

Supporting Information

An Efficient and General Enantioselective Synthesis of Sphingosine, Phytosphingosine and 4-Substituted Derivatives

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General Methods

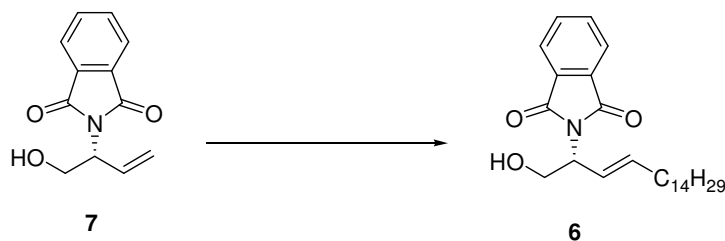
All chemicals used were reagent grade and used as supplied unless otherwise specified. HPLC grade dichloromethane (CH_2Cl_2), tetrahydrofuran (THF) and dimethylformamide (DMF) were dried using a solvent purification system (Pure SOLV system-4®). Toluene was purified using standard procedure.¹

^1H and ^{13}C NMR spectra were recorded on a Varian® Mercury VX 400 (400 MHz and 100.6 MHz respectively) or Varian 400-MR spectrometer in CDCl_3 as solvent, with chemical shifts (δ) referenced to internal standards CDCl_3 (7.26 ppm ^1H , 77.23 ppm ^{13}C) or Me_4Si as an internal reference (0.00 ppm). 2D correlation spectra (gCOSY, NOESY, gHSQC, gHMBC) were visualized using VNMR program (Varian®). ESI MS were run on an Agilent® 1100 Series LC/MSD instrument. Optical rotations were measured at room temperature in a Perkin-Elmer® 241 MC apparatus with 10 cm cells. Elemental analysis (C, H, N, S) were performed on a Carlo Erba® EA 1108 Analyser in the Servei de Recursos Científics (SRCiT-URV). IR spectra were recorded on a JASCO FT/IR-600 plus Fourier Transform Infrared Spectrometer ATR Specac Golden Gate. Melting points, determined with Reichert apparatus, are uncorrected. Optical rotations were measured at 598 nm on a Jasco DIP-370 digital polarimeter using a 100 mm cell.

Reactions were monitored by TLC carried out on 0.25 mm E. Merck® silica gel 60 F_{254} glass or aluminium plates. Developed TLC plates were visualized under a short-wave UV lamp (250 nm) and by heating plates that were dipped in ethanol/ H_2SO_4 (15:1) and basic solution of potassium permanganate. Flash column chromatography was carried out using forced flow of the indicated solvent on Fluka® or Merck® silica gel 60 (230-400 mesh). Radial chromatography was performed on 1 or 2 mm plates of Kieselgel 60 PF_{254} silica gel, depending on the amount of product. Flash column chromatography (FCC) was performed using flash silica gel (32–63 μm) and employed a solvent polarity correlated with TLC mobility.

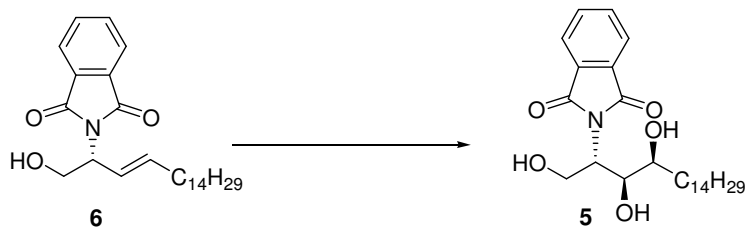
¹ Perrin, D. D.; Armarego, W. L. F. *Purification of Laboratory Chemicals*, 3rd ed., Pergamon Press, Oxford, 1989.

(2*R*)-(3*E*)-2-*N*-phthalimido-3-octadecen-1-ol (6).



Compound **7** (0.5 g, 2.3 mmol) and 1-hexadecene (2.1 g, 9.3 mmol) were dissolved in CH₂Cl₂ (25 mL) at room temperature. II generation Grubbs catalyst (5%) was added to the solution and then the reaction mixture was refluxed under argon for 12 h. After cooling the reaction mixture it was concentrated and purified by column chromatography with hexane:ethyl acetate (4:1) to afford compound **6** (0.99 g, 99%) as a white solid. $[\alpha]_D^{25} = +19.5$ (*c* 1.1, CH₂Cl₂). FT-IR (neat): 3525, 3069, 2956, 2918, 2848, 1773, 1694, 1467, 1391, 1367 cm⁻¹. ¹H NMR (CDCl₃, 400 MHz, δ ppm): δ = 7.83-7.78 (m, 2H), 7.71-7.66 (m, 2H), 5.77 (m, 2H), 4.87 (dt, 1H, *J* = 8.0, 4.8 Hz), 4.07 (m, 1H), 3.89 (dd, 1H, *J* = 12.4, 4.8 Hz), 2.64 (br s, 1H), 1.99 (td, 2H, *J* = 7.6, 6.4 Hz), 1.20-1.10 (m, 24H) 0.84 (t, 3H, *J* = 6.4 Hz). ¹³C NMR (CDCl₃, 100 MHz, δ en ppm): δ =168.6, 136.5, 134.0, 131.9, 123.3, 123.3, 63.2, 55.8, 32.3, 32.0, 29.7(2), 29.6, 29.5, 29.4, 29.2, 28.9, 22.8, 14.2. ESI-MS *m/z* (M+Na): ESI-HMRS *m/z* calcd (M+Na)⁺: 436.2828, found: 436.2819. Elemental Analysis calcd: C, 66.35; H, 5.10; N, 6.45, found: C, 66.33; H, 5.18; N, 6.43.

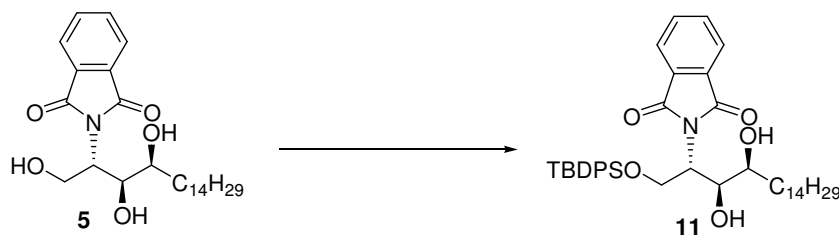
(2*S*,3*S*,4*S*)-2-*N*-phthalimido-1,3,4-octadecantriol (5).



In a 10 ml round bottomed flask NMO (0.04 g, 0.329 mmol) was dissolved in water (0.2 mL), OsO₄ (0.004 g, 0.015 mmols), acetone (0.3 mL) and ^tBuOH (0.3 ml) were added. The mixture was stirred for 5 minutes at 0 °C and then, a solution of compound **6** (0.050 g, 0.121 mmols) in acetone (0.2 mL) was added in one portion. The mixture was stirred for 20

hours at room temperature until the starting material was not observed by TLC. When the reaction had finished a solution of Na₂SO₃ was added and the resulting clear mixture was stirred for 15 minutes. The reaction mixture was diluted with ethyl acetate and the organic layer was washed with brine, dried over MgSO₄ and concentrated. The reaction mixture was purified by column chromatography with hexane:ethyl acetate (2:1 to 1:1) to obtain **5** (0.039 g, 76 %) as a white solid. $[\alpha]_D^{25} = -22.9$ (*c* 0.51, CH₂Cl₂). FT-IR (neat): 3457, 3183, 3059, 2720, 1772, 1710, 1604, 1487, 1366, 1305, 1287, 1051 cm⁻¹. NMR ¹H (CDCl₃, 400 MHz, δ in ppm): δ = 7.89-7.85 (m, 2H), 7.78-7.74 (m, 2H), 4.59 (m, 1H), 4.08-4.00 (m, 2H), 3.97 (m, 1H), 3.66 (br s, 1H), 3.45 (d, 1H, *J* = 9.2 Hz), 3.10 (br s, 1H), 2.64 (br s, 1H), 1.51 (m, 2H), 1.27 (m, 24H), 0.88 (t, 3H, *J* = 6.6 Hz). NMR ¹³C (CDCl₃, 100 MHz, δ in ppm): δ = 170.1, 134.6, 131.8, 123.9, 72.7, 71.6, 61.9, 55.7, 33.9, 32.1, 29.9, 29.7, 29.6, 25.7, 22.9, 14.3. ESI-HMRS calcd *m/z* (M+Na)⁺: 470.2882, found 470.2892. Elemental Analysis calcd: C, 69.77; H, 9.23; N, 3.13, found C, 69.59; H, 9.28; N, 3.15.

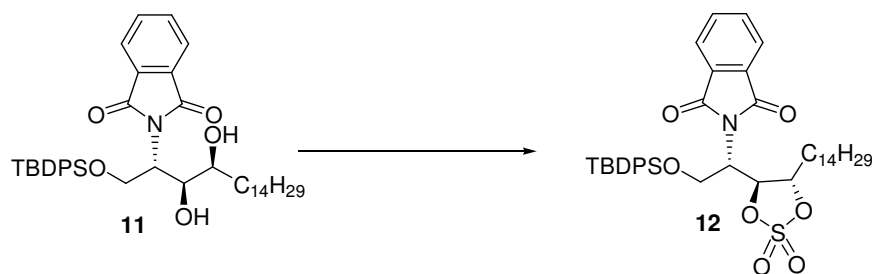
(2*R*,3*S*,4*S*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadecane-3,4-diol (11**).**



To a solution of **5** (0.200 g, 0.45 mmol) in CH₂Cl₂ (2.5 mL) and DMF (0.5 mL), triethylamine (0.16 mL, 1.1 mmol) and DMAP (2.7 mg, 0.05 mmol) were added. The solution was cooled at 0°C, TBDPSCl (0.14 mL, 0.54 mmol) was added and the mixture was stirred at this temperature for 18 h until the starting material was not observed by TLC. The reaction mixture was stirred for 5 minutes at room temperature and it was diluted with ethyl acetate. The organic layer was washed with brine, dried over MgSO₄ and concentrated. The residue was purified by column chromatography (hexane:ethyl acetate 3:1) to obtain diol **11** (150 mg, 89 %) as a colorless oil. $[\alpha]_D^{25} = +19.5$ (*c* 0.9, CH₂Cl₂). FT-IR (neat): 3447, 3182, 3055, 2925, 2854, 1773, 1703, 1468, 1428, 1391, 1112 cm⁻¹. NMR

^1H (CDCl_3 , 400 MHz, δ in ppm): δ = 7.83-7.82 (m, 2H), 7.74-7.72 (m, 2H), 7.60 (dd, 2H, J = 8.0, 1.0 Hz), 7.50 (dd, 2H, J = 8.0, 1.6 Hz), 7.32-7.41 (m, 4H), 7.27 (t, 2H, J = 8.0 Hz), 4.66 (dt, 1H, J = 8.4, 5.2 Hz), 4.14 (m, 1H), 4.02 (dd, 1H, J = 10.6, 5.2 Hz), 3.97 (d, 1H, J = 6.0 Hz), 3.74 (dt, 1H, J = 10.6, 5.2 Hz), 3.38 (m, 1H), 2.47 (d, 1H, J = 3.6 Hz), 1.43 (m, 2H), 1.31-1.21 (m, 23H), 0.92 (m, 9 H), 0.88 (t, 3H, J = 6.6 Hz). NMR ^{13}C (CDCl_3 , 100.6 MHz, δ in ppm): δ =170.1, 135.8, 135.6, 133.0, 132.9, 131.9, 131.9, 130.0, 129.9, 127.9, 127.9, 123.7, 73.1, 72.3, 61.9, 55.7, 33.1, 32.1, 29.9(2), 29.8(2), 29.7, 29.6, 26.8, 25.4, 22.9, 19.1, 14.3. ESI-HRMS m/z calcd ($\text{M}+\text{Na}$) $^+$: 708.4060, found 708,4052. Elemental Analysis calcd: C, 73.53, H, 8.67; N, 2.04, found C, 73.74; H, 8.72; N, 2.11.

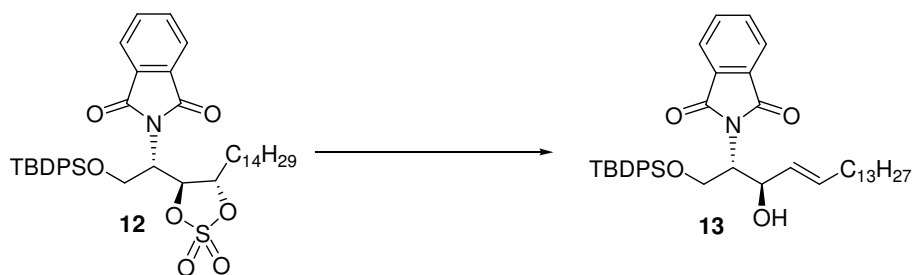
(2*S*,3*S*,4*S*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-3,4-*O*-sulfuryl-octadecane (12).



