



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 10:06 AM UTC

PDB ID : 7FSF / pdb_00007fsf
Title : CRYSTAL STRUCTURE OF T. MARITIMA REVERSE GYRASE ACTIVE SITE VARIANT Y851F
Authors : Rasche, R.; Kummel, D.; Rudolph, M.G.; Klostermeier, D.
Deposited on : 2023-01-04
Resolution : 2.77 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

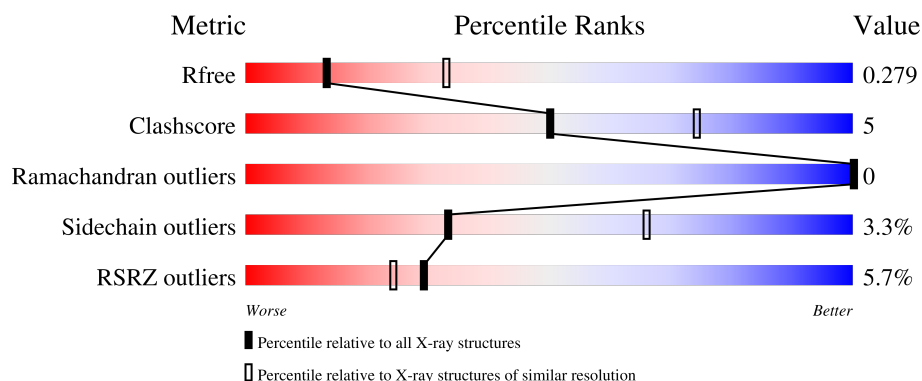
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.77 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	5248 (2.80-2.76)
Clashscore	190562	5693 (2.80-2.76)
Ramachandran outliers	187476	5590 (2.80-2.76)
Sidechain outliers	187428	5592 (2.80-2.76)
RSRZ outliers	180081	5251 (2.80-2.76)

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	1104	6% 82% 17%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 9031 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 Reverse gyrase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1102	9029	5759	1563	1681	26	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	851	PHE	TYR	engineered mutation	UNP O51934

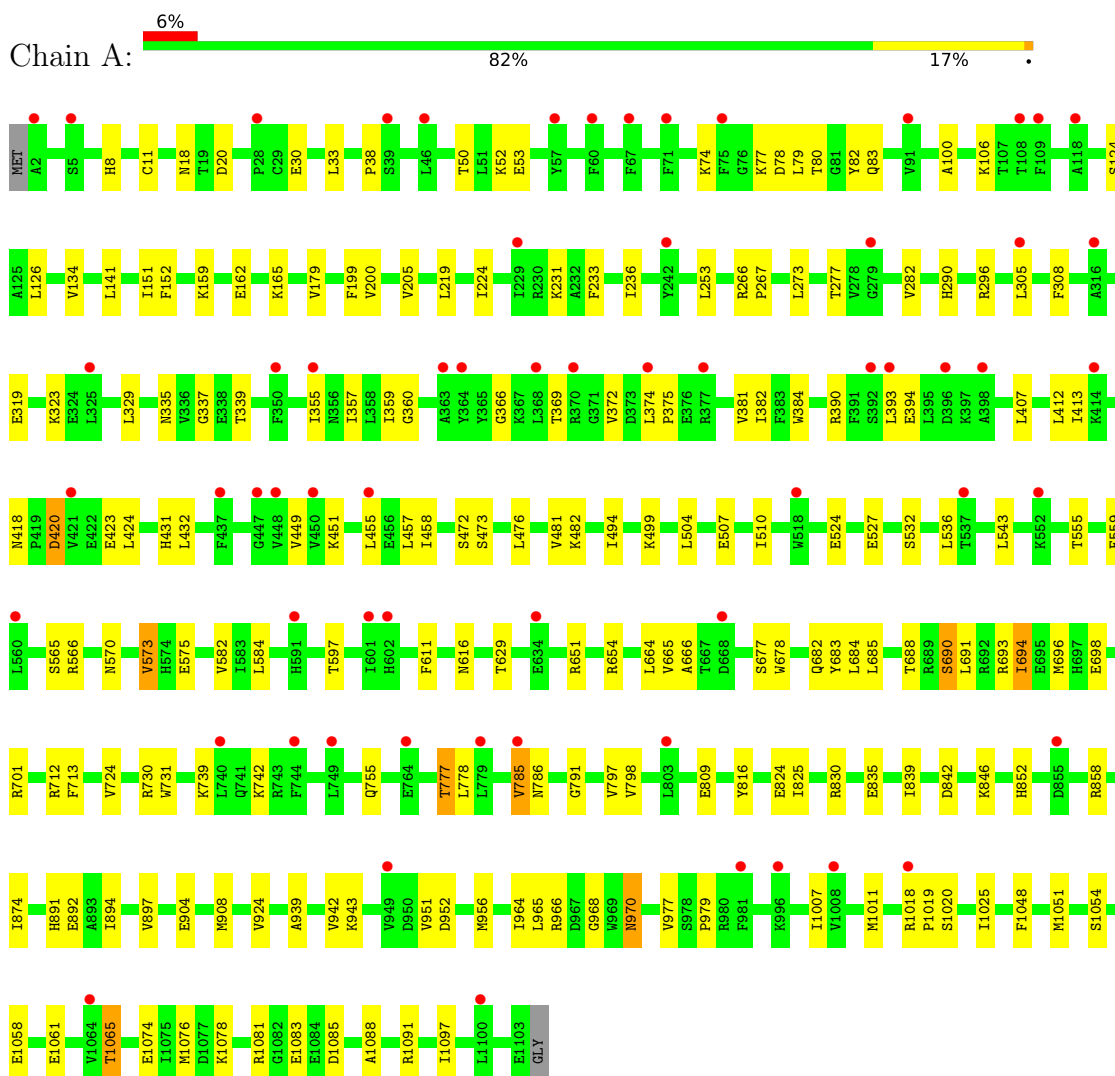
- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Zn	0	0
			2	2		

