Total Synthesis of Natural (-)-205B Alkaloid and its Activity Toward α7-nAChR

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Electronic Supplementary Information

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General details

All reactions were carried out under argon, unless otherwise stated. THF and Et_2O were distilled from Na-benzophenone, CH_2Cl_2 and iPr_2NH from CaH_2, and DMF from $CaSO_4$. All other commercial materials were used as received without purification. NMR spectra were recorded on a Bruker Avance 400, or Bruker Avance III 500 spectrometer and the coupling constants have been calculated, where possible, by using the method described by Hoye et al.[1] Melting points are uncorrected. IR spectra were recorded on neat samples with a Jasco FT/IR-4100 spectrometer. The mass spectra were recorded on a Amazon Speed (Bruker Daltonics) mass spectrometer in ESI mode. High-resolution mass spectra (HRMS) were performed on a LTQ Orbitrap XL (Thermo Scientific) mass spectrometer by the mass facility, PCN-ICMG, Grenoble. In general, extraction with the specific organic solvent was followed by appropriate aqueous washing, drying over Na_2SO_4, filtration, and evaporation of the solvent under reduced pressure.

Xenopus oocytes were prepared by surgical retrieval, and defolliculated by collagenase. Fifty nanoliters of mRNA were injected by oocytes and futher incubated in modified Barth's buffer: 1 mM KCl, 0.82 mM $MgSO_4$, 88 mM NaCl, 2.4 mM $NaHCO_3$, 0.41 mM $CaCl_2$, 16 mM HEPES, pH 7.4 supplemented with 100 U.ml−1 of penicillin and streptomycin and 0.1 mg.ml−1 of gentamycin). The composition of the ND96 buffer for TEVC recordings is: 96 mM NaCl, 2 mM KCl, 1.8 mM $CaCl_2$, 1 mM $MgCl_2$, 5 mM HEPES, pH 7.4 supplemented with 0.3 mM niflumic acid. Animal handling and experiments fully conformed to European regulations and were approved by the French Ministry of Higher Education and Research (APAFIS#4420-2016030813053199 v4 to CM). Authorization of the animal facility has been delivered by the Prefect of Isere (Authorization # D 38 185 10 001).

[1] - (a) Hoye, T. R.; Hanson, P. R.; Vyvyan, J. R. *J. Org. Chem.* **1994**, *59*, 4096-4103. (b) Hoye, T. R.; Zhao, H. *J. Org. Chem.* **2002**, *67*, 4014-4016

Experimental procedures and spectroscopic data

(2*S*,3*S*,8*R*,8a*R)*-8-Hydroxy-3-(2-methylallyl)-2-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)hexahydroindolizin-5-(1*H*)-one (3b). Prepared from previously published procedure (see reference 6). Data for **3b** : mp 170-190 °C dec. (ether); $[\alpha]^{20}_{D}$ +66.5 (c 0.88, $CHCl_3$); IR (KBr) 3348, 3074, 2961, 2922, 2869, 1614, 1461, 1410, 1370, 1326, 1210 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 7.04 (s, 1H), 6.92 (s, 1H), 5.02 (q, *J* = 6.7Hz, 1H), 4.66 (s, 1H), 4.54-4.61 (m, 2H), 4.06 (q, *J* = 2.0 Hz , 1H), 3.95 (q, *J* = 7.0 Hz, 1H), 3.78-3.90 (m, 2H), 3.10-3.22 (m, 1H), 2.84 (sept, *J* = 6.9 Hz, 1H), 2.14-2.44 (m, 5H), 1.84-2.04 (m, 3H), 1.71 (s, 3H), 1.52 (d, *J* = 6.7 Hz, 3H), 1.15-1.29 (m, 18H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.5 (C), 148.5 (C), 147.4 (C), 145.2 (C), 143.8 (C), 133.8 (C), 123.3 (2CH), 120.5, 111.7 (CH_2), 74.8 (CH), 72.9 (CH), 64.5 (CH), 58.9 (CH), 56.9 (CH), 35.4 (CH_2), 34.1 (CH), 33.2 (CH_2), 29.3 (CH), 28.8 (CH), 27.9 (CH_2), 26.2 (CH_2), 25.4 (CH_3), 25.2 (CH_3), 25.1 (CH_3), 24.4 (CH_3), 24.3 (CH_3), 24.2 (CH_3), 23.1 (CH_3), 22.7 (CH_3); HRMS calcd. for $C_{29}H_{45}NO_3Na$: 478.3297. Found: 478.3292 (MNa^+).

(2*S*,3*S*,8*R*,8a*R*)-8-(((Bromomethyl)dimethylsilyl)oxy)-3-(2-methylallyl)-2-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)hexahydroindolizin-5(1*H*)-one, 7a : To a solution of alcohol **3** (6.4 mg, 0.014 mmol, 1.0 equiv) in 250 µl of dry DCM, Et_3N (0.030 ml, 0.22 mmol, 15.7 equiv) and (bromomethyl)chlorodimethylsilane (20 µl, 27.5 mg, 0.147 mmol, 10.5 equiv) were added. The reaction mixture was stirred at 50°C in a sealed tube for 2.5h. After cooling to room temperature, the reaction mixture was extracted with DCM to give 30.1 mg of crude material which, after silica gel purification (0−20% EtOAc in pentane), gave 8.1 mg (95% yield) of **7a** as colorless oil. IR (KBr) 3072, 2960, 2930, 1644, 1456, 1255, 1104, 1073, 842, 815 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.02 (s, 1H), 6.92 (s, 1H), 5.01 (q, *J* = 6.7 Hz, 1H), 4.65 (s, 1H), 4.58 (ddd, *J* = 6.2, 6.2, 8.7 Hz, 1H), 4.54 (s, 1H), 4.14 (ddd, *J* = 2.0, 2.0, 4.1 Hz, 1H), 3.95 (ddd, *J* = 6.3, 6.3, 7.4 Hz, 1H), 3.90−3.75 (m, 2H), 3.15 (sept, *J* = 6,8 Hz, 1H), 2.84 (sept, *J* = 6.8 Hz, 1H), 2.43 (s, 2H), 2.41 (ddd, *J* = 7.0, 11.8, 18.0 Hz, 1H), 2.29 (ddd, *J* = 1.5, 7.0, 18.0 Hz, 1H), 2.25−2.16 (m, 3H), 1.99−1.91 (m, 2H), 1.84 (dddd, *J* = 1.9, 7.3, 12.1, 14.1 Hz, 1H), 1.69 (s, 3H), 1.53 (d, *J* = 6,6 Hz, 3H), 1.33−1.15 (m, 18H), 0.26 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 168.1 (C), 147.3 (C), 144.8 (C), 143.8 (C), 133.7 (C), 123.2 (CH), 120.4 (CH), 111.5 (CH_2), 74.6 (CH), 72.9 (CH), 66.1 (CH), 59.1 (CH), 56.7 (CH), 35.4 (CH_2), 34.0 (CH), 33.4 (CH_2), 29.2 (CH), 28.7 (CH), 28.2 (CH_2), 26.2 (CH_2), 25.1 (CH_3),

24.9 (CH_3), 24.3 (CH_3), 24.0 (CH_3), 23.9 (CH_3), 22.8 (CH_3), 22.4 (CH_3), 15.7 (CH_2), −2.49 (CH_3), −2.51 (CH_3); HRMS calcd for $C_{32}H_{53}BrNO_3Si$: 606.2978, found: 606.2966 (MH^+).

(2*S*,3*S*,8*R*,8a*R*)-8-(((Chloromethyl)diphenylsilyl)oxy)-3-(2-methylallyl)-2-((*R*)-1-(2,4,6 triisopropylphenyl)ethoxy)hexahydroindolizin-5(1*H*)-one, 7b : To a solution of alcohol **3** (5.4 mg, 0.012 mmol, 1.0 equiv) in 300 µl of dry DCM were added Et_3N (0.050 ml, 0.36 mmol, 30 equiv) and (chloromethyl)chlorodiphenylsilane (30.5 mg, 0.114 mmol, 9.5 equiv). The reaction mixture was stirred at 50°C in a sealed tube for 4.5h. After cooling to room temperature, the reaction mixture was quenched with water and extracted with pentane to give 28.1 mg of crude material. Purification over silica gel (0−20% of EtOAc in pentane) gave 5.7 mg (66%) of **7b** as colorless oil (in mixture with ≈10% of hydrogenated methylallyl side chain from partially purified starting material). IR (KBr) 3071, 3057, 2960, 2926, 2868, 1616, 1460, 1121, 1073 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.65−7.58 (m, 4H), 7.52−7.46 (m, 2H), 7.44−7.37 (m, 4H), 7.02 (s, 1H), 6.89 (s, 1H), 4.97 (q, *J* = 6.7 Hz, 1H), 4.65 (ddd, *J* = 6.6, 6.6, 7.8 Hz, 1H), 4.64 (s, 1H), 4.52 (s, 1H), 4.32 (ddd, *J* = 1.9, 1.9, 4.2 Hz, 1H), 4.05 (ddd, *J* = 6.2, 6.2, 7.4 Hz, 1H), 3.80 (ddd, *J* = 2.8, 7.5, 8.3 Hz, 1H), 3.84−3.72 (m, 1H), 3.30 (d, *J* = 2.1 Hz, 2H), 3.15−3.03 (m, 1H), 2.84 (sept., *J* = 6.9 Hz, 1H), 2.46 (ddd, *J* = 7.2, 11.7, 17.8 Hz, 1H), 2.34−2.23 (m, 2H), 2.22−2.15 (m, 2H), 1.90 (ddd, *J* = 6.0, 8.3, 12.5 Hz, 1H), 1.85 (dddd, *J* = 1.7, 4.2, 7.2, 13.6 Hz, 1H), 1.74 (dddd, *J* = 2.0, 7.3, 12.1, 13.9 Hz, 1H), 1.67 (s, 3H), 1.47 (d, *J* = 6.7 Hz, 3H), 1.31−1.12 (m, 18H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 168.1 (C), 147.2 (C), 143.7 (C), 134.9 (CH), 134.0 (C), 131.8 (C), 131.7 (C), 131.0 (CH), 130.90 (CH), 130.92 (CH), 128.3 (CH), 128.23 (CH), 128.21 (CH), 123.1 (CH), 120.3 (CH), 111.4 (CH_2), 75.1 (CH), 73.3 (CH), 66.9 (CH), 59.2 (CH), 56.6 (CH), 35.3 (CH_2), 34.0 (CH), 33.6 (CH_2), 29.3 (CH), 28.8 (CH), 27.8 (CH_2), 27.4 (CH_2), 26.3 (CH_2), 25.1 (CH_3), 24.9 (CH_3), 24.8 (CH_3), 24.0 (CH_3), 23.9 (CH_3), 22.6 (CH_3), 22.5 (CH_3); HRMS calcd for $C_{42}H_{57}ClNO_3Si$: 686.3791, found: 686.3787 (MH^+).

(2*S*,3*S*,8*R*,8a*R*)-8-(((Chloromethyl)diisopropylsilyl)oxy)-3-(2-methylallyl)-2-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)hexahydroindolizin-5(1*H*)-one, 7c : To a solution of indolizidinone **3** (925.0 mg, 2.03 mmol, 1.0 equiv) in 5 ml of dry DCM was added 680 mg of a chloro(chloromethyl)diisopropylsilane 134 (3.41 mmol, 1.7 equiv). Also, imidazole (300 mg, 4.40 mmol, 2.1 equiv) and DMAP (45 mg, 0.37 mmol, 0.18 equiv) were added and the solution was stirred at 60°C in a sealed tube for 2h. Additional 1.1 g of the silyl reagent 134

were added in 4-time portions with 2-hour intervals (5.52 mmol, 2.7 equiv). The reaction was followed with TLC until the disappearance of the starting material. Then it was quenched with water and brine, and the aqueous layer was extracted 3 times with pentane. The combined organic phases were dried over $MgSO_4$ and concentrated under reduced pressure to give 1.7 g of crude material which was purified over silica gel (0−20% EtOAc/cyclohexane) leaving 1.06 g of pure silyl ether **7c** (85%), along with 100.0 mg of the siloxane byproduct **S1** (7%). Analytical data for **7c** : IR (KBr) ν 3582, 3274, 2959, 2868, 1645, 1458, 1070 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 7.03 (s, 1H), 6.92 (s, 1H), 5.02 (q, *J* = 6.6 Hz, 1H), 4.65 (s, 1H), 4.60 (ddd, *J* = 6.0, 6.0, 8.5 Hz, 1H), 4.54 (s, 1H), 4.33 (ddd, *J* = 1.7, 2.4, 4.2 Hz, 1H), 4.02 (ddd, *J* = 5.7, 6.0, 7.3 Hz, 1H), 3.83 (ddd, *J* = 2.4, 8.0, 8.0 Hz, 1H), 3.87−3.78 (m, 1H), 3.20−3.08 (m, 1H), 2.94 (s, 2H), 2.84 (sept, *J* = 6.9 Hz, 1H), 2.44 (ddd, *J* = 6.9, 12.1, 18.0 Hz, 1H), 2.32 (ddd, *J* = 1.6, 7.2, 18.0 Hz, 1H), 2.28−2.16 (m, 3H), 2.04 (dddd, *J* = 1.6, 4.2, 6.9, 13.9 Hz, 1H), 1.99 (dddd, *J* = 5.7, 8.0, 12.6 Hz, 1H), 1.86 (dddd, *J* = 1.7, 7.2, 12.1, 13.9 Hz, 1H), 1.67 (s, 3H), 1.50 (d, *J* = 6.6 Hz, 3H), 1.32−1.14 (m, 19H), 1.11−1.00 (m, 12H), 0.79 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.0 (C), 148.3 (C), 147.2 (C), 144.5 (C), 143.7 (C), 133.9 (C), 123.0 (CH), 120.3 (CH), 111.4 (CH_2), 75.0 (CH), 73.1 (CH), 66.2 (CH), 59.4 (CH), 56.7 (CH), 35.2 (CH_2), 33.8 (CH), 33.6 (CH_2), 29.2 (CH), 28.3 (CH), 28.3 (CH_2), 26.3 (CH_2), 26.1 (CH_2), 25.1 (CH_3), 24.9 (CH_3), 24.8 (CH_3), 24.0 (CH_3), 23.9 (CH_3), 23.8 (CH_3), 22.6 (CH_3), 22.5 (CH_3), 17.5 (CH_3), 17.4 (CH_3), 17.1 (CH_3), 13.1 (CH_3), 12.1 (CH_3), 11.9 (CH_3); HRMS calcd for $C_{36}H_{61}ClNO_3Si$: 618.4109. Found: 618.4123 (MH^+).

Analytical data for **S1**, (2*S*,3*S*,8*R*,8a*R*)-8-((3-Hydroxy-1,1,3,3-tetraisopropyldisiloxanyl)oxy)-3-(2-methylallyl)-2-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)hexahydroindolizin-5(1*H*)-one : IR (KBr) ν 3305, 2958, 2866, 1621, 1464 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.03 (s, 1H), 6.92 (s, 1H), 5.00 (q, *J* = 6.7 Hz, 1H), 4.64 (s, 1H), 4.59 (ddd, *J* = 6.1, 6.1, 8.9 Hz, 1H), 4.52 (s, 1H), 4.33 (ddd, *J* = 1.9, 2.6, 4.2 Hz, 1H), 4.04 (ddd, *J* = 5.9, 5.9, 7.3 Hz, 1H), 3.82 (ddd, *J* = 2.5, 7.6, 7.6 Hz, 1H), 3.87−3.77 (m, 1H), 3.14 (sept, *J* = 6.9 Hz, 1H), 2.84 (sept, *J* = 6.9 Hz, 1H), 2.50 (ddd, *J* = 7.2, 12.0, 18.6 Hz, 1H), 2.39−2.29 (m, 2H), 2.24 (A of ABX, *J* = 8.7, 14.2 Hz, 1H), 2.17 (B of ABX, *J* = 5.0, 14.2 Hz, 1H), 2.10 (dddd, *J* = 1.5, 4.3, 7.2, 13.5 Hz, 1H), 1.97 (ddd, *J* = 5.6, 8.1, 13.1 Hz, 1H), 1.82 (dddd, *J* = 1.3, 7.1, 11.9, 13.5 Hz, 1H), 1.66 (s, 3H), 1.52 (d, *J* = 6.7 Hz, 3H), 1.32−1.13 (m, 18H), 1.10−1.01 (m, 24H), 1.01−0.86 (m, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 168.6 (C), 148.3 (C), 147.2 (C), 144.4 (C), 143.7 (C), 134.2 (C), 123.1 (CH), 120.3 (CH), 111.3 (CH_2), 75.2 (CH), 73.3 (CH), 65.1 (CH), 59.6 (CH), 56.6 (CH), 35.2 (CH_2), 34.0 (CH), 33.7 (CH_2), 29.3 (CH), 28.9 (CH), 28.1 (CH_2), 26.4 (CH_2), 25.2 (CH_3), 24.9 (CH_3), 24.7 (CH_3), 24.0 (CH_3), 23.9 (CH_3), 23.8 (CH_3), 22.5 (CH_3), 22.4 (CH_3),

17.5 (CH_3), 17.4 (CH_3), 17.35 (CH_3), 17.30 (CH_3), 13.6 (CH), 13.5 (CH), 13.4 (CH); HRMS calcd for $C_{41}H_{74}NO_5Si_2$: 716.5100. Found: 716.5075 (MH^+).

(1*R*,5*S*,8*S*,9*S*,10a*R*)-3,3-Dimethyl-8-(2-methylallyl)-9-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy) hexahydro-1*H*-1,5-methanopyrrolo[1,2-*f*][1,6,2]oxazasilocin-6(3*H*)-one, 8a : To a solution of silyl ether **7a** (5.0 mg, 0.008 mmol, 1.0 equiv) in 300 µl of dry THF at −78°C was added 60 µl of LiHMDS solution in THF (1.0 M, 0.06 mmol, 7.5 equiv). The reaction temperature was gradually increased to −15°C over 1 hour. TLC analysis (EtOAc) showed a complete consumption of starting material. The reaction mixture was quenched with water and extracted with DCM. The organic solution was dried on $MgSO_4$ and the solvent was removed under reduced pressure to give 5.9 mg of crude material. Purification over silica gel (10−100% EtOAc in pentane) produced 2.8 mg (65%) of **8a** as colorless oil : IR (KBr) ν 3055, 2960, 2931, 2869, 1642, 1455, 1428, 1081, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.03 (s, 1H), 6.92 (s, 1H), 5.02 (q, *J* = 6.8 Hz, 1H), 4.67 (s, 1H), 4.57 (s, 1H), 4.56 (ddd, *J* = 5.8, 6.2, 9.4 Hz, 1H), 4.26 (ddd, *J* = 2.2, 2.2, 4.6 Hz, 1H), 3.90−3.80 (m, 3H), 3.16 (sept, *J* = 6.8 Hz, 1H), 2.84 (sept, *J* = 6.8 Hz, 1H), 2.80 (dddd, *J* = 2.0, 3.1, 5.3, 7.1 Hz, 1H), 2.41 (ddd, *J* = 7.8, 7.8, 13.6 Hz, 1H), 2.33 (A of ABX, *J* = 5.8, 14.2 Hz, 1H), 2.27 (B of ABX, *J* = 9.4, 14.2 Hz, 1H), 1.98−1.90 (m, 3H), 1.72 (s, 3H), 1.54 (d, *J* = 6,8 Hz, 3H), 1.34−1.12 (m, 19H), 0.94 (dd, *J* = 7.1, 14.8 Hz, 1H), 0.14 (s, 3H), −0,17 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 170.8 (C), 148.5 (C), 147.4 (C), 145.3 (C), 143.7 (C), 133.3 (C), 123.2 (CH), 120.3 (CH), 111.6 (CH_2), 74.2 (CH), 72.4 (CH), 66.6 (CH), 60.4 (CH), 56.8 (CH), 35.3 (CH_2), 34.0 (CH), 33.2 (CH), 33.0 (CH_2), 32.7 (CH_2), 29.2 (CH), 28.5 (CH), 25.1 (CH_3), 25.0 (CH_3), 24.9 (CH_3), 24.1 (CH_3), 24.0 (CH_3), 23.9 (CH_3), 22.8 (CH_3), 22.3 (CH_3), 19.8 (CH_2), 2.4 (CH_3), 2.1 (CH_3). HRMS calcd for $C_{32}H_{53}NO_3Si$: 526.3711. Found: 526.3698 (MH^+).

(1*R*,5*S*,8*S*,9*S*,10a*R*)-3,3-Diisopropyl-8-(2-methylallyl)-9-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)hexahydro-1*H*-1,5-methanopyrrolo[1,2-*f*][1,6,2]oxazasilocin-6(3*H*)-one 8c : To a solution of silyl ether **7c** (1.0 g, 1.62 mmol, 1.0 equiv) in 15 ml THF at −78°C was added a freshly prepared solution of 0.4M LiHMDS in THF (16 ml, 6.4 mmol, 3.9 equiv). The reaction was allowed to warm to −20°C over 1h30 min, followed by TLC and quenched with brine at −25 °C. The aqueous layer was extracted 3 times with DCM. After drying over $MgSO_4$, the organic phase was concentrated under vacuum to leave 932.2 mg of crude material which was purified over silica gel (0−10% EtOAc/cyclohexane) to give 860.0 mg of pure cyclic silyl ether **8c** (91%) : IR (KBr) ν, 2959, 2866, 1644, 1462, 1610 cm^{-1}; ^1H

NMR (500 MHz, $CDCl_3$) δ 7.02 (s, 1H), 6.91 (s, 1H), 5.03 (q, *J* = 6.7 Hz, 1H), 4.66 (s, 1H), 4.61−4.54 (m, 2H), 4.27 (ddd, *J* = 1.9, 1.9, 4.2 Hz, 1H), 3.96 (ddd, *J* = 5.0, 6.6, 7.7 Hz, 1H), 3.86 (sept, *J* = 6.9 Hz, 1H), 3.81 (ddd, *J* = 2.4, 8.1, 8.1 Hz, 1H), 3.16 (sept, *J* = 7.0 Hz, 1H), 2.84 (sept, *J* = 6.9 Hz, 1H), 2.79 (dddd, *J* = 1.3, 2.3, 5.8, 7.7 Hz ,1H), 2.45 (ddd, *J* = 8.0, 8.0, 12.7 Hz, 1H), 2.31 (A of ABX, *J* = 6.1, 14.1, 1H), 2.27 (B of ABX, *J* = 8.7, 14.1 Hz, 1H), 2.01−1.89 (m, 3H), 1.71 (s, 3H), 1.53 (d, *J* = 6.7 Hz, 3H), 1.31−1.14 (m, 19 H), 1.04−0.91 (m, 8H), 0.80 (d, *J* = 7.4 Hz, 3H), 0.76 (d, *J* = 7.4 Hz, 3H), 0.61 (sept, *5*= 7.5 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 170.9 (C), 148.4 (C), 147.2 (C), 145.1 (C), 143.7 (C), 133.3 (C), 123.1 (CH), 120.3 (CH), 111.4 (CH_2), 74.3 (CH), 72.4 (CH), 66.0 (CH), 60.8 (CH), 56.8 (CH), 35.3 (CH_2), 34.0 (CH), 32.9 (CH_2), 32.7 (CH), 29.1 (CH), 28.4 (CH), 25.1 (CH_3), 24.9 (CH_3), 24.0 (CH_3), 23.9 (CH_3), 22.8 (CH_3), 22.4 (CH_3), 17.4 (CH_3), 17.3 (CH_3), 16.6 (CH_3), 16.5 (CH_3), 13.9 (CH), 13.4 (CH), 13.3 (CH_2). HRMS calcd for $C_{36}H_{60}NO_3Si$: 582.4342. Found: 582.4348 (MH^+).

(2*S*,2a*S*,4*R*,5a*R*,6*S*,8*R*,8a*R*)-8-Hydroxy-6-((hydroxydiisopropylsilyl)methyl)-4-methyl-2-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)decahydro-1*H*-pyrrolo[2,1,5-*de*]quinolizin-4-yl formate 9 and (1*S*,5*R*,5a*R*,7*S*,7a*S*,9*R*,10a*R*)-3,3-Diisopropyl-9-methyl-7-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)dodecahydro-1,5-methano[1,6,2]oxazasilocino[7,6,5-*cd*]indolizin-9-yl formate 10 and (2*S*,3*S*,6*S*,8*R*,8a*R*)-6-((Hydroxydiisopropylsilyl)methyl)-3-(2-methylallyl)-2-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)octahydroindolizin-8-ol 11 : To a solution of lactam **8c** (0.0020 g, 0.034 mmol.) in 0.300 ml of ether at −5 °C was added a 1M solution $LiAlH_4$ in ether (0,050 ml, 0.050 mmol, 1.5 equiv). The reaction was stirred at −5°C and, followed by TLC (20% AcOEt in pentane). Two additional amounts (0,050 ml and 0.025 ml) of $LiAlH_4$ was added each following hours to complete the reaction which was then quench at 0°C with formic acid (0.250 ml) for 1h. Solid K_2CO_3 was then added carefully until no more gas evolution followed by 1 ml of brine. Usual extraction with ether left 0.0217 g of crude material which was purified by silica gel chromatography (0−50% AcOEt in pentane) to give 0.0012 g of over reduced lactam **11**, 0.0018 g of silyl ether **10** and 0.0050 g of silanol **9**.

