**Supporting Information**

# First Total Synthesis of (−)-Sinularianin B

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## Experimental Section

**General**: All reagents (Aldrich, Kanto, TCI and Wako) and solvents were of commercial quality and were used as received. Reactions were monitored by thin layer chromatography on glass plates coated with a fluorescent indicator with a 254 nm excitation wavelength (Merck Merck-5554-7). Flash column chromatography was performed using Kanto Chemical Silica Gel 60N (spherical, natural) 40-50 μm. Melting points (mp) were measured using the Yanaco melting point apparatus MP-S3 and are uncorrected. Optical rotations were measured with a JASCO P-1030 polarimeter. IR spectra were recorded with a JASCO FT-IR/620 spectrometer. UV spectra were recorded using a SHIMADZU UV-1200 spectrophotometer. Single crystal X-ray diffraction was recorded using a MacScience Co., Ltd DIP 2020 Image Plate. $^{1}$H- and $^{13}$C NMR spectra were recorded on a Bruker DRX-400 or Bruker Biospin AV-600 spectrometer. Chemical shifts are given on the $\delta$ (ppm) scale using tetramethylsilane (TMS) as the internal standard (s, singlet; d, doublet; t, triplet; q, quartet; quint., quintet; m, multiplet; br, broad). High resolution ESIMS (HRESIMS) spectra were obtained using a Micromass LCT spectrometer. Elemental analysis data were obtained using an Elementar Vario EL.

**((2*R*,3*R*)-3-(2-(4-methoxybenzyloxy)ethyl)-3-methyloxiran-2-yl)methanol (3)**: To a cold (−20 °C) suspension of 4Å molecular sieves (8.44 g) in $CH_2Cl_2$ (38.0 mL) were added D-(−)-DIPT (1.50 mL, 7.13 mmol), Ti(O*i*Pr)$_4$ (1.10 mL, 3.73 mmol) and TBHP (5.55 M solution in $CH_2Cl_2$, 38.6 mL, 214 mmol). After stirring for 30 min at the same temperature, a solution of allylic alcohol **2** (16.9 g, 71.5 mmol) in $CH_2Cl_2$ (200 mL) was added over 10 hr. After stirring at −20 °C for 2 hr, NaOH (30% solution in brine, 3.25 mL) was added. The mixture was diluted with $Et_2O$, warmed to room temperature, and stirred for 10 min. Magnesium sulfate (2.90 g) and Celite (0.35 g) were then added, and after stirring for 15 min the mixture was passed through a pad of Celite and then concentrated *in vacuo*. The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 1:1) to give epoxyalcohol **3** (17.5 g, 97% yield) as a colorless oil. $R_f$ = 0.20 (hexane/AcOEt 1:1); $[\alpha]_D^{25}$ = +0.29 (*c* = 1.06 in $CHCl_3$); $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 7.24 (d, *J* = 8.6 Hz, 2H), 6.87 (d, *J* = 8.6 Hz, 2H), 4.43 (d, *J* = 14.7 Hz, 1H), 4.40 (d, *J* = 14.7 Hz, 1H), 3.80 (m, 1H), 3.79 (s, 3H), 3.65 (m, 1H), 3.57-3.51 (m, 2H), 3.02 (dd, *J* = 4.4, 6.5 Hz, 1H), 2.15 (brs, 1H), 1.94 (ddd, *J* = 5.9, 6.0, 14.3 Hz, 1H), 1.78 (ddd, *J* = 6.6, 7.1, 14.3 Hz, 1H), 1.30 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 159.1 (s), 130.2 (s), 129.2 (d)×2, 113.8 (d)×2, 72.6 (t), 66.0 (t), 62.8 (d), 61.2 (t), 59.6 (s), 55.2 (q), 38.2 (t), 17.2 (q); IR (neat): $\tilde{\nu}$ = 3441, 2932 cm$^{-1}$; HRMS (ESI): *m*/*z* calcd for $C_{14}H_{20}O_4$+Na$^+$: 275.1259 [*M*+Na$^+$]; found: 275.1247; elemental analysis calcd (%) for $C_{14}H_{20}O_4$: C 66.65, H 7.99; found: C 66.64, H 8.14.

**Determination of optical purity of synthetic (−)-epoxyalcohol 3.**

Before comparison between synthetic (−)-epoxyalcohol **3** and synthetic racemic epoxyalcohol *rac*-**3** with Chirabite-AR, we examined the effect of differing amounts of Chirabite-AR regarding *rac*-**3**, to determine sufficient signal separations between (+)- and (−)-**3**. Consequently, a mixture of *rac*-**3** with 75 mol% of Chirabite-AR was measured sequentially by 400 MHz $^{1}$H NMR at room

temperature in $CDCl_3$, the methine proton at C-9 signal separations were observed between 3.32 to 3.14 ppm, and good enantiomeric discrimination was achieved for (+)- and (−)-**3**. NMR analysis of (−)-epoxyalcohol **3** under the same conditions as used to obtain the results indicated that separated signals exhibited 71/1 ratio in numerical integration value. Therefore, the optical purity of synthetic (−)-**3** was determined as >95 %ee.

**(2*R*,3*R*)-3-benzyloxymethyl-2-(2-iodoethyl)-2-methyloxirane (4)**: To a stirring solution of epoxyalcohol **3** (16.5 g, 65.4 mmol) in THF (109 mL) were added NaH (55%, 5.70 g, 432 mmol), BnBr (11.7 mL, 98.5 mmol) and TBAI (2.40 g, 6.50 mmol) at 0 °C and then allowed to warm to room temperature. After stirring for 7 hr, MeOH (10.0 mL) was slowly added at 0 °C. The mixture was then allowed to warm to room temperature. After stirring for 1 hr, the mixture was diluted with $Et_2O$, washed with saturated aqueous $NaHCO_3$ solution, $H_2O$ and brine, and then concentrated *in vacuo*. The residue was passed through a pad of silica gel (hexane/AcOEt = 4:1) and then concentrated *in vacuo* to give a crude product.
To a stirring suspension of the crude product in $CH_2Cl_2$/saturated aqueous $NaHCO_3$ solution (10:1, 127 mL) were added DDQ (22.3 g, 98.2 mmol) over 10 min at room temperature. After stirring for 30 min, the reaction mixture was diluted with $Et_2O$, washed with saturated aqueous $NH_4Cl$ solution, $H_2O$ and brine, dried over anhydrous $Na_2SO_4$, and then concentrated *in vacuo*. The residue was passed through a pad of silica gel (hexane/AcOEt = 2:1) and then concentrated *in vacuo* to give a crude product.
To a cold (0 °C) solution of the crude product in $CH_2Cl_2$ (211 mL) were added $Ph_3P$ (19.9 g, 75.9 mmol), imidazole (6.47 g, 95.0 mmol). After stirring for 5 min at same temperature, $I_2$ (19.4 g, 76.4 mmol) was slowly added. The mixture was then allowed to warm to room temperature. After stirring for 10 min, the solvent was removed *in vacuo*. The residue was passed through a pad of silica gel (hexane/$Et_2O$ = 6:1) and then concentrated *in vacuo*. The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 9:1) to give epoxyiodide **4** (19.8 g, 91% yield for 3 steps) as a colorless oil. $R_f$ = 0.60 (hexane/AcOEt 2:1); $[\alpha]_D^{25}$ = +7.19 (*c* = 1.53 in $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 7.37-7.30 (m, 5H), 4.64 (d, *J* = 11.9 Hz, 1H), 4.55 (d, *J* = 11.9 Hz, 1H), 3.75 (dd, *J* = 4.2, 11.3 Hz, 1H), 3.55 (dd, *J* = 6.2, 11.3 Hz, 1H), 3.20 (ddd, *J* = 5.3, 8.6, 9.2 Hz, 1H), 3.15 (ddd, *J* = 1.9, 7.7, 8.6 Hz, 1H), 3.10 (dd, *J* = 4.2, 6.2 Hz, 1H), 2.24 (ddd, *J* = 5.3, 8.6, 14.3 Hz, 1H), 2.04 (ddd, *J* = 7.7, 9.2, 14.3 Hz, 1H), 1.26 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 137.8 (s), 128.4 (d)×2, 127.7 (d), 127.7 (d)×2, 73.2 (t), 68.5 (t), 61.1 (d), 60.1 (s), 42.2 (t), 16.2 (q), −1.2 (t); IR (neat): $\tilde{\nu}$ = 2925, 2857 cm$^{-1}$; HRMS (ESI): *m*/*z* calcd for $C_{13}H_{17}IO_2$+$H^+$: 333.0352 [*M*+$H^+$]; found: 333.0335; elemental analysis calcd (%) for $C_{13}H_{17}IO_2$: C 47.00, H 5.16; found: C 46.94, H 5.27.

**(1*R*,2*S*,3*R*)-2-benzyloxymethyl-1-methyl-3-phenylperoxythio-3-prop-1-en-2-ylcyclopentanol (5)**: To a solution of methallyl phenyl sulfone (1.45 g, 7.39 mmol) in THF (24.0 mL) were added $^n$BuLi (1.58 M solution in hexane, 4.50 mL, 7.11 mmol) at −78 °C. After stirring for 30 min at same temperature, a solution of epoxyiodide **4** (1.89 g, 5.69 mmol) in THF (90.0 mL) was added

and then allowed to warm to −45 °C over 18 h. After cooling to −78 °C, $^{n}$BuLi (1.58 M solution in hexane, 7.20 mL, 11.4 mmol). After stirring for 15 min at same temperature, $Me_3Al$ (1.07 M solution in hexane, 8.00 mL, 8.56 mmol) was introduced and then allowed to warm to −50 °C. After stirring for 2.5 hr, the reaction mixture was diluted with $Et_2O$, washed with saturated aqueous $NH_4Cl$ solution, 1.00 M aqueous HCl solution, $H_2O$ and brine, dried over anhydrous $Na_2SO_4$, and then concentrated *in vacuo*. The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 2:1) to give cyclopentane **5** (2.26 g, 99% yield) as a white needle-like crystalline solid. $R_f$ = 0.15 (hexane/AcOEt 2:1); m.p. 108-109 °C (recrystallized from hexane/AcOEt); $[\alpha]_D^{25}$ = −45.72 (*c* = 1.16 in $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 7.73-7.72 (m, 2H), 7.59 (m, 1H), 7.47-7.44 (m, 2H), 7.36-7.29 (m, 5H), 4.99 (s, 1H), 4.66 (d, *J* = 11.6 Hz, 1H), 4.61 (s, 1H), 4.59 (d, *J* = 11.6 Hz, 1H), 4.46 (dd, *J* = 4.8, 9.5 Hz, 1H), 4.41 (dd, *J* = 9.5, 11.4 Hz, 1H), 3.07 (brs, 1H), 2.75 (dd, *J* = 4.8, 11.4 Hz, 1H), 2.41 (dt, *J* = 6.4, 12.9 Hz, 1H), 1.98 (s, 3H), 1.92-1.81 (m, 2H), 1.71 (dt, *J* = 6.4, 12.9 Hz, 1H), 1.60 (s, 3H); NOE correlations (H/H): H-3 ($\delta_H$ 2.41)/*ortho*-H ($\delta_H$ 7.73), H-3 ($\delta_H$ 2.41)/H-10 ($\delta_H$ 1.60), H-3 ($\delta_H$ 1.71)/H-9 ($\delta_H$ 2.75), H-8 ($\delta_H$ 4.46)/H-10 ($\delta_H$ 1.60), H-8 ($\delta_H$ 4.41)/H-11 ($\delta_H$ 1.98), H-9 ($\delta_H$ 2.75)/H-11 ($\delta_H$ 1.98); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 142.2 (s), 137.8 (s), 136.0 (s), 133.5 (d), 130.3 (d)×2, 128.4 (d)×2, 128.0 (d)×2, 127.7 (d), 127.7 (d)×2, 118.1 (t), 80.4 (s), 77.5 (s), 73.6 (t), 68.8 (t), 57.9 (d), 38.0 (t), 31.4 (t), 22.9 (q), 20.8 (q); IR (KBr): $\tilde{\nu}$ = 3363, 2975, 2931, 1291, 1135 $cm^{-1}$; HRMS (ESI): *m*/*z* calcd for $C_{23}H_{28}O_4S+Na^+$: 423.1606 [*M*+$Na^+$]; found: 423.1591; elemental analysis calcd (%) for $C_{23}H_{27}O_4S$: C 68.97, H 7.05; found: C 69.17, H 7.00.

**(1*R*,2*S*,3*S*)-2-(benzyloxymethyl)-1-methyl-3-(prop-1-en-2-yl)cyclopentanol (7) and (1*R*,2*S*,3*R*)-2-(benzyloxymethyl)-1-methyl-3-(prop-1-en-2-yl)cyclopentanol (4-*epi*-7)**: $^{n}Bu_3P$ (0.82 mL, 3.28 mmol) was added to a solution of $Pd_2(dba)_3{\cdot}CHCl_3$ (1.36 g, 1.31 mmol) in 1,4-dioxane (200 mL) at room temperature and the mixture was stirred for 10 min. $Et_3N$ (18.3 mL, 131 mmol) and $HCO_2H$ (4.95 mL, 131 mmol) were added to the mixture at the same temperature. After stirring for 10 min, the mixture was refluxed. A solution of cyclopentane **5** (6.56 g, 16.4 mmol) in 1,4-dioxane (128 mL) was added to the mixture and the mixture was stirred for 15 min. The reaction mixture was concentrated *in vacuo*. The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 5:1) to give *trans*-cyclopentane **7** (3.89 g, 91% yield) as a colorless oil and *cis*-cyclopentane 4-*epi*-**7** (171 mg, 4% yield) as a colorless oil. *trans*-cyclopentane **7**: $R_f$ = 0.40 (hexane/AcOEt 3:1); $[\alpha]_D^{25}$ = +31.86 (*c* = 1.23 in $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 7.37-7.29 (m, 5H), 4.68 (s, 1H), 4.68 (s, 1H), 4.52 (d, *J* = 11.8 Hz, 1H), 4.45 (d, *J* = 11.8 Hz, 1H), 3.55 (dd, *J* = 4.0, 9.4 Hz, 1H), 3.43 (t, *J* = 9.4 Hz, 1H), 2.85 (brs, 1H), 2.28-2.16 (m, 2H), 1.87-1.59 (m, 4H), 1.72 (s, 3H), 1.24 (s, 3H); $^1$H NMR (400 MHz, $C_6D_6$): $\delta$ = 7.31-7.16 (m, 5H), 4.84 (s, 1H), 4.81 (s, 1H), 4.33 (d, *J* = 11.9 Hz, 1H), 4.26 (d, *J* = 11.9 Hz, 1H), 3.55 (dd, *J* = 4.4, 9.4 Hz, 1H), 3.38 (t, *J* = 9.4 Hz, 1H), 2.72 (brs, 1H), 2.40 (dt, *J* = 4.4, 10.7 Hz, 1H), 2.24 (dt, *J* = 10.7, 8.7 Hz, 1H), 2.05 (dt, *J* = 11.0, 7.4 Hz, 1H), 1.78-1.64 (m, 3H), 1.71 (s, 3H), 1.33 (s, 3H); NOE correlations (H/H): H-4 ($\delta_H$ 2.24)/H-10 ($\delta_H$ 1.33), H-8 ($\delta_H$ 3.55 and 3.38)/H-10 ($\delta_H$ 1.33), H-9 ($\delta_H$ 2.40)/H-11 ($\delta_H$ 1.71); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 146.7 (s),

