



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 10:41 AM UTC

PDB ID : 1HF8 / pdb_00001hf8
Title : CALM-N N-terminal domain of clathrin assembly lymphoid myeloid leukaemia protein
Authors : Ford, M.G.J.; Evans, P.R.; McMahon, H.T.
Deposited on : 2000-11-30
Resolution : 2.00 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

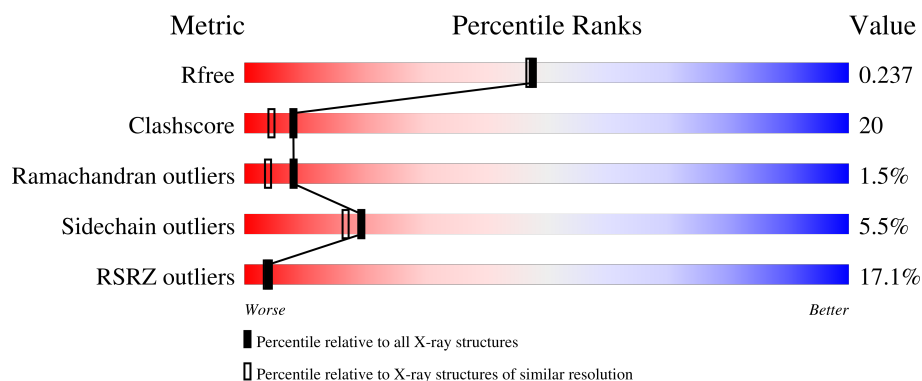
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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	289	16% 57% 27% 6% 9%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2244 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 CLATHRIN ASSEMBLY PROTEIN SHORT FORM.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	263	Total	C	N	O	S	0	0	0
			2114	1345	363	393	13			

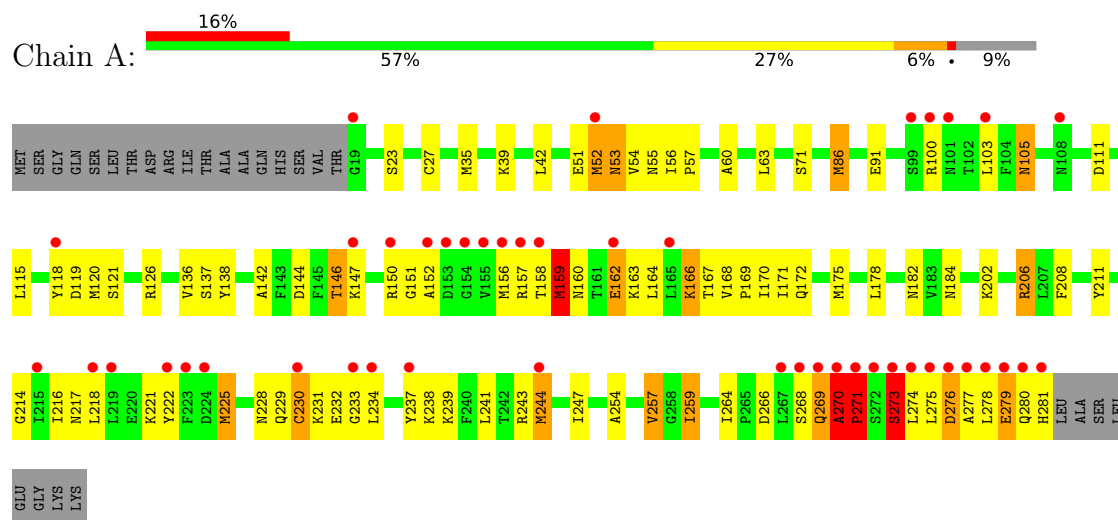
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	130	Total	O	0	0
			130	130		

3 Residue-property plots

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: CLATHRIN ASSEMBLY PROTEIN SHORT FORM



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	77.93Å 77.93Å 121.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	65.94 – 2.00 65.65 – 2.00	Depositor EDS
% Data completeness (in resolution range)	98.7 (65.94-2.00) 99.9 (65.65-2.00)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.18 (at 2.00Å)	Xtriage
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.190 , 0.223 0.201 , 0.237	Depositor DCC
R_{free} test set	1324 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	35.2	Xtriage
Anisotropy	0.530	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 46.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	2244	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.49% 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	1.95	34/2150 (1.6%)	1.54	20/2896 (0.7%)

