Electronic supplementary materials *Mendeleev Commun*., 2017, **27**, 125–127

Side-modified 15-deoxy-$\Delta^{12,14}$-prostaglandin D_2, precursor of corresponding PGJ_2. Synthesis from cloprostenol and anticancer activity

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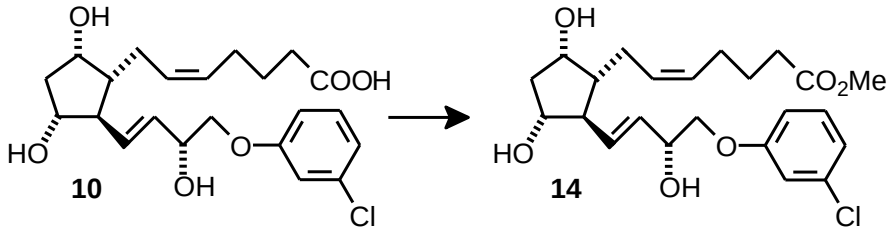
The numbers of the compounds are the same as those in the main text.

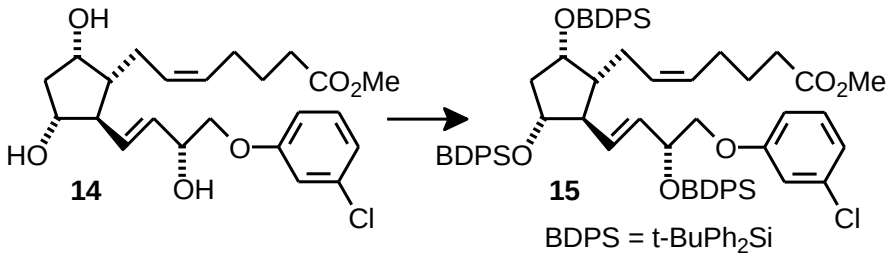
Experimental section

General

Analyses were carried out on the equipment of the Ufa Institute of chemistry of the RAS Center for Collective Use «Chemistry». IR spectra were recorded on a Shimadzu IR Prestige-21 spectrometer (thin films or vaseline oil). ^{1}H and ^{13}C NMR spectra were recorded on a spectrometer Bruker AM-300 (operating frequency of 300.13 MHz, ^{1}H and 75.47 MHz, ^{13}C) and Bruker Avance-III 500 MHz (operating frequency of 500.13 MHz ^{1}H and 125.47 MHz ^{13}C) in $CDCl_3$, internal standard residual $CHCl_3$ (δ = 7.27 ppm). Electrospray ionization mass spectra were obtained on a HPLC mass spectrometer LCMS-2010EV (Shimadzu), in the positive and negative ions mode at the electrode potentials of 4.5 kV and –3.5 kV respectively. Mobile phase was acetonitrile–water (95: 5), 0.1 ml/min. Microanalyses were obtained using a Carlo Erba 1106 Analyzer MOD 1106 instrument. TLC was carried out on Sorbfil plates (Sorbpolimer, Krasnodar, Russia) in petroleum ether (PE)–ethyl acetate (EA) and chloroform–methanol in various proportions; spots were visualized with anisaldehyde. Standard work up consisted of drying with anhydrous $MgSO_4$, vacuum evaporation and separation and purification by column chromatography on Silica gel (Silica 60, 0.04–0.063 mm).

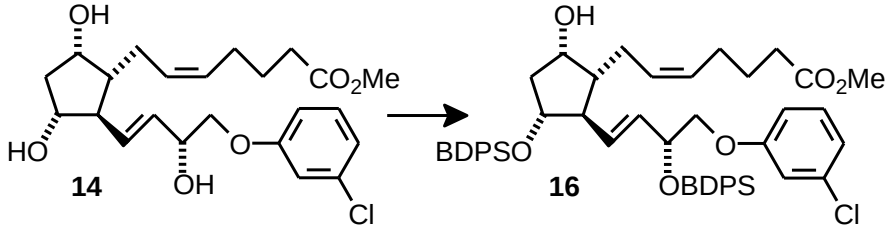


Methyl (±)-16-(3-chlorophenoxy)-9*α*,11*α*,15*α*-trihydroxy-17,18,19,20-tetranor-5*Z*,13*E*-prostadienoate (14). Potassium carbonate (5.02 g, 36.3 mmol) was added at r.t. to a stirred solution of cloprostenol **10** (7.50 g, 17.65 mmol) in acetone (150 ml) under Ar atmosphere. The mixture was stirred 2 h, and then MeI (26.5 ml, 363 mmol) was added dropwise, and a vigorous stirring was continued for 20 h. The suspension was converted into a solution by dilution with H_2O (100 ml) and extracted with $CHCl_3$ (10 x 50 ml). Standard work up afforded the title compound **14** as a yellow oil (5.98 g, 77%), R_f = 0.35 ($CHCl_3$–MeOH, 20:1). IR (KBr) ν_{max}: 3384, 2932, 1734, 1595, 1580, 1479, 1436, 1248, 1231, 1034 cm^{-1}. ^1H NMR (300.13 MHz, $CDCl_3$, *J*/Hz): δ 1.40 – 1.80 m (4H), 2.00 – 2.40 m (8H), 2.80 br.s (3H, 3 OH), 3.65 s (3H, OCH_3), 3.80 – 4.00 m (3H, CH_2O, C^{15}–H), 4.20 m (1H), 4.50 m (1H) (C^9–H, C^{11}–H), 5.35 m (2H, CH=CH), 6.85 dd (1H, *J* = 1.3, 8.0), 6.90 m (2H), 7.20 t (1H, *J* = 2.5) (Ar). ^{13}C NMR (75.47 MHz, $CDCl_3$): 24.72 (C^3), 25.32 (C^7), 26.55 (C^4), 33.37 (C^2), 42.78 (C^{10}), 49.75 (C^8), 51.62 (OMe), 55.43 (C^{12}), 70.97 (C^{15}), 71.84 (C^{16}), 72.19 (C^9), 77.28 (C^{11}), 113.06, 115.04, 121.17, 130.28, 134.80, 159.31 (*m*-ClPh), 129.05 (C^6), 129.56 (C^5), 130.28 (C^{13}), 135.59 (C^{14}), 174.46 (CO_2). ESI *m/z*: 461 $[M+Na]^+$ (100%).



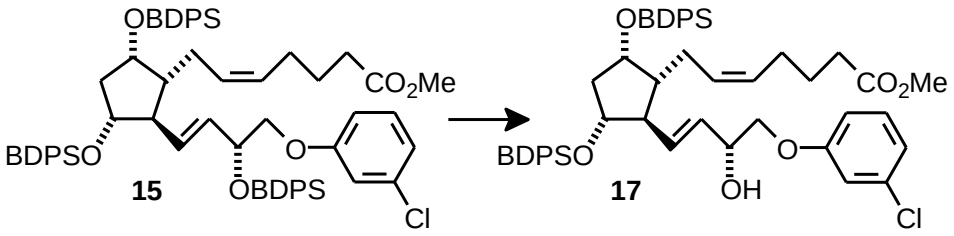
Methyl (±)-9*α*,11*α*,15*α*-tris(*tert*-butyldiphenylsilyloxy)-16-(3-chlorophenoxy)-17,18,19,20-tetranor-5*Z*,13*E*-prostadienoate (15). A solution of triol **14** (0.23 g, 0.524 mmol), imidazole (0.275 g, 4.00 mmol) and BDPSCl (0.555 g, 2.00 mmol) in CH_2Cl_2 (25 ml) was stirred at r.t. for 48 h and then diluted with brine (20 ml).

