



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2018 – 11:23 am GMT

PDB ID : 3FD2  
Title : Crystal structure of mMsoI/DNA complex with calcium  
Authors : Li, H.; Monnat, R.J.  
Deposited on : 2008-11-24  
Resolution : 2.69 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](mailto: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 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 : trunk30967  
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)  
Refmac : 5.8.0158  
CCP4 : 7.0 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk30967

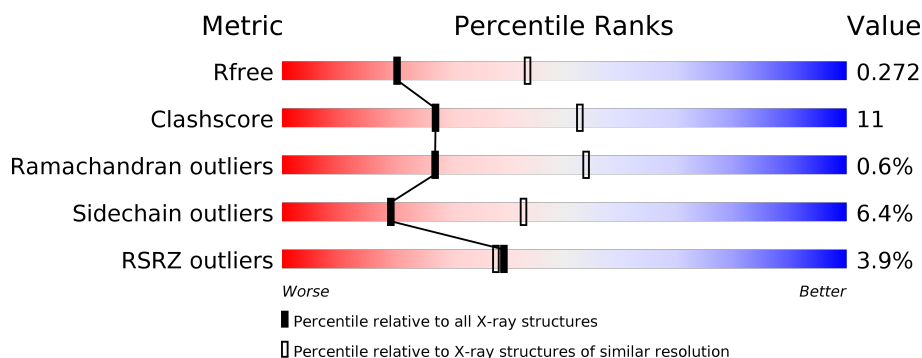
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.69 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))
$R_{free}$	111664	2449 (2.70-2.70)
Clashscore	122126	2756 (2.70-2.70)
Ramachandran outliers	120053	2716 (2.70-2.70)
Sidechain outliers	120020	2716 (2.70-2.70)
RSRZ outliers	108989	2376 (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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	373	
2	B	24	
3	C	24	

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3735 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 Site-specific DNA endonuclease I-MsoI.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
1	A	338	Total	C	N	O	0	0	0
			2720	1744	470	506			

- Molecule 2 is a DNA chain called 5'-D(\*GP\*CP\*AP\*GP\*AP\*AP\*CP\*GP\*TP\*CP\*GP\*TP\*GP\*AP\*GP\*AP\*CP\*AP\*GP\*TP\*TP\*CP\*CP\*G)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	24	Total	C	N	O	P	0	0	0
			493	234	96	140	23			

- Molecule 3 is a DNA chain called 5'-D(\*CP\*GP\*GP\*AP\*AP\*CP\*TP\*GP\*TP\*CP\*TP\*CP\*AP\*CP\*GP\*AP\*CP\*GP\*TP\*TP\*CP\*TP\*GP\*C)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	24	Total	C	N	O	P	0	0	0
			485	232	86	144	23			

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Ca	0	0
			2	2		

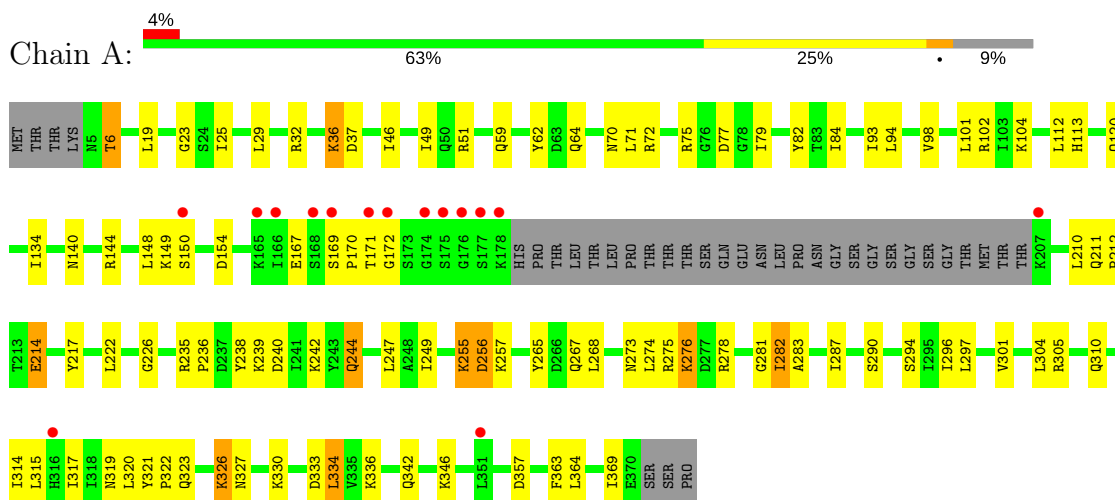
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	20	Total	O	0	0
			20	20		
5	B	7	Total	O	0	0
			7	7		
5	C	8	Total	O	0	0
			8	8		

### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Site-specific DNA endonuclease I-MsoI



- Molecule 2: 5'-D(\*GP\*CP\*AP\*GP\*AP\*AP\*CP\*GP\*TP\*CP\*GP\*TP\*GP\*AP\*GP\*AP\*CP\*A P\*GP\*TP\*TP\*CP\*CP\*G)-3'



- Molecule 3: 5'-D(\*CP\*GP\*GP\*AP\*AP\*CP\*TP\*GP\*TP\*CP\*TP\*CP\*AP\*CP\*GP\*AP\*CP\*G P\*TP\*TP\*CP\*TP\*GP\*C)-3'



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	41.93Å 41.93Å 70.96Å 107.21° 95.43° 109.44°	Depositor
Resolution (Å)	50.00 – 2.69 30.54 – 2.69	Depositor EDS
% Data completeness (in resolution range)	96.6 (50.00-2.69) 96.5 (30.54-2.69)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.48 (at 2.68Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.211 , 0.281 0.212 , 0.272	Depositor DCC
$R_{free}$ test set	546 reflections (4.79%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	64.9	Xtriage
Anisotropy	0.066	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 59.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.52$ , $\langle L^2 \rangle = 0.36$	Xtriage
Estimated twinning fraction	0.468 for k,h,-h-k-l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	3735	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.39% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: CA

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	0.43	3/2769 (0.1%)	0.55	1/3733 (0.0%)
2	B	0.67	0/554	1.27	5/854 (0.6%)
3	C	0.66	0/542	1.35	7/834 (0.8%)
All	All	0.51	3/3865 (0.1%)	0.86	13/5421 (0.2%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	357	ASP	CG-OD2	7.51	1.42	1.25
1	A	154	ASP	CG-OD2	6.44	1.40	1.25
1	A	167	GLU	CD-OE1	5.61	1.31	1.25

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	512	DT	O4'-C1'-N1	7.25	113.08	108.00
3	C	562	DC	O4'-C1'-N1	7.03	112.92	108.00
3	C	553	DG	O4'-C1'-N9	6.33	112.43	108.00
2	B	522	DC	O4'-C1'-N1	6.15	112.30	108.00
3	C	570	DT	O4'-C1'-N1	6.12	112.29	108.00
3	C	556	DC	P-O3'-C3'	5.47	126.27	119.70
2	B	503	DA	O4'-C1'-N9	5.40	111.78	108.00
2	B	514	DA	C3'-C2'-C1'	-5.37	96.05	102.50
3	C	570	DT	C1'-O4'-C4'	-5.29	104.81	110.10
2	B	512	DT	C6-C5-C7	-5.16	119.80	122.90
3	C	569	DT	C6-C5-C7	-5.12	119.83	122.90
3	C	570	DT	C3'-C2'-C1'	-5.11	96.37	102.50
1	A	154	ASP	CB-CG-OD1	-5.04	113.77	118.30

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	2720	0	2806	65	0
2	B	493	0	270	11	0
3	C	485	0	272	12	0
4	A	2	0	0	0	0
5	A	20	0	0	2	0
5	B	7	0	0	0	0
5	C	8	0	0	0	0
All	All	3735	0	3348	77	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 11.

