



# Full wwPDB X-ray Structure Validation Report ⓘ

May 18, 2020 – 08:51 am BST

PDB ID : 3T0C  
Title : Crystal structure of Streptococcus mutans MetE complexed with Zinc  
Authors : Fu, T.M.; Liang, Y.H.; Su, X.D.  
Deposited on : 2011-07-19  
Resolution : 2.19 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.

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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 : 2.11  
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) : 2.11

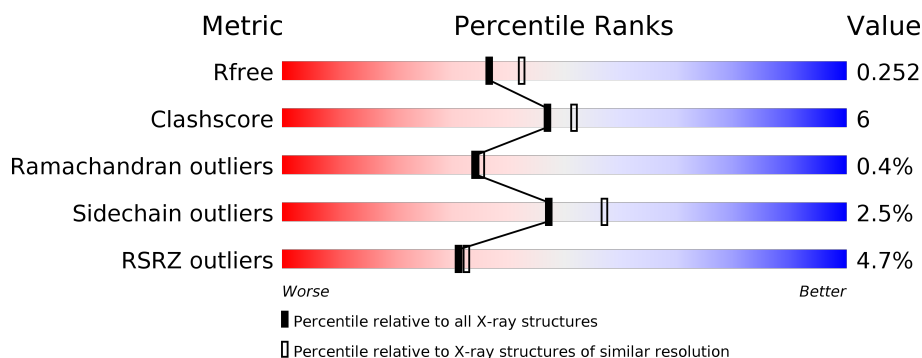
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.19 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	6864 (2.20-2.16)
Clashscore	141614	7689 (2.20-2.16)
Ramachandran outliers	138981	7564 (2.20-2.16)
Sidechain outliers	138945	7564 (2.20-2.16)
RSRZ outliers	127900	6738 (2.20-2.16)

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 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	779	<div> <div>4%</div> <div> <div></div> <div>79%</div> <div>15%</div> <div>• 5%</div> </div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6108 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 5-methyltetrahydropteroyltriglutamate--homocysteine methyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	737	Total	C	N	O	S	0	0	0
			5599	3606	913	1073	7			

There are 34 discrepancies between the modelled and reference sequences:

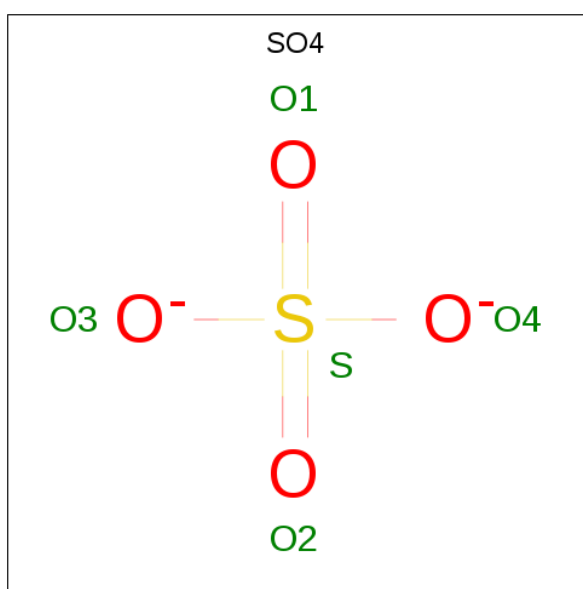
Chain	Residue	Modelled	Actual	Comment	Reference
A	-33	MET	-	EXPRESSION TAG	UNP Q8CWX6
A	-32	GLY	-	EXPRESSION TAG	UNP Q8CWX6
A	-31	SER	-	EXPRESSION TAG	UNP Q8CWX6
A	-30	SER	-	EXPRESSION TAG	UNP Q8CWX6
A	-29	HIS	-	EXPRESSION TAG	UNP Q8CWX6
A	-28	HIS	-	EXPRESSION TAG	UNP Q8CWX6
A	-27	HIS	-	EXPRESSION TAG	UNP Q8CWX6
A	-26	HIS	-	EXPRESSION TAG	UNP Q8CWX6
A	-25	HIS	-	EXPRESSION TAG	UNP Q8CWX6
A	-24	HIS	-	EXPRESSION TAG	UNP Q8CWX6
A	-23	SER	-	EXPRESSION TAG	UNP Q8CWX6
A	-22	SER	-	EXPRESSION TAG	UNP Q8CWX6
A	-21	GLY	-	EXPRESSION TAG	UNP Q8CWX6
A	-20	LEU	-	EXPRESSION TAG	UNP Q8CWX6
A	-19	VAL	-	EXPRESSION TAG	UNP Q8CWX6
A	-18	PRO	-	EXPRESSION TAG	UNP Q8CWX6
A	-17	ARG	-	EXPRESSION TAG	UNP Q8CWX6
A	-16	GLY	-	EXPRESSION TAG	UNP Q8CWX6
A	-15	SER	-	EXPRESSION TAG	UNP Q8CWX6
A	-14	HIS	-	EXPRESSION TAG	UNP Q8CWX6
A	-13	MET	-	EXPRESSION TAG	UNP Q8CWX6
A	-12	ALA	-	EXPRESSION TAG	UNP Q8CWX6
A	-11	SER	-	EXPRESSION TAG	UNP Q8CWX6
A	-10	MET	-	EXPRESSION TAG	UNP Q8CWX6
A	-9	THR	-	EXPRESSION TAG	UNP Q8CWX6
A	-8	GLY	-	EXPRESSION TAG	UNP Q8CWX6

