



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 18, 2024 – 03:28 AM EDT

PDB ID : 5RA9  
Title : PanDDA analysis group deposition Form1 MAP kinase p38-alpha – Fragment  
N08051b in complex with MAP kinase p38-alpha  
Authors : De Nicola, G.F.; Nichols, C.E.  
Deposited on : 2020-03-04  
Resolution : 1.68 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.37.1  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.37.1

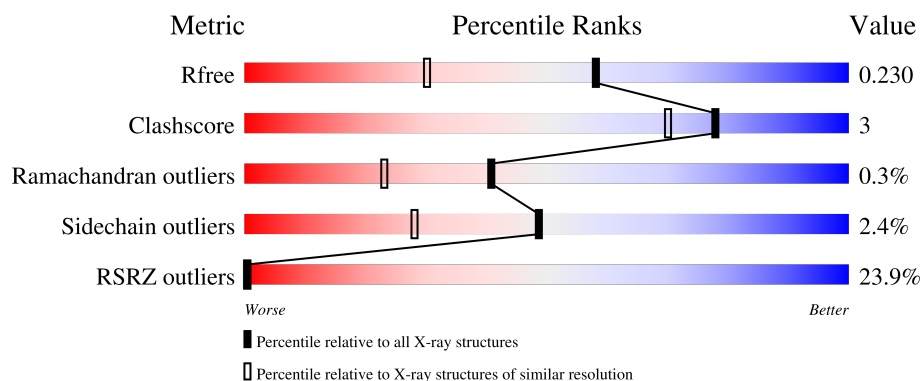
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.68 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	6780 (1.70-1.66)
Clashscore	141614	7310 (1.70-1.66)
Ramachandran outliers	138981	7173 (1.70-1.66)
Sidechain outliers	138945	7172 (1.70-1.66)
RSRZ outliers	127900	6661 (1.70-1.66)

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  $\geq 3$ , 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	360	<div> <div>23%</div> <div>89%</div> <div>6% . .</div> </div>

## 2 Entry composition [i](#)

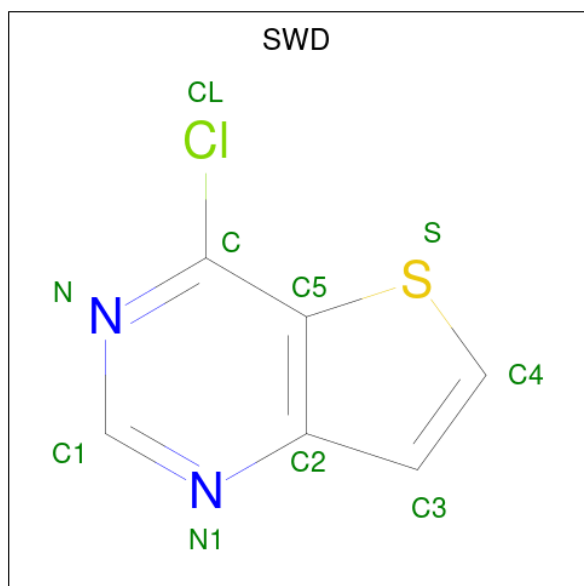
There are 7 unique types of molecules in this entry. The entry contains 3030 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Mitogen-activated protein kinase 14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	348	Total	C	N	O	S	0	3	0
			2777	1781	465	516	15			

- Molecule 2 is 4-chloranylthieno[3,2-d]pyrimidine (three-letter code: SWD) (formula:  $C_6H_3ClN_2S$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Cl	N	S	0	0
			10	6	1	2	1		

