SUPPORTING INFORMATION

Marine sediment-derived *Streptomyces* bacteria from British Columbia, Canada are a promising microbiota resource for the discovery of antimicrobial natural products

Doralyn S. Dalisay[†‡], David E. Williams[†], Xiao Ling Wang[†], Ryan Centko[†], Jessie Chen[†], Raymond J. Andersen[†]*

[†]Departments of Chemistry and Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, B.C., Canada, V6T 1Z3
[‡]Present address: Institute of Biological Chemistry, Washington State University, Pullman, WA 99164 USA

* Corresponding author: raymond.andersen@ubc.ca

Table S1. List of *Streptomyces* isolates and coordinates of the collection site

Strain (accession #)[a]	Isolation Medium	Collection site, depth (m)	Most closely related type strain[b]
RJA2895 (JX535235)	MM5	BF #6 48º52'N, 125º09'W, 82 m	*S. flavofungini* Szabo strain
RJA2910 (JX535236)	MM5	BF #5 48º52'N, 125 º08'W, 80 m	*S. hawaiiensis* NRRL 15010
RJA2921 (JX535237)	MM8	BF #8 48º50'N, 125º13'W, 65 m	*S. deccanesis* DAS-139T
RJA2926 (JX535238)	MM5	BF #8 48º50'N, 125º13'W, 65 m	*S. sporoclivatus* LMG 20312
RJA2960	MM5	IA#7 49º25'N, 122º51'W, 95 m	*S. flavofungini* Szabo strain
RJA2961 (JF719041)	MM5	IA#12 49º26'N, 122º57'W, 65 m	*S. caeruleus* QD13II
RJA2969 (JX535239)	MM5	IA#12 49º26'N, 122º57'W, 65 m	*S. sampsonii* ATCC 25495
RJA3024	MM5	IA#19 49º24'N, 122º52'W, 35 m	*S. flavofungini* Szabo strain
RJA3025(JX535240)	MM3	IA #1 new mud missile lost in process of collecting	*S. rutgersensis* DSM 40077T
RJA3040	MM19	IA#19 49º24'N, 122º52'W, 35 m	*S. sampsonii* ATCC 25495
RJA3067	MM13	IA#1 new mud missile lost in process of collecting	*S. rutgersensis* DSM 40077T
RJA3074 (JX535241)	MM7	BF #7 48º52'N, 125º09'W, 82 m	*S. griseus* strain 52-1
RJA3265	MM10	BF #8 48º50'N, 125º13'W, 65 m	*S. sampsonii* ATCC 25495
RJA3407	MM39	HS#2 49º23'N, 123º15'W, 30 m	*S. flavofungini* Szabo strain
RJA3410	MM38	HS#2 49º23'N, 123º15'W, 30 m	*S. flavofungini* Szabo strain
RJA3622	MM16	IA#15 49º26'N, 122 º52'W, 23 m	*S. sampsonii* ATCC 25495
RJA3937	MM47	GS#1 49º31'N, 123º58'W, 146 m	*S. rutgersensis* DSM 40077T
RJA3939	MM47	GS#1 49º 31'N, 123º 58'W, 146 m	*S. flavofungini* Szabo strain
RJA3948(JX535242)	MM47	GS#1 49º 31'N, 123º58'W, 146 m	*S. koyangensis* VK-A60
RJA3953	MM47	GS#1 49º 31'N, 123º58'W, 146 m	*S. sampsonii* ATCC 25495
RJA3956	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. rutgersensis* DSM 40077T
RJA3957	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. rutgersensis* DSM 40077T
RJA3958	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. flavofungini* Szabo strain
RJA3972 (JF837443)	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. rubrogriseus* LMG20318
RJA3973	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. flavofungini* Szabo strain
RJA3974	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. flavofungini* Szabo strain
RJA3980	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. rutgersensis* DSM 40077T
RJA3983 (JX535243)	MM5	GS#1 49º 31'N, 123º58'W, 146 m	*S. violaceusniger* Tu 4113
RJA3990 (JF837445)	MM49	GS#1 49º 31'N, 123º58'W, 146 m	*S. speibonae* PK-Blue
RJA3995	MM48	GS#1 49º 31'N, 123º58'W, 146 m	*S. sampsonii* ATCC 25495
RJA3996	MM48	GS#1 49º 31'N, 123º58'W, 146 m	*S. flavofungini* Szabo strain
RJA3999	MM50	GS#1 49º 31'N, 123º58'W, 146 m	*S. sampsonii* ATCC 25495
RJA4019	MM5	GS#6 49º28'N, 123º55'W, 158 m	*S. flavofungini* Szabo strain
RJA4020 (JF510466)	MM5	GS#6 49º28'N, 123º55'W, 158 m	*S. caeruleus* QD13II
RJA4028	MM50	GS#6 49º28'N, 123º55'W, 158 m	*S. sampsonii* ATCC 25495
RJA4037	MM49	GS#12 49º21'N, 123º26'W, 70 m	*S. sampsonii* ATCC 25495
RJA4038(JX535244)	MM49	GS#5 49º28'N, 123º56'W, 143 m	*S. flocculus* NBRC 13041
RJA4040	MM47	GS#5 49º28'N, 123º56'W, 143 m	*S. rutgersensis* DSM 40077T
RJA4053	MM47	GS#12 49º21'N, 123º26'W, 70 m	*S. flavofungini* Szabo strain
RJA4054	MM47	GS#3 49º31'N, 123º 59'W, 102 m	*S. sampsonii* ATCC 25495
RJA4055(JX535245)	MM47	GS#3 49º31'N, 123º 59'W, 102 m	*S. drozdowiczii* NRRL B-24297
RJA4056	MM47	GS#3 49º31'N, 123º 59'W, 102 m	*S. rutgersensis* DSM 40077T
RJA4060	MM47	GS#6 49º28'N, 123º55'W, 158 m	*S. sampsonii* ATCC 25495
RJA4068 (JX535246)	MM47	HS#1 49º23'N, 123º15'W, 15 m	*S. anulatus* strain Malaysia
RJA4077	MM17	HS#2 49º23'N, 123º15'W, 30 m	*S. flavofungini* Szabo strain
RJA4079	MM17	HS#2 49º23'N, 123º15'W, 30 m	*S. flavofungini* Szabo strain
RJA4081	MM1	GS#11 49º23'N, 123º25'W, 70 m	*S. flavofungini* Szabo strain

BF = Bamfield; IA = Indian Arm; GS = Georgia Strait; HS = Howe Sound

[a]NCBI accession number.

