



Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2020 – 06:36 am BST

PDB ID : 5A2V
Title : Crystal structure of mtPAP in Apo form
Authors : Lapkouski, M.; Hallberg, B.M.
Deposited on : 2015-05-26
Resolution : 1.82 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.11
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

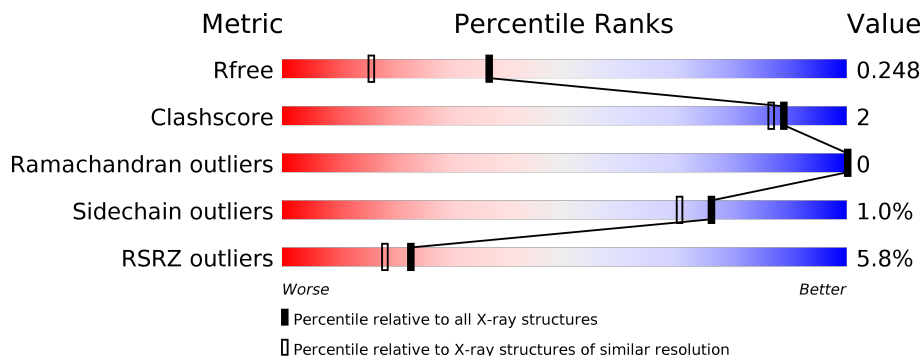
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

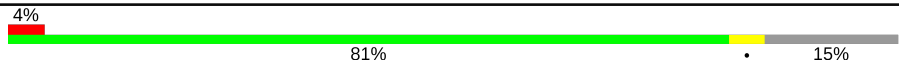
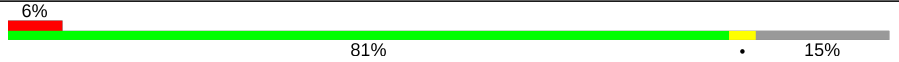
The reported resolution of this entry is 1.82 Å.

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}	130704	7484 (1.84-1.80)
Clashscore	141614	8401 (1.84-1.80)
Ramachandran outliers	138981	8290 (1.84-1.80)
Sidechain outliers	138945	8290 (1.84-1.80)
RSRZ outliers	127900	7371 (1.84-1.80)

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 on 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	555	
1	B	555	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 8229 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 MITOCHONDRIAL PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	470	Total	C	N	O	S	0	9	0
			3751	2418	614	693	26			
1	B	472	Total	C	N	O	S	0	18	0
			3805	2456	622	701	26			

There are 46 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	14	MET	-	expression tag	UNP F1NBW0
A	15	HIS	-	expression tag	UNP F1NBW0
A	16	HIS	-	expression tag	UNP F1NBW0
A	17	HIS	-	expression tag	UNP F1NBW0
A	18	HIS	-	expression tag	UNP F1NBW0
A	19	HIS	-	expression tag	UNP F1NBW0
A	20	HIS	-	expression tag	UNP F1NBW0
A	21	SER	-	expression tag	UNP F1NBW0
A	22	SER	-	expression tag	UNP F1NBW0
A	23	GLY	-	expression tag	UNP F1NBW0
A	24	VAL	-	expression tag	UNP F1NBW0
A	25	ASP	-	expression tag	UNP F1NBW0
A	26	LEU	-	expression tag	UNP F1NBW0
A	27	GLY	-	expression tag	UNP F1NBW0
A	28	THR	-	expression tag	UNP F1NBW0
A	29	GLU	-	expression tag	UNP F1NBW0
A	30	ASN	-	expression tag	UNP F1NBW0
A	31	LEU	-	expression tag	UNP F1NBW0
A	32	TYR	-	expression tag	UNP F1NBW0
A	33	PHE	-	expression tag	UNP F1NBW0
A	34	GLN	-	expression tag	UNP F1NBW0
A	35	SER	-	expression tag	UNP F1NBW0
A	36	MET	-	expression tag	UNP F1NBW0
B	14	MET	-	expression tag	UNP F1NBW0
B	15	HIS	-	expression tag	UNP F1NBW0

