^{13}C NMR as a General Tool for the Assignment of Absolute Configuration

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Electronic Supplementary Information

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Experimental Section

General Derivatization Procedure

The CDA derivatives were prepared by treatment of the compound (1.00 equiv) with the corresponding (*R*)- and (*S*)-CDA (1.25 equiv) in the presence of 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDC, 1.25 equiv) and cat DMAP (if necessary, 20 mol%) in dry CH_2Cl_2 and under a nitrogen atm. The reaction mixture was stirred overnight. Next, the organic layer was sequentially washed with water, HCl (1M), water, $NaHCO_3$ (sat) and water. Then, the layer was dried (anhyd $NaSO_4$) and concentrated under reduced pressure to provide the corresponding derivative. If needed, further purification was achieved by means of flash column chromatography.

Synthesis of (*R*)-1-(pentadeuterophenyl)ethanol-2,2,2-d_3

(*R*)-1-(pentadeuterophenyl)ethanol-2,2,2-d_3 was prepared by asymmetric reduction of acetophenone-d_8 following literature procedures.[1]

Trimethylsilyl chloride (130 mg, 1.2 mmol) was added to a suspension of $NaBH_4$ (45 mg, 1.2 mmol) in dry THF (5 mL). After the mixture was heated at 70°C for 1 h and allowed to cool to room temperature, a solution of (*S*)-α,α-diphenylpyrrolidinemethanol (25 mg, 0.1 mmol) in THF (2 mL) was added. When there was no gas emitted, a solution of acetophenone-d_8 (120 mg, 1.0 mmol) in THF (2 mL) was added slowly with a syringe controlled by a syringe pump to the system at a rate of 0.6 mL/h. After the addition was complete, the mixture was hydrolyzed overnight with 2N HCl (5 mL) and extracted with ether (3×10 mL). The combined organic layers were washed with brine, and dried with sodium sulfate. Once the solvent was removed under reduced pressure, the crude product was esterified without further purification.

Computational Methods

Main conformations of corynanthine MPA esters (*sp/ap*) were generated by rotation around Cα-C(O) bond (MPA moiety). The geometries and energies of the most relevant conformations of the MPA esters (*sp*1/*ap*1, Figure 1S) were optimized at the B3LYP/6-31+G(d), following by DFT-GIAO/B3LYP (PCM) NMR calculations using the same basis set and $CHCl_3$ parameters. A second conformation around C(2)-CO was obtained for MPA esters of (4a*S*,5*S*,6*S*,8a*R*)-methyl 6-hydroxydecahydroisoquinoline-5-carboxylate (*sp*2 conformation), taken as simplified model compound, following the steps previously described (Figure 1S). Alternatively, the methyl ester was replaced by a methyl group in the minimized structures and DFT-GIAO/B3LYP (PCM)/ 6-31+G(d) NMR calculations were carried out in order to study the influence on C(2) chemical shifts from ester group.

Relative populations were estimated on the basis of calculated and experimental ^{13}C chemical shifts [except for C(2)] for those nuclei closer to the chiral center.

Gaussian03, Revision E.01

Gaussian 03, Revision E.01, M. J. Frisch, G. W. Trucks, H. B. Schlegel, G. E. Scuseria, M. A. Robb, J. R. Cheeseman, J. A. Montgomery, Jr., T. Vreven, K. N. Kudin, J. C. Burant, J. M. Millam, S. S. Iyengar, J. Tomasi, V. Barone, B. Mennucci, M. Cossi, G. Scalmani, N. Rega, G. A. Petersson, H. Nakatsuji, M. Hada, M. Ehara, K. Toyota, R. Fukuda, J. Hasegawa, M. Ishida, T. Nakajima, Y. Honda, O. Kitao, H. Nakai, M. Klene, X. Li, J. E. Knox, H. P. Hratchian, J. B. Cross, V. Bakken, C. Adamo, J. Jaramillo, R. Gomperts, R. E. Stratmann, O. Yazyev, A. J. Austin, R. Cammi, C. Pomelli, J. W. Ochterski, P. Y. Ayala, K. Morokuma, G. A. Voth, P. Salvador, J. J. Dannenberg, V. G. Zakrzewski, S. Dapprich, A. D. Daniels, M. C. Strain, O. Farkas, D. K. Malick, A. D. Rabuck, K. Raghavachari, J. B. Foresman, J. V. Ortiz, Q. Cui, A. G. Baboul, S. Clifford, J. Cioslowski, B. B. Stefanov, G. Liu, A. Liashenko, P. Piskorz, I. Komaromi, R. L. Martin, D. J. Fox, T. Keith, M. A. Al-Laham, C. Y. Peng, A. Nanayakkara, M. Challacombe, P. M. W. Gill, B. Johnson, W. Chen, M. W. Wong, C. Gonzalez, and J. A. Pople, Gaussian, Inc., Wallingford CT, 2004.

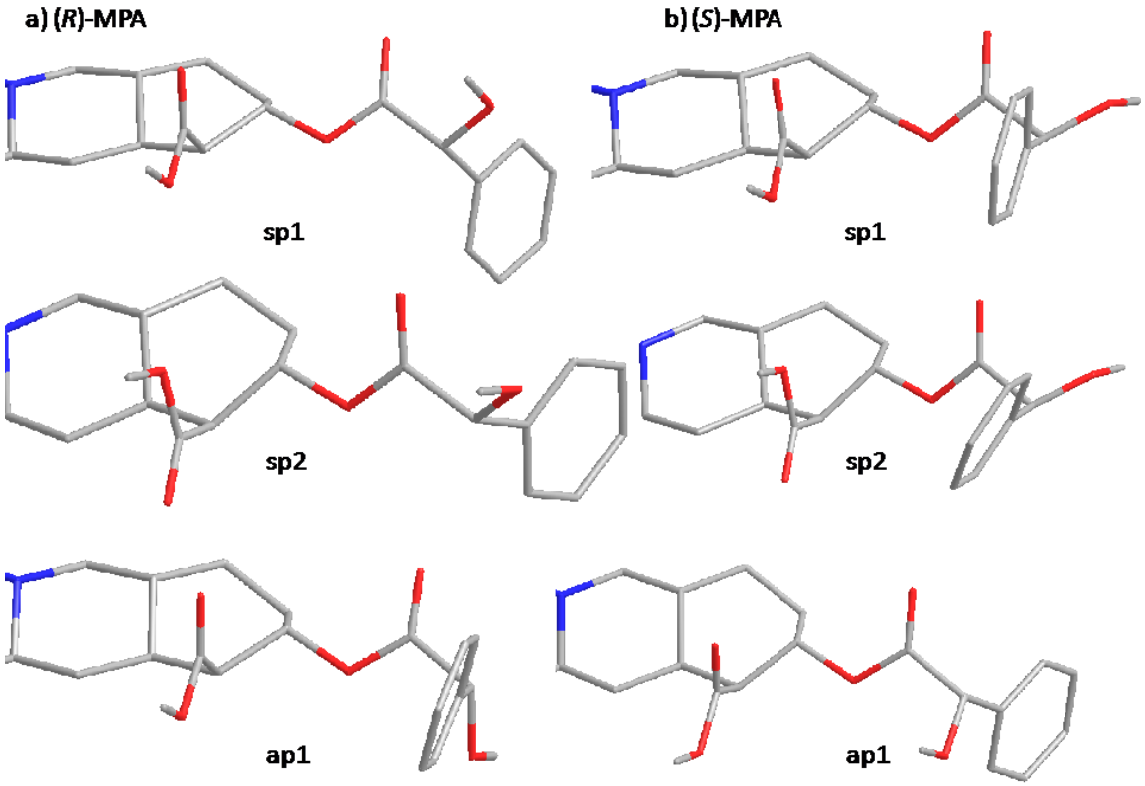

Figure 1S. Optimized structures of the main conformers of corynanthine (a) (*R*)- and (b) (*S*)-MPA [DFT/B3LYP/6-31+G(d)].

Table 1S. Absolute shieldings (σ), anisotropies (A), shielding tensor components[2] (σ_{xz}, σ_{zz}),[a] calculated and experimental $\Delta\delta^{RS}$ for the lowest energy conformers *sp* of MPA esters of corynanthine (**22b**).

		C(6)	C(5)	C(2)	C(3)	C(7)	C(8)	CO	OMe
(R)-MPA	σ	165.11	164.37	140.24	150.21	153.50	130.57	18.57	138.78
	A	18.35	24.17	24.36	11.76	22.32	24.55	99.38	68.14
	σ_{zz}	153.17	147.84	125.61	143.65	145.46	139.87	33.84	118.84
	σ_{xz}	6.03	3.68	2.43	-5.11	-6.79	5.17	10.09	6.68
(S)-MPA	σ	163.78	164.07	138.67	150.87	153.73	131.05	19.39	139.12
	A	20.22	24.14	22.17	11.03	23.17	25.20	99.38	67.42
	σ_{zz}	154.88	147.19	124.98	144.54	145.44	138.84	38.71	127.03
	σ_{xz}	9.43	8.52	4.19	-6.46	-6.79	4.66	10.09	2.47
$\Delta\delta^{RS}$**calcd**		**-1.33**	**-0.30**	**-1.57**	**+0.66**	**+0.23**	**+0.49**	**+0.82**	**+0.34**
$\Delta\delta^{RS}$**exp**		**-0.17**	**-0.34**	**+0.74**	**+0.44**	**+0.19**	**+0.99**	**+0.10**	**+0.12**

[a] DFT-GIAO/B3LYP/6-31+G(d) using $CHCl_3$ parameters.

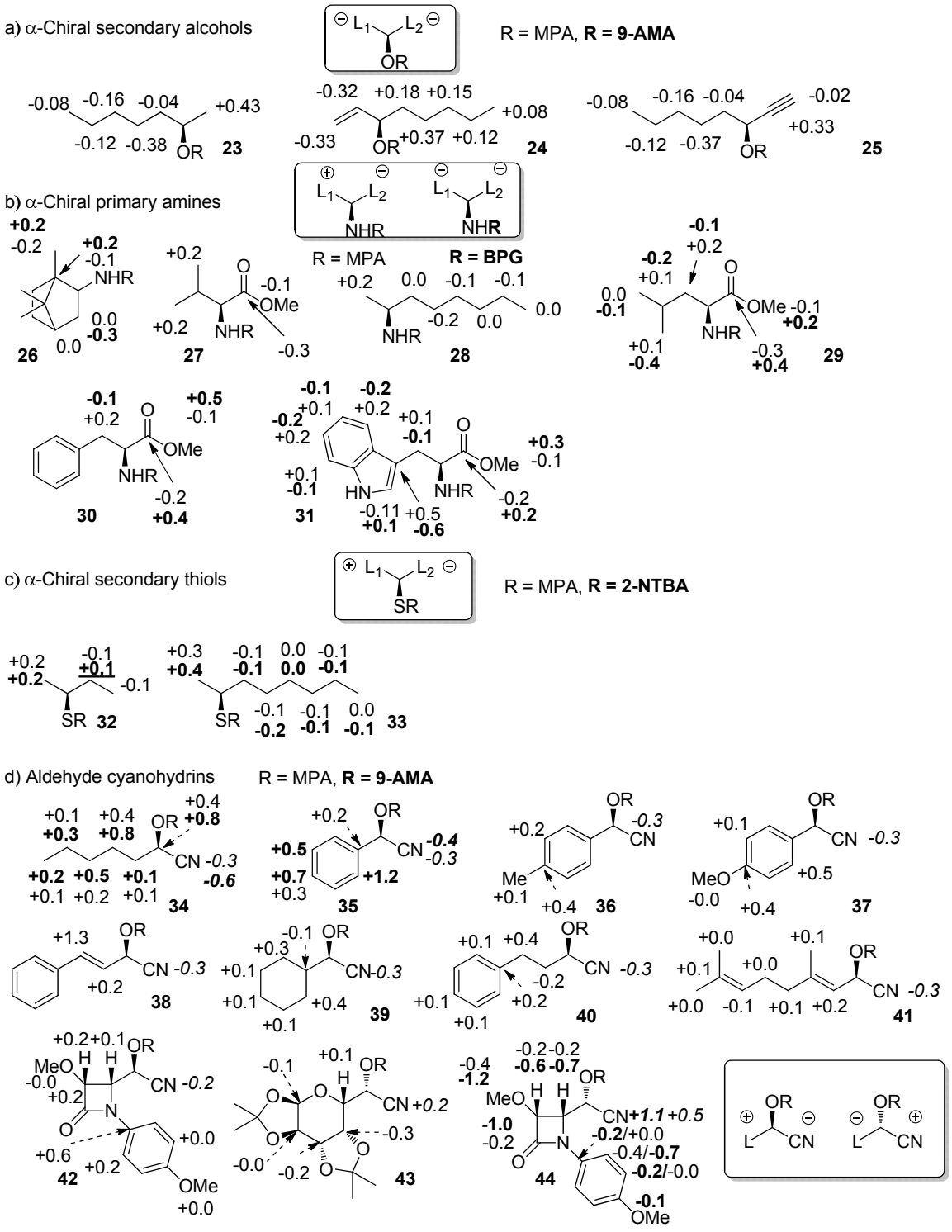

Figure 2S. ^{13}C $\Delta\delta^{RS}$ data for monofunctional chiral substrates and sign distributions according to the configuration.

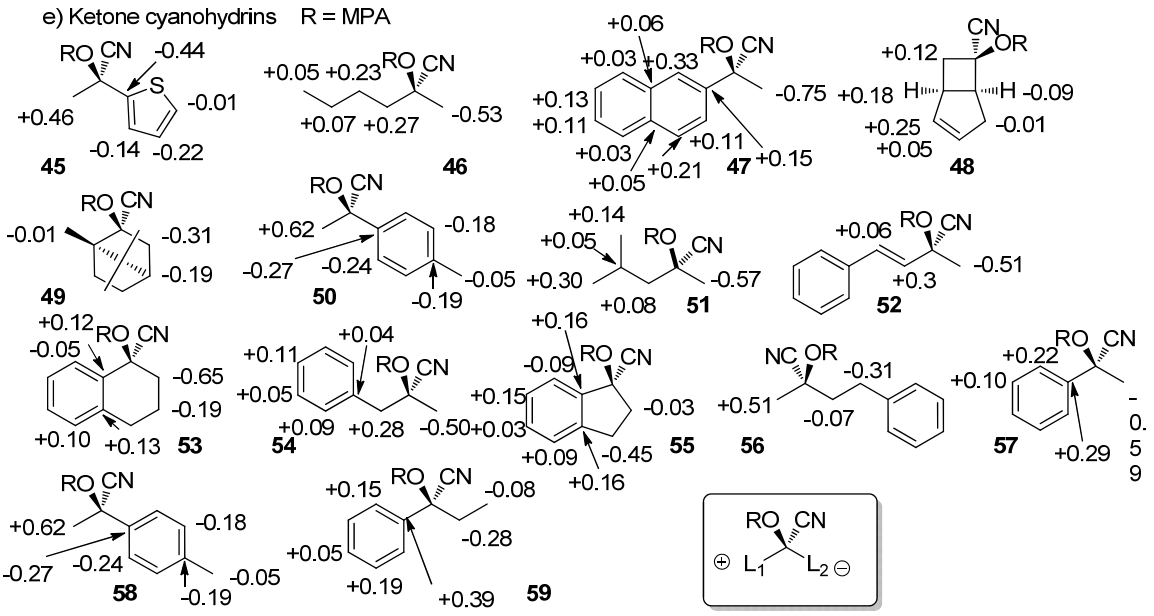

Figure 2S. ^{13}C $\Delta\delta^{RS}$ data for monofunctional chiral substrates and sign distributions according to the configuration (cont.).