Standard work up of the organic layer gave the tris-silyl ether **15** as a colorless oil (0.567 g, 94%), R_f = 0.7 (PE–EA, 5 : 1). IR (KBr): 1717, 1590, 1428, 1113, 700 cm^{-1}. ^1H NMR (300.13 MHz, $CDCl_3$, *J*/Hz): δ 0.85 – 0.90 m (2H), 0.97 s (2 Me), 1.00 s (2 Me), 1.07 s (3 Me), 1.09 s (2 Me) (3 CMe_3), 1.25 – 1.30 m (3H), 1.55 – 1.68 m (4H), 2.23 t (2H, *J* = 7.5, C^2–H), 2.55 – 2.60 m (1H), 3.50 dd (1H, *J* = 4.2, 9.6, C^{16}–H), 3.58 –3.68 m (1H, C^{16}–H), 3.64 s (3H, OCH_3), 3.72 q (1H, *J* = 7.2), 4.03 q (1H, *J* = 5.2), 4.40 quint (1H, *J* = 4.0) (C^9–H, C^{11}–H, C^{15}–H), 5.20 –5.30 m (2H, CH=CH), 5.35 – 5.40 m (2H, CH=CH),6.38 dd (1H, *J* = 2.4, 8.2), 6.50 t (1H, *J* = 2.2), 6.85 dd (1H, *J* = 1.0, *J* = 7.9), 7.05 t (1H, *J* = 8.2) (*m*-ClPh), 7.20 – 7.80 m (30H, 6 Ph). ^{13}C NMR (75.47 MHz, $CDCl_3$): 19.07, 19.20, 19.45 (3 Si<u>C</u>Me_3), 24.82 (C^3), 26.62, 27.07, 27.17 (3 C<u>Me</u>$_3$), 26.88 (C^4, C^7), 33.60 (C^2), 43.30 (C^{10}), 48.42 (C^8), 51.15 (OCH_3), 54.42 (C^{12}), 71.96 (C^{15}), 72.10 (C^{16}), 73.22 (C^9), 77.22 (C^{11}), 112.86, 114.84, 120.64, 127.51, 127.78, 128.97, 129.58, 129.69, 129.96, 133.52, 133.71, 134.01, 134.11, 134.22, 134.61, 134.87, 135.26, 135.97, 136.01, 136.07, 159.32 (6 Ph, *m*-ClPh, 2 CH=CH), 173.50 (CO_2). ESI *m/z*: 1175 $[M+Na]^+$ (100%).



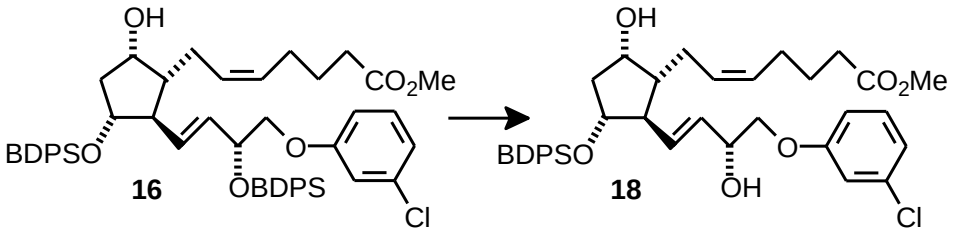
Methyl (±)-11α,15α-bis(*tert*-butyldiphenylsilyloxy)-9α-hydroxy-16-(3-chloro-phenoxy)-17,18,19,20-tetranor-5*Z*,13*E*-prostadienoate (16). To a stirred solution of imidazole (3.85 g, 56.7 mmol) and compound **14** (5.87 g, 13.37 mmol) in CH_2Cl_2 (200 ml) BDPSCl (7.4 g, 26.9 mmol) was being added in portions (7 x 1 ml) within 15 h. After full conversion of **14** (TLC) the reaction mass was evaporated *in vacuo* and the colourless residue was purified by column chromatography to afford the title compound **16** as a colourless oil (8.89 g, 73 %), R_f = 0.4 (PE – EA, 5:1). IR (KBr) ν_{max}: 3500, 2930, 2857, 1738, 1735, 1595, 1427, 1112, 702 cm^{-1}. ^1H NMR (300.13 MHz, $CDCl_3$, *J*/Hz): δ 0.90 m (2H), 1.03 s (9H,

$SiCMe_3$), 1.06 s (9H, $SiCMe_3$), 1.20 – 1.40 m (3H), 1.50 – 1.73 m (4H), 2.05 – 2.13 m (2H), 2.30 t (2H, *J* = 7.6, $\underline{CH_2}CO_2$), 3.65 s (3H, OCH_3), 3.50 – 3.70 m (3H, C^{16}–H_2, OH), 4.00 – 4.10 m (2H, C^{11}–H, C^{15}–H), 4.32 – 4.40 m (1H, C^9–H), 5.25 m (2H, CH=CH), 5.30 – 5.40 m (2H, CH=CH), 6.45 ddd (1H, *J* = 0.8, 2.4, 8.3), 6.60 t (1H, *J* = 2.3), 6.85 ddd (1H, *J* = 0.9, 1.8, 7.9), 7.10 t (1H, *J* = 8.2) (*m*-ClPh), 7.25 – 7.45 m and 7.55 –7.72 m (20H, 4 Ph). ^{13}C NMR (75.47 MHz, $CDCl_3$): 18.94, 19.30 ($Si\underline{C}Me_3$), 24.82 (C^3), 26.62 (C^4, C^6), 26.92 ($C\underline{Me}_3$), 33.47 (C^2), 42.63 (C^{10}), 50.66 (OCH_3), 51.44 (C^8), 55.49 (C^{12}), 71.82 (C^9), 71.94 (C^{16}), 74.20 (C^{15}), 80.25 (C^{11}), 112.83, 114.75, 120.67, 127.42, 133.56, 159.25 (m-Ph-Cl), 127.42, 127.68, 128.91, 129.30, 129.39, 129.60, 129.81, 129.99, 133.29, 133.70, 133.79, 134.63, 135.87, (2 $SiPh_2$, 2 CH=CH), 174.11 (CO_2). ESI *m/z*: 933 $[M+H_2O]^+$ (30%), 257 $[Me_3CPh_2SiOH+H]^+$ (100%).



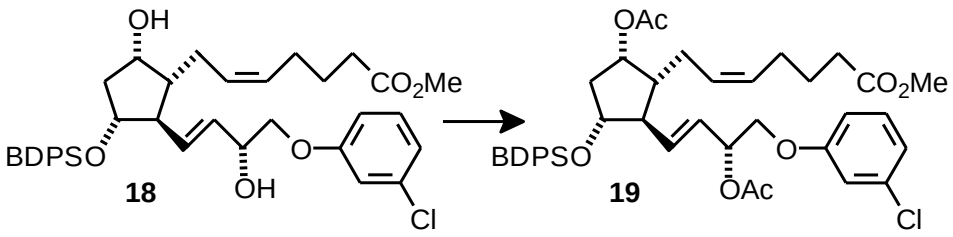
Methyl (±)-9*α*,11*α*-bis(*tert*-butyldiphenylsilyloxy)-15*α*-hydroxy-16-(3-chloro-phenoxy)-17,18,19,20-tetranor-5*Z*,13*E*-prostadienoate (17). A mixture of a solution of tris-silane **15** (0.466 g, 0.404 mmol) in THF (20 ml) and 1 *M* solution of Bu_4NF in THF (0.5 ml, 1.1 eq.) was stirred for 20 h at r.t. The reaction mixture was diluted with 50% brine and extracted with ethyl acetate. Standard work up of the extract afforded 0.217 g of bis-silane **17** as a colourless oil (59%), R_f = 0.30 (PE – EA, 7:3) IR (KBr) ν_{max}: 3500, 2930, 1738, 1735, 1595, 1427, 1112, 702 cm^{-1}. ^{1}H NMR (300.13 MHz, $CDCl_3$, *J*/Hz): δ 0.83 –0.90 m (2H), 1.00 s (3H, CH_3), 1.10 s (3H, CH_3), 1.25 –1.30 m (2H), 1.60 – 1.75 m (3H), 1.95 – 2.00 m (2H), 2.25 t (2H, *J* = 7.4, C^2–H), 2.65 – 2.75 m (1H), 3.62 s (3H, OMe), 3.65 – 3.80 m (3H, C^{16}–H_2, C^{15}–H), 3.80 – 4.15 m (1H), 4.30 – 4.35 m (1H, C^{11}), 5.20 – 5.40 m (3H, C^5–H, C^6–H, C^{13}–H), 5.50 dd (1H, *J* = 5.8, 15.0, C^{14}–H), 6.45 ddd (1H, *J* = 0.8, 2.4, 8.3), 6.60 t (1H, *J* = 2.3), 6.85 ddd (1H, *J* = 0.9, 1.8, 7.9), 7.10 t (1H, *J* = 8.2)