[b]The corresponding type of strain had a level of similarity greater than or equal to 98.5%.

Table S2. Descriptions of the aerial and substrate mycelia, and soluble pigment

Strain	Collection site, depth (m)	Color on MM1 agar		
		Aerial spore mass	**Substrate mycelium**	**Soluble pigment**
RJA2895	BF #6, 82 m	medium-grey	deep brown	reddish- brown
RJA2910	BF #5, 80 m	white	black	reddish- brown
RJA2921	BF #8, 65 m	white	yellow	none
RJA2926	BF #8, 65 m	grey	white	none
RJA2960	IA #7, 95 m	yellow-pink	light yellow	none
RJA2961	IA #12, 65 m	yellow-pink	white	none
RJA2969	IA #12, 65 m	yellow-pink	dark brown	reddish- brown
RJA3024	IA #19, 35 m	yellow-pink	light yellow	none
RJA3025	IA #1	yellow-pink	light yellow	none
RJA3040	IA #19, 35 m	white	light yellow	none
RJA3067	IA #1	medium grey	dark brown	reddish- brown
RJA3074	BF #7, 82 m	yellow	yellow-pink	yellow
RJA3265	BF #8, 65 m	white	yellow	none
RJA3407	HS #2, 30 m	yellow	yellow	none
RJA3410	HS #2, 30 m	yellow-pink	light orange	none
RJA3622	IA #15, 23 m	yellow pink	dark brown	reddish- brown
RJA3937	GS #1, 146 m	yellow pink	reddish brown	brown
RJA3939	GS #1, 146 m	yellow-pink	reddish brown	brown
RJA3948	GS #1, 146 m	yellow	light brown	none
RJA3953	GS #1, 146 m	grey	dark brown	reddish- brown
RJA3956	GS #1, 146 m	white	white	none
RJA3957	GS #1, 146 m	grey	dark brown	reddish- brown
RJA3958	GS #1, 146 m	yellow-pink	dark brown	reddish- brown
RJA3972	GS #1, 146 m	grey	dark brown	reddish- brown
RJA3973	GS #1, 146 m	light-pink	dark brown	reddish- brown
RJA3974	GS #1, 146 m	light-pink	dark brown	reddish- brown
RJA3980	GS #1, 146 m	light-pink	dark brown	reddish- brown
RJA3983	GS #1, 146 m	white	light yellow	none
RJA3990	GS #1, 146 m	white	light yellow	none
RJA3995	GS #1, 146 m	light-pink	dark brown	reddish- brown
RJA3996	GS #1, 146 m	white	yellow-pink	none
RJA3999	GS #1, 146 m	grey	dark brown	reddish- brown
RJA4019	GS #6, 158 m	yellow-pink	dark brown	reddish- brown
RJA4020	GS #6, 158 m	grey	dark brown	reddish- brown
RJA4028	GS #6, 158 m	yellow-pink	dark brown	reddish- brown
RJA4037	GS #12, 70 m	yellow-pink	dark brown	reddish- brown
RJA4038	GS #5, 143 m	white	light brown	none
RJA4040	GS #5, 143 m	yellow-pink	yellow-pink	none
RJA4053	GS #12, 70 m	yellow-pink	Light brown	none
RJA4054	GS #3, 102 m	yellow-pink	Dark brown	reddish- brown
RJA4055	GS #3, 102 m	white	yellow-pink	none
RJA4056	GS #3, 102 m	white	yellow-pink	none
RJA4060	GS #6, 158 m	yellow-pink	dark brown	reddish- brown
RJA4068	HS #1, 15 m	medium grey	light brown	light amber
RJA4077	HS #2, 30 m	yellow-pink	light brown	Light amber
RJA4079	HS #2, 30 m	yellow-pink	dark brown	reddish- brown
RJA4081	GS #11, 70 m	yellow-pink	dark brown	reddish- brown

BF = Bamfield; IA = Indian Arm; GS = Georgia Strait; HS = Howe Sound

Table S3. NMR Data for Novobiocins **1**-**6** (600 MHz, DMSO-d_6).[a]

