Total Synthesis, Biological Evaluation and Biosynthetic Re-Evaluation of *Illicium*-Derived Neolignans

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Supporting Information

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General Information

Reagents and Solvents

All compounds were stored sealed in a freezer at -20 °C. Unless otherwise noted, all reactions were carried out under an atmosphere of argon in conventional glassware. Glassware used in the presence of moisture sensitive reagents or reactions that required anhydrous conditions was dried in the oven (125 °C) for >16 hours and/or was flame-dried under vacuum and cooled under a stream of argon. Cooling to 0 °C was effected using an ice-water bath. Cooling to -18 to -20 °C was effected using an ice-salt bath (3:1 w/w respectively). For cooling at -20 °C for extended periods (>5 hours), samples were put in a freezer set to -20 °C. Temperatures below -20 °C was effected using dry-ice-acetone mixtures. All water was deionised before use. The term petroleum ether refers to the fraction with boiling point between 40 and 60 °C. When noted, distilled pentane and distilled Et_2O were collected using non-dried glassware. As BHT was removed, the distilled Et_2O was used within 2 months before being re-distilled. Commercially available solvents and reagents were used as supplied with the following exceptions. Dry THF, dry CH_2Cl_2 and dry DMF were collected from a solvent tower, where a degassed solvent was passed through two columns of activated alumina and a 7 micron filter under a 4 bar pressure, and stored under an argon atmosphere over sodium wire (THF) or activated 4 Å molecular sieves (CH_2Cl_2 and DMF). Commercially available 4-allylanisole was purified by flash column chromatography (petroleum ether/EtOAc, 9:1). TMEDA was distilled over sodium wire and was stored under argon. All butyllithium solutions were titrated with *N*-benzylbenzamide when beyond a month of the previous recorded titration. Trimethyl borate was distilled over sodium wire and was stored under argon. 'Room temperature' can vary between 18 °C and 25 °C.

Analysis and Characterisation

Analytical Thin Layer Chromatography (TLC) was performed on Merck aluminium-backed silica gel 60 F254 plates (product code: 105554.) Developed TLC plates were visualized by ultraviolet (UV) irradiation (254 nm) or by staining with a solution of potassium permanganate.

Column chromatography was carried out according using Fluorochem silica gel 60 Å, 40–63 mesh (product code = LC401).

Melting points were measured using a Stuart SMP3 (Sigma Aldrich product Z645729.)

Fourier Transform Infrared Spectrometry (FTIR) was carried out using a Bruker Tensor 27 using an Attenuated Total Reflection (ATR) attachment; species were loaded as either solids or as thin-layer films and peaks are reported in terms of frequency of absorption (cm^{-1}).

High Resolution Mass Spectrometry (HRMS) were acquired using a Bruker microTOF II with Electron Spray Ionization (ESI-TOF). HRMS data were quoted to four decimal places (0.1 mDa). The spectrometer was programmed to find the masses of species using only the following isotopes: ^{11}B, ^{79}Br, ^{35}Cl and ^{120}Sn. Masses of the species with isotopes (that are >10% abundant) ^{10}B, ^{81}Br, ^{37}Cl, ^{116}Sn and ^{118}Sn were in all cases observed by HRMS but have not been reported.

Liquid chromatography-mass spectrometry (LC-MS) analyses were performed using an Agilent 1260 Infinity HPLC with a 6120 Quadrupole mass spectrometer. Chromatography conditions: Waters XBridge C18 3.5µm 2.1 x 30 mm column. Mobile phase A: 0.1% Ammonia in water, mobile phase B: acetonitrile. Flow rate 0.8 mL/min in a gradient of 5 – 95 % mobile phase B over 3.5 minutes at 40 °C with UV detection at 210 – 400 nm reported at 254nm.

Preparative TLC was performed on Preparative TLC Plates, Analtech (VWR catalogue: 800086-350) (Supplier Miles Scientific Corp).

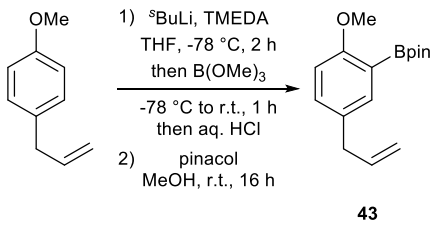
X–ray diffraction data were collected at 120 K on an Agilent SuperNova diffractometer using CuKa radiation.

All NMR spectra were recorded at 298 K on either a Bruker AV 400, Bruker AV 3400 or Bruker Ascent 500 and are internally referenced to residual solvent signals (CDCl3 is referenced at δ 7.26 and 77.16 for ^{1}H and ^{13}C NMR respectively, DMSO-d6 is referenced at δ 2.50 and 39.52 for ^{1}H and ^{13}C NMR respectively, C_6D_6 is referenced at δ 3.31 and 49.00 for ^{1}H and ^{13}C NMR respectively, acetone-d_6 is referenced at δ 2.05 and 29.84 for ^{1}H and ^{13}C NMR

respectively, toluene-d_8 is referenced at δ 2.09 and 20.4 for ^{1}H and ^{13}C NMR respectively). ^{19}F NMR spectra and ^{11}B NMR spectra were referenced through the solvent lock (2H) signal according to IUPAC-recommended secondary referencing method according to Bruker protocols. All NMR chemical shifts (δ) were reported in parts per million (ppm) and coupling constants (J) are given in Hertz (Hz). The ^{1}H NMR spectra are reported as follows: δ (multiplicity, coupling constant *J*, number of protons). The ^{13}C NMR coupling constants (*J*) are quoted to the nearest 0.1 Hz. ^{13}C NMR assignments were made using the DEPT sequence with secondary pulses at 90° and 135° and assignments were aided by 2D NMR spectroscopy techniques (COSY, HSQC, and HMBC (and by NOESY when required)). Numbering of atoms of compounds in the experimental is for the purpose of characterization and does not follow IUPAC numbering.

Experimental Procedures

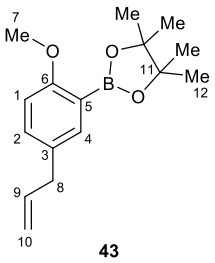
43: 2-(5-Allyl-2-methoxyphenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane.



43

To anhydrous THF (170 mL) under argon at –78 °C was added ^{s}BuLi (60.0 mL, 70.9 mmol of a 1.18 M solution in hexanes) and TMEDA (10.6 mL, 70.9 mmol). The yellow solution was stirred for 30 minutes and then a solution of 4-allylanisole (9.06 mL, 59.1 mmol) in dry THF (13.0 mL) was added over 15 minutes. After 4 hours at –78 °C, trimethyl borate (13.2 mL, 118 mmol) was added and the solution became colourless. The reaction mixture was allowed to warm to room temperature over 1 hour. To the reaction mixture was added HCl (250 mL of a 0.1 M aqueous solution) and the organics were extracted with Et_2O (3 x 50 mL). The organics were combined, dried over $MgSO_4$, filtered, and concentrated *in vacuo* which gave a colourless crude oil which was dissolved in MeOH (183 mL) and pinacol (20.9 g, 177 mmol) was added. The reaction mixture was stirred at room temperature for 16 hours and was then concentrated *in vacuo*. The organics were dissolved in Et_2O (100 mL) and were washed with H_2O (3 x 50 mL), then dried over $MgSO_4$, filtered, and

concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/EtOAc, 37:3) afforded boronic acid pinacol ester **43** as a colourless oil (8.97 g, 55%).



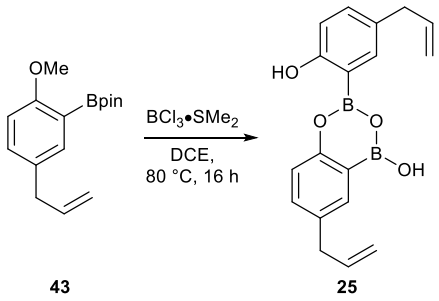
43

43: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.48 (d, *J* = 2.4 Hz, 1H, H-4), 7.21 (dd, *J* = 8.4, 2.4 Hz, 1H, H-2), 6.80 (d, *J* = 8.4 Hz, 1H, H-1), 5.95 (ddt, *J* = 16.8, 10.1, 6.7 Hz, 1H, H-9), 5.09 – 5.00 (m, 2H, H-10), 3.81 (s, 3H, H-7), 3.33 (d, *J* = 6.7 Hz, 2H, H-8), 1.35 (s, 12H, H-12); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 162.9 (Cq), 138.1 (CH), 136.8 (CH), 132.6 (CH), 131.6 (Cq), 115.5 (Cq), 110.8 (Cq), 83.6 (2x Cq), 56.1 (CH_3), 39.4 (CH_2), 25.0 (4x CH_3); **^{11}B NMR** (128 MHz, $CDCl_3$) δ: 31.0; **HRMS** (ESI^+): $C_{16}H_{23}{}^{11}BO_3$ $[M+H]^+$ calcd. 275.1813, found 275.1813; **IR** $\tilde{\nu}_{max}$ cm^{-1}: 3076, 2977, 2933, 2904, 2833, 1639, 1605, 1582, 1493, 1346, 1143, 1030.

Spectroscopic data obtained for **43** were consistent with those previously reported.[1]

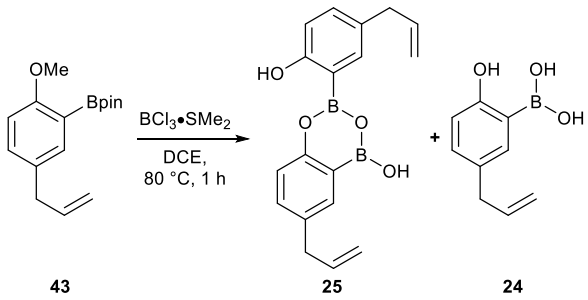
^{13}C NMR: C-5 signal was not observed due to quadrupolar relaxation.

24: (5-Allyl-2-hydroxyphenyl)boronic acid and **25:** Boronic acid dimer.



43 **25**

To a solution of boronic acid pinacol ester **43** (8.37 g, 30.5 mmol) in DCE (122 mL) was added BCl_3•SMe_2 (13.7 g, 76.3 mmol). The reaction mixture was heated at 80 °C for 16 hours. The reaction mixture was cooled to 0 °C and to the reaction mixture was added HCl (100 mL of a 1.0 M aqueous solution). The organics were extracted with EtOAc (3 x 70 mL) and the combined organics were washed with brine (70 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo* which gave a crude grey solid. Subsequent trituration with pentane gave boronic acid **25** as an off-white solid (4.14 g, 85%) **m.p.** 149–152 °C.

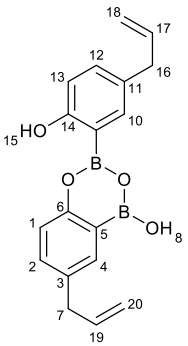


43 25 24

To a solution of boronic acid pinacol ester **43** (5.04 g, 18.4 mmol) in DCE (92.0 mL) was added BCl_3•SMe_2 (9.88 g, 55.2 mmol). The reaction mixture was heated at 80 °C for 1.2 hours. The reaction mixture was cooled to 0 °C and to the reaction mixture was added H_2O (70 mL). The organics were extracted with EtOAc (4 x 80 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo* which gave a crude grey solid. The solid was triturated with pentane and the solid was collected and dried under suction filtration which gave a 3:1 respective mixture (calculated by ^{1}H NMR spectroscopy) of boronic acid dimer **25** and boronic acid monomer **24** (2.52 g, 84%).

From a different experiment using the same procedure described (heated for 1.2 hours at 80 °C), a solid was analysed and was found to be a 3:1 respective mixture of boronic acid monomer **24** and boronic acid dimer **25** of which ^{1}H NMR spectroscopic data for **24** was obtained.

A crystal of boronic acid dimer **25** was grown by vapour diffusion method from distilled pentane/distilled Et_2O.

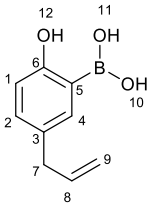


25

25: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 8.14 (s, 1H, ArOH), 7.71 (d, *J* = 2.4 Hz, 1H, H-4 or H-10), 7.63 (d, *J* = 2.3 Hz, 1H, H-4 or H-10), 7.42 (dd, *J* = 8.4, 2.3 Hz, 1H, H-2 or H-12), 7.27 (dd, *J* = 8.4, 2.4 Hz, 1H, H-2 or H-12), 7.19 (d, *J* = 8.4 Hz, 1H, H-1 or H-13), 6.89 (d, *J* = 8.4 Hz, 1H, H-1 or H-13), 6.05 – 5.91 (m, 2H, H-17 and H-19), 5.21 (s, 1H, B-OH), 5.16 – 5.02 (m, 4H, H-18 and H-20), 3.43 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H, H-7 or H-16), 3.37 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H, H-7 or H-16); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 162.8 (Cq), 158.4 (Cq), 138.1 (CH), 137.3 (CH), 136.0 (CH), 135.6 (Cq), 135.2 (CH), 135.1 (CH), 133.3 (CH), 131.2 (Cq), 117.9 (CH), 116.3 (CH_2), 116.3 (CH), 115.7 (CH_2), 39.6 (CH_2), 39.5 (CH_2); **^{11}B NMR** (128

MHz, $CDCl_3$) δ: 28.7; **HRMS** (ESI^-): $C_{18}H_{18}{}^{11}B_2O_4$ $[M-H]^-$ calcd. 319.1318, found 319.1336; **IR** V_{max} cm^{-1}: 3351, 3215, 3080, 3030, 3002, 2977, 2904, 1638, 1333, 1223.

^{13}C NMR: C-5 and C-9 signals were not observed due to quadrupolar relaxation.



24

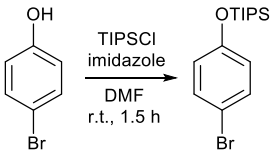
24: ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.54 (d, *J* = 2.4 Hz, 1H, H-4), 7.33 (dd, *J* = 8.3, 2.4 Hz, 1H, H-2), 7.00 (d, *J* = 8.3 Hz, 1H, H-1), 6.01 – 5.92 (m, 1H, H-8), 5.12 – 5.03 (m, 2H, H-9), 4.69 (s, 1H, OH-10 or OH-11 or OH-12), 4.04 (s, 1H, OH-10 or OH-11 or OH-12), 3.38 (ddd, *J* = 7.3, 1.4, 1.4 Hz, 2H, H-7), 1.34 – 1.27 (m, 1H, OH-10 or OH-11 or OH-12).

The sample that was a 3:1 respective mixture of **25** and **24** had dehydrated rapidly upon storage 1:3 respective mixture of **25** and **24** which prevented the collection of further spectroscopic data.

^{13}C NMR: C-5 signal was not observed due to quadrupolar relaxation.

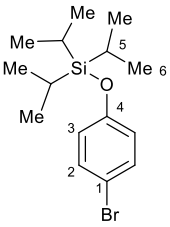
Spectroscopic data obtained for **24** were consistent with those previously reported when analysed in $CDCl_3$.[2]

26: (4-Bromophenoxy)triisopropylsilane.



26

To a solution of 4-bromophenol (1.73 g, 10.0 mmol) and imidazole (1.37 g, 20.1 mmol) in DMF (2.50 mL) at room temperature was added triisopropylsilyl chloride (2.25 mL, 10.5 mmol). The reaction mixture was stirred at room temperature for 1.5 hours and then brine (40 mL) was added. The organics were extracted with Et_2O (2 x 30 mL) and then the combined organics were washed with brine (30 mL), dried over $MgSO_4$, filtered and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/EtOAc, 39:1) afforded silyl phenol ether **26** as a colourless oil (3.20 g, 97%).



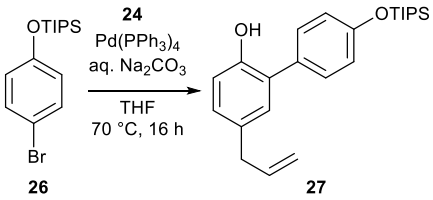
26

26: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.33 – 7.28 (m, 2H, H-2), 6.78 – 6.73 (m, 2H, H-3), 1.29 – 1.19 (m, 3H, H-5), 1.09 (d, J = 7.3 Hz, 18H, H-6); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 155.4 (Cq), 132.4 (2x CH), 121.8 (2x CH), 113.3 (Cq), 18.0 (6x CH_3), 12.8 (3x CH); **IR** ν_{max} cm^{-1}: 2946, 2893, 2868, 1586, 1487, 1273, 910, 883, 828, 732, 685.

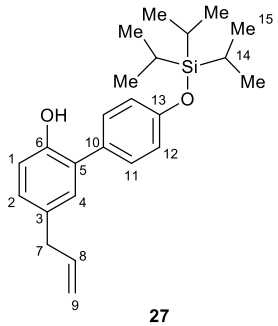
HRMS: Compound did not provide targeted mass upon ionisation.

Spectroscopic data obtained for **26** were consistent with those previously reported.[3]

27: 5-Allyl-4'-((triisopropylsilyl)oxy)-[1,1'-biphenyl]-2-ol.



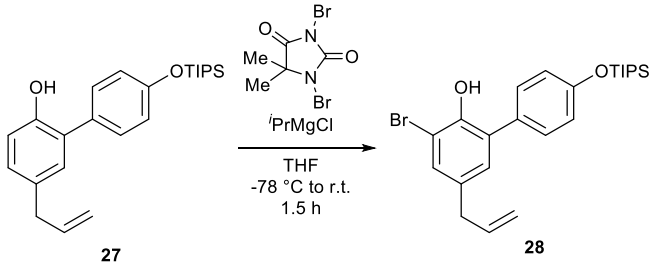
To a solution of boronic acid **24** (316 mg, 0.988 mmol) and silylether **26** (487 mg, 1.47 mmol) in THF (15.0 mL) was added $Pd(PPh_3)_4$ (85 mg, 0.074 mmol) and Na_2CO_3 (2.2 mL of a 2.0 M aqueous solution, 4.4 mmol). The reaction mixture was sparged for 5 minutes with argon and was then heated in an oil bath set at 70 °C for 16 h after which it was cooled to room temperature and diluted with EtOAc (20 mL). The organics were washed with HCl (3 x 20 mL of a 1.0 M aqueous solution) and brine (20 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 4:1) gave biaryl **27** as a colourless oil that solidified upon standing to a colourless solid (527 mg, 93%) **m.p.** 48–50 °C.



27

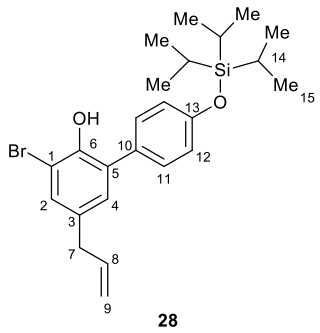
27: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.33 – 7.28 (m, 2H, H-11), 7.06 – 7.02 (m, 2H, H-2 and H-4), 7.00 – 6.96 (m, 2H, H-12), 6.90 (d, *J* = 8.1 Hz, 1H, H-1), 5.98 (ddt, *J* = 16.8, 10.0, 6.7 Hz, 1H, H-8), 5.12 – 5.03 (m, 3H, H-9 and ArOH), 3.35 (ddd, *J* = 6.6, 1.4, 1.4 Hz, 2H, H-7), 1.34 – 1.24 (m, 3H, H-14), 1.13 (d, *J* = 7.3 Hz, 18H, H-15); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 156.1 (Cq), 150.9 (Cq), 138.0 (CH), 132.3 (Cq), 130.34 (CH), 130.27 (2x CH), 129.6 (Cq), 128.9 (CH), 127.9 (Cq), 120.8 (2x CH), 115.71 (CH), 115.68 (CH_2), 39.6 (CH_2), 18.1 (6x CH_3), 12.9 (3x CH); **HRMS** (ESI^+): $C_{24}H_{34}O_2Si$ $[M+Na]^+$ calcd. 405.2220, found 405.2215; **IR** ν_{max} cm^{-1}: 3552, 3041, 2947, 2868, 1605, 1512, 1490, 1275, 1186, 997, 915.

28: 5-Allyl-3-bromo-4'-((triisopropylsilyl)oxy)-[1,1'-biphenyl]-2-ol.



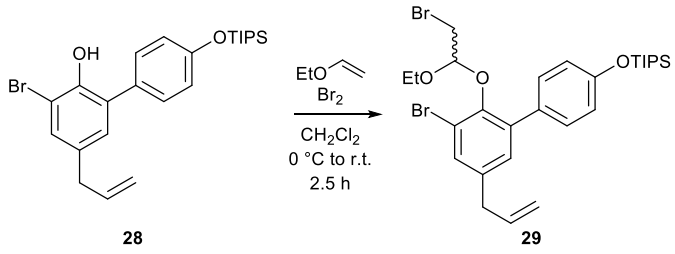
27 28

To a solution of biaryl **27** (475 mg, 1.24 mmol) in THF (6.1 mL) at -78 °C was added ^{i}PrMgCl (1.00 mL of a 1.50 M solution in Et_2O, 1.50 mmol) and the reaction mixture was stirred at -78 °C for 30 min after which 1,3-dibromo-5,5-dimethylhydantoin (284 mg, 0.992 mmol) was added and the reaction mixture was allowed to warm to room temperature and was then stirred for 1.5 hours. To the reaction mixture NH_4Cl (8 mL of a 1.0 M aqueous solution) was added and the organics were extracted with EtOAc (3 x 5 mL). The combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/CH_2Cl_2/acetone, 94:5:1) afforded biaryl **28** as a pale-yellow oil (491 mg, 86%).

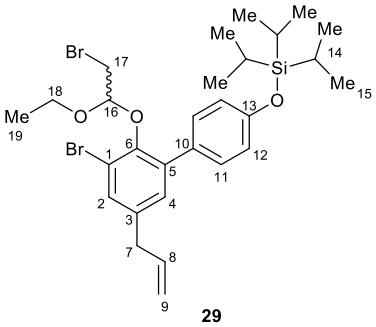


28: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.40 – 7.34 (m, 2H, H-11), 7.26 (d, *J* = 2.1 Hz, 1H, H-2) 7.04 (d, *J* = 2.1 Hz, 1H, H-4), 6.98 – 6.92 (m, 2H, H-12), 5.94 (ddt, *J* = 16.9, 10.2, 6.7 Hz, 1H, H-8), 5.55 (s, 1H, ArOH), 5.14 – 5.06 (m, 2H, H-9), 3.33 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H, H-7), 1.35 – 1.24 (m, 3H, H-14), 1.13 (d, *J* = 7.3 Hz, 18H, H-15); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 156.0 (Cq), 147.6 (Cq), 137.2 (CH), 133.5 (Cq), 131.0 (CH), 130.33 (CH), 130.29 (CH), 129.8 (Cq), 129.3 (Cq), 120.1 (CH), 116.4 (CH_2), 110.8 (Cq), 39.2 (CH_2), 18.1 (6x CH_3), 12.9 (3x CH); **HRMS** (ESI^+) $C_{24}H_{33}{}^{79}BrO_2Si$ $[M+H]^+$ calcd. 461.1506, found 461.1502; **IR** ν_{max} cm^{-1}: 3513, 3052, 3040, 3011, 2947, 2868, 1605, 1511, 1468, 1270, 1229, 938.

29: ((5'-Allyl-3'-bromo-2'-(2-bromo-1-ethoxyethoxy)-[1,1'-biphenyl]-4-yl)oxy)triisopropylsilane.

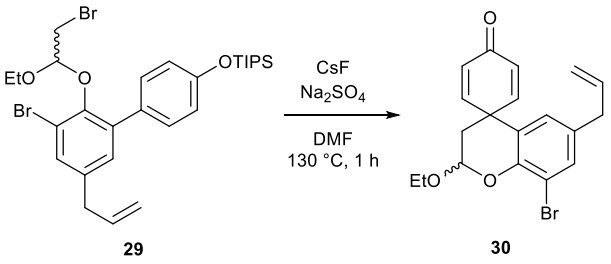


To a solution of ethyl vinyl ether (0.21 mL, 2.2 mmol) in CH_2Cl_2 (2.2 mL) at 0 °C was added bromine (87 µL, 1.7 mmol) over 1 minute and the reaction mixture was stirred at 0 °C for 15 min after which a solution of biaryl **28** (391 mg, 0.850 mmol) and DIPEA (0.59 mL, 3.4 mmol) in CH_2Cl_2 (2.2 mL) was added. The reaction mixture was warmed to room temperature, stirred for 2.5 hours, then diluted with EtOAc (15 mL). The organics were washed with $NaHCO_3$ (2 x 5 mL of saturated aqueous solution), then brine (5 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated flash column chromatography (petroleum ether/CH_2Cl_2, 9:1 to 3:1) afforded acetal **29** as a colourless oil (502 mg, 96%).



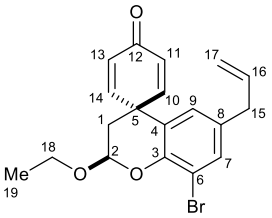
29: **^{1}H NMR** (400 MHz, C_6D_6) δ: 7.35 – 7.31 (m, 2H, H-12), 7.29 (d, *J* = 2.1 Hz, 1H, H-2), 6.96 (d, *J* = 2.1 Hz, 1H, H-4), 6.94 – 6.90 (m, 2H, H-11), 5.71 (dddd, *J* = 16.9, 10.3, 6.8, 6.8 Hz, 1H, H-8), 5.16 – 5.12 (m, 1H, H-16), 4.97 – 4.89 (m, 2H, H-9), 3.55 – 3.45 (m, 1H, H-18), 3.37 – 3.20 (m, 3H, H-17 and H-18), 3.00 (d, *J* = 6.7 Hz, 2H, H-7), 1.23 – 1.13 (m, 3H, H-14), 1.11 (d, *J* = 6.4 Hz, 18H, H-15), 0.90 (dd, *J* = 7.0, 7.0 Hz, 2H, H-19); **^{13}C NMR** (101 MHz, C_6D_6) δ: 156.3 (Cq), 149.0 (Cq), 138.1 (Cq), 137.7 (Cq), 136.7 (CH), 132.6 (CH), 131.4 (Cq), 131.1 (CH), 130.9 (CH), 120.2(CH), 119.2 (Cq), 116.6 (CH_2), 104.6 (CH), 66.1 (CH_2), 39.3 (CH_2), 32.4 (CH_2), 18.2 (CH_3), 15.2 (CH_3), 13.1 (CH); **HRMS** (ESI^+) $C_{28}H_{40}{}^{79}Br_2O_3Si$ $[M+Na]^+$ calcd. 633.1006, found 633.1021; **IR** V_{max} cm^{-1}: 3039, 3013, 2948, 2868, 1606, 1510, 1454, 1268, 1173, 918.

30: 6-Allyl-8-bromo-2-ethoxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one.



29 **30**

To a solution of acetal **29** (495 mg, 0.808 mmol) in DMF (81.0 mL) was added Na_2SO_4 (3.44 g, 24.2 mmol) and CsF (368 mg, 2.42 mmol). The reaction mixture was heated at 130°C for 1 hour after which, the reaction mixture was cooled to room temperature and then the organics were concentrated *in vacuo*. The organics were dissolved in Et_2O (60 mL) and were washed with water (30 mL), then brine (2 x 15 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated flash column chromatography (petroleum ether/Et_2O, 9:1 to 3:2) afforded spirocycle **30** as a colourless solid (284 mg, 94%) **m.p.** 128–130 °C.



30

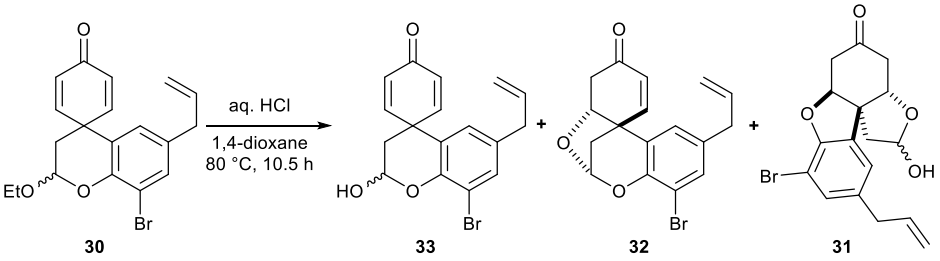
30: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.42 (dd, *J* = 10.2, 3.0 Hz, 1H, H-10), 7.29 (d, *J* = 2.1 Hz, 1H, H-7), 6.75 (dd, *J* = 10.0, 3.0 Hz, 1H, H-14), 6.65 (d, *J* = 2.1 Hz, 1H, H-9), 6.36 (dd, *J* = 10.0, 1.9 Hz, 1H, H-13), 6.22 (dd, *J* = 10.2, 1.9 Hz, 1H, H-11), 5.84 (dddd, *J* = 16.9, 10.2, 6.7, 6.7 Hz, 1H, H-16), 5.49 (dd, *J* = 3.0, 3.0 Hz, 1H, H-2), 5.08 – 5.00 (m, 2H, H-17), 3.94 (dq, *J* = 9.7, 7.1 Hz, 1H, H-18), 3.68 (dq, *J* = 9.7, 7.1 Hz, 1H, H-18), 3.22 (ddd, *J* = 6.7, 1.4, 1.4 Hz, 2H, H-15), 2.31 (dd, *J* = 14.2, 3.0 Hz, 1H, H-1), 2.14 (dd, *J* = 14.2, 3.0 Hz, 1H, H-1), 1.23 (dd, *J* = 7.1, 7.1 Hz, 3H, H-19). **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 185.9 (Cq), 154.3 (CH), 153.7 (CH), 146.1 (Cq), 136.6 (CH), 134.6 (Cq), 133.2 (CH), 128.7 (CH), 128.1 (CH), 126.4 (CH), 121.4 (Cq), 116.7 (CH_2), 112.7 (Cq), 96.3 (CH), 64.8 (CH_2), 40.9 (Cq), 39.0 (CH_2), 36.4 (CH_2), 15.2 (CH_3). **HRMS** (ESI^+) $C_{19}H_{19}{}^{79}BrO_3$ $[M+H]^+$ calcd. 375.0590, found 375.0582; **IR** ν_{max} cm^{-1}: 3038, 3026, 3011, 1666, 1467, 1208, 1126, 861.

A crystal of spirocycle **30** was grown by vapour diffusion method from distilled pentane/distilled Et_2O.

33*:* 6-Allyl-8-bromo-2-hydroxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one**.**

32*:* (±)-(6*S*,7a*R*,11a*R*)-2-Allyl-4-bromo-7a,8-dihydro-9H-6,11a-methanodibenzo[d,f][1,3]dioxepin-9-one.

31*:* (±)-Ketone species.

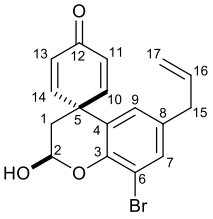


30 **33** **32** **31**

To a solution of spirocycle **30** (87 mg, 0.23 mmol) in 1,4-dioxane (4.6 mL) was added HCl (4.64 mL 13.9 mmol of a 3.0 M aqueous solution) and the reaction mixture was heated at 80 °C for 10.5 hours. The reaction mixture was allowed to cool to room

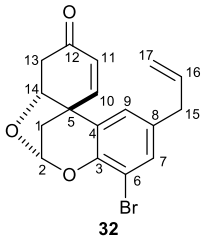
temperature and was diluted with H_2O (20 mL) and the organics were extracted with CH_2Cl_2 (4 x 15 mL). The combined organics were washed with brine (15 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated flash column chromatography (petroleum ether/EtOAc, 17:3 to 1:1) gave several products that have been summarised below:

- Dienone **33** as a colourless solid (23 mg, 28%) **m.p.** 189–191 °C.
- Enone **33** that was purified further by flash column chromatography (petroleum ether/Et_2O, 7:3) and was then triturated with pentane which gave enone **33** as a colourless solid (5 mg, 6%) **m.p.** 133–135 °C
- Inseparable[4] ketone diastereoisomers **31** (major/minor, 7:3) as an off-white solid (43 mg, 50%).

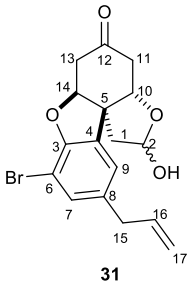


33

33: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.42 (dd, *J* = 10.2, 3.0 Hz, 1H, H-10), 7.30 (d, *J* = 2.1 Hz, 1H, H-7), 6.79 (dd, *J* = 10.0, 3.0 Hz, 1H, H-14), 6.67 (d, *J* = 2.1 Hz, 1H, H-8), 6.37 (dd, *J* = 10.0, 1.9 Hz, 1H, H-13), 6.27 (dd, *J* = 10.2, 1.9 Hz, 1H, H-11), 5.89 (ddd, *J* = 3.9, 3.9, 2.9 Hz, 1H, H-2), 5.83 (dddd, *J* = 16.9, 10.2, 6.5, 6.5 Hz, 1H, H-16), 5.08 – 4.99 (m, 2H, H-17), 3.72 (dd, *J* = 3.9, 1.7 Hz, 1H, OH), 3.22 (ddd, *J* = 6.5, 1.5, 1.5 Hz, 2H, H-15), 2.29 (ddd, *J* = 14.1, 2.9, 1.7 Hz, 1H, H-1), 2.19 (dd, *J* = 14.1, 3.9 Hz, 1H, H-1); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 185.7 (Cq), 153.8 (CH), 153.1 (CH), 146.1 (Cq), 136.4 (CH), 134.5 (Cq), 133.3(CH), 128.5 (CH), 127.9 (CH), 126.7 (CH), 120.9 (Cq), 116.6 (CH_2), 112.3 (Cq), 91.3 (CH), 40.8 (Cq), 38.8 (CH_2), 36.6 (CH_2); **HRMS** (ESI^+) $C_{17}H_{15}{}^{79}BrO_3$ $[M+H]^+$ calcd. 347.0277, found 347.0283; **IR** V_{max} cm^{-1}: 3281, 3078, 2976, 2918, 2849, 1660, 1467, 862.



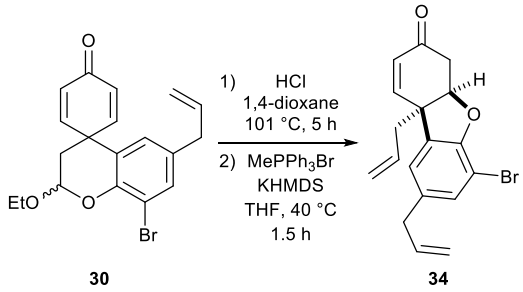
32: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.30 (d, *J* = 2.0 Hz, 1H, H-7), 7.09 (d, *J* = 10.2 Hz, 1H, H-10), 6.74 (d, *J* = 2.0 Hz, 1H, H-8), 6.30 (d, *J* = 10.2 Hz, 1H, H-11), 6.03 (dd, *J* = 1.8, 1.8 Hz, 1H, H-2), 5.89 (dddd, *J* = 16.9, 10.3, 6.7, 6.7 Hz, 1H, H-16), 5.11 – 5.04 (m, 2H, H-17), 4.78 (dd, *J* = 11.3, 6.6 Hz, 1H, H-14), 3.29 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-15), 2.87 (ddd, *J* = 16.1, 6.6, 0.9 Hz, 1H, H-13), 2.52 (dd, *J* = 16.1, 11.3 Hz 1H, H-13), 2.49 (d, *J* = 1.8 Hz, 2H, H-1); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 196.3 (Cq), 146.8 (Cq), 146.1 (CH), 136.7 (CH), 134.3 (Cq), 133.2 (CH), 131.8 (Cq), 131.6 (CH), 123.8 (CH), 116.8 (CH_2), 110.9 (Cq), 100.7 (CH), 87.5 (CH), 44.3 (Cq), 43.5 (CH_2), 39.2 (CH_2), 36.4 (CH_2); **HRMS** (ESI^+) $C_{17}H_{15}{}^{79}BrO_3$ $[M+Na]^+$ calcd. 369.0097, found 369.0086; **IR** ν_{max} cm^{-1}: 3076, 3001, 2974, 2959, 2918, 2850, 1692, 1674, 1465, 1221, 893.



31: **^{1}H NMR** (400 MHz, C_6D_6) δ: 7.12 (d, *J* = 1.7 Hz, 1H, H-major 7), 7.10 (d, *J* = 1.7 Hz, 1H, H-minor 7), 6.92 (d, *J* = 1.7 Hz, 1H, H-major 9), 6.42 (d, *J* = 1.7 Hz, 1H, H-minor 9), 5.83 – 5.64 (m, 2H, H-major 16 and H-minor 16), 5.06 – 4.87 (m, 6H, H-major 17, H-minor 17, H-major 2, H-minor 2), 4.49 (ddd, *J* = 3.6, 2.6, 1.1 Hz, 1H, H-minor 10), 4.07 (ddd, *J* = 3.1, 3.1, 1.1 Hz, 1H, H-major 10), 4.00 (ddd, *J* = 3.1, 3.1, 1.1 Hz, 1H, H-major 14), 3.59 (ddd, *J* = 3.6, 2.4, 1.1 Hz, 1H, H-minor 14), 3.37 (dd, *J* = 18.5, 3.7 Hz, 1H, H-minor 11), 3.03 (ddd, *J* = 6.8, 1.5, 1.5 Hz, 2H, H-minor 15), 2.97 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-major 15), 2.89 (dd, *J* = 18.5, 2.6 Hz, 1H, H-minor 11), 2.75 (dd, *J* = 18.4, 2.9 Hz, 1H, H-major 13), 2.58 (s, 1H, minor OH), 2.47 (dd, *J* = 17.5, 3.6 Hz, 1H, H-minor 13), 2.46 (dd, *J* = 17.7, 3.3 Hz, 1H, H-major 11), 2.29 – 2.25 (m, 1H, major OH), 2.21 (dd, *J* = 14.6, 2.1 Hz, 1H, H-major 1), 2.19 (dd, *J* = 18.4, 3.2 Hz, 1H, H-major 13), 2.09 (dd, *J* = 14.0, 6.0 Hz, 1H, H-minor 1), 1.97 (dd, *J* = 17.7, 2.8 Hz, 1H, H-major 11), 1.91 (dd, *J* = 17.5, 2.5 Hz, 1H, H-minor 13), 1.58 (d, *J* = 14.0 Hz, 1H, H-minor 1), 1.52 – 1.44 (m, 1H, H-major 1); **^{13}C NMR** (101 MHz, C_6D_6) δ: 204.82 (Cq minor), 203.54 (Cq major),

155.88 (Cq minor), 155.70 (Cq major), 137.35 (CH minor), 137.28 (CH major), 135.65 (Cq major), 134.79 (Cq minor), 132.87 (CH minor), 132.71 (CH major), 132.33 (Cq major), 131.15 (Cq minor), 122.86 (CH major), 122.17 (CH minor), 116.25 (CH_2 minor), 116.16 (CH_2 major), 103.53 (Cq major), 103.51 (Cq minor), 98.08 (CH minor), 97.46 (CH major), 88.77 (CH minor), 88.40 (CH major), 84.62 (CH minor), 81.33 (CH major), 53.37 (Cq major), 52.54 (Cq minor), 46.26 (CH_2 major), 45.69 (CH_2 minor), 40.28 (CH_2 minor), 39.91 (CH_2 minor), 39.55 (CH_2 minor), 39.49 (CH_2 major), 39.15 (CH_2 major), 38.34 (CH_2 major); **HRMS** (ESI^-) $C_{17}H_{17}{}^{79}BrO_4$ $[M-H]^-$ calcd. 363.0237, found 363.0237; **IR** ν_{max} cm^{-1}: 3417, 2923, 2854, 1721, 1469, 1048.

34: (±)-(4a*R*,9b*R*)-8,9b-Diallyl-6-bromo-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one.

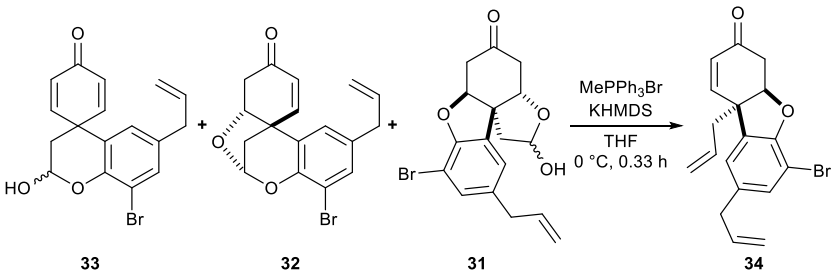


30 34

To a solution of dienone **30** (67 mg, 0.18 mmol) in 1,4-dioxane (1.8 mL) was added HCl (1.80 mL of a 3.0 M aqueous solution, 10.8 mmol). The reaction mixture was heated at 101 °C for 5 hours after which the organics were diluted with EtOAc (5 mL) and were washed with H_2O (2 x 5 mL), then brine (5 mL), dried over $MgSO_4$, filtered and concentrated *in vacuo*.

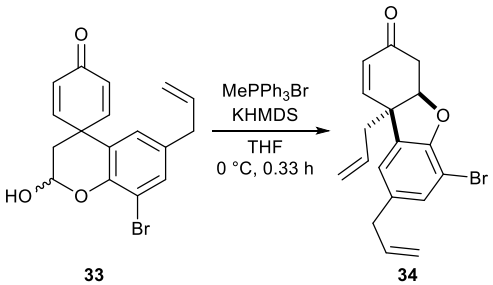
To a suspension of methyltriphenylphosphonium bromide (191 mg, 0.534 mmol) in dry THF (4.6 mL) at 0 °C was added KHMDS (0.46 mL of a 1.0 M solution in THF, 0.46 mmol) over 15 minutes. The reaction mixture was stirred at this temperature for 1 hour after which a solution of the previously prepared crude residue in dry THF (4.6 mL) was added. The reaction mixture was stirred at 40 °C for 1.5 hours after which the organics were diluted with Et_2O (10 mL), washed with H_2O (2 x 10 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*.

Flash column chromatography (hexane/Et_2O, 3:2) gave bromo-tetrahydrodibenzofuran **34** as a colourless solid (37 mg, 60%) **m.p.** 73–75 °C.



33 32 31 34

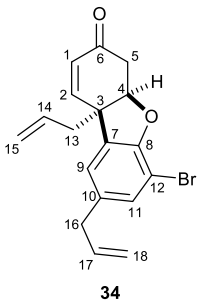
To a suspension of methyltriphenylphosphonium bromide (1.79 g, 5.00 mmol) in dry THF (33.0 mL) at 0 °C was added KHMDS (3.75 mL of a 1.0 M solution in THF, 3.75 mmol) over 15 minutes. The reaction mixture was stirred at this temperature for 30 minutes after which a solution of dienone **33** (153 mg, 0.441 mmol), enone **32** (20 mg, 0.058 mmol) and inseparable ketone diastereoisomers **31** (275 mg, 0.753 mmol) in dry THF (33.0 mL) was added over 30 minutes at 0 °C. The reaction mixture was stirred for 20 minutes post full injection and then to the reaction mixture was added H_2O (50 mL) and brine (20 mL). The organics were extracted with Et_2O (3 x 40 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 7:3) gave bromo-tetrahydrodibenzofuran **34** as a colourless solid (247 mg, 57%) **m.p.** 73–75 °C.



33 34

To a suspension of methyltriphenylphosphonium bromide (238 mg, 0.666 mmol) in dry THF (5.9 mL) at 0 °C was added KHMDS (0.56 mL of a 1.0 M solution in THF, 0.56 mmol) over 15 minutes. The reaction mixture was stirred at this temperature for 30 minutes after which a solution of dienone **33** (77 mg, 0.22 mmol) in dry THF (5.9 mL) was added over 30 minutes at 0 °C. The reaction mixture was stirred for 20 minutes post full injection and then to the reaction mixture was added H_2O (10 mL) and brine (2 mL). The organics were extracted with Et_2O (3 x 10 mL) and the combined organics were dried over

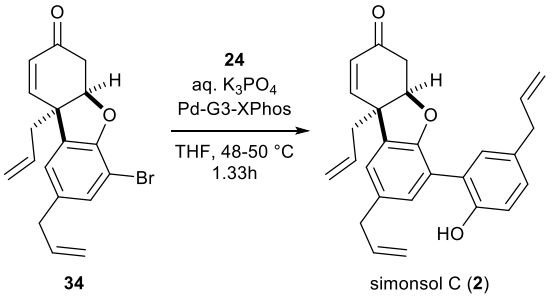
$MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 7:3) gave bromo-tetrahydrodibenzofuran **34** as a colourless solid (70 mg, 90%) **m.p.** 73–75 °C.



34

34: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.17 (d, *J* = 1.6 Hz, 1H, H-11), 6.94 (d, *J* = 1.6 Hz, 1H, H-9), 6.47 (dd, *J* = 10.2, 1.8 Hz, 1H, H-1), 6.03 (dd, *J* = 10.2, 0.8 Hz, 1H, H-2), 5.90 (dddd, *J* = 16.9, 10.4, 6.7, 6.7 Hz, 1H, H-17), 5.76 (dddd, *J* = 16.9, 10.2, 8.0, 6.8 Hz, 1H, H-14), 5.25 – 5.04 (m, 4H, H-15 and H-18), 4.91 (ddd, *J* = 4.5, 2.8, 1.8 Hz, 1H, H-4), 3.32 (d, *J* = 6.7 Hz, 2H, H-16), 3.09 (ddd, *J* = 17.7, 2.8, 0.8 Hz, 1H, H-5), 2.82 – 2.70 (m, 2H, H-5 + H-13), 2.64 (dd, *J* = 14.2, 8.0 Hz, 1H, H-13); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 194.8 (Cq), 154.6 (Cq), 147.9 (CH), 137.0 (CH), 135.3 (Cq), 132.53 (CH), 132.45 (Cq), 131.8 (CH), 127.9 (CH), 122.2 (CH), 120.24 (CH_2), 116.6 (CH_2), 103.5 (Cq), 85.40 (CH), 49.5 (Cq), 40.9 (CH_2), 39.5 (CH_2), 38.6 (CH_2); **HRMS** (ESI^+) $C_{18}H_{17}{}^{79}BrO_2$ $[M+Na]^+$ calcd. 367.0304, found 367.0307; **IR** $\tilde{\nu}_{max}$ cm^{-1}: 3040, 3027, 3010, 1686, 1471, 1216, 1197, 994.

(±)-Simonsol C (**2**): (±)-(4a*R*,9b*R*)-8,9b-Diallyl-6-(5-allyl-2-hydroxyphenyl)-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one.



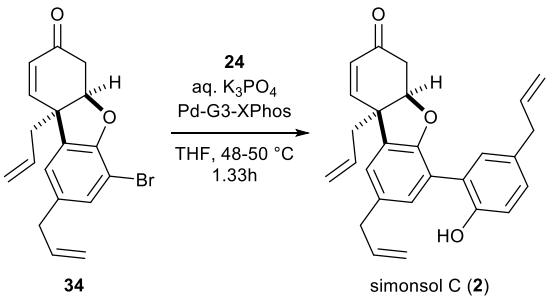
34 simonsol C (**2**)

To a solution of aryl bromide **34** (205 mg, 0.594 mmol) in THF (8.30 mL) was added K_3PO_4 (3.56 mL of a 0.5 M aqueous solution, 1.78 mmol). The biphasic mixture was sparged with argon for 5 minutes and then boronic acid **24** (295 mg, 1.78 mmol) and XPhos Pd G3 (50 mg, 0.059 mmol) were added. The reaction mixture was heated at 48-50 °C for 1.33 hours. The reaction mixture was cooled to room temperature, diluted with H_2O (10 mL) and the organics were extracted with CH_2Cl_2 (3 x 10 mL). The organics were

combined, dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (pentane/EtOAc, 4:1) gave simonsol C-(**2**) as a yellow oil (180 mg) which was dissolved in Et_2O (1 mL) and diluted with pentane (6 mL) and then cooled to –20 °C for 16 hours. A precipitate formed which was collected by suction filtration and subsequently washed with pentane (2 x 5 mL) which gave simonsol C-(**2**) as a colourless solid (3-6% isomerized, 132 mg, 56%).* The filtrate was concentrated which gave simonsol C-(**2**) as a yellow oil (3-6% isomerized, ~70% purity as determined by ^1H NMR spectroscopy, 50 mg, 15%).

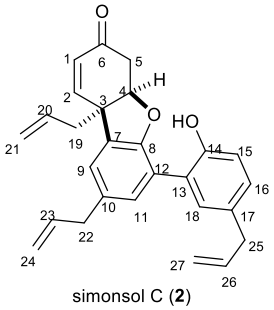
*Simonsol C (**2**) (3-6% isomerized, 132 mg, 56%) was purified according to general method A. Purification by flash column chromatography (petroleum ether/EtOAc, 4:1) gave simonsol C (**2**) as a colourless solid (113 mg, 92-95% yield dependant on 3-6% isomerized starting material) ****m.p.** 122–124 °C.

**No melting point given for either natural[5] or synthetic samples.[6]



34 simonsol C (**2**)

A biphasic mixture of bromo-tetrahydrodibenzofuran **34** (28 mg, 0.081 mmol) in THF (1.1 mL) and K_3PO_4 (0.48 mL of a 0.5 M aqueous solution, 0.24 mmol) was sparged with argon for 10 minutes (or until THF volume had reduced by ~50-70%). To the biphasic mixture was added XPhos Pd G3 (6 mg, 0.007 mmol) and boronic acid **24** (43 mg, 0.24 mmol). The reaction mixture was heated in a sealed tube at 48-50 °C for 1.33 h after which to the reaction mixture was added H_2O (3 mL) and the organics were extracted with CH_2Cl_2 (3 x 2 mL). The combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo.* Purification by flash column chromatography (hexane/EtOAc, 4:1) gave simonsol C (**2**) as a colourless solid (23 mg, 72%).



simonsol C (**2**)

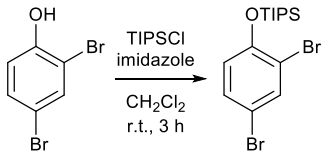
Simonsol C (2): **^{1}H NMR** (400 MHz, acetone-d_6) δ: 7.65 (s, 1H, ArOH), 7.23 (d, J = 1.8 Hz, 1H, H-9), 7.13 (d, J = 1.8 Hz, 1H, H-11), 7.08 (d, J = 2.3 Hz, 1H, H-18), 7.01 (dd, J = 8.3, 2.3 Hz, 1H, H-16), 6.86 (d, J = 8.3 Hz, 1H, H-15), 6.71 (dd, J = 10.3, 1.9 Hz, 1H, H-2), 6.07 – 5.84 (m, 3H, H-20, H-23 and H-26), 5.93 (dd, J = 10.3, 0.6 Hz, 1H, H-1), 5.32 – 5.16 (m, 2H, H-19), 5.14 – 4.96 (m, 5H, H-4, H-24 and H-27), 3.40 (ddd, J = 6.8, 1.5, 1.5 Hz, 2H, H-22), 3.31 (ddd, J = 6.8, 1.5, 1.5 Hz, 2H, H-25), 2.97 (dddd, J = 14.1, 7.1, 1.3, 1.3 Hz, 1H, H-19), 2.92 – 2.83 (m, 2H, H-5), 2.80 – 2.74 (m, 1H, H-19); **^{13}C NMR** (101 MHz, acetone-d_6) δ: 195.1 (Cq), 155.3 (Cq), 153.6 (Cq), 149.5 (CH), 139.1 (CH), 139.0 (CH), 134.3 (Cq), 133.9 (CH), 132.8 (Cq), 132.0 (CH), 131.9 (Cq), 131.7 (CH), 129.7 (CH), 127.6 (CH), 125.0 (Cq), 123.3 (CH), 122.3 (Cq), 119.7 (CH_2), 117.3 (CH), 115.8 (CH_2), 115.5 (CH_2), 85.8 (CH), 49.6 (Cq), 40.8 (CH_2), 40.4 (CH_2), 39.9 (CH_2), 39.4 (CH_2); **HRMS** (ESI^-) $C_{27}H_{26}O_3$ $[M-H]^-$ calcd. 397.1809, found 397.1803; **IR** V_{max} cm^{-1}: 3412, 3067, 3046, 3005, 1687, 1498, 1232, 1128, 994.

Nat. **2**[5]	Syn. **2**	Dif.	Nat. **2**[5]	Syn. **2**	Dif.
195.1	195.1	0	124.9	125.0	0.1
155.2	155.3	0.1	123.3	123.3	0
153.5	153.6	0.1	122.2	122.3	0.1
149.5	149.5	0	119.6	119.7	0.1
139	139.1	0.1	117.2	117.3	0.1
138.9	139.0	0.1	115.7	115.8	0.1
134.2	134.3	0.1	115.5	115.5	0
133.8	133.9	0.1	85.7	85.8	0.1
132.7	132.8	0.1	49.5	49.6	0.1
131.9	132.0	0.1	40.7	40.8	0.1
131.8	131.9	0.1	40.3	40.4	0.1
131.6	131.7	0.1	39.9	39.9	0
129.7	129.7	0	39.3	39.4	0.1
127.5	127.6	0.1			

Table S1. *Comparison (Dif. = difference (Syn. – Nat. ^{13}C δ value)) of natural (Nat.) versus synthetic (Syn.) simonsol C (**2**) ^{13}C NMR spectroscopy data in acetone-d_6.*[5]

Total Synthesis of Simonsol F (3)

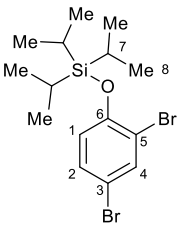
S1: (2,4-Dibromophenoxy)triisopropylsilane.



S1

To a solution of 2,4-dibromophenol (300 mg, 1.19 mmol) and imidazole (203 mg, 2.98 mmol) in CH_2Cl_2 (7.2 mL) at room temperature was added triisopropylsilyl chloride (280 µL, 1.31 mmol). The reaction mixture was stirred at room temperature for 3 hours and then H_2O (20 mL) was added. The organics were extracted with CH_2Cl_2 (3 x 5 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash

column chromatography (petroleum ether/EtOAc, 9:1) afforded silylated phenol **S1** as a colourless oil (486 mg, >99%).

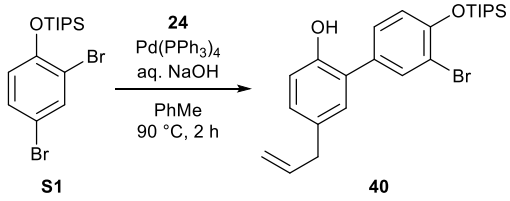


S1

S1: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.64 (d, *J* = 2.5 Hz, 1H, H-4), 7.25 (dd, *J* = 8.7, 2.5 Hz, 1H, H-2), 6.76 (d, *J* = 8.7 Hz, 1H, H-1), 1.35 – 1.25 (m, 3H, H-7), 1.12 (d, *J* = 7.4 Hz, 18H, H-8); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 152.5 (Cq), 135.7 (CH), 131.2 (CH), 120.8 (CH), 116.1 (Cq), 113.0 (Cq), 18.1 (6x CH_3), 13.1 (3x CH); **IR** ν_{max} cm^{-1}: 2944, 2891, 2866, 1576, 1469, 1380, 1287, 997.

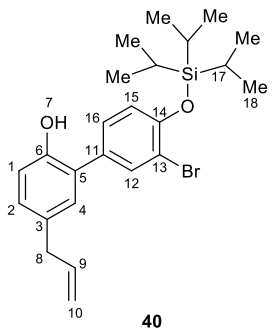
HRMS: Compound did not provide targeted mass upon ionisation.

40: 5-Allyl-3'-bromo-4'-((triisopropylsilyl)oxy)-[1,1'-biphenyl]-2-ol.



S1 **40**

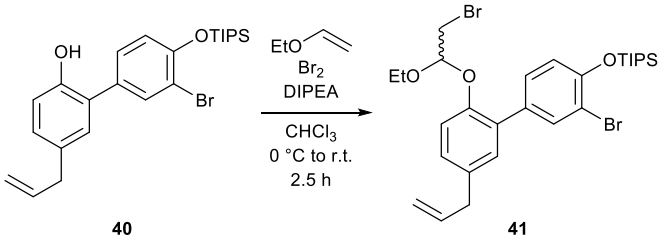
A biphasic mixture of silylether **S1** (449 mg, 1.10 mmol), boronic acid **24** (352 mg, 1.10 mmol), NaOH (5.6 mL of a 0.5 M aqueous solution, 2.8 mmol) and PhMe (11.0 mL) was sparged with argon for 5 minutes at room temperature. To the biphasic mixture was added $Pd(PPh_3)_4$ (254 mg, 0.220 mmol) and the reaction mixture was sparged with argon for a further 5 minutes and was then heated at 90 °C for 3.5 hours. The reaction mixture was cooled to room temperature, diluted with EtOAc (15 mL) and then HCl (10 mL of a 3.0 M aqueous solution) was added. The organics were extracted with EtOAc (2 x 10 mL) and the combined organics were washed with brine (15 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/EtOAc, 97:3) afforded biaryl **40** as a colourless oil (374 mg, 74%).



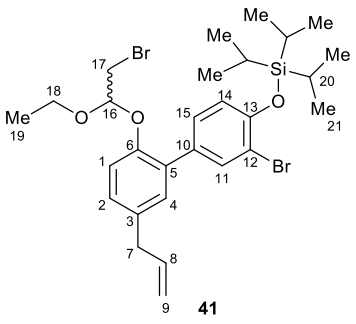
40: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.64 (d, *J* = 2.2 Hz, 1H, H-12), 7.26 (dd, *J* = 8.3, 2.2 Hz, 1H, H-16), 7.06 (dd, *J* = 8.2, 2.3 Hz, 1H, H-2), 7.02 (d, *J* = 2.2 Hz, 1H, H-4), 6.97 (d, *J* = 8.3 Hz, 1H, H-15), 6.89 (d, *J* = 8.2 Hz, 1H, H-1), 5.97 (ddt, *J* = 16.8, 10.0, 6.7 Hz, 1H, H-9), 5.12 – 5.03 (m, 2H, H-10), 4.96 (s, 1H, ArOH), 3.34 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-8), 1.42 – 1.30 (m, 3H, H-17), 1.16 (d, *J* = 7.3 Hz, 18H, H-18); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 152.8 (Cq), 150.8 (Cq), 137.8 (CH), 134.1 (CH), 132.6 (Cq), 131.0 (Cq), 130.4 (CH), 129.3 (CH), 129.0 (CH), 126.7 (Cq), 112.0 (CH), 116.0 (CH), 115.9 (Cq), 115.8 (CH), 39.5 (CH_2), 18.2 (6x CH_3), 13.1 (3x CH); **HRMS** (ESI^-): $C_{24}H_{33}{}^{79}BrO_2Si$ $[M-H]^-$ calcd. 459.1360, found 459.1350; **IR** ν_{max} cm^{-1}: 3557, 3418, 2644, 2892, 2866, 1639, 1597, 1485, 1292, 916, 882.

41: ((5'-Allyl-3-bromo-2'-(2-bromo-1-ethoxyethoxy)-[1,1'-biphenyl]-4-yl)oxy)triisopropylsilane.

To a solution of ethyl vinyl ether (0.73 mL, 7.6 mmol) in CH_2Cl_2 (7.8 mL) was added bromine



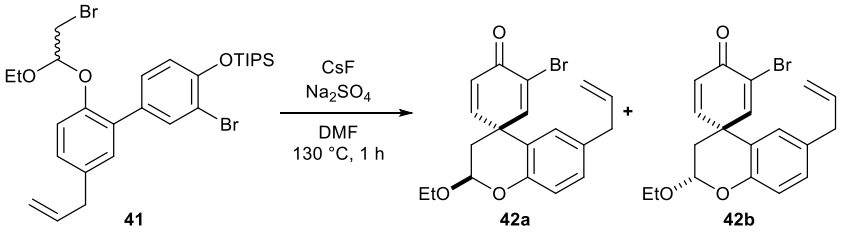
(0.31 mL, 6.1 mmol) over 1 minute at 0 °C. The solution was stirred for 15 minutes at 0 °C and then a solution of biaryl **40** (1.38 g, 3.03 mmol) and DIPEA (2.11 mL, 12.1 mmol) in CH_2Cl_2 (8.0 mL) was added. The reaction mixture was warmed to room temperature and was stirred for 2 hours. The reaction mixture was diluted with EtOAc (30 mL) and the organics were washed with $NaHCO_3$ (2 x 15 mL of a saturated aqueous solution) then brine (15 mL). The organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 97:3) afforded bromo-acetal **41** as a colourless oil (1.71 g, 93%).



41: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.71 (d, *J* = 2.2 Hz, 1H, H-11), 7.34 (dd, *J* = 8.4, 2.2 Hz, 1H, H-15), 7.15 – 7.12 (m, 1H, H-2), 7.12 – 7.06 (m, 2H, H-1 and H-4), 6.91 (d, *J* = 8.4 Hz, 1H, H-14), 5.97 (dddd, *J* = 16.8, 10.1, 6.7, 6.7 Hz, 1H, H-8), 5.12 – 5.05 (m, 2H, H-9), 3.62 (dq, *J* = 9.3, 7.0 Hz, 1H, H-18), 3.47 (dq, *J* = 9.3, 7.0 Hz, 1H, H-18), 3.40 – 3.35 (m, 4H, H-7 and H-17), 1.40 – 1.31 (m, 3H, H-20), 1.16 (d, *J* = 7.5 Hz, 18H, H-21), 1.13 (dd, *J* = 7.0, 7.0 Hz, 3H, H-19); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 152.2 (Cq), 151.8 (Cq), 137.5 (CH), 135.2 (Cq), 134.4 (CH), 132.2 (Cq), 131.6 (Cq), 131.1 (CH), 129.6 (CH), 128.8 (CH), 119.1 (CH), 118.5 (CH), 116.1 (CH_2), 114.7 (Cq), 102.4 (CH), 63.0 (CH_2), 39.6 (CH_2), 31.6 (CH_2), 18.2 (6x CH_3), 15.2 (CH_3), 13.2 (3x CH); **HRMS** (ESI^+): $C_{28}H_{40}{}^{79}Br_2O_3Si$ $[M+Na]^+$ calcd. 633.1006, found 633.1041; **IR** V_{max} cm^{-1}: 2944, 2892, 2867, 1639, 1598, 1502, 1483, 1291, 918.

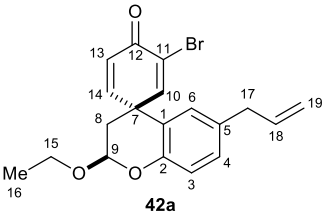
42a: (±)-(2*R*,4*R*)-6-Allyl-3'-bromo-2-ethoxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one.

42b: (±)-(2*S*,4*R*)-6-Allyl-3'-bromo-2-ethoxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one.



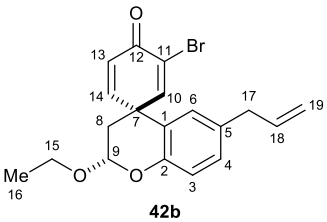
To a solution of bromo-acetal **41** (175 mg, 0.286 mmol) in dry DMF (29.0 mL) was added CsF (130 mg, 0.858 mmol) and Na_2SO_4 (406 mg, 2.86 mmol). The reaction mixture was heated at 130 °C for 1 hour and was then allowed to cool to room temperature at which point H_2O (300 mL) was added. The organics were extracted with Et_2O (2 x 50 mL) and the combined organics

were washed with H_2O (25 mL) then brine (3 x 25 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 7:3) afforded spirocycle **42a** as a colourless solid (50 mg, 47%) **m.p.** 113–116 °C and spirocycle **42b** as a pale yellow solid (53 mg, 49%) **m.p.** 70–73 °C.



42a

42a: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.98 (d, *J* = 2.7 Hz, 1H, H-10), 7.05 (dd, *J* = 8.4, 2.2 Hz, 1H, H-4), 6.88 (d, *J* = 8.4 Hz, 1H, H-3), 6.80 (dd, *J* = 9.8, 2.7 Hz, 1H, H-14), 6.68 (d, *J* = 2.2 Hz, 1H, H-6), 6.46 (d, *J* = 9.8 Hz, 1H, H-13), 5.93 – 5.82 (m, 1H, H-18), 5.38 (dd, *J* = 2.8, 2.8 Hz, 1H, H-9), 5.06 – 5.00 (m, 2H, H-19), 3.90 (dq, *J* = 9.7, 7.1 Hz, 1H, H-15), 3.65 (dq, *J* = 9.7, 7.1 Hz, 1H, H-15), 3.25 (ddd, *J* = 6.7, 1.4, 1.4 Hz, 2H, H-17), 2.29 (dd, *J* = 14.1, 2.9 Hz, 1H, H-8), 2.17 (dd, *J* = 14.1, 2.7 Hz, 1H, H-8), 1.23 (dd, *J* = 7.1, 7.1 Hz, 3H, H-16); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 178.9 (Cq), 155.0 (CH), 154.3 (CH), 149.2 (Cq), 137.2 (CH), 133.8 (Cq), 130.2 (CH), 128.5 (CH), 127.1 (CH), 122.3 (Cq), 118.9 (CH), 118.0 (Cq), 116.2 (CH_2), 95.3 (CH), 64.5 (CH_2), 43.8 (Cq), 39.4 (CH_2), 35.9 (CH_2), 15.2 (CH_3); **HRMS** (ESI^+): $C_{19}H_{19}{}^{79}BrO_3$ $[M+H]^+$ calcd. 375.0590, found 375.0583; **IR** ν_{max} cm^{-1}: 3076, 2977, 2916, 2849, 1667, 1494, 1220, 1116.

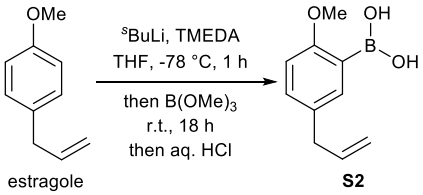


42b

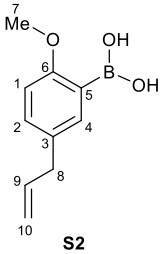
42b: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.49 (dd, *J* = 10.0, 2.7 Hz, 1H, H-14), 7.25 (d, *J* = 2.7 Hz, 1H, H-10), 7.05 (dd, *J* = 8.3, 2.2 Hz, 1H, H-4), 6.88 (d, *J* = 8.3 Hz, 1H, H-3), 6.67 (d, *J* = 2.2 Hz, 1H, H-6), 6.30 (d, *J* = 10.0 Hz, 1H, H-13), 5.92 – 5.81 (m, 1H, H-18), 5.37 (dd, *J* = 3.1, 3.1 Hz, 1H, H-9), 5.06 – 5.00 (m, 2H, H-19), 3.91 (dq, *J* = 9.7, 7.1 Hz, 1H, H-15), 3.64 (dq, *J* = 9.7, 7.1 Hz, 1H, H-15), 3.25 (ddd, *J* = 6.8, 1.4, 1.4 Hz, 2H, H-17), 2.31 (dd, *J* = 14.0, 3.0 Hz, 1H, H-8), 2.16 (dd, *J* = 14.0, 3.2 Hz, 1H, H-8), 1.21 (dd, *J* = 7.1, 7.1

Hz, 3H, H-16); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 179.0 (Cq), 154.9 (CH), 154.1 (CH), 149.3 (Cq), 137.2 (CH), 133.8 (Cq), 130.2 (CH), 128.5 (CH), 124.6 (CH), 124.5 (Cq), 118.9 (CH), 118.1 (Cq), 116.2 (CH_2), 95.5 (CH), 64.6 (CH_2), 44.1 (Cq), 39.4 (CH_2), 36.1 (CH_2), 15.3 (CH_3); **HRMS** (ESI^+): $C_{19}H_{19}{}^{79}BrO_3$ $[M+H]^+$ calcd. 375.0590, found 375.0598; **IR** ν_{max} cm^{-1}: 3076, 2976, 2928, 2908, 1666, 1494, 1225, 1116.

S2: (5-Allyl-2-methoxyphenyl)boronic acid.



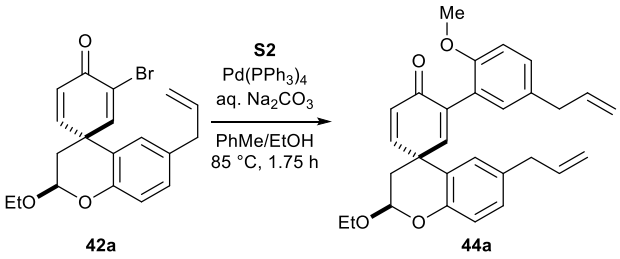
To a solution of 4-allylanisole (2.29 g, 14.7 mmol) in dry THF (46.0 mL) under argon at –78 °C was added TMEDA (2.20 mL, 14.7 mmol) followed by ^{s}BuLi (20.4 mL, 14.7 mmol of a 1.08 M solution in hexanes) that was added dropwise over 15 minutes. After addition was complete, the mixture was stirred for 1 hour at -78 °C. The reaction mixture was allowed to warm to room temperature and then trimethyl borate (1.64 mL, 14.7 mmol) was added. The reaction mixture was stirred for 18 hours at room temperature. To the reaction mixture was acidified to pH 3 with HCl (1.0 M aqueous solution) and then the resulting solution was stirred for 1 hour. The organics were diluted with EtOAc (60 mL) and were washed with brine (3 x 50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 3:1) gave boronic acid **45** as an off-white solid. Subsequent trituration with pentane provided boronic acid **45** as a colourless solid (1.15 g, 40%) **m.p.** 73–75 °C (lit. 77–79 °C).[2]



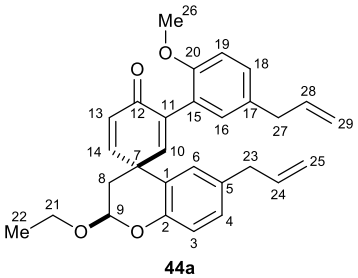
S2: ^{1}H NMR (500 MHz, C_6D_6) δ: 8.06 (d, J = 2.4 Hz, 1H, H-4), 7.05 (dd, J = 8.4, 2.4 Hz, 1H, H-2), 6.37 (d, J = 8.4 Hz, 1H, H-1), 6.28 (s, 2H, 2x B-OH), 5.96 – 5.76 (m, 1H, H-9), 4.99 – 4.94 (m, 2H, H-10), 3.17 (ddd, J = 6.6, 1.6, 1.6 Hz, 2H, H-8), 2.99 (s, 3H, H-7); **^{13}C NMR** (126 MHz, C_6D_6) δ: 163.6 (Cq),

138.2 (CH), 137.9 (CH), 132.9 (CH), 132.8 (Cq), 115.5 (CH_2), 110.2 (CH), 54.9 (CH_3), 39.6 (CH_2); **^{11}B NMR** (128 MHz, $CDCl_3$) δ: 29.2; **HRMS** (ESI^+): $C_{10}H_{13}{}^{11}BO_3$ $[M+H]^+$ calcd. 193.1031, found 193.1031; **IR** ν_{max} cm^{-1}: 3373, 1606, 1492, 1420, 1339, 1234, 1047.

44a: Acetal dienone.



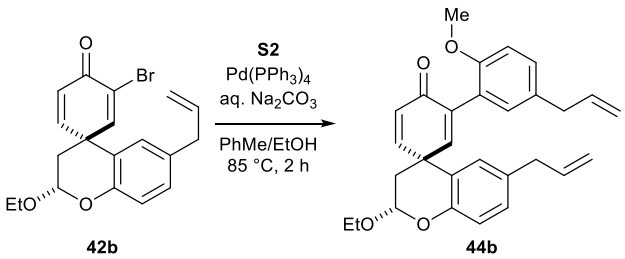
To spirocycle **42a** (250 mg, 0.667 mmol) and boronic acid **S2** (230 mg, 1.20 mmol) in PhMe (4.7 mL) and EtOH (2.1 mL) was added Na_2CO_3 (2.1 mL of a 2.0 M aqueous solution, 4.2 mmol). The biphasic mixture was sparged for 5 minutes under argon and then $Pd(PPh_3)_4$ (39 mg, 0.034 mmol) was added. The reaction mixture was sparged for a further 5 minutes and was then heated at 85 °C for 1.75 hours. The reaction mixture was allowed to cool to room temperature and was then diluted with EtOAc (20 mL). The organics were washed with HCl (2 x 10 mL of a 1.0 M aqueous solution) then brine (10 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 3:1) afforded acetal **44a** as a colourless oil (255 mg, 85%).



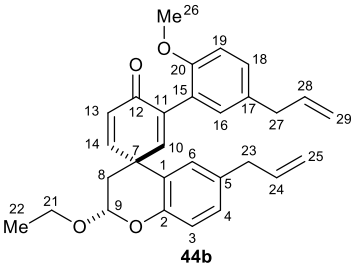
44a: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.27 (d, *J* = 3.0 Hz, 1H, H-10), 7.11 (dd, *J* = 8.4, 2.4 Hz, 1H, H-18), 7.02 (dd, *J* = 8.4, 2.2 Hz, 1H, H-6), 6.93 (d, *J* = 2.3 Hz, 1H, H-16), 6.89 – 6.81 (m, 4H, H-3, H-4, H-14 and H-19), 6.41 (d, *J* = 9.9 Hz, 1H, H-13), 6.00 – 5.82 (m, 2H, H-24 and H-28), 5.38 (dd, *J* = 4.2, 2.9 Hz, 1H, H-9), 5.08 – 4.98 (m, 4H, H-25 and H-29), 3.93 (dq, *J* = 9.7, 7.1 Hz, 1H, H-21), 3.75 (s, 3H, H-26), 3.64 (dq, *J* = 9.7, 7.1 Hz, 1H, H-21), 3.32 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-27), 3.27 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H, H-23), 2.32 (dd, *J* = 14.0, 2.9 Hz, 1H, H-8), 2.24 (dd, *J* = 14.0, 4.2 Hz, 1H, H-8), 1.19 (dd, *J* =

7.1, 7.1 Hz, 3H, H-22); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 184.4 (Cq), 155.9 (Cq), 152.7 (CH), 152.6 (CH), 149.8 (Cq), 137.9 (CH), 137.5 (CH), 135.6 (Cq), 133.4 (Cq), 132.0 (Cq), 130.9 (CH), 129.6 (CH), 129.4 (CH), 128.9 (CH), 128.6 (CH), 125.9 (Cq), 120.1 (Cq), 118.5 (CH), 115.9 (CH_2), 115.6 (CH_2), 111.3 (CH), 96.0 (CH), 64.5 (CH_2), 56.0 (CH), 41.3 (Cq), 39.5 (CH_2), 39.5 (CH_2), 37.0 (CH_2), 15.2 (CH_3); **HRMS** (ESI^+) $C_{29}H_{30}O_4$ $[M+H]^+$ calcd. 443.2217, found 443.2209; **IR** V_{max} cm^{-1}: 3075, 3001, 2975, 2930, 2834, 1666, 1637, 1496, 1267, 1241, 1117, 1035.

44b: Acetal dienone.



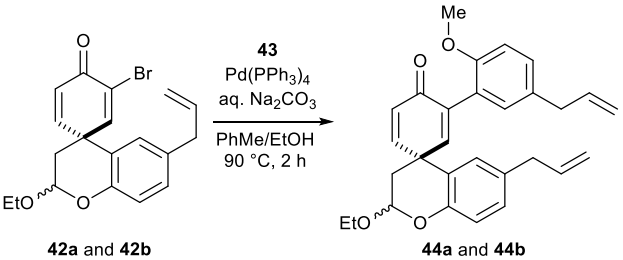
To a solution of spirocycle **42b** (425 mg, 1.13 mmol) and boronic acid **S2** (559 mg, 2.04 mmol) in PhMe (8.0 mL) and EtOH (3.7 mL) was added Na_2CO_3 (3.7 mL of a 2.0 M aqueous solution, 7.4 mmol). The biphasic mixture was sparged for 5 minutes under argon and then $Pd(PPh_3)_4$ (65 mg, 0.057 mmol) was added. The reaction mixture was sparged for a further 5 minutes and was then heated at 85 °C for 2 hours. The reaction mixture was allowed to cool to room temperature and was then diluted with EtOAc (20 mL). The organics were washed with HCl (2 x 10 mL of a 1.0 M aqueous solution) then brine (10 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 4:1) gave acetal **44b** as a colourless solid (436 mg, 87%) **m.p.** 110–112 °C.



44b

44b: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.46 (dd, *J* = 10.1, 2.9 Hz, 1H, H-14), 7.12 (dd, *J* = 8.4, 2.3 Hz, 1H, H-18), 7.03 (dd, *J* = 8.3, 2.2 Hz, 1H, H-4), 6.94 (d, *J* = 2.3 Hz, 1H, H-16), 6.90 (d, *J* = 2.2 Hz, 1H, H-6), 6.87 (d, *J* = 8.3 Hz, 1H, H-19), 6.86 (d, *J* = 8.4 Hz, 1H, H-19), 6.73 (d, *J* = 2.9 Hz, 1H, H-10), 6.30 (d, *J* = 10.1 Hz, 1H, H-13), 6.00 – 5.84 (m, 2H, H-24 and H-28), 5.38 (dd, *J* = 3.1, 3.1 Hz, 1H, H-9), 5.10 – 5.00 (m, 4H, H-25 and H-29), 3.94 (dq, *J* = 9.6, 7.1 Hz, 1H, H-21), 3.75 (s, 3H, H-26), 3.65 (dq, *J* = 9.6, 7.1 Hz, 1H, H-21), 3.33 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-27), 3.27 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-23), 2.33 (dd, *J* = 14.1, 3.0 Hz, 1H, H-8), 2.23 (dd, *J* = 14.1, 3.2 Hz, 1H, H-8), 1.23 (dd, *J* = 7.1, 7.1 Hz, 3H, H-22); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 184.5 (Cq), 155.8 (Cq), 153.6 (CH), 152.3 (CH), 149.6 (Cq), 137.9 (CH), 137.5 (CH), 137.2 (Cq), 133.4 (Cq), 132.0 (Cq), 130.9 (CH), 129.6 (CH), 129.5 (CH), 129.1 (CH), 126.6 (CH), 125.5 (Cq), 119.9 (Cq), 118.5 (CH), 115.9 (CH_2), 115.7 (CH_2), 111.3 (CH), 95.9 (Cq), 64.5 (CH_2), 56.0 (CH_3), 41.0 (Cq), 39.51 (CH_2), 39.46 (CH_2), 36.4 (CH_2), 15.3 (CH_3); **HRMS** (ESI^+): $C_{29}H_{30}O_4$ $[M+H]^+$ calcd. 443.2217, found 443.2222; **IR** V_{max} cm^{-1}: 3076, 3057, 2975, 2925, 2854, 2835, 1665, 1638, 1495, 1268, 1116, 1035, 913.

44a and **44b:** Suzuki-Miyaura cross-coupling that generated a mixture of acetals**.**



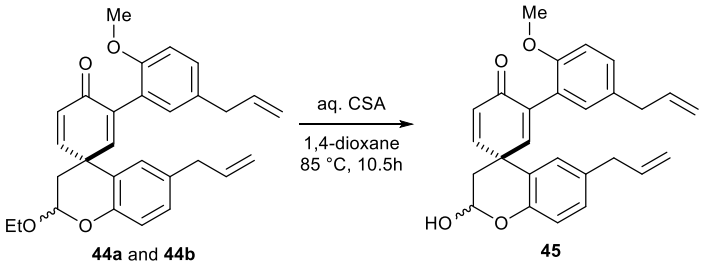
42a and **42b** **44a** and **44b**

To a solution of bromo-spirocycles **42a** (49 mg, 0.13 mmol), **42b** (46 mg, 0.12 mmol) and boronic acid ester **43** (87 mg, 0.45 mmol) in PhMe (1.8 mL) and EtOH (0.8 mL) was added Na_2CO_3 (0.80 mL of a 2.0 M aqueous solution, 1.6 mmol). The biphasic mixture was sparged for 5 minutes under argon and then $Pd(PPh_3)_4$ (15 mg, 0.013 mmol) was added. The reaction mixture was sparged for a further 5 minutes and was then heated at 90 °C for 2 hours. The reaction mixture was allowed to cool to room temperature and was then diluted

with EtOAc (20 mL). The organics were washed with HCl (2 x 10 mL of a 1.0 M aqueous solution) then brine (10 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. (*) Purification by flash column chromatography (petroleum ether/acetone/CH_2Cl_2, 90:5:5) afforded an approximate 1:1 mixture of acetals **44a** and **44b** as a pale-yellow oil (145 mg, 88%).

*Alternatively, acetals **44a** and **44b** were obtained separately by flash column chromatography (petroleum ether/Et_2O, 4:1) which separated **44a** from **44b**. Subsequent flash column chromatography (petroleum ether/acetone, 17:3) was applied to each acetal to remove minor impurities.

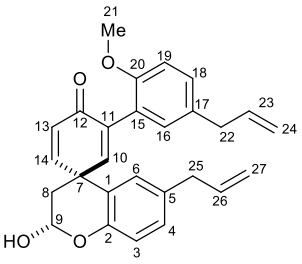
44: (±)-Dienone hemi-acetal inseparable diastereoisomers



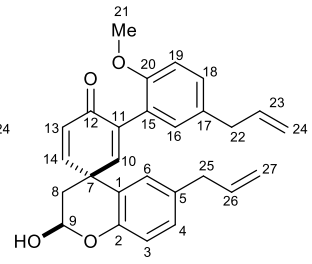
44a and **44b** **45**

To a solution of acetals **44a** and **44b** (2.76 g, 6.24 mmol) in 1,4-dioxane (125 mL) and H_2O (94 mL) was added camphor-10-sulfonic acid (86.8 g, 374 mmol). The reaction mixture was heated at 80 °C for 10.5 hours and was then allowed to cool to room temperature. The reaction mixture was diluted with water (200 mL) and the organics were extracted with CH_2Cl_2 (4 x 125 mL). The combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated column chromatography (petroleum ether/EtOAc, 9:1 to 3:7) gave an inseparable[4] mixture of diastereomeric dienones **45** as a yellow gummy solid (1.95 g) that was purified further by graduated column chromatography (petroleum ether/Et_2O/acetone, 6:3:1 to 5:4:1) which gave an inseparable[4] mixture of diastereomeric dienones **45** (major/minor, 55:45) as an off-white

solid (1.72 g, 66%) along with **59** as an orange oil that was triturated in pentane/CH_2Cl_2 (51:1) which gave **59** as a colourless solid (131 mg, 5%) **m.p.** 130–132 °C.

