Full wwPDB X-ray Structure Validation Report ⓘ

Nov 14, 2023 – 11:57 AM JST

PDB ID	:	5Z9A
Title	:	Crystal structure of chorismate synthase from Pseudomonas aeruginosa
Authors	:	Iqbal, N.; Chaudhary, A.; Kaur, P.; Sharma, S.; Singh, T.P.
Deposited on	:	2018-02-02
Resolution	:	2.79 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:

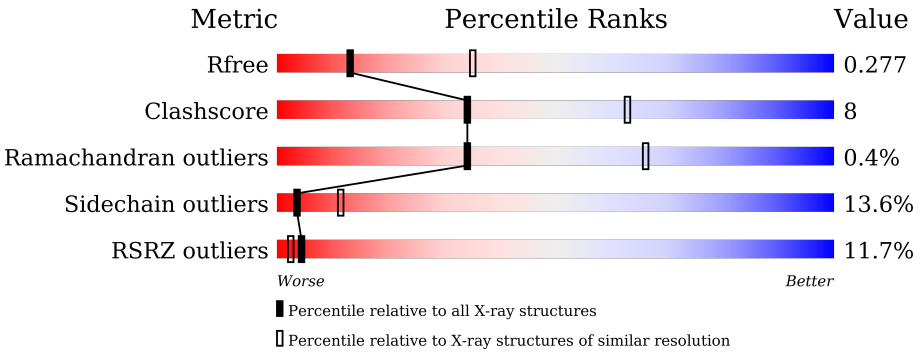
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.79 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	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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 <=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	363	13% 50% 16% · 32%
1	B	363	3% 56% 10% · 31%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 3704 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 Chorismate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	247	Total	C	N	O	S	0	0	0
			1830	1153	321	348	8			
1	B	250	Total	C	N	O	S	0	0	0
			1854	1166	327	353	8			

- Molecule 2 is water.

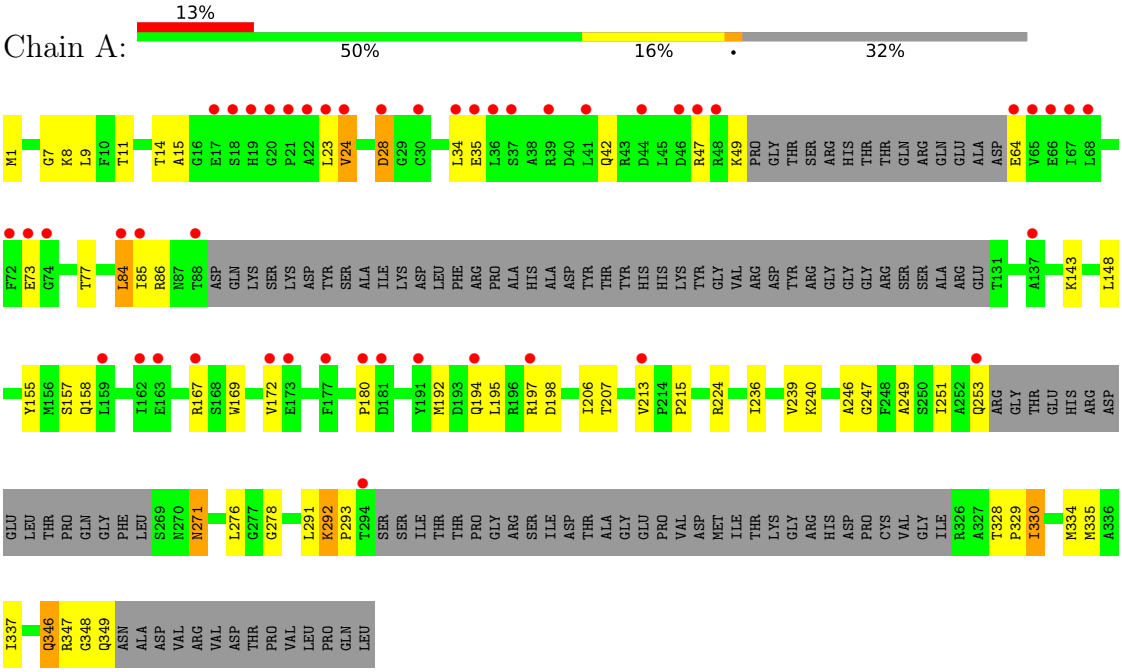
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	9	Total	O	0	0
			9	9		
2	B	11	Total	O	0	0
			11	11		

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.

