



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 08:52 AM UTC

PDB ID : 1DS1 / pdb_00001ds1
Title : CRYSTAL STRUCTURE OF CLAVAMINATE SYNTHASE IN COMPLEX
WITH FE(II) AND 2-OXOGLUTARATE
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Deposited on : 2000-01-06
Resolution : 1.08 Å(reported)

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A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

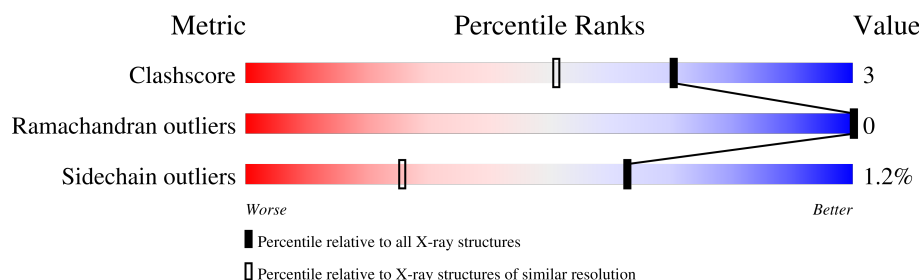
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.08 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	190562	1727 (1.10-1.06)
Ramachandran outliers	187476	1679 (1.10-1.06)
Sidechain outliers	187428	1676 (1.10-1.06)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	324	 84% 13% .

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
5	PGO	A	331	-	X	-	-

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 2927 atoms, of which 2 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called CLAVAMINATE SYNTHASE 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	323	Total	C	N	O	S	0	0	0
			2481	1545	449	478	9			

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).

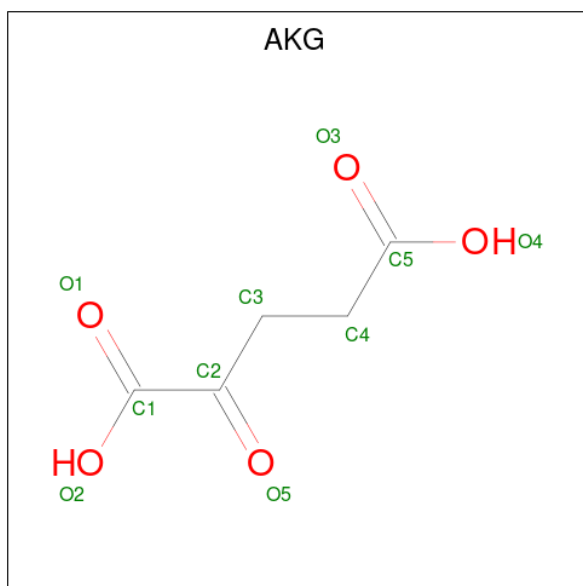


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is FE (II) ION (CCD ID: FE2) (formula: Fe).

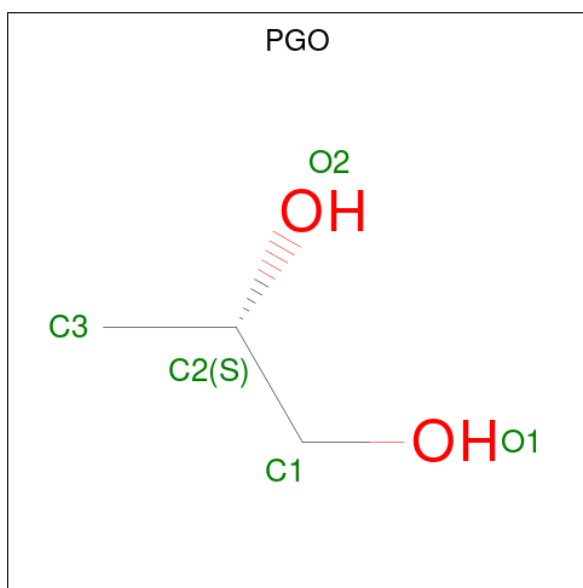
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Fe	0	0
			1	1		