Data for **9** : IR (KBr) ν 3398, 2959, 2866, 1722, 1607, 1462 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 8.03 (s, 1H), 7.03 (d, *J* =1.6 Hz, 1H), 6.94 (d, *J* = 1.6 Hz, 1H), 5.00 (q, *J* = 6.8 Hz, 1H), 3.99 (ddd, *J* = 4.3, 6.7, 9.3 Hz, 1H), 3.89 (sept, *J* = 6.8 Hz, 1H), 3.78 (app s, 1H), 3.31 (ddd, *J* = 1.3, 8.4, 9.3 Hz, 1H), 3.25 (ddd, *J* = 3.9, 6.7, 12.8 Hz, 1H), 3.15 (sept, *J* = 6.8 Hz, 1H), 2.85 (sept, *J* = 6.9 Hz, 1H), 2.81 (app. dd, *J* = 3.0, 12.7 Hz, 1H), 2.23 (dd, *J* = 12.8, 12.8

Hz, 1H), 2.14 (ddd, *J* = 8.9, 8.9, 13.1 Hz, 1H), 2.08 (ddd, *J* = 1.9, 3.4, 14.8 Hz, 1H), 2.00 (dd, *J* = 12.8, 12.8 Hz, 1H), 1.80−1.66 (m, 4H), 1.62 (ddd, *J* = 2.4, 6.0, 14.8 Hz, 1H), 1.57 (s, 3H), 1.49 (d, *J* = 6.8Hz, 3H), 1.32−1.17 (m, 18 H), 1.10 (dd, *J* = 10.4 Hz, 15.3 Hz, 1H), 1.05−0.93 (m, 12H), 0.86−0.80 (m, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 160.3 (CH), 148.8 (C), 147.3 (C), 145.9 (C), 133.1 (C), 123.2 (CH), 120.4 (CH), 84.7 (C), 74.5 (CH), 71.1 (CH), 67.1 (CH), 60.4 (CH), 59.2 (CH), 53.9 (CH), 33.9 (CH), 33.7 (CH_2), 32.6 (CH_2), 31.9 (CH), 31.0 (CH_2), 30.4 (CH_2), 29.1 (CH), 28.0 (CH), 25.0 (CH_3), 24.9 (CH_3), 24.6 (CH_3), 24.5 (CH_3), 23.9 (CH_3), 23.3 (CH_3), 22.9 (CH_3), 20.7 (CH_2), 17.7 (CH_3), 17.5 (CH_3), 17.4 (CH_3), 13.3 (CH), 13.2 (CH). HRMS calcd for $C_{37}H_{64}NO_5Si$: 630.4554. Found: 630.4565 (MH^+).

Data for **10** : IR (KBr) ν 2959, 2864, 1722, 1607, 1461 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.05 (s, 1H), 7.04 (d, *J* =1.8 Hz, 1H), 6.93 (d, *J* = 1.8 Hz, 1H), 4.99 (q, *J* = 6.8 Hz, 1H), 3.97 (app s, 1H), 3.93−3.84 (m, 2H), 3.23−3.08 (m, 3H), 2.92−2.78 (m, 2H), 2.23−2.11 (m, 2H), 2.01 (dd, *J* = 13.1, 13.1 Hz, 1H), 1.96 (br s, 1H), 1.76−1.60 (m, 5H), 1.58 (s, 3H), 1.48 (d, *J* = 6.8 Hz, 3H), 1.30−1.14 (m, 18H), 1.05 (dd, *J* = 7.8, 15.0 Hz, 1H), 1,01−0.78 (m, 14H), 0.53 (ddd, *J* = 2.0, 2.0, 15.0 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 160.3 (CH), 148.8 (C), 147.2 (C), 146.0 (C), 133.2 (C), 123.1 (CH), 120.2 (CH), 85.2 (C), 74.3 (CH), 70.7 (CH), 67.9 (CH), 60.1 (CH), 58.3 (CH), 54.7 (CH), 34.0 (CH), 33.4 (CH_2), 32.2 (CH_2), 31.5 (CH_2), 31.2 (CH), 30.2 (CH_2), 29.2 (CH), 28.0 (CH), 25.1 (CH_3), 24.8 (CH_3), 24.7 (CH_3), 24.3 (CH_3), 24.0 (CH_3), 23.8 (CH_3), 23.4 (CH_3), 22.9 (CH_3), 17.9 (CH_3), 17.6 (CH_3), 17.2 (CH_3), 16.8 (CH_3), 15.1 (CH), 14.8 (CH_2), 13.1 (CH). HRMS calcd for $C_{37}H_{62}NO_4Si$: 612.4448. Found: 612.4451 (MH^+).

Data for **11** : IR (KBr) ν 3366, 2958, 2865, 1608, 1462, 1382, 1261, 881 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.04 (d, *J* = 1.8 Hz, 1H), 6.95 (d, *J* = 1.8 Hz,1H), 5.04 (q, *J* = 6.8 Hz, 1H), 4.74 (br s, 2H), 4.00 (ddd, *J* = 6.3, 6.3, 8.7 Hz, 1H), 3.91 (sept, *J* = 6.8 Hz, 1H), 3.77 (app s, 1H), 3.38 (ddd, *J* = 3.3, 6.3, 9.3 Hz, 1H), 3.19 (sept, *J* = 6.8 Hz, 1H), 2.96 (ddd, *J* = 2.3, 6.8, 9.2 Hz, 1H), 2.86 (sept, *J* = 6.9 Hz, 1H), 2.78 (dd, *J* = 3.5, 11.3 Hz, 1H), 2.48 (app d, *J* = 11.3 Hz, 1H), 2.31 (app d, *J* = 15.4 Hz, 1H), 2.22−2.12 (m, 2H), 2.00−1.88 (m, 2H), 1.77 (ddd, *J* = 6.3, 9.2, 12.9 Hz, 1H), 1.72 (s, 3H), 1.54 (ddd, *J* = 2.5, 6.2, 14.5 Hz, 1H), 1.50 (d, *J* = 6.8 Hz, 3H), 1.34−1.13 (m, 18H), 1.07−0.80 (m, 15H), 0.69 (dd, *J* = 6.7, 15.0 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 148.8 (C), 147.2 (C), 145.7 (C), 145.3 (C), 133.5 (C), 123.1(CH), 120.4 (CH), 111.3 (CH_2), 75.8 (CH), 71.2 (CH), 68.2 (CH), 63.8 (CH), 61.6 (CH), 56.7 (CH_2), 36.3 (CH_2), 33.9 (CH), 31.2 (CH_2), 31.1 (CH_2), 29.1 (CH), 28.4 (CH), 28.2 (CH), 25.3 (CH_3), 24.9 (CH_3), 24.8 (CH_3), 24.5 (CH_3), 23.9 (CH_3), 23.8 (CH_3), 23.2 (CH_3), 22.9 (CH_3), 17.9 (CH_2),

17.6 (CH_3), 17.5 (CH_3), 17.3 (CH_3), 13.4 (CH), 13.3 (CH). HRMS calcd for $C_{36}H_{64}NO_3Si$: 586.4655. Found: 586.4652 (MH^+).

(1*S*,5*R*,5a*R*,7*S*,7a*S*,9*R*,10a*R*)-3,3-Diisopropyl-9-methyl-7-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)dodecahydro-1,5-methano[1,6,2]oxazasilocino[7,6,5-*cd*]indolizin-9-ol 12 and (1*S*,2a*R*,3*R*,5*S*,5a*R*,7*R*,8a*S*)-5-((Hydroxydiisopropylsilyl)methyl)-7-methyl-1-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy)decahydro-1*H*-pyrrolo[2,1,5-*de*]quinolizine-3,7-diol 13 : A solution of formate **9** in 2.7 ml of methanol with 0.280 g of K_2CO_3 was stirred at room temperature for 1h. After dilution with brine the mixture was processed in the usual way with methylenechloride to leave 0.0892 g of the crude mixture as a pale yellow oil. Purification on silica gel (0−50% AcOEt in pentane) gave 0.0452 g of **12** and 0.0379 g of **13**.

Data for **12** : IR (KBr) ν 3365, 2959, 2864, 1608, 1461 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 7.04 (d, *J* = 2.0 Hz, 1H), 6.92 (d, *J* = 2.0 Hz, 1H), 4.98 (q, *J* = 6.9 Hz, 1H), 3.96 (br s, 1H), 3.93−3.85 (m, 2H), 3.20−3.07 (m, 3H), 2.86 (sept, *J* = 6.9 Hz, 1H), 2.77 (ddd, *J* = 0.8, 3.0, 12.8 Hz, 1H), 2.16 (ddd, *J* = 9.2, 9.2, 12.6 Hz, 1H), 1.95 (br s, 1H), 1.82 (dd, *J* = 12.8, 12.8 Hz, 1H), 1.75−1.60 (m, 4H), 1.47 (d, *J* = 6.9Hz, 3H), 1.40 (ddd, *J* = 2.0, 3.7, 13.4 Hz, 1H), 1.31−1.11 (m, 22H), 1.07−0.95 (m, 5H), 0.95−0.87 (m, 4H), 0.87−0.78 (m, 6H), 0.53 (ddd, *J* = 1.9, 1.9, 15.0, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 148.8 (C), 147.1 (C), 146.0 (C), 133.4 (C), 123.1 (CH), 120.2 (CH), 74.3 (CH), 71.6 (C), 70.6 (CH), 68.0 (CH), 60.9 (CH), 59.2 (CH), 54.5 (CH), 36.8 (CH_2), 34.0 (CH), 33.4 (CH_2), 32.3 (CH_2), 31.6 (CH_2), 31.4 (CH), 29.2 (CH), 28.0 (CH), 25.7 (CH_3), 25.2 (CH_3), 24.8 (CH_3), 24.7 (CH_3), 24.3 (CH_3), 24.0 (CH_3), 23.8 (CH_3), 23.3 (CH_3), 17.9 (CH_3), 17.7 (CH_3), 17.2 (CH_3), 16.8 (CH_3), 15.0 (CH), 14.8 (CH_2), 13.1 (CH). HRMS calcd for $C_{36}H_{62}NO_3Si$: 584.4499. Found: 584.4500 (MH^+).

Data for **13** : IR (KBr) ν 3375, 2959, 2865, 1607, 1462 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 7.03 (d, *J* = 1.8 Hz, 1H), 6.93 (d, *J* = 1.8 Hz, 1H), 5.00 (q, *J* = 6.9 Hz, 1H), 3.99 (ddd, *J* = 4.2, 6.6, 9.4 Hz, 1H), 3.91 (sept, *J* = 6.9 Hz, 1H), 3.76 (app s, 1H), 3.28 (ddd, *J* = 1.5, 8.3, 8.3 Hz, 1H), 3.24−3.09 (m, 2H), 2.85 (sept, *J* = 6.9 Hz, 1H), 2.75 (app dd, *J* = 3.0, 13.1 Hz, 1H), 2.13 (ddd, *J* = 8.3, 9.1, 13.0 Hz, 1H), 2.07 (br d, *J* = 15.2 Hz, 1H), 1.86 (dd, *J* = 13.1, 13.1 Hz, 1H), 1.80−1.59 (m, 4H), 1.48 (d, *J* = 6.9Hz, 3H), 1.43 (ddd, *J* = 2.1, 3.8, 13.5 Hz, 1H), 1.33−1.16 (m, 22H), 1.11 (dd, *J* = 10.5, 15.3 Hz, 1H), 1.06−0.92 (m, 13H), 0.91−0.81 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 148.8 (C), 147.2 (C), 145.9 (C), 133.3 (C), 123.2 (CH), 120.3 (CH), 74.5 (CH), 71.3 (C), 71.0 (CH), 67.2 (CH), 61.2 (CH), 60.1 (CH), 53.7 (CH), 37.2

(CH_2), 33.9 (CH), 33.6 (CH_2), 32.8 (CH_2), 32.0 (CH_2), 31.0 (CH), 29.1(CH_2), 28.0 (CH), 25.8 (CH_3), 25.0 (CH_3), 24.9 (CH_3), 24.6 (CH_3), 24.5 (CH_3), 23.9 (CH_3), 23.2 (CH_3), 20.8 (CH_2), 17.7 (CH_3), 17.5 (CH_3), 17.4 (CH_3), 13.4 (CH), 13.2 (CH). HRMS calcd for $C_{36}H_{64}NO_4Si$: 602.4605. Found: 602.4611 (MH^+).

(1*S*,2a*R*,3*R*,5*S*,5a*R*,7*R*,8a*R*)-5,7-Dimethyl-1-((R)-1-(2,4,6-triisopropylphenyl)ethoxy)decahydro-1*H*-pyrrolo[2,1,5-*de*]quinolizine-3,7-diol 14 : Vaska's catalyst ($IrCl(CO)[P(C_6H_5)_3]_2$, 4.2 mg, 0.0054 mmol, 2.7 mol%) was added to a solution of lactam **8c** (0.1173 g, 0.201 mmol.) in 4.6 ml of toluene at RT. The obtained yellow suspension was stirred at RT for 5 min before the addition of TMDS (89 µl, 0.503 mmol., 2.5 eq.). The reaction mixture was stirred for more 5 min before noticing the total disappearance of starting material by TLC. Formic acid (2.3 ml) was then added and the solution was vigorously stirred for 1.5 h at RT. The resultant solution was diluted with Et_2O and then basified with saturated K_2CO_3 solution and extracted with Et_2O in the usual manner. High vacuum removal of the excess TMDS (2 h at 80 °C under 0.4 torr) left 0.116 g formate **9** in an enough purity to be engaged in the next step. This material was dissolved in 4.7 ml of dry DMSO and KOt-Bu (340 mg, 3.03 mmol, ~15 equiv), CsF (250 mg, 1.65 mmol, ~8 equiv) and 140 µl of H_2O (3%) were added at RT. After stirring 9h at 120°C, the reaction was hydrolised with brine and extracted with Et_2O in the usual way. Purification of crude material on silica gel (3% MeOH-NH_3/DCM) yielded 41.0 mg 0.087 mmol of the corresponding protodesilylated alcohol **14** (46% yield over 2 steps). $[\alpha]^{20}_D$ +14.6 (c 0.48, $CHCl_3$); IR (KBr) ν 3408, 2960, 2928, 2869, 1607, 1459, 1372, 1263 cm^{-1}; ^1H NMR (500 MHz, C_6D_6) δ 7.26 (d, *J* = 1.8 Hz, 1H), 7.10 (d, *J* = 1.8 Hz, 1H), 5.06 (q, *J* = 6.8 Hz, 1H), 4.19 (sept, *J* = 6.9 Hz, 1H), 3.91 (ddd, *J* = 4.9, 6.4, 9.2 Hz, 1H), 3.56 (app s, 1H), 3.19 (sept, *J* = 6.9 Hz, 1H), 2.95 (br t, *J* = 7.9 Hz, 1H), 2.89 (ddd, *J* = 3.9, 6.4, 12.2 Hz, 1H), 2.80 (sept, *J* = 6.9 Hz, 1H), 2.48 (ddd, *J* = 1.7, 3.0, 13.1 Hz, 1H), 2.27 (ddd, *J* = 7.9, 9.2, 12.8 Hz, 1H), 2.00 (br s, 1H), 1.65−1.51 (m, 4H), 1.61 (d, *J* = 6.8 Hz, 3H), 1.47−1.40 (m, 2H), 1.38 (d, *J* = 6.7 Hz, 3H), 1.37−1.27 (m, 7H), 1.26−1.21 (m, 6H), 1.19 (d, *J* = 6.7 Hz, 3H), 1.14 (d, *J* = 7.4 Hz, 3H), 1.06 (s, 3H), 0.98 (br d, *J* = 12.6 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 148.8 (C), 147.2 (C), 145.8 (C), 133.4 (C), 123.2 (CH), 120.3 (CH), 75.0 (CH), 71.2 (C), 71.0 (CH), 67.2 (CH), 61.2 (CH), 58.0 (CH), 53.7 (CH), 38.0 (CH_2), 34.6 (CH_2), 34.0 (CH_2), 33.9 (CH), 31.2 (CH), 30.9 (CH_2), 29.1 (CH), 28.0 (CH), 25.7 (CH_3), 25.0 (CH_3), 24.9 (CH_3), 24.6 (CH_3), 24.5 (CH_3), 24.0 (CH_3), 23.9 (CH_3), 23.7 (CH_3), 23.2 (CH_3). HRMS calcd for $C_{30}H_{50}NO_3$: 472.3791. Found: 472.3789 (MH^+).

(1*S*,2a*R*,3*S*,5*S*,5a*R*,7*R*,8a*S*)-3,5,7-Trimethyldecahydro-1*H*-pyrrolo[2,1,5-*de*]quinolizine-1,7-diol 17 : To a solution of alcohol **14** (92.0 mg, 0.195 mmol) in 2.0 ml MeCN were added DMAP (19.0 mg, 0.155 mmol, 0.8 eq.), 2,2'-bipyridyl (19.0 mg, 0.122 mmol, 0.6 eq.) and 2-azaadamantane N-oxyl (10.9 mg, 0.072 mmol, 0.4 eq.) and CuCl (32.2 mg, 0.323 mmol, 1.7 eq.) at room temperature. The mixture was stirred at the room temperature under open air atmosphere for 30 min. The reaction was monitored by TLC, noting the color change of the mixture from brown to green indicating the completion of the reaction. The reaction was quenched with saturated $NaHCO_3$ and $Na_2S_2O_3$ and the mixture was stirred vigorously at room temperature for 5 min. The mixture was then diluted with pentane and the aqueous layer extracted with pentane (3 times). The combined organic layers were dried over MgSO4 and evaporated yielding 173.0 mg of (1*S*,2a*R*,5*S*,5a*R*,7*R*,8a*S*)-7-Hydroxy-5,7-dimethyl-1-((*R*)-1-(2,4,6-triisopropylphenyl)ethoxy) decahydro-3*H*-pyrrolo[2,1,5-*de*]quinolizin-3-one **15** in mixture with 2,2'-bipyridyl, used for the next step without any further purification. Data for **15** : IR (KBr) ν 3408, 2959, 2926, 2867, 1727, 1649, 1561, 1457 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 7.01 (s, 1H), 6.92 (s, 1H), 5.03 (q, *J* = 6.9 Hz, 1H), 3.94 (ddd, *J* = 4.3, 6.0, 7.9 Hz, 1H), 3.89 (sept, *J* = 6.7 Hz, 1H), 3.74 (dd, *J* = 7.0, 9.1 Hz, 1H), 3.16 (sept, *J* = 6.9 Hz, 1H), 3.06 (ddd, *J* = 4.2, 6.0, 11.3 Hz, 1H), 2.83 (sept, *J* = 6.9 Hz, 1H), 2.56 (ddd, *J* = 3.5, 7.4, 11.1 Hz, 1H), 2.36−2.22 (m, 3H), 2.06−1.87 (m, 2H), 1.70−1.51 (m, 4H), 1.31−1.13 (m, 21H), 1.02 (d, *J* = 6.7 Hz, 3H). HRMS calcd for $C_{30}H_{48}NO_3$: 470.3629. Found: 470.3616 (MH^+). A solution of 0.6 M NaHMDS in toluene (3.2 ml, 1.92 mmol) was added to a solution of methyltriphenylphosphonium bromide (764.1 mg, 2.14 mmol) in 5.4 ml THF at −78°C. The yellow suspension was stirred for 45 min as the temperature was allowed to warm to 0°C then stirred 15 min at this temperature. The mixture was cooled back to −90°C and the previous crude ketone **15** (173.0 mg) was added as a solution in 7.5 ml THF. The reaction mixture was stirred for 1h at −90°C<T<−80°C and temperature was increased to 0°C over 2h followed by stirring at RT for 1h. Quenching was done with water and the aqueous layer was extracted with pentane (3 times). The combined organic layers were dried with $MgSO_4$ and the solvent was evaporated under vacuo. Partial purification over silica gel (10% EtOAc/cyclohexane) affored 600.0 mg of a mixture of alkene **16** and excess of Wittig reagent (~1.0:17.7). Data for **16** : IR (KBr) ν 3387, 2958, 2925, 2854, 1658, 1607, 1462, 1379 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ δ 7.01 (d, *J* = 2.0 Hz, 1H), 6.91 (d, *J* = 2.0 Hz 1H), 5.06 (q, *J* = 6.8 Hz, 1H), 4.71 (q, *J* = 1.6 Hz, 1H), 4.69 (q, *J* = 1.6 Hz, 1H), 4.02 (ddd, *J* = 2.8, 6.9, 8.6 Hz, 1H), 3.92 (sept., *J* = 6.8 Hz, 1H), 3.65 (t, *J* = 8.0 Hz, 1H), 3.19 (sept, *J* = 6.8 Hz, 1H), 3.16 (ddd, *J* = 3.6, 6.9, 12.3

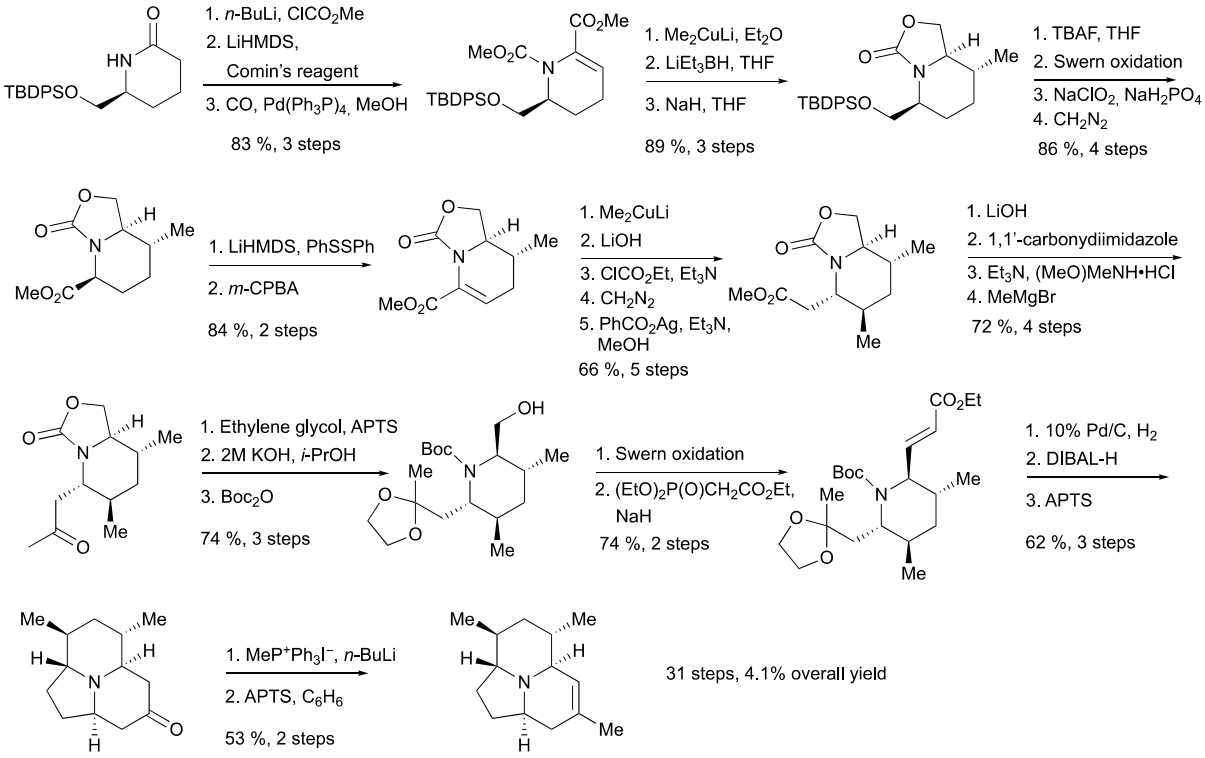
Hz, 1H), 2.83 (sept, *J* = 6.9 Hz, 1H), 2.67 (ddd, *J* = 3.0, 3.0, 12.7 Hz, 1H), 2.39 (dd, *J* = 5.6, 14.4 Hz, 1H), 2.01−1.69 (m, 6H), 1.50 (d, *J* = 6.8 Hz, 3H), 1.41 (ddd, *J* = 2.3, 3.6, 13.4 Hz, 1H), 1.30−1.16 (m, 22H), 0.98 (d, *J* = 7.0 Hz, 3H). HRMS calcd for $C_{31}H_{50}NO_2$: 468.3836. Found: 468.3827 (MH^+). To a solution of the previous mixture in 6.0 ml of *i*-PrOH were added at RT phenyl silane (1.0 ml, 8.1 mmol), *tert*-butylhydroperoxide solution (5.0−6.0M in decane, 0.200 ml, 1.0−1.2 mmol) and $Mn(dpm)_3$ (0.040 g, 0.066 mmol). The reaction mixture was stirred for 4h then the solvent was evaporated. The crude mixture was directly loaded on silica gel (1% MeOH-NH_3/DCM) to afford 0.1457 g of partially purified corresponding alkane : ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.00 (d, *J* = 1.9 Hz, 1H), 6.90 (d, *J* = 1.9 Hz, 1H), 5.00 (q, *J* = 6.8 Hz, 1H), 4.01 (ddd, *J* = 2.7, 7.1, 9.6 Hz, 1H), 3.92 (sept, *J* = 6.9 Hz, 1H), 3.16 (sept, *J* = 6.8 Hz, 1H), 3.14 (ddd, *J* = 3.8, 7.1, 12.4 Hz, 1H), 2.83 (sept, *J* = 6.9 Hz, 1H), 2.72 (ddd, *J* = 7.0, 9.4, 9.4 Hz, 1H), 2.68 (ddd, *J* = 1.4, 3.1, 13.0 Hz, 1H), 1.91−1.81 (m, 2H), 1.76−1.54 (m, 3H), 1.48 (d, *J* = 6.8 Hz, 3H), 1.47−1.39 (m, 1H), 1.36 (ddd, *J* = 2.3, 3.8,13.4 Hz, 1H), 1.34−1.15 (m, 23H), 1.13 (ddd, *J* = 2.3, 3.0, 12.5 Hz, 1H), 1.09 (d, *J* = 7.1 Hz, 3H), 0.83 (d, *J* = 6.4 Hz, 3H). HRMS calcd for $C_{31}H_{52}NO_2$: 470.39926. Found: 470.39795 (MH^+). To a solution of the previous compound in 2.5 ml of DCM at 0 °C was added drop wise 0.320 ml TFA. The reaction mixture was vigorously stirred for 1 h at 0°C, after which it was quenched with 10% NaOH solution and extracted with DCM in the usual manner to give 0.170 g of the crude material which was purified over silica gel (6% MeOH−NH_3/DCM) furnish 0.020 g of diol **17** (43% yield from **14**). IR (KBr) ν 3402, 2956, 2921, 2850, 1650, 1465, cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.33 (ddd, *J* = 1.9, 5.1, 7.1 Hz, 1H), 2.96 (ddd, *J* = 3.3, 5.1, 12.1 Hz, 1H), 2.84 (ddd, *J* = 6.9, 9.1, 10.4 Hz, 1H), 2.50 (ddd, *J* = 2.8, 5.5, 12.0 Hz, 1H), 1.85 (ddd, *J* = 2.0, 6.9, 13.4 Hz, 1H), 1.72 (ddd, *J* = 7.3, 9.0, 13.4 Hz, 1H), 1.71−1.51 (m, 4H), 1.48 (ddd, *J* = 1.9, 3.2, 12.4 Hz, 1H), 1.42 (ddd, *J* = 2.0, 2.8, 13.4 Hz, 1H), 1.37−1.31 (m, 2H), 1.26 (s, 3H), 1.02 (d, *J* = 7.0 Hz, 3H), 0.79 (d, *J* = 6.5 Hz, 3H). HRMS calcd for $C_{14}H_{26}NO_2$: 240.1964. Found: 240.1958 (MH^+).