To a solution of diol **11** (0.16 g, 0.23 mmol) in CH_2Cl_2 (2 mL), triethylamine (90 μL , 0.68 mmol) and thionyl chloride (20 μL , 0.27 mmol) were added at 0°C . After 40 minutes under stirring the reaction mixture was poured into brine and extracted with ethyl acetate. The organic layer was dried over anhydrous MgSO_4 and concentrated in vacuo. The crude was dried in vacuo for one night and then it was dissolved in $\text{CCl}_4/\text{CH}_3\text{CN}/\text{H}_2\text{O}$ (1mL:1mL:1mL). $\text{RuCl}_3\cdot 3\text{H}_2\text{O}$ (6 mg, 0.011 mmol) and NaIO_4 (0.14 g, 0.68 mmol) were added. After 2.5 hours no starting material was observed by TLC. The reaction mixture was diluted with AcOEt , washed with a saturated solution of Na_2SO_3 and the organic layer was dried over anhydrous MgSO_4 and concentrated under reduced pressure to afford compound **12** as beige oil, which was not purified and was directly used in the next reaction. NMR ^1H (CDCl_3 , 400 MHz, δ in ppm): δ = 7.86-7.84 (m, 2H), 7.76-7.74 (m, 2H), 7.63-7.58 (m, 4H), 7.44-7.42 (m, 2H), 7.40-7.36 (m, 4H), 5.2 (t, 1H, J = 6.4 Hz) 4.75 (m, 1H), 4.62 (dt, 1H, J = 7.6, 6.4 Hz), 4.24 (dd, 1H, J = 10.8, 7.6 Hz), 4.10 (m, 1H), 1.49 (m, 2H), 1.28-1.21 (m, 24H), 1.02 (s, 9H), 0.88 (t, 3H, J = 6.6 Hz). NMR ^{13}C (CDCl_3 , 100.6 MHz, δ in ppm):

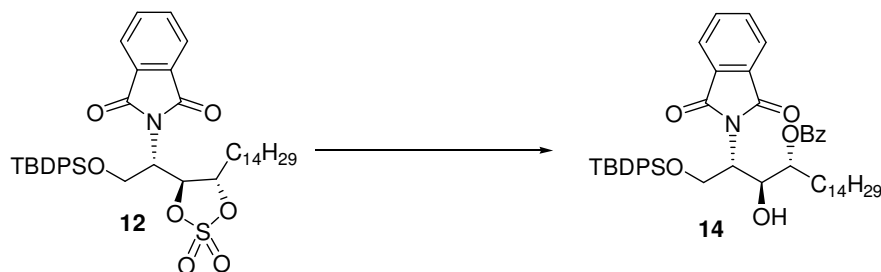
δ =167.9, 135.6, 135.6, 134.6, 132.3, 132.3, 131.5, 130.4, 130.3, 128.2, 128.2, 123.9, 84.9, 83.5, 61.0, 53.4, 32.8, 32.1, 29.9(3), 29.8, 29.7, 29.6(2), 29.5, 29.2, 26.9, 25.2, 22.9, 19.2, 14.4. ESI-HMRS m/z ($M+Na$)⁺ calcd: 770.3523, found: 770.3589.

(2*R*,3*R*)-(4*E*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadec-4-en-3-ol (13).



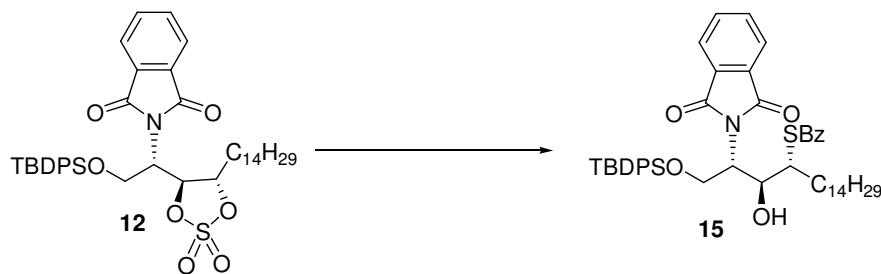
The cyclic sulphate **12** (0.075 mmol) was dissolved in toluene (2 mL) and Bu_4NI (0.03 g, 0.08 mmol) and DBU (17 μ L, 0.11 mmol) were added. The reaction mixture was heated to reflux for 3 hours. Then it was cooled at room temperature and H_2SO_4 (1.4 μ L), H_2O (1.2 μ L) and THF (20 μ L) were added. Stirring continued for 2 hours at room temperature. The reaction mixture was diluted with ethyl acetate, washed with saturated $NaHCO_3$ solution and brine and finally it was dried over anhydrous $MgSO_4$. The crude was concentrated and it was purified by radial chromatography using hexane:ethyl acetate (3:1) as eluent yielding compound **11** (0.041 g, 82 %) as a colorless oil. $[\alpha]_D^{25} = +21.7$ (c 1.7, CH_2Cl_2). FT-IR (neat): 3428, 3190, 3064, 2924, 2853, 1773, 1708, 1641, 1467, 1428, 1389, 1112 cm^{-1} . NMR 1H ($CDCl_3$, 400 MHz, δ in ppm): δ = 7.85-7.82 (m, 2H), 7.75-7.73 (m, 2H), 7.62-7.60 (m, 2H), 7.52-7.50 (m, 2H), 7.41-7.33 (m, 4H), 7.28-7.26 (m, 2H), 5.70 (dt, 1H, J = 16.0, 6.8 Hz), 5.30 (dd, 1H, J = 16.0, 4.8 Hz), 4.56 (m, 2H), 4.16 (t, 1H, J = 10.8 Hz), 4.01 (dd, 1H, J = 10.8, 4.8 Hz), 3.53 (br s, 1H), 1.90 (m, 2H), 1.26-1.13 (m, 22H), 0.92 (s, 9H), 0.88 (t, 3H, J = 6.6 Hz). NMR ^{13}C ($CDCl_3$, 100.6 MHz, δ in ppm): δ =167.9, 135.8, 135.7, 134.3, 133.4, 133.2, 133.2, 129.9, 129.8, 129.2, 129.0, 127.9, 127.8, 123.6, 70.8, 61.5, 58.6, 32.2, 32.1, 29.9(3), 29.7, 29.6, 29.2, 29.1, 26.8, 22.9, 19.2, 14.3. ESI-HMRS m/z ($M+Na+H$)⁺: 691.4033, found 691.4026. Elemental Analysis calcd: C, 75.52; H, 8.60; N, 2.10, found C, 75.42; H, 8.72; N, 2.19.

(2*R*,3*S*,4*R*)- 1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-3-hydroxy-octadecan-4-yl benzoate (14**).**



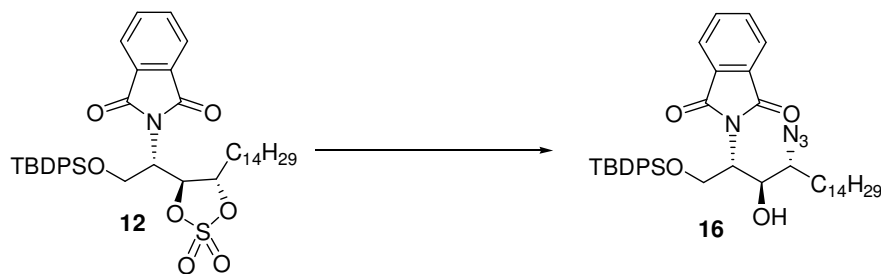
To a solution of sulfate **12** (0.052 mmol) in DMF (1 mL), benzoic acid (0.01 g, 0.08 mmol) and Cs₂CO₃ (0.025 g, 0.078 mmol) were added. The resulting mixture was stirred for 7.5 hours and H₂SO₄ (1.4 μL), H₂O (1.5 μL) and THF (20 μL) were added. Then, stirring was continued at room temperature for 3 hours. The reaction mixture was diluted with ethyl acetate, and it was washed with a solution of NaHCO₃ and brine. The organic layer was dried over anhydrous MgSO₄ and it was concentrated. The remaining crude was purified by radial chromatography with hexane:ethyl acetate (2:1) to obtain compound **14** (0.049 g, 91%) as a colorless oil. $[\alpha]_D^{25} = -2.9$ (*c* 1.5, CH₂Cl₂). FT-IR (neat): 3410, 3069, 2925, 2854, 1774, 1698, 1604, 1465, 1428, 1397, 1368, 1268, 1108, 706 cm⁻¹. NMR ¹H (CDCl₃, 400 MHz, δ in ppm): δ=7.88-7.86 (dd, 2H, *J* = 8.4, 1.2 Hz), 7.81-7.78 (m, 2H), 7.76-7.72 (m, 4H), 7.60 (dd, 2H, *J* = 8.0, 1.6 Hz), 7.47 (dd, 2H, *J* = 8.0, 1.6 Hz), 7.42-7.31 (m, 6H), 7.24 (t, 1H, *J* = 6.8 Hz), 5.04 (td, 1H, *J* = 8.4, 3.4 Hz), 4.78, (dt, 1H, *J* = 9.2, 5.2 Hz), 4.61 (d, 1H, *J* = 10.8 Hz), 4.15 (t, 1H, *J* = 9.2 Hz), 4.08 (dd, 1H, *J* = 8.4, 3.4 Hz), 4.03 (dd, 1H, *J* = 10.8, 5.2 Hz), 1.92 (br s, 1H), 1.75-1.66 (m, 2H), 1.27-1.19 (m, 24H), 1.08 (s, 12 H). NMR ¹³C (CDCl₃, 100.6 MHz, δ in ppm): δ=166.2, 135.8, 135.7, 135.4, 135.0, 134.5, 133.1, 133.1, 133.0, 130.4, 130.0, 129.9, 129.8, 129.7, 128.4, 127.9, 127.9, 127.9, 127.8, 123.7, 74.2, 71.7, 61.9, 54.6, 32.1, 31.5, 29.9(2), 29.8(2), 29.7, 29.6(2), 26.8(2), 25.0, 22.9, 19.2, 19.1, 14.3. ESI-HMRS *m/z* (M+Na)⁺ calcd: 797.4548, found 797.4542. Elemental Analysis calcd: C, 77.58; H, 8.20; N, 1.81; found: C, 77.55; H, 8.27 N, 1.80.

(2*R*,3*S*,4*R*)-1-(*tert*-butyldiphenylsilyloxy)-3-hydroxy-2-*N*-phthalimido-octadecan-4-yl thiobenzoate (15**).**



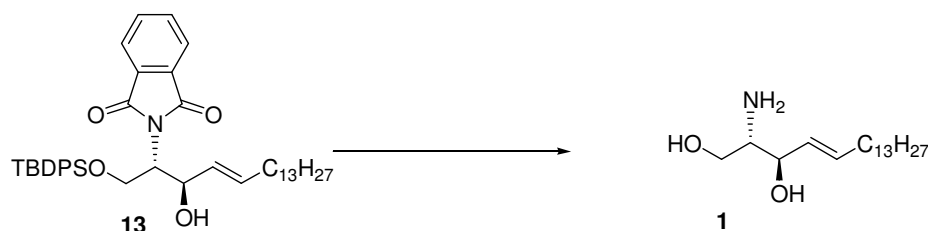
To a solution of sulfate **12** (0.19 mmol) in DMF (1 mL) acid thiobenzoic (38 μ L, 0.323 mmol) and Cs₂CO₃ (0.093 g, 0.078 mmol) were added. This mixture was stirred for 8 hours and H₂SO₄ (1.1 μ L), H₂O (1.2 μ L) and THF (20 μ L) were added. The stirring was continued at room temperature for 3 hours and then the reaction mixture was diluted with ethyl acetate and it was washed with a solution of NaHCO₃ and brine. The organic layer was dried over anhydrous MgSO₄ and it was concentrated. The mixture was purified by radial chromatography with hexane:ethyl acetate (4:1) to obtain compound **15** (0.13 g, 87 %) as a colorless oil. $[\alpha]_D^{25} = -11.7$ (c 1.3, CH₂Cl₂). FT-IR (neat): 3402, 3070, 2923, 2853, 1774, 1699, 1663, 1467, 1399, 1368, 1209, 1112, 747, 701 cm⁻¹. NMR ¹H (CDCl₃, 400 MHz, δ in ppm): δ =7.75-7.60 (m, 6H), 7.60-7.58 (m, 3H), 7.48-7.44 (m, 3H), 7.41-7.36 (m, 3H), 7.38-7.31 (m, 3H), 7.32 (t, 1H, J = 7.2 Hz), 4.98 (td, 1H, J = 8.8, 4.4 Hz), 4.58 (d, 1H, J = 10.8 Hz), 4.10 (t, 1H, J = 9.2 Hz), 4.07 (t, 1H, J = 8.8 Hz), 4.00 (td, 1H, J = 10.8, 5.2 Hz), 3.67 (td, 1H, J = 10.0, 3.2 Hz), 2.01-2.06 (m, 2H), 1.44-1.39 (m, 2H), 1.26-1.20 (m, 22 H), 0.87-0.86 (m, 12H). NMR ¹³C (CDCl₃, 100.6 MHz, δ in ppm): δ =190.8, 136.6, 135.8, 135.6, 135.4, 134.1, 133.3, 133.0, 132.8, 132.0, 129.7, 129.6, 128.8, 128.8, 128.5, 128.4, 127.7, 127.7, 127.6, 127.2, 123.3, 72.5, 62.3, 55.7, 46.2, 31.9, 31.3, 29.7(3), 29.6(2), 29.5, 29.4, 29.4, 26.6, 26.3, 22.7, 19.2, 18.9, 14.1. ESI-HMRS m/z (M+Na)⁺ calcd: 828.4028, found 828.4076. Elemental Analysis calcd: C, 70.98; H, 7.66, N, 1.69; S, 3.87, found C, 71.01; H, 7.66, N, 1.73; S, 3.85.

(2*R*,3*S*,4*R*)-4-azido-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadecan-3-ol
(16).



