



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 2, 2024 – 07:50 pm GMT

PDB ID : 4A57
Title : CRYSTAL STRUCTURE OF TOXOPLASMA GONDII NUCLEOSIDE
TRIPHOSPHATE DIPHOSPHOHYDROLASE 3 (NTPDASE3)
Authors : Krug, U.; Zebisch, M.; Straeter, N.
Deposited on : 2011-10-24
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	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

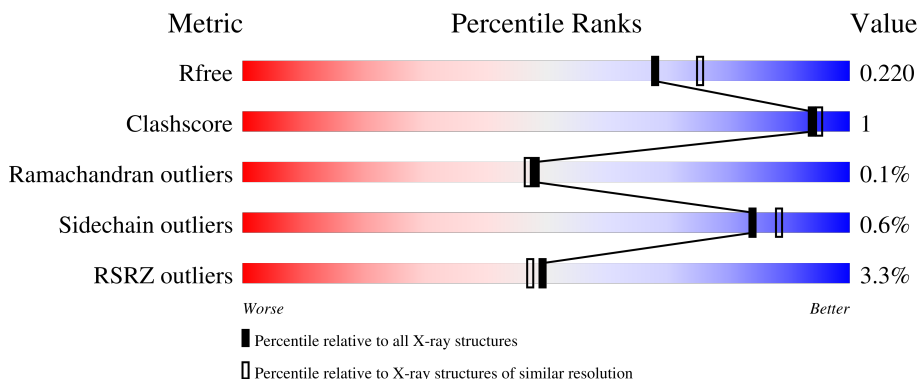
1 Overall quality at a glance

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}	164625	9409 (2.00-2.00)
Clashscore	180529	10737 (2.00-2.00)
Ramachandran outliers	177936	10628 (2.00-2.00)
Sidechain outliers	177891	10627 (2.00-2.00)
RSRZ outliers	164620	9409 (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	611	<div> <div>2%</div> <div> <div></div> <div>92%</div> <div>5%</div> <div>.</div> </div> </div>
1	B	611	<div> <div>5%</div> <div> <div></div> <div>93%</div> <div>.</div> <div>.</div> </div> </div>
1	C	611	<div> <div>%</div> <div> <div></div> <div>94%</div> <div>.</div> <div>.</div> </div> </div>
1	D	611	<div> <div>4%</div> <div> <div></div> <div>94%</div> <div>.</div> <div>.</div> </div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 19870 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 NUCLEOSIDE-TRIPHOSPHATASE 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	594	Total	C	N	O	S	0	6	0
			4640	2916	823	874	27			
1	B	594	Total	C	N	O	S	0	3	0
			4617	2905	813	872	27			
1	C	591	Total	C	N	O	S	0	4	0
			4611	2898	817	869	27			
1	D	595	Total	C	N	O	S	0	2	0
			4624	2905	817	875	27			

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	25	MET	-	expression tag	UNP Q27893
A	629	GLU	-	expression tag	UNP Q27893
A	630	HIS	-	expression tag	UNP Q27893
A	631	HIS	-	expression tag	UNP Q27893
A	632	HIS	-	expression tag	UNP Q27893
A	633	HIS	-	expression tag	UNP Q27893
A	634	HIS	-	expression tag	UNP Q27893
A	635	HIS	-	expression tag	UNP Q27893
B	25	MET	-	expression tag	UNP Q27893
B	629	GLU	-	expression tag	UNP Q27893
B	630	HIS	-	expression tag	UNP Q27893
B	631	HIS	-	expression tag	UNP Q27893
B	632	HIS	-	expression tag	UNP Q27893
B	633	HIS	-	expression tag	UNP Q27893
B	634	HIS	-	expression tag	UNP Q27893
B	635	HIS	-	expression tag	UNP Q27893
C	25	MET	-	expression tag	UNP Q27893
C	629	GLU	-	expression tag	UNP Q27893
C	630	HIS	-	expression tag	UNP Q27893
C	631	HIS	-	expression tag	UNP Q27893
C	632	HIS	-	expression tag	UNP Q27893

