General. All reactions were performed under nitrogen or argon atmosphere with flame-dried glassware. All solvents were distilled prior to use; diethyl ether and THF over sodium and benzophenone. Toluene and dichloromethane (DCM) were dried over calcium hydride. Column chromatography was performed with 60 silica gel (230-400 mesh, Merck). ^{1}H and ^{13}C NMR were recorded on Bruker instruments at 500 and 125 MHz, respectively, except where noted. IR spectra were recorded with a Bomen instrument and optical rotations were measured with a Perkin-Elmer model 241 polarimeter. Melting points are uncorrected. The high-resolution mass spectra were recorded at The University of Ottawa Mass Spectrum Center.

1S-{-[2-(*tert*-Butyl-diphenyl-silanyloxy)-ethyl]-vinyl}-6-isopropenyl-3-methyl-cyclohex-2-enol (5): To a solution of vinyl iodide (184.6 mg, 0.423 mmol) in ether (4 mL) at –90°C *t*-BuLi (1.32 M in pentane 0.56 ml, 0.423 mmol) was added and the mixture was stirred for 10 minutes. During this time, a cloudy white precipitate was formed inside the flask. A solution of the ketone **4** (42.3 mg, 0.282 mmol) in ether (5ml) at –90°C was transferred via canula into the reaction mixture . The solution was allowed to stir while warming to –40°C at which time it was quenched with a saturated aqueous solution of ammonium chloride. It was then extracted with ethyl acetate (3x 15 ml), dried ($MgSO_4$), filtered and concentrated. The residu was purified by flash chromatography (10% ethyl acetate in hexanes) to give a colourless oil (115.3 mg, 0.25 mmol, 91%). IR (neat, cm^{-1}) 3526, 1434, 1102; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.67-7.65 (m, 4H), 7.42-7.35 (m, 6H), 5.15 (d, J = 6.6 Hz, 2H), 4.90 (s, 1H), 4.84 (s 1H), 4.73 (s, 1H), 3.81-3.78 (m, 2H), 2.37-2.23 (m, 3H), 2.11 (s, 1H), 1.99-1.97 (m, 2H), 1.94-1.86 (m, 1H), 1.71 (s, 3H), 1.65 (s, 3H), 1.56 (s, 1H), 1.04 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ151.2, 147.2, 138.3, 135.5 (2 C), 135.5, 133.8, 129.5 (4 C), 127.6 (4 C), 126.5, 112.9, 110.0, 73.9, 63.8, 48.0, 35.0, 30.8, 26.8 (3 C), 24.6, 24.5, 23.4, 19.1; HRMS (EI) *m/z* (M^+ - $C_4H_{11}O$) calcd 385.1988, obsd 385.1989 $[\alpha]_D$= +10.5°, c=3.82 in CH_2Cl_2.

(1R, 6S, 7R)-7[(2-tert-butyldiphenylsiloxy) ethyl]-10-methylene-4-methylbicyclo [4.4.0^{1,6}] deca-4-en-6-ol (6): A solution of **5** (93.5 mg, 0.203 mmol) in degassed toluene (3 ml) and DBU (0.152ml, 1.01mmol) was heated at 220°C in a sealed tube for 5 hrs under argon. The tube was cooled to rt and the solution was concentrated. The yellowish oil wasIt was purified by flash chromatography (10% ethyl acetate in hexanes) to afford a colourless oil **6** (55.2 mg, 0.120 mmol, 60%). IR (neat, cm^{-1}) 2930, 1111, 702; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.68-7.65 (m, 4H), 7.42-7.35 (m, 6H), 5.69 (s, 1H), 4.87 (s, 1H), 4.63 (s 1H), 3.79-3.75 (m, 1H), 3.69-3.66 (m, 1H), 2.34 (s, 1H, OH), 2.28 (dq, J = 2.1, 13.1 Hz 1H), 2.06-1.97 (m, 5H), 1.73-1.65 (m, 6H), 1.53-1.52 (m, 1H), 1.40-1.24 (m, 3H), 1.05 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 149.5, 138.8, 135.6 (4 C), 134.0 (2 C), 129.5, 127.6 (4 C), 124.5, 124.4, 107.5, 71.6, 62.6, 48.2, 41.7, 35.8, 32.2, 30.6, 30.0, 26.9 (3 C), 23.7, 20.5, 19.2; HRMS (EI) *m/z* $[\alpha]_D$= -66.3°, c=2.79 in CH_2Cl_2.

(1R, 6S, 7R)-7-[(2-Hydroxy) ethyl]-10-methylene-4-methylbicyclo [4.4.0^{1,6}] deca-4-en-6-ol (7): To a solution of **6** (107.6 mg, 0.234 mmol) in THF (7ml) TBAF (0.257ml, 0.257mmol) was added and the solution was stirred for 1.5 hours. The mixture was concentrated and purified by flash chromatography (25% hexanes in ethyl acetate) to afford a colourless oil **7** (52.0mg, 0234mmol, 100%) which was used immediately for the next reaction.

(1R, 4R, 5R, 6S, 7R)-4,5-Epoxy-7-[(2-hydroxy) ethyl]-10-methylene-4-methylbicyclo [4.4.0^{1,6}] decan-6-ol (8): To a solution of 7 (12.2 mg, 0.055 mmol) in DCM (1.5 ml) was added $VO(acac)_2$ (65.9 μL, 0.01M solution in DCM). The reaction mixture turned from faintly green to deep purple immediately upon addition of *tert*-butyl hydroperoxide (8.3 μL, 0.060 mmol). After stirring for 1 hour the mixture had turned light yellow and was deemed complete (TLC). The solution was washed with an aqueous saturated solution of $Na_2S_2O_3$ (3x 5ml), dried over $MgSO_4$, filtered and concentrated. The residue was purified by flash chromatography (20% hexanes in ethyl acetate) to produce an oil **8** (12.4 mg, 0.052 mmol, 95%). IR (neat, cm^{-1}) 2935, 1059; ^1H NMR (500 MHz, $CDCl_3$) δ 4.80 (s, 1H), 4.51 (s 1H), 3.78-3.73 (qt, J = 5.6 Hz, 1H), 3.65-3.60 (m, 1H), 3.11 (s, 1H), 2.50 (br.s, 1H), 2.33 (dq, J = 2.1, 13.1 Hz, 1H), 2.12-1.91 (m, 4H), 1.85-1.80 (m, 1H), 1.76-1.54 (m, 5H), 1.44-1.33 (m, 2H), 1.32 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ147.9, 107.3, 70.6, 63.7, 61.2, 60.4, 48.5, 40.9, 35.6, 32.4, 30.1, 29.4, 23.3, 17.3; HRMS (EI) *m/z* (M^+) calcd 238.1569, obsd 238.1555, $[\alpha]_D$= -66.2°, c=1.56 in CH_2Cl_2.

(1R, 4R, 5R, 6S, 7R, 10S)-4,5-Epoxy-7-[(2-hydroxy) ethyl]-4,10-methylbicyclo [4.4.0^{1,6}] decan-6-ol (9): To a solution of **8** (12.0 mg, 0.050 mmol) in DCM (1.5 mL) a balloon of H_2 with a stopcock was attached. The flask was evacuated and replenished with hydrogen 3 times. A solution of Crabtree's catalyst was then added (252 μL, 0.005 M solution in DCM). After stirring for 2 hours the reaction was complete by TLC. The solution was filtered through celite and washed with ethyl acetate and concentrated. The solid was purified by flash chromatography (50% ethyl acetate in benzene) to give a white solid (10.9 mg, 0.045 mmol, 90%). IR (neat, cm^{-1}) 2926, 1056; ^1H NMR (500 MHz, $CDCl_3$) δ 3.78-3.74 (qt, J = 5.6 Hz, 1H), 3.65-3.60 (m, 1H), 3.05 (s, 1H), 2.55 (br.s, 1H), 2.05 (dd, J = 4.3, 15.2 Hz, 2H), 1.96-1.90 (m, 1H), 1.69-1.42 (m, 8H), 1.30 (s, 3H), 1.08-0.94 (m, 2H), 0.80-0.79 (d, J= 6.6 Hz, 3H), 0.61-0.56 (t, J = 11.6 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 68.8, 64.1, 61.7, 60.5, 50.5, 41.0, 35.3, 32.6, 30.6, 29.7, 27.5, 23.4, 19.7, 17.1; HRMS (EI) *m/z* (M^+) calcd 240.1725, obsd 240.1678, mp:79-81°C, $[\alpha]_D$= -1.25°, c=2.27 in CH_2Cl_2.

(1R, 4R, 5R, 6S, 7R, 10S)-4,5-Epoxy-6,7-[7, 11-(2*H*)-furan-12-one]-4,10-dimethylbicyclo [4.4.0^{1,6}] decane (13): To a solution of **9** (9.5 mg, 0.040 mmol) in DCM (1.4 mL), TPAP (1 mg, 0.002 mmol), NMO (7 mg, 0.060 mmol) and molecular sieves 4Å (20.0 mg,) were added. After stirring for 1.5 hours, the reaction mixture was concentrated to dryness and placed directly on a column and flashed with 30% hexanes in ethyl acetate yielding a white solid (8.5 mg, 0.036 mmol, 90%). IR (neat, cm^{-1}) 1768, 1175; ^1H NMR (500 MHz, $CDCl_3$) δ 2.93 (dd, J = 6.7, 17.2 Hz, 1H), 2.78 (s, 1H), 2.25 (dd, J = 6.7, 8.2 Hz, 1H), 2.18 (d, J = 17.2 Hz, 1H), 2.15-2.12 (m, 1H), 1.90-1.84 (m, 1H), 1.67-1.60 (m, 2H), 1.54-1.47 (m, 2H), 1.38 (td, J = 4.62, 12.3 Hz, 1H), 1.32 (s, 1H), 1.11-1.04 (m, 1H), 0.88 (d, J = 6.7 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 176.1, 83.6, 62.4, 58.2, 46.8, 38.8, 36.6, 31.1, 31.0, 27.8, 27.7, 25.4, 22.8, 19.5, 17.8; HRMS (EI) *m/z* (M^+) calcd 236.1412, obsd 236.1404, mp:64-66°C $[\alpha]_D$= -15.6°, c=1.85 in CH_2Cl_2.

(1R, 4R, 5R, 6S, 7R, 10S, 11R)-4,5-Epoxy-6,7-[7, 11-(2*H*)-furan-12-one]-4,10,11-trimethylbicyclo [4.4.0^{1,6}] decane (14): To a solution of **13** (53.7 mg, 0.227 mmol) in THF (3ml) at –78°C was added LDA freshly prepared (1.0 M solution in THF, 272 μL, 0.272 mmol). After stirring for 25 minutes CH_3I (141 μL, 2.27 mmol) was added and the resulting solution was stirred for 5 minutes. The reaction was quenched with NH_4Cl (saturated aqueous solution) and

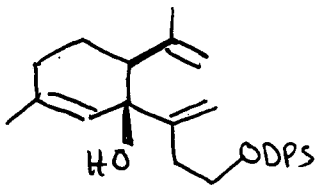
extracted with ethyl acetate (3 x 7 mL). After drying over $MgSO_4$, filtering and concentrating the product was purified by flash chromatography (50% hexanes in ethyl acetate) to give a white solid **14** (40.9 mg, 0.163 mmol, 72%), IR (neat, cm^{-1}) 2926, 1771; ^1H NMR (500 MHz, $CDCl_3$) δ 2.85 (s, 1H), 2.44-2.40 (q, J = 7.9 Hz, 1H), 2.16-2.14 (m, 1H), 2.12-2.07 (m, 1H), 1.86-1.79 (m, 1H), 1.65-1.50 (m, 3H), 1.47-1.45 (d, J = 7.9 Hz, 3H), 1.44-1.36 (m, 2H), 1.33-1.28 (m, 4H), 1.16-1.12 (m, 1H), 0.90-0.89 (d, J = 6.7 Hz, 3H), 0.88-0.85 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ179.9, 83.4, 64.3, 58.5, 45.5, 44.0, 43.7, 30.9, 26.3, 26.1, 25.9, 22.7, 20.3, 18.9, 18.0; HRMS (EI) *m/z* (M^+) calcd 250.1569, obsd 250.1552, mp: 63-64°C, $[\alpha]_D$= -16.3°, c=0.97 in CH_2Cl_2.

(1R, 4R, 5R, 6S, 7R, 10S, 11S)-4,5-Epoxy-6,7-[7, 11-(2*H*)-furan-12-one]-4,10,11-trimethylbicyclo [4.4.0^{1,6}] decane (15): To a solution of **14** (11.3 mg, 0.045 mmol) in THF (2.0 mL) at –78°C was added LDA (0.45ml, 1.0M solution). After stirring for 25 minutes at the same temperature, a saturated aqueous solution of ammonium chloride was poured into the mixture. The resulting mixture was extracted with ethyl acetate (3x, 5ml), dried ($MgSO_4$), filtered and concentrated. The residue was purified by flash chromatography (40% hexanes in ethyl acetate to afford a white solid **15** (11.0 mg, 0.044 mmol, 97%). IR (neat, cm^{-1}) 2926, 1768; ^1H NMR (500 MHz, $CDCl_3$) δ 3.09-3.06 (q, J = 6.8 Hz, 1H), 2.83 (s, 1H), 2.20-2.10 (m, 2H), 1.73-1.58 (m, 3H), 1.50-1.43 (m, 3H), 1.30 (s, 3H), 1.28-1.20 (m, 1H), 1.15-1.13 (d, J = 7.1 Hz, 3H), 1.06-1.01 (m, 1H), 0.87-0.86 (d, J = 6.6 Hz, 3H), 0.83-0.82 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ178.4, 81.3, 62.2, 57.9, 47.1, 42.9, 38.7, 31.5, 30.8, 28.2, 22.9, 22.7, 19.4, 17.6, 9.3; HRMS (EI) *m/z* (M^+) calcd 250.1569, obsd 250.1565, mp: 74-75°C, $[\alpha]_D$= -13.6°, c=2.46 in CH_2Cl_2.

(1R, 6S, 7S, 10S, 11S)-6,7 [7, 11-(2*H*)-Furan-12-one]4,10,11-triethylbicyclo [4.4.0^{1,6}] decan-4-ene (16): To THF (1.4 mL) at –78°C was added WCl_6 (82.9 mg, 0.22 mmol). Five minutes later, n-BuLi (1.9 M in hexanes, 0.33 mL, 0.628 mmol) was added over 5 minutes. After stirring for 10 minutes at –78°C, the mixture was slowly warmed to room temperature over 1 hour. After several colour changes (greenish brown, light yellow, dark brown), LiI (0.80 mg, 0.006 mmol) was added and 5 minutes later a solution of **15** (19.4 mg, 0.078 mmol) in THF (1 mL) was added. The mixture was stirred for 2.5 hours and then poured into a cold aqueous solution of $NaHCO_3$ and then extracted with ethyl acetate (2x 10 mL). After drying over $MgSO_4$, filtering and concentrating, the oily product was purified by flash chromatography (25% ethyl acetate in hexanes) to afford **16** as a colourless oil (11.0mg, 0.047mmol, 67%). IR (neat, cm^{-1}) 2930, 1764; ^1H NMR (500 MHz, $CDCl_3$) δ 5.61 (s, 1H), 3.14-3.09 (q, J = 6.3 Hz, 1H), 2.11-1.96 (m, 3H), 1.89-1.84 (m, 1H), 1.72-1.61 (m, 6H), 1.54-1.49 (m, 1H), 1.44-1.38 (m, 1H), 1.22-1.14 (m, 1H), 1.13-1.12 (d, J = 7.2 Hz, 3H), 1.06-0.98 (m, 1H), 0.92-0.91 (d, J = 6.6 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ179.2, 142.1, 121.7, 83.1, 46.5, 42.7, 39.6, 32.4, 30.8, 29.6, 23.7, 23.4, 20.9, 19.5, 9.4; HRMS (EI) *m/z* (M^+) calcd 234.1620, obsd 234.1600. $[\alpha]_D$= -42.2°, c=0.35 in CH_2Cl_2.