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: Reverse gyrase



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	183.93Å 103.26Å 95.67Å 90.00° 116.82° 90.00°	Depositor
Resolution (Å)	51.86 – 2.77 51.86 – 2.77	Depositor EDS
% Data completeness (in resolution range)	72.9 (51.86-2.77) 70.9 (51.86-2.77)	Depositor EDS
R_{merge}	0.35	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.56 (at 2.77Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.219 , 0.273 0.225 , 0.279	Depositor DCC
R_{free} test set	1475 reflections (3.62%)	wwPDB-VP
Wilson B-factor (Å ²)	62.8	Xtriage
Anisotropy	0.073	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 44.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	9031	wwPDB-VP
Average B, all atoms (Å ²)	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.72% 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: ZN

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	0.12	0/9190	0.31	0/12354

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 [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	9029	0	9186	96	0
2	A	2	0	0	0	0
All	All	9031	0	9186	96	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 5.

All (96) 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:555:THR:HG21	1:A:846:LYS:HA	1.67	0.76
1:A:688:THR:HG22	1:A:690:SER:H	1.59	0.67

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:566:ARG:HB2	1:A:573:VAL:HG13	1.79	0.64
1:A:305:LEU:HD13	1:A:357:ILE:HD13	1.78	0.63
1:A:964:ILE:HD13	1:A:970:ASN:HD21	1.64	0.61
1:A:329:LEU:HD12	1:A:359:ILE:HD11	1.85	0.58
1:A:375:PRO:HB2	1:A:476:LEU:HD21	1.83	0.58
1:A:413:ILE:HD12	1:A:424:LEU:HD21	1.85	0.58
1:A:785:VAL:HG22	1:A:979:PRO:HD2	1.86	0.57
1:A:825:ILE:HD13	1:A:924:VAL:HG13	1.86	0.57
1:A:482:LYS:HD2	1:A:524:GLU:HB3	1.86	0.56
1:A:33:LEU:HD21	1:A:38:PRO:HG3	1.88	0.56
1:A:381:VAL:HG23	1:A:472:SER:HB3	1.87	0.56
1:A:731:TRP:HB3	1:A:1097:ILE:HG13	1.88	0.56
1:A:1018:ARG:HG3	1:A:1019:PRO:HD2	1.88	0.56
1:A:319:GLU:HG2	1:A:323:LYS:HE2	1.88	0.55
1:A:665:VAL:HG11	1:A:677:SER:HA	1.89	0.54
1:A:597:THR:HG22	1:A:730:ARG:HH12	1.73	0.53
1:A:233:PHE:HA	1:A:236:ILE:HG12	1.90	0.53
1:A:684:LEU:HD12	1:A:691:LEU:HD21	1.90	0.53
1:A:152:PHE:HE1	1:A:165:LYS:HE3	1.74	0.52
1:A:611:PHE:HE2	1:A:1091:ARG:HD2	1.75	0.52
1:A:418:ASN:HB3	1:A:424:LEU:HD11	1.91	0.51
1:A:420:ASP:HB2	1:A:423:GLU:HB2	1.91	0.51
1:A:943:LYS:HE3	1:A:965:LEU:HD21	1.92	0.51
1:A:80:THR:HG23	1:A:83:GLN:H	1.74	0.51
1:A:394:GLU:HG2	1:A:455:LEU:HD13	1.93	0.51
1:A:124:SER:HB3	1:A:199:PHE:HB3	1.91	0.51
1:A:277:THR:HB	1:A:565:SER:H	1.76	0.51
1:A:366:GLY:HA2	1:A:369:THR:HG22	1.92	0.50
1:A:507:GLU:HB2	1:A:701:ARG:NH1	2.27	0.49
1:A:296:ARG:HG2	1:A:384:TRP:CE2	2.48	0.49
1:A:30:GLU:CD	1:A:30:GLU:H	2.21	0.48
