.510
C <sub>15</sub> H <sub>30</sub> O	2-Pentadecanone	2345-28-0	226	88.75	1.440
<i>Carboxylic acids</i>					
C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Acetic acid	64-19-7	60	12.00	3.167

C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	n-Propanoic acid	79-09-4	74	16.73	0.199
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	n-Butanoic acid	107-92-6	88	20.25	0.627
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	3-Methylbutanoic acid	503-74-2	102	22.94	0.115
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	n-Pentanoic acid	109-52-4	102	23.87	0.699
C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	n-Hexanoic acid	142-62-1	116	27.21	1.267
C <sub>7</sub> H <sub>14</sub> O <sub>2</sub>	n-Heptanoic acid	111-14-8	130	30.52	0.541
C <sub>8</sub> H <sub>16</sub> O <sub>2</sub>	n-Octanoic acid	124-07-2	144	33.55	1.330
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	n-Nonanoic acid	112-05-0	158	37.21	1.466
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	n-Decanoic acid	334-48-5	172	42.72	2.080
C <sub>11</sub> H <sub>22</sub> O <sub>2</sub>	n-Undecanoic acid	112-37-8	186	51.55	0.198
C <sub>12</sub> H <sub>24</sub> O <sub>2</sub>	3-Methylundecanoic acid	x	200	55.08	0.638
C <sub>12</sub> H <sub>24</sub> O <sub>2</sub>	n-Dodecanoic acid	143-07-7	200	65.77	2.330
C <sub>13</sub> H <sub>26</sub> O <sub>2</sub>	n-Tridecanoic acid	638-53-9	214	88.61	0.207
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	3-Methyltridecanoic acid	x	228	116.86	0.697
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	n-Tetradecanoic acid	544-63-8	228	121.85	2.821
<b>Heterocyclic compounds</b>					
<i>Dioxanes</i>					
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,4-Dioxane	123-91-1	88	13.75	0.012
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,3-Dioxane	505-22-6	88	17.58	0.152
<i>Furans</i>					
C <sub>5</sub> H <sub>6</sub> O	2-Methylfuran	534-22-5	82	10.38	0.174
C <sub>5</sub> H <sub>6</sub> O	3-Methylfuran	930-27-8	82	10.65	0.039
C <sub>6</sub> H <sub>8</sub> O	2-Ethylfuran	3208-16-0	96	14.14	0.024
C <sub>6</sub> H <sub>6</sub> O	2-Vinylfuran	1487-18-9	94	14.92	0.011
C <sub>7</sub> H <sub>10</sub> O	2-Propylfuran	4229-91-8	110	18.34	0.064
C <sub>8</sub> H <sub>12</sub> O	2-Butylfuran	4466-24-4	124	22.35	0.071
C <sub>9</sub> H <sub>14</sub> O	2-Pentylfuran	3777-69-3	138	26.20	0.378
C <sub>7</sub> H <sub>8</sub> O <sub>2</sub>	2-Acetyl-5-methylfuran	1193-79-9	124	29.43	0.142
C <sub>10</sub> H <sub>16</sub> O	2-Hexylfuran	3777-70-6	152	29.75	0.082
C <sub>11</sub> H <sub>18</sub> O	2-Heptylfuran	3777-71-7	166	33.03	0.040
C <sub>12</sub> H <sub>20</sub> O	2-Octylfuran	4179-38-8	180	36.68	0.109
C <sub>13</sub> H <sub>22</sub> O	2-Nonylfuran	4179-38-8	180	42.07	0.061
<b>Nitrogenated compounds</b>					
N <sub>2</sub>	Nitrogen	7727-37-9	28	1.68	1.694
C <sub>2</sub> H <sub>3</sub> N	Acetonitrile	75-05-8	41	6.98	0.613
C <sub>3</sub> H <sub>5</sub> N	Propargylamine	2450-71-7	55	9.56	0.030
C <sub>4</sub> H <sub>5</sub> N	Pyrrole	109-97-7	67	14.71	0.168
C <sub>5</sub> H <sub>7</sub> N	3-Methyl-1H-pyrrole	616-43-3	81	15.16	0.037
C <sub>5</sub> H <sub>5</sub> N	Pyridine	110-86-1	79	15.69	0.100
C <sub>2</sub> H <sub>5</sub> NO	Acetamide	60-35-5	59	16.26	0.246
C <sub>6</sub> H <sub>9</sub> N	2,3-Dimethyl-1H-pyrrole	600-28-2	95	18.53	0.050
C <sub>6</sub> H <sub>7</sub> N	2-Methylpyridine	109-06-8	93	18.89	0.081
C <sub>6</sub> H <sub>7</sub> N	3-Methylpyridine	108-99-6	93	20.80	0.057

C <sub>6</sub> H <sub>7</sub> N	4-Methylpyridine	108-89-4	93	20.98	0.062
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	5-Methylpyrimidine	2036-41-1	94	22.34	0.046
C <sub>3</sub> H <sub>4</sub> N <sub>2</sub>	1H-Pyrazole	288-13-1	68	23.11	0.226
C <sub>7</sub> H <sub>5</sub> N	Benzonitrile	100-47-0	103	25.00	0.136
C <sub>5</sub> H <sub>11</sub> NO	3-Methylbutanamide	541-46-8	101	26.39	0.229
C <sub>5</sub> H <sub>11</sub> NO	Pentanamide	626-97-1	101	27.68	0.032
C <sub>4</sub> H <sub>5</sub> NO <sub>2</sub>	Succinimide	123-56-8	99	29.05	0.190
C <sub>6</sub> H <sub>13</sub> NO	Hexanamide	628-02-4	115	31.18	0.048
C <sub>7</sub> H <sub>15</sub> NO	Enanthamide	628-62-6	129	34.52	0.050
C <sub>8</sub> H <sub>17</sub> NO	Octanamide	629-01-6	143	38.87	0.103
C <sub>9</sub> H <sub>7</sub> NO <sub>2</sub>	2-Methyl-1H-Isoindole-1,3(2H)-dione	550-44-7	161	40.66	0.366
C <sub>9</sub> H <sub>19</sub> NO	Nonanamide	1120-07-6	157	45.52	0.091
C <sub>8</sub> H <sub>5</sub> NO <sub>2</sub>	Phthalimide	85-41-6	147	43.80	0.481
C <sub>10</sub> H <sub>21</sub> NO	Decanamide	2319-29-1	171	55.73	0.153
C <sub>9</sub> H <sub>11</sub> NO	Phenylpropanamide	102-93-2	149	58.50	0.129
C <sub>11</sub> H <sub>23</sub> NO	Undecanamide	x	185	72.05	0.066
<b>Sulfonated compounds</b>					
COS	Carbonyl sulfide	463-58-1	60	3.50	0.030
O <sub>2</sub> S	Sulfur dioxide	7446-09-5	64	4.89	1.435
CH <sub>4</sub> S	Methanethiol	74-93-1	48	5.56	0.076
CS <sub>2</sub>	Carbon disulfide	75-15-0	76	7.86	0.244
C <sub>4</sub> H <sub>4</sub> S	Thiophene	110-02-1	84	12.43	0.019
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	Dimethyl disulfide	624-92-0	94	15.44	0.129
C <sub>5</sub> H <sub>6</sub> S	2-Methylthiophene	554-14-3	98	16.62	0.031
C <sub>5</sub> H <sub>6</sub> S	3-Methylthiophene	616-44-4	98	16.94	0.030
C <sub>6</sub> H <sub>8</sub> S	2-Ethylthiophene	872-55-9	112	21.48	0.028
C <sub>6</sub> H <sub>8</sub> S	3-Ethylthiophene	1795-01-3	112	21.84	0.075
C <sub>7</sub> H <sub>10</sub> S	2-Propylthiophene	1551-27-5	126	23.77	0.051
C <sub>7</sub> H <sub>10</sub> S	3-Propylthiophene	x	126	23.87	0.040
C <sub>5</sub> H <sub>4</sub> OS	2-Thiophenecarboxaldehyde	98-03-3	112	25.02	0.028
C <sub>5</sub> H <sub>4</sub> OS	3-Thiophenecarboxaldehyde	498-62-4	112	26.20	0.039
C <sub>8</sub> H <sub>12</sub> S	2-Butylthiophene	1455-20-5	140	28.45	0.027
C <sub>8</sub> H <sub>12</sub> S	3-Butylthiophene	34722-01-5	140	28.89	0.037
C <sub>9</sub> H <sub>14</sub> S	3-Pentylthiophene	x	154	31.92	0.038
<b>Phosphorus containing compounds</b>					
C <sub>6</sub> H <sub>14</sub> FO <sub>2</sub> P	n-Pentyl methylphosphonofluoridate	13454-59-6	168	29.96	0.215
<b>Inorganic compounds</b>					
<i>Oxides</i>					
CO <sub>2</sub>	Carbon dioxide	124-38-9	44	1.85	2.307
H <sub>2</sub> O	Water	7732-18-5	18	3.32	1.419

<i>Noble gases</i>					
Ar	Argon	7440-37-1	40	1.71	0.083
Xe	Xenon	7440-63-3	132	22.15	0.302
<i>Permanent gases</i>					
O <sub>2</sub>	Oxygen	7782-44-7	32	1.61	0.168

Note: <sup>1</sup>CAS/(NIST) – unique numerical identifier of chemical compounds included in the register Chemical Abstracts Service (<https://www.cas.org>) or NIST number (a unique number given to each spectrum in the NIST archive); <sup>2</sup>MW – nominal mass; <sup>3</sup>RT – retention time; <sup>4</sup>A – normalized area (the area ratio of the individual gas mixture components to the summ of the areas of all the components in the chromatogram).

Table S3. Results of GC–MS analysis of volatiles extracted by mechanical shock crushing from clinopyroxene MD-22 from rhyolites (Menshyi Brat volcano, Iturup island, species diversity 230 components).

Formula	Name	<sup>1</sup> CAS/(NIST)	<sup>2</sup> MW	Clinopyroxene MD-22	
				<sup>3</sup> RT, min	<sup>4</sup> A, %
<b>Aliphatic hydrocarbons</b>					
<i>Paraffins</i>					
CH <sub>4</sub>	Methane	74-82-8	16	1.78	0.007
C <sub>3</sub> H <sub>8</sub>	n-Propane	74-98-6	44	4.20	0.020
C <sub>4</sub> H <sub>10</sub>	n-Butane	106-97-8	58	6.20	0.160
C <sub>5</sub> H <sub>12</sub>	n-Pentane	109-66-0	72	8.70	0.148
C <sub>6</sub> H <sub>14</sub>	n-Hexane	110-54-3	86	12.14	0.173
C <sub>7</sub> H <sub>16</sub>	n-Heptane	142-82-5	100	16.22	0.233
C <sub>8</sub> H <sub>16</sub>	3-Methyleneheptane	1632-16-2	112	19.68	0.735
C <sub>8</sub> H <sub>18</sub>	n-Octane	111-65-9	114	20.31	0.377
C <sub>9</sub> H <sub>20</sub>	n-Nonane	111-84-2	128	24.19	0.597
C <sub>10</sub> H <sub>22</sub>	n-Decane	124-18-5	142	27.77	0.197
C <sub>11</sub> H <sub>24</sub>	n-Undecane	1120-21-4	156	31.09	0.128
C <sub>12</sub> H <sub>26</sub>	n-Dodecane	112-40-3	170	34.21	0.150
C <sub>13</sub> H <sub>28</sub>	n-Tridecane	629-50-5	184	38.32	0.211
C <sub>14</sub> H <sub>30</sub>	n-Tetradecane	629-59-4	198	44.49	0.179
C <sub>15</sub> H <sub>32</sub>	n-Pentadecane	629-62-9	212	54.21	0.448
C <sub>16</sub> H <sub>34</sub>	n-Hexadecane	544-76-3	226	69.88	0.197
C <sub>17</sub> H <sub>36</sub>	n-Heptadecane	629-78-7	240	95.22	0.354
<i>Halogenated paraffins</i>					
C <sub>4</sub> H <sub>9</sub> Cl	1-Chlorobutane	109-69-3	92	12.77	0.106
<i>Olefins</i>					
C <sub>2</sub> H <sub>2</sub>	Acetylene	74-86-2	26	2.28	0.033
C <sub>3</sub> H <sub>6</sub>	1-Propene	115-07-1	42	4.14	0.017
C <sub>4</sub> H <sub>8</sub>	1-Butene	106-98-9	56	5.80	0.073
C <sub>4</sub> H <sub>6</sub>	1,3-Butadiene	106-99-0	54	6.00	0.171
C <sub>4</sub> H <sub>8</sub>	(E)-2-Butene	624-64-6	56	6.22	0.058
C <sub>4</sub> H <sub>8</sub>	2-Butene	107-01-7	56	6.33	0.042
C <sub>5</sub> H <sub>8</sub>	1-Pentyne	627-19-0	68	8.41	0.006
C <sub>5</sub> H <sub>8</sub>	Isoprene	78-79-5	68	8.65	0.095
C <sub>5</sub> H <sub>8</sub>	3-Methyl-1,2-butadiene	598-25-4	68	8.86	0.023
C <sub>5</sub> H <sub>8</sub>	(E)-1,3-Pentadiene	2004-70-8	68	9.15	0.031
C <sub>6</sub> H <sub>12</sub>	1-Hexene	592-41-6	84	11.81	0.018
C <sub>6</sub> H <sub>10</sub>	(E)-2-Methyl-1,3-pentadiene	926-54-5	82	12.94	0.089
C <sub>7</sub> H <sub>14</sub>	1-Heptene	592-76-7	98	15.84	0.097
C <sub>8</sub> H <sub>16</sub>	2-Methyl-1-heptene	15870-10-7	112	19.53	0.227
C <sub>8</sub> H <sub>16</sub>	1-Octene	111-66-0	112	19.86	0.382
C <sub>8</sub> H <sub>16</sub>	(Z)-3-Octene	14850-22-7	112	19.97	0.272