(2a*R*,3*S*,5*S*,5a*R*,8a*R*)-3,5,7-Trimethyl-2,2a,3,4,5,5a,6,8a-octahydro-1*H*-pyrrolo[2,1,5-*de*] quinolizine, alkaloid (-)-205B (1): To a solution of the diol **17** (5.0 mg, 0.021 mmol, 1.0 equiv) in 250 µl DCM were added DMAP (10.0 mg, 0.082 mmol, 3.9 equiv) and O-phenyl chlorothionoformate (7.0 µl, 0.051 mmol, 2.4 equiv). The reaction mixture was stirred for 5h at RT and then quenched with 10% NaOH and diluted with DCM. The aqueous layer was then extracted with DCM (3 times) and the combined organic phases were dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified over silica gel (0−0.5%

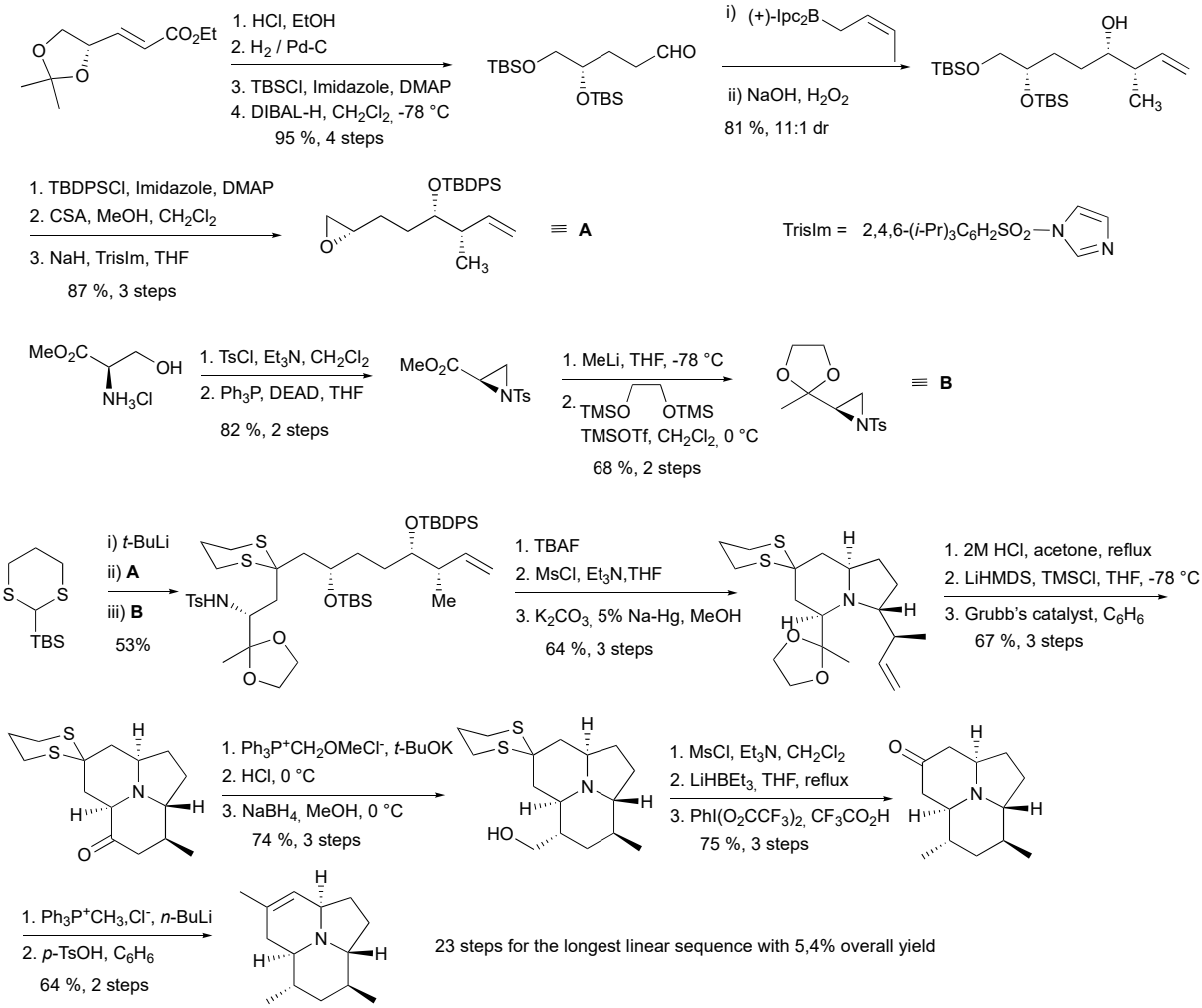
MeOH-NH_3/DCM) to afford 6.5 mg (83% yield) of O-((1*S*,2a*R*,3*S*,5*S*,5a*R*,7*R*,8a*S*)-7-Hydroxy-3,5,7-trimethyldecahydro-1*H*-pyrrolo[2,1,5-*de*]quinolizin-1-yl) O-phenyl carbonothioate. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45−7.39 (m, 2H), 7.31−7.27 (m, 1H), 7.12−7.07 (m, 2H), 5.70 (ddd, *J* = 2.6, 6.6, 9.2 Hz, 1H), 3.58 (ddd, *J* = 3.6, 6.6, 12.4 Hz, 1H), 2.78 (ddd, *J* = 6.8, 9.5, 9.5 Hz, 1H), 2.72 (ddd, *J* = 2.2, 2.9, 12.7 Hz, 1H), 2.11−1.94 (m, 3H), 1.83 (t, *J* = 12.6 Hz, 1H), 1.74−1.46 (m, 4H), 1.39−1.21 (m, 2H), 1.28 (s, 3H), 1.13 (d, *J* = 7.2 Hz, 3H), 0.84 (d, *J* = 6.6 Hz, 3H). To a refluxing solution of the previous O-phenyl carbonothioate (17.5 mg, 0.047 mmol, 1.0 equiv) in 2.8 ml of benzene was added dropwise a mixture of AIBN (3.6 mg, 0.022 mmol, 0.5 equiv) and TMS_3SiH (34.5 µl, 0.11 mmol, 2.3 equiv) in 510 µl benzene over 45 min. The mixture was refluxed for additional 4h30min, then cooled and evaporated. The residue was loaded directly on silica gel for purification (3% MeOH−NH_3/DCM) to give 10.2 mg of (2a*R*,4*S*,5a*R*,6*S*,8*S*,8a*R*)-4,6,8-trimethyldecahydro-1*H*-pyrrolo[2,1,5-*de*]quinolizin-4-ol, tertiary alcohol **18** (98%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.11 (dddd, J = 2.2, 4.0, 7.5, 11.8 Hz, 1H), 2.78 (ddd, *J* = 2.2, 3.0, 12.8 Hz, 1H), 2.43 (ddd, *J* = 6.5, 9.6, 9.6 Hz, 1H), 2.09−1.88 (m, 2H), 1.77−1.64 (m, 3H), 1.54−1.26 (m, 7H), 1.26 (s, 3H), 1.14 (d, *J* = 7.2 Hz, 3H), 0.82 (d, *J* = 6.5 Hz, 3H). HRMS calcd for $C_{14}H_{26}NO$: 224.2009. Found: 224.2008 (MH^+). To a solution of the tertiary alcohol **18** (10.4 mg, 0.05 mmol, 1.0 equiv) in 6 ml of benzene was added *p*−TsOH.H_2O (70 mg, 0.37 mmol, 7.4 equiv) followed by refluxing the reaction mixture for 8 h. The reaction was then cooled down and diluted with DCM and quenched with 10% NaOH. The aqueous layer was extracted 4 times with DCM and the combined organic layers were dried over magnesium sulphate and evaporated in vacuo to obtain the crude product as a 6:1 mixture of isomers. Purification over silica gel (10−50% AcOEt in pentane) afforded the targeted compound **1** (6.0 mg, 63% yield) as a colorless oil. $[\alpha]^{20}_D$ +2.4 (c 0.33, $CHCl_3$); IR (KBr) ν 2955, 2925, 2852, 1658, 1459, 1376 cm^{-1}; ^{1}H NMR (500 MHz, C_6D_6) δ 5.17 (br s, 1H), 3.89 (br s, 1H), 2.97 (ddd, *J* = 1.2, 4.7, 11.6 Hz, 1H), 2.15 (ddd, *J* = 5.2, 9.9, 9.9 Hz, 1H), 2.04 (br t, *J* = 14.4 Hz, 1H), 1.99 (dddd, *J* = 1.6, 9.1, 12.1, 12.1 Hz, 1H), 1.80 (dddd, *J* = 1.9, 5.2, 9.1, 11.1 Hz, 1H), 1.59 (s, 3H), 1.60-1.53 (m, 1H), 1.40-1.20 (m, 6H), 1.30 (d, *J* = 7.1 Hz, 3H), 0.81 (d, *J* = 6.5 Hz, 3H). ^{13}C NMR (125 MHz, C_6D_6) δ 129.91 (C), 126.79 (C), 60.97 (CH), 58.95 (CH), 57.02 (CH), 36.35 (CH_2), 33.34 (CH), 33.11 (CH), 30.13 (CH_2), 29.17 (CH_2), 28.72 (CH_2), 24.15 (CH_3), 20.76 (CH_3), 19.41 (CH_3). HRMS calcd for $C_{14}H_{24}N$: 206.19033 Found: 206.19045 (MH^+).

Summary of previously published synthesis of alkaloid 205B

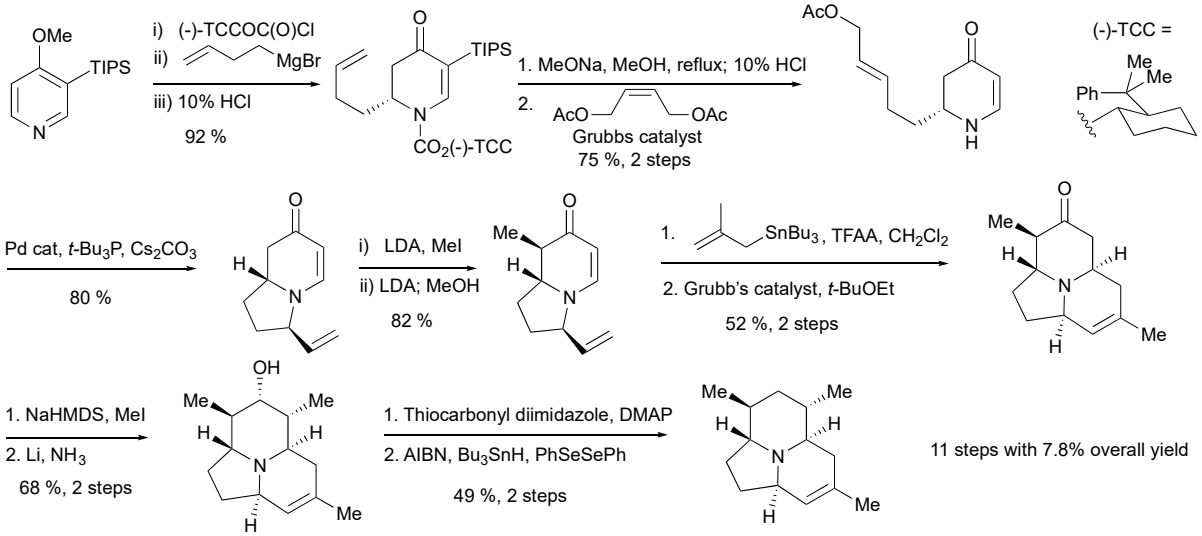
Toyooka's synthesis (ref 3a) :



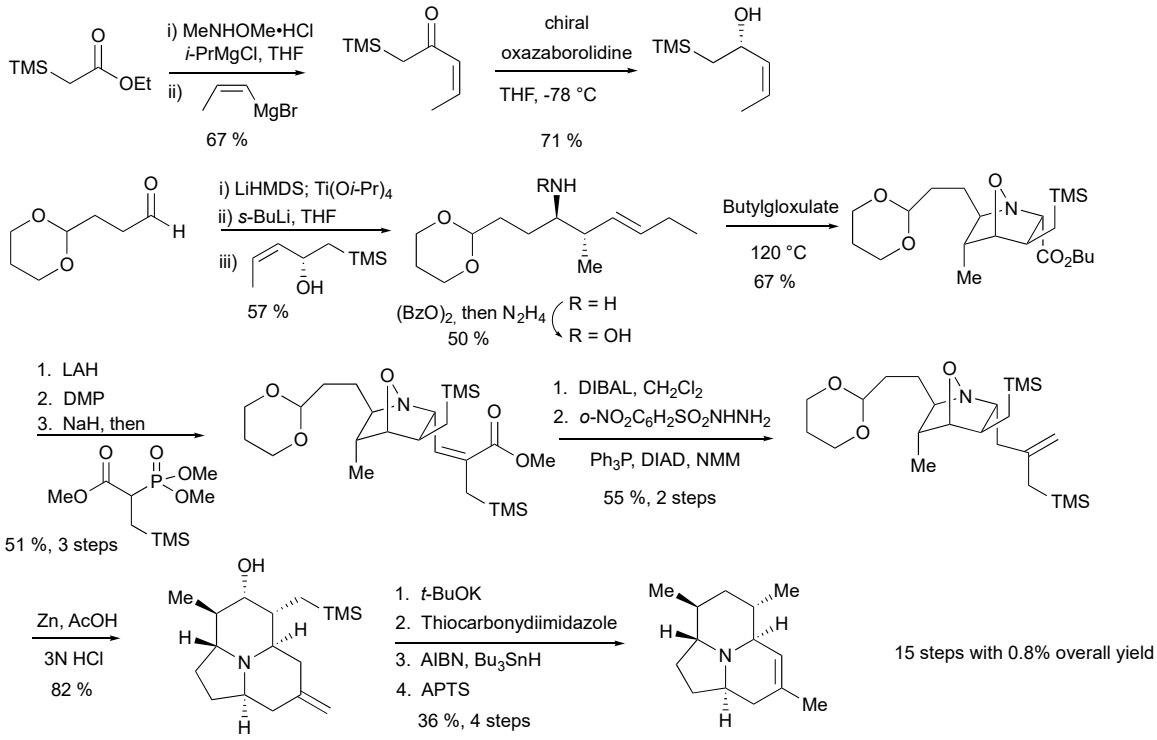
Smith's synthesis (ref 3b) :



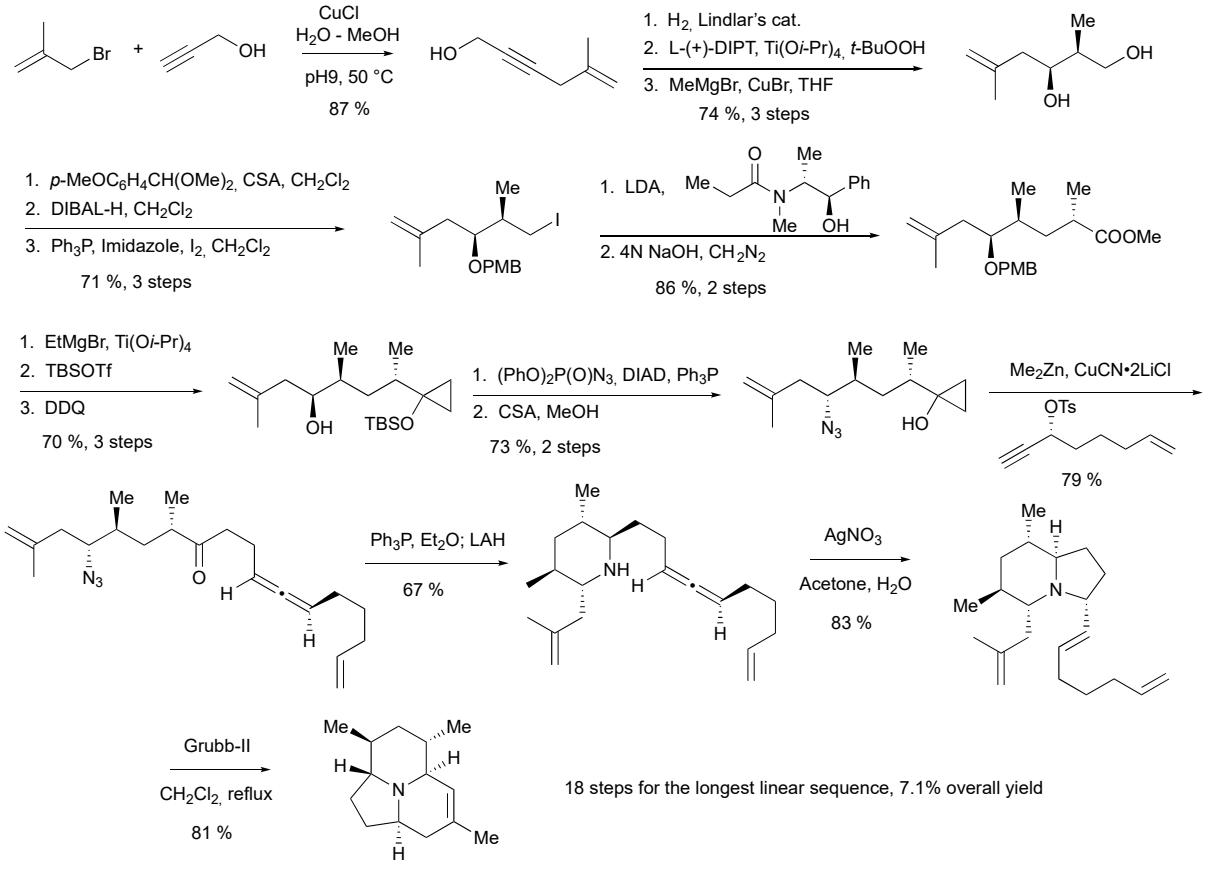
Comins's synthesis (ref 3d) :



Micalizio's synthesis (ref 3f) :



Cha's synthesis (ref 3g) :



Comparison Tables of NMR Data of 1

In $CDCl_3$:

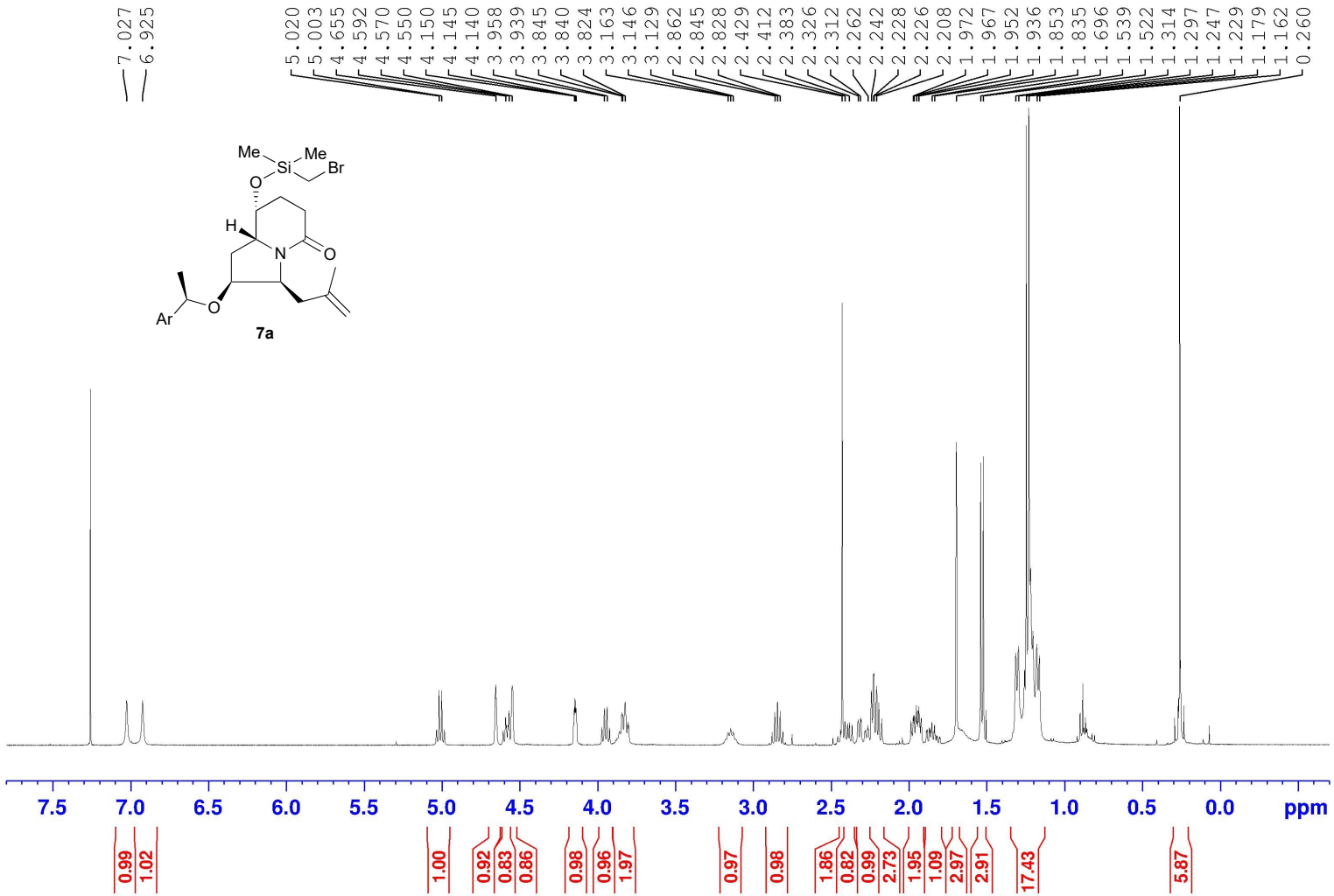
1H NMR				
Ref 1	Ref 3a	Ref 3b	Ref 3d	Ref 3f
Natural product	(500 MHz, CDCl3) 5.20 (br, 1H) 3.80 (br, 1H) 3.00 (dd, *J* = 11.2, 4.5 Hz, 1H) 2.12- 2.18 (m, 3H)	(500 MHz, CDCl3) 5.18 (br s, 1H) 3.79 (br s, 1H) 2.98 (dd, *J* = 11.4, 4.6 Hz, 1H) 2.17–2.10 (m, 3H)	(400 MHz, CDCl3) 5.18 (bs, 1H) 3.79 (bs, 1H) 2.98 (dd, *J* = 4.6, 11.2 Hz, 1H) 2.17–2.10 (m, 3H)	(400 MHz, CDCl3) 5.18 (bs, 1H) 3.76 (br, 1H) 2.98 (dd, *J* = 4.4, 12.0 Hz, 1H) 2.13–2.09 (m, 3H)
Detailed description not given	1.92 (m, 1H) 1.72 (m, 1H) 1.64 (s, 3H) 1.27-1.52 (m, 4H) 1.19 (d, *J* = 7.3 Hz, 3H) 0.86 (d, *J* = 6.4 Hz, 3H)	1.93–1.88 (m, 1H) 1.79–1.71 (m, 1H) 1.62 (s, 3H), 1.49–1.26 (m, 6H) 1.18 (d, *J* = 7.2 Hz, 3H) 0.84 (d, *J* = 6.4 Hz, 3H)	1.94 – 1.86 (m, 1H) 1.78 – 1.68 (m, 1H) 1.63 (s, 3H) 1.51 – 1.23 (m, 6H) 1.17 (d, *J* = 7.3 Hz, 3H) 0.84 (d, *J* = 6.6 Hz, 3H)	1.91 – 1.88 (m, 1H) 1.74-1.66 (m, 1H) 1.62 (s, 3H) 1.48 – 1.25 (m, 6H) 1.17 (d, *J* = 7.2 Hz, 3H) 0.83 (d, *J* = 6.4 Hz, 3H)

13C NMR				
(100 MHz, CDCl3)	(125 MHz, CDCl3)	(125 MHz, CDCl3)	(100 MHz, CDCl3)	(100 MHz, CDCl3)
129.6	129.52	129.54	129.48	129.54
125.6	125.52	125.56	125.33	125.61
60.6	60.46	60.53	60.54	60.47
58.2	58.04	58.12	57.99	58.09
56.6	56.49	56.24	56.41	56.34
35.6	35.42	35.51	35.39	35.48
32.7	32.55	32.61	32.57	32.58
32.5	32.44	32.43	32.31	32.51
29.3	29.22	29.23	29.09	29.29
28.5	28.38	28.43	28.38	28.41
28.5	28.35	28.43	28.34	28.38
23.5	23.56	23.52	23.53	23.54
20.2	20.19	20.19	20.11	20.21
18.8	18.83	18.82	18.84	18.83

In C_6D_6 :

