



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 18, 2026 – 01:21 PM UTC

PDB ID : 2X3A / pdb_00002x3a
Title : AsaP1 inactive mutant E294Q, an extracellular toxic zinc metalloendopeptidase
Authors : Bogdanovic, X.; Palm, G.J.; Singh, R.K.; Hinrichs, W.
Deposited on : 2010-01-22
Resolution : 2.00 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

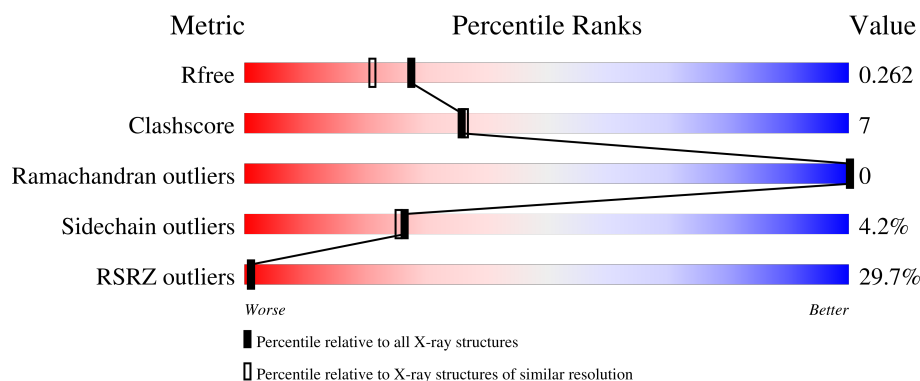
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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}	180053	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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 $\leq 5\%$. 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	343	25% 72% 11% • 15%

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 2523 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 TOXIC EXTRACELLULAR ENDOPEPTIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	293	Total	C	N	O	S	0	4	0
			2284	1429	392	458	5			

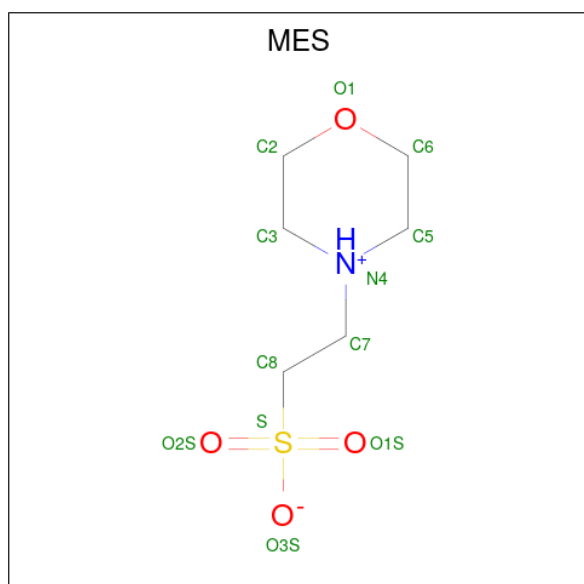
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	294	GLN	GLU	engineered mutation	UNP Q8GMV9

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

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

- Molecule 3 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: C₆H₁₃NO₄S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		

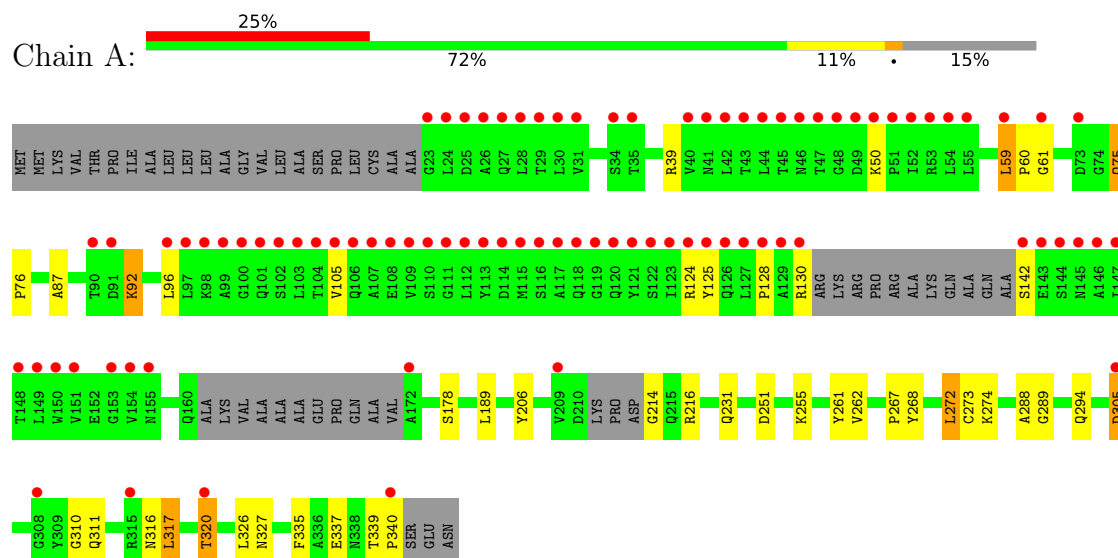
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	199	Total	O	0	0
			199	199		