(+)-Arteannuin M (17): To a solution of **16** (6.8 mg, 0.029 mmol) in THF (1.0 mL) was added NMO (4.0 mg, 0.033 mmol) a solution of OsO_4 in H_2O (4% by weight, 18.5 μL, 0.003 mmol). After stirring for 2 days, the solution was washed with brine and extracted with ethyl acetate (2x 5 mL). After concentration, the residue was purified by flash chromatography (30% hexanes in ethyl acetate) to give an oil (5.1 mg, 0.019 mmol, 66%). IR (neat, cm^{-1}) 3347, 1766; ^1H NMR (500 MHz, $CDCl_3$) δ 3.43 (s, 1H), 3.06 (dq, J = 6.9, 6.9 Hz, 1H), 2.65-2.60 (m, 1H), 1.77-1.67 (m, 3H), 1.62-1.56 (m, 2H), 1.53-1.47 (m, 2H), 1.37-1.29 (m, 1H), 1.36 (s, 3H), 1.23 (br.s 1H),

1.11 (d, J = 6.9 Hz, 3H), 1.08-1.03 (m, 1H), 0.90 (d, J = 6.7 Hz, 3H) ; ^{13}C NMR (125 MHz, $CDCl_3$) δ179.1, 86.2, 74.2, 72.6, 41.7, 39.1, 38.8, 34.3, 32.3, 29.9, 26.6, 23.9, 22.1, 20.1, 9.3; HRMS (EI) *m/z* (M^+-H_2O) calcd 250.1569, obsd 250.1569 $[\alpha]_D$= -34.3°, c=0.26 in CH_2Cl_2.



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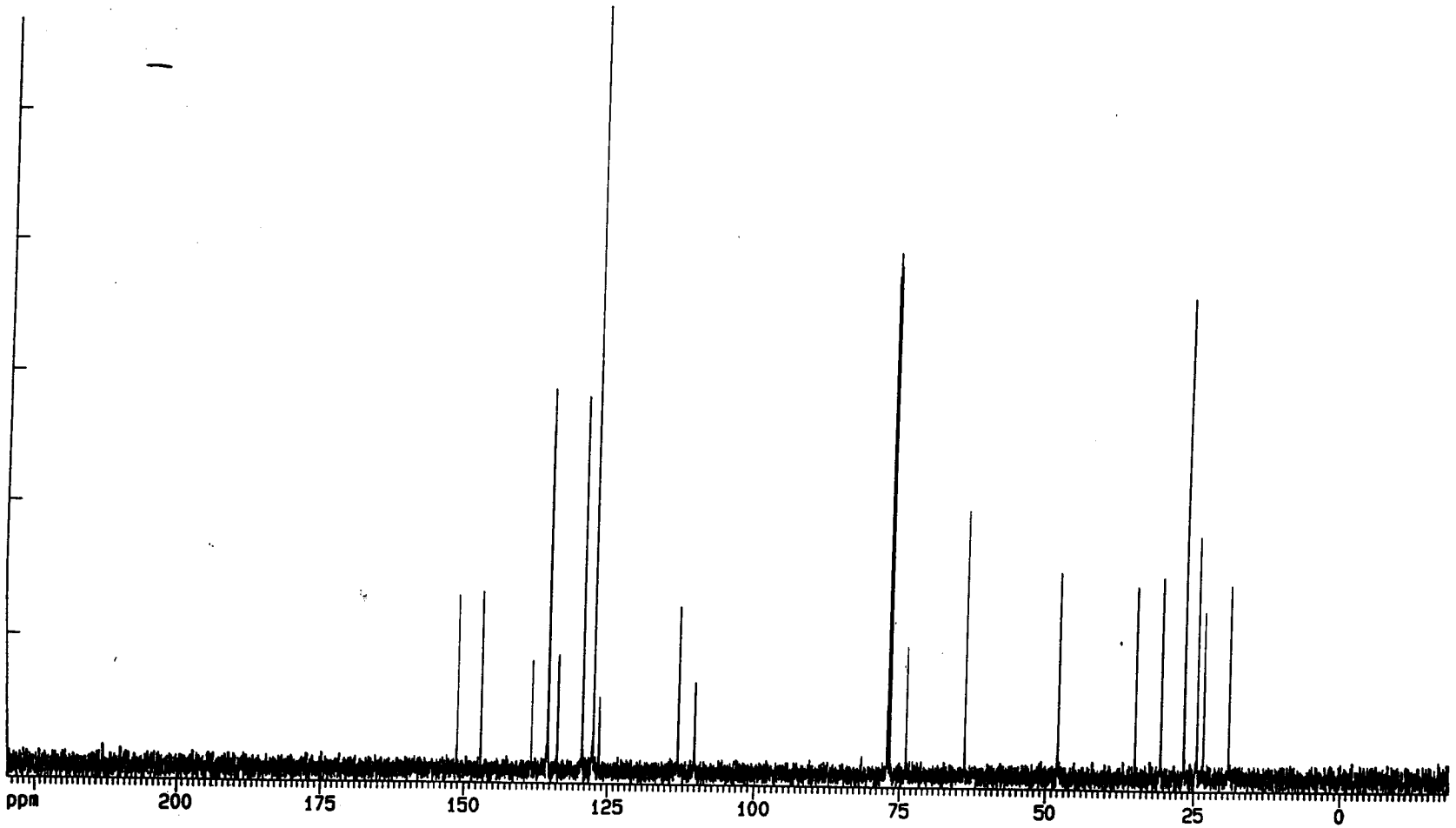

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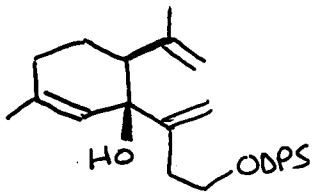

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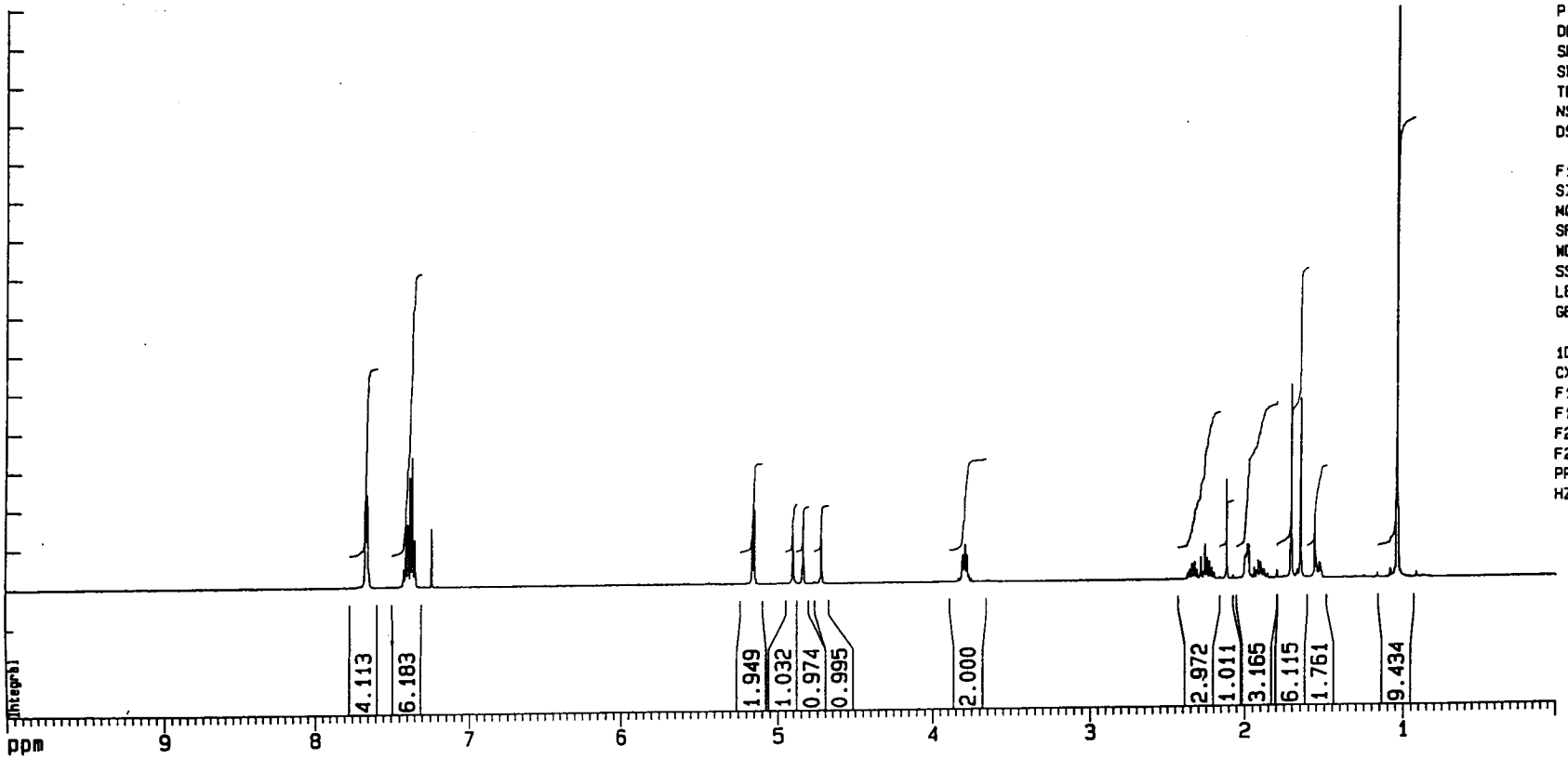

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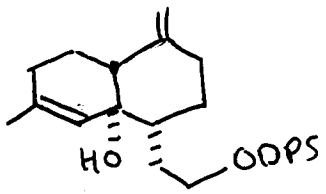
6



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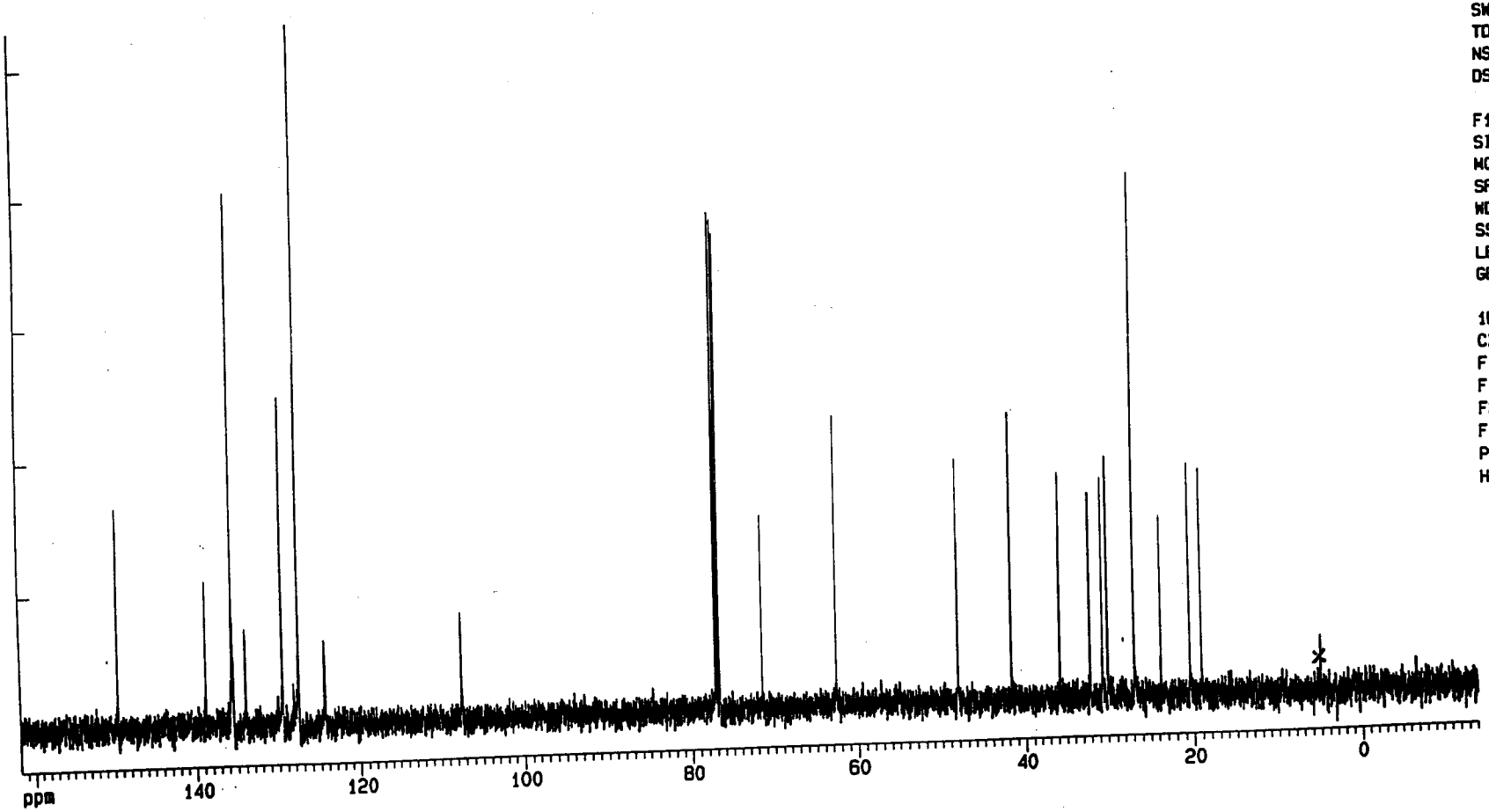

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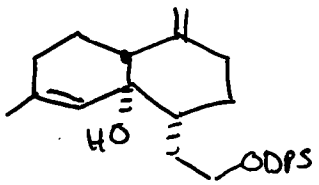