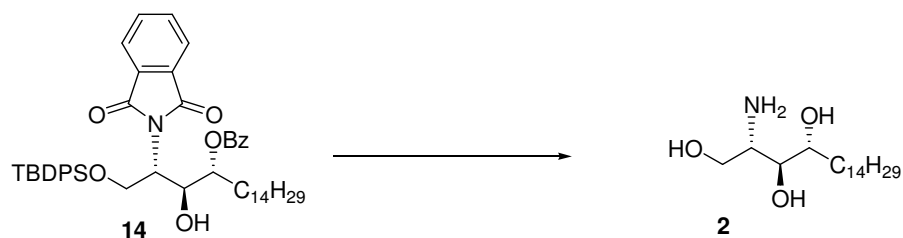
To solution of sulfate **12** (0.19 mmol) in DMF (1 mL), NaN₃ (38 mg, 0.57 mmol) and a catalytic amount of 15-crown-5 (20%) were added. The mixture was heated at 80 °C under argon for 1.5 hours and then H₂SO₄ (1 μL), H₂O (1 μL) and THF (20 μL) were added. The reaction mixture was stirred at room temperature for 3 hours, it was diluted with ethyl acetate and it was washed with NaHCO₃ and brine. The organic layer was dried over anhydrous MgSO₄ and it was concentrated. The mixture was purified by radial chromatography with hexane:ethyl acetate (8:1) to obtain compound **16** (0.124 g, 98 %) as a colorless oil. $[\alpha]_D^{25} = -21.3$ (*c* 3.5, CH₂Cl₂). FT-IR (neat): 3415, 3071, 3049, 2925, 2854, 2103, 1775, 1703, 1467, 1428, 1367, 1263, 1111, 704 cm⁻¹. NMR ¹H (CDCl₃, 400 MHz, δ in ppm): δ= 7.88-7.86 (m, 2H), 7.77-7.76 (m, 2H), 7.59 (dd, 2H, *J* = 8.0, 1.2 Hz), 7.48 (dd, 2H, *J* = 8.4, 1.6 Hz), 7.41-7.32 (m, 4H), 7.27 (t, 2H, *J* = 6.0 Hz), 4.81 (ddd, 1H, *J* = 8.8, 5.2, 4.8 Hz), 4.62 (d, 1H, *J* = 10.4 Hz), 4.12 (dd, 1H, *J* = 10.8, 9.6 Hz), 3.96 (dd, 1H, *J* = 10.8, 5.6 Hz), 3.79 (ddd, 1H, *J* = 10.8, 7.2, 3.6 Hz), 3.18 (td, 1H, *J* = 11.2, 3.6 Hz), 1.74 (m, 2H), 1.46 (m, 2H), 1.26-1.22 (m, 22 H), 0.89 (s, 9H), 0.86 (t, 3H, *J* = 6.8 Hz). NMR ¹³C (CDCl₃, 100.6 MHz, δ in ppm): δ=135.8, 135.6, 135.0, 134.6, 133.0, 133.0, 130.0, 129.9, 129.9, 127.9, 127.9, 127.8, 123.9, 72.2, 65.8, 61.9, 54.9, 29.9, 29.9, 29.9, 29.8, 29.7, 29.7, 29.6, 29.6, 26.7, 26.8, 26.4, 22.9, 19.1, 14.3. ESI-HMRS *m/z* (M+Na)⁺ calcd: 733.4125, found: 733.4125. Elemental Analysis calcd: N, 7.63; C, 68.73; H, 7.63, found N, 7.76; C, 69.01; H, 7.72.

(2*S*,3*R*)-(4*E*)-2-aminooctadec-4-ene-1,3-diol (*D*-erythro-sphingosine) (1**).**



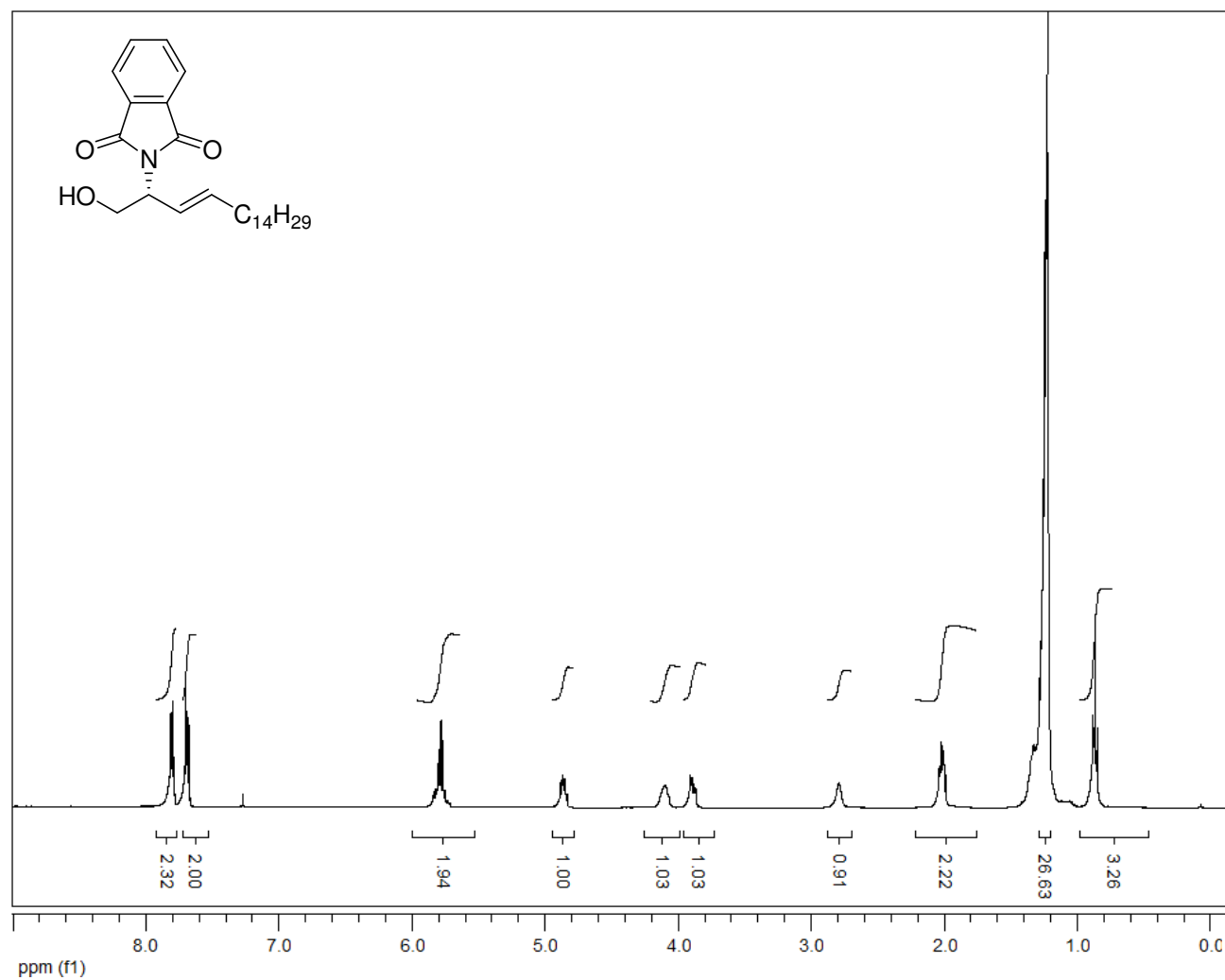
Compound **13** (0.240 g, 0.36 mmols) was dissolved in THF (2 mL) and a solution of TBAF (0.5 mL, 0.47 mmols) in THF was added under argon. The mixture was stirred at rt for 2 hours. The crude was filtered on Celite and the solvent was evaporated, then the crude was dissolved in methanol (2 mL), hydrazine (0.54 mL, 0.54 mmol) was added, and the resulting solution was refluxed under argon for 6 hours. The reaction crude was concentrated, dissolved in CHCl₃, and was filtered over Celite, and the filtrate was concentrated in vacuo. The residue was purified by column chromatography (CHCl₃, MeOH, NH₄OH, 66:12:2). The obtained solid was dissolved in CHCl₃ and filtered through a pad of Celite to remove the residual silica. The filtrate was concentrated to give sphingosine **1** (0.087 g, 87 %) as a white solid. $[\alpha]_D^{25} = -1.6$ (*c* 0.7, CHCl₃). NMR ¹H (CDCl₃, 400 MHz, δ in ppm): δ = 5.77 (dtd, 1H, *J* = 15.4, 6.8, 1.2 Hz), 5.48 (ddt, 1H, *J* = 15.4, 7.2, 1.6 Hz), 4.04 (t, 1H, *J* = 7.2 Hz), 3.69 (dd, 1H, *J* = 10.4, 4.8 Hz), 3.62 (dd, 1H, *J* = 10.4, 5.8 Hz), 2.88 (td, 1H, *J* = 5.8, 4.8 Hz), 2.05 (dt, 2H, *J* = 7.2, 6.4 Hz), 1.74 (br s, 4H), 1.37 (t, 2H, *J* = 7.2 Hz), 1.32-1.26 (m, 22H), 0.88 (t, 3H, *J* = 6.8 Hz). NMR ¹³C (CDCl₃, 100.6 MHz, δ in ppm): δ = 135.2, 129.4, 76.9, 75.9, 64.6, 56.3, 32.6, 32.1, 29.9, 29.9, 29.9, 29.8, 29.7, 29.6, 29.4, 29.3, 22.9, 14.4. ESI-HMRS *m/z* (M+H)⁺ calcd: 300.2903, found: 300.3006.

(2*S*,3*S*,4*R*)-2-amino-octadecane-1,3,4-triol (*D*-ribo-phytosphingosine) (2**).**

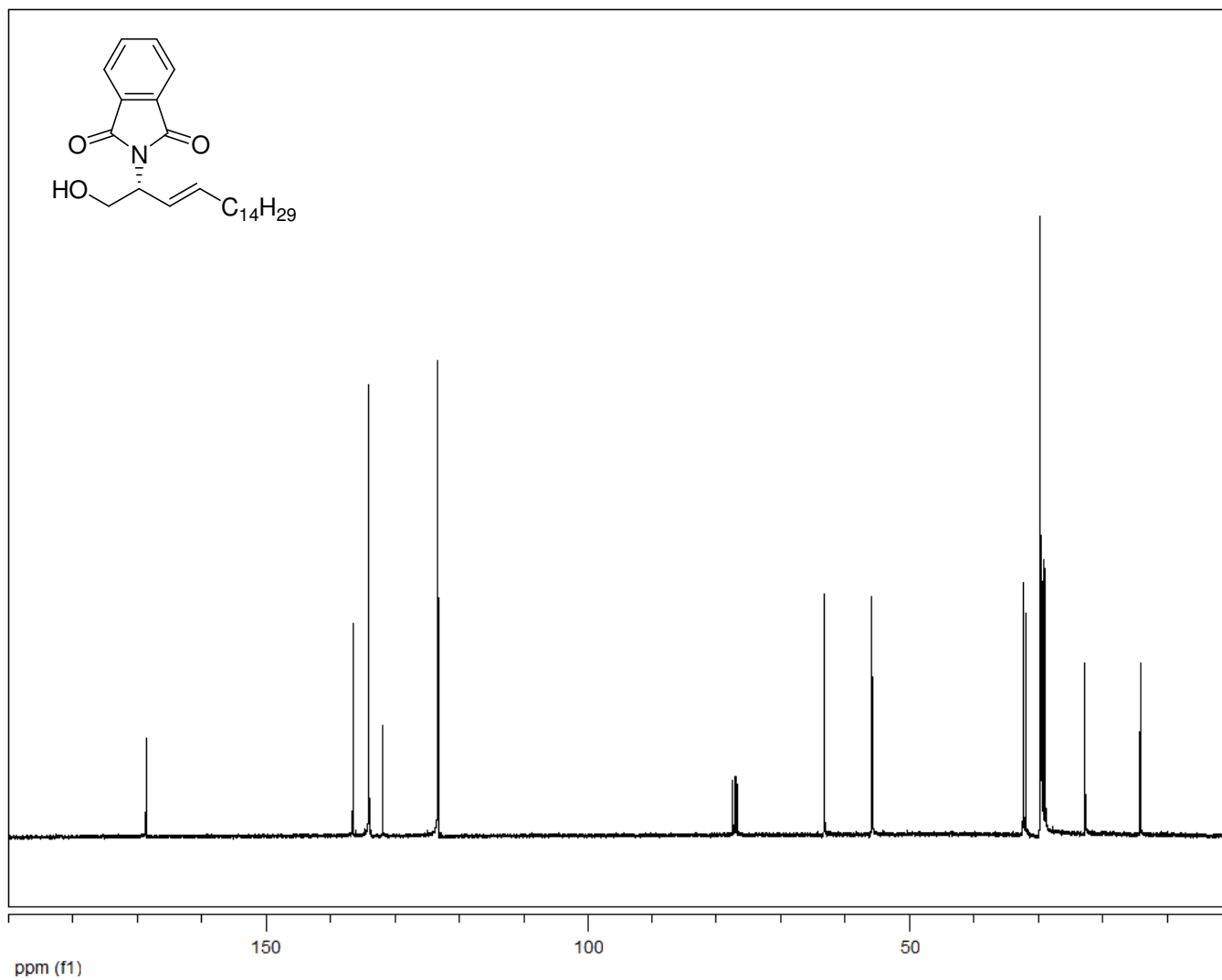


Compound **14** (0.122 g, 0.18 mmols) was dissolved in THF (2 ml) and a solution of TBAF in THF (0.3 mL, 0.28 mmols) was added. The resulting solution was stirred at rt for 2 hours. The reaction mixture was filtered over Celite and the solvent was removed under reduced pressure. The crude was dissolved in methanol (2 mL), hydrazine (0.54 mL, 0.27 mmols) was added, and the mixture was refluxed under argon for 7 hours. The reaction mixture was concentrated and the residue was dissolved in CHCl₃, filtered and the organic layer was concentrated in vacuo. The solvent was evaporated and the residue was purified by column chromatography (CH₂Cl₂, MeOH, NH₄OH, 18:6:1). The obtained solid was dissolved in CHCl₃ and filtered through a pad of Celite to remove the residual silica. The filtrate was concentrated to give phytosphingosine (0.048 g, 89 %) as a white solid. $[\alpha]_D^{25} = +9.2$ (*c* 0.9, pyridine). NMR ¹H (CD₃OD, 400 MHz, δ in ppm): $\delta = 3.75$ (dd, 1H, *J* = 10.8, 4.0 Hz), 3.53 (m, 2H), 3.34 (d, 1H, *J* = 6.0 Hz), 2.94 (d, 1H, *J* = 4.4 Hz), 1.74 (m, 1H), 1.55 (m, 1H), 1.36-1.28 (m, 24H), 0.90 (t, 3H, *J* = 6.8 Hz). NMR ¹³C (CD₃OD, 100.6 MHz, δ in ppm): $\delta = 76.6, 74.6, 64.3, 55.9, 34.9, 33.2, 31.1, 31.0, 31.0, 30.9, 30.7, 26.8, 23.9, 14.6$. ESI-HMRS *m/z* (M+H)⁺ calcd: 318.3003, found: 318.3048.