	δ_C/δ_N[b]						δ_H (J in Hz)					
Atom #	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
1	124.2	124.3	124.2	123.7	no	123.7						
2	129.8	129.8	129.8	120.6	120.6	120.6	7.74, s	7.73, s	7.74, s	7.30, s	7.30, s	7.30, s
3	127.2	127.2	127.2	127.5	127.5	127.5						
4	158.3	158.2	158.3	146.7	146.4	146.7						
5	114.2	114.2	114.2	144.3	144.3	144.3						
6	127.4	127.4	127.4	113.1	113.0	113.1	7.71, d (8.2)	7.70, d (8.4)	7.71, d (8.4)	7.29, s	7.29, s	7.29, s
7	28.1	28.1	28.1	28.3	28.3	28.3	3.26, d (7.2)	3.26, d (7.2)	3.26, d (7.3)	3.26, d (7.0)	3.26, d (7.3)	3.26, d (7.2)
8	122.6	122.6	122.6	122.8	122.8	122.8	5.30, bt (7.2)	5.30, bt (7.2)	5.30, bt (7.3)	5.30, bt (7.0)	5.30, bt (7.3)	5.30, bt, (7.2)
9	131.5	131.4	131.5	131.1	131.2	131.1						
10	17.7	17.7	17.7	17.7	17.7	17.7	1.69, bs	1.69, bs	1.69, bs	1.69, bs	1.69, bs	1.70, s
11	25.6	25.6	25.6	25.6	25.6	25.6	1.69, bs	1.69, bs	1.69, bs	1.68, bs	1.68, bs	1.68, bs
12	166.5	166.4	166.5	166.7	166.5	166.7						
4-O<u>H</u>							10.05, s	10.03, s	10.05, s	8.91, s	8.90, s	8.91, s
R (<u>H</u>/O<u>H</u>)							6.85, d (8.2)	6.84, d (8.4)	6.85, d (8.4)	9.61, s	9.60, s	9.61, s
1’	160.6	160.8	160.7	160.6	no	160.6						
2’	101.5	no	101.4	101.7	no	101.6						
3’	159.3	no	159.3	158.9	no	158.9						
4’	121.8	121.8	121.8	121.8	121.8	121.8	7.73, d (8.9)	7.71, d (8.4)	7.73, d (9.1)	7.73, d (9.1)	7.71, d (8.6)	7.73, d (9.0)
5’	110.03[1]	109.9	110.04	110.0	110.0	110.0	7.16, d (8.9)	7.15, d (8.4)	7.16, d (9.1)	7.16, d (9.1)	7.15, nd[c]	7.16, d (9.0)
6’	156.9	157.2	157.1	156.9	157.5	157.1						
7’	112.8	112.5	112.8	112.8	112.5	112.8						
8’	150.6	150.6	150.6	150.5	150.6	150.5						
9’	110.05[1]	no	109.96	110.8	no	110.0						
10’	8.3	8.4	8.32	8.3	8.3	8.3	2.21, s	2.19, s	2.22, s	2.21, s	2.19, s	2.22, s
2’-N<u>H</u>	-274.1	no	-274.6	-272.9	no	-273.0	9.23, s	9.17, bs	9.23, s	9.18, s	9.15, bs	9.17, bs
3’-O<u>H</u>							11.96, s	11.95, s	11.95, s	12.06, s	12.04, s	12.05, s
1”	98.4	98.5	98.6	98.5	98.5	98.6	5.53, d (2.7)	5.52, d (1.4)	5.52, d (2.3)	5.53, d (2.0)	5.52, bs	5.52, d (2.3)
2”	68.7	70.4	68.3	68.7	70.4	68.3	4.07, t (2.7)	3.92, m	4.07, m	4.07, m	3.92, m	4.07, m
3”	70.3	67.5	70.4	70.3	67.5	70.4	5.15, dd (10.0, 2.7)	3.89, m	5.05, dd (9.9, 3.1)	5.15, dd (9.4, 3.0)	3.89, m	5.05, dd (9.8, 3.2)
4”	80.7	72.3	69.8	80.7	72.3	69.8	3.47, d (10.0)	3.57, dd (9.1, 5.4)	3.75, d (9.9)	3.47, d(9.4)	3.57, dd (9.1, 5.4)	3.75, dd (9.8, 6.2)
5”	78.1	78.5	78.9	78.1	78.3	78.9						
6”	22.7	22.5	22.7	22.7	22.5	22.7	1.04, s	1.01, s	1.06, s	1.04, s	1.01, s	1.05, s
7”	28.4	28.6	28.4	28.4	28.6	28.4	1.26, s	1.21, s	1.23, s	1.26, s	1.21, s	1.23, s
2”-O<u>H</u>							5.60, bs	5.16, d (4.4)	no	5.59, bs	5.16, d (4.4)	5.45, d (5.1)
R’ (-C(O)N<u>H</u>$_2$/O<u>H</u>)	156.3		156.6	156.3		156.6						
R’ (-C(O)N<u>H</u>$_2$/O<u>H</u>)	-302.6		-302.9	-302.9		-302.5	6.73, bs/6.52, bs	4.79, d (5.4)	6.50, bs/6,50, bs	6.73, bs/6.52, bs	4.79, d (5.4)	6.49, bs/6.49, bs
R” (<u>Me</u>/O<u>H</u>)	61.0			61.0			3.46, s	4.96, d (5.4)	no	3.46, s	4.96, d (5.4)	5.14, d (6.2)

[a]Numbering according to reference 43.

[b]The ^{15}N assignments were not calibrated with an external standard. The δ value has an accuracy of about 1 ppm in reference to CH_3NO_2 (0 ppm) and are assigned on the basis of ^{15}NHSQC and ^{15}NlrHMQC correlations.

[c]Multiplicity not determined due to overlapping of signal with the residual TFA signal.

[1]Assignments within a column are interchangeable.

no – not observed.

Figure S1: ^{1}H NMR Spectrum of Desmethyldescarbamoylnovobiocin (**2**) recorded at 600 MHz in DMSO-d_6

