SUPPORTING INFORMATION

Synthesis of dihydrooxepin models related to the antitumor antibiotic MPC1001

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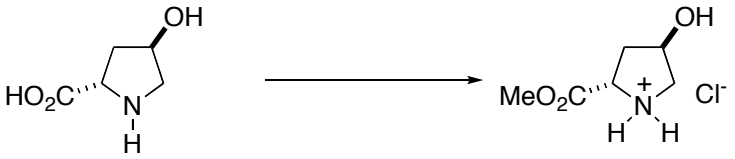
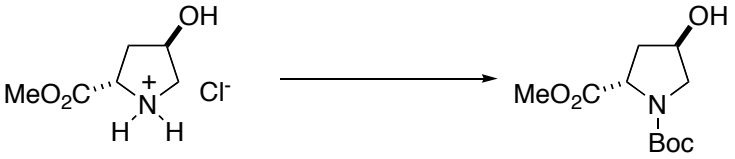
(2*S*,4*R*)-4-Hydroxypyrrolidine-2-carboxylic Acid Methyl Ester Hydrochloride (6).[14]



5 **6**

$SOCl_2$ (4 mL, 54.7 mmol) was added dropwise to a stirred and cooled (0 °C) solution of trans-4-hydroxy-L-proline (6.0 g, 45.7 mmol) in MeOH (80 mL). After 30 min, the cold bath was removed and stirring was continued for 6 h. Evaporation of the solvent gave ester hydrochloride **6** as a white solid (8.3 g, 100%), which was used for next step without further purification. The material had: mp 165-167 °C (lit.[14b] 171-172 °C).

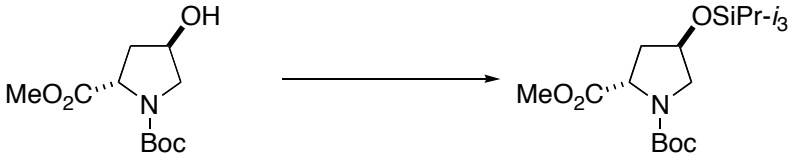
(2*S*,4*R*)-4-Hydroxypyrrolidine-1,2-dicarboxylic Acid 1-*tert*-Butyl Ester 2-Methyl Ester (7).[14]



6 **7**

Boc_2O (12.0 g, 54.8 mmol) was added to a stirred and cooled (0 °C) solution of ester hydrochloride **6** (8.3 g, 45.7 mmol) and Et_3N (14.0 mL, 100 mmol) in CH_2Cl_2 (100 mL). After 20 min, the cold bath was removed and stirring was continued for 2 h. The reaction mixture was diluted with CH_2Cl_2 (100 mL) and washed with hydrochloric acid (1 M, 60 mL). The organic extract was washed with water, saturated aqueous $NaHCO_3$, and brine, dried ($MgSO_4$) and evaporated to afford crude alcohol **7** (10.8 g, 96%), which was used directly in the next step: FTIR ($CDCl_3$, cast) 3438, 2978, 1750, 1701 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.32-1.42 (m, 9 H), 2.02-2.14 (m, 1 H), 2.22-2.40 (m, 2 H), 3.42-3.62 (m, 2 H), 3.76 (s, 3 H), 4.38-4.52 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 28.2 (q), 28.4 (q), 38.5 (t), 39.1 (t), 45.9 (t), 52.0 (q), 54.7 (t), 57.5 (d), 57.9 (d), 69.4 (d), 70.2 (d), 80.3 (s), 153.9 (s), 173.6 (s); exact mass (electrospray) *m*/*z* calcd for $C_{11}H_{19}NNaO_5$ (M + Na) 268.11554, found 268.11563.

(2*S*,4*R*)-4-[(Triisopropylsilyl)oxy]-1,2-pyrrolidinedicarboxylic Acid 1-*tert*-Butyl Ester 2-Methyl Ester (8).[15]

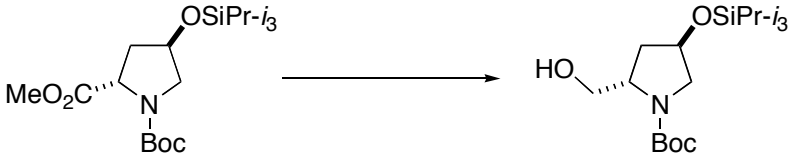


7 **8**

i-Pr_3SiCl (8.4 mL, 39.2 mmol) was added to a stirred solution of alcohol **7** (8.0 g, 32.6 mmol) and imidazole (4.5 g, 65.3 mmol) in CH_2Cl_2 (100 mL), and stirring was continued for 48 h. The mixture was diluted with CH_2Cl_2 (50 mL) and washed with hydrochloric acid (1 M, 40 mL). The organic extract was washed with water, saturated aqueous $NaHCO_3$ and brine, dried ($MgSO_4$) and evaporated. Flash chromatography of the residue over silica gel, using 1:10 EtOAc-hexane, gave silyl ether **8** (12.3 g, 94%) as an oil: FTIR ($CDCl_3$, cast) 2945, 2868, 1754, 1707 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.02 (s, 21 H), 1.40-1.42 (m, 9 H), 2.00-2.08 (m, 1 H), 2.10-2.12 (m, 1 H), 3.38-3.42 (m, 1 H), 3.58-3.64 (m, 1 H), 3.78 (s, 3 H), 4.35-4.42 (m, 1 H), 4.52 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.0, 17.9, 28.3, 39.2, 40.1, 51.9, 52.1, 54.8, 55.2, 57.7, 58.1, 69.9, 70.7, 80.0, 153.8, 173.7; exact mass (electrospray) *m/z* calcd for $C_{20}H_{40}NO_5Si$ 402.26703, found 402.26746.

(2*S*,4*R*)-2-Formyl-4-[(triisopropylsilyl)oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (9).

(a) (2*S*,4*R*)-2-Hydroxymethyl-4-[(Triisopropylsilyl)oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester.

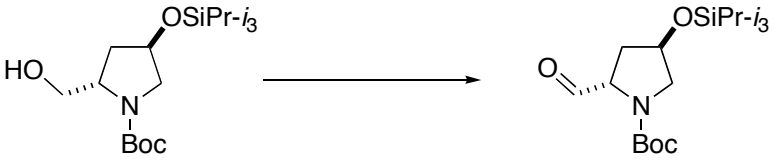


8 **-**

$NaBH_4$ (3.7 g, 109.7 mmol) was added to a stirred and cooled (0 °C) solution of ester **8** (22.0 g, 54.8 mmol) in 1:1 THF-EtOH (140 mL). Then $CaCl_2$ (5.5 g, 54.8 mmol) was added. The ice bath was left in place, but not recharged, and stirring was continued overnight. The mixture was quenched with hydrochloric acid (1 M) and extracted with EtOAc. The organic extract was washed with saturated aqueous $NaHCO_3$ and brine, dried ($MgSO_4$) and evaporated. Flash chromatography of the residue over silica gel, using 1:10 to 1:4 EtOAc-hexane, gave (2*S*,4*R*)-2-hydroxymethyl-4-[(triisopropylsilyl)oxy]pyrrolidine-1-carboxylic acid *tert*-butyl ester

(18.6 g, 91%) as an oil: FTIR ($CDCl_3$, cast) 3120, 2944, 2867, 1698, 1775 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.00-1.10 (m, 21 H), 1.42 (s, 9 H), 1.58-1.62 (m, 1 H), 1.98-2.02 (m, 1 H), 3.33 (dd, *J* = 11.5, 3.7 Hz, 1 H), 3.42-3.63 (m, 2 H)), 3.68 (t, *J* = 8.8 Hz, 1 H), 4.07-4.20 (m, 1 H), 4.36 (s, 1 H), 4.90 (d, *J* = 7.1 Hz, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.2, 17.7, 28.4, 38.2, 56.3, 59.0, 67.2, 70.0, 80.3, 157.4; exact mass (electrospray) *m/z* calcd for $C_{19}H_{39}NNaO_4Si$ (M + Na) 396.25406, found 396.25405.

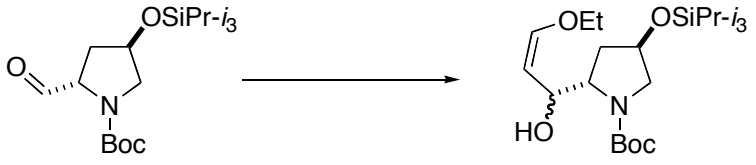
(b) (2*S*,4*R*)-2-Formyl-4-[(triisopropylsilyl)oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (9).



- **9**

DMSO (11.4 mL, 160 mmol) was added to a stirred and cooled (-78 °C) solution of $(COCl)_2$ (7.0 mL, 80.4 mmol) in CH_2Cl_2 (450 mL). After 10 min, the above alcohol (20 g, 53.6 mmol) in CH_2Cl_2 (50 mL) was added dropwise. Stirring was continued for 20 min and then Et_3N (22.4 mL, 160 mmol) was added dropwise. Stirring at -78 °C was continued for 30 min, the cold bath was removed and stirring was continued for 20 min. The mixture was quenched with saturated aqueous $KHSO_4$ and the organic extract was washed with water, saturated aqueous $NaHCO_3$ and brine, dried ($MgSO_4$) and evaporated. Flash chromatography of the residue over silica gel, using 1:4 EtOAc-hexane, gave aldehyde **9** (18.1 g, 91%) as an oil: FTIR ($CDCl_3$, cast) 2944, 2868, 1738, 1698 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.00-1.05 (m, 21 H), 1.42-1.50 (m, 9 H), 1.90-2.00 (m, 1 H), 2.02-2.17 (m, 1 H), 3.40-3.60 (m, 2 H), 4.20-4.28 (m, 0.6 H), 4.38-4.42 (m, 0.4 H), 4.50 (s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.1, 17.7, 28.2, 36.0, 37.1, 55.6, 63.5, 63.9, 70.0, 70.7, 80.5, 80.9, 154.2, 200.0, 200.4; exact mass (electrospray) *m/z* calcd for $C_{19}H_{37}NNaO_4Si$ (M + Na) 394.23842, found 394.23864.

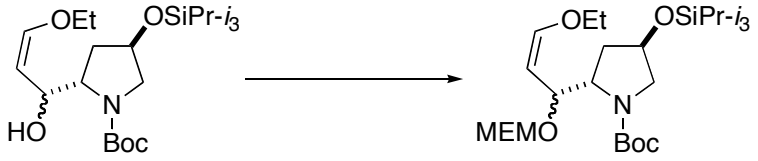
(2*S*,4*R*)-2-[(2*Z*)-3-Ethoxy-1-hydroxyallyl]-4-[(triisopropylsilyl)oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (10).



9 **10**

t-BuLi (1.7 M in pentane, 7.8 mL, 13.3 mmol) was added dropwise to a stirred and cooled (-78 °C) solution of (*Z*)-2-bromo-1-ethoxyethene (0.7 mL, 6.6 mmol) in THF (40 mL). Stirring was continued for 30 min and then aldehyde **9** (1.9 g, 5.1 mmol) in THF (10 mL) was added dropwise to the resulting vinyllithium solution. After 2 h, the mixture was quenched with saturated aqueous NH_4Cl and extracted with EtOAc. The organic extract was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:10 EtOAc-hexane, gave the isomeric alcohols **10** [(1.42 g, 63% or 87% corrected for recovered **9** (475 mg, 25%)] as an oil: FTIR ($CDCl_3$, cast) 2925, 2867, 1694, 1666 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.00-1.12 (m, 21 H), 1.15-1.1.45 (m, 3 H), 1.40- 1.55 (m, 9 H), 1.75-2.10 (m, 2 H), 3.22-3.41 (m, 1 H), 3.48-3.3.68 (m, 1 H), 3.75-3.85 (m, 2 H), 3.95- 4.05 (m, 1 H), 4.25-4.55 (m, 3 H), 4.65-4.75 (m, 0.4 H), 5.35-5.40 (m, 0.6 H), 6.08 (d, J = 6.4 Hz, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.0, 15.2, 17.9, 28.3, 37.7, 38.1, 55.7, 56.7, 62.7, 63.0, 68.0, 70.1, 70.2, 80.2, 80.5, 105.3, 146.8, 150.6; exact mass (electrospray) m/z calcd for $C_{23}H_{45}NNaO_5Si$ (M + Na) 466.29592, found 466.29611.

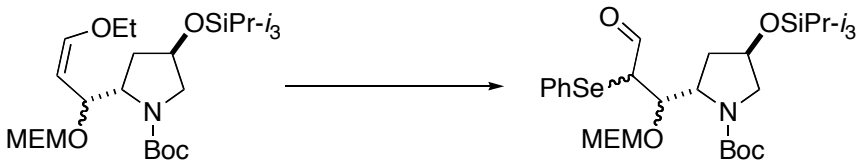
(2*S*,4*R*)-2-[(2*Z*)-3-Ethoxy-1-[(2-methoxyethoxy)methoxy]allyl]-4-[(triisopropylsilyl)-oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (11).



10 **11**

MEMCl (3.4 mL, 30.0 mmol) was added to a stirred solution of alcohols **10** (8.9 g, 20.1 mmol), *i*-Pr_2NEt (7.0 mL, 40.2 mmol) and Bu_4NI (7.4 g, 20.1 mmol) in THF (100 mL) and the mixture was refluxed for 20 h and then cooled to room temperature. Water and EtOAc were added and the organic phase was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:8 EtOAc-hexane, gave the isomeric MEM ethers **11** (8.8 g, 83%) as an oil: FTIR ($CDCl_3$, cast) 2943, 2868, 1697, 1662 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 0.97-1.10 (m, 21 H), 1.20-1.30 (m, 3 H), 1.48 (s, 9 H), 1.80-2.00 (m, 1 H), 2.05-2.20 (m, 1 H), 3.35-3.50 (m, 5 H), 3.50-3.65 (m, 7 H), 4.10-4.25 (m, 1 H), 4.50-4.80 (m, 3 H), 5.05 (d, J = 12 Hz, 1 H), 6.05 (apparent d, J = 6.5 Hz, 0.5 H), 6.14 (apparent d, J = 6.5 Hz, 0.5 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.1, 15.2, 17.9, 28.4, 35.6, 36.4, 55.0, 55.2, 58.90, 58.94, 59.2, 59.9, 66.7, 66.9, 68.0, 68.1, 70.3, 70.5, 71.7, 79.0, 102.2, 103.9, 147.7, 154.6; exact mass (electrospray) m/z calcd for $C_{27}H_{53}NNaO_7Si$ (M + Na) 554.34835 found 554.34831.

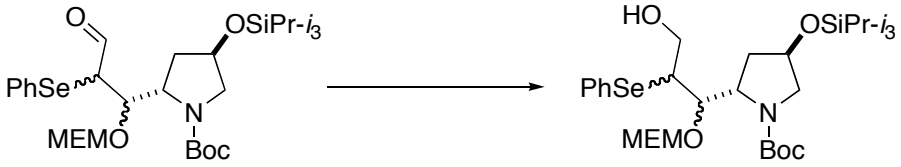
(2*S*,4*R*)-2-[1-[(2-Methoxyethoxy)methoxy]-3-oxo-2-(phenylselanyl)propyl]-4-[(triisopropylsilyl)oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (12).



11 **12**

A solution of PhSeCl (0.76 g, 3.9 mmol) in EtOAc (3 mL) was added to a stirred solution of the enol ethers **11** (1.93 g, 3.6 mmol) in a mixture of EtOAc (36 mL) and water (15 mL). After 15 min, $NaHCO_3$ (0.60 g, 7.2 mmol) was added and stirring was continued for 30 min. The mixture was diluted with EtOAc and the organic phase was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:5 EtOAc-hexane, gave the isomeric aldehydes **12** (2.3 g, 98%) as an oil: FTIR ($CDCl_3$, cast) 2943, 2867, 1699 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.00-1.10 (m, 21 H), 1.40-1.60 (m, 9 H), 1.90-2.10 (m, 2 H), 2.95-3.00 (m, 0.33 H), 3.20-3.30 (m, 0.67 H), 3.38-3.43 (m, 3 H), 3.50-3.62 (m, 3 H), 3.65-3.85 (m, 3 H), 4.40-4.60 (m, 2 H), 4.60-5.00 (m, 3 H), 7.22-7.36 (m, 3 H), 7.52-7.60 (m, 2 H), 8.98-9.02 (m, 0.3 H), 9.38-9.42 (m, 0.7 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 11.9, 17.8, 28.3, 35.8, 54.3, 55.9, 58.5, 58.9, 67.7, 70.2, 71.6, 74.9, 80.8, 97.2, 125.2, 127.6, 128.6, 129.4, 131.4, 135.4, 154.2, 187.1, 191.5; exact mass (electrospray) *m*/*z* calcd for $C_{31}H_{53}NNaO_7SeSi$ (M + Na) 682.26487, found 682.26478.

(2*S*,4*R*)-2-[3-Hydroxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-[(triisopropylsilyl)oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (13).

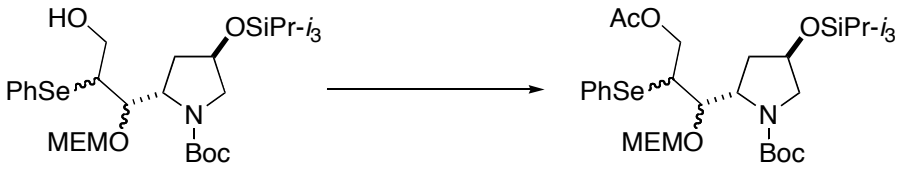


12 **13**

A solution of aldehydes **12** (2.35 g, 3.6 mmol) in Et_2O (6 mL) was added dropwise to a stirred and cooled (0 °C) suspension of $LiAlH_4$ (157 mg, 3.9 mmol) in Et_2O. Stirring was continued for 20 min and the reaction was quenched at 0 °C by addition of $Na_2SO_4 \cdot 10H_2O$. Stirring at 0 °C was continued for 15 min and the solids were filtered off through a pad (2 x 4

cm) of Celite, using Et_2O. Evaporation of the solvent gave the isomeric alcohols **13** (2.31 g, 98%) as an oil, which was used without further purification: FTIR ($CDCl_3$, cast) 3454, 2942, 2867, 1696 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.00-1.08 (m, 21 H), 1.42-1.58 (m, 9 H), 1.90-2.20 (m, 2 H), 3.22-3.35 (m, 2 H), 3.40 (s, 3 H), 3.51-3.92 (m, 7 H), 4.04-4.08 (m, 1 H), 4.10-4.18 (m, 2 H), 4.62-4.90 (m, 3 H), 7.21-7.33 (m, 3 H), 7.55-7.63 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 11.9, 17.8, 28.3, 35.1, 49.6, 55.5, 58.7, 58.9, 63.5, 67.8, 70.8, 71.6, 78.3, 79.6, 97.2, 127.2, 128.3, 129.0, 129.1, 133.4, 134.5, 155.7; exact mass (electrospray) *m*/*z* calcd for $C_{31}H_{55}NNaO_7SeSi$ (M + Na) 684.28052, found 684.28027.