(m-ClPh), 7.25 – 7.45 m and 7.55 –7.72 m (20H, 4 Ph). ^{13}C NMR (75.47 MHz, $CDCl_3$): 19.18, 19.45 (Si—$\underline{C}Me_3$), 24.68 (C^3), 25.12 (C^7), 26.65 (C^4), 27.00 ($C\underline{Me}_3$), 27.16 ($C\underline{Me}_3$), 33.41 (C^2), 44.02 (C^{10}), 49.20 (C^8), 51.53 (OMe), 55.05 (C^{12}), 70.67 (C^{15}), 70.93 (C^{16}), 73.06 (C^9), 77.62 (C^{11}), 113.21, 114.98, 121.18, 127.47, 127.53, 128.82, 129.51, 129.57, 129.83, 130.22, 133.94, 134.00, 134.27, 134.63, 134.87, 135.19, 136.01, 136.10, 159.37 (2 $SiPh_2$, 2 CH=CH, *m*-ClC_6H_4O). ESI *m/z*: 933 $[MH+H_2O]^+$ (45%), 769 (100%).

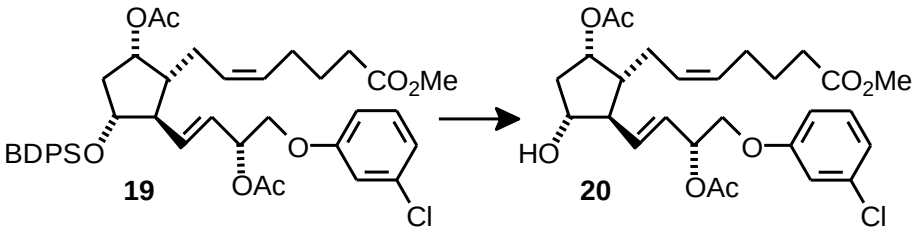


Methyl (±)-9α,15α-dihydroxy-11α-*tert*-butyldiphenylsilyloxy-16-(3-chloro-phenoxy)-17,18,19,.20-tetranor-5*Z*,13*E*-prostadienoate (18). A solution (1 *M*) of Bu_4NF in THF (10.45 ml, 10.45 mmol) was added portionwise at r.t. (0.5 ml every 2.5 h) to a solution of the bis-silane **16** (8.72 g, 9.52 mmol) in THF (45 ml). The reaction mixture was diluted with CH_2Cl_2 (100 ml) and the solution was washed with water (2 x 10 ml). Standard work up afforded the title compound **18** as a colourless viscous oil (5.16 g, 80%), R_f = 0.2 (PE – EA, 5:1). IR (KBr) ν_{max}: 3500, 1734, 1730, 1718, 1595, 1428, 1248, 1112, 703 cm^{-1}. ^{1}H NMR (300.13 MHz, $CDCl_3$, *J*/Hz): δ 1.03 s (9H, $SiCMe_3$), 1.40 – 1.50 m (1H), 1.60 –1.70 m (2H), 1.90 m (1H), 2.10 – 2.20 m (3H), 2.30 t (3H, C^2-H_2, *J* = 7.4), 2.40 –2.50 (1H), 3.63 s (3H, OMe), 3.60 – 3.70 m (2H, C^{16}–H_2), 4.00 – 4.10 m (2H, C^9–H, C^{15}–H), 4.30 – 4.40 m (1H, C^{11}–H), 5.30 – 5.50 m (4H, 2 CH=CH), 6.80 m (1H), 6.90 s (1H), 7.00 d (1H, *J* = 7.9), 7.20 t (1H, *J* = 8.1) (*m*-ClPh), 7.40 m (6H) and 7.70 m (4H) ($SiPh_2$). ^{13}C NMR (75.47 MHz, $CDCl_3$): 18.97 (Si$\underline{C}$Me), 24.76 (C^3), 26.00 (C^7), 26.80 (C^4), 26.92 (SiC$\underline{Me}_3$), 33.38 (C^2), 43.06 (C^{10}), 50.55 (C^8), 51.51 (OMe), 55.81 (C^{12}), 70.41 (C^{15}), 71.89 (C^{16}), 73.50 (C^9), 79.76 (C^{11}), 113.15, 114.92, 124.24, 127.62, 127.68, 128.77, 129.22, 129.43, 129.81, 130.20, 133.35, 133.59,

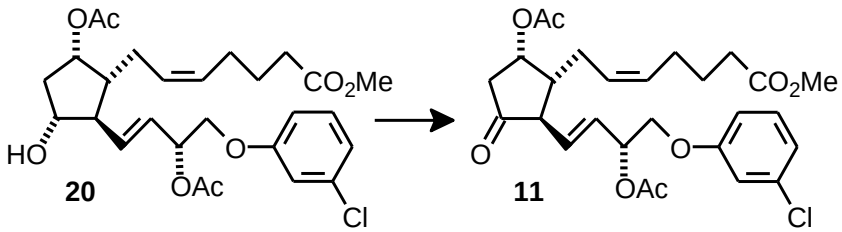
134.45, 134.85, 135.90, 136.01, 159.23, (2 Ph, 2 CH=CH), 174.00 (CO_2). ESI *m/z*: 659 $[MH - H_2O]^+$ (45%), 531 $[MH - H_2O - C_6H_5ClO]^+$ (100%).



Methyl (±)-9α,15α-Diacetoxy-11α-(*tert*-butyldiphenylsilyloxy)-16-(3-chloro-phenoxy)-17,18,19,20-tetranor-5*Z*,13*E*-prostadienoate (19). The solution of compound **18** (4.99 g, 7.36 mmol), Ac_2O (4.08 g, 40 mmol) and DMAP (0.2 g, 1.63 mmol) in Py (40 ml) was stirred at r.t. for 10 h and then diluted with water (40 ml) and EtOAc (40 ml). After 30 min stirring, the organic layer was separated and subsequently washed with water (3 x 20 ml), 0.5 *M* HCl (20 ml) and brine (20 ml). After standard work up the title compound **19** was isolated as a colourless oil (4.81 g, 86 %), R_f = 0.7 (PE – EA, 7 : 3). IR (KBr) ν_{max}: 2857—2952, 1738, 1734, 1596, 1428, 1373, 1236, 1045, 703 cm^{-1}. ^1H NMR (300.13 MHz, $CDCl_3$, *J*/Hz): δ 1.02 s (9H, $SiCMe_3$), 1.25 m (2H), 1.50 –1.70 m (5H), 1.90 – 2.20 m (2H), 2.00 s (3H, OAc), 2.07 s (3H, OAc), 2.25 t (2H, *J* = 7.4, C^2–H_2), 2.60 m (1H), 3.62 s (3H, OCH_3), 3.85 – 4.00 m (2H, C^{16}–H_2), 4.95 m (1H, C^9–H), 5.30 m (2H, CH=CH), 5.40 m (1H, C^{15}–H), 5.60 m (2H, CH=CH), 6.73 ddd (1H, *J* = 2.4, 8.2), 6.85 t (1H, *J* = 2.2), 6.93 dd (1H, *J* = 0.8, 7.9), 7.18 t (1H, *J* = 8.1), (*m*-ClPh), 7.32 –7.45 m and 7.60 – 7.65 m (10H, $SiPh_2$). ^{13}C NMR (75.47 MHz, $CDCl_3$): 19.19 ($SiCMe_3$), 21.13 (CH_3), 21.31 (CH_3), 24.73 (C^3), 25.04 (C^7), 26.55 (C^4), 26.92 ($SiCMe_3$), 33.39 (C^2), 41.77 (C^{10}), 46.87 (C^8), 51.50 (OMe), 55.82 (C^{12}), 69.24 (C^{16}), 71.99 (C^{15}), 74.24 (C^9), 113.18, 115.06, 121.33, 127.07, 127.56, 127.64, 128.25, 129.69, 129.76, 130.26, 133.79, 133.88, 134.87, 135.98, 136.10, 159.19 ($SiPh_2$, 2CH=CH), 170.01 (OAc), 170.60 (OAc), 173.99 (CO_2). ESI *m/z*: 783 $[M+Na]^+$ (100%).

