



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 14, 2017 – 12:07 am GMT

PDB ID : 4BRN
Title : Legionella pneumophila NTPDase1 crystal form III (closed) in complex with Mg AMP
Authors : Zebisch, M.; Schaefer, P.; Lauble, P.; Straeter, N.
Deposited on : 2013-06-04
Resolution : 1.69 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

<http://wwpdb.org/validation/2016/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
Mogul	:	1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix)	:	1.9-1692
EDS	:	trunk28620
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	recalc28949

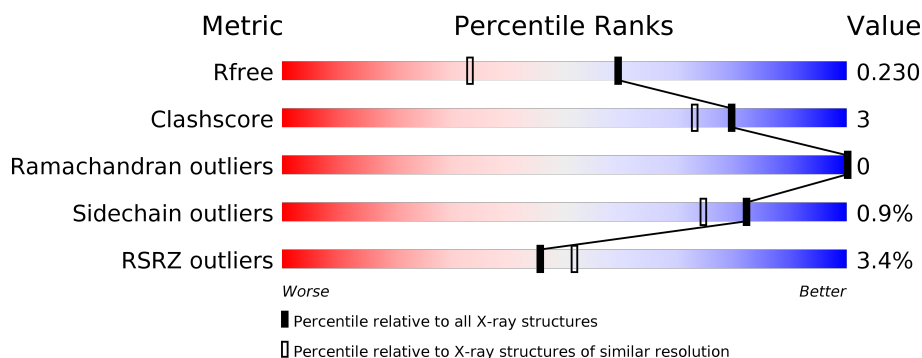
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.69 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}	100719	3453 (1.70-1.70)
Clashscore	112137	3876 (1.70-1.70)
Ramachandran outliers	110173	3815 (1.70-1.70)
Sidechain outliers	110143	3815 (1.70-1.70)
RSRZ outliers	101464	3491 (1.70-1.70)

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. 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	368	<div> <div>4%</div> <div> <div></div> <div>86%</div> <div>10%</div> <div>••</div> </div> </div>
1	B	368	<div> <div>3%</div> <div> <div></div> <div>91%</div> <div>6%</div> <div>•</div> </div> </div>

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
3	MG	A	1394	-	-	-	X

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 6140 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 ECTONUCLEOSIDE TRIPHOSPHATE DIPHOSPHOHYDROLASE I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	356	Total	C	N	O	S	0	5	0
			2870	1826	474	555	15			
1	B	358	Total	C	N	O	S	0	10	0
			2907	1852	477	563	15			

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	34	MET	-	EXPRESSION TAG	UNP Q5ZUA2
A	394	LEU	-	EXPRESSION TAG	UNP Q5ZUA2
A	395	GLU	-	EXPRESSION TAG	UNP Q5ZUA2
A	396	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
A	397	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
A	398	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
A	399	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
A	400	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
A	401	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
A	137	ASP	GLU	CONFLICT	UNP Q5ZUA2
A	149	VAL	ALA	CONFLICT	UNP Q5ZUA2
B	34	MET	-	EXPRESSION TAG	UNP Q5ZUA2
B	394	LEU	-	EXPRESSION TAG	UNP Q5ZUA2
B	395	GLU	-	EXPRESSION TAG	UNP Q5ZUA2
B	396	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
B	397	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
B	398	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
B	399	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
B	400	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
B	401	HIS	-	EXPRESSION TAG	UNP Q5ZUA2
B	137	ASP	GLU	CONFLICT	UNP Q5ZUA2
B	149	VAL	ALA	CONFLICT	UNP Q5ZUA2

- Molecule 2 is ADENOSINE MONOPHOSPHATE (three-letter code: AMP) (formula: C₁₀H₁₄N₅O₇P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			23	10	5	7	1		
2	B	1	Total	C	N	O	P	0	0
			23	10	5	7	1		

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	3	Total	Cl	0	0
			3	3		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	163	Total	O	0	0
			163	163		
5	B	147	Total	O	0	1
			148	148		

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	80.33Å 83.58Å 104.11Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.98 – 1.69 28.96 – 1.69	Depositor EDS
% Data completeness (in resolution range)	98.9 (28.98-1.69) 98.9 (28.96-1.69)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.91 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, R_{free}	0.186 , 0.230 0.185 , 0.230	Depositor DCC
R_{free} test set	1132 reflections (1.48%)	DCC
Wilson B-factor (Å ²)	18.5	Xtriage
Anisotropy	0.299	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 47.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	0.036 for k,h,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6140	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.23% 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: AMP, MG, 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	0.88	1/2961 (0.0%)	0.91	3/4037 (0.1%)
1	B	0.97	1/3013 (0.0%)	0.97	4/4107 (0.1%)
All	All	0.93	2/5974 (0.0%)	0.94	7/8144 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	315	GLU	CD-OE2	-5.44	1.19	1.25
1	B	384	TRP	CE3-CZ3	5.05	1.47	1.38