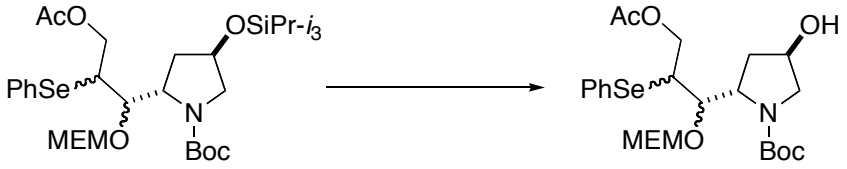
(2*S*,4*R*)-2-[3-Acetoxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-[(triisopropylsilyl)oxy]pyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (14).



13 **14**

Pyridine (0.58 mL, 7.0 mmol) was added to a stirred solution of alcohols **13** (2.31 g, 3.5 mmol), Ac_2O (0.67 mL, 7.0 mmol) and DMAP (22 mg, 0.18 mmol) in CH_2Cl_2 (40 mL). Stirring was continued for 3.5 h, and the mixture was then diluted with CH_2Cl_2 and water. The organic phase was washed with brine, dried (Na_2SO_4), and evaporated. Flash chromatography of the residue over silica gel, using 1:4 EtOAc-hexane, gave the isomeric acetates **14** (1.97 g, 80%) as an oil: FTIR ($CDCl_3$, cast) 2943, 2867 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.00-1.10 (m, 21 H), 1.42-1.58 (m, 9 H), 2.00-2.12 (m, 4.5 H), 2.40-2.48 (m, 0.5 H), 3.38-3.41 (m, 4 H), 3.52-3.72 (m, 5 H), 3.80-3.85 (m, 1 H), 4.10-4.20 (m, 1 H), 4.20-4.58 (m, 4 H), 4.75-4.85 (m, 2 H), 7.20-7.32 (m, 3 H), 7.56-7.62 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 12.0, 18.0, 20.8, 28.6, 38.1, 47.2, 55.6, 58.7, 59.0, 60.6, 65.8, 68.1, 70.5, 71.6, 78.0, 79.9, 96.4, 97.4, 127.7, 129.2, 129.5, 134.8, 155.6, 171.7; exact mass (electrospray) *m*/*z* calcd for $C_{33}H_{57}NNaO_8SeSi$ (M + Na) 726.29109, found 726.29079.

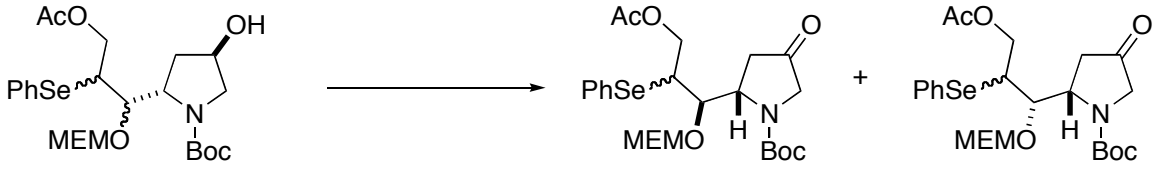
(2*S*,4*R*)-2-[3-Acetoxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-hydroxypyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (15).



14 **15**

Bu_4NF (1 M in THF, 5.6 mL, 5.6 mmol) was added dropwise to a stirred solution of the silylated alcohols **14** (1.97 g, 2.8 mmol) and AcOH (0.16 mL, 2.8 mmol) in THF (30 mL). Stirring was continued for 2 h. Brine was then added and the mixture was extracted with EtOAc. The organic extract was dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using EtOAc-hexane mixtures from 2:1 EtOAc-hexane to 100% EtOAc, gave the isomeric alcohols **15** (1.46 g, 95%) as an oil: FTIR ($CDCl_3$, cast) 3455, 2976, 2932, 1742, 1692 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.46 (s, 9 H), 1.90-2.10 (m, 5 H), 3.25-3.25 (m, 5 H), 3.45-3.55 (m, 3 H), 3.65-3.70 (m, 2 H), 3.75-3.80 (m, 1 H), 4.24-4.30 (dd, *J* = 6.5 Hz, 1 H), 4.58 (d, *J* = 6.3 Hz, 1 H), 4.80 (s, 1 H), 4.54 (q, *J* = 6.5 Hz, 1 H), 4.70-4.80 (m, 2 H), 7.20-7.24 (m, 3 H), 7.45-7.49 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 20.8, 28.6, 36.8, 44.2, 55.3, 58.3, 59.0, 64.6, 65.7, 67.8, 68.1, 70.1, 71.7, 80.2, 96.5, 127.5, 129.1, 129.2, 133.4, 134.8, 155.6, 170.7; exact mass (electrospray) *m/z* calcd for $C_{24}H_{37}NNaO_8Se$ (M + Na) 570.15766, found 570.15750.

(2*S*)-2-[(1*R*)-3-Acetoxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-oxopyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (16a) and (2*S*)-2-[(1*S*)-3-Acetoxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-oxopyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (16b).



15 **16a** **16b**

DMSO (0.57 mL, 8.0 mmol) was added to a stirred and cooled (-78 °C) solution of $(COCl)_2$ (0.35 mL, 4.0 mmol) in CH_2Cl_2 (17 mL). Stirring was continued for 10 min and then alcohols **15** (1.46 g, 2.7 mmol) in CH_2Cl_2 (10 mL) were added dropwise. Stirring was continued for 20 min, and Et_3N (1.12 mL, 8.0 mmol) was then added. Stirring at -78 °C was continued for 1 h. Water was added and the organic phase was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:3 to 1:1 EtOAc-hexane,

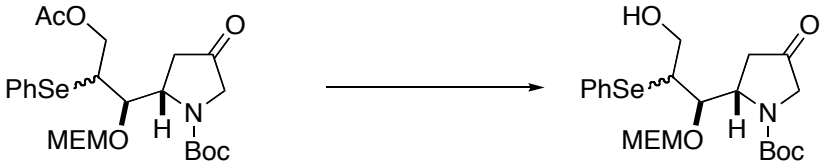
gave the ketone as a less polar fraction (**16b**) (0.58 g, 40%) and a more polar fraction (**16a**) (0.56 g, 40%).

The more polar fraction (**16a**) had: FTIR ($CDCl_3$, cast) 2976, 2929, 1762, 1742, 1696 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.36-1.55 (m, 9 H), 2.00 (s, 3 H), 2.62-2.78 (m, 2 H), 3.08-3.20 (m, 1 H), 3.36-3.40 (m, 3 H), 3.50-3.70 (m, 5 H), 3.80-3.97 (m, 2 H), 4.10-4.12 (m, 1 H), 4.30-4.39 (m, 1 H), 4.42-4.50 (m, 1 H), 4.60-4.89 (m, 2 H), 7.20-7.28 (m, 3 H), 7.48-7.62 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 20.7, 28.3, 41.1, 44.5, 53.6, 56.7, 58.9, 64.2, 65.2, 68.3, 71.5, 79.9, 81.2, 96.7, 127.2,128.9, 129.1, 132.9, 153.3, 170.4, 211.7; exact mass (electrospray) *m*/*z* calcd for $C_{24}H_{35}NNaO_8Se$ (M + Na) 568.14202 found 568.14231.

The less polar fraction (**16b**) had: FTIR ($CDCl_3$, cast) 2929, 1763, 1743, 1697 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.42-1.58 (m, 9 H), 1.90-2.05 (m, 3 H), 2.20-2.70 (m, 2 H), 3.35-3.38 (m, 3 H), 3.40-3.82 (m, 7 H), 4.00-4.12 (m, 1 H), 4.20-4.33 (m, 2 H), 3.45-3.55 (m, 1 H), 3.65-3.75 (m, 2 H), 7.20-7.30 (m, 3 H), 7.52 -7.62 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 20.7, 28.3, 38.2, 46.1, 52.9, 56.7, 58.9, 64.2, 65.2, 68.2, 68.4, 71.4, 71.5, 79.9, 81.8, 97.6, 127.7, 128.1, 128.9, 129.3, 133.9, 134.9, 153.2, 170.3, 210.2; exact mass (electrospray) *m*/*z* calcd for $C_{24}H_{35}NNaO_8Se$ (M + Na) 568.14201, found 568.14249.

In the case of both fractions we did not distinguish between the presence of more than one isomer or more than one rotamer.

(2*S*)-2-[(1*R*)-3-Hydroxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-oxopyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (17).

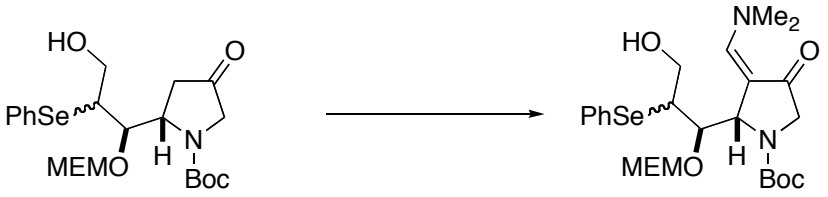


16a **17**

K_2CO_3 (157 mg, 1.1 mmol) was added to a solution of the more polar ketone fraction (**16a**) (563 mg, 1.0 mmol) in a mixture of MeOH (10 mL) and water (1 mL). Stirring was continued for 30 min, water was added and the mixture was extracted with EtOAc. The organic extract was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:1 EtOAc-hexane, gave the alcohol **17** (323 mg, 62%) as an oil (we did not distinguish between the presence of more than one isomer or more than one rotamer): FTIR ($CDCl_3$, cast) 3446, 2928, 1762, 1695 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.38-1.50 (m, 9 H), 2.42-2.51 (m, 2 H), 3.08 (br s, 1 H), 3.38 (s, 3 H), 3.42-3.86 (m, 8 H), 4.02-

4.15 (m, 1 H), 4.60-4.67 (m, 1 H), 4.80 (br s, 1 H), 4.90-5.00 (m, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.4, 41.8, 49.6, 56.8, 59.0, 64.0, 68.8, 71.6, 81.9, 82.8, 126.2, 129.1, 130.2, 133.4, 155.5, 211.4; exact mass (electrospray) *m*/*z* calcd for $C_{22}H_{33}NNaO_7Se$ 526.13144 (M + Na) found 526.13163.

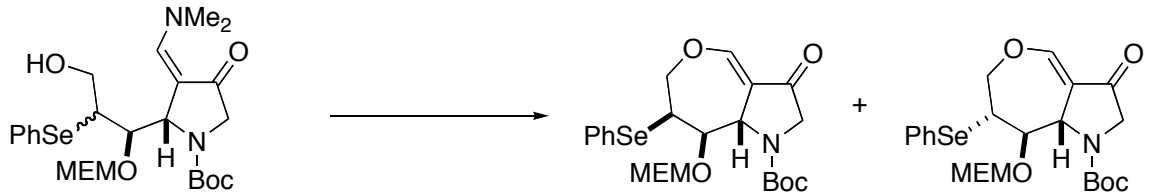
(2*S*)-3-Dimethylaminomethylene-2-[(1*R*)-3-hydroxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-oxopyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (18).



17 **18**

A mixture of alcohols **17** (27 mg, 0.05 mmol), and *t*-BuOCH(NMe_2)$_2$ (22 mg, 0.13 mmol) in THF (1 mL) was refluxed for 24 h. Evaporation of the solvent and flash chromatography of the residue over silica gel, using 1:20 to 1:10 MeOH-EtOAc, gave the product **18** (20 mg, 67%) as an oil, which was a mixture of isomers: FTIR ($CDCl_3$, cast) 3411, 2975, 2929, 1685, 1587 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.40-1.58 (m, 9 H), 3.03-3.18 (m, 6 H), 3.40 (s, 3 H), 3.48-3.65 (m, 4 H), 3.70-4.00 (m, 6 H), 4.11 (s, 1 H), 4.68-4.78 (m, 2 H), 5.62-5.79 (m, 1 H), 7.20-7.28 (m, 4 H), 7.55-7.70 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 28.3, 36.4, 50.3, 54.6, 59.0, 60.3, 63.3, 68.3, 71.7, 80.4, 82.5, 97.4, 101.1, 127.2, 129.0, 129.6, 133.5, 146.0, 155.5, 197.6; exact mass (electrospray) *m*/*z* calcd for $C_{25}H_{39}N_2O_7Se$ (M + H) 559.19170, found 559.19203.

(8*R*,8a*S*)-8-[(2-Methoxyethoxy)methoxy]-3-oxo-7-(phenylselanyl)-2,3,6,7,8,8a-hexahydrooxepino[4,3-*b*]pyrrole-1-carboxylic Acid *tert*-Butyl Ester (19a,b).



18 **19a** **19b**

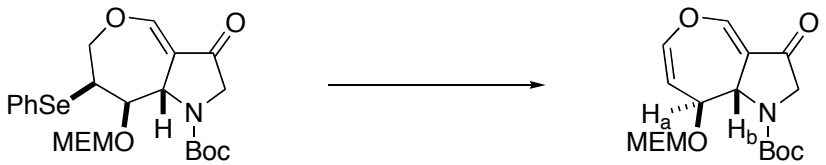
CF_3CO_2H (0.11 mL, 1.38 mmol) was added to a stirred solution of the vinylogous

amides **18** (700 mg, 1.25 mmol) in PhMe (28 mL). The mixture was stirred at 70 °C for 15 h (Ar atmosphere), and then cooled and evaporated. Flash chromatography of the residue over silica gel, using 1:3 EtOAc-hexane, gave the major (and less polar) product **19a** (288 mg, 45%), the minor (and more polar) product **19b** (43 mg, 6.7%) and recovered **18** (94 mg, 13.4%); the total yield corrected for recovered **18** was 60%.

The major product **19a** had: FTIR ($CHCl_3$, cast) 2975, 2929, 2889, 1705, 1618 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.47 (s, 9 H), 3.39 (s, 3 H), 3.47-3.74 (m, 5 H), 3.85-3.94 (m, 2 H), 4.00-4.12 (m, 2 H), 4.86 (AB q, J = 7.2 Hz, $\Delta\nu_{AB}$ = 29.2 Hz, 2 H), 4.89 (s, 1 H), 5.52 (d, J = 7.5 Hz, 1 H), 7.25-7.35 (m, 3 H), 7.38 (d, J = 1.7 Hz, 1 H), 7.60-7.65 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.3, 49.6, 53.7, 59.1, 67.6, 68.9, 71.7, 81.0, 81.6, 95.2, 110.8, 128.0, 128.6, 129.5, 135.6, 155.3, 155.7, 197.1; exact mass (electrospray) m/z calcd for $C_{23}H_{31}NNaO_7Se$ (M + Na) 536.11579, found 536.11740.

The minor isomer product **19b** had: FTIR ($CDCl_3$, cast) 2976, 2928, 2890, 1761, 1723, 1696, 1616 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.40-1.62 (m, 9 H), 3.34-3.40 (m, 3 H), 3.44-4.20 (m, 8 H), 4.22-4.36 (m, 1 H), 4.40-4.80 (m, 3 H), 5.60 (br s, 1 H), 7.20-7.40 (m, 4 H), 7.58-7.7.72 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.3, 45.5, 46.6, 53.9, 56.2, 59.0, 67.7, 68.4, 71.1, 71.6, 71.7, 71.9, 74.8, 78.4, 80.3, 80.9, 98.6, 114.5, 127.4, 128.4, 128.6, 129.4, 129.3, 133.5, 135.2, 152.7, 155.3, 197.8, 199.4; exact mass (electrospray) m/z calcd for $C_{23}H_{31}NNaO_7Se$ (M + Na) 536.11579, found 536.11532.

(8*S*,8a*S*)-8-[(2-Methoxyethoxy)methoxy]-3-oxo-7-(phenylselanyl)-2,3,8,8a-tetrahydrooxepino[4,3-*b*]pyrrole-1-carboxylic Acid *tert*-Butyl Ester (20).

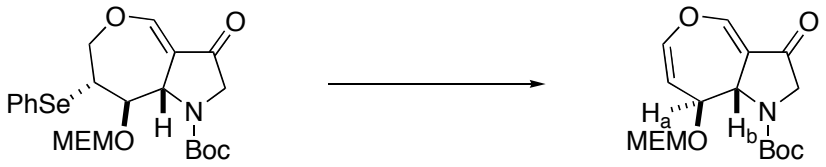


19a **20**

$NaIO_4$ (19 mg, 0.09 mmol) was added to a stirred solution of selenide **19a** (19 mg, 0.04 mmol) in a mixture of THF (0.7 mL) and water (0.7 mL). Stirring was continued for 14 h and the reaction mixture was then diluted with EtOAc and saturated aqueous $NaHCO_3$. The organic extract was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:3 to 1:2 EtOAc-hexane, gave the product **20** (9 mg, 68%) as an oil: FTIR ($CDCl_3$, cast) 2976, 2929, 1735, 1670, 1653, 1626 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.50 (s, 9 H), 3.39 (s, 3 H), 3.51-3.57 (m, 2 H), 3.70-3.76 (m, 3 H), 4.14 (d, J = 18.0 Hz, 1 H),

4.20 (td, J = 7.8, 2.2 Hz, 1 H), 4.83 (AB q, J = 7.3 Hz, $\Delta\nu_{AB}$ = 15.3 Hz, 2 H), 4.94 (d, J = 6.1 Hz, 1 H), 5.10 (dd, J = 8.3, 1.9 Hz, 1 H), 6.28 (dd, J = 8.4, 2.4 Hz, 1 H), 7.46(d, J = 2.3 Hz, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 28.3, 53.6, 59.0, 61.5, 67.0, 71.6, 74.7, 80.8, 94.7, 111.9, 113.9, 138.4, 149.4, 155.3, 197.9; exact mass (electrospray) m/z calcd for $C_{17}H_{25}NNaO_7$ (M + Na) 378.15232, found 378.15251.

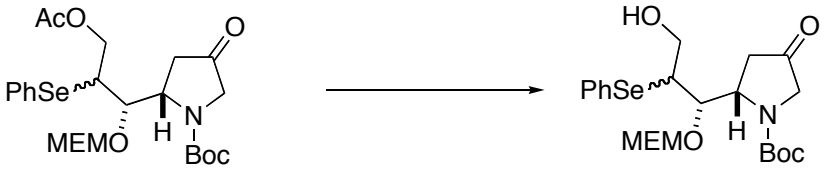
(8*S*,8a*S*)-8-[(2-Methoxyethoxy)methoxy]-3-oxo-7-(phenylselanyl)-2,3,8,8a-tetrahydrooxepino[4,3-*b*]pyrrole-1-carboxylic Acid *tert*-Butyl Ester (20).



19b **20**

$NaIO_4$ (28 mg, 0.13 mmol) was added to a stirred solution of selenide **19b** (33 mg, 0.06 mmol) in a mixture of THF (1 mL) and water (1 mL). Stirring was continued for 42 h and the reaction mixture was then diluted with EtOAc and saturated aqueous $NaHCO_3$. The organic extract was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:3 to 1:2 EtOAc-hexane, gave the product **20** (11 mg, 48%) as an oil, which was identical to material obtained from **19a**.

(2*S*)-2-[(1*S*)-3-Hydroxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-oxopyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (21).

