Cyclopropanations of Olefin-Containing Natural Products for Simultaneous Arming and Structure Activity Studies

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Supporting Information

Experimental procedures and characterization data for new compounds

A) General Procedures: All reactions were carried out under a nitrogen atmosphere in oven-dried or flame-dried glassware using dry solvents under anhydrous conditions. All anhydrous solvents were dried with activated molecular sieves (3Å or 4Å beads) and tested for trace water content with a Coulometric Karl-Fischer titrator. All solvents used for extraction and chromatography procedures were used as received from commercial suppliers without further purification. All reagents were purchased and used as received unless otherwise noted. ^{1}H NMR and ^{13}C NMR spectra were measured in deuterated chloroform ($CDCl_3$) at 500 MHz/125 MHz, respectively. All proton NMR spectra were recorded at 500 MHz and were referenced with residual chloroform (7.27 ppm) and reported in parts per million (ppm). Coupling constants (*J*) are reported in Hertz (Hz), abbreviations for signal coupling are as follows: s, singlet; d, doublet; t, triplet; q, quartet; p, pentet; dd, doublet of doublets; ddd, doublet of doublet of doublets; dt, doublet of triplets; dq, doublet of quartets; m, multiplet; bs, broad singlet. All carbon NMR spectra were measured at 125 MHz and were referenced with residual chloroform (77.23 ppm) and reported in parts per million (ppm). All FT-IR spectra were recorded on sodium chloride discs. High resolution mass spectra (ESI or MALDI) were obtained through the Center for Chemical Characterization and Analysis (Texas A&M University). Analytical Thin Layer Chromatography (TLC) was performed on precoated glass backed plates (silica gel $60F_{254}$; 0.25mm thickness). Flash chromatography was carried out with silica gel 60Å (230-400 mesh ASTM).

B) Safety hazards and precautions for use of diazoesters and azides:

Diazoesters: Diazocompounds are known to be toxic and unstable towards strong protic and Lewis acids and can decompose by prolonged exposure to light and or contact to metal salts. Even though diazoacetates are known to be more stable than their alkyl counterparts, throughout this study, all diazoacetates were stored in the dark and at -20 ºC in glass vials. Although throughout this work , no uncontrollable reactions or explosions were experienced, all reactions must be carried out in a well-ventilated fume hood and if possible behind a safety shield. Further information regarding safety issues and the chemistry of diazocompounds is available.[1]

Azides: Due to the shock sensitive nature of azides, distillation or sublimation as purification techniques are not recommended. Column chromatography may contribute to decomposition, especially when using halogenated solvents.

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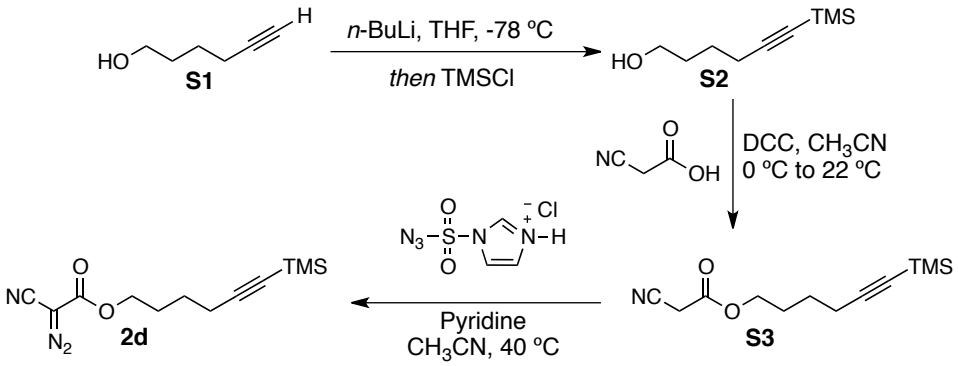
[1] Doyle, M. P.; McKervey, M. A.; Ye, T. *In Modern Catalytic Methods for Organic Synthesis with Diazo Compounds*: Wiley; New York, **1998**.

C) Synthesis of alkynyl diazo ester (2d):



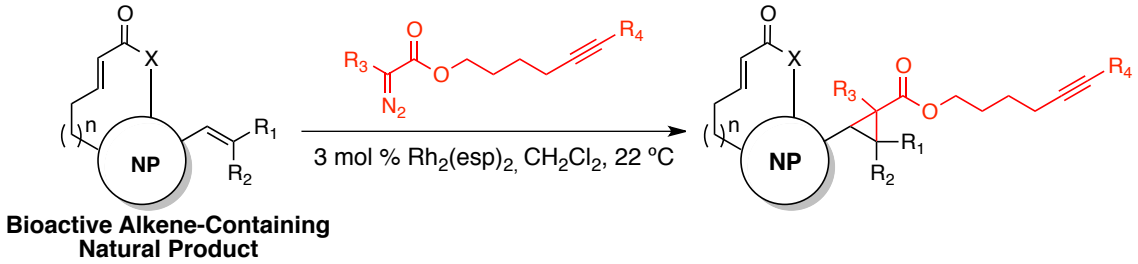
6-(Trimethylsilyl)hex-5-yn-1-ol (S2): Hex-5-yn-1-ol **S1** (1.0 g, 10.19 mmol) was dissolved in THF (20 mL) and then the solution was cooled to -78 ºC. *n*-BuLi (8.97 mL, 2.5M in hexane, 22.42 mmol) was then added slowly dropwise via syringe. The reaction mixture was stirred for 1 h at -78 ºC and then TMSCl (3.88 mL, 30.57 mmol) was added. The mixture was allowed to warm up to 22 ºC over 1 h and then further stirred for 1 h at this temperature. The reaction mixture was diluted with ether (15 mL) and then quenched with a saturated aqueous solution of NH_4Cl (15 mL). The organic fraction was washed with a 2N HCl aqueous solution (2 X 25 mL) and water (25 mL), dried over Na_2SO_4, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired alcohol **S2** (1.582 g, 91% yield), as a colorless oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 3.69 (t, *J*= 6.5 Hz, 2H), 2.28 (t, *J*= 7.0 Hz, 2H), 1.71-1.65 (m, 2H), 1.64-1.58 (m, 2H), 1.40 (bs, 1H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 107.36, 85.00, 62.61, 32.01, 25.08, 19.82, 0.35. **FT-IR** (neat, cm^{-1}): 3322, 2956, 2174. **HRMS** (ESI+): Calcd. for $C_9H_{18}OSiLi$ ($[M+Li]^+$), 177.1287. Found: 177.1294.

6-(Trimethylsilyl)hex-5-yn-1-yl 2-cyanoacetate (S3): Cyanoacetic acid (1.12 g, 13.21 mmol) was dissolved in CH_3CN (40 mL) and then the solution was cooled to 0 ºC. The DCC (2.73 g, 13.21 mmol) was added and the reaction mixture was stirred at 0 ºC for 10 min, after which the alcohol **S2** (1.5 g, 8.81 mmol) was added dropwise. The mixture was then stirred at 22 ºC for 1 h. The reaction mixture was diluted with ether (100 mL) and filtered through celite and washed with water (2 X 100 mL), dried over Na_2SO_4, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired cyanoacetate **S3** (1.80 g, 86% yield), as a pale yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 4.23 (t, *J*= 7.0 Hz, 2H), 3.46 (s, 2H), 2.27 (t, *J*= 7.0 Hz, 2H), 1.79 (p, *J*= 7.0 Hz, 2H), 1.59 (p, *J*= 7.0 Hz, 2H), 0.13 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 163.08, 113.17, 106.41, 85.44, 66.65, 27.53, 24.91, 24.88, 19.54, 0.26. **FT-IR** (neat, cm^{-1}): 2959, 2264, 2173, 1747. **HRMS** (ESI+): Calcd. for $C_{12}H_{19}NO_2SiLi$ ($[M+Li]^+$), 244.1345. Found: 244.1351.

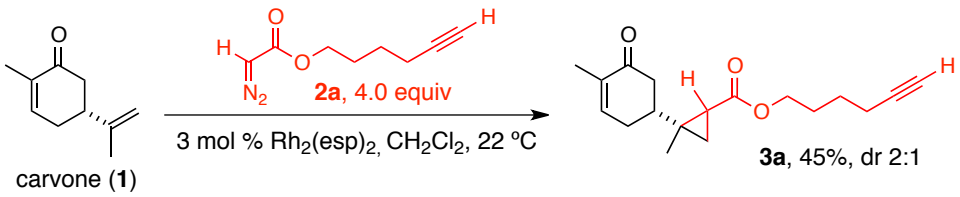
6-(Trimethylsilyl)hex-5-yn-1-yl 2-cyano-2-diazoacetate (2d): The cyanoacetate **S3** (1.50 g, 6.32 mmol) was dissolved in CH_3CN (30 mL) and then pyridine (2.55 mL, 31.60 mmol) was added followed by the imidazole-1-sulfonyl azide hydrochloride (1.99 g, 9.48 mmol). The mixture was stirred at 40 ºC for 16 h and then the reaction mixture was cooled to 22 ºC and diluted with EtOAc (75 mL), washed with a 1N HCl aqueous solution (2 X 75 mL) and water (75 mL), dried over Na_2SO_4, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexanes and ethyl acetate (9:1) as eluent to afford the desired alkynyl diazo ester **2d** (0.946 g, 57% yield), as a yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 4.31 (t, *J*= 7.0 Hz,

2H), 2.27 (t, *J*= 7.0 Hz, 2H), 1.81 (p, *J*= 7.0 Hz, 2H), 1.59 (p, *J*= 7.0 Hz, 2H), 0.14 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 161.40, 107.40, 106.36, 85.49, 67.03, 27.77, 24.86, 19.54. 0.27. **FT-IR** (neat, cm^{-1}): 2959, 2229, 2173, 2136, 1729. **HRMS** (ESI+): Calcd. for $C_{12}H_{17}N_3O_2SiLi$ ($[M+Li]^+$), 270.1250. Found: 270.1259.

D) Rhodium-catalyzed cyclopropanation of natural products with alkynyl diazo reagents.



General Procedure: The alkene-containing natural product (1.0 equiv, 1-20 mg) and $Rh_2(esp)_2$ (3 mol %) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 °C. The diazo reagent (1.2-4.0 equiv) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate as eluent.

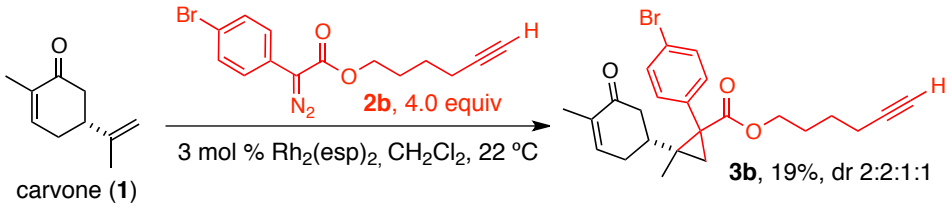


Carvone **1** (20 mg, 0.1331 mmol) and $Rh_2(esp)_2$ (3.03 mg, 0.0039 mmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC. The diazo reagent **2a** (88.5 mg, 0.5325 mmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (9:1) as eluent to afford the desired cyclopropanated product **3a** (17.2 mg, 45% yield, 2:1 mixture of inseparable diastereomers) as a colorless oil.

Data for diastereomer A: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.76-6.74 (m, 1H), 4.15-4.06 (m, 2H), 2.48-2.38 (m, 1H), 2.37-2.32 (m, 2H), 2.30-2.28 (m, 1H), 2.27-2.22 (m, 2H), 1.97 (t, *J*= 2.5 Hz, 1H), 1.79-1.73 (m, 2H), 1.76 (bs, 3H), 1.64-1.62 (m, 1H), 1.63-1.56 (m, 2H), 1.51 (d, *J*= 8.0 Hz, 1H), 1.14 (s, 3H), 1.12 (d, *J*= 4.5 Hz, 1H), 0.92 (dd, *J*= 8.0, 4.5 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 200.18, 172.19, 144.82, 135.73, 84.08, 68.96, 64.16, 45.93, 42.14, 37.26, 29.56, 29.41, 27.98, 26.21, 25.15, 21.85, 18.30, 15.94. **FT-IR** (neat, cm^{-1}): 3311, 2958, 2123, 1725, 1676. **HRMS** (ESI+): Calcd. for $C_{18}H_{25}O_3$ ($[M+H]^+$), 289.1804. Found: 289.1799.

Data for diastereomer B: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.70-6.68 (m, 1H), 4.15-4.06 (m, 2H), 2.53 (ddd, *J*= 16.0, 3.5, 1.5 Hz, 1H), 2.48-2.38 (m, 1H), 2.37-2.32 (m, 2H), 2.27-2.22 (m, 2H), 1.97 (t, *J*= 2.5 Hz, 1H), 1.79-1.73 (m, 2H), 1.75 (bs, 3H), 1.63-1.56

(m, 2H), 1.52 (dd, *J*= 11.5, 8.0 Hz, 1H), 1.42-1.36 (m, 1H), 1.11 (dd, *J*= 11.5, 5.0 Hz, 1H), 1.08 (s, 3H), 0.88 (dd, *J*= 8.0, 5.0 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.89, 172.53, 144.94, 135.65, 84.01, 68.92, 64.26, 45.93, 41.82, 37.26, 29.65, 29.26, 27.04, 26.13, 25.17, 20.60, 19.90, 12.63. **FT-IR** (neat, cm^{-1}): 3311, 2958, 2123, 1725, 1676. **HRMS** (ESI+): Calcd. for $C_{18}H_{25}O_3$ ([M+H]$^+$), 289.1804. Found: 289.1799.



Carvone **1** (20 mg, 0.1331 mmol) and $Rh_2(esp)_2$ (3.03 mg, 0.0039 mmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 °C. The diazo reagent **2b** (171 mg, 0.5325 mmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (9:1) as eluent to afford the desired cyclopropanated product **3b** (11 mg, 19% yield, 2:2:1:1 mixture of diastereomers) as a colorless oil. Analytical samples were obtained by further purification by preparative TLC using hexanes and ethyl acetate (9:1) as eluent.

Data for diastereomer A: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.44 (d, *J*= 8.5 Hz, 2H), 7.19 (d, *J*= 8.5 Hz, 2H), 6.80-6.78 (m, 1H), 4.07-3.97 (m, 2H), 2.49-2.45 (m, 2H), 2.43-2.38 (m, 1H), 2.35-2.29 (m, 1H), 2.15-2.12 (m, 2H), 2.09-2.03 (m, 1H), 1.95 (t, *J*= 2.5 Hz, 1H), 1.77 (bs, 3H), 1.74 (d, *J*= 5.0 Hz, 1H), 1.67-1.61 (m, 2H), 1.43 (p, *J*= 7.0 Hz, 2H), 1.13

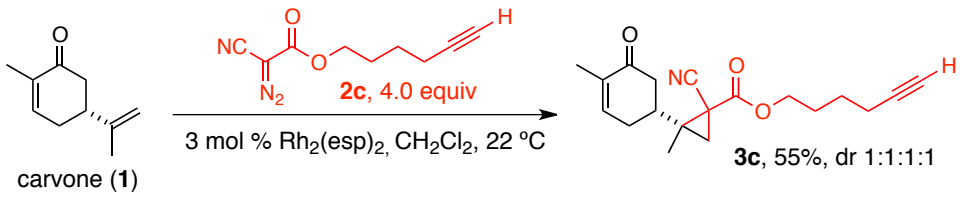
(d, *J*= 5.0 Hz, 1H), 0.75 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.49, 171.27, 145.05, 136.28, 135.67, 133.22, 131.30, 121.46, 84.02, 68.88, 65.25, 42.04, 40.34, 38.89, 32.77, 29.72, 27.64, 25.04, 24.96, 18.09, 17.16, 15.95. **FT-IR** (neat, cm^{-1}): 3299, 2953, 2116, 1716, 1672. **HRMS** (ESI+): Calcd. for $C_{24}H_{28}O_3Br$ ($[M+H]^+$), 443.1222. Found: 443.1214.

Data for diastereomer B: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.45 (d, *J*= 8.5 Hz, 2H), 7.20 (d, *J*= 8.5 Hz, 2H), 6.75-6.73 (m, 1H), 4.08-3.97 (m, 2H), 2.50 (dd, *J*= 16.0, 4.0 Hz, 1H), 2.49-2.40 (m, 2H), 2.30-2.25 (m, 1H), 2.13 (dt, *J*= 7.0, 2.5 Hz, 2H), 2.11-2.06 (m, 1H), 1.96 (t, *J*= 2.5 Hz, 1H), 1.77 (bs, 3H), 1.73 (d, *J*= 5.0 Hz, 1H), 1.65 (p, *J*= 7.0 Hz, 2H), 1.43 (p, *J*= 7.0 Hz, 2H), 1.13 (d, *J*= 5.0 Hz, 1H), 0.74 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 199.86, 171.45, 144.58, 136.49, 135.81, 133.14, 131.32, 121.47, 83.82, 69.00, 65.02, 42.27, 40.28, 39.33, 32.97, 29.36, 27.69, 25.18, 25.00, 18.12, 17.10, 15.96. **FT-IR** (neat, cm^{-1}): 3299, 2954, 2116, 1716, 1672. **HRMS** (ESI+): Calcd. for $C_{24}H_{28}O_3Br$ ($[M+H]^+$), 443.1222. Found: 443.1230.

Data for diastereomer C: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.42 (d, *J*= 8.5 Hz, 2H), 7.34 (d, *J*= 8.5 Hz, 2H), 6.66-6.64 (m, 1H), 4.13-4.07 (m, 2H), 2.53 (dd, *J*= 16.0, 2.5 Hz, 1H), 2.45-2.36 (m, 2H), 2.33-2.27 (m, 1H), 2.20-2.16 (m, 2H), 2.13-2.07 (m, 1H), 1.96 (t, *J*= 2.5 Hz, 1H), 1.75-1.68 (m, 2H), 1.66 (bs, 3H), 1.64 (d, *J*= 5.0 Hz, 1H), 1.54-1.47 (m, 2H), 1.19 (s, 3H), 1.13 (d, *J*= 5.0 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.15, 171.05, 144.86, 135.53, 135.42, 132.95, 131.49, 121.77, 83.87, 69.04, 65.00, 41.56, 41.21, 39.85, 31.89, 29.63, 27.70, 25.05, 22.98, 18.15, 15.84, 14.84. **FT-IR** (neat, cm^{-1}): 3299,

2953, 2116, 1716, 1672. **HRMS** (ESI+): Calcd. for $C_{24}H_{28}O_3Br$ ([M+H]$^+$), 443.1222. Found: 443.1229.

Data for diastereomer D: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.42 (d, *J*= 8.5 Hz, 2H), 7.32 (d, *J*= 8.5 Hz, 2H), 6.58-6.56 (m, 1H), 4.06-3.99 (m, 2H), 2.45-2.36 (m, 2H), 2.33-2.27 (m, 1H), 2.25-2.23 (m, 1H), 2.20-2.10 (m, 2H), 2.13-2.07 (m, 1H), 1.96 (t, *J*= 2.5 Hz, 1H), 1.75-1.68 (m, 2H), 1.66 (bs, 3H), 1.61 (d, *J*= 5.0 Hz, 1H), 1.54-1.47 (m, 2H), 1.19 (s, 3H), 1.16 (d, *J*= 5.0 Hz, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 199.98, 171.02, 144.71, 135.39, 135.32, 132.92, 131.30, 121.88, 83.90, 68.99, 64.98, 42.07, 41.68, 40.48, 32.14, 28.22, 27.71, 25.11, 22.98, 18.18, 15.78, 14.84. **FT-IR** (neat, cm^{-1}): 3299, 2953, 2116, 1716, 1672. **HRMS** (ESI+): Calcd. for $C_{24}H_{28}O_3Br$ ([M+H]$^+$), 443.1222. Found: 443.1239.



Carvone **1** (20 mg, 0.1331 mmol) and $Rh_2(esp)_2$ (3.03 mg, 0.0039 mmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC. The diazo reagent **2c** (101.8 mg, 0.5325 mmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired cyclopropanated product **3c** (23 mg, 55% yield, 1:1:1:1 mixture of diastereomers) as a colorless oil. Analytical samples were

obtained by further purification by preparative TLC using hexanes and ethyl acetate (4:1) as eluent.

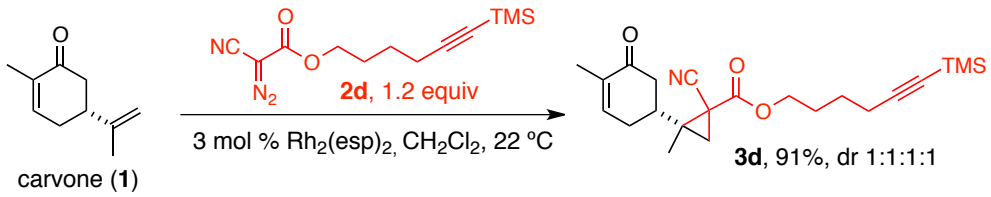
Data for diastereomer A: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.80-6.78 (m, 1H), 4.29-4.21 (m, 2H), 2.61-2.55 (m, 1H), 2.50-2.48 (m, 2H), 2.46-2.42 (m, 1H), 2.28 (dt, *J*= 7.0, 2.5 Hz, 2H), 2.04-2.00 (m, 1H), 1.98 (t, *J*= 2.5 Hz, 1H), 1.88-1.85 (m, 2H), 1.84 (d, *J*= 5.0 Hz, 1H), 1.79 (bs, 3H), 1.68-1.64 (m, 2H), 1.48 (d, *J*= 5.0 Hz, 1H), 1.21 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.40, 165.69, 144.24, 135.88, 117.89, 83.80, 69.17, 66.55, 43.52, 41.48, 38.16, 29.03, 28.26, 27.66, 25.42, 24.88, 18.22, 15.89, 12.04. **FT-IR** (neat, cm^{-1}): 3287, 2924, 2239, 2123, 1732, 1673. **HRMS** (ESI+): Calcd. for $C_{19}H_{24}NO_3$ ($[M+H]^+$), 314.1756. Found: 314.1749.

Data for diastereomer B: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.74-6.73 (m, 1H), 4.26-4.19 (m, 2H), 2.47-2.45 (m, 1H), 2.44-2.42 (m, 2H), 2.37-2.35 (m, 1H), 2.25 (dt, *J*= 7.0, 3.0 Hz, 2H), 2.22-2.17 (m, 1H), 1.98 (t, *J*= 3.0 Hz, 1H), 1.93-1.86 (m, 2H), 1.84 (d, *J*= 5.5 Hz, 1H), 1.74 (bs, 3H), 1.69-1.60 (m, 2H), 1.51 (d, *J*= 5.5 Hz, 1H), 1.42 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.07, 165.86, 143.90, 135.89, 117.83, 83.84, 69.13, 66.81, 41.31, 38.61, 36.53, 29.45, 29.39, 27.57, 25.41, 24.80, 18.12, 17.52, 15.86. **FT-IR** (neat, cm^{-1}): 3289, 2926, 2241, 2117, 1734, 1675. **HRMS** (ESI+): Calcd. for $C_{19}H_{24}NO_3$ ($[M+H]^+$), 314.1756. Found: 314.1758.

Data for diastereomer C: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.67-6.65 (m, 1H), 4.26-4.19 (m, 2H), 2.44-2.42 (m, 2H), 2.40-2.38 (m, 2H), 2.25 (dt, *J*= 7.0, 3.0 Hz, 2H), 2.12 (ddd, *J*= 15.5, 3.5, 1.5 Hz, 1H), 1.97 (t, *J*= 3.0 Hz, 1H), 1.85-1.80 (m, 2H), 1.84 (d, *J*= 5.5 Hz, 1H), 1.73 (bs, 3H), 1.69-1.60 (m, 2H), 1.51 (d, *J*= 5.5 Hz, 1H), 1.41 (s, 3H). **^{13}C NMR**

(125 MHz, $CDCl_3$) δ 198.43, 166.00, 143.66, 135.92, 117.89, 83.69, 69.18, 66.60, 41.73, 38.94, 36.80, 29.80, 28.97, 27.61, 25.39, 24.79, 18.16, 17.52, 15.86. **FT-IR** (neat, cm^{-1}): 3289, 2926, 2241, 2117, 1734, 1675. **HRMS** (ESI+): Calcd. for $C_{19}H_{24}NO_3$ ($[M+H]^+$), 314.1756. Found: 314.1758.

Data for diastereomer D: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.76-6.75 (m, 1H), 4.24 (t, *J*= 6.5 Hz, 2H), 2.70 (ddd, *J*= 16.5, 4.0, 1.5 Hz, 1H), 2.50-2.43 (m, 1H), 2.44 (dd, *J*= 16.5, 13.5 Hz, 1H), 2.33-2.29 (m, 1H), 2.27 (dt, *J*= 7.0, 2.5 Hz, 2H), 2.09-2.02 (m, 1H), 1.97 (t, *J*= 2.5 Hz, 1H), 1.87-1.82 (m, 2H), 1.84 (d, *J*= 5.5 Hz, 1H), 1.78 (bs, 3H), 1.67-1.61 (m, 2H), 1.47 (d, *J*= 5.5 Hz, 1H), 1.19 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 197.80, 165.67, 143.40, 136.25, 117.63, 83.79, 69.18, 66.53, 42.80, 40.50, 37.87, 28.96, 28.77, 27.61, 25.38, 24.79, 18.16, 15.96, 12.23. **FT-IR** (neat, cm^{-1}): 3287, 2950, 2237, 2116, 1735, 1673. **HRMS** (ESI+): Calcd. for $C_{19}H_{24}NO_3$ ($[M+H]^+$), 314.1756. Found: 314.1751.



Carvone **1** (20 mg, 0.1331 mmol) and $Rh_2(esp)_2$ (3.03 mg, 0.0039 mmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 °C. The diazo reagent **2d** (42 mg, 0.1597 mmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (9:1) as eluent to afford the desired cyclopropanated product **3d** (46.7 mg, 91% yield, 1:1:1:1 mixture of

diastereomers) as a colorless oil. Analytical samples were obtained by further purification by preparative TLC using hexanes and ethyl acetate (9:1) as eluent.

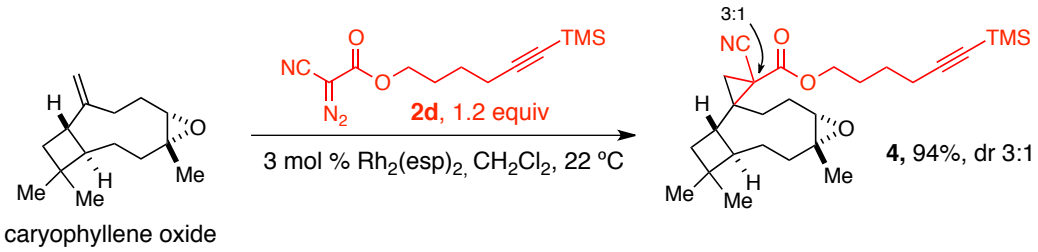
Data for diastereomer A: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.79-6.77 (m, 1H), 4.27-4.18 (m, 2H), 2.48 (dd, *J*= 6.0, 5.0 Hz, 1H), 2.46-2.39 (m, 2H), 2.31 (dt, *J*= 7.0, 1.0 Hz, 2H), 2.30 (d, *J*= 7.0 Hz, 1H), 2.24-2.18 (m, 1H), 2.13 (ddd, *J*= 15.5, 3.5, 1.5 Hz, 1H), 1.85-1.80 (m, 2H), 1.78 (bs, 3H), 1.68-1.59 (m, 2H), 1.52 (d, *J*= 5.5 Hz, 1H), 1.43 (s, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.06, 165.90, 143.86, 135.96, 117.89, 106.69, 85.31, 66.93, 43.52, 41.36, 36.57, 29.43, 28.99, 27.70, 25.46, 24.99, 19.58, 17.57, 15.90, 0.33. **FT-IR** (neat, cm^{-1}): 2958, 2239, 2173, 1734, 1677. **HRMS** (ESI+): Calcd. for $C_{22}H_{32}NO_3Si$ ($[M+H]^+$), 386.2151. Found: 386.2164.

Data for diastereomer B: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.75-6.73 (m, 1H), 4.27-4.18 (m, 2H), 2.60-2.54 (m, 1H), 2.46-2.39 (m, 2H), 2.41 (dd, *J*= 16.0, 14.0 Hz, 1H), 2.31 (dt, *J*= 7.0, 1.0 Hz, 2H), 2.29 (d, *J*= 7.0 Hz, 1H), 2.03-1.97 (m, 1H), 1.85-1.80 (m, 2H), 1.75 (bs, 3H), 1.68-1.59 (m, 2H), 1.47 (d, *J*= 5.5 Hz, 1H), 1.21 (s, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.38, 165.66, 144.21, 135.88, 117.88, 106.55, 85.44, 66.59, 41.48, 38.61, 38.11, 29.49, 28.25, 27.76, 25.42, 24.99, 19.62, 15.88, 12.04, 0.33. **FT-IR** (neat, cm^{-1}): 2958, 2239, 2173, 1734, 1677. **HRMS** (ESI+): Calcd. for $C_{22}H_{32}NO_3Si$ ($[M+H]^+$), 386.2151. Found: 386.2164.

Data for diastereomer C: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.76-6.75 (m, 1H), 4.28-4.19 (m, 2H), 2.70 (ddd, *J*= 16.5, 4.0, 1.5 Hz, 1H), 2.50-2.40 (m, 2H), 2.34-2.33 (m, 1H), 2.31-2.27 (m, 2H), 2.09-2.02 (m, 1H), 1.85 (d, *J*= 5.5 Hz, 1H), 1.84-1.80 (m, 2H), 1.79 (bs, 3H), 1.66-1.60 (m, 2H), 1.47 (d, *J*= 5.5 Hz, 1H), 1.19 (s, 3H), 0.14 (s, 9H). **^{13}C NMR**

(125 MHz, $CDCl_3$) δ 197.81, 165.68, 143.40, 136.28, 117.64, 106.58, 85.42, 66.61, 42.81, 40.51, 37.85, 28.98, 28.78, 27.73, 25.40, 24.90, 19.58, 15.98, 12.24, 0.33. **FT-IR** (neat, cm^{-1}): 2957, 2239, 2173, 1732, 1676. **HRMS** (ESI+): Calcd. for $C_{22}H_{32}NO_3Si$ ([M +H]$^+$), 386.2151. Found: 386.2166.

Data for diastereomer D: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.67-6.66 (m, 1H), 4.28-4.19 (m, 2H), 2.50-2.40 (m, 2H), 2.41-2.37 (m, 1H), 2.31-2.27 (m, 2H), 2.26-2.23 (m, 1H), 1.94-1.80 (m, 1H), 1.85 (d, *J*= 5.5 Hz, 1H), 1.84-1.80 (m, 2H), 1.75 (bs, 3H), 1.66-1.60 (m, 2H), 1.52 (d, *J*= 5.5 Hz, 1H), 1.42 (s, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 198.48, 166.05, 143.63, 136.01, 117.95, 106.47, 85.48, 66.70, 41.78, 38.95, 36.84, 29.84, 29.01, 27.74, 25.43, 24.97, 19.61, 17.56, 15.91, 0.33. **FT-IR** (neat, cm^{-1}): 2957, 2239, 2173, 1732, 1676. **HRMS** (ESI+): Calcd. for $C_{22}H_{32}NO_3Si$ ([M+H]$^+$), 386.2151. Found: 386.2166.

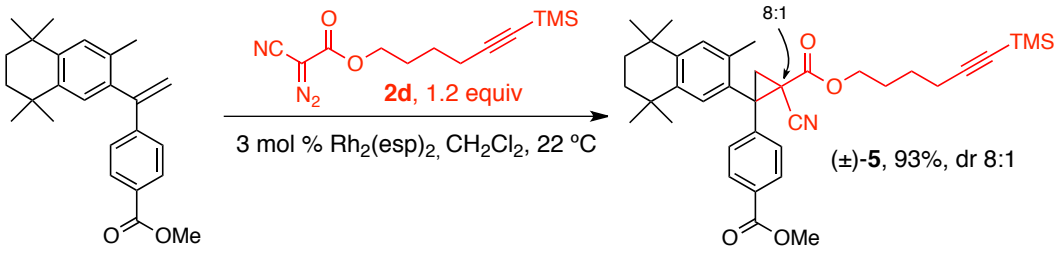


Caryophyllene oxide (20 mg, 90.76 μmol) and $Rh_2(esp)_2$ (2.07 mg, 1.52 μmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 °C. The diazo reagent **2d** (28.7 mg, 108.92 μmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl

acetate (9:1) as eluent to afford the desired cyclopropanated product **4** (38.0 mg, 94% yield, 3:1 mixture of inseparable diastereomers) as a colorless oil.

Data for diastereomer **4a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 4.26-4.20 (m, 2H), 2.99 (dd, *J*= 11.5, 3.5 Hz, 1H), 2.29 (t, *J*= 7.0 Hz, 2H), 2.26-2.23 (m, 1H), 2.18-2.12 (m, 1H), 2.11-2.06 (m, 2H), 2.00 (t, *J*= 10.0 Hz, 1H), 1.87-1.76 (m, 3H), 1.73-1.66 (m, 2H), 1.64 (p, *J*= 7.0 Hz, 2H), 1.59 (d, *J*= 5.5 Hz, 1H), 1.53-1.30 (m, 3H), 1.26 (d, *J*= 5.5 Hz, 1H), 1.23 (s, 3H), 1.06-1.02 (m, 1H), 0.97 (s, 3H), 0.89 (s, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 166.12, 118.57, 106.60, 85.38, 66.61, 64.86, 60.34, 46.70, 44.92, 43.04, 37.90, 37.12, 34.77, 31.74, 29.92, 28.46, 27.57, 27.26, 26.34, 25.47, 25.01, 21.15, 19.60, 17.19, 0.34. **FT-IR** (neat, cm^{-1}): 2957, 2237, 2174, 1733, 1678. **HRMS** (ESI+): Calcd. for $C_{27}H_{42}NO_3Si$ ($[M+H]^+$), 456.2934. Found: 456.2938.

Data for diastereomer **4b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 4.13-4.08 (m, 2H), 2.99 (dd, *J*= 11.5, 3.5 Hz, 1H), 2.42 (t, *J*= 14.0 Hz, 1H), 2.29 (t, *J*= 7.0 Hz, 2H), 2.26-2.23 (m, 1H), 2.18-2.12 (m, 1H), 2.11-2.06 (m, 2H), 1.90 (d, *J*= 5.5 Hz, 1H), 1.87-1.76 (m, 3H), 1.73-1.66 (m, 2H), 1.64 (p, *J*= 7.0 Hz, 2H), 1.53-1.30 (m, 3H), 1.28-1.20 (m, 1H), 1.23 (s, 3H), 1.21 (d, *J*= 5.5 Hz, 1H), 1.02 (s, 3H), 1.01 (s, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 166.42, 118.46, 106.60, 85.38, 66.50, 65.22, 60.41, 50.91, 47.38, 43.12, 38.05, 35.88, 35.29, 31.88, 30.07, 27.76, 26.96, 26.58, 26.29, 25.47, 24.98, 20.88, 20.39, 17.34, 0.34. **FT-IR** (neat, cm^{-1}): 2957, 2237, 2174, 1733, 1678. **HRMS** (ESI+): Calcd. for $C_{27}H_{42}NO_3Si$ ($[M+H]^+$), 456.2934. Found: 456.2938.

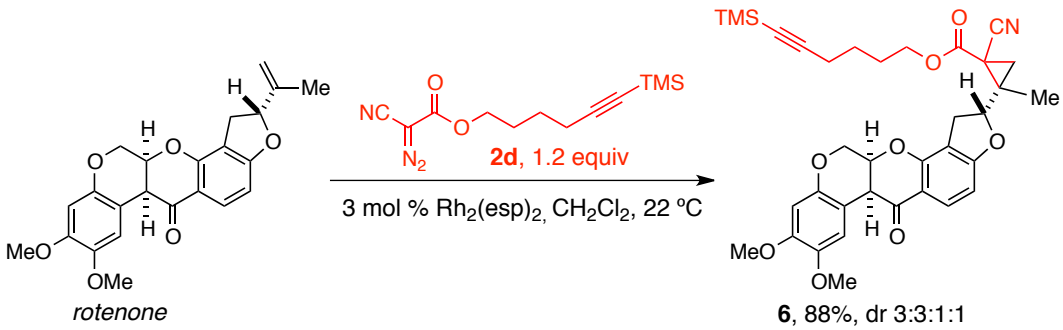


bexarotene methyl ester

Bexarotene methyl ester (20 mg, 55.17 μmol) and $Rh_2(esp)_2$ (1.26 mg, 1.66 μmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC. The diazo reagent **2d** (17.4 mg, 66.21 μmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (9:1) as eluent to afford the minor cyclopropane diastereomer **5a** (3.4 mg) and upon further elution, the major cyclopropane diastereomer **5b** (27.2 mg) as a colorless oils (93% combined yield, dr 8:1).

Data for diastereomer **5a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.94 (d, *J*= 8.5 Hz, 2H), 7.67 (s, 1H), 7.44 (d, *J*= 8.5 Hz, 2H), 7.01 (s, 1H), 4.02-3.92 (m, 2H), 3.88 (s, 3H), 2.91 (d, *J*= 5.0 Hz, 1H), 2.30 (s, 3H), 2.24 (t, *J*= 7.0 Hz, 2H), 2.11 (d, *J*= 5.0 Hz, 1H), 1.70-1.60 (m, 6H), 1.59-1.49 (m, 2H), 1.41 (s, 3H), 1.38 (s, 3H), 1.23 (s, 3H), 1.20 (s, 3H), 0.16 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 166.59, 164.77, 145.45, 143.26, 141.96, 133.50, 133.44, 129.86, 129.65, 129.46, 129.17, 129.01, 117.77, 106.56, 85.38, 66.56, 52.38, 47.12, 45.21, 35.18, 34.44, 34.14, 32.19, 31.88, 31.66, 29.92, 27.97, 27.61, 27.04, 25.03, 19.59, 0.34. **FT-IR** (neat, cm^{-1}): 2957, 2241, 2174, 1729, 1609. **HRMS** (ESI+): Calcd. for $C_{37}H_{47}NO_4SiLi$ ([M+Li]$^+$), 604.3434. Found: 604.3419.

Data for diastereomer **5b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.02 (d, *J*= 8.0 Hz, 2H), 7.53 (d, *J*= 8.0 Hz, 2H), 7.21 (s, 1H), 6.99 (s, 1H), 4.08-4.04 (m, 2H), 3.89 (s, 3H), 2.68 (bs, 1H), 2.58 (bs, 1H), 2.27 (s, 3H), 2.18 (t, *J*= 7.0 Hz, 2H), 1.65-1.58 (m, 6H), 1.44 (p, *J*= 7.0 Hz, 2H), 1.30 (s, 3H), 1.25 (s, 3H), 1.21 (s, 3H), 1.20 (s, 3H), 0.16 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 166.58, 165.21, 145.05, 142.97, 142.89, 133.72, 132.5, 130.27, 130.02, 129.47, 128.89, 127.05, 117.39, 106.55, 85.35, 66.64, 52.37, 47.57, 35.15, 35.11, 34.10, 32.25, 32.05, 32.02, 31.81, 28.77, 27.37, 26.98, 24.95, 19.54, 19.43, 0.35. **FT-IR** (neat, cm^{-1}): 2957, 2243, 2173, 1726, 1609. **HRMS** (ESI+): Calcd. for $C_{37}H_{48}NO_4Si$ ([M+H]$^+$), 598.3353. Found: 598.3331.



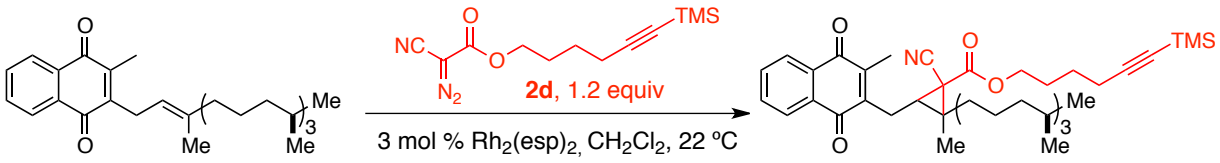
Rotenone (20 mg, 50.71 μmol) and $Rh_2(esp)_2$ (1.1 mg, 1.52 μmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 °C. The diazo reagent **2d** (16 mg, 60.85 μmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired cyclopropanated product **6** (28 mg, 88% yield, 3:3:1:1 mixture of diastereomers) as a colorless oil. Analytical samples were obtained by further purification by preparative TLC using hexanes and ethyl acetate (4:1) as eluent.

Data for diastereomer **6a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.86 (d, *J*= 9.0 Hz, 1H), 6.75 (s, 1H), 6.51 (d, *J*= 9.0 Hz, 1H), 6.45 (s, 1H), 4.98-4.95 (m, 2H), 4.65 (dd, *J*= 12.0, 3.0 Hz, 1H), 4.34-4.29 (m, 1H), 4.25-4.21 (m, 1H), 4.20 (d, *J*= 12.0 Hz, 1H), 3.87 (d, *J*= 4.0 Hz, 1H), 3.81 (s, 3H), 3.77 (s, 3H), 3.11 (dd, *J*= 16.0, 10.0 Hz, 1H), 2.99 (dd, *J*= 16.0, 7.0 Hz, 1H), 2.34 (t, *J*= 7.0 Hz, 2H), 2.21 (d, *J*= 5.5 Hz, 1H), 1.87 (p, *J*= 7.0 Hz, 2H), 1.73 (d, *J*= 5.5 Hz, 1H), 1.68 (p, *J*= 7.0 Hz, 2H), 1.42 (s, 3H), 0.16 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 189.02, 167.03, 165.80, 158.00, 149.72, 147.51, 144.11, 130.50, 117.15, 113.86, 112.57, 110.42, 106.54, 104.99, 104.77, 101.07, 85.54, 84.93, 72.57, 67.22, 66.45, 56.52, 56.05, 44.78, 37.88, 30.92, 29.59, 27.74, 24.99, 24.49, 19.65, 15.48, 0.34. **FT-IR** (neat, cm^{-1}): 2957, 2243, 2172, 1735, 1675, 1608. **HRMS** (ESI+): Calcd. for $C_{35}H_{40}NO_8Si$ ($[M+H]^+$), 630.2523. Found: 630.2510.

Data for diastereomer **6b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.85 (d, *J*= 9.0 Hz, 1H), 6.73 (s, 1H), 6.52 (d, *J*= 9.0 Hz, 1H), 6.46 (s, 1H), 5.00-4.95 (m, 1H), 4.66-4.61 (m, 2H), 4.33-4.18 (m, 3H), 3.87 (d, *J*= 4.0 Hz, 1H), 3.82 (s, 3H), 3.76 (s, 3H), 3.15 (dd, *J*= 16.0, 7.0 Hz, 1H), 3.04 (dd, *J*= 16.0, 7.0 Hz, 1H), 2.33 (t, *J*= 7.0 Hz, 2H), 2.00 (d, *J*= 5.5 Hz, 1H), 1.88-1.84 (m, 2H), 1.66 (p, *J*= 7.0 Hz, 2H), 1.41 (d, *J*= 5.5 Hz, 1H), 1.25 (s, 3H), 0.16 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 189.15, 166.87, 165.13, 158.05, 149.78, 147.63, 144.05, 130.41, 117.13, 113.86, 112.78, 110.44, 106.53, 104.93, 104.63, 101.19, 89.45, 85.57, 72.51, 66.89, 66.30, 56.54, 56.06, 44.85, 37.67, 29.91, 29.26, 27.77, 24.97, 22.57, 19.65, 10.32, 0.35. **FT-IR** (neat, cm^{-1}): 2957, 2241, 2173, 1738, 1677, 1610. **HRMS** (ESI+): Calcd. for $C_{35}H_{40}NO_8Si$ ($[M+H]^+$), 630.2523. Found: 630.2515.

Data for diastereomer **6c**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.86 (d, *J*= 8.5 Hz, 1H), 6.76 (s, 1H), 6.55 (d, *J*= 8.5 Hz, 1H), 6.46 (s, 1H), 4.98-4.96 (m, 1H), 4.84 (dd, *J*= 10.0, 8.0 Hz, 1H), 4.62 (dd, *J*= 12.0, 3.0 Hz, 1H), 4.32-4.23 (m, 2H), 4.20 (d, *J*= 15.0 Hz, 1H), 3.87 (d, *J*= 4.0 Hz, 1H), 3.82 (s, 3H), 3.77 (s, 3H), 3.41 (dd, *J*= 16.0, 10.0 Hz, 1H), 3.16 (dd, *J*= 16.0, 8.0 Hz, 1H), 2.30 (t, *J*= 7.0 Hz, 2H), 1.91 (d, *J*= 5.5 Hz, 1H), 1.85 (p, *J*= 7.0 Hz, 2H), 1.73 (d, *J*= 5.5 Hz, 1H), 1.65 (p, *J*= 7.0 Hz, 2H), 1.27 (s, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 189.03, 167.10, 165.60, 157.90, 149.73, 147.52, 144.13, 130.54, 117.28, 113.85, 112.49, 110.44, 106.59, 105.29, 104.81, 101.10, 87.01, 85.45, 72.51, 66.84, 66.44, 56.51, 56.07, 44.80, 38.43, 30.38, 27.76, 25.42, 24.99, 24.97, 19.65, 11.21, 0.34. **FT-IR** (neat, cm^{-1}): 2954, 2238, 2173, 1737, 1676, 1610. **HRMS** (ESI+): Calcd. for $C_{35}H_{40}NO_8Si$ ($[M+H]^+$), 630.2523. Found: 630.2540.