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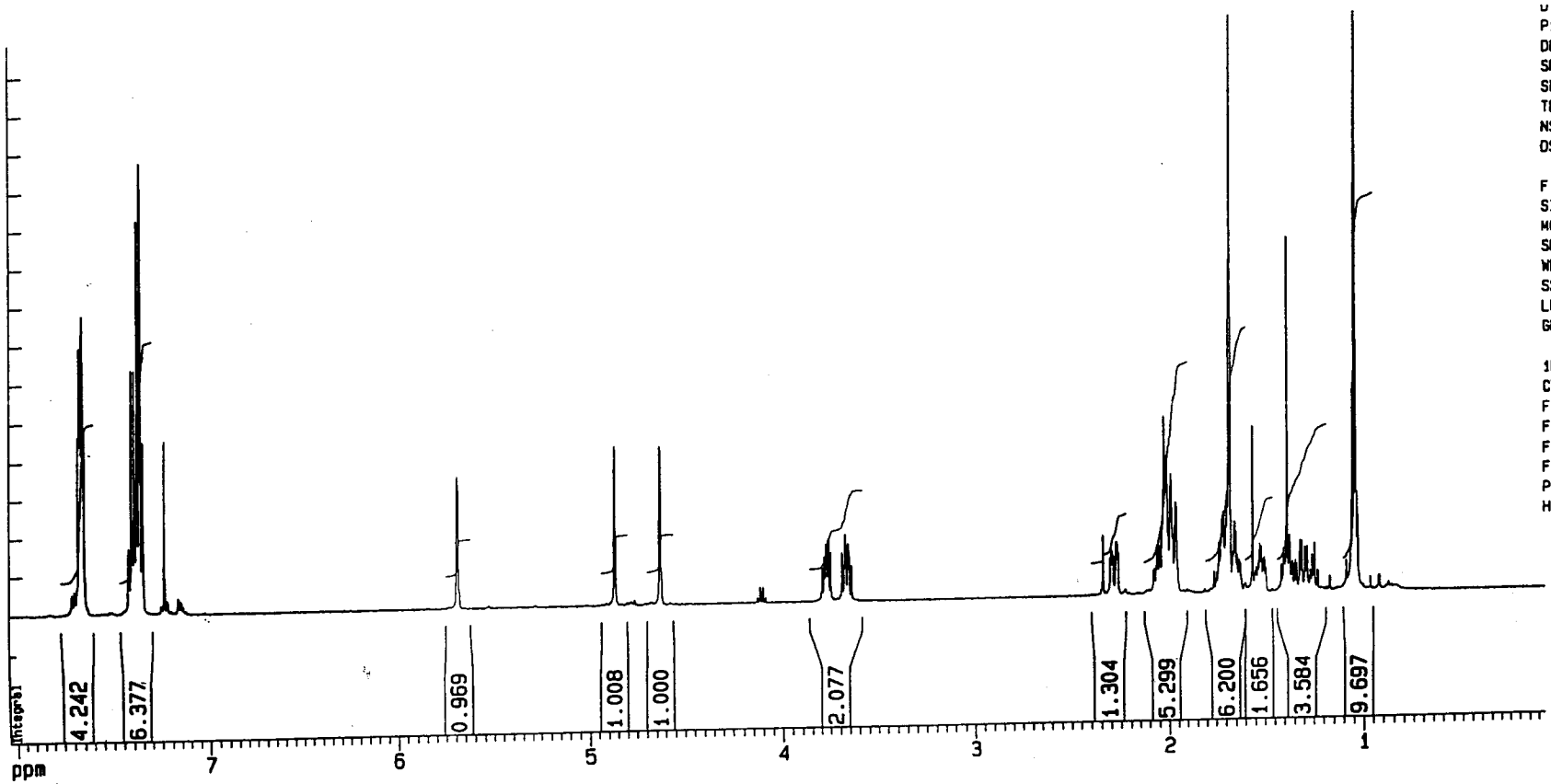

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1D NMR plot parameters

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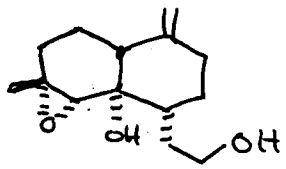

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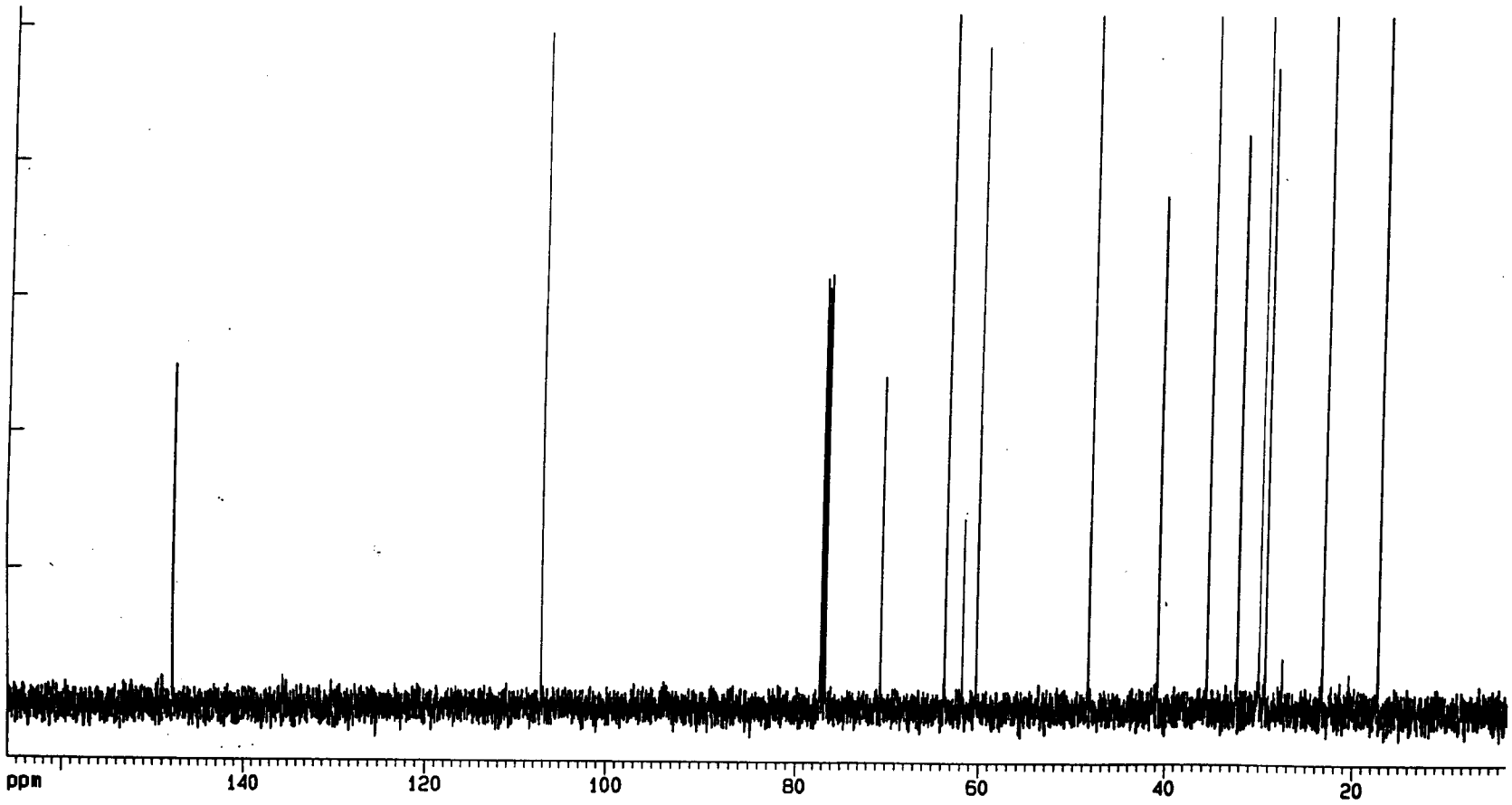

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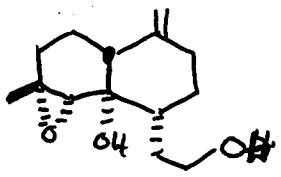

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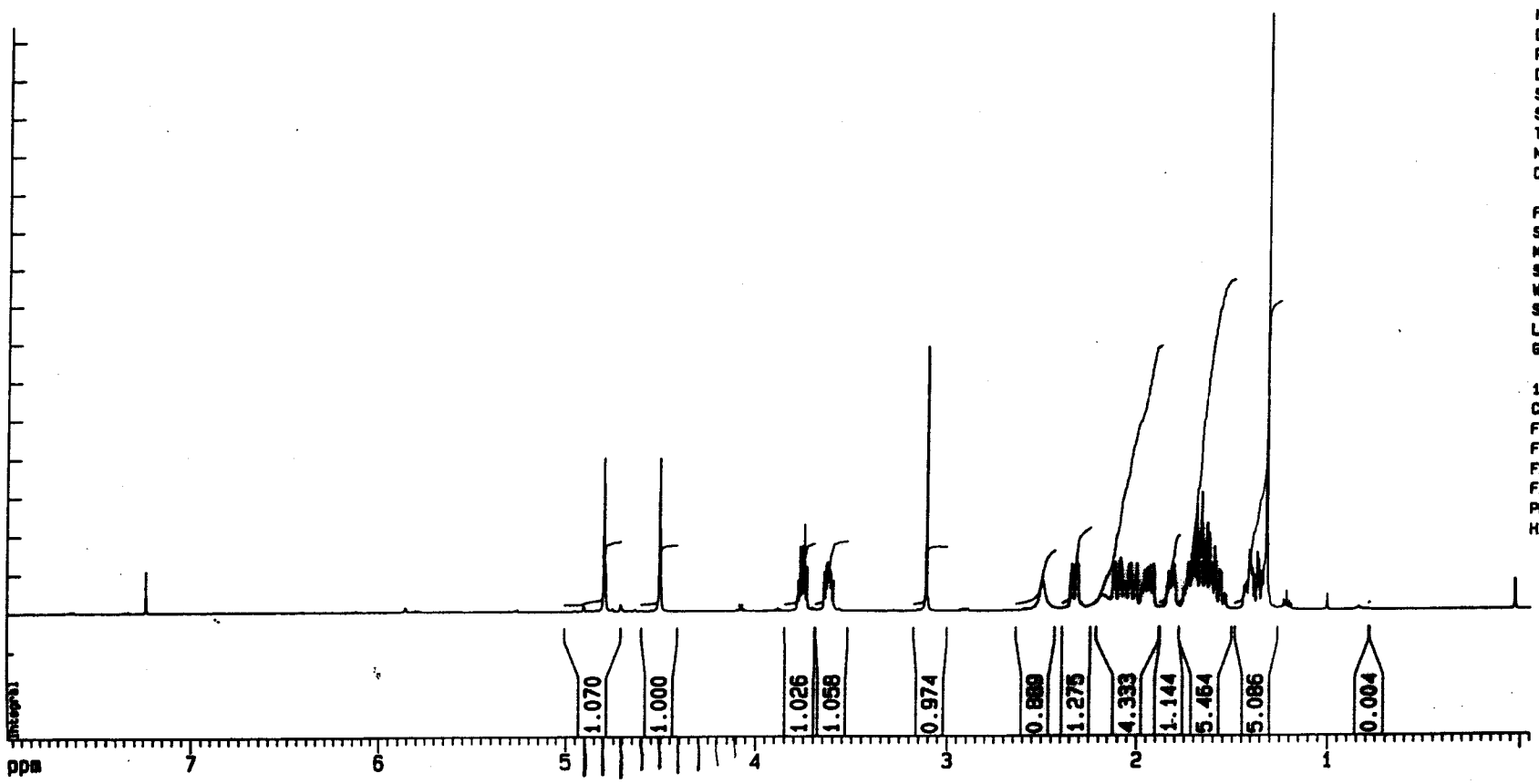

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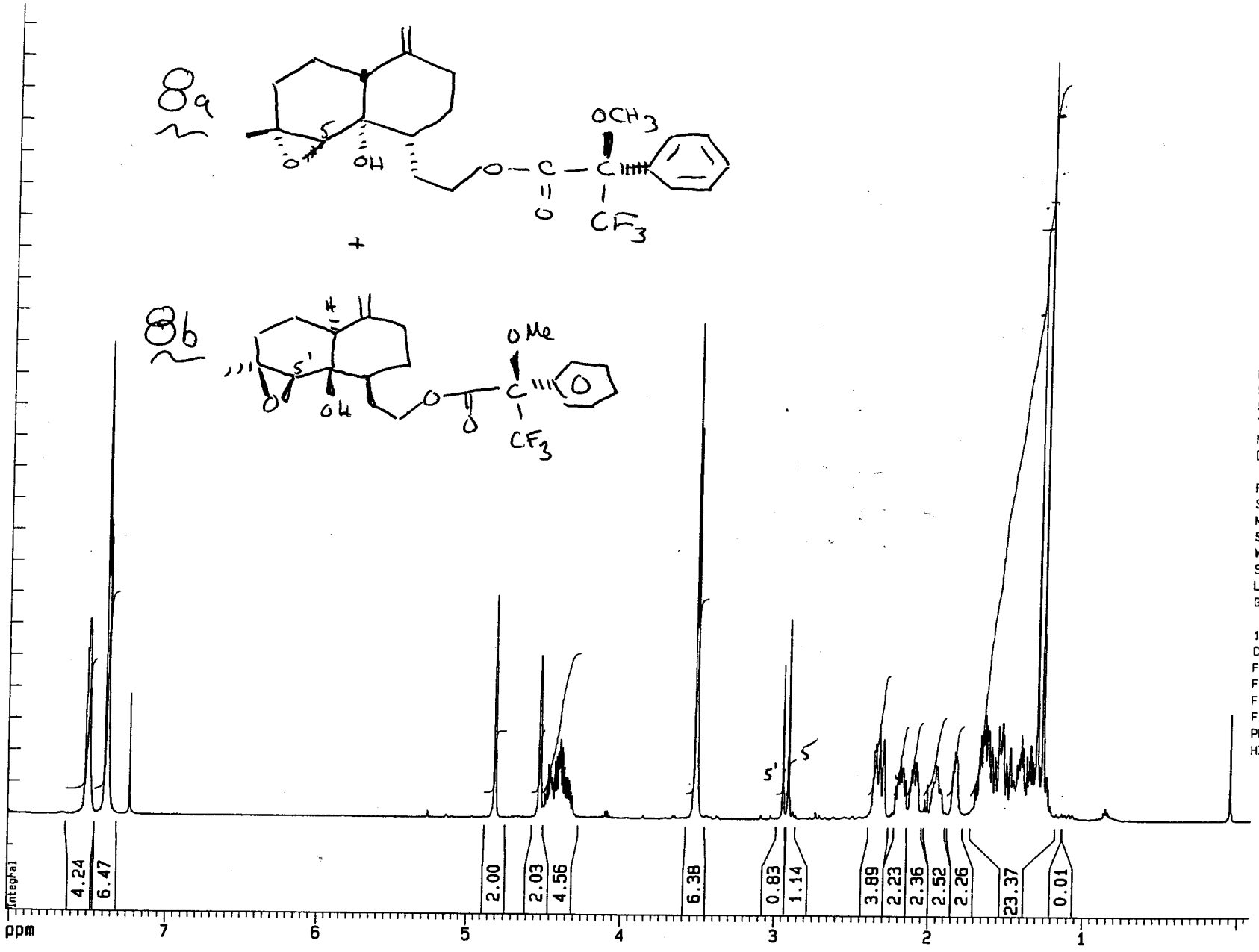

