



Full wwPDB X-ray Structure Validation Report ⓘ

Sep 6, 2022 – 02:17 pm BST

PDB ID : 7R0I
Title : STRUCTURAL BASIS OF ION UPTAKE IN COPPER-TRANSPORTING P1B-TYPE ATPASES
Authors : Salustros, N.; Groenberg, C.; Wang, K.; Gourdon, P.
Deposited on : 2022-02-02
Resolution : 2.70 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
Xtrriage (Phenix) : 1.13
EDS : 2.30
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0267
CCP4 : 7.1.010 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.30

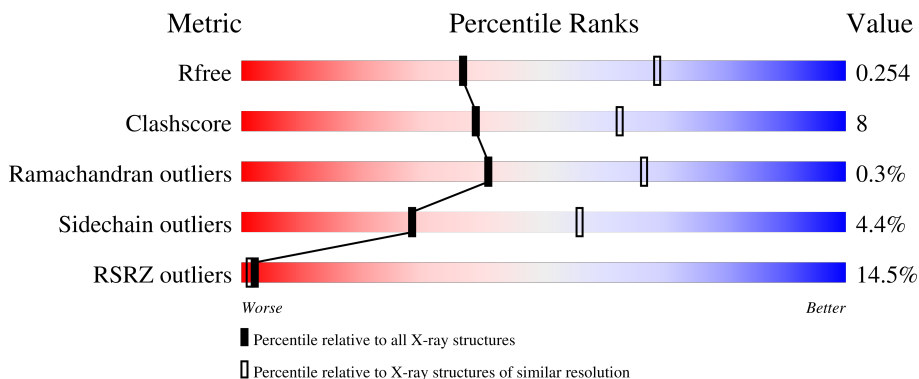
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


The reported resolution of this entry is 2.70 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}	130704	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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	658	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	MG	A	802	-	-	-	X

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 4931 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 Putative copper-exporting P-type ATPase A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	654	4929	3176	829	909	15	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	79	GLY	-	expression tag	UNP A0A117KM49

- Molecule 2 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	K	0	0
			1	1		

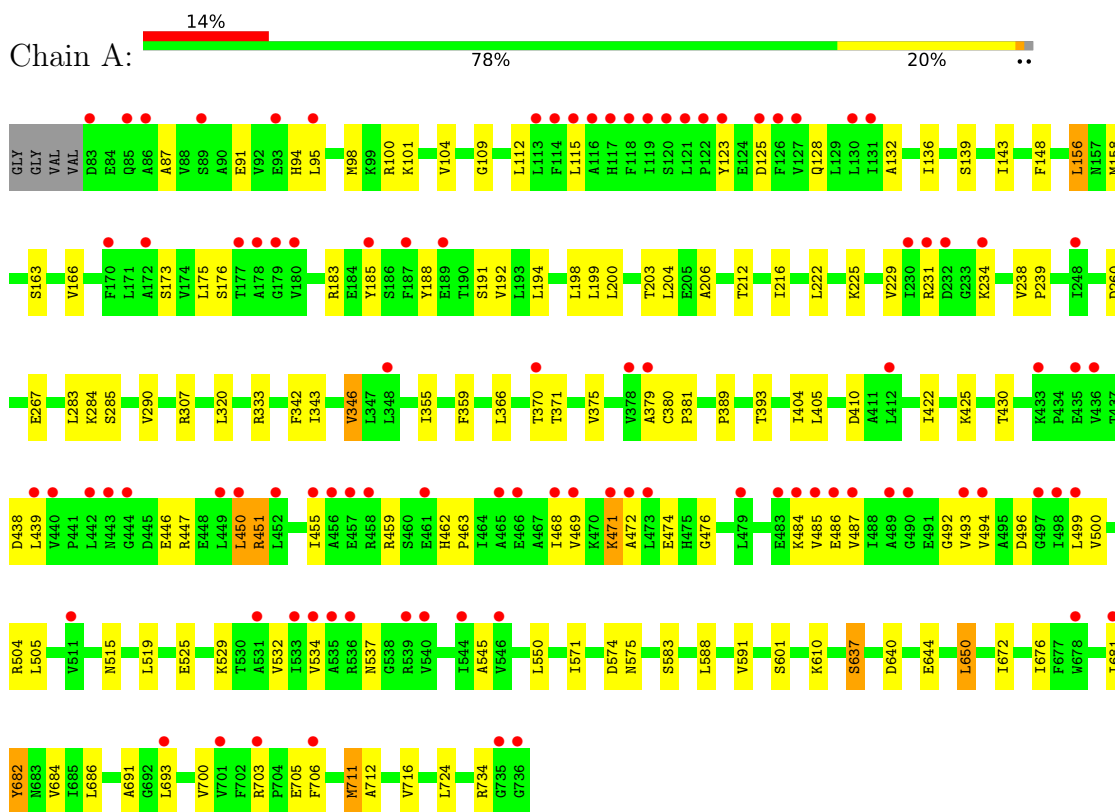
- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mg	0	0
			1	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: Putative copper-exporting P-type ATPase A