138.0 (s), 128.4 (d)×2, 127.7 (d), 127.7 (d)×2, 110.5 (t), 80.1 (s), 73.5 (t), 70.8 (t), 51.5 (d), 47.6 (d), 39.4 (t), 27.2 (t), 23.5 (q), 18.7 (q); $^{13}$C NMR (100 MHz, $C_6D_6$): $\delta$ = 147.2 (s), 138.6 (s), 128.6 (d)×2, 128.5 (d), 127.8 (d)×2, 110.6 (t), 80.0 (s), 73.5 (t), 70.9 (t), 52.5 (d), 48.4 (d), 40.4 (t), 27.8 (t), 24.1 (q), 18.8 (q); IR (neat): $\tilde{\nu}$ = 3446, 2962, 2871, 1645, 1098 cm$^{-1}$; HRMS (ESI): *m*/*z* calcd for $C_{17}H_{24}O_2$+Na$^+$: 283.1674 [*M*+Na$^+$]; found: 283.1677; elemental analysis calcd (%) for $C_{17}H_{24}O_2$: C 78.42, H 9.29; found: C 78.26, H 9.03. *cis*-cyclopentane 4-*epi*-**7**: $R_f$ = 0.35 (hexane/AcOEt 3:1); $[\alpha]_D^{25}$ = −15.57 (*c* = 1.27 in $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 7.35-7.27 (m, 5H), 4.85 (s, 1H), 4.74 (s, 1H), 4.40 (s, 2H), 3.40 (dd, *J* = 3.4, 9.8 Hz, 1H), 3.26 (dd, *J* = 7.7, 9.8 Hz, 1H), 3.08 (dd, *J* = 8.2, 16.2 Hz, 1H), 2.15 (dt, *J* = 3.4, 7.7 Hz, 1H), 1.89-1.73 (m, 4H), 1.76 (s, 3H), 1.62 (m, 1H), 1.41 (s, 3H); NOE correlations (H/H): H-4 ($\delta_H$ 3.08)/H-9 ($\delta_H$ 2.15), H-8 ($\delta_H$ 3.40 and 3.26)/H-10 ($\delta_H$ 1.41), H-8 ($\delta_H$ 3.40 and 3.26)/H-11 ($\delta_H$ 1.76); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 145.7 (s), 138.5 (s), 128.3 (d)×2, 127.4 (d)×2, 127.4 (d), 110.5 (t), 81.9 (s), 73.2 (t), 68.7 (t), 52.7 (d), 47.0 (d), 39.3 (t), 26.3 (t), 25.5 (q), 23.7 (q); IR (neat): $\tilde{\nu}$ = 3387, 2963, 2936, 2871, 1646, 1070 cm$^{-1}$; HRMS (ESI): *m*/*z* calcd for $C_{17}H_{24}O_2$+Na$^+$: 283.1674 [*M*+Na$^+$]; found: 283.1669; elemental analysis calcd (%) for $C_{17}H_{24}O_2$: C 78.42, H 9.29; found: C 78.18, H 9.29.

**(1*R*,2*R*,5*S*)-2-hydroxy-2-methyl-5-(prop-1-en-2-yl)cyclopentanecarbaldehyde (8)**: A solution of *trans*-cyclopentane **7** (2.63 g, 10.1 mmol) in THF (50.5 mL) was added to a pre-prepared Na (2.53 g, 110 mmol)/liquid ammonia (50.5 mL) at −78 °C. After stirring for 20 min, $NH_4Cl$ (10.1 g, 189 mmol) was added to the mixture and excess $NH_3$ was removed by warming. The reaction mixture was diluted with $Et_2O$, washed with $H_2O$ and brine, dried over anhydrous $Na_2SO_4$, and then concentrated *in vacuo*. The residue was passed through a pad of silica gel (hexane/AcOEt = 3:2) and then concentrated *in vacuo* to give a crude product.

To a solution of IBX (5.66 g, 20.2 mmol) in DMSO (50.5 mL) was added a solution of the above crude product in THF (50.5 mL). After stirring for 2.5 hr at room temperature, $H_2O$ was added to the mixture. After diluting with $Et_2O$, the mixture was filtered through celite, washed with $H_2O$ and brine, dried over anhydrous $Na_2SO_4$, and then concentrated *in vacuo.* The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 2:1) to give aldehyde **8** (1.64 g, 96% yield for 2 steps) as a colorless oil. $R_f$ = 0.30 (hexane/AcOEt 2:1); $[\alpha]_D^{25}$ = −29.48 (*c* = 1.27 in $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 9.72 (d, *J* = 2.8 Hz, 1H), 4.74 (s, 1H), 4.73 (s, 1H), 2.99 (m, 1H), 2.75 (dd, *J* = 2.8, 9.8 Hz, 1H), 2.12 (brs, 1H), 1.95-1.67 (m, 4H), 1.72 (s, 3H), 1.34 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 203.7 (d), 145.7 (s), 110.5 (t), 81.3 (s), 65.8 (d), 45.7 (d), 41.9 (t), 28.0 (t), 25.3 (q), 20.3 (q); IR (neat): $\tilde{\nu}$ = 3416, 2968, 1717, 1652, 1104 cm$^{-1}$; HRMS (ESI): *m*/*z* calcd for $C_{10}H_{16}O_2$+Na$^+$: 191.1048 [*M*+Na$^+$]; found: 191.1041; elemental analysis calcd (%) for $C_{10}H_{16}O_2$: C 71.39, H 9.59; found: C 71.49, H 9.50.

**(3*R*,3a*R*,4*R*,7a*S*)-4-(*tert*-butyldimethylsilyloxy)-3-hydroxy-3,7-dimethyl-2,3,3a,4,5,7a-hexahydro-1*H*-indene-4-carbaldehyde (10)**: To a stirring solution of aldehyde **8** (121 mg, 0.718 mmol) in THF (109 mL) were added TBSCN (122 mg, 0.862 mmol), and PNPCl (41.3 mg, 0.0718 mmol)

at room temperature. After stirring for 2 hr, TMSCN (0.14 mL, 1.12 mmol) was added at same temperature. The mixture was concentrated *in vacuo*, and the residue was passed through a pad of silica gel (hexane/AcOEt = 15:1) and then concentrated *in vacuo* to give a crude product.

A solution of the above crude product in THF (4.00 mL) was added to a pre-prepared LDA (0.39 M solution in THF, 4.97 mL, 1.94 mmol) at −78 °C and then allowed to warm to 0 °C. After stirring for 40 min, the mixture was cooled to −78 °C, and then pre-mixed allyl bromide (0.31 mL, 3.59 mmol) and HMPA (0.31 mL, 1.80 mmol) was introduced to the mixture. After stirring for 15 min at same temperature, the reaction mixture was diluted with $Et_2O$, washed with saturated aqueous $NH_4Cl$ solution, $H_2O$ and brine, dried over anhydrous $Na_2SO_4$, and then concentrated *in vacuo*. The residue was passed through a pad of silica gel (hexane/AcOEt = 30:1) and then concentrated *in vacuo* to give a crude diene **9**.

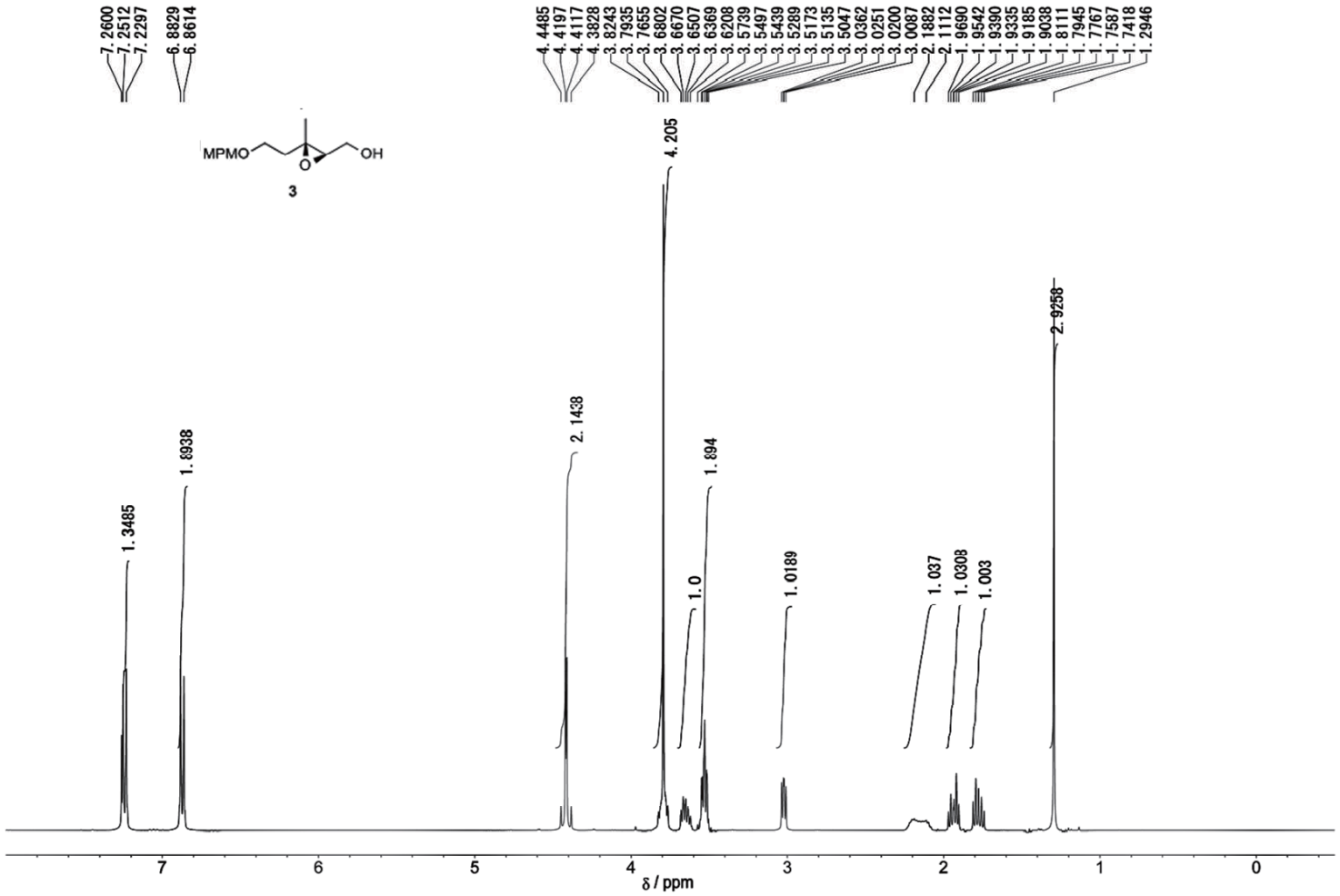
To a stirring solution of the above crude diene **9** in degassed 1,2-dichloroethane (144 mL) was added Grubbs 2$^{nd}$ generation catalyst (61.0 mg, 0.0718 mmol) at room temperature, and then refluxed. After stirring for 6 hr, cooled to room temperature, and then added DMSO (0.51 mL, 7.18 mmol). After stirring for 12 hr, the solvent was removed *in vacuo*, the residue was diluted with $Et_2O$ and the residue was passed through a pad of silica gel (hexane/AcOEt = 12:1) and then concentrated *in vacuo* to give a crude product.

To a stirring solution of the above crude product in toluene (14.4 mL) was added DIBAH (1.02 M solution in hexane, 1.41 mL, 1.44 mmol) at −78 °C and then allowed to warm to 0 °C. After stirring for 30 min, the mixture was cooled to −78 °C, and then $Et_2O$ (14.4 mL), saturated aqueous $NH_4Cl$ solution (7.18 mL), and 0.50 M aqueous $H_2SO_4$ solution (14.4 mL) were introduced to the mixture. The mixture was then allowed to warm to room temperature and then the reaction mixture was diluted with $Et_2O$, washed with saturated aqueous $NH_4Cl$ solution, $H_2O$ and brine, dried over anhydrous $Na_2SO_4$, and then concentrated *in vacuo*. The residue was passed through a pad of silica gel (hexane/AcOEt = 15:1) and then concentrated *in vacuo* to give a crude product.

To a stirring solution of the above crude product in THF (7.18 mL) were added acetic acid (0.82 mL, 14.4 mmol) and TBAF (1.00 M solution in THF, 7.18 mL, 7.18 mmol) at room temperature, and then allowed to warm to 40 °C. After stirring for 5 hr, the reaction mixture was diluted with $Et_2O$, washed with saturated aqueous $NaHCO_3$ solution, $H_2O$ and brine, dried over anhydrous $Na_2SO_4$, and then concentrated *in vacuo*. The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 4:1) to give α-siloxyaldehyde **10** (156 mg, 67% yield for 5 steps) as a white needle-like crystalline solid. $R_f$ = 0.60 (hexane/AcOEt 2:1); m.p. 77-78 °C (recrystallized from hexane/AcOEt); $[\alpha]_D^{25}$ = +9.70 ($c$ = 1.51 in $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 9.77 (s, 1H), 5.21 (s, 1H), 2.58 (m, 1H), 2.43 (m, 1H), 1.99 (d, $J$ = 12.6 Hz, 1H), 1.96-1.73 (m, 4H), 1.69 (3H, s), 1.45 (m, 1H), 1.30 (s, 3H), 0.85 (s, 9H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 204.0 (d), 137.4 (s), 116.5 (d), 81.3 (s), 78.4 (s), 58.9 (d), 41.5 (t), 39.8 (d), 35.3 (t), 27.9 (q), 25.8 (q)×3, 25.6 (t), 20.2 (q), 18.6 (s), −2.5 (q), −3.1 (q); IR (KBr): $\tilde{\nu}$ = 3420, 2956, 2931, 2857, 1733, 1653 cm$^{-1}$; HRMS (ESI): $m/z$ calcd for $C_{10}H_{16}O_2$+$Na^+$: 347.2018 [$M$+$Na^+$]; found: 347.2023; elemental analysis calcd (%) for $C_{18}H_{32}O_3Si$: C 66.62, H 9.94; found: C 66.54, H 9.90.

**(4a*S*,4a$^1$*R*,7a*S*,9a*R*)-4a-(*tert*-butyldimethylsilyloxy)-3,7,9a-trimethyl-4a,5,7a,8,9,9a-hexahydroindeno[1,7-*bc*]oxepin-2(4a$^1$*H*)-one (12)**: To a stirring solution of α-siloxyaldehyde **10** (101 mg, 0.311 mmol) in $CH_2Cl_2$ (6.22 mL) were added 2-(diethoxyphosphoryl)propanoic acid (211 mg, 0.933 mmol), and WSC (179 mg, 0.933 mmol) at room temperature. After stirring for 30 min, the mixture was diluted with $Et_2O$, washed with saturated aqueous $NaHCO_3$ solution, $H_2O$ and brine, and then concentrated *in vacuo*. The residue was passed through a pad of silica gel (hexane/AcOEt = 3:2) and then concentrated *in vacuo* to give a crude product.
To a stirring solution of the above crude product in THF (62.4 mL) was added KO$^t$Bu (48.9 mg, 0.435 mmol) at room temperature and then allowed to warm to 60 °C. After stirring for 2 hr, the mixture was cooled to room temperature and then the reaction mixture was diluted with $Et_2O$, washed with saturated aqueous $NH_4Cl$ solution, $H_2O$ and brine, and then concentrated *in vacuo*. The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 12:1) to give α,β-unsaturated lactone **12** (88.1 mg, 78% yield for 2 steps) as a colorless oil. $R_f$ = 0.35 (hexane/AcOEt 12:1); $[\alpha]_D^{25}$ = +161.66 (*c* = 1.29 in $CHCl_3$); $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 6.20 (s, 1H), 5.14 (s, 1H), 2.46 (m, 1H), 2.31 (dd, *J* = 11.4, 13.8 Hz, 1H), 2.24 (m, 1H), 2.13 (m, 1H), 2.08 (d, *J* = 12.7 Hz, 1H), 2.05 (s, 3H), 1.96 (m, 1H), 1.86 (dt, *J* = 14.8, 8.8 Hz, 1H), 1.68 (s, 3H), 1.51 (s, 3H), 1.49 (m, 1H), 0.83 (s, 9H), 0.11 (s, 6H); $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 167.9 (s), 140.7 (d), 137.0 (s), 127.7 (s), 117.7 (d), 85.8 (s), 73.1 (s), 58.7 (d), 41.3 (d), 41.1 (t), 40.7 (t), 26.5 (t), 25.7 (q)×3, 24.6 (q), 24.1 (q), 20.1 (q), 18.4 (s), −2.1 (q), −2.4 (q); IR (neat): $\tilde{\nu}$ = 2957, 2930, 2857, 1698, 1684, 1254 cm$^{-1}$; UV/Vis: $\lambda_{max}$ (MeOH)/nm 215sh ($\varepsilon$ /dm$^3$ mol$^{-1}$ cm$^{-1}$ 9100); HRMS (ESI): *m*/*z* calcd for $C_{21}H_{34}O_3Si$+H$^+$: 363.2355 [*M*+H$^+$]; found: 363.2350; elemental analysis calcd (%) for $C_{21}H_{34}O_3Si$: C 69.56, H 9.45; found: C 69.39, H 9.49.

