

## **Supporting information**

### **Total Synthesis and Elucidation of the Absolute Configuration of Clavilactone B**

Igor Larrosa, Marianne I. Da Silva, Patricio M. Gómez, Peter Hannen, Eunjung Ko, Steven R. Lenger, Simon R. Linke, Andrew J. P. White, Donna Wilton, Anthony G. M. Barrett\*

*Department of Chemistry, Imperial College London, Exhibition Road, London SW7 2AZ, England.*

*AstraZeneca, Process Research and Development, Avlon Works, Severn Road, Hallen, Bristol BS10 7ZE, England*

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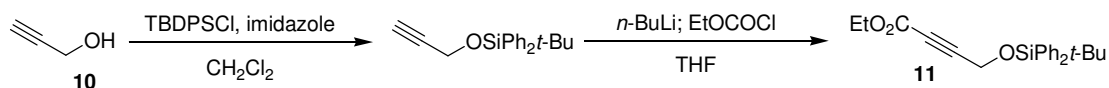
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## 1. GENERAL METHODS.

All reactions were carried out in oven-dried glassware under N<sub>2</sub> using solvents and reagents as commercially supplied, unless otherwise stated. Et<sub>2</sub>O, THF, PhMe, CH<sub>2</sub>Cl<sub>2</sub>, Et<sub>3</sub>N and MeOH were redistilled from Na-Ph<sub>2</sub>CO, Na-Ph<sub>2</sub>CO, Na, CaH<sub>2</sub>, CaH<sub>2</sub> and Mg turnings-I<sub>2</sub>, respectively. Column chromatography was carried out on silica gel, particle size 40-63 μm, using flash techniques (eluants are given in parenthesis). Analytical thin layer chromatography was performed on pre-coated silica gel F<sub>254</sub> glass plates with visualization under UV light or by staining using either acidic vanillin or anisaldehyde spray reagents. Melting points were obtained using a hot-stage apparatus and are uncorrected. IR spectra were recorded as thin films and quoted in cm<sup>-1</sup>. <sup>1</sup>H NMR spectra, recorded at 300, 400 or 500 MHz and referenced to the residual solvent peaks at 7.26 ppm (CDCl<sub>3</sub>) or 2.05 ((CD<sub>3</sub>)<sub>2</sub>CO) are quoted in ppm to 2 decimal places with coupling constants (*J*) to the nearest 0.5 Hz. <sup>13</sup>C NMR spectra, recorded at 75 MHz, 100 MHz or 125 MHz and referenced to solvent at 77.0 ppm (CDCl<sub>3</sub>) or 29.8 ppm ((CD<sub>3</sub>)<sub>2</sub>CO), are quoted in ppm to 1 decimal place.

## 1. PREPARATION OF (+)-EPOXY-ALDEHYDE 9.

### 1.1. Ethyl 4-(*tert*-Butyldiphenylsilyloxy)-but-2-ynoate (11).

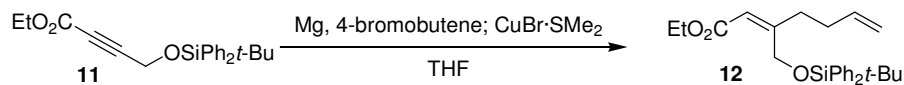


Propargyl alcohol (**10**) (10.0 g, 178 mmol), *t*-BuPh<sub>2</sub>SiCl (53.9 g, 196 mmol) and imidazole (13.4 g, 196 mmol) in dry CH<sub>2</sub>Cl<sub>2</sub> (100 mL) were stirred at room temperature 14 h. After this time, the reaction mixture was diluted with Et<sub>2</sub>O (100 mL) and washed with saturated aqueous NaCl (2 × 50 mL). The organic layer was dried (MgSO<sub>4</sub>), filtered and rotary evaporated. The resulting white solid was recrystallized from hexane and Et<sub>2</sub>O to afford 3-*tert*-butyldimethylsilyloxy-1-propyne (50.7 g, 96%) as a white solid: m.p. 58–60 °C (MeOH, lit.<sup>1</sup> 62 °C); R<sub>f</sub> 0.43 (hexanes:EtOAc 95:5); IR (KBr) 3309, 1587, 1426, 1370,

1110, 1078.  $^1\text{H}$  NMR (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.81 – 7.78 (m, 4H), 7.53 – 7.44 (m, 6H), 4.42 (s, 2H), 2.40 (s, 1H), 1.11 (s, 9H);  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ )  $\delta$  135.7, 133.0, 129.9, 127.8, 82.1, 73.2, 52.6, 26.8, 19.3; MS (CI,  $\text{NH}_3$ )  $m/z$  312 ( $\text{M} + \text{NH}_4$ ) $^+$ , 295 ( $\text{M} + \text{H}$ ) $^+$ ; HRMS (CI) calcd.  $\text{C}_{19}\text{H}_{23}\text{OSi}$ : ( $\text{M} + \text{H}$ ) $^+$ , 295.1518; found: ( $\text{M} + \text{H}$ ) $^+$ , 295.1528.

*n*-BuLi solution in hexanes (2.5 M; 41.2 mL, 103 mmol) was added dropwise to 3-*tert*-butyldiphenylsilyloxy-1-propyne (27.5 g, 93 mmol) in THF (412 mL) at  $-78^\circ\text{C}$ . The reaction mixture was stirred at this temperature for 1 h after which EtOCOCl (9.9 mL, 103 mmol) was added. The solution was warmed to room temperature and stirred for 2 h. The mixture was quenched with saturated aqueous  $\text{NH}_4\text{Cl}$  (60 mL) and extracted with EtOAc (3 x 60 mL). The organic layer was separated, dried ( $\text{MgSO}_4$ ), filtered and rotary evaporated. The crude mixture was chromatographed ( $\text{CH}_2\text{Cl}_2$ :hexanes 20:80 to 40:60) to give ethyl ester **10** (32.7 g, 96%) as a pale yellow oil:  $R_f$  0.60 ( $\text{CH}_2\text{Cl}_2$ :pentane 80:20); IR (film) 2238, 1715, 1251, 1112, 1054, 997;  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.76 – 7.71 (m, 4H), 7.47 – 7.40 (m, 6H), 4.42 (s, 2H), 4.25 (q, 2H,  $J = 7.0$  Hz), 1.34 (t, 3H,  $J = 7.0$  Hz), 1.08 (s, 9H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  153.3, 135.6, 132.3, 130.0, 127.8, 85.3, 76.6, 62.0, 52.2, 26.6, 19.1, 14.0; MS (CI,  $\text{NH}_3$ )  $m/z$  384 ( $\text{M} + \text{NH}_4$ ) $^+$ ; HRMS (CI) calcd.  $\text{C}_{22}\text{H}_{30}\text{O}_3\text{SiN}$ : ( $\text{M} + \text{NH}_4$ ) $^+$ , 384.1994; found: ( $\text{M} + \text{NH}_4$ ) $^+$ , 384.1996. Anal. calcd for  $\text{C}_{22}\text{H}_{26}\text{O}_3\text{Si}$ : C, 72.09; H, 7.15. Found: C, 71.96; H, 7.15.

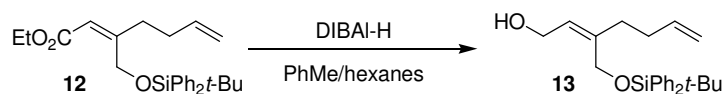
## 1.2. Ethyl 3-(*tert*-butyldiphenylsilyloxymethyl)-hepta-2,6-dienoate (**12**).



A small crystal of  $\text{I}_2$  was added to a suspension of Mg turnings (17.3 g, 712 mmol) in THF (100 mL) under  $\text{N}_2$ . The reaction mixture was heated sporadically until the solution was clear, at which point, a small portion (10%) of 4-bromo-1-butene (13.5 mL, 133 mmol) in THF (100 mL) was added. The remainder of the bromide was added dropwise over a 1 h period. After stirring for 1 h, the Grignard solution was cooled to  $0^\circ\text{C}$  and the supernatant layer was transferred via canula to a suspension of  $\text{CuBr}\cdot\text{Me}_2\text{S}$  (27.3 g, 133 mmol) in THF

(50 mL) under N<sub>2</sub> at –40 °C. The resulting suspension was stirred for 40 min. After this time, the mixture was cooled to –78 °C and a solution of alkyne **11** (31.2 g, 85 mmol) in THF (50 mL) was added dropwise. The resulting mixture was stirred at –78 °C for 1 h and then quenched with saturated aqueous NH<sub>4</sub>Cl (400 mL). The aqueous phase was extracted with Et<sub>2</sub>O (3 x 300 mL), the combined organic layers were dried (MgSO<sub>4</sub>), filtered and rotary evaporated leaving the  $\alpha,\beta$ -unsaturated ester **12** (35.0 g, 97%), which was used in the next step without further purification: R<sub>f</sub> 0.60 (pentane:Et<sub>2</sub>O 90:10); IR (film) 1712, 1641, 1471, 1427, 1222, 1147, 1110, 1041, 821; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  7.73 – 7.68 (m, 4H), 7.46 – 7.36 (m, 6H), 5.87 (ddt, 1H, *J* = 16.8, 10.2, 6.6 Hz), 5.63 (s, 1H), 5.13 – 5.01 (m, 2H), 4.95 (s, 2H), 4.03 (q, 2H, *J* = 7.0 Hz), 2.63 – 2.55 (m, 2H), 2.40 – 2.31 (m, 2H), 1.19 (t, 3H, *J* = 7.0 Hz), 1.09 (s, 9H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>)  $\delta$  165.9, 162.1, 137.6, 135.5, 133.3, 129.7, 127.7, 115.1, 115.0, 62.7, 59.7, 33.9, 32.3, 26.9, 19.3, 14.2. HRMS (CI) calcd. C<sub>26</sub>H<sub>35</sub>O<sub>3</sub>Si: (M + H)<sup>+</sup>, 423.2355; found: (M + H)<sup>+</sup>, 423.2344. Anal. calcd for C<sub>26</sub>H<sub>34</sub>O<sub>3</sub>Si: C, 73.89; H, 8.11. Found: C, 73.91; H, 8.12.

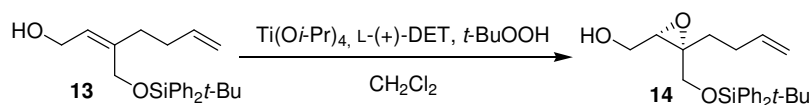
### 1.3. 3-(*tert*-Butyldiphenylsilyloxymethyl)-hepta-2,6-dien-1-ol (**13**).



DIBAL-H in hexane (1 M; 289 mL, 289 mmol) was added slowly to  $\alpha,\beta$ -unsaturated ester **12** (34.9 g, 80.7 mmol) in PhMe (800 mL) at –78 °C, and the resulting mixture was stirred at this temperature for 1.5 h. The reaction mixture was carefully quenched with MeOH (10 mL) and left to warm up to room temperature. Saturated aqueous Rochelle's salt (350 mL) was added and the resulting suspension was stirred vigorously 14 h. The reaction mixture was filtered and the two layers separated. The aqueous layer was further extracted with EtOAc (3 x 150 mL), the combined organic layers were dried (MgSO<sub>4</sub>) and rotary evaporated. The resulting dark orange oil was filtered through a short pad of SiO<sub>2</sub> using CH<sub>2</sub>Cl<sub>2</sub> to yield allylic alcohol **13** (29.7 g, 96%) as a colorless oil: R<sub>f</sub> 0.36 (hexane:EtOAc 80:20); IR (film) 3500–3100, 1640, 1428, 1112, 823; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  7.74 – 7.69 (m, 4H), 7.50 – 7.40 (m, 6H), 5.83 (ddt, 1H, *J* = 16.4, 10.2, 6.3 Hz), 5.47 (t, 1H, *J* = 7.0 Hz), 5.07 – 4.95 (m, 2H), 4.19 (s, 2H), 3.96 (bs, 2H), 2.33 – 2.16 (m, 4H), 1.04 (s, 9H);

$^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  141.4, 138.3, 135.6, 133.3, 129.8, 127.7, 125.9, 114.6, 61.5, 58.6, 34.1, 32.2, 26.8, 19.2; MS (CI,  $\text{NH}_3$ )  $m/z$  363 ( $\text{M} + \text{H} - \text{H}_2\text{O}$ ) $^+$ ; HRMS (CI) calcd. for  $\text{C}_{24}\text{H}_{31}\text{OSi}$ : ( $\text{M} + \text{H} - \text{H}_2\text{O}$ ) $^+$ , 398.2515; found: ( $\text{M} + \text{H} - \text{H}_2\text{O}$ ) $^+$ , 398.2513. Anal. calcd. for  $\text{C}_{24}\text{H}_{32}\text{O}_2\text{Si}$ : C, 75.74; H, 8.47. Found: C, 75.62; H, 8.32.

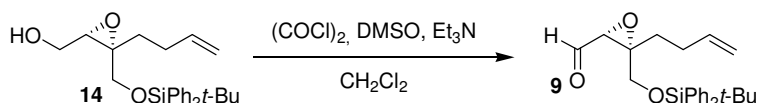
#### 1.4. Sharpless epoxidation of allylic alcohol **13**.



$\text{Ti}(\text{O}i\text{Pr})_4$  (4.33 mL, 14.6 mmol) was added to a suspension of 4 Å molecular sieves (1.67 g, 30 % w/w based on substrate) in  $\text{CH}_2\text{Cl}_2$  (50 mL). The mixture was cooled to  $-30^\circ\text{C}$  and L-(+)-diethyl tartrate (3.61 g, 17.5 mmol) in  $\text{CH}_2\text{Cl}_2$  (10 mL) was added followed by alkene **13** (5.56 g, 14.6 mmol) in  $\text{CH}_2\text{Cl}_2$  (10 mL) and the resulting suspension was stirred for 40 min. After this time anhydrous *tert*-butyl hydroperoxide in decane (5.5 M; 8.00 mL, 43.8 mmol) was added dropwise and stirring was continued for two days at  $-30^\circ\text{C}$ . After warming up to  $0^\circ\text{C}$ ,  $\text{H}_2\text{O}$  (90 mL) was added and the mixture was stirred for 1 h. 30% aqueous NaOH saturated with NaCl (17 mL) was added and stirring continued for 1.5 h during which the slurry changed color from yellow to white. The white slurry was filtered through a plug of Celite<sup>®</sup> which was rinsed thoroughly with  $\text{CH}_2\text{Cl}_2$ . The filtrate was washed with saturated aqueous NaCl, dried ( $\text{Na}_2\text{SO}_4$ ) and rotary evaporated. The resulting oil was chromatographed ( $\text{CH}_2\text{Cl}_2$ :hexanes 80:20 to EtOAc:hexanes 20:80) to give epoxy-alcohol **14** (5.33 g, 92 %) as a slightly yellow oil:  $R_f$  0.15 ( $\text{CH}_2\text{Cl}_2$ :hexanes 80:20);  $[\alpha]_D - 9.6$  ( $c$  1.0,  $\text{CHCl}_3$ ); Chiral HPLC (Chiralpak OJ-H; *i*-hexane:EtOH:TFA 95:5:0.1): **14** ( $R_t$  = 8.9 min) : **ent-14** ( $R_t$  = 12.0 min) 98.5 : 1.5; IR (film) 3600–3250, 1472, 1428, 1112, 1029, 913;  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ):  $\delta$  = 7.69 – 7.64 (m, 4H), 7.48 – 7.39 (m, 6H), 5.77 (ddt, 1H,  $J$  = 16.9, 10.2, 6.6 Hz), 5.01 – 4.95 (m, 2H), 3.83 (d, 1H,  $J$  = 11.2 Hz), 3.65 (d, 2H,  $J$  = 5.8 Hz), 3.63 (d, 1H,  $J$  = 11.2 Hz), 3.08 (t, 1H,  $J$  = 5.8 Hz), 2.16 – 2.02 (m, 3H), 1.90 – 1.75 (m, 2H), 1.08 (s, 9H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  137.9, 135.7, 135.6, 132.8, 132.6, 130.1, 127.9, 114.9, 64.0, 63.2, 62.2, 61.1, 32.8, 28.7, 26.9, 19.3; MS (CI,  $\text{NH}_3$ )  $m/z$  414 ( $\text{M} + \text{NH}_4$ ) $^+$ , 383 ( $\text{M} + \text{H}$ ) $^+$ ; HRMS (CI) calcd.  $\text{C}_{24}\text{H}_{35}\text{O}_3\text{SiN}$ : ( $\text{M} + \text{NH}_4$ ) $^+$ , 414.2464; found:

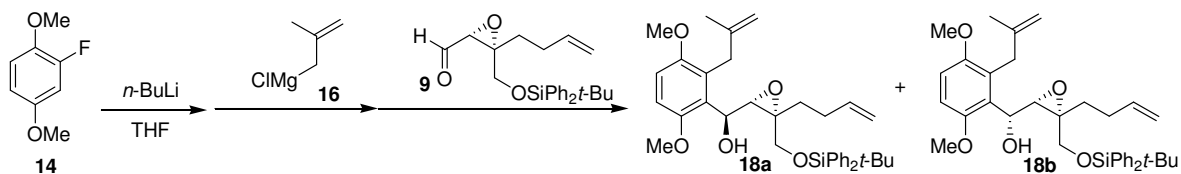
(M + NH<sub>4</sub>)<sup>+</sup>, 414.2475. Anal. calcd. for C<sub>24</sub>H<sub>32</sub>O<sub>3</sub>Si: C, 72.68; H, 8.13. Found: C, 72.64; H, 8.21.

### 1.5. Swern oxidation of epoxy-alcohol **14**.



DMSO (1.96 mL, 27.5 mmol) was added to (COCl)<sub>2</sub> (1.75 mL, 13.8 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (60 mL) at –78 °C. After stirring for 15 min, alcohol **14** (4.94 g, 12.5 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (10 mL + 5 mL) was added and the reaction mixture was stirred for 30 min at –78 °C. Et<sub>3</sub>N (8.73 mL, 63 mmol) was added slowly, the resulting solution was stirred for further 10 min and allowed to warm up to room temperature. The reaction was quenched by addition of saturated aqueous NaHCO<sub>3</sub> (30 mL). The organic layer was washed with saturated aqueous NH<sub>4</sub>Cl (20 mL) and brine (20 mL), dried (MgSO<sub>4</sub>), filtered and rotary evaporated to yield epoxy-aldehyde **9** (4.63 g, 94%) as a yellow oil, which was used in the next stage without further purification: R<sub>f</sub> 0.50 (CH<sub>2</sub>Cl<sub>2</sub>:hexanes 80:20); IR (film) 1731, 1427, 1112; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 9.48 (d, 1H, *J* = 4.5 Hz), 7.72 – 7.64 (m, 4H), 7.48 – 7.39 (m, 6H), 5.75 (ddt, 1H, *J* = 16.9, 10.3, 6.6 Hz), 5.02–4.96 (m, 2H), 3.87 (d, 1H, *J* = 11.9 Hz), 3.81 (d, 1H, *J* = 11.9 Hz), 3.2 (d, 1H, *J* = 5.0 Hz), 2.13 – 1.70 (m, 4H), 1.05 (s, 9H). <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 198.3, 137.0, 135.6, 132.3, 130.0, 127.9, 115.5, 68.0, 63.1, 62.7, 32.4, 28.6, 26.7, 19.2; MS (CI, NH<sub>3</sub>) *m/z* 412 (M + NH<sub>4</sub>)<sup>+</sup>; HRMS (CI) calcd. C<sub>24</sub>H<sub>34</sub>O<sub>3</sub>SiN: (M + NH<sub>4</sub>)<sup>+</sup>, 412.2307; found: (M + NH<sub>4</sub>)<sup>+</sup>, 412.2312. Anal. calcd. for C<sub>24</sub>H<sub>30</sub>O<sub>2</sub>Si: C, 76.14; H, 7.99. Found: C, 76.17; H, 7.99.