C <sub>8</sub> H <sub>16</sub>	3-Methyl-3-heptene	7300-03-0	112	20.07	0.551
C <sub>8</sub> H <sub>16</sub>	(E)-2-Octene	13389-42-9	112	20.19	0.270
C <sub>8</sub> H <sub>16</sub>	2-Octene	111-67-1	112	20.41	0.235
C <sub>9</sub> H <sub>18</sub>	1-Nonene	124-11-8	126	23.90	0.146
C <sub>10</sub> H <sub>20</sub>	1-Decene	872-05-9	140	27.54	0.060
C <sub>11</sub> H <sub>22</sub>	1-Undecene	821-95-4	154	30.88	0.051
C <sub>12</sub> H <sub>24</sub>	1-Dodecene	112-41-4	168	34.03	0.094
C <sub>13</sub> H <sub>26</sub>	1-Tridecene	2437-56-1	182	38.02	0.191
C <sub>14</sub> H <sub>28</sub>	1-Tetradecene	1120-36-1	196	44.06	0.179
C <sub>15</sub> H <sub>30</sub>	1-Pentadecene	13360-61-7	210	53.58	0.692
<i>Halogenated olefins</i>					
C <sub>3</sub> H <sub>3</sub> Cl	3-Chloro-1-propyne	624-65-7	74	11.45	0.111
C <sub>5</sub> H <sub>7</sub> Cl	5-Chloro-1-pentyne	14267-92-6	102	17.41	0.106
<b>Cyclic hydrocarbons</b>					
<i>Cycloalkanes (naphthenes) and cycloalkenes</i>					
C <sub>5</sub> H <sub>10</sub>	Cyclopentane	287-92-3	70	8.60	0.031
C <sub>10</sub> H <sub>16</sub>	dl-Limonene	138-86-3	136	28.03	0.064
<i>Arenes</i>					
C <sub>6</sub> H <sub>6</sub>	Benzene	71-43-2	78	12.69	0.216
C <sub>7</sub> H <sub>8</sub>	Toluene	108-88-3	92	17.14	0.189
C <sub>7</sub> H <sub>7</sub> F	(Fluoromethyl)benzene	350-50-5	110	20.82	0.017
C <sub>8</sub> H <sub>10</sub>	Ethylbenzene	100-41-4	106	21.19	0.050
C <sub>8</sub> H <sub>10</sub>	p-Xylene	106-42-3	106	21.45	0.291
C <sub>8</sub> H <sub>10</sub>	o-Xylene	95-47-6	106	21.55	0.098
C <sub>8</sub> H <sub>10</sub>	m-Xylene	108-38-3	106	21.84	0.143
C <sub>8</sub> H <sub>8</sub>	Styrene	100-42-5	104	22.10	0.060
C <sub>8</sub> H <sub>9</sub> F	p-Fluoroethylbenzene	459-47-2	124	21.71	0.019
C <sub>8</sub> H <sub>9</sub> F	3-Fluoro-o-xylene	443-82-3	124	22.27	0.105
C <sub>8</sub> H <sub>9</sub> F	5-Fluoro-m-xylene	461-97-2	124	22.55	0.027
C <sub>9</sub> H <sub>12</sub>	Propylbenzene	103-65-1	120	25.02	0.048
C <sub>10</sub> H <sub>14</sub>	Butylbenzene	104-51-8	134	28.77	0.059
C <sub>11</sub> H <sub>16</sub>	Pentylbenzene	538-68-1	148	32.21	0.103
C <sub>12</sub> H <sub>18</sub>	Hexylbenzene	1077-16-3	162	35.60	0.092
C <sub>13</sub> H <sub>20</sub>	Heptylbenzene	1078-71-3	176	40.58	0.045
C <sub>15</sub> H <sub>24</sub>	Nonylbenzene	1081-77-2	204	60.30	0.084
<i>Polycyclic aromatic hydrocarbons (PAH)</i>					
C <sub>10</sub> H <sub>8</sub>	Naphthalene	91-20-3	128	32.30	0.015
C <sub>11</sub> H <sub>10</sub>	1-Methylnaphthalene	90-12-0	142	36.14	0.017
C <sub>11</sub> H <sub>10</sub>	2-Methylnaphthalene	91-57-6	142	36.68	0.019
C <sub>12</sub> H <sub>12</sub>	2,7-Dimethylnaphthalene	582-16-1	156	42.25	0.020
C <sub>13</sub> H <sub>14</sub>	1-(1-Methylethyl)-naphthalene	6158-45-8	170	55.22	0.081
C <sub>14</sub> H <sub>10</sub>	Phenanthrene	85-01-8	178	88.56	0.035
<b>Oxygenated hydrocarbons</b>					
<i>Alcohols</i>					



CH <sub>4</sub> O	Methanol	67-56-1	32	4.71	3.541
C <sub>2</sub> H <sub>6</sub> O	Ethanol	64-17-5	46	6.73	0.911
C <sub>4</sub> H <sub>10</sub> O	1-Butanol	71-36-3	74	12.93	0.047
C <sub>6</sub> H <sub>6</sub> O	Phenol	108-95-2	94	25.08	0.212
C <sub>7</sub> H <sub>8</sub> O	2-Methylphenol	95-48-7	108	27.78	0.015
C <sub>7</sub> H <sub>8</sub> O	4-Methylphenol	106-44-5	108	28.84	0.071
C <sub>7</sub> H <sub>8</sub> O	3-Methylphenol	108-39-4	108	29.52	0.021
C <sub>8</sub> H <sub>10</sub> O	2-Ethylphenol	90-00-6	122	31.60	0.014
C <sub>8</sub> H <sub>10</sub> O	4-Ethylphenol	123-07-9	122	32.06	0.016
C <sub>8</sub> H <sub>10</sub> O	3-Ethylphenol	620-17-7	122	32.59	0.005
C <sub>11</sub> H <sub>16</sub> O	2-(1,1-Dimethylethyl)-6-methylphenol	2219-82-1	164	38.45	5.474
<i>Ethers and esters</i>					
C <sub>5</sub> H <sub>8</sub> O	3,4-Dihydropyran	110-87-2	84	13.56	0.042
C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	Methyl methacrylate	80-62-6	100	14.59	0.115
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	Butyrolactone	96-48-0	86	21.08	0.184
C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	γ-Hexalactone	695-06-7	114	27.61	0.053
C <sub>7</sub> H <sub>12</sub> O <sub>2</sub>	γ-Heptalactone	105-21-5	128	31.22	0.037
C <sub>8</sub> H <sub>14</sub> O <sub>2</sub>	γ-Octalactone	104-50-7	142	34.68	0.080
C <sub>9</sub> H <sub>16</sub> O <sub>2</sub>	γ-Nonalactone	104-61-0	156	39.21	0.107
C <sub>10</sub> H <sub>18</sub> O <sub>2</sub>	γ-Decalactone	706-14-9	170	46.17	0.118
C <sub>11</sub> H <sub>20</sub> O <sub>2</sub>	γ-Undecalactone	104-67-6	184	57.03	0.049
C <sub>12</sub> H <sub>9</sub> FO <sub>2</sub>	Pent-2-en-4-ynyl ester 3-fluorobenzoic acid	(292602)	204	57.53	0.368
C <sub>13</sub> H <sub>13</sub> FO <sub>2</sub>	Hex-4-yn-3-yl ester 3-fluorobenzoic acid	(292603)	220	59.98	0.288
C <sub>9</sub> H <sub>6</sub> Cl <sub>3</sub> FO <sub>2</sub>	2,2,2-Trichloroethyl ester 4-fluorobenzoic acid	(355676)	270	65.01	0.450
C <sub>9</sub> H <sub>6</sub> Cl <sub>3</sub> FO <sub>2</sub>	2,2,2-Trichloroethyl ester 3-fluorobenzoic acid	(355664)	270	66.09	0.480
C <sub>9</sub> H <sub>6</sub> Cl <sub>3</sub> FO <sub>2</sub>	2,2,2-Trichloroethyl ester 2-fluorobenzoic acid	(354703)	270	72.39	2.154
C <sub>12</sub> H <sub>22</sub> O <sub>2</sub>	γ-Dodecalactone	2305-05-7	198	74.32	0.223
C <sub>15</sub> H <sub>19</sub> FO <sub>2</sub>	Oct-3-en-2-yl ester 4-fluorobenzoic acid	(299154)	250	79.99	2.001
C <sub>15</sub> H <sub>19</sub> FO <sub>2</sub>	Oct-3-en-2-yl ester 2-fluorobenzoic acid	(299165)	250	89.55	0.985
C <sub>12</sub> H <sub>15</sub> ClO <sub>2</sub>	Acetate 3-chloromethyl-2,4,6-trimethylphenol	855404-19-2	226	100.38	21.586
<i>Aldehydes</i>					
C <sub>2</sub> H <sub>4</sub> O	Acetaldehyde	75-07-0	44	5.32	0.061
C <sub>3</sub> H <sub>6</sub> O	n-Propanal	123-38-6	58	7.69	0.879
C <sub>4</sub> H <sub>6</sub> O	2-Methyl-2-propenal	78-85-3	70	9.82	0.198
C <sub>4</sub> H <sub>8</sub> O	2-Methylpropanal	78-84-2	72	9.85	0.046