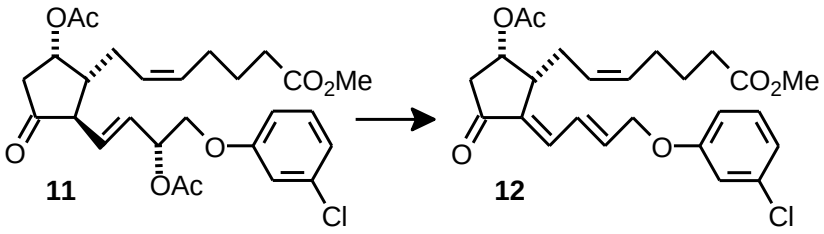


Methyl (±)-9α,15α-Diacetoxy-11α-hydroxy-16-(3-chlorophenoxy)-17,18,19,20-tetranor-5*Z*,13*E*-prostadienoate (20). The mixture of solution of diacetate **19** (4.75 g, 6.24 mmol) in THF (150 ml) and 1 *M* solution of Bu_4NF in THF (7.27 ml, 7.27 mmol) was stirred at r. t. for 12 h and after standard work up the title compound **20** was obtained as colourless oil (3.06 g, 94%), R_f = 0.25 (PE –EA, 7: 3). IR (KBr) ν_{max}: 3500, 1735, 1595, 1239, 1042 cm^{-1}. ^1H NMR (300.13 MHz, $CDCl_3$, *J*/Hz): δ 1.55 – 1.65 m (4H), 1.80 br.s (OH), 2.04 s (3H, OAc), 2.09 s (3H, OAc) 2.00 – 2.20 m (4H), 2.25 t (3H, *J* = 7.6, C^2–H_2), 2.35 – 2.55 m (1H), 3.65 s (3H, OCH_3), 3.95 – 4.10 m (3H, C^{11}–H, C^{16}–H_2), 5.10 m (1H, C^9–H), 5.30 m (2H, CH=CH), 5.60 m (1H, C^{15}–H), 5.70 m (2H, CH=CH), 6.85 m (1H), 6.90 m (2H), 7.20 t (1H, *J* = 7.9) (*m*-ClPh). ^{13}C NMR (75.47 MHz, $CDCl_3$): 21.23 ($2CH_3$), 24.67 (C^3), 25.12 (C^7), 26.55 (C^4), 33.36 (C^2), 41.02 (C^{10}), 47.59 (C^8), 51.50 (OMe), 55.85 (C^{12}), 69.30 (C^{16}), 72.32 (C^{15}), 74.40 (C^9), 76.34 (C^{11}), 113.09, 115.10, 121.42, 130.31, 134.90, 159.14 (*m*-ClPh), 127.42, 128.04 (C^5, C^6), 129.84 (C^{14}), 136.16 (C^{13}), 170.52 (OAc), 170.48 (OAc), 173.96 (CO_2). ESI *m/z*: 557 $[M+Cl]^-$ (100%). Anal. $C_{27}H_{35}ClO_8$: calcd C 62.01%, H 6.74%; found: C 62.10%, H 6.85%.



Methyl (±)-9α,15α-Diacetoxy-9-oxo-16-(3-chlorophenoxy)-17,18,19,20-tetranor-5*Z*,13*E*-prostadienoate (11). A mixture of alcohol **20** (2.92 g, 5.58 mmol) and PCC (2.35 g, 10.9 mmol) in CH_2Cl_2 (100 ml) was stirred 12 h and filtered through a pad of SiO_2. Standard work up of the filtrate gave the title compound **11** as a yellow oil (2.25 g, 77 %), R_f = 0.40 (PE – EA, 7:3). IR (KBr) ν_{max} : 1780,

1734, 1239, 1038 cm^{-1}. ^1H NMR (500.13 MHz, $CDCl_3$, *J*/Hz): δ 1.25 m (1H), 1.60 – 1.70 m (2H), 2.06 s (3H, OAc), 2.09 s (3H, OAc), 1.95 – 2.05 m (1H), 2.12 – 2.18 m (1H), 2.26 d (1H, *J* = 8.4), 2.28 t (2H, *J* = 7.5, C^2–H_2), 2.47 d (1H, *J* = 19.3, C^{10}–H), 2.53 dd (1H, *J* = 4.5, 19.3, C^{10}–H), 2.87 dd (1H, *J* = 7.3, 12, C^{12}–H), 3.65 s (3H, OCH_3), 4.00 – 4.10 m (2H, C^{16}–H_2), 5.40 m (3H, CH=CH, C^9–H), 5.63 q (1H, *J* = 5.8, C^{15}–H), 5.67 dd (1H, *J* = 6.4, 15.5), 5.75 dd (1H, *J* = 15.4, 6.3) (C^{13}–H, C^{14}–H), 6.78 dd (1H, *J* = 0.7, 2.3), 6.90 t (1H, *J* = 2.1), 6.59 m (1H), 7.19 t (1H, *J* = 8.1) (Ar). ^{13}C NMR (125.47 MHz, $CDCl_3$): 21.03 (CH_3), 21.10 (CH_3), 24.64 (C^3), 25.89 (C^7), 26.57 (C^4), 33.33 (C^2), 45.40 (C^{10}), 46.65 (C^8), 51.50 (OCH_3), 54.91 (C^{12}), 69.15 (C^{16}), 71.09 (C^9), 71.68 (C^{15}), 113.09, 115.18, 121.43, 126.63, 129.43, 129.66, 130.28, 134.91, 159.12 (2 CH=CH, Ar), 170.00 (OAc), 170.24 (OAc), 174.84 (CO_2), 213.31 (CO). ESI *m/z*: 543 $[M+Na]^+$ (73%), 461 $[M–OAc]^+$ (89%), 562 $[M+H+MeCN]^+$ (100%). Anal. $C_{27}H_{33}ClO_8$: calcd C 62.25%, H 6.38%; found: C 62.35%, H 6.40%.

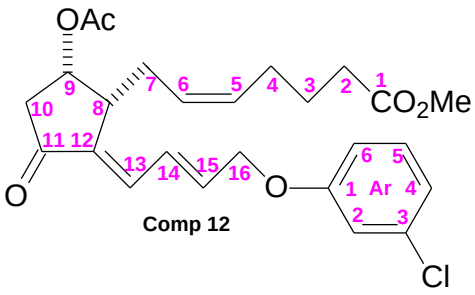


Methyl (±)-9α-Acetoxy-15-deoxy-11-oxo-17,18,19,20-tetranor-16-(3-chloro-phenoxy)-12*E*,14*E*-prostadienoate (12). A solution of compound **11** (1.91 g, 3.67 mmol) and DBU (0.4 ml, 0.393 g, 2.58 mmol) in C_6H_6 (200 ml) was stirred at room temperature for 12 h. The resulting mixture was filtered through a pad of SiO_2. Standard work up of the filtrate resulted in the title compound **12** as a yellow oil (0.767 g, 45%), R_f = 0.55 (PE – EA, 7:3). IR (KBr) ν_{max} (cm^{-1}): 1738, 1734, 1239. ^1H NMR (500.13 MHz, $CDCl_3$, *J*/Hz): δ 1.62 quint (2H, *J* = 7.5, C^3–H), 1.95 – 2.00 m (2H, C^4-H), 2.06 s (3H, OAc), 2.10 – 2.15 m (1H, C^7-H^a), 2.25 t (2H, *J* = 7.5, C^2–H), 2.30 m (1H, C^7-H^b), 2.54 dd (1H, *J* = 8.4, 18.1, C^{10}–H^a), 2.74 ddd (1H, *J* = 3.6, 7.8, 18.1, C^{10}–H^b), 3.16 q (1H, *J* = 6.5, C^8–H), 3.63 s (3H, OCH_3), 4.70 s (2H, C^{16}–H_2), 5.26 – 5.34 m (2H, C^5–H, C^6–H), 5.36 q (1H, *J* = 8.0, C^9–H), 6.23