All (77) 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:171:THR:HB	1:A:172:GLY:HA3	1.36	1.08
1:A:211:GLN:HE21	1:A:214:GLU:HG3	1.28	0.96
1:A:140:ASN:HD21	1:A:150:SER:H	1.21	0.89
1:A:171:THR:HB	1:A:172:GLY:CA	2.06	0.85
1:A:49:ILE:HD13	2:B:515:DG:H8	1.48	0.77
1:A:249:ILE:HD11	1:A:287:ILE:HD12	1.68	0.76
1:A:211:GLN:NE2	1:A:214:GLU:HG3	2.00	0.76
2:B:518:DA:H2''	2:B:519:DG:H5''	1.67	0.76
2:B:519:DG:H1	3:C:556:DC:H42	1.36	0.74
1:A:32:ARG:HH22	3:C:554:DA:H62	1.37	0.69
1:A:64:GLN:HE22	1:A:305:ARG:HH12	1.40	0.69
1:A:333:ASP:HA	1:A:336:LYS:HE3	1.76	0.68
1:A:222:LEU:HD23	1:A:304:LEU:HD21	1.77	0.66
1:A:265:TYR:CD1	1:A:274:LEU:HD11	2.33	0.63
1:A:46:ILE:HD11	1:A:84:ILE:HD12	1.82	0.62
1:A:98:VAL:HA	1:A:101:LEU:HD12	1.80	0.62
1:A:102:ARG:HH22	1:A:267:GLN:HE22	1.49	0.61

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:512:DT:H2''	2:B:513:DG:C8	2.37	0.60
1:A:278:ARG:HG2	1:A:282:ILE:O	2.03	0.58
1:A:287:ILE:HD13	1:A:296:ILE:HD13	1.87	0.56
1:A:19:LEU:HD23	1:A:101:LEU:HD21	1.87	0.56
1:A:235:ARG:HH21	1:A:244:GLN:NE2	2.03	0.56
1:A:326:LYS:H	1:A:326:LYS:HD2	1.70	0.56
1:A:113:HIS:HD2	1:A:134:ILE:HD13	1.71	0.56
3:C:562:DC:H2''	3:C:563:DA:C8	2.41	0.55
1:A:49:ILE:HD13	2:B:515:DG:C8	2.37	0.55
1:A:222:LEU:HD12	1:A:226:GLY:HA3	1.89	0.55
1:A:273:ASN:ND2	2:B:505:DA:H3'	2.22	0.55
1:A:51:ARG:HA	1:A:79:ILE:HD12	1.89	0.55
1:A:140:ASN:ND2	1:A:150:SER:H	1.97	0.54
1:A:363:PHE:HB3	1:A:369:ILE:HG12	1.90	0.54
1:A:238:TYR:HB2	1:A:242:LYS:HA	1.91	0.53
2:B:519:DG:H1	3:C:556:DC:N4	2.06	0.52
1:A:290:SER:O	1:A:294:SER:OG	2.22	0.50
1:A:320:LEU:HD12	1:A:334:LEU:HD12	1.93	0.50
2:B:510:DC:H42	3:C:565:DG:H1	1.58	0.50
1:A:211:GLN:HB2	1:A:212:PRO:HD2	1.92	0.49
2:B:518:DA:C2'	2:B:519:DG:H5''	2.41	0.49
1:A:32:ARG:HH22	3:C:554:DA:N6	2.09	0.48
1:A:323:GLN:HG2	5:A:382:HOH:O	2.13	0.48
1:A:210:LEU:HD11	1:A:268:LEU:HD23	1.95	0.47
1:A:36:LYS:HD2	1:A:37:ASP:HB2	1.96	0.47
1:A:171:THR:CB	1:A:172:GLY:CA	2.85	0.47
1:A:211:GLN:HE21	1:A:214:GLU:CG	2.13	0.46
1:A:36:LYS:HB3	1:A:36:LYS:NZ	2.29	0.46
1:A:297:LEU:O	1:A:301:VAL:HG23	2.16	0.46
3:C:551:DC:H2'	3:C:552:DG:C8	2.51	0.46
1:A:342:GLN:O	1:A:346:LYS:HE2	2.15	0.46
1:A:71:LEU:HD23	1:A:82:TYR:HB2	1.98	0.46
1:A:19:LEU:HD12	1:A:23:GLY:HA3	1.98	0.45
1:A:77:ASP:OD2	1:A:77:ASP:N	2.48	0.45
1:A:169:SER:HA	1:A:170:PRO:HD3	1.87	0.44
1:A:276:LYS:H	1:A:276:LYS:CD	2.30	0.44
1:A:255:LYS:HB3	1:A:281:GLY:O	2.18	0.44
1:A:265:TYR:CG	1:A:274:LEU:HD11	2.53	0.44
1:A:282:ILE:HD12	3:C:564:DC:H5	1.82	0.44
1:A:62:TYR:HD1	1:A:82:TYR:CE1	2.35	0.44
1:A:102:ARG:HD2	1:A:217:TYR:CZ	2.53	0.43

