



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 12:04 AM UTC

PDB ID : 5IBM / pdb_00005ibm
Title : Structure of S502P, a Cancer-Associated Mutation of the Oncogenic Phosphatase SHP2
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Deposited on : 2016-02-22
Resolution : 2.18 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

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
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

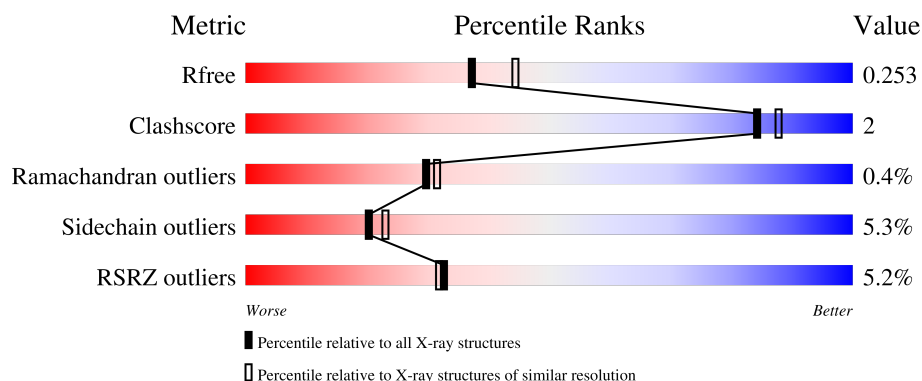
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.18 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))
R_{free}	180053	8975 (2.20-2.16)
Clashscore	190562	9786 (2.20-2.16)
Ramachandran outliers	187476	9664 (2.20-2.16)
Sidechain outliers	187428	9664 (2.20-2.16)
RSRZ outliers	180081	8979 (2.20-2.16)

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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	526	4% 82% 9% 9%
1	B	526	6% 78% 13% 8%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 8166 atoms, of which 0 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 Tyrosine-protein phosphatase non-receptor type 11.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	480	Total	C	N	O	S	0	1	0
			3899	2466	690	724	19			
1	B	482	Total	C	N	O	S	0	0	0
			3900	2463	692	727	18			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	SER	-	expression tag	UNP Q06124
A	502	PRO	SER	engineered mutation	UNP Q06124
B	0	SER	-	expression tag	UNP Q06124
B	502	PRO	SER	engineered mutation	UNP Q06124

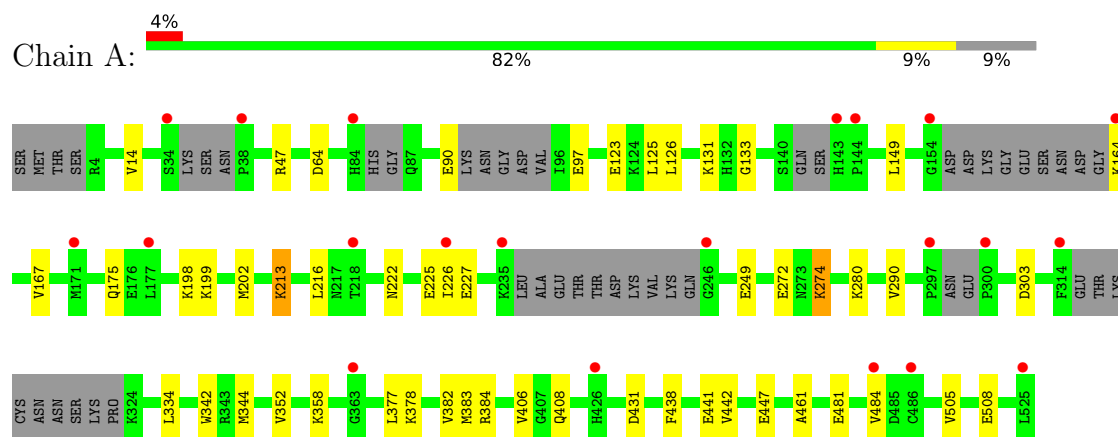
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	191	Total	O	0	0
			191	191		
2	B	176	Total	O	0	0
			176	176		