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: TOXIC EXTRACELLULAR ENDOPEPTIDASE



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	98.25Å 74.47Å 54.70Å 90.00° 112.35° 90.00°	Depositor
Resolution (Å)	57.60 – 2.00 57.60 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.3 (57.60-2.00) 99.7 (57.60-2.00)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.46 (at 2.00Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.170 , 0.205 0.250 , 0.262	Depositor DCC
R_{free} test set	1258 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	26.2	Xtriage
Anisotropy	0.087	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 40.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	2523	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.42% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: SO4, MES, ZN, GOL

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	1.26	2/2333 (0.1%)	1.15	5/3171 (0.2%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	305	ASP	N-CA	-5.24	1.39	1.45
1	A	273	CYS	N-CA	-5.13	1.38	1.46

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	59	LEU	N-CA-C	-6.67	101.11	110.31
1	A	288	ALA	N-CA-C	-5.50	105.19	111.07
1	A	310	GLY	N-CA-C	5.42	118.36	112.29
1	A	75	GLN	CA-C-N	5.07	125.07	119.90
1	A	75	GLN	C-N-CA	5.07	125.07	119.90

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	2284	0	2172	31	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	1	0	0	0	0
3	A	12	0	13	1	0
4	A	15	0	0	0	0
5	A	12	0	16	3	0
6	A	199	0	0	5	0
All	All	2523	0	2201	33	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 7.

All (33) 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:305:ASP:OD1	6:A:2172:HOH:O	1.82	0.95
1:A:316:ASN:O	1:A:320:THR:HB	1.76	0.85
1:A:125:TYR:OH	1:A:128:PRO:HD3	1.84	0.78
1:A:124:ARG:HH22	5:A:1346:GOL:H12	1.56	0.71
1:A:231:GLN:HG2	1:A:326:LEU:HD21	1.73	0.69
1:A:261:TYR:CA	1:A:294:GLN:HE22	2.08	0.67
1:A:87:ALA:HB3	6:A:2046:HOH:O	1.97	0.65
1:A:189:LEU:HD21	1:A:272:LEU:HD13	1.80	0.62
1:A:261:TYR:C	1:A:294:GLN:HE22	2.09	0.60
1:A:261:TYR:HA	1:A:294:GLN:HE22	1.67	0.60
1:A:214:GLY:N	6:A:2113:HOH:O	2.35	0.59
5:A:1347:GOL:HO1	5:A:1347:GOL:HO3	1.53	0.56
1:A:92:LYS:H	1:A:92:LYS:CE	2.20	0.54
1:A:92:LYS:H	1:A:92:LYS:HE2	1.73	0.54
1:A:261:TYR:C	1:A:294:GLN:NE2	2.66	0.52
1:A:305:ASP:OD2	1:A:327[B]:ASN:ND2	2.43	0.52
1:A:255:LYS:O	1:A:274:LYS:HE2	2.11	0.51
3:A:1342:MES:O1S	6:A:2196:HOH:O	2.19	0.50
1:A:50:LYS:NZ	6:A:2021:HOH:O	2.39	0.50
1:A:61:GLY:O	5:A:1347:GOL:H12	2.12	0.49
1:A:262:VAL:HG13	1:A:294:GLN:NE2	2.30	0.46
1:A:125:TYR:CZ	1:A:128:PRO:HD3	2.51	0.46
1:A:216:ARG:HG2	1:A:335:PHE:CE1	2.52	0.44
1:A:261:TYR:CA	1:A:294:GLN:NE2	2.78	0.43
1:A:75:GLN:HA	1:A:76:PRO:HD3	1.94	0.42
1:A:289:GLY:HA3	1:A:337:GLU:OE2	2.19	0.42
1:A:339:THR:HA	1:A:340:PRO:HA	1.82	0.42
1:A:206:TYR:CD2	1:A:206:TYR:C	2.97	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:178:SER:O	1:A:251:ASP:HA	2.20	0.41
1:A:317:LEU:HD12	1:A:317:LEU:HA	1.87	0.41
1:A:267:PRO:HA	1:A:268:TYR:HA	1.77	0.41
1:A:60:PRO:HD2	1:A:105:VAL:HG11	2.03	0.40
1:A:231:GLN:HG2	1:A:326:LEU:CD2	2.48	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	289/343 (84%)	279 (96%)	10 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	244/279 (88%)	234 (96%)	10 (4%)	27	26

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	39	ARG

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Mol	Chain	Res	Type
1	A	59	LEU
1	A	92	LYS
1	A	96	LEU
1	A	130	ARG
1	A	142	SER
1	A	272	LEU
1	A	311	GLN
1	A	317	LEU
1	A	320	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	41	ASN
1	A	106	GLN
1	A	245	ASN
1	A	294	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 7 ligands modelled in this entry, 1 is monoatomic - leaving 6 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	SO4	A	1343	-	4,4,4	0.25	0	6,6,6	0.48	0
5	GOL	A	1346	-	5,5,5	0.53	0	5,5,5	0.27	0
5	GOL	A	1347	-	5,5,5	0.69	0	5,5,5	1.16	0
4	SO4	A	1344	-	4,4,4	0.76	0	6,6,6	0.99	0
3	MES	A	1342	-	12,12,12	1.60	1 (8%)	15,16,16	2.38	4 (26%)
4	SO4	A	1345	-	4,4,4	0.21	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
3	MES	A	1342	-	-	0/6/14/14	0/1/1/1
5	GOL	A	1346	-	-	2/4/4/4	-
5	GOL	A	1347	-	-	4/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1342	MES	C8-S	-4.90	1.70	1.77

