



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 14, 2022 – 09:24 pm GMT

PDB ID : 7QNO
Title : Crystal structure of ligand-free Danio rerio HDAC6 CD1 CD2
Authors : Kempf, G.; Langousis, G.; Sanchez, J.; Matthias, P.
Deposited on : 2021-12-21
Resolution : 2.38 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
Mogul : 1.8.4, CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.31.2
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0267
CCP4 : 7.1.010 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.2

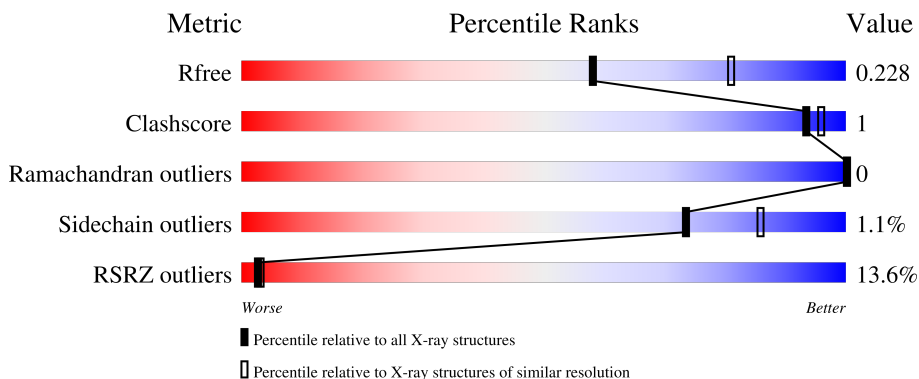
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.38 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	5509 (2.40-2.36)
Clashscore	141614	6082 (2.40-2.36)
Ramachandran outliers	138981	5973 (2.40-2.36)
Sidechain outliers	138945	5975 (2.40-2.36)
RSRZ outliers	127900	5397 (2.40-2.36)

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	837	

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 11771 atoms, of which 5818 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 Histone deacetylase 6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	755	11651	3718	5763	1029	1102	39	5851	8	0

There are 45 discrepancies between the modelled and reference sequences:

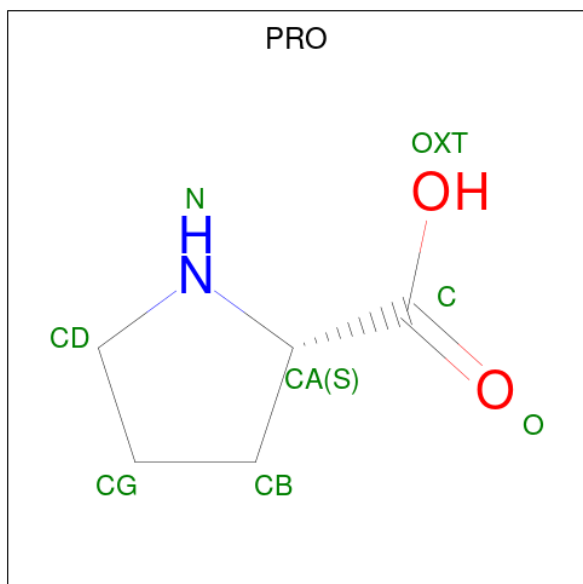
Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	MET	-	initiating methionine	UNP F8W4B7
A	-4	ASP	-	expression tag	UNP F8W4B7
A	-3	SER	-	expression tag	UNP F8W4B7
A	-2	ALA	-	expression tag	UNP F8W4B7
A	-1	TRP	-	expression tag	UNP F8W4B7
A	0	SER	-	expression tag	UNP F8W4B7
A	1	HIS	-	expression tag	UNP F8W4B7
A	2	PRO	-	expression tag	UNP F8W4B7
A	3	GLN	-	expression tag	UNP F8W4B7
A	4	PHE	-	expression tag	UNP F8W4B7
A	5	GLU	-	expression tag	UNP F8W4B7
A	6	LYS	-	expression tag	UNP F8W4B7
A	7	GLY	-	expression tag	UNP F8W4B7
A	8	GLY	-	expression tag	UNP F8W4B7
A	9	GLY	-	expression tag	UNP F8W4B7
A	10	SER	-	expression tag	UNP F8W4B7
A	11	GLY	-	expression tag	UNP F8W4B7
A	12	GLY	-	expression tag	UNP F8W4B7
A	13	GLY	-	expression tag	UNP F8W4B7
A	14	SER	-	expression tag	UNP F8W4B7
A	15	GLY	-	expression tag	UNP F8W4B7
A	16	GLY	-	expression tag	UNP F8W4B7
A	17	SER	-	expression tag	UNP F8W4B7
A	18	ALA	-	expression tag	UNP F8W4B7
A	19	TRP	-	expression tag	UNP F8W4B7
A	20	SER	-	expression tag	UNP F8W4B7
A	21	HIS	-	expression tag	UNP F8W4B7