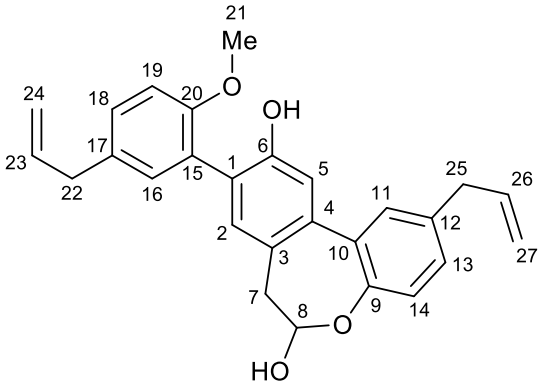


45 - major



45 - minor

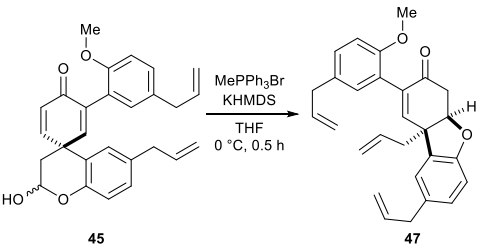
45: ^{1}**H NMR** (400 MHz, $CDCl_3$) δ: 7.40 (dd, *J* = 10.0, 3.0 Hz, 1H, H-major 14), 7.18 (d, *J* = 3.0 Hz, 1H, H-minor 10), 7.12 (dd, *J* = 8.3, 2.4 Hz, 1H, H-minor 18), 7.11 (dd, *J* = 8.3, 2.4 Hz, 1H, H-major 18), 7.05 (d, *J* = 2.2 Hz, 1H, H-minor 6), 7.02 (d, *J* = 2.3 Hz, 1H, H-major 6), 6.94 – 6.92 (m, 2H, H-major 1x ArH, minor 1x ArH), 6.91 – 6.90 (m, 1H, H-major 1x ArH), 6.90 – 6.87 (m, 2H, H-minor 2x ArH), 6.87 – 6.83 (m, 3H, H-major 2x ArH, minor 1x ArH), 6.78 (d, *J* = 3.0 Hz, 1H, H-major 10), 6.40 (d, *J* = 9.9 Hz, 1H, H-minor 13), 6.35 (d, *J* = 10.0 Hz, 1H, H-major 13), 6.00 – 5.83 (m, 4H, H-major 23 & 26, minor 23 & 26), 5.79 – 5.72 (m, 2H, H-major 9, minor 9), 5.10 – 4.98 (m, 8H, H-major 24 & 27, minor 24 & 27), 3.75 (s, 3H, H-major 21), 3.74 (s, 3H, H-minor 21), 3.35 – 3.30 (m, 4H, H-major 22 or 25, minor 22 or 25), 3.30 – 3.24 (m, 4H, H-major 22 or 25, minor 22 or 25), 3.19 (s, 2H, H-major OH, minor OH), 2.37 – 2.30 (m, 2H, H-major 8, minor 8), 2.29 – 2.22 (m, 2H, H-major 8, minor 8); ^{13}**C NMR** (101 MHz, $CDCl_3$) δ: 184.5 (Cq), 184.4 (Cq), 155.9 (Cq), 155.8 (Cq), 153.3 (CH), 152.3 (CH), 152.2 (CH), 151.8 (CH), 150.0 (Cq), 149.7 (Cq), 137.84 (CH), 137.81 (CH), 137.43 (CH), 137.42 (CH), 137.0 (Cq), 136.3 (Cq), 133.6 (Cq), 132.0 (Cq), 130.9 (CH), 130.8 (CH), 129.8 (CH), 129.7 (CH), 129.6 (CH), 129.5 (CH), 129.0 (CH), 128.9 (CH), 128.2 (CH), 127.2 (CH), 125.5 (Cq), 125.4 (Cq), 119.7 (Cq), 119.6 (Cq), 118.4 (CH), 116.0 (2 x CH_2), 115.73 (CH_2), 115.68 (CH_2), 111.3 (CH), 91.1 (CH), 91.0 (CH), 56.01 (CH_3), 55.99 (CH_3), 41.6 (Cq), 41.2 (Cq), 39.5 (2 x CH_2), 39.4 (2 x CH_2), 37.7 (CH_2), 37.1 (CH_2); **HRMS** (ESI^+): $C_{27}H_{26}O_4$ $[M+H]^+$ calcd. 415.1904, found 415.1922; **IR** V_{max} cm^{-1}: 3369, 3002, 2975, 2928, 2906, 2834, 1658, 1627, 1494, 1268, 1240, 1218, 1140, 1127, 1115, 1033, 908, 729.



59

59: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.34 (d, *J* = 2.2 Hz, 1H, H-11), 7.23 (dd, *J* = 8.2, 2.3 Hz, 1H, H-18), 7.22 (d, *J* = 2.4 Hz, 1H, H-16), 7.19 (s, 1H, H-5), 7.17 (s, 1H, H-2), 7.16 (dd, *J* = 8.2, 2.2 Hz, 1H, H-13), 7.09 (d, *J* = 8.1 Hz, 1H, H-14), 7.01 (d, *J* = 8.2 Hz, 1H, H-19), 6.39 (s, 1H, H-ArOH), 6.06 – 5.92 (m, 2H, H-23 & 26), 5.82 (dd, *J* = 9.1, 4.1 Hz, 1H, H-8), 5.17 – 5.06 (m, 4H, H-24 & 27), 3.92 (s, 3H, H-21), 3.45 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-25), 3.41 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-22), 3.09 (s, 1H, H-OH), 2.99 (dd, *J* = 14.4, 4.1 Hz, 1H, H-7), 2.70 (dd, *J* = 14.3, 8.9 Hz, 1H, H-7); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 154.0 (Cq), 153.4 (Cq), 149.3 (Cq), 139.5 (Cq), 137.5 (CH), 137.5 (CH), 136.8 (Cq), 134.1 (Cq), 133.7 (Cq), 132.7 (CH), 131.7 (CH), 129.5 (CH), 129.3 (CH), 129.2 (CH), 126.8 (Cq), 126.7 (Cq), 125.7 (Cq), 123.9 (CH), 117.1 (CH), 116.2 (CH_2), 116.1 (CH_2), 111.9 (CH), 103.6 (CH), 56.6 (CH), 39.9 (CH_2), 39.5 (CH_2), 39.0 (CH_2); **HRMS** (ESI^+): $C_{27}H_{26}O_4$ $[M+H]^+$ calcd. 415.1904, found 415.1899; **IR** V_{max} cm^{-1}: 3377, 3076, 3004, 2924, 2852, 1492, 1237, 1204, 1024, 987.

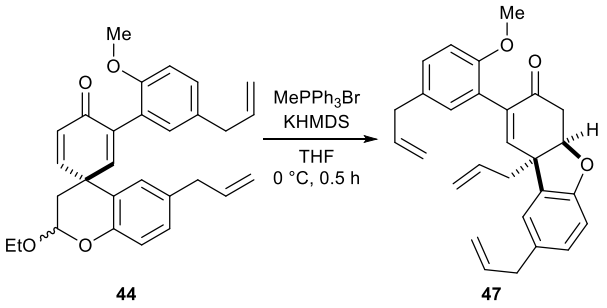
47: (±)-(4a*R*,9b*R*)-8,9b-Diallyl-2-(5-allyl-2-methoxyphenyl)-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one.



45 47

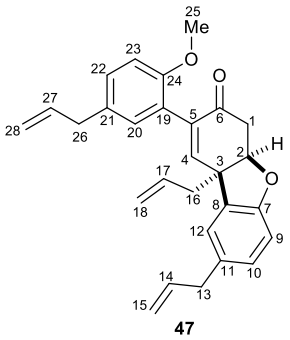
To a flame-dried flask containing methyltriphenylphosphonium bromide (3.82 g, 10.7 mmol) was added dry THF (95.0 mL). The suspension was cooled to 0 °C and KHMDS (9.10 mL of a 1.0 M solution in THF, 9.10 mmol) was added over 0.25 hours. The yellow solution was stirred for

0.66 hours at 0 °C and then a solution of **45** (1.48 g, 3.57 mmol) in dry THF (95.0 mL) was added over 30 minutes at 0 °C. Upon full addition of **45**, the reaction mixture was stirred for 0.5 hours at 0 °C and then H_2O (100 mL) and brine (50 mL) were added. The organics were extracted with Et_2O (3 x 100 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/acetone, 9:1) gave enone **47** as a yellow oil (930 mg, 63%).



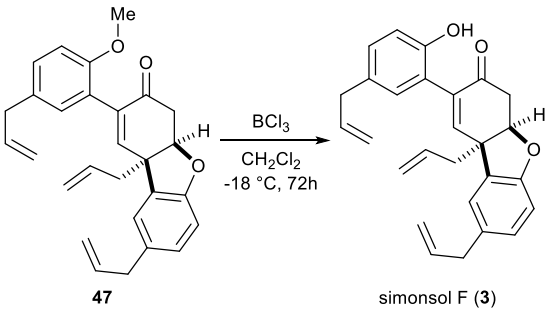
44 **47**

To a solution of dienone **44** (28 mg, 0.063 mmol) in 1,4-dioxane (1.3 mL) was added camphor-10-sulfonic acid (880 mg, 3.79 mmol) and H_2O (1.0 mL). The reaction mixture was heated at 80 °C for 10.5 hours and was then allowed to cool to room temperature. The organics were diluted with EtOAc (5 mL) and were washed with H_2O (2 x 5 mL) then brine (5 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo* which gave a crude yellow oil. To a separate flame-dried flask was added methyltriphenylphosphonium bromide (68 mg, 0.19 mmol) followed by dry THF (1.6 mL) and the suspension was cooled to 0 °C and then KHMDS (0.16 mL of a 1.0 M solution in THF, 0.16 mmol) was added over 15 minutes. The ylide solution was stirred for 1 hour at 0 °C and then the crude yellow oil was added as a solution in dry THF (1.6 mL) over 30 minutes at 0 °C. After addition was complete, the reaction mixture was stirred for a further 0.25 hours at 0 °C and then H_2O (5 mL) was added. The organics were diluted with Et_2O (10 mL) and were washed with a H_2O/brine solution (2 x 5 mL of a 4:1 respective mixture), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/acetone 9:1) provided enone **47** as a yellow oil (10 mg, 37%).



47: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.09 (dd, *J* = 8.3, 2.3 Hz, 1H, H-22), 7.04 – 6.99 (m, 2H, H-10 and H-12), 6.80 (d, *J* = 8.3 Hz, 1H, H-23 or H-9), 6.78 (d, *J* = 2.3 Hz, 1H, H-20), 6.78 (d, *J* = 8.3 Hz, 1H, H-23 or H-9), 6.48 (d, *J* = 1.6 Hz, 1H, H-4), 6.03 – 5.82 (m, 3H, H-14, H-17 and H-27), 5.26 – 5.18 (m, 2H, H-18), 5.11 – 4.99 (m, 4H, H-15 and H-28), 4.90 (ddd, *J* = 4.1, 4.1, 1.6 Hz, 1H, H-2), 3.68 (s, 3H, H-25), 3.36 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-13), 3.28 (ddd, *J* = 6.7, 1.4, 1.4 Hz, 2H, H-26), 3.10 (dd, *J* = 16.5, 3.8 Hz, 1H, H-1), 2.96 (dd, *J* = 16.5, 4.3 Hz, 1H, H-1), 2.83 (dddd, *J* = 14.1, 6.5, 1.3, 1.3 Hz, 1H, H-16), 2.66 (dddd, *J* = 14.1, 8.2, 1.0, 1.0 Hz, 1H, H-16); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 194.2 (Cq), 157.3 (Cq), 155.5 (Cq), 146.0 (CH), 137.9 (CH), 137.8 (CH), 136.6 (Cq), 133.2 (Cq), 132.7 (CH), 132.1 (Cq), 131.6 (Cq), 130.9 (CH), 129.5 (CH), 129.4 (CH), 125.6 (Cq), 123.2 (CH), 119.6 (CH_2), 115.8 (CH_2), 115.7 (CH_2), 111.3 (CH), 110.4 (CH), 85.1 (CH), 56.0 (CH_3), 49.2 (Cq), 42.0 (CH_2), 40.2 (CH_2), 39.9 (CH_2), 39.4 (CH_2); **HRMS** (ESI^+): $C_{28}H_{28}O_3$ $[M+H]^+$ calcd. 413.2111, found 413.2120; **IR** ν_{max} cm^{-1}: 3076, 3003, 2975, 2916, 2834, 1689, 1495, 1487, 1263, 1239, 1032, 993, 915.

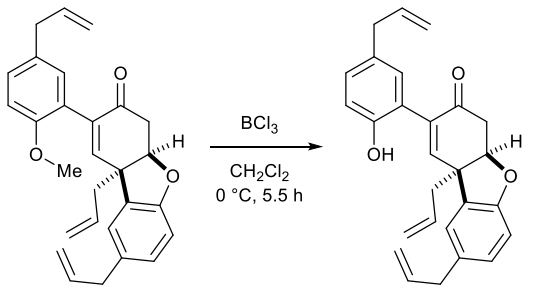
(±)-Simonsol F (3): (±)-(4a*R*,9b*R*)-8,9b-diallyl-2-(5-allyl-2-hydroxyphenyl)-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one.



47 simonsol F (**3**)

To a flame-dried microwave vial was added a solution of enone **47** (26 mg, 0.063 mmol) in dry CH_2Cl_2 (1.5 mL). The solution was cooled to -18 °C and then BCl_3 (0.13 mL of a 1.0 M solution in hexanes, 0.13 mmol) was added dropwise. The vial was sealed and was placed in the freezer at -20 °C without stirring for 72 hours. The

reaction mixture was removed from the freezer and was kept at -18 °C. To a vigorously stirring solution of CH_3CN/H_2O 95:5 (50 mL) at 0 °C was added the reaction mixture over 15 seconds. The solution was concentrated *in vacuo* at 35 °C. Purification by graduated column chromatography (petroleum ether/EtOAc, 9:1 to 7:3) gave simonsol F (**3**) as a colourless oil which solidified to give a colourless solid* (18 mg, 72%) ****m.p.** 97–99 °C, and enone **47** as a yellow oil (5 mg, 18%).



47 simonsol F (**3**)

To a flame-dried microwave vial was added methyl simonsol F **47** (200 mg, 0.484 mmol) and dry CH_2Cl_2 (3.0 mL). The solution was cooled to 0 °C and then BCl_3 (0.90 mL of a 1.0 M solution in hexanes, 0.90 mmol) was added dropwise over 2 minutes. The resulting solution was stirred for 5.5 hours at 0 °C. In a separate flask open to air was added CH_3CN (4.5 mL) and H_2O (0.5 mL) which was cooled to 0 °C and was stirred rapidly. The reaction mixture was quickly withdrawn into a syringe and was injected into the rapidly stirring CH_3CN/H_2O mixture at 0 °C over 10-20 seconds. To the quenched reaction mixture in CH_3CN/H_2O was added H_2O (20 mL) and the organics were extracted with CH_2Cl_2 (5 x 10 mL). The organics were combined, dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated column chromatography (distilled pentane/distilled Et_2O, 7:3 to 1:1) gave methyl simonsol F **47** as a yellow oil (15 mg, 8%) and simonsol F (**3**) as an off white solid* (164 mg, 85% (brsm 92%)) ****m.p.** 97–99 °C.

*Residual Et_2O must be removed for solid to form. This was accomplished by azeotroping with $CHCl_3$ followed by cooling to -20 °C for 18 hours.

**Previously reported as a gum.[7,8]

For completeness the following describes experiments which led to the development of reaction conditions above for the conversion of **47** into simonsol F (**3**).

Attempted demethylation with BBr_3.

- Initially, methylated simonsol F **47** was reacted with BBr_3 at -78 °C which was monitored by LC-MS. Aliquots were taken by quick withdrawal and injection of an aliquot of the reaction mixture into a solution of MeCN/H_2O (19:1) subsequent LC-MS analysis showed that the starting material was consumed, and a new peak associated with simonsol F (**3**) was present. However, when the reaction mixture was quenched at ambient temperature with H_2O or at -78 °C with ^{i}PrOH, methylated simonsol F **47** was the dominant species and simonsol F (**3**) was no longer detected by LC-MS analysis. Therefore, re-methylation had occurred as a result of *in situ*-generated MeBr.
- When the reaction was performed at ambient temperature, above the boiling point of MeBr (b.pt. 4 °C), several products formed but none contained the characteristic [4.3.0] ring system as judged by ^{1}H or ^{13}C NMR spectroscopy.

Demethylation with BCl_3.

- A BCl_3-mediated demethylation was investigated which generated MeCl (b.pt. -24 °C) as a by-product. No reaction was observed by LC-MS analysis when methylated simonsol F **47** was reacted with BCl_3 at -78 °C. The reaction mixture was warmed incrementally to -18 °C, 0 °C, and room temperature and aliquots of the reaction mixture were analysed by LC-MS (see Figure S1). At -18 °C, demethylation of **47** was slow whereas at 0 °C, the reaction progressed substantially after 45 minutes. At room temperature, **47**was consumed and simonsol F (**3**) was the dominant species after 1 hour, however, after 3 hours a new peak formed which became the only major species

present after 18 hours at room temperature. The peak at 2.59 minutes was later confirmed to be macranthol (**6**).

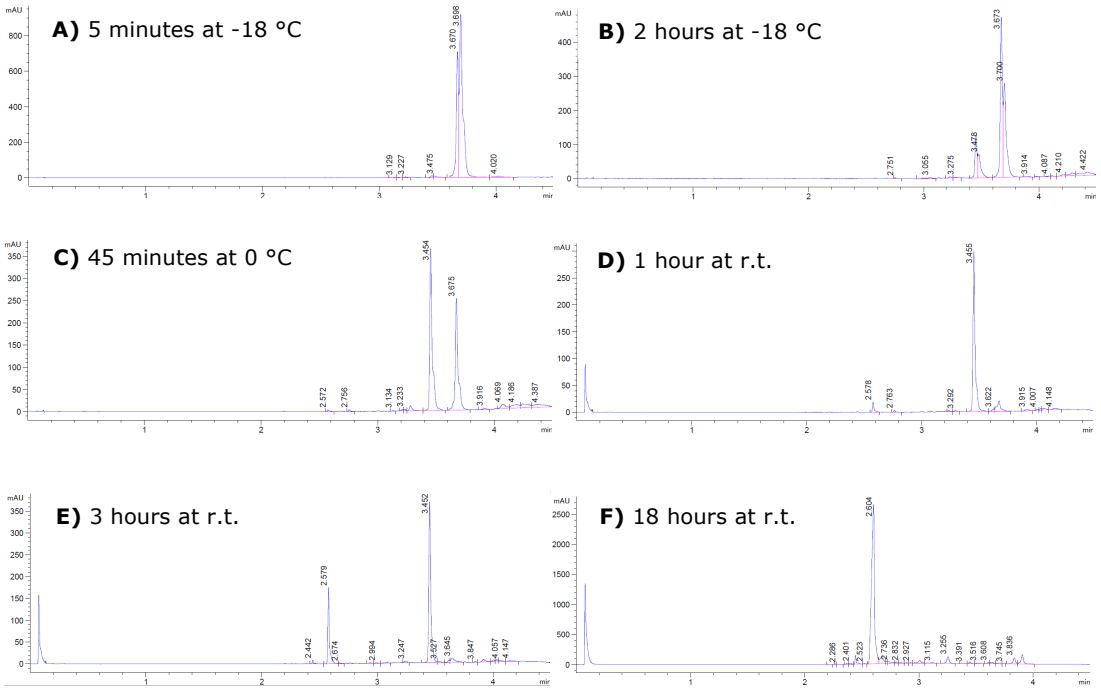
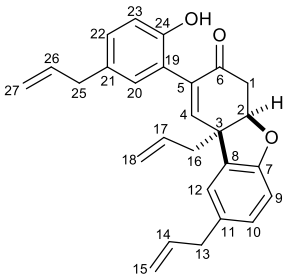


Figure S1. *LC-MS traces from aliquots taken from the same reaction mixture at different time and temperature of the BCl_3 mediated demethylation of **47**. The doubling of peaks in traces A and B is an instrument artifact. Average peak times (min); methylated simonsol F **47** = 3.68, simonsol F (**3**) = 3.45, macranthol (**6**) = 2.59.*

- Methylated simonsol F **47** was reacted with BCl_3 at -18 °C for 72 hours which showed full consumption of **47** by LC-MS analysis. The reaction mixture was injected into a large volume of MeCN/H_2O (19:1), which mimicked the quench conditions used to take aliquots of the reaction mixture for LC-MS analysis, and provided simonsol F (**3**) in 72% yield (88% brsm) as a single isomer. The final conditions developed for the demethylation of **47** provided simonsol F (**3**) in 5.5 hours and in 85% yield (92% brsm) the full details are provided above.



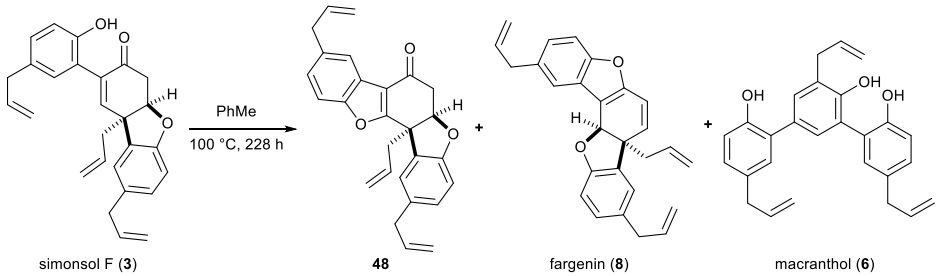
simonsol F (**3**)

Simonsol F (3): ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.49 – 7.45 (m, 1H, ArOH), 7.06 (dd, *J* = 8.2, 2.3 Hz, 1H, H-10), 7.04 – 6.99 (m, 2H, H-20 and H-22), 6.86 (d, *J* = 8.2 Hz, 1H, H-9), 6.77 (d, *J* = 8.2 Hz, 1H, H-23), 6.77 (d, *J* = 2.3 Hz, 1H, H-12), 6.62 (d, *J* = 1.7 Hz, 1H, H-4), 6.01 – 5.80 (m, 3H, H-14, H-17 and H-26), 5.32 – 5.23 (m, 2H, H-18), 5.11 – 5.02 (m, 4H, H-15 and H-27), 4.88 (ddd, *J* = 4.1, 3.2, 1.7 Hz, 1H, H-2), 3.34 (ddd, *J* = 6.9, 1.6, 1.6 Hz, 2H, H-13), 3.30 (ddd, *J* = 6.9, 1.6, 1.6 Hz, 2H, H-25), 3.21 (dd, *J* = 16.8, 3.2 Hz, 1H, H-16), 2.99 (dd, *J* = 16.8, 4.2 Hz, 1H, H-16), 2.91 (dddd, *J* = 14.2, 7.0, 1.3, 1.3 Hz, 1H, H-1), 2.73 (dddd, *J* = 14.0, 7.9, 1.0, 1.0 Hz, 1H, H-1); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 199.4 (Cq), 157.2 (Cq), 152.4 (Cq), 150.8 (CH), 137.72 (CH), 137.71 (CH), 137.6 (Cq), 133.7 (Cq), 132.3 (Cq), 132.2 (CH), 130.73 (CH), 130.69 (Cq), 130.3 (CH), 129.8 (CH), 124.3 (Cq), 123.2 (CH), 120.2 (CH_2), 118.8 (CH), 116.0 (CH_2), 115.8 (CH_2), 110.6 (CH), 84.4 (CH), 49.6 (Cq), 41.5 (CH_2), 40.4 (CH_2), 39.8 (CH_2), 39.4 (CH_2); **^{1}H NMR** (400 MHz, acetone-*d*$_6$) δ: 8.03 (s, 1H, OH), 7.27 (d, *J* = 1.8 Hz, 1H, H-12), 7.02 (dd, *J* = 8.2, 1.8 Hz, 1H, H-10), 6.96 (dd, *J* = 8.2, 2.3 Hz, 1H, H-22), 6.75 (d, *J* = 8.2 Hz, 1H, H-23), 6.74 (d, *J* = 8.2 Hz, 1H, H-9), 6.73 (d, *J* = 2.3 Hz, 1H, H-20), 6.67 (d, *J* = 1.8 Hz, 1H, H-4), 6.05 – 5.83 (m, 3H, H-14, H-17 and H-26), 5.35 – 5.15 (m, 2H, H-18), 5.09 – 4.92 (m, 5H, H-2, H-15 and H-27), 3.35 (d, *J* = 6.7 Hz, 2H, H-13), 3.23 (d, *J* = 6.7 Hz, 2H, H-25), 3.09 (dd, *J* = 16.5, 4.1 Hz, 1H, H-1), 3.04 – 2.94 (m, 2H, H-1 and H-16), 2.79 (dd, *J* = 14.2, 8.1 Hz, 1H, H-16); **^{13}C NMR** (101 MHz, acetone-*d*$_6$) δ: 195.5 (Cq), 158.2 (Cq), 153.7 (Cq), 148.1 (CH), 139.03 (CH), 139.02 (CH), 137.3 (Cq), 134.11 (CH), 134.05 (Cq), 132.8 (Cq), 131.6 (Cq), 131.5 (CH), 130.1 (CH), 129.9 (CH), 125.1 (Cq), 124.6 (CH), 119.6 (CH_2), 116.8 (CH), 115.6 (CH_2), 115.5 (CH_2), 110.6 (CH), 85.7 (CH), 50.1 (Cq), 41.6 (CH_2), 40.7 (CH_2), 40.3 (CH_2), 39.8 (CH_2); **HRMS** (ESI^+): $C_{27}H_{26}O_3$ $[M+H]^+$ calcd. 399.1955, found 399.1951; **IR** ν_{max} cm^{-1}: 3377, 3077, 3004, 2977, 2907, 1670, 1487, 1211, 993, 915, 821.

Nat. **3**[7]	Syn. **3**	Dif.	Nat. **3**[7]	Syn. **3**	Dif.
199.1	199.4	0.3	124.2	124.3	0.1
157.1	157.2	0.1	123.1	123.2	0.1
152.3	152.4	0.1	120.1	120.2	0.1
150.5	150.8	0.3	118.5	118.8	0.3
137.6	137.7	0.1	115.8	116	0.2
137.6	137.7	0.1	115.7	115.8	0.1
137.4	137.6	0.2	110.4	110.6	0.2
133.6	133.7	0.1	84.3	84.4	0.1
132.1	132.3	0.2	49.5	49.6	0.1
132.1	132.2	0.1	41.4	41.5	0.1
130.6	130.7	0.1	40.3	40.4	0.1
130.5	130.7	0.2	39.7	39.8	0.1
130.2	130.3	0.1	39.2	39.4	0.2
129.7	129.8	0.1			

Table S2. *Comparison (Dif. = difference (Syn. – Nat. ^{13}C δ value)) of natural (Nat.) versus synthetic (Syn.) simonsol F (**56**) ^{13}C NMR spectroscopy data in $CDCl_3$.*[7,8]

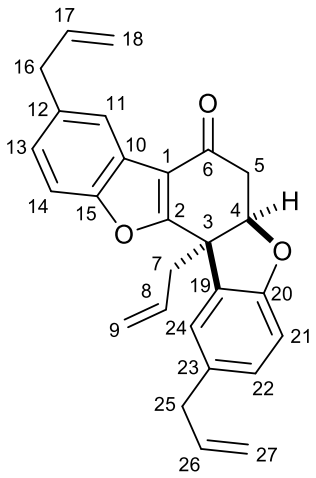
Spectroscopic data obtained for synthetic simonsol F (**3**) were in excellent agreement with the natural sample.[7,8]



simonsol F (**3**) **48** fargenin (**8**) macranthol (**6**)

To a flame-dried microwave vial was added simonsol F (**3**)

(165 mg, 0.413 mmol) and dry PhMe (14.4 mL). The vial was sealed, and the reaction mixture was heated at 100 °C for 228 hours (the vial cap was replaced at 72 hours and 144 hours) and was then cooled to room temperature and the organics were concentrated *in vacuo*. Purification by graduated flash column chromatography (pentane/acetone, 95:5 to 4:1) afforded fargenin (**4**) as a colourless oil (46 mg, 29%), benzofuran **48** as a yellow oil (38 mg, 23%), simonsol F (**3**) as a yellow oil (46 mg, 28%) and macranthol (**6**) as a pale-yellow oil (24 mg, 15%).

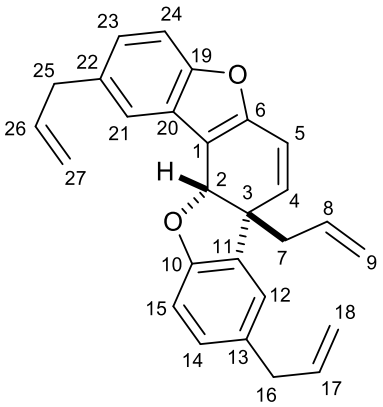


48

48: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.89 (d, *J* = 1.8 Hz, 1H, H-11), 7.41 (d, *J* = 8.5 Hz, 1H, H-14), 7.34 (d, *J* = 1.8 Hz, 1H, H-24), 7.15 (dd, *J* = 8.5, 1.8 Hz, 1H, H-13), 6.98 (dd, *J* = 8.2, 1.8 Hz, 1H, H-22), 6.70 (d, *J* = 8.2 Hz, 1H, H-21), 5.96 (dddd, *J* = 16.9, 10.2, 6.7, 6.7 Hz, 2H, H-17 and H-26), 5.64 (dddd, *J* = 16.6, 10.0, 8.2, 6.5, 6.5 Hz, 1H, H-8), 5.23 – 5.00 (m, 7H, H-4, H-9, H-18 and H-27), 3.46 (d, *J* = 6.7 Hz, 2H, H-16), 3.38 (d, *J* = 6.7 Hz, 2H, H-25), 3.32 (dd, *J* = 14.2, 6.5 Hz, 1H, H-7), 3.19 (dd, *J* = 17.7, 2.7 Hz, 1H, H-5), 2.96 (dd, *J* = 17.7, 4.4 Hz, 1H, H-5), 2.88 (dd, *J* = 14.2, 8.2 Hz, 1H, H-7); **^{13}C NMR*** (101 MHz, $CDCl_3$) δ: 190.8 (Cq), 167.3 (Cq), 157.0 (Cq), 154.0 (Cq), 137.8 (CH), 137.7 (CH), 137.0 (Cq), 133.6 (Cq), 131.9 (CH), 130.0 (CH), 129.2 (Cq), 126.3 (CH), 124.7 (CH), 123.5 (Cq), 122.0 (CH), 120.2 (CH_2), 116.0 (CH_2), 115.9 (CH_2), 111.3 (CH), 110.3 (CH), 86.2 (CH), 49.2 (Cq), 40.8 (CH_2), 40.4 (CH_2), 40.2 (CH_2), 39.8 (CH_2); **^{1}H NMR** (400 MHz, toluene-d_8) δ: 8.10 (d, *J* = 1.8 Hz, 1H, H-11), 7.32 (d, *J* = 1.8 Hz, 1H, H-24), 7.09 (d, *J* = 8.5 Hz, 1H, H-14), 6.80 (dd, *J* = 8.5, 1.8 Hz, 1H, H-13), 6.74 (dd, *J* = 8.2, 1.8 Hz, 1H, H-22), 6.60 (d, *J* = 8.2 Hz, 1H, H-21), 5.93 – 5.73 (m, 2H, H-17 and H-26), 5.27 (dddd, *J* = 16.8, 10.1, 8.1, 6.6 Hz, 1H, H-8), 5.04 – 4.95 (m, 2H, H-18 or H-27), 4.96 – 4.87 (m, 2H, H-18 or H-27), 4.86 – 4.70 (m, 2H, H-9), 4.55 (dd, *J* = 4.3, 2.8 Hz, 1H, H-4), 3.17 (d, *J* = 6.6 Hz, 4H, H-16 and H-25), 3.08 (dd, *J* = 17.5, 2.8 Hz, 1H, H-5), 2.92 (dd, *J* = 14.1, 6.6 Hz, 1H, H-7), 2.57 (dd, *J* = 17.5,

4.3 Hz, 1H, H-5), 2.42 (dd, *J* = 14.1, 8.1 Hz, 1H, H-7); **^{13}C NMR** (101 MHz, toluene-d_8) δ: 188.9 (Cq), 166.3 (Cq), 157.3 (Cq), 153.9 (Cq), 137.7 (CH), 137.6 (CH), 136.6 (Cq), 133.0 (Cq), 131.8 (CH), 129.7 (CH), 129.4 (Cq), 125.9 (CH), 124.3 (CH), 123.8 (Cq), 122.1 (CH), 119.0 (CH_2), 115.9 (Cq), 115.2 (2 x CH_2), 110.6 (CH), 110.2 (CH), 86.1 (CH), 48.8 (Cq), 40.4 (CH_2), 39.9 (CH_2), 39.8 (CH_2), 39.6 (CH_2); **HRMS** (ESI^+): $C_{27}H_{24}O_3$ $[M+H]^+$ calcd. 397.1798, found 397.1810; **IR** V_{max} cm^{-1}: 3078, 3005, 2977, 2909, 1681, 1639, 1612, 1587, 1487, 1458, 1435, 1394, 1273, 1249, 1182, 1119, 1082, 1014, 992, 916, 879, 821, 807, 793, 693, 659, 70, 525, 435.

*One quaternary carbon was not observed in $CDCl_3$.



fargenin (**4**)

Fargenin (4): ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.52 (d, *J* = 1.8 Hz, 1H, H-12), 7.37 (d, *J* = 8.4 Hz, 1H, H-15), 7.11 (dd, *J* = 8.4, 1.8 Hz, 1H, H-14), 7.03 (d, *J* = 1.9 Hz, 1H, H-21), 6.93 (dd, *J* = 8.2, 1.9 Hz, 1H, H-23), 6.77 (d, *J* = 8.2 Hz, 1H, H-24), 6.51 (d, *J* = 9.9 Hz, 1H, H-5), 6.10 – 5.90 (m, 2H, H-17 and H-26), 5.98 (d, *J* = 9.9 Hz, 1H, H-4), 5.98 (s, 1H, H-2), 5.61 (dddd, *J* = 17.2, 10.1, 7.3, 7.3 Hz, 1H, H-8), 5.17 – 5.00 (m, 6H, H-9, H-18 and H-27), 3.51 (ddd, *J* = 6.7, 1.6, 1.6 Hz, 2H, H-16), 3.35 (ddd, *J* = 6.4, 1.4, 1.4 Hz, 2H, H-25), 2.69 (dd, *J* = 14.3, 7.3 Hz, 1H, H-7), 2.64 (dd, *J* = 14.3, 7.3 Hz, 1H, H-7); **^{13}C NMR** (126 MHz, $CDCl_3$) δ: 157.3 (Cq), 154.0 (Cq), 153.2 (Cq), 138.03 (CH), 138.02 (CH), 135.9 (CH), 135.6 (Cq), 132.7 (Cq), 132.2 (CH), 131.8 (Cq), 128.6 (CH), 127.3 (Cq), 125.3 (CH), 123.7 (CH), 119.4 (CH_2), 118.9 (CH), 115.9 (CH_2), 115.7 (CH_2), 115.2 (CH), 111.4 (CH), 109.9 (CH), 108.8 (Cq), 82.0 (CH), 51.3 (Cq), 44.9 (CH_2), 40.4 (CH_2), 39.9 (CH_2); **^{1}H NMR** (400 MHz, acetone-d_6) δ: 7.53 (d, *J* = 1.7 Hz, 1H, H-21), 7.43 (d, *J* = 8.4 Hz, 1H, H-24), 7.25 (d, *J* = 1.8 Hz, 1H, H-12), 7.17 (dd, *J* = 8.4, 1.7 Hz, 1H, H-23), 6.95 (dd, *J* = 8.1, 1.8 Hz, 1H, H-14), 6.71 (d, *J* = 8.1 Hz, 1H, H-15), 6.58 (d, *J* = 10.0 Hz, 1H, H-5), 6.21 (d, *J* = 10.0

Hz, 1H, H-4), 6.06 (s, 1H, H-2), 6.13 – 5.89 (m, 2H, H-17 and H-26), 5.65 (dddd, *J* = 17.3, 10.2, 7.2, 7.2 Hz, 1H, H-8), 5.21 – 4.96 (m, 6H, H-9, H-18 and H-27), 3.53 (d, *J* = 6.8 Hz, 2H, H-25), 3.35 (d, *J* = 6.7 Hz, 2H, H-16), 2.81 (dd, *J* = 14.0, 7.2 Hz, 1H, H-7), 2.68 (dd, *J* = 14.0, 7.2 Hz, 1H, H-7); **^{13}C NMR** (101 MHz, acetone-d_6) δ: 158.1 (Cq), 154.6 (Cq), 154.0 (Cq), 139.2 (CH), 139.0 (CH), 137.5 (CH), 136.5 (Cq), 133.44 (Cq), 133.37 (CH), 132.8 (Cq), 129.2 (CH), 128.1 (Cq), 126.1 (CH), 124.9 (CH), 119.7 (CH), 119.4 (CH_2), 115.9 (CH_2), 115.5 (CH_2), 115.3 (CH), 111.9 (CH), 110.2 (CH), 109.9 (Cq), 82.4 (CH), 52.2 (Cq), 45.4 (CH_2), 40.7 (CH_2), 40.3 (CH_2); **HRMS** (ESI^+): $C_{27}H_{24}O_2$ $[M+H]^+$ calcd. 381.1849, found 381.1849; **IR** V_{max} cm^{-1}: 3076, 3006, 2977, 2900, 2850, 2835, 1637, 1611, 1486, 1455, 1434, 1415, 1331, 1273, 1240, 1192, 1124, 992, 911, 819, 801, 754, 666, 584.

Nat. **8**[9]	RNat. **8**[a]	Syn. **8**	Dif.	Nat. **8**[9]	RNat. **8**[a]	Syn. **8**	Dif.
157.2	157.1	157.3	0.2	119.2	119.3	119.4	0.1
153.9	153.8	154	0.2	119.2	118.8	118.9	0.1
152.3	153.0	153.2	0.2	115.7	115.8	115.9	0.1
137.9	137.9	138	0.1	115.6	115.6	115.7	0.1
137.9	137.9	138	0.1	115	115.1	115.2	0.1
135.5	135.8	135.9	0.1	111.2	111.3	111.4	0.1
135.4	135.4	135.6	0.2	109.8	109.8	109.9	0.1
132.5	132.6	132.7	0.1	108.7	108.8	108.8	0
132.1	132.1	132.2	0.1	81.9	82.0	82	0
131.7	131.6	131.8	0.2	51.2	51.4	51.3	-0.1
128.5	128.5	128.6	0.1	44.7	45.0	44.9	-0.1
127.1	127.1	127.3	0.2	40.2	40.5	40.4	-0.1
125.1	125.1	125.3	0.2	39.7	40.0	39.9	-0.1
123.6	123.6	123.7	0.1				

Table S3. *Comparison (Dif. = difference (Syn. – RNat. ^{13}C δ value)) of natural (Nat.)*[10] *versus raw data natural (RNat.)*[11] *versus synthetic (Syn.) fargenin (**4**) ^{13}C NMR spectroscopy data in $CDCl_3$. Reported data typographical errors highlighted in yellow.* ***a)*** *Raw ^{13}C NMR spectroscopy data that was provided by Prof. Fukuyama has been calibrated to $CHCl_3$ peak (77.16 ppm (+0.16 ppm to chemical shifts observed in ^{13}C NMR spectra (see Figure S2))).*[12]

Spectroscopic data obtained for synthetic fargenin (**4**) were in excellent agreement with the natural sample when compared against the raw ^{13}C NMR spectroscopy data supplied by Prof. Fukuyama.[12]

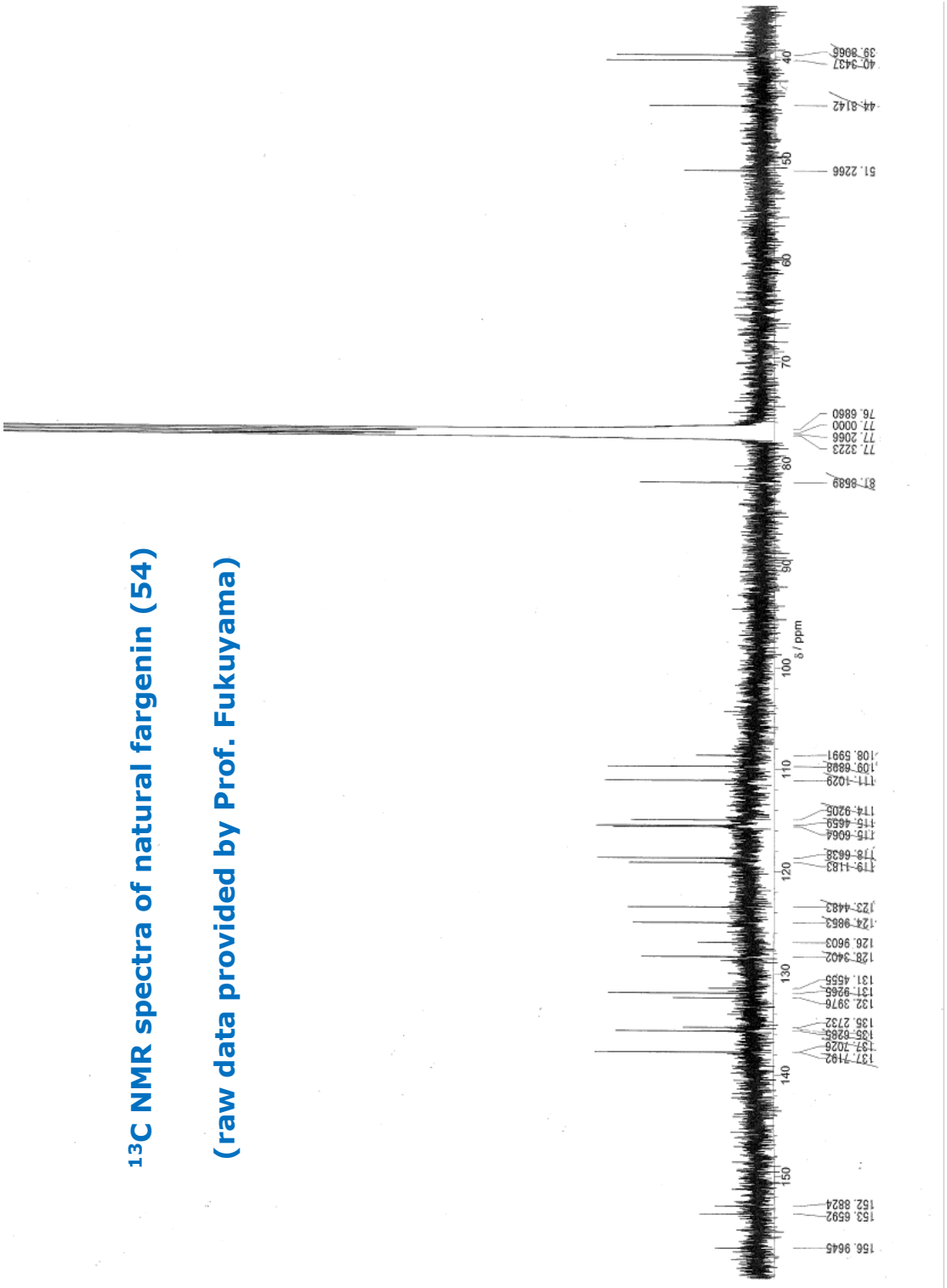
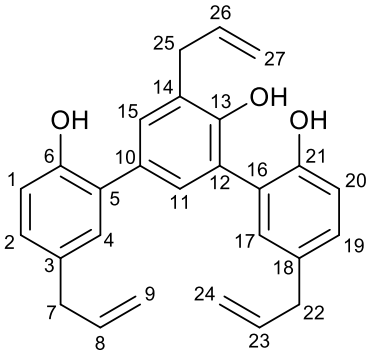

^{13}C NMR spectra of natural fargenin (54)
(raw data provided by Prof. Fukuyama)
δ / ppm

Figure S2.



macranthol (**6**)

Macranthol (6): **^{1}H NMR** (400 MHz, DMSO-d_6) δ: 9.20 (s, 1H, ArOH), 7.25 (d, J = 2.3 Hz, 1H, H-15), 7.19 (d, J = 2.3 Hz, 1H, H-11), 7.05 – 7.01 (m, 3H, H-2 or H-19, H-4 and H-17), 6.93 – 6.89 (m, 2H, H-2 or H-19 and H-1 or H-20), 6.83 (d, J = 8.1 Hz, 1H, H-1 or H-20), 6.08 – 5.88 (m, 3H, H-8, H-23 and H-26), 5.16 – 4.98 (m, 6H, H-9, H-24 and H-27), 3.43 (ddd, J = 6.7, 1.5, 1.5 Hz, 2H, H-H-25), 3.31 (ddd, J = 6.5, 1.9, 1.9 Hz, 2H, H-7 or H-22), 3.29 (ddd, J = 6.2, 1.8, 1.8 Hz, 2H, H-7 or H-22); **^{13}C NMR** (101 MHz, DMSO-d_6) δ: 152.4 (Cq), 152.0 (Cq), 150.5 (Cq), 138.4 (CH), 138.2 (CH), 137.3 (CH), 131.7 (CH), 130.7 (Cq), 130.3 (Cq), 130.1 (Cq), 130.1 (CH), 129.9 (CH), 129.4 (CH), 128.4 (CH), 127.60 (Cq), 127.58 (CH), 127.1 (Cq), 126.4 (Cq), 125.8 (Cq), 115.9 (CH), 115.7 (CH), 115.44 (CH_2), 115.40 (CH_2), 115.2 (CH_2), 38.8 (CH_2), 38.7 (CH_2), 34.4 (CH_2); **^{1}H NMR** (500 MHz, $CDCl_3$) δ: 7.30 (d, J = 2.2 Hz, 1H, H-15), 7.26 (d, J = 2.2 Hz, 1H, H-11), 7.15 (dd, J = 8.3, 2.3 Hz, 1H, H-2), 7.11 (d, J = 2.2 Hz, 1H, H-4), 7.06 (d, J = 2.2 Hz, 1H, H-17), 7.06 (dd, J = 8.9, 2.2 Hz, 1H, H-19), 6.97 (d, J = 8.2 Hz, 1H, H-1), 6.90 (d, J = 8.9 Hz, 1H, H-20), 6.07 (dddd, J = 16.8, 10.0, 6.7, 1.2 Hz, 1H, H-26), 5.98 (ddt, J = 16.9, 10.3, 6.6 Hz, 1H, H-8), 5.93 (ddt, J = 16.9, 10.3, 6.6 Hz, 1H, H-23), 5.75 – 5.70 (m, 1H, ArOH), 5.49 – 5.38 (m, 1H, ArOH), 5.24 – 5.13 (m, 2H, H-27), 5.13 – 5.11 (m, 1H, ArOH), 5.11 – 5.03 (m, 4H, H-9 and H-24), 3.53 (d, J = 6.6 Hz, 2H, H-25), 3.36 (d, J = 6.6 Hz, 2H, H-22), 3.35 (d, J = 6.6 Hz, 2H, H-7); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 151.3 (Cq), 151.0 (Cq), 150.9 (Cq), 137.9 (CH), 137.5 (CH), 136.3 (CH), 133.6 (Cq), 132.5 (Cq), 131.4 (CH), 131.0 (CH), 130.40 (CH), 130.35 (CH), 130.2 (Cq), 130.1 (CH), 129.1 (CH), 128.4 (Cq), 127.6 (Cq), 124.9 (Cq), 123.4 (Cq), 116.9 (CH), 116.9 (CH_2), 116.1 (CH_2), 115.9 (CH), 115.8 (CH_2), 39.5 (CH_2), 39.5 (CH_2), 35.2 (CH_2); **HRMS** (ESI^-): $C_{27}H_{26}O_3$ $[M-H]^-$ calcd. 397.1809, found 397.1824; **IR** V_{max} cm^{-1}: 3514, 3378, 3297, 3196, 3177, 3078, 3004, 2977,

2901, 2832, 1639, 1610, 1587, 1498, 1468, 1432, 1415, 1360, 1329, 1287, 1270, 1230, 1178, 1127, 994, 910, 820, 788, 729.

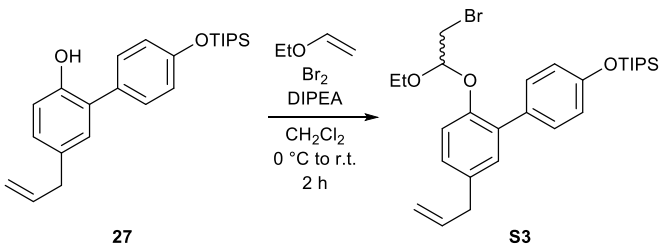
Nat. **6**[13]	Syn. 6	Dif.	Nat. **6**[13]	Syn. **6**	Dif.
151.2	151.3	0.1	129	129.1	0.1
150.9	151	0.2	128.3	128.4	0.1
150.8	150.9	0.1	127.5	127.6	0.1
137.7	137.9	0.2	124.7	124.9	0.2
137.4	137.5	0.1	123.3	123.4	0.1
136.2	136.3	0.1	116.8	116.9	0.1
133.4	133.6	0.2	116.7	116.9	0.2
132.4	132.5	0.1	116	116.1	0.1
131.3	131.4	0.1	115.8	115.9	0.1
130.9	131	0.1	115.6	115.8	0.2
130.3	130.4	0.1	39.4	39.5	0.1
130.3	130.4	0.1	39.3	39.5	0.2
130.2	130.2	0	35	35.2	0.2
130	130.1	0.1	123.3	123.4	0.1

Table S4. *Comparison (Dif. = difference (Syn. – Nat. ^{13}C δ value)) of natural (Nat.) versus synthetic (Syn.) macranthol (**6**) ^{13}C NMR spectroscopy data in $CDCl_3$.*[13]

Spectroscopic data obtained for synthetic macranthol (**6**) were in excellent agreement with both natural[13] and synthetic samples.[14]

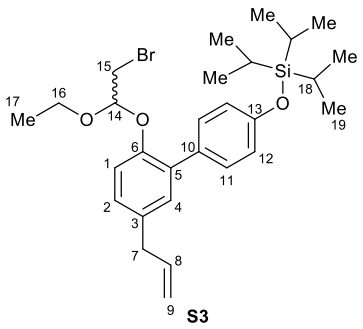
Total Synthesis of Simonsol G (1)

S3 ((5'-Allyl-2'-(2-bromo-1-ethoxyethoxy)-[1,1'-biphenyl]-4-yl)oxy)triisopropylsilane.



27 S3

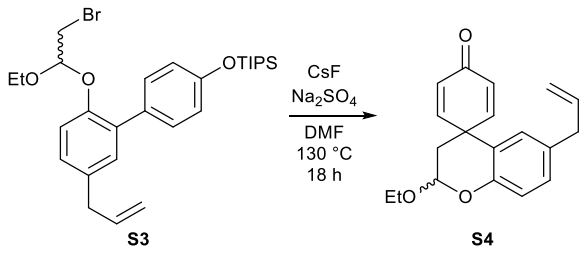
To a solution of ethyl vinyl ether (2.60 mL, 27.2 mmol) in CH_2Cl_2 (30.0 mL) at 0 °C was added bromine (1.09 mL, 21.2 mmol) over 10 minutes. The solution was stirred for 20 minutes at 0 °C and then a solution of biaryl **27** (3.24 g, 8.45 mmol) and DIPEA (5.92 mL, 34.0 mmol) in CH_2Cl_2 (14.0 mL) was added over 15 minutes at 0 °C. The reaction mixture was warmed to room temperature and was stirred for 1.5 hours. The organics were diluted with EtOAc (100 mL) and were washed with $NaHCO_3$ (2 x 50 mL of a saturated aqueous solution), then brine (50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/CH_2Cl_2, 7:3) afforded acetal **S3** as a colourless oil (4.22 g, 94%).



S3

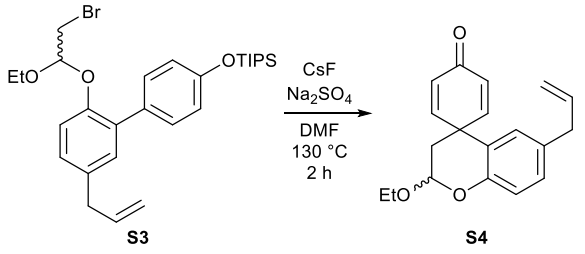
S3: **^{1}H NMR** (400 MHz, $CDCl_3$) δ: 7.41 – 7.36 (m, 2H, H-11), 7.17 – 7.14 (m, 1H, H-4), 7.09 – 7.07 (m, 2H, H-1 and H-2), 6.93 – 6.89 (m, 2H, H-12), 5.98 (dddd, *J* = 16.8, 10.0, 6.7, 6.7 Hz, 1H, H-8), 5.15 – 5.04 (m, 3H, H-9 and H-14), 3.62 (dq, *J* = 9.3, 7.0 Hz, 1H, H-16), 3.45 (dq, *J* = 9.3, 7.0 Hz, 1H, H-16), 3.38 (ddd, *J* = 6.8, 1.5, 1.5 Hz, 2H, H-7), 3.35 – 3.28 (m, 2H, H-15), 1.36 – 1.21 (m, 3H, H-18), 1.15 – 1.10 (m, 21H, H-17 and H-19); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 155.5 (Cq), 151.8 (Cq), 137.6 (CH), 135.2 (Cq), 133.2 (Cq), 131.2 (CH), 131.0 (Cq), 130.8 (CH), 128.2 (CH), 119.6 (CH), 119.0 (CH), 116.0 (CH_2), 102.7 (CH), 63.1 (CH_2), 39.7 (CH_2), 31.7 (CH_2), 18.1 (CH_3), 15.1 (CH_3), 12.9 (CH); **HRMS** (ESI^+): $C_{28}H_{41}{}^{79}BrO_3Si$ $[M+Na]^+$ calcd. 555.1901, found 555.1911; **IR** ν_{max} cm^{-1}: 2943, 2892, 2866, 1606, 1512, 1487, 1262, 909, 882, 838, 676.

S4: 6-Allyl-2-ethoxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one.



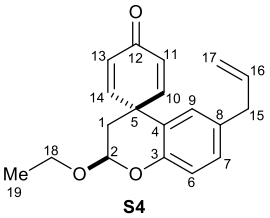
To an oven-dried flask was added Na_2SO_4 (68.6 g, 483 mmol) and CsF (7.34 g, 48.3 mmol) and the flask was cooled under argon, after which dry DMF (380 mL) was added and the suspension was heated to 130 °C. To the suspension was added a solution of acetal **S3** (5.13 g, 9.65 mmol) in dry DMF (16.0 mL) over 15 hours. Upon full addition, the reaction mixture stirred for a further 3 hours at 130 °C. The reaction mixture was cooled to room temperature, filtered, and then concentrated *in vacuo*. The organics were dissolved in EtOAc (150 mL) and were washed with water (50 mL), then brine (2 x 50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated column chromatography (petroleum ether/Et_2O, 4:1 to 7:3) afforded spirocycle **S4** as a yellow oil. To the oil was added Et_2O (~1.0-2.0 mL (until homogenous)) followed by pentane (20 mL) and the mixture was cooled to -20 °C for 16 hours. A precipitate formed which was collected by suction filtration and the filter cake was washed with pentane (3 x 5 mL) which gave **S4** as a colourless solid (2.43 g, 85%) **m.p.** 44–46 °C. The filtrate was concentrated which gave **S4** as a yellow oil* (90% purity by ^1H NMR spectroscopy, 339 mg, 11% yield).

*The yellow 10% impurity was the desilylated derivative of acetal **S3**. Separation is possible by first TIPS protecting the free-phenol impurity under standard conditions followed by graduated column chromatography (petroleum ether/Et_2O, 9:1 to 3:2).



Split evenly between two flame-dried flasks cooled under argon was added Na_2SO_4 (7.10 g, 50.0 mmol), dry DMF (500 mL) and CsF (2.28 g, 15.0 mmol mmol). The suspensions were

heated to 130 °C and then a solution of acetal **S3** (2.66 g, 5.00 mmol) in dry DMF (16.0 mL) was added over 5 minutes between the two flasks and the reaction mixtures were heated at 130 °C for 1.5 hours. The reaction mixtures were cooled to room temperature and the organics were combined, filtered through cotton wool, and concentrated *in vacuo*. The organics were dissolved in Et_2O (100 mL) and were washed with brine (2 x 50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 4:1) gave spirocycle **S4** as an off-white solid (1.26 g, 85%).



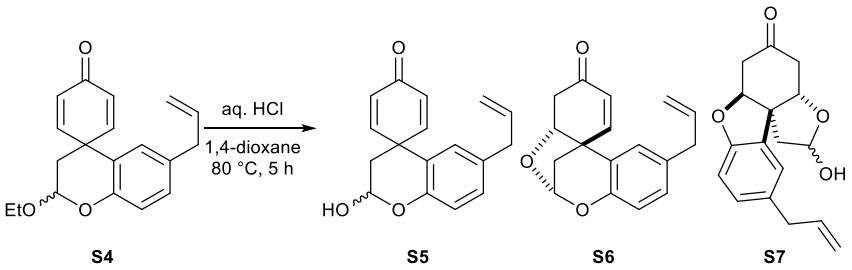
S4

S4: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.45 (dd, *J* = 10.1, 2.9 Hz, 1H, H-10), 7.02 (dd, *J* = 8.3, 2.2 Hz, 1H, H-7), 6.87 (d, *J* = 8.3 Hz, 1H, H-6), 6.80 (dd, *J* = 10.0, 2.9 Hz, 1H, H-14), 6.69 (d, *J* = 2.2 Hz, 1H, H-9), 6.35 (dd, *J* = 10.0, 1.9 Hz, 1H, H-13), 6.22 (dd, *J* = 10.1, 1.9 Hz, 1H, H-11), 5.87 (dddd, *J* = 17.6, 9.5, 6.7, 6.7 Hz, 1H, H-16), 5.37 (dd, *J* = 3.1, 3.1 Hz, 1H, H-2), 5.06 – 4.98 (m, 2H, H-17), 3.92 (dq, *J* = 9.6, 7.1 Hz, 1H, H-18), 3.64 (dq, *J* = 9.6, 7.1 Hz, 1H, H-18), 3.24 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-15), 2.26 (dd, *J* = 14.1, 2.9 Hz, 1H, H-1), 2.12 (dd, *J* = 14.1, 3.3 Hz, 1H, H-1), 1.21 (dd, *J* = 7.1, 7.1 Hz, 3H, H-19); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 186.2 (Cq), 154.9 (CH), 154.2 (CH), 149.5 (Cq), 137.4 (CH), 133.5 (Cq), 129.8 (CH), 128.7 (CH), 128.5 (CH), 126.2 (CH), 119.4 (Cq), 118.6 (CH), 116.0 (CH_2), 95.7 (CH), 64.5 (CH_2), 40.8 (Cq), 39.4 (CH_2), 36.4 (CH_2), 15.3 (CH_3). **HRMS** (ESI^+): $C_{19}H_{20}O_3$ $[M+H]^+$ calcd. 297.1485, found 297.1476; **IR** ν_{max} cm^{-1}: 2975, 2930, 2895, 1663, 1625, 1494, 1397, 1254, 1175, 915, 853, 823, 684.

S5: 6-Allyl-2-hydroxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one.

S6: (±)-(6*R*,7a*R*,11a*S*)-2-Allyl-7a,8-dihydro-9H-6,11a-methanodibenzo[d,f][1,3]dioxepin-9-one.

S7: (±)-Ketone species.

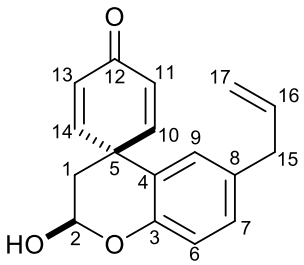


To spirocycle **S4** (1.70 g, 5.74 mmol) in 1,4-dioxane (115 mL) was added HCl (115 mL of a 3.0 M aqueous solution, 345 mmol). The reaction mixture was heated at 80 °C open to air for 5 hours. The reaction mixture was cooled to room temperature, diluted with H_2O (200 mL) and the organics were extracted with CH_2Cl_2 (4 x 115 mL). The organics were combined and were washed with brine (115 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated column chromatography (petroleum ether/EtOAc, 9:1 to 1:1) gave several products that have been summarised below:

- Enone **S6** as a light-yellow solid and subsequent trituration with 2-propanol gave enone **S6** a colourless solid (95 mg, 6%) **m.p.** 115–117 °C.
- Dienone **S5** as an off-white solid which was dissolved in a minimum amount of Et_2O and then pentane was added until precipitation was observed. The mixture was cooled to -20 °C for 16 hours and then the precipitate was collected by suction filtration. The filter cake was washed with pentane (3 x 3 mL) which gave dienone **S5** as a colourless solid (326 mg, 21%) **m.p.** 143–145 °C.
- A mixture of dienone **S5** and inseparable ketone diastereoisomers **S7** (major/minor, 13:7) as a yellow solid to which the filtrate from the trituration of **S5** was added. The

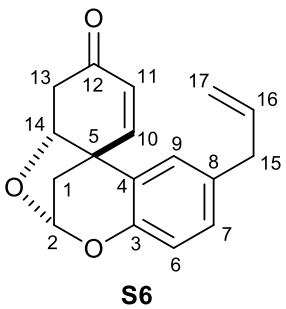
mixture was purified by graduated flash column chromatography (petroleum ether/Et_2O, 7:3 to 1:4) which gave:

- Dienone **S5** as a colourless solid (330 mg, 21%).
- An inseparable mixture of diastereotopic ketones **S7** (major/minor, 13:7) as a colourless solid (661 mg, 40%).



S5

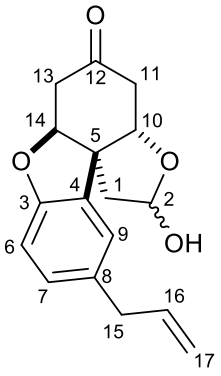
S5: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.39 (dd, *J* = 10.1, 3.0 Hz, 1H, H-10), 7.04 (dd, *J* = 8.3, 2.2 Hz, 1H, H-7), 6.87 (d, *J* = 8.3 Hz, 1H, H-9), 6.85 (dd, *J* = 10.0, 3.0 Hz, 1H, H-14), 6.71 (d, *J* = 2.2 Hz, 1H, H-9), 6.35 (dd, *J* = 10.0, 1.9 Hz, 1H, H-13), 6.28 (dd, *J* = 10.1, 1.9 Hz, 1H, H-11), 5.86 (dddd, *J* = 18.2, 9.4, 6.7, 6.7 Hz, 1H, H-16), 5.77 (ddd, *J* = 4.2, 4.2, 2.8 Hz, 1H, H-2), 5.05 – 4.98 (m, 2H, H-17), 3.30 (dd, *J* = 4.1, 1.6 Hz, 1H, OH), 3.24 (ddd, *J* = 6.4, 1.4, 1.4 Hz, 2H, H-15), 2.26 (ddd, *J* = 14.0, 2.8, 1.6 Hz, 1H, H-1), 2.16 (dd, *J* = 14.0, 4.3 Hz, 1H, H-1); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 186.1 (Cq), 154.5 (CH), 153.7 (CH), 149.6 (Cq), 137.3 (CH), 133.8 (Cq), 123.0 (CH), 128.6 (Cq), 128.3 (CH), 126.9 (CH), 119.1 (Cq), 118.6 (CH), 116.1 (CH_2), 90.9 (CH), 41.0 (Cq), 39.4 (CH_2), 37.0 (CH_2); **HRMS** (ESI^+): $C_{17}H_{16}O_3$ $[M+H]^+$ calcd. 269.1172, found 269.1180; **IR** ν_{max} cm^{-1}: 3339, 3076, 3057, 2976, 2928, 1657, 1614, 1493, 1129, 1029, 860.



S6

S6: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.14 (d, *J* = 10.3 Hz, 1H, H-11), 7.04 (dd, *J* = 8.3, 2.1 Hz, 1H, H-9), 6.83 (d, *J* = 8.3 Hz, 1H, H-6), 6.79 (d, *J* = 2.1 Hz, 1H, H-7), 6.29 (dd, *J* = 10.3, 0.9 Hz, 1H, H-10), 5.97 – 5.86 (m, 2H, H-2 and H-16), 5.10 – 5.02 (m, 2H, H-17), 4.78 (dd, *J* = 11.3, 6.6 Hz, 1H, H-14), 3.31 (ddd, *J* = 6.8, 1.6, 1.6 Hz, 2H, H-15), 2.85 (ddd, *J* = 16.1, 6.6, 1.0 Hz, 1H, H-13), 2.52 (dd, *J* = 16.1, 11.4 Hz, 1H, H-13), 2.47 – 2.44

(m, 2H, H-1); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 196.5 (Cq), 149.5 (Cq), 146.8 (CH), 137.4 (CH), 133.0 (Cq), 131.3 (CH), 130.4 (Cq), 129.5 (CH), 124.3 (CH), 116.9 (CH), 116.0 (CH_2), 100.2 (CH), 87.4 (CH), 44.1 (Cq), 43.5 (CH_2), 39.5 (CH_2), 36.3 (CH_2); **HRMS** (ESI^+): $C_{17}H_{16}O_3$ $[M+H]^+$ calcd. 269.1172, found 269.1176; **IR** ν_{max} cm^{-1}: 3076, 3000, 2920, 2837, 1685, 1492, 1210, 1140, 1050, 1039, 982, 890.

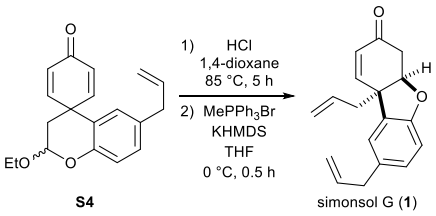


S7

S7: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.17 (d, *J* = 1.8 Hz, 1H, H-major 9), 7.08 – 7.01 (m, 2H, H-major 7 and H-minor 7), 6.98 (d, *J* = 1.8 Hz, 1H, H-minor 9), 6.75 (d, *J* = 8.1 Hz, 2H, H-major 7 and H-minor 7), 6.01 – 5.89 (m, 2H, H-major 16 and H-minor 16), 5.76 – 5.70 (m, 2H, H-major 2 and H-minor 2), 5.12 – 5.04 (m, 4H, H-major 17 and H-minor 17), 4.96 (ddd, *J* = 3.1, 3.1, 1.0 Hz, 1H, H-minor 14), 4.72 (ddd, *J* = 3.0, 3.0, 1.0 Hz, 1H, H-major 14), 4.42 (ddd, *J* = 3.0, 3.0, 1.0 Hz, 1H, H-major 10), 4.18 (ddd, *J* = 3.1, 3.1, 1.0 Hz, 1H, H-minor 10), 3.54 (dd, *J* = 18.4, 3.5 Hz, 1H, H-minor 13), 3.39 – 3.32 (m, 4H, H-major 15 and H-minor 15), 3.07 (s, 1H, minor OH), 2.98 – 2.89 (m, 2H, H-major 13 and H-minor 13), 2.81 (s, 1H, major OH), 2.77 – 2.63 (m, 5H, H-major 11, H-major 13, H-minor 11), 2.41 – 2.34 (m, 2H, H-major 1), 2.31 (dd, *J* = 17.8, 2.5 Hz, 1H, H-minor 1), 2.23 (d, *J* = 14.2 Hz, 1H, H-minor 1); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 207.1 (Cq minor), 205.9 (Cq major), 158.0 (Cq minor), 157.8 (Cq major), 137.72 (CH major), 137.68 (CH minor), 133.9 (Cq major), 133.3 (Cq minor), 130.0 (CH minor), 129.8 (CH major), 128.9 (Cq minor), *, 123.7 (CH major), 123.0 (CH minor), 116.02 (CH_2 minor), 115.95 (CH_2 major), 110.12 (CH major), 110.11 (CH minor), 98.4 (CH minor), 97.7 (CH major), 87.9 (CH minor), 87.8 (CH major), 84.7 (CH minor), 81.3 (CH major), 52.8 (Cq major), 51.7 (Cq minor), 46.4 (CH_2 major), 45.8 (CH_2 minor), 40.3 (CH_2 minor), 40.2 (CH_2 minor), 39.89 (CH_2 major), 39.87 (CH_2 minor), 39.2 (CH_2 major), 39.0 (CH_2 major); **HRMS** (ESI^-): $C_{17}H_{18}O_4$ $[M-H]^-$ calcd. 285.1132, found 285.1138; **IR** ν_{max} cm^{-1}: 3410, 2903, 1714, 1486, 1246, 1212, 1041, 917.

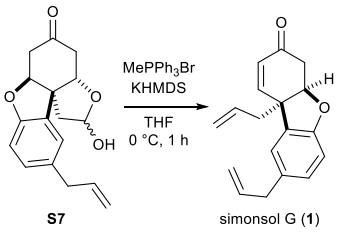
*Quaternary carbon from major diastereoisomer was not observed.

(±)-Simonsol G (1): (±)-(4a*R*,9b*R*)-8,9b-diallyl-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one



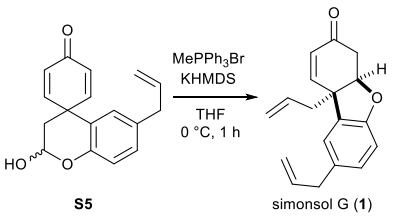
To a solution of dienone acetal **S4** (1.01 g, 3.41 mmol) in 1,4-dioxane (68.0 mL) was added HCl (68.0 mL of a 3.0 M aqueous solution, 204 mmol). The reaction mixture was heated at 85 °C for 5 hours. The reaction mixture was cooled to room temperature and then H_2O (200 mL) was added. The organics were extracted with CH_2Cl_2 (4 x 100 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo* which gave a crude yellow oil.

In a separate flame-dried flask was added methyltriphenylphosphonium bromide (4.86 g, 13.6 mmol) and dry THF (90.0 mL). To the suspension at 0 °C was added KHMDS (11.9 mL of a 1.0 M solution in THF, 11.9 mmol) over 15 minutes. The ylide mixture was stirred at 0 °C for 0.5 hours after which a solution of the previously prepared crude yellow oil in dry THF (90.0 mL) was added over 30 minutes at 0 °C. After addition, the reaction mixture was stirred for a further 0.5 hours at 0 °C and then H_2O (100 mL) and brine (50 mL) were added. The organics were extracted with Et_2O (3 x 80 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated column chromatography (petroleum ether/acetone, 9:1 to 4:1) gave simonsol G (**1**) as a pale-yellow oil (543 mg, 60%).

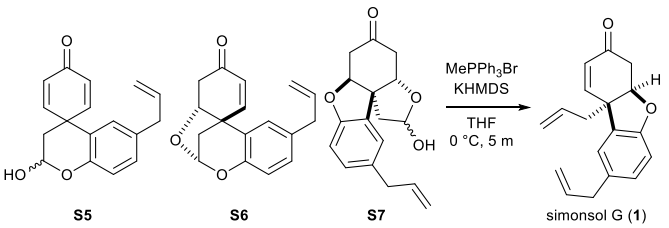


To a flame-dried flask was added methyltriphenylphosphonium bromide (135 mg, 0.378 mmol) and dry THF (1.60 mL). The suspension was cooled to 0 °C and KHMDS (0.32 mL of a 1.0 M solution in THF, 0.32 mmol) was added over 15 minutes. The yellow solution was stirred for 0.75 hours at 0 °C and then a solution of ketone **S7** (18 mg, 0.063 mmol) in dry THF (1.60 mL) was added over 30 minutes at 0 °C. Upon full addition, the

reaction mixture was stirred for 60 minutes at 0 °C and then H_2O (10 mL) and brine (3 mL) were added. The organics were extracted with Et_2O (2 x 20 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated flash column chromatography (petroleum ether/Et_2O, 85:15 to 3:2) gave simonsol G (**1**) as a colourless oil (11 mg, 65%).

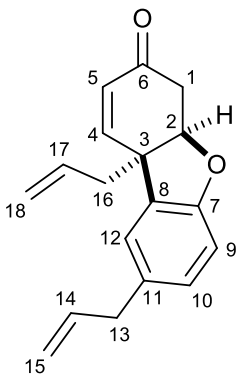


To a flame-dried flask was added methyltriphenylphosphonium bromide (100 mg, 0.280 mmol) and dry THF (2.50 mL). The suspension was cooled to 0 °C and KHMDS (0.24 mL of a 1.0 M solution in THF, 0.24 mmol) was added over 15 minutes. The yellow solution was stirred for 0.75 hours at 0 °C and then a solution of hemi-acetal **S5** (25 mg, 0.093 mmol) in dry THF (2.50 mL) was added over 30 minutes at 0 °C. Upon full addition, the reaction mixture was stirred for 60 minutes at 0 °C and then H_2O (10 mL) and brine (3 mL) were added. The organics were extracted with Et_2O (2 x 20 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated flash column chromatography (petroleum ether/Et_2O, 85:15 to 3:2) gave simonsol G (**1**) as a colourless oil (18 mg, 72%).



To a flame-dried flask was added methyltriphenylphosphonium bromide (700 mg, 1.96 mmol) and dry THF (11.6 mL). The suspension was cooled to 0 °C and KHMDS (1.53 mL of a 1.0 M solution in THF, 1.53 mmol) was added over 15 minutes. The yellow solution was stirred for 0.75 hours at 0 °C and then a solution of **S5**, **S6** and **S7** (95 mg, 45:10:45 mixture respectively, 0.344 mmol) in dry THF (11.6 mL) was added over 30 minutes at 0 °C. Upon full addition, the reaction mixture was stirred for 5 minutes at 0 °C and then H_2O (25 mL) and brine (10 mL) were added. The organics were extracted with Et_2O (2 x

20 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by graduated flash column chromatography (petroleum ether/EtOAc, 9:1 to 3:2) afforded simonsol G (**30**) as a pale-yellow oil (58 mg, 63%).



simonsol G (**1**)

Simonsol G (1): ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.03 – 6.99 (m, 2H, H-10 and H-12), 6.76 – 6.72 (m, 1H, H-9), 6.50 (dd, *J* = 10.2, 1.9 Hz, 1H, H-5), 6.01 (dd, *J* = 10.2, 0.7 Hz, 1H, H-4), 6.00 – 5.87 (m, 1H, H-14), 5.79 (dddd, *J* = 16.9, 10.1, 8.1, 6.7 Hz, 1H, H-17), 5.24 – 5.16 (m, 2H, H-18), 5.11 – 5.04 (m, 2H, H-15), 4.82 (ddd, *J* = 4.6, 2.9, 1.9 Hz, 1H, H-2), 3.35 (ddd, *J* = 6.8, 1.5, 1.5 Hz, 2H, H-13), 3.00 (ddd, *J* = 17.6, 2.9, 0.8 Hz, 1H, H-1), 2.80 (dddd, *J* = 14.1, 6.7, 1.5, 1.5 Hz, 1H, H-16), 2.76 (dd, *J* = 17.6, 4.2 Hz, 1H, H-1), 2.64 (dddd, *J* = 14.1, 8.1, 1.0, 1.0 Hz, 1H, H-16); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 195.5 (Cq), 157.2 (Cq), 148.6 (CH), 137.8 (CH), 133.5 (Cq), 132.3 (CH), 131.2 (Cq), 129.6 (CH), 127.4 (CH), 123.1 (CH), 119.8 (CH_2), 115.9 (CH_2), 110.4 (CH), 84.9 (CH), 48.6 (Cq), 40.8 (CH_2), 39.9 (CH_2), 38.9 (CH_2); **^{1}H NMR** (500 MHz, acetone-d_6) δ: 7.24 (d, *J* = 1.8 Hz, 1H, H-12), 7.02 (dd, *J* = 8.1, 1.8 Hz, 1H, H-10), 6.71 (d, *J* = 8.1 Hz, 1H, H-9), 6.66 (dd, *J* = 10.2, 1.9 Hz, 1H, H-4), 6.04 – 5.81 (m, 2H, H-14 and H-17), 5.91 (d, *J* = 10.2 Hz, 1H, H-5), 5.30 – 5.15 (m, 2H, H-18), 5.09 – 4.98 (m, 2H, H-15), 4.91 – 4.88 (m, 1H, H-2), 3.35 (ddd, *J* = 6.6, 1.5 Hz, 2H, H-13), 2.93 (dddd, *J* = 14.2, 7.2, 1.4, 1.4 Hz, 1H, H-16), 2.88 – 2.83 (m, 2H, H-1), 2.77 – 2.72 (m, 1H, H-16); **^{13}C NMR** (126 MHz, acetone-d_6) δ: 195.2 (Cq), 158.1 (Cq), 149.5 (CH), 139.0 (CH), 134.1 (Cq), 133.9 (CH), 132.6 (Cq), 130.0 (CH), 127.5 (CH), 124.5 (CH), 119.6 (CH_2), 115.7 (CH_2), 110.5 (CH), 85.7 (CH), 49.5 (Cq), 40.5 (CH_2), 40.3 (CH_2), 39.4 (CH_2); **^{1}H NMR** (500 MHz, DMSO-d_6) δ: 7.23 (d, *J* = 1.9 Hz, 1H, H-12), 6.98 (dd, *J* = 8.1, 1.9 Hz, 1H, H-10), 6.73 (d, *J* = 8.1 Hz, 1H, H-9), 6.67 (dd, *J* = 10.2, 1.9 Hz, 1H, H-4), 5.94 (dddd, *J* = 16.8, 10.0, 6.7 Hz, 1H, H-14), 5.92 (dd, *J* = 10.2, 0.9 Hz, 1H, H-5), 5.79 (dddd, *J* = 17.4, 10.1, 7.4 Hz, 1H, H-17), 5.27 – 5.11 (m, 2H, H-18), 5.09 – 5.01 (m, 2H, H-15), 4.88 – 4.84 (m, 1H, H-

2), 3.31 (d, *J* = 6.7 Hz, 2H, H-13), 2.90 (dd, *J* = 17.5, 3.9 Hz, 1H, H-1), 2.85 (dddd, *J* = 14.0, 7.4, 1.2 Hz, 1H, H-16), 2.78 (ddd, *J* = 17.5, 2.7, 0.9 Hz, 1H, H-1), 2.70 (dddd, *J* = 14.0, 7.4, 1.1 Hz, 1H, H-16); **^{13}C NMR** (126 MHz, DMSO-d_6) δ: 195.2 (Cq), 156.6 (Cq), 149.4 (CH), 138.0 (CH), 132.9 (CH), 132.8 (Cq), 131.3 (Cq), 128.9 (CH), 126.2 (CH), 123.9 (CH), 119.4 (CH_2), 115.6 (CH_2), 109.5 (CH), 84.2 (CH), 48.2(Cq), 39.0 (CH_2), 38.8 (CH_2), 38.5 (CH_2); **HRMS** (ESI^+): $C_{18}H_{18}O_2$ $[M+H]^+$ calcd. 267.1380, found 267.1380; **IR** ν_{max} cm^{-1}: 3054, 2923, 2854, 1685, 1486, 1265, 1250, 996, 733, 703.

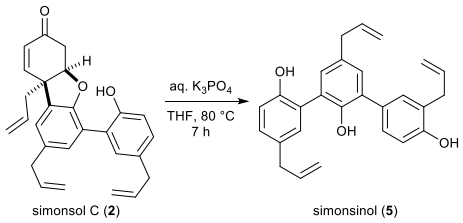
Rep. Syn. **1**[15]	Syn. **1**	Dif.	Rep. Syn. **1**[15]	Syn. 1	Dif.
195.2	195.5	0.3	122.9	123.1	0.2
157	157.2	0.2	119.6	119.8	0.2
148.4	148.6	0.2	115.7	115.9	0.2
137.5	137.8	0.3	110.1	110.4	0.3
133.2	133.5	0.3	84.6	84.9	0.3
132.1	132.3	0.2	48.4	48.6	0.2
131	131.2	0.2	40.5	40.8	0.3
129.4	129.6	0.2	39.6	39.9	0.3
127.1	127.4	0.3	38.7	38.9	0.2

Table S5. *Comparison (Dif. = difference (Syn. – Rep. Syn. ^{13}C δ value)) of reported synthetic (Rep. Syn.) versus synthetic (Syn.) simonsol G (**1**) ^{13}C NMR spectroscopy data in $CDCl_3$.*[15] *Only ^{1}H NMR spectroscopy data in $CDCl_3$ was reported for natural simonsol G (**1**).*[16]

Spectroscopic data obtained for synthetic simonsol G (**1**) were in excellent agreement with both natural[16] and synthetic samples.[15,17]

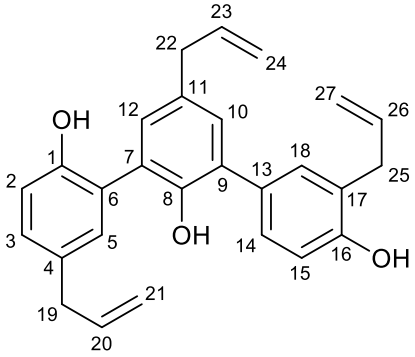
Total Synthesis of Simonsinol (5), Macranthol (6), and Honokiol (14) by natural product isomerization.

Simonsinol (5): 3",5,5'-triallyl-[1,1':3',1"-terphenyl]-2,2',4"-triol.



To a solution of simonsol C (**2**) (11 mg, 0.028 mmol) in THF (60 µL) was added K_3PO_4 (0.11 mL of a 0.5 M aqueous solution, 0.06 mmol) and the reaction mixture was heated in a sealed tube at 80 °C for 7 h. The organics were diluted with EtOAc (2 mL), washed with H_2O (2 x 2 mL), then brine (2 mL), dried over $MgSO_4$ and concentrated *in vacuo*. Flash column chromatography (hexane/EtOAc, 2:1) gave simonsinol (**5**) as a colourless solid (10 mg, 91%) ***m.p.** 69–71 °C.

*Previously reported as an oil.[10]


simonsinol (**5**)

Simonsinol (5): **^{1}H NMR** (500 MHz, $CDCl_3$) δ: 7.30 – 7.27 (m, 2H, H-6 and H-14), 7.14 (dd, *J* = 8.0, 1.8 Hz, 1H, H-4), 7.13 – 7.11 (m, 2H, H-10 and H-12), 7.09 (d, *J* = 2.2 Hz, 1H, H-18), 6.98 (d, *J* = 8.1 Hz, 1H, H-3), 6.93 (d, *J* = 7.9 Hz, 1H, H-15), 6.08 – 5.94 (m, 3H, H-20, H-23 and H-26), 5.76 (s, 1H, ArOH), 5.59 (s, 1H, ArOH), 5.24 – 5.17 (m, 2H, H-27), 5.15 – 5.04 (m, 5H, H-21, H-24 and ArOH), 3.47 (ddd, *J* = 6.4, 1.6, 1.6 Hz, 2H, H-25), 3.40 (ddd, *J* = 7.4, 1.4, 1.4 Hz, 2H, H-19), 3.38 (ddd, *J* = 7.4, 1.4, 1.4 Hz, 2H, H-22); **^{13}C NMR** (126 MHz, $CDCl_3$) δ: 154.2 (Cq), 151.9 (Cq), 147.4 (Cq), 137.8 (CH), 137.5 (CH), 136.1 (CH), 133.3 (Cq), 133.0 (Cq), 131.4 (CH), 131.3 (CH), 131.0 (CH), 130.6 (CH), 129.9 (CH), 129.5 (Cq), 128.9 (CH), 128.8 (Cq), 126.4 (Cq), 124.9 (Cq), 124.5 (Cq), 117.3 (CH), 117.2 (CH_2), 116.7 (CH), 116.1 (CH_2), 115.8 (CH_2), 39.6 (2x CH_2), 35.4 (CH_2); **HRMS** (ESI^-)

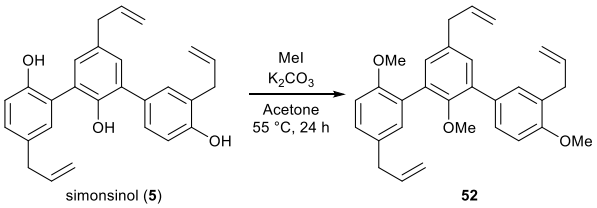
$C_{27}H_{26}O_3$ $[M-H]^-$ calcd. 397.1809, found 397.1805; **IR** V_{max} cm^{-1}: 3594, 3536, 3047, 3005, 1638, 1499, 1461, 1250, 1183, 931.