4 Data and refinement statistics

Property	Value	Source
Space group	F 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	129.53Å 150.10Å 218.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.65 – 2.70 45.65 – 2.71	Depositor EDS
% Data completeness (in resolution range)	99.3 (45.65-2.70) 91.5 (45.65-2.71)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.65 (at 2.73Å)	Xtriage
Refinement program	PHENIX 1.19.2	Depositor
R, R_{free}	0.225 , 0.256 0.225 , 0.254	Depositor DCC
R_{free} test set	1993 reflections (6.86%)	wwPDB-VP
Wilson B-factor (Å ²)	68.2	Xtriage
Anisotropy	0.145	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	(Not available) , (Not available)	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	0.90	EDS
Total number of atoms	4931	wwPDB-VP
Average B, all atoms (Å ²)	93.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.69% 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: K, 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	0.51	0/5003	0.74	1/6785 (0.0%)

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	2

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	450	LEU	CA-CB-CG	5.44	127.81	115.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	222	LEU	Peptide
1	A	346	VAL	Peptide

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	4929	0	5172	76	0
2	A	1	0	0	0	0
3	A	1	0	0	0	0
All	All	4931	0	5172	76	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 8.

All (76) 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:115:LEU:HB3	1:A:128:GLN:HE22	1.50	0.77
1:A:176:SER:HB2	1:A:185:TYR:HB2	1.70	0.72
1:A:260:ASP:HB2	1:A:307:ARG:HB2	1.73	0.71
1:A:163:SER:HA	1:A:166:VAL:HG12	1.73	0.70
1:A:583:SER:HB2	1:A:591:VAL:HG21	1.73	0.69
1:A:425:LYS:NZ	1:A:574:ASP:OD2	2.29	0.64
1:A:484:LYS:HB3	1:A:496:ASP:H	1.63	0.63
1:A:447:ARG:NH2	1:A:476:GLY:O	2.32	0.62
1:A:191:SER:HA	1:A:194:LEU:HB2	1.83	0.60
1:A:156:LEU:HD23	1:A:343:ILE:HG22	1.83	0.60
1:A:450:LEU:HD21	1:A:472:ALA:HA	1.85	0.58
1:A:355:ILE:O	1:A:359:PHE:HB2	2.03	0.58
1:A:422:ILE:HG21	1:A:571:ILE:HG13	1.87	0.56
1:A:471:LYS:NZ	1:A:474:GLU:OE2	2.37	0.56
1:A:438:ASP:OD2	1:A:529:LYS:NZ	2.35	0.55
1:A:681:ILE:HA	1:A:684:VAL:HG22	1.90	0.54
1:A:381:PRO:HA	1:A:711:MET:HE3	1.88	0.54
1:A:200:LEU:HD23	1:A:712:ALA:HB1	1.89	0.54
1:A:95:LEU:HD22	1:A:206:ALA:HB1	1.90	0.54
1:A:101:LYS:HG2	1:A:139:SER:HA	1.90	0.53
1:A:212:THR:O	1:A:216:ILE:HD12	2.09	0.53
1:A:459:ARG:HD2	1:A:485:VAL:HG21	1.90	0.53
1:A:143:ILE:HG21	1:A:198:LEU:HD21	1.89	0.53
1:A:204:LEU:HD11	1:A:716:VAL:HG12	1.90	0.53