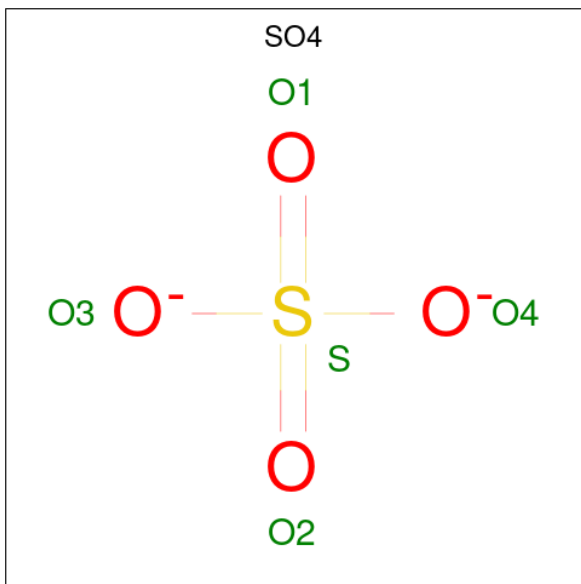
- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula:  $Cl$ ).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	5	Total	Cl	0	0
			5	5		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

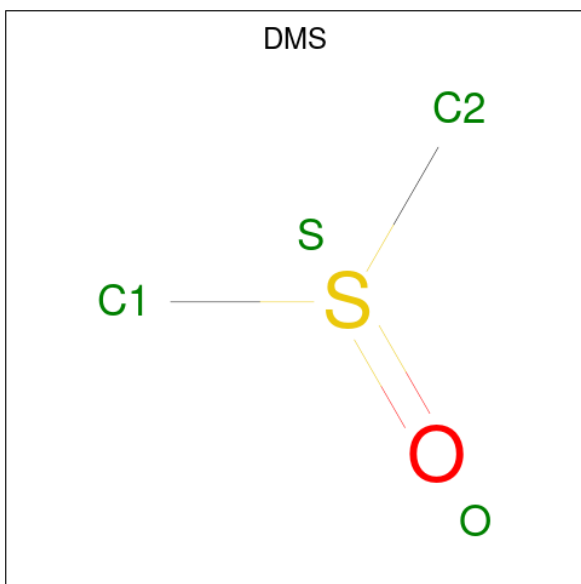
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Mg	0	0
			1	1		

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is DIMETHYL SULFOXIDE (three-letter code: DMS) (formula: C<sub>2</sub>H<sub>6</sub>OS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	O	S	0	0
			4	2	1	1		

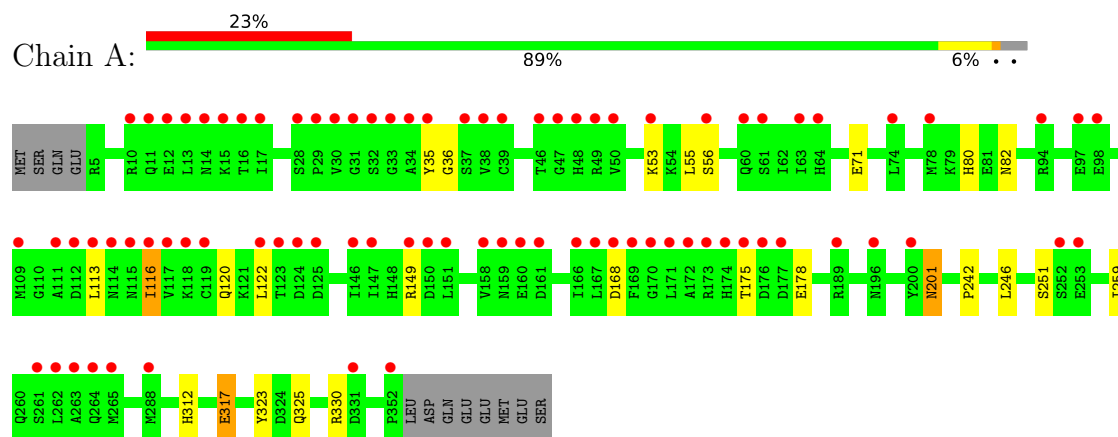
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	228	Total	O	0	0
			228	228		

