



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 13, 2026 – 11:31 PM UTC

PDB ID : 5K7J / pdb_00005k7j
Title : Structure of designed zinc binding protein ZE2 bound to Zn²⁺
Authors : Guffy, S.L.; Der, B.S.; Kuhlman, B.
Deposited on : 2016-05-26
Resolution : 1.39 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
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

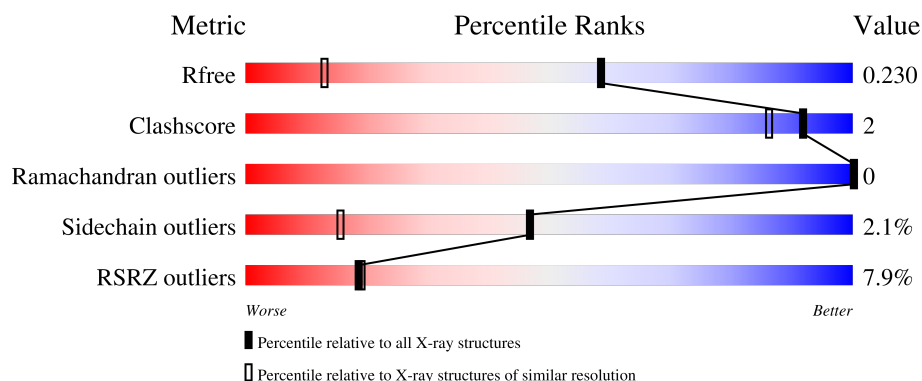
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.39 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	2563 (1.40-1.40)
Clashscore	190562	2660 (1.40-1.40)
Ramachandran outliers	187476	2611 (1.40-1.40)
Sidechain outliers	187428	2610 (1.40-1.40)
RSRZ outliers	180081	2561 (1.40-1.40)

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	249	6% 88% 8% ••
1	B	249	9% 84% 13% •

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4045 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 Indole-3-glycerol phosphate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	240	Total	C	N	O	S	0	7	0
			1956	1248	342	360	6			
1	B	243	Total	C	N	O	S	0	2	0
			1956	1248	340	362	6			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP Q06121
A	0	SER	-	expression tag	UNP Q06121
A	109	ALA	LYS	engineered mutation	UNP Q06121
A	158	GLY	GLU	engineered mutation	UNP Q06121
A	179	HIS	ASN	engineered mutation	UNP Q06121
A	181	ALA	ARG	engineered mutation	UNP Q06121
A	183	HIS	LEU	engineered mutation	UNP Q06121
A	209	ALA	GLU	engineered mutation	UNP Q06121
A	210	HIS	SER	engineered mutation	UNP Q06121
B	-1	GLY	-	expression tag	UNP Q06121
B	0	SER	-	expression tag	UNP Q06121
B	109	ALA	LYS	engineered mutation	UNP Q06121
B	158	GLY	GLU	engineered mutation	UNP Q06121
B	179	HIS	ASN	engineered mutation	UNP Q06121
B	181	ALA	ARG	engineered mutation	UNP Q06121
B	183	HIS	LEU	engineered mutation	UNP Q06121
B	209	ALA	GLU	engineered mutation	UNP Q06121
B	210	HIS	SER	engineered mutation	UNP Q06121

- 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		

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

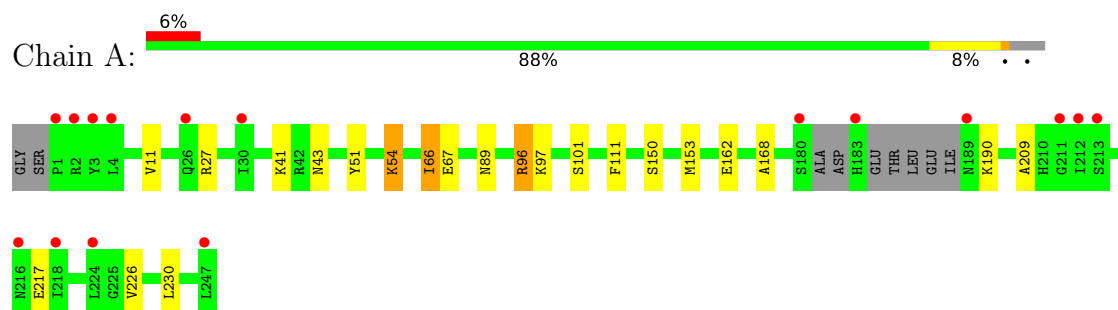
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	63	Total 63	O 63	0	0
3	B	68	Total 68	O 68	0	0