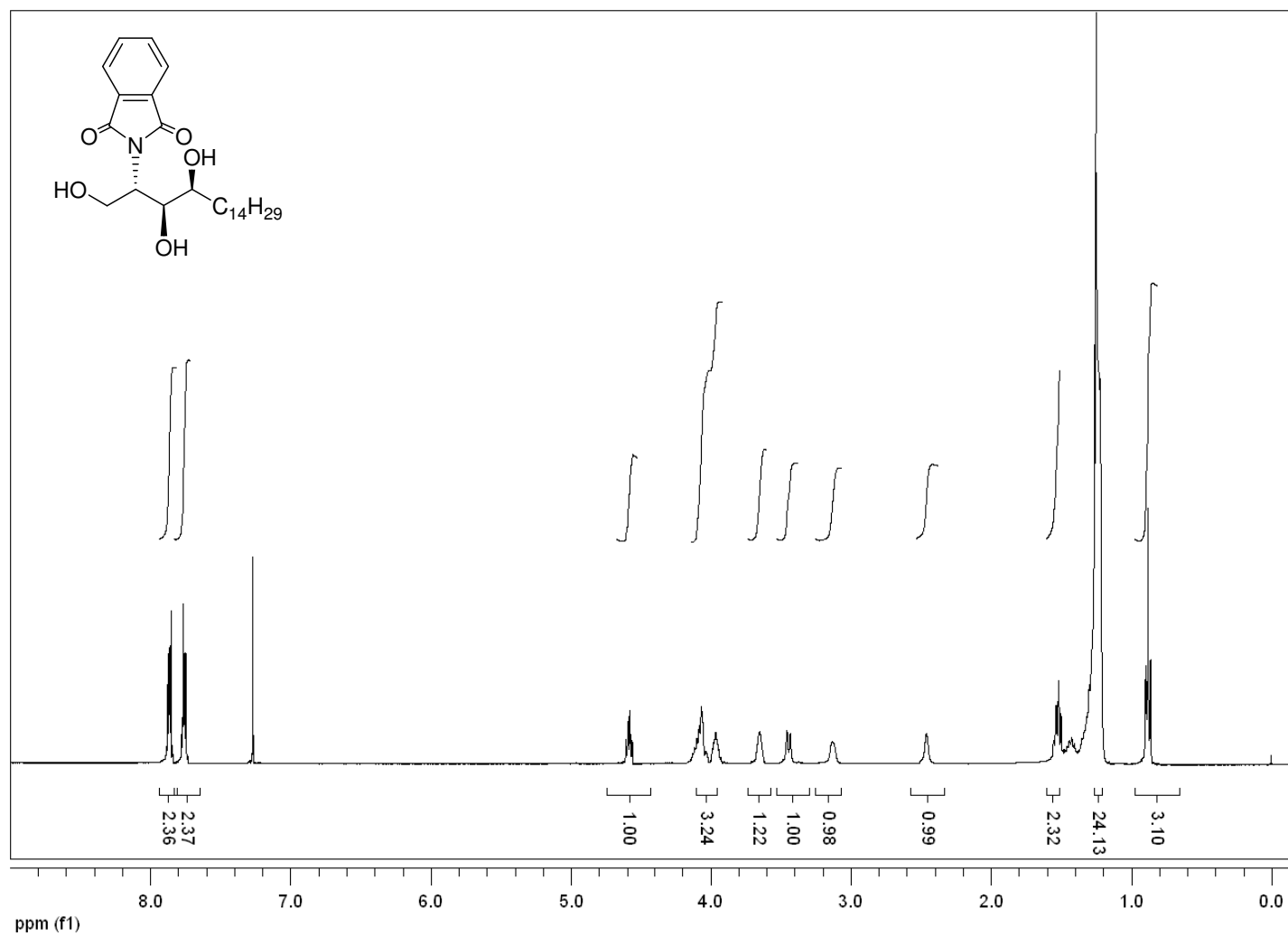
^1H NMR (CDCl_3 , 400 MHz, δ in ppm) of (2*R*)-(3*E*)-2-N-phthalimido-3-octadecen-1-ol (6).



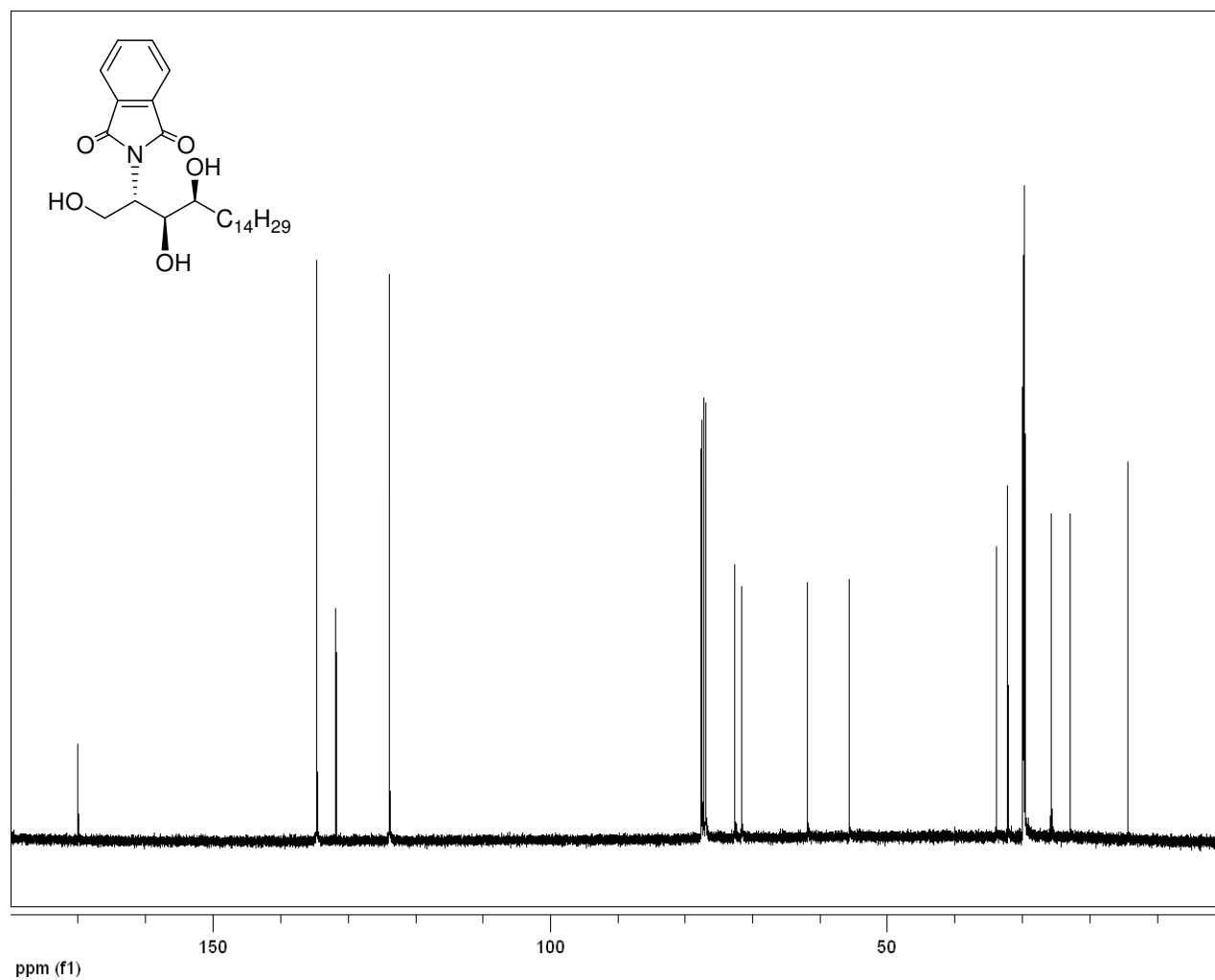
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*R*)-(3*E*)-2-*N*-phthalimido-3-octadecen-1-ol (6).



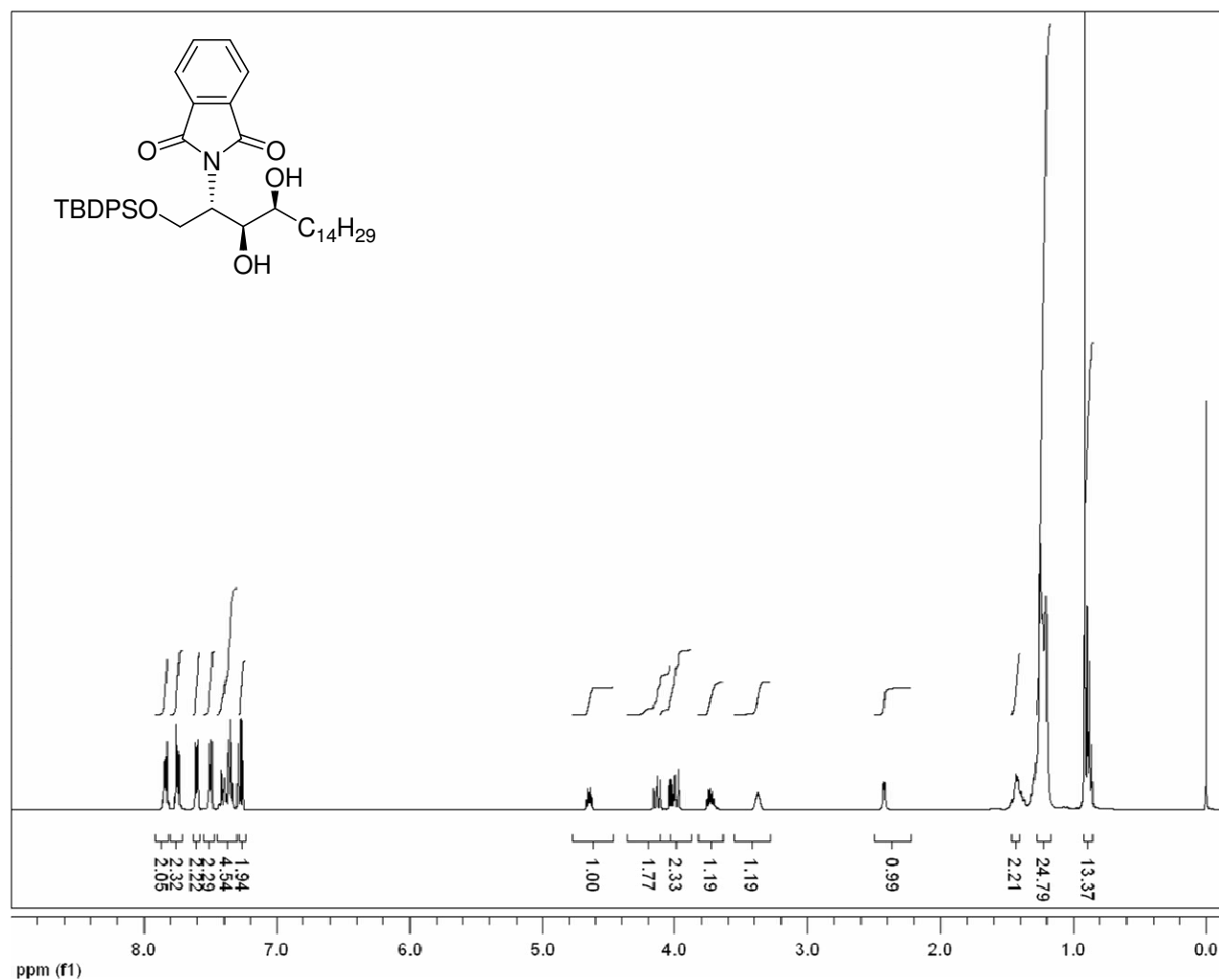
¹H NMR (CDCl₃, 400 MHz, δ in ppm) of (2*S*,3*S*,4*R*)-2-*N*-phthalimido-1,3,4-octadecantriol (5).