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Chain	Residue	Modelled	Actual	Comment	Reference
A	22	PRO	-	expression tag	UNP F8W4B7
A	23	GLN	-	expression tag	UNP F8W4B7
A	24	PHE	-	expression tag	UNP F8W4B7
A	25	GLU	-	expression tag	UNP F8W4B7
A	26	LYS	-	expression tag	UNP F8W4B7
A	27	SER	-	expression tag	UNP F8W4B7
A	28	ALA	-	expression tag	UNP F8W4B7
A	29	VAL	-	expression tag	UNP F8W4B7
A	30	ASP	-	expression tag	UNP F8W4B7
A	31	LEU	-	expression tag	UNP F8W4B7
A	32	GLU	-	expression tag	UNP F8W4B7
A	33	VAL	-	expression tag	UNP F8W4B7
A	34	LEU	-	expression tag	UNP F8W4B7
A	35	PHE	-	expression tag	UNP F8W4B7
A	36	GLN	-	expression tag	UNP F8W4B7
A	37	GLY	-	expression tag	UNP F8W4B7
A	38	PRO	-	expression tag	UNP F8W4B7
A	39	GLY	-	expression tag	UNP F8W4B7

- Molecule 2 is PROLINE (three-letter code: PRO) (formula: C₅H₉NO₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	H	N			O
2	A	1	14	5	7	1	1	7	0

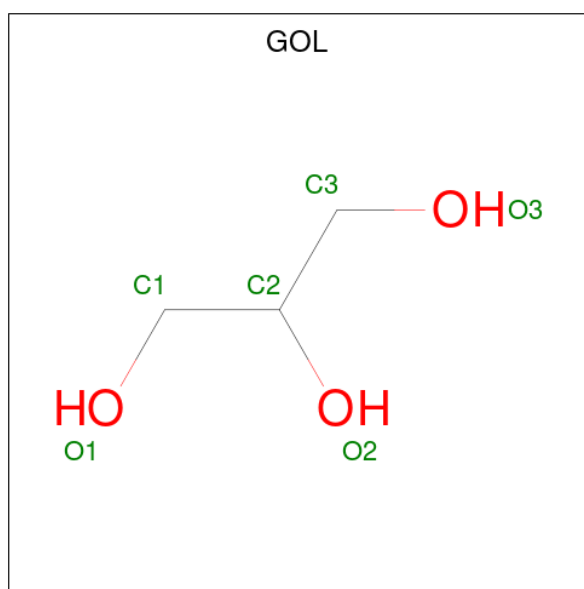
- Molecule 3 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	4	Total K 4 4	0	0

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C H O 14 3 8 3	8	0
5	A	1	Total C H O 14 3 8 3	8	0
5	A	1	Total C H O 14 3 8 3	8	0
5	A	1	Total C H O 14 3 8 3	8	0
5	A	1	Total C H O 14 3 8 3	8	0
5	A	1	Total C H O 14 3 8 3	8	0