Data for diastereomer **6d**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.84 (d, *J*= 9.0 Hz, 1H), 6.75 (s, 1H), 6.48 (d, *J*= 9.0 Hz, 1H), 6.45 (s, 1H), 4.96-4.95 (m, 1H), 4.92 (dd, *J*= 10.0, 7.0 Hz, 1H), 4.61 (dd, *J*= 12.0, 3.0 Hz, 1H), 4.35-4.30 (m, 1H), 4.26-4.21 (m, 1H), 4.19 (d, *J*= 12.0 Hz, 1H), 3.86 (d, *J*= 4.0 Hz, 1H), 3.81 (s, 3H), 3.76 (s, 3H), 3.31 (dd, *J*= 16.0, 10.0 Hz, 1H), 3.13 (dd, *J*= 16.0, 7.0 Hz, 1H), 2.29 (t, *J*= 7.0 Hz, 2H), 1.95 (d, *J*= 5.5 Hz, 1H), 1.84 (p, *J*= 7.0 Hz, 2H), 1.67 (p, *J*= 7.0 Hz, 2H), 1.58 (d, *J*= 5.5 Hz, 1H), 1.45 (s, 3H), 0.14 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 188.98, 167.17, 165.72, 157.98, 149.71, 147.51, 144.09, 130.48, 117.47, 113.75, 112.44, 110.45, 106.66, 104.98, 104.79, 101.08, 85.37, 82.77, 72.52, 66.95, 66.40, 56.50, 56.05, 44.77, 38.09, 29.84, 27.73, 26.63, 25.83, 24.90, 19.61, 15.47, 0.31. **FT-IR** (neat, cm^{-1}): 2957, 2242, 2173, 1734, 1675, 1613. **HRMS** (ESI+): Calcd. for $C_{35}H_{40}NO_8Si$ ($[M+H]^+$), 630.2523. Found: 630.2529.



Vitamin K1 (20 mg, 44.38 μmol) and $Rh_2(esp)_2$ (1 mg, 1.33 μmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC. The diazo reagent **2d** (14 mg, 53.25 μmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (9:1) as eluent to afford the desired cyclopropanated product **7** (25.7 mg, 84% yield, 4:4:1:1 mixture of diastereomers) as a yellow oil. Analytical samples were obtained by further purification by preparative TLC using hexanes and ethyl acetate (9:1) as eluent.

Data for diastereomer **7a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.11-8.07 (m, 2H), 7.74-7.72 (m, 2H), 4.28-4.17 (m, 2H), 3.13-3.05 (m, 2H), 2.31 (t, *J*= 7.0 Hz, 2H), 2.28 (t, *J*= 6.0 Hz, 1H), 2.22 (s, 3H), 1.88-1.79 (m, 4H), 1.74-1.58 (m, 5H), 1.56-1.48 (m, 4H), 1.41 (s, 3H), 1.26-1.11 (m, 12H), 0.87 (d, *J*= 6.5 Hz, 6H, 2 overlapping methyls), 0.83 (d, *J*= 7.0 Hz, 3H), 0.76 (d, *J*= 6.5 Hz, 3H), 0.16 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 185.19, 184.72, 165.68, 145.03, 144.85, 133.85 (2 carbons), 132.21, 126.63 (2 carbons), 118.80, 106.75, 85.35, 65.95, 45.21, 41.86, 40.33, 39.58, 39.55, 37.58, 37.48, 37.41, 36.87, 33.01, 32.84, 29.93, 28.20, 27.81, 27.02, 25.08, 24.66, 23.93, 22.85, 21.61, 19.94, 19.87, 19.67, 19.59, 13.37, 12.23, 0.36. **FT-IR** (neat, cm^{-1}): 2955, 2236, 2174, 1734,

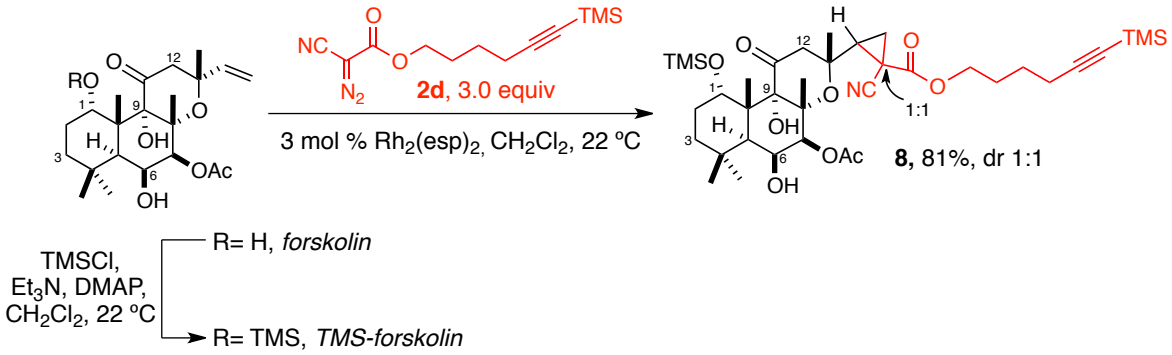
1661, 1620. **HRMS** (ESI+): Calcd. for $C_{43}H_{63}NO_4SiLi$ ([M+Li]$^+$), 692.4686. Found: 692.4679.

Data for diastereomer **7b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.11-8.07 (m, 2H), 7.74-7.72 (m, 2H), 4.28-4.17 (m, 2H), 3.13-3.05 (m, 2H), 2.31 (t, *J*= 7.0 Hz, 2H), 2.28 (t, *J*= 6.0 Hz, 1H), 2.22 (s, 3H), 1.88-1.79 (m, 4H), 1.74-1.58 (m, 5H), 1.56-1.48 (m, 4H), 1.41 (s, 3H), 1.26-1.11 (m, 12H), 0.87 (d, *J*= 6.5 Hz, 6H, 2 overlapping methyls), 0.82 (d, *J*= 7.0 Hz, 3H), 0.78 (d, *J*= 6.5 Hz, 3H), 0.16 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 185.19, 184.73, 166.68, 145.03, 144.85, 133.85 (2 carbons), 132.21, 126.59 (2 carbons), 118.79, 106.75, 85.35, 66.95, 45.20, 41.86, 40.36, 39.58, 39.46, 37.61, 37.48, 37.38, 36.96, 33.01, 32.84, 29.93, 28.20, 27.81, 27.02, 25.02, 24.62, 23.95, 22.95, 21.64, 19.95, 19.87, 19.67, 19.63, 13.37, 12.26, 0.36. **FT-IR** (neat, cm^{-1}): 2955, 2236, 2174, 1734, 1661, 1620. **HRMS** (ESI+): Calcd. for $C_{43}H_{63}NO_4SiLi$ ([M+Li]$^+$), 692.4686. Found: 692.4679.

Data for diastereomer **7c**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.12-8.07 (m, 2H), 7.74-7.70 (m, 2H), 4.22-4.16 (m, 2H), 2.98 (dd, *J*= 14.0, 6.0 Hz, 1H), 2.83 (dd, *J*= 14.0, 6.0 Hz, 1H), 2.28 (t, *J*= 7.0 Hz, 2H), 2.27 (s, 3H), 2.12 (t, *J*= 6.0 Hz, 1H), 1.81 (p, *J*= 7.0 Hz, 2H), 1.62 (p, *J*= 7.0 Hz, 2H), 1.54-1.50 (m, 3H), 1.50 (s, 3H), 1.29-1.11 (m, 18H), 0.87 (d, *J*= 6.5 Hz, 6H, 2 overlapping methyls), 0.83 (d, *J*= 6.5 Hz, 3H), 0.77 (d, *J*= 6.0 Hz, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 185.09, 184.45, 166.34, 144.96, 144.32, 133.83 (2 carbons), 132.22, 126.63 (2 carbons), 117.03, 106.62, 85.34, 66.40, 41.67, 39.56, 37.86, 37.57, 37.47, 36.88, 36.79, 34.10, 32.99, 32.82, 30.46, 28.18, 27.75, 25.04, 25.00, 24.66, 24.61, 24.14, 23.69, 22.84, 19.93, 19.67, 19.64, 19.61, 16.53,

13.55, 0.34. **FT-IR** (neat, cm^{-1}): 2955, 2236, 2174, 1735, 1667, 1620. **HRMS** (ESI+): Calcd. for $C_{43}H_{64}NO_4Si$ ($[M+H]^+$), 686.4605. Found: 686.4618.

Data for diastereomer **7d**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.12-8.07 (m, 2H), 7.74-7.70 (m, 2H), 4.22-4.16 (m, 2H), 2.98 (dd, *J*= 14.0, 6.0 Hz, 1H), 2.82 (dd, *J*= 14.0, 6.0 Hz, 1H), 2.28 (t, *J*= 7.0 Hz, 2H), 2.27 (s, 3H), 2.12 (t, *J*= 6.0 Hz, 1H), 1.81 (p, *J*= 7.0 Hz, 2H), 1.62 (p, *J*= 7.0 Hz, 2H), 1.54-1.50 (m, 3H), 1.50 (s, 3H), 1.29-1.11 (m, 18H), 0.87 (d, *J*= 6.5 Hz, 6H, 2 overlapping methyls), 0.83 (d, *J*= 6.5 Hz, 3H), 0.75 (d, *J*= 6.0 Hz, 3H), 0.15 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 185.09, 184.44, 166.31, 144.95, 144.32, 133.83 (2 carbons), 132.16, 126.63 (2 carbons), 117.03, 106.62, 85.34, 66.40, 41.59, 39.56, 37.89, 37.61, 37.46, 36.96, 36.88, 34.03, 32.99, 32.84, 30.46, 28.18, 27.75, 25.04, 25.01, 24.67, 24.61, 24.24, 23.69, 22.94, 19.86, 19.67, 19.64, 19.57, 16.55, 13.55, 0.34. **FT-IR** (neat, cm^{-1}): 2955, 2236, 2174, 1735, 1667, 1620. **HRMS** (ESI+): Calcd. for $C_{43}H_{64}NO_4Si$ ($[M+H]^+$), 686.4605. Found: 686.4618.



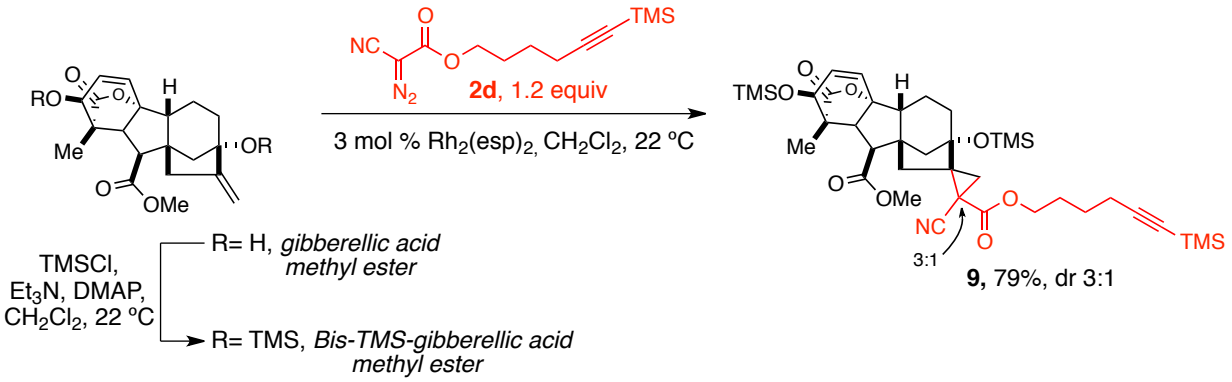
Forskolin (12 mg, 29.23 μmol) was dissolved in 2 mL of dry CH_2Cl_2 and then the DMAP (357 μg, 2.923 μmol) was added followed by the Et_3N (8 μL, 58.47 μmol) and TMSCl (7.5 μL, 58.47 μmol). The reaction mixture was stirred for 2 h at 22 ºC and then quenched with a pH 7 phosphate buffer solution (1 mL). The organic fraction was dried

over Na_2SO_4, filtered and concentrated under reduced pressure. The residue was filtered through a short plug of silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired TMS-forskolin derivative (13 mg, 92% yield) as a colorless oil.

TMS-forskolin (13 mg, 26.93 μmol) and $Rh_2(esp)_2$ (0.61 mg, 0.80 μmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC. The diazo reagent **2d** (21.3 mg, 80.80 μmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the cyclopropane diastereomer **8a** (7.7 mg) and upon further elution, cyclopropane diastereomer **8b** (7.8 mg) as a colorless oils (81% combined yield, dr 1:1).

Data for diastereomer **8a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.02 (s, 1H), 5.59 (d, *J*= 4.5 Hz, 1H), 4.46 (bs, 1H), 4.41 (bs, 1H), 4.24-4.15 (m, 2H), 3.60 (d, *J*= 14.0 Hz, 1H), 2.46 (dd, *J*= 8.0, 4.0 Hz, 1H), 2.28 (t, *J*= 7.0 Hz, 2H), 2.26 (d, *J*= 14.0 Hz, 1H), 2.21 (d, *J*= 1.5 Hz, 1H), 2.19-2.17 (m, 1H), 2.15 (s, 3H), 1.89 (dd, *J*= 8.0, 8.0 Hz, 1H), 1.84-1.77 (m, 3H), 1.67-1.61 (m, 4H), 1.64 (s, 3H), 1.58, (s, 3H), 1.48 (s, 3H), 1.43-1.38 (m, 1H), 1.24 (s, 3H), 1.08 (dt, J= 13.0, 3.0 Hz, 1H), 1.03 (s, 3H), 0.15 (s, 9H), 0.13 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 207.92, 170.80, 168.98, 116.96, 106.72, 85.33, 83.59, 82.82, 76.43, 75.78, 73.24, 70.18, 66.45, 50.46, 44.11, 43.62, 43.59, 36.26, 34.46, 32.95, 29.94, 27.74, 26.12, 24.98, 24.18, 23.70, 22.03, 21.30, 19.84, 19.64, 17.38, 0.49, 0.35. **FT-IR** (neat, cm^{-1}): 3529, 2956, 2242, 2171, 1747, 1717. **HRMS** (ESI+): Calcd. for $C_{37}H_{60}NO_9Si_2$ ($[M+H]^+$), 718.3807. Found: 718.3824.

Data for diastereomer **8b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.15 (s, 1H), 5.53 (d, *J*= 4.0 Hz, 1H), 4.62 (bs, 1H), 4.45 (bs, 1H), 4.30-4.25 (m, 1H), 4.23-4.18 (m, 1H), 3.23 (d, *J*= 16.0 Hz, 1H), 2.44 (t, *J*= 9.0 Hz, 1H), 2.42 (d, *J*= 16.0 Hz, 1H), 2.30 (t, *J*= 7.0 Hz, 2H), 2.21 (d, *J*= 2.5 Hz, 1H), 2.19 (s, 3H), 1.87-1.80 (m, 3H), 1.76 (bs, 1H), 1.69-1.62 (m, 6H), 1.65 (s, 3H), 1.43, (s, 3H), 1.37 (s, 3H), 1.24 (s, 3H), 1.08 (dt, J= 13.0, 3.0 Hz, 1H), 1.03 (s, 3H), 0.15 (s, 9H), 0.14 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 205.84, 169.89, 168.22, 117.41, 106.91, 85.21, 82.33, 82.00, 76.86, 76.80, 74.06, 70.10, 66.47, 49.41, 43.38, 43.36, 43.17, 36.21, 34.56, 33.03, 29.93, 27.70, 26.17, 24.95, 24.30, 24.02, 22.69, 21.41, 20.00, 19.64, 17.19, 0.53, 0.37. **FT-IR** (neat, cm^{-1}): 3526, 2956, 2240, 2173, 1738, 1717. **HRMS** (ESI+): Calcd. for $C_{37}H_{60}NO_9Si_2$ ([M+H]$^+$), 718.3807. Found: 718.3822.



Gibberellic acid methyl ester (100 mg, 277.47 μmol) was dissolved in 5 mL of dry CH_2Cl_2 and then DMAP (3.4 mg, 27.75 μmol) was added followed by Et_3N (85 μL, 610.43 μmol) and TMSCl (77 μL, 610.43 μmol) The reaction mixture was stirred for 8 h at 22 °C and then quenched with a pH 7 phosphate buffer solution (3 mL). The organic fraction was dried over Na_2SO_4, filtered and concentrated under reduced pressure. The residue was filtered through a short plug of silica gel using hexanes and ethyl acetate

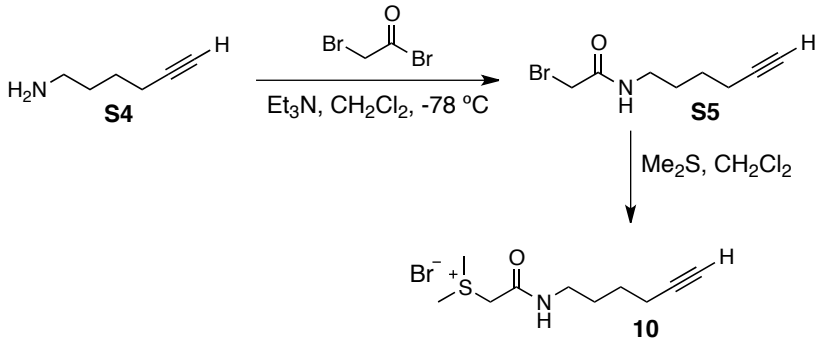
(9:1) as eluent to afford the desired bis-TMS-gibberellic acid methyl ester derivative (117.2 mg, 84% yield) as a colorless oil.

Bis-TMS-gibberellic acid methyl ester (20 mg, 39.62 μmol) and $Rh_2(esp)_2$ (0.90 mg, 1.19 μmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC. The diazo reagent **2d** (12.5 mg, 47.55 μmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (400 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (9:1) as eluent to afford the cyclopropane diastereomer **9a** (17.3 mg) and upon further elution, cyclopropane diastereomer **9b** (5.8 mg) as a colorless oils (79% combined yield, dr 3:1).

Data for diastereomer **9a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.30 (d, *J*= 10.0 Hz, 1H), 5.76 (dd, *J*= 10.0, 3.5 Hz, 1H), 4.22-4.16 (m, 2H), 4.13 (d, *J*= 3.5 Hz, 1H), 3.74 (s, 3H), 3.32 (d, *J*= 9.5 Hz, 1H), 2.71 (d, *J*= 9.5 Hz, 1H), 2.50 (d, *J*= 5.0 Hz, 1H), 2.29 (t, *J*= 7.0 Hz, 2H), 2.16 (dd, *J*= 11.0, 2.5 Hz, 1H), 2.12 (t, *J*= 7.5 Hz, 1H), 2.06 (dd, *J*= 14.0, 2.5 Hz, 1H), 1.98-1.91 (m, 2H), 1.87-1.78 (m, 4H), 1.75 (d, *J*= 14.0 Hz, 1H), 1.63 (p, *J*= 7.0 Hz, 2H), 1.57-1.51 (m, 1H), 1.35 (d, *J*= 5.0 Hz, 1H), 1.17 (s, 3H), 0.16 (s, 9H), 0.15 (s, 9H), 0.10 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 179.19, 172.46, 164.83, 133.55, 131.04, 118.50, 106.56, 90.97, 85.39, 77.98, 70.37, 66.31, 53.84, 53.60, 52.38, 51.32, 51.10, 50.64, 48.66, 45.39 (2 carbons), 36.09, 27.70, 27.49, 25.18, 25.09, 19.65, 17.49, 14.97, 2.21, 0.42, 0.35. **FT-IR** (neat, cm^{-1}): 2957, 2239, 2174, 1777, 1741. **HRMS** (ESI+): Calcd. for $C_{38}H_{58}NO_8Si_3$ ($[M+H]^+$), 740.3470. Found: 740.3485.

Data for diastereomer **9b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.25 (d, *J*= 9.0 Hz, 1H), 5.75 (dd, *J*= 9.0, 4.0 Hz, 1H), 4.37-4.32 (m, 1H), 4.12 (d, *J*= 4.0 Hz, 1H), 4.08-4.03 (m, 1H), 3.81 (s, 3H), 3.33 (d, *J*= 10.5 Hz, 1H), 2.78 (d, *J*= 10.5 Hz, 1H), 2.31 (t, *J*= 7.0 Hz, 2H), 2.30 (t, *J*= 7.0 Hz, 1H), 2.22 (d, *J*= 13.5 Hz, 1H), 2.14 (d, *J*= 5.0 Hz, 1H), 2.02-1.93 (m, 4H), 1.85-1.79 (m, 4H), 1.69-1.64 (m, 3H), 1.40 (d, *J*= 5.0 Hz, 1H), 1.18 (s, 3H), 0.16 (s, 9H), 0.15 (s, 9H), 0.08 (s, 9H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 179.14, 172.38, 164.49, 133.69, 131.05, 118.17, 106.75, 90.97, 85.33, 78.29, 70.19, 66.15, 54.02, 53.13, 52.69, 51.23, 51.22, 50.46, 48.25, 46.91, 46.65, 36.73, 27.81, 27.10, 25.08, 24.76, 19.69, 17.26, 15.05, 2.19, 0.42, 0.36. **FT-IR** (neat, cm^{-1}): 2957, 2239, 2175, 1777, 1740. **HRMS** (ESI+): Calcd. for $C_{38}H_{58}NO_8Si_3$ ($[M+H]^+$), 740.3470. Found: 740.3463.

E) Synthesis of alkynyl sulfonium salt 10.



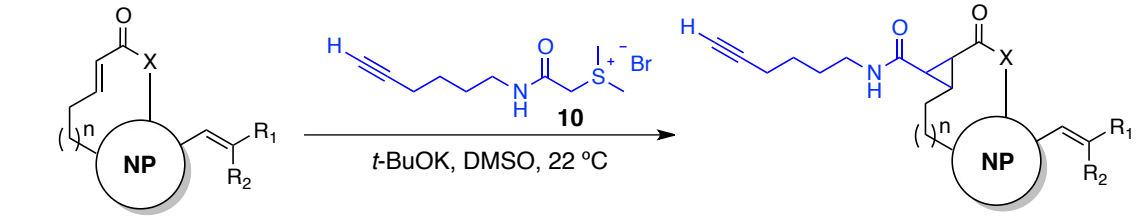
2-Bromo-*N*-(hex-5-yn-1-yl)acetamide (S5): Hex-5-yn-1-amine **S4** (1.8 g, 18.53 mmol) was dissolved in dry CH_2Cl_2 (37 mL) and then the Et_3N (5.16 mL, 37.05 mmol) was added. The reaction mixture was then cooled to -78 ºC and then the bromoacetyl

bromide (3.23 mL, 37.05 mmol) dropwise slowly. The reaction mixture was stirred at -78 ºC for 1 h and then it was allowed to warm up to room temperature and stirred further for 4 h. The reaction was then quenched with a saturated $NaHCO_3$ aqueous solution (20 mL). The mixture was extracted with CH_2Cl_2 (2 X 50 mL), the combined organic fractions were dried over $MgSO_4$, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1 to 3:2) as eluents to provide the desired amide **S5** (1.65, 41% yield) as a light yellow oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.70 (bs, 1H), 3.84 (s, 2H) 3.28 (q, *J*= 7.0 Hz, 2H), 2.20 (dt, *J*= 7.0, 3.0 Hz, 2H), 1.95 (t, *J*= 3.0 Hz, 1H), 1.67-1.61 (m, 2H), 1.56-1.50 (m, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 165.67, 83.94, 69.00, 39.74, 29.38, 28.40, 25.63, 18.14. **FT-IR** (neat, cm^{-1}): 3295, 3088, 2942, 2115, 1726, 1651. **HRMS** (ESI+): Calcd. for $C_8H_{13}NOBr$ ($[M+H]^+$), 218.0181. Found: 218.0184.

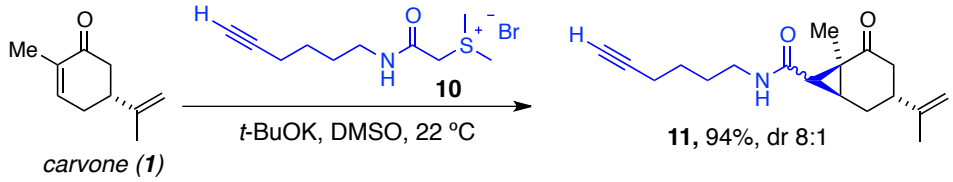
Alkynyl Sulfonium (10): 2-Bromo-*N*-(hex-5-yn-1-yl)acetamide **S5** (0.746 g, 3.42 mmol) was dissolved in dry CH_2Cl_2 and then dimethyl sulfide (1.26 mL, 17.10 mmol) was added dropwise. The reaction mixture was stirred at room temperature for 8 h, after which time all starting material was consumed and a yellow-orange liquid precipitate was formed. The supernatant liquid was removed with a pasteur pipet and then the residue was dried under high vacuum to provide pure alkynyl sulfonium salt **10** (0.927 g, 97% yield, 10:1 mixture of amide rotamers) as a viscous orange oil. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.54 (t, *J*= 5.5 Hz, 1H), 4.93 (s, 2H), 3.29 (s, 6H), 3.22 (q, *J*= 7.0 Hz, 2H), 2.18 (dt, *J*= 7.0, 2.5 Hz, 2H), 2.01 (t, *J*= 2.5 Hz, 1H), 1.63 (p, *J*= 7.0 Hz, 2H), 1.52 (p, *J*= 7.0 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 162.57, 84.17, 69.30, 46.70, 39.73, 28.21, 25.85,

25.83, 18.13. **FT-IR** (neat, cm^{-1}): 3422, 3065, 2940, 2206, 2113, 1666. **HRMS** (ESI+): Calcd. for $C_{10}H_{18}NOS$ ($[M+H]^+$), 200.1109. Found: 200.1104.

F) Cyclopropanation of natural products bearing e- poor alkenes with alkynyl sulfonium 10.



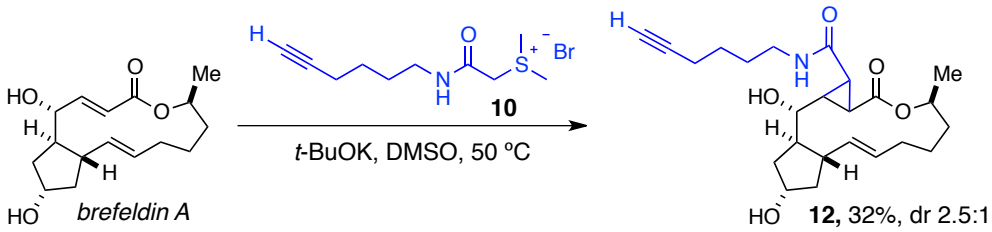
General Procedure: The alkynyl sulfonium salt **10** (1.5-3.0 equiv) was dissolved in dry DMSO (0.5-1.0 mL) in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC and then the *t*-BuOK (1.5-3.0 equiv, 1M in DMSO) was added dropwise. The reaction mixture was stirred for 30 min and then the alkene-containing natural product (1.0 equiv, 1-20 mg) was added dissolved in 0.5 mL of dry DMSO. After the addition was completed, the reaction mixture was stirred at 22 ºC (or in some cases at 50 ºC) and the reaction was monitored by TLC. The reaction was quenched by the addition of water followed by the extraction with CH_2Cl_2. The combined organic layers were washed with water and brine, dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate as eluent.



The alkynyl sulfonium salt **10** (111.9 mg, 399 μmol)) was dissolved in dry DMSO (1.0 mL) in a flame-dried vial under a positive atmosphere of nitrogen at 22 °C and then the *t*-BuOK (399 μL, 1M in DMSO, 399 μmol) was added dropwise. The reaction mixture was stirred for 30 min and then carvone **1** (20 mg, 133 μmol) was added dissolved in 0.5 mL of dry DMSO. After the addition was completed, the reaction mixture was stirred at 22 °C for 8 h. The reaction was quenched by the addition of water (5 mL) followed by the extraction with CH_2Cl_2 (3 X 5 mL). The combined organic layers were washed with water (5 mL) and brine (5 mL), dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired cyclopropanated product **11** (36 mg, 94% yield, 8:1 mixture of inseparable diastereomers) as a white solid.

Data for diastereomer **11a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.24 (bs, 1H), 4.77 (s, 1H), 4.70 (s, 1H), 3.33-3.23 (m, 2H), 2.38 (dd, *J*= 4.5, 1.5 Hz, 1H), 2.34-2.28 (m, 2H), 2.20 (dt, *J*= 6.5, 2.5 Hz, 2H), 2.10 (d, *J*= 5.5 Hz, 1H), 2.09-2.04 (m, 2H), 1.94 (t, *J*= 2.5 Hz, 1H), 1.90 (ddd, *J*= 13.0, 11.0, 4.0 Hz, 1H), 1.69 (bs, 3H), 1.65-1.59 (m, 2H), 1.57-1.51 (m, 2H), 1.23 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 208.28, 167.84, 146.48, 110.78, 84.08, 68.93, 42.30, 39.54, 37.53, 35.13, 30.01, 28.91, 27.37, 26.07, 25.81, 20.60, 18.23, 13.09. **FT-IR** (neat, cm^{-1}): 3302, 3083, 2934, 2116, 1689, 1646.

Data for diastereomer **11b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.19 (bs, 1H), 4.74 (s, 1H), 4.65 (s, 1H), 3.33-3.23 (m, 2H), 2.34-2.28 (m, 2H), 2.27-2.23 (m, 1H), 2.20 (dt, *J*= 6.5, 2.5 Hz, 2H), 2.10 (d, *J*= 5.5 Hz, 1H), 2.09-2.04 (m, 2H), 1.94 (t, *J*= 2.5 Hz, 1H), 1.90 (ddd, *J*= 13.0, 11.0, 4.0 Hz, 1H), 1.68 (bs, 3H), 1.65-1.59 (m, 2H), 1.57-1.51 (m, 2H), 1.22 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 209.20, 167.84, 146.59, 110.51, 83.55, 68.99, 44.96, 41.84, 38.52, 35.65, 29.92, 28.79, 27.37, 26.07, 25.81, 20.63, 18.23, 13.02. **FT-IR** (neat, cm^{-1}): 3302, 3083, 2934, 2116, 1689, 1646. **HRMS** (ESI+): Calcd. for $C_{18}H_{26}NO_2$ ($[M+H]^+$), 288.1964. Found: 288.1957.

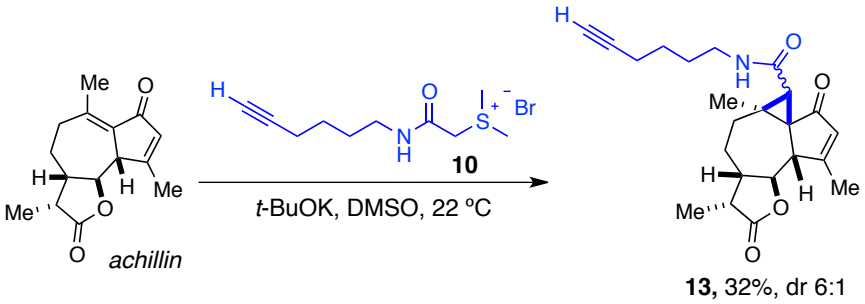


The alkynyl sulfonium salt **10** (30 mg, 107.01 μmol)) was dissolved in dry DMSO (1.0 mL) in a flame-dried vial under a positive atmosphere of nitrogen at 22 °C and then the *t*-BuOK (107 μL, 1M in DMSO, 107 μmol) was added dropwise. The reaction mixture was stirred for 30 min and then brefeldin A (10 mg, 35.67 μmol) was added dissolved in 0.5 mL of dry DMSO. After the addition was completed, the reaction mixture was stirred at 50 °C for 48 h. The reaction was quenched by the addition of water (5 mL) followed by the extraction with CH_2Cl_2 (3 X 5 mL). The combined organic layers were washed with water (5 mL) and brine (5 mL), dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (2:3) as eluent to afford the desired cyclopropanated product **12** (4.7

mg, 32% yield, dr 2.5:1) as white solid. Analytical samples were obtained by further purification by preparative TLC using hexanes and ethyl acetate (2:3) as eluent.

Data for diastereomer **12a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 5.42-5.34 (m, 2H), 4.34 (p, *J*= 4.5 Hz, 1H), 3.81-3.78 (m, 1H), 3.77 (t, *J*= 7.0 Hz, 2H), 3.43 (t, *J*= 5.0 Hz, 1H), 2.85 (ddd, *J*= 17.0, 4.5, 2.5 Hz, 1H), 2.70 (ddd, *J*= 17.0, 4.5, 2.5 Hz, 1H), 2.54 (dd, *J*= 24.0, 17.0 Hz, 1H), 2.53 (dd, *J*= 17.0, 1.5 Hz, 1H), 2.27-2.18 (m, 3H), 2.21 (dt, *J*= 7.0, 2.5 Hz, 2H), 2.09-1.97 (m, 4H), 1.95 (t, *J*= 2.5 Hz, 1H), 1.76 (dd, *J*= 9.0, 4.5 Hz, 2H), 1.63-1.59 (m, 2H), 1.55-1.33 (m, 4H), 1.29-1.21 (m, 2H), 1.19 (d, *J*= 6.0 Hz, 3H), 0.90-0.87 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 172.59, 172.38, 134.12, 131.12, 84.27, 74.64, 72.41, 68.80, 68.05, 46.51, 44.45, 43.31, 39.34, 38.96, 36.96, 36.63, 34.45, 33.57, 32.40, 29.92, 27.32, 25.83, 23.77, 18.37. **FT-IR** (neat, cm^{-1}): 3384, 3299, 2921, 2123, 1719, 1661. **HRMS** (ESI+): Calcd. for $C_{24}H_{36}NO_5$ ($[M+H]^+$), 418.2593. Found: 418.2611.

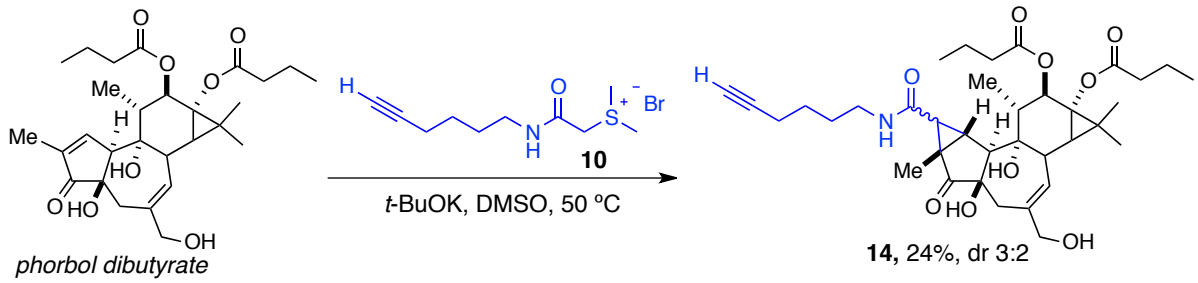
Data for diastereomer **12b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 5.71 (t, *J*= 5.0 Hz, 1H), 5.53 (ddd, J= 15.5, 7.5, 5.5 Hz, 1H), 5.45 (dd, J= 15.5, 8.5 Hz, 1H), 4.98-4.92 (m, 1H), 4.32 (p, *J*= 4.5 Hz, 1H), 3.73 (d, *J*= 10.0 Hz, 1H), 3.41-3.37 (m, 1H), 3.12-3.05 (m, 1H), 2.50 (t, *J*= 5.5 Hz, 1H), 2.42 (p, *J*= 7.5 Hz, 1H), 2.27-2.15 (m, 4H), 2.05-1.93 (m, 6H), 1.71-1.52 (m, 9H), 1.34-1.19 (m, 2H), 1.09 (d, *J*= 6.5 Hz, 3H), 0.90-0.87 (m, 1H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 170.77, 167.83, 136.35, 129.33, 84.14, 72.95, 72.23, 71.31, 69.01, 50.00, 43.79, 40.93, 39.50, 33.68, 30.69, 29.93, 28.77, 28.11, 27.78, 25.89, 24.86, 22.53, 20.48, 18.29. **FT-IR** (neat, cm^{-1}): 3366, 3301, 2923, 2115, 1695, 1652. **HRMS** (ESI+): Calcd. for $C_{24}H_{36}NO_5$ ($[M+H]^+$), 418.2593. Found: 418.2604.



The alkynyl sulfonium salt **10** (6.8 mg, 24.36 μmol)) was dissolved in dry DMSO (1.0 mL) in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC and then the *t*-BuOK (24 μL, 1M in DMSO, 24 μmol) was added dropwise. The reaction mixture was stirred for 30 min and then achillin (2 mg, 8.12 μmol) was added dissolved in 0.5 mL of dry DMSO. After the addition was completed, the reaction mixture was stirred at 22 ºC for 48 h. The reaction was quenched by the addition of water (5 mL) followed by the extraction with CH_2Cl_2 (3 X 5 mL). The combined organic layers were washed with water (5 mL) and brine (5 mL), dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired cyclopropanated product **13** (1 mg, 32% yield, 6:1 mixture of inseparable diastereomers) as white solid.

Data for diastereomer **13a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.08 (s, 1H), 4.66 (d, *J*= 15.0 Hz, 1H), 4.56 (dd, *J*= 15.0, 14.0 Hz, 1H), 3.35-3.26 (m, 2H), 2.92-2.89 (m, 1H), 2.79-2.74 (m, 1H), 2.62-2.59 (m, 1H), 2.44 (s, 3H), 2.27 (t, *J*= 1.5 Hz, 1H), 2.24-2.21 (m, 2H), 2.12 (s, 3H), 2.02-2.00 (m, 1H), 1.85-1.77 (m, 1H), 1.65-1.47 (m, 4H), 1.34-1.22 (m, 2H), 1.15 (d, *J*= 7.0 Hz, 3H), 0.90-0.87 (m, 1H). **FT-IR** (neat, cm^{-1}): 3301, 3083, 2934, 2122, 1693, 1637. **LRMS** (LC-MS, APCI+): Calcd. for $C_{23}H_{30}NO_4$ ($[M+H]^+$), 384.21. Found: 384.0.

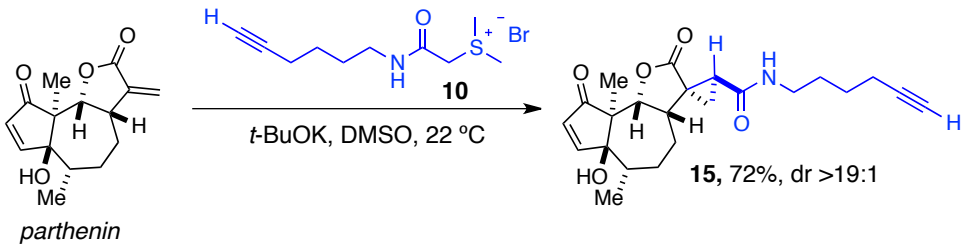
Data for diastereomer **13b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.00 (s, 1H), 4.66 (d, *J*= 15.0 Hz, 1H), 4.56 (dd, *J*= 15.0, 14.0 Hz, 1H), 3.35-3.26 (m, 2H), 2.92-2.89 (m, 1H), 2.79-2.74 (m, 1H), 2.62-2.59 (m, 1H), 2.41 (s, 3H), 2.24-2.21 (m, 2H), 2.14 (s, 3H), 1.96 (t, *J*= 2.5 Hz, 1H), 1.95-1.89 (m, 1H), 1.85-1.77 (m, 1H), 1.65-1.47 (m, 4H), 1.34-1.22 (m, 2H), 1.28 (d, *J*= 7.0 Hz, 3H), 0.90-0.87 (m, 1H). **FT-IR** (neat, cm^{-1}): 3301, 3083, 2934, 2122, 1693, 1637. **LRMS** (LC-MS, APCI+): Calcd. for $C_{23}H_{30}NO_4$ ($[M+H]^+$), 384.21. Found: 384.0.



The alkynyl sulfonium salt **10** (3.3 mg, 11.89 μmol)) was dissolved in dry DMSO (1.0 mL) in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC and then the *t*-BuOK (12 μL, 1M in DMSO, 12 μmol) was added dropwise. The reaction mixture was stirred for 30 min and then phorbol dibutyrate (2 mg, 3.96 μmol) was added dissolved in 0.5 mL of dry DMSO. After the addition was completed, the reaction mixture was stirred at 50 ºC for 48 h. The reaction was quenched by the addition of water (5 mL) followed by the extraction with CH_2Cl_2 (3 X 5 mL). The combined organic layers were washed with water (5 mL) and brine (5 mL), dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (4:1) as eluent to afford the desired cyclopropanated product **15** (0.6 mg, 24% yield, 3:2 mixture of inseparable diastereomers) as white solid.

Data for diastereomer **14a**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 6.01 (bs, 1H), 5.83-5.80 (m, 2H), 5.46 (d, *J*= 10.5 Hz, 1H), 3.97-3.92 (m, 2H), 3.42-3.24 (m, 2H), 2.95 (d, *J*= 2.5 Hz, 1H), 2.56 (bs, 1H), 2.42 (bs, 1H), 2.36-2.29 (m, 4H), 2.28-2.21 (m, 4H), 2.06-1.96 (m, 3H), 1.73-1.52 (m, 8H), 1.45 (s, 3H), 1.44-1.38 (m, 1H), 1.30 (s, 3H), 1.29 (s, 3H), 1.14-1.07 (m, 2H), 0.99-0.94 (m, 6H), 0.89 (d, *J*= 7.0 Hz, 3H). **FT-IR** (neat, cm^{-1}): 3404, 3287, 2956, 2111, 1721, 1658. **HRMS** (ESI+): Calcd. for $C_{36}H_{52}NO_9$ ([M+H]$^+$), 642.3642. Found: 642.3664.

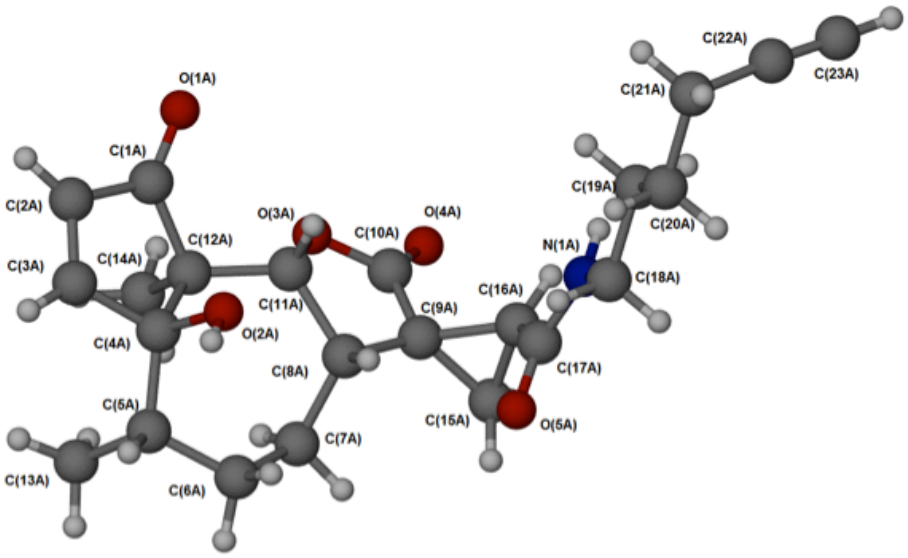
Data for diastereomer **14b**: **^{1}H NMR** (500 MHz, $CDCl_3$) δ 5.68 (d, *J*= 5.0 Hz, 1H), 5.63 (t, *J*= 5.0 Hz, 1H), 5.46 (d, *J*= 10.5 Hz, 1H), 5.35 (bs, 1H), 4.16-4.02 (m, 2H), 3.42-3.24 (m, 2H), 2.92 (t, *J*= 5.5 Hz, 1H), 2.44 (bs, 1H), 2.36-2.29 (m, 4H), 2.28-2.21 (m, 4H), 2.06-1.96 (m, 3H), 1.95 (bs, 1H), 1.73-1.52 (m, 8H), 1.44-1.38 (m, 1H), 1.36 (s, 3H), 1.24 (s, 3H), 1.22 (s, 3H), 1.14-1.07 (m, 2H), 0.99-0.94 (m, 6H), 0.88 (d, *J*= 7.0 Hz, 3H). **FT-IR** (neat, cm^{-1}): 3404, 3287, 2956, 2111, 1721, 1658. **HRMS** (ESI+): Calcd. for $C_{36}H_{52}NO_9$ ([M+H]$^+$), 642.3642. Found: 642.3664.