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SOLVENT	CDCl3
AQ	4.6530805 sec
FIDRES	0.107456 Hz
DW	71.0 usec
RG	2048
NUCLEUS	1H
HL1	0 dB
D1	0.0100000 sec
P1	3.0 usec
DE	88.8 usec
SFO1	500.1381707 MHz
SWH	7042.25 Hz
TD	65536
NS	16
DS	0

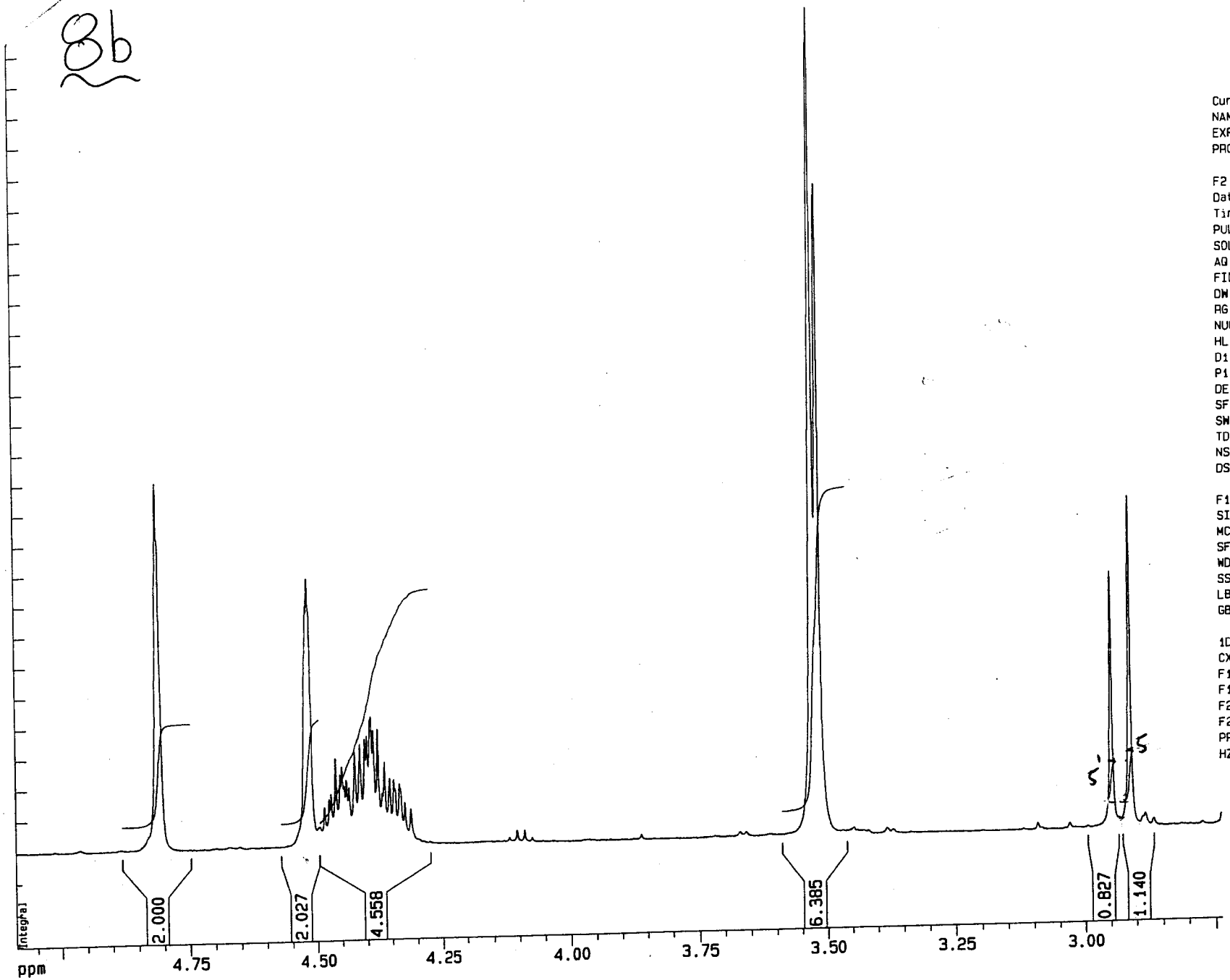
F1 - Processing parameters

SI	32768
MC2	QF
SF	500.1354311 MHz
WDW	EM
SSB	0
LB	0.00 Hz
GB	0

1D NMR plot parameters

CX	22.00 cm
F1P	8.015 ppm
F1	4008.58 Hz
F2P	-0.084 ppm
F2	-41.98 Hz
PPMCM	0.36813 ppm/
HZCM	184.11603 Hz/

8b



Current Data Parameters

NAME	dhd_312
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date	20010108
Time	6.20
PULPROG	zg
SOLVENT	CDCl3
AQ	4.6530805 sec
FIDRES	0.107456 Hz
DW	71.0 usec
RG	2048
NUCLEUS	1H
HL1	0 dB
D1	0.0100000 sec
P1	3.0 usec
DE	88.8 usec
SFO1	500.1381707 MHz
SWH	7042.25 Hz
TD	65536
NS	16
DS	0

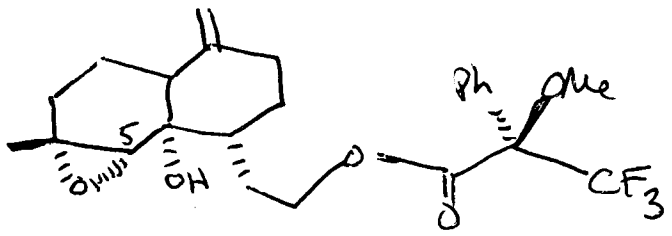
F1 - Processing parameters

SI	32768
WC2	QF
SF	500.1354311 MHz
WDW	EM
SSB	0
LB	0.00 Hz
GB	0

1D NMR plot parameters

CX	22.00 cm
F1P	5.091 ppm
F1	2546.34 Hz
F2P	2.739 ppm
F2	1369.83 Hz
PPMCM	0.10693 ppm/
HZCM	53.47768 Hz/

21



8a

Jan. 18, 2001

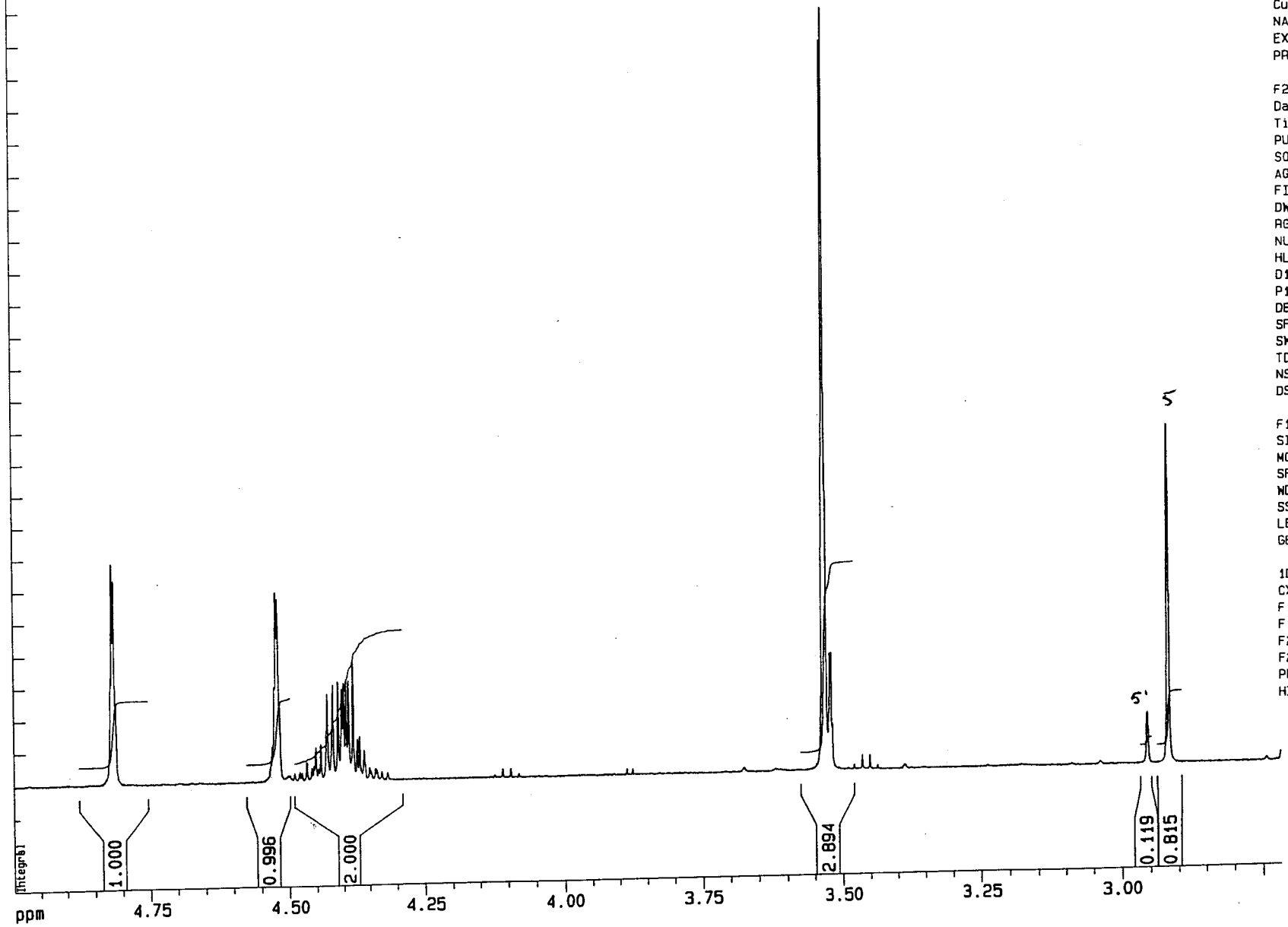
Current Data Parameters
NAME dhd_328
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date 20010116
Time 4.25
PULPROG zg
SOLVENT CDCl3
AQ 4.6530805 sec
FIDRES 0.107456 Hz
DW 71.0 usec
RG 512
NUCLEUS 1H
HL1 0 dB
D1 0.0100000 sec
P1 3.0 usec
DE 88.8 usec
SFO1 500.1381707 MHz
SWH 7042.25 Hz
TD 65536
NS 16
DS 0

F1 - Processing parameters
SI 32768
MC2 QF
SF 500.1354311 MHz
WDW EM
SSB 0
LB 0.00 Hz
GB 0

1D NMR plot parameters
CX 22.00 cm
F1P 8.015 ppm
F1 4008.59 Hz
F2P -0.084 ppm
F2 -42.01 Hz
PPMCM 0.36814 ppm/
HZCM 184.11804 Hz/

8a



Current Data Parameters

NAME	dhd_328
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

Date	20010116
Time	4.25
PULPROG	zg
SOLVENT	CDCl3
AQ	4.6530805 sec
FIDRES	0.107456 Hz
DW	71.0 usec
RG	512
NUCLEUS	1H
HL1	0 dB
D1	0.0100000 sec
P1	3.0 usec
DE	88.8 usec
SFO1	500.1381707 MHz
SWH	7042.25 Hz
TD	65536
NS	16
DS	0

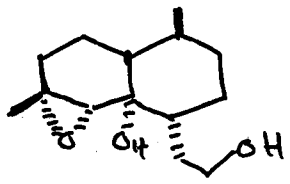
F1 - Processing parameters

SI	32768
MC2	QF
SF	500.1354311 MHz
WDW	EM
SSB	0
LB	0.00 Hz
GB	0

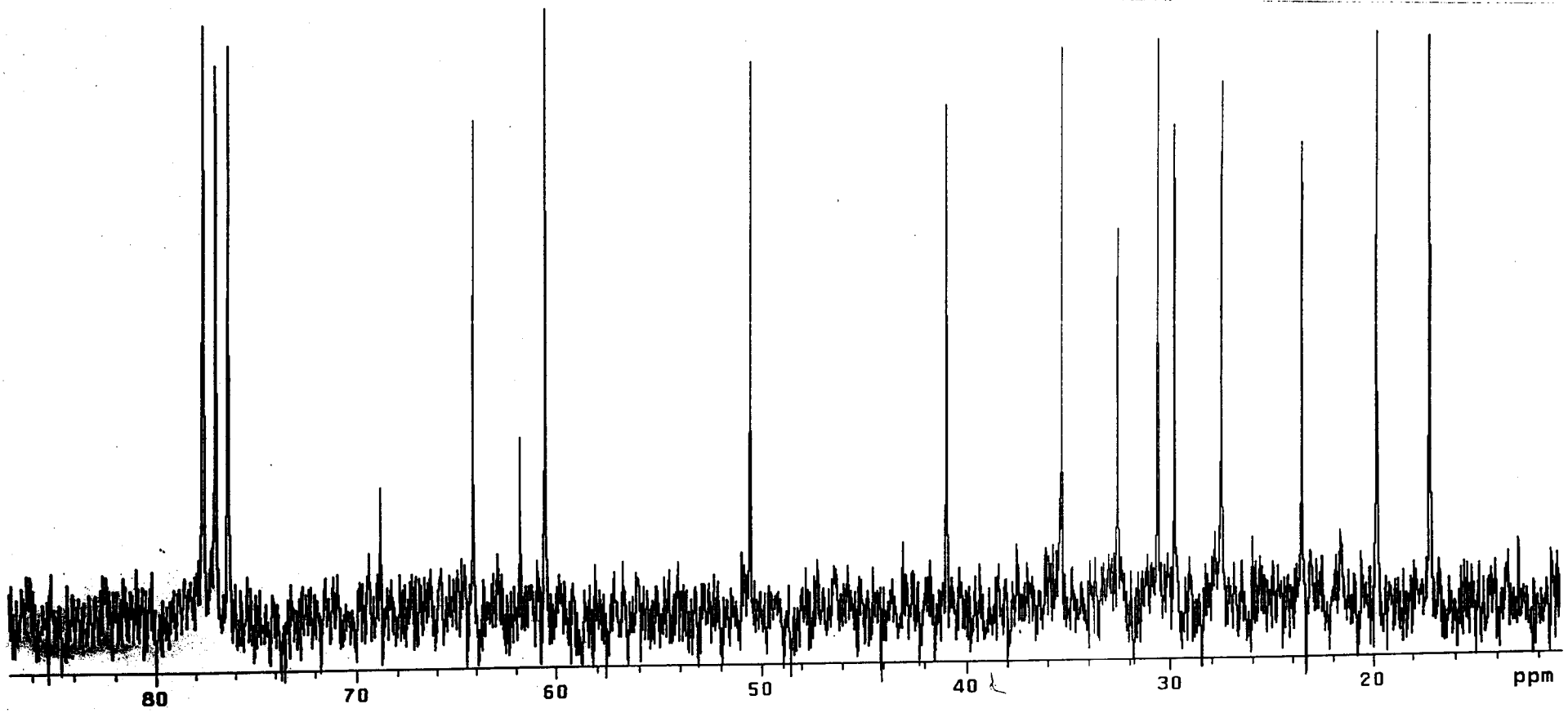
1D NMR plot parameters

CX	22.00 cm
F1P	5.000 ppm
F1	2500.49 Hz
F2P	2.719 ppm
F2	1359.75 Hz
PPMCM	0.10368 ppm/
HZCM	51.85186 Hz/