br.t (1H, *J* = 1.2, C^{13}–H), 6.42 d (1H, *J* = 16.0, C^{14}–H), 6.77 dd (1H, *J* = 2.3, 8.4, $C^{4'}$-H), 6.89 t (1H, *J* = 2.1, $C^{2'}$-H), 6.95 dd (1H, *J* = 1.1, 8.0, $C^{6'}$-H), 7.19 t (1H, *J* = 8.1, $C^{5'}$-H), 7.38 d (1H, *J* = 16.0, C^{15}–H). ^{13}C NMR (125.47 MHz, $CDCl_3$): 21.01 ($OC\underline{C}H_3$), 24.69 (C^3), 25.16 (C^7), 26.64 (C^4), 33.38 (C^2), 37.27 (C^{10}), 44.45 (C^8), 51.48 (OCH_3), 72.29 (C^{16}), 75.42 (C^9), 112.96 ($C^{4'}$), 115.22 ($C^{2'}$), 121.69 (C^{14}), 121.90 ($C^{6'}$), 127.96 ($C^{5/6}$), 129.91 ($C^{5/6}$), 130.42 ($C^{5'}$), 135.06 ($C^{3'}$), 138.91 (C^{13}), 139.50 (C^{15}), 142.99 (C^{12}), 158.56 ($C^{1'}$), 170.84 ($O\underline{C}Me$), 173.92 (CO_2), 195.29 (C^{11}). ESI *m/z*: 461 $[M+H]^+$ (94%), 401 $[M - OAc]^+$ (88%), 483 $[M+Na]^+$ (100%). Anal. $C_{25}H_{29}ClO_6$: calcd C 65.14%, H 6.34%; found C 65.25%, H 6.38%.

Table 1

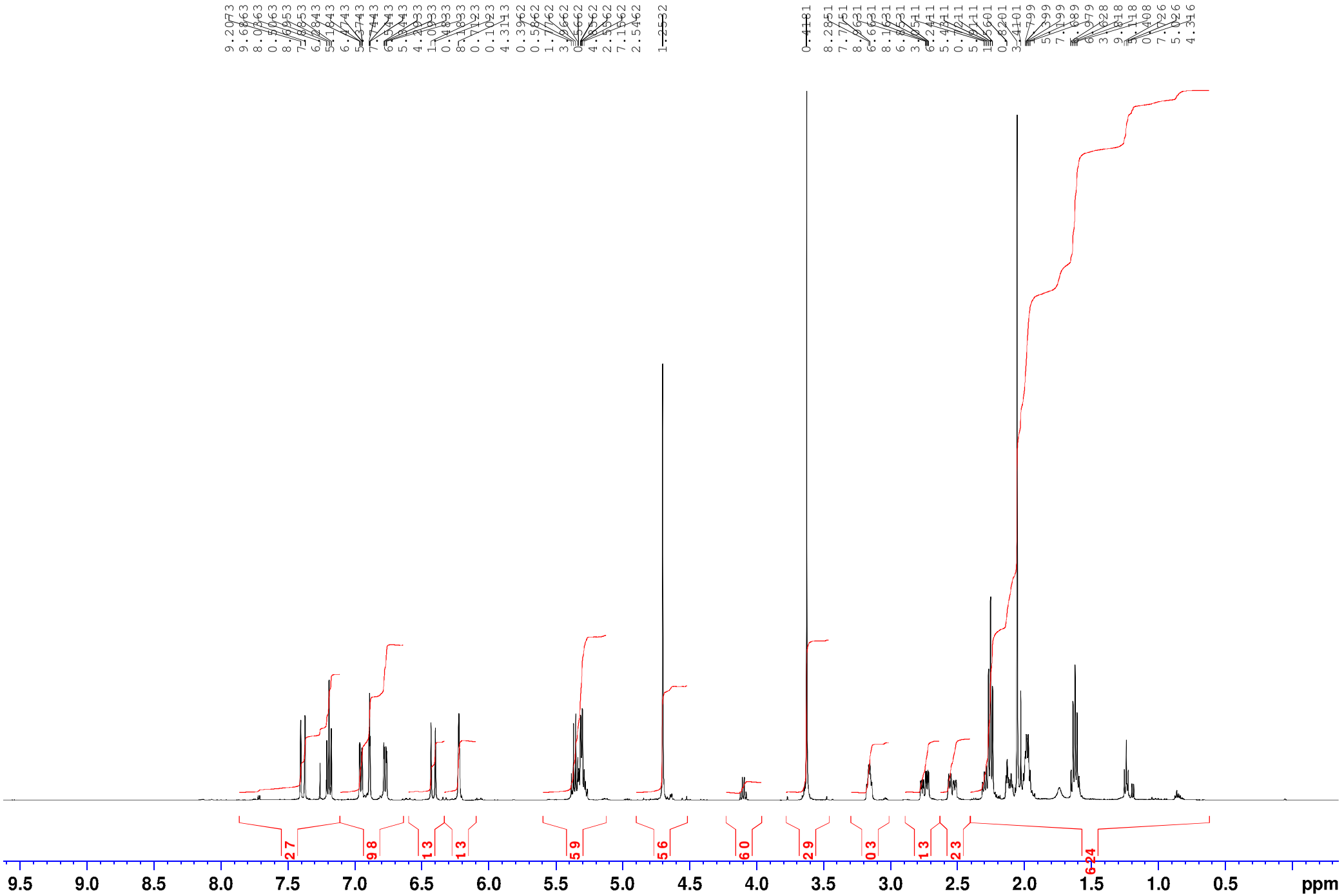
NMR data and most significant correlations in 2D spectra of compound **12**