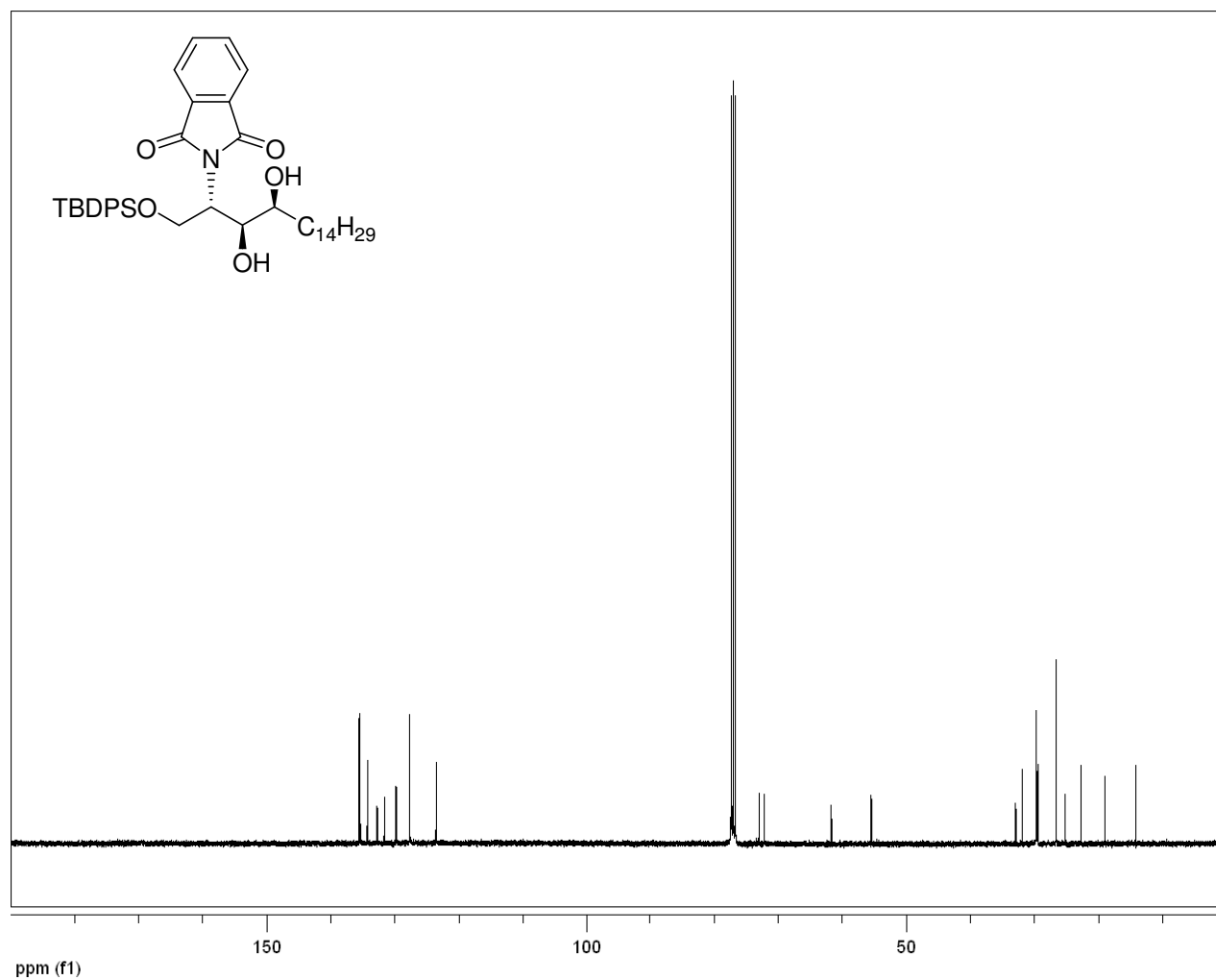
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*S*,3*S*,4*R*)-2-*N*-phthalimido-1,3,4-octadecantriol (5).



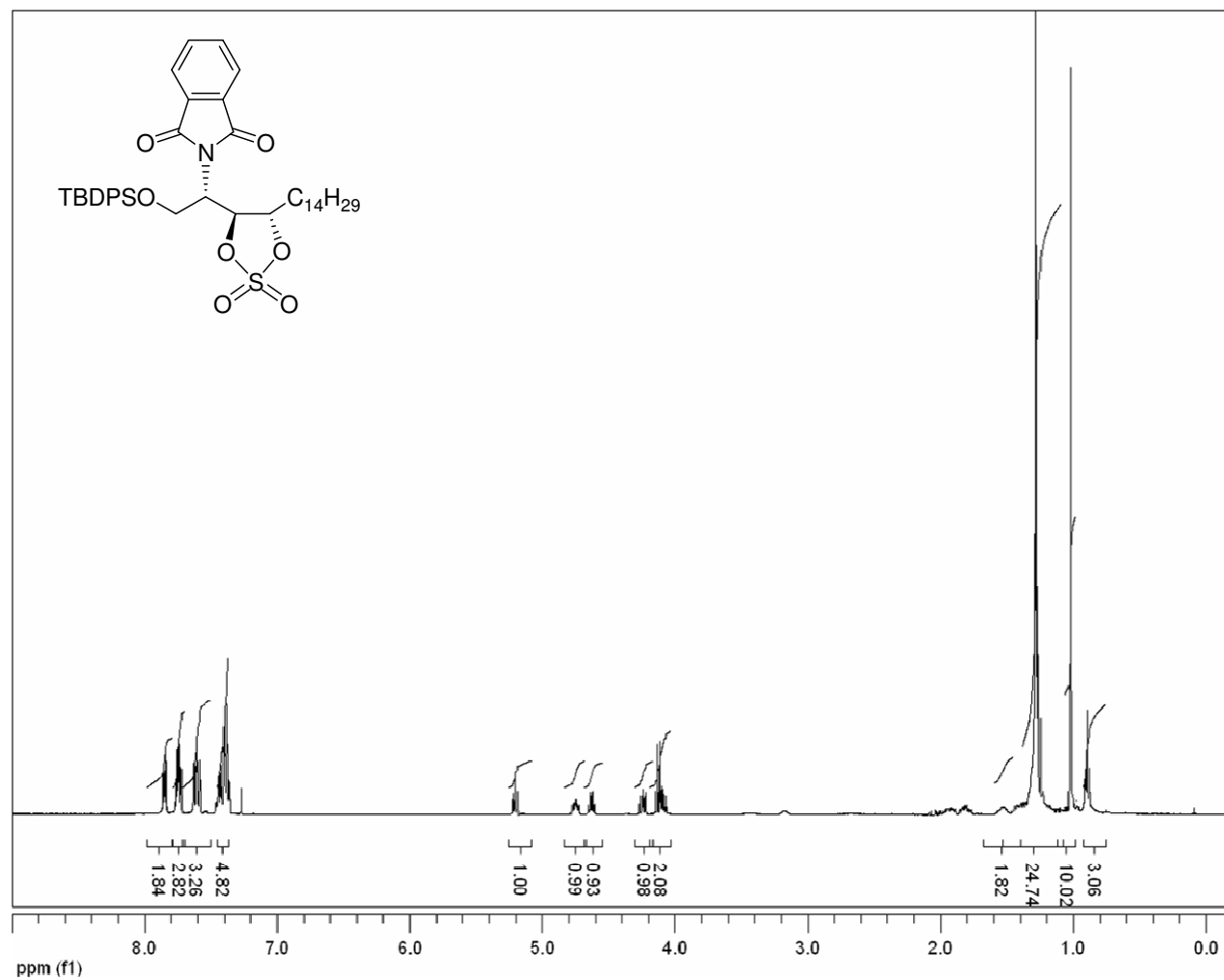
^1H NMR (CDCl_3 , 400 MHz, δ in ppm) of (2*R*,3*S*,4*S*)- 1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadecane-3,4-diol (11).



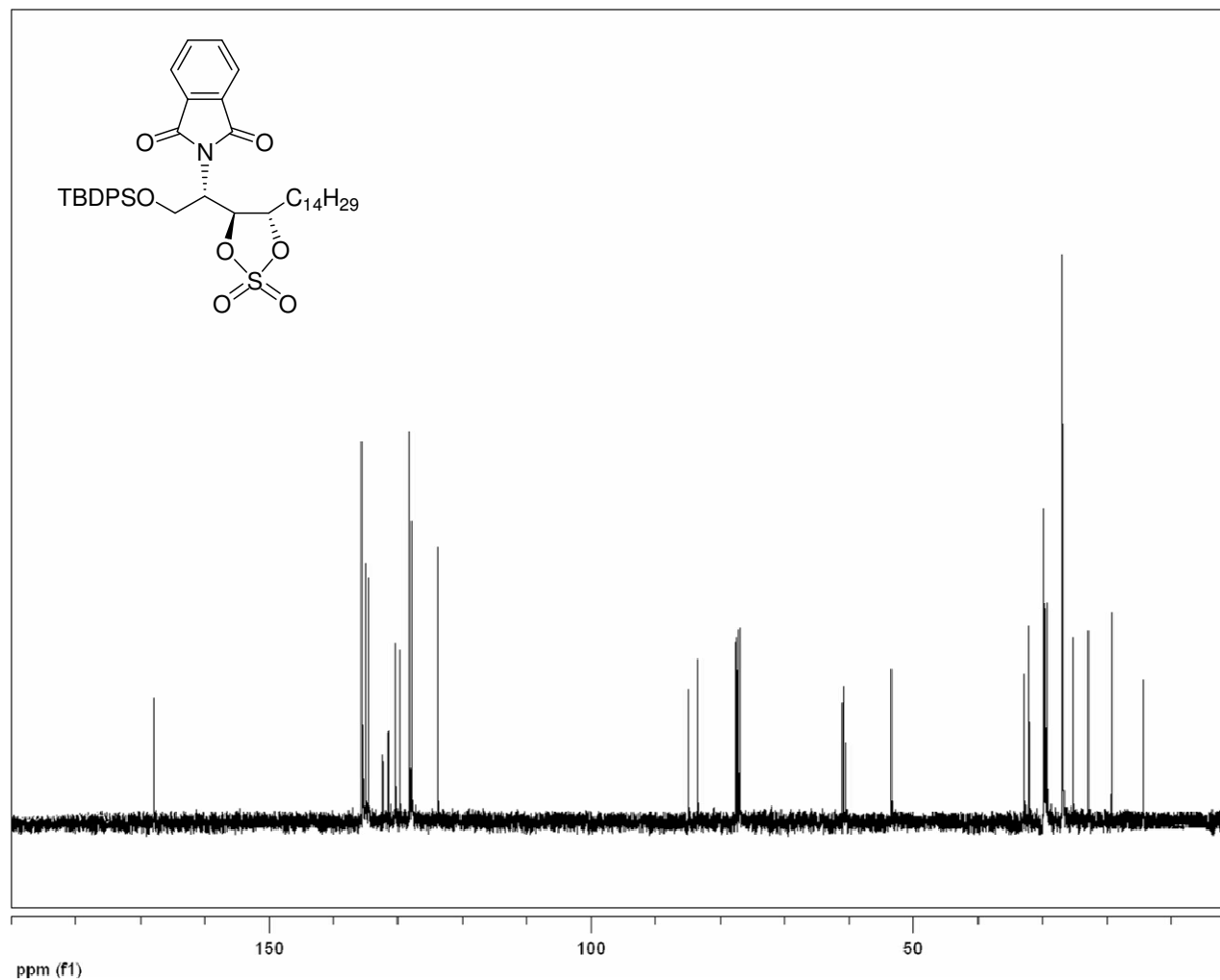
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*R*,3*S*,4*S*)- 1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadecane-3,4-diol (11).



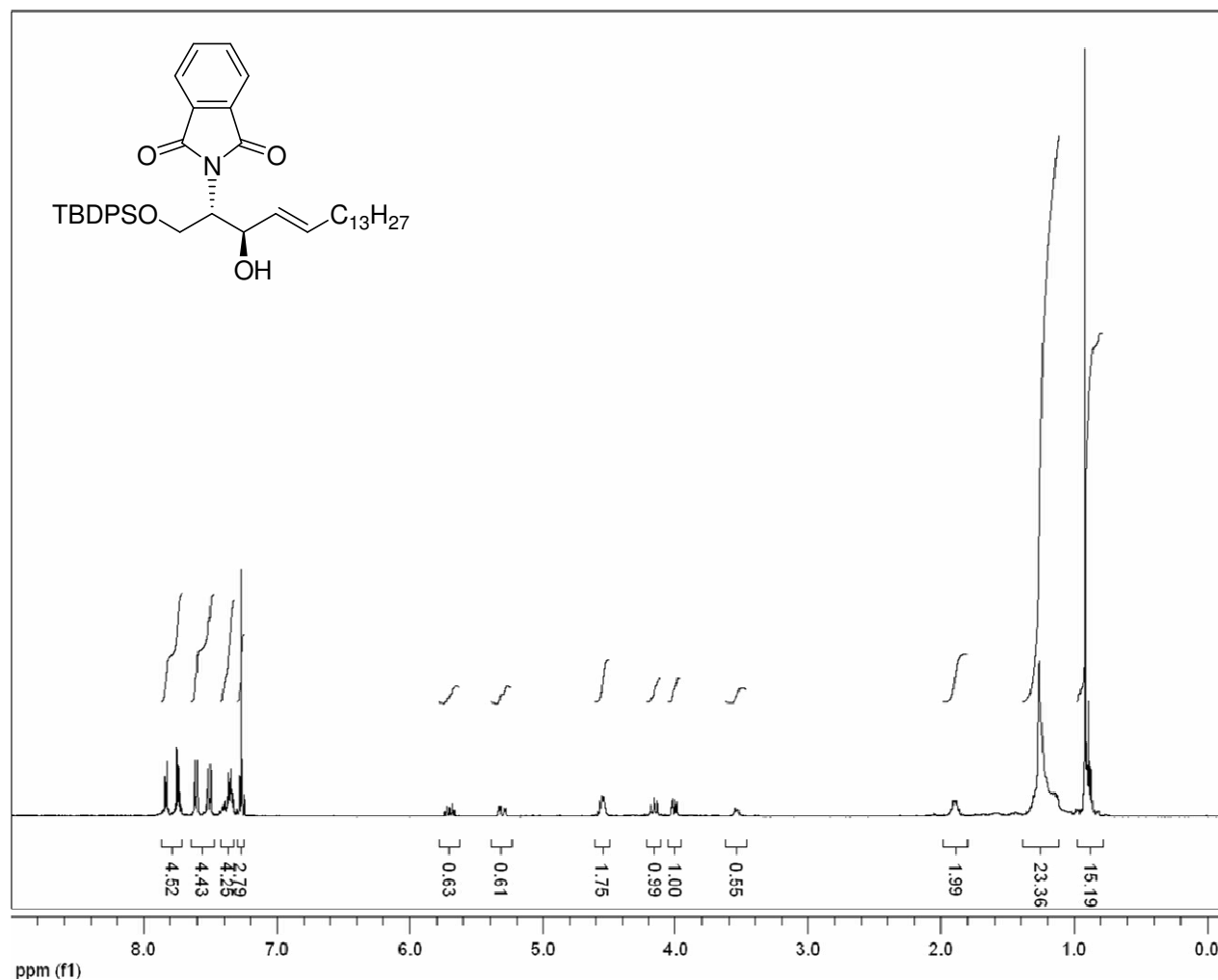
^1H NMR (CDCl_3 , 400 MHz, δ in ppm) of (2*S*, 4*S*, 4*S*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-3,4-*O*-sulphuryl-octadecan (12).