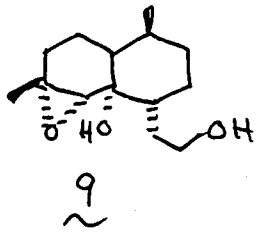
14



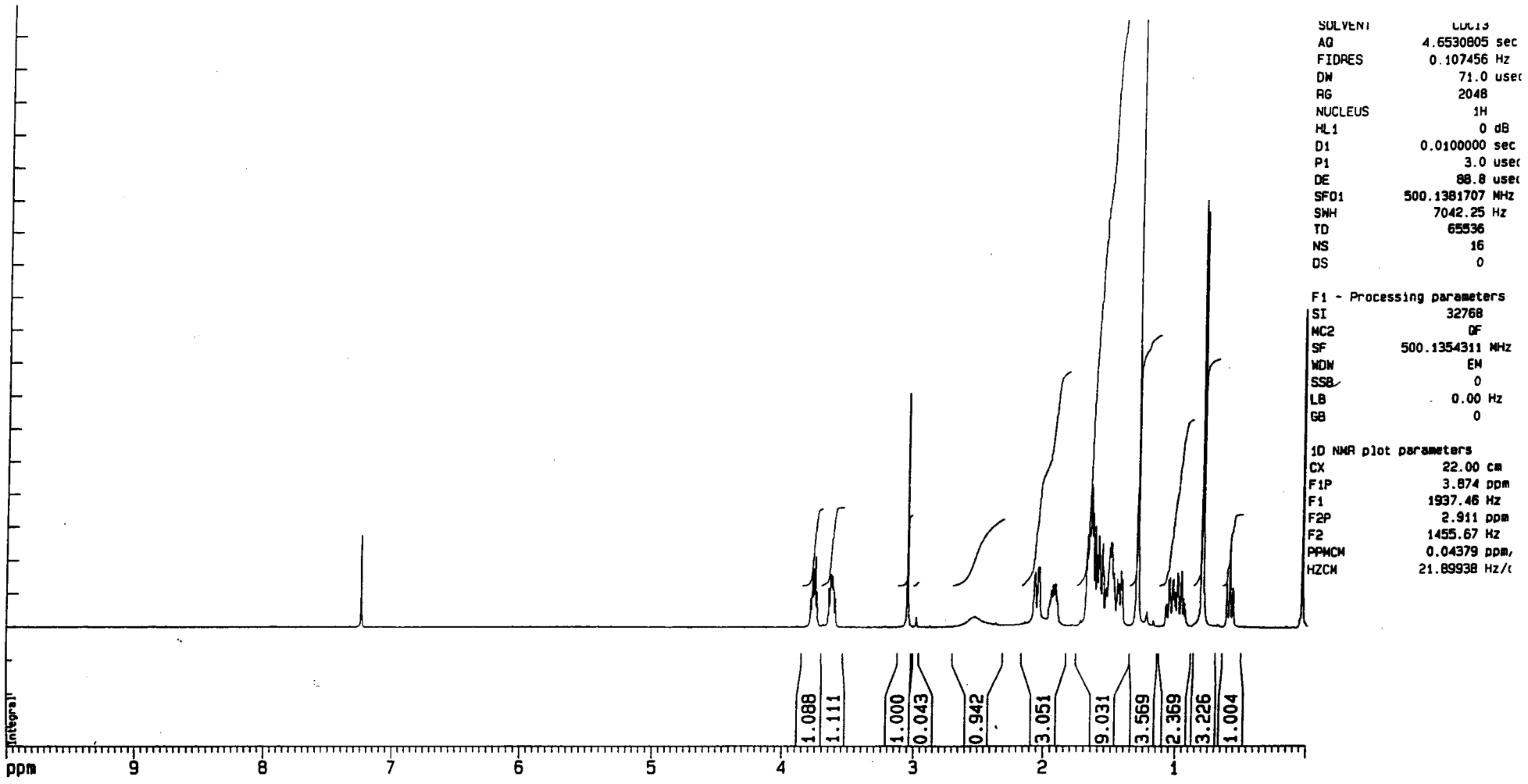
9

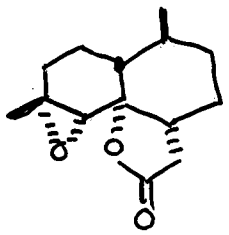


51

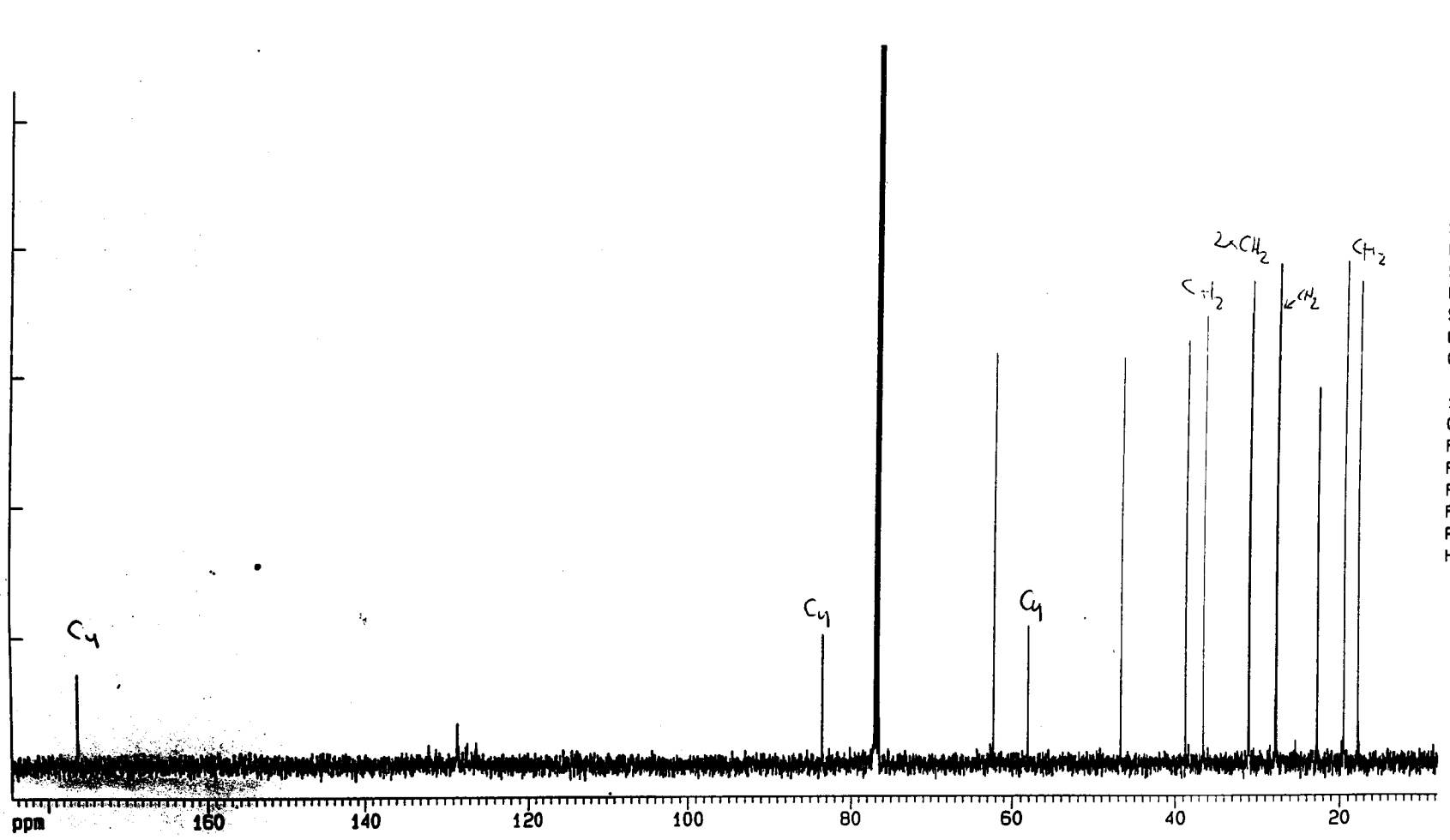

OH

9


SOLVENT CDCl3
AQ 4.6530805 sec
FIDRES 0.107456 Hz
DW 71.0 usec
RG 2048
NUCLEUS 1H
HL1 0 dB
D1 0.0100000 sec
P1 3.0 usec
DE 88.8 usec
SFO1 500.1381707 MHz
SWH 7042.25 Hz
TD 65536
NS 16
DS 0
F1 - Processing parameters
SI 32768
WDW EM
SSB 0
LB 0.00 Hz
GB 0
1D NMR plot parameters
CX 22.00 cm
F1P 3.874 ppm
F1 1937.46 Hz
F2P 2.911 ppm
F2 1455.67 Hz
PPMCM 0.04379 ppm/
HZCM 21.89938 Hz/
Integral
1.088
1.111
1.000
0.043
0.942
3.051
9.031
3.569
2.369
3.226
1.004
ppm
9
8
7
6
5
4
3
2
1



13



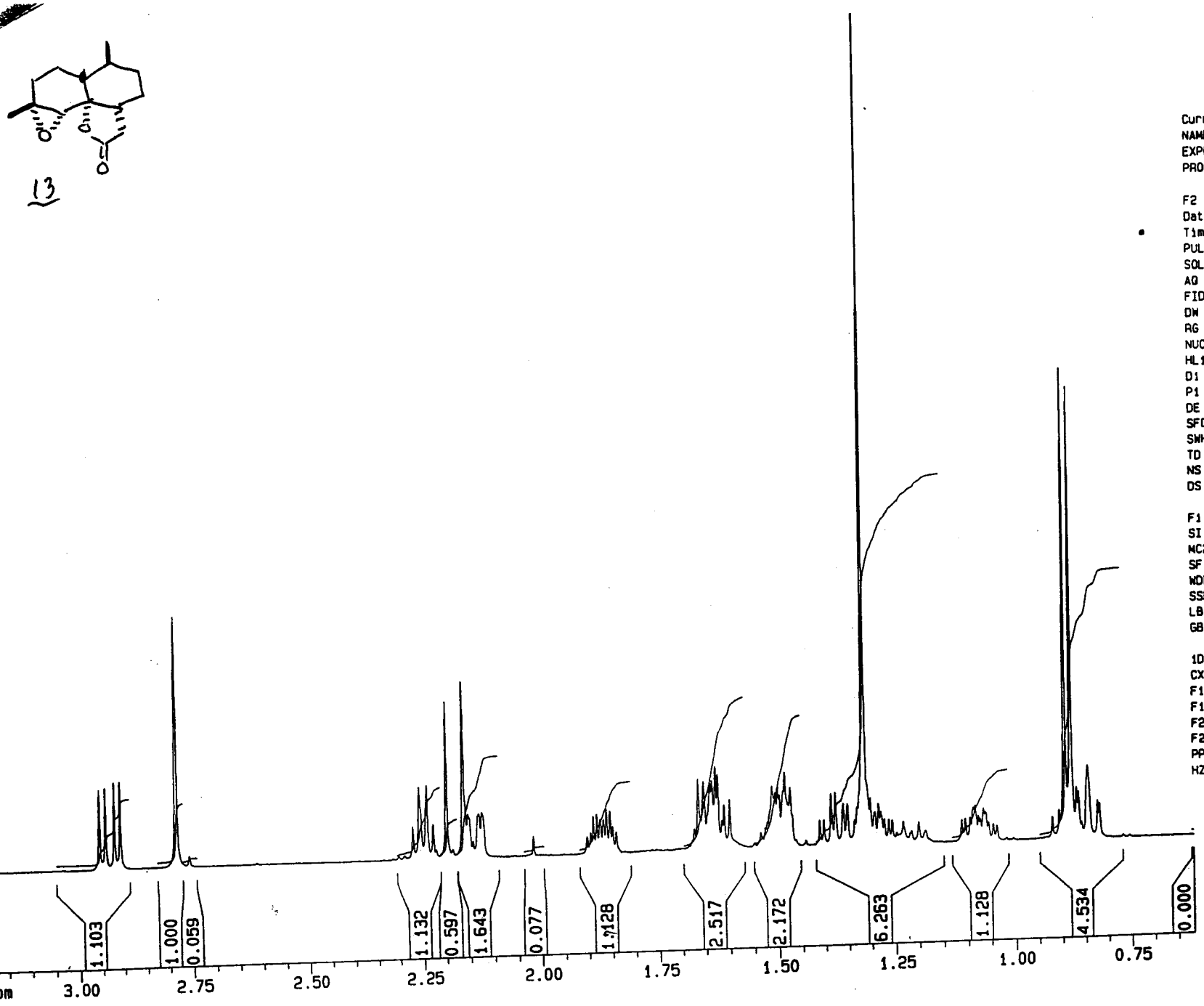
--	1.0000000
P1	5.0
DE	20.0
SFO1	125.7724464
SWH	31250.00
TD	65536
NS	1654
OS	0

F1 - Processing paramet

SI	32768
MC2	GF
SF	125.7591571
WDW	EM
SSB	0
LB	1.00
GB	0

1D NMR plot parameters

CX	22.00
F1P	184.790
F1	23239.01
F2P	7.704
F2	968.90
PPMCM	8.04934
HZCM	1012.27783



Current Data Parameters

NAME	dhd_325
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

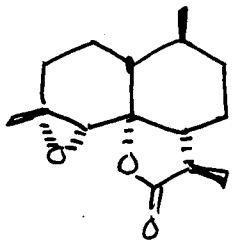
Date	20010112
Time	3.44
PULPRDG	zg
SOLVENT	CDCl3
AQ	4.6530805 sec
FIDRES	0.107456 Hz
DW	71.0 usec
RG	4096
NUCLEUS	1H
HL1	0 dB
D1	0.0100000 sec
P1	3.0 usec
DE	88.8 usec
SFO1	500.1381707 MHz
SWH	7042.25 Hz
TD	65536
NS	16
DS	0