Nat. **5**[10]	Syn. **5**	Dif.		Nat. **5**[10]	Syn. **5**	Dif.
154.1	154.2	0.1		129.7	129.9	0.2
151.7	151.9	0.2		129.4	129.5	0.1
147.4	147.4	0		128.9	128.9	0
133.1	133.3	0.2		128.7	128.8	0.1
132.8	133	0.2		126.4	126.4	0
131.3	131.4	0.1		124.9	124.9	0
131.2	131.3	0.1		124.5	124.5	0
130.8	131	0.2		117.7	117.3	-0.4[a]
130.5	130.6	0.1		116.4	116.7	0.3

Table S6. *Comparison (Dif. = difference (Syn. – Nat. ^{13}C δ value)) of natural (Nat.) versus synthetic (Syn.) simonsinol (**5**) ^{13}C NMR spectroscopy data in $CDCl_3$.*[10] *The ^{13}C NMR spectral data for the allyl groups of natural simonsinol (**5**) was not provided by the authors due to overlapped signals.*[10] *For full comparison, see permethylated simonsinol **52. a)** Likely typographical error as no signal was observed between 117.3 ppm to 124.5 ppm for synthetic simonsinol (**5**).*

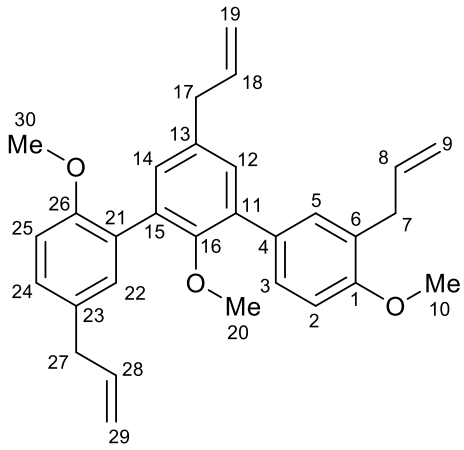
Spectroscopic data obtained for synthetic simonsinol (**5**) were in excellent agreement with the natural sample.[10] Due to the overlapped signals in the ^{13}C NMR spectral data, full comparison was made against permethylated simonsinol **52**.

52: 3",5,5'-Triallyl-2,2',4"-trimethoxy-1,1':3',1"-terphenyl.



simonsinol (**5**) **52**

To a solution of simonsinol (**5**) (7 mg, 0.02 mmol) in acetone (2 mL) was added iodomethane (0.11 mL, 1.76 mmol) and K_2CO_3 (121 mg, 0.877 mmol). The reaction mixture was heated at 55 °C in a sealed tube for 24 hours. The reaction mixture was allowed to cool to room temperature and was then filtered through a short pad of celite. The organics were concentrated *in vacuo* which gave permethylated simonsinol **52** as a colourless oil (8 mg, >90% yield).



52

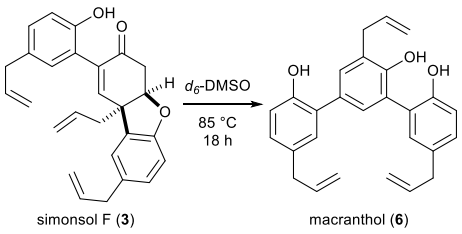
52: ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.43 (dd, *J* = 8.4, 2.3 Hz, 1H, H-24), 7.39 (d, *J* = 2.3 Hz, 1H, H-22), 7.15 (dd, *J* = 8.3, 2.2 Hz, 1H, H-3), 7.14 – 7.12 (m, 2H, H-5 and H-12 or H-14), 7.03 (d, *J* = 2.4 Hz, 1H, H-12 or H-14), 6.92 (d, *J* = 8.3 Hz, 1H, H-2), 6.90 (d, *J* = 8.4 Hz, 1H, H-25), 6.08 – 5.93 (m, 3H, H-8, H-18 and H-28), 5.17 – 5.00 (m, 6H, H-9, H-19 and H-29), 3.87 (s, 3H, H-30), 3.78 (s, 3H, H-20), 3.43 (ddd, *J* = 7.1, 1.6, 1.6 Hz, 1H, H-7), 3.41 (ddd, *J* = 7.1, 1.4, 1.4 Hz, 2H, H-17 or H-27), 3.37 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-17 or H-27), 3.20 (s, 3H, H-10); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 156.6 (Cq), 155.4 (Cq), 153.9 (Cq), 138.0 (CH), 137.6 (CH), 137.2 (CH), 135.0 (Cq), 134.5 (Cq), 132.6 (Cq), 131.9 (Cq), 131.7 (CH), 131.4 (Cq), 130.9 (CH), 130.6 (CH), 130.5 (CH), 128.6 (CH), 128.3 (Cq), 128.2 (Cq), 128.1 (CH), 116.0 (CH_2), 115.6 (CH_2), 115.5 (CH_2), 111.1 (CH), 110.2 (CH), 60.6 (CH), 55.9 (CH), 55.6 (CH), 39.8 (CH_2), 39.5 (CH_2), 34.5 (CH_2); **HRMS** (ESI^+) $C_{30}H_{32}O_3$ $[M+H]^+$ calcd. 441.2424, found 441.2430.

Rep. Syn. **52**[10]	Syn. **52**	Dif.	Rep. Syn. **52**[10]	Syn. **52**	Dif.
156.4	156.6	0.2	128.3	128.6	0.3
155.2	155.4	0.2	128.1	128.3	0.2
153.7	153.9	0.2	128.0	128.2	0.2
137.8	138.0	0.2	127.9	128.1	0.2
137.4	137.6	0.2	115.7	116.0	0.3
137.0	137.2	0.2	115.3	115.6	0.3
134.7	135.0	0.3	115.2	115.5	0.3
134.3	134.5	0.2	110.9	111.1	0.2
132.4	132.6	0.2	110.0	110.2	0.2
131.7	131.9	0.2	60.2	60.6	0.4
131.5	131.7	0.2	55.7	55.9	0.2
131.2	131.4	0.2	55.3	55.6	0.3
130.7	130.9	0.2	39.5	39.8	0.3
130.4	130.6	0.2	39.2	39.5	0.3
130.2	130.5	0.3	34.2	34.5	0.3

Table S7. *Comparison (Dif. = difference (Syn. – Rep. Syn. ^{13}C δ value)) of reported synthetic (Rep. Syn.) versus synthetic (Syn.) permethylated simonsinol* ***52*** *^{13}C NMR spectroscopy data in $CDCl_3$.*[10]

Spectroscopic data obtained for permethylated simonsinol **52** were in excellent agreement with the synthetic sample provided whereby natural simonsinol (**5**) was used as the precursor to **52**.[10]

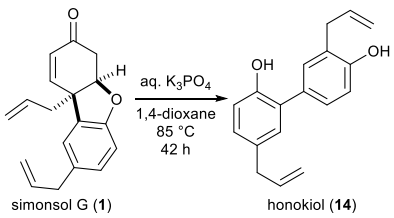
Macranthol (6): 5,5',5"-triallyl-[1,1':3',1"-terphenyl]-2,2",4'-triol.



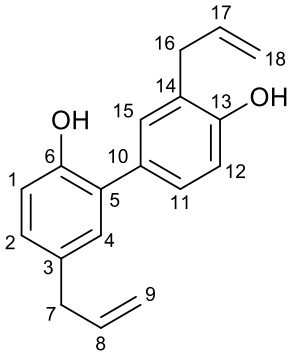
Simonsol F (**3**) (10 mg, 0.025 mmol) was dissolved in d_6-DMSO (0.55 mL) and was heated in an NMR spectroscopy tube at 85 °C for 18 hours. Analysis by ^{1}H NMR showed complete conversion of simonsol F (**3**) to macranthol (**6**). Previous NMR spectral data reported for macranthol (**6**) is analysed in $CDCl_3$. The organics were diluted with Et_2O (10 mL) and were washed with H_2O (3 x 5 mL) then brine (3 x 2 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo* which gave macranthol (**6**) as a colourless solid (9 mg, 90%) **m.p.** 136–138 °C (lit. 140–141 °C).[13]

Full characterisation data for macranthol (**6**) can be found above.

Honokiol (33): 3',5-diallyl-[1,1'-biphenyl]-2,4'-diol.



To simonsol G (**1**) (20 mg, 75 μmol) in 1,4-dioxane (0.60 mL) and H_2O (0.20 mL) at room temperature was added K_3PO_4 (95 mg, 0.45 mmol). The reaction mixture was heated in a sealed tube at 85 °C for 42 hours and was then cooled to room temperature. The organics were diluted with Et_2O (15 mL) and were then washed with HCl (2 x 5 mL of a 1.0 M aqueous solution), then brine (5 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (distilled pentane/distilled Et_2O, 7:3) gave honokiol (**14**) as a colourless solid (14 mg, 70%) **m.p.** 89–91 °C (lit. 85–87 °C).[18]



honokiol (**14**)

Honokiol (14): ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.25 – 7.20 (m, 2H, H-11 and H-15), 7.05 (dd, J = 8.2, 2.2 Hz, 1H, H-2), 7.02 (d, J = 2.2 Hz, 1H, H-4), 6.92 (d, J = 8.2 Hz, 1H, H-12), 6.90 (d, J = 8.2 Hz, 1H, H-1), 6.11 – 5.90 (m, 2H, H-8 and H-17), 5.25 – 5.16 (m, 2H, H-18), 5.14 – 5.01 (m, 4H, H-9 and 2x OH), 3.46 (ddd, J = 6.4, 1.5, 1.5 Hz, 2H, H-16), 3.35 (ddd, J = 6.7, 1.5, 1.5 Hz, 2H, H-7); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 154.1 (Cq), 150.9 (Cq), 137.9 (CH), 136.1 (CH), 132.4 (Cq), 131.3 (CH), 130.3 (Cq), 129.8 (CH), 129.0 (CH), 128.7 (CH), 127.8 (Cq), 126.5 (Cq), 117.1 (CH_2), 116.8 (CH), 115.7 (2x CH), 39.6 (CH_2), 35.4 (CH_2); **HRMS** (ESI^-): $C_{18}H_{18}O_2$ $[M-H]^-$ calcd. 265.1234, found 265.1236.

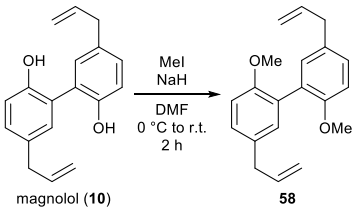
Rep. Syn. **14**[18]	Syn. **14**	Dif.		Rep. Syn. **14**[18]	Syn. **14**	Dif.
153.9	154.1	0.2		128.5	128.7	0.2
150.7	150.9	0.2		127.7	127.8	0.1
137.8	137.9	0.1		126.3	126.5	0.2
135.9	136.1	0.2		116.9	117.1	0.2
132.2	132.4	0.2		116.6	116.8	0.2
131.1	131.3	0.2		115.6	115.7	0.1
130.2	130.3	0.1		115.5	115.7	0.2
129.6	129.8	0.2		39.4	39.6	0.2
128.8	129.0	0.2		35.2	35.4	0.2

Table S8. *Comparison (Dif. = difference (Syn. – Rep. Syn. ^{13}C δ value)) of reported synthetic (Rep. Syn.) versus synthetic (Syn.) honokiol (**14**) ^{13}C NMR spectroscopy data in $CDCl_3$.*[18] *Only ^{1}H NMR spectroscopy data in $CDCl_3$ was reported for natural honokiol (**14**).*[19]

Spectroscopic data obtained for synthetic honokiol (**14**) were in excellent agreement with both the natural[19] and synthetic samples.[18]

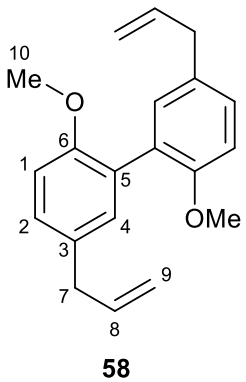
Synthesis of additional compounds for biological testing

58: 5,5'-Diallyl-2,2'-dimethoxy-1,1'-biphenyl.



To a solution of magnolol (**10**) (106 mg, 0.400 mmol) in dry DMF (1.20 mL) at 0 °C was added NaH (35 mg of a 60% w/w dispersion in mineral oil, 0.88 mmol). The reaction mixture was stirred for 2 minutes at 0 °C and then iodomethane (55 µL, 0.88 mmol) was added. The reaction mixture was allowed to warm to room temperature and was stirred for 2 hours. To the reaction mixture was added NaOH (0.25 mL of a 2.0 M aqueous solution) and the biphasic mixture was stirred for 0.5 hours. To the biphasic mixture was added H_2O (10 mL) and the organics were extracted with Et_2O (2 x 10 mL). The combined organics were washed with brine (2 x 5 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (distilled pentane/distilled Et_2O, 9:1) gave dimethyl magnolol **58** as a colourless solid (97 mg, 82%) ***m.p.** 45–47 °C.

*Previously reported as an oil.[20]



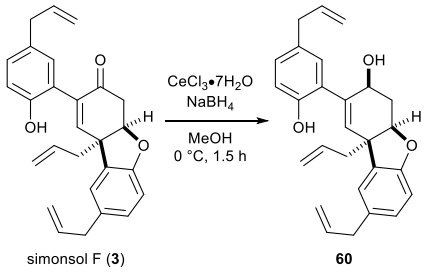
58

58: ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.14 (dd, *J* = 8.3, 2.3 Hz, 2H, H-2), 7.07 (d, *J* = 2.3 Hz, 2H, H-4), 6.91 (d, *J* = 8.3 Hz, 2H, H-1), 6.00 (ddt, *J* = 16.8, 10.0, 6.7 Hz, 2H, H-8), 5.14 – 5.03 (m, 4H, H-9), 3.76 (s, 6H, H-10), 3.37 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 4H, H-7); **^{13}C NMR** (101 MHz, $CDCl_3$) δ: 155.6 (Cq), 138.0 (CH), 131.9 (Cq), 131.7 (CH), 128.6 (CH), 128.0 (Cq), 115.6 (CH_2), 111.3 (CH), 56.0 (CH_3), 39.6 (CH_2); **HRMS** (ESI$^+$): $C_{20}H_{20}O_2$ $[M+H]^+$ calcd. 295.1693, found 295.1694; **IR** ν_{max} cm^{-1}: 3079, 3019, 3003,

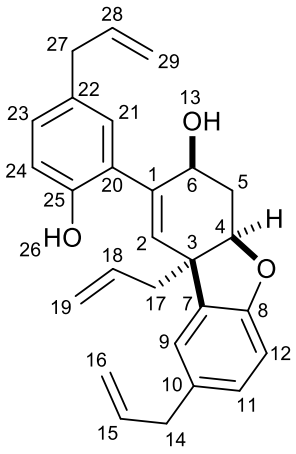
2977, 2952, 2934, 2900, 2830, 1639, 1603, 1504, 1490, 1463, 1426, 1286, 1264, 1228, 1175, 1141, 1047, 1024, 995, 909, 811, 768, 718, 639, 596, 542, 497, 448.

Spectroscopic data obtained for **58** were consistent with those previously reported however the authors reported an extra ^{13}C chemical shift at 127.7 ppm which is assumed to be a typographical error.[20]

60: (±)-(3*S*,4a*R*,9b*R*)-8,9b-Diallyl-2-(5-allyl-2-hydroxyphenyl)-3,4,4a,9b-tetrahydrodibenzo[b,d]furan-3-ol.



To a solution of simonsol F (**3**) (12 mg, 0.030 mmol) in MeOH (0.30 mL) at 0 °C was added sequentially $CeCl_3•7H_2O$ (30 mg, 0.080 mmol) and $NaBH_4$ (2 mg, 0.05 mmol). The reaction mixture was stirred for 1.5 hours at 0 °C. To the reaction mixture was added H_2O (0.5 mL) and the organics were extracted with EtOAc (3 x 0.5 mL). The organics were combined, dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 3:2) gave allylic alcohol **60** as a colourless oil (~90% purity determined by ^1H NMR spectroscopy, 8 mg) and likely the corresponding diastereoisomeric allylic alcohol (~60% purity, 3 mg) which was discarded. The ~90% pure allylic alcohol **60** was further purified by flash column chromatography (petroleum ether/EtOAc/acetone, 8:1:1) which gave allylic alcohol **62** as a colourless oil (7 mg, 58%).

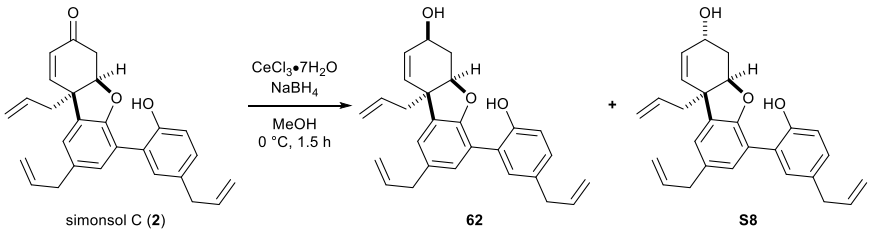


60

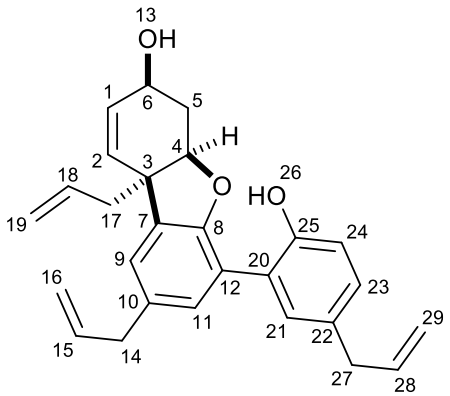
60: ^{1}H NMR (500 MHz, $CDCl_3$) δ: 9.33 (s, 1H, OH-26), 7.02 (d, *J* = 1.8 Hz, 1H, H-9), 6.99 (dd, *J* = 8.2, 2.2 Hz, 1H, H-23), 6.98 (dd, *J* = 8.0, 1.8 Hz, 1H, H-11), 6.83 (d, *J* = 2.2 Hz, 1H, H-21), 6.79 (d, *J* = 8.2 Hz, 1H, H-24), 6.77 (d, *J* = 8.0 Hz, 1H, H-12), 6.01 – 5.87 (m, 2H, H-15 and H-28), 5.78 (s, 1H, H-2), 5.83 – 5.71 (m, 1H, H-18), 5.21 – 5.15 (m, 2H, H-19), 5.11 – 5.02 (m, 4H, H-16 and H-29), 4.83 – 4.78 (m, 1H, H-4), 4.42 – 4.35 (m, 1H, H-5), 4.07 (s, 1H, OH-13), 3.32 (d, *J* = 7.1 Hz, 2H, H-14), 3.30 (d, *J* = 7.1 Hz, 2H, H-27), 2.79 (ddd, *J* = 15.5, 3.2, 2.1 Hz, 1H, H-5), 2.76 (dd, *J* = 14.1, 7.1 Hz, 1H, H-17), 2.61 (dd, *J* = 14.1, 7.1 Hz, 1H, H-17), 2.09 (ddd, *J* = 15.5, 4.1, 2.5 Hz, 1H, H-5); **^{13}C NMR** (126 MHz, $CDCl_3$) δ: 155.6 (Cq), 153.0 (Cq), 138.1 (CH), 137.7 (CH), 137.5 (Cq), 134.2 (Cq), 133.4 (Cq), 133.03 (CH), 132.97 (CH), 130.8 (Cq), 129.94 (CH), 129.89 (CH), 129.0 (CH), 127.9 (Cq), 123.7 (CH), 119.2 (CH_2), 117.3 (CH), 116.0 (CH_2), 115.5 (CH_2), 110.6 (CH), 85.1 (CH), 65.9 (CH), 48.4 (Cq), 41.7 (CH_2), 39.9 (CH_2), 39.4 (CH_2), 30.5 (CH_2); **HRMS** (ESI^-): $C_{27}H_{28}O_3$ $[M-H]^-$ calcd. 399.1966, found 399.1971; **IR** V_{max} cm^{-1}: 3482, 3218, 3104, 3077, 3016, 3006, 2977, 2924, 2900, 2834, 1638, 1611, 1584, 1488, 1434, 1407, 1371, 1271, 1242, 1219, 1194, 1123, 1033, 993, 916, 824, 789.

62: (±)-(3*S*,4a*R*,9b*R*)-8,9b-Diallyl-6-(5-allyl-2-hydroxyphenyl)-3,4,4a,9b-tetrahydrodibenzo[b,d]furan-3-ol**.**

S8: (±)-(3*R*,4a*R*,9b*R*)-8,9b-Diallyl-6-(5-allyl-2-hydroxyphenyl)-3,4,4a,9b-tetrahydrodibenzo[b,d]furan-3-ol.



To a solution of simonsol C (**2**) (12 mg, 0.030 mmol) in MeOH (0.30 mL) at 0 °C was added sequentially $CeCl_3•7H_2O$ (34 mg, 0.090 mmol) and $NaBH_4$ (2 mg, 0.05 mmol). The solution was stirred for 1.5 hours at 0 °C and then H_2O (0.5 mL) was added. The organics were extracted with EtOAc (3 x 0.5 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. Purification by flash column chromatography (petroleum ether/Et_2O, 2:3) provided a mixture of allylic alcohols **62** and **S8** as a light-yellow oil (15 mg). The mixture of allylic alcohols **62** and **S8** were subjected to column chromatography (CH_2Cl_2/MeOH, 39:1) which provided a mixture of allylic alcohols **62** and **S8** as a colourless oil (12 mg). The mixture of allylic alcohols **62** and **S8** were separated by preparative TLC (CH_2Cl_2/MeOH, 39:1 (3 runs)) which gave allylic alcohol **62** as a colourless oil (6 mg) and allylic alcohol **S8** as a colourless oil (5 mg, 42%). Allylic alcohol **62** was freeze-dried which gave **62** as a colourless solid (5 mg, 42%) **m.p.** 128–130 °C (lit. 110–112 °C).[6]



62

62: ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.27 – 7.17 (m, 1H, ArOH-26), 7.09 (d, *J* = 2.3 Hz, 1H, H-21), 7.06 (dd, *J* = 8.2, 2.3 Hz, 1H, H-23), 7.01 (d, *J* = 1.7 Hz, 1H, H-11), 6.98 (d, *J* = 1.7 Hz, 1H, H-9), 6.90 (d, *J* = 8.2 Hz, 1H, H-24), 5.98 (d, *J* = 10.0 Hz, 1H, H-1), 6.04 – 5.92 (m, 2H, H-15 and H-28), 5.77 – 5.65 (m, 1H, H-18), 5.68 (d, *J* = 10.0 Hz, 1H, H-2), 5.15 – 5.03 (m, 6H, H-16, H-19 and H-29), 4.81 – 4.76 (m, 1H, H-4), 4.25 – 4.18 (m, 1H, H-6), 3.40 (d, *J* = 6.6 Hz, 2H, H-14), 3.36 (d, *J* = 6.6 Hz, 2H, H-27), 3.15 – 2.85 (m, 1H, OH-13), 2.62 (dddd, *J* = 14.2, 7.0, 1.4, 1.4 Hz, 1H, H-17), 2.57 – 2.49 (m, 2H, H-5 and H-17), 1.98 (ddd, *J* = 15.1, 4.7, 2.9 Hz, 1H, H-5); **^{13}C NMR** (126 MHz, $CDCl_3$) δ: 153.1 (Cq), 152.3 (Cq), 138.0 (CH), 137.8 (CH), 134.0 (Cq), 133.32 (Cq), 133.25 (CH), 132.4 (CH), 132.3 (Cq), 130.8 (CH), 130.1 (CH), 129.4 (CH), 127.7 (CH), 124.8 (Cq), 122.5 (CH), 121.5 (Cq), 118.9 (CH_2), 117.3 (CH), 116.0 (CH_2), 115.7 (CH_2), 85.3 (CH), 61.8 (CH), 48.1 (Cq), 41.8 (CH_2), 40.0 (CH_2), 39.6 (CH_2), 31.5 (CH_2); **HRMS** (ESI^-): $C_{27}H_{28}O_3$ $[M-H]^-$ calcd. 399.1966, found 399.1968; **IR** V_{max} cm^{-1}: 3436, 3178, 3076, 3019, 3005, 2976, 2918, 2898, 2829, 1639, 1607, 1510, 1474, 1417, 1369, 1287, 1255, 1220, 1045, 994, 987, 911, 826, 766, 746, 733, 661, 546.

Banwell and co-workers obtained crystal data for compound **62** in order to confirm its relative stereochemistry.[6] Our melting point for **62** is significantly higher than that reported,[6] however this is likely due to the presence of allyl group isomers Banwell's sample (see Figure S2, highlighted as "* = impurity").

There are also some discrepancies between our ^{13}C chemical shifts (δ values (ppm)) and those reported by Banwell and co-workers.[6] Differences in chemical shift values range from -0.5 to 1.0 (see Table S9). This discrepancy could be due to sample concentration (the concentration of **62** in Banwell and co-workers NMR sample (see Figures S3 and S4),[6] was increased when

the ^{13}C NMR spectral data was obtained compared to when the ^{1}H NMR spectral data was obtained) as well as the presence of impurities in Banwell's sample.

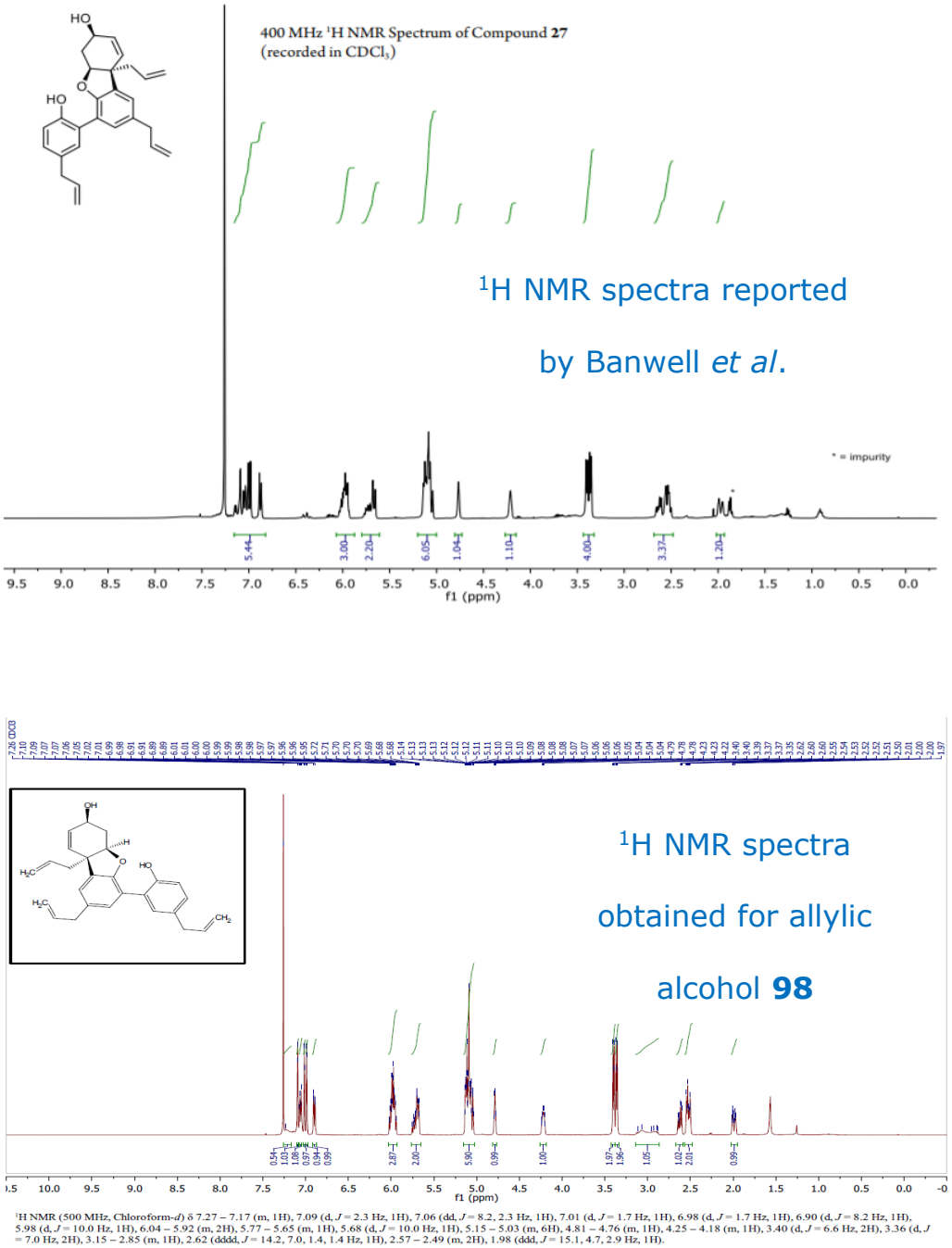


Figure S3. *Banwell and co-workers*[6] *versus our reported* ^{1}H *NMR spectra of* ***98*** *in* $CDCl_3$.

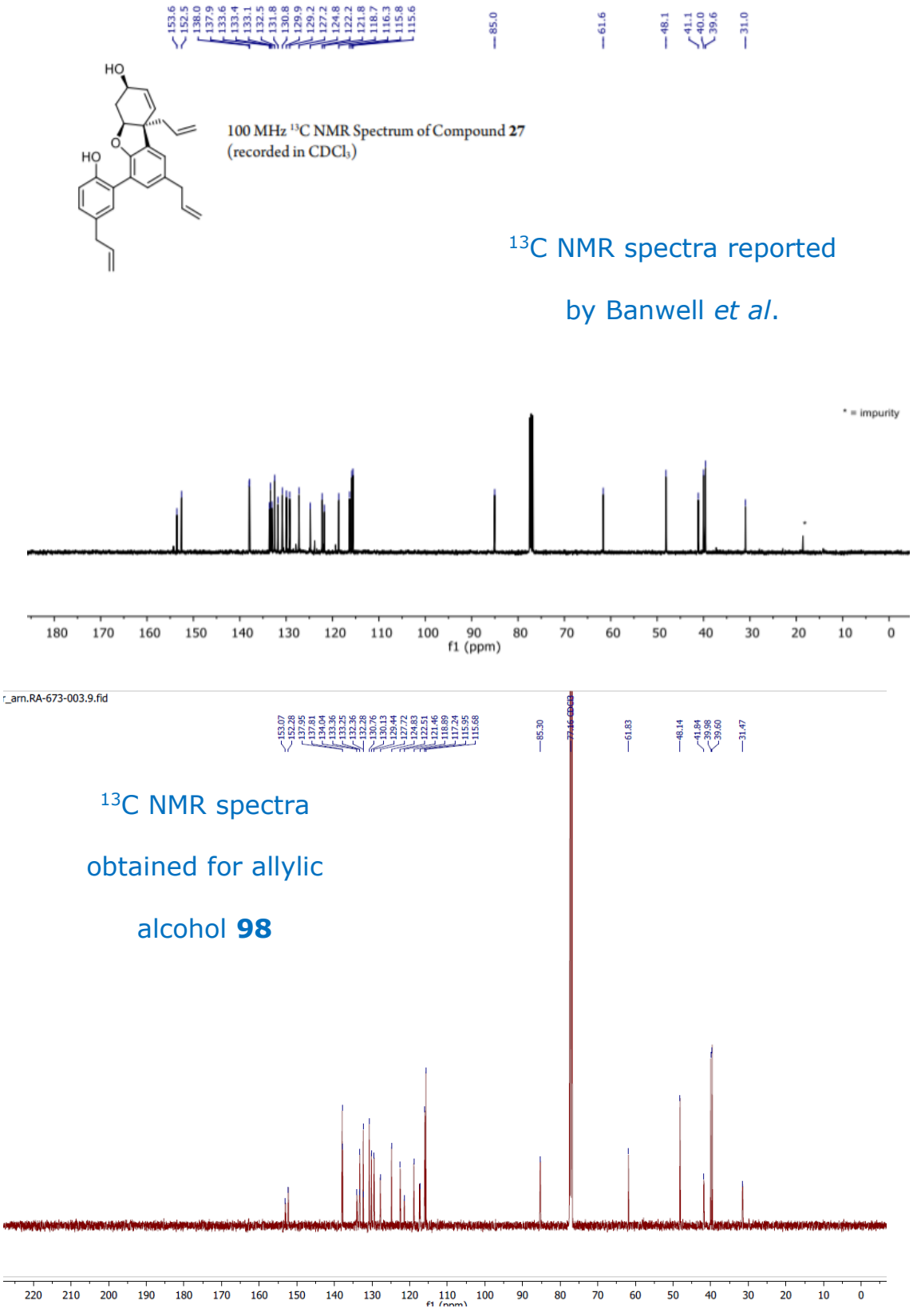
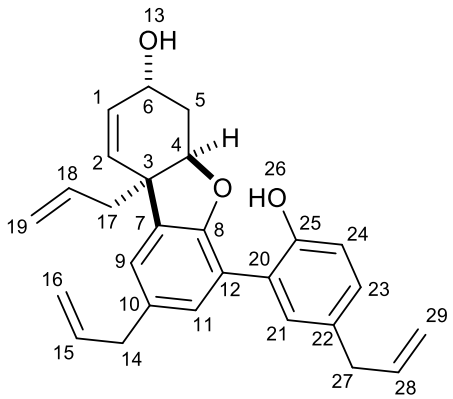


Figure S4. *Banwell and co-workers*[6] *versus our reported* ^{13}C *NMR spectra of* ***62*** *in* $CDCl_3$.

Rep. Syn. **62**[6]	Syn. **62**	Dif.	Rep. Syn. **62**[6]	Syn. **62**	Dif.
153.6	153.1	-0.5	122.2	122.5	0.3
152.5	152.3	-0.2	121.8	121.5	-0.3
138.0	138.0	0	118.7	118.9	0.2
137.9	137.8	-0.1	116.3	117.3	1.0
133.6	134.0	0.4	115.8	116.0	0.2
133.4	133.3	-0.1	115.6	115.7	0.1
133.1	133.3	0.2	85.0	85.3	0.3
132.5	132.4	-0.1	61.6	61.8	0.2
131.8	132.3	0.5	48.1	48.1	0
130.8	130.8	0	41.1	41.8	0.7
129.9	130.1	0.2	40.0	40.0	0
129.2	129.4	0.2	39.6	39.6	0
127.2	127.7	0.5	31.0	31.5	0.5
124.8	124.8	0			

Table S9. *Comparison (Dif. = difference (Syn. – Rep. Syn. ^{13}C δ value)) of reported synthetic (Rep. Syn.) versus synthetic (Syn.) allylic alcohol* ***62*** *^{13}C NMR spectroscopy data in $CDCl_3$.*[10]

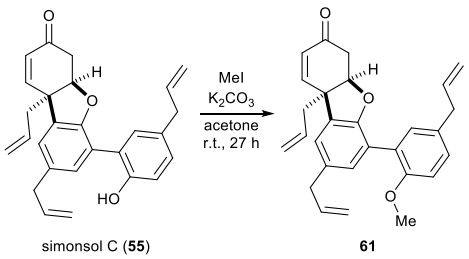
A tabulated comparison of the ^1H NMR spectroscopy data is not provided as Banwell and co-workers described the majority of their reported ^1H chemical shifts of **62** as a multiplet (which is likely due to the overlapped signals produced from the present allyl group isomer). However, the chemical shift δ values (ppm) are in excellent agreement.



S8

S8: ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.13 (d, *J* = 2.2 Hz, 1H, H-21), 7.11 (dd, *J* = 8.2, 2.2 Hz, 1H, H-23), 7.05 (d, *J* = 1.6 Hz, 1H, H-11), 6.97 (d, *J* = 8.2 Hz, 2H, H-24), 6.96 (d, *J* = 1.6 Hz, 1H, H-9), 6.53 (s, 1H, ArOH-26), 5.97 (dddd, *J* = 16.8, 10.0, 6.8, 6.8 Hz, 2H, H-15 and H-28), 5.87 (ddd, *J* = 10.1, 2.2, 1.1 Hz, 1H, H-1), 5.80 – 5.70 (m, 1H, H-18), 5.65 (ddd, *J* = 10.1, 1.9, 1.1 Hz, 1H, H-2), 5.16 – 5.03 (m, 7H, H-16, H-19 and H-29), 4.88 (ddd, *J* = 4.4, 3.3, 0.9 Hz, 1H, H-4), 4.48 – 4.39 (m, 1H, H-6), 3.39 (d, *J* = 6.8 Hz, 2H, H-14), 3.38 (d, *J* = 6.8 Hz, 2H, H-27), 2.66 (dddd, *J* = 14.3, 6.7, 1.3, 1.3 Hz, 1H, H-17), 2.61 – 2.51 (m, 2H, H-5 and H-17), 1.80 (ddd, *J* = 13.9, 9.5, 3.2 Hz, 1H, H-5), 1.57 (d, *J* = 5.8 Hz, 1H, OH-13); **^{13}C NMR** (126 MHz, $CDCl_3$) δ: 152.6 (Cq), 152.1 (Cq), 137.9 (CH), 137.6 (CH), 134.6 (Cq), 133.6 (Cq), 133.3 (CH), 132.9 (Cq), 131.7 (CH), 131.6 (CH), 130.7 (CH), 130.4 (CH), 129.7 (CH), 125.0 (Cq), 122.9 (CH), 121.0 (Cq), 119.1 (CH_2), 118.5 (CH), 116.1 (CH_2), 115.7 (CH_2), 85.5 (CH), 62.6 (CH), 47.9 (Cq), 42.8 (CH_2), 39.9 (CH_2), 39.6 (CH_2), 33.6 (CH_2); **HRMS** (ESI^-): $C_{27}H_{28}O_3$ $[M-H]^-$ calcd. 399.1966, found 399.1964; **IR** ν_{max} cm^{-1}: 3354, 3075, 2924, 2855, 1733, 1639, 1497, 1472, 1433, 1416, 1279, 1245, 1219, 1034, 996, 915.

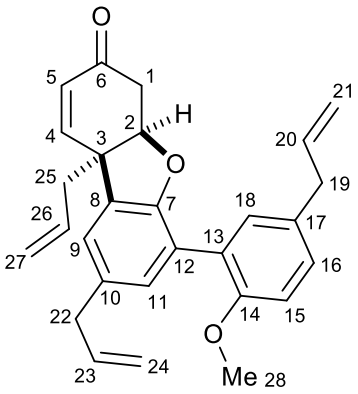
61: (±)-(4a*R*,9b*R*)-8,9b-Diallyl-6-(5-allyl-2-methoxyphenyl)-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one.



simonsol C (**55**) **61**

To a solution of simonsol C (**2**) (45 mg, 0.11 mmol) in acetone (2.85 mL) was added K_2CO_3 (236 mg, 1.71 mmol) and iodomethane (71 µL, 1.1 mmol). The reaction mixture was stirred for 27 hours at room

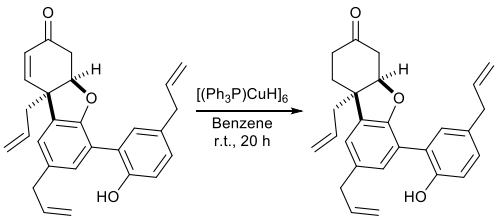
temperature and then the organics were concentrated under a stream of nitrogen. Purification by graduated column chromatography (petroleum ether/EtOAc, 9:1 to 4:1) gave an inseparable 4:1 respective mixture (determined by ^{1}H NMR spectroscopy) of methyl simonsol C **61** and an unknown impurity. The mixture was dissolved in a minimal amount of distilled Et_2O (~0.2 mL) and the solution was diluted with distilled pentane (~2.0 mL), sealed and cooled to -20 °C for 18 hours. A colourless precipitate formed which was collected by suction filtration and the filter cake was washed with distilled pentane (3 x 1 mL) which gave methyl simonsol C **61** as a colourless solid (12 mg, 26%) **m.p.** 103–105 °C.



61

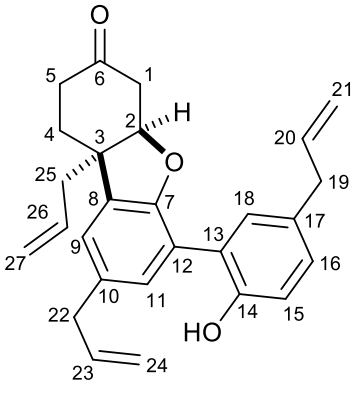
61: ^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.13 (dd, *J* = 8.3, 2.3 Hz, 1H, H-16), 7.10 (d, *J* = 2.3 Hz, 1H, H-18), 7.07 (d, *J* = 1.7 Hz, 1H, H-11), 6.99 (d, *J* = 1.7 Hz, 1H, H-9), 6.89 (d, *J* = 8.3 Hz, 1H, H-15), 6.56 (dd, *J* = 10.2, 1.8 Hz, 1H, H-4), 6.04 (d, *J* = 10.2 Hz, 1H, H-5), 5.97 (dddd, *J* = 16.8, 9.9, 6.8, 6.8 Hz, 2H, H-20 and H-23), 5.82 (dddd, *J* = 16.8, 10.0, 8.1, 6.6 Hz, 1H, H-26), 5.23 – 5.16 (m, 2H, H-27), 5.15 – 5.03 (m, 4H, H-21 and H-24), 4.79 (ddd, *J* = 4.1, 3.0, 1.8 Hz, 1H, H-2), 3.72 (s, 3H, H-28), 3.39 (d, *J* = 6.8 Hz, 2H, H-22), 3.35 (d, *J* = 6.8 Hz, 2H, H-19), 2.97 (dd, *J* = 17.5, 3.0 Hz, 1H, H-1), 2.83 (dddd, *J* = 14.2, 6.6, 1.4, 1.4 Hz, 1H, H-25), 2.73 (dd, *J* = 17.5, 4.1 Hz, 1H, H-1), 2.66 (dd, *J* = 14.2, 8.1 Hz, 1H, H-25); **^{13}C NMR** (126 MHz, $CDCl_3$) δ: 195.8 (Cq), 155.5 (Cq), 155.0 (Cq), 148.8 (CH), 137.81 (CH), 137.78 (CH), 133.3 (Cq), 132.4 (CH), 132.1 (Cq), 131.3 (CH), 131.06 (Cq), 131.05 (CH), 129.1 (CH), 127.4 (CH), 125.9 (Cq), 121.9 (CH), 121.8 (Cq), 119.7 (CH_2), 116.0 (CH_2), 115.8 (CH_2), 111.6 (CH), 84.6 (CH), 55.9 (CH_3), 48.8 (Cq), 41.0 (CH_2), 40.0 (CH_2), 39.5 (CH_2), 39.0 (CH_2); **HRMS** (ESI^+): $C_{28}H_{28}O_3$ $[M+H]^+$ calcd. 413.2111, found 413.2100; **IR** ν_{max} cm^{-1}: 3076, 3001, 2956, 2904, 2848, 2834, 1686, 1639, 1616, 1503, 1466, 1437, 1415, 1404, 1276, 1245, 1217, 1182, 1132, 1082, 1027, 994, 916, 880, 815, 795, 765, 659, 592, 551.

63: (±)-(4a*R*,9b*S*)-8,9b-Diallyl-6-(5-allyl-2-hydroxyphenyl)-1,4,4a,9b-tetrahydrodibenzo[b,d]furan-3(2H)-one.



simonsol C (**2**) **63**

To a flame-dried microwave was added simonsol C (**2**) (25 mg, 0.063 mmol) and benzene (1.00 mL which had been sparged with argon for 5 minutes). The solution was then sparged with argon for a further 5 minutes and then Stryker's reagent[21] (247 mg, 0.126 mmol) was added and the reaction mixture was stirred at room temperature for 20 hours. The reaction mixture was filtered through a plug of celite and the celite was washed with Et_2O. Purification by flash column chromatography (petroleum ether/Et_2O, 3:2) gave a mixture of ketone **63** and triphenylphosphine (as well as other baseline impurities). The mixture was purified by preparative TLC (petroleum ether/acetone, 33:7) which gave a mixture of ketone **63** and baseline impurities as a colourless solid (14 mg). The solid was dissolved in the minimum amount of distilled Et_2O (~0.2 mL) and the solution was diluted with distilled pentane (~2.0 mL). The solution was cooled to -20 °C for 20 hours. A colourless precipitate formed which was collected by suction filtration and the filter cake was washed with distilled pentane (3 x 0.5 mL) which gave ketone **63** as a colourless solid (10 mg, 40%) **m.p.** 91–93 °C.



63

63: **^{1}H NMR** (500 MHz, $CDCl_3$) δ: 7.11 – 7.08 (m, 2H, H-15 and H-18), 7.08 (d, *J* = 1.8 Hz, 1H, H-11), 6.98 (d, *J* = 1.8 Hz, 1H, H-9), 6.98 – 6.92 (m, 1H, H-16), 6.14 (s, 1H, OH), 6.03 – 5.93 (m, 2H, H-20 and H-22), 5.74 (dddd, *J* = 16.8, 10.5, 8.2, 6.6 Hz, 1H, H-26), 5.22 – 5.16 (m, 2H, H-27), 5.13 – 5.04 (m, 5H, H-2, H-21 and H-24), 3.41 (ddd, *J* = 6.8, 1.5, 1.5 Hz, 2H, H-22), 3.37 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H, H-19), 2.90 (dd, *J* = 17.1, 3.3 Hz, 1H, H-1), 2.67 (dd, *J* = 17.1, 3.7 Hz, 1H, H-1), 2.66 (dddd, *J* = 14.0, 6.6, 1.2, 1.2

Hz, 1H, H-25), 2.55 (dd, *J* = 14.0, 8.2 Hz, 1H, H-25), 2.35 – 2.29 (m, 1H, H-5), 2.22 – 2.13 (m, 1H, H-4), 2.08 – 1.97 (m, 2H, H-4 and H-5); **^{13}C NMR** (126 MHz, $CDCl_3$) δ: 208.6 (Cq), 153.4 (Cq), 152.0 (Cq), 137.9 (CH), 137.6 (CH), 134.8 (Cq), 132.8 (Cq), 132.6 (CH), 132.5 (Cq), 131.0 (CH), 130.7 (CH), 129.8 (CH), 124.6 (Cq), 123.1 (CH), 120.6 (Cq), 120.3 (CH_2), 118.4 (CH), 116.2 (CH_2), 115.8 (CH_2), 85.7 (CH), 47.7 (Cq), 44.6 (CH_2), 42.1 (CH_2), 39.9 (CH_2), 39.6 (CH_2), 35.9 (CH_2), 32.4 (CH_2); **HRMS** (ESI^+): $C_{27}H_{28}O_3$ $[M+H]^+$ calcd. 401.2111, found 401.2116; **IR** V_{max} cm^{-1}: 3390, 3076, 3003, 2976, 2902, 2838, 1719, 1638, 1609, 1497, 1472, 1433, 1416, 1365, 1349, 1327, 1287, 1271, 1242, 1213, 1148, 1122, 1047, 995, 914, 867, 825, 803, 792, 764, 692, 655, 564, 553, 544, 492.

Biological Methods and Data

Mouse primary cortical cultures: Mice (C57/BL6) were housed, bred and sacrificed (Schedule 1) in compliance with the ethics and animal welfare in accordance to the Animal (Scientific Procedures) Act 1986, in place in the University of Nottingham.

Mouse cortical neuron cultures were prepared in accordance to the procedure detailed in Lucci, Dajas-Bailador, Lucci and co-workers.[22] In brief, E16-E17 mouse embryos were culled and their brains removed. Brain cortices were dissected, and the meninges separated using a dissection microscope. Dissected cortices were incubated in Hanks Balanced Salt Solution (HBSS, Ca^{2+} and Mg^{2+}-free; Gibco) with 1mg/ml trypsin and 5mg/ml DNAseI (Sigma) at 37oC/5% CO_2 for 30 min. Following treatment with 0.05% (v/v) trypsin inhibitor (Life Technologies), the tissue was washed in Neurobasal media (Gibco) and 5mg/ml DNAseI was added before mechanical dissociation. Dissociated cells were spun down at 250x g/5 min, further resuspended in Neurobasal media supplemented with 1x GlutaMax and 2% (v/v) B-27 (Gibco) and plated onto poly-L-ornithine coated coverslips (0.05mg/mL overnight; Sigma) in a 12-well plate layout (Corning) at a seeding density of $5.0x10^4$/mL. Neolignan compounds were added to the cultures 48h after plating at 1 μM and following a 48h incubation period, the

cells were fixed with 4% paraformaldehyde (3.6% sucrose, 1x PBS, 5mM MgCl2, pH 7.4; ThermoFisher) for 30 min.

Immunostaining: To allow for visualisation of neuron morphology, cultures underwent immunostaining of the cytoskeleton marker acetylated tubulin. Briefly, cells were permeabilised in PBS/Glycine-Triton (1x PBS, 10mM glycine, 0.2% Triton X-100; Sigma) for 20 min, blocked with 3% bovine serum albumin in PBS for 1h (Sigma), followed by 4ºC/overnight incubation with anti-acetylated tubulin (1:300 in 3% BSA-PBS; clone 611B-1, Sigma) and further incubation for 1h with secondary antibody goat anti-mouse Alexa Fluor 488 (1:300 in 3% BSA-PBS; Molecular Probes). Imaging was performed with a Zeiss LSM Exciter wide field fluorescence microscope coupled to a Retiga R1 CCD camera and acquired with Micro-Manager 1.4.21 software (Schindelin et al 2012).[23]

Data analysis: For axon length measurements, axons were defined as the longest neuronal projection with at least 3 times the length of any other projection and measured from the cell body to the growth cone of the longest branch parallel to the direction of growth using Fiji 2.0.0. (Lucci et al. 2020, Edelstein et al 2014).[24]

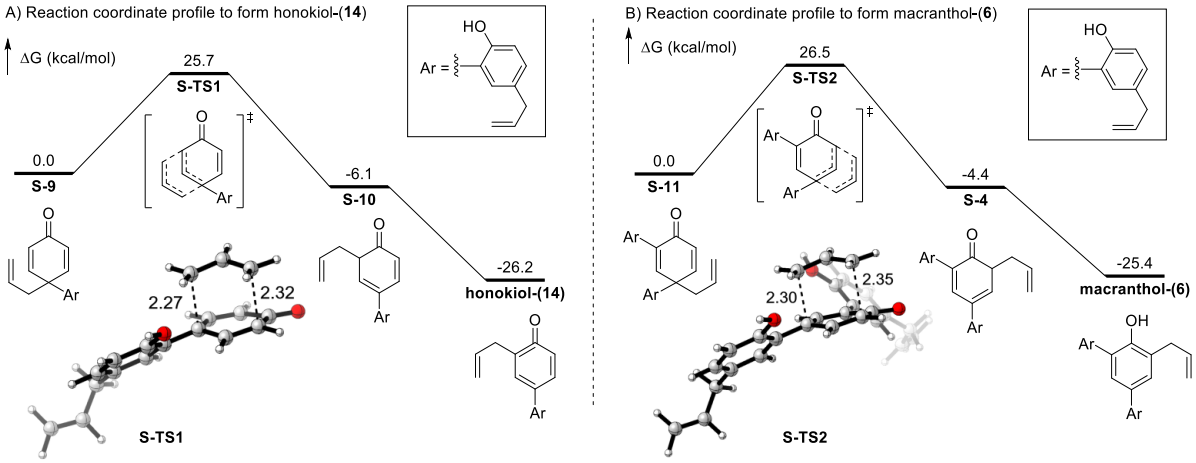
Data was obtained from 3-5 independent experiments, each conducted in duplicate. For each technical duplicate 80-100 neurons from approximately 20 random field images were analysed (~160-200 axons measured per condition in each independent experiment). Data are expressed as percentage of respective controls and presented as mean ± SEM. All axon length data analysis and statistical evaluation were carried out in Graphpad Prism (version 8.2.0 for Windows). The probability distribution of the data set was analysed before further statistical analysis (Shapiro–Wilk test). Group analysis was carried out with One-way ANOVA with Dunnett's *post hoc* analysis, alpha=0.05 two tailed.

Computational Methods

All geometry optimizations were performed in water using the dispersion-corrected ωb97xd [25] functional with def2SVP[26]basis set. Single point energies were calculated with the M06-2X [27]functional and the def2TZVP basis set. Solvation effects were included by performing single point energy calculations with the SMD [28]solvation model in corresponding solvents (Scheme 4B, solvent = THF; Scheme X (cope TS), solvent = 1,4-dioxane; Scheme 6B, solvent = toluene). We conducted CREST [29]conformational analysis on key intermediates. Only the lowest energy conformations are included in this work. To obtain more accurate Gibbs free energies and enthalpies, we applied the quasiharmonic approximation from Grimme to compute the thermal corrections with a cut-off frequency of 50 cm^{-1}. [30]The quasiharmonic approximations were calculated using GoodVibes. [31]All calculations were performed with Gaussian 16 [32]on UCLA Hoffman2 and XSEDE [33] supercomputers.

Computed Neutral Cope Rearrangement Pathways

We conducted DFT calculations to study the proposed mechanism that forms aromatic neolignans honokiol-(**14**), and macranthol-(**6**). Our calculation suggests that the Cope rearrangement transition state (**S-TS1**) from the dienone intermediate **S-9** has a relatively low free energy barrier of 25.7 kcal/mol. The formation of the new dienone intermediate **S-10** is exergonic by 6.1 kcal/mol, suggesting the cope rearrangement is irreversible at the reaction condition. Subsequent tautomerization to form the product honokiol-(**14**) exergonic by 26.2 kcal/mol (**Scheme S1-A**). The computed reaction coordinate profile to form the macranthol-**(6)** from intermediate **S-11** via **S-TS2** has a similarly low free energy barrier of 26.5 kcal/mol, suggesting that substitutions on the dienone intermediate does have a significant effect on the Cope rearrangement mechanism (**Scheme S1-B**). Both computed cope rearrangement transition states adopt the favored chair-like conformation.