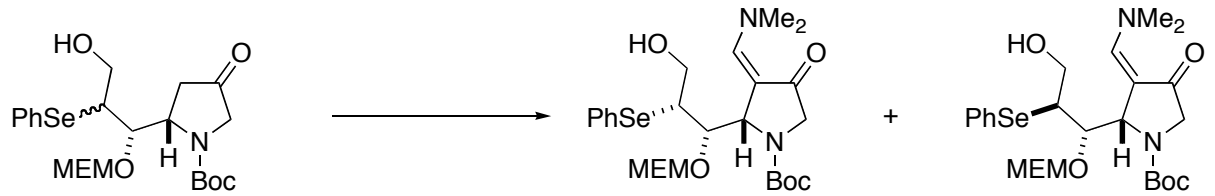


16b **21**

K_2CO_3 (160 mg, 1.1 mmol) was added to a solution of the less polar ketone fraction (**16b**) (576 mg, 1.0 mmol) in a mixture of MeOH (10 mL) and water (1 mL). Stirring was continued for 30 min, water was added and the mixture was extracted with EtOAc. The organic extract was washed with brine, dried (Na_2SO_4) and evaporated. Flash chromatography of the residue over silica gel, using 1:1 EtOAc-hexane, gave alcohols **21** (340 mg, 64%) as an oil:

FTIR ($CDCl_3$, cast) 3470, 2975, 2929, 1763, 1670 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.40-1.60 (m, 9 H), 2.10-2.40 (m, 1 H), 2.52-2.68 (m, 1 H), 2.98-3.22 (m, 1 H), 3.38 (s, 3 H), 3.40-3.92 (m, 8 H), 4.12-4.42 (m, 2 H), 4.60-4.80 (m, 3 H), 3.82 (br s, 1 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.4, 37.7, 50.8, 53.0, 56.2, 58.9, 62.1, 68.2, 71.5, 79.7, 81.0, 97.1, 127.7, 127.9, 128.8, 129.3, 129.4, 134.4, 134.7, 152.8, 210.1; exact mass (electrospray) *m*/*z* calcd for $C_{22}H_{33}NNaO_7Se$ 526.13144 (M + Na), found 526.13185.

(2*S*)-3-Dimethylaminomethylene-2-[(1*S*)-3-hydroxy-1-[(2-methoxyethoxy)methoxy]-2-(phenylselanyl)propyl]-4-oxopyrrolidine-1-carboxylic Acid *tert*-Butyl Ester (22a) and (22b).



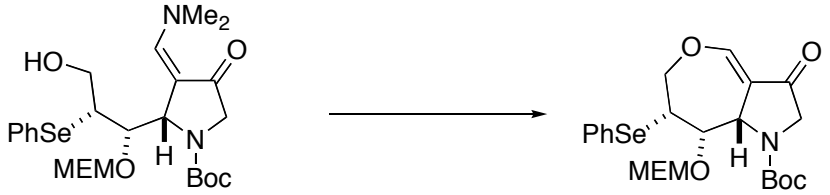
21 **22a** **22b**

A mixture of alcohols **21** (20 mg, 0.04 mmol) and *t*-BuOCH(NMe_2)$_2$ (16 mg, 0.09 mmol) in THF (1 mL) was refluxed for 24 h. Evaporation of the solvent and flash chromatography of the residue over silica gel, using 1:20 to 1:10 MeOH-EtOAc, gave the major product **22a** (11.8 mg, 53%) and the minor product **22b** (2.4 mg, 11%) as oils. Both products were single isomers.

Isomer **22a** had: FTIR ($CDCl_3$, cast) 3426, 2975, 2928, 1685, 1593 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.46 (s, 9 H), 3.15 (s, 6 H), 3.28-3.38 (m, 1 H), 3.40 (s, 3 H), 3.49-3.77 (m, 5 H), 3.84-3.94 (m, 3 H), 4.06-4.14 (m, 2 H), 4.77 (AB, J = 6.5 Hz, $\Delta\nu_{AB}$ = 33.3 Hz, 2 H), 5.77 (d, J = 8.5 Hz, 1 H), 7.21-7.32 (m, 4 H), 7.47-7.54 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 28.4, 47.0, 52.3, 59.0, 59.9, 63.0, 68.4, 71.7, 80.8, 83.5, 97.3, 101.2, 127.4, 129.2, 130.5, 133.5, 147.4, 155.0, 195.9; exact mass (electrospray) *m*/*z* calcd for $C_{25}H_{39}N_2O_7Se$ (M + H) 559.19170, found 559.19303.

Isomer **22b** had: FTIR ($CDCl_3$, cast) 3419, 2975, 2929, 1687, 1592 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 1.32-1.52 (m , 9 H), 3.00-3.22 (m, 6 H), 3.30-3.40 (m, 4 H), 3.42-3.92 (m, 8 H), 4.00-4.12 (m, 1 H), 4.62 (AB, J = 7.4 Hz, $\Delta\nu_{AB}$ = 60.4, Hz, 2 H), 5.95 (d, J = 6.4 Hz, 1 H), 7.12-7.39 (m, 3 H), 7.62-7.80 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.3, 49.3, 52.9, 58.9, 59.1, 62.9, 67.5, 71.7, 78.2, 80.3, 96.4, 101.3, 127.2, 128.7, 128.8, 134.3, 147.3, 154.8, 197.5; exact mass (electrospray) *m*/*z* calcd for $C_{25}H_{39}N_2O_7Se$ (M + H) 559.19170 found 559.19092.

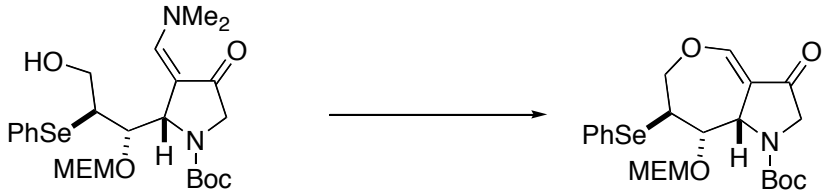
(8*S*,8a*S*)-8-[(2-Methoxyethoxy)methoxy]-3-oxo-7-(phenylselanyl)-2,3,6,7,8,8a-hexahydrooxepino[4,3-*b*]pyrrole-1-carboxylic Acid *tert*-Butyl Ester (23a).



22a **23a**

CF_3CO_2H (0.55 mL, 0.72 mmol) was added to a stirred solution of enamine **22a** (380 mg, 0.68 mmol) in PhMe (30 mL) and stirring was continued for 31 h. Evaporation of the solvent and flash chromatography of the residue over silica gel, using 1:3 EtOAc-hexane, gave the cyclized product **23a** [212 mg, 61% or 71% corrected for recovered **22a** ((53 mg, 14%)]: FTIR ($CDCl_3$, cast) 2976, 2930, 1727, 1697, 1627 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 1.44-1.61 (m, 9 H), 3.39 (s, 3 H), 3.51-3.82 (m, 5 H), 3.84-3.88 (m, 2 H), 4.19 (dd, *J* = 12.4, 8.6 Hz, 1 H), 4.39 (dd, *J* = 26.7, 3.8 Hz, 1 H), 4.70-5.06 (m, 4 H), 7.28-7.36 (m, 3 H), 7.55 (d, *J* = 2.4 Hz, 1 H), 7.58-7.64 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.3, 47.5, 54.8, 59.0, 62.8, 68.2, 70.3, 71.6, 75.9, 81.0, 97.5, 115.4, 128.3, 128.5, 130.6, 134.9, 154.6, 156.2, 197.2; exact mass (electrospray) *m*/*z* calcd for $C_{23}H_{31}NNaO_7Se$ (M + Na) 536.11579, found 536.11629.

(8*S*,8a*S*)-8-[(2-Methoxyethoxy)methoxy]-3-oxo-7-(phenylselanyl)-2,3,6,7,8,8a-hexahydrooxepino[4,3-*b*]pyrrole-1-carboxylic Acid *tert*-Butyl Ester (23b).

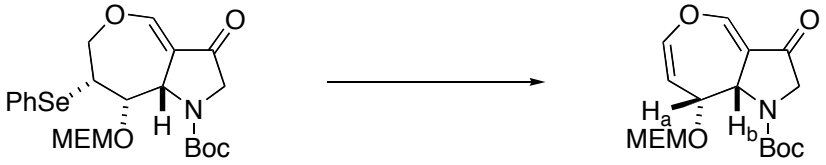


22b **23b**

CF_3CO_2H (0.12 mL, 0.16 mmol) was added to a stirred solution of enamine **22b** (80 mg, 0.15 mmol) in PhMe (7.5 mL) and stirring was continued for 42 h. Evaporation of the solvent and flash chromatography of the residue over silica gel, using 1:3 EtOAc-hexane, gave the cyclized product **23b** [40 mg, 52% or 57% yield corrected for recovered **22b** (8.3 mg, 9.9%)]: FTIR ($CDCl_3$, cast) 2927, 1726, 1699, 1622 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) δ 1.45-1.60 (m, 9 H), 3.38 (s, 3 H), 3.48-3.95 (m, 7 H), 4.00-4.19 (m, 1 H), 4.54-4.64 (m, 1 H), 4.78 (AB q, *J* =

24.5 Hz, $\Delta\nu_{AB}$ = 46.1 Hz, 2 H), 5.02 (AB q, *J* = 24.5 Hz, $\Delta\nu_{AB}$ = 87.1 Hz, 2 H), 7.24-7.38 (m, 3 H), 7.41 (d, *J* = 1.7 Hz, 1 H), 7.59-7.68 (m, 2 H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.3, 44.5, 54.4, 58.9, 67.3, 71.5, 72.2, 79.9, 81.5, 95.3, 112.8, 127.5, 129.4, 134.3, 153.8, 155.8, 197.3; exact mass (electrospray) *m*/*z* calcd for $C_{23}H_{31}NNaO_7Se$ (M + Na) 536.11579, found 536.11615.

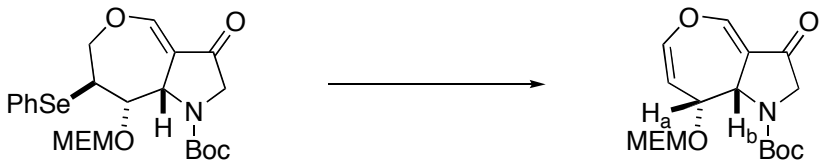
(8*R*,8a*S*)-8-[(2-Methoxyethoxy)methoxy]-3-oxo-7-(phenylselanyl)-2,3,8,8a-tetrahydrooxepino[4,3-*b*]pyrrole-1-carboxylic Acid *tert*-Butyl Ester (24).



23a **24**

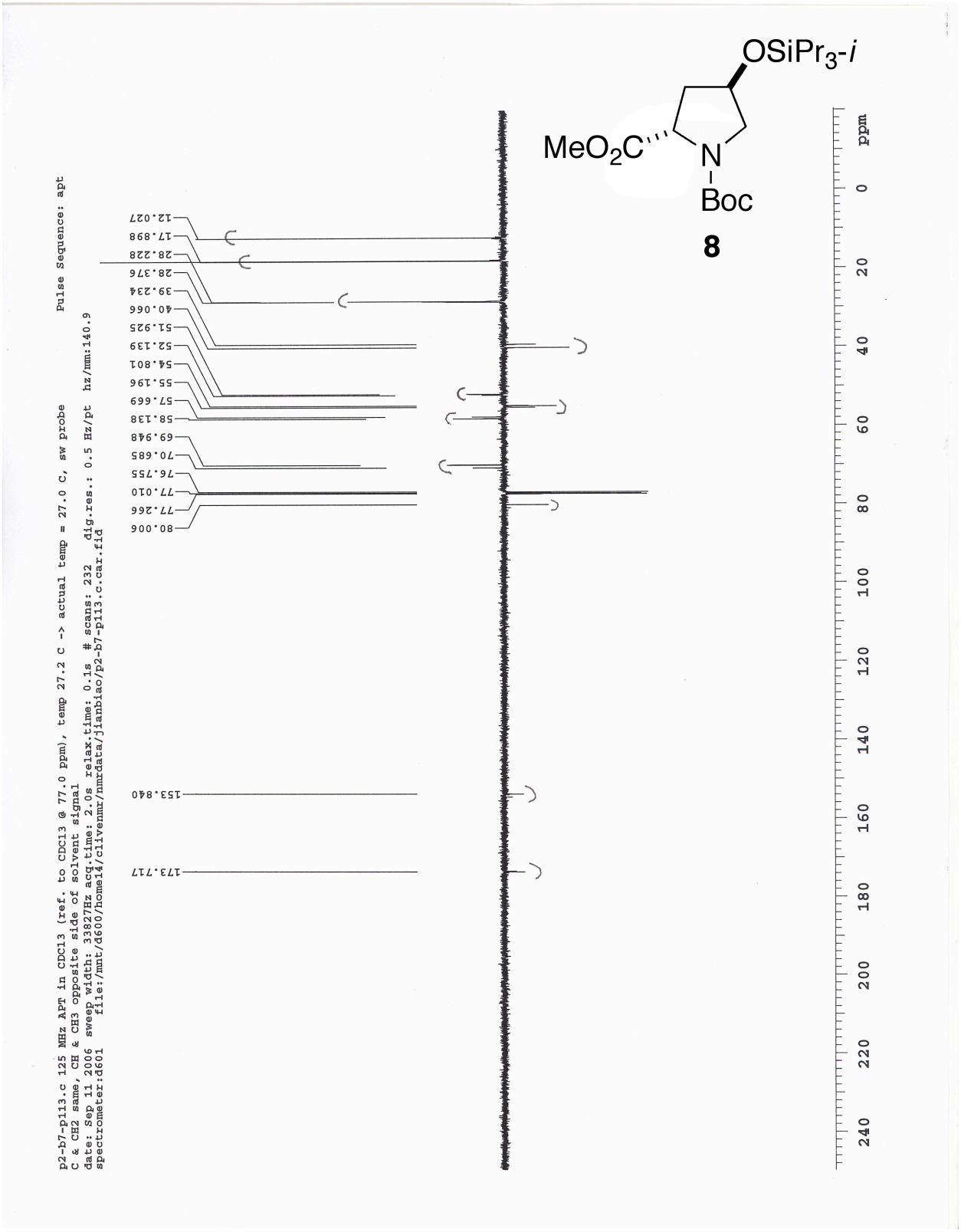
$NaIO_4$ (23 mg, 0.11 mmol) was added to a stirred solution of selenide **23a** (28 mg, 0.05 mmol) in a mixture of THF (1 mL) and water (1 mL). Stirring was continued for 5 h and the mixture was then extracted with CH_2Cl_2. The organic extract was washed with brine, dried (Na_2SO_4) and evaporated. The residue was dissolved in CH_2Cl_2 and the solution was refluxed for 12 h. Evaporation of the solvent and flash chromatography of the residue over silica gel, using 1:3 to 1:2 EtOAc-hexane, gave the product **24** (13 mg, 67%) as an oil: FTIR ($CDCl_3$, cast) 2976, 2931, 1735, 1670, 1655, 1626 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) δ 1.51 (s, 9 H), 3.38 (s, 3 H), 3.48-3.55 (m, 2 H), 3.57-3.66 (m, 2 H), 3.81-4.07 (m, 2 H), 4.69 (d, *J* = 6.9 Hz, 1 H), 4.79 (s, 1 H), 4.86 (s, 1 H), 5.07 (d, *J* = 5.7 Hz, 1 H), 5.22-5.30 (m, 1 H), 6.43 (d, *J* = 7.5 Hz, 1 H), 7.42 (s, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 28.4, 53.9, 54.2, 59.0, 61.4, 61.6, 66.7, 66.9, 70.9, 71.6, 72.1, 80.7, 80.9, 94.2, 108.4, 109.0, 113.8, 144.5, 144.7, 147.5, 147.7, 154.2, 198.1; exact mass (electrospray) *m*/*z* calcd for $C_{17}H_{25}NNaO_7$ (M + Na) 378.15232, found 378.15268.

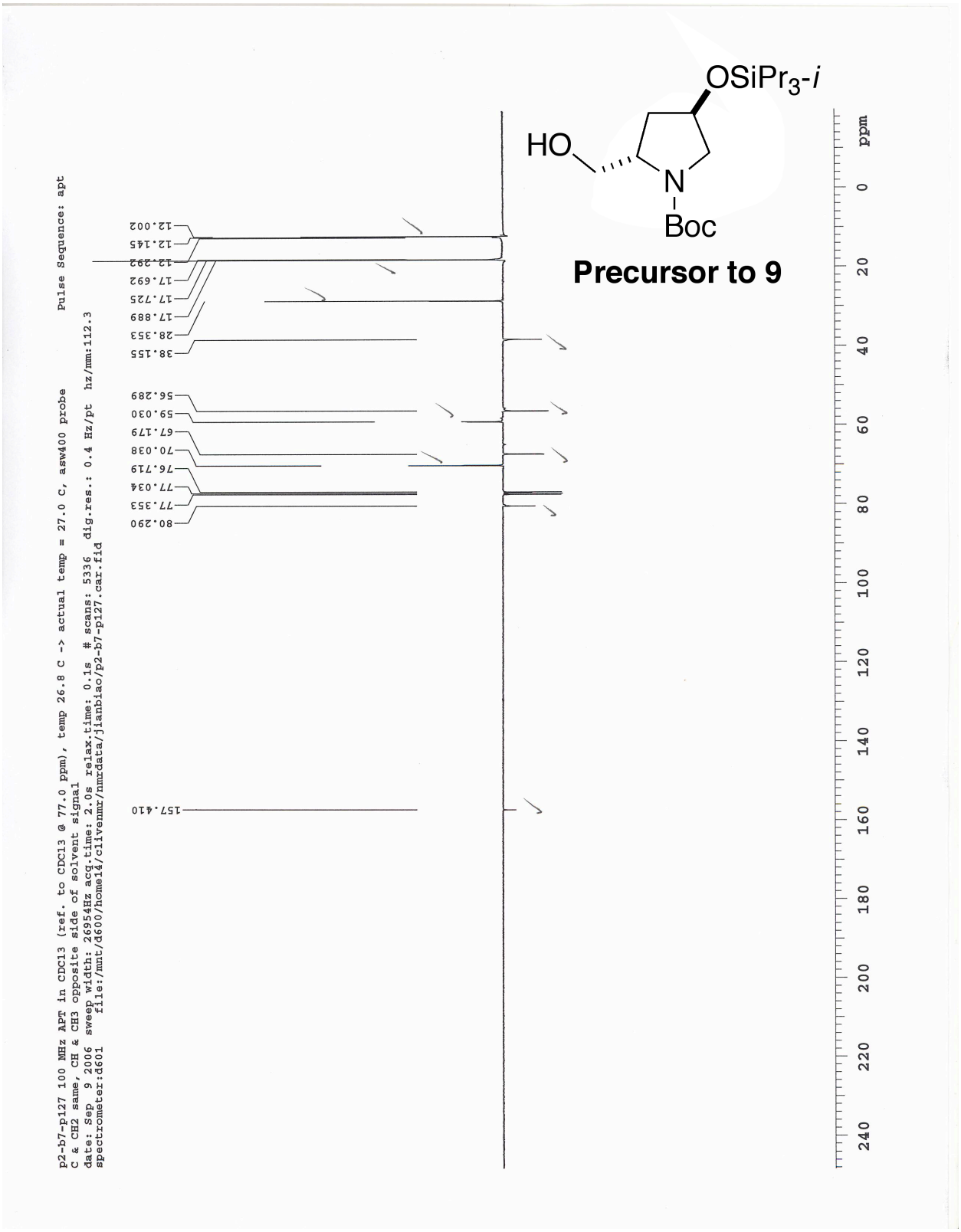
(8*R*,8a*S*)-8-[(2-Methoxyethoxy)methoxy]-3-oxo-7-(phenylselanyl)-2,3,8,8a-tetrahydrooxepino[4,3-*b*]pyrrole-1-carboxylic Acid *tert*-Butyl Ester (24).