F1 - Processing parameters

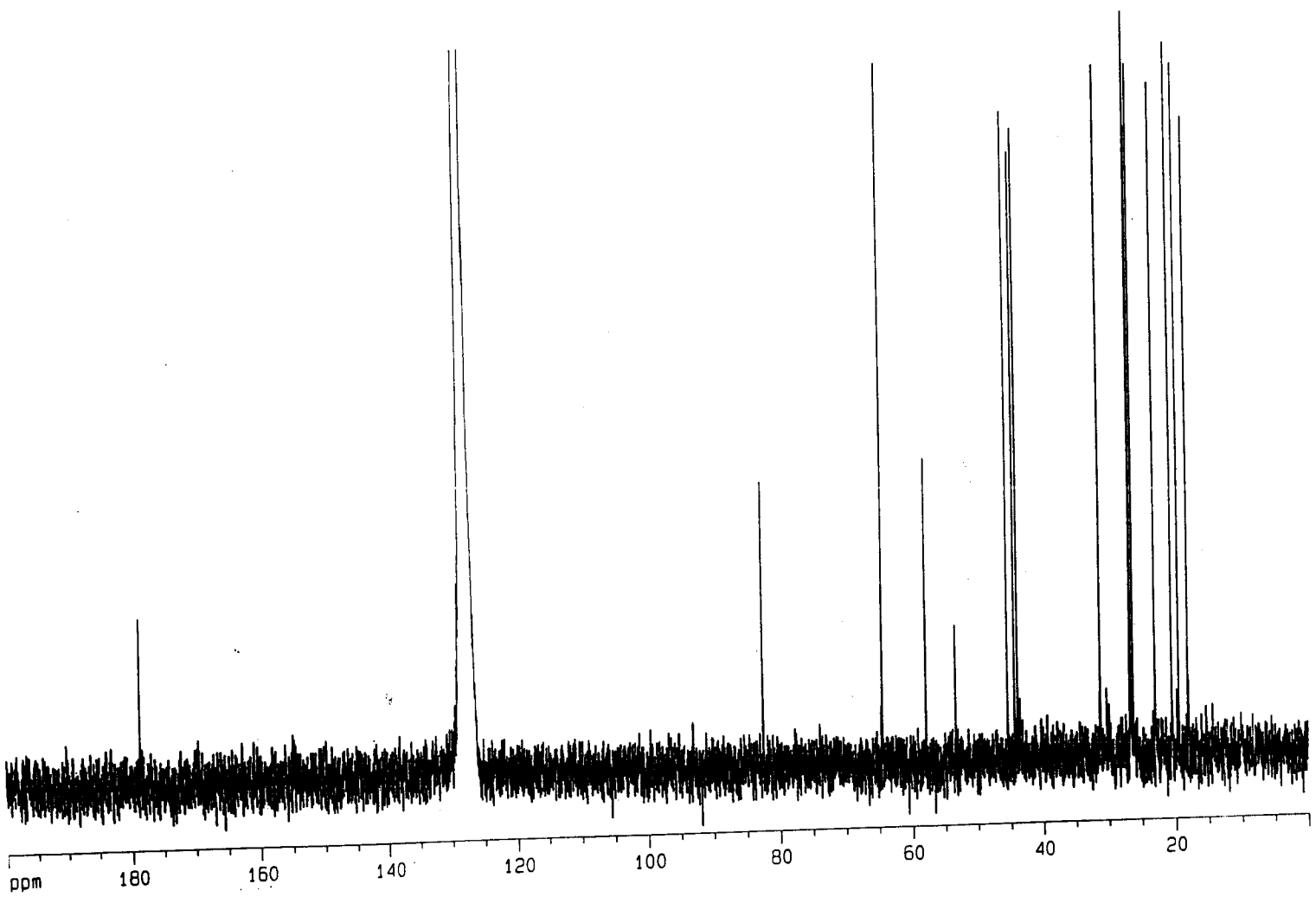
SI	32768
WC2	QF
SF	500.1354311 MHz
WDW	EM
SSB	0
LB	0.00 Hz
GB	0

1D NMR plot parameters

CX	22.00 cm
F1P	3.207 ppm
F1	1603.97 Hz
F2P	0.617 ppm
F2	308.57 Hz
PPMCM	0.11773 ppm/
HZCM	58.88197 Hz/



14



NS	16000
DS	0
SWH	17985.611 Hz
FIDRES	0.548877 Hz
AQ	0.9110004 sec
RG	3649.1
DW	27.800 usec
DE	6.00 usec
TE	300.0 K
D1	1.00000000 sec
d11	0.03000000 sec
d12	0.00002000 sec

CHANNEL f1

NUC1	13C
P1	5.10 usec
PL1	-6.00 dB
SFO1	75.4752653 MHz

CHANNEL f2

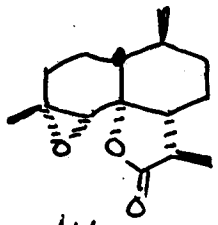
CPDPRG2	waltz16
NUC2	1H
PCPD2	70.00 usec
PL2	-3.00 dB
PL12	15.00 dB
PL13	15.00 dB
SFO2	300.1314860 MHz

F2 - Processing parameters

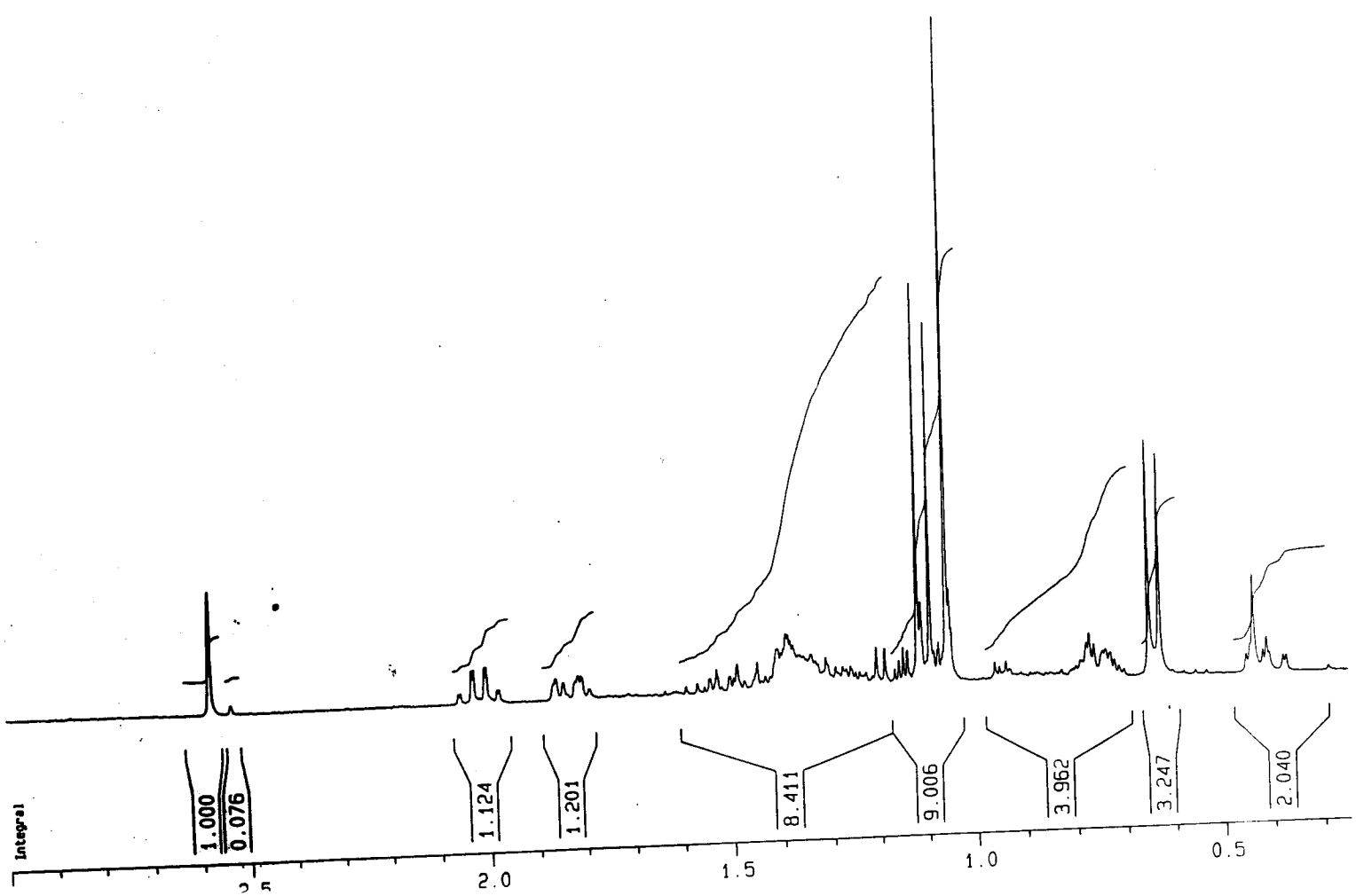
SI	65536
SF	75.4677190 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

1D NMR plot parameters

CX	20.00 cm
CY	800.00 cm
F1P	200.000 ppm
F1	15093.54 Hz
F2P	0.000 ppm
F2	0.00 Hz
PPMCM	10.00000 ppm/cm
HZCM	754.67719 Hz/cm



14



SOLVENT	CDCl3
NS	16
DS	0
SWH	5081.301 Hz
FIDRES	0.165407 Hz
AQ	3.0228980 sec
RG	128
DW	98.400 usec
DE	6.00 usec
TE	300.0 K
D1	1.00000000 sec

========== CHANNEL f1 ==========

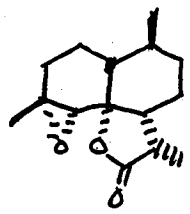
NUC1	1H
P1	9.50 usec
PL1	-3.00 dB
SFO1	300.1319477 MHz

F2 - Processing parameters

SI	65536
SF	300.1300000 MHz
WDW	EM
SSB	0
LB	0.10 Hz
GB	0
PC	1.00

1D NMR plot parameters

CX	20.00 cm
CY	10.00 cm
F1P	3.000 ppm
F1	900.39 Hz
F2P	0.250 ppm
F2	75.03 Hz
PPMCM	0.13750 ppm/cm
HZCM	41.26788 Hz/cm



15

P1	3.0
DE	20.0
SFO1	125.7724464
SWH	31250.00
TD	65536
NS	20000
DS	0

F1 - Processing paramet

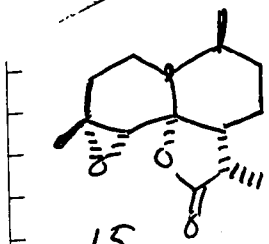
SI	32768
MC2	QF
SF	125.7591571
WDW	EM
SSB	0
LB	1.00
GB	0

1D NMR plot parameters

CX	22.00
F1P	229.918
F1	28914.29
F2P	-18.573
F2	-2335.70
PPMCM	11.29504
HZCM	1420.45435

ppm 200 175 150 125 100 75 50 25 0

12



15

Current Data Parameters

NAME	dhd_331
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

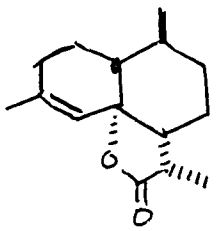
Date	20010120
Time	6.04
PULPROG	zg
SOLVENT	CDCl3
AQ	4.6530805 sec
FIDRES	0.107456 Hz
DW	71.0 usec
RG	2048
NUCLEUS	1H
HL1	0 dB
D1	0.0100000 sec
P1	3.0 usec
DE	88.8 usec
SFO1	500.1381707 MHz
SWH	7042.25 Hz
TD	65536
NS	16
DS	0

F1 - Processing parameters

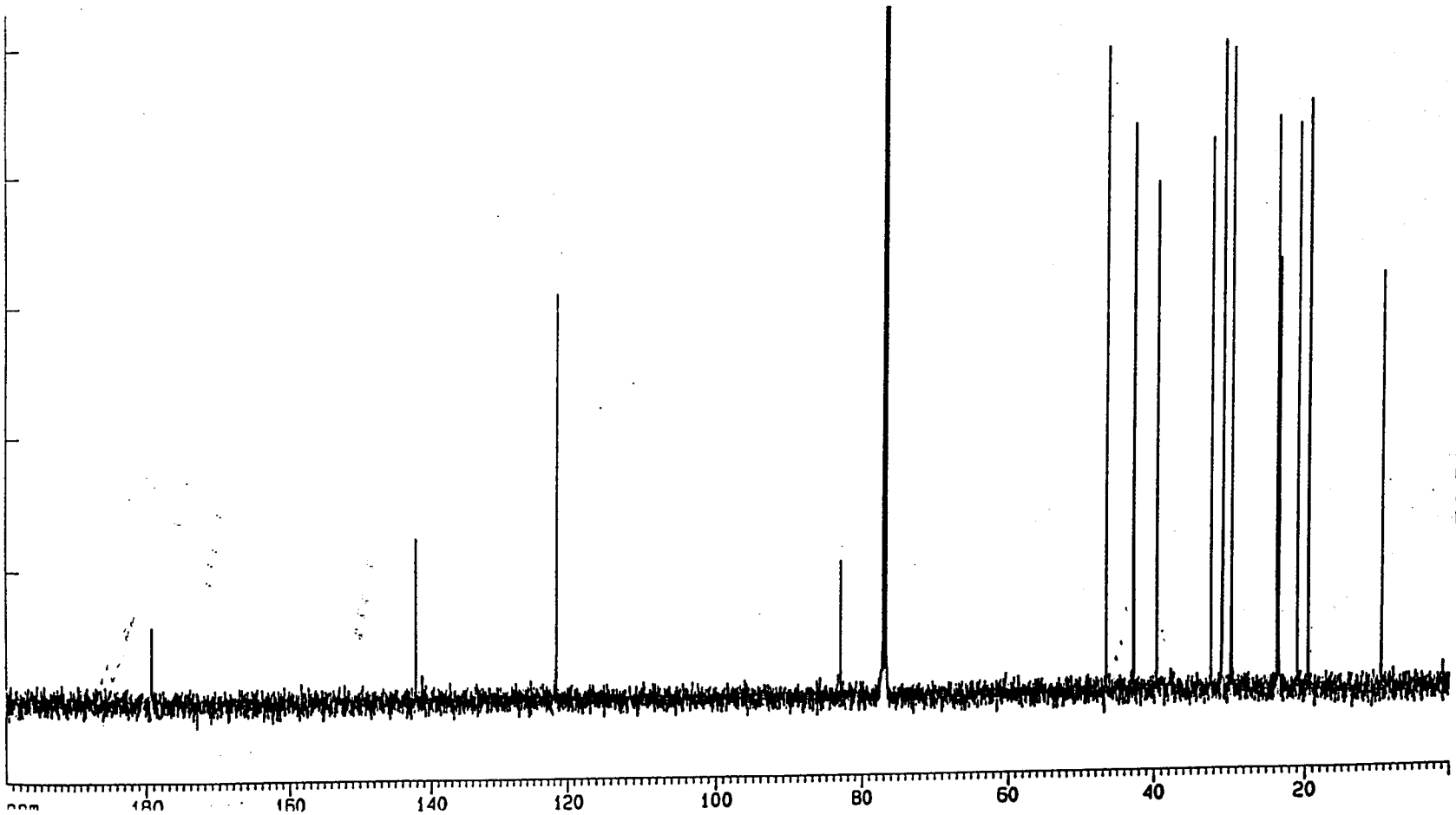
SI	32768
MC2	QF
SF	500.1354311 MHz
WDW	EM
SSB	0
LB	0.00 Hz
GB	0

1D NMR plot parameters

CX	22.00 cm
F1P	2.553 ppm
F1	1331.74 Hz
F2P	0.232 ppm
F2	115.84 Hz
PPMCM	0.11051 ppm/
HZCM	55.26848 Hz/c