1H NMR				
Ref 3b	Ref 3d	Ref 3f	Ref 3g	This work
(500 MHz, C6D6)	(400 MHz, C6D6)	(400 MHz, C6D6)	(400 MHz, C6D6)	(500 MHz, C6D6)
5.19 (br s, 1H)	5.19 (bs, 1H)	5.19 (d, *J* = 1.2 Hz, 1H)	5.19 (br s, 1H)	5.17 (br s, 1H)
3.87 (br s, 1H)	3.87 (bs, 1H)	3.87 (br, 1H)	3.86 (m, 1H)	3.89 (br s, 1H)
2.95 (dd, *J* = 4.6, 11.5 Hz, 1H)	2.95 (dd, *J* = 4.8, 14.2 Hz, 1H)	2.95 (dd, *J* = 4.4, 11.6 Hz, 1H)	2.95 (dd, *J* = 11.7, 4.8 Hz, 1H)	2.97 (ddd, *J* = 1.2, 4.7, 11.6 Hz, 1H)
2.15 (dd, *J* = 5.2, 9.8 Hz, 1H)	2.15 (dt, *J* = 5.1, 9.8 Hz, 1H)	2.15 (td, *J* = 4.8, 9.6 Hz, 1H)	2.15 (dd, *J* = 9.8, 4.8 Hz, 1H)	2.15 (ddd, *J* = 5.2, 9.9, 9.9 Hz, 1H)
2.06 (app t, *J* = 14.3 Hz, 1H)	2.05 (bt, *J* = 15.0 Hz, 1H)	2.06 (t, *J* = 14.8 Hz, 1H)	2.06 (br t, *J* = 14.6 Hz, 1H)	2.04 (br t, *J* = 14.4 Hz, 1H)
2.02–1.95 (m, 1H)	2.02–1.95 (m, 1H)	2.01–1.95 (td, *J* = 2.4, 10.0 Hz, 1H)	2.02–1.95 (m, 1H)	1.99 (dddd, *J* = 1.6, 9.1, 12.1, 12.1 Hz, 1H)
1.84–1.79 (m, 1H)	1.84–1.78 (m, 1H)	1.82–1.78 (m, 1H)		1.80 (dddd, *J* = 1.9, 5.2, 9.1, 11.1 Hz, 1H)
1.60–1.53 (m, 1H)	1.60–1.52 (m, 1H)	1.60–1.53 (m, 1H)	1.60–1.52 (m, 1H)	1.60-1.53 (m, 1H)
1.59 (s, 3H)	1.59 (s, 3H)	1.59 (s, 3H)	1.59 (s, 3H)	1.59 (s, 3H)
1.39- 1.21 (m, 6H)	1.40–1.23 (m, 6H)	1.36–1.23 (m, 6H)	1.39–1.21 (m, 6H)	1.40–1.20 (m, 6H)
1.29 (d, *J* = 7.1 Hz, 3H)	1.29 (d, *J* = 7.0 Hz, 3H)	1.29 (d, *J* = 7.2 Hz, 3H)	1.29 (d, *J* = 6.8 Hz, 3H)	1.30 (d, *J* = 7.1 Hz, 3H)
0.81 (d, *J* = 6.6 Hz, 3H)	0.81 (d, *J* = 6.6 Hz, 3H)	0.81 (d, *J* = 6.8 Hz, 3H)	0.81(d, *J* = 6.8 Hz, 3H)	0.81 (d, *J* = 6.5 Hz, 3H)