1:A:583:SER:HA	1:A:588:LEU:HD12	1.91	0.51
1:A:438:ASP:HB2	1:A:545:ALA:HB3	1.92	0.51
1:A:342:PHE:O	1:A:346:VAL:HG22	2.12	0.49
1:A:125:ASP:OD2	1:A:183:ARG:NH2	2.41	0.49
1:A:430:THR:HG22	1:A:550:LEU:HD23	1.95	0.49
1:A:494:VAL:HG22	1:A:499:LEU:HD21	1.94	0.49
1:A:500:VAL:HG22	1:A:534:VAL:HG12	1.94	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:212:THR:HG22	1:A:393:THR:HG21	1.96	0.48
1:A:136:ILE:HD11	1:A:192:VAL:HG22	1.96	0.47
1:A:682:TYR:CZ	1:A:686:LEU:HD22	2.50	0.47
1:A:462:HIS:CG	1:A:463:PRO:HD2	2.50	0.47
1:A:109:GLY:HA2	1:A:112:LEU:HB2	1.97	0.46
1:A:267:GLU:HG3	1:A:285:SER:HB3	1.98	0.46
1:A:320:LEU:HD22	1:A:405:LEU:HB3	1.97	0.46
1:A:468:ILE:HD12	1:A:469:VAL:N	2.30	0.46
1:A:158:MET:HA	1:A:380:CYS:SG	2.56	0.46
1:A:371:THR:HB	1:A:691:ALA:HA	1.97	0.46
1:A:422:ILE:CG2	1:A:571:ILE:HG13	2.46	0.46
1:A:525:GLU:OE2	1:A:575:ASN:ND2	2.48	0.46
1:A:389:PRO:O	1:A:393:THR:HG23	2.15	0.45
1:A:537:ASN:N	1:A:537:ASN:OD1	2.49	0.45
1:A:499:LEU:HD22	1:A:505:LEU:HD11	1.97	0.45
1:A:672:ILE:O	1:A:676:ILE:HG13	2.17	0.44
1:A:87:ALA:O	1:A:91:GLU:HG3	2.18	0.43
1:A:229:VAL:HG12	1:A:231:ARG:HG3	1.99	0.43
1:A:366:LEU:O	1:A:370:THR:HG23	2.18	0.43
1:A:284:LYS:HE3	1:A:290:VAL:HG12	2.00	0.43
1:A:375:VAL:HG21	1:A:691:ALA:HB2	2.00	0.43
1:A:637:SER:HB2	1:A:644:GLU:HG3	2.00	0.43
1:A:375:VAL:CG2	1:A:691:ALA:HB2	2.49	0.43
1:A:112:LEU:HD21	1:A:132:ALA:HB2	2.01	0.42
1:A:98:MET:HB3	1:A:203:THR:HG22	2.01	0.42
1:A:375:VAL:O	1:A:379:ALA:N	2.52	0.42
1:A:439:LEU:HD23	1:A:439:LEU:HA	1.81	0.42
1:A:446:GLU:N	1:A:446:GLU:OE1	2.53	0.42
1:A:100:ARG:O	1:A:104:VAL:HG23	2.19	0.42
1:A:112:LEU:HD23	1:A:188:TYR:O	2.20	0.42
1:A:705:GLU:H	1:A:705:GLU:CD	2.23	0.42
1:A:500:VAL:HG13	1:A:532:VAL:HG21	2.00	0.42
1:A:515:ASN:O	1:A:519:LEU:HD22	2.20	0.41
1:A:492:GLY:HA3	1:A:505:LEU:HG	2.01	0.41
1:A:267:GLU:HG2	1:A:283:LEU:HD11	2.02	0.41
1:A:468:ILE:HD12	1:A:469:VAL:H	1.85	0.41
1:A:487:VAL:HG13	1:A:493:VAL:HG12	2.03	0.41
1:A:681:ILE:HG13	1:A:682:TYR:N	2.36	0.41
1:A:199:LEU:HA	1:A:199:LEU:HD23	1.72	0.40
1:A:404:ILE:HA	1:A:650:LEU:HD13	2.02	0.40
1:A:173:SER:HA	1:A:185:TYR:O	2.22	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:238:VAL:HG23	1:A:239:PRO:O	2.22	0.40
1:A:451:ARG:O	1:A:455:ILE:HG12	2.21	0.40
1:A:499:LEU:HD23	1:A:499:LEU:HA	1.63	0.40
1:A:640:ASP:O	1:A:644:GLU:HG2	2.22	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	652/658 (99%)	612 (94%)	38 (6%)	2 (0%)	41 66

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	700	VAL
1	A	693	LEU

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	521/523 (100%)	498 (96%)	23 (4%)	28 56