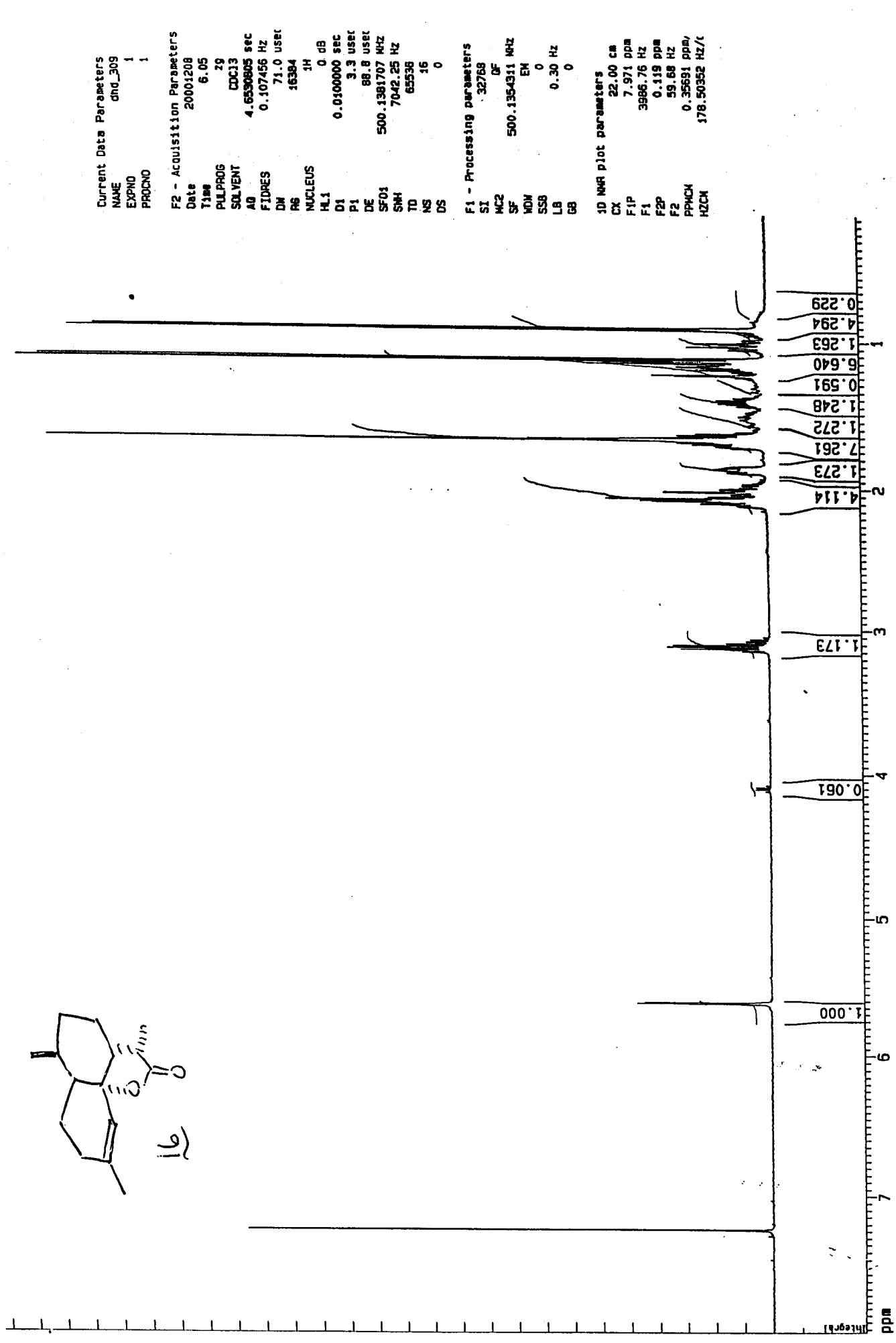


16

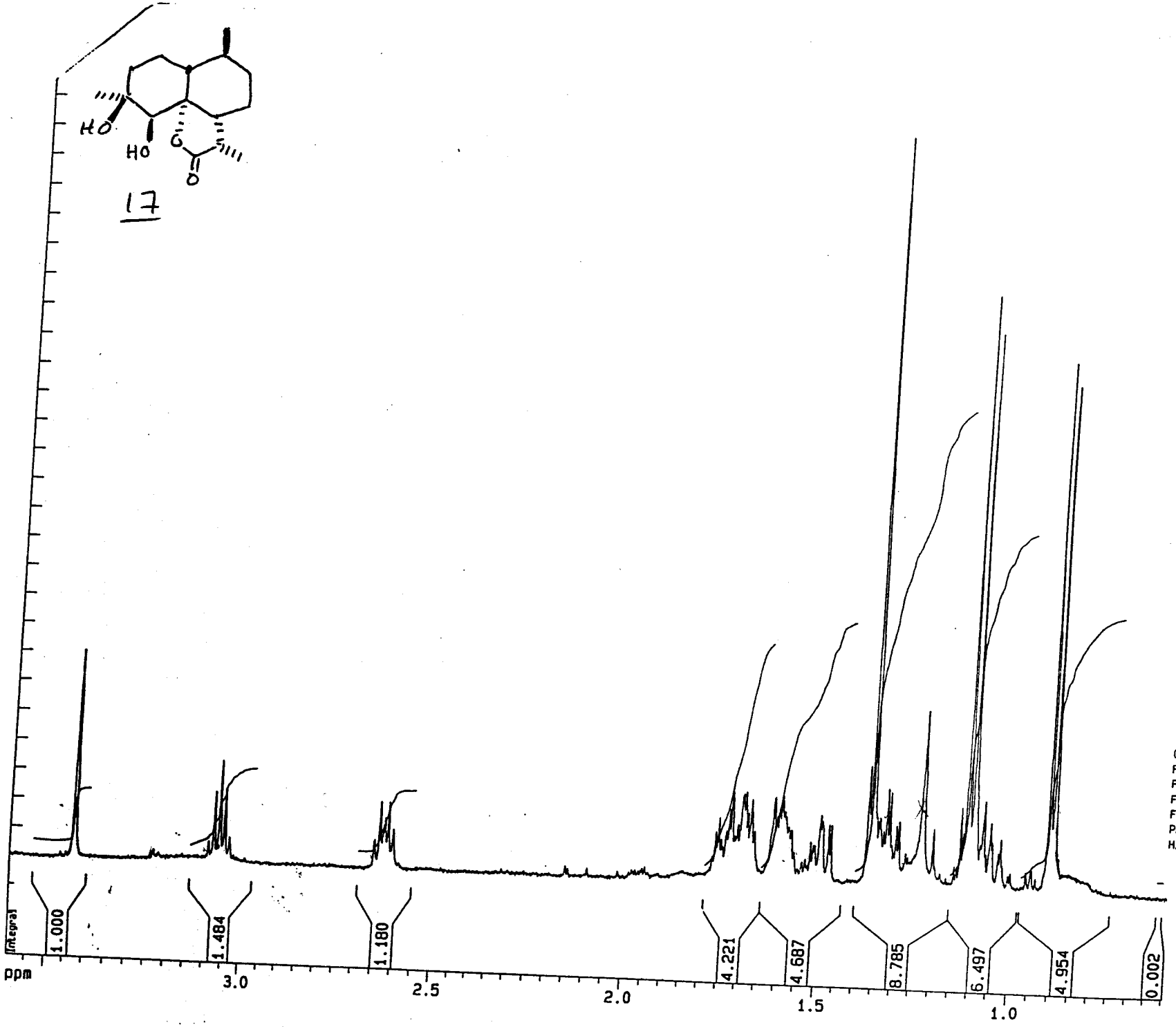


DE	20.0
SFO1	125.7724464
SWH	31250.00
TD	65536
NS	17000
DS	0
F1 - Processing paramet	
SI	32768
WC2	QF
SF	125.7591571
WDW	EM
SSB	0
LB	1.00
GB	0
1D NMR plot parameters	
CX	22.00
F1P	200.000
F1	25151.83
F2P	0.000
F2	0.00
PPMCM	9.09091
HZCM	1143.26501

23


Current Data Parameters
NAME dnd_309
EXPNO 1
PROCNO 1
F2 - Acquisition Parameters
Date 20001208
Time 6.05
PULPROG zg
SOLVENT CDCl3
AQ 4.6530805 sec
FIDRES 0.107456 Hz
DW 71.0 use
RG 16384
NUCLEUS 1H
HL1 0 dB
D1 0.0100000 sec
P1 3.3 use
DE 88.8 use
SFO1 500.1381707 MHz
SWH 7042.25 Hz
TD 65536
NS 16
DS 0
F1 - Processing parameters
SI 32768
WC2 0F
SF 500.1354311 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
1D NMR plot parameters
CX 22.00 cm
F1P 7.971 ppm
F1 3986.76 Hz
F2P 0.119 ppm
F2 59.68 Hz
PPMCM 0.35691 ppm/
HZCM 178.50352 Hz/
0.229
4.294
1.263
6.640
0.591
1.248
1.272
7.261
1.273
4.114
1.173
0.061
1.000
ppm
Integral

16)



Current Data Parameters

NAME	dhd_3033
EXPNO	1
PROCNO	1

F2 - Acquisition Parameters

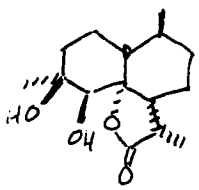
Date	20010114
Time	3.48
PULPROG	zg
SOLVENT	CDCl3
AQ	4.6530805 sec
FIDRES	0.107456 Hz
DW	71.0 usec
RG	16384
NUCLEUS	1H
HL1	0 dB
D1	0.0100000 sec
P1	3.0 usec
DE	88.8 usec
SFO1	500.1381707 MHz
SWH	7042.25 Hz
TD	65536
NS	64
DS	0

F1 - Processing parameters

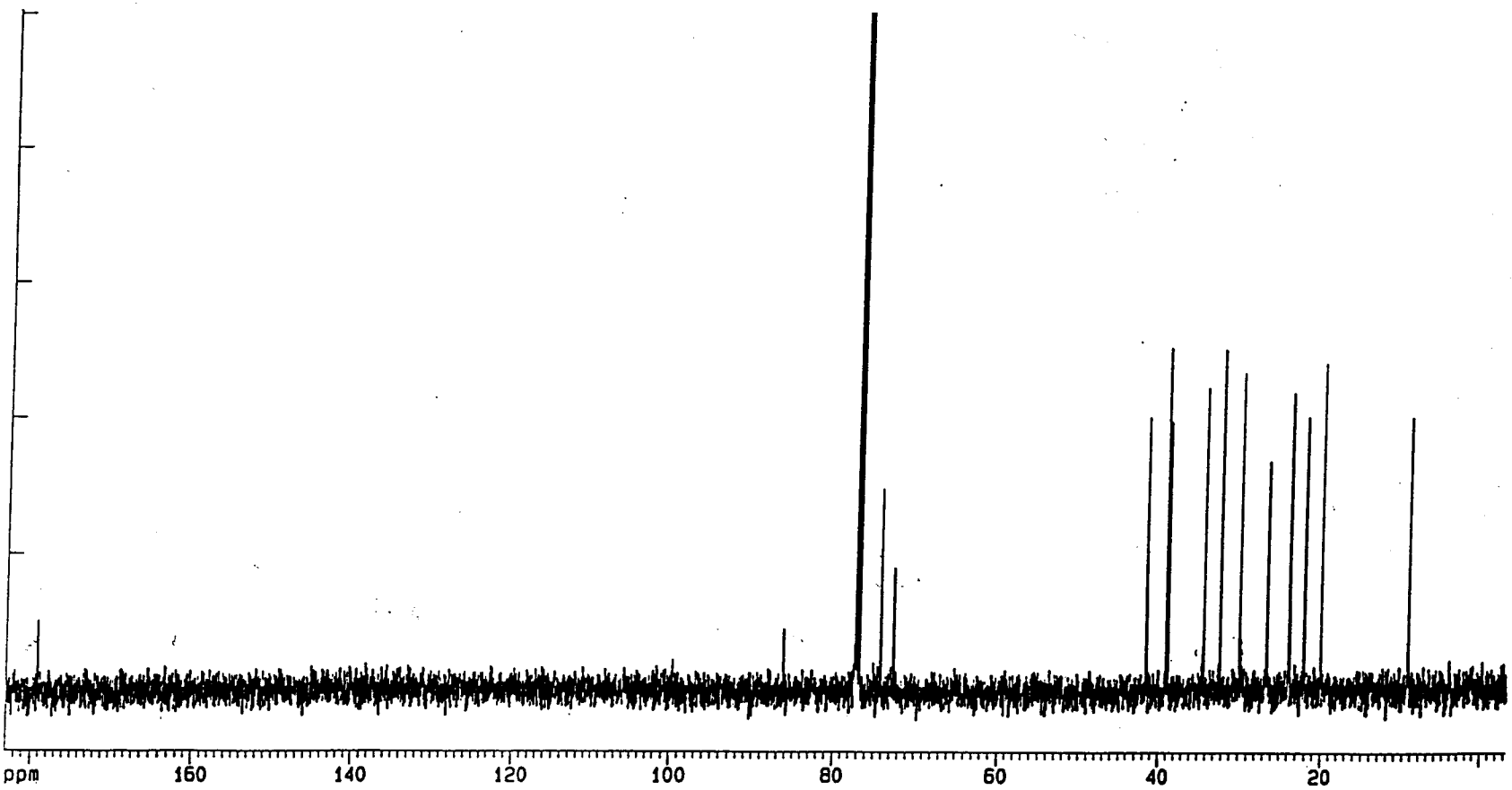
SI	32768
MC2	QF
SF	500.1354311 MHz
WDW	EM
SSB	0
LB	0.00 Hz
GB	0

1D NMR plot parameters

CX	22.00 cm
F1P	3.595 ppm
F1	1798.20 Hz
F2P	0.596 ppm
F2	298.30 Hz
PPMCM	0.13632 ppm/
HZCM	68.17721 Hz/c

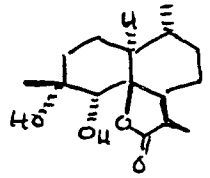


17



SWH	31250.00
TD	65536
NS	1792
DS	0
F1 - Processing paramet	
SI	32768
WC2	QF
SF	125.7591480
WDW	EM
SSB	0
LB	1.00
GB	0
1D NMR plot parameters	
CX	22.00
F1P	182.978
F1	23011.20
F2P	-3.301
F2	-415.19
PPMCM	8.46726
HZCM	1064.83582

Natural (-)-ARTEANNIUM M

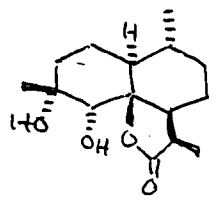


179.2 C
86.3 C
74.2 a
72.6 C
41.7
39.1
38.8
34.3
32.3
29.9
26.5
23.9
22.1
20.1
9.3

ppm 225 200 175 150 125 100 75 50 25 0

27

Natural ARTEANNIUN M



artemisia anuua, 7.1mg shaked with 0.5ml Na2CO3

(1)