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	234	MET	CG-SD-CE	9.67	115.68	100.20
1	A	234	MET	CG-SD-CE	8.04	113.07	100.20
1	A	121	MET	CG-SD-CE	-7.63	87.99	100.20
1	B	56	ARG	NE-CZ-NH2	-6.23	117.19	120.30
1	A	392	ARG	CG-CD-NE	-5.31	100.64	111.80
1	B	227	LEU	CB-CG-CD2	-5.05	102.42	111.00
1	B	347	LEU	CB-CG-CD1	-5.01	102.48	111.00

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	2870	0	2744	22	0
1	B	2907	0	2792	14	0
2	A	23	0	12	0	0
2	B	23	0	12	0	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
4	A	3	0	0	0	0
5	A	163	0	0	4	0
5	B	148	0	0	2	0
All	All	6140	0	5560	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 3.

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:A:147[B]:GLN:NE2	5:A:2051:HOH:O	1.69	1.21
1:B:204:ILE:HD11	1:B:285:LEU:HD21	1.44	1.00
1:B:109:HIS:HB3	1:B:145:GLN:HB2	1.61	0.82
1:B:231:GLN:HG3	5:B:2082:HOH:O	1.87	0.74
1:A:104:ALA:O	1:A:105:ASP:HB2	1.87	0.74
1:B:265:LYS:NZ	1:B:266:GLU:OE2	2.22	0.72
1:A:165:LEU:HD21	1:A:212:LEU:HD21	1.71	0.72
1:A:147[B]:GLN:NE2	5:A:2052:HOH:O	2.14	0.69
1:A:206:LYS:HE3	1:A:207:HIS:CE1	2.38	0.58
1:B:92[A]:SER:HB2	1:B:135[A]:GLU:OE1	2.04	0.56
1:A:248:ASP:OD2	1:A:333:GLN:OE1	2.23	0.56
1:B:201:ASN:ND2	1:B:204:ILE:HD12	2.24	0.52
1:A:57:LEU:HD22	1:A:103:LEU:HD23	1.91	0.51
1:A:147[B]:GLN:CD	5:A:2051:HOH:O	2.23	0.50
1:A:50:ALA:HB3	1:A:117:ALA:HA	1.93	0.50
1:B:310:HIS:HD2	5:B:2126:HOH:O	1.96	0.48
1:A:64:THR:HB	1:A:68:ASN:HA	1.96	0.48
1:A:231:GLN:HG3	1:A:353:LEU:HD21	1.97	0.47
1:A:86:ALA:HB2	1:A:121:MET:HG2	1.96	0.47
1:B:201:ASN:ND2	1:B:204:ILE:CD1	2.78	0.47
1:A:231:GLN:HG3	1:A:353:LEU:CD2	2.44	0.46
1:B:303:LEU:HD23	1:B:303:LEU:C	2.36	0.45
1:A:204:ILE:O	1:A:205:SER:C	2.55	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:341:TYR:HB2	1:A:347:LEU:HD22	1.99	0.44
1:A:136:LEU:HD23	1:A:136:LEU:C	2.38	0.44
1:A:210:VAL:HG22	1:A:221:LEU:HB2	1.99	0.44
1:A:283:GLN:HG2	1:A:366:GLY:HA3	2.00	0.43
1:B:201:ASN:HD22	1:B:204:ILE:HD12	1.83	0.43
1:A:110:ASN:ND2	1:A:145:GLN:HA	2.34	0.43
1:B:50:ALA:HB3	1:B:117:ALA:HA	2.00	0.43
1:A:206:LYS:HE3	1:A:207:HIS:HE1	1.81	0.42
1:B:81:ILE:HG21	1:B:101[A]:MET:HG2	2.00	0.42
1:A:319:GLN:NE2	5:A:2148:HOH:O	2.50	0.42
1:B:109:HIS:CB	1:B:145:GLN:HB2	2.42	0.42
1:B:198:MET:SD	1:B:204:ILE:CD1	3.09	0.41
1:A:377:PRO:HA	1:A:378:PRO:HD3	1.95	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	359/368 (98%)	347 (97%)	12 (3%)	0	100	100
1	B	366/368 (100%)	356 (97%)	10 (3%)	0	100	100
All	All	725/736 (98%)	703 (97%)	22 (3%)	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	322/328 (98%)	319 (99%)	3 (1%)	82	74
1	B	328/328 (100%)	325 (99%)	3 (1%)	82	74
All	All	650/656 (99%)	644 (99%)	6 (1%)	82	74