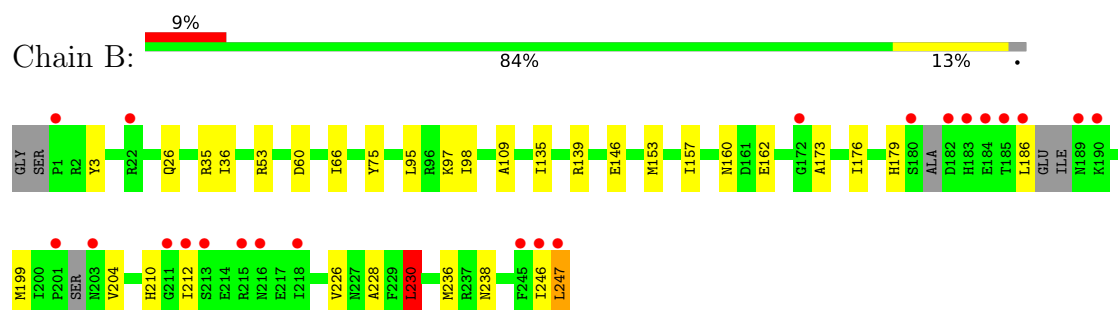
3 Residue-property plots [i](#)

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: Indole-3-glycerol phosphate synthase



- Molecule 1: Indole-3-glycerol phosphate synthase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	41.72Å 79.03Å 74.08Å 90.00° 95.70° 90.00°	Depositor
Resolution (Å)	28.62 – 1.39 28.62 – 1.39	Depositor EDS
% Data completeness (in resolution range)	94.3 (28.62-1.39) 94.6 (28.62-1.39)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.45 (at 1.39Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.196 , 0.230 0.196 , 0.230	Depositor DCC
R_{free} test set	4579 reflections (4.75%)	wwPDB-VP
Wilson B-factor (Å ²)	15.6	Xtriage
Anisotropy	0.033	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 25.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4045	wwPDB-VP
Average B, all atoms (Å ²)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.28% 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: ZN

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	1.54	7/2002 (0.3%)	1.41	7/2689 (0.3%)
1	B	1.61	11/1989 (0.6%)	1.50	15/2671 (0.6%)
All	All	1.58	18/3991 (0.5%)	1.46	22/5360 (0.4%)

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	153	MET	SD-CE	-10.32	1.53	1.79
1	A	153	MET	SD-CE	-8.45	1.58	1.79
1	A	162	GLU	N-CA	-7.78	1.36	1.46
1	A	168	ALA	N-CA	6.82	1.54	1.46
1	B	157	ILE	CB-CG1	6.74	1.67	1.53
1	B	146	GLU	CA-C	-5.92	1.45	1.52
1	B	228	ALA	N-CA	5.91	1.53	1.45
1	B	3	TYR	N-CA	5.74	1.53	1.46
1	B	75	TYR	N-CA	5.60	1.54	1.46
1	B	226	VAL	N-CA	5.58	1.53	1.46
1	B	173	ALA	CA-C	-5.58	1.45	1.52
1	B	26	GLN	CA-C	-5.57	1.45	1.52
1	A	226	VAL	N-CA	5.53	1.53	1.46
1	A	51	TYR	C-O	5.48	1.30	1.24
1	A	66	ILE	C-O	5.45	1.30	1.24
1	B	98	ILE	CA-CB	5.35	1.60	1.54
1	B	176	ILE	C-N	5.26	1.36	1.33
1	A	27	ARG	CZ-NH1	5.01	1.39	1.32

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	53	ARG	NE-CZ-NH2	12.01	130.01	119.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	153	MET	CG-SD-CE	-10.74	77.26	100.90
1	A	153	MET	CG-SD-CE	-9.72	79.52	100.90
1	B	53	ARG	NE-CZ-NH1	-8.42	113.08	121.50
1	A	54	LYS	CD-CE-NZ	7.16	134.81	111.90
1	B	95	LEU	O-C-N	7.15	129.43	122.07
1	B	230	LEU	CB-CG-CD1	6.50	130.19	110.70
1	B	179	HIS	N-CA-CB	-6.28	101.03	111.20
1	B	35	ARG	NE-CZ-NH2	6.03	124.63	119.20
1	B	238	ASN	O-C-N	5.79	124.74	121.27
1	B	36	ILE	O-C-N	5.71	127.51	121.91
1	B	212	ILE	CB-CA-C	-5.43	103.54	110.98
1	A	67	GLU	CA-CB-CG	-5.36	103.39	114.10
1	A	101	SER	CA-C-N	-5.34	113.69	122.67
1	A	101	SER	C-N-CA	-5.34	113.69	122.67
1	B	109	ALA	CA-C-O	5.27	126.09	120.46
1	B	236	MET	CA-C-N	-5.10	112.21	121.14
1	B	236	MET	C-N-CA	-5.10	112.21	121.14
1	B	135	ILE	N-CA-C	5.08	117.86	112.83
1	A	43	ASN	CA-C-N	-5.07	116.50	123.14
1	A	43	ASN	C-N-CA	-5.07	116.50	123.14
1	B	204	VAL	N-CA-C	-5.05	101.20	108.87