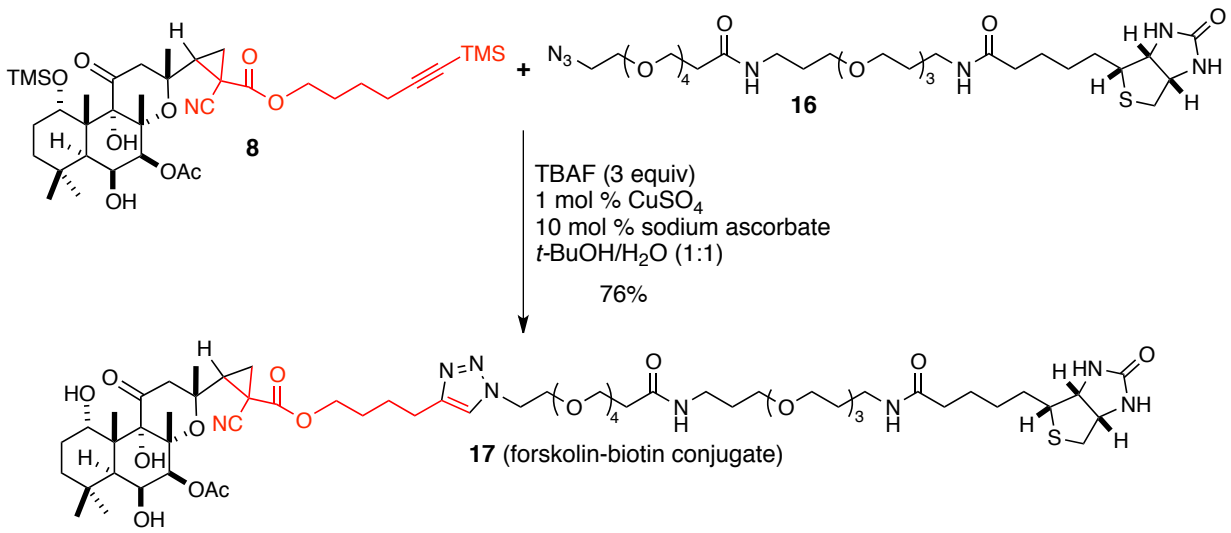
The alkynyl sulfonium salt **10** (32 mg, 114.37 μmol)) was dissolved in dry DMSO (1.0 mL) in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC and then the *t*-BuOK (114 μL, 1M in DMSO, 114 μmol) was added dropwise. The reaction mixture was stirred for 30 min and then parthenin (20 mg, 76.25 μmol) was added dissolved in

0.5 mL of dry DMSO. After the addition was completed, the reaction mixture was stirred at 22 ºC for 8 h. The reaction was quenched by the addition of water (5 mL) followed by the extraction with CH_2Cl_2 (3 X 5 mL). The combined organic layers were washed with water (5 mL) and brine (5 mL), dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash chromatography on silica gel using hexanes and ethyl acetate (3:2) as eluent to afford the desired cyclopropanated product **15** (21.8 mg, 72% yield, single diastereomer) as white solid. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.83 (dd, *J*= 7.5, 4.5 Hz, 1H), 7.58 (d, *J*= 6.0 Hz, 1H), 5.89 (d, *J*= 6.0 Hz, 1H), 5.20 (d, *J*= 8.5 Hz, 1H), 3.61-3.53 (m, 1H), 3.48 (s, 1H), 3.09-3.06 (m, 1H), 2.79 (ddd, *J*= 12.5, 7.5, 2.0 Hz, 1H), 2.37 (p, *J*= 7.5 Hz, 1H), 2.25-2.18 (m, 1H), 2.17-2.10 (m, 2H), 2.08 (dd, *J*= 9.0, 6.5 Hz, 1H), 2.07-2.00 (m, 1H), 1.86 (t, *J*= 2.5 Hz, 1H), 1.78 (dd, *J*= 6.5, 5.0 Hz, 1H), 1.69-1.43 (m, 6H), 1.44 (dd, *J*= 9.0, 5.0 Hz, 1H), 1.33 (s, 3H), 1.08 (d, *J*= 8.0 Hz, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 214.04, 180.52, 167.66, 167.47, 130.02, 84.68, 84.52, 79.68, 68.50, 58.79, 41.36, 39.39, 39.09, 33.40, 32.12, 30.97, 28.82, 25.61, 25.50, 20.05, 18.02, 17.93, 13.14. **FT-IR** (neat, cm^{-1}): 3478, 3303, 2927, 2117, 1747, 1722, 1651. **HRMS** (ESI+): Calcd. for $C_{23}H_{30}NO_5$ ($[M+H]^+$), 400.2124. Found: 400.2133.

G) X-ray structure of 15: Slow recrystallization of compound **15** from a mixture of heptane and CH_2Cl_2 provided crystals suitable for structural characterization by X-ray crystallography, resulting in the thermal ellipsoid diagram below:



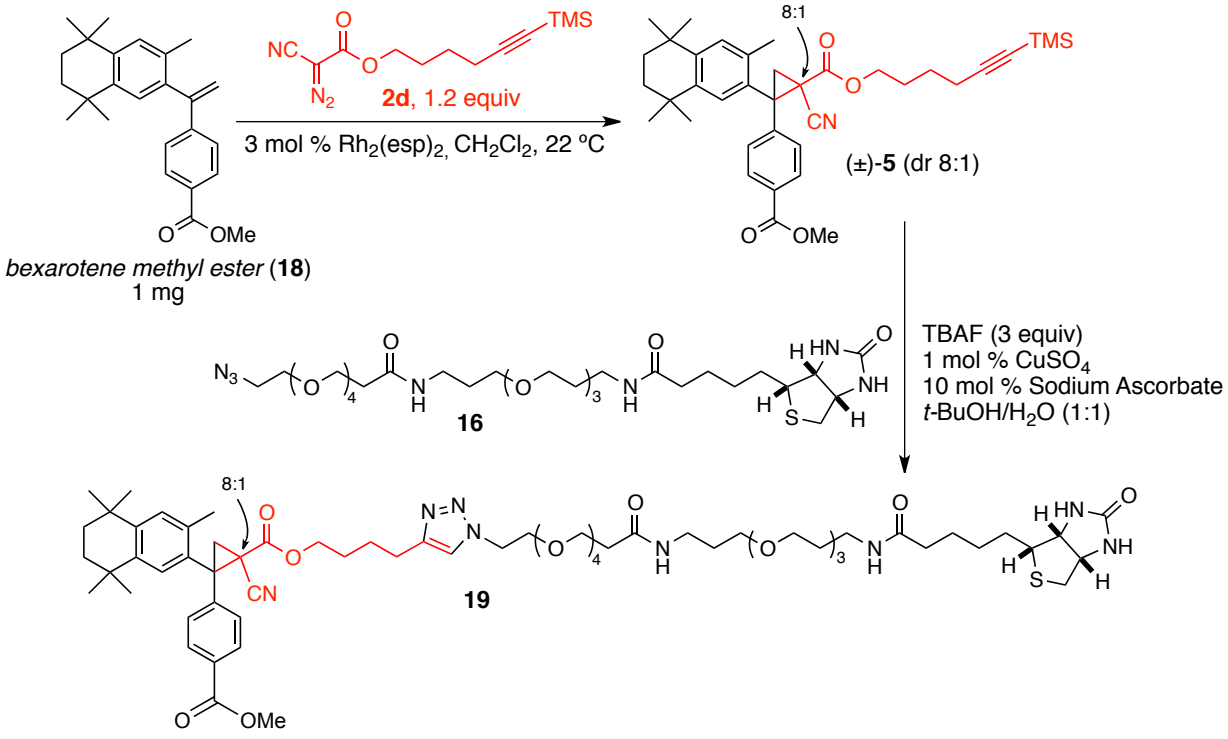
H) Desilylation/conjugation of 8a with a biotin tag



Forskolin-biotin conjugate 17: The forskolin derivative **8a** (8 mg, 11.14 μmol) and biotin azide **16** (8 mg, 11.14 μmol) were dissolved in a mixture of *t*-BuOH:H_2O (1 mL, 1:1) in a vial at 22 ºC, and then the TBAF (33.4 μL,1M in THF, 33.4 μmol) was added. A Cu(I) solution (5 μL, freshly prepared from 2.5 mL of a 1M aqueous solution of $CuSO_4$-5H_2O and 2.5 mL of a 10M aqueous solution of sodium ascorbate, the solutions of $CuSO_4$ and sodium ascorbate were mixed and stirred at 22 ºC until the black solution turned light yellow-brown) was added and the reaction mixture was stirred at 22 ºC for 24 h. The reaction mixture was then filtered through a cotton plug in a glass pipette to remove solid residues and rinsed with 5 mL of MeOH. The filtrate was concentrated under reduced pressure and the residue was purified by flash chromatography on silica gel using ethyl acetate and MeOH (4:1) as eluent to afford the forskolin-biotin conjugate **17** (11 mg, 76% yield) as a white solid. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.53 (s, 1H), 7.31 (s, 1H), 7.03 (bs, 1H), 6.89 (bs, 1H), 6.00 (bs, 1H), 5.55 (d, *J*= 4.0 Hz, 1H), 5.35 (bs, 1H), 4.53 (t, *J*= 5.0 Hz, 2H), 4.51-4.49 (m, 1H), 4.45 (bs, 1H), 4.42 (bs, 1H), 4.32 (dd, *J*=

7.0, 5.0 Hz, 1H), 4.23-4.19 (m, 1H), 4.17-4.11 (m, 1H), 3.87 (t, *J*= 5.0 Hz, 2H), 3.73 (t, *J*= 6.0 Hz, 2H), 3.64-3.58 (m, 26H), 3.55 (t, *J*= 6.0 Hz, 2H), 3.37-3.29 (m, 4H), 3.16 (dd, *J*= 12.0, 7.0 Hz, 1H), 2.91 (dd, *J*= 13.0, 5.0 Hz, 1H), 2.75 (t, *J*= 7.0 Hz, 2H), 2.73 (d, *J*= 12.0 Hz, 1H), 2.47 (t, *J*= 6.0 Hz, 2H), 2.44 (dd, *J*= 8.0, 4.0 Hz, 1H), 2.29 (d, *J*= 14.0 Hz, 1H), 2.21-2.17 (m, 4H), 2.12 (s, 3H), 2.03 (bs, 1H), 1.94 (dd, *J*= 9.0, 8.0 Hz, 1H), 1.78-1.72 (m, 10H), 1.71-1.61 (m, 4H), 1.65 (s, 3H), 1.54 (s, 3H), 1.48 (s, 3H), 1.46-1.40 (m, 1H), 1.24 (s, 3H), 1.11 (dt, *J*= 13.0, 3.0 Hz, 1H), 1.02 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 207.89, 173.35, 171.80, 170.92, 168.87, 163.77, 147.53, 122.31, 117.09, 83.27, 82.89, 75.94, 74.22, 72.97, 70.61, 70.56 (3 carbons), 70.49, 70.41, 70.26, 70.15, 70.07, 70.03, 69.98, 69.83, 69.55, 67.58, 66.56, 62.04, 60.30, 55.82, 50.29, 50.25, 44.06, 43.27, 42.98, 40.79, 37.84, 37.29, 37.02, 36.38, 35.95, 34.51, 33.04, 30.19, 29.91, 29.33, 28.97, 28.31, 28.18, 28.08, 27.06, 25.78, 25.71, 25.29, 24.23, 23.67, 22.05, 21.32, 19.95, 17.44. **FT-IR** (neat, cm^{-1}): 3286, 2921, 2247, 1711, 1651. **HRMS** (MALDI+): Calcd. for $C_{62}H_{101}N_8O_{19}S$ ($[M+H]^+$), 1293.6904. Found: 1293.6847.

I) Microscale cyclopropanation/conjugation of bexarotene methyl ester 18



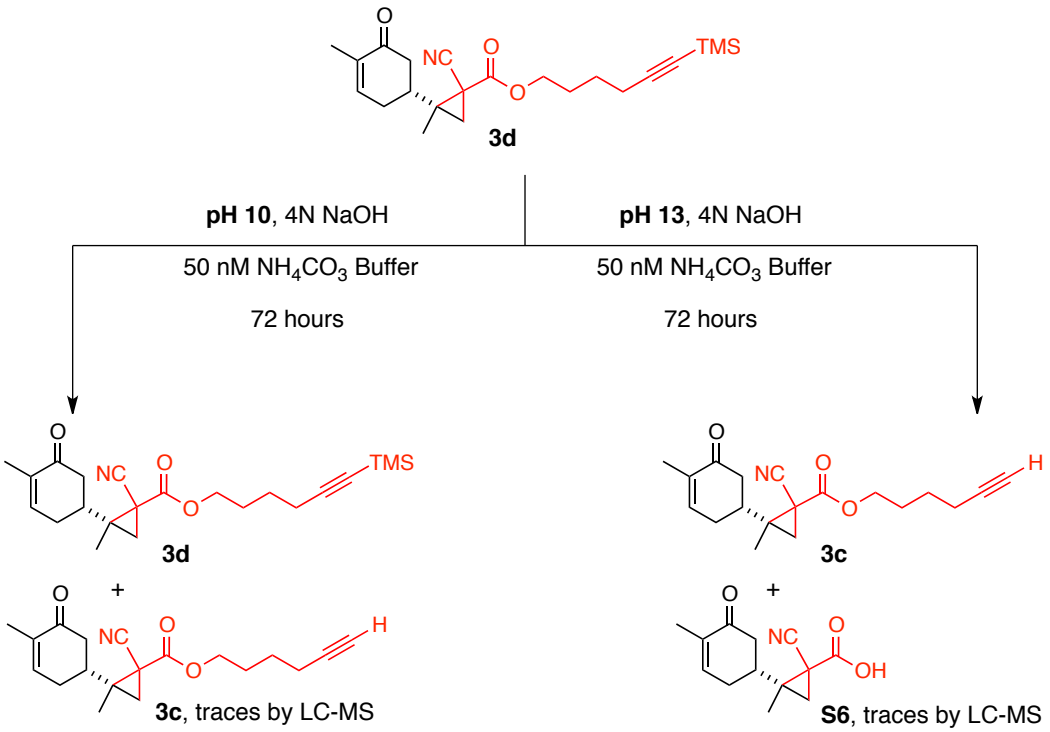
Bexarotene methyl ester **18** (1 mg, 2.76 μmol) and $Rh_2(esp)_2$ (60.1 μg, 0.08 μmol) were dissolved in 250 μL of dry CH_2Cl_2 in a flame-dried vial under a positive atmosphere of nitrogen at 22 ºC. The diazo reagent **2d** (871.8 μg, 3.31 μmol) was then added slowly via syringe pump dissolved in dry CH_2Cl_2 (200 μL) over 4 h. After the addition was completed, the reaction mixture was concentrated under reduced pressure and the crude was filtered through a silica gel plug in a glass pipette using hexanes and ethyl acetate (9:1) as eluent to afford the desired crude cyclopropane **5** (dr 8:1) as a colorless oil.

The crude cyclopropane **5** (dr 8:1) and biotin azide **16** (2 mg, 2.76 μmol) were dissolved in a mixture of *t*-BuOH:H_2O (500 μL, 1:1) in a vial at 22 ºC, and then the TBAF (9 μL,1M

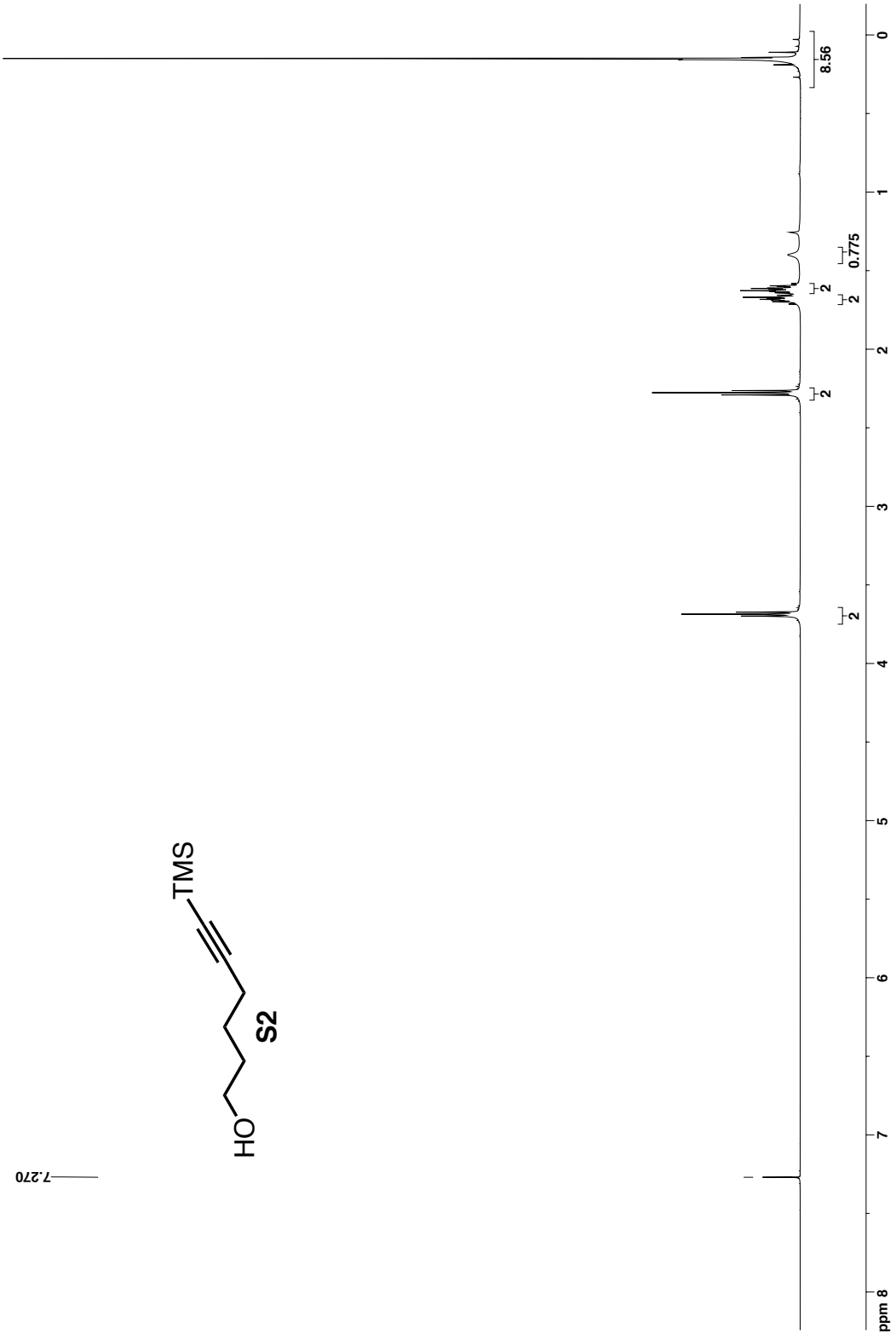
in THF, 9 μmol) was added. A Cu(I) solution (5 μL, freshly prepared from 2.5 mL of a 1M aqueous solution of $CuSO_4$-$5H_2O$ and 2.5 mL of a 10M aqueous solution of sodium ascorbate, the solutions of $CuSO_4$ and sodium ascorbate were mixed and stirred at 22 ºC until the black solution turned light yellow-brown) was added and the reaction mixture was stirred at 22 ºC for 24 h. The reaction mixture was then filtered through a cotton plug in a glass pipette to remove solid residues and rinsed with 5 mL of MeOH. The filtrate was concentrated under reduced pressure and the residue was purified by by preparative TLC using dichloromethane and MeOH (4:1) as eluent to afford the Bexarotene methyl ester-biotin conjugate **19** as a white solid. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.02 (d, *J*= 8.0 Hz, 2H), 7.53 (d, *J*= 8.0 Hz, 2H), 7.48 (s, 1H), 7.18 (s, 1H), 6.99 (s, 1H), 6.85 (bs, 1H), 6.59 (bs, 1H), 5.30 (bs, 1H), 4.67 (bs, 1H), 4.51 (t, *J*= 5.0 Hz, 2H), 4.34-4.31 (m, 1H), 4.10-4.03 (m, 2H), 3.89 (s, 3H), 3.87 (t, *J*= 5.0 Hz, 2H), 3.74 (t, *J*= 6.0 Hz, 2H), 3.67-3.57 (m, 26H), 3.54 (t, *J*= 6.0 Hz, 2H), 3.40-3.32 (m, 4H), 3.16 (dd, *J*= 12.0, 7.0 Hz, 1H), 2.93 (dd, *J*= 13.0, 5.0 Hz, 1H), 2.74 (bs, 1H), 2.71 (t, *J*= 7.0 Hz, 2H), 2.56 (bs, 1H), 2.46 (t, *J*= 6.0 Hz, 2H), 2.25 (s, 3H), 2.21-2.17 (m, 4H), 1.80-1.75 (m, 8H), 1.50-1.43 (m, 16H), 1.29 (s, 3H), 1.26 (s, 3H), 1.23 (s, 3H), 1.20 (s, 3H). **FT-IR** (neat, cm^{-1}): 3285, 2957, 2103, 1703, 1657. **HRMS** (MALDI+): Calcd. for $C_{65}H_{97}N_8O_{14}S$ ($[M+H]^+$), 1245.6845. Found: 1245.6781.

J) Hydrolytic experiments of 3d

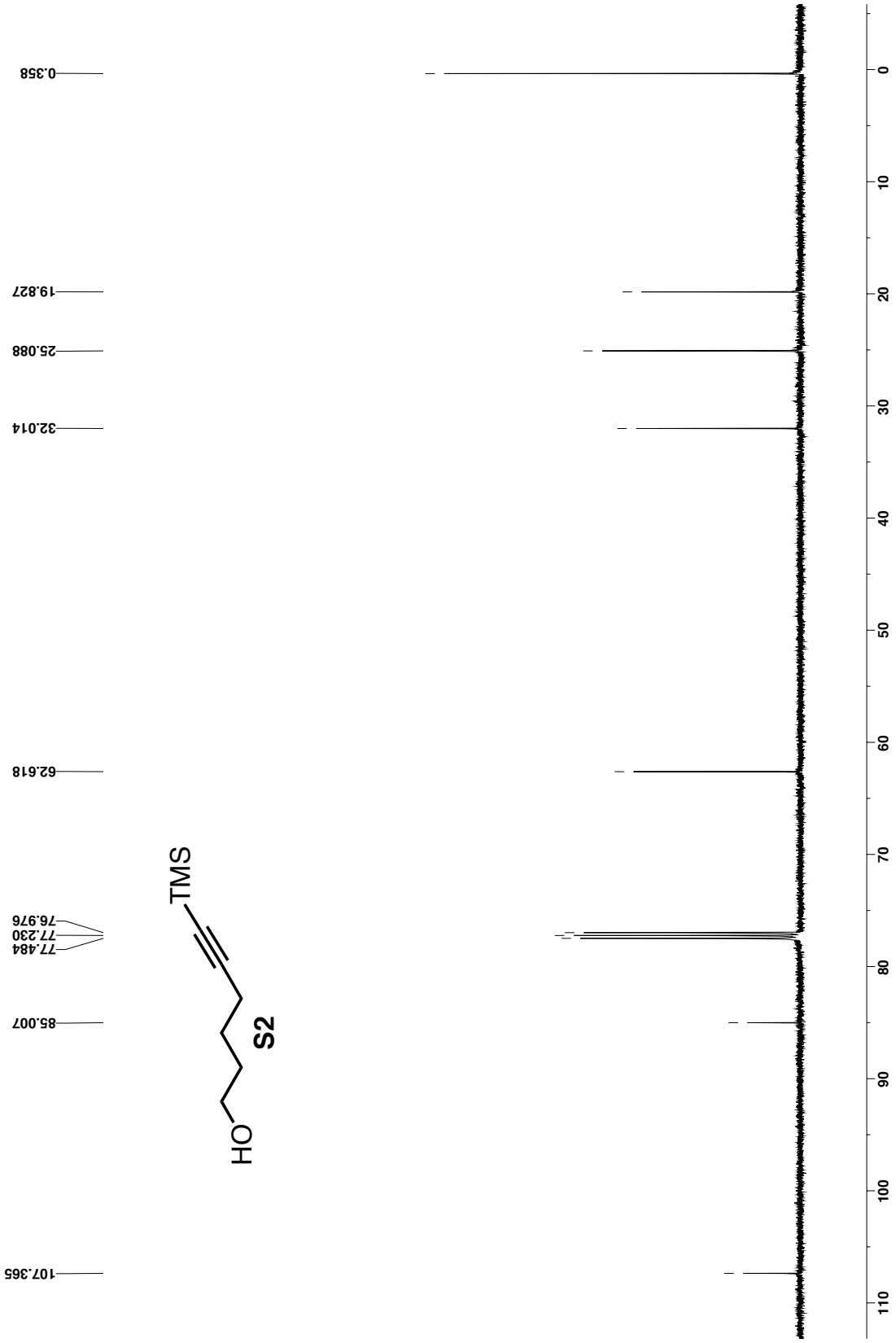
Hydrolysis experiments were performed with compound **3d** as a simple model to determine the stability of the cyanoacetate esters at different pH (10 and 13). The cyanoacetates turned out to be quite robust to hydrolysis under these conditions, probably due to the fact that the ester is highly sterically congested having an alpha-quaternary carbon. At pH 10 no hydrolysis was observed after 72 h (only partial alkyne desilylation to afford **3c**). At pH 13 complete desilylation was observed, but only traces of the acid were found by LC-MS.



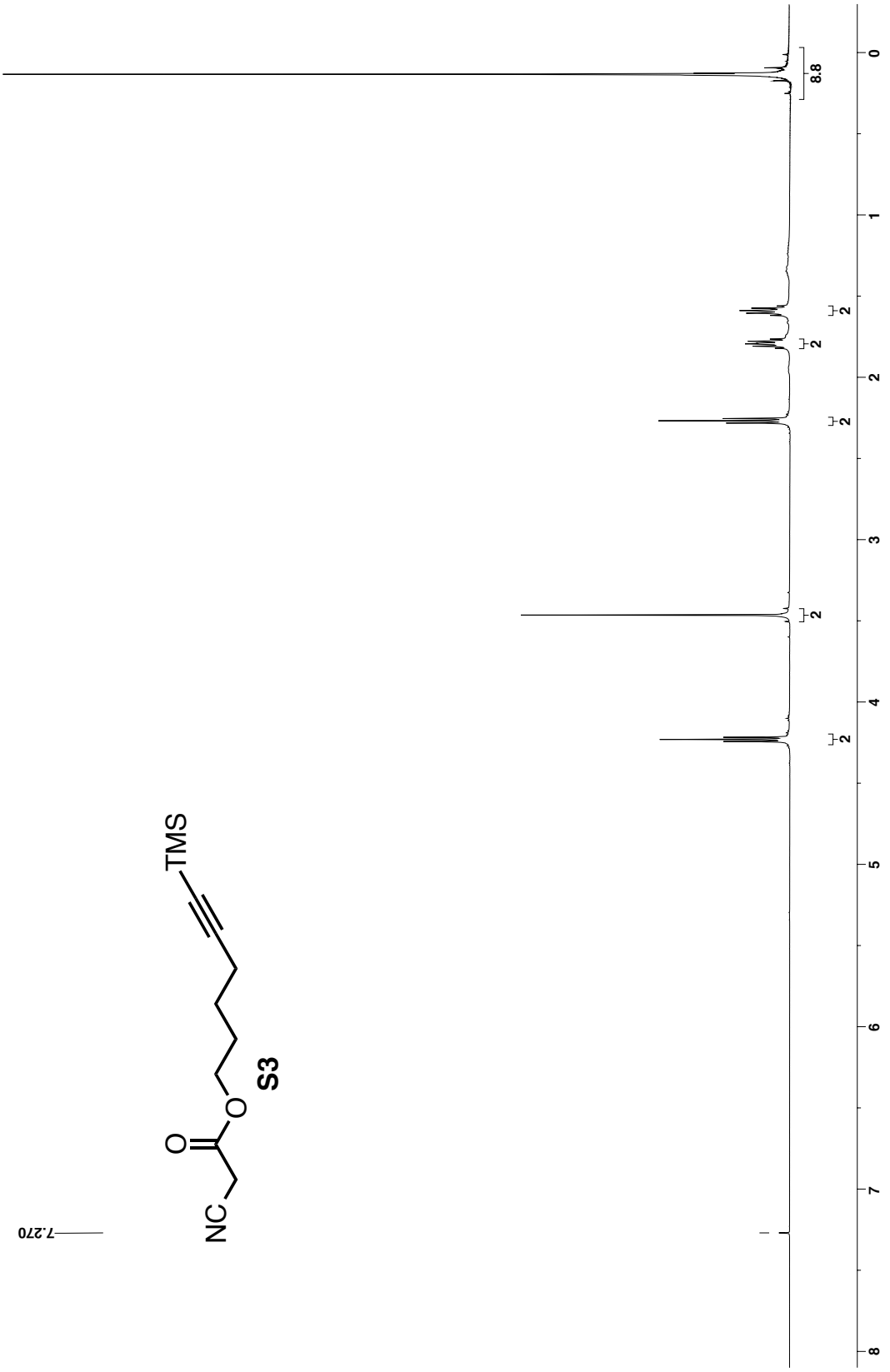
K) ^{1}H and ^{13}C spectra for new compounds



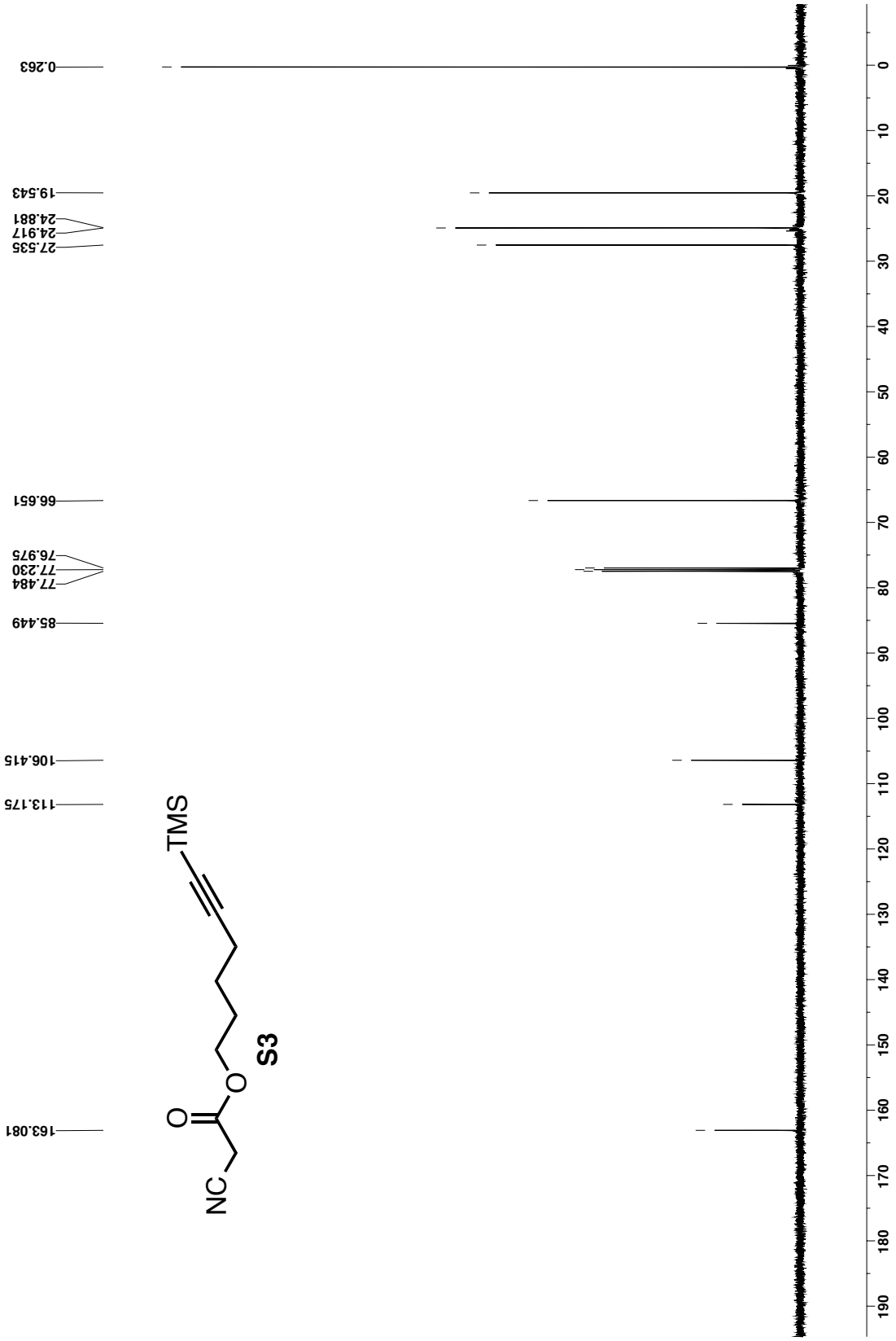
^{1}H NMR (500 MHz) of TMS-alkynol **S2** in $CDCl_3$



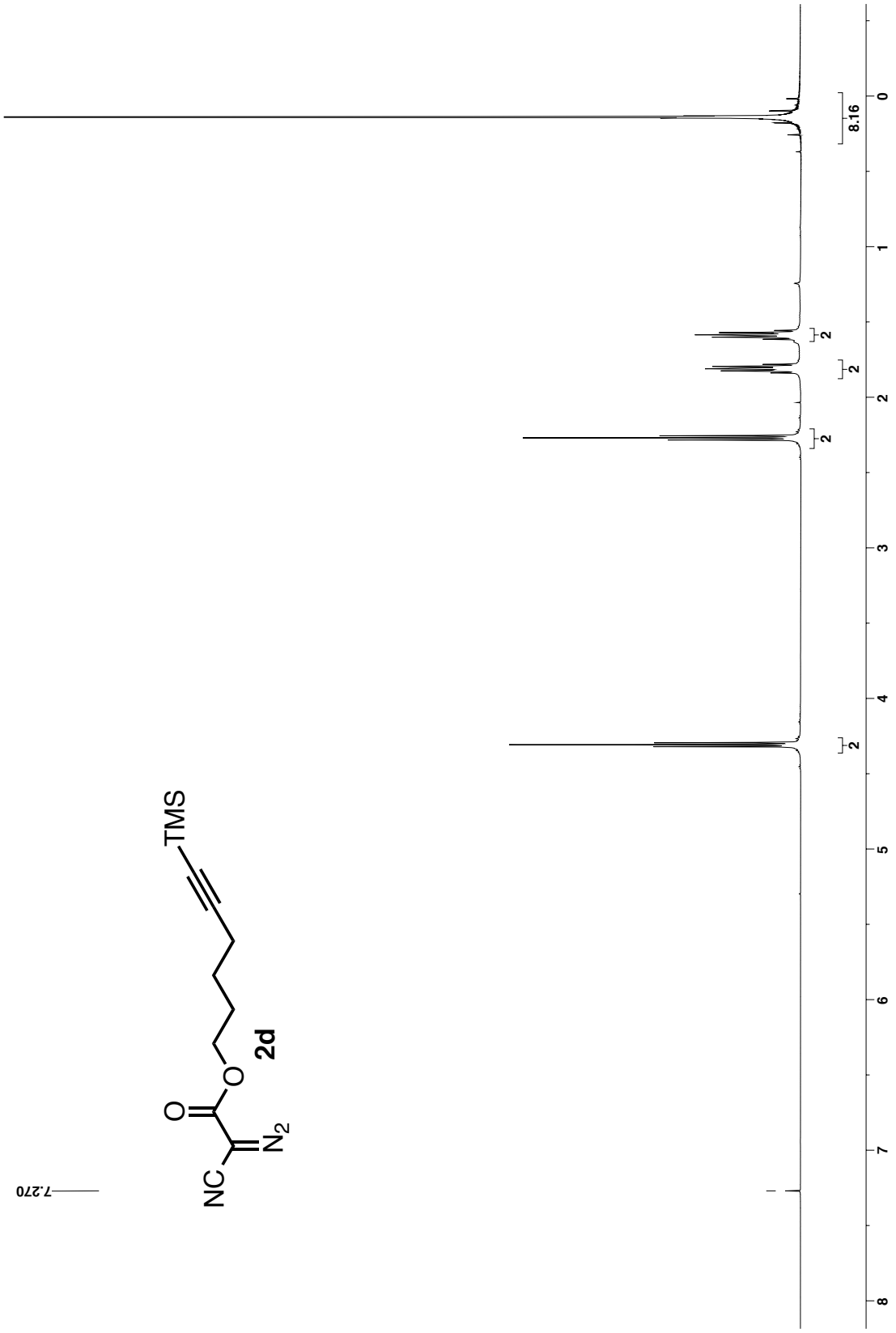
^{13}C NMR (125 MHz) of TMS-alkynol **S2** in $CDCl_3$



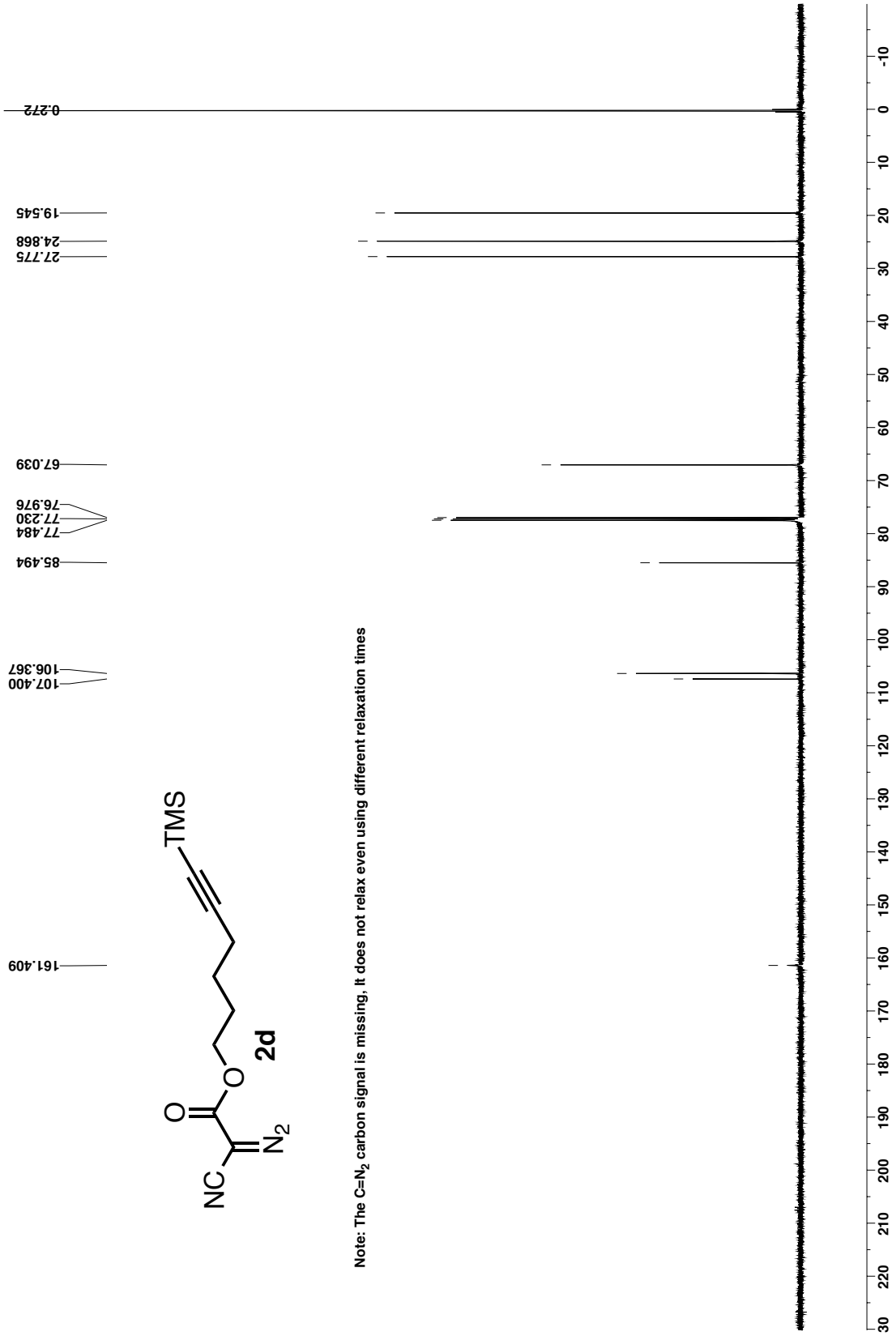
^{1}H NMR (500 MHz) of cyanoacetate **S3** in $CDCl_3$



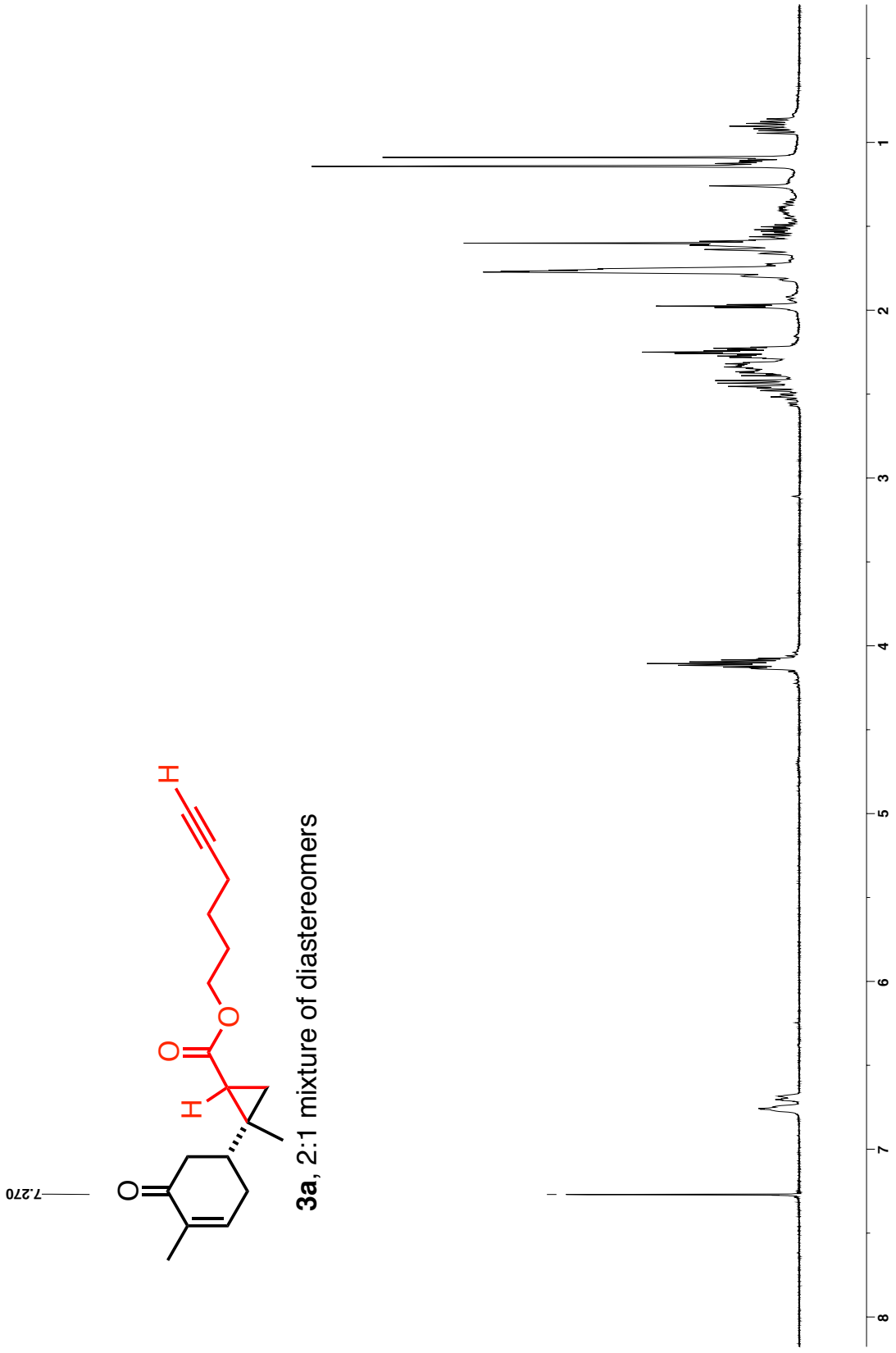
^{13}C NMR (125 MHz) of cyanoacetate **S3** in $CDCl_3$



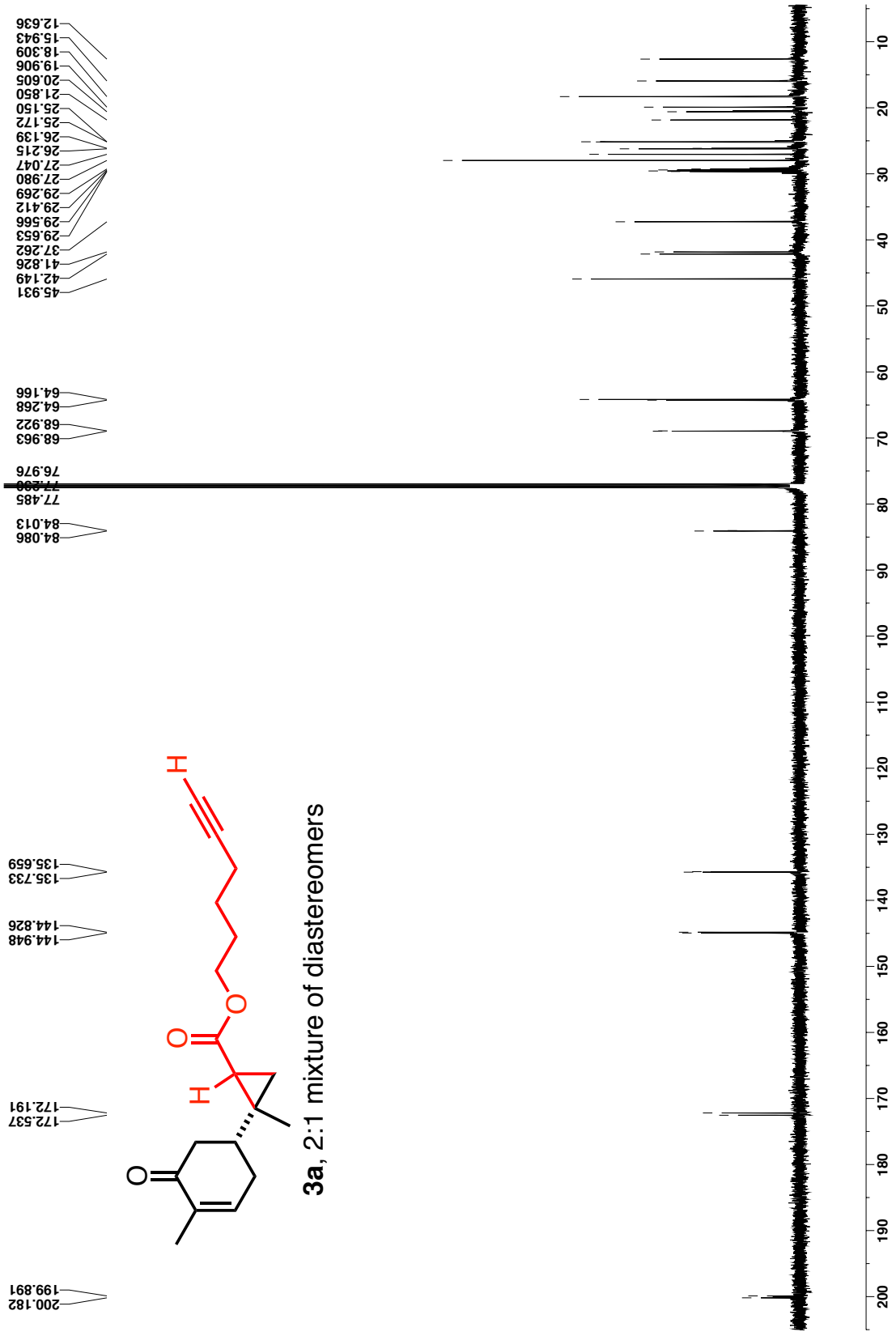
^{1}H NMR (500 MHz) of alkynyl cyano diazoacetate **2d** in $CDCl_3$