## 2. THREE-COMPONENT BENZYNE COUPLING.



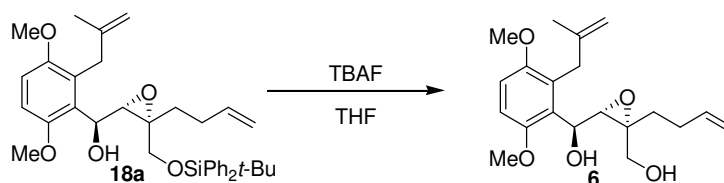
*n*-BuLi in hexanes (1.54 M; 3.1 mL, 4.7 mmol) was added dropwise to fluoroarene **14** (0.65 mL, 4.7 mmol) in dry THF (45 mL), under N<sub>2</sub> at –78 °C, and the resulting mixture was stirred for 30 min at that temperature. After this time, **16** in THF (0.5 M; 9.0 mL, 4.5 mmol) was added dropwise and the resulting solution was stirred for 15 min at –78 °C, allowed to warm up to room temperature and stirred for further 1.5 h. After this time, the pink colored solution of aryl Grignard **17** was cooled to –78 °C and epoxy-aldehyde **9** (1.50 g, 3.8 mmol) was added slowly. After 20 min, the mixture was allowed to warm up to –35 °C and quenched with saturated aqueous NH<sub>4</sub>Cl (20 mL). The resulting mixture was extracted with Et<sub>2</sub>O (3 × 40 mL), the combined organic layers were dried (MgSO<sub>4</sub>), filtered and rotary evaporated. The resulting oil was chromatographed (CH<sub>2</sub>Cl<sub>2</sub>:hexanes 70:30 to hexanes:EtOAc 80:20) to give **18a** (0.55 g, 25%) as a colorless oil and **18b** (0.88 g, 40%) as a white solid: **18a**. R<sub>f</sub> 0.20 (CH<sub>2</sub>Cl<sub>2</sub>:hexanes 70:30); [α]<sub>D</sub> –23.3 (*c* 1, CHCl<sub>3</sub>); IR (KBr) 3550–3300, 1642, 1590, 1480, 1428, 1231, 1112, 1085. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.78 – 7.76 (m, 4H), 7.47 – 7.43 (m, 6H), 6.79 (s, 2H), 5.95 – 5.84 (m, 1H), 5.10 – 4.99 (m, 2H), 4.63 (s, 1H), 4.48 (t, 1H, *J* = 9.2 Hz), 4.23 (s, 1H), 4.17 (d, 1H, *J* = 11.7 Hz), 4.05 (d, 1H, *J* = 9.8 Hz), 3.86 (s, 3H), 3.84 (d, 1H, *J* = 11.7), 3.75 (s, 3H), 3.48 (d, 1H, *J* = 16.8 Hz), 3.36 (d, 1H, *J* = 8.7 Hz), 3.03 (d, 1H, *J* = 16.8 Hz), 2.22 – 2.17 (m, 3H), 1.70 – 1.60 (m, 1H), 1.50 (s, 3H), 1.12 (s, 9H); <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>) δ 152.2, 151.8, 144.0, 138.2, 135.7, 135.6, 133.1, 133.0, 129.7, 127.7, 114.6, 110.6, 110.5, 109.3, 69.0, 64.5, 64.3, 63.8, 56.4, 55.6, 33.2, 32.4, 29.2, 26.9, 22.9, 19.4, 14.2; MS (CI, NH<sub>3</sub>) *m/z* 587 (M + H)<sup>+</sup>; HRMS (CI) calcd. C<sub>36</sub>H<sub>47</sub>O<sub>5</sub>Si: (M + H)<sup>+</sup>, 587.3192; found: (M + H)<sup>+</sup>, 587.3180. Anal. calcd. for C<sub>36</sub>H<sub>46</sub>O<sub>5</sub>Si: C, 73.68; H, 7.90. Found: C, 73.69; H, 7.86.

**18b**. m.p. 116–118 °C (CH<sub>2</sub>Cl<sub>2</sub>); R<sub>f</sub> 0.25 (hexanes:AcOEt 80:20); [α]<sub>D</sub> +8.0 (*c* 1.0, CHCl<sub>3</sub>); IR(film) 3550–3300, 1641, 1590, 1478, 1428, 1237, 1111, 1082, 998, 911; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.72 – 7.62 (m, 4H), 7.48 – 7.34 (m, 6H), 6.76 (d, 1H, *J* = 9.0 Hz), 6.73 (d, 1H, *J* = 9.0 Hz), 5.75 – 5.64 (m, 1H), 4.87 (dd, 1H, *J* = 17.1 Hz, 1.4 Hz), 4.83 (d, 1H, *J* = 10.1 Hz), 4.70 (dd, 1H, *J* = 8.8 Hz, *J* = 5.5 Hz), 4.64 (s, 1H), 4.20 (s, 1H), 3.80 (d, 1H, *J* = 11.4 Hz), 3.75 (s, 3H), 3.75 (m, 1H), 3.72 (s, 3H), 3.31 (d, 1H, *J* = 16.4 Hz), 3.30 (d, 1H, *J* = 5.5 Hz), 3.17 (d, 1H, *J* = 8.8 Hz), 3.10 (d, 1H, *J* = 16.4 Hz), 2.24 – 1.90 (m, 3H), 1.62 (s, 3H), 1.50 – 1.41 (m, 1H), 1.08 (s, 9H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 152.2, 151.9, 145.1, 138.1, 135.8, 135.7, 133.5, 133.2, 129.7, 129.6, 129.5, 127.7, 114.5, 110.8, 110.5, 109.5, 67.4, 65.1, 63.8, 56.3, 55.6, 33.3, 32.2, 29.0, 26.9, 23.1, 19.4; MS (CI, NH<sub>3</sub>) *m/z* 587 (M +



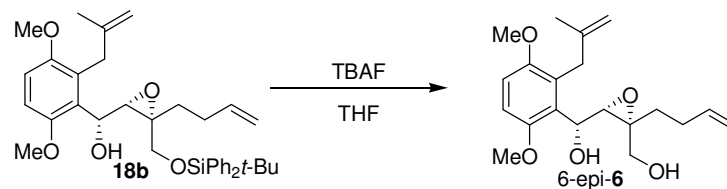
H)<sup>+</sup>; HRMS (CI) calcd. C<sub>36</sub>H<sub>46</sub>O<sub>5</sub>Si: (M + H)<sup>+</sup>, 587.3192; found: (M + H)<sup>+</sup>, 587.3216. Anal. calcd. for C<sub>36</sub>H<sub>46</sub>O<sub>5</sub>Si: C, 73.68; H, 7.90. Found: C, 73.67; H, 7.92.

### 3. DEPROTECTION OF SILYL ETHER **18a**.



TBAF in THF (1 M; 0.83 mL, 0.83 mmol) was added to silyl ether **18a** (323 mg, 0.55 mmol) in THF (10 mL). After stirring for 1 h, the reaction was quenched with saturated aqueous NH<sub>4</sub>Cl (5 mL) and the aqueous layer extracted with EtOAc (5 × 10 mL). The combined organic layers were dried (MgSO<sub>4</sub>), filtered and rotary evaporated. The resulting oil was chromatographed (CH<sub>2</sub>Cl<sub>2</sub>:EtOAc 95:5 to 70:30) to yield **6** (167 mg, 87%) as a white solid: m.p. 89–91 °C (CH<sub>2</sub>Cl<sub>2</sub>:pentane); R<sub>f</sub> 0.25 (CH<sub>2</sub>Cl<sub>2</sub>:EtOAc 90:10); [α]<sub>D</sub> –22.7 (*c* 1, CHCl<sub>3</sub>); IR (film) 3500–3300, 1483, 1450, 1239, 1024; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 6.83 (s, 2H), 5.85 (ddt, 1H, *J* = 16.8, 10.2, 6.5 Hz), 5.08 (d, 1H, *J* = 16.8 Hz), 5.00 (d, 1H, *J* = 10.2 Hz), 4.79 (s, 1H), 4.71 (d, 1H, *J* = 8.1 Hz), 4.63 (bs, 1H), 4.41 (s, 1H), 3.97 (d, 1H, *J* = 12.0 Hz), 3.90 (s, 3H), 3.76 (s, 3H), 3.75 (d, 1H, *J* = 12.0 Hz), 3.60 (d, 1H, *J* = 16.8 Hz), 3.31 (d, 1H, *J* = 8.1 Hz), 3.24 (d, 1H, *J* = 16.8 Hz), 2.30–2.12 (m, 2H), 2.00–1.90 (m, 1H), 1.83–1.73 (m, 1H), 1.79 (s, 3H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 152.4, 151.5, 144.3, 138.0, 128.6, 127.9, 114.8, 110.8, 110.6, 109.7, 109.3, 70.7, 64.5, 63.8, 63.7, 56.4, 55.6, 33.3, 33.1, 28.6, 23.2; MS (CI, NH<sub>3</sub>) *m/z* 366 (M + NH<sub>4</sub>)<sup>+</sup>, 348 (M + H)<sup>+</sup>; HRMS (CI) calcd. C<sub>20</sub>H<sub>32</sub>O<sub>5</sub>N: (M + NH<sub>4</sub>)<sup>+</sup>, 366.2280; found: (M + NH<sub>4</sub>)<sup>+</sup>, 366.2268. Anal. calcd. for C<sub>20</sub>H<sub>28</sub>O<sub>5</sub>: C, 68.94; H, 8.10. Found: C, 68.81; H, 8.42.

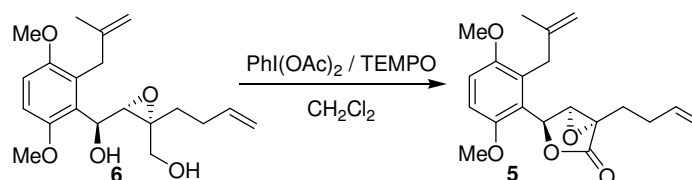
#### 4. DEPROTECTION OF SILYL ETHER **18b**.



TBAF in THF (1 M; 0.47 mL, 0.47 mmol) was added to silyl ether **18b** (182 mg, 0.31 mmol) in THF (6 mL). After stirring for 1 h, the reaction mixture was quenched with saturated aqueous NH<sub>4</sub>Cl (5 mL) and the aqueous layer extracted with EtOAc (5 × 10 mL). The combined organic layers were dried (MgSO<sub>4</sub>), filtered and rotary evaporated. The resulting oil was chromatographed (CH<sub>2</sub>Cl<sub>2</sub>:EtOAc 80:20 to 60:40) to yield the *syn* diol **6-epi-6** (93 mg, 86%) as a colorless oil: R<sub>f</sub> 0.20 (CH<sub>2</sub>Cl<sub>2</sub>:EtOAc 80:20); [α]<sub>D</sub> −8.7 (*c* 0.83, CHCl<sub>3</sub>); IR (film) 3550–3250, 1622, 1597, 1464, 1249, 1081, 1039, 910; <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) δ 6.82 (s, 2H), 5.71 (ddt, 1H, *J* = 16.8, 10.2, 6.6 Hz), 4.99 – 4.84 (m, 3H), 4.76 (s, 1H), 4.32 (s, 1H), 3.87 (s, 3H), 3.78 (s, 3H), 3.76 – 3.71 (m, 2H), 3.59 (d, 1H, *J* = 8.7 Hz), 3.48 (d, 1H, *J* = 6.0 Hz), 3.36 (d, 1H, *J* = 6.0 Hz), 2.16 – 2.04 (m, 2H), 1.96 – 1.86 (m, 1H), 1.83 (s, 3H), 1.60 – 1.49 (m, 1H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 152.4, 151.7, 145.3, 137.7, 128.9, 128.0, 114.8, 110.9, 110.3, 109.7, 67.1, 65.6, 64.0, 62.2, 56.4, 55.9, 33.4, 33.0, 28.8, 23.3; MS (CI, NH<sub>3</sub>) *m/z* 366 (M + NH<sub>4</sub>)<sup>+</sup>, 348 (M + H)<sup>+</sup>; HRMS (CI) calcd. C<sub>20</sub>H<sub>29</sub>O<sub>5</sub>: (M + H)<sup>+</sup>, 349.2014; found: (M + H)<sup>+</sup>, 349.2026. Anal. calcd. for C<sub>20</sub>H<sub>28</sub>O<sub>5</sub>: C, 68.94; H, 8.10. Found: C, 68.86; H, 8.06.

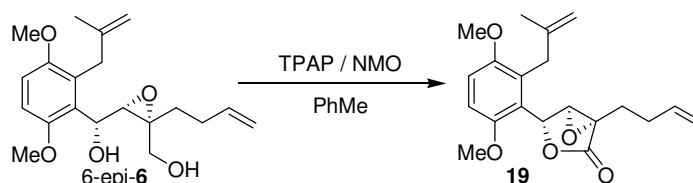
#### 5. LACTONE **5**.

##### 5.1. Oxidation of diol **6**.



PhI(OAc)<sub>2</sub> (437 mg, 1.36 mmol) was added in portions to diol **6** (135 mg, 0.39 mmol) and TEMPO (12 mg, 0.08 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (3 mL) with stirring. After 20 h, saturated aqueous Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> (10 mL) was added and the resulting suspension was extracted with CH<sub>2</sub>Cl<sub>2</sub> (2 × 10 mL). The combined organic layers were washed with 10% aqueous NaHCO<sub>3</sub> (5 mL) and brine (5 mL), dried (MgSO<sub>4</sub>) and rotary evaporated. The resulting oil was chromatographed (CH<sub>2</sub>Cl<sub>2</sub>) to yield **5** (107 mg, 80%) as a colorless oil: R<sub>f</sub> 0.25 (CH<sub>2</sub>Cl<sub>2</sub>); [α]<sub>D</sub> +14 (*c* 1.0, CHCl<sub>3</sub>); IR (film) 1780, 1711, 1483, 1266, 1113, 909; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 6.90 (d, 1H, *J* = 9.0 Hz), 6.79 (d, 1H, *J* = 9.0 Hz), 5.86 (ddt, 1H, *J* = 16.8, 10.1, 6.4 Hz), 5.53 (s, 1H), 5.14 – 4.99 (m, 2H), 4.82 (s, 1H), 4.36 (s, 1H), 3.91 (s, 1H), 3.78 (s, 3H), 3.75 (s, 3H), 3.62 (d, 1H, *J* = 16.9 Hz), 3.36 (d, 1H, *J* = 16.5 Hz), 2.42 – 2.32 (m, 2H), 2.20 – 1.96 (m, 2H), 1.82 (s, 3H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 173.0, 153.0, 152.0, 144.6, 137.2, 129.4, 122.2, 115.4, 112.8, 111.2, 110.2, 76.4, 62.9, 61.6, 56.5, 56.2, 33.3, 27.6, 24.1, 23.1; HRMS (CI) calcd. C<sub>20</sub>H<sub>28</sub>O<sub>5</sub>N: (M + NH<sub>4</sub>)<sup>+</sup>, 362.1967; found: (M + NH<sub>4</sub>)<sup>+</sup>, 362.1958. Anal. calcd. for C<sub>20</sub>H<sub>24</sub>O<sub>5</sub>: C, 69.75; H, 7.02. Found: C, 69.76; H, 6.97.

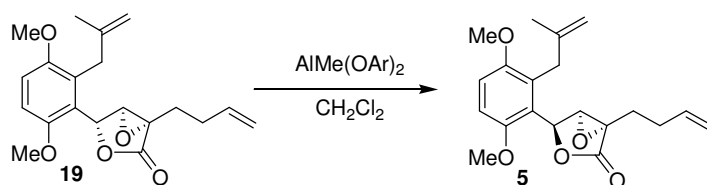
## 5.2. Oxidation of *syn* diol 6-*epi*-6.



TPAP (10 mg, 0.026 mmol) was added in one portion to a suspension of *syn* diol 6-*epi*-**6** (62 mg, 0.18 mmol), *N*-methylmorpholine-*N*-oxide (63 mg, 0.53 mmol) and 4 Å molecular sieves (80 mg) in dry MeCN (3 mL) and the resulting suspension was stirred for 2 h at room temperature. After this time, the mixture was rotary evaporated and the resulting slurry was chromatographed (CH<sub>2</sub>Cl<sub>2</sub>) to yield **19** (47 mg, 74%) as a white solid: m.p. 85–86 (CH<sub>2</sub>Cl<sub>2</sub>); R<sub>f</sub> 0.25 (CH<sub>2</sub>Cl<sub>2</sub>); [α]<sub>D</sub> –74 (*c* 1.9, CHCl<sub>3</sub>); IR (film) 1783, 1473, 1437, 1256, 1084, 1051; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 6.85 (d, 1H, *J* = 9.0 Hz), 6.79 (d, 1H, *J* = 9.0 Hz), 5.88 (d, 1H, *J* = 1.3 Hz), 5.82 (ddt, 1H, *J* = 16.8, 10.2, 6.5 Hz), 5.11 – 5.00 (m, 2H), 4.69 (s, 1H), 4.23 (d, 1H, *J* = 1.3 Hz), 4.14 (s, 1H), 3.82 (s, 3H), 3.74 (s, 3H), 3.46

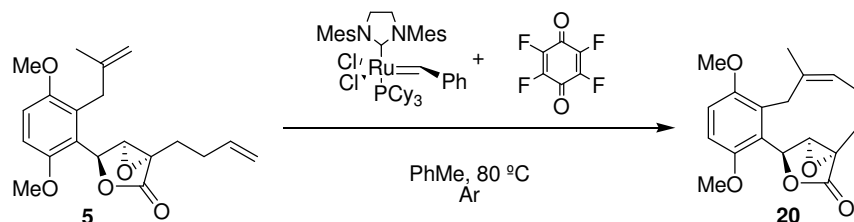
(d, 1H,  $J = 16.7$  Hz), 3.29 (d, 1H,  $J = 16.7$  Hz), 2.38 – 2.18 (m, 3H), 2.08 – 1.98 (m, 1H), 1.81 (s, 3H);  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  171.5, 152.8, 151.2, 145.7, 136.9, 129.7, 121.5, 115.8, 111.6, 109.3, 108.8, 75.5, 61.9, 60.0, 56.5, 56.2, 33.8, 28.4, 24.4, 23.6; MS (CI,  $\text{NH}_3$ )  $m/z$  362 ( $\text{M} + \text{NH}_4$ ) $^+$ , 345 ( $\text{M} + \text{H}$ ) $^+$ ; HRMS (CI) calcd.  $\text{C}_{20}\text{H}_{28}\text{O}_5\text{N}$ : ( $\text{M} + \text{NH}_4$ ) $^+$ , 362.1967, found: ( $\text{M} + \text{NH}_4$ ) $^+$ , 362.1970. Anal. calcd. for  $\text{C}_{20}\text{H}_{24}\text{O}_5$ : C, 69.75; H, 7.02. Found: C, 69.76; H, 7.14.

### 5.3. Epimerization of lactone **19** to **5**.



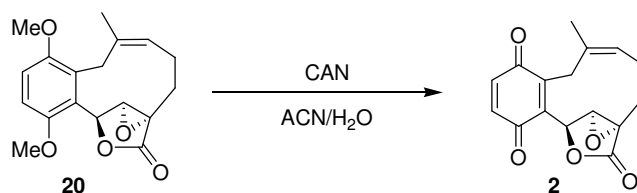
$\text{AlMe}_3$  in hexane (2.0 M; 113  $\mu\text{L}$ , 0.23 mmol) was added dropwise to 2,6-diphenyl-4-nitrophenol (100 mg, 0.34 mmol) in dry  $\text{CH}_2\text{Cl}_2$  (2.2 mL). The resulting red Lewis acid solution (0.05 M; 2.4 mL, 0.12 mmol) was added dropwise to **19** (68 mg, 0.20 mmol) in  $\text{CH}_2\text{Cl}_2$  (5 mL) and stirred for 36 h. After this time, the reaction mixture was quenched with saturated aqueous  $\text{NH}_4\text{Cl}$  (4 mL), saturated aqueous Rochelle's salt (10 mL) was added and the resulting suspension was stirred for 2 h. After this time, the aqueous phase was extracted with  $\text{CH}_2\text{Cl}_2$  ( $3 \times 15$  mL) and the combined organic layers were dried ( $\text{MgSO}_4$ ) and rotary evaporated. The oil was chromatographed ( $\text{CH}_2\text{Cl}_2$ ) to yield **5** (56 mg, 83%) as a colorless oil.