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Chain	Residue	Modelled	Actual	Comment	Reference
B	16	HIS	-	expression tag	UNP F1NBW0
B	17	HIS	-	expression tag	UNP F1NBW0
B	18	HIS	-	expression tag	UNP F1NBW0
B	19	HIS	-	expression tag	UNP F1NBW0
B	20	HIS	-	expression tag	UNP F1NBW0
B	21	SER	-	expression tag	UNP F1NBW0
B	22	SER	-	expression tag	UNP F1NBW0
B	23	GLY	-	expression tag	UNP F1NBW0
B	24	VAL	-	expression tag	UNP F1NBW0
B	25	ASP	-	expression tag	UNP F1NBW0
B	26	LEU	-	expression tag	UNP F1NBW0
B	27	GLY	-	expression tag	UNP F1NBW0
B	28	THR	-	expression tag	UNP F1NBW0
B	29	GLU	-	expression tag	UNP F1NBW0
B	30	ASN	-	expression tag	UNP F1NBW0
B	31	LEU	-	expression tag	UNP F1NBW0
B	32	TYR	-	expression tag	UNP F1NBW0
B	33	PHE	-	expression tag	UNP F1NBW0
B	34	GLN	-	expression tag	UNP F1NBW0
B	35	SER	-	expression tag	UNP F1NBW0
B	36	MET	-	expression tag	UNP F1NBW0

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	3	Total Cl 3 3	0	0
2	A	1	Total Cl 1 1	0	0

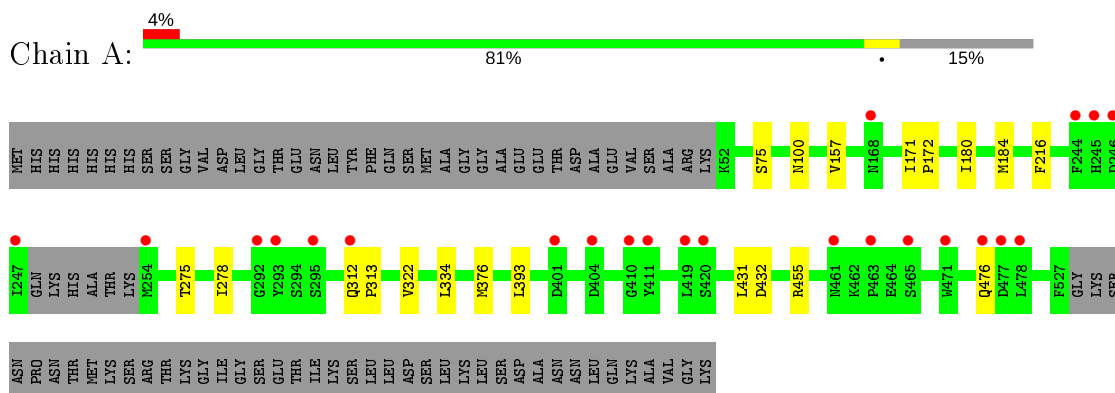
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	343	Total O 343 343	0	0
3	B	326	Total O 326 326	0	0