All (34) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	86	MET	SD-CE	-30.51	1.03	1.79
1	A	35	MET	SD-CE	-12.71	1.47	1.79
1	A	156	MET	SD-CE	-11.63	1.50	1.79
1	A	52	MET	SD-CE	11.17	2.07	1.79
1	A	175	MET	SD-CE	-9.55	1.55	1.79
1	A	264	ILE	CA-CB	-9.24	1.42	1.54
1	A	120	MET	SD-CE	-8.17	1.59	1.79
1	A	257	VAL	C-O	-8.15	1.13	1.24
1	A	244	MET	SD-CE	-7.99	1.59	1.79
1	A	171	ILE	CA-CB	-7.68	1.44	1.54
1	A	146	THR	CA-CB	7.49	1.66	1.53
1	A	27	CYS	C-O	-7.48	1.15	1.24
1	A	159	MET	SD-CE	-7.28	1.61	1.79
1	A	100	ARG	CA-C	-6.96	1.43	1.53
1	A	54	VAL	C-O	-6.90	1.15	1.24
1	A	206	ARG	CG-CD	-6.82	1.31	1.52
1	A	136	VAL	CA-CB	-6.26	1.46	1.54
1	A	184	ASN	CA-C	-6.25	1.45	1.52
1	A	126	ARG	CA-C	6.25	1.60	1.52
1	A	56	ILE	CA-CB	-6.14	1.49	1.53
1	A	175	MET	CA-C	-6.14	1.44	1.52
1	A	39	LYS	CA-C	6.08	1.60	1.52
1	A	225	MET	SD-CE	-6.00	1.64	1.79
1	A	42	LEU	CA-CB	5.94	1.62	1.53
1	A	211	TYR	CA-C	5.79	1.60	1.52
1	A	257	VAL	CA-CB	5.55	1.62	1.54
1	A	71	SER	C-O	5.51	1.30	1.24
1	A	172	GLN	CA-C	-5.45	1.45	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	266	ASP	C-O	-5.40	1.17	1.24
1	A	119	ASP	CA-C	5.35	1.59	1.52
1	A	121	SER	CA-CB	5.20	1.61	1.53
1	A	115	LEU	CA-C	5.20	1.59	1.52
1	A	268	SER	CA-CB	5.14	1.59	1.53
1	A	259	ILE	C-O	-5.00	1.19	1.24

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	206	ARG	CA-CB-CG	-8.33	97.44	114.10
1	A	268	SER	N-CA-C	-7.87	93.21	107.60
1	A	103	LEU	N-CA-CB	-7.20	104.89	111.59
1	A	257	VAL	CB-CA-C	-6.33	102.01	112.26
1	A	60	ALA	N-CA-C	6.24	118.59	111.11
1	A	270	ALA	N-CA-C	6.24	123.59	109.81
1	A	276	ASP	N-CA-C	-6.19	104.10	113.89
1	A	118	TYR	CB-CA-C	-5.99	101.48	110.88
1	A	268	SER	CB-CA-C	5.87	120.62	111.70
1	A	142	ALA	N-CA-C	5.78	119.91	112.86
1	A	271	PRO	CB-CA-C	-5.60	102.31	111.56
1	A	63	LEU	N-CA-C	-5.58	105.27	111.36
1	A	277	ALA	N-CA-C	-5.54	106.60	113.19
1	A	178	LEU	N-CA-C	-5.43	105.26	111.07
1	A	214	GLY	N-CA-C	-5.37	106.00	112.49
1	A	152	ALA	N-CA-C	-5.31	107.81	114.56
1	A	42	LEU	N-CA-C	5.20	117.62	111.33
1	A	111	ASP	N-CA-C	-5.15	100.13	108.52
1	A	273	SER	N-CA-C	5.09	121.64	110.80
1	A	279	GLU	CA-CB-CG	-5.00	104.09	114.10

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	2114	0	2137	83	0
2	A	130	0	0	6	1
All	All	2244	0	2137	83	1

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 20.