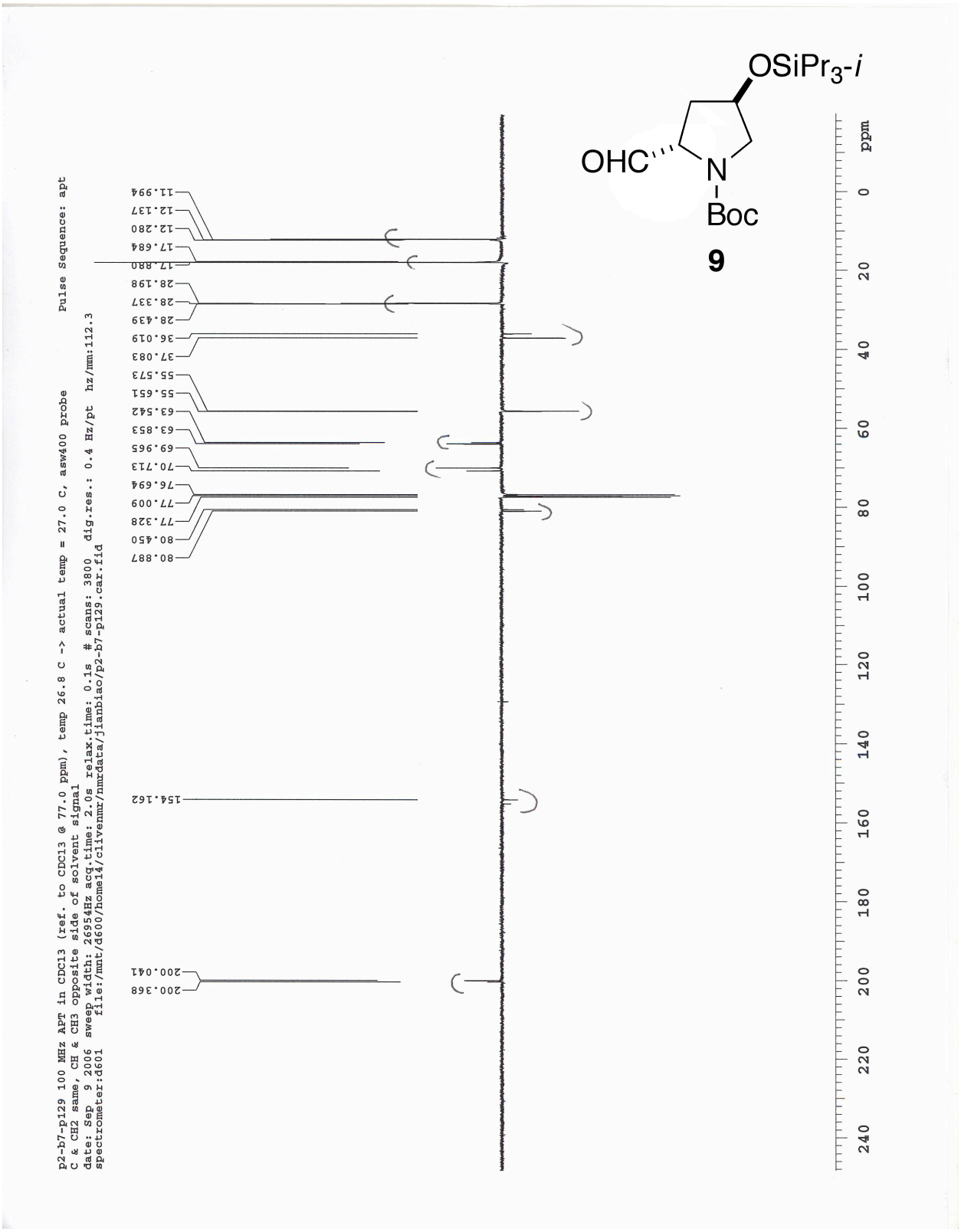


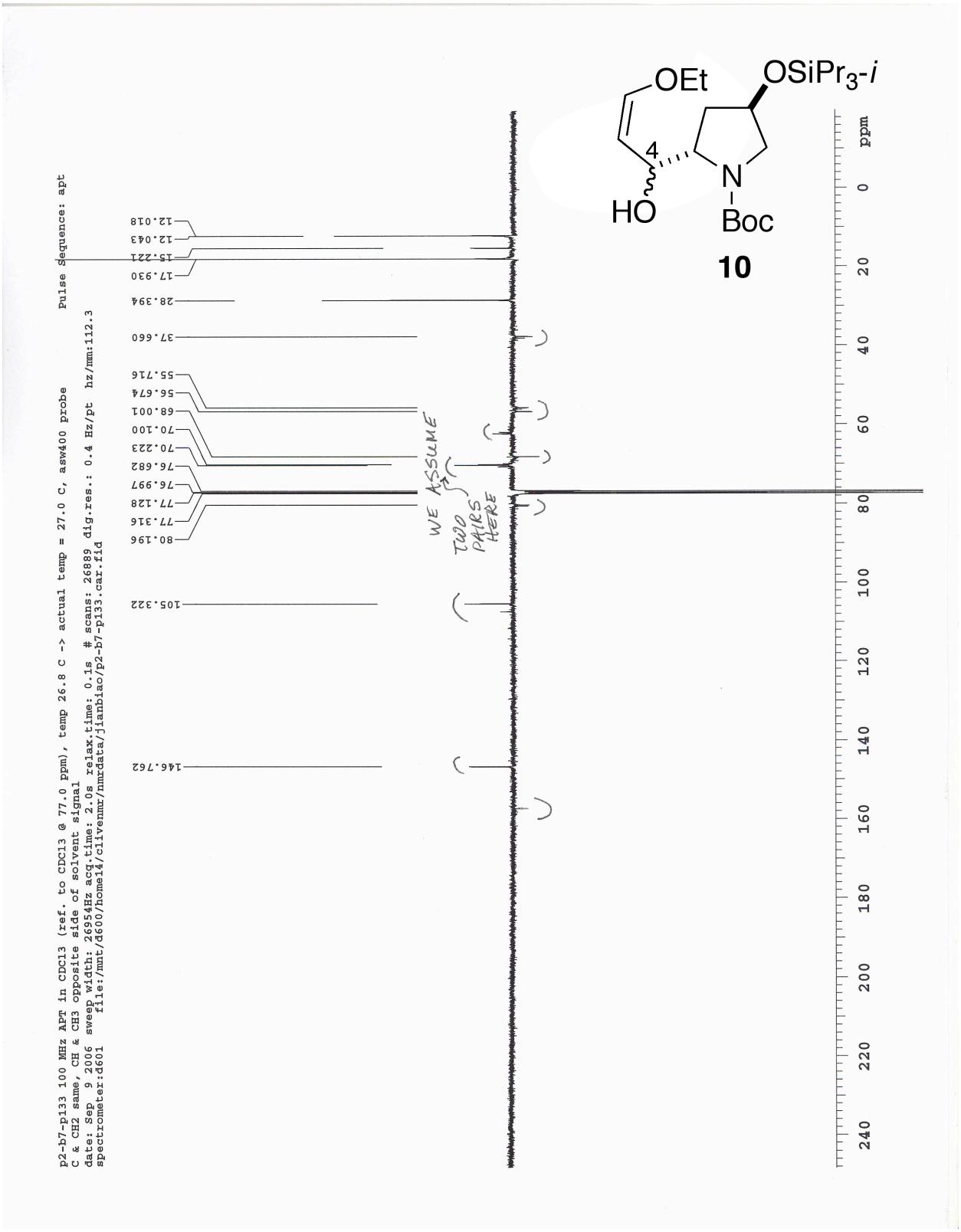
23b **24**

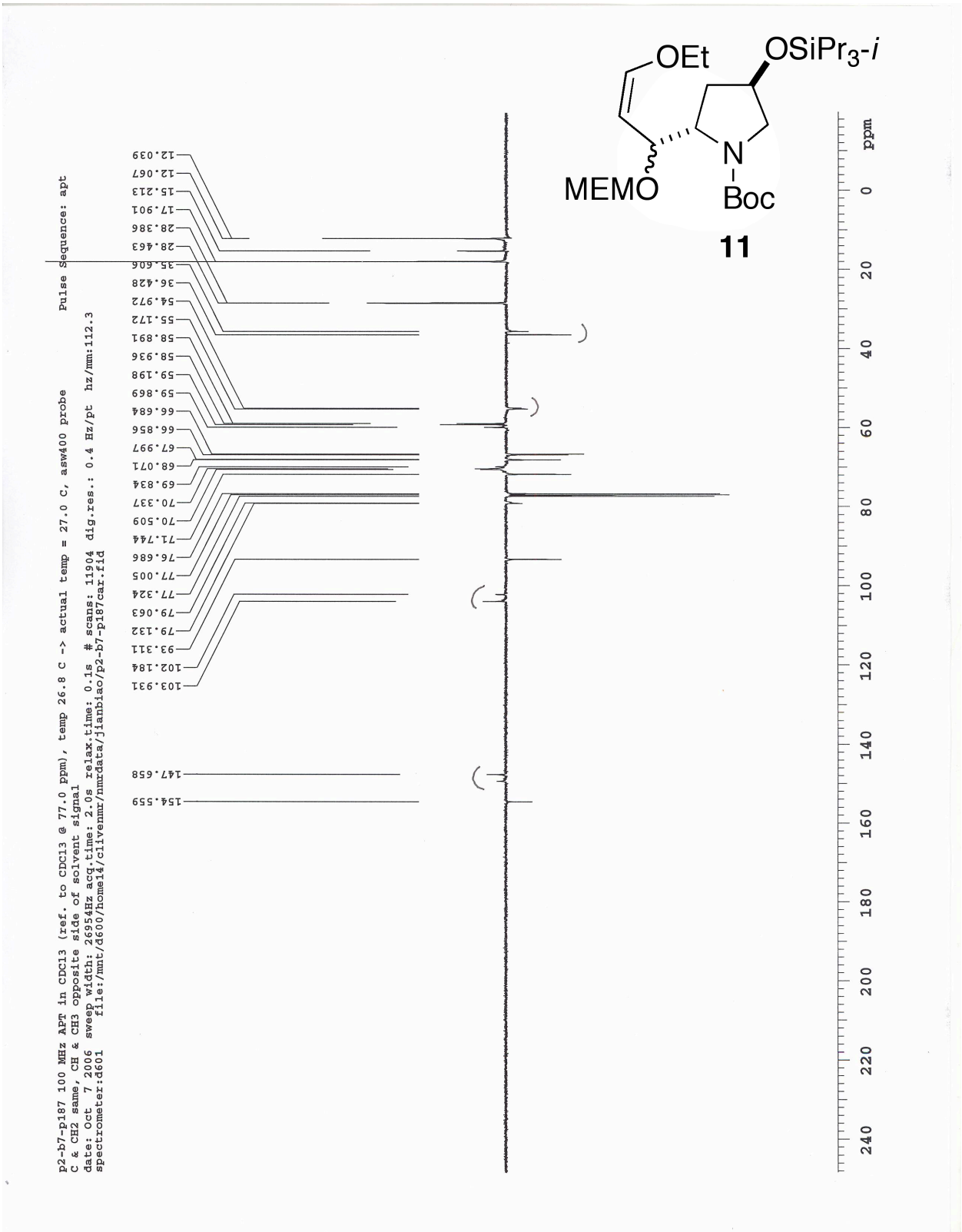
$NaIO_4$ (29 mg, 0.14 mmol) was added to a stirred solution of selenide **23b** (35 mg, 0.07 mmol) in a mixture of THF (1 mL) and water (1 mL). Stirring was continued for 48 h and the mixture was then extracted with CH_2Cl_2. The organic extract was washed with brine, dried (Na_2SO_4) and evaporated. The residue was dissolved in CH_2Cl_2 and the solution was refluxed for 12 h. Evaporation of the solvent and flash chromatography of the residue over silica gel, using 1:3 to 1:2 EtOAc-hexane, gave the product **24** (8.7 mg, 36%) as an oil, which was identical to material obtained from **23a**.

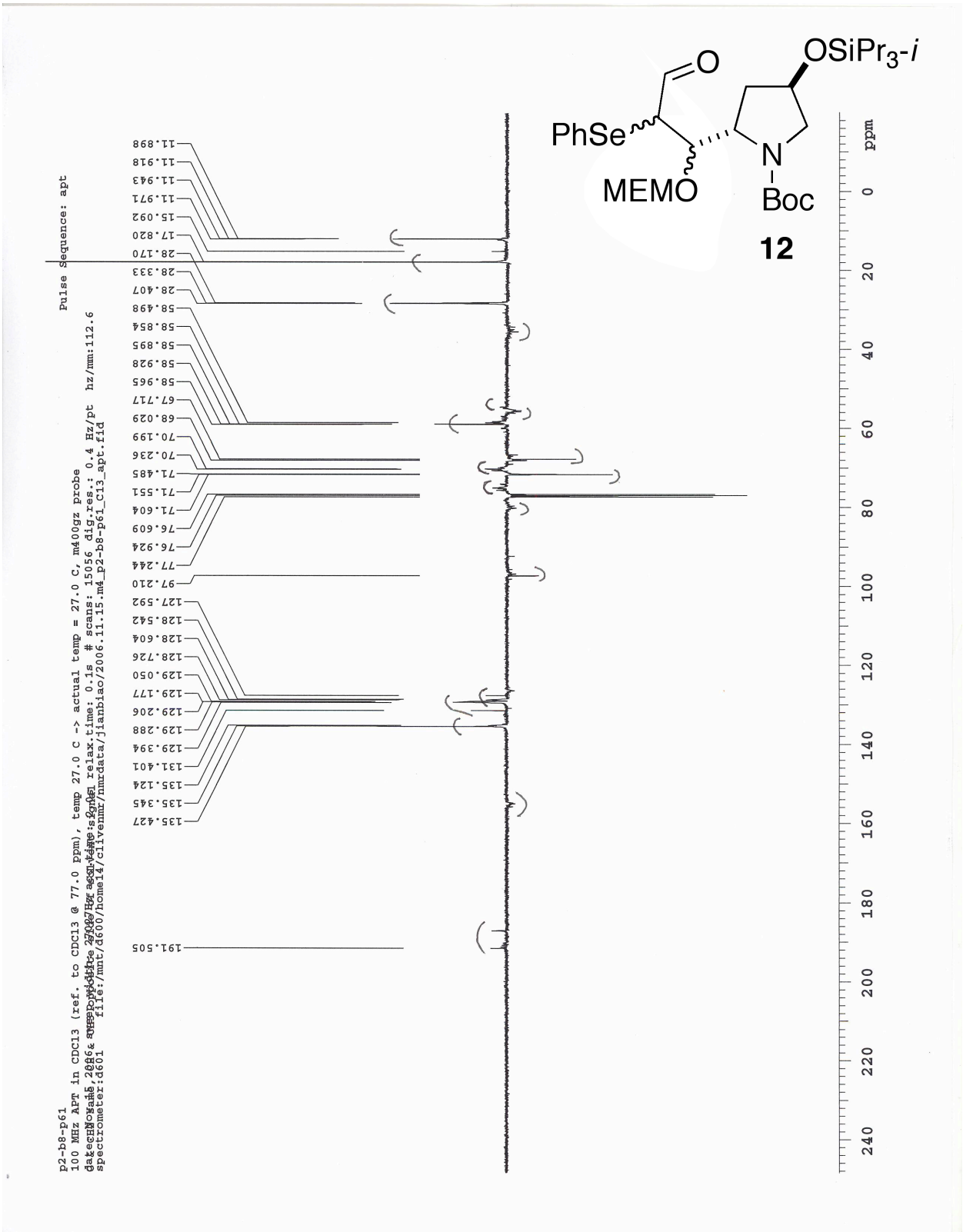

OSiPr3-i
MeO2C
N
Boc
8
12.027
17.898
28.228
28.376
39.234
40.066
51.925
52.139
54.801
55.196
57.669
58.138
69.948
70.685
76.755
77.010
77.266
80.006
153.840
173.717
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240
Pulse Sequence: apt
p2-b7-p113.c 125 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.2 C -> actual temp = 27.0 C, sw probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Sep 11 2006 sweep width: 33827Hz acq.time: 2.0s relax.time: 0.1s # scans: 232 dig.res.: 0.5 Hz/pt hz/mm:140.9
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b7-p113.c.car.fid

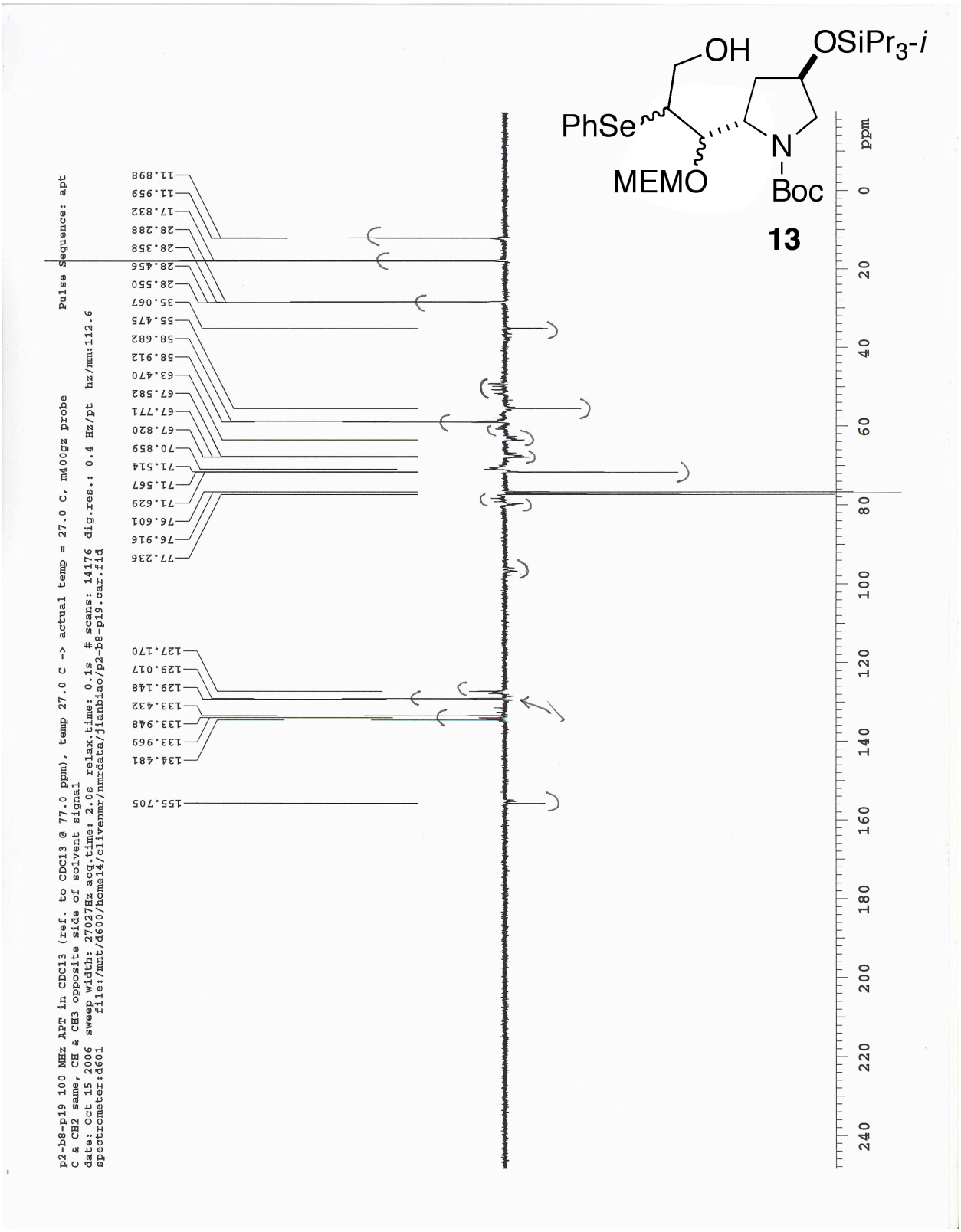

p2-b7-p127 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Sep 9 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 5336 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b7-p127.car.fid
Pulse Sequence: apt
12.002
12.145
12.292
17.692
17.725
17.889
28.353
38.155
56.289
59.030
67.179
70.038
76.719
77.034
77.353
80.290
157.410
HO
N
Boc
OSiPr3-i
Precursor to 9
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

