wwPDB X-ray Structure Validation Summary Report (i)

Jan 23, 2021 – 04:08 PM EST

PDB ID	:	1Z2L
Title	:	Crystal structure of Allantoate-amidohydrolase from E.coli K12 in complex with substrate Allantoate
Authors	:	Agarwal, R.; Swaminathan, S.; Burley, S.K.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on	:	2005-03-08
Resolution	:	2.25 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

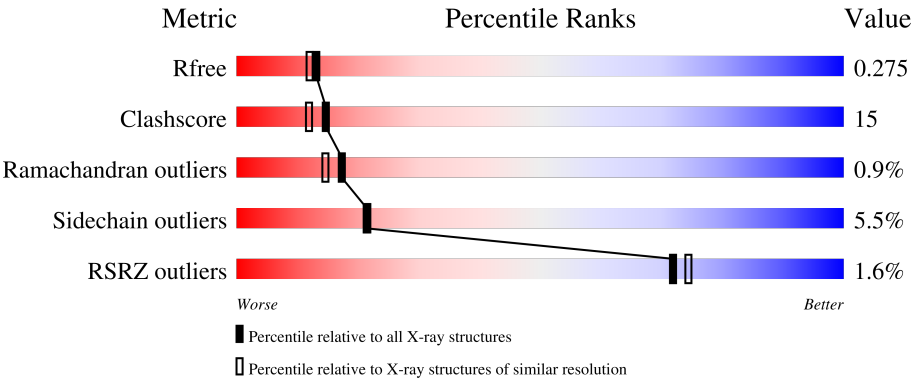
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.16
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.16

1 Overall quality at a glance (i)

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

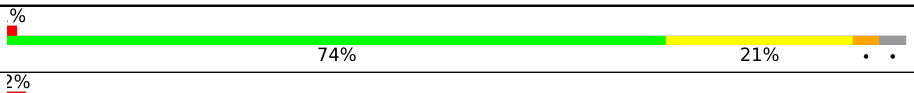
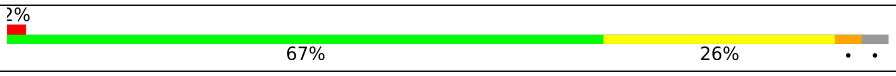
The reported resolution of this entry is 2.25 Å.

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	1377 (2.26-2.26)
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)
RSRZ outliers	127900	1356 (2.26-2.26)

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	423	
1	B	423	

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	SO4	A	513	-	-	X	-
3	SO4	B	515	-	-	X	-
4	1AL	B	516	-	-	X	X

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 6625 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 Allantoate amidohydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	411	Total	C	N	O	S	0	0	0
			3207	2021	558	607	21			
1	B	410	Total	C	N	O	S	0	0	0
			3198	2015	556	606	21			

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP P77425
A	2	SER	-	expression tag	UNP P77425
A	3	LEU	-	expression tag	UNP P77425
A	414	GLU	-	expression tag	UNP P77425
A	415	GLY	-	expression tag	UNP P77425
A	416	GLY	-	expression tag	UNP P77425
A	417	SER	-	expression tag	UNP P77425
A	418	HIS	-	expression tag	UNP P77425
A	419	HIS	-	expression tag	UNP P77425
A	420	HIS	-	expression tag	UNP P77425
A	421	HIS	-	expression tag	UNP P77425
A	422	HIS	-	expression tag	UNP P77425
A	423	HIS	-	expression tag	UNP P77425
B	1	MET	-	expression tag	UNP P77425
B	2	SER	-	expression tag	UNP P77425
B	3	LEU	-	expression tag	UNP P77425
B	414	GLU	-	expression tag	UNP P77425
B	415	GLY	-	expression tag	UNP P77425
B	416	GLY	-	expression tag	UNP P77425
B	417	SER	-	expression tag	UNP P77425
B	418	HIS	-	expression tag	UNP P77425
B	419	HIS	-	expression tag	UNP P77425
B	420	HIS	-	expression tag	UNP P77425
B	421	HIS	-	expression tag	UNP P77425
B	422	HIS	-	expression tag	UNP P77425