## 6. RING CLOSING METATHESIS OF **5**.<sup>2</sup>



Cl<sub>2</sub>(Cy<sub>3</sub>P)(sIMes)Ru=CHPh (47 mg, 56 μmol) in PhMe (58 mL) and tetrafluoro-p-benzoquinone (20 mg, 0.11 mmol) in PhMe (58 mL) were added simultaneously via syringe pump over 12 h to diene **5** (48 mg, 0.14 mmol) in PhMe (48 mL), at 80 °C, and stirred for further 6 h. Argon was bubbled through the reaction mixture during the course of the reaction. After this time, the resulting dark solution was rotary evaporated and the crude oil was chromatographed on 5% AgNO<sub>3</sub>/SiO<sub>2</sub> (pentane:EtOAc 90:10) to yield **20** (29 mg, 65%) as a colorless oil: R<sub>f</sub> 0.20 (CH<sub>2</sub>Cl<sub>2</sub>:hexanes 80:20); [α]<sub>D</sub> –105 (*c* 0.1, MeOH); [α]<sub>D</sub> –102 (*c* 0.1, MeOH) (lit. +111 (*c* 0.1, MeOH)); IR (film) 1675, 1458, 1429, 1406, 1377, 1262, 1126, 1076, 1041; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 6.96 (d, 1H, *J* = 9.0 Hz), 6.85 (d, 1H, *J* = 9.0 Hz), 6.40 (s, 1H), 5.27 (t, 1H, *J* = 8.0 Hz), 4.03 (s, 1H), 3.83 (s, 3H), 3.81 (s, 3H), 3.74 (d, 1H, *J* = 15.4 Hz), 3.02 (d, 1H, *J* = 15.4 Hz), 2.79 – 2.71 (m, 1H), 2.57 – 2.44 (m, 1H), 2.25 – 2.14 (m, 1H), 1.51 (s, 3H), 1.31 – 1.26 (m, 1H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ 172.4, 152.9, 152.5, 137.9, 130.3, 122.2, 121.9, 112.9, 110.2, 74.5, 63.7, 61.6, 56.6, 55.9, 27.4, 25.1, 22.5, 21.3. MS (CI, NH<sub>3</sub>) *m/z* 334 (M + NH<sub>4</sub>)<sup>+</sup>, 318 (M + H)<sup>+</sup>; HRMS (CI) calcd. C<sub>18</sub>H<sub>24</sub>O<sub>5</sub>N: (M + NH<sub>4</sub>)<sup>+</sup>, 334.1654; found: (M + NH<sub>4</sub>)<sup>+</sup>, 334.1648.

## 7. OXIDATIVE DEPROTECTION OF **20**.

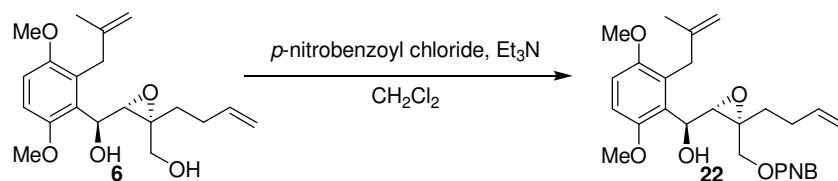


CAN (188 mg, 0.34 mmol) in H<sub>2</sub>O (1.0 mL) was added dropwise to lactone **20** (43.6 mg, 0.138 mmol) in MeCN (2.0 mL). After 10 min, the reaction mixture was extracted with CHCl<sub>3</sub> (3 × 20 mL) and the combined organic layers were dried (MgSO<sub>4</sub>) and rotary evaporated. The resulting oil was chromatographed (pentane:EtOAc 85:15) to yield **2** (27.2 mg, 69%) as a yellow oil: R<sub>f</sub> 0.10 (pentane:EtOAc 85:15); [α]<sub>D</sub> +42 (*c* 0.77, CHCl<sub>3</sub>), (lit.<sup>2</sup> –55 (*c* 0.15; CHCl<sub>3</sub>)); IR (film) 1781, 1655, 1599, 1430, 1287, 1124, 1081, 1032; <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 6.95 (d, 1H, *J* = 10.0 Hz), 6.91 (d, 1H, *J* = 10.0 Hz), 6.05 (s, 1H), 5.34 (m, 1H), 3.97 (s, 1H), 3.62 (d, 1H, *J* = 14.0 Hz), 2.95 (d, 1H, *J* = 14.0 Hz), 2.78 – 2.69 (m, 1H), 2.50 – 2.20 (m, 2H), 1.50 (s, 3H), 1.31 – 1.26 (m, 1H); <sup>13</sup>C NMR (100 MHz, CDCl<sub>3</sub>) δ

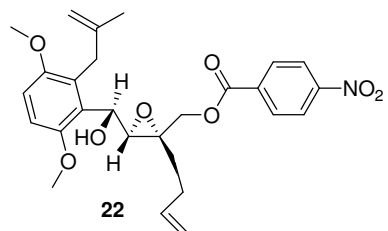
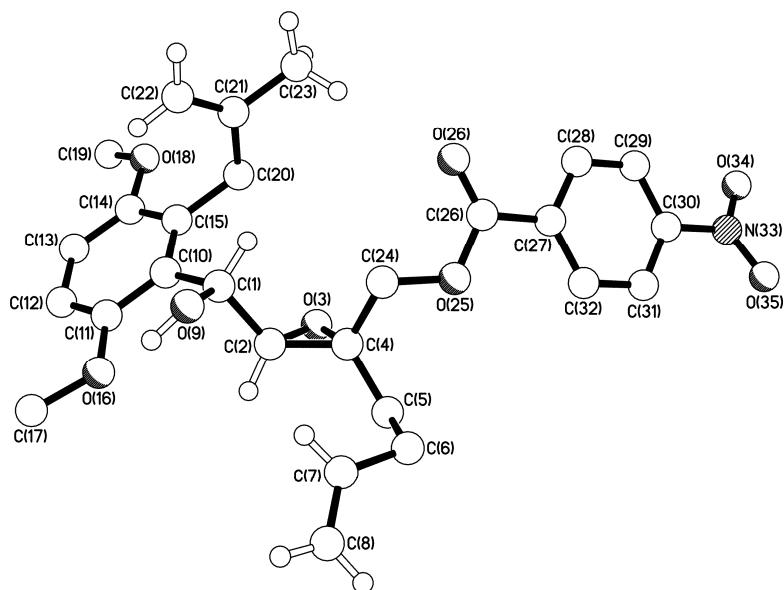
186.4, 184.7, 171.3, 149.2, 136.8, 136.7, 136.4, 134.7, 124.0, 71.7, 62.6, 60.6, 26.9, 24.6, 22.9, 22.7;  $^1\text{H}$  NMR (400 MHz,  $(\text{CD}_3)_2\text{CO}$ )  $\delta$  7.06 (d, 1H,  $J = 10.0$  Hz), 7.02 (d, 1H,  $J = 10.0$  Hz), 5.94 (s, 1H), 5.44 – 5.36 (m, 1H), 4.41 (s, 1H), 3.61 (d, 1H,  $J = 13.7$  Hz), 2.93 (d, 1H,  $J = 13.7$  Hz), 2.64 – 2.56 (m, 1H), 2.44 – 2.18 (m, 2H), 1.52 (s, 3H), 1.38 – 1.26 (m, 1H); MS (EI)  $m/z$  286 ( $\text{M}^+$ ); HRMS (EI) calcd.  $\text{C}_{16}\text{H}_{14}\text{O}_5$ : ( $\text{M}^+$ ), 286.0841, found: ( $\text{M}^+$ ), 286.0840.

## 8. DETERMINATION OF RELATIVE STEREOCHEMISTRY OF **18A** AND **18B**.

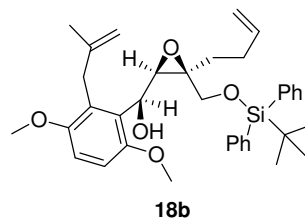
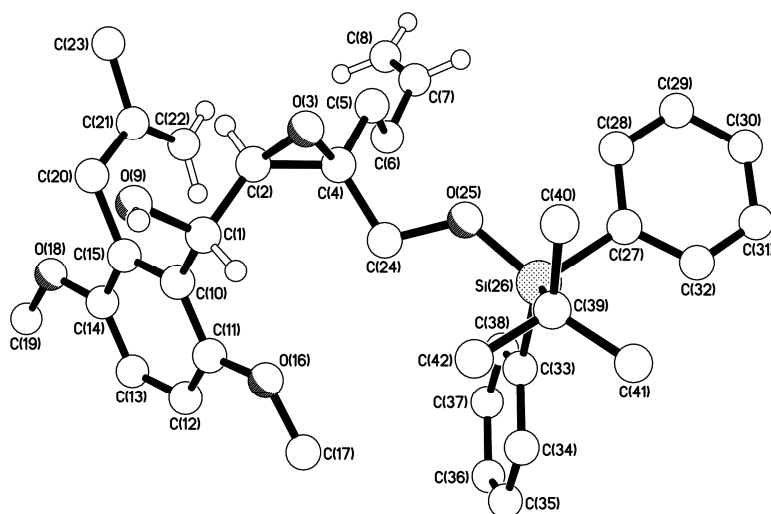
Silyl ether **18a** was deprotected to provide diol **6**, which was selectively esterified at the primary alcohol to form the *para*-nitrobenzoyl ester (**22**) as follows:



Diol **6a** (41 mg, 0.12 mmol),  $\text{Et}_3\text{N}$  (18  $\mu\text{L}$ , 0.13 mmol) and 4-nitrobenzoyl chloride (24 mg, 0.13 mmol) in  $\text{CH}_2\text{Cl}_2$  (5 mL) were stirred for 30 min. After this time, saturated aqueous  $\text{NH}_4\text{Cl}$  (3 mL) was added. The organic layer was washed with  $\text{H}_2\text{O}$  (5 mL) and brine (5 mL), dried ( $\text{MgSO}_4$ ), filtered and rotary evaporated. The resulting oil was chromatographed (hexane:EtOAc 80:20) to give **22** (78 mg, 75%) as pale yellow crystals:  $R_f$  0.30 (8:2, hexanes: EtOAc); IR (KBr) 3531, 1727, 1529, 1269, 1101, 719;  $^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  8.31 (d, 2H,  $J = 8.9$  Hz), 8.28 (d, 2H,  $J = 8.5$  Hz), 6.81 (s, 2H), 5.85 (m, 1H), 5.07 (dd, 1H,  $J = 1.5$  Hz,  $J = 17.1$  Hz), 5.01 (dd, 1H,  $J = 10.1$  Hz,  $J = 1.1$  Hz), 4.71 (m, 3H), 4.69 (s, 1H), 4.41 (s, 1H), 4.18 (d, 1H,  $J = 11.0$  Hz), 3.90 (s, 3H), 3.76 (s, 3H), 3.59 (d, 1H;  $J = 17.1$  Hz), 3.42 (d, 1H,  $J = 8.3$  Hz), 3.23 (d, 1H,  $J = 16.8$  Hz), 2.27 – 2.05 (m, 3H), 1.79 (s, 3H), 1.67 (m, 1H);  $^{13}\text{C}$  NMR (500 MHz,  $\text{CDCl}_3$ )  $\delta$  164.4, 152.4, 151.7, 150.6, 144.3, 137.4, 135.3, 130.9, 128.7, 128.0, 123.6, 115.4, 110.9, 110.7, 109.4, 69.4, 65.6, 64.6, 61.8, 56.4, 55.6, 33.3, 32.9, 28.9, 23.1; MS (CI,  $\text{NH}_3$ )  $m/z$  515 ( $\text{M} + \text{NH}_4$ ) $^+$ , 498 ( $\text{M} + \text{H}$ ) $^+$ . The structure of **22** was determined by X-ray diffraction.



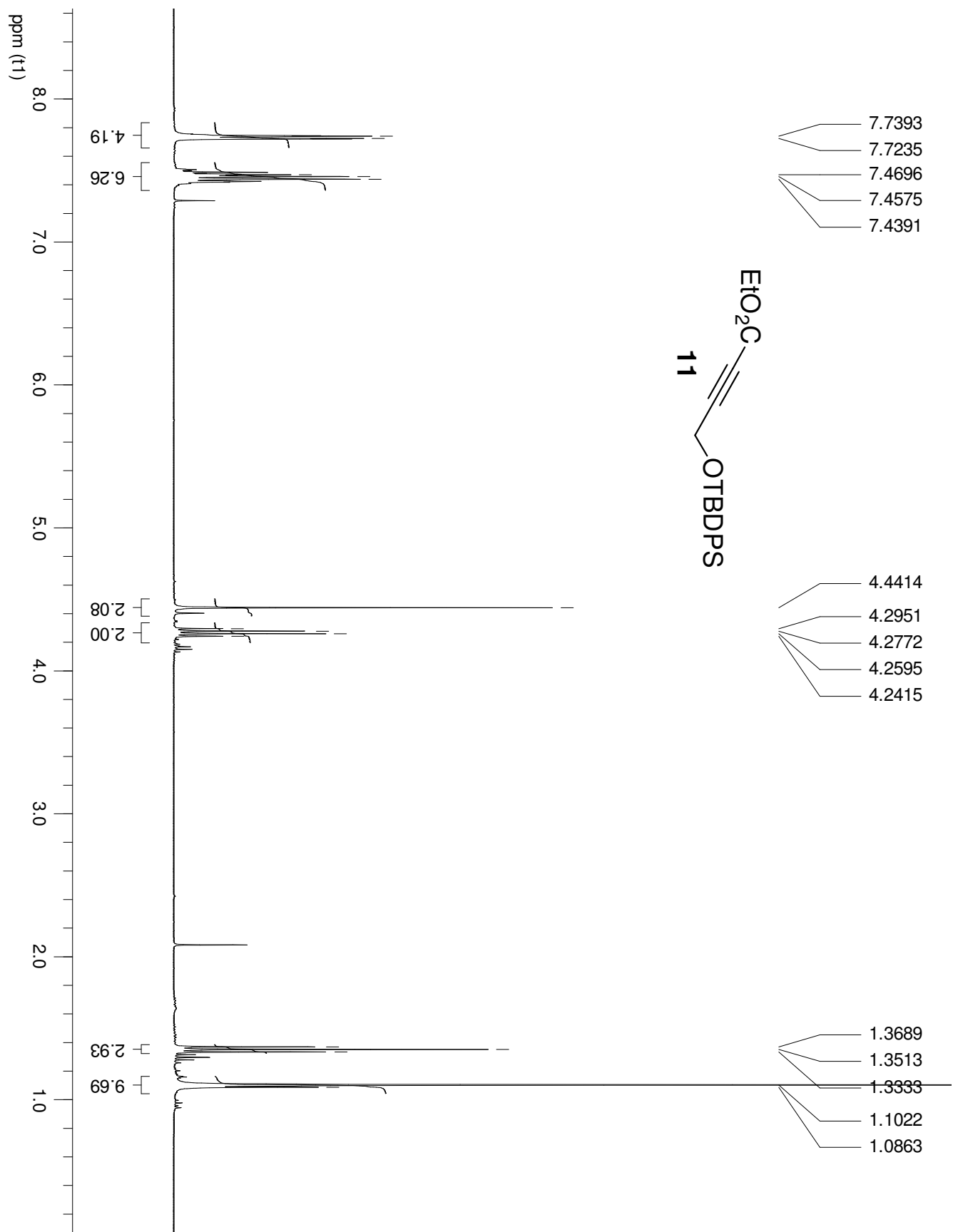
**18b** was a crystalline solid and its structure was confirmed by X-ray diffraction.

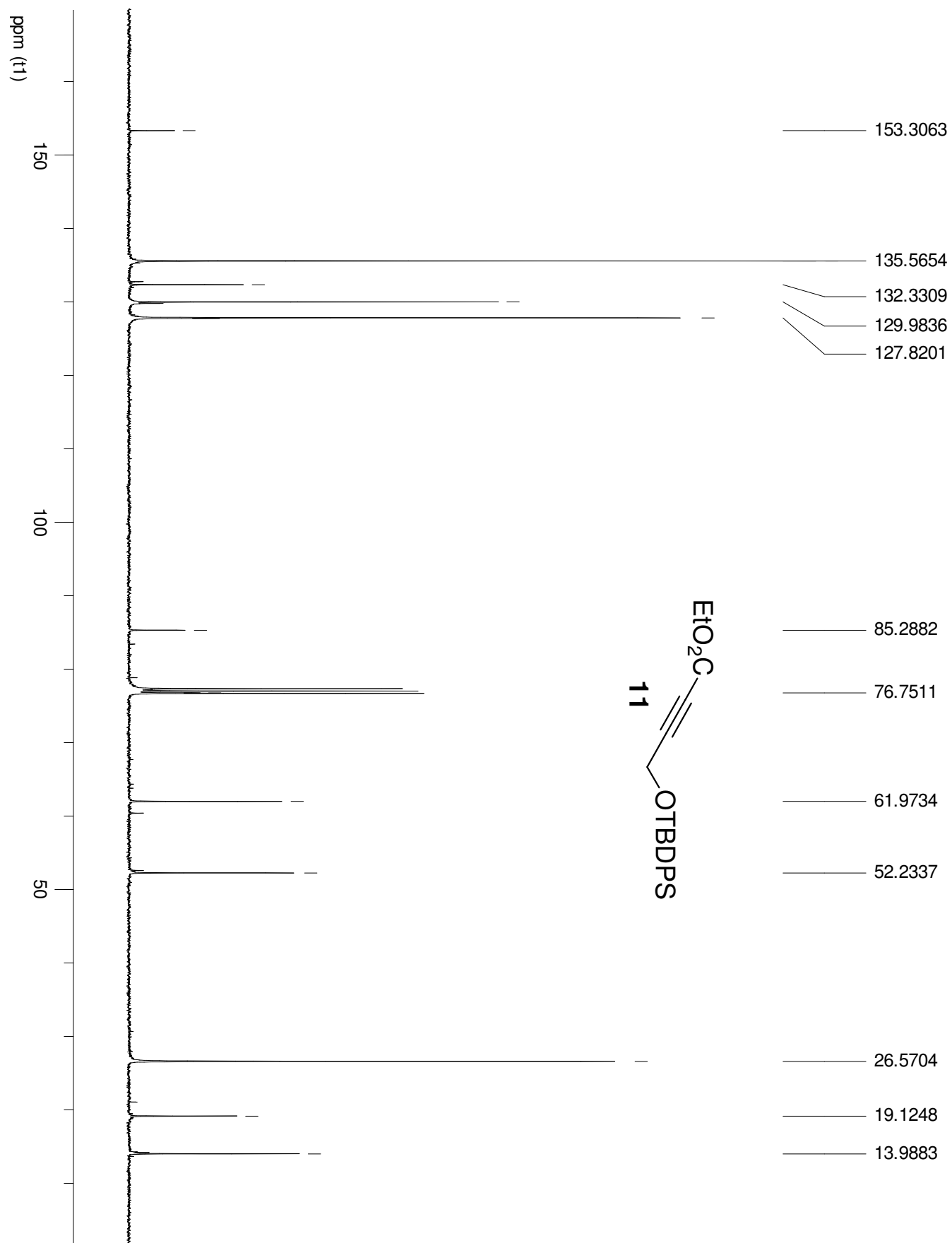


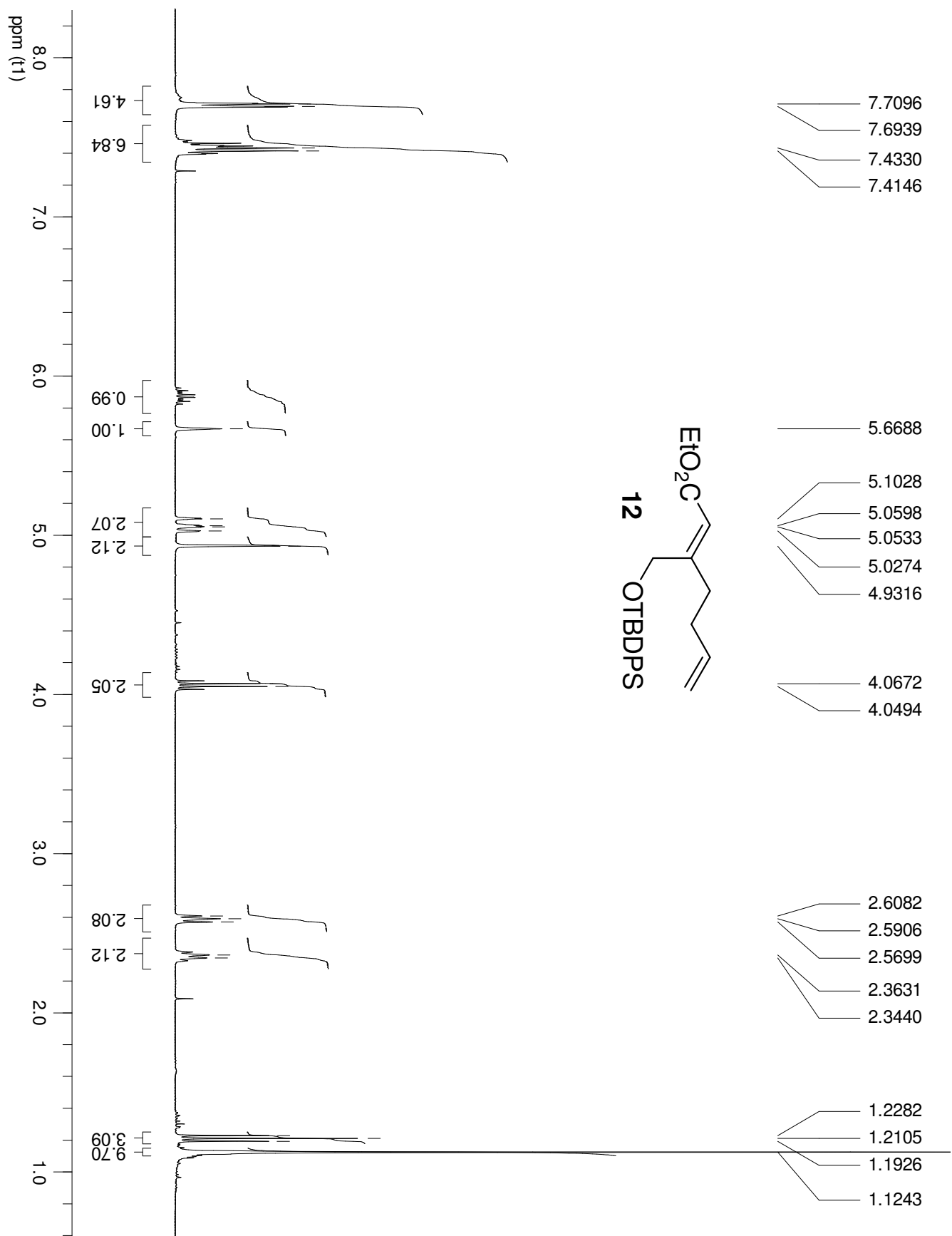
## 9. $^1\text{H}$ AND $^{13}\text{C}$ NMR SPECTRA OF ALL NEW COMPOUNDS.

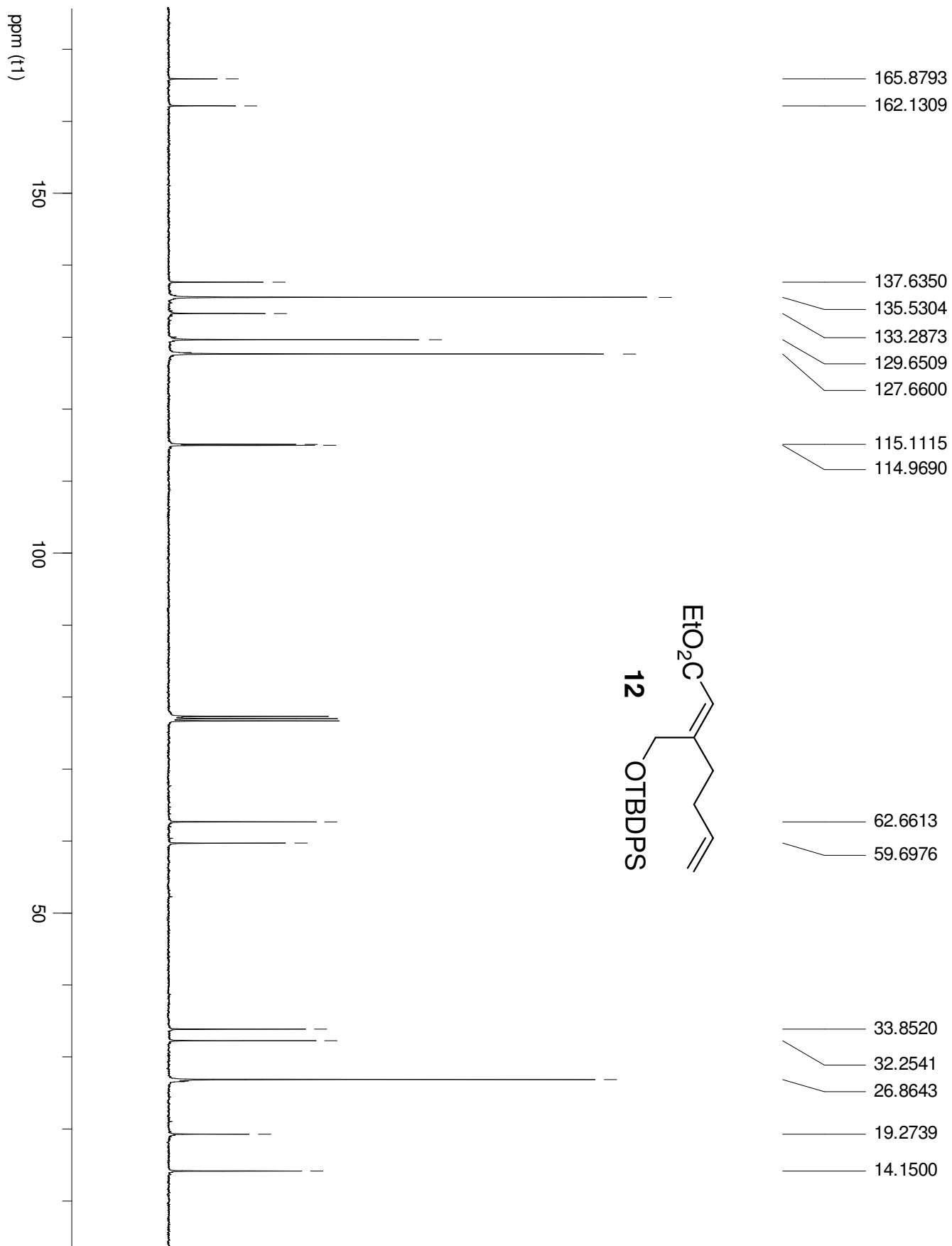


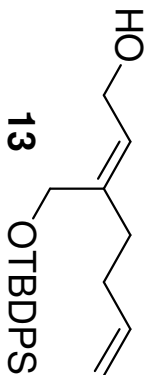


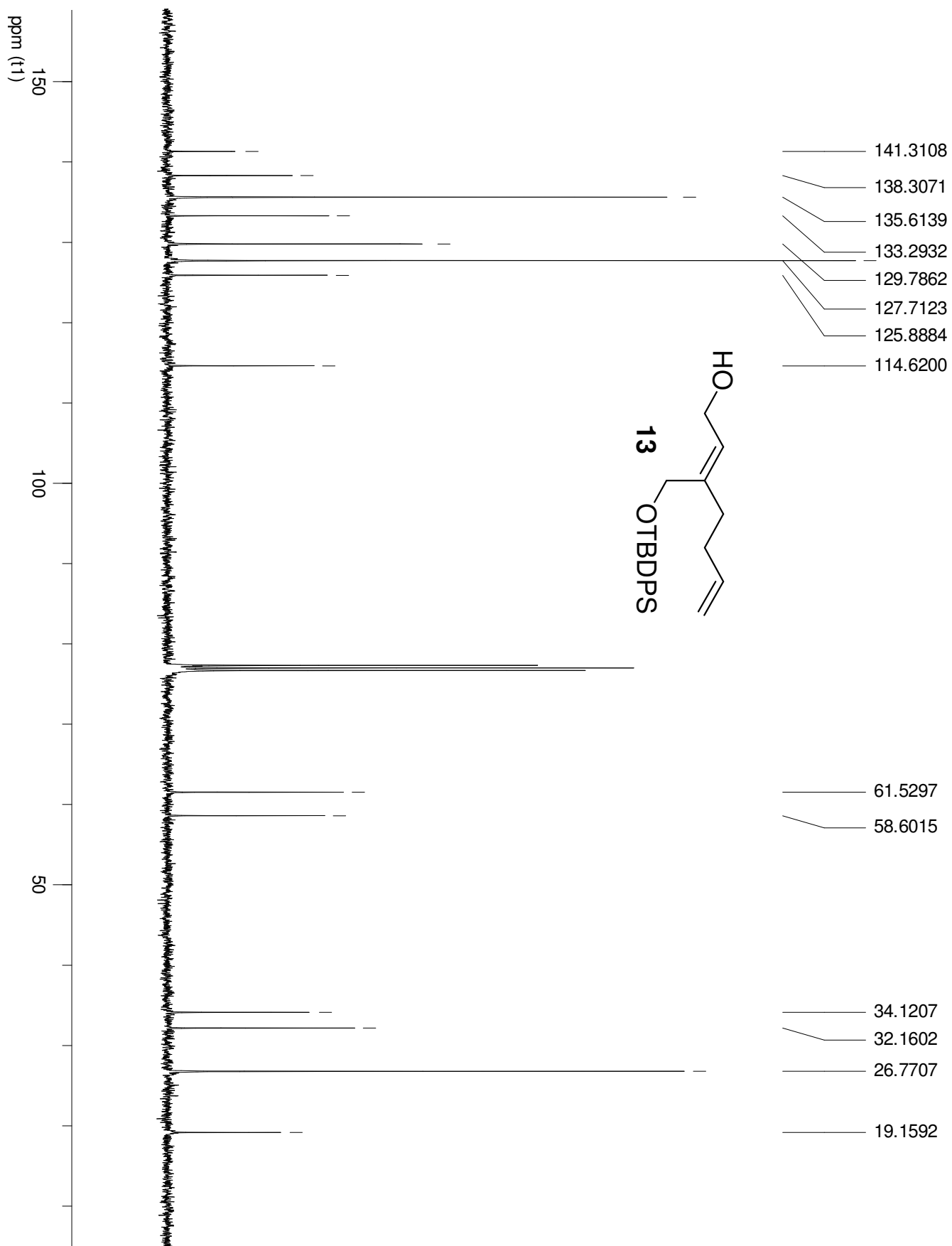


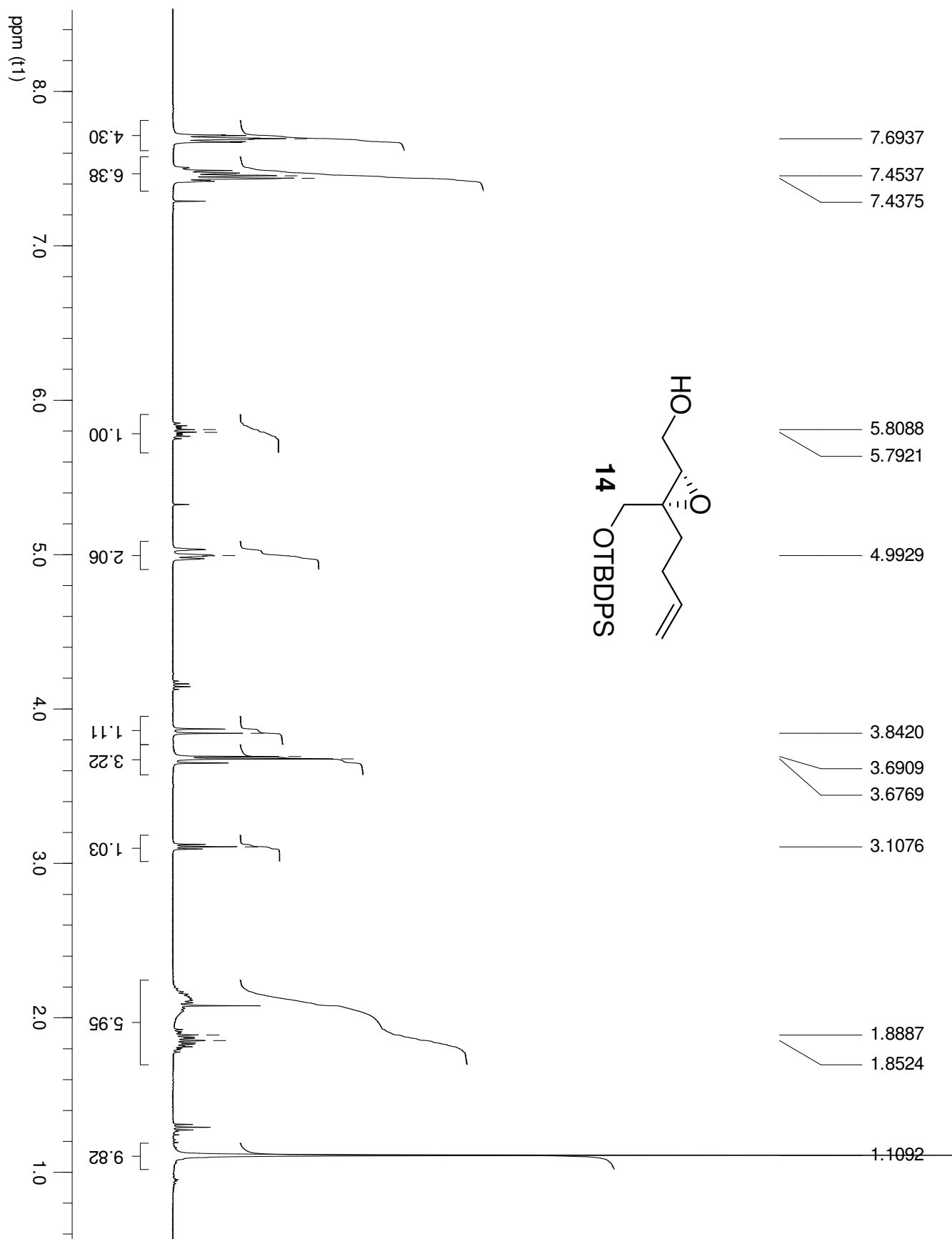


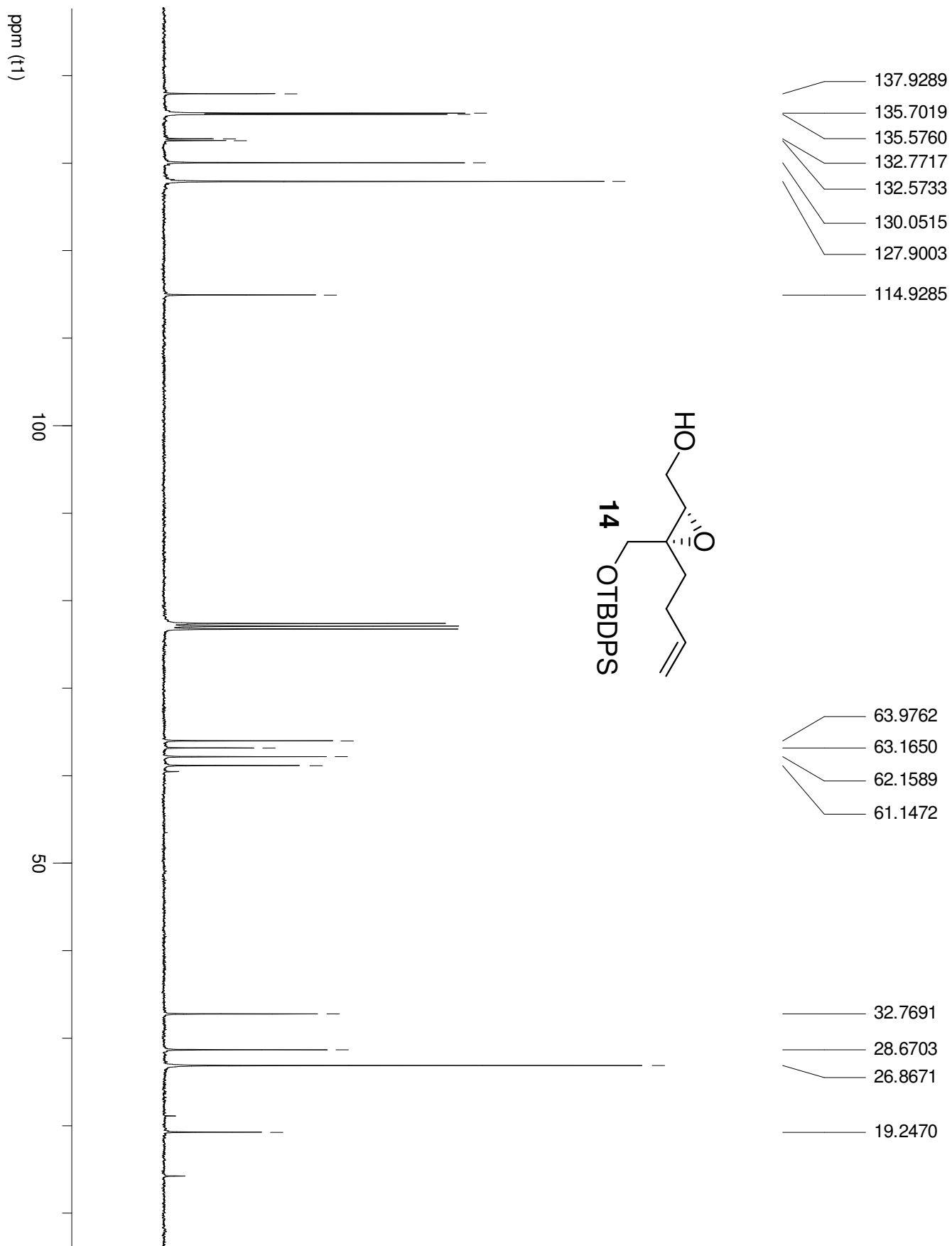




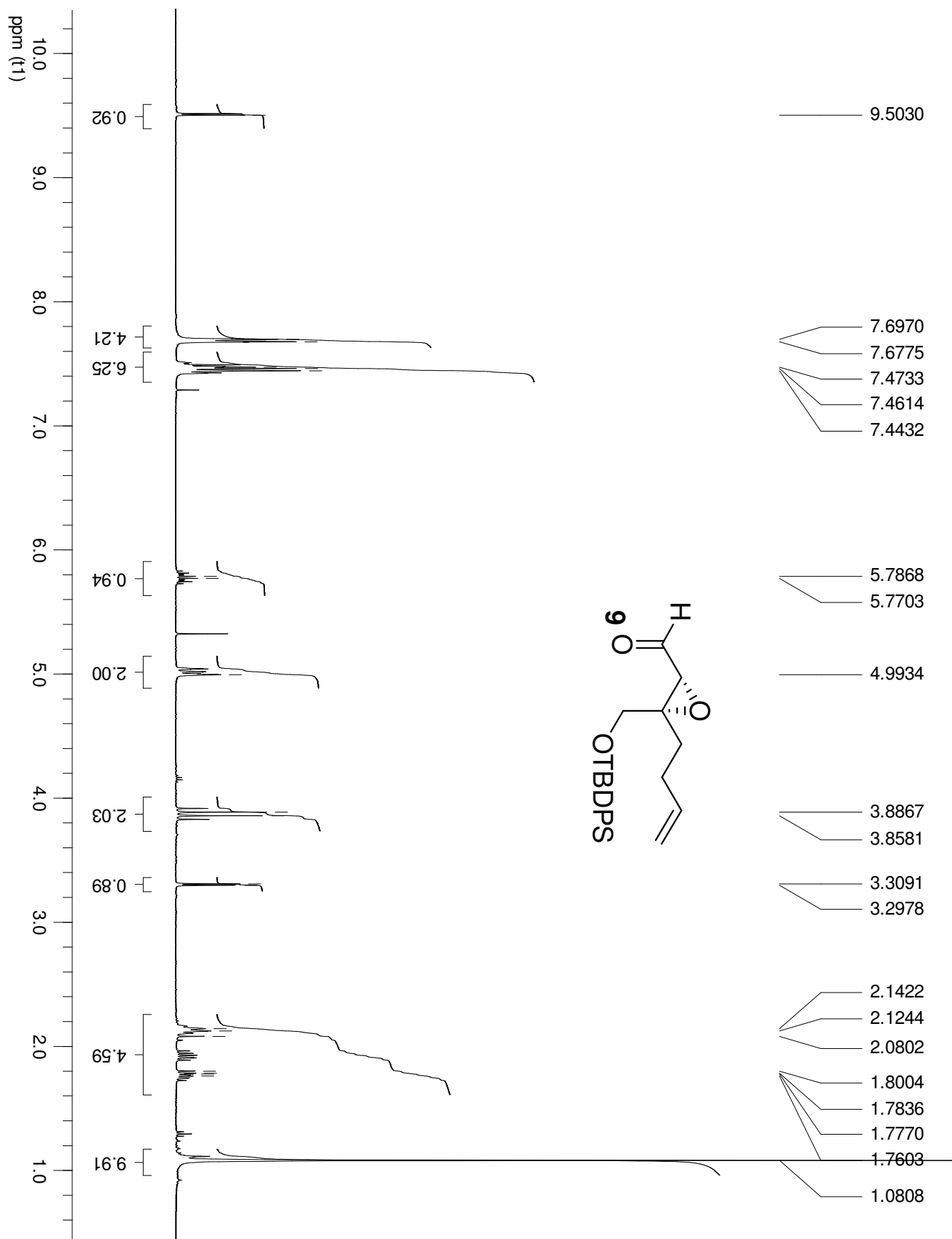


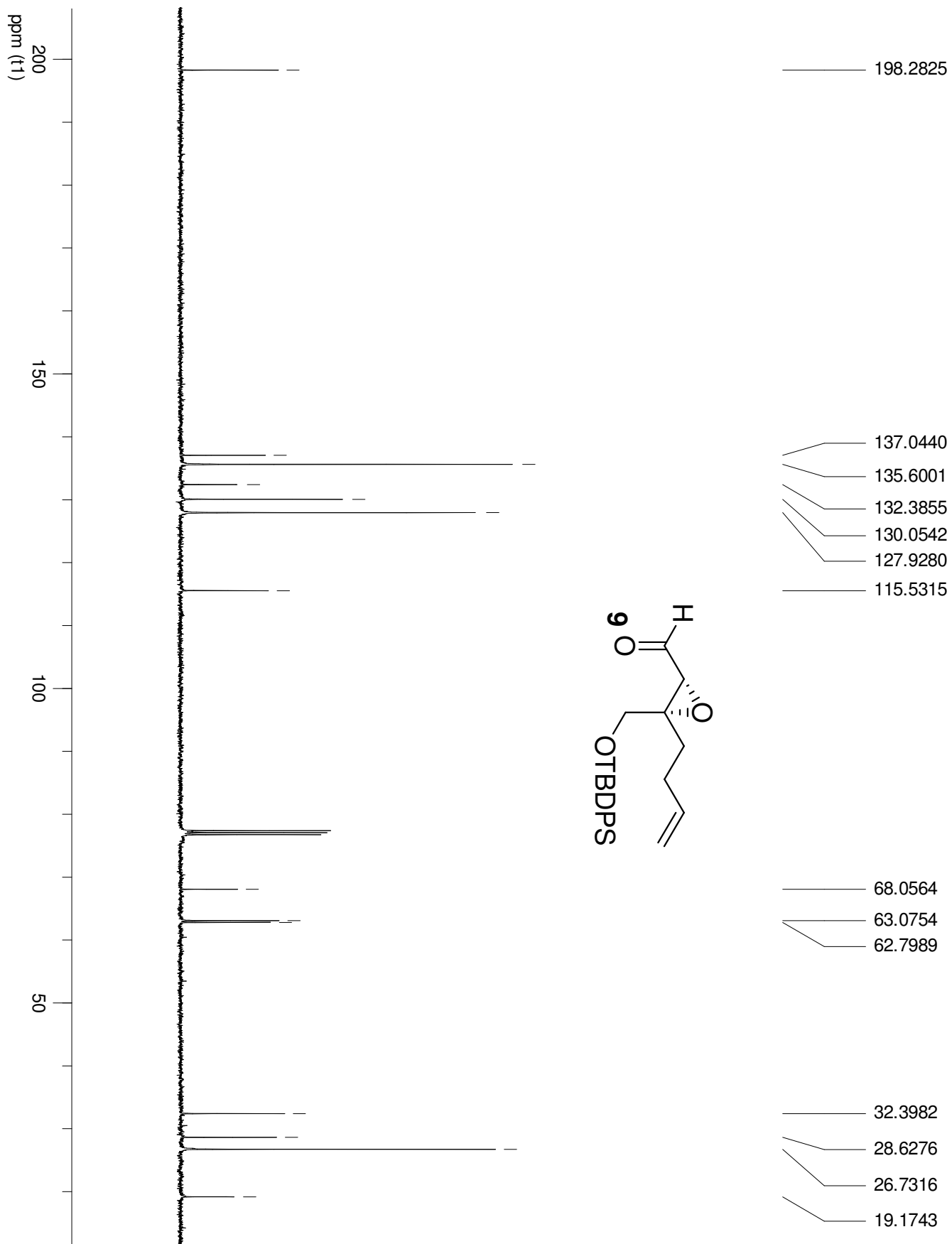
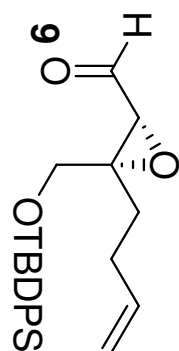