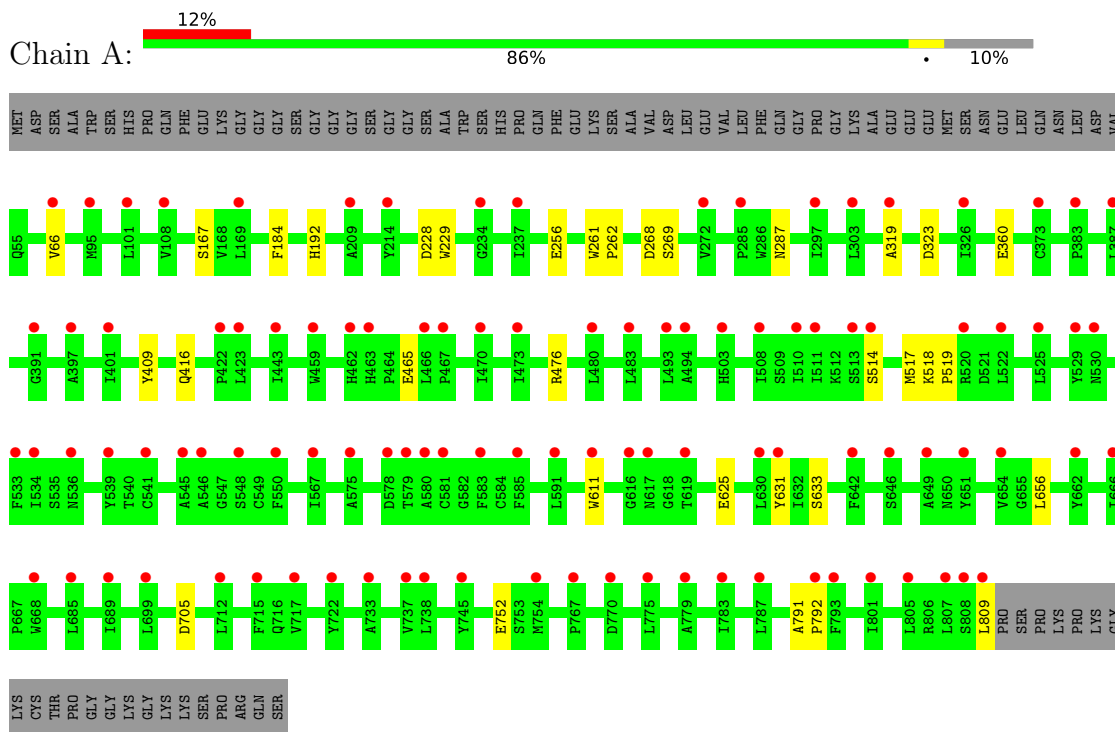
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	17	Total	O	0	0
			17	17		

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: Histone deacetylase 6



4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α , β , γ	186.13Å 186.13Å 102.44Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	63.34 – 2.38 161.20 – 2.38	Depositor EDS
% Data completeness (in resolution range)	53.6 (63.34-2.38) 53.6 (161.20-2.38)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.38 (at 2.37Å)	Xtrriage
Refinement program	PHENIX (1.19.1_4122: ???), ISOLDE	Depositor
R, R_{free}	0.212 , 0.228 0.212 , 0.228	Depositor DCC
R_{free} test set	2217 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	56.6	Xtrriage
Anisotropy	0.100	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	(Not available) , (Not available)	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.032 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	11771	wwPDB-VP
Average B, all atoms (Å ²)	82.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.18% 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: GOL, ZN, K

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	0.29	0/6059	0.52	0/8222

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 [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	5888	5763	5734	16	0
2	A	7	7	7	2	0
3	A	4	0	0	0	0
4	A	1	0	0	0	0
5	A	36	48	48	0	0
6	A	17	0	0	0	0
All	All	5953	5818	5789	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 1.