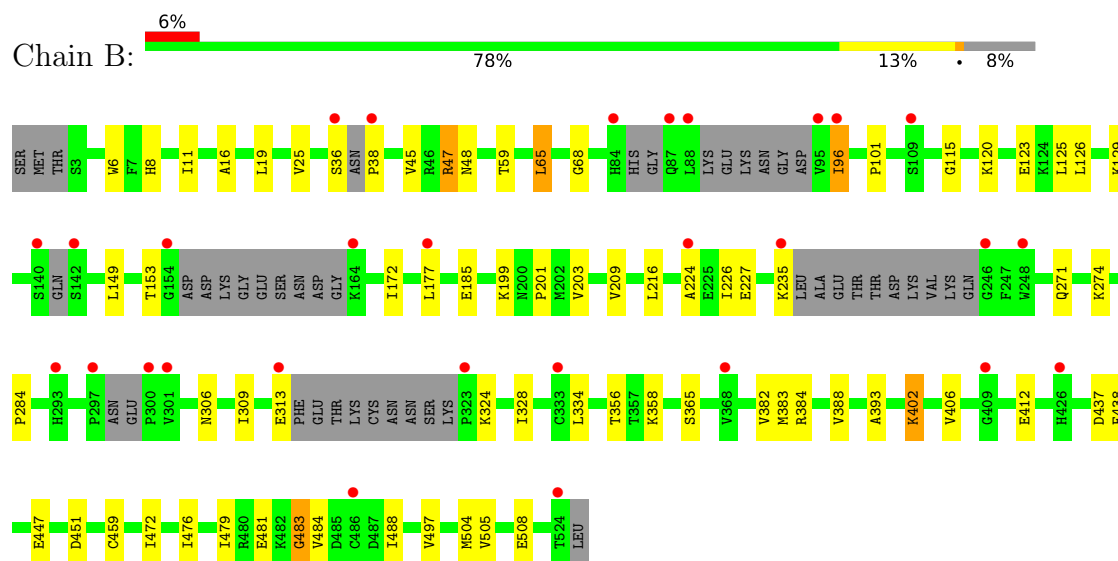
3 Residue-property plots [i](#)

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

- Molecule 1: Tyrosine-protein phosphatase non-receptor type 11



- Molecule 1: Tyrosine-protein phosphatase non-receptor type 11



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	45.19Å 214.24Å 55.47Å 90.00° 95.55° 90.00°	Depositor
Resolution (Å)	43.60 – 2.18 43.60 – 2.18	Depositor EDS
% Data completeness (in resolution range)	99.0 (43.60-2.18) 99.1 (43.60-2.18)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.39 (at 2.18Å)	Xtriage
Refinement program	BUSTER 2.11.5	Depositor
R, R_{free}	0.189 , 0.240 0.197 , 0.253	Depositor DCC
R_{free} test set	2651 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å ²)	37.2	Xtriage
Anisotropy	0.471	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 55.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8166	wwPDB-VP
Average B, all atoms (Å ²)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.80% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

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	0.86	0/3982	1.25	10/5365 (0.2%)
1	B	0.89	0/3980	1.27	8/5363 (0.1%)
All	All	0.87	0/7962	1.26	18/10728 (0.2%)

There are no bond length outliers.

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	303	ASP	CA-CB-CG	7.25	119.85	112.60
1	B	437	ASP	CA-CB-CG	6.90	119.50	112.60
1	B	358	LYS	N-CA-C	-6.55	101.09	110.59
1	A	358	LYS	N-CA-C	-6.49	101.79	110.55
1	B	483	GLY	CA-C-N	6.14	129.18	120.53
1	B	483	GLY	C-N-CA	6.14	129.18	120.53
1	B	438	PHE	CA-CB-CG	6.05	119.86	113.80
1	A	334	LEU	N-CA-C	-6.03	101.27	110.14
1	A	64	ASP	CA-CB-CG	5.98	118.58	112.60
1	B	334	LEU	N-CA-C	-5.69	101.60	110.42
1	B	393	ALA	N-CA-C	-5.49	101.79	109.69
1	A	226	ILE	CA-C-N	5.35	127.44	120.28
1	A	226	ILE	C-N-CA	5.35	127.44	120.28
1	B	472	ILE	N-CA-C	-5.19	105.44	110.42
1	A	438	PHE	CA-CB-CG	5.16	118.96	113.80
1	A	342	TRP	CA-C-N	5.03	127.02	120.28
1	A	342	TRP	C-N-CA	5.03	127.02	120.28
1	A	198	LYS	N-CA-C	-5.01	105.73	111.14

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

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	3899	0	3847	13	0
1	B	3900	0	3848	24	0
2	A	191	0	0	1	0
2	B	176	0	0	0	0
All	All	8166	0	7695	36	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 2.