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	1956	0	2032	8	0
1	B	1956	0	2019	6	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	63	0	0	0	0
3	B	68	0	0	0	0
All	All	4045	0	4051	13	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 2.

All (13) 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:246:ILE:O	1:B:247:LEU:HB2	1.84	0.76
1:A:66:ILE:HD11	1:A:97:LYS:HG2	1.82	0.61
1:A:96:ARG:HH11	1:A:96:ARG:HG3	1.71	0.55
1:A:96:ARG:HH11	1:A:96:ARG:CG	2.26	0.48
1:B:210:HIS:CD2	1:B:230:LEU:HD12	2.49	0.47
1:B:246:ILE:O	1:B:247:LEU:CB	2.60	0.47
1:B:162:GLU:HG3	1:B:199:MET:HE1	1.97	0.46
1:A:150:SER:HA	1:B:60:ASP:O	2.18	0.44
1:A:54:LYS:HE2	1:A:54:LYS:HB2	1.84	0.43
1:A:11:VAL:HG11	1:A:111:PHE:CD1	2.54	0.43
1:B:66:ILE:HD11	1:B:97:LYS:HG2	2.03	0.41
1:A:209:ALA:HA	1:A:230:LEU:HB3	2.03	0.41
1:A:54:LYS:HE2	1:A:89:ASN:OD1	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	242/249 (97%)	237 (98%)	5 (2%)	0	100	100
1	B	237/249 (95%)	232 (98%)	5 (2%)	0	100	100
All	All	479/498 (96%)	469 (98%)	10 (2%)	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	217/221 (98%)	213 (98%)	4 (2%)	51	20
1	B	215/221 (97%)	210 (98%)	5 (2%)	44	13
All	All	432/442 (98%)	423 (98%)	9 (2%)	47	15

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	LYS
1	A	96	ARG
1	A	190	LYS
1	A	217	GLU
1	B	139	ARG
1	B	160	ASN
1	B	186	LEU
1	B	230	LEU
1	B	247	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	193	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 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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 [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	240/249 (96%)	0.43	16 (6%)	24 25	5, 16, 38, 69	7 (2%)
1	B	243/249 (97%)	0.60	22 (9%)	15 14	7, 17, 42, 78	2 (0%)
All	All	483/498 (96%)	0.51	38 (7%)	18 19	5, 17, 41, 78	9 (1%)

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	186	LEU	8.5
1	B	185	THR	7.1
1	A	1	PRO	6.3
1	B	1	PRO	6.2
1	B	247	LEU	5.4
1	A	247	LEU	4.8
1	A	183	HIS	4.0
1	A	180	SER	3.6
1	B	212	ILE	3.5
1	A	3	TYR	3.4
1	B	203	ASN	3.4
1	A	213	SER	3.4
1	A	189	ASN	3.2
1	B	201	PRO	3.1
1	B	184	GLU	3.0
1	B	183	HIS	3.0
1	B	213	SER	3.0
1	B	180	SER	2.9
1	B	190	LYS	2.9
1	A	212	ILE	2.6
1	A	4	LEU	2.6
1	A	26	GLN	2.4
1	B	182	ASP	2.4
1	A	218	ILE	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	2	ARG	2.3
1	B	189	ASN	2.3
1	B	216	ASN	2.3
1	A	211	GLY	2.2
1	B	218	ILE	2.2
1	B	215	ARG	2.2
1	A	30	ILE	2.2
1	B	211	GLY	2.2
1	B	245	PHE	2.1
1	B	172	GLY	2.1
1	A	216	ASN	2.1
1	A	224	LEU	2.1
1	B	246	ILE	2.1
1	B	22	ARG	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 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
2	ZN	A	301	1/1	0.95	0.07	25,25,25,25	0
2	ZN	B	301	1/1	0.97	0.05	22,22,22,22	0

6.5 Other polymers [i](#)

There are no such residues in this entry.