### 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: Mitogen-activated protein kinase 14



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	45.92Å 86.50Å 126.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.76 – 1.68 29.74 – 1.68	Depositor EDS
% Data completeness (in resolution range)	99.6 (29.76-1.68) 99.7 (29.74-1.68)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.80 (at 1.68Å)	Xtriage
Refinement program	REFMAC 5.8.0238	Depositor
R, $R_{free}$	0.184 , 0.201 0.225 , 0.230	Depositor DCC
$R_{free}$ test set	2901 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	24.1	Xtriage
Anisotropy	0.026	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 51.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	3030	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.84% 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CL, SWD, MG, DMS, SO4

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	0.88	1/2844 (0.0%)	0.85	2/3870 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	317	GLU	CD-OE1	-5.61	1.19	1.25

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	330	ARG	NE-CZ-NH2	-6.41	117.10	120.30
1	A	330	ARG	NE-CZ-NH1	5.20	122.90	120.30

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	2777	0	2697	16	0
2	A	10	0	0	1	0
3	A	5	0	0	0	0
4	A	1	0	0	0	0
5	A	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	4	0	6	0	0
7	A	228	0	0	1	0
All	All	3030	0	2703	16	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 3.

All (16) 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:80:HIS:HD2	1:A:82:ASN:H	1.35	0.73
1:A:80:HIS:CD2	1:A:82:ASN:H	2.09	0.70
1:A:201:ASN:HD22	1:A:201:ASN:C	1.97	0.67
1:A:71:GLU:OE2	2:A:401:SWD:N1	2.35	0.60
1:A:53:LYS:HE2	1:A:55:LEU:HD23	1.86	0.58
1:A:35:TYR:O	1:A:53:LYS:HE3	2.06	0.56
1:A:36:GLY:HA3	1:A:53:LYS:HE3	1.89	0.53
1:A:312:HIS:HD2	1:A:317:GLU:OE2	1.93	0.51
1:A:53:LYS:HE2	1:A:55:LEU:CD2	2.41	0.50
1:A:242:PRO:HG2	1:A:259:ILE:HG21	1.93	0.49
1:A:35:TYR:O	1:A:53:LYS:CE	2.64	0.46
1:A:116:ILE:HD13	1:A:122:LEU:HD21	1.97	0.46
1:A:201:ASN:HB2	7:A:654:HOH:O	2.16	0.45
1:A:323:TYR:CE2	1:A:325:GLN:HG2	2.52	0.45
1:A:175:THR:HG23	1:A:178:GLU:H	1.84	0.42
1:A:242:PRO:HB3	1:A:246:LEU:HD23	2.04	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles ⓘ

### 5.3.1 Protein backbone ⓘ

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	349/360 (97%)	342 (98%)	6 (2%)	1 (0%)	41 23

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	168	ASP

### 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	295/319 (92%)	288 (98%)	7 (2%)	49 28

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	SER
1	A	113	LEU
1	A	116	ILE
1	A	120	GLN
1	A	149	ARG
1	A	201	ASN
1	A	251	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	77	HIS
1	A	80	HIS
1	A	115	ASN
1	A	120	GLN
1	A	128	GLN
1	A	201	ASN
1	A	272	ASN
1	A	310	GLN

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Mol	Chain	Res	Type
1	A	312	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 9 ligands modelled in this entry, 6 are monoatomic - leaving 3 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
2	SWD	A	401	-	9,11,11	2.60	4 (44%)	7,15,15	1.94	2 (28%)
6	DMS	A	409	-	3,3,3	0.21	0	3,3,3	0.09	0
5	SO4	A	408	-	4,4,4	0.31	0	6,6,6	0.35	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	SWD	A	401	-	-	-	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	SWD	C-CL	-5.17	1.62	1.74
2	A	401	SWD	C-C5	-4.80	1.37	1.43
2	A	401	SWD	C1-N1	2.21	1.35	1.32
2	A	401	SWD	C1-N	2.11	1.37	1.33