C <sub>4</sub> H <sub>8</sub> O	n-Butanal	123-72-8	72	10.67	0.142
C <sub>4</sub> H <sub>6</sub> O	(E)-2-Butenal	123-73-9	70	11.05	0.034
C <sub>4</sub> H <sub>6</sub> O	2-Butenal	4170-30-3	70	12.28	0.061
C <sub>5</sub> H <sub>10</sub> O	3-Methylbutanal	590-86-3	86	13.83	0.068
C <sub>5</sub> H <sub>10</sub> O	n-Pentanal	110-62-3	86	14.83	0.150
C <sub>5</sub> H <sub>8</sub> O	(E)-2-Pentenal	1576-87-0	84	17.04	0.107
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	2-Furaldehyde	98-01-1	96	17.58	0.020
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	3-Furaldehyde	498-60-2	96	18.48	0.169
C <sub>6</sub> H <sub>12</sub> O	n-Hexanal	66-25-1	100	19.15	0.249
C <sub>7</sub> H <sub>14</sub> O	n-Heptanal	111-71-7	114	23.27	0.250
C <sub>6</sub> H <sub>6</sub> O <sub>2</sub>	5-Methyl-2-furancarboxaldehyde	620-02-0	110	23.53	0.042
C <sub>7</sub> H <sub>6</sub> O	Benzaldehyde	100-52-7	106	24.22	0.400
C <sub>8</sub> H <sub>16</sub> O	2-Ethylhexanal	123-05-7	128	25.74	0.294
C <sub>8</sub> H <sub>16</sub> O	n-Octanal	124-13-0	128	27.08	0.368
C <sub>9</sub> H <sub>18</sub> O	n-Nonanal	124-19-6	142	30.57	0.505
C <sub>10</sub> H <sub>20</sub> O	n-Decanal	112-31-2	156	33.81	0.770
C <sub>11</sub> H <sub>22</sub> O	n-Undecanal	112-44-7	170	37.79	0.229
C <sub>12</sub> H <sub>24</sub> O	n-Dodecanal	112-54-9	184	43.81	0.184
C <sub>13</sub> H <sub>26</sub> O	n-Tridecanal	10486-19-8	198	53.31	0.230
C <sub>14</sub> H <sub>28</sub> O	n-Tetradecanal	124-25-4	212	68.19	0.633
C <sub>15</sub> H <sub>30</sub> O	n-Pentadecanal	2765-11-9	226	92.38	0.461
<i>Ketones</i>					
C <sub>3</sub> H <sub>6</sub> O	2-Propanone	67-64-1	58	7.75	0.744
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	2,3-Butanedione	431-03-8	86	10.75	0.193
C <sub>4</sub> H <sub>8</sub> O	2-Butanone	78-93-3	72	10.84	0.255
C <sub>5</sub> H <sub>10</sub> O	2-Pentanone	107-87-9	86	14.59	0.099
C <sub>5</sub> H <sub>8</sub> O	Cyclopentanone	120-92-3	84	17.31	0.097
C <sub>6</sub> H <sub>12</sub> O	2-Hexanone	591-78-6	100	18.88	0.050
C <sub>7</sub> H <sub>14</sub> O	2-Heptanone	110-43-0	114	22.98	0.200
C <sub>5</sub> H <sub>9</sub> ClO	5-Chloro-2-pentanone	5891-21-4	120	25.96	0.148
C <sub>5</sub> H <sub>6</sub> O <sub>3</sub>	Dihydro-3-methyl-2,5-furandione	4100-80-5	114	26.79	0.249
C <sub>8</sub> H <sub>16</sub> O	2-Octanone	111-13-7	128	26.76	0.134
C <sub>9</sub> H <sub>18</sub> O	2-Nonanone	821-55-6	142	30.26	0.075
C <sub>10</sub> H <sub>20</sub> O	2-Decanone	693-54-9	156	33.47	0.130
C <sub>8</sub> H <sub>4</sub> O <sub>3</sub>	1,3-Isobenzofurandione	85-44-9	148	36.11	0.815
C <sub>11</sub> H <sub>22</sub> O	2-Undecanone	53452-70-3	170	37.27	0.151
C <sub>12</sub> H <sub>24</sub> O	2-Dodecanone	6175-49-1	184	42.95	0.099
C <sub>13</sub> H <sub>22</sub> O	(E)-6,10-Dimethyl-5,9-undecadien-2-one	3796-70-1	194	47.48	0.264
C <sub>13</sub> H <sub>26</sub> O	2-Tridecanone	593-08-8	198	51.86	0.216
C <sub>14</sub> H <sub>28</sub> O	2-Tetradecanone	2345-27-9	212	66.00	0.259
C <sub>15</sub> H <sub>30</sub> O	2-Pentadecanone	2345-28-0	226	88.66	1.114
<i>Carboxylic acids</i>					

C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Acetic acid	64-19-7	60	11.89	1.456
C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	n-Propanoic acid	79-09-4	74	16.43	0.047
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	n-Butanoic acid	107-92-6	88	19.99	0.393
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	3-Methylbutanoic acid	503-74-2	102	22.73	0.044
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	n-Pentanoic acid	109-52-4	102	23.70	0.441
C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	n-Hexanoic acid	142-62-1	116	27.12	0.853
C <sub>7</sub> H <sub>14</sub> O <sub>2</sub>	n-Heptanoic acid	111-14-8	130	30.44	0.457
C <sub>8</sub> H <sub>16</sub> O <sub>2</sub>	3-Methylheptanoic acid	x	144	33.13	0.017
C <sub>8</sub> H <sub>16</sub> O <sub>2</sub>	n-Octanoic acid	124-07-2	144	33.43	1.286
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	3-Methyloctanoic acid	6061-10-5	158	36.36	0.023
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	n-Nonanoic acid	112-05-0	158	37.04	1.704
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	3-Methylnonanoic acid	x	172	41.66	0.056
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	n-Decanoic acid	334-48-5	172	42.43	2.215
C <sub>11</sub> H <sub>22</sub> O <sub>2</sub>	3-Methyldecanoic acid	60308-82-9	186	49.94	0.067
C <sub>11</sub> H <sub>22</sub> O <sub>2</sub>	n-Undecanoic acid	112-37-8	186	51.71	0.277
C <sub>12</sub> H <sub>24</sub> O <sub>2</sub>	n-Dodecanoic acid	143-07-7	200	64.99	2.147
C <sub>13</sub> H <sub>26</sub> O <sub>2</sub>	n-Tridecanoic acid	638-53-9	214	88.57	0.166
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	3-Methyltridecanoic acid	x	228	107.03	0.981
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	n-Tetradecanoic acid	544-63-8	228	121.59	2.202
<b>Heterocyclic compounds</b>					
<i>Dioxanes</i>					
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,4-Dioxane	123-91-1	88	13.79	0.009
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,3-Dioxane	505-22-6	88	17.59	0.020
<i>Furans</i>					
C <sub>5</sub> H <sub>6</sub> O	2-Methylfuran	534-22-5	82	10.41	0.059
C <sub>5</sub> H <sub>6</sub> O	3-Methylfuran	930-27-8	82	10.69	0.029
C <sub>6</sub> H <sub>8</sub> O	2-Ethylfuran	3208-16-0	96	14.17	0.006
C <sub>6</sub> H <sub>6</sub> O	2-Vinylfuran	1487-18-9	94	14.97	0.005
C <sub>7</sub> H <sub>10</sub> O	2-Propylfuran	4229-91-8	110	18.40	0.016
C <sub>8</sub> H <sub>12</sub> O	2-Butylfuran	4466-24-4	124	22.38	0.017
C <sub>9</sub> H <sub>14</sub> O	2-Pentylfuran	3777-69-3	138	26.21	0.175
C <sub>7</sub> H <sub>8</sub> O <sub>2</sub>	2-Acetyl-5-methylfuran	1193-79-9	124	29.45	0.035
C <sub>10</sub> H <sub>16</sub> O	2-Hexylfuran	3777-70-6	152	29.77	0.051
C <sub>11</sub> H <sub>18</sub> O	2-Heptylfuran	3777-71-7	166	33.03	0.020
C <sub>12</sub> H <sub>20</sub> O	2-Octylfuran	4179-38-8	180	36.68	0.049
C <sub>13</sub> H <sub>22</sub> O	2-Nonylfuran	4179-38-8	180	42.11	0.038
<b>Nitrogenated compounds</b>					
N <sub>2</sub>	Nitrogen	7727-37-9	28	1.75	2.916
C <sub>2</sub> H <sub>3</sub> N	Acetonitrile	75-05-8	41	6.99	0.368
C <sub>3</sub> H <sub>5</sub> N	Propargylamine	2450-71-7	55	9.58	0.016
C <sub>4</sub> H <sub>4</sub> N <sub>2</sub>	1,3-Diazine	289-95-2	80	14.47	0.142
C <sub>4</sub> H <sub>5</sub> N	Pyrrole	109-97-7	67	14.75	0.105
C <sub>5</sub> H <sub>7</sub> N	3-Methyl-1H-pyrrole	616-43-3	81	15.16	0.035
C <sub>5</sub> H <sub>5</sub> N	Pyridine	110-86-1	79	15.73	0.031

C <sub>2</sub> H <sub>5</sub> NO	Acetamide	60-35-5	59	16.25	0.100
C <sub>6</sub> H <sub>9</sub> N	2,3-Dimethyl-1H-pyrrole	600-28-2	95	18.56	0.024
C <sub>6</sub> H <sub>7</sub> N	2-Methylpyridine	109-06-8	93	18.93	0.018
C <sub>6</sub> H <sub>7</sub> N	3-Methylpyridine	108-99-6	93	20.82	0.017
C <sub>6</sub> H <sub>7</sub> N	4-Methylpyridine	108-89-4	93	21.01	0.037
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	4-Methylpyrimidine	3438-46-8	94	21.71	0.015
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	5-Methylpyrimidine	2036-41-1	94	22.35	0.012
C <sub>3</sub> H <sub>4</sub> N <sub>2</sub>	1H-Pyrazole	288-13-1	68	23.12	0.400
C <sub>7</sub> H <sub>5</sub> N	Benzonitrile	100-47-0	103	25.01	0.057
C <sub>5</sub> H <sub>11</sub> NO	3-Methylbutanamide	541-46-8	101	26.45	0.124
C <sub>5</sub> H <sub>11</sub> NO	Pentanamide	626-97-1	101	27.64	0.023
C <sub>4</sub> H <sub>5</sub> NO <sub>2</sub>	Succinimide	123-56-8	99	29.05	0.118
C <sub>6</sub> H <sub>13</sub> NO	Hexanamide	628-02-4	115	31.18	0.025
C <sub>7</sub> H <sub>15</sub> NO	Enanthamide	628-62-6	129	34.52	0.024
C <sub>8</sub> H <sub>17</sub> NO	Octanamide	629-01-6	143	38.87	0.053
C <sub>9</sub> H <sub>7</sub> NO <sub>2</sub>	2-Methyl-1H-Isoindole-1,3(2H)-dione	550-44-7	161	40.70	0.189
C <sub>9</sub> H <sub>19</sub> NO	Nonanamide	1120-07-6	157	45.47	0.047
C <sub>8</sub> H <sub>5</sub> NO <sub>2</sub>	Phthalimide	85-41-6	147	43.84	0.331
C <sub>10</sub> H <sub>21</sub> NO	Decanamide	2319-29-1	171	55.78	0.073
<b>Sulfonated compounds</b>					
H <sub>2</sub> S	Hydrogen sulfide	7783-06-4	34	2.91	0.023
COS	Carbonyl sulfide	463-58-1	60	3.52	0.025
O <sub>2</sub> S	Sulfur dioxide	7446-09-5	64	4.87	1.470
CH <sub>4</sub> S	Methanethiol	74-93-1	48	5.58	0.028
CS <sub>2</sub>	Carbon disulfide	75-15-0	76	7.90	0.131
C <sub>4</sub> H <sub>4</sub> S	Thiophene	110-02-1	84	12.44	0.013
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	Dimethyl disulfide	624-92-0	94	15.47	0.028
C <sub>5</sub> H <sub>6</sub> S	2-Methylthiophene	554-14-3	98	16.64	0.013
C <sub>5</sub> H <sub>6</sub> S	3-Methylthiophene	616-44-4	98	16.98	0.016
C <sub>6</sub> H <sub>8</sub> S	2-Ethylthiophene	872-55-9	112	21.48	0.027
C <sub>6</sub> H <sub>8</sub> S	3-Ethylthiophene	1795-01-3	112	21.84	0.028
C <sub>7</sub> H <sub>10</sub> S	2-Propylthiophene	1551-27-5	126	23.81	0.083
C <sub>7</sub> H <sub>10</sub> S	3-Propylthiophene	x	126	23.90	0.026
C <sub>5</sub> H <sub>4</sub> OS	2-Thiophenecarboxaldehyde	98-03-3	112	25.05	0.022
C <sub>5</sub> H <sub>4</sub> OS	3-Thiophenecarboxaldehyde	498-62-4	112	26.21	0.015
C <sub>8</sub> H <sub>12</sub> S	2-Butylthiophene	1455-20-5	140	28.46	0.023
C <sub>8</sub> H <sub>12</sub> S	3-Butylthiophene	34722-01-5	140	28.89	0.050
C <sub>9</sub> H <sub>14</sub> S	2-Pentylthiophene	4861-58-9	154	31.66	0.008
C <sub>9</sub> H <sub>14</sub> S	3-Pentylthiophene	x	154	31.94	0.011
C <sub>10</sub> H <sub>16</sub> S	2-Hexylthiophene	18794-77-9	168	35.40	0.018