- Molecule 4 is 2-OXOGLUTARIC ACID (CCD ID: AKG) (formula: $C_5H_6O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			10	5	5		

- Molecule 5 is S-1,2-PROPANEDIOL (CCD ID: PGO) (formula: $C_3H_8O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	H	O	0	0
			6	3	1	2		
5	A	1	Total	C	H	O	0	0
			6	3	1	2		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	403	Total	O	0	0
			403	403		

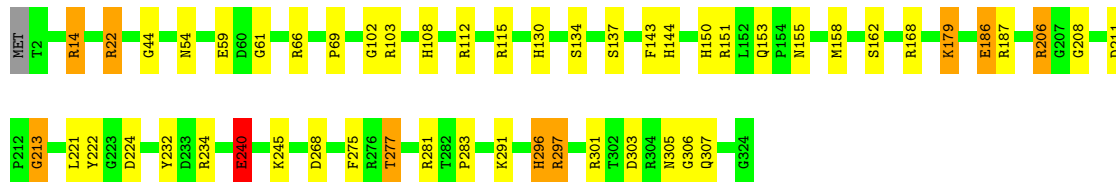
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

Note EDS was not executed.

• Molecule 1: CLAVAMINATE SYNTHASE 1

Chain A:  84% 13% .



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	67.08Å 67.94Å 68.87Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 1.08	Depositor
% Data completeness (in resolution range)	88.6 (8.00-1.08)	Depositor
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	SHELXL-97, CNS	Depositor
R, R_{free}	0.135 , 0.166	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2927	wwPDB-VP
Average B, all atoms (Å ²)	15.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FE2, PGO, SO4, AKG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	1.02	6/2537 (0.2%)	1.72	70/3457 (2.0%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	69	PRO	C-N	-8.12	1.21	1.33
1	A	108	HIS	ND1-CE1	5.68	1.38	1.32
1	A	14	ARG	CD-NE	5.15	1.53	1.46
1	A	232	TYR	C-O	-5.14	1.18	1.23
1	A	108	HIS	CD2-NE2	-5.11	1.32	1.37
1	A	130	HIS	CG-ND1	-5.08	1.32	1.38