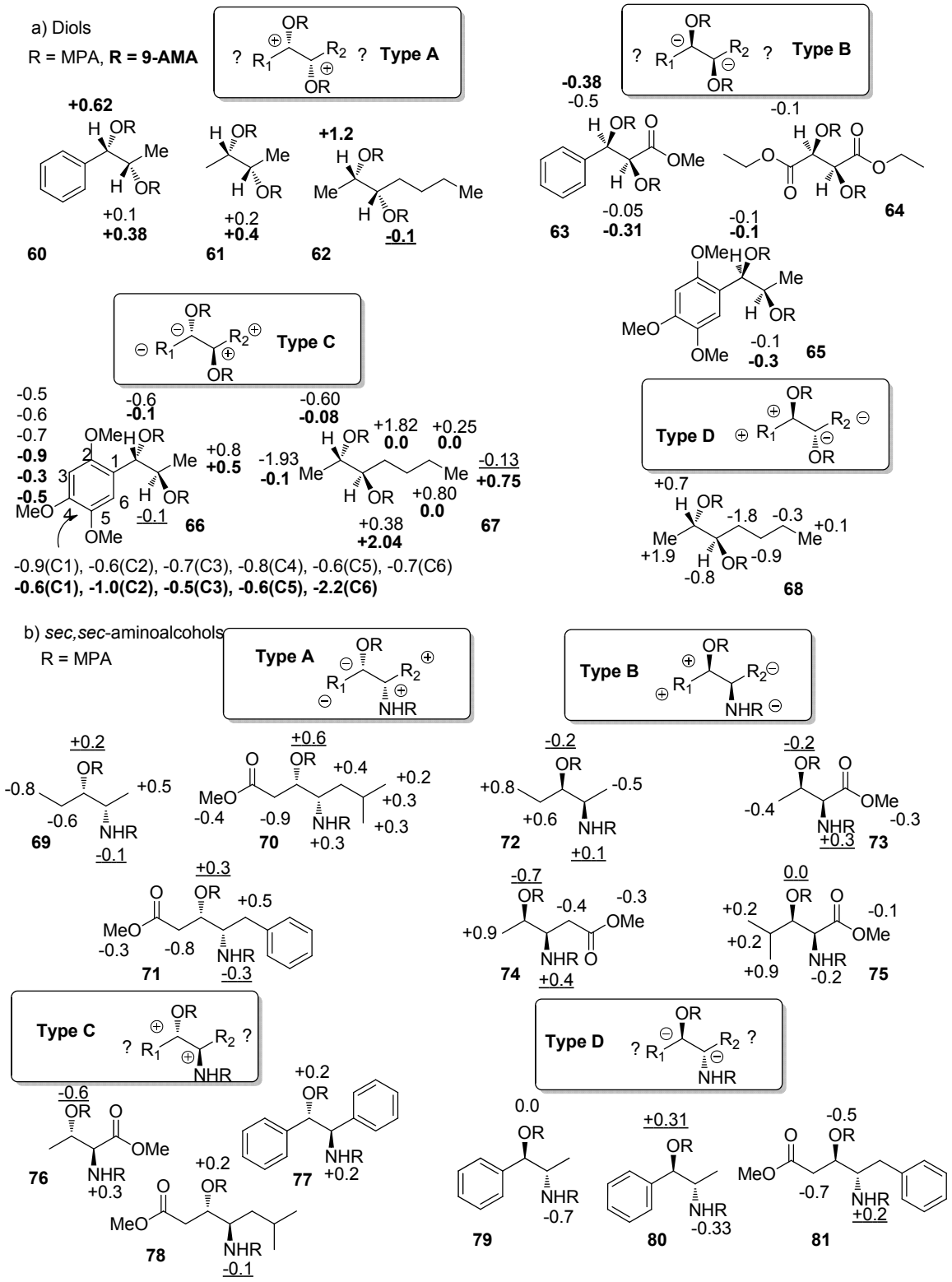

Figure 3S. ^{13}C $\Delta\delta^{RS}$ data for bifunctional chiral substrates and sign distributions according to the configuration.

NMR Spectroscopy

(*R*)- 1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (1)

[α]= +10.1 (c = 1.0, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 2.26 (bs, 1H), 4.87 (s, 1H).; ^{13}C NMR ($CDCl_3$, 101 MHz) δ(ppm): 24.2 (quint, *J* = 19.1 Hz, 1C), 70.0, 124.9 (t, *J* = 24.0 Hz, 2C), 126.8 (t, *J* = 24.4 Hz, 1C), 127.8 (t, *J* = 24.4 Hz, 2C), 145.6 ; HRMS (ESI) calculated for $C_8H_3D_8O$ [M+1]: 131.1307, found: 131.1301.

(*R*)- 1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*R*)-MPA ester [(*R*)-MPA-1]

[α]= -9.4 (c = 1.6, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 3.40 (s, 3H), 4.80 (s, 1H), 5.91 (s, 1H), 7.30-7.34 (m, 3H), 7.36-7.40 (m, 2H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 57.3, 72.8, 82.7, 127.3, 128.5, 128.6, 136.1, 140.8, 169.8; HRMS (ESI) calculated for $C_{17}H_{10}D_8NaO_3$ [M+Na]: 301.1650, found: 301.1653.

(*R*)- 1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*S*)-MPA ester [(*S*)-MPA-1]

[α]= +57.0 (c = 1.2, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 3.39 (s, 3H), 4.78 (s, 1H), 5.92 (s, 1H), 7.31-7.39 (m, 3H), 7.44-7.47 (m, 2H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 57.3, 72.9, 82.6, 127.1, 128.5, 128.6, 136.2, 140.7, 169.9; HRMS (ESI) calculated for $C_{17}H_{10}D_8NaO_3$ [M+Na]: 301.1650, found: 301.1652.

(*R*)- 1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*R*)-9-AMA ester [(*R*)-9-AMA-1]

[α]= -22.1 (c = 1.1, CH_2Cl_2; ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 3.44 (s, 3H), 5.87 (s, 1H), 6.33 (s, 1H), 7.41-7.46 (m, 4H), 7.98-8.02 (m, 2H), 8.46-8.53 (m, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 57.5, 72.9, 77.3, 124.4, 124.9, 126.4, 127.2, 129.0, 129.1, 130.6, 131.4, 140.5, 170.5; HRMS (ESI) calculated for $C_{25}H_{14}D_8NaO_3$ [M+Na]: 401.1963, found: 401.1954.

(*R*)- 1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*S*)-9-AMA ester [(*S*)-9-AMA-1]

[α]= +68.3 (c = 1.4, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 3.39 (s, 3H), 5.92 (s, 1H), 6.26 (s, 1H), 7.45-7.54 (m, 4H), 8.00-8.04 (m, 2H), 8.48 (s, 1H), 8.54-8.58 (m, 2H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 57.5, 73.1, 77.4, 124.5, 125.0, 126.4, 127.5, 129.1, 129.2, 130.5, 131.5, 140.8, 170.6; HRMS (ESI) calculated for $C_{25}H_{14}D_8NaO_3$ [M+Na]: 401.1963, found: 401.1960.

Corynanthine *(R)*-MPA ester [*(R)*-22b]

[α]= -56.7 (c = 1.9, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 0.78-0.89 (m, 1H), 1.28-1.36 (m, 1H), 1.52 (dd, *J* = 23.8, 12.2 Hz, 1H), 1.61-1.71 (m, 2H), 1.88-2.01 (m, 3H), 2.07 (ddt, *J* = 14.4, 4.5, 2.8 Hz, 1H), 2.60 (dt, *J* = 10.9, 4.4 Hz, 1H), 2.72 (dd, *J* = 15.1, 4.3 Hz, 1H), 2.78-2.82 (m, 1H), 2.90-3.09 (m, 3H), 3.27 (da, *J* = 10.6 Hz, 1H), 3.45 (s, 3H), 3.58 (s, 3H), 4.81 (s, 1H), 5.22 (q, *J* = 2.4 Hz, 1H), 7.06-7.16 (m, 2H), 7.30-7.33 (m, 1H), 7.35-7.48 (m, 6H), 7.77 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 21.6, 24.0, 25.5, 33.8, 34.5, 37.8, 47.8, 51.6, 52.8, 57.4, 60.3, 62.0, 70.7, 82.6, 108.2, 110.7,

118.2, 119.5, 121.5, 127.1, 127.3, 128.2, 128.7, 128.8, 129.0, 134.3, 136.0, 136.4, 169.5, 171.1; HRMS (ESI) calculated for $C_{30}H_{35}N_2O_5$ [M+1]: 503.2540, found: 503.2522.

Corynanthine *(S)*-MPA ester [*(S)*-22b]

[α]= -32.5 (c = 1.3, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 1.02-1.21 (m, 2H), 1.38 (dd, *J* = 23.8, 12.3 Hz, 1H), 1.43-1.50 (m, 1H), 1.58 (td, *J* = 12.5, 2.9 Hz, 1H), 1.75-1.82 (m, 1H), 1.85-1.94 (m, 2H), 2.20 (tdd, *J* = 14.4, 4.6, 2.8 Hz, 1H), 2.52-2.58 (m, 2H), 2.68-2.73 (m, 1H), 2.89-3.06 (m, 4H), 3.44 (s, 3H), 3.54 (s, 3H), 4.81 (s, 1H), 5.20 (q, *J* = 2.6 Hz, 1H), 7.06-7.15 (m, 2H), 7.28-7.31 (m, 1H), 7.32-7.36 (m, 1H), 7.40-7.50 (m, 5H), 7.73 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 21.5, 24.3, 25.6, 33.6, 34.5, 37.3, 47.1, 51.5, 52.8, 57.3, 60.0, 62.0, 70.5, 82.3, 108.0, 110.7, 118.1, 119.4, 121.4, 127.3, 128.7, 128.8, 134.3, 135.9, 136.7, 169.4, 171.0; HRMS (ESI) calculated for $C_{30}H_{35}N_2O_5$ [M+1]: 503.2540, found: 503.2522.

Corynanthine *(R)*-2-NMA ester [*(R)*-2-NMA-22]

[α]= -41.9 (c = 0.6, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 0.79 (dq, *J* = 13.3, 3.9 Hz, 1H), 1.22-1.29 (m, 1H), 1.40-1.54 (m, 2H), 1.62-1.78 (m, 3H), 1.81-1.93 (m, 1H), 1.99-2.10 (m, 1H), 2.47-2.55 (m, 1H), 2.66-2.74 (m, 2H), 2.80 (dd, *J* = 11.1, 3.8 Hz, 1H), 2.90-3.06 (m, 3H), 3.51 (s, 3H), 3.56 (s, 3H), 5.00 (s, 1H), 5.21 (q, *J* = 2.4 Hz, 1H), 7.08 (dt, *J* = 7.5, 7.2, 1.1 Hz, 1H), 7.11-7.16 (m, 1H), 7.44-7.52 (m, 3H), 7.59 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.82-7.89 (m, 3H), 7.96 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 21.5, 24.0, 25.4, 33.6, 34.3, 37.6, 47.7, 51.6, 52.6, 57.5, 60.0, 61.7, 70.9, 82.9, 108.0, 110.7, 118.1, 119.4, 121.4, 124.2, 126.5, 126.5, 127.3, 127.8, 128.1, 128.6, 133.2, 133.4, 133.9, 134.2, 135.9, 169.5, 171.0; HRMS (ESI) calculated for $C_{34}H_{37}N_2O_5$ [M+1]: 553.2697, found: 553.2693.

Corynanthine *(S)*-2-NMA ester [*(S)*-2-NMA-22]

[α]= +13.4 (c = 1.0, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 0.57 (tt, *J* = 12.1, 4.1 Hz, 1H), 0.98 (td, *J* = 12.4, 2.9 Hz, 1H), 1.06-1.18 (m, 2H), 1.42 (td, *J* = 10.3, 5.4 Hz, 1H), 1.61 (t, *J* = 10.8 Hz, 1H), 1.68-1.81 (m, 2H), 2.14-2.23 (m, 2H), 2.29-2.36 (m, 2H), 2.60-2.66 (m, 1H), 2.77 (dd, *J* = 11.0, 3.8 Hz, 1H), 2.82-2.93 (m, 2H), 3.50 (s, 6H), 4.99 (s, 1H), 5.20 (q, *J* = 2.5 Hz, 1H), 7.05-7.09 (m, 1H), 7.12-7.16 (m, 1H), 7.22 (sa, 1H), 7.28-7.31 (m, 1H), 7.38 (ddd, *J* = 8.0, 7.0, 1.1 Hz, 1H), 7.43 (d, *J* = 7.6 Hz, 1H), 7.49 (ddd, *J* = 8.0, 7.0, 1.1 Hz, 1H), 7.62 (dd, *J* = 8.4, 1.7 Hz, 1H), 7.79 (d, *J* = 8.2 Hz, 1H), 7.92 (d, *J* = 8.3 Hz, 1H), 7.98 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 21.5, 24.4, 25.5, 33.4, 34.2, 37.1, 46.9, 51.5, 52.5, 57.4, 59.4, 61.7, 70.5, 82.3, 107.8, 110.5, 118.1, 119.3, 121.3, 124.9, 126.6, 126.7, 126.9, 127.3, 127.8, 128.2, 128.7, 133.3, 133.5, 134.1, 134.4, 135.8, 169.4, 170.9; HRMS (ESI) calculated for $C_{34}H_{37}N_2O_5$ [M+1]: 553.2697, found: 553.2693.