All (83) 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:52:MET:CE	1:A:52:MET:SD	2.07	1.42
1:A:86:MET:CE	1:A:86:MET:CG	2.08	1.30
1:A:86:MET:CE	1:A:86:MET:SD	1.03	1.13
1:A:208:PHE:HE1	1:A:244:MET:HE1	1.09	1.11
1:A:86:MET:SD	1:A:86:MET:HE1	1.63	1.05
1:A:86:MET:SD	1:A:86:MET:HE3	1.63	1.03
1:A:86:MET:SD	1:A:86:MET:HE2	1.63	1.03
1:A:159:MET:HE2	1:A:163:LYS:HG3	1.46	0.98
1:A:208:PHE:CE1	1:A:244:MET:HE1	1.98	0.97
1:A:159:MET:HE2	1:A:163:LYS:CG	1.95	0.95
1:A:244:MET:HE3	1:A:244:MET:HA	1.59	0.82
1:A:279:GLU:O	1:A:279:GLU:HG2	1.82	0.79
1:A:208:PHE:HE1	1:A:244:MET:CE	1.94	0.78
1:A:208:PHE:CE1	1:A:244:MET:CE	2.70	0.74
1:A:105:ASN:C	1:A:105:ASN:HD22	1.98	0.72
1:A:243:ARG:O	1:A:247:ILE:HG13	1.91	0.71
1:A:228:ASN:O	1:A:231:LYS:HB3	1.92	0.70
1:A:274:LEU:HG	1:A:274:LEU:O	1.92	0.70
1:A:159:MET:HE2	1:A:163:LYS:HG2	1.73	0.68
1:A:164:LEU:HD22	1:A:217:ASN:ND2	2.09	0.67
1:A:151:GLY:O	1:A:157:ARG:HD3	1.96	0.65
1:A:270:ALA:N	1:A:271:PRO:HD3	2.13	0.63
1:A:158:THR:O	1:A:158:THR:HG22	2.00	0.61
1:A:105:ASN:C	1:A:105:ASN:ND2	2.57	0.60
1:A:86:MET:CE	1:A:86:MET:HG3	2.23	0.60
1:A:147:LYS:HE3	2:A:2083:HOH:O	2.02	0.59
1:A:86:MET:CG	1:A:86:MET:HE2	2.09	0.59
1:A:86:MET:HE2	1:A:86:MET:HG3	1.82	0.59
1:A:225:MET:CE	1:A:230:CYS:HA	2.33	0.59
1:A:144:ASP:OD1	1:A:146:THR:OG1	2.21	0.58
1:A:237:TYR:CE1	1:A:241:LEU:HD11	2.38	0.58
1:A:86:MET:HE3	1:A:86:MET:CB	2.35	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:168:VAL:N	1:A:169:PRO:CD	2.70	0.55
1:A:229:GLN:O	1:A:232:GLU:N	2.40	0.54
1:A:86:MET:CG	1:A:86:MET:HE3	2.09	0.54
1:A:225:MET:HE3	1:A:230:CYS:N	2.23	0.53
1:A:229:GLN:O	1:A:230:CYS:C	2.51	0.53
1:A:233:GLY:O	1:A:234:LEU:C	2.50	0.53
1:A:225:MET:HE2	1:A:230:CYS:HA	1.91	0.53
1:A:159:MET:CE	1:A:163:LYS:HG2	2.39	0.52
1:A:276:ASP:C	1:A:278:LEU:H	2.16	0.52
1:A:163:LYS:O	1:A:166:LYS:HB2	2.11	0.51
1:A:160:ASN:OD1	1:A:162:GLU:N	2.43	0.50
1:A:232:GLU:O	1:A:233:GLY:C	2.55	0.50
1:A:222:TYR:HE2	1:A:276:ASP:HB2	1.78	0.48
1:A:91:GLU:OE2	1:A:138:TYR:OH	2.27	0.48
1:A:86:MET:HE3	1:A:86:MET:HB2	1.96	0.48
1:A:222:TYR:CE2	1:A:276:ASP:HB2	2.49	0.48
1:A:55:ASN:OD1	1:A:57:PRO:HD2	2.14	0.48
1:A:147:LYS:CE	2:A:2083:HOH:O	2.59	0.48
1:A:160:ASN:OD1	1:A:160:ASN:C	2.57	0.47
1:A:225:MET:HE3	1:A:230:CYS:HA	1.97	0.47
1:A:86:MET:CE	1:A:86:MET:CB	2.88	0.46
1:A:167:THR:O	1:A:170:ILE:N	2.44	0.46
1:A:229:GLN:O	1:A:231:LYS:N	2.48	0.46
1:A:254:ALA:HB1	1:A:259:ILE:HD12	1.97	0.46
1:A:273:SER:C	1:A:275:LEU:H	2.24	0.46
1:A:51:GLU:HB3	2:A:2018:HOH:O	2.15	0.46
1:A:244:MET:HA	1:A:244:MET:CE	2.35	0.46
1:A:269:GLN:C	1:A:271:PRO:HD3	2.41	0.45
1:A:274:LEU:O	1:A:274:LEU:CG	2.63	0.45
1:A:276:ASP:C	1:A:278:LEU:N	2.72	0.45
1:A:229:GLN:C	1:A:231:LYS:N	2.71	0.45
1:A:160:ASN:ND2	2:A:2088:HOH:O	2.44	0.45
1:A:162:GLU:HG2	1:A:163:LYS:N	2.32	0.44
1:A:53:ASN:HB2	2:A:2018:HOH:O	2.17	0.44
1:A:257:VAL:O	1:A:257:VAL:CG1	2.65	0.43
1:A:237:TYR:O	1:A:238:LYS:C	2.62	0.43
1:A:150:ARG:NH2	2:A:2086:HOH:O	2.50	0.43
1:A:206:ARG:HH11	1:A:206:ARG:HD3	1.68	0.42
1:A:217:ASN:OD1	1:A:221:LYS:HD2	2.20	0.42
1:A:239:LYS:O	1:A:243:ARG:HD2	2.19	0.42
1:A:234:LEU:HA	1:A:234:LEU:HD12	1.76	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:157:ARG:HH21	1:A:216:ILE:HG21	1.85	0.41
1:A:159:MET:CE	1:A:163:LYS:CG	2.81	0.41
1:A:167:THR:O	1:A:168:VAL:C	2.63	0.41
1:A:273:SER:O	1:A:275:LEU:N	2.53	0.41
1:A:105:ASN:ND2	1:A:105:ASN:O	2.45	0.41
1:A:225:MET:HE3	1:A:229:GLN:C	2.45	0.41
1:A:150:ARG:NH2	1:A:206:ARG:HD2	2.36	0.41
1:A:273:SER:C	1:A:275:LEU:N	2.79	0.40
1:A:157:ARG:HD3	1:A:157:ARG:HH11	1.71	0.40
1:A:225:MET:HE3	1:A:230:CYS:CA	2.52	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:2044:HOH:O	2:A:2044:HOH:O[7_556]	2.02	0.18