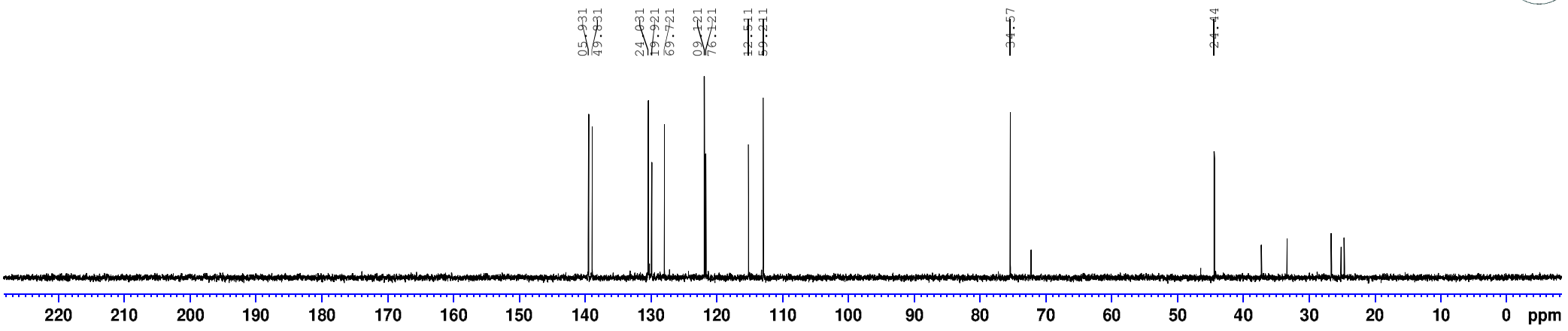
Comp 12

Atom number	Type	Signals in 1D spectra, ppm (500 MHz, $CDCl_3$) ^1H		^{13}C	Correlations to atoms, in 2D spectra COSY H→H	HSQC H→C	HMBC H→C	NOESY H→H
1	COO	**-**	-	**173.92**	-	-	9, OMe	
2	CH_2	**2.25**	t 7.5	**33.38**	3	+		
3	CH_2	**1.62**	quin 7.5	**24.69**	2	+		
4	CH_2	**1.98**	m	**26.64**	5	+		
5	=CH	**5.30**	m	**127.96/ 129.91**	4	+		
6	=CH	**5.30**	m	**- " -**	7a,b	+		
7-a	CH_2	**2.13**	m	**25.16**	6, 7b	+		
7-b	CH_2	**2.30**	m	**- " -**	6, 7a	+		
8	CH	**3.16**	q 6.5	**44.45**	7a,b	+		
9	CHO	**5.36**	q 8.0	**75.42**	8, 10a,b	+		
10_a	CH_2a	**2.54**	dd 8.4, 18.1	**37.27**	9, 10b	+		
10_b	CH_2b	**2.74**	ddd 3.6, 7.8, 18.1	- " -	9, 10a	+		
11	C=O	**-**	-	**195.29**	-	-	14-16	
12	=C	**-**	-	**142.99**	-	-	7a,b, 8, 10a,b, 14, 15	
13	=CH	**6.23**	br.t 1.2	**138.91**	10a,b	+	8, 9, 10a,b, 12, 14, 15	
14	=CH	**6.42**	d 16.0	**121.69**	15	+	11-13, 16	8, 15, 16
15	=CH	**7.38**	d 16.0	**139.50**	14	+	8, 11-14	13, 14, 16
16	CH_2O	**4.70**	s	**72.29**	-	+	9, 1Ar	14, 15, 2Ar, 4Ar
1Ar	C	**-**	-	**158.56**	-	-	2,4,5,6Ar	
2Ar	CH	**6.89**	t 2.1	**115.22**	4Ar, 6Ar	+	4,5,6Ar	
3Ar	CCl	**-**	-	**135.06**	-	-	2,4,5,6Ar	
4Ar	CH	**6.77**	dd 2.3, 8.4	**112.96**	2Ar, 5Ar	+	2,5,6Ar	
5Ar	CH	**7.19**	t 8.1	**130.42**	4Ar, 6Ar	+	none	
6Ar	CH	**6.95**	dd 1.1, 8.0	**121.90**	2Ar, 5Ar	+	2,4,5Ar	
OMe	OCH_3	**3.63**	s	**51.48**	-	+		
OAc_a	COO	**-**	-	**170.84**	-	-	9, Ac	
OAc_b	CH_3	**2.06**	s	**21.01**	-	+		

Pic. 1. ^{1}H spectrm of compound **12** in $CDCl_3$ at 500.13 MHz

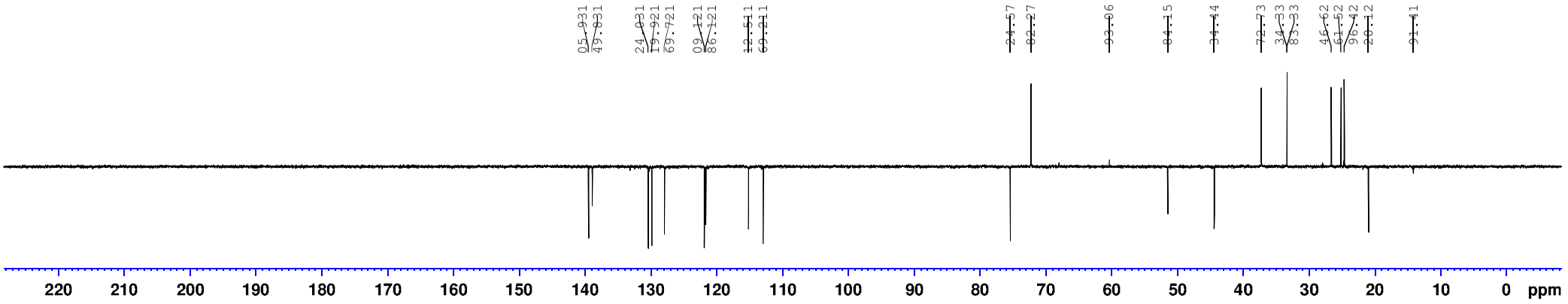


Pic. 2. ^{13}C spectra of compound **12** in $CDCl_3$ at 125.47 MHz



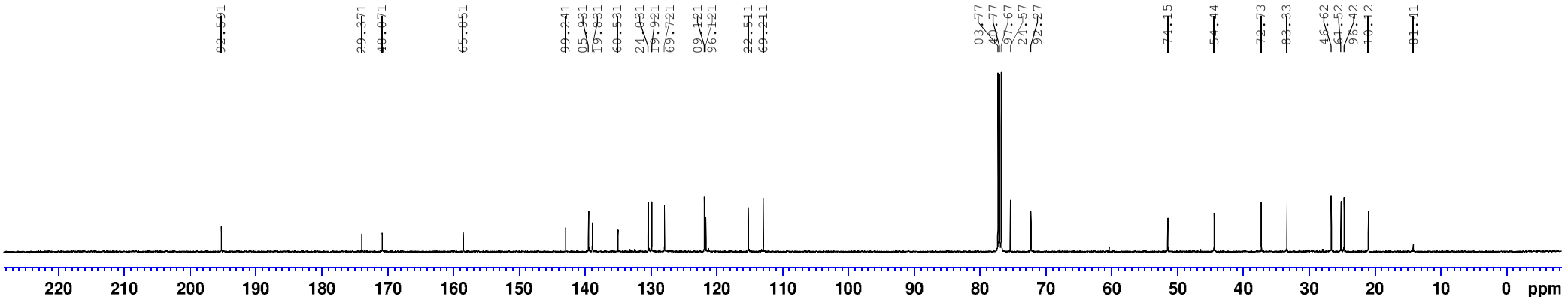
Sp-198 lobco camp-8a 51mg in CDCl3, 13C{1H} dept135 AV500 04.06.2015 SSH

SW(13C)=236.63ppm; O1(13C)=110.00ppm; Obs.Freq.:125.76MHz; D1=2.0s; T=294.0K; Probe:BBO; Exp.Time: 7 min 9 sec; Time&Date: 10:11:36 04 Jun 2015.