All (70) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	234	ARG	CD-NE-CZ	26.06	160.89	124.40
1	A	234	ARG	NE-CZ-NH2	16.82	134.33	119.20
1	A	234	ARG	NE-CZ-NH1	-14.17	107.33	121.50
1	A	297	ARG	NE-CZ-NH2	13.39	131.25	119.20
1	A	134	SER	CA-C-N	12.41	142.86	121.14
1	A	134	SER	C-N-CA	12.41	142.86	121.14
1	A	305	ASN	O-C-N	-11.45	107.40	122.40
1	A	306	GLY	N-CA-C	10.22	129.42	115.32
1	A	306	GLY	CA-C-O	9.81	130.04	119.06
1	A	277	THR	CA-CB-OG1	-9.76	94.96	109.60
1	A	103	ARG	CD-NE-CZ	9.40	137.56	124.40
1	A	179	LYS	CG-CD-CE	8.63	131.15	111.30
1	A	134	SER	O-C-N	-8.62	110.97	122.43
1	A	206	ARG	NE-CZ-NH2	8.51	126.86	119.20
1	A	66	ARG	CD-NE-CZ	8.45	136.22	124.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	186	GLU	CB-CG-CD	8.21	126.55	112.60
1	A	69	PRO	O-C-N	-8.18	113.93	123.10
1	A	179	LYS	CD-CE-NZ	7.97	137.42	111.90
1	A	277	THR	OG1-CB-CG2	7.68	124.67	109.30
1	A	206	ARG	CD-NE-CZ	7.61	135.05	124.40
1	A	305	ASN	N-CA-C	7.57	121.84	111.54
1	A	112	ARG	NE-CZ-NH2	-7.53	112.42	119.20
1	A	306	GLY	O-C-N	-7.32	113.14	122.43
1	A	155	ASN	CA-CB-CG	7.24	119.84	112.60
1	A	151	ARG	CA-C-N	7.04	134.06	122.73
1	A	151	ARG	C-N-CA	7.04	134.06	122.73
1	A	281	ARG	NE-CZ-NH1	-6.78	114.72	121.50
1	A	103	ARG	NE-CZ-NH2	6.76	125.28	119.20
1	A	150	HIS	ND1-CE1-NE2	-6.71	101.69	108.40
1	A	151	ARG	O-C-N	-6.59	114.51	122.22
1	A	224	ASP	CA-CB-CG	6.54	119.14	112.60
1	A	168	ARG	CD-NE-CZ	-6.41	115.42	124.40
1	A	240	GLU	CB-CG-CD	6.33	123.36	112.60
1	A	168	ARG	NE-CZ-NH2	-6.29	113.54	119.20
1	A	69	PRO	CB-CA-C	6.20	118.96	111.46
1	A	187	ARG	NE-CZ-NH2	6.16	124.74	119.20
1	A	115	ARG	NE-CZ-NH2	-6.08	113.73	119.20
1	A	143	PHE	CA-CB-CG	6.04	119.84	113.80
1	A	69	PRO	CA-C-N	6.02	132.27	122.69
1	A	69	PRO	C-N-CA	6.02	132.27	122.69
1	A	115	ARG	NE-CZ-NH1	6.00	127.50	121.50
1	A	305	ASN	CB-CA-C	-5.99	103.05	111.80
1	A	44	GLY	O-C-N	-5.88	116.46	122.17
1	A	240	GLU	N-CA-CB	5.81	118.83	110.40
1	A	22	ARG	NH1-CZ-NH2	5.81	126.85	119.30
1	A	303	ASP	CA-C-N	5.80	129.00	120.82
1	A	303	ASP	C-N-CA	5.80	129.00	120.82
1	A	213	GLY	CA-C-O	5.78	126.64	120.40
1	A	206	ARG	CA-C-N	5.62	130.21	122.06
1	A	206	ARG	C-N-CA	5.62	130.21	122.06
1	A	69	PRO	N-CA-C	-5.59	102.36	110.80
1	A	66	ARG	NE-CZ-NH1	-5.57	115.93	121.50
1	A	221	LEU	CA-C-O	-5.49	114.91	121.11
1	A	22	ARG	NE-CZ-NH1	-5.47	116.03	121.50
1	A	115	ARG	CD-NE-CZ	5.47	132.06	124.40
1	A	22	ARG	CD-NE-CZ	5.43	132.00	124.40
1	A	297	ARG	NH1-CZ-NH2	-5.38	112.30	119.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	296	HIS	CB-CG-CD2	-5.34	124.25	131.20
1	A	144	HIS	CG-CD2-NE2	5.32	112.52	107.20
1	A	54	ASN	CA-CB-CG	5.26	117.86	112.60
1	A	108	HIS	CB-CG-CD2	-5.23	124.40	131.20
1	A	222	TYR	CA-C-O	5.19	126.78	121.23
1	A	268	ASP	CA-CB-CG	5.10	117.70	112.60
1	A	296	HIS	CB-CG-ND1	5.10	130.35	122.70
1	A	275	PHE	CA-CB-CG	5.08	118.89	113.80
1	A	297	ARG	NE-CZ-NH1	-5.06	116.44	121.50
1	A	153	GLN	OE1-CD-NE2	-5.03	117.57	122.60
1	A	168	ARG	NE-CZ-NH1	5.01	126.52	121.50
1	A	208	GLY	CA-C-N	-5.00	116.75	122.95
1	A	208	GLY	C-N-CA	-5.00	116.75	122.95