Corynanthine *(R)*-1-NMA ester [*(R)*-1-NMA-22]

[α]= -96.0 (c = 1.1, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): 0.06 (ddd, *J* = 17.2, 13.6, 4.0 Hz, 1H), 0.73-0.97 (m, 2H), 1.13-1.22 (m, 1H), 1.35-1.50 (m, 3H), 1.64-1.79

(m, 2H), 1.85-1.94 (m, 1H), 2.46-2.53 (m, 1H), 2.63-2.70 (m, 3H), 2.89-3.03 (m, 3H), 3.52 (s, 3H), 3.54 (s, 3H), 5.16-5.19 (m, 1H), 5.49 (s, 1H), 7.06-7.17 (m, 2H), 7.31 (d, *J* = 8.0 Hz, 1H), 7.45-7.59 (m, 4H), 7.70 (d, *J* = 7.1 Hz, 1H), 7.74 (sa, 1H), 7.86 (d, *J* = 8.2 Hz, 1H), 7.89 (d, *J* = 8.1 Hz, 1H), 8.30 (d, *J* = 8.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 21.6, 23.3, 25.1, 33.6, 34.2, 37.3, 47.7, 51.6, 52.8, 57.6, 60.0, 61.6, 71.0, 80.5, 108.1, 110.7, 118.1, 119.4, 121.4, 123.9, 125.4, 125.9, 125.9, 126.5, 127.3, 128.9, 129.3, 131.0, 132.5, 134.0, 134.4, 135.9, 169.4, 171.0; HRMS (ESI) calculated for $C_{34}H_{37}N_2O_5$ [M+1]: 553.2697, found: 553.2695.

Corynanthine *(S)*-1-NMA ester [*(S)*-1-NMA-22]

[α]= -31.2 (c = 1.1, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): -0.12- -0.02 (m, 1H), 0.71-0.86 (m, 2H), 1.06 (q, *J* = 12.1 Hz, 1H), 1.22-1.35 (m, 2H), 1.54-1.76 (m, 2H), 2.04-2.15 (m, 1H), 2.28 (s, 1H), 2.36-2.43 (m, 2H), 2.63-2.70 (m, 2H), 2.85-2.96 (m, 2H), 3.47 (s, 3H), 3.48 (s, 3H), 5.15-5.19 (m, 1H), 5.38 (s, 1H), 7.05-7.18 (m, 2H), 7.33 (d, *J* = 7.9 Hz, 1H), 7.44 (d, *J* = 7.6 Hz, 1H), 7.48-7.70 (m, 6H), 7.81-7.84 (m, 2H), 8.40 (d, *J* = 8.5 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 21.4, 24.0, 25.4, 32.9, 33.9, 36.6, 46.5, 51.4, 52.7, 57.4, 59.5, 61.4, 70.4, 81.2, 107.7, 110.7, 118.0, 119.3, 121.3, 124.4, 125.4, 125.9, 126.8, 127.2, 127.5, 128.9, 129.4, 131.0, 132.8, 134.0, 134.3, 135.8, 169.7, 170.8; HRMS (ESI) calculated for $C_{34}H_{37}N_2O_5$ [M+1]: 553.2697, found: 553.2694.

Corynanthine *(R)*-9-AMA ester [*(R)*-9-AMA-22]

[α]= -63.1 (c = 1.1, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): -0.78 (dq, *J* = 13.4, 4.1 Hz, 1H), 0.51-0.59 (m, 1H), 0.83-1.01 (m, 2H), 1.17-1.39 (m, 2H), 1.48-1.59 (m, 1H), 1.64-1.63 (m, 2H), 2.38-2.45 (m, 2H), 2.60-2.70 (m, 2H), 2.75 (da, *J* = 10.8 Hz, 1H), 2.86-2.94 (m, 2H), 3.49 (s, 3H), 3.50 (s, 3H), 5.15 (q, *J* = 2.2 Hz, 1H), 6.37 (s, 1H), 7.06-7.15 (m, 2H), 7.28-7.30 (m, 1H), 7.43-7.49 (m, 3H), 7.55 (ddd, *J* = 9.0, 6.5, 1.4 Hz, 3H), 7.73 (s, 1H), 8.01-8.04 (m, 1H), 8.50 (s, 1H), 8.65 (d, J = 8.6 Hz, 2H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm):21.5, 22.6, 24.8, 33.5, 33.8, 37.2, 47.8, 51.5, 52.7, 57.5, 60.0, 61.4, 70.8, 77.5, 108.0, 110.7, 118.1, 119.4, 121.4, 124.5, 125.1, 126.5, 127.3, 127.5, 129.2, 130.5, 131.5, 134.4, 135.9, 169.5, 170.9; HRMS (ESI) calculated for $C_{38}H_{39}N_2O_5$ [M+1]: 603.2853, found: 603.2849.

Corynanthine *(S)*-9-AMA ester [*(S)*-9-AMA-22]

[α]= +21.6 (c = 1.4, CH_2Cl_2); ^{1}H NMR ($CDCl_3$, 400 MHz) δ(ppm): -0.73 (tt, *J* = 12.1, 3.9 Hz, 1H), 0.23 (ddd, *J* = 26.0, 13.0, 3.9 Hz, 1H), 0.36-0.44 (m, 1H), 0.76 (t, *J* = 10.6 Hz, 1H), 0.82-1.06 (m, 2H), 1.39-1.62 (m, 2H), 1.90-2.02 (m, 1H), 2.08-2.50 (m, 4H), 2.63-2.72 (m, 1H), 2.81-2.96 (m, 2H), 3.43 (s, 3H), 3.41(s, 3H), 5.14-5.17 (m, 1H), 6.38 (s, 1H), 7.07-7.12 (m, 1H), 7.15-7.20 (m, 1H), 7.36-7.39 (m, 1H), 7.43-7.46 (m, 1H), 7.55-7.60 (m, 2H), 7.62-7.70 (m, 2H), 8.01 (d, *J* = 8.3 Hz, 1H), 8.44 (s, 1H), 8.66 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 21.2, 23.7, 25.2, 32.5, 33.3, 36.2, 46.3, 51.4, 52.6, 57.6, 59.4, 61.1, 70.3, 76.9, 107.7, 110.7, 118.1, 119.5, 121.4, 124.5, 125.3, 126.8, 127.2, 128.2, 129.1, 129.3, 130.5, 131.5, 133.8, 135.9, 169.9, 170.6; HRMS (ESI) calculated for $C_{38}H_{39}N_2O_5$ [M+1]: 603.2853, found: 603.2849.

(*R*)-2-(furan-3-yl)-2-hydroxyacetonitrile *(R)*-9-AMA ester [*(R)*-9-AMA-10]
$[\alpha]_D$ = -63.6 (c = 1.5, CH_2Cl_2)**;** ^{1}H NMR ($CDCl_3$, 500.13 MHz) δ(ppm): 3.41 (s, 3H), 6.33 (s, 1H), 6.36 (m, 1H), 6.36 (s, 1H), 7.38 (m, 1H), 7.46-7.54 (m, 5H), 8.02-8.04 (m, 2H), 8.43 (d, *J* = 8.3 Hz, 2H), 8.52 (s, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz) δ(ppm): 56.3, 57.6, 76.9, 109.2, 114.8, 117.5, 123.7, 125.1, 125.6, 126.9, 129.3, 130.0, 130.6, 131.4, 142.7, 144.3, 169.9; HRMS (ESI) calculated for $C_{23}H_{17}NNaO_4$ [M+Na]: 394.1050, found: 410.1046.

(*R*)-2-(furan-3-yl)-2-hydroxyacetonitrile *(S)*-9-AMA ester [*(S)*-9-AMA-10]
$[\alpha]_D$ = +78.5 (c = 1.2, CH_2Cl_2)**;** ^{1}H NMR ($CDCl_3$, 500.13 MHz) δ(ppm): 3.49 (s, 3H), 6.35 (s, 1H), 6.37 (s, 1H), 7.05(m, 2H), 7.46-7.54 (m, 4H), 8.00-8.02 (m, 2H), 8.44 (d, *J* = 8.9 Hz, 2H), 8.50 (s, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz) δ(ppm):56.2, 57.7, 76.7, 115.1, 123.7, 125.1, 125.7, 126.9, 129.3, 129.8, 130.5, 131.3, 141.7, 143.9, 169.8; HRMS (ESI) calculated for $C_{23}H_{17}NNaO_4$ [M+Na]: 394.1050, found: 394.1046.

***(R)*-mandelonitrile (*R*)-9-AMA ester [*(R)*-9-AMA-35]**
$[\alpha]_D$ = -43.2 (c = 1.2, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 500.13MHz) δ(ppm): 3.42 (s, 3H), 6.34 (s, 1H 9-AMA), 6.43 (s, 1H), 7.32-7.37 (m, 4H), 7.39-7.42 (m, 1H), 7.50 (m, 4H), 8.03-8.05 (m, 2H), 8.42 (d, *J* = 8.2 Hz, 2H), 8.53 (s, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz) δ(ppm): 57.6, 63.5, 77.0, 115.2, 123.8, 125.1, 125.7, 126.9, 127.8, 129.1, 129.3, 130.0, 130.4, 130.6, 131.4, 169.8; HRMS (CI) calculated for $C_{25}H_{19}NO_3$ [M+]: 381.1365, found: 381.1373.

***(R)*-mandelonitrile *(S)*-9-AMA ester [*(S)*-9-AMA-35]**
$[\alpha]_D$ = +71.2 (c = 1.0, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 500.13 MHz) δ(ppm): 3.50 (s, 3H), 6.40 (s, 1H 9-AMA), 6.42 (s, 1H), 6.63 (dd, *J* = 7.3, 0.5 Hz, 2H), 6.97 (t, *J* = 7.9 Hz, 2H), 7.13 (m, 1H), 7.47 (m, 4H), 8.00-8.01 (m, 2H), 8.42 (d, *J* = 8.8 Hz, 2H), 8.48 (s, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz) δ(ppm): 57.8, 63.0, 76.7, 115.6, 123.8, 125.1, 125.7, 126.6, 125.7, 126.9, 128.6, 129.2, 129.7, 130.5, 130.8, 131.4, 169.7; HRMS (CI) calculated for $C_{25}H_{19}NO_3$ [M+]: 381.1365, found: 381.1373.

(*S*)-2-hydroxy-2-((2*S*,3*R*)-3-methoxy-1-(4-methoxyphenyl)-4-oxoazetidin-2-yl)acetonitrile (*R*)-9-AMA ester [*(R)*-9-AMA-44]
$[\alpha]_D$ = -20.5 (c = 1.1, CH_2Cl_2)**;** ^{1}H NMR ($CDCl_3$, 500.13 MHz) δ(ppm): 2.76 (s, 3H), 3.40 (s, 3H), 3.79 (s, 3H), 4.16 (d, *J* = 5.1 Hz, 1H), 4.31 (dd, *J* = 5.0, 4.5 Hz, 1H), 5.73 (d, *J* = 4.5 Hz, 1H), 6.22 (s, 1H), 6.59 (d, *J* = 9.1 Hz, 2H), 6.91 (d, *J* = 9.2 Hz, 2H), 7.47-7.54 (m, 4H), 8.03-8.06 (m, 2H), 8.34 (d, *J* = 8.3 Hz, 2H), 8.51 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ(ppm): 55.5, 56.4, 57.6, 58.8, 59.2, 76.5, 82.3, 114.1, 114.9, 119.0, 123.8, 125.0, 125.2, 127.0, 129.0, 129.4, 130.0, 130.6, 131.5, 156.7, 162.5, 169.3; HRMS (ESI) calculated for $C_{30}H_{26}N_2NaO_6$ [M+Na]: 533.1683, found: 533.1675.

_(S)_-2-hydroxy-2-((2_S_,3_R_)-3-methoxy-1-(4-methoxyphenyl)-4-oxoazetidin-2-yl)acetonitrile (_S_)-9-AMA ester [_(S)_-9-AMA-44]

$[\alpha]_D$ = +80.0 (c = 0.8, CH_2Cl_2)**;** ^{1}H NMR ($CDCl_3$, 500.13 MHz) δ(ppm): 3.35 (s, 3H), 3.56 (s, 3H), 3.79 (s, 3H), 4.38 (dd, *J* = 7.0, 5.1 Hz, 1H), 4.62 (d, *J* = 5.1 Hz, 1H), 5.74 (d, *J* = 7.1 Hz, 1H), 6.02 (s, 1H), 6.66 (d, *J* = 9.0 Hz, 2H), 7.03 (d, *J* = 9.0 Hz, 2H), 7.48-7.57 (m, 4H), 8.03-8.05 (m, 2H), 8.26 (d, *J* = 8.8 Hz, 2H), 8.51 (s, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz) δ(ppm): 55.5, 57.1, 57.7, 60.4, 60.8, 76.2, 82.9, 113.8, 114.2, 119.7, 123.5, 125.2, 125.3, 127.2, 129.1, 129.3, 130.0, 130.5, 131.4, 157.1, 163.6, 169.8; HRMS (ESI) calculated for $C_{30}H_{26}N_2NaO_6$ [M+Na]: 533.1683, found: 533.1675.

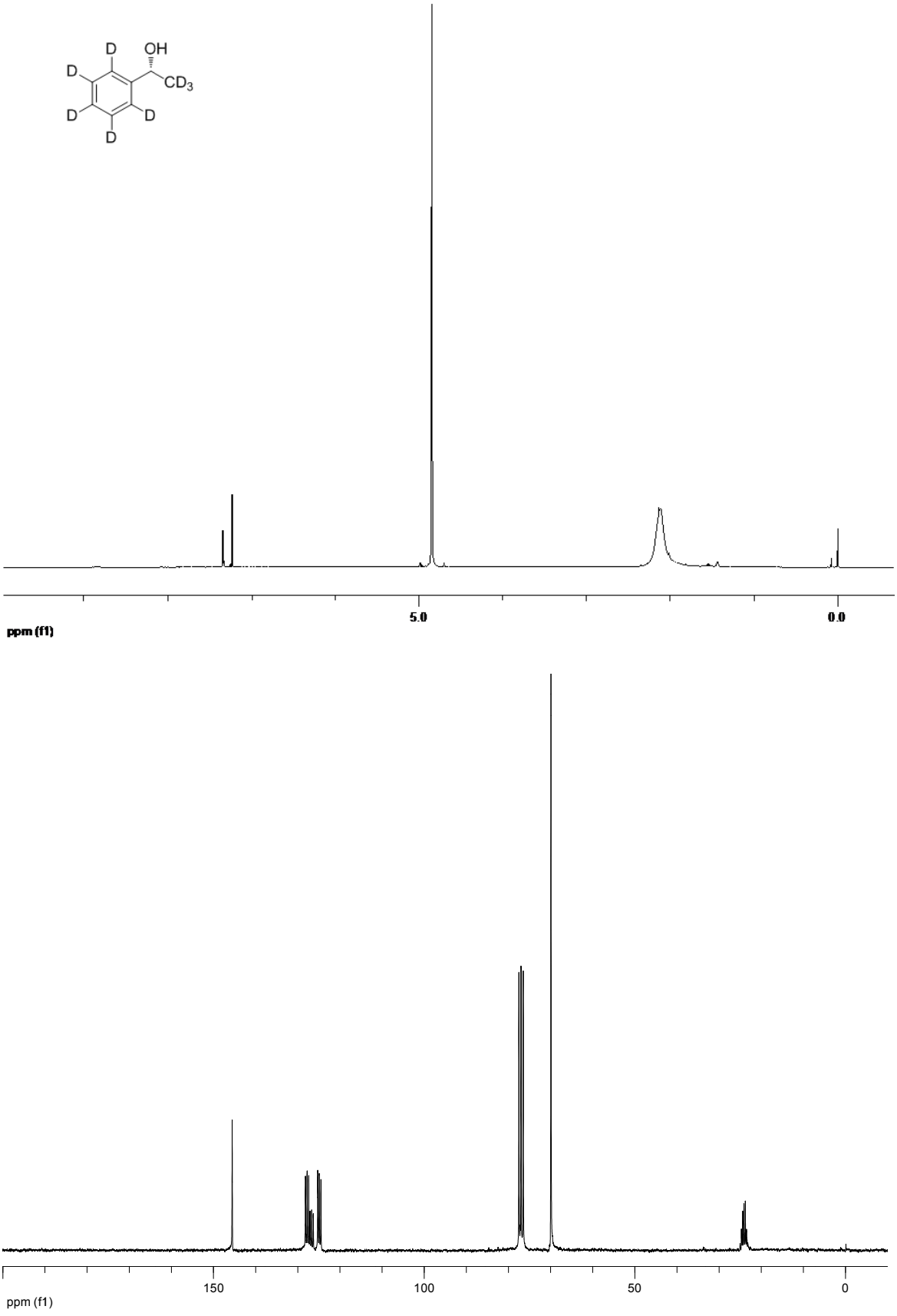

Figure 4S. ^{1}H and ^{13}C NMR spectra of (*R*)-1-(pentadeuterophenyl)ethanol-2,2,2-d_3 **1** (500 and 62.90 MHz respectively, $CDCl_3$, 300 K).