C <sub>11</sub> H <sub>18</sub> S	2-Heptylthiophene	18794-78-0	182	40.24	0.039
<b>Phosphorus containing compounds</b>					
C <sub>6</sub> H <sub>14</sub> FO <sub>2</sub> P	n-Pentyl methylphosphonofluoridate	13454-59-6	168	29.95	0.052
<b>Inorganic compounds</b>					
<i>Oxides</i>					
CO <sub>2</sub>	Carbon dioxide	124-38-9	44	1.88	1.638
H <sub>2</sub> O	Water	7732-18-5	18	4.29	13.240
<i>Noble gases</i>					
Ar	Argon	7440-37-1	40	1.69	0.013
Xe	Xenon	7440-63-3	132	22.20	0.092
<i>Permanent gases</i>					
O <sub>2</sub>	Oxygen	7782-44-7	32	1.59	0.053

Note: <sup>1</sup>CAS/(NIST) – unique numerical identifier of chemical compounds included in the register Chemical Abstracts Service (<https://www.cas.org>) or NIST number (a unique number given to each spectrum in the NIST archive); <sup>2</sup>MW – nominal mass; <sup>3</sup>RT – retention time; <sup>4</sup>A – normalized area (the area ratio of the individual gas mixture components to the sum of the areas of all the components in the chromatogram).

Table S4. Results of GC–MS analysis of volatiles extracted by mechanical shock crushing from orthopyroxene MD-22 from rhyolites (Menshyi Brat volcano, Iturup island, species diversity 227 components).

Formula	Name	<sup>1</sup> CAS/(NIST)	<sup>2</sup> MW	Orthopyroxene MD-22	
				<sup>3</sup> RT, min	<sup>4</sup> A, %
<b>Aliphatic hydrocarbons</b>					
<i>Paraffins</i>					
CH <sub>4</sub>	Methane	74-82-8	16	1.71	0.013
C <sub>2</sub> H <sub>6</sub>	Ethane	74-84-0	30	2.50	0.062
C <sub>3</sub> H <sub>8</sub>	n-Propane	74-98-6	44	4.27	0.024
C <sub>4</sub> H <sub>10</sub>	n-Butane	106-97-8	58	6.18	0.151
C <sub>5</sub> H <sub>12</sub>	n-Pentane	109-66-0	72	8.68	0.090
C <sub>6</sub> H <sub>14</sub>	n-Hexane	110-54-3	86	12.13	0.084
C <sub>7</sub> H <sub>16</sub>	n-Heptane	142-82-5	100	16.21	0.111
C <sub>8</sub> H <sub>16</sub>	3-Methyleneheptane	1632-16-2	112	19.68	0.954
C <sub>8</sub> H <sub>18</sub>	n-Octane	111-65-9	114	20.30	0.258
C <sub>9</sub> H <sub>20</sub>	n-Nonane	111-84-2	128	24.18	0.338
C <sub>10</sub> H <sub>22</sub>	n-Decane	124-18-5	142	27.78	0.138
C <sub>11</sub> H <sub>24</sub>	n-Undecane	1120-21-4	156	31.10	0.119
C <sub>12</sub> H <sub>26</sub>	n-Dodecane	112-40-3	170	34.24	0.109
C <sub>13</sub> H <sub>28</sub>	n-Tridecane	629-50-5	184	38.33	0.117
C <sub>14</sub> H <sub>30</sub>	n-Tetradecane	629-59-4	198	44.58	0.144
C <sub>15</sub> H <sub>32</sub>	5-Methyltetradecane	25117-32-2	212	46.59	0.562
C <sub>15</sub> H <sub>32</sub>	n-Pentadecane	629-62-9	212	54.47	0.306
C <sub>16</sub> H <sub>34</sub>	5-Methylpentadecane	25117-33-3	226	62.53	1.407
C <sub>16</sub> H <sub>34</sub>	n-Hexadecane	544-76-3	226	70.05	0.221
C <sub>17</sub> H <sub>36</sub>	3-Methylhexadecane	6418-43-5	240	88.34	2.622
C <sub>17</sub> H <sub>36</sub>	n-Heptadecane	629-78-7	240	95.64	0.717
<i>Halogenated paraffins</i>					
C <sub>4</sub> H <sub>9</sub> Cl	1-Chlorobutane	109-69-3	92	12.75	0.151
C <sub>10</sub> H <sub>21</sub> Cl	1-Chlorodecane	1002-69-3	176	35.49	0.293
C <sub>13</sub> H <sub>27</sub> Cl	1-Chlorotridecane	822-13-9	219	58.65	0.268
C <sub>14</sub> H <sub>29</sub> Cl	1-Chlorotetradecane	2425-54-9	232	74.69	0.320
<i>Olefins</i>					
C <sub>2</sub> H <sub>2</sub>	Acetylene	74-86-2	26	2.23	0.043
C <sub>2</sub> H <sub>4</sub>	Ethylene	74-85-1	28	2.39	0.052
C <sub>3</sub> H <sub>6</sub>	1-Propene	115-07-1	42	4.11	0.043
C <sub>4</sub> H <sub>8</sub>	1-Butene	106-98-9	56	5.89	0.577
C <sub>4</sub> H <sub>6</sub>	1,3-Butadiene	106-99-0	54	5.99	0.649
C <sub>4</sub> H <sub>8</sub>	(E)-2-Butene	624-64-6	56	6.21	0.252
C <sub>4</sub> H <sub>8</sub>	2-Butene	107-01-7	56	6.32	0.358
C <sub>5</sub> H <sub>10</sub>	1-Pentene	109-67-1	70	8.38	0.093
C <sub>5</sub> H <sub>8</sub>	Isoprene	78-79-5	68	8.62	0.193
C <sub>5</sub> H <sub>8</sub>	3-Methyl-1,2-butadiene	598-25-4	68	8.86	0.037

C <sub>5</sub> H <sub>8</sub>	(E)-1,3-Pentadiene	2004-70-8	68	9.13	0.022
C <sub>6</sub> H <sub>12</sub>	1-Hexene	592-41-6	84	11.79	0.046
C <sub>6</sub> H <sub>10</sub>	(E)-2-Methyl-1,3-pentadiene	926-54-5	82	12.91	0.085
C <sub>7</sub> H <sub>14</sub>	1-Heptene	592-76-7	98	15.84	0.071
C <sub>8</sub> H <sub>16</sub>	2-Methyl-1-heptene	15870-10-7	112	19.51	0.281
C <sub>8</sub> H <sub>16</sub>	1-Octene	111-66-0	112	19.85	0.525
C <sub>8</sub> H <sub>16</sub>	(Z)-3-Octene	14850-22-7	112	19.97	0.269
C <sub>8</sub> H <sub>16</sub>	3-Methyl-3-heptene	7300-03-0	112	20.07	0.769
C <sub>8</sub> H <sub>16</sub>	(E)-2-Octene	13389-42-9	112	20.16	0.267
C <sub>8</sub> H <sub>16</sub>	2-Octene	111-67-1	112	20.40	0.254
C <sub>9</sub> H <sub>18</sub>	1-Nonene	124-11-8	126	23.90	0.062
C <sub>10</sub> H <sub>20</sub>	1-Decene	872-05-9	140	27.53	0.093
C <sub>11</sub> H <sub>22</sub>	1-Undecene	821-95-4	154	30.90	0.035
C <sub>12</sub> H <sub>24</sub>	1-Dodecene	112-41-4	168	34.03	0.051
C <sub>13</sub> H <sub>26</sub>	1-Tridecene	2437-56-1	182	38.07	0.121
C <sub>14</sub> H <sub>28</sub>	1-Tetradecene	1120-36-1	196	44.14	0.092
C <sub>15</sub> H <sub>30</sub>	1-Pentadecene	13360-61-7	210	53.71	0.352
<i>Halogenated olefins</i>					
C <sub>6</sub> H <sub>11</sub> Cl	3-Chloro-1-hexene	53101-38-5	118	16.07	0.018
<b>Cyclic hydrocarbons</b>					
<i>Cycloalkanes (naphthenes) and cycloalkenes</i>					
C <sub>5</sub> H <sub>10</sub>	Cyclopentane	287-92-3	70	8.60	0.035
C <sub>10</sub> H <sub>16</sub>	dl-Limonene	138-86-3	136	28.04	0.049
<i>Arenes</i>					
C <sub>6</sub> H <sub>6</sub>	Benzene	71-43-2	78	12.66	0.137
C <sub>7</sub> H <sub>8</sub>	Toluene	108-88-3	92	17.12	0.236
C <sub>7</sub> H <sub>7</sub> F	(Fluoromethyl)benzene	350-50-5	110	20.80	0.036
C <sub>8</sub> H <sub>10</sub>	Ethylbenzene	100-41-4	106	21.15	0.049
C <sub>8</sub> H <sub>10</sub>	p-Xylene	106-42-3	106	21.43	0.299
C <sub>8</sub> H <sub>10</sub>	o-Xylene	95-47-6	106	21.55	0.074
C <sub>8</sub> H <sub>10</sub>	m-Xylene	108-38-3	106	21.79	0.115
C <sub>8</sub> H <sub>8</sub>	Styrene	100-42-5	104	22.07	0.054
C <sub>8</sub> H <sub>9</sub> F	p-Fluoroethylbenzene	459-47-2	124	21.70	0.008
C <sub>8</sub> H <sub>9</sub> F	3-Fluoro-o-xylene	443-82-3	124	22.30	0.060
C <sub>8</sub> H <sub>9</sub> F	5-Fluoro-m-xylene	461-97-2	124	22.54	0.073
C <sub>9</sub> H <sub>12</sub>	Propylbenzene	103-65-1	120	25.04	0.029
C <sub>10</sub> H <sub>14</sub>	Butylbenzene	104-51-8	134	28.83	0.049
C <sub>11</sub> H <sub>16</sub>	Pentylbenzene	538-68-1	148	32.18	0.059
<i>Polycyclic aromatic hydrocarbons (PAH)</i>					
C <sub>10</sub> H <sub>8</sub>	Naphthalene	91-20-3	128	32.29	0.025
C <sub>13</sub> H <sub>14</sub>	1-(1-Methylethyl)-naphthalene	6158-45-8	170	55.22	0.050
C <sub>14</sub> H <sub>10</sub>	Phenanthrene	85-01-8	178	88.93	0.055
<b>Oxygenated hydrocarbons</b>					
<i>Alcohols</i>					