Scheme S1. Reaction coordinate profiles to form A) honokiol-(14) and B) macranthol-(6) and C) computed Cope rearrangement transition states

```
59
47-SP                                                Eopt  -1309.394421
C      2.585209      2.893922      0.179953
C      1.709301      1.803735      0.268217
C      2.148974      0.491320      0.137529
C      3.514632      0.248139     -0.114467
C      4.403461      1.319355     -0.191589
C      3.932528      2.627375     -0.044858
```

```
H     0.647114     1.981371     0.460191
H     5.464211     1.152926    -0.379587
H     4.644286     3.454845    -0.110936
O     3.859072    -1.044230    -0.301484
C     5.215482    -1.392569    -0.323189
H     5.733714    -1.054378     0.590132
H     5.259074    -2.487402    -0.372159
H     5.732932    -0.977493    -1.205992
C     2.057549     4.306382     0.331621
H     2.899999     5.012689     0.248728
H     1.629282     4.441482     1.338799
C     1.019624     4.644325    -0.702986
H     1.354416     4.586199    -1.745904
C    -0.245532     4.972216    -0.442606
H    -0.953829     5.194125    -1.244612
H    -0.620364     5.030878     0.584573
C    -0.943833    -1.804841    -0.466360
C     0.682248    -2.960849     1.185577
C    -0.751174    -2.748768     0.752056
H     1.189508    -3.580728     0.428002
H     0.722839    -3.493889     2.144638
H    -1.222001    -3.722272     0.522546
C     0.128684    -0.746365    -0.546579
H    -0.030671     0.020607    -1.314097
C     1.208589    -0.649061     0.245836
C     1.466989    -1.672215     1.308969
O     2.275195    -1.495176     2.188238
C    -1.057295    -2.568136    -1.801049
H    -1.255684    -1.829534    -2.597789
H    -1.935537    -3.231530    -1.757235
C     0.175488    -3.349950    -2.149886
H     1.105058    -2.772087    -2.229090
C     0.210606    -4.668288    -2.344253
H    -0.693004    -5.281858    -2.267749
H     1.141224    -5.183139    -2.595293
O    -1.484911    -2.160344     1.835079
C    -2.229806    -1.109101    -0.056217
C    -2.422101    -1.345708     1.303940
C    -3.477264    -0.770729     1.998369
H    -3.617686    -0.966220     3.061974
C    -4.342410     0.060335     1.282200
H    -5.178740     0.529489     1.807404
C    -4.176120     0.312630    -0.085162
C    -3.094919    -0.280947    -0.753860
H    -2.937144    -0.078719    -1.817454
C    -5.100339     1.256889    -0.812870
H    -5.232392     0.923061    -1.856808
H    -6.108896     1.212361    -0.366928
C    -4.652266     2.698573    -0.828501
H    -5.328650     3.384803    -1.352758
C    -3.543339     3.187605    -0.274759
H    -2.834114     2.548428     0.259450
H    -3.307582     4.252357    -0.337152
59
49-SP                                                  Eopt  -1309.389500
C    -0.772351     0.165804     0.215913
C     1.195910    -1.254508     1.189600
C    -0.037115    -1.198805     0.295192
H     1.410991    -2.315146     1.379252
H     0.241704    -1.514661    -0.722930
C    -0.753934     0.877600     1.548513
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H    -1.433595     1.732804     1.635757
C    -0.011821     0.510079     2.601255
C     0.958188    -0.607327     2.549726
O     1.570762    -0.960277     3.531535
C    -0.262529     1.119791    -0.886977
H     0.712690     1.530927    -0.589407
H    -0.961469     1.973954    -0.928337
C    -0.156469     0.496188    -2.246541
H    -1.089460     0.124659    -2.687301
C     0.987354     0.366589    -2.919146
H     1.937997     0.709263    -2.495869
H     1.016157    -0.090552    -3.911631
O    -1.010856    -2.136331     0.780795
C    -2.193227    -0.337170     0.012344
C    -2.225880    -1.670513     0.422815
C    -3.410777    -2.390971     0.448653
H    -3.425094    -3.431626     0.774352
C    -4.574811    -1.731958     0.040154
H    -5.519945    -2.281765     0.047466
C    -4.569234    -0.399271    -0.386387
C    -3.353586     0.304445    -0.385770
H    -3.336342     1.354381    -0.693593
C    -5.841179     0.283822    -0.852111
H    -5.799067     0.453300    -1.941560
H    -6.692957    -0.393013    -0.674097
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H    -6.196608     1.534759     0.936131
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C     2.389859    -0.659183     0.463550
C     2.830531     0.642139     0.663843
C     3.036648    -1.441754    -0.517076
C     3.875844     1.205697    -0.079720
H     2.328622     1.267558     1.406829
C     4.095515    -0.908651    -1.251637
O     2.550881    -2.691065    -0.686547
C     4.501831     0.410441    -1.033470
C     4.244229     2.658974     0.135749
H     4.605831    -1.504645    -2.007896
C     3.103751    -3.517382    -1.673779
H     5.323521     0.818140    -1.628254
H     5.150784     2.894055    -0.445046
H     4.487151     2.834292     1.196346
C     3.123885     3.572701    -0.283388
H     4.170945    -3.723757    -1.483030
H     2.547690    -4.461771    -1.639252
H     2.997284    -3.074547    -2.679267
H     2.861146     3.541896    -1.348161
C     2.425086     4.356323     0.537729
H     1.605768     4.979989     0.171804
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59
50-SP                                          Eopt  -1309.381359
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C     1.214370    -1.643095     1.081280
C     1.700387    -1.348334    -0.371536
H     2.467758    -2.087207    -0.639297
C     2.951422     0.666794     0.562742
H     3.536938     1.573081     0.370350
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C     2.146212    -1.054769     2.147168
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C     3.168376     0.104623    -1.859318
H     3.365566     1.162604    -2.104075
H     2.622940    -0.324227    -2.713710
C     4.464161    -0.623559    -1.655818
H     5.145739    -0.210789    -0.902369
C     4.821340    -1.729864    -2.308570
H     4.170230    -2.179167    -3.065644
H     5.777330    -2.223417    -2.117189
O     0.622913    -1.499040    -1.296277
C     0.917863     0.753539    -1.008698
C     0.067406    -0.266446    -1.438632
C    -1.203202    -0.006119    -1.923997
H    -1.869262    -0.814733    -2.226001
C    -1.608167     1.330354    -1.963912
H    -2.610927     1.563786    -2.332314
C    -0.782462     2.374919    -1.533197
C     0.502154     2.072801    -1.051329
H     1.158918     2.876195    -0.704753
C    -1.283204     3.805274    -1.538240
H    -0.452826     4.498930    -1.743620
H    -2.009675     3.927776    -2.359077
C    -1.947751     4.184781    -0.241908
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C    -1.575694     5.191297     0.548878
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H    -4.568099    -2.772670     0.631218
H    -3.290316    -3.997977     0.676528
C    -3.503320    -3.024043    -1.214455
H    -0.772448     2.144421     3.381423
H     0.814203     2.640232     2.717783
H    -0.627060     2.642458     1.656950
H    -2.536466    -3.299998    -1.654766
C    -4.519566    -2.717179    -2.020045
H    -4.414297    -2.746312    -3.107506
H    -5.497590    -2.428656    -1.621403
H     1.296175    -2.729708     1.227312
37
53-SP                                              Eopt   -846.571238
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C    -1.116623    -2.769666    -0.197851
C    -0.063806    -1.859326    -0.322371
C    -0.326956    -0.474903    -0.366636
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H    -4.804348    -1.248510     0.088971
H    -4.421005     0.107988    -0.979481
C    -4.320375     0.563676     1.104844
H    -4.064067     0.168042     2.095486
C    -4.738197     1.825213     0.996239
H    -4.981910     2.260907     0.021314
H    -4.842250     2.472412     1.871089
C     1.979579    -0.892052    -0.838231
H     1.931887    -1.007658    -1.936832
C     1.005208     0.246179    -0.418494
O     1.213924    -2.173029    -0.397294
C     1.115175     1.381255    -1.469297
H     2.183372     1.650200    -1.505618
H     0.844883     0.959726    -2.452462
C     0.283175     2.603796    -1.213775
H    -0.770193     2.553819    -1.516032
C     0.728026     3.725327    -0.645030
H     1.768656     3.815875    -0.317689
H     0.068317     4.580339    -0.470990
C     1.345800     0.772246     0.960330
H     0.568576     1.353388     1.469017
C     2.541131     0.564251     1.520028
H     2.777253     0.967991     2.510632
C     3.679461    -0.170259     0.850817
C     3.344665    -0.804950    -0.358442
H     4.127498    -1.355299    -0.886868
O     4.797183    -0.109679     1.399116
37
54-SP                                                  Eopt   -846.583338
C    -2.333003     1.194534     1.491974
C    -1.770511     0.040398     1.097955
C    -1.207740    -0.202398    -0.276055
H    -1.664380    -0.818278     1.767996
C    -4.407600    -1.912244    -0.564027
H    -2.708857     1.333479     2.509064
C    -3.462235    -1.141966    -1.104070
H    -4.144763    -2.787143     0.039401
C    -1.989170    -1.377401    -0.960423
H    -5.471153    -1.691685    -0.694664
H    -3.769887    -0.262099    -1.684857
H    -1.783381    -2.273604    -0.357165
H    -1.531813    -1.523049    -1.955133
C    -1.353001     1.003616    -1.156128
H    -0.970602     0.896573    -2.177765
C    -1.940203     2.148887    -0.783818
H    -2.049495     2.995075    -1.467697
C     0.265366    -0.617213    -0.096106
C     1.304519     0.180849    -0.575261
C     0.549661    -1.841760     0.637734
C     2.655471    -0.152755    -0.437895
H     1.061807     1.122081    -1.080947
C     1.952266    -2.158599     0.742151
C     2.950895    -1.350911     0.234418
H     2.193478    -3.083640     1.274193
H     3.999974    -1.643324     0.365462
C    -2.478548     2.343973     0.583368
O    -3.007829     3.393405     0.917769
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O    -0.342710    -2.572431     1.150913
C     3.755327     0.738998    -0.975756
H     3.290966     1.594585    -1.497432
H     4.371716     0.212818    -1.728143
C     4.656900     1.270625     0.103338
H     4.149069     1.826899     0.901372
C     5.976650     1.087913     0.175912
H     6.513191     0.519607    -0.591913
H     6.568180     1.486635     1.004902
37
55-SP                                              Eopt   -846.570154
C     3.327810    -0.102912    -0.361187
C     3.563867    -1.478578    -0.271837
C     2.535205    -2.398752    -0.039850
C     1.235559    -1.914992     0.103690
C     0.978104    -0.527878     0.019465
C     2.010670     0.366348    -0.214306
H     4.587938    -1.849015    -0.385888
H     2.732298    -3.470358     0.024425
H     1.802844     1.439014    -0.278292
C     4.460128     0.875505    -0.608463
H     5.401269     0.308890    -0.714288
H     4.307408     1.411017    -1.561650
C     4.618042     1.878699     0.499890
H     4.781572     1.454034     1.498223
C     4.544131     3.202534     0.360101
H     4.361838     3.661480    -0.617443
H     4.652198     3.876284     1.214179
O     0.150311    -2.651950     0.310271
C    -0.479049    -0.397609     0.118988
C    -1.301196     0.516573    -0.402703
H    -0.880691     1.417900    -0.866905
C    -2.781242     0.286257    -0.472304
H    -3.117085     0.550338    -1.491575
C    -3.238038    -1.189894    -0.250370
O    -4.444036    -1.404228    -0.501037
C    -0.966894    -1.702515     0.700113
H    -0.822268    -1.683351     1.805951
C    -3.592959     1.177657     0.494003
H    -4.646869     0.887330     0.368240
H    -3.291913     0.912378     1.523814
C    -3.407244     2.649180     0.285649
H    -2.403290     3.045939     0.490404
C    -4.347077     3.494845    -0.142287
H    -5.360795     3.144840    -0.364829
H    -4.141328     4.559427    -0.289777
C    -2.312837    -2.092681     0.277667
H    -2.695210    -3.067452     0.593989
37
56-SP                                              Eopt   -846.585640
C     1.260870    -0.117410    -0.917710
C     0.533956     0.740769    -0.165588
H     0.751732    -0.784684    -1.621085
C     1.265607     1.638077     0.745908
H     0.656814     2.321207     1.338680
C     2.614518     1.663532     0.836736
H     3.131947     2.355098     1.506297
C    -0.940660     0.792709    -0.172074
C    -1.603324     2.082549    -0.026136
C    -1.687044    -0.380482    -0.337989
C    -3.049607     2.013155    -0.061680
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C    -3.080156    -0.403133    -0.378752
C    -3.742582     0.834601    -0.234289
H    -4.839582     0.852219    -0.247320
C     3.458813     0.810281     0.003435
O     4.674579     0.909778    -0.036326
O    -0.984344     3.164950     0.109795
H    -1.145362    -1.331715    -0.415968
H    -3.578163     2.964875     0.048160
C    -3.858178    -1.693163    -0.531979
H    -3.142068    -2.518349    -0.693659
H    -4.510718    -1.667268    -1.424330
C    -4.697384    -2.017815     0.672596
H    -4.145855    -2.083335     1.619160
C    -6.020985    -2.186786     0.678581
H    -6.606540    -2.107192    -0.243995
H    -6.570274    -2.398419     1.600357
C     2.749380    -0.270369    -0.809131
H     3.200941    -0.229077    -1.817203
C     3.084366    -1.667711    -0.220724
H     2.549081    -2.410185    -0.839462
H     2.654609    -1.742988     0.791906
C     4.540533    -2.025499    -0.198931
H     5.092979    -1.846580    -1.128780
C     5.182266    -2.552345     0.843180
H     4.674298    -2.722130     1.798197
H     6.241955    -2.815056     0.788577
37
57-SP                                                  Eopt   -846.613542
C    -0.919121     0.281567    -0.444818
C    -1.190014     1.706256    -0.643571
C    -1.986949    -0.600194    -0.220531
C    -2.598916     2.048733    -0.662438
C    -3.328879    -0.223844    -0.215941
C    -3.609309     1.137476    -0.452560
H    -4.653297     1.475431    -0.454795
O    -0.310456     2.588195    -0.792267
H    -1.758908    -1.652662    -0.013629
H    -2.822283     3.105699    -0.836882
C    -4.439006    -1.216266     0.058177
H    -3.997673    -2.226064     0.134672
H    -5.163168    -1.254690    -0.776893
C    -5.183864    -0.923939     1.331151
H    -4.559836    -0.873815     2.232597
C    -6.493762    -0.690207     1.433592
H    -7.143333    -0.709733     0.551453
H    -6.964266    -0.458633     2.393472
C     0.465555    -0.243499    -0.484690