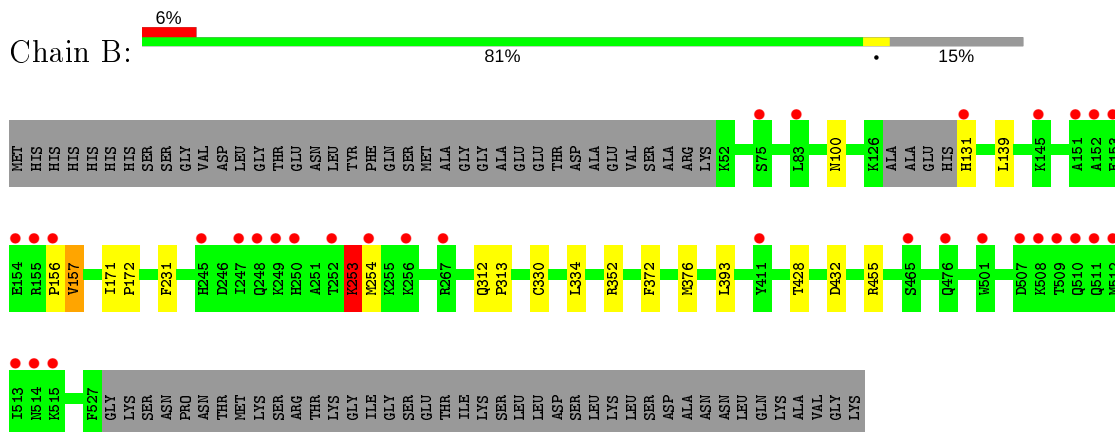
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: MITOCHONDRIAL PROTEIN



- Molecule 1: MITOCHONDRIAL PROTEIN



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	59.39Å 94.37Å 191.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.00 – 1.82 37.97 – 1.82	Depositor EDS
% Data completeness (in resolution range)	100.0 (38.00-1.82) 100.0 (37.97-1.82)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.27 (at 1.82Å)	Xtrriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.222 , 0.245 0.225 , 0.248	Depositor DCC
R_{free} test set	4876 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	30.1	Xtrriage
Anisotropy	0.099	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 38.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8229	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.40% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CL

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	0.30	0/3870	0.50	0/5246
1	B	0.29	0/3949	0.51	1/5352 (0.0%)
All	All	0.30	0/7819	0.50	1/10598 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	B	253	LYS	CB-CA-C	10.52	131.45	110.40

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	253	LYS	Peptide

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	3751	0	3690	16	0
1	B	3805	0	3761	13	0
2	A	1	0	0	0	0
2	B	3	0	0	0	0
3	A	343	0	0	0	0
3	B	326	0	0	1	0
All	All	8229	0	7451	29	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 (29) 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:180:ILE:HG22	1:A:184[A]:MET:CE	2.23	0.68
1:A:180:ILE:HG22	1:A:184[A]:MET:HE2	1.76	0.66
1:A:180:ILE:CG2	1:A:184[A]:MET:HE2	2.33	0.57
1:A:376[A]:MET:HA	1:A:376[A]:MET:CE	2.40	0.52
1:B:312[A]:GLN:HA	1:B:312[A]:GLN:NE2	2.25	0.52
1:A:334:LEU:HD21	1:A:376[A]:MET:CE	2.41	0.50
1:A:376[A]:MET:HE2	1:A:376[A]:MET:HA	1.93	0.50
1:A:334:LEU:HD21	1:A:376[A]:MET:HE1	1.95	0.49
1:A:184[A]:MET:HE1	1:A:431:LEU:O	2.13	0.48
1:A:180:ILE:HG22	1:A:184[A]:MET:HE3	1.96	0.47
1:B:253:LYS:HD2	1:B:254:MET:H	1.80	0.47
1:B:334:LEU:HD21	1:B:376[A]:MET:CE	2.45	0.46
1:A:275:THR:HG23	1:A:322:VAL:CG2	2.46	0.46
1:A:100:ASN:ND2	1:A:312:GLN:O	2.49	0.46
1:B:334:LEU:HD21	1:B:376[A]:MET:HE1	1.98	0.46
1:B:139:LEU:HD11	3:B:2186:HOH:O	2.17	0.44
1:B:156:PRO:HB2	1:B:157:VAL:HG13	2.00	0.44
1:A:393:LEU:HB3	1:A:455:ARG:HA	2.00	0.43
1:B:231:PHE:O	1:B:352[A]:ARG:NH2	2.52	0.43
1:A:216:PHE:CE1	1:A:278:ILE:HD13	2.54	0.42
1:B:376[A]:MET:CE	1:B:376[A]:MET:HA	2.49	0.42
1:A:171:ILE:HB	1:A:172:PRO:HD3	2.02	0.42
1:A:275:THR:HG23	1:A:322:VAL:HG23	2.02	0.41
1:B:330[B]:CYS:SG	1:B:372:PHE:CE1	3.14	0.41
1:B:171:ILE:HB	1:B:172:PRO:HD3	2.02	0.41
1:A:312:GLN:N	1:A:313:PRO:CD	2.84	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:393:LEU:HB3	1:B:455:ARG:HA	2.03	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	476/555 (86%)	468 (98%)	8 (2%)	0	100	100
1	B	486/555 (88%)	478 (98%)	8 (2%)	0	100	100
All	All	962/1110 (87%)	946 (98%)	16 (2%)	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	415/497 (84%)	411 (99%)	4 (1%)	76	70
1	B	423/497 (85%)	417 (99%)	6 (1%)	67	58
All	All	838/994 (84%)	828 (99%)	10 (1%)	76	64