All (36) 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:B:65:LEU:HD12	1:B:68:GLY:HA3	1.66	0.78
1:A:126:LEU:HD23	1:A:216:LEU:HD13	1.82	0.60
1:B:47:ARG:HH11	1:B:48:ASN:HD22	1.50	0.59
1:B:271:GLN:HA	1:B:274:LYS:HE2	1.84	0.59
1:A:133:GLY:HA3	1:A:213:LYS:HB2	1.84	0.58
1:B:125:LEU:HB3	1:B:216:LEU:HD21	1.88	0.54
1:A:125:LEU:HB3	1:A:216:LEU:HD21	1.89	0.53
1:B:382:VAL:HG23	1:B:383:MET:HE2	1.89	0.53
1:B:126:LEU:HD23	1:B:216:LEU:HD13	1.92	0.51
1:B:309:ILE:HD13	1:B:328:ILE:HG12	1.93	0.51
1:B:203:VAL:HG22	1:B:209:VAL:HG22	1.94	0.49
1:A:222:ASN:O	1:A:225:GLU:HB2	2.14	0.48
1:B:384:ARG:HB2	1:B:406:VAL:HG12	1.95	0.48
1:B:388:VAL:HG21	1:B:402:LYS:HE3	1.96	0.48
1:B:11:ILE:HD12	1:B:16:ALA:HB2	1.96	0.48
1:A:352:VAL:HG11	1:A:442:VAL:HG13	1.97	0.46
1:B:149:LEU:HB2	1:B:172:ILE:HD11	1.98	0.46
1:A:123:GLU:HG2	1:A:167:VAL:HG11	1.99	0.44
1:A:175:GLN:HB3	1:B:25:VAL:HG11	1.99	0.44
1:B:479:ILE:O	1:B:483:GLY:HA2	2.18	0.44
1:B:402:LYS:HG2	1:B:412:GLU:CD	2.43	0.44
1:B:47:ARG:HG2	1:B:96:ILE:CD1	2.48	0.44
1:B:36:SER:O	1:B:38:PRO:HD3	2.19	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:290:VAL:HG11	1:A:344:MET:HG3	2.01	0.43
1:B:6:TRP:HB3	1:B:101:PRO:HB3	2.00	0.43
1:B:199:LYS:O	1:B:201:PRO:HD3	2.18	0.42
1:A:377:LEU:HD11	1:A:384:ARG:HG2	2.01	0.42
1:B:497:VAL:HG12	1:B:504:MET:HG3	2.00	0.42
1:A:274:LYS:HD3	1:A:280:LYS:HB2	2.00	0.42
1:A:382:VAL:HG23	1:A:383:MET:HE2	2.01	0.42
1:A:461:ALA:HB3	2:A:632:HOH:O	2.20	0.42
1:A:149:LEU:HD13	1:A:202:MET:HE1	2.01	0.41
1:B:224:ALA:HB2	1:B:484:VAL:CG2	2.50	0.41
1:B:8:HIS:HB3	1:B:11:ILE:HG12	2.02	0.41
1:B:284:PRO:HG3	1:B:306:ASN:HA	2.03	0.41
1:B:356:THR:OG1	1:B:459:CYS:HB3	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	463/526 (88%)	450 (97%)	12 (3%)	1 (0%)	43	49
1	B	464/526 (88%)	444 (96%)	17 (4%)	3 (1%)	21	20
All	All	927/1052 (88%)	894 (96%)	29 (3%)	4 (0%)	30	31

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	324	LYS
1	A	505	VAL
1	B	115	GLY
1	B	505	VAL