1:A:141:LEU:HB3	1:A:151:ILE:HD13	1.96	0.48
1:A:1078:LYS:HB3	1:A:1083:GLU:HB2	1.94	0.48
1:A:755:GLN:HG3	1:A:1025:ILE:HG23	1.95	0.48
1:A:777:THR:HG22	1:A:791:GLY:HA2	1.94	0.48
1:A:904:GLU:O	1:A:908:MET:HG2	2.14	0.48
1:A:1054:SER:O	1:A:1058:GLU:HB2	2.15	0.47
1:A:778:LEU:HD11	1:A:786:ASN:HB2	1.96	0.46
1:A:858:ARG:O	1:A:892:GLU:HB2	2.15	0.46
1:A:134:VAL:HG13	1:A:179:VAL:HG12	1.98	0.46
1:A:78:ASP:OD1	1:A:79:LEU:N	2.45	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:393:LEU:HG	1:A:457:LEU:HB2	1.97	0.46
1:A:559:PHE:HB2	1:A:701:ARG:HG3	1.97	0.46
1:A:611:PHE:CE2	1:A:1091:ARG:HD2	2.50	0.45
1:A:126:LEU:HD12	1:A:179:VAL:HG22	1.99	0.45
1:A:390:ARG:HE	1:A:458:ILE:HG12	1.81	0.45
1:A:698:GLU:HG3	1:A:897:VAL:HG11	1.99	0.45
1:A:739:LYS:HA	1:A:742:LYS:HE2	1.99	0.45
1:A:473:SER:OG	1:A:481:VAL:O	2.32	0.44
1:A:449:VAL:HG21	1:A:494:ILE:HA	1.98	0.44
1:A:1085:ASP:HB3	1:A:1088:ALA:HB3	2.00	0.44
1:A:543:LEU:HD11	1:A:664:LEU:HG	1.98	0.44
1:A:835:GLU:O	1:A:839:ILE:HG12	2.17	0.44
1:A:82:TYR:CE1	1:A:582:VAL:HG23	2.53	0.44
1:A:684:LEU:HB2	1:A:691:LEU:HD11	2.00	0.44
1:A:507:GLU:HB2	1:A:701:ARG:HH11	1.83	0.43
1:A:852:HIS:HA	1:A:894:ILE:HG12	2.00	0.43
1:A:1007:ILE:O	1:A:1011:MET:HG3	2.19	0.43
1:A:77:LYS:HE2	1:A:77:LYS:HB3	1.76	0.43
1:A:1078:LYS:HA	1:A:1081:ARG:HD2	2.00	0.43
1:A:682:GLN:HA	1:A:685:LEU:HD12	1.99	0.43
1:A:693:ARG:NH1	1:A:694:ILE:O	2.52	0.43
1:A:798:VAL:HG22	1:A:951:VAL:HG22	2.00	0.43
1:A:337:GLY:HA3	1:A:355:ILE:HD13	2.01	0.43
1:A:575:GLU:HG2	1:A:584:LEU:HD22	2.00	0.43
1:A:968:GLY:C	1:A:970:ASN:H	2.26	0.43
1:A:266:ARG:N	1:A:267:PRO:HD2	2.34	0.42
1:A:616:ASN:HB3	1:A:629:THR:CG2	2.49	0.42
1:A:224:ILE:HD13	1:A:273:LEU:HB3	2.01	0.42
1:A:724:VAL:HG12	1:A:1076:MET:HE2	2.00	0.42
1:A:74:LYS:HA	1:A:74:LYS:HD3	1.90	0.42
1:A:407:LEU:HD22	1:A:412:LEU:HD12	2.01	0.42
1:A:532:SER:HA	1:A:536:LEU:HD11	2.02	0.42
1:A:809:GLU:HG2	1:A:939:ALA:HB3	2.02	0.42
1:A:11:CYS:HB2	1:A:18:ASN:HB2	2.02	0.41
1:A:100:ALA:HB3	1:A:106:LYS:HE3	2.01	0.41
1:A:654:ARG:NH1	1:A:683:TYR:O	2.52	0.41
1:A:816:TYR:OH	1:A:824:GLU:OE1	2.34	0.41
1:A:290:HIS:HB2	1:A:510:ILE:HA	2.03	0.41
1:A:308:PHE:HE2	1:A:382:ILE:HD11	1.85	0.41
1:A:809:GLU:OE2	1:A:966:ARG:NH2	2.54	0.41
1:A:1061:GLU:HG2	1:A:1065:THR:HG23	2.01	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:964:ILE:HD13	1:A:970:ASN:ND2	2.34	0.41
1:A:1048:PHE:HA	1:A:1051:MET:HE2	2.03	0.41
1:A:451:LYS:HA	1:A:451:LYS:HD3	1.83	0.41
1:A:200:VAL:HB	1:A:253:LEU:HD12	2.03	0.41
1:A:20:ASP:OD1	1:A:678:TRP:NE1	2.54	0.41
1:A:50:THR:O	1:A:52:LYS:HG3	2.21	0.41
1:A:159:LYS:HE2	1:A:162:GLU:HG3	2.02	0.41
1:A:339:THR:OG1	1:A:360:GLY:HA2	2.21	0.41
1:A:219:LEU:HD13	1:A:273:LEU:HD12	2.02	0.40
1:A:374:LEU:N	1:A:375:PRO:HD3	2.37	0.40
1:A:712:ARG:NH1	1:A:713:PHE:O	2.53	0.40
1:A:666:ALA:HB1	1:A:696:MET:HE2	2.03	0.40