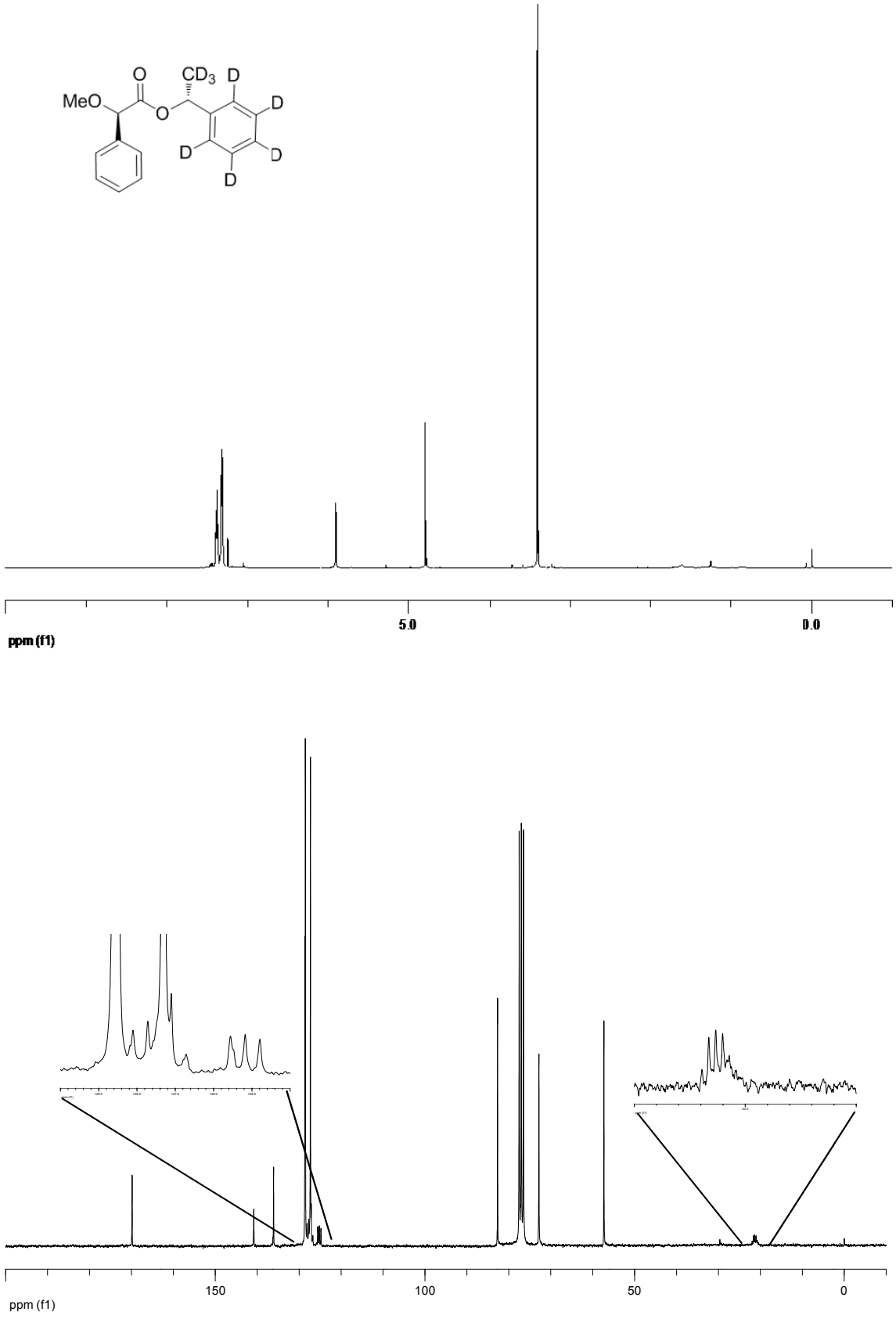

Figure 5S. ^{1}H and ^{13}C NMR spectra of (*R*)-1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*R*)-MPA ester **[(*R*)-MPA-1]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

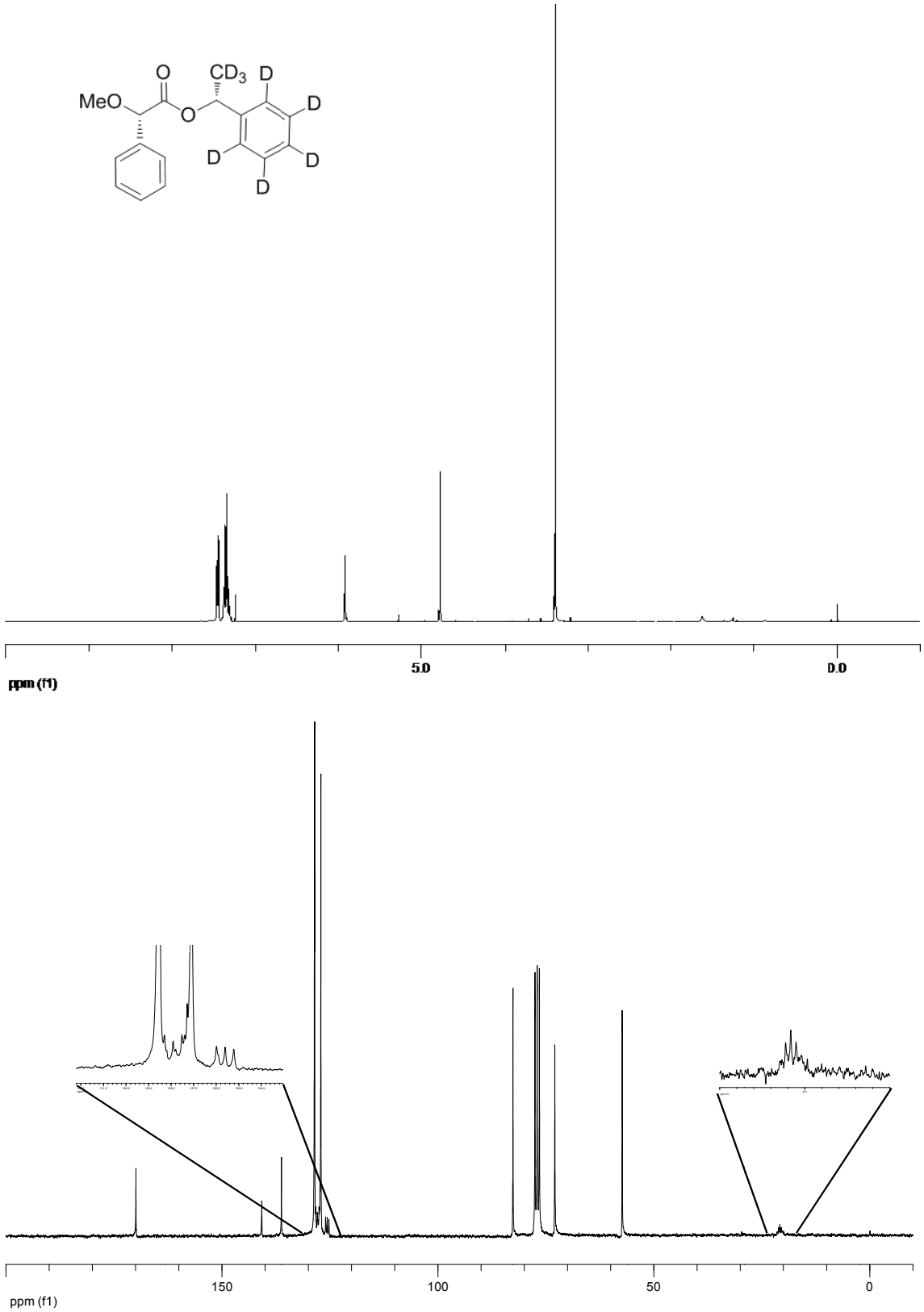

Figure 6S. ^{1}H and ^{13}C NMR spectra of (*R*)-1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*S*)-MPA ester **[(*S*)-MPA-1]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

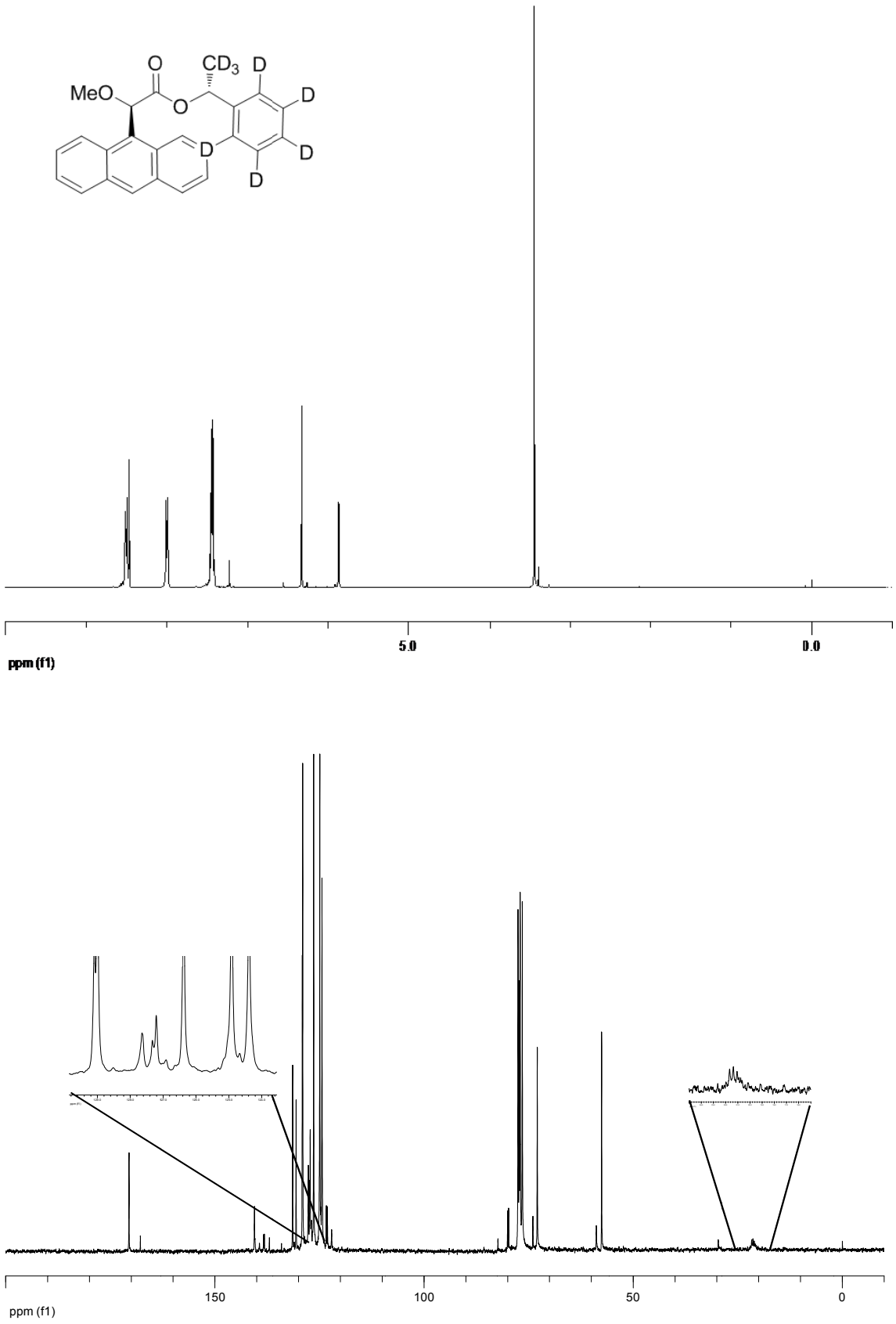

Figure 7S. ^{1}H and ^{13}C NMR spectra of (*R*)-1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*R*)-9-AMA ester **[(*R*)-9-AMA-1]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