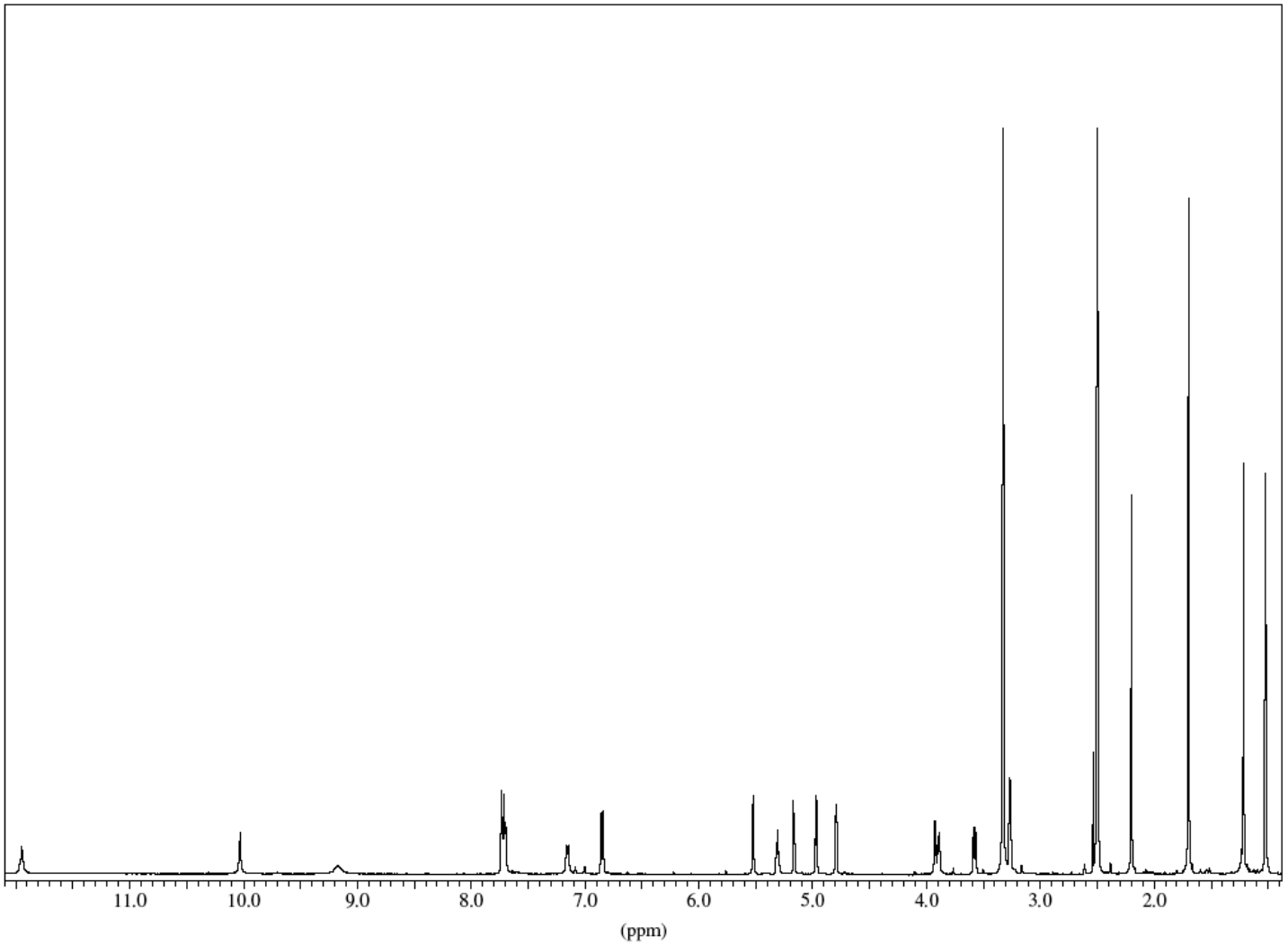

Figure S2: ^{13}C NMR Spectrum of Desmethyldescarbamoylnovobiocin (**2**) recorded at 150 MHz in DMSO-d_6

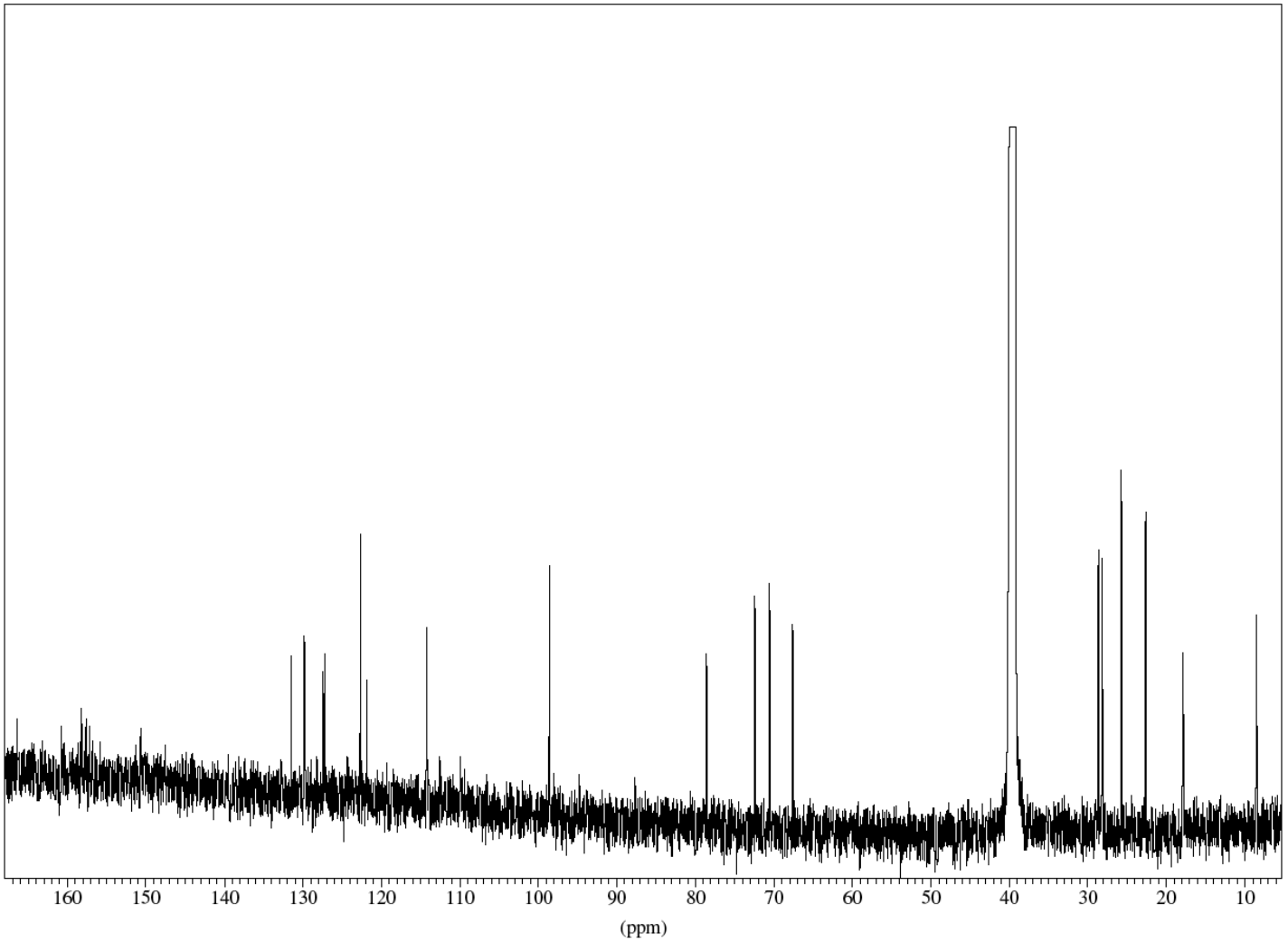

Figure S3: ^{1}H NMR Spectrum of Desmethylnovobiocin (**3**) recorded at 600 MHz in DMSO-d_6