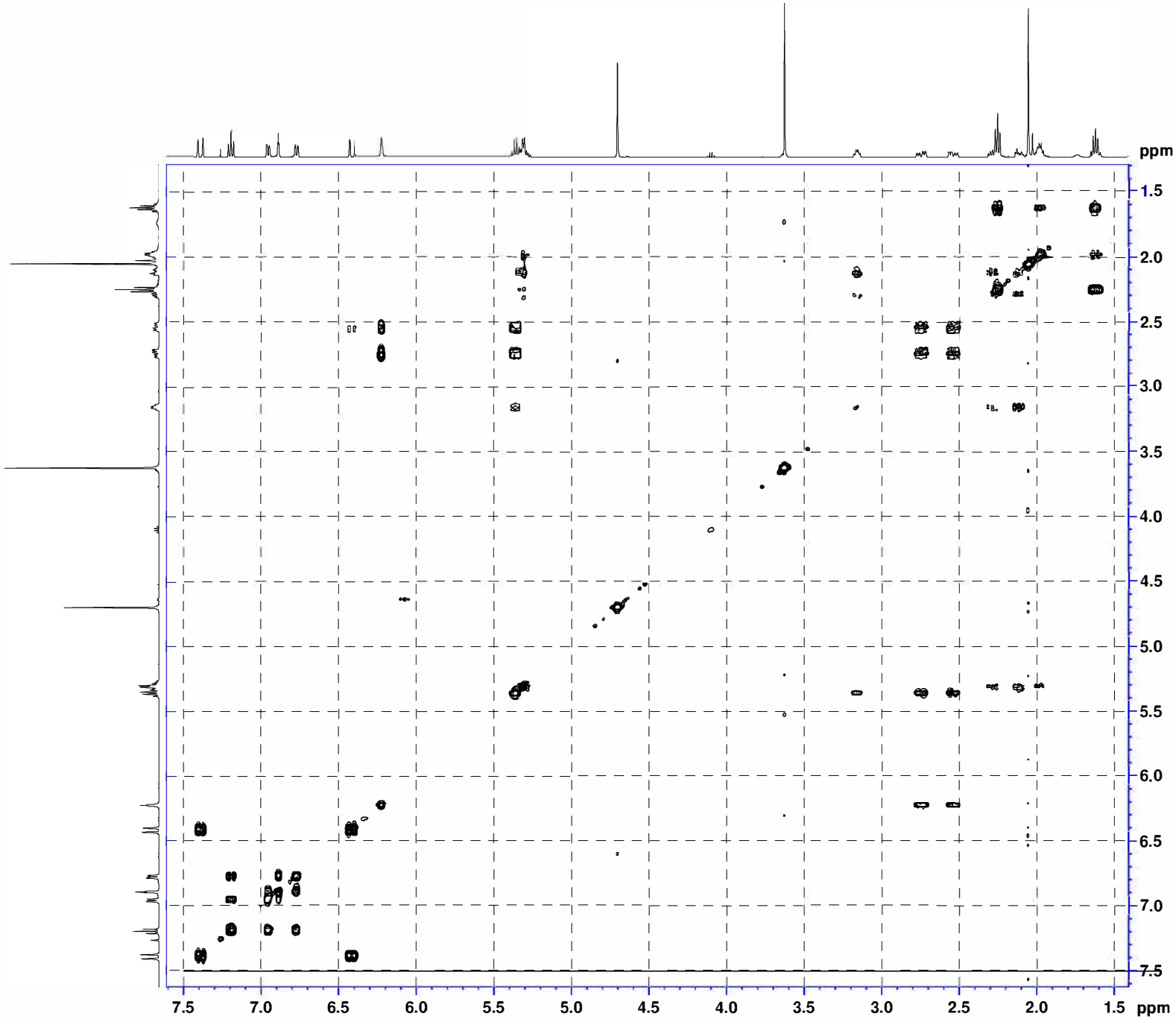


Sp-198 lobco camp-8a 51mg in CDCl3, 13C{1H} com AV500 04.06.2015 SSH

SW(13C)=236.63ppm; O1(13C)=110.00ppm; Obs.Freq.:125.76MHz; D1=0.9s; T=294.5K; Probe:BBO; Exp.Time:17 min 38 sec; Time&Date: 10:04:24 04 Jun 2015.



Pic. 3. ^{1}H-^{1}H COSY spectrum of compound **12** in $CDCl_3$

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PROCNO                 1

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TD                 2048
SOLVENT            CDCl3
NS                    1
DS                   16
SWH          5000.000 Hz
FIDRES       2.441406 Hz
AQ           0.2048500 sec
RG                38.27
DW             100.000 usec
DE               6.50 usec
TE              293.3 K
D0           0.00000300 sec
D1           1.50000000 sec
D13          0.00000400 sec
D16          0.00010000 sec
IN0          0.00020000 sec

======== CHANNEL f1 ========
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P1                11.50 usec
PLW1         15.84899998 W
SFO1         500.1320005 MHz

====== GRADIENT CHANNEL =====
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GPZ1              10.00 %
P16             1000.00 usec

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FIDRES       9.765625 Hz
SW              9.997 ppm
FnMODE               QF

F2 - Processing parameters
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SF          500.1300125 MHz
WDW               QSINE
SSB       0
LB        0 Hz
GB        0
PC                  1.00