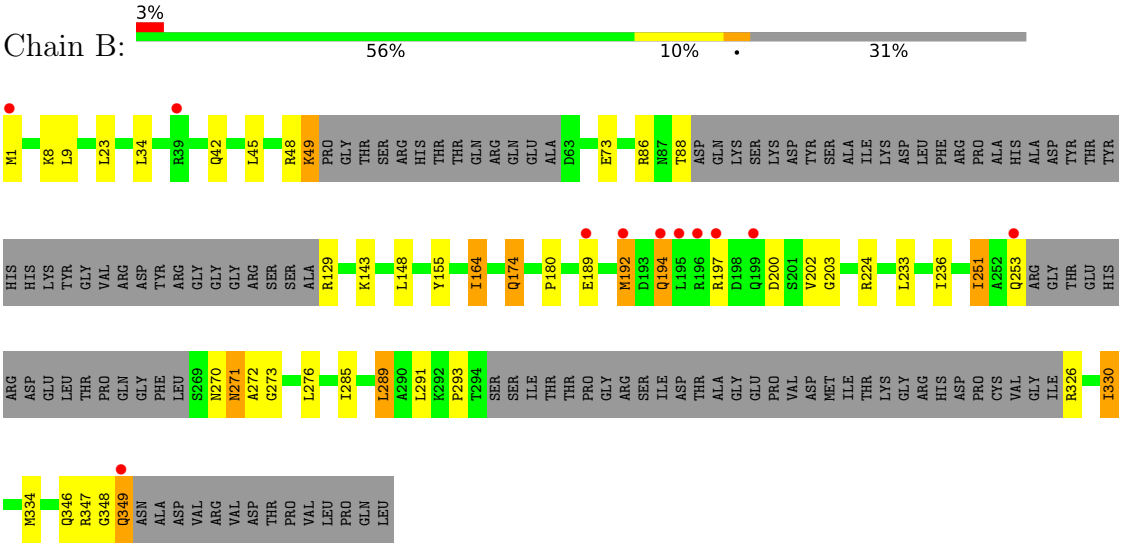
• Molecule 1: Chorismate synthase

Chain A:



• Molecule 1: Chorismate synthase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α, β, γ	76.53Å 76.53Å 389.13Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	66.28 – 2.79 65.34 – 2.79	Depositor EDS
% Data completeness (in resolution range)	96.4 (66.28-2.79) 96.4 (65.34-2.79)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.13 (at 2.77Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.207 , 0.276 0.212 , 0.277	Depositor DCC
R_{free} test set	865 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	89.5	Xtriage
Anisotropy	0.286	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 76.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	3704	wwPDB-VP
Average B, all atoms (Å^2)	97.0	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.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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

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	0.83	0/1856	0.97	3/2508 (0.1%)
1	B	0.88	0/1880	1.05	1/2540 (0.0%)
All	All	0.85	0/3736	1.01	4/5048 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	167	ARG	NE-CZ-NH1	6.64	123.62	120.30
1	B	192	MET	CA-CB-CG	6.52	124.38	113.30
1	A	28	ASP	O-C-N	-5.39	114.04	123.20
1	A	77	THR	O-C-N	-5.29	114.22	123.20

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	1830	0	1863	32	0
1	B	1854	0	1882	35	0
2	A	9	0	0	0	0
2	B	11	0	0	1	0
All	All	3704	0	3745	62	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 (62) 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:233:LEU:HD13	1:B:289:LEU:HD21	1.39	1.03
1:B:273:GLY:O	1:B:285:ILE:HA	1.70	0.91
1:A:253:GLN:H	1:B:202:VAL:HG23	1.39	0.88
1:B:45:LEU:O	1:B:48:ARG:HB2	1.81	0.80
1:A:253:GLN:N	1:B:202:VAL:HG23	1.99	0.76
1:A:253:GLN:H	1:B:202:VAL:CG2	2.03	0.71
1:A:328:THR:OG1	1:A:329:PRO:HD3	1.90	0.71
1:A:169:TRP:O	1:A:172:VAL:HG23	1.90	0.70
1:B:49:LYS:O	1:B:49:LYS:HD2	1.91	0.70
1:A:253:GLN:HG3	1:A:253:GLN:O	1.93	0.68
1:A:348:GLY:O	1:A:349:GLN:HB2	1.93	0.68
1:B:271:ASN:ND2	1:B:271:ASN:H	1.92	0.66
1:B:346:GLN:HA	1:B:346:GLN:OE1	1.96	0.66
1:B:348:GLY:O	1:B:349:GLN:HB3	1.95	0.66
1:B:233:LEU:HB3	1:B:289:LEU:CD2	2.29	0.62
1:B:202:VAL:HG22	1:B:203:GLY:N	2.17	0.59
1:B:233:LEU:HD13	1:B:289:LEU:CD2	2.24	0.57
1:B:233:LEU:CD1	1:B:289:LEU:HD21	2.25	0.56
1:A:240:LYS:HG3	1:A:292:LYS:HB3	1.86	0.56
1:A:224:ARG:HD3	1:A:278:GLY:HA3	1.89	0.55
1:B:194:GLN:HA	1:B:194:GLN:OE1	2.07	0.55
1:A:157:SER:HG	1:A:207:THR:HG1	1.52	0.54
1:A:84:LEU:HD22	1:A:85:ILE:N	2.23	0.53
1:B:233:LEU:HB3	1:B:289:LEU:HD22	1.90	0.53
1:A:11:THR:OG1	1:A:28:ASP:HB3	2.08	0.53
1:A:206:ILE:HG12	1:A:291:LEU:CD2	2.38	0.53
1:B:34:LEU:HD11	1:B:143:LYS:HG3	1.92	0.52
1:B:224:ARG:HB2	2:B:403:HOH:O	2.09	0.51
1:B:155:TYR:HB2	1:B:180:PRO:HD3	1.92	0.51
1:A:197:ARG:HG2	1:A:198:ASP:OD1	2.11	0.50
1:B:202:VAL:CG2	1:B:203:GLY:N	2.74	0.50
1:B:174:GLN:HE21	1:B:174:GLN:HA	1.77	0.49
1:A:155:TYR:HB2	1:A:180:PRO:HD3	1.95	0.49
1:A:158:GLN:NE2	1:B:251:ILE:HG13	2.28	0.48
1:B:346:GLN:O	1:B:348:GLY:N	2.48	0.47
1:A:246:ALA:HB2	1:A:271:ASN:HB3	1.97	0.47
1:A:346:GLN:NE2	1:A:346:GLN:HA	2.29	0.46
1:A:7:GLY:C	1:A:11:THR:HG22	2.36	0.46

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:189:GLU:O	1:B:192:MET:HB2	2.15	0.46
1:A:84:LEU:HD22	1:A:85:ILE:H	1.81	0.46
1:B:346:GLN:C	1:B:348:GLY:N	2.70	0.45
1:B:23:LEU:HD11	1:B:129:ARG:HD2	1.98	0.45
1:A:206:ILE:HG12	1:A:291:LEU:HD21	1.99	0.45
1:A:247:GLY:O	1:A:249:ALA:O	2.35	0.45
1:A:15:ALA:HB3	1:A:24:VAL:HG12	1.99	0.44
1:B:349:GLN:HE21	1:B:349:GLN:HB2	1.69	0.44
1:B:346:GLN:C	1:B:348:GLY:H	2.20	0.44
1:A:348:GLY:O	1:A:349:GLN:CB	2.64	0.44
1:B:164:ILE:CD1	1:B:180:PRO:HD2	2.48	0.44
1:A:236:ILE:HG12	1:A:330:ILE:CD1	2.49	0.43
1:A:239:VAL:HG22	1:A:291:LEU:HD11	2.01	0.43
1:A:292:LYS:HD2	1:A:293:PRO:O	2.19	0.42
1:B:49:LYS:HD2	1:B:49:LYS:C	2.39	0.42
1:B:251:ILE:H	1:B:251:ILE:HG12	1.47	0.42
1:A:34:LEU:HD11	1:A:143:LYS:HG3	2.00	0.42
1:B:330:ILE:O	1:B:334:MET:HG2	2.19	0.42
1:A:253:GLN:HG2	1:B:293:PRO:CG	2.50	0.42
1:A:236:ILE:HG12	1:A:330:ILE:HD12	2.02	0.41
1:A:334:MET:HE1	1:A:337:ILE:HD12	2.02	0.41
1:B:174:GLN:HE21	1:B:174:GLN:CA	2.33	0.41
1:B:236:ILE:HG12	1:B:330:ILE:CD1	2.51	0.41
1:A:206:ILE:HG12	1:A:291:LEU:HD23	2.02	0.41

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	237/363 (65%)	230 (97%)	7 (3%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	B	240/363 (66%)	232 (97%)	6 (2%)	2 (1%)	19 49
All	All	477/726 (66%)	462 (97%)	13 (3%)	2 (0%)	34 66

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	272	ALA
1	B	347	ARG

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	190/289 (66%)	162 (85%)	28 (15%)	3 9
1	B	192/289 (66%)	168 (88%)	24 (12%)	4 14
All	All	382/578 (66%)	330 (86%)	52 (14%)	3 11

All (52) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	8	LYS
1	A	9	LEU
1	A	14	THR
1	A	23	LEU
1	A	24	VAL
1	A	35	GLU
1	A	42	GLN
1	A	47	ARG
1	A	49	LYS
1	A	64	GLU
1	A	73	GLU
1	A	84	LEU
1	A	86	ARG

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	148	LEU
1	A	192	MET
1	A	194	GLN
1	A	195	LEU
1	A	213	VAL
1	A	215	PRO
1	A	251	ILE
1	A	271	ASN
1	A	276	LEU
1	A	292	LYS
1	A	330	ILE
1	A	335	MET
1	A	346	GLN
1	A	347	ARG
1	B	1	MET
1	B	8	LYS
1	B	9	LEU
1	B	42	GLN
1	B	49	LYS
1	B	73	GLU
1	B	86	ARG
1	B	88	THR
1	B	148	LEU
1	B	164	ILE
1	B	174	GLN
1	B	194	GLN
1	B	197	ARG
1	B	200	ASP
1	B	251	ILE
1	B	253	GLN
1	B	270	ASN
1	B	271	ASN
1	B	276	LEU
1	B	289	LEU
1	B	291	LEU
1	B	326	ARG
1	B	330	ILE
1	B	349	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	174	GLN
1	B	271	ASN
1	B	283	GLN
1	B	288	HIS
1	B	349	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 monosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

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, 95^{th} 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	247/363 (68%)	1.13	47 (19%) 1 1	70, 97, 146, 175	0
1	B	250/363 (68%)	0.77	11 (4%) 34 24	62, 82, 136, 160	0
All	All	497/726 (68%)	0.95	58 (11%) 4 2	62, 89, 142, 175	0

All (58) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	39	ARG	4.9
1	A	197	ARG	4.4
1	A	21	PRO	4.4
1	A	65	VAL	4.3
1	A	88	THR	4.3
1	A	68	LEU	4.2
1	A	72	PHE	4.0
1	A	34	LEU	3.9
1	B	1	MET	3.8
1	A	172	VAL	3.8
1	A	64	GLU	3.7
1	B	195	LEU	3.6
1	A	294	THR	3.6
1	A	46	ASP	3.6
1	A	36	LEU	3.5
1	A	48	ARG	3.4
1	A	253	GLN	3.4
1	B	192	MET	3.2
1	A	18	SER	3.2
1	A	19	HIS	3.1
1	A	67	ILE	3.1
1	A	181	ASP	3.0
1	A	20	GLY	2.9
1	A	22	ALA	2.9

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	197	ARG	2.8
1	A	41	LEU	2.8
1	A	28	ASP	2.7
1	A	30	CYS	2.7
1	A	74	GLY	2.7
1	A	37	SER	2.6
1	A	17	GLU	2.5
1	A	163	GLU	2.5
1	B	253	GLN	2.5
1	A	180	PRO	2.5
1	B	199	GLN	2.5
1	A	44	ASP	2.4
1	A	167	ARG	2.4
1	A	191	TYR	2.4
1	A	162	ILE	2.3
1	A	23	LEU	2.3
1	A	35	GLU	2.3
1	A	66	GLU	2.3
1	A	137	ALA	2.3
1	B	39	ARG	2.3
1	A	173	GLU	2.2
1	B	194	GLN	2.2
1	A	47	ARG	2.2
1	A	213	VAL	2.2
1	B	189	GLU	2.1
1	A	73	GLU	2.1
1	A	159	LEU	2.1
1	A	177	PHE	2.1
1	A	84	LEU	2.0
1	A	24	VAL	2.0
1	B	196	ARG	2.0
1	A	85	ILE	2.0
1	A	194	GLN	2.0
1	B	349	GLN	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)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.