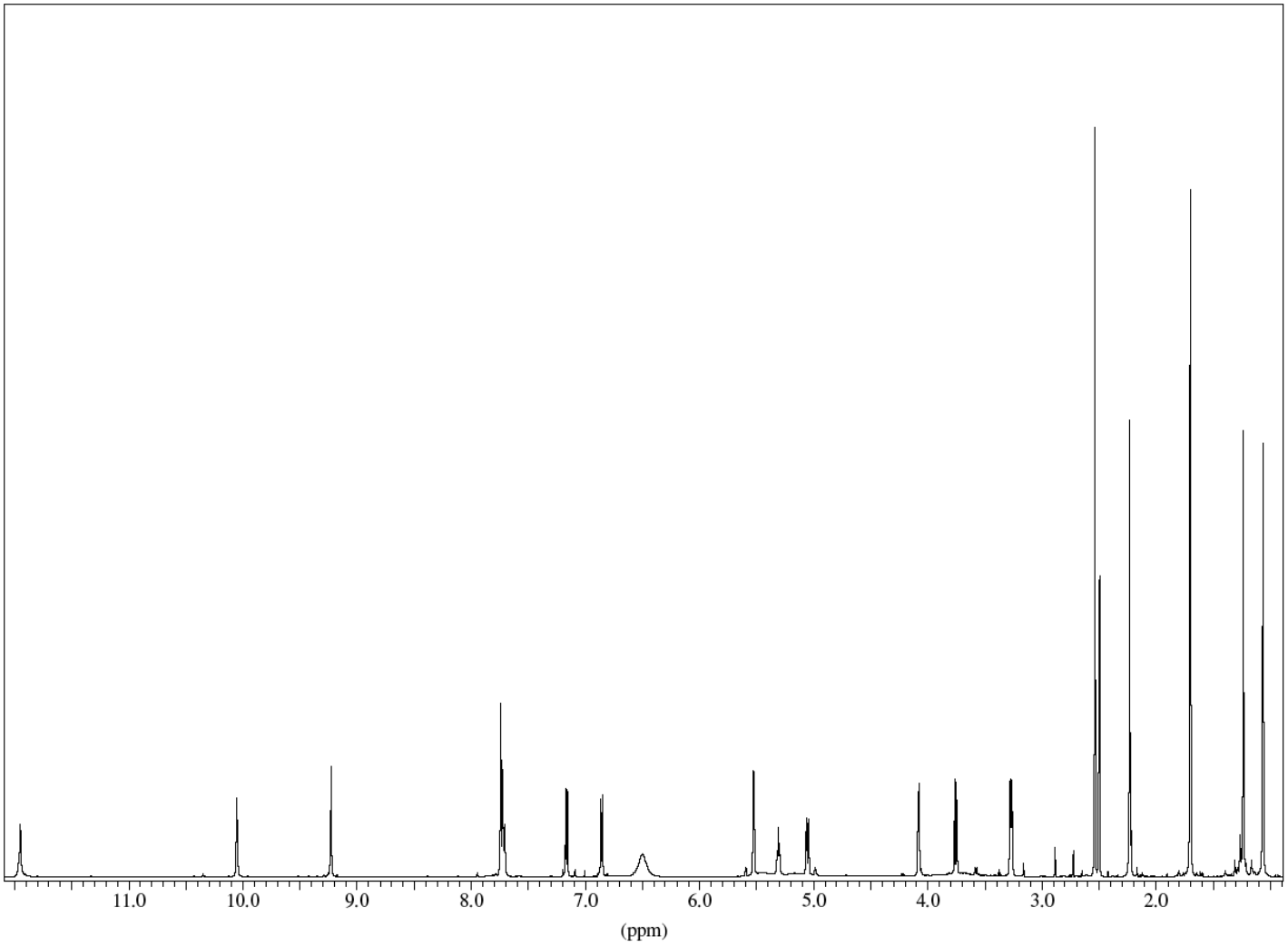

Figure S4: ^{13}C NMR Spectrum of Desmethylnovobiocin (**3**) recorded at 150 MHz in DMSO-d_6