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	GLY	-	EXPRESSION TAG	UNP Q8CWX6
A	-6	GLN	-	EXPRESSION TAG	UNP Q8CWX6
A	-5	GLN	-	EXPRESSION TAG	UNP Q8CWX6
A	-4	MET	-	EXPRESSION TAG	UNP Q8CWX6
A	-3	GLY	-	EXPRESSION TAG	UNP Q8CWX6
A	-2	ARG	-	EXPRESSION TAG	UNP Q8CWX6
A	-1	GLY	-	EXPRESSION TAG	UNP Q8CWX6
A	0	SER	-	EXPRESSION TAG	UNP Q8CWX6

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Zn 1 1	0	0

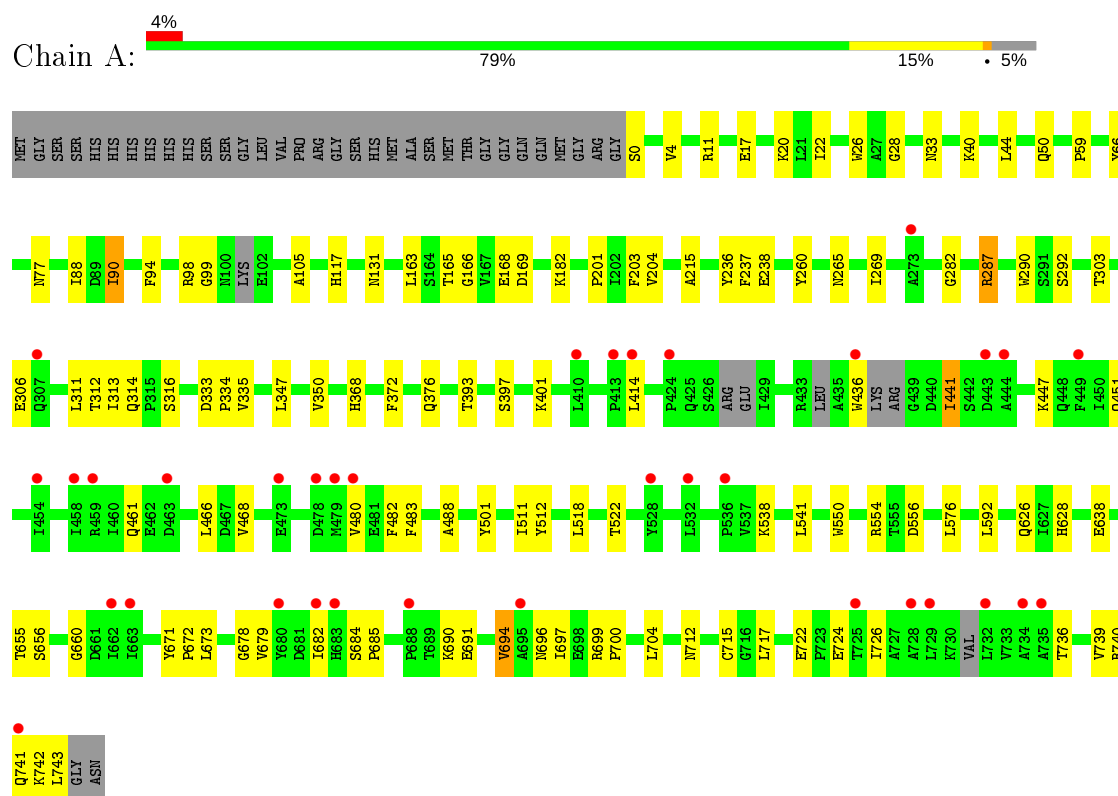
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	493	Total 493	O 493	0	0

### 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: 5-methyltetrahydropteroyltriglutamate--homocysteine methyltransferase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	52.84Å 99.48Å 77.88Å 90.00° 94.55° 90.00°	Depositor
Resolution (Å)	42.07 – 2.19 52.68 – 2.19	Depositor EDS
% Data completeness (in resolution range)	47.8 (42.07-2.19) 94.1 (52.68-2.19)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.52 (at 2.18Å)	Xtriage
Refinement program	PHENIX (phenix.refine)	Depositor
R, $R_{free}$	0.209 , 0.256 0.203 , 0.252	Depositor DCC
$R_{free}$ test set	1948 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.8	Xtriage
Anisotropy	0.795	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 51.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.52$ , $\langle L^2 \rangle = 0.36$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	6108	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.84% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 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	0.24	0/5719	0.41	0/7800

There are no bond length outliers.