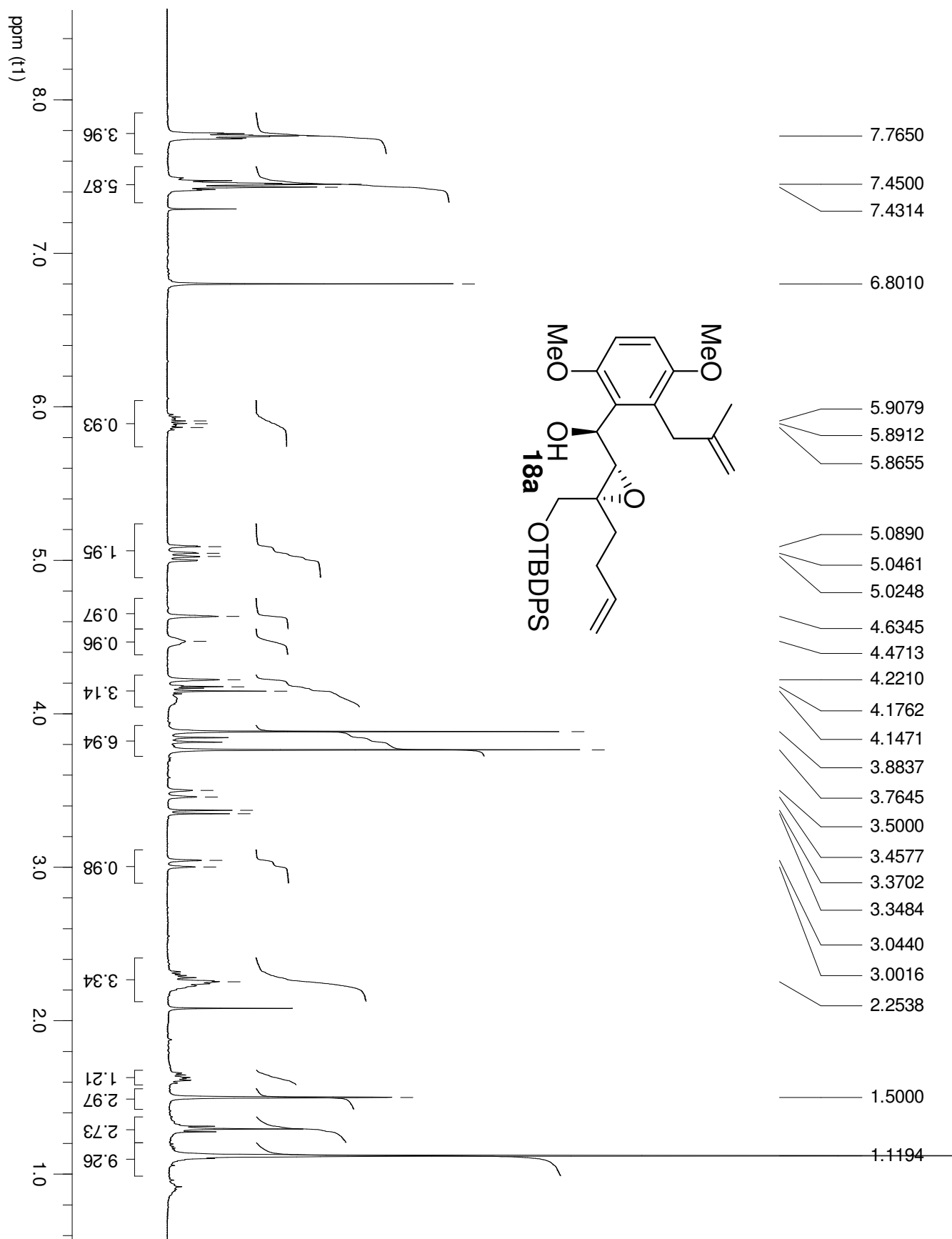


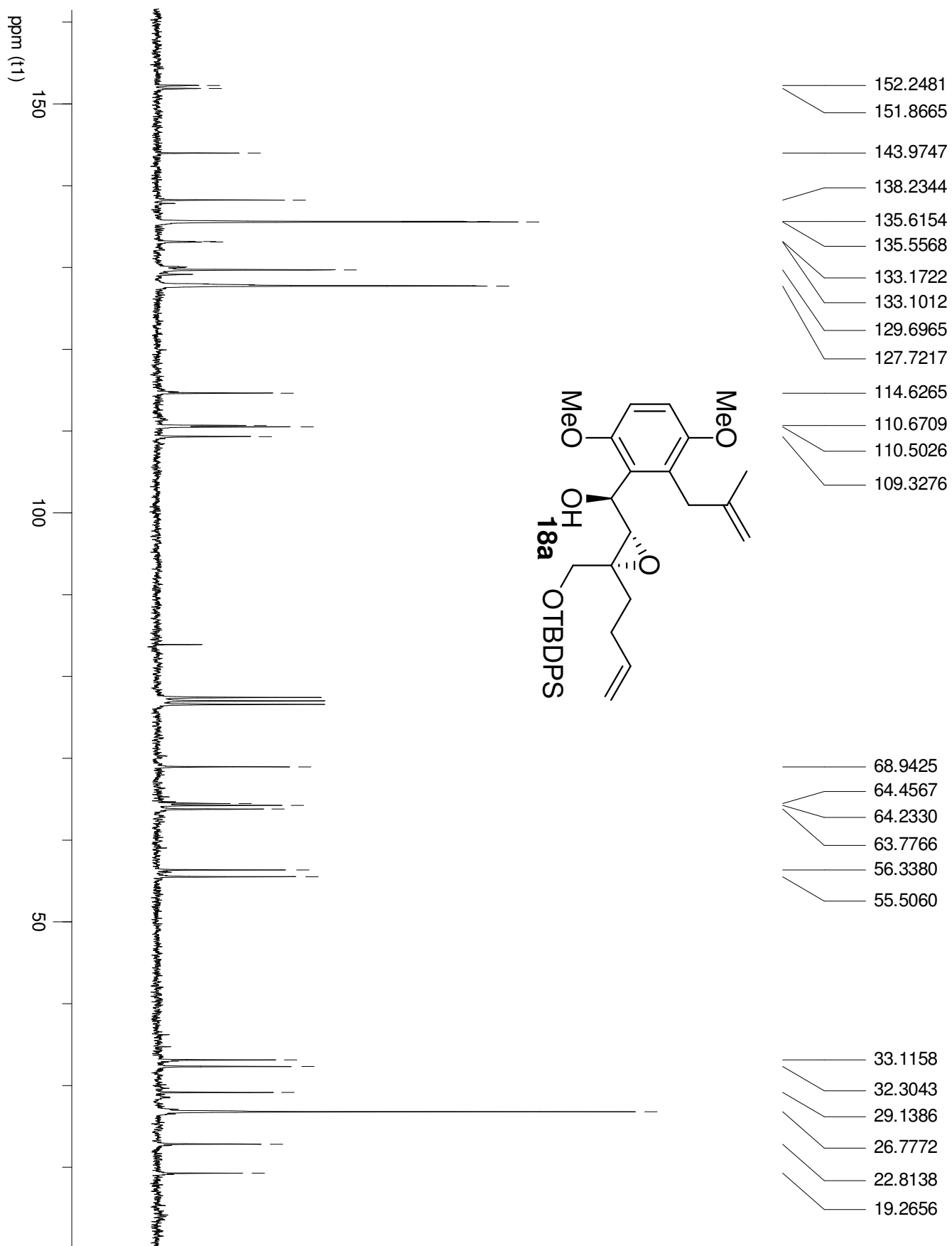


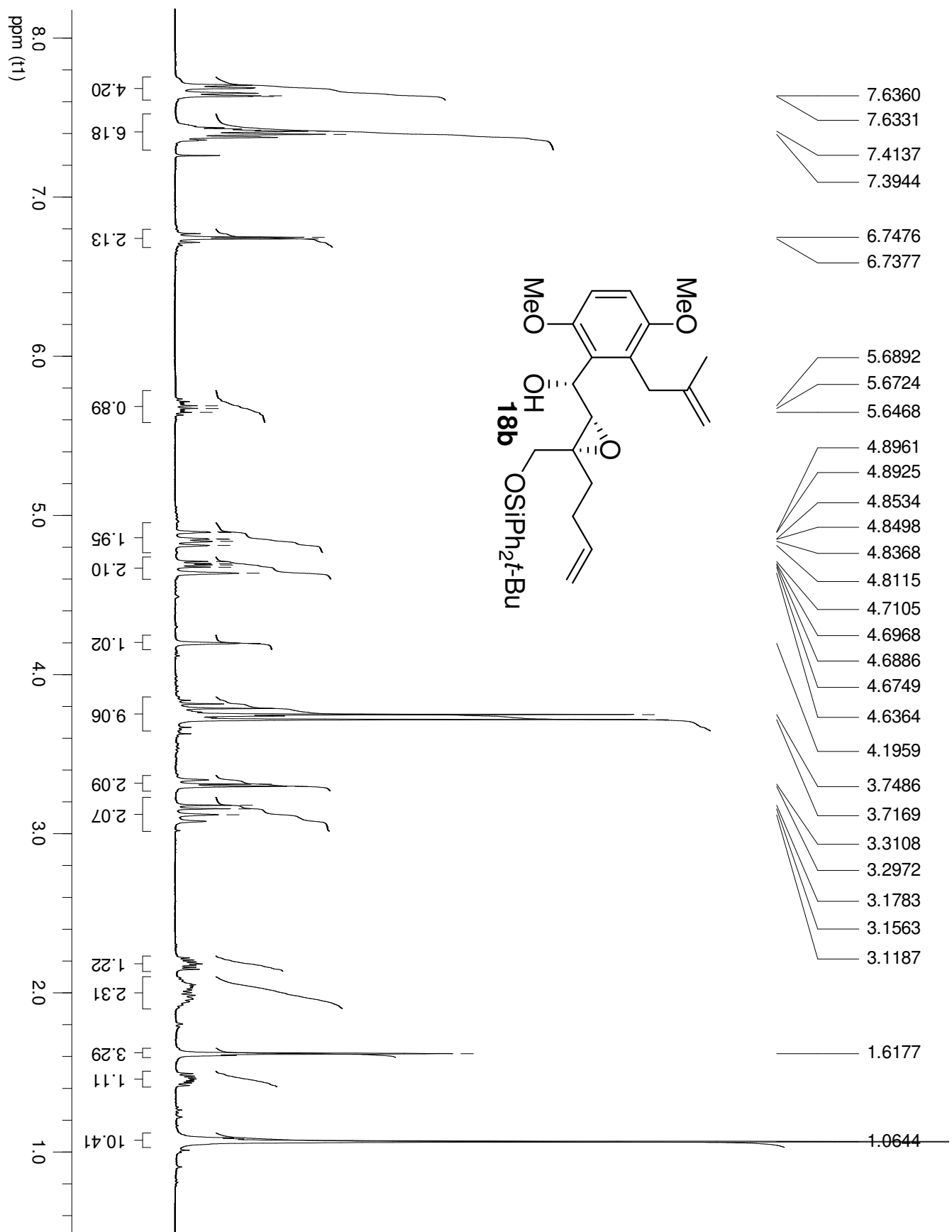


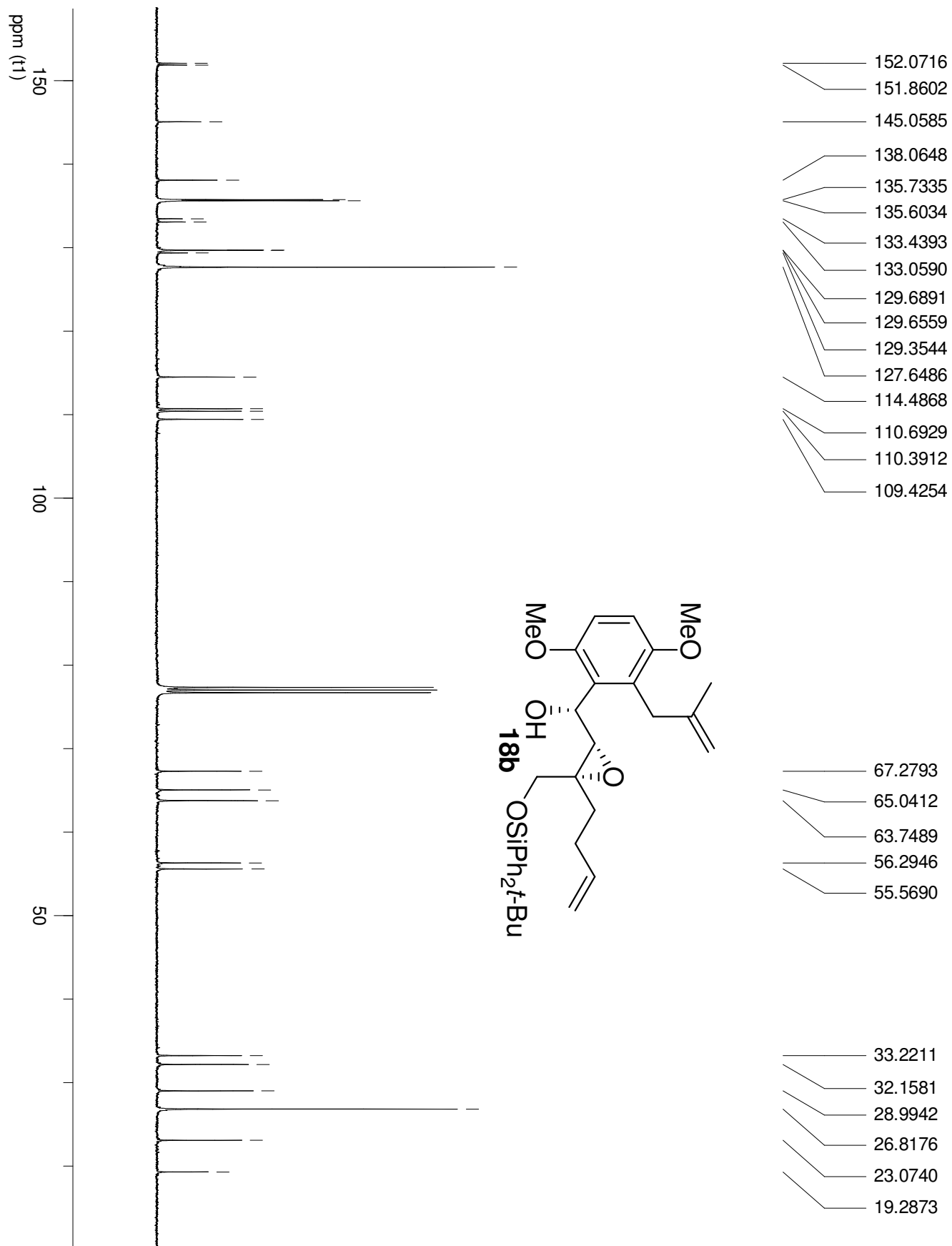


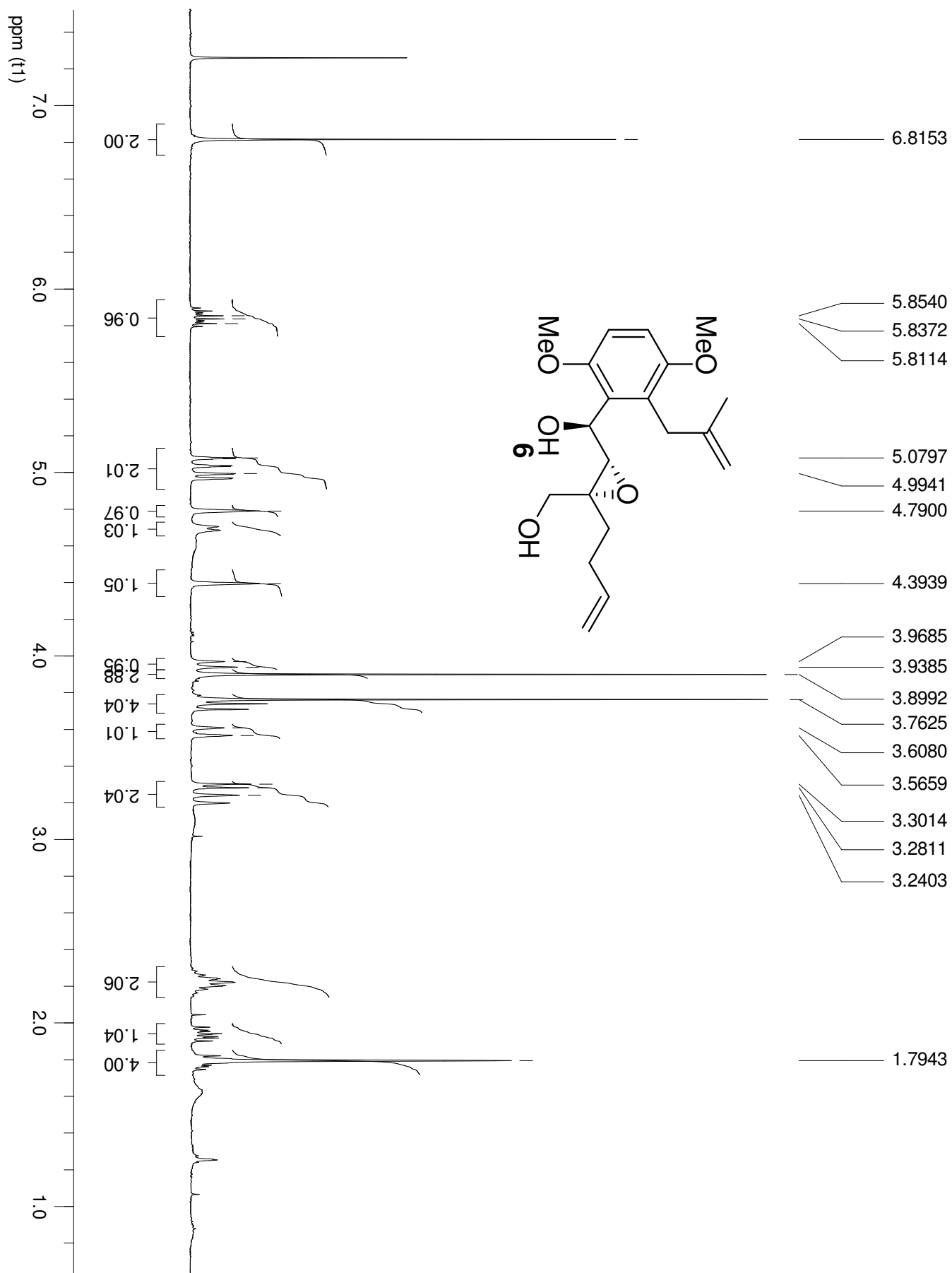


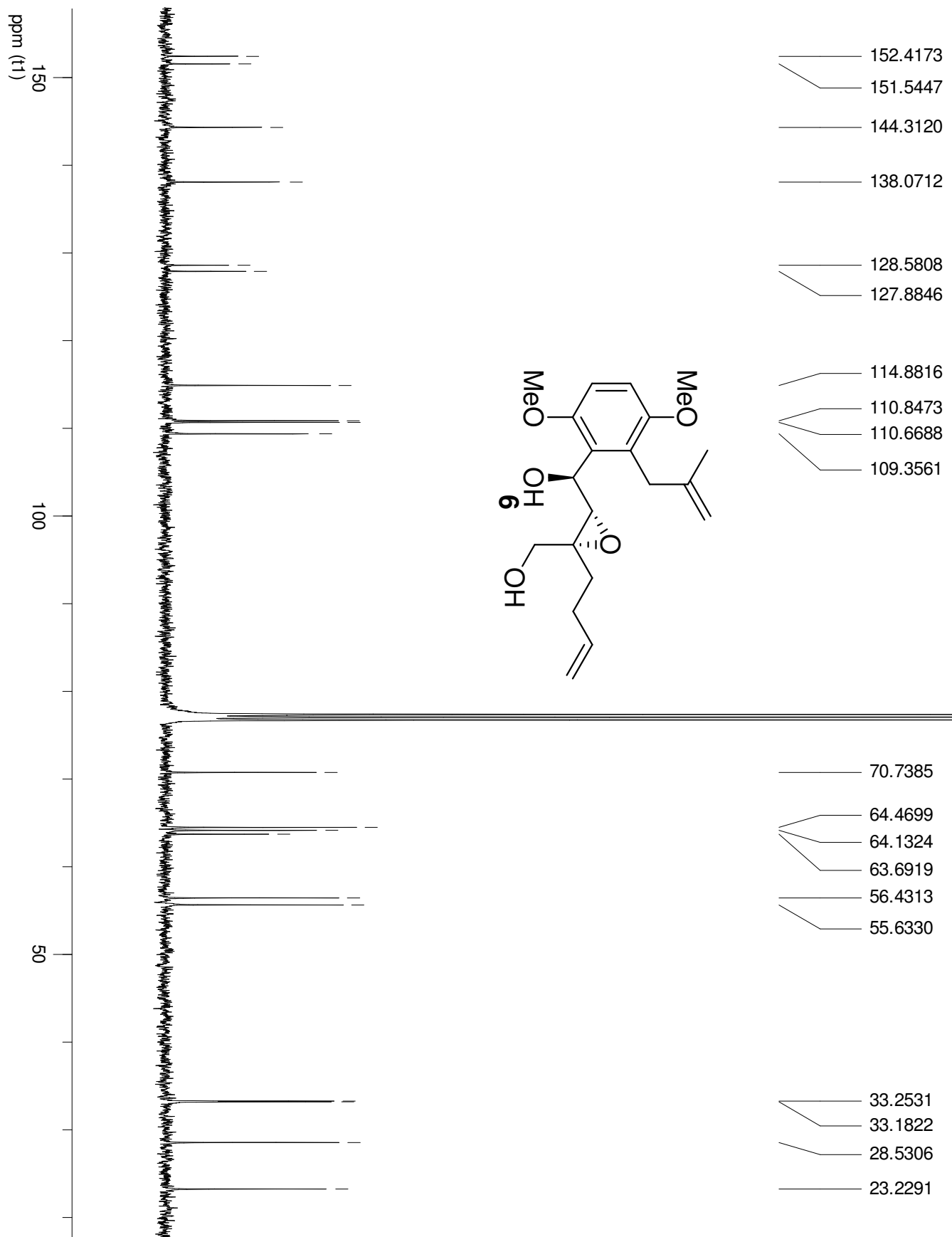




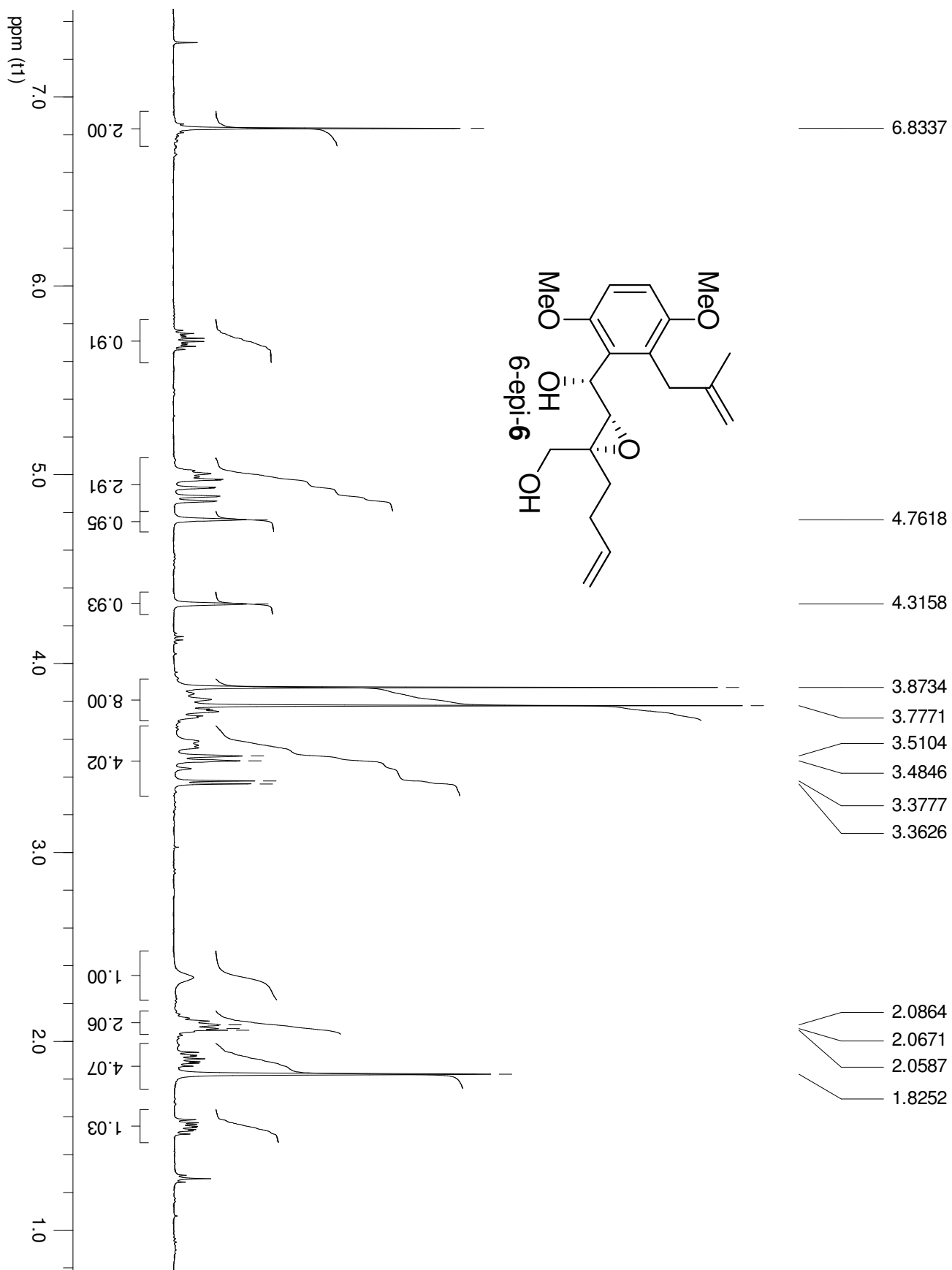


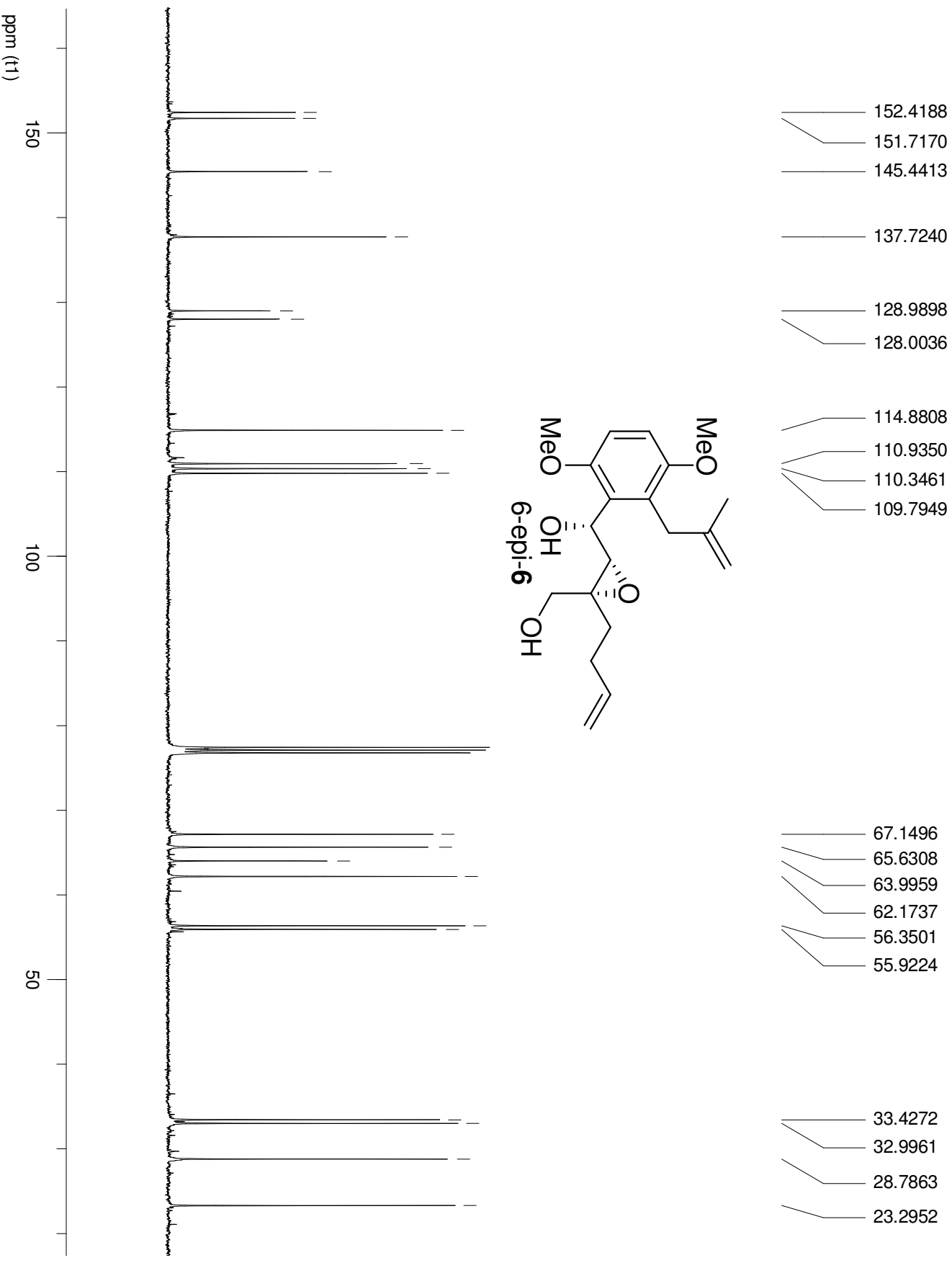


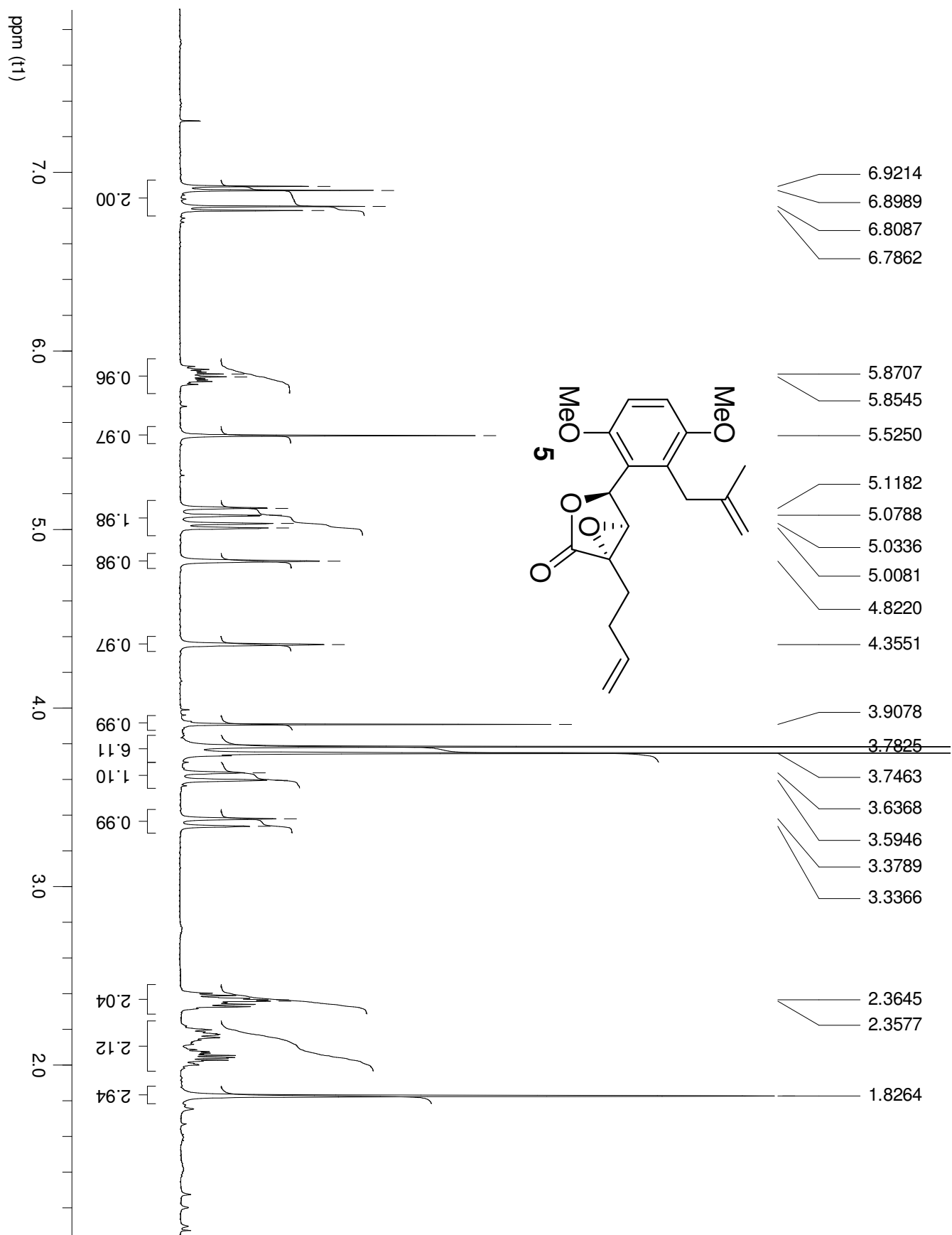


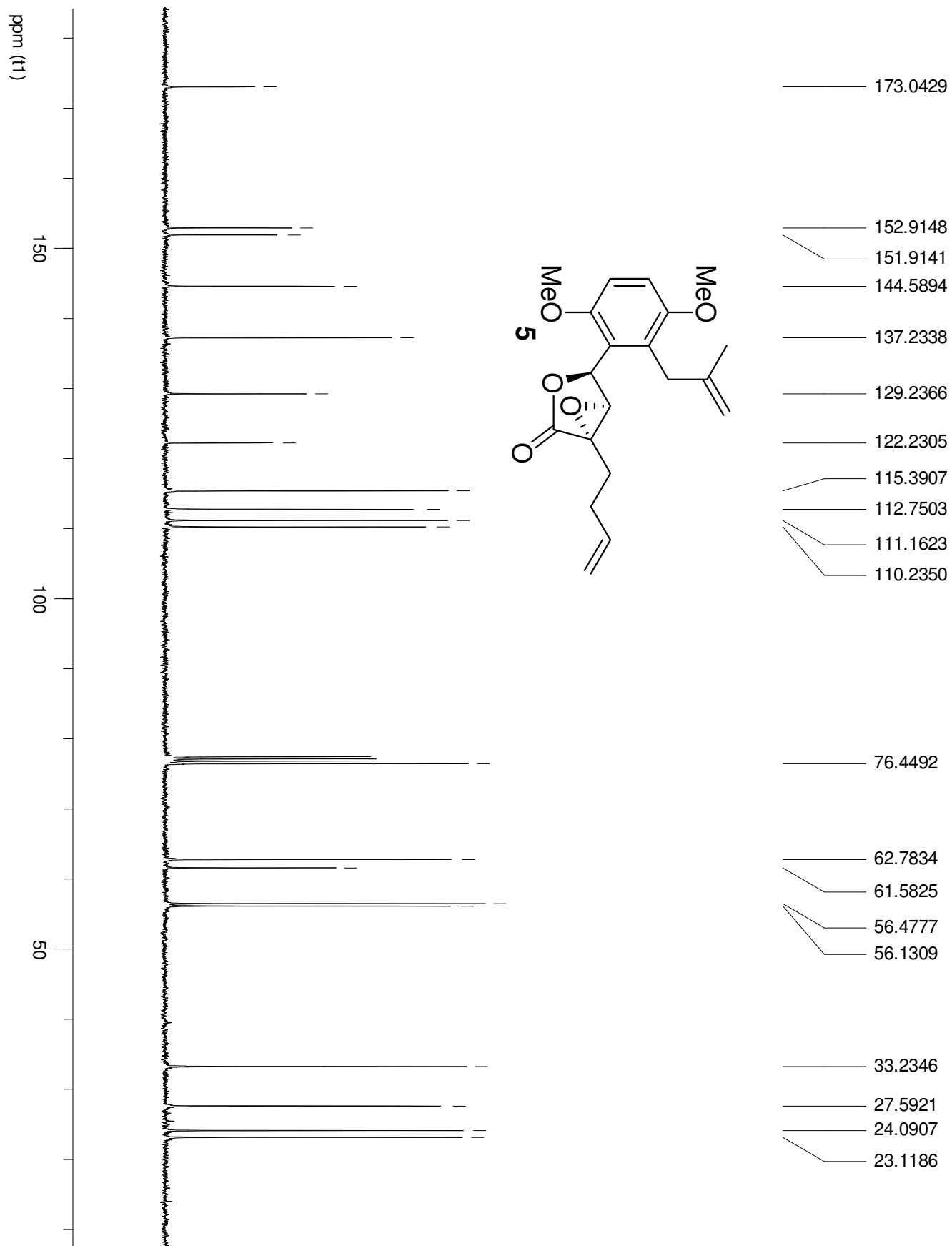


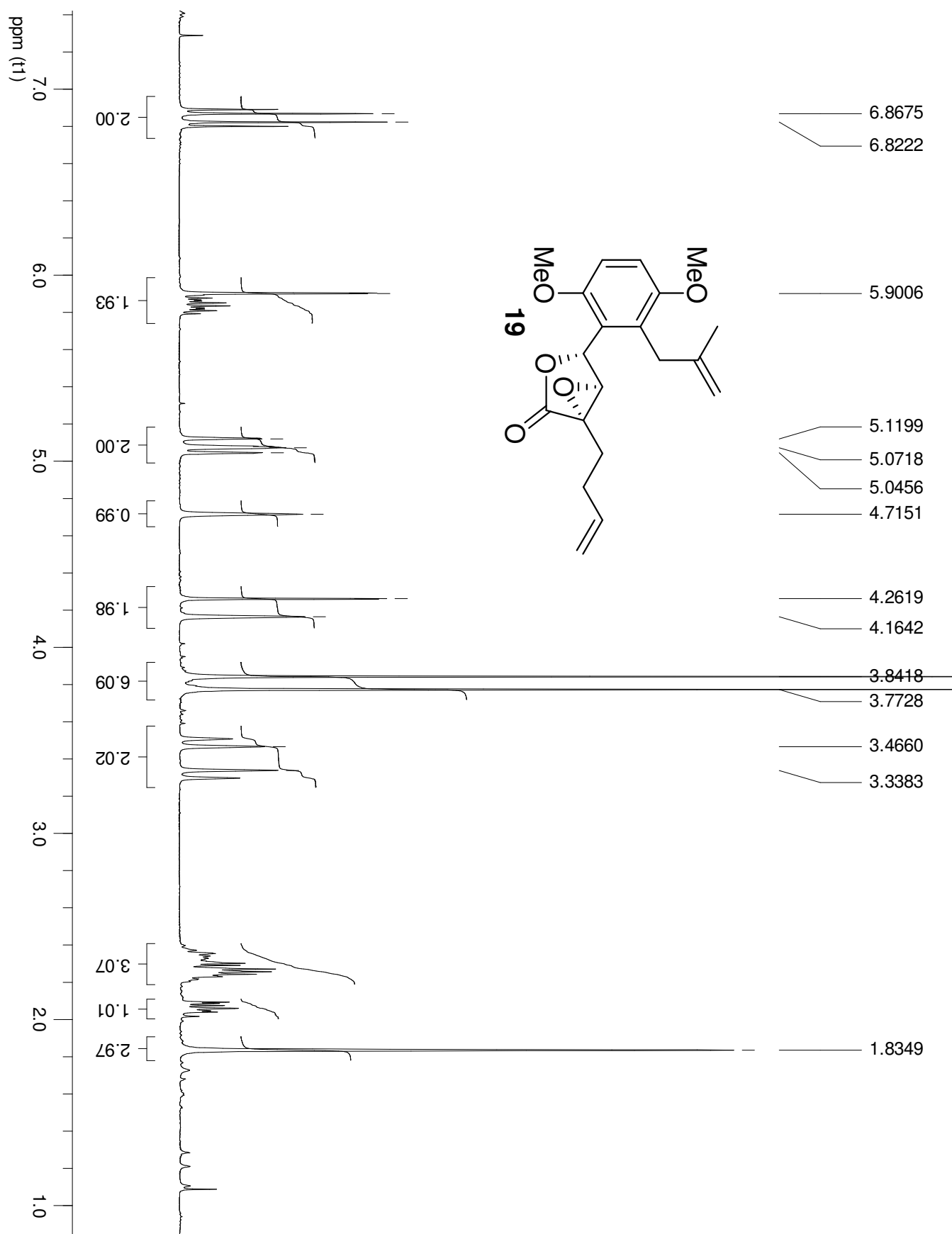


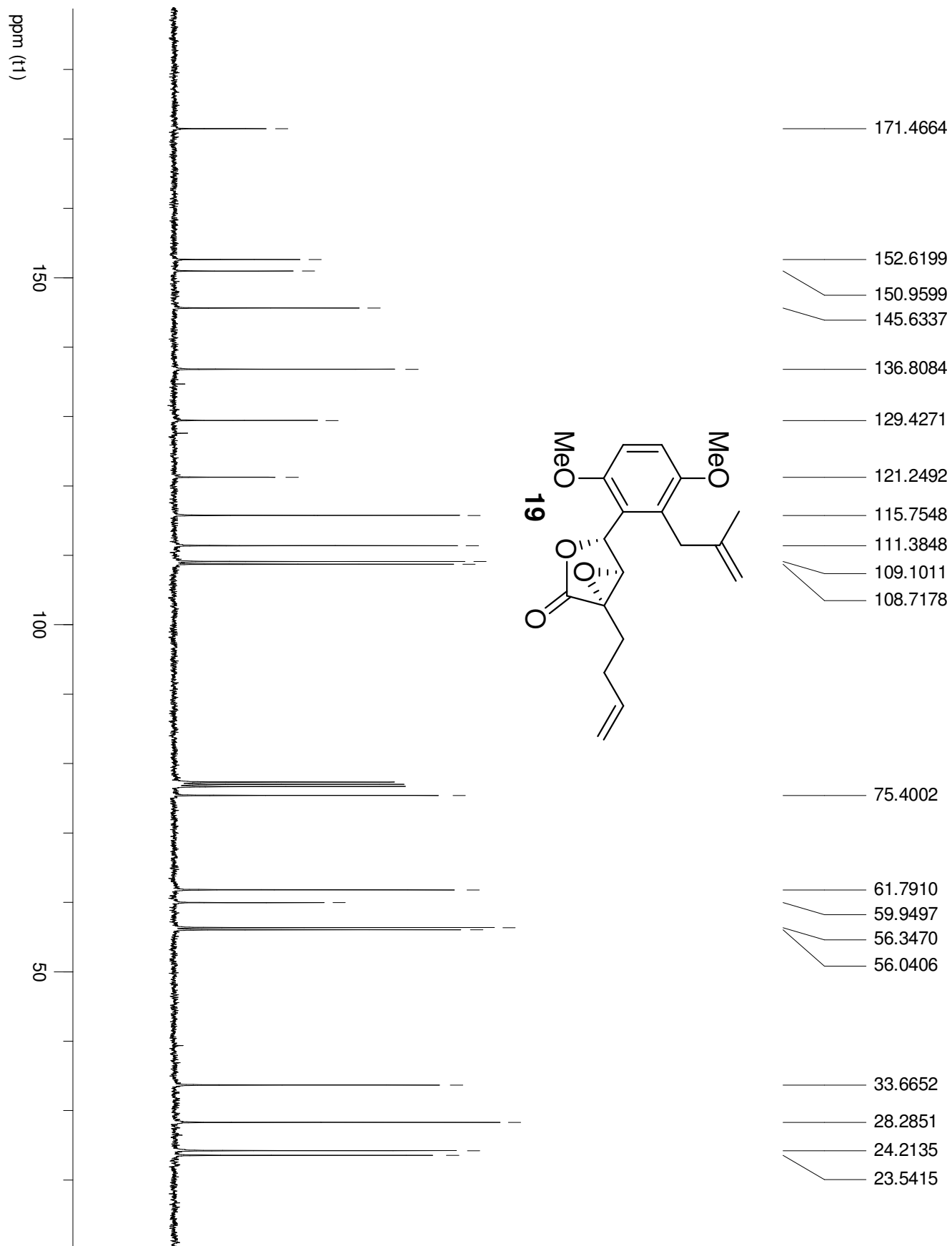


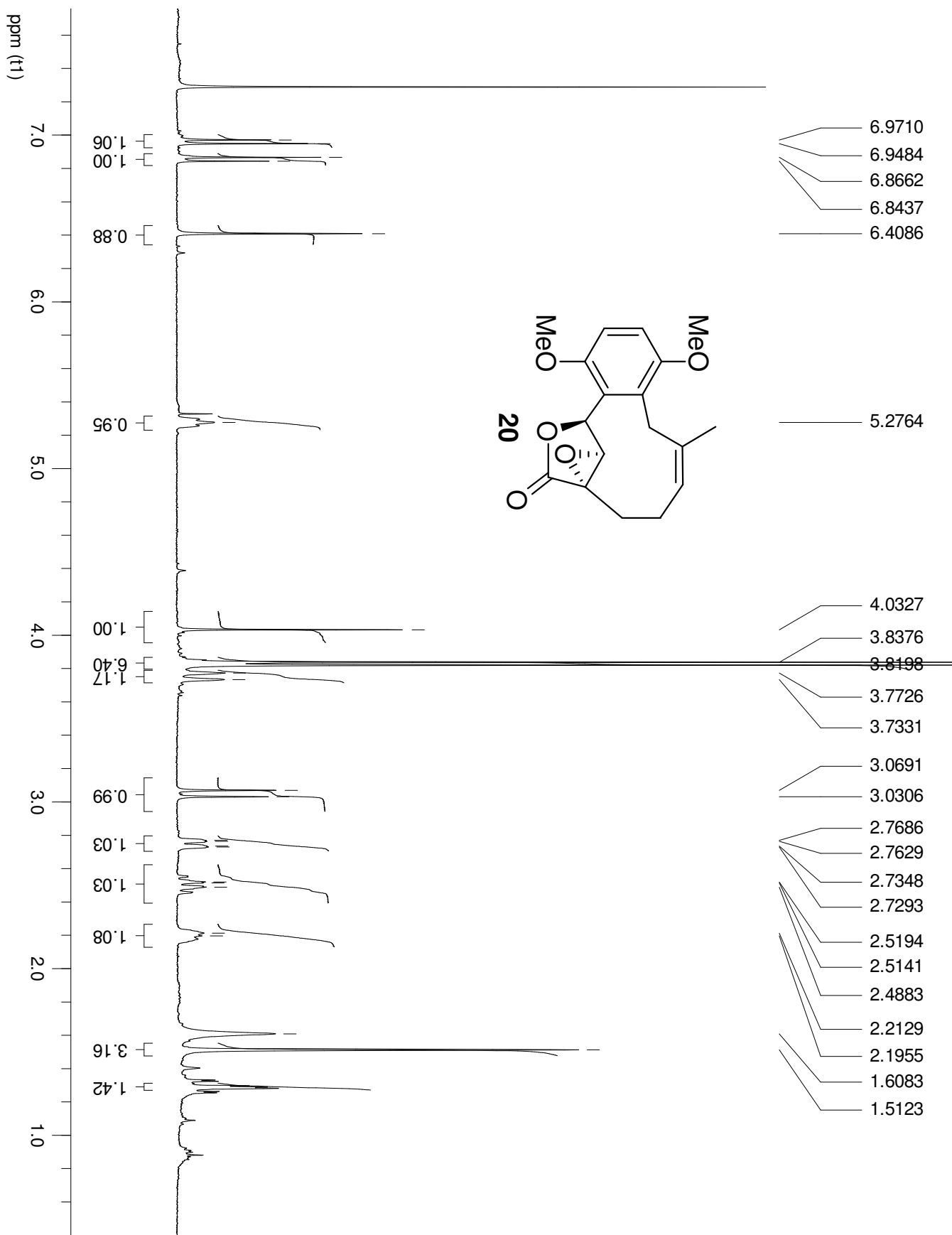


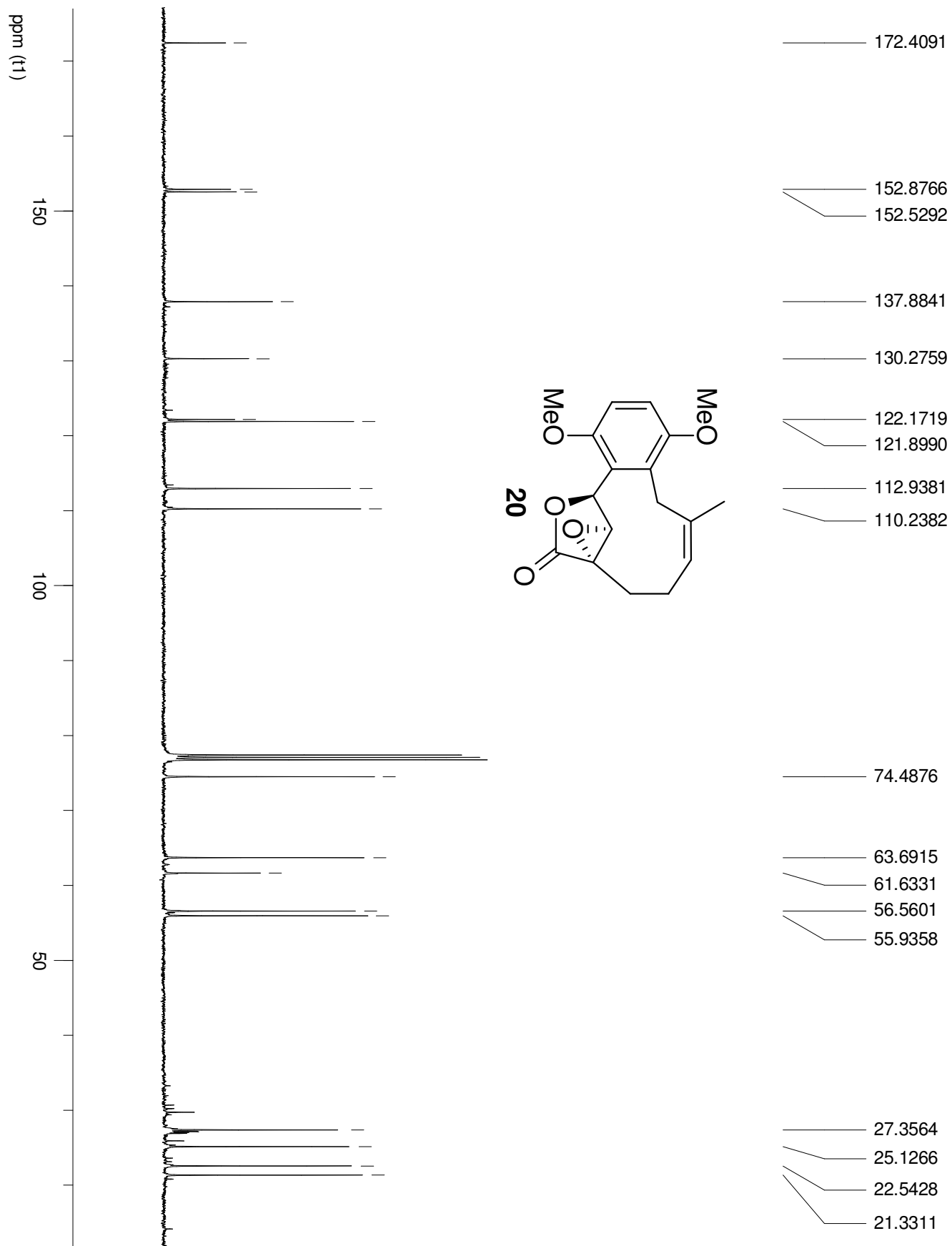




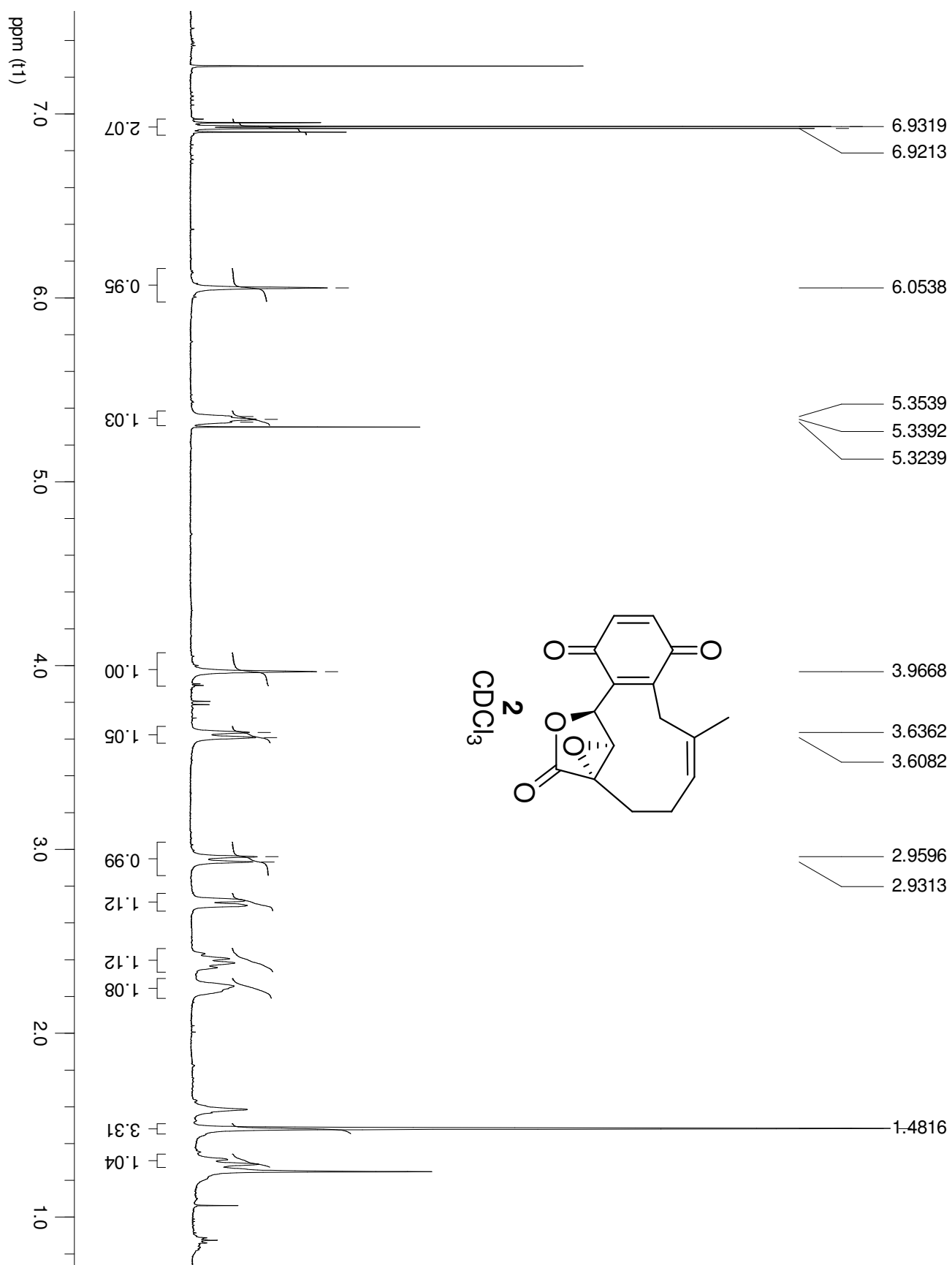


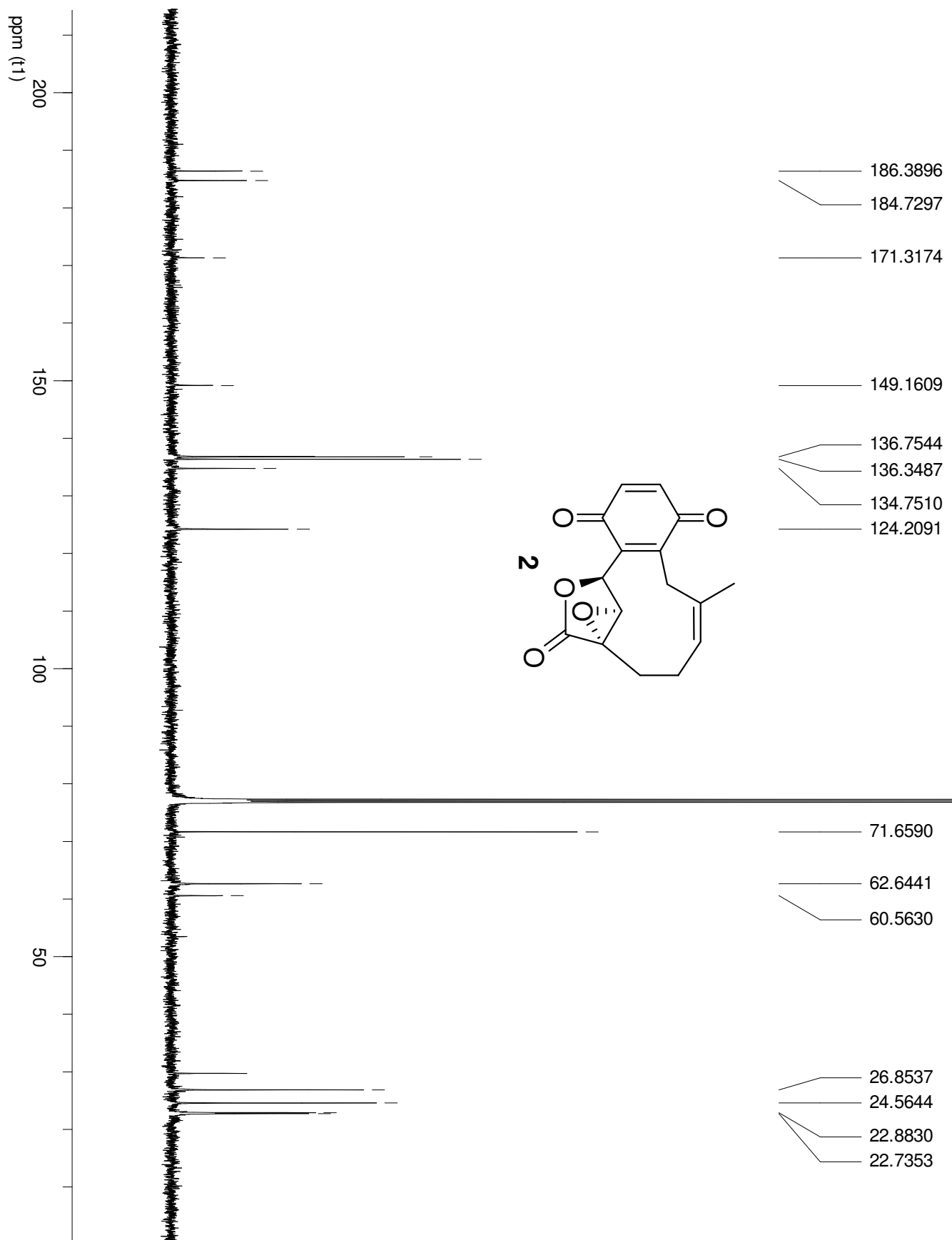


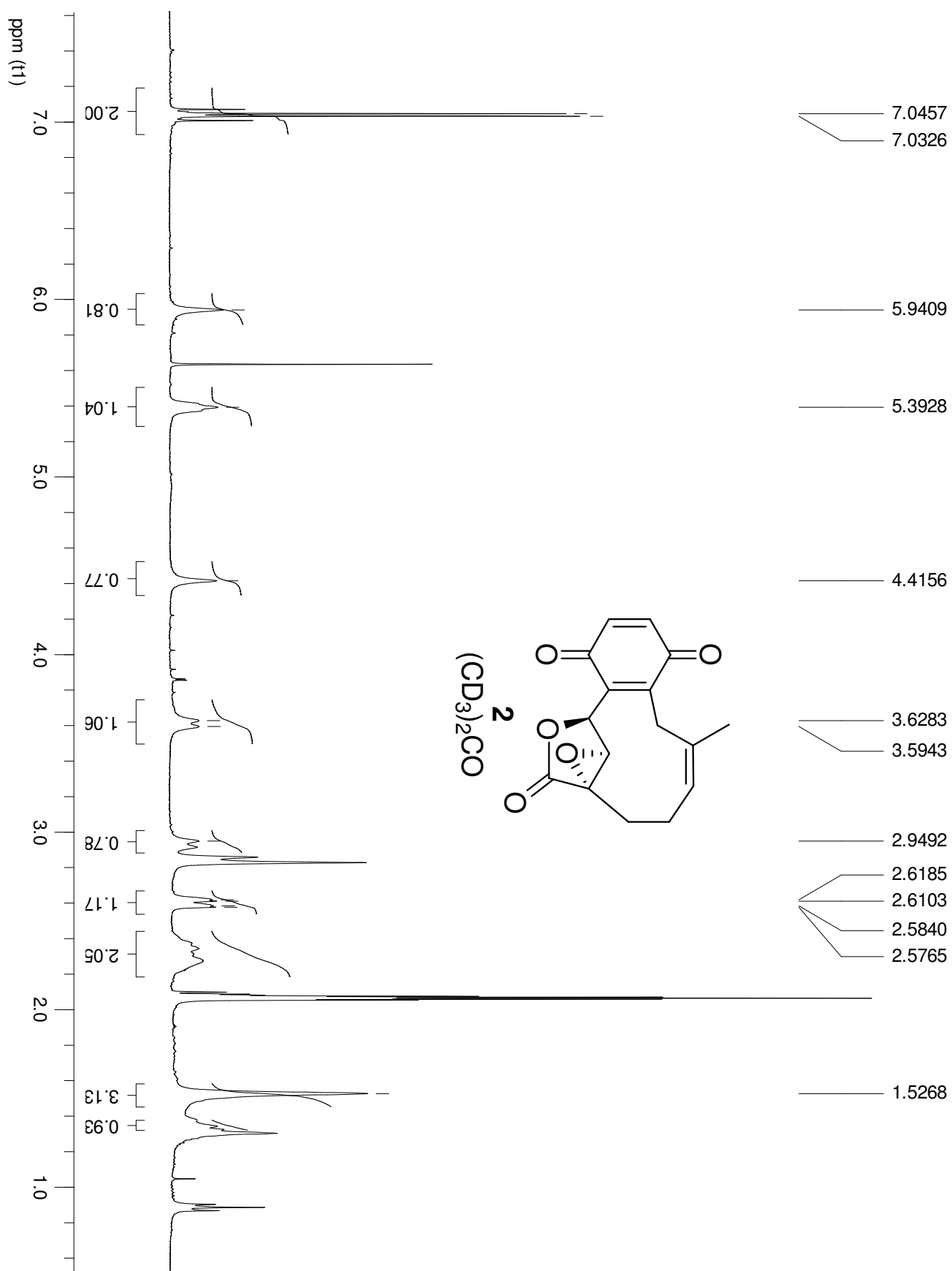