F1 - Processing parameters
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MC2                  QF
SF          500.1300125 MHz
WDW               QSINE
SSB       0
LB        0 Hz
GB        0
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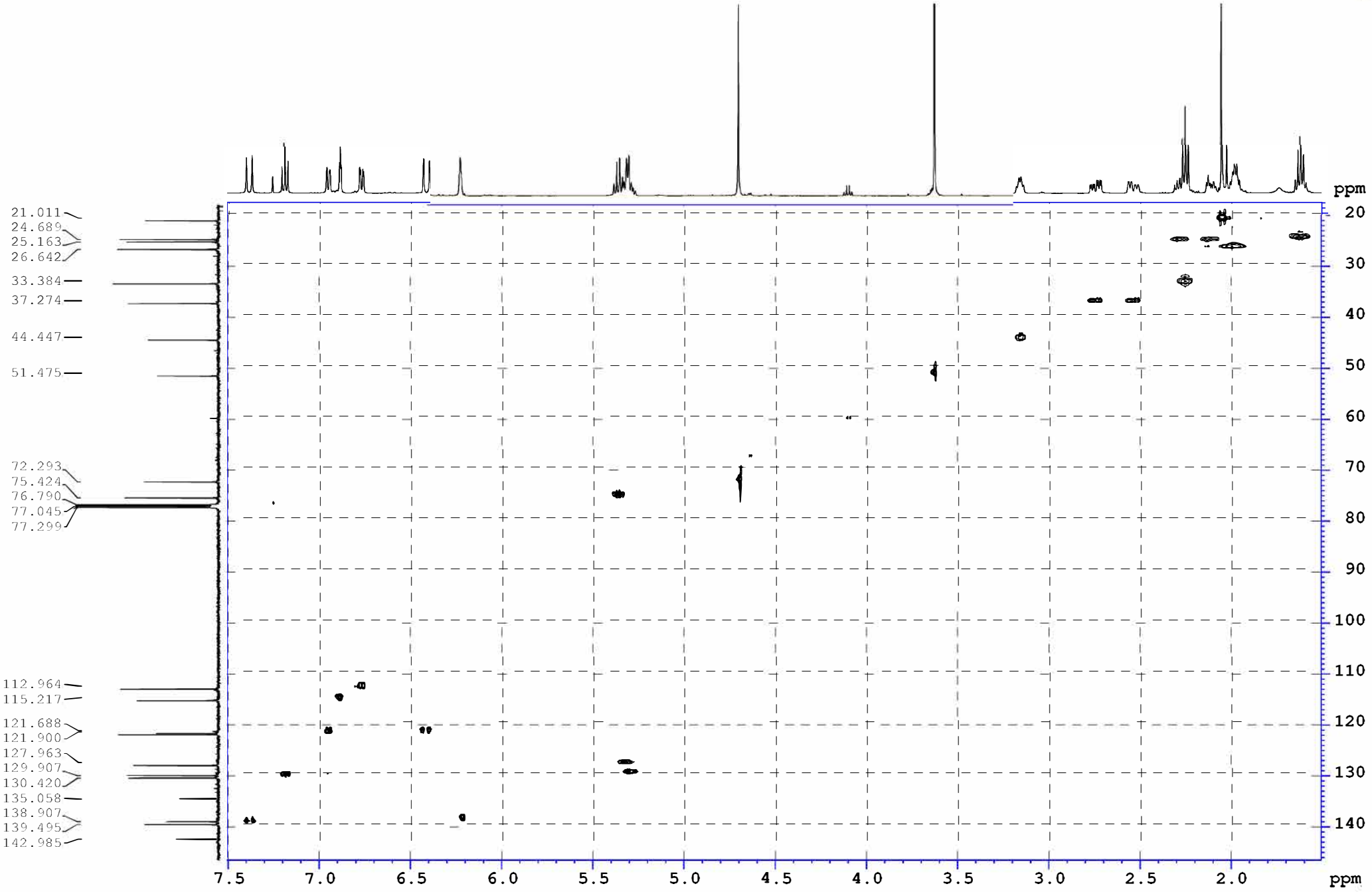
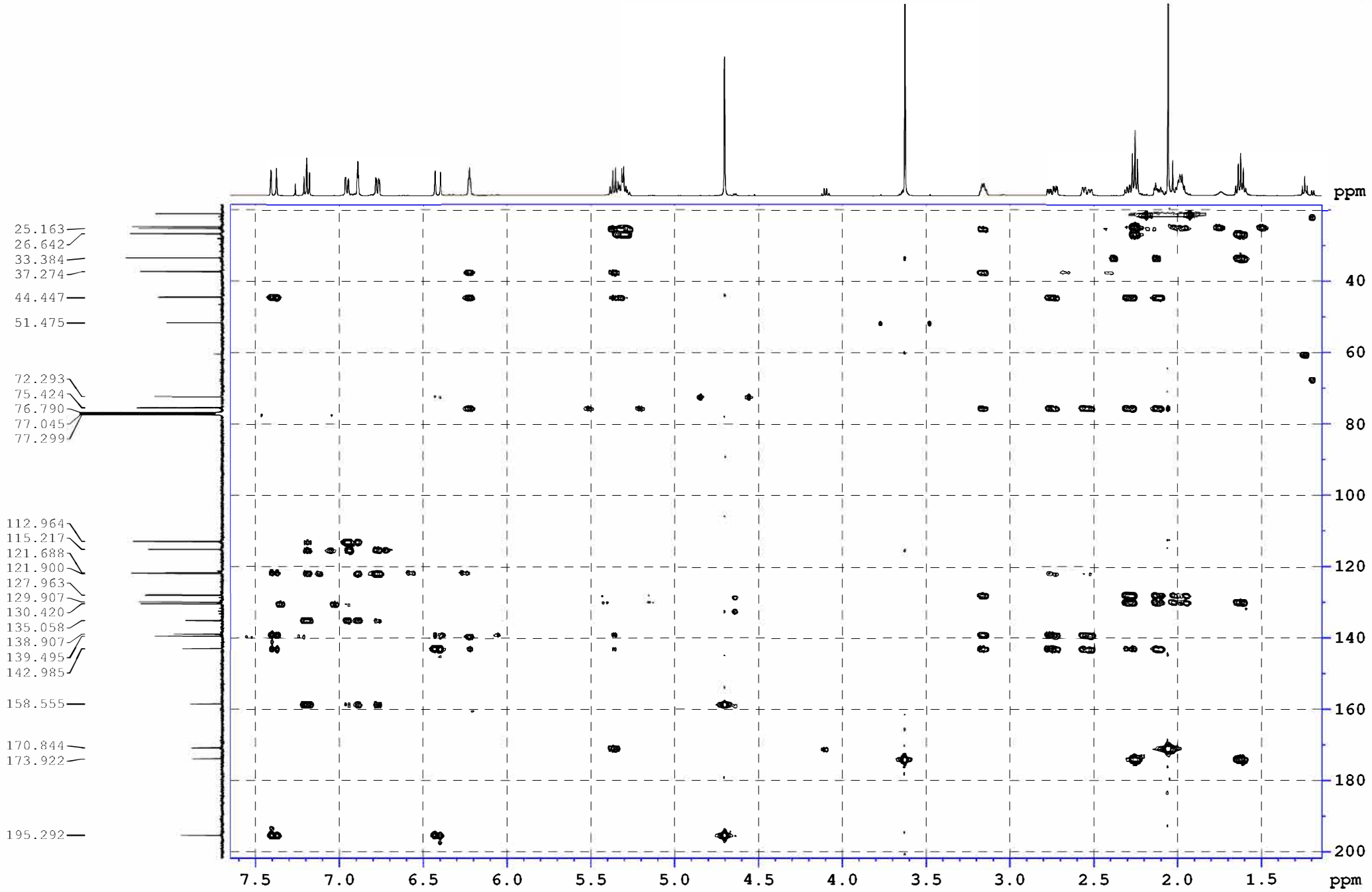
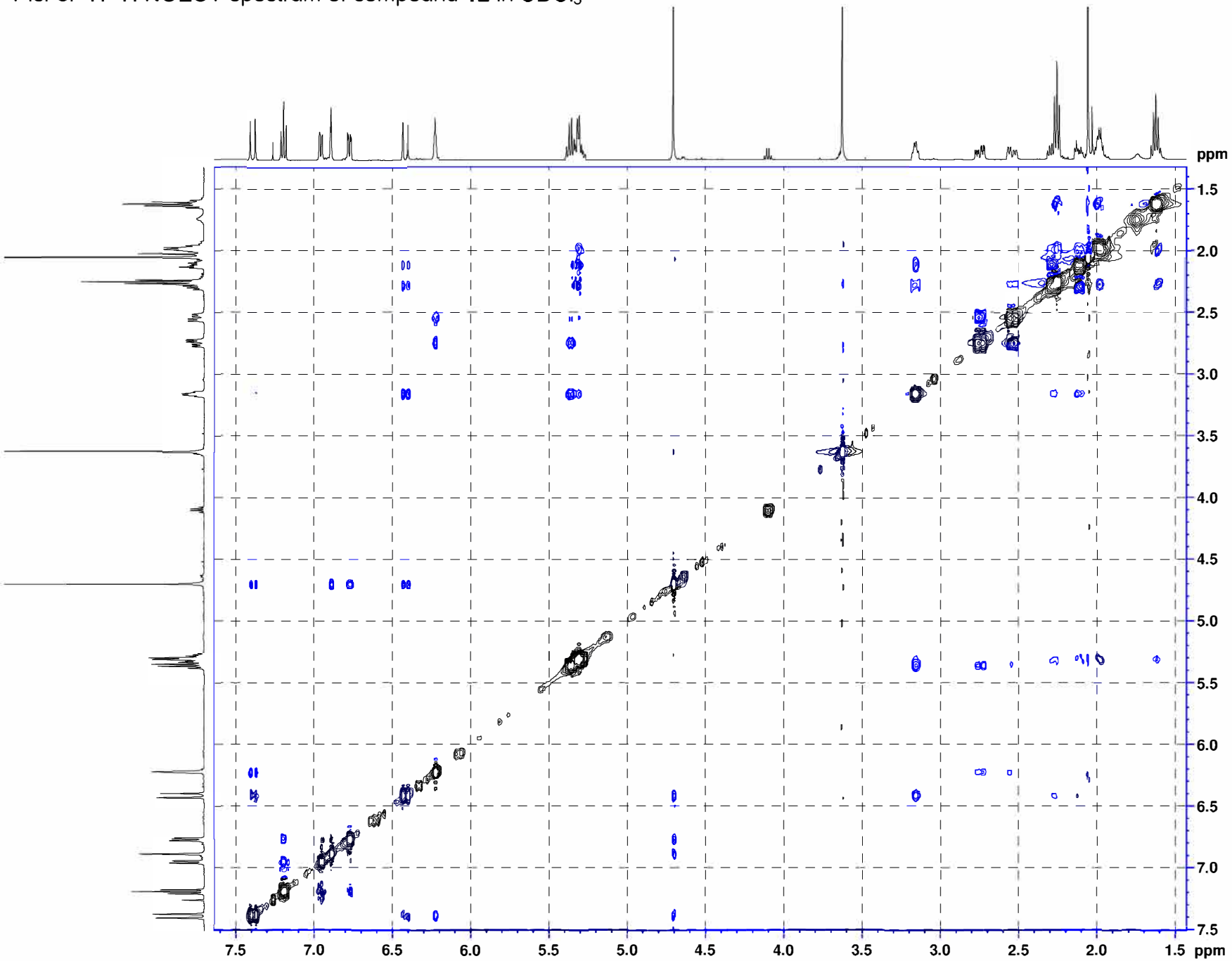
Pic. 4. ^{1}H-^{13}C HSQC spectrum of compound **12** in $CDCl_3$



Pic. 5. ^{1}H-^{13}C HMBC spectrum of compound **12** in $CDCl_3$



Pic. 6. ^{1}H-^{1}H NOESY spectrum of compound **12** in $CDCl_3$

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EXPNO                          9
PROCNO                         1

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PULPROG             noesygpph
TD                      4096
SOLVENT                 CDCl3
NS                         4
DS                        16
SWH                 5000.000 Hz
FIDRES              1.220703 Hz
AQ                  0.4096500 sec
RG                      52.29
DW                    100.000 usec
DE                      6.50 usec
TE                    293.2 K
D0                  0.00008536 sec
D1                  1.50000000 sec
D8                  0.50000000 sec
D16                 0.00010000 sec
IN0                 0.00020000 sec

======== CHANNEL f1 ========
NUC1                       1H
P1                      11.50 usec
P2                      23.00 usec
PLW1               15.84899998 W
SFO1              500.1320005 MHz

====== GRADIENT CHANNEL =====
GPNAM1               SINE.100
GPZ1                    40.00 %
P16                   1000.00 usec

F1 - Acquisition parameters
TD                         512
SFO1                500.132 MHz
FIDRES              9.765625 Hz
SW                      9.997 ppm
FnMODE           States-TPPI

F2 - Processing parameters
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SF                500.1300125 MHz
WDW                      QSINE
SSB                         2
LB             0 Hz
GB             0
PC                        1.00

F1 - Processing parameters
SI                        1024
MC2              States-TPPI
SF                500.1300125 MHz
WDW                    States
SSB                         2
LB             0 Hz
GB             0
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