C     1.583331     0.583003    -0.243228
C     0.745570    -1.592125    -0.770936
C     2.894475     0.106528    -0.247113
H     1.381168     1.644036    -0.084931
C     2.047491    -2.088850    -0.776360
H    -0.068486    -2.275693    -1.020742
C     3.127362    -1.250165    -0.506457
H     2.227630    -3.144846    -1.010175
C     4.058275     1.023491     0.064104
H     3.755412     2.056918    -0.169559
H     4.923482     0.774011    -0.569489
C     4.458990     0.948174     1.512695
H     3.682807     1.252223     2.226228
C     5.636666     0.522986     1.969872
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H     6.420624     0.185495     1.284310
H     5.853130     0.479064     3.041048
O     4.419728    -1.701739    -0.511704
H     4.405456    -2.643139    -0.700598
37
Cope-TS1-SP                                          Eopt   -846.542464
C    -3.061970    -0.224171    -1.246498
C    -1.778262     0.282486    -1.155391
C    -0.892574    -0.142215    -0.141348
H    -1.471473     1.140783    -1.754055
C    -4.017172     1.101681     0.477777
H    -3.737603     0.113789    -2.037649
C    -3.138603     0.866489     1.522390
H    -3.842479     1.938209    -0.200534
C    -1.818807     1.294066     1.471013
H    -5.019133     0.666084     0.473191
H    -3.420689     0.118052     2.270235
H    -1.489159     2.090501     0.793467
H    -1.122921     1.021179     2.268222
C    -1.294865    -1.339353     0.594073
H    -0.606486    -1.722970     1.352622
C    -2.481298    -1.964089     0.406346
H    -2.754389    -2.858180     0.972825
C     0.505849     0.340328    -0.087003
C     1.543633    -0.528103     0.279231
C     0.802480     1.728296    -0.424823
C     2.881811    -0.144152     0.355219
H     1.303791    -1.576080     0.492497
C     2.196524     2.088177    -0.321567
C     3.182560     1.195642     0.041925
H     2.438807     3.127690    -0.560909
H     4.226222     1.530508     0.083166
C    -3.467947    -1.467560    -0.561310
O    -4.538037    -2.032019    -0.772459
O    -0.075376     2.567814    -0.760139
C     3.974882    -1.123198     0.730039
H     3.508062    -2.087989     0.996404
H     4.526812    -0.785527     1.626504
C     4.956496    -1.358137    -0.384287
H     4.516071    -1.710066    -1.325797
C     6.271477    -1.140974    -0.322606
H     6.742335    -0.769923     0.594416
H     6.924240    -1.313687    -1.182901
37
Cope-TS2-SP                                          Eopt   -846.514977
C     2.593370    -1.054508    -1.033427
C     1.209798    -0.848580    -0.923866
C     0.781824    -0.066431     0.171384
H     0.485478    -1.498995    -1.428910
C     2.998010    -2.167136     0.430236
H     2.954010    -1.664887    -1.871054
C     2.512659    -1.473598     1.562722
H     2.456007    -3.069792     0.123556
C     1.128598    -1.217341     1.650910
H     4.083494    -2.259441     0.313456
H     3.191707    -0.776435     2.061205
H     0.439998    -2.030227     1.390833
H     0.763319    -0.623961     2.497742
O     4.693820     0.034587    -1.198323
C    -0.625204     0.422388     0.199915
C    -0.564707     1.823169     0.039885
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C    -1.840148    -0.231730     0.266883
C    -1.742255     2.564347    -0.051590
O     0.667777     2.304732    -0.023850
C    -3.040908     0.501811     0.189060
H    -1.872652    -1.321209     0.370888
C    -2.966078     1.886127     0.022841
H    -1.699235     3.647258    -0.182639
C    -4.375963    -0.211673     0.280201
H    -3.894351     2.463350    -0.044248
H    -5.183217     0.536589     0.198683
H    -4.493144    -0.693635     1.266719
C    -4.560308    -1.244502    -0.796390
H    -4.469939    -0.872104    -1.824437
C    -4.785643    -2.542673    -0.592051
H    -4.860961    -2.953798     0.420328
H    -4.893095    -3.244023    -1.423739
C     1.610848     1.192905     0.473556
H     1.583060     1.404354     1.562587
C     3.523416     0.151656    -0.788852
C     2.958243     1.217019    -0.078891
H     3.623439     2.034905     0.211256
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56
IM11-intermediate-SP                                  Eopt  -1270.076283
C     0.172274     2.914564    -0.334945
C     1.339478     1.997266    -0.513925
C     1.200492     0.674312    -0.719182
H     2.336425     2.448146    -0.503959
C     0.457650     4.070766     0.638132
H    -0.026247     3.360709    -1.333952
C     0.783840     3.582529     2.019711
H     1.288627     4.677286     0.244377
C     1.958332     3.740716     2.630081
H    -0.439222     4.706853     0.675724
H    -0.022574     3.047502     2.534896
H     2.785604     4.273161     2.148650
H     2.135496     3.354614     3.637048
C    -0.147452     0.100931    -0.768469
H    -0.238613    -0.953270    -1.039289
C    -1.269427     0.801206    -0.483880
C     2.385036    -0.214266    -0.848427
C     2.504934    -1.139223    -1.900108
C     3.425018    -0.136829     0.085069
C     3.638176    -1.951094    -1.987468
C     4.569145    -0.933465     0.007063
C     4.656184    -1.848874    -1.045005
H     5.530696    -2.499782    -1.124900
C    -1.148426     2.213006    -0.030024
O    -2.047678     2.789065     0.541594
O     1.504860    -1.199881    -2.811158
H     1.706130    -1.869370    -3.471175
H     3.315684     0.570826     0.912066
H     3.724273    -2.667716    -2.809996
C     5.685159    -0.814387     1.026749
H     5.362854    -0.124755     1.824201
H     6.572917    -0.357095     0.557745
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C     6.067816    -2.133979     1.636822
H     5.265246    -2.662707     2.165347
C     7.276248    -2.690817     1.561240
H     8.100123    -2.196324     1.036144
H     7.490508    -3.656791     2.025074
C    -2.610075     0.172429    -0.465856
C    -3.663291     0.740853    -1.202391
C    -2.861217    -0.989493     0.268358
C    -4.929708     0.154131    -1.166600
O    -3.391418     1.832765    -1.950047
C    -4.118832    -1.596749     0.305211
H    -2.039555    -1.418305     0.849409
C    -5.152905    -0.997773    -0.418371
H    -5.747672     0.602179    -1.738734
H    -4.208616     2.200563    -2.297422
C    -4.362748    -2.861690     1.105192
H    -6.153725    -1.436941    -0.393877
H    -3.449780    -3.100676     1.675386
H    -4.536403    -3.711022     0.422637
C    -5.521605    -2.741280     2.055208
H    -5.439815    -1.943579     2.803477
C    -6.613836    -3.504622     2.031607
H    -6.734464    -4.304716     1.293754
H    -7.425559    -3.363396     2.749502
56
IM11-reactant-SP                                      Eopt  -1270.068111
C     0.220825    -2.083906     1.992553
C     1.264600    -2.245806     1.173456
C     1.373570    -1.580937    -0.173855
H     2.106973    -2.877370     1.465737
C     0.367624    -4.887947    -1.168685
H     0.176581    -2.568080     2.970508
C     0.325390    -3.576040    -1.397058
H     1.300962    -5.388451    -0.890972
C     1.510833    -2.660823    -1.300189
H    -0.526240    -5.511346    -1.249491
H    -0.632430    -3.113591    -1.663269
H     2.423385    -3.243902    -1.127038
H     1.645204    -2.117652    -2.251559
C     0.149531    -0.769442    -0.496479
H     0.151917    -0.296772    -1.483424
C    -0.920819    -0.597916     0.297094
C     2.618079    -0.667918    -0.152017
C     3.918143    -1.182165     0.017699
C     2.486265     0.721567    -0.251541
C     5.017391    -0.321323     0.047133
C     3.574945     1.596257    -0.218815
C     4.851205     1.053477    -0.070700
H     5.724034     1.710100    -0.032707
C    -0.949526    -1.251835     1.644864
O    -1.882372    -1.123992     2.413468
O     4.088108    -2.522419     0.172402
H     5.021696    -2.714661     0.299032
H     1.486204     1.148493    -0.349164
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H     6.019609    -0.741795     0.176373
C     3.371372     3.093302    -0.350851
H     2.290861     3.303772    -0.289279
H     3.702255     3.430325    -1.348215
C     4.090679     3.883025     0.706380
H     3.807560     3.656936     1.741583
C     5.032058     4.796811     0.471890
H     5.346173     5.043420    -0.547732
H     5.520287     5.336656     1.286971
C    -2.086282     0.226009    -0.114602
C    -1.927404     1.508004    -0.668441
C    -3.390319    -0.259634     0.049776
C    -3.049403     2.253172    -1.041385
O    -0.673872     2.010430    -0.828486
C    -4.519389     0.467714    -0.324139
H    -3.518780    -1.246194     0.497772
C    -4.328878     1.740271    -0.869655
H    -2.913278     3.252034    -1.467546
H    -0.734066     2.906863    -1.170554
C    -5.916073    -0.093425    -0.142250
H    -5.194533     2.343066    -1.156477
H    -5.840309    -1.075168     0.352930
H    -6.381701    -0.271019    -1.126463
C    -6.801634     0.806146     0.674362
H    -6.449015     1.020801     1.690378
C    -7.938498     1.354770     0.246696
H    -8.317451     1.167576    -0.763543
H    -8.536501     2.005351     0.889641
38
IM51-intermediate-SP                                  Eopt   -847.099462
C     1.293213    -0.093197    -0.917646
C     0.579975     0.679590    -0.075887
H     0.777126    -0.683053    -1.682117
C     1.290478     1.466421     0.942606
H     0.687639     2.044525     1.646032
C     2.634257     1.505543     1.022750
H     3.152647     2.114408     1.766164
C    -0.904985     0.719230    -0.127957
C    -1.601500     1.940650    -0.142634
C    -1.649161    -0.464793    -0.178887
C    -2.996939     1.946427    -0.202537
C    -3.043713    -0.477787    -0.247932
C    -3.707478     0.751826    -0.253819
H    -4.799635     0.776566    -0.290453
C     3.477249     0.784961     0.053115
O     4.673384     0.967912    -0.029492
O    -0.877951     3.084039    -0.109920
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H     5.107531    -1.864548    -1.247519
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H    -1.809215    -0.872157     1.765691
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H    -4.233757    -2.688538    -0.084178
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H    -5.491800    -1.571798    -0.892008
H    -3.711734    -0.212735    -1.846117
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H    -1.495534    -1.493004    -1.997392
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H    -0.991055     0.931007    -2.149936
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C     2.626072    -0.047963    -0.385019
H     0.998260     1.180859    -1.025661
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H     2.261008    -3.002084     1.269487
H     4.024589    -1.487407     0.411795
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O    -0.325774    -2.593101     1.096696
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38
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C    -0.947445    -0.100524    -0.096196
H    -1.508553     1.158436    -1.759931
C    -4.010568     1.081919     0.484819
H    -3.761394     0.158426    -2.022184
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C    -1.841829     1.196539     1.541303
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H    -3.467771    -0.025106     2.224104
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H    -1.171087     0.902977     2.352871
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H    -0.618393    -1.753162     1.322408
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H     2.508119     3.063463    -0.496589
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C    -3.475502    -1.465309    -0.587918
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H     3.444307    -2.269961     0.608705
H     4.326431    -1.089965     1.583818
C     5.042481    -1.293949    -0.421918
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C     6.322414    -1.057123    -0.136220
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56
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C    -1.371539    -1.112064    -0.383801
H    -2.113893    -2.580930    -1.786912
C     0.117749    -4.025118     0.337634
H     0.137449    -3.480829    -2.321550
C    -0.116737    -3.089445     1.328991
H    -0.710448    -4.597164    -0.084642
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H     1.120182    -4.424114     0.166178
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H    -2.260455    -2.975389     1.087594
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C     1.100139    -0.826801    -0.308402
C    -2.676447    -0.405309    -0.203689
C    -3.915844    -1.077860    -0.193190
C    -2.711619     0.989661    -0.058542
C    -5.104517    -0.366076    -0.020806
C    -3.890059     1.717208     0.113082
C    -5.096286     1.014947     0.131605
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C     3.362729     0.204522    -0.620762
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C    -1.892988    -0.624412    -0.241357
C    -2.681935     2.012857    -0.379103
C    -3.249890    -0.324921    -0.106525
C    -3.630933     1.017187    -0.175835
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H    -4.905890    -1.521586    -0.799081
C    -5.168250    -1.163301     1.293419
H    -4.653454    -1.073572     2.257773
C    -6.493237    -1.027705     1.246403
H    -7.040875    -1.103020     0.301170
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C     3.978685     0.943502     0.715409
H     3.635720     1.959514     0.969354
H     4.874625     1.044781     0.085097
C     4.332640     0.207850     1.982186
H     3.527388     0.129667     2.723180
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56
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C     2.787073     0.769520     0.072571
C     4.763980    -0.455765    -1.405302
O     3.275453    -2.289507    -1.832850
C     4.014663     1.418873    -0.069055
H     2.004310     1.239984     0.674473
C     5.006021     0.781423    -0.818749
H     5.547895    -0.942845    -1.993759
H     4.044141    -2.567702    -2.338575
C     4.270829     2.772329     0.564907
H     5.984547     1.253590    -0.938709
H     3.402310     3.040615     1.188956
H     4.344062     3.545895    -0.218371
C     5.514072     2.799873     1.409585
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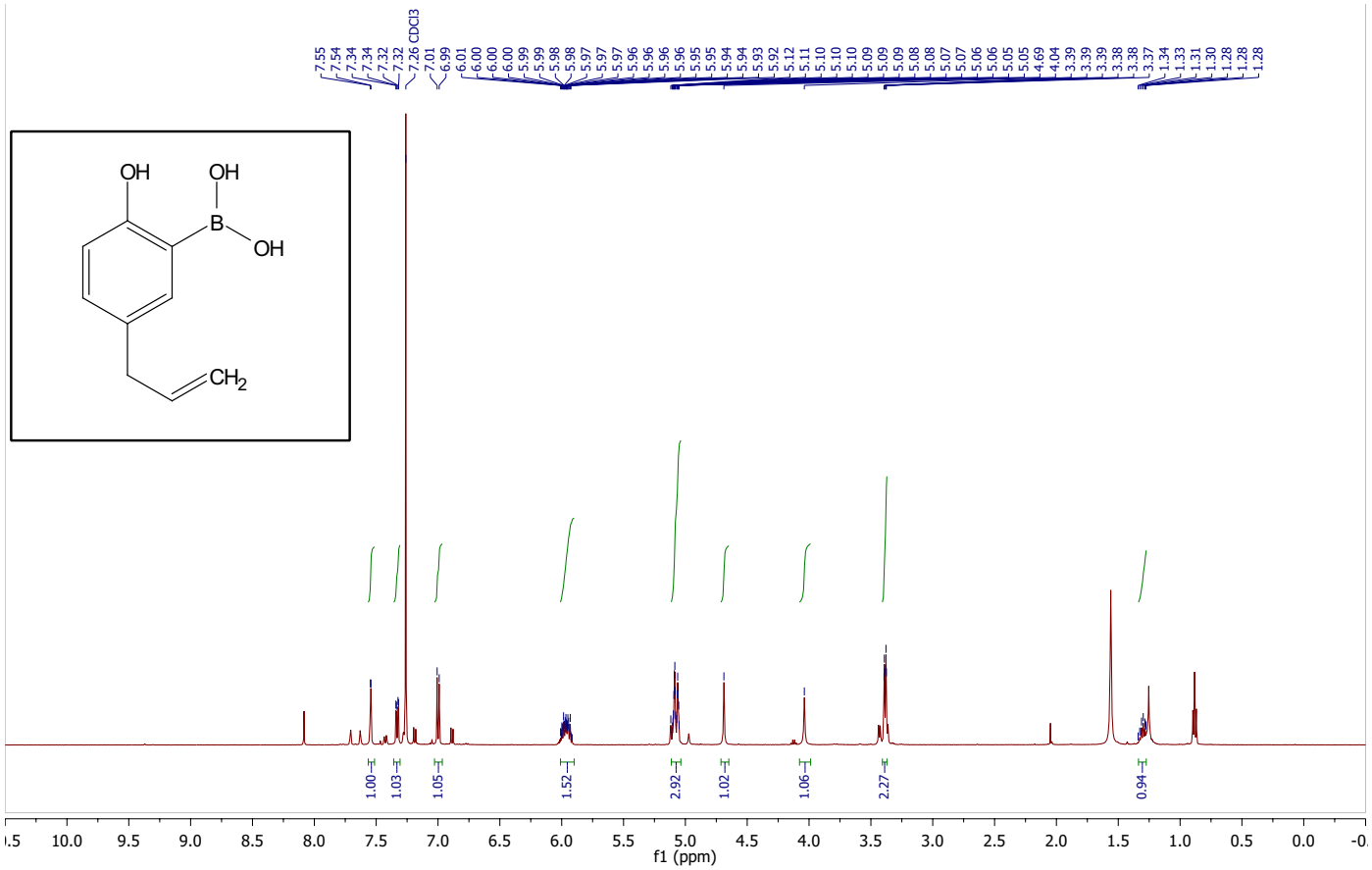
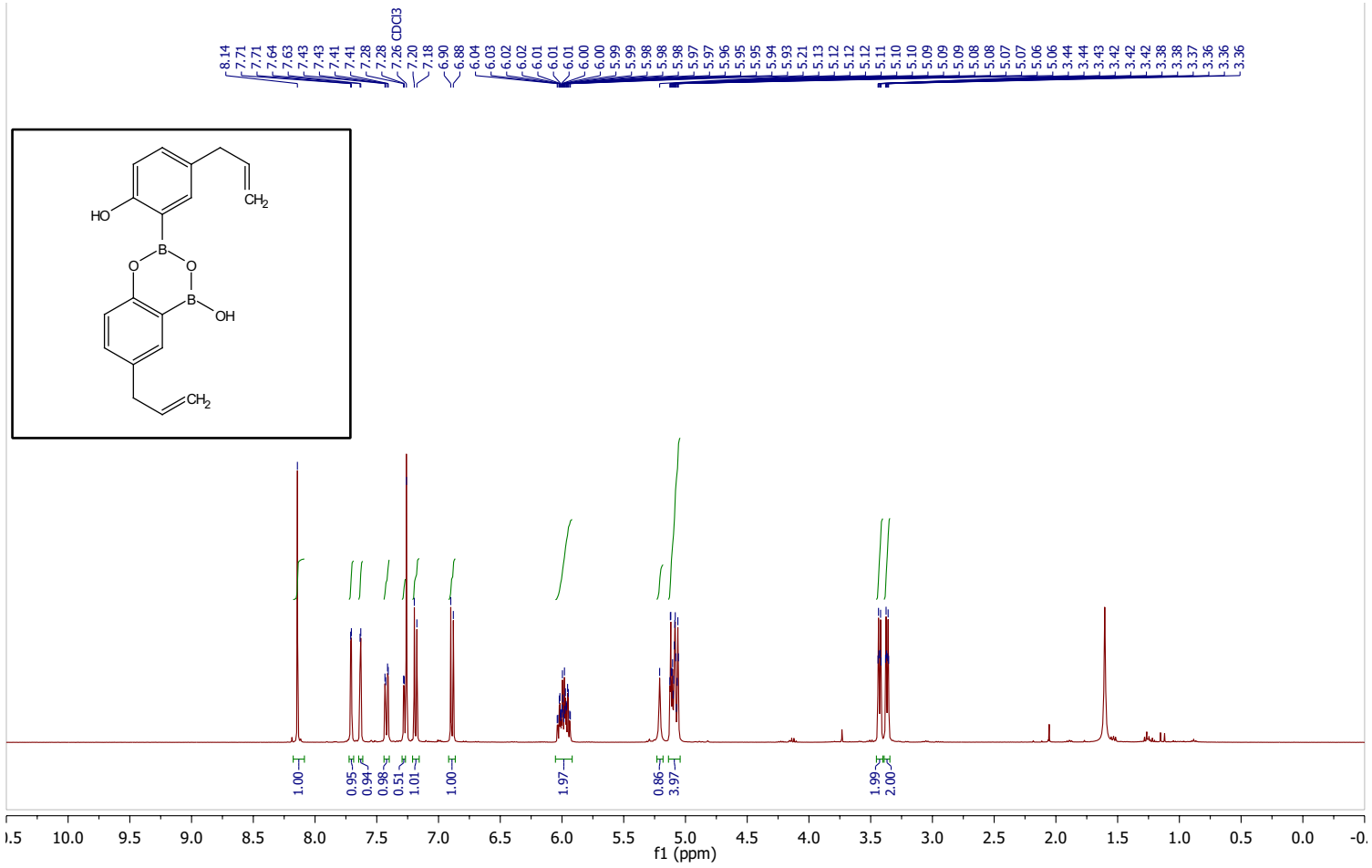