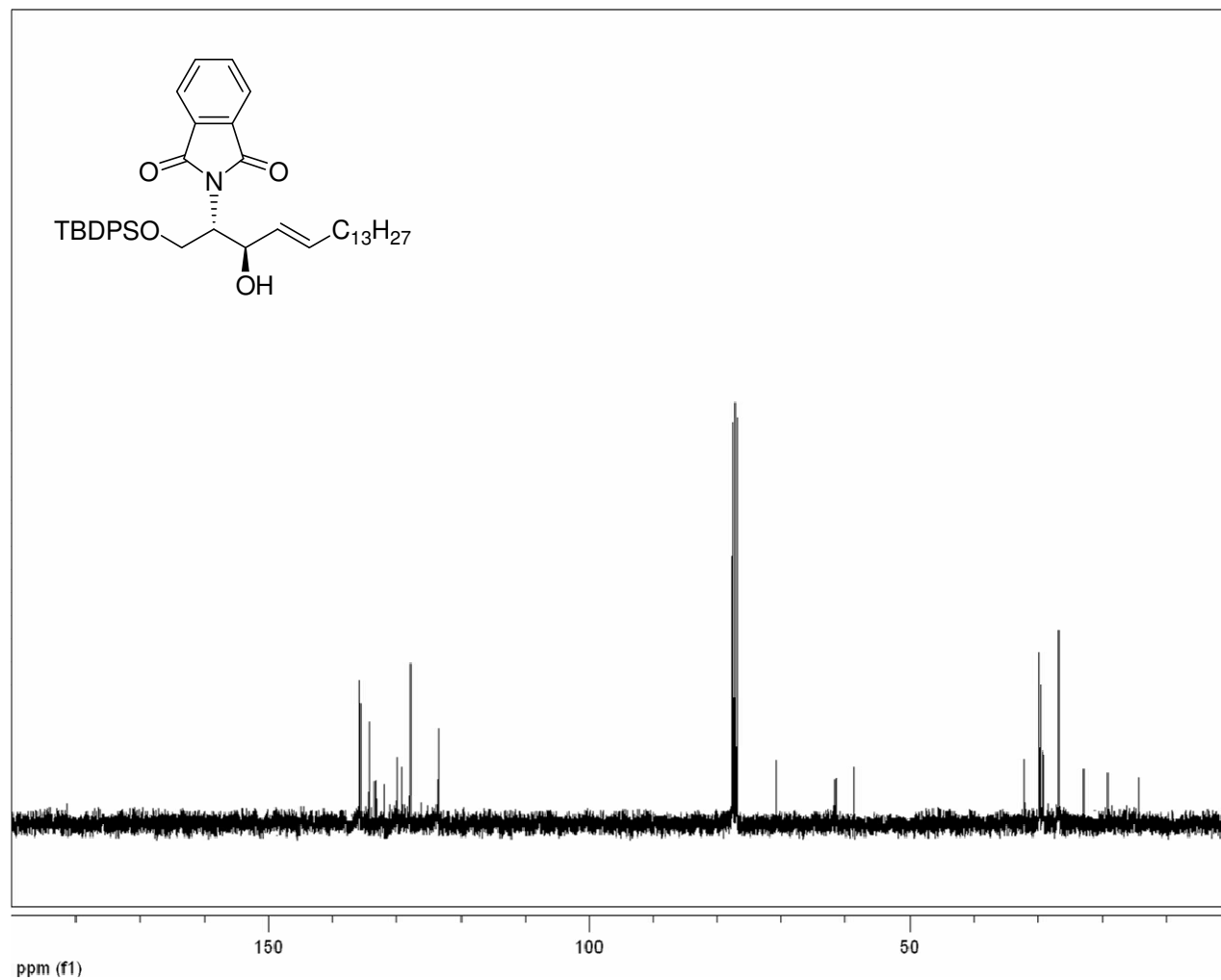
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*S*, 3*S*, 4*S*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-3,4-*O*-sulphuryl-octadecan (12).



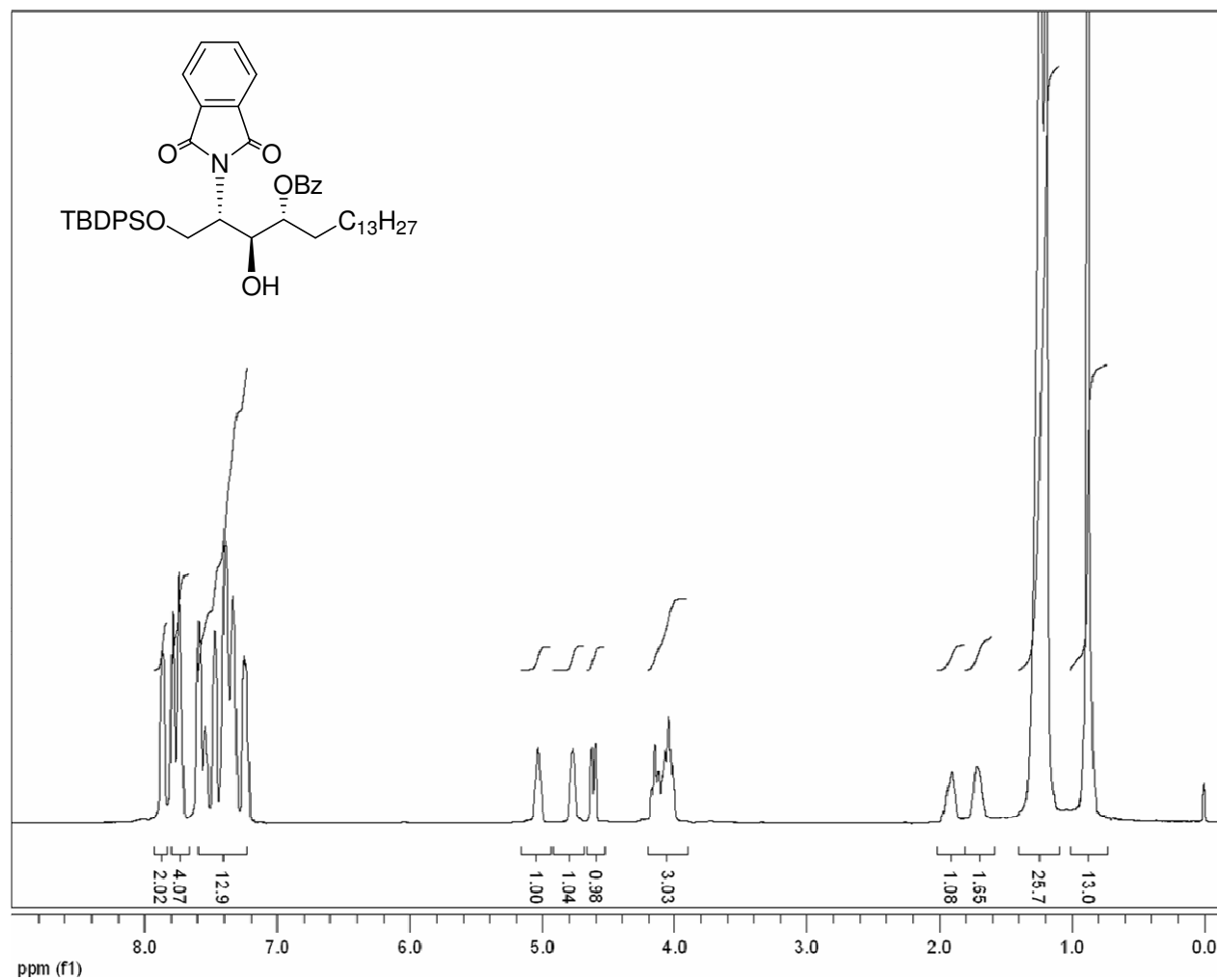
^1H NMR (CDCl_3 , 400 MHz, δ in ppm) of (2*R*,3*R*)-(4*E*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadec-4-en-3-ol (13).



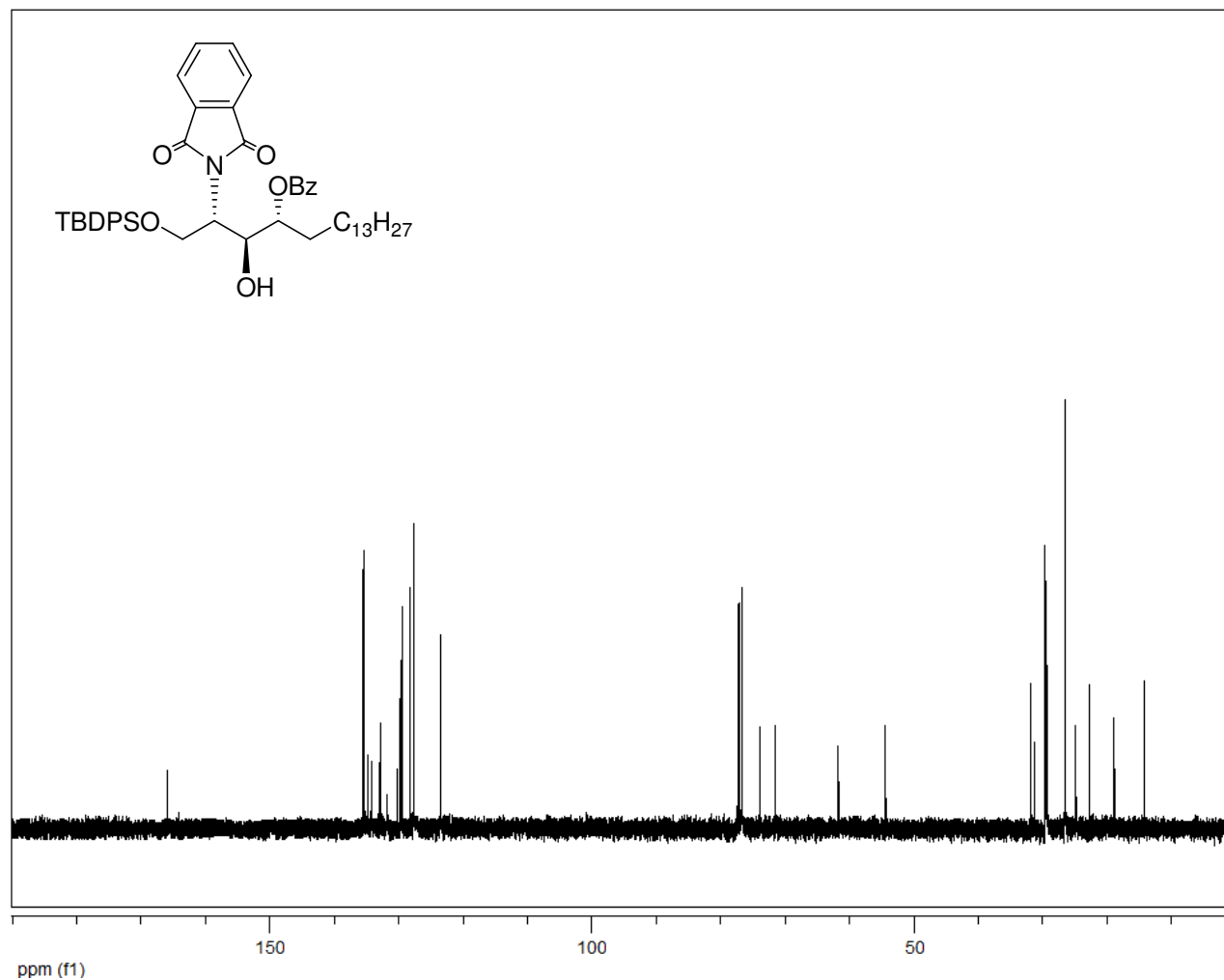
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*R*,3*R*)-(4*E*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadec-4-en-3-ol (13).