**Sinularianin B (1)**: To a stirring solution of α,β-unsaturated lactone **12** (71.0 mg, 0.196 mmol) in THF (1.96 mL) was added TBAF (1.00 M solution in THF, 0.49 mL, 0.490 mmol) at room temperature. After stirring for 2 hr, a suspension of 4Å molecular sieves (14.0 mg) and $K_2CO_3$ (271 mg, 1.96 mmol) in MeOH (9.80 mL) was added and the mixture was warmed to 40 °C. After stirring for 36 hr, the solvent was removed *in vacuo*. The residue was passed through a pad of silica gel ($Et_2O$) and then concentrated *in vacuo*. The residue was purified with flash column chromatography on silica gel (hexane/AcOEt = 2:1) to give sinularianin B **(1)** (48.0 mg, 99% yield) as a colorless oil. $R_f$ = 0.15 (hexane/AcOEt 2:1); $[\alpha]_D^{25}$ = −111.40 (*c* = 1.55 in $CHCl_3$); $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 7.16 (d, *J* = 1.5 Hz, 1H), 5.24 (dd, *J* = 1.9, 2.3 Hz, 1H), 2.57 (m, 1H), 2.53 (m, 1H), 1.98 (d, *J* = 12.8 Hz, 1H), 1.95-1.75 (m, 4H), 