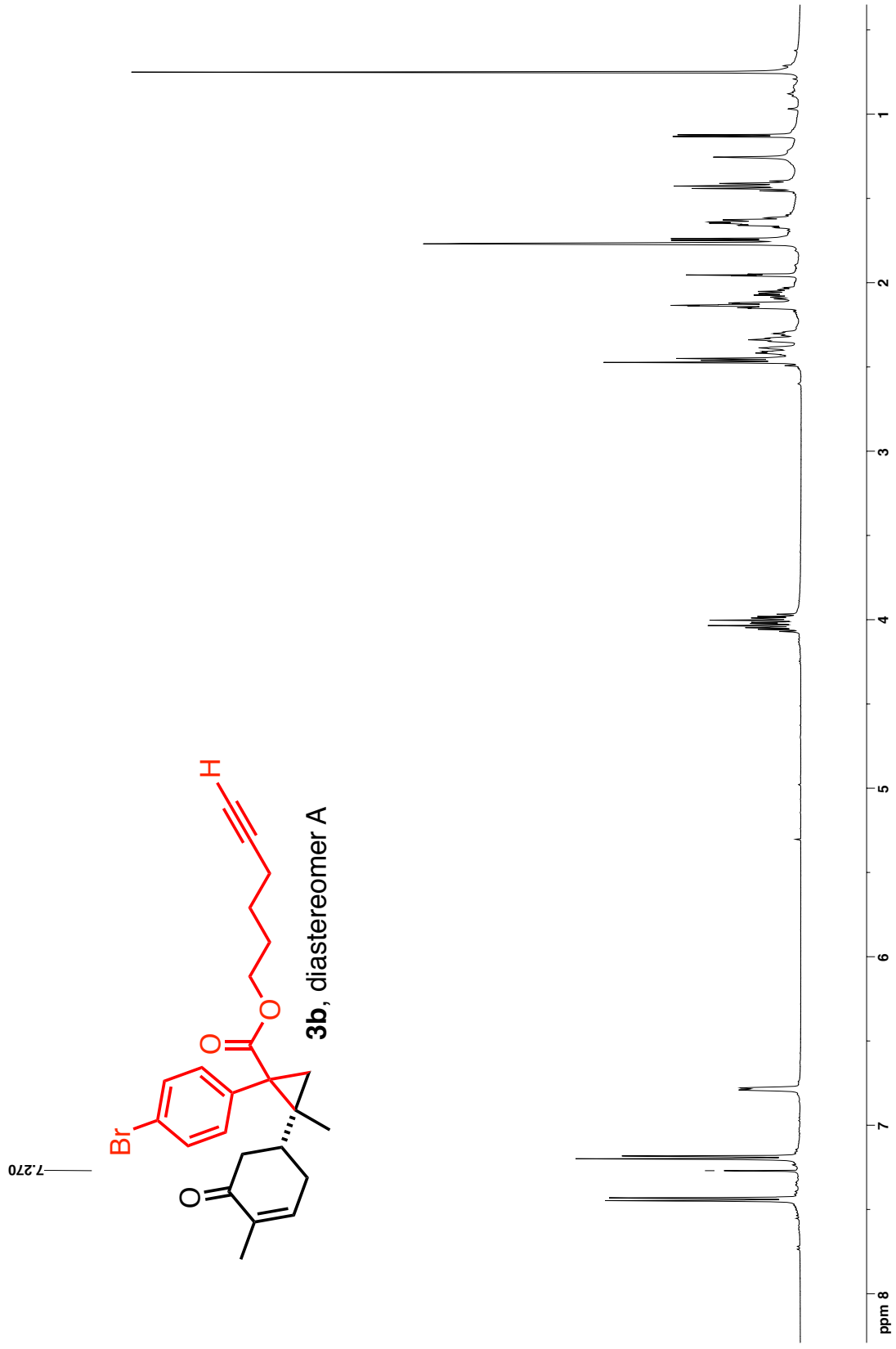
^{13}C NMR (125 MHz) of alkynyl cyano diazoacetate **2d** in $CDCl_3$



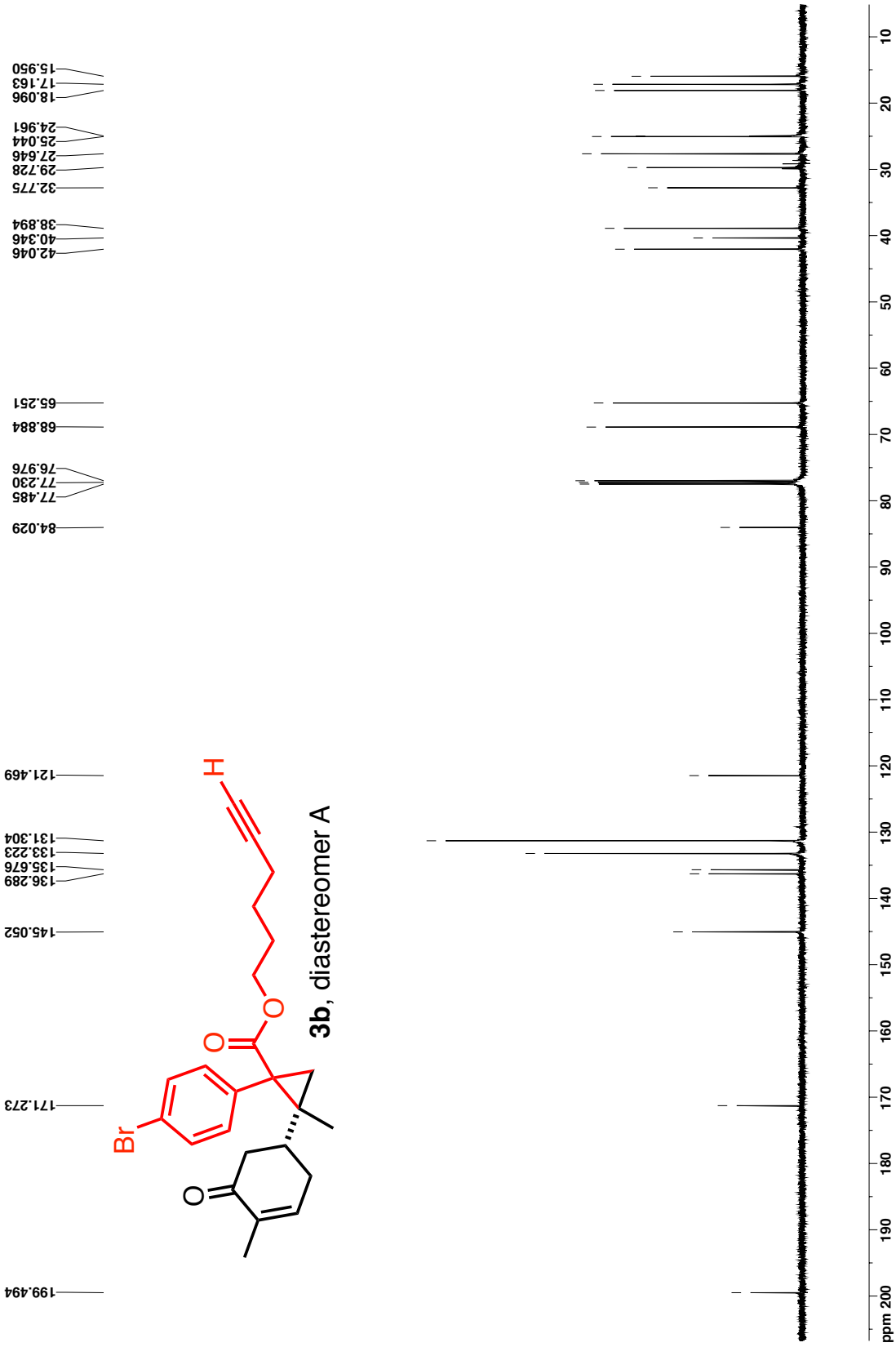
^{1}H NMR (500 MHz) of cyclopropanated carvone **3a** in $CDCl_3$



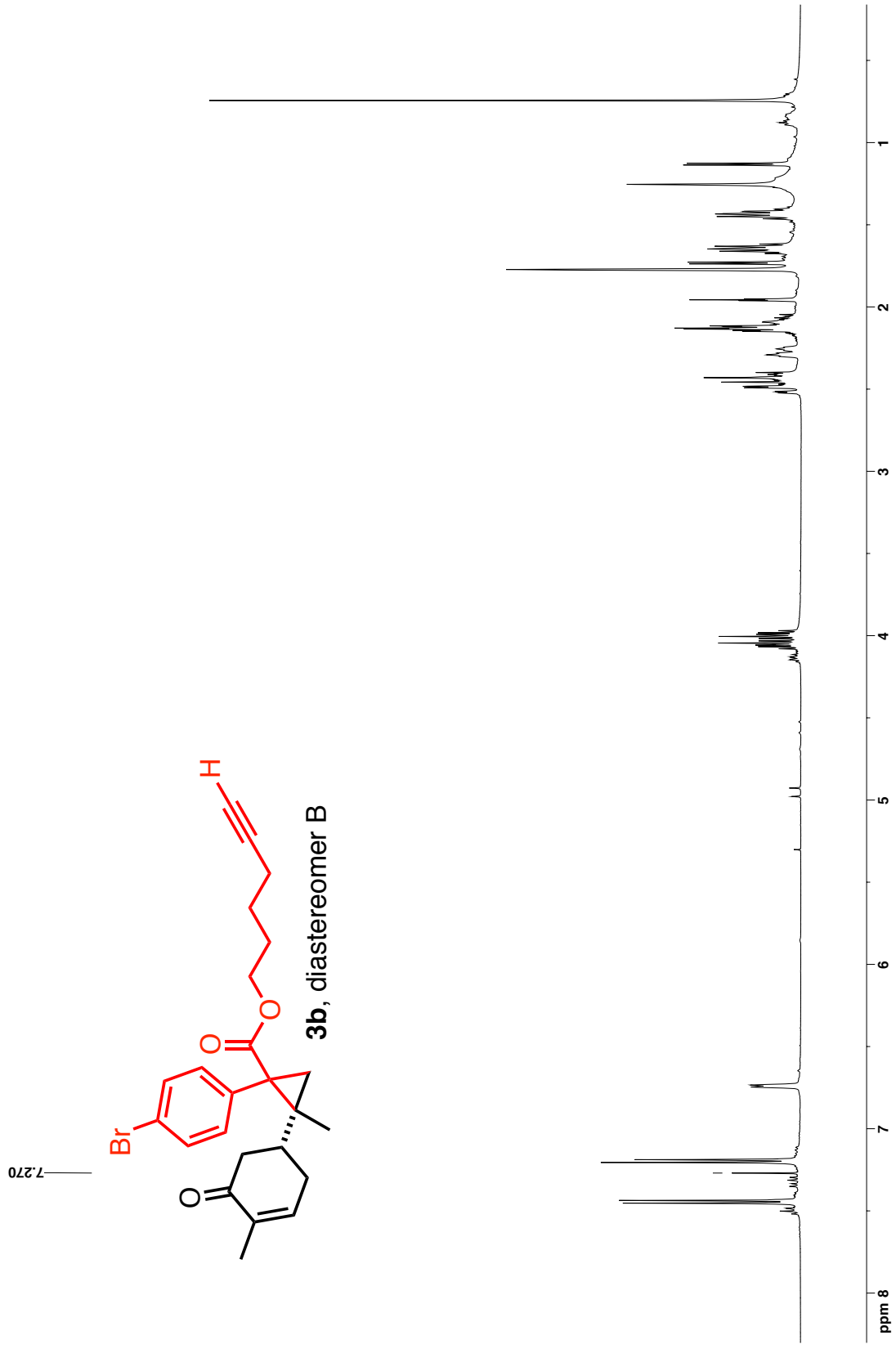
^{13}C NMR (125 MHz) of cyclopropanated carvone **3a** in $CDCl_3$



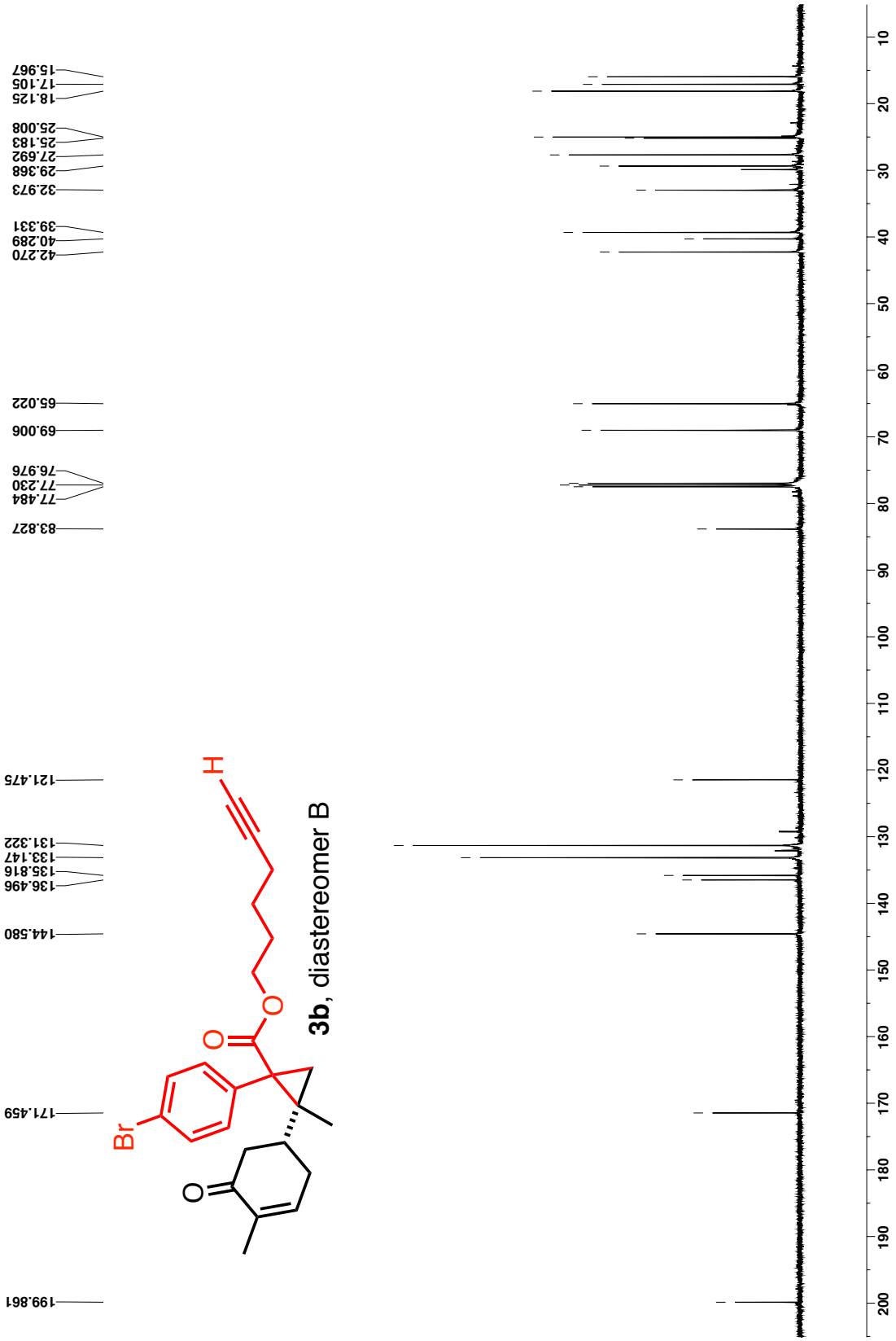
^{1}H NMR (500 MHz) of cyclopropanated carvone **3b** diastereomer A in $CDCl_3$



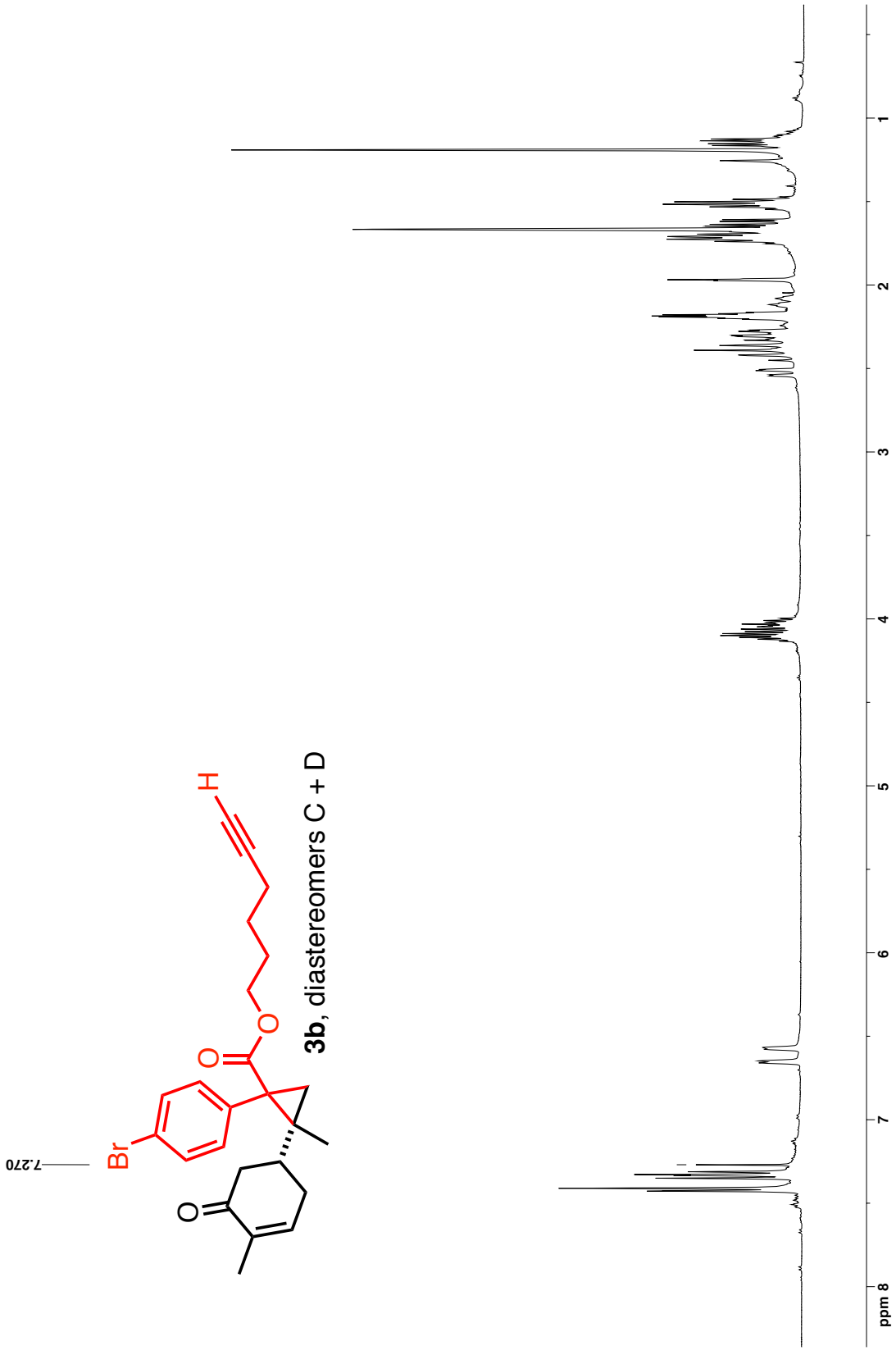
^{13}C NMR (125 MHz) of cyclopropanated carvone **3b** diastereomer A in $CDCl_3$



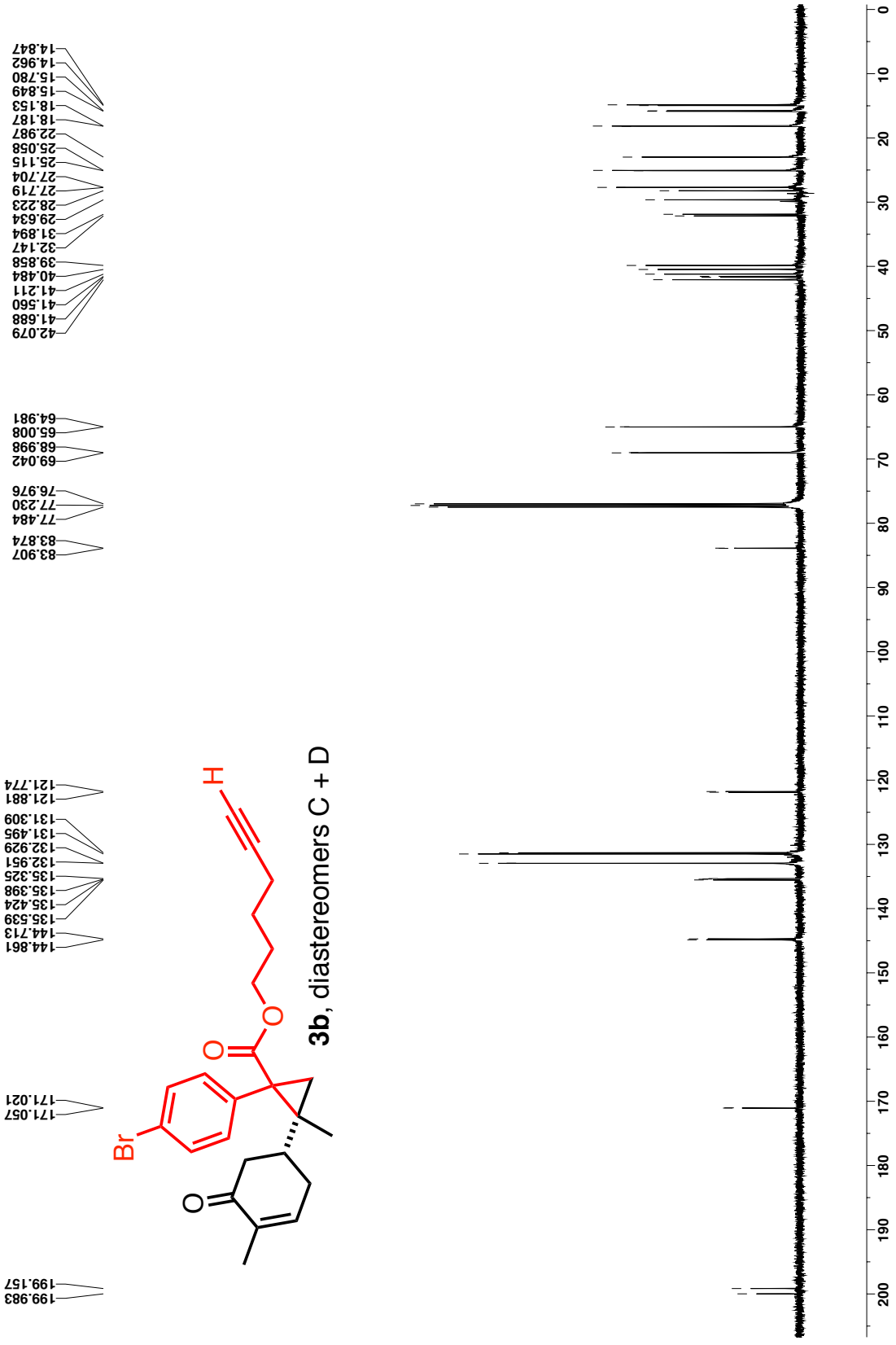
^{1}H NMR (500 MHz) of cyclopropanated carvone **3b** diastereomer B in $CDCl_3$



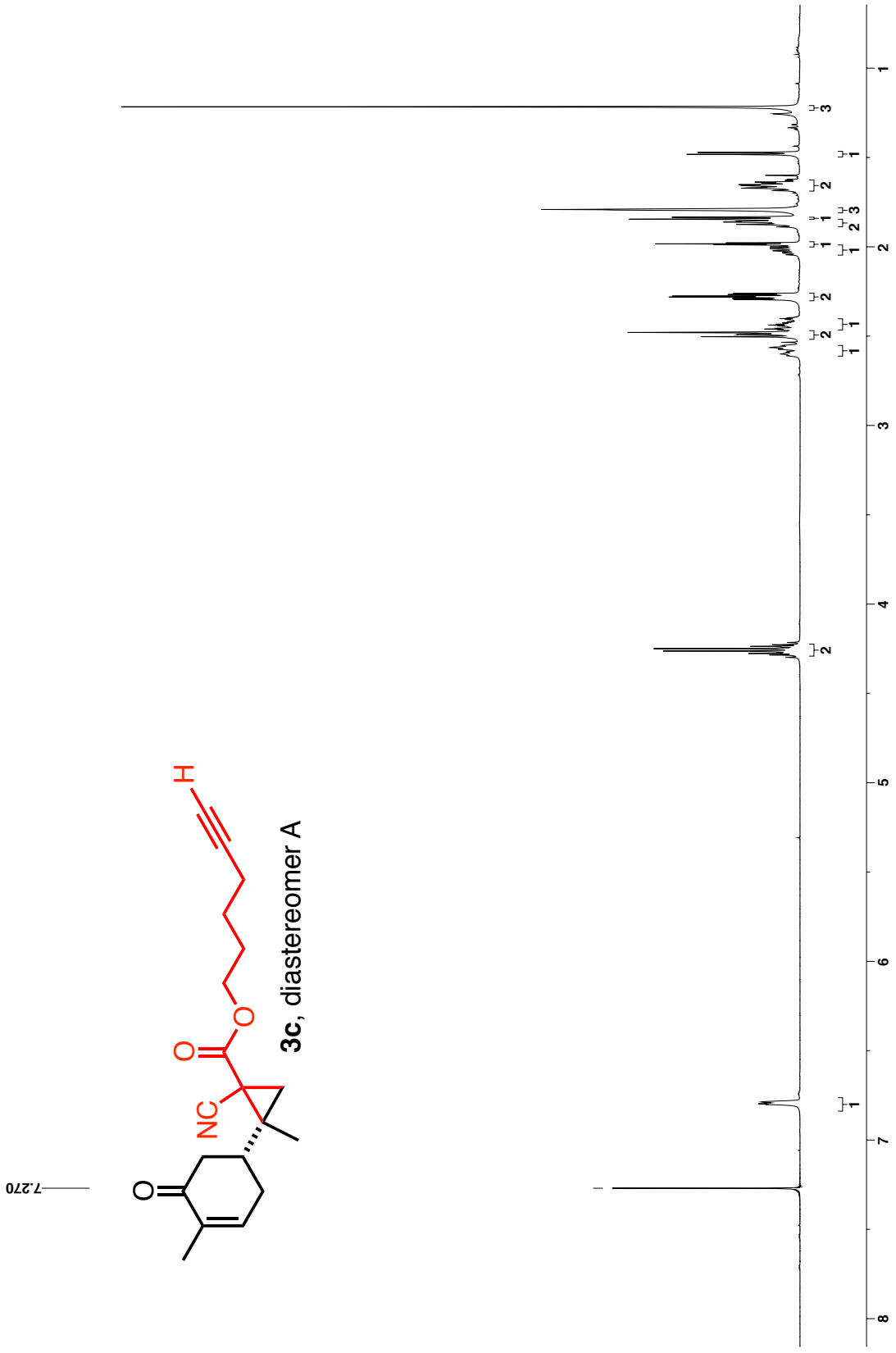
^{13}C NMR (125 MHz) of cyclopropanated carvone **3b** diastereomer B in $CDCl_3$



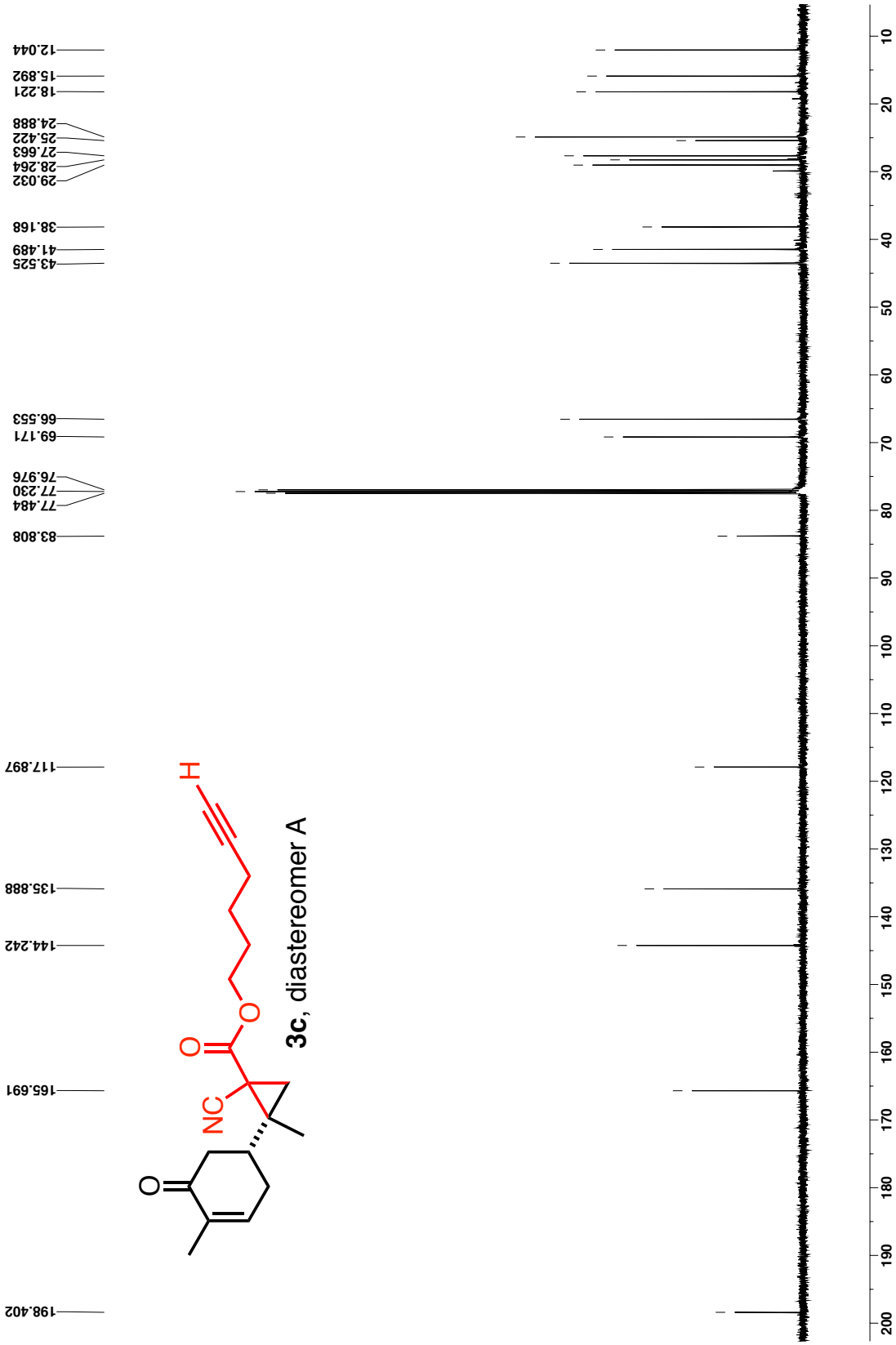
^{1}H NMR (500 MHz) of cyclopropanated carvone **3b** diastereomers C + D in $CDCl_3$



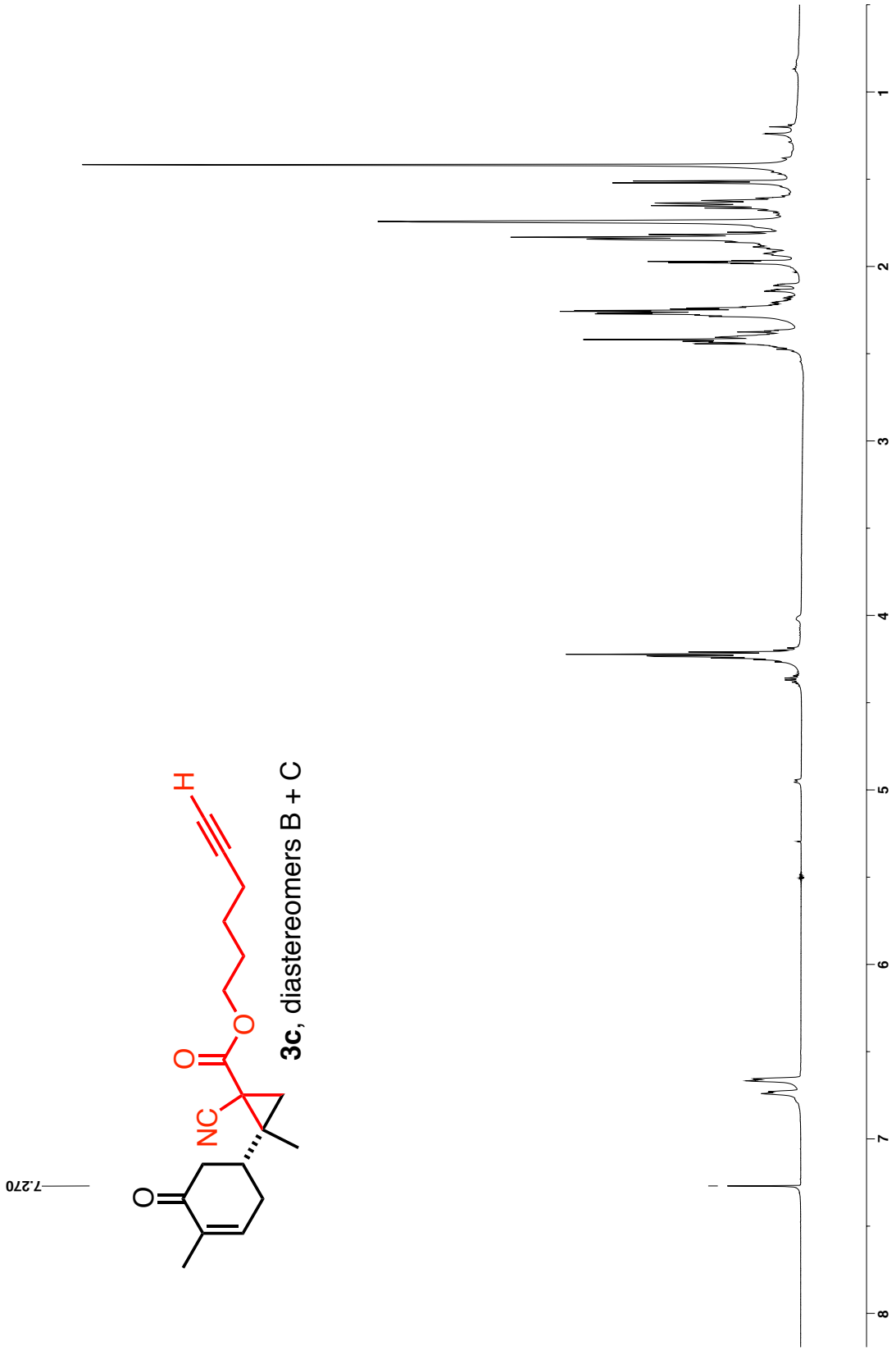
^{13}C NMR (125 MHz) of cyclopropanated carvone **3b** diastereomers C + D in $CDCl_3$



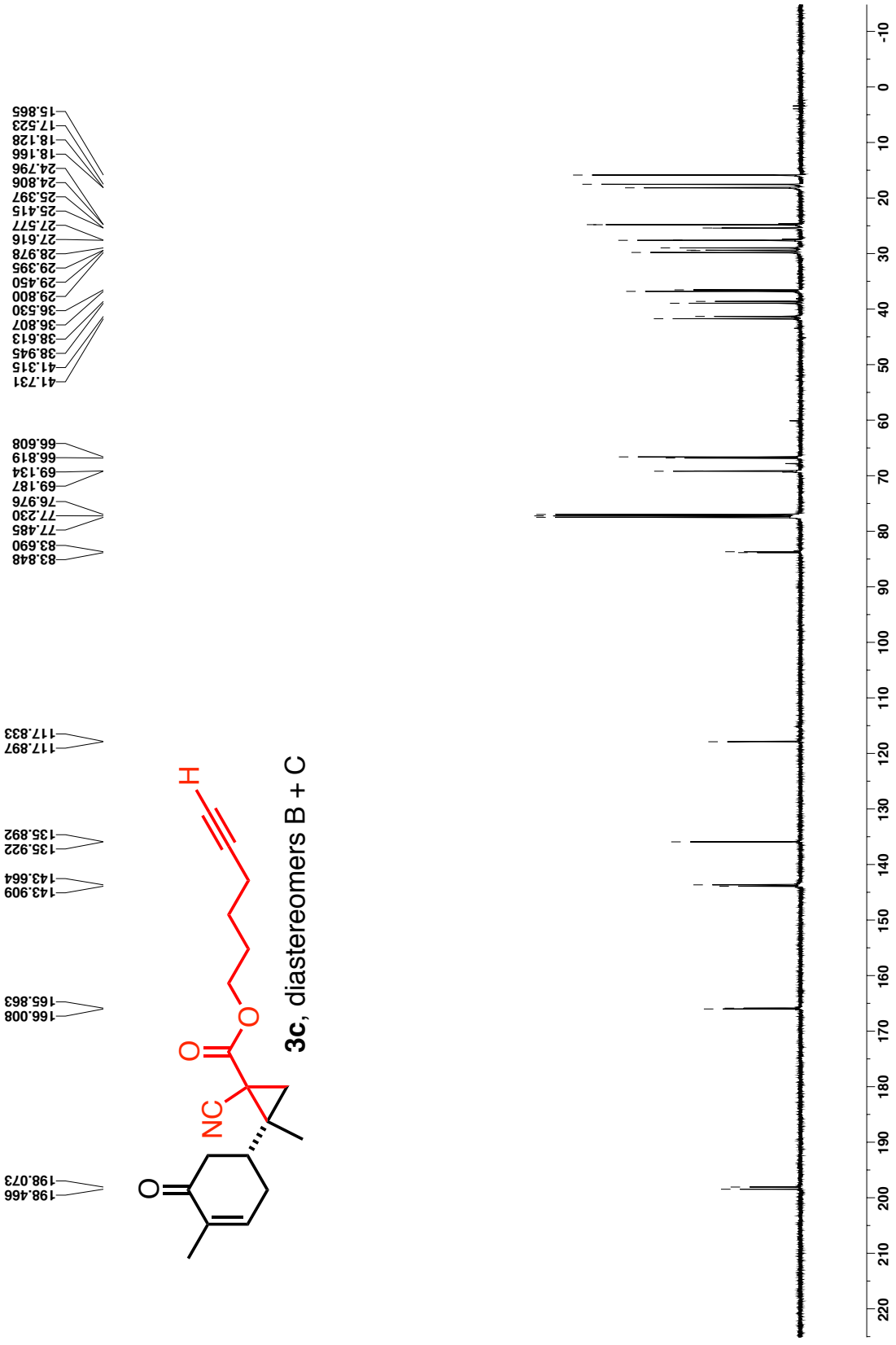
^{1}H NMR (500 MHz) of cyclopropanated carvone **3c** diastereomer A in $CDCl_3$



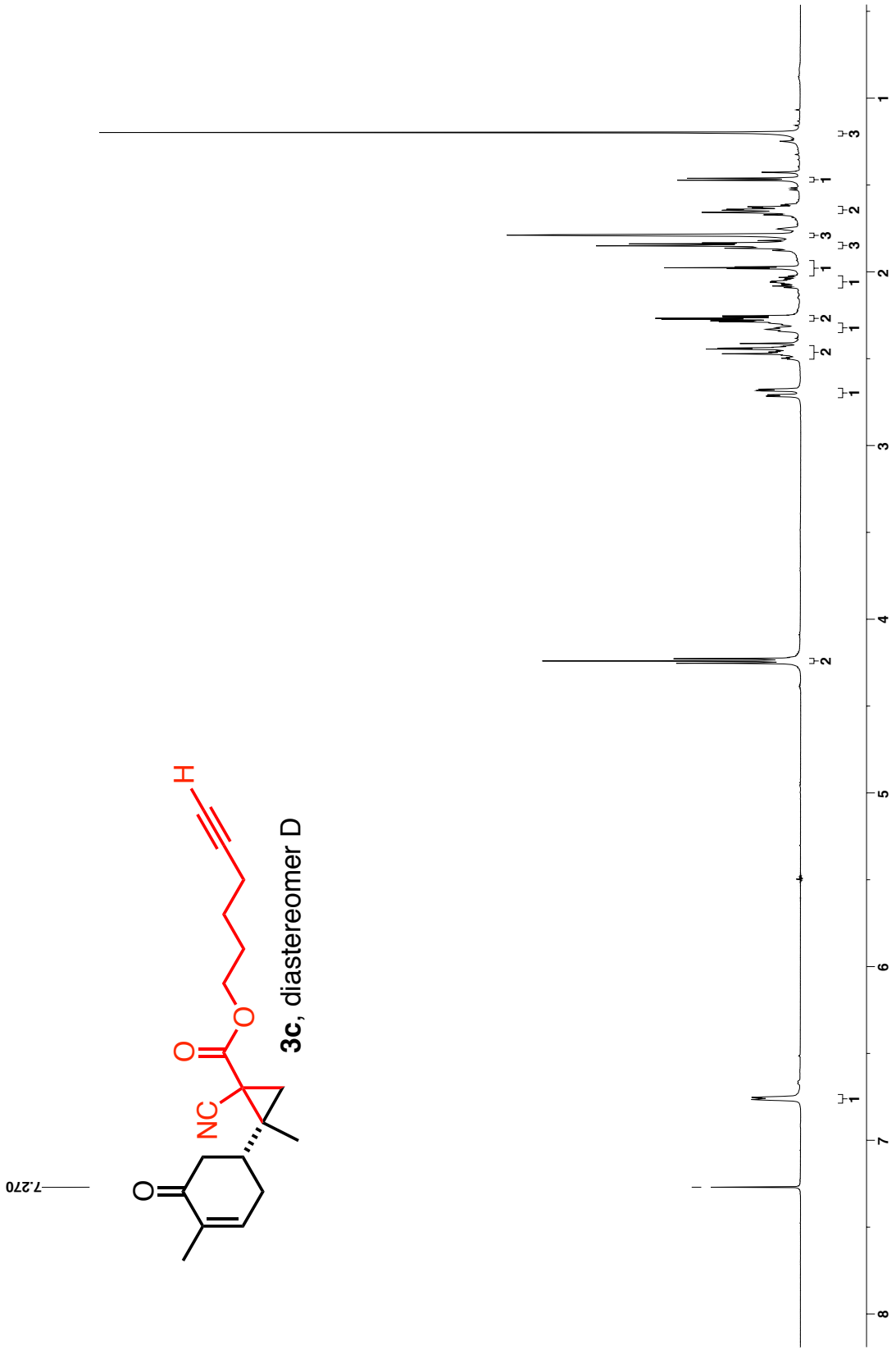
^{13}C NMR (125 MHz) of cyclopropanated carvone **3c** diastereomer A in $CDCl_3$