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	ARG
1	A	265	LYS
1	A	319	GLN
1	B	56	ARG
1	B	195	VAL
1	B	200	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	110	ASN
1	A	207	HIS
1	A	319	GLN
1	A	323	GLN
1	A	333	GLN
1	A	391	HIS
1	B	147	GLN
1	B	307	GLN
1	B	310	HIS
1	B	328	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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 8 ligands modelled in this entry, 6 are monoatomic - leaving 2 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$
2	AMP	A	1393	3	22,25,25	1.25	3 (13%)	24,38,38	2.57	5 (20%)
2	AMP	B	1395	3	22,25,25	1.24	3 (13%)	24,38,38	2.62	6 (25%)

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
2	AMP	A	1393	3	-	0/6/26/26	0/3/3/3
2	AMP	B	1395	3	-	0/6/26/26	0/3/3/3

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1393	AMP	C8-N7	2.02	1.38	1.34
2	B	1395	AMP	C8-N7	2.05	1.38	1.34
2	A	1393	AMP	C5-C4	2.38	1.45	1.40
2	B	1395	AMP	C5-C4	2.45	1.46	1.40
2	B	1395	AMP	C2-N3	2.72	1.36	1.32
2	A	1393	AMP	C2-N3	2.95	1.37	1.32

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1395	AMP	N3-C2-N1	-10.43	119.77	128.86

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1393	AMP	N3-C2-N1	-8.56	121.40	128.86
2	A	1393	AMP	C4'-O4'-C1'	-5.08	104.36	109.77
2	B	1395	AMP	C1'-N9-C4	-4.17	119.42	126.64
2	B	1395	AMP	O5'-P-O1P	-2.80	98.62	106.47
2	A	1393	AMP	C1'-N9-C4	-2.57	122.19	126.64
2	B	1395	AMP	C4'-O4'-C1'	-2.41	107.20	109.77
2	B	1395	AMP	C4-C5-N7	-2.09	107.39	109.41
2	B	1395	AMP	P-O5'-C5'	2.91	126.31	118.30
2	A	1393	AMP	C2-N1-C6	3.25	124.45	118.77
2	A	1393	AMP	N6-C6-N1	3.86	126.42	118.77

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 [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	356/368 (96%)	0.13	13 (3%) 42 48	11, 22, 40, 63	0
1	B	358/368 (97%)	0.03	11 (3%) 49 55	11, 18, 35, 53	0
All	All	714/736 (97%)	0.08	24 (3%) 46 52	11, 20, 38, 63	0

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	202	ALA	6.7
1	A	203	GLU	5.5
1	A	177	VAL	5.1
1	B	177	VAL	4.8
1	B	204	ILE	4.6
1	A	179	ASN	4.5
1	B	207	HIS	3.4
1	A	67	THR	3.0
1	A	66	ASP	3.0
1	A	343	ASP	2.9
1	B	66	ASP	2.8
1	B	179	ASN	2.8
1	B	216	GLY	2.7
1	A	200	LYS	2.5
1	B	343	ASP	2.5
1	A	206	LYS	2.4
1	B	206	LYS	2.4
1	B	144	SER	2.3
1	B	394	LEU	2.2
1	A	68	ASN	2.1
1	A	207	HIS	2.1
1	B	393	ALA	2.1
1	A	141	ARG	2.0
1	A	201	ASN	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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(\AA^2)	Q<0.9
3	MG	A	1394	1/1	0.99	0.12	2.01	13,13,13,13	0
2	AMP	A	1393	23/23	0.98	0.07	-0.53	15,18,26,29	0
3	MG	A	1398	1/1	0.99	0.10	-0.66	25,25,25,25	0
4	CL	A	1395	1/1	0.98	0.06	-0.96	20,20,20,20	0
4	CL	A	1397	1/1	0.97	0.07	-1.20	21,21,21,21	0
3	MG	B	1396	1/1	0.98	0.09	-1.34	12,12,12,12	0
2	AMP	B	1395	23/23	0.98	0.06	-1.55	12,17,22,26	0
4	CL	A	1396	1/1	0.99	0.05	-2.37	19,19,19,19	0

6.5 Other polymers [i](#)

There are no such residues in this entry.