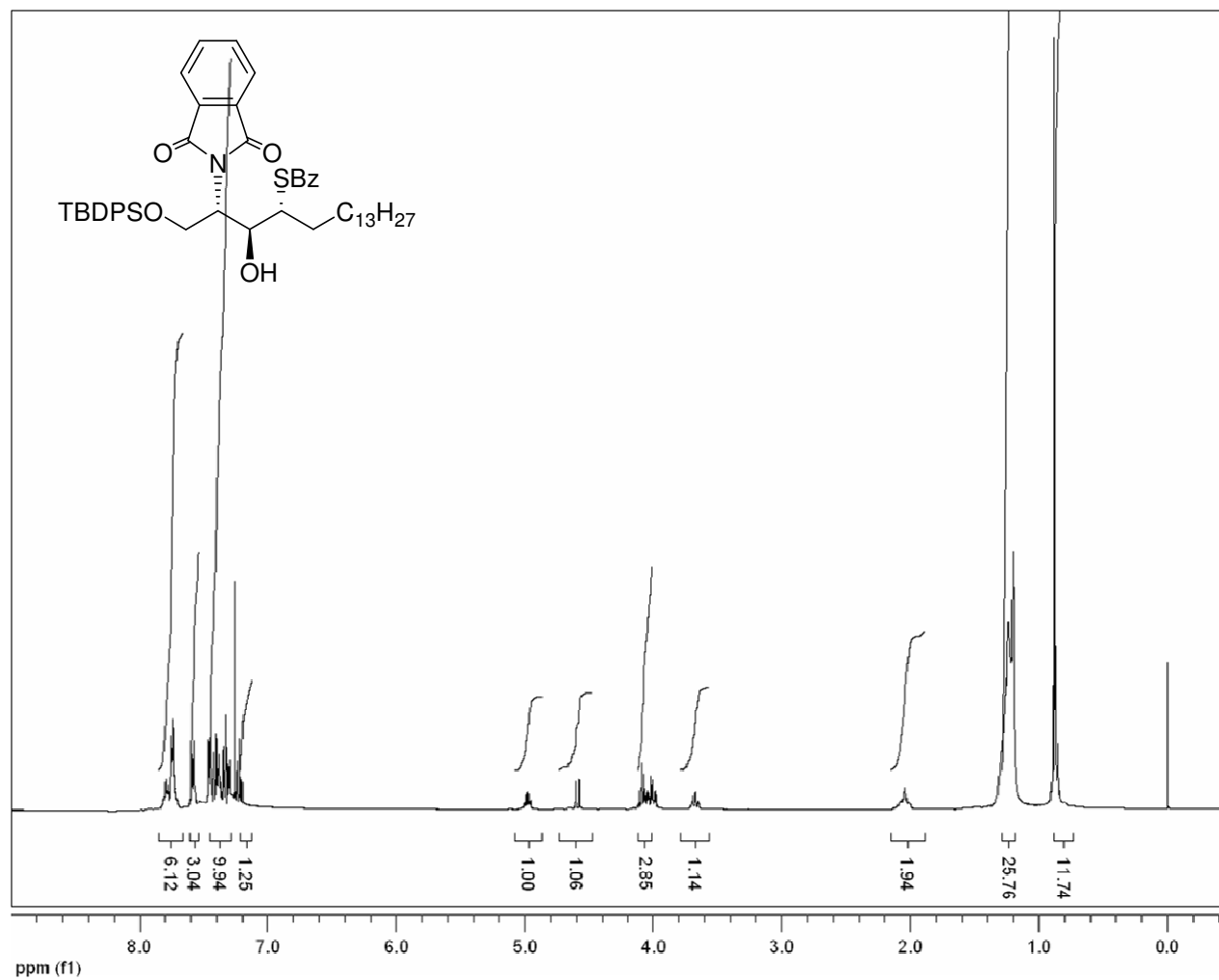
^1H NMR (CDCl_3 , 400 MHz, δ in ppm) of (2*R*,3*S*,4*R*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-3-hydroxy-octadecan-4-yl benzoate (14).



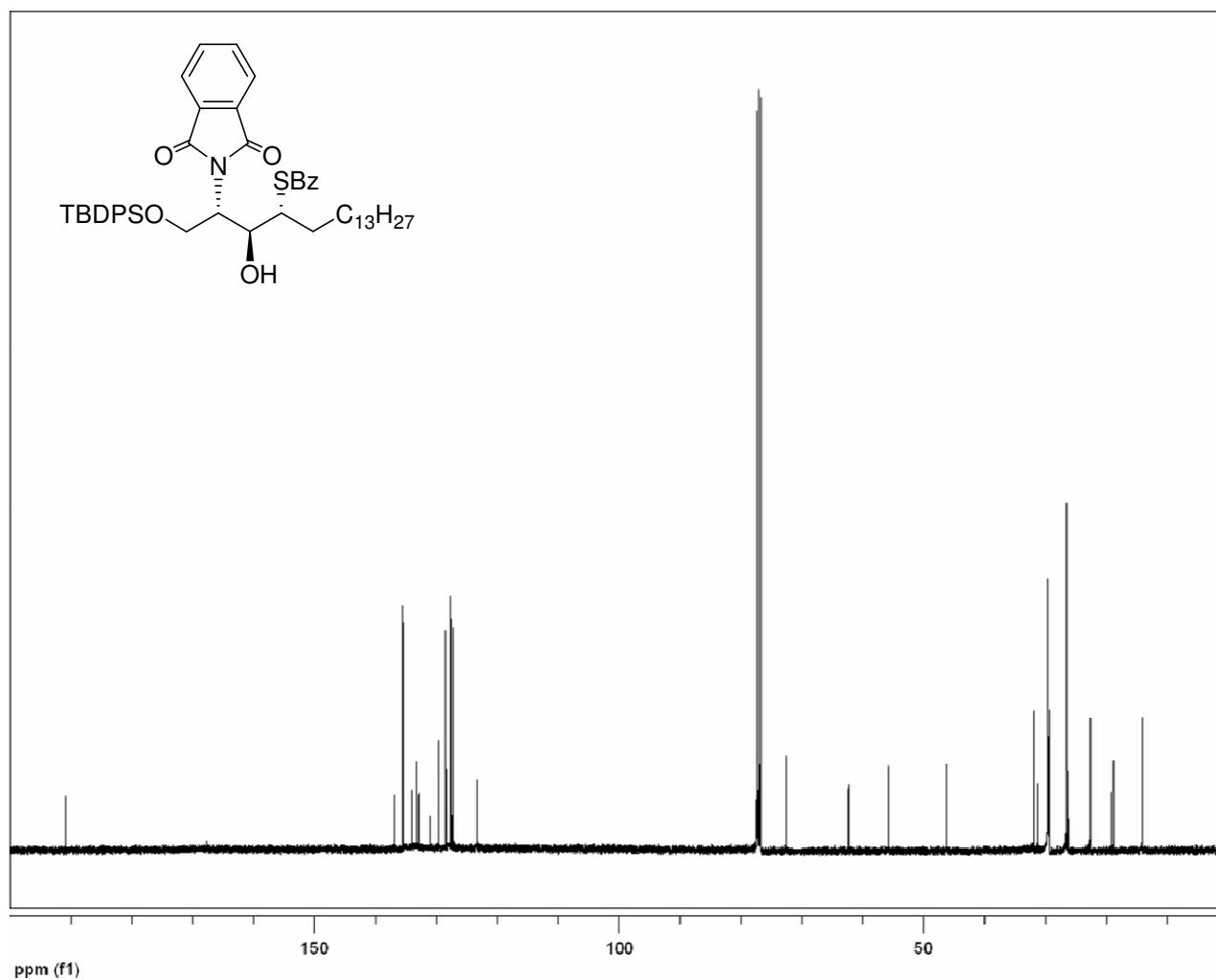
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*R*,3*S*,4*R*)-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-3-hydroxy-octadecan-4-yl benzoate (14).



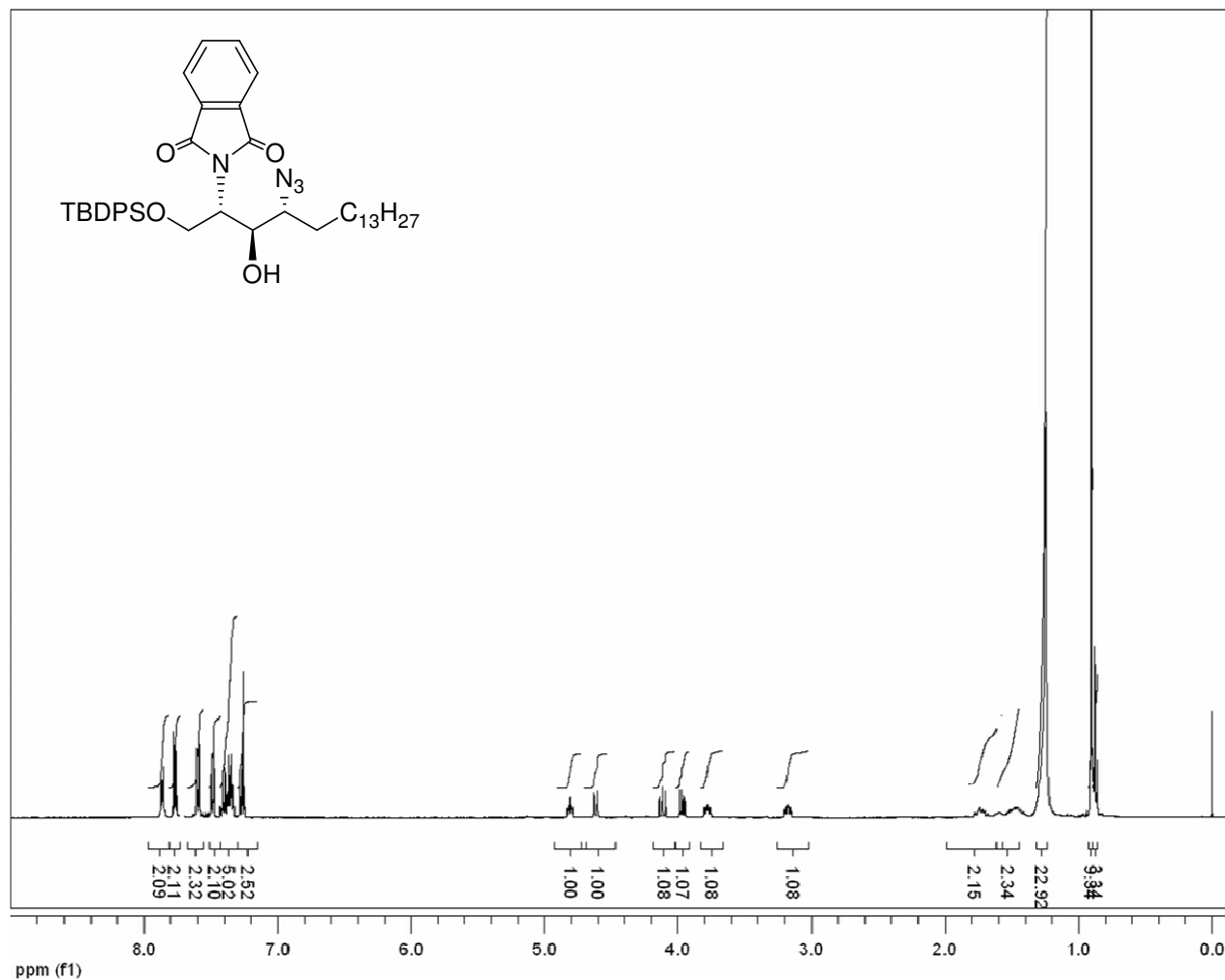
^1H NMR (CDCl_3 , 400 MHz, δ in ppm) of (2*R*,3*S*,4*R*)-1-(*tert*-butyldiphenylsilyloxy)-3-hydroxy-2-*N*-phthalimido octadecan-4-thiobenzoate (15).



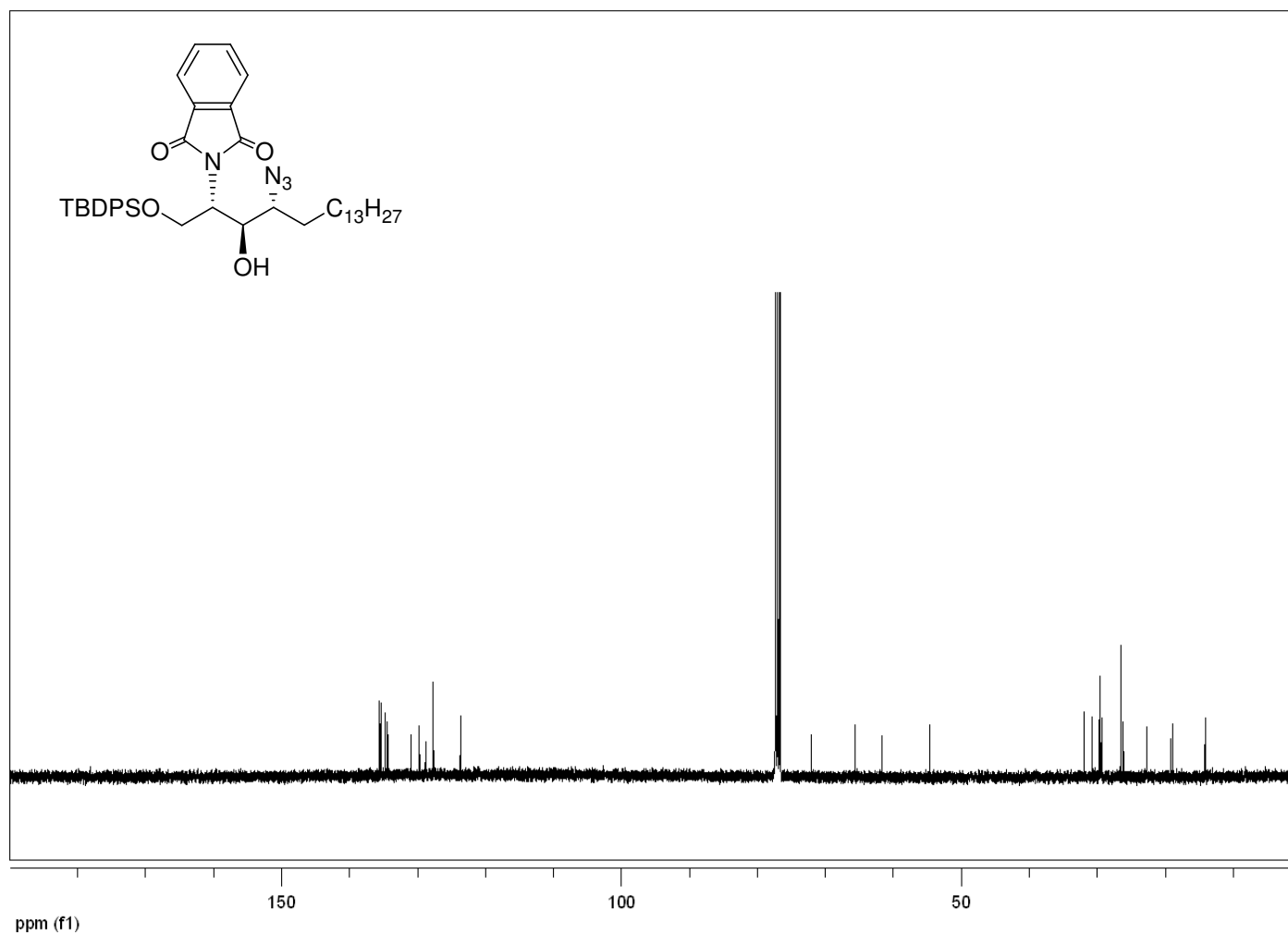
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) (2*R*,3*S*,4*R*)-1-(*tert*-butyldiphenylsilyloxy)-3-hydroxy-2-*N*-phthalimido-octadecan-4-thiobenzoate (15).