CH <sub>4</sub> O	Methanol	67-56-1	32	4.87	2.298
C <sub>2</sub> H <sub>6</sub> O	Ethanol	64-17-5	46	6.72	0.555
C <sub>3</sub> H <sub>8</sub> O	1-Propanol	71-23-8	60	8.40	0.041
C <sub>4</sub> H <sub>10</sub> O	1-Butanol	71-36-3	74	12.91	0.046
C <sub>6</sub> H <sub>14</sub> O	4-Methyl-2-pentanol	108-11-2	102	17.65	0.121
C <sub>6</sub> H <sub>6</sub> O	Phenol	108-95-2	94	25.29	0.103
C <sub>8</sub> H <sub>16</sub> O	2-Ethyl-2-hexen-1-ol	50639-00-4	128	26.58	0.080
C <sub>7</sub> H <sub>8</sub> O	2-Methylphenol	95-48-7	108	27.75	0.020
<i>Ethers and esters</i>					
C <sub>5</sub> H <sub>8</sub> O	3,4-Dihydropyran	110-87-2	84	13.55	0.058
C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	Methyl methacrylate	80-62-6	100	14.60	0.058
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	Butyrolactone	96-48-0	86	21.08	0.122
C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	γ-Hexalactone	695-06-7	114	27.62	0.039
C <sub>7</sub> H <sub>12</sub> O <sub>2</sub>	γ-Heptalactone	105-21-5	128	31.21	0.031
C <sub>8</sub> H <sub>14</sub> O <sub>2</sub>	γ-Octalactone	104-50-7	142	34.68	0.086
C <sub>9</sub> H <sub>16</sub> O <sub>2</sub>	γ-Nonalactone	104-61-0	156	39.23	0.385
C <sub>10</sub> H <sub>18</sub> O <sub>2</sub>	γ-Decalactone	706-14-9	170	46.18	0.221
C <sub>13</sub> H <sub>18</sub> O <sub>2</sub>	Acetate 2-tert-butyl-4-methylphenol	6950-09-0	206	50.66	0.165
C <sub>11</sub> H <sub>20</sub> O <sub>2</sub>	γ-Undecalactone	104-67-6	184	57.10	0.058
C <sub>12</sub> H <sub>22</sub> O <sub>2</sub>	γ-Dodecalactone	2305-05-7	198	74.59	0.094
C <sub>11</sub> H <sub>12</sub> O <sub>4</sub>	Mono(1-methylethyl) ester 1,2-benzenedicarboxylic acid	35118-50-4	208	90.11	0.535
C <sub>13</sub> H <sub>24</sub> O <sub>2</sub>	γ-Tridecalactone	x	212	102.60	0.046
C <sub>16</sub> H <sub>8</sub> F <sub>6</sub> O <sub>3</sub>	Pentafluoropropionate 2-fluoro-4'-hydroxybenzophenone	(462287)	362	108.14	0.215
C <sub>13</sub> H <sub>8</sub> ClFO <sub>2</sub>	2-Chlorophenyl ester 3-fluorobenzoic acid	(299057)	250	110.91	0.209
C <sub>15</sub> H <sub>8</sub> F <sub>4</sub> O <sub>3</sub>	Trifluoroacetate 4-fluoro-4'-hydroxybenzophenone	(462408)	312	117.34	0.934
C <sub>16</sub> H <sub>8</sub> F <sub>6</sub> O <sub>3</sub>	Pentafluoropropionate 4-fluoro-4'-hydroxybenzophenone	(462406)	362	123.41	2.226
C <sub>13</sub> H <sub>7</sub> BrF <sub>2</sub> O <sub>2</sub>	2-Bromo-4-fluorophenyl ester 4-fluorobenzoic acid	(299051)	312	129.94	1.317
C <sub>13</sub> H <sub>7</sub> BrF <sub>2</sub> O <sub>2</sub>	2-Bromo-4-fluorophenyl ester 3-fluorobenzoic acid	(299058)	312	130.93	1.368
<i>Aldehydes</i>					
C <sub>2</sub> H <sub>4</sub> O	Acetaldehyde	75-07-0	44	5.08	4.533
C <sub>3</sub> H <sub>4</sub> O	2-Propenal	107-02-8	56	7.33	0.155
C <sub>3</sub> H <sub>6</sub> O	n-Propanal	123-38-6	58	7.61	0.144
C <sub>4</sub> H <sub>6</sub> O	2-Methyl-2-propenal	78-85-3	70	9.83	0.189



C <sub>4</sub> H <sub>8</sub> O	2-Methylpropanal	78-84-2	72	9.85	0.107
C <sub>4</sub> H <sub>8</sub> O	n-Butanal	123-72-8	72	10.67	0.089
C <sub>5</sub> H <sub>10</sub> O	3-Methylbutanal	590-86-3	86	13.80	0.113
C <sub>5</sub> H <sub>10</sub> O	n-Pentanal	110-62-3	86	14.80	0.059
C <sub>5</sub> H <sub>8</sub> O	(E)-2-Pentenal	1576-87-0	84	17.03	0.046
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	2-Furaldehyde	98-01-1	96	17.56	0.015
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	3-Furaldehyde	498-60-2	96	18.45	0.058
C <sub>6</sub> H <sub>12</sub> O	n-Hexanal	66-25-1	100	19.13	0.269
C <sub>7</sub> H <sub>14</sub> O	n-Heptanal	111-71-7	114	23.26	0.097
C <sub>6</sub> H <sub>6</sub> O <sub>2</sub>	5-Methyl-2-furancarboxaldehyde	620-02-0	110	23.51	0.021
C <sub>7</sub> H <sub>6</sub> O	Benzaldehyde	100-52-7	106	24.21	0.290
C <sub>8</sub> H <sub>16</sub> O	2-Ethylhexanal	123-05-7	128	25.74	0.171
C <sub>8</sub> H <sub>16</sub> O	n-Octanal	124-13-0	128	27.08	0.186
C <sub>9</sub> H <sub>18</sub> O	n-Nonanal	124-19-6	142	30.59	0.402
C <sub>10</sub> H <sub>20</sub> O	n-Decanal	112-31-2	156	33.82	0.609
C <sub>11</sub> H <sub>22</sub> O	n-Undecanal	112-44-7	170	37.82	0.135
C <sub>12</sub> H <sub>24</sub> O	n-Dodecanal	112-54-9	184	43.86	0.160
C <sub>13</sub> H <sub>26</sub> O	n-Tridecanal	10486-19-8	198	53.28	0.103
C <sub>14</sub> H <sub>28</sub> O	n-Tetradecanal	124-25-4	212	67.68	0.162
C <sub>16</sub> H <sub>32</sub> O	n-Hexadecanal	629-80-1	240	129.79	2.936
<i>Ketones</i>					
C <sub>3</sub> H <sub>6</sub> O	2-Propanone	67-64-1	58	7.72	1.640
C <sub>4</sub> H <sub>6</sub> O	2-Butenone	78-94-4	70	10.44	0.015
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	2,3-Butanedione	431-03-8	86	10.73	0.094
C <sub>4</sub> H <sub>8</sub> O	2-Butanone	78-93-3	72	10.83	0.180
C <sub>5</sub> H <sub>10</sub> O	2-Pentanone	107-87-9	86	14.59	0.044
C <sub>5</sub> H <sub>8</sub> O	Cyclopentanone	120-92-3	84	17.28	0.058
C <sub>6</sub> H <sub>12</sub> O	2-Hexanone	591-78-6	100	18.86	0.068
C <sub>7</sub> H <sub>14</sub> O	2-Heptanone	110-43-0	114	22.96	0.196
C <sub>5</sub> H <sub>9</sub> ClO	5-Chloro-2-pentanone	5891-21-4	120	25.96	0.144
C <sub>8</sub> H <sub>16</sub> O	2-Octanone	111-13-7	128	26.77	0.092
C <sub>9</sub> H <sub>18</sub> O	2-Nonanone	821-55-6	142	30.25	0.057
C <sub>10</sub> H <sub>20</sub> O	2-Decanone	693-54-9	156	33.49	0.166
C <sub>8</sub> H <sub>4</sub> O <sub>3</sub>	1,3-Isobenzofurandione	85-44-9	148	36.17	0.428
C <sub>11</sub> H <sub>22</sub> O	2-Undecanone	53452-70-3	170	37.31	0.072
C <sub>12</sub> H <sub>24</sub> O	2-Dodecanone	6175-49-1	184	42.96	0.080
C <sub>13</sub> H <sub>26</sub> O	2-Tridecanone	593-08-8	198	52.04	0.143
C <sub>14</sub> H <sub>28</sub> O	2-Tetradecanone	2345-27-9	212	66.13	0.181
C <sub>15</sub> H <sub>30</sub> O	2-Pentadecanone	2345-28-0	226	81.92	0.325
<i>Carboxylic acids</i>					
C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Acetic acid	64-19-7	60	12.16	1.067
C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	n-Propanoic acid	79-09-4	74	17.10	0.076
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	n-Butanoic acid	107-92-6	88	20.27	0.165
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	3-Methylbutanoic acid	503-74-2	102	23.05	0.037

C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	n-Pentanoic acid	109-52-4	102	23.84	0.347
C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	n-Hexanoic acid	142-62-1	116	27.21	0.795
C <sub>7</sub> H <sub>14</sub> O <sub>2</sub>	n-Heptanoic acid	111-14-8	130	30.57	0.451
C <sub>8</sub> H <sub>16</sub> O <sub>2</sub>	n-Octanoic acid	124-07-2	144	33.49	0.905
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	2-Methyloctanoic acid	3004-93-1	158	34.99	0.100
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	3-Methyloctanoic acid	x	158	36.58	0.020
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	n-Nonanoic acid	112-05-0	158	37.11	1.828
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	3-Methylnonanoic acid	x	172	41.93	0.053
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	n-Decanoic acid	334-48-5	172	42.61	1.899
C <sub>11</sub> H <sub>22</sub> O <sub>2</sub>	n-Undecanoic acid	112-37-8	186	52.27	0.159
C <sub>12</sub> H <sub>24</sub> O <sub>2</sub>	3-Methylundecanoic acid	x	200	59.50	0.454
C <sub>12</sub> H <sub>24</sub> O <sub>2</sub>	n-Dodecanoic acid	143-07-7	200	65.54	1.654
C <sub>13</sub> H <sub>26</sub> O <sub>2</sub>	3-Methyldodecanoic acid	638-53-9	214	67.75	0.111
C <sub>13</sub> H <sub>26</sub> O <sub>2</sub>	n-Tridecanoic acid	638-53-9	214	88.66	0.079
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	n-Tetradecanoic acid	544-63-8	228	122.25	4.668
<b>Heterocyclic compounds</b>					
<i>Dioxanes</i>					
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,4-Dioxane	123-91-1	88	13.78	0.006
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,3-Dioxane	505-22-6	88	17.57	0.013
<i>Furans</i>					
C <sub>5</sub> H <sub>6</sub> O	2-Methylfuran	534-22-5	82	10.39	0.097
C <sub>5</sub> H <sub>6</sub> O	3-Methylfuran	930-27-8	82	10.67	0.021
C <sub>6</sub> H <sub>8</sub> O	2-Ethylfuran	3208-16-0	96	14.15	0.015
C <sub>6</sub> H <sub>6</sub> O	2-Vinylfuran	1487-18-9	94	14.89	0.005
C <sub>7</sub> H <sub>10</sub> O	2-Propylfuran	4229-91-8	110	18.34	0.034
C <sub>8</sub> H <sub>12</sub> O	2-Butylfuran	4466-24-4	124	22.39	0.016
C <sub>9</sub> H <sub>14</sub> O	2-Pentylfuran	3777-69-3	138	26.22	0.111
C <sub>7</sub> H <sub>8</sub> O <sub>2</sub>	2-Acetyl-5-methylfuran	1193-79-9	124	29.46	0.065
C <sub>10</sub> H <sub>16</sub> O	2-Hexylfuran	3777-70-6	152	29.76	0.031
C <sub>11</sub> H <sub>18</sub> O	2-Heptylfuran	3777-71-7	166	33.08	0.023
C <sub>12</sub> H <sub>20</sub> O	2-Octylfuran	4179-38-8	180	36.72	0.029
C <sub>13</sub> H <sub>22</sub> O	2-Nonylfuran	4179-38-8	180	42.16	0.055
<b>Nitrogenated compounds</b>					
N <sub>2</sub>	Nitrogen	7727-37-9	28	1.75	2.664
CHNO	Hydrogen isocyanate	75-13-8	43	6.71	1.810
C <sub>2</sub> H <sub>3</sub> N	Acetonitrile	75-05-8	41	6.97	0.523
C <sub>3</sub> H <sub>5</sub> N	Propargylamine	2450-71-7	55	9.55	0.007
C <sub>4</sub> H <sub>5</sub> N	Pyrrole	109-97-7	67	14.73	0.086
C <sub>5</sub> H <sub>7</sub> N	3-Methyl-1H-pyrrole	616-43-3	81	15.15	0.023
C <sub>5</sub> H <sub>5</sub> N	Pyridine	110-86-1	79	15.66	0.045
C <sub>2</sub> H <sub>5</sub> NO	Acetamide	60-35-5	59	16.27	0.108
C <sub>6</sub> H <sub>9</sub> N	2,3-Dimethyl-1H-pyrrole	600-28-2	95	18.53	0.021
C <sub>6</sub> H <sub>7</sub> N	2-Methylpyridine	109-06-8	93	18.89	0.023