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	1100/1104 (100%)	1065 (97%)	35 (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	992/993 (100%)	959 (97%)	33 (3%)	33	66

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	HIS
1	A	53	GLU
1	A	205	VAL
1	A	231	LYS
1	A	282	VAL
1	A	335	ASN
1	A	372	VAL
1	A	420	ASP
1	A	431	HIS
1	A	432	LEU
1	A	499	LYS
1	A	504	LEU
1	A	527	GLU
1	A	570	ASN
1	A	573	VAL
1	A	651	ARG
1	A	690	SER
1	A	694	ILE
1	A	777	THR
1	A	785	VAL
1	A	797	VAL
1	A	830	ARG
1	A	842	ASP
1	A	874	ILE
1	A	891	HIS
1	A	942	VAL
1	A	952	ASP
1	A	956	MET
1	A	970	ASN
1	A	977	VAL
1	A	1020	SER
1	A	1065	THR
1	A	1074	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	58	HIS
1	A	92	GLN
1	A	418	ASN
1	A	811	ASN

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](#)

Of 2 ligands modelled in this entry, 2 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	1102/1104 (99%)	0.48	63 (5%)	29 24	40, 71, 124, 194	0

All (63) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	368	LEU	4.2
1	A	57	TYR	4.1
1	A	949	VAL	3.9
1	A	377	ARG	3.8
1	A	1008	VAL	3.6
1	A	350	PHE	3.6
1	A	118	ALA	3.2
1	A	109	PHE	3.2
1	A	67	PHE	3.1
1	A	437	PHE	3.1
1	A	764	GLU	3.0
1	A	2	ALA	3.0
1	A	393	LEU	2.9
1	A	5	SER	2.9
1	A	749	LEU	2.9
1	A	396	ASP	2.8
1	A	355	ILE	2.8
1	A	448	VAL	2.8
1	A	421	VAL	2.8
1	A	91	VAL	2.7
1	A	108	THR	2.6
1	A	740	LEU	2.6
1	A	1018	ARG	2.6
1	A	71	PHE	2.6
1	A	363	ALA	2.6
1	A	39	SER	2.5
1	A	305	LEU	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	996	LYS	2.5
1	A	450	VAL	2.5
1	A	75	PHE	2.5
1	A	447	GLY	2.5
1	A	855	ASP	2.4
1	A	634	GLU	2.4
1	A	279	GLY	2.4
1	A	398	ALA	2.4
1	A	744	PHE	2.4
1	A	779	LEU	2.4
1	A	591	HIS	2.4
1	A	785	VAL	2.3
1	A	560	LEU	2.3
1	A	364	TYR	2.3
1	A	374	LEU	2.3
1	A	46	LEU	2.2
1	A	325	LEU	2.2
1	A	229	ILE	2.2
1	A	668	ASP	2.2
1	A	803	LEU	2.2
1	A	602	HIS	2.2
1	A	316	ALA	2.2
1	A	414	LYS	2.2
1	A	981	PHE	2.2
1	A	370	ARG	2.1
1	A	601	ILE	2.1
1	A	60	PHE	2.1
1	A	28	PRO	2.1
1	A	537	THR	2.1
1	A	455	LEU	2.1
1	A	242	TYR	2.1
1	A	1064	VAL	2.1
1	A	392	SER	2.0
1	A	1100	LEU	2.0
1	A	552	LYS	2.0
1	A	518	TRP	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 [i](#)

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($\text{\AA}^2$)	Q<0.9
2	ZN	A	1201	1/1	0.99	0.08	80,80,80,80	0
2	ZN	A	1202	1/1	1.00	0.06	69,69,69,69	0

6.5 Other polymers [i](#)

There are no such residues in this entry.