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	94	HIS
1	A	123	TYR
1	A	148	PHE
1	A	156	LEU
1	A	175	LEU
1	A	225	LYS
1	A	234	LYS
1	A	333	ARG
1	A	410	ASP
1	A	451	ARG
1	A	471	LYS
1	A	486	GLU
1	A	504	ARG
1	A	601	SER
1	A	610	LYS
1	A	637	SER
1	A	650	LEU
1	A	682	TYR
1	A	703	ARG
1	A	706	PHE
1	A	711	MET
1	A	724	LEU
1	A	734	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	128	GLN
1	A	559	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 monosaccharides 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	654/658 (99%)	0.89	95 (14%) 2 1	47, 86, 146, 171	0

All (95) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	119	ILE	9.8
1	A	116	ALA	8.8
1	A	114	PHE	8.4
1	A	121	LEU	8.2
1	A	120	SER	8.0
1	A	736	GLY	7.5
1	A	498	ILE	6.6
1	A	117	HIS	6.5
1	A	115	LEU	6.4
1	A	118	PHE	6.4
1	A	461	GLU	6.0
1	A	127	VAL	6.0
1	A	499	LEU	5.8
1	A	439	LEU	5.5
1	A	468	ILE	5.5
1	A	536	ARG	5.5
1	A	123	TYR	5.4
1	A	449	LEU	5.4
1	A	234	LYS	5.3
1	A	535	ALA	5.3
1	A	489	ALA	5.3
1	A	442	LEU	5.1
1	A	484	LYS	4.9
1	A	486	GLU	4.7
1	A	130	LEU	4.6
1	A	473	LEU	4.5
1	A	494	VAL	4.4

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Mol	Chain	Res	Type	RSRZ
1	A	378	VAL	4.3
1	A	485	VAL	4.3
1	A	472	ALA	4.2
1	A	122	PRO	4.0
1	A	456	ALA	3.9
1	A	180	VAL	3.8
1	A	457	GLU	3.8
1	A	497	GLY	3.7
1	A	539	ARG	3.7
1	A	452	LEU	3.6
1	A	435	GLU	3.6
1	A	544	ILE	3.6
1	A	458	ARG	3.5
1	A	86	ALA	3.4
1	A	113	LEU	3.4
1	A	444	GLY	3.4
1	A	230	ILE	3.3
1	A	187	PHE	3.3
1	A	735	GLY	3.3
1	A	490	GLY	3.2
1	A	469	VAL	3.2
1	A	126	PHE	3.2
1	A	703	ARG	3.2
1	A	466	GLU	3.2
1	A	493	VAL	3.2
1	A	701	VAL	3.2
1	A	178	ALA	3.2
1	A	379	ALA	3.2
1	A	533	ILE	3.2
1	A	89	SER	3.1
1	A	131	ILE	3.1
1	A	455	ILE	3.1
1	A	534	VAL	3.0
1	A	125	ASP	3.0
1	A	179	GLY	3.0
1	A	531	ALA	2.9
1	A	185	TYR	2.9
1	A	706	PHE	2.8
1	A	232	ASP	2.8
1	A	172	ALA	2.8
1	A	450	LEU	2.8
1	A	189	GLU	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	95	LEU	2.8
1	A	83	ASP	2.7
1	A	479	LEU	2.6
1	A	170	PHE	2.6
1	A	370	THR	2.5
1	A	412	LEU	2.5
1	A	487	VAL	2.5
1	A	465	ALA	2.5
1	A	231	ARG	2.5
1	A	471	LYS	2.4
1	A	693	LEU	2.3
1	A	546	VAL	2.3
1	A	436	VAL	2.3
1	A	440	VAL	2.2
1	A	511	VAL	2.2
1	A	540	VAL	2.2
1	A	681	ILE	2.2
1	A	443	ASN	2.2
1	A	93	GLU	2.2
1	A	678	TRP	2.2
1	A	483	GLU	2.1
1	A	85	GLN	2.1
1	A	248	ILE	2.1
1	A	177	THR	2.1
1	A	433	LYS	2.1
1	A	348	LEU	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
3	MG	A	802	1/1	0.72	0.51	83,83,83,83	0
2	K	A	801	1/1	0.98	0.14	86,86,86,86	0

6.5 Other polymers [i](#)

There are no such residues in this entry.