C <sub>6</sub> H <sub>7</sub> N	3-Methylpyridine	108-99-6	93	20.79	0.014
C <sub>6</sub> H <sub>7</sub> N	4-Methylpyridine	108-89-4	93	20.97	0.016
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	4-Methylpyrimidine	3438-46-8	94	21.70	0.008
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	5-Methylpyrimidine	2036-41-1	94	22.33	0.014
C <sub>3</sub> H <sub>4</sub> N <sub>2</sub>	1H-Pyrazole	288-13-1	68	23.09	0.116
C <sub>7</sub> H <sub>5</sub> N	Benzonitrile	100-47-0	103	25.00	0.047
C <sub>5</sub> H <sub>11</sub> NO	Pentanamide	626-97-1	101	26.45	0.032
C <sub>4</sub> H <sub>5</sub> NO <sub>2</sub>	Succinimide	123-56-8	99	29.04	0.047
C <sub>6</sub> H <sub>13</sub> NO	Hexanamide	628-02-4	115	31.17	0.027
C <sub>7</sub> H <sub>15</sub> NO	Enanthamide	628-62-6	129	34.52	0.017
C <sub>10</sub> H <sub>19</sub> N	Decanenitrile	1975-78-6	153	36.34	0.256
C <sub>8</sub> H <sub>17</sub> NO	Octanamide	629-01-6	143	38.90	0.027
C <sub>9</sub> H <sub>7</sub> NO <sub>2</sub>	2-Methyl-1H-Isoindole-1,3(2H)-dione	550-44-7	161	40.70	0.064
C <sub>9</sub> H <sub>19</sub> NO	Nonanamide	1120-07-6	157	45.47	0.038
C <sub>10</sub> H <sub>16</sub> N <sub>2</sub>	N,N-Diethyl-1,4-benzenediamine	93-05-0	164	46.66	0.580
C <sub>10</sub> H <sub>21</sub> NO	Decanamide	2319-29-1	171	55.86	0.047
C <sub>9</sub> H <sub>11</sub> NO	Phenylpropanamide	102-93-2	149	58.62	0.063
C <sub>11</sub> H <sub>23</sub> NO	Undecanamide	x	185	72.49	0.026
<b>Sulfonated compounds</b>					
COS	Carbonyl sulfide	463-58-1	60	3.51	0.080
O <sub>2</sub> S	Sulfur dioxide	7446-09-5	64	4.85	0.722
CH <sub>4</sub> S	Methanethiol	74-93-1	48	5.55	0.038
CS <sub>2</sub>	Carbon disulfide	75-15-0	76	7.85	0.109
C <sub>2</sub> H <sub>6</sub> S	Ethanethiol	75-08-1	62	7.88	0.024
C <sub>4</sub> H <sub>4</sub> S	Thiophene	110-02-1	84	12.41	0.011
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	Dimethyl disulfide	624-92-0	94	15.46	0.024
C <sub>5</sub> H <sub>6</sub> S	2-Methylthiophene	554-14-3	98	16.63	0.015
C <sub>5</sub> H <sub>6</sub> S	3-Methylthiophene	616-44-4	98	16.96	0.023
C <sub>6</sub> H <sub>8</sub> S	2-Ethylthiophene	872-55-9	112	21.42	0.015
C <sub>6</sub> H <sub>8</sub> S	3-Ethylthiophene	1795-01-3	112	21.95	0.043
C <sub>7</sub> H <sub>10</sub> S	2-Propylthiophene	1551-27-5	126	23.79	0.041
C <sub>7</sub> H <sub>10</sub> S	3-Propylthiophene	x	126	23.91	0.029
C <sub>5</sub> H <sub>4</sub> OS	2-Thiophenecarboxaldehyde	98-03-3	112	24.57	0.008
C <sub>5</sub> H <sub>4</sub> OS	3-Thiophenecarboxaldehyde	498-62-4	112	25.02	0.012
C <sub>8</sub> H <sub>12</sub> S	2-Butylthiophene	1455-20-5	140	28.47	0.025
C <sub>8</sub> H <sub>12</sub> S	3-Butylthiophene	34722-01-5	140	28.91	0.047
C <sub>9</sub> H <sub>14</sub> S	2-Pentylthiophene	4861-58-9	154	31.44	0.009
C <sub>9</sub> H <sub>14</sub> S	3-Pentylthiophene	x	154	31.93	0.015
<b>Phosphorus containing compounds</b>					
C <sub>6</sub> H <sub>14</sub> FO <sub>2</sub> P	n-Pentyl	13454-59-6	168	29.98	0.095

	methylphosphonofluoride				
<b>Inorganic compounds</b>					
<i>Oxides</i>					
CO <sub>2</sub>	Carbon dioxide	124-38-9	44	2.11	15.629
H <sub>2</sub> O	Water	7732-18-5	18	4.27	17.354
<i>Noble gases</i>					
Ar	Argon	7440-37-1	40	1.76	0.042
Xe	Xenon	7440-63-3	132	22.20	0.099
<i>Permanent gases</i>					
O <sub>2</sub>	Oxygen	7782-44-7	32	1.60	0.113

Note: <sup>1</sup>CAS/(NIST) – unique numerical identifier of chemical compounds included in the register Chemical Abstracts Service (<https://www.cas.org>) or NIST number (a unique number given to each spectrum in the NIST archive); <sup>2</sup>MW – nominal mass; <sup>3</sup>RT – retention time; <sup>4</sup>A – normalized area (the area ratio of the individual gas mixture components to the sum of the areas of all the components in the chromatogram).

Table S5. Results of GC–MS analysis of volatiles extracted by mechanical shock crushing from quartz MD-22 from rhyolites (Menshyi Brat volcano, Iturup island, species diversity 242 components).

Formula	Name	<sup>1</sup> CAS/(NIST)	<sup>2</sup> MW	Quartz MD-22	
				<sup>3</sup> RT, min	<sup>4</sup> A, %
<b>Aliphatic hydrocarbons</b>					
<i>Paraffins</i>					
CH <sub>4</sub>	Methane	74-82-8	16	1.83	0.007
C <sub>2</sub> H <sub>6</sub>	Ethane	74-84-0	30	3.05	0.012
C <sub>3</sub> H <sub>8</sub>	n-Propane	74-98-6	44	4.23	0.026
C <sub>4</sub> H <sub>10</sub>	n-Butane	106-97-8	58	6.17	0.121
C <sub>5</sub> H <sub>12</sub>	n-Pentane	109-66-0	72	8.69	0.148
C <sub>6</sub> H <sub>14</sub>	n-Hexane	110-54-3	86	12.14	0.041
C <sub>7</sub> H <sub>16</sub>	n-Heptane	142-82-5	100	16.21	0.279
C <sub>8</sub> H <sub>16</sub>	4-Methyleneheptane	15918-08-8	112	19.30	0.259
C <sub>8</sub> H <sub>16</sub>	3-Methyleneheptane	1632-16-2	112	19.68	0.900
C <sub>8</sub> H <sub>18</sub>	n-Octane	111-65-9	114	20.30	0.348
C <sub>9</sub> H <sub>20</sub>	n-Nonane	111-84-2	128	24.19	0.177
C <sub>10</sub> H <sub>22</sub>	n-Decane	124-18-5	142	27.80	0.299
C <sub>11</sub> H <sub>24</sub>	n-Undecane	1120-21-4	156	31.12	0.098
C <sub>12</sub> H <sub>26</sub>	n-Dodecane	112-40-3	170	34.25	0.058
C <sub>13</sub> H <sub>28</sub>	n-Tridecane	629-50-5	184	38.36	0.070
C <sub>16</sub> H <sub>34</sub>	5,6-Dipropyldecane	119209-20-0	226	43.75	1.563
C <sub>14</sub> H <sub>30</sub>	n-Tetradecane	629-59-4	198	44.55	0.086
C <sub>15</sub> H <sub>32</sub>	n-Pentadecane	629-62-9	212	54.47	0.275
C <sub>17</sub> H <sub>36</sub>	5,5-Diethyltridecane	(360413)	240	69.46	2.549
C <sub>17</sub> H <sub>36</sub>	n-Heptadecane	629-78-7	240	95.50	0.178
<i>Halogenated paraffins</i>					
C <sub>4</sub> H <sub>9</sub> Cl	1-Chlorobutane	109-69-3	92	12.71	0.057
<i>Olefins</i>					
C <sub>2</sub> H <sub>2</sub>	Acetylene	74-86-2	26	2.30	0.106
C <sub>2</sub> H <sub>4</sub>	Ethylene	74-85-1	28	2.86	0.018
C <sub>3</sub> H <sub>6</sub>	1-Propene	115-07-1	42	4.09	0.081
C <sub>4</sub> H <sub>8</sub>	1-Butene	106-98-9	56	5.98	0.100
C <sub>4</sub> H <sub>6</sub>	1,3-Butadiene	106-99-0	54	6.06	0.013
C <sub>4</sub> H <sub>8</sub>	(E)-2-Butene	624-64-6	56	6.19	0.040
C <sub>4</sub> H <sub>8</sub>	2-Butene	107-01-7	56	6.30	0.025
C <sub>5</sub> H <sub>8</sub>	1,4-Pentadiene	591-93-5	68	8.03	0.005
C <sub>5</sub> H <sub>10</sub>	1-Pentene	109-67-1	70	8.37	0.381
C <sub>5</sub> H <sub>8</sub>	1-Pentyne	627-19-0	68	8.38	0.035
C <sub>5</sub> H <sub>8</sub>	Isoprene	78-79-5	68	8.61	0.028
C <sub>5</sub> H <sub>8</sub>	3-Methyl-1,2-butadiene	598-25-4	68	8.84	0.013
C <sub>5</sub> H <sub>8</sub>	(E)-1,3-Pentadiene	2004-70-8	68	9.12	0.007
C <sub>5</sub> H <sub>8</sub>	1,3-Pentadiene	1574-41-0	68	9.20	0.005