1.93 (d, *J* = 1.5 Hz, 3H), 1.71 (s, 3H), 1.47 (brs, 1H), 1.43 (m, 1H), 1.12 (s, 3H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 173.7 (s), 152.2 (d), 137.3 (s), 129.1 (s), 117.2 (d), 85.4 (s), 78.4 (s), 56.6 (d), 41.8 (t), 40.9 (d), 39.7 (t), 26.0 (q), 25.3 (t), 20.2 (q), 10.6 (q); IR (neat): $\tilde{\nu}$ = 3445, 2962, 1734, 1658 cm$^{-1}$; UV/Vis $\lambda_{max}$ (MeOH)/nm 213sh ($\varepsilon$ /dm$^3$ mol$^{-1}$ cm$^{-1}$ 9600); HRMS (ESI): *m*/*z* calcd for $C_{15}H_{20}O_3$+Na$^+$: 271.1310 [*M*+Na$^+$]; found: 271.1313; elemental analysis calcd (%) for $C_{15}H_{20}O_3$: C 72.55, H 8.12; found: C 72.37, H 7.93.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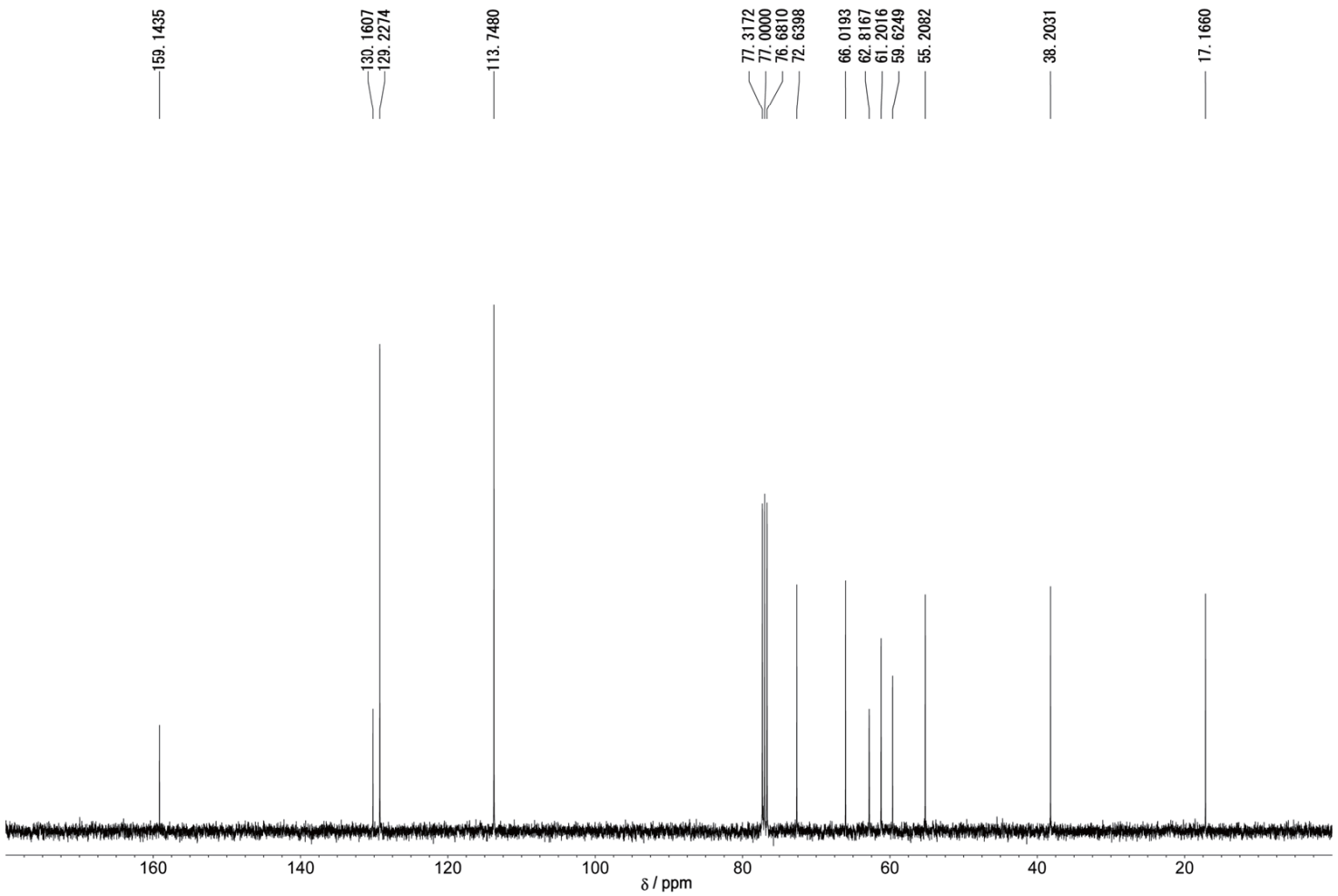
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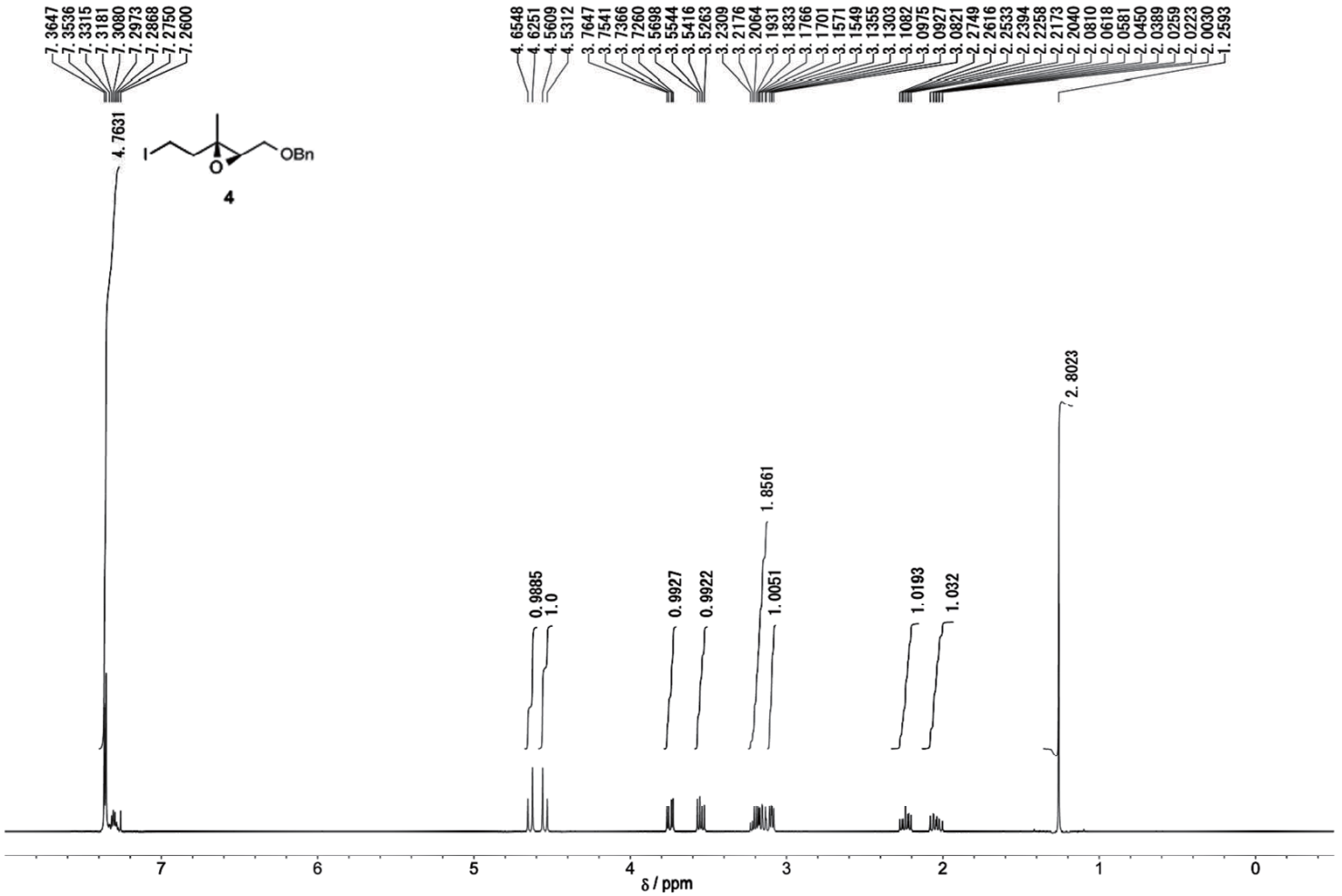
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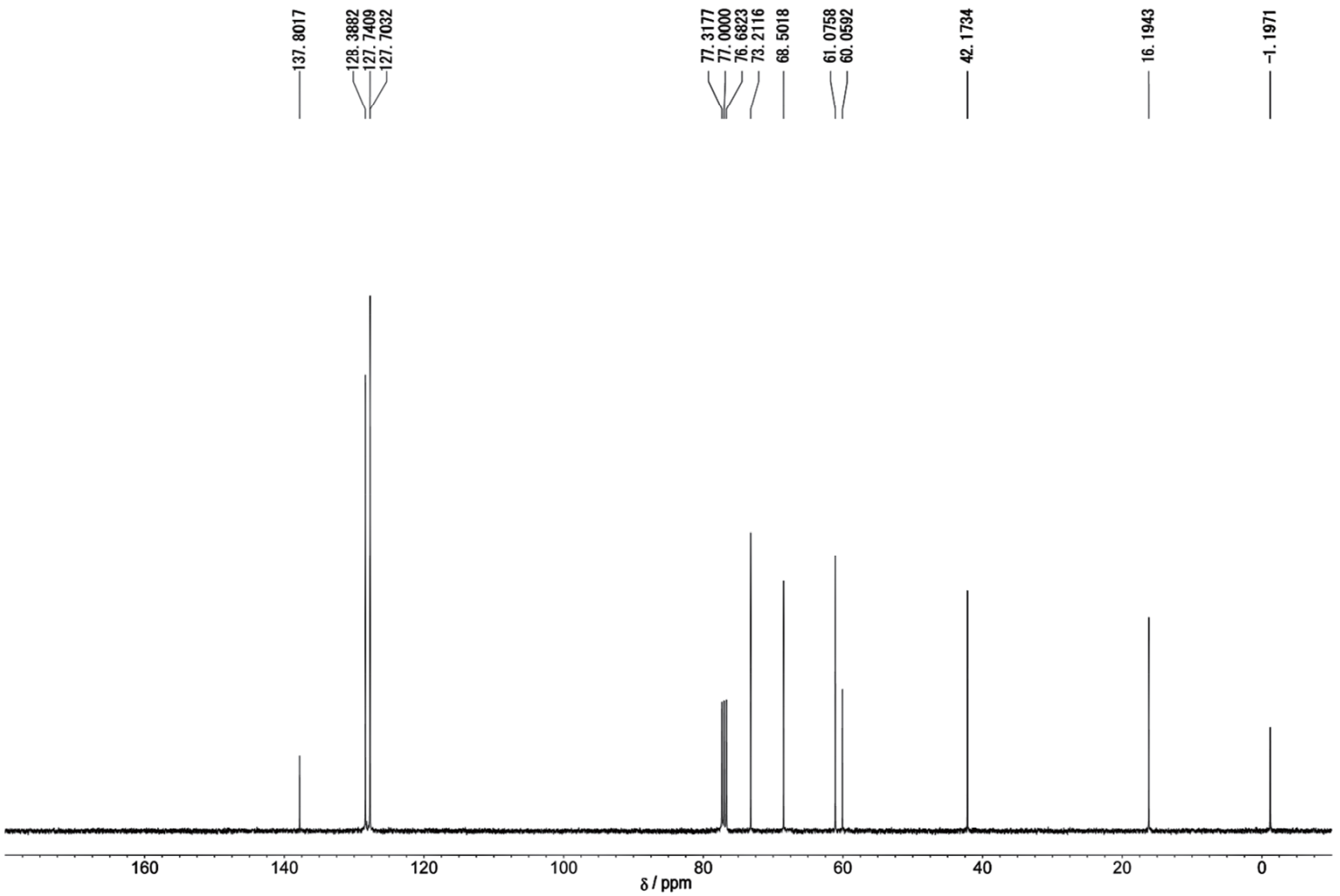
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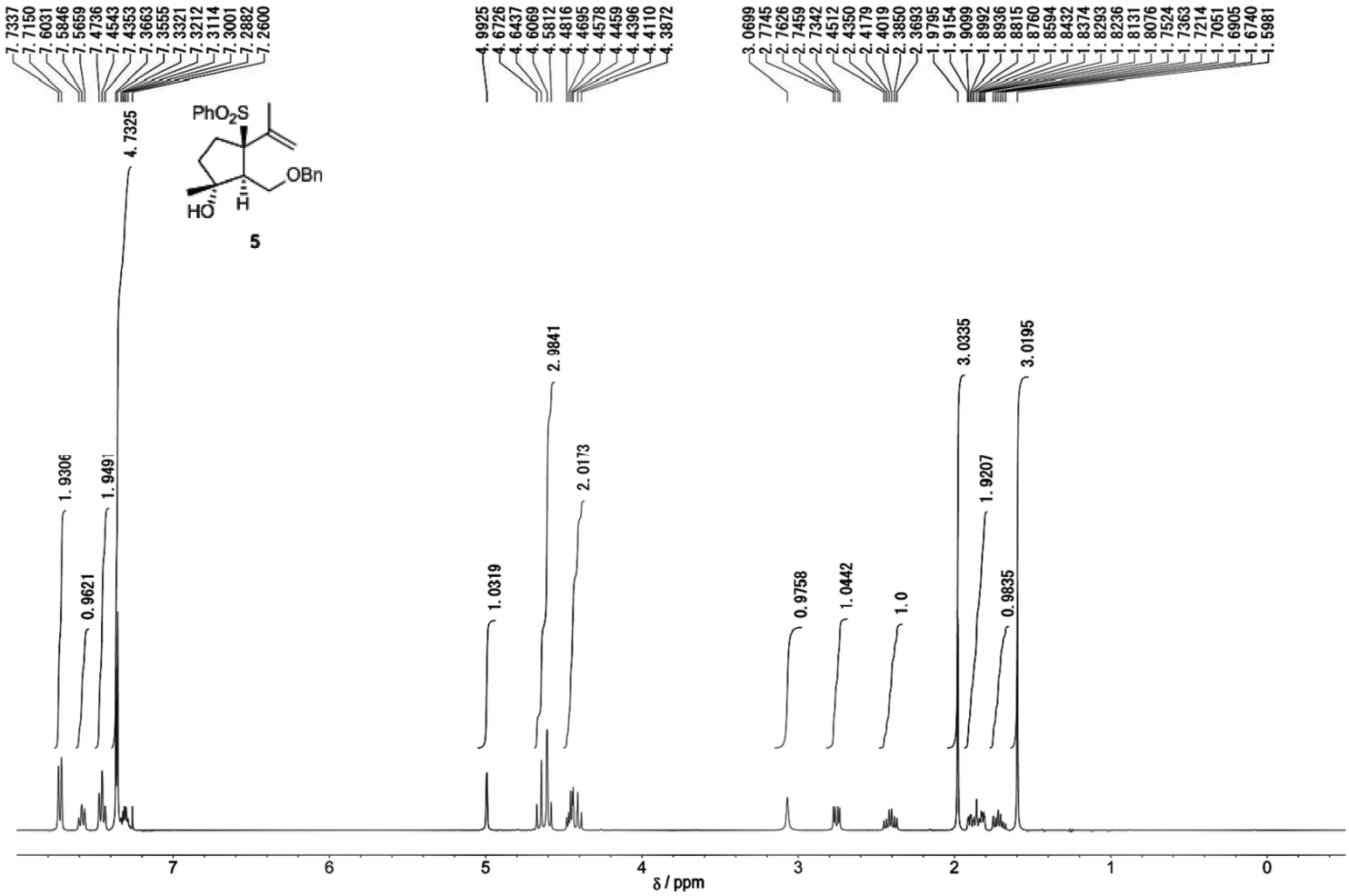