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:476:ARG:NE	1:A:752:GLU:OE2	2.43	0.52
1:A:268:ASP:OD1	1:A:269:SER:N	2.44	0.51
1:A:791:ALA:N	1:A:792:PRO:HD2	2.26	0.51
1:A:319:ALA:HB1	1:A:360:GLU:HG3	1.94	0.49
1:A:66:VAL:HG11	1:A:167:SER:HB2	1.94	0.48
1:A:625:GLU:HA	1:A:656:LEU:O	2.14	0.47
1:A:809:LEU:C	2:A:901:PRO:N	2.69	0.45
1:A:409:TYR:CE1	1:A:416:GLN:HA	2.51	0.45
1:A:809:LEU:C	1:A:809:LEU:HD12	2.37	0.45
1:A:631:TYR:CZ	1:A:633:SER:HB2	2.53	0.44
1:A:809:LEU:HA	2:A:901:PRO:HD2	1.98	0.44
1:A:228:ASP:HA	1:A:319:ALA:HB3	1.99	0.44
1:A:514:SER:HA	1:A:517:MET:HB2	2.00	0.44
1:A:256:GLU:HA	1:A:287:ASN:HA	2.00	0.42
1:A:518:LYS:HB3	1:A:519:PRO:HD2	2.01	0.42
1:A:261:TRP:CG	1:A:262:PRO:HA	2.56	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	761/837 (91%)	733 (96%)	28 (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	645/703 (92%)	638 (99%)	7 (1%)	73 86

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

Mol	Chain	Res	Type
1	A	184	PHE
1	A	192	HIS
1	A	229	TRP
1	A	323	ASP
1	A	465	GLU
1	A	611	TRP
1	A	705	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 12 ligands modelled in this entry, 5 are monoatomic - leaving 7 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
5	GOL	A	909	-	5,5,5	0.79	0	5,5,5	0.85	0
5	GOL	A	907	-	5,5,5	0.70	0	5,5,5	0.84	0
5	GOL	A	908	-	5,5,5	0.88	0	5,5,5	0.95	0
5	GOL	A	911	-	5,5,5	0.81	0	5,5,5	0.98	0
5	GOL	A	910	-	5,5,5	0.80	0	5,5,5	0.96	0
2	PRO	A	901	-	5,7,8	0.48	0	7,8,10	1.35	1 (14%)
5	GOL	A	912	-	5,5,5	0.89	0	5,5,5	1.01	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
5	GOL	A	909	-	-	0/4/4/4	-
5	GOL	A	907	-	-	0/4/4/4	-
5	GOL	A	908	-	-	2/4/4/4	-
5	GOL	A	911	-	-	0/4/4/4	-
5	GOL	A	910	-	-	2/4/4/4	-
2	PRO	A	901	-	-	0/0/9/11	0/1/1/1
5	GOL	A	912	-	-	2/4/4/4	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	901	PRO	O-C-CA	-2.41	118.45	124.78

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	908	GOL	C1-C2-C3-O3
5	A	912	GOL	C1-C2-C3-O3
5	A	910	GOL	O1-C1-C2-C3
5	A	908	GOL	O2-C2-C3-O3
5	A	912	GOL	O2-C2-C3-O3
5	A	910	GOL	O1-C1-C2-O2

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	901	PRO	2	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	755/837 (90%)	1.21	103 (13%) 3 3	36, 72, 109, 146	20 (2%)