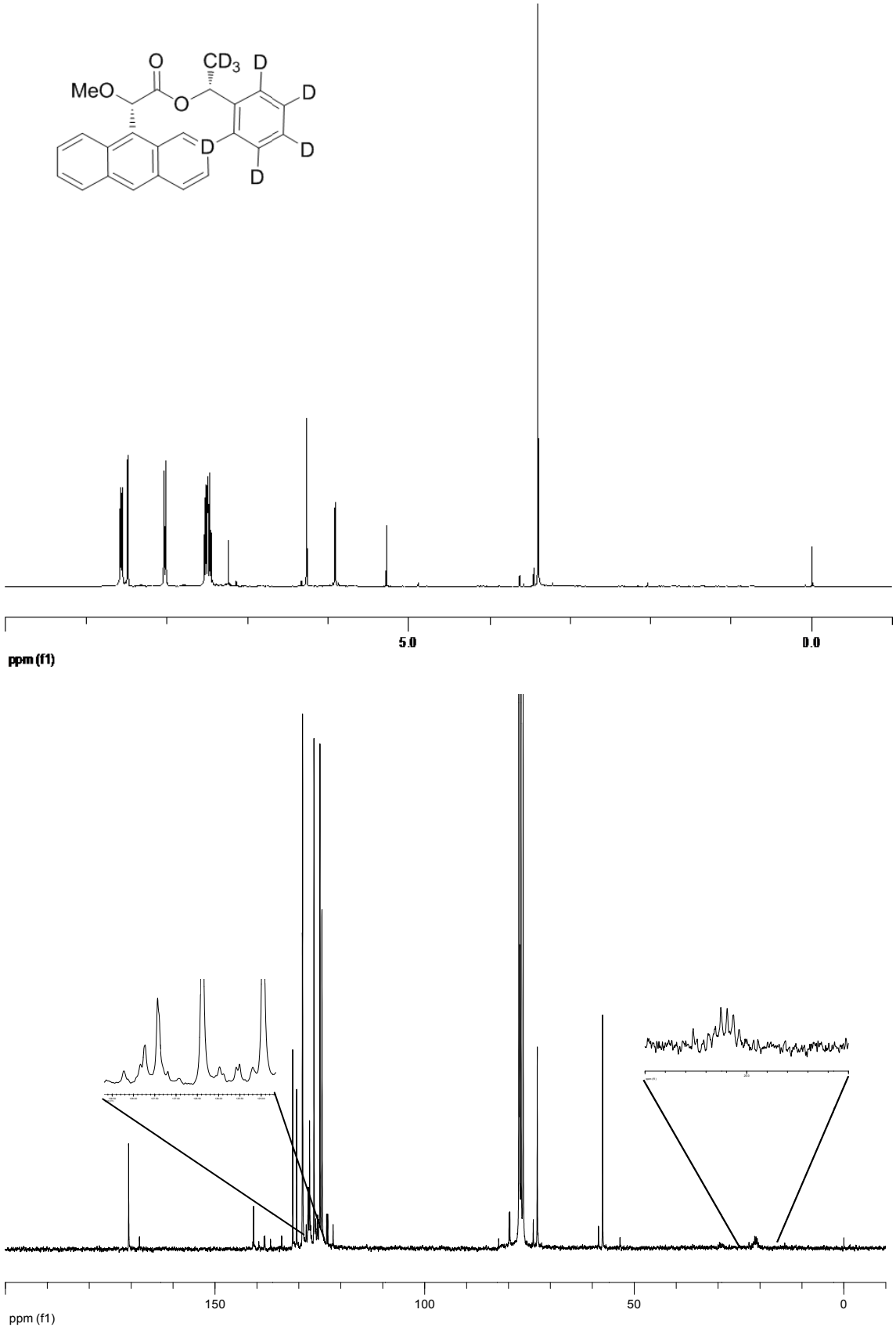

Figure 8S. ^{1}H and ^{13}C NMR spectra of (*R*)-1-(pentadeuterophenyl)ethanol-2,2,2-d_3 (*S*)-9-AMA ester **[(*S*)-9-AMA-1]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

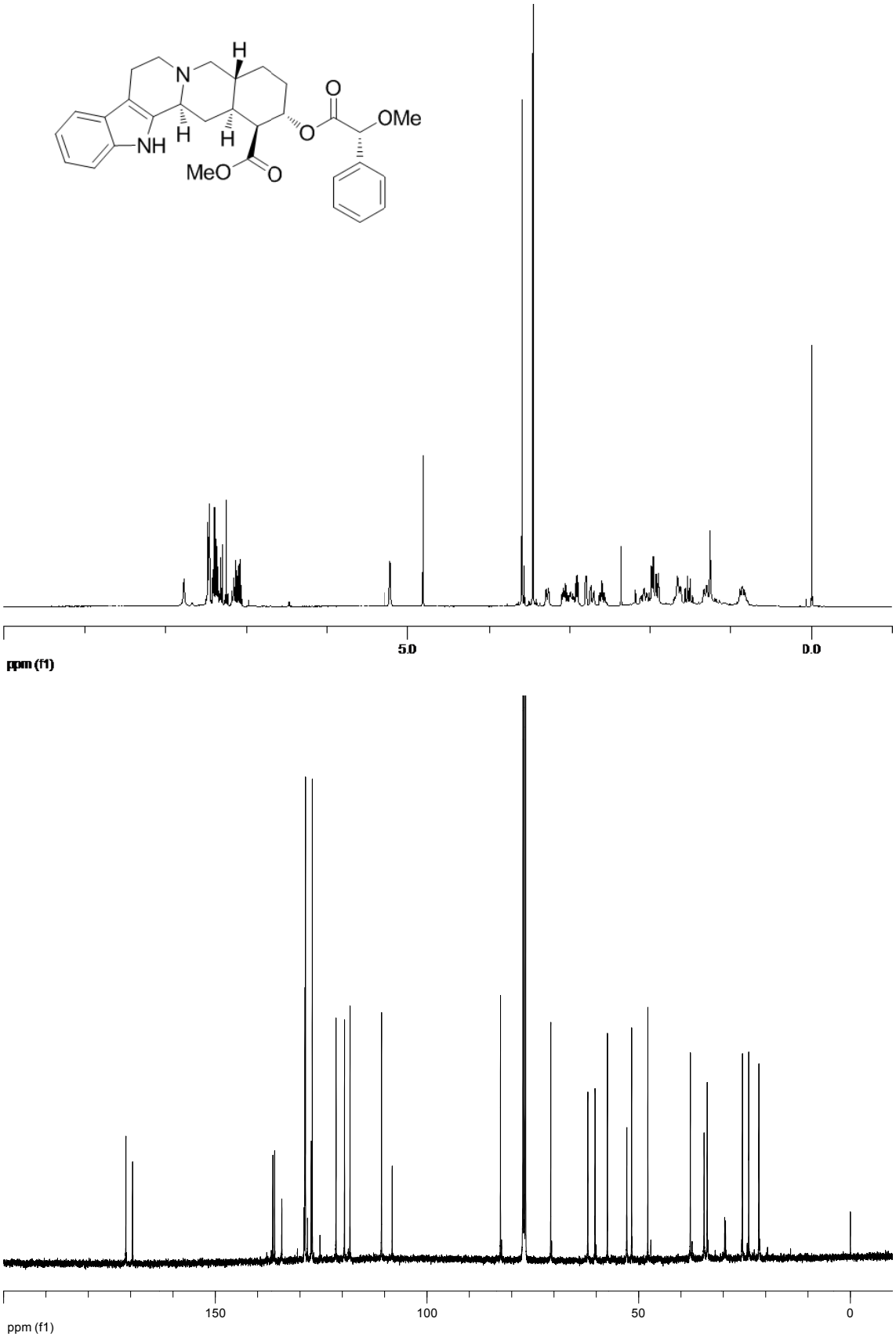

Figure 9S. ^{1}H and ^{13}C NMR spectra of corynanthine (*R*)-MPA ester **[*(R)*-22b]** (100 and 400 MHz respectively, $CDCl_3$, 300 K).

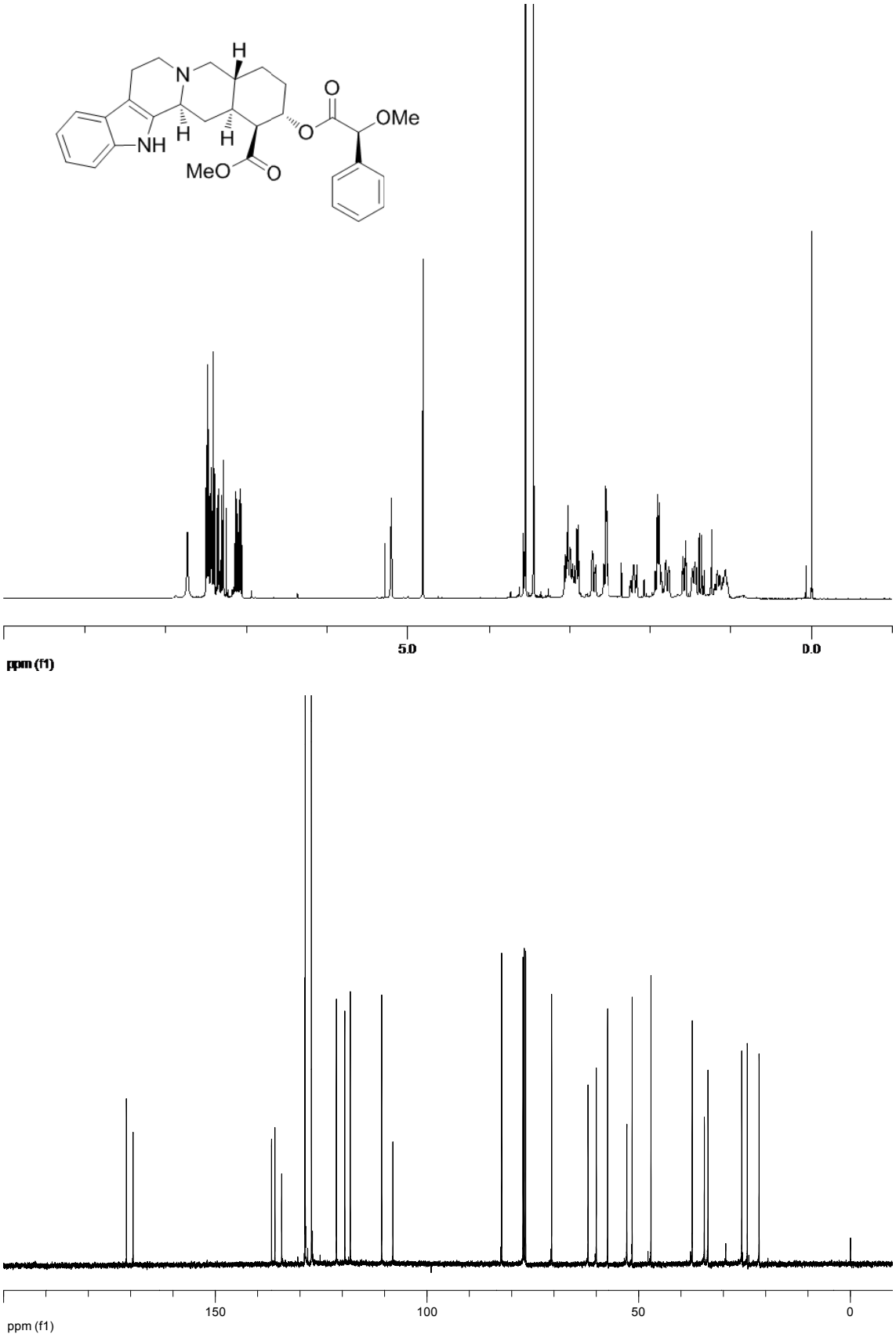

Figure 10S. ^{1}H and ^{13}C NMR spectra of corynanthine (*S*)-MPA ester **[*(S)*-22b]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

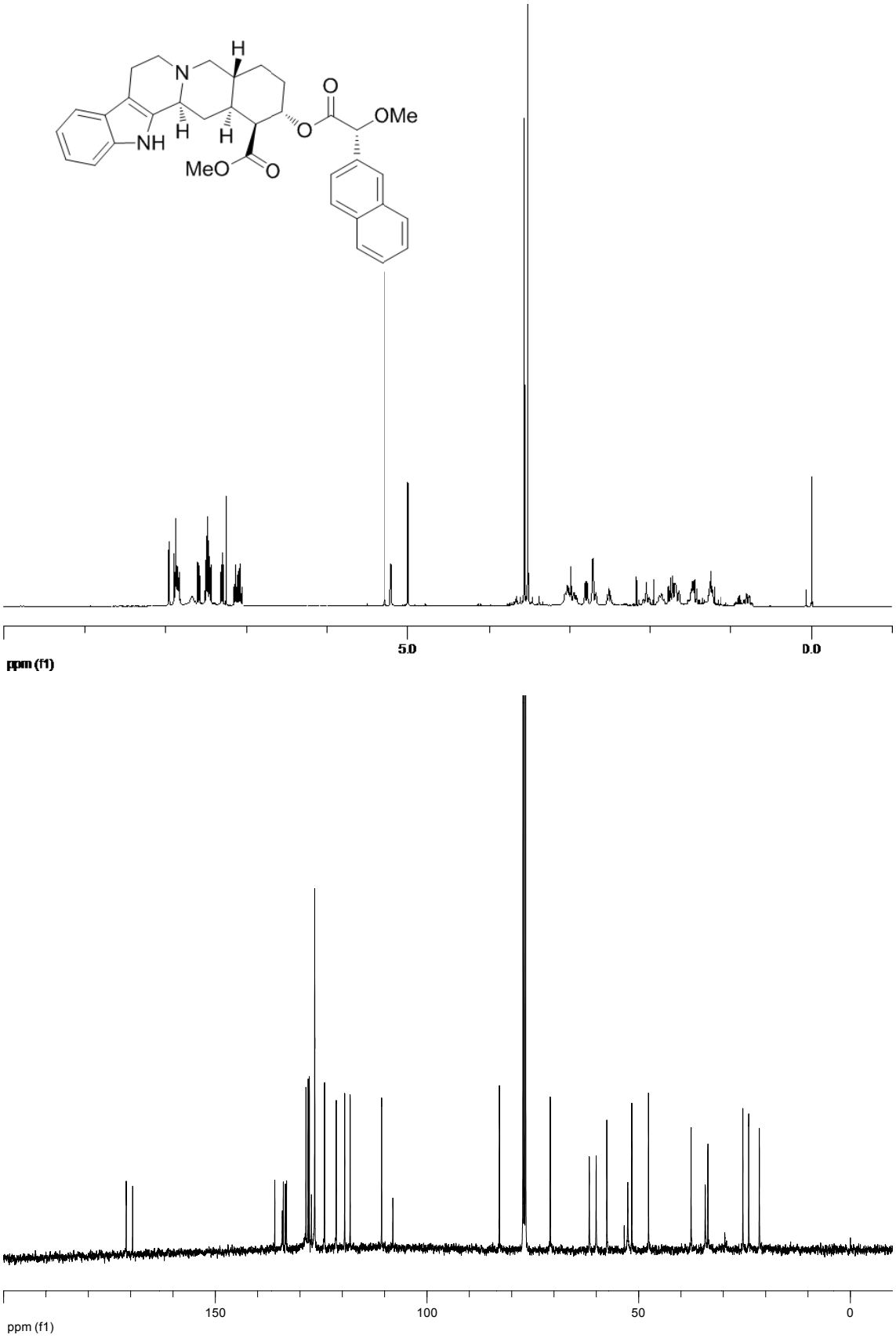

Figure 11S. ^{1}H and ^{13}C NMR spectra of corynanthine (*R*)-2-NMA ester **[*(R)*-2-NMA-22]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