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2481	0	2421	17	0
2	A	20	0	0	2	0
3	A	1	0	0	0	0
4	A	10	0	4	0	0
5	A	10	2	16	2	0
6	A	403	0	0	4	0
All	All	2925	2	2441	17	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (17) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:22:ARG:HG2	2:A:335:SO4:O1	1.91	0.70

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:291:LYS:HD3	6:A:681:HOH:O	1.98	0.63
1:A:297:ARG:HG2	6:A:788:HOH:O	1.99	0.62
1:A:22:ARG:HH12	5:A:331:PGO:H12	1.67	0.59
1:A:22:ARG:HH12	5:A:331:PGO:C1	2.15	0.59
1:A:162:SER:OG	1:A:296:HIS:HE1	1.87	0.58
1:A:277:THR:O	1:A:277:THR:OG1	2.29	0.49
1:A:61:GLY:O	1:A:277:THR:HG21	2.15	0.46
1:A:206:ARG:NE	6:A:617:HOH:O	2.47	0.46
1:A:240:GLU:O	1:A:245:LYS:NZ	2.48	0.46
1:A:14:ARG:NH1	6:A:702:HOH:O	2.49	0.46
1:A:211:ASP:OD2	1:A:213:GLY:N	2.49	0.45
1:A:61:GLY:HA3	1:A:277:THR:CG2	2.47	0.44
1:A:59:GLU:N	2:A:336:SO4:O3	2.48	0.43
1:A:102:GLY:CA	1:A:158:MET:HE1	2.49	0.43
1:A:301:ARG:HA	1:A:307:GLN:NE2	2.36	0.41
1:A:137:SER:O	1:A:283:PRO:HA	2.20	0.41

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	321/324 (99%)	318 (99%)	3 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	258/259 (100%)	255 (99%)	3 (1%)	63	26

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	179	LYS
1	A	186	GLU
1	A	240	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	108	HIS
1	A	296	HIS
1	A	307	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 1 is monoatomic - leaving 7 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the

expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	AKG	A	330	3	9,9,9	1.45	1 (11%)	11,11,11	1.87	3 (27%)
2	SO4	A	340	-	4,4,4	0.62	0	6,6,6	0.72	0
5	PGO	A	332	-	4,4,4	1.52	1 (25%)	4,4,4	0.95	0
2	SO4	A	336	-	4,4,4	0.55	0	6,6,6	0.48	0
5	PGO	A	331	-	4,4,4	1.33	1 (25%)	4,4,4	2.10	2 (50%)
2	SO4	A	335	-	4,4,4	0.56	0	6,6,6	0.78	0
2	SO4	A	339	-	4,4,4	0.65	0	6,6,6	0.83	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	AKG	A	330	3	-	1/9/9/9	-
5	PGO	A	331	-	-	2/2/2/2	-
5	PGO	A	332	-	-	0/2/2/2	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	330	AKG	C2-C1	-3.24	1.48	1.53
5	A	331	PGO	C1-C2	2.39	1.58	1.46
5	A	332	PGO	C1-C2	2.32	1.58	1.46

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	330	AKG	C3-C2-C1	3.40	121.64	115.86
4	A	330	AKG	O1-C1-C2	-3.36	117.64	121.81
4	A	330	AKG	O5-C2-C1	-2.99	115.39	119.67
5	A	331	PGO	O2-C2-C1	-2.72	101.67	114.99
5	A	331	PGO	O2-C2-C3	2.01	118.12	109.45

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	330	AKG	C1-C2-C3-C4
5	A	331	PGO	O1-C1-C2-O2
5	A	331	PGO	O1-C1-C2-C3

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	336	SO4	1	0
5	A	331	PGO	2	0
2	A	335	SO4	1	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

6.4 Ligands ⓘ

EDS was not executed - this section is therefore empty.

6.5 Other polymers ⓘ

EDS was not executed - this section is therefore empty.