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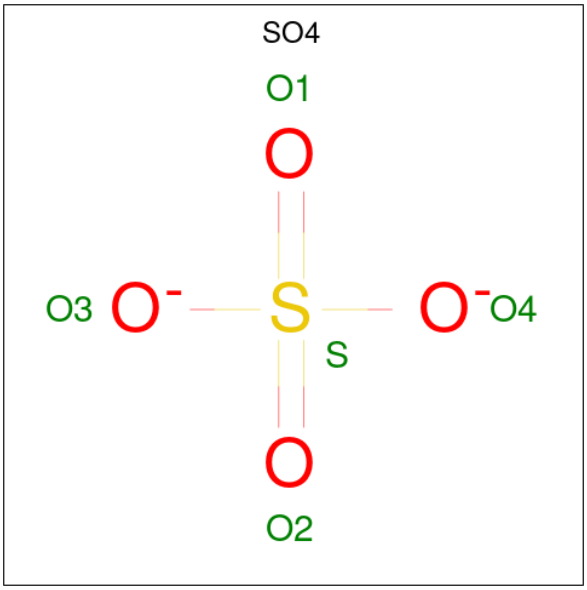
Chain	Residue	Modelled	Actual	Comment	Reference
B	423	HIS	-	expression tag	UNP P77425

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

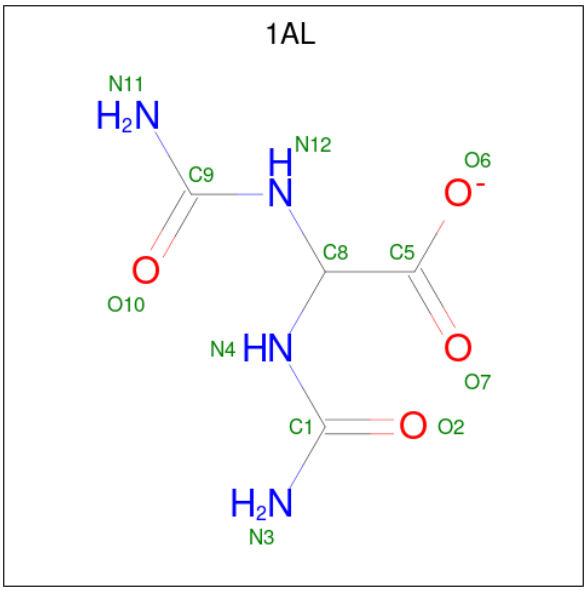
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	2	Total Zn 2 2	0	0
2	A	2	Total Zn 2 2	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



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

- Molecule 4 is ALLANTOATE ION (three-letter code: 1AL) (formula: $C_4H_7N_4O_4$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total C N O 12 4 4 4	0	0

- Molecule 5 is water.

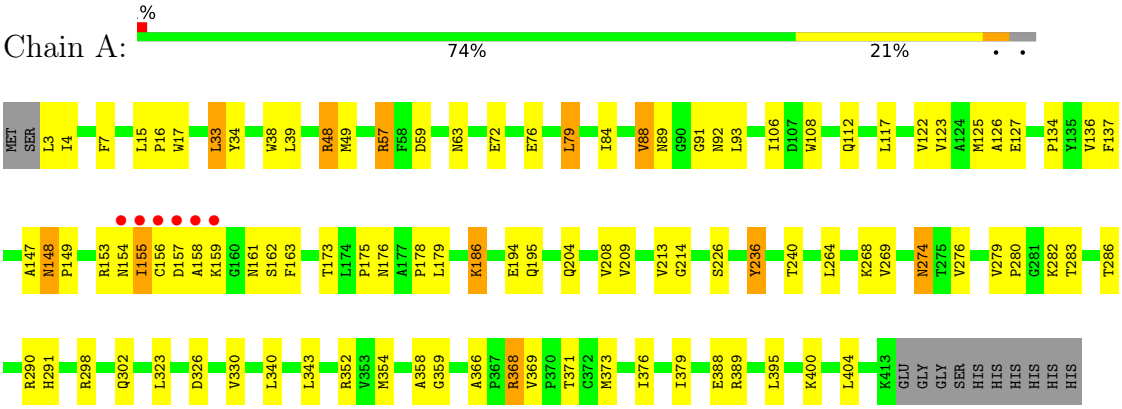
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	119	Total O 119 119	0	0
5	B	75	Total O 75 75	0	0

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.

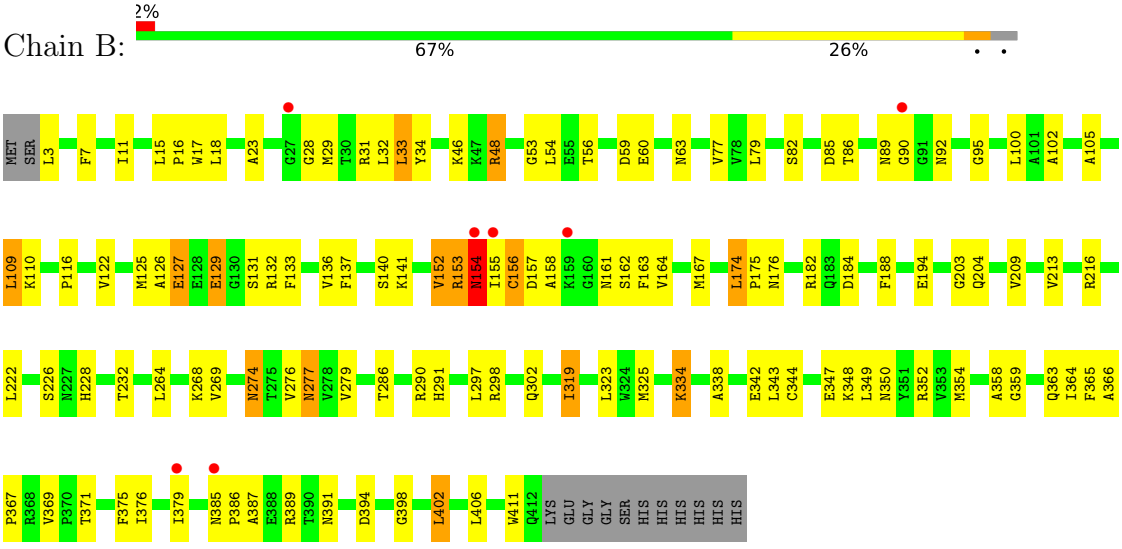
• Molecule 1: Allantoate amidohydrolase

Chain A:



• Molecule 1: Allantoate amidohydrolase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	95.53Å 186.58Å 49.22Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.22 – 2.25 49.22 – 2.25	Depositor EDS
% Data completeness (in resolution range)	94.3 (49.22-2.25) 94.1 (49.22-2.25)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	6.67 (at 2.24Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.229 , 0.273 0.229 , 0.275	Depositor DCC
R_{free} test set	1211 reflections (2.92%)	wwPDB-VP
Wilson B-factor (Å^2)	30.8	Xtriage
Anisotropy	0.397	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 41.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	6625	wwPDB-VP
Average B, all atoms (Å^2)	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.61% 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

Bond lengths and bond angles in the following residue types are not validated in this section: 1AL, ZN, 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	0.41	0/3277	0.66	0/4451
1	B	0.37	0/3268	0.66	1/4440 (0.0%)
All	All	0.39	0/6545	0.66	1/8891 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	153	ARG	N-CA-C	5.24	125.14	111.00

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	3207	0	3144	90	0
1	B	3198	0	3131	109	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	5	0	0	3	0
3	B	5	0	0	3	0
4	B	12	0	7	4	0
5	A	119	0	0	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	B	75	0	0	6	0
All	All	6625	0	6282	194	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 15.