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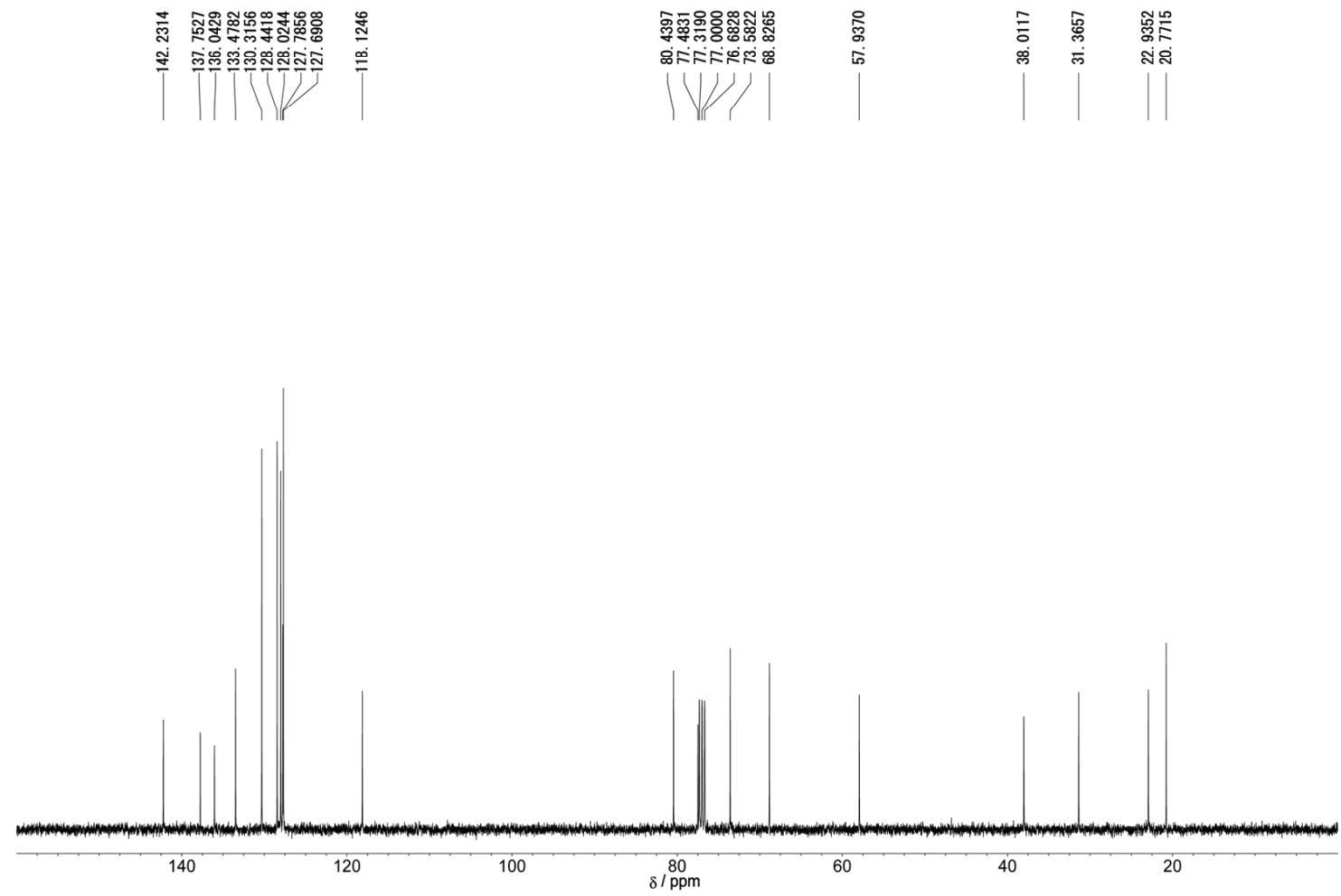
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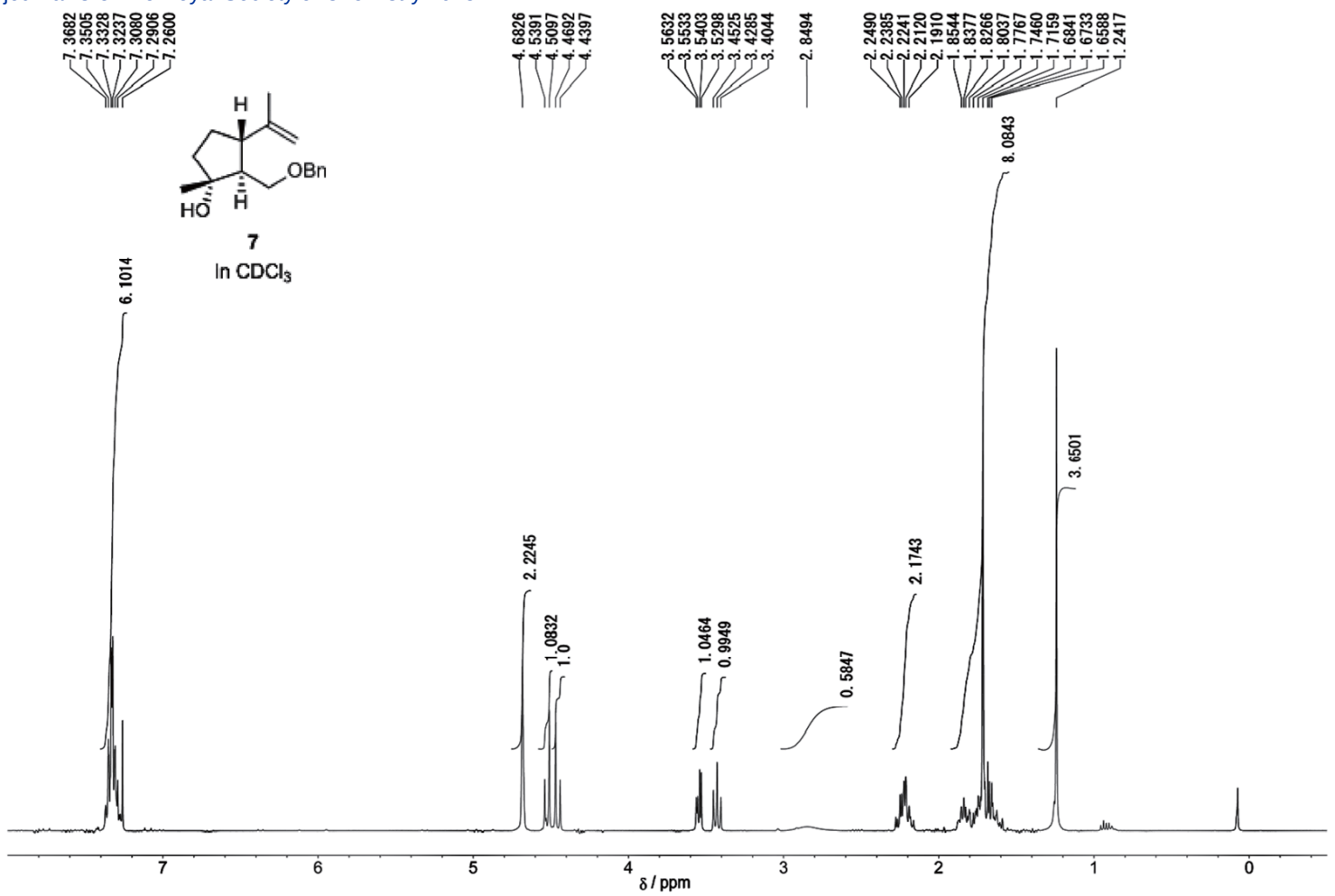
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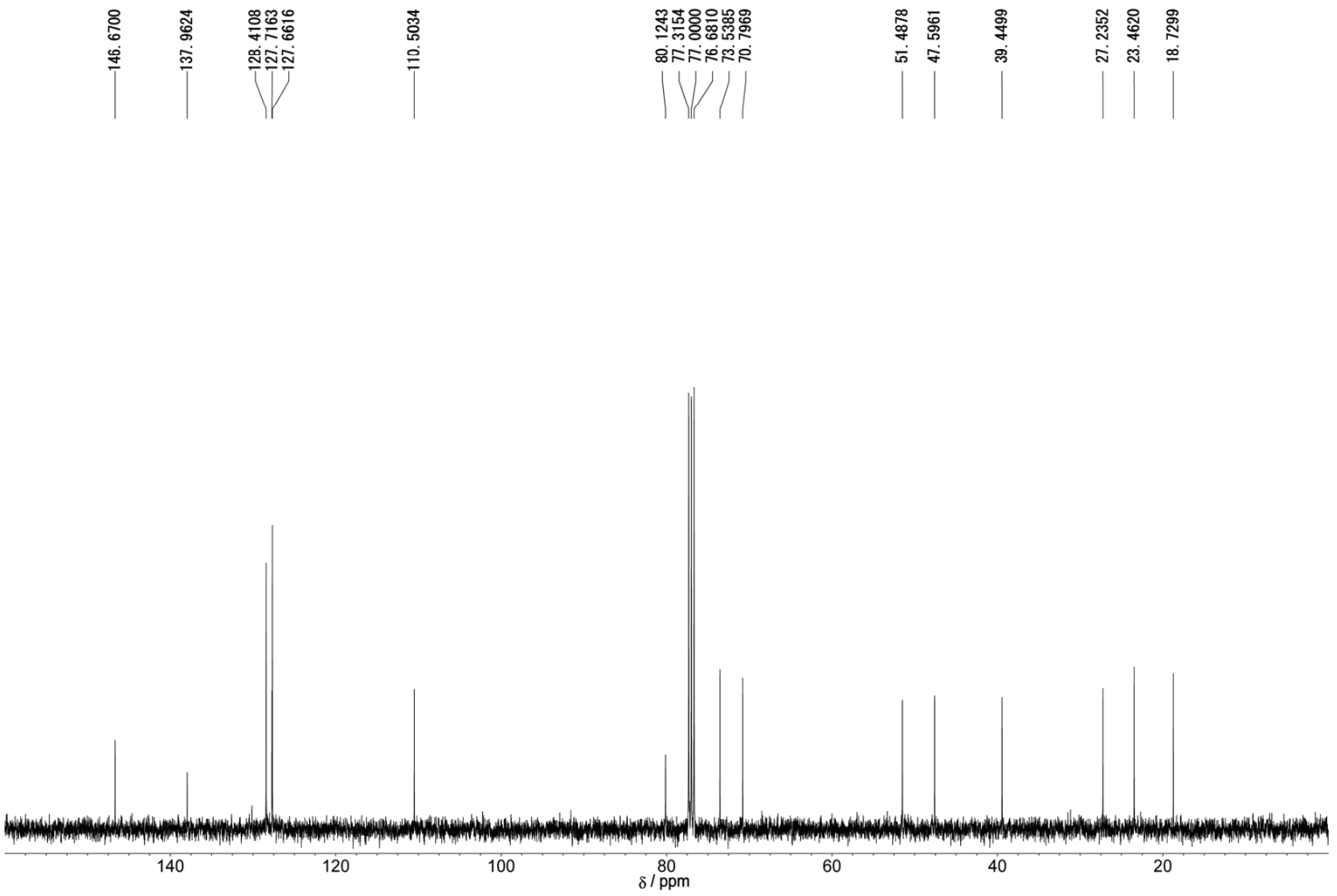
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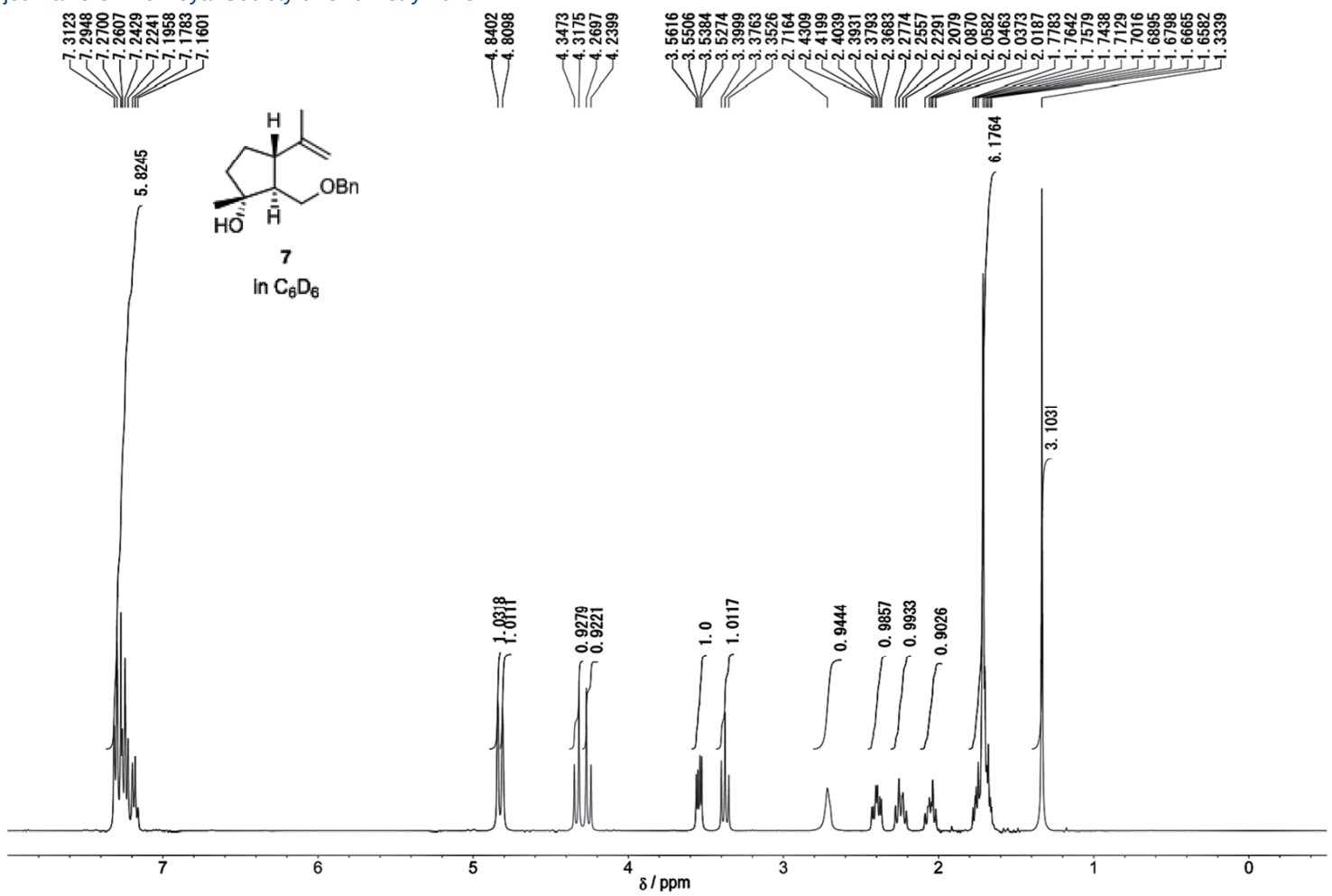
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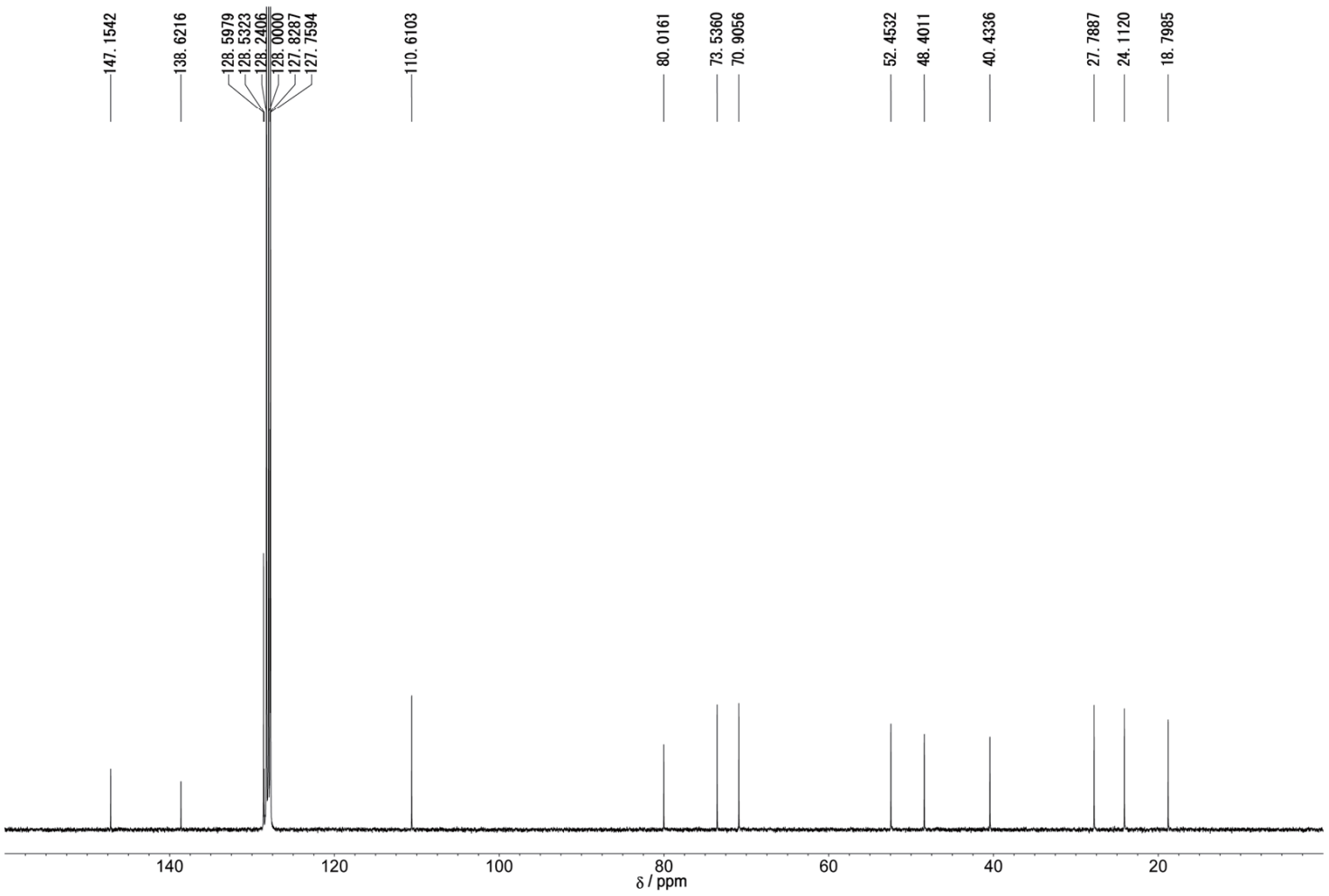
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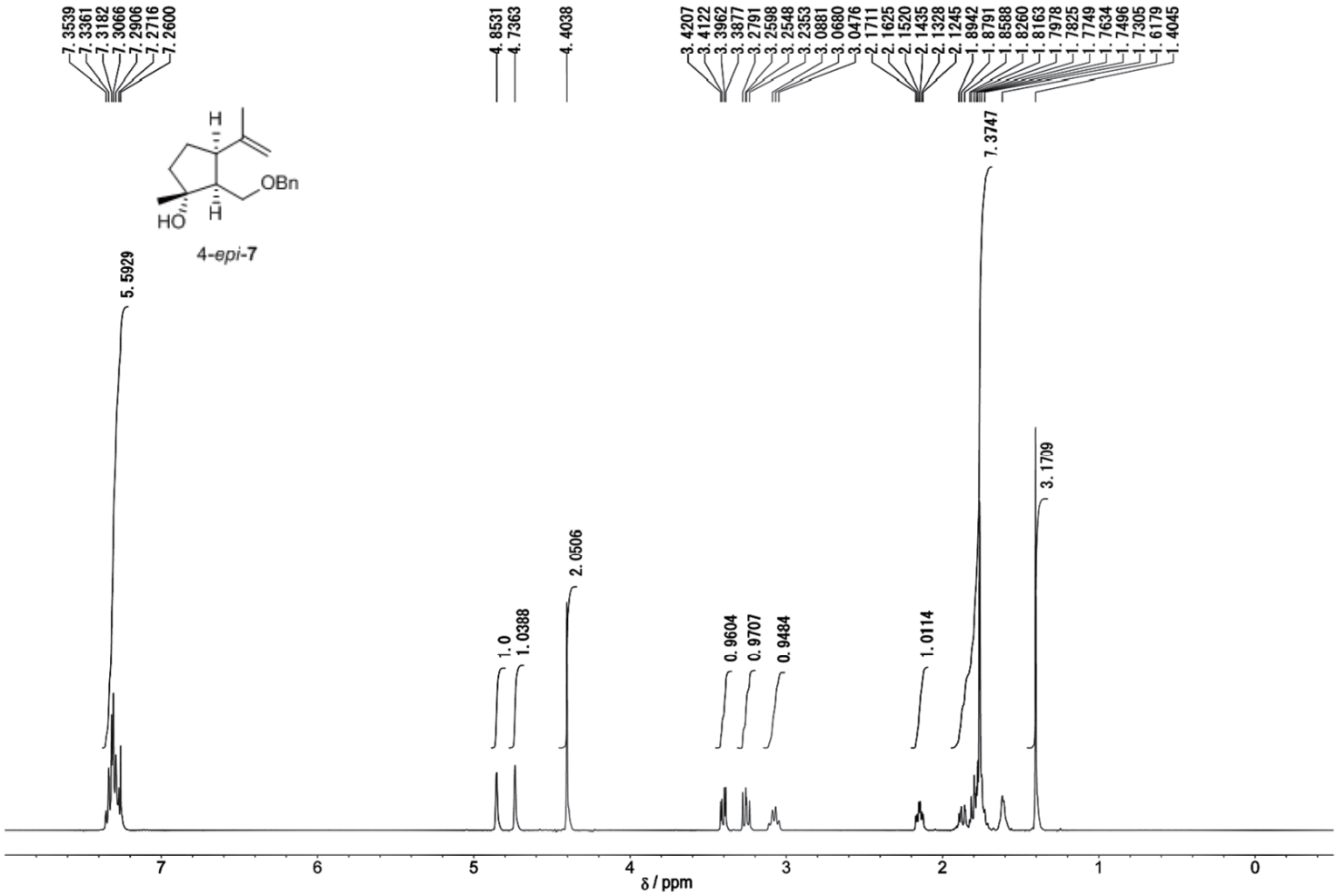
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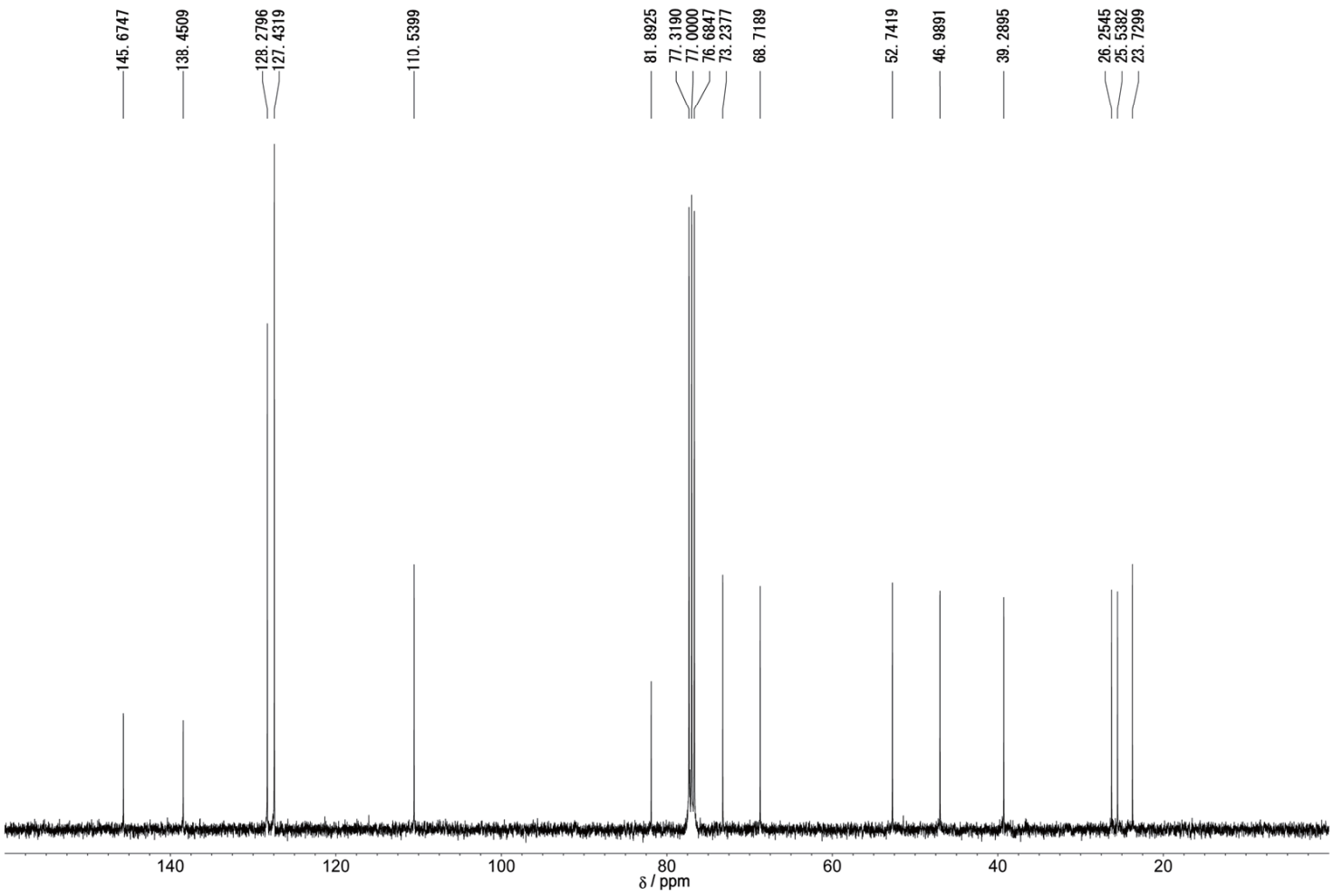
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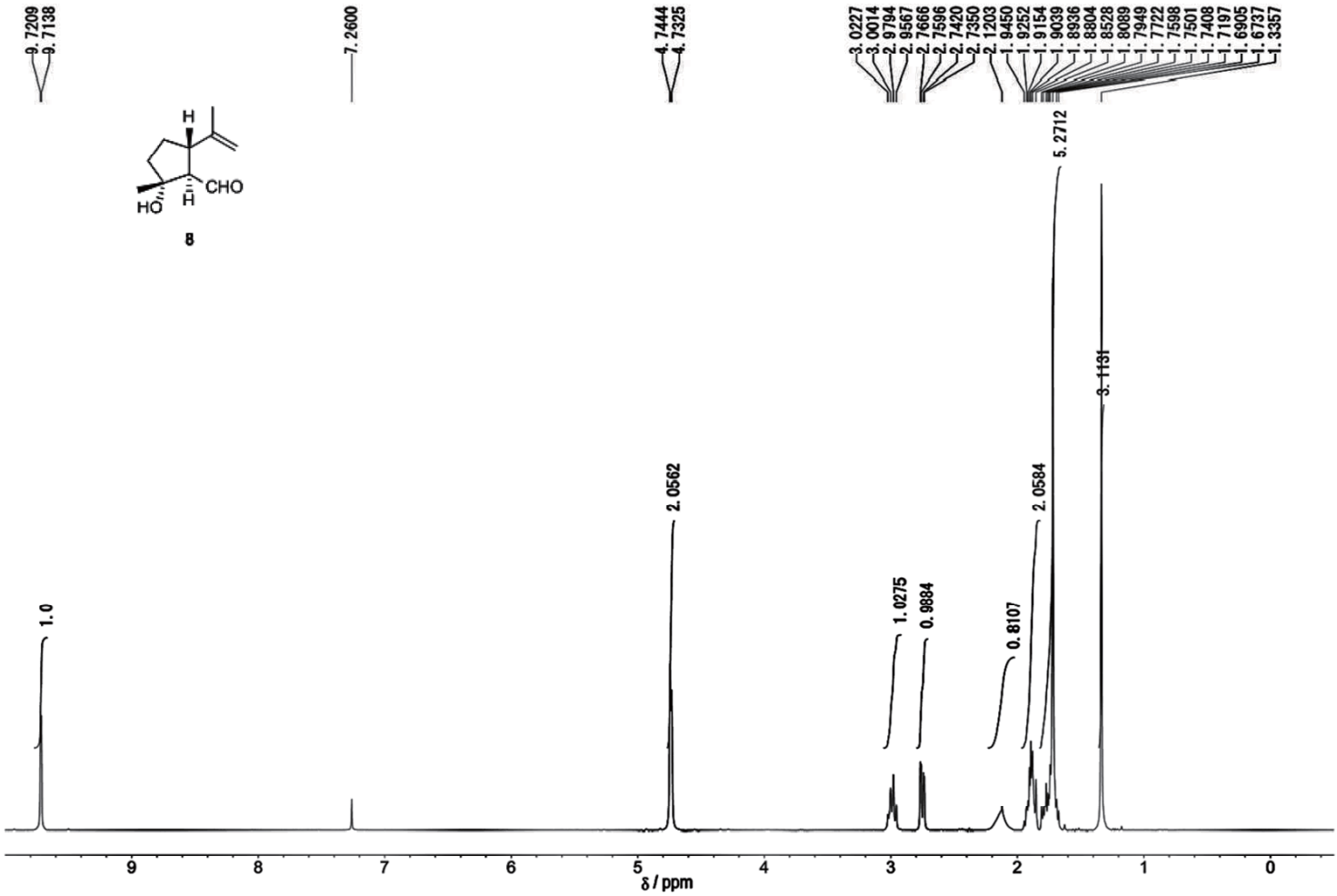
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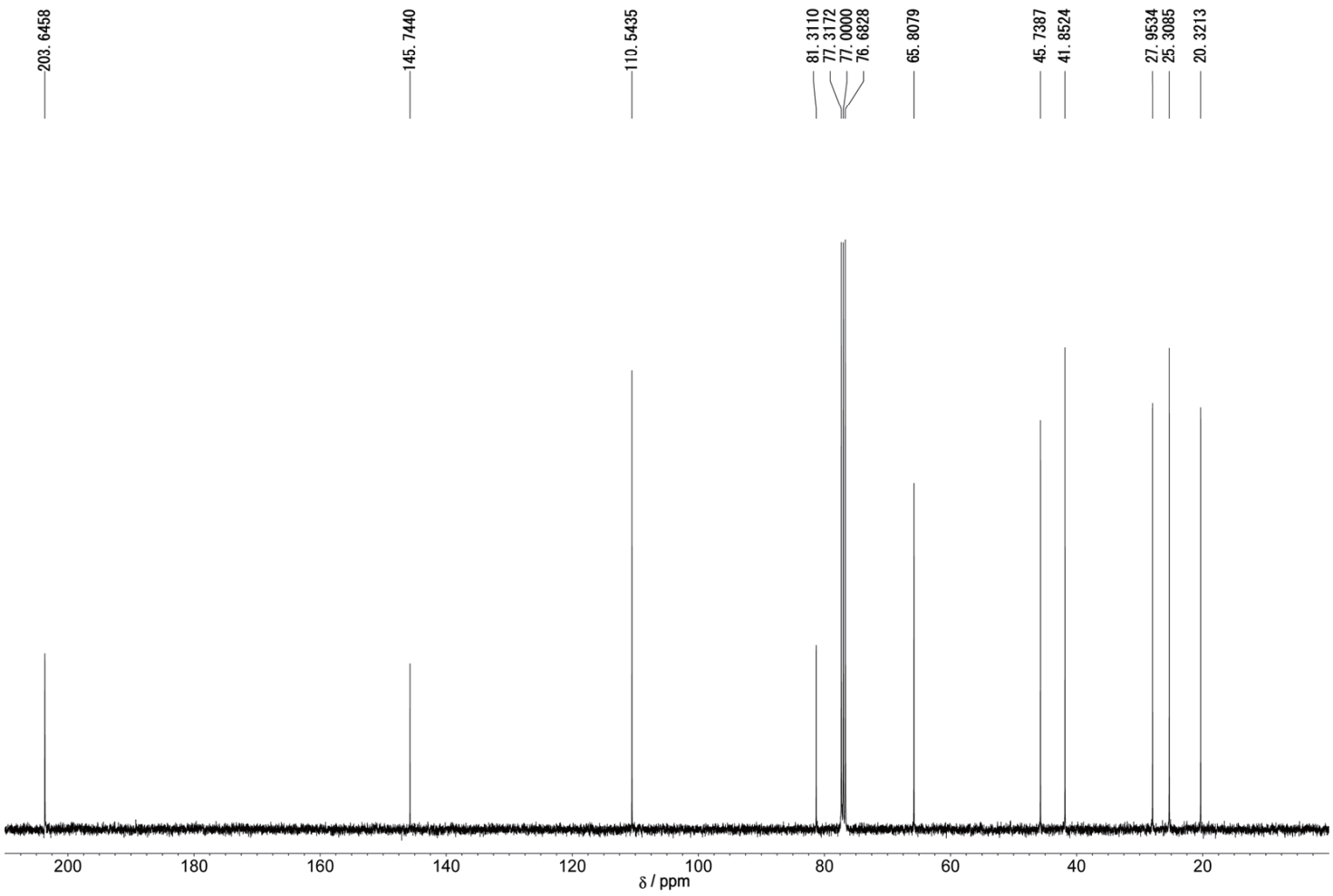
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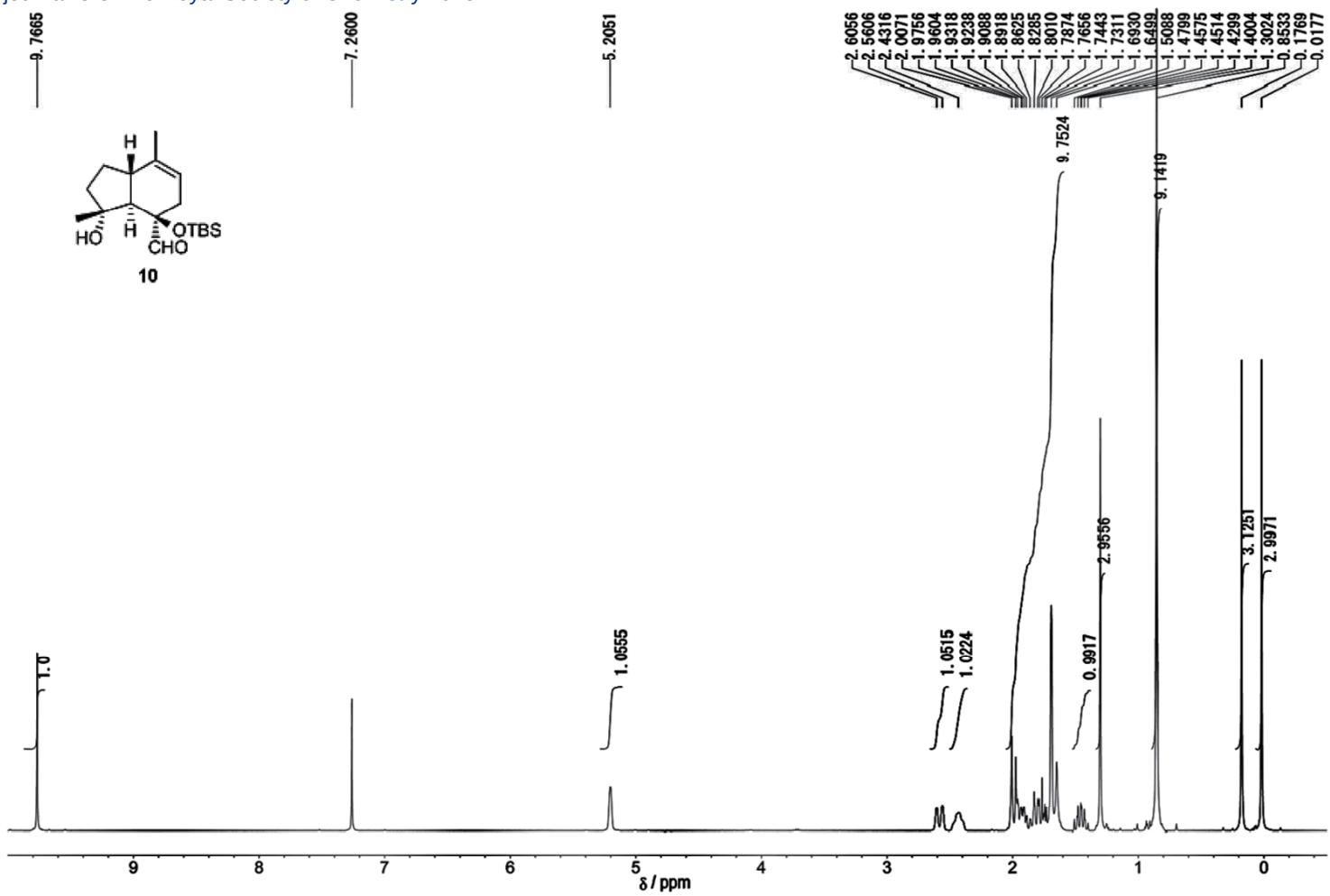