*Continued on next page...*



Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:72:ARG:CZ	3:C:557:DT:H72	2.48	0.43
1:A:84:ILE:HD13	1:A:93:ILE:HD13	2.01	0.43
1:A:256:ASP:OD1	1:A:257:LYS:HG3	2.19	0.43
1:A:321:TYR:N	1:A:322:PRO:HD2	2.33	0.43
1:A:25:ILE:HD12	1:A:104:LYS:HB3	2.01	0.43
1:A:247:LEU:HD21	1:A:317:ILE:HG21	2.02	0.42
1:A:244:GLN:HE21	1:A:244:GLN:HB3	1.52	0.42
5:A:395:HOH:O	3:C:565:DG:H5'	2.19	0.42
1:A:72:ARG:CZ	1:A:75:ARG:HB2	2.50	0.42
1:A:94:LEU:O	1:A:98:VAL:HG23	2.20	0.42
2:B:517:DC:H2'	2:B:518:DA:C8	2.53	0.42
1:A:239:LYS:HG3	1:A:240:ASP:N	2.35	0.42
3:C:551:DC:H2'	3:C:552:DG:H8	1.85	0.42
1:A:310:GLN:O	1:A:314:ILE:HG12	2.20	0.41
1:A:275:ARG:O	1:A:283:ALA:HB1	2.20	0.41
1:A:112:LEU:HD12	1:A:112:LEU:HA	1.98	0.41
1:A:144:ARG:HD3	3:C:563:DA:OP1	2.21	0.41
1:A:327:ASN:HD22	1:A:330:LYS:HD2	1.87	0.40
2:B:510:DC:H2''	2:B:511:DG:O5'	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	334/373 (90%)	305 (91%)	27 (8%)	2 (1%)	27 54

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	6	THR
1	A	236	PRO

### 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	297/328 (90%)	278 (94%)	19 (6%)	19	43

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	THR
1	A	29	LEU
1	A	36	LYS
1	A	59	GLN
1	A	70	ASN
1	A	120	GLN
1	A	148	LEU
1	A	149	LYS
1	A	214	GLU
1	A	244	GLN
1	A	255	LYS
1	A	256	ASP
1	A	276	LYS
1	A	282	ILE
1	A	315	LEU
1	A	319	ASN
1	A	326	LYS
1	A	334	LEU
1	A	364	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	89	HIS
1	A	109	ASN
1	A	113	HIS
1	A	122	GLN
1	A	140	ASN
1	A	211	GLN

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	A	244	GLN
1	A	267	GLN
1	A	273	ASN
1	A	327	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 carbohydrates 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	338/373 (90%)	0.07	15 (4%) 34 32	45, 52, 64, 76	0
2	B	24/24 (100%)	-0.31	0 100 100	64, 74, 92, 98	0
3	C	24/24 (100%)	-0.38	0 100 100	61, 79, 87, 90	0
All	All	386/421 (91%)	0.01	15 (3%) 39 38	45, 53, 79, 98	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	176	GLY	11.1
1	A	168	SER	8.6
1	A	177	SER	7.2
1	A	172	GLY	5.9
1	A	178	LYS	5.7
1	A	165	LYS	5.3
1	A	171	THR	4.3
1	A	174	GLY	4.0
1	A	175	SER	3.9
1	A	351	LEU	2.9
1	A	207	LYS	2.8
1	A	166	ILE	2.5
1	A	169	SER	2.2
1	A	150	SER	2.2
1	A	316	HIS	2.1

### 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 carbohydrates 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, 95<sup>th</sup> 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
4	CA	A	374	1/1	0.93	0.06	57,57,57,57	0
4	CA	A	375	1/1	0.98	0.07	50,50,50,50	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.