## 10. CRYSTAL AND DATA STRUCTURE.

*Crystal data for 18b:* C<sub>36</sub>H<sub>46</sub>O<sub>5</sub>Si,  $M = 586.82$ , triclinic,  $P\bar{1}$  (no. 2),  $a = 9.5415(18)$ ,  $b = 13.767(2)$ ,  $c = 14.084(4)$  Å,  $\alpha = 88.852(18)$ ,  $\beta = 72.68(2)$ ,  $\gamma = 72.912(15)^\circ$ ,  $V = 1683.6(6)$  Å<sup>3</sup>,  $Z = 2$ ,  $D_c = 1.158$  g cm<sup>-3</sup>,  $\mu(\text{Cu-K}\alpha) = 0.921$  mm<sup>-1</sup>,  $T = 173$  K, colourless blocky needles, Oxford Diffraction Xcalibur PX Ultra diffractometer; 6442 independent measured reflections,  $F^2$  refinement,  $R_1 = 0.045$ ,  $wR_2 = 0.113$ , 6291 independent observed absorption-corrected reflections [ $|F_o| > 4\sigma(|F_o|)$ ],  $2\theta_{\text{max}} = 142^\circ$ ], 386 parameters. CCDC 618906.

*Crystal data for 22:* C<sub>27</sub>H<sub>31</sub>NO<sub>8</sub>,  $M = 497.53$ , triclinic,  $P\bar{1}$  (no. 2),  $a = 10.976(2)$ ,  $b = 11.368(2)$ ,  $c = 11.4464(18)$  Å,  $\alpha = 90.079(14)$ ,  $\beta = 116.397(17)$ ,  $\gamma = 101.338(15)^\circ$ ,  $V = 1248.0(4)$  Å<sup>3</sup>,  $Z = 2$ ,  $D_c = 1.324$  g cm<sup>-3</sup>,  $\mu(\text{Mo-K}\alpha) = 0.098$  mm<sup>-1</sup>,  $T = 173$  K, pale yellow shards, Oxford Diffraction Xcalibur 3 diffractometer; 7850 independent measured reflections,  $F^2$  refinement,  $R_1 = 0.042$ ,  $wR_2 = 0.112$ , 5981 independent observed absorption-corrected reflections [ $|F_o| > 4\sigma(|F_o|)$ ],  $2\theta_{\text{max}} = 64^\circ$ ], 330 parameters. CCDC 618907.