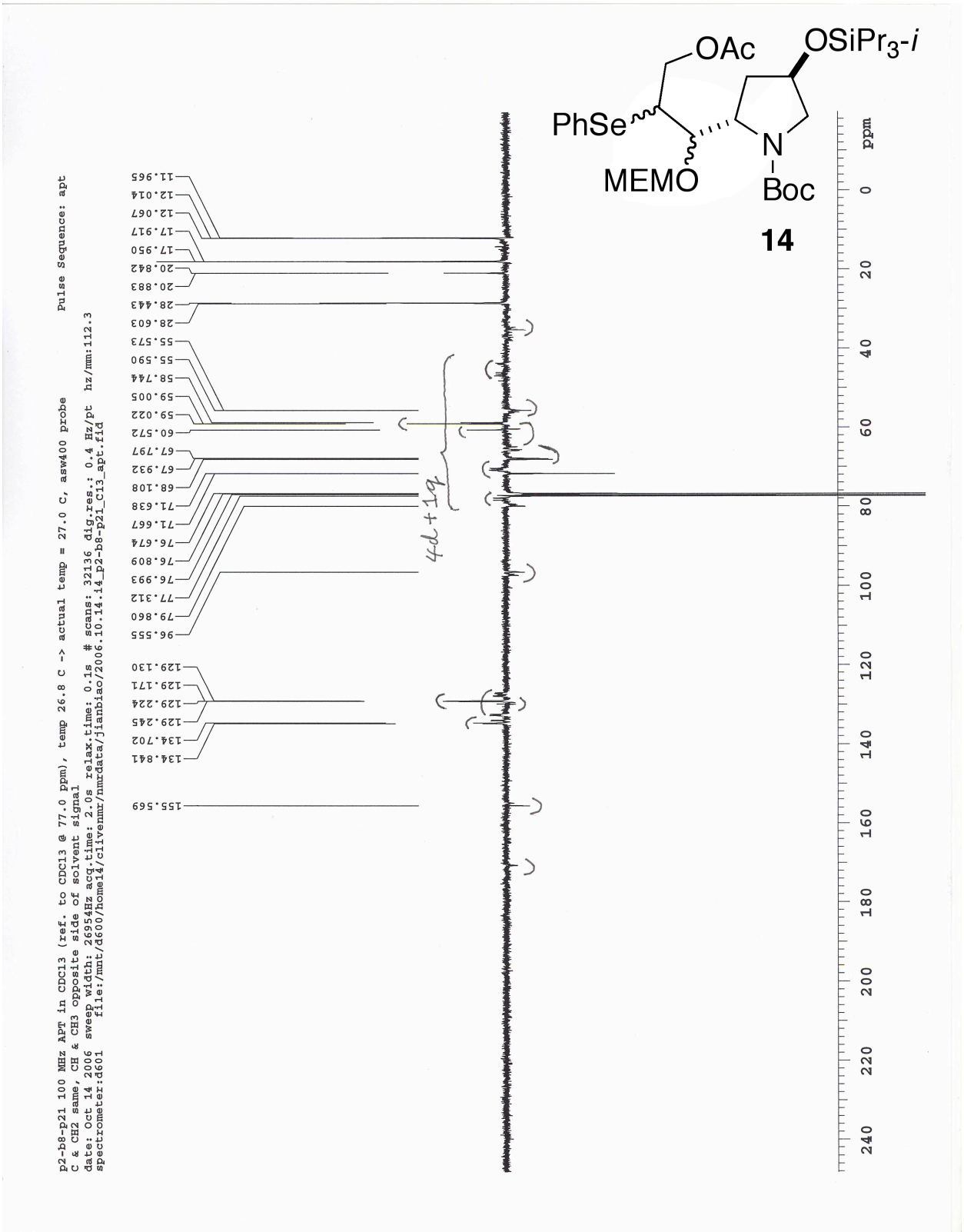

OSiPr3-i
OHC
N
Boc
9
p2-b7-p129 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Sep 9 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 3800 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b7-p129.car.fid
Pulse Sequence: apt
11.994
12.137
12.280
17.684
17.880
28.198
28.337
28.439
36.019
37.083
55.573
55.651
63.542
63.853
69.965
70.713
76.694
77.009
77.328
80.450
80.887
154.162
200.041
200.368
ppm

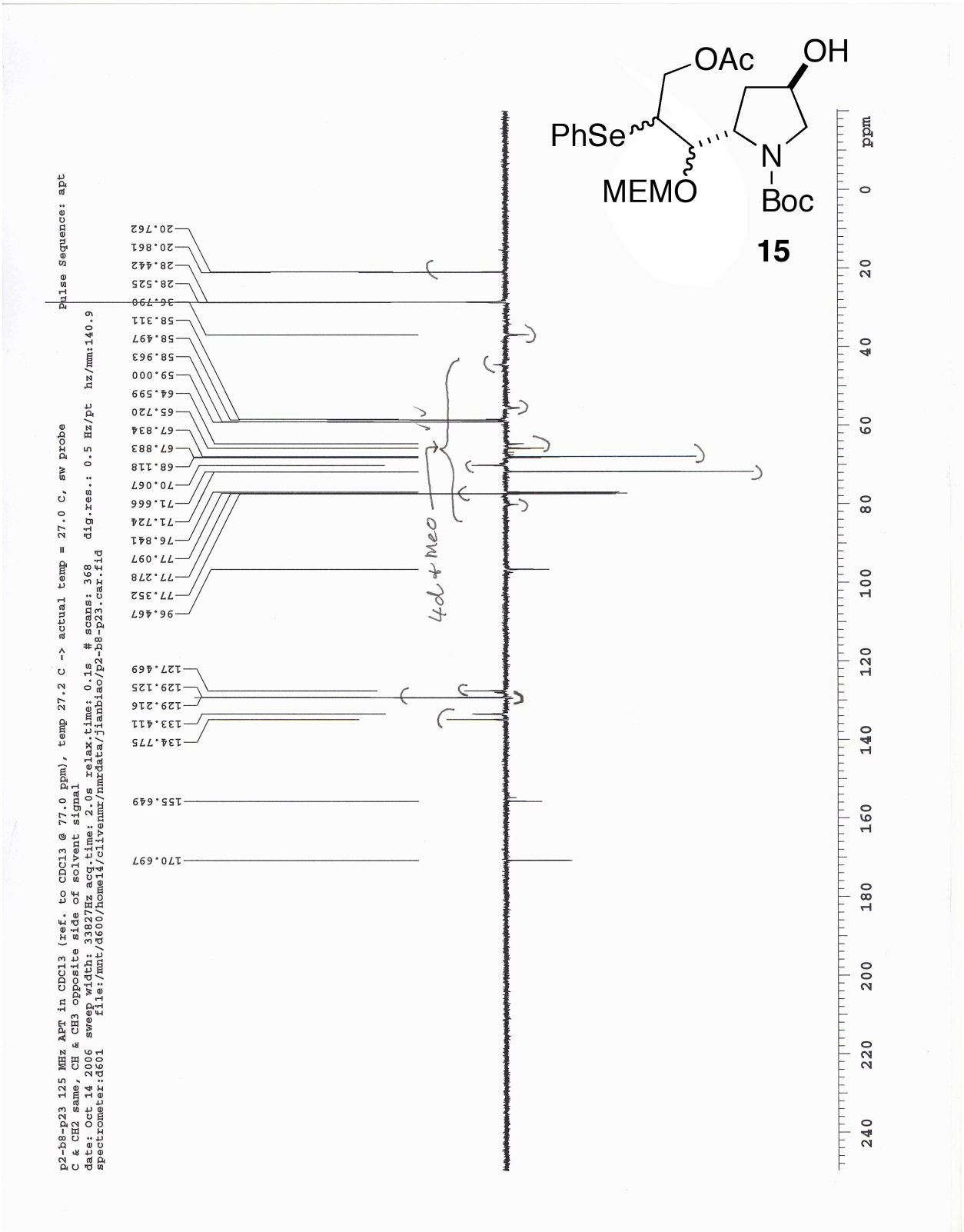

p2-b7-p133 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Sep 9 2006 sweep width: 26954Hz acq.time: 0.1s # scans: 26889 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b7-p133.car.fid
Pulse Sequence: apt
12.018
12.043
15.221
17.930
28.394
37.660
55.716
56.674
68.001
70.100
70.223
76.682
76.997
77.128
77.316
80.196
105.322
146.762
WE ASSUME TWO PAIRS HERE
OEt
OSiPr3-i
4
HO
N
Boc
10
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

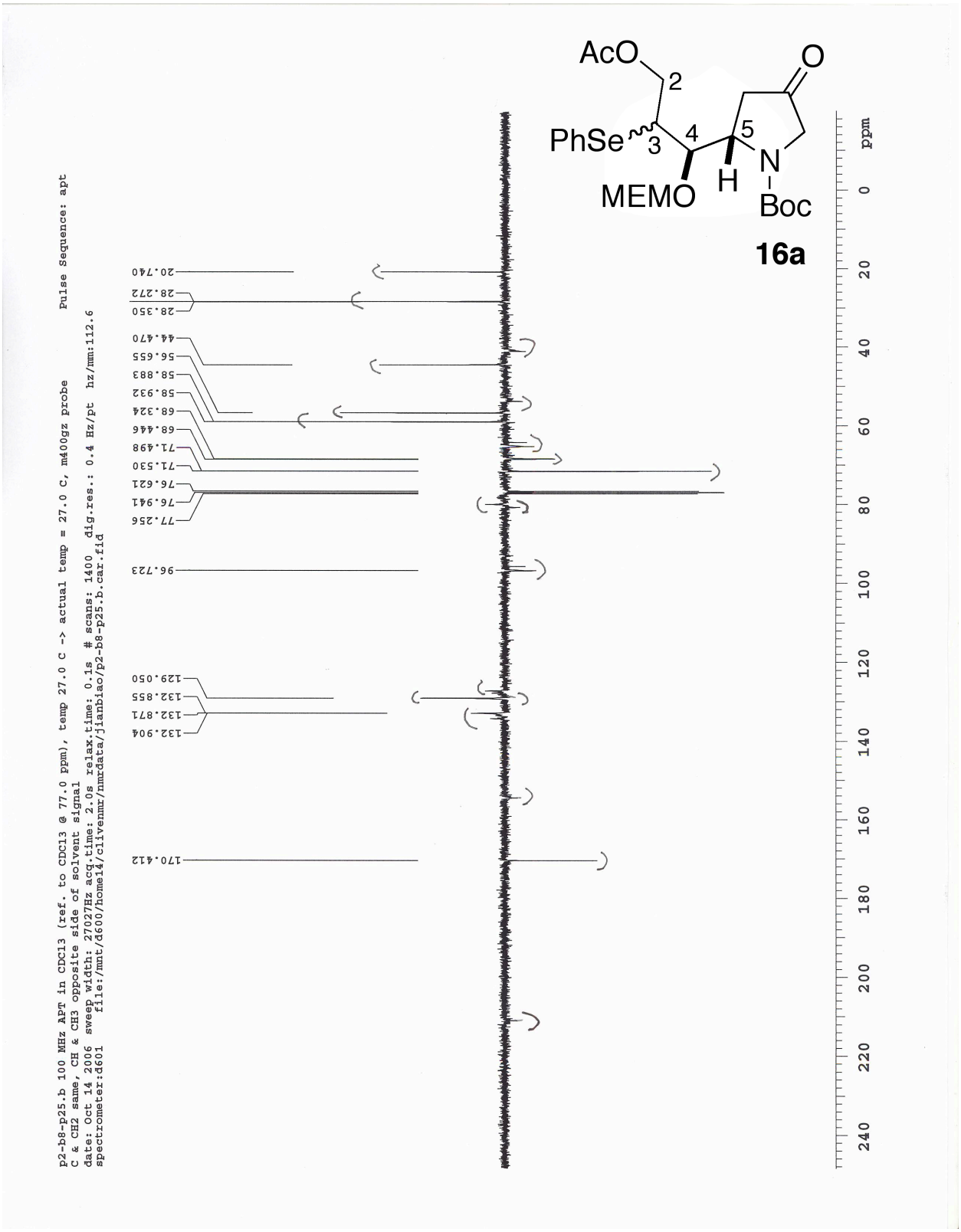

OEt
OSiPr3-i
MEMO
N
Boc
11
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240
12.039
12.067
15.213
17.901
28.386
28.463
35.606
36.428
54.972
55.172
58.891
58.936
59.198
59.869
66.684
66.856
67.997
68.071
69.834
70.337
70.509
71.744
76.686
77.005
77.324
79.063
79.132
93.311
102.184
103.931
147.658
154.559
p2-b7-p187 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 7 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 11904 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b7-p187car.fid
Pulse Sequence: apt


OSiPr3-i
O
PhSe
MEMO
N
Boc
12
ppm

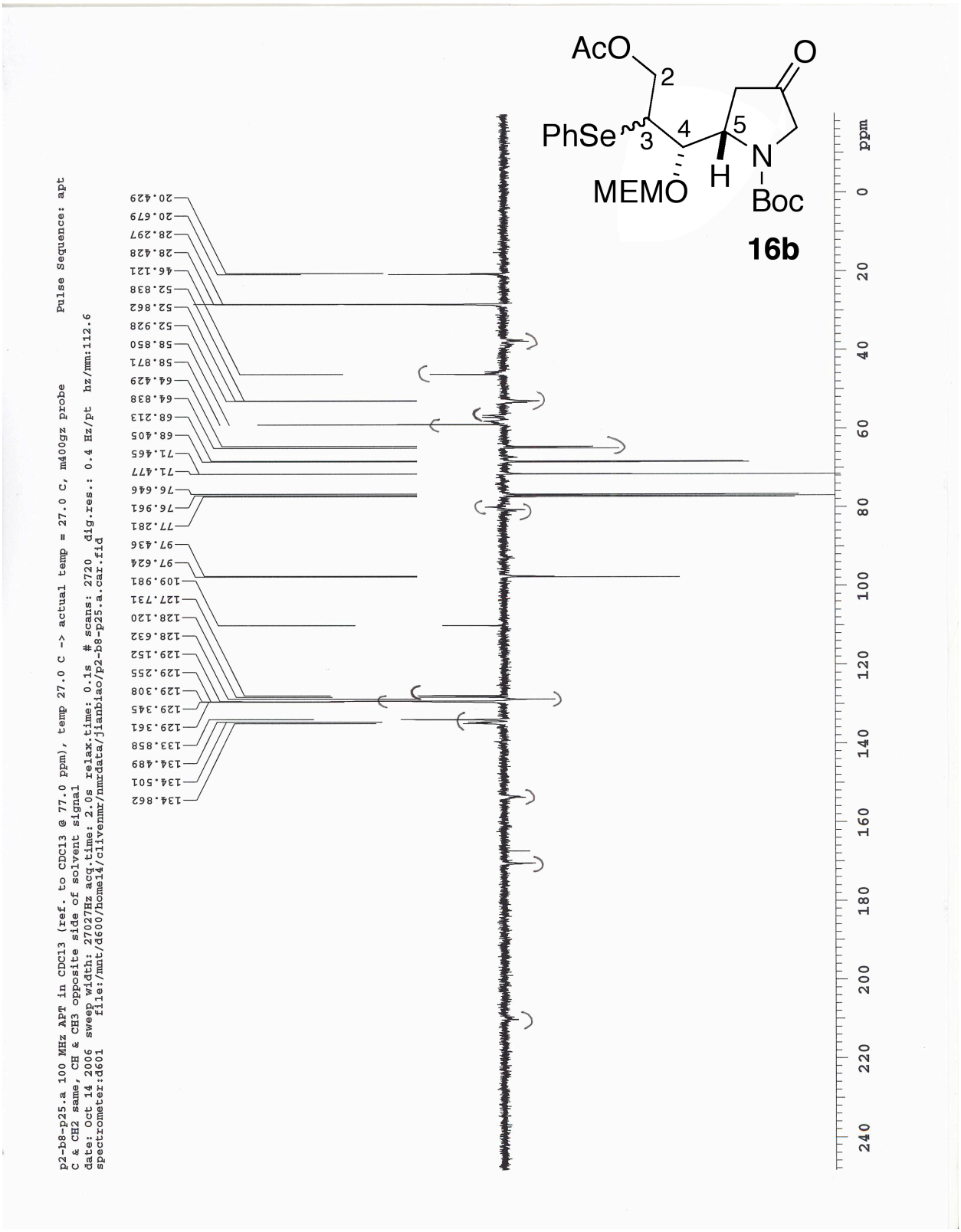

OH
OSiPr3-i
PhSe
N
MEMO
Boc
13
p2-b8-p19 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.0 C -> actual temp = 27.0 C, m400gz probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 15 2006 sweep width: 27027Hz acq.time: 2.0s relax.time: 0.1s # scans: 14176 dig.res.: 0.4 Hz/pt hz/mm:112.6
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p19.car.fid
Pulse Sequence: apt
11.898
11.959
17.832
28.288
28.358
28.456
28.550
35.067
55.475
58.682
58.912
63.470
67.582
67.771
67.820
70.859
71.514
71.567
71.629
76.601
76.916
77.236
127.170
129.017
129.148
133.432
133.948
133.969
134.481
155.705
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