The worst 5 of 194 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:156:CYS:HB3	1:A:163:PHE:H	1.05	1.06
1:A:209:VAL:HG11	1:A:373:MET:HB2	1.42	1.01
1:B:379:ILE:HG21	1:B:389:ARG:HG3	1.46	0.97
1:A:156:CYS:HB3	1:A:163:PHE:N	1.85	0.90
1:B:344:CYS:HA	1:B:349:LEU:HD12	1.58	0.85

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	409/423 (97%)	389 (95%)	17 (4%)	3 (1%)	22 21
1	B	408/423 (96%)	377 (92%)	27 (7%)	4 (1%)	15 13
All	All	817/846 (97%)	766 (94%)	44 (5%)	7 (1%)	17 14

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	154	ASN
1	B	127	GLU
1	A	148	ASN

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Mol	Chain	Res	Type
1	B	32	LEU
1	B	152	VAL

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	345/355 (97%)	330 (96%)	15 (4%)	29	33
1	B	344/355 (97%)	321 (93%)	23 (7%)	16	15
All	All	689/710 (97%)	651 (94%)	38 (6%)	21	21

5 of 38 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	48	ARG
1	B	129	GLU
1	B	363	GLN
1	B	100	LEU
1	B	152	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 24 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	42	GLN
1	B	142	ASN
1	B	391	ASN
1	B	63	ASN
1	B	112	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 7 ligands modelled in this entry, 4 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	$\#\|Z\| > 2$
4	1AL	B	516	-	6,11,11	1.16	1 (16%)	9,14,14	2.63	4 (44%)
3	SO4	B	515	-	4,4,4	0.34	0	6,6,6	0.27	0
3	SO4	A	513	-	4,4,4	0.33	0	6,6,6	0.91	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
4	1AL	B	516	-	-	5/8/12/12	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	516	1AL	C9-N12	2.39	1.40	1.35

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	B	516	1AL	C5-C8-N12	4.77	118.42	110.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	B	516	1AL	N11-C9-N12	4.15	126.08	116.77
4	B	516	1AL	O10-C9-N12	-3.03	111.62	121.45
4	B	516	1AL	N3-C1-N4	2.30	121.93	116.77

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	516	1AL	O2-C1-N4-C8
4	B	516	1AL	N3-C1-N4-C8
4	B	516	1AL	C5-C8-N12-C9
4	B	516	1AL	O10-C9-N12-C8
4	B	516	1AL	N11-C9-N12-C8

There are no ring outliers.

3 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	516	1AL	4	0
3	B	515	SO4	3	0
3	A	513	SO4	3	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^{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	411/423 (97%)	-0.41	6 (1%)	73	75	16, 27, 44, 60	0
1	B	410/423 (96%)	-0.11	7 (1%)	70	73	17, 36, 54, 63	0
All	All	821/846 (97%)	-0.26	13 (1%)	72	74	16, 32, 52, 63	0

The worst 5 of 13 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	154	ASN	8.4
1	A	155	ILE	6.4
1	B	155	ILE	4.4
1	A	157	ASP	3.5
1	B	379	ILE	2.8

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

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^{th} 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(Å^2)	Q<0.9
4	1AL	B	516	12/12	0.68	0.71	17,23,33,54	0
3	SO4	A	513	5/5	0.94	0.61	27,27,28,28	0
3	SO4	B	515	5/5	0.96	0.66	27,27,28,28	0
2	ZN	B	514	1/1	0.98	0.04	48,48,48,48	0
2	ZN	A	512	1/1	0.99	0.07	39,39,39,39	0
2	ZN	A	511	1/1	0.99	0.11	33,33,33,33	0
2	ZN	B	513	1/1	1.00	0.09	36,36,36,36	0

6.5 Other polymers (i)

There are no such residues in this entry.