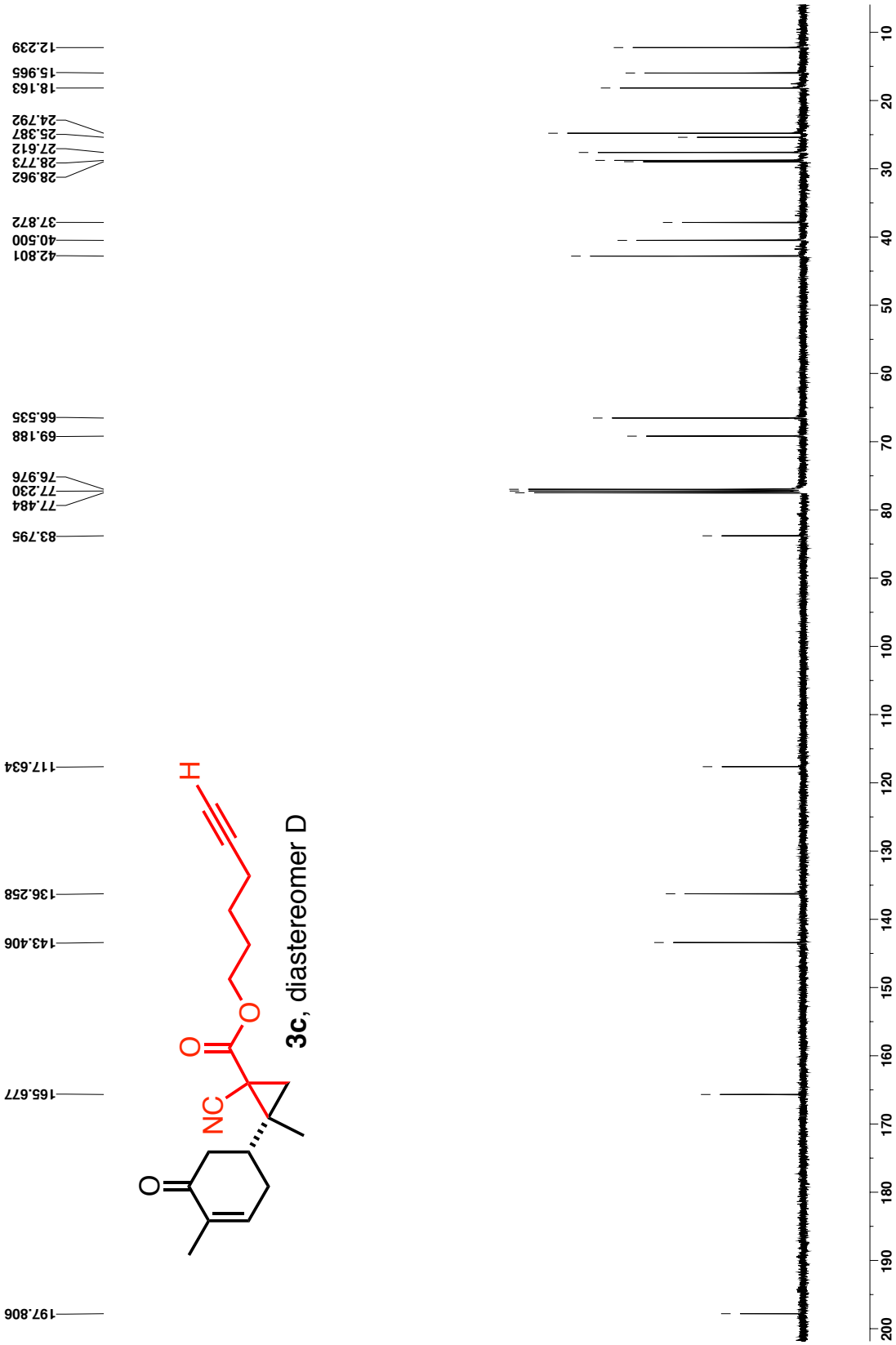
^{1}H NMR (500 MHz) of cyclopropanated carvone **3c** diastereomers B + C in $CDCl_3$



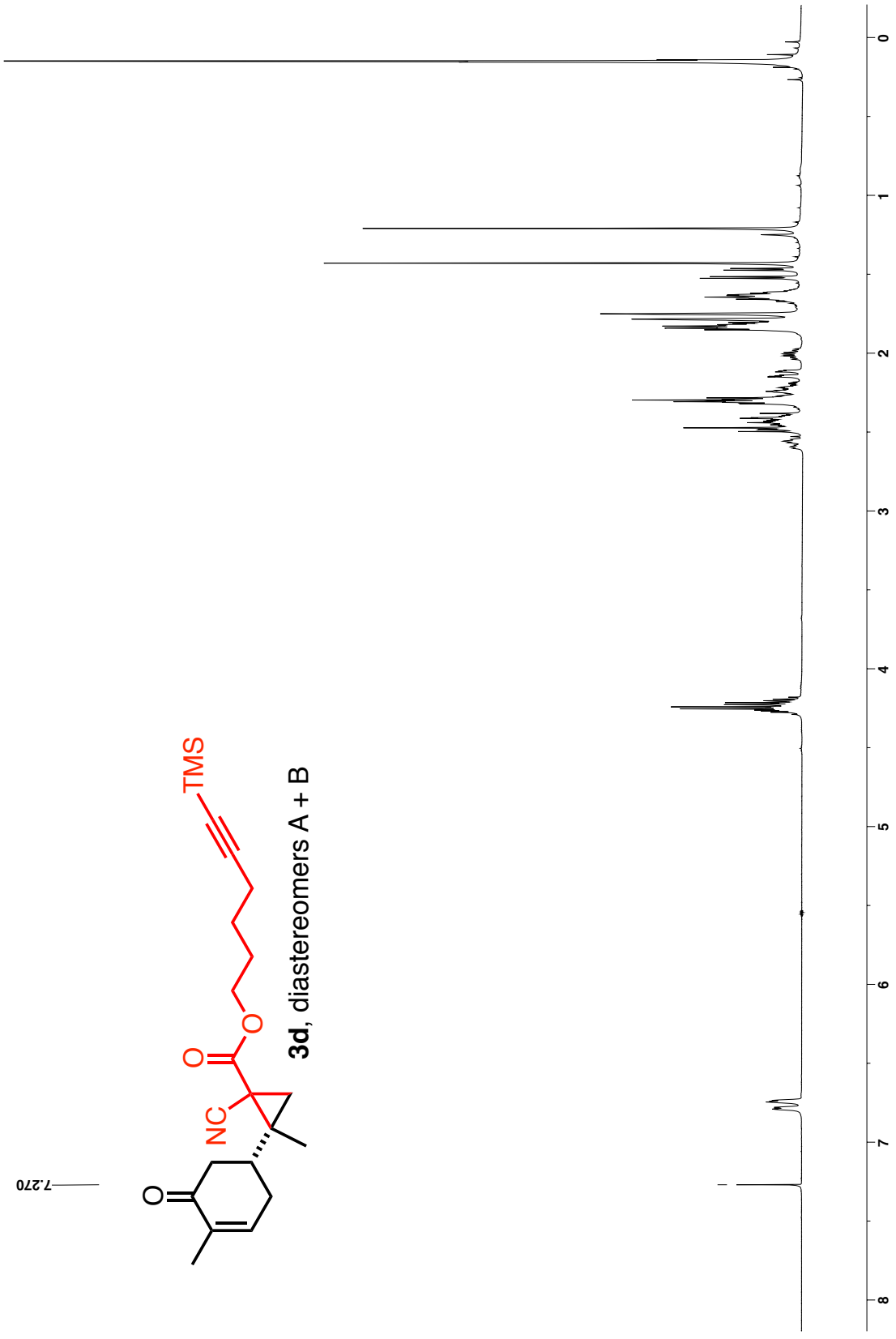
^{13}C NMR (125 MHz) of cyclopropanated carvone **3c** diastereomers B + C in $CDCl_3$



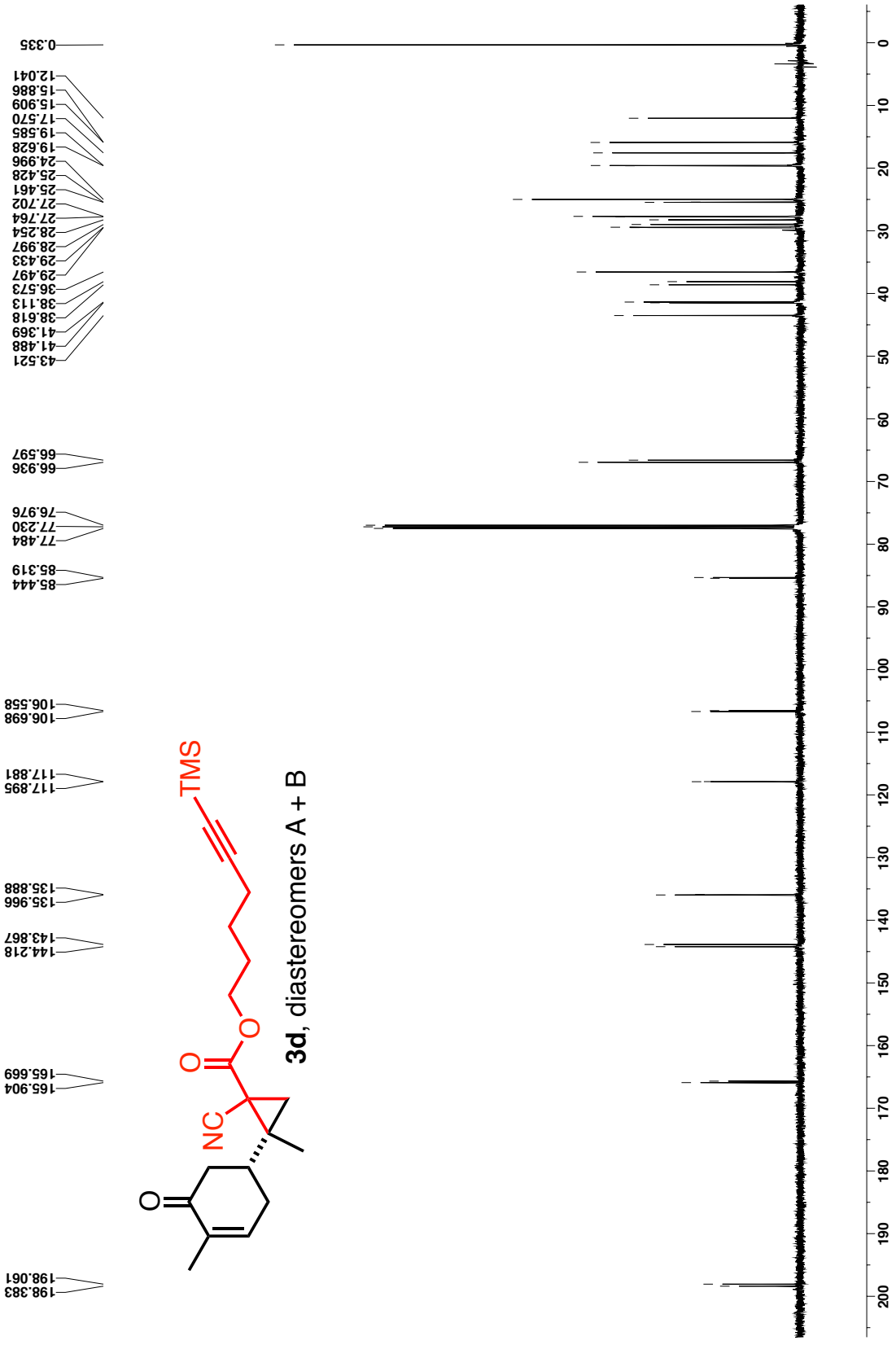
^{1}H NMR (500 MHz) of cyclopropanated carvone **3c** diastereomer D in $CDCl_3$



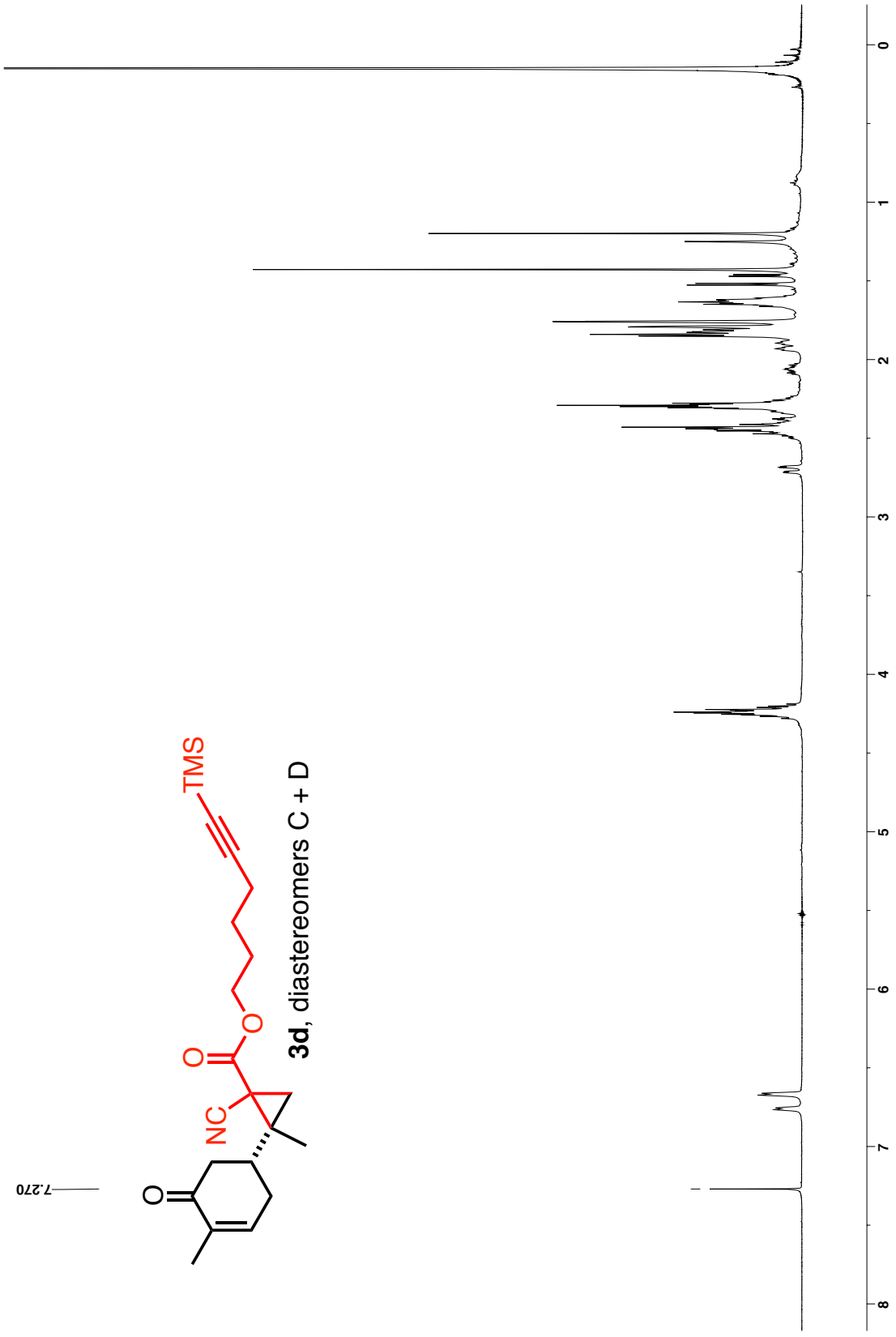
^{13}C NMR (125 MHz) of cyclopropanated carvone **3c** diastereomer D in $CDCl_3$



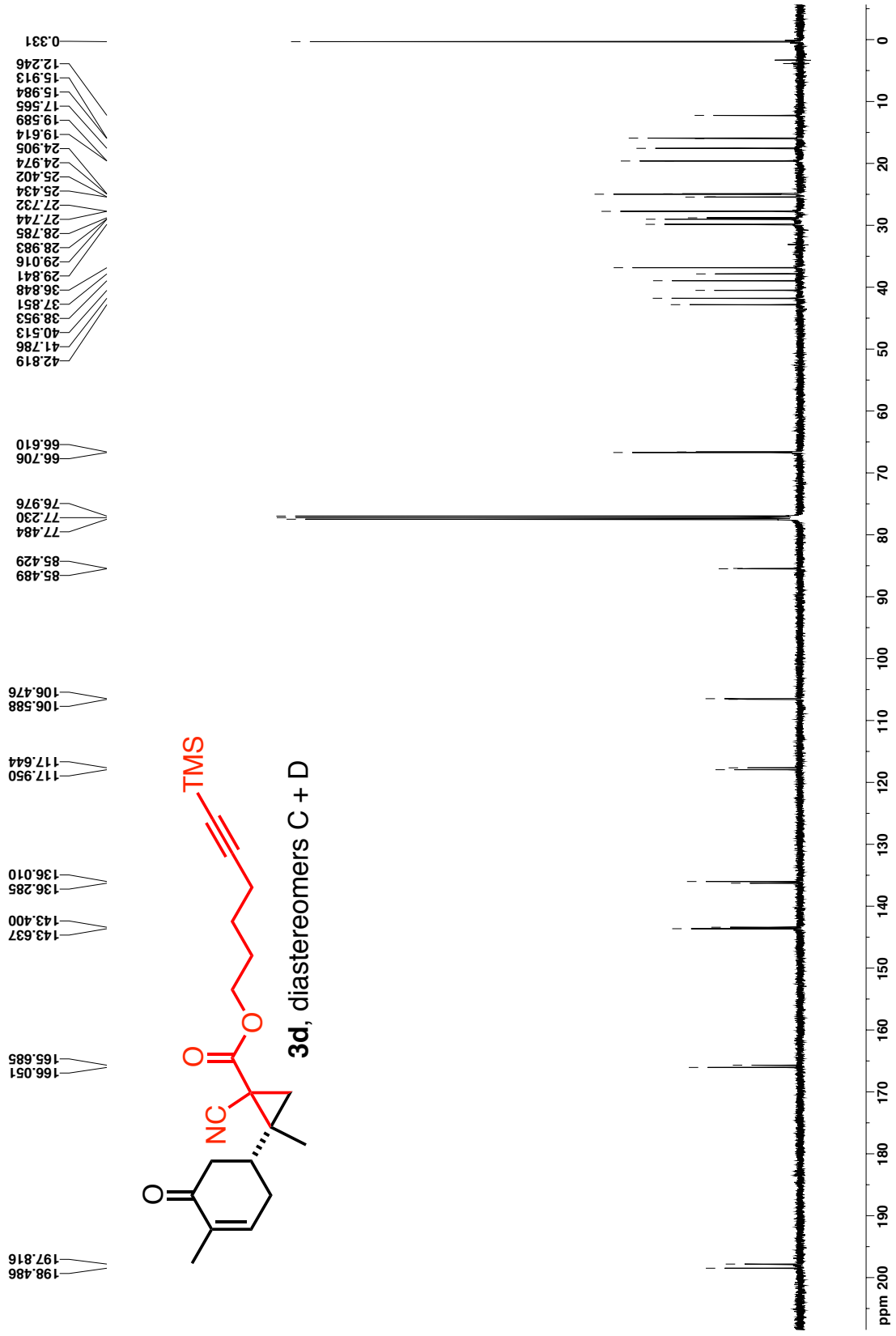
^{1}H NMR (500 MHz) of cyclopropanated carvone **3d** diastereomers A + B in $CDCl_3$



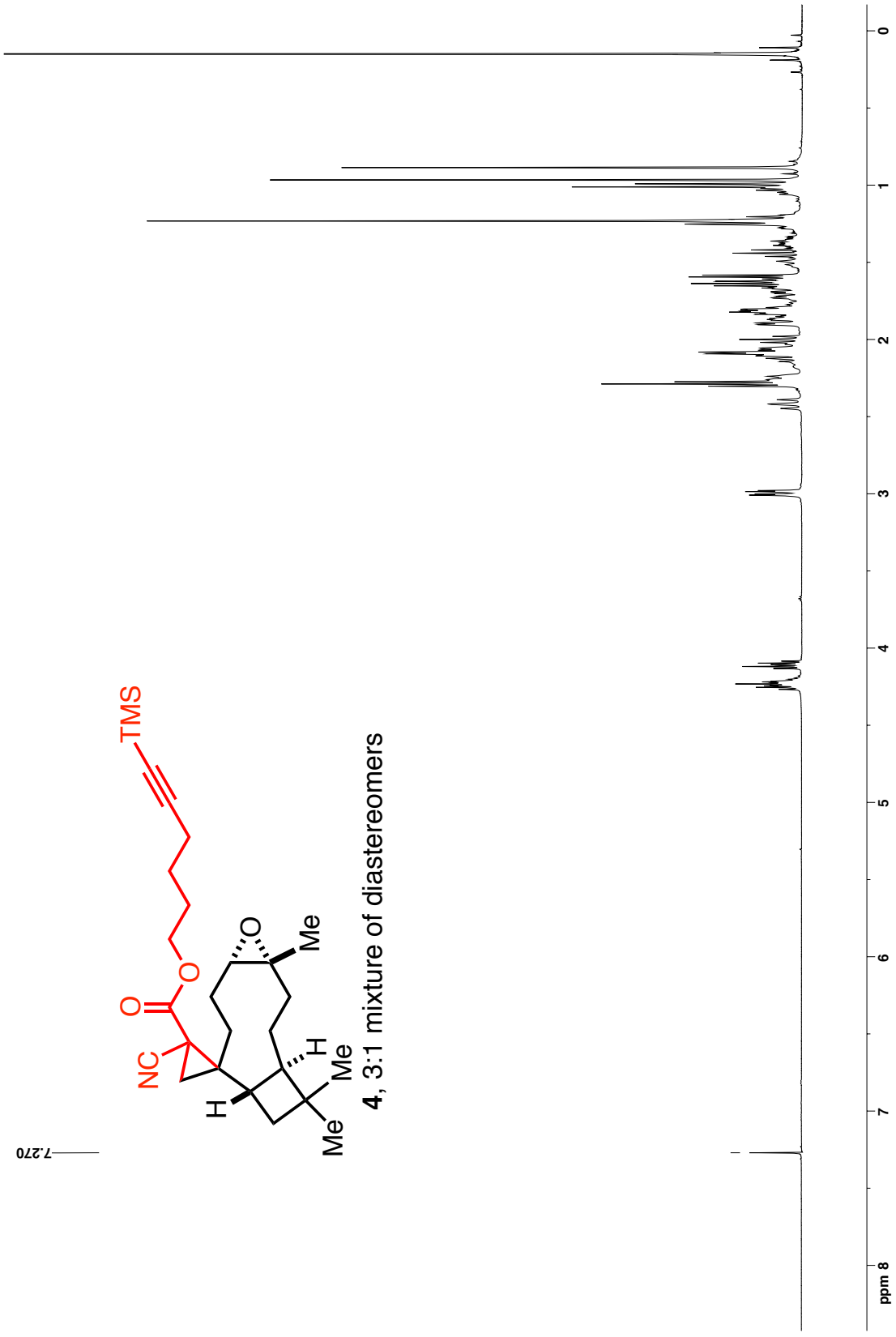
^{13}C NMR (125 MHz) of cyclopropanated carvone **3d** diastereomers A + B in $CDCl_3$



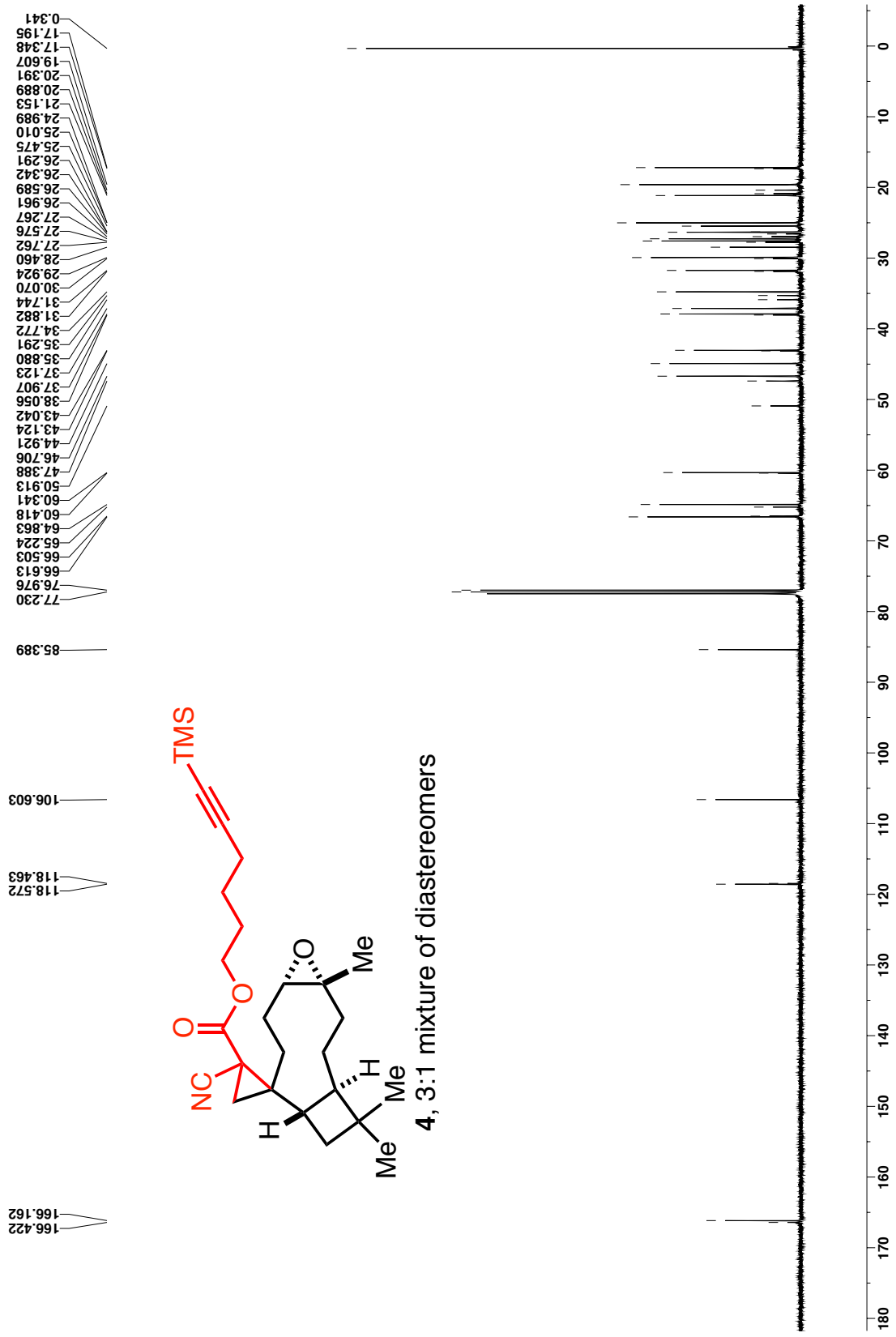
^{1}H NMR (500 MHz) of cyclopropanated carvone **3d** diastereomers C + D in $CDCl_3$



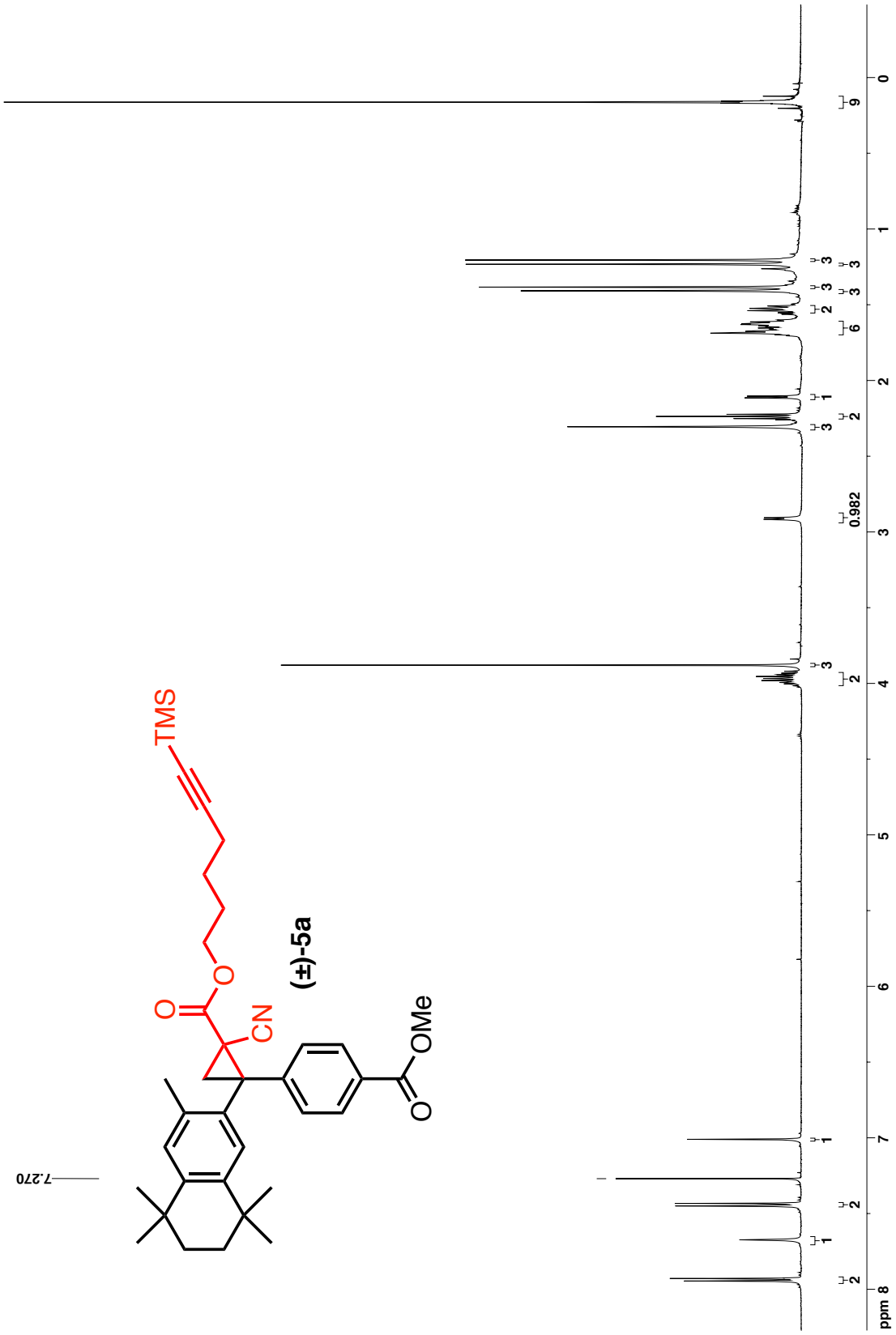
^{13}C NMR (125 MHz) of cyclopropanated carvone **3d** diastereomers C + D in $CDCl_3$



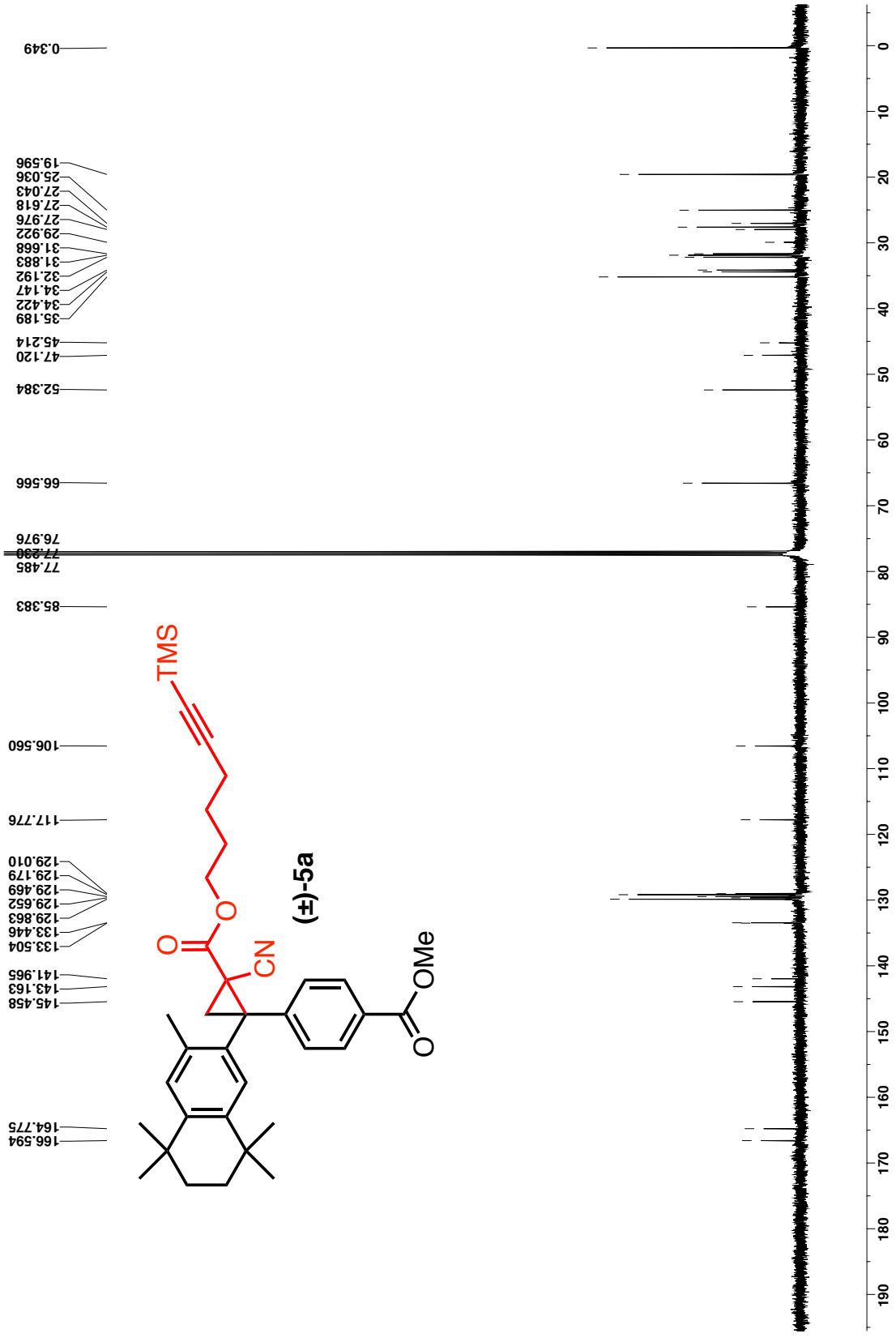
^{1}H NMR (500 MHz) of cyclopropanated caryophyllene oxide **4** in $CDCl_3$



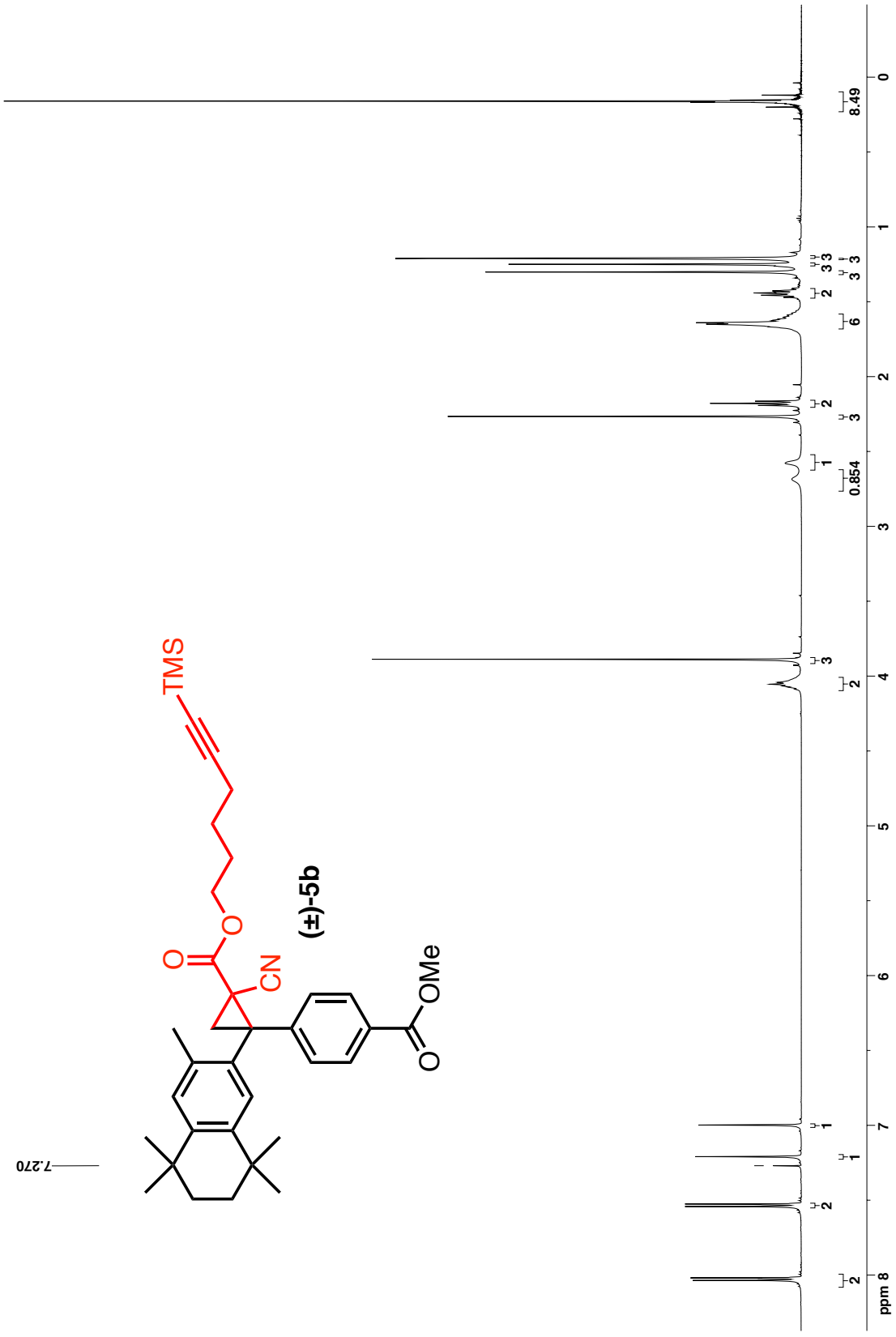
^{13}C NMR (125 MHz) of cyclopropanated caryophyllene oxide **4** in $CDCl_3$



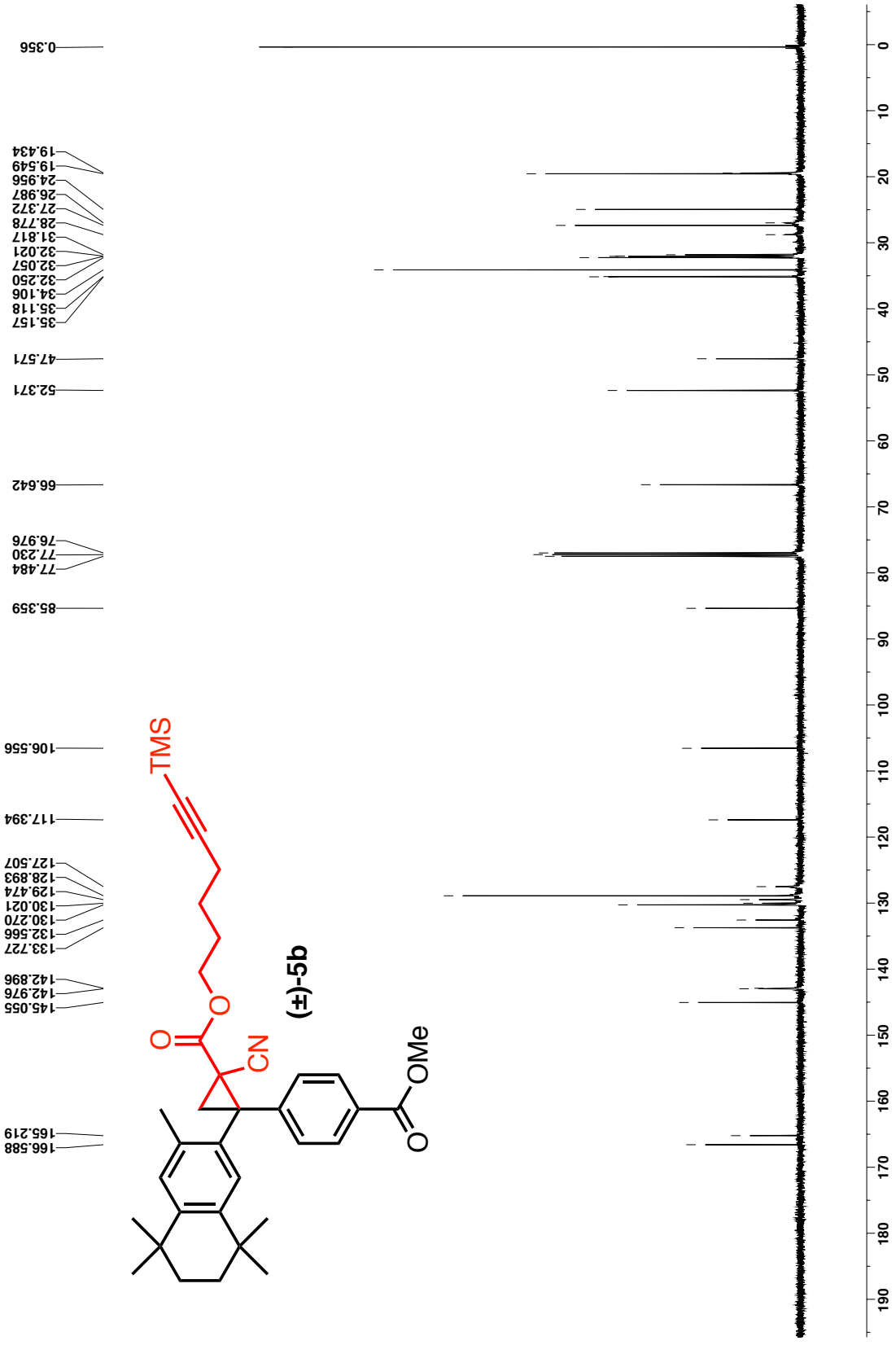
^{1}H NMR (500 MHz) of cyclopropanated bexarotene methyl ester **(±)-5a** in $CDCl_3$



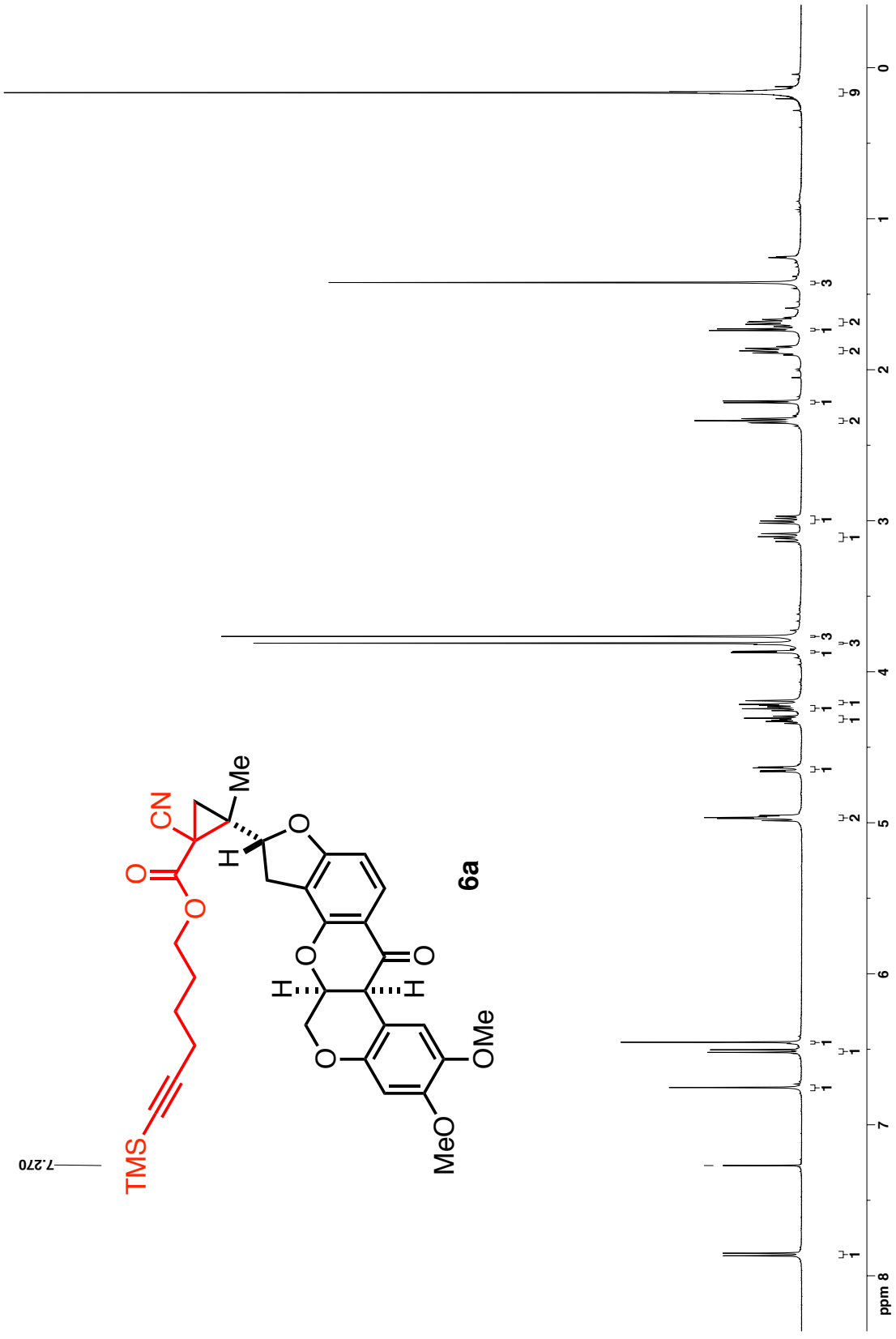
^{13}C NMR (125 MHz) of cyclopropanated bexarotene methyl ester **(±)-5a** in $CDCl_3$