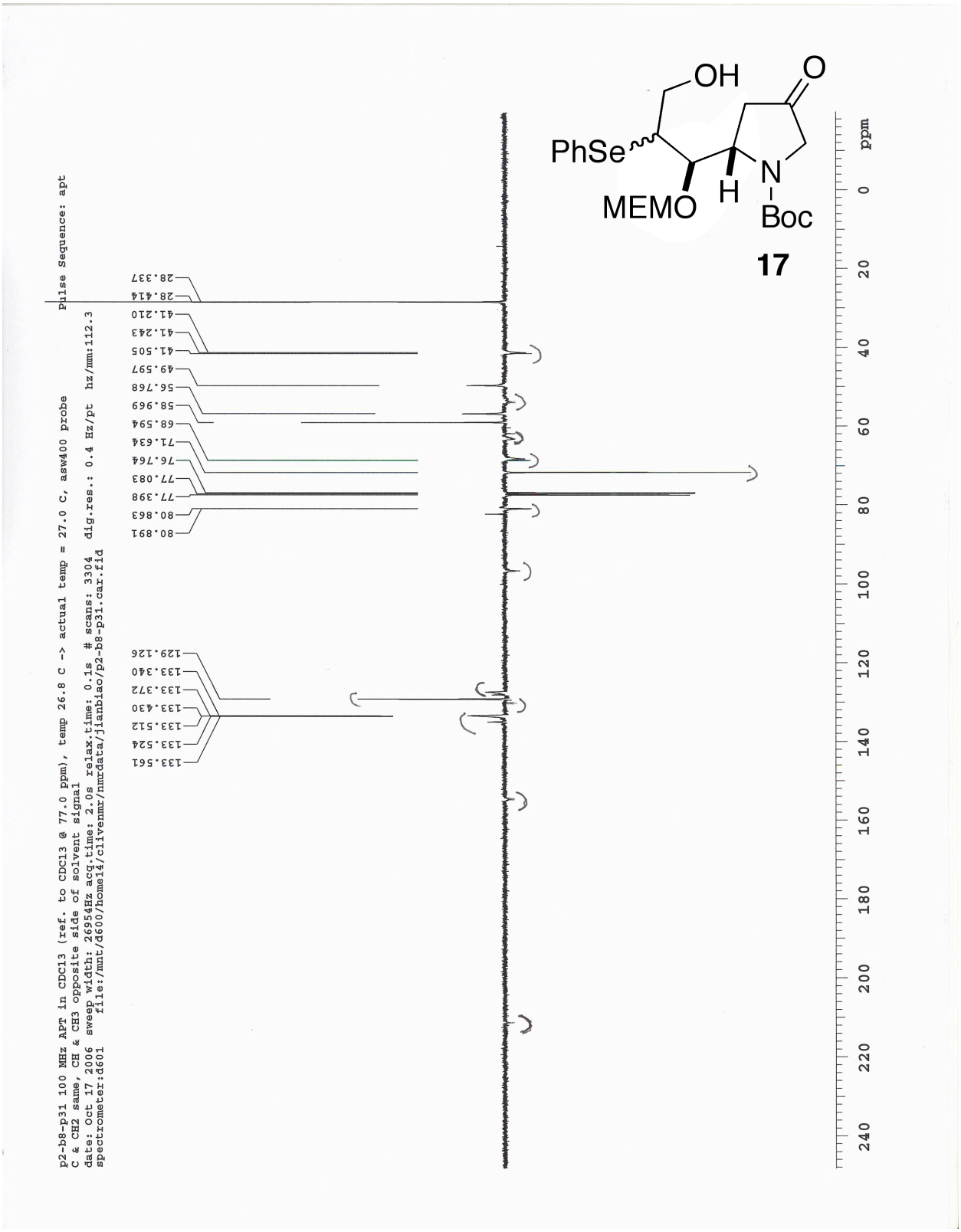

OAc
OSiPr3-i
PhSe
MEMO
N
Boc
14
4d+1q
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240
11.965
12.014
12.067
17.917
17.950
20.842
20.883
28.443
28.603
55.573
55.590
58.744
59.005
59.022
60.572
67.797
67.932
68.108
71.638
71.667
76.674
76.809
76.993
77.312
79.860
96.555
129.130
129.171
129.224
129.245
134.702
134.841
155.569
p2-b8-p21 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 14 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 32136 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/2006.10.14.i4_p2-b8-p21_C13_apt.fid
Pulse Sequence: apt

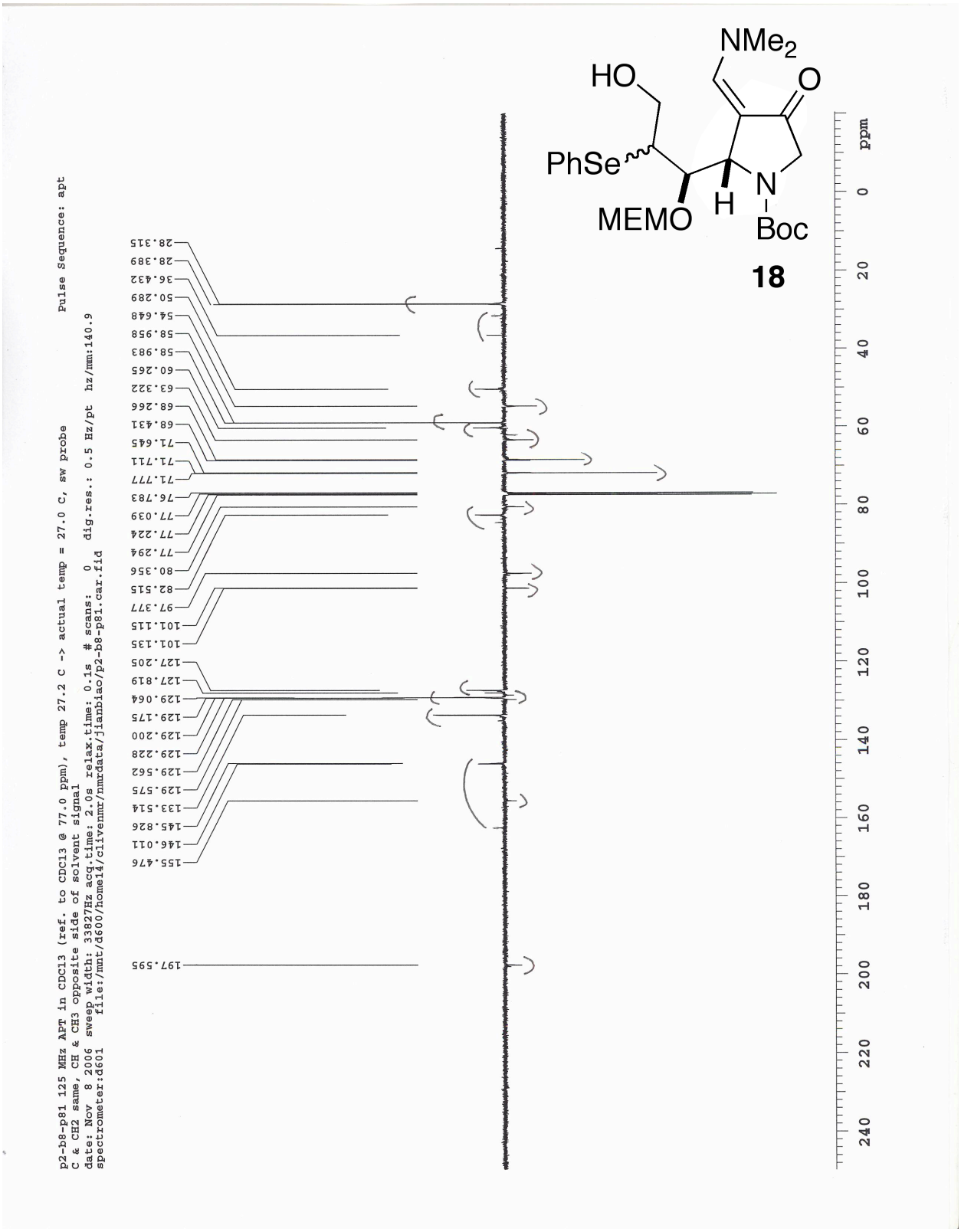

OAc
OH
PhSe
N
MEMO
Boc
15
4d + MeO
p2-b8-p23 125 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.2 C -> actual temp = 27.0 C, sw probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 14 2006 sweep width: 33827Hz acq.time: 2.0s relax.time: 0.1s # scans: 368 dig.res.: 0.5 Hz/pt hz/mm:140.9
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p23.car.fid
Pulse Sequence: apt
20.762
20.861
28.442
28.525
36.790
58.311
58.497
58.963
59.000
64.599
65.720
67.834
67.883
68.118
70.067
71.666
71.724
76.841
77.097
77.278
77.352
96.467
127.469
129.125
129.216
133.411
134.775
155.649
170.697
ppm

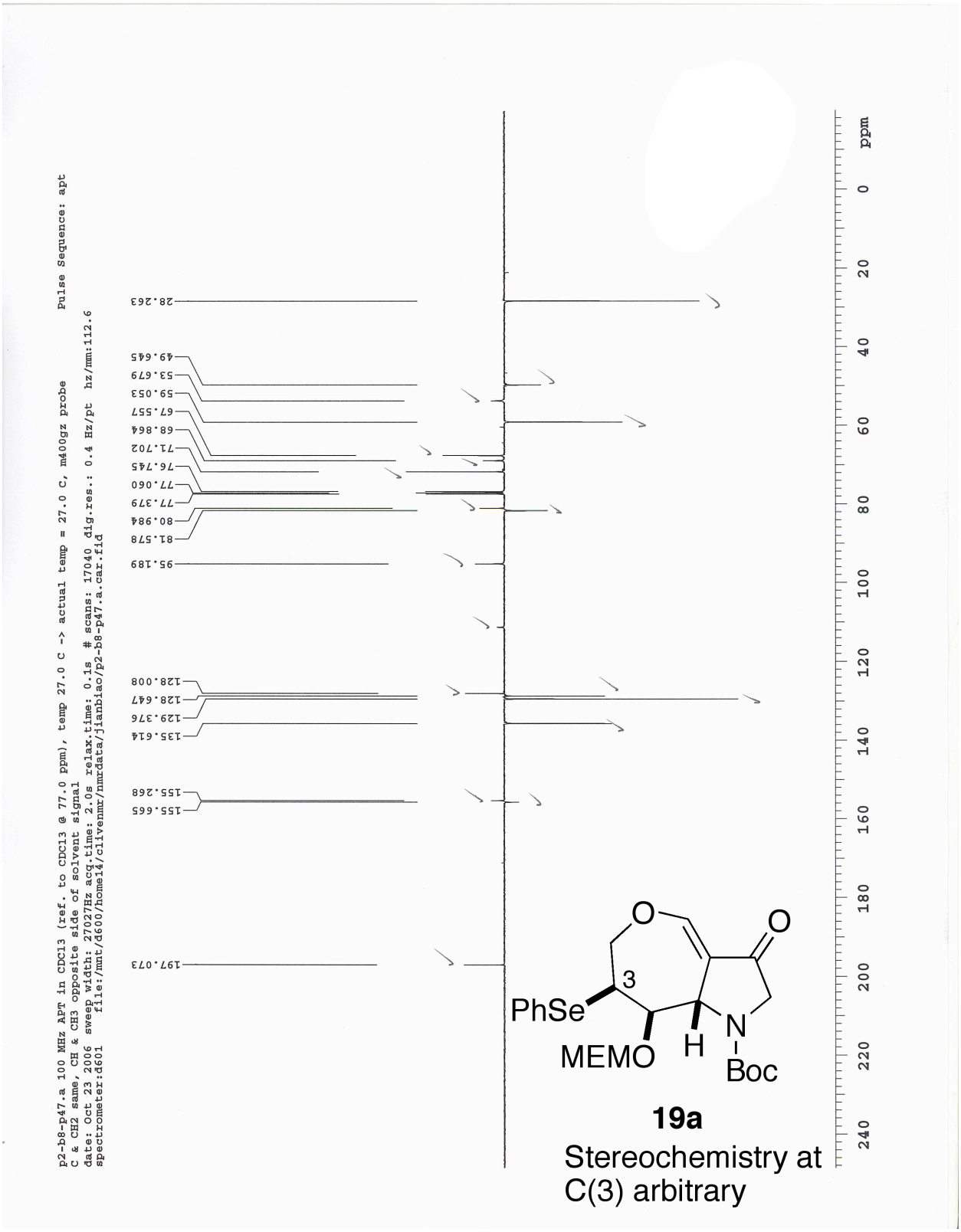


p2-b8-p25.b 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.0 C -> actual temp = 27.0 C, m400gz probe Pulse Sequence: apt
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 14 2006 sweep width: 27027Hz acq.time: 2.0s relax.time: 0.1s # scans: 1400 dig.res.: 0.4 Hz/pt hz/mm:112.6
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p25.b.car.fid


AcO
2
O
PhSe
3
4
5
N
MEMO
H
Boc
16b
p2-b8-p25.a 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.0 C -> actual temp = 27.0 C, m400gz probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 14 2006 sweep width: 27027Hz acq.time: 2.0s relax.time: 0.1s # scans: 2720 dig.res.: 0.4 Hz/pt hz/mm:112.6
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p25.a.car.fid
Pulse Sequence: apt
20.429
20.679
28.297
28.428
46.121
52.838
52.862
52.928
58.850
58.871
64.429
64.838
68.213
68.405
71.465
71.477
76.646
76.961
77.281
97.436
97.624
109.981
127.731
128.120
128.632
129.152
129.255
129.308
129.345
129.361
133.858
134.489
134.501
134.862
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

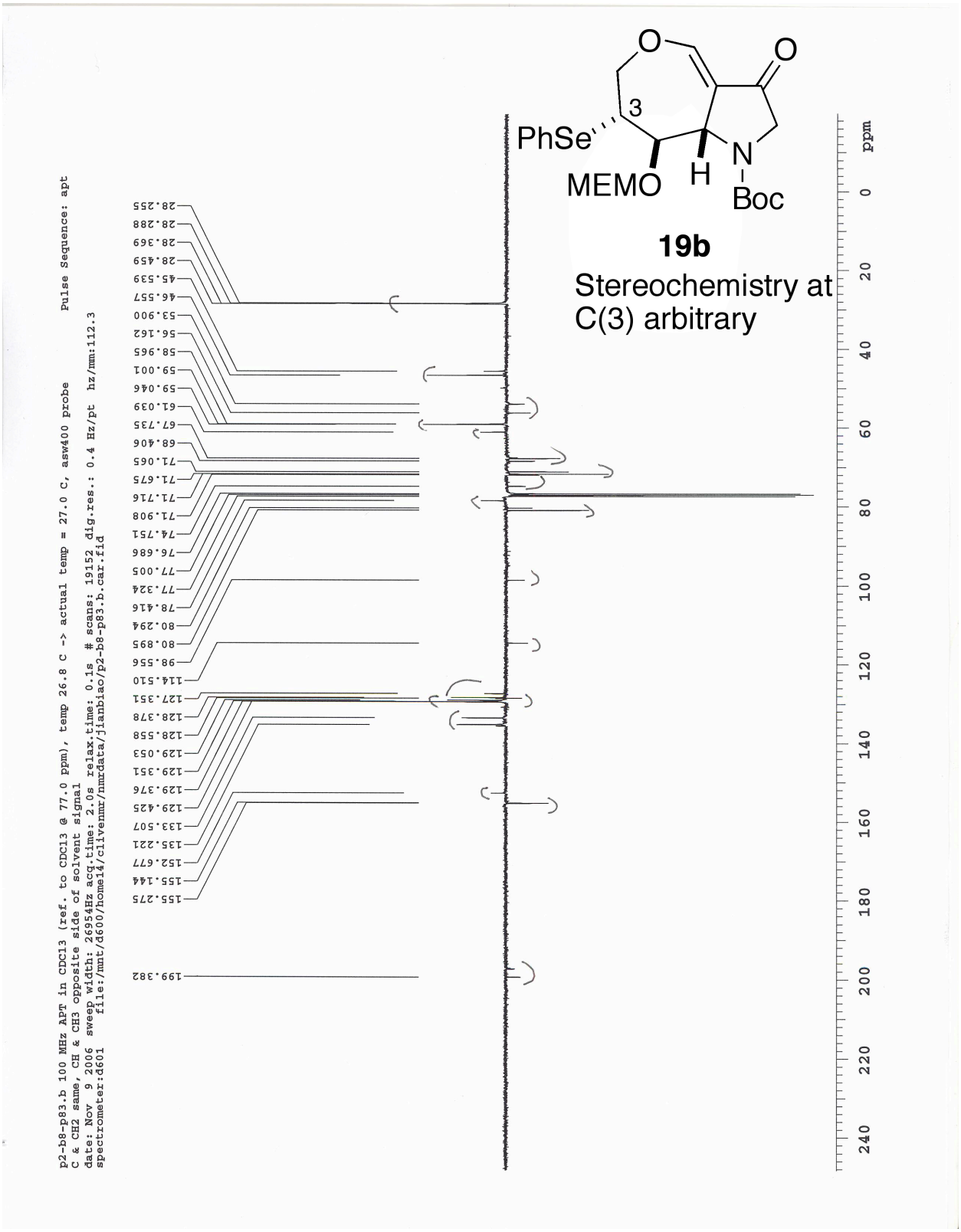

p2-b8-p31 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 17 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 3304 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmx/nmrdata/jianbiao/p2-b8-p31.car.fid
Pulse Sequence: apt
28.337
28.414
41.210
41.243
41.505
49.597
56.768
58.969
68.594
71.634
76.764
77.083
77.398
80.863
80.891
129.126
133.340
133.372
133.430
133.512
133.524
133.561
OH
O
PhSe
N
H
MEMO
Boc
17
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