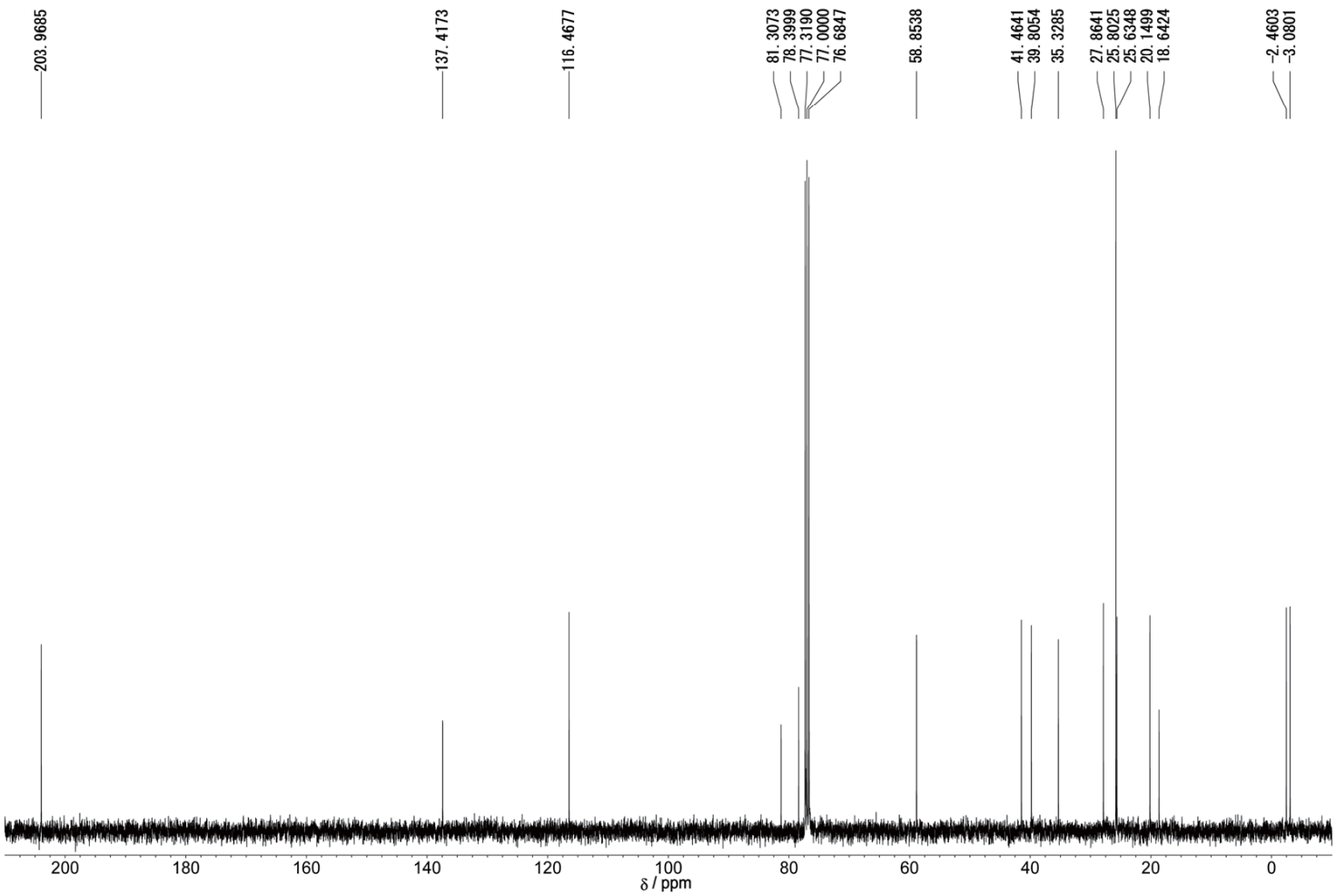

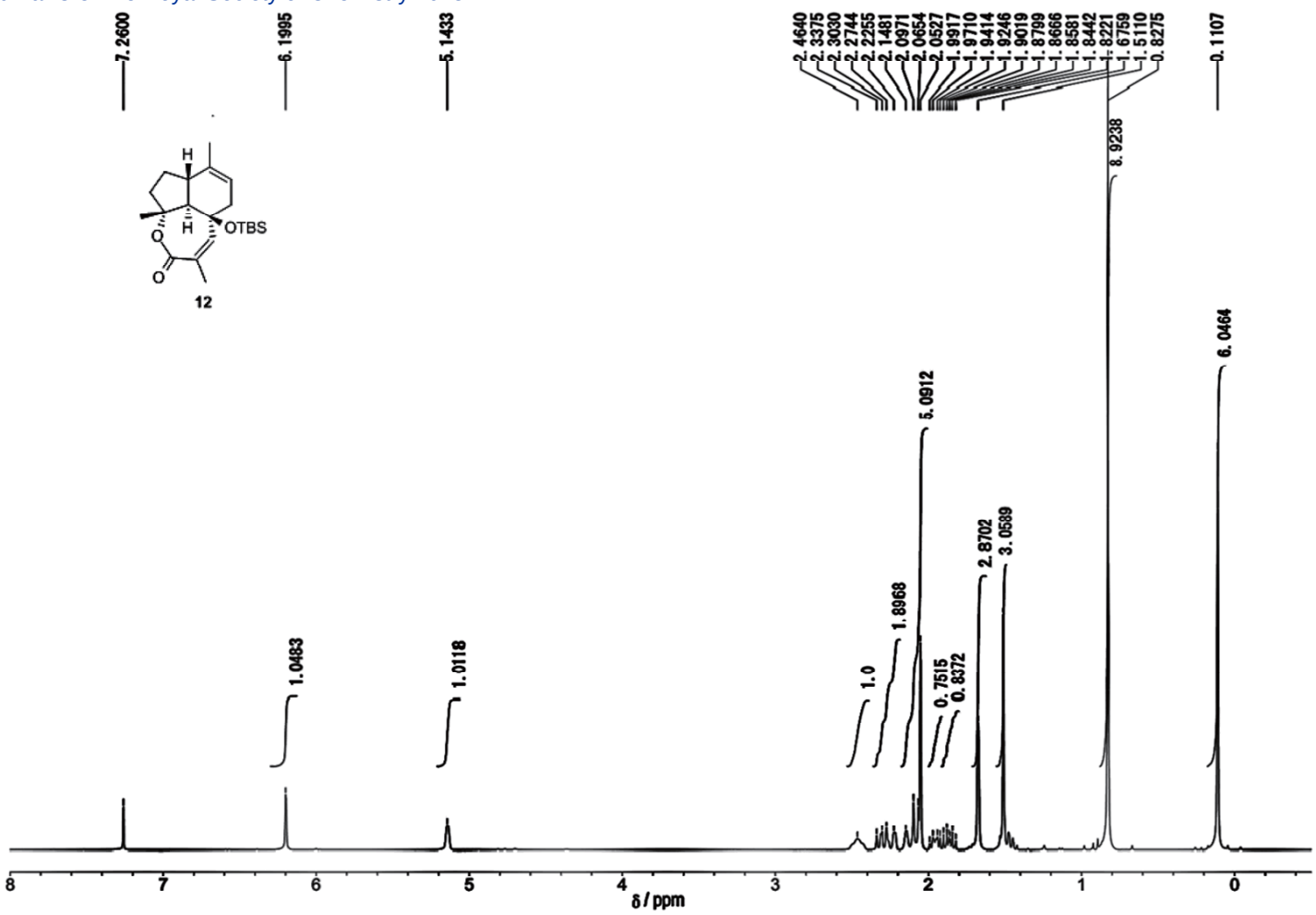
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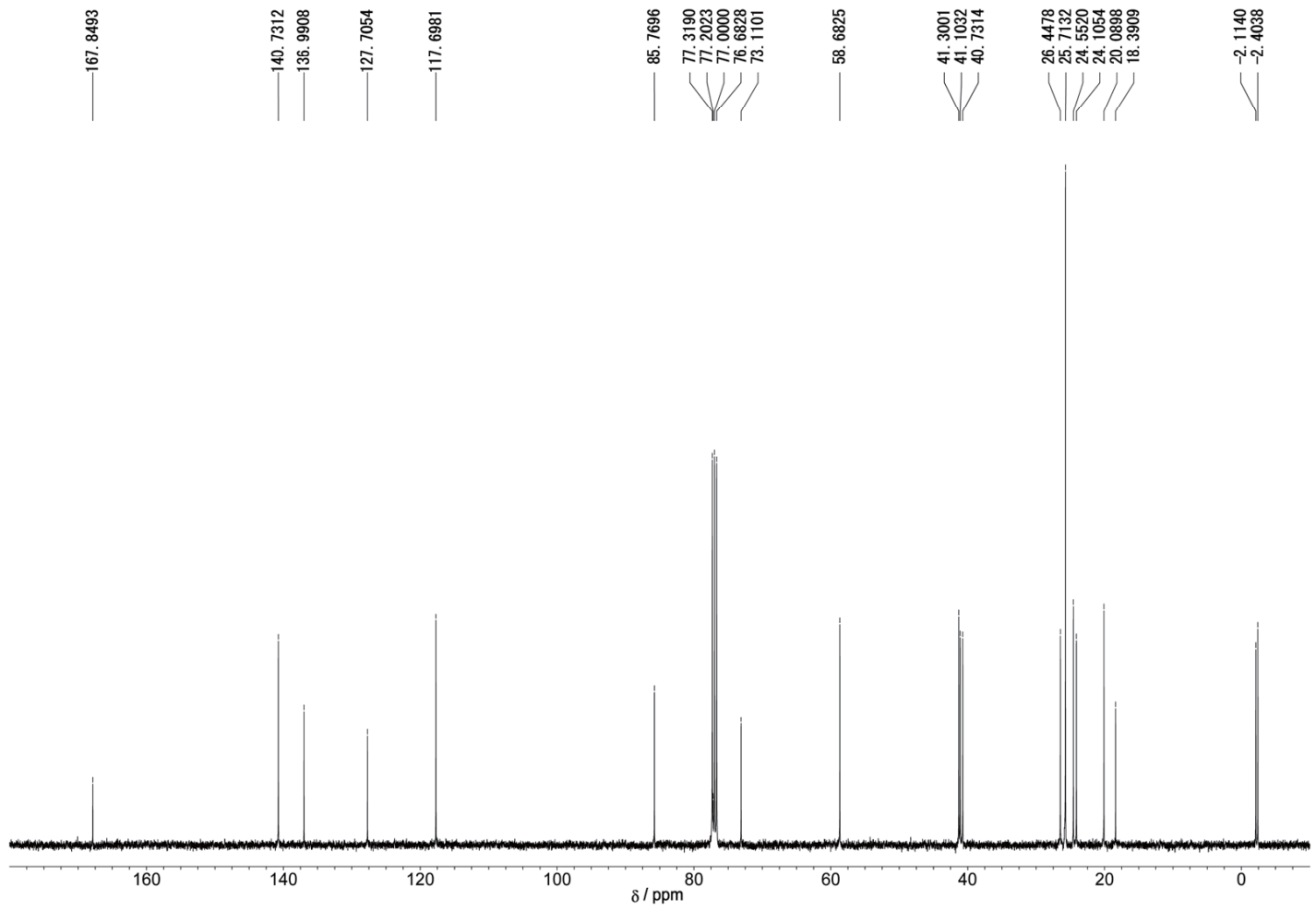
6.1995
5.1433
2.4640
2.3375
2.3030
2.2744
2.2255
2.1481
2.0971
2.0654
2.0527
1.9917
1.9710
1.9414
1.9246
1.9019
1.8799
1.8666
1.8581
1.8442
1.8221
1.6759
1.5110
0.8275
0.1107
8.9238
6.0464
5.0912
1.8968
2.8702
3.0589
1.0483
1.0118
1.0
0.7515
0.8372
OTBS
12
δ / ppm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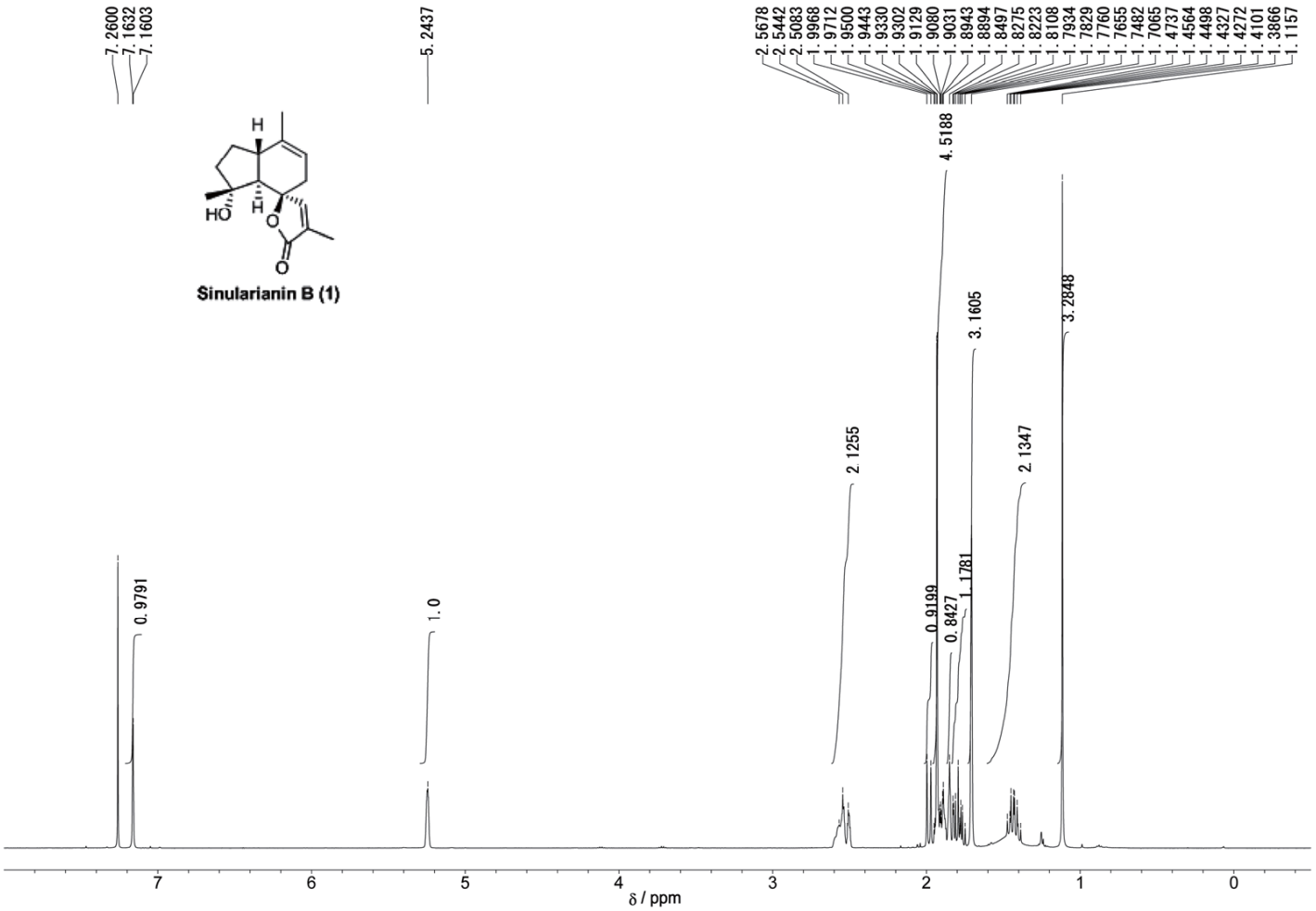
140.7312
136.9908
127.7054
117.6981
85.7696
77.3190
77.2023
77.0000
76.6828
73.1101
58.6825
41.3001
41.1032
40.7314
26.4478
25.7132
24.5520
24.1054
20.0898
18.3909
-2.1140
-2.4038
δ / ppm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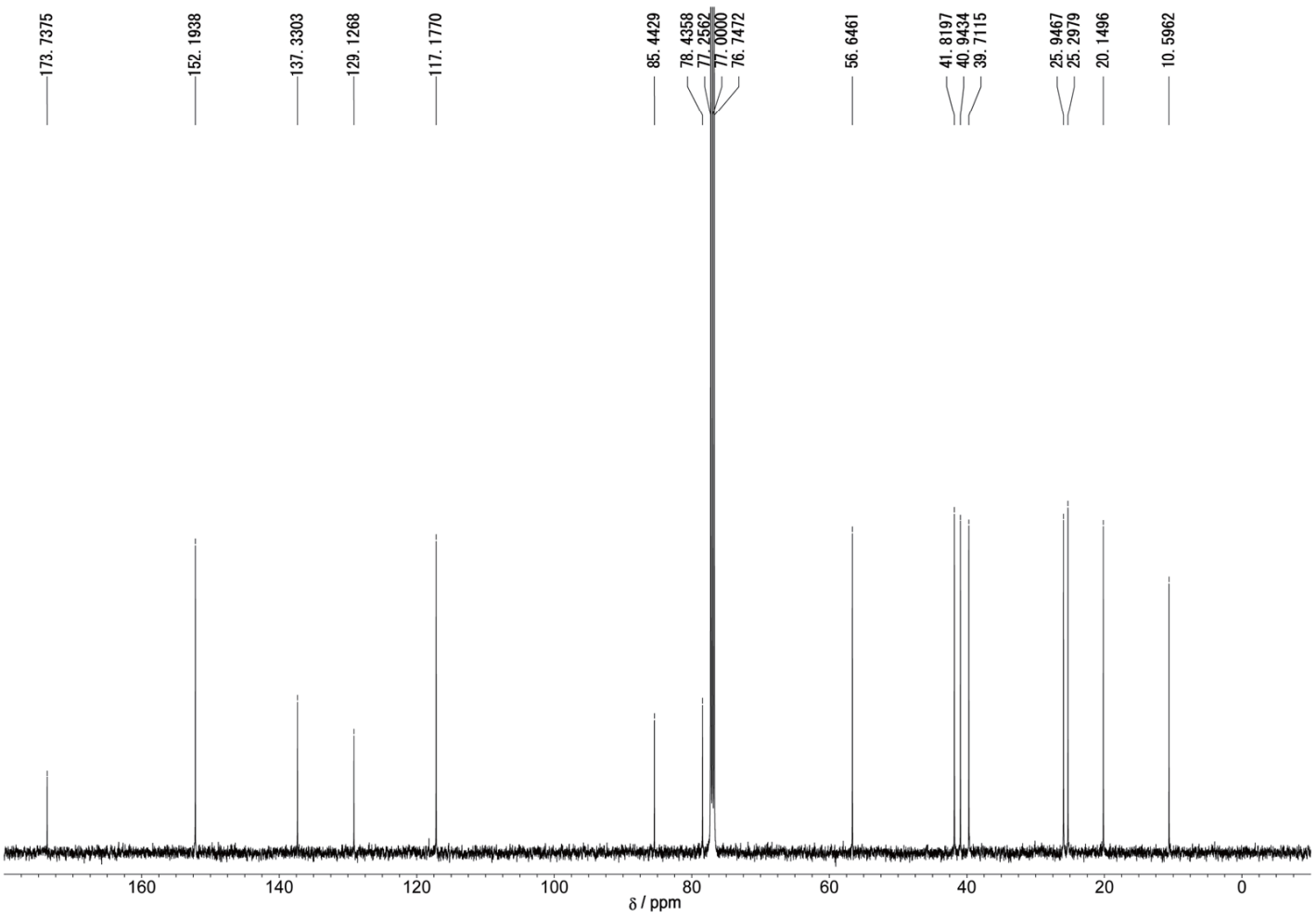
7.1632
7.1603
5.2437
2.5678
2.5442
2.5083
1.9968