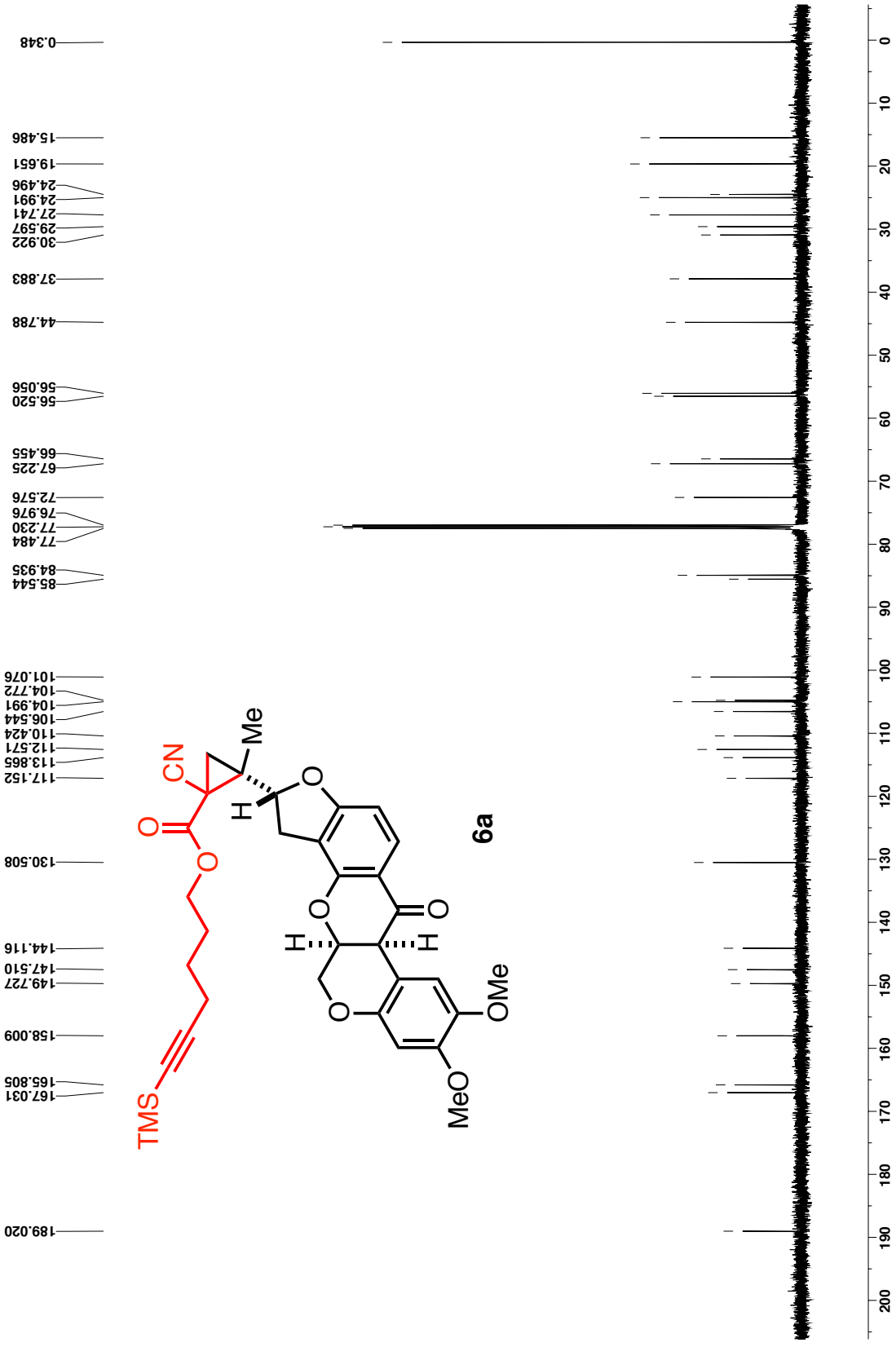
^{1}H NMR (500 MHz) of cyclopropanated bexarotene methyl ester **(±)-5b** in $CDCl_3$



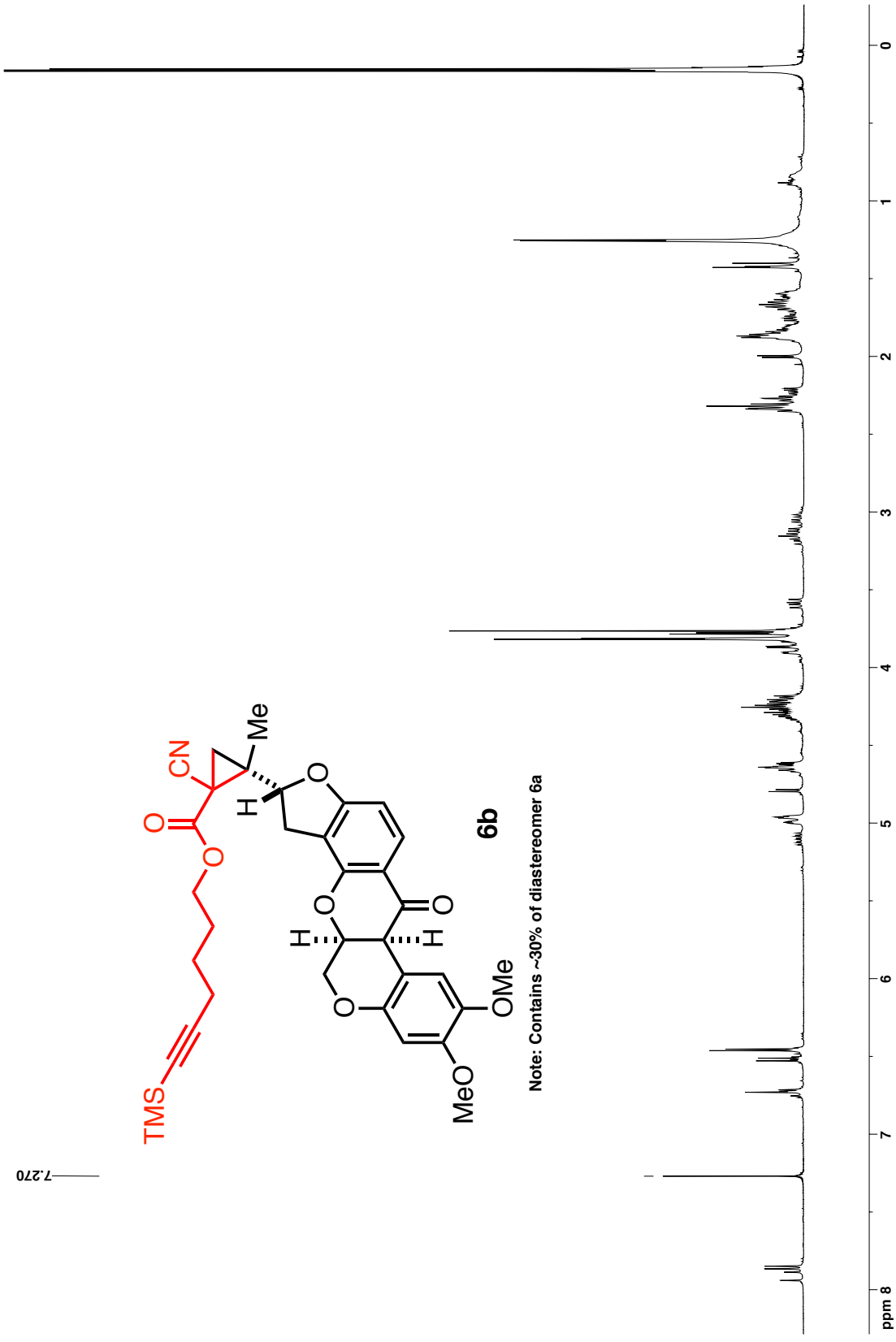
^{13}C NMR (125 MHz) of cyclopropanated bexarotene methyl ester **(±)-5b** in $CDCl_3$



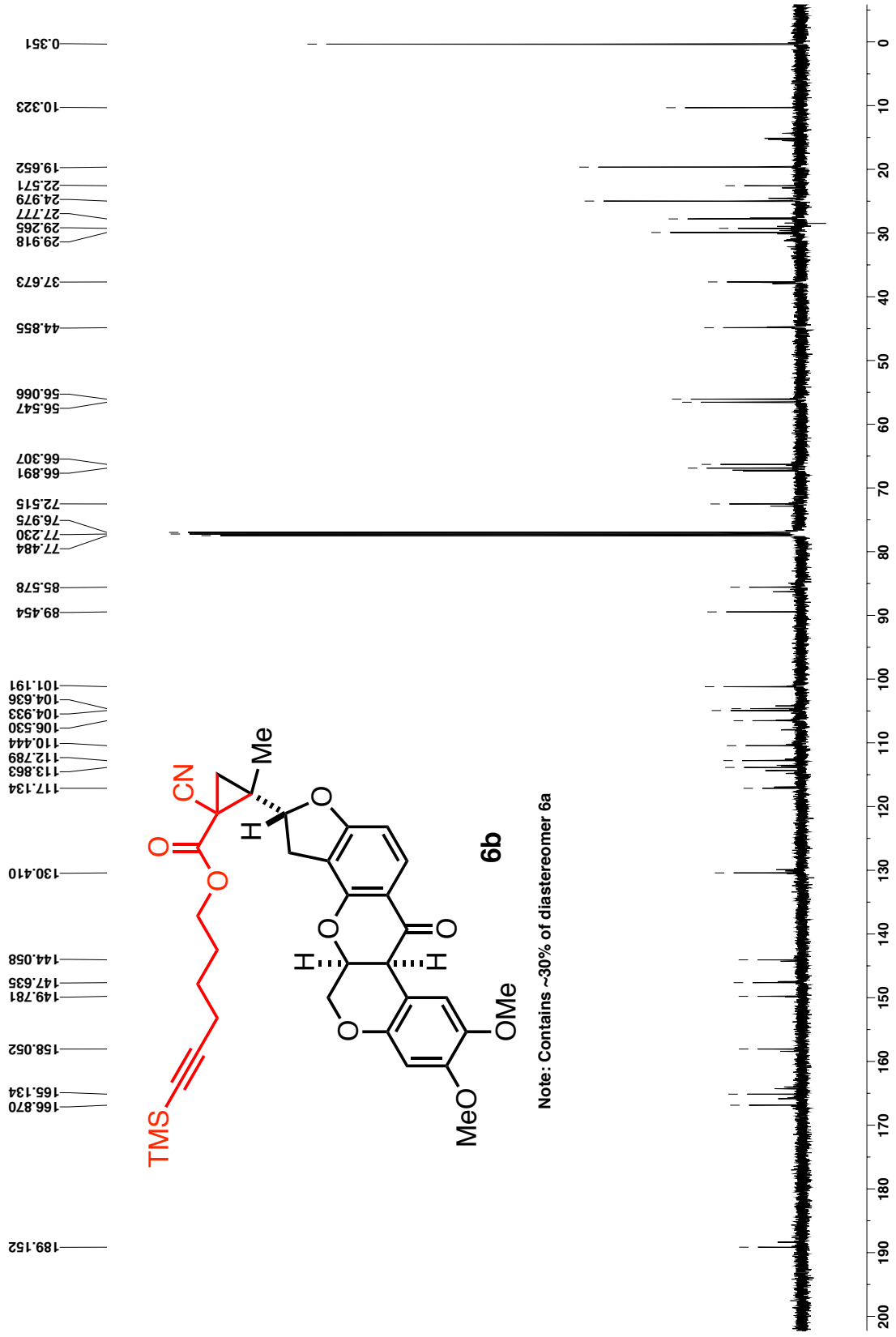
^{1}H NMR (500 MHz) of cyclopropanated rotenone **6a** in $CDCl_3$



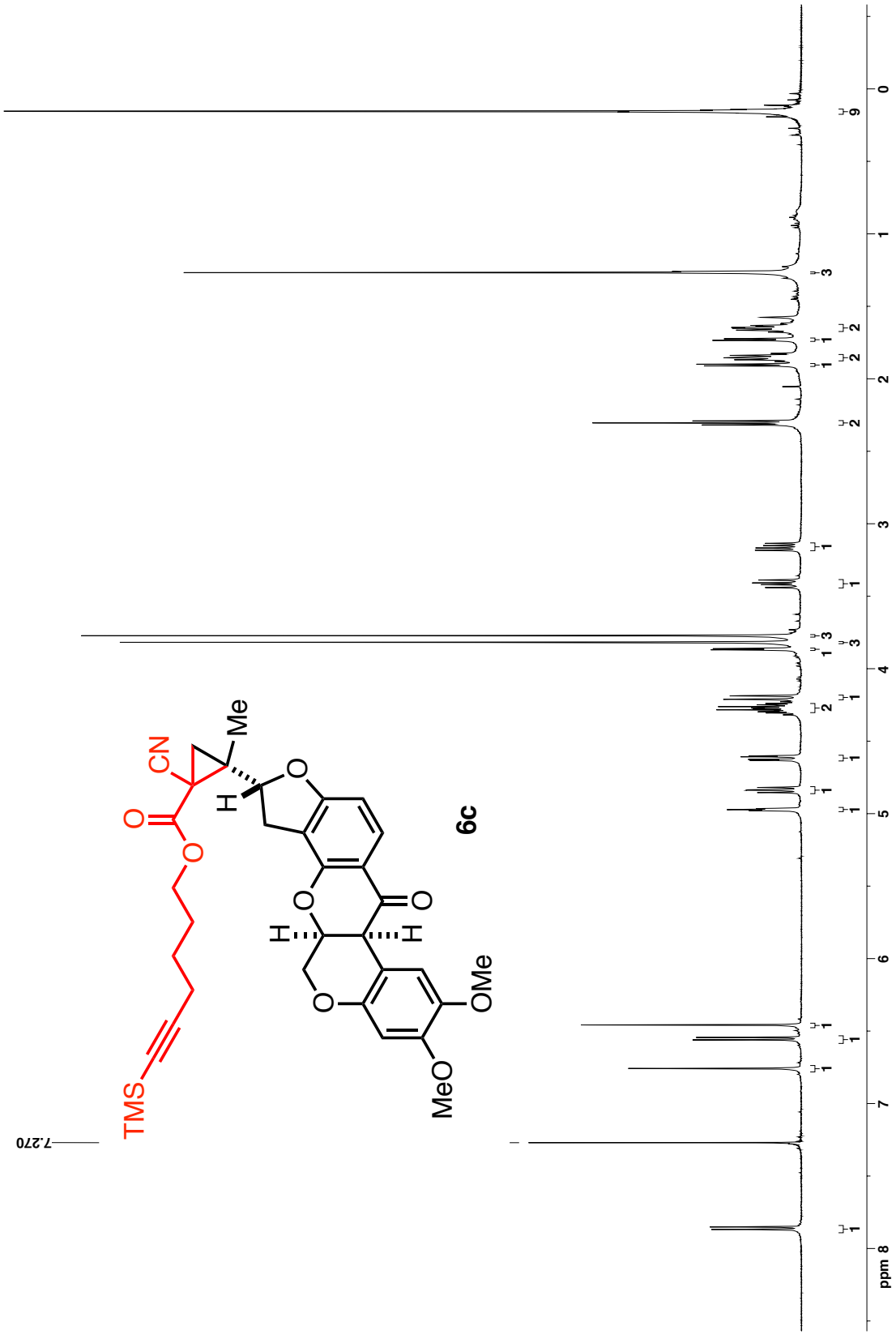
^{13}C NMR (125 MHz) of cyclopropanated rotenone **6a** in $CDCl_3$



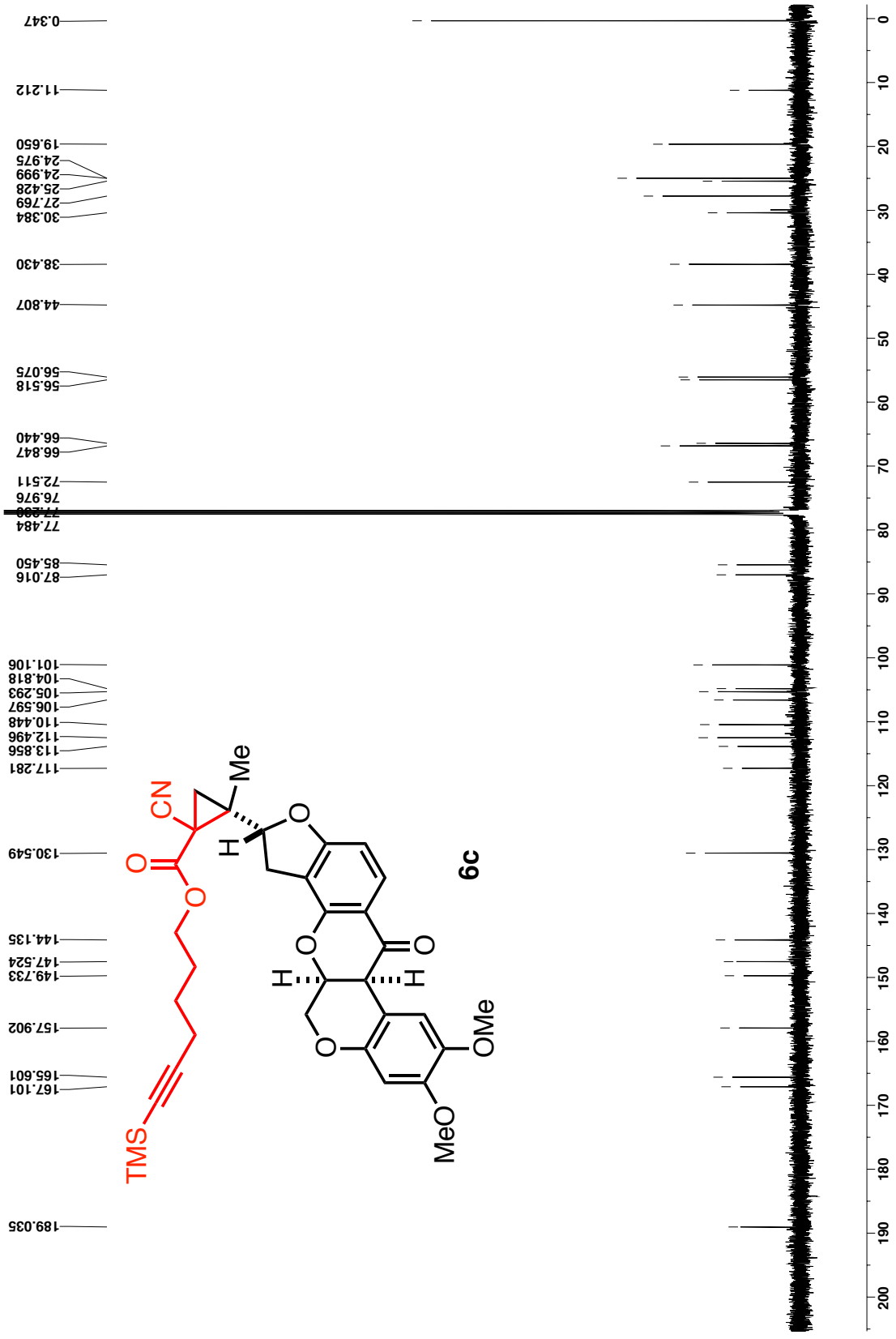
^{1}H NMR (500 MHz) of cyclopropanated rotenone **6b** in $CDCl_3$



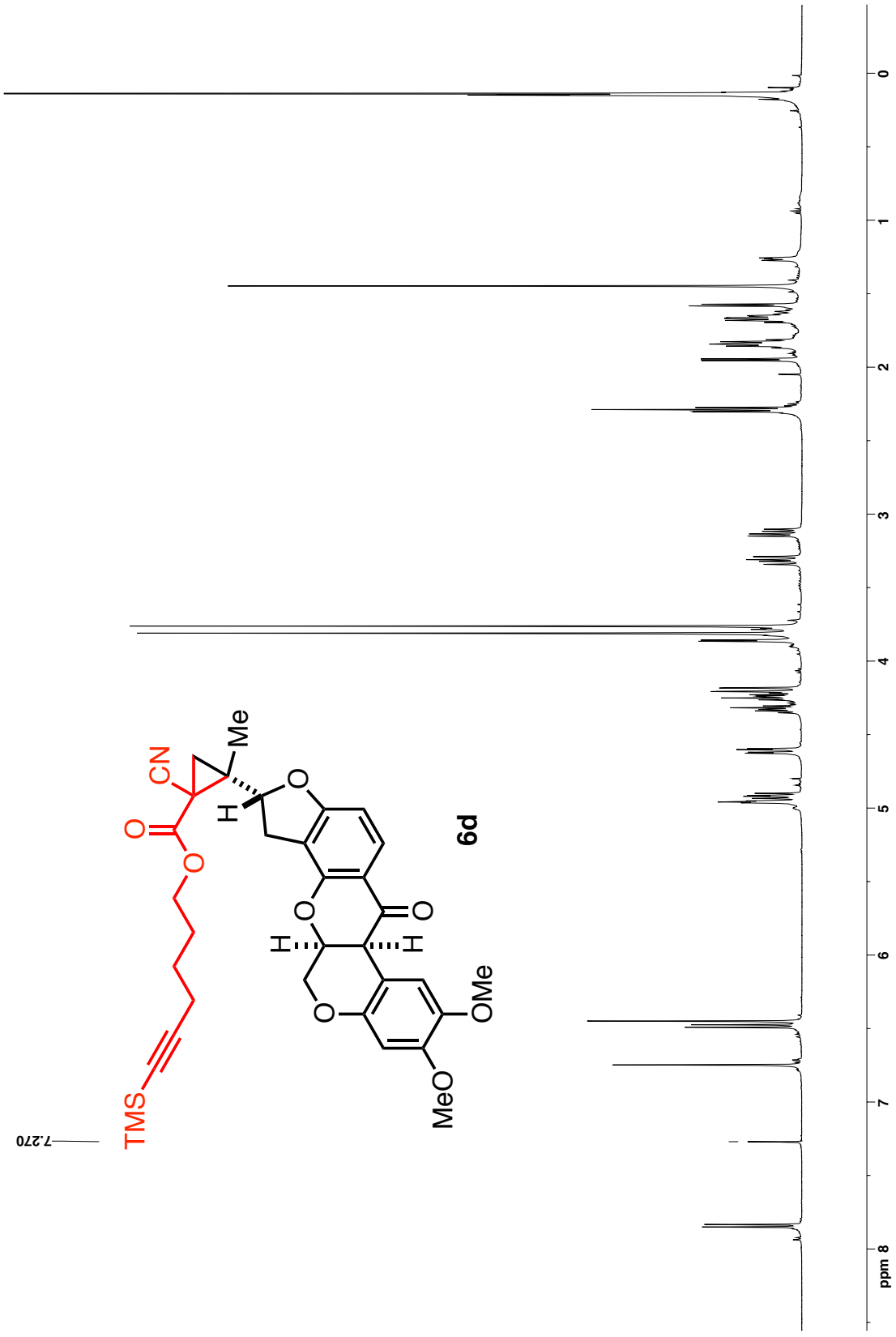
^{13}C NMR (125 MHz) of cyclopropanated rotenone **6b** in $CDCl_3$



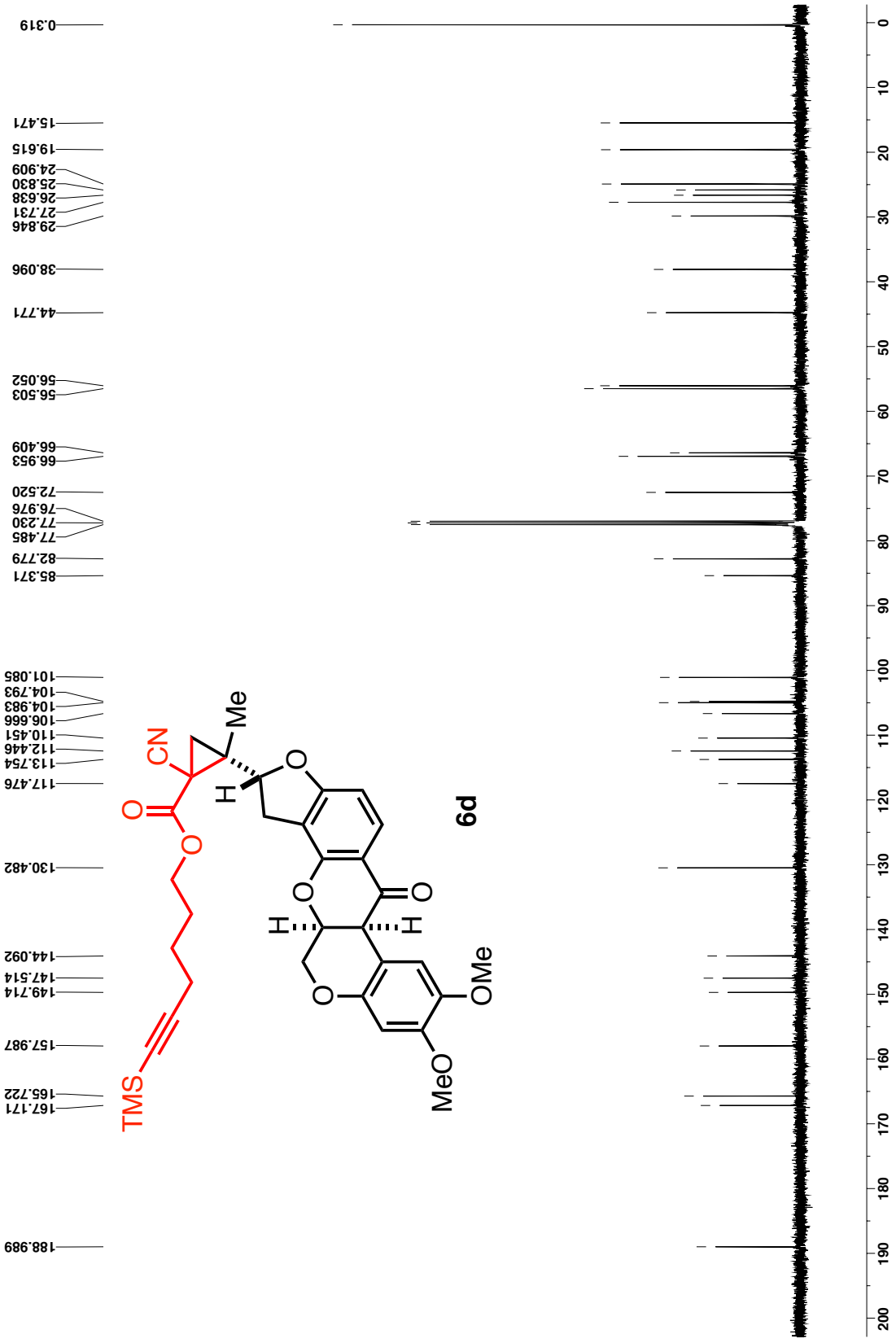
^{1}H NMR (500 MHz) of cyclopropanated rotenone **6c** in $CDCl_3$



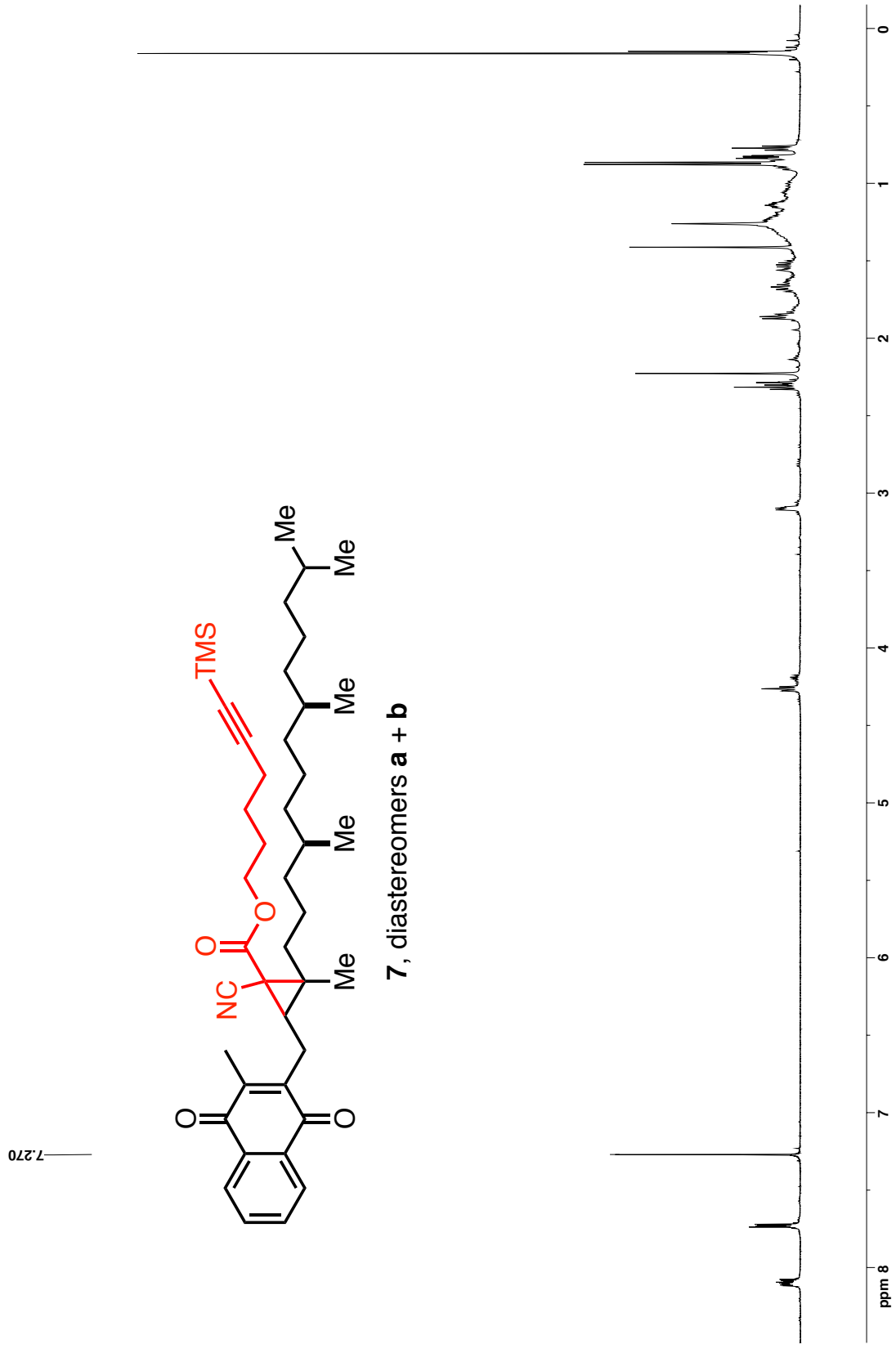
^{13}C NMR (125 MHz) of cyclopropanated rotenone **6c** in $CDCl_3$



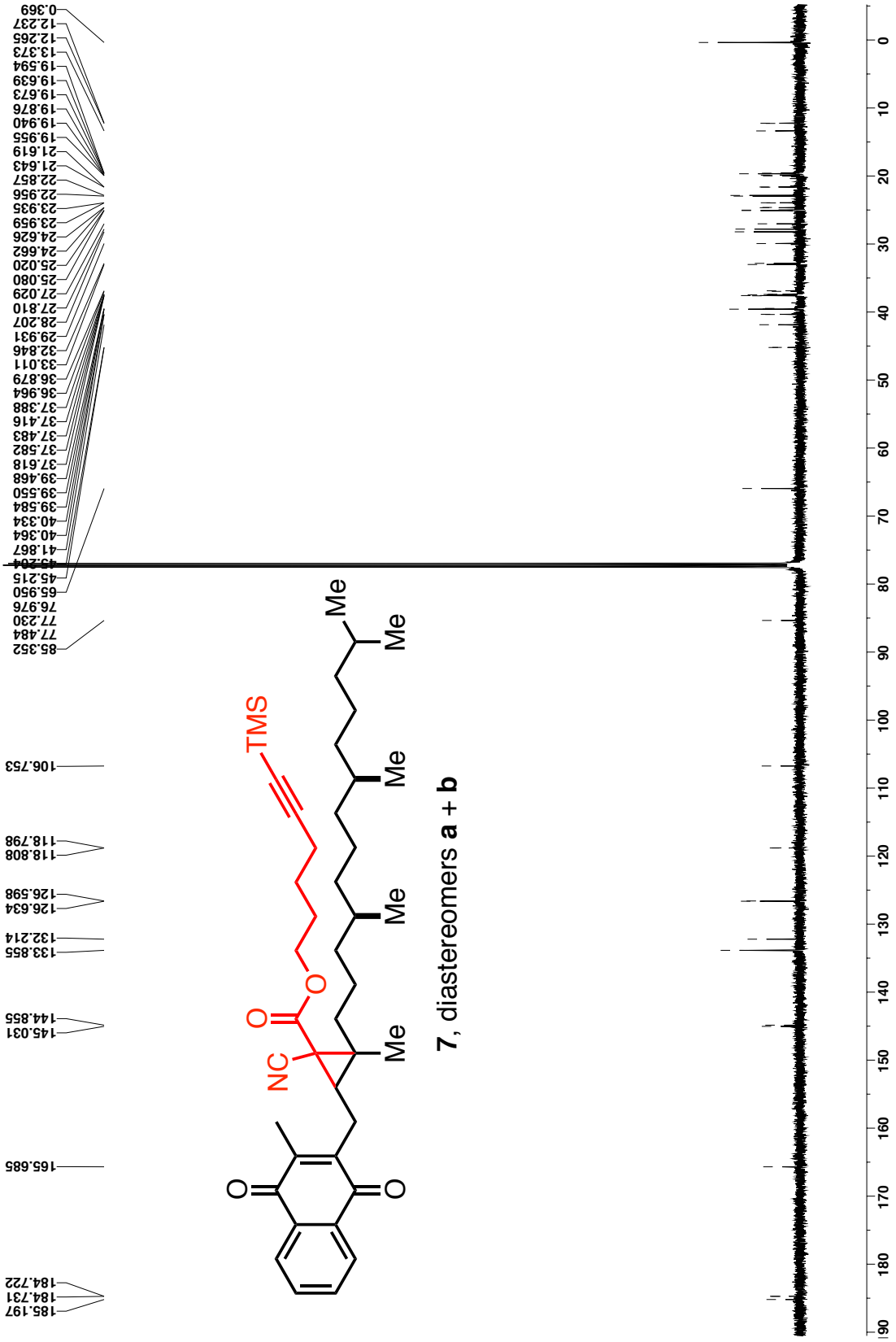
^{1}H NMR (500 MHz) of cyclopropanated rotenone **6d** in $CDCl_3$



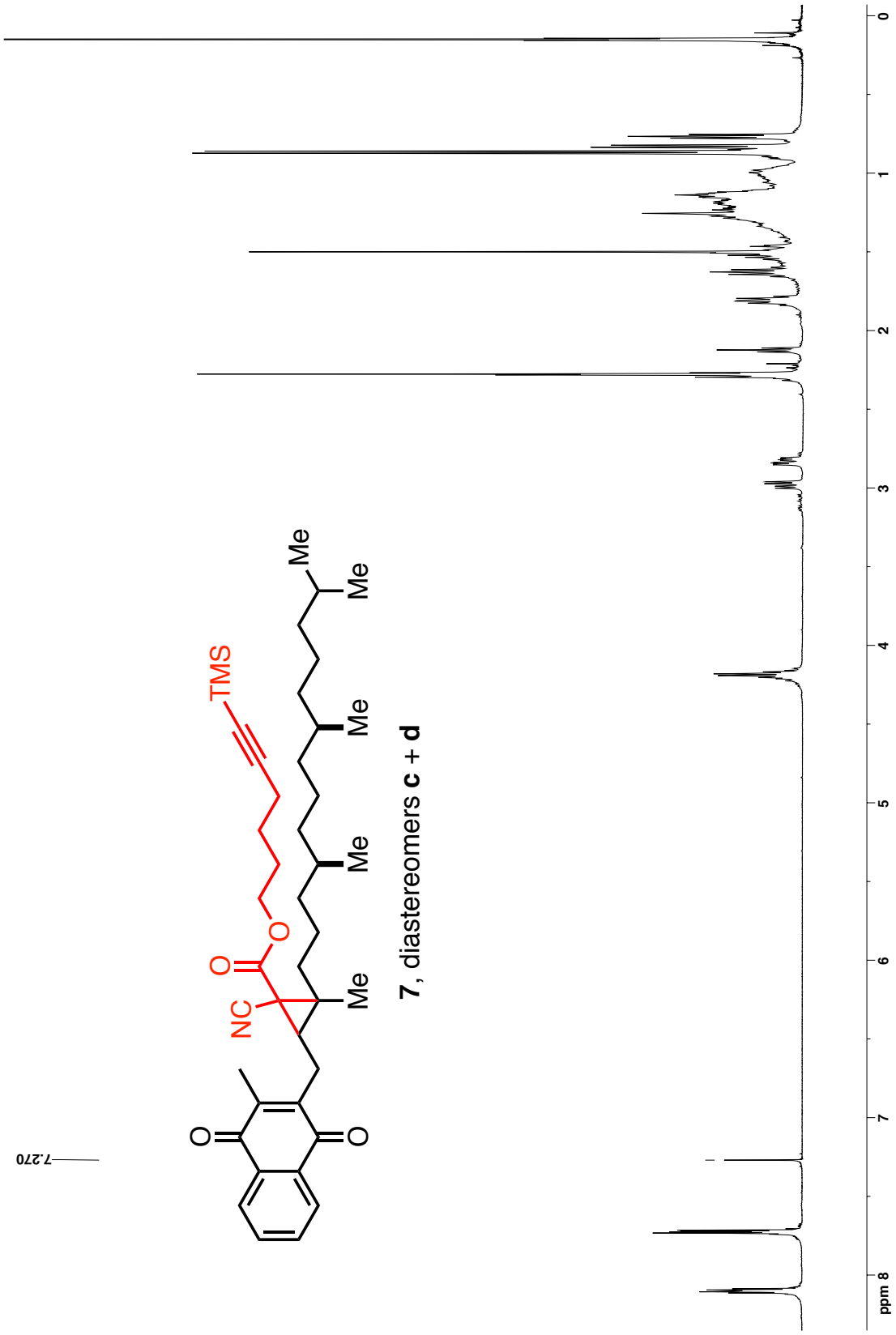
^{13}C NMR (125 MHz) of cyclopropanated rotenone **6d** in $CDCl_3$



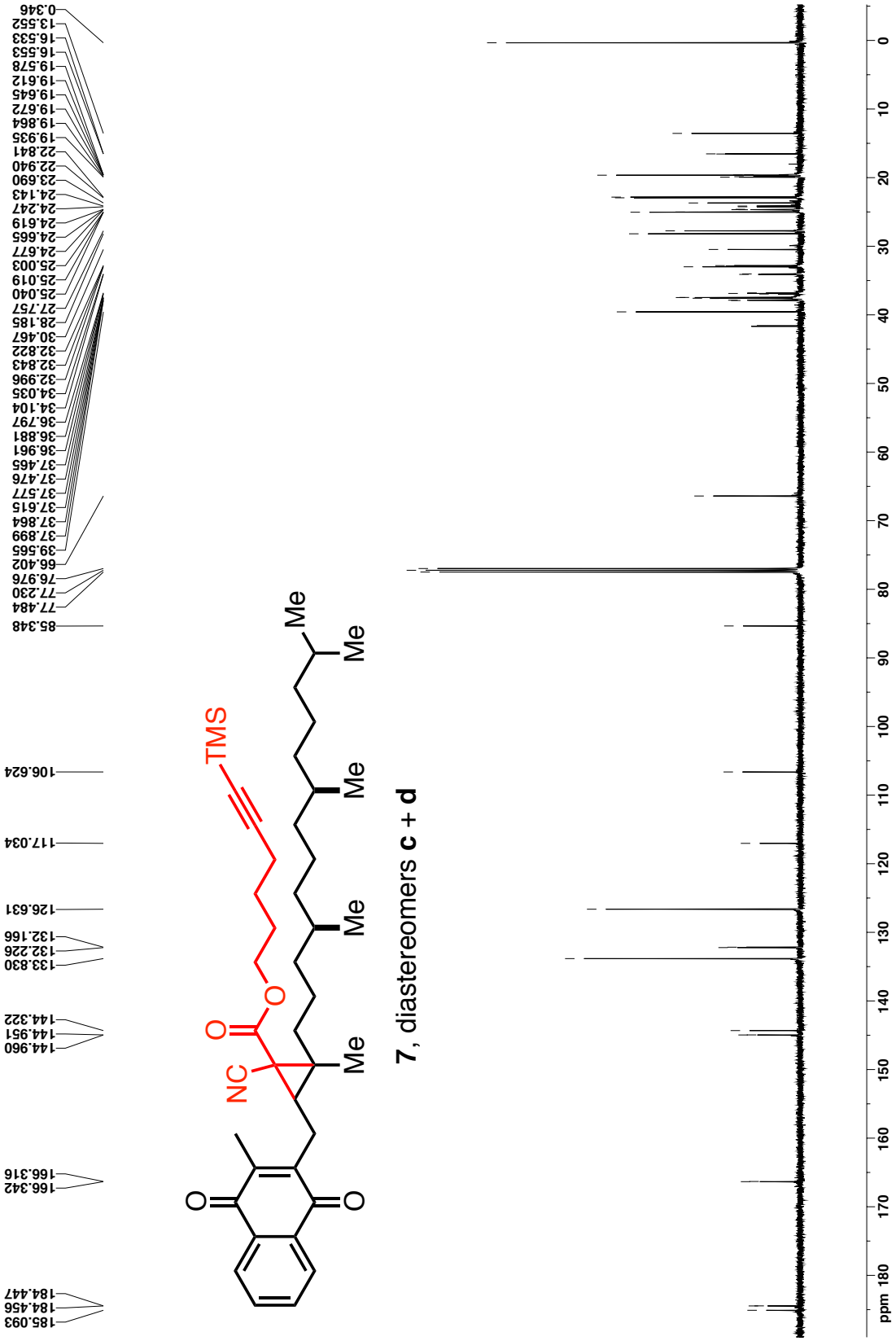
^{1}H NMR (500 MHz) of cyclopropanated vitamin K1 **7** diastereomers **a** + **b** in $CDCl_3$



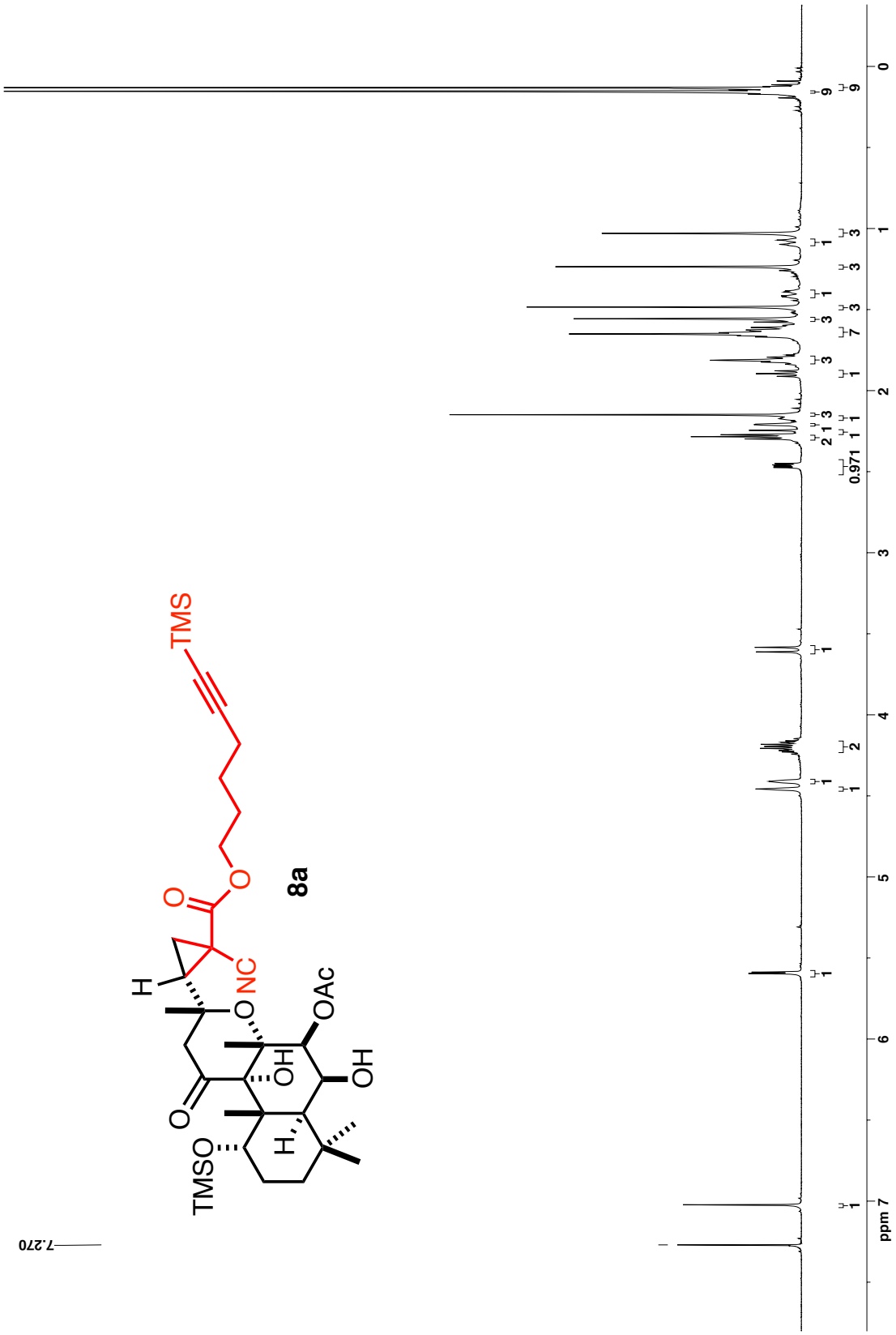
^{13}C NMR (125 MHz) of cyclopropanated vitamin K1 **7** diastereomers **a** + **b** in $CDCl_3$