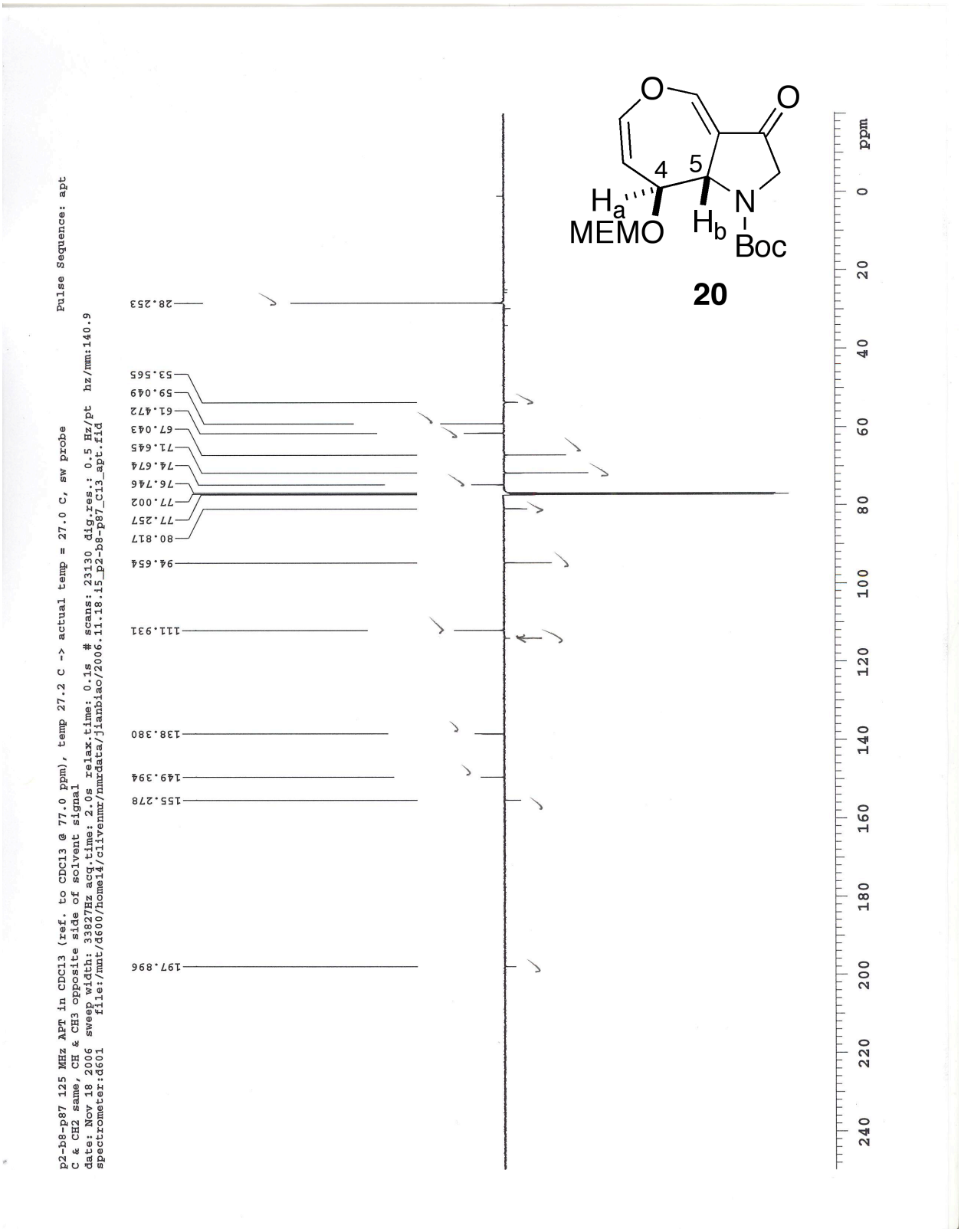

p2-b8-p81 125 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.2 C -> actual temp = 27.0 C, sw probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Nov 8 2006 sweep width: 33827Hz acq.time: 2.0s relax.time: 0.1s # scans: 0 dig.res.: 0.5 Hz/pt hz/mm:140.9
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p81.car.fid
Pulse Sequence: apt
28.315
28.389
36.432
50.289
54.648
58.958
58.983
60.265
63.322
68.266
68.431
71.645
71.711
71.777
76.783
77.039
77.224
77.294
80.356
82.515
97.377
101.115
101.135
127.205
127.819
129.064
129.175
129.200
129.228
129.562
129.575
133.514
145.826
146.011
155.476
197.595
NMe2
HO
O
PhSe
MEMO
H
N
Boc
18
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

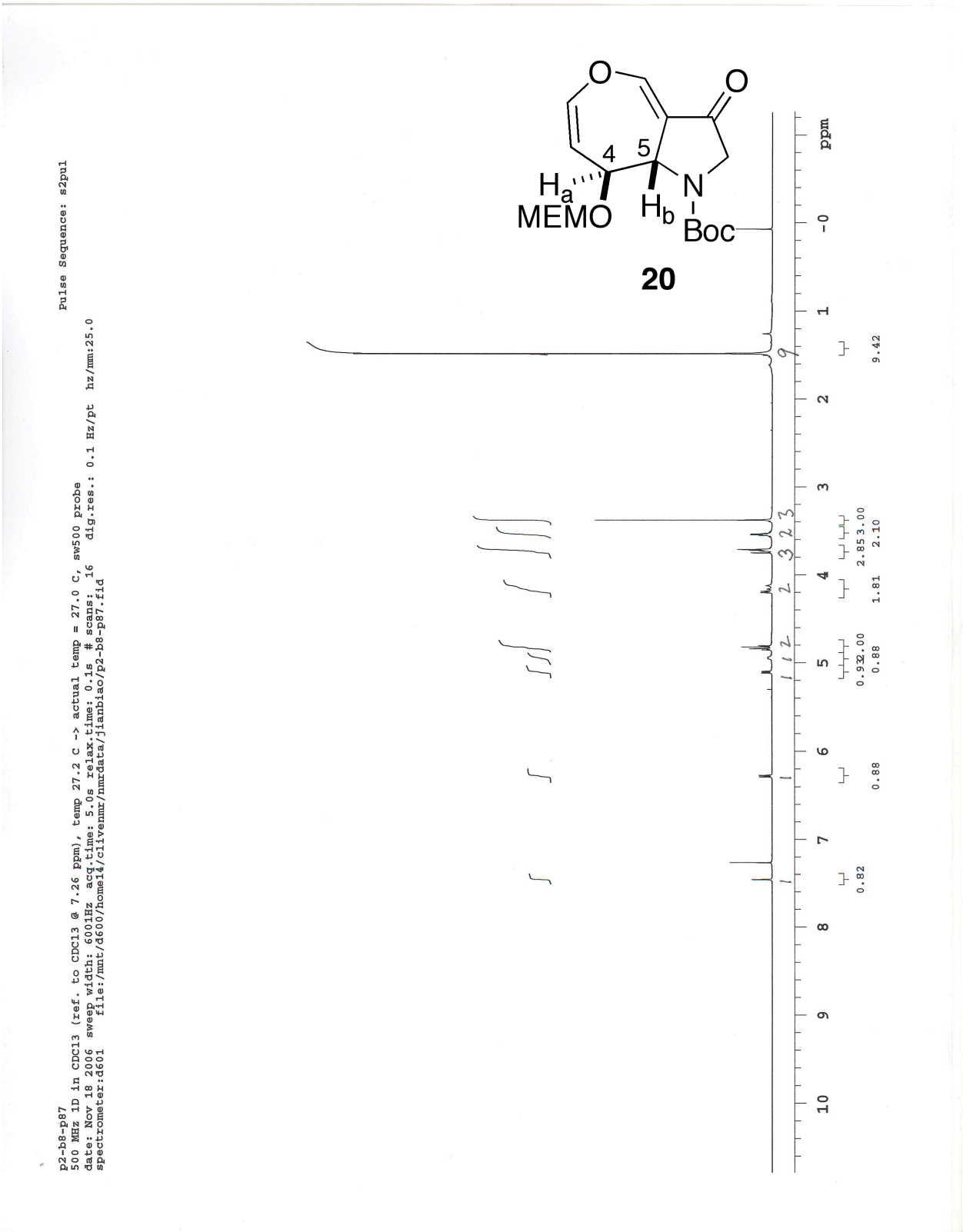


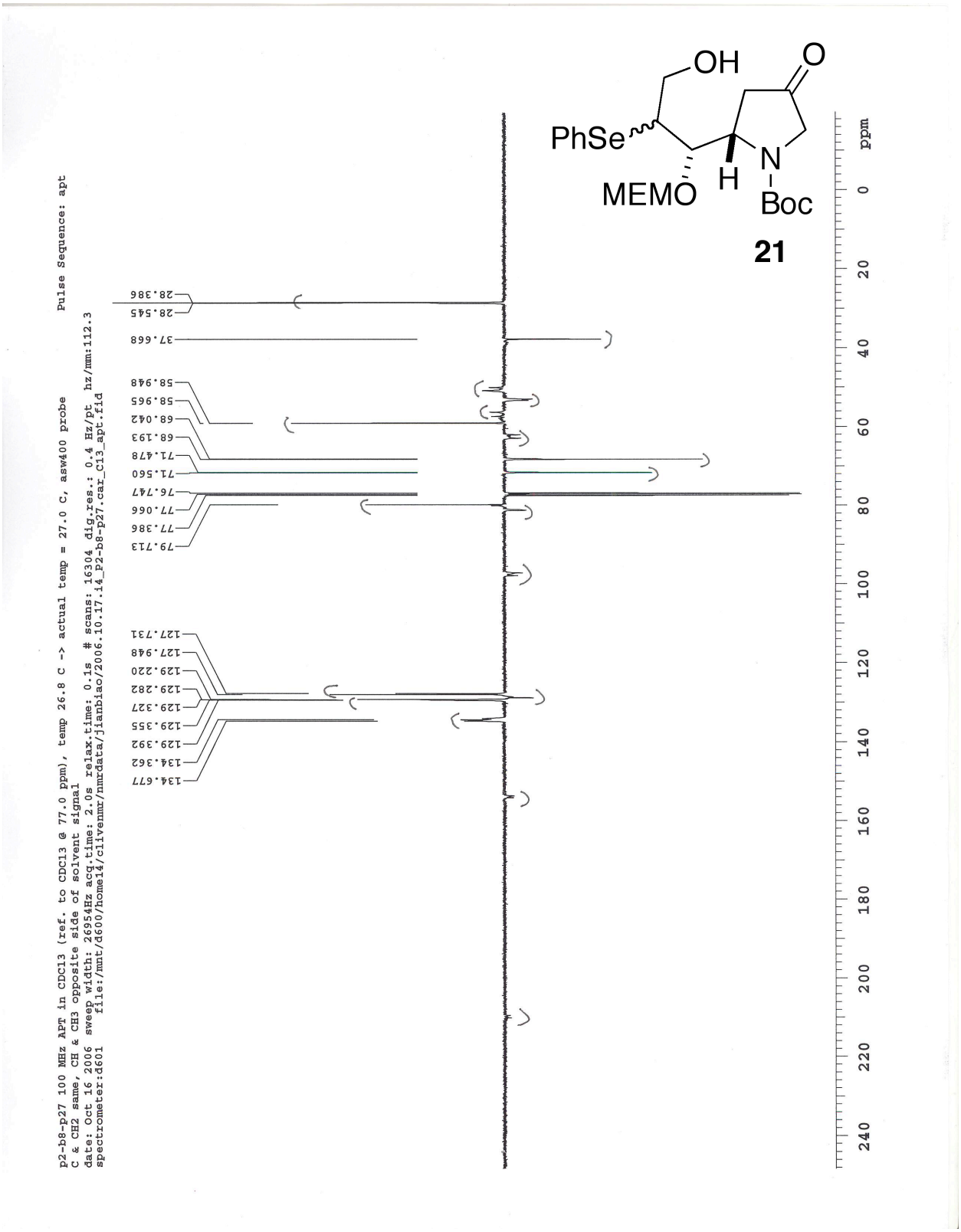
19a

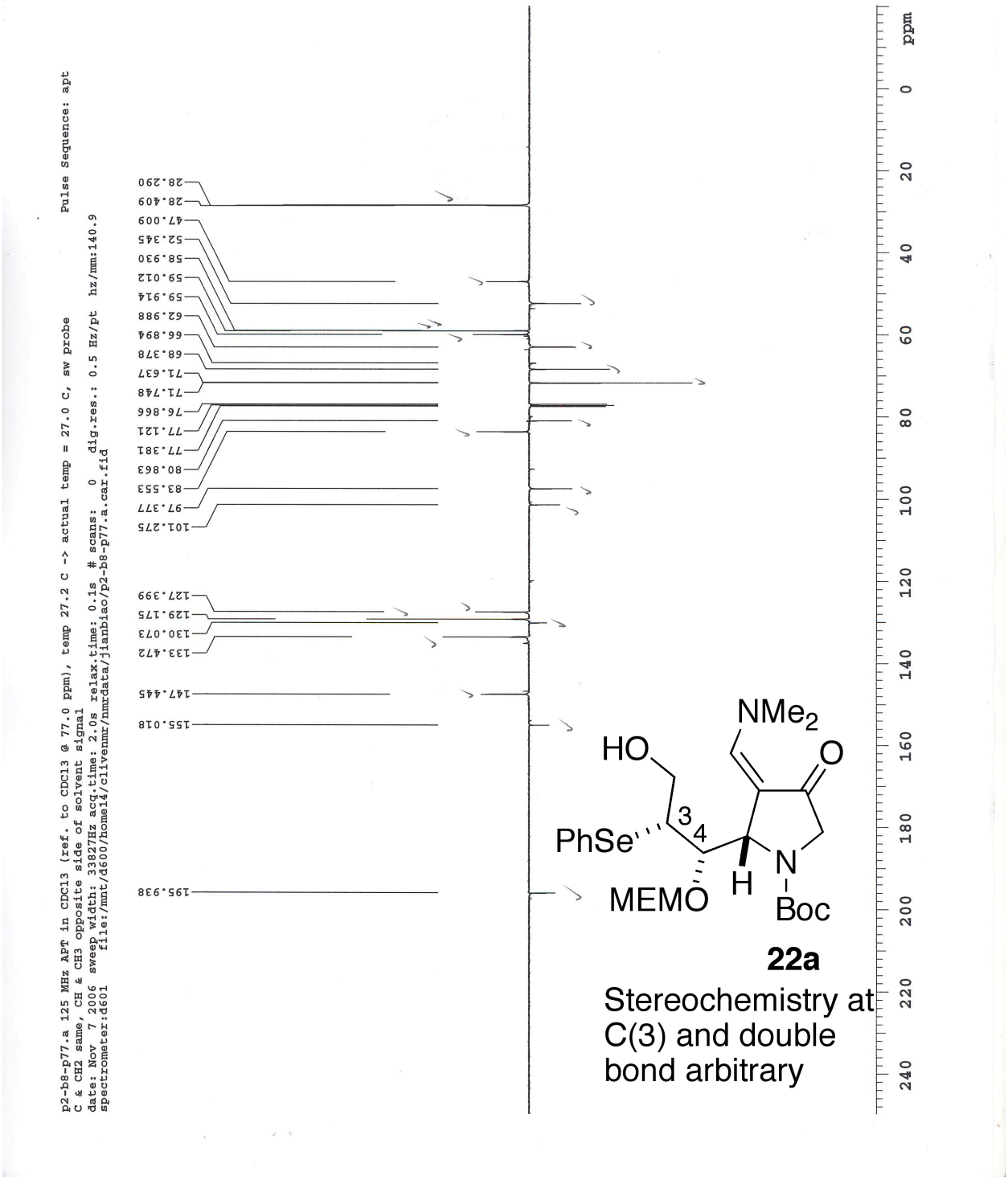
Stereochemistry at C(3) arbitrary


p2-b8-p83.b 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Nov 9 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 19152 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p83.b.car.fid
Pulse Sequence: apt
28.255
28.288
28.369
28.459
45.539
46.557
53.900
56.162
58.965
59.001
59.046
61.039
67.735
68.406
71.065
71.675
71.716
71.908
74.751
76.686
77.005
77.324
78.416
80.294
80.895
98.556
114.510
127.351
128.378
128.558
129.053
129.351
129.376
129.425
133.507
135.221
152.677
155.144
155.275
199.382
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240
O
O
3
PhSe
MEMO
H
N
Boc
19b
Stereochemistry at
C(3) arbitrary


p2-b8-p87 125 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.2 C -> actual temp = 27.0 C, sw probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Nov 18 2006 sweep width: 33827Hz acq.time: 2.0s relax.time: 0.1s # scans: 23130 dig.res.: 0.5 Hz/pt hz/mm:140.9
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/2006.11.18.i5_p2-b8-p87_C13_apt.fid
Pulse Sequence: apt
28.253
53.565
59.049
61.472
67.043
71.645
74.674
76.746
77.002
77.257
80.817
94.654
111.931
138.380
149.394
155.278
197.896
O
O
4
5
Ha
MEMO
Hb
N
Boc
20
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

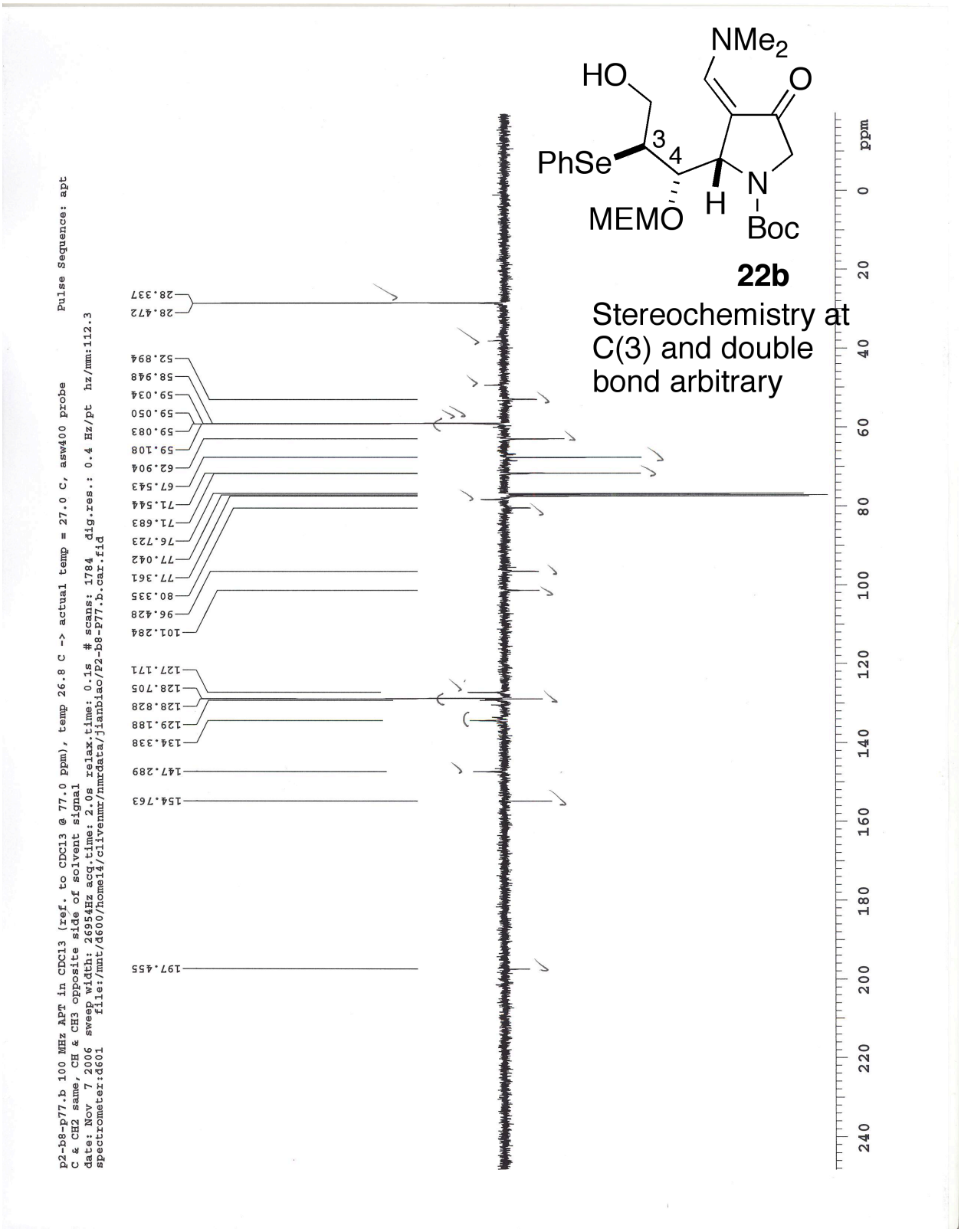

p2-b8-p87
500 MHz 1D in CDCl3 (ref. to CDCl3 @ 7.26 ppm), temp 27.2 C -> actual temp = 27.0 C, sw500 probe
date: Nov 18 2006 sweep width: 6001Hz acq.time: 5.0s relax.time: 0.1s # scans: 16 dig.res.: 0.1 Hz/pt hz/mm:25.0
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p87.fid
Pulse Sequence: s2pul
O
O
4
5
Ha
MEMO
Hb
N
Boc
20
ppm
0.82
0.88
0.93
2.00
0.88
1.81
2.85
3.00
2.10
9.42