Spectroscopic Data

24



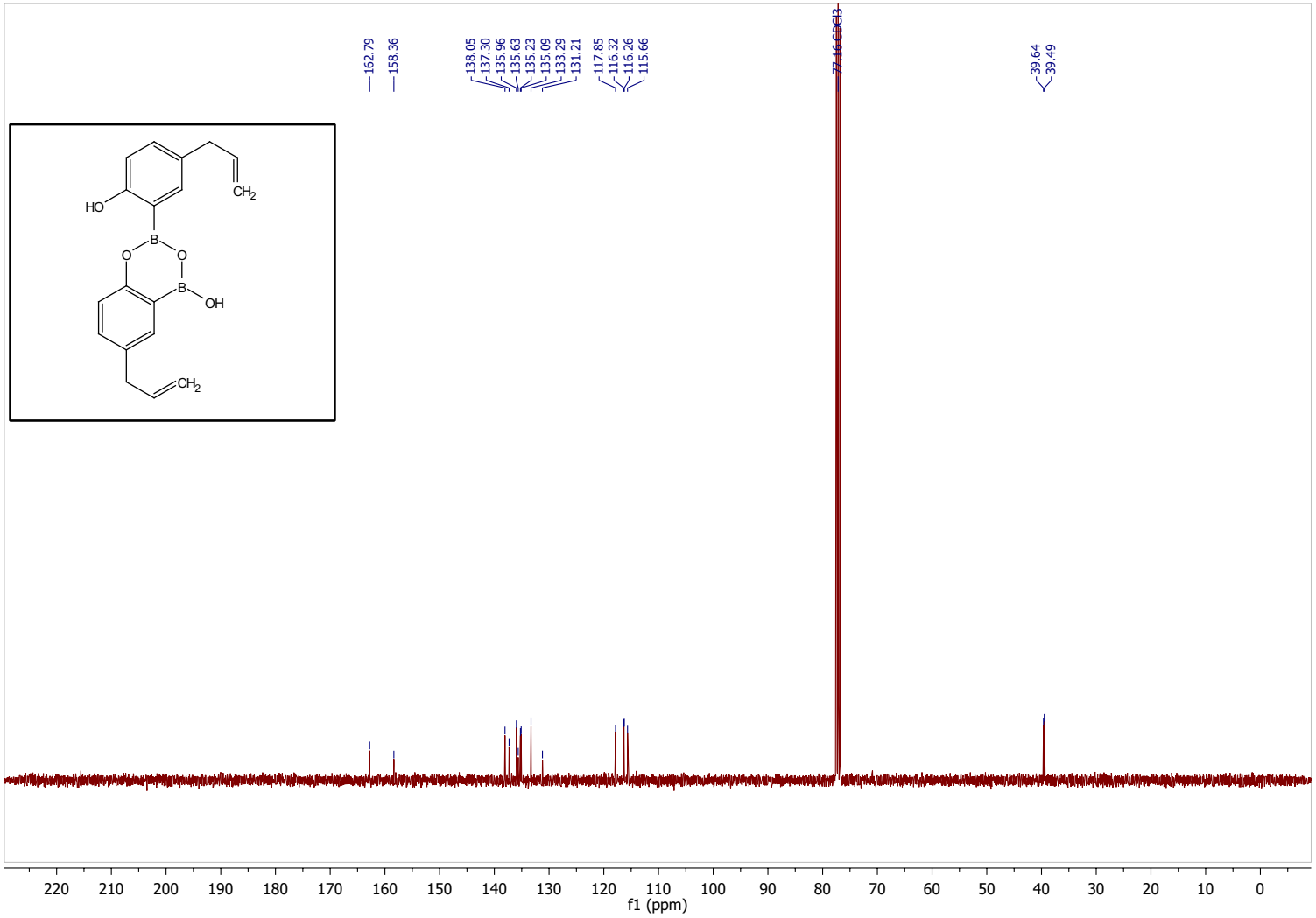
^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.54 (d, *J* = 2.4 Hz, 1H), 7.33 (dd, *J* = 8.3, 2.4 Hz, 1H), 7.00 (d, *J* = 8.3 Hz, 1H), 6.01 – 5.92 (m, 1H), 5.12 – 5.03 (m, 2H), 4.69 (s, 1H), 4.04 (s, 1H), 3.38 (ddd, *J* = 7.3, 1.4, 1.4 Hz, 2H), 1.34 – 1.27 (m, 1H).

25



^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.14 (s, 1H), 7.71 (d, *J* = 2.4 Hz, 1H), 7.63 (d, *J* = 2.3 Hz, 1H), 7.42 (dd, *J* = 8.4, 2.3 Hz, 1H), 7.27 (dd, *J* = 8.4, 2.4 Hz, 1H), 7.19 (d, *J* = 8.4 Hz, 1H), 6.89 (d, *J* = 8.4 Hz, 1H), 6.05 – 5.91 (m, 2H), 5.21 (s, 1H), 5.16 – 5.02 (m, 4H), 3.43 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H), 3.37 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H).

25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135.96
135.63
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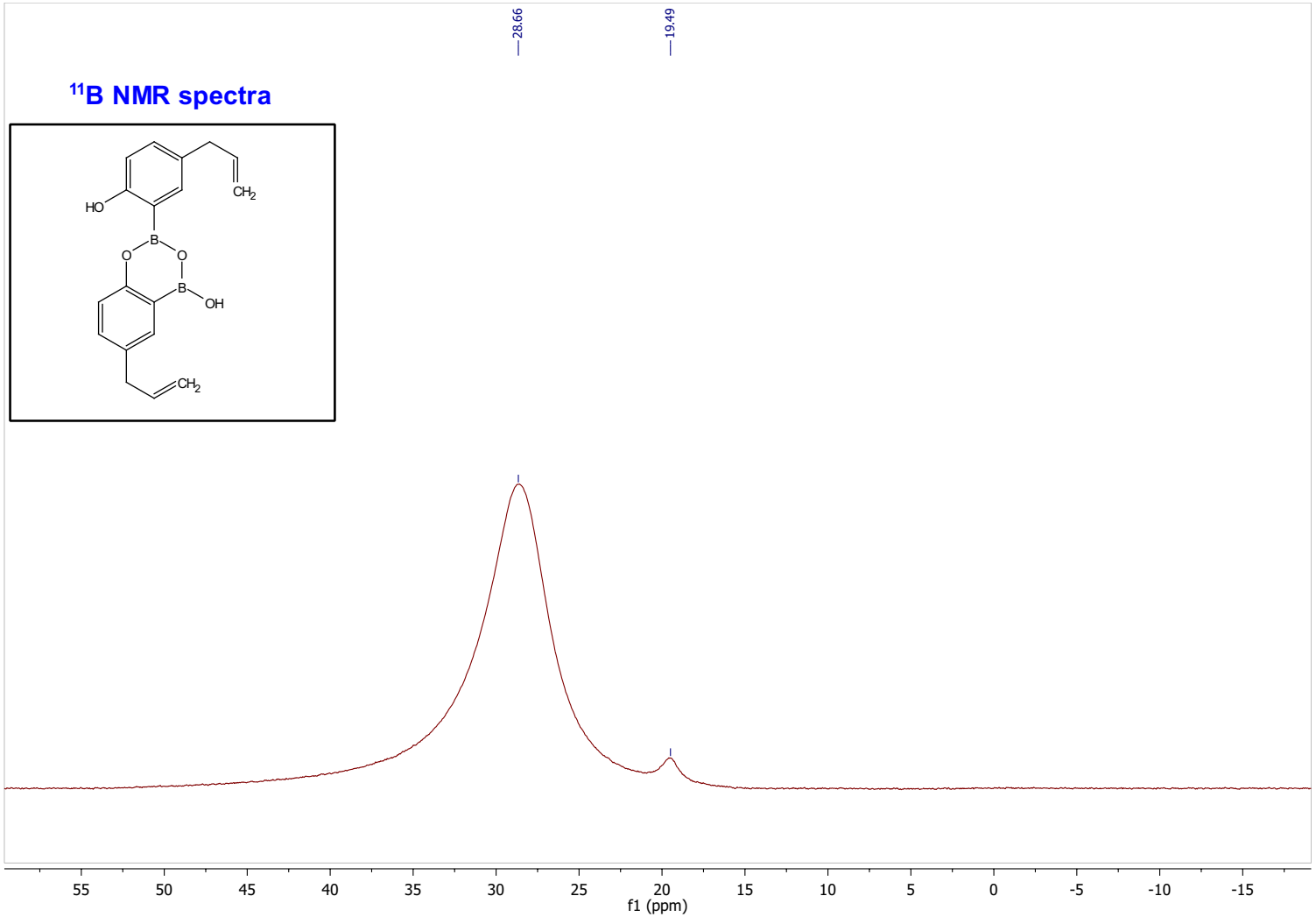
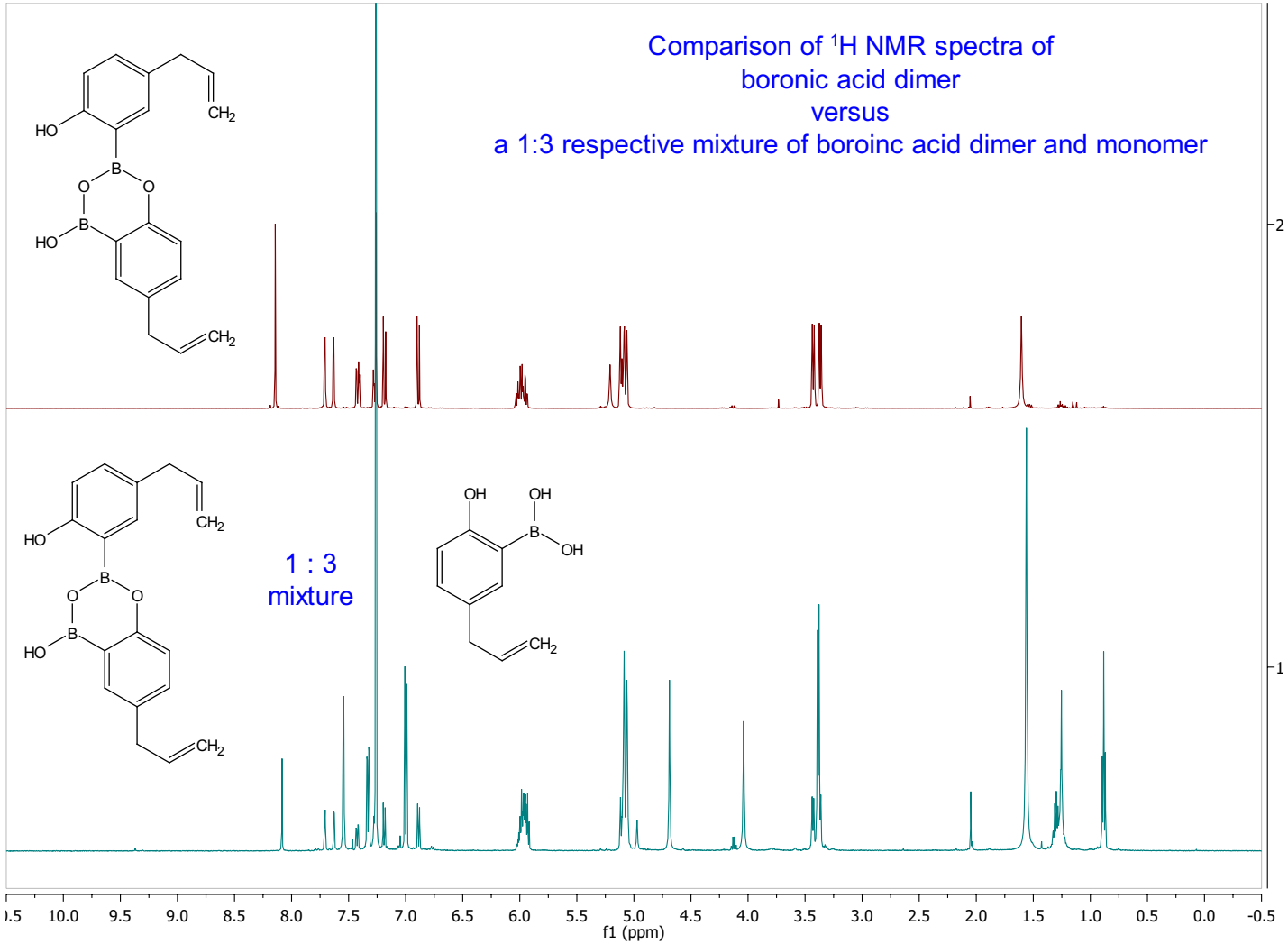
135.09
133.29
131.21
117.85
116.32
116.26
115.66
77.16 CDCl3
39.64
39.49
HO
CH2
B
O
O
B
OH
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

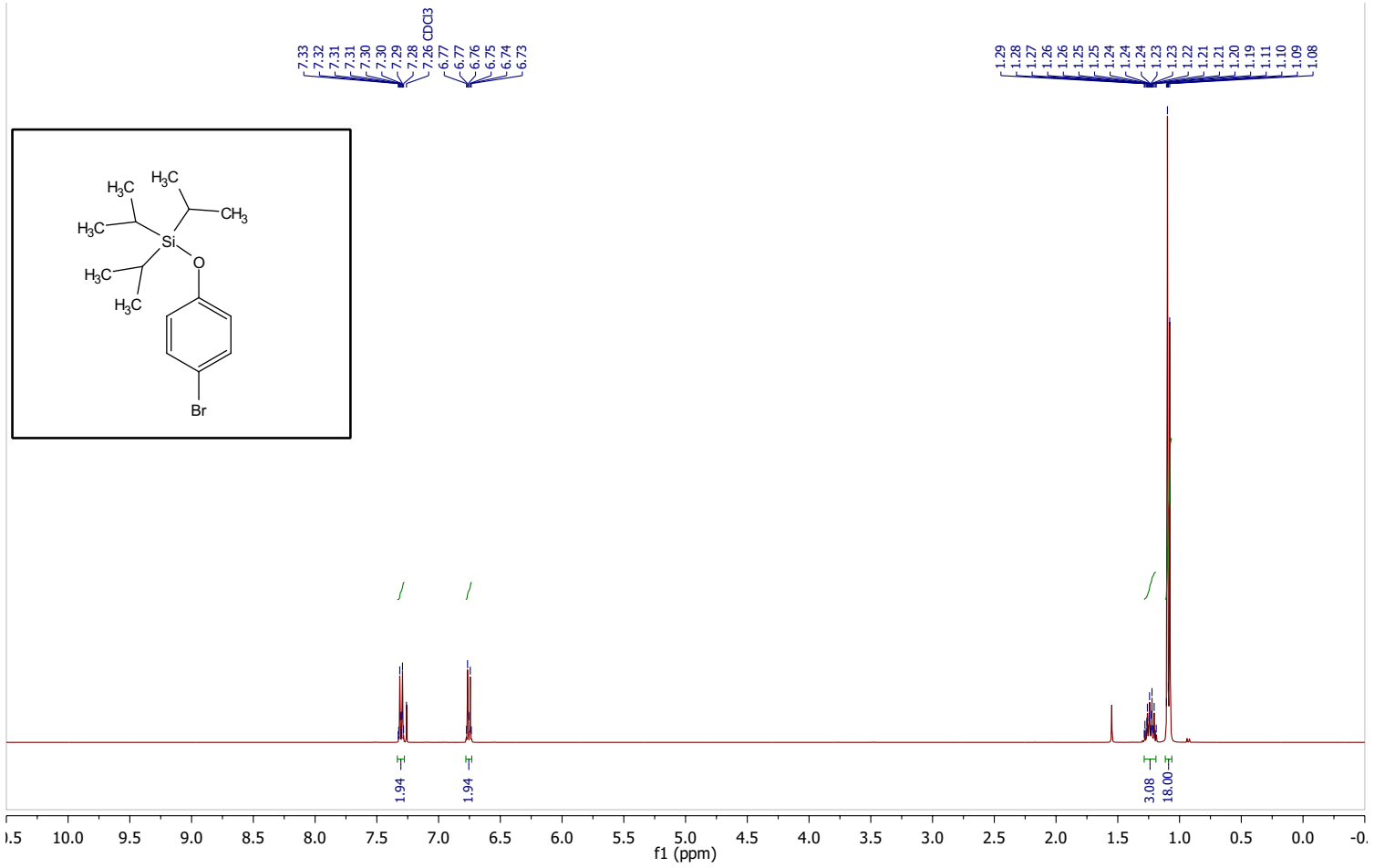
25


28.66
19.49
11B NMR spectra
HO
CH2
B
O
O
B
OH
CH2
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
f1 (ppm)

Mixture of 24 and 25

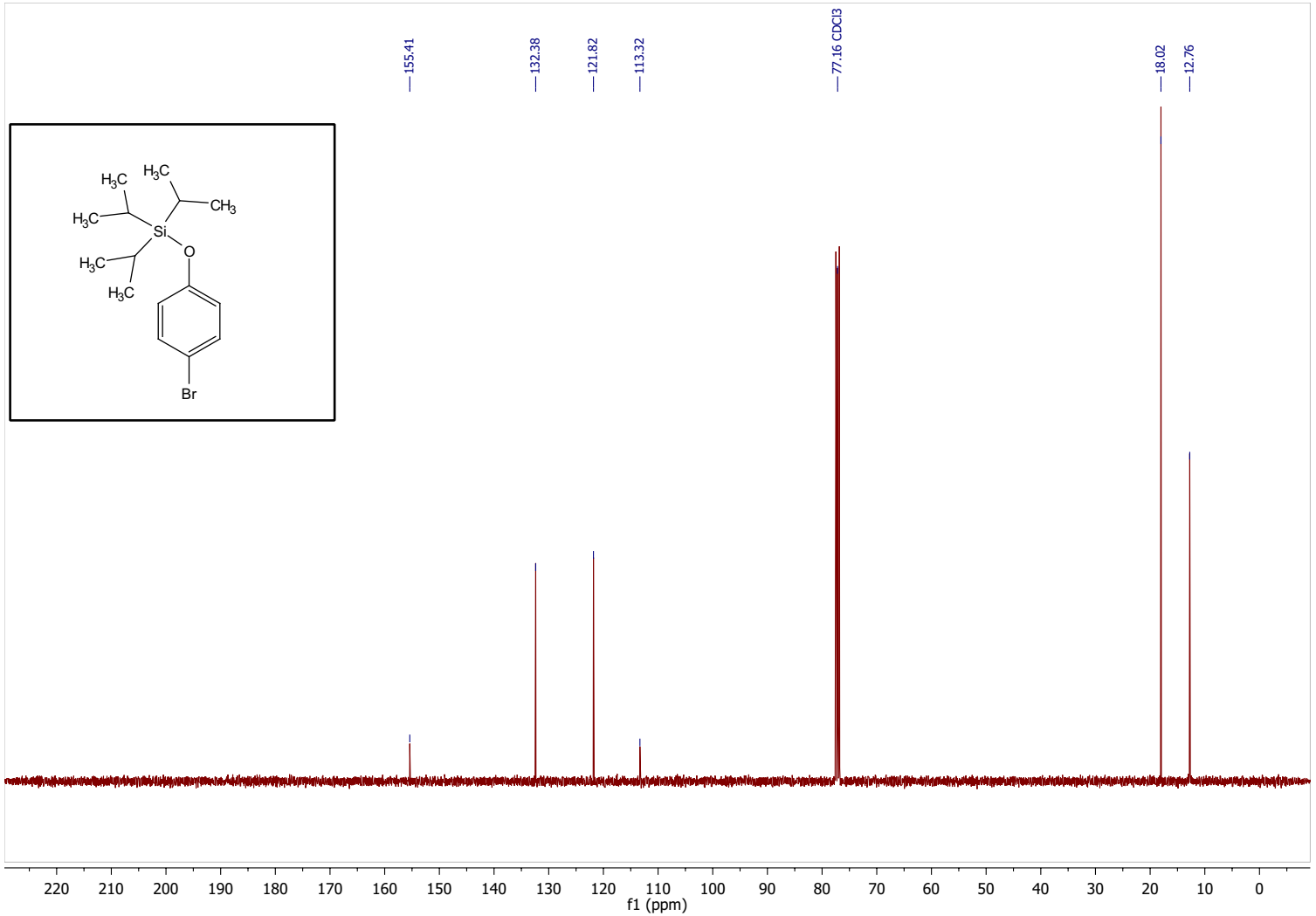


26



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.33 – 7.28 (m, 2H), 6.78 – 6.73 (m, 2H), 1.29 – 1.19 (m, 3H), 1.09 (d, *J* = 7.3 Hz, 18H).

26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121.82
113.32
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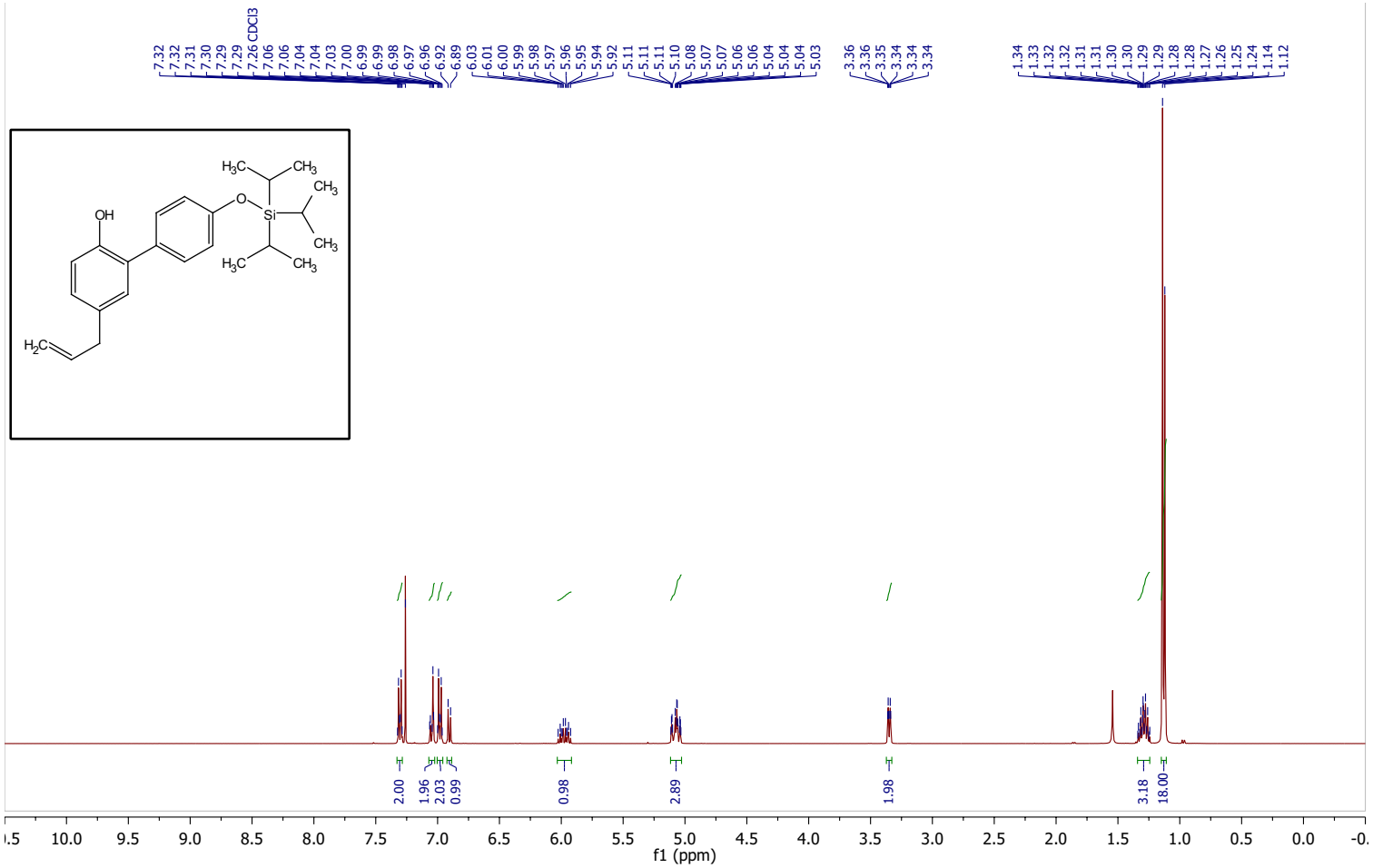
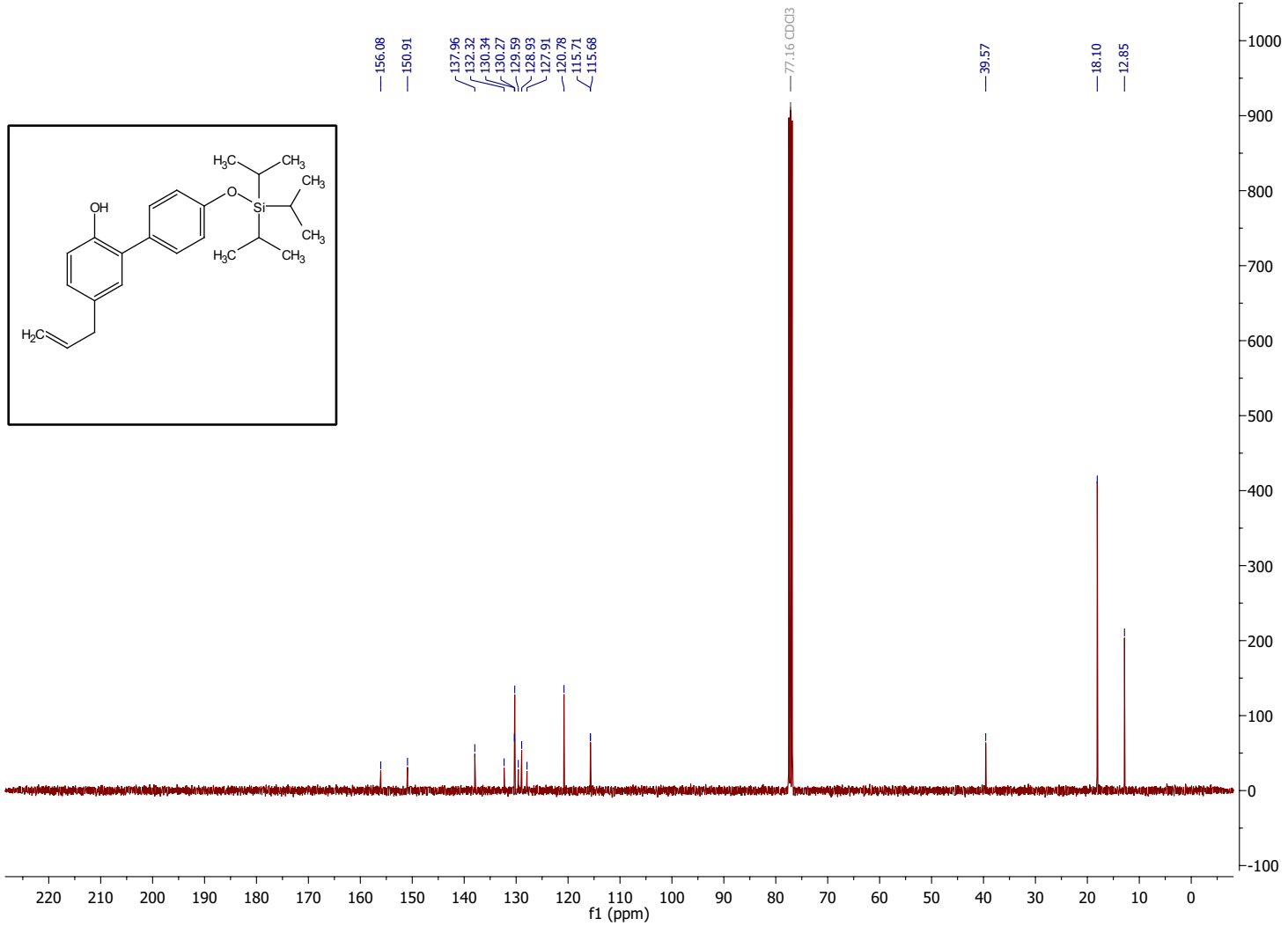
18.02
12.76
H3C
H3C
H3C
CH3
Si
O
H3C
H3C
Br
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

27



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.33 – 7.28 (m, 2H), 7.06 – 7.02 (m, 2H), 7.00 – 6.96 (m, 2H), 6.90 (d, *J* = 8.1 Hz, 1H), 5.98 (ddt, *J* = 16.8, 10.0, 6.7 Hz, 1H), 5.12 – 5.03 (m, 3H), 3.35 (ddd, *J* = 6.6, 1.4, 1.4 Hz, 2H), 1.34 – 1.24 (m, 3H), 1.13 (d, *J* = 7.3 Hz, 18H).

27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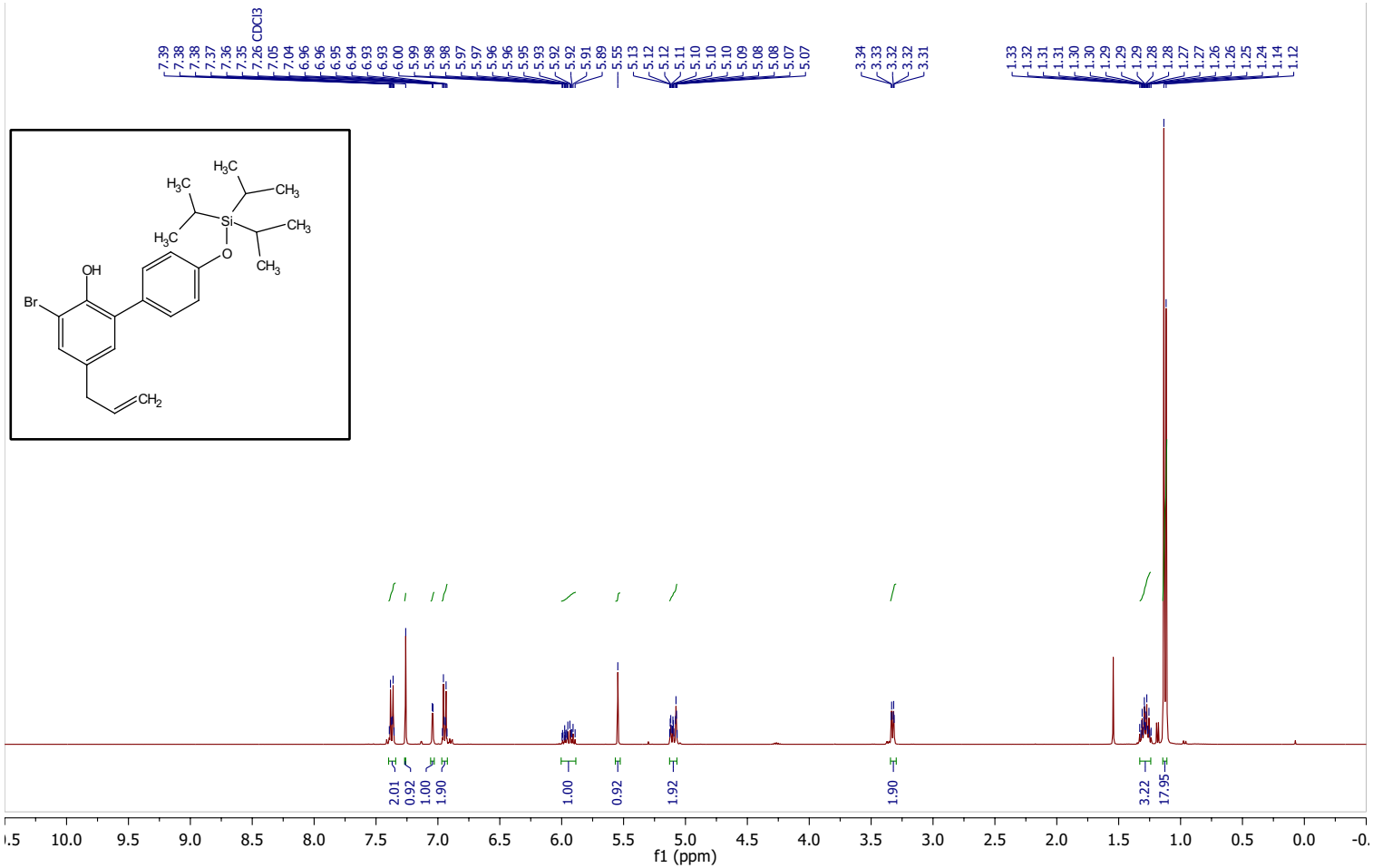
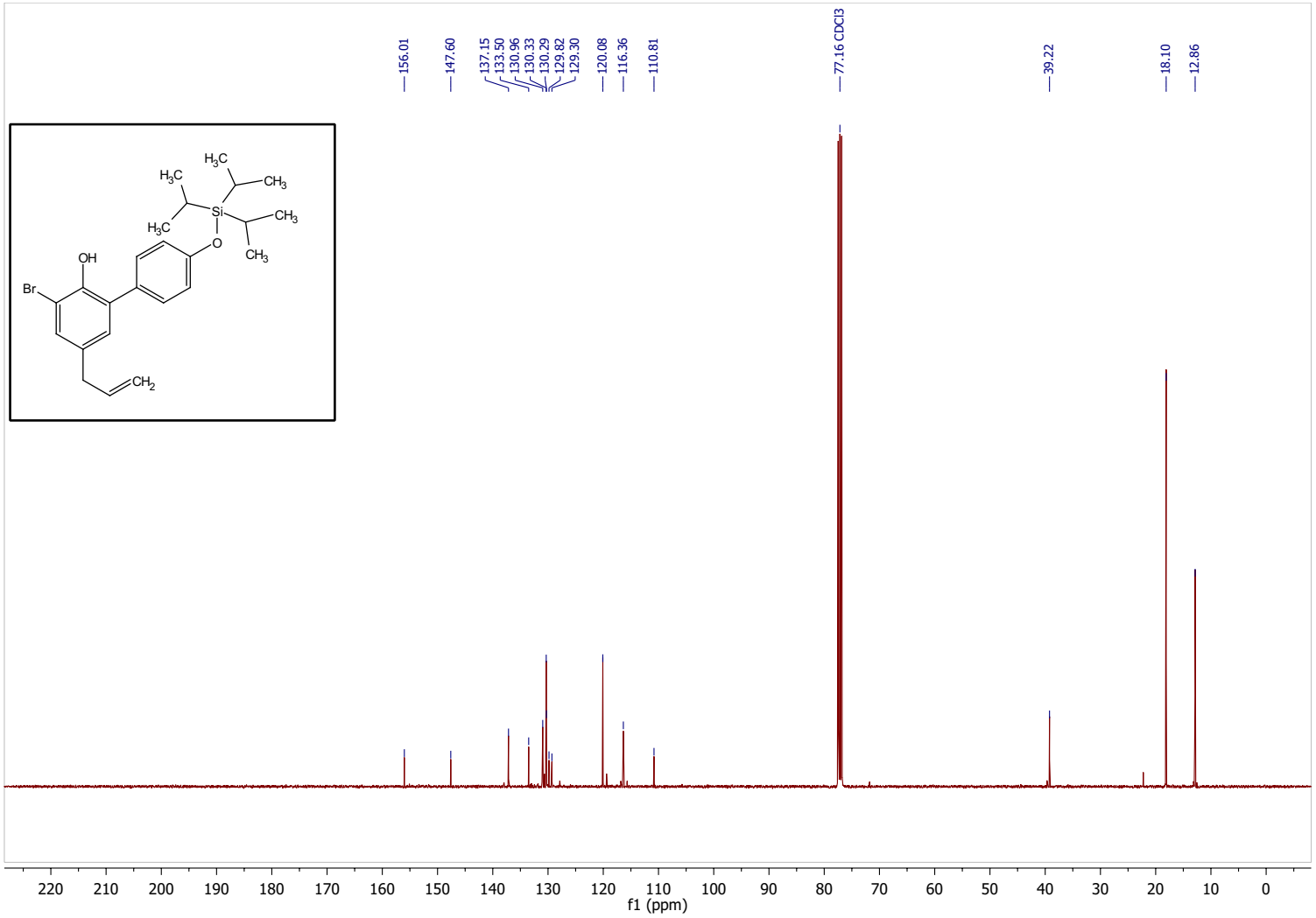
137.96
132.32
130.34
130.27
129.59
128.93
127.91
120.78
115.71
115.68
77.16 CDCl3
39.57
18.10
12.85
OH
O
Si
H3C
CH3
CH3
CH3
H3C
CH3
H2C
1000
900
800
700
600
500
400
300
200
100
0
-100
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

28

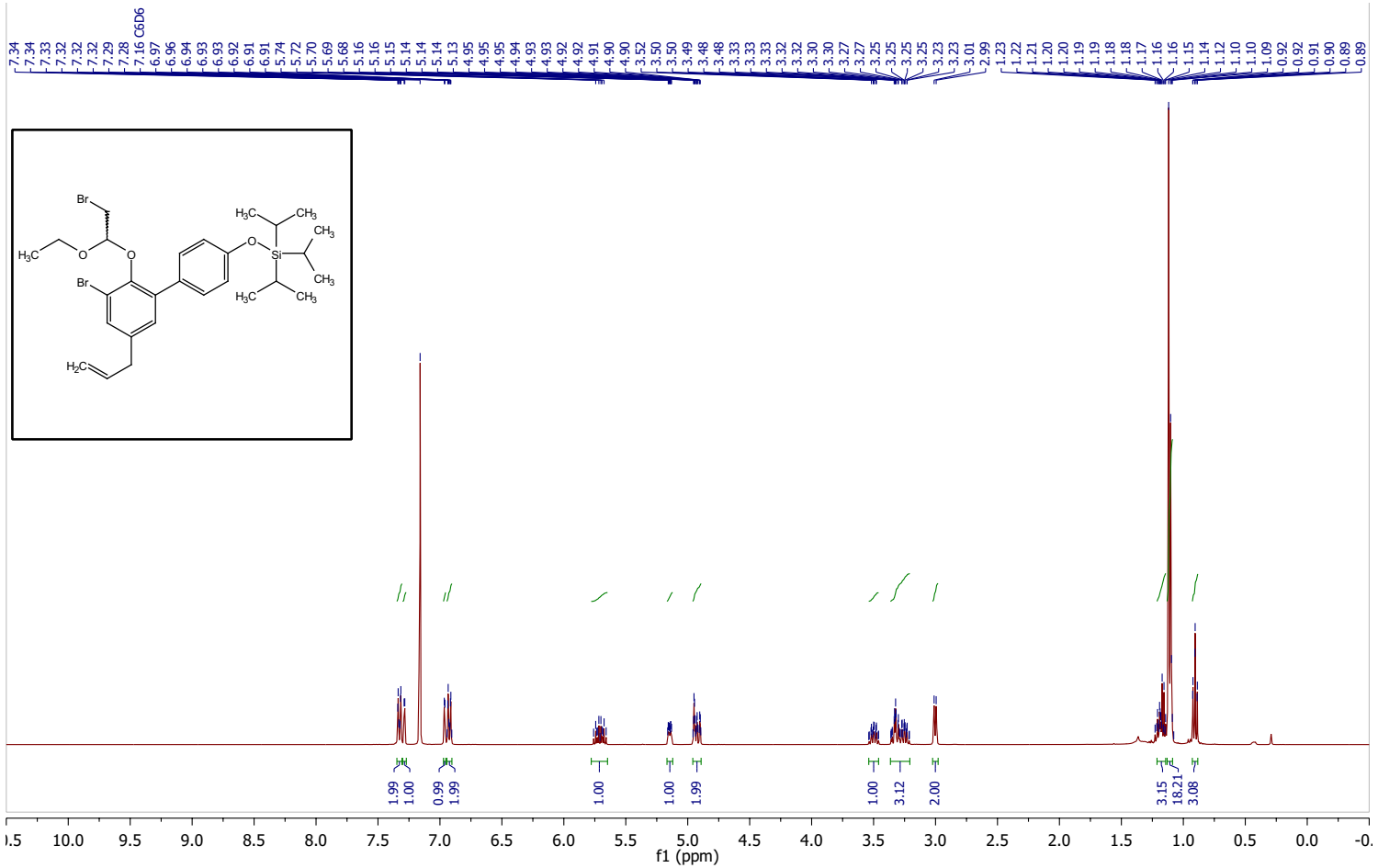


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.34 (m, 2H), 7.26 (d, *J* = 2.1 Hz, 1H) 7.04 (d, *J* = 2.1 Hz, 1H), 6.98 – 6.92 (m, 2H), 5.94 (ddt, *J* = 16.9, 10.2, 6.7 Hz, 1H), 5.55 (s, 1H), 5.14 – 5.06 (m, 2H), 3.33 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H), 1.35 – 1.24 (m, 3H), 1.13 (d, *J* = 7.3 Hz, 18H).

28

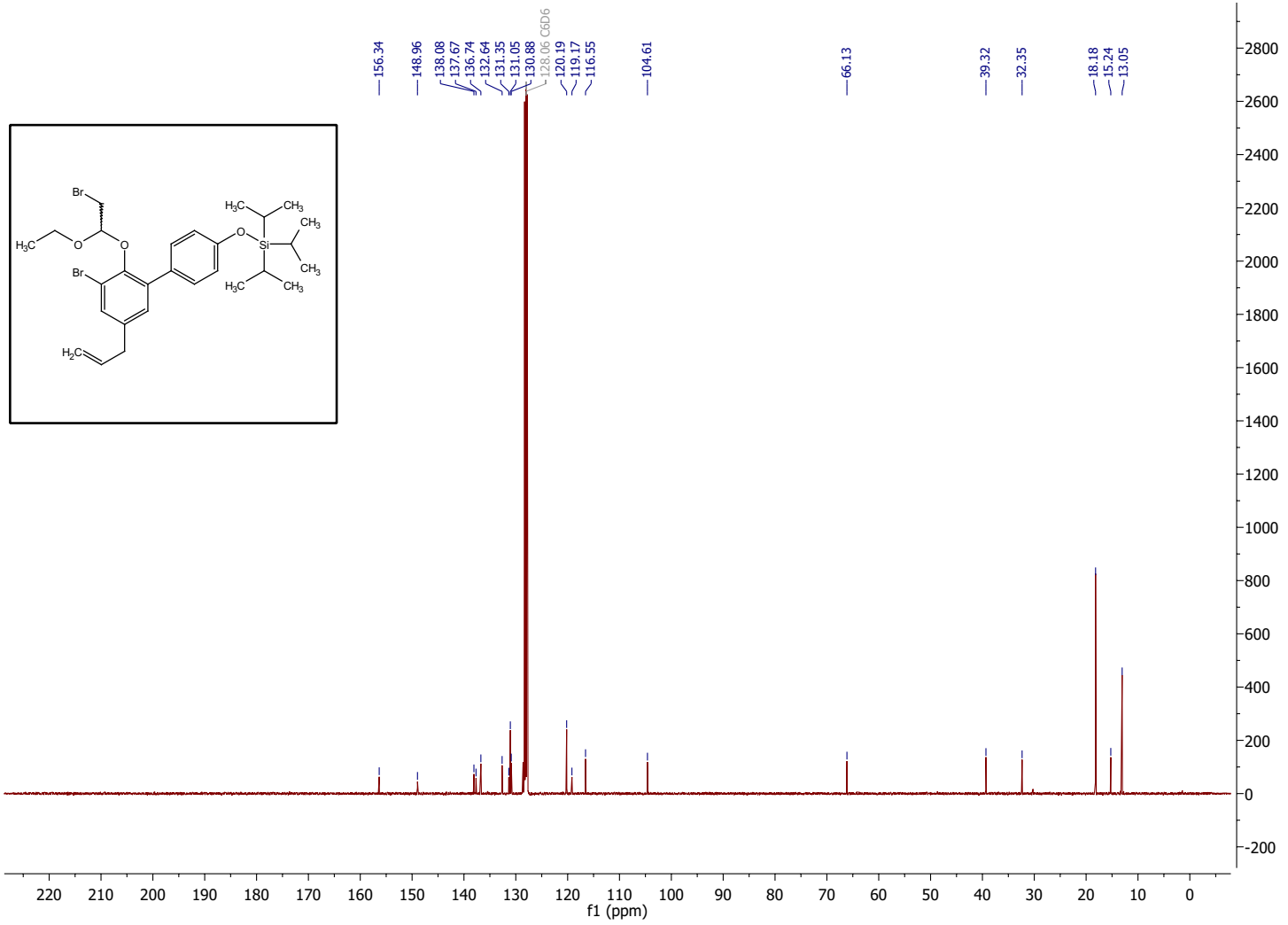

156.01
147.60
137.15
133.50
130.96
130.33
130.29
129.82
129.30
120.08
116.36
110.81
77.16 CDCl3
39.22
18.10
12.86
OH
Br
O
Si
CH2
f1 (ppm)

29

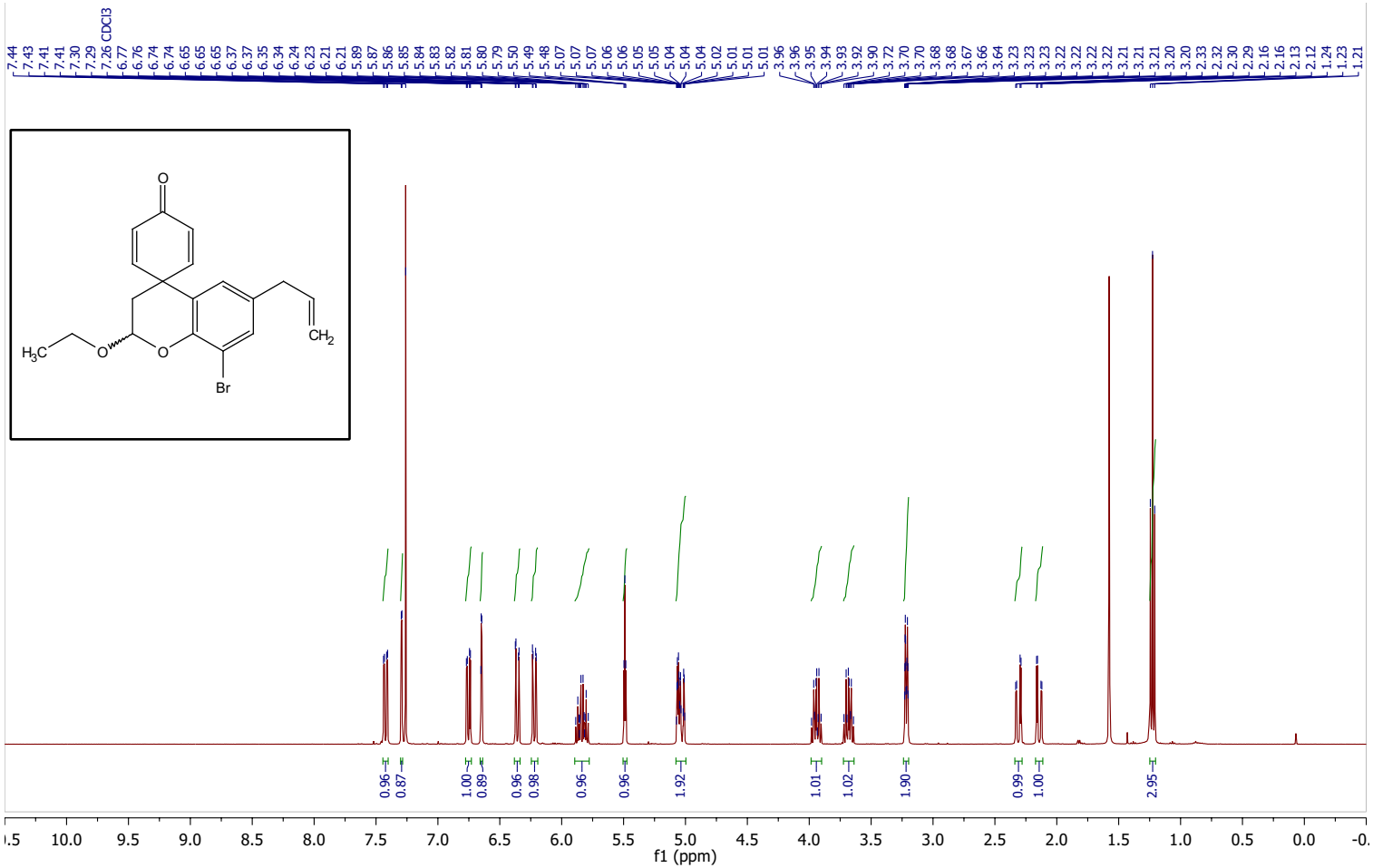


^{1}H NMR (400 MHz, Benzene-d_6) δ 7.35 – 7.31 (m, 2H), 7.29 (d, J = 2.1 Hz, 1H), 6.96 (d, J = 2.1 Hz, 1H), 6.94 – 6.90 (m, 2H), 5.71 (dddd, J = 16.9, 10.3, 6.8, 6.8 Hz, 1H), 5.16 – 5.12 (m, 1H), 4.97 – 4.89 (m, 2H), 3.55 – 3.45 (m, 1H), 3.37 – 3.20 (m, 3H), 3.00 (d, J = 6.7 Hz, 2H), 1.23 – 1.13 (m, 3H), 1.11 (d, J = 6.4 Hz, 18H), 0.90 (dd, J = 7.0, 7.0 Hz, 2H).

29

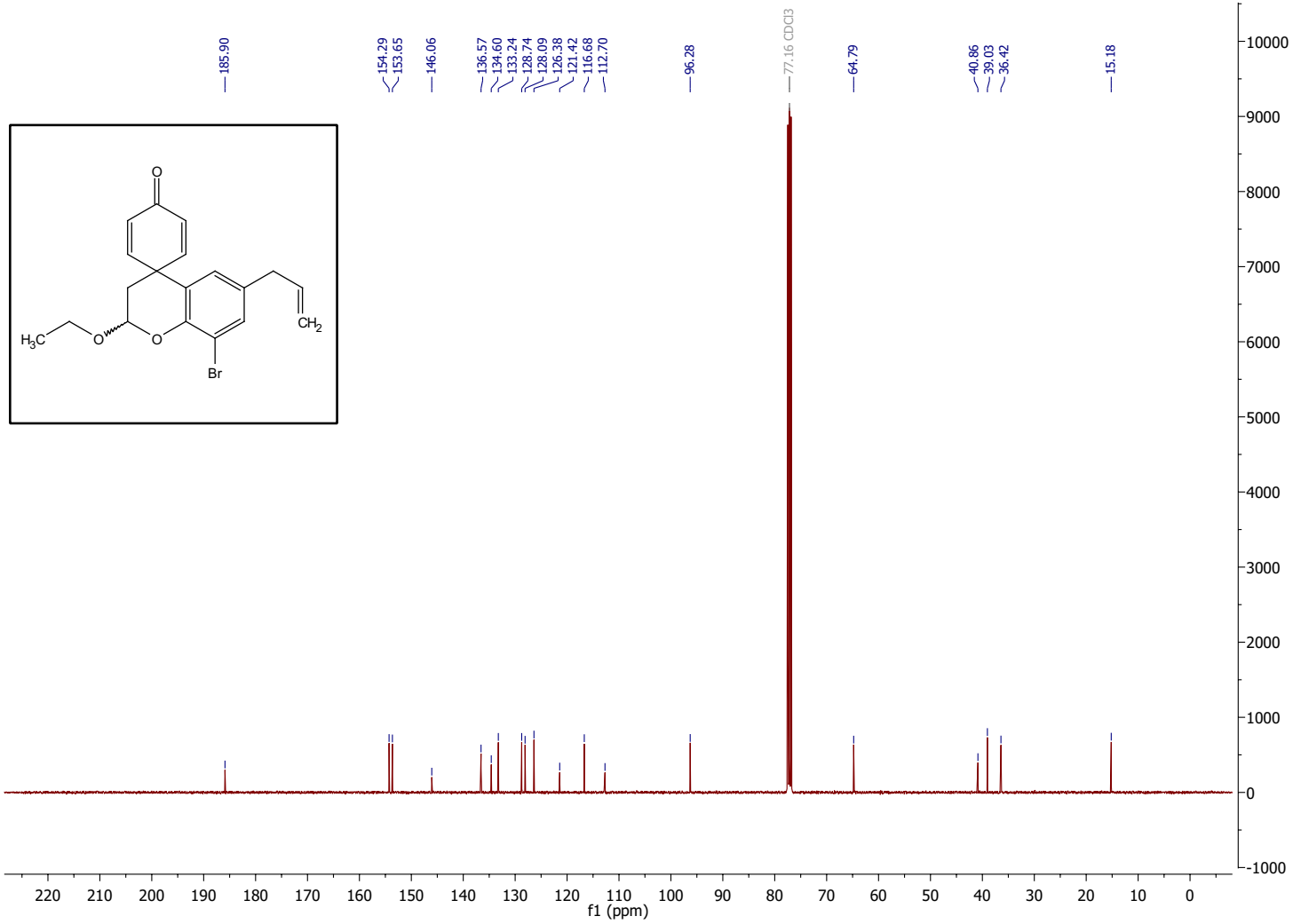

156.34
148.96
138.08
137.67
136.74
132.64
131.35
131.05
130.88
128.06 C6D6
120.19
119.17
116.55
104.61
66.13
39.32
32.35
18.18
15.24
13.05
f1 (ppm)

30

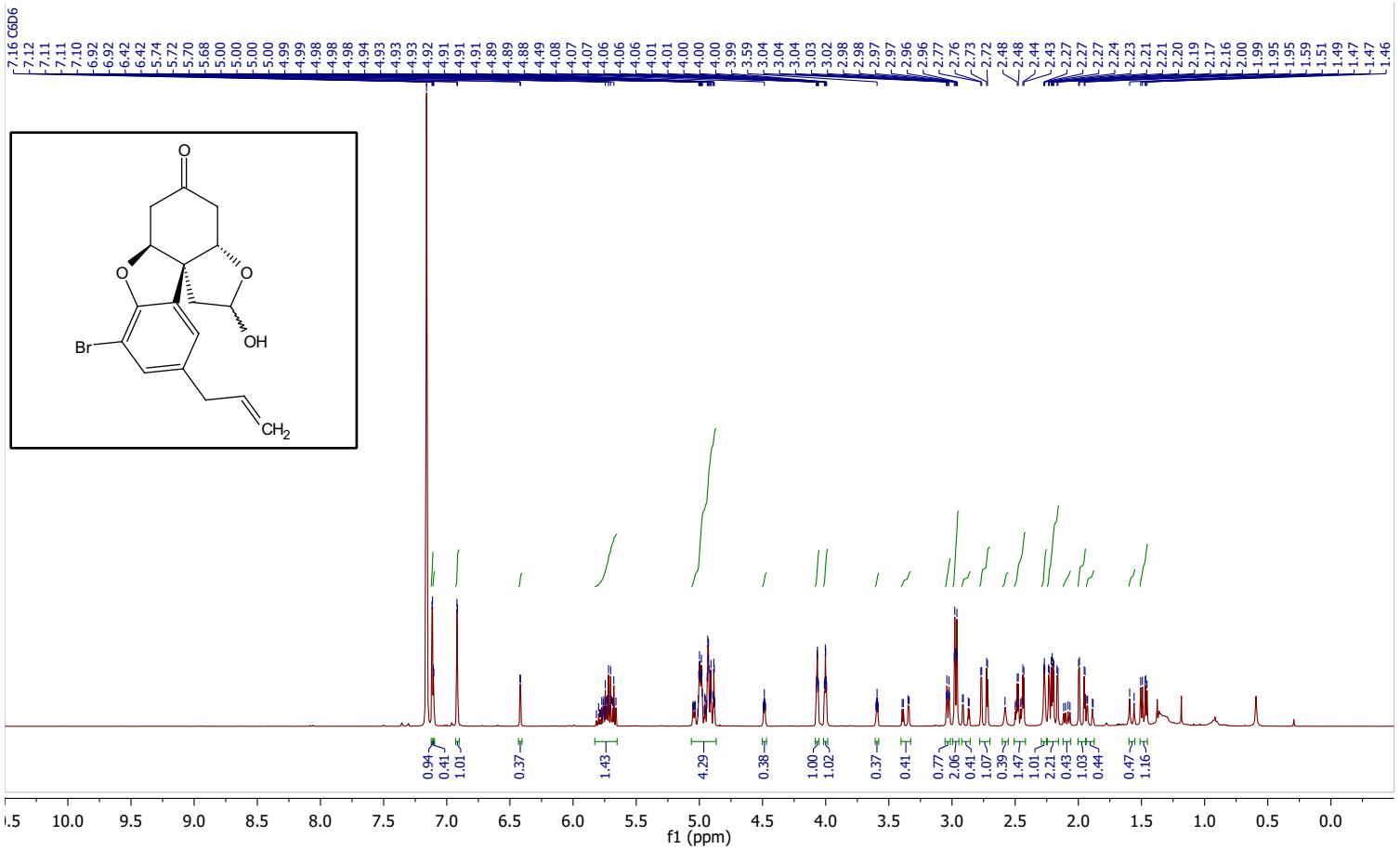


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.42 (dd, *J* = 10.2, 3.0 Hz, 1H), 7.29 (d, *J* = 2.1 Hz, 1H), 6.75 (dd, *J* = 10.0, 3.0 Hz, 1H), 6.65 (d, *J* = 2.1 Hz, 1H), 6.36 (dd, *J* = 10.0, 1.9 Hz, 1H), 6.22 (dd, *J* = 10.2, 1.9 Hz, 1H), 5.84 (dddd, *J* = 16.9, 10.2, 6.7, 6.7 Hz, 1H), 5.49 (dd, *J* = 3.0, 3.0 Hz, 1H), 5.08 – 5.00 (m, 2H), 3.94 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.68 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.22 (ddd, *J* = 6.7, 1.4, 1.4 Hz, 2H), 2.31 (dd, *J* = 14.2, 3.0 Hz, 1H), 2.14 (dd, *J* = 14.2, 3.0 Hz, 1H), 1.23 (dd, *J* = 7.1, 7.1 Hz, 3H).

30

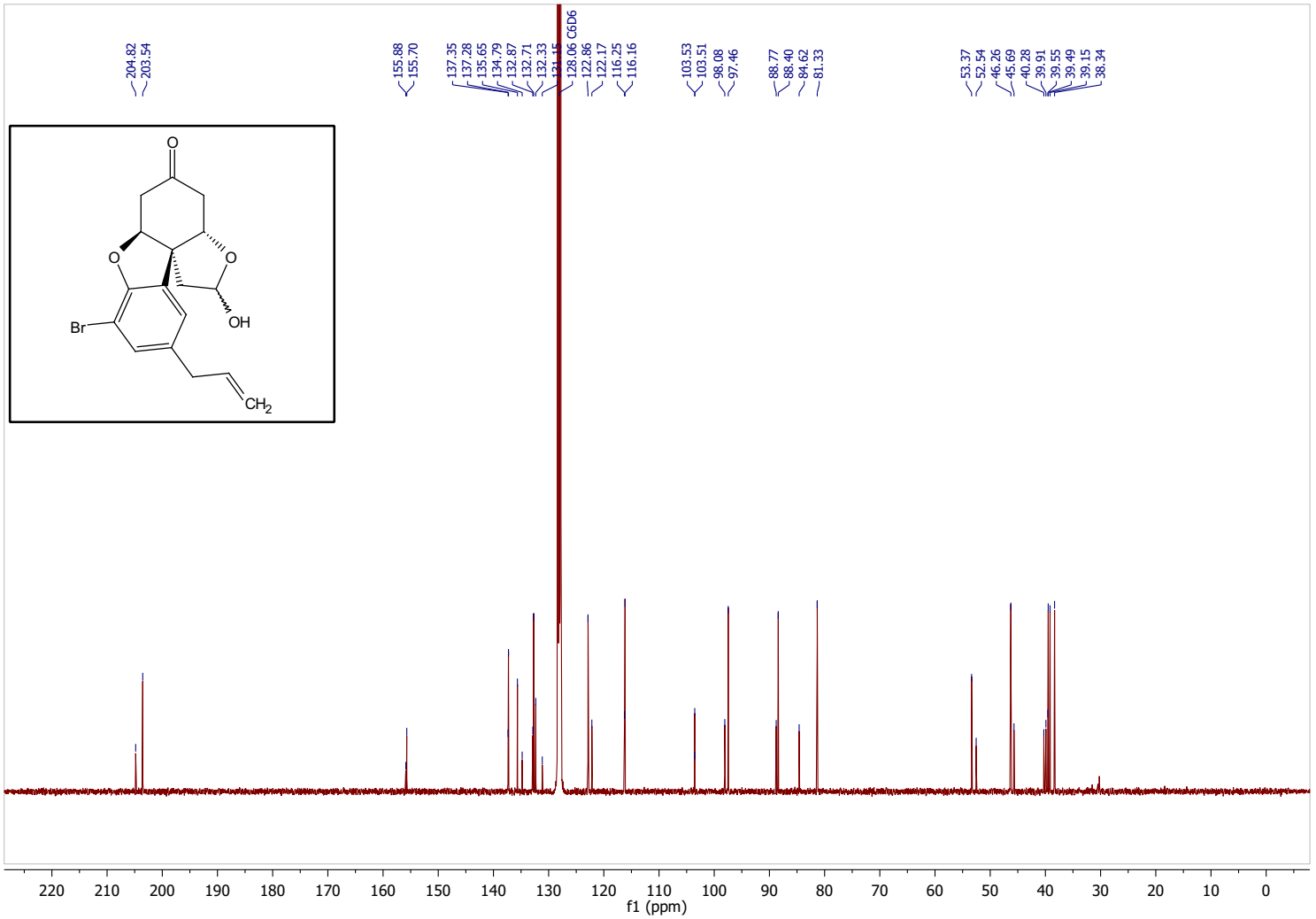

185.90
154.29
153.65
146.06
136.57
134.60
133.24
128.74
128.09
126.38
121.42
116.68
112.70
96.28
77.16 CDCl3
64.79
40.86
39.03
36.42
15.18
O
H3C
O
O
Br
CH2
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

31

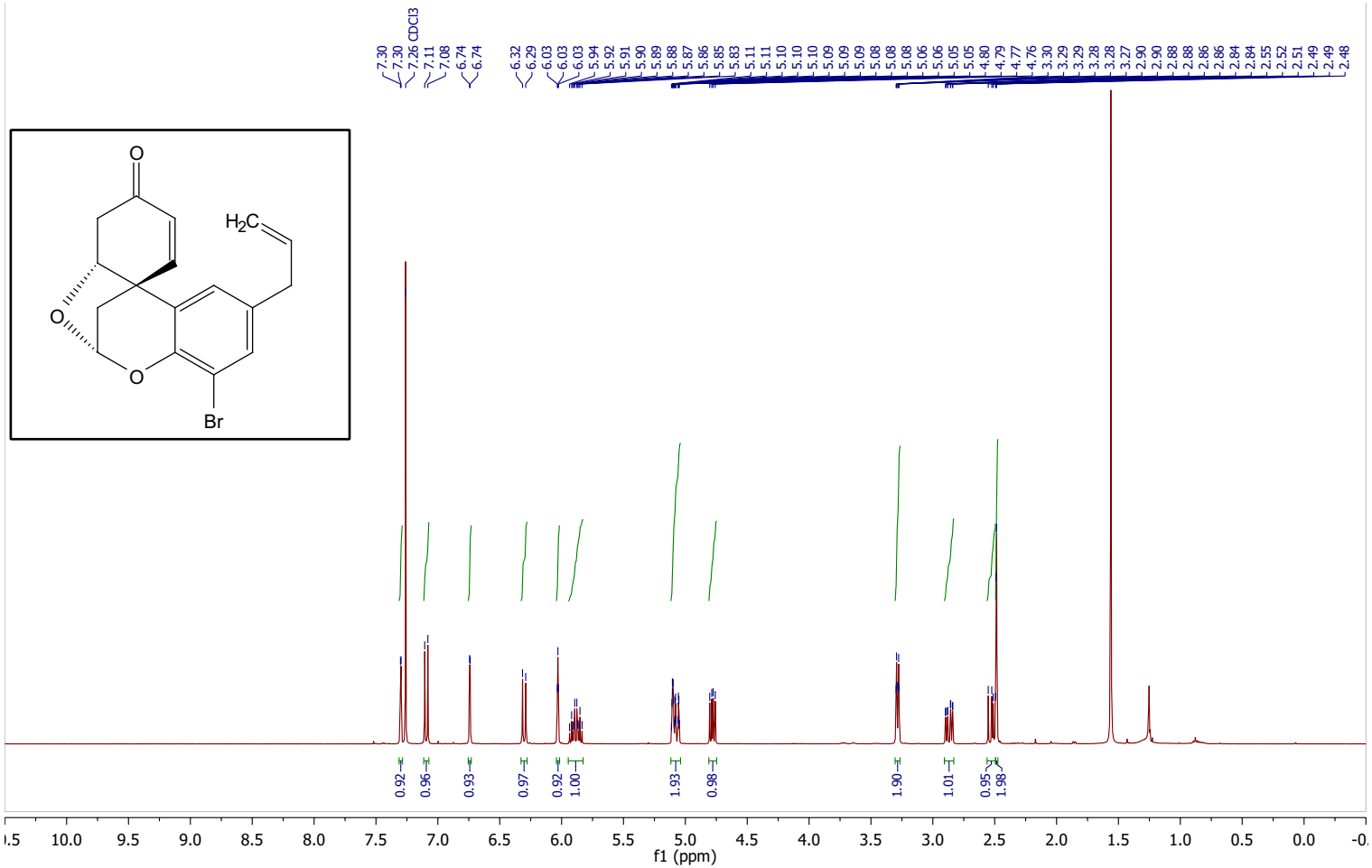


^{1}H NMR (400 MHz, Benzene-d_6) δ 7.12 (d, J = 1.7 Hz, 1H), 7.10 (d, J = 1.7 Hz, 1H), 6.92 (d, J = 1.7 Hz, 1H), 6.42 (d, J = 1.7 Hz, 1H), 5.83 – 5.64 (m, 2H), 5.06 – 4.87 (m, 6H), 4.49 (ddd, J = 3.6, 2.6, 1.1 Hz, 1H), 4.07 (ddd, J = 3.1, 3.1, 1.1 Hz, 1H), 4.00 (ddd, J = 3.1, 3.1, 1.1 Hz, 1H), 3.59 (ddd, J = 3.6, 2.4, 1.1 Hz, 1H), 3.37 (dd, J = 18.5, 3.7 Hz, 1H), 3.03 (ddd, J = 6.8, 1.5, 1.5 Hz, 2H), 2.97 (ddd, J = 6.7, 1.5, 1.5 Hz, 2H), 2.89 (dd, J = 18.5, 2.6 Hz, 1H), 2.75 (dd, J = 18.4, 2.9 Hz, 1H), 2.58 (s, 1H), 2.47 (dd, J = 17.5, 3.6 Hz, 1H), 2.46 (dd, J = 17.7, 3.3 Hz, 1H), 2.29 – 2.25 (m, 1H), 2.21 (dd, J = 14.6, 2.1 Hz, 1H), 2.19 (dd, J = 18.4, 3.2 Hz, 1H), 2.09 (dd, J = 14.0, 6.0 Hz, 1H), 1.97 (dd, J = 17.7, 2.8 Hz, 1H), 1.91 (dd, J = 17.5, 2.5 Hz, 1H), 1.58 (d, J = 14.0 Hz, 1H), 1.52 – 1.44 (m, 1H).

31

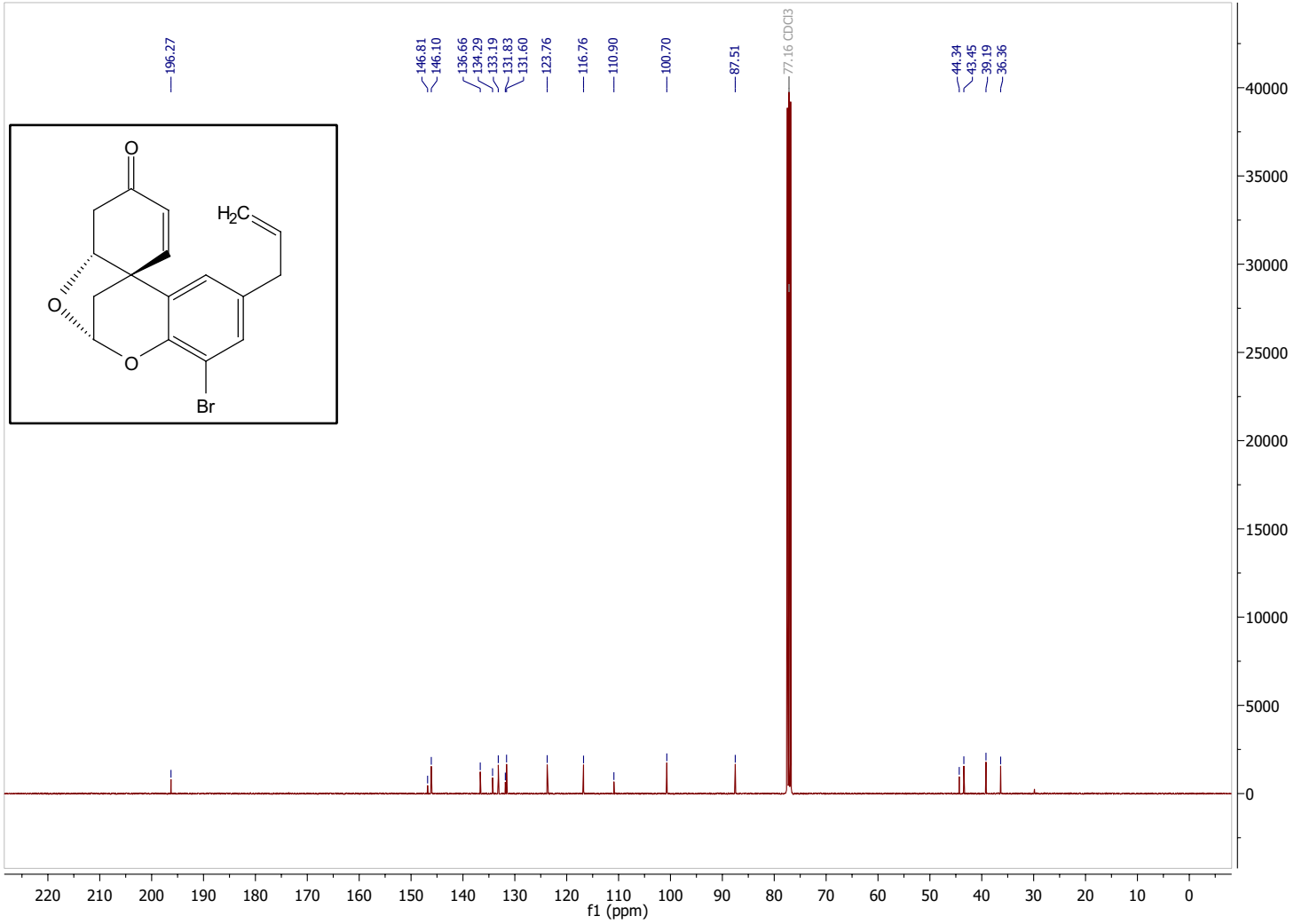

204.82
203.54
155.88
155.70
137.35
137.28
135.65
134.79
132.87
132.71
132.33
131.15
128.06 C6D6
122.86
122.17
116.25
116.16
103.53
103.51
98.08
97.46
88.77
88.40
84.62
81.33
53.37
52.54
46.26
45.69
40.28
39.91
39.55
39.49
39.15
38.34
O
O
O
Br
OH
CH2
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

32

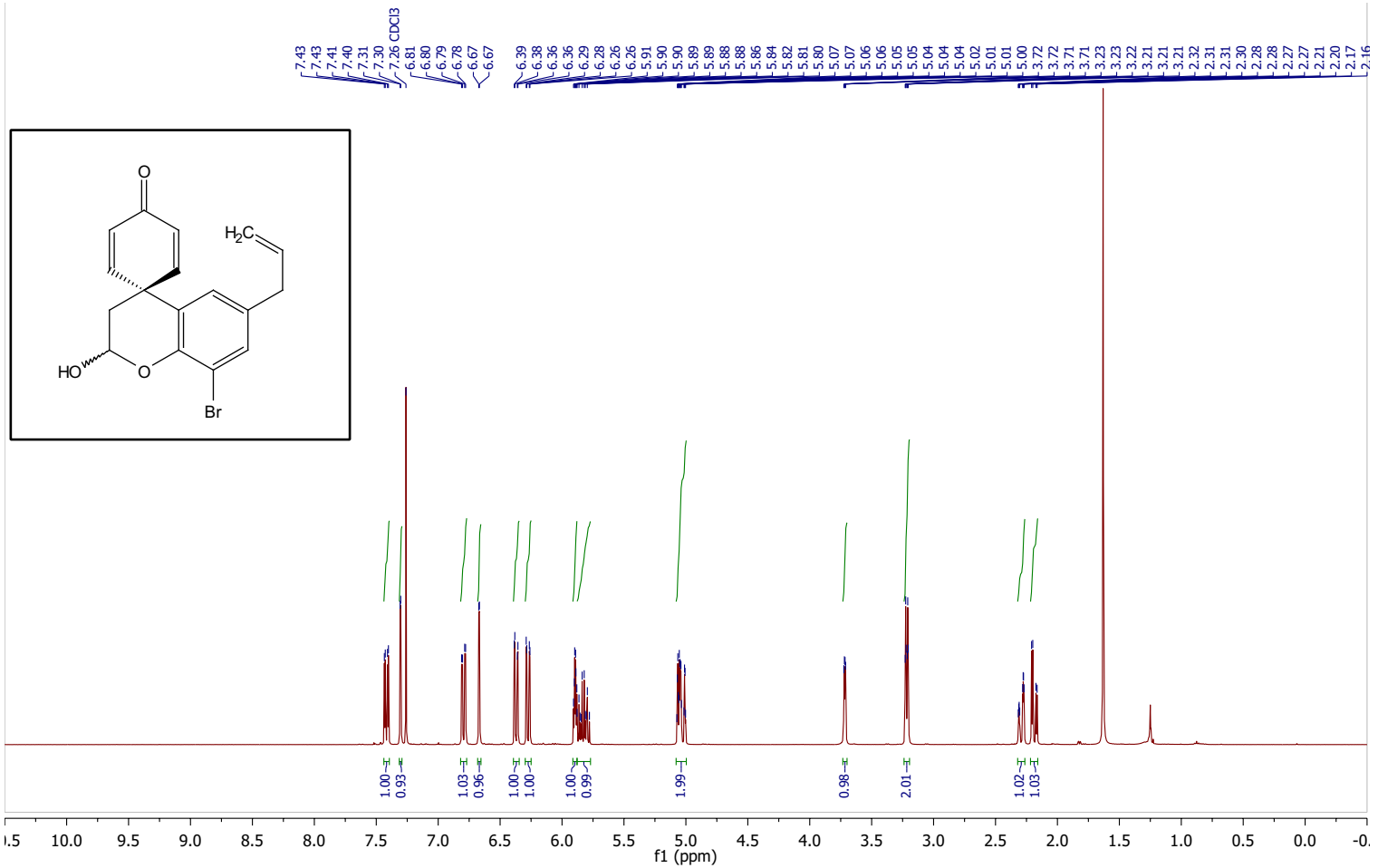


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.30 (d, *J* = 2.0 Hz, 1H), 7.09 (d, *J* = 10.2 Hz, 1H), 6.74 (d, *J* = 2.0 Hz, 1H), 6.30 (d, *J* = 10.2 Hz, 1H), 6.03 (dd, *J* = 1.8, 1.8 Hz, 1H), 5.89 (dddd, *J* = 16.9, 10.3, 6.7, 6.7 Hz, 1H), 5.11 – 5.04 (m, 2H), 4.78 (dd, *J* = 11.3, 6.6 Hz, 1H), 3.29 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 2.87 (ddd, *J* = 16.1, 6.6, 0.9 Hz, 1H), 2.52 (dd, *J* = 16.1, 11.3 Hz 1H), 2.49 (d, *J* = 1.8 Hz, 2H).

32

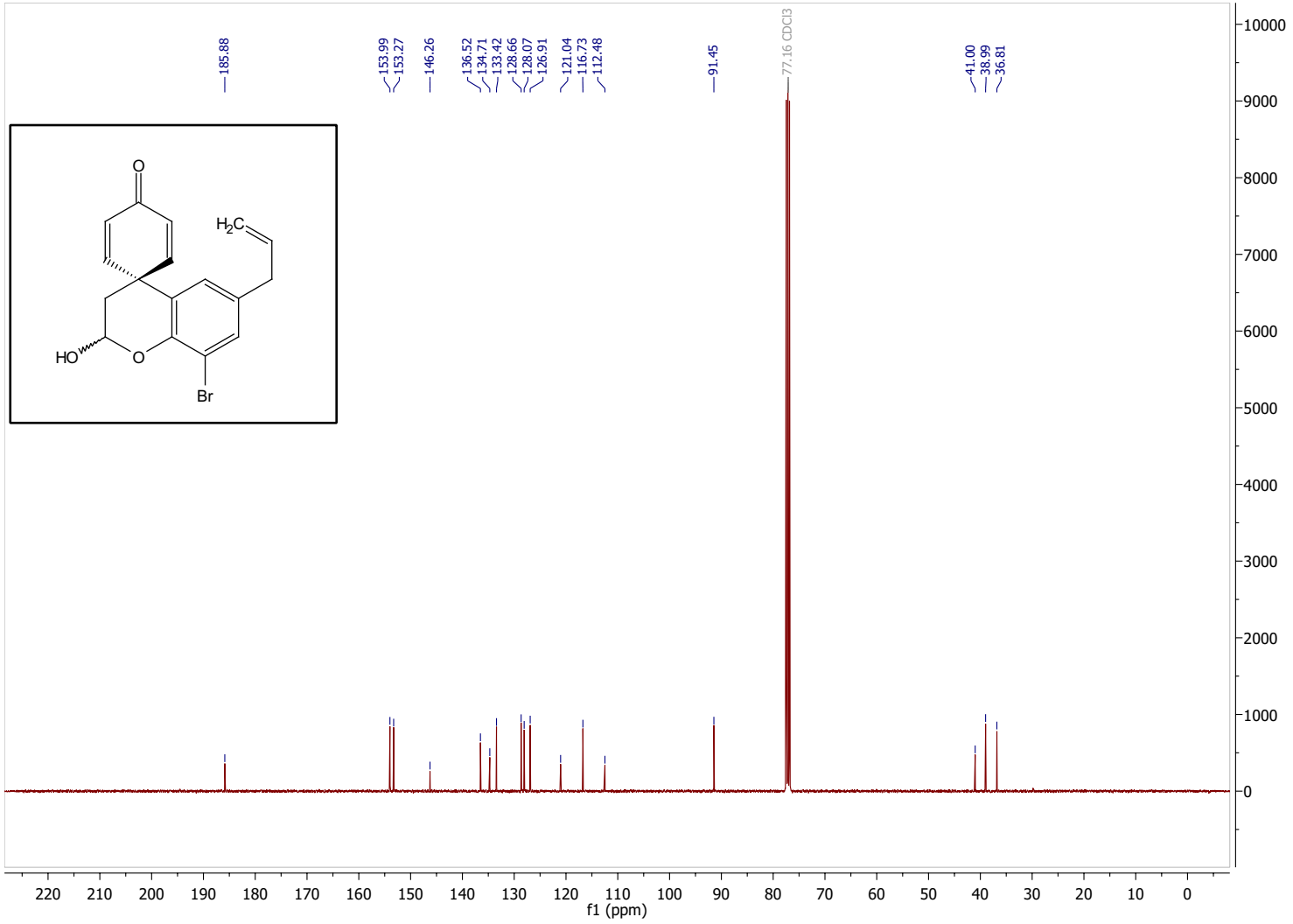

196.27
146.81
146.10
136.66
134.29
133.19
131.83
131.60
123.76
116.76
110.90
100.70
87.51
77.16 CDCl3
44.34
43.45
39.19
36.36
O
H2C
O
O
Br
40000
35000
30000
25000
20000
15000
10000
5000
0
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

33

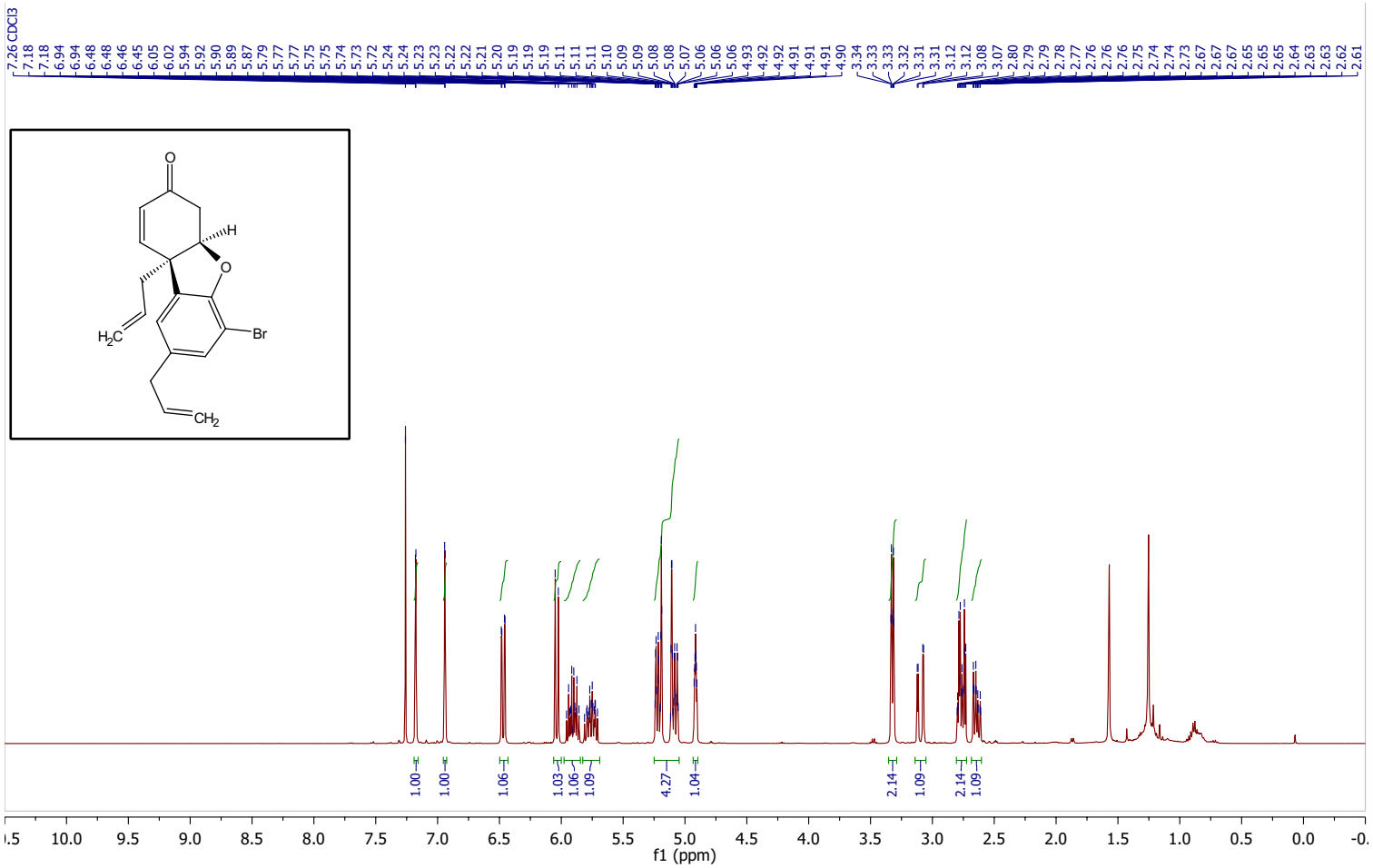


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.42 (dd, *J* = 10.2, 3.0 Hz, 1H), 7.30 (d, *J* = 2.1 Hz, 1H), 6.79 (dd, *J* = 10.0, 3.0 Hz, 1H), 6.67 (d, *J* = 2.1 Hz, 1H), 6.37 (dd, *J* = 10.0, 1.9 Hz, 1H), 6.27 (dd, *J* = 10.2, 1.9 Hz, 1H), 5.89 (ddd, *J* = 3.9, 3.9, 2.9 Hz, 1H), 5.83 (dddd, *J* = 16.9, 10.2, 6.5, 6.5 Hz, 1H), 5.08 – 4.99 (m, 2H), 3.72 (dd, *J* = 3.9, 1.7 Hz, 1H), 3.22 (ddd, *J* = 6.5, 1.5, 1.5 Hz, 2H), 2.29 (ddd, *J* = 14.1, 2.9, 1.7 Hz, 1H), 2.19 (dd, *J* = 14.1, 3.9 Hz, 1H).

33

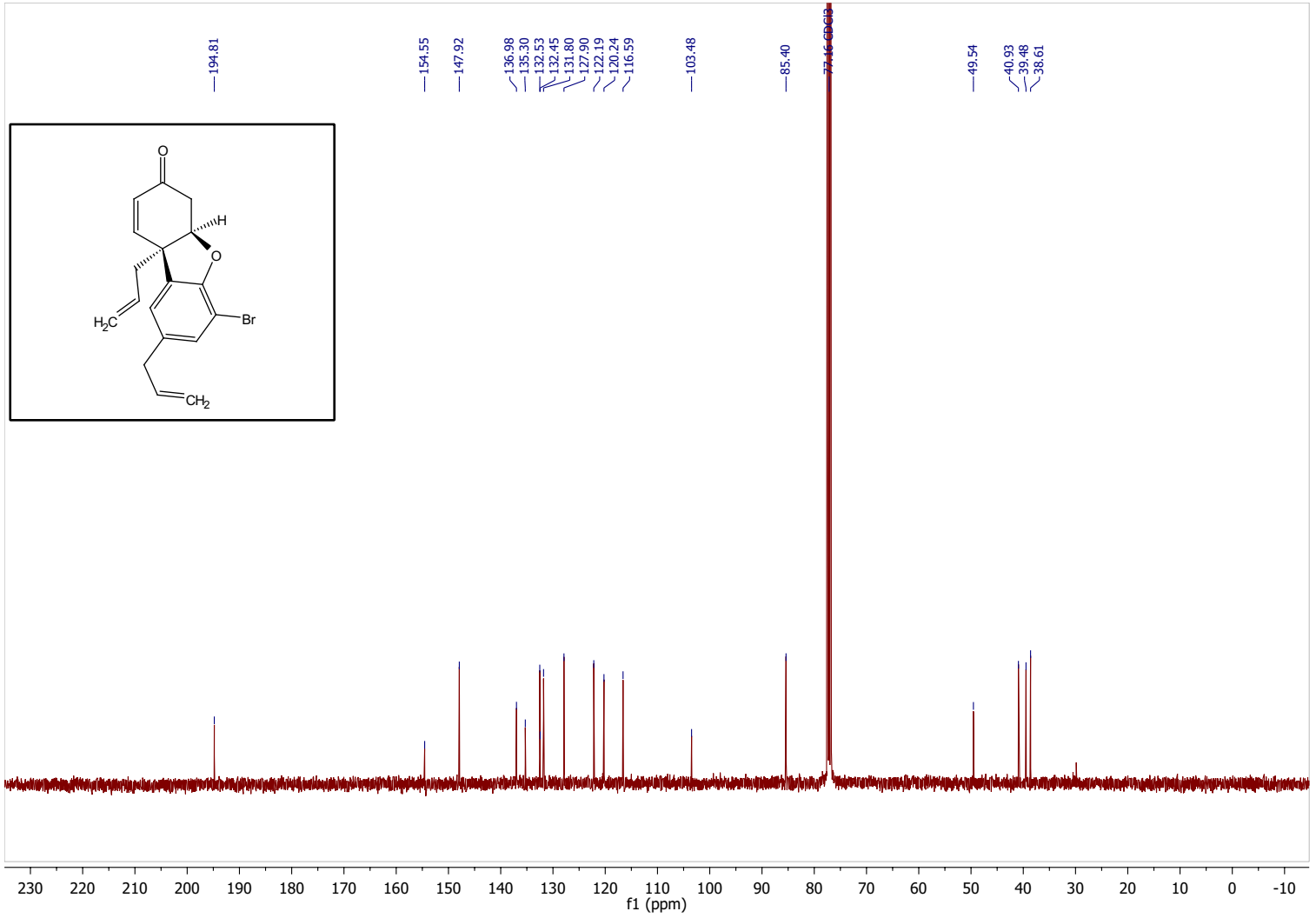

185.88
153.99
153.27
146.26
136.52
134.71
133.42
128.66
128.07
126.91
121.04
116.73
112.48
91.45
77.16 CDCl3
41.00
38.99
36.81
O
H2C
HO
O
Br
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

34

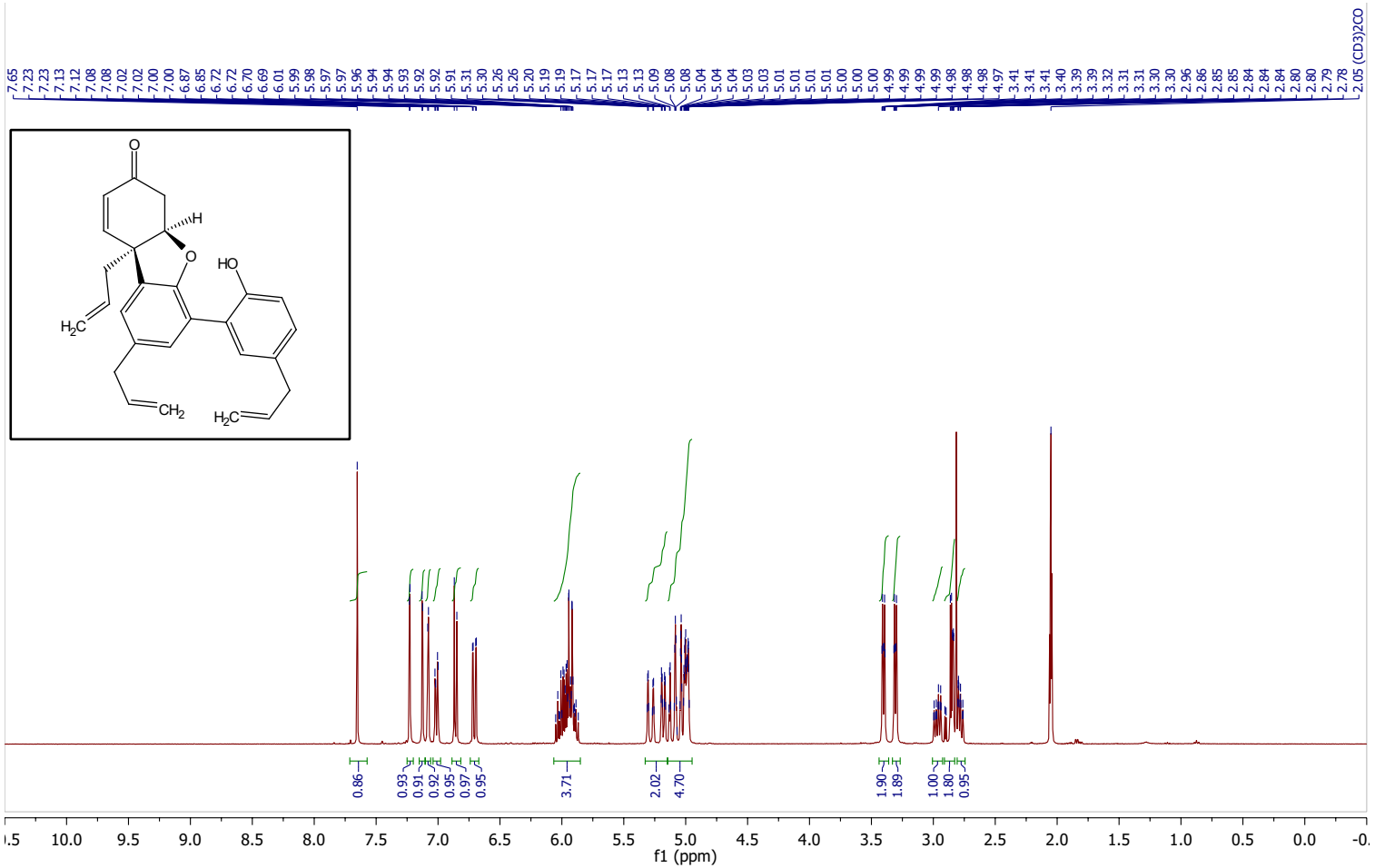


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.17 (d, *J* = 1.6 Hz, 1H), 6.94 (d, *J* = 1.6 Hz, 1H), 6.47 (dd, *J* = 10.2, 1.8 Hz, 1H), 6.03 (dd, *J* = 10.2, 0.8 Hz, 1H), 5.90 (dddd, *J* = 16.9, 10.4, 6.7, 6.7 Hz, 1H), 5.76 (dddd, *J* = 16.9, 10.2, 8.0, 6.8 Hz, 1H), 5.25 – 5.04 (m, 4H), 4.91 (ddd, *J* = 4.5, 2.8, 1.8 Hz, 1H), 3.32 (d, *J* = 6.7 Hz, 2H), 3.09 (ddd, *J* = 17.7, 2.8, 0.8 Hz, 1H), 2.82 – 2.70 (m, 2H), 2.64 (dd, *J* = 14.2, 8.0 Hz, 1H).

34

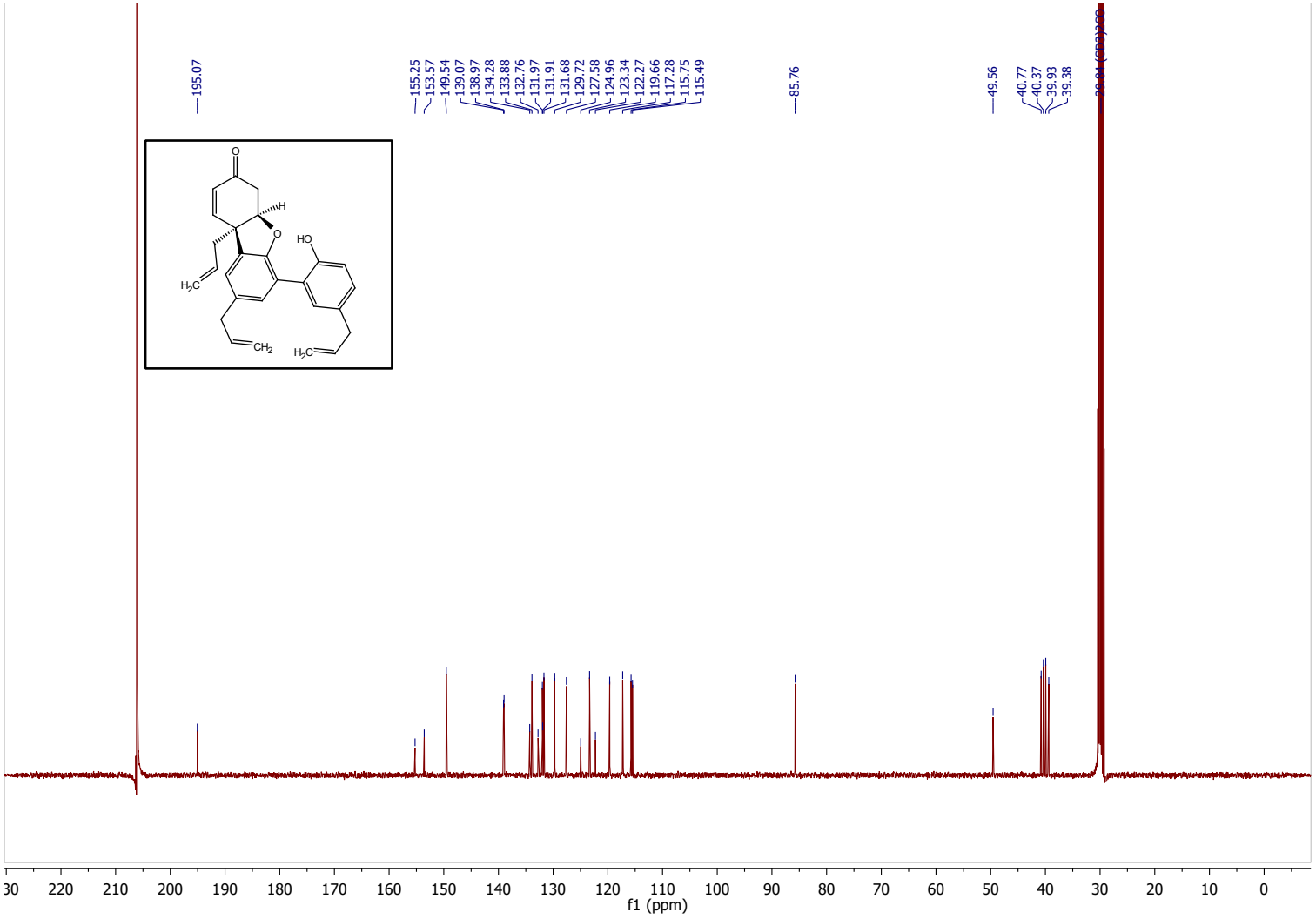

194.81
154.55
147.92
136.98
135.30
132.53
132.45
131.80
127.90
122.19
120.24
116.59
103.48
85.40
77.16 CDCl3
49.54
40.93
39.48
38.61
O
H
O
H2C
Br
CH2
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

Simonsol C (**2**)

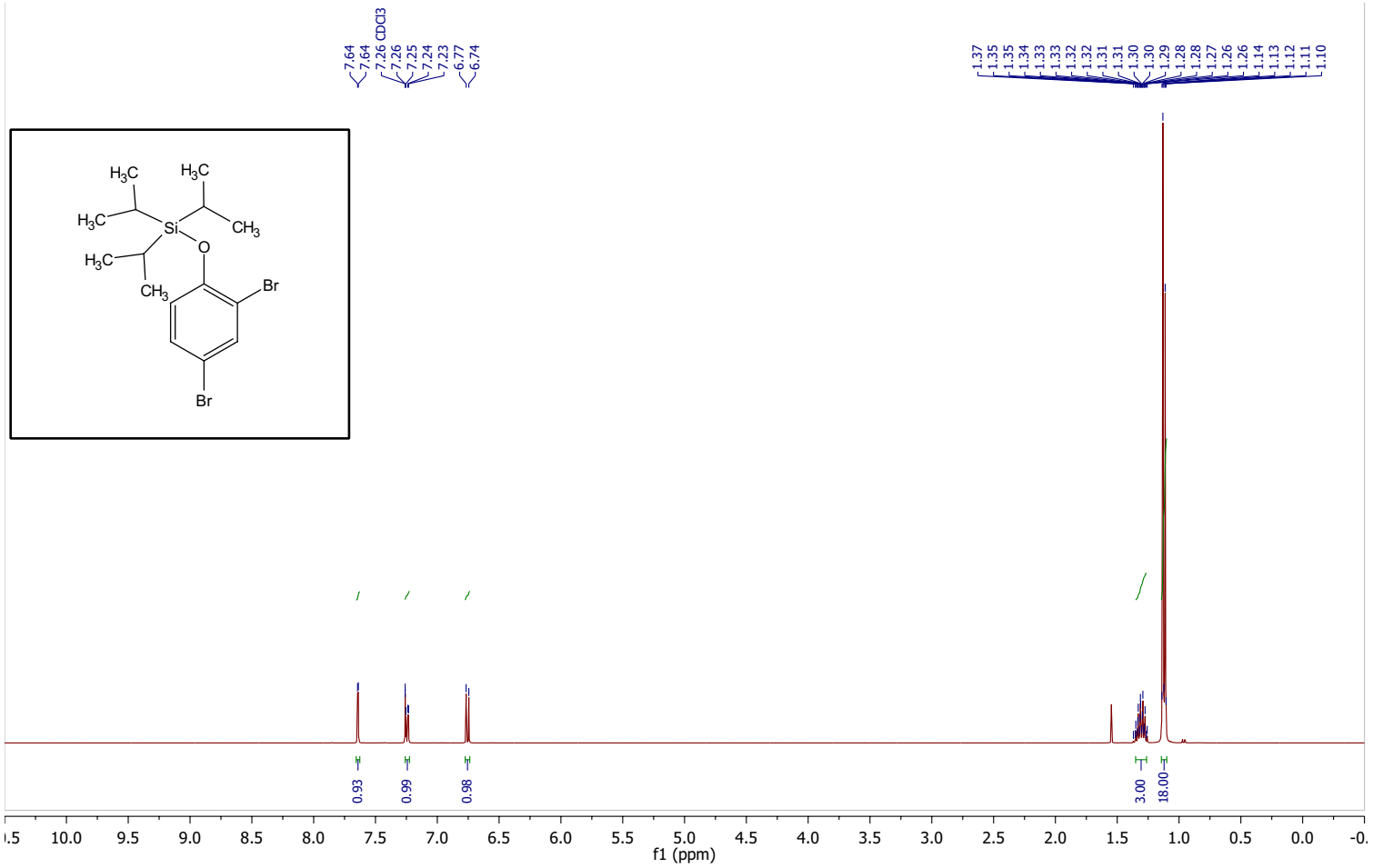


^{1}H NMR (400 MHz, Acetone-d_6) δ 7.65 (s, 1H), 7.23 (d, J = 1.8 Hz, 1H), 7.13 (d, J = 1.8 Hz, 1H), 7.08 (d, J = 2.3 Hz, 1H), 7.01 (dd, J = 8.3, 2.3 Hz, 1H), 6.86 (d, J = 8.3 Hz, 1H), 6.71 (dd, J = 10.3, 1.9 Hz, 1H), 6.07 – 5.84 (m, 3H), 5.93 (dd, J = 10.3, 0.6 Hz, 1H), 5.32 – 5.16 (m, 2H), 5.14 – 4.96 (m, 5H), 3.40 (ddd, J = 6.8, 1.5, 1.5 Hz, 2H), 3.31 (ddd, J = 6.8, 1.5, 1.5 Hz, 2H), 2.97 (dddd, J = 14.1, 7.1, 1.3, 1.3 Hz, 1H), 2.92 – 2.83 (m, 2H), 2.80 – 2.74 (m, 1H).

Simonsol C (**2**)

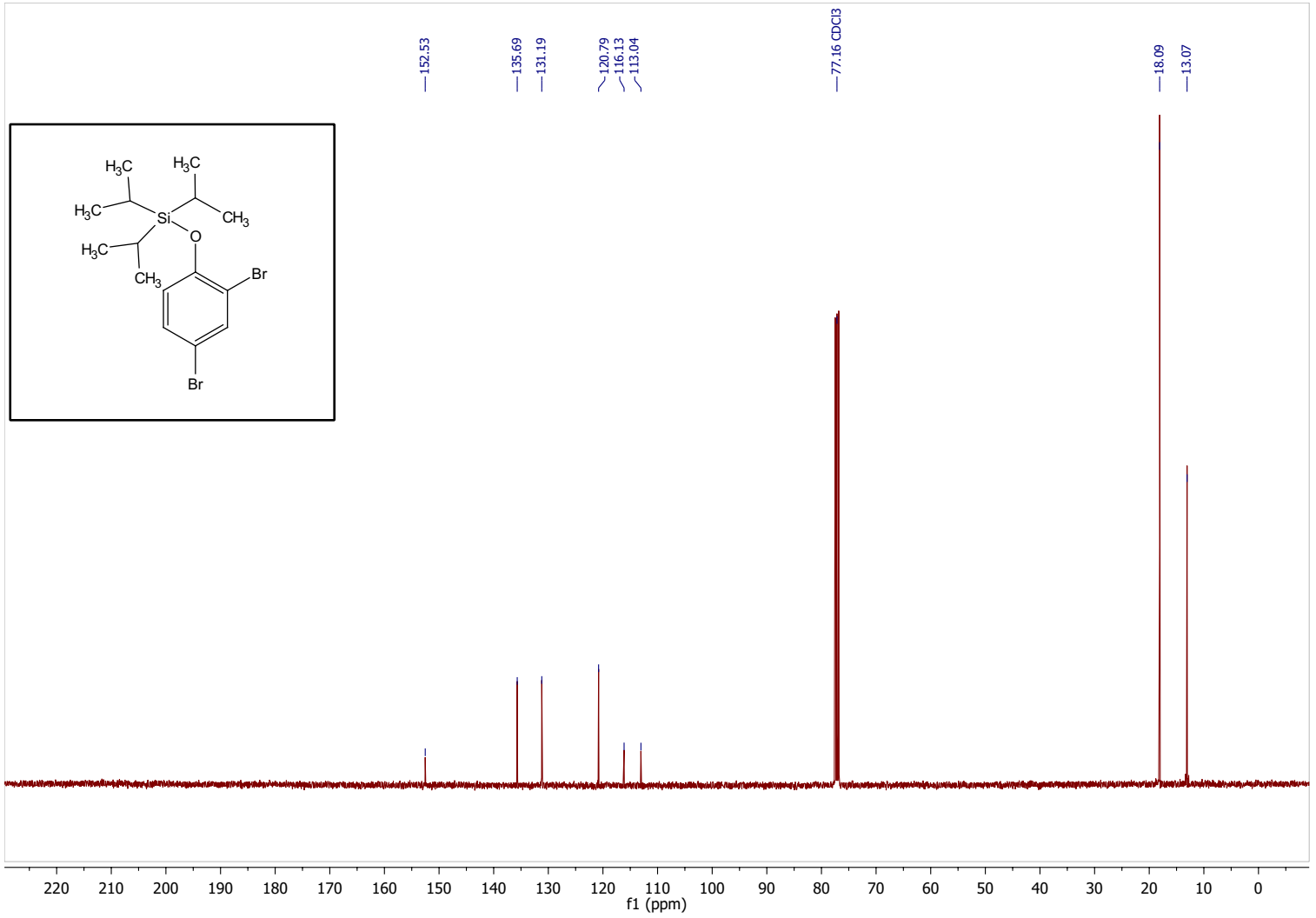

195.07
155.25
153.57
149.54
139.07
138.97
134.28
133.88
132.76
131.97
131.91
131.68
129.72
127.58
124.96
123.34
122.27
119.66
117.28
115.75
115.49
85.76
49.56
40.77
40.37
39.93
39.38
30.84 (65)300
O
H
O
HO
H2C
CH2
H2C
f1 (ppm)

S1

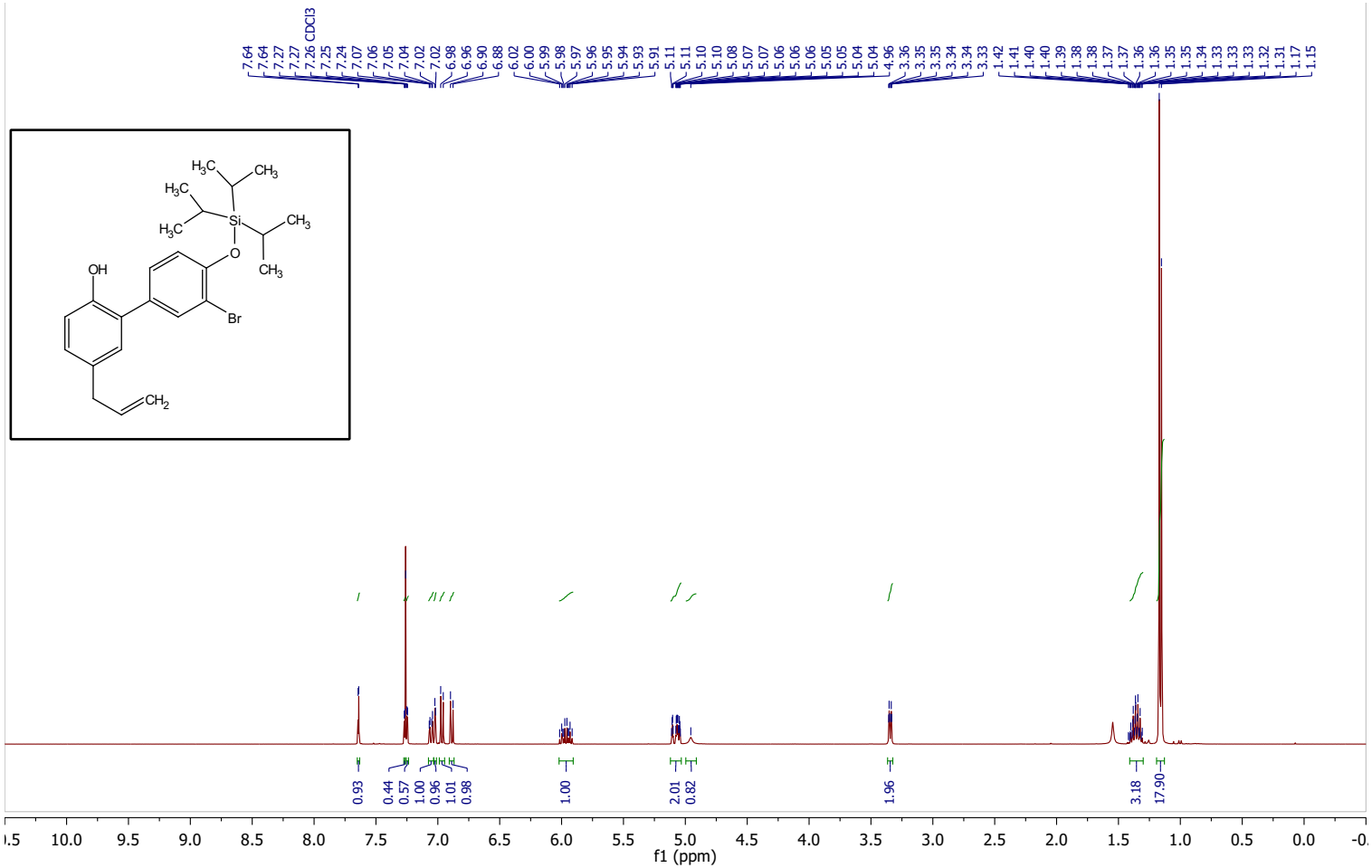


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.64 (d, *J* = 2.5 Hz, 1H), 7.25 (dd, *J* = 8.7, 2.5 Hz, 1H), 6.76 (d, *J* = 8.7 Hz, 1H), 1.35 – 1.25 (m, 3H), 1.12 (d, *J* = 7.4 Hz, 18H).

S1

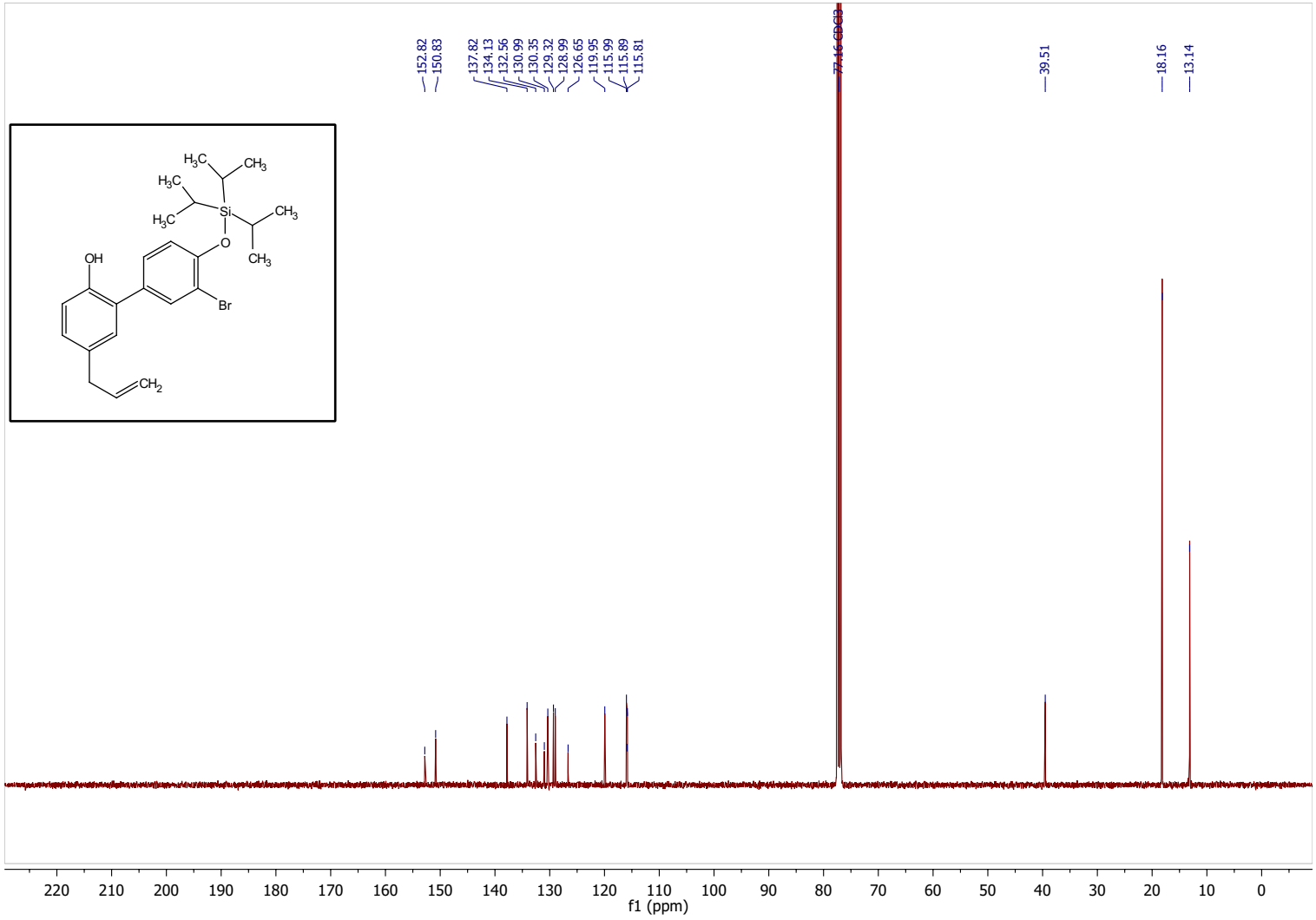

152.53
135.69
131.19
120.79
116.13
113.04
77.16 CDCl3
18.09
13.07
H3C
H3C
H3C
Si
CH3
H3C
O
CH3
Br
Br
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

40

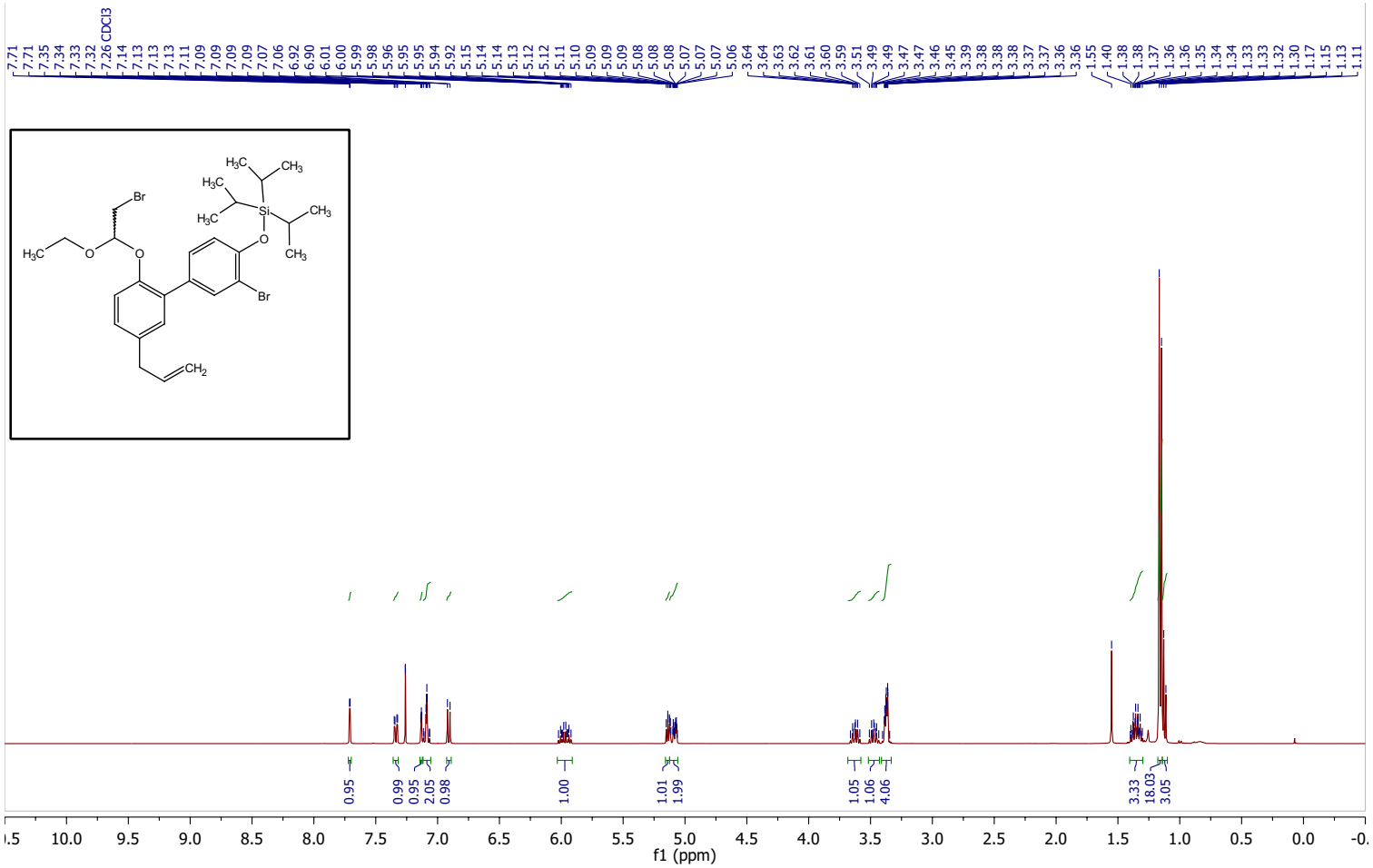


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.64 (d, *J* = 2.2 Hz, 1H), 7.26 (dd, *J* = 8.3, 2.2 Hz, 1H), 7.06 (dd, *J* = 8.2, 2.3 Hz, 1H), 7.02 (d, *J* = 2.2 Hz, 1H), 6.97 (d, *J* = 8.3 Hz, 1H), 6.89 (d, *J* = 8.2 Hz, 1H), 5.97 (ddt, *J* = 16.8, 10.0, 6.7 Hz, 1H), 5.12 – 5.03 (m, 2H), 4.96 (s, 1H), 3.34 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 1.42 – 1.30 (m, 3H), 1.16 (d, *J* = 7.3 Hz, 18H).

40

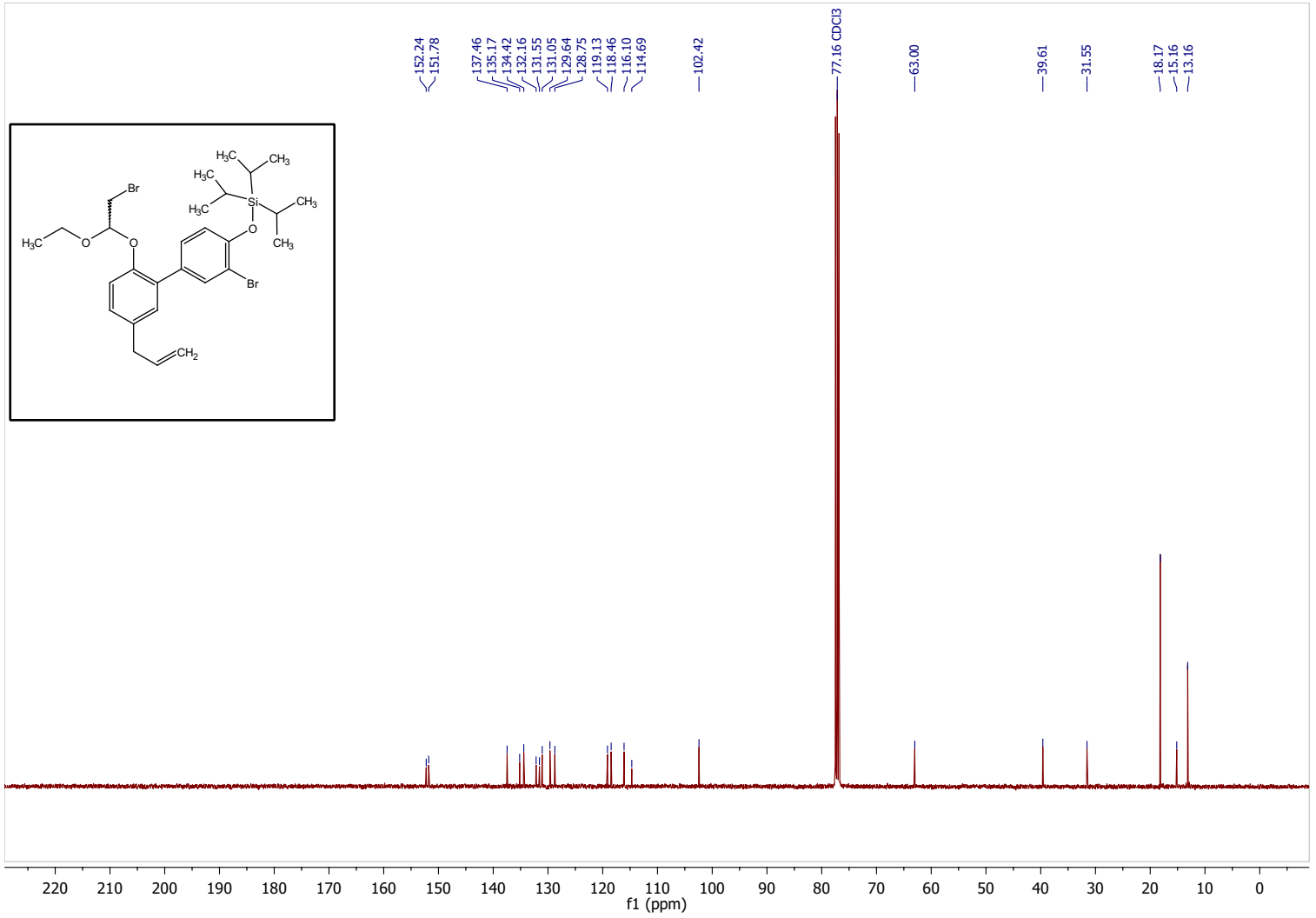

152.82
150.83
137.82
134.13
132.56
130.99
130.35
129.32
128.99
126.65
119.95
115.99
115.89
115.81
77.16 CDCl3
39.51
18.16
13.14
OH
Br
O
Si
CH3
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

41

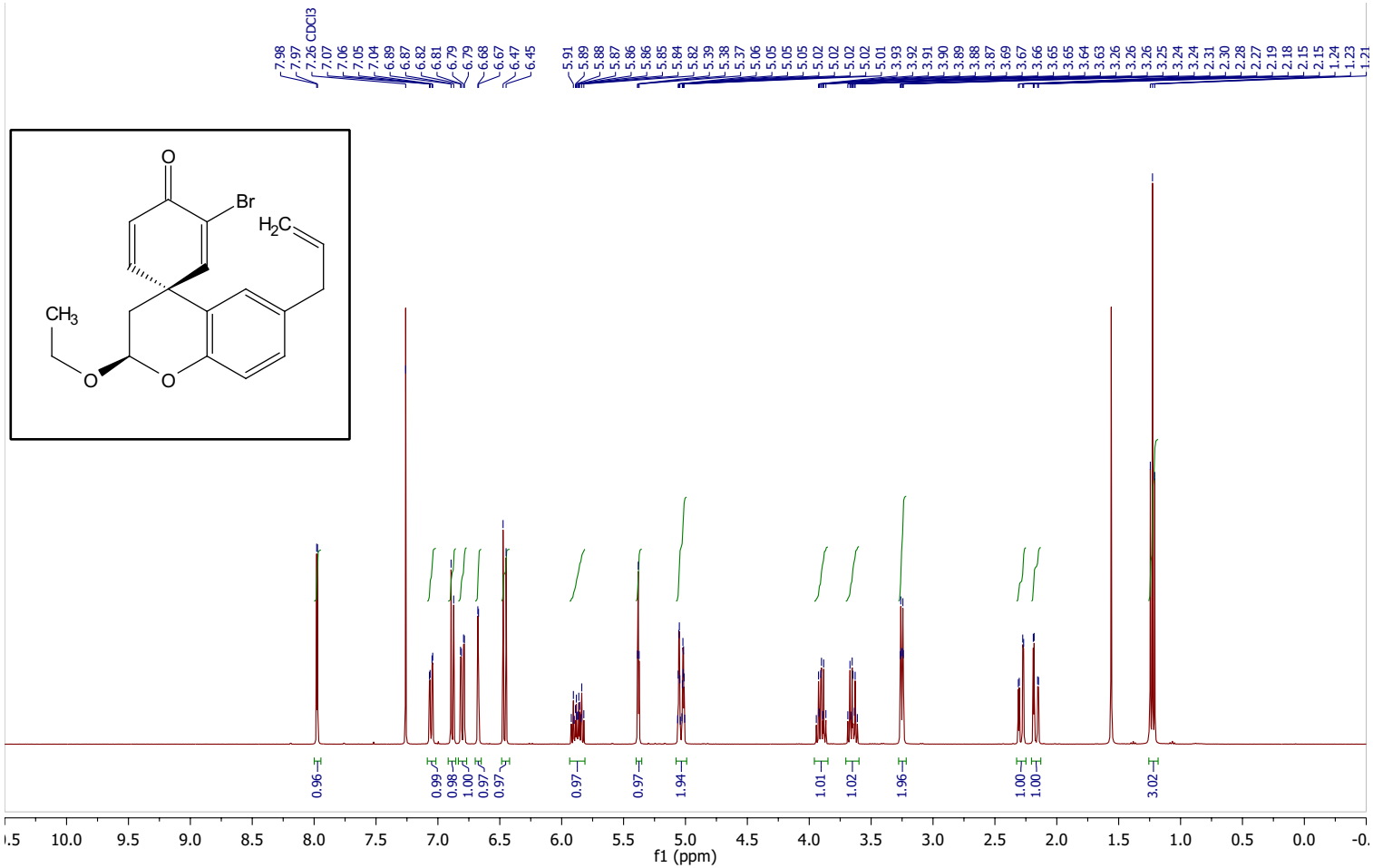


^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.71 (d, *J* = 2.2 Hz, 1H), 7.34 (dd, *J* = 8.4, 2.2 Hz, 1H), 7.15 – 7.12 (m, 1H), 7.12 – 7.06 (m, 2H), 6.91 (d, *J* = 8.4 Hz, 1H), 5.97 (dddd, *J* = 16.8, 10.1, 6.7, 6.7 Hz, 1H), 5.16 – 5.12 (m, 1H), 5.12 – 5.05 (m, 2H), 3.62 (dq, *J* = 9.3, 7.0 Hz, 1H), 3.47 (dq, *J* = 9.3, 7.0 Hz, 1H), 3.40 – 3.35 (m, 4H), 1.40 – 1.31 (m, 3H), 1.16 (d, *J* = 7.5 Hz, 18H), 1.13 (dd, *J* = 7.0, 7.0 Hz, 3H).

41

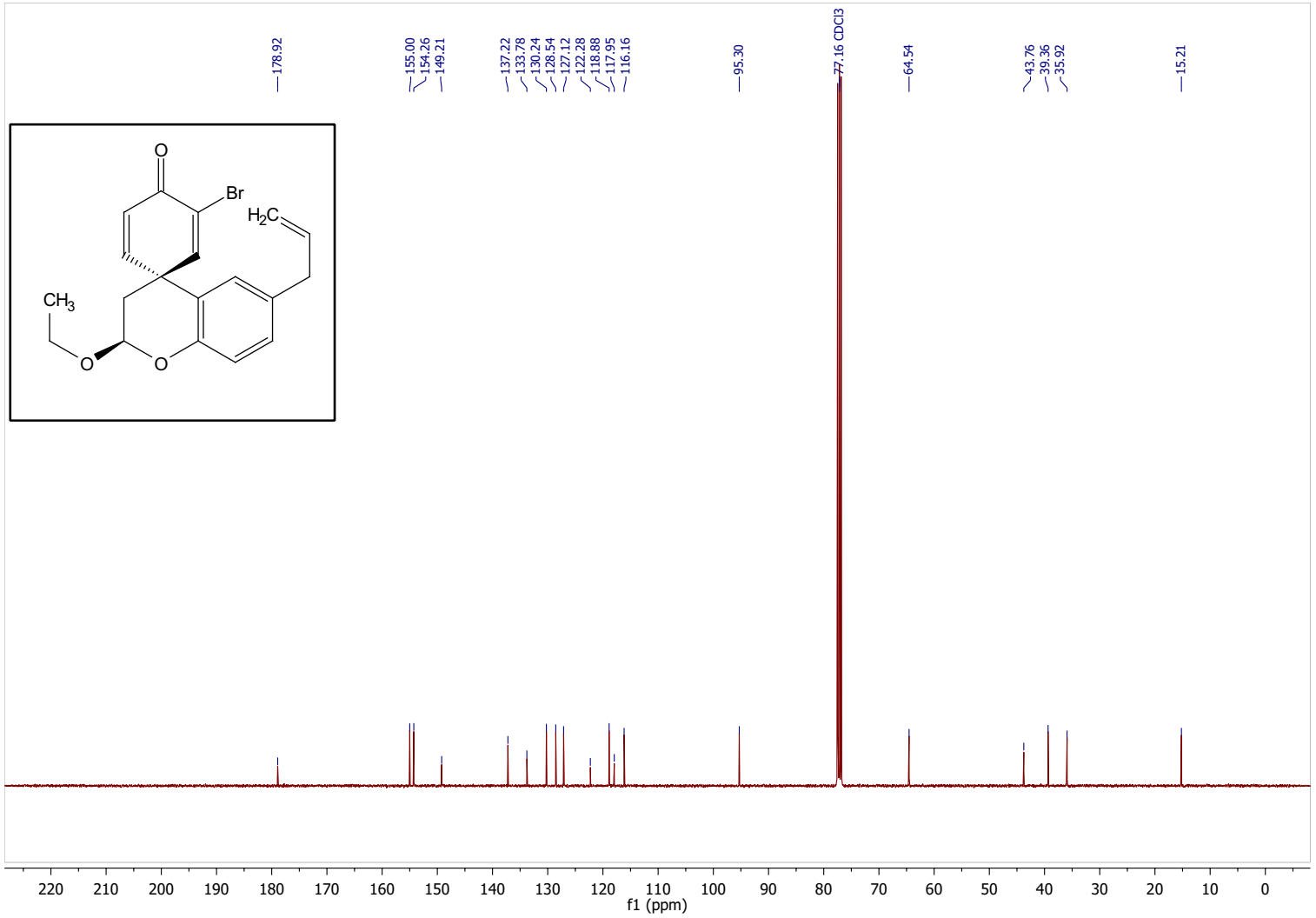

152.24
151.78
137.46
135.17
134.42
132.16
131.55
131.05
129.64
128.75
119.13
118.46
116.10
114.69
102.42
77.16 CDCl3
63.00
39.61
31.55
18.17
15.16
13.16
Br
Br
Si
O
O
O
CH2
f1 (ppm)

42a

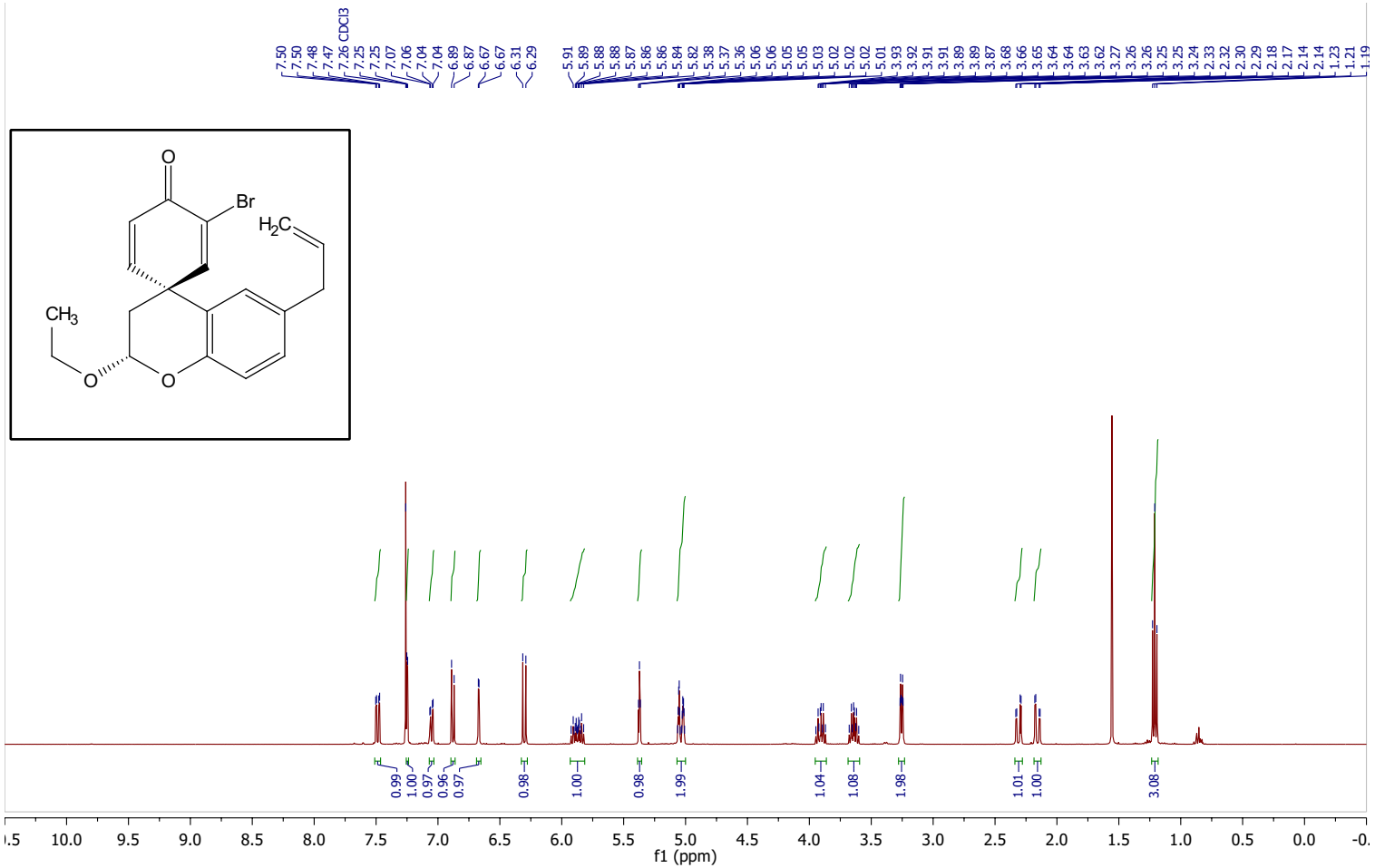


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.98 (d, *J* = 2.7 Hz, 1H), 7.05 (dd, *J* = 8.4, 2.2 Hz, 1H), 6.88 (d, *J* = 8.4 Hz, 1H), 6.80 (dd, *J* = 9.8, 2.7 Hz, 1H), 6.68 (d, *J* = 2.2 Hz, 1H), 6.46 (d, *J* = 9.8 Hz, 1H), 5.93 – 5.82 (m, 1H), 5.38 (dd, *J* = 2.8, 2.8 Hz, 1H), 5.06 – 5.00 (m, 2H), 3.90 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.65 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.25 (ddd, *J* = 6.7, 1.4, 1.4 Hz, 2H), 2.29 (dd, *J* = 14.1, 2.9 Hz, 1H), 2.17 (dd, *J* = 14.1, 2.7 Hz, 1H), 1.23 (dd, *J* = 7.1, 7.1 Hz, 3H).

42a

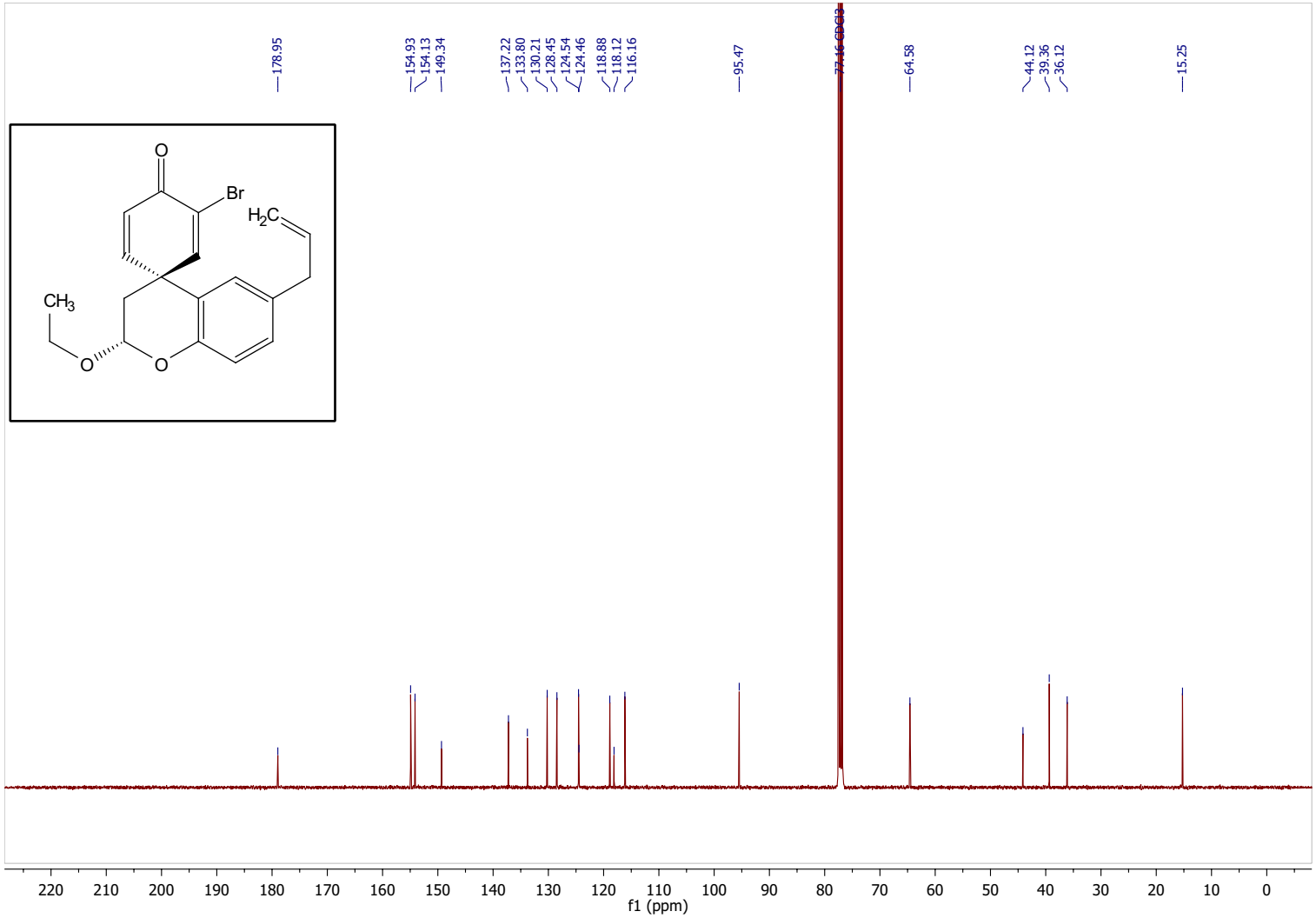

178.92
155.00
154.26
149.21
137.22
133.78
130.24
128.54
127.12
122.28
118.88
117.95
116.16
95.30
77.16 CDCl3
64.54
43.76
39.36
35.92
15.21
O
Br
H2C
CH3
O
O
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

42b

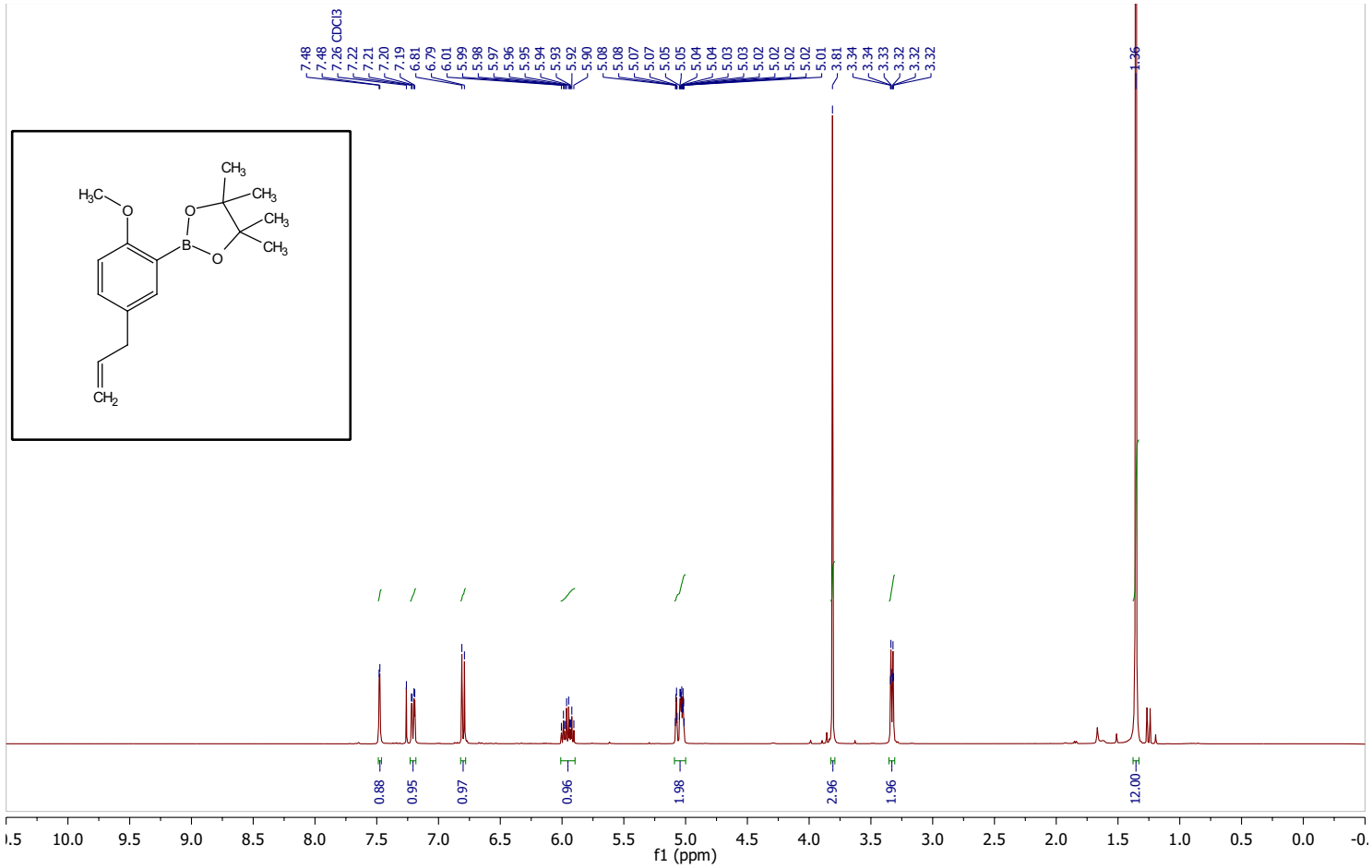


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.49 (dd, *J* = 10.0, 2.7 Hz, 1H), 7.25 (d, *J* = 2.7 Hz, 1H), 7.05 (dd, *J* = 8.3, 2.2 Hz, 1H), 6.88 (d, *J* = 8.3 Hz, 1H), 6.67 (d, *J* = 2.2 Hz, 1H), 6.30 (d, *J* = 10.0 Hz, 1H), 5.92 – 5.81 (m, 1H), 5.37 (dd, *J* = 3.1, 3.1 Hz, 1H), 5.06 – 5.00 (m, 2H), 3.91 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.64 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.25 (ddd, *J* = 6.8, 1.4, 1.4 Hz, 2H), 2.31 (dd, *J* = 14.0, 3.0 Hz, 1H), 2.16 (dd, *J* = 14.0, 3.2 Hz, 1H), 1.21 (dd, *J* = 7.1, 7.1 Hz, 3H).

42b

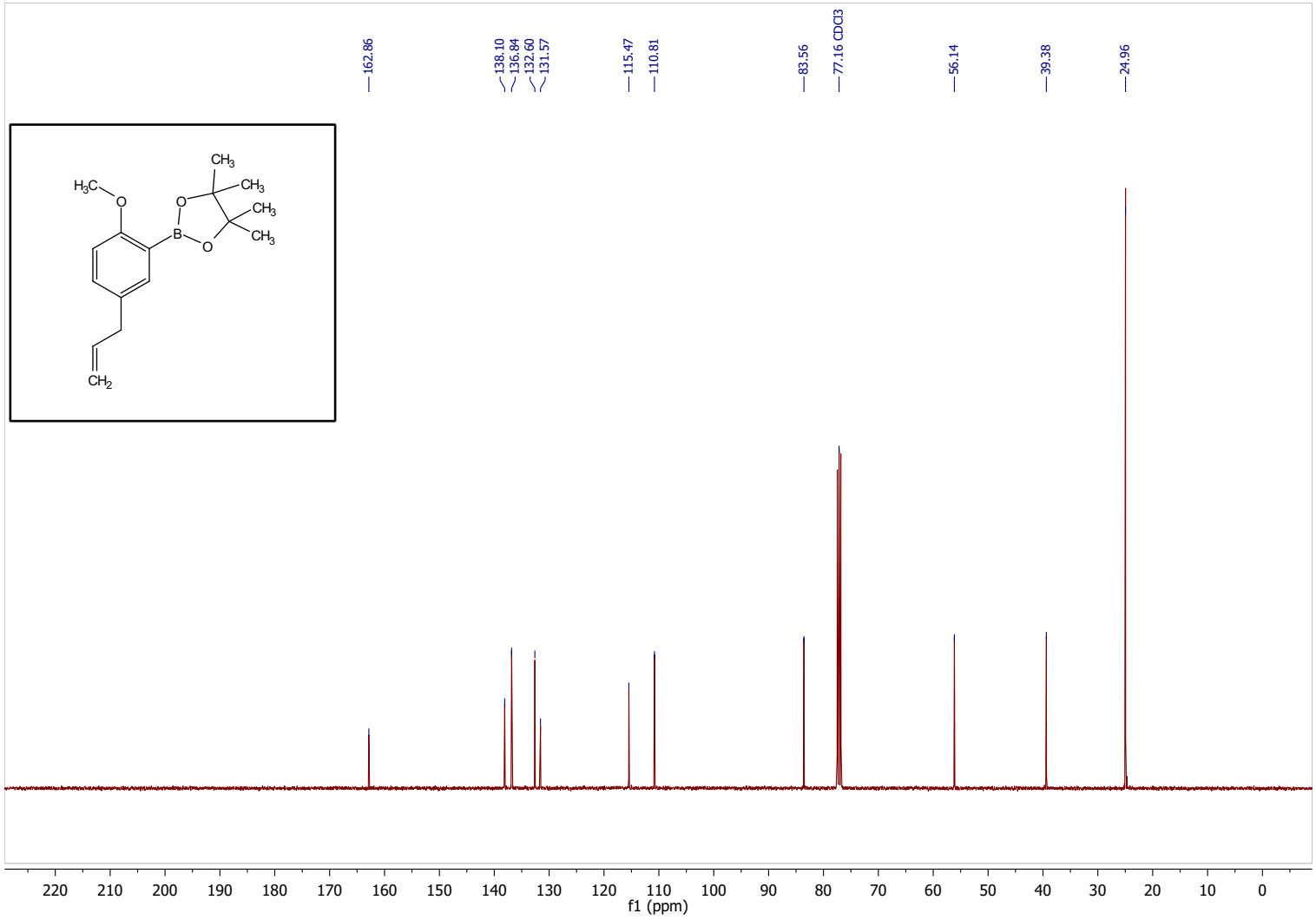

178.95
154.93
154.13
149.34
137.22
133.80
130.21
128.45
124.54
124.46
118.88
118.12
116.16
95.47
77.16 CDCl3
64.58
44.12
39.36
36.12
15.25
O
Br
H2C
CH3
O
O
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

43

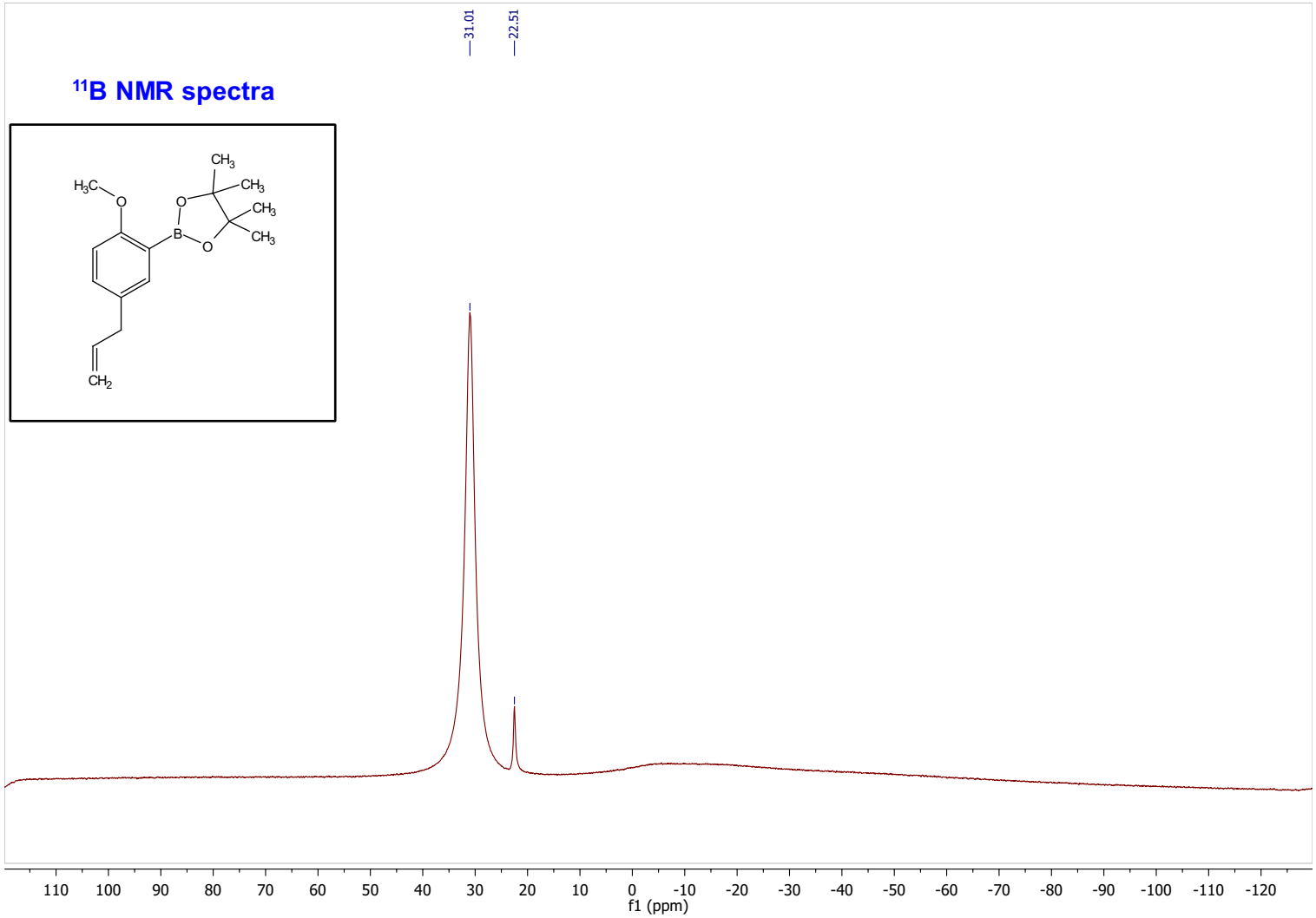


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.48 (d, *J* = 2.4 Hz, 1H), 7.21 (dd, *J* = 8.4, 2.4 Hz, 1H), 6.80 (d, *J* = 8.4 Hz, 1H), 5.95 (ddt, *J* = 16.8, 10.1, 6.7 Hz, 1H), 5.09 – 5.00 (m, 2H), 3.81 (s, 3H), 3.33 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 1.36 (s, 12H).

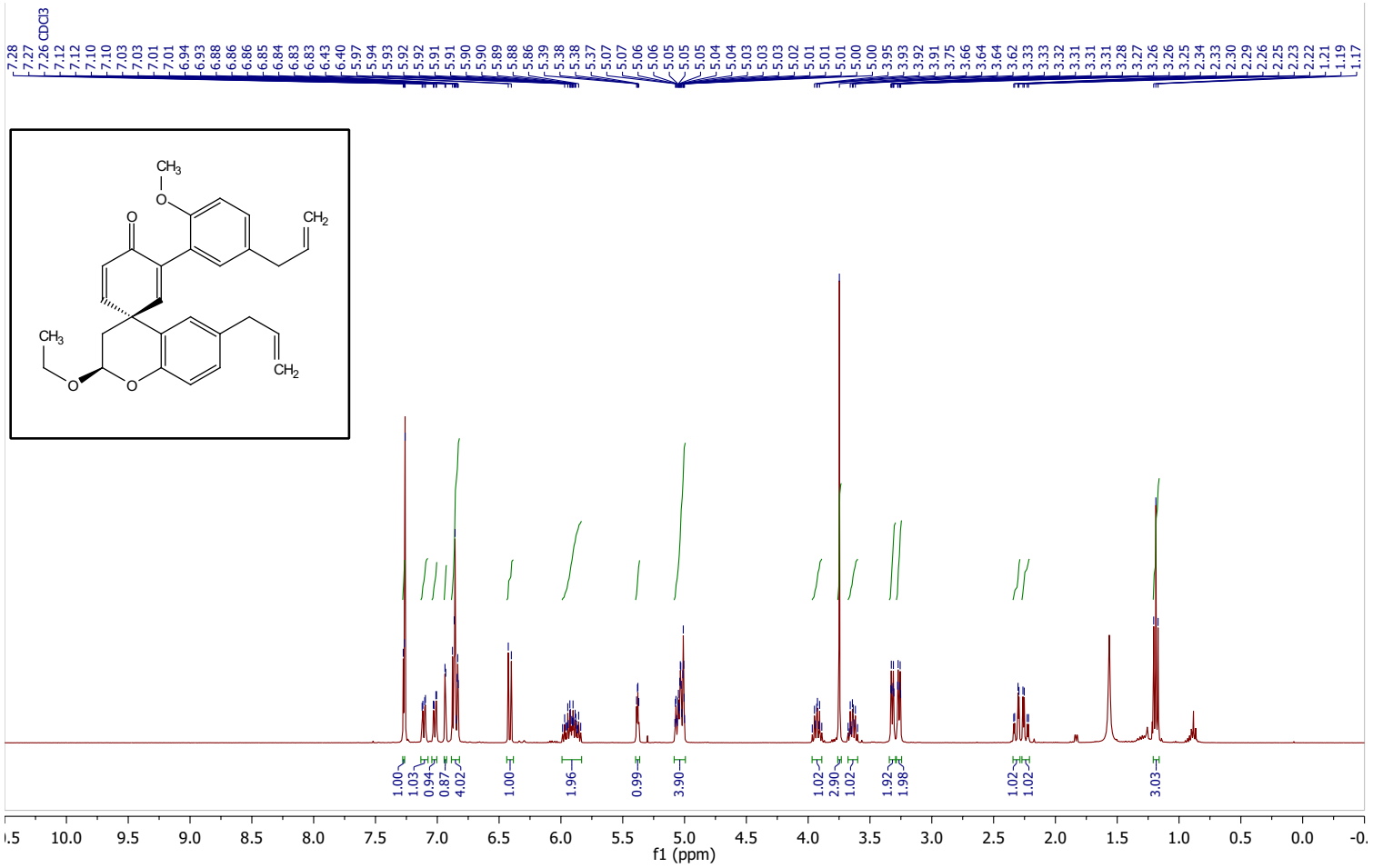
43


162.86
138.10
136.84
132.60
131.57
115.47
110.81
83.56
77.16 CDCl3
56.14
39.38
24.96
H3C
O
O
B
O
CH3
CH3
CH3
CH3
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

43

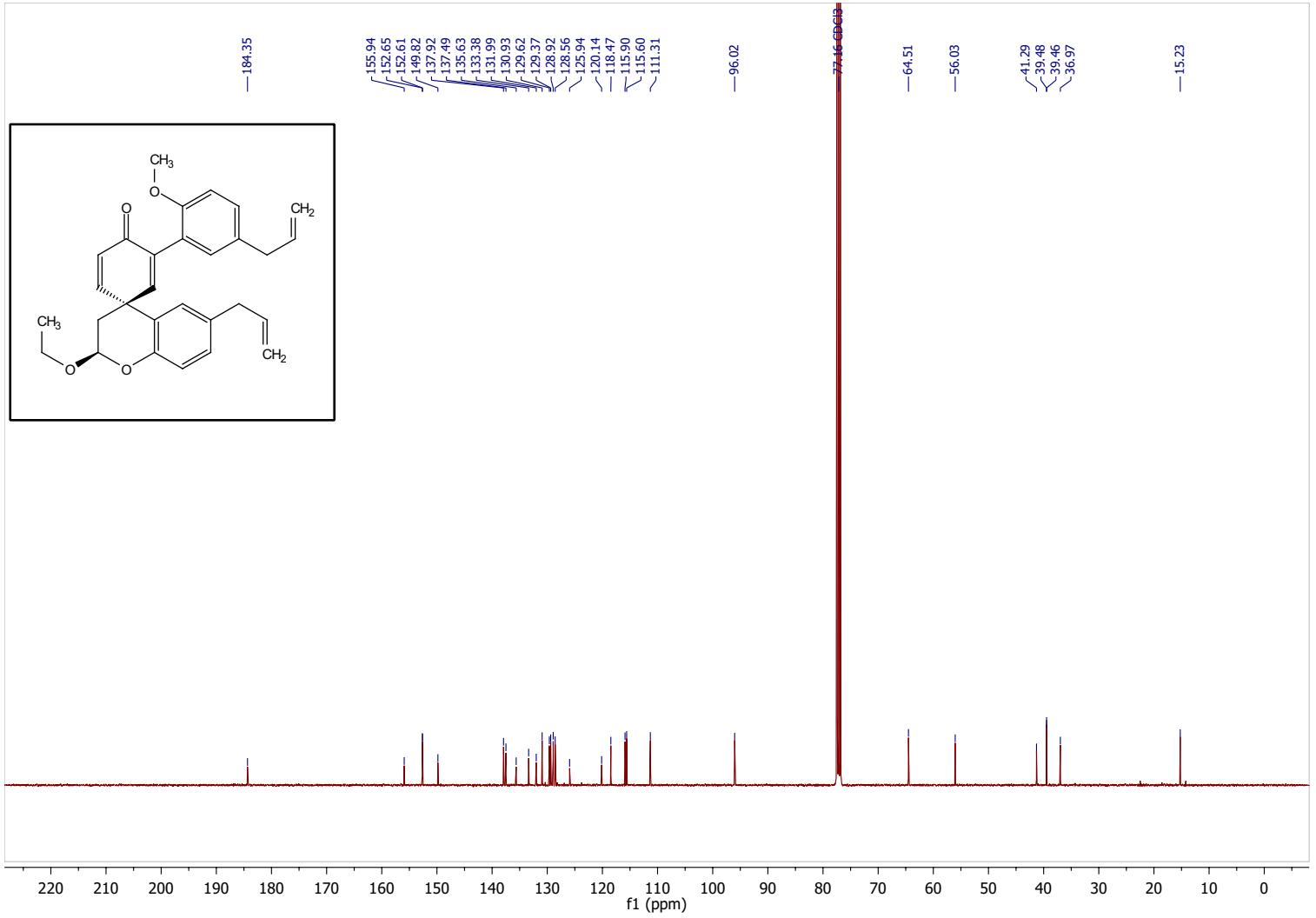

31.01
22.51
11B NMR spectra
H3C
O
O
B
O
CH3
CH3
CH3
CH3
CH2
110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120
f1 (ppm)

44a

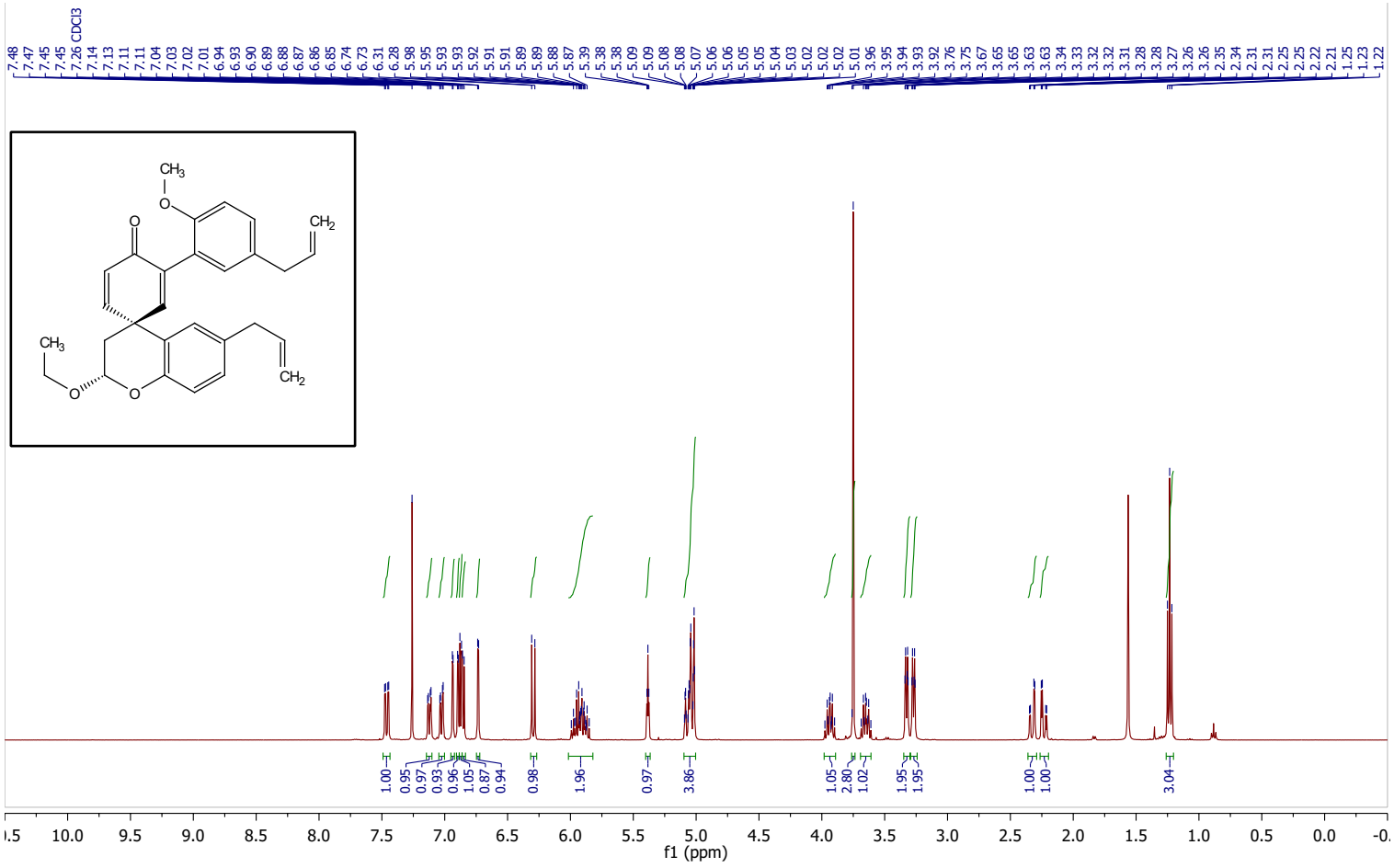


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.27 (d, *J* = 3.0 Hz, 1H), 7.11 (dd, *J* = 8.4, 2.4 Hz, 1H), 7.02 (dd, *J* = 8.4, 2.2 Hz, 1H), 6.93 (d, *J* = 2.3 Hz, 1H), 6.89 – 6.81 (m, 4H), 6.41 (d, *J* = 9.9 Hz, 1H), 6.00 – 5.82 (m, 2H), 5.38 (dd, *J* = 4.2, 2.9 Hz, 1H), 5.08 – 4.98 (m, 4H), 3.93 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.75 (s, 3H), 3.64 (dq, *J* = 9.7, 7.1 Hz, 1H), 3.32 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 3.27 (ddd, *J* = 6.6, 1.5, 1.5 Hz, 2H), 2.32 (dd, *J* = 14.0, 2.9 Hz, 1H), 2.24 (dd, *J* = 14.0, 4.2 Hz, 1H), 1.19 (dd, *J* = 7.1, 7.1 Hz, 3H).

44a

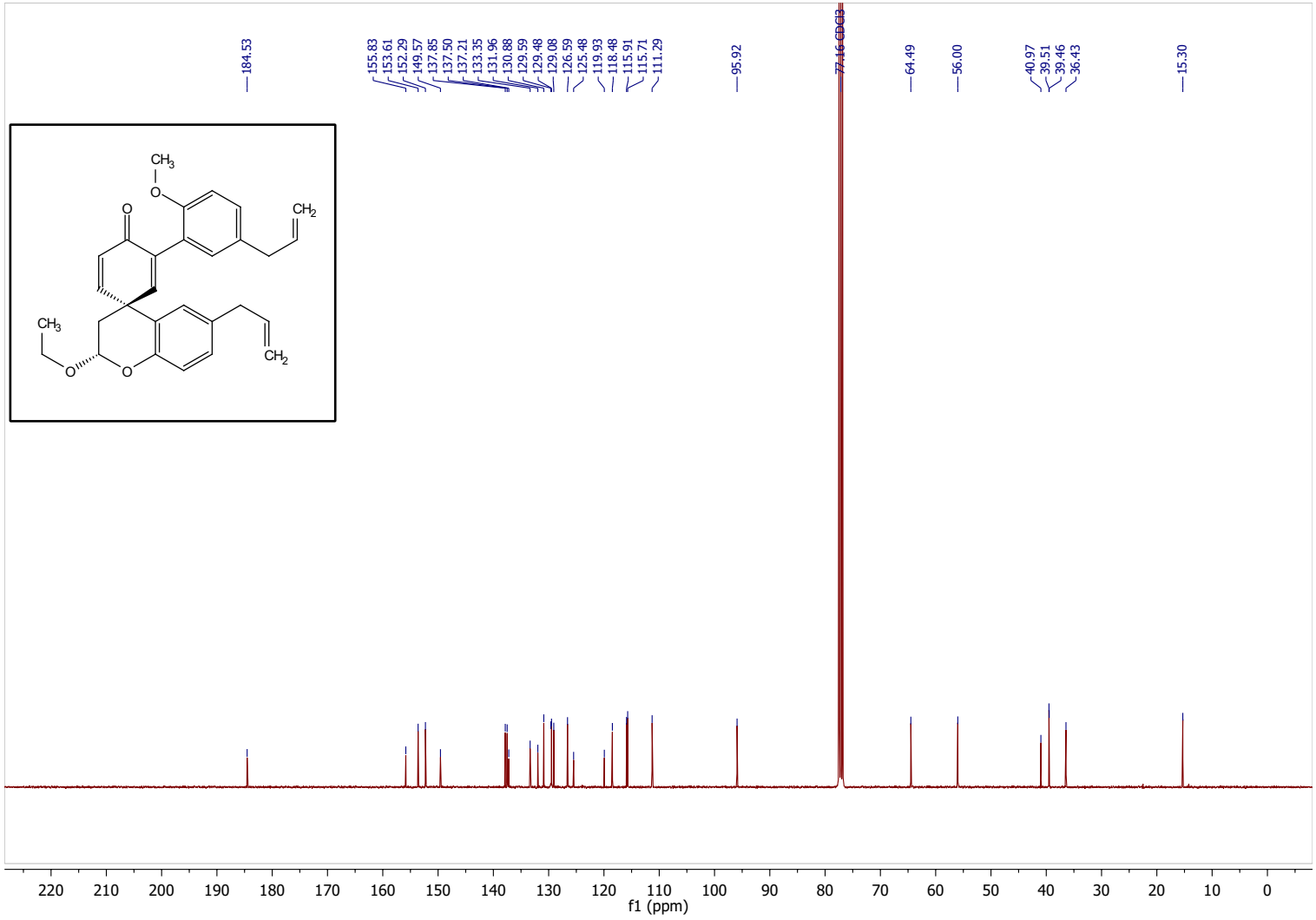

184.35
155.94
152.65
152.61
149.82
137.92
137.49
135.63
133.38
131.99
130.93
129.62
129.37
128.92
128.56
125.94
120.14
118.47
115.90
115.60
111.31
96.02
77.16 CDCl3
64.51
56.03
41.29
39.48
39.46
36.97
15.23
CH3
O
O
CH2
CH3
O
O