All (103) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	579	THR	5.2
1	A	546	ALA	4.9
1	A	459	TRP	4.3
1	A	466	LEU	4.1
1	A	585	PHE	4.0
1	A	642	PHE	3.9
1	A	511	ILE	3.9
1	A	783	ILE	3.9
1	A	712	LEU	3.8
1	A	807	LEU	3.8
1	A	808	SER	3.6
1	A	616	GLY	3.6
1	A	649	ALA	3.5
1	A	801	ILE	3.4
1	A	534	ILE	3.4
1	A	617	ASN	3.3
1	A	619	THR	3.3
1	A	513	SER	3.2
1	A	578	ASP	3.2
1	A	423	LEU	3.2
1	A	462	HIS	3.1
1	A	463	HIS	3.1
1	A	685	LEU	3.0
1	A	809	LEU	3.0
1	A	508	ILE	3.0
1	A	793	PHE	3.0
1	A	503	HIS	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	666	ILE	2.8
1	A	651	TYR	2.8
1	A	722	TYR	2.8
1	A	525	LEU	2.8
1	A	575	ALA	2.8
1	A	539	TYR	2.7
1	A	717	VAL	2.7
1	A	545	ALA	2.7
1	A	787	LEU	2.7
1	A	611	TRP	2.7
1	A	443	ILE	2.7
1	A	754	MET	2.7
1	A	689	ILE	2.6
1	A	654	VAL	2.6
1	A	581	CYS	2.6
1	A	715	PHE	2.5
1	A	520	ARG	2.5
1	A	470	ILE	2.5
1	A	530	ASN	2.5
1	A	483	LEU	2.5
1	A	580	ALA	2.5
1	A	631	TYR	2.5
1	A	779	ALA	2.4
1	A	95	MET	2.4
1	A	326	ILE	2.4
1	A	646	SER	2.4
1	A	473	ILE	2.4
1	A	591	LEU	2.4
1	A	805	LEU	2.4
1	A	467	PRO	2.4
1	A	272	VAL	2.4
1	A	319	ALA	2.4
1	A	533	PHE	2.4
1	A	303	LEU	2.3
1	A	480	LEU	2.3
1	A	494	ALA	2.3
1	A	493	LEU	2.3
1	A	775	LEU	2.3
1	A	373	CYS	2.3
1	A	541	CYS	2.3
1	A	108	VAL	2.3
1	A	536	ASN	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	548	SER	2.3
1	A	630	LEU	2.2
1	A	738	LEU	2.2
1	A	770	ASP	2.2
1	A	66	VAL	2.2
1	A	514	SER	2.2
1	A	297	ILE	2.2
1	A	510	ILE	2.2
1	A	397	ALA	2.2
1	A	214	TYR	2.2
1	A	422	PRO	2.2
1	A	522	LEU	2.2
1	A	391[A]	GLY	2.2
1	A	550	PHE	2.2
1	A	733	ALA	2.2
1	A	567	ILE	2.2
1	A	699	LEU	2.2
1	A	737	VAL	2.1
1	A	387	LEU	2.1
1	A	792	PRO	2.1
1	A	209	ALA	2.1
1	A	529	TYR	2.1
1	A	662	TYR	2.1
1	A	285	PRO	2.1
1	A	383	PRO	2.1
1	A	668	TRP	2.1
1	A	745	TYR	2.1
1	A	101	LEU	2.0
1	A	237	ILE	2.0
1	A	767	PRO	2.0
1	A	583	PHE	2.0
1	A	169	LEU	2.0
1	A	401	ILE	2.0
1	A	234	GLY	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, 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(Å ²)	Q<0.9
4	ZN	A	904	1/1	0.58	0.14	99,99,99,99	0
5	GOL	A	907	6/6	0.69	0.34	70,86,97,98	8
5	GOL	A	910	6/6	0.69	0.15	73,89,96,101	8
5	GOL	A	909	6/6	0.81	0.26	54,67,87,87	8
3	K	A	906	1/1	0.82	0.08	81,81,81,81	0
3	K	A	905	1/1	0.83	0.13	95,95,95,95	0
3	K	A	902	1/1	0.85	0.12	60,60,60,60	0
2	PRO	A	901	7/8	0.87	0.18	116,130,142,158	7
5	GOL	A	912	6/6	0.87	0.28	67,82,91,92	8
5	GOL	A	908	6/6	0.89	0.23	74,90,105,105	8
5	GOL	A	911	6/6	0.92	0.36	58,71,78,80	14
3	K	A	903	1/1	0.98	0.17	72,72,72,72	0

6.5 Other polymers [i](#)

There are no such residues in this entry.