There are no bond angle outliers.

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	5599	0	5298	68	0
2	A	15	0	0	0	0
3	A	1	0	0	0	0
4	A	493	0	0	3	0
All	All	6108	0	5298	68	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 6.

All (68) 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:656:SER:HA	1:A:696:ASN:HD21	1.33	0.91
1:A:656:SER:HA	1:A:696:ASN:ND2	2.08	0.69
1:A:17:GLU:HA	1:A:20:LYS:HE3	1.75	0.69
1:A:488:ALA:HB2	1:A:518:LEU:HD11	1.80	0.63
1:A:671:TYR:CE2	1:A:673:LEU:HB2	2.33	0.63
1:A:203:PHE:CZ	1:A:215:ALA:HB2	2.36	0.60
1:A:393:THR:HG22	1:A:393:THR:O	2.02	0.60
1:A:511:ILE:O	1:A:554:ARG:HG3	2.01	0.60
1:A:690:LYS:O	1:A:694:VAL:HG12	2.02	0.60
1:A:313:ILE:HG22	1:A:350:VAL:HG23	1.84	0.60
1:A:655:THR:HB	1:A:660:GLY:HA2	1.84	0.59
1:A:333:ASP:OD1	1:A:334:PRO:HD2	2.03	0.58
1:A:672:PRO:HD2	1:A:673:LEU:HD12	1.86	0.57
1:A:90:ILE:HD11	1:A:94:PHE:CE2	2.40	0.56
1:A:236:TYR:O	1:A:237:PHE:HB2	2.05	0.56
1:A:685:PRO:HA	1:A:724:GLU:OE1	2.07	0.55
1:A:414:LEU:O	1:A:740:ARG:HD3	2.07	0.55
1:A:461:GLN:HG2	1:A:466:LEU:HD12	1.88	0.54
1:A:22:ILE:HG22	1:A:26:TRP:CE2	2.43	0.53
1:A:117:HIS:HB2	1:A:501:TYR:HB3	1.91	0.53
1:A:699:ARG:HB3	1:A:700:PRO:HD3	1.90	0.52
1:A:697:ILE:O	1:A:700:PRO:HD2	2.09	0.52
1:A:447:LYS:O	1:A:451:GLN:HG3	2.11	0.51
1:A:682:ILE:HG12	1:A:715:CYS:HB3	1.92	0.51
1:A:201:PRO:O	1:A:204:VAL:HG22	2.11	0.51
1:A:290:TRP:HH2	1:A:512:TYR:HA	1.76	0.50
1:A:292:SER:O	1:A:368:HIS:HE1	1.94	0.50
1:A:0:SER:HB3	4:A:1040:HOH:O	2.12	0.49
1:A:260:TYR:OH	1:A:287:ARG:HG3	2.12	0.49
1:A:265:ASN:O	1:A:269:ILE:HG23	2.11	0.49
1:A:311:LEU:HD23	1:A:312:THR:N	2.28	0.49
1:A:77:ASN:ND2	1:A:131:ASN:HD21	2.11	0.49
1:A:372:PHE:O	1:A:376:GLN:HG2	2.13	0.48
1:A:168:GLU:HG3	1:A:169:ASP:N	2.29	0.48
1:A:28:GLY:HA2	4:A:1122:HOH:O	2.13	0.47
1:A:303:THR:O	1:A:306:GLU:HG2	2.13	0.47
1:A:98:ARG:C	1:A:105:ALA:HB2	2.35	0.47
1:A:554:ARG:HB3	1:A:556:ASP:OD1	2.15	0.47
1:A:736:THR:O	1:A:740:ARG:HG3	2.15	0.47
1:A:436:TRP:HA	1:A:441:ILE:N	2.30	0.46
1:A:480:VAL:HG21	1:A:550:TRP:HB2	1.96	0.46
1:A:741:GLN:C	1:A:743:LEU:H	2.18	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:468:VAL:CG1	1:A:538:LYS:HG3	2.46	0.46
1:A:290:TRP:CH2	1:A:512:TYR:HA	2.51	0.46
1:A:50:GLN:HE22	1:A:59:PRO:HG2	1.81	0.45
1:A:694:VAL:HG23	1:A:739:VAL:CG1	2.47	0.45
1:A:724:GLU:HG2	4:A:1078:HOH:O	2.16	0.45
1:A:314:GLN:HA	1:A:350:VAL:HG21	1.99	0.45
1:A:483:PHE:CZ	1:A:541:LEU:HA	2.52	0.45
1:A:626:GLN:HG2	1:A:628:HIS:CD2	2.51	0.45
1:A:691:GLU:HA	1:A:694:VAL:CG1	2.47	0.44
1:A:482:PHE:HE2	1:A:522:THR:HG22	1.82	0.44
1:A:282:GLY:HA3	1:A:316:SER:HA	1.99	0.44
1:A:684:SER:HA	1:A:685:PRO:HD3	1.84	0.43
1:A:722:GLU:O	1:A:726:ILE:HG12	2.18	0.43
1:A:347:LEU:O	1:A:350:VAL:HG12	2.17	0.43
1:A:236:TYR:O	1:A:237:PHE:CB	2.66	0.43
1:A:679:VAL:HG11	1:A:697:ILE:HG12	2.00	0.43
1:A:22:ILE:HG22	1:A:26:TRP:CZ2	2.54	0.43
1:A:397:SER:HB3	1:A:401:LYS:HB3	2.00	0.42
1:A:673:LEU:HD12	1:A:673:LEU:N	2.34	0.42
1:A:678:GLY:HA2	1:A:712:ASN:O	2.18	0.42
1:A:671:TYR:HA	1:A:672:PRO:HD3	1.72	0.42
1:A:99:GLY:N	1:A:105:ALA:HB2	2.35	0.41
1:A:333:ASP:OD2	1:A:335:VAL:HG12	2.20	0.41
1:A:88:ILE:N	1:A:88:ILE:HD12	2.35	0.41
1:A:40:LYS:O	1:A:44:LEU:HG	2.21	0.40
1:A:165:THR:HG22	1:A:166:GLY:N	2.37	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	725/779 (93%)	705 (97%)	17 (2%)	3 (0%)	34 35