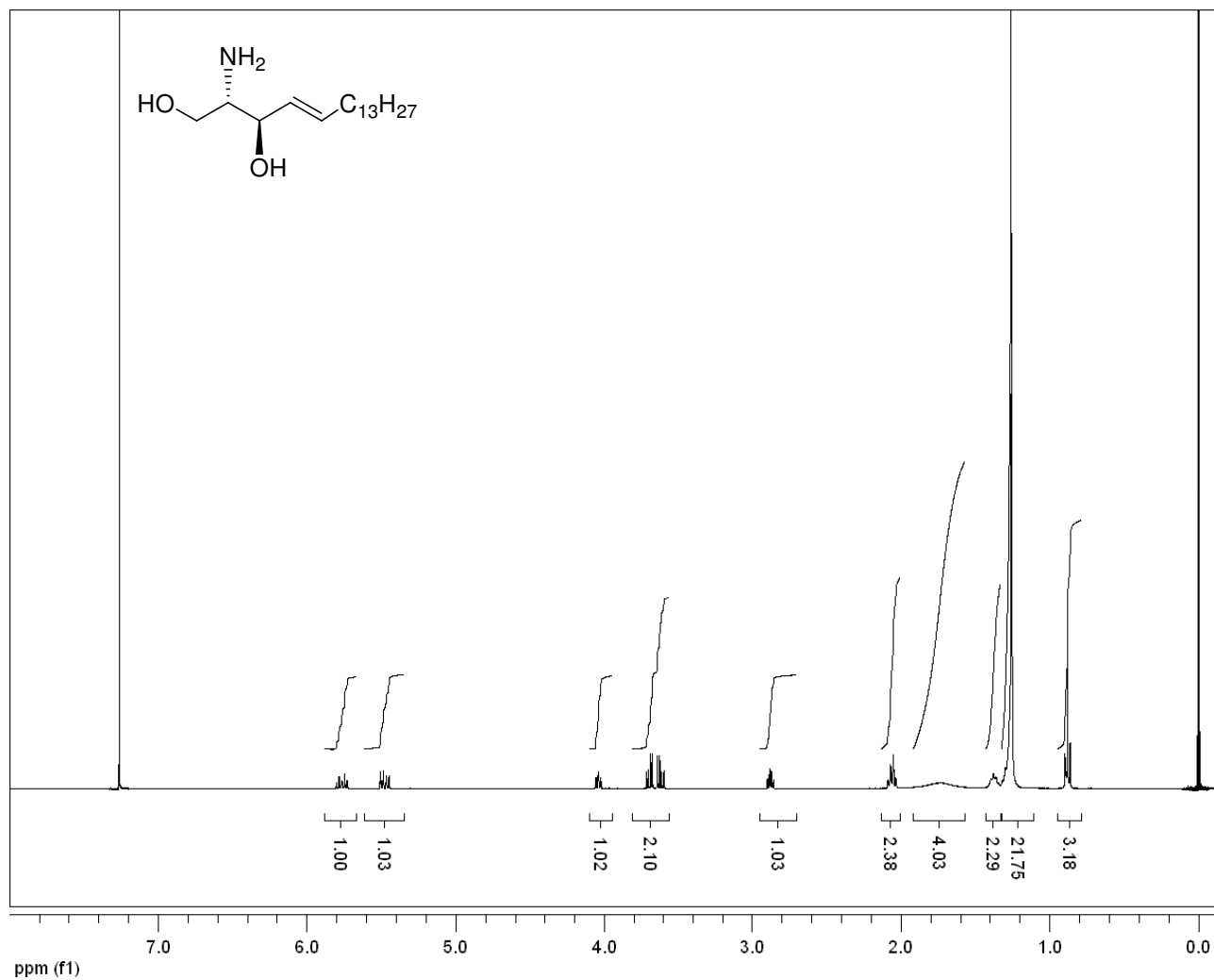
^1H NMR (CDCl_3 , 400 MHz, δ in ppm) of (2*R*,3*S*,4*R*)-4-azide-1-(*tert*-butyldiphenylsilyloxy)-2-*N*-phthalimido-octadecan-3-ol (16).



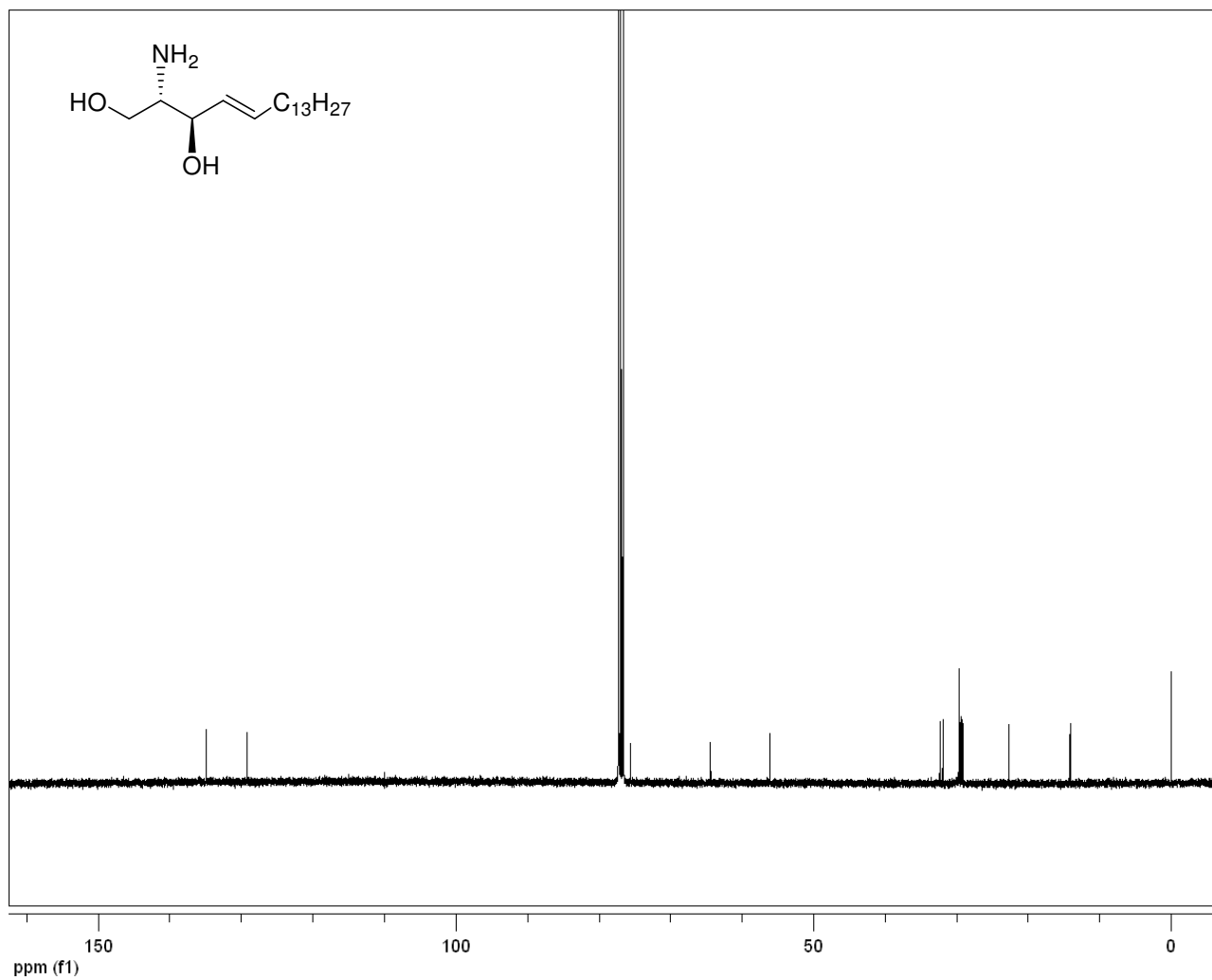
^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*S*,3*S*,4*R*)-4-azido-1-(*tert*-butyldiphenylsilyloxy)-2*N*-phthalimido-octadecan-3-ol (15).



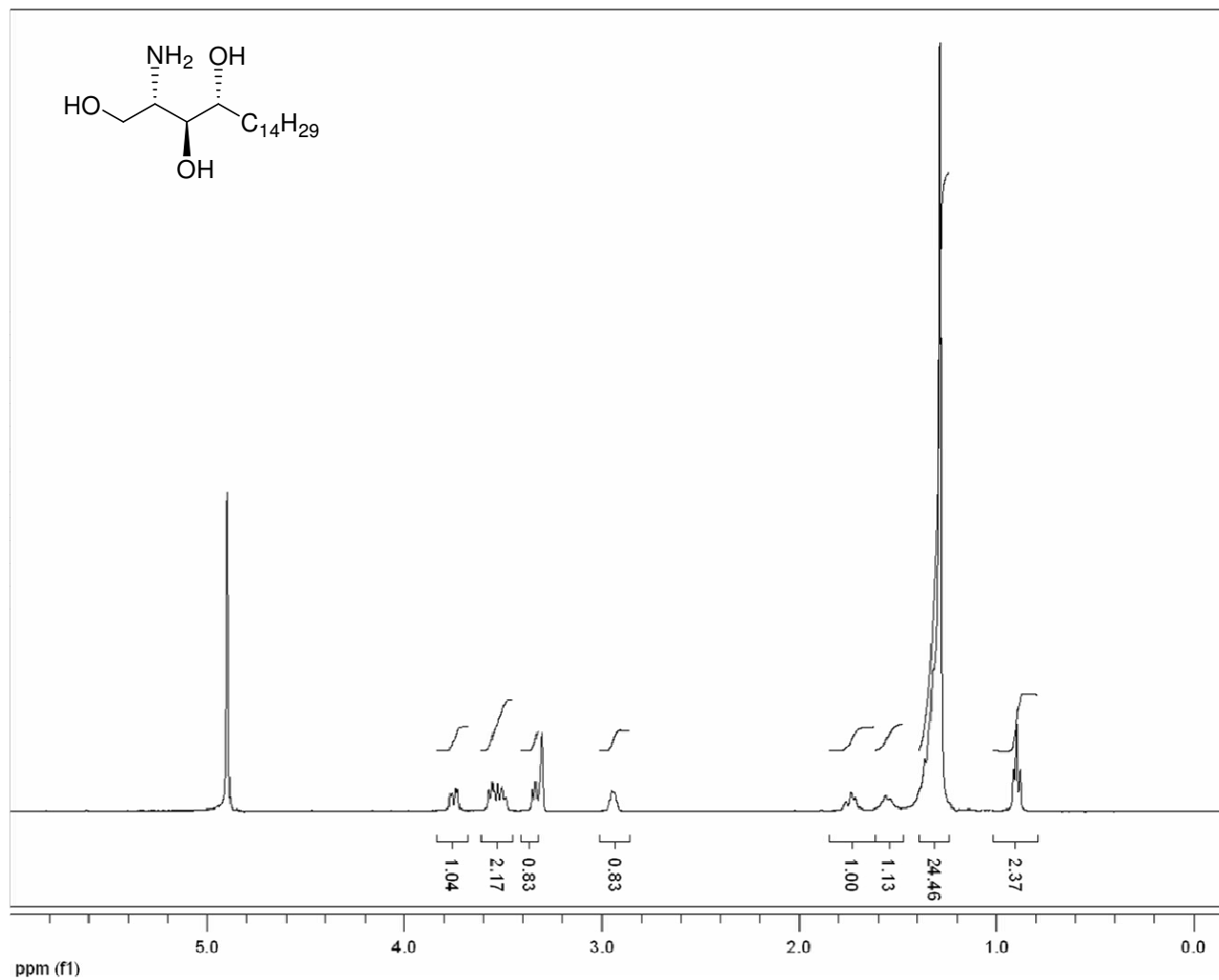
¹H NMR (CDCl₃, 400 MHz, δ in ppm) of (2*S*,3*R*)-(4*E*)-2-amino-octadec-4-ene-1,4-diol (*D*-erythro-sphingosine) (1).



^{13}C NMR (CDCl_3 , 100.6 MHz, δ in ppm) of (2*S*,3*R*)-(4*E*)-2-amino-octadec-4-ene-1,4-diol (*D*-erythro-sphingosine) (1).



^1H NMR (CD_3OD , 400 MHz, δ in ppm) of (2*S*,3*S*,4*R*)-2-amino-octadecane-1,3,4-triol (*D*-ribo- phytosphingosine) (**2**).



^{13}C NMR (CD_3OD , 100.6 MHz, δ in ppm) of (2*S*,3*S*,4*R*)-2-amino-octadecane-1,3,4-triol (*D*-ribo- phytosphingosine) (**2**).