13C NMR				
(125 MHz, C6D6)	(100 MHz, C6D6)	(100 MHz, C6D6)	(150 MHz, C6D6)	(125 MHz, C6D6)
129.94	129.92	129.90	129.90	129.91
126.85	126.81	126.85	129.81	129.79
60.99	60.96	60.98	60.94	60.97
59.00	58.96	59.00	58.96	58.95
57.02	56.97	57.01	56.97	57.02
36.39	36.34	36.38	36.34	36.35
33.36	33.34	33.36	33.32	33.34
33.16	33.14	33.16	33.13	33.11
30.18	30.15	30.19	30.15	30.13
29.20	29.18	29.20	29.17	29.17
28.74	28.70	28.73	28.70	28.72
24.15	24.18	24.17	24.14	24.15
20.79	20.79	20.79	20.76	20.76
19.43	19.43	19.42	19.40	19.41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4.140
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3.939
3.845
3.840
3.824
3.163
3.146
3.129
2.862
2.845
2.828
2.429
2.412
2.383
2.326
2.312
2.262
2.242
2.228
2.226
2.208
1.972
1.967
1.952
1.936
1.853
1.835
1.696
1.539
1.522
1.314
1.297
1.247
1.229
1.179
1.162
0.260
Me
Si
Me
Br
O
H
N
O
Ar
O
7a
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
0.99
1.02
1.00
0.92
0.83
0.86
0.98
0.96
1.97
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0.98
1.86
0.82
0.99
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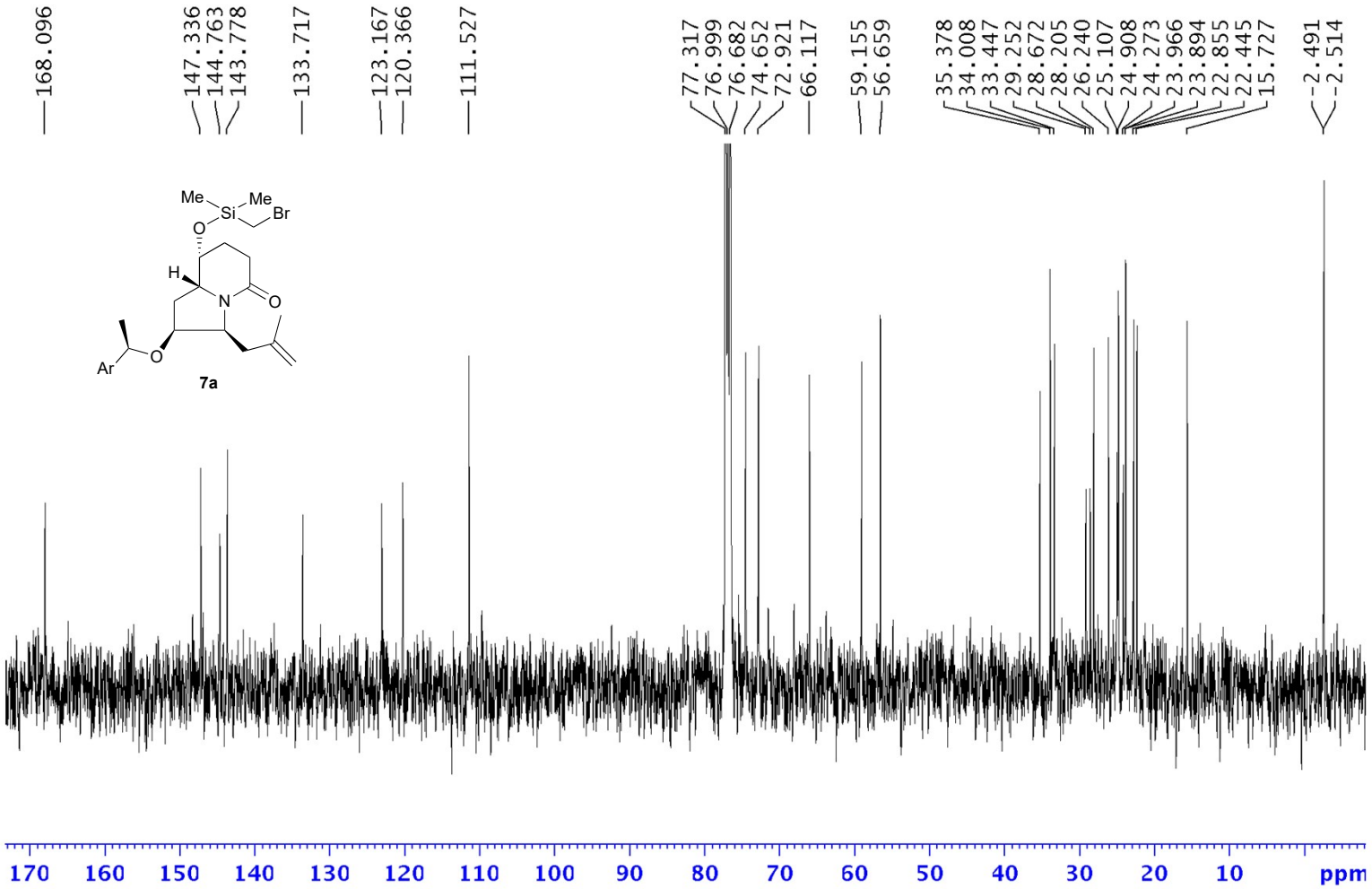
1.95
1.09
2.97
2.91
17.43
5.87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74.652
72.921
66.117
59.155
56.659
35.378
34.008
33.447
29.252
28.672
28.205
26.240
25.107
24.908
24.273
23.966
23.894
22.855
22.445
15.727
2.491
2.514
Me
Si
Me
Br
O
H
N
O
Ar
O
7a
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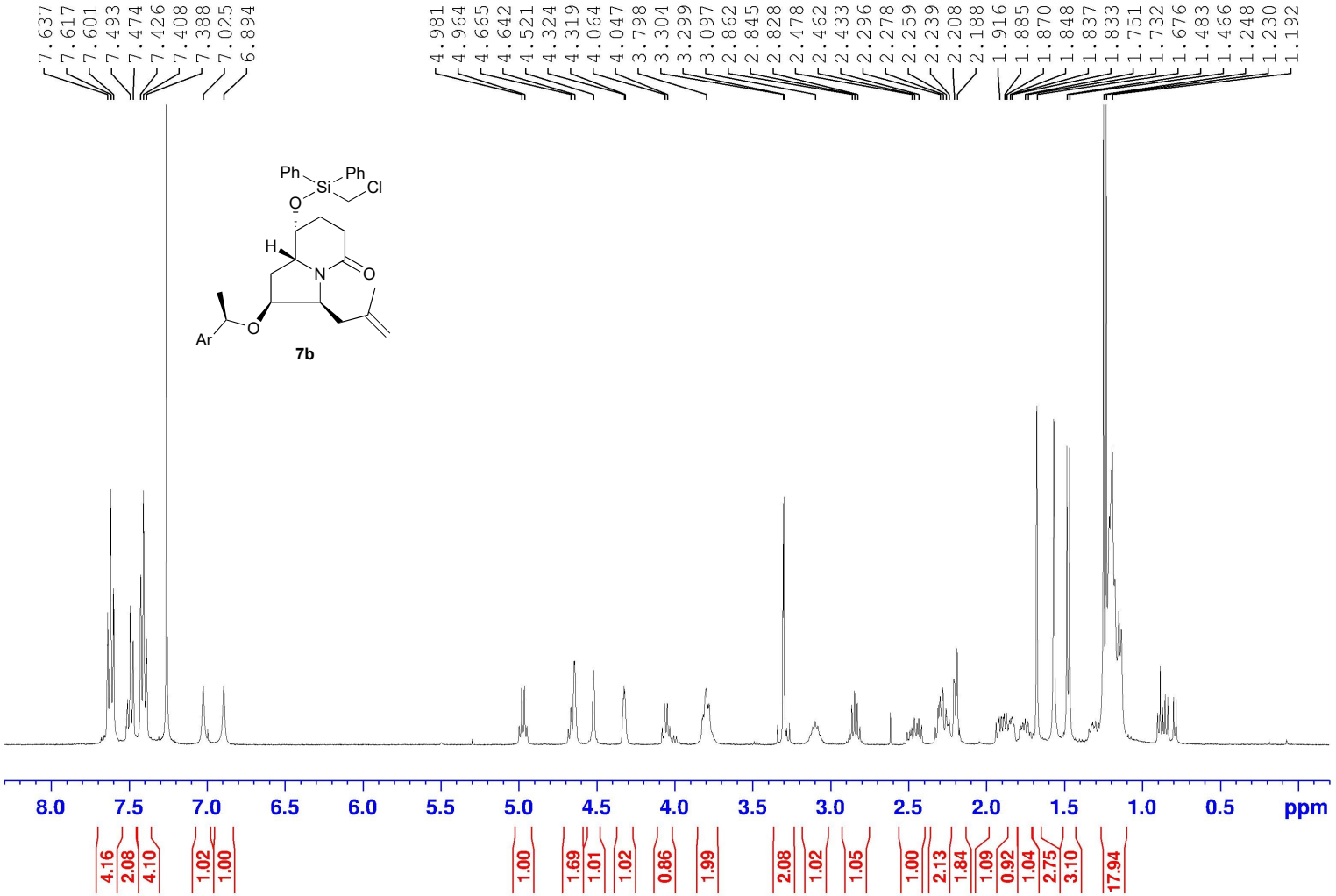
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm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4.665
4.642
4.521
4.324
4.319
4.064
4.047
3.798
3.304
3.299
3.097
2.862
2.845
2.828
2.478
2.462
2.433
2.296
2.278
2.259
2.239
2.208
2.188
1.916
1.885
1.870
1.848
1.837
1.833
1.751
1.732
1.676
1.483
1.466
1.248
1.230
1.192
Ph
Si
Ph
Cl
O
H
N
O
Ar
O
7b
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
4.16
2.08
4.10
1.02
1.00
1.00
1.69
1.01
1.02
0.86
1.99
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1.00
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1.09
0.92
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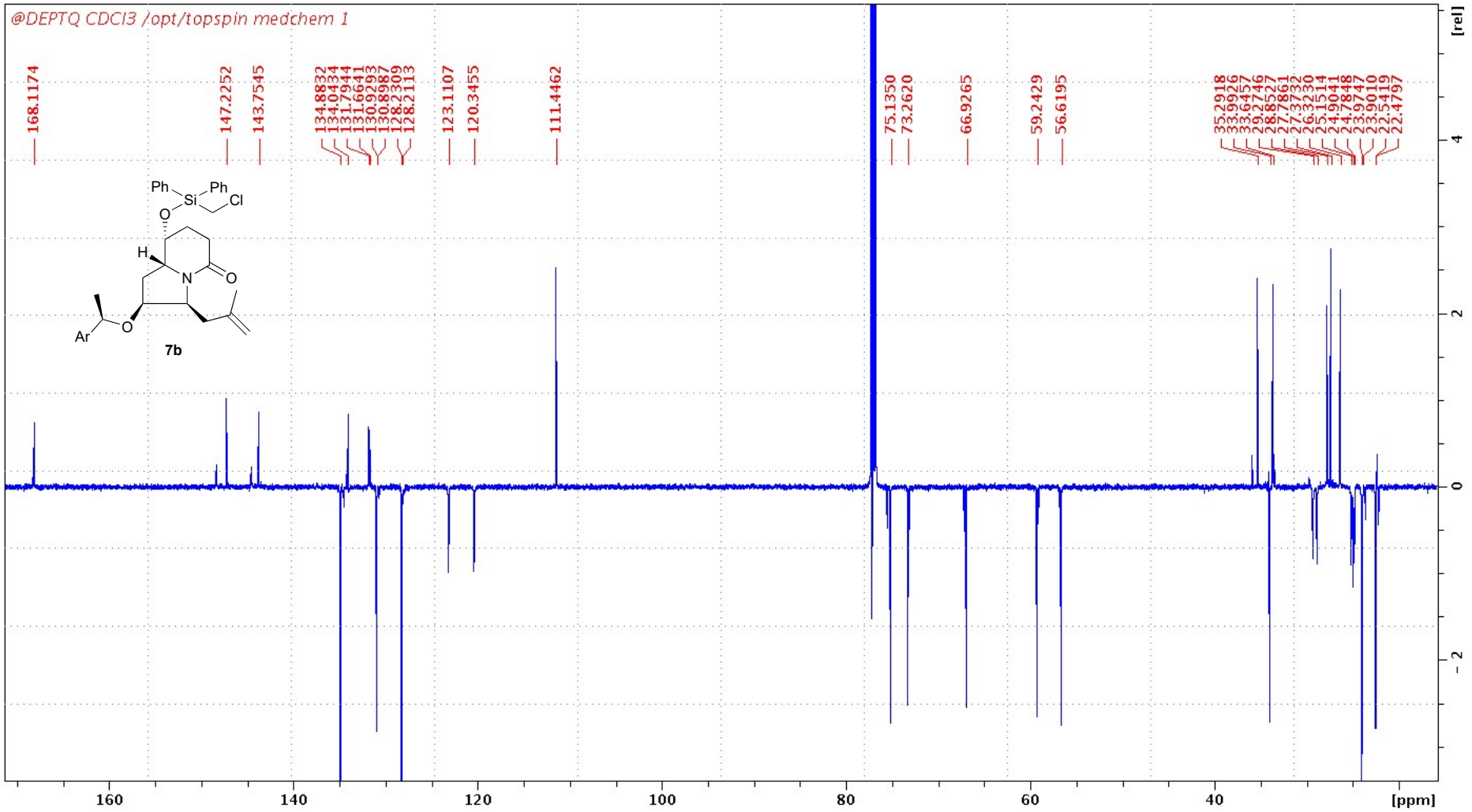
3.10
17.94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130.8887
128.2309
128.2113
123.1107
120.3455
111.4462
75.1350
73.2620
66.9265
59.2429
56.6195
35.2918
33.9929
33.6457
29.2746
28.8527
27.7861
27.3732
26.3230
25.1514
24.9041
24.7848
23.9747
23.9010
22.5419
22.4797
Ph
Si
Ph
Cl
O
H
N
O
O
Ar
7b
[rel]
4
2
0
– 2
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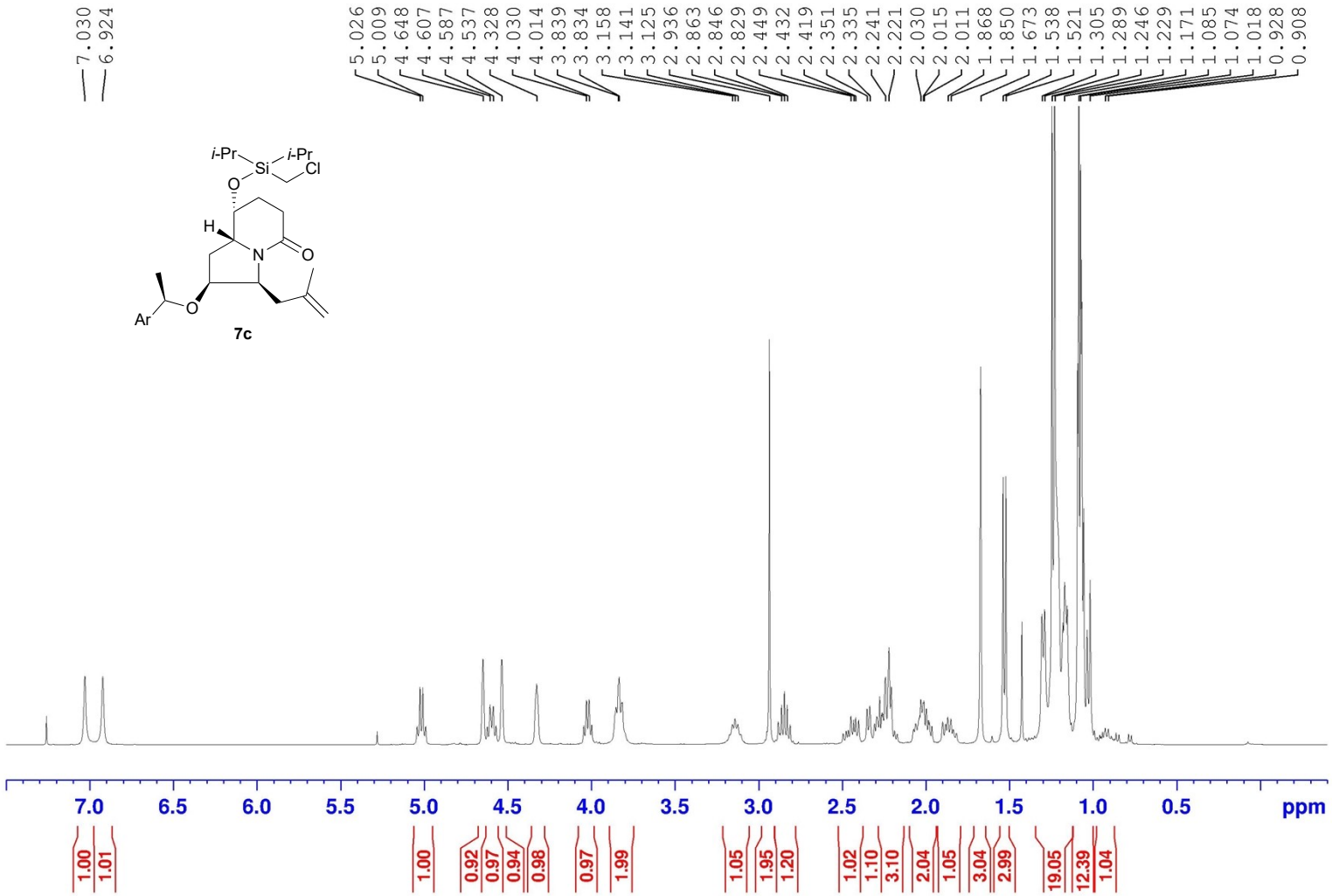
140
120
100
80
60
40
[ppm]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5.026
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4.607
4.587
4.537
4.328
4.030
4.014
3.839
3.834
3.158
3.141
3.125
2.936
2.863
2.846
2.829
2.449
2.432
2.419
2.351
2.335
2.241
2.221
2.030
2.015
2.011
1.868
1.850
1.673
1.538
1.521
1.305
1.289
1.246
1.229
1.171
1.085
1.074
1.018
0.928
0.908
i-Pr
Si
i-Pr
Cl
O
H
N
O
Ar
O
7c
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.00
1.01
1.00
0.92
0.97
0.94
0.98
0.97
1.99
1.05
1.95
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1.10
3.10
2.04
1.05
3.04
2.99
19.05
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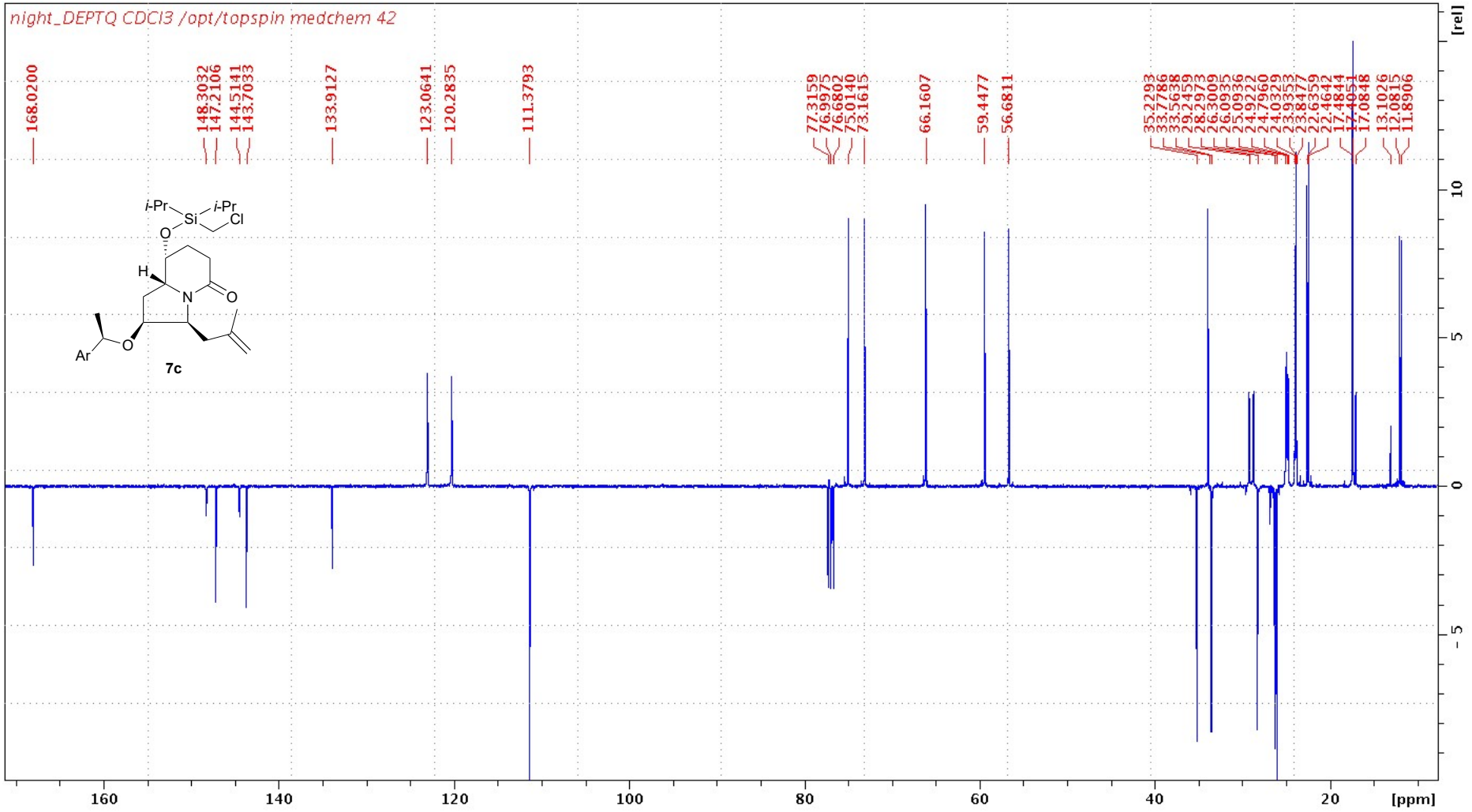
1.04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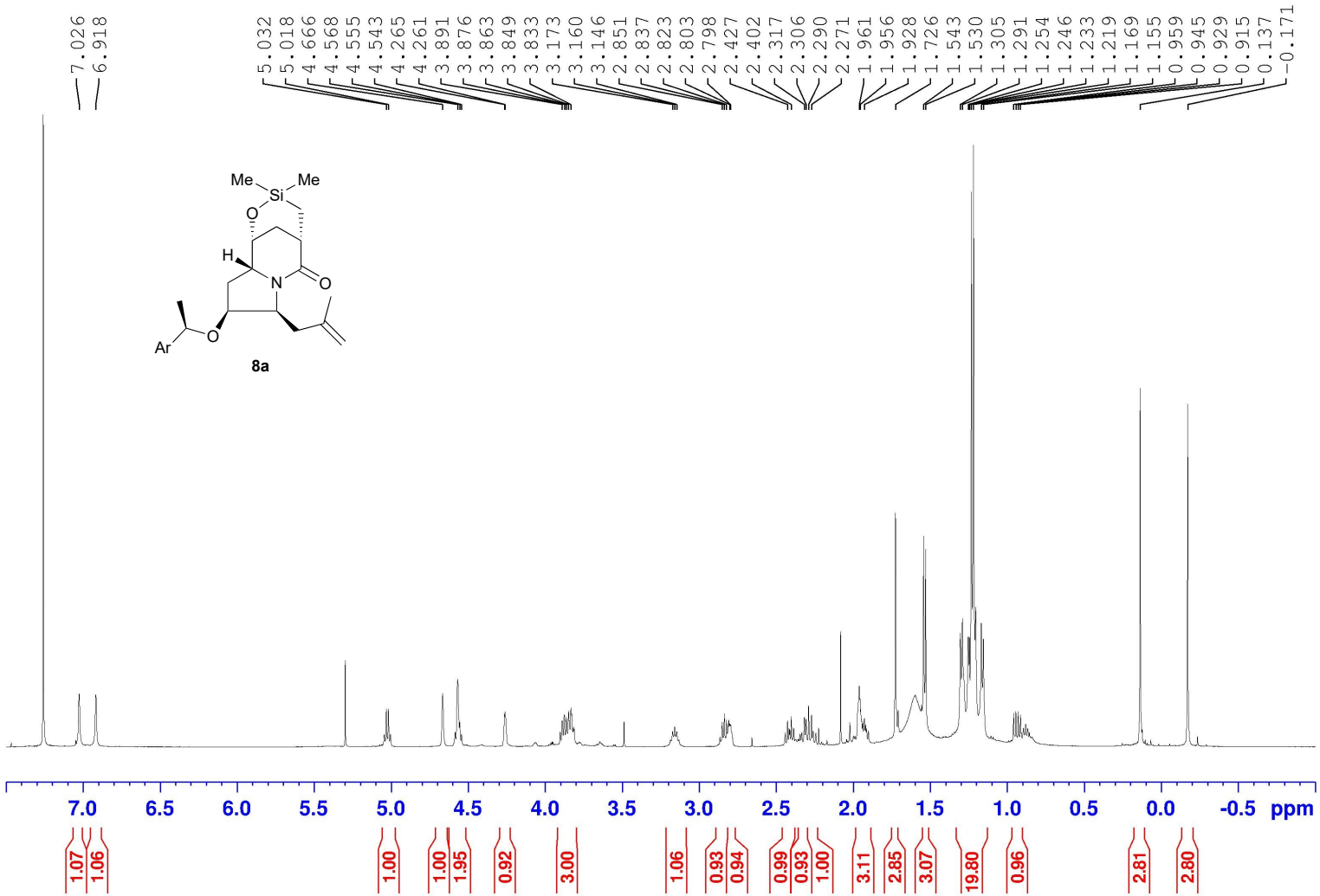
76.9975
76.6802
75.0140
73.1615
66.1607
59.4477
56.6811
35.2293
33.7786
33.5638
29.2459
28.2973
26.3009
26.0935
25.0936
24.9222
24.7960
24.0329
23.9353
23.8477
22.6359
22.4642
17.4844
17.4051
17.0848
13.1026
12.0815
11.8906
i-Pr
Si
i-Pr
Cl
O
H
N
O
O
Ar
7c
[rel]
10
5
0
– 5
160
140
120
100
80
60
40
20
[ppm]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5.018
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4.555
4.543
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4.261
3.891
3.876
3.863
3.849
3.833
3.173
3.160
3.146
2.851
2.837
2.823
2.803
2.798
2.427
2.402
2.317
2.306
2.290
2.271
1.961
1.956
1.928
1.726
1.543
1.530
1.305
1.291
1.254
1.246
1.233
1.219
1.169
1.155
0.959
0.945
0.929
0.915
0.137
-0.171
Me
Si
Me
O
H
N
O
Ar
O
8a
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
ppm
1.07
1.06
1.00
1.00
1.95
0.92
3.00
1.06
0.93
0.94
0.99
0.93
1.00
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3.07
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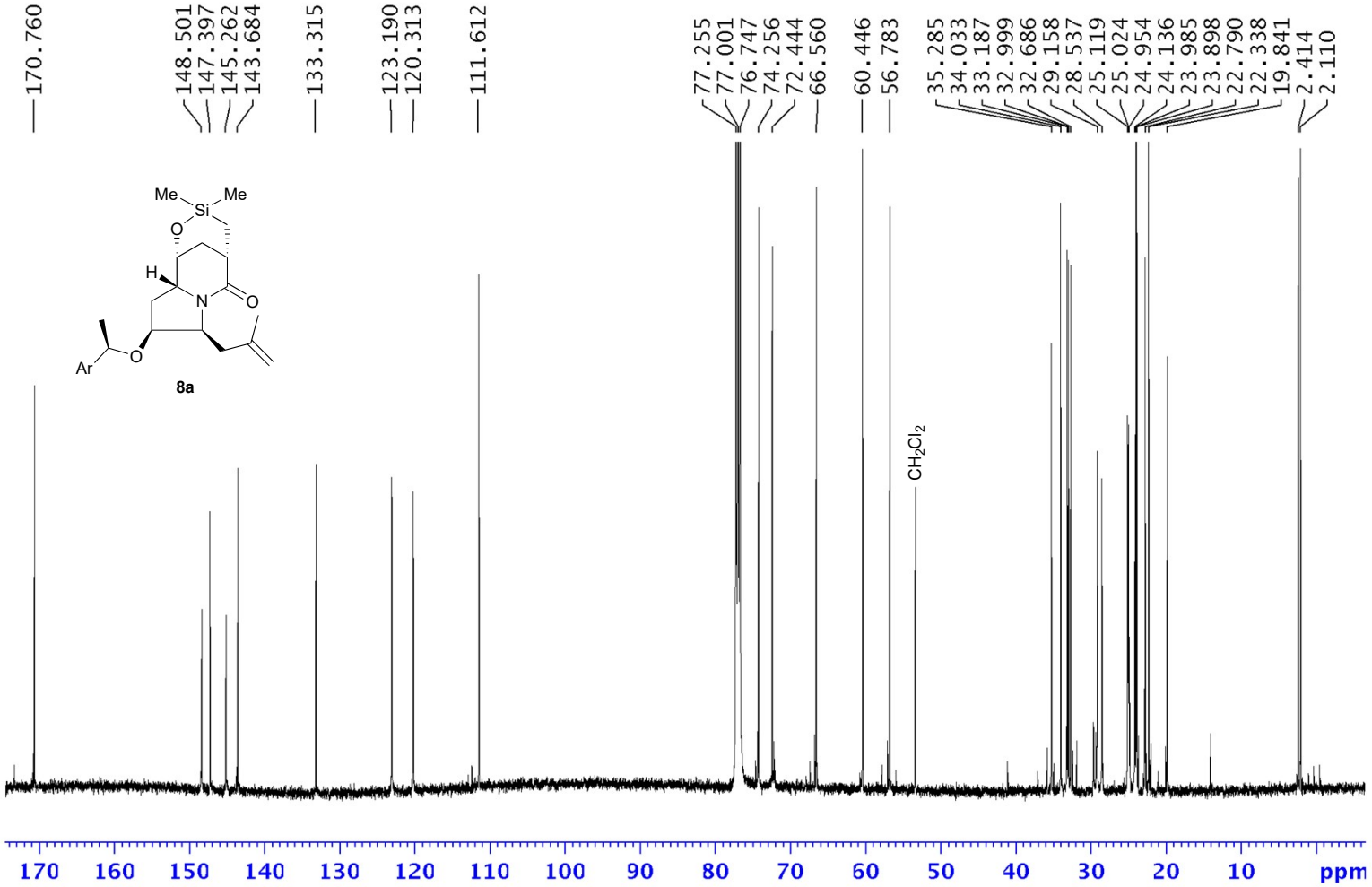
0.96
2.81
2.80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120.313
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76.747
74.256
72.444
66.560
60.446
56.783
35.285
34.033
33.187
32.999
32.686
29.158
28.537
25.119
25.024
24.954
24.136
23.985
23.898
22.790
22.338
19.841
2.414
2.110
CH2Cl2
Me
Si
Me
O
H
N
O
Ar
O
8a
170
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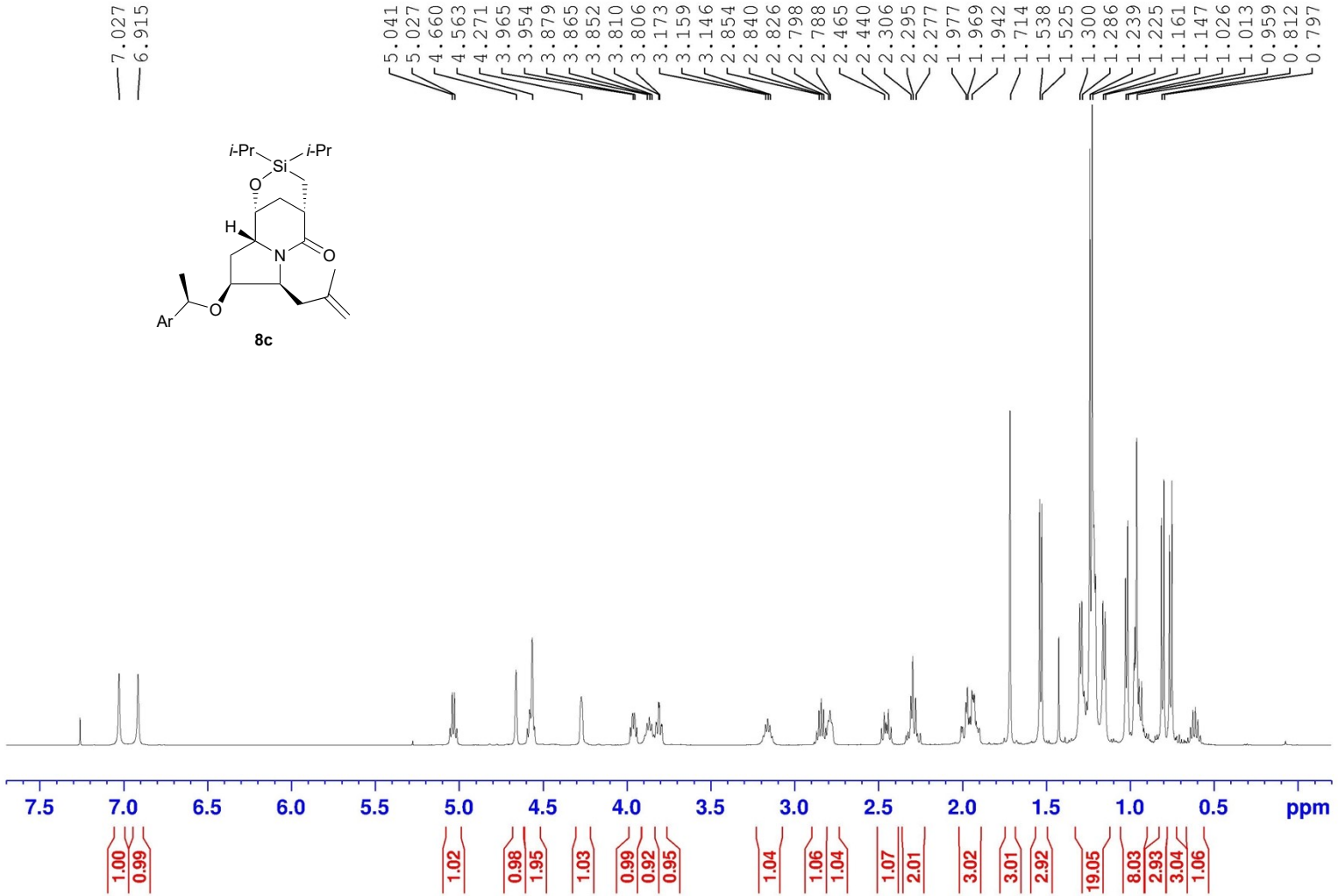
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm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5.027
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3.965
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3.879
3.865
3.852
3.810
3.806
3.173
3.159
3.146
2.854
2.840
2.826
2.798
2.788
2.465
2.440
2.306
2.295
2.277
1.977
1.969
1.942
1.714
1.538
1.525
1.300
1.286
1.239
1.225
1.161
1.147
1.026
1.013
0.959
0.812
0.797
i-Pr
Si
i-Pr
O
H
N
O
Ar
O
8c
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.00
0.99
1.02
0.98
1.95
1.03
0.99
0.92
0.95
1.04
1.06
1.04
1.07
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3.02
3.01
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19.05
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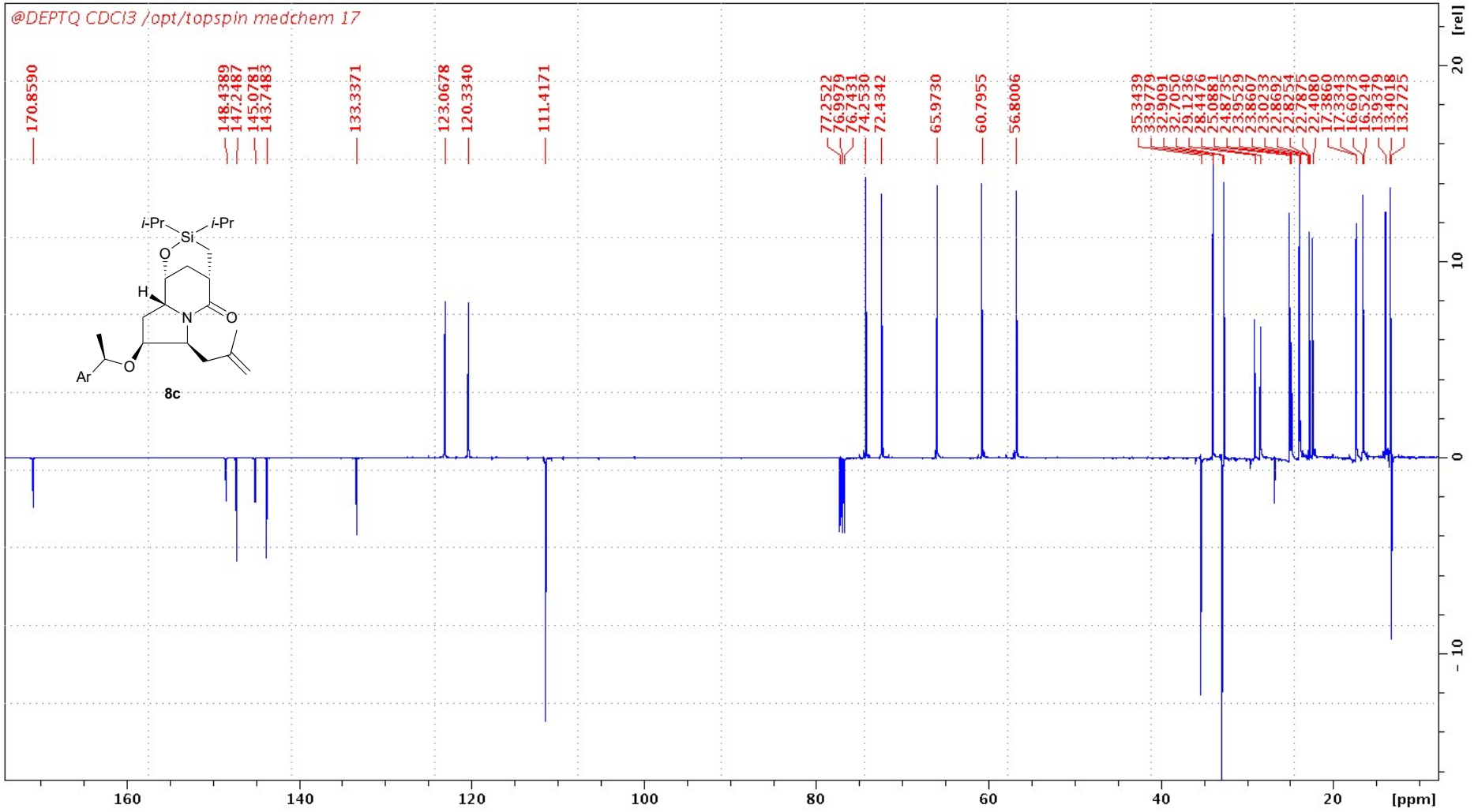
3.04
1.06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76.9979
76.7431
74.2530
72.4342
65.9730
60.7955
56.8006
35.3439
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32.9091
32.7050
29.1236
28.4476
25.0881
24.8735
23.9529
23.8607
23.0233
22.8692
22.8254
22.7875
22.4080
17.3860
17.3343
16.6073
16.5240
13.9379
13.4018
13.2725
i-Pr
Si
i-Pr
O
H
N
O
O
Ar
8c
[rel]
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0
– 10
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120
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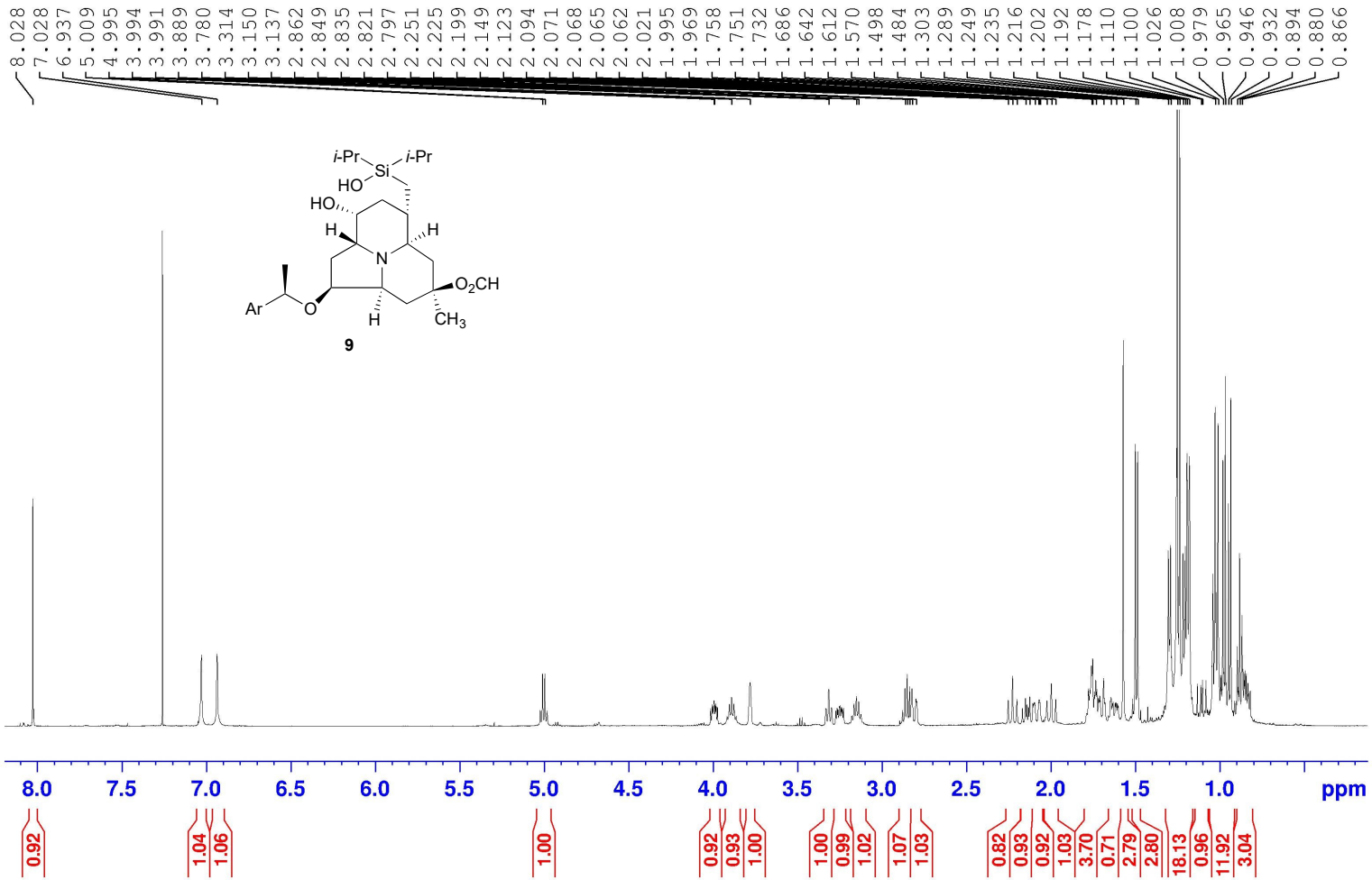
80
60
40
20
[ppm]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7.028
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3.994
3.991
3.889
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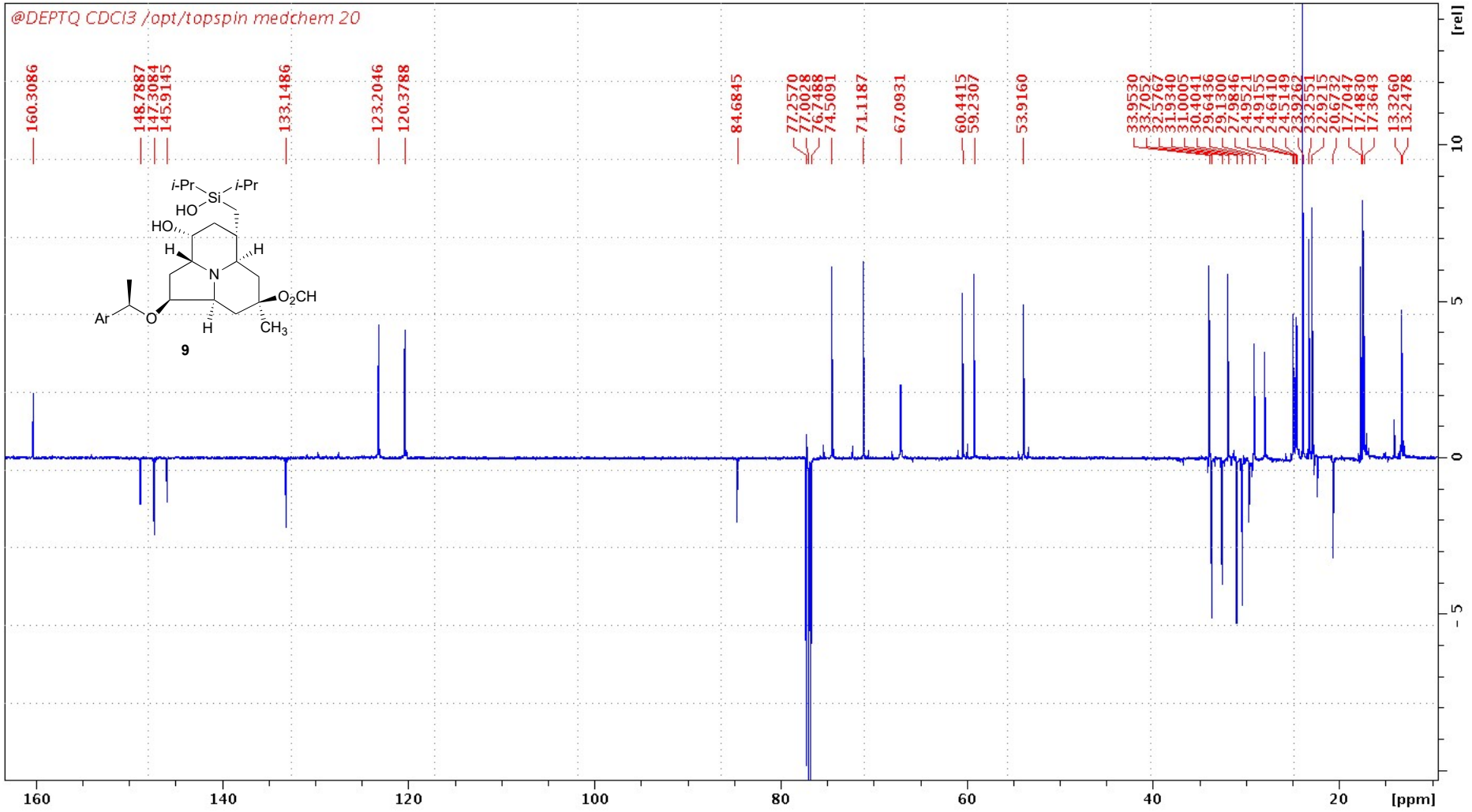
3.314
3.150
3.137
2.862
2.849
2.835
2.821
2.797
2.251
2.225
2.199
2.149
2.123
2.094
2.071
2.068
2.065
2.062
2.021
1.995
1.969
1.758
1.751
1.732
1.686
1.642
1.612
1.570
1.498
1.484
1.303
1.289
1.249
1.235
1.216
1.202
1.192
1.178
1.110
1.100
1.026
1.008
0.979
0.965
0.946
0.932
0.894
0.880
0.866
i-Pr
Si
i-Pr
HO
HO
H
H
N
O2CH
Ar
O
H
CH3
9
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
ppm
0.92
1.04
1.06
1.00
0.92
0.93
1.00
1.00
0.99
1.02
1.07
1.03
0.82
0.93
0.92
1.03
3.70
0.71
2.79
2.80
18.13
0.96
11.92
3.04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84.6845
77.2570
77.0028
76.7488
74.5091
71.1187
67.0931
60.4415
59.2307
53.9160
33.9530
33.7052
32.5767
31.9340
31.0005
30.4041
29.6436
29.1300
27.9846
24.9521
24.9155
24.6410
24.5149
23.9262
23.2551
22.9215
20.6732
17.7047
17.4830
17.3643
13.3260
13.2478
i-Pr
Si
i-Pr
HO
HO
H
H
N
O2CH
Ar
O
H
CH3
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[rel]
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0
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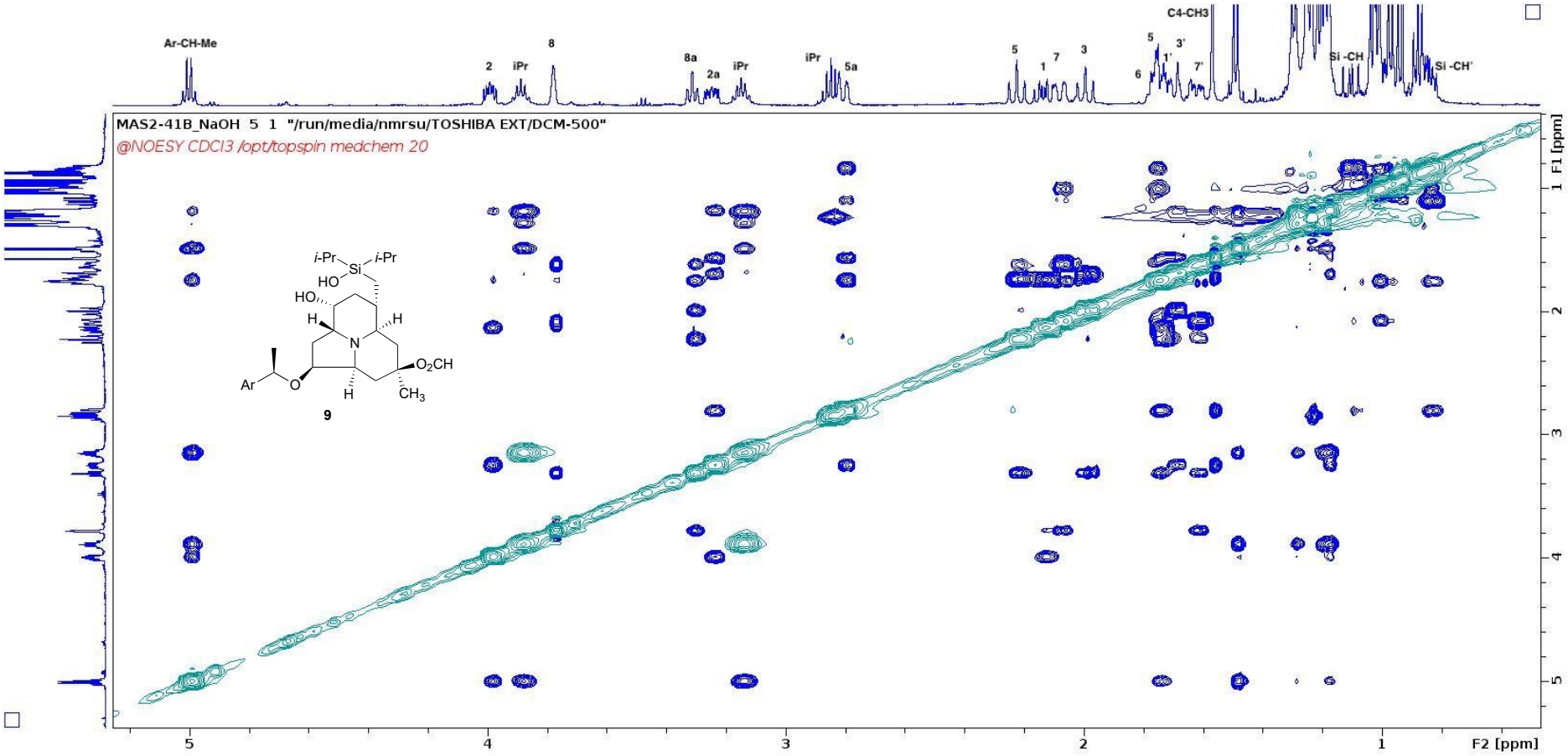
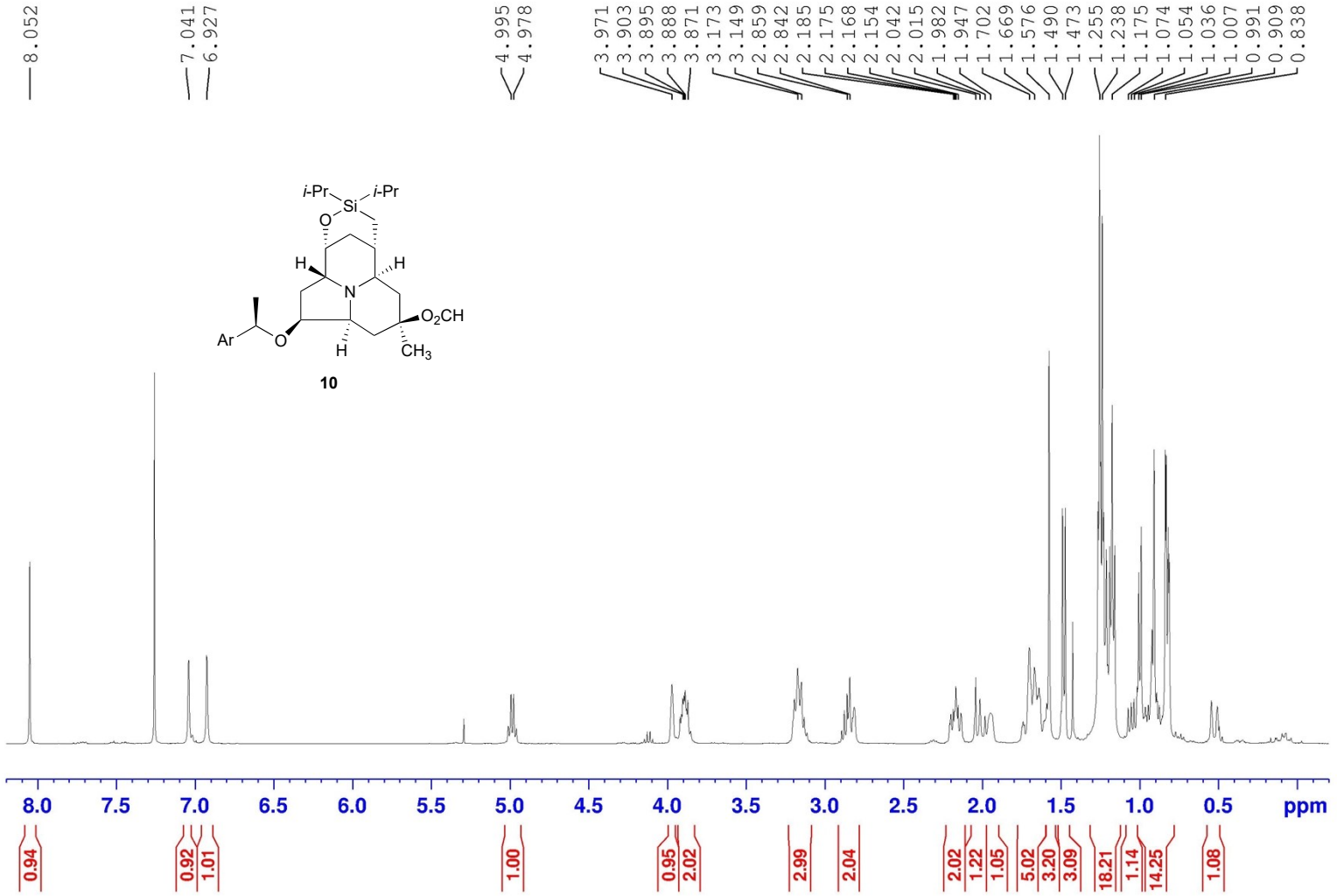
140
120
100
80
60
40
20
[ppm]