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	261/289 (90%)	242 (93%)	15 (6%)	4 (2%)	 

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	270	ALA
1	A	230	CYS
1	A	273	SER
1	A	271	PRO

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	235/256 (92%)	222 (94%)	13 (6%)	19	17

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	23	SER
1	A	53	ASN
1	A	105	ASN
1	A	137	SER
1	A	159	MET
1	A	162	GLU
1	A	166	LYS
1	A	182	ASN
1	A	202	LYS
1	A	218	LEU
1	A	269	GLN
1	A	280	GLN
1	A	281	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	95	GLN
1	A	116	GLN
1	A	173	ASN
1	A	212	ASN
1	A	269	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	263/289 (91%)	0.70	45 (17%) 4 4	22, 41, 90, 125	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	275	LEU	5.8
1	A	281	HIS	5.2
1	A	222	TYR	5.1
1	A	277	ALA	4.8
1	A	218	LEU	4.4
1	A	270	ALA	4.4
1	A	274	LEU	4.3
1	A	230	CYS	4.1
1	A	155	VAL	4.1
1	A	278	LEU	4.0
1	A	52	MET	3.9
1	A	219	LEU	3.4
1	A	234	LEU	3.4
1	A	153	ASP	3.3
1	A	279	GLU	3.3
1	A	268	SER	3.2
1	A	154	GLY	3.1
1	A	224	ASP	3.1
1	A	267	LEU	3.1
1	A	269	GLN	2.9
1	A	158	THR	2.9
1	A	19	GLY	2.9
1	A	99	SER	2.9
1	A	152	ALA	2.8
1	A	165	LEU	2.8
1	A	271	PRO	2.8
1	A	280	GLN	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	101	ASN	2.6
1	A	272	SER	2.6
1	A	147	LYS	2.6
1	A	150	ARG	2.6
1	A	100	ARG	2.5
1	A	244	MET	2.5
1	A	118	TYR	2.5
1	A	237	TYR	2.4
1	A	156	MET	2.4
1	A	276	ASP	2.4
1	A	157	ARG	2.3
1	A	273	SER	2.3
1	A	103	LEU	2.2
1	A	162	GLU	2.1
1	A	215	ILE	2.1
1	A	223	PHE	2.1
1	A	108	ASN	2.1
1	A	233	GLY	2.1

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.