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

44b

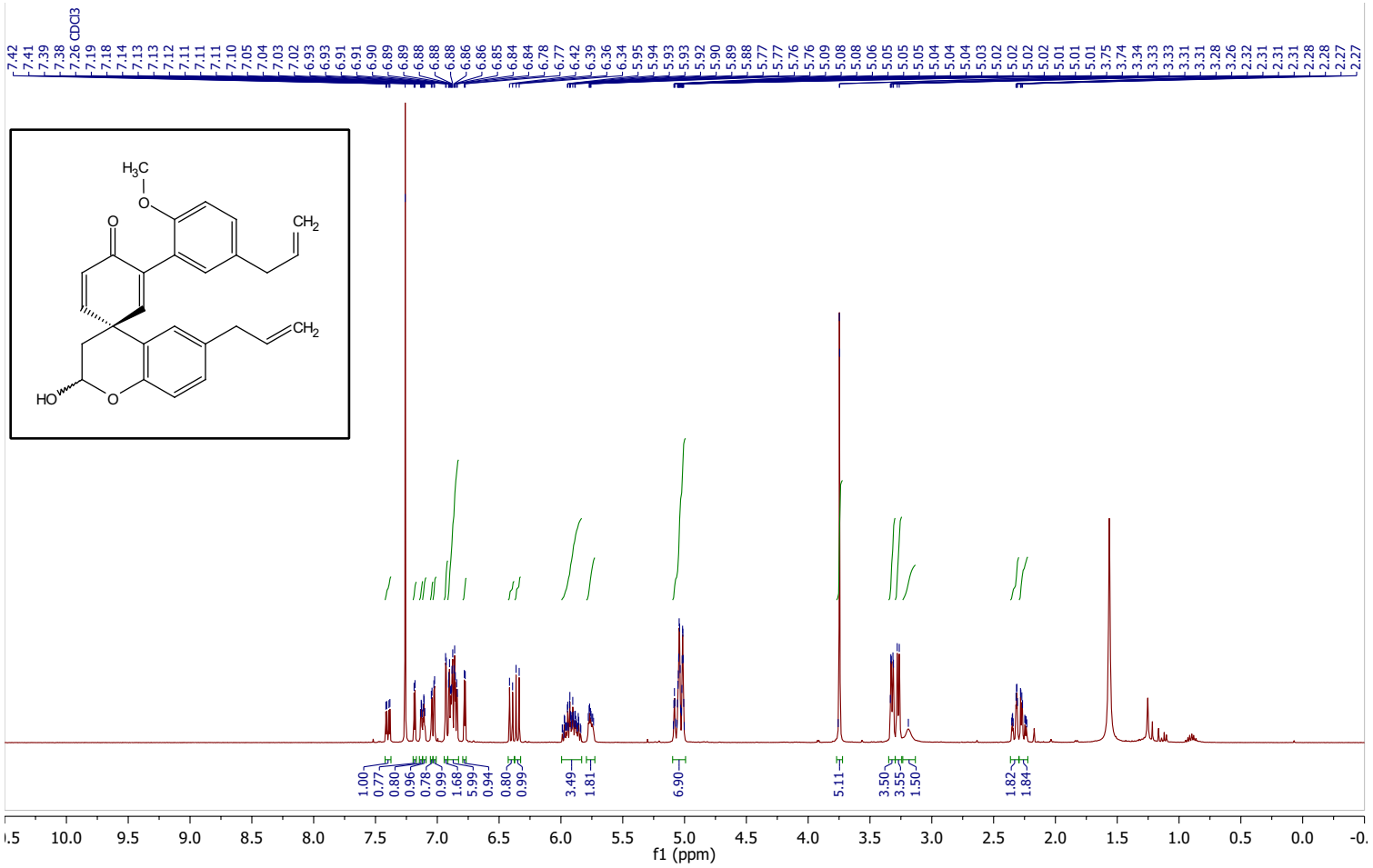


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.46 (dd, *J* = 10.1, 2.9 Hz, 1H), 7.12 (dd, *J* = 8.4, 2.3 Hz, 1H), 7.03 (dd, *J* = 8.3, 2.2 Hz, 1H), 6.94 (d, *J* = 2.3 Hz, 1H), 6.90 (d, *J* = 2.2 Hz, 1H), 6.87 (d, *J* = 8.3 Hz, 1H), 6.86 (d, *J* = 8.4 Hz, 1H), 6.73 (d, *J* = 2.9 Hz, 1H), 6.30 (d, *J* = 10.1 Hz, 1H), 6.00 – 5.84 (m, 2H), 5.38 (dd, *J* = 3.1, 3.1 Hz, 1H), 5.10 – 5.00 (m, 4H), 3.94 (dq, *J* = 9.6, 7.1 Hz, 1H), 3.75 (s, 3H), 3.65 (dq, *J* = 9.6, 7.1 Hz, 1H), 3.33 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 3.27 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 2.33 (dd, *J* = 14.1, 3.0 Hz, 1H), 2.23 (dd, *J* = 14.1, 3.2 Hz, 1H), 1.23 (dd, *J* = 7.1, 7.1 Hz, 3H).

44b

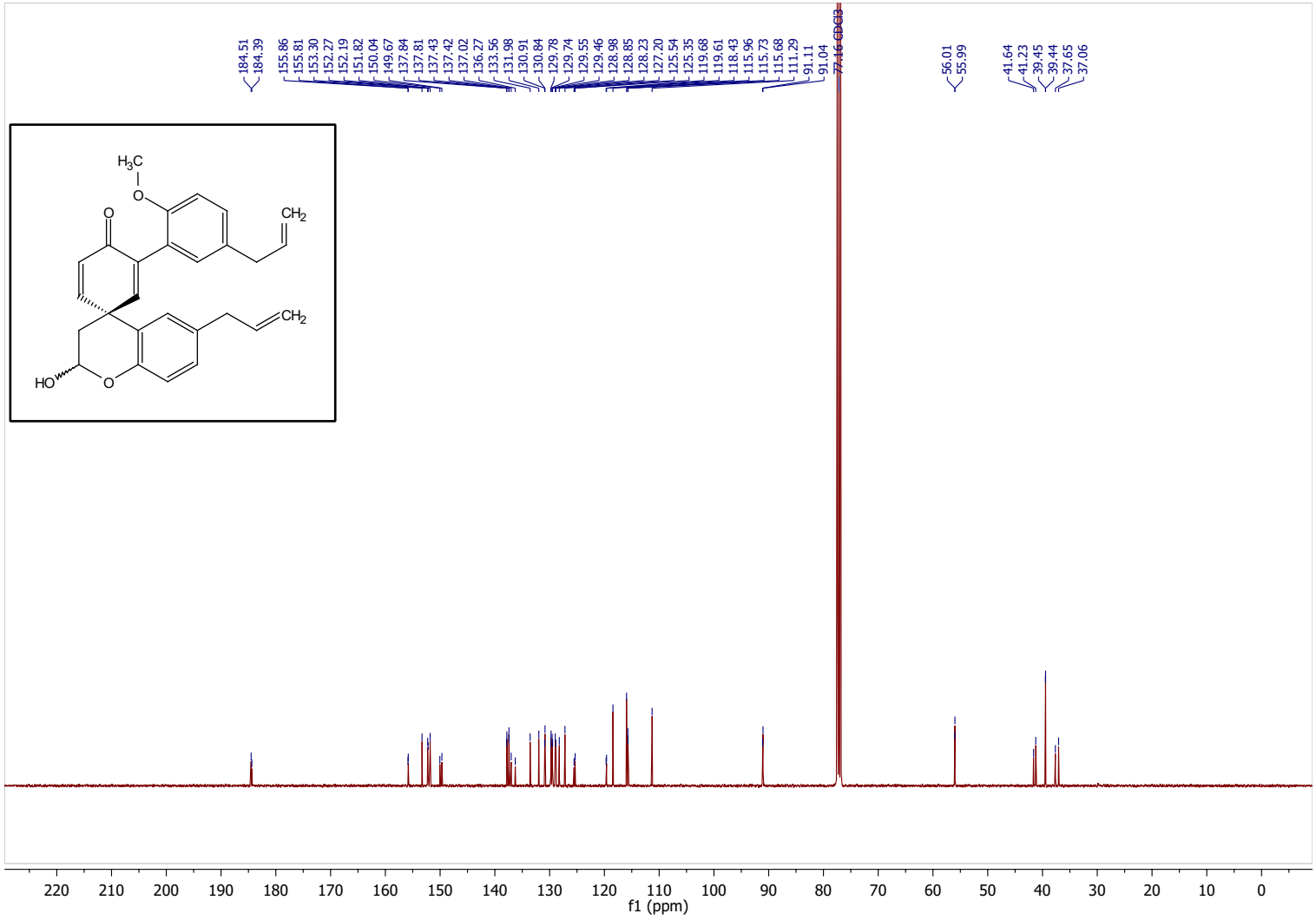

184.53
155.83
153.61
152.29
149.57
137.85
137.50
137.21
133.35
131.96
130.88
129.59
129.48
129.08
126.59
125.48
119.93
118.48
115.91
115.71
111.29
95.92
77.16 CDCl3
64.49
56.00
40.97
39.51
39.46
36.43
15.30
CH3
O
CH2
O
CH3
O
O
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

45

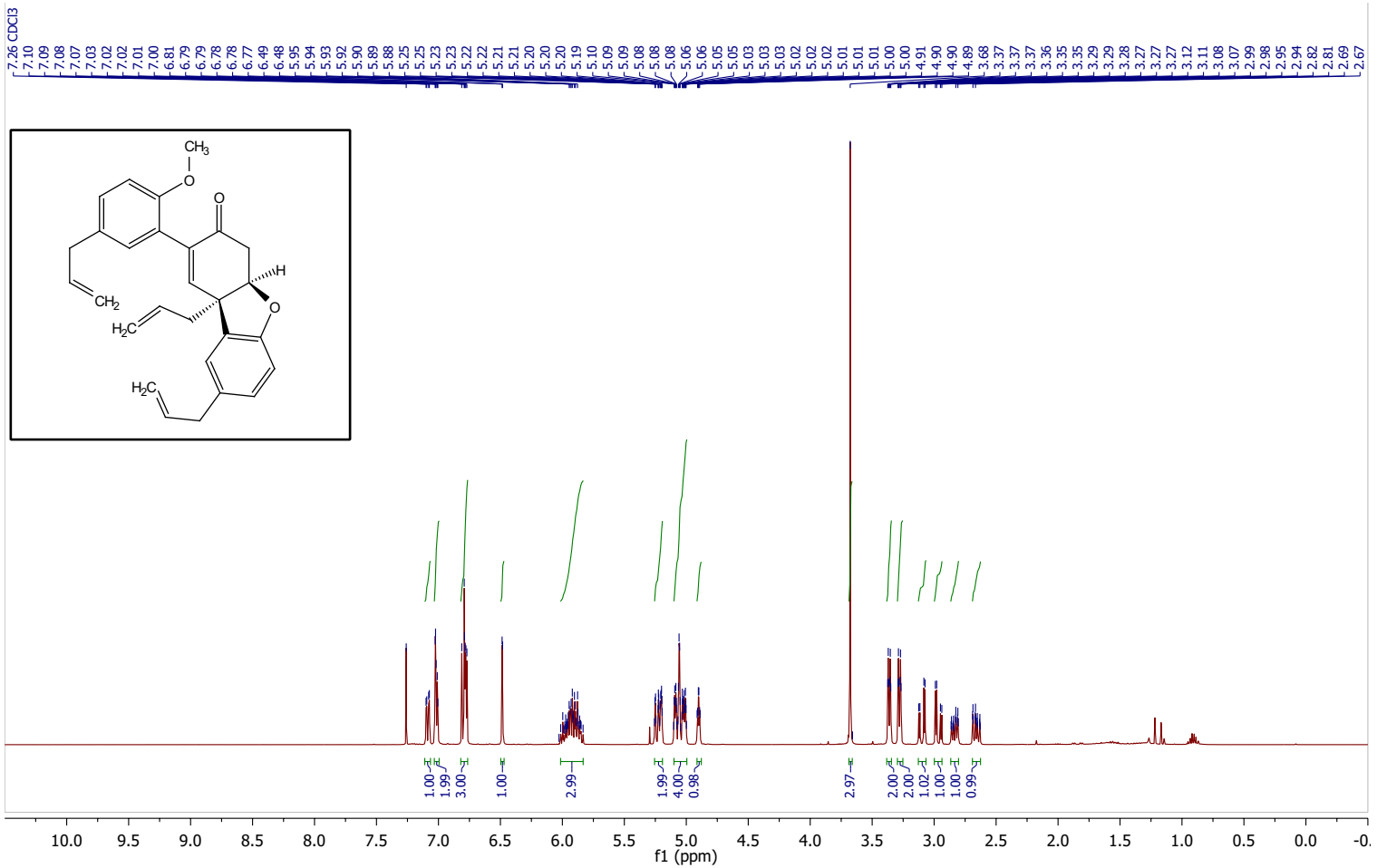


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.40 (dd, *J* = 10.0, 3.0 Hz, 1H), 7.18 (d, *J* = 3.0 Hz, 1H), 7.12 (dd, *J* = 8.3, 2.4 Hz, 1H), 7.11 (dd, *J* = 8.3, 2.4 Hz, 1H), 7.05 (d, *J* = 2.2 Hz, 1H), 7.02 (d, *J* = 2.3 Hz, 1H), 6.94 – 6.92 (m, 2H), 6.91 – 6.90 (m, 1H), 6.90 – 6.87 (m, 2H), 6.87 – 6.83 (m, 3H), 6.78 (d, *J* = 3.0 Hz, 1H), 6.40 (d, *J* = 9.9 Hz, 1H), 6.35 (d, *J* = 10.0 Hz, 1H), 6.00 – 5.83 (m, 4H), 5.79 – 5.72 (m, 2H), 5.10 – 4.98 (m, 8H), 3.75 (s, 3H), 3.74 (s, 3H), 3.35 – 3.30 (m, 4H), 3.30 – 3.24 (m, 4H), 3.19 (s, 2H), 2.37 – 2.30 (m, 2H), 2.29 – 2.22 (m, 2H).

45

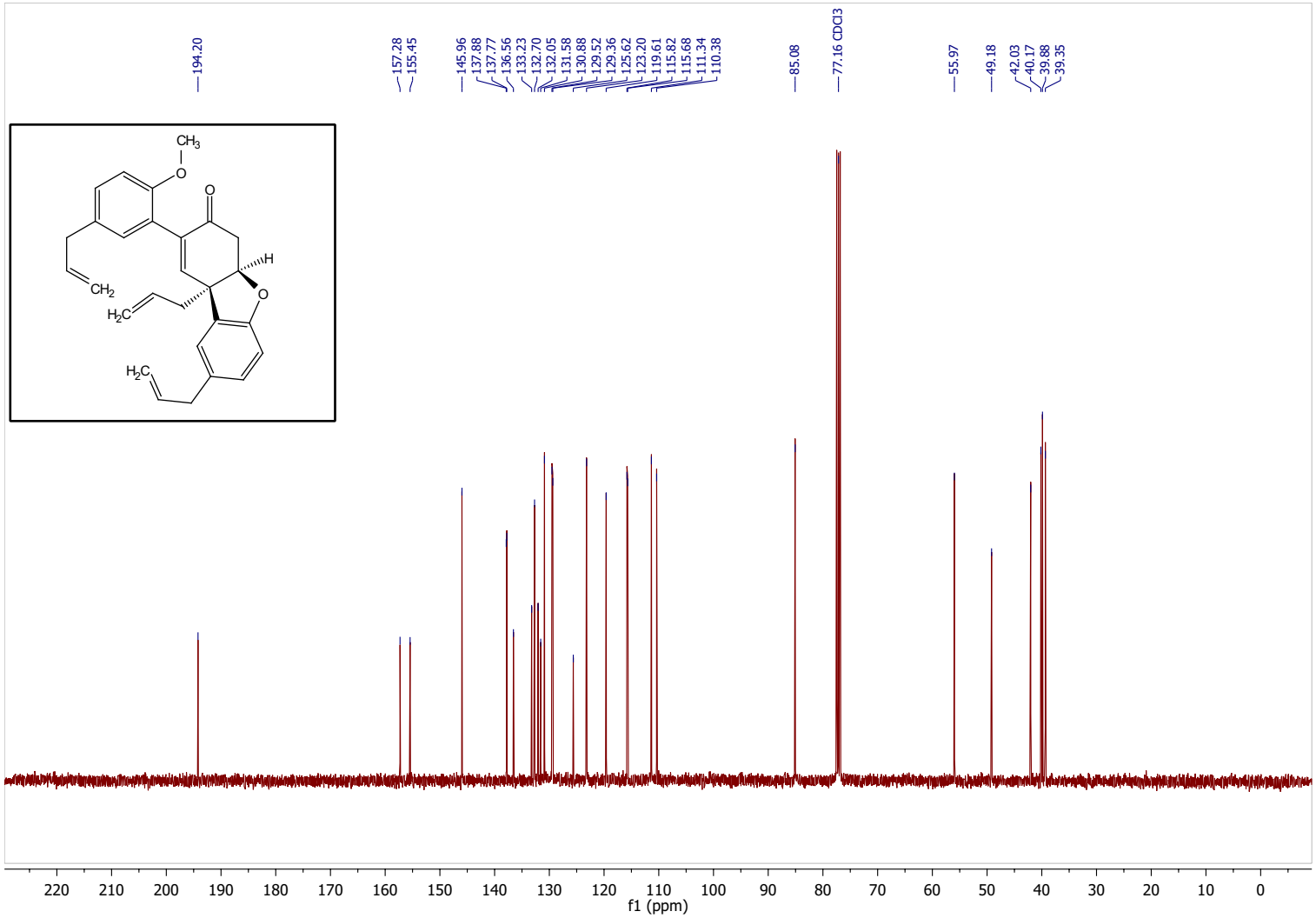

184.51
184.39
155.86
155.81
153.30
152.27
152.19
151.82
150.04
149.67
137.84
137.81
137.43
137.42
137.02
136.27
133.56
131.98
130.91
130.84
129.78
129.74
129.55
129.46
128.98
128.85
128.23
127.20
125.54
125.35
119.68
119.61
118.43
115.96
115.73
115.68
111.29
91.11
91.04
77.16 CDCl3
56.01
55.99
41.64
41.23
39.45
39.44
37.65
37.06
H3C
O
O
CH2
CH2
HO
O
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

47

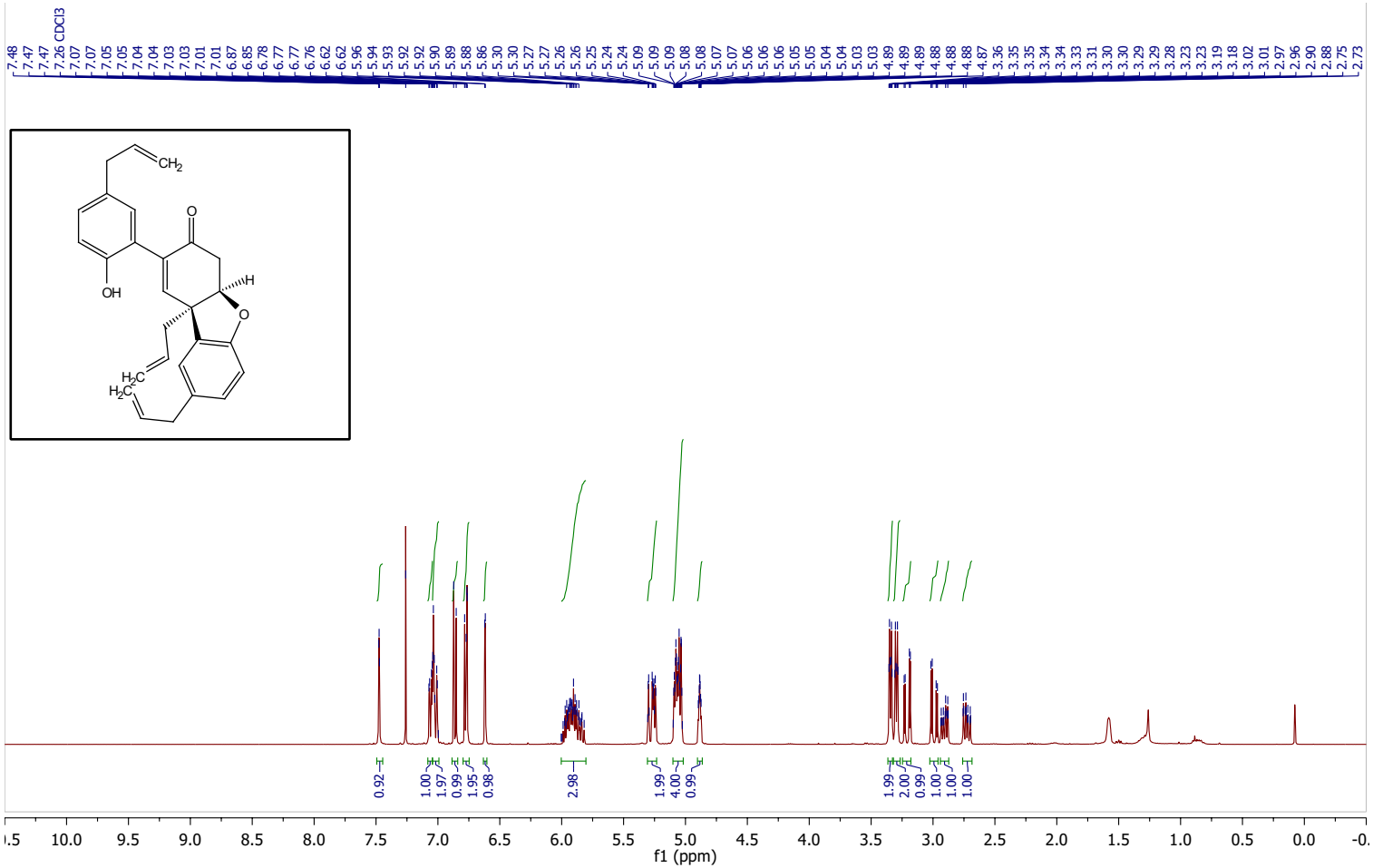


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.09 (dd, *J* = 8.3, 2.3 Hz, 1H), 7.04 – 6.99 (m, 2H), 6.80 (d, *J* = 8.3 Hz, 1H), 6.78 (d, *J* = 2.3 Hz, 1H), 6.78 (d, *J* = 8.3 Hz, 1H), 6.48 (d, *J* = 1.6 Hz, 1H), 6.03 – 5.82 (m, 3H), 5.26 – 5.18 (m, 2H), 5.11 – 4.99 (m, 4H), 4.90 (ddd, *J* = 4.1, 4.1, 1.6 Hz, 1H), 3.68 (s, 3H), 3.36 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 3.28 (ddd, *J* = 6.7, 1.4, 1.4 Hz, 2H), 3.10 (dd, *J* = 16.5, 3.8 Hz, 1H), 2.96 (dd, *J* = 16.5, 4.3 Hz, 1H), 2.83 (dddd, *J* = 14.1, 6.5, 1.3, 1.3 Hz, 1H), 2.66 (dddd, *J* = 14.1, 8.2, 1.0, 1.0 Hz, 1H).

47

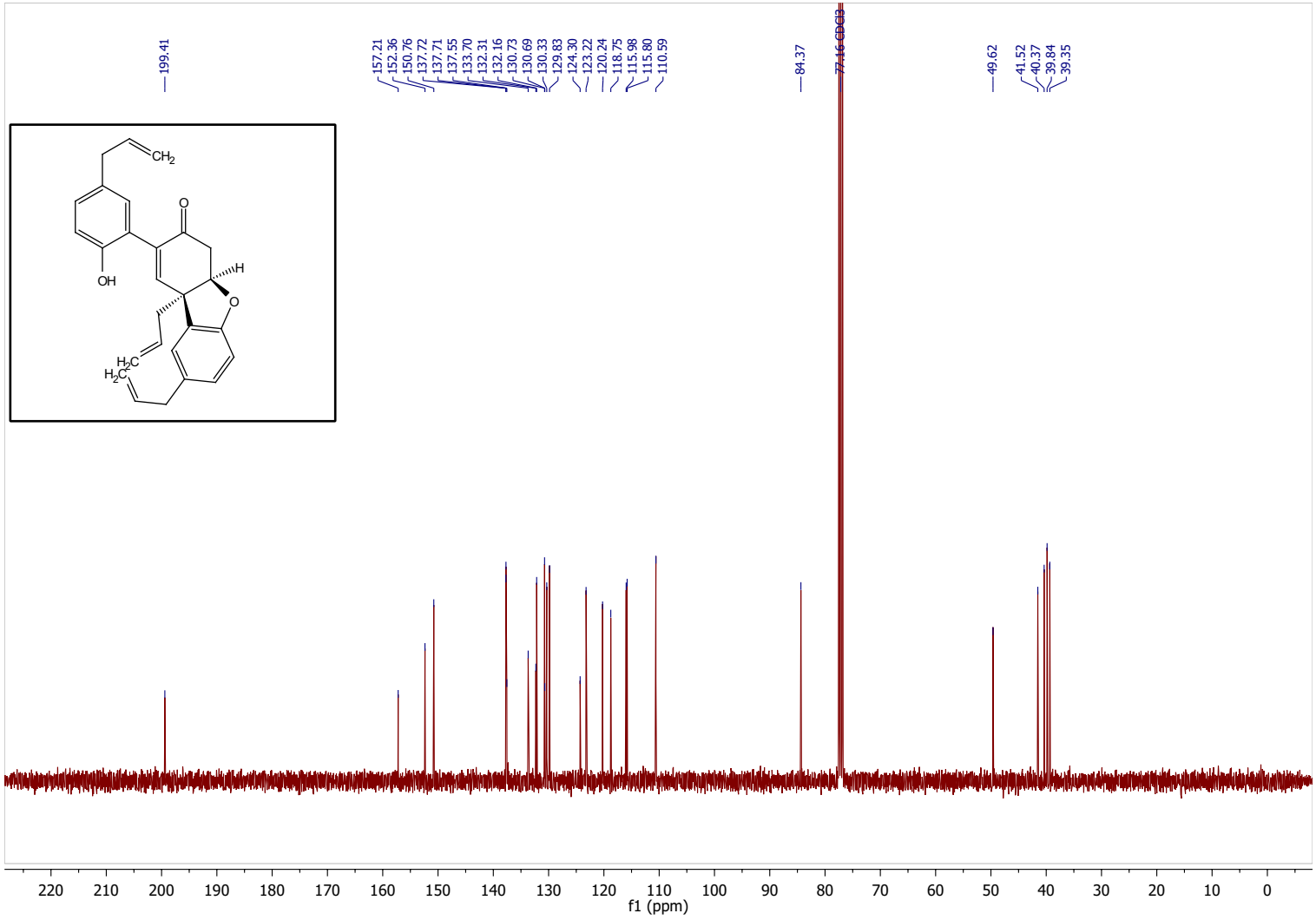

194.20
157.28
155.45
145.96
137.88
137.77
136.56
133.23
132.70
132.05
131.58
130.88
129.52
129.36
125.62
123.20
119.61
115.82
115.68
111.34
110.38
85.08
77.16 CDCl3
55.97
49.18
42.03
40.17
39.88
39.35
CH3
O
O
H
O
CH2
H2C
H2C
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

Simonsol (F) (**3**) $CDCl_3$

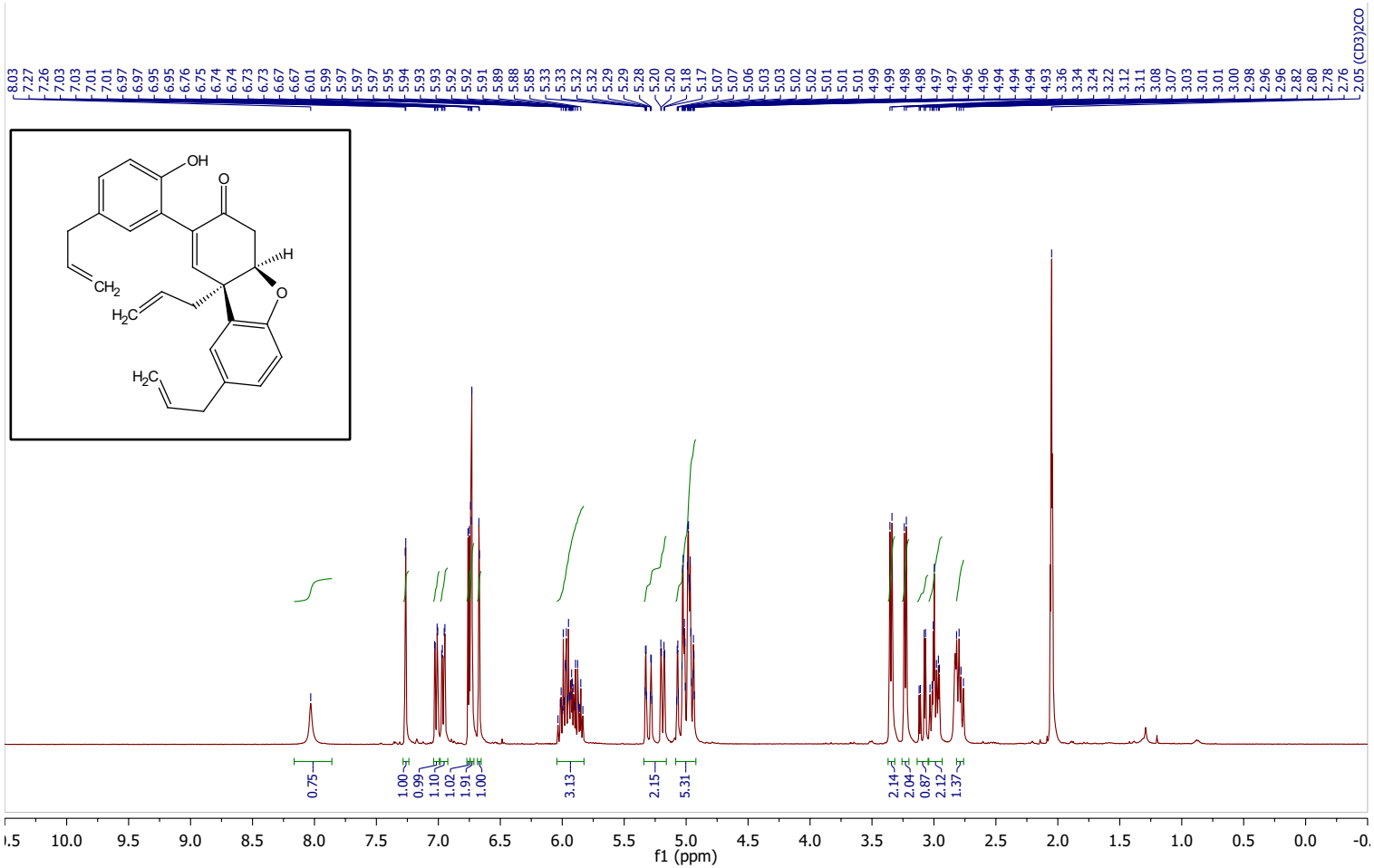


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.49 – 7.45 (m, 1H), 7.06 (dd, *J* = 8.2, 2.3 Hz, 1H), 7.04 – 6.99 (m, 2H), 6.86 (d, *J* = 8.2 Hz, 1H), 6.77 (d, *J* = 8.2 Hz, 1H), 6.77 (d, *J* = 2.3 Hz, 1H), 6.62 (d, *J* = 1.7 Hz, 1H), 6.01 – 5.80 (m, 3H), 5.32 – 5.23 (m, 2H), 5.11 – 5.02 (m, 4H), 4.88 (ddd, *J* = 4.1, 3.2, 1.7 Hz, 1H), 3.34 (ddd, *J* = 6.9, 1.6, 1.6 Hz, 2H), 3.30 (ddd, *J* = 6.9, 1.6, 1.6 Hz, 2H), 3.21 (dd, *J* = 16.8, 3.2 Hz, 1H), 2.99 (dd, *J* = 16.8, 4.2 Hz, 1H), 2.91 (dddd, *J* = 14.2, 7.0, 1.3, 1.3 Hz, 1H), 2.73 (dddd, *J* = 14.0, 7.9, 1.0, 1.0 Hz, 1H).

Simonsol (F) (**3**) $CDCl_3$

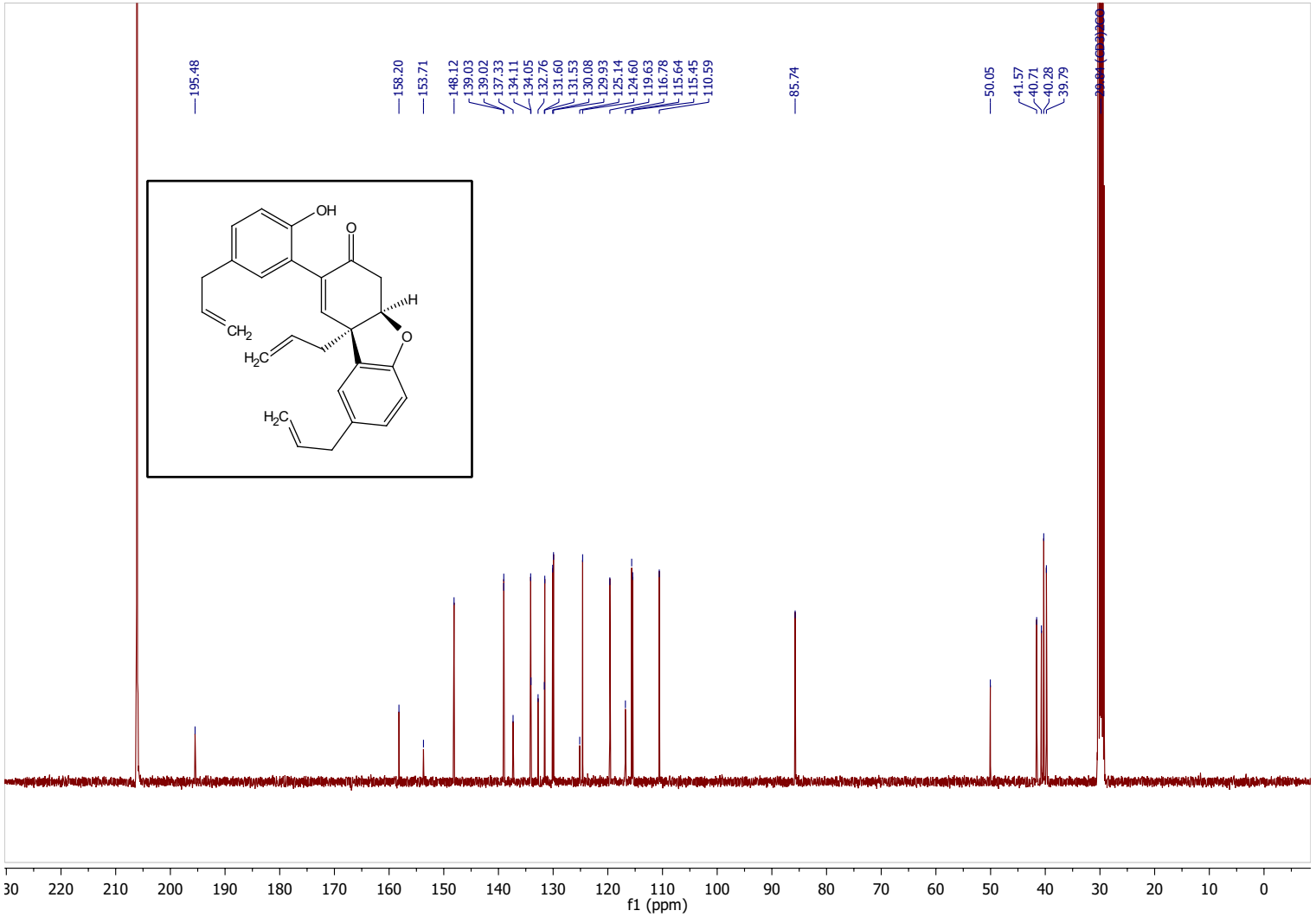


Simonsol (F) (**3**) acetone D_6

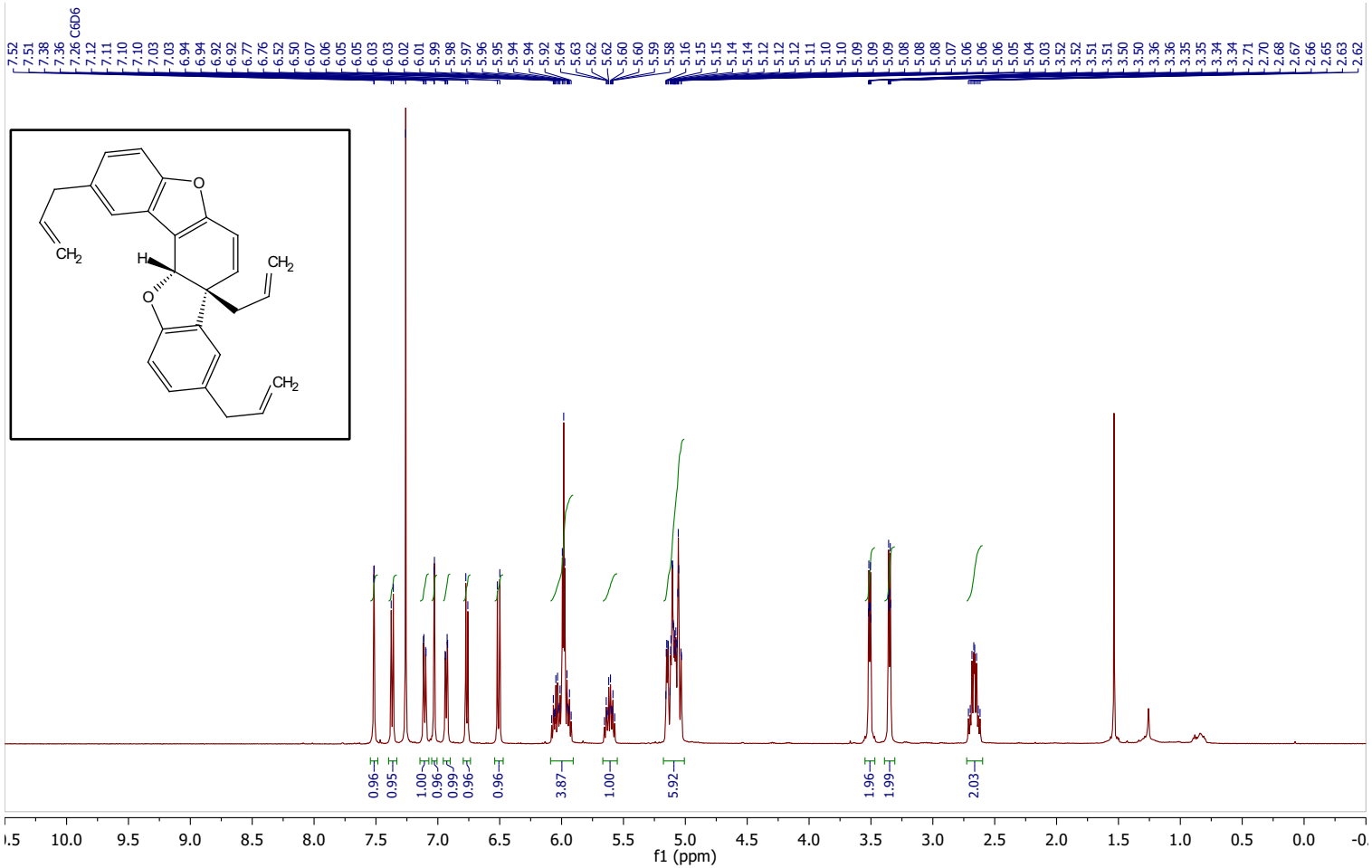


^{1}H NMR (400 MHz, Acetone-d_6) δ 8.03 (s, 1H), 7.27 (d, *J* = 1.8 Hz, 1H), 7.02 (dd, *J* = 8.2, 1.8 Hz, 1H), 6.96 (dd, *J* = 8.2, 2.3 Hz, 1H), 6.75 (d, *J* = 8.2 Hz, 1H), 6.74 (d, *J* = 8.0 Hz, 1H), 6.73 (d, *J* = 2.3 Hz, 1H), 6.67 (d, *J* = 1.8 Hz, 1H), 6.05 – 5.83 (m, 3H), 5.35 – 5.15 (m, 2H), 5.09 – 4.92 (m, 5H), 3.35 (d, *J* = 6.7 Hz, 2H), 3.23 (d, *J* = 6.7 Hz, 2H), 3.09 (dd, *J* = 16.5, 4.1 Hz, 1H), 3.04 – 2.94 (m, 2H), 2.79 (dd, *J* = 14.2, 8.1 Hz, 1H).

Simonsol (F) (**3**) acetone D_6

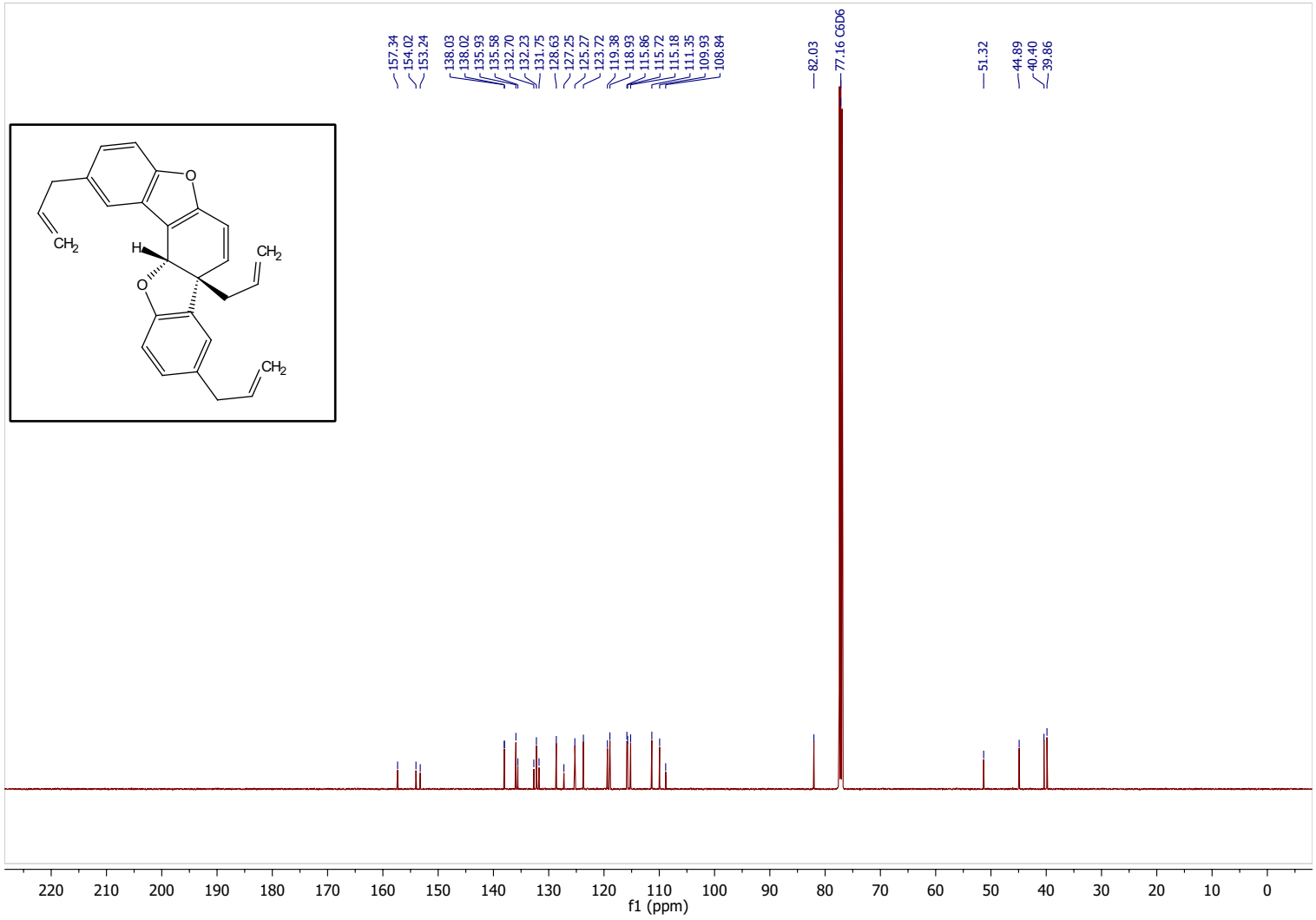


Fargenin (**4**) $CDCl_3$

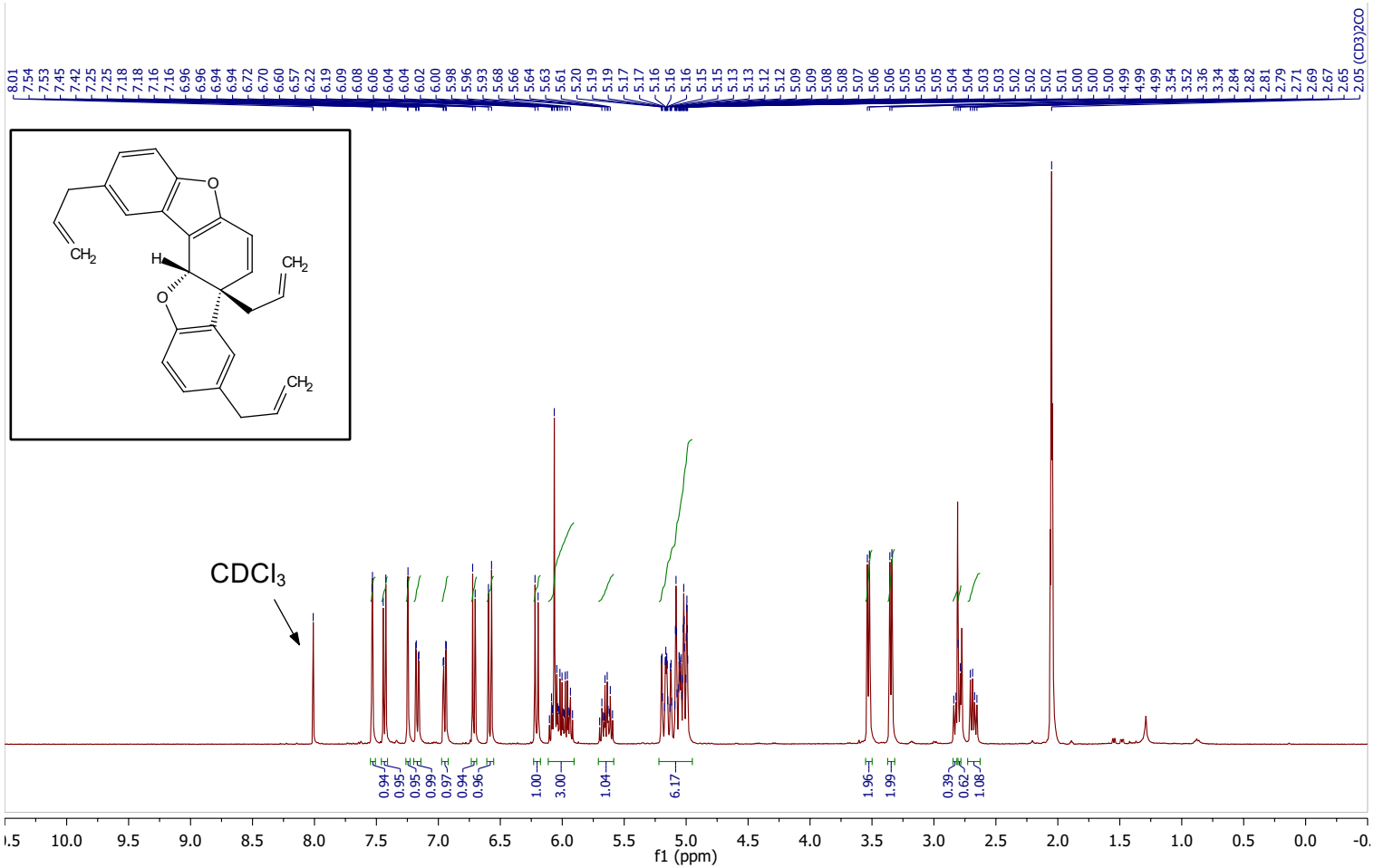


^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.52 (d, *J* = 1.8 Hz, 1H), 7.37 (d, *J* = 8.4 Hz, 1H), 7.11 (dd, *J* = 8.4, 1.8 Hz, 1H), 7.03 (d, *J* = 1.9 Hz, 1H), 6.93 (dd, *J* = 8.2, 1.9 Hz, 1H), 6.77 (d, *J* = 8.2 Hz, 1H), 6.51 (d, *J* = 9.9 Hz, 1H), 6.10 – 5.90 (m, 2H), 5.98 (d, *J* = 9.9 Hz, 1H), 5.98 (s, 1H), 5.61 (dddd, *J* = 17.2, 10.1, 7.3, 7.3 Hz, 1H), 5.17 – 5.00 (m, 6H), 3.51 (ddd, *J* = 6.7, 1.6, 1.6 Hz, 2H), 3.35 (ddd, *J* = 6.4, 1.4, 1.4 Hz, 2H), 2.69 (dd, *J* = 14.3, 7.3 Hz, 1H), 2.64 (dd, *J* = 14.3, 7.3 Hz, 1H).

Fargenin (**4**) $CDCl_3$

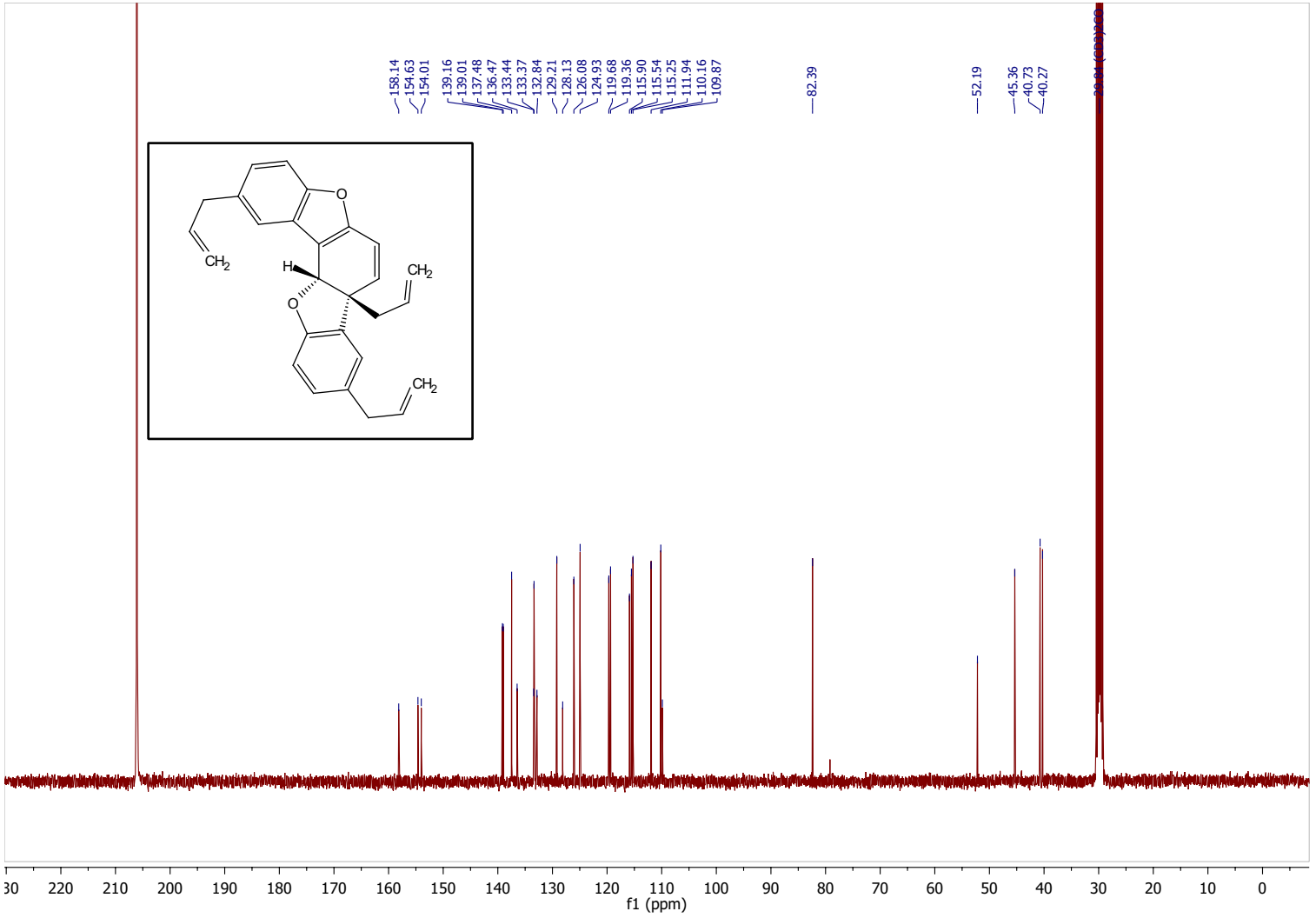


Fargenin (**4**) acetone D6

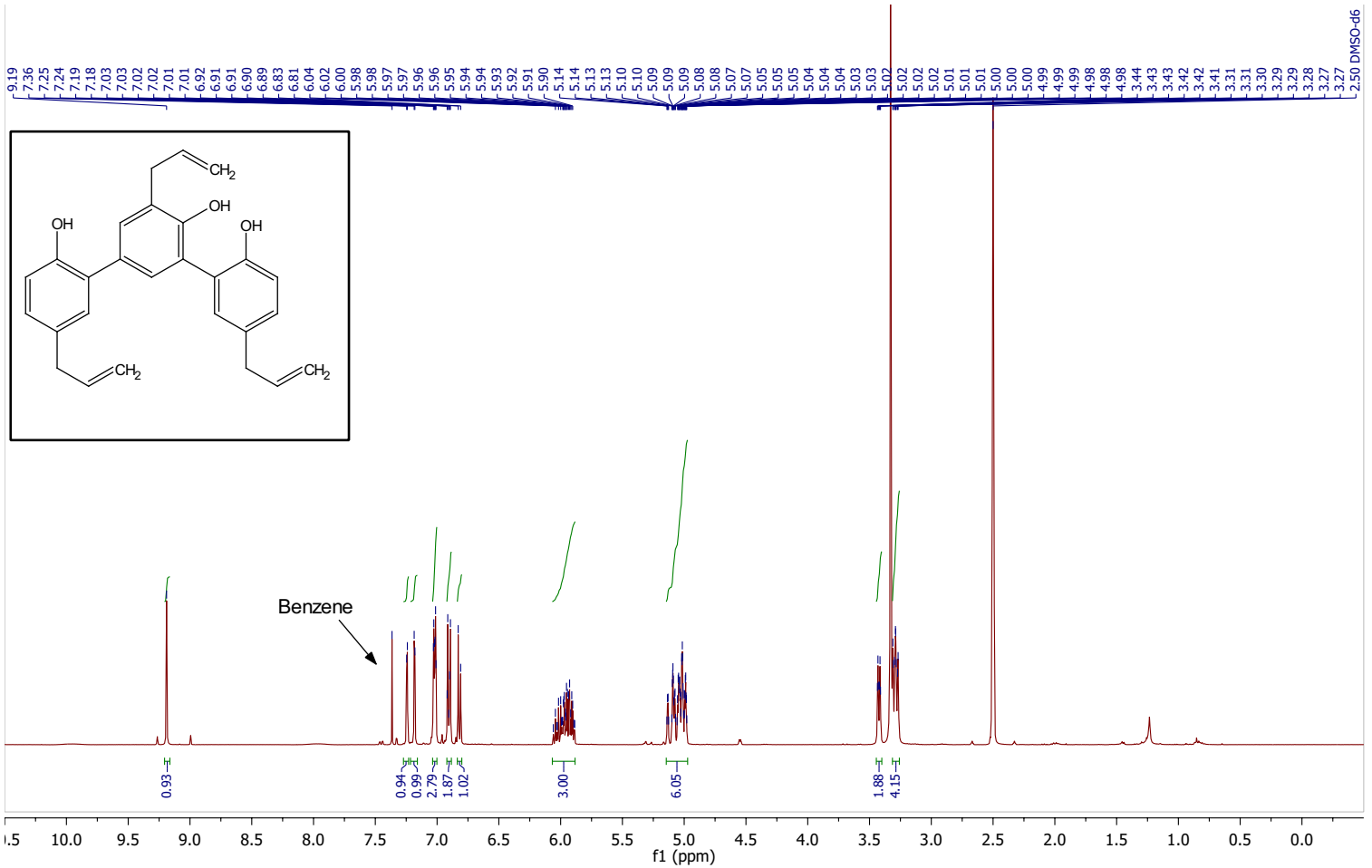


^{1}H NMR (400 MHz, Acetone-d_6) δ 7.53 (d, J = 1.7 Hz, 1H), 7.43 (d, J = 8.4 Hz, 1H), 7.25 (d, J = 1.8 Hz, 1H), 7.17 (dd, J = 8.4, 1.7 Hz, 1H), 6.95 (dd, J = 8.1, 1.8 Hz, 1H), 6.71 (d, J = 8.1 Hz, 1H), 6.58 (d, J = 10.0 Hz, 1H), 6.21 (d, J = 10.0 Hz, 1H), 6.06 (s, 1H), 6.13 – 5.89 (m, 2H), 5.65 (dddd, J = 17.3, 10.2, 7.2, 7.2 Hz, 1H), 5.21 – 4.96 (m, 6H), 3.53 (d, J = 6.8 Hz, 2H), 3.35 (d, J = 6.7 Hz, 2H), 2.81 (dd, J = 14.0, 7.2 Hz, 1H), 2.68 (dd, J = 14.0, 7.2 Hz, 1H).

Fargenin (**8**) acetone D6

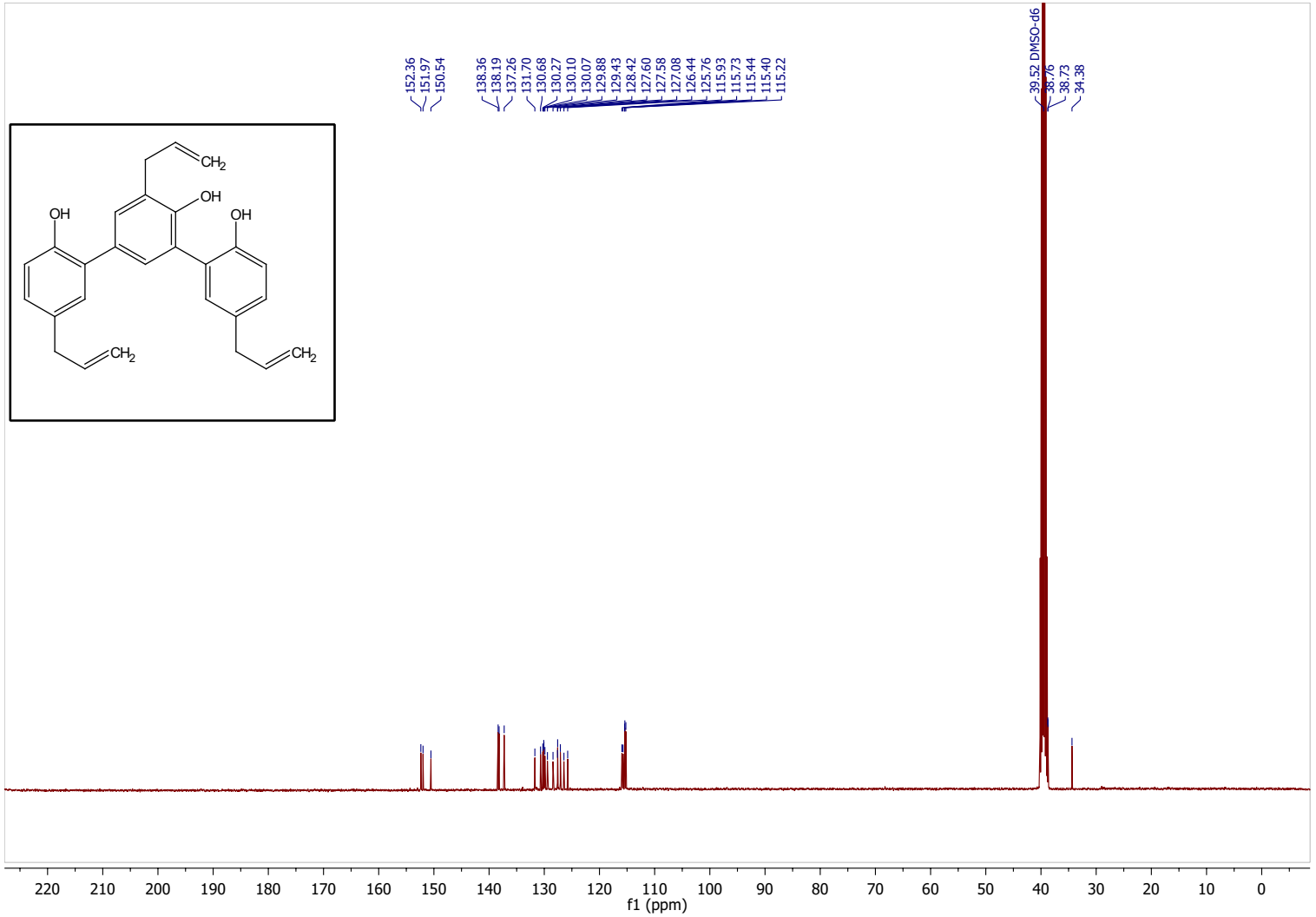


Macranthol (**6**) DMSO D_6

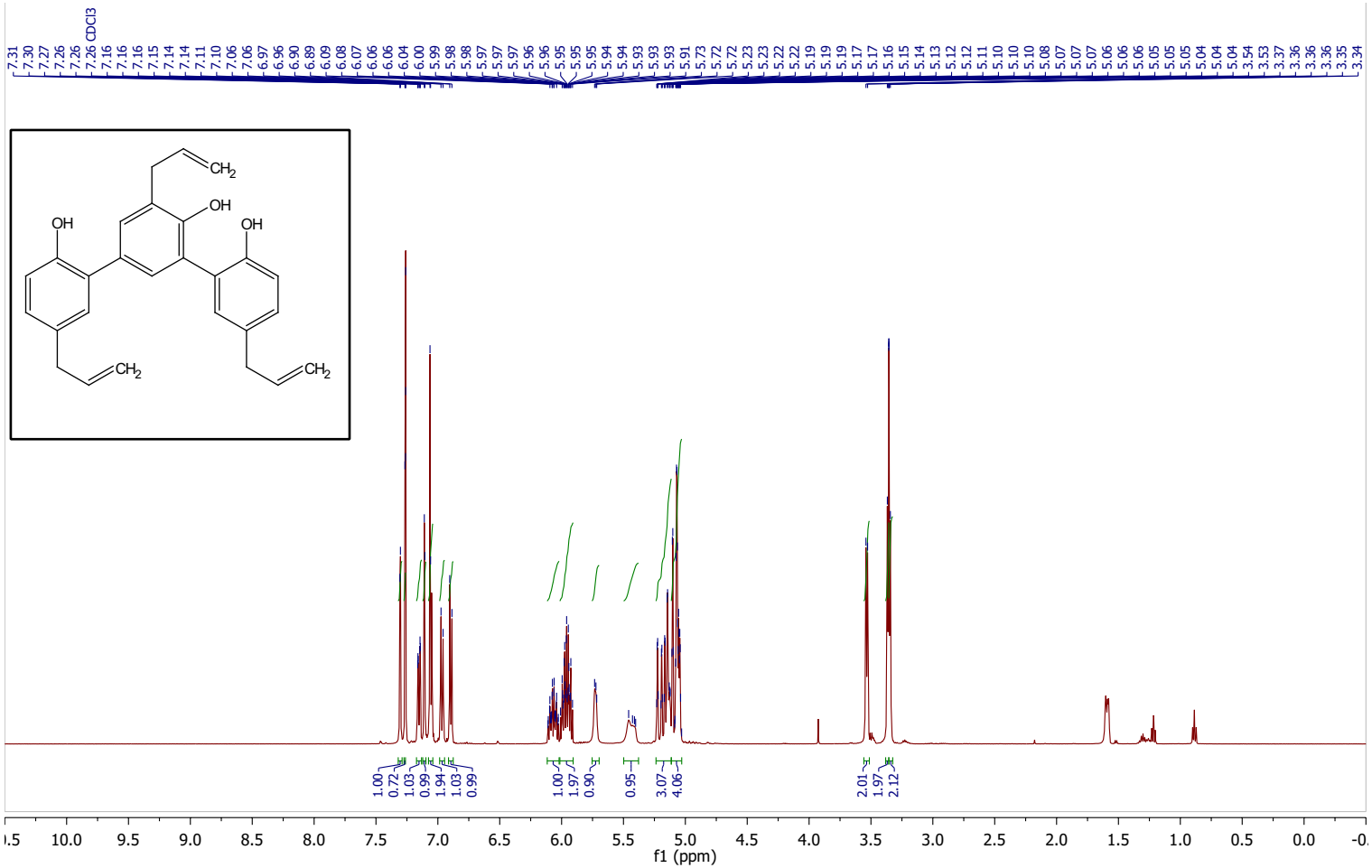


^{1}H NMR (400 MHz, DMSO-d_6) δ 9.19 (s, 1H), 7.24 (d, J = 2.3 Hz, 1H), 7.18 (d, J = 2.3 Hz, 1H), 7.04 – 7.00 (m, 3H), 6.93 – 6.88 (m, 2H), 6.82 (d, J = 8.1 Hz, 1H), 6.07 – 5.88 (m, 3H), 5.15 – 4.97 (m, 6H), 3.43 (ddd, J = 6.7, 1.5, 1.5 Hz, 2H), 3.30 (ddd, J = 6.5, 1.9, 1.9 Hz, 2H), 3.28 (ddd, J = 6.2, 1.8, 1.8 Hz, 2H).

Macranthol (**6**) DMSO D_6

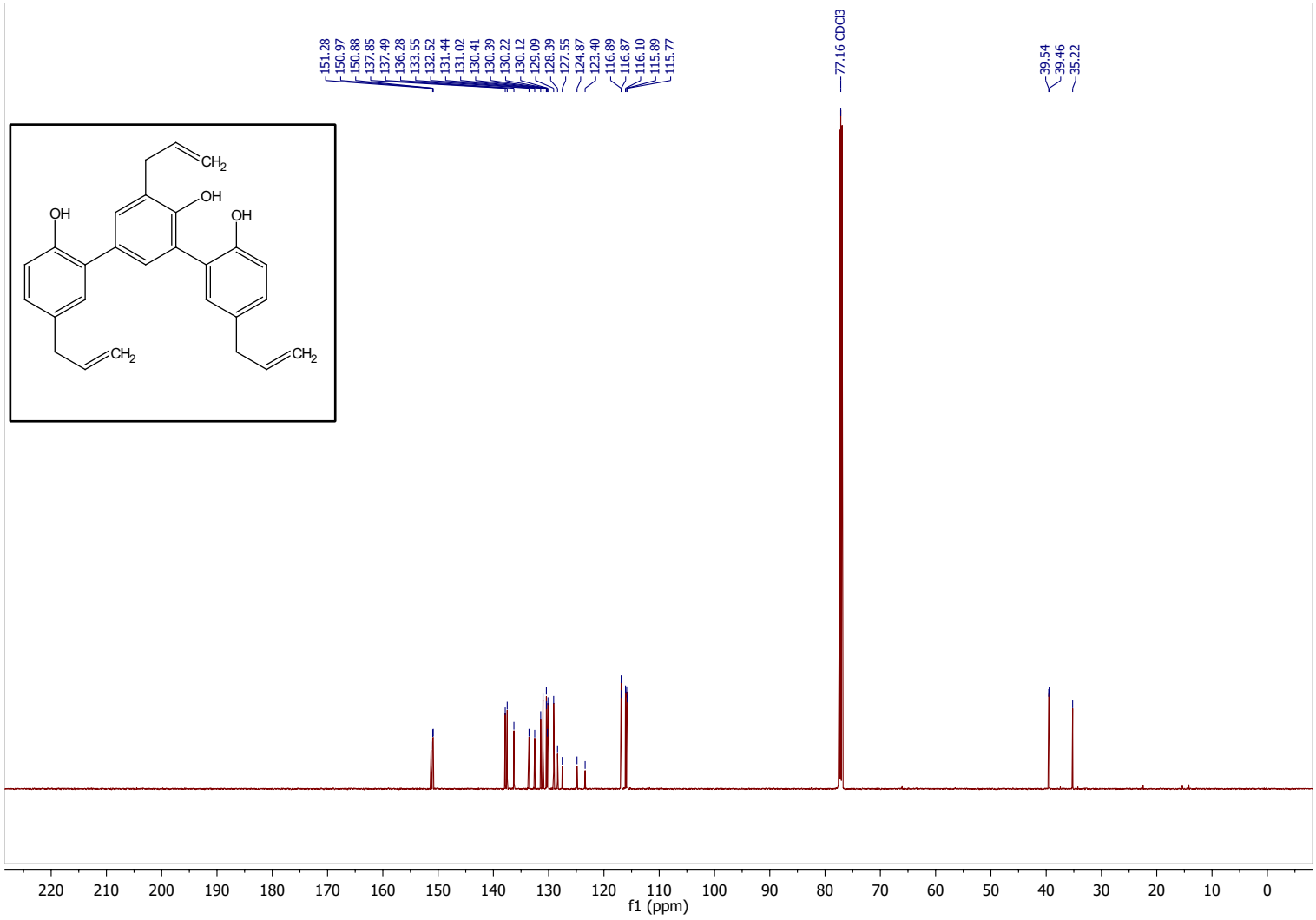


Macranthol (**6**) $CDCl_3$

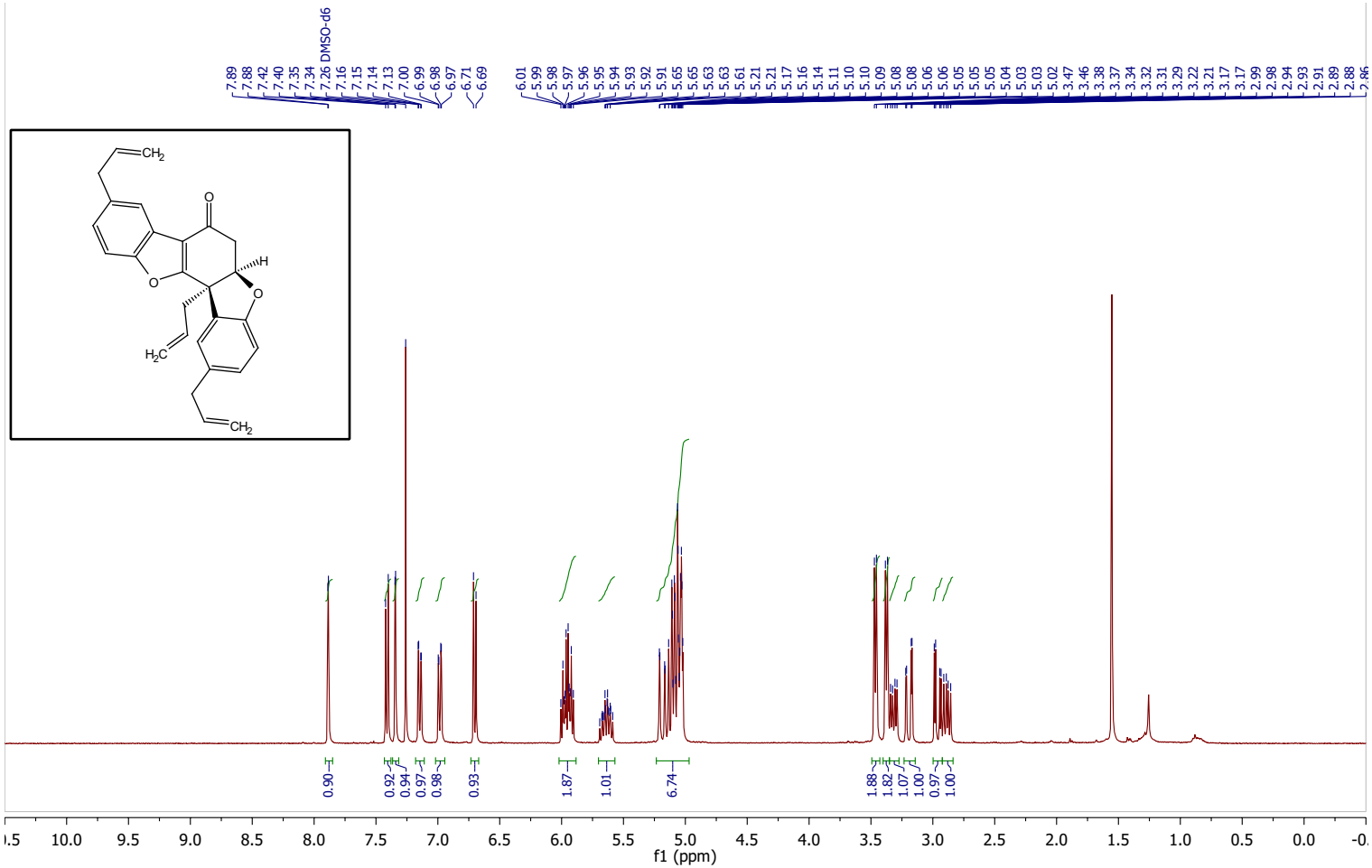


^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.30 (d, *J* = 2.2 Hz, 1H), 7.26 (d, *J* = 2.2 Hz, 1H), 7.15 (dd, *J* = 8.3, 2.3 Hz, 1H), 7.11 (d, *J* = 2.2 Hz, 1H), 7.06 (d, *J* = 2.2 Hz, 1H), 7.06 (dd, *J* = 8.9, 2.2 Hz, 1H), 6.97 (d, *J* = 8.2 Hz, 1H), 6.90 (d, *J* = 8.9 Hz, 1H), 6.07 (dddd, *J* = 16.8, 10.0, 6.7, 1.2 Hz, 1H), 5.98 (ddt, *J* = 16.9, 10.3, 6.6 Hz, 1H), 5.93 (ddt, *J* = 16.9, 10.3, 6.6 Hz, 1H), 5.75 – 5.70 (m, 1H), 5.49 – 5.38 (m, 1H), 5.24 – 5.13 (m, 2H), 5.13 – 5.11 (m, 1H), 5.11 – 5.03 (m, 4H), 3.53 (d, *J* = 6.6 Hz, 2H), 3.36 (d, *J* = 6.6 Hz, 2H), 3.35 (d, *J* = 6.6 Hz, 2H).

Macranthol (**6**) $CDCl_3$

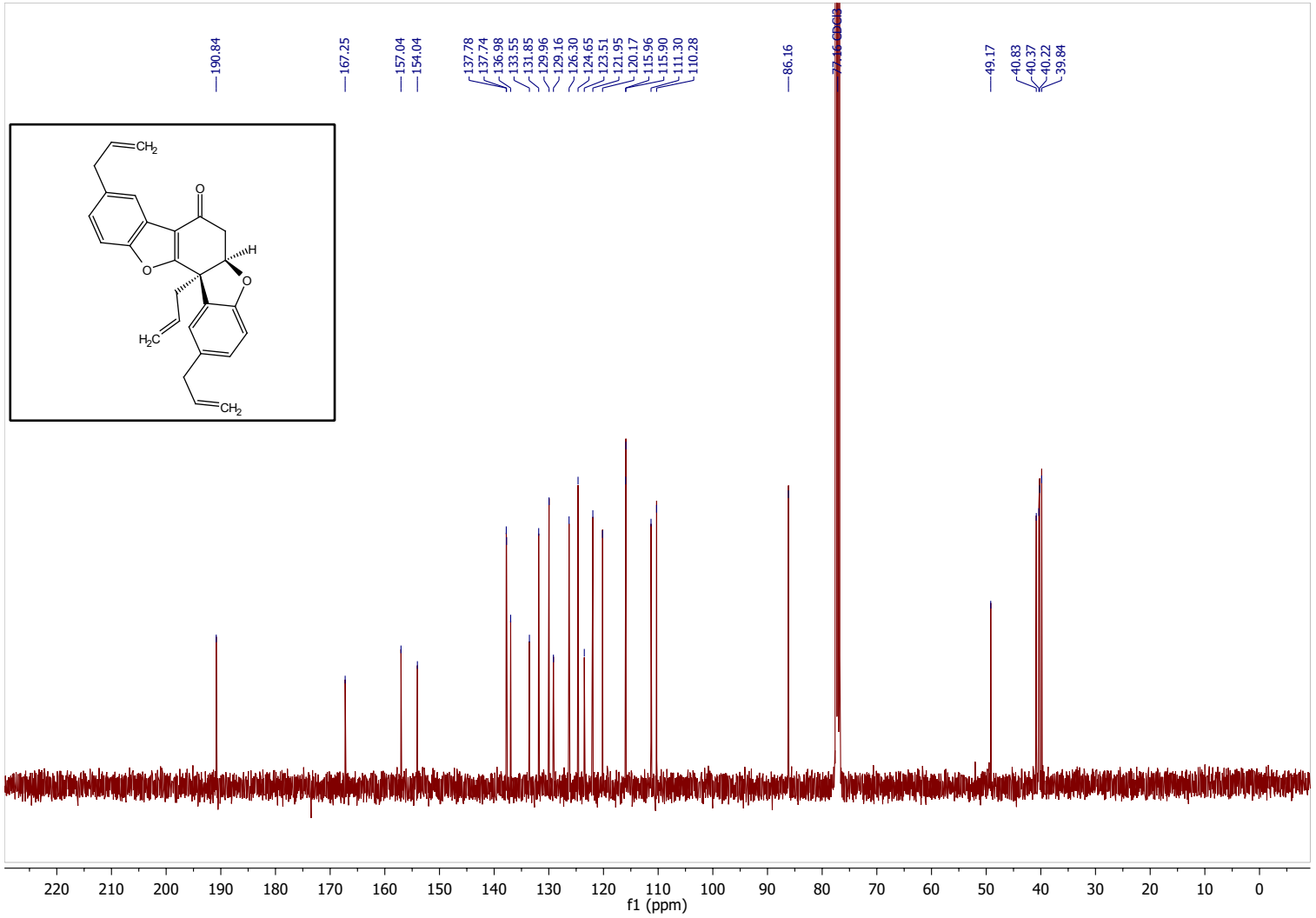


48 $CDCl_3$

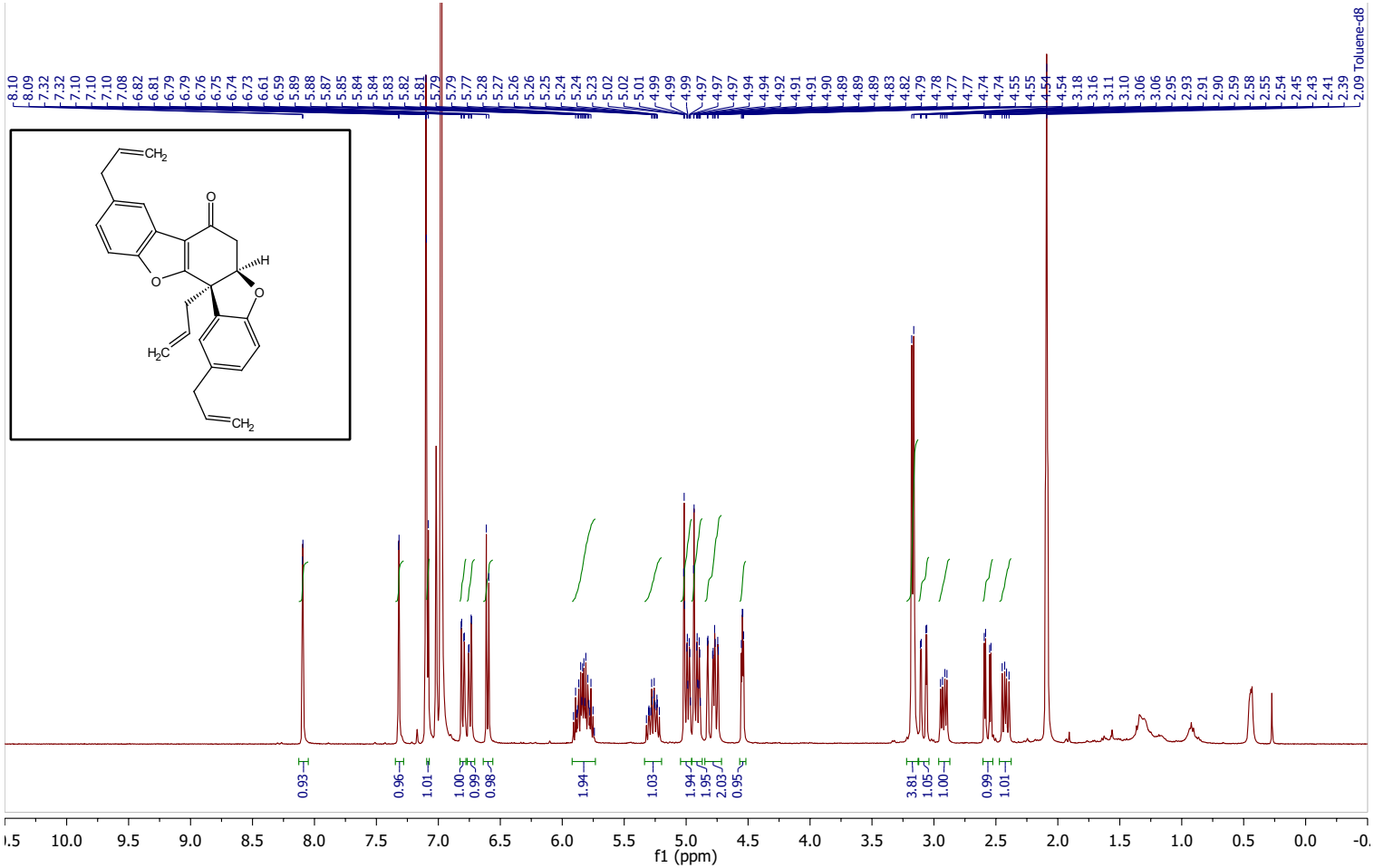


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (d, *J* = 1.8 Hz, 1H), 7.41 (d, *J* = 8.5 Hz, 1H), 7.34 (d, *J* = 1.8 Hz, 1H), 7.15 (dd, *J* = 8.5, 1.8 Hz, 1H), 6.98 (dd, *J* = 8.2, 1.8 Hz, 1H), 6.70 (d, *J* = 8.2 Hz, 1H), 5.96 (dddd, *J* = 16.9, 10.2, 6.7, 6.7 Hz, 2H), 5.64 (dddd, *J* = 16.6, 10.0, 8.2, 6.5, 6.5 Hz, 1H), 5.23 – 5.00 (m, 7H), 3.46 (d, *J* = 6.7 Hz, 2H), 3.38 (d, *J* = 6.7 Hz, 2H), 3.32 (dd, *J* = 14.2, 6.5 Hz, 1H), 3.19 (dd, *J* = 17.7, 2.7 Hz, 1H), 2.96 (dd, *J* = 17.7, 4.4 Hz, 1H), 2.88 (dd, *J* = 14.2, 8.2 Hz, 1H).

48 $CDCl_3$

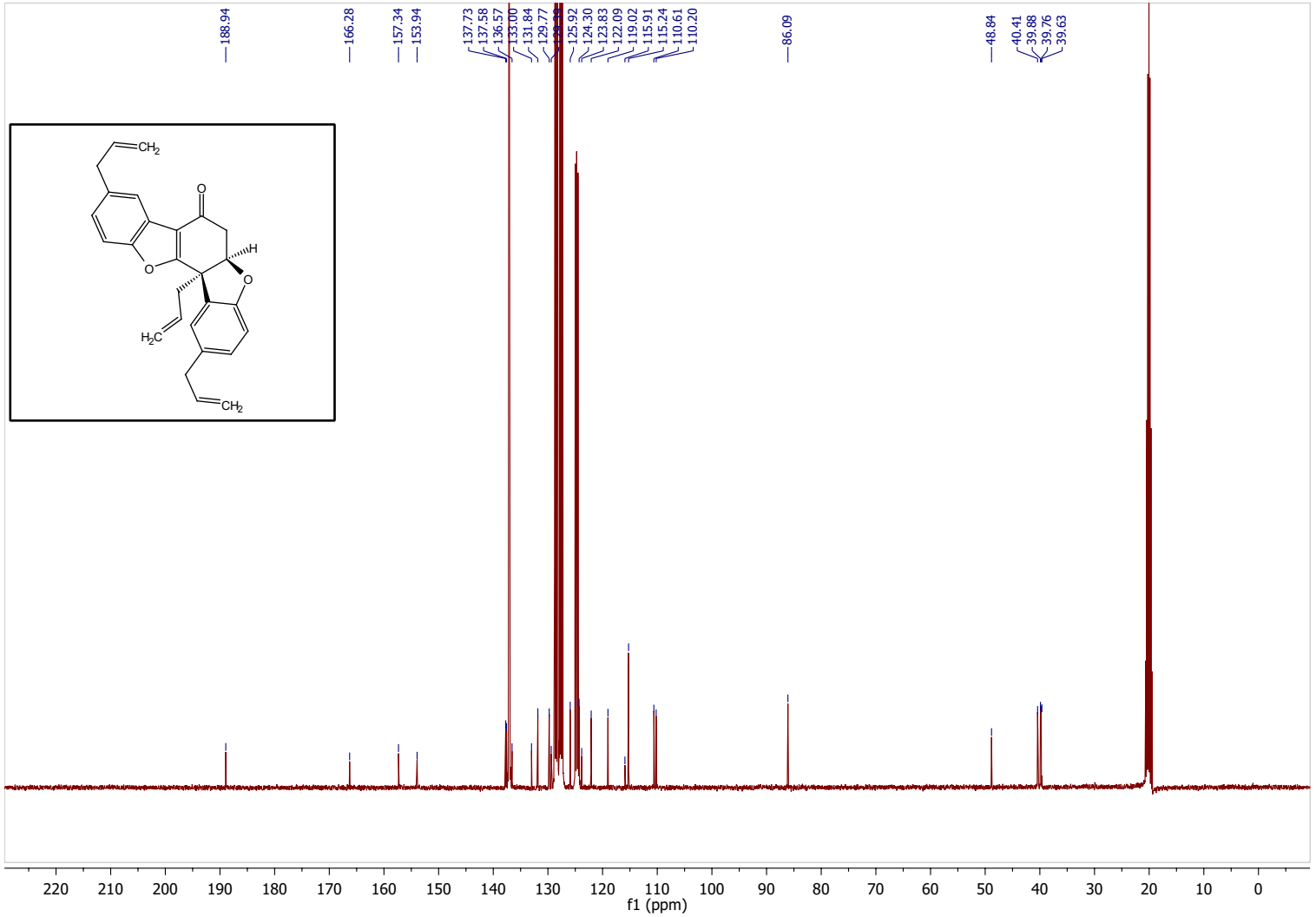

190.84
167.25
157.04
154.04
137.78
137.74
136.98
133.55
131.85
129.96
129.16
126.30
124.65
123.51
121.95
120.17
115.96
115.90
111.30
110.28
86.16
77.16 CDCl3
49.17
40.83
40.37
40.22
39.84
O
O
H
O
H2C
CH2
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

48 toluene D8

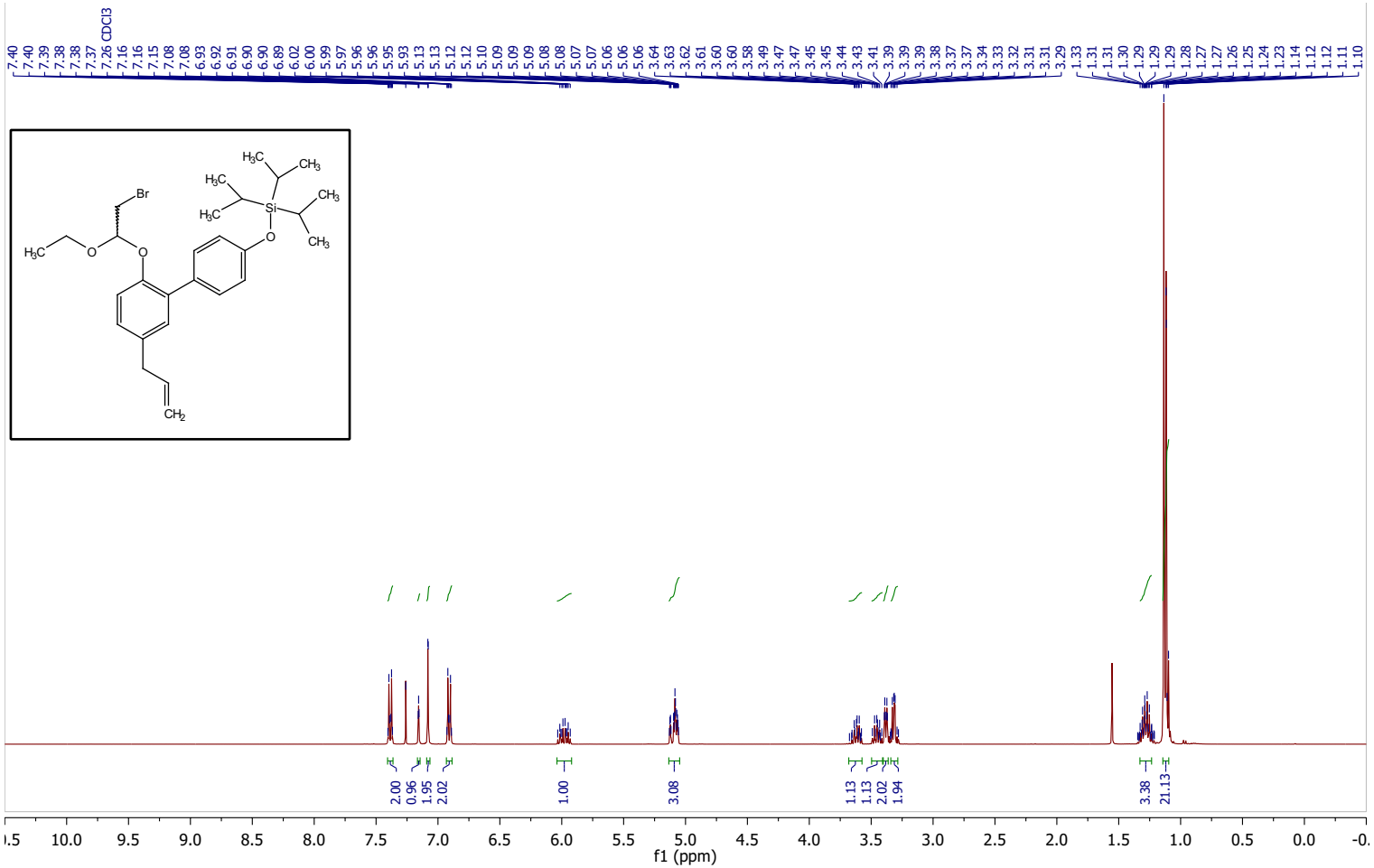


^{1}H NMR (400 MHz, Toluene-d_8) δ 8.10 (d, J = 1.8 Hz, 1H), 7.32 (d, J = 1.8 Hz, 1H), 7.09 (d, J = 8.5 Hz, 1H), 6.80 (dd, J = 8.5, 1.8 Hz, 1H), 6.74 (dd, J = 8.2, 1.8 Hz, 1H), 6.60 (d, J = 8.2 Hz, 1H), 5.93 – 5.73 (m, 2H), 5.27 (dddd, J = 16.8, 10.1, 8.1, 6.6 Hz, 1H), 5.04 – 4.95 (m, 2H), 4.96 – 4.87 (m, 2H), 4.86 – 4.70 (m, 2H), 4.55 (dd, J = 4.3, 2.8 Hz, 1H), 3.17 (d, J = 6.6 Hz, 4H), 3.08 (dd, J = 17.5, 2.8 Hz, 1H), 2.92 (dd, J = 14.1, 6.6 Hz, 1H), 2.57 (dd, J = 17.5, 4.3 Hz, 1H), 2.42 (dd, J = 14.1, 8.1 Hz, 1H).

48 toluene D8

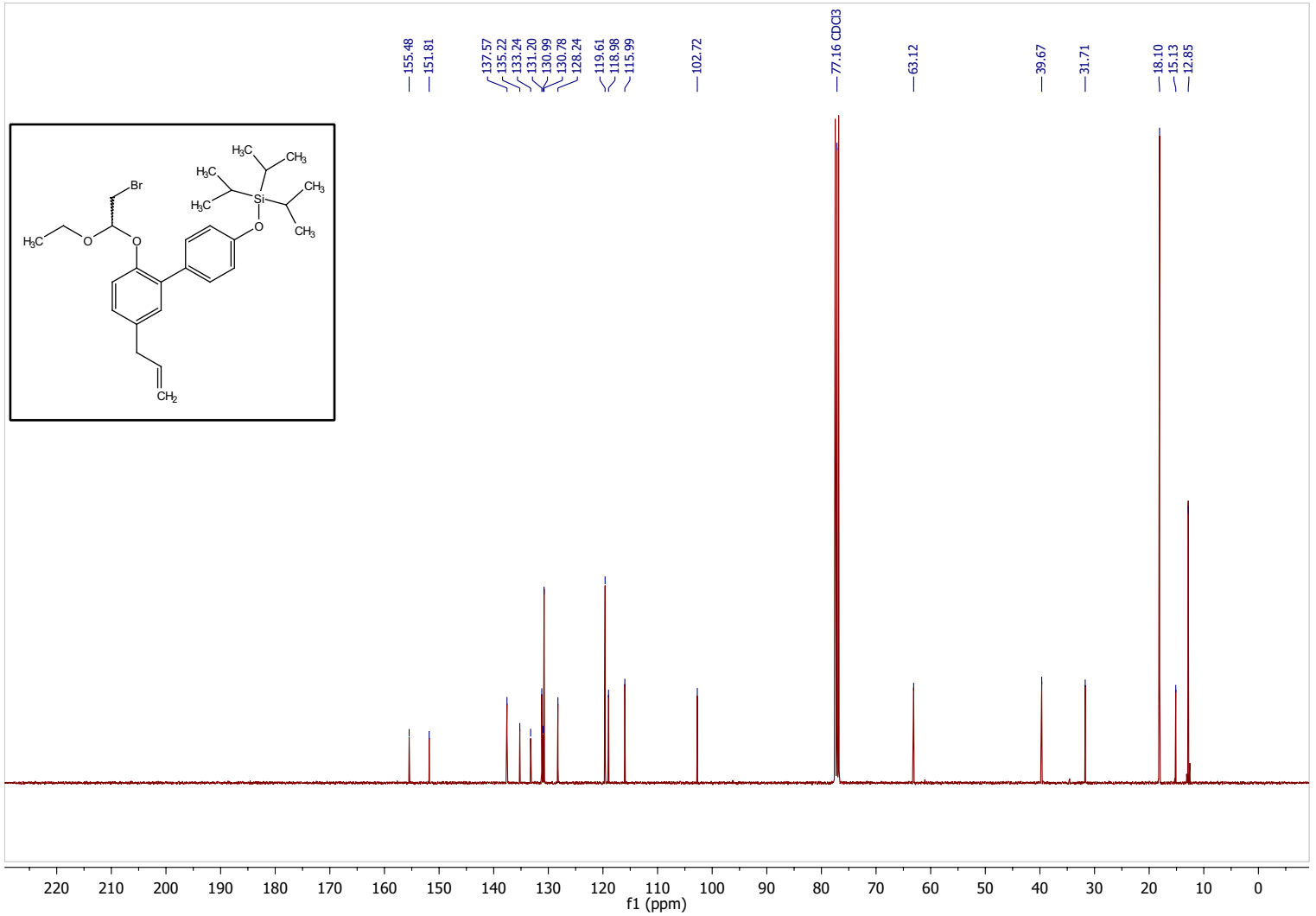


S3

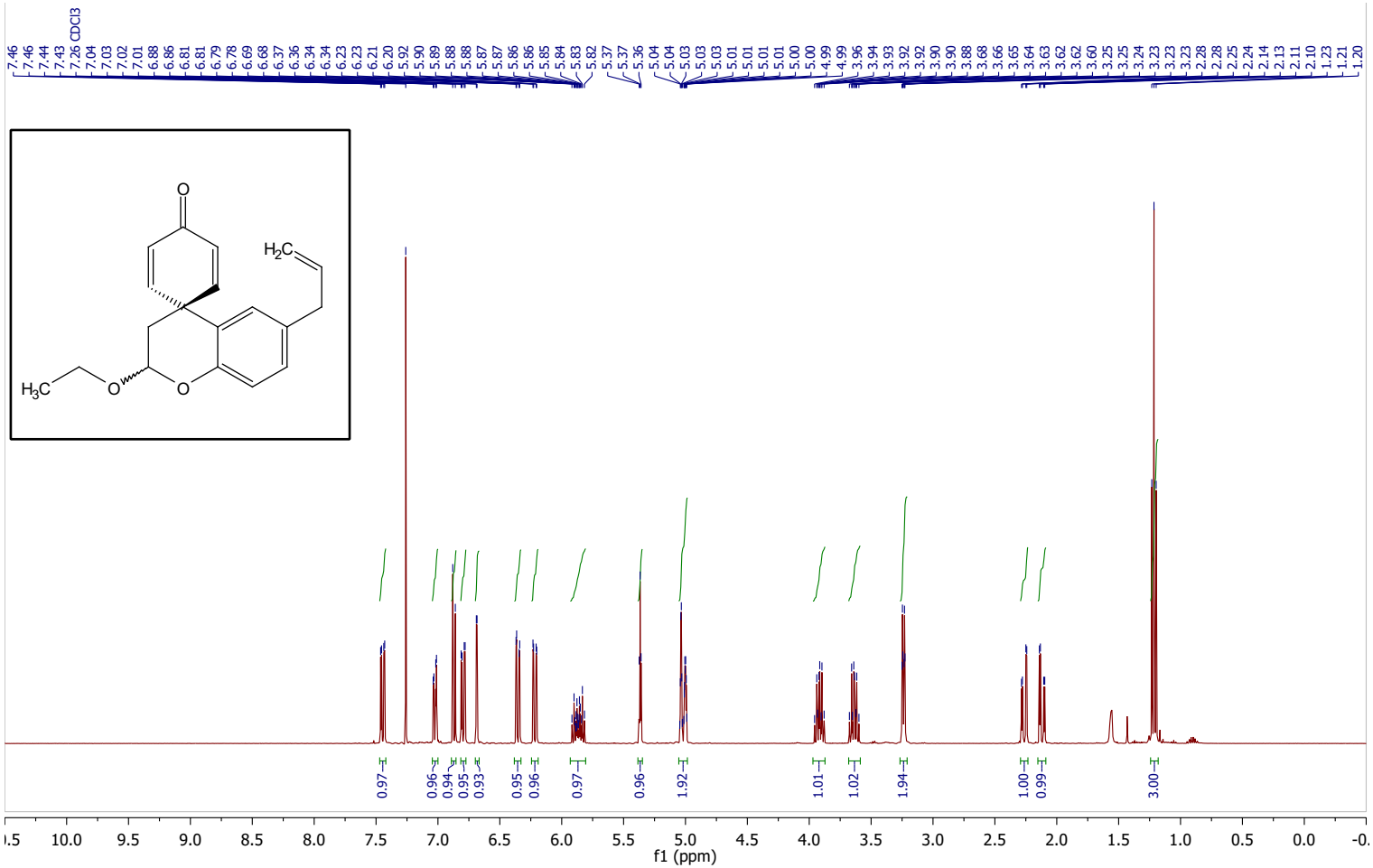


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.41 – 7.36 (m, 2H), 7.17 – 7.14 (m, 1H), 7.09 – 7.07 (m, 2H), 6.93 – 6.89 (m, 2H), 5.98 (dddd, *J* = 16.8, 10.0, 6.7, 6.7 Hz, 1H), 5.15 – 5.04 (m, 3H), 3.62 (dq, *J* = 9.3, 7.0 Hz, 1H), 3.45 (dq, *J* = 9.3, 7.0 Hz, 1H), 3.38 (ddd, *J* = 6.8, 1.5, 1.5 Hz, 2H), 3.35 – 3.28 (m, 2H), 1.36 – 1.21 (m, 3H), 1.15 – 1.10 (m, 21H).

S3

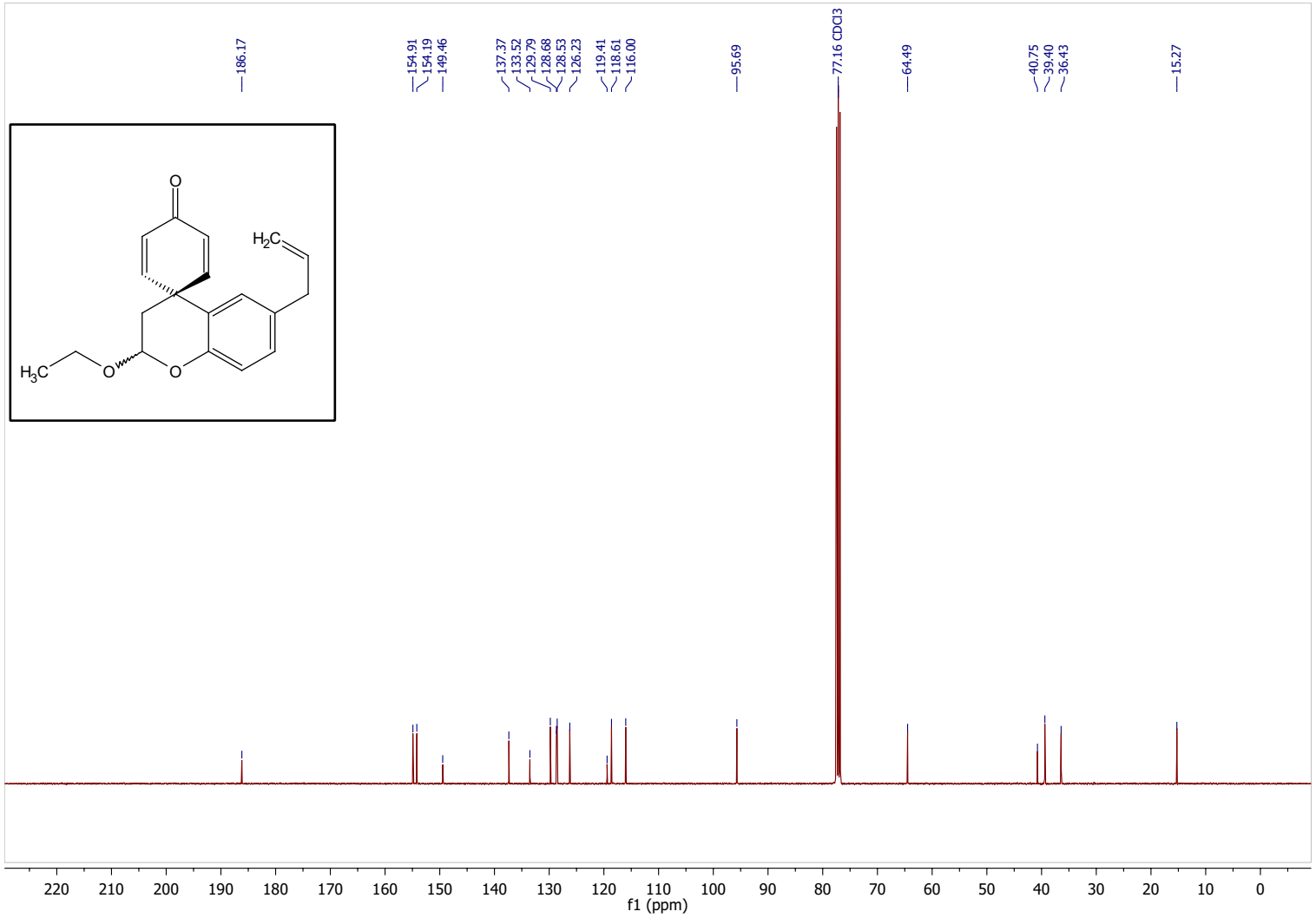

155.48
151.81
137.57
135.22
133.24
131.20
130.99
130.78
128.24
119.61
118.98
115.99
102.72
77.16 CDCl3
63.12
39.67
31.71
18.10
15.13
12.85
Br
Si
O
CH2
f1 (ppm)

S4

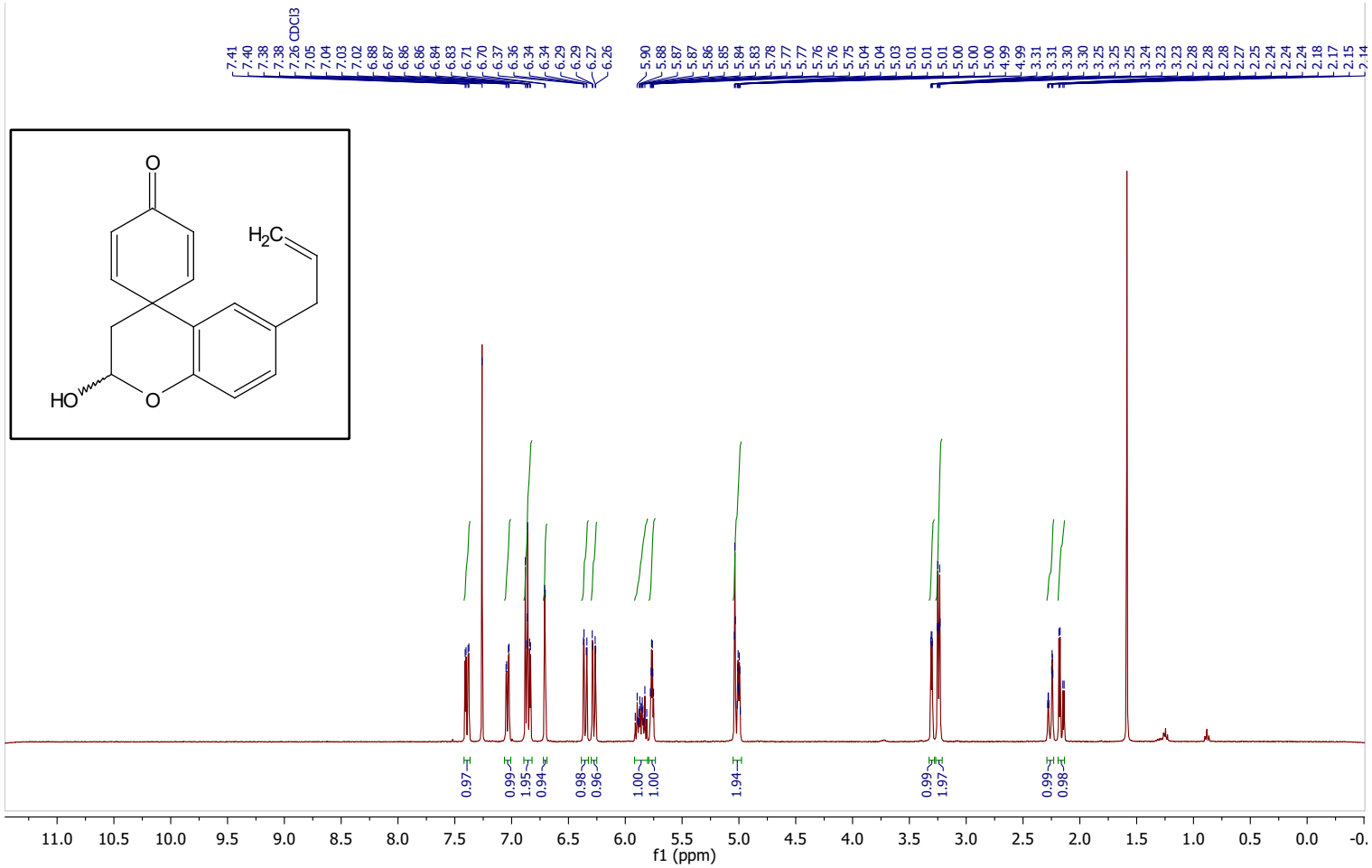


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.45 (dd, *J* = 10.1, 2.9 Hz, 1H), 7.02 (dd, *J* = 8.3, 2.2 Hz, 1H), 6.87 (d, *J* = 8.3 Hz, 1H), 6.80 (dd, *J* = 10.0, 2.9 Hz, 1H), 6.69 (d, *J* = 2.2 Hz, 1H), 6.35 (dd, *J* = 10.0, 1.9 Hz, 1H), 6.22 (dd, *J* = 10.1, 1.9 Hz, 1H), 5.87 (dddd, *J* = 17.6, 9.5, 6.7, 6.7 Hz, 1H), 5.37 (dd, *J* = 3.1, 3.1 Hz, 1H), 5.06 – 4.98 (m, 2H), 3.92 (dq, *J* = 9.6, 7.1 Hz, 1H), 3.64 (dq, *J* = 9.6, 7.1 Hz, 1H), 3.24 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 2.26 (dd, *J* = 14.1, 2.9 Hz, 1H), 2.12 (dd, *J* = 14.1, 3.3 Hz, 1H), 1.21 (dd, *J* = 7.1, 7.1 Hz, 3H).

S4

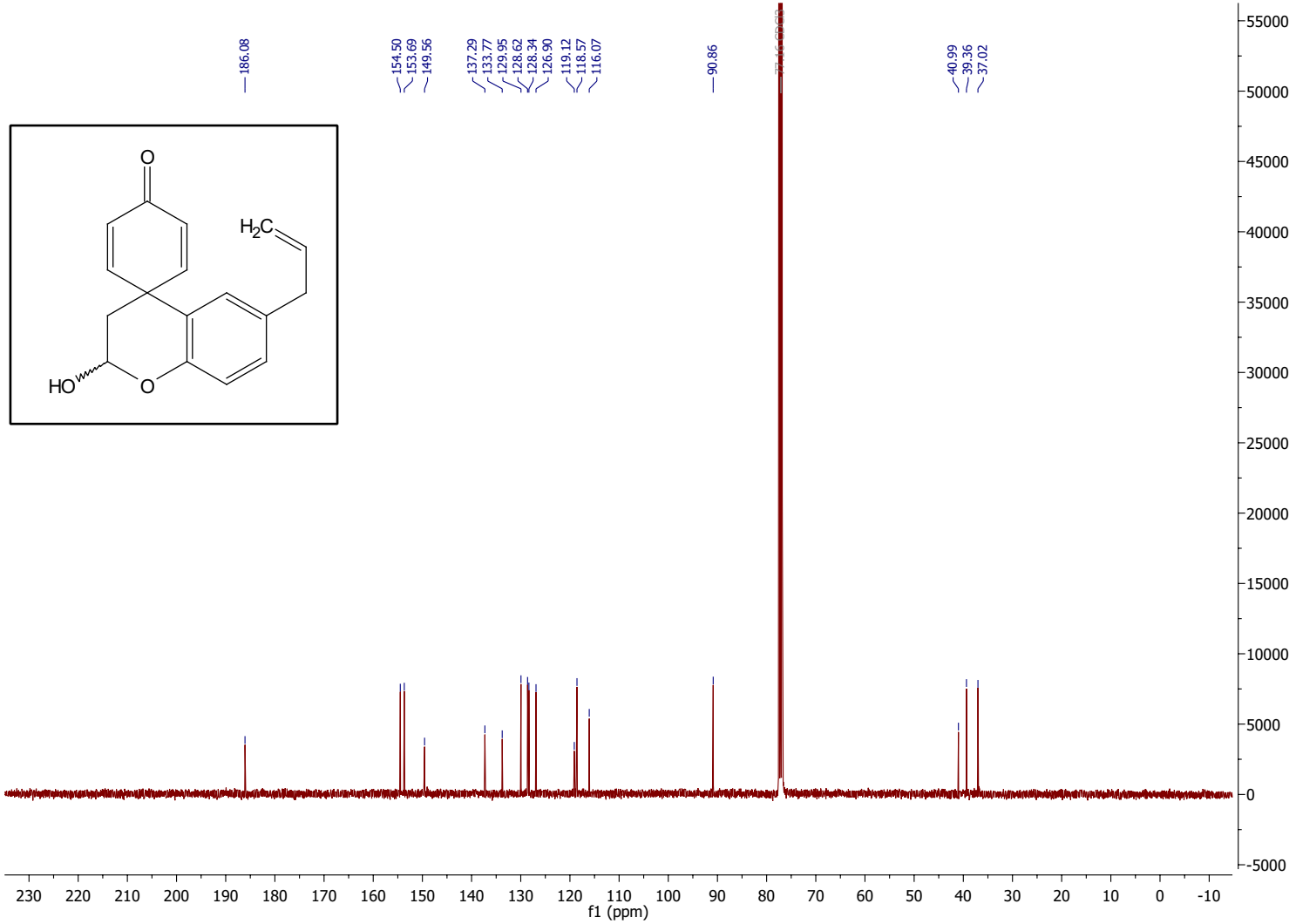

186.17
154.91
154.19
149.46
137.37
133.52
129.79
128.68
128.53
126.23
119.41
118.61
116.00
95.69
77.16 CDCl3
64.49
40.75
39.40
36.43
15.27
O
H2C
H3C
O
O
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

S5

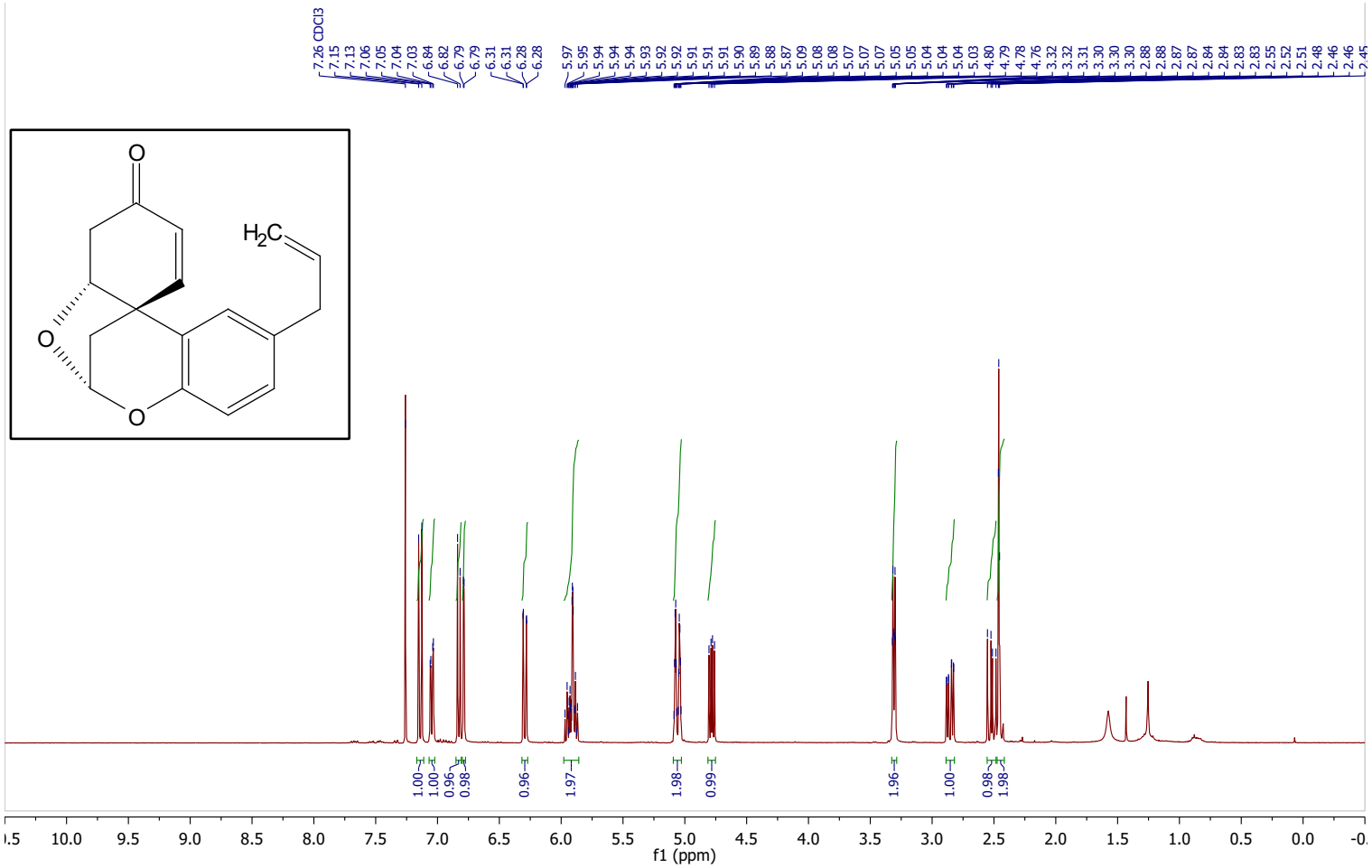


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.39 (dd, *J* = 10.1, 3.0 Hz, 1H), 7.04 (dd, *J* = 8.3, 2.2 Hz, 1H), 6.87 (d, *J* = 8.3 Hz, 1H), 6.85 (dd, *J* = 10.0, 3.0 Hz, 1H), 6.71 (d, *J* = 2.2 Hz, 1H), 6.35 (dd, *J* = 10.0, 1.9 Hz, 1H), 6.28 (dd, *J* = 10.1, 1.9 Hz, 1H), 5.86 (dddd, *J* = 18.2, 9.4, 6.7, 6.7 Hz, 1H), 5.77 (ddd, *J* = 4.2, 4.2, 2.8 Hz, 1H), 5.05 – 4.98 (m, 2H), 3.30 (dd, *J* = 4.1, 1.6 Hz, 1H), 3.24 (ddd, *J* = 6.4, 1.4, 1.4 Hz, 2H), 2.26 (ddd, *J* = 14.0, 2.8, 1.6 Hz, 1H), 2.16 (dd, *J* = 14.0, 4.3 Hz, 1H).

S5

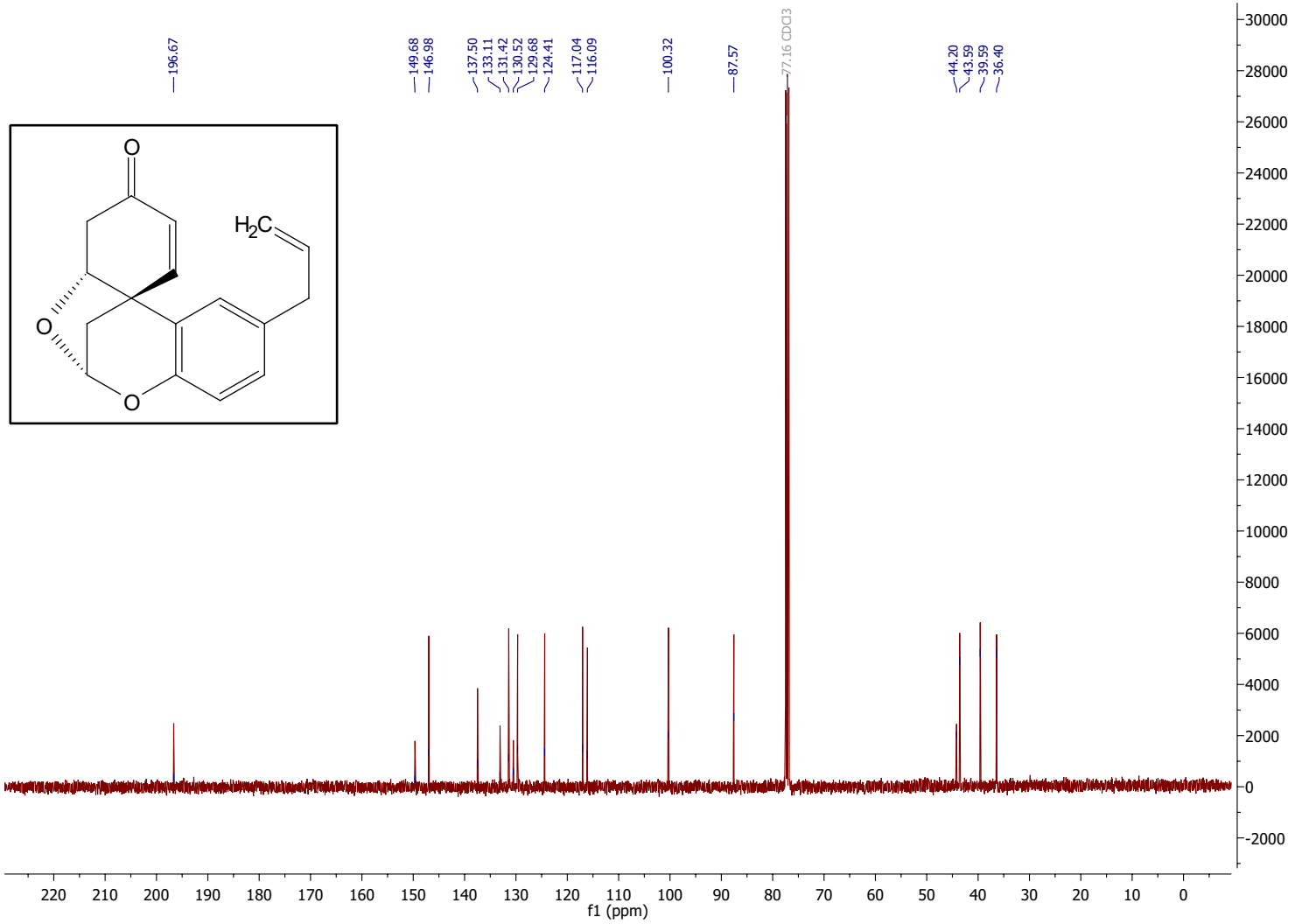

186.08
154.50
153.69
149.56
137.29
133.77
129.95
128.62
128.34
126.90
119.12
118.57
116.07
90.86
40.99
39.36
37.02
O
H2C
HO
O
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

S6

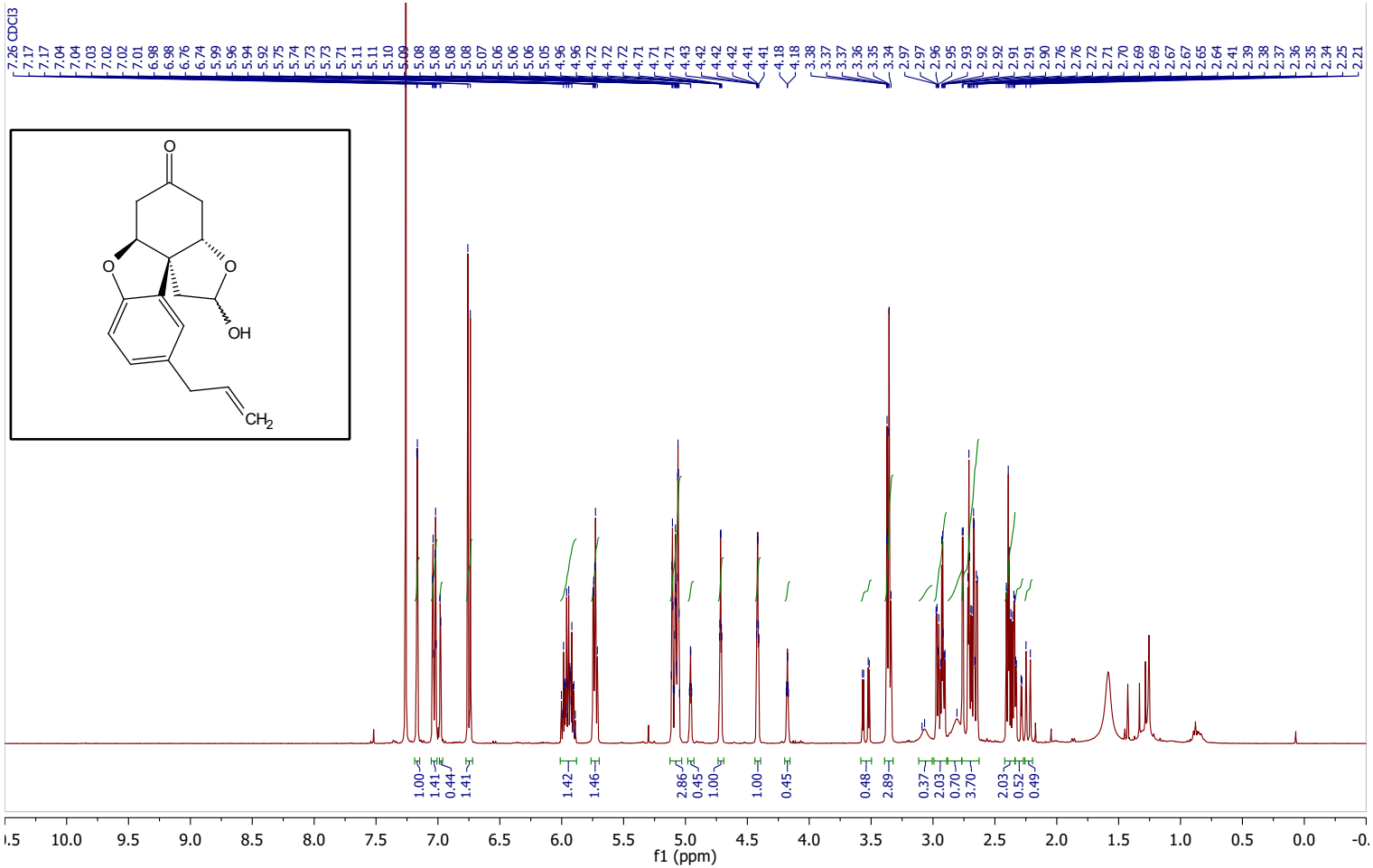


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.14 (d, *J* = 10.3 Hz, 1H), 7.04 (dd, *J* = 8.3, 2.1 Hz, 1H), 6.83 (d, *J* = 8.3 Hz, 1H), 6.79 (d, *J* = 2.1 Hz, 1H), 6.29 (dd, *J* = 10.3, 0.9 Hz, 1H), 5.97 – 5.86 (m, 2H), 5.10 – 5.02 (m, 2H), 4.78 (dd, *J* = 11.3, 6.6 Hz, 1H), 3.31 (ddd, *J* = 6.8, 1.6, 1.6 Hz, 2H), 2.85 (ddd, *J* = 16.1, 6.6, 1.0 Hz, 1H), 2.52 (dd, *J* = 16.1, 11.4 Hz, 1H), 2.47 – 2.44 (m, 2H).

S6

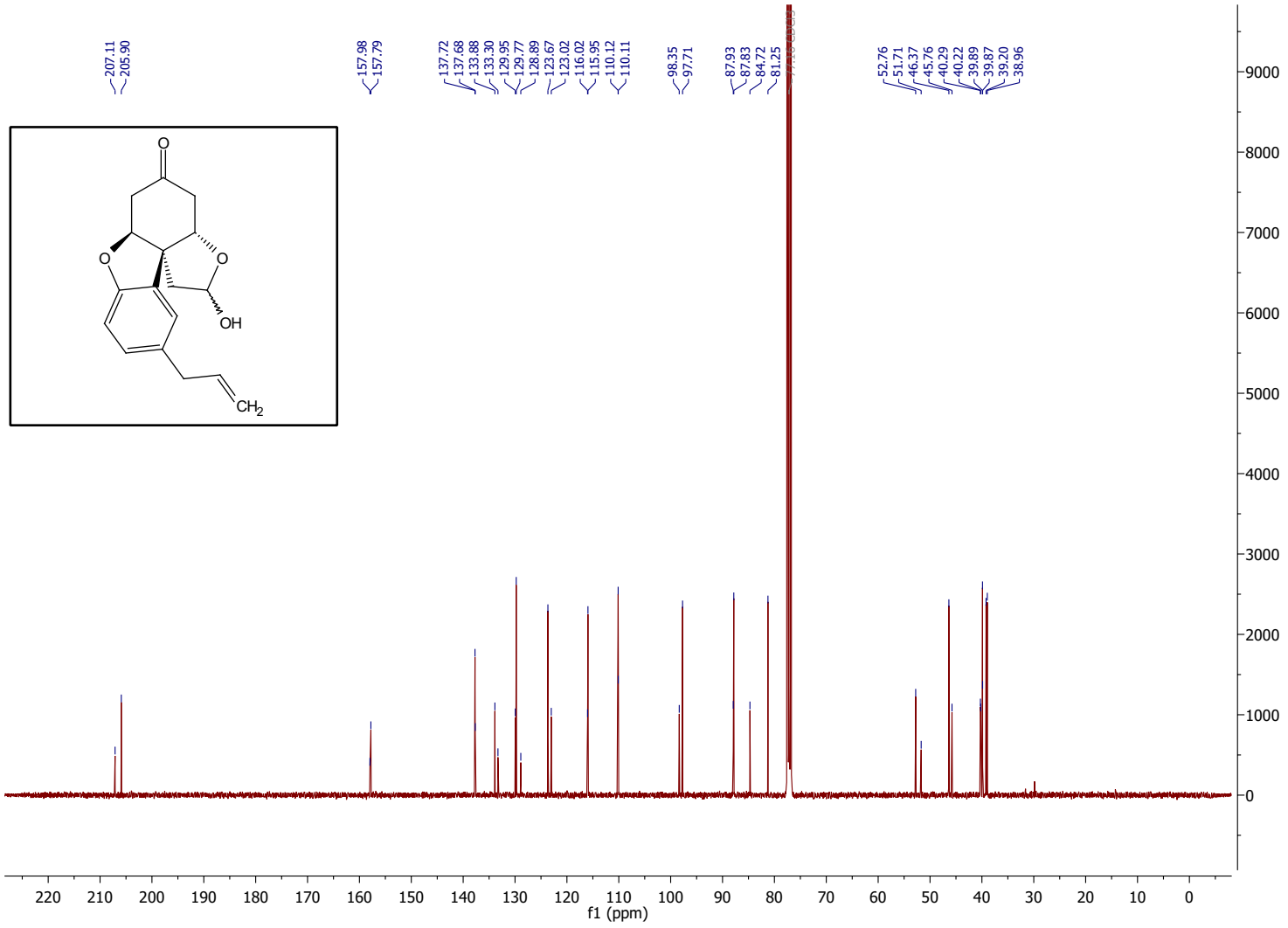

196.67
149.68
146.98
137.50
133.11
131.42
130.52
129.68
124.41
117.04
116.09
100.32
87.57
77.16 CDCl3
44.20
43.59
39.59
36.40
O
H2C
O
O
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-2000
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

S7

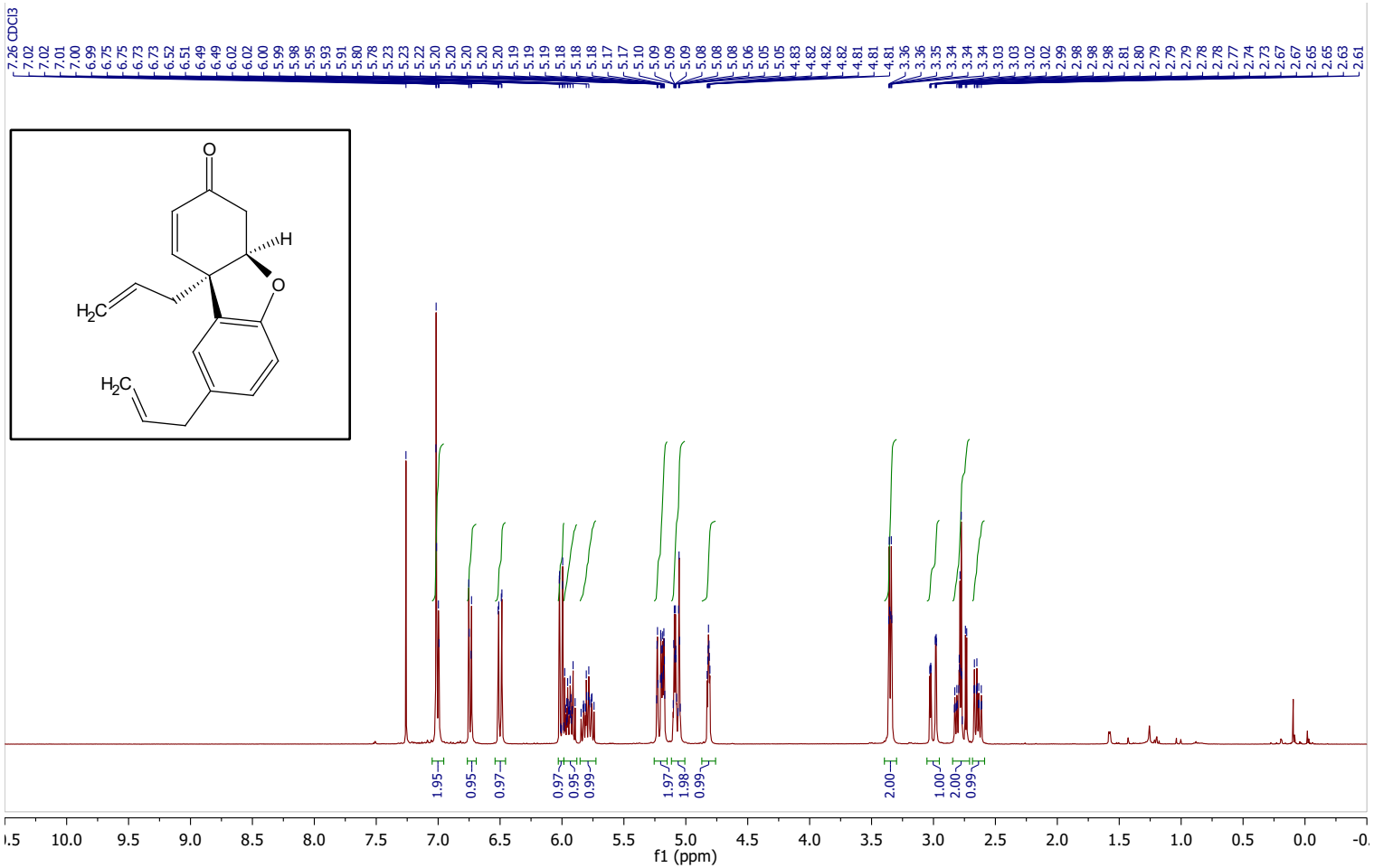


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.17 (d, *J* = 1.8 Hz, 1H), 7.08 – 7.01 (m, 2H), 6.98 (d, *J* = 1.8 Hz, 1H), 6.75 (d, *J* = 8.1 Hz, 2H), 6.01 – 5.89 (m, 2H), 5.76 – 5.70 (m, 2H), 5.12 – 5.04 (m, 4H), 4.96 (ddd, *J* = 3.1, 3.1, 1.0 Hz, 1H), 4.72 (ddd, *J* = 3.0, 3.0, 1.0 Hz, 1H), 4.42 (ddd, *J* = 3.0, 3.0, 1.0 Hz, 1H), 4.18 (ddd, *J* = 3.1, 3.1, 1.0 Hz, 1H), 3.54 (dd, *J* = 18.4, 3.5 Hz, 1H), 3.39 – 3.32 (m, 4H), 3.07 (s, 1H), 2.98 – 2.89 (m, 2H), 2.81 (s, 1H), 2.77 – 2.63 (m, 5H), 2.41 – 2.34 (m, 2H), 2.31 (dd, *J* = 17.8, 2.5 Hz, 1H), 2.23 (d, *J* = 14.2 Hz, 1H).

S7

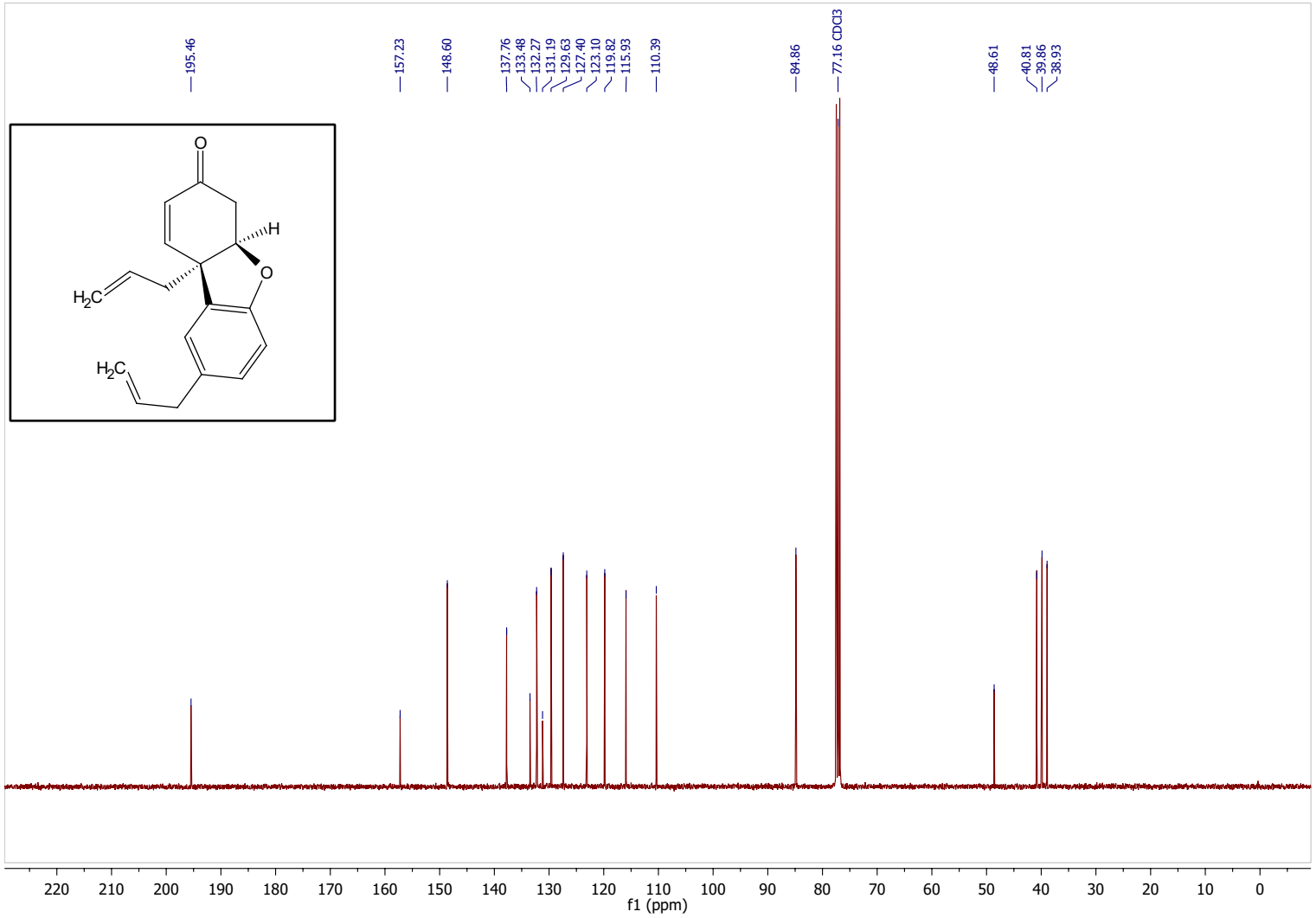

207.11
205.90
157.98
157.79
137.72
137.68
133.88
133.30
129.95
129.77
128.89
123.67
123.02
116.02
115.95
110.12
110.11
98.35
97.71
87.93
87.83
84.72
81.25
52.76
51.71
46.37
45.76
40.29
40.22
39.89
39.87
39.20
38.96
O
O
O
OH
CH2
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

Simonsol G (**1**) $CDCl_3$

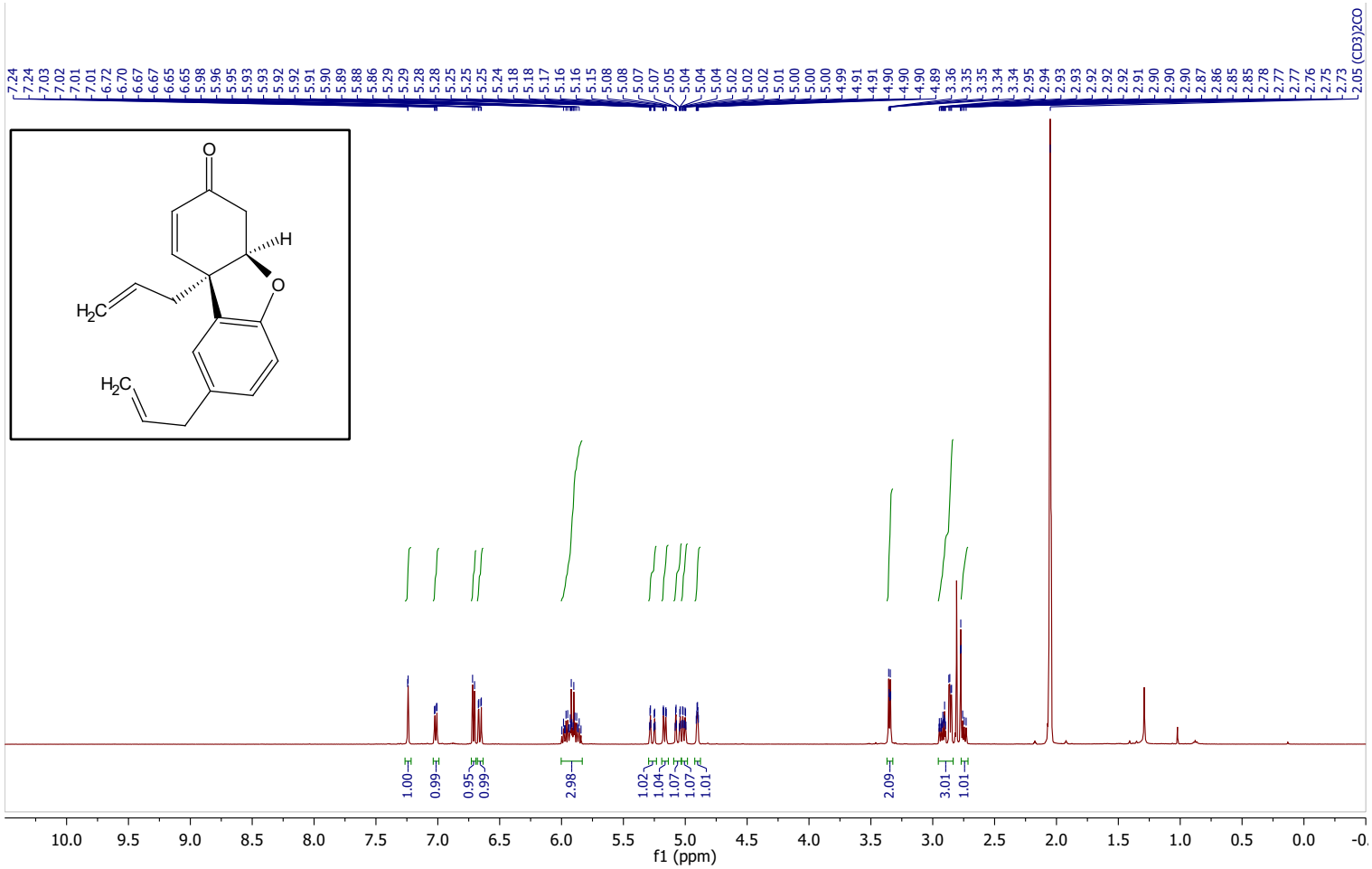


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.03 – 6.99 (m, 2H), 6.76 – 6.72 (m, 1H), 6.50 (dd, *J* = 10.2, 1.9 Hz, 1H), 6.01 (dd, *J* = 10.2, 0.7 Hz, 1H), 6.00 – 5.87 (m, 1H), 5.79 (dddd, *J* = 16.9, 10.1, 8.1, 6.7 Hz, 1H), 5.24 – 5.16 (m, 2H), 5.11 – 5.04 (m, 2H), 4.82 (ddd, *J* = 4.6, 2.9, 1.9 Hz, 1H), 3.35 (ddd, *J* = 6.8, 1.5, 1.5 Hz, 2H), 3.00 (ddd, *J* = 17.6, 2.9, 0.8 Hz, 1H), 2.80 (dddd, *J* = 14.1, 6.7, 1.5, 1.5 Hz, 1H), 2.76 (dd, *J* = 17.6, 4.2 Hz, 1H), 2.64 (dddd, *J* = 14.1, 8.1, 1.0, 1.0 Hz, 1H).

Simonsol G (**1**) $CDCl_3$

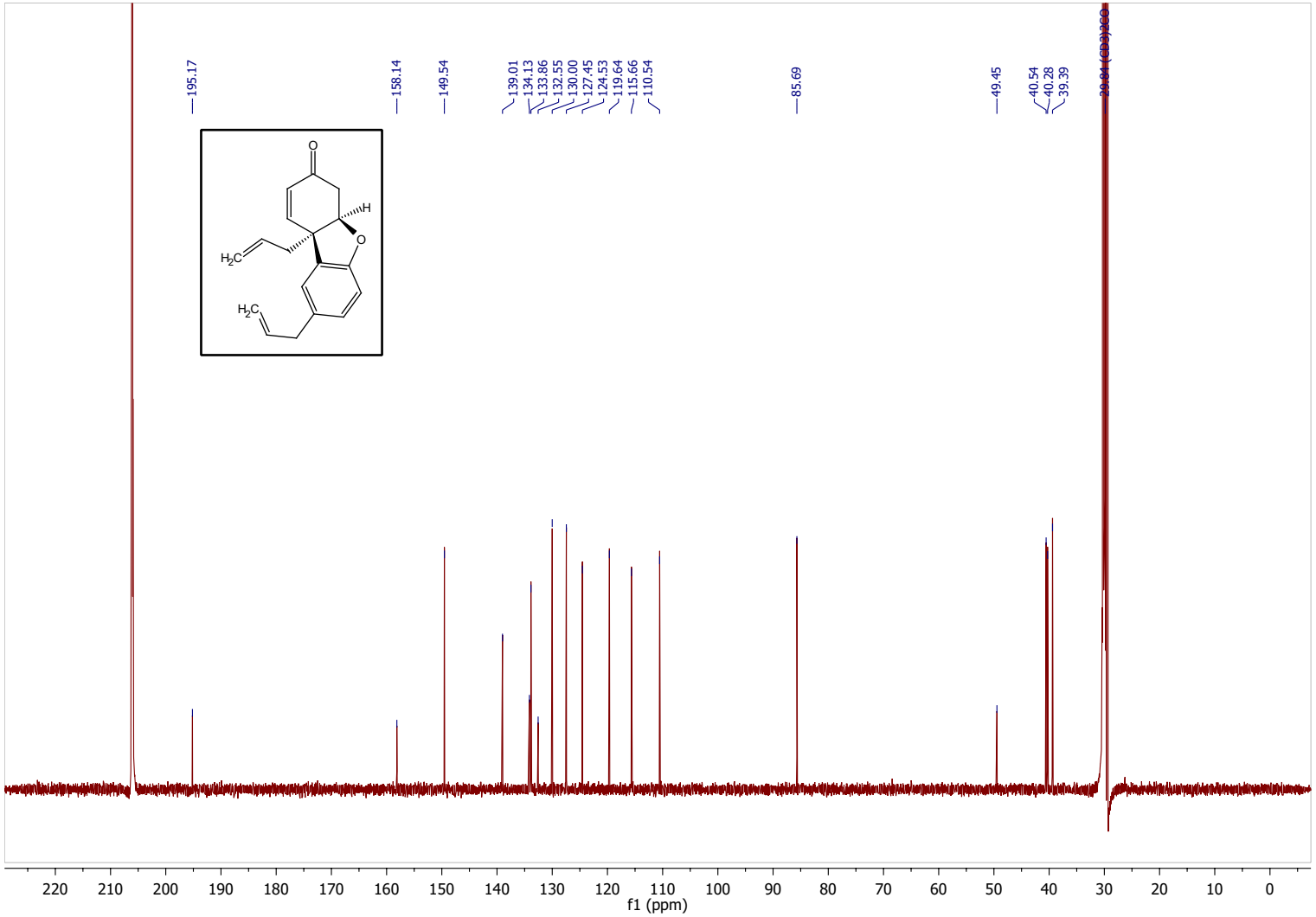


Simonsol G (**1**) acetone D_6

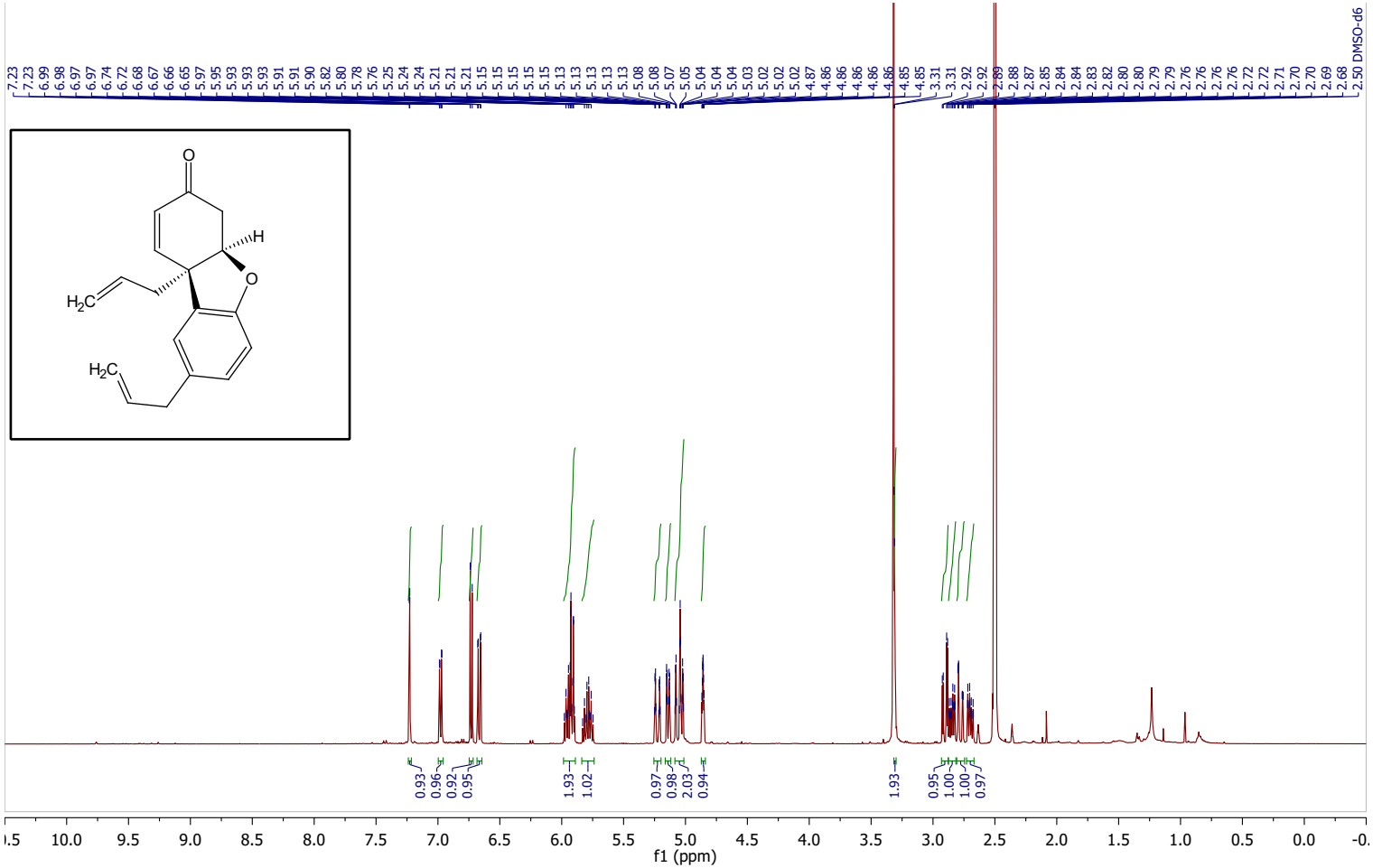


^{1}H NMR (500 MHz, Acetone-d_6) δ 7.24 (d, J = 1.8 Hz, 1H), 7.02 (dd, J = 8.1, 1.8 Hz, 1H), 6.71 (d, J = 8.1 Hz, 1H), 6.66 (dd, J = 10.2, 1.9 Hz, 1H), 6.04 – 5.81 (m, 2H), 5.91 (d, J = 10.2 Hz, 1H), 5.30 – 5.15 (m, 2H), 5.09 – 4.98 (m, 2H), 4.91 – 4.88 (m, 1H), 3.35 (ddd, J = 6.6, 1.5 Hz, 2H), 2.93 (dddd, J = 14.2, 7.2, 1.4, 1.4 Hz, 1H), 2.88 – 2.83 (m, 2H), 2.77 – 2.72 (m, 1H).

Simonsol G (**1**) acetone D_6

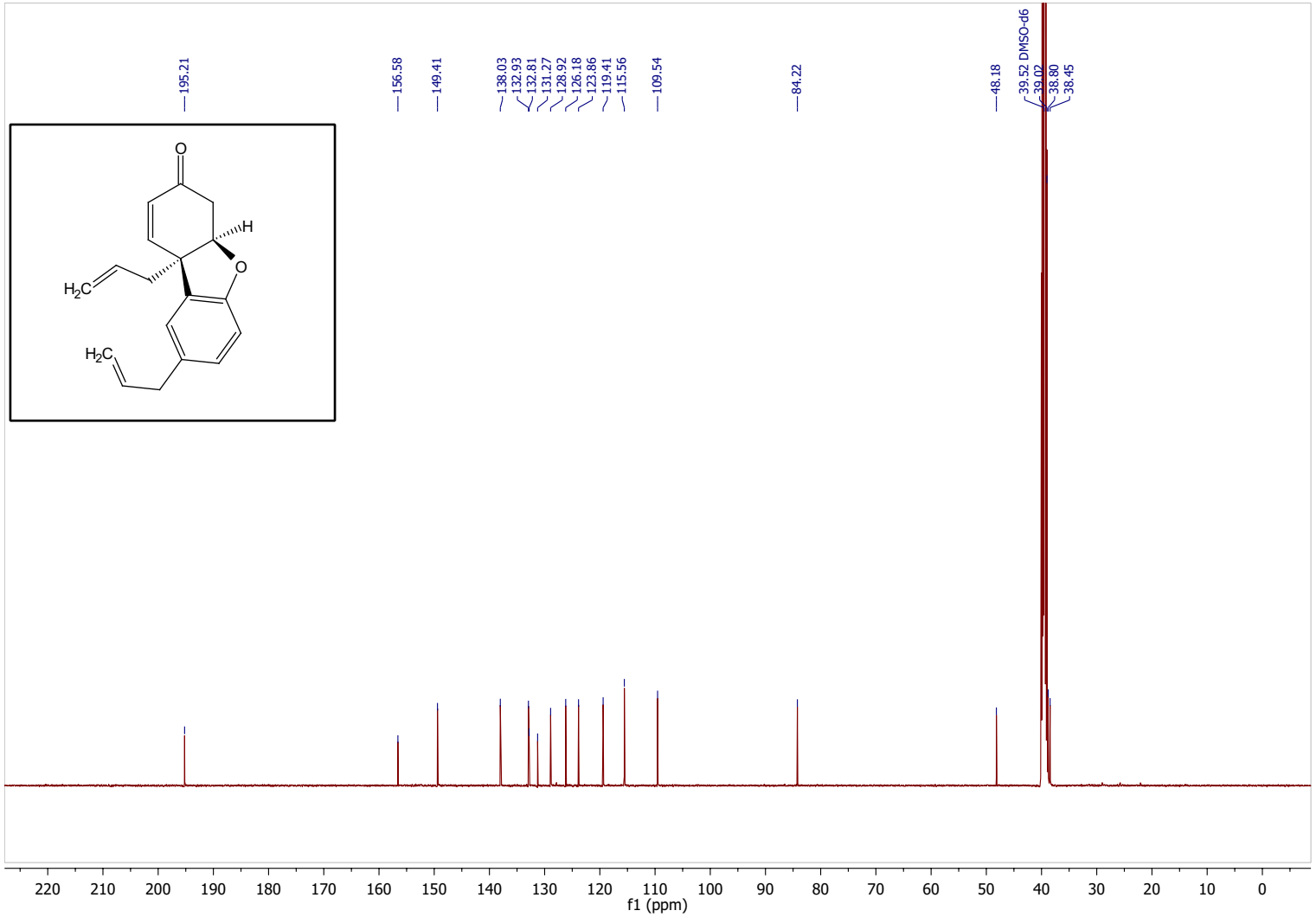


Simonsol G (**1**) DMSO D_6

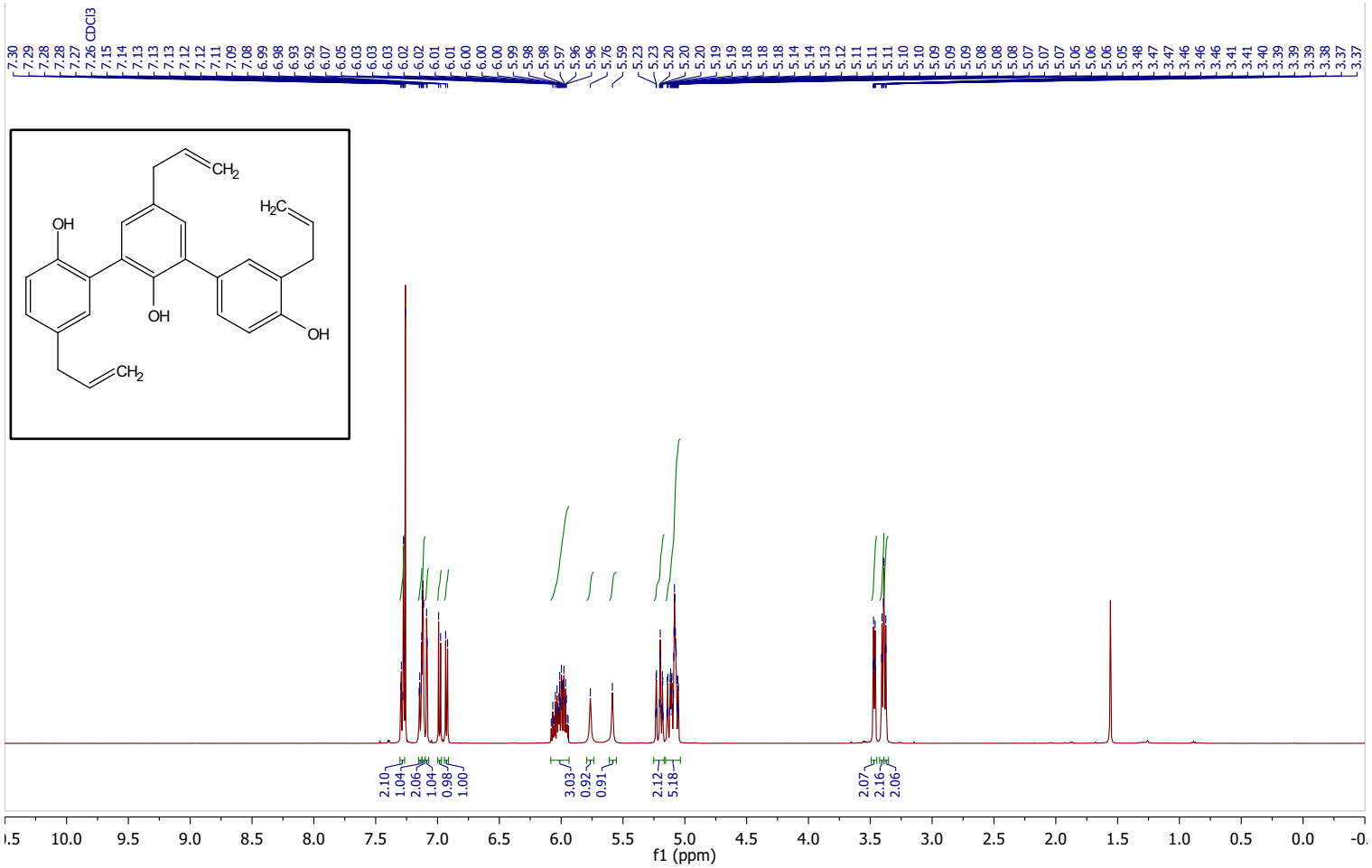