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Chain	Residue	Modelled	Actual	Comment	Reference
C	633	HIS	-	expression tag	UNP Q27893
C	634	HIS	-	expression tag	UNP Q27893
C	635	HIS	-	expression tag	UNP Q27893
D	25	MET	-	expression tag	UNP Q27893
D	629	GLU	-	expression tag	UNP Q27893
D	630	HIS	-	expression tag	UNP Q27893
D	631	HIS	-	expression tag	UNP Q27893
D	632	HIS	-	expression tag	UNP Q27893
D	633	HIS	-	expression tag	UNP Q27893
D	634	HIS	-	expression tag	UNP Q27893
D	635	HIS	-	expression tag	UNP Q27893

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

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

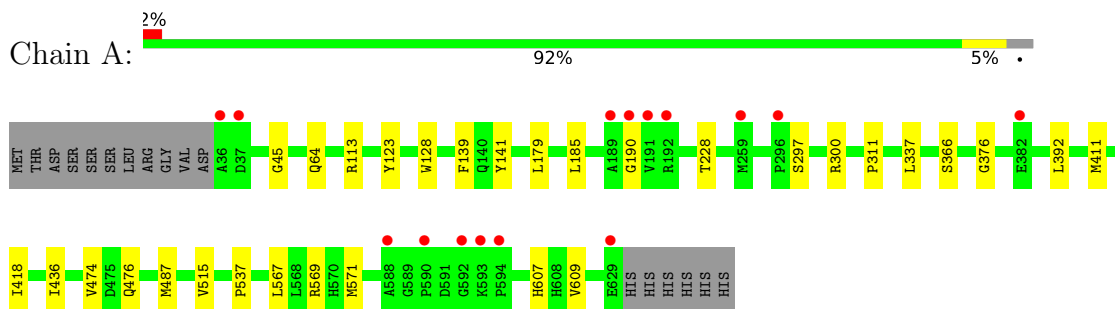
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	451	Total O 452 452	0	1
3	B	306	Total O 307 307	0	1
3	C	366	Total O 366 366	0	0
3	D	248	Total O 249 249	0	1

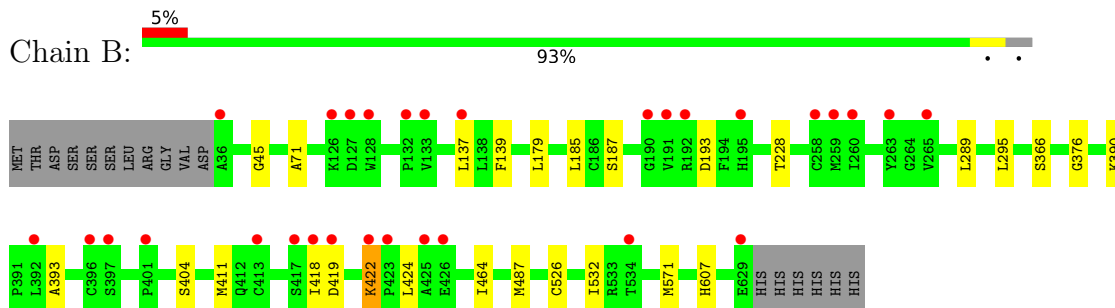
3 Residue-property plots

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.

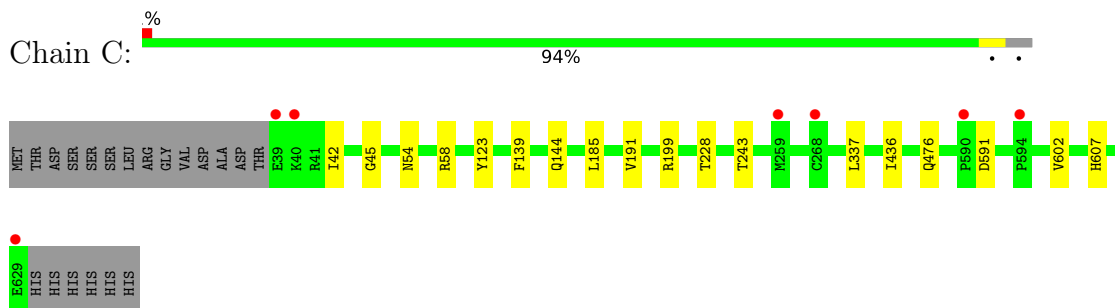
• Molecule 1: NUCLEOSIDE-TRIPHOSPHATASE 1



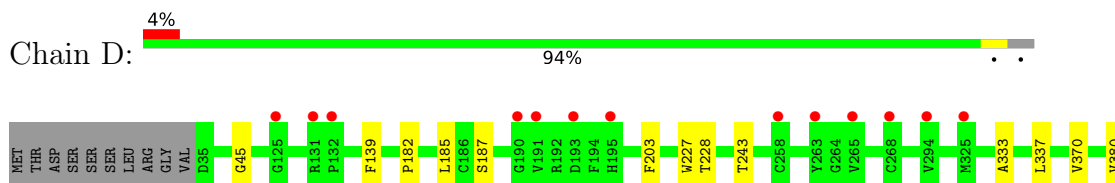
• Molecule 1: NUCLEOSIDE-TRIPHOSPHATASE 1

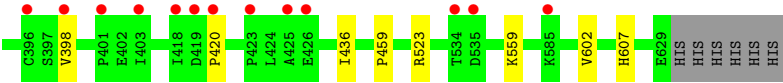


• Molecule 1: NUCLEOSIDE-TRIPHOSPHATASE 1



• Molecule 1: NUCLEOSIDE-TRIPHOSPHATASE 1





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	88.96Å 165.94Å 97.51Å 90.00° 97.03° 90.00°	Depositor
Resolution (Å)	39.43 – 2.00 39.43 – 2.00	Depositor EDS
% Data completeness (in resolution range)	(Not available) (39.43-2.00) 97.1 (39.43-2.00)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.57 (at 2.00Å)	Xtriage
Refinement program	BUSTER 2.8.0	Depositor
R, R_{free}	0.174 , 0.210 0.179 , 0.220	Depositor DCC
R_{free} test set	1844 reflections (1.01%)	wwPDB-VP
Wilson B-factor (Å ²)	22.8	Xtriage
Anisotropy	0.170	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 46.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	19870	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.71% 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	0.51	0/4748	0.63	0/6424
1	B	0.49	0/4716	0.63	0/6384
1	C	0.50	0/4711	0.63	0/6374
1	D	0.49	0/4719	0.61	0/6386
All	All	0.50	0/18894	0.63	0/25568

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	4640	0	4632	17	0
1	B	4617	0	4600	15	0
1	C	4611	0	4590	10	0
1	D	4624	0	4599	11	0
2	A	3	0	0	2	0
2	C	1	0	0	1	0
3	A	452	0	0	0	0
3	B	307	0	0	1	0
3	C	366	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	249	0	0	1	0
All	All	19870	0	18421	47	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 1.

All (47) 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:B:419:ASP:HB3	1:B:422:LYS:HD3	1.55	0.89
1:A:300[A]:ARG:HG3	1:B:464:ILE:HD12	1.68	0.76
1:A:487:MET:HG3	1:A:571:MET:HE1	1.72	0.70
1:A:476:GLN:HG3	2:A:1630:CL:CL	2.30	0.69
1:B:289:LEU:HD11	1:B:295[A]:LEU:HD21	1.75	0.67
1:A:113:ARG:HB2	1:A:190:GLY:O	2.00	0.62
1:B:185:LEU:HB3	1:B:228:THR:HG23	1.88	0.55
1:A:45:GLY:HA3	1:D:139:PHE:O	2.08	0.54
1:D:459:PRO:HD2	3:D:2182:HOH:O	2.09	0.53
1:B:45:GLY:HA3	1:C:139:PHE:O	2.11	0.50
1:D:243:THR:HG23	1:D:602:VAL:HB	1.95	0.48
1:A:185:LEU:HB3	1:A:228:THR:HG23	1.96	0.48
1:A:411:MET:HE2	1:A:411:MET:HB3	1.73	0.48
1:C:337:LEU:HD22	1:C:436:ILE:HD13	1.96	0.48
1:B:487:MET:HG3	1:B:571:MET:HE1	1.96	0.47
1:D:185:LEU:HB3	1:D:228:THR:HG23	1.95	0.47
1:C:123:TYR:OH	1:C:144:GLN:HG2	2.15	0.46
1:A:64:GLN:HB2	1:A:179:LEU:HD12	1.97	0.46
1:B:376:GLY:HA3	1:B:532:ILE:HD12	1.96	0.46
1:C:54:ASN:HB3	1:C:58:ARG:HE	1.81	0.46
1:C:191:VAL:O	1:C:199:ARG:HD3	2.16	0.46
1:C:476:GLN:HG3	2:C:1630:CL:CL	2.53	0.45
1:A:515:VAL:HG11	1:A:569:ARG:HG3	1.99	0.45
1:D:398:VAL:HG13	1:D:420:PRO:HB2	1.99	0.45
1:B:139:PHE:O	1:C:45:GLY:HA3	2.16	0.45
1:A:311:PRO:HB2	2:A:1631:CL:CL	2.54	0.45
1:A:392:LEU:HB3	1:A:418:ILE:HD13	1.99	0.45
1:B:390:LYS:HE2	1:B:424:LEU:HD21	1.99	0.44
1:D:187:SER:HG	1:D:203:PHE:HZ	1.64	0.44
1:D:370:VAL:HG22	1:D:380:VAL:HG22	2.00	0.43
1:A:123:TYR:HB3	1:A:141:TYR:CD2	2.53	0.43
1:A:474:VAL:HG11	1:A:567:LEU:CD2	2.49	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:411:MET:HB3	1:B:411:MET:HE2	1.78	0.43
1:B:393:ALA:HA	1:B:418:ILE:HG21	2.01	0.43
1:A:139:PHE:O	1:D:45:GLY:HA3	2.19	0.43
1:B:487:MET:HG3	1:B:571:MET:CE	2.49	0.43
1:D:337:LEU:HD22	1:D:436:ILE:HD13	2.00	0.43
1:D:333:ALA:HA	1:D:559:LYS:HE2	2.01	0.42
1:B:137:LEU:HD23	1:C:42:ILE:HD11	2.02	0.42
1:C:185:LEU:HB3	1:C:228:THR:HG23	2.02	0.42
1:C:243:THR:HG23	1:C:602:VAL:HB	2.01	0.41
1:D:182:PRO:HB3	1:D:227:TRP:CZ3	2.55	0.41
1:A:474:VAL:HG11	1:A:567:LEU:HD23	2.03	0.41
1:A:376:GLY:HA2	1:A:537:PRO:HG3	2.02	0.41
1:A:337:LEU:HD22	1:A:436:ILE:HD13	2.03	0.41
1:B:71:ALA:O	1:B:187:SER:HA	2.20	0.41
1:B:526:CYS:HB3	3:B:2175:HOH:O	2.21	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	598/611 (98%)	588 (98%)	8 (1%)	2 (0%)	37	35
1	B	595/611 (97%)	587 (99%)	8 (1%)	0	100	100
1	C	593/611 (97%)	584 (98%)	9 (2%)	0	100	100
1	D	595/611 (97%)	588 (99%)	7 (1%)	0	100	100
All	All	2381/2444 (97%)	2347 (99%)	32 (1%)	2 (0%)	48	47

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	128	TRP
1	A	297	SER

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	511/521 (98%)	508 (99%)	3 (1%)	84	88
1	B	508/521 (98%)	501 (99%)	7 (1%)	62	68
1	C	507/521 (97%)	505 (100%)	2 (0%)	89	92
1	D	508/521 (98%)	506 (100%)	2 (0%)	89	92
All	All	2034/2084 (98%)	2020 (99%)	14 (1%)	84	86

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	366	SER
1	A	607	HIS
1	A	609	VAL
1	B	179[A]	LEU
1	B	179[B]	LEU
1	B	193	ASP
1	B	366	SER
1	B	404	SER
1	B	422	LYS
1	B	607	HIS
1	C	591	ASP
1	C	607	HIS
1	D	523	ARG
1	D	607	HIS

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

Mol	Chain	Res	Type
1	B	348	GLN

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Mol	Chain	Res	Type
1	C	284	GLN
1	C	548	GLN
1	D	348	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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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	594/611 (97%)	-0.36	15 (2%) 58 57	10, 24, 55, 92	6 (1%)
1	B	594/611 (97%)	0.01	30 (5%) 34 32	16, 30, 64, 126	3 (0%)
1	C	591/611 (96%)	-0.36	7 (1%) 76 75	12, 25, 50, 88	4 (0%)
1	D	595/611 (97%)	-0.07	26 (4%) 39 38	12, 31, 60, 81	2 (0%)
All	All	2374/2444 (97%)	-0.19	78 (3%) 49 47	10, 28, 59, 126	15 (0%)

All (78) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	126	LYS	4.5
1	A	592	GLY	4.2
1	B	36	ALA	4.0
1	A	588	ALA	3.6
1	B	132	PRO	3.4
1	A	191	VAL	3.4
1	A	189	ALA	3.4
1	B	128	TRP	3.3
1	B	418	ILE	3.3
1	D	401	PRO	3.2
1	B	191	VAL	3.2
1	A	36	ALA	3.2
1	B	629	GLU	3.2
1	C	268	CYS	3.1
1	D	191	VAL	3.0
1	B	190	GLY	3.0
1	B	396	CYS	3.0
1	A	192	ARG	3.0
1	A	590	PRO	3.0
1	C	590	PRO	3.0
1	B	133	VAL	3.0

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Mol	Chain	Res	Type	RSRZ
1	B	127	ASP	2.9
1	D	534	THR	2.9
1	B	417	SER	2.9
1	C	40	LYS	2.9
1	B	419	ASP	2.8
1	B	425	ALA	2.8
1	D	403	ILE	2.8
1	B	263	TYR	2.8
1	A	190	GLY	2.7
1	D	398	VAL	2.7
1	B	401	PRO	2.7
1	D	418	ILE	2.7
1	C	39	GLU	2.6
1	A	296	PRO	2.5
1	D	190	GLY	2.5
1	D	420	PRO	2.5
1	D	193	ASP	2.4
1	A	629	GLU	2.4
1	D	294	VAL	2.4
1	B	423	PRO	2.4
1	A	259	MET	2.4
1	B	259	MET	2.4
1	D	125	GLY	2.4
1	D	535	ASP	2.4
1	B	413	CYS	2.4
1	A	593	LYS	2.4
1	D	265	VAL	2.4
1	D	425	ALA	2.4
1	C	259	MET	2.4
1	D	263	TYR	2.4
1	B	422	LYS	2.3
1	D	585	LYS	2.3
1	B	392	LEU	2.3
1	B	397	SER	2.3
1	D	423	PRO	2.3
1	D	258	CYS	2.3
1	D	426	GLU	2.3
1	B	260	ILE	2.3
1	B	192	ARG	2.3
1	D	195	HIS	2.2
1	B	265	VAL	2.2
1	A	382	GLU	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	258	CYS	2.2
1	D	131	ARG	2.2
1	C	594	PRO	2.2
1	D	325	MET	2.2
1	B	137	LEU	2.1
1	D	419	ASP	2.1
1	C	629	GLU	2.1
1	A	594	PRO	2.1
1	D	132	PRO	2.1
1	D	268	CYS	2.1
1	D	396	CYS	2.1
1	A	37	ASP	2.1
1	B	534	THR	2.1
1	B	195	HIS	2.0
1	B	426	GLU	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 monosaccharides 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(\AA^2)	Q<0.9
2	CL	A	1632	1/1	0.88	0.22	36,36,36,36	1
2	CL	A	1631	1/1	0.97	0.14	29,29,29,29	1
2	CL	A	1630	1/1	0.98	0.07	32,32,32,32	0
2	CL	C	1630	1/1	0.98	0.12	34,34,34,34	0

6.5 Other polymers [i](#)

There are no such residues in this entry.