1.9712
1.9500
1.9443
1.9330
1.9302
1.9129
1.9080
1.9031
1.8943
1.8894
1.8497
1.8275
1.8223
1.8108
1.7934
1.7829
1.7760
1.7655
1.7482
1.7065
1.4737
1.4564
1.4498
1.4327
1.4272
1.4101
1.3866
1.1157
4.5188
3.1605
3.2848
2.1255
2.1347
0.9791
1.0
0.9199
0.8427
1.1781
H
HO
H
O
O
Sinularianin B (1)
7
6
5
4
3
2
1
0
δ / ppm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129.1268
117.1770
85.4429
78.4358
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77.0000
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41.8197
40.9434
39.7115
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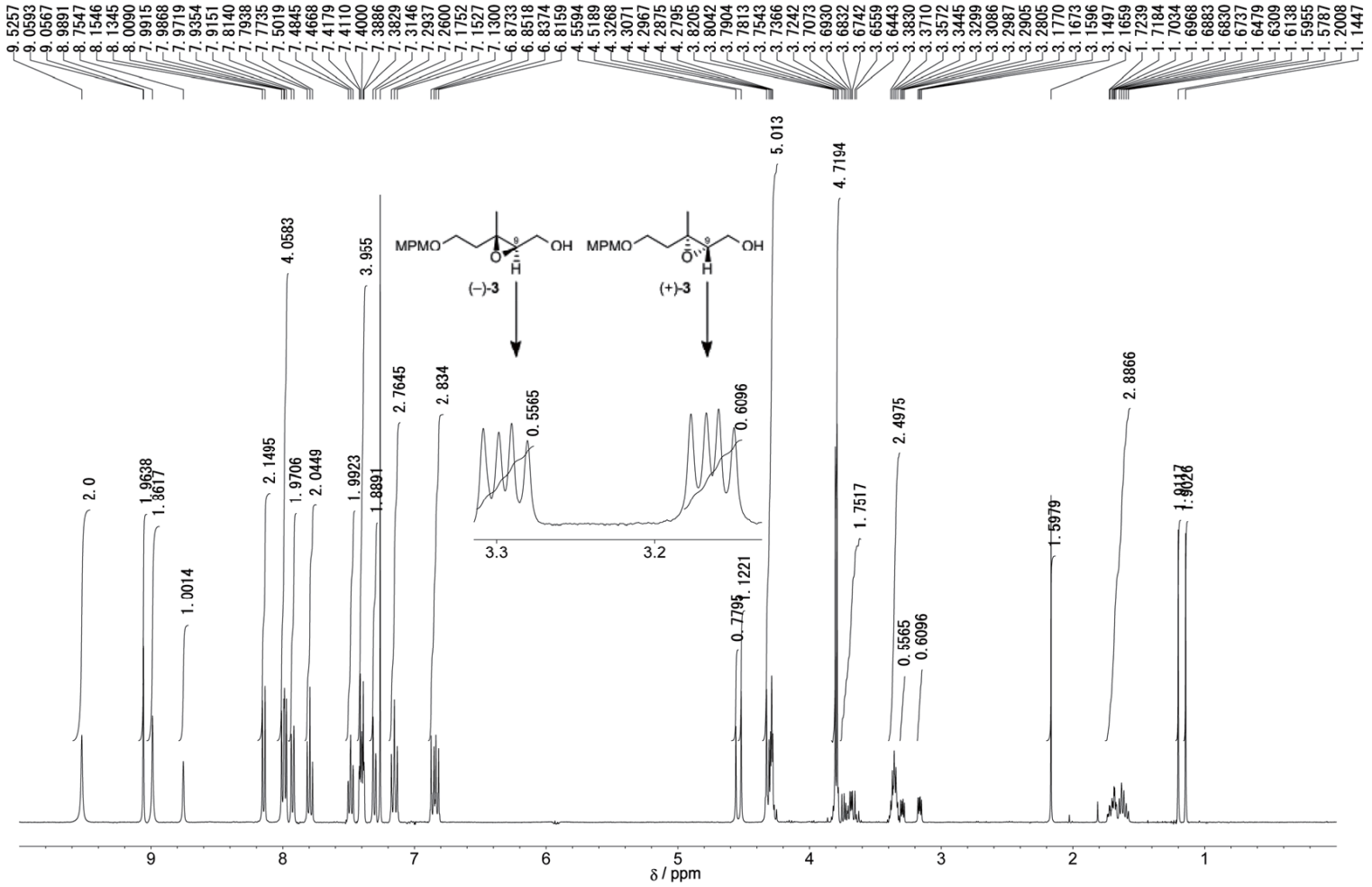
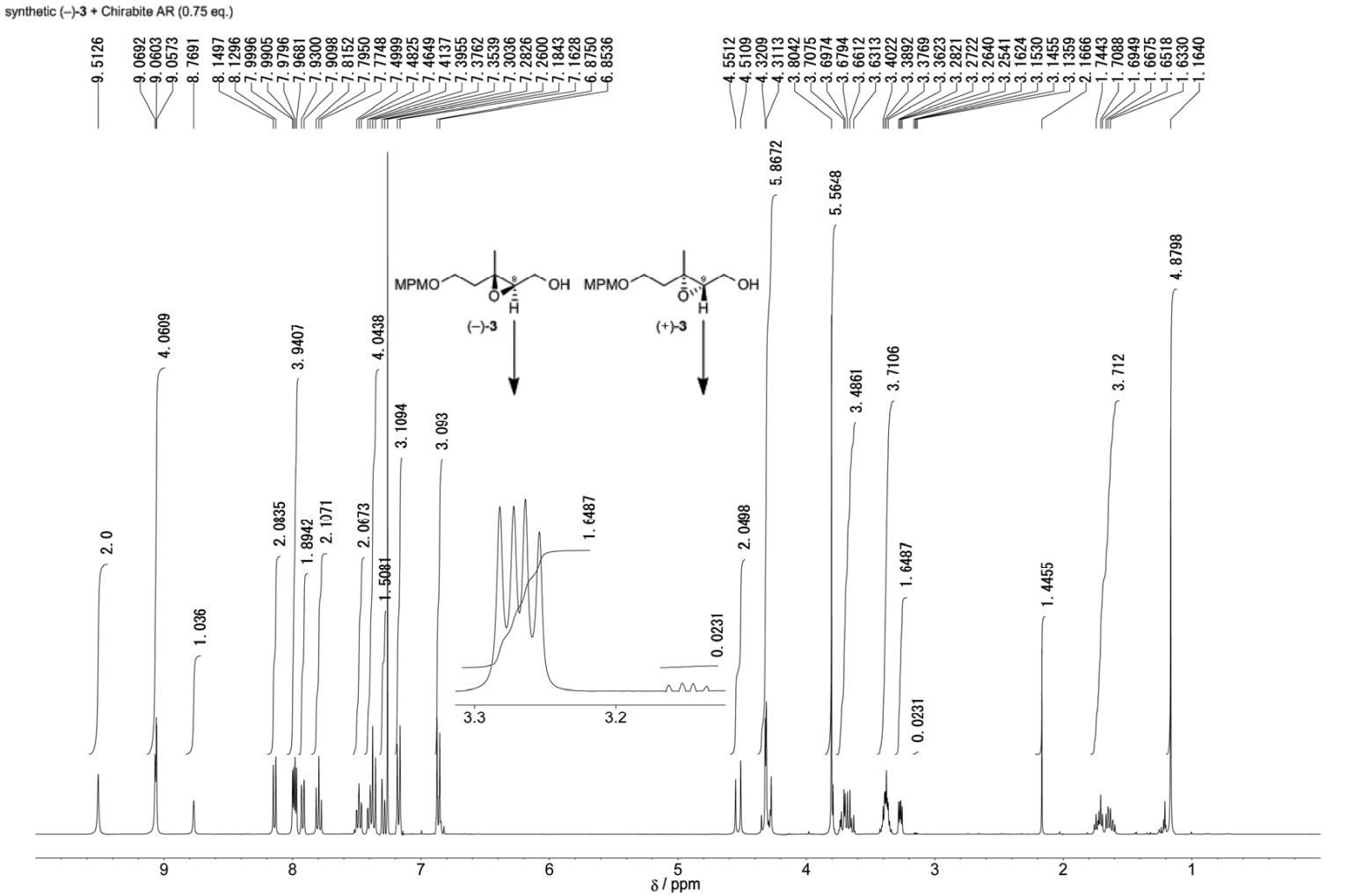
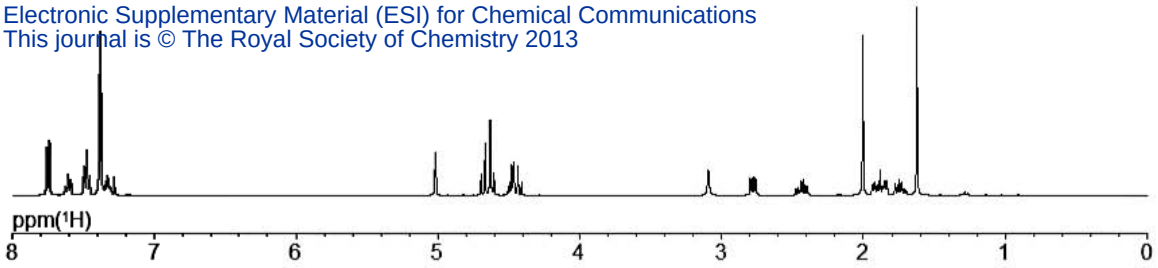
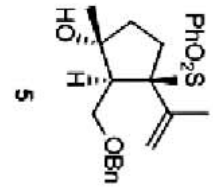
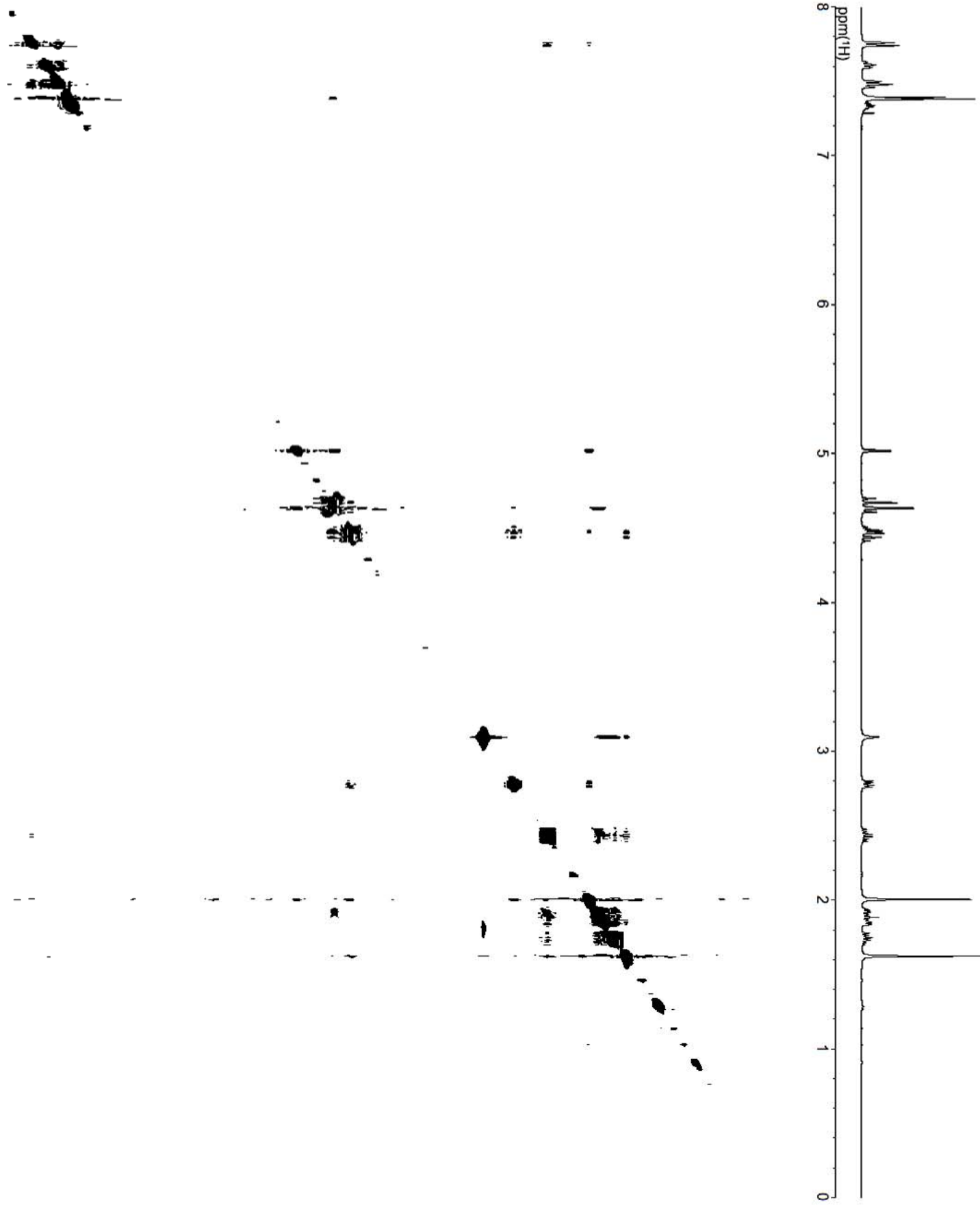
25.2979
20.1496
10.5962
160
140
120
100
80
60
40
20
0
δ / ppm