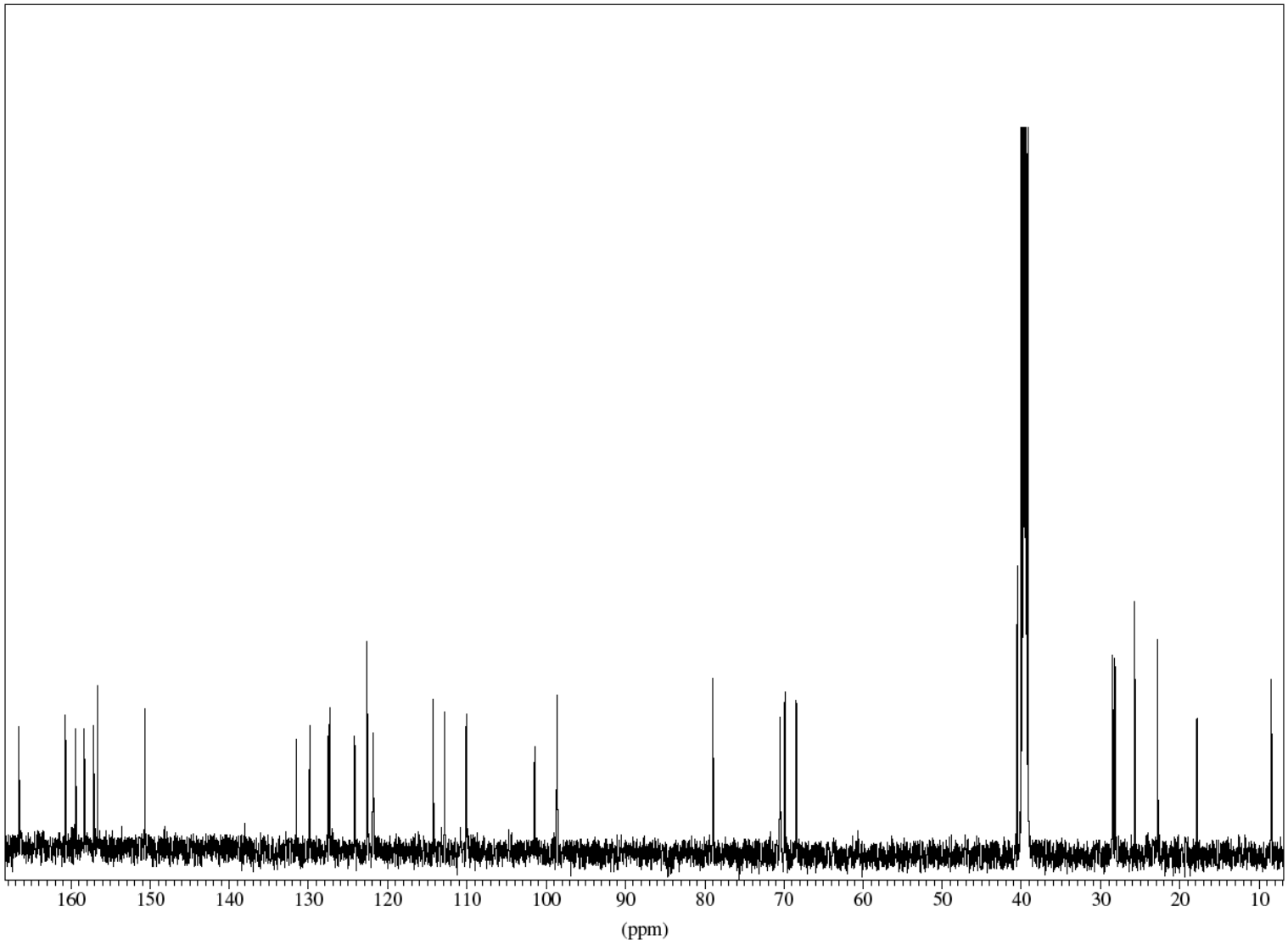

Figure S5: ^{1}H NMR Spectrum of 4-Hydroxynovobiocin (**4**) recorded at 600 MHz in DMSO-d_6

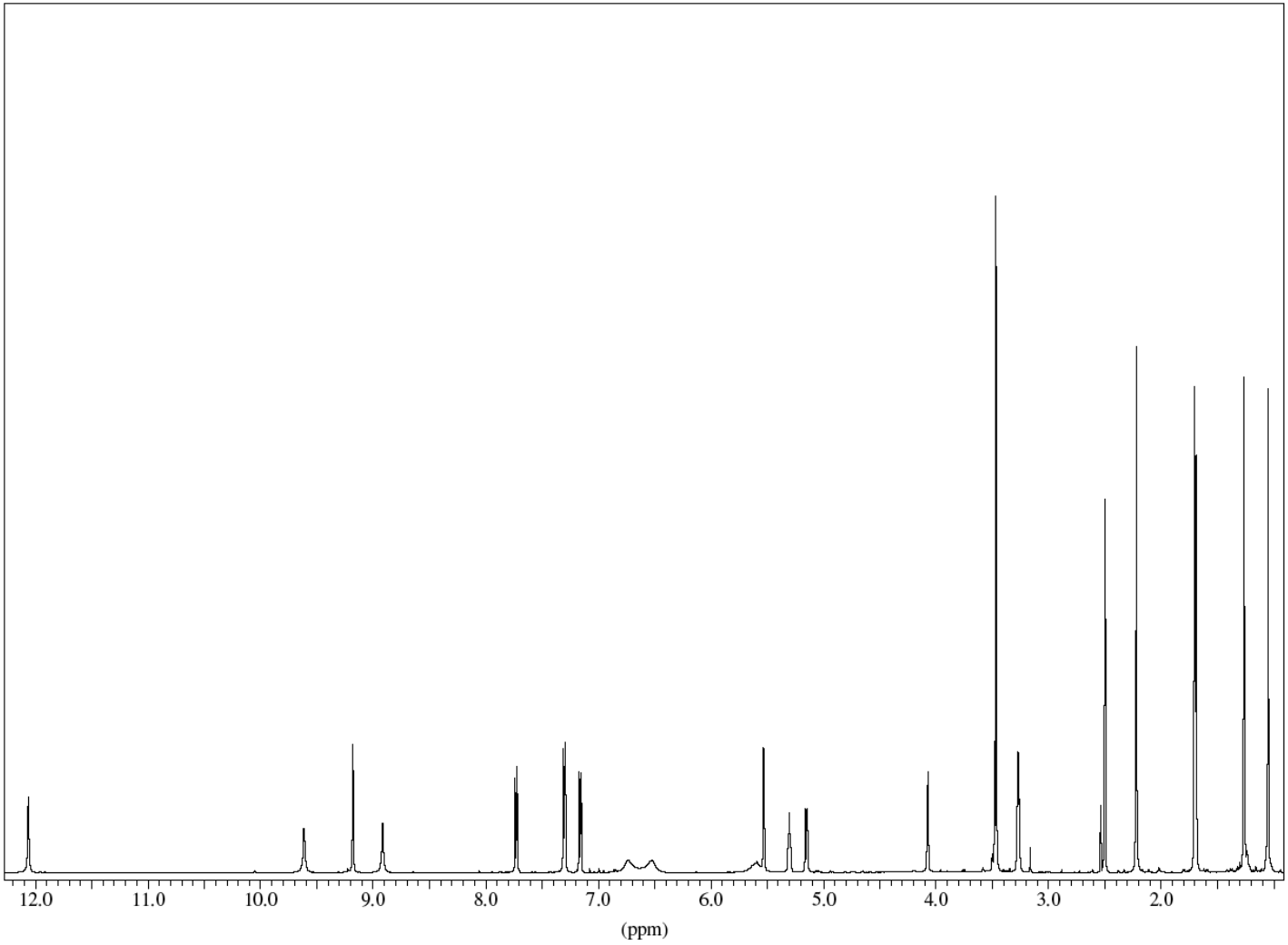

Figure S6: ^{13}C NMR Spectrum of 4-Hydroxynovobiocin (**4**) recorded at 150 MHz in DMSO-d_6

