



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:52 PM UTC

PDB ID : 8VYD / pdb_00008vyd
Title : A novel synthase generates m4(2)C to stabilize the archaeal ribosome
Authors : Ho, P.S.; Santangelo, T.J.; Fluke, K.
Deposited on : 2024-02-08
Resolution : 1.95 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

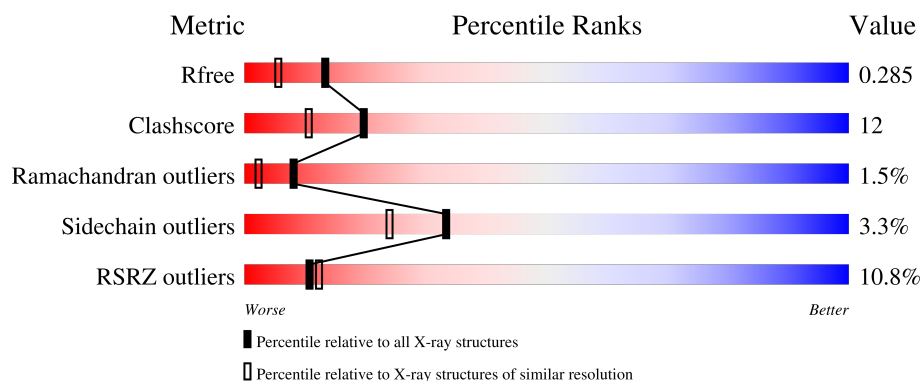
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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	3494 (1.96-1.96)
Clashscore	190562	3612 (1.96-1.96)
Ramachandran outliers	187476	3587 (1.96-1.96)
Sidechain outliers	187428	3587 (1.96-1.96)
RSRZ outliers	180081	3495 (1.96-1.96)

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	290	9% 68% 20% •• 8%
1	B	290	10% 71% 19% • 9%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4489 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 SAM-dependent methyltransferase, UPF0020 family.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	267	Total	C	N	O	S	0	8	0
			2189	1397	387	398	7			
1	B	263	Total	C	N	O	S	0	2	0
			2112	1347	370	388	7			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	103	ALA	ARG	conflict	UNP Q5JDR0
B	103	ALA	ARG	conflict	UNP Q5JDR0

- Molecule 2 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	6	Total	Na	0	0
			6	6		

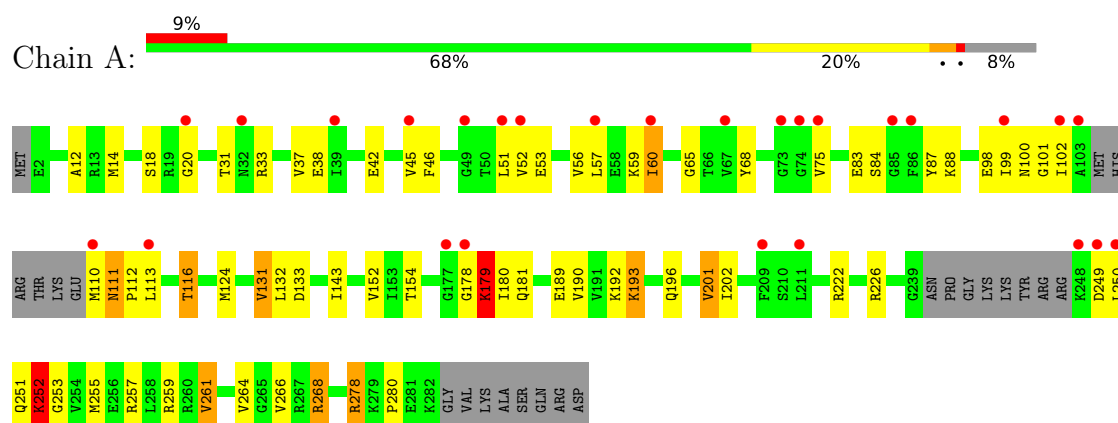
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	113	Total	O	0	0
			113	113		
3	B	69	Total	O	0	0
			69	69		