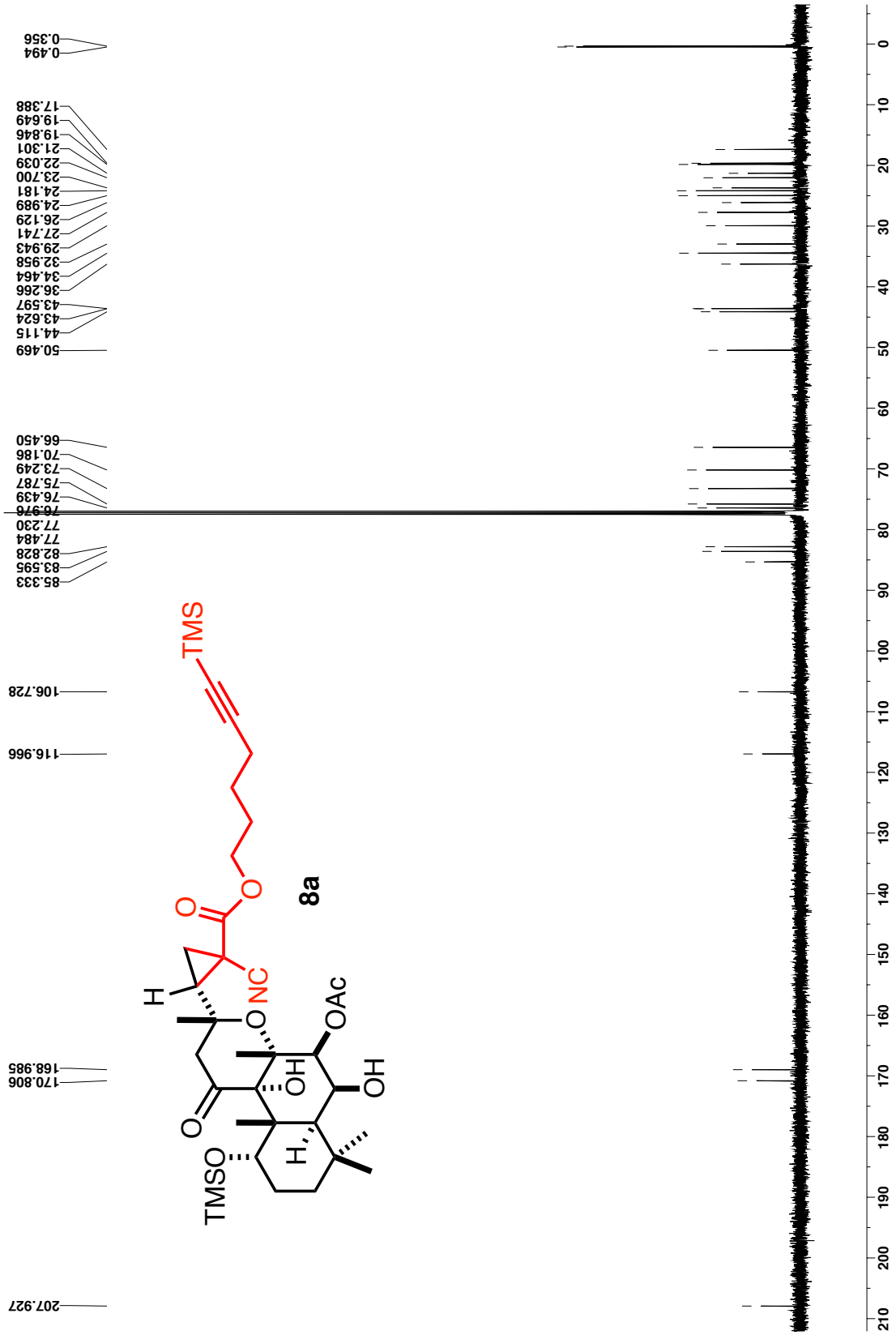
^{1}H NMR (500 MHz) of cyclopropanated vitamin K1 **7** diastereomers **c** + **d** in $CDCl_3$



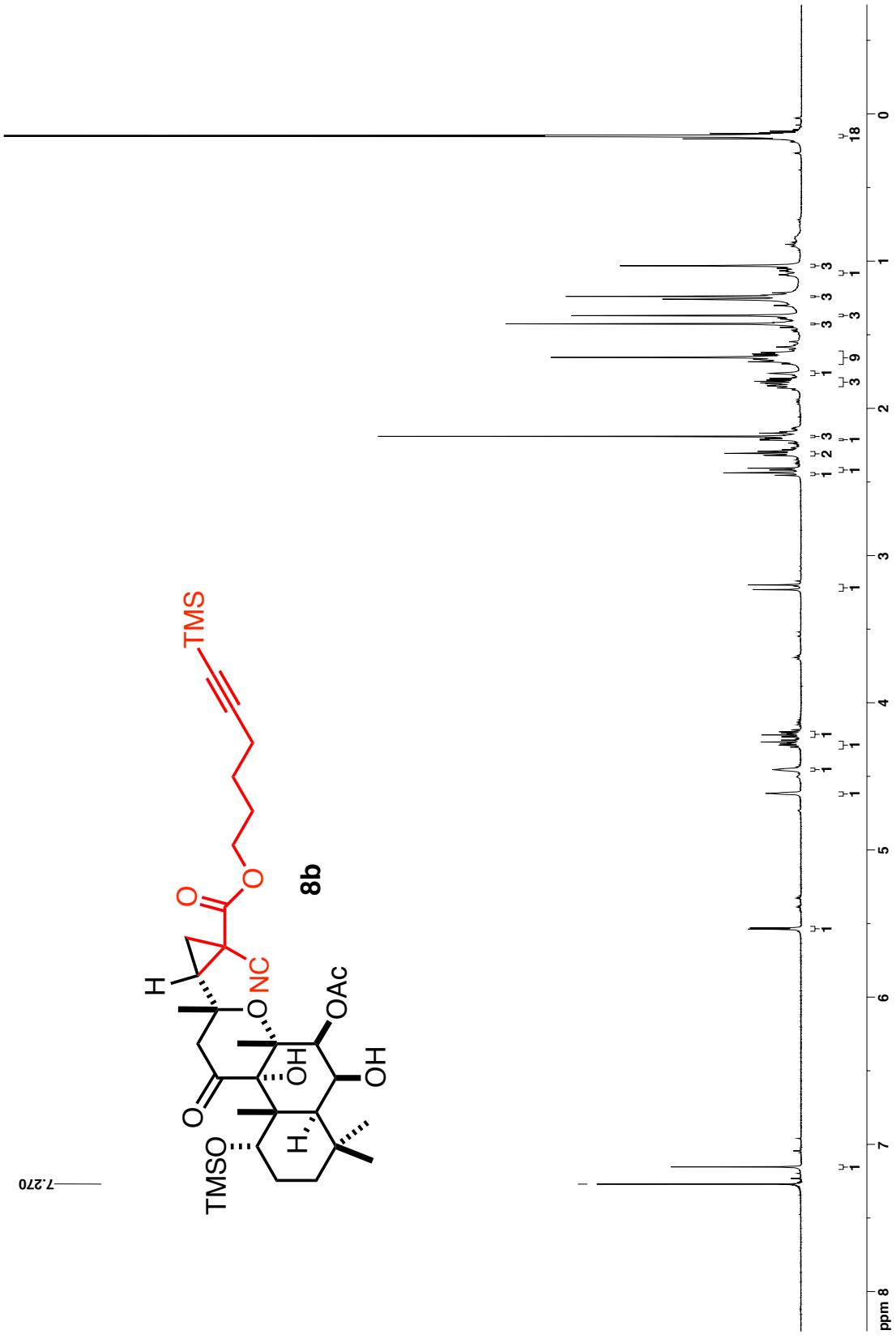
^{13}C NMR (125 MHz) of cyclopropanated vitamin K1 **7** diastereomers **c** + **d** in $CDCl_3$



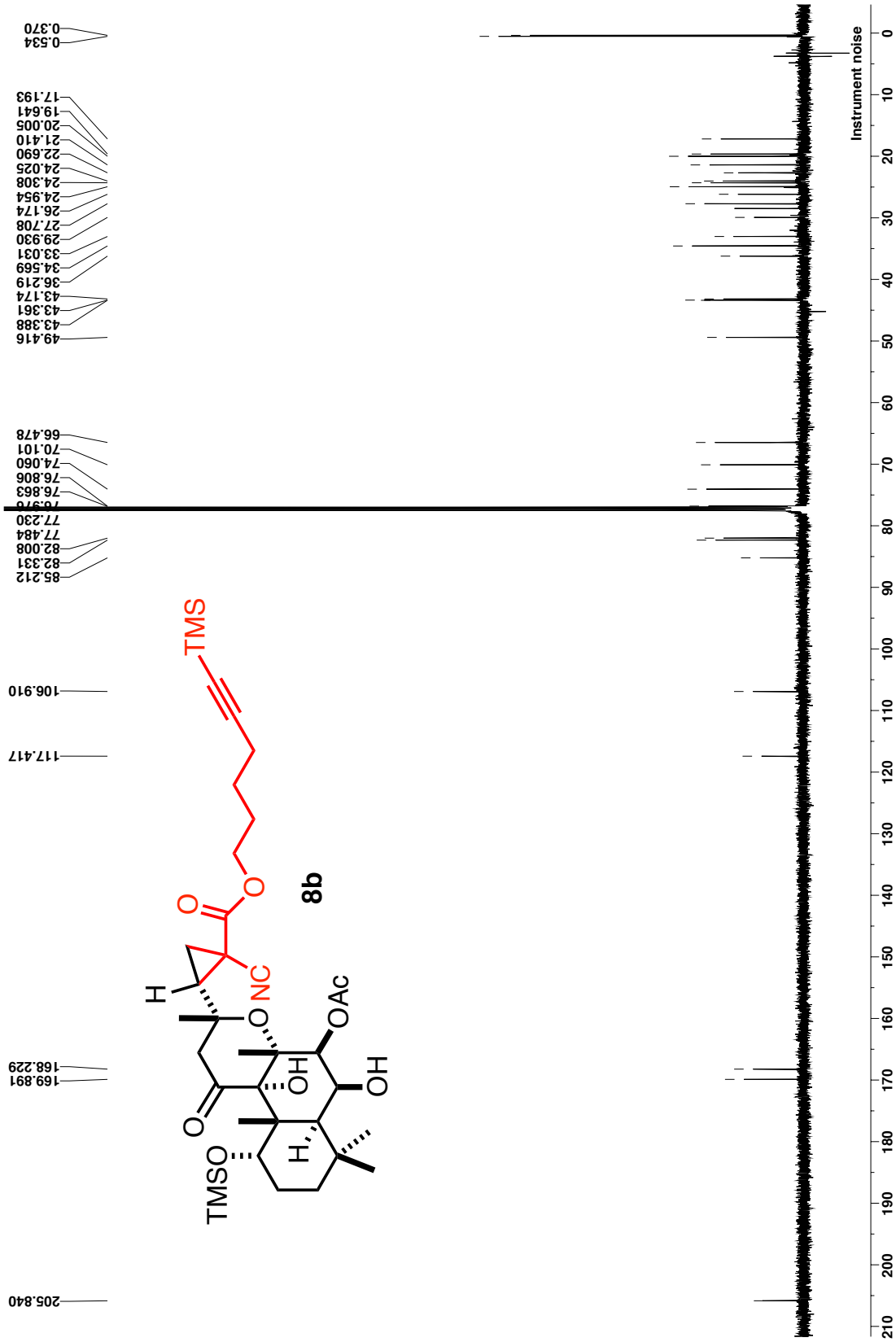
^{1}H NMR (500 MHz) of cyclopropanated forskolin **8a** in $CDCl_3$



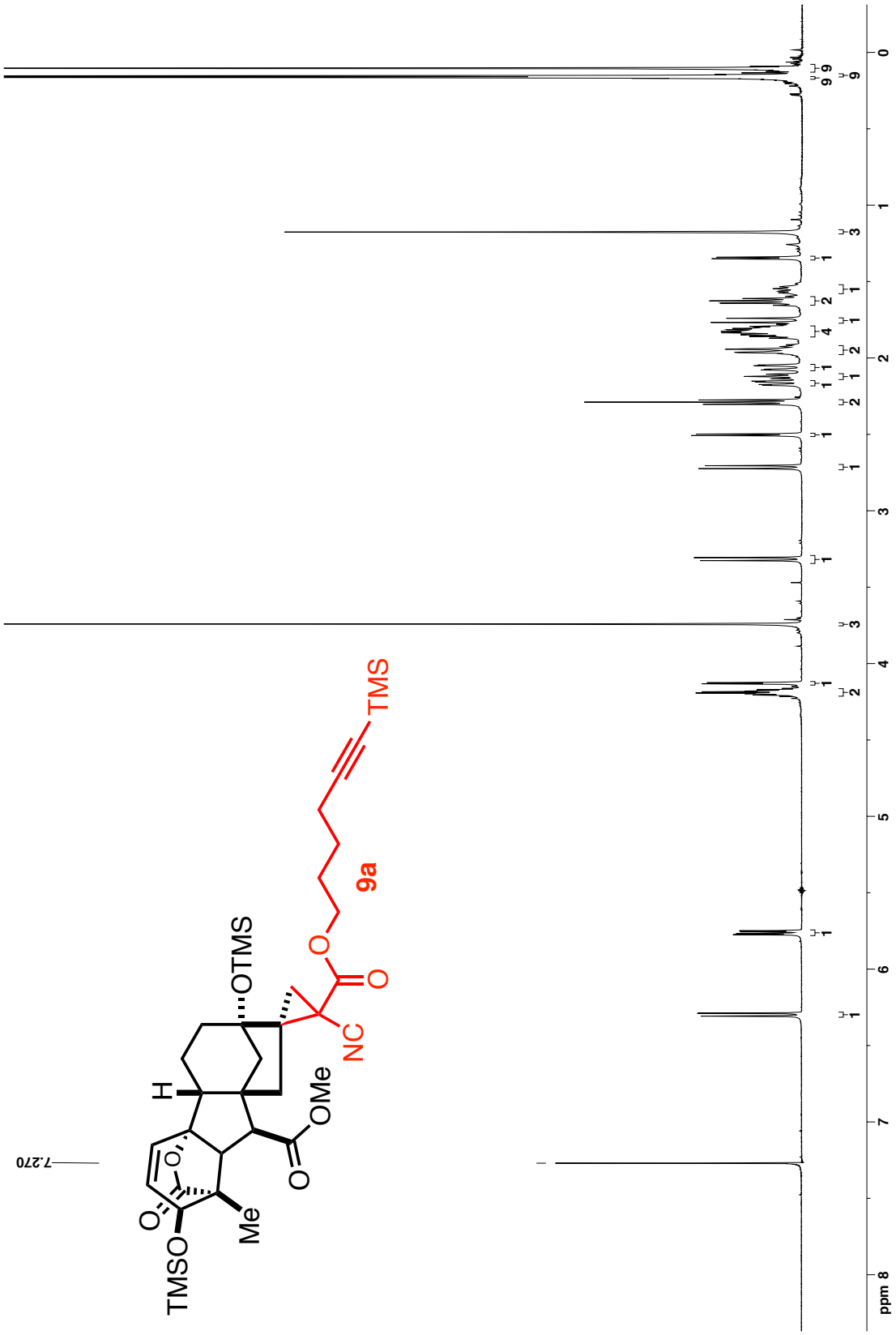
^{13}C NMR (125 MHz) of cyclopropanated forskolin **8a** in $CDCl_3$



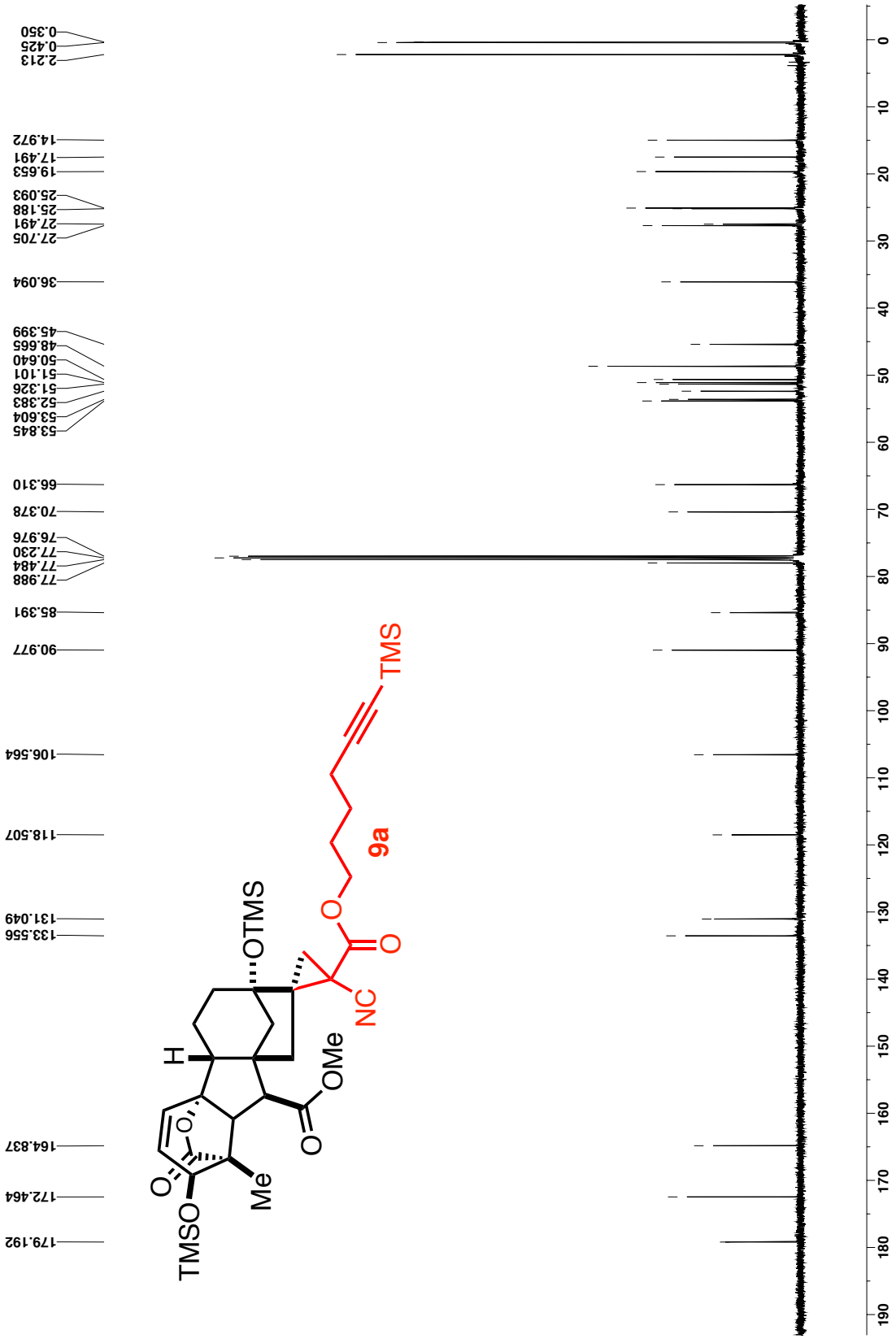
^{1}H NMR (500 MHz) of cyclopropanated forskolin **8b** in $CDCl_3$



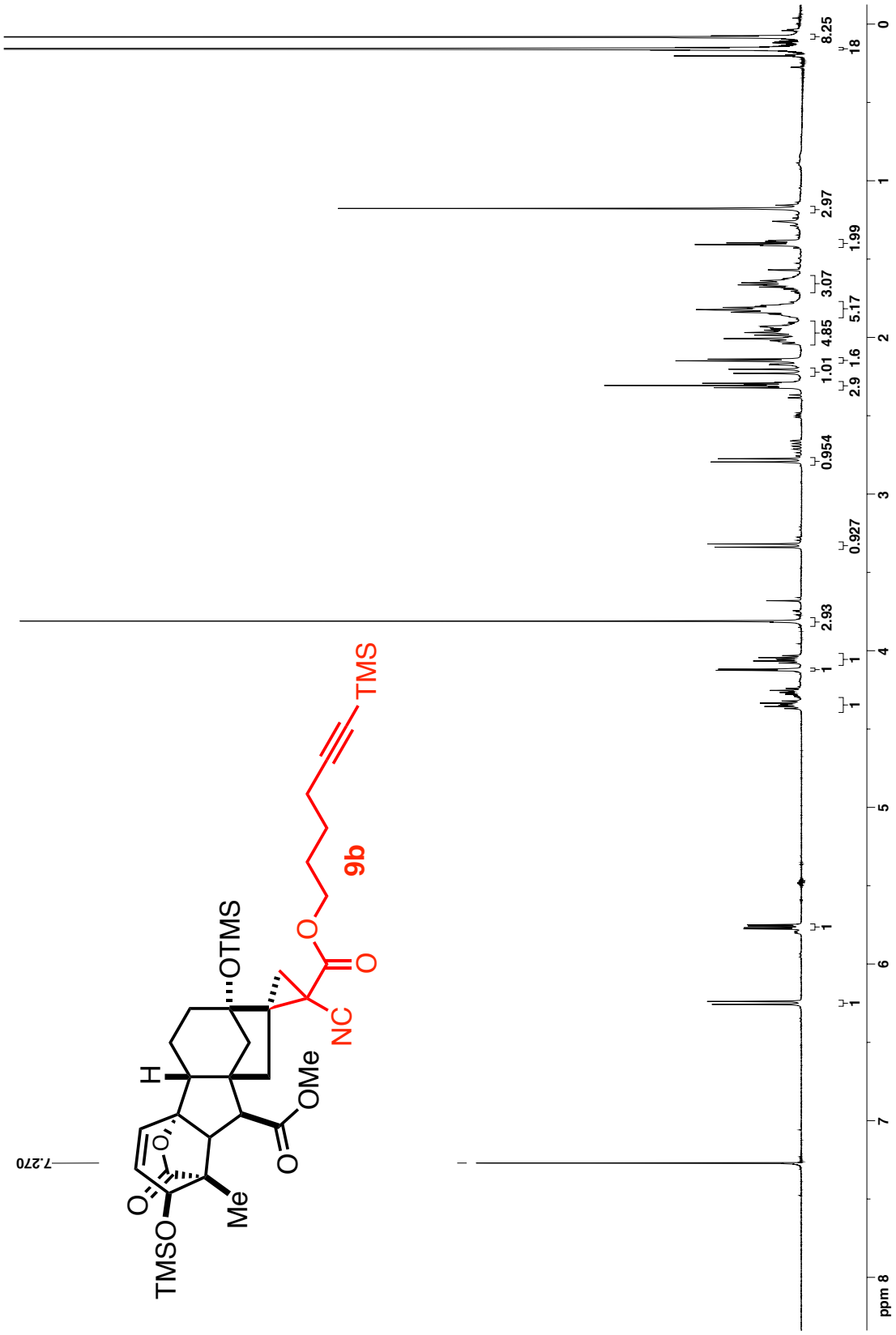
^{13}C NMR (125 MHz) of cyclopropanated forskolin **8b** in $CDCl_3$



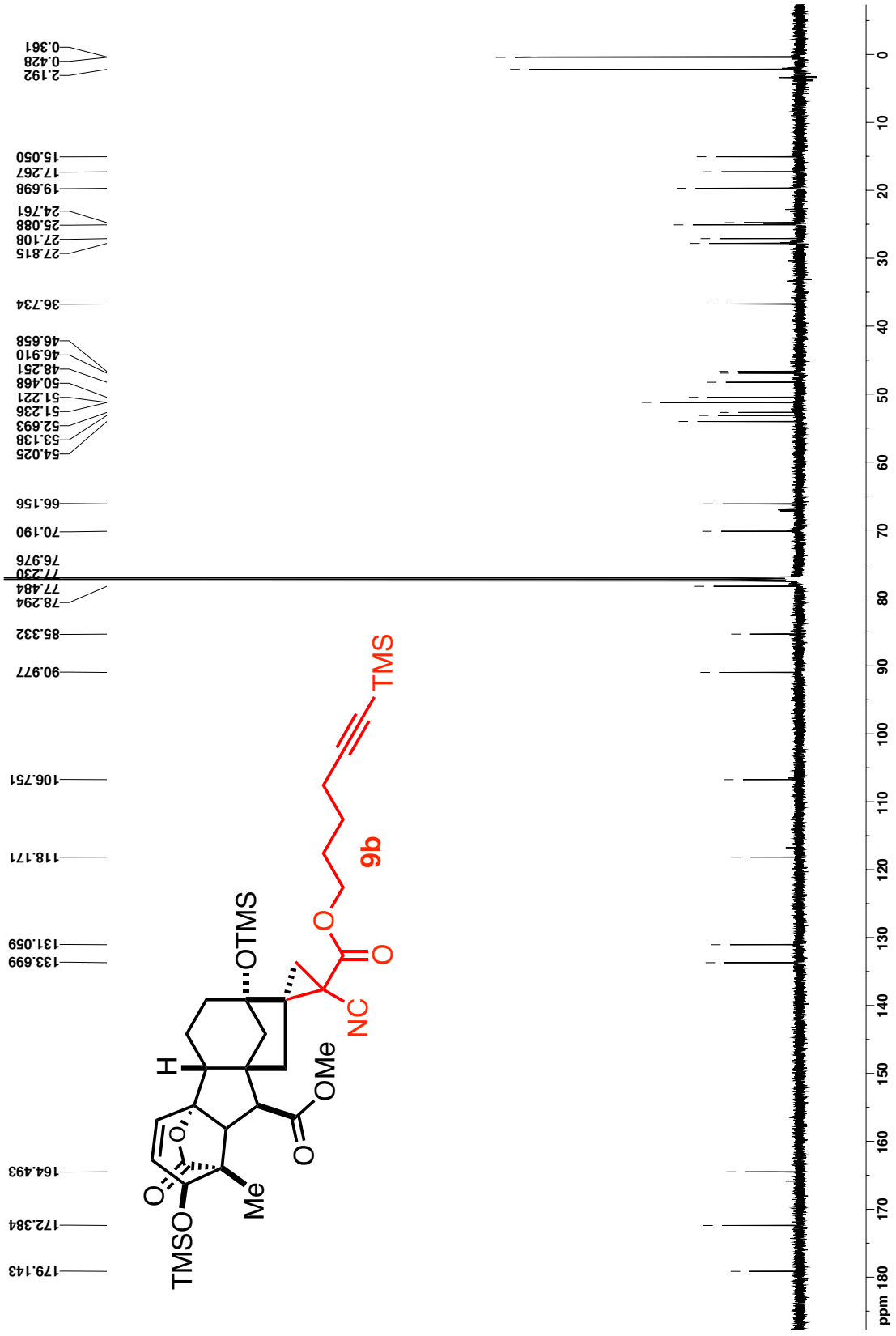
^{1}H NMR (500 MHz) of cyclopropanated gibberellic acid methyl ester **9a** in $CDCl_3$



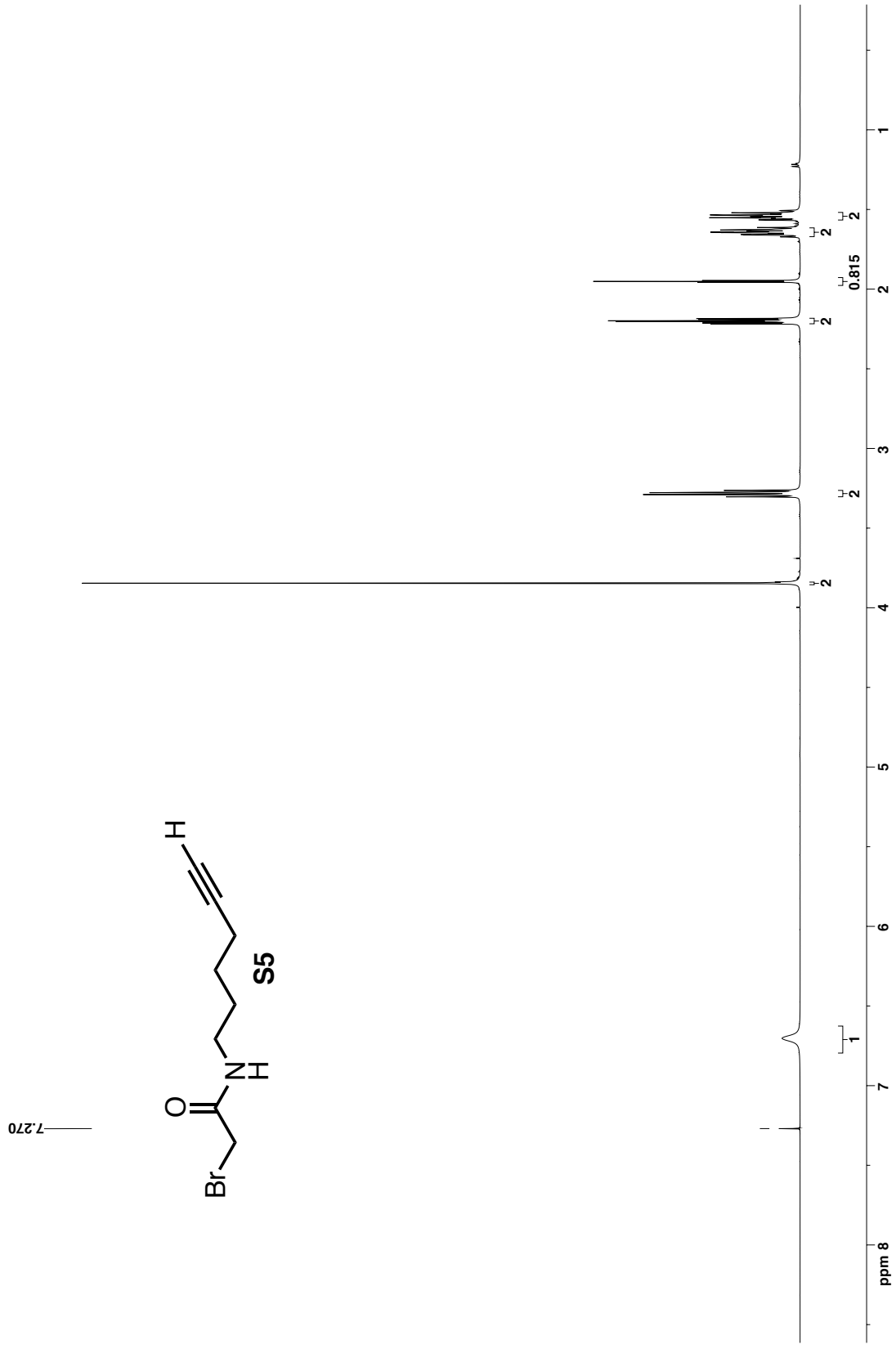
^{13}C NMR (125 MHz) of cyclopropanated gibberellic acid methyl ester **9a** in $CDCl_3$



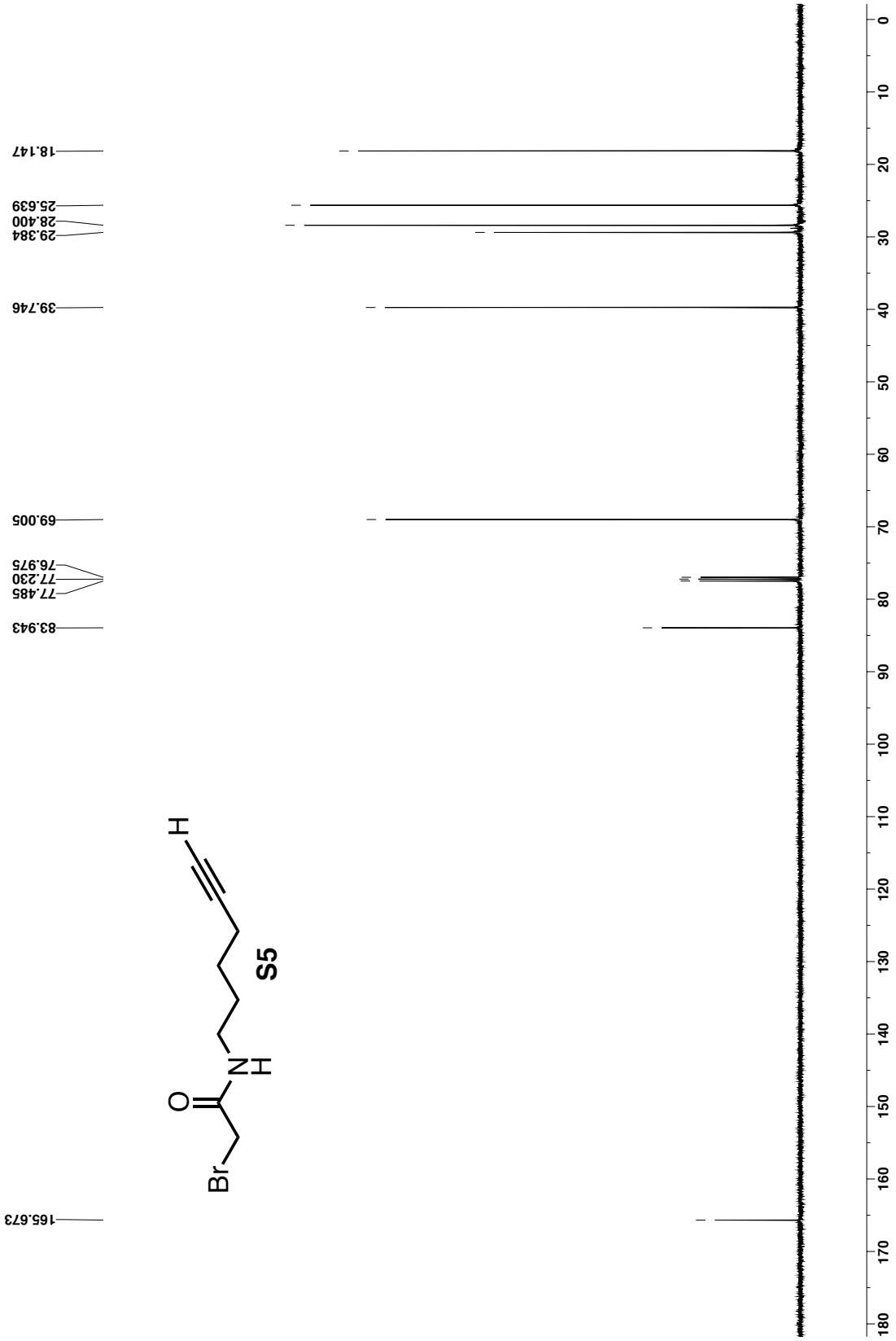
^{1}H NMR (500 MHz) of cyclopropanated gibberellic acid methyl ester **9b** in $CDCl_3$



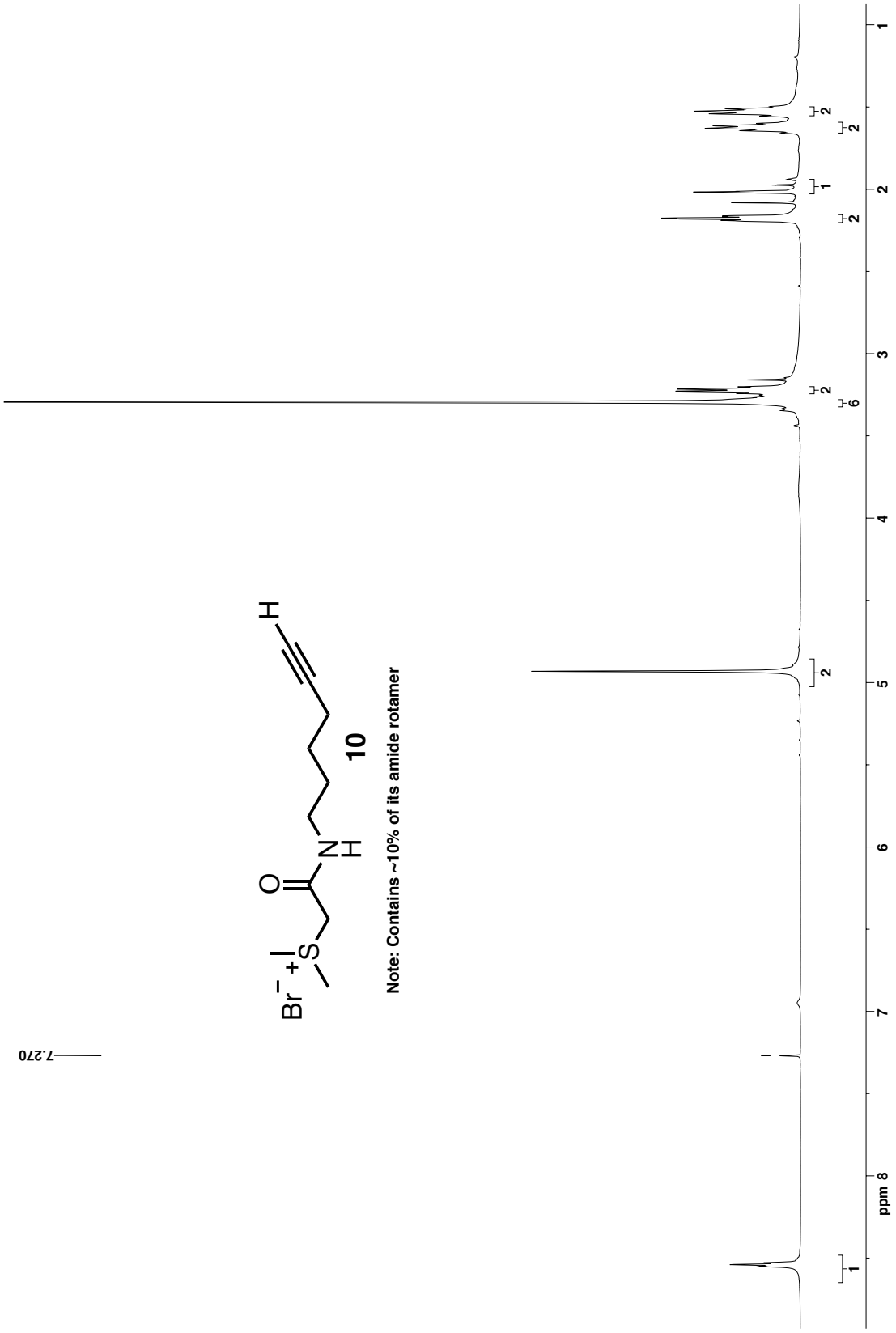
^{13}C NMR (125 MHz) of cyclopropanated gibberellic acid methyl ester **9b** in $CDCl_3$



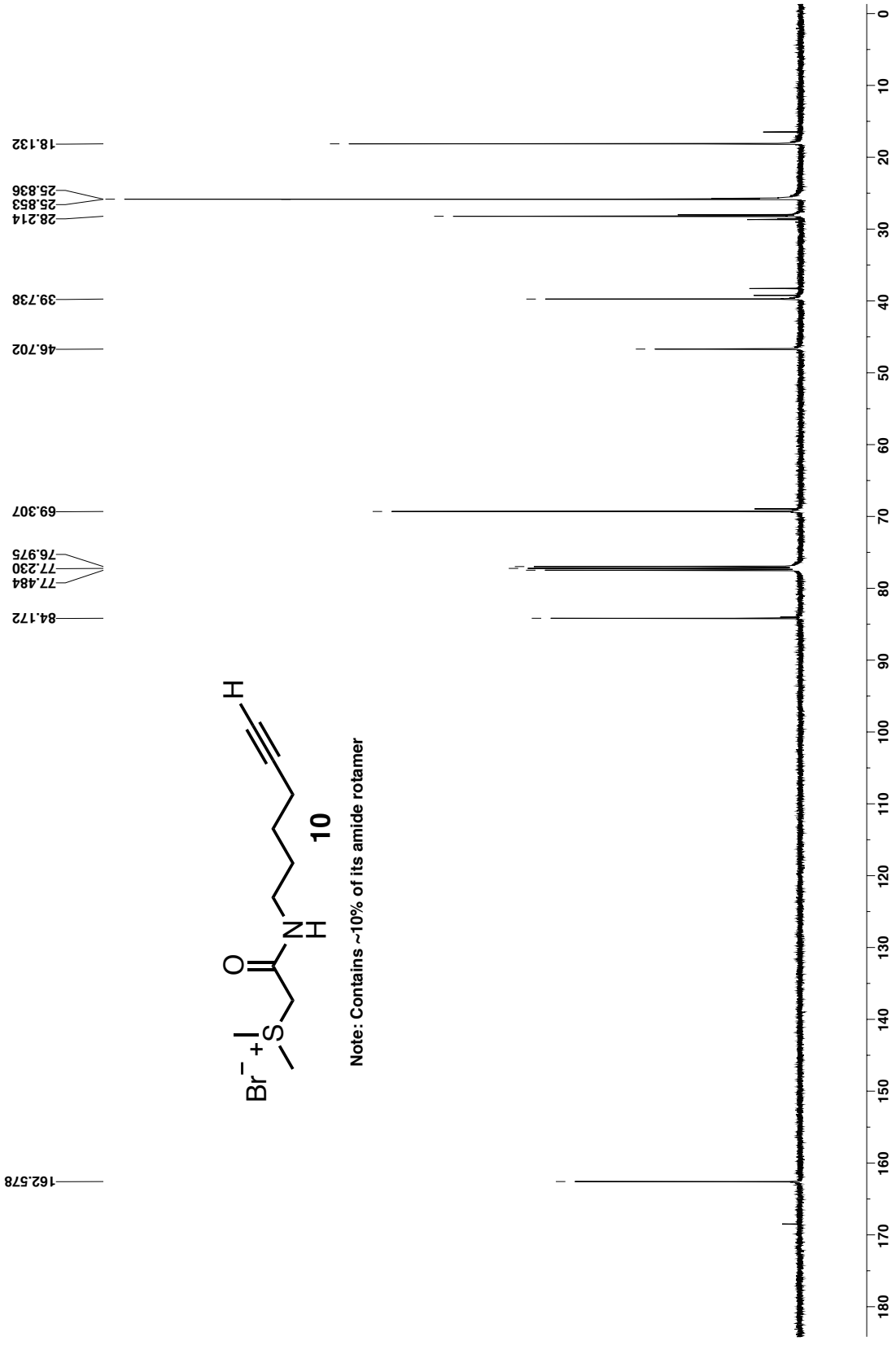
^{1}H NMR (500 MHz) of amide **S5** in $CDCl_3$



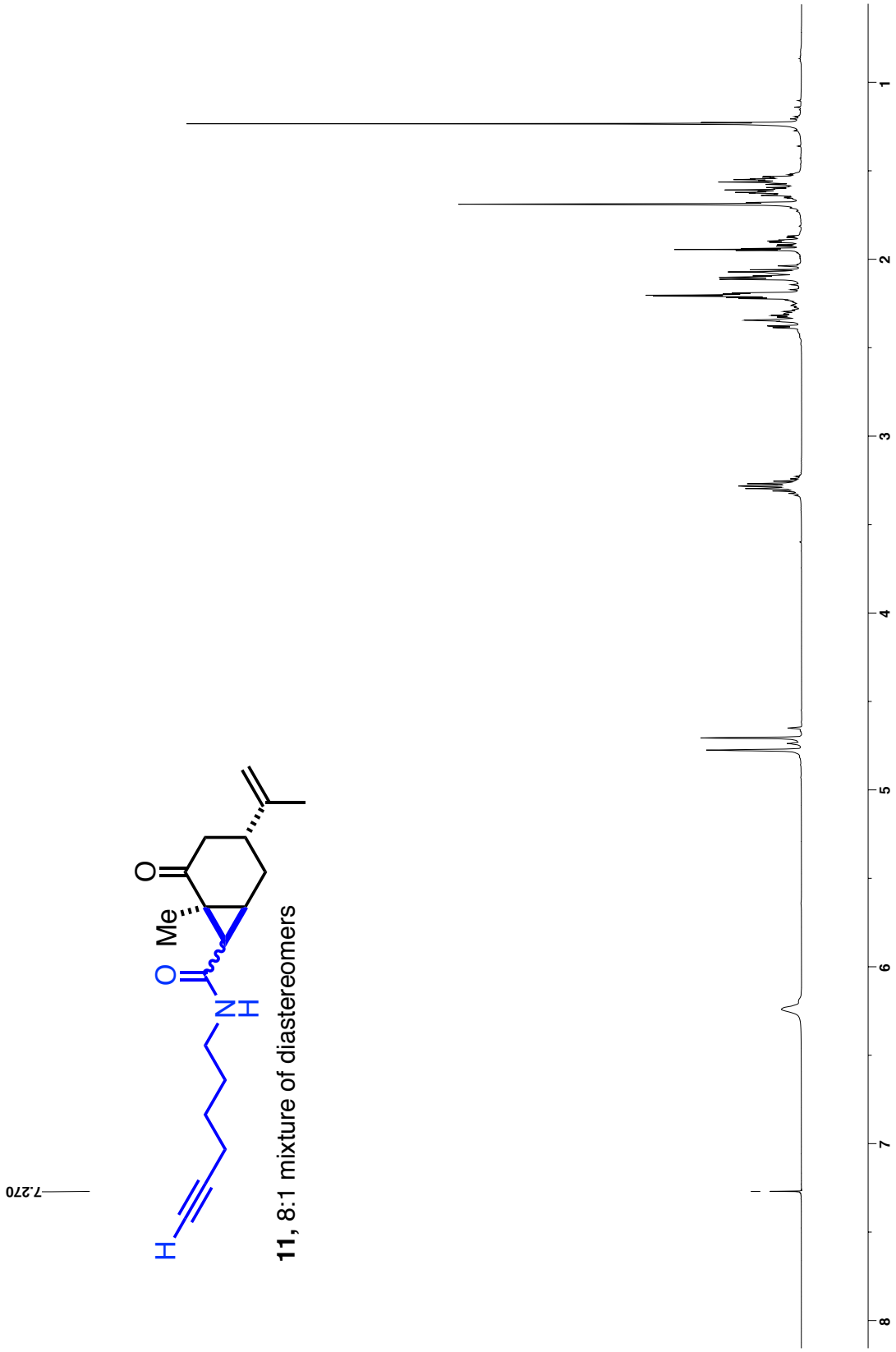
^{13}C NMR (125 MHz) of amide **S5** in $CDCl_3$