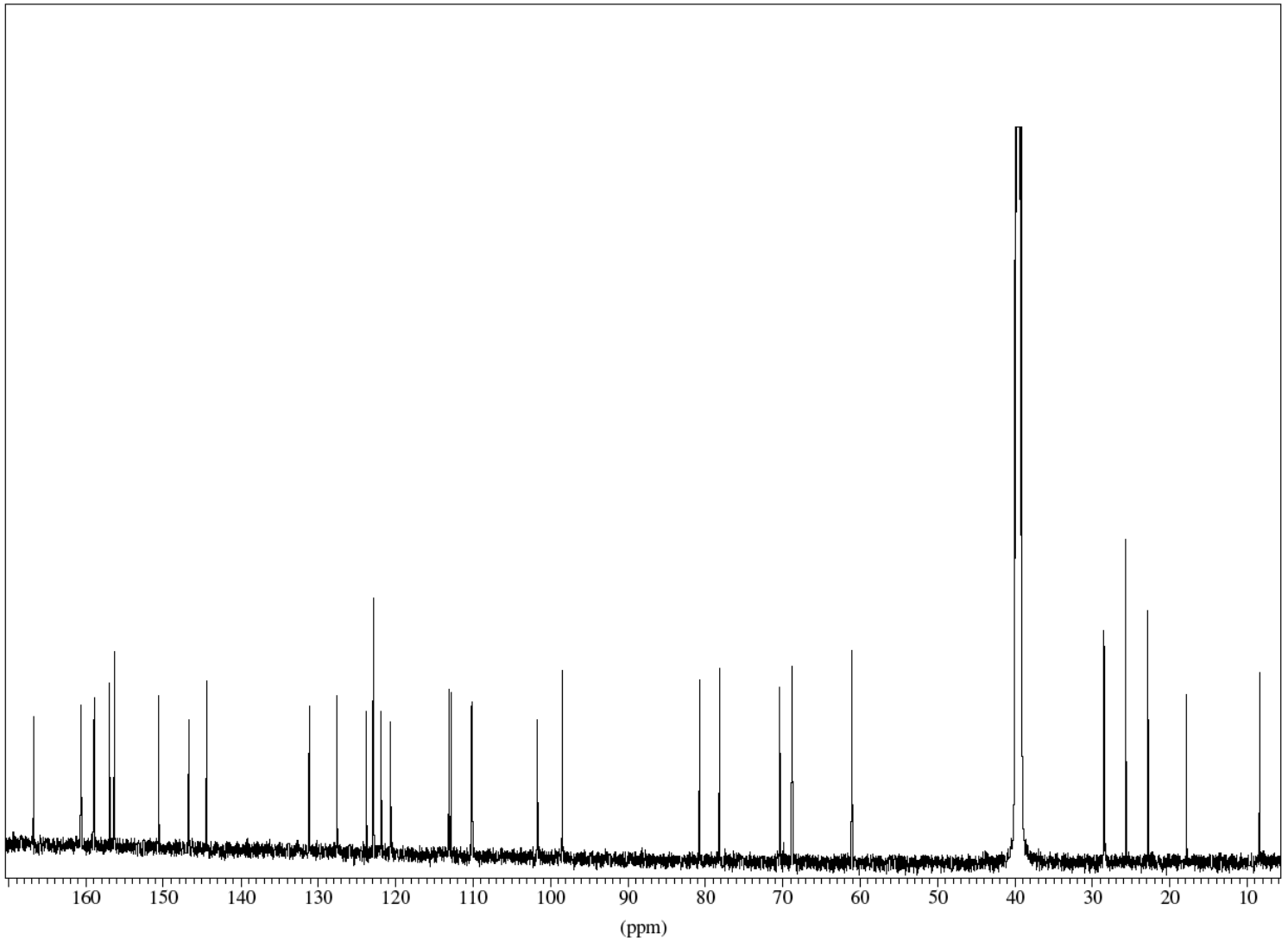

Figure S7: ^{1}H NMR Spectrum of Desmethyldescarbamoyl-4-hydroxynovobiocin (**5**) recorded at 600 MHz in DMSO-d_6