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	66	TYR
1	A	742	LYS
1	A	441	ILE

### 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	556/668 (83%)	542 (98%)	14 (2%)	47 57

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	VAL
1	A	11	ARG
1	A	33	ASN
1	A	90	ILE
1	A	163	LEU
1	A	182	LYS
1	A	238	GLU
1	A	287	ARG
1	A	576	LEU
1	A	592	LEU
1	A	638	GLU
1	A	694	VAL
1	A	704	LEU
1	A	717	LEU

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

Mol	Chain	Res	Type
1	A	33	ASN
1	A	50	GLN
1	A	77	ASN
1	A	248	GLN
1	A	368	HIS
1	A	530	GLN
1	A	696	ASN
1	A	712	ASN
1	A	721	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 carbohydrates in this entry.

### 5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 1 is 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	SO4	A	746	-	4,4,4	0.16	0	6,6,6	0.05	0
2	SO4	A	747	-	4,4,4	0.15	0	6,6,6	0.11	0
2	SO4	A	748	-	4,4,4	0.13	0	6,6,6	0.11	0

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

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<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	737/779 (94%)	0.38	35 (4%) 31 32	13, 23, 45, 65	0

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	680	TYR	5.3
1	A	443	ASP	4.7
1	A	729	LEU	4.6
1	A	663	ILE	4.3
1	A	424	PRO	4.1
1	A	734	ALA	3.8
1	A	662	ILE	3.7
1	A	688	PRO	3.6
1	A	444	ALA	3.6
1	A	732	LEU	3.0
1	A	273	ALA	3.0
1	A	458	ILE	2.9
1	A	728	ALA	2.7
1	A	725	THR	2.6
1	A	436	TRP	2.5
1	A	414	LEU	2.5
1	A	536	PRO	2.4
1	A	695	ALA	2.4
1	A	449	PHE	2.3
1	A	480	VAL	2.3
1	A	473	GLU	2.3
1	A	741	GLN	2.3
1	A	532	LEU	2.2
1	A	683	HIS	2.2
1	A	410	LEU	2.1
1	A	459	ARG	2.1
1	A	735	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	478	ASP	2.1
1	A	413	PRO	2.1
1	A	528	TYR	2.1
1	A	307	GLN	2.1
1	A	454	ILE	2.0
1	A	479	MET	2.0
1	A	682	ILE	2.0
1	A	463	ASP	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 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
2	SO4	A	747	5/5	0.89	0.21	26,36,50,52	0
2	SO4	A	748	5/5	0.90	0.14	20,28,35,38	1
2	SO4	A	746	5/5	0.93	0.15	39,43,47,47	0
3	ZN	A	749	1/1	0.99	0.07	39,39,39,39	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.