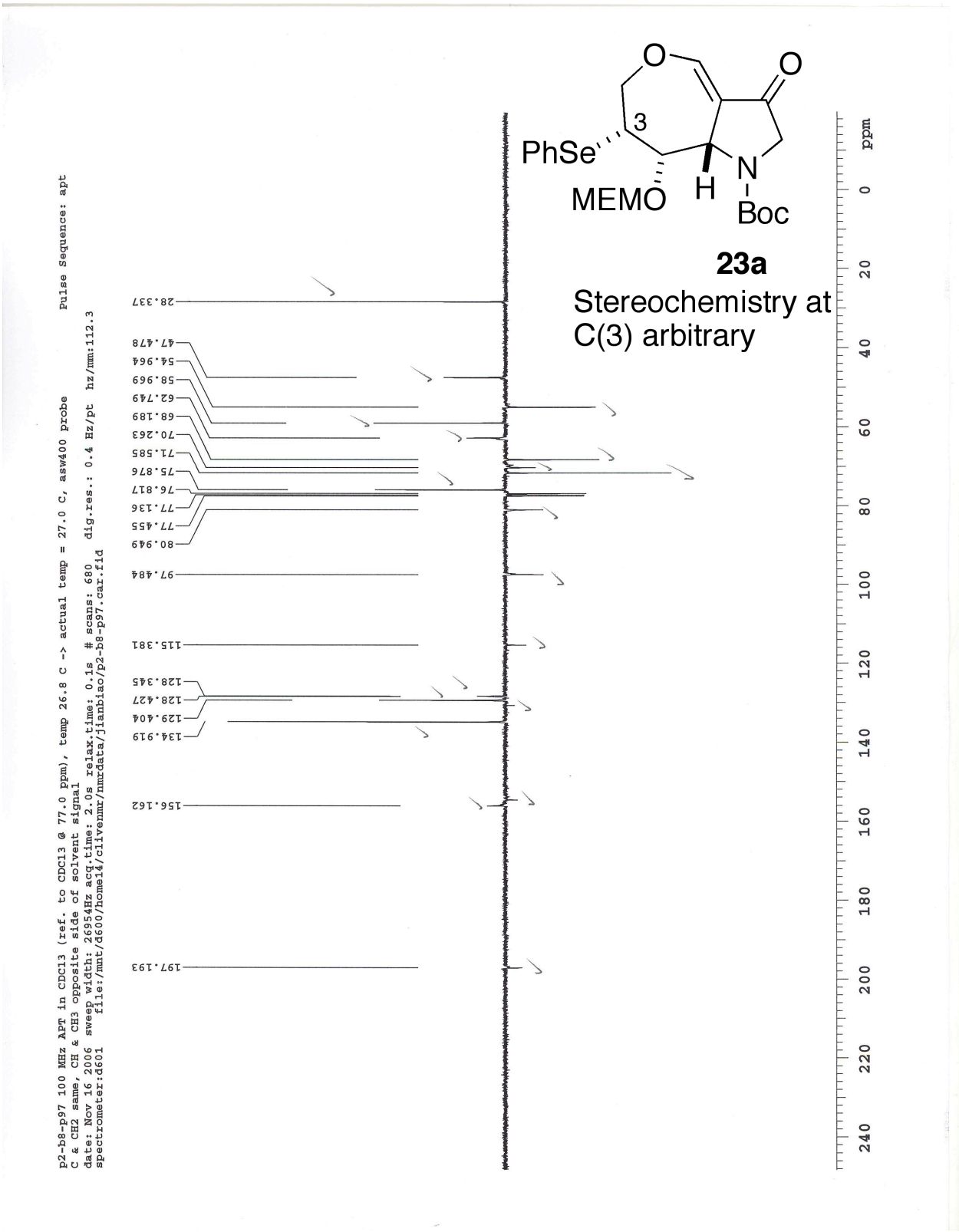

p2-b8-p27 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Oct 16 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 16304 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/2006.10.17.i4_P2-b8-p27.car_C13_apt.fid
Pulse Sequence: apt
28.386
28.545
37.668
58.948
58.965
68.042
68.193
71.478
71.560
76.747
77.066
77.386
79.713
127.731
127.948
129.220
129.282
129.327
129.355
129.392
134.362
134.677
OH
O
PhSe
N
MEMO
H
Boc
21
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240

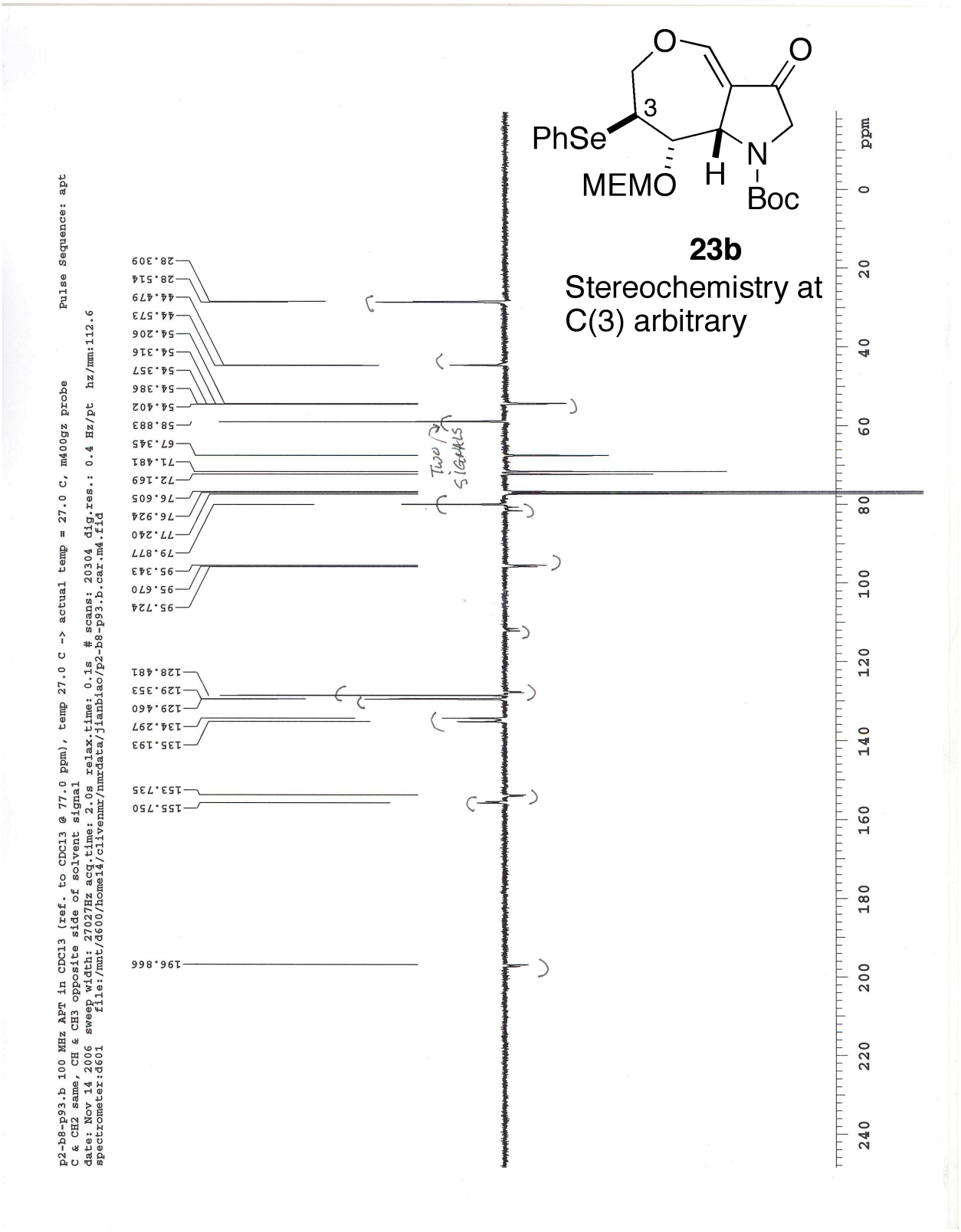


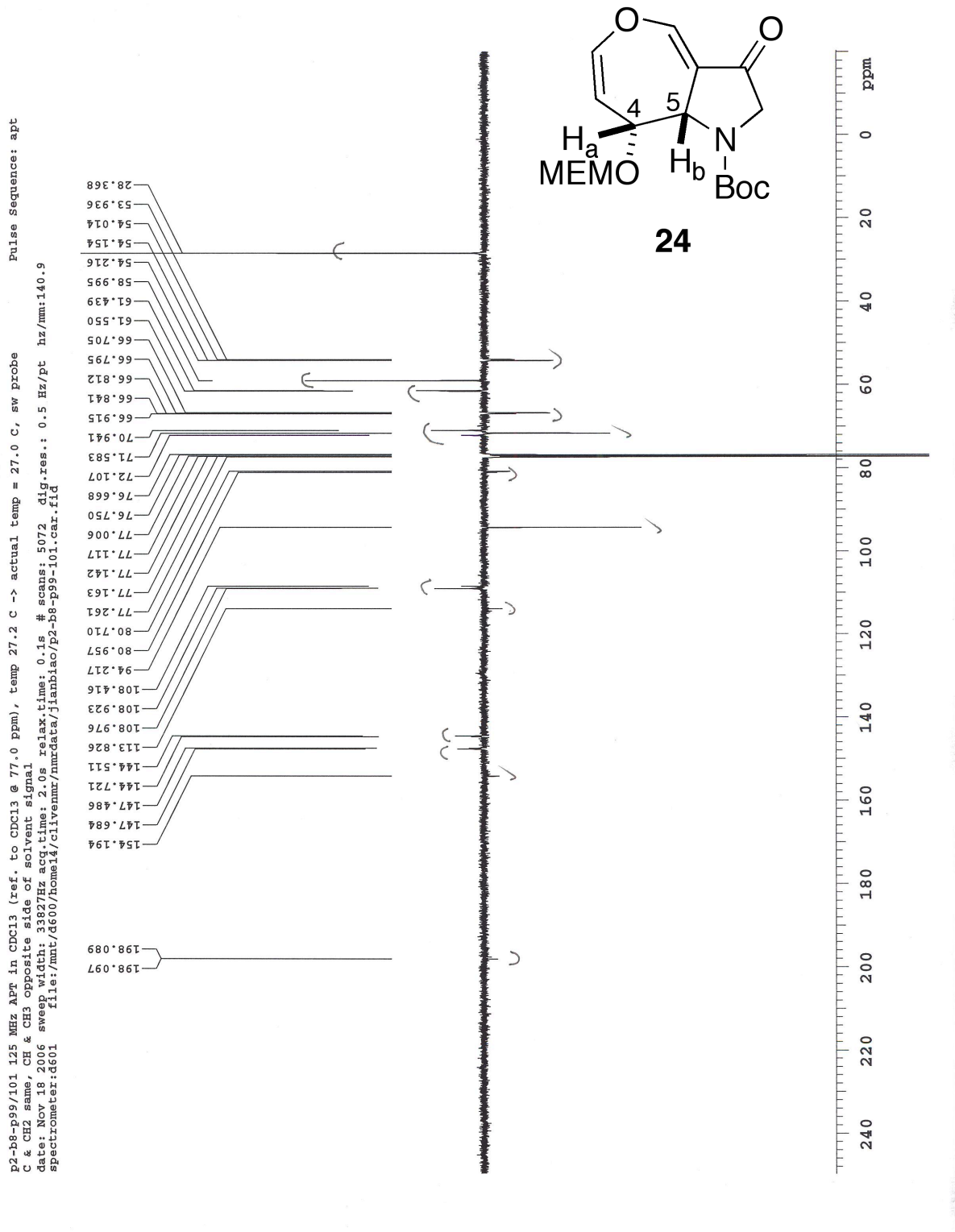
22a

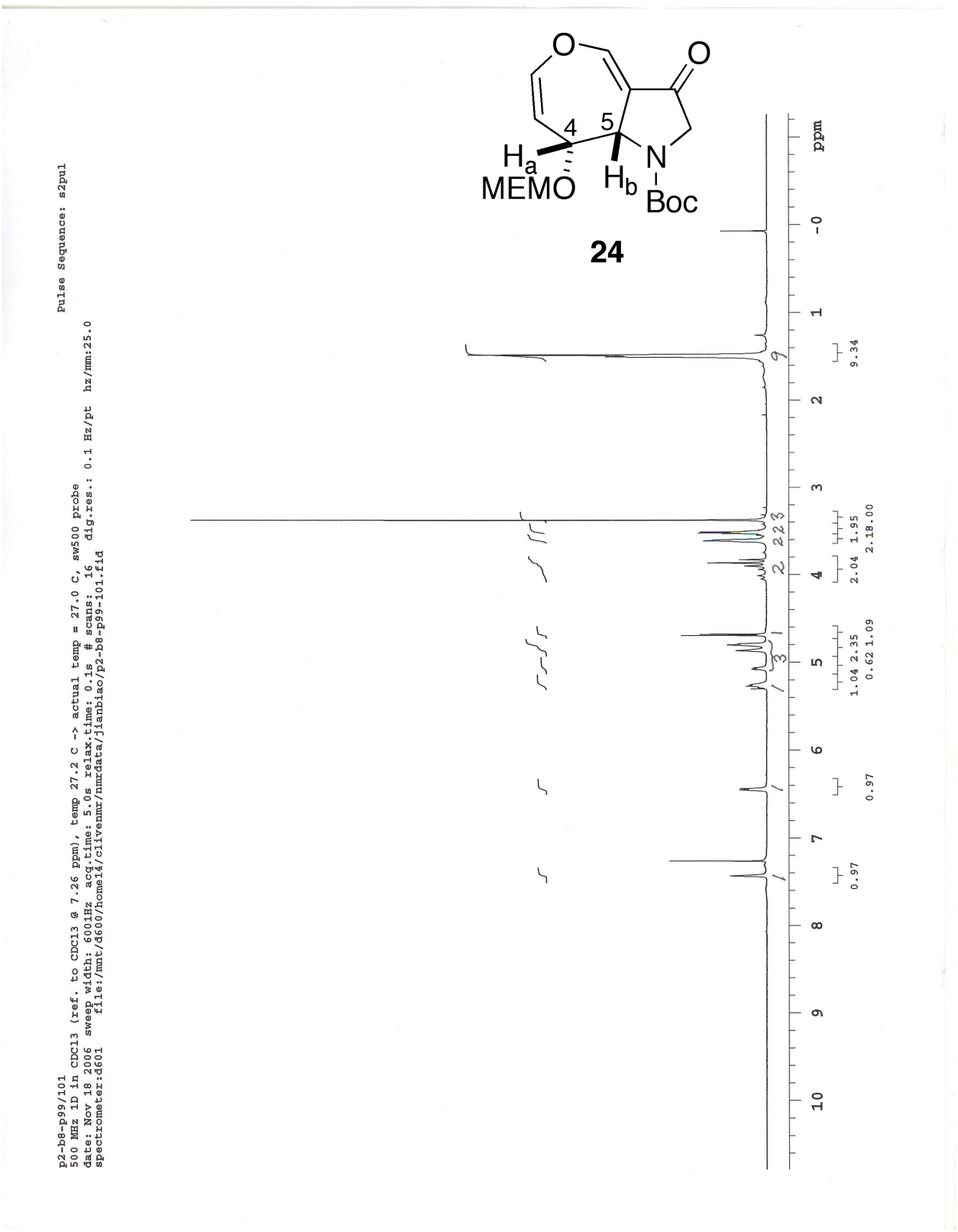
Stereochemistry at C(3) and double bond arbitrary


p2-b8-p77.b 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Nov 7 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 1784 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/P2-b8-P77.b.car.fid
Pulse Sequence: apt
28.337
28.472
52.894
58.948
59.034
59.050
59.083
59.108
62.904
67.543
71.544
71.683
76.723
77.042
77.361
80.335
96.428
101.284
127.171
128.705
128.828
129.188
134.338
147.289
154.763
197.455
NMe2
HO
O
PhSe
3
4
N
H
MEMO
Boc
22b
Stereochemistry at C(3) and double bond arbitrary
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240


p2-b8-p97 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 26.8 C -> actual temp = 27.0 C, asw400 probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Nov 16 2006 sweep width: 26954Hz acq.time: 2.0s relax.time: 0.1s # scans: 680 dig.res.: 0.4 Hz/pt hz/mm:112.3
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p97.car.fid
Pulse Sequence: apt
28.337
47.478
54.964
58.969
62.749
68.189
70.263
71.585
75.876
76.817
77.136
77.455
80.949
97.484
115.381
128.345
128.427
129.404
134.919
156.162
197.193
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240
O
O
3
PhSe
MEMO
H
N
Boc
23a
Stereochemistry at C(3) arbitrary


p2-b8-p93.b 100 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.0 C -> actual temp = 27.0 C, m400gz probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Nov 14 2006 sweep width: 27027Hz acq.time: 0.1s # scans: 20304 dig.res.: 0.4 Hz/pt hz/mm:112.6
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p93.b.car.m4.fid
Pulse Sequence: apt
28.309
28.514
44.479
44.573
54.206
54.316
54.357
54.386
54.402
58.883
67.345
71.481
72.169
76.605
76.924
77.240
79.877
95.343
95.670
95.724
128.481
129.353
129.460
134.297
135.193
153.735
155.750
196.866
Two C signals
ppm
0
20
40
60
80
100
120
140
160
180
200
220
240
O
O
3
PhSe
MEMO
H
N
Boc
23b
Stereochemistry at
C(3) arbitrary


p2-b8-p99/101 125 MHz APT in CDCl3 (ref. to CDCl3 @ 77.0 ppm), temp 27.2 C -> actual temp = 27.0 C, sw probe
C & CH2 same, CH & CH3 opposite side of solvent signal
date: Nov 18 2006 sweep width: 33827Hz acq.time: 2.0s relax.time: 0.1s # scans: 5072 dig.res.: 0.5 Hz/pt hz/mm:140.9
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p99-101.car.fid
Pulse Sequence: apt
28.368
53.936
54.014
54.154
54.216
58.995
61.439
61.550
66.705
66.795
66.812
66.841
66.915
70.941
71.583
72.107
76.668
76.750
77.006
77.117
77.142
77.163
77.261
80.710
80.957
94.217
108.416
108.923
108.976
113.826
144.511
144.721
147.486
147.684
154.194
198.089
198.097
ppm
O
O
4
5
Ha
MEMO
Hb
N
Boc
24


Pulse Sequence: s2pul
p2-b8-p99/101
500 MHz 1D in CDCl3 (ref. to CDCl3 @ 7.26 ppm), temp 27.2 C -> actual temp = 27.0 C, sw500 probe
date: Nov 18 2006 sweep width: 6001Hz acq.time: 5.0s relax.time: 0.1s # scans: 16 dig.res.: 0.1 Hz/pt hz/mm:25.0
spectrometer:d601 file:/mnt/d600/home14/clivenmr/nmrdata/jianbiao/p2-b8-p99-101.fid
O
O
4
5
Ha
MEMO
Hb
N
Boc
24
ppm
0.97
0.97
1.04
2.35
0.62
1.09
2.04
1.95
2.18.00
9.34