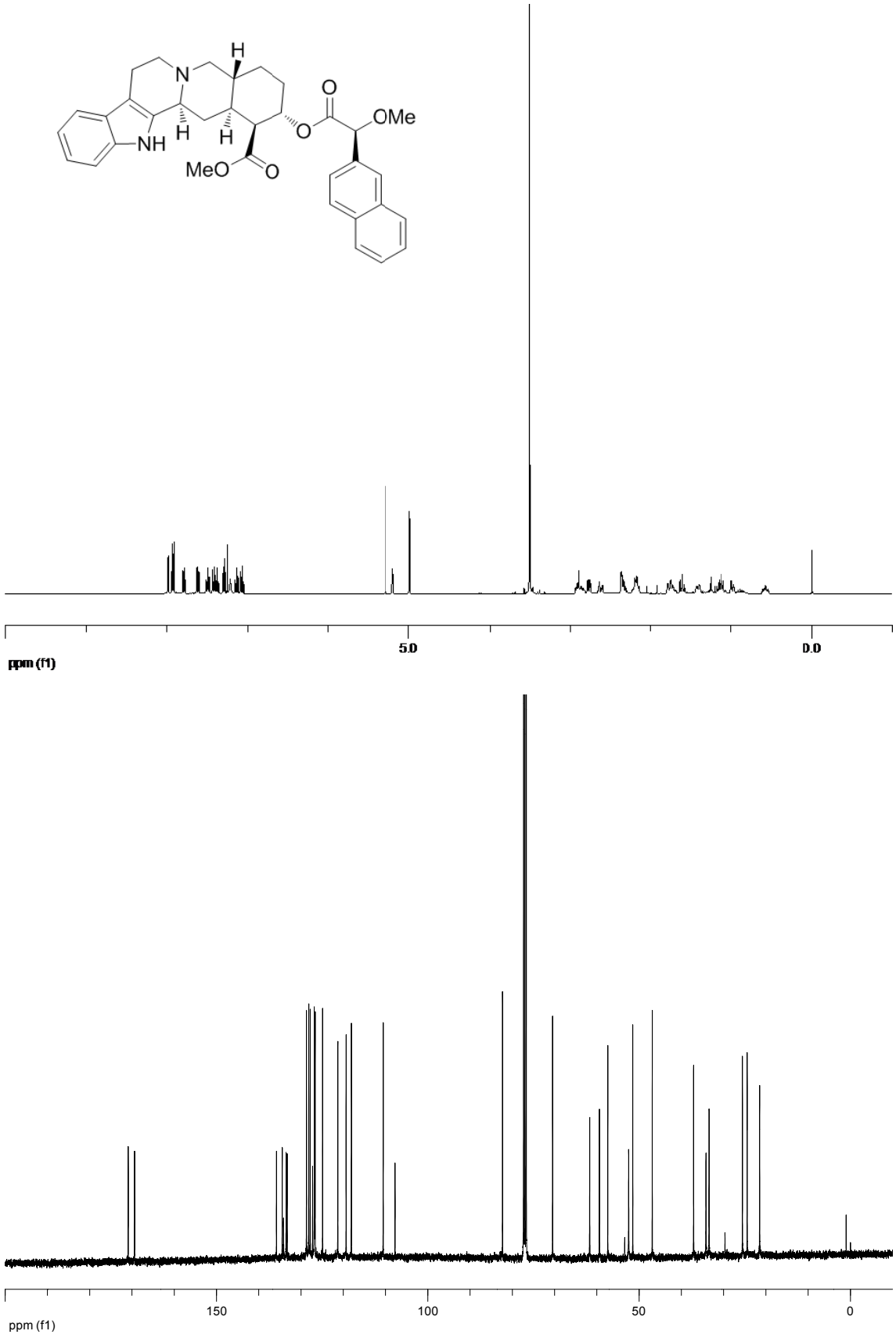

Figure 12S. ^{1}H and ^{13}C NMR spectra of corynanthine (*S*)-2-NMA ester **[*(S)*-2-NMA-22]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

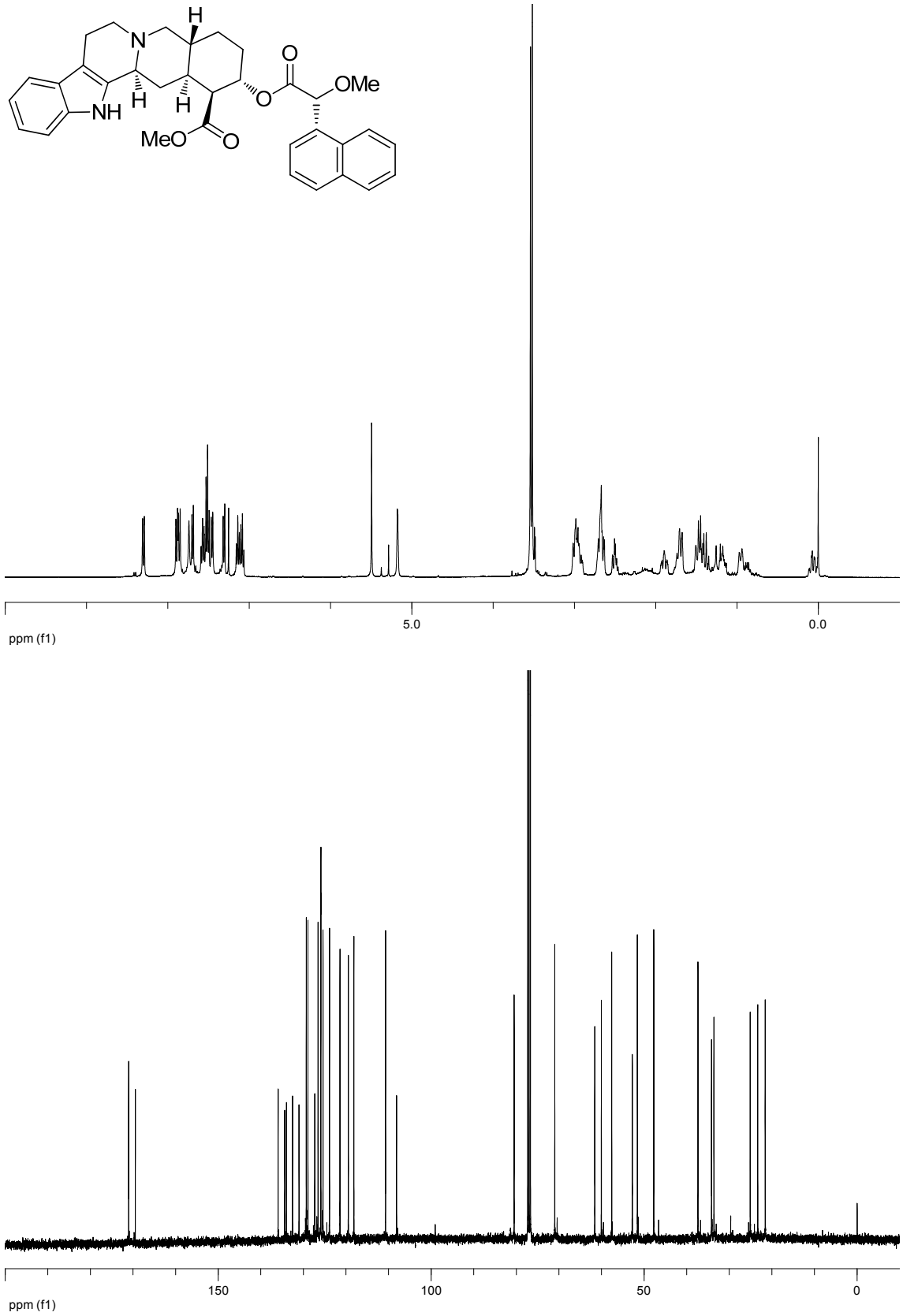

Figure 13S. ^{1}H and ^{13}C NMR spectrum of corynanthine (*R*)-1-NMA ester **[*(R)*-1-NMA-22]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

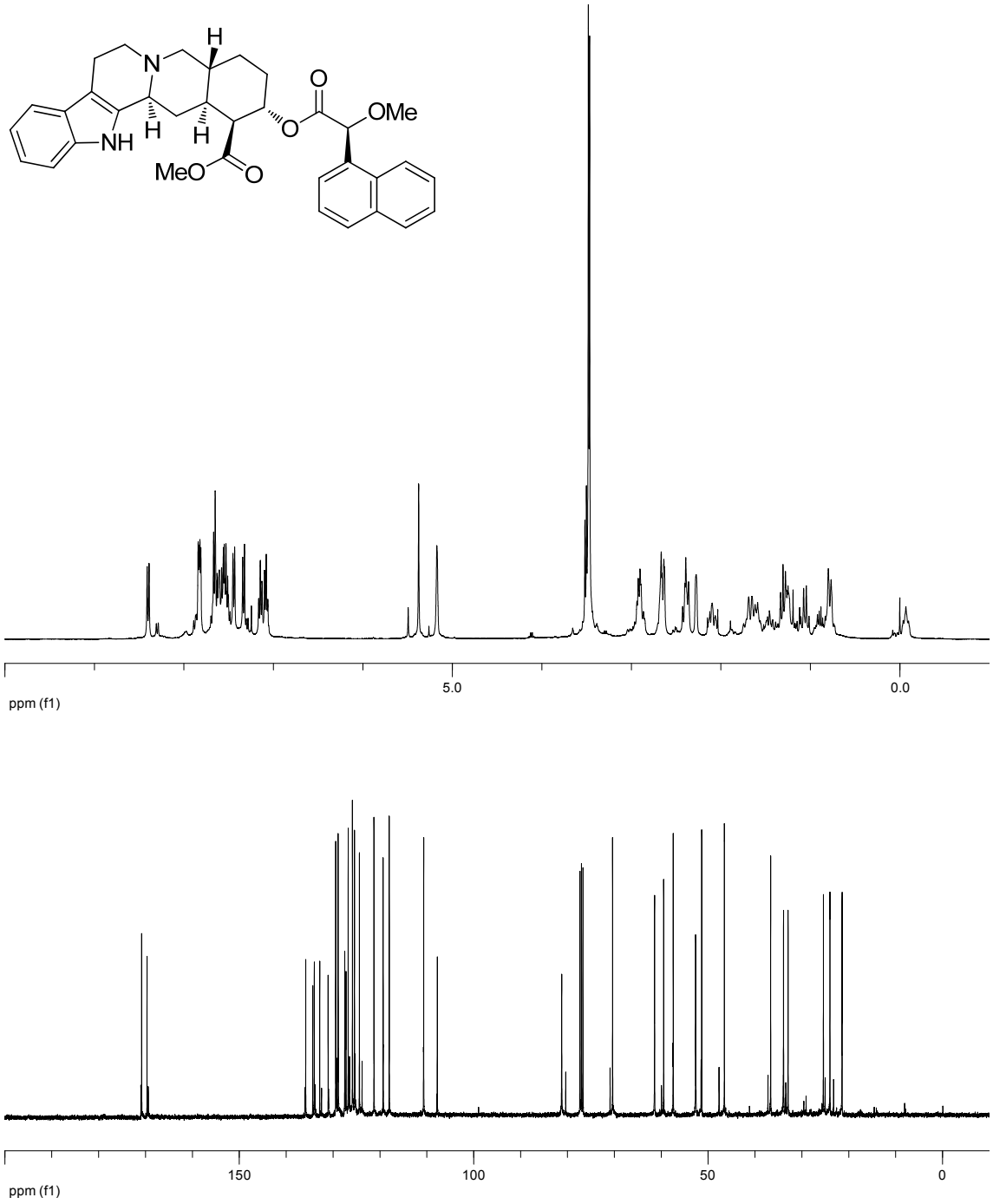

Figure 14S. ^{1}H and ^{13}C NMR spectrum of corynanthine (*S*)-1-NMA ester **[*(S)*-1-NMA-22]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

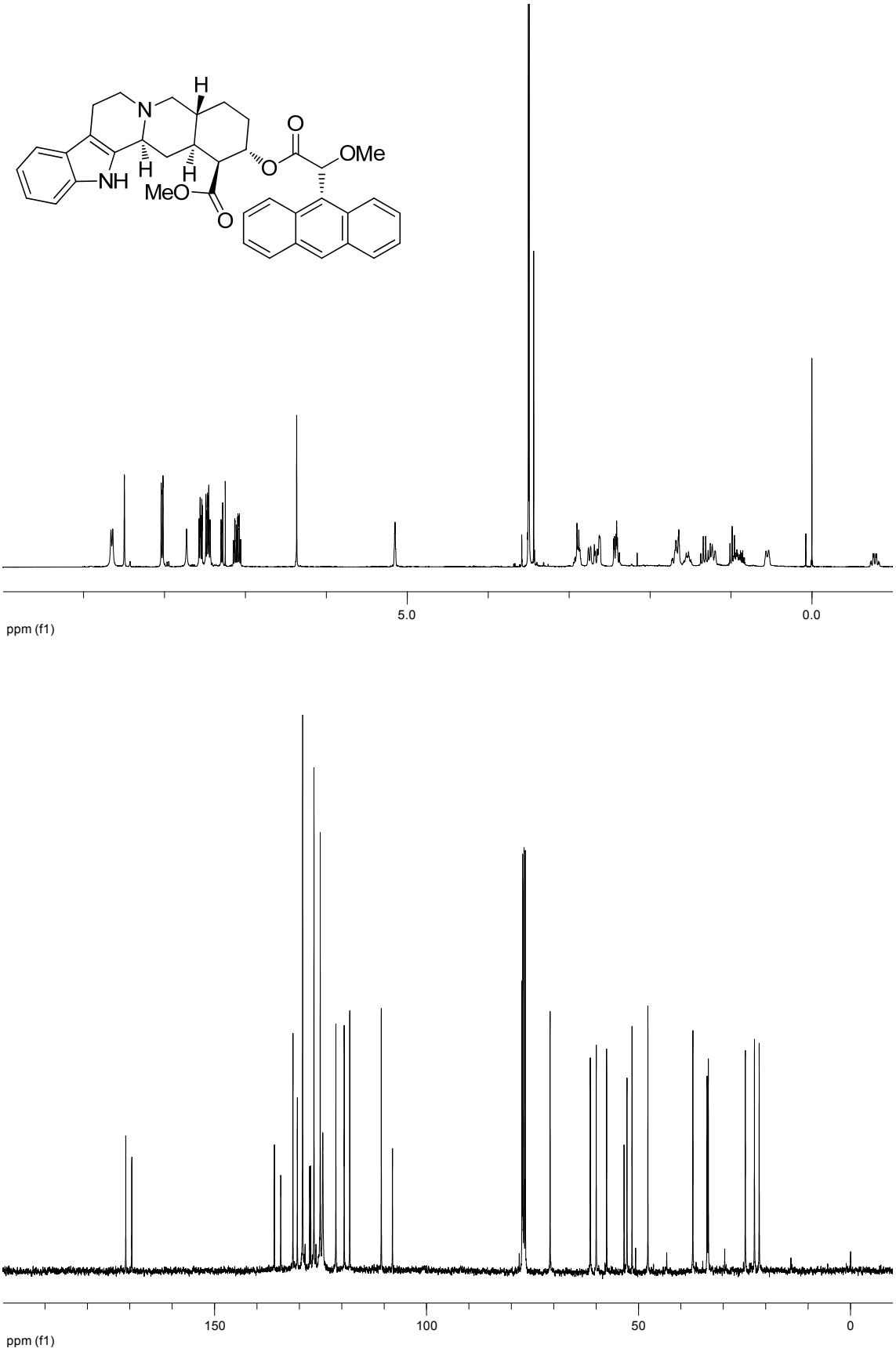

Figure 15S. ^{1}H and ^{13}C NMR spectra of corynanthine (*R*)-9-AMA ester **[*(R)*-9-AMA-22]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