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1342	MES	C2-C3-N4	-5.30	102.06	110.12
3	A	1342	MES	O3S-S-C8	4.72	115.24	106.00
3	A	1342	MES	C7-N4-C3	-3.51	101.87	111.24
3	A	1342	MES	O1S-S-C8	-3.50	101.43	106.73

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	1346	GOL	O1-C1-C2-C3
5	A	1347	GOL	O1-C1-C2-O2
5	A	1347	GOL	O1-C1-C2-C3
5	A	1347	GOL	C1-C2-C3-O3

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Mol	Chain	Res	Type	Atoms
5	A	1346	GOL	O1-C1-C2-O2
5	A	1347	GOL	O2-C2-C3-O3

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	1346	GOL	1	0
5	A	1347	GOL	2	0
3	A	1342	MES	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, 95th 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	293/343 (85%)	1.30	87 (29%) 1 1	11, 35, 108, 144	4 (1%)

All (87) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	145	ASN	6.8
1	A	144	SER	6.7
1	A	147	ILE	6.5
1	A	123	ILE	6.3
1	A	142	SER	6.2
1	A	105	VAL	6.2
1	A	104	THR	6.1
1	A	148	THR	6.1
1	A	129	ALA	6.0
1	A	23	GLY	6.0
1	A	51	PRO	5.9
1	A	124	ARG	5.9
1	A	146	ALA	5.8
1	A	128	PRO	5.6
1	A	125	TYR	5.6
1	A	122	SER	5.4
1	A	130	ARG	5.4
1	A	109	VAL	5.4
1	A	117	ALA	5.3
1	A	149	LEU	5.3
1	A	48	GLY	4.9
1	A	127	LEU	4.9
1	A	24	LEU	4.6
1	A	47	THR	4.5
1	A	153	GLY	4.5
1	A	34	SER	4.5
1	A	45	THR	4.5

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Mol	Chain	Res	Type	RSRZ
1	A	49	ASP	4.4
1	A	111	GLY	4.3
1	A	120	GLN	4.3
1	A	112	LEU	4.2
1	A	154	VAL	4.2
1	A	143	GLU	4.2
1	A	44	LEU	4.1
1	A	121	TYR	4.0
1	A	150	TRP	4.0
1	A	52	ILE	3.9
1	A	118	GLN	3.9
1	A	99	ALA	3.9
1	A	50	LYS	3.9
1	A	46	ASN	3.8
1	A	151	VAL	3.8
1	A	106	GLN	3.7
1	A	96	LEU	3.7
1	A	126	GLN	3.6
1	A	119	GLY	3.6
1	A	107	ALA	3.5
1	A	54	LEU	3.5
1	A	28	LEU	3.4
1	A	113[A]	TYR	3.4
1	A	101	GLN	3.4
1	A	115	MET	3.2
1	A	98	LYS	3.2
1	A	31	VAL	3.1
1	A	114	ASP	3.1
1	A	53	ARG	3.1
1	A	103	LEU	3.1
1	A	27	GLN	3.1
1	A	116	SER	3.1
1	A	55	LEU	3.0
1	A	26	ALA	3.0
1	A	209	VAL	2.9
1	A	29	THR	2.9
1	A	91	ASP	2.9
1	A	42	LEU	2.8
1	A	97	LEU	2.8
1	A	43	THR	2.8
1	A	172	ALA	2.8
1	A	30	LEU	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	320	THR	2.8
1	A	35	THR	2.7
1	A	340	PRO	2.7
1	A	110	SER	2.7
1	A	25	ASP	2.7
1	A	41	ASN	2.6
1	A	61	GLY	2.5
1	A	90	THR	2.5
1	A	305	ASP	2.5
1	A	102	SER	2.5
1	A	59	LEU	2.5
1	A	40	VAL	2.4
1	A	100	GLY	2.4
1	A	155	ASN	2.3
1	A	308	GLY	2.3
1	A	108	GLU	2.1
1	A	315	ARG	2.1
1	A	73	ASP	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 oligosaccharides 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, 95th 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	SO4	A	1344	5/5	0.76	0.17	39,42,49,51	5
5	GOL	A	1346	6/6	0.76	0.12	46,56,58,60	0
4	SO4	A	1345	5/5	0.81	0.15	59,59,61,61	5
5	GOL	A	1347	6/6	0.88	0.12	34,41,44,46	0
4	SO4	A	1343	5/5	0.95	0.08	60,61,62,62	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	MES	A	1342	12/12	0.96	0.07	19,24,34,35	0
2	ZN	A	1341	1/1	0.96	0.08	37,37,37,37	1

6.5 Other polymers [i](#)

There are no such residues in this entry.