Ar-CH-Me
2
iPr
8
8a
2a
iPr
iPr
5a
5
1
7
3
6
5
1'
3'
7'
C4-CH3
Si -CH
Si -CH'
MAS2-41B_NaOH 5 1 "/run/media/nmrsu/TOSHIBA EXT/DCM-500"
@NOESY CDCl3 /opt/topspin medchem 20
i-Pr
Si
i-Pr
HO
HO
H
H
N
O2CH
Ar
O
H
CH3
9
F1 [ppm]
F2 [ppm]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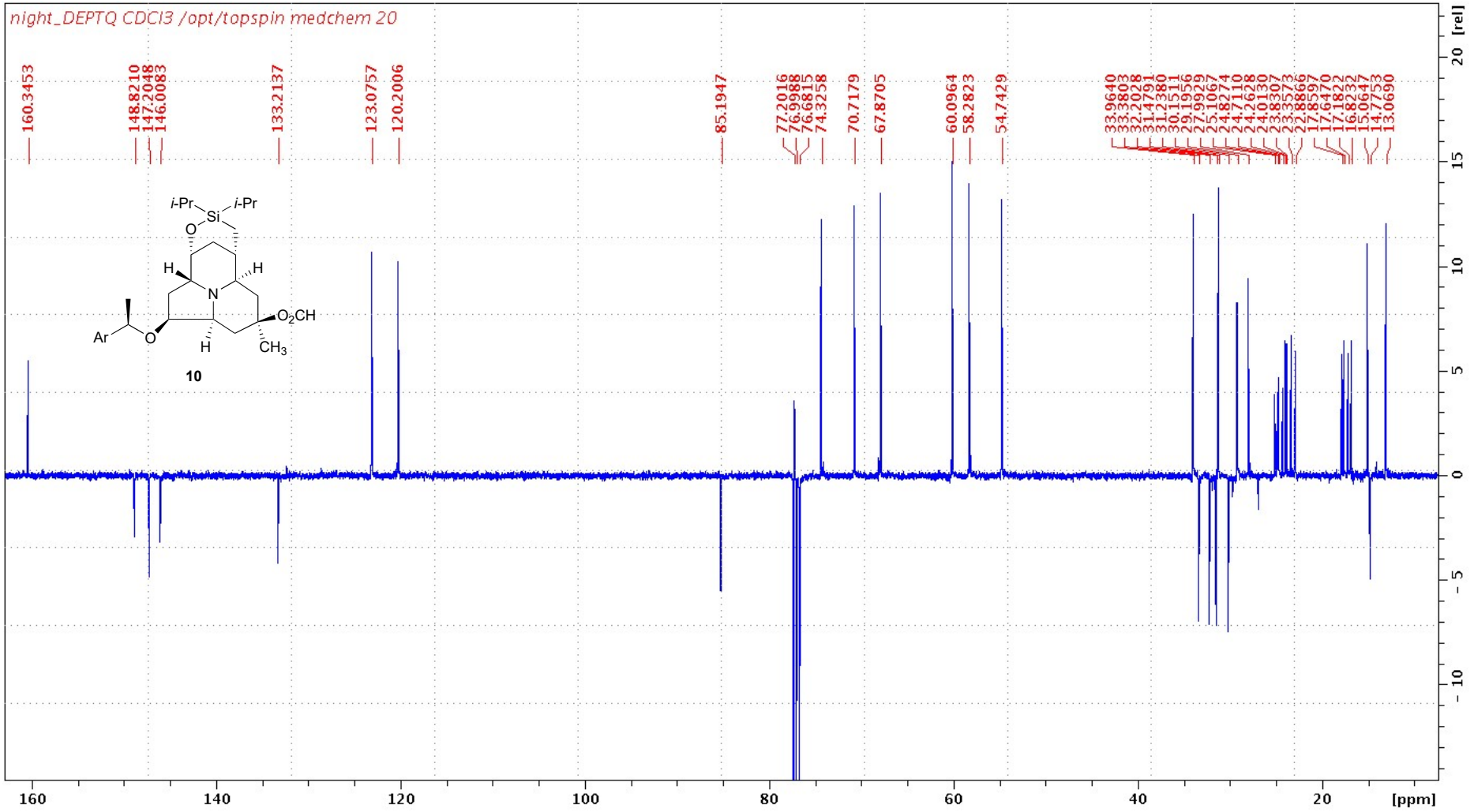
3.149
2.859
2.842
2.185
2.175
2.168
2.154
2.042
2.015
1.982
1.947
1.702
1.669
1.576
1.490
1.473
1.255
1.238
1.175
1.074
1.054
1.036
1.007
0.991
0.909
0.838
i-Pr
Si
i-Pr
O
H
H
N
O2CH
Ar
O
H
CH3
10
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
0.94
0.92
1.01
1.00
0.95
2.02
2.99
2.04
2.02
1.22
1.05
5.02
3.20
3.09
18.21
1.14
14.25
1.08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85.1947
77.2016
76.9988
76.6815
74.3258
70.7179
67.8705
60.0964
58.2823
54.7429
33.9640
33.3803
32.2028
31.4791
31.2380
30.1511
29.1956
27.9929
25.1067
24.8274
24.7110
24.2628
24.0130
23.8307
23.3573
22.8869
17.8597
17.6470
17.1822
16.8232
15.0647
14.7753
13.0690
i-Pr
Si
i-Pr
O
H
H
N
Ar
O
O2CH
H
CH3
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10
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- 5
- 10
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120
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40
20
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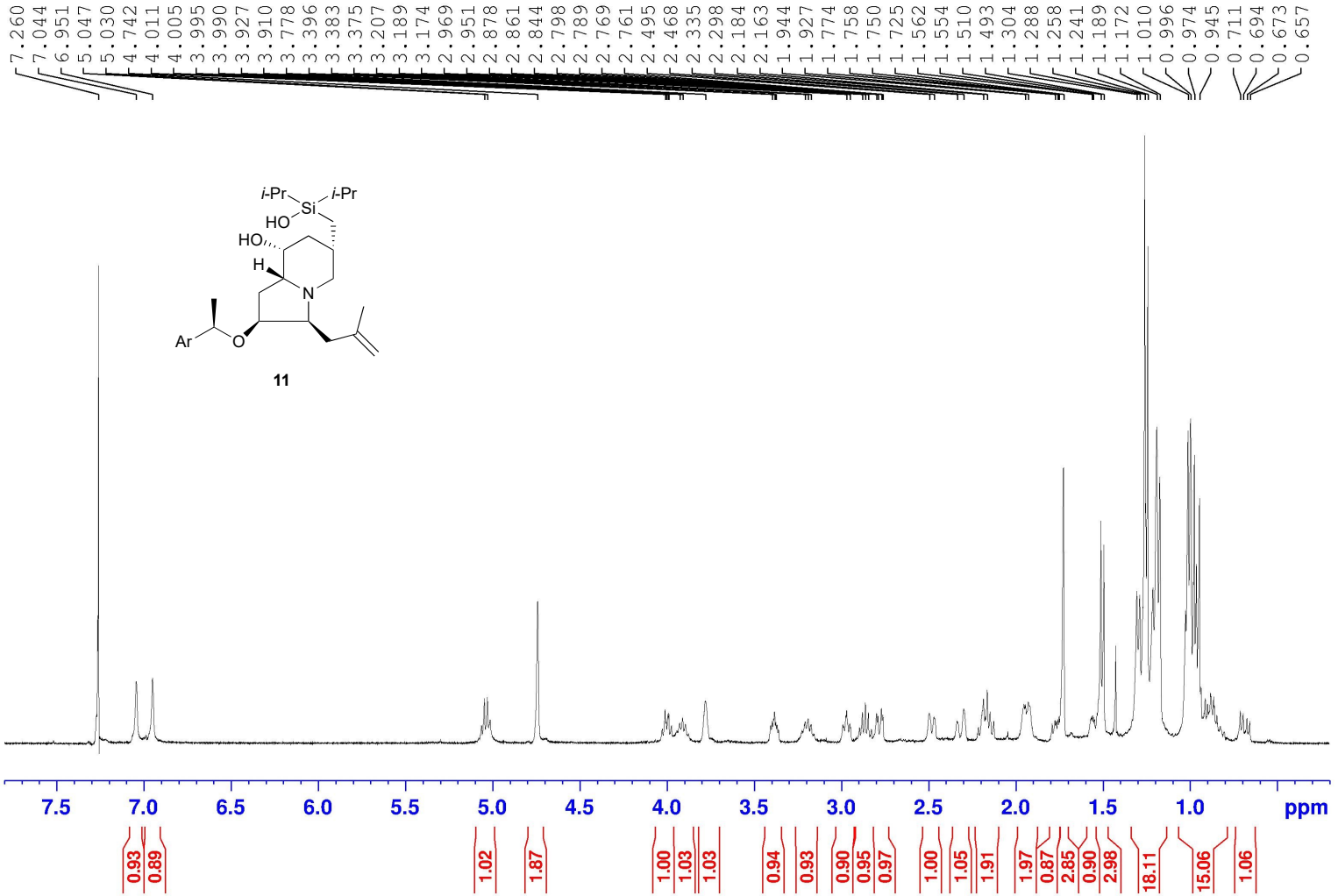
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3.396
3.383
3.375
3.207
3.189
3.174
2.969
2.951
2.878
2.861
2.844
2.798
2.789
2.769
2.761
2.495
2.468
2.335
2.298
2.184
2.163
1.944
1.927
1.774
1.758
1.750
1.725
1.562
1.554
1.510
1.493
1.304
1.288
1.258
1.241
1.189
1.172
1.010
0.996
0.974
0.945
0.711
0.694
0.673
0.657
i-Pr
Si
i-Pr
HO
HO
H
N
Ar
O
11
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7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
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1.0
ppm
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0.89
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1.87
1.00
1.03
1.03
0.94
0.93
0.90
0.95
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0.90
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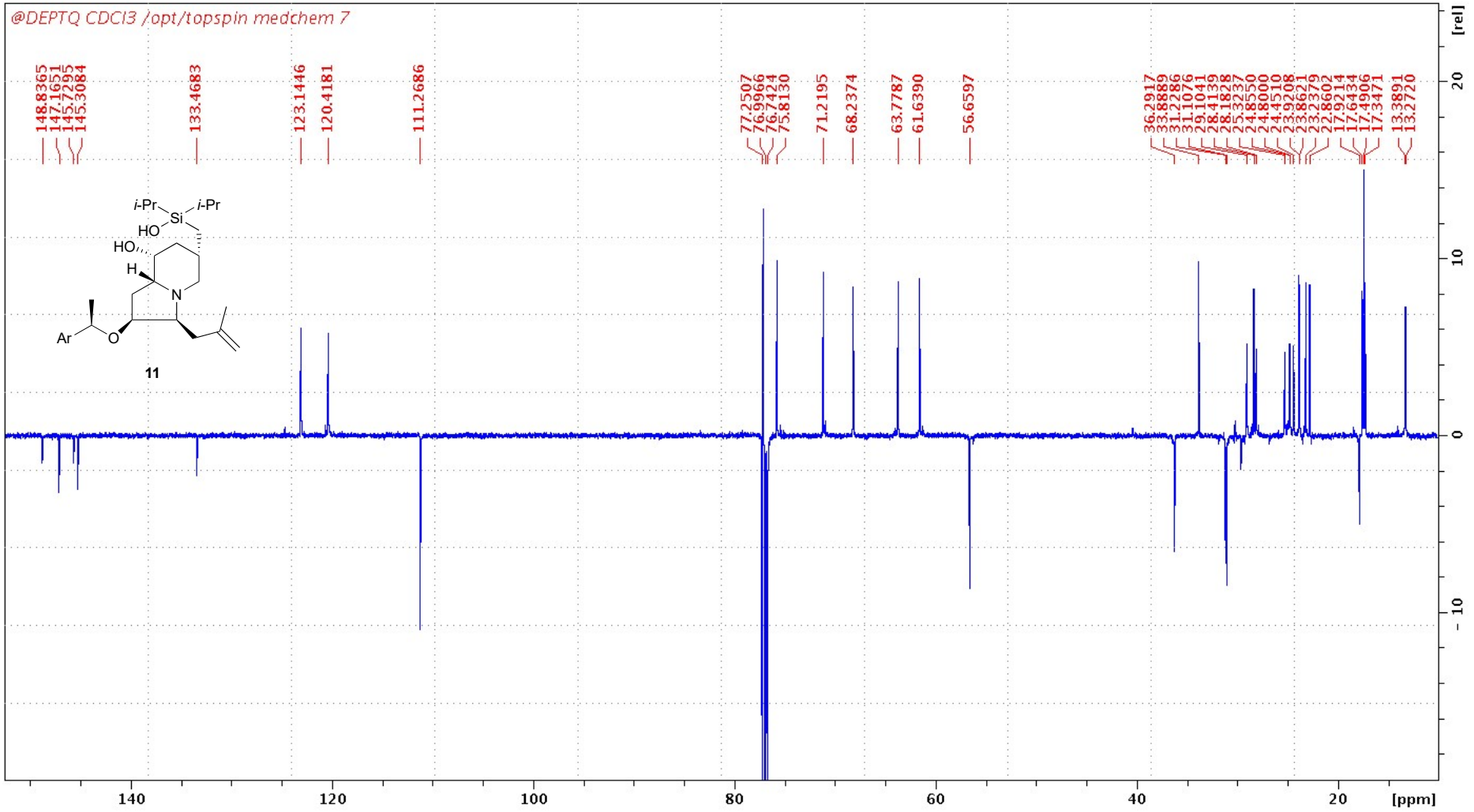
1.06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76.7424
75.8130
71.2195
68.2374
63.7787
61.6390
56.6597
36.2917
33.8889
31.2286
31.1076
29.1041
28.4139
28.1828
25.3237
24.8550
24.8000
24.4510
23.9208
23.8621
23.2379
22.8602
17.9214
17.6434
17.4906
17.3471
13.3891
13.2720
i-Pr
Si
i-Pr
HO
HO
H
N
Ar
O
11
[rel]
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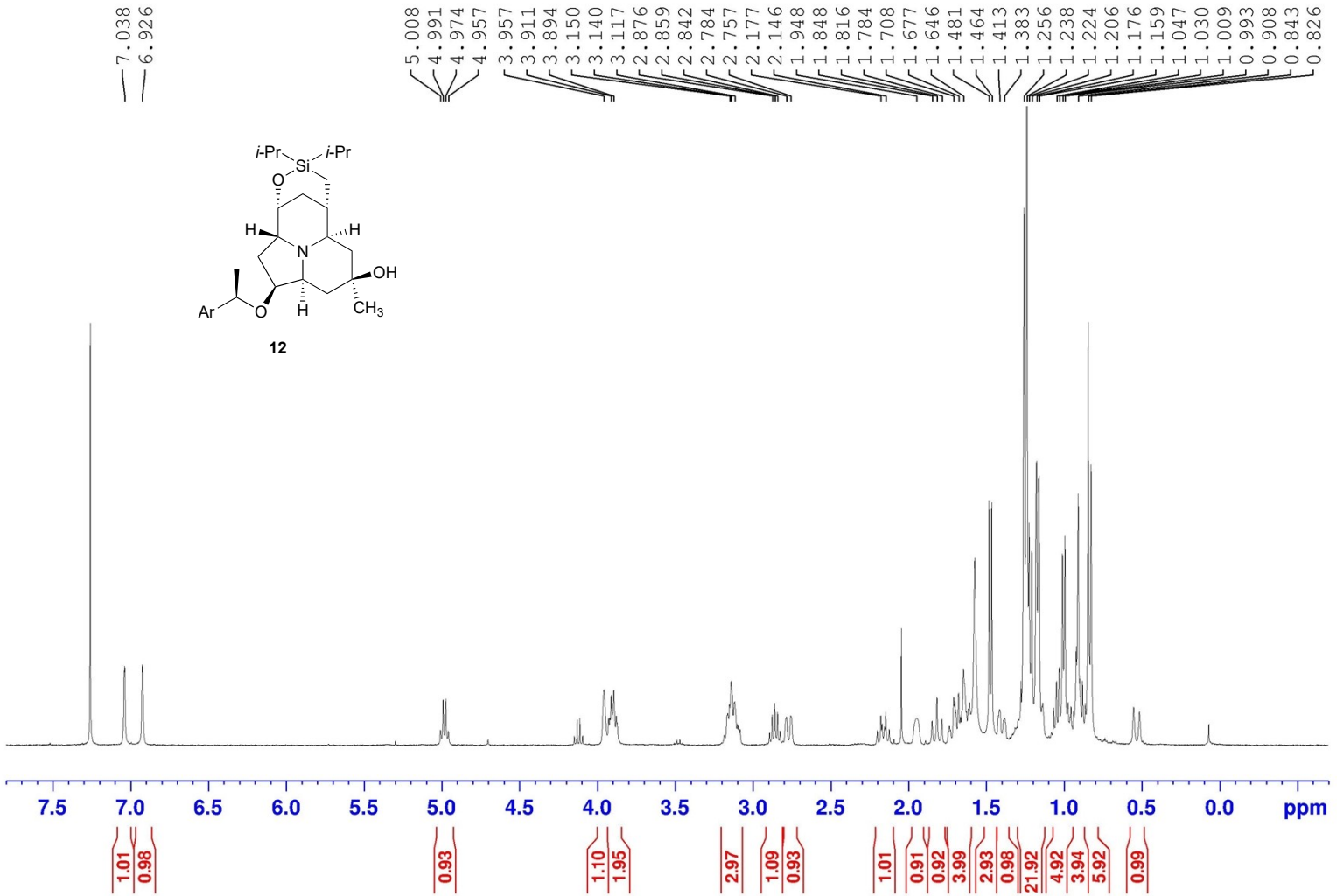
0
– 10
140
120
100
80
60
40
20
[ppm]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3.911
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3.140
3.117
2.876
2.859
2.842
2.784
2.757
2.177
2.146
1.948
1.848
1.816
1.784
1.708
1.677
1.646
1.481
1.464
1.413
1.383
1.256
1.238
1.224
1.206
1.176
1.159
1.047
1.030
1.009
0.993
0.908
0.843
0.826
i-Pr
Si
i-Pr
O
H
H
N
OH
Ar
O
H
CH3
12
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
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0.98
0.93
1.10
1.95
2.97
1.09
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1.01
0.91
0.92
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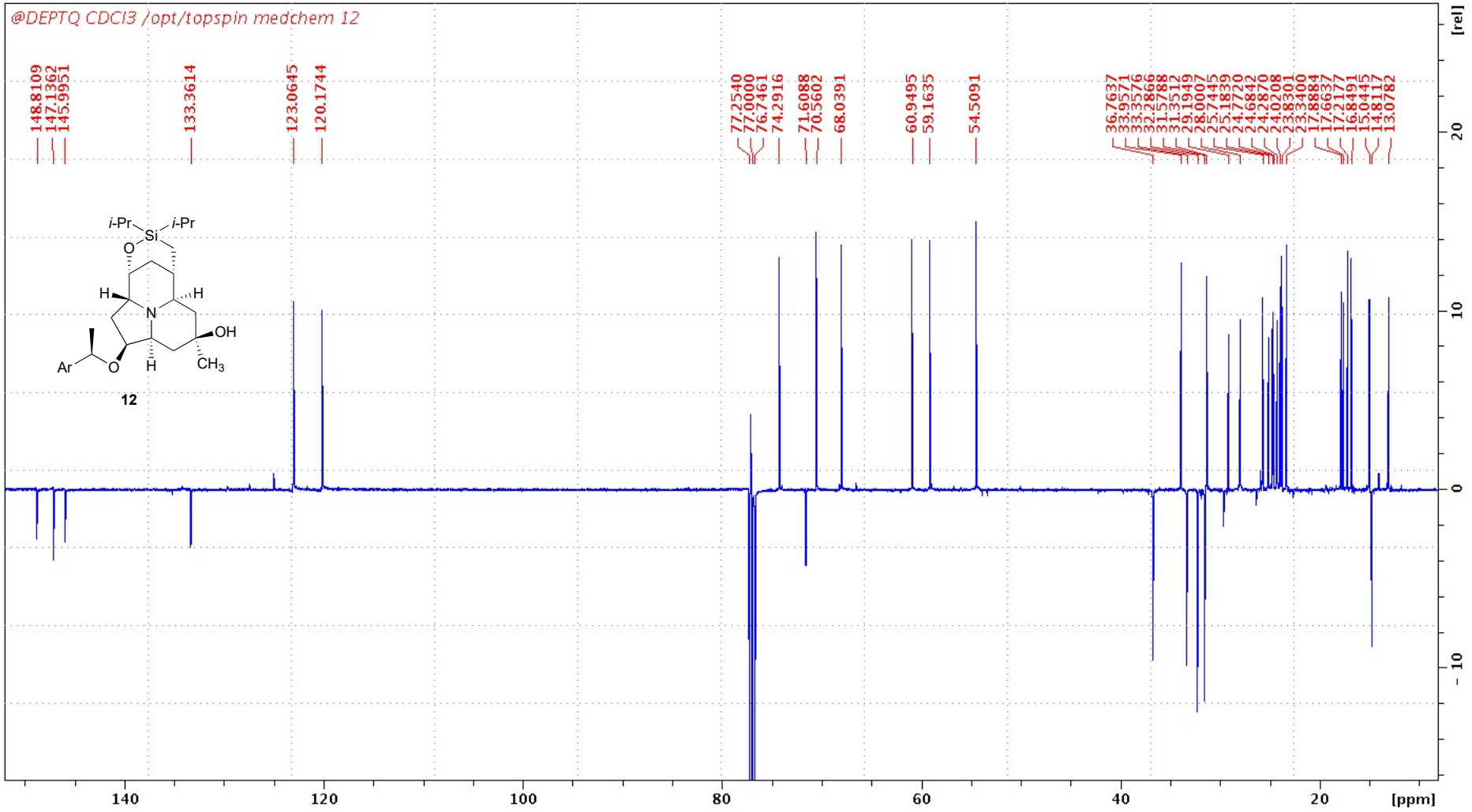
5.92
0.99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76.7461
74.2916
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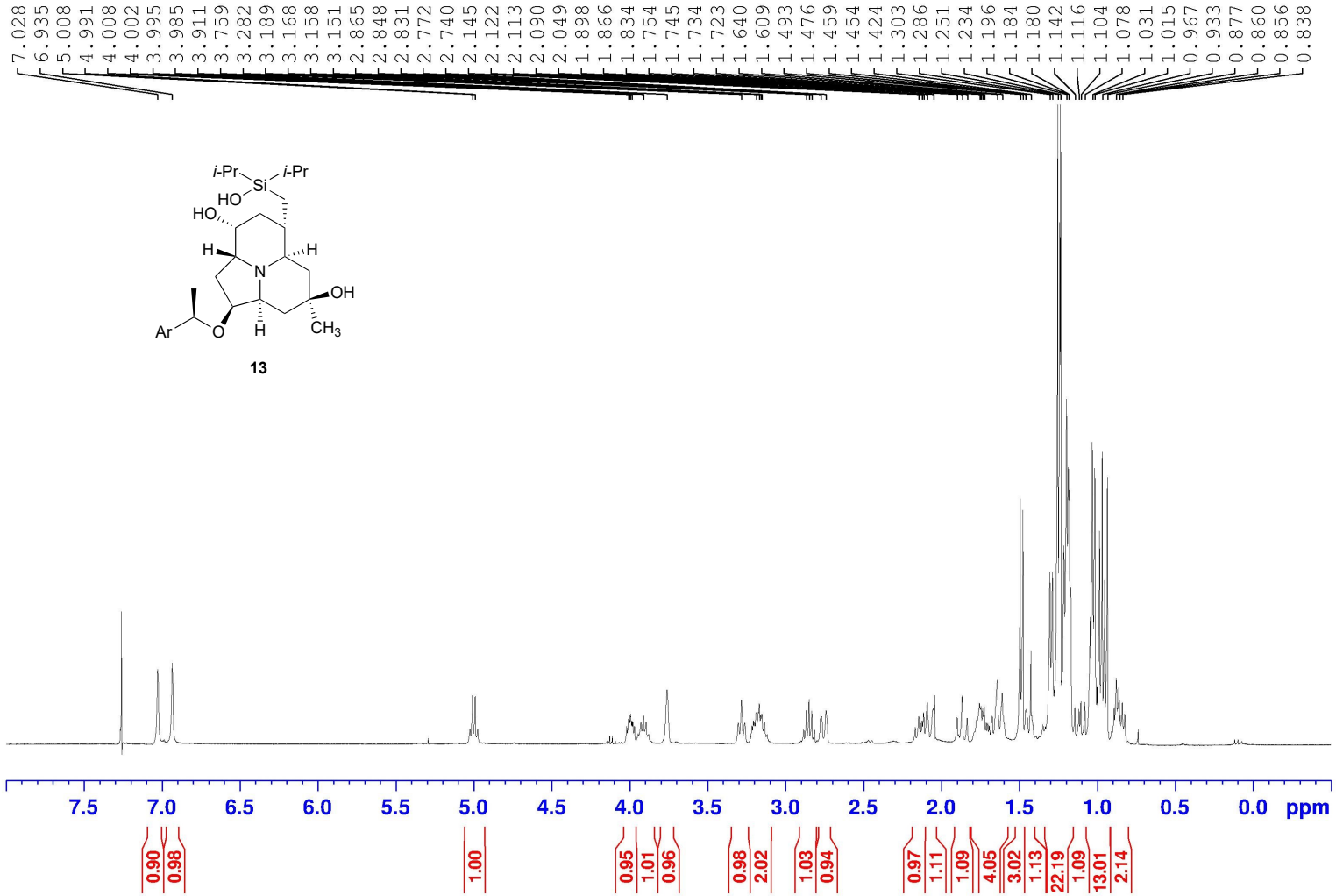
70.5602
68.0391
60.9495
59.1635
54.5091
36.7637
33.9571
33.3576
32.2866
31.5788
31.3512
29.1949
28.0007
25.7445
25.1839
24.7720
24.6842
24.2870
24.0208
23.8301
23.3400
17.8884
17.6637
17.2177
16.8491
15.0445
14.8117
13.0782
i-Pr
Si
i-Pr
O
H
N
H
OH
Ar
O
H
CH3
12
[rel]
20
10
0
– 10
140
120
100
80
60
40
20
[ppm]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4.008
4.002
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3.985
3.911
3.759
3.282
3.189
3.168
3.158
3.151
2.865
2.848
2.831
2.772
2.740
2.145
2.122
2.113
2.090
2.049
1.898
1.866
1.834
1.754
1.745
1.734
1.723
1.640
1.609
1.493
1.476
1.459
1.454
1.424
1.303
1.286
1.251
1.234
1.196
1.184
1.180
1.142
1.116
1.104
1.078
1.031
1.015
0.967
0.933
0.877
0.860
0.856
0.838
i-Pr
Si
i-Pr
HO
HO
H
H
N
OH
Ar
O
H
CH3
13
7.5
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6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
0.90
0.98
1.00
0.95
1.01
0.96
0.98
2.02
1.03
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0.97
1.11
1.09
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1.13
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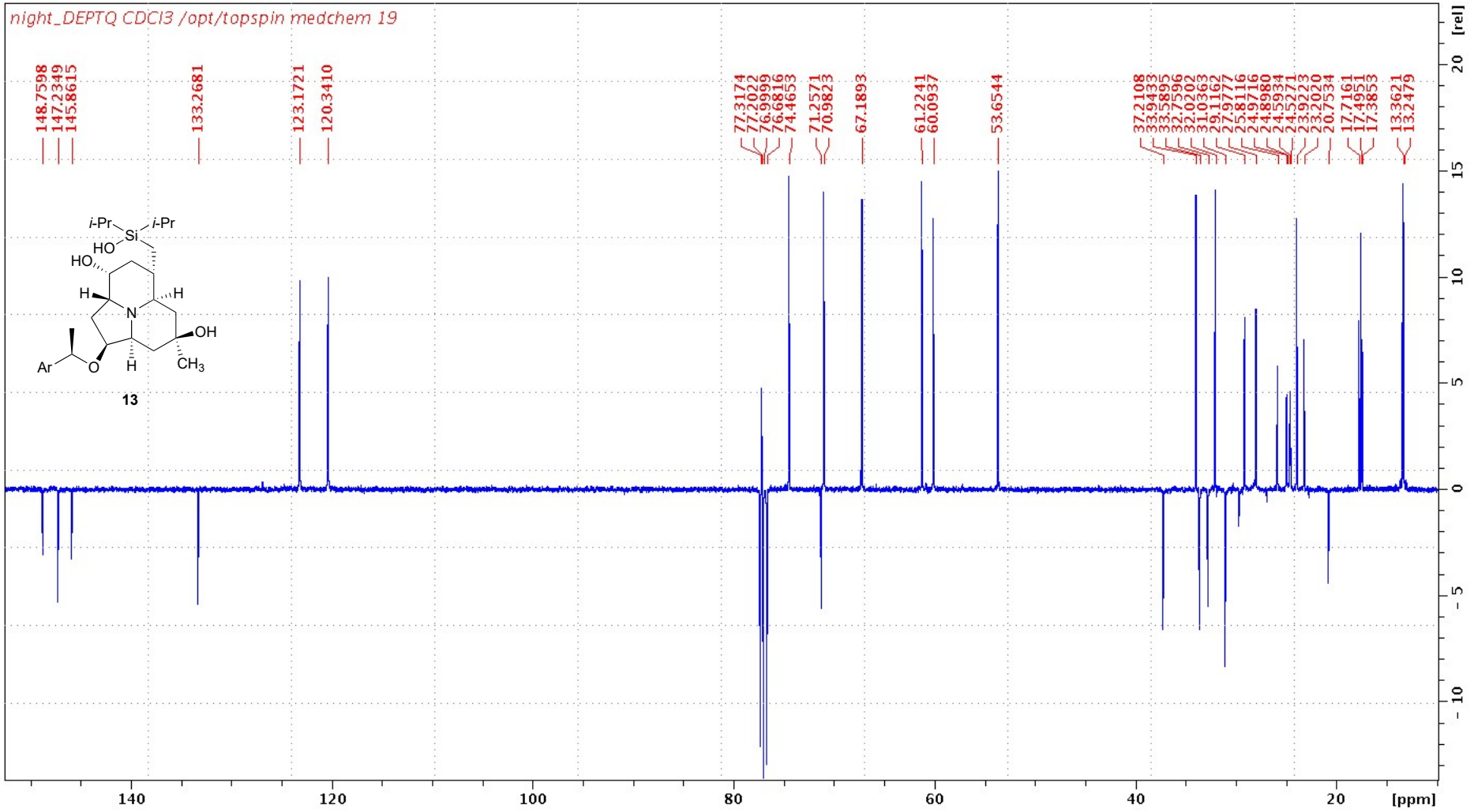
1.09
13.01
2.14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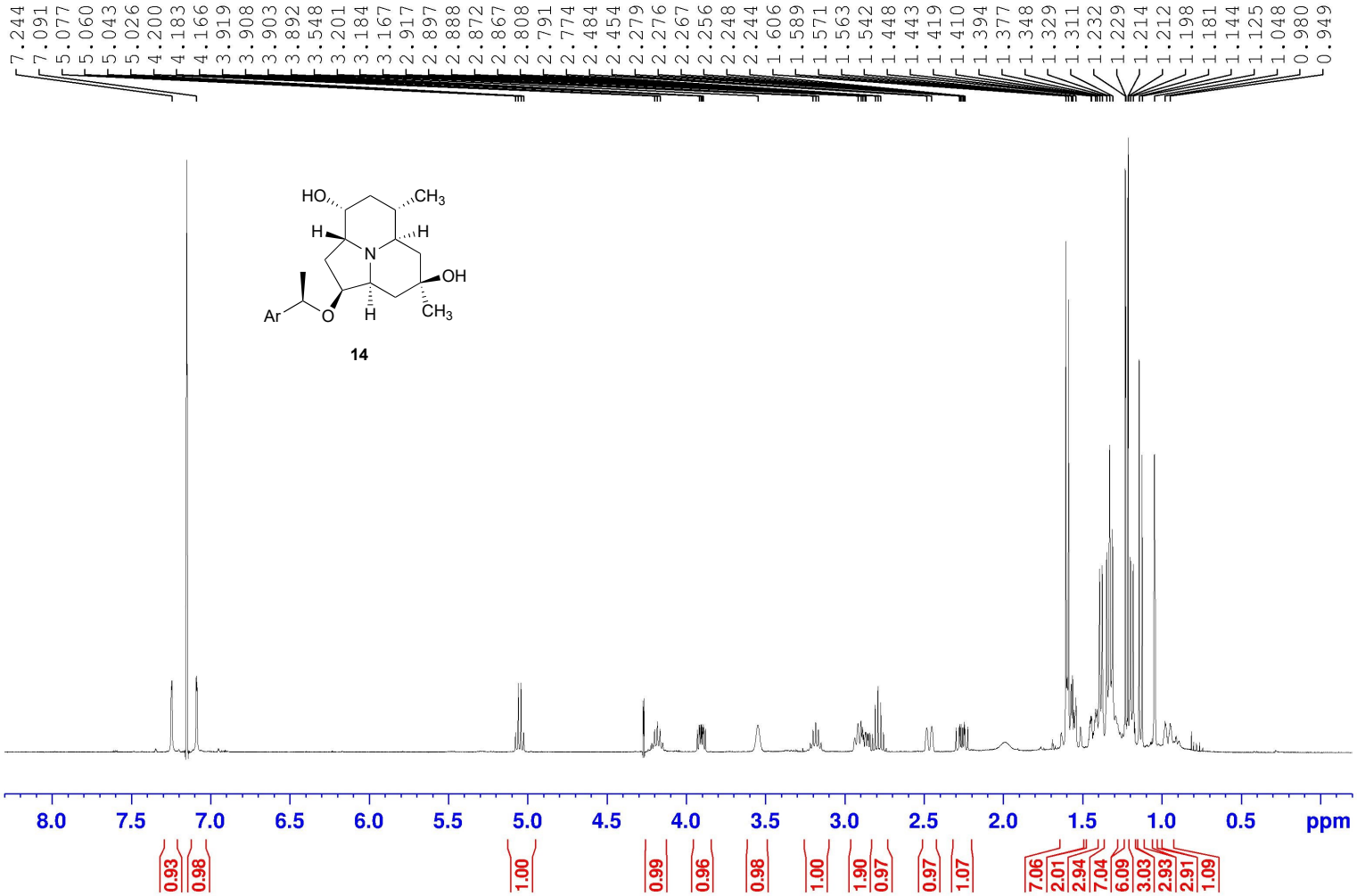
120.3410
77.3174
77.2022
76.9999
76.6816
74.4653
71.2571
70.9823
67.1893
61.2241
60.0937
53.6544
37.2108
33.9433
33.5895
32.7596
32.0202
31.0363
29.1162
27.9777
25.8116
24.9716
24.8980
24.5934
24.5271
23.9223
23.2020
20.7534
17.7161
17.4951
17.3853
13.3621
13.2479
i-Pr
Si
i-Pr
HO
HO
H
H
N
OH
Ar
O
H
CH3
13
[rel]
[ppm]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5.060
5.043
5.026
4.200
4.183
4.166
3.919
3.908
3.903
3.892
3.548
3.201
3.184
3.167
2.917
2.897
2.888
2.872
2.867
2.808
2.791
2.774
2.484
2.454
2.279
2.276
2.267
2.256
2.248
2.244
1.606
1.589
1.571
1.563
1.542
1.448
1.443
1.419
1.410
1.394
1.377
1.348
1.329
1.311
1.232
1.229
1.214
1.212
1.198
1.181
1.144
1.125
1.048
0.980
0.949
HO
CH3
H
H
N
OH
Ar
O
H
CH3
14
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
0.93
0.98
1.00
0.99
0.96
0.98
1.00
1.90
0.97
0.97
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7.06
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6.09
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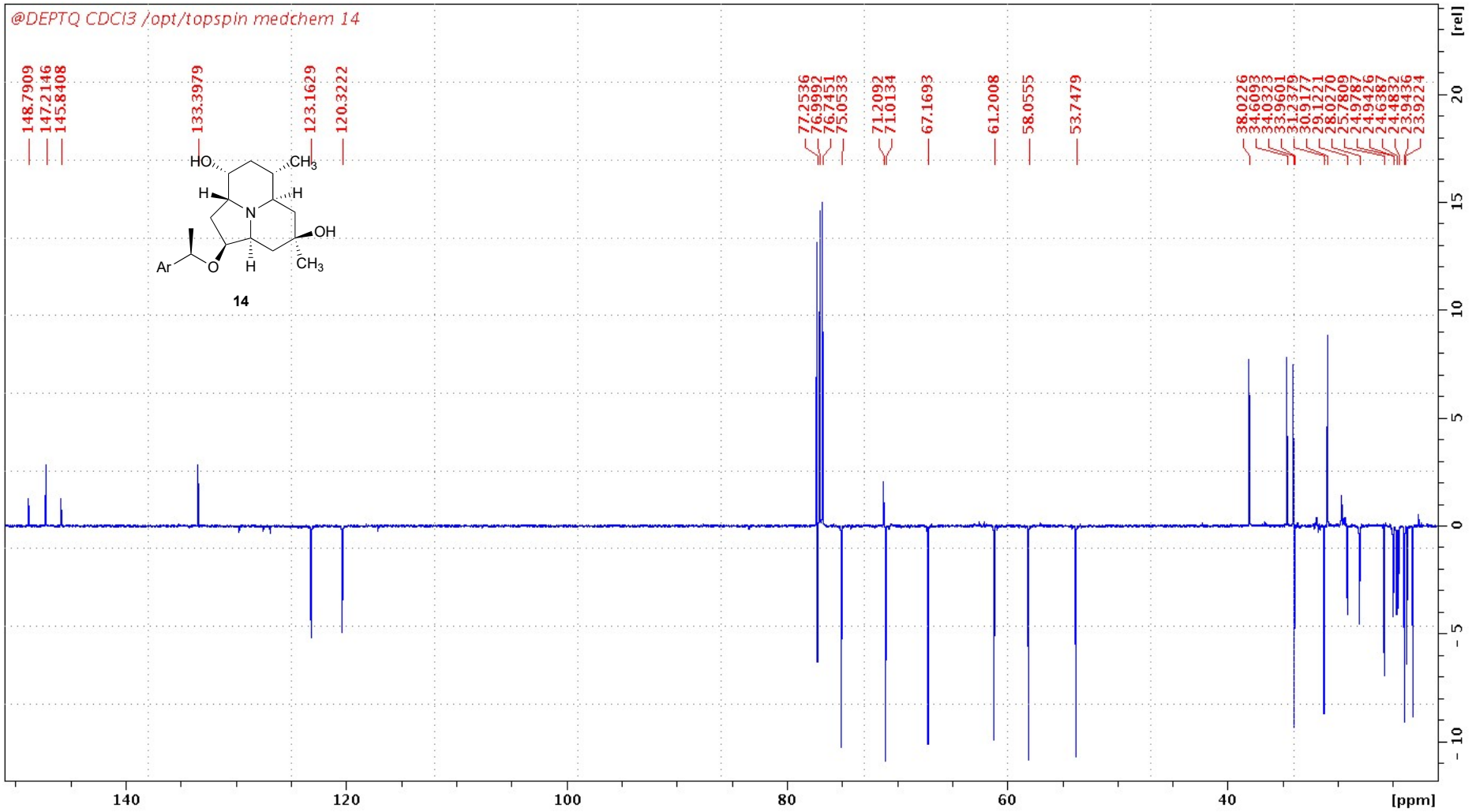
2.93
2.91
1.09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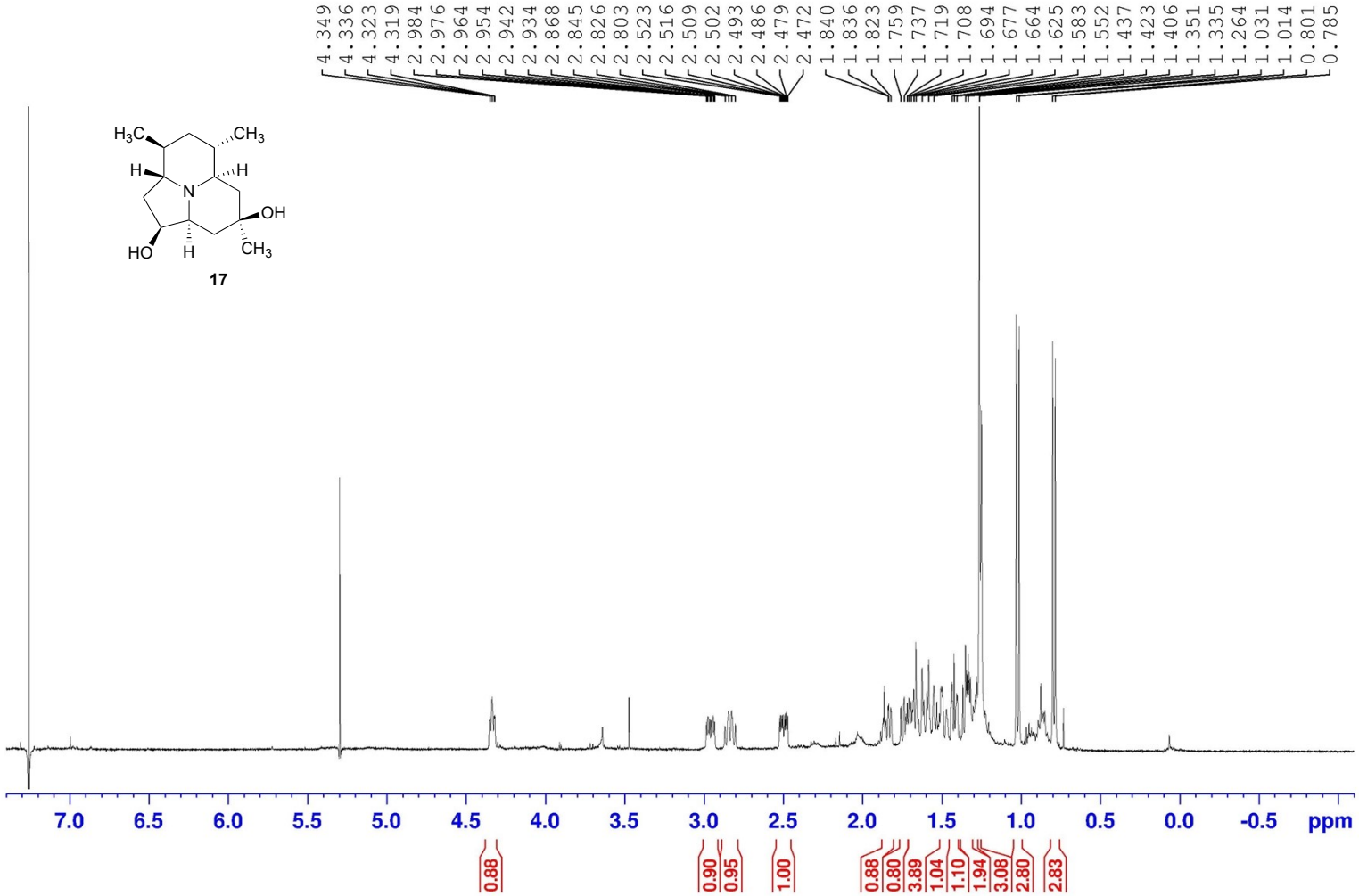
75.0533
71.2092
71.0134
67.1693
61.2008
58.0555
53.7479
38.0226
34.6093
34.0323
33.9601
31.2379
30.9177
29.1221
28.0270
25.7809
24.9787
24.9426
24.6387
24.4832
23.9436
23.9224
HO
CH3
H
H
N
OH
Ar
O
H
CH3
14
[rel]
20
15
10
5
0
- 5
- 10
140
120
100
80
60
40
[ppm]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4.336
4.323
4.319
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2.976
2.964
2.954
2.942
2.934
2.868
2.845
2.826
2.803
2.523
2.516
2.509
2.502
2.493
2.486
2.479
2.472
1.840
1.836
1.823
1.759
1.737
1.719
1.708
1.694
1.677
1.664
1.625
1.583
1.552
1.437
1.423
1.406
1.351
1.335
1.264
1.031
1.014
0.801
0.785
H3C
CH3
H
H
N
OH
HO
H
CH3
17
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
ppm
0.88
0.90
0.95
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0.88
0.80
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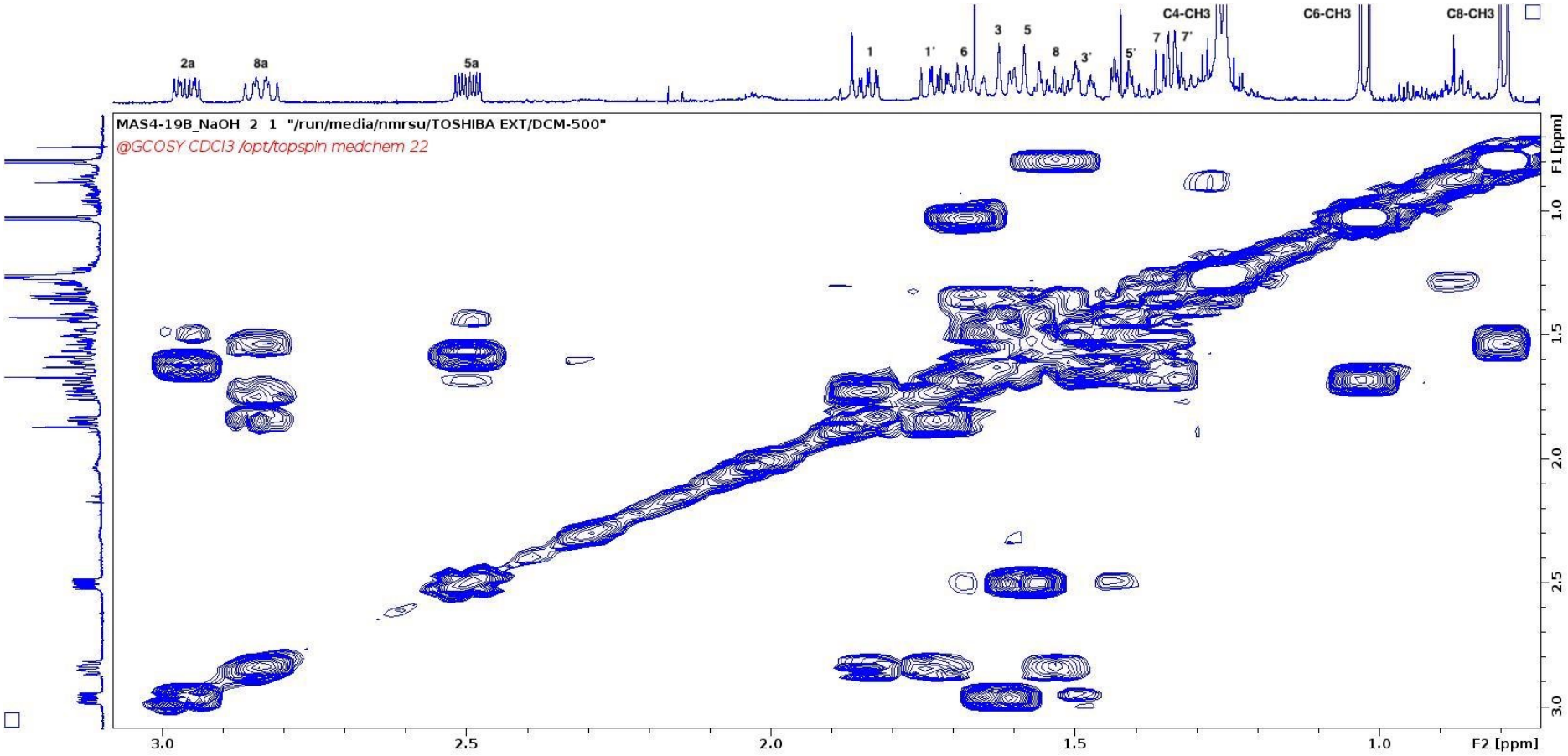
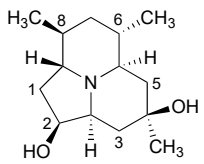
1.10
1.94
3.08
2.80
2.83