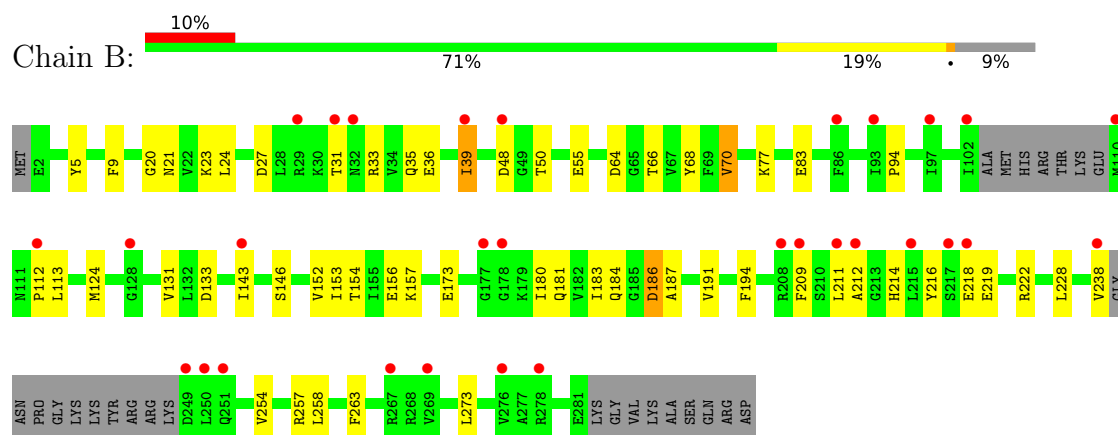
3 Residue-property plots [i](#)

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: SAM-dependent methyltransferase, UPF0020 family



- Molecule 1: SAM-dependent methyltransferase, UPF0020 family



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	37.67Å 97.28Å 89.02Å 90.00° 99.64° 90.00°	Depositor
Resolution (Å)	42.54 – 1.95 42.54 – 1.95	Depositor EDS
% Data completeness (in resolution range)	84.7 (42.54-1.95) 84.6 (42.54-1.95)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.44 (at 1.95Å)	Xtriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, R_{free}	0.238 , 0.287 0.251 , 0.285	Depositor DCC
R_{free} test set	1981 reflections (3.64%)	wwPDB-VP
Wilson B-factor (Å ²)	32.1	Xtriage
Anisotropy	0.235	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 40.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.033 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4489	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.90% 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

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

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	0.34	0/2226	0.60	0/2999
1	B	0.32	0/2149	0.54	0/2897
All	All	0.33	0/4375	0.58	0/5896

There are no bond length outliers.

There are no bond angle outliers.

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	2189	0	2234	56	0
1	B	2112	0	2138	44	0
2	A	6	0	0	0	0
3	A	113	0	0	3	0
3	B	69	0	0	1	0
All	All	4489	0	4372	100	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 12.