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	SWD	C5-C-CL	-3.66	114.67	121.04
2	A	401	SWD	C1-N-C	-2.61	112.73	116.26

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	SWD	1	0

## 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, 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	348/360 (96%)	1.61	83 (23%) <b>0</b> <b>0</b>	14, 24, 49, 114	69 (19%)

All (83) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	166	ILE	18.9
1	A	151	LEU	18.8
1	A	147	ILE	15.6
1	A	17	ILE	15.6
1	A	13	LEU	15.6
1	A	74	LEU	15.6
1	A	146	ILE	15.1
1	A	169	PHE	14.5
1	A	167	LEU	14.2
1	A	263	ALA	14.2
1	A	50	VAL	14.2
1	A	39	CYS	14.2
1	A	11	GLN	13.3
1	A	48	HIS	13.0
1	A	78[A]	MET	12.5
1	A	47	GLY	11.2
1	A	189	ARG	10.1
1	A	113	LEU	10.1
1	A	10	ARG	9.9
1	A	38	VAL	9.9
1	A	46	THR	9.6
1	A	288[A]	MET	9.5
1	A	32	SER	9.1
1	A	30	VAL	8.9
1	A	149	ARG	8.6
1	A	28	SER	8.6
1	A	33	GLY	8.4

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Mol	Chain	Res	Type	RSRZ
1	A	29	PRO	8.4
1	A	16	THR	8.4
1	A	53	LYS	8.1
1	A	49	ARG	8.0
1	A	119	CYS	8.0
1	A	34	ALA	7.8
1	A	262	LEU	7.8
1	A	150	ASP	7.5
1	A	168	ASP	7.4
1	A	175	THR	7.4
1	A	172	ALA	7.2
1	A	170	GLY	7.0
1	A	117	VAL	6.8
1	A	31	GLY	6.8
1	A	37	SER	6.6
1	A	12	GLU	6.6
1	A	122	LEU	6.5
1	A	35	TYR	5.9
1	A	116	ILE	5.9
1	A	177	ASP	5.8
1	A	176	ASP	5.6
1	A	265	MET	5.3
1	A	352	PRO	5.1
1	A	171	LEU	4.8
1	A	261	SER	4.8
1	A	15	LYS	4.7
1	A	118	LYS	4.6
1	A	114	ASN	4.6
1	A	14	ASN	4.5
1	A	264	GLN	4.2
1	A	174	HIS	3.8
1	A	115	ASN	3.5
1	A	63	ILE	3.5
1	A	123	THR	3.4
1	A	56	SER	3.4
1	A	160	GLU	3.3
1	A	173	ARG	3.2
1	A	124	ASP	3.1
1	A	111	ALA	3.1
1	A	112	ASP	3.0
1	A	125[A]	ASP	2.9
1	A	109	MET	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	161	ASP	2.7
1	A	159	ASN	2.6
1	A	60	GLN	2.5
1	A	61	SER	2.4
1	A	98	GLU	2.3
1	A	331	ASP	2.3
1	A	252	SER	2.2
1	A	196	ASN	2.2
1	A	158	VAL	2.1
1	A	94	ARG	2.1
1	A	253	GLU	2.1
1	A	64	HIS	2.1
1	A	97	GLU	2.0
1	A	200	TYR	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, 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	MG	A	407	1/1	0.60	0.17	19,19,19,19	1
2	SWD	A	401	10/10	0.71	0.37	21,23,24,29	10
6	DMS	A	409	4/4	0.80	0.14	73,79,80,86	0
3	CL	A	404	1/1	0.87	0.18	62,62,62,62	0
5	SO4	A	408	5/5	0.92	0.20	50,51,59,63	0
3	CL	A	403	1/1	0.98	0.03	42,42,42,42	0
3	CL	A	402	1/1	0.99	0.15	42,42,42,42	0
3	CL	A	405	1/1	0.99	0.20	39,39,39,39	0
3	CL	A	406	1/1	0.99	0.04	33,33,33,33	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.