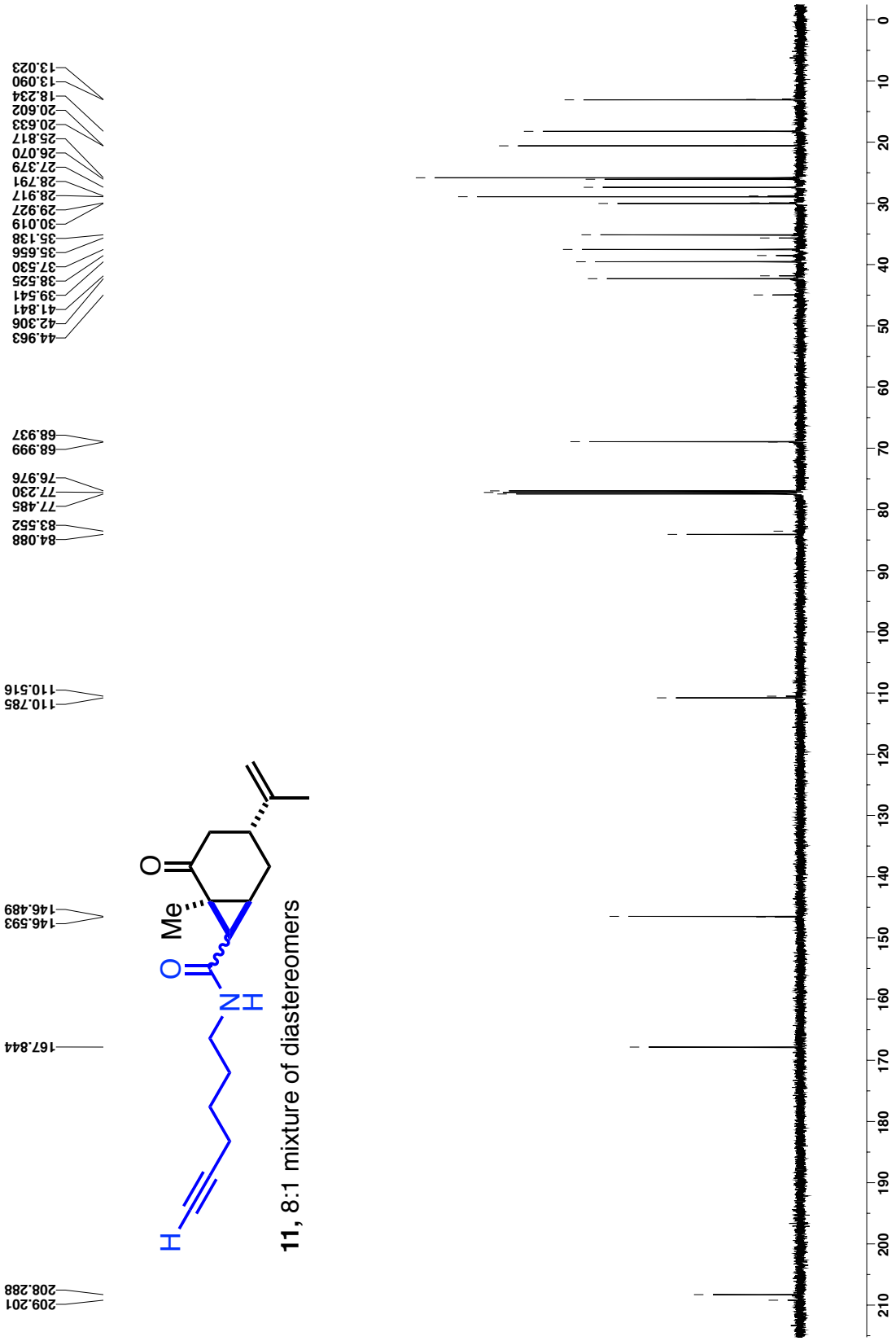
^{1}H NMR (500 MHz) of alkynyl sulfonium **10** in $CDCl_3$



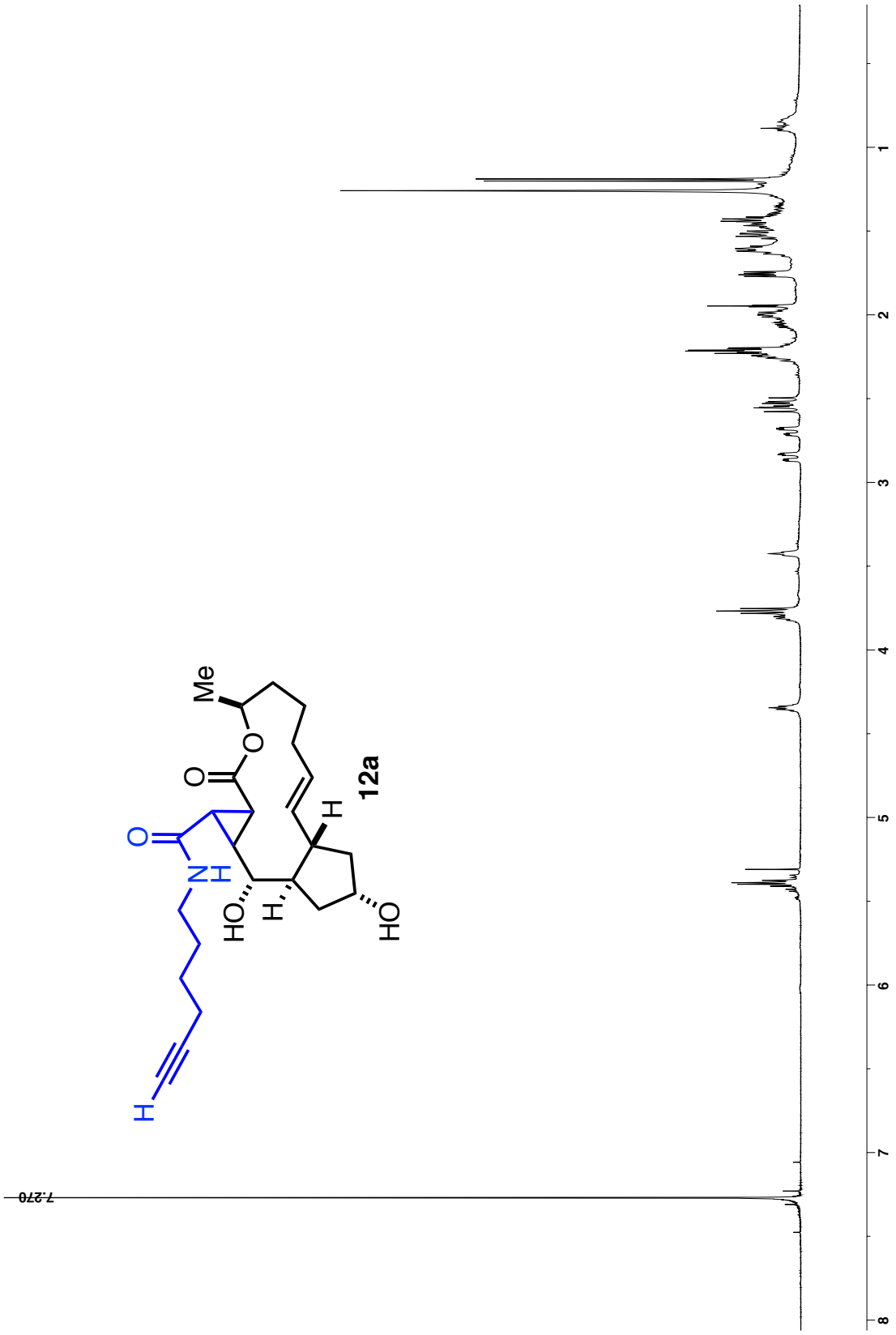
^{13}C NMR (125 MHz) of alkynyl sulfonium **10** in $CDCl_3$



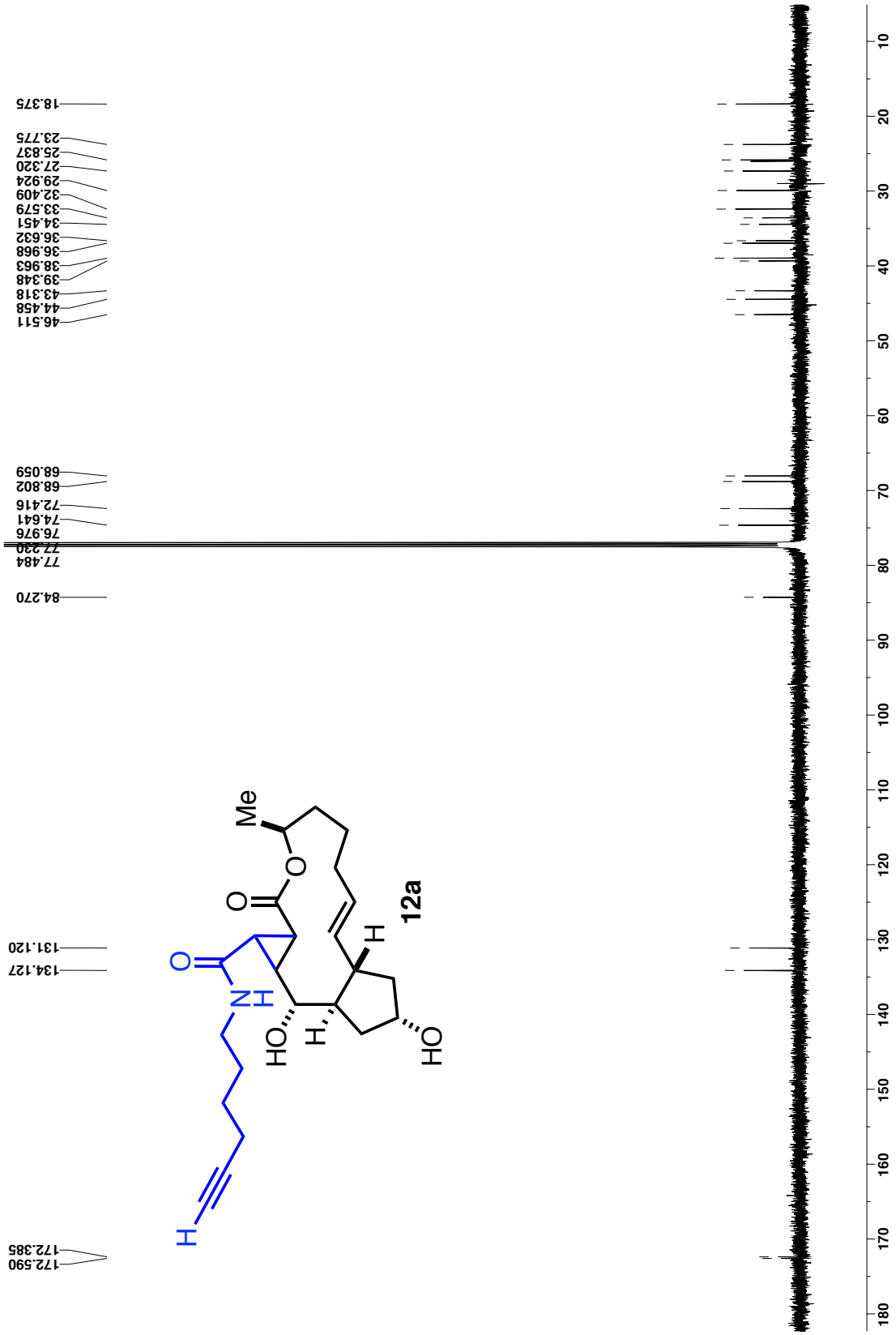
^{1}H NMR (500 MHz) of cyclopropanated carvone **11** in $CDCl_3$



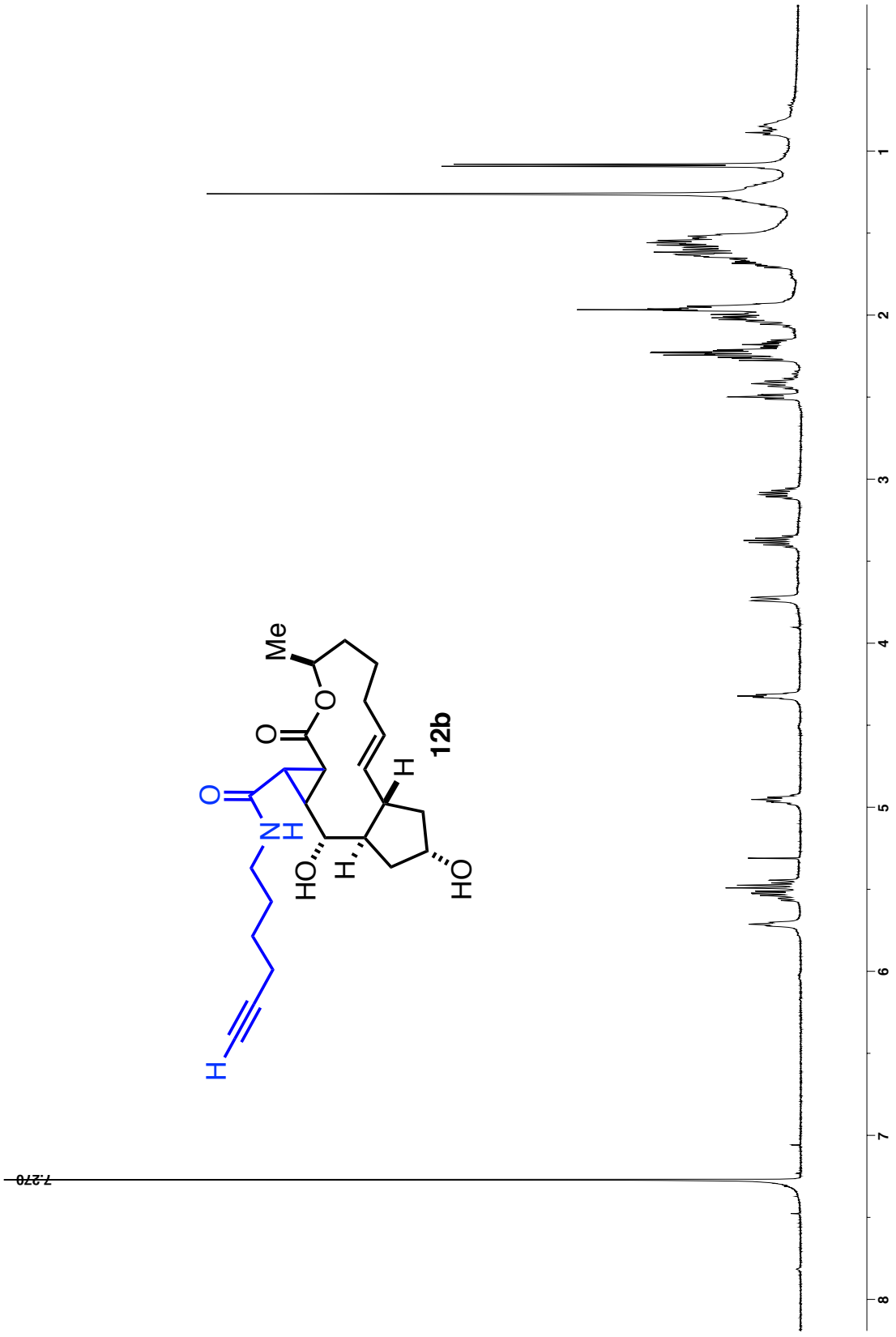
^{13}C NMR (125 MHz) of cyclopropanated carvone **11** in $CDCl_3$



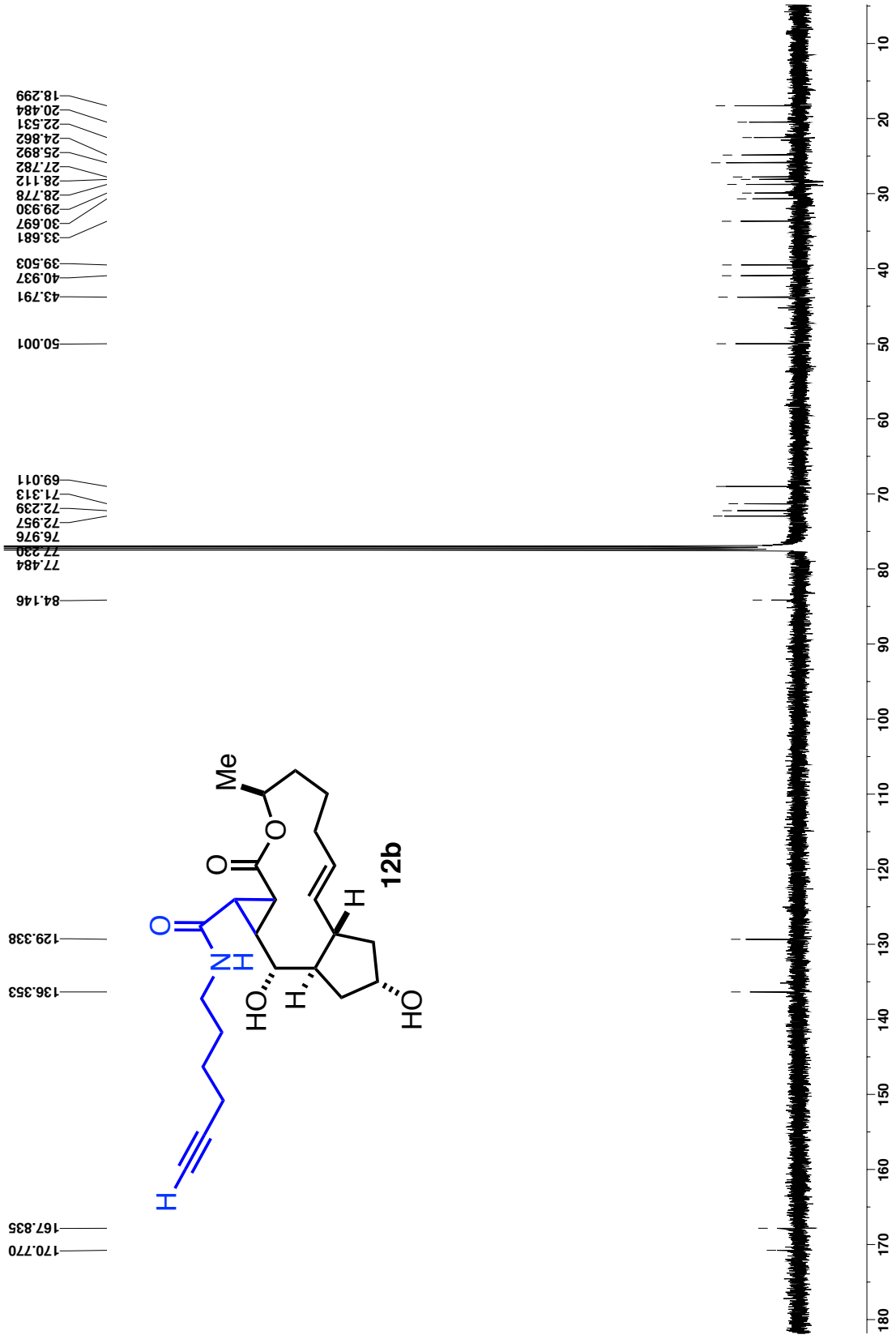
^{1}H NMR (500 MHz) of cyclopropanated brefeldin A **12a** in $CDCl_3$



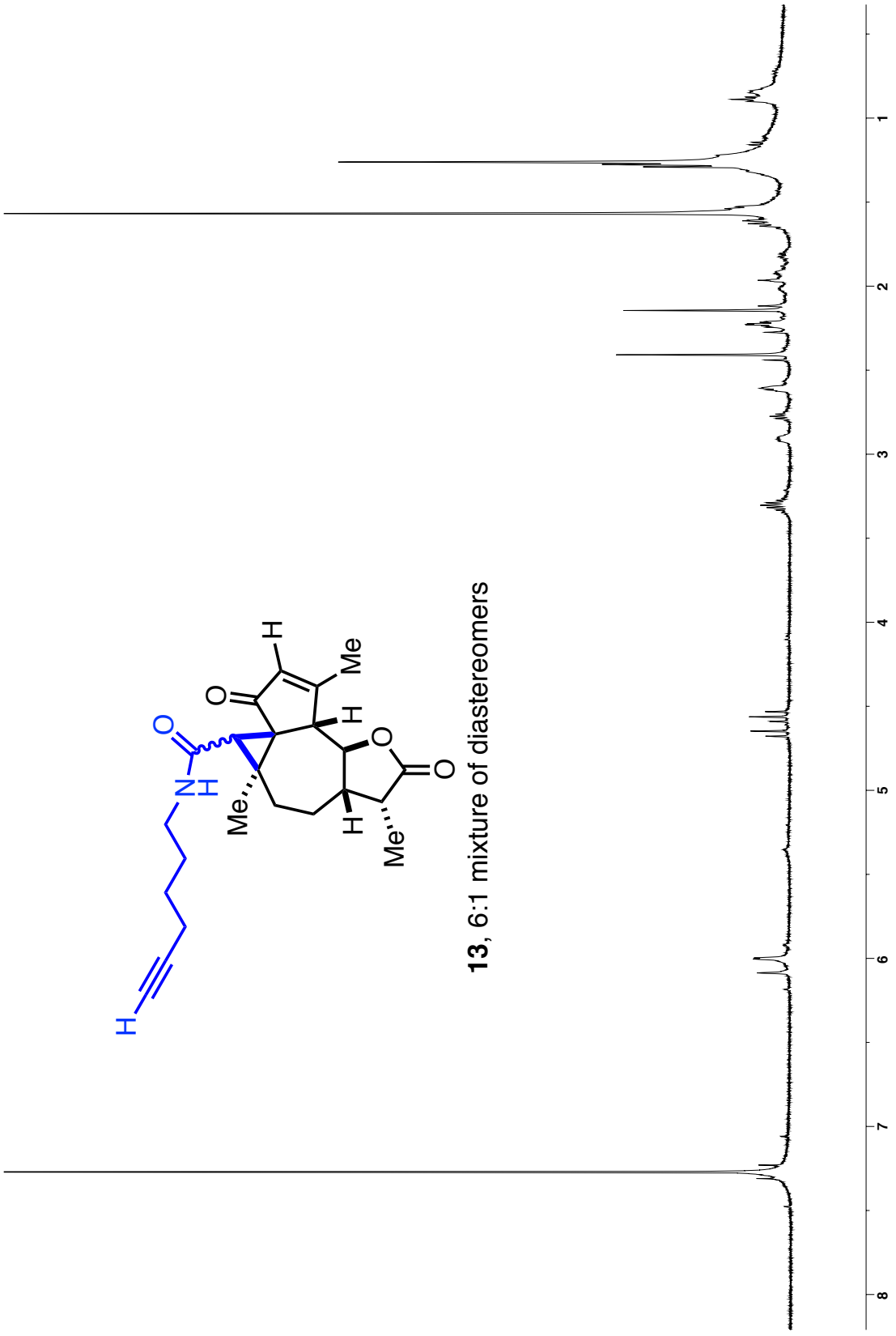
^{13}C NMR (125 MHz) of cyclopropanated brefeldin A **12a** in $CDCl_3$



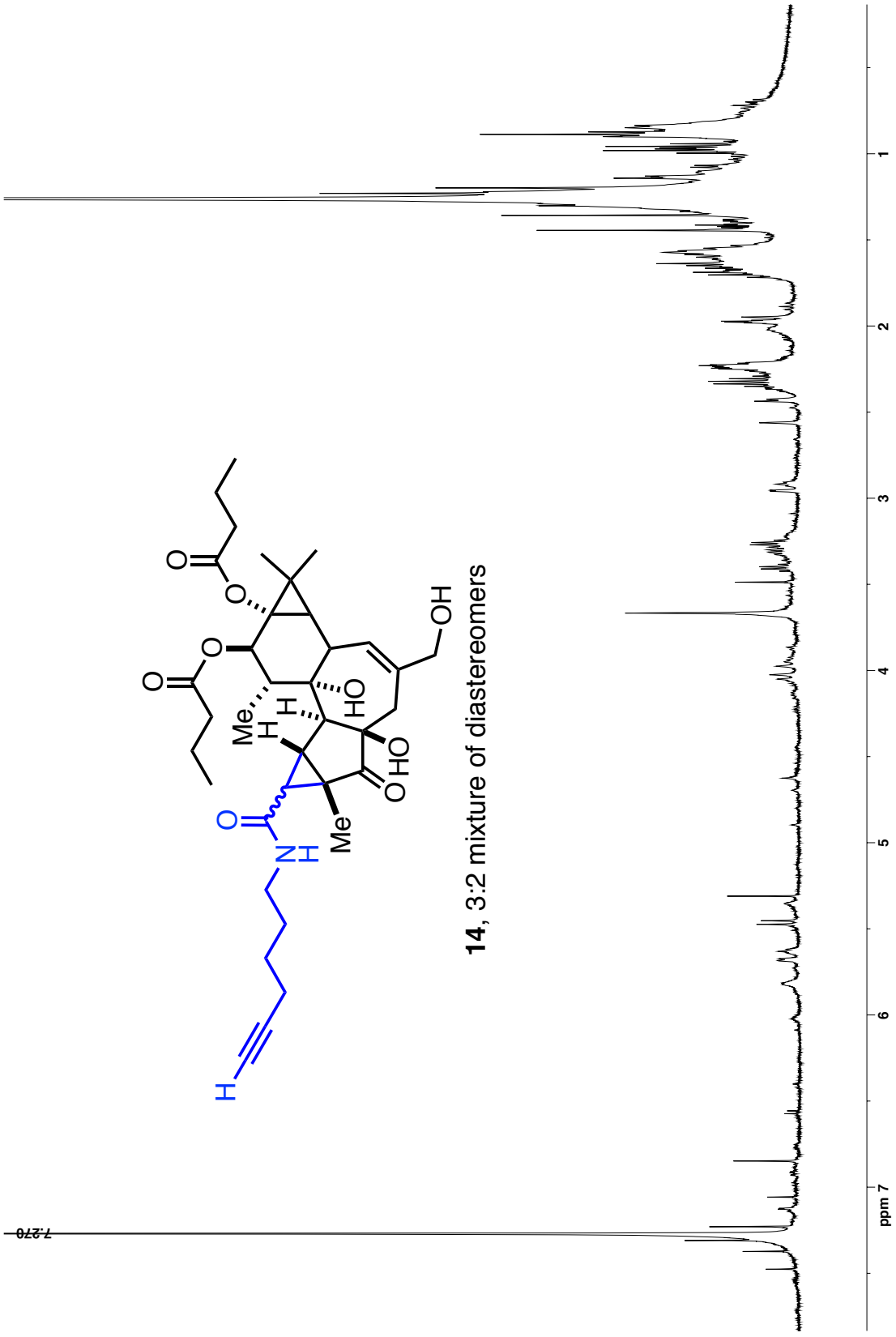
^{1}H NMR (500 MHz) of cyclopropanated brefeldin A **12b** in $CDCl_3$



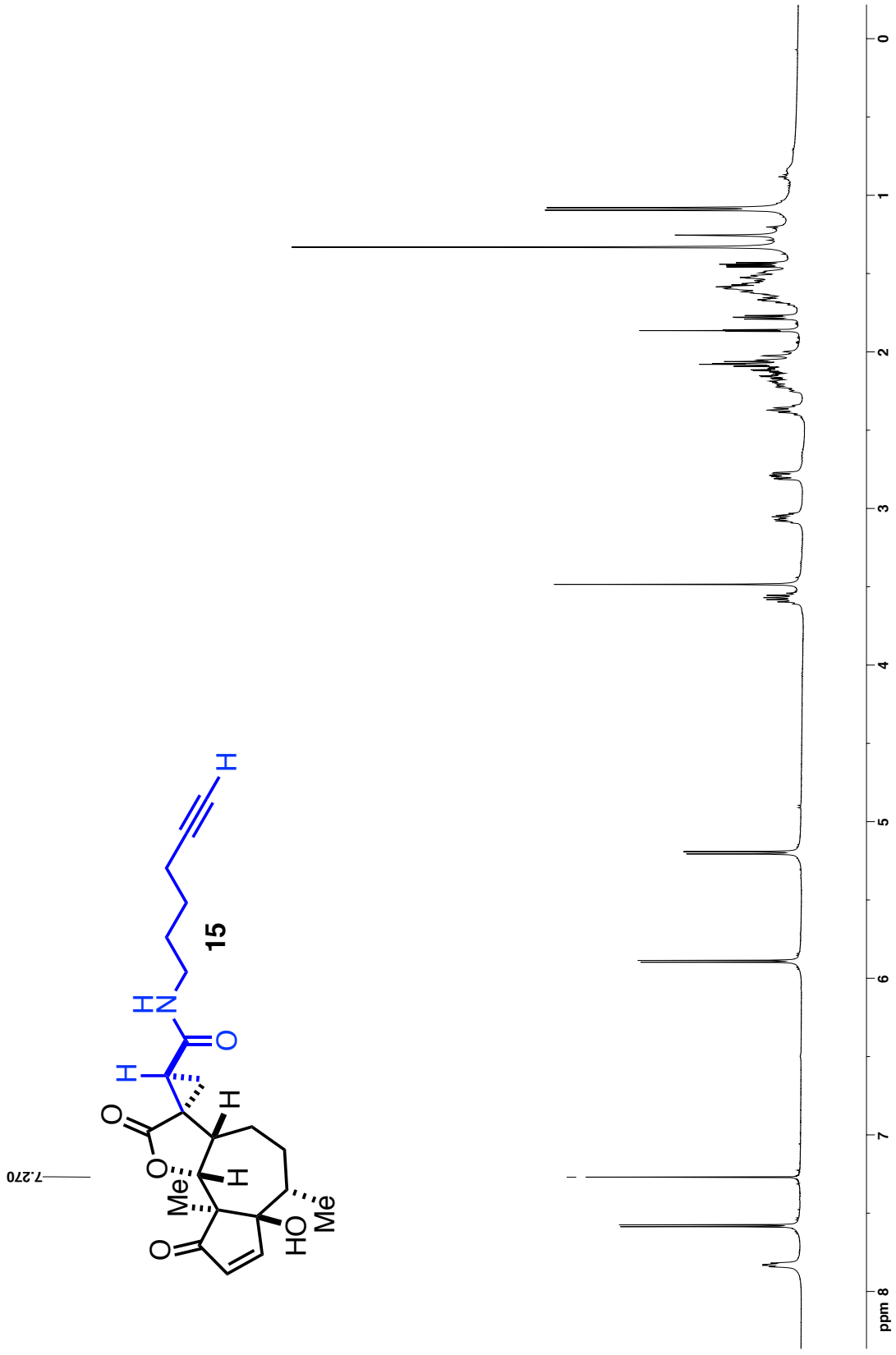
^{13}C NMR (125 MHz) of cyclopropanated brefeldin A **12b** in $CDCl_3$



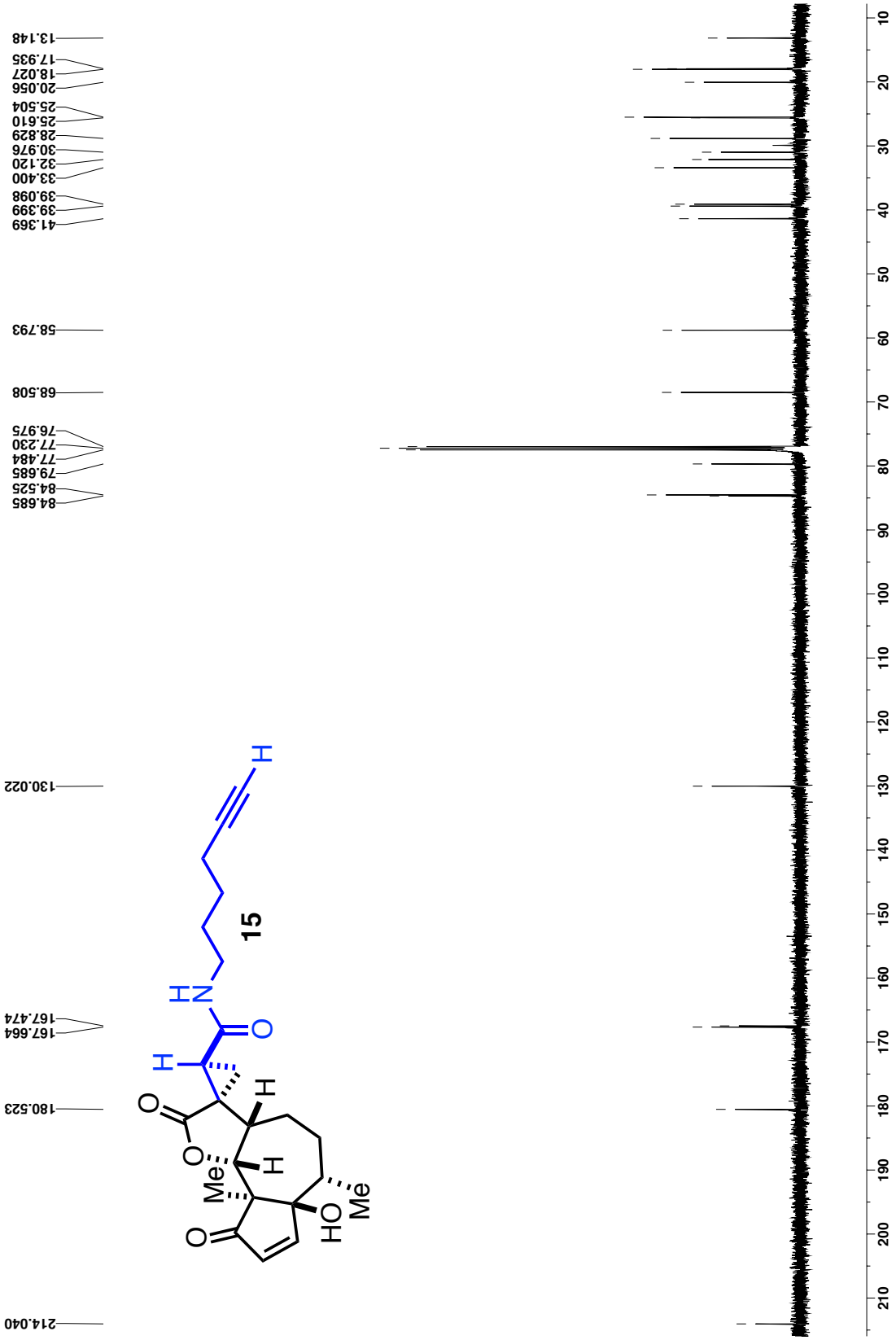
^{1}H NMR (500 MHz) of cyclopropanated achillin **13** in $CDCl_3$



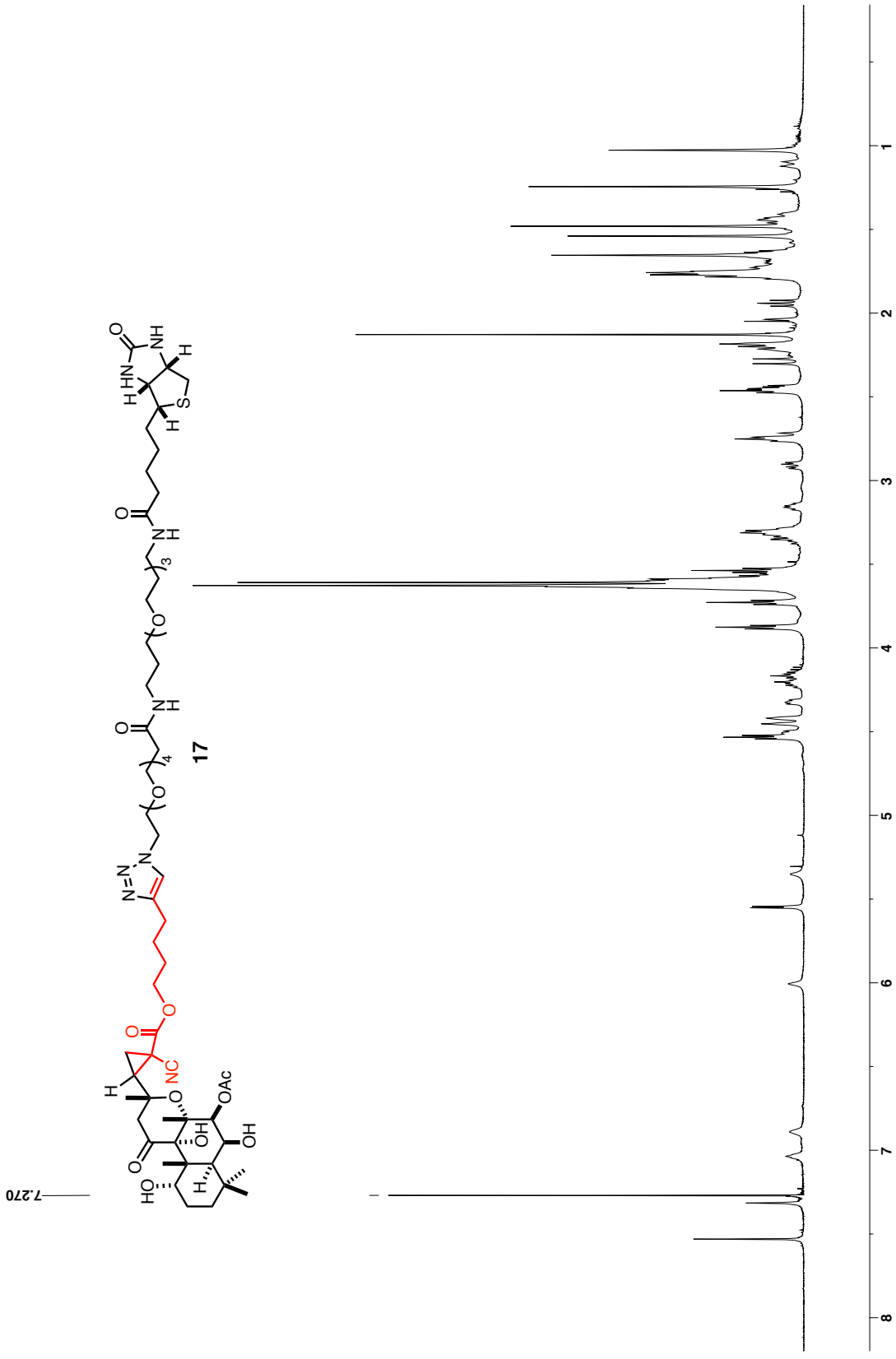
^{1}H NMR (500 MHz) of cyclopropanated phorbol dibutyrate **14** in $CDCl_3$



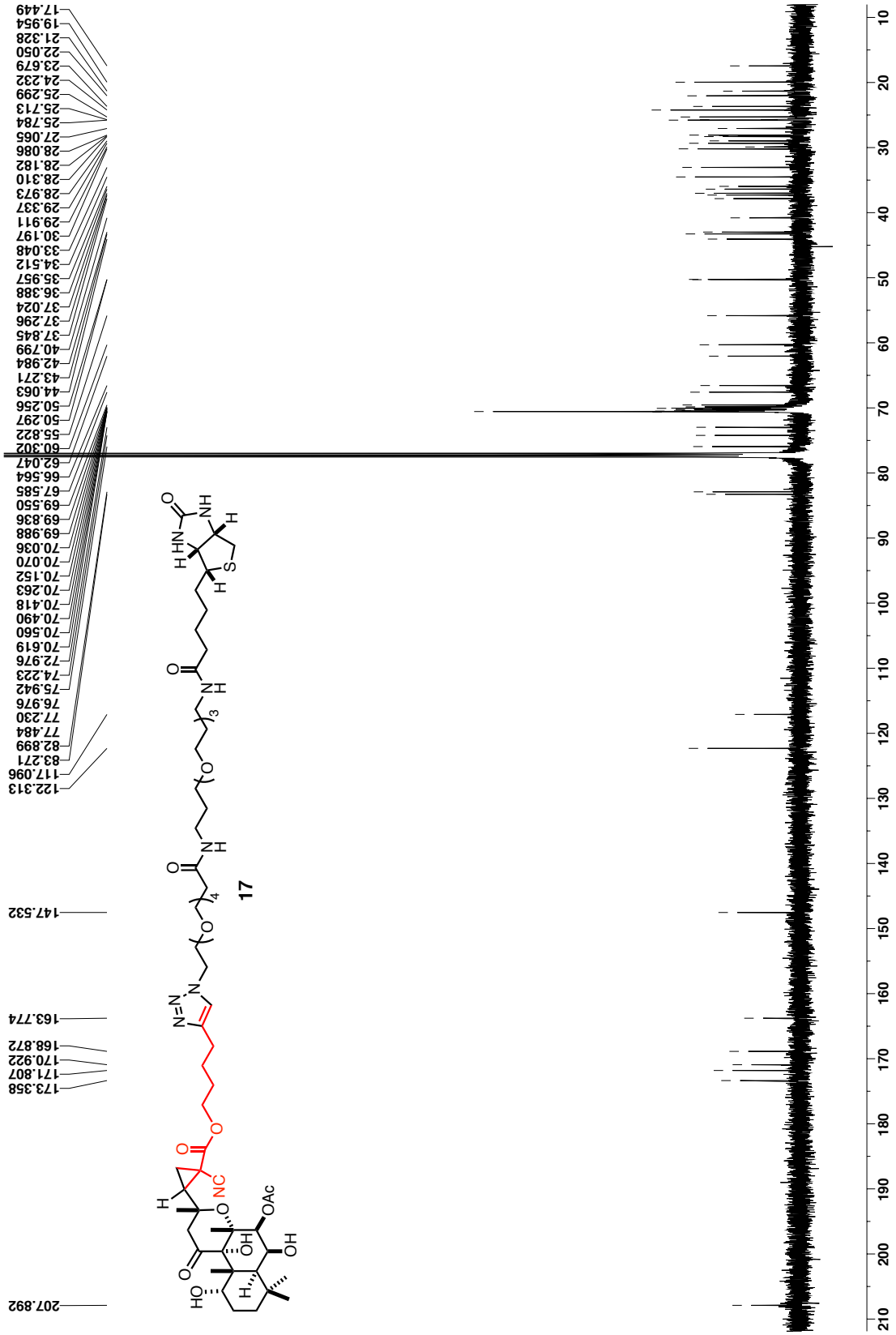
^{1}H NMR (500 MHz) of cyclopropanated parthenin **15** in $CDCl_3$



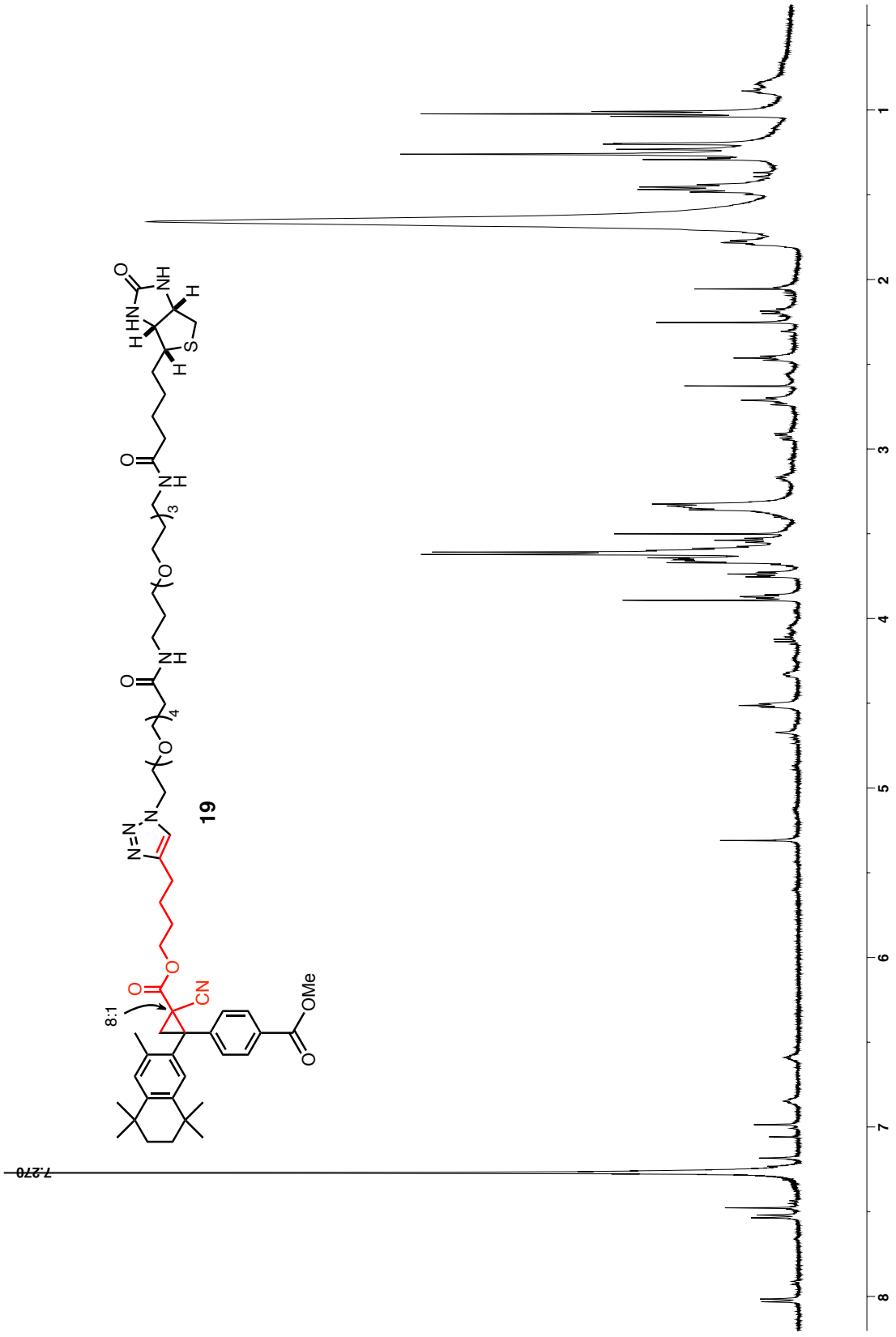
^{13}C NMR (125 MHz) of cyclopropanated parthenin **15** in $CDCl_3$



^{1}H NMR (500 MHz) of forskolin-biotin conjugate **17** in $CDCl_3$



^{13}C NMR (125 MHz) of forskolin-biotin conjugate **17** in $CDCl_3$



^{1}H NMR (500 MHz) of bexarotene methyl ester-biotin conjugate **19** in $CDCl_3$