2a
8a
5a
1
1'
6
3
5
8
3'
5'
7
7'
C4-CH3
C6-CH3
C8-CH3
MAS4-19B_NaOH 2 1 "/run/media/nmrsu/TOSHIBA EXT/DCM-500"
@GCOSY CDCl3 /opt/topspin medchem 22
F1 [ppm]
1.0
1.5
2.0
2.5
3.0
3.0
2.5
2.0
1.5
1.0
F2 [ppm]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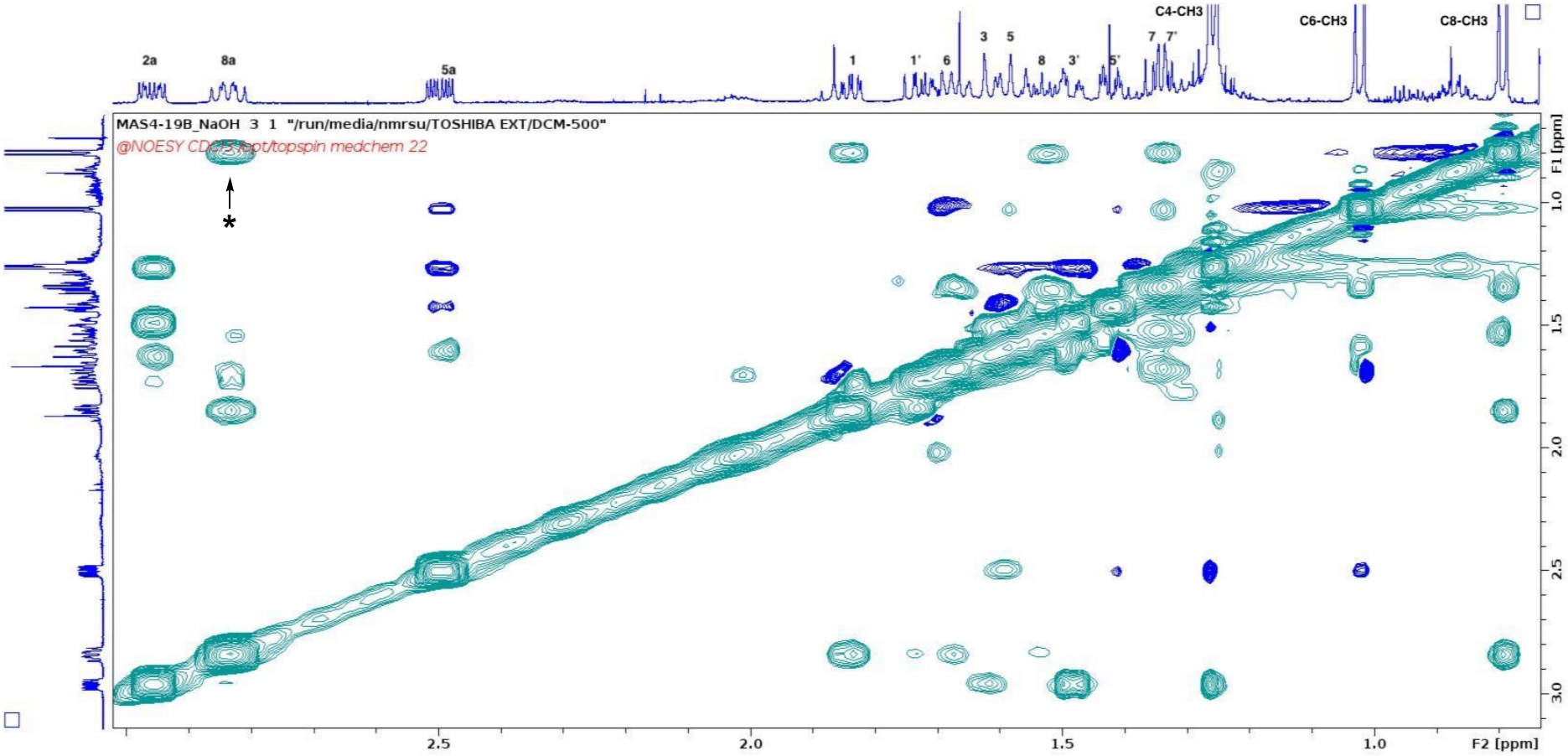
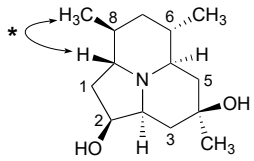
8
6
CH3
H
H
N
1
5
OH
2
HO
H
3
CH3