3.45 s (1H)
3.22 s (1H) OH
3.09 dq 6.8, 6.8 (1H)
2.65 ddd 10.9, 6.8, 6.1 (1H)
1.87 br (1H) OH
1.39 s (3H)
1.13 d 7.1 (3H)
0.93 d 6.6 (3H)

82

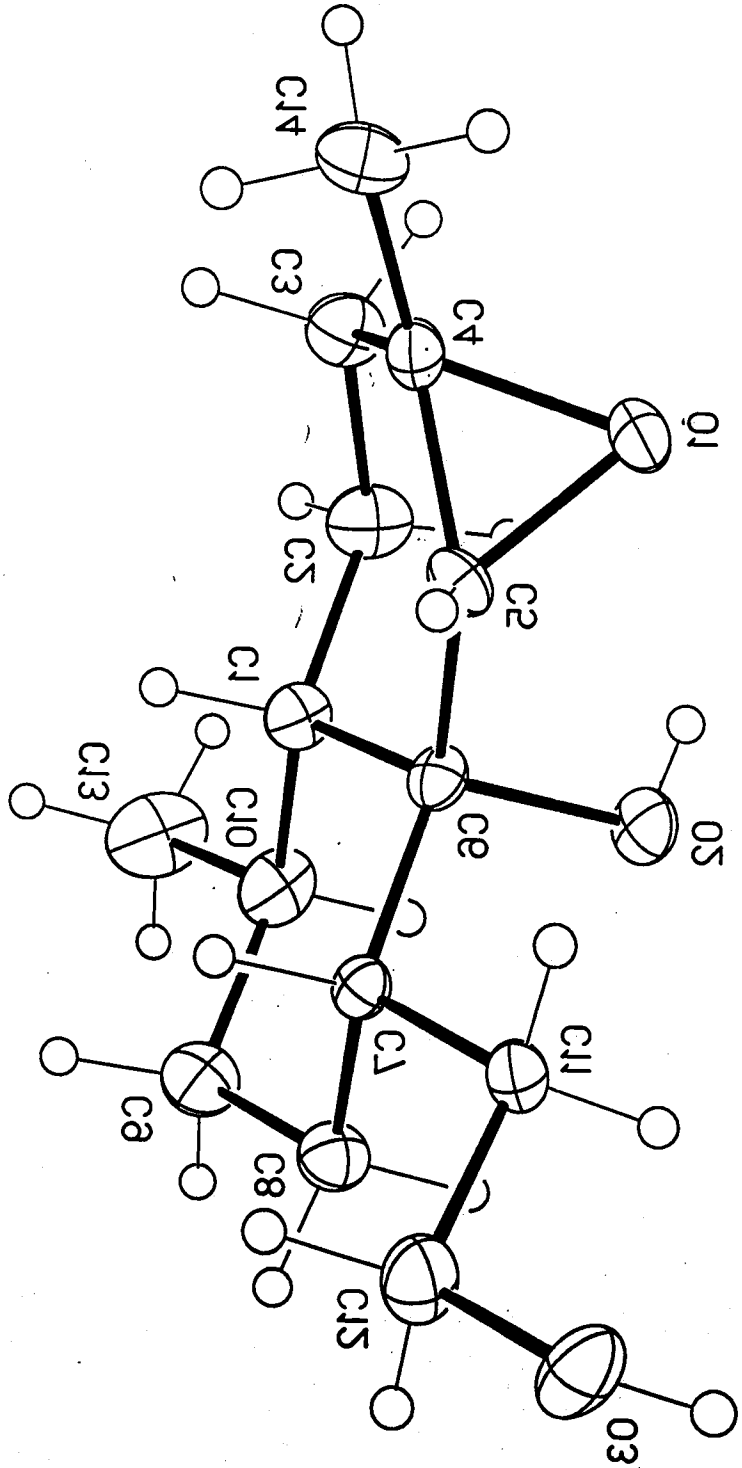

C14
C3
C4
O1
C5
C2
C1
C13
C10
C9
O2
C7
C11
C6
C8
C12
O3

Table 1. Crystal data and structure refinement for lb004.

Identification code	lb004
Empirical formula	C14 H24 O3
Formula weight	240.33
Temperature	203(2) K
Wavelength	0.71073 A
Crystal system, space group	Orthorhombic, P2(1)2(1)2(1)
Unit cell dimensions	a = 5.2738(8) A alpha = 90 deg. b = 10.6132(16) A beta = 90 deg. c = 24.204(4) A gamma = 90 deg.
Volume	1354.7(4) A^3
Z, Calculated density	4, 1.178 Mg/m^3
Absorption coefficient	0.081 mm^-1
F(000)	528
Crystal size	0.10 x 0.02 x 0.02 mm
Theta range for data collection	1.68 to 20.78 deg.
Limiting indices	-5<=h<=5, 0<=k<=10, 0<=l<=24
Reflections collected / unique	10721 / 1409 [R(int) = 0.1449]
Completeness to theta = 20.78	100.0 %
Absorption correction	None
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	1409 / 0 / 155
Goodness-of-fit on F^2	1.032
Final R indices [I>2sigma(I)]	R1 = 0.0450, wR2 = 0.0890
R indices (all data)	R1 = 0.0698, wR2 = 0.0934
Absolute structure parameter	0(3)
Extinction coefficient	0.023(3)
Largest diff. peak and hole	0.151 and -0.220 e.A^-3

Table 2. Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (A^2 x 10^3) for lb004.
U(eq) is defined as one third of the trace of the orthogonalized Uij tensor.

	x	y	z	U(eq)
O(1)	2233(6)	6842(3)	9550(1)	38(1)
O(2)	4076(5)	8888(3)	9057(1)	37(1)
O(3)	-2387(6)	12070(3)	9876(1)	41(1)
C(1)	1989(9)	7902(4)	8266(2)	31(1)
C(2)	3366(10)	6659(4)	8335(2)	44(2)
C(3)	1773(11)	5703(4)	8658(2)	43(2)
C(4)	534(8)	6231(5)	9161(2)	29(1)
C(5)	428(9)	7606(4)	9240(2)	26(1)
C(6)	1635(8)	8536(4)	8836(2)	27(1)
C(7)	122(8)	9765(4)	8798(2)	23(1)
C(8)	1294(9)	10636(4)	8363(2)	36(1)
C(9)	1608(9)	9993(4)	7808(2)	42(1)
C(10)	3187(10)	8798(5)	7845(2)	42(1)
C(11)	-200(9)	10442(4)	9351(2)	30(1)
C(12)	-2078(10)	11503(4)	9345(2)	42(1)
C(13)	3575(11)	8229(5)	7280(2)	65(2)
C(14)	-1352(9)	5376(4)	9443(2)	44(1)

Table 3. Bond lengths [A] and angles [deg] for lb004.

O(1)-C(4)	1.454(5)
O(1)-C(5)	1.458(5)
O(2)-C(6)	1.443(5)
O(3)-C(12)	1.427(4)
C(1)-C(2)	1.515(6)
C(1)-C(10)	1.529(6)
C(1)-C(6)	1.547(5)
C(2)-C(3)	1.532(6)
C(3)-C(4)	1.490(6)
C(4)-C(5)	1.473(6)
C(4)-C(14)	1.509(6)
C(5)-C(6)	1.529(5)
C(6)-C(7)	1.531(5)
C(7)-C(11)	1.529(5)
C(7)-C(8)	1.532(5)
C(8)-C(9)	1.514(5)
C(9)-C(10)	1.519(6)
C(10)-C(13)	1.511(5)
C(11)-C(12)	1.500(5)
C(4)-O(1)-C(5)	60.8(3)
C(2)-C(1)-C(10)	114.6(4)
C(2)-C(1)-C(6)	109.8(4)
C(10)-C(1)-C(6)	111.9(4)
C(1)-C(2)-C(3)	111.7(4)
C(4)-C(3)-C(2)	114.1(4)
O(1)-C(4)-C(5)	59.7(3)
O(1)-C(4)-C(3)	115.3(4)
C(5)-C(4)-C(3)	119.8(4)
O(1)-C(4)-C(14)	112.4(4)
C(5)-C(4)-C(14)	120.7(4)
C(3)-C(4)-C(14)	115.6(4)
O(1)-C(5)-C(4)	59.5(2)
O(1)-C(5)-C(6)	114.6(4)
C(4)-C(5)-C(6)	122.7(4)
O(2)-C(6)-C(5)	107.5(3)
O(2)-C(6)-C(7)	105.5(3)
C(5)-C(6)-C(7)	111.8(3)
O(2)-C(6)-C(1)	109.6(3)
C(5)-C(6)-C(1)	109.9(4)
C(7)-C(6)-C(1)	112.3(3)
C(11)-C(7)-C(6)	113.9(3)
C(11)-C(7)-C(8)	111.3(3)
C(6)-C(7)-C(8)	110.2(4)
C(9)-C(8)-C(7)	112.4(4)
C(8)-C(9)-C(10)	112.6(4)
C(13)-C(10)-C(9)	110.8(4)
C(13)-C(10)-C(1)	114.2(4)
C(9)-C(10)-C(1)	109.4(4)
C(12)-C(11)-C(7)	114.7(3)
O(3)-C(12)-C(11)	112.5(4)

Symmetry transformations used to generate equivalent atoms:

Table 4. Anisotropic displacement parameters (A^2 x 10^3) for lb004. The anisotropic displacement factor exponent takes the form: -2 pi^2 [h^2 a*^2 U11 + ... + 2 h k a* b* U12]

	U11	U22	U33	U23	U13	U12
O(1)	46(2)	33(2)	34(2)	2(2)	-16(2)	2(2)
O(2)	21(2)	43(2)	47(2)	-3(2)	-3(2)	3(2)
O(3)	34(2)	41(2)	47(2)	-21(2)	1(2)	2(2)
C(1)	34(3)	31(3)	27(3)	-2(2)	3(3)	0(3)
C(2)	55(4)	38(4)	39(3)	-4(3)	13(3)	1(3)
C(3)	54(4)	37(3)	36(3)	-4(3)	7(3)	6(3)
C(4)	28(3)	33(3)	26(3)	-1(2)	-4(3)	-5(3)
C(5)	23(3)	31(3)	24(3)	6(2)	5(3)	7(3)
C(6)	19(3)	33(3)	29(3)	0(2)	1(2)	-8(3)
C(7)	18(3)	24(3)	26(3)	0(2)	2(2)	-3(3)
C(8)	42(4)	34(3)	32(3)	-2(2)	2(3)	-2(3)
C(9)	47(4)	44(4)	34(3)	10(3)	6(3)	-5(3)
C(10)	57(4)	46(3)	24(3)	-4(2)	8(3)	-8(3)
C(11)	33(3)	29(3)	28(3)	1(2)	-5(2)	0(3)
C(12)	41(3)	48(4)	37(3)	-16(3)	-6(3)	8(3)
C(13)	90(5)	65(4)	40(3)	-5(3)	24(3)	-13(4)
C(14)	54(4)	39(3)	39(3)	12(3)	6(3)	-2(3)

Table 5. Hydrogen coordinates (x 10^4) and isotropic displacement parameters (A^2 x 10^3) for lb004.

	x	y	z	U(eq)
H(2B)	4989	8253	9081	56
H(3C)	-1001	12344	9985	61
H(1A)	271	7700	8127	37
H(2A)	4968	6803	8530	53
H(2C)	3765	6313	7970	53
H(3A)	459	5365	8413	51
H(3B)	2866	5000	8769	51
H(5A)	-1045	7925	9452	31
H(7A)	-1597	9542	8666	27
H(8A)	211	11379	8317	43
H(8B)	2956	10923	8493	43
H(9A)	2421	10578	7550	50
H(9B)	-70	9783	7661	50
H(10A)	4877	9039	7989	51
H(11A)	-733	9825	9629	36
H(11B)	1451	10776	9466	36
H(12A)	-1512	12145	9082	51
H(12B)	-3721	11183	9218	51
H(13A)	4327	8852	7036	97
H(13B)	1953	7963	7131	97
H(13C)	4694	7507	7308	97
H(14A)	-972	4506	9352	66
H(14B)	-3051	5581	9318	66
H(14C)	-1244	5492	9840	66

Table 6. Torsion angles [deg] for lb004.

C(10)-C(1)-C(2)-C(3)	-167.3(4)
C(6)-C(1)-C(2)-C(3)	65.8(5)
C(1)-C(2)-C(3)-C(4)	-45.1(6)
C(5)-O(1)-C(4)-C(3)	111.1(5)
C(5)-O(1)-C(4)-C(14)	-113.5(4)
C(2)-C(3)-C(4)-O(1)	-54.7(6)
C(2)-C(3)-C(4)-C(5)	13.4(6)
C(2)-C(3)-C(4)-C(14)	171.4(4)
C(4)-O(1)-C(5)-C(6)	-114.8(4)
C(3)-C(4)-C(5)-O(1)	-103.6(5)
C(14)-C(4)-C(5)-O(1)	99.6(4)
O(1)-C(4)-C(5)-C(6)	101.3(4)
C(3)-C(4)-C(5)-C(6)	-2.4(7)
C(14)-C(4)-C(5)-C(6)	-159.2(4)
O(1)-C(5)-C(6)-O(2)	-29.5(5)
C(4)-C(5)-C(6)-O(2)	-97.8(5)
O(1)-C(5)-C(6)-C(7)	-144.8(3)
C(4)-C(5)-C(6)-C(7)	146.9(4)
O(1)-C(5)-C(6)-C(1)	89.8(4)
C(4)-C(5)-C(6)-C(1)	21.5(6)
C(2)-C(1)-C(6)-O(2)	66.3(5)
C(10)-C(1)-C(6)-O(2)	-62.2(5)
C(2)-C(1)-C(6)-C(5)	-51.7(5)
C(10)-C(1)-C(6)-C(5)	179.8(4)
C(2)-C(1)-C(6)-C(7)	-176.8(4)
C(10)-C(1)-C(6)-C(7)	54.7(5)
O(2)-C(6)-C(7)-C(11)	-58.9(4)
C(5)-C(6)-C(7)-C(11)	57.7(5)
C(1)-C(6)-C(7)-C(11)	-178.2(4)
O(2)-C(6)-C(7)-C(8)	67.0(4)
C(5)-C(6)-C(7)-C(8)	-176.4(3)
C(1)-C(6)-C(7)-C(8)	-52.3(5)
C(11)-C(7)-C(8)-C(9)	-179.4(4)
C(6)-C(7)-C(8)-C(9)	53.3(5)
C(7)-C(8)-C(9)-C(10)	-56.6(5)
C(8)-C(9)-C(10)-C(13)	-176.8(4)
C(8)-C(9)-C(10)-C(1)	56.4(5)
C(2)-C(1)-C(10)-C(13)	54.2(6)
C(6)-C(1)-C(10)-C(13)	-179.9(4)
C(2)-C(1)-C(10)-C(9)	179.0(4)
C(6)-C(1)-C(10)-C(9)	-55.2(5)
C(6)-C(7)-C(11)-C(12)	-168.7(4)
C(8)-C(7)-C(11)-C(12)	66.0(5)
C(7)-C(11)-C(12)-O(3)	177.6(4)

Symmetry transformations used to generate equivalent atoms: