



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 08:10 PM UTC

PDB ID : 8V31 / pdb_00008v31
Title : Structure of Alistipes sp. 3-Keto-2-hydroxy-glucal-hydratase AL2
Authors : Lazarski, A.C.; Worrall, L.J.; Strynadka, N.C.J.
Deposited on : 2023-11-25
Resolution : 2.65 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

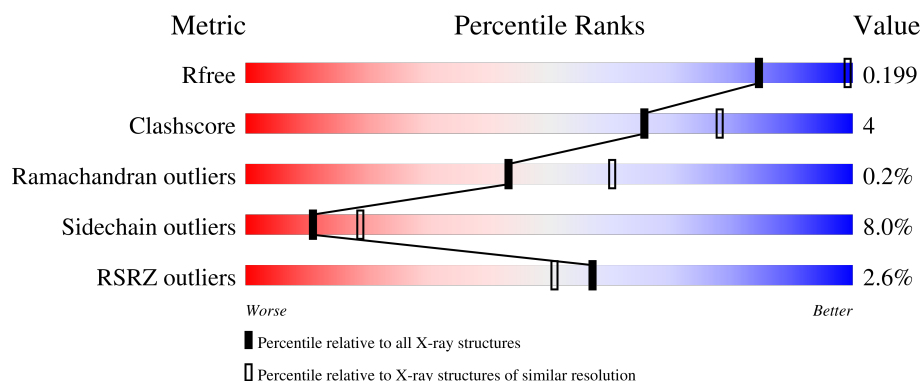
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

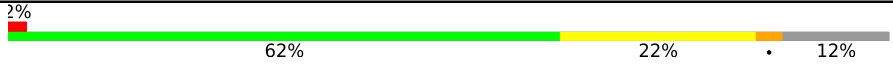
The reported resolution of this entry is 2.65 Å.

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	1110 (2.66-2.66)
Clashscore	190562	1141 (2.66-2.66)
Ramachandran outliers	187476	1126 (2.66-2.66)
Sidechain outliers	187428	1126 (2.66-2.66)
RSRZ outliers	180081	1110 (2.66-2.66)

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	277	
1	C	277	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3980 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 Glycosyl hydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	243	Total	C	N	O	S	0	0	0
			1943	1245	327	365	6			
1	C	251	Total	C	N	O	S	0	0	0
			1995	1273	336	380	6			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	MET	-	initiating methionine	UNP A0A4Y1WGD9
A	291	HIS	-	expression tag	UNP A0A4Y1WGD9
A	292	HIS	-	expression tag	UNP A0A4Y1WGD9
A	293	HIS	-	expression tag	UNP A0A4Y1WGD9
A	294	HIS	-	expression tag	UNP A0A4Y1WGD9
A	295	HIS	-	expression tag	UNP A0A4Y1WGD9
A	296	HIS	-	expression tag	UNP A0A4Y1WGD9
C	20	MET	-	initiating methionine	UNP A0A4Y1WGD9
C	291	HIS	-	expression tag	UNP A0A4Y1WGD9
C	292	HIS	-	expression tag	UNP A0A4Y1WGD9
C	293	HIS	-	expression tag	UNP A0A4Y1WGD9
C	294	HIS	-	expression tag	UNP A0A4Y1WGD9
C	295	HIS	-	expression tag	UNP A0A4Y1WGD9
C	296	HIS	-	expression tag	UNP A0A4Y1WGD9

- Molecule 2 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

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

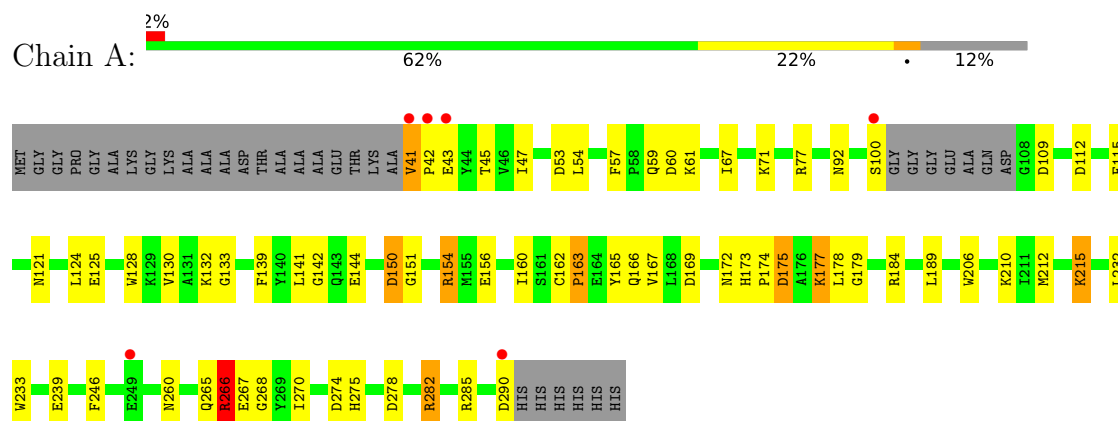
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	17	Total 17	O 17	0	0
3	C	23	Total 23	O 23	0	0

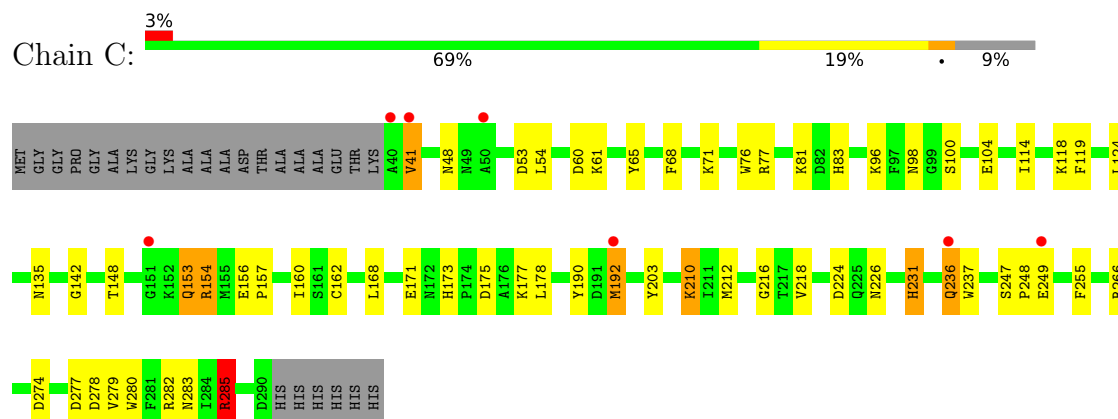
3 Residue-property plots

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: Glycosyl hydrolase



• Molecule 1: Glycosyl hydrolase



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	95.09Å 95.09Å 159.54Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	47.54 – 2.65 47.54 – 2.65	Depositor EDS
% Data completeness (in resolution range)	99.1 (47.54-2.65) 98.3 (47.54-2.65)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.55 (at 2.65Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.197 , 0.244 (Not available) , 0.199	Depositor DCC
R_{free} test set	1239 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	57.2	Xtriage
Anisotropy	0.159	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 32.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.033 for -h,-k,l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3980	wwPDB-VP
Average B, all atoms (Å ²)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.36% 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: MG

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	1.05	1/1999 (0.1%)	1.76	36/2711 (1.3%)
1	C	1.01	1/2052 (0.0%)	1.68	32/2783 (1.1%)
All	All	1.03	2/4051 (0.0%)	1.72	68/5494 (1.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	4
1	C	0	3
All	All	0	7

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	60	ASP	CG-OD1	5.34	1.35	1.25
1	C	231	HIS	CE1-NE2	5.25	1.37	1.32

All (68) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	178	LEU	CA-C-N	-13.49	107.71	122.55
1	A	178	LEU	C-N-CA	-13.49	107.71	122.55
1	A	150	ASP	CA-CB-CG	9.54	122.14	112.60
1	A	45	THR	CA-CB-OG1	-9.07	96.00	109.60
1	C	175	ASP	CA-CB-CG	8.64	121.24	112.60
1	A	43	GLU	CB-CA-C	-8.59	97.61	110.67
1	C	41	VAL	N-CA-CB	7.82	122.16	111.21

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	236	GLN	CB-CA-C	7.32	122.94	110.79
1	A	260	ASN	CB-CA-C	7.30	123.64	111.23
1	C	249	GLU	CB-CG-CD	6.95	124.41	112.60
1	A	278	ASP	CA-CB-CG	6.93	119.53	112.60
1	C	178	LEU	CA-C-N	-6.78	108.11	121.41
1	C	178	LEU	C-N-CA	-6.78	108.11	121.41
1	A	132	LYS	CA-C-O	-6.77	112.91	120.70
1	C	285	ARG	CG-CD-NE	-6.76	97.12	112.00
1	A	175	ASP	CA-CB-CG	6.60	119.20	112.60
1	C	283	ASN	CA-CB-CG	-6.56	106.04	112.60
1	A	156	GLU	CG-CD-OE1	6.50	133.35	118.40
1	C	77	ARG	N-CA-CB	-6.49	101.50	111.56
1	C	83	HIS	CA-CB-CG	6.48	120.28	113.80
1	A	112	ASP	CB-CA-C	6.41	121.33	109.54
1	A	169	ASP	CA-CB-CG	6.33	118.93	112.60
1	A	290	ASP	CA-CB-CG	6.32	118.92	112.60
1	A	59	GLN	N-CA-CB	-6.26	100.61	110.69
1	A	109	ASP	CA-CB-CG	6.25	118.85	112.60
1	A	53	ASP	CB-CA-C	-6.24	97.98	109.46
1	C	277	ASP	CA-CB-CG	6.20	118.80	112.60
1	A	60	ASP	CA-CB-CG	6.19	118.79	112.60
1	C	236	GLN	N-CA-CB	-6.14	101.10	110.12
1	A	115	PHE	CB-CA-C	6.04	119.62	109.48
1	C	278	ASP	CA-CB-CG	6.03	118.63	112.60
1	A	57	PHE	CB-CA-C	6.03	116.72	109.85
1	C	203	TYR	N-CA-CB	6.03	119.27	109.69
1	C	177	LYS	CA-C-O	-6.02	112.52	119.56
1	A	163	PRO	CA-C-O	-6.02	114.43	121.95
1	C	224	ASP	CA-CB-CG	5.95	118.55	112.60
1	C	279	VAL	N-CA-CB	-5.91	101.20	110.96
1	A	43	GLU	N-CA-CB	5.91	119.28	109.60
1	C	135	ASN	CA-CB-CG	5.90	118.50	112.60
1	C	104	GLU	CB-CG-CD	5.86	122.56	112.60
1	A	178	LEU	CA-C-O	5.81	125.77	119.15
1	A	246	PHE	N-CA-C	-5.73	105.60	112.59
1	A	275	HIS	CA-CB-CG	5.71	119.51	113.80
1	C	153	GLN	N-CA-CB	5.71	118.79	109.95
1	A	274	ASP	CA-CB-CG	5.69	118.29	112.60
1	C	119	PHE	N-CA-CB	-5.67	101.78	110.85
1	A	67	ILE	CA-C-O	-5.66	114.48	120.14
1	C	237	TRP	N-CA-C	-5.50	105.20	111.14
1	A	266	ARG	CB-CG-CD	5.41	123.73	111.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	53	ASP	CB-CA-C	5.36	119.39	109.54
1	C	81	LYS	N-CA-CB	-5.33	102.57	111.20
1	C	226	ASN	CA-CB-CG	-5.28	107.32	112.60
1	C	119	PHE	CA-C-O	-5.25	115.23	121.16
1	A	144	GLU	CB-CG-CD	5.23	121.50	112.60
1	A	172	ASN	CA-CB-CG	-5.23	107.37	112.60
1	A	282	ARG	NE-CZ-NH1	-5.22	116.28	121.50
1	C	274	ASP	CA-CB-CG	5.15	117.75	112.60
1	A	121	ASN	CA-CB-CG	-5.15	107.45	112.60
1	A	215	LYS	CB-CA-C	5.09	119.11	111.89
1	C	148	THR	OG1-CB-CG2	-5.08	99.14	109.30
1	A	57	PHE	CA-CB-CG	-5.08	108.72	113.80
1	A	139	PHE	CA-C-O	-5.07	115.30	121.28
1	C	249	GLU	CB-CA-C	5.06	118.79	110.95
1	C	68	PHE	CA-CB-CG	-5.05	108.75	113.80
1	A	232	LEU	O-C-N	5.05	128.55	122.79
1	A	274	ASP	CB-CA-C	-5.03	102.37	110.77
1	C	98	ASN	CA-C-N	-5.02	116.70	121.57
1	C	98	ASN	C-N-CA	-5.02	116.70	121.57

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	154	ARG	Sidechain
1	A	177	LYS	Peptide
1	A	285	ARG	Sidechain
1	A	77	ARG	Sidechain
1	C	154	ARG	Sidechain
1	C	282	ARG	Sidechain
1	C	285	ARG	Sidechain

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	1943	0	1835	15	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1995	0	1877	14	0
2	A	1	0	0	0	0
2	C	1	0	0	0	0
3	A	17	0	0	1	0
3	C	23	0	0	0	0
All	All	3980	0	3712	29	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 4.