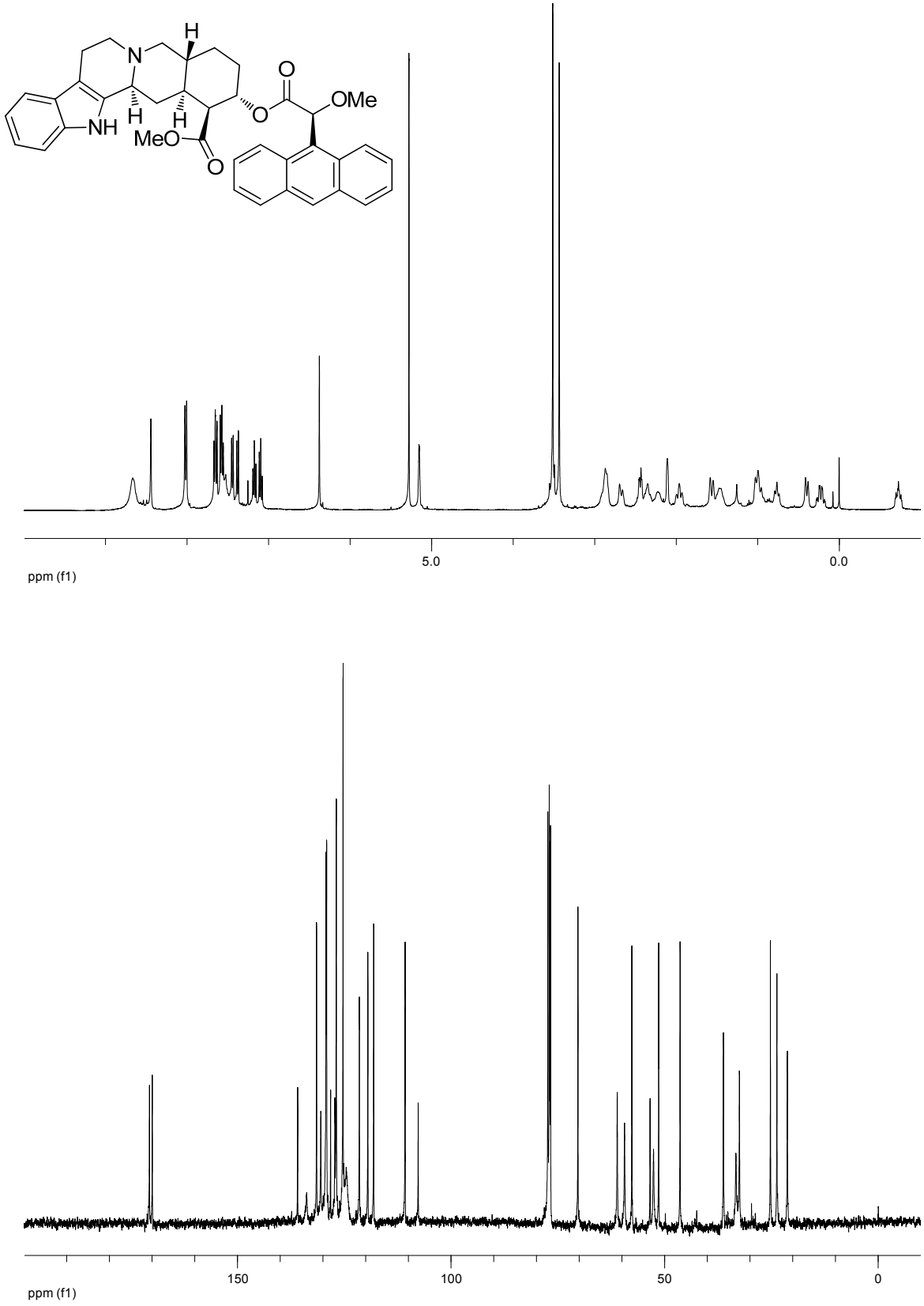

Figure 16S. ^{1}H and ^{13}C NMR spectra of corynanthine (*S*)-9-AMA ester **[*(S)*-9-AMA-22]** (400 and 100 MHz respectively, $CDCl_3$, 300 K).

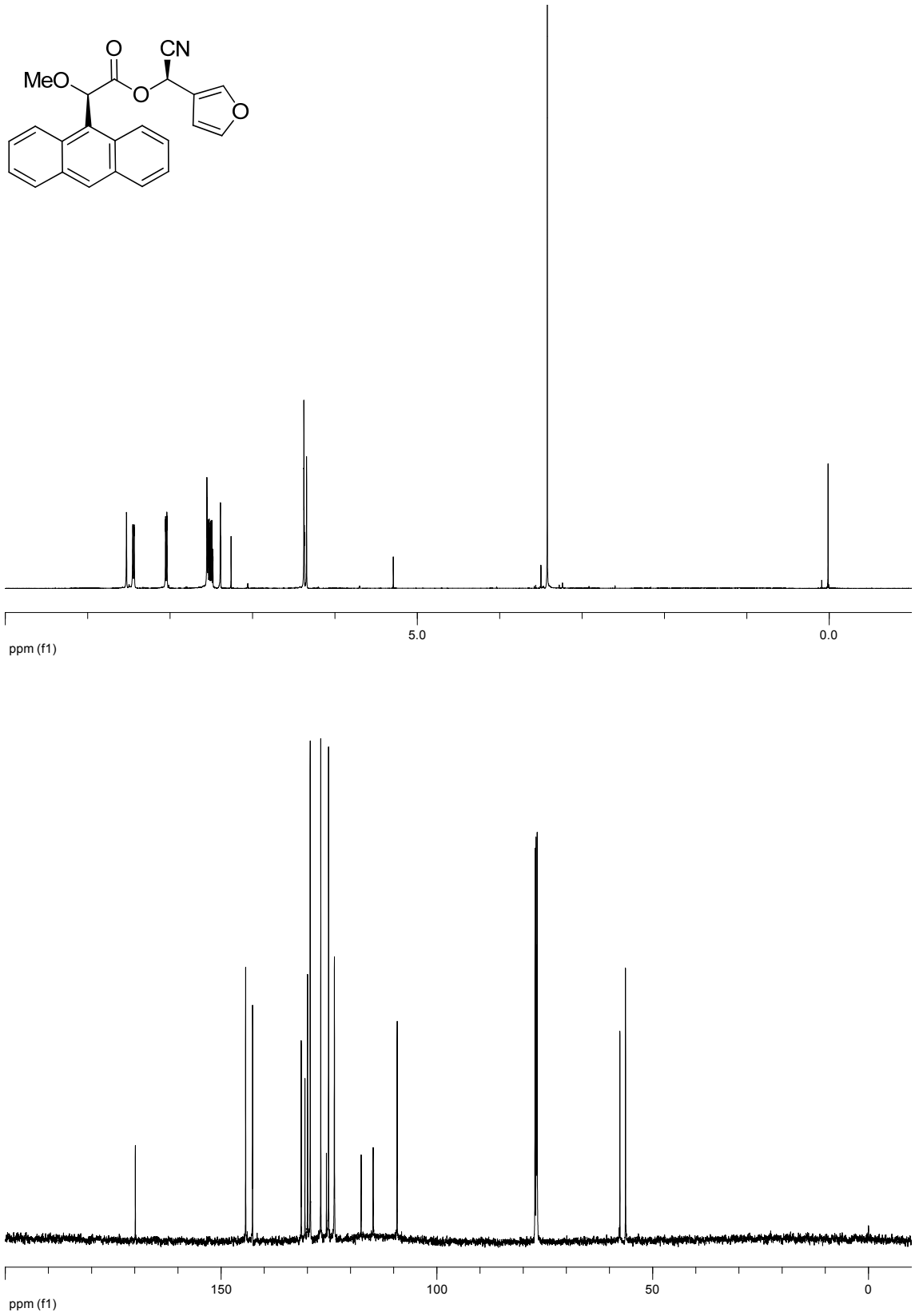

Figure 17S. ^{1}H and ^{13}C NMR spectra of (*R*)-2-(furan-3-yl)-2-hydroxyacetonitrile *(R)*-9-AMA ester **[*(R)*-9-AMA-10]** (500 and 125 MHz respectively, $CDCl_3$, 300 K).

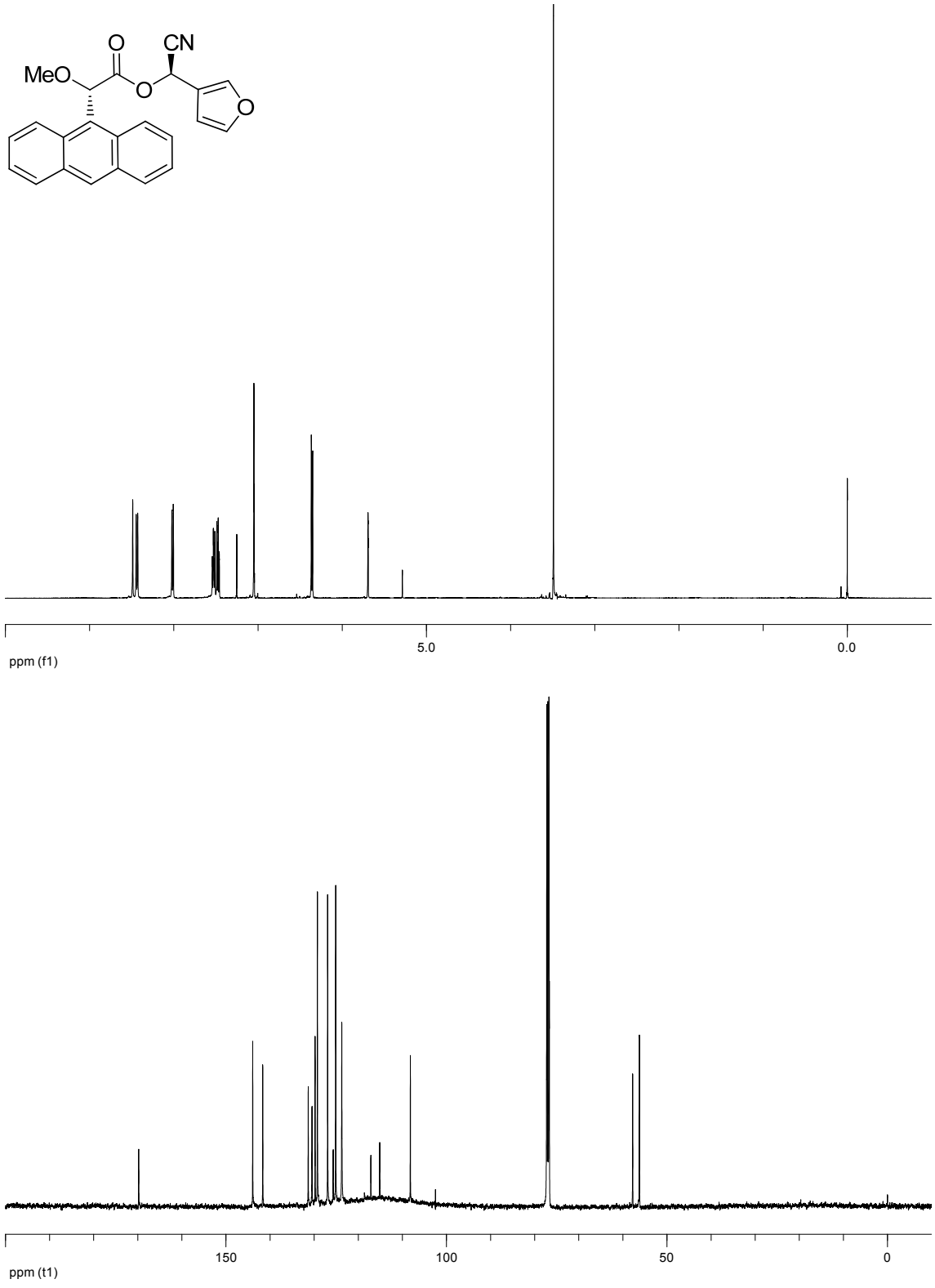

Figure 18S. ^{1}H and ^{13}C NMR spectra of (*R*)-2-(furan-3-yl)-2-hydroxyacetonitrile *(S)*-9-AMA ester **[*(S)*-9-AMA-10]** (500 and 125 MHz respectively, $CDCl_3$, 300 K).