5.3.2 Protein sidechains ⓘ

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	428/468 (92%)	407 (95%)	21 (5%)	22	26
1	B	429/468 (92%)	405 (94%)	24 (6%)	19	21
All	All	857/936 (92%)	812 (95%)	45 (5%)	20	23

All (45) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	VAL
1	A	47	ARG
1	A	90	GLU
1	A	97	GLU
1	A	131	LYS
1	A	164	LYS
1	A	199	LYS
1	A	213	LYS
1	A	227	GLU
1	A	249	GLU
1	A	272	GLU
1	A	274	LYS
1	A	378	LYS
1	A	406	VAL
1	A	408	GLN
1	A	431	ASP
1	A	441	GLU
1	A	447	GLU
1	A	481	GLU
1	A	484	VAL
1	A	508	GLU
1	B	19	LEU
1	B	45	VAL
1	B	47	ARG
1	B	59	THR
1	B	65	LEU
1	B	96	ILE

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Mol	Chain	Res	Type
1	B	120	LYS
1	B	123	GLU
1	B	129	LYS
1	B	153	THR
1	B	177	LEU
1	B	185	GLU
1	B	226	ILE
1	B	227	GLU
1	B	235	LYS
1	B	313	GLU
1	B	365	SER
1	B	402	LYS
1	B	447	GLU
1	B	451	ASP
1	B	476	ILE
1	B	481	GLU
1	B	488	ILE
1	B	508	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	18	ASN
1	A	57	GLN
1	A	103	ASN
1	A	114	HIS
1	A	175	GLN
1	A	256	GLN
1	A	257	GLN
1	A	287	HIS
1	A	446	GLN
1	A	520	HIS
1	B	18	ASN
1	B	48	ASN
1	B	87	GLN
1	B	103	ASN
1	B	114	HIS
1	B	143	HIS
1	B	256	GLN
1	B	257	GLN
1	B	281	ASN
1	B	339	ASN

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Mol	Chain	Res	Type
1	B	495	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](#)

There are no ligands in this entry.

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

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å ²)	Q<0.9
1	A	480/526 (91%)	0.42	21 (4%)	39 38	23, 48, 77, 99	1 (0%)
1	B	482/526 (91%)	0.46	29 (6%)	27 27	28, 50, 79, 114	0
All	All	962/1052 (91%)	0.44	50 (5%)	33 32	23, 49, 79, 114	1 (0%)

All (50) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	95	VAL	3.6
1	B	297	PRO	3.4
1	A	154	GLY	3.4
1	A	300	PRO	3.2
1	B	36	SER	3.2
1	B	486	CYS	3.1
1	B	235	LYS	3.1
1	A	177	LEU	3.0
1	A	525	LEU	3.0
1	A	38	PRO	3.0
1	B	154	GLY	3.0
1	A	171	MET	3.0
1	B	84	HIS	2.9
1	B	38	PRO	2.9
1	B	300	PRO	2.8
1	A	314	PHE	2.8
1	A	84	HIS	2.8
1	A	297	PRO	2.8
1	B	140	SER	2.7
1	B	313	GLU	2.7
1	A	226	ILE	2.7
1	B	409	GLY	2.7
1	A	34	SER	2.7
1	B	142	SER	2.6

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Mol	Chain	Res	Type	RSRZ
1	B	164	LYS	2.6
1	B	88	LEU	2.6
1	B	248	TRP	2.5
1	B	246	GLY	2.5
1	A	143	HIS	2.5
1	A	218	THR	2.5
1	B	224	ALA	2.5
1	B	109	SER	2.4
1	A	484	VAL	2.4
1	A	246	GLY	2.4
1	B	426	HIS	2.4
1	B	301	VAL	2.3
1	A	426	HIS	2.3
1	B	177	LEU	2.3
1	A	164	LYS	2.3
1	A	235	LYS	2.2
1	B	96	ILE	2.2
1	B	323	PRO	2.2
1	B	87	GLN	2.2
1	A	144	PRO	2.1
1	A	486	CYS	2.1
1	A	363	GLY	2.1
1	B	333	CYS	2.0
1	B	368	VAL	2.0
1	B	293	HIS	2.0
1	B	524	THR	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.