All (100) 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:99[B]:ILE:HG12	1:A:102:ILE:HD12	1.55	0.89
1:A:222:ARG:HG3	1:A:261:VAL:HG22	1.56	0.87
1:A:83:GLU:HG3	1:A:84:SER:H	1.46	0.78
1:A:38:GLU:HG3	1:A:45:VAL:HG12	1.69	0.73
1:A:53:GLU:HG2	1:A:56:VAL:HG23	1.71	0.73
1:A:111[B]:ASN:N	1:A:111[B]:ASN:OD1	2.21	0.73
1:A:83:GLU:HG3	1:A:84:SER:N	2.05	0.70
1:B:143:ILE:CD1	1:B:173:GLU:HB2	2.21	0.70
1:B:55:GLU:H	1:B:55:GLU:CD	2.01	0.68
1:A:65:GLY:O	1:A:88:LYS:NZ	2.22	0.67
1:A:110:MET:HE1	1:A:113:LEU:HG	1.76	0.66
1:B:21:ASN:ND2	1:B:36:GLU:OE2	2.29	0.65
1:A:56:VAL:HG11	1:A:75:VAL:HG21	1.78	0.64
1:A:37:VAL:HG22	1:A:46:PHE:HA	1.79	0.63
1:A:52:VAL:HG13	1:A:75:VAL:HG11	1.80	0.62
1:A:99[B]:ILE:O	1:A:101:GLY:N	2.33	0.61
1:A:124:MET:HE3	1:A:124:MET:HA	1.84	0.60
1:A:255:MET:HG2	1:A:266:VAL:HG12	1.83	0.60
1:B:216:TYR:O	1:B:257:ARG:NH1	2.35	0.59
1:A:42:GLU:HG2	1:A:51:LEU:HD11	1.85	0.59
1:B:5:TYR:HE2	1:B:48:ASP:HB2	1.68	0.58
1:B:146:SER:HB3	1:B:180:ILE:HD11	1.84	0.58
1:A:131:VAL:HG22	1:A:152:VAL:HG13	1.87	0.57
1:B:66:THR:HG21	1:B:77:LYS:HE2	1.87	0.56
1:B:131:VAL:HG13	1:B:152:VAL:HG13	1.88	0.55
1:A:38:GLU:CG	1:A:45:VAL:HG12	2.35	0.55
1:B:5:TYR:CE2	1:B:48:ASP:HB2	2.41	0.55
1:A:42:GLU:H	1:A:42:GLU:CD	2.14	0.55
1:B:238:VAL:HG22	1:B:273:LEU:O	2.07	0.54
1:A:190:VAL:O	1:A:193[A]:LYS:HG3	2.07	0.54
1:A:178:GLY:O	1:A:179:LYS:HB2	2.06	0.54
1:A:12:ALA:HB2	1:A:60[A]:ILE:HG13	1.88	0.53
1:B:143:ILE:HD11	1:B:173:GLU:HB2	1.90	0.53
1:A:131:VAL:HB	1:A:201:VAL:HG22	1.91	0.52
1:A:250:LEU:HD23	1:A:251:GLN:H	1.75	0.52
1:B:187:ALA:O	1:B:191:VAL:HG13	2.10	0.52
1:B:5:TYR:HB2	1:B:70:VAL:HG13	1.92	0.52
1:A:251:GLN:HE22	1:A:268:ARG:NH1	2.07	0.51
1:B:153:ILE:HG23	1:B:183:ILE:HD13	1.92	0.51
1:A:31:THR:O	1:A:33:ARG:N	2.44	0.51
1:B:31:THR:HG22	1:B:33:ARG:HB2	1.93	0.50
1:B:218:GLU:HG3	1:B:222:ARG:NH1	2.27	0.50