**Fig. S1** The molecular structure of **18b**.

**Fig. S2** The molecular structure of **18b** (50% probability ellipsoids).

**Fig. S3** The molecular structure of **22**.

**Fig. S4** The molecular structure of **22** (50% probability ellipsoids).

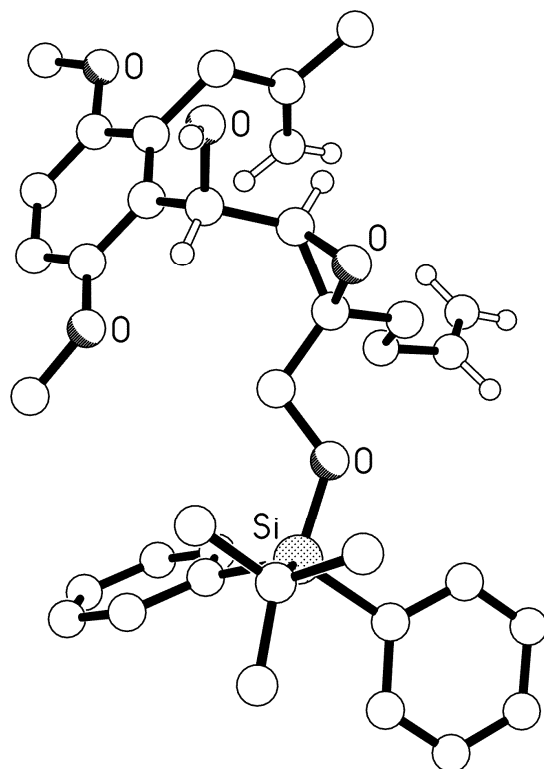


Fig. S1

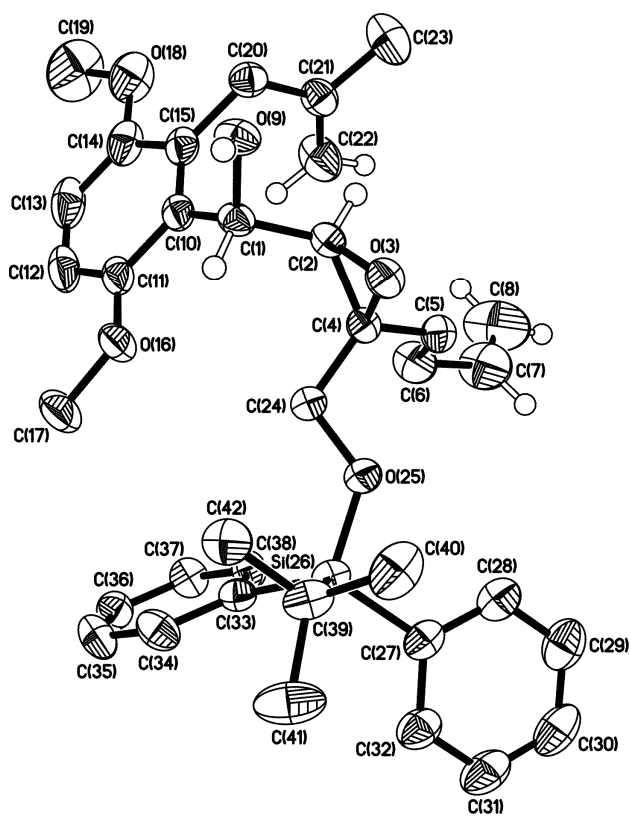


Fig. S2

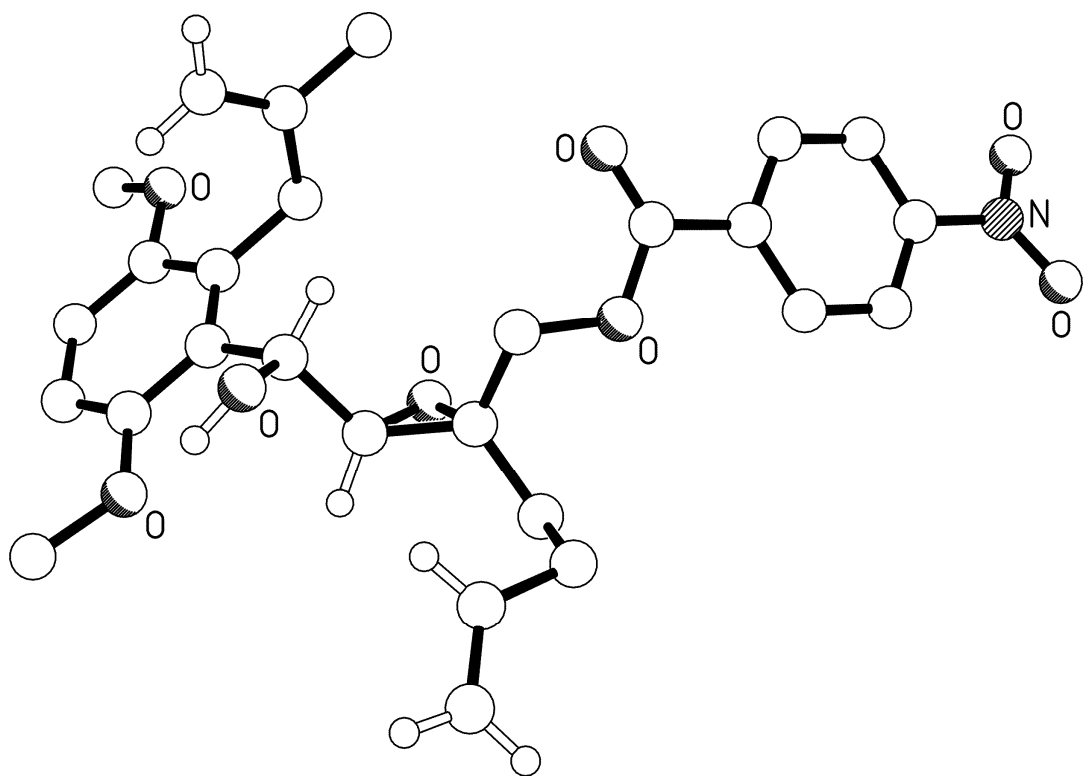


Fig. S3

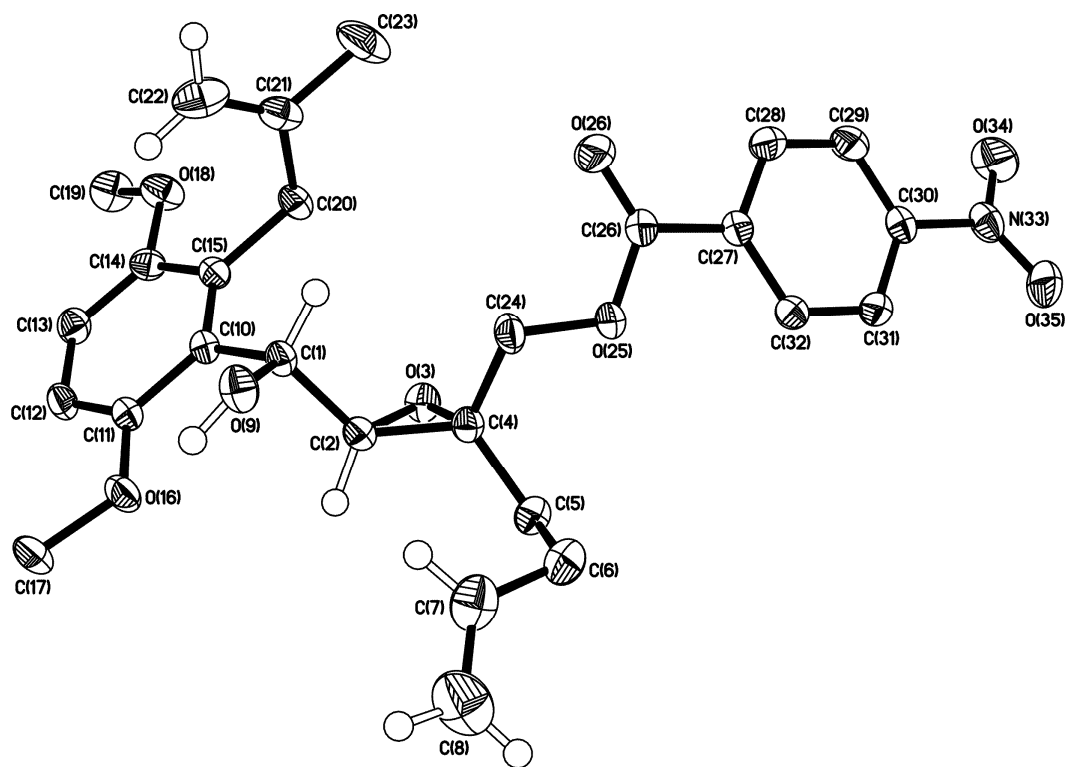


Fig. S4

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<sup>1</sup> Bekele, T; Brunette, S. R.; Lipton, M. A. *J. Org. Chem.* **2003**, 68, 8471.

<sup>2</sup> Arnone, A.; Cardillo, R.; Meille, S.V; Nasini, G.; Tollazi, M. *J. Chem. Soc., Perkin Trans. I* **1994**, 2165.