17


2a
8a
5a
1
1'
6
3
5
8
3'
5'
7
7'
C4-CH3
C6-CH3
C8-CH3
MAS4-19B_NaOH 3 1 "/run/media/nmrsu/TOSHIBA EXT/DCM-500"
@NOESY CDCl3 /opt/topspin medchem 22
*
F1 [ppm]
1.0
1.5
2.0
2.5
3.0
2.5
2.0
1.5
1.0
F2 [ppm]


*
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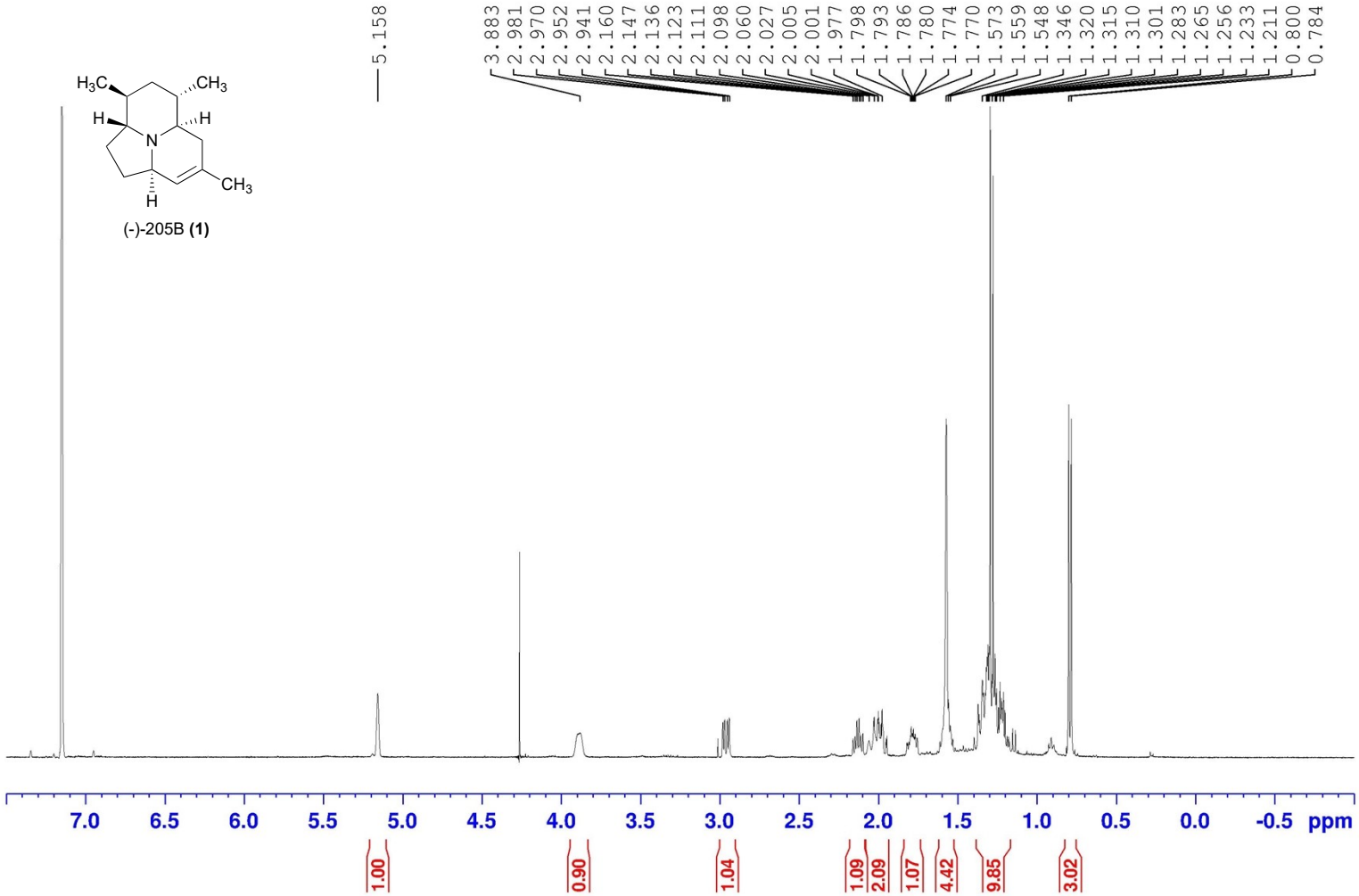
8
6
CH3
H
H
1
N
5
OH
2
HO
H
3
CH3

17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2.147
2.136
2.123
2.111
2.098
2.060
2.027
2.005
2.001
1.977
1.798
1.793
1.786
1.780
1.774
1.770
1.573
1.559
1.548
1.346
1.320
1.315
1.310
1.301
1.283
1.265
1.256
1.233
1.211
0.800
0.784
H3C
CH3
H
H
N
CH3
H
(-)-205B (1)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
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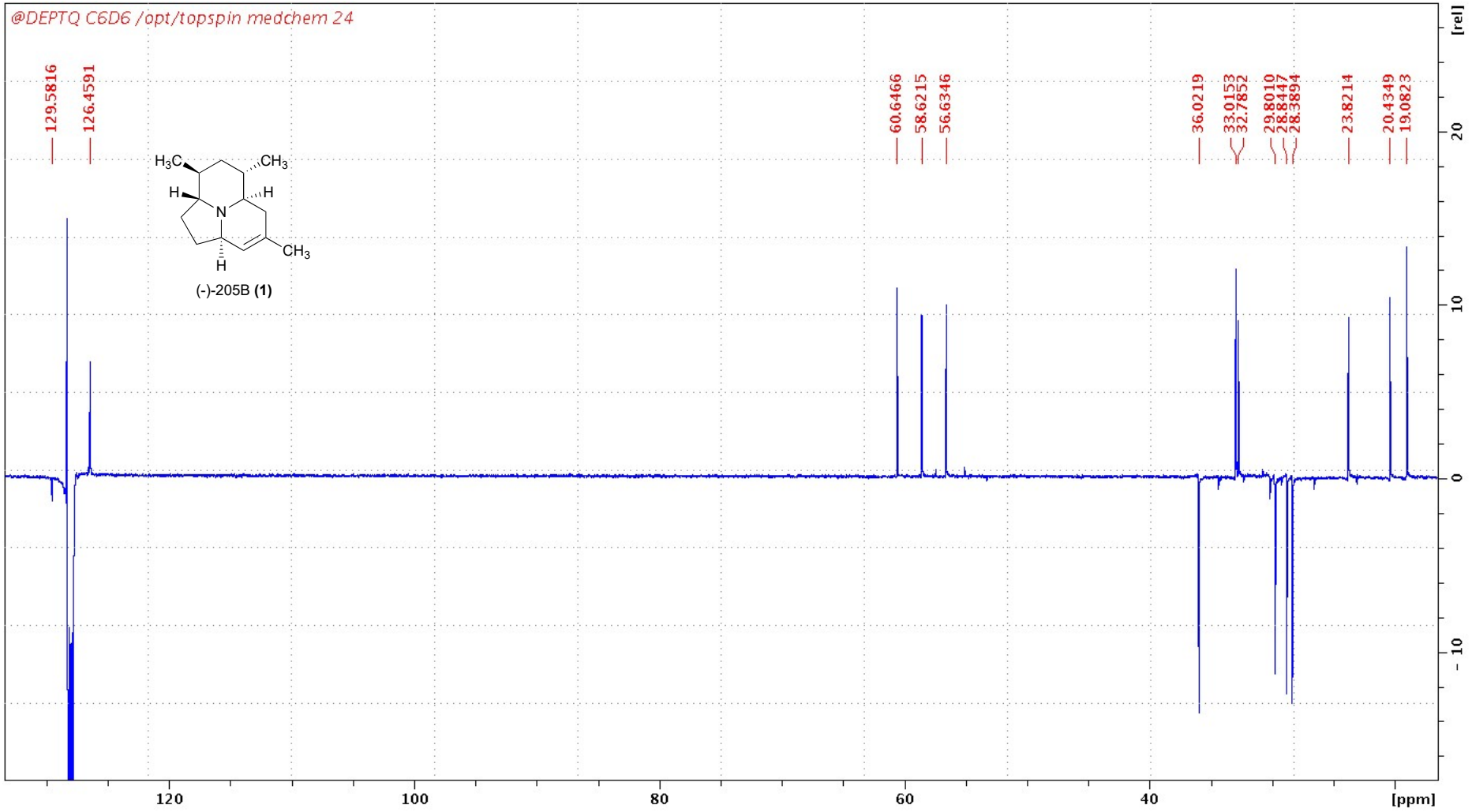
3.02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33.0153
32.7852
29.8010
28.8447
28.3894
23.8214
20.4349
19.0823
H3C
CH3
H
H
N
H
CH3
(-)-205B (1)
[rel]
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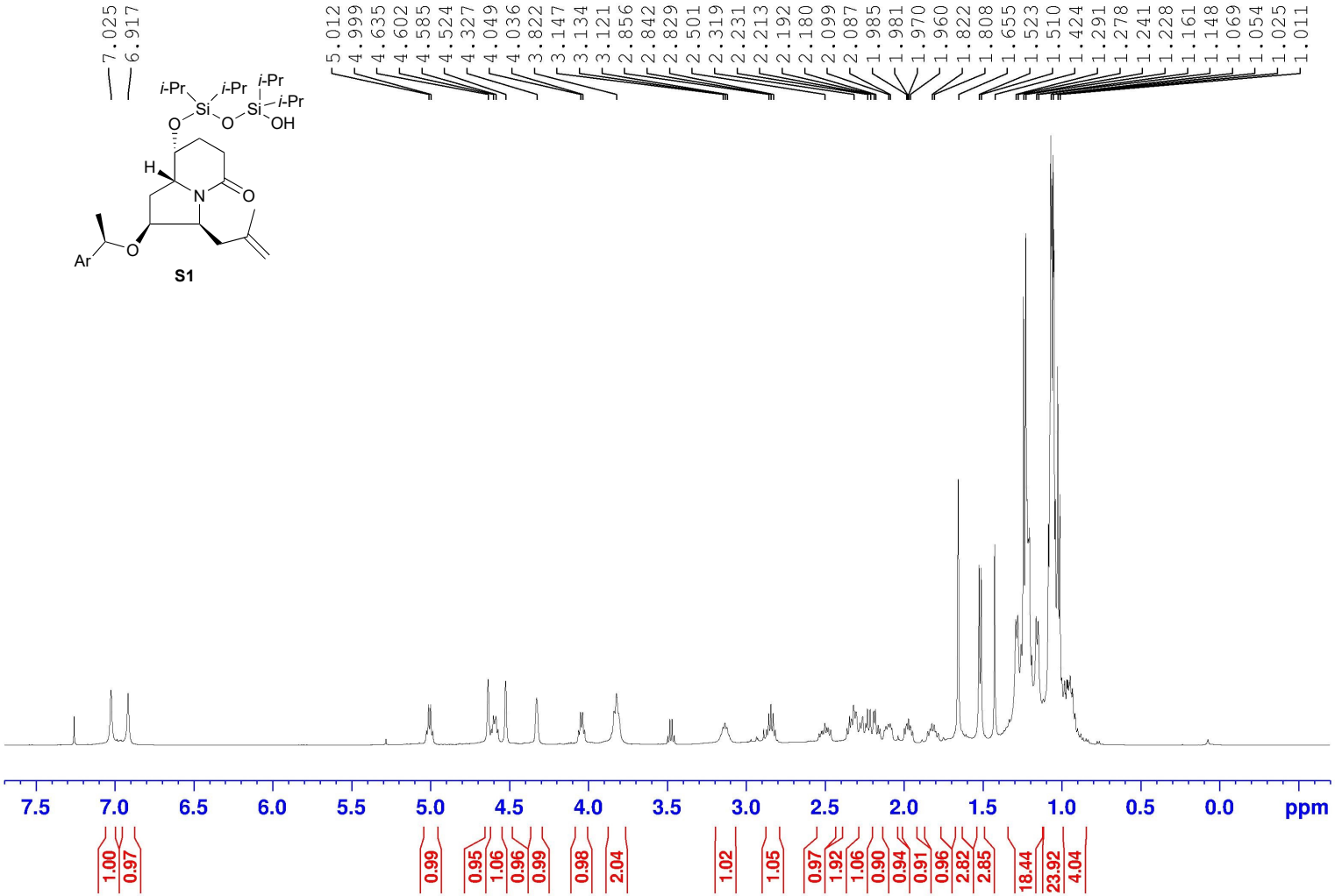
10
0
- 10
120
100
80
60
40
[ppm]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4.524
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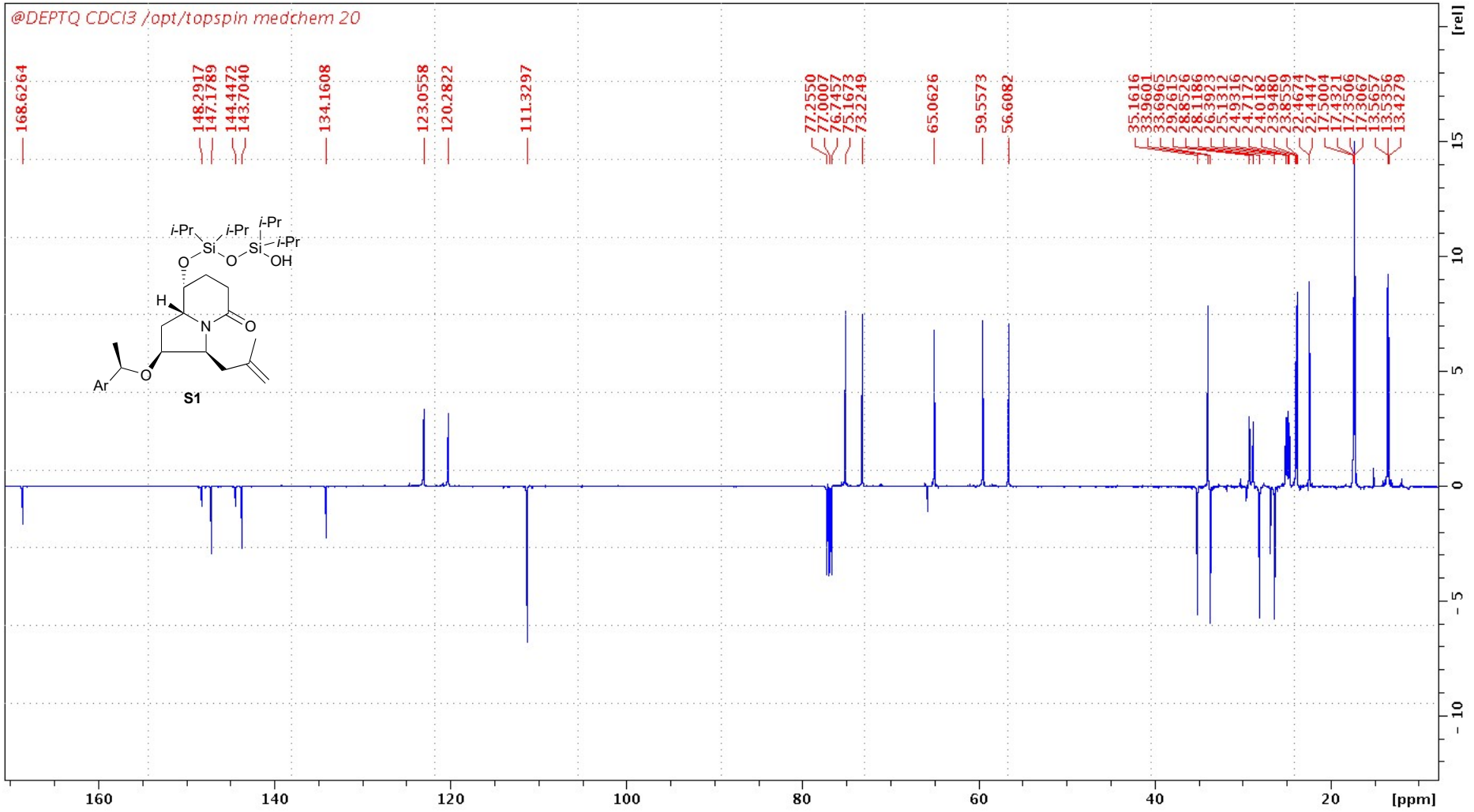
4.049
4.036
3.822
3.147
3.134
3.121
2.856
2.842
2.829
2.501
2.319
2.231
2.213
2.192
2.180
2.099
2.087
1.985
1.981
1.970
1.960
1.822
1.808
1.655
1.523
1.510
1.424
1.291
1.278
1.241
1.228
1.161
1.148
1.069
1.054
1.025
1.011
i-Pr
i-Pr
i-Pr
i-Pr
Si
Si
O
O
OH
H
N
O
Ar
O
S1
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
1.00
0.97
0.99
0.95
1.06
0.96
0.99
0.98
2.04
1.02
1.05
0.97
1.92
1.06
0.90
0.94
0.91
0.96
2.82
2.85
18.44
23.92
4.04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120.2822
111.3297
77.2550
77.0007
76.7457
75.1673
73.2249
65.0626
59.5573
56.6082
35.1616
33.9601
33.6965
29.2615
28.8526
28.1186
26.3923
25.1312
24.9316
24.7172
24.0182
23.9480
23.8559
22.4674
22.4447
17.5004
17.4321
17.3506
17.3067
13.5657
13.5356
13.4279
i-Pr
i-Pr
i-Pr
i-Pr
Si
Si
O
O
OH
H
N
O
O
Ar
S1
[rel]
15
10
5
0
- 5
- 10
160
140
120
100
80
60
40
20
[ppm]