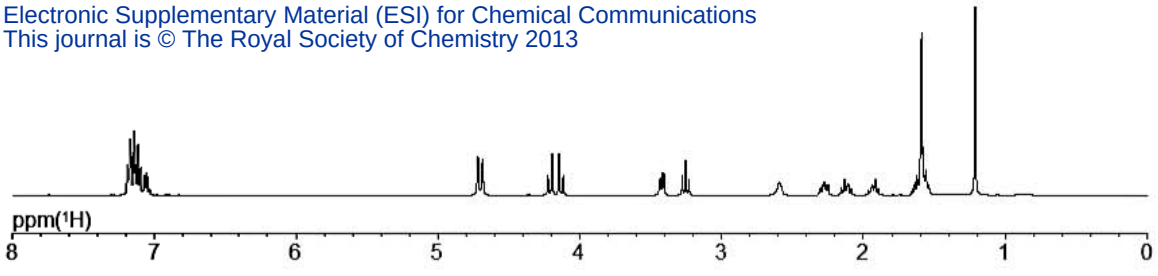

rac-3 + Chirabite AR (0.75 eq.)
MPMO
OH
(–)-3
(+)-3
δ / ppm

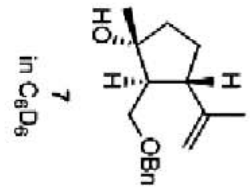

synthetic (–)-3 + Chirabite AR (0.75 eq.)
MPMO
OH
(–)-3
(+)-3
δ / ppm


ppm(¹H)
8
7
6
5
4
3
2
1
0

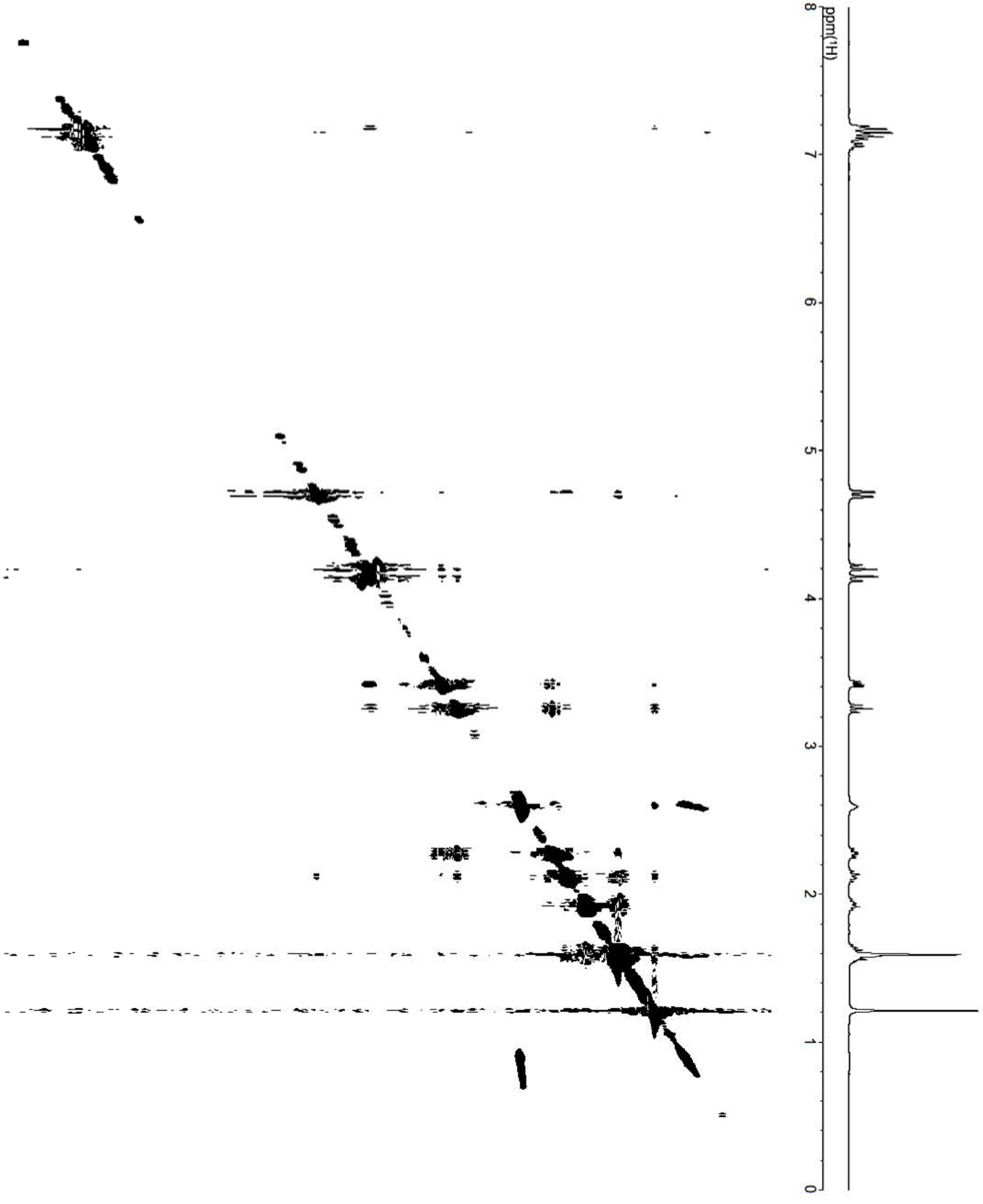

HO
H
PhO2S
OBn
5

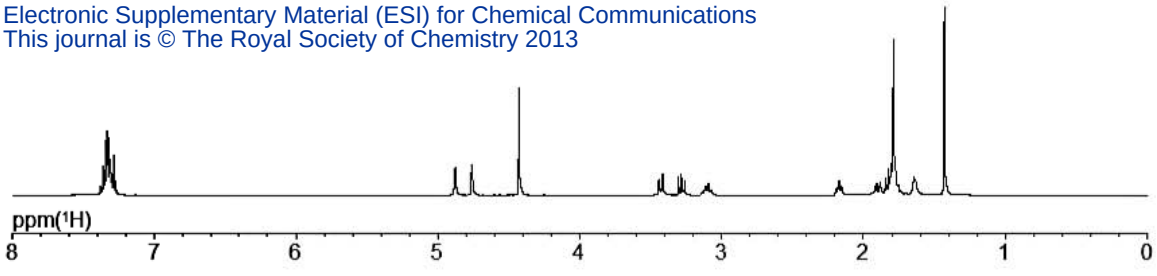

ppm(¹H)
8
7
6
5
4
3
2
1
0

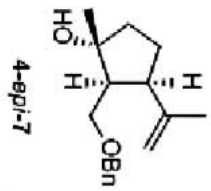



7
in $C_6D_6$






4-*epi*-7