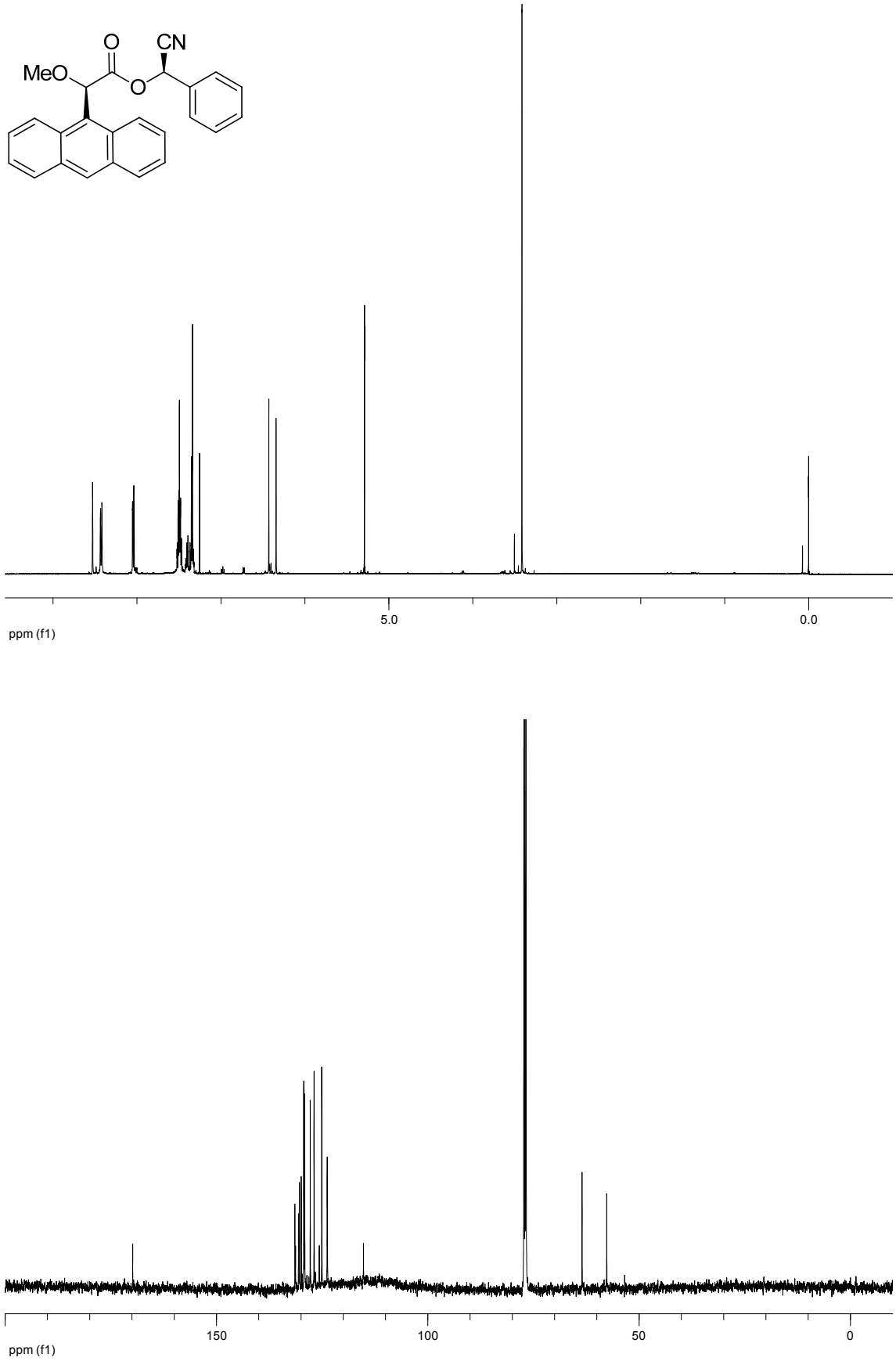

Figure 19S. ^{1}H and ^{13}C NMR spectra of (*R*)-mandelonitrile (*R*)-9-AMA ester **[*(R)*-9-AMA-30]** (500 and 125 MHz respectively, $CDCl_3$, 300 K).

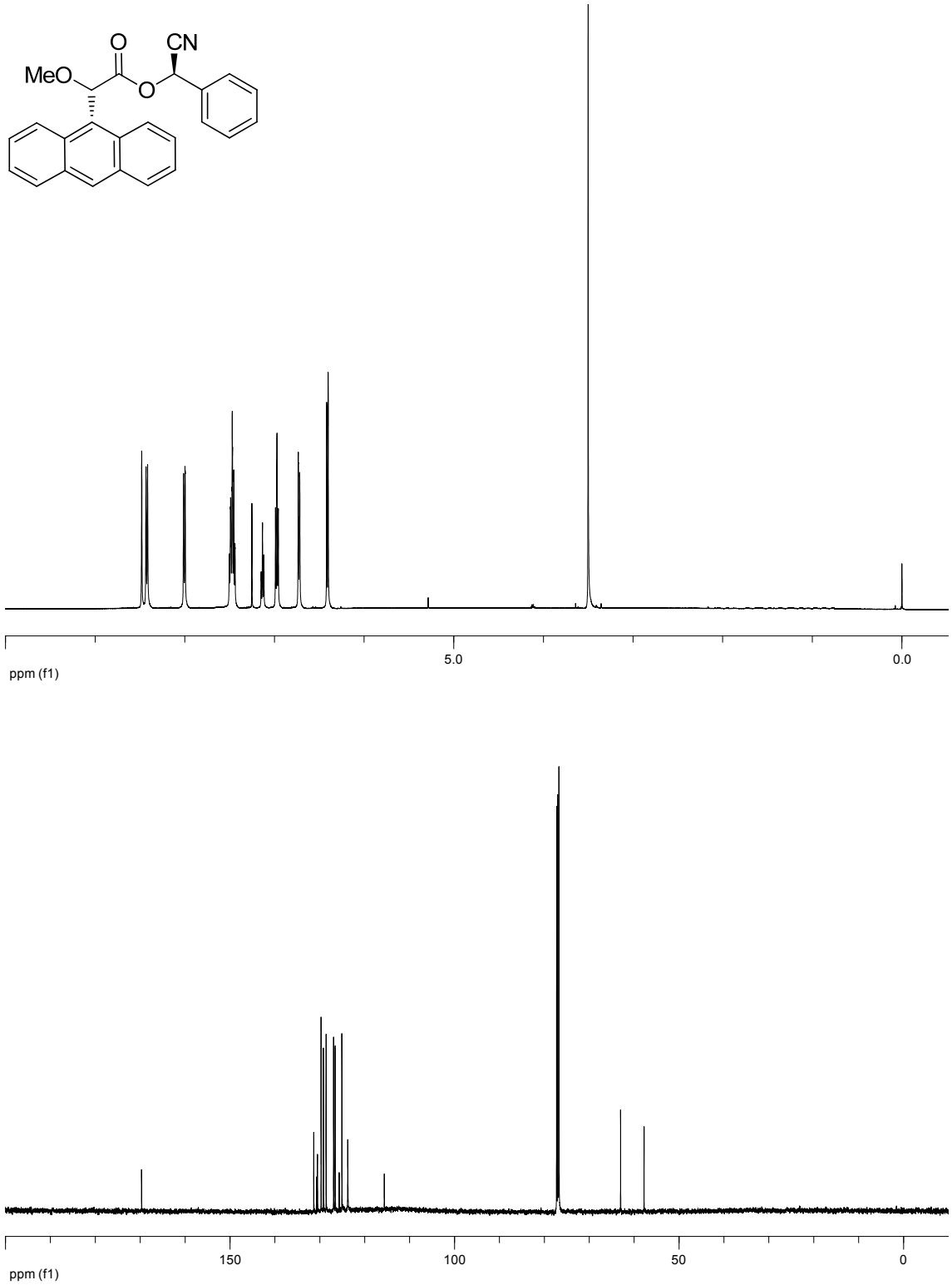

Figure 20S. ^{1}H and ^{13}C NMR spectra of (*R*)-mandelonitrile (*S*)-9-AMA ester **[*(S)*-9-AMA-30]** (500 and 125 MHz respectively, $CDCl_3$, 300 K).

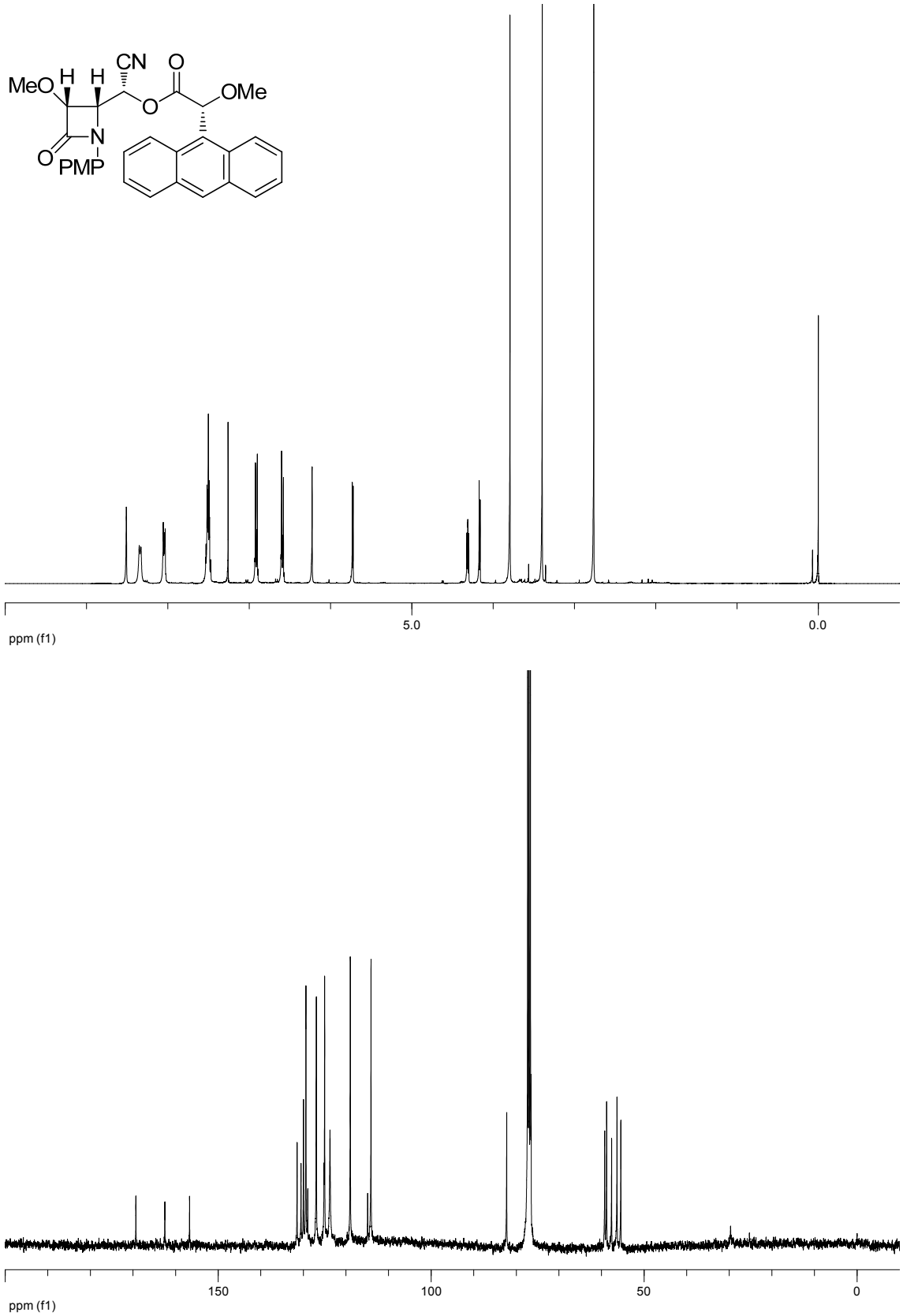

Figure 21S. (*S*)-2-hydroxy-2-((2*S*,3*R*)-3-methoxy-1-(4-methoxyphenyl)-4-oxoazetidin-2-yl)acetonitrile (*R*)-9-AMA ester **[*(R)*-9-AMA-39]** (500 and 125 MHz respectively, $CDCl_3$, 300 K). PMP = *p*-methoxyphenyl.

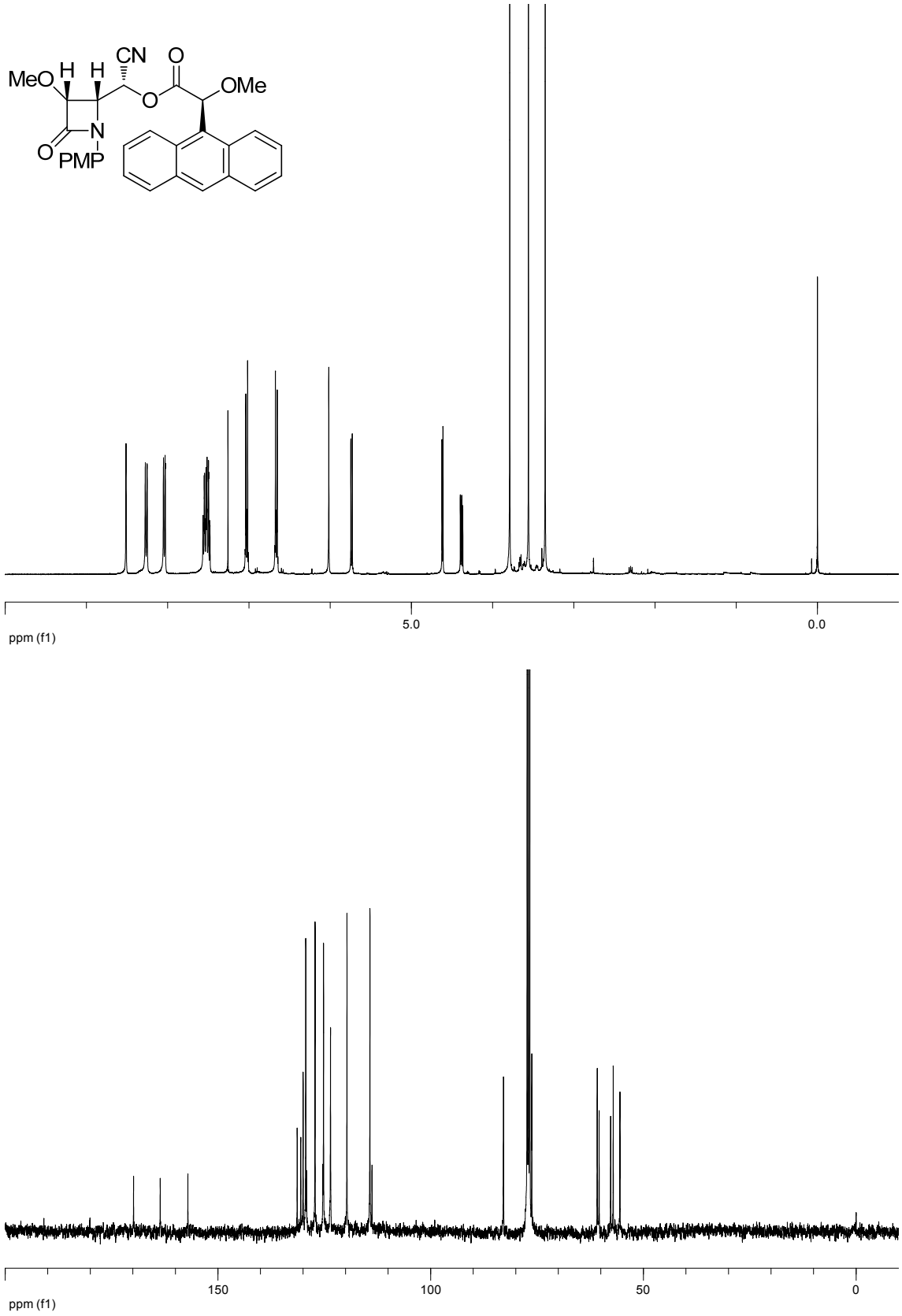

Figure 22S. (*S*)-2-hydroxy-2-((2*S*,3*R*)-3-methoxy-1-(4-methoxyphenyl)-4-oxoazetidin-2-yl)acetonitrile (*S*)-9-AMA ester **[*(S)*-9-AMA-39]** (500 and 125 MHz respectively, $CDCl_3$, 300 K). PMP = *p*-methoxyphenyl.

References

[1] B. Jiang, Y. Feng and J. Zheng, *Tetrahedron Lett.* 2000, **41**, 10281.
[2] J. Boyd and N. R. Skrynnikov, *J. Am. Chem. Soc.* 2002, **124**, 1832.