All (29) 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:173:HIS:CG	1:A:174:PRO:HD2	2.39	0.57
1:C:157:PRO:O	1:C:160:ILE:HG12	2.05	0.57
1:C:142:GLY:HA2	1:C:162:CYS:HB3	1.90	0.53
1:A:166:GLN:HG3	1:A:167:VAL:N	2.23	0.52
1:C:96:LYS:HE3	1:C:280:TRP:CZ2	2.44	0.52
1:A:233:TRP:CE2	1:A:266:ARG:HD2	2.46	0.51
1:A:206:TRP:CZ3	1:A:282:ARG:HG2	2.46	0.50
1:C:156:GLU:HB3	1:C:160:ILE:HD11	1.93	0.50
1:A:141:LEU:HA	1:A:268:GLY:HA3	1.93	0.50
1:C:168:LEU:HD11	1:C:173:HIS:CG	2.48	0.49
1:A:124:LEU:HD22	1:A:270:ILE:HD12	1.96	0.48
1:A:184:ARG:HB2	3:A:402:HOH:O	2.14	0.48
1:A:265:GLN:HB2	1:A:267:GLU:HG2	1.95	0.47
1:A:142:GLY:HA2	1:A:162:CYS:HB3	1.97	0.46
1:A:163:PRO:HB3	1:A:189:LEU:HD11	1.95	0.46
1:A:41:VAL:N	1:A:42:PRO:HD3	2.30	0.46
1:C:60:ASP:OD2	1:C:285:ARG:NH1	2.47	0.46
1:A:133:GLY:O	1:A:173:HIS:HD2	1.99	0.46
1:A:128:TRP:CE3	1:A:167:VAL:HG13	2.51	0.45
1:C:248:PRO:HD3	1:C:255:PHE:CD2	2.53	0.43
1:C:48:ASN:OD1	1:C:118:LYS:NZ	2.48	0.43
1:C:65:TYR:O	1:C:285:ARG:HA	2.19	0.42
1:C:76:TRP:HA	1:C:114:ILE:O	2.20	0.42
1:C:190:TYR:O	1:C:192:MET:HE3	2.20	0.41
1:A:206:TRP:CH2	1:A:282:ARG:HG2	2.55	0.41
1:C:124:LEU:O	1:C:210:LYS:HA	2.20	0.41
1:A:179:GLY:HA3	1:A:184:ARG:HG3	2.03	0.41
1:C:216:GLY:O	1:C:231:HIS:HA	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:212:MET:O	1:C:218:VAL:HA	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	239/277 (86%)	229 (96%)	9 (4%)	1 (0%)	30	45
1	C	249/277 (90%)	235 (94%)	14 (6%)	0	100	100
All	All	488/554 (88%)	464 (95%)	23 (5%)	1 (0%)	43	60

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	151	GLY

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	203/224 (91%)	183 (90%)	20 (10%)	7	11
1	C	207/224 (92%)	194 (94%)	13 (6%)	16	29
All	All	410/448 (92%)	377 (92%)	33 (8%)	11	19

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

Mol	Chain	Res	Type
1	A	41	VAL
1	A	47	ILE
1	A	54	LEU
1	A	61	LYS
1	A	71	LYS
1	A	92	ASN
1	A	100	SER
1	A	125	GLU
1	A	130	VAL
1	A	150	ASP
1	A	154	ARG
1	A	160	ILE
1	A	165	TYR
1	A	175	ASP
1	A	177	LYS
1	A	210	LYS
1	A	212	MET
1	A	215	LYS
1	A	239	GLU
1	A	266	ARG
1	C	41	VAL
1	C	54	LEU
1	C	61	LYS
1	C	71	LYS
1	C	100	SER
1	C	153	GLN
1	C	154	ARG
1	C	171	GLU
1	C	192	MET
1	C	210	LYS
1	C	236	GLN
1	C	247	SER
1	C	266	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	74	ASN
1	A	153	GLN
1	A	259	ASN
1	A	273	GLN

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Mol	Chain	Res	Type
1	C	153	GLN
1	C	236	GLN
1	C	260	ASN
1	C	275	HIS

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	243/277 (87%)	0.06	6 (2%) 58 52	43, 60, 93, 134	0
1	C	251/277 (90%)	-0.06	7 (2%) 55 48	42, 58, 90, 125	0
All	All	494/554 (89%)	-0.00	13 (2%) 57 51	42, 59, 91, 134	0

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	290	ASP	4.9
1	C	236	GLN	4.3
1	C	249	GLU	3.9
1	A	42	PRO	3.8
1	A	100	SER	3.8
1	A	41	VAL	3.7
1	C	40	ALA	3.7
1	C	192	MET	3.0
1	C	41	VAL	2.8
1	A	43	GLU	2.0
1	A	249	GLU	2.0
1	C	50	ALA	2.0
1	C	151	GLY	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 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	MG	A	301	1/1	0.99	0.03	50,50,50,50	0
2	MG	C	301	1/1	0.99	0.04	34,34,34,34	0

6.5 Other polymers [i](#)

There are no such residues in this entry.