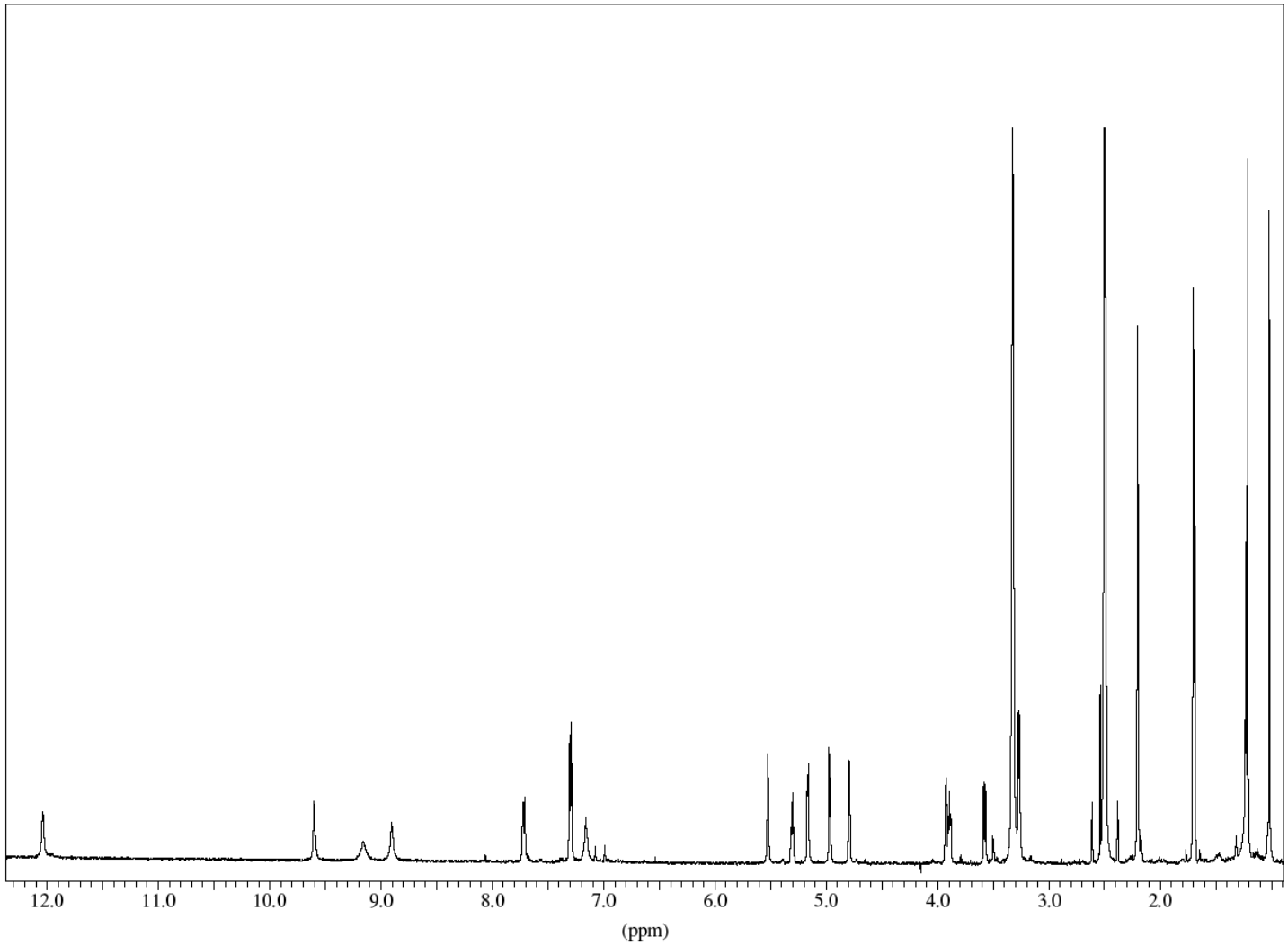

Figure S8: ^{1}H NMR Spectrum of Desmethyl-4-hydroxynovobiocin (**6**) recorded at 600 MHz in DMSO-d_6

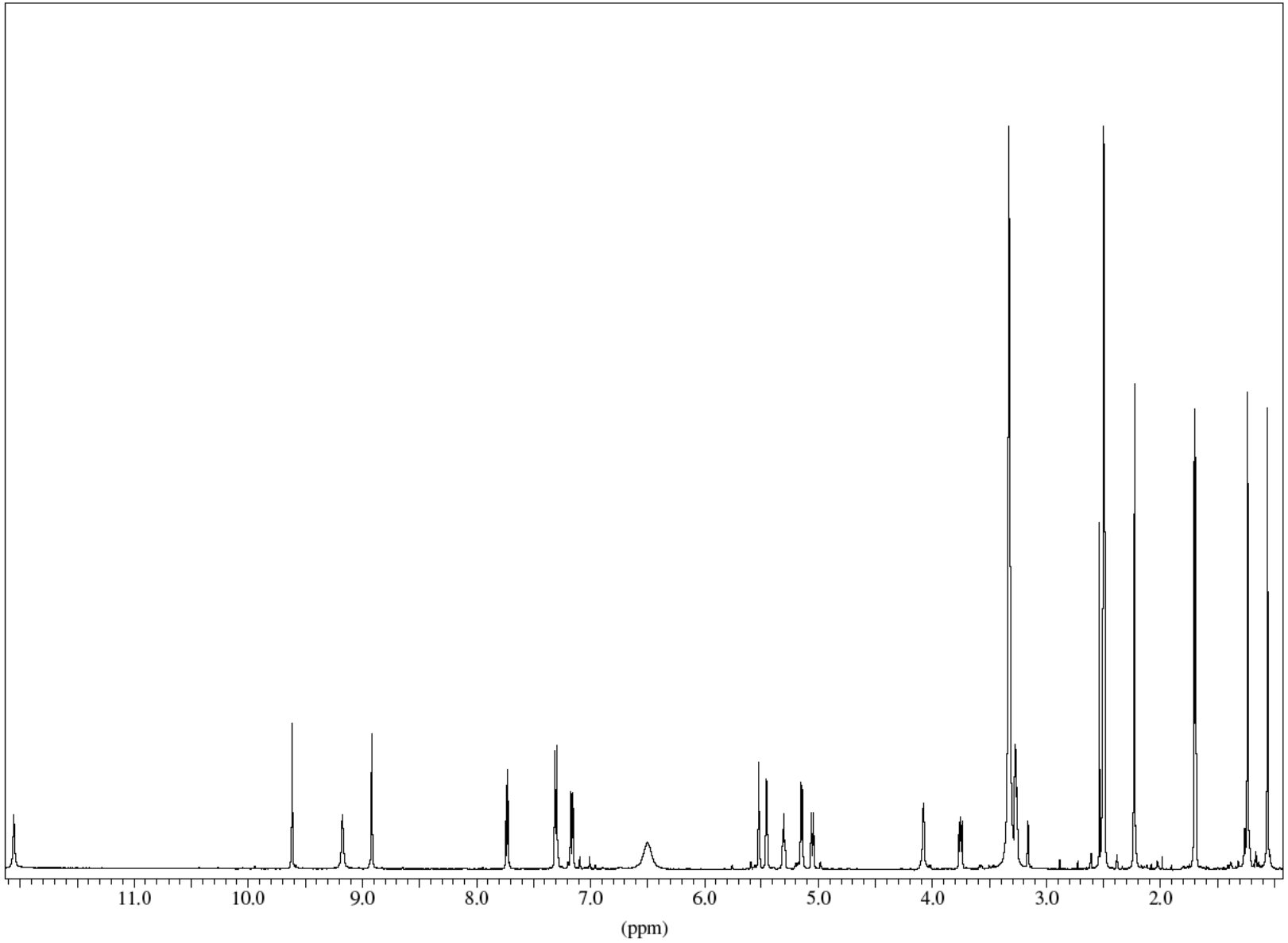

Figure S9: ^{13}C NMR Spectrum of Desmethyl-4-hydroxynovobiocin (**6**) recorded at 150 MHz in DMSO-d_6