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:33:ARG:HH11	1:B:33:ARG:HG2	1.75	0.50
1:B:143:ILE:HD12	1:B:173:GLU:HB2	1.91	0.50
1:A:226:ARG:NH1	1:A:226:ARG:HG2	2.27	0.49
1:A:60[A]:ILE:HG22	1:A:68:TYR:CZ	2.47	0.49
1:A:31:THR:C	1:A:33:ARG:H	2.19	0.49
1:A:190:VAL:HG13	1:A:193[A]:LYS:HE2	1.95	0.49
1:A:133:ASP:O	1:A:154:THR:HA	2.13	0.49
1:B:9:PHE:CD1	1:B:64:ASP:HA	2.48	0.49
1:B:31:THR:C	1:B:33:ARG:H	2.21	0.48
1:A:251:GLN:OE1	1:A:268:ARG:HD3	2.13	0.48
1:A:99[A]:ILE:O	1:A:101:GLY:N	2.46	0.48
1:B:212:ALA:HB1	1:B:214:HIS:CE1	2.49	0.48
1:A:249:ASP:O	1:A:252:LYS:HB2	2.14	0.48
1:B:143:ILE:HD13	1:B:143:ILE:HA	1.68	0.48
1:A:222:ARG:HD3	3:A:465:HOH:O	2.13	0.47
1:A:59:LYS:HD3	1:A:60[B]:ILE:HG22	1.96	0.47
1:A:143:ILE:HA	1:A:180:ILE:HD11	1.97	0.47
1:B:228:LEU:HD12	1:B:263:PHE:HE1	1.79	0.47
1:B:33:ARG:NH1	1:B:35:GLN:HG2	2.29	0.46
1:A:99[B]:ILE:CG1	1:A:102:ILE:HD12	2.38	0.46
1:B:133:ASP:O	1:B:154:THR:HA	2.16	0.46
1:A:250:LEU:HD23	1:A:251:GLN:N	2.31	0.45
1:B:157:LYS:HE3	1:B:186:ASP:OD2	2.17	0.45
1:A:57:LEU:H	1:A:57:LEU:HD12	1.82	0.44
1:A:98:GLU:HG3	1:A:102:ILE:H	1.82	0.44
1:B:146:SER:CB	1:B:180:ILE:HD11	2.47	0.44
1:A:87:TYR:CD1	1:A:87:TYR:N	2.86	0.43
1:A:14:MET:HE2	1:A:14:MET:HB2	1.83	0.43
1:A:255:MET:O	1:A:259:ARG:HG3	2.18	0.43
1:B:27:ASP:OD2	1:B:31:THR:HB	2.18	0.43
1:B:48:ASP:HB3	1:B:50:THR:H	1.83	0.43
1:B:23:LYS:O	1:B:24:LEU:HD23	2.18	0.43
1:B:156:GLU:O	1:B:184:GLN:HA	2.18	0.43
1:A:264:VAL:HG23	1:A:278[A]:ARG:HG2	2.01	0.43
1:A:196:GLN:HG3	1:A:226:ARG:O	2.19	0.42
1:B:218:GLU:HA	1:B:218:GLU:OE1	2.17	0.42
1:A:253:GLY:HA3	1:A:257:ARG:NH2	2.34	0.42
1:B:191:VAL:HA	1:B:194:PHE:CD2	2.54	0.42
1:A:52:VAL:HG12	1:A:56:VAL:HB	2.01	0.42
1:A:14:MET:O	1:A:18:SER:HB2	2.20	0.42
1:A:132:LEU:HB3	1:A:202:ILE:HG12	2.02	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:226:ARG:HG2	1:A:226:ARG:HH11	1.85	0.42
1:B:113:LEU:HD12	1:B:113:LEU:HA	1.84	0.42
1:B:184:GLN:O	3:B:301:HOH:O	2.22	0.42
1:B:68:TYR:CE2	1:B:77:LYS:HG2	2.54	0.42
1:B:94:PRO:HD3	1:B:112:PRO:HG2	2.01	0.42
1:A:87:TYR:CD2	1:A:99[A]:ILE:HG12	2.54	0.41
1:A:259:ARG:HD2	3:A:446:HOH:O	2.20	0.41
1:B:254:VAL:O	1:B:258:LEU:HD22	2.20	0.41
1:A:189:GLU:OE2	1:A:192:LYS:NZ	2.43	0.41
1:A:252:LYS:HA	1:A:252:LYS:HD2	1.66	0.41
1:B:181:GLN:NE2	1:B:183:ILE:HD11	2.35	0.41
1:B:209:PHE:C	1:B:209:PHE:CD1	2.99	0.41
1:B:143:ILE:HD12	1:B:143:ILE:HG23	1.85	0.41
1:B:83:GLU:H	1:B:83:GLU:HG2	1.73	0.41
1:B:219:GLU:H	1:B:219:GLU:HG2	1.70	0.41
1:B:20:GLY:O	1:B:39:ILE:HG13	2.21	0.40
1:A:116:THR:HB	3:A:455:HOH:O	2.20	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	269/290 (93%)	251 (93%)	10 (4%)	8 (3%)	3	0
1	B	258/290 (89%)	246 (95%)	11 (4%)	1 (0%)	30	21
All	All	527/580 (91%)	497 (94%)	21 (4%)	9 (2%)	8	2