C <sub>6</sub> H <sub>12</sub>	1-Hexene	592-41-6	84	11.79	0.013
C <sub>6</sub> H <sub>10</sub>	(E)-2-Methyl-1,3-pentadiene	926-54-5	82	12.89	0.056
C <sub>7</sub> H <sub>14</sub>	1-Heptene	592-76-7	98	15.84	0.372
C <sub>8</sub> H <sub>16</sub>	2-Methyl-1-heptene	15870-10-7	112	19.53	0.457
C <sub>8</sub> H <sub>16</sub>	1-Octene	111-66-0	112	19.83	0.468
C <sub>8</sub> H <sub>16</sub>	(Z)-3-Octene	14850-22-7	112	19.98	0.404
C <sub>8</sub> H <sub>16</sub>	3-Methyl-3-heptene	7300-03-0	112	20.06	0.462
C <sub>8</sub> H <sub>16</sub>	(E)-2-Octene	13389-42-9	112	20.21	0.279
C <sub>9</sub> H <sub>18</sub>	1-Nonene	124-11-8	126	23.91	0.428
C <sub>10</sub> H <sub>20</sub>	1-Decene	872-05-9	140	27.53	0.488
C <sub>11</sub> H <sub>22</sub>	1-Undecene	821-95-4	154	30.91	0.031
C <sub>12</sub> H <sub>24</sub>	1-Dodecene	112-41-4	168	34.04	0.039
C <sub>13</sub> H <sub>26</sub>	1-Tridecene	2437-56-1	182	38.06	0.055
C <sub>14</sub> H <sub>28</sub>	1-Tetradecene	1120-36-1	196	44.11	0.144
C <sub>15</sub> H <sub>30</sub>	1-Pentadecene	13360-61-7	210	53.75	0.424
<b>Cyclic hydrocarbons</b>					
<i>Cycloalkanes (naphthenes) and cycloalkenes</i>					
C <sub>5</sub> H <sub>10</sub>	Cyclopentane	287-92-3	70	8.59	0.017
C <sub>10</sub> H <sub>16</sub>	dl-Limonene	138-86-3	136	28.03	0.015
<i>Arenes</i>					
C <sub>6</sub> H <sub>6</sub>	Benzene	71-43-2	78	12.65	0.175
C <sub>7</sub> H <sub>8</sub>	Toluene	108-88-3	92	17.11	0.251
C <sub>7</sub> H <sub>7</sub> F	(Fluoromethyl)benzene	350-50-5	110	20.83	0.027
C <sub>8</sub> H <sub>10</sub>	Ethylbenzene	100-41-4	106	21.17	0.038
C <sub>8</sub> H <sub>10</sub>	p-Xylene	106-42-3	106	21.43	0.126
C <sub>8</sub> H <sub>10</sub>	o-Xylene	95-47-6	106	21.55	0.018
C <sub>8</sub> H <sub>10</sub>	m-Xylene	108-38-3	106	21.81	0.048
C <sub>8</sub> H <sub>8</sub>	Styrene	100-42-5	104	22.08	0.044
C <sub>8</sub> H <sub>9</sub> F	p-Fluoroethylbenzene	459-47-2	124	21.69	0.013
C <sub>8</sub> H <sub>9</sub> F	3-Fluoro-o-xylene	443-82-3	124	22.18	0.016
C <sub>8</sub> H <sub>9</sub> F	5-Fluoro-m-xylene	461-97-2	124	22.52	0.005
C <sub>9</sub> H <sub>12</sub>	Propylbenzene	103-65-1	120	25.00	0.024
C <sub>10</sub> H <sub>14</sub>	Butylbenzene	104-51-8	134	28.77	0.040
C <sub>11</sub> H <sub>16</sub>	Pentylbenzene	538-68-1	148	32.17	0.070
C <sub>12</sub> H <sub>18</sub>	Hexylbenzene	1077-16-3	162	35.68	0.051
C <sub>13</sub> H <sub>20</sub>	Heptylbenzene	1078-71-3	176	40.64	0.069
C <sub>15</sub> H <sub>24</sub>	Nonylbenzene	1081-77-2	204	60.65	0.114
<i>Polycyclic aromatic hydrocarbons (PAH)</i>					
C <sub>10</sub> H <sub>8</sub>	Naphthalene	91-20-3	128	32.24	0.018
C <sub>11</sub> H <sub>10</sub>	1-Methylnaphthalene	90-12-0	142	36.14	0.009
C <sub>11</sub> H <sub>10</sub>	2-Methylnaphthalene	91-57-6	142	36.66	0.011
C <sub>12</sub> H <sub>12</sub>	2,6-Dimethylnaphthalene	581-42-0	156	41.43	0.004
C <sub>12</sub> H <sub>12</sub>	2,7-Dimethylnaphthalene	582-16-1	156	42.27	0.010

C <sub>12</sub> H <sub>12</sub>	1,7-Dimethylnaphthalene	575-37-1	156	43.16	0.008
C <sub>12</sub> H <sub>12</sub>	1,3-Dimethylnaphthalene	575-41-7	156	43.85	0.010
C <sub>12</sub> H <sub>12</sub>	1,6-Dimethylnaphthalene	575-43-9	156	45.12	0.003
C <sub>12</sub> H <sub>12</sub>	1,4-Dimethylnaphthalene	571-58-4	156	47.19	0.021
C <sub>13</sub> H <sub>14</sub>	2-(1-Methylethyl)-naphthalene	2027-17-0	170	43.82	0.042
C <sub>13</sub> H <sub>14</sub>	1-(1-Methylethyl)-naphthalene	6158-45-8	170	55.02	0.049
C <sub>14</sub> H <sub>10</sub>	Phenanthrene	85-01-8	178	88.73	0.036
<b>Oxygenated hydrocarbons</b>					
<i>Alcohols</i>					
CH <sub>4</sub> O	Methanol	67-56-1	32	4.77	0.049
C <sub>2</sub> H <sub>6</sub> O	Ethanol	64-17-5	46	5.93	0.192
C <sub>3</sub> H <sub>8</sub> O	Isopropyl Alcohol	67-63-0	60	7.54	0.014
C <sub>3</sub> H <sub>8</sub> O	1-Propanol	71-23-8	60	8.46	0.018
C <sub>4</sub> H <sub>10</sub> O	1-Butanol	71-36-3	74	12.88	0.016
C <sub>6</sub> H <sub>6</sub> O	Phenol	108-95-2	94	25.02	0.155
C <sub>7</sub> H <sub>8</sub> O	2-Methylphenol	95-48-7	108	27.75	0.031
C <sub>7</sub> H <sub>8</sub> O	4-Methylphenol	106-44-5	108	28.62	0.038
C <sub>7</sub> H <sub>8</sub> O	3-Methylphenol	108-39-4	108	29.52	0.005
C <sub>8</sub> H <sub>10</sub> O	2-Ethylphenol	90-00-6	122	31.38	0.004
C <sub>8</sub> H <sub>10</sub> O	4-Ethylphenol	123-07-9	122	32.09	0.006
C <sub>8</sub> H <sub>10</sub> O	3-Ethylphenol	620-17-7	122	32.55	0.002
C <sub>10</sub> H <sub>13</sub> ClO	3-Chloromethyl-2,4,6-trimethylphenol	99187-90-3	184	71.04	0.463
<i>Ethers and esters</i>					
C <sub>5</sub> H <sub>8</sub> O	3,4-Dihydropyran	110-87-2	84	13.51	0.015
C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	Methyl methacrylate	80-62-6	100	14.56	0.686
C <sub>4</sub> H <sub>4</sub> O <sub>2</sub>	α-Crotonolactone	20825-71-2	84	20.99	0.009
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	Butyrolactone	96-48-0	86	20.99	0.099
C <sub>6</sub> H <sub>10</sub> O <sub>2</sub>	γ-Hexalactone	695-06-7	114	27.56	0.025
C <sub>7</sub> H <sub>12</sub> O <sub>2</sub>	γ-Heptalactone	105-21-5	128	31.16	0.029
C <sub>8</sub> H <sub>14</sub> O <sub>2</sub>	γ-Octalactone	104-50-7	142	34.62	0.050
C <sub>9</sub> H <sub>16</sub> O <sub>2</sub>	γ-Nonalactone	104-61-0	156	39.19	0.100
C <sub>10</sub> H <sub>12</sub> O <sub>2</sub>	2-Methyl-4-phenyl-1,3-dioxolane	(284904)	164	39.60	0.298
C <sub>10</sub> H <sub>18</sub> O <sub>2</sub>	γ-Decalactone	706-14-9	170	46.12	0.085
C <sub>11</sub> H <sub>20</sub> O <sub>2</sub>	γ-Undecalactone	104-67-6	184	57.03	0.049
C <sub>12</sub> H <sub>22</sub> O <sub>2</sub>	γ-Dodecalactone	2305-05-7	198	74.36	0.173
C <sub>13</sub> H <sub>9</sub> FO <sub>2</sub>	Phenyl ester 2-fluorobenzoic acid	(299044)	216	88.68	0.199
C <sub>14</sub> H <sub>11</sub> FO <sub>2</sub>	2-Methylphenyl ester 4-fluorobenzoic acid	(299053)	230	91.12	0.191
C <sub>16</sub> H <sub>19</sub> FO <sub>2</sub>	2-Methyloct-5-yn-4-yl	(292605)	262	96.70	0.300

	ester 3-fluorobenzoic acid				
C <sub>16</sub> H <sub>19</sub> FO <sub>2</sub>	2-Methyloct-5-yn-4-yl ester 2-fluorobenzoic acid	(299166)	262	98.18	0.201
C <sub>13</sub> H <sub>8</sub> ClFO <sub>2</sub>	2-Chlorophenyl ester 4-fluorobenzoic acid	(299050)	250	104.30	1.090
C <sub>13</sub> H <sub>8</sub> ClFO <sub>2</sub>	2-Chlorophenyl ester 3-fluorobenzoic acid	(299057)	250	111.50	0.915
C <sub>14</sub> H <sub>11</sub> FO <sub>2</sub>	3-Methylphenyl ester 2-fluorobenzoic acid	(307685)	230	121.22	0.402
C <sub>16</sub> H <sub>22</sub> O <sub>4</sub>	Diisobutyl phthalate	84-69-5	278	131.18	3.536
<i>Aldehydes</i>					
C <sub>2</sub> H <sub>4</sub> O	Acetaldehyde	75-07-0	44	5.31	0.177
C <sub>3</sub> H <sub>4</sub> O	2-Propenal	107-02-8	56	7.38	0.025
C <sub>3</sub> H <sub>6</sub> O	n-Propanal	123-38-6	58	7.54	1.644
C <sub>4</sub> H <sub>6</sub> O	2-Methyl-2-propenal	78-85-3	70	9.79	0.038
C <sub>4</sub> H <sub>8</sub> O	2-Methylpropanal	78-84-2	72	9.84	0.026
C <sub>4</sub> H <sub>8</sub> O	n-Butanal	123-72-8	72	10.62	0.236
C <sub>4</sub> H <sub>6</sub> O	(E)-2-Butenal	123-73-9	70	10.96	0.012
C <sub>5</sub> H <sub>10</sub> O	3-Methylbutanal	590-86-3	86	13.75	0.360
C <sub>5</sub> H <sub>10</sub> O	n-Pentanal	110-62-3	86	14.81	0.489
C <sub>5</sub> H <sub>8</sub> O	(E)-2-Methyl-2-butenal	497-03-0	84	16.96	0.043
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	2-Furaldehyde	98-01-1	96	17.53	0.031
C <sub>5</sub> H <sub>4</sub> O <sub>2</sub>	3-Furaldehyde	498-60-2	96	18.40	0.366
C <sub>6</sub> H <sub>12</sub> O	n-Hexanal	66-25-1	100	19.10	2.020
C <sub>7</sub> H <sub>14</sub> O	n-Heptanal	111-71-7	114	23.25	0.767
C <sub>6</sub> H <sub>6</sub> O <sub>2</sub>	5-Methyl-2-furancarboxaldehyde	620-02-0	110	23.46	0.048
C <sub>7</sub> H <sub>6</sub> O	Benzaldehyde	100-52-7	106	24.19	0.930
C <sub>8</sub> H <sub>16</sub> O	2-Ethylhexanal	123-05-7	128	25.76	0.289
C <sub>8</sub> H <sub>16</sub> O	n-Octanal	124-13-0	128	27.08	0.502
C <sub>9</sub> H <sub>18</sub> O	n-Nonanal	124-19-6	142	30.58	0.182
C <sub>10</sub> H <sub>20</sub> O	n-Decanal	112-31-2	156	33.82	0.232
C <sub>11</sub> H <sub>22</sub> O	n-Undecanal	112-44-7	170	37.84	0.054
C <sub>13</sub> H <sub>26</sub> O	n-Tridecanal	10486-19-8	198	53.47	0.121
C <sub>14</sub> H <sub>28</sub> O	n-Tetradecanal	124-25-4	212	66.12	0.296
C <sub>16</sub> H <sub>32</sub> O	n-Hexadecanal	629-80-1	240	111.12	1.517
<i>Ketones</i>					
C <sub>3</sub> H <sub>6</sub> O	2-Propanone	67-64-1	58	7.70	1.181
C <sub>4</sub> H <sub>6</sub> O	2-Butenone	78-94-4	70	10.37	0.013
C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	2,3-Butanedione	431-03-8	86	10.69	0.020
C <sub>4</sub> H <sub>8</sub> O	2-Butanone	78-93-3	72	10.79	0.601
C <sub>5</sub> H <sub>10</sub> O	2-Pentanone	107-87-9	86	14.54	0.082
C <sub>5</sub> H <sub>8</sub> O	Cyclopentanone	120-92-3	84	17.25	0.024
C <sub>6</sub> H <sub>12</sub> O	2-Hexanone	591-78-6	100	18.86	0.312