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	75	SER
1	A	157	VAL
1	A	432	ASP
1	A	476	GLN
1	B	131	HIS
1	B	157	VAL
1	B	428[A]	THR
1	B	428[B]	THR
1	B	432[A]	ASP
1	B	432[B]	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	470/555 (84%)	0.40	23 (4%) 29 24	20, 33, 54, 69	0
1	B	472/555 (85%)	0.39	32 (6%) 17 13	18, 29, 60, 87	1 (0%)
All	All	942/1110 (84%)	0.40	55 (5%) 23 18	18, 31, 55, 87	1 (0%)

All (55) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	154	GLU	10.7
1	A	293	TYR	7.3
1	B	513	ILE	7.3
1	B	509	THR	7.3
1	B	152	ALA	7.0
1	B	247	ILE	6.7
1	B	252	THR	6.7
1	B	155	ARG	5.4
1	A	246	ASP	4.9
1	A	254	MET	4.8
1	B	156	PRO	4.7
1	A	247	ILE	4.3
1	B	250	HIS	4.3
1	A	463	PRO	3.8
1	A	476	GLN	3.8
1	B	507	ASP	3.7
1	B	256	LYS	3.6
1	B	512	MET	3.6
1	A	477	ASP	3.4
1	A	245	HIS	3.4
1	A	292	GLY	3.3
1	A	401	ASP	3.3
1	A	295	SER	3.3
1	B	245	HIS	3.3

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Mol	Chain	Res	Type	RSRZ
1	B	511	GLN	3.2
1	A	411	TYR	3.0
1	B	465	SER	3.0
1	B	508	LYS	2.9
1	B	254	MET	2.9
1	B	510	GLN	2.9
1	B	515	LYS	2.8
1	A	419	LEU	2.7
1	A	461	ASN	2.7
1	B	501	TRP	2.7
1	B	248	GLN	2.7
1	B	476	GLN	2.7
1	A	404	ASP	2.6
1	A	168	ASN	2.6
1	A	478	LEU	2.6
1	B	145	LYS	2.6
1	B	83[A]	LEU	2.6
1	A	410	GLY	2.6
1	B	151	ALA	2.5
1	B	514	ASN	2.5
1	A	420	SER	2.5
1	B	75	SER	2.5
1	B	131	HIS	2.4
1	B	153	GLU	2.4
1	B	267	ARG	2.3
1	B	411	TYR	2.2
1	A	244	PHE	2.2
1	B	249	LYS	2.2
1	A	465	SER	2.1
1	A	312	GLN	2.0
1	A	471	TRP	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 carbohydrates in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q < 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	CL	B	1530	1/1	0.97	0.06	50,50,50,50	0
2	CL	B	1529	1/1	0.97	0.05	34,34,34,34	0
2	CL	A	1528	1/1	0.98	0.10	28,28,28,28	0
2	CL	B	1528	1/1	0.99	0.05	24,24,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.