^{1}H NMR (500 MHz, DMSO-d_6) δ 7.23 (d, J = 1.9 Hz, 1H), 6.98 (dd, J = 8.1, 1.9 Hz, 1H), 6.73 (d, J = 8.1 Hz, 1H), 6.67 (dd, J = 10.2, 1.9 Hz, 1H), 5.94 (dddd, J = 16.8, 10.0, 6.7 Hz, 1H), 5.92 (dd, J = 10.2, 0.9 Hz, 1H), 5.79 (dddd, J = 17.4, 10.1, 7.4 Hz, 1H), 5.27 – 5.11 (m, 2H), 5.09 – 5.01 (m, 2H), 4.88 – 4.84 (m, 1H), 3.31 (d, J = 6.7 Hz, 2H), 2.90 (dd, J = 17.5, 3.9 Hz, 1H), 2.85 (dddd, J = 14.0, 7.4, 1.2 Hz, 1H), 2.78 (ddd, J = 17.5, 2.7, 0.9 Hz, 1H), 2.70 (dddd, J = 14.0, 7.4, 1.1 Hz, 1H).

Simonsol G (**1**) DMSO D_6

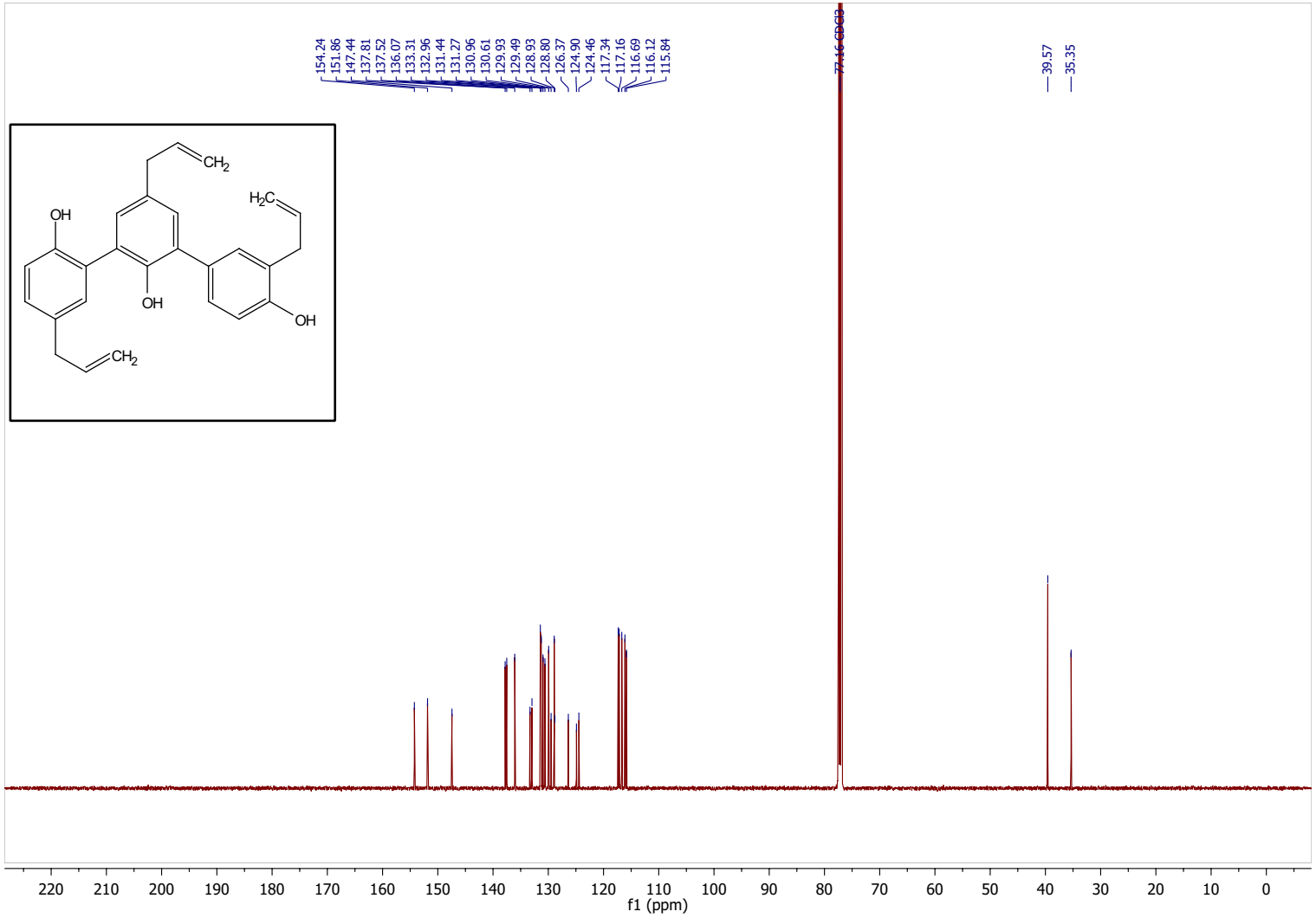


Simonsinol (**5**)

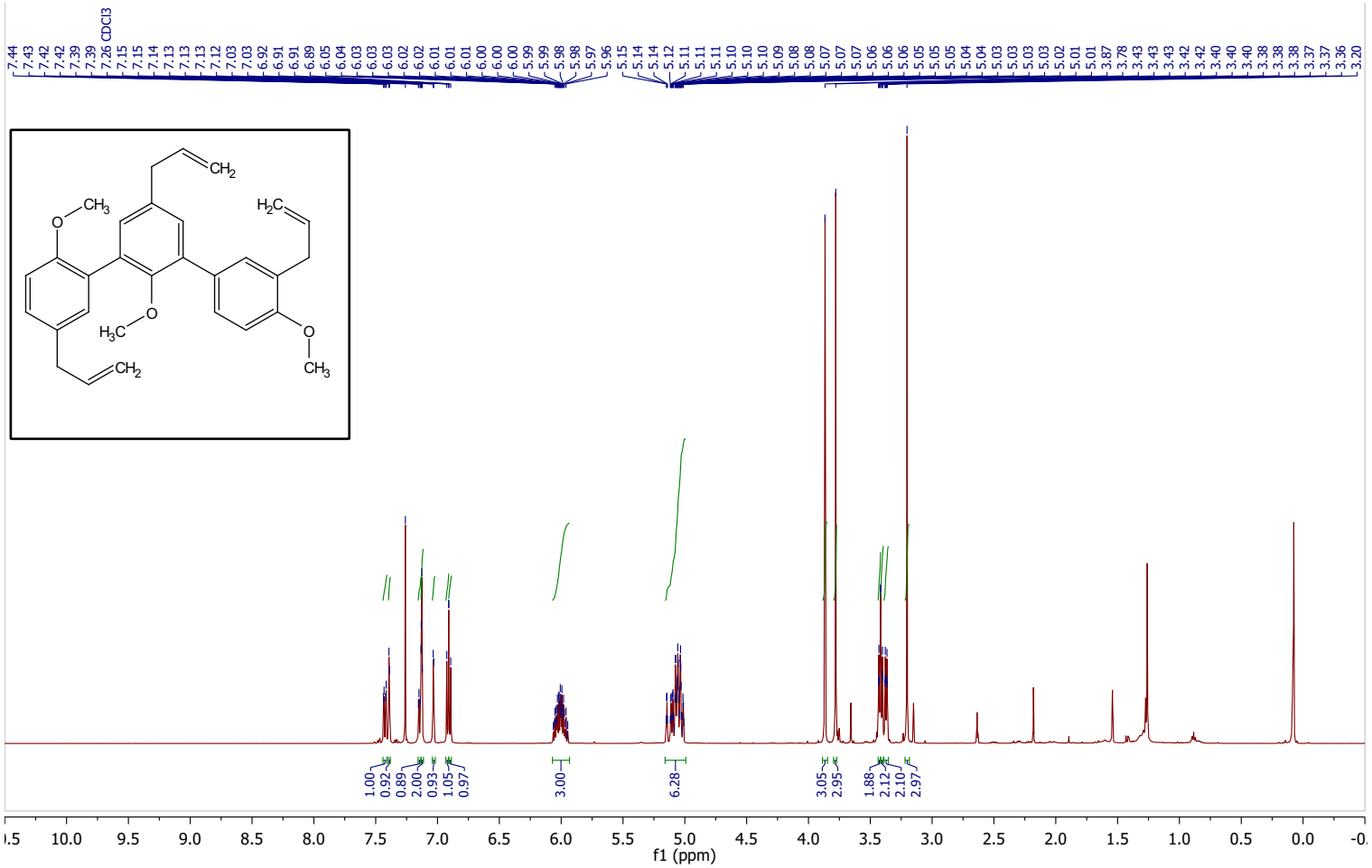


^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.30 – 7.27 (m, 2H), 7.14 (dd, *J* = 8.0, 1.8 Hz, 1H), 7.13 – 7.11 (m, 2H), 7.09 (d, *J* = 2.2 Hz, 1H), 6.98 (d, *J* = 8.1 Hz, 1H), 6.93 (d, *J* = 7.9 Hz, 1H), 6.08 – 5.94 (m, 3H), 5.76 (s, 1H), 5.59 (s, 1H), 5.24 – 5.17 (m, 2H), 5.15 – 5.04 (m, 5H), 3.47 (ddd, *J* = 6.4, 1.6, 1.6 Hz, 2H), 3.40 (ddd, *J* = 7.4, 1.4, 1.4 Hz, 2H), 3.38 (ddd, *J* = 7.4, 1.4, 1.4 Hz, 2H).

Simonsinol (**5**)

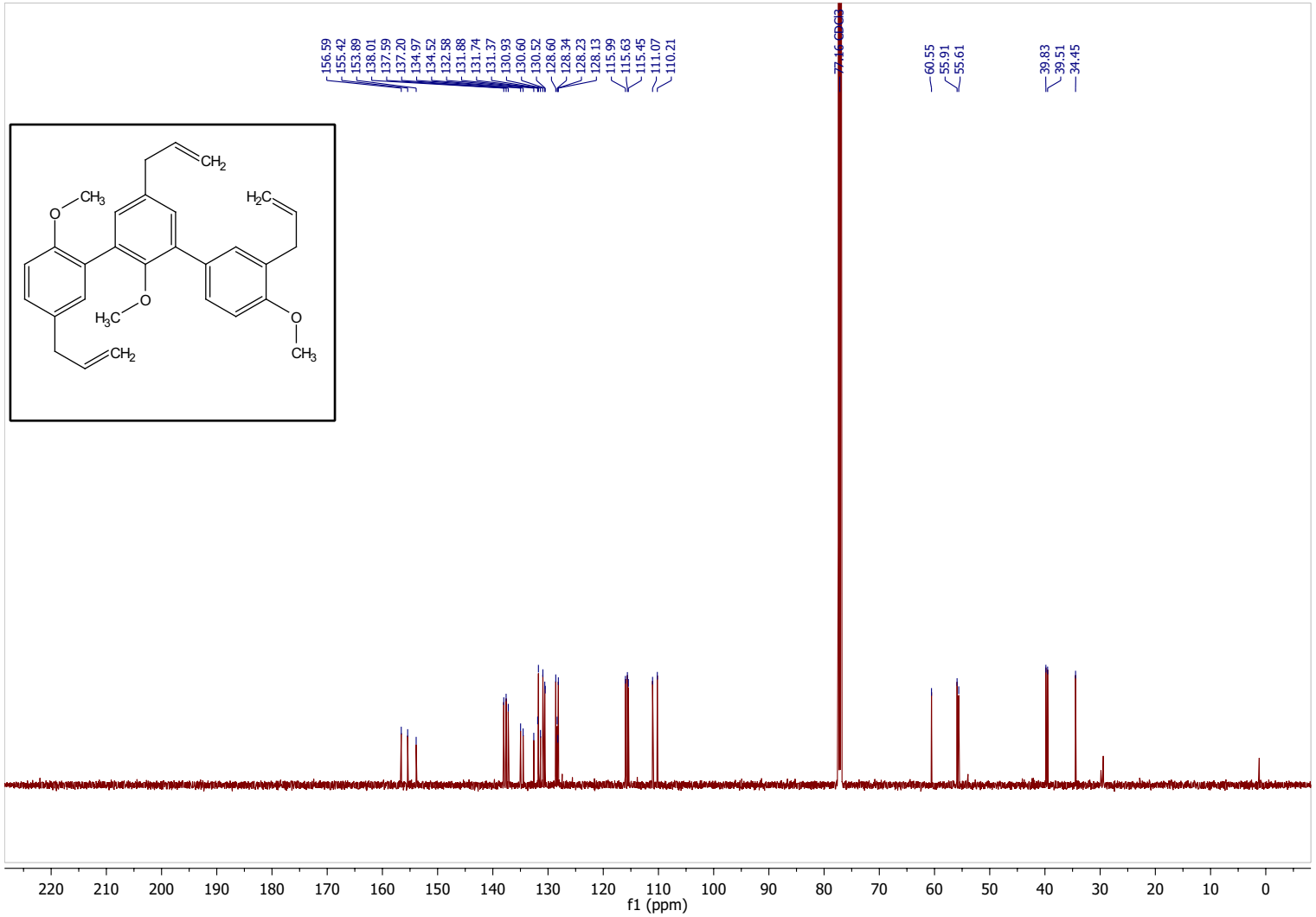


52

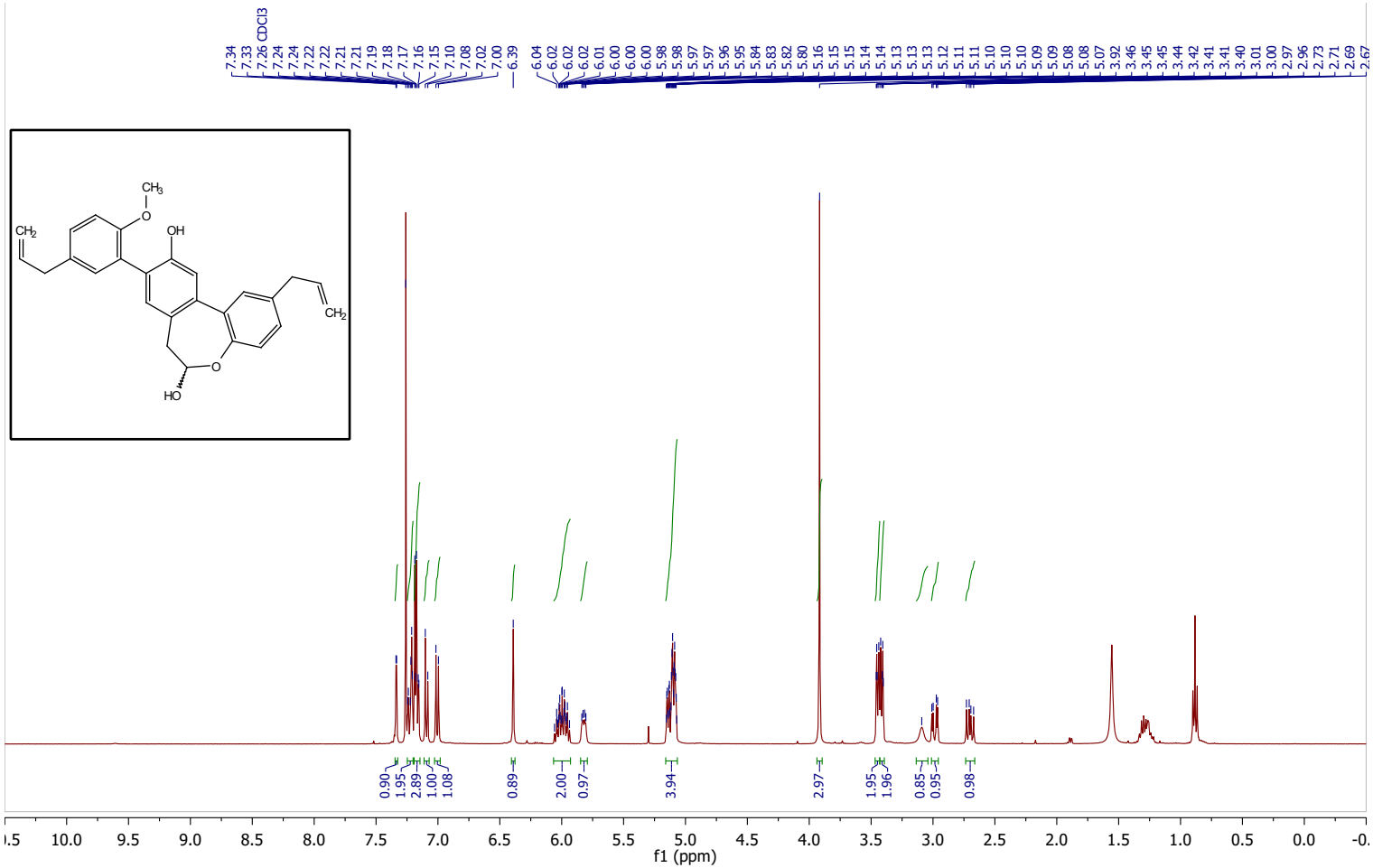


^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.43 (dd, *J* = 8.4, 2.3 Hz, 1H), 7.39 (d, *J* = 2.3 Hz, 1H), 7.15 (dd, *J* = 8.3, 2.2 Hz, 1H), 7.14 – 7.12 (m, 2H), 7.03 (d, *J* = 2.4 Hz, 1H), 6.92 (d, *J* = 8.3 Hz, 1H), 6.90 (d, *J* = 8.4 Hz, 1H), 6.08 – 5.93 (m, 3H), 5.17 – 5.00 (m, 6H), 3.87 (s, 3H), 3.78 (s, 3H), 3.43 (ddd, *J* = 7.1, 1.6, 1.6 Hz, 1H), 3.41 (ddd, *J* = 7.1, 1.4, 1.4 Hz, 2H), 3.37 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 3.20 (s, 3H).

52

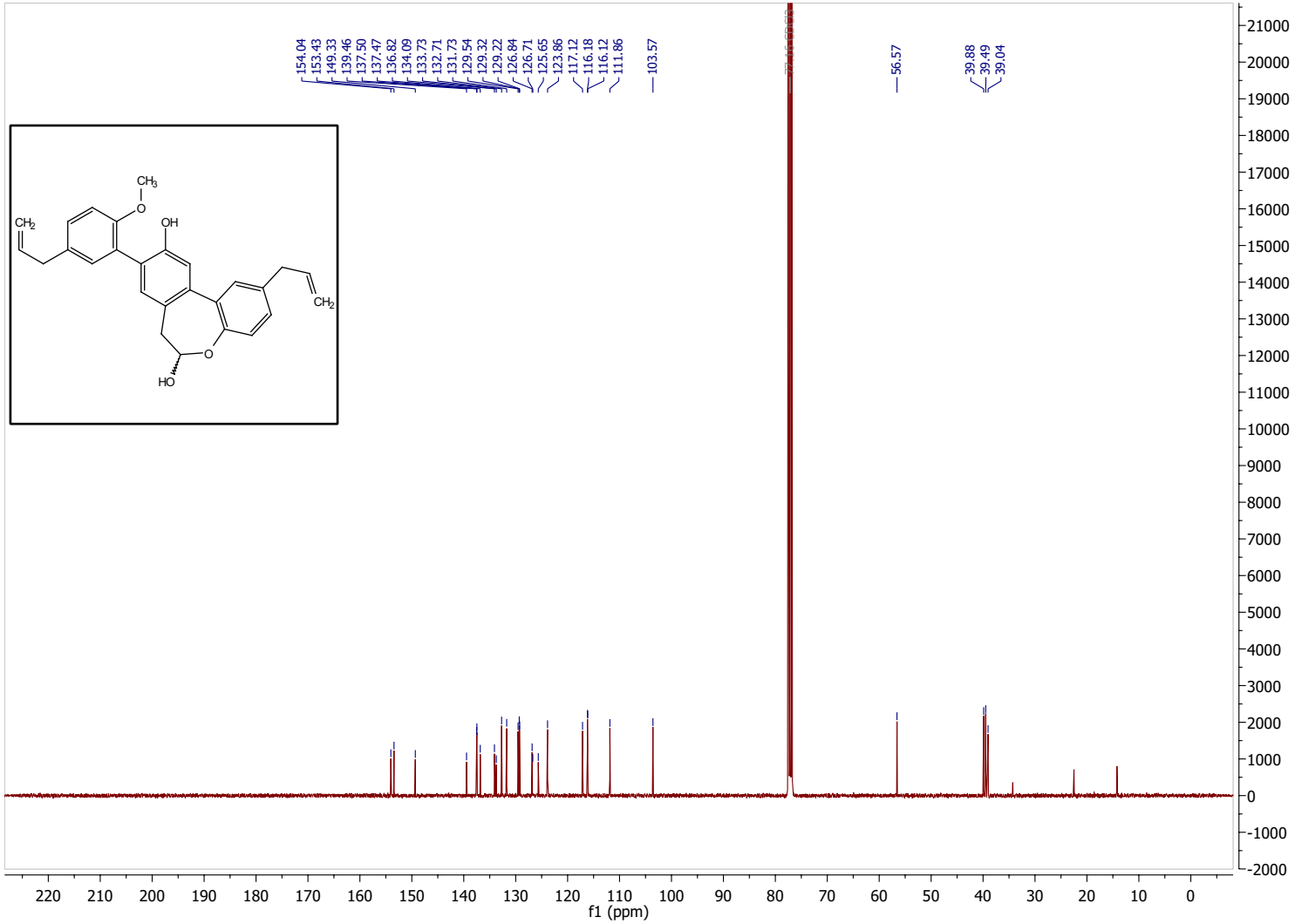

156.59
155.42
153.89
138.01
137.59
137.20
134.97
134.52
132.58
131.88
131.74
131.37
130.93
130.60
130.52
128.60
128.34
128.23
128.13
115.99
115.63
115.45
111.07
110.21
77.16 CDCl3
60.55
55.91
55.61
39.83
39.51
34.45
CH2
CH3
O
H2C
H3C
O
O
CH3
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

59

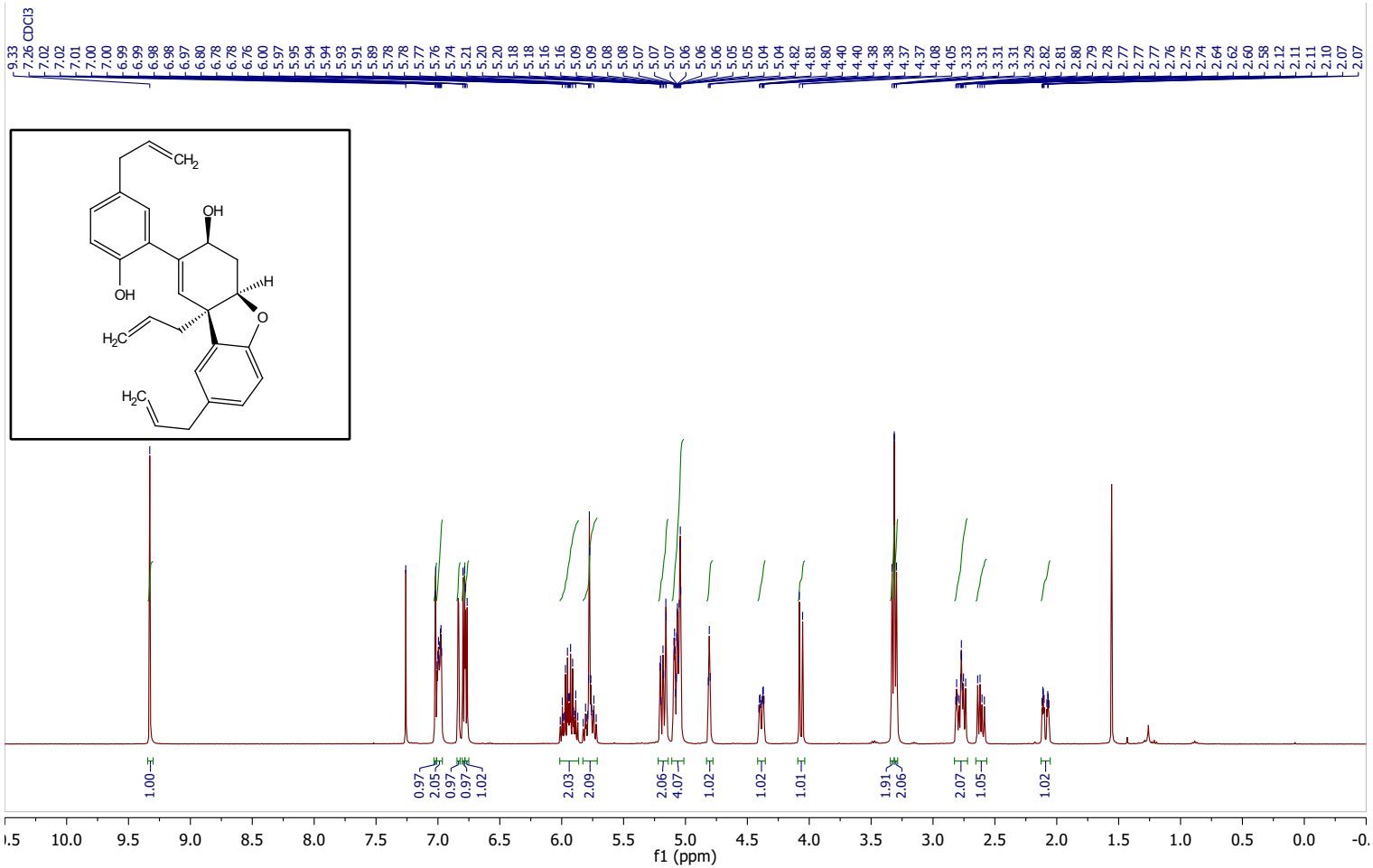


^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.34 (d, *J* = 2.2 Hz, 1H), 7.23 (dd, *J* = 8.2, 2.3 Hz, 1H), 7.22 (d, *J* = 2.4 Hz, 1H), 7.19 (s, 1H), 7.17 (s, 1H), 7.16 (dd, *J* = 8.2, 2.2 Hz, 1H), 7.09 (d, *J* = 8.1 Hz, 1H), 7.01 (d, *J* = 8.2 Hz, 1H), 6.39 (s, 1H), 6.06 – 5.92 (m, 2H), 5.82 (dd, *J* = 9.1, 4.1 Hz, 1H), 5.17 – 5.06 (m, 4H), 3.92 (s, 3H), 3.45 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 3.41 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 3.09 (s, 1H), 2.99 (dd, *J* = 14.4, 4.1 Hz, 1H), 2.70 (dd, *J* = 14.3, 8.9 Hz, 1H).

59

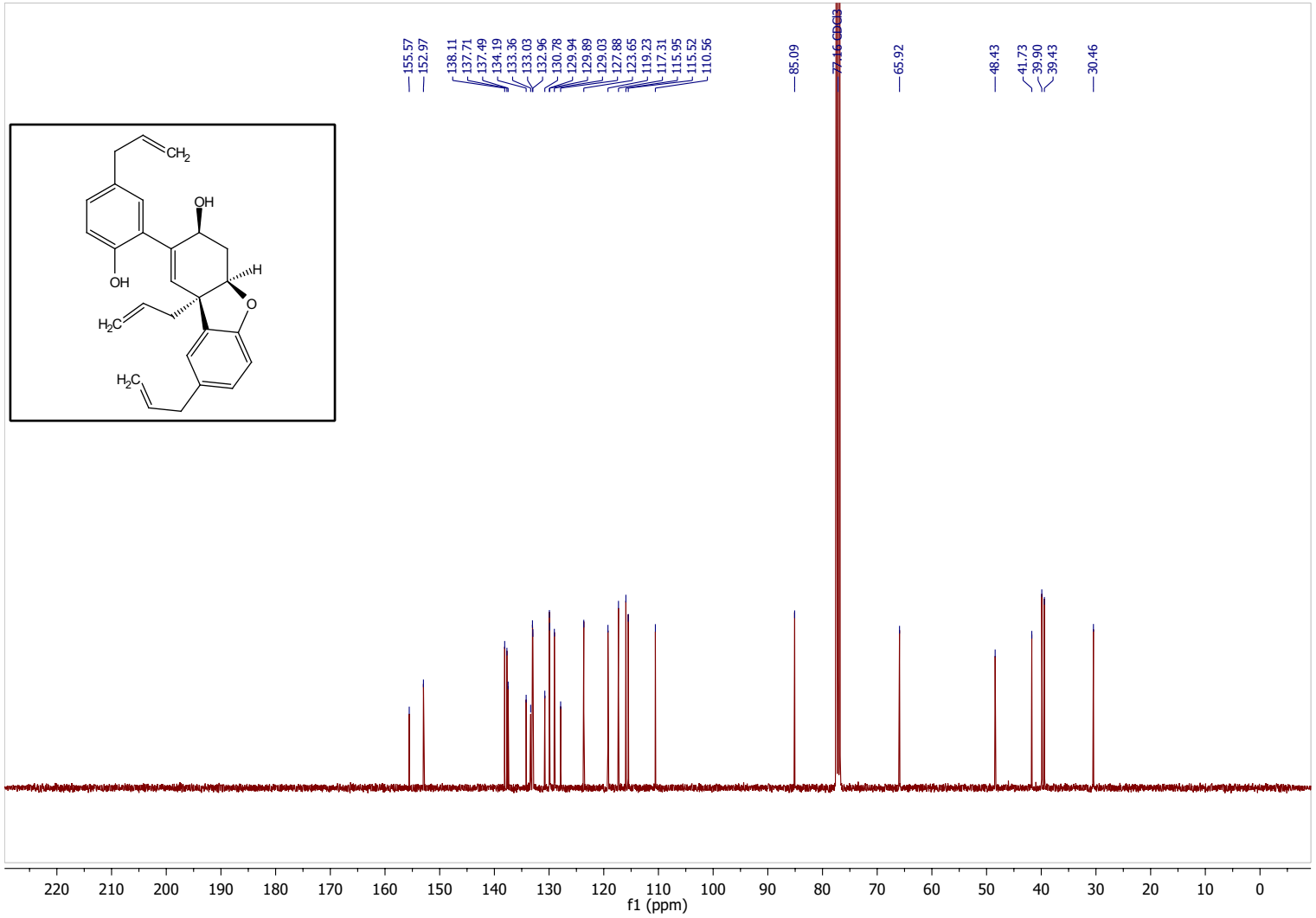

154.04
153.43
149.33
139.46
137.50
137.47
136.82
134.09
133.73
132.71
131.73
129.54
129.32
129.22
126.84
126.71
125.65
123.86
117.12
116.18
116.12
111.86
103.57
56.57
39.88
39.49
39.04
CH3
O
OH
CH2
CH2
O
HO
f1 (ppm)

60

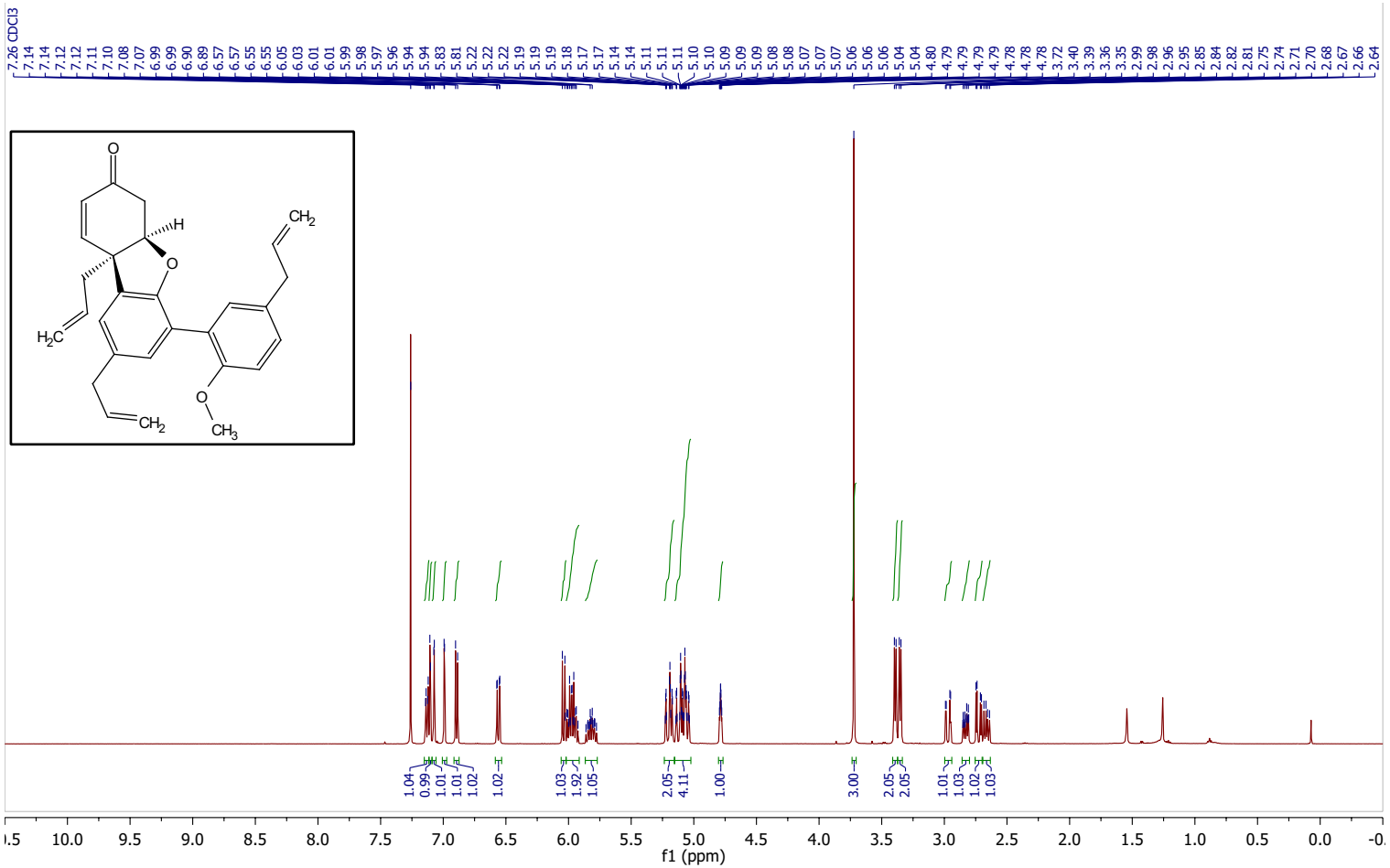


1H NMR (500 MHz, Chloroform-d) δ 9.33 (s, 1H), 7.02 (d, J = 1.8 Hz, 1H), 6.99 (dd, J = 8.2, 2.2 Hz, 1H), 6.98 (dd, J = 8.0, 1.8 Hz, 1H), 6.83 (d, J = 2.2 Hz, 1H), 6.79 (d, J = 8.2 Hz, 1H), 6.77 (d, J = 8.0 Hz, 1H), 6.01 – 5.87 (m, 2H), 5.78 (s, 1H), 5.83 – 5.71 (m, 1H), 5.21 – 5.15 (m, 2H), 5.11 – 5.02 (m, 4H), 4.83 – 4.78 (m, 1H), 4.42 – 4.35 (m, 1H), 4.07 (s, 1H), 3.32 (d, J = 7.1 Hz, 2H), 3.30 (d, J = 7.1 Hz, 2H), 2.79 (ddd, J = 15.5, 3.2, 2.1 Hz, 1H), 2.76 (dd, J = 14.1, 7.1 Hz, 1H), 2.61 (dd, J = 14.1, 7.1 Hz, 1H), 2.09 (ddd, J = 15.5, 4.1, 2.5 Hz, 1H).

60

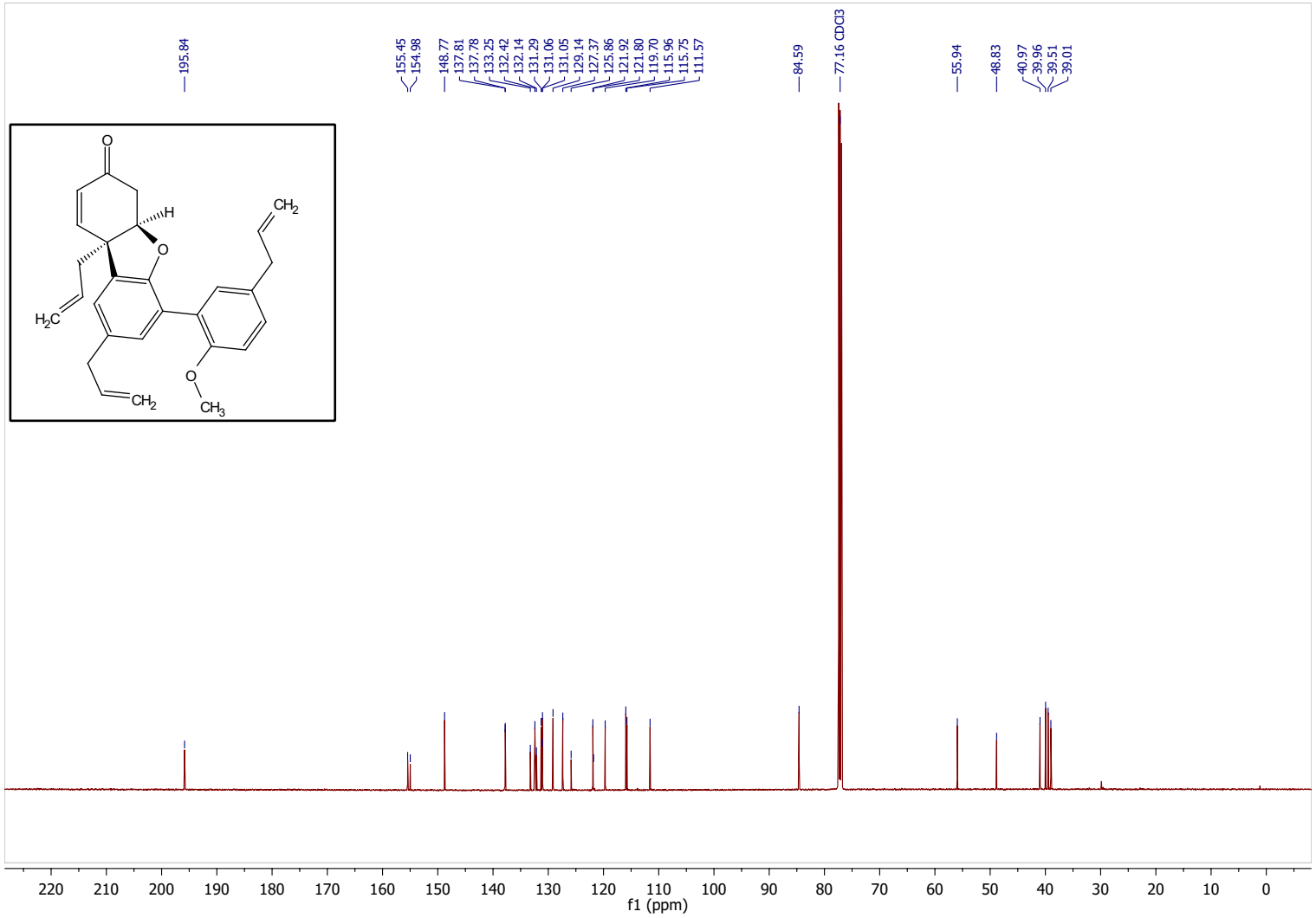

155.57
152.97
138.11
137.71
137.49
134.19
133.36
133.03
132.96
130.78
129.94
129.89
129.03
127.88
123.65
119.23
117.31
115.95
115.52
110.56
85.09
77.16 CDCl3
65.92
48.43
41.73
39.90
39.43
30.46
OH
OH
H
O
CH2
H2C
H2C
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

61

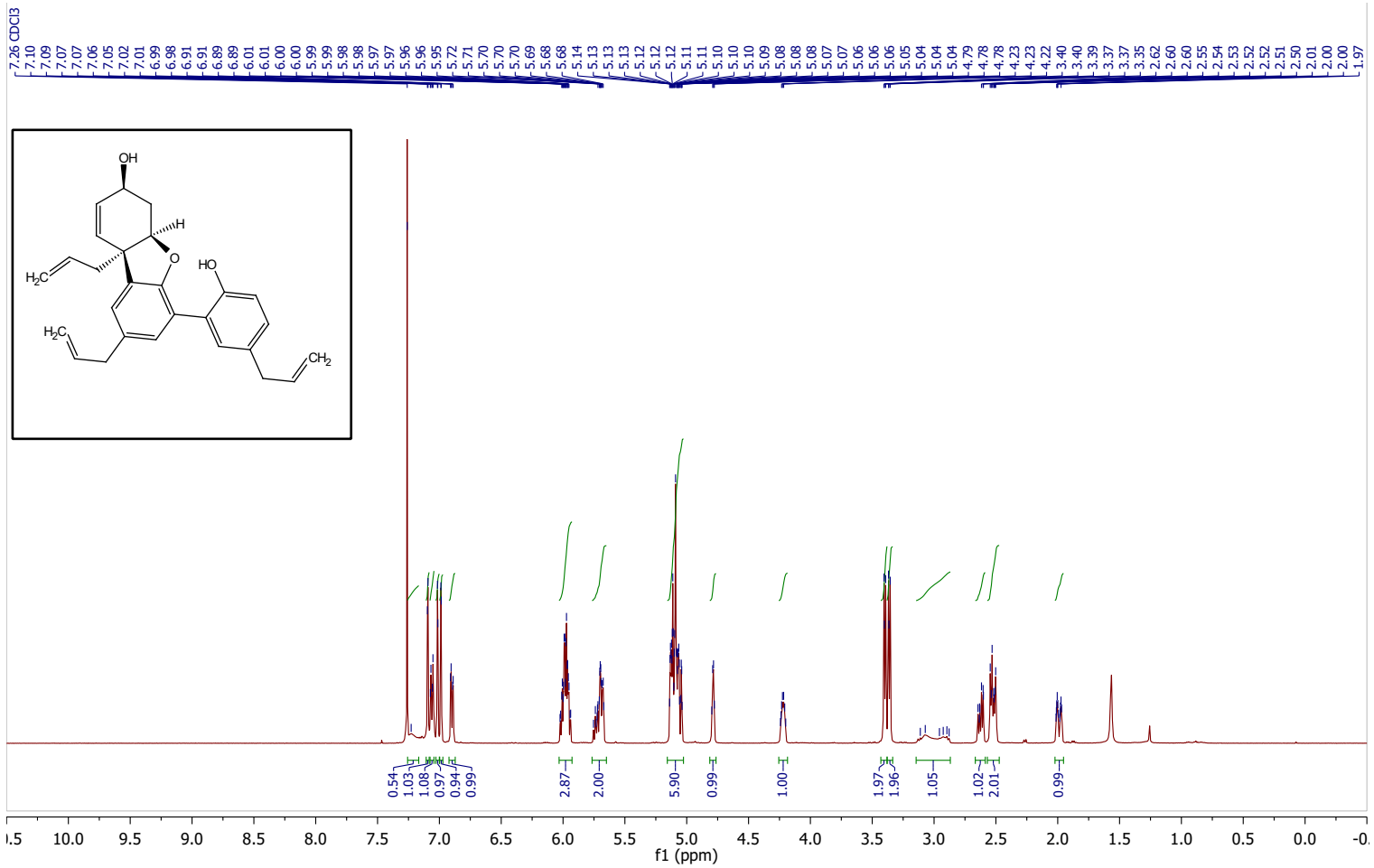


^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.13 (dd, *J* = 8.3, 2.3 Hz, 1H), 7.10 (d, *J* = 2.3 Hz, 1H), 7.07 (d, *J* = 1.7 Hz, 1H), 6.99 (d, *J* = 1.7 Hz, 1H), 6.89 (d, *J* = 8.3 Hz, 1H), 6.56 (dd, *J* = 10.2, 1.8 Hz, 1H), 6.04 (d, *J* = 10.2 Hz, 1H), 5.97 (dddd, *J* = 16.8, 9.9, 6.8, 6.8 Hz, 2H), 5.82 (dddd, *J* = 16.8, 10.0, 8.1, 6.6 Hz, 1H), 5.23 – 5.16 (m, 2H), 5.15 – 5.03 (m, 4H), 4.79 (ddd, *J* = 4.1, 3.0, 1.8 Hz, 1H), 3.72 (s, 3H), 3.39 (d, *J* = 6.8 Hz, 2H), 3.35 (d, *J* = 6.8 Hz, 2H), 2.97 (dd, *J* = 17.5, 3.0 Hz, 1H), 2.83 (dddd, *J* = 14.2, 6.6, 1.4, 1.4 Hz, 1H), 2.73 (dd, *J* = 17.5, 4.1 Hz, 1H), 2.66 (dd, *J* = 14.2, 8.1 Hz, 1H).

61

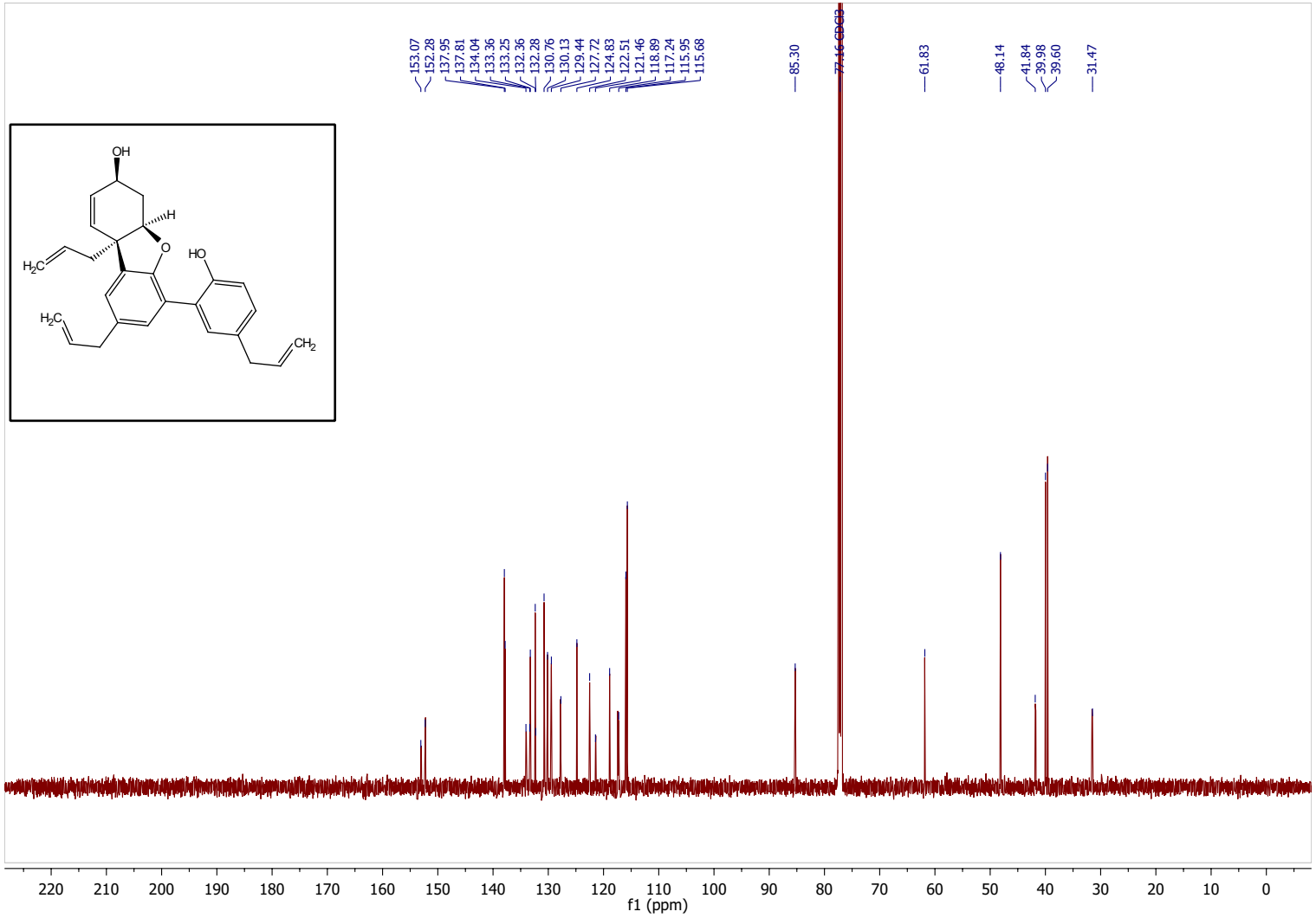

195.84
155.45
154.98
148.77
137.81
137.78
133.25
132.42
132.14
131.29
131.06
131.05
129.14
127.37
125.86
121.92
121.80
119.70
115.96
115.75
111.57
84.59
77.16 CDCl3
55.94
48.83
40.97
39.96
39.51
39.01
O
H
O
CH2
H2C
CH2
O
CH3
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

62

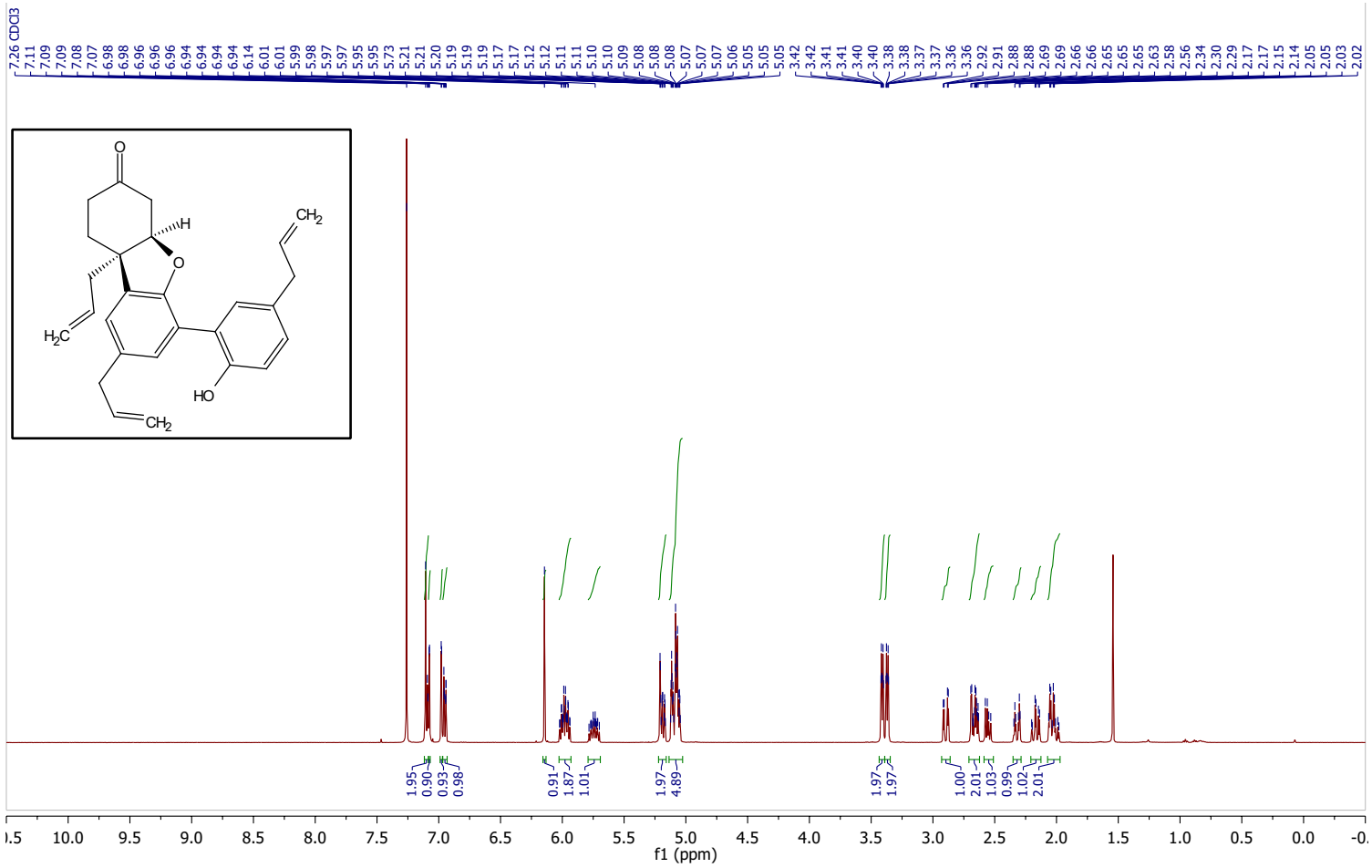


^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.27 – 7.17 (m, 1H), 7.09 (d, *J* = 2.3 Hz, 1H), 7.06 (dd, *J* = 8.2, 2.3 Hz, 1H), 7.01 (d, *J* = 1.7 Hz, 1H), 6.98 (d, *J* = 1.7 Hz, 1H), 6.90 (d, *J* = 8.2 Hz, 1H), 5.98 (d, *J* = 10.0 Hz, 1H), 6.04 – 5.92 (m, 2H), 5.77 – 5.65 (m, 1H), 5.68 (d, *J* = 10.0 Hz, 1H), 5.15 – 5.03 (m, 6H), 4.81 – 4.76 (m, 1H), 4.25 – 4.18 (m, 1H), 3.40 (d, *J* = 6.6 Hz, 2H), 3.36 (d, *J* = 6.6 Hz, 2H), 3.15 – 2.85 (m, 1H), 2.62 (dddd, *J* = 14.2, 7.0, 1.4, 1.4 Hz, 1H), 2.57 – 2.49 (m, 2H), 1.98 (ddd, *J* = 15.1, 4.7, 2.9 Hz, 1H).

62

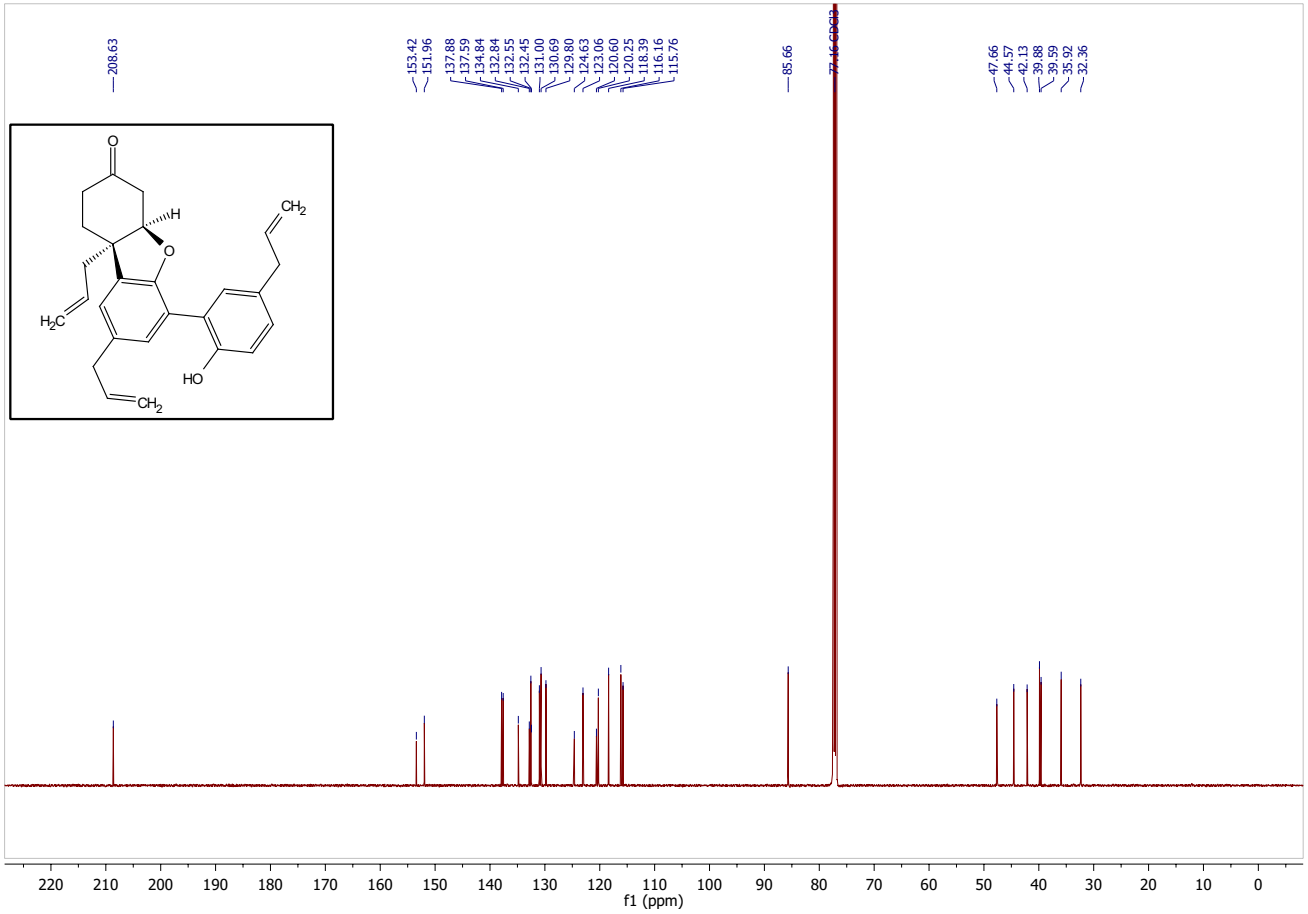

153.07
152.28
137.95
137.81
134.04
133.36
133.25
132.36
132.28
130.76
130.13
129.44
127.72
124.83
122.51
121.46
118.89
117.24
115.95
115.68
85.30
77.16
61.83
48.14
41.84
39.98
39.60
31.47
OH
H
O
HO
H2C
H2C
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

63



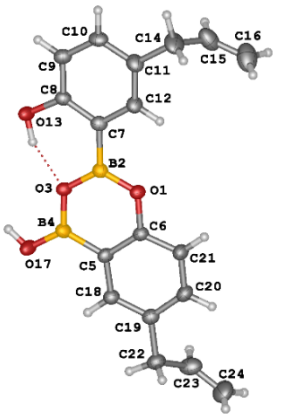
^{1}H NMR (500 MHz, Chloroform-*d*) δ 7.11 – 7.08 (m, 2H), 7.08 (d, *J* = 1.8 Hz, 1H), 6.98 (d, *J* = 1.8 Hz, 1H), 6.98 – 6.92 (m, 1H), 6.14 (s, 1H), 6.03 – 5.93 (m, 2H), 5.74 (dddd, *J* = 16.8, 10.5, 8.2, 6.6 Hz, 1H), 5.22 – 5.16 (m, 2H), 5.13 – 5.04 (m, 5H), 3.41 (ddd, *J* = 6.8, 1.5, 1.5 Hz, 2H), 3.37 (ddd, *J* = 6.7, 1.5, 1.5 Hz, 2H), 2.90 (dd, *J* = 17.1, 3.3 Hz, 1H), 2.67 (dd, *J* = 17.1, 3.7 Hz, 1H), 2.66 (dddd, *J* = 14.0, 6.6, 1.2, 1.2 Hz, 1H), 2.55 (dd, *J* = 14.0, 8.2 Hz, 1H), 2.35 – 2.29 (m, 1H), 2.22 – 2.13 (m, 1H), 2.08 – 1.97 (m, 2H).

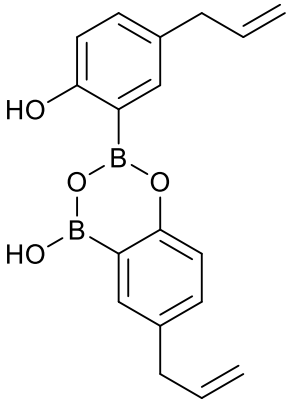
63


208.63
153.42
151.96
137.88
137.59
134.84
132.84
132.55
132.45
131.00
130.69
129.80
124.63
123.06
120.60
120.25
118.39
116.16
115.76
85.66
77.16 CDCl3
47.66
44.57
42.13
39.88
39.59
35.92
32.36
O
H
O
CH2
H2C
HO
CH2
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

Crystallographic data

25: 6-allyl-2-(5-allyl-2-hydroxyphenyl)-4H-benzo[e][1,3,2,4]dioxadiborinin-4-ol





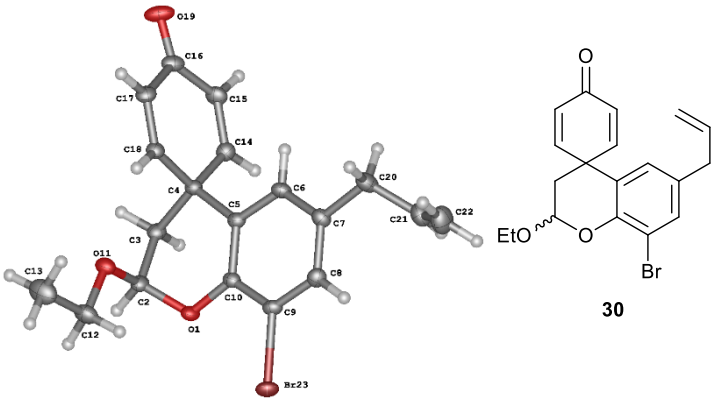
25

Crystal data and structure refinement for 25

Empirical formula	$C_{18}H_{18}B_2O_4$
Formula weight	319.94
Temperature/K	120(2)
Crystal system	monoclinic
Space group	C2/c
a/Å	31.4184(9)
b/Å	4.96092(16)
c/Å	21.7474(7)
α/°	90
β/°	101.804(3)
γ/°	90
Volume/Å^3	3317.97(19)
Z	8
ρ_{calc}g/cm^3	1.281
μ/mm^{-1}	0.706
F(000)	1344.0
Crystal size/mm^3	0.347 × 0.06 × 0.019

Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	8.308 to 147.492
Index ranges	-38 ≤ h ≤ 38, -6 ≤ k ≤ 6, -24 ≤ l ≤ 26
Reflections collected	19859
Independent reflections	3296 [R_{int} = 0.0353, R_{sigma} = 0.0179]
Data/restraints/parameters	3296/0/233
Goodness-of-fit on F^2	1.151
Final R indexes [I>=2σ (I)]	R_1 = 0.0835, wR_2 = 0.2607
Final R indexes [all data]	R_1 = 0.0875, wR_2 = 0.2630
Largest diff. peak/hole / e $Å^{-3}$	0.35/-0.38

30: 6-allyl-8-bromo-2-ethoxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one

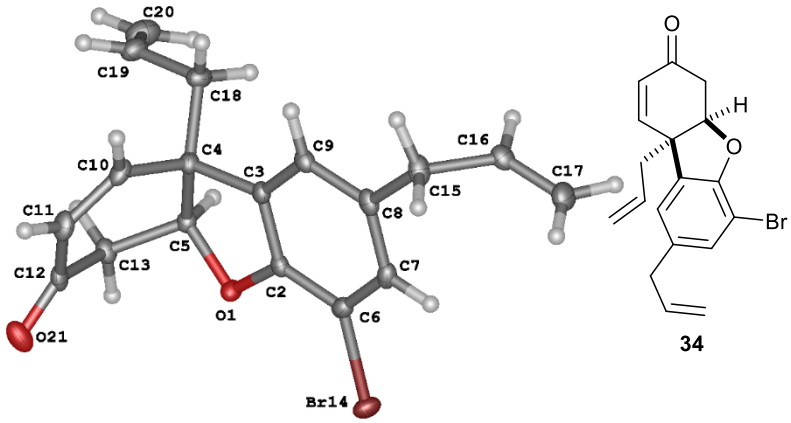


Crystal data and structure refinement for 30

Empirical formula	$C_{19}H_{19}O_3Br$
Formula weight	375.25
Temperature/K	120(2)
Crystal system	triclinic
Space group	P-1
a/Å	8.0674(3)
b/Å	10.0413(5)
c/Å	11.4509(5)
α/°	90.265(4)
β/°	105.787(4)
γ/°	106.880(4)
Volume/$Å^3$	850.63(7)
Z	2

ρ_{calc}g/cm^3	1.465
μ/mm^{-1}	3.393
F(000)	384.0
Crystal size/mm^3	0.391 × 0.06 × 0.028
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	8.058 to 149.252
Index ranges	-9 ≤ h ≤ 10, -12 ≤ k ≤ 12, -14 ≤ l ≤ 13
Reflections collected	16326
Independent reflections	3423 [R_{int} = 0.0294, R_{sigma} = 0.0173]
Data/restraints/parameters	3423/0/209
Goodness-of-fit on F^2	1.060
Final R indexes [I>=2σ (I)]	R_1 = 0.0234, wR_2 = 0.0612
Final R indexes [all data]	R_1 = 0.0242, wR_2 = 0.0617
Largest diff. peak/hole / e Å^{-3}	0.36/-0.32

34 (±)-(4a*R*,9b*R*)-8,9b-diallyl-6-bromo-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one

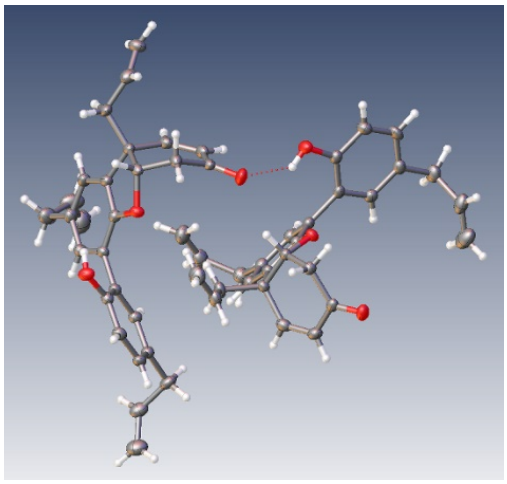


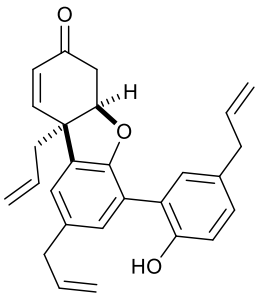
Crystal data and structure refinement for 34

Empirical formula	$C_{18}H_{17}O_2Br$
Formula weight	345.23
Temperature/K	120(2)
Crystal system	monoclinic
Space group	$P2_1/c$
a/Å	17.6068(5)
b/Å	7.4294(2)
c/Å	12.3043(4)
α/°	90
β/°	108.692(3)
γ/°	90
Volume/Å^3	1524.62(8)

Z	4
ρ_{calc}g/cm^3	1.504
μ/mm^{-1}	3.683
F(000)	704.0
Crystal size/mm^3	0.601 × 0.543 × 0.233
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	10.608 to 149.108
Index ranges	-21 ≤ h ≤ 21, -8 ≤ k ≤ 9, -15 ≤ l ≤ 15
Reflections collected	25893
Independent reflections	3083 [R_{int} = 0.0310, R_{sigma} = 0.0122]
Data/restraints/parameters	3083/0/190
Goodness-of-fit on F^2	1.188
Final R indexes [I>=2σ (I)]	R_1 = 0.0291, wR_2 = 0.0750
Final R indexes [all data]	R_1 = 0.0292, wR_2 = 0.0751
Largest diff. peak/hole / e Å^{-3}	0.40/-0.70

simonsol C (2): (±)-(4a*R*,9b*R*)-8,9b-diallyl-6-(5-allyl-2-hydroxyphenyl)-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one





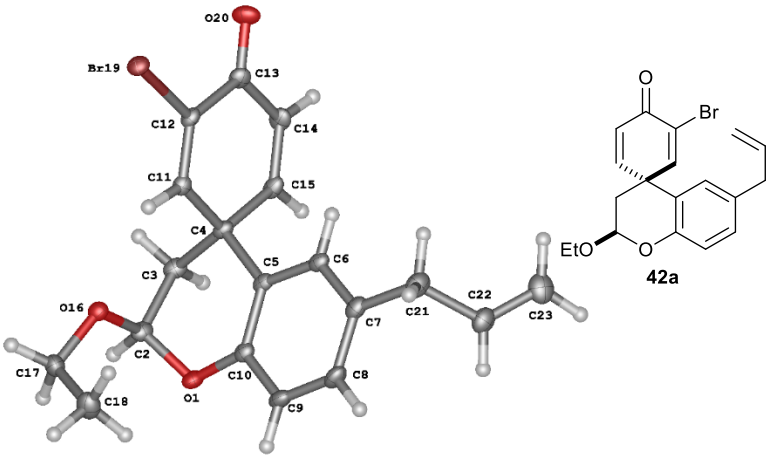
simonsol C (**2**)

Crystal data and structure refinement for simonsol C (2)

Empirical formula	$C_{27}H_{26}O_3$
Formula weight	398.48
Temperature/K	120(2)
Crystal system	monoclinic
Space group	$P2_1/n$
a/Å	11.5253(3)
b/Å	11.2640(3)
c/Å	33.0222(10)
α/°	90
β/°	92.545(2)

γ/°	90
Volume/Å^3	4282.7(2)
Z	8
ρ_{calc}g/cm^3	1.236
μ/mm^{-1}	0.627
F(000)	1696.0
Crystal size/mm^3	0.418 × 0.108 × 0.039
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	5.358 to 147.942
Index ranges	-13 ≤ h ≤ 14, -13 ≤ k ≤ 13, -39 ≤ l ≤ 40
Reflections collected	32607
Independent reflections	8478 [R_{int} = 0.0603, R_{sigma} = 0.0498]
Data/restraints/parameters	8478/0/543
Goodness-of-fit on F^2	1.085
Final R indexes [I>=2σ (I)]	R_1 = 0.0730, wR_2 = 0.1582
Final R indexes [all data]	R_1 = 0.0939, wR_2 = 0.1713
Largest diff. peak/hole / e Å^{-3}	0.57/-0.30

42a: (±)-(2*R*,4*R*)-6-allyl-3'-bromo-2-ethoxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one

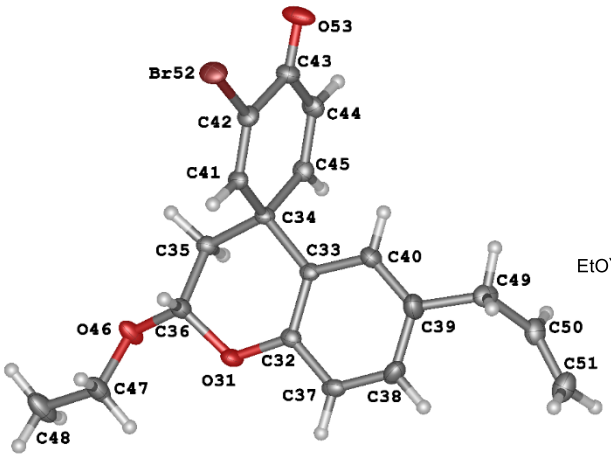


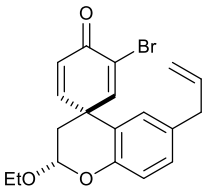
Crystal data and structure refinement for 42a

Empirical formula	$C_{19}H_{19}BrO_3$
Formula weight	375.25
Temperature/K	120(2)
Crystal system	monoclinic
Space group	$P2_1/n$
a/Å	9.0694(3)
b/Å	10.5320(3)

c/Å	17.2799(6)
α/°	90
β/°	100.156(3)
γ/°	90
Volume/Å^3	1624.70(9)
Z	4
ρ_{calc}g/cm^3	1.534
μ/mm^{-1}	3.553
F(000)	768.0
Crystal size/mm^3	0.719 × 0.486 × 0.412
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	9.878 to 148.898
Index ranges	-10 ≤ h ≤ 11, -13 ≤ k ≤ 11, -21 ≤ l ≤ 12
Reflections collected	6146
Independent reflections	3197 [R_{int} = 0.0244, R_{sigma} = 0.0245]
Data/restraints/parameters	3197/0/210
Goodness-of-fit on F^2	1.104
Final R indexes [I>=2σ (I)]	R_1 = 0.0294, wR_2 = 0.0777
Final R indexes [all data]	R_1 = 0.0307, wR_2 = 0.0785
Largest diff. peak/hole / e Å^{-3}	0.42/-0.37

42b: (±)-(2*S*,4*R*)-6-allyl-3'-bromo-2-ethoxyspiro[chromane-4,1'-cyclohexane]-2',5'-dien-4'-one





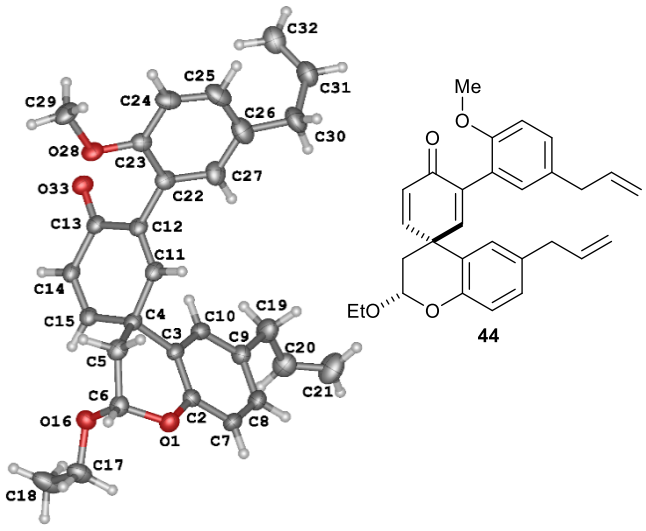
42b

Crystal data and structure refinement for 42b

Empirical formula	$C_{19}H_{19}O_3Br$
Formula weight	375.25
Temperature/K	120(2)
Crystal system	triclinic
Space group	P-1

a/Å	11.1367(5)
b/Å	12.0896(6)
c/Å	14.1443(7)
α/°	66.361(5)
β/°	82.591(4)
γ/°	75.387(4)
Volume/Å^3	1687.30(16)
Z	4
ρ_{calc}g/cm^3	1.477
μ/mm^{-1}	3.421
F(000)	768.0
Crystal size/mm^3	0.345 × 0.254 × 0.105
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	6.826 to 147.354
Index ranges	-13 ≤ h ≤ 11, -14 ≤ k ≤ 15, -17 ≤ l ≤ 15
Reflections collected	12597
Independent reflections	6604 [R_{int} = 0.0214, R_{sigma} = 0.0249]
Data/restraints/parameters	6604/0/445
Goodness-of-fit on F^2	1.075
Final R indexes [I>=2σ (I)]	R_1 = 0.0357, wR_2 = 0.1009
Final R indexes [all data]	R_1 = 0.0383, wR_2 = 0.1022
Largest diff. peak/hole / e Å^{-3}	0.60/-0.52

44: (±)-acetal dienone

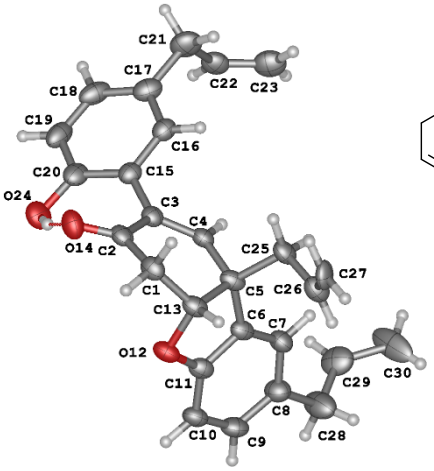


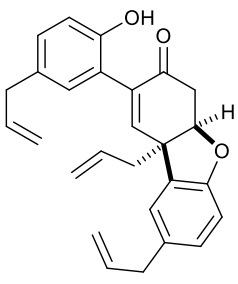
Crystal data and structure refinement for 44

Empirical formula	$C_{29}H_{30}O_4$
Formula weight	442.53

Temperature/K	120(2)
Crystal system	monoclinic
Space group	I2/a
a/Å	19.1851(6)
b/Å	7.8229(2)
c/Å	31.2872(11)
α/°	90
β/°	90.510(3)
γ/°	90
Volume/Å^3	4695.5(3)
Z	8
ρ_{calc}g/cm^3	1.252
μ/mm^{-1}	0.655
F(000)	1888.0
Crystal size/mm^3	0.32 × 0.283 × 0.044
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	5.65 to 147.386
Index ranges	-21 ≤ h ≤ 23, -6 ≤ k ≤ 9, -37 ≤ l ≤ 38
Reflections collected	9181
Independent reflections	4611 [R_{int} = 0.0230, R_{sigma} = 0.0263]
Data/restraints/parameters	4611/273/387
Goodness-of-fit on F^2	1.040
Final R indexes [I>=2σ (I)]	R_1 = 0.0456, wR_2 = 0.1214
Final R indexes [all data]	R_1 = 0.0497, wR_2 = 0.1261
Largest diff. peak/hole / e Å^{-3}	0.49/-0.26

simonsol F (**3**): (±)-(4a*R*,9b*R*)-8,9b-diallyl-2-(5-allyl-2-hydroxyphenyl)-4a,9b-dihydrodibenzo[b,d]furan-3(4H)-one





simonsol F (**3**)

Crystal data and structure refinement for simonsol F (3).

Empirical formula	$C_{27}H_{26}O_3$
Formula weight	398.48
Temperature/K	120(2)
Crystal system	monoclinic
Space group	$P2_1/c$
a/Å	18.6576(9)
b/Å	11.7041(5)
c/Å	10.0865(3)
α/°	90
β/°	102.695(4)
γ/°	90
Volume/Å^3	2148.74(16)
Z	4
ρ_{calc}g/cm^3	1.232
μ/mm^{-1}	0.625
F(000)	848.0
Crystal size/mm^3	0.402 × 0.05 × 0.026
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	4.854 to 147.642
Index ranges	-22 ≤ h ≤ 23, -14 ≤ k ≤ 14, -12 ≤ l ≤ 7
Reflections collected	8284
Independent reflections	4132 [R_{int} = 0.0423, R_{sigma} = 0.0505]
Data/restraints/parameters	4132/180/331
Goodness-of-fit on F^2	1.133
Final R indexes [I>=2σ (I)]	R_1 = 0.0584, wR_2 = 0.1526
Final R indexes [all data]	R_1 = 0.0934, wR_2 = 0.2029
Largest diff. peak/hole / e Å^{-3}	0.40/-0.35

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