C <sub>7</sub> H <sub>14</sub> O	2-Heptanone	110-43-0	114	22.97	0.454
C <sub>5</sub> H <sub>9</sub> ClO	5-Chloro-2-pentanone	5891-21-4	120	25.95	0.260
C <sub>5</sub> H <sub>6</sub> O <sub>3</sub>	Dihydro-3-methyl-2,5-furandione	4100-80-5	114	26.72	0.077
C <sub>8</sub> H <sub>16</sub> O	2-Octanone	111-13-7	128	26.73	0.645
C <sub>9</sub> H <sub>18</sub> O	2-Nonanone	821-55-6	142	30.26	0.113
C <sub>10</sub> H <sub>20</sub> O	2-Decanone	693-54-9	156	33.47	0.129
C <sub>8</sub> H <sub>4</sub> O <sub>3</sub>	1,3-Isobenzofurandione	85-44-9	148	36.02	0.136
C <sub>11</sub> H <sub>22</sub> O	2-Undecanone	53452-70-3	170	37.30	0.123
C <sub>12</sub> H <sub>24</sub> O	2-Dodecanone	6175-49-1	184	42.97	0.020
C <sub>13</sub> H <sub>26</sub> O	2-Tridecanone	593-08-8	198	51.90	0.144
C <sub>14</sub> H <sub>28</sub> O	2-Tetradecanone	2345-27-9	212	62.87	0.650
C <sub>15</sub> H <sub>30</sub> O	2-Pentadecanone	2345-28-0	226	88.99	0.813
<i>Carboxylic acids</i>					
C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Acetic acid	64-19-7	60	11.52	4.022
C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	n-Propanoic acid	79-09-4	74	15.94	0.093
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	n-Butanoic acid	107-92-6	88	19.67	0.396
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	3-Methylbutanoic acid	503-74-2	102	22.49	0.110
C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	n-Pentanoic acid	109-52-4	102	23.56	1.062
C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	3-Methylpentanoic acid	105-43-1	116	26.38	0.010
C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	n-Hexanoic acid	142-62-1	116	26.90	0.864
C <sub>7</sub> H <sub>14</sub> O <sub>2</sub>	n-Heptanoic acid	111-14-8	130	30.35	0.327
C <sub>8</sub> H <sub>16</sub> O <sub>2</sub>	n-Octanoic acid	124-07-2	144	33.38	0.599
C <sub>9</sub> H <sub>18</sub> O <sub>2</sub>	n-Nonanoic acid	112-05-0	158	37.11	0.582
C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	n-Decanoic acid	334-48-5	172	42.74	0.371
C <sub>11</sub> H <sub>22</sub> O <sub>2</sub>	n-Undecanoic acid	112-37-8	186	52.05	0.042
C <sub>12</sub> H <sub>24</sub> O <sub>2</sub>	n-Dodecanoic acid	143-07-7	200	66.03	0.375
C <sub>13</sub> H <sub>26</sub> O <sub>2</sub>	n-Tridecanoic acid	638-53-9	214	89.07	0.033
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	3-Methyltridecanoic acid	x	228	97.96	0.076
C <sub>14</sub> H <sub>28</sub> O <sub>2</sub>	n-Tetradecanoic acid	544-63-8	228	124.25	0.484
<b>Heterocyclic compounds</b>					
<i>Dioxanes</i>					
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,4-Dioxane	123-91-1	88	13.72	0.007
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	1,3-Dioxane	505-22-6	88	17.52	0.011
<i>Furans</i>					
C <sub>5</sub> H <sub>6</sub> O	2-Methylfuran	534-22-5	82	10.38	0.053
C <sub>5</sub> H <sub>6</sub> O	3-Methylfuran	930-27-8	82	10.65	0.011
C <sub>6</sub> H <sub>8</sub> O	2-Ethylfuran	3208-16-0	96	14.15	0.007
C <sub>6</sub> H <sub>6</sub> O	2-Vinylfuran	1487-18-9	94	14.94	0.003
C <sub>7</sub> H <sub>10</sub> O	2-Propylfuran	4229-91-8	110	18.29	0.006
C <sub>8</sub> H <sub>12</sub> O	2-Butylfuran	4466-24-4	124	22.39	0.018
C <sub>9</sub> H <sub>14</sub> O	2-Pentylfuran	3777-69-3	138	26.21	0.464
C <sub>7</sub> H <sub>8</sub> O <sub>2</sub>	2-Acetyl-5-methylfuran	1193-79-9	124	29.43	0.022
C <sub>10</sub> H <sub>16</sub> O	2-Hexylfuran	3777-70-6	152	29.77	0.015

C <sub>11</sub> H <sub>18</sub> O	2-Heptylfuran	3777-71-7	166	33.06	0.006
C <sub>12</sub> H <sub>20</sub> O	2-Octylfuran	4179-38-8	180	36.71	0.011
C <sub>13</sub> H <sub>22</sub> O	2-Nonylfuran	4179-38-8	180	42.17	0.013
<b>Nitrogenated compounds</b>					
N <sub>2</sub>	Nitrogen	7727-37-9	28	1.75	1.925
C <sub>2</sub> H <sub>3</sub> N	Acetonitrile	75-05-8	41	6.95	0.113
C <sub>3</sub> H <sub>5</sub> N	Propargylamine	2450-71-7	55	9.53	0.014
C <sub>4</sub> H <sub>5</sub> N	Pyrrole	109-97-7	67	14.68	0.093
C <sub>5</sub> H <sub>7</sub> N	3-Methyl-1H-pyrrole	616-43-3	81	15.11	0.015
C <sub>5</sub> H <sub>5</sub> N	Pyridine	110-86-1	79	15.58	0.032
C <sub>2</sub> H <sub>5</sub> NO	Acetamide	60-35-5	59	16.06	0.083
C <sub>6</sub> H <sub>9</sub> N	2,3-Dimethyl-1H-pyrrole	600-28-2	95	18.49	0.017
C <sub>6</sub> H <sub>7</sub> N	2-Methylpyridine	109-06-8	93	18.85	0.016
C <sub>6</sub> H <sub>7</sub> N	3-Methylpyridine	108-99-6	93	20.68	0.013
C <sub>6</sub> H <sub>7</sub> N	4-Methylpyridine	108-89-4	93	20.89	0.016
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	4-Methylpyrimidine	3438-46-8	94	21.66	0.013
C <sub>5</sub> H <sub>6</sub> N <sub>2</sub>	5-Methylpyrimidine	2036-41-1	94	22.33	0.008
C <sub>3</sub> H <sub>4</sub> N <sub>2</sub>	1H-Pyrazole	288-13-1	68	23.02	0.305
C <sub>7</sub> H <sub>5</sub> N	Benzonitrile	100-47-0	103	24.95	0.062
C <sub>5</sub> H <sub>11</sub> NO	3-Methylbutanamide	541-46-8	101	26.38	0.313
C <sub>5</sub> H <sub>11</sub> NO	Pentanamide	626-97-1	101	27.57	0.015
C <sub>4</sub> H <sub>5</sub> NO <sub>2</sub>	Succinimide	123-56-8	99	28.94	0.269
C <sub>6</sub> H <sub>13</sub> NO	Hexanamide	628-02-4	115	31.13	0.017
C <sub>7</sub> H <sub>15</sub> NO	Enanthamide	628-62-6	129	34.47	0.014
C <sub>8</sub> H <sub>17</sub> NO	Octanamide	629-01-6	143	38.82	0.036
C <sub>9</sub> H <sub>7</sub> NO <sub>2</sub>	2-Methyl-1H-Isoindole-1,3(2H)-dione	550-44-7	161	40.58	0.041
C <sub>9</sub> H <sub>19</sub> NO	Nonanamide	1120-07-6	157	45.39	0.021
C <sub>8</sub> H <sub>5</sub> NO <sub>2</sub>	Phthalimide	85-41-6	147	43.75	0.333
C <sub>10</sub> H <sub>21</sub> NO	Decanamide	2319-29-1	171	55.77	0.025
C <sub>9</sub> H <sub>11</sub> NO	Phenylpropanamide	102-93-2	149	58.43	0.036
C <sub>10</sub> H <sub>23</sub> NO <sub>2</sub> S	N-(2-Pentyl)-N-butyl-methanesulphonamide	(464447)	221	61.90	0.099
<b>Sulfonated compounds</b>					
H <sub>2</sub> S	Hydrogen sulfide	7783-06-4	34	2.91	0.002
COS	Carbonyl sulfide	463-58-1	60	3.56	0.038
O <sub>2</sub> S	Sulfur dioxide	7446-09-5	64	4.83	2.733
CH <sub>4</sub> S	Methanethiol	74-93-1	48	5.54	0.013
CS <sub>2</sub>	Carbon disulfide	75-15-0	76	7.88	0.147
C <sub>4</sub> H <sub>4</sub> S	Thiophene	110-02-1	84	12.38	0.007
C <sub>2</sub> H <sub>6</sub> S <sub>2</sub>	Dimethyl disulfide	624-92-0	94	15.44	0.022
C <sub>5</sub> H <sub>6</sub> S	2-Methylthiophene	554-14-3	98	16.59	0.011
C <sub>5</sub> H <sub>6</sub> S	3-Methylthiophene	616-44-4	98	16.94	0.010
C <sub>6</sub> H <sub>8</sub> S	2-Ethylthiophene	872-55-9	112	21.40	0.014

C <sub>6</sub> H <sub>8</sub> S	3-Ethylthiophene	1795-01-3	112	21.79	0.017
C <sub>5</sub> H <sub>10</sub> S	Tetrahydro-2-methylthiophene	1795-09-1	102	22.57	0.051
C <sub>7</sub> H <sub>10</sub> S	2-Propylthiophene	1551-27-5	126	23.73	0.018
C <sub>7</sub> H <sub>10</sub> S	3-Propylthiophene	x	126	23.91	0.014
C <sub>5</sub> H <sub>4</sub> OS	2-Thiophenecarboxaldehyde	98-03-3	112	24.99	0.008
C <sub>5</sub> H <sub>4</sub> OS	3-Thiophenecarboxaldehyde	498-62-4	112	26.22	0.005
C <sub>8</sub> H <sub>12</sub> S	2-Butylthiophene	1455-20-5	140	28.47	0.008
C <sub>8</sub> H <sub>12</sub> S	3-Butylthiophene	34722-01-5	140	28.67	0.006
C <sub>9</sub> H <sub>14</sub> S	2-Pentylthiophene	4861-58-9	154	31.46	0.006
C <sub>9</sub> H <sub>14</sub> S	3-Pentylthiophene	x	154	31.93	0.012
C <sub>10</sub> H <sub>16</sub> S	2-Hexylthiophene	18794-77-9	168	35.41	0.009
<b>Phosphorus containing compounds</b>					
C <sub>3</sub> H <sub>9</sub> O <sub>3</sub> P	Dimethyl methylphosphonate	756-79-6	124	22.23	0.008
C <sub>6</sub> H <sub>14</sub> FO <sub>2</sub> P	n-Pentyl methylphosphonofluoride	13454-59-6	168	29.99	0.422
<b>Inorganic compounds</b>					
<i>Oxides</i>					
CO <sub>2</sub>	Carbon dioxide	124-38-9	44	1.98	29.105
H <sub>2</sub> O	Water	7732-18-5	18	4.27	13.551
<i>Noble gases</i>					
Ar	Argon	7440-37-1	40	1.81	0.030
Xe	Xenon	7440-63-3	132	22.25	0.065
<i>Permanent gases</i>					
O <sub>2</sub>	Oxygen	7782-44-7	32	1.57	0.076

Note: <sup>1</sup>CAS/(NIST) – unique numerical identifier of chemical compounds included in the register Chemical Abstracts Service (<https://www.cas.org>) or NIST number (a unique number given to each spectrum in the NIST archive); <sup>2</sup>MW – nominal mass; <sup>3</sup>RT – retention time; <sup>4</sup>A – normalized area (the area ratio of the individual gas mixture components to the sum of the areas of all the components in the chromatogram).