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	20	GLY

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	100	ASN
1	A	179	LYS
1	A	252	LYS
1	A	112	PRO
1	A	111[A]	ASN
1	A	111[B]	ASN
1	A	280	PRO
1	B	124	MET

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	234/246 (95%)	220 (94%)	14 (6%)	17	7
1	B	226/246 (92%)	222 (98%)	4 (2%)	51	47
All	All	460/492 (94%)	442 (96%)	18 (4%)	33	18

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	60[A]	ILE
1	A	60[B]	ILE
1	A	116	THR
1	A	131	VAL
1	A	179	LYS
1	A	181	GLN
1	A	193[A]	LYS
1	A	193[B]	LYS
1	A	201	VAL
1	A	252	LYS
1	A	261	VAL
1	A	268	ARG
1	A	278[A]	ARG
1	A	278[B]	ARG
1	B	39	ILE

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	70	VAL
1	B	186	ASP
1	B	211	LEU

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

Mol	Chain	Res	Type
1	B	72	ASN
1	B	181	GLN
1	B	214	HIS

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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 6 ligands modelled in this entry, 6 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 [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	267/290 (92%)	0.70	27 (10%)	12 14	14, 40, 78, 92	8 (2%)
1	B	263/290 (90%)	0.88	30 (11%)	10 11	18, 45, 75, 86	2 (0%)
All	All	530/580 (91%)	0.79	57 (10%)	11 12	14, 43, 78, 92	10 (1%)

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	102	ILE	6.9
1	A	103	ALA	4.9
1	A	67[A]	VAL	4.0
1	B	209	PHE	4.0
1	B	250	LEU	3.8
1	B	102	ILE	3.6
1	B	238	VAL	3.6
1	B	251	GLN	3.5
1	A	75	VAL	3.4
1	B	249[A]	ASP	3.4
1	A	178	GLY	3.3
1	A	99[A]	ILE	3.0
1	B	32	ASN	2.9
1	B	143	ILE	2.9
1	B	212	ALA	2.8
1	B	48	ASP	2.8
1	A	86	PHE	2.7
1	B	276	VAL	2.7
1	A	73	GLY	2.7
1	A	209	PHE	2.7
1	B	269	VAL	2.7
1	A	211	LEU	2.7
1	B	211	LEU	2.7
1	A	39	ILE	2.7

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	31	THR	2.6
1	B	112	PRO	2.6
1	B	128	GLY	2.6
1	B	178	GLY	2.6
1	A	250	LEU	2.5
1	A	113	LEU	2.5
1	B	110	MET	2.5
1	B	93	ILE	2.4
1	B	29	ARG	2.4
1	B	86	PHE	2.4
1	B	39	ILE	2.4
1	B	278	ARG	2.4
1	A	249	ASP	2.4
1	B	177	GLY	2.4
1	A	20	GLY	2.3
1	A	45	VAL	2.3
1	A	60[A]	ILE	2.2
1	A	110	MET	2.2
1	A	248	LYS	2.2
1	B	208	ARG	2.2
1	A	51	LEU	2.2
1	A	85	GLY	2.2
1	B	215	LEU	2.2
1	B	267	ARG	2.2
1	A	74	GLY	2.1
1	A	32	ASN	2.1
1	A	49	GLY	2.1
1	A	57	LEU	2.1
1	A	177	GLY	2.1
1	A	52	VAL	2.1
1	B	218	GLU	2.0
1	B	217	SER	2.0
1	B	97	ILE	2.0

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

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

6.3 Carbohydrates ⓘ

There are no oligosaccharides 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	NA	A	304	1/1	0.83	0.11	46,46,46,46	0
2	NA	A	303	1/1	0.85	0.30	43,43,43,43	0
2	NA	A	305	1/1	0.86	0.10	60,60,60,60	0
2	NA	A	306	1/1	0.89	0.13	49,49,49,49	0
2	NA	A	302	1/1	0.94	0.13	35,35,35,35	0
2	NA	A	301	1/1	0.97	0.07	32,32,32,32	0

6.5 Other polymers [i](#)

There are no such residues in this entry.